LIBRARIES
UNIVERSITY OF WISCONSIN–MADISON

# Appendix 3.5-3 to Appendix 3.5-16. Volume IV

Foth and Van Dyke and Associates, Inc.
Green Bay, Wisconsin: Foth and Van Dyke, [s.d.]

https://digital.library.wisc.edu/1711.dl/PDOL7B65H2B6Z83

http://rightsstatements.org/vocab/InC/1.0/

Copyright, Foth and Van Dyke 2000.

For information on re-use see:
http://digital.library.wisc.edu/1711.dl/Copyright

The libraries provide public access to a wide range of material, including online exhibits, digitized collections, archival finding aids, our catalog, online articles, and a growing range of materials in many media.

When possible, we provide rights information in catalog records, finding aids, and other metadata that accompanies collections or items. However, it is always the user's obligation to evaluate copyright and rights issues in light of their own use.

728 State Street | Madison, Wisconsin 53706 | library.wisc.edu

# Appendix 3.5-3

## Logs for Braun Engineering Testing 1981 BE Series Borings

BORING LOGS

BRAUN ENGINEERING TESTING

| Boring Logs | Number of Sheets |
|---|---|
| BE 211-1 | 8 |
| BE 211-2 | 8 |
| BE 211-3 | 9 |
| BE 213-1 | 4 |
| BE 213-2 | 4 |
| BE 213-3 | 5 |
| BE 216-1 | 6 |
| BE 216-2 | 6 |
| BE 216-3 | 7 |

# LOG OF BORING

BRAUN ENGINEERING TESTING

| | |
|---|---|
| **PROJECT:** DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | **BORING:** BE 211-1<br>**LOCATION:** At Staked Location<br>**SCALE:** 25.4 mm = 1.22 m<br>1" = 4'<br>**DATE:** 3-3-81 |

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 0.0 | 0.0 | | | | | | Page 1 of 8 |
| | | SM | SILTY SAND, some coarse gravel & boulders, brown, wet | 7<br>9<br>6 | | 1 | Bore hole advanced with tri-cone roller bit & revert drilling fluid.<br><br>Six inch diameter casing driven to 4-1/2 feet.<br><br>3-inch OD sampler driven with 250# hammer falling 24 inches. |
| | | | | 6<br>8<br>9 | | 2 | |
| 4.0 | 13.0 | SW & GP | SAND & GRAVEL, some boulders, brown, moist to wet | 43<br>53 | | 3 | |
| | | | | 56<br>100 | | 4 | |
| 7.6 | 25.0 | | | 67<br>101 | | 5 | |
| | | | Continued on next page | | | | Crew Chief: Ron Kwilinski |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 211-1 (Continued)<br>LOCATION: At Staked Location | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |
|---|---|---|

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 7.6 | 25.0 | | | | | | Page 2 of 8 |
| | | SW & GP | SAND & GRAVEL, some boulders, brown, wet | 72<br>140 | | 6 | |
| 10.4 | 34.0 | | | | | | |
| | | SP to SM | SAND to SILTY SAND, fine grained, with coarse gravel, a few boulders, reddish brown, moist | 60<br>154 | | 7 | |
| | | | Boulder from 38' to 41' | 125/6" | | 8 | |
| 14.9 | 49.0 | | | | | | |
| 15.2 | 50.0 | SP | SAND, fine to medium grained,** | 86<br>100 | | 9 | |
| | | | **with medium to coarse gravel, brown, wet | | | | |
| | | | Continued on next page | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 211-1 (Continued) |
|---|---|
| | LOCATION: At Staked Location |
| | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |

(See Report and Standard Plates for evaluation and descriptive terminology.)

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 15.2 | 50.0 | | | | | | Page 3 of 8 |
| | | SP | SAND, fine to medium grained, with medium to coarse gravel, a few boulders, brown, wet | | | | |
| | | | | 150/1" | | * | *No Recovery |
| 18.0 | 59.0 | | | | | | |
| | | SP to SM | SAND TO SILTY SAND, fine grained, with medium to coarse gravel, reddish brown, wet to waterbearing | 100/6" | | 10 | |
| | | | | 120/6" | | 11 | |
| 21.0 | 69.0 | | | | | | |
| | | SM | SILTY SAND, fine grained, with medium to coarse gravel, brown, moist | 36/79 | | 12 | |
| 22.9 | 75.0 | | | 200/5" | | 13 | |
| | | | Continued on next page | | | | |

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 211-1 (Continued) |
|---|---|
| | LOCATION: At Staked Location |
| | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes<br>Page 4 of 8 |
|---|---|---|---|---|---|---|---|
| 22.9 | 75.0 | SP to SM | SAND TO SILTY SAND, fine grained, with medium to coarse gravel, brown, waterbearing | 120/4" | | 14 | |
| 25.6 | 84.0 | SM | SILTY SAND, with coarse gravel, brown, moist<br><br>Boulder encountered at 87' | 95/100 | | 15 | |
| 27.1 | 89.0 | SP | SAND, fine grained, with coarse gravel, brown, moist | 200/6" | | 16 | |
| 28.7 | 94.0 | GP | COARSE GRAVEL & BOULDERS | 200/6" | | * | *No Recovery |
| 30.2 | 99.0 | SM | SILTY SAND, fine grained, with*** | 200/3" | | 17 | |
| 30.5 | 100.0 | | ***coarse gravel, reddish brown, moist<br><br>Continued on next page | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 211-1 (Continued) |
|---|---|
| | LOCATION: At Staked Location |
| | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |

(See Report and Standard Plates for evaluation and descriptive terminology.)

| DEPTH METERS 30.5 | DEPTH FEET 100.0 | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes<br>Page 5 of 8 |
|---|---|---|---|---|---|---|---|
| | | SM | SILTY SAND, with medium to coarse gravel, reddish brown, moist | | | | |
| | | | | 118/6" | | 18 | |
| | | | Boulder encountered at 120' | 135/6" | | 19 | |
| 38.1 | 125.0 | | | | | | |
| | | | Continued on next page | | | | |

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 211-1 (Continued) |
|---|---|
| | LOCATION: At Staked Location |
| | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 38.1 | 125.0 | | | | | | Page 6 of 8 |
| | | SM | SILTY SAND, with coarse gravel, reddish brown, moist | | | | |
| | | | | 214/6" | | 20 | |
| | | | | 300/5" | | 21 | |
| 45.7 | 150.0 | | | 300/5" | | 22 | |
| | | | Continued on next page | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 211-1 (Continued) |
|---|---|
| | LOCATION: At Staked Location |
| | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |

(See Report and Standard Plates for evaluation and descriptive terminology.)

| DEPTH METERS 45.7 | DEPTH FEET 150.0 | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes<br>Page 7 of 8 |
|---|---|---|---|---|---|---|---|
| | | SM | SILTY SAND, with coarse gravel, brown to reddish brown, moist | | | | |
| 47.9 | 157.0 | | | | | | |
| | | SP | SAND, fine to medium grained, with coarse gravel, brown, moist | 133/6" | | 23 | |
| 51.2 | 168.0 | | | | | | |
| | | SM to ML | SILTY SAND TO SANDY SILT, with coarse gravel, reddish brown, moist | 118/6" | | 24 | |
| 53.3 | 175.0 | | | | | | |
| | | | Continued on next page | | | | |

(Corrected Log 5/6/81)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 211-1 (Continued) |
|---|---|
| | LOCATION: At Staked Location |
| | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |
| | DATE: 3-12-81 |

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes<br>Page 8 of 8 |
|---|---|---|---|---|---|---|---|
| 53.3 | 175.0 | SM to SM-SC | SILTY SAND TO SILTY CLAYEY SAND, with coarse gravel, reddish brown, moist | 100/211 | | 25 | |
| 57.3 | 188.0 | | Bedrock, weathered, red | 100/130 | | 26 | |
| 61.1 | 200.5 | | | 400/6" | | 27 | |
| | | | Drilling fluid level down 3' immediately after completion.<br><br>Water level not measured due to the presence of drilling fluid. | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| | |
|---|---|
| **PROJECT:** DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | **BORING:** BE 211-2<br>**LOCATION:** At Staked Location<br>**SCALE:** 25.4 mm = 1.22 m<br>1" = 4'<br>**DATE:** 2-19-81 |

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 0.0 | 0.0 | | | | | | Page 1 of 8 |
| | | CL | SILTY SANDY CLAY, gray, wet | | | | Bore hole advanced with tri-cone roller bits & Revert drilling fluid. |
| | | | | 10<br>12<br>15 | | 24 | Six inch diameter casing driven to 8 feet |
| 2.1 | 7.0 | | | | | | |
| | | SM-SC | SILTY CLAYEY SAND, a trace of fine gravel, brownish gray, wet | | | | 3-inch OD sampler driven with 250# hammer falling 24 inches. |
| | | | | 19<br>31<br>33 | | 25 | |
| 4.0 | 13.0 | | | | | | |
| | | SM | SILTY SAND, some fine to medium gravel, brown, moist | | | | |
| | | | | 60<br>69<br>53 | | 26 | |
| | | | | 57<br>49<br>53 | | 27 | |
| 6.7 | 22.0 | | | | | | |
| | | SP | SAND, a little fine to medium gravel, orange-brown, moist | | | | |
| 7.6 | 25.0 | | | 100/3" | | 28 | |
| | | | Continued on next page | | | | Crew Chief: William Donahue |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 211-2 (Continued) |
|---|---|
| | LOCATION: At Staked Location |
| | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes<br>Page 2 of 8 |
|---|---|---|---|---|---|---|---|
| | | SP | SAND, a little fine to medium gravel, a few boulders, orange-brown, moist | | | | |
| | | | | 100/4" | | 29 | |
| | | | | 100/4" | | 30 | |
| | | | | 100/3" | | 31 | |
| | | | | 100/4" | | 32 | |
| 15.2 | 50.0 | | | | | * | *Boulder Encountered |
| | | | Continued on next page | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 211-2 (Continued) |
|---|---|
| | LOCATION: At Staked Location |
| | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| | | | | | | | Page 3 of 8 |
| 15.8 | 52.0 | SP | SAND, a little fine to medium gravel, a few boulders, orange-brown, moist | | | | |
| | | CL with SM | SILTY CLAY varved with fine SILTY SAND, some fine to medium gravel, a few cobbles, red, moist | 100/6" | | 33 | |
| | | | | 100/5" | | 34 | |
| 18.9 | 62.0 | | | | | | |
| | | SM & GP | SILTY SAND & GRAVEL, a few cobbles, reddish brown, moist | 59<br>100/4" | | 35 | |
| | | | | 100/4" | | 36 | |
| 22.9 | 75.0 | | | 100/4" | | 37 | |
| | | | Continued on next page | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

**PROJECT:** DS81-04 Soil Borings & Piezometer Installation
Proposed Mine Facility
Crandon, Wisconsin

**BORING:** BE 211-2 (Continued)

**LOCATION:** At Staked Location

**SCALE:** 25.4 mm = 1.22 m
1" = 4'

| DEPTH METERS 22.9 | DEPTH FEET 75.0 | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes Page 4 of 8 |
|---|---|---|---|---|---|---|---|
| | | SM & GP | SILTY SAND & GRAVEL, a few cobbles & boulders, reddish brown, moist | | | | |
| | | | | 89 | | | |
| | | | | 100/3" | | 38 | |
| | | | Waterbearing at 83' | | | | |
| | | | | 57 | | | |
| | | | | 63 | | 39 | |
| | | | | 69 | | | |
| | | | | 64 | | | |
| | | | | 69 | | 40 | |
| | | | | 72 | | | |
| | | | | 100/4" | | 41 | |
| | | | | | | * | *Boulder Encountered |
| 30.5 | 100.0 | | | | | | |
| | | | Continued on next page | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 211-2 (Continued) |
|---|---|
| | LOCATION: At Staked Location |
| | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |

| DEPTH METERS 30.5 | DEPTH FEET 100.0 | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| | | | | | | | Page 5 of 8 |
| | | SM & GP | SILTY SAND & GRAVEL, a few cobbles & boulders, reddish brown, waterbearing | | | | |
| | | | | 57<br>62<br>79 | | 42 | |
| 34.1 | 112.0 | | | | | | |
| | | SP | SAND, a trace of fine gravel, brown, waterbearing | | | | |
| | | | | 100/<br>2-1/2" | | 43 | |
| 38.1 | 125.0 | | | | | | |
| | | | Continued on next page | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 211-2 (Continued) |
|---|---|
| | LOCATION: At Staked Location |
| | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 38.1 | 125.0 | | | | | | Page 6 of 8 |
| | | SP | SAND, a trace of fine gravel, brown, waterbearing | | | | |
| | | | | 100/4" | | 44 | |
| 40.8 | 134.0 | | | | | | |
| | | GP | GRAVEL & BOULDERS | | | | |
| | | | | 100/6" | | * | *No Recovery |
| 44.2 | 145.0 | | | | | | |
| | | SP & GP | SAND & GRAVEL, brown, wet | | | | |
| 45.7 | 150.0 | | | 29<br>67<br>52 | | 45 | |
| | | | Continued on next page | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 211-2 (Continued) |
|---|---|
| | LOCATION: At Staked Location |
| | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |

(See Report and Standard Plates for evaluation and descriptive terminology.)

| DEPTH METERS 45.7 | DEPTH FEET 150.0 | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes<br>Page 7 of 8 |
|---|---|---|---|---|---|---|---|
| 46.3 | 152.0 | SP & GP | SAND & GRAVEL, brown, wet | | | | |
| | | CL | SANDY CLAY, a few cobbles, reddish brown, moist to wet | 79<br>100/3" | | 46 | |
| | | | | 67<br>43<br>93 | | 47 | |
| 53.3 | 175.0 | | | | | | |
| | | | Continued on next page | | | | |

# LOG OF BORING

BRAUN ENGINEERING TESTING

| | |
|---|---|
| **PROJECT:** DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | **BORING:** BE 211-2 (Continued)<br>**LOCATION:** At Staked Location<br>**SCALE:** 25.4 mm = 1.22 m<br>1" = 4'<br>**DATE:** 2-25-81 |

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 53.3 | 175.0 | | | | | | Page 8 of 8 |
| 53.9 | 177.0 | CL | SANDY CLAY, a few cobbles, reddish brown, moist to wet. | | | | |
| | | SP | SAND, orange-brown, waterbearing | 149 | 6" | 48 | |
| | | | (Evidence of higher water pressure at 177') . | | | | |
| 55.8 | 183.0 | | | | | | |
| | | SM | SILTY SAND, some fine to medium gravel, reddish brown | 259 | | 49 | |
| 56.8 | 186.5 | | | 750/3" | | | |
| 57.5 | 188.5 | | Bedrock | | | | |
| | | | Water level not measured due to the presence of drilling fluid. | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

**PROJECT:** DS81-04 Soil Borings & Piezometer Installation
Proposed Mine Facility
Crandon, Wisconsin

**BORING:** BE 211-3

**LOCATION:** At Staked Location

**SCALE:** 25.4 mm = 1.22 m
1" = 4'

**DATE:** 3-19-81

(See Report and Standard Plates for evaluation and descriptive terminology.)

| DEPTH METERS 0.0 | DEPTH FEET 0.0 | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| | | SM | SILTY SAND, brown, moist | | | | Page 1 of 9 |
| | | | | 29<br>30<br>35 | | 93 | Bore hole advanced with tri-cone roller bits & Revert drilling fluid to the 197 foot depth. |
| | | | | | | | Six inch diameter casing driven to 8 feet. |
| | | | | 31<br>42<br>49 | | 94 | 3 inch OD sampler driven with 250# hammer falling 24 inches. |
| 3.7 | 12.0 | | | | | | |
| | | GP | GRAVEL, with a few cobbles | 100/3" | | 95 | |
| 5.2 | 17.0 | | | | | | |
| | | SM & GP | SILTY SAND & GRAVEL, brown, moist | 92<br>100/2" | | 96 | |
| 6.7 | 22.0 | | | | | | |
| | | SP | SAND, mostly fine to medium grained, brown, moist | 52<br>60<br>76 | | 97 | |
| 7.6 | 25.0 | | | | | | |
| | | | Continued on next page | | | | Crew Chief: Ron Kwilinski |

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 211-3 (Continued) |
|---|---|
| | LOCATION: At Staked Location |
| | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 7.6 | 25.0 | SP | SAND, mostly fine to medium grained, brown, moist | 39<br>50<br>50 | | 98 | Page 2 of 9 |
| 10.4 | 34.0 | SP | SAND, medium to coarse grained, brown, moist | 100/6" | | 99 | |
| 12.8 | 42.0 | | | 42<br>49<br>62 | | 100 | |
| 15.2 | 50.0 | SP & GP | SAND & GRAVEL, brown, moist | 79<br>100/3" | | 101 | |
| | | | | 100/6" | | 102 | |
| | | | Continued on next page | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

**PROJECT:** DS81-04 Soil Borings & Piezometer Installation
Proposed Mine Facility
Crandon, Wisconsin

**BORING:** BE 211-3 (Continued)

**LOCATION:** At Staked Location

**SCALE:** 25.4 mm = 1.22 m
1" = 4'

| DEPTH METERS 15.2 | DEPTH FEET 50.0 | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| | | SP & GP | SAND & GRAVEL | | | | Page 3 of 9 |
| 15.8 | 52.0 | | | | | | |
| | | SM | SILTY SAND, a trace of fine gravel, a few cobbles, brown, moist | 57<br>63<br>100/3" | | 103 | |
| | | | | 76<br>83<br>100/3" | | 104 | |
| | | | | 59<br>100/3" | | 105 | |
| | | | Layer of olive CLAYEY SILT at 70' | 100/5" | | 106 | |
| 22.9 | 75.0 | | | | | | |
| | | | Continued on next page | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 211-3 (Continued) |
|---|---|
| | LOCATION: At Staked Location |
| | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 22.9 | 75.0 | | | | | | Page 4 of 9 |
| | | SM | SILTY SAND, a trace of fine gravel, a few cobbles, brown, moist | | | | |
| | | | | 100/4" | | 107 | |
| | | | | 83 | | | |
| | | | | 100/2" | | 108 | |
| | | | | 100/4" | | 109 | |
| | | | | 97 | | | |
| | | | | 100/1" | | 110 | |
| 30.5 | 100.0 | | | | | | |
| | | | Continued on next page | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 211-3 (Continued) |
|---|---|
| | LOCATION: At Staked Location |
| | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |

(See Report and Standard Plates for evaluation and descriptive terminology.)

| DEPTH METERS 30.5 | DEPTH FEET 100.0 | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes<br>Page 5 of 9 |
|---|---|---|---|---|---|---|---|
| | | SM | SILTY SAND, a trace of fine gravel, a few cobbles, brown, moist | | | | |
| 33.2 | 109.0 | | | | | | |
| | | GP | FINE GRAVEL, brown, wet | 100/3" | | 111 | |
| 34.1 | 112.0 | | | | | | |
| | | SM | SILTY SAND, a little fine to medium gravel, brown, moist | | | | |
| | | | | 100/4" | | 112 | |
| 38.1 | 125.0 | | | | | | |
| | | | Continued on next page | | | | |

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 211-3 (Continued) |
|---|---|
| | LOCATION: At Staked Location |
| | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |

| DEPTH METERS 38.1 | DEPTH FEET 125.0 | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes<br>Page 6 of 9 |
|---|---|---|---|---|---|---|---|
| | | SM | SILTY SAND, a little fine to medium gravel, brown-reddish brown at 148', moist | | | | |
| | | | | 73<br>100/2" | | 113 | |
| | | | | 100/4" | | 114 | |
| 45.7 | 150.0 | | | 100/3" | | 115 | |
| | | | Continued on next page | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 213-3 (Continued) |
|---|---|
| | LOCATION: At Staked Location |
| | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |

(See Report and Standard Plates for evaluation and descriptive terminology.)

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 45.7 | 150.0 | | | | | | Page 7 of 9 |
| | | SM | SILTY SAND, a little fine to medium gravel, a few cobbles, reddish brown | | | | |
| | | | | 100/4" | | 116 | |
| | | | Boulder encountered from 169' to 175' | | | | |
| 53.3 | 175.0 | | | | | | |
| | | | Continued on next page | | | | |

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 211-3 (Continued) |
|---|---|
| | LOCATION: At Staked Location |
| | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes<br>Page 8 of 9 |
|---|---|---|---|---|---|---|---|
| 53.3 | 175.0 | SM | SILTY SAND, a little fine to medium gravel, a few cobbles, reddish brown, moist | 73<br>79<br>100/3" | | 117 | NW Casing driven to 193'. |
| 55.5 | 182.0 | CL | SILTY SANDY CLAY, brown, moist to wet | 100/3" | | 118 | |
| 58.5 | 192.0 | | Bedrock, reddish orange from 197' to 202' & silver-gray from 202' to 220-1/2'<br>Fractured from 207' to 209'<br><br>Normal to fast rate of advance<br><br>Water pressure -- Normal<br><br>Minimal loss of water | 100/4" | | 119 | Bore hole extended from 197' to 220-1/2' with NQ diamond bit & "Q" series wire line coring equipment. |
| 62.5 | 205.0 | | | | | | |
| | | | Continued on next page | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| | |
|---|---|
| **PROJECT:** DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | **BORING:** BE 211-3 (Continued)<br>**LOCATION:** At Staked Location<br>**SCALE:** 25.4 mm = 1.22 m<br>1" = 4'<br>**DATE:** 4-3-81 |

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 62.5 | 205.0 | | | | | | Page 9 of 9 |
| | | | Bedrock, silver-gray | | | | |
| | | | Recovery: 197' - 202' 23.3% | 14" | | | |
| | | | 202' - 205-1/2' 63.3% | 26½" | | | |
| | | | 205-1/2'-210-1/2' 90.0% | 54" | | | |
| | | | 210-1/2'-215-1/2' 98.3% | 59" | | | |
| | | | 215-1/2'-220-1/2' 89.2% | 53½" | | | |
| | | | Diamond bit plugged at 202' | | | | |
| 67.2 | 220.5 | | | | | | |
| | | | Water level not measured due to the presence of drilling fluid. | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

**PROJECT:** DS81-04 Soil Borings & Piezometer Installation
Proposed Mine Facility
Crandon, Wisconsin

**BORING:** BE 213-1

**LOCATION:** At Staked Location

**SCALE:** 25.4 mm = 1.22 m
1" = 4'

**DATE:** 2-7-81

(See Report and Standard Plates for evaluation and descriptive terminology.)

| DEPTH METERS 0.0 | DEPTH FEET 0.0 | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| | | | | | | | Page 1 of 4 |
| | | SM-SC | SILTY CLAYEY SAND, brown, frozen to 2-1/2' then moist | | | | Bore hole advanced with tri-cone roller bits & Revert drilling fluid. |
| | | | | 5<br>7<br>9 | | 1 | Six-inch diameter casing driven to 8 feet |
| | | | | | | | 3-inch OD sampler driven with 250# hammer falling 24 inches. |
| | | | | 8<br>8<br>6 | | 2 | |
| 4.0 | 13.0 | | | | | | |
| | | SP-SM | SLIGHTLY SILTY SAND, some fine to medium gravel, some boulders, brown, moist | 100/2" | | | |
| | | | Continuous boulders from 14-1/2' to 19' | 9<br>19<br>17 | | 3 | |
| 7.6 | 25.0 | | | 18<br>19 | | 4 | |
| | | | | 19 | | | |
| | | | Continued on next page | | | | Crew Chief: William Donahue |

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 213-1 (Continued) |
|---|---|
| | LOCATION: At Staked Location |
| | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 7.6 | 25.0 | | | | | | Page 2 of 4 |
| | | SP-SM | SLIGHTLY SILTY SAND, some fine to medium gravel, some boulders, brown, moist | | | | |
| 8.8 | 29.0 | | | | | | |
| | | SP-SM & GP | SLIGHTLY SILTY SAND & GRAVEL, some boulders, brown, moist to wet | 100/4" | | 5 | |
| | | | Continuous boulder from 48' to 65' | 168/6" | | 6 | |
| | | | | 97<br>85<br>76 | | 7 | |
| | | | | 100/0" | | * | *No Penetration |
| 15.2 | 50.0 | | | 100/0" | | * | *No Penetration |
| | | | Continued on next page | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 213-1 (Continued) |
|---|---|
| | LOCATION: At Staked Location |
| | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes<br>Page 3 of 4 |
|---|---|---|---|---|---|---|---|
| 15.2 | 50.0 | SP-SM & GP | SLIGHTLY SILTY SAND & GRAVEL, some boulders, brown, moist to wet<br>Large boulder from 54' to 66' | | | | |
| 19.8 | 65.0 | SP | COARSE GRAVEL & COBBLES | | | | |
| 21.3 | 70.0 | | | 100/1" | | * | *No Recovery |
| | | SP-SM | SLIGHTLY SILTY SAND, some fine to medium gravel, brown, wet to waterbearing<br>(Water pressure evident at 70') | | | | |
| 22.9 | 75.0 | | | 50<br>54<br>72 | | 8 | |
| | | | Continued on next page | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| | |
|---|---|
| **PROJECT:** DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | **BORING:** BE 213-1 (Continued)<br>**LOCATION:** At Staked Location<br>**SCALE:** 25.4 mm = 1.22 m, 1" = 4'<br>**DATE:** 2-13-81 |

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| | | | | | | | Page 4 of 4 |
| 23.5 | 77.0 | SP-SM | SLIGHTLY SILTY SAND, some fine to medium gravel, brown, wet to waterbearing | | | | |
| 25.3 | 83.0 | | COBBLES | 100/4" | | 9 | |
| 26.8 | 88.0 | CL | SILTY CLAY, a trace of fine gravel, red, moist to wet | 113/6" | | 10 | |
| 28.2 | 92.5 | | Bedrock<br><br>Water pressure noted at 88' | | | | |
| | | | Water level not measured due to the presence of drilling fluid. | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

**PROJECT:** DS81-04 Soil Borings & Piezometer Installation
Proposed Mine Facility
Crandon, Wisconsin

**BORING:** BE 213-2

**LOCATION:** At Staked Location

**SCALE:** 25.4 mm = 1.22 m
1" = 4'

**DATE:** 2-16-81

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 0.0 | 0.0 | | | | | | Page 1 of 4 |
| | | SM-SC | SILTY CLAYEY SAND, a few boulders, brown, frozen to 2' then moist | | | | Bore hole advanced with tri-cone roller bits & Revert drilling fluid. |
| | | | | 8<br>11<br>12 | | 11 | Six-inch diameter Casing driven to 8 feet. |
| | | | | 10<br>10<br>10 | | 12 | 3-inch OD sampler driven with 250# hammer falling 24 inches. |
| | | | | 15<br>16<br>15 | | 13 | |
| 4.9 | 16.0 | | | | | | |
| | | SP-SM | SLIGHTLY SILTY SAND, some fine to medium gravel, some boulders, light brown, moist | 12<br>15<br>13 | | 14 | |
| 7.6 | 25.0 | | | 29<br>33<br>42 | | 15 | |
| | | | Continued on next page | | | | Crew Chief: William Donahue |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 213-2 (Continued) |
|---|---|
| | LOCATION: At Staked Location |
| | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |

(See Report and Standard Plates for evaluation and descriptive terminology.)

| DEPTH METERS 7.6 | DEPTH FEET 25.0 | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes<br>Page 2 of 4 |
|---|---|---|---|---|---|---|---|
| | | SP & GP | SAND & GRAVEL, brown, wet | 49<br>45<br>42 | | 16 | |
| | | | | 100/7" | | 17 | |
| 11.6 | 38.0 | GP | GRAVEL, fine to coarse, some boulders, moist to wet | 100/4" | | 18 | |
| | | | | 100/4" | | * | *No Recovery |
| 15.2 | 50.0 | | | 100/6" | | 19 | |
| | | | Continued on next page | | | | |

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 213-2 (Continued)<br>LOCATION: At Staked Location | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |
|---|---|---|

| DEPTH METERS 15.2 | DEPTH FEET 50.0 | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes<br>Page 3 of 4 |
|---|---|---|---|---|---|---|---|
| | | GP | GRAVEL, fine to coarse, some boulders & Cobbles, moist to wet | | | | |
| | | | Large boulder from 52' - 57' | | | | |
| | | | | 100/2" | | * | *No Recovery |
| | | | | 100/2" | | * | *No Recovery |
| 22.3 | 73.0 | | | | | | |
| 22.9 | 75.0 | SP-SM | SLIGHTLY SILTY SAND, a trace of fine gravel, brown, moist | 100/4" | | 20 | |
| | | | Continued on next page | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| | |
|---|---|
| **PROJECT:** DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | **BORING:** BE 213-2 (Continued)<br>**LOCATION:** At Staked Location<br>**SCALE:** 25.4 mm = 1.22 m<br>1" = 4'<br>**DATE:** 2-17-81 |

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 22.9 | 75.0 | | | | | | Page 4 of 4 |
| | | SP-SM | SLIGHTLY SILTY SAND, a trace of fine gravel, brown, moist | | | | |
| | | | | 100/3-1/2" | | 21 | |
| | | | | 100/4" | | 22 | |
| 26.2 | 86.0 | | | | | | |
| | | CL | SILTY CLAY, a trace of fine gravel, reddish brown, moist | | | | |
| | | | | 100/5" | | 23 | |
| 28.3 | 93.0 | | | | | | |
| | | | Bedrock | | | | |
| 29.0 | 95.0 | | | | | | |
| | | | Water level not measured due to the presence of drilling fluid. | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 213-3<br>LOCATION: At Staked Location<br>DATE: 3-13-81 | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |
|---|---|---|

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes<br>Page 1 of 5 |
|---|---|---|---|---|---|---|---|
| 0.0 | 0.0 | SP to SP-SM | SAND TO SLIGHTLY SILTY SAND, fine grained, with coarse gravel, brown, moist | 8<br>14<br>16 | | 28 | Bore hole advanced with tri-cone roller bits & Revert drilling fluid.<br><br>Six-inch diameter casing driven to 4-1/2 feet.<br><br>3-inch OD sampler driven with 250# hammer falling 24 inches. |
| | | | | 13<br>12<br>13 | | 29 | |
| | | | | 33<br>39<br>36 | | 30 | |
| 5.5 | 18.0 | | | | | | |
| | | SM | SILTY SAND, fine grained, brown, moist, waterbearing<br><br>Loss of drilling fluid from 15 feet | 46<br>75<br>79 | | 31 | |
| 7.3 | 24.0 | | | | | | |
| 7.6 | 25.0 | SP | SAND, fine grained, with medium** | 50<br>104 | | 32 | |
| | | | **gravel, brown, waterbearing<br><br>Continued on next page | | | | Crew Chief:<br>William Donahue |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 213-3 (Continued) |
|---|---|
| | LOCATION: At Staked Location |
| | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 7.6 | 25.0 | | | | | | Page 2 of 5 |
| 8.8 | 29.0 | SP | SAND, fine to medium grained, with medium to coarse gravel, brown, waterbearing | | | | |
| 10.4 | 34.0 | SP | SAND, fine grained, brown, waterbearing | 50/100 | | 33 | |
| 15.2 | 50.0 | SP | SAND, fine to medium grained, with medium to coarse gravel, some boulders, brown, moist<br>Boulder encountered at 44' | 53/118<br>67/100<br>200/4"<br>70/100 | | 34<br>35<br>36<br>37 | |
| | | | Continued on next page | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 213-3 (Continued)<br>LOCATION: At Staked Location | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |
|---|---|---|

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 15.2 | 50.0 | | | | | | Page 3 of 5 |
| | | SP | SAND, fine to medium grained, with coarse gravel & boulders, brown, moist | | | | |
| | | | | 120/6" | | 38 | |
| | | | | 200/5" | | 39 | |
| | | | | 200/2" | | * | *No Recovery |
| 22.3 | 73.0 | | | | | | |
| | | SM | SILTY SAND, a little medium gravel, brown to reddish brown, moist | 38 | | 40 | |
| 22.9 | 75.0 | | | 78 | | | |
| | | | Continued on next page | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 213-3 (Continued) |
|---|---|
| | LOCATION: At Staked Location |
| | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |

(See Report and Standard Plates for evaluation and descriptive terminology.)

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 22.9 | 75.0 | | | | | | Page 4 of 5 |
| | | SM | SILTY SAND, a little medium gravel brown to reddish brown, moist. | 88<br>112 | | 41 | |
| 25.3 | 83.0 | | | | | | |
| | | CL | SILTY CLAY, a trace of fine to medium gravel, reddish brown, moist | 52<br>95 | | 42 | |
| 27.1 | 89.0 | | | | | | |
| | | | Bedrock<br><br>Normal rate of advance<br>Water pressure -- Normal<br>Minimal loss of water from 100 to 110'<br>High loss of water from 110' to 115' | 200/5" | | 43 | Bore hole extended from 89' to 100' with tri-cone roller bits & Revert drilling fluid. |
| | | | | 200/5" | | 44 | |
| 30.5 | 100.0 | | | 500/5" | | 45 | |
| | | | Continued on next page | | | | |

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 213-3 (Continued) | |
|---|---|---|
| | LOCATION: At Staked Location | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |
| | DATE: 3-24-81 | |

| DEPTH METERS 30.5 | DEPTH FEET 100.0 | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes<br>Page 5 of 5 |
|---|---|---|---|---|---|---|---|
| | | | Diamond Bit plugged at the 101-1/2 foot depth:<br><br>Recovery: 100' - 105' ---- 10% 6"<br>105' - 110' ----57.5% 34½"<br>110' - 115' 0% 0" | | | | NW Casing driven to 89'<br>Bore hole extended from 100' to 115' with NQ diamond bit & "Q" series wire line coring equipment. |
| 35.1 | 115.0 | | | | | | |
| | | | Drilling fluid level down 25' immediately after completion.<br><br>Water level not measured due to the presence of drilling fluid. | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

**PROJECT:** DS81-04 Soil Borings & Piezometer Installation
Proposed Mine Facility
Crandon, Wisconsin

**BORING:** BE 216-1
**LOCATION:** At Staked Location
**SCALE:** 25.4 mm = 1.22 m
1" = 4'
**DATE:** 3-2-81

(See Report and Standard Plates for evaluation and descriptive terminology.)

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 0.0 | 0.0 | | | | | | Page 1 of 6 |
| | | ML | SANDY CLAYEY SILT, brown, moist | | | | Bore hole advanced with tri-cone roller bits & Revert drilling fluid. |
| | | | | 9 | | | |
| | | | | 12 | | 50 | Six-inch diameter casing driven to 8 feet. |
| | | | | 19 | | | |
| 2.1 | 7.0 | | | | | | |
| | | SM | SILTY SAND, fine grained, brown, moist | | | | 3-inch OD sampler driven with 250# hammer falling 24 inches. |
| | | | | 10 | | | |
| | | | | 19 | | 51 | |
| | | | | 25 | | | |
| 4.3 | 14.0 | | | | | | |
| | | ML with SM | CLAYEY SILT, brown with intrusions of orange-brown SILTY SAND, moist to wet | 12 | | | |
| | | | | 15 | | 52 | |
| | | | | 17 | | | |
| 5.5 | 18.0 | | | | | | |
| | | SM | SILTY SAND, fine grained, brown, moist | | | | |
| | | | | 19 | | | |
| | | | | 27 | | 53 | |
| | | | | 38 | | | |
| 6.7 | 22.0 | | | | | | |
| | | SP & GP | SAND & GRAVEL, brown, moist to wet | | | | |
| | | | | 86 | | | |
| 7.6 | 25.0 | | | 100/4" | | 54 | |
| | | | Continued on next page | | | | Crew Chief: William Donahue |

# LOG OF BORING

BRAUN ENGINEERING TESTING

| | |
|---|---|
| **PROJECT:** DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | **BORING:** BE 216-1 (Continued)<br>**LOCATION:** At Staked Location<br>**SCALE:** 25.4 mm = 1.22 m<br>1" = 4' |

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes<br>Page 2 of 6 |
|---|---|---|---|---|---|---|---|
| | | SP & GP | SAND & GRAVEL, a few cobbles, brown, moist<br><br>Boulder 27' - 29' | 96<br>84<br>73 | | 55 | |
| | | | | 49<br>53<br>74 | | 56 | |
| 11.3 | 37.0 | SM | SILTY SAND, some fine to medium gravel, brown | 100/6" | | 57 | |
| | | | | 59<br>67<br>67 | | 58 | |
| 15.2 | 50.0 | | | 59<br>43<br>49 | | 59 | |
| | | | Continued on next page | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

**PROJECT:** DS81-04 Soil Borings & Piezometer Installation
Proposed Mine Facility
Crandon, Wisconsin

**BORING:** BE 216-1 (Continued)

**LOCATION:** At Staked Location

**SCALE:** 25.4 mm = 1.22 m
1" = 4'

(See Report and Standard Plates for evaluation and descriptive terminology.)

| DEPTH METERS 15.2 | DEPTH FEET 50.0 | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| | | | | | | | Page 3 of 6 |
| | | SM & GP | SILTY SAND & GRAVEL, some cobbles & boulders, brown, moist to wet | | | | |
| | | | | 100/3" | | * | *No Recovery |
| | | | | 97 | | | |
| | | | | 100/3" | | 60 | |
| | | | (Boulder encountered from 62' to 67') | | | | |
| | | | | 87 | | | |
| | | | | 72 | | | |
| | | | | 100/2" | | 61 | |
| | | | | 92 | | | |
| 22.9 | 75.0 | | | 83 | | 62 | |
| | | | | 87 | | | |
| | | | Continued on next page | | | | |

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 216-1 (Continued) |
|---|---|
| | LOCATION: At Staked Location |
| | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 22.9 | 75.0 | | | | | | Page 4 of 6 |
| | | SM & GP | SILTY SAND & GRAVEL, some cobbles & boulders, brown, moist to wet | | | | |
| | | | | 97<br>100/4" | | 63 | |
| | | | | 100/3" | | 64 | |
| | | | | 82<br>87<br>100/3" | | 65 | |
| | | | (Boulder from 91' to 94') | | | | |
| | | | | 100/4" | | * | *No Recovery |
| | | | | 72<br>79<br>100/3" | | 66 | |
| 30.5 | 100.0 | | Continued on next page | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 216-1 (Continued) |
|---|---|
| | LOCATION: At Staked Location |
| | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |

| DEPTH METERS 30.5 | DEPTH FEET 100.0 | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes<br>Page 5 of 6 |
|---|---|---|---|---|---|---|---|
| | | SM & GP | SILTY SAND & GRAVEL, some cobbles & boulders; brown; moist to wet | | | | |
| | | | (Boulder from 103' to 107') | | | | |
| | | | | 49<br>57<br>69 | | 67 | |
| | | | | 52<br>59<br>78 | | 68 | |
| 38.1 | 125.0 | | | | | | |
| | | | Continued on next page | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| | |
|---|---|
| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 216-1 (Continued)<br>LOCATION: At Staked Location<br>SCALE: 25.4 mm = 1.22 m<br>1" = 4'<br>DATE: 3-10-81 |

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 38.1 | 125.0 | | | | | | Page 6 of 6 |
| | | SM | SILTY SAND, some fine to medium gravel, reddish brown, moist | | | | |
| | | | | 54 | | | |
| | | | | 57 | | 69 | |
| | | | | 78 | | | |
| | | | Boulder from 136' to 138' | | | | |
| | | | | 69 | | | |
| | | | | 73 | | 70 | |
| | | | | 72 | | | |
| 45.4 | 149.0 | | | | | | |
| | | | Bedrock | | | | |
| 46.2 | 151.5 | | | | | | |
| | | | Water level not measured due to the presence of drilling fluid. | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

**PROJECT:** DS81-04 Soil Borings & Piezometer Installation
Proposed Mine Facility
Crandon, Wisconsin

**BORING:** BE 216-2

**LOCATION:** At Staked Location

**SCALE:** 25.4 mm = 1.22 m
1" = 4'

**DATE:** 3-11-81

(See Report and Standard Plates for evaluation and descriptive terminology.)

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 0.0 | 0.0 | | | | | | Page 1 of 6 |
| | | SM | SILTY SAND, a trace of fine gravel, brown, moist | | | | Bore hole advanced with tri-cone roller bits & Revert drilling fluid. |
| | | | | 39<br>53<br>64 | | 71 | Six-inch diameter casing driven to 8 feet |
| | | | | | | | 3-inch OD sampler driven with 250# hammer falling 24 inches. |
| | | | | 42<br>45<br>59 | | 72 | |
| 4.0 | 13.0 | | | | | | Redrilled bore hole 5' NW of staked location due to caving conditions at the 52 foot depth. |
| | | SP & GP | SAND & GRAVEL, mostly medium to coarse grained, moist to wet | 29<br>28<br>31 | | 73 | |
| | | | | 30<br>26<br>35 | | 74 | |
| 7.0 | 23.0 | | | | | | |
| | | GP | GRAVEL, brown, moist | | | | |
| 7.6 | 25.0 | | | | | | |
| | | | Continued on next page | 100/3" | | * | *No Recovery |
| | | | | | | | Crew Chief: William Donahue |

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation Proposed Mine Facility Crandon, Wisconsin | BORING: BE 216-2 (Continued) |
|---|---|
| | LOCATION: At Staked Location |
| | SCALE: 25.4 mm = 1.22 m 1" = 4' |

| DEPTH METERS 7.6 | DEPTH FEET 25.0 | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| | | | | | | | Page 2 of 6 |
| | | GP | GRAVEL, some cobbles, brown, moist | | | | |
| | | | | 100/4" | | 75 | |
| 10.4 | 34.0 | | | | | | |
| | | SP | SAND, mostly medium grained, brown, moist | 68<br>72<br>100/3" | | 76 | |
| | | | | 59<br>53<br>79 | | 77 | |
| | | | Boulders from 44' to 49' | | | | |
| 14.6 | 48.0 | | | | | | |
| | | SP & GP | SAND & GRAVEL, some boulders, brown, moist | | | | |
| 15.2 | 50.0 | | | 100/3" | | 78 | |
| | | | Continued on next page | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 216-2 (Continued) |
|---|---|
| | LOCATION: At Staked Location |
| | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |

(See Report and Standard Plates for evaluation and descriptive terminology.)

| DEPTH METERS 15.2 | DEPTH FEET 50.0 | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes<br>Page 3 of 6 |
|---|---|---|---|---|---|---|---|
| | | SP & GR | SAND & GRAVEL, some boulders, brown, moist | | | | |
| | | | Loss of water at 52', Caving conditions | 100/4" | | 79 | |
| 18.6 | 61.0 | | | 100/3" | | 80 | |
| | | SM | SILTY SAND, a little fine gravel, a few boulders, brown, moist | 59<br>100/4" | | 81 | |
| | | | | 78<br>85<br>97 | | 82 | |
| 22.9 | 75.0 | | | 100/3" | | 83 | |
| | | | Continued on next page | | | | |

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 216-2 (Continued)<br>LOCATION: At Staked Location<br>SCALE: 25.4 mm = 1.22 m<br>1" = 4' |
|---|---|

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes<br>Page 4 of 6 |
|---|---|---|---|---|---|---|---|
| 22.9 | 75.0 | | | | | | |
| | | SM | SILTY SAND, a little fine gravel, brown, moist | | | | |
| | | | | 99<br>100/1" | | 84 | |
| | | | | 69<br>76<br>93 | | 85 | |
| | | | | 100/4" | | 86 | |
| | | | | 100/4" | | 87 | |
| 30.5 | 100.0 | | | | | | |
| | | | Continued on next page | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| | |
|---|---|
| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 216-2 (Continued)<br>LOCATION: At Staked Location<br>SCALE: 25.4 mm = 1.22 m<br>1" = 4' |

(See Report and Standard Plates for evaluation and descriptive terminology.)

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 30.5 | 100.0 | | | | | | Page 5 of 6 |
| | | SM | SILTY SAND, a little fine gravel, brown, moist | 59<br>63<br>47 | | 88 | |
| | | | | 79<br>93<br>100/3" | | 89 | |
| | | | | 63<br>94<br>100/2" | | 90 | |
| 38.1 | 125.0 | | Continued on next page | | | | |

# LOG OF BORING

BRAUN ENGINEERING TESTING

| | |
|---|---|
| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 216-2 (Continued)<br>LOCATION: At Staked Location<br>SCALE: 25.4 mm = 1.22 m<br>1" = 4'<br>DATE: 3-18-81 |

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes<br>Page 6 of 6 |
|---|---|---|---|---|---|---|---|
| 38.1 | 125.0 | SM | SILTY SAND, a little fine gravel, brown, moist | | | | |
| 39.3 | 129.0 | CH | FAT CLAY, red, moist to wet | 87<br>100/4" | | 91 | |
| 42.1 | 138.0 | | Bedrock | 100/3" | | 92 | |
| 42.8 | 140.5 | | Water level not measured due to the presence of drilling fluid. | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

**PROJECT:** DS81-04 Soil Borings & Piezometer Installation
Proposed Mine Facility
Crandon, Wisconsin

**BORING:** BE 216-3
**LOCATION:** At Staked Location
**SCALE:** 25.4 mm = 1.22 m
1" = 4'
**DATE:** 4-6-81

(See Report and Standard Plates for evaluation and descriptive terminology.)

| DEPTH METERS 0.0 | DEPTH FEET 0.0 | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| | | | | | | | Page 1 of 7 |
| | | | Boulders | | | | Bore hole advanced with tri-cone roller bits & Revert drilling fluid to the 150 foot depth. |
| .92 | 3.0 | | | | | | |
| | | ML | SANDY SILT, brown, wet | 10<br>5<br>6 | | 120 | Six inch diameter casing driven to 8 feet. |
| 2.4 | 8.0 | | | | | | |
| | | SM | SILTY SAND, brown, wet | 12<br>6<br>4 | | 121 | 3 inch OD sampler driven with 250# hammer falling 24 inches |
| | | | | 5<br>6<br>10 | | 122 | |
| 6.1 | 20.0 | | | | | | |
| | | SP | SAND, mostly fine to medium grained, brown, moist | 23<br>45<br>67 | | 123 | |
| 7.6 | 25.0 | | | | | | |
| | | | Continued on next page | | | | Crew Chief: William Donahue |

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 216-3 (Continued)<br>LOCATION: At Staked Location<br>SCALE: 25.4 mm = 1.22 m<br>1" = 4' |
|---|---|

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes<br>Page 2 of 7 |
|---|---|---|---|---|---|---|---|
| 7.6 | 25.0 | SP | SAND, mostly fine to medium grained, a few cobbles, brown, moist | 87<br>100/2" | | 124 | |
| 9.9 | 32.5 | | | 87<br>69<br>73 | | 125 | |
| | | SM | SILTY SAND, a trace of fine gravel, a few cobbles & boulders, brown, moist | 100/4" | | 126 | |
| | | | | 92<br>100/0" | | 127 | |
| 15.2 | 50.0 | | | 63<br>69<br>100/2" | | 128 | |
| | | | Continued on next page | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| | |
|---|---|
| **PROJECT:** DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | **BORING:** BE 216-3 (Continued)<br>**LOCATION:** At Staked Location<br>**SCALE:** 25.4 mm = 1.22 m<br>1" = 4' |

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes |
|---|---|---|---|---|---|---|---|
| | | | | | | | Page 3 of 7 |
| | | GP | GRAVEL, medium, moist to wet | 100/3" | | 129 | |
| | | | | 100/4" | | 130 | |
| 18.0 | 59.0 | | | | | | |
| | | SM | SILTY SAND, a trace of fine gravel, brown, moist | 67<br>78<br>100/2" | | 131 | |
| | | | | 71<br>53<br>89 | | 132 | |
| | | | | 100/4" | | 133 | |
| 22.9 | 75.0 | | | | | | |
| | | | Continued on next page | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 216-3 (Continued)<br>LOCATION: At Staked Location | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |
|---|---|---|

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes<br>Page 4 of 7 |
|---|---|---|---|---|---|---|---|
| 22.9 | 75.0 | SM | SILTY SAND, a little fine to medium gravel, a few boulders, reddish brown, moist | 89<br>92<br>100/2" | | 134 | |
| | | | Boulders from 82' to 86' | 100/5" | | 135 | |
| | | | | 43<br>49<br>98 | | 136 | |
| 27.1 | 89.0 | SP | SAND, mostly fine to medium grained, some cobbles, brown, moist to wet | 61<br>72<br>100/2" | | 137 | |
| | | | Cobbles from 94' to 99' | 100/3" | | * | *No Recovery |
| 30.5 | 100.0 | | | | | | |
| | | | Continued on next page | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 216-3 (Continued) | |
|---|---|---|
| | LOCATION: At Staked Location | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |

(See Report and Standard Plates for evaluation and descriptive terminology.)

| DEPTH METERS 30.5 | DEPTH FEET 100.0 | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes<br>Page 5 of 7 |
|---|---|---|---|---|---|---|---|
| | | SP | SAND, mostly fine to medium grained, some fine to medium gravel, a few cobbles, brown, moist to wet | 84<br>97<br>100/2" | | 138 | |
| | | | | 93<br>100/3" | | 139 | |
| | | | | 100/6" | | 140 | |
| 38.1 | 125.0 | | Continued on next page | | | | |

# LOG OF BORING

BRAUN ENGINEERING TESTING

| PROJECT: DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | BORING: BE 216-3 (Continued) |
|---|---|
| | LOCATION: At Staked Location |
| | SCALE: 25.4 mm = 1.22 m<br>1" = 4' |

| DEPTH METERS 38.1 | DEPTH FEET 125.0 | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes<br>Page 6 of 7 |
|---|---|---|---|---|---|---|---|
| 38.7 | 127.0 | SP | SAND, mostly fine to medium grained, some fine to medium gravel, brown, moist to wet | | | | |
| | | SM | SILTY SAND, some fine to medium gravel, a few boulders, reddish brown, moist | 100/4" | | 141 | |
| | | | | 53<br>93<br>100/2" | | 142 | |
| 45.7 | 150.0 | | | | | | |
| | | | Continued on next page | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

# LOG OF BORING

BRAUN ENGINEERING TESTING

| | |
|---|---|
| **PROJECT:** DS81-04 Soil Borings & Piezometer Installation<br>Proposed Mine Facility<br>Crandon, Wisconsin | **BORING:** BE 216-3 (Continued)<br>**LOCATION:** At Staked Location<br>**SCALE:** 25.4 mm = 1.22 m<br>1" = 4'<br>**DATE:** 4-14-81 |

| DEPTH METERS | DEPTH FEET | ASTM D2487 Symbol | Description of Materials (ASTM: D2488) | BPF | WL | Sample Number | Tests or Notes<br>Page 7 of 7 |
|---|---|---|---|---|---|---|---|
| 45.7 | 150.0 | | Bedrock, reddish orange<br><br>Normal rate of advance<br>Increased pressure needed to drill from 169-1/2' to 178-1/2'<br><br>Minimal loss of drilling fluid.<br><br>Water pressure -- normal<br><br>Recovery: 152' - 154-1/2' 93.3% 28"<br>154-1/2'-159-1/2' 100% 60"<br>159-1/2'-164-1/2' 100% 60"<br>164-1/2'-169-1/2' 97.5% 58"<br>169-1/2'-174-1/2' 100% 60"<br>174-1/2'-178-1/2' 0%* 0" | | | | NW casing driven to 152'.<br><br>Bore hole extended from 152' to 178-1/2' with NQ Diamond Bit & "Q" series wire line coring equipment.<br><br>*NQ core barrel abandoned in bore hole |
| 54.4 | 178.5 | | | | | | |
| | | | Water level not measured due to the presence of drilling fluid. | | | | |

(See Report and Standard Plates for evaluation and descriptive terminology.)

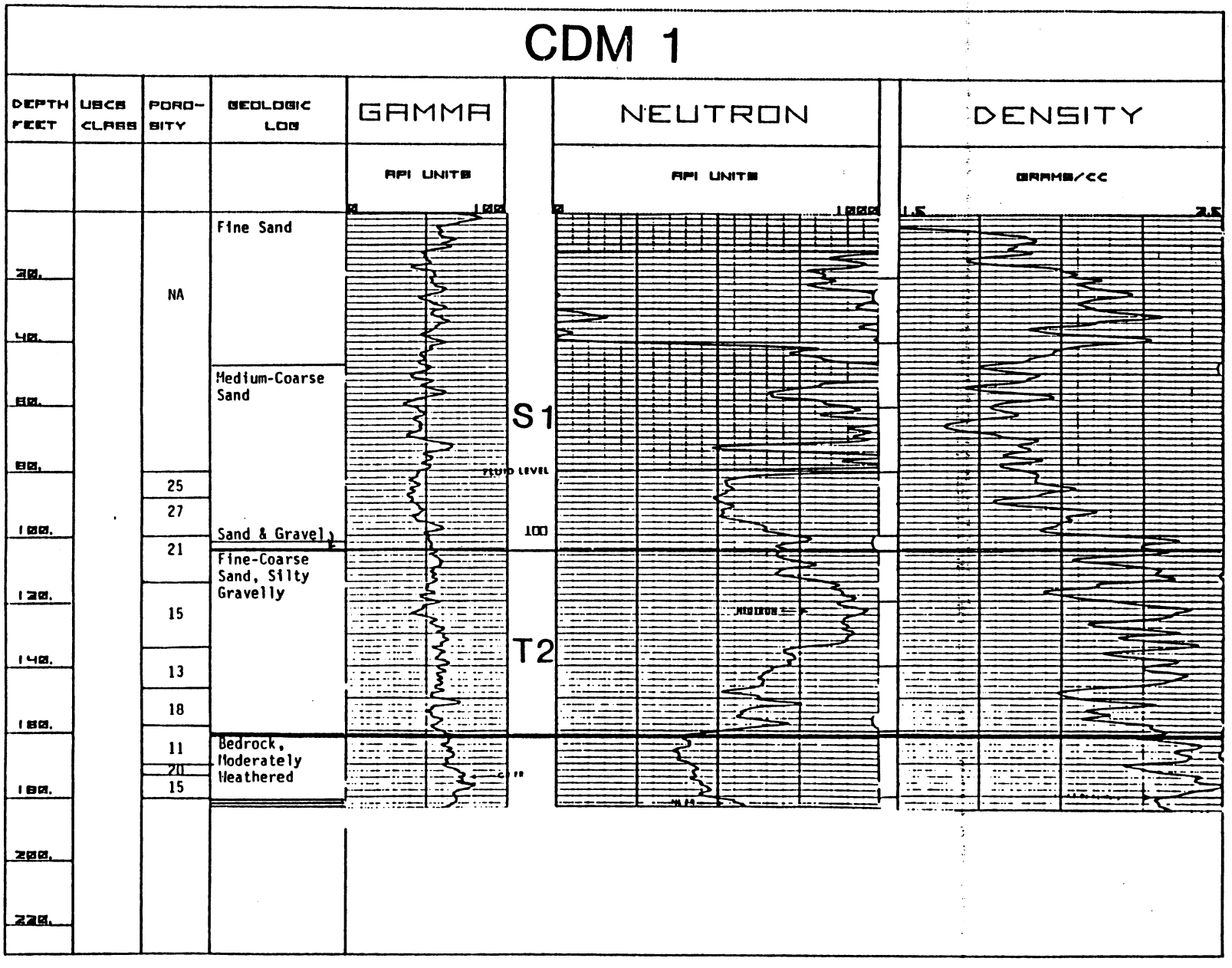
# Appendix 3.5-4

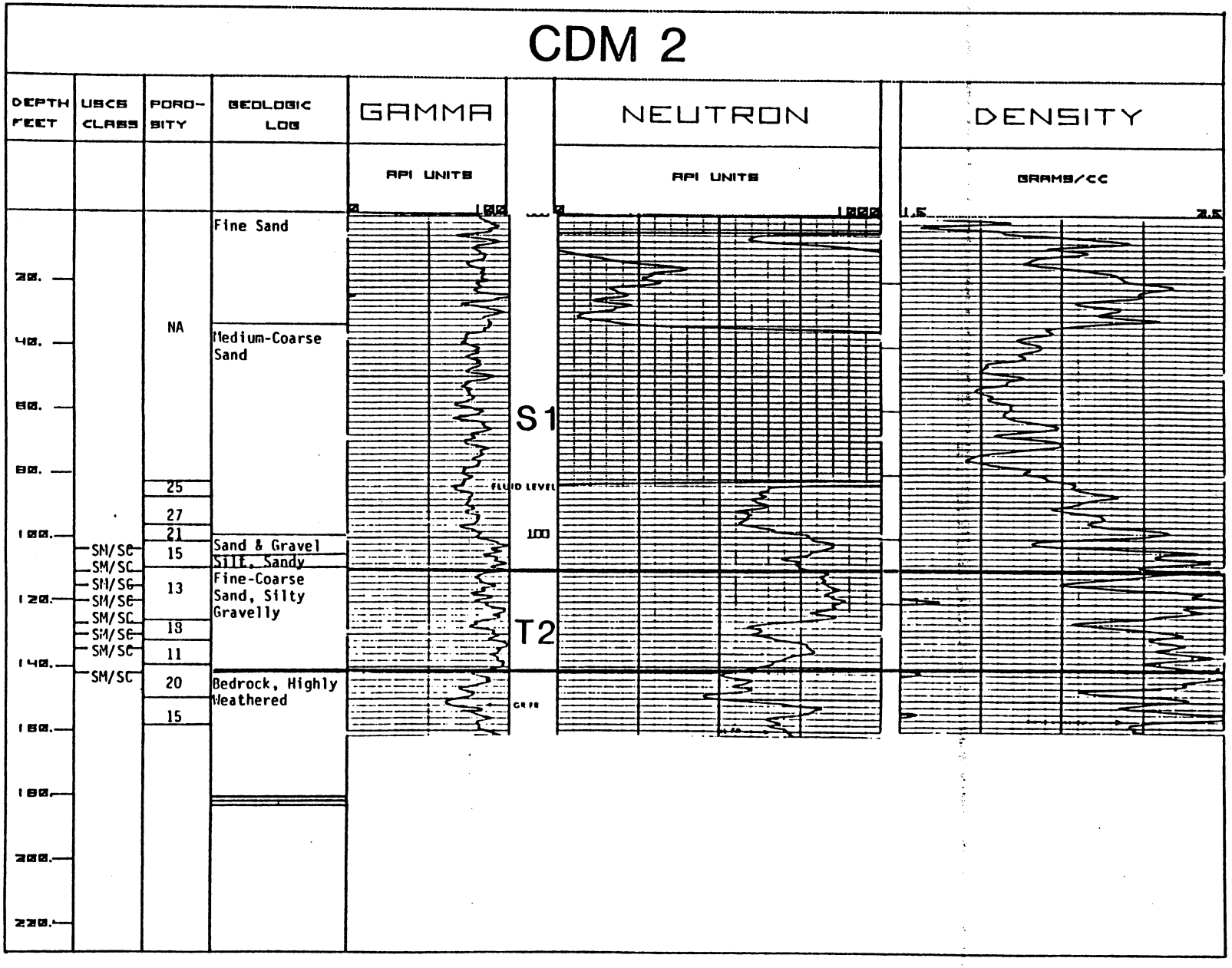
## Boring and Geophysical Logs for Camp, Dresser & McKee
## 1981 CDM Series Borings

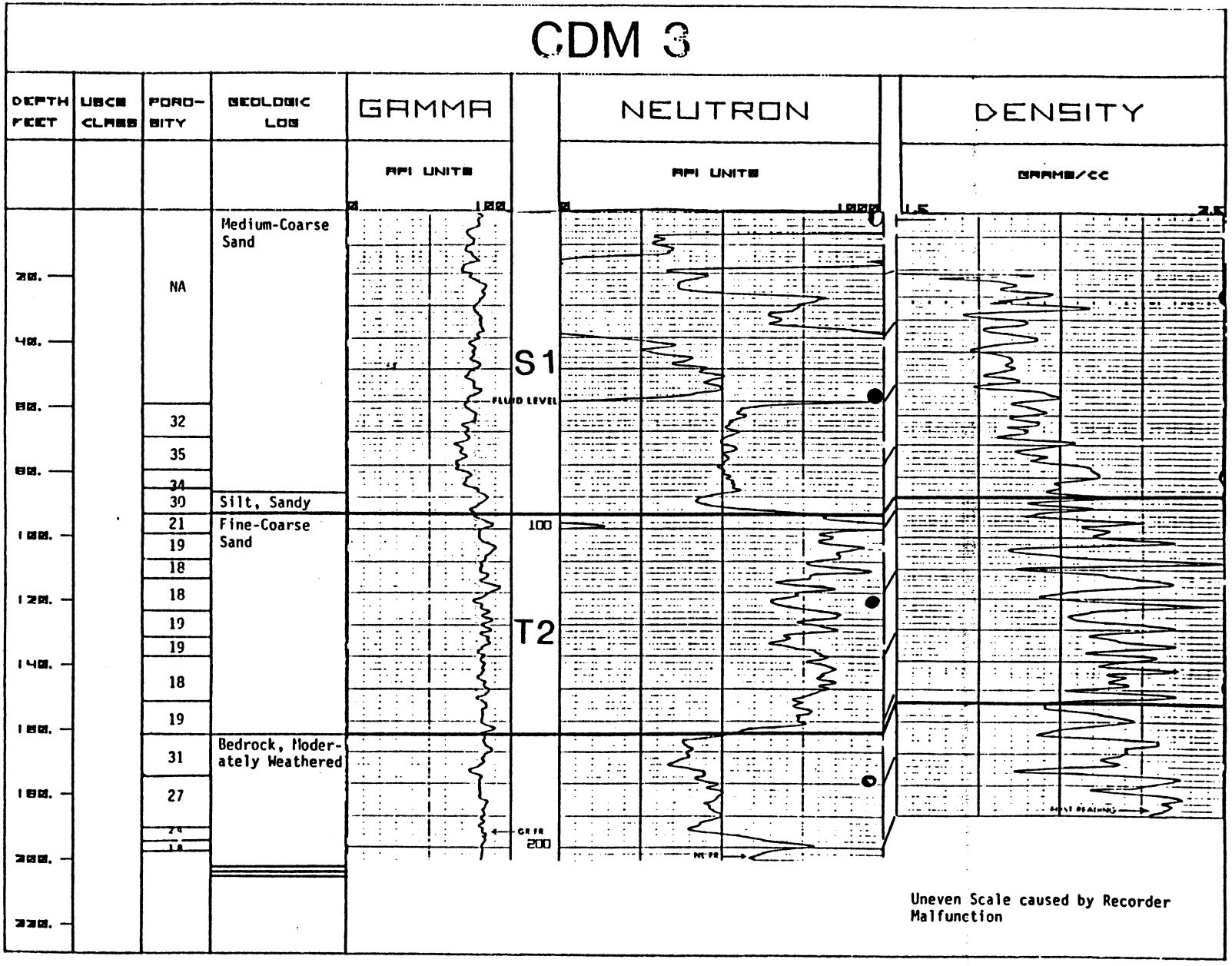
BORING LOGS

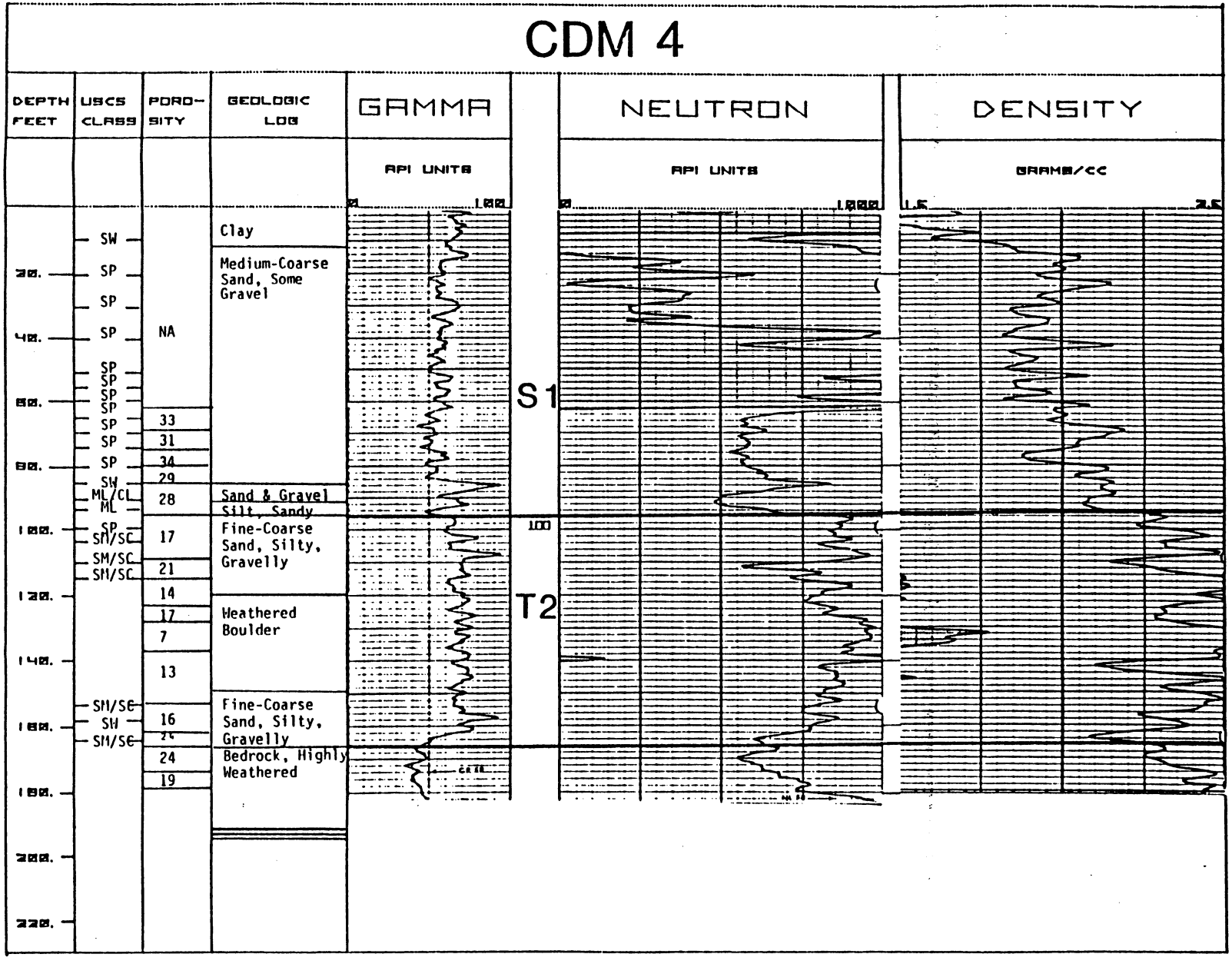
CAMP DRESSER & McKEE

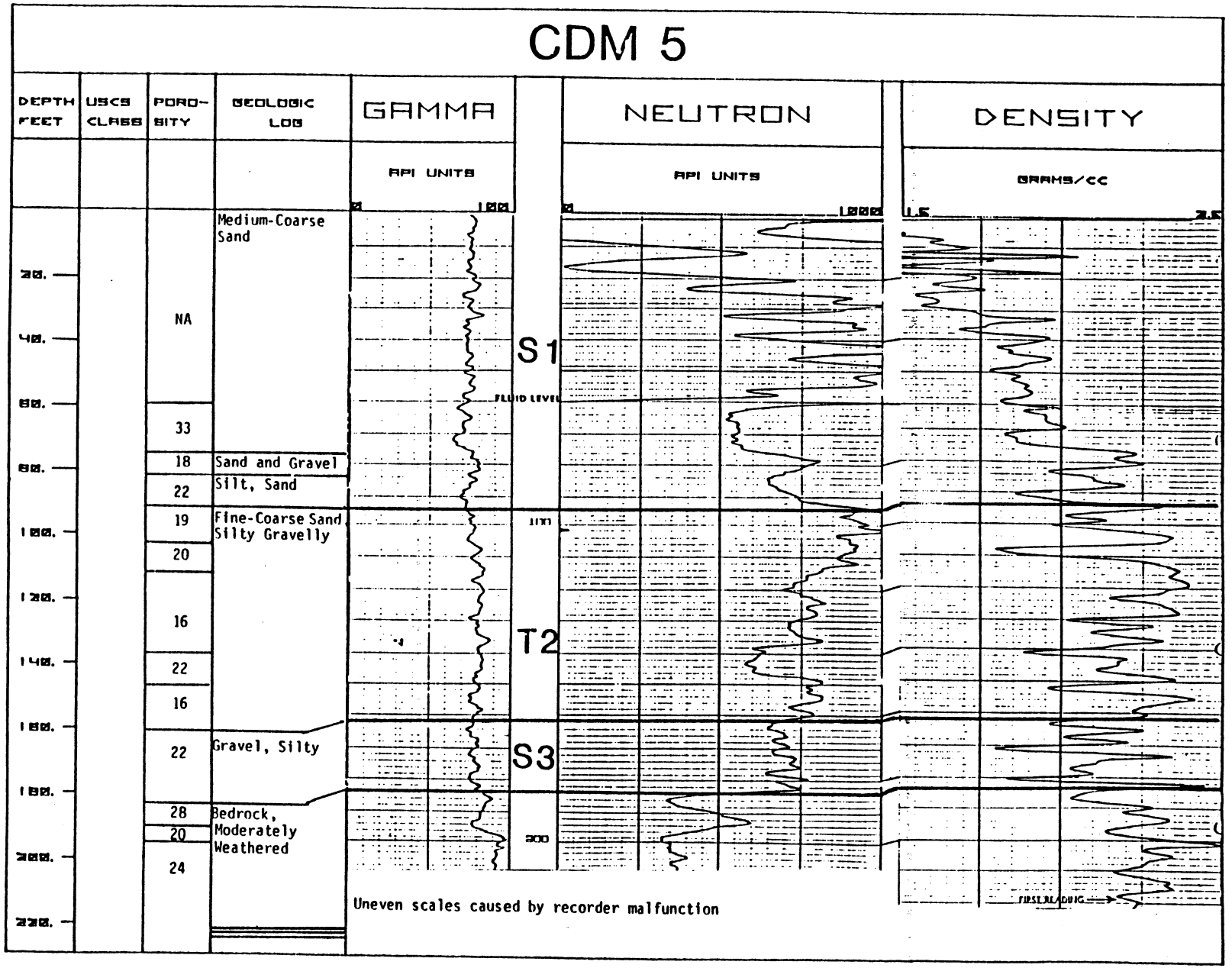
| Boring Logs | Number of Sheets |
|---|---|
| CDM 1 | 1 |
| CDM 2 | 1 |
| CDM 3 | 1 |
| CDM 4 | 1 |
| CDM 5 | 1 |
| CDM 6 | 1 |
| CDM 7 | 1 |
| CDM 8 | 1 |
| CDM 9 | 1 |
| CDM 10 | 1 |
| CDM 11 | 1 |
| CDM 12 | 1 |
| CDM 13 | 1 |
| CDM 14 | 1 |
| CDM 15 | 1 |
| CDM 16 | 1 |

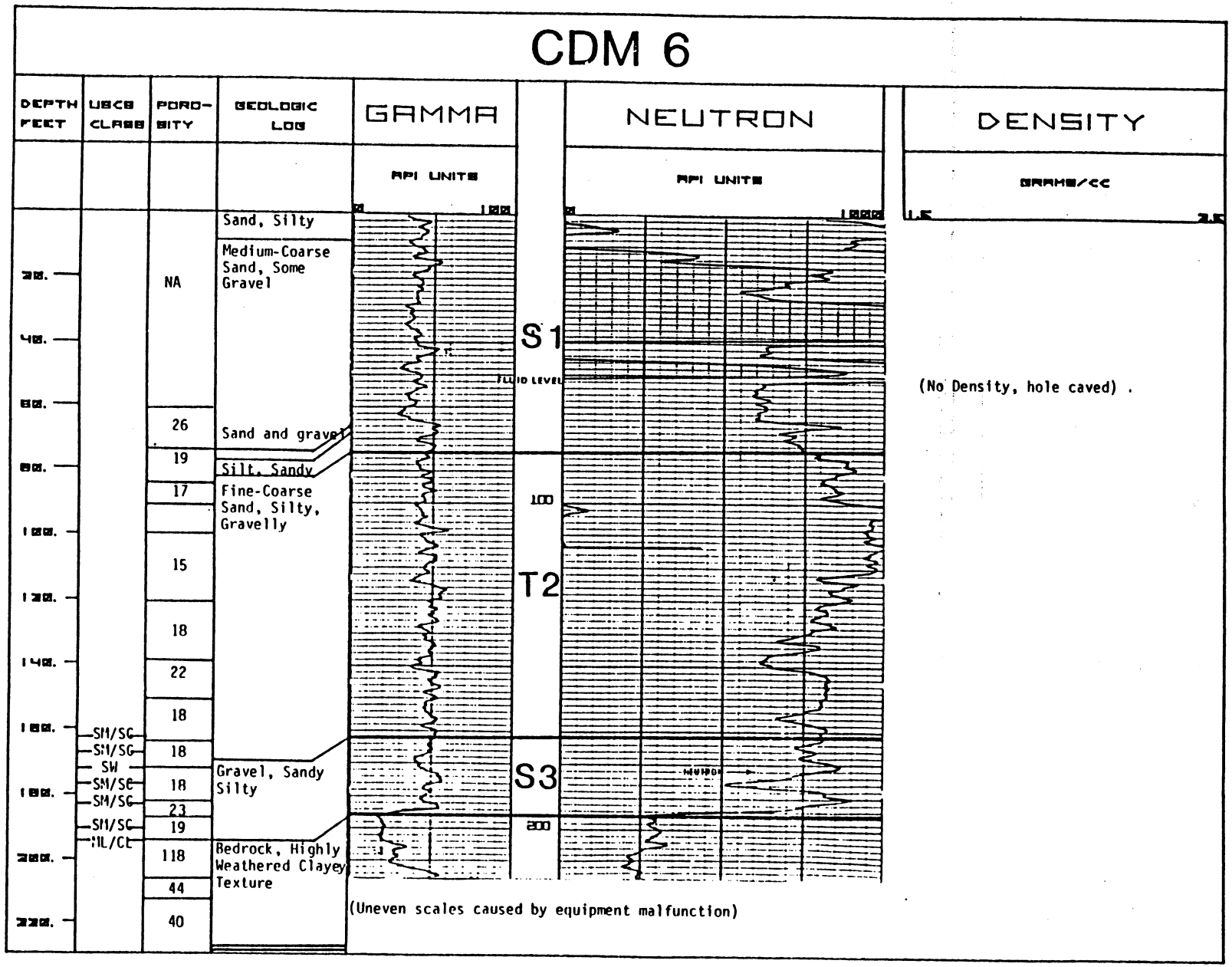

CDM 1
DEPTH FEET
USCS CLASS
POROSITY
GEOLOGIC LOG
GAMMA
API UNITS
0
100
NEUTRON
API UNITS
0
1000
DENSITY
GRAMS/CC
1.5
2.5
20.
40.
60.
80.
100.
120.
140.
160.
180.
200.
220.
NA
25
27
21
15
13
18
11
20
15
Fine Sand
Medium-Coarse Sand
Sand & Gravel
Fine-Coarse Sand, Silty Gravelly
Bedrock, Moderately Weathered
S1
FLUID LEVEL
100
T2

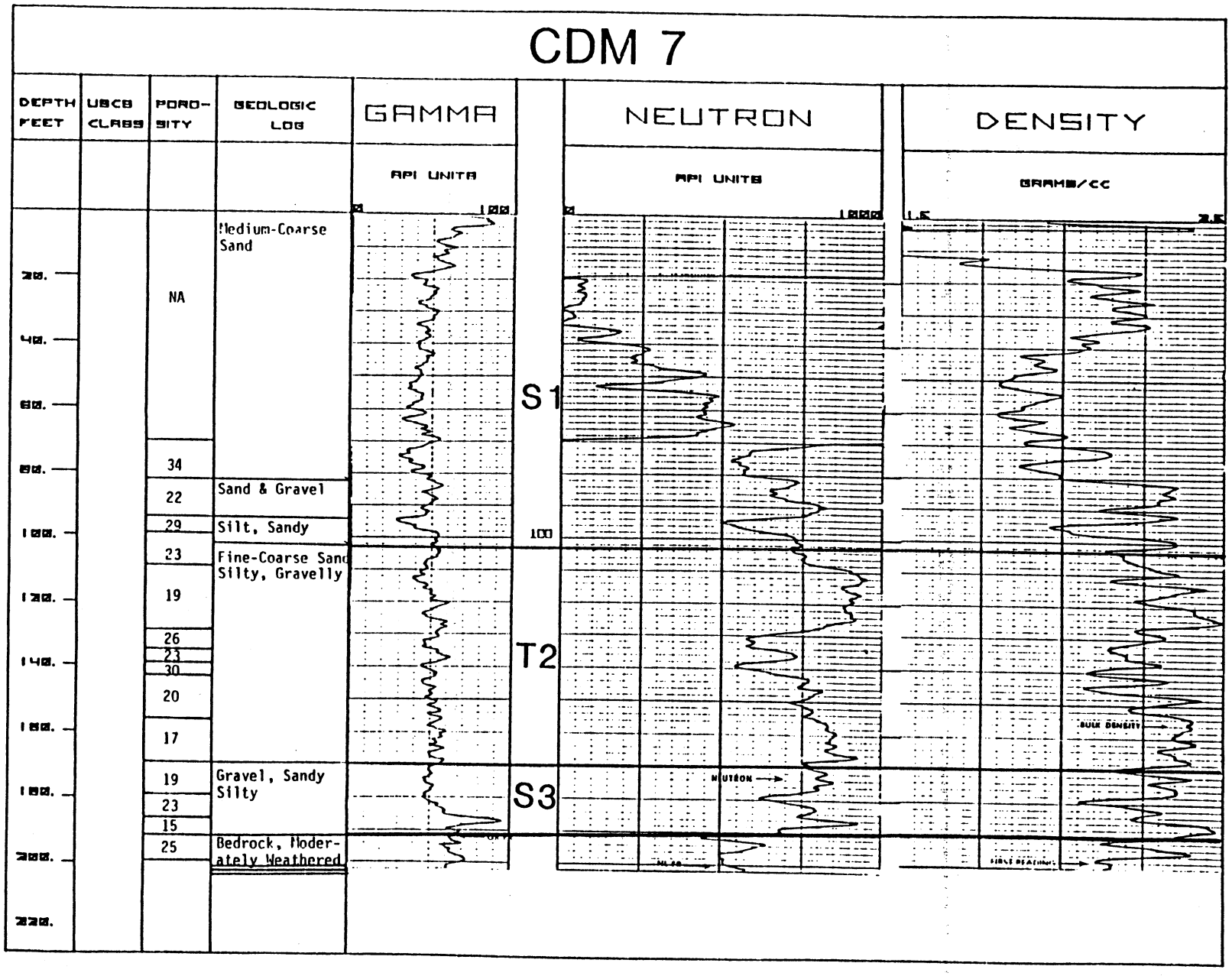

CDM 2
DEPTH FEET
USCS CLASS
POROSITY
GEOLOGIC LOG
GAMMA
API UNITS
0
100
NEUTRON
API UNITS
0
1000
DENSITY
GRAMS/CC
1.5
2.5
20.
40.
60.
80.
100.
120.
140.
160.
180.
200.
220.
Fine Sand
Medium-Coarse Sand
Sand & Gravel
Silt, Sandy
Fine-Coarse Sand, Silty Gravelly
Bedrock, Highly Weathered
NA
25
27
21
15
13
18
11
20
15
SM/SC
SM/SC
SM/SC
SM/SC
SM/SC
SM/SC
SM/SC
SM/SC
S1
FLUID LEVEL
100
T2

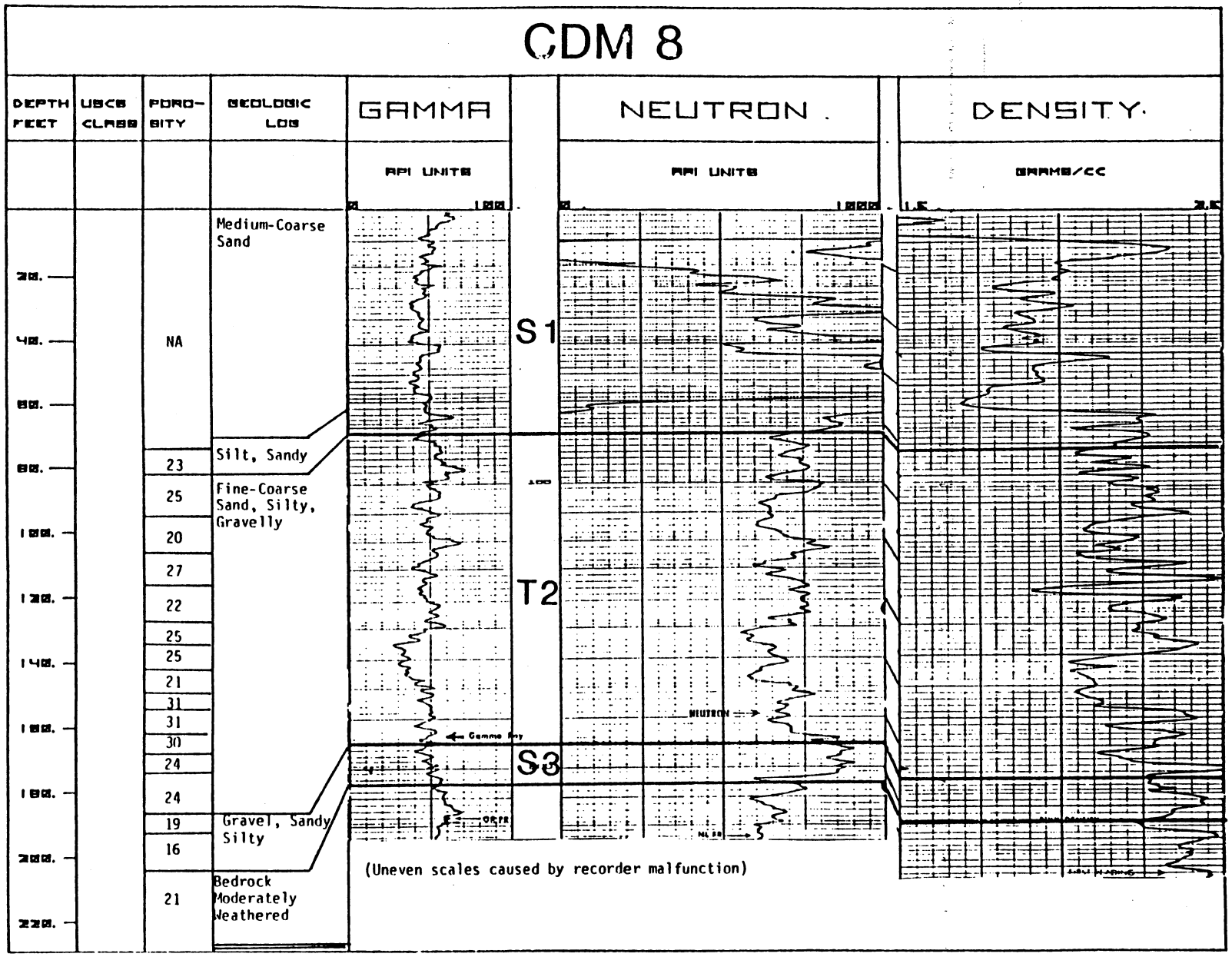

CDM 3
DEPTH FEET
USCS CLASS
POROSITY
GEOLOGIC LOG
GAMMA
API UNITS
NEUTRON
API UNITS
DENSITY
GRAMS/CC
Medium-Coarse Sand
Silt, Sandy
Fine-Coarse Sand
Bedrock, Moderately Weathered
NA
32
35
34
30
21
19
18
18
19
19
18
19
31
27
S1
FLUID LEVEL
100
T2
200
20.
40.
60.
80.
100.
120.
140.
160.
180.
200.
220.
Uneven Scale caused by Recorder Malfunction

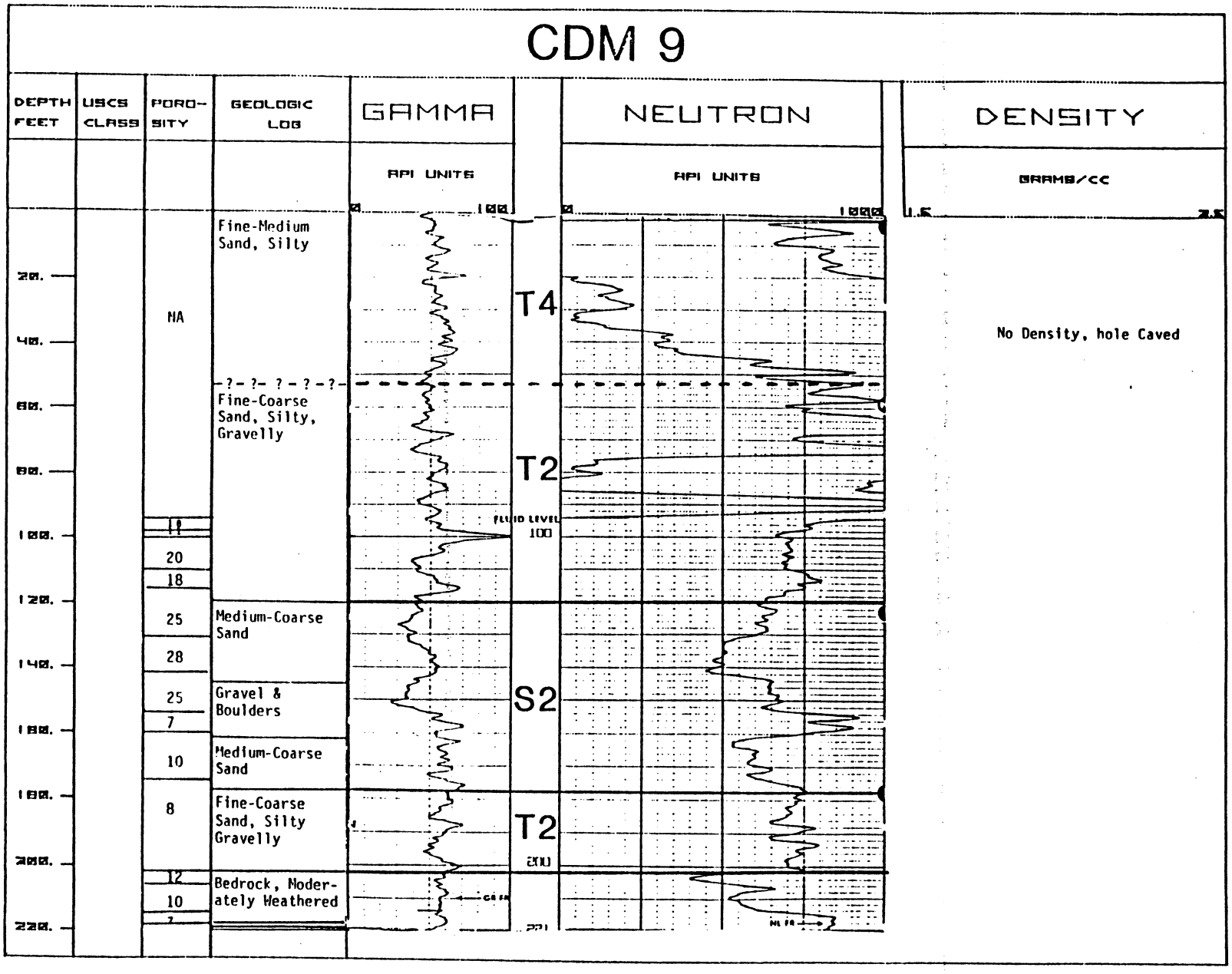

CDM 4
DEPTH FEET
USCS CLASS
POROSITY
GEOLOGIC LOG
GAMMA
API UNITS
0
100
NEUTRON
API UNITS
0
1000
DENSITY
GRAMS/CC
1.5
2.5
20.
40.
60.
80.
100.
120.
140.
160.
180.
200.
220.
SW
SP
SP
SP
SP
SP
SP
SP
SP
SP
SW
ML/CL
ML
SP
SM/SC
SM/SC
SM/SC
SM/SC
SW
SM/SC
NA
33
31
34
29
28
17
21
14
17
7
13
16
24
19
Clay
Medium-Coarse Sand, Some Gravel
Sand & Gravel
Silt, Sandy
Fine-Coarse Sand, Silty, Gravelly
Weathered Boulder
Fine-Coarse Sand, Silty, Gravelly
Bedrock, Highly Weathered
S1
100
T2

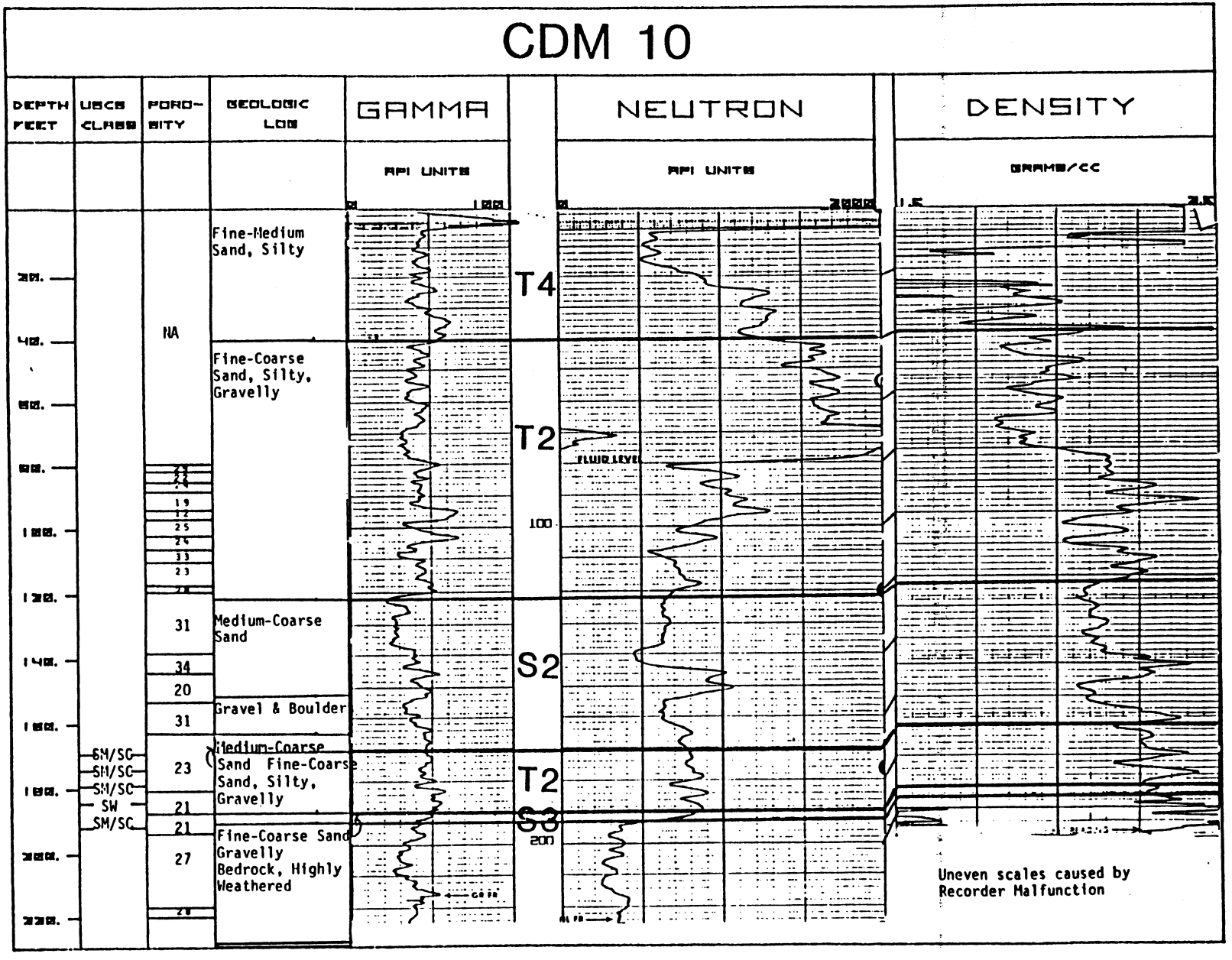

CDM 5
DEPTH FEET
USCS CLASS
POROSITY
GEOLOGIC LOG
GAMMA
API UNITS
0
100
NEUTRON
API UNITS
0
1000
DENSITY
GRAMS/CC
1.5
2.5
20.
40.
60.
80.
100.
120.
140.
160.
180.
200.
220.
NA
33
18
22
19
20
16
22
16
22
28
20
24
Medium-Coarse Sand
Sand and Gravel
Silt, Sand
Fine-Coarse Sand Silty Gravelly
Gravel, Silty
Bedrock, Moderately Weathered
S1
FLUID LEVEL
T2
S3
Uneven scales caused by recorder malfunction

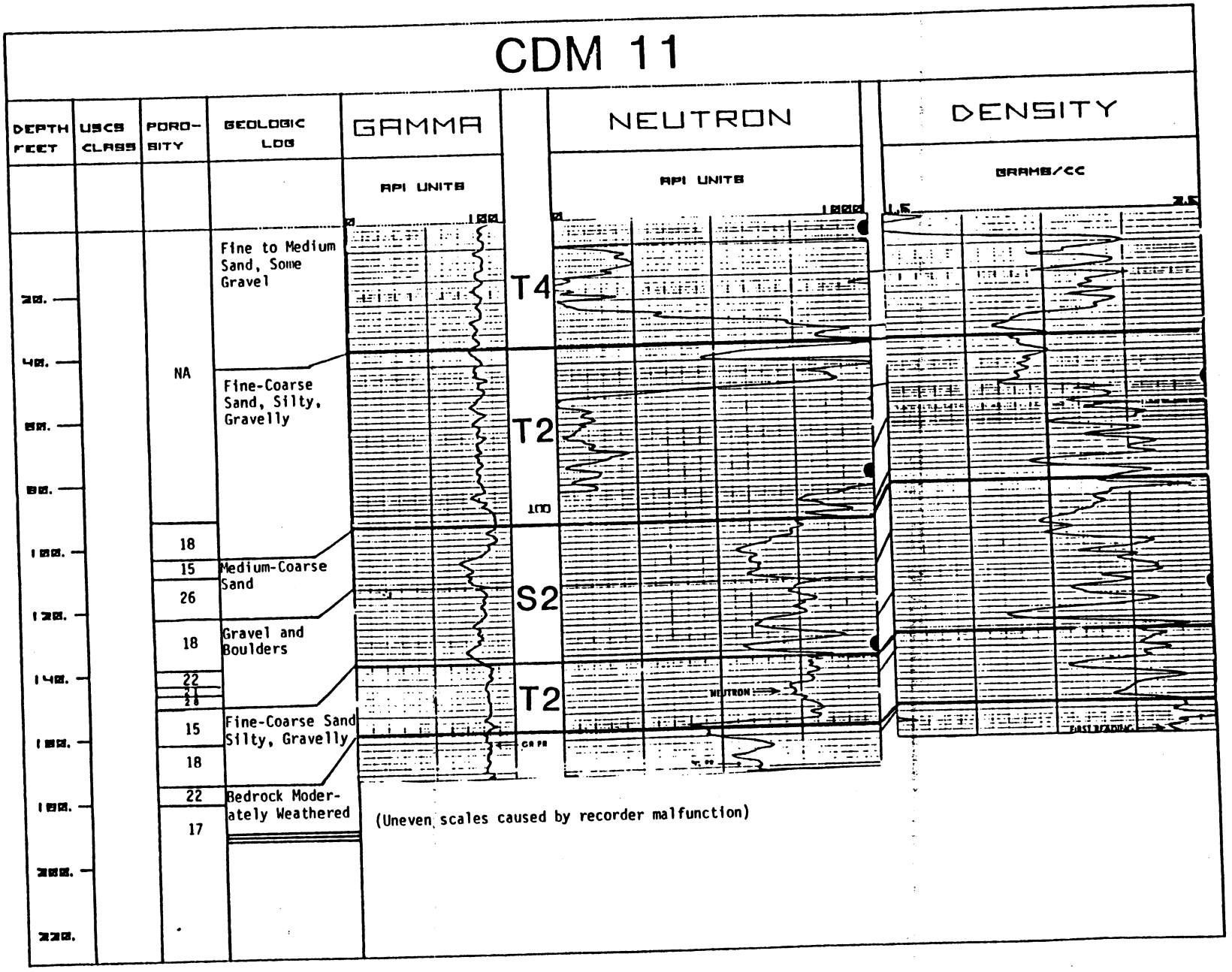

CDM 6
DEPTH FEET
USCS CLASS
POROSITY
GEOLOGIC LOG
GAMMA
API UNITS
NEUTRON
API UNITS
DENSITY
GRAMS/CC
Sand, Silty
Medium-Coarse Sand, Some Gravel
NA
Sand and gravel
26
Silt, Sandy
19
Fine-Coarse Sand, Silty, Gravelly
17
15
18
22
18
Gravel, Sandy Silty
SM/SC
SM/SC
SW
SM/SC
SM/SC
SM/SC
ML/CL
18
23
19
118
44
40
Bedrock, Highly Weathered Clayey Texture
S1
FLUID LEVEL
T2
S3
100
200
(No Density, hole caved) .
(Uneven scales caused by equipment malfunction)


CDM 7
DEPTH FEET
USCS CLASS
POROSITY
GEOLOGIC LOG
GAMMA
API UNITS
NEUTRON
API UNITS
DENSITY
GRAMS/CC
Medium-Coarse Sand
NA
34
Sand & Gravel
22
Silt, Sandy
29
Fine-Coarse Sand Silty, Gravelly
23
19
26
23
30
20
17
Gravel, Sandy Silty
19
23
15
Bedrock, Moderately Weathered
25
S1
T2
S3
20.
40.
60.
80.
100.
120.
140.
160.
180.
200.
220.

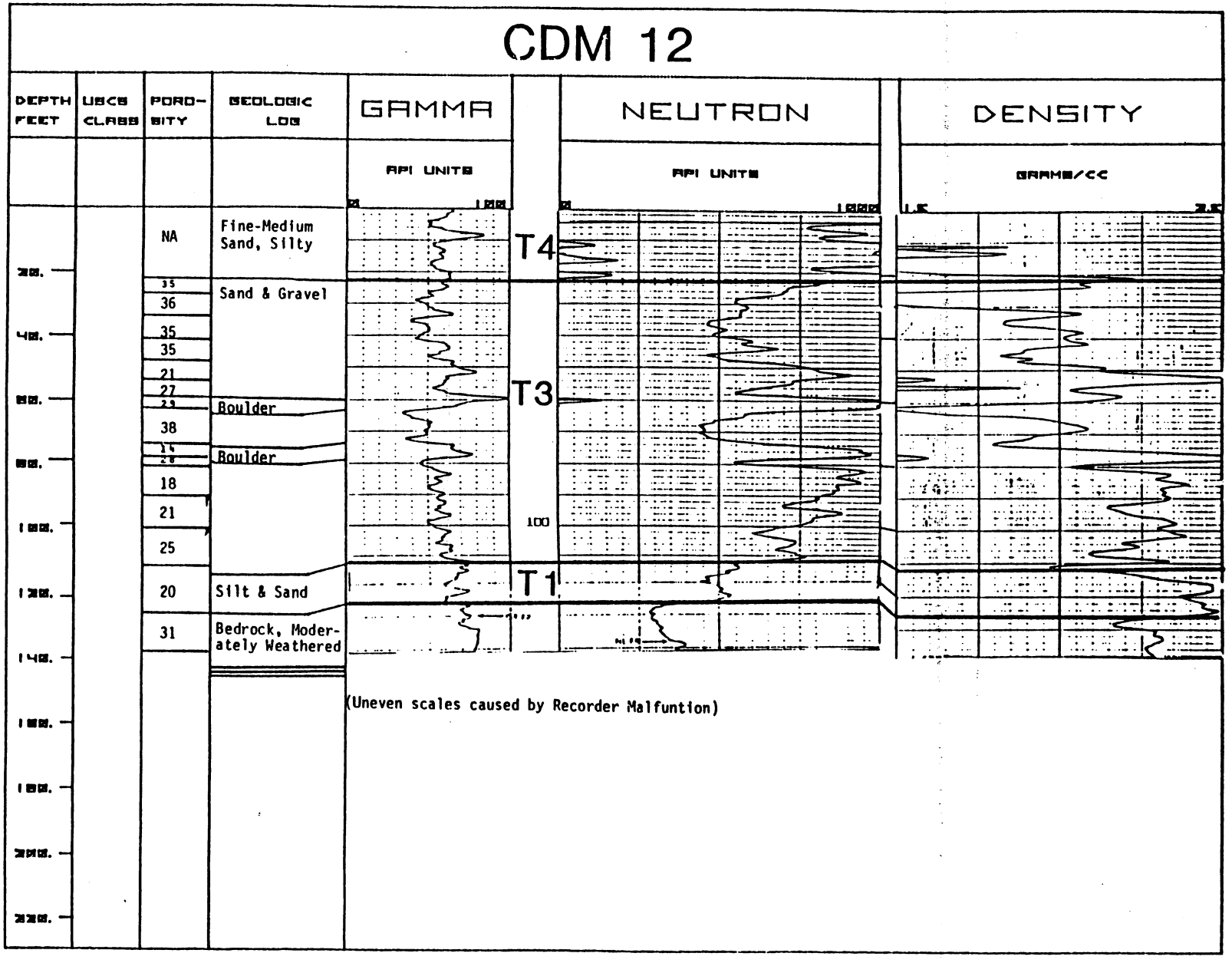

CDM 8
DEPTH FEET
USCS CLASS
POROSITY
GEOLOGIC LOG
GAMMA
API UNITS
NEUTRON
API UNITS
DENSITY
GRAMS/CC
20.
40.
60.
80.
100.
120.
140.
160.
180.
200.
220.
NA
23
25
20
27
22
25
25
21
31
31
30
24
24
19
16
21
Medium-Coarse Sand
Silt, Sandy
Fine-Coarse Sand, Silty, Gravelly
Gravel, Sandy Silty
Bedrock Moderately Weathered
S1
T2
S3
Gamma Ray
NEUTRON
(Uneven scales caused by recorder malfunction)

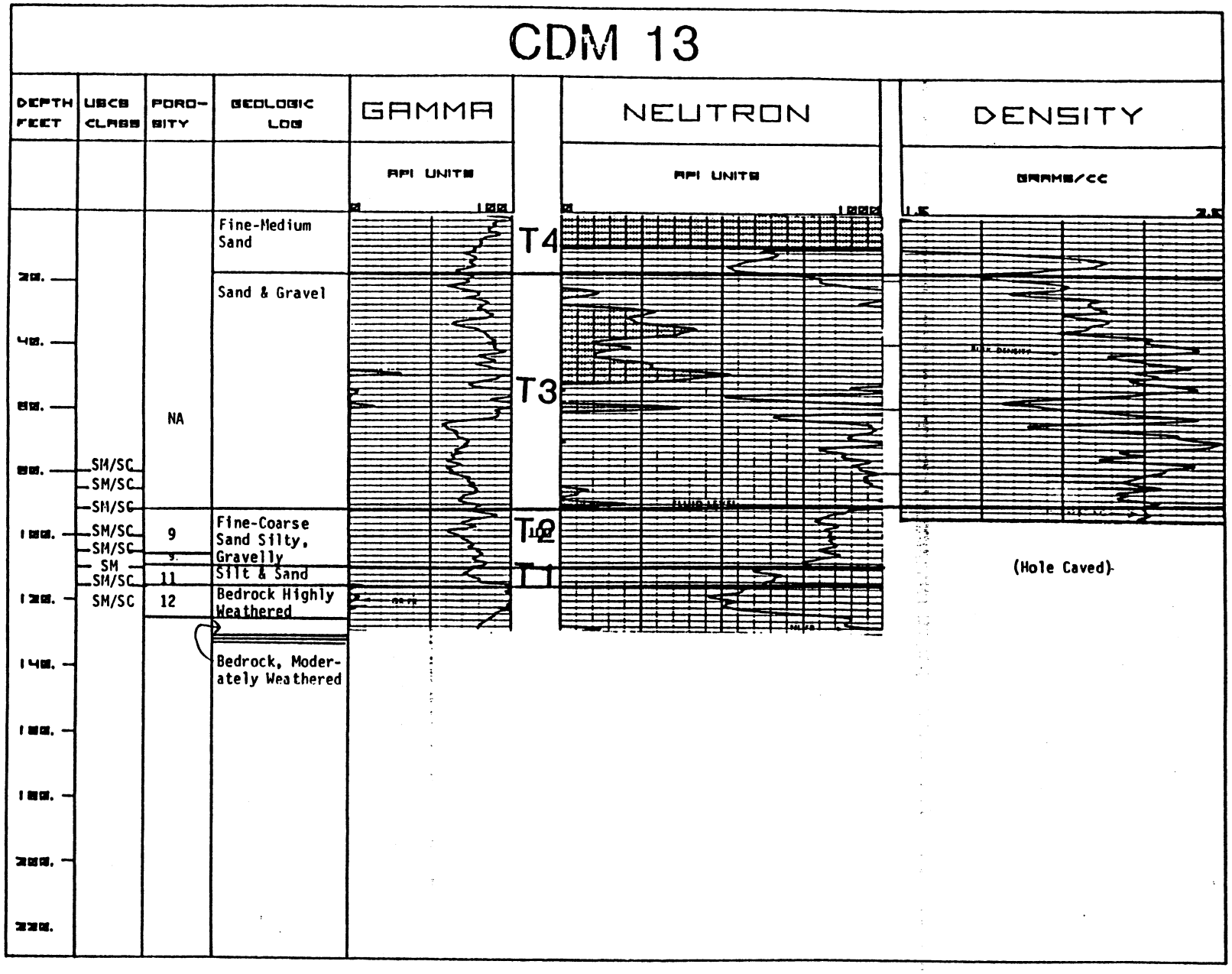

CDM 9
DEPTH FEET
USCS CLASS
POROSITY
GEOLOGIC LOG
GAMMA
API UNITS
0
100
NEUTRON
API UNITS
0
1000
DENSITY
GRAMS/CC
1.5
2.5
No Density, hole Caved
20.
40.
60.
80.
100.
120.
140.
160.
180.
200.
220.
NA
11
20
18
25
28
25
7
10
8
12
10
7
Fine-Medium Sand, Silty
Fine-Coarse Sand, Silty, Gravelly
Medium-Coarse Sand
Gravel & Boulders
Medium-Coarse Sand
Fine-Coarse Sand, Silty Gravelly
Bedrock, Moderately Weathered
T4
T2
S2
T2
FLUID LEVEL
100
200
221

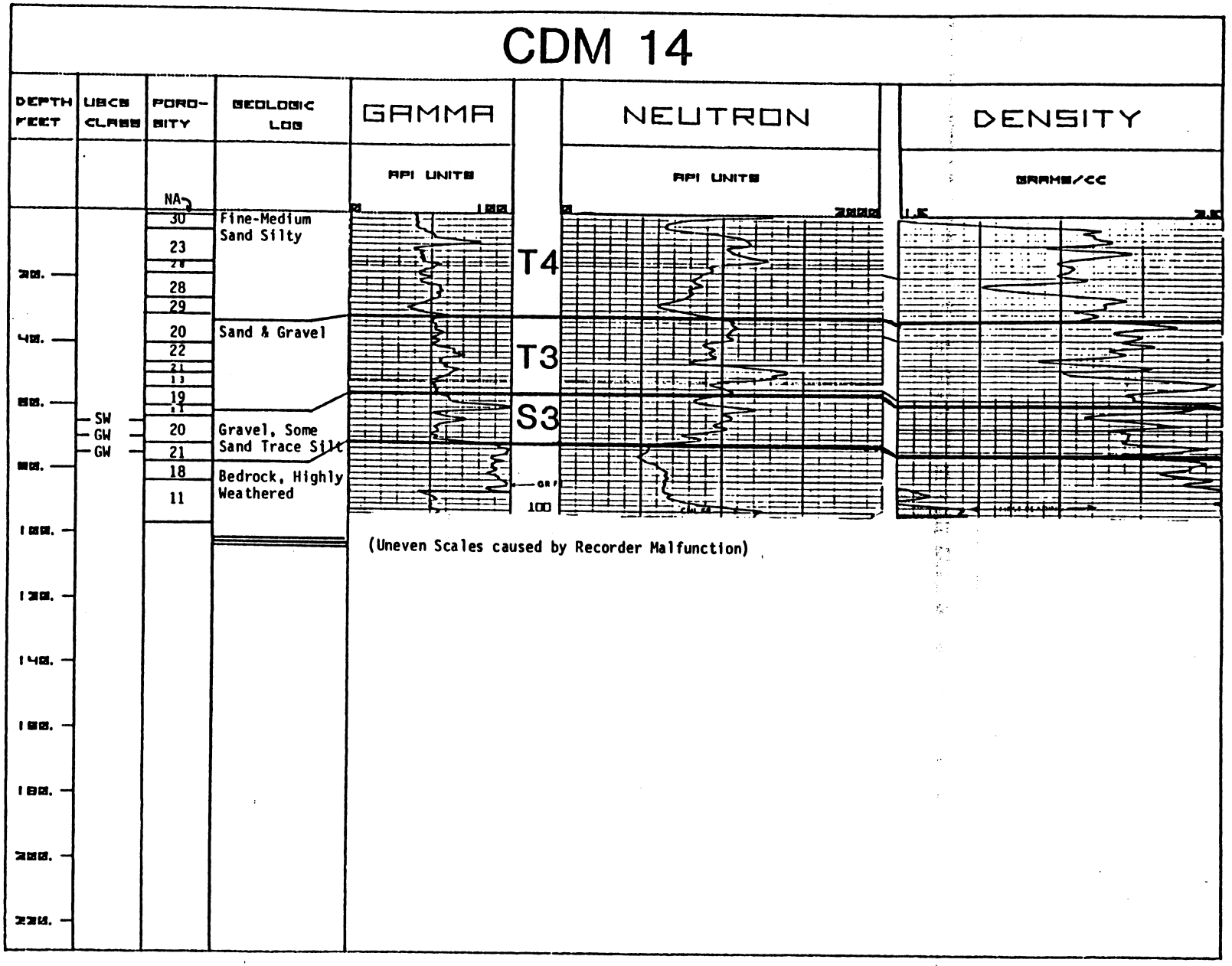

CDM 10
DEPTH FEET
USCS CLASS
POROSITY
GEOLOGIC LOG
GAMMA
API UNITS
NEUTRON
API UNITS
DENSITY
GRAMS/CC
Fine-Medium Sand, Silty
Fine-Coarse Sand, Silty, Gravelly
Medium-Coarse Sand
Gravel & Boulder
Medium-Coarse Sand Fine-Coarse Sand, Silty, Gravelly
Fine-Coarse Sand Gravelly Bedrock, Highly Weathered
NA
31
34
20
31
23
21
21
27
SM/SC
SM/SC
SM/SC
SW
SM/SC
T4
T2
FLUID LEVEL
S2
T2
S3
Uneven scales caused by Recorder Malfunction




(Uneven scales caused by recorder malfunction)

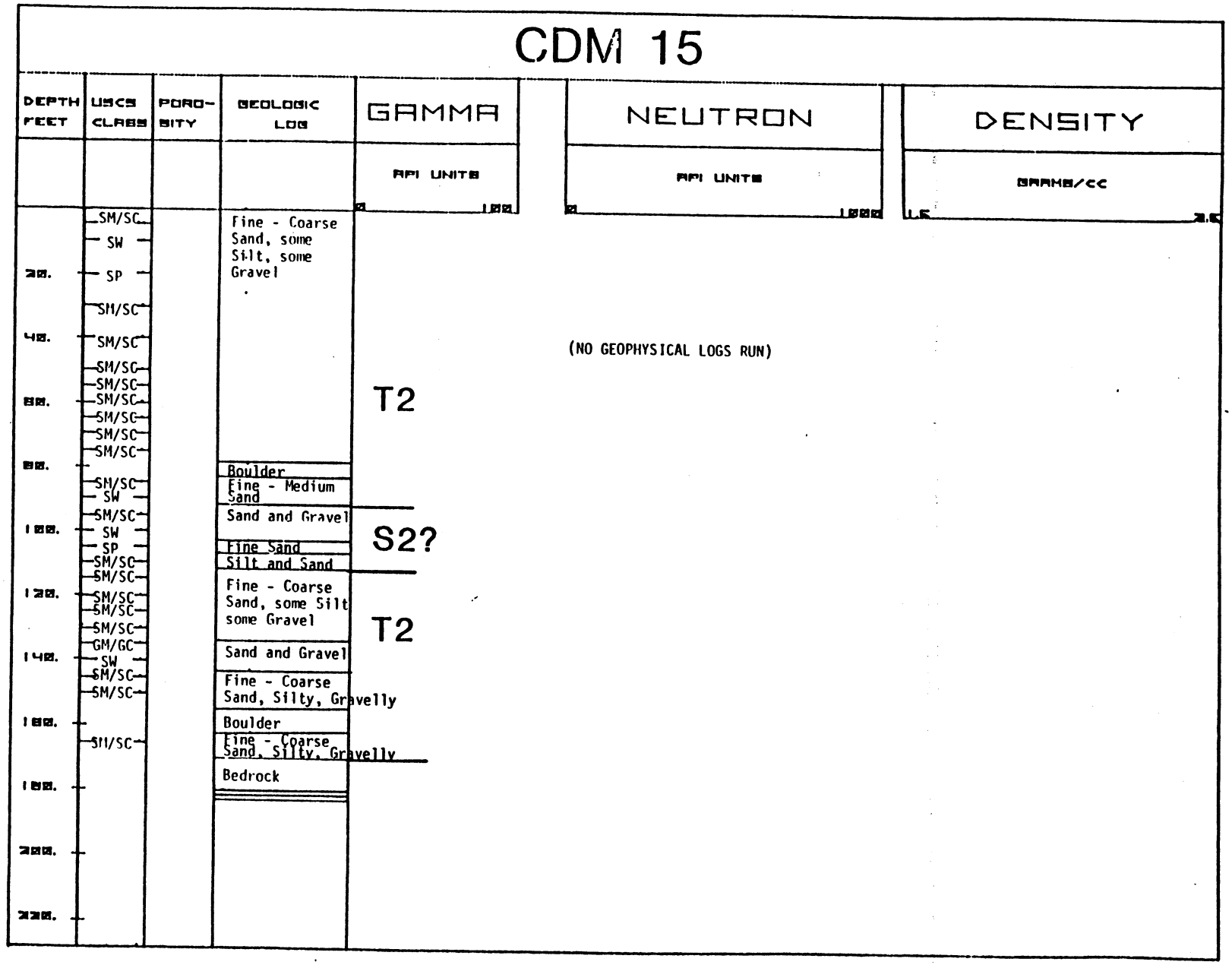

CDM 12
DEPTH FEET
USCS CLASS
POROSITY
GEOLOGIC LOG
GAMMA
API UNITS
NEUTRON
API UNITS
DENSITY
GRAMS/CC
NA
Fine-Medium Sand, Silty
35
36
35
35
21
27
29
Boulder
38
14
28
Boulder
18
21
25
20
Silt & Sand
31
Bedrock, Moderately Weathered
T4
T3
T1
100
(Uneven scales caused by Recorder Malfuntion)

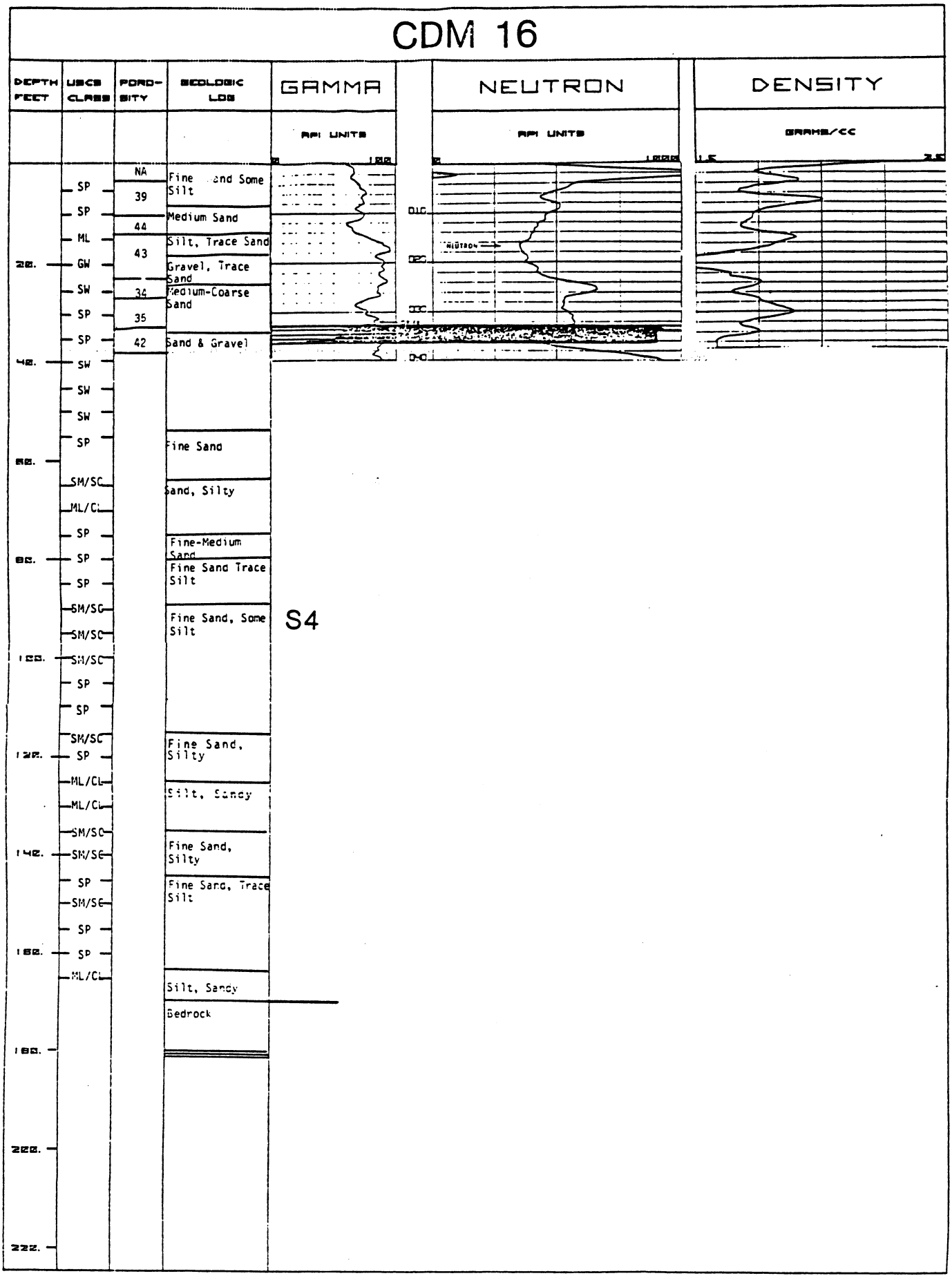

CDM 13
DEPTH FEET
USCS CLASS
POROSITY
GEOLOGIC LOG
GAMMA
API UNITS
NEUTRON
API UNITS
DENSITY
GRAMS/CC
20.
40.
60.
80.
100.
120.
140.
160.
180.
200.
220.
SM/SC
SM/SC
SM/SC
SM/SC
SM/SC
SM
SM/SC
SM/SC
NA
9
11
12
Fine-Medium Sand
Sand & Gravel
Fine-Coarse Sand Silty, Gravelly
Silt & Sand
Bedrock Highly Weathered
Bedrock, Moderately Weathered
T4
T3
T2
T1
(Hole Caved)




(Uneven Scales caused by Recorder Malfunction)

# CDM 15


DEPTH FEET
USCS CLASS
POROSITY
GEOLOGIC LOG
GAMMA
API UNITS
0
100
NEUTRON
API UNITS
0
1000
DENSITY
GRAMS/CC
1.5
3.0
20.
40.
60.
80.
100.
120.
140.
160.
180.
200.
220.
SM/SC
SW
SP
SM/SC
SM/SC
SM/SC
SM/SC
SM/SC
SM/SC
SM/SC
SM/SC
SM/SC
SW
SM/SC
SW
SP
SM/SC
SM/SC
SM/SC
SM/SC
SM/SC
GM/GC
SW
SM/SC
SM/SC
SM/SC
Fine - Coarse Sand, some Silt, some Gravel
Boulder
Fine - Medium Sand
Sand and Gravel
Fine Sand
Silt and Sand
Fine - Coarse Sand, some Silt some Gravel
Sand and Gravel
Fine - Coarse Sand, Silty, Gravelly
Boulder
Fine - Coarse Sand, Silty, Gravelly
Bedrock
T2
S2?
T2
(NO GEOPHYSICAL LOGS RUN)


CDM 16
DEPTH FEET
USCS CLASS
POROSITY
GEOLOGIC LOG
GAMMA
API UNITS
NEUTRON
API UNITS
DENSITY
GRAMS/CC
NA
39
44
43
34
35
42
SP
SP
ML
GW
SW
SP
SP
SW
SW
SW
SP
SM/SC
ML/CL
SP
SP
SP
SM/SC
SM/SC
SM/SC
SP
SP
SM/SC
SP
ML/CL
ML/CL
SM/SC
SM/SC
SP
SM/SC
SP
SP
ML/CL
20.
40.
60.
80.
100.
120.
140.
160.
180.
200.
220.
Fine and Some Silt
Medium Sand
Silt, Trace Sand
Gravel, Trace Sand
Medium-Coarse Sand
Sand & Gravel
Fine Sand
Sand, Silty
Fine-Medium Sand
Fine Sand Trace Silt
Fine Sand, Some Silt
Fine Sand, Silty
Silt, Sandy
Fine Sand, Silty
Fine Sand, Trace Silt
Silt, Sandy
Bedrock
S4

# Appendix 3.5-5

## Logs for STS Consultants, Ltd. 1984 WP and EX Series Borings (WP-1 through 7 and EX-1 through EX-16)

*(Note: Well construction information is included on the respective EX Series boring logs.)*

## APPENDIX A

### Summary of Driller's Observations During Well Point Installations

| Location | Depth Ft. | Depth M. | Soil Description |
|---|---|---|---|
| WP-1 | 0 | 0 | Peat |
| | 1 | 0.3 | Grayish brown silty fine to medium sand |
| | 30.0 | 9.1 | |
| WP-2 | 0 | 0 | Peat and green organic silt |
| | 24.0 | 7.3 | Brown medium to coarse sand |
| | 29.5 | 9.0 | |
| WP-3 | | | No observations |
| WP-4 | | | No observations |
| WP-5 | 0 | 0 | Peat |
| | 5.0 | 1.5 | Brown silty fine to medium sand with gravel |
| | 29.5 | 9.0 | |
| WP-6 | 0 | 0 | Peat |
| | 10.0 | 3.0 | Brown silty fine to medium sand with gravel |
| | 33.0 | 10.1 | |
| WP-7 | 0 | 0 | Brown silty fine to medium sand with gravel |
| | 30.0 | 9.1 | |

STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

SITE LOCATION: Crandon Project

LOG OF BORING NUMBER: EX-1

Feet: N-104151 E-2273714 Meters: N-31745 E-693029

WELL INSTALLATION
TOP STANDPIPE EL. +

DESCRIPTION OF MATERIAL

SURFACE ELEVATION 1555.48-ft. 474.111-m

| DEPTH FEET ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | SS | | | Brown silty fine to coarse sand (SM) - trace to little gravel | | | 15 | | | 40 | |
| | | | | | 5-24-84 ▽ | | | | | | | |
| 10 | 2 | SS | | | | BU | | 17 | | | 13 | |
| 20 | 3 | SS | | | | | | 22 | | | - | |
| | | | | | Brown slightly silty fine to coarse gravel (GP-GM) - little fine to coarse sand - boulders from 26 to 28.5' - coarse drift | | CD | 12 | | | 8 | |
| 30 | 4 | SS | | | | | | | | | | |
| 40 | 5 | SS | | | Brown slightly silty fine to coarse sand (SM-SP) - some gravel - coarse drift | BL | | 10 | | | - | $6x10^{-3}$ |
| 50 | 6 | SS | | | | | | 8 | | | 6 | |
| 60 | 7 | SS | | | | | CD | 11 | | | 6 | |
| 70 | 8 | SS | | | | | | 13 | | | - | |
| 80 | 9 | SS | | | | | | 13 | | | - | |
| 90 | | | | | Continued | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 2-28-84
BORING COMPLETED 2-29-84
RIG Denny's Drilling
FOREMAN Denny

STS OFFICE Green Bay
DRAWN BY
SHEET 1 OF 2
APP'D. BY JAS
STS JOB NO. 12959

BL 5-983

STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

LOG OF BORING NUMBER: EX-1

Feet: N-104151 E-2273714 Meters: N-31745 E-693029

SITE LOCATION: Crandon Project

WELL INSTALLATION TOP STANDPIPE EL. +

SURFACE ELEVATION 155.48-ft. 474.111-m

| DEPTH FEET / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Continued | | | | | | | |
| 90 | | | | | | | | | | | | |
| | 10 | SS | | | Brown slightly silty fine to coarse sand (SM-SP)- some gravel - coarse drift | | CD | 13 | | | 9 | |
| 100 | 11 | SS | | | | AU | | 14 | | | - | $6x10^{-3}$ |
| 110 | 12 | SS | | | Reddish brown silty fine to coarse sand (SM) - trace gravel - basal till | | | 16 | | | 32 | |
| 120 | 13 | SS | | | | AL | BT | 13 | | | - | $9x10^{-5}$ |
| 130 | | | | | | | | | | | | |
| 132.8 | 14 | SS | | | Bedrock - sample logged by Exxon | | | | | | | |
| | | | | | End of boring in bedrock<br>Boring advanced to 132.8' by rock bit and bentonite mud. | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 2-28-84
BORING COMPLETED 2-29-84
RIG Denny's Drilling
FOREMAN Denny

STS OFFICE Green Bay
DRAWN BY SD SHEET 2 OF 2
APP'D. BY JAS STS JOB NO. 12959

BL 5-983

STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

SITE LOCATION: Crandon Project

LOG OF BORING NUMBER: EX-2

Feet: N-110340 E-2262240

Meters: N-33632 E-689532

WELL INSTALLATION
TOP STANDPIPE EL. +

SURFACE ELEVATION 1592.11-ft. 485.276-m

| DEPTH FEET / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | SS | | | Brown silty fine to coarse sand (SM) - trace to some gravel - glacial till | | | - | | | 16 | |
| 10 | 2 | SS | | | | | | 6 | | | 16 | |
| 20 | 3 | SS | | | | | T | 8 | | | - | |
| 30 | 4 | SS | | | 5-24-84 ▽ | CL | | 10 | | | - | |
| 40 | 5 | SS | | | | | | 10 | | | 21 | |
| 50 | 6 | SS | | | Brown silty fine to medium sand (SM) - coarse drift | | | 11 | | | 16 | |
| 60 | 7 | SS | | | | | CD | 16 | | | – | |
| 70 | 8 | SS | | | Brown slightly silty fine to medium sand (SM-SP) - coarse drift | AU | | 17 | | | 6 | $5 \times 10^{-3}$ |
| 80 | 9 | SS | | | | | CD | 18 | | | 8 | |
| 90 | | | | | Brown very fine sandy silt (ML) - lacustrine | | | | | | | |

Continued

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 3-26-84
BORING COMPLETED 3-28-84
RIG Denny's Drilling
FOREMAN Denny

STS OFFICE 540 Lambeau Street, Green Bay, WI. 494-9656
DRAWN BY SD
SHEET 1 OF 3
APP'D. BY JAS
STS JOB NO. 12959

BL 5-983

STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

LOG OF BORING NUMBER: EX-2

Feet: N-110340 E-2262240 Meters: N-33632 E-689532

SITE LOCATION: Crandon Project

WELL INSTALLATION TOP STANDPIPE EL. +

SURFACE ELEVATION 1592.11-ft. 485.276-m

| DEPTH FEET / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Continued | | | | | | | |
| 90 | | | | | | | | | | | | |
| | 10 | SS | | | Brown very fine sandy silt (ML) - lacustrine | | L | 22 | | | 55 | |
| 100 | | | | | Reddish brown silty clay (CL) - includes varves of gray silt and very fine sand - lacustrine | | | | | | | |
| | 11 | SS | | | | | L | 14 | | | 85 | |
| 110 | | | | | Reddish brown silty fine to coarse sand (SM) - trace gravel - glacial till | | | | | | | |
| | 12 | SS | | | | | | 11 | | | 24 | |
| 120 | | | | | | | | | | | | |
| | 13 | SS | | | | | T | 12 | | | - | |
| 130 | | | | | | | | | | | | |
| | 14 | SS | | | | | | 11 | | | - | |
| 140 | | | | | | | | | | | | |
| | 15 | SS | | | | | | 10 | | | 30 | |
| 150 | | | | | Brown silty fine to medium sand (SM) - fine drift | | | | | | | |
| | 16 | SS | | | | | AL FD | 14 | | | 14 | 7x10⁻⁴ |
| 160 | | | | | | | | | | | | |
| | 17 | SS | | | | | | 21 | | | 31 | |
| 170 | | | | | | | | | | | | |
| | | | | | Continued | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL-T. PIPE | DATE | TIME | WL-T PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 3-26-84

BORING COMPLETED 3-28-84

RIG Denny's Drilling

FOREMAN Denny

STS OFFICE 540 Lambeau Street Green Bay, WI. 414-494-9656

DRAWN BY SD SHEET 2 OF 3

APP'D. BY JAS STS JOB NO. 12959

BL 5-983

STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

SITE LOCATION: Crandon Project

LOG OF BORING NUMBER: EX-2

Feet: N-110340 E-2262240 Meters: N-33632 E-689532

WELL INSTALLATION
TOP STANDPIPE EL. +

SURFACE ELEVATION 1592.11-ft. 485.276-m

| DEPTH FEET ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Continued | | | | | | | |
| 170 | 18 | SS | | | Reddish brown silty clay (CL-CH) - varves of gray silt and high plasticity clay - lacustrine | | L | 25 | | | 96 | |
| 180 | 19 | SS | | | Grayish brown silty fine to coarse sand (SM) - little gravel - weathered boulders - basal till | | BT | 9 | | | - | |
| 190 | | | | | | | | | | | | |
| 192 | | | | | End of boring on bedrock<br>Boring advanced to 192' by rock bit and bentonite mud. | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 3-26-84
BORING COMPLETED 3-28-84
RIG Denny' Drilling
FOREMAN Denny

STS OFFICE 540 Lambeau Street Green Bay, WI. 414-494-9656
DRAWN BY SD SHEET 3 OF 3
APP'D. BY JAS STS JOB NO. 12959

BL. 5 983

STS Consultants Ltd.

OWNER: Exxon Minerals Company

LOG OF BORING NUMBER: EX-3

PROJECT NAME: Piezometer Installations

Feet: N-110285 E-2263941 | Meters: N-33615 E-690051

SITE LOCATION: Crandon Project

WELL INSTALLATION
TOP STANDPIPE EL. +

SURFACE ELEVATION 1559.09-ft. 475.212-m

| DEPTH FEET / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | SS | | | Brown slightly silty fine to coarse sand (SM-SP)- some gravel | | | 7 | | | 6 | |
| 10 | | | | | 5-24-84 ▽ | CL | | | | | | |
| | 2 | SS | | | Brown fine sand (SP) - fine drift | | FD | 22 | | | 2 | |
| 20 | 3 | SS | | | Reddish brown silty clay (CL) - varves of gray sandy silt (ML) - lacustrine | | L | 29 | | | 75 | |
| 30 | 4 | SS | | | Reddish brown silty fine sand (SM) - varves of gray silt and red clay - lacustrine | | L | 20 | | | 34 | |
| 40 | 5 | SS | | | Brown slightly silty fine sand (SM-SP) - fine drift | BU | FD | 19 | | | -- | $2x10^{-3}$ |
| 50 | 6 | SS | | | | | | 18 | | | 7 | |
| 60 | 7 | SS | | | Brown silty fine to coarse sand (SM) - trace gravel, glacial till, boulder from 64.0 to 65.0 feet | | T | 12 | | | 45 | |
| 70 | 8 | SS | | | Brown slightly silty fine to coarse sand (SM-SP) - waterbearing - coarse drift | BL | CD | 11 | | | 8 | $1x10^{-3}$ |
| 80 | 9 | SS | | | | | | 12 | | | - | |
| 90 | | | | | Continued | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | ACR | |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 3-29-84
BORING COMPLETED 3-31-84
RIG Denny's Drilling
FOREMAN Denny

STS OFFICE 540 Lambeau Green Bay, WI 54303
DRAWN BY SMD SHEET 1 OF 2
APP'D. BY JAS STS JOB NO. 12959

BL 5-983

STS Consultants Ltd.

OWNER
Exxon Minerals Company

PROJECT NAME
Piezometer Installations

SITE LOCATION
Crandon Project

LOG OF BORING NUMBER
EX-3 Continued

Feet: M-110285 E-2263941 Meters: N-33615 E-690051

WELL INSTALLATION
TOP STANDPIPE EL. +

SURFACE ELEVATION 1559.09-ft. 475.212-m

| DEPTH FEET ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 90 | | | | | | | | | | | | |
| | 10 | SS | | | Brown slightly silty fine to coarse sand (SM-SP) - waterbearing - coarse drift | | CD | 15 | | | -- | |
| 100 | | | | | | | | | | | | |
| | 11 | SS | | | Brown silty fine sand (SM) - fine drift | AU | FD | 18 | | | 23 | |
| 110 | | | | | | | | 19 | | | -- | $1 \times 10^{-3}$ |
| | 12 | SS | | | | | | | | | | |
| 120 | | | | | | | | | | | | |
| | 13 | SS | | | | | | 20 | | | 24 | |
| 130 | | | | | | | | | | | | |
| | 14 | SS | | | Reddish brown silty fine to coarse sand (SM) - trace to a little gravel - basal till | | BT | 14 | | | -- | |
| 140 | | | | | | | | | | | | |
| | 15 | SS | | | | AL | | 10 | | | 29 | $3 \times 10^{-4}$ |
| 150 | | | | | | | | | | | | |
| | 16 | SS | | | | | | 11 | | | 40 | |
| 160 | | | | | Weathered bedrock - cuttings logged by Exxon | | | | | | | |
| 162 | | | | | End of Boring in Bedrock<br>Boring advanced to 162.0 feet with rockbit and bentonite mud | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | | BCR | | | ACR |
|---|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

BORING STARTED 3-29-84
BORING COMPLETED 3-31-84
RIG Denny's Drilling
FOREMAN Denny

STS OFFICE 540 Lambeau Green Bay, WI 54303
DRAWN BY SMD SHEET 2 OF 2
APP'D. BY JAS STS JOB NO. 12959

BL 5-983

STS Consultants Ltd.

**OWNER** Exxon Minerals Company

**PROJECT NAME** Piezometer Installations

**SITE LOCATION** Crandon, Wisconsin

**LOG OF BORING NUMBER** EX-4

Feet N-119912 E-2274288 Meters N-36549 E-693204

WELL INSTALLATION
TOP STANDPIPE EL. +

| DEPTH FEET / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1573.87-ft. 479.717-m | | | | | | | |
| | 1 | SS | | | Brown silty fine to medium sand (SM) - trace of fine gravel | | | 8 | | | 25 | |
| | 2 | SS | | | Brown slightly silty fine sand (SM-SP) - trace of fine gravel | | | 9 | | | 10 | |
| 10 | 3 | SS | | | | | | 6 | | | 4 | |
| | 4 | SS | | | Brown fine to coarse sand (SP) - trace to some fine gravel- coarse drift 5-24-84 ▽ | CL | CD | 7 | | | 5 | |
| 20 | NR | | | | | | | | | | | |
| 30 | 5 | SS | | | | | | 10 | | | 11 | |
| | 6 | SS | | | Brown slightly silty fine to coarse sand (SM-SP)- trace to some fine gravel - glacial till | BU | T | 11 | | | 10 | $7x10^{-4}$ |
| 40 | 7 | SS | | | Boulders from 42.0 to 43.0 feet and 47.0 to 48.0 feet | | | 5 | | | 10 | |
| | 8 | SS | | | | | | 9 | | | 7 | |
| 50 | 9 | SS | | | Brown slightly silty fine gravel (GM-GP) - some fine to coarse sand | | CD | 8 | | | 6 | |
| | 10 | SS | | | Brown slightly silty fine sand (SM-SP) - trace of fine gravel | | CD | 13 | | | 9 | |
| 60 | 11 | SS | | | Brown silty fine sand (SM) | | CD | 13 | | | 16 | |
| | 12 | SS | | | Driller's note: Obstruction at 60.0 feet probable boulder | BL | | 13 | | | 12 | $1x10^{-3}$ |
| 70 | 13 | SS | | | Brown slightly silty fine to coarse sand (SM-SP)- trace of fine gravel- coarse drift | | CD | 12 | | | 9 | |
| | 14 | SS | | | | | | 13 | | | 6 | |
| 80 | 15 | SS | | | | | | 12 | | | 7 | |
| | 16 | SS | | | Brown slightly silty fine sand (SM-SP) | | FD | 21 | | | 7 | |
| 90 | | | | | CONTINUED | | | | | | | |

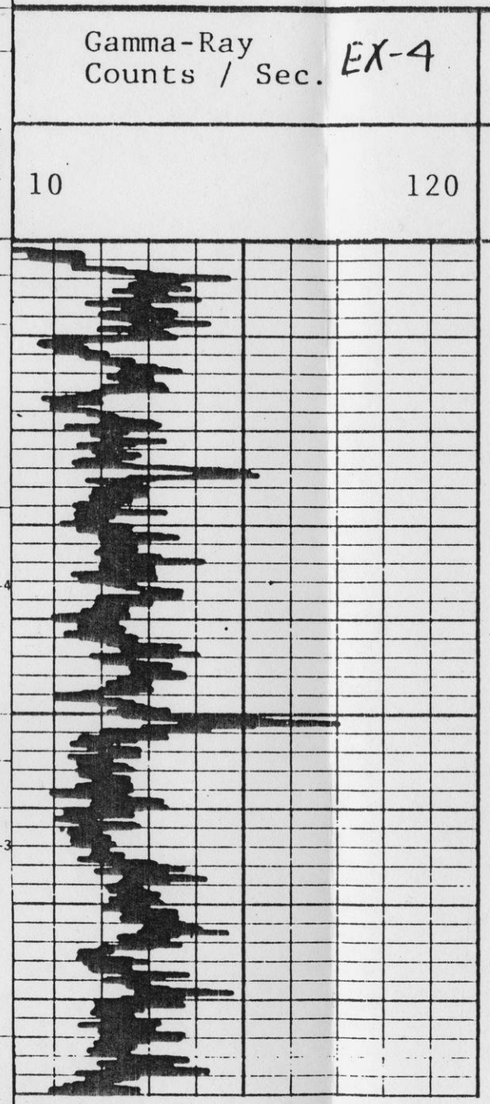
The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | BCR | | ACR | | |
|---|---|---|---|---|---|
| WL-T. PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 1-30-84
BORING COMPLETED 2-2-84
RIG Denny's Drilling
FOREMAN Denny

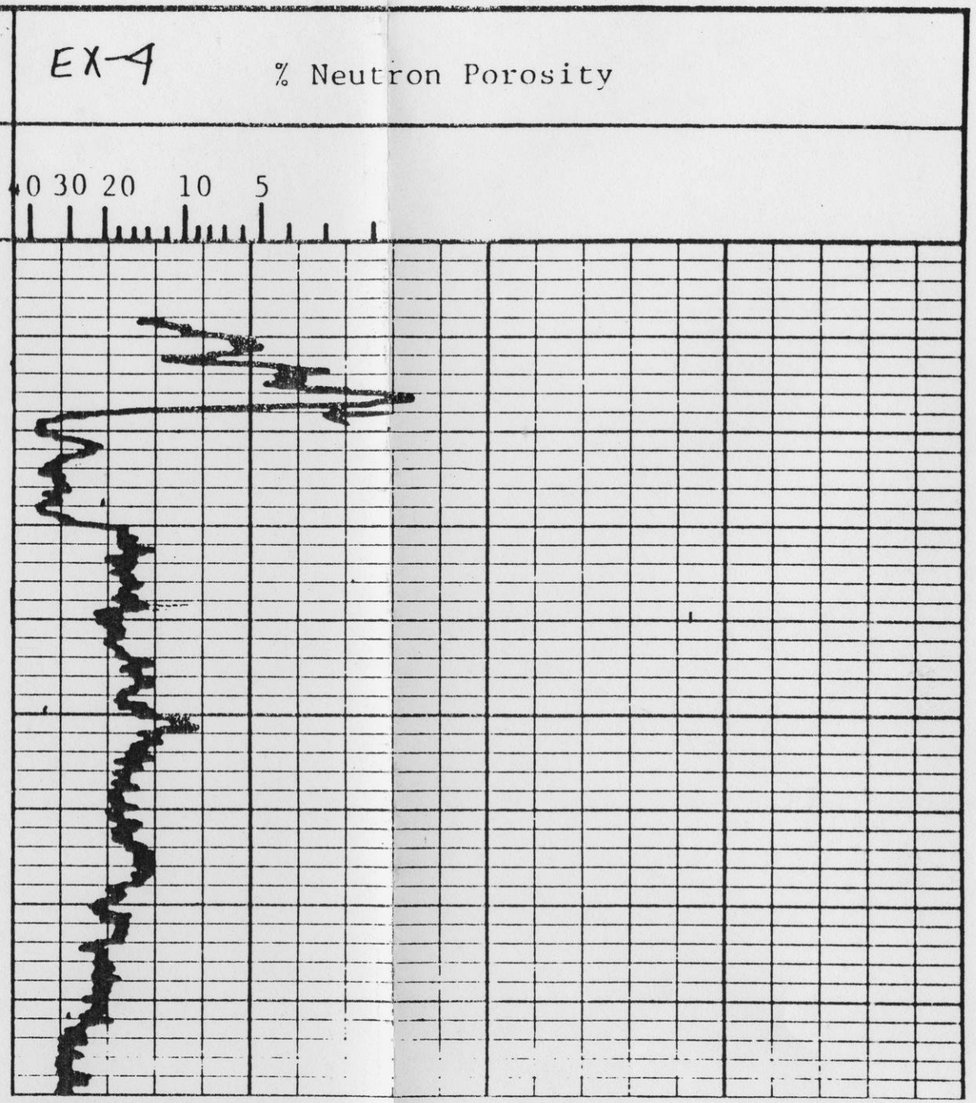
STS OFFICE 540 Lambeau Street, Green Bay, Wi. 54303
DRAWN BY JAS SHEET 1 OF 2
APP'D. BY JAS STS JOB NO. 12959

BL. 5-883




DEPTH

50



STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

SITE LOCATION: Crandon, Wisconsin

LOG OF BORING NUMBER: EX-4 Continued

Feet: M-119912 E-2274288 Meters: N-36549 E-693204

WELL INSTALLATION TOP STANDPIPE EL. +

SURFACE ELEVATION 1573.87-ft. 479.717-m

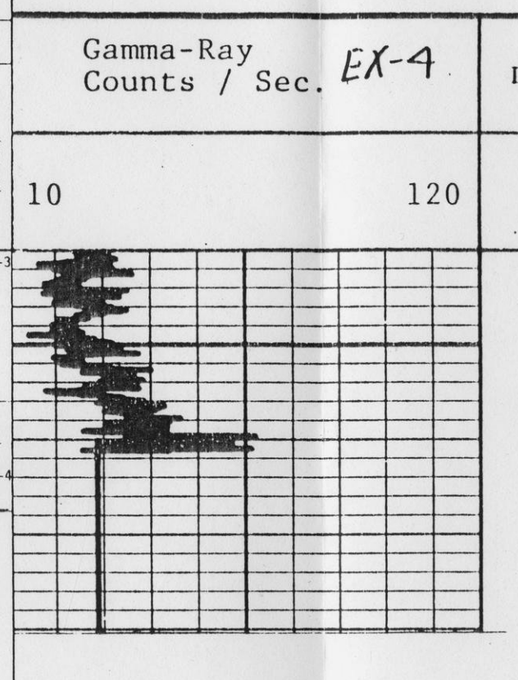
| DEPTH FEET / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | CONTINUED | AU | | 21 | | | 5 | $1x10^{-3}$ |
| 100 | 18 | SS | | | Brown slightly silty fine sand (SM-SP)-fine drift | | FD | 17 | | | 8 | |
| | 19 | SS | | | | | | 15 | | | 8 | |
| 110 | 20 | SS | | | Reddish brown silty clay (CL), seams of fine sand | | BL | 21 | | | 63 | |
| 117 | 21 | SS | | | Reddish brown fine to coarse sand (SM) - trace of fine gravel - glacial till | AL | BT | 10 | | | 28 | $7x10^{-4}$ |
| | 22 | SS | | | Weathered bedrock | | | | | | | |
| | | | | | End of boring in bedrock<br>Boring advanced to 117.0 feet by rock bit and bentonite mud | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL T. PIPE | DATE | TIME | WL T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

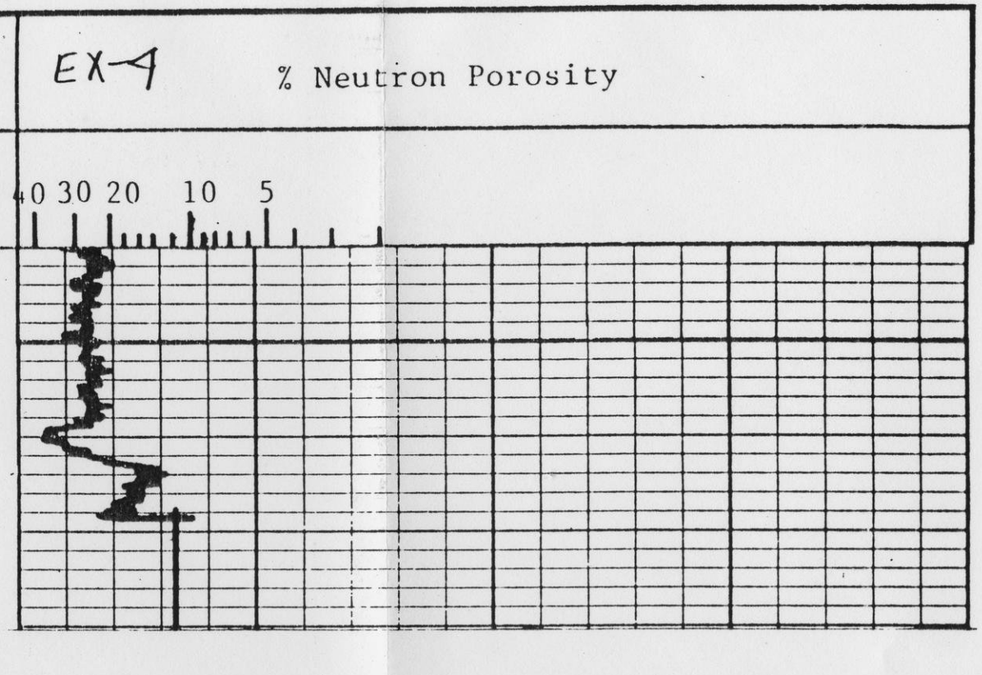
| | | | |
|---|---|---|---|
| BORING STARTED | 1-30-84 | STS OFFICE | 540 Lambeau Street<br>Green Bay, Wi. 54303 |
| BORING COMPLETED | 2-2-84 | DRAWN BY JAS | SHEET 2 OF 2 |
| RIG | Denny's Drilling | | |
| FOREMAN | Denny | APP'D. BY JAS | STS JOB NO. 12959 |

BL: 5-083




DEPTH

100



STS Consultants Ltd

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installation

SITE LOCATION: Crandon, Wisconsin

WELL INSTALLATION TOP STANDPIPE EL. +

LOG OF BORING NUMBER: EX-5

Feet: N-119857 E-2276790 Meters: N-36533 E-693967

SURFACE ELEVATION 1632.50-ft. 497.587-m

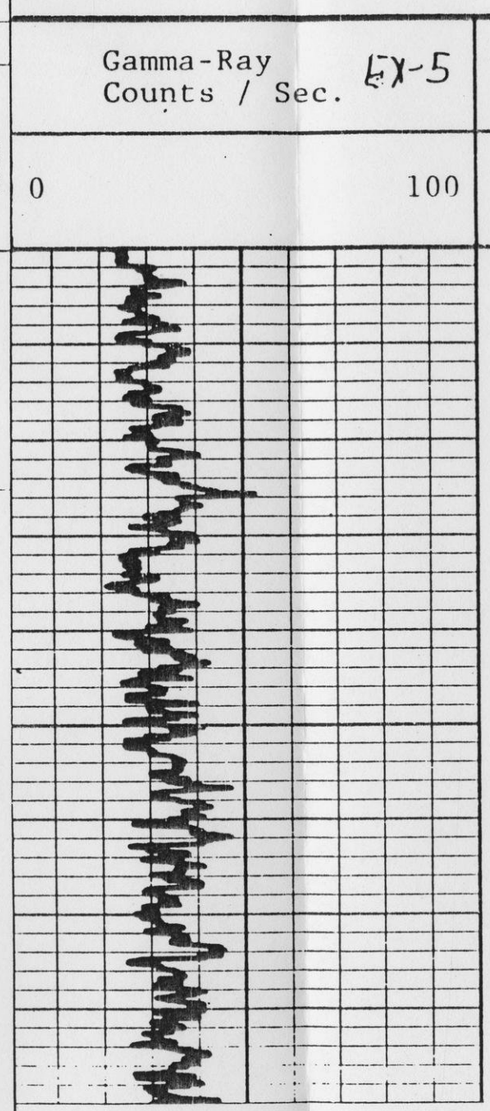
| DEPTH FEET ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | SS | | | | | | 15 | | | 36 | |
| 10 | 2 | SS | | | Brown silty fine to medium sand (SM) - trace to some gravel - glacial till | | T | 6 | | | 26 | |
| 20 | 3 | SS | | | | | | 5 | | | 16 | |
| 30 | 4 | SS | | | Brown slightly silty fine to medium sand (SM-SP) - trace to some gravel | | T | 8 | | | 7 | |
| 40 | 5 | SS | | | | | | 8 | | | 13 | |
| 50 | 6 | SS | | | | | | 8 | | | 13 | |
| 60 | 7 | SS | | | 5-24-84 ▽ Brown silty fine to coarse sand (SM) - trace of fine gravel - glacial till | | CL T | 10 | | | 20 | |
| 70 | 8 | SS | | | | | | 10 | | | 17 | |
| 80 | 9 | SS | | | | | | 9 | | | 23 | |
| 90 | 10 | SS | | | CONTINUED | | | 11 | | | 20 | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | BCR | | ACR | | |
|---|---|---|---|---|---|
| WL-T. PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

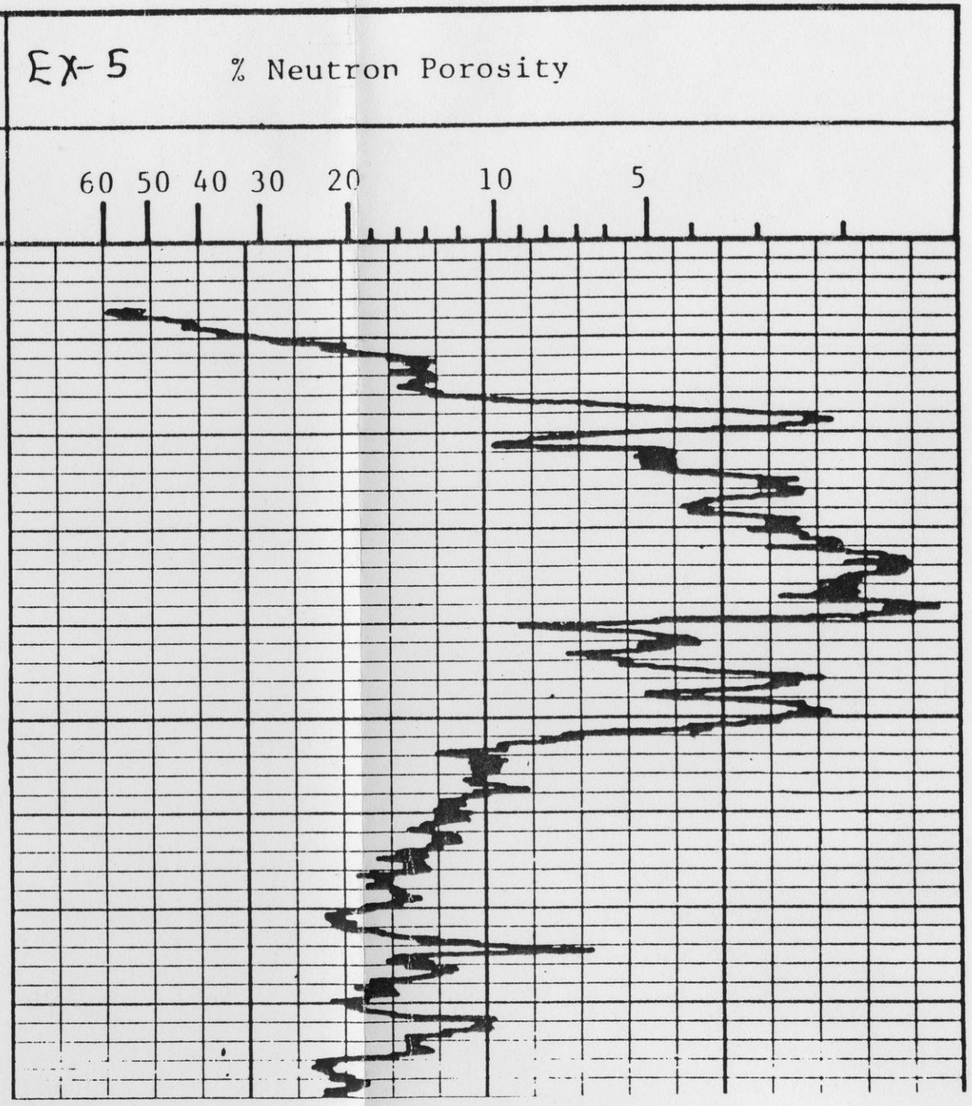
| | | | |
|---|---|---|---|
| BORING STARTED | 1-30-84 | STS OFFICE | 540 Lambeau Street Green Bay, Wi. 54303 |
| BORING COMPLETED | 2-1-84 | DRAWN BY JAS | SHEET 1 OF 2 |
| RIG Lusiers | | APP'D BY JAS | STS JOB NO. 12959 |
| FOREMAN Keith | | | |

BL. 5-003




DEPTH

50



STS Consultants Ltd

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

SITE LOCATION: Crandon, Wisconsin

LOG OF BORING NUMBER: EX-5 Continued

Feet: N-119857 E-2276790 Meters: N-36533 E-693967

WELL INSTALLATION TOP STANDPIPE EL. +

SURFACE ELEVATION 1632.50-ft. 497.587-m

| DEPTH FEET / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE / RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | CONTINUED | | | | | | | |
| 100 | 11 | SS | | Brown silty fine to coarse sand (SM) - trace of fine gravel | | T | 8 | | | 14 | |
| 110 | 12 | SS | | Brown fine to coarse sand and gravel (GP and SP) coarse drift | BL | CD | 10 | | | 4 | $1x10^{-2}$ |
| 120 | 13 | SS | | | | | 9 | | | 2 | |
| 130 | 14 | SS | | Brown slightly silty fine to coarse sand (SM-SP)- trace of fine gravel | | CD | 11 | | | 10 | |
| 140 | 15 | SS | | Reddish brown silty fine to coarse sand (SM) - trace of fine gravel - glacial till | | BT | 11 | | | 26 | |
| 150 | 16 | SS | | | | | 10 | | | 27 | |
| 160 | | | | Weathered bedrock<br>Bedrock core logged by Exxon | | AU | | | | | $2x10^{-6}$ |
| 170 | | | | End of boring in bedrock<br>Boring advanced to 156.0 feet by rock bit and bentonite mud - Boring advanced from 156.0 to 186.0 feet by diamond bit and core barrel | | AL | | | | | $1x10^{-7}$ |
| 180 | | | | | | | | | | | |

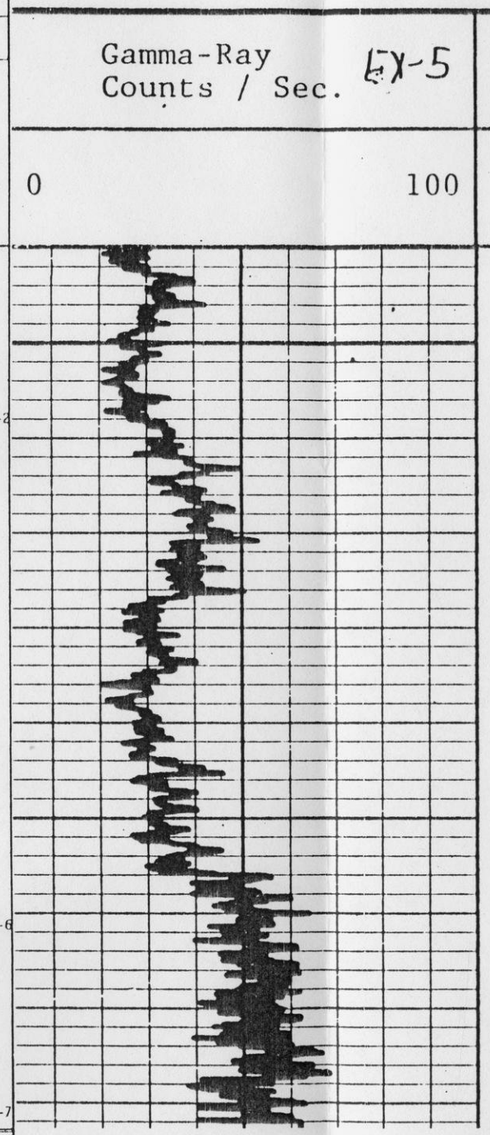
The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | | BCR | | | ACR |
|---|---|---|---|---|---|---|
| WL T. PIPE | DATE | TIME | WL T. PIPE | DATE | TIME | |
| | | | | | | |
| | | | | | | |

BORING STARTED 1-30-84
BORING COMPLETED 2-1-84
RIG Lusiers
FOREMAN Keith

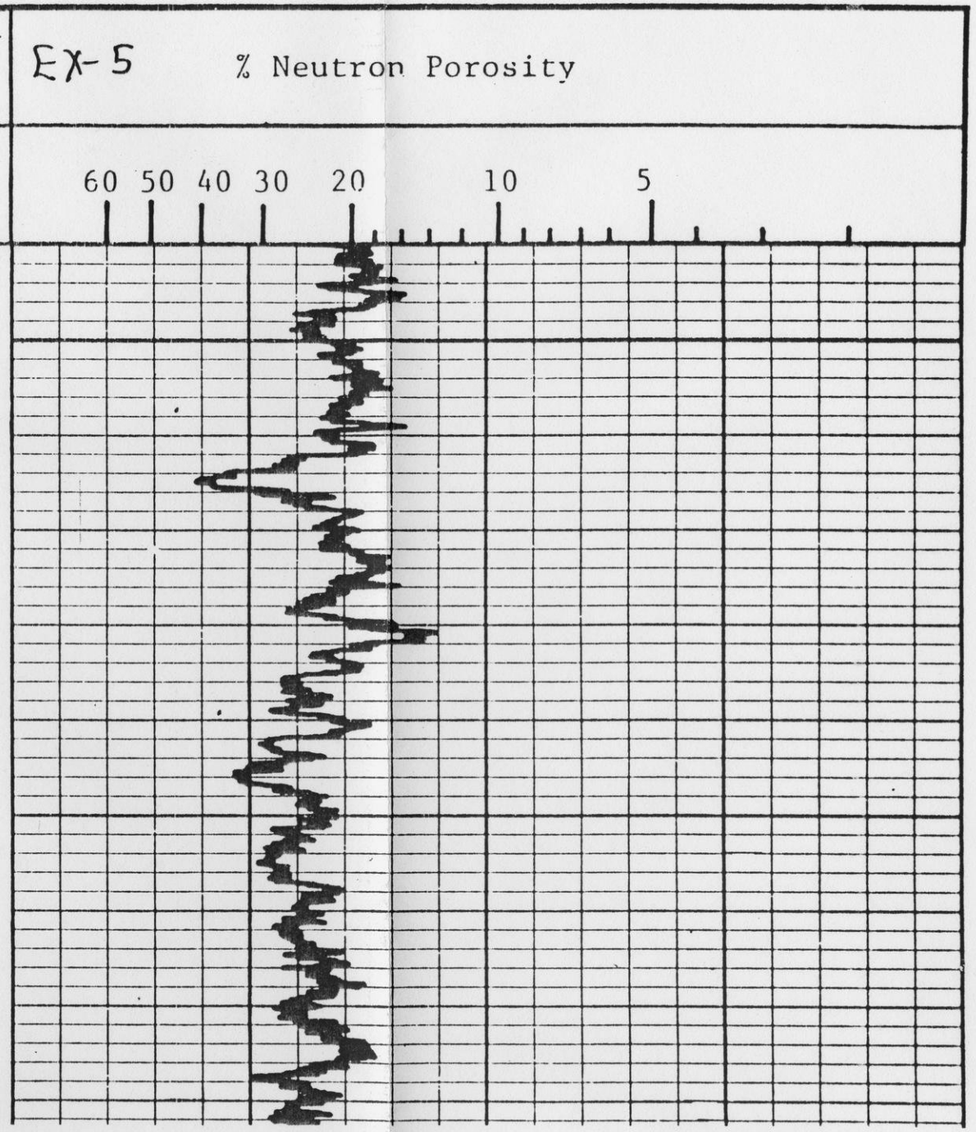
STS OFFICE 540 Lambeau Street, Green Bay, Wi. 54303
DRAWN BY JAS SHEET 2 OF 2
APP'D BY JAS STS JOB NO. 12959

BL 5-685




DEPTH

100



STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

LOG OF BORING NUMBER: EX-6

Feet: N-120340 E-2289928 Meters: N-36680 E-697972

SITE LOCATION: Crandon Project

WELL INSTALLATION TOP STANDPIPE EL. +

SURFACE ELEVATION 1606.94-ft. 489.796-m

| DEPTH FEET / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | SS | | | Brown fine to coarse sand (SP) - some gravel - coarse drift | | | 19 | | | - | |
| 10 | 2 | SS | | | | | CD | 5 | | | 4 | |
| 20 | 3 | SS | | | 5-24-84 ▽ | BU | | 16 | | | - | |
| 30 | 4 | SS | | | | | | 13 | | | - | |
| 40 | 5 | SS | | | Brown fine sand (SP) - fine drift | | FD | 24 | | | 3 | |
| 50 | 6 | SS | | | | | | 31 | | | - | |
| 60 | 7 | SS | | | Brown fine sandy silt (ML) - varves of fine sand - lacustrine | | L | 17 | | | 64 | |
| 70 | 8 | SS | | | Brown slightly silty fine sand (SM-SP) - fine drift | | FD | 20 | | | 9 | |
| 80 | 9 | SS | | | Brown fine sand (SP) - fine drift | BL | FD | 21 | | | 4 | $2x10^{-3}$ |
| 90 | | | | | Continued | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 3-3-84
BORING COMPLETED 3-5-84
RIG Denny's Drilling
FOREMAN

STS OFFICE 540 Lambeau Street Green Ba, WI. 414-494-9656
DRAWN BY SD
SHEET 1 OF 3
APP'D. BY JAS
STS JOB NO. 12959

BL 5-953

STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

LOG OF BORING NUMBER: EX-6

Feet: N-120340 E-2289928 Meters: N-36680 E-697972

SITE LOCATION: Crandon Project

WELL INSTALLATION: TOP STANDPIPE EL. +

SURFACE ELEVATION: 1606.94-ft. 489.796-m

| DEPTH FEET ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Continued | | | | | | | |
| 90 | | | | | | | | | | | | |
| | 10 | SS | | | Brown silty fine sand (SM) - occasional silt lenses - fine drift | | FD | 22 | | | 27 | |
| 100 | | | | | | | | | | | | |
| | 11 | SS | | | Dark brown clayey silt (ML) - lacustrine | | L | 23 | | | - | |
| 110 | | | | | | | | | | | | |
| | 12 | SS | | | | | | 25 | | | 96 | |
| 120 | | | | | Brown slightly silty fine to coarse sand (SM-SP) - some gravel - coarse drift | AU | CD | 10 | | | 7 | $4x10^{-3}$ |
| | 13 | SS | | | | | | | | | | |
| 130 | | | | | | | | | | | | |
| | 14 | SS | | | | | | 11 | | | - | |
| 140 | | | | | Brown fine to coarse gravel (GP) - some fine to coarse sand - coarse drift | | CD | 17 | | | 4 | |
| | 15 | SS | | | | | | | | | | |
| 150 | | | | | | | | | | | | |
| | 16 | SS | | | Brown slightly silty fine to coarse gravel (GP-GM) - some fine to coarse sand - coarse drift | | CD | 11 | | | 6 | |
| 160 | | | | | Brown slightly silty fine to coarse sand (SP-SM) some gravel - coarse drift - boulder from 161' to 164.5' | | CD | | | | | |
| | 17 | SS | | | | | | 13 | | | 6 | |
| | | | | | Continued | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | BCR | | ACR | | |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 3-3-84
BORING COMPLETED 3-5-84
RIG Denny's Drilling
FOREMAN Denny

STS OFFICE 540 Lambeau Street Green Bay, WI. 414-494-9656
DRAWN BY SD SHEET 2 OF 3
APP'D. BY JAS STS JOB NO. 12959

BL 983

STS Consultants Ltd.

**OWNER** Exxon Minerals Company

**PROJECT NAME** Piezometer Installations

**LOG OF BORING NUMBER** EX-6

Feet: N-120340 E-2289928 Meters: N-36680 E-697972

**SITE LOCATION** Crandon Project

WELL INSTALLATION
TOP STANDPIPE EL. +

SURFACE ELEVATION 1606.94-ft. 489.796-m

| DEPTH FEET / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 170 | | | | | | | | | | | | |
| | 18 | SS | | | Brown to greenish gray slightly silty fine to coarse gravel (GM-GP) - some fine to coarse sand - basal till | AL | BT | 8 | | | - | $3x10^{-4}$ |
| 180 | 19 | SS | | | | | | 10 | | | 9 | |
| 190 | | | | | Weathered bedrock - cuttings logged by Exxon | | | | | | | |
| 196 | | | | | End of boring<br>Boring advanced to 196' by rock bit and bentonite mud. | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 3-3-84
BORING COMPLETED 3-5-84
RIG Denny's Drilling
FOREMAN Denny

STS OFFICE 540 Lambeau Street Green Bay, WI. 414-494-9656
DRAWN BY SD
SHEET 3 OF 3
APP'D. BY JAS
STS JOB NO. 12959

BL 5-983

STS Consultants Ltd

**OWNER** Exxon Minerals Company

**LOG OF BORING NUMBER** EX-7

**PROJECT NAME** Piezometer Installations

Feet N-117862 E-2286791 Meters N-35924 E-697015

**SITE LOCATION** Crandon Project

WELL INSTALLATION
TOP STANDPIPE EL. +

| DEPTH FEET ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1580.35-ft. 481.692-m | | | | | | | |
| | | | | | Reddish brown silty fine sand (SM) - trace gravel fill | | | | | | | |
| | | | | | Black peat (PT) and organic silt - bog deposit ▽ 5-24-84 | | | | | | | |
| 10 | | | | | Brown fine sand (SP) - waterbearing - fine drift | CL | FD | | | | | |
| 20 | | | | | | | | | | | | |
| 30 | | | | | Brown slightly silty fine to medium sand (SM-SP) - trace gravel - waterbearing - coarse drift | | | | | | | |
| 40 | | | | | | | | | | | | |
| 50 | | | | | | | CD | | | | | |
| 60 | 1 | SS | | 11 | | | | 22 | | | 9 | |
| 70 | | | | | | BU | | | | | | $1 \times 10^{-3}$ |
| 80 | | | | | | | | | | | | |
| 90 | | | | | Brown silty fine to medium sand (SM) - trace gravel, occasional 1/4" thick clay seams, boulders from 89-92' and from 142.0 to 142.5 feet - glacial till | | | | | | | |
| | | | | | Continued | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | | BCR | | | ACR |
|---|---|---|---|---|---|---|
| WL T. PIPE | DATE | TIME | WL T. PIPE | DATE | TIME | |
| | | | | | | |

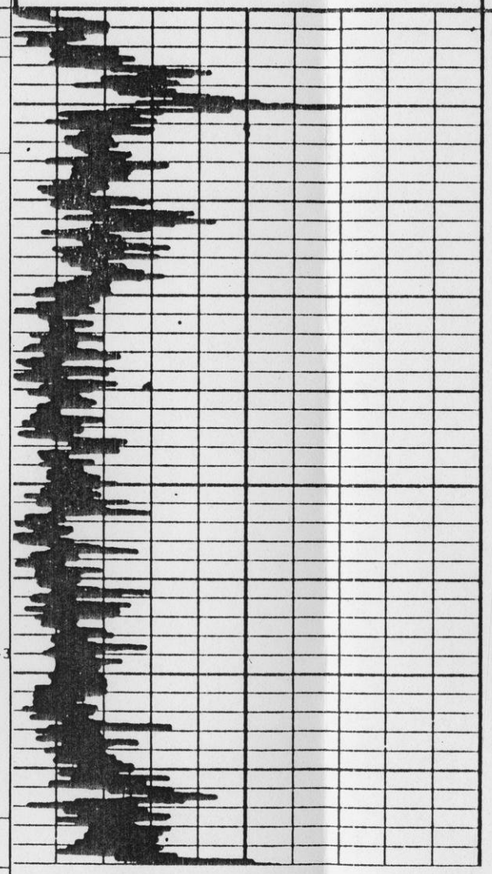
BORING STARTED 2-9-84
BORING COMPLETED 2-10-84
RIG Lusiers
FOREMAN Keith

STS OFFICE 540 Lambeau Green Bay, WI 54303
DRAWN BY SMD SHEET 1 OF 2
APP'D. BY JAS STS JOB NO. 12959

BL 5-883

Gamma-Ray Counts / Second EX-7

0 85

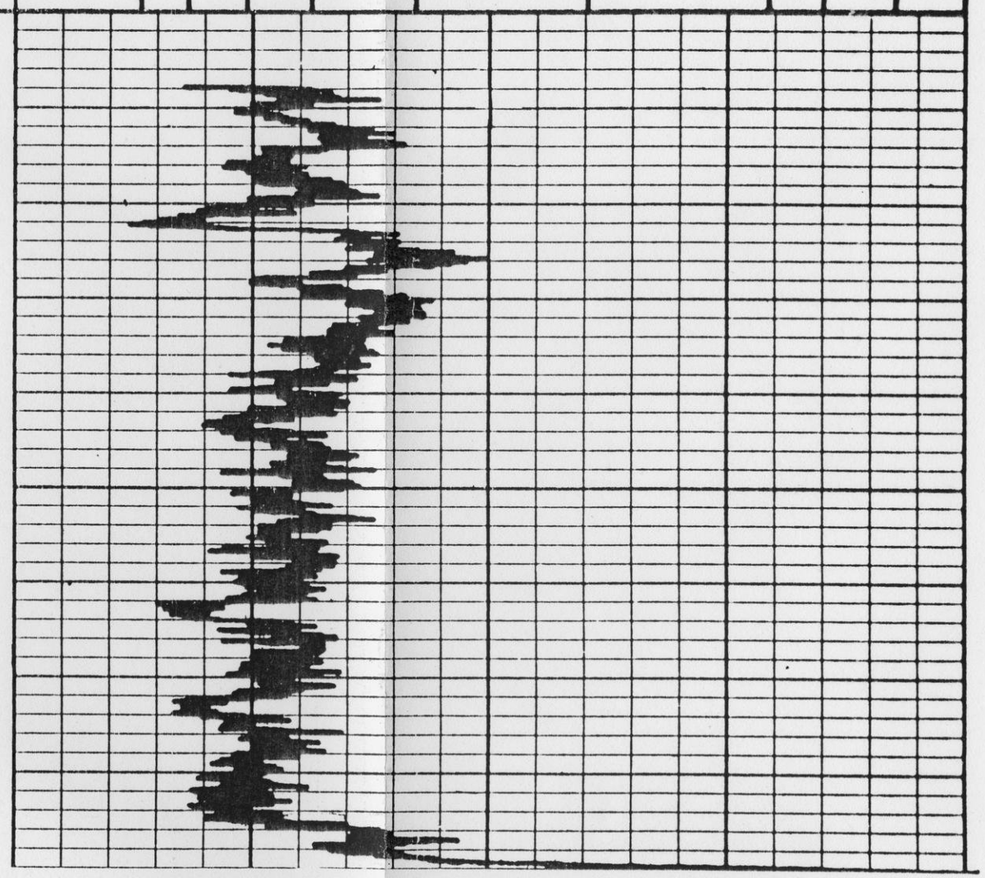


DEPTH

50

EX-7 % Neutron Limestone Porosity

60 50 40 30 20 10 5 4 3



3.5-5-16

STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

SITE LOCATION: Crandon Project

LOG OF BORING NUMBER: EX-7 Continued

Feet: N-117862 E-2286791 Meters: N-35924 E-697015

WELL INSTALLATION TOP STANDPIPE EL. +

SURFACE ELEVATION 1580.35-ft. 481.692-m

| DEPTH FEET ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 100 | | | | | Brown silty fine to medium sand (SM) - trace gravel, occasional 1/4" thick clay seams, boulder from 142.0 to 142.5 feet - glacial till | BL | T | | | | | $1x10^{-3}$ |
| 110 | | | | | | | | | | | | |
| 120 | 2 | SS | | | | | | 13 | | | 41 | |
| 130 | | | | | | | | | | | | |
| 140 | | | | | | | | | | | | |
| 150 | | | | | | AL | | | | | | $9x10^{-4}$ |
| 160 | 3 | SS | | | Weathered bedrock - core logged by Exxon | | | 10 | | | 12 | |
| 169 | | | | | End of Boring<br>Boring advanced to 163.0 feet with rock bit and bentonite mud<br>Boring advanced from 163.0 to 169.0 feet with carbide bit and core barrel | | | | | | | |

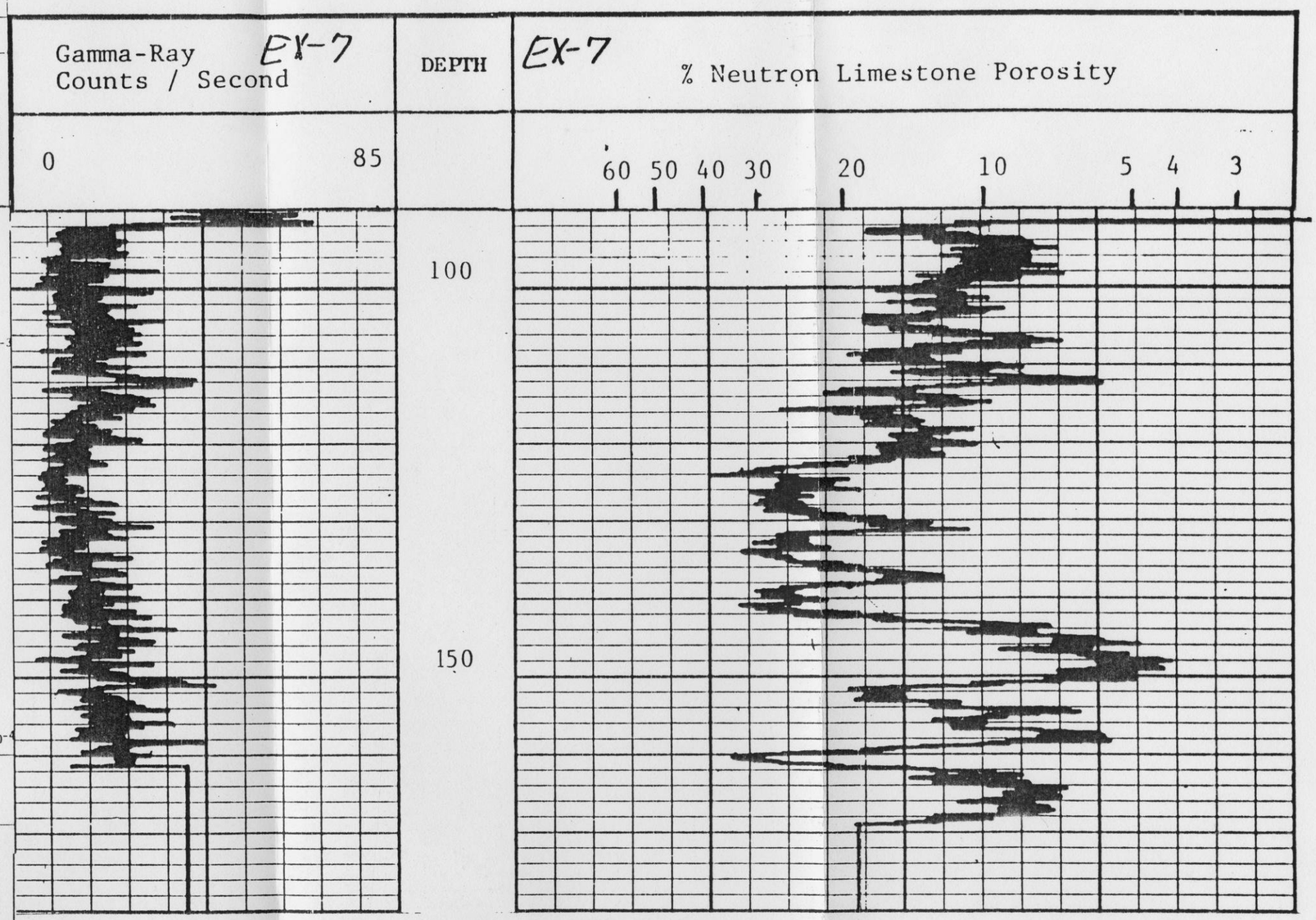
The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL T. PIPE | DATE | TIME | WL T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |

BORING STARTED 2-9-84
BORING COMPLETED 2-10-84
RIG Lusiers
FOREMAN Keith

STS OFFICE 540 Lambeau Green Bay, WI 54303
DRAWN BY SMD SHEET 2 OF 2
APP'D. BY JAS STS JOB NO. 12959

BL 5-083



STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

SITE LOCATION: Crandon Project

LOG OF BORING NUMBER: EX-8

Feet: N-116362 E-2287655 | Meters: N-35467 E-697279

WELL INSTALLATION
TOP STANDPIPE EL. +

SURFACE ELEVATION 1586.46-ft. 483.554-m

| DEPTH FEET / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | SS | | | Brown fine to medium sand (SP) - trace coarse sand and gravel. | | | 4 | | | 3 | |
| 10 | | | | | 5-24-84 ▽ | BU | | | | | | 1x10⁻³ |
| | 2 | SS | | | | | CD | 16 | | | - | |
| 20 | 3 | SS | | | Brown slightly silty fine to coarse sand (SM-SP) - some gravel - coarse drift | | CD | 21 | | | 10 | |
| 30 | 4 | SS | | | Brown fine sand (SP) - fine drift | | FD | 22 | | | - | |
| 40 | 5 | SS | | | | | | 25 | | | 3 | |
| 50 | 6 | SS | | | | | | 22 | | | - | |
| 60 | 7 | SS | | | Brown silty fine sand (SM) - fine drift | | FD | 23 | | | - | |
| 70 | 8 | SS | | | | BL | | 21 | | | 13 | 2x10⁻³ |
| 80 | 9 | SS | | | | | | 22 | | | - | |
| 90 | | | | | Continued | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL-T. PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 3-12-84
BORING COMPLETED 3-14-84
RIG Denny's Drilling
FOREMAN Denny

STS OFFICE 540 Lambeau Street, Green Bay, WI. 414-494-9656
DRAWN BY SD
SHEET 1 OF 3
APP'D. BY JAS
STS JOB NO. 12959

BL 5-983

STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

LOG OF BORING NUMBER: EX-8

Feet: N-116362 E-2287655 Meters: N-35467 E-697279

SITE LOCATION: Crandon Project

WELL INSTALLATION: TOP STANDPIPE EL. +

SURFACE ELEVATION 1586.46-ft. 483.554-m

| DEPTH FEET / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Continued | | | | | | | |
| 90 | | | | | | | | | | | | |
| | 10 | SS | | | Brown to reddish brown silty fine to coarse sand (SM) - some gravel - glacial till | | T | 8 | | | 30 | |
| 100 | | | | | | AU | | | | | | |
| | 11 | SS | | | | | | 9 | | | - | $2x10^{-4}$ |
| | | | | | Brown slightly silty fine to coarse sand (SM-SP) - little gravel - glacial till | | T | | | | | |
| 110 | | | | | | | | | | | | |
| | 12 | SS | | | | | | 10 | | | 11 | |
| 120 | | | | | | | | | | | | |
| | 13 | SS | | | | | | 10 | | | - | |
| 130 | | | | | | | | | | | | |
| | 14 | SS | | | | | | 10 | | | 11 | |
| 140 | | | | | Brown silty fine to coarse sand (SM) - little gravel - glacial till - boulders from 145 to 146', 148 to 149', and 150 to 151'. | | T | | | | | |
| | 15 | SS | | | | | | 10 | | | 21 | |
| 150 | | | | | | | | | | | | |
| | 16 | SS | | | Reddish brown silty fine to coarse sand (SM) - some gravel - basal till | | BT | 9 | | | - | |
| 160 | | | | | | AL | | | | | | $1x10^{-4}$ |
| | 17 | SS | | | | | | 10 | | | 19 | |
| 170 | | | | | | | | | | | | |
| | | | | | Continued | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | BCR | | ACR | | |
|---|---|---|---|---|---|
| WL T PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 3-12-84
BORING COMPLETED 3-14-84
RIG Denny's Drilling
FOREMAN Denny

STS OFFICE 540 Lambeau Street Green Bay, WI. 414-494-9656
DRAWN BY SD SHEET 2 OF 3
APP'D. BY JAS STS JOB NO. 12959



BL 5-983

STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

LOG OF BORING NUMBER: EX-8

Feet: N-116362 E-2287655 | Meters: N-35467 E-697279

SITE LOCATION: Crandon Project

WELL INSTALLATION
TOP STANDPIPE EL. +

SURFACE ELEVATION 1586.46-ft. 483.554-m

| DEPTH FEET / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Continued | | | | | | | |
| 170 | | | | | Reddish brown silty fine to coarse sand (SM) - some gravel - basal till | | | | | | | |
| 174 | 18 | SS | | | Weathered bedrock - sample logged by Exxon | | | 11 | | | - | |
| | | | | | End of boring in bedrock<br>Boring advanced to 175' With rock bit and bentonite mud. | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | ACR | |
|---|---|---|---|---|---|
| WL-T. PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 3-12-84
BORING COMPLETED 3-14-84
RIG Denny's Drilling
FOREMAN Denny

STS OFFICE 540 Lambeau Street Green Bay, WI. 414-494-9656
DRAWN BY SD | SHEET 3 OF 3
APP'D. BY JAS | STS JOB NO. 12959

BL: 5-983

STS Consultants Ltd.

**OWNER** Exxon Minerals Company

**PROJECT NAME** Piezometer Installations

**LOG OF BORING NUMBER** EX-9

Feet: N-116461 E-2284725 Meters: N-35497 E-696386

**SITE LOCATION** Crandon Project

WELL INSTALLATION
TOP STANDPIPE EL. +

SURFACE ELEVATION 1708.86-ft. 520.862-m

| DEPTH FEET / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | SS | | | Brown fine to coarse sand (SP) - coarse drift | | CD | 5 | | | 3 | |
| 10 | 1 | SS | | | Reddish brown silty fine to coarse sand (SM) - some gravel, glacial till | | T | 6 | | | 13 | |
| 20 | 2 | SS | | | | | | | | | | |
| 30 | 3 | SS | | | | | | 4 | | | 17 | |
| 40 | 4 | SS | | | | | | 6 | | | -- | |
| | 4A | SS | | | | | | | | | | |
| 50 | 5 | SS | | | Brown slightly silty fine to coarse sand (SM-SP)- some gravel - coarse drift | | T | 6 | | | 11 | |
| 60 | 6 | SS | | | | | | 9 | | | -- | |
| 70 | 7 | SS | | | | | | 11 | | | 6 | |
| 80 | 8 | SS | | | | | | 5 | | | -- | |
| 90 | | | | | Brown fine to coarse gravel (GP) and fine to coarse sand (SP) - coarse drift | | | | | | | |

Continued

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 3-16-84
BORING COMPLETED 3-21-84
RIG Denny's Drilling
FOREMAN Denny

STS OFFICE 540 Lambeau Green Bay, WI 54303
DRAWN BY SMD SHEET 1 OF 4
APP'D. BY JAS STS JOB NO. 12959

BL 5/83

STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

LOG OF BORING NUMBER: EX-9 Continued

Feet: N-116461 E-2284725 Meters: N-35497 E-696386

SITE LOCATION: Crandon Project

WELL INSTALLATION
TOP STANDPIPE EL. +

SURFACE ELEVATION 1708.86-ft. 520.862-m

| DEPTH FEET ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 90 | | | | | | | | | | | | |
| | 9 | SS | | | Brown fine to coarse gravel (GP) and fine to coarse sand (SP) - coarse drift | | | 8 | | | 4 | |
| 100 | 10 | SS | | | Reddish brown silty fine to coarse sand (SM) - some gravel - glacial till | | T | 8 | | | 20 | |
| 110 | 11 | SS | | | 5-24-84 ▽ | | | 7 | | | -- | |
| 120 | 12 | SS | | | | BU | | 9 | | | 19 | |
| 130 | 13 | SS | | | Brown slightly silty fine to coarse sand (SM-SP)- some gravel - waterbearing - coarse drift | | | 11 | | | 6 | |
| 140 | 14 | SS | | | | | CD | 13 | | | 9 | |
| 150 | 15 | SS | | | | | | 9 | | | -- | |
| 160 | 16 | SS | | | Reddish brown silty fine to coarse sand (SM) - a little gravel - glacial till | | T | 9 | | | 21 | |
| 170 | | | | | Continued | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | | BCR | | | ACR |
|---|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T PIPE | DATE | TIME | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

BORING STARTED 3-16-84
BORING COMPLETED 3-21-84
RIG Denny's Drilling
FOREMAN Denny

STS OFFICE 540 Lambeau Green Bay, WI 54303
DRAWN BY SMD SHEET 2 OF 4
APP'D. BY JAS STS JOB NO. 12959

BL: 5-983

STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

SITE LOCATION: Crandon Project

LOG OF BORING NUMBER: EX-9

Feet: N-116461 E-2284725

Meters: N-35497 E-696386

WELL INSTALLATION
TOP STANDPIPE EL. +

SURFACE ELEVATION 1708.86-ft. 520.862-m

| DEPTH FEET ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 170 | | | | | | | | | | | | |
| | 17 | SS | | LS | Reddish brown silty fine to coarse sand (SM) - a little gravel - glacial till | | T | 10 | | | -- | |
| 180 | 17A | SS | | | | | | | | | | |
| | 18 | SS | | | Dark reddish brown slightly silty fine to coarse sand (SM-SP) - some gravel - coarse drift | BL | CD | 10 | | | 11 | $2x10^{-6}$ |
| 190 | 19 | SS | | | | | | 14 | | | -- | |
| 200 | | | | | Brown silty fine to coarse sand (SM) - trace gravel - coarse drift | | CD | 14 | | | 13 | |
| 210 | 20 | SS | | | | | | | | | | |
| | 21 | SS | | | Brown silty fine to medium sand (SM) - fine drift | | FD | 21 | | | -- | |
| 220 | 22 | SS | | | | | | 20 | | | -- | |
| 230 | 23 | SS | | | | | | 18 | | | -- | |
| 240 | 24 | SS | | | | AU | | 20 | | | -- | $6x10^{-3}$ |
| 250 | | | | | Continued | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | ACR |
|---|---|---|---|---|
| WL T. PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 3-16-84
BORING COMPLETED 3-21-84
RIG Denny's Drilling
FOREMAN Denny

STS OFFICE 540 Lambeau Green Bay, WI 54303
DRAWN BY SMD SHEET 3 OF 4
APP'D. BY JAS STS JOB NO. 12959

BL 5-983

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Company | LOG OF BORING NUMBER: EX-9 Continued |
| PROJECT NAME: Piezometer Installations | Feet: N-116461 E-2284725 / Meters: N-35497 E-696386 |
| SITE LOCATION: Crandon Project | |

WELL INSTALLATION
TOP STANDPIPE EL. +

SURFACE ELEVATION 1708.86-ft. 520.862-m

| DEPTH FEET / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 250 | | | | | | | | | | | | |
| | 25 | SS | | | Brown silty fine to medium sand (SM) - fine drift | | FD | 17 | | | 17 | |
| 260 | | | | | Reddish brown fine to coarse sandy silt (ML) - trace gravel - basal till | | BT | | | | | |
| | 26 | SS | | | | | | 13 | | | -- | |
| 270 | | | | | Bedrock | | AL | | | | | $2x10^{-8}$ |
| 280 | | | | | End of Boring in Bedrock<br>Boring advanced to 280.0 feet with rock bit and bentonite mud | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL-T. PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

| | |
|---|---|
| BORING STARTED | 3-16-84 |
| BORING COMPLETED | 3-21-84 |
| RIG | Denny's Drilling |
| FOREMAN | Denny |
| STS OFFICE | 540 Lambeau Green Bay, WI 54303 |
| DRAWN BY | SMD |
| SHEET | 4 OF 4 |
| APP'D. BY | JAS |
| STS JOB NO. | 12959 |

BL 5-983

STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

LOG OF BORING NUMBER: EX-10

Feet: N-115111 E-2284239 Meters: N-35086 E-696237

SITE LOCATION: Crandon Project

WELL INSTALLATION
TOP STANDPIPE EL. +

SURFACE ELEVATION 1674.93-ft. 510.520-m

| DEPTH FEET / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 1 | SS | | | Brown silty fine to medium sand (SM) - trace gravel | | CD | 19 | | | - | |
| 20 | 2 | SS | | | Reddish brown fine to coarse sand (SP) - little gravel - coarse drift | | CD | 15 | | | 37 | |
| 30 | 3 | SS | | | | | | 8 | | | 4 | |
| 40 | 4 | SS | | | Brown slightly silty fine to coarse sand (SM-SP)- some gravel - coarse drift | | CD | 5 | | | 6 | |
| 50 | 5 | SS | | | Reddish brown silty fine to coarse sand (SM) - trace to little gravel - glacial till | | T | 9 | | | 24 | |
| 60 | 6 | SS | | | | | | 10 | | | 24 | |
| 70 | 7 | SS | | | | | | 9 | | | - | |
| 80 | 8 | SS | | | 5-24-84 ▽ | | BU | 12 | | | - | |
| 90 | | | | | Continued | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | | BCR | | ACR |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 3-13-84
BORING COMPLETED 3-15-84
RIG Lusiers
FOREMAN Keith

STS OFFICE 540 Lambeau Street Green Bay, WI. 414-494-9656
DRAWN BY SD
SHEET 1 OF 4
APP'D. BY JAS
STS JOB NO. 12959

BL: 5-983

STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

LOG OF BORING NUMBER: EX-10

Feet: N-115111 E-2284239 Meters: N-35086 E-696237

SITE LOCATION: Crandon Project

WELL INSTALLATION
TOP STANDPIPE EL. +

SURFACE ELEVATION 1674.93-ft. 510.520-m

| DEPTH FEET / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Continued | | | | | | | |
| 90 | | | | | | BU | | | | | | |
| | 9 | SS | | | Reddish brown silty fine to coarse sand (SM) - trace to little gravel - glacial till | | T | 14 | | | 25 | |
| 100 | | | | | | | | | | | | |
| | 10 | SS | | | | | | 9 | | | 14 | |
| 110 | | | | | | | | | | | | |
| | 11 | SS | | | | | | 8 | | | - | |
| 120 | | | | | | | | | | | | |
| | 12 | SS | | | | | | 10 | | | - | |
| 130 | | | | | | | | | | | | |
| | 13 | SS | | | | | | 11 | | | 20 | |
| 140 | | | | | | BL | | | | | | $2x10^{-5}$ |
| | 14 | SS | | | | | | 10 | | | - | |
| 150 | | | | | | | | | | | | |
| | 15 | SS | | | | | | 10 | | | - | |
| 160 | | | | | | | | | | | | |
| | 16 | SS | | | | | | 7 | | | - | |
| 170 | | | | | | | | | | | | |
| | | | | | Continued | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL T PIPE | DATE | TIME | WL T PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 3-13-84
BORING COMPLETED 3-15-84
RIG Lusiers
FOREMAN Keith

STS OFFICE 540 Lambeau Street, Green Bay, WI. 414-494-9656
DRAWN BY SD SHEET 2 OF 4
APP'D. BY JAS STS JOB NO. 12959

BL 5-983

STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

LOG OF BORING NUMBER: EX-10

Feet: N-115111 E-2284239 Meters: N-35086 E-696237

SITE LOCATION: Crandon Project

WELL INSTALLATION: TOP STANDPIPE EL. +

SURFACE ELEVATION 1674.93-ft. 510.520-m

| DEPTH FEET / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Continued | | | | | | | |
| 170 | | | | | | | | | | | | |
| | 17 | SS | | | Brown slightly silty fine to medium sand (SM-SP) - trace gravel - fine drift | | FD | 13 | | | 6 | |
| 180 | | | | | | | | | | | | |
| | 18 | SS | | | | | | 19 | | | 6 | |
| 190 | | | | | | | | | | | | |
| | 19 | SS | | | | AU | | 18 | | | - | $1x10^{-3}$ |
| 200 | | | | | | | | | | | | |
| | 20 | SS | | | | | | 17 | | | - | |
| 210 | | | | | | | | | | | | |
| | 21 | SS | | | Brown silty fine sand (SM) - with thin silt seams - lacustrine | | L | 17 | | | 38 | |
| 220 | | | | | | | | | | | | |
| | 22 | SS | | | Brown silt (ML) - lacustrine | | L | 22 | | | 93 | |
| 230 | | | | | | | | | | | | |
| | 23 | SS | | | Reddish brown silty clay (CL) - with varves of gray very fine sandy silt (ML) - lacustrine | | L | 21 | | | 92 | |
| 240 | | | | | | | | | | | | |
| | 24 | SS | | | Brown slightly silty fine to medium sand (SM-SP) with thin seams of coarse sand - lacustrine | | L | 14 | | | 9 | |
| 250 | | | | | Continued | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | | BCR | | | ACR |
|---|---|---|---|---|---|---|
| WL-T. PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

BORING STARTED 3-13-84
BORING COMPLETED 3-15-84
RIG Lusiers
FOREMAN Keith

STS OFFICE 540 Lambeau Street, Green Bay, WI, 414-494-9656
DRAWN BY SD
SHEET 3 OF 4
APP'D. BY JAS
STS JOB NO. 12959

BL 5-983

STS Consultants Ltd.

**OWNER** Exxon Minerals Company

**LOG OF BORING NUMBER** EX-10

**PROJECT NAME** Piezometer Installations

Feet N-115111 E-2284239 Meters N-35086 E-696237

**SITE LOCATION** Crandon Project

WELL INSTALLATION
TOP STANDPIPE EL. +

SURFACE ELEVATION 1674.93-ft. 510.520-m

| DEPTH FEET / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 250 | | | | | Continued | AL | | | | | | $1x10^{-5}$ |
| 256 | | | | | Weathered bedrock | | | | | | | |
| | | | | | End of boring<br>Boring advanced to 256' with rock bit and bentonite mud | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 3-13-84
BORING COMPLETED 3-15-84
RIG Lusiers
FOREMAN Keith

STS OFFICE 540 Lambeau Street Green Bay, WI. 414-494-9656
DRAWN BY SD SHEET 4 OF 4
APP'D. BY JAS STS JOB NO. 12959

BL 5-983

STS Consultants Ltd.

**OWNER** Exxon Minerals Company

**PROJECT NAME** Piezometer Installations

**LOG OF BORING NUMBER** EX-11

Feet: N-113254 E-2283698 Meters: N-34520 E-696073

**SITE LOCATION** Crandon Project

WELL INSTALLATION
TOP STANDPIPE EL. +

SURFACE ELEVATION 1682.05-ft. 512.690-m

| DEPTH FEET / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | SS | | | | | | 15 | | | 20 | |
| 10 | 2 | SS | | | | | | 5 | | | 22 | |
| 20 | 3 | SS | | | Brown to reddish brown silty fine to coarse sand (SM) - trace to some gravel - glacial till | | T | 9 | | | 17 | |
| 30 | 4 | SS | | | | | | 9 | | | 26 | |
| 40 | 5 | SS | | | | | | 9 | | | 22 | |
| | 6 | SS | | | | | | 9 | | | 22 | |
| 50 | 7 | SS | | | | | | 8 | | | 24 | |
| | 8 | SS | | | | | | 8 | | | 22 | |
| 60 | 9 | SS | | | | | | 9 | | | 20 | |
| | 10 | SS | | | | | | 8 | | | 16 | |
| 70 | 11 | SS | | | | | | 17 | | | -- | |
| 80 | 12 | SS | | | | | CL | 9 | | | 25 | |
| 90 | | | | | Continued | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | BCR | | ACR | | |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 3-20-84
BORING COMPLETED 3-24-84
RIG Lusiers
FOREMAN Keith

STS OFFICE 540 Lambeau Green Bay, WI 54303
DRAWN BY SMD SHEET 1 OF 4
APP'D. BY JAS STS JOB NO. 12959

BL 5-983

STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

SITE LOCATION: Crandon Project

LOG OF BORING NUMBER: EX-11 Continued

Feet: N-113254 E-2283698 Meters: N-34520 E-696073

WELL INSTALLATION TOP STANDPIPE EL. +

SURFACE ELEVATION 1682.05-ft. 512.690-m

| DEPTH FEET ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 90 | | | | | | CL | | | | | | |
| | | | | | 5-24-84 ▽ | | | | | | | |
| | 13 | SS | | | | | | 11 | | | -- | |
| 100 | | | | | | | | | | | | |
| | 14 | SS | | | Brown to reddish brown silty fine to coarse sland (SM) - trace to some gravel - glacial till | | T | 9 | | | -- | |
| 110 | | | | | | | | | | | | |
| | 15 | SS | | | | | | 9 | | | -- | |
| 120 | | | | | | | | | | | | |
| | 16 | SS | | | | | | 10 | | | 15 | |
| 130 | | | | | | | | | | | | |
| | 17 | SS | | | | BU | | 11 | | | -- | $1 \times 10^{-4}$ |
| 140 | | | | | | | | | | | | |
| | 18 | SS | | | | | | 9 | | | -- | |
| 150 | | | | | | | | | | | | |
| | 19 | SS | | | | | | 8 | | | 18 | |
| 160 | | | | | | | | | | | | |
| | 20 | SS | | | Brown slightly silty fine to coarse sand (SM-SP)- some gravel - coarse drift | | CD | 6 | | | 7 | |
| 170 | | | | | | | | | | | | |

Continued

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 3-20-84
BORING COMPLETED 3-24-84
RIG Lusiers
FOREMAN Keith

STS OFFICE 540 Lambeau Green Bay, WI 54303
DRAWN BY SMD SHEET 2 OF 4
APP'D. BY JAS STS JOB NO. 12959

BL: 5-983

STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

LOG OF BORING NUMBER: EX-11 Continued

Feet: N-113254 E-2283698 Meters: N-34520 E-696073

SITE LOCATION: Crandon Project

WELL INSTALLATION: TOP STANDPIPE EL. +

SURFACE ELEVATION 1682.05-ft. 512.690-m

| DEPTH FEET ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 170 | | | | | | BL | | | | | | $6x10^{-3}$ |
| | 21 | SS | | | Brown slightly silty fine to coarse sand (SM-SP)- some gravel - coarse drift | | CD | 11 | | | -- | |
| 180 | | | | | | | | | | | | |
| | 22 | SS | | | | | | 12 | | | 6 | |
| 190 | | | | | | | | | | | | |
| | 23 | SS | | | | | | 20 | | | -- | |
| 200 | | | | | | | | | | | | |
| | 24 | SS | | | | | | 21 | | | 4 | |
| 210 | | | | | Brown fine sand (SP) - fine drift | | FD | | | | | |
| | 25 | SS | | | | | | 22 | | | -- | |
| 220 | | | | | | AU | | | | | | $1x10^{-3}$ |
| | 26 | SS | | | | | | 23 | | | -- | |
| 230 | | | | | | | | | | | | |
| | 27 | SS | | | Reddish brown silty fine to medium sand (SM) - lacustrine | | L | 22 | | | 22 | |
| 240 | | | | | | | | | | | | |
| | 28 | SS | | | | | | 23 | | | -- | |
| 250 | | | | | Continued | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | BCR | | ACR | | |
|---|---|---|---|---|---|
| WL-T. PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 3-20-84
BORING COMPLETED 3-24-84
RIG Lusiers
FOREMAN Keith

STS OFFICE 540 Lambeau Green Bay, WI 54303
DRAWN BY SMD SHEET 3 OF 4
APP'D. BY JAS STS JOB NO. 12959

BL 5-983

STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

SITE LOCATION: Crandon Project

LOG OF BORING NUMBER: EX-11 Continued

Feet: N-113254 E-2283698 Meters: N-34520 E-696073

WELL INSTALLATION
TOP STANDPIPE EL. +

SURFACE ELEVATION 1682.05-ft. 512.690-m

| DEPTH FEET / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 250 | | | | | Reddish brown silty fine to medium sand (SM) - lacustrine | | | | | | | |
| | 29 | SS | | | Reddish brown silty clay (CL) with varves of gray silt (ML) - lacustrine | | L | 27 | | | 96 | |
| 260 | | | | | Brown slightly silty fine to coarse sand (SM-SP)- some gravel - coarse drift | AL | CD | 10 | | | 11 | $2x10^{-3}$ |
| 270 | 30 | SS | | | | | | | | | | |
| | 31 | SS | | | Reddish brown silty clay (CL) with varves of gray silt - lacustrine | | L | 26 | | | 98 | |
| 280 | | | | | Weathered bedrock - cuttings logged by Exxon | | | | | | | |
| 285 | | | | | End of Boring in Bedrock<br>Boring advanced to 285.0 feet with rock bit and bentonite mud | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 3-20-84
BORING COMPLETED 3-24-84
RIG Lusiers
FOREMAN Keith

STS OFFICE 540 Lambeau Green Bay, WI 54303
DRAWN BY SMD SHEET 4 OF 4
APP'D. BY JAS STS JOB NO. 12959

BL 5-983

STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

SITE LOCATION: Crandon Project

LOG OF BORING NUMBER: EX-12

Feet: N-113,156 E-2,284,707 Meters: N-34,490 E-696,380

WELL INSTALLATION
TOP STANDPIPE EL. +

SURFACE ELEVATION 1687.76-ft. 514.430-m

| DEPTH FEET / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT. % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY. K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 1 | SS | | | Brown slightly silty fine to coarse sand (SM-SP)- trace gravel - glacial till | | T | 12 | | | 8 | |
| 20 | 2 | SS | | | Reddish brown to brown silty fine to coarse sand (SM) - a little gravel - glacial till boulder from 14.0 to 15.0 feet | | T | 8 | | | 31 | |
| | 3 | SS | | | | | | 7 | | | 20 | |
| 30 | | | | | Grayish brown silty fine to coarse gravel (GM) - coarse drift | | CD | | | | | |
| 40 | 4 | SS | | | | | | 15 | | | 14 | |
| 50 | 5 | SS | | | Grayish brown fine to coarse gravel and sand (GW-SW), trace silt - coarse drift | | CD | 8 | | | 2 | |
| 60 | 6 | SS | | | | | | 6 | | | 3 | |
| 70 | 7 | SS | | | Reddish brown silty fine to coarse sand (SM) - trace to some gravel - glacial till | | T | 12 | | | 43 | |
| 80 | 8 | SS | | | | | | 13 | | | 15 | |
| 90 | | | | | Continued | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | BCR | | ACR | | |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 3-2-84
BORING COMPLETED 3-5-84
RIG Lusiers
FOREMAN Keith

STS OFFICE 540 Lambeau, Green Bay, WI 54303
DRAWN BY SMD SHEET 1 OF 4
APP'D. BY JAS STS JOB NO. 12959

BL 5-983

3.5-5-33

STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

LOG OF BORING NUMBER: EX-12 Continued

Feet: N-113,156 E-2,284,707 Meters: N34,490 E-696,380

SITE LOCATION: Crandon Project

WELL INSTALLATION TOP STANDPIPE EL. +

SURFACE ELEVATION 1687.76 ft. 514.430-m

| DEPTH FEET / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 90 | 9 | SS | | | | | | 20 | | | 14 | |
| | | | | | 5-24-84 ▽ | | | | | | | |
| 100 | 10 | SS | | | Reddish brown silty fine to coarse sand (SM) - trace to some gravel - glacial till | | T | 11 | | | -- | |
| 110 | 11 | SS | | | | BU | | 11 | | | 25 | |
| 120 | 12 | SS | | | | | | 7 | | | -- | |
| 130 | 13 | SS | | | | | | 10 | | | -- | |
| 140 | 14 | SS | | | | | | 9 | | | 14 | |
| 150 | 15 | SS | | | | | | 9 | | | -- | |
| 160 | 16 | SS | | | | | | 8 | | | -- | |
| 170 | | | | | Brown slightly silty fine to coarse sand (SM-SP) and gravel - coarse drift | | | | | | | |

Continued

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | ACR | |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 3-2-84
BORING COMPLETED 3-5-83
RIG Lusiers
FOREMAN Keith

STS OFFICE 540 Lambeau Green Bay, WI 54303
DRAWN BY SMD SHEET 2 OF 4
APP'D. BY JAS STS JOB NO. 12959

BL 5-983

STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

SITE LOCATION: Crandon Project

LOG OF BORING NUMBER: EX-12 Continued

Feet: N-113,156 E-2,284,707

Meters: N-34,490 E-696,380

WELL INSTALLATION TOP STANDPIPE EL. +

SURFACE ELEVATION 1687.76-ft. 514,430-m

| DEPTH FEET / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 170 | | | | | | | | | | | | |
| | 17 | SS | | | | | | 11 | | | -- | |
| 180 | | | | | | | | | | | | |
| | 18 | SS | | | Brown slightly silty fine to coarse sand (SM-SP) and gravel - coarse drift | BL | CD | 9 | | | -- | |
| 190 | | | | | | | | | | | | |
| | 19 | SS | | | | | | 11 | | | 7 | |
| 200 | | | | | | | | | | | | |
| | 20 | SS | | | Brown slightly silty fine sand (SM-SP) - fine drift | | FD | 21 | | | 6 | |
| 210 | | | | | | | | | | | | |
| | 21 | SS | | | Brown silty fine to coarse sand (SM), trace to a little gravel - glacial till | | T | 10 | | | 25 | |
| 220 | | | | | | | | | | | | |
| | 22 | SS | | | | | | 9 | | | 17 | |
| 230 | | | | | | | | | | | | |
| | 23 | SS | | | | AU | | 13 | | | -- | $3x10^{-3}$ |
| 240 | | | | | | | | | | | | |
| | 24 | SS | | | Reddish brown silty fine sand (SM) - fine drift | | FD | 20 | | | 17 | |
| 250 | | | | | Continued | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | BCR | | ACR | | |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 3-2-84

BORING COMPLETED 3-5-84

RIG Lusiers

FOREMAN Keith

STS OFFICE 540 Lambeau Green Bay, WI 54303

DRAWN BY SMD

SHEET 3 OF 4

APP'D. BY JAS

STS JOB NO. 12959

BL 5-963

STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

LOG OF BORING NUMBER: EX-12 Continued

Feet: N-113,156 E-2,284,707 Meters: N-34,490 E-696,380

SITE LOCATION: Crandon Project

WELL INSTALLATION TOP STANDPIPE EL. +

SURFACE ELEVATION 1687.76-ft. 514,430-m

| DEPTH FEET / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 250 | | | | | | | | | | | | |
| | 25 | SS | | LS | Reddish brown silty fine sand (SM) - fine drift | | FD | -- | | | -- | |
| 260 | | | | | | | | | | | | |
| | 26 | SS | | | | | | 13 | | | -- | |
| 270 | | | | | Reddish brown silty fine to coarse sand (SM), trace gravel - glacial till | | T | 11 | | | 25 | |
| 280 | | | | | | | | | | | | |
| | 27 | SS | | | | | | | | | | |
| | 28 | SS | | | Grayish brown very fine sandy silt (ML) with varves of reddish brown silty clay (CH) - high plasticity - lacustrine | AL | L | 21 | | | 62 | $2 \times 10^{-4}$ |
| 290 | | | | | | | | | | | | |
| | 29 | SS | | | | | | 26 | | | 96 | |
| 300 | | | | | Weathered bedrock | | | | | | | |
| 305 | | | | | End of Boring in Bedrock<br>Boring advanced to 305.0 feet with rock bit and bentonite mud | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL-T. PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 3-2-84

BORING COMPLETED 3-5-84

RIG Lusiers

FOREMAN Keith

STS OFFICE 540 Lambeau Green Bay, WI 54303

DRAWN BY SMD SHEET 4 OF 4

APP'D. BY JAS STS JOB NO. 12959

BL 5-983

STS Consultants Ltd

| | |
|---|---|
| OWNER | Exxon Minerals Company |
| PROJECT NAME | Piezometer Installations |
| SITE LOCATION | Crandon, Wisconsin |
| LOG OF BORING NUMBER | EX-13 |
| Feet | N-111,555 E-2,283,499 |
| Meters | N-34,002 E-696-01[illegible] |

WELL INSTALLATION
TOP STANDPIPE EL. +

SURFACE ELEVATION 1657.32-ft. 505.152-m

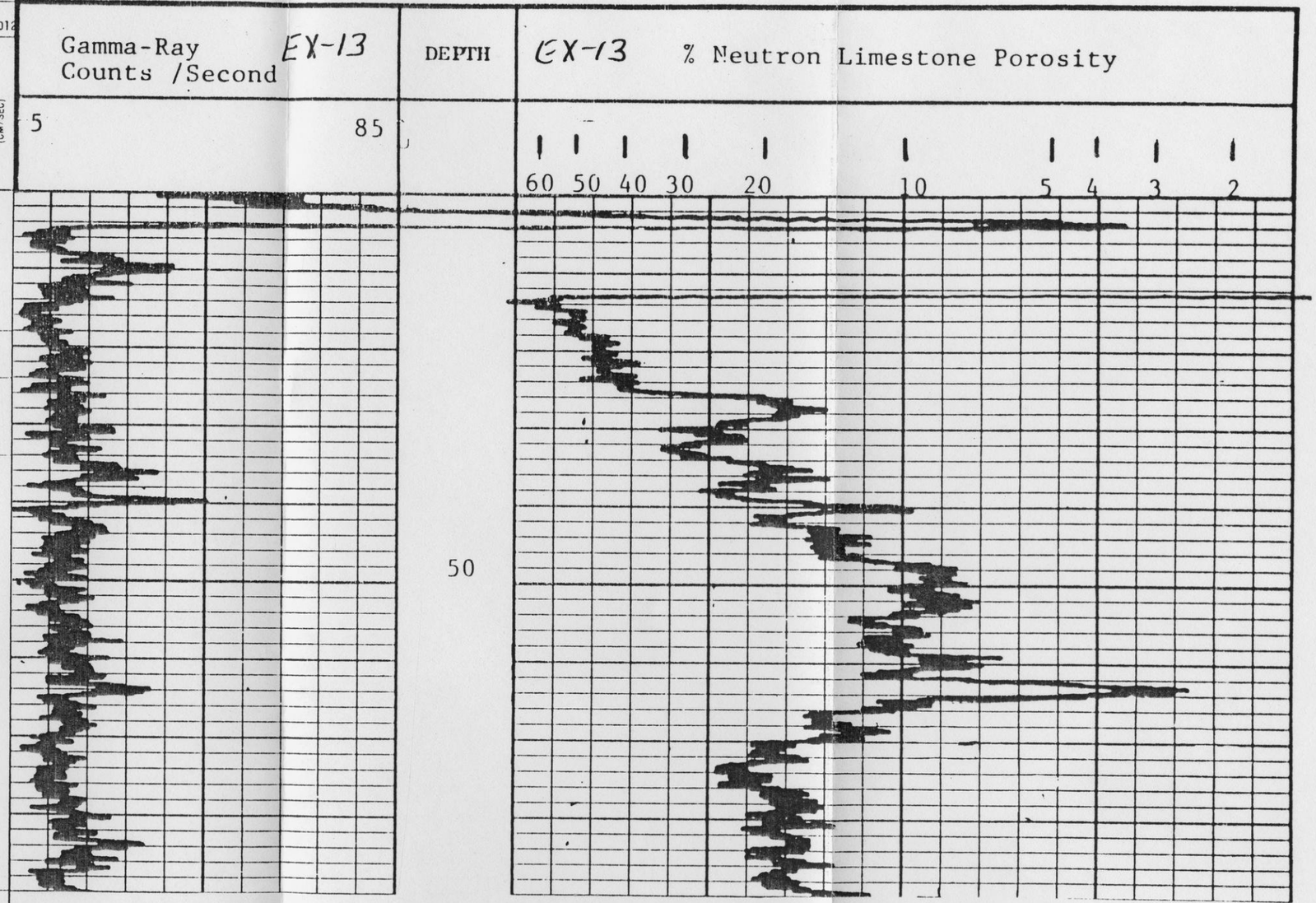
| DEPTH FEET / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT. % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY. K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 1A | SS | | | Reddish brown fine to coarse gravel and sand (GW-SW), coarse drift | | CD | 12 | | | - | |
| | 2A | SS | | | | | | 14 | | | 4 | |
| 20 | 3A | SS | | | Reddish brown silty fine to coarse sand (SM), a little gravel, glacial till | | T | 5 | | | 46 | |
| | 4A | SS | | | Reddish brown slightly silty fine to coarse sand (SM-SP) some gravel, glacial till | | | 11 | | | 11 | |
| 30 | 5A | SS | | | | | T | 9 | | | 11 | |
| | 6A | SS | | | | | | 7 | | | 17 | |
| 40 | 7A | SS | | | | | | 11 | | | 19 | |
| 50 | 8A | SS | | | Reddish brown silty fine to coarse sand (SM), trace to a little gravel, glacial till | | T | 10 | | | 21 | |
| 60 | 9A | SS | | | | DL | | 9 | | | - | |
| 70 | 10A | SS | | | 5-24-84 ▽ | | | 11 | | | 15 | |
| 80 | 11A | SS | | | | | | 11 | | | - | |
| 90 | | | | | Continued | | | | | | | |

The stratification lines represent the approximate boundary between soil types in situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T PIPE | DATE | TIME |
| | | | | | |

| | |
|---|---|
| BORING STARTED | 2-15-84 |
| BORING COMPLETED | 2-22-84 |
| RIG | Lusiers |
| FOREMAN | Ken |
| STS OFFICE | 540 Lambeau<br>Green Bay, WI 54303 |
| DRAWN BY | |
| SHEET | 1 OF 3 |
| APP'D BY | JAS |
| STS JOB NO. | 12959 |

BL 5-883



STS Consultants Ltd

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

SITE LOCATION: Crandon, Wisconsin

LOG OF BORING NUMBER: EX-13

Feet: N-111,555 E-2,283,499 Meters: N34,002 E-696,012

WELL INSTALLATION
TOP STANDPIPE EL. +

SURFACE ELEVATION 1657.32-ft. 505,152-m

| DEPTH FEET / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 12A | SS | | | | | T | 11 | | | 24 | |
| 100 | | | | | | | | | | | | |
| | 13A | SS | | | Reddish brown silty fine to coarse sand (SM), trace to a little gravel, glacial till | CL | | 11 | | | 13 | 6x10⁻⁵ |
| 110 | 14A | SS | | | | | | 11 | | | 16 | |
| 120 | 15A | SS | | | | | | 11 | | | - | |
| 130 | 16A | SS | | | Brown slightly silty fine to coarse sand (SM-SP), some gravel, coarse drift | | CD | 9 | | | 6 | |
| 140 | 17A | SS | | | | BU | | 12 | | | - | 3x10⁻³ |
| 150 | 1 | SS | | | Brown slightly silty fine to coarse gravel (GM-GP), some fine-coarse sand, coarse drift | | CD | 11 | | | 6 | |
| 160 | 2 | SS | | | Brown slightly silty fine to coarse sand (SM-SP), trace gravel, fine drift | | FD | 12 | | | 6 | |
| 170 | | | | | Continued | | | | | | | |

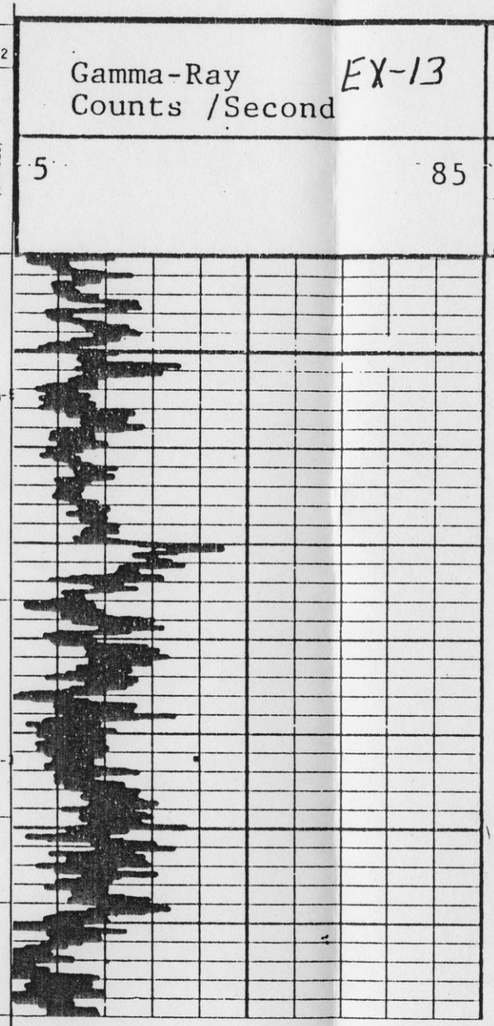
The stratification lines represent the approximate boundary between soil types, in situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL T. PIPE | DATE | TIME | WL T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

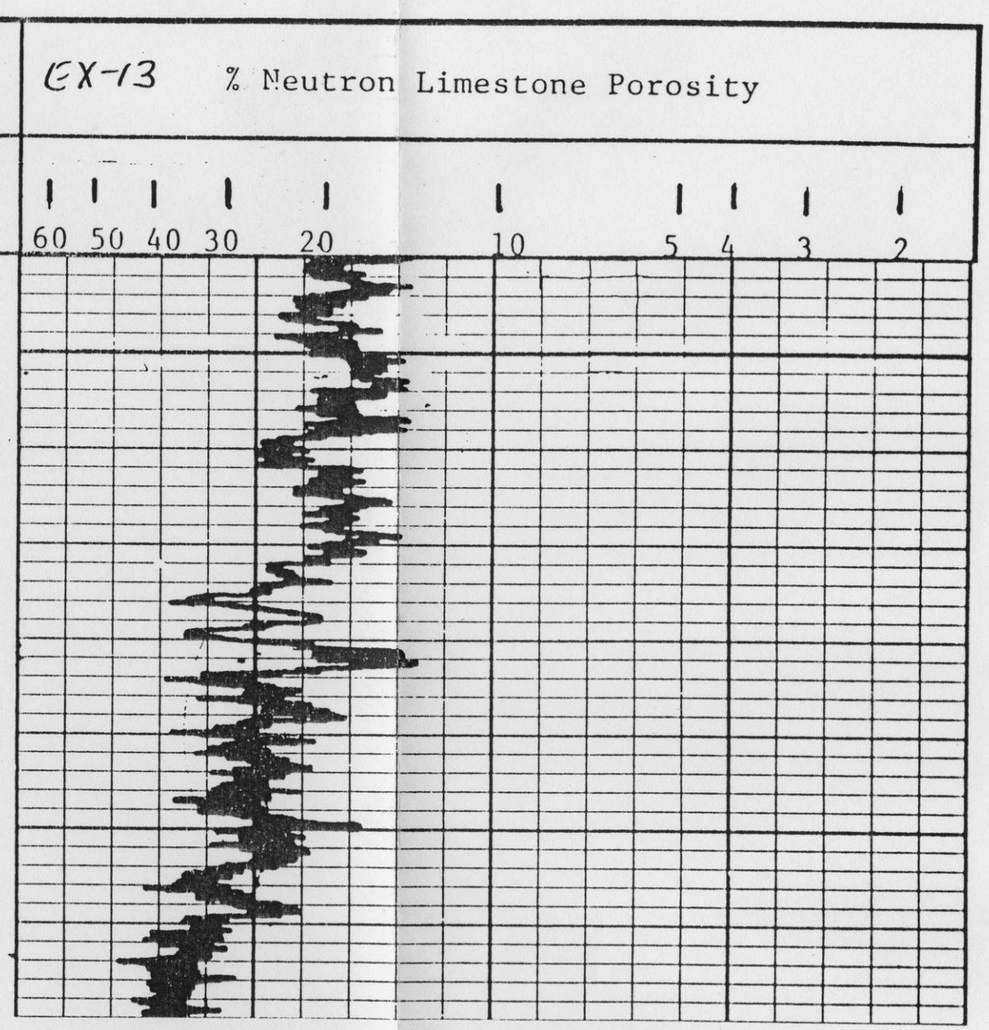
BORING STARTED 2-15-84
BORING COMPLETED 2-22-84
RIG Lusiers
FOREMAN Ken

STS OFFICE 540 Lambeau, Green Bay, WI 54303
DRAWN BY
SHEET 2 OF 3
APP'D. BY JAS
STS JOB NO. 12959

BL 5-083




DEPTH



STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

SITE LOCATION: Crandon, Wisconsin

LOG OF BORING NUMBER: EX-13

Feet: N-111,555 E-2,283,499 Meters: N-34,002 E-696,012

WELL INSTALLATION TOP STANDPIPE EL. +

SURFACE ELEVATION 1657.32-ft. 505.152-m

| DEPTH FEET / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 180 | 3 | SS | | | Brown slightly silty fine to coarse sand (SM-SP), trace gravel, fine drift | | FD | 18 | | | 6 | |
| | 4 | SS | | | | BL | | 19 | | | 6 | $8 \times 10^{-4}$ |
| 190 | | | | | | | | | | | | |
| 200 | 5 | SS | | | Reddish brown silty fine to coarse sand (SM), trace to some gravel, glacial till | | T | 12 | | | 27 | |
| | 6 | SS | | | | | | 10 | | | 25 | |
| 210 | | | | | | | | | | | | |
| 220 | 7A/7B | SS | | | Reddish brown slightly silty fine to coarse sand (SM), trace gravel, glacial till | | T | 16 | | | 6 | |
| | 8 | SS | | | Reddish brown silty clay (CL) with varves of grayish brown clayey silt (ML) and red clay (CH), lacustrine | | AL | L 26 | | | 69 | $5 \times 10^{-4}$ |
| 230 | | | | | | | | | | | | |
| 235 | | | | | Bedrock | | | | | | | |
| | | | | | End of boring in bedrock<br>Boring advanced to 235 feet with rock bit and bentonite mud | | | | | | | |

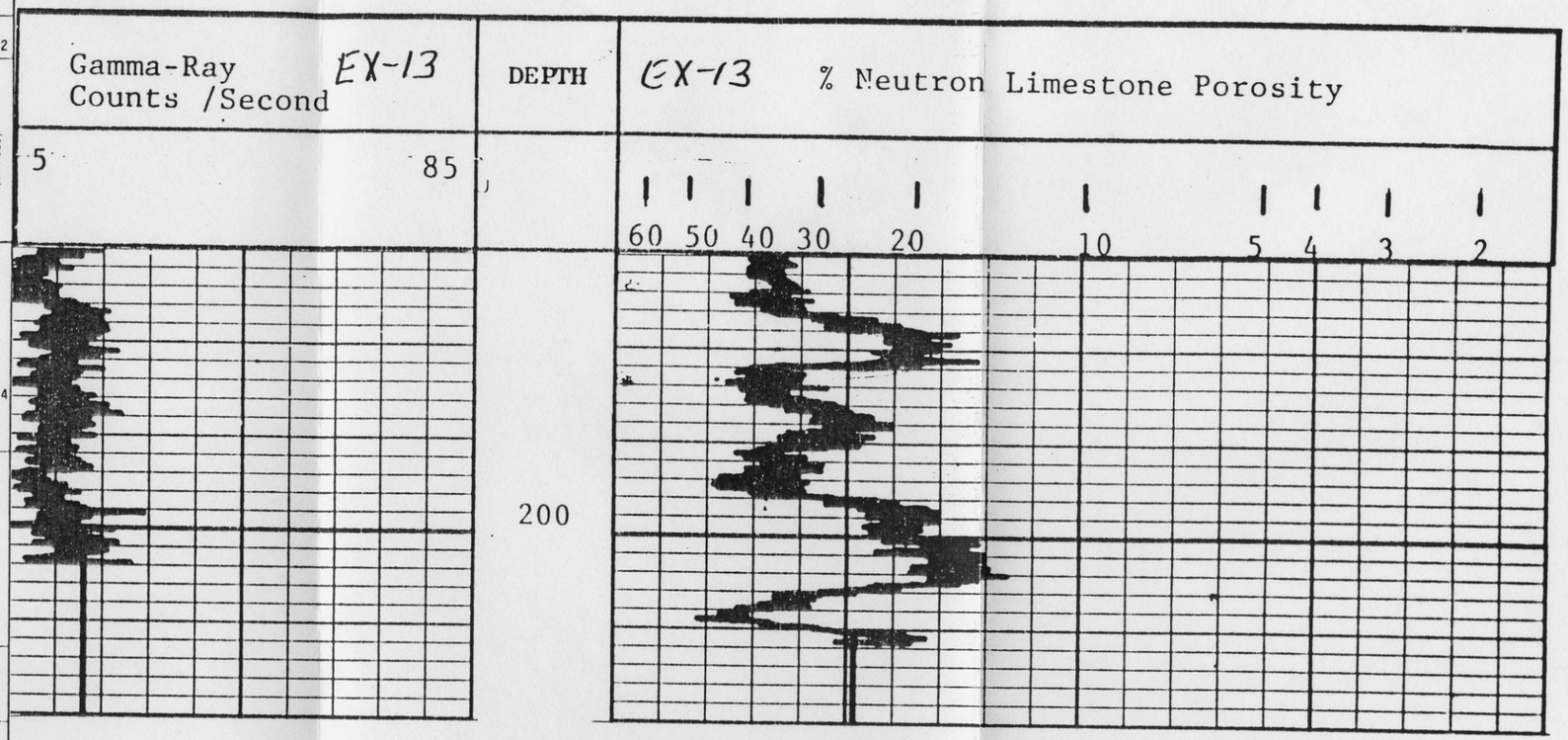
The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | | BCR | | ACR |
|---|---|---|---|---|---|
| WL T. PIPE | DATE | TIME | WL T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 2-15-84
BORING COMPLETED 2-22-84
RIG Lusiers
FOREMAN Ken

STS OFFICE 540 Lambeau, Green Bay, WI 54303
DRAWN BY
SHEET 3 OF 3
APP'D. BY JAS
STS JOB NO. 12959

BL 5-983



STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

SITE LOCATION: Crandon, Wisconsin

LOG OF BORING NUMBER: EX-14

Feet: N-110251 E-2286304 Meters: N-33605 E-696867

WELL INSTALLATION
TOP STANDPIPE EL. +

SURFACE ELEVATION 1682.67-ft. 512.879-m

| DEPTH FEET / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | SS | | | Yellowish brown clayey silt (ML) with thin seams of fine sand | | T | 21 | | | 69 | |
| 10 | 2 | SS | | | Reddish brown silty fine to coarse sand (SM), some gravel, glacial till | | T | 6 | | | 21 | |
| 20 | 3 | SS | | | Brown slightly silty fine to coarse sand (SM-SP), some gravel, glacial till | | T | 9 | | | 8 | |
| 30 | 4 | SS | | | Brown silty fine to coarse sand (SM), a little gravel, glacial till, boulders from 30-31' and 39-40' | | T | 7 | | | 19 | |
| 40 | 5 | SS | | | | | | 6 | | | 13 | |
| 50 | 6 | SS | | | Brown slightly silty fine to coarse sand (SM-SP), some gravel, coarse drift, boulders from 50-52', 62-63' and 79-80' | | CD | 10 | | | 7 | |
| 60 | 7 | SS | | | | | | 11 | | | 6 | |
| 70 | 8 | SS | | | | | | 6 | | | 6 | |
| 80 | 9 | SS | | | | | | 10 | | | 7 | |
| 90 | | | | | Continued | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally

| WL | | | BCR | | | ACR |
|---|---|---|---|---|---|---|
| WL-T. PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

BORING STARTED 2-17-84
BORING COMPLETED 2-22-84
RIG Denny's Drilling
FOREMAN Denny

STS OFFICE 540 Lambeau Green Bay, WI 54303
DRAWN BY
SHEET 1 OF 4
APP'D. BY JAS
STS JOB NO. 12959

BL 5-983

STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

SITE LOCATION: Crandon, Wisconsin

LOG OF BORING NUMBER: EX-14

Feet: N-110251 E-2286304 | Meters: N-33605 E-696867

WELL INSTALLATION
TOP STANDPIPE EL. +

SURFACE ELEVATION 1682.67-ft. 512.879-m

| DEPTH FEET / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Continued | | | | | | | |
| 90 | | | | | | | | | | | | |
| 100 | 10 | SS | | | 5-24-84 ▽ Brown slightly silty fine to coarse sand (SM-SP), some gravel, coarse drift, boulders from 50-52', 62-63' and 79-80' | | CD | 8 | | | - | |
| | 11 | SS | | | | BU | | 11 | | | 6 | |
| 110 | 12 | SS | | | | | | 17 | | | - | |
| 120 | 13 | SS | | | | | | 9 | | | 17 | |
| 130 | 14 | SS | | | Reddish brown silty fine to coarse sand (SM), trace to a little gravel, glacial till, boulder from 141-142' | | T | 10 | | | - | |
| 140 | 15 | SS | | | | | | 8 | | | 14 | |
| 150 | 16 | SS | | | | | | 7 | | | - | |
| 160 | 17 | SS | | | | BL | | 8 | | | - | $5 \times 10^{-5}$ |
| 170 | | | | | Continued | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | BCR | | ACR | | |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 2-17-84
BORING COMPLETED 2-22-84
RIG Denny's Drilling
FOREMAN Denny

STS OFFICE 540 Lambeau, Green Bay, WI 54303
DRAWN BY
SHEET 2 OF 4
APP'D. BY JAS
STS JOB NO. 12959

BL 5-983

STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Piezometer Installations

SITE LOCATION: Crandon, Wisconsin

LOG OF BORING NUMBER: EX-14

Feet: N-110251 E-2286304 Meters: N-33605 E-696867

WELL INSTALLATION
TOP STANDPIPE EL. +_____

SURFACE ELEVATION 1682.67-ft. 512.879-m

| DEPTH FEET ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 170 | | | | | Continued | | | | | | | |
| | 18 | SS | | | Reddish brown silty fine to coarse sand (SM), trace to a little gravel, glacial till, boulder from 141-142' | | T | 10 | | | 16 | |
| 180 | | | | | | | | | | | | |
| | 19 | SS | | | Brown slightly silty fine sand (SM-SP), fine drift | | FD | 17 | | | 6 | |
| 190 | | | | | | | | | | | | |
| | 20 | SS | | | | AU | | 16 | | | - | $2x10^{-3}$ |
| 200 | | | | | | | | | | | | |
| | 21 | SS | | | | | | 14 | | | - | |
| 210 | | | | | | | | | | | | |
| | 22 | SS | | | | | | 18 | | | 11 | |
| 220 | | | | | | | | | | | | |
| | 23 | SS | | | Brown silty fine sand (SM), fine drift | | FD | 19 | | | 22 | |
| 230 | | | | | | | | | | | | |
| | 24 | SS | | | | | | 17 | | | - | |
| 240 | | | | | | | | | | | | |
| | 25 | SS | | | Brown very fine sandy silt (ML), fine drift | | FD | 20 | | | 52 | |
| 250 | | | | | Continued | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | | BCR | | ACR |
|---|---|---|---|---|---|
| WL-T. PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 2-17-84
BORING COMPLETED 2-22-84
RIG Denny's Drilling
FOREMAN Denny

STS OFFICE 540 Lambeau Green Bay, WI 54303
DRAWN BY
SHEET 3 OF 4
APP'D. BY JAS
STS JOB NO. 12959

BL 5-983

STS Consultants Ltd.

**OWNER** Exxon Minerals Company

**PROJECT NAME** Piezometer Installations

**LOG OF BORING NUMBER** EX-14

Feet N-110251 E-2286304 Meters N-33605 E-696867

**SITE LOCATION** Crandon, Wisconsin

WELL INSTALLATION
TOP STANDPIPE EL. +

SURFACE ELEVATION 1682.67-ft. 512.879-m

| DEPTH FEET / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 250 | | | | | | | | | | | | |
| 260 | 26 | SS | | | Reddish brown fine sandy silt (ML) with varves of red clayey silt with moderate plasticity, lacustrine | | L | 20 | | | - | |
| 270 | 27 | SS | | | Brown silty fine to coarse sand (SM) with thin seams of fine sandy silt, trace gravel, transition zone between lacustrine and basal till | AL | L | 14 | | | 14 | $7 \times 10^{-5}$ |
| 280 | 28 | SS | | | Dark brown silty fine to coarse sand (SM), some gravel, trace clay, basal till | | BT | 8 | | | 18 | |
| 283 | | | | | Bedrock | | | | | | | |
| | | | | | End of boring in bedrock<br>Boring advanced to 283 feet with rock bit and bentonite mud | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | BCR | | ACR | | |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 2-17-84
BORING COMPLETED 2-22-84
RIG Denny's Drilling
FOREMAN Denny

STS OFFICE 540 Lambeau Green Bay, WI 54303
DRAWN BY
SHEET 4 OF 4
APP'D. BY JAS
STS JOB NO. 12959

BEST COPY AVAILABLE

STS Consultants Ltd

| | |
|---|---|
| OWNER | Exxon Minerals |
| PROJECT NAME | Piezometer Installations |
| SITE LOCATION | Crandon, Wisconsin |
| LOG OF BORING NUMBER | EX-15 |
| Feet | N-112443 E-2280005 |
| Meters | N-34273 E-694947 |

WELL INSTALLATION
TOP STANDPIPE EL. +

SURFACE ELEVATION 1626.64-ft. 495.801-m

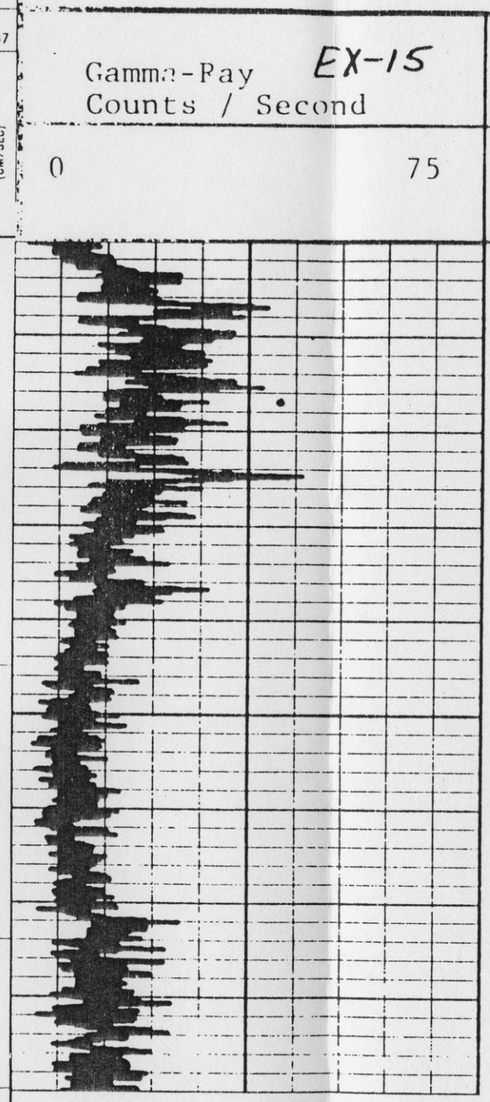
| DEPTH FEET / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | | | | | Brown silty fine to medium sand (SM), trace to some gravel, glacial till | | T | | | | | |
| 20 | | | | | | | | | | | | |
| 30 | | | | | | BL | | | | | | |
| 40 | | | | | 5-24-84 ▽ | | | | | | | |
| 50 | | | | | Brown fine sand (SP), trace silt, fine drift | | FD | | | | | |
| 60 | 1 | SS | | | | | | 19 | | | 3 | |
| 70 | | | | | | | | | | | | |
| 80 | | | | | Brown silty fine to coarse sand (SM), trace to some gravel, glacial till, boulder at 86-87' | | T | | | | | |
| | | | | | Continued | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | BCR | | ACR | | |
|---|---|---|---|---|---|
| WL T. PIPE | DATE | TIME | WL T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

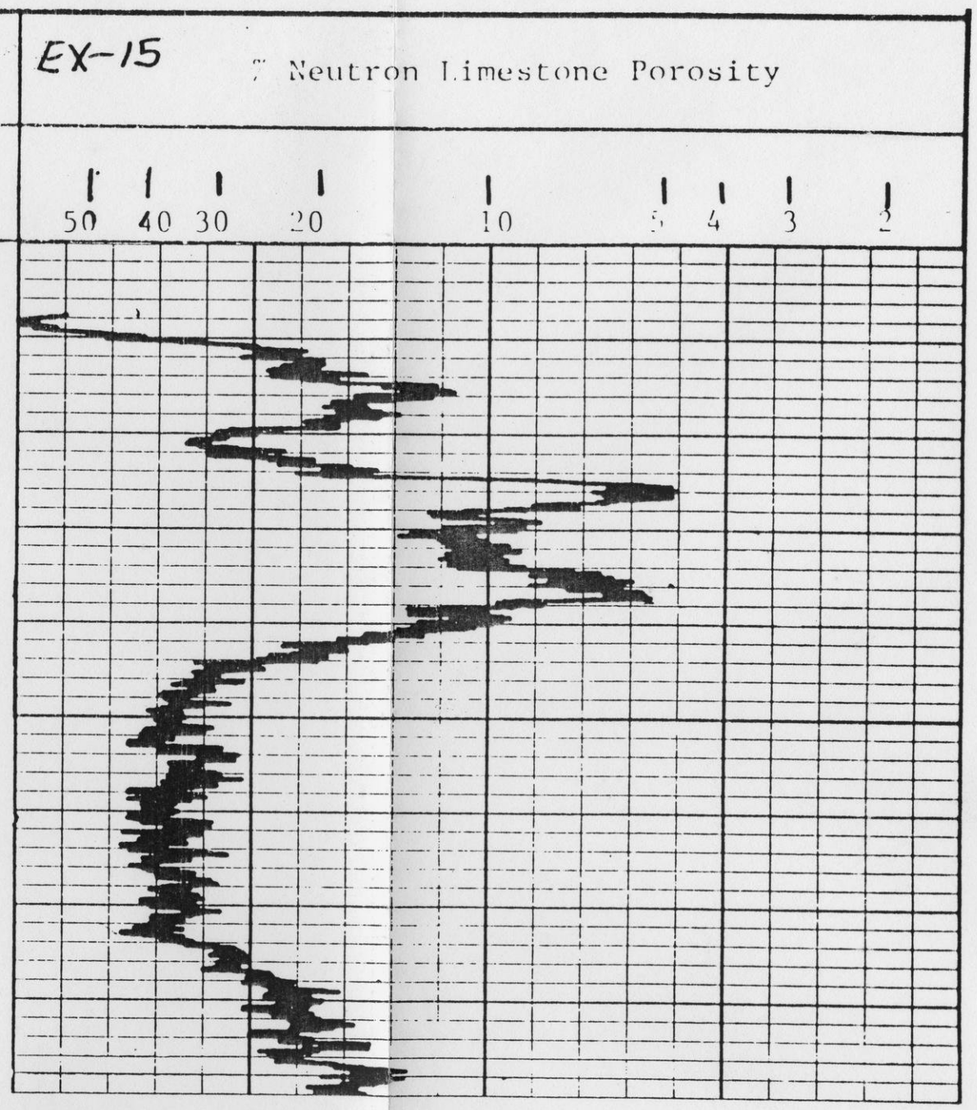
| | |
|---|---|
| BORING STARTED | 2-8-84 |
| BORING COMPLETED | 2-10-84 |
| RIG | Denny's Drilling |
| FOREMAN | Denny |
| STS OFFICE | 540 Lambeau Green Bay, WI 54303 |
| DRAWN BY | |
| SHEET | 1 OF 3 |
| APP'D. BY | JAS |
| STS JOB NO. | 12959 |

BL. 5-983




DEPTH

50



BEST COPY AVAILABLE

STS Consultants Ltd

OWNER: Exxon Minerals

PROJECT NAME: Piezometer Installations

LOG OF BORING NUMBER: EX-15

Feet: N-112443 E-2280005 Meters: N-34273 E-694947

SITE LOCATION: Crandon, Wisconsin

WELL INSTALLATION TOP STANDPIPE EL. +

SURFACE ELEVATION 1626.64-ft. 495.801-m

| DEPTH FEET / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 100 | | | | | Brown silty fine to coarse sand (SM), trace to some gravel, glacial till, boulder at 86-87' | | T | | | | | |
| 120 | 2 | SS | | | Dark grayish brown silty medium to coarse sand (SM), some gravel, coarse drift | AU | CD | - | | | 11 | $4x10^{-3}$ |
| 150 | | | | | Reddish brown silty fine to coarse sand (SM), trace to some gravel, basal till, boulder from 151-152' | | BT | | | | | |
| 170 | | | | | Continued | | | | | | | |

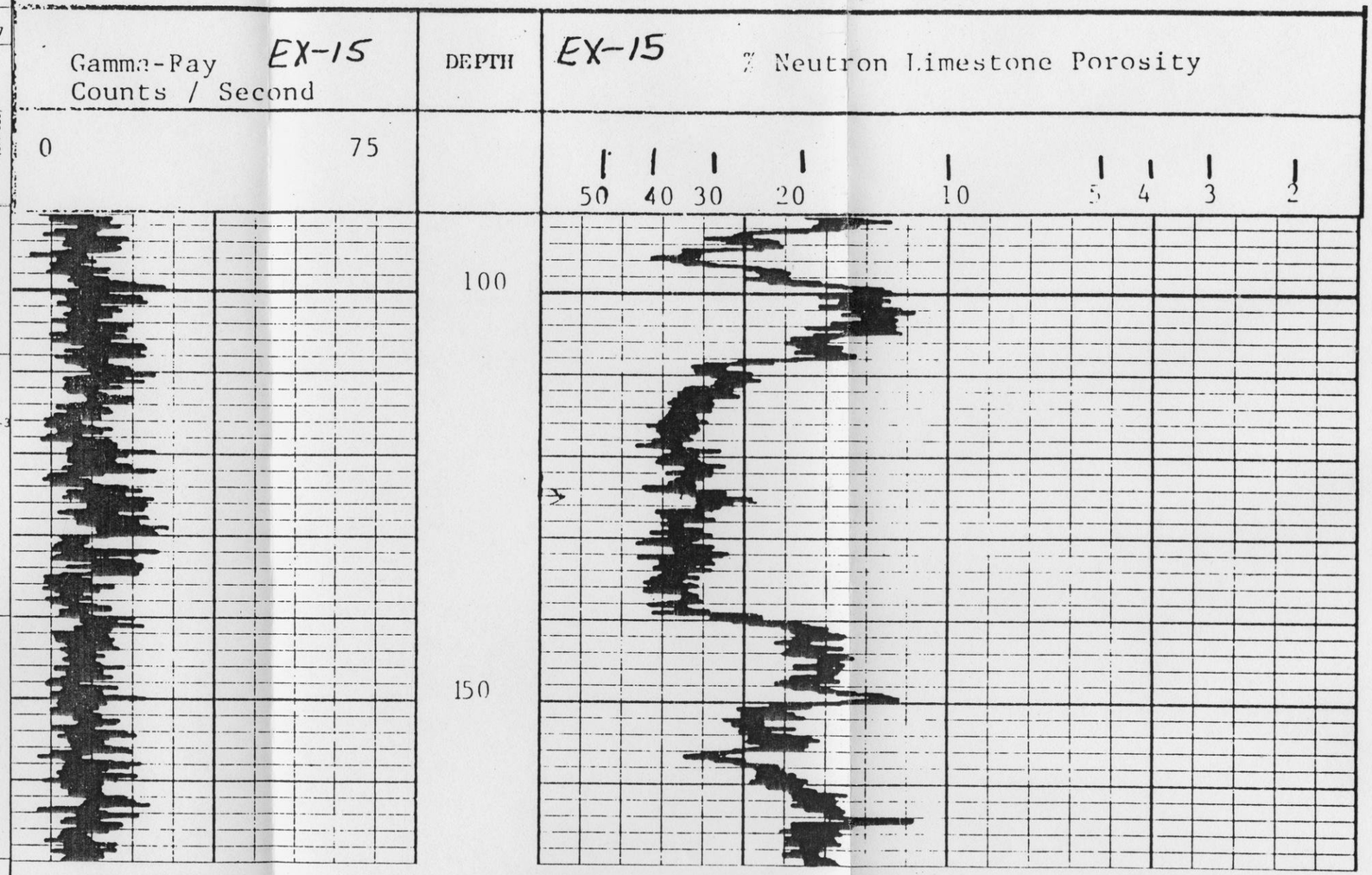
The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL T. PIPE | DATE | TIME | WL T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |

BORING STARTED 2-8-84
BORING COMPLETED 2-10-84
RIG Denny's Drilling
FOREMAN Ken

STS OFFICE 540 Lambeau, Green Bay, WI 54303
DRAWN BY
SHEET 2 OF 3
APP'D. BY JAS
STS JOB NO. 12959

BL. 5-983



BEST COPY AVAILABLE

STS Consultants Ltd

OWNER: Exxon Minerals

PROJECT NAME: Piezometer Installations

SITE LOCATION: Crandon, Wisconsin

LOG OF BORING NUMBER: EX-15

Feet: N-112443 E-2280005 Meters: N-34273 E-694947

WELL INSTALLATION: TOP STANDPIPE EL. +

SURFACE ELEVATION: 1626.64-ft. 495.801-m

| DEPTH FEET ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 180 | | | | | Reddish brown silty fine to coarse sand (SM), trace to some gravel, basal till, boulder from 151-152' | | BT | | | | | |
| | 3 | SS | | | Reddish brown clayey silt (ML), with varves of fine silty sand and silty clay, lacustrine | | L | 22 | | | 90 | |
| 190 | | | | | | | | | | | | |
| 200 | | | | | Reddish brown silty fine to coarse sand (SM), trace to some gravel, basal till grading to clayey silt (ML) above bedrock | | BT | | | | | |
| 210 | | | | | | | | | | | | |
| 220 | 4 | SS | | | | | AL | 14 | | | 74 | $2x10^{-4}$ |
| 230 | | | | | Bedrock | | | | | | | |
| 235 | | | | | End of boring in bedrock<br>Boring advanced to 235 feet with rock bit and bentonite mud | | | | | | | |

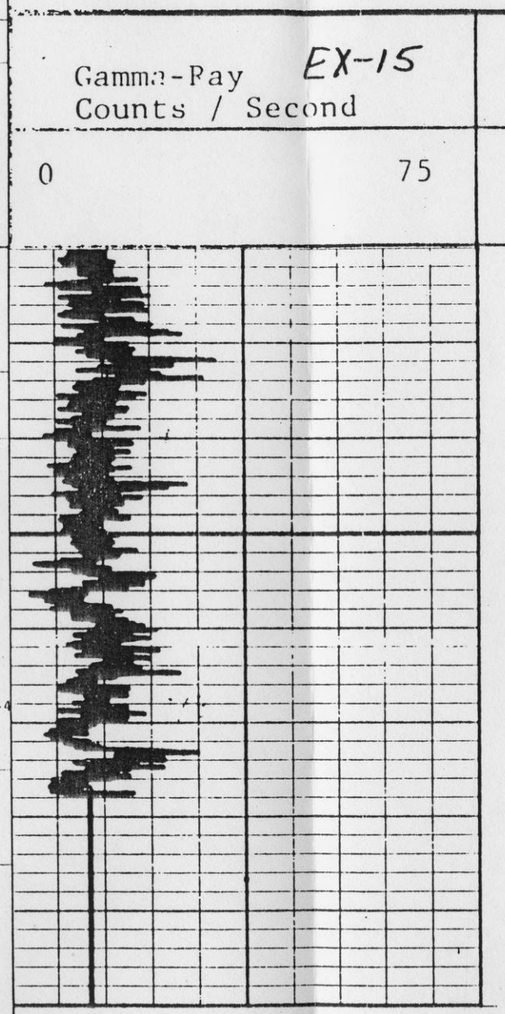
The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

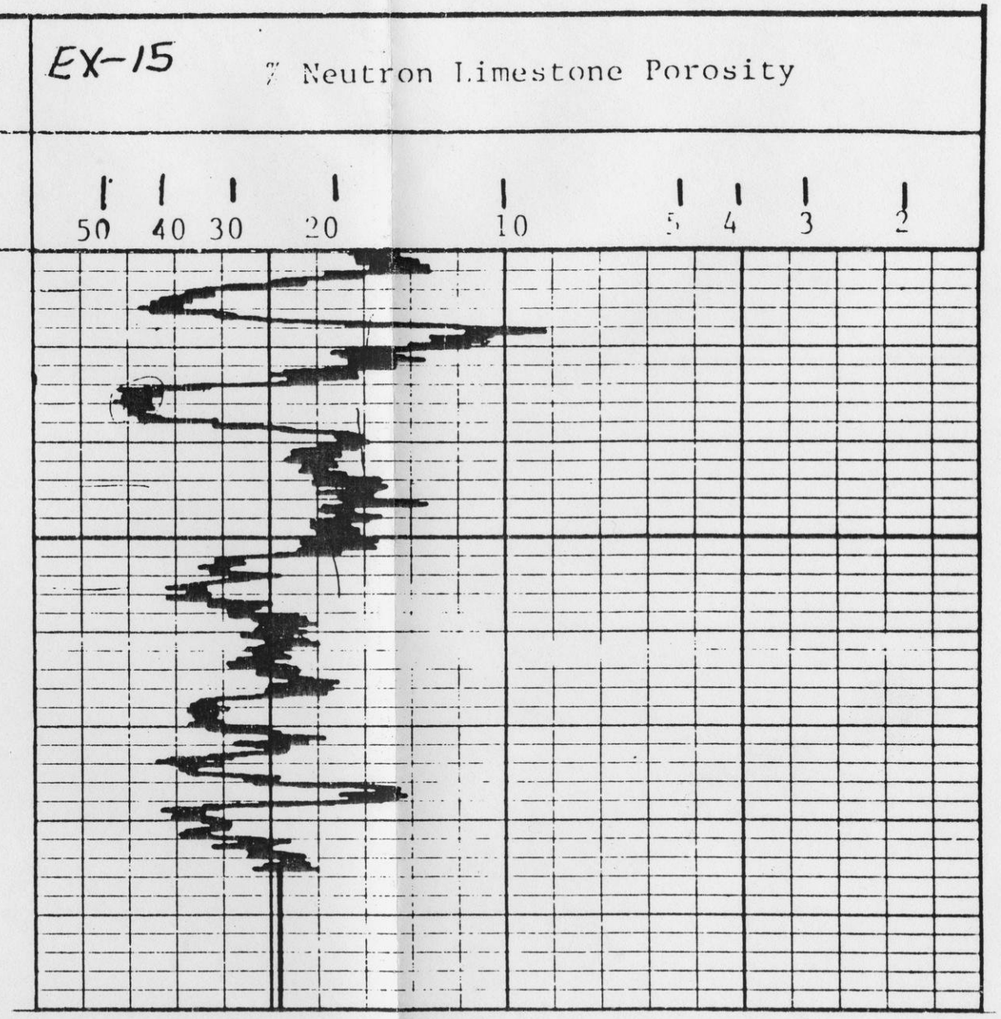
| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL T. PIPE | DATE | TIME | WL T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

| | |
|---|---|
| BORING STARTED | 2-8-84 |
| BORING COMPLETED | 2-10-84 |
| RIG | Denny's Drilling |
| FOREMAN | Ken |

| | |
|---|---|
| STS OFFICE | 540 Lambeau<br>Green Bay, WI 54303 |
| DRAWN BY | SHEET 3 OF 3 |
| APP'D. BY JAS | STS JOB NO. 12959 |

BL 5-883



STS Consultants Ltd

| | |
|---|---|
| OWNER | Exxon Minerals |
| PROJECT NAME | Piezometer Installations |
| SITE LOCATION | Crandon, Wisconsin |

LOG OF BORING NUMBER: EX-16

Feet: N-113316 E-2282043 — Meters: N-34539 E-695568

WELL INSTALLATION
TOP STANDPIPE EL. +

SURFACE ELEVATION 1614.70-ft. 492.162-m

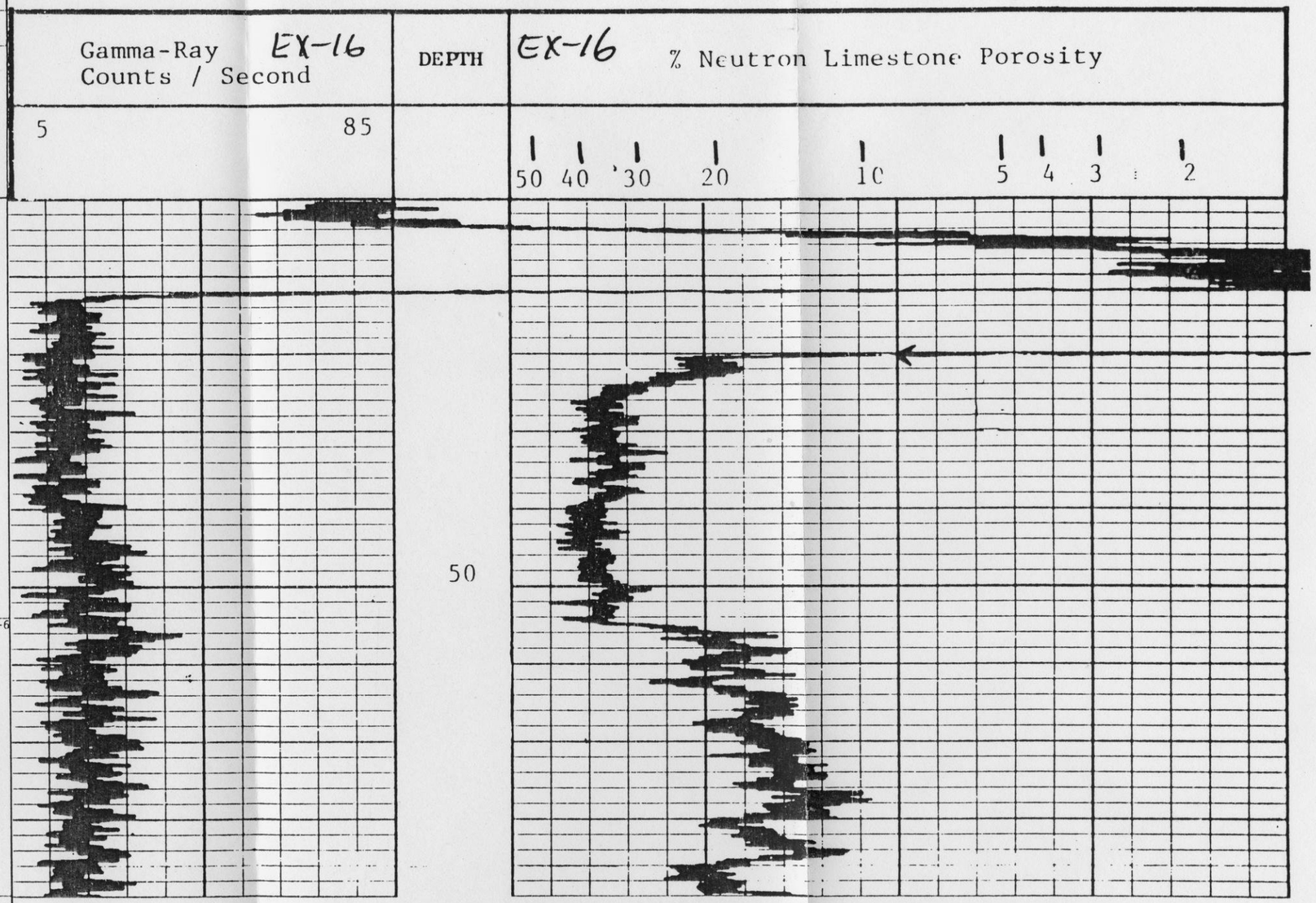
| DEPTH FEET / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | | | | | | | | | | | | |
| 20 | | | | | 5-24-84 ▽ | | | | | | | |
| | | | | | Brown fine sand (SP), trace coarse sand, fine drift | | FD | | | | | |
| 30 | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | |
| 60 | | | | | | BL | | | | | | $9x10^{-6}$ |
| 70 | 1 | SS | | | Brown silty fine to medium sand (SM), trace gravel, glacial till | | T | 14 | | | 22 | |
| 80 | | | | | | | | | | | | |
| 90 | | | | | Continued | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL T PIPE | DATE | TIME | WL T PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

| | | | |
|---|---|---|---|
| BORING STARTED | 2-9-84 | STS OFFICE | 540 Lambeau<br>Green Bay, WI 54303 |
| BORING COMPLETED | 2-9-84 | | |
| RIG | Lusiers | DRAWN BY | SMD |
| FOREMAN | Keith | APP'D. BY | JAS |
| | | SHEET | 1 OF 2 |
| | | STS JOB NO. | 12959 |

BL 5-883



BEST COPY AVAILABLE

STS Consultants Ltd

OWNER: Exxon Minerals

PROJECT NAME: Piezometer Installations

SITE LOCATION: Crandon, Wisconsin

LOG OF BORING NUMBER: EX-16

Feet: N-113316 E-2282043 Meters: N-34539 E-695568

WELL INSTALLATION
TOP STANDPIPE EL. +

SURFACE ELEVATION 1614.70-ft. 492.162-m

| DEPTH FEET / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | PIEZOMETER ID | GEOLOGIC UNIT | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 100 | | | | | Brown silty fine to medium sand (SM), trace gravel, glacial till | | T | | | | | |
| 110 | 2 | SS | | | Brown slightly silty fine to coarse sand (SM-SP) some gravel, coarse drift | AU | CD | 13 | | | 9 | $6 \times 10^{-3}$ |
| 120 | | | | | | | | | | | | |
| 130 | | | | | Brown slightly silty fine sand (SM-SP), trace gravel, fine drift | | FD | | | | | |
| 140 | 3 | SS | | | | AL | | 21 | | | 6 | $1 \times 10^{-3}$ |
| 145 | | | | | End of boring at 145 feet in fine drift<br>Boring advanced to 145 feet by rock bit and bentonite mud | | | | | | | |

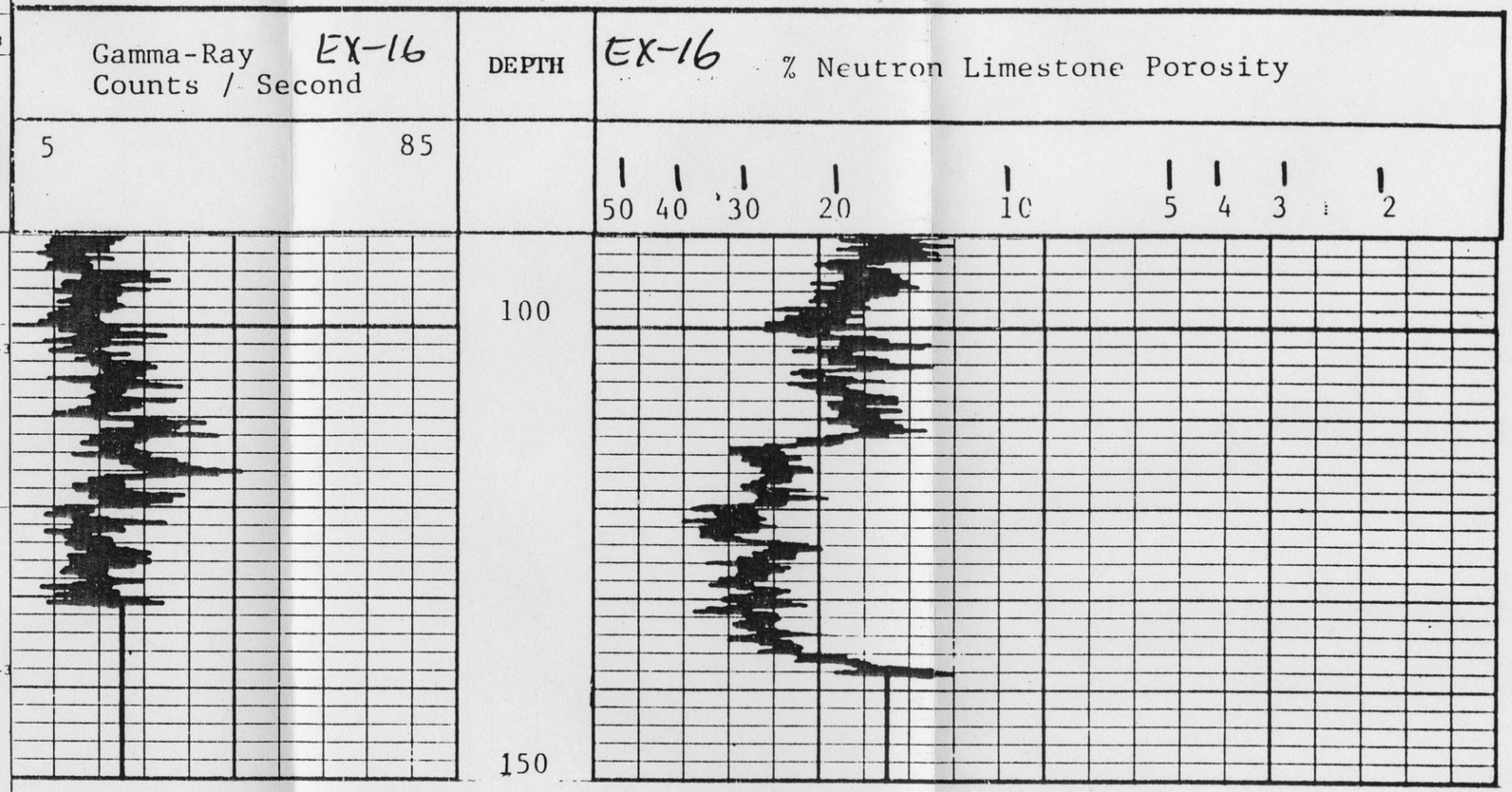
The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL BCR | | | WL | | ACR |
|---|---|---|---|---|---|
| WL-T. PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 2-9-84
BORING COMPLETED 2-9-84
RIG Lusiers
FOREMAN Keith

STS OFFICE 540 Lambeau Green Bay, WI 54303
DRAWN BY SMD SHEET 2 OF 2
APP'D. BY JAS STS JOB NO 12959

BL. S-883



# Appendix 3.5-6

## Miscellaneous Boring Logs

- Soil Testing Services of Wisconsin, Inc., 1978 East (EVS) and West (WVS) Borings
- Soil Testing Services of Wisconsin, Inc., 1980 Plant Facility Borings (STS-B1 through 11)
- Soil Testing Services of Wisconsin, Inc., 1981 Geotechnical Borings for Proposed Bridges (RR1 and 2, AR-1 and 1A, AR-2 and 2A, AR3 and AR4)
- Foth & Van Dyke and Associates, Inc., 1981 Access Road Borings (FVD-AR-1 through 31)
- Foth & Van Dyke and Associates, Inc., 1981 Railroad Spur Borings (FVD-RR-1 through 35)
- STS Consultants, LTD., 1984 Reclaim Pond Borings (RP-1 through 15)

**Soil Testing Services of Wisconsin, Inc.**
**1978 East (EVS) and West (WVS) Borings**

# LOG OF BORING NO. EVS

| | |
|---|---|
| OWNER Exxon Minerals USA | ARCHITECT-ENGINEER |
| SITE Crandon Mine Development | PROJECT NAME East Ventilator Shaft |

BEST COPY AVAILABLE

SURFACE ELEVATION 1614.4 Sta. 16,340.8 N, 78,955.8 E.

| DEPTH ELEVATION | SAMPLE NO. | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.3 | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.2 (1 2 3 4 5); PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT %; STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| | 1 | SS | 1 | | Brown silty fine sand (SM)-trace to a little roots and stems-moist-medium dense Note: 0.8' topsoil observed | | 14, 22.9 |
| 10 | 2 | SS | 1 | | Brown fine to medium sand (SP)-trace to a little fine to medium gravel-trace silt-moist-dense Note: 6" silty fine sand seam observed at 5.7' | | 10.4, 33 |
| | 3 | SS | 1 | | Brown silty fine to coarse sand (SM)-some fine to coarse gravel-moist-very dense Note: broken stone observed in sample | | 12.9, 83 |
| 20 | 4 | SS | 1 | | Brown fine to medium sand (SP)-moist-extremely dense | | 14.0, 90 |
| | 5 | SS | 1 | | Brown slightly silty fine sand (SP-SM)-moist-extremely dense Note: 1" sandy silt seam observed at 20.5' Note: broken stone observed in sample | | 8.2, 94 |
| | 6 | SS | 2 | | | 106.3 | 17.6, 41 |
| 30 | 7 | SS | 2 | | Brown silty fine to medium sand (SM)-trace fine gravel-wet-extremely dense-occasional pockets of fine sand | | 151/12" |
| | 8 | SS | 2 | | Note: 1.0' boulder from 30' to 31' | | BOUNCING 32/6" |
| | 9 | SS | 3 | | | 121.0 | 15.7, 80/12" |
| 40 | 10 | SS | 2 | | Brown fine to coarse sand (SW)-a little to some fine to coarse gravel-trace to a little silt-wet-extremely dense Note 1: Broken stones observed in samples Note 2: Gravel fraction increases with depth Note 3: Boundary or cobble encountered from 57-58' Boundary or cobble encountered from 60-61' Boundary or cobble encountered from 61-63' Boundary or cobble encountered from 64-70' | 133.0 | 6.5, 127/12" |
| | 11 | SS | 2 | | | 127.9 | 7.9, 109/4" |
| 50 | 12 | SS | 3 | | | | 8.9, 52/6", 70/4" BOUNCING |
| | 13 | SS | 3 | | | 129.5 | 11.2, 132/12" |
| 60 | | | | | | 126.8 | |

CONTINUED ON PAGE 2

WATER LEVEL OBSERVATIONS

| | | |
|---|---|---|
| W.L. | 25.0' WS | |
| W.L. | B.C.R. | A.C.R. |
| W.L. | 27.7' on 3-29-78 | |
| | 28.0' on 4-4-78 | |
| | 29.8' on 4-7-78 | |

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | |
|---|---|
| BORING STARTED | 3-20-78 |
| BORING COMPLETED | 3-21-78 |
| RIG W-8 | FOREMAN EVH |
| DRAWN CRB | APPROVED DJH |
| JOB # 8736 | SHEET |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

BBS 10/

# LOG OF BORING NO. [illegible] (CONTINUED)

| | |
|---|---|
| OWNER: Exxon Minerals USA | ARCHITECT-ENGINEER: BEST COPY AVAILABLE |
| SITE: Crandon Mine Development | PROJECT NAME: East Ventilator Shaft |

| DEPTH ELEVATION | SAMPLE NO. | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.3 | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.) |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION → 1614.4 Sta. 16,340.8 N, 78,955.8 E | | |
| 60 | 1 | SS | | | Brown fine to coarse sand (SW)-a little to some fine to coarse gravel-trace to a little silt-wet-extremely dense<br>Note 1: Broken stones observed in samples<br>Note 2: Gravel fraction increases with depth<br>Note 3: Boulder or cobble encountered from 57-58'<br>Boulder or cobble encountered from 60-61'<br>Boulder or cobble encountered from 61-63'<br>Boulder or cobble encountered from 64-70' | | BOULDING 6/16 70/4" |
| 70 | 15 | SS | 3 | | | | 133 PCF |
| | Run #1 | DB | | | Felsic Phyllite* with mafic chloritic fragments-vertical cleavage-mostly vertical fractures-a few fractures filled with saprolite-Mohs hardness-3 to 5 | | |
| | Run #2 | DB | | | Run #1 Depth 75.0-76.3' Rec. 100% Fract.Freq. 0.8/ft. RQD 100%<br>Run #2 76.3-78.8' 82% 1.5/ft. 80%<br>Run #3 78.8-83.8' 91% 0.22/ft. 100% | | |
| 80 | Run #3 | DB | | | *Parent rock classified as Felsic-Intermediated Lapilli Tuff | | |
| 83.8 | | | | | End of Boring - Boring terminated in Phyllite (bedrock)<br>Boring advanced to 5' by solid-stem auger<br>Boring advanced to 75' by 10' of 4" casing, 3 7/8" tricone roller bit with stabilizer and Revert drilling mud<br>Boring advanced to 83.8' by 10' of 4" casing, NX split tube core barrel and wash water<br><br>2" Ø Observation well installed at 65.5' with protector pipe<br><br>Note: Penetration test results labeled as blows/distance<br><br>Penetration Test Method: 1. Standard 2" split barrel sampler, N-rod and 140# hammer ASTM 1586-67<br>2. 2 1/2" split barrel sampler, N-rod and 380# hammer<br>3. 3" split barrel sampler, N-rod and 380# hammer | | |

| WATER LEVEL OBSERVATIONS | | |
|---|---|---|
| W.L. | 25.0' WS | |
| W.L. | B.C.R. | A.C.R. |
| W.L. | 27.7' on 3-29-78 | |
| | 28.0' on 4-4-78 | |
| | 29.8' on 4-7-78 | |

**SOIL TESTING SERVICES**
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | |
|---|---|
| BORING STARTED | 3-20-78 |
| BORING COMPLETED | 3-21-78 |
| RIG W-8 | FOREMAN EVH |
| DRAWN CRB | APPROVED DJH |
| JOB # 8736 | SHEET |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

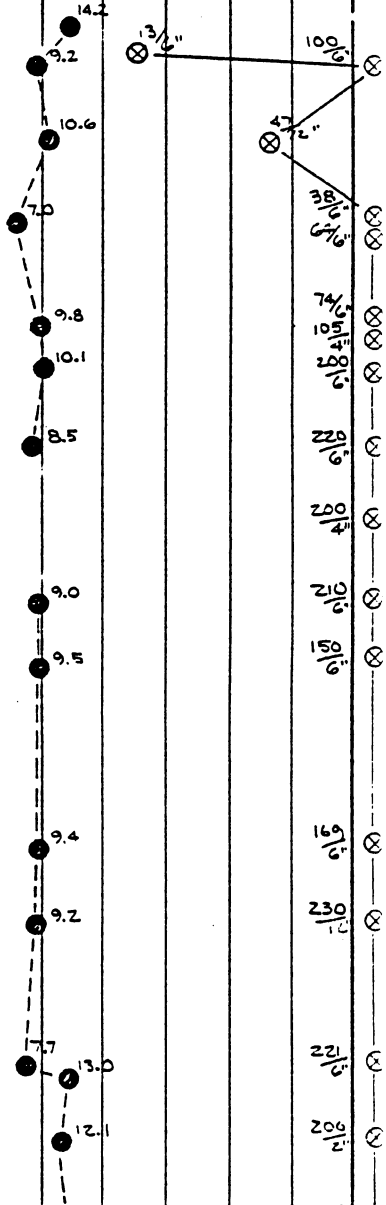
# LOG OF BORING NO. WV3

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals USA | BEST COPY AVAILABLE |
| **SITE** Crandon Mine Development | **PROJECT NAME** West Ventilator Shaft |

SURFACE ELEVATION 1683.4 Sta. 16,744.5 N; 74,385.9 E

| DEPTH ELEVATION | SAMPLE NO. | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.3 |
|---|---|---|---|---|---|---|
| | 1 | AS | | | Brown silty fine to medium sand (SM)-trace roots and stems from 0-2'-trace to a little fine to medium gravel-moist-extremely dense with boulders and cobbles-grades coarser with depth-2" varved silty clay and silt zone encountered at 71.0' | |
| | 2 | SS | 1 | 11 | 1.0' boulder observed at 20.0-21.0' | |
| 10 | 3 | SS | 1 | | 1.0' boulder observed at 22.5-23.5' | |
| | 4 | SS | 1 | | 1.0' boulder observed at 23.5-24.5' | |
| 20 | | | | | 1.0' boulder observed at 36.0-37.0' | |
| | 5 | SS | 1 | | 1.0' boulder observed at 54.5-55.5' | |
| | 6 | SS | 1 | | 1.5' boulder observed at 65.0-66.5' | |
| 30 | 7 | SS | 3 | | 0.8' boulder observed at 74.0-74.8' | |
| | 8 | SS | 3 | | | |
| 40 | 9 | SS | 3 | | | 129.4 |
| | 10 | SS | 3 | | | |
| 50 | | | | | | |
| | 11 | SS | 3 | | | |
| 60 | 12 | SS | 3 | | | 124.5 |
| 70 | 13 | SS | 3 | | | 130.9 |
| | 14 | SS | 1 | | | |
| 80 | | | | | CONTINUED ON PAGE 2 | |

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.²
1 2 3 4 5
PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.)
10 20 30 40 50




| WATER LEVEL OBSERVATIONS | |
|---|---|
| W.L. | 110.0 WS |
| W.L. | Bailed to 50' (3-30-78) |
| W.L. | 70.8' on 3-31-78 |
| | > 100.0' on 4-2-78 |
| | 106.5' on 4-4-78 |
| | 110.0' on 4-7-78 |

**SOIL TESTING SERVICES**
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | |
|---|---|
| BORING STARTED | 3-21-78 |
| BORING COMPLETED | 3-22-78 |
| RIG 8 | FOREMAN EVH |
| DRAWN CRB | APPROVED DJH |
| JOB # 8736 | SHEET |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

BAS 10/75

LOG OF BORING NO.

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals USA | BEST COPY AVAILABLE |
| **SITE** | **PROJECT NAME** |
| Crandon Mine Development | West Ventilator Shaft |

SURFACE ELEVATION → 1683.4 Sta. 16,744.5 N; 74,385.9 E

| DEPTH ELEVATION | SAMPLE NO. | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.3 | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % — STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50) | |
|---|---|---|---|---|---|---|---|---|
| 80 | 15 | SS | 3 | | Brown fine to medium sand (SP)-trace to a little fine to medium gravel-moist-extremely dense | | 13.6 | 200/6" |
| | 16 | SS | 3 | | Brown silty fine to medium sand (SM)-trace to a little fine gravel-moist-extremely dense-thin seams of fine to medium sand encountered at 95.0'-trace clay in silty sand at 96.0' | 144.0 | 9.0 | 125/6" |
| 90 | 17 | SS | 3 | | | | 7.9 | 200/6" |
| | 18 | SS | 3 | | | 125.0 | 8.8 | 185/6" |
| | 18A | SS | 3 | | | | 8.8 | 200/2" |
| 100 | 19 | SS | 3 | | | | | |
| | 20 | SS | 3 | | Brown slightly silty fine to medium sand (SP-SM)-moist-extremely dense-grades less silty with depth | | 12.2 | 185/3" |
| 110 | 21 | SS | 3 | | Brown fine to medium sand (SP)-trace silt-trace fine gravel-moist-extremely dense-grades more silty with depth | 103.6 | 18.7 | 334/5" 5/6" |
| | 22 | SS | 3 | | Brown silty fine to medium sand (SM)-trace fine gravel-moist-extremely dense | 125.0 | 13.2 | 5/6" 5/6" 5/6" |
| 120 | 23 | SS | 3 | | | | 12.5 | |
| | 24 | SS | 3 | | | | 11.4 | 85/12" |
| 130 | 25 | SS | 3 | | Reddish brown silty fine to medium sand (SM)-trace clay-trace to a little fine to medium gravel-moist-extremely dense-slightly cemented in selected zones | | 11.6 | 123/12" |
| | 26 | SS | 3 | | | 115.0 | 10.9 | BOUNCING 172/5" |
| 140 | 27 | SS | 3 | | | 128.0 | | BOUNCING 175/4" |
| | 28 | SS | 3 | | | | 13.1 | 230/5" |
| 150 | 29 | SS | 3 | | | | 9.7 | 169/6" |
| | 30 | SS | 3 | | | 132.8 | 9.4 | 89/6" 162/4" |
| 160 | | | | | CONTINUED ON PAGE 3 | | | |

| WATER LEVEL OBSERVATIONS | |
|---|---|
| W.L. | 110.0 WS |
| W.L. | Bailed to 50' (3-30-78) |
| W.L. | 70.8' on 3-31-78 |
| | >100.0' on 4-2-78 |
| | 106.5' on 4-4-78 |
| | 110.0' on 4-7-78 |

**SOIL TESTING SERVICES**
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | 3-21-78 | |
| BORING COMPLETED | | 3-22-78 | |
| RIG | 8 | FOREMAN | EVH |
| DRAWN | CRB | APPROVED | DJH |
| JOB # | 8736 | SHEET | |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

# LOG OF BORING NO. WVS (CONTINUED)

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals USA | |
| **SITE** | **PROJECT NAME** |
| Crandon Mine Development | West Ventilator Shaft |

SURFACE ELEVATION → 1683.4 Sta. 16,744.5 N; 74,385.9 E

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5)
PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50)

| DEPTH ELEVATION | SAMPLE NO. RUN | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.³ |
|---|---|---|---|---|---|---|
| 160 | #1 | DB | | | Felsic Phyllite* decomposed to red and yellowish brown Saprolite having a silty and clayey sand texture (SC-SM)-vertical cleavage-degree of decomposition varies from moderate to severe-some zones have decomposed to a moderately plastic clay-rock pieces. grade coarser with depth-generally extremely dense and hard with some zones having a stiff consistency | |
| | #2 | DB | | | | |
| 170 | #3 | DB | | | | |
| | #4 | DB | | | | |
| | 31 | SS | | | | |
| | #5 | DB | | | | |
| 180 | #6 | DB | | | | |
| | #7 | DB | | | Felsic Phyllite* mafic fragments-very closely fractured mostly in the vertical direction-a few fractures filled with Saprolite-degree of weathering in fractures decreases with depth-talc observed along vertical cleavage-Mohs hardness=1 | |
| 189.5 | | | | | | |

| | Depth | Rec. | Frac. Freq. | RQD | Remarks |
|---|---|---|---|---|---|
| Run #1 | 160.0-165.0' | 42% | Very Broken and | 0% | |
| Run #2 | 165.0-169.0' | 72% | decomposed | 0% | |
| Run #3 | 169.0-169.5' | 0% | - | - | |
| Run #4 | 169.0-171.0' | 0% | - | - | |
| 3" Split Spoon | 171.0-171.3' | 100% | Very broken and | 0% | |
| Run #5 | 171.3-176.3' | 46% | decomposed | 0% | |
| Run #6 | 180.0-185.0' | 66% | Saprolite @ top; remainder 2.2/ft. | 62% | Vertical Cleavage |
| Run #7 | 185.0-189.5' | 100% | 2.0/ft. | 87% | Vertical Cleavage |

*Parent rock classified as Felsic-Intermediated Lapilli Tuff

17.1 MEASURED IN SILTY CLAY LENSE

20.4 (18.0 — 28.6) MEASURED IN SILTY CLAY LENSE

200/4" ⊗

End of Boring

Boring advanced to 5.0' by solid-stem auger
Boring advanced to 160.0' by 10' of 4" casing, 3 7/8" tricone roller bit with stabilizer & Revert
Boring advanced to 171.0' by 10' of 4" casing, NX split tube core barrel and thin Revert drilling mud reamed with 3 7/8" roller bit
Boring advanced to 185.0' by 10' of 4" casing, NX split tube core barrel and thin Revert drilling mud
Boring advanced to 189.5' by 10' of 4" casing, NX split tube core barrel and thin Revert drilling mud

2" Ø Observation well installed at 145' with protector pipe

Pressure meter tests were performed at 46.5', 63.5' and 83.5' using a shielded probe having a 600 PSI maximum pressure capability

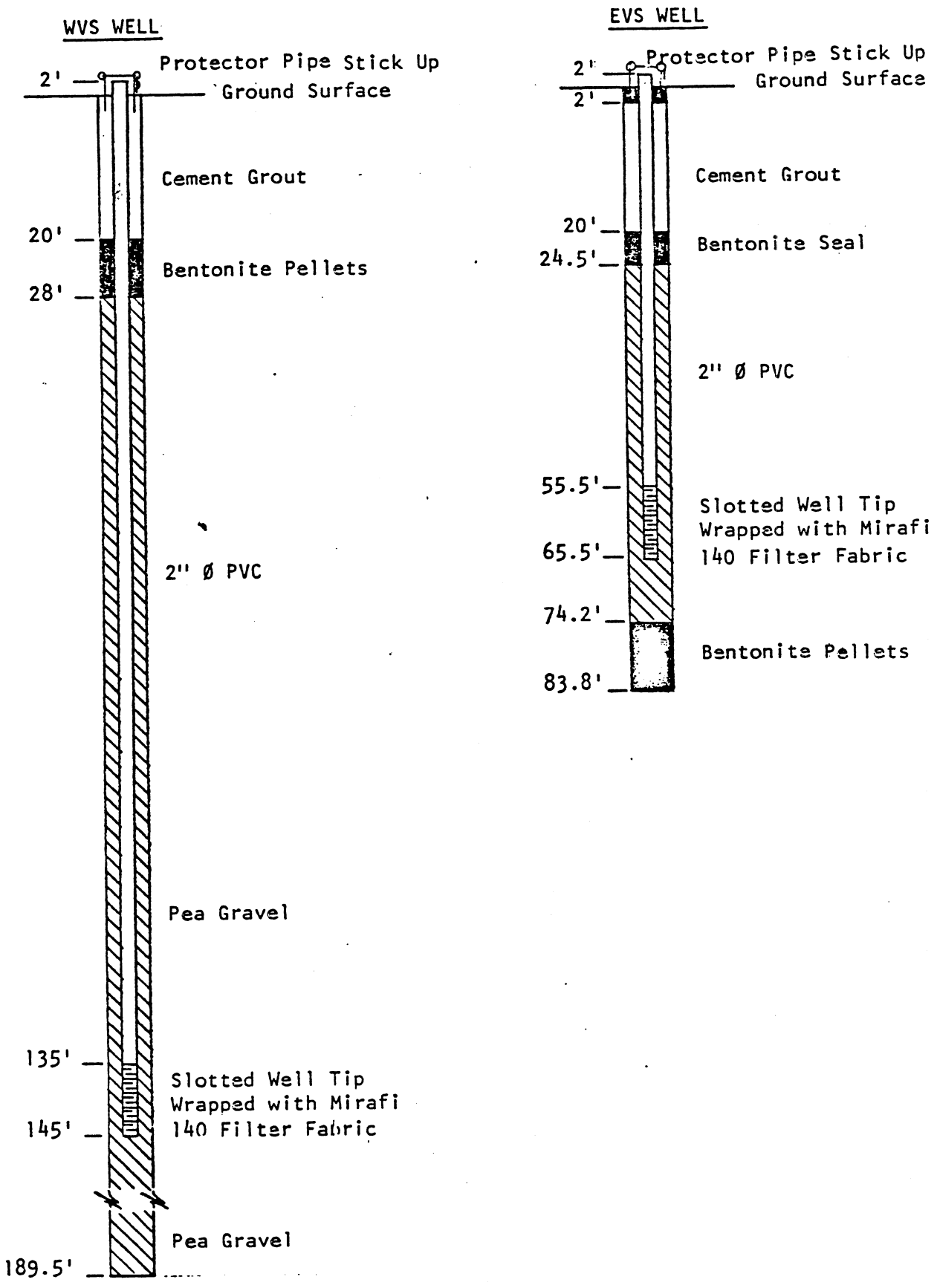
Note: Penetration test results labeled as # blows/penetration distance
Penetration Test Method: 1. Standard 2" split barrel sampler, N-rod, and 380# hammer
2. 2 1/2" split barrel sampler, N-rod and 380# hammer
3. 3" split barrel sampler, N-rod and 380# hammer

| WATER LEVEL OBSERVATIONS | | |
|---|---|---|
| W.L. | 110.0 WS | |
| W.L. | Bailed to 50' (3-30-78) | A.C.R. |
| W.L. | 70.8' on 3-31-78 | |
| | > 100.0' on 4-2-78 | |
| | 106.5' on 4-4-78 | |
| | 110.0' on 4-7-78 | |


SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303


| | | | |
|---|---|---|---|
| BORING STARTED | 3-21-78 | | |
| BORING COMPLETED | 3-30-78 | | |
| RIG | W-8 | FOREMAN | EVH |
| DRAWN | CRB | APPROVED | DJH |
| JOB # | 8736 | SHEET | |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.




Observation Well Diagrams
Exxon Mine Development
Crandon, Wisconsin

SOIL TESTING SERVICES OF WISCONSIN, INC.
540 LAMBEAU ST. GREEN BAY, WISCONSIN 54303

| CRB | 4-12-78 | 8736 |
|---|---|---|

**Soil Testing Services of Wisconsin, Inc.**
**Facility Borings (STS-B1 through 11)**

## LOG OF BORING NO. 1

BEST COPY AVAILABLE

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals U.S.A. | |
| **SITE** | **PROJECT NAME** |
| Crandon Mine Development | Prospecting Project |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST. RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS/FT.³ |
|---|---|---|---|---|---|
| SURFACE ELEVATION | | | | | |
| 0 | 1 | SS | | Brown silty very fine to fine sand (SM-ML) - trace of gravel trace of clay - with a trace of roots to 1.5 feet - moist - loose to medium dense | |
| | 2 | SS | | | |
| | 3 | SS | | Brown silty clayey fine to medium sand (SC)- with lenses of silty fine sand - some gravel - moist - dense | |
| | 4 | SS | | Brown silty fine to coarse sand (SM) - with pockets and lenses of sandy silt (ML)- some fine to coarse gravel - moist - extremely dense<br>Note: Broken stone at tip of of sample | |
| 10 | 6 | SS | | Cobble and boulder layer - cobbles average ±6 inch in size, interbedded with brown fine to medium sand (SP) - with a trace of silt<br>Note: Broken stones in samples at 10 and 15 feet | |
| 15 | 7 | SS | | | |
| 20 | 8 | SS | | Brown fine to coarse sand (SW)- trace of silt - a little to some fine to coarse gravel - grades finer with depth - moist - extremely dense<br>Note: Boulder encountered at 18.5 to 20.0 feet<br>Occasional boulders or cobbles encountered at 22.7 to 32.3 feet | |
| 25 | 9 | SS | | | |
| 30 | 10 | SS | | | |
| 35 | 11 | SS | | | |
| 40 | 12 | SS | | Brown silty fine to medium sand (SM) - with pockets and lenses of sandy silt (ML) - with a little clay - trace of gravel - moist - extremely dense | 121.9 |
| | | | | Continued | |

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.²
1 2 3 4 5
PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.)
10 20 30 40 50

| WATER LEVEL OBSERVATIONS | | | |
|---|---|---|---|
| W.L. | | | |
| W.L. | B.C.R. | A.C.R. | |
| W.L. | | | |

**SOIL TESTING SERVICES**
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 1-21-80 |
| BORING COMPLETED | | | 1-25-80 |
| RIG | W-8 | FOREMAN | EVH |
| DRAWN | JPJ | APPROVED | DWC |
| JOB # | 8736 A | SHEET | 3 of 3 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

## LOG OF BORING NO. 1 (cont.)

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals U.S.A. | |
| **SITE** | **PROJECT NAME** |
| Crandon Mine Development | Prospecting Project |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.³ | UNCONFINED COMPRESSIVE STRENGTH TONS FT.² / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.) |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION | | |
| 42 | | | | | Continued | | |
| 45 | 13 | SS | | | Brown mottled grayish brown sandy silt (ML) - trace of clay - a little fine gravel - very moist - extremely dense | 116.0 | 110/1" |
| 50 | 14 | SS | | | | | 180/1" BWCG |
| 55 | 15 | SS | | | | 130.1 | 121/6" |
| 60 | 16 | SS | | | | 131.7 | 76 |
| 65 | 17 | SS | | | Brown silty fine to medium sand (SM) - trace of coarse sand - a little to some fine to coarse gravel - with decomposed gravel fragments - color changes to orange brown at 65 feet - grades finer at 70 feet - with pockets of silty fine sand at 75 feet - moist changing to wet at 70 feet - extremely dense<br>Note: Boulder encountered at 80.5 to 82.5 feet | 134.6 | 110/6" |
| 70 | 18 | SS | | | | | 130/6" |
| 75 | 19 | SS | | | | 143.4 | 136/6" |
| 80 | 20 | SS | | | | | 137/6" |
| 85 | 21 | SS | | | | | 102 |
| 87 | | | | | Continued | | |

| WATER LEVEL OBSERVATIONS | | | SOIL TESTING SERVICES OF WIS., INC. 540 LAMBEAU STREET GREEN BAY, WIS. 54303 | BORING STARTED | | 1-21-80 |
|---|---|---|---|---|---|---|
| WL | | | | BORING COMPLETED | | 1-25-80 |
| WL | U.C.R. | A.C.P. | | RIG W-8 | FOREMAN | EVH |
| WL | | | | DRAWN JPC | APPROVED | TWW |
| | | | | JOB # 8736 A | SHEET | 2 of 3 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

LOG OF BORING NO. 1 (cont.)

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals U.S.A. | |
| **SITE** | **PROJECT NAME** |
| Crandon Mine Development | Prospecting Project |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST. RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.3 | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) · PLASTIC LIMIT % · WATER CONTENT % · LIQUID LIMIT % · STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50) |
|---|---|---|---|---|---|---|
| SURFACE ELEVATION → | | | | | | |
| 86 | 22 | SS | | Continued | | |
| | | | | Reddish brown silty fine to coarse sand (SM) - a little gravel - trace to a little clay - moist - extremely dense | | |
| 90 | 22 | SS | | | | |
| 95 | 23 | SS | | Felsic phyllite* with mafic chloritic fragments - moderately weathered at 90 feet (observation of wash sample obtained in split spoon) - vertical cleavage - predominantly vertical fractures - some fractures filled with a trace of saprolite - a few fractures with higher clay content - gray and greenish gray with some local rust staining | | |
| | | Run #1 | | | | |
| 100 | | Run #2 | | | | |
| | | Run #3 | | | | |

| | DEPTH | REC | FRACTURE FREQ | ROD |
|---|---|---|---|---|
| Run #1 | 95.0-97.5 | 92% | 1.3/ft. | 83% |
| Run #2 | 97.5-102.8 | 100% | .9/ft + | 76% |
| Run #3 | 102.8-110.3 | 89% | .7/ft.+ | 86% |

\+ Core is highly fractured from 102.5 to 103.5 feet
* Parent rock classified as Felsic - Intermediated Lapilli Tuff

End of Boring
Boring terminated in phyllite bedrock
Boring advanced to 8.0 feet by solid stem auger
5 feet of 6 inch casing installed
Boring advanced to 95 ffet by roller bit and Revert drilling mud
Boring advanced to 110.3 feet by NX split barrel core barrel and Revert
2"ϕ observation well installed at 84.7 feet
Top of metal protector pipe elevation = 1657.72

Note: Penetration test results labled as blows/distance

Penetration Test Method:

1. 2 inch split barrel sampler, N ROD, 140 lb. hammer 0-10'
2. 3 inch split barrel sampler, N ROD, 360 lb. hammer 10-40'
3. 2½ inch split barrel sampler, N ROD, 360 lb. hammer 40-95'

| WATER LEVEL OBSERVATIONS | | | |
|---|---|---|---|
| WL | | | |
| WL | BCR | ACR | |
| WL | Ground water elevation = 1590.6 | | |
| | on 2-13-80 | | |

**SOIL TESTING SERVICES**
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 1-21-80 |
| BORING COMPLETED | | | 1-25-80 |
| RIG | W-8 | FOREMAN | EVH |
| DRAWN | JTJ | APPROVED | TWW |
| JOB | 8736 A | SHEET | 3 of 3 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

# LOG OF BORING NO. 2

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals U.S.A. | |
| **SITE** | **PROJECT NAME** |
| Crandon Mine Development | Prospecting Project |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.3 | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.2 (1 2 3 4 5) PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| SURFACE ELEVATION | | | | | | | |
| | 1 | SS | | | Yellowish brown silty very fine to fine sand (SM) - trace of gravel - trace of medium to coarse sand - moist - loose | | 5 |
| | 2 | SS | | | Brown silty fine sand (SM) - trace of medium to coarse sand - trace of gravel - moist - medium dense | | 21 |
| 5 | 3 | SS | | | | | 21 |
| | 4 | SS | | | | | 17 |
| | 5 | SS | | | Brown fine to medium sand (SP) - trace of silt - trace to a little gravel - grades fine to coarse from 8 to 10 feet - moist to wet - medium dense to very dense - Note: Broken stone in sample at 8 feet | | 73 |
| | 6 | SS | | | | | 57 |
| | 7 | SS | | | | | 61 |
| 10 | 8 | SS | | | | | 57/6" |
| | 9 | SS | | | | | 102/2" |
| | 10 | SS | | | | | 103/3 |
| | 11 | SS | | | | | 103/2" BNCG |
| | 12 | SS | 5 | 5 | Brown fine to coarse sand (SW-SP) - trace of silt - some fine to medium gravel - trace of decomposed gravel fragments - with pockets of fine sand to 14 feet - grades to sandy gravel at 30 to 32 feet with numerous cobbles and boulders - moist to wet - extremely dense Note: Boulder or cobbles encountered at 20 to 20.4 feet 1.5 foot boulders between 21.0 and 25.0 feet 0.5 foot boulders between 25.0 and 26.0 feet 1.1 foot boulders between 26.0 and 30.0 feet 1.4 foot boulders between 30.0 and 35.8 feet | | 174/SET |
| | 13 | SS | 5 | 5 | | | 102/1" |
| | 14 | SS | 5 | 4 | | | 198/1" |
| | 15 | SS | 5 | 4 | | | 101/2" BNCG |
| 40 | 16 | SS | 5 | 4 | | | 149/2" |
| 40.5 | | | | | End of Boring Boring terminated in fine to coarse sand Boring advanced to 10.0 feet by solid stem auger Boring advanced from 10.0 to 40.5 feet by roller bit and Revert drilling mud 15 feet of HW casing used Frost encountered to 0.5 feet | | 157/SET |

| WATER LEVEL OBSERVATIONS | | |
|---|---|---|
| WL | | |
| WL | BCR | ACR |
| WL | | |

**SOIL TESTING SERVICES**
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 1-25-80 |
| BORING COMPLETED | | | 1-28-80 |
| RIG | W-8 | FOREMAN | EVH |
| DRAWN | JPJ | APPROVED | TWW |
| JOB # | 6736 A | SHEET | 1 of 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

## LOG OF BORING NO. 3

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals U.S.A. | |
| **SITE** | **PROJECT NAME** |
| Crandon Mine Development | Prospecting Project |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.) |
|---|---|---|---|---|---|---|---|
| SURFACE ELEVATION | | | | | | | 1 2 3 4 5 — 10 20 30 40 50 |
| | 1 | SS | | | Brown very fine sandy silt (ML) - trace of roots and organics to 1.5 feet - some seams of silty fine sand (SM) - a little medium to coarse sand and fine gravel - broken stone in sample at 0.2 feet - moist - medium dense | | 4 |
| | 2 | SS | | | | | 14 |
| 5 | 3 | SS | | | Brown silty fine to medium sand (SM) - a little to some gravel - moist - medium dense | | 28 |
| | 4 | SS | | | | | 15 |
| | 5 | SS | | | brown silty fine to coarse sand (SM) and gravel with broken stone observed in sample from 15 to 16.5 feet - grades coarser with depth - moist to wet - medium dense to extremely dense | | 13 |
| 10 | 6 | SS | | | | | 27 |
| 15 | 7 | SS | | | | | 103 |
| 20 | | | | | | | |
| 21 | 8 | SS | | | End of Boring<br>Boring terminated in silty fine to coarse sand<br>Boring advanced to 21.0 feet by solid stem auger | | 65/2" |

WATER LEVEL OBSERVATIONS

WL
WL — B.C.R. — A.C.R.
WL

**SOIL TESTING SERVICES**
OF WIS., INC
540 LAMBEAU STREET
GREEN BAY, WIS 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 1-18-80 |
| BORING COMPLETED | | | 1-18-80 |
| RIG | W-8 | FOREMAN | EVH |
| DRAWN | JTC | APPROVED | DW |
| JOB | 8736-A | SHEET | 1 of 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

## LOG OF BORING NO. 4

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals U.S.A. | |
| **SITE** | **PROJECT NAME** |
| Crandon Mine Development | Prospecting Project |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS/FT 3 |
|---|---|---|---|---|---|---|
| SURFACE ELEVATION → | | | | | | |
| | 1 | SS | | | Brown silty very fine sand (SM) - trace of roots, trace of medium sand to fine gravel - moist - loose | |
| | 2 | SS | | | Brown silty fine to medium sand (SM) - trace of fine gravel - moist - medium dense to dense | |
| 5 | 3 | SS | | | | |
| | 4 | SS | | | Dark reddish brown fine sand (SP) - with a 1 inch lense of brown silty fine sand - some gravel and broken rock fragments - moist - dense | |
| | 5 | SS | | | | |
| | 6 | SS | | | Brown silty fine sand (SM) - a little to some fine gravel - with ½ inch seams of fine sand (SP) - grades fine to medium at 15 feet - moist - medium dense to very dense<br>Note: Occasional boulders encountered from 12 feet | |
| 15 | 7 | SS | | | | |
| 20 | | | | | Brown fine to coarse sand and gravel (SP-GP) - trace of silt - some broken stone fragments - moist - extremely dense | |
| 21 | 8 | SS | | | | |

UNCONFINED COMPRESSIVE STRENGTH TONS FT.
1 2 3 4 5
PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.)
10 20 30 40 50

5 — 1½" — 20 — 22½" — 35 — 26 — 32 — 80 — 50/6"

End of Boring
Boring terminated in fine to coarse sand
Boring advanced to 10.0 feet by solid stem auger
Boring advanced from 10.0 to 21.0 feet by roller bit and Revert drilling mud
10 feet of NW casing used

| WATER LEVEL OBSERVATIONS | | |
|---|---|---|
| WL | | |
| WL | BCR | ACH |
| WL | | |

**SOIL TESTING SERVICES**
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 1-16-80 |
| BORING COMPLETED | | | 1-16-80 |
| RIG | M-8 | FOREMAN | EVH |
| DRAWN | JPS | APPROVED | TWW |
| JOB | 6736 A | SHEET | 1 of 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

## LOG OF BORING NO. 5

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals U.S.A. | |
| **SITE** | **PROJECT NAME** |
| Crandon Mine Development | Prospecting Project |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST. RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.³ | UNCONFINED COMPRESSIVE STRENGTH TONS./FT.² / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.) |
|---|---|---|---|---|---|---|
| SURFACE ELEVATION | | | | | | |
| 0 | 1 | SS | 1.5 | Brown silty fine to medium sand (SM) - trace of clayey sand seams (SC) to 8 feet - trace of coarse sand - a little gravel - moist - medium dense to dense - color changes to rusty brown at 2 feet | | 19, 29 |
| | 2 | SS | 1.5 | | | 20 |
| | 3 | SS | | | | 9 |
| | 4 | SS | | | | 12 |
| 10 | 5 | SS | | | | 13, 24 |
| | 6 | SS | | | | |
| 15 | 7 | SS | | | | 16 |
| 20 | 8 | SS | | | | 17 |
| 25 | 9 | SS | | Brown fine to coarse sand (SP) - trace of silt - some gravel - trace of pockets of fine sand at 40.2 feet - moist to wet - very dense to extremely dense<br>Note: Broken stone observed in sample at 35 feet | | 80 |
| 30 | 10 | SS | | | | 100/4" |
| 35 | 11 | SS | | | | 100/4" |
| 40 | 12 | SS | | | | 50/6" |
| 41 | | | | End of Boring<br>Boring terminated in fine to coarse sand<br>Boring advanced to 8.0 feet by solid stem auger<br>Boring advanced from 8.0 to 41.0 feet by roller bit and Revert<br>15 feet of HW casing used<br>Frost encountered to 1.0 feet | | |

| WATER LEVEL OBSERVATIONS | | |
|---|---|---|
| WL | | |
| WL | B.C.H | A.C.H |
| WL | | |

**SOIL TESTING SERVICES**
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 1-29-80 |
| BORING COMPLETED | | | 1-29-80 |
| RIG | W-R | FOREMAN | EVH |
| DRAWN | JPJ | APPROVED | TWW |
| JOB # | 8230.A | SHEET | 1 of 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

## LOG OF BORING NO. 6

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals U.S.A. | |
| **SITE** | **PROJECT NAME** |
| Crandon Mine Development | Prospecting Project |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT² (1 2 3 4 5) · PLASTIC LIMIT % · WATER CONTENT % · LIQUID LIMIT % · STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| SURFACE ELEVATION | | | | | | | |
| | 1 | PA | | | Dark brown very fine sandy silt (ML) - trace of roots - trace of gravel - wet | | |
| | 2 | SS | | | Rusty brown silty fine sand (SM) - a little medium to coarse sand - trace of gravel - trace of clay and clayey sand seams - moist - medium dense to dense<br>Note: Broken stone in sample at 8.0 feet | | 24 |
| | 3 | SS | | | | | 25 |
| | 4 | SS | | | | | 30 |
| | 5 | SS | | | | | 23 |
| | 6 | SS | | | Brown fine to coarse sand (SP) - some gravel - trace to a little silt - grades coarser with depth - moist - dense to extremely dense | | 35 |
| | 7 | SS | | | | | 85/1 BNCG |
| | 8 | SS | | | | | 100/5" |
| | | | | | End of Boring<br>Boring terminated in fine to coarse sand<br>Boring advanced to 20.4 feet by solid stem auger<br>Frost encountered to 0.7 feet | | |

| WATER LEVEL OBSERVATIONS | | | SOIL TESTING SERVICES OF WIS., INC. 540 LAMBEAU STREET GREEN BAY, WIS. 54303 | BORING STARTED | 1-30-80 | |
|---|---|---|---|---|---|---|
| WL | | | | BORING COMPLETED | 1-30-80 | |
| WL | BCR | ACR | | RIG W-8 | FOREMAN EVH | |
| WL | | | | DRAWN JPJ | APPROVED TWW | |
| | | | | JOB 8736 A | SHEET 1 of 1 | |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

## LOG OF BORING NO. 7

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals U.S.A. | |
| **SITE** | **PROJECT NAME** |
| Crandon Mine Development | Prospecting Project |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT LBS./FT 3 | UNCONFINED COMPRESSIVE STRENGTH TONS/FT² / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT) |
|---|---|---|---|---|---|---|---|
| SURFACE ELEVATION | | | | | | | |
| | 1 | SS | | | Brown silty very fine to fine sand (SM-ML) - some fine to medium gravel - trace of roots - moist - medium dense | | 14 |
| | 2 | SS | | | Rusty brown silty fine sand (SM) - trace of medium to coarse sand - a little gravel - moist - very dense to dense<br>Note: Broken stone in sample at 2 feet | | 20 |
| | 3 | SS | | | | | 72 |
| | 4 | SS | | | Brown to rusty brown silty fine to coarse sand (SM) and gravel - moist - medium dense | | 32 |
| | 5 | SS | | | | | 35 |
| | 6 | SS | | | | | |
| | 7 | SS | | | Brown fine to coarse sand (SW) - some fine to coarse gravel - trace to a little silt - with pieces of weathered gravel at 20 feet - grades coarser with depth - moist - dense to extremely dense | | 60 |
| 20 | 8 | SS | | | | | 102 |
| | | | | | End of Boring<br>Boring terminated in fine to coarse sand<br>Boring advanced to 8.0 feet by solid stem auger<br>Boring advanced from 8.0 to 21.5 feet by roller bit and Revert<br>10 feet of HW casing used | | |

| WATER LEVEL OBSERVATIONS | | |
|---|---|---|
| WL | | |
| WL | BCR | ACR |
| WL | | |

**SOIL TESTING SERVICES**
OF WIS., INC
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 1-29-80 |
| BORING COMPLETED | | | 1-29-80 |
| RIG | W-8 | FOREMAN | EVH |
| DRAWN | JPJ | APPROVED | TWW |
| JOB | 8736 A | SHEET | 1 of 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

## LOG OF BORING NO. 8

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals U.S.A. | |
| **SITE** | **PROJECT NAME** |
| Crandor Mine Development | Prospecting Project |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS/FT 3 | UNCONFINED COMPRESSIVE STRENGTH TONS FT 2 (1 2 3 4 5) · PLASTIC LIMIT % · WATER CONTENT % · LIQUID LIMIT % · STANDARD "N" PENETRATION (BLOWS/FT) (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| SURFACE ELEVATION | | | | | | | |
| | 1 | SS | | | Yellowish brown mottled grayish brown silty very fine sand (SM) - trace of roots - trace of gravel - a little medium to coarse sand - moist - medium dense - color changes to brown a t 0.5 feet | | 1½" |
| | 2 | SS | | | | | 1½" 25 20 6" |
| | 3 | SS | | | Rusty brown silty fine sand (SM) - a little medium to coarse sand - a little to some gravel - trace of fine sand pockets at 8 feet - moist - dense to medium dense | | 9½" 1/8 1½" 6" |
| | 4 | SS | | | | | |
| | 5 | SS | | | | | 8½" 27 |
| | 6 | SS | | | | | |
| | 7 | SS | | | Brown fine to medium sand (SP) - trace of silt - trace to a little gravel - grades to fine sand (SP) at 15 feet - moist to wet - medium dense to extremely dense Note: Cobble or boulder at 20 feet | | 10½" 5" |
| | 8 | SS | | | | | 100 SET BARG |
| | | | | | End of Boring Boring terminated in fine to medium sand Boring advanced tc 8.0 feet by solid stem auger Boring advanced from 8.0 to 20.0 feet by roller bit and Revert 10 feet of NW casing used | | |

WATER LEVEL OBSERVATIONS

W.L. ___ W.L. ___ W.L. ___ ACR ___ ACR ___

**SOIL TESTING SERVICES**
OF WIS. INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 1-25-80 |
| BORING COMPLETED | | | 1-26-80 |
| DRG. NO. | W-8 | FOREMAN | EVE |
| DRAWN | JTC | APPROVED | TWW |
| JOB NO. | 8750-A | SHEET | 1 of 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

## LOG OF BORING NO. 9

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals U.S.A. | |
| **SITE** | **PROJECT NAME** |
| Crandon Mine Development | Prospecting Project |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST. RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT LBS/FT.³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.) |
|---|---|---|---|---|---|---|
| | | | | SURFACE ELEVATION | | 1 2 3 4 5 — 10 20 30 40 50 |
| | 1 | SS | | Dark brown silty fine sand (SM) - trace of roots to 1.5 feet - trace of gravel - moist - medium dense - color changes to brown at 2 feet | | 25, 26 |
| | 2 | SS | | | | |
| | 3 | SS | | Brown silty fine to medium sand (SM) - a little to some gravel - trace of clay - moist - medium dense | | 14, 28, 8/6" |
| | 4 | SS | | | | |
| | 5 | SS | | | | |
| | 6 | SS | | Light brown fine sand (SP) - moist - dense to extremely dense | | 11/6", 39, 95 |
| | 7 | SS | | | | |
| | 8 | SS | | Brown fine to coarse sand (SP) - a little fine gravel - wet - extremely dense | | 100/4" |
| | | | | End of Boring<br>Boring terminated in fine to coarse sand<br>Boring advanced to 10.0 feet by solid stem auger<br>Boring advanced from 10.0 to 20.9 feet by roller bit and Revert<br>Boulders or obstructions encountered from 0 to 2 feet<br>10 feet of NW casing used | | |

| WATER LEVEL OBSERVATIONS | | |
|---|---|---|
| W.L. | | |
| W.L. | B.C.R. | A.C.R. |
| W.L. | | |

**SOIL TESTING SERVICES**
OF WIS., INC
540 LAMBEAU STREET
GREEN BAY, WIS. 54301

| | |
|---|---|
| BORING STARTED | 1-17-80 |
| BORING COMPLETED | 1-16-80 |
| DRG. NO. B-5 | FOREMAN TW |
| DRAWN JEC | APPROVED TWW |
| SCALE 1" = 5' | SHEET 1 OF 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

## LOG OF BORING NO. 10

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals U.S.A. | |
| **SITE** | **PROJECT NAME** |
| Crandon Mine Development | Prospecting Project |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT LBS/FT.3 | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.2 (1 2 3 4 5) · PLASTIC LIMIT % · WATER CONTENT % · LIQUID LIMIT % · STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| SURFACE ELEVATION | | | | | | | |
| | 1A | SS | | | Dark brown slightly organic silty topsoil (OL-ML) - trace of gravel - a little very fine sand - trace of roots - moist - medium dense | | 10 |
| | 2 | SS | | | Brown very fine sandy silt (ML) - trace of clay - trace of fine gravel - trace of roots to 2 feet - moist - medium dense | | 22 |
| 5 | 3 | SS | | | | | 19 |
| | 4 | SS | | | | | 19 |
| | 5 | SS | | | Brown silty fine to medium sand (SM) - trace to a little gravel - trace of coarse sand - becomes slightly silty at 10 feet - moist - medium dense | | 17 |
| | 6 | SS | | | | | 18 |
| 15 | 7 | SS | | | Brown fine to coarse sand (SP) - trace of silt - trace to a little gravel - moist to wet - extremely dense to very dense | | 75/5.0 |
| 20 | 8 | SS | | | | | 72 |
| | | | | | End of Boring<br>Boring terminated in fine to coarse sand<br>Boring advanced to 10.0 feet by solid stem auger<br>Boring advanced from 10.0 to 21.5 feet by roller bit and Revert<br>10 feet of NW casing used | | |

WATER LEVEL OBSERVATIONS

WL
WL — BCR — ACR
WL

**SOIL TESTING SERVICES**
OF WIS., INC
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 1-16-80 |
| BORING COMPLETED | | | 1-16-80 |
| RIG | M-E | FOREMAN | EVE |
| DRAWN | SPS | APPROVED | TWW |
| [illegible] | ET-50-A | SHEET | 1 OF 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

## LOG OF BORING NO. 11

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals U.S.A. | |
| **SITE** | **PROJECT NAME** |
| Crandon Mine Development | Prospecting Project |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS/FT.3 | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION | | 1 2 3 4 5 — PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % — STANDARD "N" PENETRATION (BLOWS/FT) 10 20 30 40 50 |
| | 1 | SS | | | Brown silty very fine sand (SM-ML) - trace of roots - moist - loose | | 2 |
| | 2 | SS | | | Brown silty fine to medium sand (SM) - a little coarse sand to fine gravel - moist - medium dense to dense | | 28 |
| 5 | 3 | SS | | | | | 44 |
| | 4 | SS | | | | | 12 |
| | 5 | SS | | | | | 21 |
| | 6 | SS | | | Brown fine to medium sand (SP-SM) - trace of silt - with some lenses of silty fine sand to 10.0 feet - lense of fine to coarse sand at 20 feet - grades fine to medium at 10 to 11.5 feet - moist - medium dense to extremely dense | | 43 |
| 15 | 7 | SS | | | | | |
| 20 | | | | | | | |
| 21.5 | 8 | SS | | | | | 85 |
| | | | | | End of Boring<br>Boring terminated in fine sand<br>Boring advanced to 10.0 feet by solid stem auger<br>Boring advanced from 10.0 to 21.5 feet by roller bit and Revert<br>10 feet of NW casing used | | |

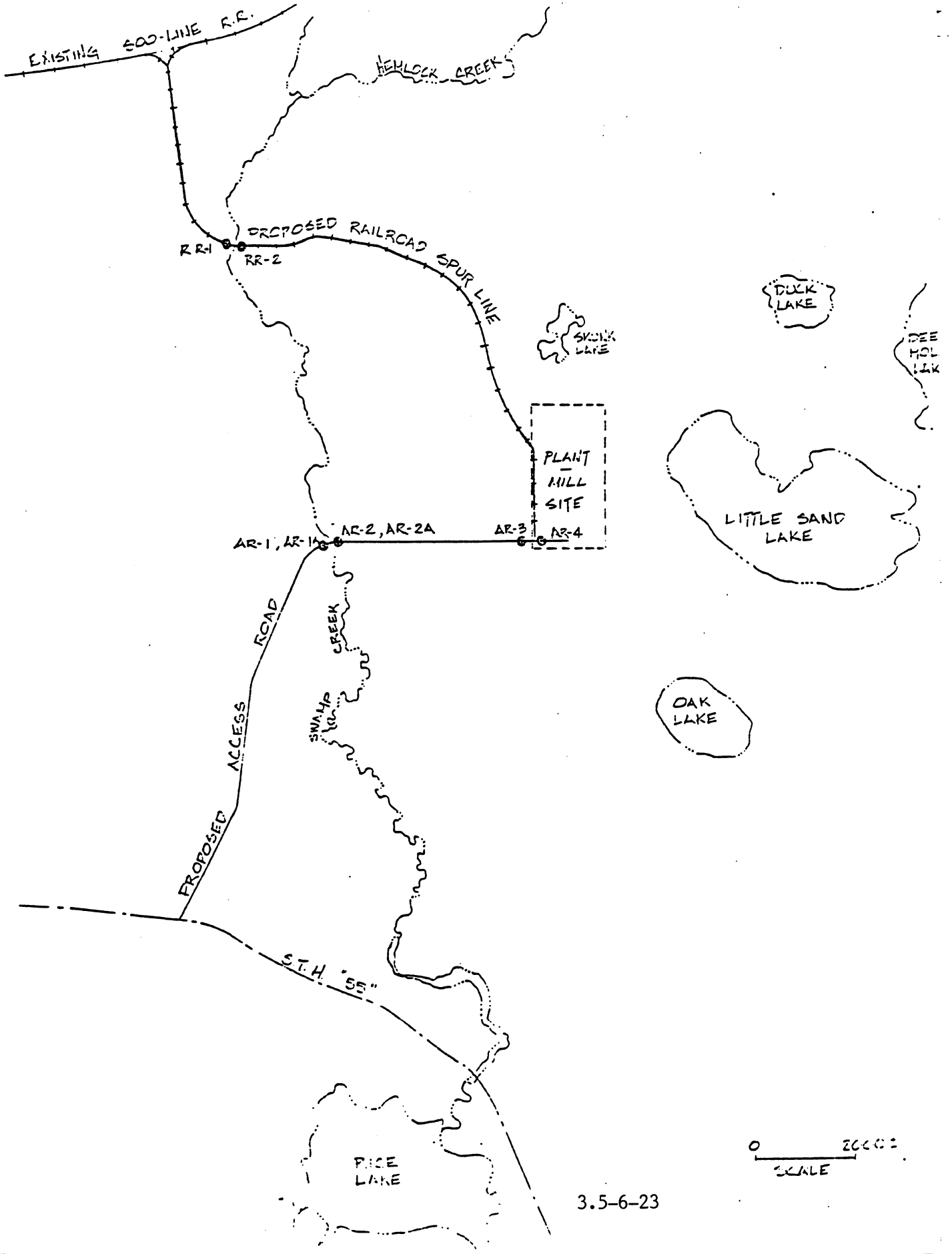
| WATER LEVEL OBSERVATIONS | | | |
|---|---|---|---|
| WL | | | |
| WL | BCR | ACH | |
| WL | | | |

**SOIL TESTING SERVICES**
OF WIS., INC
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 1-18-80 |
| BORING COMPLETED | | | 1-18-80 |
| RIG | W-6 | FOREMAN | EVH |
| DRAWN | JPJ | APPROVED | TWW |
| | 6736 A | SHEET | 1 OF 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

Soil Testing Services of Wisconsin, Inc.
1981 Geotechnical Borings for Proposed Bridges
(RR-1 and 2, AR-1 and 1A, AR-2 and 2A, AR3 and AR4)




SOIL BORING LOCATION DIAGRAM
PROPOSED BRIDGE CROSSING - EAGLE TIMBER CO.
MINE DEVELOPMENT SITE - CRANDON, WIS.

SOIL TESTING SERVICES
OF WISCONSIN, INC

LOG OF BORING NO. AR-1

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals Company | AR-1 |
| **SITE** | **PROJECT NAME** |
| Mine Development Site - Crandon, Wisconsin | Proposed Bridge Structures (Access Road) |

| DEPTH ELEVATION | SAMPLE NO. | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.3 | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| SURFACE ELEVATION | | | | | | | |
| | 1 | SS | | | Black sandy peat (Pt) - with some roots - moist - 0.7 feet of frost | | 15 |
| | 2 | SS | | | Dark gray to black silty fine to medium sand (SM) and gravel - wet - medium dense | | 16 |
| 5 | 3 | SS | | | | | 22 |
| | 4 | SS | | | | | 29 |
| | 5 | SS | | | | | 28 |
| 10 | 6 | SS | | | | | 47 |
| 15 | 7 | SS | | | Reddish brown to brown silty fine to medium sand (SM) - a little to some gravel - trace of clay - moist - medium dense to extremely dense | | 65 |
| 20 | 8 | SS | | | | | 30 |
| 25 | 9 | WS | | | Light brown sandy silt, decomposed bedrock (ML) (Pt) with seams of reddishbrown silty clay (CL) - some gravel size fragments - wet - extremely dense | | 50/5 |
| 30 | 10 | SS | | | | | |
| 30.4 | | | | | End of Boring<br>Boring advanced to 4.0 feet by solid stem auger<br>Boring advanced from 4.0 to 30.4 feet by roller bit and Revert drilling mud<br>Boulders or obstructions encountered from 23.0 to 30.4 feet | | |

| WATER LEVEL OBSERVATIONS | | | |
|---|---|---|---|
| WL | 2.0' W.S. | | |
| WL | 1.0' | UCR | 0.5' ACR |
| WL | | | |

**SOIL TESTING SERVICES**
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 1-8-81 |
| BORING COMPLETED | | | 1-8-81 |
| RIG | Bomb | FOREMAN | TT |
| DRAWN | JPJ | APPROVED | TWW |
| JOB # | 10935 | SHEET | 1 of 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

LOG OF BORING NO. AR-1A

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals Company | AR-1A |
| **SITE** | **PROJECT NAME** |
| Mine Development Site-Crandon, Wisconsin | Proposed Bridge Structures |

| DEPTH ELEVATION | SAMPLE NO. | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.³ | UNCONFINED COMPRESSIVE STRENGTH TONS FT.² (1 2 3 4 5) / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS FT.) (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION → | | |
| 5 | | | | | | | |
| 10 | | | | | Not Sampled | | |
| 15 | | RB | | | | | |
| 20 | | | | | | | |
| 25 | | | | | Fractured rock (rock sample) | | |
| 30 | | | | | | | |
| 35 | | | | | | | |
| 40 | | | | | Sericite schist bedrock with sparse quartz veins, 10 to 50 fractures per foot | | |
| 42 | | DB | | | Chert bedrock, 5 to 10 fractures per foot | | |
| | | | | | End of Boring<br>Boring advanced to 35.0 feet by roller bit and Revert drilling mud<br>Boring advanced from 35.0 to 42.8 feet by diamond bit and Revert wash water<br>10 feet of HW casing used - 25 feet of NW casing used | | |

| WATER LEVEL OBSERVATIONS | | |
|---|---|---|
| WL | 1.0 to 3.0' W.D. | |
| WL | BCR | 0.5' ACR |
| WL | 5.0' BCR | |

**SOIL TESTING SERVICES**
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 2-9-81 |
| BORING COMPLETED | | | 2-10-81 |
| RIG | Bomb | FOREMAN | TJ |
| DRAWN | MJP | APPROVED | TWW |
| JOB # | 10935 | SHEET | 1 of 1 |

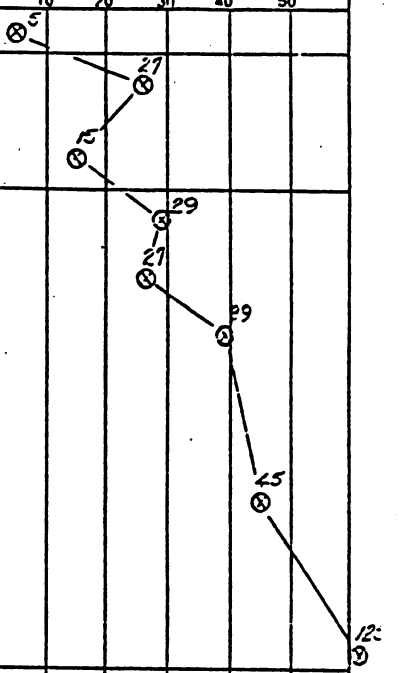
The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

# LOG OF BORING NO. AR-2

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals Company | AR-2 |
| **SITE** | **PROJECT NAME** |
| Mine Development Site - Crandon, Wisconsin | Proposed Bridge Structures (Access Road) |

| DEPTH ELEVATION | SAMPLE NO. | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.3 |
|---|---|---|---|---|---|---|
| SURFACE ELEVATION | | | | | | |
| | 1 | SS | | | Black silty peat (Pt) - some roots and grass - wet - 1.0 feet of frost | |
| | 2 | SS | | | Brown slightly silty fine to coarse sand (SP-SM) - some gravel - wet - medium dense | |
| 5 | 3 | SS | | | | |
| | 4 | SS | | | | |
| | 5 | SS | | | | |
| 10 | 6 | SS | | | Brown silty fine to medium sand (SM) - a little to some gravel - grades to silty fine to coarse sand and gravel from 10.0 to 18.0 feet - very moist - medium dense to extremely dense | |
| 15 | 7 | SS | | | | |
| 20 | | | | | | |
| 21.5 | 8 | SS | | | End of Boring<br>Boring advanced to 4.0 feet by solid stem auger<br>Boring advanced from 4.0 to 21.5 feet by rollet bit and Revert drilling mud<br>Occasional cobbles or obstructions encountered from 0.0 to 21.5 feet | |

UNCONFINED COMPRESSIVE STRENGTH TONS FT.²
1 2 3 4 5
PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.)
10 20 30 40 50




| WATER LEVEL OBSERVATIONS | | | |
|---|---|---|---|
| WL | 2.0' W.S. | | |
| WL | 1.0' | BCR | 0.5' ACR |
| WL | | | |

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 1-9-81 |
| BORING COMPLETED | | | 1-9-81 |
| RIG | Bomb | FOREMAN | TT |
| DRAWN | JPJ | APPROVED | TWW |
| JOB # | 10935 | SHEET | 1 of 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

LOG OF BORING NO. AR-2A

| | |
|---|---|
| OWNER: Exxon Minerals Company | ARCHITECT-ENGINEER |
| SITE: Mine Development Site - Crandon, Wisconsin | PROJECT NAME: Proposed Bridge Structures |

AR-2A

| DEPTH ELEVATION | SAMPLE NO. | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.3 | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.2 (1 2 3 4 5) / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| SURFACE ELEVATION | | | | | | | |
| 5 | | PA | | | | | |
| 10 | | RB | | | | | |
| 15 | | DB | | | Not Sampled | | |
| 20 | | | | | | | |
| 25 | | | | | | | |
| 30 | | | | | Chert Bedrock, 1 to 5 fractures per foot | | |
| 31.5 | | | | | End of Boring<br>Borint advanced to 18.0 feet by roller bit ane Revert drilling mud<br>Boulder encountered at 18.0 feet - Boring offset 2.0 feet and advanced<br>Boring advanced from 25.0 to 31.5 feet by diamond bits and wash water<br>10 feet of NW casing used | | |

WATER LEVEL OBSERVATIONS

| | | |
|---|---|---|
| WL | 1.0 to 5.0' W.D. | |
| WL | BCR | ACR |
| WL | | |

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 2-6-81 |
| BORING COMPLETED | | | 2-6-81 |
| RIG | Bomb | FOREMAN | TT |
| DRAWN | MJP | APPROVED | TWW |
| JOB # | 10935 | SHEET | 1 of 1 |

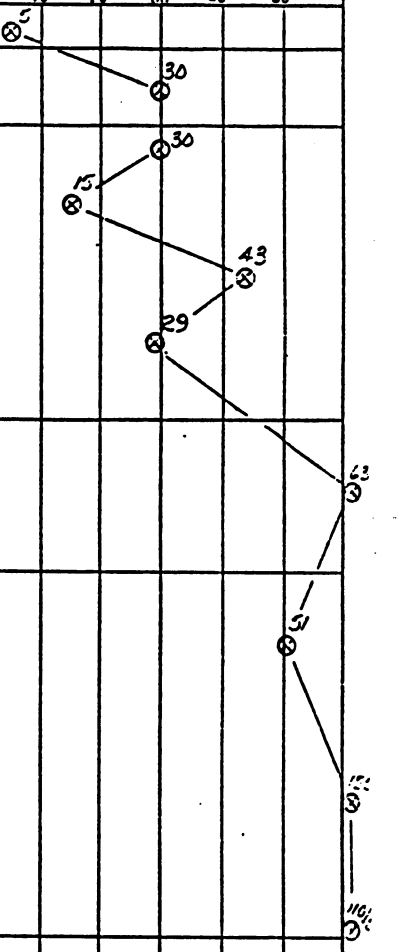
The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

# LOG OF BORING NO. AR-3

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals Company | AR-3 |
| **SITE** | **PROJECT NAME** |
| Mine Development Site - Crandon, Wisconsin | Proposed Bridge Structures (Grade Separation) |

| DEPTH ELEVATION | SAMPLE NO. | TYPE SAMPLE | SAMPLE DIST. | % RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.3 |
|---|---|---|---|---|---|---|
| SURFACE ELEVATION → | | | | | | |
| | 1 | SS | | | Brown very silty very fine sand (SM-ML) - trace of roots - trace of gravel - moist - loose - 0.7 feet of frost | |
| | 2 | SS | | | Brown slightly silty fine to medium sand (SP-SM) - some gravel - moist - dense | |
| 5 | 3 | SS | | | | |
| | 4 | SS | | | | |
| | 5 | SS | | | Reddish brown silty fine sand (SM) - trace of clay - a little gravel - moist becoming very moist at 6 feet - medium dense to dense | |
| 10 | 6 | SS | | | | |
| 15 | 7 | SS | | | Brown fine to coarse sand (SW) - trace of silt - trace to a little gravel - moist - very dense | |
| 20 | 8 | SS | | | | |
| | | | | | Brown silty fine sand (SM) - a little medium to coarse sand - a little gravel - moist - very dense to extremely dense | |
| 25 | 9 | SS | | | | |
| 30 | | | | | | |
| 30.5 | 10 | SS | | | | |
| | | | | | End of Boring<br>Boring advanced to 10.0 feet by solid stem auger<br>Boring advanced from 10.0 to 30.5 feet by roller bit and Revert drilling mud<br>Occasional cobbles or obstructions encountered from 0.0 to 30.5 feet | |

UNCONFINED COMPRESSIVE STRENGTH TONS FT.²
1 2 3 4 5
PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.)
10 20 30 40 50




| WATER LEVEL OBSERVATIONS | | | | |
|---|---|---|---|---|
| WL | | | | |
| WL | 8.0' | BCR | 9.0' | ACR |
| WL | 10.0' | 24 hr. A.B. | | |

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 1-5-81 |
| BORING COMPLETED | | | 1-5-81 |
| RIG | Bomb | FOREMAN | JT |
| DRAWN | JPJ | APPROVED | TWW |
| JOB # | 10335 | SHEET | 1 of 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

LOG OF BORING NO. AR-4

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals Company | AR-4 |
| **SITE** | **PROJECT NAME** |
| Mine Development Site - Crandon, Wisconsin | Proposed Bridge Structures (Grade Separation) |

| DEPTH ELEVATION | SAMPLE NO. | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.3 |
|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION | |
| | 1 | SS | | | Brown sandy silt (ML) - trace of gravel - trace of roots - moist - loose | |
| | 2 | SS | | | Brown silty fine to medium sand (SM) - trace of gravel - moist - dense | |
| 5 | 3 | SS | | | Reddish brown to brown silty fine sand (SM) - trace of clay - a little gravel - moist becoming very moist at 8 feet - medium dense | |
| | 4 | SS | | | | |
| 10 | 5 | SS | | | | |
| | 6 | SS | | | | |
| 15 | 7 | SS | | | Light brown fine to medium sand (SP) - trace of gravel - trace of silt - moist changing to very moist at 20 feet - extremely dense to dense - Note: Boulder encountered at 16.0 to 17.0 feet | |
| 20 | 8 | SS | | | | |
| 25 | 9 | SS | | | Brown silty fine to medium sand (SM) - a little to some gravel and decomposed gravel fragments - moist - extremely dense - boulders or obstructions encountered at 23.0 to 25.0 feet and 28.0 to 29.0 feet | |
| 30 | 10 | SS | | | | |
| | | | | | End of Boring<br>Boring advanced to 10.0 feet by solid stem auger<br>Boring advanced from 10.0 to 30.4 feet by roller bit and Revert drilling mud<br>Boulders or obstructions encountered from 16.0 to 17.0 feet, 23.0 to 25.0 feet and 28.0 to 29.0 feet | |

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.
1 2 3 4 5
PLASTIC LIMIT % WATER CONTENT % LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.)
10 20 30 40 50

| WATER LEVEL OBSERVATIONS | | | |
|---|---|---|---|
| WL | | | |
| WL | 3.0' | HCR | 4.0' ACR |
| WL | | | |

SOIL TESTING SERVICES
OF WIS., INC
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 1-5-81 |
| BORING COMPLETED | | | 1-6-81 |
| RIG | Bomb | FOREMAN | JJ |
| DRAWN | JPJ | APPROVED | TWF |
| JOB # | 10025 | SHEET | 1 of 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

# LOG OF BORING NO. RR-1

| | |
|---|---|
| OWNER: Exxon Minerals Company | ARCHITECT-ENGINEER: RR-1 |
| SITE: Mine Development Site - Crandon, Wisconsin | PROJECT NAME: Proposed Bridge Structures (spur line) |

| DEPTH ELEVATION | SAMPLE NO. | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.3 |
|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION → | |
| | 1 | SS | | | Black silty fibrous peat (Pt) | |
| | 2 | SS | | | | |
| 2.4 | | SS | | | | |
| 5 | 3 | SS | | | Grayish brown fine to medium and fine to coarse sand (SP) - trace to a little gravel - trace of silt - very moist - loose to medium dense | |
| | 4 | SS | | | | |
| | 5 | SS | | | | |
| 10 | 6 | SS | | | | |
| 15 | 7 | SS | | | Reddish brown clayey fine to medium sand (SC) - a little gravel - wet - medium dense | |
| 20 | 8 | SS | | | Brown sandy silt (ML) - trace to a little gravel - wet - medium dense | |
| 25 | 9 | SS | | | Yellowish brown fine to coarse sand (SW) - trace of silt - a little gravel - very moist - dense | |
| 30 | 10 | SS | | | | |
| 35 | 11 | SS | | | Brown slightly silty fine to coarse sand (SP-SM) - a little to some gravel - very moist - very dense | |
| 40 | | | | | Brown fine to medium sand (SP) - trace of silt - trace to a little gravel - very moist - extremely dense | |
| 41 | 12 | SS | | | | |
| | | | | | End of Boring<br>Boring advanced to 4.0 feet by solid stem auger<br>Boring advanced from 4.0 to 41.0 feet by roller bit and Revert drilling mud<br>Note: Artesian flow condition observed in borehole after boring completion. Drill crew estimates a 2 to 3 GPM flow rate. | |

UNCONFINED COMPRESSIVE STRENGTH TONS FT.²
1 2 3 4 5
PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS FT.)
10 20 30 40 50

WATER LEVEL OBSERVATIONS
WL 1.0' W.S.
WL Surface 11 CR Surface 4 CR
WL

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | |
|---|---|
| BORING STARTED | 1-8-81 |
| BORING COMPLETED | 1-8-81 |
| RIG Lamb | FOREMAN JI |
| DRAWN JPJ | APPROVED TWH |
| JOB # 10035 | SHEET 1 of 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

LOG OF BORING NO. RR-2

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals Company | RR-2 |
| **SITE** Mine Development Site - Crandon, Wisconsin | **PROJECT NAME** Proposed Bridge Structures (spur line) |

| DEPTH ELEVATION | SAMPLE NO. | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.³ | UNCONFINED COMPRESSIVE STRENGTH TONS FT.² (1 2 3 4 5) · PLASTIC LIMIT % · WATER CONTENT % · LIQUID LIMIT % · STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| SURFACE ELEVATION | | | | | | | |
| | 1 | SS | | | Black silty peat (Pt) - with some roots and wood - wet - very loose - 0.7 feet of frost | | 2, 2 |
| | 2A | SS | | | | | 8 |
| 5 | 3 | SS | | | Brown fine to medium sand (SP) - trace of fine gravel - wet - medium dense | | 10 |
| | 4 | SS | | | | | 10 |
| | 5 | SS | | | Brown fine sand (SP) - saturated - medium dense | | 13 |
| 10 | 6 | SS | | | | | 12 |
| 15 | 7 | SS | | | | | 8 |
| 20 | 8 | SS | | | Brown silty fine sand (SM) - trace of clay and clayey sand seams - a little gravel - very moist - loose to extremely dense | | 67 |
| 25 | 9 | SS | | | | | 100/3" |
| 30 | 10 | SS | | | | | 73 |
| 35 | 11 | SS | | | Brown silty fine to coarse sand (SM) - a little gravel - very moist - very dense to extremely dense | | 88 |
| 40 | | | | | | | |
| 41.5 | 12 | SS | | | | | 74 |
| | | | | | End of Boring<br>Boring advanced to 4.0 feet by solid stem auger<br>Boring advanced from 4.0 to 41.5 feet by roller bit and Revert drilling mud | | |

| WATER LEVEL OBSERVATIONS | | |
|---|---|---|
| WL | 1.0' W.S. | |
| WL | Surface DCR | Surface ACR |
| WL | | |

**SOIL TESTING SERVICES**
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

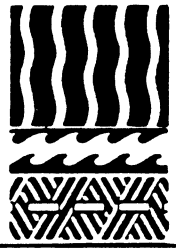
| | | | |
|---|---|---|---|
| BORING STARTED | | | 1-6-81 |
| BORING COMPLETED | | | 1-6-81 |
| RIG | Bomb | FOREMAN | TT |
| DRAWN | JPJ | APPROVED | TWW |
| JOB # | 10935 | SHEET | 1 of 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

Foth & Van Dyke and Associates, Inc.
1981 Access Road Borings (FVD-AR-1 through 31)

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*



PROJECT Exxon Access Rd. DATE 4/21/81

BORING LOCATION (PI) Sta. 160 BORING NO. 1

SURFACE ELEVATION 488.0± JOB NO. XX-8106

| ELEV. METERS(FT) | DEPTH METERS(FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | SAMPLE $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0<br>.23 | | | | | | Dark brown silt loam (topsoil) moist - loose (OL) |
| | .23<br>.50 | | | | | | Light brown fine sandy SILT, slightly mottled, moist, firm (SM) |
| | .50<br>1.3 | | | | | | Light to dark brown clayey SILT, some fine sand, moist, firm (ML) |
| | 1.3<br>1.7 | | | | | | Light brown fine to coarse SAND, some fine to medium gravel, wet, firm (SW) |
| | | | | | | | |
| | | | | | | | |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| DRILLING METHOD 3½" Hand Auger | WHILE DRILLING Wet @ 1.3M |
| | AFTER DRILLING |
| | HOURS AFTER DRILLING |
| LOG BY: REM | |

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*

PROJECT Exxon Access Road — DATE 4/22/81

BORING LOCATION Sta. 280 — BORING NO. 2

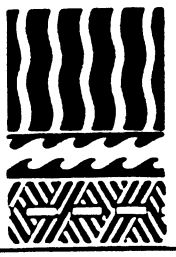
SURFACE ELEVATION 482+ — JOB NO. XX8106

| ELEV. METERS(FT) | DEPTH METERS(FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | SAMPLE $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0<br>.30 | | | | | | Black, silt loam topsoil, moist (OL) |
| | .30<br>.60 | | | .3-.45<br>.45-6 | 125<br>158 | | Light brown, silty clayey SAND, slightly mottled, moist, firm (SM-SC) |
| | .60<br>.75 | | | | | | Light to dark brown, clayey SILT, some fine sand, moist, firm (ML) |
| | .75<br>1.6 | | | | | | Light brown, fine to coarse SAND, some fine to coarse gravel, wet, firm (SW) |
| | | | | | | | |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| DRILLING METHOD 3½" Hand Auger | WHILE DRILLING Wet @ .6 |
| | AFTER DRILLING |
| | HOURS AFTER DRILLING |
| LOG BY: REM | |

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*



PROJECT Exxon Access Rd. DATE 4/22/81

BORING LOCATION Sta. 450 BORING NO. 3

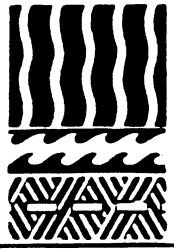
SURFACE ELEVATION JOB NO. XX8106

| ELEV. METERS(FT) | DEPTH METERS(FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | SAMPLE $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0<br>.24 | | | | | | Black silt loam topsoil (OL) |
| | .70 | | | | | | Light brown, clayey SILT, slightly mottled, moist, firm (SM-ML)<br>Note: Bulk sample - .24 - 70M |
| | .70<br>1.32 | | | | | | Light brown, fine to coarse SAND, some fine to coarse gravel, wet, firm (SW)<br>Note: Bulk sample -.7 - 1.32M |
| | | | | | | | |
| | | | | | | | |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| DRILLING METHOD 4½" Hand Auger | WHILE DRILLING None |
| | AFTER DRILLING |
| | HOURS AFTER DRILLING |
| LOG BY: REM | |

# LOG OF TEST BORINGS

FOTH & VAN DYKE
and Associates, Inc.
*Consulting Engineers*



PROJECT Exxon Access Road DATE 4/22/81

BORING LOCATION Sta. 610 BORING NO. 4

SURFACE ELEVATION 487± JOB NO. XX8106

| ELEV. METERS(FT) | DEPTH METERS(FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | SAMPLE $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0<br>.30 | | | | | | Black, silty loam, topsoil, moist (OL) |
| | .30<br>.94 | | | | | | Brown, silty SAND, some fine to coarse gravel, moist, firm (SM)<br>Note: Bulk sample - .3 - .9M |
| | .94<br>1.5 | | | | | | Light brown, fine to coarse SAND, some fine to medium gravel, moist, firm (SW) |
| | | | | | | | |
| | | | | | | | |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| DRILLING METHOD 4½" Hand Auger | WHILE DRILLING |
| | AFTER DRILLING |
| | HOURS AFTER DRILLING |
| LOG BY: REM | |

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*

PROJECT Exxon Access Rd. DATE 4/22/81

BORING LOCATION Sta. 730 BORING NO. 5

SURFACE ELEVATION 484± JOB NO. XX8106

| ELEV. METERS(FT) | DEPTH METERS(FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | SAMPLE $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0<br>.29 | | | | | | Black, silt loam, (topsoil) (OL) |
| | .29<br>.4 | | | 3-4.5 | 184 | | Brown, silty SAND, trace fine gravel, moist, firm (SM) |
| | .4<br>.9 | | | | | | Light brown, fine to medium SAND, moist, firm (SP) |
| | .9<br>1.0 | | | | | | Light brown, fine to coarse SAND, some gravel, wet, firm (SW)<br>(Hole abandoned due to coarse gravel) |
| | | | | | | | |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| DRILLING METHOD 3½" Hand Auger | WHILE DRILLING Wet @ .9' |
| | AFTER DRILLING |
| | HOURS AFTER DRILLING |
| LOG BY: REM | |

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*

PROJECT Exxon Access Rd. DATE 4/22/81

BORING LOCATION Sta. 850 BORING NO. 6

SURFACE ELEVATION 482.5± JOB NO. XX8106

| ELEV. METERS(FT) | DEPTH METERS(FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | SAMPLE $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0<br>.30 | | | | | | Black, silt loam topsoil, moist (OL) |
| | .30<br>.75 | | | .3-.4<br>.5-.6<br>.6-.7 | 119<br>123<br>174 | | Light to dark brown, clayey SILT, some fine sand, slightly mottled, moist, loose (ML-SM) |
| | .75<br>1.45 | | | | | | Light brown to reddish brown, silty and/or clayey SAND, some gravel, wet to saturated, firm (SC-SM) |
| | | | | | | | |
| | | | | | | | |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| DRILLING METHOD 3½" Hand Auger | WHILE DRILLING Wet @ .75M |
| | AFTER DRILLING |
| | HOURS AFTER DRILLING |
| LOG BY: REM | |

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*

PROJECT Exxon Access Rd. DATE 4/22/81

BORING LOCATION Sta. 1000 BORING NO. 7

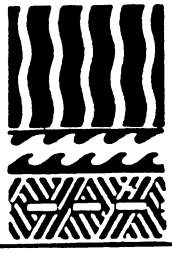
SURFACE ELEVATION ≈ 485.5 JOB NO. XX8106

| ELEV. METERS(FT) | DEPTH METERS(FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | SAMPLE $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0<br>.24 | | | | | | Black, sandy LOAM (topsoil) |
| | .24<br>1.05 | | | | | | Brown, silty fine to coarse SAND, some gravel, trace clay, moist, firm (SM)<br>Note: Bulk sample - .24 - 1.05 |
| | 1.05<br>1.5 | | | | | | Brown, fine to coarse SAND, some gravel and silt, trace clay, wet, firm (SM) |
| | | | | | | | |
| | | | | | | | |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| DRILLING METHOD 4½" Hand Auger | WHILE DRILLING None |
| | AFTER DRILLING |
| | HOURS AFTER DRILLING |
| LOG BY: REM | |

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*



PROJECT Exxon Access Rd. DATE 4/22/81

BORING LOCATION Sta. 1100 BORING NO. 8

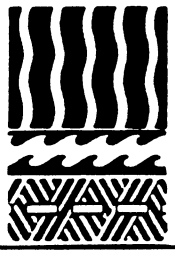
SURFACE ELEVATION 483.5± JOB NO. XX8106

| ELEV. METERS(FT) | DEPTH METERS(FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | SAMPLE $Q_P$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0<br>.25 | | | | | | Black, sandy LOAM, moist (topsoil) |
| | .25<br>1.10 | | | | | | Brown, silty fine to coarse SAND, some gravel, trace clay (SM)<br>Note: Bulk sample - .2 - 1.1M |
| | 1.1<br>1.4 | | | | | | Brown to gray, silty fine to coarse SAND with gravel, mottled (SW-SM) |
| | | | | | | | |
| | | | | | | | |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| DRILLING METHOD 3½" Hand Auger | WHILE DRILLING Wet @ 1.0M |
| | AFTER DRILLING |
| | HOURS AFTER DRILLING |
| LOG BY: REM | |

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*



PROJECT Exxon Access Rd. DATE 4/22/81

BORING LOCATION Sta. 1200 BORING NO. 9

SURFACE ELEVATION 482± JOB NO. XX8106

| ELEV. METERS(FT) | DEPTH METERS(FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | SAMPLE $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0<br>.17 | | | | | | Black silt loam, moist (topsoil) (OL) |
| | .17<br>.70 | | | | | | Brown, clayey silt and/or silty CLAY, some sand, moist, stiff (ML-CL) |
| | .7<br>.90 | | | | | | Light to dark brown, silty fine to coarse sand, trace clay, mottled moist to wet, firm (SM) |
| | .90<br>1.8 | | | | | | Light brown, fine to medium SAND, trace gravel, wet, firm, (SP) |
| | 1.8<br>1.95 | | | | | | Brown, fine to coarse SAND, little fine to medium gravel, wet, firm (SW) |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| DRILLING METHOD 3½" Hand Auger | WHILE DRILLING Wet @ .9M |
| | AFTER DRILLING |
| | HOURS AFTER DRILLING |
| LOG BY: REM | |

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*

PROJECT Exxon Access Rd. DATE 4/22/81

BORING LOCATION Sta. 1300 BORING NO. 10

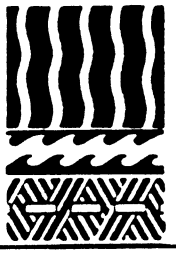
SURFACE ELEVATION 481± JOB NO. XX8106

| ELEV. METERS (FT) | DEPTH METERS (FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | SAMPLE $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0<br>.15 | | | | | | Black, organic silt loam topsoil (OL) |
| | .15<br>.65 | | | | | | Brown, silty SAND, some clay, wet, firm (SM-ML) |
| | .65<br>1.09 | | | | | | Brown, clayey SILT, little sand, moist, firm (ML) |
| | 1.09<br>1.45 | | | | | | Brown, fine to medium SAND to wet, firm (SP) |
| | 1.45<br>1.65 | | | | | | Brown fine to coarse SAND, some fine to coarse gravel (SW) |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| DRILLING METHOD 3½" Hand Auger | WHILE DRILLING Wet @ 1.09 |
| | AFTER DRILLING |
| | HOURS AFTER DRILLING |
| LOG BY: REM | |

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*



PROJECT Exxon Access Rd. DATE 4/22/81

BORING LOCATION Sta. 1500 BORING NO. 11

SURFACE ELEVATION 479± JOB NO. XX8106

| ELEV. METERS (FT) | DEPTH METERS (FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | SAMPLE $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0<br>.07 | | | | | | Black, sandy loam topsoil (OL) |
| | .07<br>.70 | | | .45-.6 | 162 | | Brown, silty fine to medium SAND, little to trace clay, moist, firm (SM-ML) |
| | .70<br>1.0 | | | | | | Brown, silty fine to coarse sand some gravel and cobbles, trace clay, moist, firm (SM) |
| | | | | | | | (Hole could not be advanced further due to gravel and cobbles) |
| | | | | | | | |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| DRILLING METHOD 3½" Hand Auger | WHILE DRILLING None |
| | AFTER DRILLING |
| | HOURS AFTER DRILLING |
| LOG BY: REM | |

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*

PROJECT Exxon Access Rd. DATE 4/22/81

BORING LOCATION Sta. 1700 BORING NO. 12

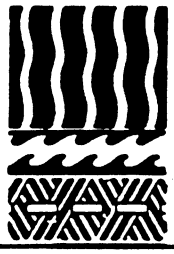
SURFACE ELEVATION 477.5± JOB NO. XX8106

| ELEV. METERS(FT) | DEPTH METERS(FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | SAMPLE $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0<br>.15 | | | | | | Black silt LOAM (topsoil) |
| | .15<br>.5 | | | .2-.35<br>.35-5 | 88<br>136 | | Brown to light gray clayey SILT, with fine sand, mottled, wet, loose (SM-SC-ML) |
| | .5<br>.71 | | | | | | Brown to dark brown, fine to medium SAND some silt and clay (SM) |
| | .71<br>1.53 | | | | | | Light brown, fine to medium SAND, little fine to coarse gravel (SP)<br><br>Note: Hole could not be advanced further due to gravel and cobbles. |
| | | | | | | | |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| DRILLING METHOD 3½" Hand Auger | WHILE DRILLING None |
| | AFTER DRILLING |
| | HOURS AFTER DRILLING |
| LOG BY: REM | |

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*



PROJECT Exxon Access Rd. DATE 4/22/81

BORING LOCATION Sta. 1850 BORING NO. 13

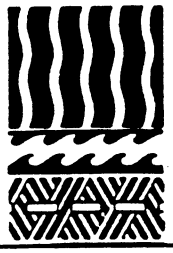
SURFACE ELEVATION 481± JOB NO. XX8106

| ELEV. METERS(FT) | DEPTH METERS(FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | SAMPLE $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0<br>.09 | | | | | | Black, sandy humus (topsoil) (OL) |
| | .09<br>1.82 | | | | | | Light brown to yellowish to reddish brown fine to medium SAND, little gravel, trace silt (SP)<br><br>Note: Bulk sample - .09 - 1.82M |
| | 1.82<br>1.95 | | | | | | Brown, fine to coarse SAND, some fine to medium gravel (SW) |
| | | | | | | | |
| | | | | | | | |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| DRILLING METHOD 3½" Hand Auger | WHILE DRILLING None |
| | AFTER DRILLING |
| | HOURS AFTER DRILLING |
| LOG BY: REM | |

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*



PROJECT Exxon Access Rd. DATE 4/22/81

BORING LOCATION Sta. 1950 BORING NO. 14

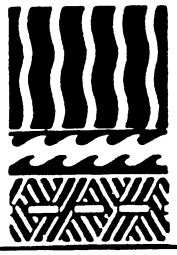
SURFACE ELEVATION 473.5 JOB NO. XX8106

| ELEV. METERS(FT) | DEPTH METERS(FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0<br>.6 | | | | | | Black to dark brown, PEAT, saturated, very soft (PT) |
| | .6<br>0.9 | | | | | | Dark gray, black to brown, fine SAND with seams of black peat and/or sandy peat - saturated, very loose (SP-PT) |
| | 0.9<br>1.3 | | | | | | Brown to gray, fine to medium SAND, some silt - saturated - loose (SM-SP)<br>Note: Partial frozen |
| | | | | | | | |
| | | | | | | | |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| DRILLING METHOD 3½" Hand Auger | WHILE DRILLING |
| | AFTER DRILLING .30M |
| | HOURS AFTER DRILLING |
| LOG BY: REM | |

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*



PROJECT Exxon Access Rd. DATE 4/22/81

BORING LOCATION Sta. 2100 BORING NO. 15

SURFACE ELEVATION 472.5 JOB NO. XX8106

| ELEV. METERS (FT) | DEPTH METERS (FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | SAMPLE $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | 0 | | | 0-.15 | 12 | | Black to dark brown, fiborous peat, saturated, very soft (PT) |
| | | | | .15-.30 | 12 | | |
| | | | | .3 -.45 | 39 | | |
| | | | | .45-.60 | 58 | | |
| | | | | .60-.75 | 53 | | |
| | | | | .75-.90 | 53 | | |
| | 1.85 | | | | | | |
| | 1.85 | | | | | | Dark gray, fine to medium SAND, some organic matter and seams of peat (SP-PT) |
| | 1.95 | | | | | | |
| | | | | | | | |
| | | | | | | | |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| DRILLING METHOD 3½" Hand Auger | WHILE DRILLING Ground Surface |
| | AFTER DRILLING Ground Surface |
| | HOURS AFTER DRILLING |
| LOG BY: REM | |

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*

PROJECT Exxon Access Rd. DATE 4/24/81

BORING LOCATION Sta. 2300 BORING NO. 16

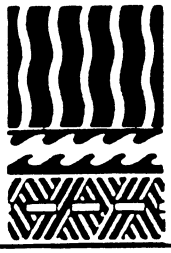
SURFACE ELEVATION 473.5 JOB NO. XX8106

| ELEV. METERS (FT) | DEPTH METERS (FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | SAMPLE $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0<br><br><br><br><br>1.65 | | | .15-3<br>3 -.45<br>.45-.6<br>.6 -.75<br>.75-.9 | 25<br>47<br>52<br>70<br>67 | | Black to dark brown fiberous PEAT - saturated very soft (becoming dryer with depth) (PT) |
| | 1.65<br><br><br><br><br>1.95 | | | | | | Light to dark gray fine to medium SAND - trace of gravel, water bearing, loose (SP) |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| DRILLING METHOD 3½" Hand Auger | WHILE DRILLING |
| | AFTER DRILLING .34M to Water Level |
| | HOURS AFTER DRILLING |
| LOG BY: REM | |

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*



PROJECT Exxon Access Rd. DATE 4/24/81

BORING LOCATION Sta. 2400 BORING NO. 17

SURFACE ELEVATION 473.0 JOB NO. XX8106

| ELEV. METERS(FT) | DEPTH METERS(FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | SAMPLE $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0 | | | | | | Water |
| | .18 | | | | | | Black fiberous PEAT saturated, very soft (PT) |
| | .92 | | | | | | Light gray, fine SAND, water bearing, loose (SP) |
| | 1.07 | | | | | | Fine sandy SILT, saturated loose (ML) |
| | 1.12 | | | | | | Light gray, fine SAND, water bearing, loose (SP) |
| | 1.50 | | | | | | |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| DRILLING METHOD 3½" Hand Auger | WHILE DRILLING At Surface |
| | AFTER DRILLING |
| | HOURS AFTER DRILLING |
| LOG BY: REM | |

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*

PROJECT Exxon Access Rd. DATE 4/24/81

BORING LOCATION Sta. 2500 BORING NO. 18

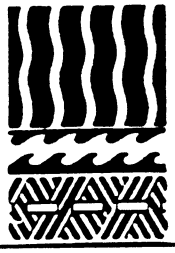
SURFACE ELEVATION 475.5 JOB NO. XX8106

| ELEV. METERS(FT) | DEPTH METERS(FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | SAMPLE $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0 | | | | | | Black, sandy loam with humus (topsoil) (OL) |
| | .06 | | | | | | |
| | .06 | | | | | | Brown, silty, fine to medium SAND, little clay, moist, loose |
| | .46 | | | | | | |
| | .46 | | | | | | Light brown, fine to medium SAND, trace gravel, moist, firm (SP) |
| | .88 | | | | | | |
| | .88 | | | | | | Brown, fine to coarse SAND, trace fine gravel (SW) |
| | 1.55 | | | | | | |
| | | | | | | | |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| DRILLING METHOD 3½" Hand Auger | WHILE DRILLING None |
| | AFTER DRILLING |
| | HOURS AFTER DRILLING |
| LOG BY: REM | |

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*



**PROJECT** Exxon Access Road **DATE** 4/24/81

**BORING LOCATION** Sta. 2600 **BORING NO.** 19

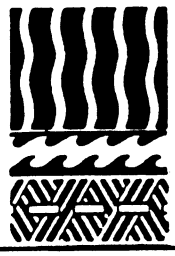
**SURFACE ELEVATION** 480.0± **JOB NO.** XX8106

| ELEV. METERS(FT) | DEPTH METERS(FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0<br>.10 | | | | | | Black silt loam (topsoil) (OL) |
| | .10<br>1.95 | | | | | | Brown fine to coarse SAND<br>Some GRAVEL, trace of SILT<br>(Becoming finer with depth)<br>(SW) |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| **DRILLING METHOD** 3½" Hand Auger | **WHILE DRILLING** NONE |
| | **AFTER DRILLING** |
| | **HOURS AFTER DRILLING** |
| **LOG BY:** REM | |

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*



PROJECT Exxon Access Road — DATE 4/23/81

BORING LOCATION Sta. 2700 — BORING NO. 20

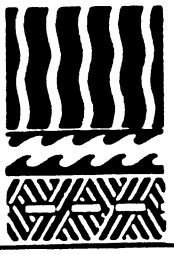
SURFACE ELEVATION 480.5± — JOB NO. XX8106

| ELEV. METERS (FT) | DEPTH METERS (FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | SAMPLE $Q_p$ (tsi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0<br>.017 | | | | | | Black, silt loam with humus (topsoil) (OL) |
| | .017<br>.83 | | | | | | Brown, clayey SILT, with SAND<br>Moist to wet, loose (ML) |
| | .83<br>1.95 | | | | | | Lt. brown, fine to coarse SAND<br>Little fine GRAVEL<br>(SW) |
| | | | | | | | |
| | | | | | | | |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| DRILLING METHOD 3½" Hand Auger | WHILE DRILLING NONE |
| | AFTER DRILLING |
| | HOURS AFTER DRILLING |
| LOG BY: REM | |

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*



**PROJECT** Exxon Access Road **DATE** 4-23-81

**BORING LOCATION** Edge of Swamp Creek Sta. 2800 **BORING NO.** 21

**SURFACE ELEVATION** 472.0 **JOB NO.** XX8106

| ELEV. METERS(FT) | DEPTH METERS(FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0 | | | 0-1.5 | 29 | | Black to gray, organic, fine to medium SAND, saturated, loose (SP-PT) |
| | | | | .15-.30 | 27 | | |
| | | | | .30-.95 | 55 | | |
| | .25 | | | | | | |
| | .25 | | | | | | Gray fine to med SAND Water bearing, loose (SP) |
| | .50 | | | | | | |
| | .50 | | | 45-.6 | 56 | | Dark brown fiberous PEAT Wet, soft (PT) |
| | | | | 6-.75 | 123 | | |
| | .80 | | | | | | |
| | .80 | | | 75-.9 | 181 | | Brownish gray, fine to coarse SAND with fine to coarse GRAVEL (SW-GW) |
| | | | | | | | (Refusal to to coarse gravel) |
| | .9 | | | | | | |

**GENERAL NOTES**

**DRILLING METHOD** 3½" Flight Augers

**LOG BY:** REM

**WATER LEVEL OBSERVATIONS**

**WHILE DRILLING** At Surface

**AFTER DRILLING**

**HOURS AFTER DRILLING**

# LOG OF TEST BORINGS

FOTH & VAN DYKE
and Associates, Inc.
*Consulting Engineers*

| | | | |
|---|---|---|---|
| **PROJECT** | Exxon Access Road | **DATE** | 4/23/81 |
| **BORING LOCATION** | Sta. 2900 | **BORING NO.** | 22 |
| **SURFACE ELEVATION** | 473.5 | **JOB NO.** | XX8106 |

| ELEV. METERS (FT) | DEPTH METERS (FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | SAMPLE $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0<br>.25 | | | | | | Black PEAT<br>Saturated very soft<br>(PT) |
| | .25<br>1.0 | | | | | | Dark gray to black fine SAND<br>Some organic matter and SILT<br>Wet, loose<br>(SP-PT) |
| | 1.0<br>1.25 | | | | | | Dark brown organic SILT<br>Saturated, very soft<br>(OH) |
| | 1.25 | | | | | | Encountered boulder-refusal<br><br>NOTE: Ice below Peat at 3" |
| | | | | | | | |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| **DRILLING METHOD** 3½" Hand Auger | **WHILE DRILLING** At Surface |
| | **AFTER DRILLING** |
| | **HOURS AFTER DRILLING** |
| **LOG BY:** REM | 3.5-6-53 |

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*

**PROJECT** Exxon Access Road **DATE** 4/23/81

**BORING LOCATION** Sta. 3000 **BORING NO.** 23

**SURFACE ELEVATION** 477.5± **JOB NO.** XX8106

| ELEV. METERS(FT) | DEPTH METERS(FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | SAMPLE $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0<br>0.9 | | | | | | Sandy loam with humus (topsoil) (OL) |
| | 0.0<br>.30 | | | | | | Light brown, fine to medium SAND<br>Trace silt<br>Moist firm<br>(SP) |
| | .30<br>1.10 | | | | | | Brown - fine to coarse SAND<br>Little fine to coarse GRAVEL<br>Moist firm (SW) |
| | | | | | | | |
| | | | | | | | |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| **DRILLING METHOD** 3½" Hand Auger | **WHILE DRILLING** NONE |
| | **AFTER DRILLING** |
| | **HOURS AFTER DRILLING** |
| **LOG BY:** REM | 3.5-6-54 |

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*

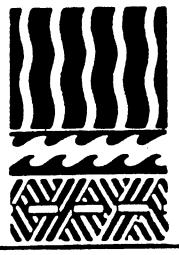
| | | | |
|---|---|---|---|
| **PROJECT** | Exxon Access Road | **DATE** | 4/23/81 |
| **BORING LOCATION** | Sta. 3050 | **BORING NO.** | 24 |
| **SURFACE ELEVATION** | 481± | **JOB NO.** | XX8106 |

| ELEV. METERS(FT) | DEPTH METERS(FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | SAMPLE $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0<br>.02 | | | | | | Black sandy loam with humas (topsoil) |
| | .02<br>.65 | | | 02-17<br>17-32 | 103<br>138 | | Brown, silty fine to medium SAND<br>Trace clay, moist firm<br>(SM) |
| | .65<br>1.95 | | | | | | Lt. brown, fine to coarse SAND<br>Some fine to medium GRAVEL<br>(SW)<br><br>NOTE: Bulk Sample - .65 to 1.95 m |
| | | | | | | | |
| | | | | | | | |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| **DRILLING METHOD** 4½" Hand Auger | **WHILE DRILLING** NONE |
| | **AFTER DRILLING** |
| | **HOURS AFTER DRILLING** |
| **LOG BY:** REM | 3.5-6-55 |

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*



PROJECT Exxon Access Road — DATE 4/23/81

BORING LOCATION Sta. 3200 — BORING NO. 25

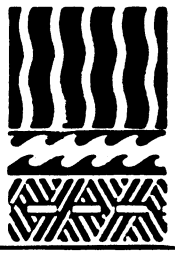
SURFACE ELEVATION 483.5± — JOB NO. XX8106

| ELEV. METERS(FT) | DEPTH METERS(FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | SAMPLE $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0<br>.05 | | | | | | Black, silt loam with humus (topsoil) (OL) |
| | .05<br>.45 | | | 15-3<br>3-45 | 117<br>165 | | Light brown to reddish brown clayey SILT some sand mottled, moist to wet, firm (ML) |
| | .45<br>1.35 | | | | | | Slightly reddish brown, silty fine to coarse SAND, some gravel, trace clay, moist to wet, firm (SM) |
| | | | | | | | |
| | | | | | | | |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| DRILLING METHOD 3½" Hand Auger | WHILE DRILLING |
| | AFTER DRILLING .52M |
| | HOURS AFTER DRILLING |
| LOG BY: REM | 3.5-6-56 |

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*



| | | | |
|---|---|---|---|
| **PROJECT** | Exxon Access Road | **DATE** | 4/23/81 |
| **BORING LOCATION** | Sta. 3450 | **BORING NO.** | 26 |
| **SURFACE ELEVATION** | 497.5± | **JOB NO.** | XX8106 |

| ELEV. METERS(FT) | DEPTH METERS(FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | SAMPLE $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0<br>.045 | | | | | | Black, sandy loam with humus (topsoil) (OL) |
| | .045<br>.15 | | | | | | Brown, clayey SILT with sand, wet, loose (ML) |
| | .15<br>1.16 | | | | | | Brown to slightly reddish brown, fine to coarse SAND, some SILT and GRAVEL, wet, firm, saturated (SM)<br>NOTE: Partially frozen |
| | | | | | | | |
| | | | | | | | |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| **DRILLING METHOD** 3½" Hand Auger | **WHILE DRILLING** |
| | **AFTER DRILLING** .55 |
| | **HOURS AFTER DRILLING** |
| **LOG BY:** REM | 3.5-6-57 |

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*

PROJECT Exxon Access Road — DATE 4/23/81

BORING LOCATION Sta. 3600 — BORING NO. 27

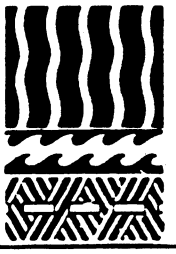
SURFACE ELEVATION 502± — JOB NO. XX8106

| ELEV. METERS(FT) | DEPTH METERS(FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | SAMPLE $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0<br>.06 | | | | | | Black, silty loam with humus (topsoil) (OL) |
| | .06<br>.45 | | | | | | Brown, clayer SILT, some sand, trace gravel, wet - medium (ML)<br>NOTE: Bulk Sample .06-.45M |
| | .45<br>1.22 | | | | | | Brown, fine to coarse SAND, some GRAVEL little SILT (SM-SW) |
| | | | | | | | |
| | | | | | | | |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| DRILLING METHOD 4½" Hand Auger | WHILE DRILLING .305 |
| | AFTER DRILLING .305 |
| | HOURS AFTER DRILLING |
| LOG BY: REM | 3.5-6-58 |

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*



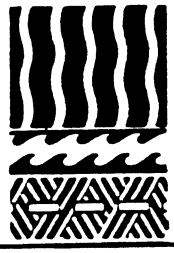
| | | | |
|---|---|---|---|
| **PROJECT** | Exxon Access Road | **DATE** | 4/22/81 |
| **BORING LOCATION** | Sta. 3800 | **BORING NO.** | 28 |
| **SURFACE ELEVATION** | 504± | **JOB NO.** | XX8106 |

| ELEV. METERS(FT) | DEPTH METERS(FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | SAMPLE $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0<br>.06 | | | | | | Black, silt loam with humus (topsoil) (OL) |
| | .06<br>.5 | | | .1-.25<br>.25-.4<br>.4-.55 | 63<br>88<br>125 | | Brown, clayey SILT, some SAND, trace GRAVEL, moist, soft to medium (ML) |
| | .5<br>1.05 | | | | | | Brown, fine to coarse SAND<br>Some fine to coarse GRAVEL<br>Little SILT<br>(SW-SM) |
| | | | | | | | |
| | | | | | | | |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| **DRILLING METHOD** 3½" Hand Auger | **WHILE DRILLING** |
| | **AFTER DRILLING** .47M |
| | **HOURS AFTER DRILLING** |
| **LOG BY:** REM | 3.5-6-59 |

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*



PROJECT Exxon Access Road DATE 4/23/81

BORING LOCATION Sta. 4000 BORING NO. 29

SURFACE ELEVATION 505± JOB NO. XX8106

| ELEV. METERS (FT) | DEPTH METERS (FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | SAMPLE $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0<br>.06 | | | | | | Black, silt loam with humus (topsoil) (OL) |
| | .06<br>.60 | | | 1-25<br>25-4<br>4-55 | 74<br>110<br>167 | | Brown, clayey SILT, some sand, trace gravel, moist, firm (SM-ML) |
| | .60<br>1.2 | | | | | | Brown, fine to coarse SAND<br>Some SILT and GRAVEL<br>Moist, firm<br>(SM-SW) |
| | | | | | | | |
| | | | | | | | |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| DRILLING METHOD 3½" Hand Auger | WHILE DRILLING NONE |
| | AFTER DRILLING |
| | HOURS AFTER DRILLING |
| LOG BY: REM | 3.5-6-60 |

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*

**PROJECT** Exxon Access Road **DATE** 4/22/81

**BORING LOCATION** Sta. 4200 **BORING NO.** 30

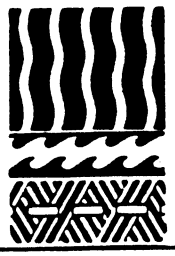
**SURFACE ELEVATION** 506± **JOB NO.** XX8106

| ELEV. METERS(FT) | DEPTH METERS(FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | SAMPLE $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0<br>.1 | | | | | | Black silt loam<br>(topsoil) |
| | .1<br>.6 | | | .2-.35<br>.35-.5<br>.5-.65 | 41<br>104<br>165 | | Brown, clayey SILT, some SAND, little GRAVEL, moist to wet, medium<br>(ML-CL) |
| | .6<br>1.15 | | | | | | Brown, fine to coarse SAND, some SILT and GRAVEL, trace CLAY<br>(SM) |
| | | | | | | | |
| | | | | | | | |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| **DRILLING METHOD** 3½" Hand Auger | **WHILE DRILLING** |
| | **AFTER DRILLING** .95M |
| | **HOURS AFTER DRILLING** |
| **LOG BY:** REM | 3.5-6-61 |

# LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
*Consulting Engineers*



PROJECT Exxon Access Road — DATE 4/23/81

BORING LOCATION Sta. 4400 — BORING NO. 31

SURFACE ELEVATION 506± — JOB NO. XX8106

| ELEV. METERS(FT) | DEPTH METERS(FT) | SAMPLE TYPE | SAMPLE BLOW COUNT | SAMPLE From-To | SAMPLE $Q_p$ (psi) | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| | 0<br>.1 | | | | | | Dark brown, clay loam (topsoil) wet (OL) |
| | .1<br>.4 | | | .3-.45<br>.45-6 | 78<br>142 | | Brown clay SILT and/or silty CLAY Some SAND, wet to moist - soft (ML-CL) |
| | .4<br>1.2 | | | | | | Brown, fine to coarse SAND, some GRAVEL, little SILT - wet, firm (SW-SP) |
| | | | | | | | |
| | | | | | | | |

| GENERAL NOTES | WATER LEVEL OBSERVATIONS |
|---|---|
| DRILLING METHOD 3½" Hand Auger | WHILE DRILLING |
| | AFTER DRILLING .25 |
| | HOURS AFTER DRILLING |
| LOG BY: REM | 3.5-6-62 |

Foth & Van Dyke and Associates, Inc.
1981 Railroad Spur Borings (FVD-RR-1 through 35)

# LOG OF TEST BORING

DATE 9/8/81

PROJECT Exxon R.R. Spur

BORING LOCATION Sta. 533+80 (15m SE of Survey Alignment)

SURFACE ELEVATION 492±

BORING NO. 1

JOB NO. XX8126

BORING DEPTH 1.2m

| DEPTH OF STRATA (m) | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black, silt LOAM TOPSOIL with cobbles and boulders (OL). | |
| .20m | | | | | | | |
| .20m | | | | | | Brown, fine sandy SILT, moist, loose (SM-ML). | |
| .36m | | | | | | | |
| .36m | | | | | | Light brown, fine sand, little to some SILT, trace gravel, mottled after .50m, moist, firm (SP). | |
| .70m | | | | | | | |
| .70m | | | | | | Dark brown, silty fine to medium SAND, trace clay and gravel, moist, firm (SM-ML). | |
| .91m | | | | | | | |
| .91m | | | | | | Brown, well graded SAND and gravel, moist, firm (SW-GW). | |
| 1.2m | | | | | | | |
| | | | | | | Auger refusal at 1.2m - cobbles and coarse gravel. | |

DRILLING DATA: 3½" Bucket-type Hand Auger

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

3.5-6-64

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/8/81

PROJECT Exxon R.R. Spur

BORING NO. 2

BORING LOCATION Sta. 532+28 - (15m SE of Alignment)

JOB NO. XX8126

SURFACE ELEVATION 498+

BORING DEPTH 1.22m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black, fine sandy LOAM with cobbles and boulders (topsoil), moist (OL). | |
| .11m | | | | | | | |
| .11m | | | | | | Brown to dark brown, silty fine SAND trace gravel, moist, firm (SM). | |
| .40m | | | | | | | |
| .40m | | | | | | Light brown, fine to medium SAND, little silt, trace gravel, moist, firm (SP). | |
| .70m | | | | | | | |
| .70m | | | | | | Brown, well graded sand, with gravel and cobbles, moist, dense (GW-SW). | |
| 1.22m | | | | | | | |
| 1.22m | | | | | | Auger refusal - cobbles and gravel. | |

DRILLING DATA: 3½" Bucket-type Hand Auger

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc. 3.5-6-65

# LOG OF TEST BORING

DATE 9/8/81

PROJECT Exxon R.R. Spur

BORING NO. 3

BORING LOCATION Sta. 530+73 - (4m east of Alignment)

JOB NO. XX8126

SURFACE ELEVATION 497+

BORING DEPTH 2.1m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black, sandy LOAM with boulders and cobbles, (topsoil) (OL). | |
| .06m | | | | | | | |
| .06m | .4m | A | 1 | | | Brown to dark brown, fine sandy SILT, moist, firm (SM-ML). | |
| .84m | | | | | | | |
| .84m | | | | | | Light to dark brown, clayey SILT, some fine sand, moist, firm (ML-CL). | |
| 1.0m | | | | | | | |
| [illegible]m | | | | | | Light brown, fine SAND, trace silt with seams of dark brown silty sand, moist to wet, firm (SP-SM). | |
| .47m | | | | | | | |
| .47m | | | | | | Light brown, fine to medium sand, moist, firm (SP). | |
| 2.1m | | | | | | | |

DRILLING DATA: 3½" Bucket-type Hand Auger

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

3.5-6-66

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/8/81

PROJECT Exxon R.R. Spur

BORING LOCATION Sta. 528+64 on Alignment

SURFACE ELEVATION 492.5

BORING NO. 4

JOB NO. XX8126

BORING DEPTH 0.82m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black, loamy SAND (Topsoil) (OL). | |
| 0.12m | | | | | | | |
| 0.12m | .50m | A | 1 | | | Brown, fine sandy SILT, trace clay, moist, firm (SM-ML). | |
| 0.60m | | | | | | | |
| 0.60m | | | | | | Light to reddish brown, fine to medium SAND, some silt, mottled, moist, firm (SM). | |
| 0.68m | | | | | | | |
| 0.68m | | | | | | Brown, well graded SAND and gravel, little silt, moist, firm (SW). | |
| 0.82m | | | | | | | |
| | | | | | | Auger refusal - cobbles at 0.82m. | |

DRILLING DATA: 3½" Bucket-type Hand Auger

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

3.5-6-67

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/8/81

PROJECT Exxon R.R. Spur

BORING LOCATION Sta. 527+43 - 10m east of Alignment

SURFACE ELEVATION 492±

BORING NO. 5

JOB NO. XX8126

BORING DEPTH .92m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black, sandy LOAM with humus (topsoil) (OL). | |
| .09m | | | | | | | |
| .09m | | | | | | Dark brown, fine sandy SILT, trace clay, moist, firm (SM-ML). | |
| .32m | | | | | | | |
| .32m | | | | | | Light brown, silty fine SAND and well graded GRAVEL and cobbles, moist, firm (GM). | |
| .92m | | | | | | Auger refusal - cobbles | |

DRILLING DATA: 3½" Bucket-type Hand Auger

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

3.5-6-68

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/8/81

PROJECT Exxon R.R. Spur

BORING NO. 6

BORING LOCATION 527+43 - 10m west of Alignment

JOB NO. XX8126

SURFACE ELEVATION 490.5+

BORING DEPTH .80m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black, sandy LOAM with humus, (topsoil) (OL). | |
| .09m | | | | | | | |
| .09m | | | | | | Brown, SILT, some fine sand, trace clay moist, firm (ML). | |
| .72m | | | | | | | |
| .72m | | | | | | Light brown, fine sandy SILT with gravel and cobbles, moist, firm (GM). | |
| .80m | | | | | | | |
| | | | | | | Auger refusal .80m - cobbles and gravel | |

DRILLING DATA: 3½" Bucket-type Hand Auger

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

3.5-6-69

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/8/81

PROJECT Exxon R.R. Spur

BORING NO. 7

BORING LOCATION Sta. 526+25 - (5m west)

JOB NO. XX8126

SURFACE ELEVATION 492+

BORING DEPTH 1.1m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black, sandy LOAM with humus and boulders, topsoil (OL). | |
| .06m | | | | | | | |
| .06m | | | | | | Brown, fine sandy SILT, trace clay, moist, firm (SM-ML). | |
| .32m | | | | | | | |
| .32m | | | | | | Light brown, silty fine SAND with well graded gravel and cobbles, moist, firm (GM). | |
| 1m | | | | | | | |
| | | | | | | Auger refusal at 1.1m - cobbles | |

DRILLING DATA: 3½" Bucket-type Hand Auger

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

3.5-6-70

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/8/81

PROJECT Exxon R.R. Spur

BORING LOCATION Sta. 524+16 - 7m west of Alignment

SURFACE ELEVATION 488±

BORING NO. 8

JOB NO. XX8126

BORING DEPTH 1.23m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black, sandy LOAM with humus, topsoil (OL). | |
| .11m | | | | | | | |
| .11m | | | | | | Light to dark brown, silty fine SAND, trace gravel, moist, firm (SM-ML). | |
| .5m | | | | | | | |
| .5m | | | | | | Brown, well graded sand and gravel, trace to little silt (less silt with depth), moist, firm (SW). | |
| 1.23m | | | | | | | |

DRILLING DATA: 3½" Bucket-type Hand Auger

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

3.5-6-71

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/8/81

PROJECT Exxon R.R. Spur

BORING NO. 9

BORING LOCATION Sta. 521+21

JOB NO. XX8126

SURFACE ELEVATION 490±

BORING DEPTH .85m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black, sandy LOAM with humus (topsoil). | |
| .5m | | | | | | | |
| .15m | | | | | | Dark brown, silty fine SAND, moist, firm (SM). | |
| .37m | | | | | | | |
| .37m | | | | | | Lt. brown to whitish brown, silty fine sand with well graded gravel and cobbles, moist, firm (GM). | |
| .85m | | | | | | Auger refusal at .85m - boulders | |

DRILLING DATA: 3½" Bucket-type Hand Auger

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

3.5-6-72

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/8/81

PROJECT Exxon R.R. Spur

BORING LOCATION Sta. 518+14

SURFACE ELEVATION 483+

BORING NO. 10

JOB NO. XX8126

BORING DEPTH .95m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black, sandy LOAM with humus topsoil (OL). | |
| .06m | | | | | | | |
| .06m | | | | | | Grey, silty fine SAND, moist, firm (SM). | |
| .30m | | | | | | | |
| .30m | | | | | | Light brown to yellowish brown, silty fine SAND, trace gravel, moist, firm (SM-GM) | |
| .95m | | | | | | | |
| | | | | | | Auger refusal at .95m - cobbles | |

DRILLING DATA: 3½" Bucket -type Hand Auger

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

3.5-6-73

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/8/81

PROJECT Exxon R.R. Spur

BORING NO. 11

BORING LOCATION 501+60

JOB NO. XX8126

SURFACE ELEVATION 482.369

BORING DEPTH 1.90m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black, fiborous PEAT, saturated, very soft (PT). | |
| .25m | | | | | | | |
| .25m | | | | | | Dark, brown to black, silty fine to medium SAND, little gravel, moist, firm (SM). | |
| 1.26m | | | | | | | |
| 1.26m | | | | | | Grey, clayey SILT with fine sand, moist, stiff (ML-CL). | |
| 1.32m | | | | | | | |
| .32m | | | | | | Brown, fine to medium SAND, water bearing, firm (SP). | |
| 1.70m | | | | | | | |
| 1.70m | | | | | | Brown, well graded SAND with fine to medium gravel, water bearing, firm (SW). | |
| 1.90m | | | | | | | |

DRILLING DATA: 3½" Bucket-type Hand Auger

WATER LEVEL INFORMATION

AT DRILLING 1.22m

HOURS AFTER DRILLING

3.5-6-74

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/8/81

PROJECT Exxon R.R. Spur

BORING NO. 12

BORING LOCATION 501+90

JOB NO. XX8126

SURFACE ELEVATION 482.304

BORING DEPTH 1.95m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black to dk. brown, fiborous PEAT, saturated, very soft (PT). | |
| 1.58m | | | | | | | |
| 1.58m | | | | | | Dark brown, silty fine to coarse SAND, trace clay, wet, firm (SM). | |
| 1.68m | | | | | | | |
| 1.68m | | | | | | Grey, clayey SILT with fine sand, moist, very stiff (ML-CL). | |
| 1.72m | | | | | | | |
| 1.72m | | | | | | Brown, fine to medium SAND, trace silt, water bearing, firm (SP). | |
| 1.95m | | | | | | | |

DRILLING DATA: 3½" Bucket-type Hand Auger

WATER LEVEL INFORMATION

AT DRILLING Caved in 1.2m

HOURS AFTER DRILLING

3.5-6-75

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/8/81

PROJECT Exxon R.R. Spur

BORING NO. 13

BORING LOCATION 503+50

JOB NO. XX8126

SURFACE ELEVATION 483.194

BORING DEPTH 1.90m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Dark brown, sandy LOAM topsoil (OL). | |
| .23m | | | | | | | |
| .23m | | | | | | Light brown, silty fine SAND, little gravel, moist to dry, firm (SM). | |
| .52m | | | | | | | |
| .52m | | | | | | Light brown, fine to medium SAND, trace silt, moist, firm (SP). | |
| .96m | | | | | | | |
| .96m | | | | | | Brown, well graded SAND with fine to medium gravel, moist, dense (SW-GW). | |
| 1.90m | | | | | | | |

DRILLING DATA: 3½" Bucket-type Hand Auger

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

3.5-6-76

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/8/81

PROJECT Exxon R.R. Spur

BORING NO. 14

BORING LOCATION 505+10 - (20m S of Alignment)

JOB NO. XX8126

SURFACE ELEVATION 483±

BORING DEPTH 1.90m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black, sandy loam with humus (topsoil) | |
| | | | | | | (OL). | |
| .05m | | | | | | | |
| .05m | | | | | | Dark brown, light to reddish brown, silty | |
| | | | | | | fine SAND trace clay, slightly mottled, | |
| | | | | | | moist, firm (SM). | |
| .45m | | | | | | | |
| .45m | | | | | | Light Brown, silty fine SAND, moist, | |
| | | | | | | firm (mottling in upper portion of strata) | |
| | | | | | | (SM). | |
| .82m | | | | | | | |
| .82m | | | | | | Light brown, fine SAND, moist, firm (SP). | |
| 1.32m | | | | | | | |
| 1.32m | | | | | | Brown, fine to coarse SAND with fine | |
| | | | | | | to medium gravel, moist, firm (SW). Strata | |
| | | | | | | water bearing at 1.8m. | |
| 1.90m | | | | | | | |

DRILLING DATA: 3½" Bucket-type Hand Auger

WATER LEVEL INFORMATION

AT DRILLING 1.80m

HOURS AFTER DRILLING

3.5-6-77

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/8/81

PROJECT Exxon R.R. Spur

BORING NO. 15

BORING LOCATION Sta. 506+90 (on Alignment)

JOB NO. XX8126

SURFACE ELEVATION 482.5+

BORING DEPTH 1.90m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black, loamy SAND with humus, topsoil (OL). | |
| .18m | | | | | | | |
| .18m | | | | | | Dark brown, silty fine to medium SAND, trace gravel, moist, firm (SP-SM). | |
| .85m | | | | | | | |
| .85m | | | | | | Light brown, fine to medium SAND, moist, firm (SP) seams of silty sand at 1.30-1.38m. | |
| 1.48m | | | | | | | |
| 1.48m | | | | | | Brown, fine to coarse SAND, some fine to medium gravel, water bearing, firm (SW). | |
| 1.90m | | | | | | | |

DRILLING DATA: 3½" Bucket-type Hand Auger

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING 1.48m

HOURS AFTER DRILLING

3.5-6-78

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/8/81

PROJECT Exxon R.R. Spur

BORING LOCATION Sta. 508+10 - 15m N of Alignment

SURFACE ELEVATION 481.5+

BORING NO. 16

JOB NO. XX8126

BORING DEPTH 1.65m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black, fiborous PEAT, saturated, very soft (Pt). | |
| .35m | | | | | | | |
| .35m | | | | | | Grey, fine to medium sand, water bearing, loose (SP). | |
| .55m | | | | | | | |
| .55m | | | | | | Grey, silty CLAY, little fine sand, moist to wet, soft (CL). | |
| .63m | | | | | | | |
| .63m | | | | | | Brown, fine to medium SAND, water bearing, firm (SP). | |
| 1.65m | | | | | | | |

DRILLING DATA: 3½" Bucket-type Hand Auger

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING .35m

HOURS AFTER DRILLING

3.5-6-79

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/8/81

PROJECT Exxon R.R. Spur

BORING NO. 17

BORING LOCATION 509+60 - (30m N of Alignment)

JOB NO. XX8126

SURFACE ELEVATION 483+

BORING DEPTH 1.83m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0 | | | | | | Black, fiborous PEAT, saturated, very soft (Pt). | |
| .93m | | | | | | | |
| .93m | | | | | | Grey, fine SAND, trace silt, water bearing, loose (SP). | |
| 1.27m | | | | | | | |
| 1.27m | | | | | | Brown, fine to medium SAND, water bearing, firm (SP). | |
| 1.83m | | | | | | | |

DRILLING DATA: 3½" Bucket-type Hand Auger

WATER LEVEL INFORMATION

AT DRILLING .93m caved in and water

HOURS AFTER DRILLING

3.5-6-80

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/9/81

PROJECT Exxon R.R. Spur

BORING NO. 18

BORING LOCATION Sta. 511+10 (45m N of Alignment)

JOB NO. XX8126

SURFACE ELEVATION 482+

BORING DEPTH 1.85m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Dark brown, sandy LOAM topsoil (OL). | |
| .25m | | | | | | | |
| .25m | | | | | | Light brown, silty fine SAND, moist, firm (SM-SP). | |
| .38m | | | | | | | |
| .38m | | | | | | Light brown, fine and fine to medium SAND, moist, firm (SP). | |
| .81m | | | | | | | |
| .81m | | | | | | Brown, fine to coarse SAND with fine to medium gravel, trace to little silt, moist, firm (SW). | |
| 1.0m | | | | | | | |
| 1.0m | | | | | | Light brown, fine to medium sand, moist, firm (SP). | |
| 1.85m | | | | | | | |

DRILLING DATA: 3½" Bucket-type Hand Auger

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

3.5-6-81

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/9/81

PROJECT Exxon R.R. Spur

BORING NO. 19

BORING LOCATION Sta. 512 (60m NW of Alignment)

JOB NO. XX8126

SURFACE ELEVATION 481±

BORING DEPTH 1.53m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black, fiborous PEAT saturated, very soft (Pt). | |
| 1.0m | | | | | | | |
| 1.0m | | | | | | Grey, fine to medium sand, some fine to medium gravel, water bearing, firm (SW-SP). | |
| 1.53m | | | | | | | |

DRILLING DATA: 3½" Bucket-type Hand Auger

WATER LEVEL INFORMATION

AT DRILLING .30m caved in

HOURS AFTER DRILLING

3.5-6-82

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/9/81

PROJECT Exxon R.R. Spur

BORING NO. 20

BORING LOCATION Sta. 513+93 - 73m W By N

JOB NO. XX8126

SURFACE ELEVATION 483±

BORING DEPTH 1.83m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black, sandy LOAM topsoil (OL). | |
| .5m | | | | | | | |
| .5m | | | | | | Light to dark brown, fine sandy SILT trace clay, moist, firm (SM-ML). | |
| .61m | | | | | | | |
| .61m | | | | | | Brown, fine to coarse SAND, some fine to medium gravel, moist, firm (SW). | |
| .90m | | | | | | | |
| .90m | | | | | | Light brown, fine to medium SAND, water bearing, firm (SP). | |
| 1.83m | | | | | | | |

DRILLING DATA: 3¼" Bucket-type Hand Auger

WATER LEVEL INFORMATION

AT DRILLING .90m

HOURS AFTER DRILLING

LOG BY: REM

3.5-6-83

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/9/81

PROJECT Exxon R.R. Spur

BORING NO. 21

BORING LOCATION Sta. 514+50 - 75m West

JOB NO. XX8126

SURFACE ELEVATION 482±

BORING DEPTH 1.90m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black, sandy LOAM with humus topsoil (OL) | |
| .18m | | | | | | | |
| .18m | | | | | | Dark brown to brown, silty fine to medium SAND, moist, firm (SM). | |
| .50m | | | | | | | |
| .50m | | | | | | Brown, fine to medium SAND, wet, firm (SP). | |
| .81m | | | | | | | |
| .81m | | | | | | Brown, fine to coarse SAND, some fine gravel, water bearing, firm (SW). | |
| 1.0m | | | | | | | |
| 1.0m | | | | | | Brown, fine to medium SAND, water bearing, firm (SP). | |
| 1.9m | | | | | | | |

DRILLING DATA: 3½" Bucket-type Hand Auger

WATER LEVEL INFORMATION

AT DRILLING .98m

HOURS AFTER DRILLING

3.5-6-84

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/9/81

PROJECT Exxon R.R. Spur

BORING NO. 22

BORING LOCATION Sta. 516+36 - 35m West of Alignment

JOB NO. XX8126

SURFACE ELEVATION 486+

BORING DEPTH 1.5m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black, loamy SAND with humus (topsoil) | |
| | | | | | | (OL). | |
| .15m | | | | | | | |
| .15m | | | | | | Dark brown, silty fine to medium SAND, | |
| | | | | | | moist, firm (SM). | |
| .48m | | | | | | | |
| .48m | | | | | | Light brown, silty fine SAND, moist, firm | |
| | | | | | | (SM). | |
| .70m | | | | | | | |
| .70m | | | | | | Lt. brown, fine to coarse SAND with fine | |
| | | | | | | to coarse gravel and cobbles, moist firm | |
| 1.5m | | | | | | (SW). | |
| | | | | | | Auger refusal 1.5m - cobbles | |

DRILLING DATA: 3½" Bucket-type Hand Auger

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

LOG BY: REM

3.5-6-85

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/9/81

PROJECT Exxon R.R. Spur

BORING NO. 23

BORING LOCATION Sta. 516+80

JOB NO. XX8126

SURFACE ELEVATION 479±

BORING DEPTH 1.90m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black, fiborous PEAT with coarse gravel, cobbles and boulders, saturated, soft (Pt). | |
| .35m | | | | | | | |
| .35m | | | | | | Grey, fine to coarse SAND some silt, clay and gravel, wet, firm (GC). | |
| 1.34m | | | | | | | |
| 1.34m | | | | | | Grey, fine to coarse sand with gravel, water bearing, dense (SW). | |
| 1.75m | | | | | | | |
| .75m | | | | | | Reddish brown, silty fine to coarse SAND some gravel, saturated, firm (SM-GM). | |
| 1.90m | | | | | | | |

DRILLING DATA: 3½" Bucket-type Hand Auger

WATER LEVEL INFORMATION

AT DRILLING .95m

HOURS AFTER DRILLING

LOG BY: REM

3.5-6-86

FOTH & VAN DYKE and Associates, Inc.

BEST COPY AVAILABLE

# LOG OF TEST BORING

DATE 9/9/81

PROJECT Exxon R.R. Spur

BORING LOCATION Sta. 517+20 approx. centerline approximate centerline of Swamp Ck. on Alignment

SURFACE ELEVATION 478.7±

BORING NO. 24

JOB NO. XX8126

BORING DEPTH 1.21m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Grey, fine to medium SAND with numerous shell fragments, water bearing, firm (SP) | |
| .25m | | | | | | | |
| .25m | | | | | | Brown, fine to coarse SAND, some gravel water bearing, firm (SW). | |
| .44m | | | | | | | |
| .44m | | | | | | Brown, fine to medium SAND, water bearing firm (SP). | |
| 1.21m | | | | | | | |

DRILLING DATA: 3½" Bucket-type Hand Auger

WATER LEVEL INFORMATION

AT DRILLING Elev. 479.5+

HOURS AFTER DRILLING

3.5-6-87

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/9/81

PROJECT Exxon R.R. Spur

BORING NO. 25

BORING LOCATION Sta. 517+62

JOB NO. XX8126

SURFACE ELEVATION 480.5

BORING DEPTH 1.75m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black, fiborous PEAT, some sand, saturated, very soft (Pt). | |
| 1.0m | | | | | | | |
| 1.0m | | | | | | Black, organic, fine to medium SAND, some silt (peaty sand), saturated, loose (SM-Pt). | |
| 1.25m | | | | | | | |
| 1.25m | | | | | | Grey, fine to coarse SAND some fine gravel, saturated, firm (SW). | |
| 1.50m | | | | | | | |
| 1.50m | | | | | | Light brown, fine SAND, some silt, saturated, firm (SP). | |
| 1.75m | | | | | | | |

DRILLING DATA: 3½" Bucket-type Hand Auger

WATER LEVEL INFORMATION

AT DRILLING .35m

HOURS AFTER DRILLING

LOG BY: REM

3.5-6-88

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/9/81

PROJECT Exxon R.R. Spur

BORING NO. 26

BORING LOCATION 517+95

JOB NO. XX8126

SURFACE ELEVATION 481.5

BORING DEPTH 1.85m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black, sandy PEAT, saturated, loose (Pt). | |
| .10m | | | | | | | |
| .10m | | | | | | Light to dark brown, silty fine SAND, wet, firm (SM). | |
| .58m | | | | | | | |
| .58m | | | | | | Light to yellowish brown, fine, sandy SILT, mottled, wet, firm (SM-ML). | |
| 1.0m | | | | | | | |
| 1.0m | | | | | | Light brown, fine to medium SAND, water bearing, firm (SP). | |
| 1.85m | | | | | | | |

DRILLING DATA: 3½" Bucket-type Hand Auger

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

LOG BY: REM

3.5-6-89

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/10/81

PROJECT Exxon R.R. Spur

BORING NO. 27

BORING LOCATION Sta. 535+45 (on Alignment)

JOB NO. XX8126

SURFACE ELEVATION 493+

BORING DEPTH 1.45m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black, silty LOAM with humus topsoil (OL) | |
| .05m | | | | | | | |
| .05m | | | | | | Dark brown, silty fine SAND, moist, firm (SM). | |
| .32m | | | | | | | |
| .32m | .35m | A | 1 | | | Light brown, fine sandy SILT, moist, firm (SM-ML). | |
| .45m | | | | | | | |
| .45m | | | | | | Light brown, silty fine to medium SAND, some gravel, moist, firm (SM). | |
| .70m | | | | | | | |
| .70m | | | | | | Light brown, fine sandy SILT, trace clay (ML). | |
| .81m | | | | | | | |
| .81m | | | | | | Brown, fine to coarse, sand, some gravel, little silt, moist, firm (SM-GM). | |
| 1.45m | | | | | | | |

Refusal 1.45m - cobbles and coarse gravel.

DRILLING DATA: 3½" Bucket-type Hand Auger

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

3.5-6-90

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/10/81

PROJECT Exxon R.R. Spur

BORING LOCATION Sta. 535+89 (10m North of Survey Alignment)

SURFACE ELEVATION 496+

BORING NO. 28

JOB NO. XX8126

BORING DEPTH .95m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black, sandy loam with humus (topsoil) (OL). | |
| .05m | | | | | | | |
| .05m | | | | | | Dark brown, silty, fine to coarse SAND with gravel, moist, firm (SM). | |
| .53m | | | | | | | |
| .53m | | | | | | Brown, fine to coarse SAND with gravel, moist, firm (SW-GW). | |
| .95m | | | | | | | |
| .95m | | | | | | Auger refusal - cobbles at .95m | |

DRILLING DATA: 3½" Bucket-type Hand Auger

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

3.5-6-91

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/10/81

PROJECT Exxon R.R. Spur

BORING NO. 29

BORING LOCATION Sta. 537+42 (13m North of Alignment)

JOB NO. XX8126

SURFACE ELEVATION 497.5±

BORING DEPTH .95m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black, sandy LOAM with gravel and cobbles | |
| | | | | | | topsoil (OL). | |
| .15m | | | | | | | |
| .15m | | | | | | Dark brown, silty fine to medium SAND, | |
| | | | | | | moist, firm (SM). | |
| .36m | | | | | | | |
| .36m | | | | | | Light brown, fine sandy SILT to silty | |
| | | | | | | fine SAND, moist, firm (SM-ML). | |
| .50m | | | | | | | |
| .50m | | | | | | Light brown, fine sand with well graded | |
| | | | | | | gravel and cobbles, little silt (GM). | |
| .95m | | | | | | | |
| | | | | | | Auger refusal - cobbles at .95m | |

DRILLING DATA: 3½" Bucket-type Hand Auger

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

LOG BY: REM

3.5-6-92

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/10/81

PROJECT Exxon R.R. Spur

BORING NO. 30

BORING LOCATION Sta. 538+10 - 12m North of Alignment

JOB NO. XX8126

SURFACE ELEVATION 490±

BORING DEPTH 1.0m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black, sandy LOAM with humus topsoil (OL). | |
| .14m | | | | | | | |
| .14m | | | | | | Dark brown, fine sandy SILT, moist, firm (SM). | |
| .35m | | | | | | | |
| .35m | | | | | | Light brown, silty fine SAND, some gravel moist, firm (SM). | |
| .80m | | | | | | | |
| .80m | | | | | | Brown, fine to coarse SAND with gravel and cobbles, moist, firm (SW). | |
| 1.0m | | | | | | | |
| | | | | | | Auger refusal - cobbles at 1.0m | |

DRILLING DATA: 3½" Bucket-type Hand Auger

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

3.5-6-93

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/10/81

PROJECT Exxon R.R. Spur

BORING NO. 31

BORING LOCATION Sta. 540+23 (5m N of Alignment)

JOB NO. XX8126

SURFACE ELEVATION 495.5±

BORING DEPTH .93m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black, sandy LOAM with humus (topsoil) | |
| | | | | | | (OL). | |
| .07m | | | | | | | |
| .07m | | | | | | Dark brown, fine sandy SILT, moist, firm | |
| | | | | | | (ML-SM). | |
| .35m | | | | | | | |
| .35m | | | | | | Brown, fine to coarse SAND with gravel | |
| | | | | | | and cobbles, little trace silt, moist, | |
| | | | | | | firm (SW). | |
| .95m | | | | | | | |
| | | | | | | Auger refusal due to cobbles at .95m. | |

DRILLING DATA: 3½" Bucket-type Hand Auger

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

LOG BY: REM

3.5-6-94

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/10/81

PROJECT Exxon R.R. Spur

BORING NO. 32

BORING LOCATION Sta. 542+21

JOB NO. XX8126

SURFACE ELEVATION 500±

BORING DEPTH 1.45m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black, sandy LOAM with humus, (topsoil). | |
| .07m | | | | | | | |
| .07m | | | | | | Dark brown, fine sandy SILT, moist, firm (SM-ML). | |
| .32m | | | | | | | |
| .32m | | | | | | Light brown, fine sandy SILT to silty fine SAND, mottled, moist, firm to dense (SM-ML). | |
| .76m | | | | | | | |
| .76m | | | | | | Brown, fine to coarse SAND, some gravel, and cobbles, trace silt (SW-GW). | |
| 1.45m | | | | | | | |
| | | | | | | Auger refusal at 1.45m - cobbles | |

DRILLING DATA: 3½" Bucket-type Hand Auger

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

LOG BY: REM

3.5-6-95

FOTH & VAN DYKE and Associates, Inc.

# LOG OF TEST BORING

DATE 9/10/81

PROJECT Exxon R.R. Spur

BORING NO. 33

BORING LOCATION 503+30

JOB NO. XX8126

SURFACE ELEVATION 482+

BORING DEPTH 1.90m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Brown, loamy SAND, topsoil (OL). | |
| .04m | | | | | | | |
| .04m | | | | | | Brown, fine to medium SAND, some silt, slightly mottled, moist, firm (SM). | |
| .46m | | | | | | | |
| .46m | | | | | | Light brown, fine to medium SAND, wet to water bearing (@ .80m) (SP). | |
| 1.56m | | | | | | | |
| 1.56m | | | | | | Brown to grey fine to coarse sand, with fine to medium gravel, water bearing, firm (SW). | |
| 1.90m | | | | | | | |

DRILLING DATA: 3½" Bucket-type Hand Auger

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING .95m

HOURS AFTER DRILLING

3.5-6-96

FOTH & VAN DYKE and Associates, Inc.

LOG OF TEST BORING

DATE 9/10/81

PROJECT Exxon R.R. Spur

BORING NO. 34

BORING LOCATION Sta. 504+80

JOB NO. XX8126

SURFACE ELEVATION 480.8

BORING DEPTH 1.95m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Black to dark brown, fiborous PEAT, saturated, very soft (Pt). | |
| 1.67m | | | | | | | |
| 1.67m | | | | | | Grey, fine to coarse SAND, some fine to medium gravel, water bearing, firm (SW). | |
| 1.80m | | | | | | | |
| 1.80m | | | | | | Grey, fine to medium SAND, water bearing, firm (SP). | |
| 1.55m | | | | | | | |

DRILLING DATA: 3½" Bucket-type Hand Auger

WATER LEVEL INFORMATION

AT DRILLING .16m

HOURS AFTER DRILLING

3.5-6-97

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

DATE 9/10/81

PROJECT Exxon R.R. Spur

BORING NO. 35

BORING LOCATION Sta. 502+40

JOB NO. XX8126

SURFACE ELEVATION 483

BORING DEPTH 1.90m

| DEPTH OF STRATA | DEPTH SAMPLE TAKEN | SAMPLE TYPE | SAMPLE NUMBER | BLOWS PER FT. | POCKET PEN. | SOIL CLASSIFICATION | ENGINEERS REMARKS |
|---|---|---|---|---|---|---|---|
| 0' | | | | | | Dark brown, loamy SAND (topsoil) (OL). | |
| .18m | | | | | | | |
| .18m | | | | | | Dark brown, silty fine to medium SAND, moist, firm (SM). | |
| .38m | | | | | | | |
| .38m | | | | | | Light brown, fine to coarse SAND and fine to medium sand, moist, firm (SP-SW). | |
| 1.40m | | | | | | | |
| 1.40m | | | | | | Light to reddish brown, fine sandy SILT, trace clay, mottled, moist to wet, firm (ML). | |
| 1.64m | | | | | | | |
| 1.64m | | | | | | Light to light brown, fine to medium SAND, mottled, wet, firm, water bearing at 1.90m (SP). | |
| 1.90m | | | | | | | |

DRILLING DATA: 3½" Bucket-type Hand Auger

WATER LEVEL INFORMATION

AT DRILLING 1.85m

HOURS AFTER DRILLING

3.5-6-98

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

**STS Consultants, LTD.**
**1984 Reclaim Pond Borings (RP-1 through 15)**

STS Consultants Ltd.

OWNER: Exxon Minerals Company

LOG OF BORING NUMBER: RP-1

PROJECT NAME: Reclaim Pond Borings

Feet: N-115604 E-2280542 | Meters: N-35236 E-695111

SITE LOCATION: Crandon Project

SURFACE ELEVATION 1634.71-ft. 498.261-m

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS/FT³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT² | PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT % | STANDARD PENETRATION BLOWS/FT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 20 | 1 | SS | 24" | | Brown silty fine to coarse sand (SM) - some gravel - very dense - boulder from 18.0 to 19.0 feet | | | | | | 54 |
| 25 | 2 | SS | 24" | | Brown slightly silty fine to coarse gravel (GM-GP) - some fine to coarse sand - very dense - cobble from 21.3 to 21.7 feet | | | | | | 62 |
| 27.5 | 3 | SS | 3" | | End of Boring<br>Boring advanced to 27.5 feet with roller bit and Revert drilling mud<br>10.0 feet of HW casing used<br>Borehole grouted upon completion | | | | | | 25/2" SMCG. |

Note: 300 lb. Hammer used

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION MAY BE GRADUAL.

| | | | |
|---|---|---|---|
| WL | BORING STARTED 2-21-84 | STS OFFICE | 540 Lambeau Green Bay, WI 54303 |
| WL BCR ARC | BORING COMPLETED 2-22-84 | DRAWN BY SMD | SHEET NO. 1 OF 1 |
| WL | RIG Bomb FOREMAN EVH | APP'D BY JAS | STS JOB NO. 12991 |

STS Consultants Ltd.

OWNER: Exxon Minerals Company

LOG OF BORING NUMBER: RP-2

PROJECT NAME: Reclaim Pond Borings

Feet: N-115652 E-2281119 Meters: N-35251 E-695286

SITE LOCATION: Crandon Project

| DEPTH ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS /FT³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT² 1 2 3 4 5 | PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % 10 20 30 40 50 | STANDARD PENETRATION BLOWS / FT. 10 20 30 40 50 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1642.51-ft. 500.638-m | | | | |
| 5 | | | | | Reddish brown to brown silty fine to coarse sand (SM) - little gravel - extremely dense | | | | |
| 10 | | | | | | | | | |
| 15 | | | | | | | | | |
| 20 | | | | | | | | | |
| 25 | 1 | SS | | | | | | | 50/6" |
| | | | | | | | | | 100/.2 |
| 30 | 2 | SS | | | | | | | 100/6 |
| 35 | 3 | SS | | | | | | | 100/6 |
| | | | | | End of Boring<br>Boring advanced to 34.0 feet with roller bit and Revert drilling mud<br>12.0 feet of HW casing used<br>Borehole grouted upon compietion | | | | |

Note: 300 lb. Hammer used

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION MAY BE GRADUAL.

| | | | |
|---|---|---|---|
| WL | BORING STARTED 3-8-84 | STS OFFICE | 540 Lambeau Green Bay, WI 54303 |
| WL BCR ARC | BORING COMPLETED 3-8-84 | DRAWN BY SMD | SHEET NO 1 OF 1 |
| WL | RIG DR-2 FOREMAN BZ | APP'D BY JAS | STS JOB NO. 12991 |

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Company | LOG OF BORING NUMBER: RP-3 |
| PROJECT NAME: Reclaim Pond Borings | Feet: N-115712 E-2281620 — Meters: N-35269 E-695439 |
| SITE LOCATION: Crandon Project | |

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS /FT³ |
|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1642.48-ft. 500.629-m | |
| 5 | | | | | Brown silty fine to coarse sand (SM) - trace to some gravel - extremely dense - cobble from 14.5 to 15.0 feet | |
| 10 | | | | | | |
| 15 | | | | | | |
| 20 | | | | | | |
| 25 | 1 | SS | 3" | | | |
| | 2 | SS | 3" | | | |
| 30 | | | | | | |
| 33.5 | 3 | SS | 3" | | | |
| | | | | | End of Boring<br>Boring advanced to 33.5 feet with roller bit and Revert drilling mud<br>7.0 feet of HW casing used<br>Borehole grouted upon completion | |

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² — 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

10 20 30 40 50

STANDARD PENETRATION BLOWS / FT. — 10 20 30 40 50

82/6"

120/6"

139

Note: 300 lb. Hammer used

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| WL | BORING STARTED 3-12-84 | STS OFFICE | 540 Lambeau Green Bay, WI 54303 |
| WL BCR ARC | BORING COMPLETED 3-12-84 | DRAWN BY SMD | SHEET NO 1 OF 1 |
| WL | RIG DR-2 FOREMAN EVH | APP'D BY JAS | STS JOB NO. 12991 |

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Company | LOG OF BORING NUMBER: RP-4 |
| PROJECT NAME: Reclaim Pond Borings | Feet: N-115903 E-2282534 — Meters: N-35327 E-695718 |
| SITE LOCATION: Crandon Project | |

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS/FT³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT² 1 2 3 4 5 / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % 10 20 30 40 50 / STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50 |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1659.07-ft. 505.686-m | | |
| 5 | | | | | Brown silty fine to coarse sand (SM) - little to some gravel - very dense to extremely dense - cobbles from 16.5 to 17.0 feet and 21.5 to 22.0 feet | | |
| 10 | | | | | | | |
| 15 | | | | | | | |
| 20 | | | | | | | |
| 25 | 1 | SS | | | | | 71 |
| | 2 | SS | | | | | 110/6" |
| 30 | | | | | Brown slightly silty fine to coarse sand (SM-SP) - some gravel - extremely dense | | |
| 33.7 | 3 | SS | | | | | 100/2" |
| | | | | | End of Boring<br>Boring advanced to 33.7 feet with roller bit and Revert drilling mud<br>7.0 feet of HW casing used<br>Borehole grouted upon completion | | Note: 300 lb. Hammer used |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN SITU. THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| WL | BORING STARTED 3-7-84 | STS OFFICE | 540 Lambeau Green Bay, WI 54303 |
| WL BCR ARC | BORING COMPLETED 3-7-84 | DRAWN BY SMD | SHEET NO 1 OF 1 |
| WL | RIG DR-2 FOREMAN BZ | APP'D BY JAS | STS JOB NO 12991 |

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Company | LOG OF BORING NUMBER: RP-5 |
| PROJECT NAME: Reclaim Pond Borings | Feet: N-115119 E-2280901 — Meters: N-35088 E-695220 |
| SITE LOCATION: Crandon Project | |

SURFACE ELEVATION 1644.62-ft. 501.281-m

| DEPTH ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS/FT³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT² 1 2 3 4 5 | PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % 10 20 30 40 50 | STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50 |
|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | Brown silty fine to coarse sand (SM) - little to some gravel - extremely dense - cobble from 31.0 to 31.5 feet | | | | |
| 10 | | | | | | | | | |
| 15 | | | | | | | | | |
| 20 | | | | | | | | | |
| 25 | | | | | | | | | |
| 30 | 1 | SS | | | | | | | ⊗ 50/6 |
| 35 | 2 | SS | | | | | | | ⊗ 50/6" |
| 40 | 3 | SS | | | | | | | ⊗ 50/6 |
| | | | | | End of Boring<br>Boring advanced to 40.0 feet with roller bit and Revert drilling mud<br>7.0 feet of HW casing used<br>Borehole grouted upon completion | | | | Note: 300 lb. Hammer used |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN SITU. THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| WL | BORING STARTED 3-8-84 | STS OFFICE | 540 Lambeau Green Bay, WI 54303 |
| WL BCR ARC | BORING COMPLETED 3-9-84 | DRAWN BY SMD | SHEET NO 1 OF 1 |
| WL | RIG DR-2 FOREMAN BZ | APP'D BY JAS | STS JOB NO 12991 |

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Company | LOG OF BORING NUMBER: RP-6 |
| PROJECT NAME: Reclaim Pond Borings | Feet: N-115346 E-2281381 — Meters: N-35158 E-695366 |
| SITE LOCATION: Crandon Project | |

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS/FT³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT² (1 2 3 4 5) / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % (10 20 30 40 50) / STANDARD PENETRATION BLOWS/FT. (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1644.51-ft. 501.248-m | | |
| 5 | | | | | Brown silty fine to coarse sand (SM) - trace to some gravel - medium dense to very dense - boulder from 13.5 to 14.5 feet | | |
| 10 | | | | | | | |
| 15 | | | | | | | |
| | 1 | SS | | | | | 16 |
| 20 | | | | | | | |
| | 2 | SS | | | | | 15 |
| 25 | | | | | | | |
| 27.5 | 3 | SS | | | | | 79 |
| | | | | | End of Boring<br>Boring advanced to 27.5 feet with roller bit and Revert drilling mud<br>7.0 feet of HW casing used<br>Borehole grouted upon completion | | Note: 300 lb. Hammer used |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION MAY BE GRADUAL.

| | | | |
|---|---|---|---|
| WL | BORING STARTED 3-10-84 | STS OFFICE | 540 Lambeau Green Bay, WI 54303 |
| WL BCR ARC | BORING COMPLETED 3-10-84 | DRAWN BY SMD | SHEET NO. 1 OF 1 |
| WL | RIG DR-2 FOREMAN BZ | APP'D BY JAS | STS JOB NO. 12911 |

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Company | LOG OF BORING NUMBER: RP-7 |
| PROJECT NAME: Reclaim Pond Borings | Feet: N-115410 E-2281782 — Meters: N-35177 E-695489 |
| SITE LOCATION: Crandon Project | |

SURFACE ELEVATION 1636.08-ft. 498.678-m

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE / RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT LBS/FT³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT² (1 2 3 4 5) / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % (10 20 30 40 50) / STANDARD PENETRATION BLOWS/FT (10 20 30 40 50) |
|---|---|---|---|---|---|---|
| 5 | | | | Brown silty fine to coarse sand (SM) - trace to some gravel - very dense to extremely dense | | |
| 10 | 1 | 3" SS | | | | ⊗ 104 |
| 15 | 2 | 3" SS | | | | ⊗ 100/2 BNCG. |
| 20 | | | | | | |
| 21.5 | 3 | 3" SS | | | | ⊗ 51 |

End of Boring
Boring advanced to 21.5 feet with roller bit and Revert drilling mud
7.0 feet of HW casing used
Borehole grouted upon completion

Note: 300 lb. Hammer used

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN SITU. THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| WL | BORING STARTED 3-12-84 | STS OFFICE | 540 Lambeau Green Bay, WI 54303 |
| WL BCR ARC | BORING COMPLETED 3-12-84 | DRAWN BY SMD | SHEET NO 1 OF 1 |
| WL | RIG DR-2 FOREMAN EVH | APP'D BY JAS | STS JOB NO. 12991 |

STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Reclaim Pond Borings

LOG OF BORING NUMBER: RP-8

Feet: N-115562 E-2282668 Meters: N-35223 E-695759

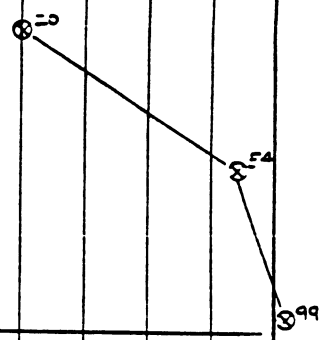
SITE LOCATION: Crandon Project

| DEPTH ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT LBS/FT³ |
|---|---|---|---|---|---|
| | | | | SURFACE ELEVATION 1654.91-ft. 504.418-m | |
| 10 | | | | Brown silty fine to coarse sand (SM) - trace to some gravel - medium dense to extremely dense - cobble from 14.0 to 14.5 feet | |
| 20 | 1 | 3" SS | | | |
| 25 | 2 | 3" SS | | | |
| 30 30.5 | 3 | 3" SS | | | |
| | | | | End of Boring<br>Boring advanced to 30.5 feet with roller bit and Revert drilling mud<br>7.0 feet of HW casing used<br>Borehole grouted upon completion | |

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² (1 2 3 4 5)

PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT % (10 20 30 40 50)

STANDARD PENETRATION BLOWS/FT. (10 20 30 40 50)




Note: 300 lb. Hammer used

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN SITU, THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| WL | BORING STARTED 3-2-84 | STS OFFICE | 540 Lambeau Green Bay, WI 54303 |
| WL BCR ARC | BORING COMPLETED 3-2-84 | DRAWN BY SMD | SHEET NO 1 OF 1 |
| WL | RIG DR-2 FOREMAN EVH | APP'D BY JAS | STS JOB NO 12991 |

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Company | LOG OF BORING NUMBER: RP-9 |
| PROJECT NAME: Reclaim Pond Borings | Feet: N-114750 E-2280723 Meters: N-34976 E-695166 |
| SITE LOCATION: Crandon Project | |

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT LBS/FT³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT² 1 2 3 4 5 / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / 10 20 30 40 50 / STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50 |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1654.67-ft. 504.344-m | | |
| 0 | | | | | Brown silty fine to coarse sand (SM) - trace to some gravel - very dense to extremely dense - boulder from 14.0 to 16.0 feet | | |
| 10 | | | | | | | |
| 15 | | | | | | | |
| 20 | | | | | | | |
| 25 | 1 | SS | | | | | 63 |
| | 2 | SS | | | | | 100/6" |
| 30 | | | | | | | |
| 34 | 3 | SS | | | | | 111/6" |
| | | | | | End of Boring<br>Boring advanced to 34.0 feet with roller bit and Revert drilling mud<br>7.0 feet of HW casing used<br>Borehole grouted upon completion | | Note: 300 lb. Hammer used |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN SITU. THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| WL | BORING STARTED 3-9-84 | STS OFFICE | 540 Lambeau Green Bay, WI 54303 |
| WL BCR ARC | BORING COMPLETED 3-9-84 | DRAWN BY SMD | SHEET NO 1 OF 1 |
| WL | RIG DR-2 FOREMAN BZ | APP'D BY JAS | STS JOB NO. 12991 |

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Company | LOG OF BORING NUMBER: RP-10 |
| PROJECT NAME: Reclaim Pond Borings | Feet: N-114892 E-2281336 Meters: N-35019 E-695353 |
| SITE LOCATION: Crandon Project | |

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT LBS/FT³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT² (1 2 3 4 5) / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % (10 20 30 40 50) / STANDARD PENETRATION BLOWS/FT (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| SURFACE ELEVATION 1625.80-ft. 495.545-m | | | | | | | |
| | 1 | SS | | | Brown fine sandy silt (ML) - trace gravel - trace of roots - dense - topsoil | | 32 |
| 5 | 2 | SS | | | Brown silty fine to coarse sand (SM) - little gravel - dense to very dense | | 58 |
| 10 | | | | | | | |
| 11.5 | 3 | SS | | | | | 41 |
| | | | | | End of Boring<br>Boring advanced to 11.5 feet with power auger<br>Borehole grouted upon completion | | Note: 300 lb. Hammer used |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN SITU. THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| | BORING STARTED 3-9-84 | STS OFFICE | 540 Lambeau<br>Green Bay, WI 54303 |
| BCR ARC | BORING COMPLETED 3-9-84 | DRAWN BY SMD | SHEET NO 1 OF 1 |
| | RIG DR-2 FOREMAN BZ | APP'D BY JAS | STS JOB NO 12991 |

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Company | LOG OF BORING NUMBER: RP-11 |
| PROJECT NAME: Reclaim Pond Borings | Feet: N-115033 E-2282358 Meters: N-35062 E-695664 |
| SITE LOCATION: Crandon Project | |

SURFACE ELEVATION 1630.33-ft. 496.926-m

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT LBS /FT³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT² 1 2 3 4 5 / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % 10 20 30 40 50 / STANDARD PENETRATION BLOWS / FT. 10 20 30 40 50 |
|---|---|---|---|---|---|---|---|
| | 1 | 3" SS | | | Brown fine sandy silt (ML) - little gravel - trace roots - loose - topsoil | | 4 |
| 5 | 2 | 3" SS | | | Brown silty fine to coarse sand (SM) - some gravel - medium dense | | 25 |
| 10 | | | | | | | 25 |
| 11.5 | 3 | 3" SS | | | End of Boring<br>Boring advanced to 11.5 feet with power auger<br>Borehole grouted upon completion | | Note: 300 lb. Hammer used |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN SITU THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| WL | BORING STARTED 3-1-84 | STS OFFICE | 540 Lambeau Green Bay, WI 54303 |
| WL BCR ARC | BORING COMPLETED 3-1-84 | DRAWN BY SMD | SHEET NO 1 OF 1 |
| WL | RIG DR-2 FOREMAN EVH | APP'D BY JAS | STS JOB NO 12991 |

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Company | LOG OF BORING NUMBER: RP-12 |
| PROJECT NAME: Reclaim Pond Borings | Feet: N-115000 E-2282868 / Meters: N-35052 E-695820 |
| SITE LOCATION: Crandon Project | |

SURFACE ELEVATION 1648.79-ft. 502.552-m

| DEPTH ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT LBS/FT³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT² 1 2 3 4 5 | PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % 10 20 30 40 50 | STANDARD PENETRATION BLOWS/FT 10 20 30 40 50 |
|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | Brown silty fine to coarse sand (SM) - some gravel - extremely dense | | | | |
| 10 | | | | | | | | | |
| 15 | 1 | SS | 3" | | | | | | 58/6" |
| | | | | | | | | | 100/2" |
| 20 | 2 | SS | 3" | | | | | | 100/5E BNCG |
| 25 | 3 | SS | 3" | | | | | | 12E/5 |
| 26.4 | | | | | End of Boring<br>Boring advanced to 26.0 feet with roller bit and Revert drilling mud<br>7.0 feet of HW casing used<br>Borehole grouted upon completion | | | | |

Note: 300 lb. Hammer used

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN SITU. THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| WL | BORING STARTED 3-1-84 | STS OFFICE | 540 Lambeau Green Bay, WI 54303 |
| WL BCR ARC | BORING COMPLETED 3-1-84 | DRAWN BY SMD | SHEET NO 1 OF 1 |
| WL | RIG DR-2 FOREMAN EVH | APP'D BY JAS | STS JOB NO 12991 |

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Company | LOG OF BORING NUMBER: RP-13 |
| PROJECT NAME: Reclaim Pond Borings | Feet: N-114509 E-2282328 Meters: N-34902 E-695655 |
| SITE LOCATION: Crandon Project | |

| DEPTH ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT LBS/FT³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT² 1 2 3 4 5 / PLASTIC LIMIT % WATER CONTENT % LIQUID LIMIT % 10 20 30 40 50 / STANDARD PENETRATION BLOWS/FT 10 20 30 40 50 |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1620.30-ft. 493.868-m | | |
| | 1 | 3" SS | | | Brown fine sandy silt (ML) - trace gravel, trace clay, trace roots - loose - topsoil | | ⊗ 6 |
| 5 | | | | | Brown silty fine to coarse sand (SM) - little gravel - medium dense | | |
| 7.5 | 2 | 3" SS | | | | | ⊗ 20 |
| | | | | | End of Boring<br>Boring advanced to 6.0 feet with power auger<br>Borehole grouted upon completion | | Note: 300 lb. Hammer used |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN SITU THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| WL | BORING STARTED 3-1-84 | STS OFFICE | 540 Lambeau Green Bay, WI 54303 |
| WL BCP ARC | BORING COMPLETED 3-1-84 | DRAWN BY SMD | SHEET NO 1 OF 1 |
| WL | RIG DR-2 FOREMAN EVH | APP'D BY JAS | STS JOB NO. 12991 |

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Company | LOG OF BORING NUMBER: RP-14 |
| PROJECT NAME: Reclaim Pond Borings | Feet: N-115863 E-2281985 / Meters: N-35315 E-695550 |
| SITE LOCATION: Crandon Project | |

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT LBS/FT³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT² 1 2 3 4 5 / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / 10 20 30 40 50 / STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50 |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1645.44-ft. 501.531-m | | |
| 5 | | | | | Brown silty fine to coarse sand (SM) - some gravel - very dense | | |
| 10 | 1 | 3" SS | | | | | ⊗54 |
| 15 | | | | | Brown slightly silty fine to coarse sand (SM-SP) - some gravel - extremely dense | | |
| 20 | 2 | 3" SS | | | | | ⊗91 |
| 23.8 | 3 | 3" SS | | | Brown silty fine to coarse sand (SM) - some gravel - extremely dense | | ⊗105/4 |
| | | | | | End of Boring<br>Boring advanced to 23.0 feet with roller bit and Revert drilling mud<br>13.0 feet of HW casing used<br>Borehole grouted upon completion | | Note: 300 lb. Hammer used |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN SITU. THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| WL | BORING STARTED 2-29-84 | STS OFFICE | 540 Lambeau Green Bay, WI 54303 |
| WL BCR ARC | BORING COMPLETED 2-29-84 | DRAWN BY SMD | SHEET NO 1 OF 1 |
| WL | RIG DR-2 FOREMAN EVH | APP'D BY JAS | STS JOB NO 12991 |

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Company | LOG OF BORING NUMBER: RP-15 |
| PROJECT NAME: Reclaim Pond Borings | Feet: N-115462 E-2282287 Meters: N-35193 E-695642 |
| SITE LOCATION: Crandon Project | |

| DEPTH / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT² 1 2 3 4 5 / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % 10 20 30 40 50 / STANDARD PENETRATION BLOWS / FT. 10 20 30 40 50 |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1642.23-ft. 500.553-m | | |
| 5 | | | | | Brown slightly silty fine to coarse sand (SM-SP) - some gravel - medium dense | | |
| 10 | | | | | | | |
| 15 | 1 | 3" SS | | 11 | | | 24 |
| 20 | 2 | 3" SS | | 1 | Brown silty fine to coarse sand (SM) and gravel - very dense to extremely dense | | 59 |
| 23.5 | 3 | 3" SS | | = | | | 107/6" |
| | | | | | End of Boring<br>Boring advanced to 23.0 feet with roller bit and Revert drilling mud<br>7.0 feet of HW casing used<br>Borehole grouted upon completion | | Note: 300 lb. Hammer used |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION MAY BE GRADUAL.

| | | | |
|---|---|---|---|
| WL | BORING STARTED 3-2-84 | STS OFFICE | 540 Lambeau Green Bay, WI 54303 |
| WL BCR ARC | BORING COMPLETED 3-2-84 | DRAWN BY SMD | SHEET NO. 1 OF 1 |
| WL | RIG DR-2 FOREMAN EVH | APP'D BY JAS | STS JOB NO. 12991 |

# Appendix 3.5-7

## Logs for Soil Testing Services of Wisconsin, Inc. 1982 Little Sand Lake Borings (STS-LSL-1 through 6)

## LOG OF BORING NO. STS LSL-1

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| EXXON Minerals Company | |
| **SITE** | **PROJECT NAME** |
| Little Sand Lake | Sediment Sampling |

| DEPTH ELEVATION | SAMPLE NO. | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.3 | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % — STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| SURFACE ELEVATION | | PA | | | Ice | | |
| 5 | | | | | Water | | |
| 10 | | | | | | | |
| 15 | 1 | ST | | | Black and green organic silt (OL) - fibrous - wet - very loose | | |
| | 2 | ST | | | | | |
| | 3 | ST | | | | | |
| 20 | 4 | ST | | | | | |
| | 5 | ST | | | | | |
| 25 | 6 | ST | | | Grayish brown mottled black organic silt (OH) - trace of fibers - wet - soft | | |
| | 7 | ST | | | | | |
| 30 | 8 | ST | | | | | |
| | 9 | ST | | | | 73.1 | X - - - - - △ - - - ● |
| | 10 | ST | | | Grayish brown mottled black silty clay (CL) - trace of organics - trace of sand seams - wet - soft to firm | | |
| 35 | 11 | ST | | | | | |
| | 12 | ST | | | | | |
| 40 | | | | | CONTINUED | | |

| WATER LEVEL OBSERVATIONS | | | |
|---|---|---|---|
| W.L. | | | |
| W.L. | B.C.R. | A.C.R. | |
| W.L. | | | |

**SOIL TESTING SERVICES**
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 3-19-82 |
| BORING COMPLETED | | | 3-18-82 |
| RIG | CME 55 | FOREMAN | TT |
| DRAWN | KDO | APPROVED | TKH |
| JOB # | 11728 | SHEET | 1 of 2 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

## LOG OF BORING NO. STS LSL-1 Continued

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| EXXON Minerals Company | |
| **SITE** | **PROJECT NAME** |
| Little Sand Lake | Sediment Sampling |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| SURFACE ELEVATION → | | | | | | | |
| | | | | | CONTINUED | | |
| 40 | | | | | | | |
| | 13 | ST | | | | | |
| | 14 | ST | | | Grayish brown mottled black silty clay (CL) - trace of organics - trace of sand seams - wet - soft to firm | | |
| | 15 | ST | | | | 88.6 | ● |
| | 16 | ST | | | | | |
| | 17 | SS | | LS | Brown sandy gravel (GP) - wet - dense | | ⊗ 26 |
| | 18 | SS | | | | | ⊗ 44 |
| | | | | | End of Boring<br>Boring advanced to 52.0 feet by roller bit and wash water<br>28.0 feet of HW casing used | | |

| WATER LEVEL OBSERVATIONS | | | |
|---|---|---|---|
| WL | | | |
| WL | ECR | | ACR |
| WL | | | |

**SOIL TESTING SERVICES**
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 3-18-82 |
| BORING COMPLETED | | | 3-18-82 |
| RIG | CME 55 | FOREMAN | TT |
| DRAWN | KOO | APPROVED | TWW |
| JOB # | 11726 | SHEET | 2 of 2 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

## LOG OF BORING NO. STS LSL-2

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| EXXON Minerals Company | |
| **SITE** | **PROJECT NAME** |
| Little Sand Lake | Sediment Sampling |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| SURFACE ELEVATION → | | | | | Ice | | |
| 5 | | | | | Water | | |
| 10 | | | | | | | |
| 15 | 1 | SS | | | Black organic silt (OL) - wet - very loose | | |
| 20 | 2 | SS | | | | | |
| | 3 | ST | | | | | |
| | 4 | ST | | | | | |
| 25 | 5 | OS | | | | 80.0 | ● |
| | 6 | OS | | | | | |
| 30 | 7 | ST | | NR | Grayish brown mottled black silty clay (CL) - trace of organics and fibers - trace of sand - wet - firm | | |
| | 8 | ST | | | | | |
| | 9 | ST | | | | | |
| 35 | 10 | ST | | NR | | | |
| | 11 | ST | | | | | |
| AU 40.5 | 12 | BL | | | Brown fine to medium sand (SP) - trace of silt - trace of clay - wet - medium dense | | ⊗ 15 |
| | | | | | End of Boring<br>Boring advanced to 40.5 feet by roller bit and wash water<br>39.0 feet of HW casing used | | |

| WATER LEVEL OBSERVATIONS | | |
|---|---|---|
| WL | | |
| WL | B.C.R | A.C.R |
| WL | | |

**SOIL TESTING SERVICES**
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 3-22-82 |
| BORING COMPLETED | | | 3-22-82 |
| RIG | CME 55 | FOREMAN | TT |
| DRAWN | KDO | APPROVED | TWK |
| JOB # | 11728 | SHEET | 1 of 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

## LOG OF BORING NO. STS LSL-3

OWNER: EXXON Minerals Company
ARCHITECT-ENGINEER:
SITE: Little Sand Lake
PROJECT NAME: Sediment Sampling

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION → | | |
| | | | | | Ice | | |
| 0 | | | | | Water | | |
| 10 | | | | | | | |
| | 1 | ST | | | Black organic silt (OL) - fibrous - wet - very loose | | |
| 15 | 2 | ST | | | | | |
| | 3 | ST | | | | | |
| 20 | 4 | SS | | | | | |
| | 5 | SS | | | | | |
| 25 | 6 | SS | | | Greenish brown organic silt (OH) - trace of fibers - wet - very loose | | |
| | 7 | ST | | | Grayish brown organic clayey silt (OL to ML) - trace of fibers - trace of sand - wet - firm | 67.1 | |
| 30 | 8 | ST | | | | | |
| | 9 | ST | | | Grayish brown mottled black silty clay (CL) - trace of organics - trace of sand - wet - firm | 87.8 | |
| 35 | 10 | ST | | | | | |
| | 11 | ST | | | | | |
| | 12 | ST | | | | | |
| 40 | 13 | ST | | | | | |
| | 14 | SS | | | | | |
| | 14A | SS | | | Brown fine to medium sand (SP) - trace of silt - wet - medium dense | | 15 |
| 45 | 15 | BL | | | | | |
| | | | | | End of Boring<br>Boring advanced to 45.0 feet by roller bit and wash water<br>45.0 feet of HW casing used | | |

WATER LEVEL OBSERVATIONS

WL ECE ACE
WS
WL

SOIL TESTING SERVICES
OF WISCONSIN, INC.
540 LAMBEAU STREET
GREEN BAY, WISCONSIN 54303

BORING STARTED 3-19-82
BORING COMPLETED 3-19-82
RIG CME 55 FOREMAN TT
DRAWN KDC APPROVED TWM
SCALE 1 of 1

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

## LOG OF BORING NO. STS LSL-4

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| EXXON Minerals Company | |
| **SITE** | **PROJECT NAME** |
| Little Sand Lake | Sediment Sampling |

| DEPTH ELEVATION | SAMPLE NO. | TYPE SAMPLE | SAMPLE DIST | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % — STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| SURFACE ELEVATION | | | | | ICE | | |
| 5 | | PA | | | Water | | |
| 10 | | | | | | | |
| 15 | 1 | SS | | LS | Black organic silt (OL) - fibrous - wet - very loose | | ROD WEIGHT |
| | 2 | SS | | | | | ROD WEIGHT |
| 20 | 3 | SS | | | | | ROD WEIGHT |
| | 4 | SS | | | | | ROD WEIGHT |
| | 5 | OS | | | | | |
| 25 | 6 | OS | | | | | |
| | 7 | ST | | | Greenish gray organic silt (OH) - trace of fibers - trace of sand - wet - firm | | |
| 30 | 8 | ST | | | | | |
| | 9 | ST | | | | 81.0© | X - - - △ - - ● |
| | 10 | ST | | LS | | | |
| 35 | 11 | ST | | | Grayish brown mottled black silty clay (CL) - trace of organics - trace of sand - wet - firm | | |
| | 12 | ST | | | | | |
| 50 | 13 | ST | | LS | | | |
| | 14 | ST | | | | | |
| 43 | | | | | CONTINUED | | |

| WATER LEVEL OBSERVATIONS | | |
|---|---|---|
| WL | | |
| WL | BCR | ACR |
| WL | | |

**SOIL TESTING SERVICES**
OF WIS INC
540 LAMBEAU STREET
GREEN BAY, WIS 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 3-20-82 |
| BORING COMPLETED | | | 3-21-82 |
| RIG | CME 55 | FOREMAN | TT |
| DRAWN | KDD | APPROVED | TMK |
| JOB | 1222 | SHEET | 1 of 2 |

The stratification lines represent the approximate boundaries between soil types and the transition may be gradual.

## LOG OF BORING NO. STS LSL-4 Continued

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| EXXON Minerals Company | |
| **SITE** | **PROJECT NAME** |
| Little Sand Lake | Sediment Sampling |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.3 | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5); PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %; STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| SURFACE ELEVATION | | | | | | | |
| 40 | | | | | CONTINUED | | |
| | 15A | ST | | | | | |
| 45 | | | | | Brown silty fine to medium sand (SM) - trace of gravel - wet - medium dense | | ⊗ 37 |
| | 16 | BL | | | | | |
| 47 | | | | | End of Boring<br>Boring advanced to 47.5 feet by roller bit and wash water<br>47.0 feet of HW casing used | | ⊖ ORGANIC CONTENT |

| WATER LEVEL OBSERVATIONS | | | |
|---|---|---|---|
| WL | | | |
| WL | BCP | ACP | |
| WL | | | |

**SOIL TESTING SERVICES**
OF WIS INC
540 LAMBEAU STREET
GREEN BAY WIS 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 3-20-82 |
| BORING COMPLETED | | | 3-21-82 |
| RIG | CME 55 | FOREMAN | TT |
| DRAWN | KDO | APPROVED | TWW |
| [illegible] | 11729 | SHEET | 2 of 2 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

## LOG OF BORING NO. STS LSL-5

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| EXXON Minerals Company | |
| **SITE** | **PROJECT NAME** |
| Little Sand Lake | Sediment Sampling |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.3 | UNCONFINED COMPRESSIVE STRENGTH TONS/FT² (1 2 3 4 5) PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % — STANDARD "N" PENETRATION (BLOWS/FT) (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| | | PA | | | Ice | | |
| 5 | | | | | Water | | |
| 10 | | | | | | | |
| | 1 | SS | | | Black organic silt (OL) - fibrous - wet - very loose | | |
| 15 | 2 | SS | | | Greenish brown organic silt (OH) - trace of fibers - trace of sand - wet - firm | | |
| | 3 | OS | | | | | |
| | 4 | ST | | LS | | | |
| 20 | 4A | ST | | | | | |
| | 5 | ST | | | Grayish brown mottled black silty clay (CL) - trace of organics - trace of sand - wet - firm | 78.5 | ● |
| | 6 | SS | | | | | |
| 25 | 7 | SS | | | | | |
| | 8 | SS | | | | | |
| 30 | 9 | SS | | | | 84.5 | ● |
| | 10 | SS | | | Brown clayey sand (SC) - trace of gravel - wet | | |
| | 11 | BL | | | Brown silty fine to coarse sand (SM) - trace of gravel - wet - loose | | ⊗ 7 |
| 35 | | | | | | | |
| 36 | | | | | End of Boring<br>Boring advanced to 36.0 feet by roller bit and wash water<br>18.0 feet of HW casing used | | |

| WATER LEVEL OBSERVATIONS | | | |
|---|---|---|---|
| WL | | | |
| WL | B C R | | A C R |
| WL | | | |

**SOIL TESTING SERVICES**
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY WIS 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 3-21-82 |
| BORING COMPLETED | | | 3-21-82 |
| RIG | CME 55 | FOREMAN | TT |
| DRAWN | KCO | APPROVED | TWW |
| JOB # | 11729 | SHEET | 1 of 1 |

The stratification lines represent the approximate boundaries between soil types and the transition may be gradual

## LOG OF BORING NO. STS LSL-6

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| EXXON Minerals Company | |
| **SITE** | **PROJECT NAME** |
| Little Sand Lake | Sediment Sampling |

| DEPTH ELEVATION | SAMPLE NO. | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) · PLASTIC LIMIT % · WATER CONTENT % · LIQUID LIMIT % · STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| SURFACE ELEVATION | | | | | | | |
| | | PA | | | Ice | | |
| 5 | | | | | Water | | |
| 10 | 1 | SS | | | Brown and black organic silt (OL) - fibrous - wet - very loose | | ROD WEIGHT |
| | 2 | SS | | | | | ROD WEIGHT |
| 15 | 3 | SS | | | Greenish brown organic silt (OH) - trace to a little fiber - trace of sand - wet - soft | | ROD WEIGHT |
| | 4 | OS | | | | 41.8 | © 107A 115.2 62.6 |
| 20 | 5 | ST | | | Grayish brown mottled black silty clay (CL) - trace of organics - trace of sand - wet - firm | | ROD WEIGHT |
| | 6 | SS | | | | | |
| | 7 | OS | | | | | ROD WEIGHT |
| 25 | 8 | SS | | | | | ROD WEIGHT |
| | 9 | SS | | | | | |
| | 10 | OS | | | | 86.8 | ● |
| 30 | 11 | ST | | | | | |
| | 12 | SS | | | Brown clayey fine to medium sand (SC) - trace of gravel - wet - medium dense | | ⊗ 23 |
| 35 | 13 | BL | | | Brown fine to coarse sand (SP) - trace of silt - a little gravel - wet - medium dense | | ⊗ 38 |
| 36 | | | | | End of Boring<br>Boring advanced to 36.0 feet by roller bit and wash water<br>34.0 feet of HW casing used | | © ORGANIC CONTENT |

| WATER LEVEL OBSERVATIONS | | |
|---|---|---|
| WL | | |
| WL | B C R | A C R |
| WL | | |

**SOIL TESTING SERVICES**
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 3-20-82 |
| BORING COMPLETED | | | 3-20-82 |
| RIG | CME 55 | FOREMAN | TT |
| DRAWN | KDD | APPROVED | TWW |
| JOB # | 11728 | SHEET | 1 of 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

# Appendix 3.5-8

## Logs for STS Consultants, Ltd.
## 1984 Duck, Skunk, Oak and Deep Hole Lake Borings
## (STS-DL-1, SL-1, SC-2, OL-1 and DHL-1)

| OWNER | LOG OF BORING NUMBER |
|---|---|
| Exxon Minerals Company | DL-1 |
| **PROJECT NAME** | **ARCHITECT-ENGINEER** |
| Lake Sediment Borings | |

STS Consultants Ltd.

**SITE LOCATION**

Duck Lake

BEST COPY AVAILABLE

| ELEVATION / DEPTH | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT LBS/FT³ |
|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1611.8' - 491.29m | |
| | | | | | Ice | |
| 5 | | | | | Water | |
| | 1 | SS | | | Brown to green organic silt (OL) - moderately fibrous - with trace of sand - wet - very loose | |
| 10 | 2 | SS | | | | |
| | 2A | SS | | | Brown organic silt fine to medium sand (SM) - with trace of fibers - wet - loose | |
| | 3 | SS | | | Gray organic silty clay (OL) - with traces of sand and fibers - very moist to wet - soft | |
| | 4 | OS | | | Gray silty fine to medium sand (SM) - with trace of organics - wet - very loose | |
| 15 | 5 | SS | | | | |
| | 6 | SS | | | Gray fine sand (SP) - with trace of silt and organics - a few thin layers of gray clayey silt - wet - very loose | |
| 20 | 7 | SS | | | | |
| | 8 | SS | | | Gray very silty clay (CL) - with traces of sand and organics - seams and layers of fine sand - 3 to 6 inch layers of fine to medium sand below 43.0 feet - thin varves of brown silty clay below 54.0 feet - very moist to wet - soft to firm | 104 |
| 25 | 9 | SS | | | | |
| | 10 | OS | | | | |
| 30 | 11 | OS | | | | |
| | | | | | Continued | |

UNCONFINED COMPRESSIVE STRENGTH TONS/FT²
1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %
10 20 30 40 50

STANDARD PENETRATION BLOWS FT
10 20 30 40 50

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN SITU THE TRANSITION MAY BE GRADUAL.

| | | | |
|---|---|---|---|
| WL | WS OR WD | BORING STARTED 2-7-84 | 540 Lambeau Green Bay, WI 54303 |
| WL | BCR ACR | BORING COMPLETED 2-8-84 | |
| WL | | RIG Bomb 45 FOREMAN EVH | APP'D BY BKT STS JOB NO 12949 |



BL1

| OWNER | LOG OF BORING NUMBER |
|---|---|
| Exxon Minerals Company | DL-1 Continued |
| **PROJECT NAME** | **ARCHITECT-ENGINEER** |
| Lake Sediment Borings | BEST COPY AVAILABLE |

STS Consultants Ltd.

**SITE LOCATION**

Duck Lake

UNCONFINED COMPRESSIVE STRENGTH TONS/FT²: 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50

| ELEVATION / DEPTH | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT LBS/FT³ |
|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION | |
| | | | | | Continued | |
| | 12 | SS | | | | W/H |
| 35 | 13 | SS | | | | W/H |
| | 14 | ST | | | | |
| | 15 | ST | | | Gray very silty clay (CL) - with traces of sand and organics - seams and layers of fine sand - 3 to 5 inch layers of fine to medium sand below 43.0 feet - thin varves of brown silty clay below 54.0 feet - very moist to wet - soft to firm | 99 |
| 40 | 16 | ST | | | | |
| | 17 | ST | | | | |
| 45 | 18 | SS | | | | |
| | 19 | SS | | | | |
| 50 | 20 | SS | | | | |
| | 21 | SS | | | | |
| 55 | 21A | SS | | | | |
| | 22 | SS | | | Brown clayey fine to coarse sand (SC) - with a little to some fine gravel - wet - medium dense to very dense | |
| | 23 | SS | | | Brown fine to medium sand (SP) - with trace of silt - a little fine to medium gravel - wet - extremely dense | |
| 60 | | | | | End of Boring<br>Boring advanced to 60.0 feet with roller bit and wash water<br>60.0 feet of HW casing used<br>1-1/2" PVC well installed at 59.7 feet with deep seal<br>Well removed and borehole grouted on 2-28-84 | |

1.4 17 30 24 4½" 5½"

© Organic Content

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN SITU THE TRANSITION MAY BE GRADUAL

| OWNER | LOG OF BORING NUMBER |
|---|---|
| Exxon Minerals Company | SL-1 |
| **PROJECT NAME** | **ARCHITECT-ENGINEER** |
| Lake Sediment Borings | BEST COPY AVAILABLE |

STS Consultants Ltd.

**SITE LOCATION**

Skunk Lake

UNCONFINED COMPRESSIVE STRENGTH TONS FT²: 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %: 10 20 30 40 50

STANDARD PENETRATION BLOWS FT: 10 20 30 40 50

| ELEVATION / DEPTH | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT LBS FT³ |
|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1598.0' - 487.07m | |
| | | | | | Ice | |
| | | | | | Water - decayed organic odor | |
| 5 | 1 | SS | | | Dark brown organic silt (OL) - moderately fibrous - with trace of sand - wet - very loose | |
| | 2 | SS | | | | |
| | 3 | SS | | | Black organic silty clay (OL) - with trace of sand - trace of fibers - very moist - firm | |
| | 3A | SS | | | | |
| 10 | | | | | Bluish gray silty clay (CL) - with trace of sand - trace of organics - moist - firm | |
| | 4 | SS | | | | |
| | 5 | SS | | | Brown silty fine to coarse sand (SP-SM) - with a little fine to medium gravel - a few silty clay lenses - cobbles below 15.0 feet - wet - medium dense to dense | |
| 15 | 6 | SS | | | | |
| 17.4 | | | | | End of Boring<br>Boring advanced to 17.4 feet with roller bit and wash water<br>17.0 feet of HW casing used - 40% water loss from 10.3 to 10.5 feet<br>1-1/2" PVC well installed at 17.4 feet with deep seal<br>Well removed and borehole grouted on 2-27-84 | |

W/R, W/R, W/H, W/H, 4, 24

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN SITU. THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| WL WS OR WD | BORING STARTED 2-9-84 | STS Consultants Ltd. | 540 Lambeau<br>Green Bay, WI 54303 |
| WL BCR ACR | BORING COMPLETED 2-9-84 | | |
| WL | RIG Bomb 45 FOREMAN EVH | APP'D BY GMT | STS JOB NO 12949 |

| OWNER | LOG OF BORING NUMBER |
|---|---|
| Exxon Minerals Company | SL-2 (6' East of SL-1) |
| **PROJECT NAME** | **ARCHITECT-ENGINEER** |
| Lake Sediment Borings | BEST COPY AVAILABLE |

STS Consultants Ltd.

**SITE LOCATION**

Skunk Lake

UNCONFINED COMPRESSIVE STRENGTH TONS FT²

1 2 3 4 5

PLASTIC LIMIT % WATER CONTENT % LIQUID LIMIT %

10 20 30 40 50

STANDARD PENETRATION BLOWS FT

10 20 30 40 50

| ELEVATION / DEPTH | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT LBS FT³ |
|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1598.0' - 487.07m | |
| | | | | | Ice | |
| | | | | | Water - decayed organic odor | |
| 5 | | | | | Dark brown organic silt - drillers observation | |
| | 1 | ST | | | Black organic silty clay (OL) - with a little sand - trace of gravel and fibers - wet - soft | |
| 10 | 1A | ST | | | Gray very silty clay (CL) - with traces of sand and organics - moist - firm | 108 |
| 10.5 | 1B | ST | | | Gray silty fine to coarse sand (SP-SM) - with some gravel and cobbles - wet - medium dense | |

© ORGANIC CONTENT

End of Boring
Boring advanced to 8.5 feet with wash water
8.5 feet of HW casing used
Borehole grouted on 2-27-84

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN SITU THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| WL | WS OR WD | BORING STARTED 2-27-84 | 540 Lambeau Street Green Bay, Wi. 54303 |
| WL | BCR ACR | BORING COMPLETED 2-27-84 | |
| WL | | RIG Hand Equip. FOREMAN EVH | APP'D BY GMT STS JOB NO 12949 |

| OWNER | LOG OF BORING NUMBER |
|---|---|
| Exxon Minerals Company | OL-1 |
| PROJECT NAME | ARCHITECT-ENGINEER |
| Lake Sediment Borings | BEST COPY AVAILABLE |

STS Consultants Ltd

SITE LOCATION: Oak Lake

UNCONFINED COMPRESSIVE STRENGTH TONS FT²: 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %: 10 20 30 40 50

STANDARD PENETRATION BLOWS FT: 10 20 30 40 50

| ELEVATION / DEPTH | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT LBS FT³ |
|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1633.5' - 497.88m | |
| | | | | | Ice | |
| 5 | | | | | | |
| 10 | | | | | | |
| 15 | | | | | Water | |
| 20 | | | | | | |
| 25 | | | | | | |
| 30 | | | | | | |
| | | | | | Continued | |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN SITU. THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| WL | WS ☐ WD | BORING STARTED 2-9-84 | 540 Lambeau Green Bay, WI 54303 |
| WL | BCR ACR | BORING COMPLETED 2-10-84 | |
| WL | | RIG Bomb 45 FOREMAN EVH | APP'D BY GMT — STS JOB NO 12949 |

BL1

| OWNER | LOG OF BORING NUMBER |
|---|---|
| Exxon Minerals Company | OL-1 Continued |
| **PROJECT NAME** | **ARCHITECT-ENGINEER** |
| Lake Sediment Borings | BEST COPY AVAILABLE |

STS Consultants Ltd

**SITE LOCATION**

Oak Lake

| ELEVATION / DEPTH | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT LBS/FT³ | UNCONFINED COMPRESSIVE STRENGTH TONS FT² / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD PENETRATION BLOWS FT |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION | | 1 2 3 4 5 / 10 20 30 40 50 / °C 20 30 40 50 |
| | - | | | | Continued | | |
| | 1 | SS | | | Green to black organic silt (OL) - slightly fibrous - very moist to wet - very loose | | W/R |
| | 2 | SS | | | | | W/R |
| 35 | | | | | | | |
| | 3 | ST | | | | | |
| | 4 | ST | | | Gray very silty clay (CL) - with traces of sand, fibers and organics - occasional seams of fine sand - grading to grayish brown below 45.0 feet - moist to very moist - firm | 103 | |
| 40 | 5 | ST | | | | | |
| | 6 | ST | | | | 101 | © 9.7 |
| 45 | 7 | ST | | | | | |
| | 8 | SS | | | | | |
| | 8A | SS | | | Brown fine to medium sand (SP) - with trace of silt - a little coarse sand and fine gravel - moist - extremely dense | | |
| 50 | | | | | Basalt cobble | | |
| | 9 | SS | | | Brown silty fine to coarse sand (SM) - with a little fine to medium gravel - moist - extremely dense | | |
| 53 | | | | | | | |
| | | | | | End of Boring<br>Boring advanced to 53.0 feet with roller bit and wash water<br>49.1 feet of HW casing used - 100% water loss from 49.1 to 53.0 feet<br>1-1/2" PVC well installed at 50.0 feet with deep seal<br>Well removed and borehole grouted on 2-23-84 | | © Organic Content |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN SITU, THE TRANSITION MAY BE GRADUAL

| OWNER | LOG OF BORING NUMBER |
|---|---|
| Exxon Minerals Company | DHL-1 |
| **PROJECT NAME** | **ARCHITECT-ENGINEER** |
| Lake Sediment Borings | BEST COPY AVAILABLE |

STS Consultants Ltd

**SITE LOCATION**

Deep Hole Lake

UNCONFINED COMPRESSIVE STRENGTH TONS FT²

1 2 3 4 5

PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT %

10 20 30 40 50

STANDARD PENETRATION BLOWS FT

10 20 30 40 50

| ELEVATION / DEPTH | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS/FT³ |
|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1605.4' - 489.32m | |
| | | | | | Ice | |
| 5 | | | | | Water | |
| 10 | 1 | SS | | | Brown and green organic silt (OL) - moderately fibrous - with trace of sand - wet - very loose | |
| | 2 | OS | | | | |
| 15 | 3 | SS | | | | |
| | 4 | SS | | | | |
| | 4A | SS | | | Greenish gray organic silt (OL) - with traces of clay, sand and fibers - very moist - soft | |
| 20 | 5 | SS | | | | |
| | 6 | ST | | | Gray silt (ML) - with traces of clay, sand and organics - occasional seams of fine sand below 26.0 feet - very moist - loose to very loose | 95 |
| 25 | 7 | ST | | | | |
| | 8 | ST | | | | |
| 30 | 9 | ST | | | | |
| | | | | | Continued | |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN SITU THE TRANSITION MAY BE GRADUAL.

| | | | |
|---|---|---|---|
| WL | WS OR WD | BORING STARTED 2-11-84 | 540 Lambeau Green Bay, WI 54303 |
| WL | BCR ACR | BORING COMPLETED 2-13-84 | |
| WL | | RIG Bomb 45 FOREMAN EVH | APP'D BY GHT STS JOB NO 12949 |

| OWNER | LOG OF BORING NUMBER |
|---|---|
| Exxon Minerals Company | DHL-1 Continued |
| **PROJECT NAME** | **ARCHITECT-ENGINEER** |
| Lake Sediment Borings | BEST COPY AVAILABLE |

STS Consultants Ltd

**SITE LOCATION**

Deep Hole Lake

| ELEVATION / DEPTH | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT LBS/FT³ | UNCONFINED COMPRESSIVE STRENGTH TONS FT² 1 2 3 4 5 / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % 10 20 30 40 50 / STANDARD PENETRATION BLOWS FT 10 20 30 40 50 |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION | | |
| | | | | | Continued | | |
| | 10 | SS | | | Gray silt (ML) - with trace of clay, sand and organics - occasional seams of fine sand below 26.0 feet - very moist - loose to very loose | | |
| 35 | 11 | ST | | | | 92 | |
| | 12 | SS | | | Brown silty fine to coarse sand (SM) - with trace of clay - a little to some gravel - wet - medium dense to very dense | | 12 ⊗ — 49 ⊗ |
| 40 | 13 | SS | | | | | |
| 43 | | | | | End of Boring<br>Boring advanced to 43.0 feet with roller bit and wash water<br>41.0 feet of HW casing used<br>1-1/2" PVC well installed at 41.8 feet with deep seal<br>Well removed anc borehole grouted on 2-23-84 | | © Organic Content |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN SITU THE TRANSITION MAY BE GRADUAL

# Appendix 3.5-9

## Logs for STS Consultants, Ltd.
## 1985 Skunk and Duck Lake Borings
## (SL-3 through 5 and DL-2)

STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Wetland Well Installation

SITE LOCATION: Skunk Lake

LOG OF BORING NUMBER: SL-3 meters
feet - 117.767N 2,281,028E 35895N 695259E
1600.3ft 487.77m 1602.63ft 488.483 m

ENGINEER

BEST COPY AVAILABLE

| DEPTH ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | WELL INSTALLATION TOP STANDPIPE EL. + | | | | | | | |
| | | | | | SURFACE ELEVATION Swamp Level 10-14-85 | | | | | | | |
| | | | | | Peat | | | | | | | |
| | | | | | Clay | | | | | | | |
| 2 | | | | | Clayey sand | | | | | | | |
| | | | | | 33" (1-/15/85) | | | | | | | |
| | | | | | Silty sand | | | | | | | |
| | | | | | Sandy clay | | | | | | | |
| 4 | | | | | Silty sand | | | | | | | |
| | | | | | Sand - fine to medium gravel - trace of silt | | | | | | | |
| 6 | | | | | | | | | | | | |

Notes added by Exxon 02-06-86

1) Top of 2" diameter standpipe 23" above swamp level at time of well installation.

2) Water level elevation shown on log has not stablized. See hydrologic data base for current water level readings and indication of stablized water level.

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally

| WL | | BCR | | ACR | |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 10-14-85
BORING COMPLETED 10-25-85
RIG
FOREMAN

STS OFFICE 540 Lambeau Street Green Bay, WI. 54303
DRAWN BY JJT
SHEET 1 OF 1
APP'D BY TMF
STS JOB NO. 14071

BL 5-983

STS Consultants Ltd.

OWNER
Exxon Minerals Company

LOG OF BORING NUMBER SL-4 meters
feet 118,073N 2,281,304E 35,989N 695,343E
1602.7ft 488.50m 1603.06ft 488.614m

PROJECT NAME
Wetland Well Installation

ENGINEER

SITE LOCATION
Skunk Lake

WELL INSTALLATION
TOP STANDPIPE EL. +

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION Swamp Level 10-14-85 | | | | | | | |
| | | | | | Organic brown silty clay - trace of sand | | | | | | | |
| | | | | | Sandy silt to clayey silt | | | | | | | |
| 2 | | | | | Clayey sand | | | | | | | |
| | | | | | Silty sand - trace of clay | | | | | | | |
| | | | | | Silty clayey sand | | | | | | | |
| | | | | | Silty sand - trace of clay | | | | | | | |
| 4 | | | | | Silty sand - with clay beds | | | | | | | |
| | | | | | 60" 10/21/85 | | | | | | | |
| | | | | | Sand - fine to medium gravel - trace of silt | | | | | | | |
| 6 | | | | | | | | | | | | |
| 7.5 | | | | | | | | | | | | |

Notes added by Exxon 02-06-86

1) Top of 2" diameter standpipe 29" above swamp level at time of well installation.

2) Water level elevation shown on log has not stablized. See hydrologic data base for current water level readings and indication of stablized water level.

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally

| WL | | | BCR | | ACR |
|---|---|---|---|---|---|
| WL-T. PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 10-14-85
BORING COMPLETED 10-25-85
RIG
FOREMAN

STS OFFICE 540 Lambeau Street
Green Bay, WI. 54303

DRAWN BY JJT
SHEET 1 OF 1
APP'D BY TMF
STS JOB NO. 14071

BL 5-983

STS Consultants Ltd.

OWNER
Exxon Minerals Company

PROJECT NAME
Wetland Well Installation

LOG OF BORING NUMBER meters
feet- 117,779N 2,281,091E 35,899N 695,278E
SL-5 1601.2ft 488.05m 1602.63ft 488.483m

ENGINEER

BEST COPY AVAILABLE

SITE LOCATION
Skunk Lake

WELL INSTALLATION
TOP STANDPIPE EL. +

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION Swamp Level 10-23-85 | | | | | | | |
| | | | | | Peat | | | | | | | |
| | | | | | Clayey silt | | | | | | | |
| 5 | | | | | Silty fine to medium sand - gray | | | | | | | |
| | | | | | Sandy clay to clayey sand | | | | | | | |
| | | | | | Silty fine to medium sand - gray | | | | | | | |
| | | | | | Sand fine to medium - little silt - brown | | | | | | | |
| 10 | | | | | Sand fine to medium - brown | | | | | | | |
| 15 | | | | | Clayey silt becoming sandy silt with depth | | | | | | | |
| 20 | | | | | Silty sand | | | | | | | |
| 25 | | | | | | | | | | | | |

Notes added by Exxon 02-06-86

1) Top of 2" diameter standpipe 30" above swamp level at time of well installation.

2) Water level elevation shown on log has not stablized. See hydrologic data base for current water level readings and indication of stablized water level.

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | ACR | |
|---|---|---|---|---|---|
| WL-T. PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 10-14-85
BORING COMPLETED 10-25-85
RIG
FOREMAN

STS OFFICE 540 Lambeau Street Green Bay, WI. 54303
DRAWN BY JJT
SHEET 1 OF 1
APP'D BY TMF
STS JOB NO 14071

BL 5-983

STS Consultants Ltd.

OWNER: Exxon Minerals Company

LOG OF BORING NUMBER: DL-2 (meters: 1614.2ft 492.21m; feet-113,175N 2,281778E; meters 34,496N 695,487E; 1614.79ft 492.189m)

PROJECT NAME: Wetland Well Installation

ENGINEER

BEST COPY AVAILABLE

SITE LOCATION: Duck Lake

| DEPTH / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | WELL INSTALLATION TOP STANDPIPE EL. + _____ | | | | | | | |
| | | | | | SURFACE ELEVATION Swamp Level 10-15-85 | | | | | | | |
| | | | | | Moss roots (floating bog) | | | | | | | |
| | | | | | Water | | | | | | | |
| 5 | | | | | Peat - organic - fiberous - silty - dark brown | | | | | | | |
| | | | | | Silty medium sand - dark brown | | | | | | | |
| | | | | | Silty medium sand - brown | | | | | | | |
| 10 | | | | | Silty fine to medium sand to sandy silt - grayish brown | | | | | | | |
| | | | | | Fine to medium sand - trace to some silt | | | | | | | |
| 15 | | | | | Fine to medium sand - trace to some silt | | | | | | | |
| 20 | | | | | Till | | | | | | | |
| 25 | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | |
| 35.5 | | | | | Notes added by Exxon 02-06-86<br><br>1) Top of 2" diameter standpipe 30" above swamp level at time of well installation.<br><br>2) Water level elevation shown on log has not stablized. See hydrologic data base for current water level readings and indication of stablized water level. | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 10-14-85
BORING COMPLETED 10-25-85
RIG
FOREMAN

STS OFFICE 540 Lambeau Street, Green Bay, WI. 54303
DRAWN BY JJT | SHEET 1 OF 1
APP'D BY TMF | STS JOB NO. 14071

BL 5-983

STS Consultants Ltd.

OWNER
Exxon Minerals Company

LOG OF BORING NUMBER meters
feet-113,175N 2,281,778E 34,496N 695,487E
DL-3 1616.0ft 492.56m 1614.95ft 492.238m

PROJECT NAME
Wetland Well Installation

ENGINEER

SITE LOCATION
Duck Lake

WELL INSTALLATION
TOP STANDPIPE EL. +

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION Swamp Level 10-16-85 | | | | | | | |
| | | | | | Moss roots | | | | | | | |
| | | | | | Peat | | | | | | | |
| 5 | | | | | Organic silts - trace of fiber | | | | | | | |
| | | | | | Silty sand - slightly plastic | | | | | | | |
| | | | | | Silty sand - dark brown | | | | | | | |
| | | | | | Silty sand - brown | | | | | | | |
| | | | | | Silty sand - fine gravel - slightly plastic | | | | | | | |
| 10 | | | | | Sand - fine to medium gravel - trace of silt | | | | | | | |
| | | | | | Sand - fine to coarse gravel - trace of silt | | | | | | | |
| | | | | | Sand | | | | | | | |
| | | | | | Clayey silt - grayish brown | | | | | | | |
| | | | | | Sandy silt - gray | | | | | | | |
| 15 | | | | | Clayey silt | | | | | | | |
| | | | | | 212" (10/21/85) | | | | | | | |
| | | | | | Till | | | | | | | |
| 19.5 | | | | | | | | | | | | |

Notes added by Exxon 02-06-86

1) Top of 2" diameter standpipe 42" above swamp level at time of well installation.

2) Water level elevation shown on log has not stablized. See hydrologic data base for current water level readings and indication of stablized water level.

The stratification lines represent the approximate boundary between soil types, in situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally

| BCR | | | ACR | | | BORING STARTED 10-14-85 | STS OFFICE 540 Lambeau Street Green Bay, WI. 54303 | |
|---|---|---|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T PIPE | DATE | TIME | BORING COMPLETED 10-25-85 | DRAWN BY JJT | SHEET 1 OF 1 |
| | | | | | | RIG | | |
| | | | | | | FOREMAN | APP'D BY TMF | STS JOB NO 14071 |

BL 5-983

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Company | LOG OF BORING NUMBER meters feet-1[illegible],114N 2,281,574E 34,477N 695,249E DL-2 1615.5ft 492.44m 1615.04ft 492.265m |
| PROJECT NAME: Wetland Well Installation | ENGINEER |

SITE LOCATION: Duck Lake

WELL INSTALLATION
TOP STANDPIPE EL. +

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION Swamp Level 10-18-85 | | | | | | | |
| | | | | | Organic vegetation | | | | | | | |
| 5 | | | | | Peat - fibrous - dark brown | | | | | | | |
| | | | | | Peat - less fibrous - organic silt | | | | | | | |
| | | | | | Silty fine sand - some organic - brown | | | | | | | |
| | | | | | Silty fine sand - some organic - reddish brown | | | | | | | |
| | | | | | Silty fine to medium sand - brown | | | | | | | |
| 10 | | | | | Sand - fine brown - trace of silt<br>144" 10/22/85 ▽ | | | | | | | |
| | | | | | Clayey sandy silt - gray | | | | | | | |
| 15 | | | | | Sand fine to medium - some silt grading to trace of silt with depth | | | | | | | |
| | | | | | Silty sand - gray | | | | | | | |
| 20 | | | | | | | | | | | | |

Notes added by Exxon 02-06-86

1) Top of 2" diameter standpipe 36" above swamp level at time of well installation.

2) Water level elevation shown on log has not stablized. See hydrologic data base for current water level readings and indication of stablized water level.

The stratification lines represent the approximate boundary between soil types, in situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | | BCR | | | ACR |
|---|---|---|---|---|---|---|
| WL-T. PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| | |
|---|---|
| BORING STARTED | 10-14-85 |
| BORING COMPLETED | 10-25-85 |
| RIG | |
| FOREMAN | |

| | |
|---|---|
| STS OFFICE | 540 Lambeau Street Green Bay, WI. 54303 |
| DRAWN BY JJT | SHEET 1 OF 1 |
| APP'D BY TMF | STS JOB NO. 14071 |

BL 5-983

STS Consultants Ltd.

OWNER: Exxon Minerals Company

LOG OF BORING NUMBER: DL-5 (meters)
feet - 112,448N 2,280,776E 34,274N 695,179E
1615.7ft 492.47m 1615.07ft 492.274m

PROJECT NAME: Wetland Well Installation

ENGINEER:

SITE LOCATION: Duck Lake

WELL INSTALLATION
TOP STANDPIPE EL. +

| DEPTH | ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | SURFACE ELEVATION Swamp Level 10-17-85 | | | | | | | |
| | | | | | | Roots - moss | | | | | | | |
| | | | | | | Peat | | | | | | | |
| 5 | | | | | | Sandy peat | | | | | | | |
| | | | | | | Silty sand - greenish brown | | | | | | | |
| | | | | | | Clayey silt - trace of sand - grayish | | | | | | | |
| | | | | | | Clayey sandy silt - grayish | | | | | | | |
| 10 | | | | | | Silty sand - brown | | | | | | | |
| | | | | | | Sand - medium gravel - some silt | | | | | | | |
| 15 | | | | | | Clay - gray - sticky - silty | | | | | | | |
| | | | | | | Sand - medium gravel - trace of silt near base | | | | | | | |
| | | | | | | Clay - gray - silty | | | | | | | |
| | | | | | | Clay - silty - reddish brown | | | | | | | |
| | | | | | | Till | | | | | | | |
| 20 | | | | | | 233" 10/22/85 ▽ | | | | | | | |

Notes added by Exxon 02-06-86

1) Top of 2" diameter standpipe 37" above swamp level at time of well installation.

2) Water level elevation shown on log has not stablized. See hydrologic data base for current water level readings and indication of stablized water level.

The stratification lines represent the approximate boundary between soil types, in situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL-T. PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 10-14-85
BORING COMPLETED 10-25-85
RIG
FOREMAN

STS OFFICE 540 Lambeau Street Green Bay, WI. 54303
DRAWN BY JJT
SHEET 1 OF 1
APP'D BY TMF
STS JOB NO. 14071

BL 5-983

STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Wetland Well Installation

LOG OF BORING NUMBER: DL-6 (meters)
feet- 117,779N 2,281,091E 35,899N 695,278E
1615.2ft 492.31m 1614.27ft 492.030m

ENGINEER:

SITE LOCATION: Duck Lake

| DEPTH / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | WELL INSTALLATION | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION Swamp Level 10-21-85 | TOP STANDPIPE EL. + | | | | | | | |
| | | | | | Vegetation | | | | | | | | |
| | | | | | Peat | | | | | | | | |
| 5 | | | | | Organic silts and clays | | | | | | | | |
| | | | | | Sandy silt - light brown | | | | | | | | |
| 10 | | | | | Sandy silt to silt | | | | | | | | |
| | | | | | Sandy silty to silt - trace clean sand beds | | | | | | | | |
| 15 | | | | | Sandy silt | no water | | | | | | | |
| | | | | | Silty clay - trace of sand | | | | | | | | |
| | | | | | Till? | | | | | | | | |
| 20 | | | | | | | | | | | | | |

Notes added by Exxon 02-06-86

1) Top of 2" diameter standpipe 36" above swamp level at time of well installation.

2) Water level elevation shown on log has not stablized. See hydrologic data base for current water level readings and indication of stablized water level.

The stratification lines represent the approximate boundary between soil types, in situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

| | |
|---|---|
| BORING STARTED | 10-14-85 |
| BORING COMPLETED | 10-25-85 |
| RIG | |
| FOREMAN | |

STS OFFICE: 540 Lambeau Street, Green Bay, WI. 54303

DRAWN BY: JJT | SHEET 1 OF 1

APP'D. BY: TMF | STS JOB NO. 14071

BL 5-983

# Appendix 3.5-10

## Logs for WTD Environmental Drilling, Inc. 1994 Little Sand Lake; Skunk and Duck Lake Wetlands; Burr Oak Swamp; Swamp Creek Cedars and Wetlands Adjacent to Swamp Creek Borings

**CMC-LSL-101**
**CMC-LSL-102**
**CMC-LSL-102A**
**CMC-LSL-102B**
**CMC-LSL-103**
**CMC-LSL-104**
**CMC-LSL-104A**
**CMC-LSL-104B**
**CMC-LSL-105**
**CMC-SL-103A**
**CMC-SL-103B**
**CMC-SL-103C**
**CMC-SL-104**
**CMC-DL-103A**
**CMC-LSL-103B**
**CMC-LSL-103C**
**CMC-BO-101A**
**CMC-BO-101B**
**CMC-BO-102**
**CMC-SCC-101**
**CMC-SCC-102A**
**CMC-SCC-102B**
**SC-101**
**SC-102**

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-LSL-101 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Dan Tinnacour | 02/11/94<br>MM/DD/YY | 02/11/94<br>MM/DD/YY | 4" Rotary Wash<br>(w/water) |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | NA | NA | 1592.1 (Ice) | 4.25" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 113,246.7N, 2,278,416 E S/C/N Lat<br>SE 1/4 of NW 1/4 of Section 29, T 35 N, R 13 E Long | ___ Feet N/S ___ Feet E/W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | Ice ~17". | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 2 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | 4" steel casing set to 10' (below top of | | | | | | | | | | |
| | | | -- | ice). | | | | | | | | | | |
| | | | -- 4 | | | | | | | | | | | |
| | | | -- | Lake bed ~4.8'. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| SS1 | 18 | RW/RW | -- 6 | 6-7' V. soft to soft, interlayered black | OL/ | | | | | | | | | |
| | | 3/1 | -- | (2.5Y2/0) organic silts and olive brown | ML | | | | | | | | | |
| | | | -- | (2.5Y4/4) and very dk. gray (2.5Y3/0) | | | | | | | | | | |
| | | | -- | f. sandy silt, tr. fibers. Lacustrine | | | | | | | | | | |
| | | | -- 8 | to 26'. Soft, gray (5Y5/1) silty clay, | CL | | | | | | | | | |
| | | | -- | trace organics in spoon tip (~7.9'). | | | | | | | | | | |
| | | | -- | As above. | CL | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| SS2 | 24 | RW/RW | -- 10 | Very soft, dk. gray (5Y4/1) silty clay, | CL | | | | | | | | | |
| | | 3/1 | -- | tr. organics. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 12 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| SS3 | 24 | 1/1 | -- | V. soft, dk. gray (5Y4/1) silty clay (as | CL | | | | | | | | | |
| | | 1/2 | -- | above), tr. organics. | | | | | | | | | | |
| | | | -- 14 | | | | | | | | | | | |
| | | | -- | As above. | CL | | | | | | | | | |
| ST4 | 23 | TWT | -- | | | | | | | | | | | |
| | | | -- | Shelby tube placed in heated pick-up. | | | | | | | | | | |
| | | | -- 16 | | | | | | | | | | | |
| | | | -- | V. soft, dk. gray (5Y1/1) silty clay,tr. | CL | | | | | | | | | |
| SS5 | 24 | 2/2 | -- | organics. | | | | | | | | | | |
| | | 3/3 | -- | Grayish brown (10YR5/2) f. sand layer | CL | | | | | | | | | |
| | | | -- 18 | (1") @ 17'. | | | | | | | | | | |
| | | | -- | Soft v. dk. gray (5Y3/1) silty clay, tr. | CL | | | | | | | | | |
| SS6 | 24 | RW/RW | -- | organics. | | | | | | | | | | |
| | | RW/RW | -- | V. soft, v. dk. gray (5Y3/1) silty clay, | CL | | | | | | | | | |
| | | | -- 20 | tr. organics. | | | | | | | | | | |
| | | | -- | V. soft, black (2.5Y2/0) silty clay, | CL | | | | | | | | | |
| SS7 | 22 | RW/RW | -- | tr. organics. | | | | | | | | | | |
| | | RW/RW | -- | | | | | | | | | | | |
| | | | -- 22 | V. soft, v. dk. gray (5Y3/1) silty clay, | CL | | | | | | | | | |
| | | | -- | tr. organics. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Steve Ward

Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-LSL-101

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | P200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 24 | | | | | | | | | | | |
| SS8 | 24 | RW/RW | | | | | | | | | | | | |
| | | RW/RW | | V. soft, v. dk. gray (5Y3/1) silty clay, | CL | | | | | | | | | |
| | | | 26 | tr. organics. | | | | | | | | | | |
| SS9 | 20 | RW/RW | | Dk. grayish brown (10YR4/2) f. sand @ | SP/ | | | | | | | | | |
| | | RW/5 | | 26.8', tr.to some silt. Outwash to EOB. | SM | | | | | | | | | |
| | | | 28 | Dk. grayish brown (10YR4/2) f. sand, tr. | SM | | | | | | | | | |
| | | | | silt to silty f. sand. | | | | | | | | | | |
| SS10 | 20 | 5/7 | | Brown (10YR4/3) m. to c. sand, tr. f. | SM/ | | | | | | | | | |
| | | 7/9 | | gravel, tr. to some silt. | SW | | | | | | | | | |
| | | | 30 | Brown (10YR4/3) m. to c. sand, tr. silt. | SW | | | | | | | | | |
| | | | | Brown (7.5YR4/2) silty f. sand, tr. to | SM | | | | | | | | | |
| SS11 | 18 | 7/7 | | some f. gravel. | | | | | | | | | | |
| | | 9/11 | | | | | | | | | | | | |
| | | | 32 | E.O.B. @ 31'. | | | | | | | | | | |
| | | | | Drilling cuttings and wash water disposed in sump pits at mine site. | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

WELL/DRILLHOLE/BOREHOLE
Form 3300-5W

11-89

All abandonment work shall be performed in accordance with the provisions of Chapters NR 111, NR 112 or NR 141, Wis. Admin. Code, whichever is applicable. Also, see instructions on back.

(1) GENERAL INFORMATION

Well/Drillhole/Borehole Location: County: Forest

SE 1/4 of NW 1/4 of Sec. 31 ; T. 35 N; R. 13 [x] E [ ] W

(If applicable) Gov't Lot _____ Grid Number _____

Grid Location: 113,246.7 ft. [XX] N. [ ] S., 2,278,416.6 ft. [X] E. [ ] W.

Civil Town Name: Lincoln

Street Address of Well: Little Sand Lake

City, Village: NA

(2) FACILITY NAME

Original Well Owner (If Known): Crandon Mining Company

Present Well Owner: Crandon Mining Company

Street or Route: 7 North Brown Street

City, State, Zip Code: Rhinelander, WI 54501-0856

Facility Well No. and/or Name (If Applicable): CMC-LSL-101

WI Unique Well No.: _ _ _ _ _ _

Reason For Abandonment: Investigative Only

Date of Abandonment: 2-11-94

WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drillhole/Borehole Construction Completed On

(Date) 2-11-94

[ ] Monitoring Well
[ ] Water Well
[ ] Drillhole
[x] Borehole

Construction Report Available? [x] Yes [ ] No

Construction Type:
[x] Drilled [ ] Driven (Sandpoint) [ ] Dug
[ ] Other (Specify) _____

Formation Type:
[x] Unconsolidated Formation [ ] Bedrock

Total Well Depth (ft.) 31.0* Casing Diameter (ins.) ____
(From ~~ground surface~~) lake surface

Casing Depth (ft.) _____

Was Well Annular Space Grouted? [ ] Yes [ ] No [ ] Unknown
If Yes, To What Depth? _____ Feet

(4) Depth to Water (Feet) 0.0

| | | | |
|---|---|---|---|
| Pump & Piping Removed? | [ ] Yes | [ ] No | [x] Not Applicable |
| Liner(s) Removed? | [ ] Yes | [ ] No | [x] Not Applicable |
| Screen Removed? | [ ] Yes | [ ] No | [x] Not Applicable |
| Casing Left in Place? | [ ] Yes | [ ] No | |

If No, Explain _____

| | | |
|---|---|---|
| Was Casing Cut Off Below Surface? | [ ] Yes | [ ] No |
| Did Sealing Material Rise to Surface? | [ ] Yes | [ ] No |
| Did Material Settle After 24 Hours? | [ ] Yes | [ ] No |
| If Yes, Was Hole Retopped? | [ ] Yes | [ ] No |

(5) Required Method of Placing Sealing Material
Temp casing
[x] Conductor Pipe-Gravity [ ] Conductor Pipe-Pumped
[ ] Dump Bailer [ ] Other (Explain)

(6) Sealing Materials

[ ] Neat Cement Grout
[ ] Sand-Cement (Concrete) Grout
[ ] Concrete
[ ] Clay-Sand Slurry
[ ] Bentonite-Sand Slurry
[x] Chipped Bentonite

For monitoring wells and monitoring well boreholes only
[ ] Bentonite Pellets
[ ] Granular Bentonite
[ ] Bentonite - Cement Grout

| (7) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks Sealant or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| 3/8" Hole plug * bentonite chips | ~~Surface~~ 7.5' | 28.5' | 8 50 lb bags | |
| | | | | |
| | | | | |
| * ref to lake level (ice level), lake bottom with 5' below lake | | | | |

(8) Comments: _____

(9) Name of Person or Firm Doing Sealing Work
Dan Tinnacour WTD Environmental Drilling

Signature of Person Doing Work: Dan Tinnacour (SUB)
Date Signed: 3-1-94
Street or Route: 101 Alderson Street
Telephone Number: (715) 359-7090
City, State, Zip Code: Schofield, WI 54476

(10) FOR DNR OR COUNTY USE ONLY

Date Received/Inspected
District/County
Reviewer/Inspector
Follow-up Necessary

DNR/COUNTY

State of Wisconsin
Department of Natural Resources

Route to:
Solid Waste
Emergency Response
Wastewater
Haz. Waste
Underground Tanks
Water Resources
X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91

Page 1 of 1

| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-LSL-102 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Dan Tinnancour | 02/12/94<br>MM/DD/YY | 02/16/94<br>MM/DD/YY | 5-7/8" I.D.<br>Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | NA | NA | 1592.1 | 6" |

Boring Location
State Plane 114,872.5N, 2,278,461.8 E S/C/N
NE 1/4 of NW 1/4 of Section 31, T 35 N, R 13 E
Lat
Long

Local Grid Location (if applicable)
Feet ___ N S
Feet ___ E W

County: Forest
DNR County Code: 21
Civil Town/City/or Village: Lincoln

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | Ice 0-17". | | | | | | | | | | |
| | | | -- | Water 17" - 3'. | | | | | | | | | | |
| | | | -- 2 | | | | | | | | | | | |
| SS1 | 12 | 1/3<br>3/4 | -- | 3-7 Dark brown (2.5Y3/2) silty sand with organics, structureless, wet. Lacustrine. | SM | | | | | | | | | |
| | | | -- 4 | | | | | | | | | | | |
| SS2 | 12 | 4/5<br>5/7 | -- | Grey brown (2.5Y4/3) fine sand with silt, structureless, wet, soft. Lacustrine. | SP | | | | | | | | | |
| | | | -- 6 | | | | | | | | | | | |
| SS3 | 2 | 1/1<br>1/1 | -- | 7-9 As above. Grey (2.5Y5/1) fine sand, structureless, wet, loose. Lacustrine. | SP | | | | | | | | | |
| | | | -- 8 | | | | | | | | | | | |
| SS4 | 24 | 1/3<br>2/3 | -- | 9-11 Grey (2.5Y5/1) silty clay with fine sand lenses, massive, wet, sticky, organics. Lacustrine to E.O.B. | CL | | | | | | | | | |
| | | | -- 10 | | | | | | | | | | | |
| ST5 | 24 | TWT | -- | 11-13 Push TWT 2' 24" recovery. Grey clay as above, sl. firm. | CL | | | | | | | | | |
| | | | -- 12 | | | | | | | | | | | |
| SS6 | 24 | 1/1<br>12/6 | -- | 13-14.8 Gray clay as above. | | | | | | | | | | |
| | | | -- 14 | 14.8-15 Grey (2.5Y4/1) fine-med. sand, wet, structureless, loose. | SP | | | | | | | | | |
| SS7 | 20 | 2/1<br>1/1 | -- | 15-16.3 Grey (2.5Y5/1) silty clay, structureless, wet, loose. | CL | | | | | | | | | |
| | | | -- 16 | 16.3-17 Grey (2.5Y2/1) fine sand, wet, loose. | SP | | | | | | | | | |
| SS8 | 24 | 1/1<br>1/1 | -- | 17-19 Grey (2.5Y5/1) silty clay with organics and sand, massive, wet, sticky. | CL | | | | | | | | | |
| | | | -- 18 | | | | | | | | | | | |
| | | | -- | E.O.B. @ 17' (Collapse)<br>3.0 bags holeplug. | | | | | | | | | | |
| | | | -- 20 | | | | | | | | | | | |
| | | | -- | Drilling mud disposed in sump pits at mine site. | | | | | | | | | | |
| | | | -- | Note drill rig broke down and boring | | | | | | | | | | |
| | | | -- 22 | could not be completed due to weak ice. | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Steph Ward
Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources

# WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Form 3300-5W 11-89

All abandonment work shall be performed in accordance with the provisions of Chapters NR 111, NR 112 or NR 141, Wis. Admin. Code, whichever is applicable. Also, see instructions on back.

## (1) GENERAL INFORMATION

Well/Drillhole/Borehole Location

County: Forest

NE 1/4 of NW 1/4 of Sec. 31 ; T. 35 N; R. 13 [X] E [ ] W

(If applicable) Gov't Lot _____ Grid Number _____

Grid Location: 114,872.5 ft. [X] N. [ ] S. 2,278,461.8 ft. [X] E. [ ] W.

Civil Town Name: Lincoln

Street Address of Well: Little Sand Lake

City, Village: NA

## (2) FACILITY NAME

Original Well Owner (If Known): Crandon Mining Company

Present Well Owner: Crandon Mining Company

Street or Route: 7 North Brown Street

City, State, Zip Code: Rhinelander, WI 54501-0856

Facility Well No. and/or Name (If Applicable): CMC-LSL-102

WI Unique Well No.: _ _ _ _ _ _

Reason For Abandonment: Completion

Date of Abandonment: 02/16/94

## WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drillhole/Borehole Construction Completed On

(Date) 02/12/94

[ ] Monitoring Well
[ ] Water Well
[ ] Drillhole
[X] Borehole

Construction Report Available? [ ] Yes [ ] No

Construction Type:
[X] Drilled [ ] Driven (Sandpoint) [ ] Dug
[ ] Other (Specify) _____

Formation Type:
[X] Unconsolidated Formation [ ] Bedrock

Total Well Depth (ft.) 19' (From groundsurface) Casing Diameter (ins.) 6"

Casing Depth (ft.) 12

Was Well Annular Space Grouted? [ ] Yes [ ] No [ ] Unknown
If Yes, To What Depth? _____ Feet

(4) Depth to Water (Feet) 0'

| | | | |
|---|---|---|---|
| Pump & Piping Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Liner(s) Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Screen Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Casing Left in Place? | [ ] Yes | [X] No | |

If No, Explain: Hole in lake bed abandoned and casing pulled

| | | |
|---|---|---|
| Was Casing Cut Off Below Surface? | [ ] Yes | [X] No |
| Did Sealing Material Rise to Surface? | [ ] Yes | [X] No |
| Did Material Settle After 24 Hours? | [ ] Yes | [X] No |
| If Yes, Was Hole Retopped? | [ ] Yes | [ ] No |

(5) Required Method of Placing Sealing Material
[X] Conductor Pipe-Gravity [ ] Conductor Pipe-Pumped
[ ] Dump Bailer [ ] Other (Explain)

(6) Sealing Materials
[ ] Neat Cement Grout
[ ] Sand-Cement (Concrete) Grout
[ ] Concrete
[ ] Clay-Sand Slurry
[ ] Bentonite-Sand Slurry
[X] Chipped Bentonite

For monitoring wells and monitoring well boreholes only
[ ] Bentonite Pellets
[ ] Granular Bentonite
[ ] Bentonite - Cement Grout

| (7) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks Sealant or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| 3/8" Hole Plug Chipped Bentonite | Surface | 19 | 3 50-lb bags | |
| | | | | |
| | | | | |
| | | | | |

(8) Comments: _____

(9) Name of Person or Firm Doing Sealing Work
Dan Tinnancour, WTD Environmental Drilling

Signature of Person Doing Work: Dan Tinnancour (GV) Date Signed: 3-1-94

Street or Route: 101 Alderson Street Telephone Number: (715)359-7090

City, State, Zip Code: Schofield, WI 54476

(10) FOR DNR OR COUNTY USE ONLY

Date Received/Inspected | District/County

Reviewer/Inspector

Follow-up Necessary

3.5-10-5

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-LSL-102A |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Dan Tinnancour | 02/15/94<br>MM/DD/YY | 02/15/94<br>MM/DD/YY | 5-7/8" Rotary Wash |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | CMC-LSL-102A | 4.54 (2/28/94) | 1592.1 | 6" |

Boring Location
State Plane 114,399.1N, 2,278,953.7E S/C/N Lat
SE 1/4 of NW 1/4 of Section 31, T 35 N, R 13 E Long

Local Grid Location (if applicable)
___ Feet ___ N S ___ Feet ___ E W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2 | 3' of water 15" of ice.<br>See boring log CMC-LSL-102B. | | | | | | | | | | |
| | | | 4 | Blind drilled to 16'.<br>Lost circulation @ 10'.<br>Cased hole to 10'. | | | | | | | | | | |
| | | | 6 | Sampled over screened<br>Interval from 16-18'. | | | | | | | | | | |
| | | | 8 | No additives used to<br>drill hole. | | | | | | | | | | |
| | | | 10 | See CMC-LSL-102A well construction<br>diagram for construction details. | | | | | | | | | | |
| | | | 12 | | | | | | | | | | | |
| | | | 14 | | | | | | | | | | | |
| SS-1 | 24 | RW | 16 | 2.5Y4/0 Dark grey v. soft silty clay with thin (>1mm) laminations of fine sand. Lacustrine. | CL/ML | | | | | | | | | |
| | | | 18 | | | | | | | | | | | |
| | | | 20 | E.O.B. @ 18.5'. | | | | | | | | | | |
| | | | 22 | Cuttings and water disposed in sump pits at mine site. | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Steph Wand

Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-LSL-102B |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Dan Tinnacour | 02/14/94<br>MM/DD/YY | 02/14/94<br>MM/DD/YY | 5-7/8" Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | CMC-LSL-102B | 6.87 (2/28/94) | 1592.1 (Ice) | 6" |

Boring Location
State Plane 114,284.9N, 2,279,010.6E S/C/N Lat
SE 1/4 of NW 1/4 of Section 35, T 35 N, R 13 E Long

Local Grid Location (if applicable)
Feet ___ N S Feet ___ E W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | 15" ice. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | 4' of water. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 2 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| SS-1 | 12 | 6/7<br>6/5 | -- 4 | 4-8 Gray (10YR5/1) wet firm to loose fine sand w/minor silt. | SP | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| SS-2 | 12 | 7/2<br>2/3 | -- 6 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| SS-3 | 6 | RW<br>1/2 | -- 8 | 8-28 Dk. grey (2.5Y4/0) v. soft clay w/minor silt and occasional thin laminations of fine sand (<1 mm) lacustrine. | CL | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| SS-4 | 24 | RW<br>1/1 | -- 10 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | As above, lacustrine. | CL | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| ST-5 | 30/30 | TWT | -- 12 | Shelby tube from 12-14. Clay top, clay bottom, 24"/24" lacustrine. | CL | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| SS-6 | 12 | RW<br>RW | -- 14 | As above, no sand laminations, lacustrine. | CL | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| ST-7 | 30/30 | TWT | -- 16 | Shelby tube 16-18. Dk grey clay top and bottom. 24"/24" lacustrine. | CL | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| SS-8 | 24 | RW | -- 18 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | As above - no sand laminations, lacustrine. | CL | | | | | | | | | |
| SS-9 | 24 | RW | -- 20 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | As above - no sand laminations, lacustrine. | CL | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| SS10 | 24 | RW | -- 22 | As above w/thin fine sand laminations @23.5-23.8, <1 mm lacustrine. | CL | | | | | | | | | |
| | | | -- | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Steph Wong

Firm: Foth & Van Dyke

This form is authorized by Chapters 114, 147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-LSL-102B

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | P200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ST11 | 30/30 | TWT | 24 | 24-26 Shelby tube dk. grey clay top and bottom. 24"/24" lacustrine. | CL | | | | | | | | | |
| SS12 | 24 | 3/3 5/7 | 26 | As above, grading to a greyish-brn (10YR4/2) silty clay w/tr. of fine sand, lacustrine. | CL | | | | | | | | | |
| ST13 | 18/18 | TWT | 28 | Shelby tube silty sand, greyish-brn top and bottom loose-firm, lacustrine. | SM | | | | | | | | | |
| SS14 | 18 | 3/9 9/11 | 30 | 30-31 Dk. grey loose silty sand fine-med. text. | SM | | | | | | | | | |
| | | | | 31-32 Brown (10YR4/2) stiff silty clay-till. | CL | | | | | | | | | |
| SS15 | 16 | 4/9 10/11 | 32 | 32-34 Dk. brown (10YR4/4) dense to v. dense clayey sand. Blocky structure-till. | SC | | | | | | | | | |
| | | | 34 | E.O.B. @ 34'. | | | | | | | | | | |

Cased to 30'.

Mud consisted of 100 gallons H20/65 lbs. benseal.

Note: Gravel wedged between tricone and casing @ 28-30'. Casing partially unscrewed.

See CMC-LSL-102B well construction diagram for construction details.

Mud disposed in sump pits @ mine site.

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-LSL-103 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Jeff Flamino | 02/12/94<br>MM/DD/YY | 02/12/94<br>MM/DD/YY | 5-7/8" Rotary Mud |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | NA | NA | 1592.2 | 6" |

Boring Location
State Plane 113,851.1N, 2,276,753.9E S/C/N Lat
SW 1/4 of NW 1/4 of Section 35, T 35 N, R 13 E Long

Local Grid Location (if applicable)
___ Feet ___ N ___ S ___ Feet ___ E ___ W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | 13" Ice | | | | | | | | | | |
| | | | -- | Water 0-5'. | | | | | | | | | | |
| | | | -- 2 | | | | | | | | | | | |
| | | | -- 4 | | | | | | | | | | | |
| SS-1 | 20 | 4/4<br>4/4 | -- 6 | 5-14.8 Brown (10YR5/3) wet loose fine-med. text. Silty sand. Lost circulation @9'. Casing driven to 10' and drilled out. Lacustrine sand. | SM | | | | | | | | | |
| | | | -- 8 | | | | | | | | | | | |
| SS-2 | 20 | 4/4<br>4/4 | -- 10 | As above. | SM | | | | | | | | | |
| SS-3 | 20 | 4/4<br>4/6 | -- 12 | As above. | SM | | | | | | | | | |
| SS-4 | 24 | 4/4<br>5/6 | -- 14 | As above to 14.8'.<br>14.8-15.6 Dk. gray soft-firm sandy silt.<br>15.6-16 Dk. gray loose silty sand.<br>Lacustrine to 41'. | SM<br>ML<br>SM | | | | | | | | | |
| SS-5 | 24 | RW | -- 16 | 16-28.5 Dk. gray (2.5Y4/0) wet soft silty clay w/2" fine sand seam @ 17.7-17.9. Lacustrine.<br>18-19.6 Shelby tube. | CL | | | | | | | | | |
| SS-6 | 24 | 3/4<br>4/4 | -- 18 | As above, fine silty clay, sand seam @ 19.6-20. | CL | | | | | | | | | |
| | 0 | TWT | -- 20 | No recovery w/Shelby tube. | | | | | | | | | | |
| SS-7 | 24 | 2/2<br>2/4 | -- 22 | As above, dk. gray v. soft silty clay. | CL | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Steve Van Dyke Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-LSL-103

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | P200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 24 | | | | | | | | | | | |
| SS-8 | 24 | RW | | As above. | CL | | | | | | | | | |
| | | | 26 | | | | | | | | | | | |
| SS-9 | 12 | RW | | As above to 28.5'. | CL | | | | | | | | | |
| | | | | 28.5-29 Dk. gray loose silty sand, med. | SM | | | | | | | | | |
| SS10 | 24 | RW | 28 | textured. | | | | | | | | | | |
| | | | | 29-39 Dk. gray (2.5Y4/0) v. soft to soft silty clay, 1cm silty sand seam fine text. @ 29.5'. Lacustrine. | CL | | | | | | | | | |
| ST11 | 36/36 | TWT | 30 | 30-33 Shelby tube. 36"/36" full recovery clay top and bottom. | CL/ML | | | | | | | | | |
| | | | 32 | | | | | | | | | | | |
| ST12 | 28/28 | TWT | | 33-35 Shelby tube 24"/24" full recovery clay top and bottom. | CL | | | | | | | | | |
| SS13 (35-37) | 24 | RW | 34 | | | | | | | | | | | |
| | | | | As above, dk. gray silty clay. | CL | | | | | | | | | |
| | | | 36 | | | | | | | | | | | |
| SS14 (37-39) | 24 | RW | 38 | As above. | | | | | | | | | | |
| | | | | 39-41 V. soft brown (10YR5/3) clay, minor silt. | CL | | | | | | | | | |
| SS15 (39-41) | 24 | 5/6 7/9 | 40 | | | | | | | | | | | |
| | | | | 41-46 No recovery. Appears to be loose sand. Outwash sands to E.O.B. | | | | | | | | | | |
| | | | 42 | | | | | | | | | | | |
| | | | 44 | | | | | | | | | | | |
| SS16 (46-49) | 20 | 10/12 16/19 | 46 | 46-49 Gray (2.5Y4/2) wet gravelly sand, med. texture. | SP | | | | | | | | | |
| | | | 48 | E.O.B. @ 48'. | | | | | | | | | | |
| | | | | Hole cased to 25'. Abandoned w/10 50-lb. bags of 3/8" chipped bentonite. | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

Form 3300-5W

11-89

All abandonment work shall be performed in accordance with the provisions of Chapters NR 111, NR 112 or NR 141, Wis. Admin. Code, whichever is applicable. Also, see instructions on back.

## (1) GENERAL INFORMATION

Well/Drillhole/Borehole Location

County: Forest

SW 1/4 of NW 1/4 of Sec. 31 ; T. 35 N; R. 13 [X] E [ ] W

(If applicable) Gov't Lot _____ Grid Number _____

Grid Location: 113,851.1 ft. [X] N. [ ] S., 2,276,753.9 ft. [X] E. [ ] W.

Civil Town Name: Lincoln

Street Address of Well: Little Sand Lake

City, Village: NA

## (2) FACILITY NAME

Original Well Owner (If Known): Crandon Mining Company

Present Well Owner: Crandon Mining Company

Street or Route: 7 North Brown Street

City, State, Zip Code: Rhinelander, WI 54501-0856

Facility Well No. and/or Name (If Applicable): CMC-LSL-103

WI Unique Well No.: _ _ _ _ _ _

Reason For Abandonment: Investigative Only

Date of Abandonment: 02-12-94

## WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drillhole/Borehole Construction Completed On

(Date) 2-12-94

[ ] Monitoring Well
[ ] Water Well
[ ] Drillhole
[X] Borehole

Construction Report Available? [ ] Yes [ ] No

Construction Type:
[X] Drilled [ ] Driven (Sandpoint) [ ] Dug
[ ] Other (Specify) _____

Formation Type:
[X] Unconsolidated Formation [ ] Bedrock

Total Well Depth (ft.) 49 Casing Diameter (ins.) NA

(From ~~ground surface~~) Lake surface

Casing Depth (ft.) _____

Was Well Annular Space Grouted? [ ] Yes [ ] No [ ] Unknown

If Yes, To What Depth? _____ Feet

(4) Depth to Water (Feet) 0

| | | | |
|---|---|---|---|
| Pump & Piping Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Liner(s) Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Screen Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Casing Left in Place? | [ ] Yes | [ ] No | |

If No, Explain _____

| | | | |
|---|---|---|---|
| Was Casing Cut Off Below Surface? | [ ] Yes | [ ] No | NA |
| Did Sealing Material Rise to Surface? | [ ] Yes | [ ] No | NA |
| Did Material Settle After 24 Hours? | [ ] Yes | [ ] No | NA |
| If Yes, Was Hole Retopped? | [ ] Yes | [ ] No | NA |

(5) Required Method of Placing Sealing Material

[X] ~~Conductor Pipe-Gravity~~ Temporary Casing [ ] Conductor Pipe-Pumped
[ ] Dump Bailer [ ] Other (Explain)

(6) Sealing Materials

[ ] Neat Cement Grout
[ ] Sand-Cement (Concrete) Grout
[ ] Concrete
[ ] Clay-Sand Slurry
[ ] Bentonite-Sand Slurry
[X] Chipped Bentonite

For monitoring wells and monitoring well boreholes only

[ ] Bentonite Pellets
[ ] Granular Bentonite
[ ] Bentonite - Cement Grout

| (7) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks Sealant or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Hole plug 3/8" chipped bentonite | ~~Surface~~ 10 | 49 | 16 50 lb bags | |
| | | | | |
| | | | | |
| | | | | |

(8) Comments: _____

(9) Name of Person or Firm Doing Sealing Work: Jeff Famino WTD Environmental Drilling

Signature of Person Doing Work: Jeff Famino SVD — Date Signed: 3-1-94

Street or Route: 101 Alderson Street — Telephone Number: (715) 359-7090

City, State, Zip Code: Schofield, WI 54476

(10) FOR DNR OR COUNTY USE ONLY

Date Received/Inspected | District/County

Reviewer/Inspector

Follow-up Necessary

DNR/COUNTY

3.5-10-11

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-LSL-104A |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Dan Tinnacour | 02/13/94<br>MM/DD/YY | 02/13/94<br>MM/DD/YY | 5-7/8" Rotary Wash |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | CMC-LSL-104A | 5.65 (2/28/94) | 1592.1 | 6" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 112,076.2N, 2,275,945.0E S/C/N<br>NE 1/4 of SE 1/4 of Section 36, T 35 N, R 12 E | Lat<br>Long<br>Feet ___ N S Feet ___ E W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Nashville |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Blind drill to 15'. See log CMC-LSL-104B. | | | | | | | | | | |
| | | | 2 | See CMC-LSL-104A well construction diagram for construction details. | | | | | | | | | | |
| | | | 4 | No additives used to drill hole. | | | | | | | | | | |
| | | | 6 | | | | | | | | | | | |
| | | | 8 | | | | | | | | | | | |
| | | | 10 | | | | | | | | | | | |
| | | | 12 | | | | | | | | | | | |
| | | | 14 | | | | | | | | | | | |
| ST-1 | 30/30 | TWT | 16 | 15.5-17.5 Shelby tube, dk. gray v. soft to soft clay top and bottom. Lacustrine. Full recovery. | CL | | | | | | | | | |
| | | | 18 | E.O.B. @ 18'. | | | | | | | | | | |
| | | | 20 | Drill cuttings and wash water disposed in sump pits at mine site. | | | | | | | | | | |
| | | | 22 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

| Signature | Firm |
|---|---|
| Stephen H Wanta | Foth & Van Dyke |

This form is authorized by Chapters 114, 147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-LSL-104B |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Dan Tinnacour | 02/13/94<br>MM/DD/YY | 02/13/94<br>MM/DD/YY | 5-7/8" Rotary Wash |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | CMC-LSL-104B | 14.73 (2/28/94) | 1592.1 | 6" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 112,072.7N, 2,275,937.4E S/C/N Lat<br>NE 1/4 of SE 1/4 of Section 36, T 35 N, R 12 E Long | ___ Feet ___ N ___ S ___ Feet ___ E ___ W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Nashville |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | 13" Ice 6.5' H2O. | | | | | | | | | | |
| | | | -- 2 | | | | | | | | | | | |
| | | | -- 4 | | | | | | | | | | | |
| | | | -- 6 | | | | | | | | | | | |
| SS-1 | 12 | 11/13<br>15/13 | -- | 6.5-9.3 Dk. brn. (10YR4/4) firm-v.firm, wet, med. text. sand w/minor silt, poorly graded. Lacustrine. | SP | | | | | | | | | |
| | | | -- 8 | | | | | | | | | | | |
| SS-2 | 24 | 13/12<br>11/11 | -- | 9.3-12 Grayish brn (2.5Y5/2) firm silty clayey fine sand. Lacustrine. | SM | | | | | | | | | |
| | | | -- 10 | | | | | | | | | | | |
| SS-3 | 12 | RW | -- | As above. | SM | | | | | | | | | |
| SS-4 | 24 | RW | -- 12 | 12-23 Dk. grey (2.5Y4/0) v. soft to soft wet clay w/silt. Occasional thin sand laminations (<1mm thick). Lacustrine. | CL | | | | | | | | | |
| SS-5 | 24 | 4/5<br>5/5 | -- 14 | Overdrilled 1' from 16-17 (no sample). | | | | | | | | | | |
| | | | -- | As above. | CL | | | | | | | | | |
| | | | -- 16 | | | | | | | | | | | |
| ST-6 | 30/30 | TWT | -- | 17-19.5 Shelby tube, dk. gray v. soft to soft clay top and bottom, 30"/30". | CL | | | | | | | | | |
| | | | -- 18 | | | | | | | | | | | |
| SS-7 | 24 | RW | -- 20 | As above grading to dk. brown (10YR3/3) clay w/thin sand lamination @ 21.5'. | CL | | | | | | | | | |
| SS-8 | 10/24 | 6/11<br>7/9 | -- 22 | 23-24.2 Brown (10YR3/3) wet stiff sandy clay. Mod. med. blocky. | CL/SC | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Steph H Wood

Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-LSL-104B

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | P200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 24 | 24.2+ Dk. brn (10YR3/4) wet firm med. text. sand. poorly graded, w/gravel (10%). Outwash sands w/gravel. | SP/ SM | | | | | | | | | |
| | | | 26 | | | | | | | | | | | |
| | | | 28 | E.O.B. @ 28'. | | | | | | | | | | |
| | | | | Mud containing 12 lbs. bentonite/75 gal. H2O. Could not keep hole open beyond ~25'. Well set @ this point. Mud disposed in sump pit @ mine site. Protective casing driven to 15'. | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-LSL-105 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Jeff Flamidio | 02/15/94<br>MM/DD/YY | 02/15/94<br>MM/DD/YY | 4" I.D.<br>Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | NA | NA | 1592.1 | 4.25" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 110,284.7N, 2,276,504.7E S/C/N<br>NW 1/4 of NW 1/4 of Section 6, T 34 N, R 13E Lat Long | ___ Feet N/S ___ Feet E/W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | 0-16" Ice. | | | | | | | | | | |
| | | | -- | 16" - 2' Water. | | | | | | | | | | |
| SS1 | 10 | 1/1<br>1/1 | -- 2 | 2-3.9 Dark brown (7.5YR2/1) organic muck, roots, fibrous, wet, sticky. | OL | | | | | | | | | |
| SS2 | 18 | 2/3<br>4/3 | -- 4 | 3.9-5.6 Brown (10YR5/4) fine-med. sand with silt, wet, loose. Lacustrine. | SP | | | | | | | | | |
| ST3 | 20 | TWT | -- 6 | 5.6-12 Grey (2.5Y5/2) silty clay with organics, massive, wet, sticky. Lacustrine clay. | CL | | | | | | | | | |
| | | | -- | 20" no recovery. | | | | | | | | | | |
| SS4 | 22 | 1/1<br>1/1 | -- 8 | 8-10 As above, minor sand. | CL | | | | | | | | | |
| ST5 | 0 | TWT | -- 10 | 10-12 Push TWT 0" recovery. | CL | | | | | | | | | |
| ST6 | 14 | TWT | -- 12 | 12-14 Push TWT - could only push 10". 14" recovery tube tip bent at end of push. | CL<br>SP | | | | | | | | | |
| SS7 | 10 | 3/5<br>7/7 | -- 14 | ~13-17.8 Brown (10YR7/3) fine-med. sand with gravel, structureless, wet, loose. Outwash sands with gravel. | SP | | | | | | | | | |
| SS8 | 16 | 6/8<br>7/6 | -- 16 | | | | | | | | | | | |
| SS9 | 20 | 18/22<br>19/23 | -- 18 | 17.8-18.2 Brown (10YR7/3) fine sand, structureless, wet, loose.<br>18.2-20 Brown (10YR7/3) fine-med. sand with gravel, structureless, wet, loose. | SP<br>SP | | | | | | | | | |
| | | | -- 20 | E.O.B. @ 20'. | | | | | | | | | | |
| | | | -- 22 | 3 bags hole plug.<br>Cuttings disposed in mud sump pits at mine site. | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Steph K Wand

Firm: Foth & Van Dyke

This form is authorized by Chapters 144.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources

# WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Form 3300-5W 11-89

All abandonment work shall be performed in accordance with the provisions of Chapters NR 111, NR 112 or NR 141, Wis. Admin. Code, whichever is applicable. Also, see instructions on back.

## (1) GENERAL INFORMATION

Well/Drillhole/Borehole Location

County: Forest

NW 1/4 of NW 1/4 of Sec. 6 ; T. 34 N; R. 13 [X] E [ ] W

(If applicable) Gov't Lot _____ Grid Number _____

Grid Location: 110,284.7ft. [X] N. [ ] S., 2,276,504.7ft. [X] E. [ ] W.

Civil Town Name: Lincoln

Street Address of Well: Little Sand Lake

City, Village: NA

## (2) FACILITY NAME

Original Well Owner (If Known): Crandon Mining Company

Present Well Owner: Crandon Mining Company

Street or Route: 7 North Brown Street

City, State, Zip Code: Rhinelander, WI 54501-0856

Facility Well No. and/or Name (If Applicable): CMC-LSL-105

WI Unique Well No.: _ _ _ _ _ _

Reason For Abandonment: Completion

Date of Abandonment: 02/15/94

## WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drillhole/Borehole Construction Completed On

(Date) 02/15/94

[ ] Monitoring Well
[ ] Water Well
[ ] Drillhole
[X] Borehole

Construction Report Available? [ ] Yes [ ] No

Construction Type:
[X] Drilled [ ] Driven (Sandpoint) [ ] Dug
[ ] Other (Specify) _____

Formation Type:
[X] Unconsolidated Formation [ ] Bedrock

Total Well Depth (ft.) 20' Casing Diameter (ins.) 4"
(From groundsurface)

Casing Depth (ft.) 14

Was Well Annular Space Grouted? [ ] Yes [ ] No [ ] Unknown
If Yes, To What Depth? _____ Feet

(4) Depth to Water (Feet) 0

| | | | |
|---|---|---|---|
| Pump & Piping Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Liner(s) Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Screen Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Casing Left in Place? | [ ] Yes | [X] No | |

If No, Explain: Removed

| | | |
|---|---|---|
| Was Casing Cut Off Below Surface? | [ ] Yes | [X] No |
| Did Sealing Material Rise to Surface? | [ ] Yes | [X] No |
| Did Material Settle After 24 Hours? | [ ] Yes | [X] No |
| If Yes, Was Hole Retopped? | [ ] Yes | [ ] No |

(5) Required Method of Placing Sealing Material
[X] Conductor Pipe-Gravity [ ] Conductor Pipe-Pumped
[ ] Dump Bailer [ ] Other (Explain)

(6) Sealing Materials
[ ] Neat Cement Grout
[ ] Sand-Cement (Concrete) Grout
[ ] Concrete
[ ] Clay-Sand Slurry
[ ] Bentonite-Sand Slurry
[X] Chipped Bentonite

For monitoring wells and monitoring well boreholes only
[ ] Bentonite Pellets
[ ] Granular Bentonite
[ ] Bentonite - Cement Grout

| (7) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks Sealant or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| 3/8" holeplug chipped bentonite | Surface | 19' | 3 bags | |
| | | | | |
| | | | | |
| | | | | |

(8) Comments: _____

(9) Name of Person or Firm Doing Sealing Work: Jeff Flamino, WTD Environmental Drilling

Signature of Person Doing Work: Jeff Flamino (5/10) Date Signed: 3-1-94

Street or Route: 101 Alderson Street Telephone Number: (715) 359-7090

City, State, Zip Code: Schofield, WI 54476

(10) FOR DNR OR COUNTY USE ONLY

Date Received/Inspected | District/County

Reviewer/Inspector

Follow-up Necessary

3.5-10-16

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-SL-103A |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc. | 02/07/94<br>MM/DD/YY | 02/08/94<br>MM/DD/YY | 4.25" I.D.<br>Hollow-Stem Auger |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | CMC-SL-103A | 7.87 | 1599.2 | 8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 117,856.6 N, 2,281,146.9 E S/C/N<br>1/4 of SE 1/4 of Section 30, T 35 N, R 13 E Lat Long | ___ Feet N/S ___ Feet E/W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS-1 | 12 | 16/14<br>9/10 | 2 | 2-4 Lt. brownish grey (2.5Y6/2) greenish clay w/tr. of sand, stiff. Ice contact deposit to E.O.B. | CL | | | | | | | | | |
| SS-2 | 16 | 14/13<br>8/14 | 4 | 4-5.2 Greyish green clayey sand w/tr. of gravel, wet. | SC | | | | | | | | | |
| | | | | 5.2-8 Olive grey (10YR4/1) sandy clay. | CL | | | | | | | | | |
| ST-3 | 24/24 | TWT | 6 | Shelby tube 6;-8'. Full recovery. | SC/SM | | | | | | | | | |
| SS-4 | 12 | 8/24<br>33/32 | 8 | 8-12 Brown-red brn. (10YR5/5) wet poorly graded. Med. text. sand dense-v. dense. | SP | | | | | | | | | |
| | | | 10 | | | | | | | | | | | |
| SS-5 | 14 | 16/9<br>16/23 | | As above. | SP | | | | | | | | | |
| | | | 12 | Heaving sands at 12'. 3-5' of blowup in augers- Augers removed and plug inserted. Redrilled to 30'. | | | | | | | | | | |
| | | | 14 | Well set @ ~28' w/5' screen. | | | | | | | | | | |
| | | | 16 | | | | | | | | | | | |
| | | | 18 | | | | | | | | | | | |
| | | | 20 | | | | | | | | | | | |
| | | | | E.O.B. @ 30'. | | | | | | | | | | |
| | | | 22 | Soil cuttings disposed in sump pits at mine site. | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

| Signature | Firm |
|---|---|
| Steve Wood | Foth & Van Dyke |

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources

Route to:
Solid Waste
Emergency Response
Wastewater
Haz. Waste
Underground Tanks
Water Resources
X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-SL-103B |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Dan Tinnacour | 02/08/94<br>MM/DD/YY | 02/08/94<br>MM/DD/YY | 4.25" I.D.<br>Hollow-Stem Auger |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | NA | NA | 1599.2 | 8" |

Boring Location Ten feet from CMC-SL-103A
State Plane ___ N, ____ E S/C/N Lat
1/4 of SW 1/4 of Section 30, T 35 N, R 13 E Long

Local Grid Location (if applicable)
____ Feet ___ N / S ____ Feet ___ E / W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2 | See CMC-SL-103A for log of shallow deposits. | | | | | | | | | | |
| | | | 4 | | | | | | | | | | | |
| | | | 6 | | | | | | | | | | | |
| | | | 8 | Soils could not be sampled from 12-20' due to running sands. | | | | | | | | | | |
| | | | 10 | | | | | | | | | | | |
| | | | 12 | | | | | | | | | | | |
| | | | 14 | | | | | | | | | | | |
| | | | 16 | | | | | | | | | | | |
| | | | 18 | | | | | | | | | | | |
| SS-1 | 20 | 4/2<br>7/13 | 20 | 20-22 V. Dk. gray (2.5Y3/0) silty clay w/tr. of sand, soft. Ice contact deposit to 29.8'. | CL | | | | | | | | | |
| SS-2 | 6 | 10/11<br>14/12 | 22 | 22-25 Brown (10YR5/4) clayey sand, v. firm, mod. med. blocky. | SC | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Steph. Wood

Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-SL-103B

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | P200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 24 | | | | | | | | | | | |
| SS-3 | 24 | 9/11<br>13/17 | | 25-28 Dk. grey clayey silt w/tr. of sand. | | | | | | | | | | |
| ST-4 | 21 | TWT | 26 | As above, Shelby tube, 26-28'. | CL | | | | | | | | | |
| SS-5 | 20 | 10/12<br>13/20 | 28 | 28-29.8 Dk. grey (10YR3/1) silty clay w/tr. of sand. | CL | | | | | | | | | |
| | | | | 29.8-30 Grayish brn (10YR4/2) fine-med. text. sand w/silt. Outwash sands with | SM | | | | | | | | | |
| SS-6 | 26 | 9/18<br>14/16 | 30 | gravel to E.O.B.<br>30-40 Grayish brown (10YR4/2) fine to med. text. sand w/tr. of gravel, grading to 15% gravel @ 36'. | SP | | | | | | | | | |
| SS-7 | 24 | 10/29<br>39/43 | 32 | | | | | | | | | | | |
| | | | | As above. | SP | | | | | | | | | |
| | | | 34 | | | | | | | | | | | |
| SS-8 | 20 | 53/32<br>29/10 | 36 | As above. | SP | | | | | | | | | |
| SS-9 | 12 | 65/36<br>76/26 | 38 | As above. | SP | | | | | | | | | |
| SS10 | 12 | 70/51<br>55/61 | 40 | As above. | SP/GP | | | | | | | | | |
| | | | 42 | | | | | | | | | | | |
| | | | 44 | | | | | | | | | | | |
| | | | 46 | | | | | | | | | | | |
| | | | 48 | | | | | | | | | | | |
| | | | 50 | | | | | | | | | | | |
| | | | | E.O.B. @ 50'. | | | | | | | | | | |
| | | | | Advanced augers to 50', 6' of blow-up.<br>Well can't be set.<br>Abandoned w/10 bags of holeplug.<br>Was blind drilled w/a plug on 2/9/94. | | | | | | | | | | |
| | | | | Reference log CMC-SL-103C. | | | | | | | | | | |
| | | | | Soil cuttings disposed in sump pits at mine site. | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

Form 3300-5W

11-89

All abandonment work shall be performed in accordance with the provisions of Chapters NR 111, NR 112 or NR 141, Wis. Admin. Code, whichever is applicable. Also, see instructions on back.

## (1) GENERAL INFORMATION

Well/Drillhole/Borehole Location

County: Forest

__ 1/4 of SE 1/4 of Sec. 30 ; T. 35 N; R. 13 [X] E [ ] W

(If applicable) Gov't Lot _____ Grid Number _____

Grid Location _____ ft. [ ] N. [ ] S., _____ ft. [ ] E. [ ] W.

Civil Town Name: Lincoln

Street Address of Well: Skunk Lake Wetland

City, Village: Lincoln

## (2) FACILITY NAME

Original Well Owner (If Known): Crandon Mining Company

Present Well Owner: Same as above

Street or Route: 7 North Brown Street

City, State, Zip Code: Rhinelander, WI 54501-0856

Facility Well No. and/or Name (If Applicable): CMC-SL-103B

WI Unique Well No.: _ _ _ _ _ _

Reason For Abandonment: Investigative Boring

Date of Abandonment: 02-09-94

## WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drillhole/Borehole Construction Completed On

(Date) 02-09-94

[ ] Monitoring Well
[ ] Water Well
[ ] Drillhole
[X] Borehole

Construction Report Available? [ ] Yes [ ] No

Construction Type:
[X] Drilled [ ] Driven (Sandpoint) [ ] Dug
[ ] Other (Specify) _____

Formation Type:
[X] Unconsolidated Formation [ ] Bedrock

Total Well Depth (ft.) 50 Casing Diameter (ins.) ____
(From groundsurface)

Casing Depth (ft.) NA

Was Well Annular Space Grouted? [ ] Yes [ ] No [ ] Unknown
If Yes, To What Depth? NA Feet

(4) Depth to Water (Feet) NA

| | | | |
|---|---|---|---|
| Pump & Piping Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Liner(s) Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Screen Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Casing Left in Place? | [ ] Yes | [ ] No | NA |

If No, Explain _____

| | | | |
|---|---|---|---|
| Was Casing Cut Off Below Surface? | [ ] Yes | [ ] No | NA |
| Did Sealing Material Rise to Surface? | [X] Yes | [ ] No | |
| Did Material Settle After 24 Hours? | [ ] Yes | [X] No | |
| If Yes, Was Hole Retopped? | [ ] Yes | [ ] No | NA |

(5) Required Method of Placing Sealing Material
[X] Conductor Pipe-Gravity [ ] Conductor Pipe-Pumped
[ ] Dump Bailer [ ] Other (Explain)

(6) Sealing Materials
[ ] Neat Cement Grout
[ ] Sand-Cement (Concrete) Grout
[ ] Concrete
[ ] Clay-Sand Slurry
[ ] Bentonite-Sand Slurry
[X] Chipped Bentonite

For monitoring wells and monitoring well boreholes only
[ ] Bentonite Pellets
[ ] Granular Bentonite
[ ] Bentonite - Cement Grout

(7)

| Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks Sealant or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| 3/8" Chipped Bentonite - Hole plug | Surface | 50 | 10 50 lb bags | |
| | | | | |
| | | | | |
| | | | | |

(8) Comments: _____

(9) Name of Person or Firm Doing Sealing Work: Dan Tinnacour WTD Environmental Drilling

Signature of Person Doing Work: Dan Tinnacour
Date Signed: 3-1-94
Street or Route: 101 Alderson St.
Telephone Number: ( 715) 359-7090
City, State, Zip Code: Schofield, WI 54115

(10) FOR DNR OR COUNTY USE ONLY

Date Received/Inspected
District/County
Reviewer/Inspector
Follow-up Necessary

DNR/COUNTY

3.5-10-20

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91

Page 1 of 1

| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-SL-103C |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc. | 02/09/94<br>MM/DD/YY | 02/09/94<br>MM/DD/YY | 4.25" I.D.<br>Hollow-Stem Auger |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | CMC-SL-103B | 18.5' | 1599.1 | 8" |

Boring Location
State Plane 117,848.7 N 2,281,133.9 E S/C/N Lat
1/4 of SE 1/4 of Section 30, T 35 N, R 13 E Long

Local Grid Location (if applicable)
___ Feet ___ N S ___ Feet ___ E W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2 | Blind drilled to 50'. | | | | | | | | | | |
| | | | | See CMC-SL-103A and CMC-SL-103B for log of lithology. | | | | | | | | | | |
| | | | 4 | | | | | | | | | | | |
| | | | 6 | Soil cuttings disposed in sump pits at mine site. | | | | | | | | | | |
| | | | 8 | | | | | | | | | | | |
| | | | 10 | | | | | | | | | | | |
| | | | 12 | | | | | | | | | | | |
| | | | 14 | | | | | | | | | | | |
| | | | 16 | | | | | | | | | | | |
| | | | 18 | | | | | | | | | | | |
| | | | 20 | | | | | | | | | | | |
| | | | 22 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature] Firm Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-SL-104 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Bill Zamow | 02/08/94<br>MM/DD/YY | 02/08/94<br>MM/DD/YY | 4.25" I.D.<br>Hollow-Stem Auger |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | NA | NA | 1598.5 | 8" |

Boring Location
State Plane 117,613.2 N 2,280,834.5 E S/C/N Lat
1/4 of SW 1/4 of Section 29, T 35 N, R 13 E Long

Local Grid Location (if applicable)
___ Feet ___ N ___ S ___ Feet ___ E ___ W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS-1 | 12 | 6/12<br>8/9 | -- | 0-4 Greyish green wet firm sandy clay. Ice contact deposits to 22'. | CL | | | | | | | | | |
| SS-2 | 12 | 4/3<br>5/7 | -- 2 | As above. | | | | | | | | | | |
| ST-3 | 30/30 | TWT | -- 4 | Shelby tube 4-6' full recovery. | SC/SM | | | | | | | | | |
| SS-4 | 20 | 11/11<br>13/16 | -- 6 | 6-8.8 Brown (10YR5/5) wet med. text. sand, v. firm, poorly graded. | SP | | | | | | | | | |
| SS-5 | 24 | 7/9<br>9/11 | -- 8 | 8.8-10 Brown wet sandy silt, platey. Firm-stiff. | ML | | | | | | | | | |
| SS-6 | 24 | 6/6<br>7/7 | -- 10 | 10-12.5 Grayish brn (10YR4/2), stiff, wet sandy clay w/tr. of gravel, grading to v.dk. grey (2.5Y3/0) silty clay w/ 1" sand seam @ 11.2'. | CL | | | | | | | | | |
| SS-7 | 24 | 4/1<br>1/1 | -- 12 | 12.5-16 Dk. grey (2.5Y3/0) clayey silty sand v. loose. | SM | | | | | | | | | |
| SS-8 | 20 | 1/1<br>2/2 | -- 14 | As above. | SM | | | | | | | | | |
| ST-9 | 30/30 | TWT | -- 16 | 16-19 Shelby tube 36"/36" full recovery. | CL/ML | | | | | | | | | |
| SS10 | 24 | 21/26<br>41/39 | -- 18<br>-- | 19-24 V. loose grey clayey sand, structureless. | SC | | | | | | | | | |
| | | | -- 20 | As above. | SC | | | | | | | | | |
| SS11 | 12 | 3/21<br>24/19 | -- 22 | As above. | SC | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Steph Wood Firm: Foth & Van Dyke

This form is authorized by chapters 114, 147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-SL-104

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | P200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS12 | 16 | 49/210<br>100/92 | 24 | 24- Grayish brown (10YR4/3) poorly graded med. coarse text. sand. Outwash. | SP | | | | | | | | | |
| SS13 | 16 | 21/50<br>54/61 | 26 | As above w/gravel. | SP/ GP | | | | | | | | | |
| SS14 | 16 | 14/7<br>15/17 | 28 | As above w/gravel. | SP/ GP | | | | | | | | | |
| SS15 | 12 | 50/42<br>39/56 | 30 | As above. | SP/ GP | | | | | | | | | |
| SS16 | 10 | 36/53<br>102/94 | 32 | As above. | SP/ GP | | | | | | | | | |
| SS17 | 3 | 100<br>100/.2 | 34 | As above. | SW/ SM | | | | | | | | | |
| | | | 36 | E.O.B. 36'. | | | | | | | | | | |
| | | | | Augers siezing @ 36', end of boring. | | | | | | | | | | |
| | | | | Abandoned w/10 50-lb. bags of holeplug. | | | | | | | | | | |
| | | | | Soil cuttings disposed in sump pits at mine site. | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

Form 3300-5W

11-89

All abandonment work shall be performed in accordance with the provisions of Chapters NR 111, NR 112 or NR 141, Wis. Admin. Code, whichever is applicable. Also, see instructions on back.

## (1) GENERAL INFORMATION

Well/Drillhole/Borehole Location

County: Forest

___ 1/4 of SE 1/4 of Sec. 30 ; T. 35 N; R. 13 [X] E [ ] W

(If applicable) ____ Gov't Lot ____ Grid Number

Grid Location ____ ft. [ ] N. [ ] S., ____ ft. [ ] E. [ ] W.

Civil Town Name: Lincoln

Street Address of Well: Skunk Lake Wetland

City, Village: Lincoln

## (2) FACILITY NAME

Original Well Owner (If Known): Crandon Mining Company

Present Well Owner: Crandon Mining Company

Street or Route: 7 North Brown Street

City, State, Zip Code: Rhinelander, WI 54501-0856

Facility Well No. and/or Name (If Applicable): CMC-SL-104

WI Unique Well No.: _ _ _ _ _ _

Reason For Abandonment: Investigative Boring

Date of Abandonment: 02-08-94

## WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drillhole/Borehole Construction Completed On

(Date) 02-08-94

[ ] Monitoring Well
[ ] Water Well
[ ] Drillhole
[X] Borehole

Construction Report Available? [ ] Yes [ ] No

Construction Type:
[X] Drilled [ ] Driven (Sandpoint) [ ] Dug
[ ] Other (Specify) ____

Formation Type:
[X] Unconsolidated Formation [ ] Bedrock

Total Well Depth (ft.) 36 Casing Diameter (ins.) ____
(From groundsurface)

Casing Depth (ft.) NA

Was Well Annular Space Grouted? [ ] Yes [ ] No [ ] Unknown
If Yes, To What Depth? ____ Feet

(4) Depth to Water (Feet) NA

| | | | |
|---|---|---|---|
| Pump & Piping Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Liner(s) Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Screen Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Casing Left in Place? | [ ] Yes | [ ] No | NA |

If No, Explain ____

| | | | |
|---|---|---|---|
| Was Casing Cut Off Below Surface? | [ ] Yes | [ ] No | NA |
| Did Sealing Material Rise to Surface? | [X] Yes | [ ] No | |
| Did Material Settle After 24 Hours? | [ ] Yes | [X] No | |
| If Yes, Was Hole Retopped? | [ ] Yes | [ ] No | NA |

(5) Required Method of Placing Sealing Material
[X] Conductor Pipe-Gravity [ ] Conductor Pipe-Pumped
[ ] Dump Bailer [ ] Other (Explain)

(6) Sealing Materials
[ ] Neat Cement Grout
[ ] Sand-Cement (Concrete) Grout
[ ] Concrete
[ ] Clay-Sand Slurry
[ ] Bentonite-Sand Slurry
[X] Chipped Bentonite

For monitoring wells and monitoring well boreholes only
[ ] Bentonite Pellets
[ ] Granular Bentonite
[ ] Bentonite - Cement Grout

| (7) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks Sealant or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| 3/8" Chipped Bentonite - Hole plug | Surface | 36 | 10 50 lb bags | |
| | | | | |
| | | | | |
| | | | | |

(8) Comments: ____

(9) Name of Person or Firm Doing Sealing Work
Bill Zamow WTD Environmental Drilling

Signature of Person Doing Work: Bill Zamow SVD
Date Signed: 3-1-94

Street or Route: 101 Alderson St.
Telephone Number: (715) 359-7090

City, State, Zip Code: Schofield, WI 54476

(10) FOR DNR OR COUNTY USE ONLY

Date Received/Inspected | District/County

Reviewer/Inspector

Follow-up Necessary

DNR/COUNTY

State of Wisconsin
Department of Natural Resources

Route to:
Solid Waste
Emergency Response
Wastewater
Haz. Waste
Underground Tanks
Water Resources
X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-DL-103A |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Chuck Blunt | 02/11/94<br>MM/DD/YY | 02/11/94<br>MM/DD/YY | 4.25" I.D.<br>Hollow-Stem Auger |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | CMC-DL-103A | Dry | 1613.6 | 8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 113,334.6 N, 2,281,957.0 E S/C/N<br>SE 1/4 of NE 1/4 of Section 31, T 35 N, R 13 E | Lat<br>Long<br>Feet ___ N S Feet ___ E W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | Blind drill reference CMC-DL-103B log. | | | | | | | | | | |
| | | | -- 2 | | | | | | | | | | | |
| | | | -- 4 | | | | | | | | | | | |
| 1 | 21 | 8/10<br>15/12 | -- 6 | 5-6.1 Brown (7.5YR5/4) silty clay with sand, massive, wet, sticky.<br>6.1-7 Brown (7.5YR5/4) silty sand, structureless, wet, loose. Till. | SC/SM<br>SP | | | | | | | | | |
| | | | -- 8 | | | | | | | | | | | |
| | | | -- 10 | E.O.B. @ 9'. | | | | | | | | | | |
| | | | -- 12 | Soil cuttings disposed in sump pits at mine site. | | | | | | | | | | |
| | | | -- 14 | | | | | | | | | | | |
| | | | -- 16 | | | | | | | | | | | |
| | | | -- 18 | | | | | | | | | | | |
| | | | -- 20 | | | | | | | | | | | |
| | | | -- 22 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Steve Wood

Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-DL-103B |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Chuck Blunt | 02/11/94<br>MM/DD/YY | 02/11/94<br>MM/DD/YY | 4.25" I.D.<br>Hollow-Stem Auger |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | CMC-DL-103B | 18.0 | 1613.6 | 8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 113,333.3 N, 2,281,954.3 E S/C/N Lat<br>SE 1/4 of NE 1/4 of Section 31, T 35 N, R 13 E Long | ___ N Feet ___ S ___ E Feet ___ W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS1 | 17 | 3/6<br>9/11 | -- | 0-.4 Dk. brown (10YR2/2) organic silt, frozen. | OL | | | | | | | | | |
| | | | -- | .4-2 Brown (7.5YR5/6) sandy silt, frozen. | ML/SM | | | | | | | | | |
| SS2 | 18 | 2/3<br>3/2 | -- 2 | 2-6.4 Brown (7.5YR6/6) sandy clay to clayey sand, minor gravel, massive, wet, soft. Till. | CL/SC | | | | | | | | | |
| SS3 | 24 | Push | -- 4 | 4-6 Push TWT. | | | | | | | | | | |
| SS4 | 14 | 4/5<br>5/6 | -- 6 | 6.4-21 Brown (7.5YR5/5) fine-med. sand with silt, structureless, wet, loose. | SP | | | | | | | | | |
| SS5 | 14 | 1/2<br>4/5 | -- 8 | As above. | SP | | | | | | | | | |
| SS6 | 15 | 2/5<br>5/7 | -- 10 | As above, damp-wet silt lense.<br>10-10.4 Damp. | SP | | | | | | | | | |
| SS7 | 20 | 2/2<br>3/5 | -- 12 | As above. | SP | | | | | | | | | |
| SS8 | 20 | 2/3<br>3/2 | -- 14 | As above. | SP | | | | | | | | | |
| SS9 | 22 | 4/7<br>7/4 | -- 16 | As above with minor silt, compact. | SP | | | | | | | | | |
| SS10 | 20 | 6/6<br>9/11 | -- 18 | As above, wet. | SP | | | | | | | | | |
| SS11 | 18 | 5/10<br>10/11 | -- 20 | As above.<br>21 - Brown (7.5YR5/4) silty fine sand, massive, wet, soft. Outwash. | SM | | | | | | | | | |
| SS12 | 22 | 10/11<br>11/13 | -- 22 | As above. | SM | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Steve Wood

Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-DL-103B

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | Soil Properties: mois cont | Soil Properties: liqu limi | Soil Properties: plas limi | Soil Properties: P200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS13 | 24 | 6/6<br>7/7 | 24 | As above, slightly more sand. | SP/<br>SM | | | | | | | | | |
| SS14 | 22 | 10/10<br>13/15 | 26 | As above. | SP/<br>SM | | | | | | | | | |
| SS15 | 24 | 10/13<br>22/35 | 28 | As above. | SP/<br>SM | | | | | | | | | |
| SS16 | 24 | --<br>11/11 | 30 | As above, more sand. | SP/<br>SM | | | | | | | | | |
| SS17 | 22 | 9/9<br>13/5 | 32 | Brown (7.5YR5/4) fine-medium sand, structureless, wet, loose. | SP | | | | | | | | | |
| SS18 | 8 | 11/7<br>9/14 | 34 | As above. | SP | | | | | | | | | |
| | | | | Made 3 attempts to pound out 5-7 feet of blowup to sample. Could not pound out blowup. | | | | | | | | | | |
| | | | 36 | E.O.B. @ 36.5'. | — | | | | | | | | | |
| | | | 38 | Soil cuttings disposed in sump pits at mine site. | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-DL-103C |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Chuck Blunt | 02/08/94<br>MM/DD/YY | 02/09/94<br>MM/DD/YY | 4.25" I.D.<br>Hollow-Stem Auger |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | N/A | N/A | 1611.8 | 8" |

Boring Location
State Plane 113,207.7 N, 2,281,788.4 E S/C/N Lat
NE 1/4 of SE 1/4 of Section 31, T 35 N, R 13 E Long

Local Grid Location (if applicable)
Feet — N S Feet — E W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS1 | 10 | 0/0<br>1/1 | -- | 0-4.8 Brown (10YR6/6) organic mat. bog frozen to 1.5. | FB | | | | | | | | | |
| SS2 | 0 | 1 | -- 2 | | | | | | | | | | | |
| SS3 | 12 | 1 | -- 4 | 4.8-6.2 Brown (10YR3/3) organic mat. with sand, wet, loose. Ice contact deposit to 23.4'. | OL | | | | | | | | | |
| SS4 | 18 | 1/1<br>1 | -- 6 | 6.2-8 Grey (2.5Y6/2) clayey sand, structureless, wet, sticky. | SC | | | | | | | | | |
| SS5 | 19 | 1/1<br>1/6 | -- 8 | 8-23.4 Grey (2.5Y5/2) firm sand, structureless, wet, loose. | SP | | | | | | | | | |
| SS6 | 22 | 5/9<br>11/7 | -- 10 | As above. | SP | | | | | | | | | |
| SS7 | 13 | 4/4<br>5/4 | -- 12 | As above. | SP | | | | | | | | | |
| SS8 | 13 | 6/4<br>4/3 | -- 14 | As above. | SP | | | | | | | | | |
| SS9 | 22 | 1/2<br>1/3 | -- 16 | As above. | SP | | | | | | | | | |
| SS10 | 18 | 3/2<br>3/4 | -- 18 | As above. | SP | | | | | | | | | |
| SS11 | 16 | 5/6<br>7/7 | -- 20 | As above. | SP | | | | | | | | | |
| SS12 | 0 | 1/1<br>1/2 | -- 22 | As above. | SP | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Stephen H Wood

Firm: Foth & Van Dyke

This form is authorized by Chapters 144, 147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-DL-103C

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | P200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | 23.4 Grey (10YR5/3) silty clay, structureless, wet, sticky. | CL | | | | | | | | | |
| | 0 | TWT | -- 24 | Push TWT 24-26, no recovery. | | | | | | | | | | |
| | 0 | TWT | -- 26 | Push TWT 26-28, no recovery. | | | | | | | | | | |
| | | | -- 28 | 10' blowup - redrill 2/9/94 to 28'. Abandon through augers and move to redrill at CMC-SL-103B and A. | | | | | | | | | | |
| | | | | E.O.B. @ 28'. 8.5 bags holeplug. | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

# WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Form 3300-5W 11-89

All abandonment work shall be performed in accordance with the provisions of Chapters NR 111, NR 112 or NR 141, Wis. Admin. Code, whichever is applicable. Also, see instructions on back.

## (1) GENERAL INFORMATION

Well/Drillhole/Borehole Location

County: Forest

SE 1/4 of NE 1/4 of Sec. 31 ; T. 35 N; R. 13 [X] E [ ] W

(If applicable) Gov't Lot ____ Grid Number ____

Grid Location ____ ft. [ ] N. [ ] S., ____ ft. [ ] E. [ ] W.

Civil Town Name: Lincoln

Street Address of Well: Duck Lake Wetland

City, Village:

## (2) FACILITY NAME

Original Well Owner (If Known): Crandon Mining Company

Present Well Owner: Crandon Mining Company

Street or Route: 7 North Brown Street

City, State, Zip Code: Rhinelander, WI 54501-0856

Facility Well No. and/or Name (If Applicable): CMC-DL-103C

WI Unique Well No.: _ _ _ _ _ _

Reason For Abandonment: Completion

Date of Abandonment: 02/09/94

## WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drillhole/Borehole Construction Completed On

(Date) 02/09/94

[ ] Monitoring Well
[ ] Water Well
[ ] Drillhole
[X] Borehole

Construction Report Available? [ ] Yes [ ] No

Construction Type:
[X] Drilled [ ] Driven (Sandpoint) [ ] Dug
[ ] Other (Specify)

Formation Type:
[X] Unconsolidated Formation [ ] Bedrock

Total Well Depth (ft.) 28 (From groundsurface) Casing Diameter (ins.) ____

Casing Depth (ft.) ____

Was Well Annular Space Grouted? [ ] Yes [ ] No [ ] Unknown
If Yes, To What Depth? ____ Feet

(4) Depth to Water (Feet) 1

| | | | |
|---|---|---|---|
| Pump & Piping Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Liner(s) Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Screen Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Casing Left in Place? | [ ] Yes | [ ] No | |

If No, Explain ____

| | | |
|---|---|---|
| Was Casing Cut Off Below Surface? | [ ] Yes | [X] No |
| Did Sealing Material Rise to Surface? | [ ] Yes | [X] No |
| Did Material Settle After 24 Hours? | [ ] Yes | [X] No |
| If Yes, Was Hole Retopped? | [ ] Yes | [ ] No |

(5) Required Method of Placing Sealing Material
[X] Conductor Pipe-Gravity [ ] Conductor Pipe-Pumped
[ ] Dump Bailer [ ] Other (Explain)

(6) Sealing Materials
[ ] Neat Cement Grout
[ ] Sand-Cement (Concrete) Grout
[ ] Concrete
[ ] Clay-Sand Slurry
[ ] Bentonite-Sand Slurry
[X] Chipped Bentonite

For monitoring wells and monitoring well boreholes only
[ ] Bentonite Pellets
[ ] Granular Bentonite
[ ] Bentonite - Cement Grout

| (7) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks Sealant or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| 3/8" Hole Plug Chipped Bentonite | Surface | 28 | 8.5 | |
| | | | | |
| | | | | |
| | | | | |

(8) Comments:

(9) Name of Person or Firm Doing Sealing Work
Chuck Blunt, WTD Drilling

Signature of Person Doing Work: Chuck Blunt SVD
Date Signed: 3-1-94

Street or Route: 101 Alderson Street
Telephone Number: (715) 359-7090

City, State, Zip Code: Schofield, WI 54476

(10) FOR DNR OR COUNTY USE ONLY

Date Received/Inspected
District/County
Reviewer/Inspector
Follow-up Necessary

3.5-10-30

State of Wisconsin
Department of Natural Resources

Route to:
Solid Waste
Emergency Response
Wastewater
Haz. Waste
Underground Tanks
Water Resources
X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-BO-101A |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Dan Tinnacour | 02/07/94<br>MM/DD/YY | 02/07/94<br>MM/DD/YY | 4.25" I.D.<br>Hollow-Stem Auger |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | CMC-BO-101A | 12.47 | 1637.3 | 8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 117,361.6' N, 2,283,366.9' E S/C/N<br>1/4 of SW 1/4 of Section 29, T 35 N, R 13 E Lat Long | Feet ___ N S Feet ___ E W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2 | Blind drilled to 14'.<br>See CMC-BO-101B for log. | | | | | | | | | | |
| | | | 4 | | | | | | | | | | | |
| | | | 6 | | | | | | | | | | | |
| | | | 8 | | | | | | | | | | | |
| | | | 10 | | | | | | | | | | | |
| | | | 12 | | | | | | | | | | | |
| SS-1 | 16 | 6/10<br>22/26 | 14 | 14-16 Brown (10YR4/4) wet very stiff silty clay, lacustrine. | CL | | | | | | | | | |
| | | | 16 | E.O.B. @ 16'. | | | | | | | | | | |
| | | | 18 | Soil cuttings disposed in sump pits at mine site. | | | | | | | | | | |
| | | | 20 | | | | | | | | | | | |
| | | | 22 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Stanley K Wood

Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources

Route to:
Solid Waste
Emergency Response
Wastewater
Haz. Waste
Underground Tanks
Water Resources
X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-BO-101B |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc. | 01/31/94<br>MM/DD/YY | 02/01/94<br>MM/DD/YY | 4.25" I.D.<br>Hollow-Stem Auger |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | CMC-BO-101B | Dry | 1637.3 | 8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 117,357.6 N, 2,283,369.6 E S/C/N Lat<br>1/4 of SW 1/4 of Section 29, T 35 N, R 13 E Long | Feet ___ N S Feet ___ E W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS-1 | 24 | 62/15<br>18/25 | -- | 0-1 Dk yellowish brown (10YR3/4) frozen clayey silty sand w. ab. roots. 7.5YR5/8 moist silty fine grained sand w/tr. gravel. | SC | | | | | | | | | |
| SS-2 | 24 | 16/21<br>17/17 | -- 2 | 2-6 Reddish brown to grey mottled fine sandy clay - moist to wet (10YR6/2). | CL | | | | | | | | | |
| ST-3 | 20/20 | TWT | -- 4 | 4-6 Shelby tube. | SC/SM | | | | | | | | | |
| SS-4 | 18 | 8/20<br>30/24 | -- 6 | 6-11.2 Reddish brown (10YR6/2) poorly graded sand, fine to medium, moist-wet. Lacustrine. | SP | | | | | | | | | |
| SS-5 | 16 | 8/20<br>30/48 | -- 8 | | | | | | | | | | | |
| SS-6 | 16 | 15/18<br>18/20 | -- 10 | | | | | | | | | | | |
| | | | -- | 11.2-17.2 Reddish brown (7.5YR4/6) stiff clayey silt wet blocky structure | ML | | | | | | | | | |
| ST-7 | 30/30 | TWT | -- 12 | lacustrine. | | | | | | | | | | |
| | | | -- | Shelby tube 30"/30" full recovery. | CL | | | | | | | | | |
| SS-8 | 22 | 9/15<br>19/22 | -- 14 | As above. | CL | | | | | | | | | |
| SS-9 | 22 | 16/21<br>100 | -- 16 | | | | | | | | | | | |
| | | | -- | 17.2-18 Brown (10YR4/4) very firm clay sand med. text w/10-15% gravel till. | SC | | | | | | | | | |
| SS10 | 24 | 76/29<br>34/52 | -- 18 | 18-20 Brown very stiff wet silty clay w/trace of sand, spoon resistance @ 20.5. Lacustrine. | CL | | | | | | | | | |
| SS11 | 12 | 47/<br>100.4 | -- 20 | 20-22 Brown (10YR4/4) clayey sand grading to poorly gr. sand w/gravel moist-wet @ 20.5'. Outwash sands with gravel. | SP/GP | | | | | | | | | |
| SS12 | 16 | 70/50<br>30/41 | -- 22 | 22-24 Very dense reddish brn (7.5YR4/4) silty sand w/grv 10% moist. Outwash sands with gravel. | SM | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Steve Wandt

Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-BO-101B

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | P200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS13 | 3 | 100/ 0.4 | 24 | No recovery - rock. | | | | | | | | | | |
| SS14 | 12 | 45/51 39/62 | 26 | 26-40 Poorly graded sand lt. br. (10YR6/6) w/grvl, 10%, very moist. Outwash sands w/gravel. | SP | | | | | | | | | |
| | | | 28 | | | | | | | | | | | |
| SS15 | 10 | 50/ 100.4 | | Yellowish brown poorly graded med. text sand (10YR6/6), tr. of gr. moist-wet. | SP | | | | | | | | | |
| | | | 30 | Outwash sands w/gravel. | | | | | | | | | | |
| SS16 | 10 | 100/.4 | | As above, moist. | SP | | | | | | | | | |
| | | | 32 | | | | | | | | | | | |
| | | | | As above, moist. | SP | | | | | | | | | |
| SS17 | 6 | 100/.4 | 34 | | | | | | | | | | | |
| | | | | As above, moist. | SP | | | | | | | | | |
| SS18 | 6 | 100/.4 | 36 | | | | | | | | | | | |
| | | | | As above. | SP | | | | | | | | | |
| SS19 | 6 | 100/.4 | 38 | | | | | | | | | | | |
| | | | 40 | | | | | | | | | | | |
| | | | 42 | E.O.B. @ 41.5'. | | | | | | | | | | |
| | | | | Soil cuttings disposed in sump pits at mine site. | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

Route to:
Solid Waste
Emergency Response
Wastewater
Haz. Waste
Underground Tanks
Water Resources
X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-BO-102 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Bill Zamow | 01/31/94<br>MM/DD/YY | 02/07/94<br>MM/DD/YY | 4.25" I.D.<br>Hollow-Stem Auger |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | NA | NA | 1636.3 | 8" |

Boring Location
State Plane 117,942.1 N, 2,283,283.6 E S/C/N
1/4 of SW 1/4 of Section 29, T 35 N, R 13 E
Lat
Long

Local Grid Location (if applicable)
Feet ___ N S Feet ___ E W

County: Forest
DNR County Code: 21
Civil Town/City/or Village: Lincoln

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS-1 | 12 | 7/7<br>5/6 | -- | 0-2 Grayish brown (10YR5/2) clayey silty sand w/aband roots, grading to 10YR4/4 dk. brown. | SC | | | | | | | | | |
| SS-2 | 18 | 50/26<br>50/50 | -- 2 | 2-5.1 Red-brown (7.5YR4/4) moist-wet poorly graded sand. Till. | SP | | | | | | | | | |
| SS-3 | 18 | 20/22<br>23/24 | -- 4 | 5.1-6 Brown (10YR4/4) silty sand. Till. | SM | | | | | | | | | |
| SS-4 | 19 | 10/6<br>8/10 | -- 6 | 6-7.2 Brown (7.5YR5/4) silty sand with clay, massive, damp, firm. Till. | SM | | | | | | | | | |
| | | | | 7.2-7.4 Brown (7.5YR7/3) fine sand, structureless, loose-damp. Till. | SP | | | | | | | | | |
| SS-5 | 19 | 4/6<br>10/11 | -- 8 | 7.2-9 Brown (10YR5/4) silty sand with clay, massive, damp, wet at 8'. Till. | SM | | | | | | | | | |
| | | | | 9-9.6 Brown (10YR5/4) med. sand with silt, structureless, wet, soft. Till. | SP/SM | | | | | | | | | |
| SS-6 | 8 | 16/20<br>26/50 | -- 10 | 9.6-10.7 Brown (10YR5/4) clayey silt, massive, wet, sticky. Till. | ML | | | | | | | | | |
| | | | | 10.7-12 Brown (7.5YR5/5) med.-coarse sand, structureless, damp, loose. Till. | SP | | | | | | | | | |
| SS-7 | 9 | 16/20<br>8/21 | -- 12 | 12-18 Brown (7.5YR4/4) silty sand with gravel, massive, very damp, sl. firm. Till. | SM | | | | | | | | | |
| SS-8 | 10 | 10/15<br>20/22 | -- 14 | 14-16 As above, wet. Till. | SM | | | | | | | | | |
| SS-9 | 10 | 20/50<br>100f.3 | -- 16 | As above. | SC | | | | | | | | | |
| SS10 | 10 | 18/20<br>24/36 | -- 18 | As above, wet. Till. | SM | | | | | | | | | |
| SS11 | 0 | 100<br>f.1 | -- 20 | No recovery. | | | | | | | | | | |
| SS12 | 0 | 100<br>f.1 | -- 22 | No recovery. | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-BO-102

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties Std pen | mois cont | liqu limi | plas limi | P200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS13 | 0 | 100 f.1 | 24 | No recovery - red quartzite rock. | | | | | | | | | | |
| SS14 | 0 | 100/ 2" | 26 | No recovery as above. | | | | | | | | | | |
| SS15 | 6 | 93/100 f.1 | 28 | 28-30 Reddish brown (10YR5/6), moist, very dense clayey silty sand w/gravel 5% till. | SM | | | | | | | | | |
| | | 100 f.1 | 30 | No recovery. | | | | | | | | | | |
| | | 100 f.1 | 32 | No recovery. | | | | | | | | | | |
| | | 100 f.1 | 34 | No recovery. | | | | | | | | | | |
| SS16 | 6 | 81/100 f.1 | 36 | 36-40 Lite reddish brown (10YR5/6) damp fine sand, outwash poorly graded. | SM | | | | | | | | | |
| SS17 | 6 | 89/100 f.1 | 38 | As above. | | | | | | | | | | |
| | | | | | SP | | | | | | | | | |
| | | | 40 | E.O.B. @ 40'. | | | | | | | | | | |
| | | | | Abandon w/12 50-lb. bags of holeplug. | | | | | | | | | | |
| | | | | Drill cuttings disposed in sump pits at mine site. | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

WELL/DRILLHOLE/BOREHOLE
Form 3300-5W

11-89

All abandonment work shall be performed in accordance with the provisions of Chapters NR 111, NR 112 or NR 141, Wis. Admin. Code, whichever is applicable. Also, see instructions on back.

## (1) GENERAL INFORMATION

Well/Drillhole/Borehole Location

County: Forest

___ 1/4 of SW 1/4 of Sec. 29 ; T. 35 N; R. 13 [X] E [ ] W

(If applicable) ____ Gov't Lot ____ Grid Number

Grid Location ____ ft. [ ] N. [ ] S., ____ ft. [ ] E. [ ] W.

Civil Town Name: Lincoln

Street Address of Well: Burr Oak Swamp

City, Village: Lincoln

## (2) FACILITY NAME

Original Well Owner (If Known): Crandon Mining Company

Present Well Owner: Crandon Mining Company

Street or Route: 7 North Brown Street

City, State, Zip Code: Rhinelander, WI 54501-0856

Facility Well No. and/or Name (If Applicable): CMC-BO-102

WI Unique Well No.: _ _ _ _ _ _

Reason For Abandonment: Investigative Boring

Date of Abandonment: 02-07-94

## WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drillhole/Borehole Construction Completed On

(Date) 02-07-94

[ ] Monitoring Well
[ ] Water Well
[ ] Drillhole
[X] Borehole

Construction Report Available? [ ] Yes [ ] No

Construction Type:
[X] Drilled [ ] Driven (Sandpoint) [ ] Dug
[ ] Other (Specify)

Formation Type:
[X] Unconsolidated Formation [ ] Bedrock

Total Well Depth (ft.) 46 (From groundsurface) Casing Diameter (ins.) ____

C g Depth (ft.) NA

Was Well Annular Space Grouted? [ ] Yes [ ] No [ ] Unknown
If Yes, To What Depth? NA Feet

(4) Depth to Water (Feet) NA

| | | | |
|---|---|---|---|
| Pump & Piping Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Liner(s) Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Screen Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Casing Left in Place? | [ ] Yes | [ ] No | NA |

If No, Explain ____

| | | | |
|---|---|---|---|
| Was Casing Cut Off Below Surface? | [ ] Yes | [ ] No | NA |
| Did Sealing Material Rise to Surface? | [X] Yes | [ ] No | |
| Did Material Settle After 24 Hours? | [ ] Yes | [X] No | |
| If Yes, Was Hole Retopped? | [ ] Yes | [ ] No | NA |

(5) Required Method of Placing Sealing Material
[X] Conductor Pipe-Gravity [ ] Conductor Pipe-Pumped
[ ] Dump Bailer [ ] Other (Explain)

(6) Sealing Materials
[ ] Neat Cement Grout
[ ] Sand-Cement (Concrete) Grout
[ ] Concrete
[ ] Clay-Sand Slurry
[ ] Bentonite-Sand Slurry
[X] Chipped Bentonite

For monitoring wells and monitoring well boreholes only
[ ] Bentonite Pellets
[ ] Granular Bentonite
[ ] Bentonite - Cement Grout

| (7) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks Sealant or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| 3/8" Chipped Bentonite - Hole plug | Surface | 40 | 12 50 lb bags | |
| | | | | |
| | | | | |
| | | | | |

(8) Comments: ____

(9) Name of Person or Firm Doing Sealing Work
Bill Zamow WTD Environmental Drilling

Signature of Person Doing Work: Bill Zamow (Sub) — Date Signed: 3-1-94

Street or Route: 101 Alderson Street — Telephone Number: (715) 359-7090

City, State, Zip Code: Schofield, WI

(10) FOR DNR OR COUNTY USE ONLY

| | |
|---|---|
| Date Received/Inspected | District/County |
| Reviewer/Inspector | |
| Follow-up Necessary | |

DNR/COUNTY 3.5-10-36

State of Wisconsin
Department of Natural Resources

Route to:
Solid Waste
Emergency Response
Wastewater
Haz. Waste
Underground Tanks
Water Resources
X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-SCC-101 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Scott Butke & Chuck Blunt | 01/31/94<br>MM/DD/YY | 02/07/94<br>MM/DD/YY | 4.25" I.D.<br>Hollow-Stem Auger |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | NA | NA | 1582.9 | 8" |

Boring Location
State Plane 120,369.9 N, 2,281,221.2 E S/C/N Lat
1/4 of NE 1/4 of Section 30, T 35 N, R 13 E Long

Local Grid Location (if applicable)
___ Feet ___ N ___ S ___ Feet ___ E ___ W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS1 | 0 | 1/2<br>1/2 | -- | 0-2 Black (10YR3/1) organic topsoil, frozen to 0.1, weak, med. blocky structure, wet. | OL | | | | | | | | | |
| SS2 | 2 | 5/7<br>4/6 | -- 2 | 2.8-3.4 Brown (7.5YR6/4) fine sand, structureless, wet-loose, soft. | SP | | | | | | | | | |
| SS3 | 3 | 10/17<br>31/26 | -- 4 | 3.4 Brown (7.5YR5/4) silty clay with gravel, massive, wet, firm. Till. | CL | | | | | | | | | |
| SS4 | 12 | TWT | -- 6 | 6-8 Push TWT - push 1.1' - refusal poor sample - 1/4' blowup 3/4' sample tube crushed. Till. | SC | | | | | | | | | |
| SS5 | 23 | 26/24<br>16/8 | -- 8 | 8.7 Brown (7.5YR5/5) fine-med. sand with gravel structureless, wet, loose, as above, blowup water rises to surface. | SP | | | | | | | | | |
| SS6 | 20 | 10/16<br>24/31 | -- 10 | Outwash. | | | | | | | | | | |
| SS7 | 5 | 11/23<br>32/39 | -- 12 | As above, wet. | SP | | | | | | | | | |
| SS8 | 18 | 12/19<br>26/29 | -- 14 | As above with gravel, wet. | SP | | | | | | | | | |
| SS9 | 20 | 19/23<br>26/25 | -- 16 | As above with gravel and minor silt, wet. | SP | | | | | | | | | |
| SS10 | 20 | 20/12<br>14/11 | -- 18 | As above, wet. | SP | | | | | | | | | |
| SS11 | 20 | 11/9<br>4/15 | -- 20 | As above, wet. | SP | | | | | | | | | |
| SS12 | 20 | 12/9<br>6/9 | -- 22 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

| Signature | Firm |
|---|---|
| Steve K Wood | Foth & Van Dyke |

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-SCC-101

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | P200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS13 | 0 | 0 | 24 | E.O.B. @ 24'. | | | | | | | | | | |
| | | | 26 | Soil cuttings disposed in sump pits at mine site. | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

# WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Form 3300-5W
11-89

All abandonment work shall be performed in accordance with the provisions of Chapters NR 111, NR 112 or NR 141, Wis. Admin. Code, whichever is applicable. Also, see instructions on back.

## (1) GENERAL INFORMATION

Well/Drillhole/Borehole Location

County: Forest

__ 1/4 of NE 1/4 of Sec. 30 ; T. 35 N; R. 13 [X] E [ ] W

(If applicable)

_____ Gov't Lot _____ Grid Number

Grid Location

_____ ft. [ ] N. [ ] S., _____ ft. [ ] E. [ ] W.

Civil Town Name: Lincoln

Street Address of Well: Swamp Creek Cedars

City, Village:

## (2) FACILITY NAME

Original Well Owner (If Known): Crandon Mining Company

Present Well Owner: Crandon Mining Company

Street or Route: 7 North Brown Street

City, State, Zip Code: Rhinelander, WI 54501-0856

Facility Well No. and/or Name (If Applicable): CMC-SCC-101

WI Unique Well No.: _ _ _ _ _ _

Reason For Abandonment: Completion

Date of Abandonment: 02/07/94

## WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drillhole/Borehole Construction Completed On

(Date) 02/07/94

[ ] Monitoring Well
[ ] Water Well
[X] Drillhole
[ ] Borehole

Construction Report Available? [ ] Yes [ ] No

Construction Type:
[X] Drilled [ ] Driven (Sandpoint) [ ] Dug
[ ] Other (Specify)

Formation Type:
[X] Unconsolidated Formation [ ] Bedrock

Total Well Depth (ft.) 24 Casing Diameter (ins.) --
(From groundsurface)

Casing Depth (ft.) _____

Was Well Annular Space Grouted? [ ] Yes [ ] No [ ] Unknown
If Yes, To What Depth? _____ Feet

(4) Depth to Water (Feet) _____

| | | | |
|---|---|---|---|
| Pump & Piping Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Liner(s) Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Screen Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Casing Left in Place? | [ ] Yes | [ ] No | |

If No, Explain _____

| | | |
|---|---|---|
| Was Casing Cut Off Below Surface? | [ ] Yes | [X] No |
| Did Sealing Material Rise to Surface? | [X] Yes | [ ] No |
| Did Material Settle After 24 Hours? | [ ] Yes | [X] No |
| If Yes, Was Hole Retopped? | [ ] Yes | [ ] No |

(5) Required Method of Placing Sealing Material
[X] Conductor Pipe-Gravity [ ] Conductor Pipe-Pumped
[ ] Dump Bailer [ ] Other (Explain)

(6) Sealing Materials
[ ] Neat Cement Grout
[ ] Sand-Cement (Concrete) Grout
[ ] Concrete
[ ] Clay-Sand Slurry
[ ] Bentonite-Sand Slurry
[X] Chipped Bentonite

For monitoring wells and monitoring well boreholes only
[ ] Bentonite Pellets
[ ] Granular Bentonite
[ ] Bentonite - Cement Grout

(7)

| Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks Sealant or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| 3/8" Hole Plug Chipped Bentonite | Surface | 24' | 7 bags | |
| | | | | |
| | | | | |
| | | | | |

(8) Comments: _____

(9) Name of Person or Firm Doing Sealing Work
Chuck Blunt, WTD Drilling

Signature of Person Doing Work: Chuck Blunt
Date Signed: 3-1-94

Street or Route: 101 Alderson Street
Telephone Number: (715)359-7090

City, State, Zip Code: Schofield, WI 59476

(10) FOR DNR OR COUNTY USE ONLY

Date Received/Inspected
District/County
Reviewer/Inspector
Follow-up Necessary

3.5-10-39

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-SCC-102A |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Mike Mueller | 02/07/94<br>MM/DD/YY | 02/07/94<br>MM/DD/YY | 4.25" I.D.<br>Hollow-Stem Auger |

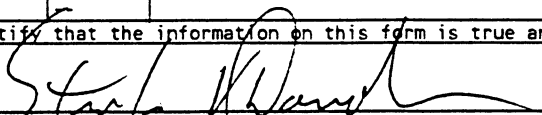
| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | CMC-SCC-102A | TBD | 1583.7 | 8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 120,038.8 N, 2,280,679.9 E S/C/N<br>1/4 of NE 1/4 of Section 30, T 35 N, R 13 E | Lat<br>Long |
| | Feet ___ N S Feet ___ E W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | Blind drill. See log for CMC-SCC-102B. | | | | | | | | | | |
| 1 | 1.5 | TWT | -- 2 | Push TWT 2' from 2-4. | SC/SM | | | | | | | | | |
| | | | -- 4 | | | | | | | | | | | |
| | | | -- 6 | | | | | | | | | | | |
| | | | -- 8 | | | | | | | | | | | |
| | | | -- | | SC | | | | | | | | | |
| | | | -- 10 | | | | | | | | | | | |
| | | | -- | E.O.B. @ 11'. | | | | | | | | | | |
| | | | -- 12 | | | | | | | | | | | |
| | | | -- | Soil cuttings disposed in sump pits at mine site. | | | | | | | | | | |
| | | | -- 14 | | | | | | | | | | | |
| | | | -- 16 | | | | | | | | | | | |
| | | | -- 18 | | | | | | | | | | | |
| | | | -- 20 | | | | | | | | | | | |
| | | | -- 22 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature  Firm Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-SCC-102B |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Mike Mueller | 01/31/94<br>MM/DD/YY | 02/07/94<br>MM/DD/YY | 4.25 I.D.<br>Hollow-Stem Auger |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | CMC-SCC-102B | TBD | 1583.7 | 8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 120,042.8 N, 2,280,678.2 R S/C/N<br>1/4 of NE 1/4 of Section 30, T 35 N, R 13 E Lat Long | ___ Feet N S ___ Feet E W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 24 | 14/6<br>1/11 | -- | 0-1.9 Black (10YRY1) organic topsoil frozen to 1.2, mod. med. blocky structure, damp, soft. Till to 14'. | OL | | | | | | | | | |
| | | | -- | 1.9 Lt. brown (10YR7/4) sandy clay, | SC/ | | | | | | | | | |
| 2 | 11 | 0/1<br>1/1 | -- 2 | mod. med. blocky structure, damp, soft, oxidized. | CL | | | | | | | | | |
| | | | -- | At 2.1 color changes to 5YR5/5, wet. | | | | | | | | | | |
| | | | -- | At 3.1 minor gravel. | | | | | | | | | | |
| 3 | 10 | 1/5<br>6/7 | -- 4 | As above, slightly more sand, damp. | SC | | | | | | | | | |
| 4 | 2 | 1/11<br>6/7 | -- 6 | Rock in shoe, as above. | SC | | | | | | | | | |
| 5 | 7 | 5/15<br>1/2 | -- 8 | As above, wet. | SC | | | | | | | | | |
| 6 | 4 | 1/5<br>6/5 | -- 10 | As above. | SC | | | | | | | | | |
| 7 | 11 | TWT | -- 12 | 12-14 Push T.W.T. - could only push 1'. Tube crushed. | | | | | | | | | | |
| 8 | 24 | 3/5<br>20/21 | -- 14 | 14-21 Brown (7.5YR5/6) fine to med. sand, wet, structureless, loose, water rises to 2'. Outwash to E.O.B. | SP | | | | | | | | | |
| 9 | 24 | 20/15<br>21/22 | -- 16 | As above with gravel, dense. | SM | | | | | | | | | |
| 10 | 22 | 20/100 | -- 18 | As above with gravel, dense. | SP | | | | | | | | | |
| 11 | 18 | 6/15<br>15 | -- 20 | As above. | SP | | | | | | | | | |
| | | | -- | 21 Brown (7.5YR5/6) med.-coarse sand, | SP | | | | | | | | | |
| | | | -- | structureless, wet, loose, minor gravel. | | | | | | | | | | |
| 12 | 0 | 0 | -- 22 | | | | | | | | | | | |
| | | | -- | E.O.B. @ 22.5'. | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Stephen K. Ward

Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources

Route to:
Solid Waste
Emergency Response
Wastewater
Haz. Waste
Underground Tanks
Water Resources
X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-SC-101 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Bill Zamow | 02/10/94<br>MM/DD/YY | 02/10/94<br>MM/DD/YY | 4.25" I.D.<br>Hollow-Stem Auger |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | NA | NA | 1540.5 | 8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 121,709.7 N, 2,274,141.3 E S/C/N<br>1/4 of SW 1/4 of Section 24, T 35 N, R 12 E | Lat<br>Long |
| | ___ Feet ___ N ___ S<br>___ Feet ___ E ___ W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Nashville |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | 0-2.5 Grab sample, v.dark brn (10YR2/2) sandy muck. | PT | | | | | | | | | |
| SS-1 | 3 | 5/5<br>2/5 | -- 2 | 2.5- Dk. grey (2.5Y4/0) sandy clay w/organic fibers, pred. med. blocky. | OL | | | | | | | | | |
| | | | -- 4 | | | | | | | | | | | |
| SS-2 | 10 | 5/3<br>3/7 | -- 6 | V. Dk. brn (10YR2/2) sandy peat w/clay. | OL/PT | | | | | | | | | |
| | | | -- 8 | | | | | | | | | | | |
| SS-3 | 10 | 2/2<br>3/5 | -- | As above. | OL/PT | | | | | | | | | |
| SS-4 | 12 | 2/7<br>3/5 | -- 10 | 10-27 Dk. grayish brn (2.5Y4/2) wet loose poorly graded sand w/silt, tr. of gravel. Med. textured. Outwash sand with gravel. | SP | | | | | | | | | |
| | | | -- 12 | | | | | | | | | | | |
| SS-5 | 12 | 14/16<br>15/11 | -- 14 | As above w/no silt. 3' of blown up. | SP | | | | | | | | | |
| | | | -- 16 | Cannot keep running sands out of the augers. Will blind drill to 25' and sample to confirm substantial thickness of outwash deposit. | | | | | | | | | | |
| | | | -- 18 | | | | | | | | | | | |
| ST-6 | 0 | TWT | -- 20 | No recovery of Shelby tube at 25 feet. | | | | | | | | | | |
| | | | -- 22 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

| Signature | Firm |
|---|---|
| Steve Wood | Foth & Van Dyke |

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-SC-101

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | P200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 24 | | | | | | | | | | | |
| SS-7 | 20 | 24/40<br>46/54 | 26 | 25-27 Same as above, med. to coarse text. poorly graded sand w/tr. of gravel. Outwash. | SP | | | | | | | | | |
| | | | | E.O.B. 27'. | | | | | | | | | | |
| | | | 28 | Abandoned w/13 50-lb. bags of holeplug. | | | | | | | | | | |
| | | | | Soil cuttings disposed in sump pits at mine site. | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

WELL/DRILLHOLE/BOREHOLE
Form 3300-5W

11-89

All abandonment work shall be performed in accordance with the provisions of Chapters NR 111, NR 112 or NR 141, Wis. Admin. Code, whichever is applicable. Also, see instructions on back.

## (1) GENERAL INFORMATION

Well/Drillhole/Borehole Location

County

___ 1/4 of SW 1/4 of Sec. 24 ; T. 12 N; R. 35 [X] E [ ] W

(If applicable) _____ Gov't Lot _____ Grid Number

Grid Location _____ ft. [ ] N. [ ] S., _____ ft. [ ] E. [ ] W.

Civil Town Name: Nashville

Street Address of Well: Swamp Creek Wetlands

City, Village: Nashville

## (2) FACILITY NAME

Original Well Owner (If Known): Crandon Mining Company

Present Well Owner: Crandon Mining Company

Street or Route: 7 North Brown Street

City, State, Zip Code: Rhinelander, WI 54501-0856

Facility Well No. and/or Name (If Applicable): CMC-SC-101

WI Unique Well No.: _ _ _ _ _ _

Reason For Abandonment: Investigative Boring

Date of Abandonment: 2-10-94

## WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drillhole/Borehole Construction Completed On

(Date) 2-10-94

[ ] Monitoring Well
[ ] Water Well
[ ] Drillhole
[X] Borehole

Construction Report Available? [ ] Yes [ ] No

Construction Type:
[X] Drilled [ ] Driven (Sandpoint) [ ] Dug
[ ] Other (Specify) _____

Formation Type:
[X] Unconsolidated Formation [ ] Bedrock

Total Well Depth (ft.) 27 Casing Diameter (ins.) ____
(From groundsurface)

Casing Depth (ft.) ____

Was Well Annular Space Grouted? [ ] Yes [ ] No [ ] Unknown
If Yes, To What Depth? _____ Feet

(4) Depth to Water (Feet) NA

| | | | |
|---|---|---|---|
| Pump & Piping Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Liner(s) Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Screen Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Casing Left in Place? | [ ] Yes | [ ] No | NA |

If No, Explain _____

| | | | |
|---|---|---|---|
| Was Casing Cut Off Below Surface? | [ ] Yes | [ ] No | NA |
| Did Sealing Material Rise to Surface? | [X] Yes | [ ] No | |
| Did Material Settle After 24 Hours? | [ ] Yes | [X] No | |
| If Yes, Was Hole Retopped? | [ ] Yes | [ ] No | NA |

(5) Required Method of Placing Sealing Material
[X] Conductor Pipe-Gravity [ ] Conductor Pipe-Pumped
[ ] Dump Bailer [ ] Other (Explain)

(6) Sealing Materials
[ ] Neat Cement Grout
[ ] Sand-Cement (Concrete) Grout
[ ] Concrete
[ ] Clay-Sand Slurry
[ ] Bentonite-Sand Slurry
[X] Chipped Bentonite

For monitoring wells and monitoring well boreholes only
[ ] Bentonite Pellets
[ ] Granular Bentonite
[ ] Bentonite - Cement Grout

| (7) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks Sealant or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| 3/8" Chipped bentonite - hole plug | Surface | 27 | 13 50 lb bags | |
| | | | | |
| | | | | |
| | | | | |

(8) Comments: _____

(9) Name of Person or Firm Doing Sealing Work
Bill Zamow WTD Environmental Drilling

Signature of Person Doing Work: Bill Zamow (Env.)
Date Signed: 3-1-94
Street or Route: 101 Alderson St.
Telephone Number: (715) 359-7090
City, State, Zip Code: Schofield, WI 54476

(10) FOR DNR OR COUNTY USE ONLY

| | |
|---|---|
| Date Received/Inspected | District/County |
| Reviewer/Inspector | |
| Follow-up Necessary | |

DNR/COUNTY 3.5-10-44

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-SC-102 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Dan Tinnancour | 02/10/94<br>MM/DD/YY | 02/ /94<br>MM/DD/YY | 4.25" I.D.<br>Hollow-Stem Auger |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | NA | NA | 1540.4 | 8" |

Boring Location
State Plane 121,956.5 N, 2,274,409.3 E S/C/N Lat
1/4 of SW 1/4 of Section 24, T 35 N, R 12 E Long

Local Grid Location (if applicable)
___ Feet ___ N ___ S ___ Feet ___ E ___ W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | 0-2.2 Black (10YR1/1) organic topsoil (silt) frozen to 1.8', mod. med. blocky structure, wet, sticky. | OL | | | | | | | | | |
| SS1 | 13 | 19/20<br>21/17 | -- 2 | 2.2-4.1 Dark grey (2.5Y4/1) silty sand, structureless, wet, loose, minor gravel. Outwash sands w/gravel to E.O.B. | SP | | | | | | | | | |
| SS2 | 17 | 8/11<br>13/14 | -- 4 | 4.1 Brown (10YR6/4) med.-fine sand, wet, structureless, loose, v. minor gravel. | SP | | | | | | | | | |
| | | | -- 6 | | | | | | | | | | | |
| SS3 | 20 | 8/9<br>17/8 | -- 8 | As above but sl. coarser med.-coarse. | SP | | | | | | | | | |
| SS4 | 16 | 4/3<br>3/7 | -- 10 | As above. | SP | | | | | | | | | |
| SS5 | | | -- 12 | 5' of blowup at 12', pound blowup out. Pound blowout out and abandon with three bags of holeplug. | | | | | | | | | | |
| | | | | E.O.B. @ 12'. | | | | | | | | | | |
| | | | -- 14 | | | | | | | | | | | |
| | | | | Soil cuttings disposed in sump pits at mine site. | | | | | | | | | | |
| | | | -- 16 | | | | | | | | | | | |
| | | | -- 18 | | | | | | | | | | | |
| | | | -- 20 | | | | | | | | | | | |
| | | | -- 22 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources

# WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Form 3300-5W
11-89

All abandonment work shall be performed in accordance with the provisions of Chapters NR 111, NR 112 or NR 141, Wis. Admin. Code, whichever is applicable. Also, see instructions on back.

## (1) GENERAL INFORMATION

Well/Drillhole/Borehole Location

County

SW 1/4 of SW 1/4 of Sec. 24 ; T. 35 N; R. 12 ☒ E ☐ W

(If applicable) Gov't Lot _____ Grid Number _____

Grid Location _____ ft. ☐ N. ☐ S., _____ ft. ☐ E. ☐ W.

Civil Town Name: Nashville

Street Address of Well: Swamp Creek Wetlands

City, Village

## (2) FACILITY NAME

Original Well Owner (If Known): Crandon Mining Company

Present Well Owner: Crandon Mining Company

Street or Route: 7 North Brown Street

City, State, Zip Code: Rhinelander, WI 54501-0856

Facility Well No. and/or Name (If Applicable): CMC-SC-102

WI Unique Well No.: _ _ _ _ _ _

Reason For Abandonment: Completion

Date of Abandonment: 02/10/94

## WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drillhole/Borehole Construction Completed On

(Date) 02/10/94

☐ Monitoring Well
☐ Water Well
☐ Drillhole
☒ Borehole

Construction Report Available? ☐ Yes ☐ No

Construction Type:
☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) _____

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft.) 12 Casing Diameter (ins.) _____
(From groundsurface)

Casing Depth (ft.) NA

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown
If Yes, To What Depth? _____ Feet

(4) Depth to Water (Feet) _____

| | | | |
|---|---|---|---|
| Pump & Piping Removed? | ☐ Yes | ☐ No | ☒ Not Applicable |
| Liner(s) Removed? | ☐ Yes | ☐ No | ☒ Not Applicable |
| Screen Removed? | ☐ Yes | ☐ No | ☒ Not Applicable |
| Casing Left in Place? | ☐ Yes | ☐ No | |

If No, Explain _____

| | | |
|---|---|---|
| Was Casing Cut Off Below Surface? | ☐ Yes | ☒ No |
| Did Sealing Material Rise to Surface? | ☐ Yes | ☒ No |
| Did Material Settle After 24 Hours? | ☐ Yes | ☒ No |
| If Yes, Was Hole Retopped? | ☐ Yes | ☐ No |

(5) Required Method of Placing Sealing Material
☒ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☐ Dump Bailer ☐ Other (Explain)

(6) Sealing Materials
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☐ Bentonite-Sand Slurry
☒ Chipped Bentonite

For monitoring wells and monitoring well boreholes only
☐ Bentonite Pellets
☐ Granular Bentonite
☐ Bentonite - Cement Grout

| (7) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks Sealant or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| 3/8" Hole Plug Chipped Bentonite | Surface | 12 | 3 bags | |
| | | | | |
| | | | | |
| | | | | |

(8) Comments: _____

(9) Name of Person or Firm Doing Sealing Work
Dan Tinnacour, WTD Drilling

Signature of Person Doing Work: Dan Tinnacour
Date Signed: 3-1-94

Street or Route: 101 Alderson Street
Telephone Number: ( 715) 359-7090

City, State, Zip Code: Schofield, WI 54476

(10) FOR DNR OR COUNTY USE ONLY

Date Received/Inspected | District/County

Reviewer/Inspector

Follow-up Necessary

3.5-10-46

# Appendix 3.5-11

## May 1994 Subsurface Detection Investigations, Inc. Report Titled "Geophysical Lake Bed and Wetland Investigation for the Crandon Mining Site"

# FINAL REPORT

## GEOPHYSICAL LAKE BED AND WETLAND INVESTIGATION

## CRANDON MINING COMPANY SITE
## FOREST COUNTY, WISCONSIN

Prepared For:

**FOTH & VAN DYKE**
GREEN BAY, WISCONSIN

MAY 1994

3.5-11-1

SDII
SUBSURFACE
DETECTION
INVESTIGATIONS
INCORPORATED

May 18, 1994

Foth & Van Dyke
2737 South Ridge Road
P.O. Box 19012
Green Bay, WI 54307-9012

Attention: Mr. Stephen Donohue
Project Manager

Subject: **Final Report - Crandon Mining Project Site**
**Forest County, Wisconsin**
**SDII Project Number 94727**

Dear Mr. Donohue:

Subsurface Detection Investigations, Inc. (SDII) is pleased to submit the final report for the above referenced project. The purpose of the investigation was to utilize geophysical techniques to help characterize lake bed thickness, continuity and lithology across Little Sand, Deep Hole, Duck and Skunk Lakes. The project was performed in accordance with our Proposal Number 94344, dated February 8, 1994.

SDII appreciates the opportunity to have assisted Foth & Van Dyke on this project. If you have any questions or comments about the report, please contact us.

Sincerely,

**SUBSURFACE DETECTION INVESTIGATIONS, INC.**

Robert J. Windschauer

Robert J. Windschauer, P.G.
Principal Geologist

RJW/ℒ
94727

3.5-11-2

## TABLE OF CONTENTS


LIST OF FIGURES . . . . . iii

LIST OF TABLES . . . . . iv

LIST OF APPENDICES . . . . . iv

1.0 INTRODUCTION . . . . . 1-1
- 1.1 Background . . . . . 1-1
- 1.2 Purpose . . . . . 1-1
- 1.3 Scope of Work . . . . . 1-2
- 1.4 Site Description . . . . . 1-2

2.0 METHODOLOGY . . . . . 2-1
- 2.1 Electromagnetics - General Theory . . . . . 2-1
  - 2.1.1 Time-Domain Electromagnetics . . . . . 2-2

3.0 FIELD DATA ACQUISITION PARAMETERS . . . . . 3-1
- 3.1 Protem TEM-47 . . . . . 3-1
  - 3.1.1 Generalized Description of Equipment . . . . . 3-1
  - 3.1.2 Field Setup and Procedures . . . . . 3-1
  - 3.1.3 Description of QC Procedures . . . . . 3-2
  - 3.1.4 Description of Induced EMF Field . . . . . 3-3
- 3.2 GPS - Trimble 4000RS Reference Surveyor . . . . . 3-4
  - 3.2.1 Generalized Description of Equipment . . . . . 3-4
  - 3.2.2 Field Setup and Logistics . . . . . 3-4
- 3.3 Hydrogeologic (Data) Characterization . . . . . 3-5
  - 3.3.1 Existing Site Specific Data . . . . . 3-5

4.0 DATA PROCESSING AND EVALUATION PROCEDURES . . . . . 4-1
- 4.1 Description of Data Transfer Procedures . . . . . 4-1
- 4.2 Description of Processing & Modeling Software . . . . . 4-1
  - 4.2.1 TDEM Data . . . . . 4-3
  - 4.2.2 GPS Data . . . . . 4-3
- 4.3 Evaluation of TDEM Models . . . . . 4-3

## TABLE OF CONTENTS (Cont.)


5.0 RESULTS . . . . . 5-1
5.1 General . . . . . 5-1
5.1.1 Little Sand Lake . . . . . 5-1
5.1.2 Deep Hole Lake . . . . . 5-2
5.1.3 Duck Lake . . . . . 5-2
5.1.4 Skunk Lake . . . . . 5-2

6.0 CONCLUSION . . . . . 6-1

REFERENCES

## LIST OF FIGURES


Figure

1 Site Location Map

2 Block Diagram Showing TDEM Field Setup

3 Diagram Showing System Waveforms - TDEM

4 Well Locations from 1982-1985 Hydrogeologic Investigations

5 Completed Wetland/Lake Borings and Well Installations for 1994 Investigations

6 Demonstration TDEM Survey Results Showing Apparent Resistivity Versus Time

7 Demonstration TDEM Survey Results Showing Best Fit Model and Equivalence Analysis

8 Site Plan Showing Location of TDEM Survey Stations - Little Sand Lake

9 Isopach Map and Cross Section Showing Estimated Thickness of Clay Stratum - Little Sand Lake

10 Site Map Showing Location of TDEM Survey Stations - Deep Hole Lake

11 Isopach Map and Cross Section Showing Estimated Thickness of Clay Stratum - Deep Hole Lake

12 Site Map Showing Location of TDEM Survey Stations - Duck and Skunk Lakes

13 Isopach Map and Cross Section Showing Estimated Thickness of Clay Stratum - Duck and Skunk Lakes

## LIST OF TABLES

Table

1 Data from 1982-1984 Lake Bed Soil Testing Program - Crandon Project

2 1994 Hydrogeologic Investigation Soil Laboratory Testing Data - Crandon Project

## LIST OF APPENDICES

Appendix

1 Soil Boring Data

2 TDEM Modeling Data

Crandon Mining Company

7 N. BROWN ST., 3RD FLOOR
RHINELANDER, WI 54501-3161

COPY

May 16, 1994

Mr. James Bauer
Wisconsin Department of Natural Resources
Bureau of Solid Waste and Hazardous Waste Management
101 South Webster, P.O. Box 7921
Madison, WI 53707-7921

Dear Mr. Bauer:

RE: Crandon Project-Technical Report on 1994 Lake Bed and Wetland Geophysical Study

Enclosed is a technical report regarding the Crandon Project's 1994 Lake Bed and Wetland Geophysical Studies. The report was prepared by Subsurface Detection Investigations, Inc. (SDII). The geophysical study employed time-domain electromagnetics (TDEM) to assess the continuity and relative thickness of lacustrine clays and silts underlying Little Sand, Deep Hole, Duck and Skunk Lakes and accessible areas of adjacent wetlands. The results of this study, in conjunction with lake bed boring work, establish that the lacustrine clays and silts underlying the above-mentioned lakes are continuous.

We look forward to discussing the results of this technical report at our meeting scheduled for June 1, 1994 at 1:00 p.m. at the Wisconsin Department of Natural Resources, Madison office. Should you have any questions, please call either myself at 715-365-1453 or Steve Donohue of Foth & Van Dyke at 414-497-2500.

Sincerely,

D. E. Moe

Don Moe
*Technical and Permitting Manager*

Enclosure
cc: Bill Tans, WDNR-Madison
Archie Wilson, WDNR-Rhinelander
Larry Lynch, WDNR-Madison
Dr. Kenneth Bradbury, Wisconsin Geological and Natural History Survey
Dr. James Krohelski, U.S. Geological Survey
Robert Jaeger, U.S. Department of the Interior
Al Milham, Forest County Potawatomi
Arlyn Ackley, Sokaogon Chippewa Community
John Coleman, GLIFWC
Claudia Johnson-Schultz, USEPA-Water Division
Laura Sutherland, Wisconsin Department of Justice
Mike Frimpter, Ph.D., P.HG., Horsley & Witten
Dr. Douglas Cherkauer, University of Wisconsin-Milwaukee
Jerry Sevick, P.E., Foth & Van Dyke
Stephen Donohue, Foth & Van Dyke
Peter Andersen, GeoTrans, Inc.

RHINELANDER BUSINESS OFFICE
7 N. BROWN ST., 3RD FLOOR
RHINELANDER, WI 54501-3161
TEL.: (715) 365-1450 FAX: (715) 365-1457

3.5-11-7

CRANDON FIELD OFFICE
P.O. BOX 336 104 W. MADISON
CRANDON, WI 54520-0336
TEL.: (715) 478-3393 FAX: (715) 478-3641

# 1.0 INTRODUCTION

## 1.1 Background

The project site is a proposed mining project area located approximately 5 miles south of the City of Crandon, Wisconsin. Foth & Van Dyke is conducting an environmental assessment of the site for the Crandon Mining Company in order to obtain the necessary permits and approvals for the project. The four areas of investigation within the project site include Little Sand, Skunk, Duck and Deep Hole Lakes and adjacent wetlands. A geophysical investigation regarding lake bed characteristics was commissioned to provide data to be used with a groundwater flow model to quantify lake seepage. Of specific concern is the determination of the thickness and continuity of fine-grained lacustrine strata observed in soil borings performed at each of the lakes.

## 1.2 Purpose

The purpose of this investigation is to utilize geophysical (electromagnetic) techniques to help characterize lake bed thickness, continuity, and lithology across the four lakes and adjacent wetlands. Electromagnetic techniques have been used in similar settings to establish a geo-electrical stratigraphy which describes the horizontal layering of earth materials based on their electrical properties.

Two electromagnetic techniques were applied to this investigation. The techniques performed were frequency-domain electromagnetics (EM) and time-domain electromagnetics (TDEM). Initial results indicated that the EM technique could not delineate the lacustrine strata from the overlying and underlying sediments. The EM technique was subsequently deleted from the investigation. The initial TDEM results indicated the ability to delineate the lacustrine strata from the overlying/underlying sediments and was selected as the appropriate technique to proceed with the investigation. The TDEM survey was performed across the four lakes included in the investigation on

200 to 300-foot centers. Selected locations in wetland areas were also investigated adjacent to Duck Lake and Skunk Lake. The position of the TDEM soundings were determined using a Global Positioning System (GPS) on Little Sand Lake and Deep Hole Lake. A Brunton surveying compass and available site maps were used on Duck Lake and Skunk Lake due to thin ice conditions. Surveyed control points were used to establish survey transects on all water bodies.

## 1.3 Scope of Work

SDII implemented the following scope of work to complete this investigation:

- Mobilize to the project site and construct the field data collection systems required to perform the investigations;
- Establish the effectiveness of each of the electromagnetic techniques in achieving the project objectives;
- Once the effectiveness of each of the electromagnetic techniques was established, perform the investigation using the appropriate method;
- Demobilize from the site and perform reduction and evaluation of the field data; and
- Prepare a final report that summarizes the methodology and results of the geophysical investigation.

## 1.4 Site Description

The project site is a proposed mining project area located approximately 5 miles south of the City of Crandon, Wisconsin. The four lakes and surrounding wetland areas (Figure 1) investigated by SDII are in close proximity to the project site. At the time of the SDII investigation (from March 7 to March 13, 1994), each of the lakes were covered by ice. The investigation was conducted during frozen conditions to facilitate access with the geophysical equipment.

The lakes range in depth from approximately 3 to 18 feet (ft). Previous geological studies at the project site indicate that the lakes and wetlands are underlain predominantly by lacustrine clays and silts which are underlain by glacial deposits of glacial outwash and till. Based on past boring work, it has been established that lacustrine clays and silts range in thickness from 5 to approximately 25 ft. Top of bedrock is encountered at a depth of approximately 175 ft below Little Sand Lake, 190 ft below Deep Hole Lake, 200 ft below Duck Lake, and 130 ft below Skunk Lake. Boring logs from previous geotechnical investigations performed at the site and utilized as calibration and control points are provided in Appendix 1.

# 2.0 METHODOLOGY

## 2.1 Electromagnetics - General Theory

Electrical resistivity is an intrinsic physical property of soils and rocks. It is measured in ohm-meters. Conductivity (the reciprocal of resistivity) is measured in mhos/meter and is a measure of the ability of a substance to conduct an electric current. Resistance is a function of both resistivity and the specific size and shape of an object. Typical ranges of resistivities for the types of materials encountered at the project site are provided below.

| RANGE OF TYPICAL RESISTIVITY VALUES FOR SEDIMENTS | |
|---|---|
| SEDIMENT TYPE | RESISTIVITY (in ohm-m) |
| Unconsolidated Wet Clay [1] | 20 |
| Clays [1] | 1-100 |
| Alluvium and Sands [1] | 10-800 |
| Conglomerates [1] | $2x10^3$ - $10^4$ |
| Glacial Till [2] | $10^1$ - $6x10^3$ |
| 1 From Telford et al<br>2 From Culley et al | |

Bulk electrical resistivity of porous earth materials is dependent upon several factors. For unconsolidated sediments, the most important are porosity and fluid conductivity. Most minerals are poor conductors. Current flow in porous rocks and soils is concentrated within the interconnected pore spaces. The interconnectedness and area of pore spaces and the electrical conductivity of fluids in the pores are therefore the predominant factors affecting the bulk resistivity of porous earth materials. Sediments with high porosities exhibit lower bulk resistivities (higher conductivity). Clay and clayey soils have relatively

high porosities and low bulk resistivities. In addition, clays have a high cation exchange capacity (CEC) which contributes to the low bulk resistivity of clay-rich sediments.

Fine-grained sediments such as silt and clays have high porosities and low bulk resistivities. Because of the small grain sizes of the sediments, the pores are very small. Therefore, the hydraulic conductivity of these sediments are very low. In sediments saturated with fresh water, low bulk resistivities are often associated with clay-rich sediments and low hydraulic conductivities.

All electromagnetic methods depend on the electromagnetic induction of secondary eddy currents in the ground. A primary current in the transmitter coil generates a magnetic field, the direction and strength of which are directly related to the direction and strength of the current. If the current and its attendant magnetic field vary with time, an electromotive force is created. The magnitude of this force is proportional in the time rate of change of the magnetic field. The electromotive force causes secondary currents to flow in the ground. In general, the more conductive the ground, the stronger are the induced secondary currents. These secondary currents induce a voltage in the receiver coil. Therefore, the voltage output of the receiver coil is related to the strength of the induced secondary currents, and hence, the conductivity of the ground.

2.1.1 Time-Domain Electromagnetics (TDEM)

In a TDEM sounding, an electrical current is caused to flow in a horizontal transmitter coil laid on the ground. The current is maintained until a static magnetic field is established, then the current flowing in the coil is rapidly terminated. This produces a strong electromotive force which induces eddy (secondary) currents in the ground (Figure 2). Immediately after transmitter shut off, the maximum current density of the eddy currents is at the surface beneath the transmitter coil. With increasing time, the position of the maximum current density of the eddy currents diffuses downward and outward into the subsurface, also decreasing in strength. The eddy currents induce a voltage in the receiver coil which is proportional to eddy current strength. Monitoring the

voltage output from the receiver coil with increasing time is equivalent to measuring resistivity as a function of depth. Measurements are made with the transmitter off.

TDEM soundings are obtained by placing the transmitter, a large loop of wire, on the ground. The receiver coil is placed at the center of the transmitter coil for large transmitters loops, or off to one side for small loops. The receiver is linked to the transmitter by a reference wire so that the time at which the primary current is terminated can be known precisely (Figure 3). The output of the receiver coil is recorded at 20 logarithmically-spaced intervals or gates. For example, using a transmitter current repetition rate of 30 cycles/sec (30 Hz), the voltage output of the receiver coil is measured from 80 nanoseconds to 8 milliseconds.

The ideal transmitter current waveform would be a step function, with the current terminating instantaneously. Practically, this is not possible, and it takes a finite time for current shut off. Useful transient data cannot be obtained at times before termination of the primary current. Very rapid current turn off is required to sense transients from shallow layers. This requires small transmitter coils and low transmitter currents, which limit the maximum depth of penetration, but allow measurement of transients from conductive layers within a few feet of the surface. For this reason, a small 16 ft by 16 ft transmitter coil was used in this study.

Field measurements consist of the output voltage from the receiver coil versus time. In order to enhance the signal-to-noise ratio, many transients are measured at each sounding site. The transmitter pulse repetition rate used in this study was 315 Mz, so 315 transient cycles were measured each second. This allows the induced transient responses to be distinguished from naturally-occurring background noise.

# 3.0 FIELD DATA ACQUISITION PARAMETERS

## 3.1 Protem TEM-47

### 3.1.1 Generalized Description of Equipment

SDII employed the Geonics Protem TDEM system to perform the TDEM portion of the project. The principal components of the Protem are:

- Protem Receiver Module (system control, parameter selection, data storage)
- Protem Transmitter, battery operated, maximum 3 amperes output, 30 Hz, 75 Hz, or 315 Hz repetition rate Transmitter (Tx) loop 16 ft by 16 ft in dimension, constructed of insulated 14 gauge AWG wire
- Receiver (Rx) coil (269 $ft^2$ effective area)

The Tx loop is energized by a bi-polar electrical current (up to a maximum of 3 amperes). The response of the ground is sensed by a search coil (receiver, or Rx coil) offset from the Tx loop. A block diagram of the field setup of the system is given in Figure 3. The TDEM system was towed across the frozen lakes using either an automobile or snowmobile.

### 3.1.2 Field Setup and Procedures

Through comparison of preliminary sounding results with available lithologic logs, it was determined that a 16 ft by 16 ft transmitter loop, with a pass through current of 3 amperes, at a repetition rate of 315 Hz was the optimal configuration to determine the thickness of the near-surface lacustrine clays and silts. Each component of the TDEM system was connected using rope and the entire system was pulled across the lakes using a tow vehicle. The TDEM transmitter loop was made of 14-gauge AWG insulated wire and was constructed over a 16 ft by 16 ft PVC framework.

To estimate the lacustrine clay deposits, TDEM survey stations were separated 200 to 300 ft apart. The survey station separations utilized during the project were appropriate to meet the purpose of the investigation.

The geophysical investigation was conducted from March 7 through March 13, 1994. TDEM soundings were performed at each of the four lakes (Figures 8, 10, and 12). A total of 368 TDEM soundings were performed during the investigation. The SDII field crew consisted of one senior project geophysicist, Robert J. Windschauer, P.G., and one geophysical field technician. Two additional technicians were provided by Foth & Van Dyke and GeoTrans, Inc. Representatives of the Wisconsin Department of Natural Resources frequently observed the completion of the field work.

3.1.3 Description of Quality Control Procedures

Prior to the commencement of actual TDEM surveying, multiple TDEM soundings were performed using separations of varying distances between the tow vehicle and TDEM equipment. Results of these soundings indicated that there was no impact on survey results using a distance of 41 ft between the tow vehicle and TDEM equipment. The framework used for the transmitter loop was constructed with pieces of PVC pipe, a non-metallic material, glued together. Accordingly, the framework materials used for the Tx loop had no impact on the survey results.

Interference sources typically encountered during TDEM investigations are buried metal pipelines, overhead power lines, or electrical storms. No sources of interference were observed at any of the lake sites. The effect of cultural interference sources such as pipelines is that if there is a source of noise to one side of a Tx loop, then the coupling of the incident pulse from the transmitter with the pipe would impart voltage gradients within the loop that would not otherwise exist. Each of these interference sources has a characteristic affect upon TDEM results. None of the TDEM soundings collected during the SDII investigation were affected by such sources of interference.

At each of the TDEM stations, soundings were performed using two different gain settings (amplification). Different gain settings were used to provide two apparent resistivity values at the majority of the time gates. Having two apparent resistivity values at a particular time gate increases the precision in the data. Collecting data at two gain

settings provided additional confidence that sufficient geophysical data was recorded to evaluate the thickness of the lacustrine clay strata.

3.1.4 Description of Induced EMF Field

Once the field setup is completed, a current waveform (as depicted by Figure 2) is injected into the Tx loop. The rapid turn-off of current in the loop creates a strong electromotive force (EMF) which generates eddy currents in conductive materials. These currents have an associated secondary magnetic field which is detected by the Rx coil as shown on Figure 2. Eddy currents close to the Tx coil are induced first and decay below detection limits before deeper currents. Currents in resistive materials also decay faster than currents in conductors. Deeper conductors contribute to responses at later times at the Rx coil than do shallower subsurface features. Thus, by measuring the rate and nature of the decaying magnetic field seen by the Rx coil after Tx shutoff, the distribution of subsurface resistivity can be determined. The survey variables that can be selected by the TDEM operator are the size of the Tx coil, Tx coil current (which controls the penetration depth), analog stacking (number of repetitions of summed transients in order to increase signal-to-noise ratio), gain at the receiver, and repetition rate (frequency) of the current cycles. For this investigation, SDII used a frequency of 315 Hz with 2 different gain settings to acquire detailed and overlapping segments of the decay curve which enabled resolution of shallow (low-gain data) and deeper (high-gain data) portions of the subsurface. Lower gains can be used to avoid saturating the receiver coil in early channels, and higher gains can be used to amplify weaker signals in later channels. A frequency of 315 Hz was used based on the results of initial soundings that were performed near the locations of borings where the variation of lithology with depth was known. The selected frequency of 315 Hz provided the optimal combination of depth of investigation and resolution of relatively near surface sediment changes.

## 3.2 Global Positioning System - Trimble 4000RS Reference Surveyor

### 3.2.1 Generalized Description of Equipment

A global positioning system (GPS) was used by SDII to determine the position of the TDEM system at survey stations located at Little Sand and Deep Hole Lakes. The system used for the investigation was the GPS - Trimble 4000RS Reference Surveyor system. The principal components of the GPS are:

- Trimble SE Receiver-Base Station
- Trimble SE Receiver-Rover
- Trimtalk Radio

The global positioning system (GPS) is a constellation of satellites maintained by the U.S. Department of Defense. It consists of 21 active satellites and 3 in-orbit spares. Due to ionospheric and tropospheric delays, and errors deliberately added by the Department of Defense, GPS can only be relied upon to be accurate within approximately 300 ft. However, if a GPS receiver is installed in a known, surveyed location, then the error inherent in the GPS position can be determined by comparing the calculated range to the satellite constellation, terrain, and GPS receiver. This correction can then be broadcast in real time to other GPS receivers, providing accuracy in the 3 to 30-foot range, depending upon the quality of the satellite constellation, terrain, and GPS receiver. The location of the GPS receiver base station was surveyed prior to the SDII field investigation to allow this correction to be made.

### 3.2.2 Field Setup and Logistics

The GPS system was set up at Little Sand Lake and Deep Hole Lake. The base station was placed near the center of the lakes to allow the receiver-rover to be in direct line of sight between itself and the base stations. The GPS rover station was kept inside of the tow vehicle during the survey. This was necessary to maintain the GPS rover station within the required operating temperature range. The locations of the TDEM stations, determined by the GPS system, were corrected for the separation distance between the rover station and the receiver coil location. Because of thin ice, it was not

possible to operate the tow vehicle on either Skunk or Duck Lakes. The location of the TDEM station for these two lakes was determined using a Brunton surveying compass, a measuring wheel with an accuracy of 0.5 ft per 100 linear ft, and site maps provided by Foth and Van Dyke. The positions of each of the TDEM stations based on GPS positioning are provided on Figures 8 and 10. The position of each of the TDEM stations, based on the Brunton surveying compass, are illustrated on Figure 12.

## 3.3 Hydrogeologic (Data) Characterization

### 3.3.1 Existing Site Specific Data

A number of hydrogeologic investigations have been performed over the years to define the regional hydrogeologic conditions within the Crandon Project study area. In addition to defining the regional groundwater flow regime, a primary purpose of these historical investigations was to evaluate the hydrogeologic characteristics of area surface water bodies such as lakes and wetlands. Of particular concern was the hydrogeologic characteristics (i.e., thickness, continuity and hydraulic conductivity) of fine-grained sediments (clay and silt) which form the bottoms of lakes and adjoining wetlands in the immediate vicinity of the mine/mill site. These lakes include Little Sand, Deep Hole, Oak, Duck, and Skunk Lakes. The focus of the geophysical investigation performed by SDII was to evaluate the continuity and thickness of fine-grained sediments that line the bottom of Little Sand, Deep Hole, Skunk, and Duck Lakes. Oak Lake was not investigated since, as summarized below, previous studies have shown this lake to be perched and thus not subject to possible drawdown due to mine dewatering activities.

The regional hydrogeologic setting in the Crandon Project study area is characterized by a sequence of stratified glacial deposits over low permeability bedrock. Groundwater occurs primarily in the glacial deposits under unconfined conditions and forms the primary aquifer in the study area. Typically, the glacial deposits consist of a surficial glacial till, which is material deposited directly by the glacier. Below the till resides a layer of

stratified glacial outwash consisting of sands and gravel. The outwash is typically separated from the bedrock by a deeper layer of unconsolidated material consisting of a lower till layer and/or saprolite. On a regional scale, groundwater flow occurs primarily in the glacial deposits.

Several investigations have been conducted to evaluate the hydrogeologic relationship between area lakes and the glacial aquifer. An investigation conducted by STS Consultants in 1982 showed that Little Sand Lake is a seepage lake that is underlain by a low-permeability glacial lacustrine clay. Similarly, STS (1984) showed that Deep Hole, Duck, Skunk and Oak Lakes were also underlain by low permeability glacial lacustrine deposits. Oak Lake was shown to be a perched lake underlain by a low permeability lacustrine clay. Deep Hole and Duck Lakes were shown to be seepage lakes underlain by low permeability silts and clays, respectively. Skunk Lake was shown to be a seepage lake underlain by vertically low permeable ice margin contact deposits of clays and silts with interlayered lenses of sand and gravel.

Additional studies conducted by Foth & Van Dyke (1994) physically confirmed the presence of low permeability lacustrine clay in shallow shoreline areas of Little Sand Lake via soil borings, and in-situ and lab permeability tests. Studies conducted by STS (1986) and Foth & Van Dyke (1994) showed that the wetland associated with Duck and Skunk Lakes to be underlain by ice margin contact deposits forming a complex sequence of interlayered clays, silts and sands. The Skunk Lake wetland was shown to be a seepage wetland, whereas the Duck Lake wetland was shown to be perched.

As part of the investigations that were conducted in the 1980's and 1994, an extensive number of borings were completed on the lakes and adjoining wetlands in the vicinity of the mine site. Figure 4 displays the location of borings that were completed for the investigations conducted in the 1980's and Figure 5 displays the locations of borings and well installations completed for the 1994 investigation. Boring logs from the investigations conducted at the lakes are contained in Appendix 1.

As part of the geophysical investigation, the data obtained from previous investigations was used to provide control points for the geophysical survey. Tables 1 and 2 summarize the data on soil types and hydraulic conductivity obtained from previous investigations that were used in evaluating the results from the geophysical study.

# 4.0 DATA PROCESSING AND EVALUATION PROCEDURES

## 4.1 Description of TDEM Data Transfer Procedures

The voltage response seen at each time gate during the TDEM soundings is recorded digitally by the data-logging module within the receiver. In addition, information such as station designation, Tx coil amperage, relative position of Tx and Rx coils, and Tx coil shut off times are also recorded. Information is stored in a software program called Protem (Geonics, Inc.), which is stored internally within the receiver. Using the Protem program, data are downloaded into a portable computer for future analysis.

## 4.2 Description of Processing and Modeling Software

### 4.2.1 TDEM Data

Data acquired by the TDEM receiver were downloaded to a portable computer for data editing, processing, and interpretation (inversion) using Protem. The software program used to process the data was TEMIXGL (Interpex, Ltd.) This program accepts raw data from the receiver and proceeds through the following general processing steps:

Data Set Editing - Allows for modification of general survey information, for example, loop size or Tx coil amperage. Decay curves for all frequencies and gain values taken at a site are displayed; data sets can be edited and data taken at different gains are averaged and converted to a single, apparent resistivity versus time field curve (Figure 6). Each data point represents an apparent resistivity collected at a particular time or time gate. The combined data are interpreted as one sounding curve. Rx voltages at early times are sometimes saturated, or beyond the operating range of the Rx coil and are muted during interpretation. Data from gates before or near the end of the Tx shut off ramp are also muted. These are usually the first one or two channels. Often, data from late

channels are muted because the weak transients in late channels are most affected by noise. Operating parameters for this survey were selected so that transient responses from the clay layer do not fall in the first one or two or the last few channels.

Initial Model - As part of the modeling procedure, early and late time data are muted, for the reasons discussed above. In order to maximize the number of usable data points, two different gain settings were used at each TDEM sounding station. Review of the apparent resistivity curve shape allows a trained geophysicist to make an initial judgment as to the true resistivity versus depth (layered) model which would produce the observed data set. After the model is created, a field curve is calculated from the model and compared with the data. The degree of agreement between model and field data is measured statistically and expressed as the fitting error. The geophysicist may then, in an interactive mode, adjust the model to obtain a better fit, can modify the starting model, or use regression routines, as was done here, to obtain a "best fit" without creating bias.

Automatic Inversion - Based upon the initial model, the program creates a better fit to the observed data using an iterative, Inman Ridge Regression routine to adjust layer thicknesses and resistivities until a minimum error of fit is realized. Our goal was to produce models which fit the observed data within a 5-10% error of fit. This final model is termed the "best fit" model (see Figure 7). Only the data points utilized in the determination of the modeled curve are used in calculation of the fitting error.

Equivalence Analysis - Electrical resistivity methods, as do other geophysical methods, produce non-unique solutions. That is, while a best-fit model produces an acceptable fit to field data curves, there can be several models with different thicknesses and resistivities which will also provide a "reasonable" fit to the same data. TEMIXGL will produce a suite of models, using the best-fit model as a start, which would produce a reasonably close fit (see Figure 7). If the equivalent model segments (layers and resistivities) do not vary much from the original model, then the layering provided by the best-fit model is very good. If the equivalent models differ quite a bit from the best-fit

model, then there is less confidence in the absolute values of layer thickness or resistivity for that layer or boundary. A less-well constrained equivalent model for a given layer means either there are too few data points in the raw data to adequately describe that layer, the data have been affected by noise, or the data are just not very sensitive to that specific layer.

4.2.2 GPS Data

Pfinder (Trimble Navigation, Inc.) is a software program used to convert GPS data to various types of data formats. Pfinder was used in this investigation to convert GPS data collected at each TDEM station to DFX file format for importation into AutoCad (a computer aided design software package). GPS determined positions were adjusted to corrected for the difference in location between the GPS receiver rover station (located in the tow vehicle) and the receiver coil for the TDEM system.

## 4.3 Evaluation of TDEM Models

Little Sand Lake - TDEM data collected at Little Sand Lake was analyzed using either a three or four-layer model. The selection of either a three or four-layered model was based upon the geometry of the sounding curve. The first layer represented water and near-lake bottom organic sediments and sand. The second layer represented the clay stratum. The third and fourth layers represented glacial till and bedrock, respectively.

The resistivity of the second layer was determined by modeling the TDEM soundings that were near the location of soil borings where lithologic logs were available. In the modeling of the TDEM data at these control points, the thickness of the second layer (clay) was fixed and the statistically best-fit resistivity value was left to be determined by the modeling program. The resultant resistivity values from each of the modeled soundings were averaged to develop a representative resistivity of the clay layer.

This representative second layer resistivity (21 ohm-meters) was then used in the subsequent modeling of the remaining of the TDEM soundings collected at Little Sand Lake.

In the modeling of the TDEM soundings collected at Sand Lake all other layer thickness and resistivities were left unconstrained. Resistivity values of layer 1 (water and uppermost organic sediments) ranged from 200-400 ohm-meters. Resistivity values of the third (glacial till) and fourth (bedrock) layers varied considerably from 300-400 to over 2000 ohm-meters, respectively.

Deep Hole Lake - TDEM data collected at Deep Hole Lake was analyzed using either a three or four-layer model. The selection of either a three or four-layered model was based upon the geometry of the sounding curve.

The first layer represented water and near-lake bottom organic sediments. The second layer represented the clayey-silt stratum. The third and fourth layers represented glacial till and bedrock, respectively.

The resistivity of the second layer was determined by modeling the TDEM sounding number 2.7.2 that was near the location of STS-DHL-1 (Figure 10). In the modeling of the TDEM data at this sounding the thickness of the second layer (clayey-silt) was fixed and the best-fit resistivity value was left to be determined by the modeling program. This representative second layer resistivity (18 ohm-meters) was then used in the subsequent modeling of the remaining of the TDEM soundings collected at Deep Hole Lake.

In the modeling of the TDEM soundings collected at Deep Hole Lake, all other layer thickness and resistivities were left unconstrained. Resistivity values of layer 1 (water and uppermost organic sediments) ranged from 100-400 ohm-meters. Resistivity values of the third (glacial till) and fourth (bedrock) layers varied considerably from 300-400 to over 2000 ohm-meters, respectively.

Duck Lake - TDEM data collected at Duck Lake was analyzed using either a three or four-layer model. The selection of either a three or four-layered model was based upon the geometry of the sounding curve. The first layer represented water and near-lake bottom organic sediments. The second layer represented the clay stratum. The third and fourth layers represented glacial till and bedrock, respectively.

The resistivity of the second layer was determined by modeling the TDEM sounding number 2.6.2 that was near the location of STS-DL-1 (Figure 12). In the modeling of the TDEM data at this sounding the thickness of the second layer (clay) was fixed and the best-fit resistivity value was left to be determined by the modeling program. This representative second layer resistivity (22 ohm-meters) was then used in the subsequent modeling of the remaining TDEM soundings collected at Duck Lake.

In the modeling of the TDEM soundings collected at Duck Lake all other layer thickness and resistivities were left unconstrained. Resistivity values of layer 1 (water and uppermost organic sediments) ranged from 100-400 ohm-meters. Resistivity values of the third (glacial till) and fourth (bedrock) layers varied considerably from 300-400 to over 2000 ohm-meters, respectively.

Skunk Lake - TDEM data collected at Skunk Lake was analyzed using either a three or four-layer model. The selection of either a three or four-layered model was based upon the geometry of the sounding curve. The first layer represented water and near-lake bottom organic sediments. The second layer represented the clay stratum. The third and fourth layers represented glacial till and bedrock, respectively.

The resistivity of the second layer was determined by modeling the TDEM sounding number 4.1.2 that was near the location of STS-SL-1 (Figure 12). In the modeling of the TDEM data at this sounding the thickness of the second layer (clay) was fixed and the best-fit resistivity value was left to be determined by the modeling program. This representative second layer resistivity (18 ohm-meters) was then used in the subsequent modeling of the remaining of the TDEM sounding collected at Skunk Lake.

In the modeling of the TDEM soundings collected at Skunk Lake all other layer thickness and resistivities were left unconstrained. Resistivity values of layer 1 (water and uppermost organic sediments) ranged from 100-400 ohm-meters. Resistivity values of the third (glacial till) and fourth (bedrock) layers varied considerably from 300-400 to over 2000 ohm-meters, respectively.

# 5.0 RESULTS

## 5.1 General

TDEM survey results indicated that a lacustrine clay and silt stratum is continuous across each of the lakes investigated. Correlation of the TDEM results to the lithologic logs indicates that the clay layer defined by the TDEM modeling is composed of either homogenous clay or interbedded sequences of silty-clay, clayey-silt, or sandy-clay. Accordingly, the clay, silty-clay, clayey-silt, or sandy clay sediments were modeled as a bulk unit. Based on the comparison of TDEM results to lithologic logs, the estimated clay thickness from the TDEM soundings tends to be less than the thickness of clay determined from the lithologic logs. Results of the modeling for each of the TDEM soundings obtained near boring locations are provided in Appendix 2.

### 5.1.1 Little Sand Lake

Results from the TDEM survey are presented in Figure 9. The estimated thickness of clay ranges from approximately 1 to 18 ft. Approximately 90% of the lake area is underlain by a clay stratum with a thickness of 3 ft or greater. The thickness of the clay stratum is greatest near the center of the lake and thinnest near the southwest corner of the lake. Correlation of TDEM results to soil boring results is also presented in Figure 9. The geophysical profile for estimated clay thickness (TDEM) shown on the figure is based upon the results from approximately 20 soundings. The geologic profile is based upon lithologic logs from six soil borings completed across the lake. The general trend of changes in the thickness of the clay stratum is similar for both profiles. TDEM results indicate that the clay stratum is continuous across the lake and that the geophysical results tended to underestimate the clay thickness near LSL-105, where the clay is the thinnest.

5.1.2 Deep Hole Lake

Results from the TDEM survey are presented in Figure 11. The estimated thickness of clayey silt ranges from approximately 3 to 24 ft. The thickness of the clayey silt is greatest near the center of the lake and thinnest near the lake boundaries. Correlation of TDEM results to soil boring results is also presented in Figure 11. The geophysical profile for estimated clay thickness (TDEM) is based upon the results from approximately 11 soundings. The lithologic log from STS-DHL-1 is plotted on the profile. At the boring location, the estimated clay thickness indicated by the TDEM study was within 1 ft of the lithologic log results. Based on the TDEM results, the clayey silt stratum is continuous across the lake.

5.1.3 Duck Lake

Results from the TDEM survey are presented in Figure 13. The estimated thickness of clay ranges from approximately 4 to 19 ft. The thickness of the clay is greatest near the northeast corner of the lake and thinnest at the lake boundaries. Correlation of TDEM results to soil boring results is also presented in Figure 13. The profile for estimated clay thickness (TDEM) is based upon the results from approximately 7 soundings. The lithologic log from STS-DL-1 is plotted on the profile. At the boring location, the estimated clay thickness from the TDEM study was within 3 ft of the lithologic log results. Based on the TDEM results, the clayey silt stratum is continuous across the lake.

5.1.4 Skunk Lake

Results from the TDEM survey are presented in Figure 13. The estimated thickness of clay ranges from approximately 1 to 6 ft. The thickness of the clay increases from west to east. Correlation of TDEM results to soil boring results is also presented in Figure 13. The profile for estimated clay thickness (TDEM) is based upon the results from approximately 3 soundings, while the profile based upon the lithologic logs is based

upon the lithologic logs from STS-SL-1 and STS-SL-5. At each of the boring locations, the estimated clay thickness from the TDEM study was within 1 ft of the lithologic log results. Based on the TDEM results, the clayey silt stratum is continuous across the lake.

# 6.0 CONCLUSIONS

The following can be concluded regarding the geophysical investigation conducted at Little Sand, Deep Hole, Duck, and Skunk Lakes:

- TDEM was demonstrated to be the appropriate electromagnetic technique to determine the lateral extent and thickness of the lacustrine clay and silt strata underlying each of the lakes.

- Results of the TDEM investigation indicate that the lacustrine clay and silt strata is continuous across the bottoms of each of the lakes.

- The estimated thickness of the lacustrine clay and silt strata determined using TDEM ranges from approximately 1 to over 24 ft in thickness.

- Comparison of the TDEM results to lithologic logs indicate that the TDEM technique tends to underestimate clay/silt thickness.

## REFERENCES

Culley, R. W.; Jagodits, Fl. L.; Middleton, R. S. (1975) "E-Phase System for Detection of Buried Granular Deposits. Symposium on Modern Innovations in Subsurface Exploration", 54th Annual Meeting of Transportation Research Board.

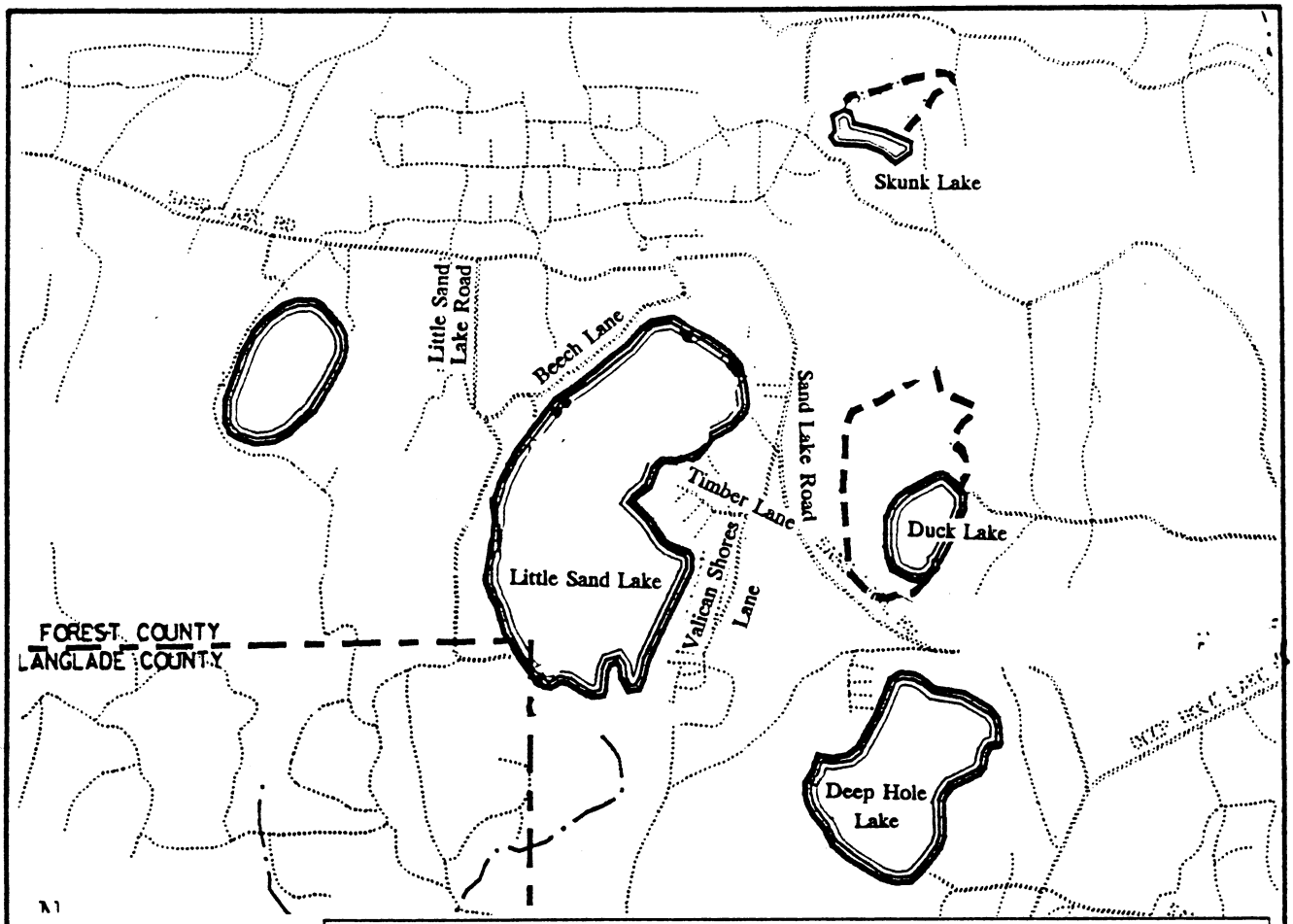
STS Consultants, 1982. Soil Boring and Test Results of Little Sand Lake Drilling Project.

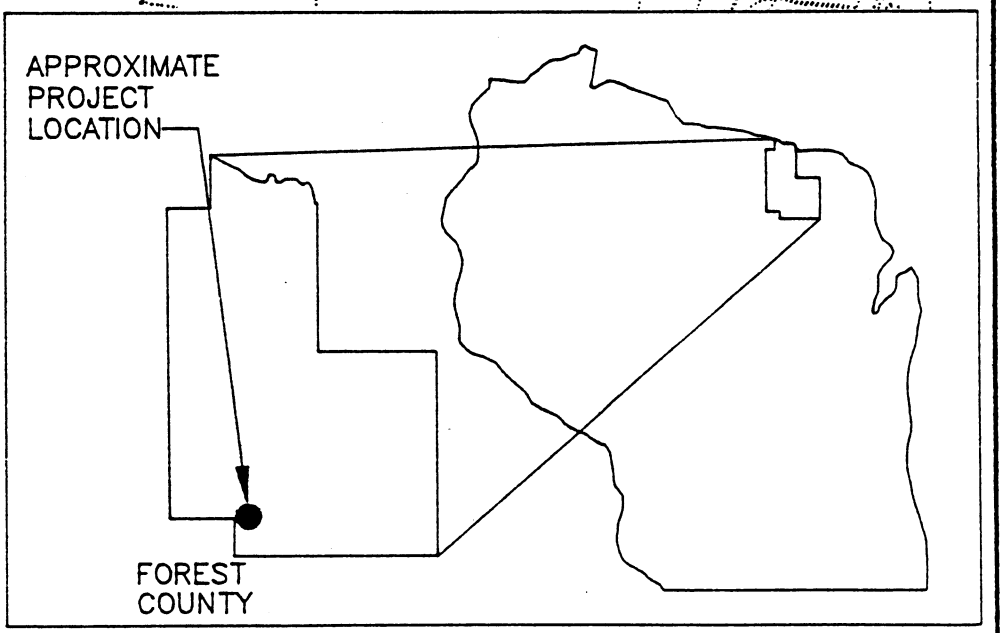
STS Consultants, 1984. Lake Sediment Sampling on Duck, Skunk, Oak, and Deep Hole Lakes - Crandon Project.

STS Consultants, 1986. Duck Lake and Skunk Lake Wetland Well Installation.

Telford, W. M.; Geldart, L. P.; Sheriff, R. E.; Keys, D. A. (1976). Applied Geophysics, Ch. 5, Cambridge University Press, N.Y.

# FIGURES




N

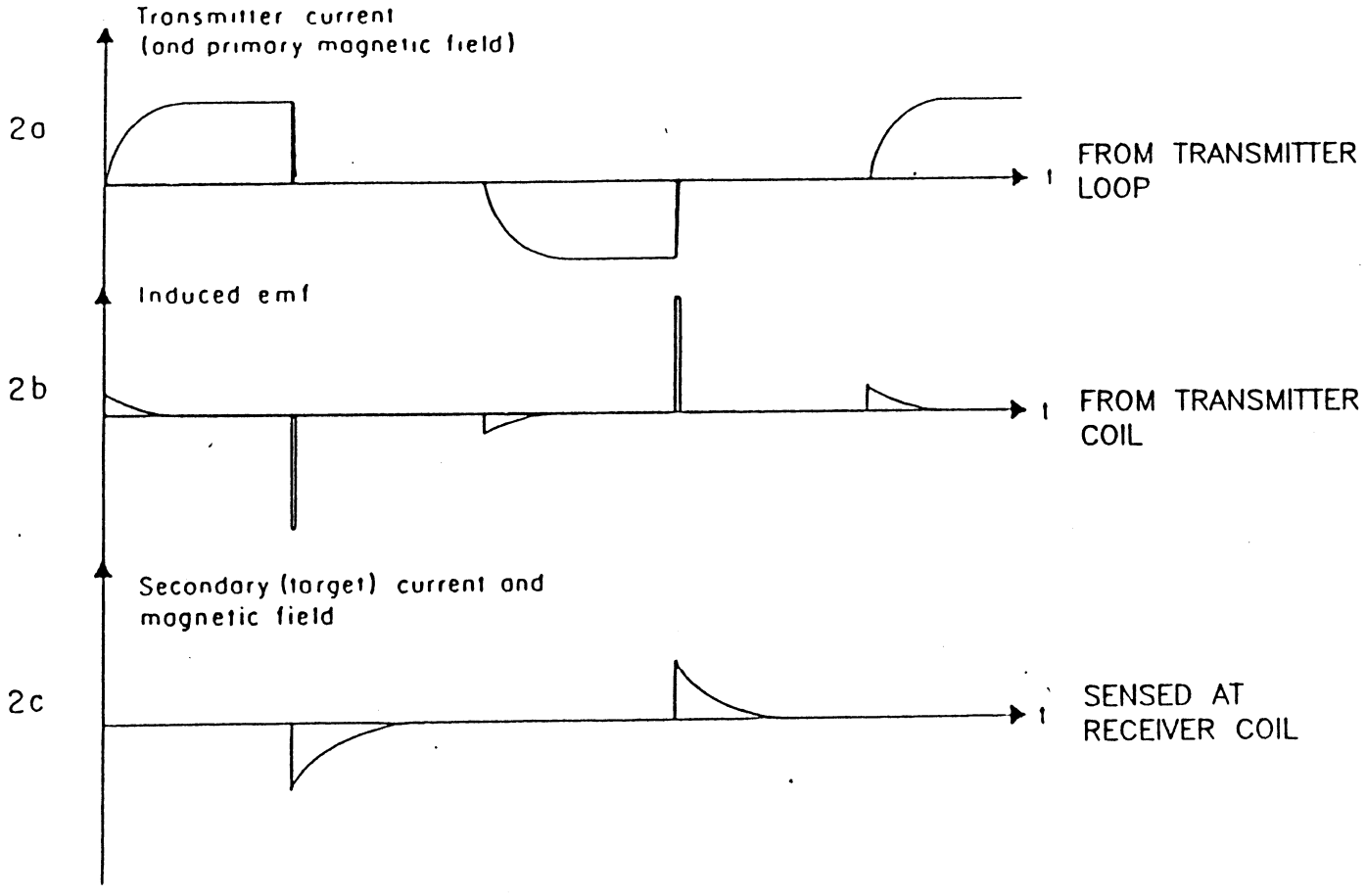
NOT TO SCALE

FOTH & VAN DYKE
GREEN BAY, WI

SDII
SUBSURFACE DETECTION INVESTIGATIONS INCORPORATED

SITE LOCATION MAP
CRANDON MINING COMPANY SITE
FOREST COUNTY, WISCONSIN

| | | | | |
|---|---|---|---|---|
| DESIGNED BY: | RJW | PROJECT NO.: | 94727 | FIGURE |
| CHECKED BY: | MJW | DRAWING NO.: | LOC | 1 |
| DRAWN BY: | RBT | DATE: | 04/25/94 | |

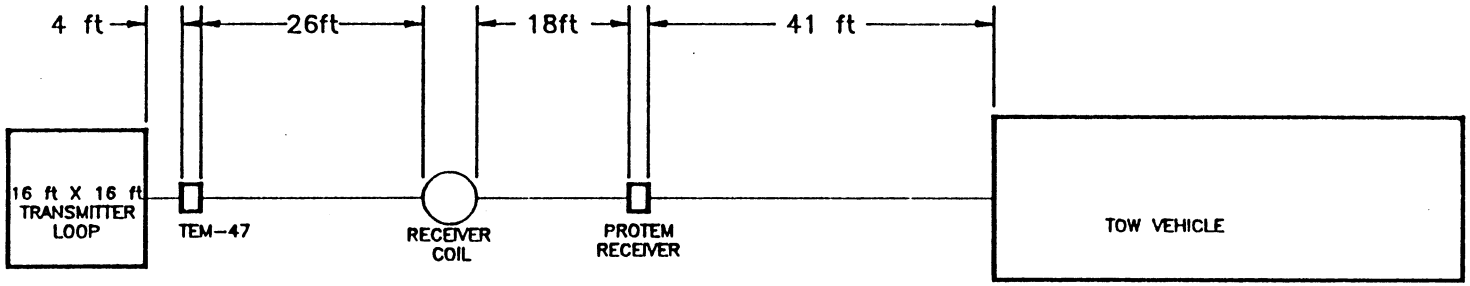



FOTH & VAN DYKE
GREEN BAY, WI

SDII
SUBSURFACE
DETECTION
INVESTIGATIONS
INCORPORATED

DIAGRAM SHOWING
SYSTEM WAVEFORMS – TDEM
CRANDON MINING COMPANY SITE
FOREST COUNTY, WISCONSIN

| | | | | |
|---|---|---|---|---|
| DESIGNED BY: | RJW | PROJECT NO.: | 94727 | FIGURE |
| CHECKED BY: | MJW | DRAWING NO.: | DIA2 | 2 |
| DRAWN BY: | RBT | DATE: | 04/25/94 | |

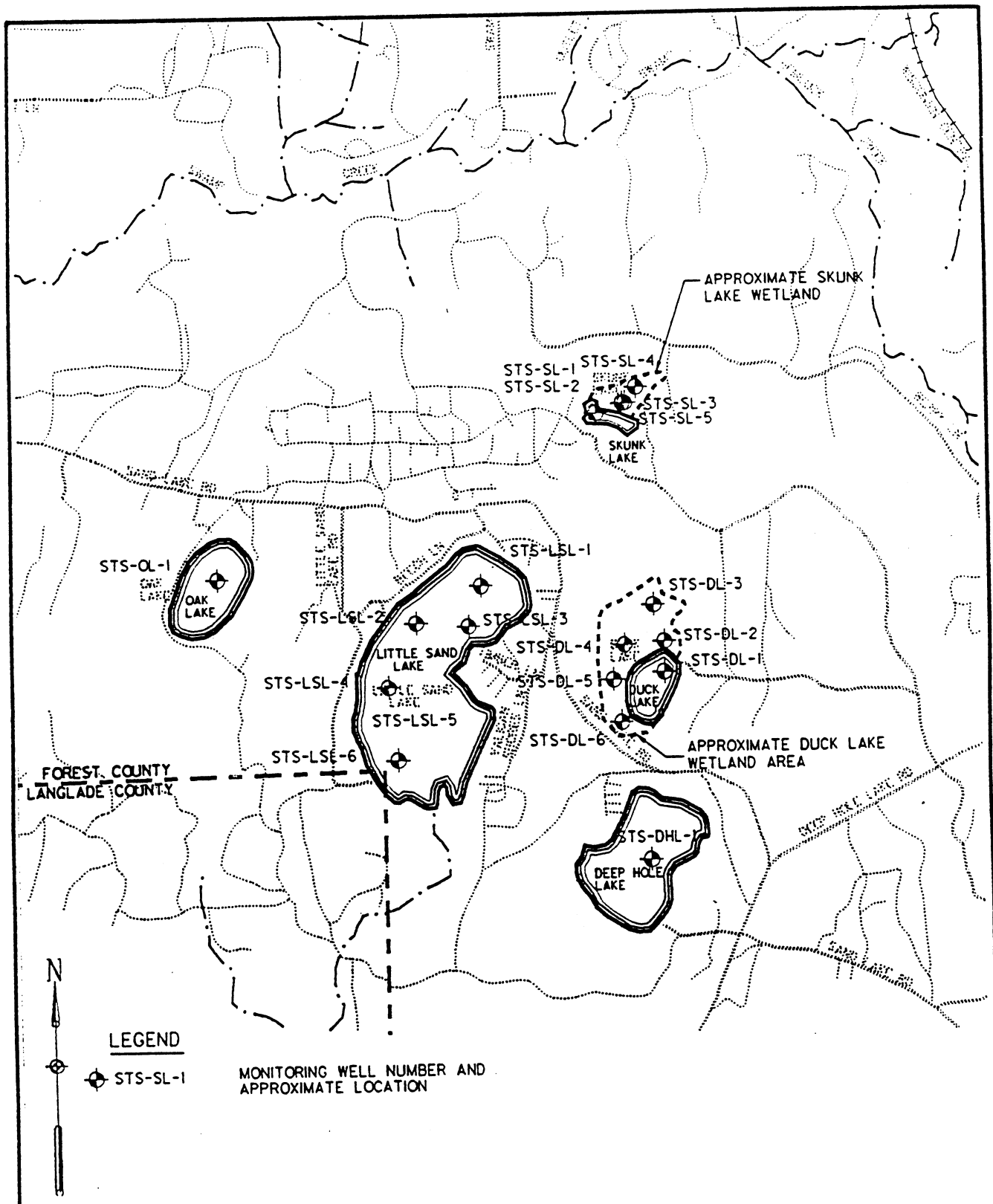



FOTH & VAN DYKE
GREEN BAY, WI

SDII
SUBSURFACE
DETECTION
INVESTIGATIONS
INCORPORATED

BLOCK DIAGRAM SHOWING
PROTEM TEM-47 FIELD SETUP
CRANDON MINING COMPANY SITE
FOREST COUNTY, WISCONSIN

| | | | | |
|---|---|---|---|---|
| DESIGNED BY: | RJW | PROJECT NO.: | 94727 | FIGURE |
| CHECKED BY: | MJW | DRAWING NO.: | DIA1 | 3 |
| DRAWN BY: | RBT | DATE: | 04/25/94 | |




FOTH & VAN DYKE
GREEN BAY, WI

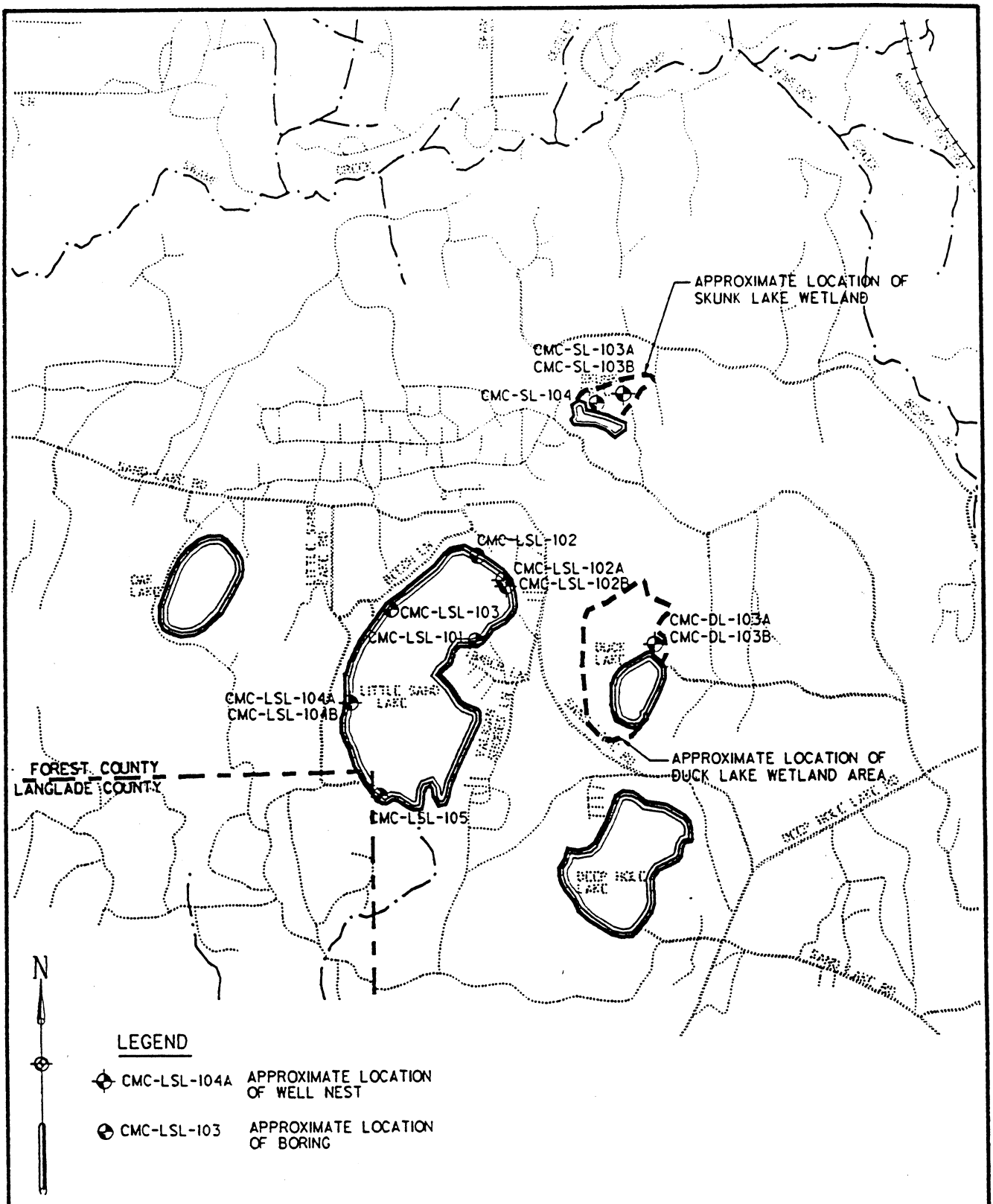
SDII
SUBSURFACE DETECTION INVESTIGATIONS INCORPORATED

# WELL LOCATIONS FROM 1982–1985 HYDRGEOLOGIC INVESTIGATIONS CRANDON MINING COMPANY SITE FOREST COUNTY, WISCONSIN

MAP PROVIDED BY FOTH AND VAN DYKE

| | |
|---|---|
| PROJECT NO.: | 94727 |
| DRAWING NO.: | DIA3 |
| DATE: | 04/25/94 |

FIGURE 4




FOTH & VAN DYKE
GREEN BAY, WI

SDII
SUBSURFACE DETECTION INVESTIGATIONS INCORPORATED

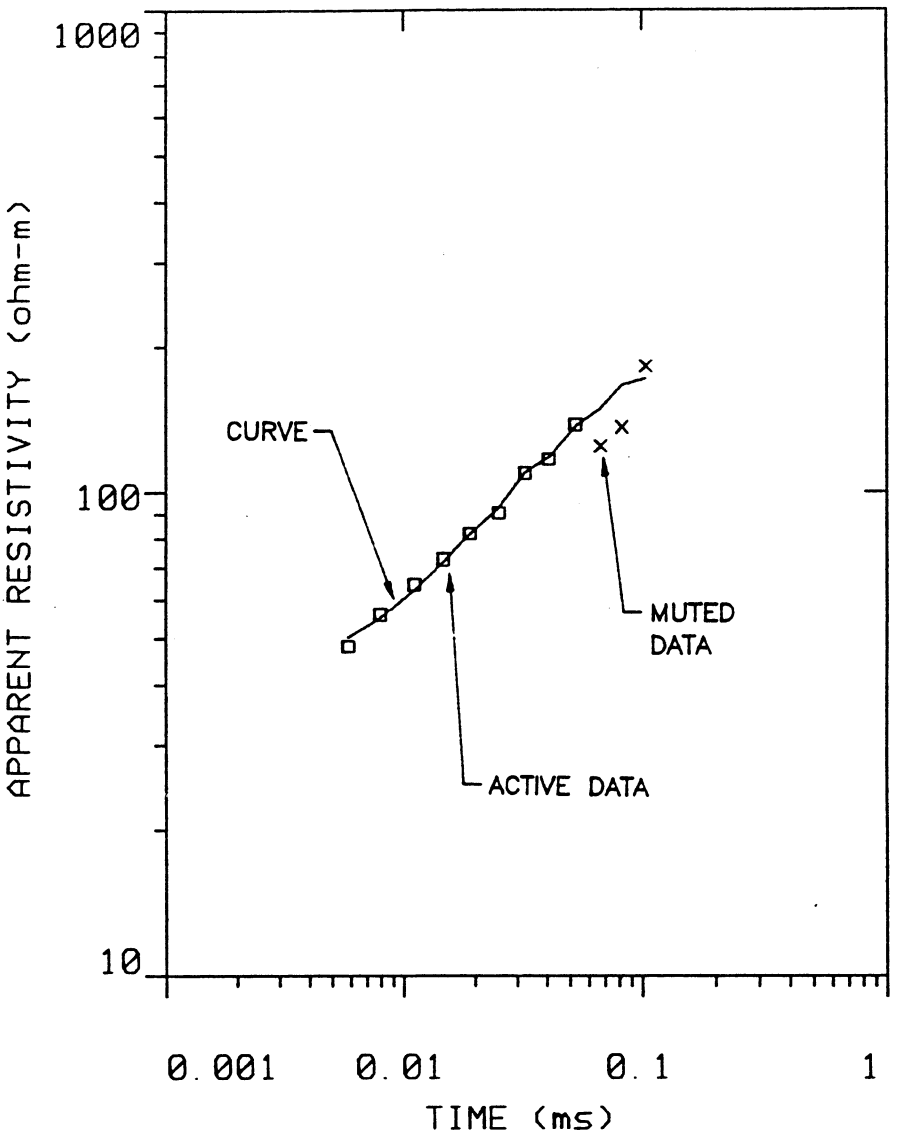
COMPLETED WETLAND LAKE BORINGS AND WELL INSTALLATIONS FOR 1994 INVESITGATION
CRANDON MINING COMPANY SITE
FOREST COUNTY, WISCONSIN

MAP PROVIDED BY FOTH AND VAN DYKE

PROJECT NO.: 94727
DRAWING NO.: DIA4
DATE: 04/25/94

FIGURE 5

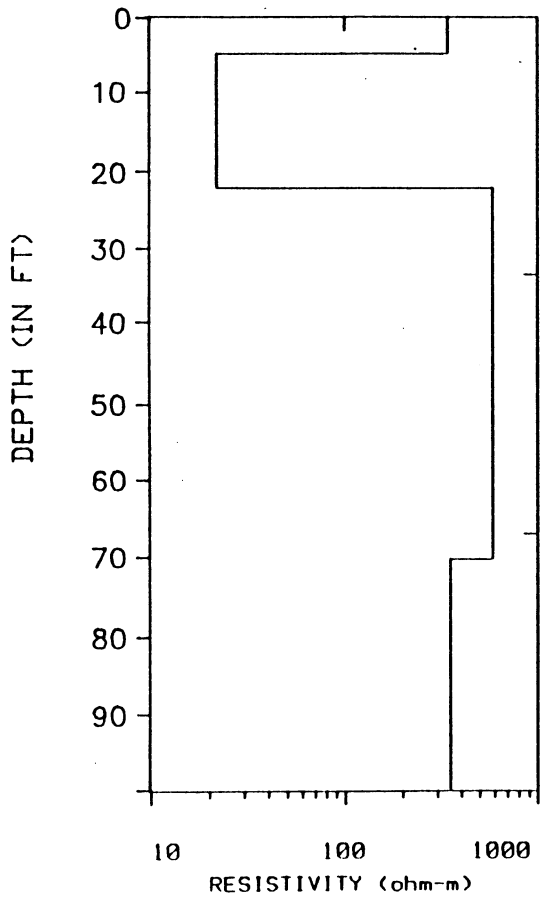
341

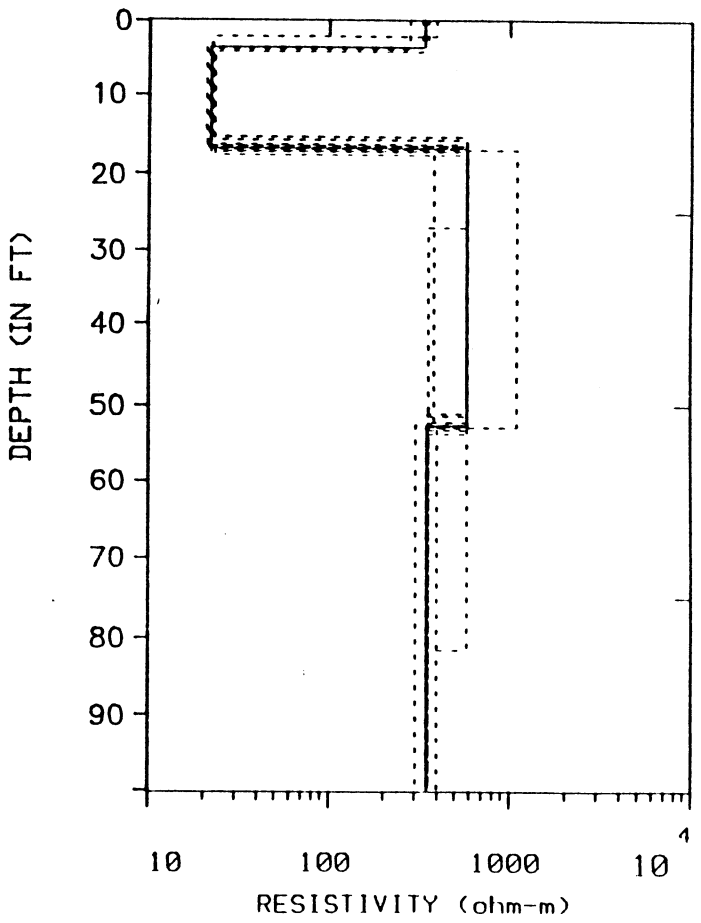



EXPLANATION

- ▫ DATA POINT USED IN MODELING
- x DATA POINT NOT USED IN MODELING

| | | | |
|---|---|---|---|
| FOTH & VAN DYKE<br>GREEN BAY, WI | SDII<br>SUBSURFACE DETECTION INVESTIGATIONS INCORPORATED | DEMONSTRATION TDEM SURVEY RESULTS SHOWING APPARENT RESISTIVITY VERSES TIME<br>CRANDON MINING COMPANY SITE<br>FOREST COUNTY, WISCONSIN | |
| | | DESIGNED BY: RJW<br>CHECKED BY: MJW<br>DRAWN BY: RBT | PROJECT NO.: 94731<br>DRAWING NO.: DIA5<br>DATE: 04/25/94 | FIGURE 6 |




EXPLANATION

: EQUIVALENCE MODEL SOLUTIONS

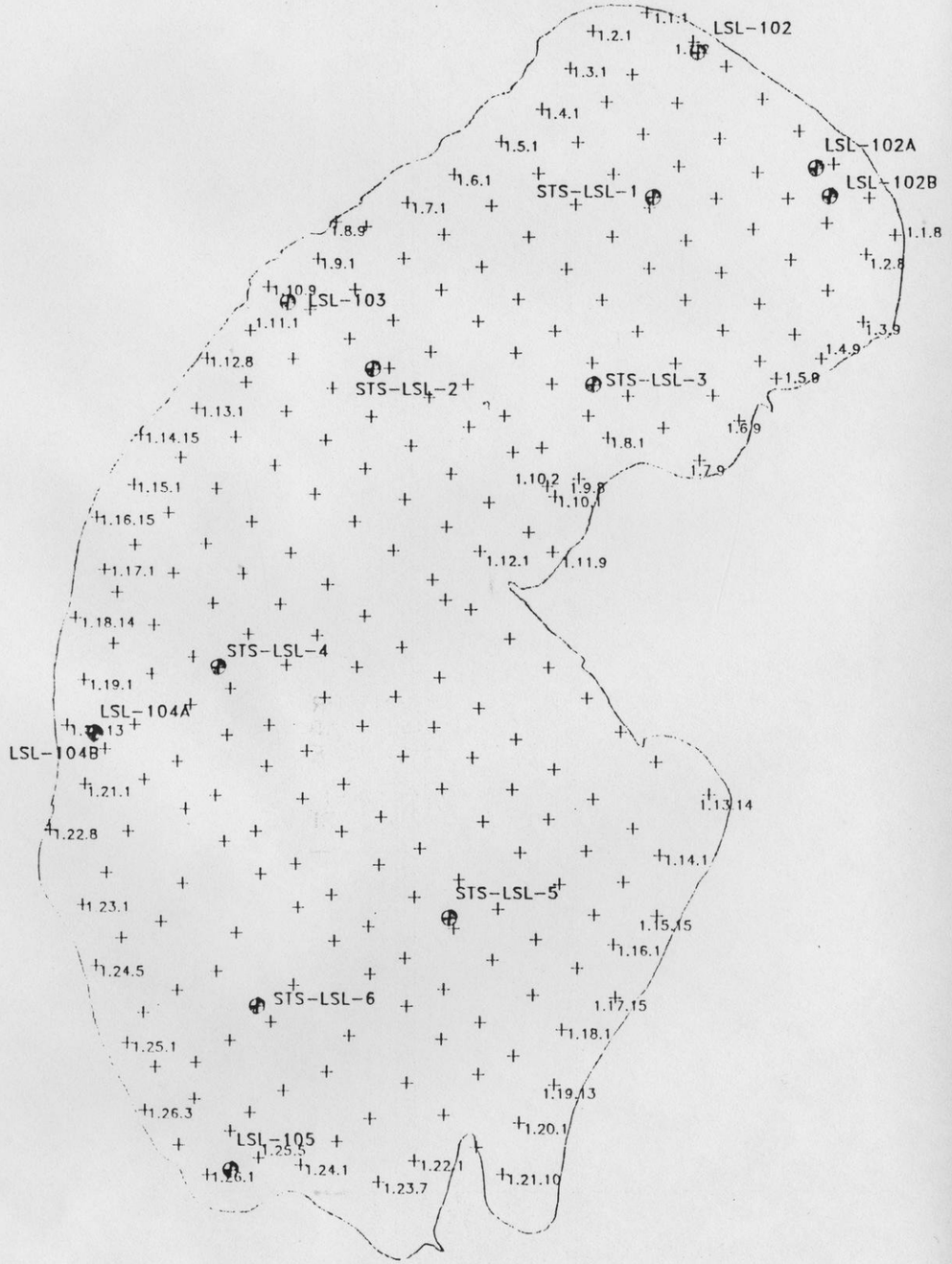
| BEST-FIT MODEL SOLUTIONS

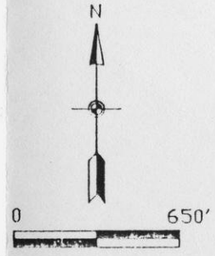
FOTH & VAN DYKE
GREEN BAY, WI

SDII
SUBSURFACE DETECTION INVESTIGATIONS INCORPORATED

DEMONSTRATION TDEM SURVEY RESULTS SHOWING
BEST FIT MODEL AND EQUIVALENCE MODELS
CRANDON MINING COMPANY SITE
FOREST COUNTY, WISCONSIN

| | | | | |
|---|---|---|---|---|
| DESIGNED BY: | RJW | PROJECT NO.: | 94727 | FIGURE |
| CHECKED BY: | MJW | DRAWING NO.: | DIA6 | 7 |
| DRAWN BY: | RBT | DATE: | 04/25/94 | |




EXPLANATION

+ TDEM SURVEY STATION (DESIGNATIONS INDICATED AT START AND END OF EACH SURVEY LINE)

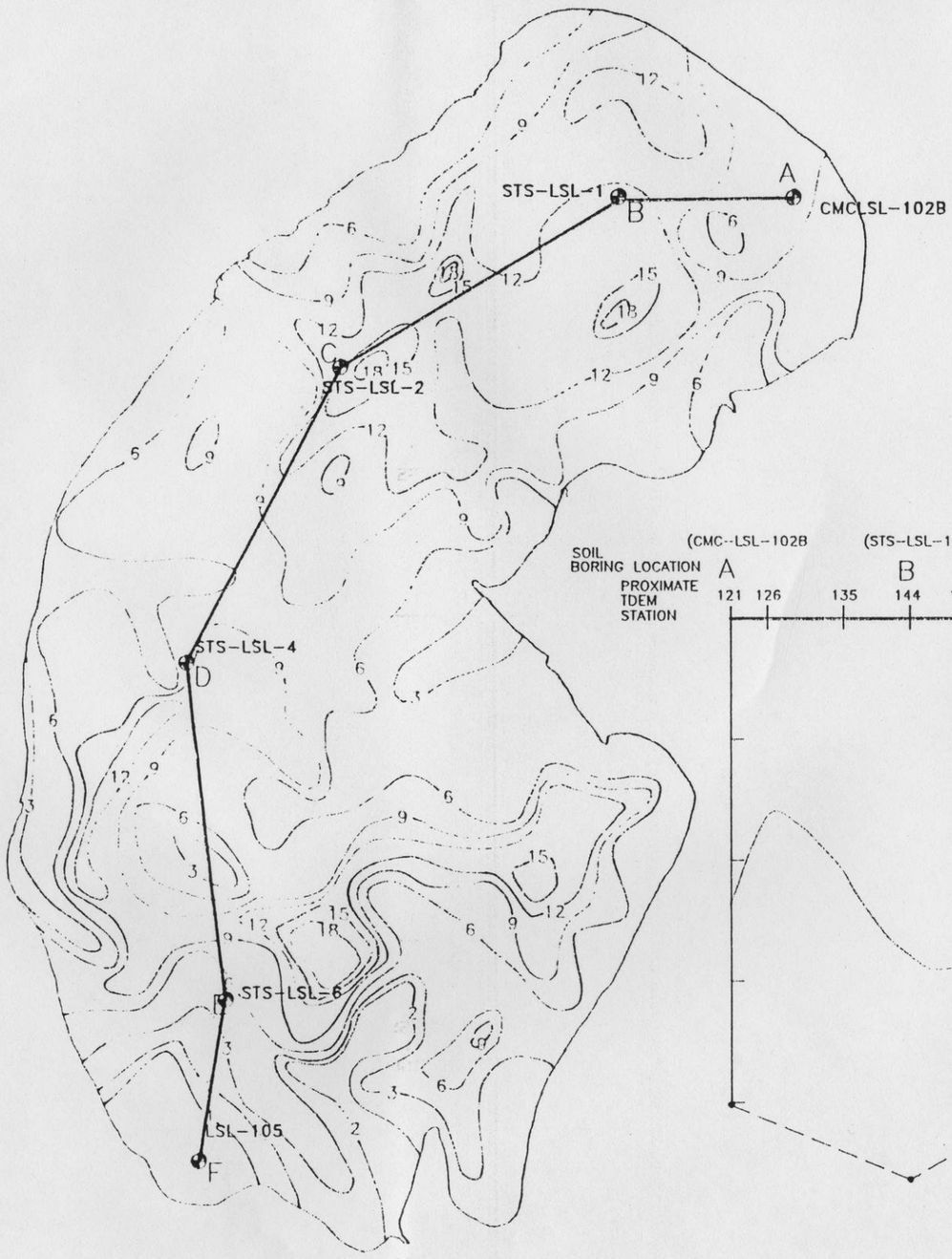
⊕ LOCATION AND DESIGNATION OF SOIL BORINGS (FROM OTHERS)

FOTH & VAN DYKE
GREEN BAY, WI.

SDII
SUBSURFACE DETECTION INVESTIGATIONS INCORPORATED

SITE PLAN SHOWING LOCATION OF TDEM SURVEY STATIONS – LITTLE SAND LAKE CRANDON MINING COMPANY SITE FOREST COUNTY, WISCONSIN

| | | | | |
|---|---|---|---|---|
| Designed By: | RJW | Proj. No. | 94727 | Fig. No. |
| Checked By: | MJW | DWG | SUR2 | 8 |
| Drawn By: | RBT | Date: | 04/25/94 | |




0 650′
FEET

EXPLANATION

6 ISOPACH LINE SHOWING ESTIMATED THICKNESS OF CLAY STRATUM (IN FEET)

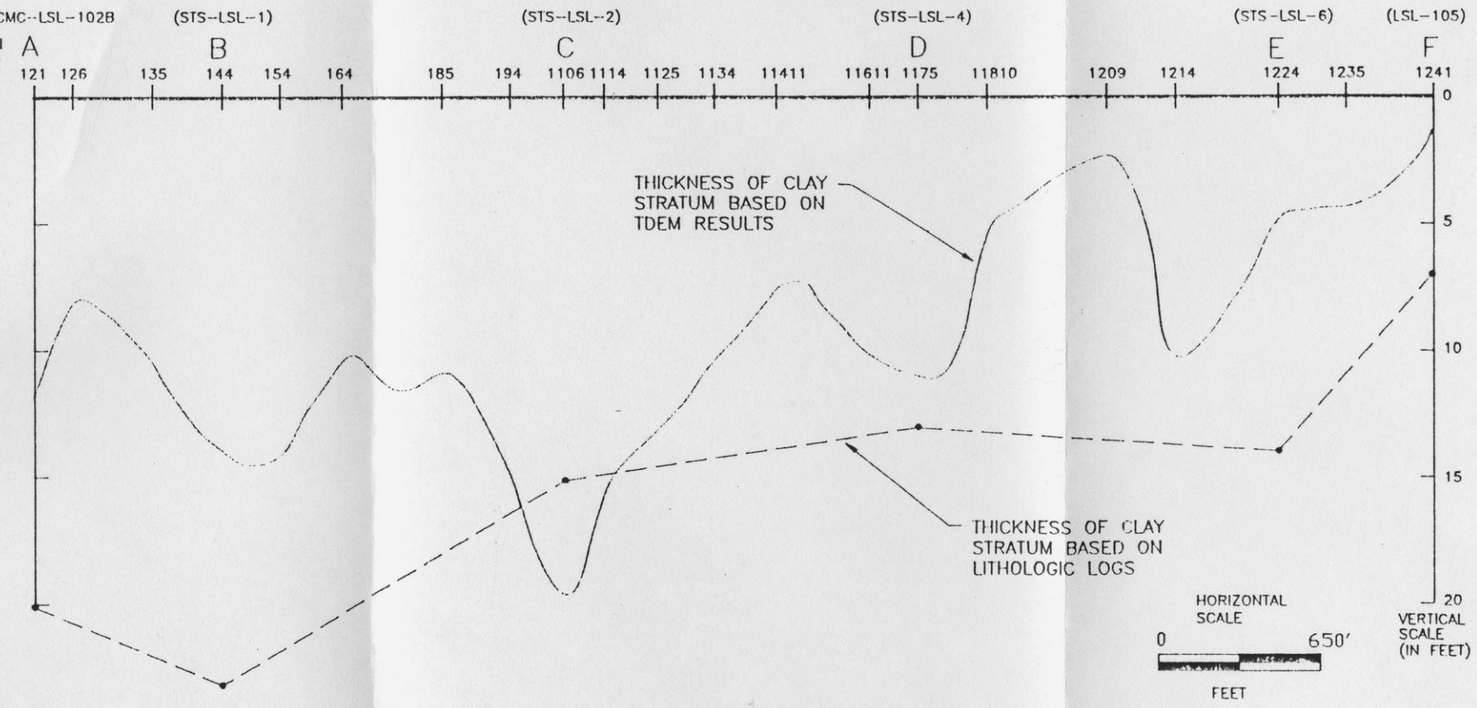
LOCATION OF GEOLOGICAL CROSS-SECTION

LOCATION AND DESIGNATION OF SOIL BORINGS (FROM OTHERS)

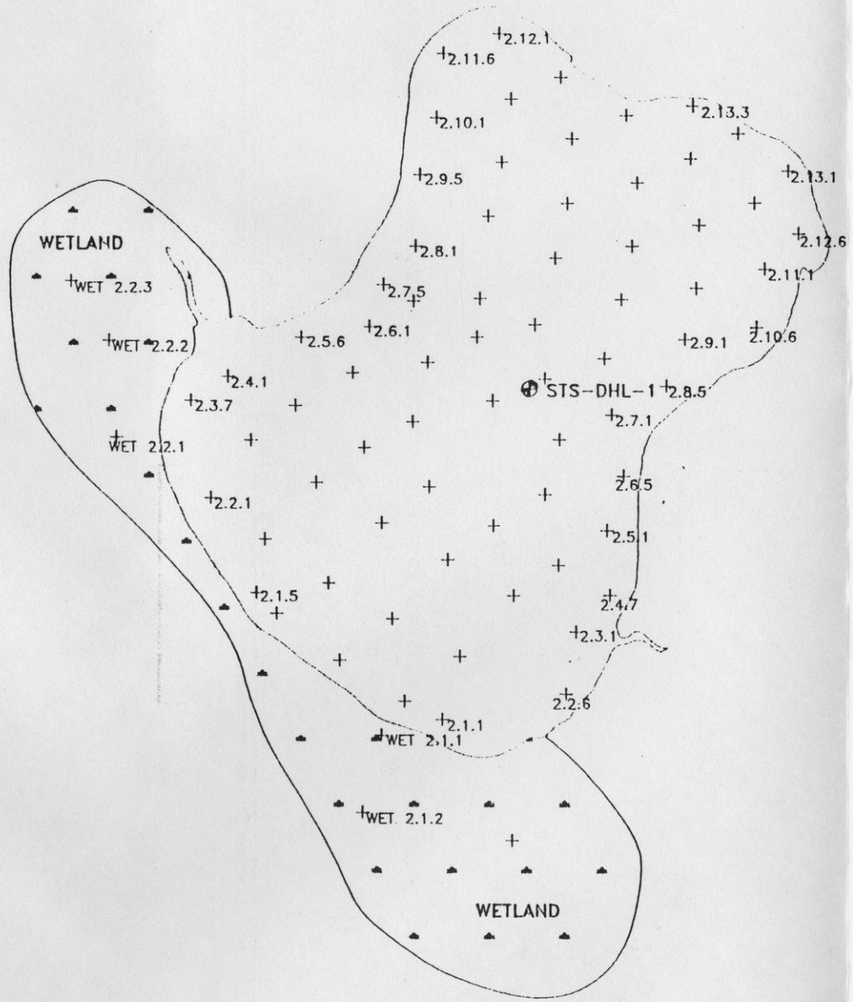
N

CROSS-SECTIONAL PERSPECTIVE OF CLAY STRATUM THICKNESS

LITTLE SAND LAKE




| | | | | |
|---|---|---|---|---|
| FOTH & VAN DYKE GREEN BAY, WI. | SDII SUBSURFACE DETECTION INVESTIGATIONS INCORPORATED | ISOPACH MAP AND CROSS-SECTION SHOWING ESTIMATED THICKNESS OF CLAY STRATUM – LITTLE SAND LAKE CRANDON MINING COMPANY SITE FOREST COUNTY, WISCONSIN | | |
| | | Designed By: RJW<br>Checked By: MJW<br>Drawn By: RBT | Proj. No. 94727<br>DWG SUR3<br>Date: 04/25/94 | Fig. No. 9 |



0 650'

FEET

## EXPLANATION

+ TDEM SURVEY STATION (DESIGNATIONS INDICATED AT START AND END OF EACH SURVEY LINE)

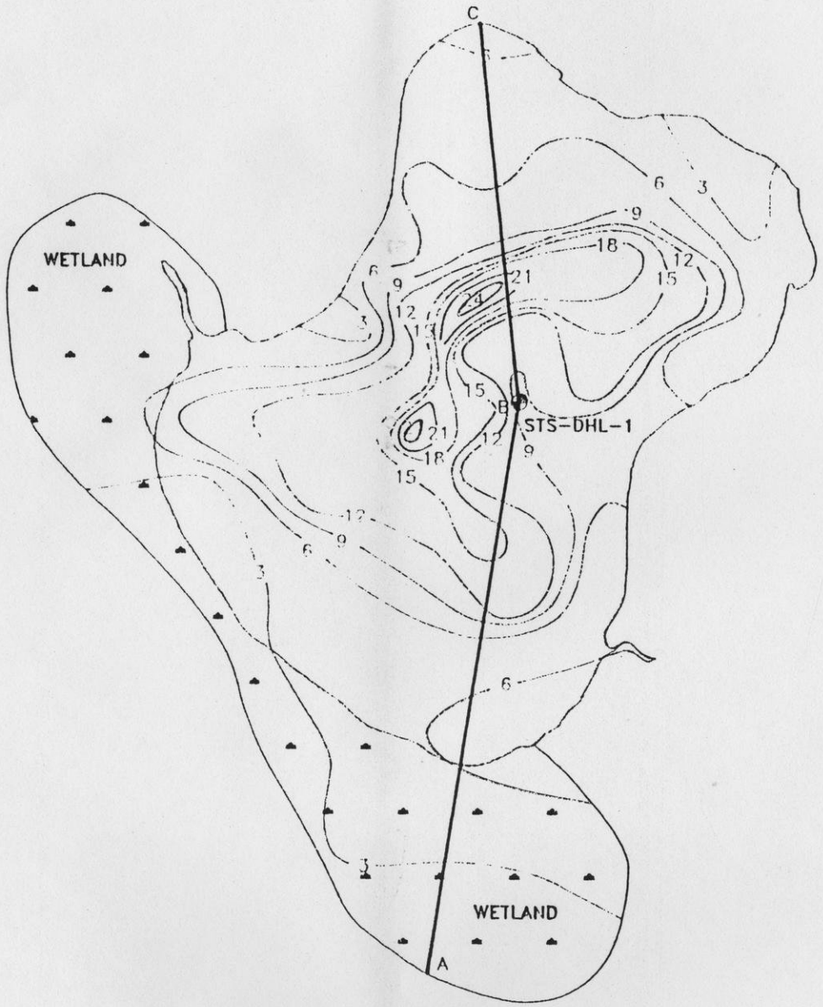
⊕ LOCATION AND DESIGNATION OF SOIL BORINGS (FROM OTHERS)

FOTH & VAN DYKE
GREEN BAY, WI.

SDII
SUBSURFACE DETECTION INVESTIGATIONS INCORPORATED

SITE MAP SHOWING LOCATION OF TDEM SURVEY STATIONS – DEEP HOLE LAKE
GRANDON MINING COMPANY SITE
FOREST COUNTY, WISCONSIN

| | | | | |
|---|---|---|---|---|
| Designed By: | RJW | Proj. No. | 94727 | Fig. No. |
| Checked By: | MJW | DWG | SUR4 | 10 |
| Drawn By: | RBT | Date: | 04/25/94 | |



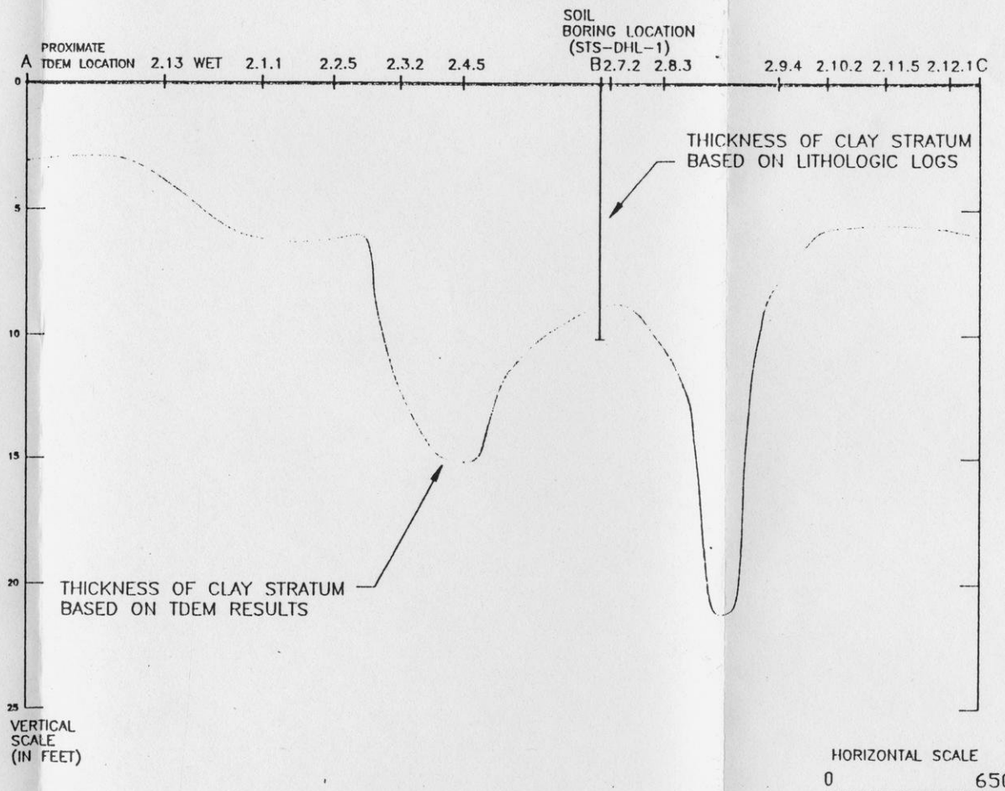

EXPLANATION

6 — ISOPACH LINE SHOWING ESTIMATED THICKNESS OF CLAY STRATUM (IN FEET)

——— LOCATION OF GEOLOGICAL CROSS-SECTION

⊕ LOCATION AND DESIGNATION OF SOIL BORINGS (FROM OTHERS)

CROSS-SECTIONAL PERSPECTIVE OF CLAY STRATUM THICKNESS
DEEP HOLE LAKE



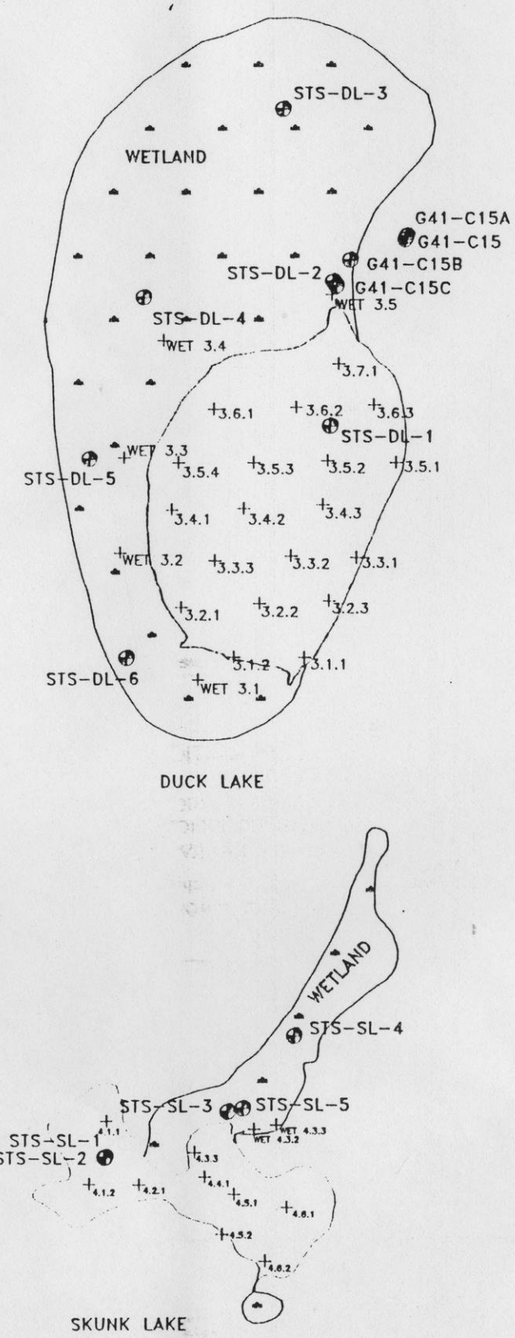

N

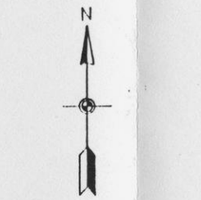
FOTH & VAN DYKE
GREEN BAY, WI.

SDII
SUBSURFACE DETECTION INVESTIGATIONS INCORPORATED

ISOPACH MAP AND CROSS-SECTION SHOWING
ESTIMATED THICKNESS OF CLAY STRATUM - DEEP HOLE LAKE
CRANDON MINING COMPANY SITE
FOREST COUNTY, WISCONSIN

| | | | | |
|---|---|---|---|---|
| Designed By: | RJW | Proj. No. | 94727 | Fig. No. |
| Checked By: | MJW | DWG | SUR5 | 11 |
| Drawn By: | RBT | Date: | 04/25/94 | |




0 650'

FEET

EXPLANATION

+ TDEM SURVEY STATION (DESIGNATIONS INDICATED AT START AND END OF EACH SURVEY LINE)

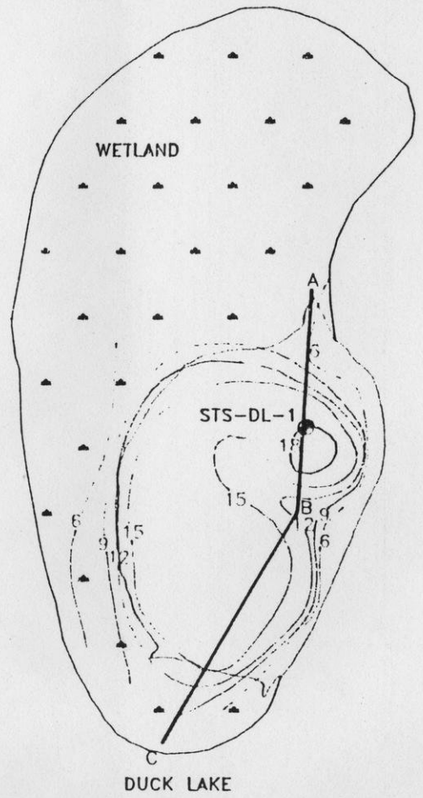
⊕ LOCATION AND DESIGNATION OF SOIL BORINGS (FROM OTHERS)

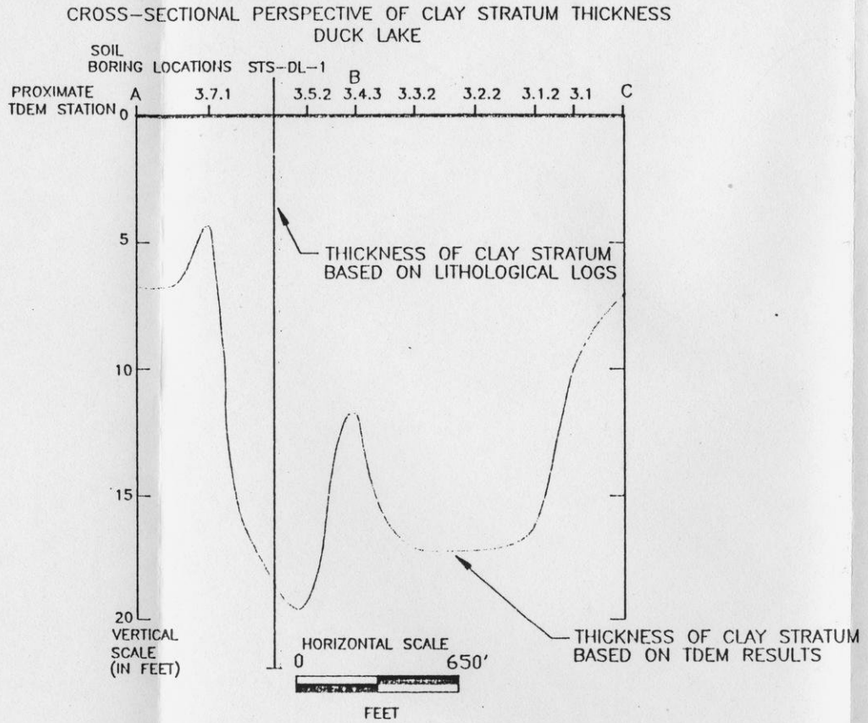
FOTH & VAN DYKE
GREEN BAY, WI.

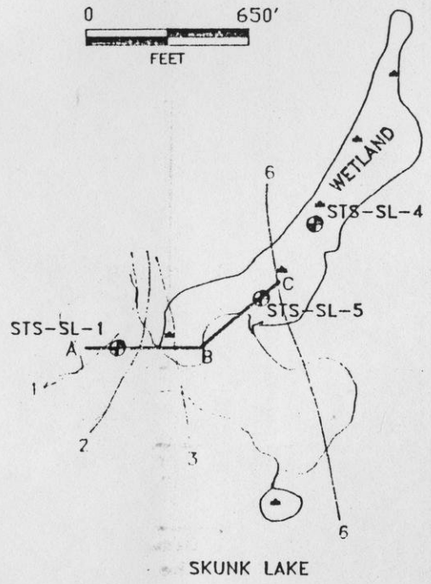
SDII
SUBSURFACE DETECTION INVESTIGATIONS INCORPORATED

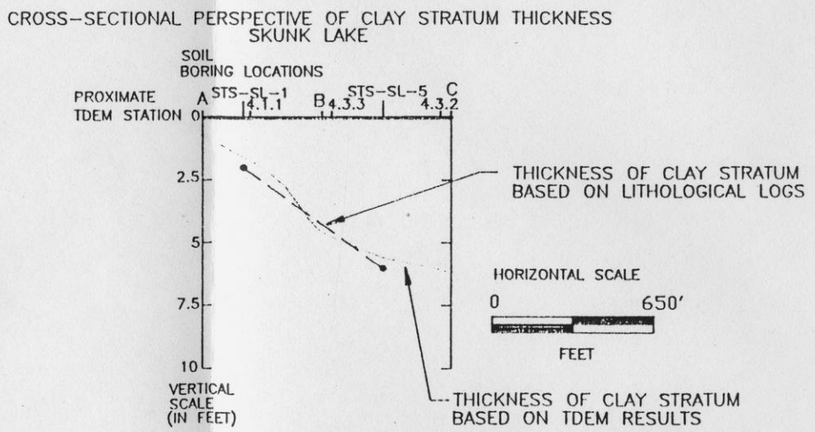
SITE MAP SHOWING LOCATION OF
TDEM SURVEY STATIONS – DUCK AND SKUNK LAKES
CRANDON MINING COMPANY SITE
FOREST COUNTY, WISCONSIN

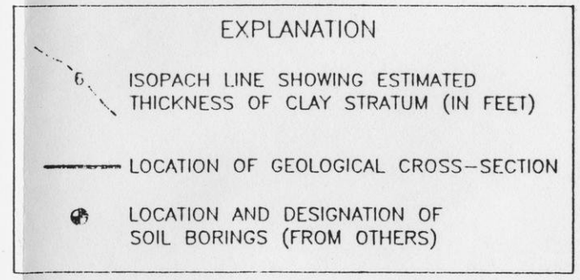
| | | | | |
|---|---|---|---|---|
| Designed By: | RJW | Proj. No. | 94727 | Fig. No. |
| Checked By: | MJW | DWG | SUR6 | 12 |
| Drawn By: | RBT | Date: | 04/24/94 | |






FOTH & VAN DYKE
GREEN BAY, WI.

SDII
SUBSURFACE DETECTION INVESTIGATIONS INCORPORATED

ISOPACH MAP AND CROSS-SECTION SHOWING ESTIMATED THICKNESS OF CLAY STRATUM – DUCK AND SKUNK LAKES
CRANDON MINING COMPANY SITE
FOREST COUNTY, WISCONSIN

| | | | | |
|---|---|---|---|---|
| Designed By: | RJW | Proj. No. | 94727 | Fig. No. |
| Checked By: | MJW | DWG | SUR7 | 13 |
| Drawn By: | RBT | Date: | 04/25/94 | |

3.5-11-45

# TABLES

TABLE 1
DATA FROM 1982-1984 LAKE BED SOIL TESTING PROGRAM
CRANDON PROJECT

| BORING LOCATION | BORING NUMBER | DEPTH FROM LAKE SURFACE (ft) | P-200 | HYDRAULIC CONDUCTIVITY, Kv (cm/s) | |
|---|---|---|---|---|---|
| | | | | (cm/s) | (ft/d) |
| Little Sand Lake | STS-LSL-1 | 30-32 | 99.2 | $1.4 \times 10^{-7}$ | $3.9 \times 10^{-4}$ |
| | | 44.5-47 | 94.4 | $1.7 \times 10^{-7}$ | $4.8 \times 10^{-4}$ |
| | STS-LSL-2 | 24.5-26.5 | 97.7 | $7.3 \times 10^{-7}$ | $2.1 \times 10^{-3}$ |
| | | 39-40.5 | 4.6 | --- | |
| | STS-LSL-3 | 28-30 | 99 | $3.7 \times 10^{-7}$ | $1.0 \times 10^{-3}$ |
| | | 37-39 | 99.5 | $1.5 \times 10^{-7}$ | $4.3 \times 10^{-4}$ |
| | | 43.5-45 | 4.2 | --- | |
| | STS-LSL-4 | 30.5-32.5 | 96.8 | $1.1 \times 10^{-7}$ | $3.1 \times 10^{-4}$ |
| | | 45.5-47 | 18.7 | --- | |
| | STS-LSL-5 | 20-22 | 98.4 | $1.6 \times 10^{-4*}$ | $4.5 \times 10^{-1}$ |
| | | 28-30 | 96.8 | $1.5 \times 10^{-7}$ | $4.2 \times 10^{-4}$ |
| | STS-LSL-6 | 16-18 | 93.3 | $3.7 \times 10^{-7}$ | $1.0 \times 10^{-3}$ |
| | | 28-30 | 98.3 | $1.6 \times 10^{-6}$ | $4.5 \times 10^{-3}$ |
| Duck Lake | STS-DL-1 | 25.5-28 | 78 | $1.3 \times 10^{-6}$ | $3.7 \times 10^{-3}$ |
| | | 38-40 | 93 | $1.0 \times 10^{-7}$ | $2.8 \times 10^{-4}$ |
| Skunk Lake | STS-SL-2 | 9.1-10 | 93 | $4.3 \times 10^{-8}$ | $1.2 \times 10^{-4}$ |
| Oak Lake | STS-OL-1 | 37.5-39.5 | 88 | $2.3 \times 10^{-6}$ | $6.5 \times 10^{-3}$ |
| | | 42.5-44.5 | 93 | $3.5 \times 10^{-7}$ | $9.9 \times 10^{-4}$ |
| Deep Hole Lake | STS-DHL-1 | 21-23 | 95 | $6.8 \times 10^{-7}$ | $1.9 \times 10^{-3}$ |
| | | 33.5-35.2 | 88 | $6.8 \times 10^{-8}$ | $1.9 \times 10^{-4}$ |

3.5-11-47

* Probable side channeling was noted in this test.

TABLE 2
1994 HYDROGEOLOGIC INVESTIGATION
SOIL LABORATORY TESTING DATA
CRANDON PROJECT

| BORING LOCATION | BORING NUMBER | DEPTH FROM LAKE SURFACE (ft) | % GRAVEL | % SAND | % SILT | % CLAY | USCS | HYDRAULIC CONDUCTIVITY Kv (cm/s) ft/d |
|---|---|---|---|---|---|---|---|---|
| Little Sand Lake | CMC-LSL-101 | 14-16 | 0 | 4 | 70.6 | 25.4 | CL | $1.8x10^{-7}$ $5.1x10^{-4}$ |
| | | 20-22 | 0 | 4.9 | 75.3 | 19.8 | CL | --- |
| | CMC-LSL-102 | 11-13 | 0 | 18.5 | 57.1 | 24.4 | CL | $2.5x10^{-7}$ $7.1x10^{-4}$ |
| | CMC-LSL-102B | 12-14 | 0 | 10.9 | 63.1 | 26 | CL | $3.0x10^{-7}$ $8.5x10^{-4}$ |
| | | 16-18 | 0 | 5.8 | 67.0 | 27.2 | CL | $1.8x10^{-7}$ $5.1x10^{-4}$ |
| | | 24-26 | 0 | 17.7 | 56.1 | 26.2 | CL | $2.3x10^{-7}$ $6.5x10^{-4}$ |
| | | 28-30 | 0 | 2.2 | 58.0 | 39.8 | CL | $4.5x10^{-7}$ $1.3x10^{-3}$ |
| | | 32-34 | 17.7 | 58.8 | 11.6 | 11.9 | SC | --- |
| | CMC-LSL-102A | 16-18 | 0 | 12.8 | 67.6 | 19.6 | CL-ML | --- |
| | CMC-LSL-103 | 30-33 | 0 | 10.4 | 72.8 | 16.8 | CL-ML | $1.2x10^{-7}$ $3.4x10^{-4}$ |
| | | 33-35 | 0 | 6.6 | 72.3 | 21.1 | CL | $8.8x10^{-8}$ $2.5x10^{-4}$ |
| | | 18-19.6 | 0 | 27.6 | 55.8 | 16.6 | CL | --- |
| | CMC-LSL-104A | 15.4-17.4 | 0 | 6.6 | 70.4 | 23.0 | CL | $2.3x10^{-7}$ $6.5x10^{-4}$ |
| | CMC-LSL-104B | 17-19 | 0 | 7.7 | 65.2 | 27.1 | CL | $2.4x10^{-7}$ $6.8x10^{-4}$ |
| | | 12-14 | 0 | 2.5 | 70.0 | 27.5 | CL | --- |
| | | 24-26 | 29.1 | 62.0 | 8.9 | | SP-SM | --- |
| | CMC-LSL-105 | 6-8 | 0 | 10.2 | 65.2 | 24.6 | CL | $2.1x10^{-7}$ $6.0x10^{-4}$ |
| | | 8-10 | 0 | 4.9 | 64.7 | 30.4 | CL | --- |
| | | 12-14 | 0 | 19.7 | 55.2 | 25.1 | CL | $2.4x10^{-7}$ $6.8x10^{-4}$ |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Skunk Lake Wetland | CMC-SL-103A | 6-8.5 | 0.1 | 57.4 | 19.6 | 22.9 | SC-SM | $4.2x10^{-7}$ $1.2x10^{-3}$ |
| | CMC-SL-103B | 26-28 | 0 | 14.8 | 61.1 | 24.1 | CL | $3.5x10^{-6}$ $9.9x10^{-3}$ |
| | | 38-40 | 25.5 | 70.1 | 4.4 | | SP | --- |
| | CMC-SL-104 | 4-6 | 0 | 69.7 | 15.6 | 14.7 | SC-SM | $1.8x10^{-6}$ $5.1x10^{-3}$ |
| | | 16-19 | 0 | 30.5 | 56.0 | 13.5 | CL-ML | $6.4x10^{-7*}$ $1.8x10^{-3}$ |
| | | 34-36 | 16.3 | 74.7 | 9 | | SW-SM | --- |
| Duck Lake Wetland | CMC-DL-103A | 4-6 | 11.8 | 53.5 | 21.0 | 13.7 | SC-SM | $9.3x10^{-8}$ $2.6x10^{-4}$ |
| | CMC-DL-103B | 20-22 | 0 | 67.4 | 27.6 | 5 | SM | --- |

# APPENDICES

## Appendix 1
## Soil Boring Logs - Little Sand Lake

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-LSL-101 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Dan Tinnacour | 02/11/94<br>MM/DD/YY | 02/11/94<br>MM/DD/YY | 4" Rotary Wash<br>(w/water) |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | NA | | 4.25" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 113,246.7N, 2,278,416 E S/C/N Lat Long<br>SE 1/4 of NW 1/4 of Section 29, T 35 N, R 13 E | Feet ___ N S Feet ___ E W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | Ice ~17". | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 2 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | 4" steel casing set to 10' (below top of | | | | | | | | | | |
| | | | -- | ice). | | | | | | | | | | |
| | | | -- 4 | | | | | | | | | | | |
| | | | -- | Lake bed ~4.8'. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 1 | 18 | RW/RW | -- 6 | 6-7 V. soft to soft, interlayered black | OL/ | | | | | | | | | |
| | | 3/1 | -- | (2.5Y2/0) organic silts and olive brown | ML | | | | | | | | | |
| | | | -- | (2.5Y4/4) and very dk. gray (2.5Y3/0) | | | | | | | | | | |
| | | | -- | f. sandy silt, tr. fibers. Lacustrine. | | | | | | | | | | |
| | | | -- 8 | Soft, gray (5Y5/1) silty clay, trace | CL | | | | | | | | | |
| | | | -- | organics in spoon tip (~7.9'). | | | | | | | | | | |
| | | | -- | As above. | CL | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 2 | 24 | RW/RW | -- 10 | Very soft, dk. gray (5Y4/1) silty clay, | CL | | | | | | | | | |
| | | 3/1 | -- | tr. organics. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 12 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 3 | 24 | 1/1 | -- | V. soft, dk. gray (5Y4/1) silty clay (as | CL | | | | | | | | | |
| | | 1/2 | -- | above), tr. organics. | | | | | | | | | | |
| | | | -- 14 | | | | | | | | | | | |
| | | | -- | As above. | CL | | | | | | | | | |
| 4 | 23 | NA | -- | | | | | | | | | | | |
| | | | -- | Shelby tube placed in heated pick-up. | | | | | | | | | | |
| | | | -- 16 | | | | | | | | | | | |
| | | | -- | V. soft, dk. gray (5Y1/1) silty clay,tr. | CL | | | | | | | | | |
| 5 | 24 | 2/2 | -- | organics. | | | | | | | | | | |
| | | 3/3 | -- | Grayish brown (10YR5/2) f. sand layer | CL | | | | | | | | | |
| | | | -- 18 | (1") @ 17'. | | | | | | | | | | |
| | | | -- | Soft v. dk. gray (5Y3/1) silty clay, tr. | CL | | | | | | | | | |
| 6 | 24 | RW/RW | -- | organics. | | | | | | | | | | |
| | | RW/RW | -- | V. soft, v. dk. gray (5Y3/1) silty clay, | CL | | | | | | | | | |
| | | | -- 20 | tr. organics. | | | | | | | | | | |
| | | | -- | V. soft, black (2.5Y2/0) silty clay, | CL | | | | | | | | | |
| 7 | 22 | RW/RW | -- | tr. organics. | | | | | | | | | | |
| | | RW/RW | -- | | | | | | | | | | | |
| | | | -- 22 | V. soft, v. dk. gray (5Y3/1) silty clay, | CL | | | | | | | | | |
| | | | -- | tr. organics. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |

DRAFT

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature] Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-LSL-101

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/FID | Soil Properties: Std pen | Soil Properties: mois cont | Soil Properties: liqu limi | Soil Properties: plas limi | Soil Properties: P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 24 | | | | | | | | | | | |
| 8 | 24 | RW/RW<br>RW/RW | 26 | V. soft, v. dk. gray (5Y3/1) silty clay, tr. organics. | CL | | | | | | | | | |
| 9 | 20 | RW/RW<br>RW/5 | 28 | Dk. grayish brown (10YR4/2) f. sand @ 26.8', tr. to some silt.<br>Dk. grayish brown (10YR4/2) f. sand, tr. silt to silty f. sand. | SP/SM<br>SM | | | | | | | | | |
| 10 | 20 | 5/7<br>7/9 | 30 | Brown (10YR4/3) m. to c. sand, tr. f. gravel, tr. to some silt.<br>Brown (10YR4/3) m. to c. sand, tr. silt. | SM/SW<br>SW | | | | | | | | | |
| 11 | 18 | 7/7<br>9/11 | 32 | Brown (7.5YR4/2) silty f. sand, tr. to some f. gravel.<br>E.O.B. @ 31'. | SM | | | | | | | | | |
| | | | | Drilling cuttings and wash water disposed in sump pits at mine site. | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-LSL-102 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Dan Tinnancour | 02/12/94<br>MM/DD/YY | 02/16/94<br>MM/DD/YY | 6.25 I.D.<br>Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | NA | NA | 1592.1 | 6.25" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 114,872.5N, 2,278,461.8 E S/C/N<br>NE 1/4 of NW 1/4 of Section 31, T 35 N, R 13 E | Lat<br>Long<br>Feet ___ N S Feet ___ E W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | Ice 0-17'. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | Water 17" - 3'. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 2 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 1 | 12 | 1/3 | -- | 3-7 Dark brown (2.5Y3/2) silty sand | SM | | | | | | | | | |
| | | 3/4 | -- | with organics, structureless, wet. | | | | | | | | | | |
| | | | -- 4 | Lacustrine. | | | | | | | | | | |
| | | | -- | Grey brown (2.5Y4/3) fine sand with | SP | | | | | | | | | |
| 2 | 12 | 4/5 | -- | silt, structureless, wet, soft. | | | | | | | | | | |
| | | 5/7 | -- | Lacustrine. | | | | | | | | | | |
| | | | -- 6 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 3 | 2 | 1/1 | -- | 7-9 As above. Grey (2.5Y5/1) fine sand, | SP | | | | | | | | | |
| | | 1/1 | -- | structureless, wet, loose. | | | | | | | | | | |
| | | | -- 8 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 4 | 24 | 1/3 | -- | 9-11 Grey (2.5Y5/1) silty clay with | CL | | | | | | | | | |
| | | 2/3 | -- | fine sand lenses, massive, wet, sticky, | | | | | | | | | | |
| | | | -- 10 | organics. Lacustrine. | | | | | | | | | | |
| | | | -- | Shelby tube. | | | | | | | | | | |
| 5 | 24 | TWT | -- | 11-13 Push TWT 2' 24" recovery. | CL | | | | | | | | | |
| | | | -- | Grey clay as above, sl. firm. | | | | | | | | | | |
| | | | -- 12 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 6 | 24 | 1/1 | -- | 13-14.8 Gray clay as above. | | | | | | | | | | |
| | | 12/6 | -- | | | | | | | | | | | |
| | | | -- 14 | 14.8-15 Grey (2.5Y4/1) fine-med. sand, | SP | | | | | | | | | |
| | | | -- | wet, structureless, loose. | | | | | | | | | | |
| 7 | 20 | 2/1 | -- | 15-16.3 Grey (2.5Y5/1) silty clay, | CL | | | | | | | | | |
| | | 1/1 | -- | structureless, wet, loose. | | | | | | | | | | |
| | | | -- 16 | 16.3-17 Grey (2.5Y2/1) fine sand, wet, | SP | | | | | | | | | |
| | | | -- | loose. | | | | | | | | | | |
| 8 | 24 | 1/1 | -- | 17-19 Grey (2.5Y5/1) silty clay with | CL | | | | | | | | | |
| | | 1/1 | -- | organics and sand, massive, wet, sticky. | | | | | | | | | | |
| | | | -- 18 | | | | | | | | | | | |
| | | | -- | E.O.B. @ 17' (Collapse) | | | | | | | | | | |
| | | | -- | 3.0 bags H.P. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 20 | | | | | | | | | | | |
| | | | -- | Drilling mud disposed in mud sumps at | | | | | | | | | | |
| | | | -- | mine site. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 22 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |

DRAFT

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature] Firm Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste / Emergency Response / Wastewater / Haz. Waste / Underground Tanks / Water Resources / X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-LSL-102A |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Dan Tinnancour | 02/15/94<br>MM/DD/YY | 02/15/94<br>MM/DD/YY | 6" Rotary Wash |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | CMC-LSL-102A | 4.54 (2/28/94) | 1592.1 | 6" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 114,399.1N, 2,278,953.7E S/C/N<br>SE 1/4 of NW 1/4 of Section 31, T 35 N, R 13 E | Feet — N / S Feet — E / W |
| Lat<br>Long | |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2 | 3' of water 15" of ice.<br>See boring log CMC-LSL-102B. | | | | | | | | | | |
| | | | 4 | Blind drilled to 16'.<br>Lost circulation @ 10'.<br>Cased hole to 10'. | | | | | | | | | | |
| | | | 6 | Sampled over screened Interval from 16-18'. | | | | | | | | | | |
| | | | 8 | No additives used to drill hole. | | | | | | | | | | |
| | | | 10 | See CMC-LSL-102A well construction diagram for construction details. | | | | | | | | | | |
| | | | 12 | | | | | | | | | | | |
| | | | 14 | | | | | | | | | | | |
| SS-1 | 24 | RW | 16 | 2.5Y4/0 Dark grey v. soft silty clay with thin (>1mm) laminations of fine sand. Lacustrine. | CL | | | | | | | | | |
| | | | 18 | | | | | | | | | | | |
| | | | | E.O.B. @ 18.5'. | | | | | | | | | | |
| | | | 20 | Cuttings and water disposed in sump pits at mine site. | | | | | | | | | | |
| | | | 22 | | | | | | | | | | | |

DRAFT

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Steve Wood

Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-LSL-102B |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Dan Tinnacour | 02/14/94<br>MM/DD/YY | 02/14/94<br>MM/DD/YY | 6" Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | CMC-LSL-102B | 6.87 (2/28/94) | 1592.1 (Ice) | 6" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 114,284.9N, 2,279,010.6E S/C/N Lat<br>SE 1/4 of NW 1/4 of Section 35, T 35 N, R 13 E Long | Feet — N S Feet — E W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | 15" ice. | | | | | | | | | | |
| | | | -- | 4' of water. | | | | | | | | | | |
| | | | -- 2 | | | | | | | | | | | |
| SS-1 | 12 | 6/7<br>6/5 | -- 4 | 4-8 Gray (10YR5/1) wet firm to loose fine sand w/minor silt. | SP | | | | | | | | | |
| SS-2 | 12 | 7/2<br>2/3 | -- 6 | | | | | | | | | | | |
| SS-3 | 6 | WR<br>1/2 | -- 8 | 8-28 Dk. grey (2.5Y4/0) v. soft clay w/minor silt and occasional thin laminations (<1 mm) lacustrine. | CL | | | | | | | | | |
| SS-4 | 24 | WR<br>1/1 | -- 10 | | | | | | | | | | | |
| | | | -- | As above, lacustrine. | CL | | | | | | | | | |
| ST-5 | 30/30 | | -- 12 | Shelby tube from 12-14. Clay top, clay bottom, 24"/24" lacustrine. | CL | | | | | | | | | |
| SS-6 | 12 | WR<br>WR | -- 14 | As above, no sand laminations, lacustrine. | CL | | | | | | | | | |
| ST-7 | 30/30 | | -- 16 | Shelby tube 16-18. Dk grey clay top and bottom. 24"/24" lacustrine. | CL | | | | | | | | | |
| SS-8 | 24 | WR | -- 18 | | | | | | | | | | | |
| | | | -- | As above - no sand laminations, lacustrine. | CL | | | | | | | | | |
| SS-9 | 24 | WR | -- 20 | | | | | | | | | | | |
| | | | -- | As above - no sand laminations, lacustrine. | CL | | | | | | | | | |
| SS10 | | | -- 22 | As above w/thin fine sand laminations @23.5-23.8, <1 mm lacustrine. | CL | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Stefan K Wanner — Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-LSL-102B

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | P200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | | | | | | | | | | | |
| ST11 | 30/30 | | -- 24 | 24-26 Shelby tube dk. grey clay top and bottom. 24"/24" lacustrine. | CL | | | | | | | | | |
| SS12 | 24 | 3/3 5/7 | -- 26 | As above, grading to a greyish-brn (10YR4/2) silty clay w/tr. of fine sand, lacustrine. | CL | | | | | | | | | |
| ST13 | 18/18 | | -- 28 | Shelby tube silty sand, greyish-brn top and bottom loose-firm, lacustrine. | SM | | | | | | | | | |
| SS14 | 18 | 3/9 9/11 | -- 30 | 30-31 Dk. grey loose silty sand fine-med. text. | SM | | | | | | | | | |
| | | | | 31-32 Brown (10YR4/2) stiff silty clay-till. | CL | | | | | | | | | |
| SS15 | 16 | 4/9 10/11 | -- 32 | 32-34 Dk. brown (10YR4/4) dense to v. dense clayey sand. Blocky structure-till. | SC | | | | | | | | | |
| | | | -- 34 | E.O.B. @ 34'. | | | | | | | | | | |
| | | | | Cased to 30'. | | | | | | | | | | |
| | | | | Mud consisted of 100 gallons H20/65 lbs. benseal. | | | | | | | | | | |
| | | | | Note: Gravel wedged between tricone and casing @ 28-30'. Casing partially unscrewed. | | | | | | | | | | |
| | | | | See CMC-LSL-102B well construction diagram for construction details. | | | | | | | | | | |
| | | | | Mud disposed in sump pits @ mine site. | | | | | | | | | | |

DRAFT

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-LSL-103 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Jeff Flamino | 02/12/94<br>MM/DD/YY | 02/12/94<br>MM/DD/YY | 6" Rotary Mud |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | NA | NA | 1592.2 | 6" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 113,851.1N, 2,276,753.9E S/C/N<br>SW 1/4 of NW 1/4 of Section 35, T 35 N, R 13 E | Feet ___ N S, Feet ___ E W |
| Lat<br>Long | |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | 13" Ice<br>Water 0-5'. | | | | | | | | | | |
| | | | -- 2 | | | | | | | | | | | |
| | | | -- 4 | | | | | | | | | | | |
| SS-1 | 20 | 4/4<br>4/4 | -- 6 | 5-14.8 Brown (10YR5/3) wet loose fine-med. text. Silty sand. Lost circulation @9'. Casing driven to 10' and drilled out. | SM | | | | | | | | | |
| | | | -- 8 | | | | | | | | | | | |
| SS-2 | 20 | 4/4<br>4/4 | -- 10 | As above. | SM | | | | | | | | | |
| SS-3 | 20 | 4/4<br>4/6 | -- 12 | As above. | SM | | | | | | | | | |
| SS-4 | 24 | 4/4<br>5/6 | -- 14 | As above to 14.8'.<br>14.8-15.6 Dk. gray soft-firm sandy silt.<br>15.6-16 Dk. gray loose silty sand. | SM<br>ML<br>SM | | | | | | | | | |
| SS-5 | 24 | WR | -- 16 | 16-28.5 Dk. gray (2.5Y4/0) wet soft silty clay w/2" fine sand seam @ 17.7-17.9. Lacustrine. | CL | | | | | | | | | |
| SS-6 | 24 | 3/4<br>4/4 | -- 18 | As above, fine silty clay, sand seam @ 19.6-20. | CL | | | | | | | | | |
| | | | -- 20 | No recovery w/Shelby tube. | | | | | | | | | | |
| SS-7 | 24 | 2/2<br>2/4 | -- 22 | As above, dk. gray v. soft silty clay. | CL | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Steve Wood

Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-LSL-103

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- 24 | | | | | | | | | | | |
| SS-8 | 24 | WR | -- | As above. | CL | | | | | | | | | |
| | | | -- 26 | | | | | | | | | | | |
| SS-9 | 12 | WR | -- | As above to 28.5'. | CL | | | | | | | | | |
| | | | -- | 28.5-29 Dk. gray loose silty sand, med. | SM | | | | | | | | | |
| SS10 | 24 | WR | -- 28 | textured. | | | | | | | | | | |
| | | | -- | 29-39 Dk. gray (2.5Y4/0) v. soft to | CL | | | | | | | | | |
| | | | -- | soft silty clay, 1cm silty sand seam | | | | | | | | | | |
| | | | -- | fine text. @ 29.5'. Lacustrine. | | | | | | | | | | |
| ST11 | 36/36 | | -- 30 | 30-33 Shelby tube. 36"/36" full | CL | | | | | | | | | |
| | | | -- | recovery clay top and bottom. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 32 | | | | | | | | | | | |
| ST12 | 28/28 | | -- | 33-35 Shelby tube 24"/24" full | CL | | | | | | | | | |
| | | | -- | recovery clay top and bottom. | | | | | | | | | | |
| SS13 (35-37) | 24 | WR | -- 34 | | | | | | | | | | | |
| | | | -- | As above, dk. gray silty clay. | CL | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 36 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | D | B | A | F | T | | | |
| | | | -- | | | | | | | | | | | |
| SS14 (37-39) | 24 | WR | -- 38 | As above. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | 39-41 V. soft brown (10YR5/3) clay, | CL | | | | | | | | | |
| | | | -- | minor silt. | | | | | | | | | | |
| SS15 (39-41) | 24 | 5/6 7/9 | -- 40 | | | | | | | | | | | |
| | | | -- | 41-46 No recovery. Appears to be | | | | | | | | | | |
| | | | -- | loose sand. | | | | | | | | | | |
| | | | -- 42 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 44 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| SS-6 (46-49) | 20 | 10/12 16/19 | -- 46 | 46-49 Gray wet gravelly sand, med. | SP | | | | | | | | | |
| | | | -- | texture. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 48 | | | | | | | | | | | |
| | | | -- | E.O.B. @ 48'. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | Hole cased to 25'. | | | | | | | | | | |
| | | | -- | Abandoned w/10 50-lb. bags of 3/8" | | | | | | | | | | |
| | | | -- | chipped bentonite. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- |

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-LSL-104A |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Dan Tinnacour | 02/13/94<br>MM/DD/YY | 02/13/94<br>MM/DD/YY | 6" Rotary Wash |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | CMC-LSL-104A | 5.65 (2/28/94) | 1592.1 | 6" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 112,076.2N, 2,275,945.0E S/C/N Lat Long<br>NE 1/4 of SE 1/4 of Section 36, T 35 N, R 12 E | Feet — N S Feet — E W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Nashville |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2 | Blind drill to 15'.<br>See log CMC-LSL-104B.<br><br>See CMC-LSL-104A well construction diagram for construction details. | | | | | | | | | | |
| ST-1 | 30/30 | | 16 | 15.5-17.5 Shelby tube, dk. gray v. soft to soft clay top and bottom.<br>Full recovery. | CL | | | | | | | | | |
| | | | 18 | E.O.B. @ 18'. | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Scott Watermolen — Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-LSL-104B |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Dan Tinnacour | 02/13/94<br>MM/DD/YY | 02/13/94<br>MM/DD/YY | 6" Rotary Wash |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | CMC-LSL-104B | 14.73 (2/28/94) | 1592.1 | 6" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 112,072.7N, 2,275,937.4E S/C/N<br>NE 1/4 of SE 1/4 of Section 36, T 35 N, R 12 E Lat Long | Feet — N S Feet — E W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Nashville |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2 | 13" Ice 6.5' H2O. | | | | | | | | | | |
| SS-1 | 12 | 11/13<br>15/13 | 6 | 6.5-9.3 Dk. brn. (10YR4/4) firm-v.firm, wet, med. text. sand w/minor silt, poorly graded. | SP | | | | | | | | | |
| SS-2 | 24 | 13/12<br>11/11 | 8 | 9.3-12 Grayish brn (2.5Y5/2) firm silty clayey fine sand. | SM | | | | | | | | | |
| SS-3 | 12 | WR | 10 | As above. | SM | | | | | | | | | |
| SS-4 | 24 | WR | 12 | 12-23 Dk. grey (2.5Y4/0) v. soft to soft wet clay w/silt. Occasional thin sand laminations (<1mm thick). Lacustrine. | CL | | | | | | | | | |
| SS-5 | 24 | 4/5<br>5/5 | 14 | Overdrilled 1' from 16-17 (no sample). | | | | | | | | | | |
| | | | 16 | As above. | CL | | | | | | | | | |
| ST-6 | 30/30 | | 18 | 17-19.5 Shelby tube, dk. gray v. soft to soft clay top and bottom, 30"/30". | CL | | | | | | | | | |
| SS-7 | 24 | | 20 | As above grading to dk. brown (10YR3/3) clay w/thin sand lamination @ 21.5'. | CL | | | | | | | | | |
| SS-8 | | 6/11<br>7/9 | 22 | 23-24.2 Brown (10YR3/3) wet stiff sandy clay. Mod. med. blocky. | CL/SC | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature] Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-LSL-104B

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | P200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | | | | | | | | | | | |
| | | | -- 24 | 24.2+ Dk. brn (10YR3/4) wet firm med. text. sand. poorly graded, w/gravel (10%). | SP | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 26 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 28 | Hole drilled to 28'. | | | | | | | | | | |
| | | | -- | Mud containing 12 lbs. bentonite/75 gal. | | | | | | | | | | |
| | | | -- | H2O could not keep hole open beyond | | | | | | | | | | |
| | | | -- | -25'. Well set @ this point. | | | | | | | | | | |
| | | | -- | Mud disposed in sump pit @ mine site. | | | | | | | | | | |
| | | | -- | Protective casing driven to 15'. | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-LSL-105 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Jeff Flamidio | 02/15/94<br>MM/DD/YY | 02/15/94<br>MM/DD/YY | 4.25" I.D.<br>Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | NA | NA | 1592.1 | 4.25" |

Boring Location
State Plane 110,284.7N, 2,276,504.7E S/C/N
NW 1/4 of NW 1/4 of Section 6, T 34 N, R 13E
Lat
Long

Local Grid Location (if applicable)
Feet ___ N S Feet ___ E W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | 0-16" Ice. | | | | | | | | | | |
| | | | -- | 16" - 2' Water. | | | | | | | | | | |
| 1 | 10 | 1/1<br>1/1 | -- 2 | 2-3.9 Dark brown (7.5YR2/1) organic muck, roots, fibrous, wet, sticky. | OL | | | | | | | | | |
| 2 | 18 | 2/3<br>4/3 | -- 4 | 3.9-5.6 Brown (10YR5/4) fine-med. sand with silt, wet, loose. | SP | | DRAFT | | | | | | | |
| | | | -- | 5.6-12 Grey (2.5Y5/2) silty clay with organics, massive, wet, sticky. | CL | | | | | | | | | |
| 3 | 20 | TWT | -- 6 | Push TWT 6-8. | | | | | | | | | | |
| | | | -- | 20" no recovery. | | | | | | | | | | |
| 4 | 22 | 1/1<br>1/1 | -- 8 | 8-10 As above, minor sand. | CL | | | | | | | | | |
| 5 | 0 | TWT | -- 10 | 10-12 Push TWT 0" recovery. | CL | | | | | | | | | |
| 6 | 14 | TWT | -- 12 | 12-14 Push TWT - could only push 10". 14" recovery tube tip bent at end of push. | CL/SP | | | | | | | | | |
| 7 | 10 | 3/5<br>7/7 | -- 14 | -13-17.8 Brown (10YR7/3) fine-med. sand with gravel, structureless, wet, loose. | SP | | | | | | | | | |
| 8 | 16 | 6/8<br>7/6 | -- 16 | | | | | | | | | | | |
| | | | -- | 17.8-18.2 Brown (10YR7/3) fine sand, structureless, wet, loose. | SP | | | | | | | | | |
| 9 | 20 | 18/22<br>19/23 | -- 18 | 18.2-20 Brown (10YR7/3) fine-med. sand with gravel, structureless, wet, loose. | SP | | | | | | | | | |
| | | | -- 20 | E.O.B. @ 20'. | | | | | | | | | | |
| | | | -- | 3 bags hole plug. | | | | | | | | | | |
| | | | -- 22 | Cuttings disposed in mud sumps at mine site. | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature]

Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

## LOG OF BORING NO. STS LSL-1

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| EXXON Minerals Company | |
| **SITE** | **PROJECT NAME** |
| Little Sand Lake | Sediment Sampling |

| DEPTH ELEVATION | SAMPLE NO. | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.3 | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.2 (1 2 3 4 5) / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| SURFACE ELEVATION → | | | | | | | |
| | | PA | | | Ice | | |
| 5 | | | | | Water | | |
| 10 | | | | | | | |
| | 1 | ST | | | | | |
| 15 | 2 | ST | | | Black and green organic silt (OL) - fibrous - wet - very loose | | |
| | 3 | ST | | | | | |
| 20 | 4 | ST | | | | | |
| | 5 | ST | | | | | |
| 25 | 6 | ST | | | Grayish brown mottled black organic silt (OH) - trace of fibers - wet - soft | | |
| | 7 | ST | | | | | |
| | 8 | ST | | | | | |
| 30 | 9 | ST | | | | 73.1 | X - - - - - △ - - - ● |
| | 10 | ST | | | Grayish brown mottled black silty clay (CL) - trace of organics - trace of sand seams - wet - soft to firm | | |
| 35 | 11 | ST | | | | | |
| | 12 | ST | | | | | |
| 40 | | | | | CONTINUED | | |

| WATER LEVEL OBSERVATIONS | | |
|---|---|---|
| W.L | | |
| W.L | B.C.R | A.C.R |
| W.L | | |

**SOIL TESTING SERVICES**
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 3-19-82 |
| BORING COMPLETED | | | 3-19-82 |
| RIG | CME 55 | FOREMAN | TT |
| DRAWN | KDD | APPROVED | TWM |
| JOB # | 11728 | SHEET | 1 of 2 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

## LOG OF BORING NO. STS LSL-1 Continued

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| EXXON Minerals Company | |
| **SITE** | **PROJECT NAME** |
| Little Sand Lake | Sediment Sampling |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.3 | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % — STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION | | |
| | | | | | CONTINUED | | |
| 40 | | | | | | | |
| | 13 | ST | | | | | |
| | 14 | ST | | | Grayish brown mottled black silty clay (CL) - trace of organics - trace of sand seams - wet - soft to firm | | |
| | 15 | ST | | | | 88.6 | ● |
| | 16 | ST | | | | | |
| | 17 | SS | | LS | Brown sandy gravel (GP) - wet - dense | | ⊗ 24 |
| | 18 | SS | | | | | ⊗ 44 |
| | | | | | End of Boring<br>Boring advanced to 52.0 feet by roller bit and wash water<br>28.0 feet of HW casing used | | |

WATER LEVEL OBSERVATIONS

W.L. —

W.L. BCR — ACP

W.L. —

**SOIL TESTING SERVICES**
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 3-16-82 |
| BORING COMPLETED | | | 3-16-82 |
| RIG | CME 55 | FOREMAN | TT |
| DRAWN | KOO | APPROVED | TWW |
| JOB # | 11728 | SHEET | 2 of 2 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

## LOG OF BORING NO. STS LSL-2

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| EXXON Minerals Company | |
| **SITE** | **PROJECT NAME** |
| Little Sand Lake | Sediment Sampling |

| DEPTH ELEVATION | SAMPLE NO. | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.3 | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| SURFACE ELEVATION → | | | | | Ice | | |
| 5 | | | | | Water | | |
| 10 | | | | | | | |
| 15 | 1 | SS | | | Black organic silt (OL) - wet - very loose | | |
| 20 | 2 | SS | | | | | |
| | 3 | ST | | | | | |
| | 4 | ST | | | | | |
| 25 | 5 | OS | | | | 80.0 | ● |
| | 6 | OS | | | | | |
| 30 | 7 | ST | | INR | Grayish brown mottled black silty clay (CL) - trace of organics and fibers - trace of sand - wet - firm | | |
| | 8 | ST | | | | | |
| 35 | 9 | ST | | | | | |
| | 10 | ST | | INR | | | |
| | 11 | ST | | | | | |
| 41 40.5 | 12 | BL | | | Brown fine to medium sand (SP) - trace of silt - trace of clay - wet - medium dense | | ⊗ 15 |
| | | | | | End of Boring<br>Boring advanced to 40.5 feet by roller bit and wash water<br>39.0 feet of HW casing used | | |

| WATER LEVEL OBSERVATIONS | | |
|---|---|---|
| W.L | | |
| W.L | B.C.R | A.C.R |
| W.L | | |

**SOIL TESTING SERVICES**
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 3-22-82 |
| BORING COMPLETED | | | 3-22-82 |
| RIG | CME 55 | FOREMAN | TT |
| DRAWN | KDO | APPROVED | TWW |
| JOB # | 11728 | SHEET | 1 of 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

# LOG OF BORING NO. STS LSL-3

| | |
|---|---|
| OWNER: EXXON Minerals Company | ARCHITECT-ENGINEER: |
| SITE: Little Sand Lake | PROJECT NAME: Sediment Sampling |

| DEPTH ELEVATION | SAMPLE NO. | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.3 | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) · PLASTIC LIMIT % · WATER CONTENT % · LIQUID LIMIT % · STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION | | |
| | | | | | Ice | | |
| 5 | | | | | Water | | |
| 10 | | | | | | | |
| | 1 | ST | | | Black organic silt (OL) - fibrous - wet - very loose | | |
| 15 | 2 | ST | | | | | |
| | 3 | ST | | | | | |
| 20 | 4 | SS | | | | | |
| | 5 | SS | | | | | |
| 25 | 6 | SS | | | Greenish brown organic silt (OH) - trace of fibers - wet - very loose | | |
| | 7 | ST | | | Grayish brown organic clayey silt (OL to ML) - trace of fibers - trace of sand - wet - firm | | |
| 30 | 8 | ST | | | | 67.1 | ● |
| | 9 | ST | | | Grayish brown mottled black silty clay (CL) - trace of organics - trace of sand - wet - firm | | |
| 35 | 10 | ST | | | | | |
| | 11 | ST | | | | | |
| | 12 | ST | | | | 87.8 | ● |
| 40 | 13 | ST | | | | | |
| | 14 | SS | | | | | |
| | 14A | SS | | | | | |
| 45 | 15 | BL | | | Brown fine to medium sand (SP) - trace of silt - wet - medium dense | | ⊗ 15 |
| | | | | | End of Boring<br>Boring advanced to 45.0 feet by roller bit and wash water<br>45.0 feet of HW casing used | | |

WATER LEVEL OBSERVATIONS

W.L
W.L B.C.R A.C.R
W.L

**SOIL TESTING SERVICES**
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 3-19-82 |
| BORING COMPLETED | | | 3-19-82 |
| RIG | CME 55 | FOREMAN | TT |
| DRAWN | KDD | APPROVED | TWH |
| JOB # | 11728 | SHEET | 1 of 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

## LOG OF BORING NO. STS LSL-4

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| EXXON Minerals Company | |
| **SITE** | **PROJECT NAME** |
| Little Sand Lake | Sediment Sampling |

| DEPTH ELEVATION | SAMPLE NO. | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.3 | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.2 / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.) |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION | | 1 2 3 4 5 — 10 20 30 40 50 |
| | | | | | ICE | | |
| 5 | | PA | | | Water | | |
| 10 | | | | | | | |
| 15 | 1 | SS | | LS | Black organic silt (OL) - fibrous - wet - very loose | | ROD WEIGHT |
| | 2 | SS | | | | | ROD WEIGHT |
| 20 | 3 | SS | | | | | ROD WEIGHT |
| | 4 | SS | | | | | ROD WEIGHT |
| | 5 | OS | | | | | |
| 25 | 6 | OS | | | | | |
| | 7 | ST | | | Greenish gray organic silt (OH) - trace of fibers - trace of sand - wet - firm | | |
| 30 | 8 | ST | | | | | |
| | 9 | ST | | | | 81.0© | X - - - △ - - ● |
| | 10 | ST | | LS | | | |
| 35 | 11 | ST | | | | | |
| | 12 | ST | | | Grayish brown mottled black silty clay (CL) - trace of organics - trace of sand - wet - firm | | |
| 40 | 13 | ST | | LS | | | |
| | 14 | ST | | | | | |
| 43 | | | | | CONTINUED | | |

| WATER LEVEL OBSERVATIONS | | |
|---|---|---|
| W.L | | |
| W.L | B.C.R | A.C.R |
| W.L | | |

**SOIL TESTING SERVICES**
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 3-20-82 |
| BORING COMPLETED | | | 3-21-82 |
| RIG | CME 55 | FOREMAN | TT |
| DRAWN | KOO | APPROVED | TWH |
| JOB | 11728 | SHEET | 1 of 2 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

## LOG OF BORING NO. STS LSL-4 Continued

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| EXXON Minerals Company | |
| **SITE** | **PROJECT NAME** |
| Little Sand Lake | Sediment Sampling |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) · PLASTIC LIMIT % · WATER CONTENT % · LIQUID LIMIT % · STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| SURFACE ELEVATION → | | | | | | | |
| 40 | | | | | CONTINUED | | |
| | 15 | ST | | | | | |
| | 15A | ST | | | | | |
| 45 | | | | | Brown silty fine to medium sand (SM) - trace of gravel - wet - medium dense | | ⊗ 37 |
| | 16 | BL | | | | | |
| 47 | | | | | End of Boring<br>Boring advanced to 47.5 feet by roller bit and wash water<br>47.0 feet of HW casing used | | © ORGANIC CONTENT |

| WATER LEVEL OBSERVATIONS | | |
|---|---|---|
| W.L | | |
| W.L | B.C.R | A.C.R |
| W.L | | |

**SOIL TESTING SERVICES**
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 3-20-82 |
| BORING COMPLETED | | | 3-21-82 |
| RIG | CME 55 | FOREMAN | TT |
| DRAWN | KDO | APPROVED | TWW |
| JOB # | 11728 | SHEET | 2 of 2 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

# LOG OF BORING NO. STS LSL-5

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| EXXON Minerals Company | |
| **SITE** | **PROJECT NAME** |
| Little Sand Lake | Sediment Sampling |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.3 | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % — STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| SURFACE ELEVATION → | | | | | | | |
| | | PA | | | Ice | | |
| 5 | | | | | Water | | |
| 10 | | | | | | | |
| | 1 | SS | | | Black organic silt (OL) - fibrous - wet - very loose | | |
| 15 | 2 | SS | | | Greenish brown organic silt (OH) - trace of fibers - trace of sand - wet - firm | | |
| | 3 | OS | | | | | |
| | 4 | ST | | LS | | | |
| 20 | 4A | ST | | | | | |
| | 5 | ST | | | Grayish brown mottled black silty clay (CL) - trace of organics - trace of sand - wet - firm | 78.5 | ● |
| | 6 | SS | | | | | |
| 25 | 7 | SS | | | | | |
| | 8 | SS | | | | | |
| 30 | 9 | SS | | | | 84.5 | ● |
| | 10 | SS | | | Brown clayey sand (SC) - trace of gravel - wet | | |
| | 11 | BL | | | Brown silty fine to coarse sand (SM) - trace of gravel - wet - loose | | ⊗ 7 |
| 35 | | | | | | | |
| 36 | | | | | End of Boring<br>Boring advanced to 36.0 feet by roller bit and wash water<br>18.0 feet of HW casing used | | |

WATER LEVEL OBSERVATIONS

W.L.

W.L. B.C.R. A.C.R.

W.L.

**SOIL TESTING SERVICES**
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 3-21-82 |
| BORING COMPLETED | | | 3-21-82 |
| RIG | CME 55 | FOREMAN | TT |
| DRAWN | KCO | APPROVED | TWW |
| JOB # | 11728 | SHEET | 1 of 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

# LOG OF BORING NO. STS LSL-6

| | |
|---|---|
| OWNER: EXXON Minerals Company | ARCHITECT-ENGINEER: |
| SITE: Little Sand Lake | PROJECT NAME: Sediment Sampling |

| DEPTH ELEVATION | SAMPLE NO. | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.3 | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.2 (1 2 3 4 5); PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %; STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION | | |
| | | PA | | | Ice | | |
| 5 | | | | | Water | | |
| 10 | 1 | SS | | | Brown and black organic silt (OL) - fibrous - wet - very loose | | ROD WEIGHT |
| | 2 | SS | | | | | ROD WEIGHT |
| 15 | 3 | SS | | | Greenish brown organic silt (OH) - trace to a little fiber - trace of sand - wet - soft | | ROD WEIGHT |
| | 4 | OS | | | | 41.8 © | |
| 20 | 5 | ST | | | Grayish brown mottled black silty clay (CL) - trace of organics - trace of sand - wet - firm | | |
| | 6 | SS | | | | | ROD WEIGHT |
| | 7 | OS | | | | | |
| 25 | 8 | SS | | | | | ROD WEIGHT |
| | 9 | SS | | | | | ROD WEIGHT |
| 30 | 10 | OS | | | | 86.8 | |
| | 11 | ST | | | | | |
| | 12 | SS | | | Brown clayey fine to medium sand (SC) - trace of gravel - wet - medium dense | | 23 |
| 35 | 13 | BL | | | Brown fine to coarse sand (SP) - trace of silt - a little gravel - wet - medium dense | | 38 |
| 36 | | | | | End of Boring<br>Boring advanced to 36.0 feet by roller bit and wash water<br>34.0 feet of HW casing used | | © ORGANIC CONTENT |

107A
115.5
62.6

WATER LEVEL OBSERVATIONS

W.L
W.L B.C.R A.C.R
W.L

**SOIL TESTING SERVICES**
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 3-20-82 |
| BORING COMPLETED | | | 3-20-82 |
| RIG | CME 55 | FOREMAN | TT |
| DRAWN | KOO | APPROVED | TWW |
| JOB # | 11728 | SHEET | 1 of 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

# Appendix 1
# Soil Boring Logs - Deep Hole Lake

APR 12 '94 04:27PM FOTH&VAN DYKE ANNEX OF BORING NUMBER

| | |
|---|---|
| Minerals Company | DHL-1 |
| PROJECT NAME | ARCHITECT-ENGINEER |
| Lake Sediment Borings | |

STS Consultants Ltd

SITE LOCATION
Deep Hole Lake

UNCONFINED COMPRESSIVE STRENGTH TONS FT²
1 2 3 4 5

PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT %
10 20 30 40 50

STANDARD PENETRATION BLOWS FT
10 20 30 40 50

| ELEVATION / DEPTH | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.³ |
|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1605.4' - 489.32m | |
| | | | | | Ice | |
| 5 | | | | | Water | |
| 10 | 1 | SS | | | Brown and green organic silt (OL) - moderately fibrous - with trace of sand - wet - very loose | |
| | 2 | OS | | | | |
| 15 | 3 | SS | | | | |
| | 4 | SS | | | | |
| | 4A | SS | | | Greenish gray organic silt (OL) - with traces of clay, sand and fibers - very moist - soft | |
| 20 | 5 | SS | | | | |
| | 6 | ST | | | Gray silt (ML) - with traces of clay, sand and organics - occasional seams of fine sand below 26.0 feet - very moist - loose to very loose | 95 |
| 25 | 7 | ST | | | | |
| | 8 | ST | | | | |
| 30 | 9 | ST | | | | |

3.5-11-73

Continued

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN SITU THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| WL | WS-WAD | BORING STARTED 2-11-84 | 540 Lambeau Green Bay, WI 54303 |
| WL | BCR ACR | BORING COMPLETED 2-13-84 | |
| WL | | RIG Bomb 45 FOREMAN EVH | APP'D BY BRT STS JOB NO 12949 |

Kaiser Minerals Company

PROJECT NAME
Lake Sediment Borings

DHL-1 Continued

ARCHITECT-ENGINEER

STS Consultants Ltd.

SITE LOCATION
Deep Hole Lake

| ELEVATION / DEPTH | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT LBS/FT³ | UNCONFINED COMPRESSIVE STRENGTH TONS FT² (1 2 3 4 5) / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % (10 20 30 40 50) / STANDARD PENETRATION BLOWS FT (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION | | |
| | | | | | Continued | | |
| | 10 | SS | | | Gray silt (ML) - with trace of clay, sand and organics - occasional seams of fine sand below 26.0 feet - very moist - loose to very loose | | |
| 35 | 11 | ST | | | | 92 | ● |
| | 12 | SS | | | Brown silty fine to coarse sand (SM) - with trace of clay - a little to some gravel - wet - medium dense to very dense | | 12 ⊗ — ⊗ 49 |
| 40 | 13 | SS | | | | | |
| 43 | | | | | End of Boring<br>Boring advanced to 43.0 feet with roller bit and wash water<br>41.0 feet of HW casing used<br>1-1/2" PVC well installed at 41.8 feet with deep seal<br>Well removed anc borehole grouted on 2-23-84 | | |

© Organic Content

3.5-11-74

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES IN SITU THE TRANSITION MAY BE GRADUAL

# Appendix 1
# Soil Boring Logs - Skunk Lake

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-SL-103A |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc. | 02/07/94<br>MM/DD/YY | 02/08/94<br>MM/DD/YY | 4.25" I.D.<br>Hollow-Stem Auger |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | CMC-SL-103A | | 1599.3 | 8" |

Boring Location 117,856.6 N 2,281,146.9 E
State Plane ___ N, ___ E S/C/N
1/4 of SE 1/4 of Section 30, T 35 N, R 13 E Lat Long

Local Grid Location (if applicable): ___ Feet ___ N S, ___ Feet ___ E W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS-1 | 12 | 16/14<br>9/10 | 2 | 2-4 Lt. brownish grey (2.5Y6/2) greenish clay w/tr. of sand, stiff. | CL | | | | | | | | | |
| SS-2 | 16 | 14/13<br>8/14 | 4 | 4-5.2 Greyish green clayey sand w/tr. of gravel, wet. | SC | | | | | | | | | |
| | | | | 5.2-8 Olive grey (10YR4/1) sandy clay. | CL | | | | | | | | | |
| ST-3 | 24/24 | | 6 | Shelby tube 6;-8'. Full recovery. | | | | | | | | | | |
| SS-4 | 12 | 8/24<br>33/32 | 8 | 8-12 Brown-red brn. (10YR5/5) wet poorly graded. Med. text. sand dense-v. dense. | SP | | | | | | | | | |
| | | | 10 | | | | | | | | | | | |
| SS-5 | 14 | 16/9<br>16/23 | | As above. | SP | | | | | | | | | |
| | | | 12 | Heavy sands at 12'. 3-5' of blowup in augers- Augers removed and plug inserted. Redrilled to 30'. | | | | | | | | | | |
| | | | 14 | Well set @ -28' w/5' screen. | | | | | | | | | | |
| | | | 16 | | | | | | | | | | | |
| | | | 18 | | | | | | | | | | | |
| | | | 20 | | | | | | | | | | | |
| | | | 22 | E.O.B. @ 30'. | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Steve Wood Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-SL-103B |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Dan Tinnacour | 02/08/94<br>MM/DD/YY | 02/08/94<br>MM/DD/YY | 4.25" I.D.<br>Hollow-Stem Auger |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | | 1599.2 | 8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane ___ N, ___ E S/C/N<br>1/4 of SW 1/4 of Section 30, T 35 N, R 13 E<br>Lat<br>Long | ___ N / S ___ Feet<br>___ E / W ___ Feet |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0 | See CMC-SL-103A for log of shallow deposits. | | | | | | | | | | |
| | | | 2 | | | | | | | | | | | |
| | | | 4 | | | | | | | | | | | |
| | | | 6 | | | | | | | | | | | |
| | | | 8 | Soils could not be sampled from 12-20' due to running sands. | | | DRAFT | | | | | | | |
| | | | 10 | | | | | | | | | | | |
| | | | 12 | | | | | | | | | | | |
| | | | 14 | | | | | | | | | | | |
| | | | 16 | | | | | | | | | | | |
| | | | 18 | | | | | | | | | | | |
| SS-1 | 20 | 4/2<br>7/13 | 20 | 20-22 V. Dk. gray (2.5Y3/0) silty clay w/tr. of sand, soft. | CL | | | | | | | | | |
| SS-2 | 6 | 10/11<br>14/12 | 22 | 22-25 Brown (10YR5/4) clayey sand, v. firm, mod. med. blocky. | SC | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature]

Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


BORING NUMBER: CMC-SL-103B

| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | P200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 24 | | | | | | | | | | | |
| SS-3 | 24 | 9/11 13/17 | | 25-28 Dk. grey clayey silt w/tr. of sand. | | | | | | | | | | |
| ST-4 | 21 | | 26 | As above, Shelby tube, 26-28'. | ML | | | | | | | | | |
| SS-5 | 20 | 10/12 13/20 | 28 | 28-29.8 Dk. grey (10YR3/1) silty clay w/tr. of sand. | CL | | | | | | | | | |
| | | | | 29.8-30 Grayish brn (10YR4/2) fine-med. text. sand w/silt. | SM | | | | | | | | | |
| SS-6 | 26 | 9/18 14/16 | 30 | 30-40 Grayish brown (10YR4/2) fine to med. text. sand w/tr. of gravel, grading to 15% gravel @ 36'. | SP | | | | | | | | | |
| SS-7 | 24 | 10/29 39/43 | 32 | As above. | SP | | | | | | | | | |
| | | | 34 | | | | | | | | | | | |
| SS-8 | 20 | 53/32 29/10 | 36 | As above. | SP | | | | | | | | | |
| SS-9 | 12 | | 38 | As above. | SP/GP | | | | | | | | | |
| SS10 | 12 | | 40 | As above. | SP/GP | | | | | | | | | |
| | | | 42 | | | | | | | | | | | |
| | | | 44 | | | | | | | | | | | |
| | | | 46 | | | | | | | | | | | |
| | | | 48 | | | | | | | | | | | |
| | | | 50 | Abandoned augers to 50', 6' of blow-up. Well can't be set. Abandoned w/10 bags of holeplug. Was blind drilled w/a plug on 2/9/94. | | | | | | | | | | |

DRAFT

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-SL-103C |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc. | 02/09/94<br>MM/DD/YY | 02/09/94<br>MM/DD/YY | 4.25" I.D.<br>Hollow-Stem Auger |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | CMC-SL-103B | 18.5' | 1599.1 | 8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 117,848.7 N, 2,281,133.9 E S/C/N<br>Lat<br>Long<br>1/4 of SE 1/4 of Section 30, T 35 N, R 13 E | Feet ___ N ___ S, Feet ___ E ___ W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2 | Blind drilled to 50'. See CMC-SL-103A and CMC-SL-103B for log. | | | | | | | | | | |
| | | | 4 | | | | | | | | | | | |
| | | | 6 | | | | DRAFT | | | | | | | |
| | | | 8 | | | | | | | | | | | |
| | | | 10 | | | | | | | | | | | |
| | | | 12 | | | | | | | | | | | |
| | | | 14 | | | | | | | | | | | |
| | | | 16 | | | | | | | | | | | |
| | | | 18 | | | | | | | | | | | |
| | | | 20 | | | | | | | | | | | |
| | | | 22 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

| Signature | Firm |
|---|---|
| Stephen A. Foth | Foth & Van Dyke |

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-SL-104 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Bill Zamow | 02/08/94<br>MM/DD/YY | 02/08/94<br>MM/DD/YY | 4.25" I.D.<br>Hollow-Stem Auger |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | — | — | 1598.5 | 8" |

Boring Location
State Plane 117,613.2 N, 2,280,834.5 E S/C/N
1/4 of SW 1/4 of Section 29, T 35 N, R 13 E Lat Long

Local Grid Location (if applicable)
___ Feet ___ N S ___ Feet ___ E W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS-1 | 12 | 6/12<br>8/9 | -- | 0-4 Greyish green wet firm sandy clay. | CL | | | | | | | | | |
| SS-2 | 12 | 4/3<br>5/7 | -- 2 | As above. | | | | | | | | | | |
| ST-3 | 30/30 | | -- 4 | Shelby tube 4-6' full recovery. | CL | | | | | | | | | |
| SS-4 | 20 | 11/11<br>13/16 | -- 6 | 6-8.8 Brown wet med. text. sand, v.firm, poorly graded. | SP | | | | | | | | | |
| SS-5 | 24 | 7/9<br>9/11 | -- 8 | 8.8-10 Brown wet sandy silt, platey. Firm-stiff. | ML | | | | | | | | | |
| SS-6 | 24 | 6/6<br>7/7 | -- 10 | 10-12.5 Grayish brn (10YR4/2), stiff, wet sandy clay w/tr. of gravel, grading to v.dk. grey (2.5Y3/0) silty clay w/ 1" sand seam @ 11.2'. | CL | | | | | | | | | |
| SS-7 | 24 | 4/1<br>1/1 | -- 12 | 12.5-16 Dk. grey (2.5Y3/0) clayey silty sand v. loose. | SM | | | | | | | | | |
| SS-8 | 20 | 1/1<br>2/2 | -- 14 | As above. | SM | | | | | | | | | |
| ST-9 | 30/30 | | -- 16 | 16-19 Shelby tube 36"/36" full recovery. | | | | | | | | | | |
| SS10 | 24 | 21/26<br>41/39 | -- 18<br>-- | 19-24 V. loose grey clayey sand, structureless. | SC | | | | | | | | | |
| | | | -- 20 | As above. | SC | | | | | | | | | |
| SS11 | 12 | 3/21<br>24/19 | -- 22 | As above. | SC | | | | | | | | | |

DRAFT

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Steve Wood Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-SL-104

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | P200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS12 | 16 | 49/210<br>100/92 | 24 | 24- Grayish brown (10YR4/3) poorly graded med. coarse text. sand. Outwash. | SP | | | | | | | | | |
| SS13 | 16 | 21/50<br>54/61 | 26 | As above w/gravel. | SP/GP | | | | | | | | | |
| SS14 | 16 | 14/7<br>15/17 | 28 | As above w/gravel. | SP/GP | | | | | | | | | |
| SS15 | 12 | 50/42<br>39/56 | 30 | As above. | SP/GP | | | | | | | | | |
| SS16 | 10 | 36/53<br>102/94 | 32 | As above. | SP/GP | | | | | | | | | |
| SS17 | 3 | 100<br>100/.2 | 34 | As above. | SP/GP | | | | | | | | | |
| | | | 36 | Augers siezing @ 36', end of boring. | | | | | | | | | | |
| | | | | Abandoned w/10 50-lb. bags of holeplug. | | | | | | | | | | |

| OWNER | LOG OF BORING NUMBER |
|---|---|
| Exxon Minerals Company | SL-1 |
| **PROJECT NAME** | **ARCHITECT-ENGINEER** |
| Lake Sediment Borings | |

STS Consultants Ltd.

**SITE LOCATION**

Skunk Lake

| ELEVATION / DEPTH | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT LBS FT³ |
|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1598.0' - 487.07m | |
| | | | | | Ice | |
| | | | | | Water - decayed organic odor | |
| 5 | 1 | SS | | | Dark brown organic silt (OL) - moderately fibrous - with trace of sand - wet - very loose | |
| | 2 | SS | | | | |
| | 3 | SS | | | Black organic silty clay (OL) - with trace of sand - trace of fibers - very moist - firm | |
| | 3A | SS | | | | |
| 10 | | | | | Bluish gray silty clay (CL) - with trace of sand - trace of organics - moist - firm | |
| | 4 | SS | | | | |
| | 5 | SS | | | Brown silty fine to coarse sand (SP-SM) - with a little fine to medium gravel - a few silty clay lenses - cobbles below 15.0 feet - wet - medium dense to dense | |
| 15 | | | | | | |
| | 6 | SS | | | | |
| 17.4 | | | | | End of Boring<br>Boring advanced to 17.4 feet with roller bit and wash water<br>17.0 feet of HW casing used - 40% water loss from 10.3 to 10.5 feet<br>1-1/2" PVC well installed at 17.4 feet with deep seal<br>Well removed and borehole grouted on 2-27-84 | |

UNCONFINED COMPRESSIVE STRENGTH TONS FT²

1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

10 20 30 40 50

STANDARD PENETRATION BLOWS FT

10 20 30 40 50

W/R W/R W/M W/M 14 21

3.5-11-82

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN SITU. THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| WL | WS OR WD | BORING STARTED 2-9-84 | 540 Lambeau<br>Green Bay, WI 54303 |
| WL | BCR ACR | BORING COMPLETED 2-9-84 | |
| WL | | RIG Bomb 45 FOREMAN EVH | APP'D BY GMT STS JOB NO 12949 |

| | |
|---|---|
| OWNER: Exxon Minerals Company | LOG OF BORING NUMBER: SL-2 (6' East of SL-1) |
| PROJECT NAME: Lake Sediment Borings | ARCHITECT-ENGINEER |
| SITE LOCATION: Skunk Lake | |

STS Consultants Ltd.

| ELEVATION / DEPTH | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT LBS FT³ | UNCONFINED COMPRESSIVE STRENGTH TONS FT² / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD PENETRATION BLOWS FT |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1598.0' - 487.07m | | 1 2 3 4 5 — 10 20 30 40 50 — 10 20 30 40 50 |
| | | | | | Ice | | |
| | | | | | Water - decayed organic odor | | |
| 5 | | | | | Dark brown organic silt - drillers observation | | |
| | 1 | ST | | | Black organic silty clay (OL) - with a little sand - trace of gravel and fibers - wet - soft | 108 | © |
| 10 | 1A | ST | | | Gray very silty clay (CL) - with traces of sand and organics - moist - firm | | |
| 10.5 | 1B | ST | | | Gray silty fine to coarse sand (SP-SM) - with some gravel and cobbles - wet - medium dense | | |
| | | | | | End of Boring<br>Boring advanced to 8.5 feet with wash water<br>8.5 feet of HW casing used<br>Borehole grouted on 2-27-84 | | |

© ORGANIC CONTENT

3.5-11-83

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN SITU THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| WL | WS OR WD | BORING STARTED 2-27-84 | 540 Lambeau Street<br>Green Bay, Wi. 54303 |
| WL | BCR ACR | BORING COMPLETED 2-27-84 | |
| WL | | RIG Hand Equip. FOREMAN EVH | APP'D BY GMT STS JOB NO 12949 |

STS Consultants Ltd

OWNER: Exxon Minerals Company

PROJECT NAME: Wetland Well Installation

SITE LOCATION: Skunk Lake

LOG OF BORING NUMBER — meters
feet - [illegible] 2,281,028E 35895N 695259E
SI-3 [illegible] 487.77m 1602.63ft 488.483 m

ENGINEER

BEST COPY AVAILABLE

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | WELL INSTALLATION TOP STANDPIPE EL. + | | | | | | | |
| | | | | | SURFACE ELEVATION Swamp Level 10-14-85 | | | | | | | |
| | | | | | Peat | | | | | | | |
| | | | | | Clay | | | | | | | |
| | | | | | Clayey sand | | | | | | | |
| | | | | | 33" (1-/15/85) ▽ | | | | | | | |
| | | | | | Silty sand | | | | | | | |
| | | | | | Sandy clay | | | | | | | |
| | | | | | Silty sand | | | | | | | |
| | | | | | Sand - fine to medium gravel - trace of silt | | | | | | | |

Notes added by Exxon 02-06-86

1) Top of 2" diameter standpipe 23" above swamp level at time of well installation.

2) Water level elevation shown on log has not stablized. See hydrologic data base for current water level readings and indication of stablized water level.

3.5-11-84

The stratification lines represent the approximate boundary between soil types, in situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | | BCR | | | ACR | | |
|---|---|---|---|---|---|---|---|---|
| WL-T. PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

| | |
|---|---|
| BORING STARTED | 10-14-85 |
| BORING COMPLETED | 10-25-85 |
| RIG | |
| FOREMAN | |

| | |
|---|---|
| STS OFFICE | 540 Lambeau Street<br>Green Bay, WI. 54303 |
| DRAWN BY | JJT |
| SHEET | 1 OF 1 |
| APP'D. BY | TMF |
| STS JOB NO. | 14071 |

STS Consultants Ltd

OWNER: Exxon Minerals Company

PROJECT NAME: Wetland Well Installation

LOG OF BORING NUMBER SL-4

meters: 2,281,304E 35,989N 695.343E

feet: 2,281,073N 1602.7ft 488.50m 1603.06ft 488.614m

ENGINEER

BEST COPY AVAILABLE

SITE LOCATION: Skunk Lake

WELL INSTALLATION
TOP STANDPIPE EL. +

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION Swamp Level 10-14-85 | | | | | | | |
| | | | | | Organic brown silty clay - trace of sand | | | | | | | |
| | | | | | Sandy silt to clayey silt | | | | | | | |
| | | | | | Clayey sand | | | | | | | |
| | | | | | Silty sand - trace of clay | | | | | | | |
| | | | | | Silty clayey sand | | | | | | | |
| | | | | | Silty sand - trace of clay | | | | | | | |
| | | | | | Silty sand - with clay beds | | | | | | | |
| | | | | | 60" 10/21/85 | | | | | | | |
| | | | | | Sand - fine to medium gravel - trace of silt | | | | | | | |

Notes added by Exxon 02-06-86

1) Top of 2" diameter standpipe 29" above swamp level at time of well installation.

2) Water level elevation shown on log has not stablized. See hydrologic data base for current water level readings and indication of stablized water level.

3-5-11-85

The stratification lines represent the approximate boundary between soil types. In situ the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL BCR | | | ACR | | |
|---|---|---|---|---|---|
| WL* PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 10-14-85

BORING COMPLETED 10-25-85

RIG

FOREMAN

STS OFFICE 540 Lambeau Street, Green Bay, WI. 54303

DRAWN BY JJT

SHEET 1 OF 1

APP'D. BY TMF

STS JOB NO. 14071

STS Consultants Ltd

OWNER
Exxon Minerals Company

PROJECT NAME
Wetland Well Installation

LOG OF BORING NUMBER SL-5 meters
feet- 217,779N 2,281,091E 35,899N 695,278E
1601.26ft 488.05m 1602.636ft 488.483m

ENGINEER

SITE LOCATION
Skunk Lake

BEST COPY AVAILABLE

| DEPTH | ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qu (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | WELL INSTALLATION TOP STANDPIPE EL. + | | | | | | | |
| | | | | | | SURFACE ELEVATION Swamp Level 10-23-85 | | | | | | | |
| | | | | | | Peat | | | | | | | |
| | | | | | | Clayey silt | | | | | | | |
| | | | | | | Silty fine to medium sand - gray | | | | | | | |
| | | | | | | Sandy clay to clayey sand | | | | | | | |
| | | | | | | Silty fine to medium sand - gray | | | | | | | |
| | | | | | | Sand fine to medium - little silt - brown | | | | | | | |
| 10 | | | | | | Sand fine to medium - brown | | | | | | | |
| 15 | | | | | | Clayey silt becoming sandy silt with depth | | | | | | | |
| 20 | | | | | | Silty sand | | | | | | | |
| 25 | | | | | | | | | | | | | |

Notes added by Exxon 02-06-86

1) Top of 2" diameter standpipe 30" above swamp level at time of well installation.

2) Water level elevation shown on log has not stablized. See hydrologic data base for current water level readings and indication of stablized water level.

3.5-11-86

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | ACR | |
|---|---|---|---|---|---|
| WL-T. PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 10-14-85
BORING COMPLETED 10-25-85
RIG
FOREMAN

STS OFFICE 540 Lambeau Street, Green Bay, WI. 54303
DRAWN BY JJT | SHEET 1 OF 1
APP'D BY TMF | STS JOB NO. 14071

# Appendix 1
# Soil Boring Logs - Duck Lake

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-DL-103A |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Chuck Blunt | 02/11/94<br>MM/DD/YY | 02/11/94<br>MM/DD/YY | 4.25" I.D.<br>Hollow-Stem Auger |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | CMC-DL-103A | Dry | 1613.6 | 8.25" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane ___ N, ___ E S/C/N 113,334.6 N 2,281,957.0 E Lat Long<br>SE 1/4 of NE 1/4 of Section 31, T 35 N, R 13 E | ___ Feet ___ N S ___ Feet ___ E W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | Blind drill reference CMC-DL-103B log. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 2 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 4 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 1 | 21 | 8/10<br>15/12 | -- | 5-6.1 Brown (7.5YR5/4) silty clay with sand, massive, wet, sticky. | CL | | D | B | A | F | T | | | |
| | | | -- 6 | 6.1-7 Brown (7.5YR5/4) silty sand, structureless, wet, loose. | SP | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 8 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | E.O.B. @ 9'. | | | | | | | | | | |
| | | | -- 10 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 12 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 14 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 16 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 18 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 20 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 22 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

| Signature | Firm |
|---|---|
| Stephen K Woods | Foth & Van Dyke |

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-DL-103B |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Chuck Blunt | 02/11/94<br>MM/DD/YY | 02/11/94<br>MM/DD/YY | 4.25" I.D.<br>Hollow-Stem Auger |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | 18.0 | 1613.6 | 8.25" |

Boring Location: State Plane ___ N, ___ E S/C/N — 113,333.3 N 2,281,954.3 E — Lat Long
SE 1/4 of NE 1/4 of Section 31, T 35 N, R 13 E

Local Grid Location (if applicable): ___ Feet ___ N S, ___ Feet ___ E W

County: Forest
DNR County Code: 21
Civil Town/City/or Village: Lincoln

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 17 | 3/6<br>9/11 | -- | 0-.4 Dk. brown (10YR2/2) organic silt, frozen. | OL | | | | | | | | | |
| | | | -- | .4-2 Brown (7.5YR5/6) sandy silt, frozen. | ML/SM | | | | | | | | | |
| 2 | 18 | 2/3<br>3/2 | -- 2 | 2-6.4 Brown (7.5YR6/6) sandy clay to clayey sand, minor gravel, massive, wet, soft. | CL/SC | | | | | | | | | |
| 3 | 24 | Push | -- 4 | 4-6 Push TWT. | | | | | | | | | | |
| 4 | 14 | 4/5<br>5/6 | -- 6 | 6.4-21 Brown (7.5YR5/5) fine-med. sand with silt, structureless, wet, loose. | SP | | | | | | | | | |
| 5 | 14 | 1/2<br>4/5 | -- 8 | As above. | SP | | | | | | | | | |
| 6 | 15 | 2/5<br>5/7 | -- 10 | As above, damp-wet silt lense.<br>10-10.4 Damp. | SP | | | | | | | | | |
| 7 | 20 | 2/2<br>3/5 | -- 12 | As above. | SP | | | | | | | | | |
| 8 | 20 | 2/3<br>3/2 | -- 14 | As above. | SP | | | | | | | | | |
| 9 | 22 | 4/7<br>7/4 | -- 16 | As above with minor silt, compact. | SP | | | | | | | | | |
| 10 | 20 | 6/6<br>9/11 | -- 18 | As above, wet. | SP | | | | | | | | | |
| 11 | 18 | 5/10<br>10/11 | -- 20 | As above.<br>21 - Brown (7.5YR5/4) silty fine sand, massive, wet, soft. | SM | | | | | | | | | |
| 12 | 22 | 10/11<br>11/13 | -- 22 | As above. | SM | | | | | | | | | |

DRAFT

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Steven K Waugh — Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-DL-103B

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | Soil Properties: mois cont | Soil Properties: liqu limi | Soil Properties: plas limi | Soil Properties: P200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 13 | 24 | 6/6<br>7/7 | 24 | As above, slightly more sand. | SP/<br>SM | | | | | | | | | |
| 14 | 22 | 10/10<br>13/15 | 26 | As above. | SP/<br>SM | | | | | | | | | |
| 15 | 24 | 10/13<br>22/35 | 28 | As above. | SP/<br>SM | | | | | | | | | |
| 16 | 24 | --<br>11/11 | 30 | As above, more sand. | SP/<br>SM | | | | | | | | | |
| 17 | 22 | 9/9<br>13/5 | 32 | Brown (7.5YR5/4) fine-medium sand, structureless, wet, loose. | SP | | | | | | | | | |
| 18 | 8 | 11/7<br>9/14 | 34 | As above. | SP | | | | | | | | | |
| | | | | Made 3 attempts to pound out 5-7 feet of blowup to sample. Could not pound out blowup. | | | | | | | | | | |
| | | | 36 | E.O.B. @ 36.5'. | | | | | | | | | | |
| | | | 38 | | | | | | | | | | | |

DRAFT

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, X Other - Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Hydrogeologic Investigation | | CMC-DL-103C |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling, Inc.<br>Chuck Blunt | 02/08/94<br>MM/DD/YY | 02/09/94<br>MM/DD/YY | 6.25" I.D.<br>Hollow-Stem Auger |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | | 1611.8 | 6.25" |

Boring Location: State Plane 113,207.7 N, 2,281,788.4 E S/C/N; Lat; Long
Local Grid Location (if applicable): ___ Feet ___ N ___ S, ___ Feet ___ E ___ W
SE 1/4 of NE 1/4 of Section 31, T 35 N, R 13 E

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10 | 0/0 | -- | 0-4.8 Brown (10YR6/6) organic mat. bog frozen to 1.5. | FB | | | | | | | | | |
| | | 1/1 | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | 0 | 1 | -- 2 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | 12 | 1 | -- 4 | | | | | | | | | | | |
| | | | -- | 4.8-6.2 Brown (10YR3/3) organic mat. with sand, wet, loose. | OL | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | 18 | 1/1 | -- 6 | | | | | | | | | | | |
| | | 1 | -- | 6.2-8 Grey (2.5Y6/2) clayey sand, structureless, wet, sticky. | SC | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | 19 | 1/1 | -- 8 | 8-23.4 Grey (2.5Y5/2) firm sand, structureless, wet, loose. | SP | | | | | | | | | |
| | | 1/6 | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | 22 | 5/9 | -- 10 | As above. | SP | | | | | | | | | |
| | | 11/7 | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | 13 | 4/4 | -- 12 | As above. | SP | | | | | | | | | |
| | | 5/4 | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | 13 | | -- 14 | As above. | SP | | | | | | | | | |
| | | 4/3 | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | 22 | 1/2 | -- 16 | As above. | SP | | | | | | | | | |
| | | 1/3 | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | 18 | 3/2 | -- 18 | As above. | SP | | | | | | | | | |
| | | 3/4 | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | 16 | 5/6 | -- 20 | As above. | SP | | | | | | | | | |
| | | 7/7 | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | 0 | 1/1 | -- 22 | As above. | SP | | | | | | | | | |
| | | 1/2 | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |

DRAFT

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature] Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-DL-103C

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | P200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | 23.4 Grey (10YR5/3) silty clay, structureless, wet, sticky. | CL | | | | | | | | | |
| | | | -- 24 | Push TNT 24-26, no recovery. | | | | | | | | | | |
| | | | -- 26 | Push TWT 26-28, no recovery. | | | | | | | | | | |
| | | | -- 28 | 10' blowup - redrill 2/9/94 to 28'. Abandon through augers and move to redrill. CMC-DL-103 B + A | | | | | | | | | | |
| | | | | E.O.B. @ 28'. 8.5 bags holeplug. | | | | | | | | | | |

DRAFT

OWNER: Exxon Minerals Company

LOG OF BORING NUMBER: DL-1

PROJECT NAME: Lake Sediment Borings

ARCHITECT-ENGINEER: STS Consultants Ltd.

BEST COPY AVAILABLE

SITE LOCATION: Duck Lake

SURFACE ELEVATION 1611.8' - 491.29m

UNCONFINED COMPRESSIVE STRENGTH TONS FT² (1 2 3 4 5)

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % (10 20 30 40 50)

STANDARD PENETRATION BLOWS FT (10 20 30 40 50)

| ELEVATION / DEPTH | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT LBS·FT³ |
|---|---|---|---|---|---|---|
| | | | | | Ice | |
| | | | | | Water | |
| 5 | | | | | 1.9 | |
| | 1 | SS | | | Brown to green organic silt (OL) - moderately fibrous - with trace of sand - wet - very loose | |
| 10 | 2 | SS | | | 3.048 | |
| | 2A | SS | | | Brown organic silt fine to medium sand (SM) - with trace of fibers - wet - loose | |
| | 3 | SS | | | Gray organic silty clay (OL) - with traces of sand and fibers - very moist to wet - soft | |
| | 4 | OS | | | 4 | |
| 15 | | | | | Gray silty fine to medium sand (SM) - with trace of organics - wet - very loose | |
| | 5 | SS | | | | |
| | 6 | SS | | | Gray fine sand (SP) - with trace of silt and organics - a few thin layers of gray clayey silt - wet - very loose | |
| 20 | 7 | SS | | | 6.4 | |
| | 8 | SS | | | | |
| 25 | 9 | SS | | | Gray very silty clay (CL) - with traces of sand and organics - seams and layers of fine sand - 3 to 6 inch layers of fine to medium sand below 43.0 feet - thin varves of brown silty clay below 54.0 feet - very moist to wet - soft to firm | 104 |
| | 10 | OS | | | | |
| 30 | 11 | OS | | | 13.10 3.5-11-93 | |
| | | | | | Continued | |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN SITU THE TRANSITION MAY BE GRADUAL.

| | | | |
|---|---|---|---|
| WL | WS OR WD | BORING STARTED 2-7-84 | 540 Lambeau Green Bay, WI 54303 |
| WL | BCR ACR | BORING COMPLETED 2-8-84 | |
| | | RIG Bomb 45 FOREMAN EVH | APP'D BY BKT STS JOB NO 12949 |

OWNER: Exxon Minerals Company

LOG OF BORING NUMBER: DL-1 Continued

PROJECT NAME: Lake Sediment Borings

ARCHITECT-ENGINEER: BEST COPY AVAILABLE

STS Consultants Ltd.

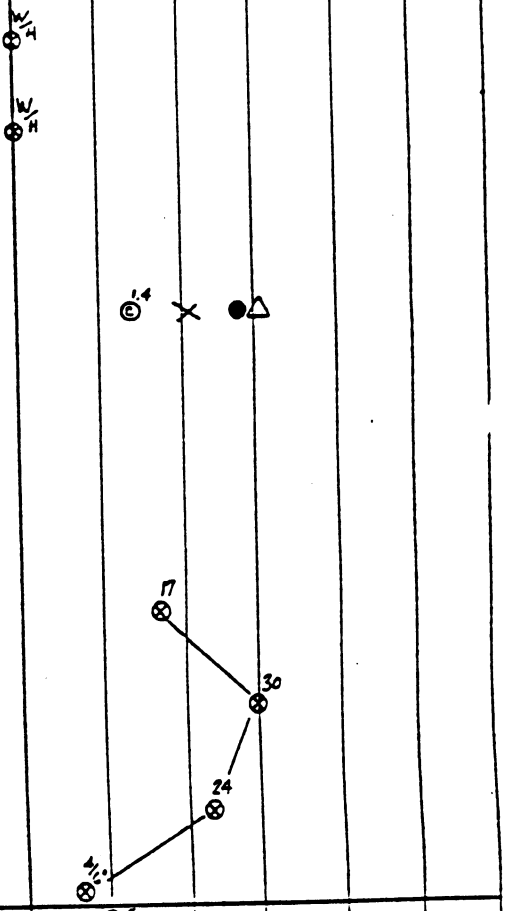
SITE LOCATION: Duck Lake

| ELEVATION / DEPTH | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT LBS/FT³ |
|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION | |
| | | | | | Continued | |
| | 12 | SS | | | | |
| | 13 | SS | | | | |
| 35 | | | | | | |
| | 14 | ST | | | | |
| | 15 | ST | | | Gray very silty clay (CL) - with traces of sand and organics - seams and layers of fine sand - 3 to 5 inch layers of fine to medium sand below 48.0 feet - thin varves of brown silty clay below 54.0 feet - very moist to wet - soft to firm | 99 |
| 40 | | | | | | |
| | 16 | ST | | | | |
| | 17 | ST | | | | |
| 45 | | | | | | |
| | 18 | SS | | | | |
| | 19 | SS | | | | |
| 50 | | | | | | |
| | 20 | SS | | | | |
| | 21 | SS | | | | |
| 55 | 21A | SS | | | | |
| | 22 | SS | | | Brown clayey fine to coarse sand (SC) - with a little to some fine gravel - wet - medium dense to very dense | |
| | 23 | SS | | | Brown fine to medium sand (SP) - with trace of silt - a little fine to medium gravel - wet - extremely dense | |
| 60 | | | | | End of Boring<br>Boring advanced to 60.0 feet with roller bit and wash water<br>60.0 feet of HW casing used<br>1-1/2" PVC well installed at 59.7 feet with deep seal<br>Well removed and borehole grouted on 2-28-84 | |

UNCONFINED COMPRESSIVE STRENGTH TONS/FT²
1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %
10 20 30 40 50

STANDARD PENETRATION BLOWS/FT
10 20 30 40 50




© Organic Content

3.5-11-94

STS Consultants Ltd.

OWNER: Exxon Minerals Company

LOG OF BORING NUMBER: DL-2 meters
feet-113,175N 2,281778E 34,496N 695,487E
1614.2ft 492.21m 1614.79ft 492.189m

PROJECT NAME: Wetland Well Installation

ENGINEER

BEST COPY AVAILABLE

SITE LOCATION: Duck Lake

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PI | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | WELL INSTALLATION TOP STANDPIPE EL. + _____ | | | | | | | |
| | | | | | SURFACE ELEVATION Swamp Level 10-15-85 | | | | | | | |
| | | | | | Moss roots (floating bog) | | | | | | | |
| | | | | | Water | | | | | | | |
| | | | | | Peat - organic - fiberous - silty - dark brown | | | | | | | |
| | | | | | Silty medium sand - dark brown | | | | | | | |
| | | | | | Silty medium sand - brown | | | | | | | |
| | | | | | Silty fine to medium sand to sandy silt - grayish brown | | | | | | | |
| | | | | | Fine to medium sand - trace to some silt | | | | | | | |
| | | | | | Fine to medium sand - trace to some silt | | | | | | | |
| | | | | | Till | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | Notes added by Exxon 02-06-86<br><br>1) Top of 2" diameter standpipe 30" above swamp level at time of well installation.<br><br>2) Water level elevation shown on log has not stablized. See hydrologic data base for current water level readings and indication of stablized water level. | | | | | | | |

3.5-11-95

The stratification lines represent the approximate boundary between soil types, in situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | ACR | |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 10-14-85
BORING COMPLETED 10-25-85
RIG
FOREMAN

STS OFFICE 540 Lambeau Street Green Bay, WI. 54303
DRAWN BY JJT | SHEET 1 OF 1
APP'D. BY TMF | STS JOB NO. 14071

5_ 5-85J

STS Consultants Ltd

OWNER
Exxon Minerals Company

PROJECT NAME
Wetland Well Installation

SITE LOCATION
Duck Lake

LOG OF BORING NUMBER meters
feet-113,175N 2,281,778E 34,496N 695,487E
DL-3 1616.0ft 492.56m 1614.95ft 492.238m

ENGINEER

BEST COPY AVAILABLE

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | WELL INSTALLATION TOP STANDPIPE EL. + | | | | | | | |
| | | | | | SURFACE ELEVATION Swamp Level 10-16-85 | | | | | | | |
| | | | | | Moss roots | | | | | | | |
| | | | | | Peat | | | | | | | |
| | | | | | Organic silts - trace of fiber | | | | | | | |
| | | | | | Silty sand - slightly plastic | | | | | | | |
| | | | | | Silty sand - dark brown | | | | | | | |
| | | | | | Silty sand - brown | | | | | | | |
| | | | | | Silty sand - fine gravel - slightly p | | | | | | | |
| | | | | | Sand - fine to medium gravel - trace | | | | | | | |
| | | | | | Sand - fine to coarse gravel - trace | | | | | | | |
| | | | | | Sand | | | | | | | |
| | | | | | Clayey silt - grayish brown | | | | | | | |
| | | | | | Sandy silt - gray | | | | | | | |
| | | | | | Clayey silt | | | | | | | |
| | | | | | 212" (10/21/85) | | | | | | | |
| | | | | | Till | | | | | | | |

Notes added by Exxon 02-06-86

1) Top of 2" diameter standpipe 42" above swamp level at time of well installation.

2) Water level elevation shown on log has not stablized. See hydrologic data base for current water level readings and indication of stablized water level.

3.5-11-96

The stratification lines represent the approximate boundary between soil types, in situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| BCR | | | ACR | | |
|---|---|---|---|---|---|
| WL* PIPE | DATE | TIME | WL*. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

| | |
|---|---|
| BORING STARTED | 10-14-85 |
| BORING COMPLETED | 10-25-85 |
| RIG | |
| FOREMAN | |

| | |
|---|---|
| STS OFFICE | 540 Lambeau Street<br>Green Bay, WI. 54303 |
| DRAWN BY | JJT |
| SHEET | 1 OF 1 |
| APP'D BY | TMF |
| STS JOB NO | 14071 |

STS Consultants Ltd

OWNER: Exxon Minerals Company

LOG OF BORING NUMBER meters
feet-[illegible],114N 2,281,574E 34,477N 695,249E
D[illegible] 1615.6ft 492.44m 1615.04ft 492.265m

PROJECT NAME: Wetland Well Installation

ENGINEER

BEST COPY AVAILABLE

SITE LOCATION: Duck Lake

WELL INSTALLATION
TOP STANDPIPE EL. +

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | STANDARD PENETRATION RESISTANCE, N (BLOWS/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION Swamp Level 10-18-85 | | | | | | | |
| | | | | | Organic vegetation | | | | | | | |
| | | | | | Peat - fibrous - dark brown | | | | | | | |
| | | | | | Peat - less fibrous - organic silt | | | | | | | |
| | | | | | Silty fine sand - some organic - brown | | | | | | | |
| | | | | | Silty fine sand - some organic - reddish brown | | | | | | | |
| | | | | | Silty fine to medium sand - brown | | | | | | | |
| | | | | | Sand - fine brown - trace of silt<br>144" 10/22/85 ▽ | | | | | | | |
| | | | | | Clayey sandy silt - gray | | | | | | | |
| | | | | | Sand fine to medium - some silt grading to trace of silt with depth | | | | | | | |
| | | | | | Silty sand - gray | | | | | | | |

Notes added by Exxon 02-06-86

1) Top of 2" diameter standpipe 36" above swamp level at time of well installation.

2) Water level elevation shown on log has not stablized. See hydrologic data base for current water level readings and indication of stablized water level.

3.5-11-97

The stratification lines represent the approximate boundary between soil types, in situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | ACR | |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

BORING STARTED 10-14-85
BORING COMPLETED 10-25-85
RIG
FOREMAN

STS OFFICE 540 Lambeau Street
Green Bay, WI. 54303

DRAWN BY JJT | SHEET 1 OF 1
APP'D BY TMF | STS JOB NO. 14071

STS Consultants Ltd

OWNER
Exxon Minerals Company

LOG OF BORING NUMBER
DL-5

meters
feet - 112,448N 2,280,776E 34,274N 695,179E
1615.7ft 492.47m 1615.07ft 492.274m

PROJECT NAME
Wetland Well Installation

ENGINEER

BEST COPY AVAILABLE

SITE LOCATION
Duck Lake

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | WELL INSTALLATION TOP STANDPIPE EL. + | | | | | | | |
| | | | | | SURFACE ELEVATION Swamp Level 10-17-85 | | | | | | | |
| | | | | | Roots - moss | | | | | | | |
| | | | | | Peat | | | | | | | |
| | | | | | Sandy peat | | | | | | | |
| | | | | | Silty sand - greenish brown | | | | | | | |
| | | | | | Clayey silt - trace of sand - grayish | | | | | | | |
| | | | | | Clayey sandy silt - grayish | | | | | | | |
| | | | | | Silty sand - brown | | | | | | | |
| | | | | | Sand - medium gravel - some silt | | | | | | | |
| | | | | | Clay - gray - sticky - silty | | | | | | | |
| | | | | | Sand - medium gravel - trace of silt near base | | | | | | | |
| | | | | | Clay - gray - silty | | | | | | | |
| | | | | | Clay - silty - reddish brown | | | | | | | |
| | | | | | Till | | | | | | | |
| | | | | | 233" 10/22/85 | | | | | | | |

Notes added by Exxon 02-06-86

1) Top of 2" diameter standpipe 37" above swamp level at time of well installation.

2) Water level elevation shown on log has not stablized. See hydrologic data base for current water level readings and indication of stablized water level.

3.5-11-98

The stratification lines represent the approximate boundary between soil types, in situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | | BCR | | | ACR |
|---|---|---|---|---|---|---|
| WL-T. PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

BORING STARTED 10-14-85
BORING COMPLETED 10-25-85
RIG
FOREMAN

STS OFFICE 540 Lambeau Street
Green Bay, WI. 54303

DRAWN BY JJT | SHEET 1 OF 1
APP'D BY TMF | STS JOB NO. 14071

STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: Wetland Well Installation

LOG OF BORING NUMBER: DL-6

meters: 1615.2ft 492.31m 1614.27ft 492.030m

feet: 117,779N 2,281,091E 35,899N 695,278E

ENGINEER

BEST COPY AVAILABLE

SITE LOCATION: Duck Lake

WELL INSTALLATION
TOP STANDPIPE EL. +

| DEPTH | ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | SURFACE ELEVATION Swamp Level 10-21-85 | | | | | | | |
| | | | | | | Vegetation | | | | | | | |
| | | | | | | Peat | | | | | | | |
| | | | | | | Organic silts and clays | | | | | | | |
| | | | | | | Sandy silt - light brown | | | | | | | |
| 10 | | | | | | Sandy silt to silt | | | | | | | |
| | | | | | | Sandy silty to silt - trace clean sand beds | | | | | | | |
| 15 | | | | | | Sandy silt — no water | | | | | | | |
| | | | | | | Silty clay - trace of sand | | | | | | | |
| | | | | | | Till? | | | | | | | |
| 20 | | | | | | | | | | | | | |

Notes added by Exxon 02-06-86

1) Top of 2" diameter standpipe 36" above swamp level at time of well installation.

2) Water level elevation shown on log has not stablized. See hydrologic data base for current water level readings and indication of stablized water level.

3.5-11-99

The stratification lines represent the approximate boundary between soil types, in situ the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally

| WL | | | BCR | | | ACR | | |
|---|---|---|---|---|---|---|---|---|
| WL-T. PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

BORING STARTED 10-14-85

BORING COMPLETED 10-25-85

RIG

FOREMAN

STS OFFICE 540 Lambeau Street
Green Bay, WI. 54303

DRAWN BY JJT SHEET 1 OF 1

APP'D. BY TMF STS JOB NO. 14071

S_ 5-86J

# Appendix 2

# TDEM Modeling Data

DATA SET: 126

CLIENT: Foth & Van Dyke
LOCATION: Little Sand Lake
COUNTY: Forest
PROJECT: Crandon Mining Project
LOOP SIZE: 5.000 m by 5.000 m
COIL LOC: 10.000 m (X), 0.000 m (Y)
SOUNDING COORDINATES: E: 1.0000 N: 18.0000

DATE: 09-MAR-94
SOUNDING: 00000
ELEVATION: 0.00 m
EQUIPMENT: Geonics PROTEM
AZIMUTH: 0

FITTING ERROR: 9.037 PERCENT

| L # | RESISTIVITY (ohm-m) | | THICKNESS (meters) | ELEVATION (meters) | CONDUCTANCE (Siemens) |
|---|---|---|---|---|---|
| | | | | 0.0 | |
| 1 | 200.3 | | 1.21 | -1.21 | 0.00606 |
| 2 | 20.84 | * | 2.43 | -3.65 | 0.116 |
| 3 | 761.2 | | 46.19 | -49.84 | 0.0606 |
| 4 | 5177.3 | | | | |

"*" INDICATES FIXED PARAMETER

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

| | LAYER | MINIMUM | BEST | MAXIMUM |
|---|---|---|---|---|
| RHO | 1 | 183.281 | 200.394 | 409.274 |
| | 2 | 20.840 | 20.840 | 20.840 |
| | 3 | 509.005 | 761.233 | 1012.019 |
| | 4 | 1268.042 | 5177.376 | 43183.867 |
| THICK | 1 | 1.136 | -0.102 | 1.459 |
| | 2 | 2.150 | -0.029 | 2.661 |
| | 3 | 35.005 | 1.000 | 72.018 |
| DEPTH | 1 | 1.136 | 1.215 | 1.459 |
| | 2 | 3.328 | 3.651 | 3.978 |
| | 3 | 38.711 | 49.846 | 75.584 |

CURRENT: 2.90 AMPS EM-47 COIL AREA: 31.40 sq m.
FREQUENCY: 315.00 Hz GAIN: 6 RAMP TIME: 0.40 muSEC

| No. | TIME (ms) | emf (nV/m sqrd) DATA | SYNTHETIC | DIFFERENCE (percent) |
|---|---|---|---|---|
| 1 | 0.00685 | 12904.7 | -7538.9 | 41.58 |
| 2 | 0.00895 | 2941.7 | -3130.3 | -6.41 |
| 3 | 0.0120 | 986.1 | -1078.9 | -9.41 |
| 4 | 0.0157 | 452.0 | -447.3 | 1.03 |
| 5 | 0.0200 | 228.2 | -195.9 | 14.16 |
| 6 | 0.0261 | 75.87 | -73.84 | 2.67 |
| 7 | 0.0334 | 30.14 | -32.39 | -7.44 |
| 8 | 0.0421 | 5.25 | -13.11 | -149.6 |

DATA SET: 127

CLIENT: Foth & Van Dyke
LOCATION: Little Sand Lake
COUNTY: Forest
PROJECT: Crandon Mining Project
DATE: 09-MAR-94
SOUNDING: 00000
ELEVATION: 0.00 m
EQUIPMENT: Geonics PROTEM
LOOP SIZE: 5.000 m By 5.000 m
COIL LOC: 10.000 m (X), 0.000 m (Y)
AZIMUTH: 0
SOUNDING COORDINATES: E: 1.0000 N: 20.0000

FITTING ERROR: 2.691 PERCENT

| L # | RESISTIVITY (ohm-m) | | THICKNESS (meters) | ELEVATION (meters) | CONDUCTANCE (Siemens) |
|---|---|---|---|---|---|
| | | | | 0.0 | |
| 1 | 251.5 | | 0.609 | -0.609 | 0.00242 |
| 2 | 20.84 | * | 3.60 | -4.21 | 0.173 |
| 3 | 401.9 | | 0.373 | -4.58 | 9.290E-04 |
| 4 | 34409.4 | | | | |

"*" INDICATES FIXED PARAMETER

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

| | LAYER | MINIMUM | BEST | MAXIMUM |
|---|---|---|---|---|
| RHO | 1 | 197.921 | 251.576 | 275.142 |
| | 2 | 20.840 | 20.840 | 20.840 |
| | 3 | 127.108 | 401.952 | 4019.521 |
| | 4 | 10881.226 | 34409.457 | 186923.620 |
| THICK | 1 | 0.541 | 0.000 | 0.675 |
| | 2 | 3.580 | -0.004 | 3.646 |
| | 3 | 0.030 | 1.000 | 1.305 |
| DEPTH | 1 | 0.541 | 0.610 | 0.675 |
| | 2 | 4.137 | 4.215 | 4.276 |
| | 3 | 4.285 | 4.589 | 5.501 |

CURRENT: 2.90 AMPS EM-47 COIL AREA: 31.40 sq m.
FREQUENCY: 315.00 Hz GAIN: 7 RAMP TIME: 0.40 muSEC

| No. | TIME (ms) | emf (nV/m sqrd) DATA | SYNTHETIC | DIFFERENCE (percent) |
|---|---|---|---|---|
| 1 | 0.00585 | 35010.6 | -23505.4 | 32.86 |
| 2 | 0.00795 | 8753.5 | -8600.2 | 1.75 |
| 3 | 0.0110 | 2489.4 | -2582.7 | -3.74 |
| 4 | 0.0147 | 929.7 | -945.0 | -1.64 |
| 5 | 0.0190 | 372.7 | -361.7 | 2.93 |
| 6 | 0.0251 | 96.10 | -110.9 | -15.44 |
| 7 | 0.0324 | 26.44 | -53.29 | -101.5 |

DATA SET: 144

CLIENT: Foth & Van Dyke
LOCATION: Little Sand Lake
COUNTY: Forest
PROJECT: Crandon Mining Project
LOOP SIZE: 5.000 m by 5.000 m
COIL LOC: 10.000 m (X), 0.000 m (Y)
SOUNDING COORDINATES: E: 4.0000 N: 7.0000

DATE: 09-MAR-94
SOUNDING: 00000
ELEVATION: 0.00 m
EQUIPMENT: Geonics PROTEM
AZIMUTH: 0

FITTING ERROR: 5.575 PERCENT

| L # | RESISTIVITY (ohm-m) | | THICKNESS (meters) | ELEVATION (meters) | CONDUCTANCE (Siemens) |
|---|---|---|---|---|---|
| | | | | 0.0 | |
| 1 | 290.9 | | 0.860 | -0.860 | 0.00296 |
| 2 | 20.84 | * | 4.44 | -5.30 | 0.213 |
| 3 | 1013.1 | | | | |

"*" INDICATES FIXED PARAMETER

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

| | LAYER | MINIMUM | BEST | MAXIMUM |
|---|---|---|---|---|
| RHO | 1 | 243.551 | 290.976 | 416.000 |
| | 2 | 20.846 | 20.846 | 20.846 |
| | 3 | 747.950 | 1013.108 | 1769.842 |
| THICK | 1 | 0.631 | -0.136 | 0.968 |
| | 2 | 4.333 | 1.000 | 4.653 |
| DEPTH | 1 | 0.631 | 0.861 | 0.968 |
| | 2 | 5.089 | 5.310 | 5.519 |

CURRENT: 2.90 AMPS EM-47 COIL AREA: 31.40 sq m.
FREQUENCY: 315.00 Hz GAIN: 6 RAMP TIME: 0.40 muSEC

| No. | TIME (ms) | emf (nV/m sqrd) DATA | SYNTHETIC | DIFFERENCE (percent) |
|---|---|---|---|---|
| 1 | 0.00585 | 39408.0 | -35678.4 | 9.46 |
| 2 | 0.00795 | 13012.8 | -13613.3 | -4.61 |
| 3 | 0.0110 | 4271.9 | -4584.2 | -7.31 |
| 4 | 0.0147 | 1762.6 | -1741.6 | 1.19 |
| 5 | 0.0190 | 739.0 | -704.6 | 4.64 |
| 6 | 0.0251 | 271.3 | -276.0 | -1.74 |
| 7 | 0.0324 | 101.8 | -105.1 | -3.20 |
| 8 | 0.0411 | 36.35 | -48.96 | -34.68 |

DATA SET: 1106

CLIENT: Foth & Van Dyke
LOCATION: Little Sand Lake
COUNTY: Forest
PROJECT: Crandon Mining Project
LOOP SIZE: 5.000 m by 5.000 m
COIL LOC: 10.000 m (X), 0.000 m (Y)
SOUNDING COORDINATES: E: 10.0000 N: 11.0000

DATE: 10-MAR-94
SOUNDING: 00000
ELEVATION: 0.00 m
EQUIPMENT: Geonics PROTEM
AZIMUTH: 0

FITTING ERROR: 8.664 PERCENT

| L # | RESISTIVITY (ohm-m) | | THICKNESS (meters) | ELEVATION (meters) | CONDUCTANCE (Siemens) |
|---|---|---|---|---|---|
| | | | | 0.0 | |
| 1 | 174.5 | | 0.955 | -0.955 | 0.00547 |
| 2 | 20.84 | * | 6.00 | -6.96 | 0.288 |
| 3 | 423.0 | | 4.83 | -11.79 | 0.0114 |
| 4 | 2990.2 | | | | |

"*" INDICATES FIXED PARAMETER

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

| | LAYER | MINIMUM | BEST | MAXIMUM |
|---|---|---|---|---|
| RHO | 1 | 71.914 | 174.549 | 594.581 |
| | 2 | 20.840 | 20.840 | 20.840 |
| | 3 | 166.037 | 423.045 | 1664.496 |
| | 4 | 1173.617 | 2990.262 | 19976.359 |
| THICK | 1 | 0.621 | -0.008 | 1.432 |
| | 2 | 5.806 | -0.026 | 6.296 |
| | 3 | 0.909 | 1.000 | 17.374 |
| DEPTH | 1 | 0.621 | 0.955 | 1.432 |
| | 2 | 6.730 | 6.961 | 7.351 |
| | 3 | 8.154 | 11.793 | 24.125 |

CURRENT: 2.90 AMPS EM-47 COIL AREA: 31.40 sq m.
FREQUENCY: 315.00 Hz GAIN: 7 RAMP TIME: 0.40 muSEC

| No. | TIME (ms) | emf (nV/m sqrd) DATA | SYNTHETIC | DIFFERENCE (percent) |
|---|---|---|---|---|
| 1 | 0.00685 | 40811.5 | -35512.3 | 12.98 |
| 2 | 0.00895 | 15893.7 | -16028.0 | -0.845 |
| 3 | 0.0120 | 5989.2 | -6165.7 | -2.94 |
| 4 | 0.0157 | 2750.9 | -2584.2 | 6.05 |
| 5 | 0.0200 | 1220.3 | -1131.2 | 7.30 |
| 6 | 0.0261 | 472.9 | -435.0 | 8.02 |
| 7 | 0.0334 | 179.4 | -183.8 | -2.46 |
| 8 | 0.0421 | 65.12 | -77.48 | -18.97 |
| 9 | 0.0541 | 14.26 | -31.75 | -122.5 |
| 10 | 0.0682 | 7.22 | -12.73 | -76.30 |

DATA SET: 1173

CLIENT: Foth & Van Dyke
LOCATION: Little Sand Lake
COUNTY: Forest
PROJECT: Crandon Mining Project
LOOP SIZE: 5.000 m by 5.000 m
COIL LOC: 10.000 m (X), 0.000 m (Y)
SOUNDING COORDINATES: E: 17.0000 N: 5.0000

DATE: 10-MAR-94
SOUNDING: 00000
ELEVATION: 0.00 m
EQUIPMENT: Geonics PROTEM
AZIMUTH: 0

FITTING ERROR: 2.320 PERCENT

| L # | RESISTIVITY (ohm-m) | | THICKNESS (meters) | ELEVATION (meters) | CONDUCTANCE (Siemens) |
|---|---|---|---|---|---|
| | | | | 0.0 | |
| 1 | 147.0 | | 0.980 | -0.980 | 0.00667 |
| 2 | 20.84 | * | 1.90 | -2.88 | 0.0915 |
| 3 | 247.3 | | 11.47 | -14.35 | 0.0463 |
| 4 | 156.2 | | | | |

"*" INDICATES FIXED PARAMETER

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

| | LAYER | MINIMUM | BEST | MAXIMUM |
|---|---|---|---|---|
| RHO | 1 | 134.633 | 147.043 | 150.999 |
| | 2 | 20.840 | 20.840 | 20.840 |
| | 3 | 217.386 | 247.380 | 450.243 |
| | 4 | 146.256 | 156.276 | 163.188 |
| THICK | 1 | 0.809 | 0.007 | 1.438 |
| | 2 | 1.556 | 0.092 | 2.219 |
| | 3 | 6.451 | 1.000 | 15.944 |
| DEPTH | 1 | 0.809 | 0.980 | 1.438 |
| | 2 | 2.534 | 2.888 | 3.348 |
| | 3 | 9.236 | 14.359 | 18.893 |

CURRENT: 2.90 AMPS EM-47 COIL AREA: 31.40 sq m.
FREQUENCY: 315.00 Hz GAIN: 7 RAMP TIME: 0.40 muSEC

| No. | TIME (ms) | emf (nV/m sqrd) DATA | SYNTHETIC | DIFFERENCE (percent) |
|---|---|---|---|---|
| 1 | 0.00585 | 32134.8 | -14152.5 | 55.95 |
| 2 | 0.00795 | 7982.3 | -6024.3 | 24.52 |
| 3 | 0.0110 | 2233.7 | -2339.0 | -4.71 |
| 4 | 0.0147 | 1110.7 | -1104.4 | 0.573 |
| 5 | 0.0190 | 540.8 | -541.4 | -0.116 |
| 6 | 0.0251 | 258.8 | -251.8 | 2.70 |
| 7 | 0.0324 | 135.0 | -133.0 | 1.48 |
| 8 | 0.0411 | 68.82 | -69.18 | -0.524 |
| 9 | 0.0531 | 26.92 | -35.41 | -31.55 |
| 10 | 0.0672 | 13.37 | -19.52 | -46.04 |
| 11 | 0.0828 | 5.77 | -11.15 | -93.03 |

DATA SET: 1174

CLIENT: Foth & Van Dyke
LOCATION: Little Sand Lake
COUNTY: Forest
PROJECT: Crandon Mining Project
LOOP SIZE: 5.000 m by 5.000 m
COIL LOC: 10.000 m (X), 0.000 m (Y)
SOUNDING COORDINATES: E: 17.0000 N: 7.0000

DATE: 10-MAR-94
SOUNDING: 00000
ELEVATION: 0.00 m
EQUIPMENT: Geonics PROTEM
AZIMUTH: 0

FITTING ERROR: 2.196 PERCENT

| L # | RESISTIVITY (ohm-m) | | THICKNESS (meters) | ELEVATION (meters) | CONDUCTANCE (Siemens) |
|---|---|---|---|---|---|
| | | | | 0.0 | |
| 1 | 204.5 | | 1.07 | -1.07 | 0.00527 |
| 2 | 20.84 | * | 1.54 | -2.62 | 0.0740 |
| 3 | 185.7 | | 12.92 | -15.54 | 0.0695 |
| 4 | 122.9 | | | | |

"*" INDICATES FIXED PARAMETER

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

| | LAYER | MINIMUM | BEST | MAXIMUM |
|---|---|---|---|---|
| RHO | 1 | 189.467 | 204.585 | 431.153 |
| | 2 | 20.840 | 20.840 | 20.840 |
| | 3 | 178.021 | 185.744 | 199.080 |
| | 4 | 120.044 | 122.990 | 125.525 |
| THICK | 1 | 0.341 | -0.003 | 1.128 |
| | 2 | 1.432 | 0.041 | 1.601 |
| | 3 | 11.250 | 1.000 | 14.704 |
| DEPTH | 1 | 0.341 | 1.079 | 1.128 |
| | 2 | 1.861 | 2.621 | 2.681 |
| | 3 | 13.862 | 15.543 | 17.333 |

CURRENT: 2.90 AMPS EM-47 COIL AREA: 31.40 sq m.
FREQUENCY: 315.00 Hz GAIN: 6 RAMP TIME: 0.40 muSEC

| No. | TIME (ms) | emf (nV/m sqrd) DATA | SYNTHETIC | DIFFERENCE (percent) |
|---|---|---|---|---|
| 1 | 0.00585 | 20095.9 | -13060.0 | 35.01 |
| 2 | 0.00795 | 5553.2 | -5926.3 | -6.71 |
| 3 | 0.0110 | 1972.5 | -2507.0 | -27.09 |
| 4 | 0.0147 | 1120.3 | -1149.7 | -2.62 |
| 5 | 0.0190 | 610.0 | -608.1 | 0.321 |
| 6 | 0.0251 | 301.0 | -298.3 | 0.902 |
| 7 | 0.0324 | 159.6 | -154.3 | 3.36 |
| 8 | 0.0411 | 83.03 | -84.75 | -2.07 |
| 9 | 0.0531 | 35.81 | -43.62 | -21.81 |
| 10 | 0.0672 | 21.54 | -24.76 | -14.92 |
| 11 | 0.0828 | 9.67 | -14.20 | -46.92 |

DATA SET: 1224

CLIENT: Foth & Van Dyke
LOCATION: Little Sand Lake
COUNTY: Forest
PROJECT: Crandon Mining Project
LOOP SIZE: 5.000 m By 5.000 m
COIL LOC: 10.000 m (X), 0.000 m (Y)
SOUNDING COORDINATES: E: 22.0000 N: 9.0000

DATE: 11-MAR-94
SOUNDING: 00000
ELEVATION: 0.00 m
EQUIPMENT: Geonics PROTEM
AZIMUTH: 0

FITTING ERROR: 9.702 PERCENT

| L # | RESISTIVITY (ohm-m) | | THICKNESS (meters) | ELEVATION (meters) | CONDUCTANCE (Siemens) |
|---|---|---|---|---|---|
| | | | | 0.0 | |
| 1 | 1011.3 | | 6.22 | -6.22 | 0.00616 |
| 2 | 20.84 | * | 1.39 | -7.62 | 0.0671 |
| 3 | 173.6 | | 66.51 | -74.13 | 0.383 |
| 4 | 5433.2 | | | | |

"*" INDICATES FIXED PARAMETER

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

| | LAYER | MINIMUM | BEST | MAXIMUM |
|---|---|---|---|---|
| RHO | 1 | 341.883 | 1011.315 | 3198.059 |
| | 2 | 20.840 | 20.840 | 20.840 |
| | 3 | 147.516 | 173.647 | 207.787 |
| | 4 | 382.918 | 5433.286 | 54332.855 |
| THICK | 1 | 2.103 | -0.117 | 17.639 |
| | 2 | 0.808 | 0.453 | 2.367 |
| | 3 | 53.008 | 1.000 | 90.400 |
| DEPTH | 1 | 2.103 | 6.226 | 17.639 |
| | 2 | 2.911 | 7.625 | 20.007 |
| | 3 | 60.663 | 74.138 | 98.014 |

CURRENT: 2.90 AMPS EM-47 COIL AREA: 31.40 sq m.
FREQUENCY: 315.00 Hz GAIN: 7 RAMP TIME: 0.40 muSEC

| No. | TIME (ms) | emf (nV/m sqrd) DATA | SYNTHETIC | DIFFERENCE (percent) |
|---|---|---|---|---|
| 1 | 0.00585 | 16596.6 | -7696.3 | 53.62 |
| 2 | 0.00795 | 3253.3 | -3594.9 | -10.49 |
| 3 | 0.0110 | 1195.7 | -1565.3 | -30.90 |
| 4 | 0.0147 | 648.7 | -762.5 | -17.53 |
| 5 | 0.0190 | 417.8 | -398.5 | 4.61 |
| 6 | 0.0251 | 194.6 | -193.6 | 0.465 |
| 7 | 0.0324 | 106.1 | -97.93 | 7.78 |
| 8 | 0.0411 | 56.59 | -50.87 | 10.09 |
| 9 | 0.0531 | 21.60 | -24.28 | -12.36 |
| 10 | 0.0672 | 12.35 | -12.19 | 1.28 |

DATA SET: 1261

CLIENT: Foth & Van Dyke
LOCATION: Little Sand Lake
COUNTY: Forest
PROJECT: Crandon Mining Company
DATE: 11-MAR-94
SOUNDING: 00000
ELEVATION: 0.00 m
EQUIPMENT: Geonics PROTEM
LOOP SIZE: 5.000 m by 5.000 m
COIL LOC: 10.000 m (X), 0.000 m (Y)
AZIMUTH: 0
SOUNDING COORDINATES: E: 26.0000 N: 1.0000

FITTING ERROR: 17.049 PERCENT

| L # | RESISTIVITY (ohm-m) | | THICKNESS (meters) | ELEVATION (meters) | CONDUCTANCE (Siemens) |
|---|---|---|---|---|---|
| | | | | 0.0 | |
| 1 | 3681.7 | | 17.57 | -17.57 | 0.00477 |
| 2 | 20.84 | * | 0.121 | -17.69 | 0.00584 |
| 3 | 134.2 | | 29.89 | -47.59 | 0.222 |
| 4 | 7310.0 | | | | |

"*" INDICATES FIXED PARAMETER

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

| | LAYER | MINIMUM | BEST | MAXIMUM |
|---|---|---|---|---|
| RHO | 1 | 727.468 | 3681.745 | 36817.441 |
| | 2 | 20.840 | 20.840 | 20.840 |
| | 3 | 111.001 | 134.208 | 220.563 |
| | 4 | 890.012 | 7310.073 | 73100.734 |
| THICK | 1 | 9.568 | -0.918 | 22.194 |
| | 2 | 0.010 | -0.044 | 0.728 |
| | 3 | 23.630 | 1.000 | 55.292 |
| DEPTH | 1 | 9.568 | 17.577 | 22.194 |
| | 2 | 9.679 | 17.699 | 22.320 |
| | 3 | 45.729 | 47.591 | 65.214 |

CURRENT: 2.90 AMPS EM-47 COIL AREA: 31.40 sq m.
FREQUENCY: 315.00 Hz GAIN: 7 RAMP TIME: 0.40 muSEC

| No. | TIME (ms) | emf (nV/m sqrd) DATA | SYNTHETIC | DIFFERENCE (percent) |
|---|---|---|---|---|
| 1 | 0.00585 | 7801.8 | -2470.6 | 68.33 |
| 2 | 0.00795 | 934.8 | -1345.3 | -43.91 |
| 3 | 0.0110 | 585.4 | -646.4 | -10.40 |
| 4 | 0.0147 | 309.2 | -324.0 | -4.81 |
| 5 | 0.0190 | 216.5 | -165.7 | 23.46 |
| 6 | 0.0251 | 90.25 | -76.47 | 15.27 |
| 7 | 0.0324 | 38.14 | -36.30 | 4.82 |
| 8 | 0.0411 | 14.56 | -17.57 | -20.66 |

DATA SET: 272

CLIENT: Foth & Van Dyke
LOCATION: Deep Hole Lake
COUNTY: Forest
PROJECT: Crandon Mining Project
LOOP SIZE: 5.000 m By 5.000 m
COIL LOC: 10.000 m (X), 0.000 m (Y)
SOUNDING COORDINATES: E: 2.7000 N: 3.0000

DATE: 11-MAR-94
SOUNDING: 00000
ELEVATION: 0.00 m
EQUIPMENT: Geonics PROTEM
AZIMUTH: 0

FITTING ERROR: 7.769 PERCENT

| L # | RESISTIVITY (ohm-m) | | THICKNESS (meters) | ELEVATION (meters) | CONDUCTANCE (Siemens) |
|---|---|---|---|---|---|
| 1 | 231.6 | | 0.776 | 0.0 | |
| 2 | 18.00 | * | 2.95 | -0.776 | 0.00335 |
| 3 | 342.1 | | 20.26 | -3.72 | 0.163 |
| 4 | 470.8 | | | -23.99 | 0.0592 |

"*" INDICATES FIXED PARAMETER

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

| LAYER | | MINIMUM | BEST | MAXIMUM |
|---|---|---|---|---|
| RHO | 1 | 156.797 | 231.629 | 815.360 |
| | 2 | 18.000 | 18.000 | 18.000 |
| | 3 | 276.580 | 342.190 | 688.053 |
| | 4 | 358.506 | 470.893 | 921.575 |
| THICK | 1 | 0.069 | 0.002 | 1.051 |
| | 2 | 2.811 | -0.027 | 3.357 |
| | 3 | 1.639 | 1.000 | 56.494 |
| DEPTH | 1 | 0.069 | 0.776 | 1.051 |
| | 2 | 2.929 | 3.727 | 4.130 |
| | 3 | 5.570 | 23.993 | 60.142 |

CURRENT: 2.90 AMPS EM-47 COIL AREA: 31.40 sq m.
FREQUENCY: 315.00 Hz GAIN: 6 RAMP TIME: 0.40 muSEC

| No. | TIME (ms) | emf (nV/m sqrd) DATA | SYNTHETIC | DIFFERENCE (percent) |
|---|---|---|---|---|
| 1 | 0.00585 | 40676.6 | -27930.2 | 31.33 |
| 2 | 0.00795 | 11982.0 | -10523.6 | 12.17 |
| 3 | 0.0110 | 3341.4 | -3664.8 | -9.67 |
| 4 | 0.0147 | 1381.8 | -1408.6 | -1.94 |
| 5 | 0.0190 | 589.0 | -604.3 | -2.59 |
| 6 | 0.0251 | 264.2 | -257.9 | 2.38 |
| 7 | 0.0324 | 92.28 | -100.0 | -8.46 |
| 8 | 0.0411 | 47.51 | -52.06 | -9.58 |
| 9 | 0.0531 | 13.07 | -21.96 | -68.03 |

DATA SET: 362

CLIENT: Foth & Van Dyke
LOCATION: Duck Lake
COUNTY: Forest
PROJECT: Crandon Mining Project
LOOP SIZE: 5.000 m by 5.000 m
COIL LOC: 10.000 m (X), 0.000 m (Y)
SOUNDING COORDINATES: E: 3.5000 N: 13.0000

DATE: 13-MAR-94
SOUNDING: 00000
ELEVATION: 0.00 m
EQUIPMENT: Geonics PROTEM
AZIMUTH: 0

FITTING ERROR: 4.451 PERCENT

| L # | RESISTIVITY (ohm-m) | | THICKNESS (meters) | ELEVATION (meters) | CONDUCTANCE (Siemens) |
|---|---|---|---|---|---|
| | | | | 0.0 | |
| 1 | 598.3 | | 1.83 | -1.83 | 0.00307 |
| 2 | 22.00 | * | 5.08 | -6.92 | 0.231 |
| 3 | 221.0 | | 11.40 | -18.32 | 0.0516 |
| 4 | 382.3 | | | | |

"*" INDICATES FIXED PARAMETER

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

| | LAYER | MINIMUM | BEST | MAXIMUM |
|---|---|---|---|---|
| RHO | 1 | 388.050 | 598.339 | 1116.663 |
| | 2 | 22.000 | 22.000 | 22.000 |
| | 3 | 161.890 | 221.013 | 399.249 |
| | 4 | 316.218 | 382.377 | 491.288 |
| THICK | 1 | 1.505 | -0.017 | 2.328 |
| | 2 | 4.886 | -0.017 | 5.486 |
| | 3 | 2.604 | 1.000 | 24.610 |
| DEPTH | 1 | 1.505 | 1.838 | 2.328 |
| | 2 | 6.501 | 6.924 | 7.572 |
| | 3 | 9.700 | 18.328 | 31.445 |

CURRENT: 2.90 AMPS EM-47 COIL AREA: 31.40 sq m.
FREQUENCY: 315.00 Hz GAIN: 6 RAMP TIME: 0.40 muSEC

| No. | TIME (ms) | emf (nV/m sqrd) DATA | SYNTHETIC | DIFFERENCE (percent) |
|---|---|---|---|---|
| 1 | 0.00585 | 40861.4 | -38564.1 | 5.62 |
| 2 | 0.00795 | 15231.5 | -16192.1 | -6.30 |
| 3 | 0.0110 | 5701.2 | -5998.2 | -5.20 |
| 4 | 0.0147 | 2465.6 | -2475.1 | -0.384 |
| 5 | 0.0190 | 1105.2 | -1084.2 | 1.90 |
| 6 | 0.0251 | 477.7 | -449.8 | 5.84 |
| 7 | 0.0324 | 194.6 | -190.9 | 1.92 |
| 8 | 0.0411 | 91.09 | -91.36 | -0.296 |
| 9 | 0.0531 | 37.30 | -39.41 | -5.63 |

DATA SET: 412

CLIENT: Foth & Van Dyke
LOCATION: Skunk Lake
COUNTY: Forest
PROJECT: Crandon Mining Project
LOOP SIZE: 5.000 m by 5.000 m
COIL LOC: 10.000 m (X), 0.000 m (Y)
SOUNDING COORDINATES: E: 4.1000 N: 6.0000

DATE: 13-MAR-94
SOUNDING: 00000
ELEVATION: 0.00 m
EQUIPMENT: Geonics PROTEM
AZIMUTH: 0

FITTING ERROR: 3.054 PERCENT

| L # | RESISTIVITY (ohm-m) | | THICKNESS (meters) | ELEVATION (meters) | CONDUCTANCE (Siemens) |
|---|---|---|---|---|---|
| | | | | 0.0 | |
| 1 | 98.36 | | 2.66 | -2.66 | 0.0270 |
| 2 | 18.00 | * | 0.549 | -3.21 | 0.0305 |
| 3 | 324.5 | | | | |

"*" INDICATES FIXED PARAMETER

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

| | LAYER | MINIMUM | BEST | MAXIMUM |
|---|---|---|---|---|
| RHO | 1 | 91.156 | 98.369 | 103.666 |
| | 2 | 18.000 | 18.000 | 18.000 |
| | 3 | 317.598 | 324.581 | 329.308 |
| THICK | 1 | 2.560 | -0.034 | 2.820 |
| | 2 | 0.493 | 1.000 | 0.601 |
| DEPTH | 1 | 2.560 | 2.665 | 2.820 |
| | 2 | 3.110 | 3.215 | 3.368 |

CURRENT: 2.90 AMPS EM-47 COIL AREA: 31.40 sq m.
FREQUENCY: 315.00 Hz GAIN: 6 RAMP TIME: 0.40 muSEC

| No. | TIME (ms) | emf (nV/m sqrd) DATA | SYNTHETIC | DIFFERENCE (percent) |
|---|---|---|---|---|
| 1 | 0.00685 | 5608.1 | -3446.6 | 38.54 |
| 2 | 0.00895 | 1577.6 | -1627.3 | -3.15 |
| 3 | 0.0120 | 708.2 | -698.6 | 1.35 |
| 4 | 0.0157 | 346.2 | -342.0 | 1.20 |
| 5 | 0.0200 | 176.9 | -173.6 | 1.82 |
| 6 | 0.0261 | 91.75 | -86.47 | 5.75 |
| 7 | 0.0334 | 42.32 | -43.59 | -2.99 |
| 8 | 0.0421 | 23.34 | -23.75 | -1.79 |

DATA SET: 432

CLIENT: Foth & Van Dyke
LOCATION: Skunk Lake
COUNTY: Forest
PROJECT: Crandon Mining Project
LOOP SIZE: 5.000 m by 5.000 m
COIL LOC: 10.000 m (X), 0.000 m (Y)
SOUNDING COORDINATES: E: 4.3000 N: 3.0000

DATE: 13-MAR-94
SOUNDING: 00000
ELEVATION: 0.00 m
EQUIPMENT: Geonics PROTEM
AZIMUTH: 0

FITTING ERROR: 0.875 PERCENT

| L # | RESISTIVITY (ohm-m) | | THICKNESS (meters) | ELEVATION (meters) | CONDUCTANCE (Siemens) |
|---|---|---|---|---|---|
| | | | | 0.0 | |
| 1 | 217.1 | | 1.09 | -1.09 | 0.00505 |
| 2 | 18.00 | * | 1.69 | -2.78 | 0.0939 |
| 3 | 387.9 | | 9.51 | -12.29 | 0.0245 |
| 4 | 271.9 | | | | |

"*" INDICATES FIXED PARAMETER

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

| | LAYER | MINIMUM | BEST | MAXIMUM |
|---|---|---|---|---|
| RHO | 1 | 181.840 | 217.193 | 300.090 |
| | 2 | 18.000 | 18.000 | 18.000 |
| | 3 | 339.000 | 387.946 | 508.973 |
| | 4 | 261.034 | 271.997 | 277.122 |
| THICK | 1 | 0.903 | 0.024 | 1.232 |
| | 2 | 1.652 | 0.049 | 1.773 |
| | 3 | 6.065 | 1.000 | 12.113 |
| DEPTH | 1 | 0.903 | 1.096 | 1.232 |
| | 2 | 2.588 | 2.787 | 2.932 |
| | 3 | 8.803 | 12.298 | 14.927 |

CURRENT: 2.90 AMPS EM-47 COIL AREA: 31.40 sq m.
FREQUENCY: 315.00 Hz GAIN: 6 RAMP TIME: 0.40 muSEC

| No. | TIME (ms) | emf (nV/m sqrd) DATA | SYNTHETIC | DIFFERENCE (percent) |
|---|---|---|---|---|
| 1 | 0.00685 | 11429.7 | -7285.8 | 36.25 |
| 2 | 0.00895 | 3118.6 | -3138.8 | -0.680 |
| 3 | 0.0120 | 1323.0 | -1336.2 | -0.996 |
| 4 | 0.0157 | 615.8 | -612.8 | 0.477 |
| 5 | 0.0200 | 297.2 | -293.0 | 1.43 |
| 6 | 0.0261 | 145.9 | -146.2 | -0.203 |
| 7 | 0.0334 | 58.32 | -68.77 | -17.92 |
| 8 | 0.0421 | 23.87 | -37.75 | -58.11 |

# Appendix 3.5-12

## Logs for WTD Environmental Drilling, Inc.
## 1994 Groundwater Monitoring Well Installation Program Borings

**CMC-01**
**CMC-01R**
**CMC-01P**
**CMC-02**
**CMC-02R**
**CMC-02P**
**CMC-03**
**CMC-03R**
**CMC-03RR**
**CMC-03P**
**CMC-04**
**CMC-SB-05**
**CMC-05**
**CMC-06P**
**CMC-07**
**CMC-SB-08A**
**CMC-SB-08B**
**CMC-08**
**CMC-08P**
**CMC-09**
**CMC-09P**
**CMC-10**
**CMC-SB-1OP**
**CMC-10P**

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Monitoring Well Installation | | CMC-01 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling<br>Mike Mueller | 03/29/94<br>MM/DD/YY | 03/31/94<br>MM/DD/YY | 6" Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | 56.7' MSL | 1650.2' MSL | 5-7/8" |

Boring Location
State Plane 116166.6 N, 2282677.1 E S/C/N Lat
SE 1/4 of SW 1/4 of Section 29, T 35 N, R 13 E Long

Local Grid Location (if applicable)
Feet ___ N S Feet ___ E W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | Blind drill. See CMC-01P. | | | | | | | | | | |
| | | | -- 2 | | | | | | | | | | | |
| | | | -- 4 | | | | | | | | | | | |
| | | | -- 6 | | | | | | | | | | | |
| | | | -- 8 | | | | | | | | | | | |
| | | | -- 10 | | | | | | | | | | | |
| | | | -- 12 | | | | | | | | | | | |
| | | | -- 14 | | | | | | | | | | | |
| | | | -- 16 | | | | | | | | | | | |
| | | | -- 18 | | | | | | | | | | | |
| | | | -- 20 | | | | | | | | | | | |
| | | | -- 22 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Firm Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-01

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- 24 | | | | | | | | | | | |
| | | | -- 26 | | | | | | | | | | | |
| | | | -- 28 | | | | | | | | | | | |
| | | | -- 30 | | | | | | | | | | | |
| | | | -- 32 | | | | | | | | | | | |
| | | | -- 34 | | | | | | | | | | | |
| | | | -- 36 | | | | | | | | | | | |
| | | | -- 38 | | | | | | | | | | | |
| | | | -- 40 | | | | | | | | | | | |
| | | | -- 42 | | | | | | | | | | | |
| | | | -- 44 | | | | | | | | | | | |
| | | | -- 46 | | | | | | | | | | | |
| | | | -- 48 | | | | | | | | | | | |
| | | | -- 50 | | | | | | | | | | | |
| | | | -- 52 | | | | | | | | | | | |
| | | | -- 54 | | | | | | | | | | | |
| | | | -- 56 | | | | | | | | | | | |
| | | | -- 58 | | | | | | | | | | | |
| | | | -- 60 | | | | | | | | | | | |

| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 62 | | | | | | | | | | | |
| | | | 64 | | | | | | | | | | | |
| | | | 66 | | | | | | | | | | | |
| | | | 68 | | | | | | | | | | | |
| | | | 70 | | | | | | | | | | | |
| | | | 72 | | | | | | | | | | | |
| | | | 74 | | | | | | | | | | | |
| | | | 76 | | | | | | | | | | | |
| 1 | 16 | 31/40 68 | 78 | Sample 77.5-79.5 Brown (7.5YR5/4) silty sand with gravel, massive damp, hard wet at last 3" (till). | SM | | | | | | | | | |
| | | | 80 | | | | | | | | | | | |
| | | | 82 | | | | | | | | | | | |
| 2 | 18 | 25/19 17/23 | 84 | Sample 82.5-84.5 Brown (7.5YR5/8) med sand with coarse sand lenses, structureless, wet, loose (outwash). | SP | | | | | | | | | |
| | | | 86 | | | | | | | | | | | |
| | | | 88 | | | | | | | | | | | |
| | | | 90 | | | | | | | | | | | |
| | | | 92 | | | | | | | | | | | |
| | | | | E.O.B. @ 92.5'. | | | | | | | | | | |
| | | | 94 | | | | | | | | | | | |
| | | | 96 | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

Route to:
Solid Waste
Emergency Response
Wastewater
Haz. Waste
Underground Tanks
Water Resources
Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Monitoring Well Installation | | CMC-01R |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling<br>Mike Mueller | 04/28/94<br>MM/DD/YY | 05/03/94<br>MM/DD/YY | 6" Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | 56.3' MSL | 1650.1' MSL | 5-7/8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 116156.5N, 2282675.1 E S/C/N<br>SE 1/4 of SW 1/4 of Section 29, T 35 N, R 13 E | Lat<br>Long<br>Feet ___ N S Feet ___ E W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | Blind drill to 48'. See CMC-01P. | | | | | | | | | | |
| | | | -- 2 | | | | | | | | | | | |
| | | | -- 4 | | | | | | | | | | | |
| | | | -- 6 | | | | | | | | | | | |
| | | | -- 8 | | | | | | | | | | | |
| | | | -- 10 | | | | | | | | | | | |
| | | | -- 12 | | | | | | | | | | | |
| | | | -- 14 | | | | | | | | | | | |
| | | | -- 16 | | | | | | | | | | | |
| | | | -- 18 | | | | | | | | | | | |
| | | | -- 20 | | | | | | | | | | | |
| | | | -- 22 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature] Firm Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-01R

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 24 | | | | | | | | | | | |
| | | | 26 | | | | | | | | | | | |
| | | | 28 | | | | | | | | | | | |
| | | | 30 | | | | | | | | | | | |
| | | | 32 | | | | | | | | | | | |
| | | | 34 | | | | | | | | | | | |
| | | | 36 | | | | | | | | | | | |
| | | | 38 | | | | | | | | | | | |
| | | | 40 | | | | | | | | | | | |
| | | | 42 | | | | | | | | | | | |
| | | | 44 | | | | | | | | | | | |
| | | | 46 | | | | | | | | | | | |
| 1 | 7 | 36/50 f.2 | 48 | Sample 48-50. Red brown (5YR4/4) silty sand with gravel, massive, damp, sl. firm (till). | SM | | | | | | | | | |
| | | | 50 | | | | | | | | | | | |
| | | | 52 | | | | | | | | | | | |
| 2 | 10 | 37/65 | | Sample 53-55 As above, very damp, wet at bottom 2". | SM | | | | | | | | | |
| | | | 54 | | | | | | | | | | | |
| | | | 56 | | | | | | | | | | | |
| | | | 58 | | | | | | | | | | | |
| | | | 60 | E.O.B. @ 68'. | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Monitoring Well Installation | | CMC-01P |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling<br>Mike Mueller | 03/15/94<br>MM/DD/YY | 03/25/94<br>MM/DD/YY | 6" Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | 57.5' MSL | 1650.1' MSL | 5-7/8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 116168.3 N, 2282682.7 E S/C/N Lat<br>SE 1/4 of SW 1/4 of Section 29, T 35 N, R 13 E Long | ___ N Feet ___ S ___ E Feet ___ W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | 0-.5 Dk brown (10YR2/2) organic topsoil, mod., med blocky structure, frozen. | OL | | | | | | | | | |
| | | | -- | .5-1 Brown (10YR5/5) silty sand, structureless, frozen. | SM-SP | | | | | | | | | |
| | | | -- 2 | 1-3 Brown (7.5YR5/5) silty clay with gravel, mod, med. blocky structure, damp, sl. firm. | CL | | | | | | | | | |
| | | | -- 4 | 3-8 Brown (7.5YR5/4) silty sand with gravel, weak, med. blocky structure, damp, sl. firm (till). | SM | | | | | | | | | |
| | | | -- 6 | | | | | | | | | | | |
| 1 | 14 | 5/8<br>14/16 | -- 8 | Sample 8-10 Brown (7.5YR5/4) silty sand with gravel, weak, med. blocky structure damp, sl. firm (till). | SM | | | | | | | | | |
| | | | -- 10 | | | | | | | | | | | |
| | | | -- 12 | | | | | | | | | | | |
| 2 | 12 | 27/33<br>20/15 | -- 14 | Sample 13-15 Brown (7.5YR5/6) fine-med sand with silt, structureless, damp, loose (outwash). | SP | | | | | | | | | |
| | | | -- 16 | | | | | | | | | | | |
| 3 | 16 | 13/23<br>34/37 | -- 18 | Sample 18-20 As above to 19'. | SP | | | | | | | | | |
| | | | -- 20 | 19-20 Brown (7.5YR5/4) silty sand with gravel, weak med. blocky structure, damp, sl. firm (till). | SM | | | | | | | | | |
| | | | -- 22 | Boulder 23-24. | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature] Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 24 | | | | | | | | | | | |
| | | | 26 | | | | | | | | | | | |
| 4 | 26 | 26/31<br>67 | 28 | Sample 28-30 As above. | SM | | | | | | | | | |
| | | | 30 | | | | | | | | | | | |
| | | | 32 | | | | | | | | | | | |
| 5 | 12 | 37/65 | 34 | Sample 33-35 Red brown (5YR4/4) silty sand with gravel, structureless, damp, sl. firm (till). | SM | | | | | | | | | |
| | | | 36 | | | | | | | | | | | |
| 6 | 13 | 41/85 | 38 | Sample 38-40 As above. | SM | | | | | | | | | |
| | | | 40 | | | | | | | | | | | |
| | | | 42 | | | | | | | | | | | |
| 7 | 11 | 45/52 | | Sample 43-45 As above. | SM | | | | | | | | | |
| | | | 44 | | | | | | | | | | | |
| | | | 46 | | | | | | | | | | | |
| 8 | 0 | 50<br>f.0 | 48 | Sample 48-50 No recovery, boulder. | -- | | | | | | | | | |
| | | | 50 | | | | | | | | | | | |
| | | | 52 | | | | | | | | | | | |
| | | | | Boulder 53-55. | -- | | | | | | | | | |
| | | | 54 | | | | | | | | | | | |
| | | | 56 | | | | | | | | | | | |
| 9 | 18 | 30/36<br>47/51 | 58 | Sample 58-60 As above red brown silty sand with gravel, damp (till). | SM | | | | | | | | | |
| | | | 60 | | | | | | | | | | | |

| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 62 | | | | | | | | | | | |
| 10 | 18 | 21/36<br>35/72 | 64 | Sample 63-65 As above. | SM | | | | | | | | | |
| | | | 66 | | | | | | | | | | | |
| 11 | 10 | 27/82 | 68 | Sample 68-70 Red brown (5YR5/5) silty sand with gravel, massive, v. weak stratification, damp, sl. firm (till). | SM | | | | | | | | | |
| | | | 70 | | | | | | | | | | | |
| | | | 72 | | | | | | | | | | | |
| 12 | 15 | 34/38<br>68 | 74 | Sample 73-75 As above. | SM | | | | | | | | | |
| | | | 76 | | | | | | | | | | | |
| 13 | 13 | 36/50<br>f.2 | 78 | Sample 78-80 As above.<br>Wet at bottom 3". | SM | | | | | | | | | |
| | | | 80 | | | | | | | | | | | |
| | | | 82 | | | | | | | | | | | |
| 14 | 15 | 36/49<br>70 | 84 | Sample 83-85 Brown (7.5YR5/6) silty sand with gravel and clay, massive, wet, hard, weakly stratified (till). | SM-ML | | | | | | | | | |
| | | | 86 | | | | | | | | | | | |
| 15 | 18 | 7/17<br>28/31 | 88 | Sample 88-90 Brown (10YR6/6) silty sand with gravel, massive, wet, hard, highly oxidized, minor clay (till). | SM-SP | | | | | | | | | |
| | | | 90 | | | | | | | | | | | |
| | | | 92 | | | | | | | | | | | |
| 16 | 15 | 7/17<br>16/23 | 94 | Sample 93-95 Lt. brown (10YR7/3) fine-med sand, structureless, wet, loose, stratified, s. oxidized (outwash). | SP | | | | | | | | | |
| | | | 96 | | | | | | | | | | | |

| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | 16 | 12/12<br>63 | -- 98<br>-- 100<br>-- 102 | Sample 98-100 Brown (7.5YR5/6) med.-coarse sand with gravel, structureless, wet, loose, weakly oxidized, sl. stratified weakly (outwash). | SP | | | | | | | | | |
| 18 | 18 | 24/37<br>41/66 | -- 104<br>-- 106 | Sample 103-105 Red brown (5YR5/5) silty sand with gravel, massive, damp to wet, firm (till). | SM | | | | | | | | | |
| -- | -- | -- | -- 108<br>-- 110<br>-- 112 | Boulder 108-110. | -- | | | | | | | | | |
| 19 | 16 | 20/29<br>38/37 | -- 114<br>-- 116 | Sample 113-115 Brown (7.5YR5/5) fine to med. sand with gravel, structureless, wet, soft, weak stratification (outwash). | SP | | | | | | | | | |
| 20 | 17 | 17/39<br>36/50 | -- 118<br>-- 120<br>-- 122 | Sample 118-120 Brown (10YR5/6) med. coarse sand with gravel, massive, wet, sl. hard, highly oxidized (till). | SP-GP | | | | | | | | | |
| 21 | 15 | 25/48<br>50f.2 | -- 124<br>-- 126 | Sample 123-125 As above, less oxidized. | SP | | | | | | | | | |
| 22 | 10 | 39/50<br>f.3 | -- 128<br>-- 130<br>-- 132 | Sample 128-130 Lt. brown (7.5YR6/5) fine-med sand with gravel, structureless, wet, sl. firm (outwash). | SP | | | | | | | | | |
| 23 | 15 | 24/31<br>50f.2 | | Sample 133-138 As above. | SP | | | | | | | | | |

| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- 134 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 136 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 24 | 18 | 13/17<br>47/50<br>f.3 | -- 138 | Sample 138-140 As above. | SP | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 140 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 142 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 25 | 17 | 13/17<br>29/33 | -- | Sample 143-145 As above, sl. finer sand. | SP | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 144 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 146 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 26 | 20 | 15/19 | -- 148 | Sample 148-150 As above. | SP | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 150 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 152 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 27 | 20 | 17/20<br>29/34 | -- | Sample 153-155 As above, slightly coarser. | SP | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 154 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 156 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 28 | 10 | 37/50<br>f.2 | -- 158 | 158-158.5 Red brown (5YR5/4) silty fine sand, massive, wet, firm (till). | SM | | | | | | | | | |
| | | | -- | 158.5-159 Brown (7.5YR7/5) med.-fine sand with minor gravel, wet, loose. | SP | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 160 | 160+ Bedrock, grey green metavolcanic tuff. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 162 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 164 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 166 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 168 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-01P

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- 170 | | | | | | | | | | | |
| | | | -- 172 | | | | | | | | | | | |
| | | | -- 174 | | | | | | | | | | | |
| | | | -- 176 | | | | | | | | | | | |
| | | | -- 178 | | | | | | | | | | | |
| | | | -- 180 | | | | | | | | | | | |
| | | | -- 182 | | | | | | | | | | | |
| | | | -- 184 | | | | | | | | | | | |
| | | | -- 186 | | | | | | | | | | | |
| | | | -- 188 | | | | | | | | | | | |
| | | | -- 190 | | | | | | | | | | | |
| | | | -- 192 | | | | | | | | | | | |
| | | | -- 194 | | | | | | | | | | | |
| | | | -- 196 | | | | | | | | | | | |
| | | | -- 198 | | | | | | | | | | | |
| | | | -- 200 | | | | | | | | | | | |
| | | | -- 202 | E.O.B. @ 202'. | | | | | | | | | | |
| | | | -- 204 | | | | | | | | | | | |
| | | | -- 206 | | | | | | | | | | | |

State of Wisconsin | Route to: | SOIL BORING LOG INFORMATION

Department of Natural Resources | Solid Waste | Haz. Waste | Form 4400-122 | 7-91

Emergency Response | Underground Tanks

Wastewater | Water Resources

Other



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company - 93C049 | | CMC-02 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started MM/DD/YY | Date Completed MM/DD/YY | Drilling Method |
|---|---|---|---|
| WTD Environmental<br>Dan Tinnancour | 03/24/94 | 03/28/94 | 6"<br>Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | Dry | 1697.9 | 5-7/8" |

| Boring Location | | Local Grid Location (if applicable) |
|---|---|---|
| State Plane 115308.700N, 2286070.100E | Lat | ____ N ____ E |
| NE1/4 of NE1/4 of Section 32, T35N, R13E | Long | Feet ____ S Feet ____ W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0 | Blind drill. See CMC-02P. | | | | | | | | | | |
| | | | 2 | | | | | | | | | | | |
| | | | 4 | | | | | | | | | | | |
| | | | 6 | | | | | | | | | | | |
| | | | 8 | | | | | | | | | | | |
| | | | 10 | | | | | | | | | | | |
| | | | 12 | | | | | | | | | | | |
| | | | 14 | | | | | | | | | | | |
| | | | 16 | | | | | | | | | | | |
| | | | 18 | | | | | | | | | | | |
| | | | 20 | | | | | | | | | | | |
| | | | 22 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

| Signature | Firm |
|---|---|
| | Foth & Van Dyke |

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory.
Penalties: Forfeit not less than $10 nor more then $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-02

Route to:

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 24 | | | | | | | | | | | |
| | | | 26 | | | | | | | | | | | |
| | | | 28 | | | | | | | | | | | |
| | | | 30 | | | | | | | | | | | |
| | | | 32 | | | | | | | | | | | |
| | | | 34 | | | | | | | | | | | |
| | | | 36 | | | | | | | | | | | |
| | | | 38 | | | | | | | | | | | |
| | | | 40 | | | | | | | | | | | |
| | | | 42 | | | | | | | | | | | |
| | | | 44 | | | | | | | | | | | |
| | | | 46 | | | | | | | | | | | |
| | | | 48 | | | | | | | | | | | |
| | | | 50 | | | | | | | | | | | |
| | | | 52 | | | | | | | | | | | |
| | | | 54 | | | | | | | | | | | |
| | | | 56 | | | | | | | | | | | |
| | | | 58 | | | | | | | | | | | |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 60 | | | | | | | | | | | |
| | | | 62 | | | | | | | | | | | |
| | | | 64 | | | | | | | | | | | |
| | | | 66 | | | | | | | | | | | |
| | | | 68 | | | | | | | | | | | |
| | | | 70 | | | | | | | | | | | |
| 1 | 6 | 36/78<br>50/41 | 72 | Sample 72-74 Brown (10YR6/4) med. sand with gravel and silt, massive, damp, sl. firm (till). | SP-SM | | | | | | | | | |
| | | | 74 | | | | | | | | | | | |
| | | | 76 | | | | | | | | | | | |
| | | | 78 | | | | | | | | | | | |
| | | | 80 | | | | | | | | | | | |
| 2 | 6 | 38/62<br>100f.2 | 82 | Sample 82-84 Brown (10YR7/4) coarse sand with gravel, structureless, wet, loose (outwash). | SP | | | | | | | | | |
| | | | 84 | | | | | | | | | | | |
| | | | 86 | | | | | | | | | | | |
| | | | 88 | | | | | | | | | | | |
| | | | 90 | | | | | | | | | | | |
| | | | 92 | | | | | | | | | | | |
| | | | 94 | | | | | | | | | | | |
| | | | 96 | E.O.B. @ 95'. | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☐ Underground Tanks ☐ Other ☐ _____

# MONITORING WELL CONSTRUCTION
Form 4400-113A Rev. 4-90

| | | |
|---|---|---|
| Facility/Project Name: Crandon Mining Company | Local Grid Location of Well: 115308.7 ft. ☒ N. ☐ S. 2286070.1 ft. ☒ E. ☐ W. | Well Name: CMC-02 |
| Facility License, Permit or Monitoring Number: _____ | Grid Origin Location: Lat. _____ Long. _____ or St. Plane _____ ft. N. _____ ft. E. | Wis. Unique Well Number or DNR Well Number: |
| Type of Well: Water Table Observation Well ☒ 11; Piezometer ☐ 12 | Section Location of Waste/Source: NE 1/4 of NE 1/4 of Sec. 32 T. 35 N, R. 13 ☒ E. ☐ W. | Date Well Installed: 03 / 28 / 94 (m m d d y y) |
| Distance Well Is From Waste/Source Boundary: _____ ft. | Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known | Well Installed By: (Person's Name and Firm): Dan Tinnancour; WID Environmental Drilling |
| Is Well A Point of Enforcement Std. Application? ☐ Yes ☐ No | | |

A. Protective pipe, top elevation: N/A ft. MSL
B. Well casing, top elevation: N/A ft. MSL
C. Land surface elevation: 1697.9 ft. MSL
D. Surface seal, bottom: 1696.9 ft. MSL or 1.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☒
SM ☒ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

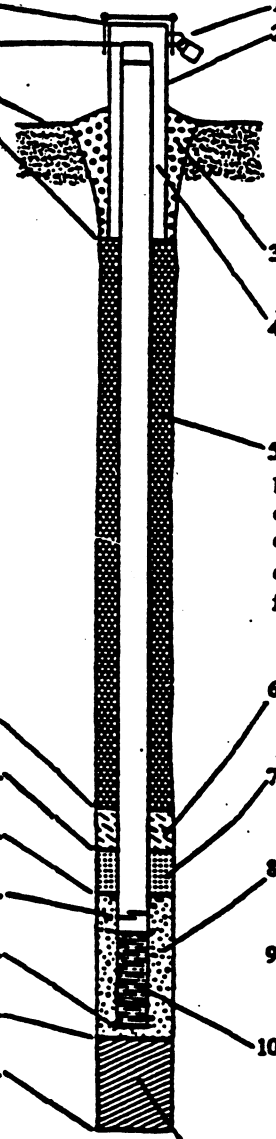
14. Drilling method used: Rotary ☒ 50; Hollow Stem Auger ☐ 41; Other ☐ _____

15. Drilling fluid used: Water ☐ 02; Air ☐ 01; Drilling Mud ☒ 03; None ☐ 99

16. Drilling additives used? ☐ Yes ☐ No
Describe _____

17. Source of water (attach analysis): _____

E. Bentonite seal, top: 1696.9 ft. MSL or 1.0 ft.
F. Fine sand, top: 1623.9 ft. MSL or 71.5 ft.
G. Filter pack, top: 1621.9 ft. MSL or 73.5 ft.
H. Screen joint, top: 1619.9 ft. MSL or 78.0 ft.
I. Well bottom: 1604.9 ft. MSL or 93.0 ft.
J. Filter pack, bottom: 1602.9 ft. MSL or 95.0 ft.
K. Borehole, bottom: 1602.9 ft. MSL or 95.0 ft.
L. Borehole, diameter: 6.0 in.
M. O.D. well casing: 2.38 in.
N. I.D. well casing: 2.10 in.



1. Cap and lock? ☐ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 7.0 ft.
c. Material: Steel ☒ 04; Other ☐ _____
d. Additional protection? ☐ Yes ☐ No
If yes, describe: _____
3. Surface seal: Bentonite ☒ 30; Concrete ☐ 01; Other ☐ _____
4. Material between well casing and protective pipe: Bentonite ☒ 30; Annular space seal ☐ _____; Other ☐ _____
5. Annular space seal: a. Granular Bentonite ☒ 33 (Chipped)
b. _____ Lbs/gal mud weight ... Bentonite-sand slurry ☐ 35
c. _____ Lbs/gal mud weight ..... Bentonite slurry ☐ 31
d. _____ % Bentonite .... Bentonite-cement grout ☐ 50
e. 23.8 Ft³ volume added for any of the above
f. How installed: Tremie ☐ 01; Tremie pumped ☐ 02; Gravity ☒ 08
6. Bentonite seal: a. Bentonite granules ☐ 33
b. ☐ 1/4 in. ☐ 3/8 in. ☐ 1/2 in. Bentonite pellets ☐ 32
c. 3/8" Bentonite Chips Other ☐ _____
7. Fine sand material: Manufacturer, product name & mesh size
a. Badger Mining BB#7
b. Volume added 0.6 ft³
8. Filter pack material: Manufacturer, product name and mesh size
a. Red Flint Filter #30
b. Volume added S.S. ft³
9. Well casing: Flush threaded PVC schedule 40 ☒ 23; Flush threaded PVC schedule 80 ☐ 24; Other ☐ _____
10. Screen material: PVC
a. Screen type: Factory cut ☒ 11; Continuous slot ☐ 01; Other ☐ _____
b. Manufacturer Northern Air
c. Slot size: 0.010 in.
d. Slotted length: 15.0 ft.
11. Backfill material (below filter pack): None ☒ 14; Other ☐ _____

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: _____ Firm: Fathi Van Dyke

Please complete both sides of this form and return to the appropriate DNR office listed at the top of this form as required by chs. 144, 147 and 160, Wis. Stats., and ch. NR 141, Wis. Ad. Code. In accordance with ch.144, Wis Stats., failure to file this form may result in a forfeiture of not less than $10, nor more than $5000 for each day of violation. In accordance with ch. 147, Wis. Stats., failure to file this form may result in a forfeiture of not more than $10,000 for each day of violation. NOTE: Shaded areas are for DNR use only. See instructions for more information including where the completed form should be sent.

3.5-12-15

State of Wisconsin
Department of Natural Resources

# MONITORING WELL DEVELOPMENT

Form 4400-113B Rev. 4-90

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☐ Underground Tanks ☐ Other ☐ _____

| Facility/Project Name | County Name | Well Name |
|---|---|---|
| Crandon Mining Company | Forest | CMC-02 |
| **Facility License, Permit or Monitoring Number** | **County Code** | **Wis. Unique Well Number** / **DNR Well Number** |
| _____ | 71 | |

| | | Before Development | After Development |
|---|---|---|---|
| 1. Can this well be purged dry? | ☐ Yes ☐ No | | |
| 2. Well development method | | | |
| surged with bailer and bailed | ☐ 41 | | |
| surged with bailer and pumped | ☐ 61 | | |
| surged with block and bailed | ☐ 42 | | |
| surged with block and pumped | ☐ 62 | | |
| surged with block, bailed and pumped | ☐ 70 | | |
| compressed air | ☐ 20 | | |
| bailed only | ☒ 10 | | |
| pumped only | ☒ 51 | | |
| pumped slowly | ☐ 50 | | |
| Other _____ | ☐ | | |
| 11. Depth to Water (from top of well casing) | | a. 74.3 ft. | Dry ___.__ ft. |
| Date | | b. 03/30/94 (mm/dd/yy) | 04/12/94 (mm/dd/yy) |
| Time | | c. NA: ☐ a.m. ☐ p.m. | N/A: ☐ a.m. ☐ p.m. |
| 12. Sediment in well bottom | | NA ___.__ inches | N/A .__ inches |
| 13. Water clarity | | Clear ☐ 10 Turbid ☒ 15 (Describe) Brown | Clear ☐ 20 Turbid ☒ 25 (Describe) Brown |
| 3. Time spent developing well | ___180 min. | | |
| 4. Depth of well (from top of well casing) | ___960 ft. | | |
| 5. Inside diameter of well | ___2.10 in. | | |
| 6. Volume of water in filter pack and well casing | ___NA.__ gal. | | |
| 7. Volume of water removed from well | ___17.2 gal. | | |
| 8. Volume of water added (if any) | ___NA.__ gal. | | |
| 9. Source of water added | _____ | | |
| 10. Analysis performed on water added? (If yes, attach results) | ☐ Yes ☐ No | | |
| Fill in if drilling fluids were used and well is at solid waste facility: | | | |
| 14. Total suspended solids | | _____.__ mg/l | _____.__ mg/l |
| 15. COD | | _____.__ mg/l | _____.__ mg/l |

16. Additional comments on development:

Well bailed dry twice - remained dry.

Well developed by: Person's Name and Firm

Name: Scott Janssen

Firm: Foth & Van Dyke

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: _____

Print Initials: E A S

Firm: Foth & Van Dyke

NOTE: Shaded areas are for DNR use only. See instructions for more information including a list of county codes.

State of Wisconsin
Department of Natural Resources

# WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Form 3300-5W
11-89

All abandonment work shall be performed in accordance with the provisions of Chapters NR 111, NR 112 or NR 141, Wis. Admin. Code, whichever is applicable. Also, see instructions on back.

## (1) GENERAL INFORMATION

Well/Drillhole/Borehole Location

County: Forest

NE 1/4 of NE 1/4 of Sec. 32 ; T. 35 N; R. 13 [x] E [ ] W

(If applicable) Gov't Lot _____ Grid Number _____

Grid Location: 115308.7 ft. [x] N. [ ] S., 2286070.1 ft. [x] E. [ ] W.

Civil Town Name: Lincoln

Street Address of Well: NA

City, Village: NA

## (2) FACILITY NAME

Original Well Owner (If Known): Crandon Mining Company

Present Well Owner: Crandon Mining Company

Street or Route: 7 North Brown Street, 3rd Floor

City, State, Zip Code: Rhinelander, WI 54501-3161

Facility Well No. and/or Name (If Applicable): CMC-02

WI Unique Well No.: _ _ _ _ _ _

Reason For Abandonment: Dry Well

Date of Abandonment: 09/08/94

## WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drillhole/Borehole Construction Completed On

(Date) 3/28/94

[x] Monitoring Well
[ ] Water Well
[ ] Drillhole
[ ] Borehole

Construction Report Available? [x] Yes [ ] No

Construction Type:
[x] Drilled [ ] Driven (Sandpoint) [ ] Dug
[ ] Other (Specify)

Formation Type:
[x] Unconsolidated Formation [ ] Bedrock

Total Well Depth (ft.) 95 Casing Diameter (ins.) NA
(From groundsurface)

Casing Depth (ft.) NA

Was Well Annular Space Grouted? [x] Yes [ ] No [ ] Unknown
If Yes, To What Depth? 71.5 Feet

(4) Depth to Water (Feet) NA

| | | | |
|---|---|---|---|
| Pump & Piping Removed? | [ ] Yes | [ ] No | [x] Not Applicable |
| Liner(s) Removed? | [ ] Yes | [ ] No | [x] Not Applicable |
| Screen Removed? | [ ] Yes | [x] No | [ ] Not Applicable |
| Casing Left in Place? | [x] Yes | [ ] No | |

If No, Explain: Monitoring well was abandoned in place.

| | | |
|---|---|---|
| Was Casing Cut Off Below Surface? | [x] Yes | [ ] No |
| Did Sealing Material Rise to Surface? | [x] Yes | [ ] No |
| Did Material Settle After 24 Hours? | [ ] Yes | [x] No |
| If Yes, Was Hole Retopped? | [ ] Yes | [ ] No |

(5) Required Method of Placing Sealing Material
[x] Conductor Pipe-Gravity [ ] Conductor Pipe-Pumped
[ ] Dump Bailer [ ] Other (Explain)

(6) Sealing Materials
[ ] Neat Cement Grout
[ ] Sand-Cement (Concrete) Grout
[ ] Concrete
[ ] Clay-Sand Slurry
[ ] Bentonite-Sand Slurry
[x] Chipped Bentonite

For monitoring wells and monitoring well boreholes only
[ ] Bentonite Pellets
[ ] Granular Bentonite
[ ] Bentonite - Cement Grout

| (7) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks Sealant or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| 3/8" Hole plug Chipped Bentonite | Surface | 93 | 5-50 lbs | |
| | | | | |
| | | | | |
| | | | | |

(8) Comments:

(9) Name of Person or Firm Doing Sealing Work
WTD - Environmental Drilling

Signature of Person Doing Work: [signature] EAS 4/28/95
Date Signed: 4/28/95

Street or Route: 101 Alderson Box 89
Telephone Number: (715) 359-7090

City, State, Zip Code: Schofield, WI

(10) FOR DNR OR COUNTY USE ONLY

Date Received/Inspected
District/County
Reviewer/Inspector
Follow-up Necessary

3.5-12-17

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company - 93C049 | | CMC-02R |

| Boring Drilled by (Firm name and name of crew chief) | Date Started MM/DD/YY | Date Completed MM/DD/YY | Drilling Method |
|---|---|---|---|
| North Star Drilling<br>Jon Anderson | 09/08/94 | 09/08/94 | 8" I.D.<br>Rotasonic |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | Dry | 1697.6 | 5-7/8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 115299.210N, 2286062.480E Lat<br>NE1/4 of NE1/4 of Section 32, T35N, R13E Long | ____ N ____ E<br>Feet ____ S Feet ____ W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0 | Blind drill. See CMC-02P. | | | | | | | | | | |
| | | | 2 | | | | | | | | | | | |
| | | | 4 | | | | | | | | | | | |
| | | | 6 | | | | | | | | | | | |
| | | | 8 | | | | | | | | | | | |
| | | | 10 | | | | | | | | | | | |
| | | | 12 | | | | | | | | | | | |
| | | | 14 | | | | | | | | | | | |
| | | | 16 | | | | | | | | | | | |
| | | | 18 | | | | | | | | | | | |
| | | | 20 | | | | | | | | | | | |
| | | | 22 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

| Signature | Firm |
|---|---|
| | Foth & Van Dyke |

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory.
Penalties: Forfeit not less than $10 nor more then $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 24 | | | | | | | | | | | |
| | | | 26 | | | | | | | | | | | |
| | | | 28 | | | | | | | | | | | |
| | | | 30 | | | | | | | | | | | |
| | | | 32 | | | | | | | | | | | |
| | | | 34 | | | | | | | | | | | |
| | | | 36 | | | | | | | | | | | |
| | | | 38 | | | | | | | | | | | |
| | | | 40 | | | | | | | | | | | |
| | | | 42 | | | | | | | | | | | |
| | | | 44 | | | | | | | | | | | |
| | | | 46 | | | | | | | | | | | |
| | | | 48 | | | | | | | | | | | |
| | | | 50 | | | | | | | | | | | |
| | | | 52 | | | | | | | | | | | |
| | | | 54 | | | | | | | | | | | |
| | | | 56 | | | | | | | | | | | |
| | | | 58 | | | | | | | | | | | |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 60 | | | | | | | | | | | |
| | | | 62 | | | | | | | | | | | |
| | | | 64 | | | | | | | | | | | |
| | | | 66 | | | | | | | | | | | |
| | | | 68 | | | | | | | | | | | |
| | | | 70 | | | | | | | | | | | |
| | | | 72 | | | | | | | | | | | |
| | | | 74 | | | | | | | | | | | |
| | | | 76 | | | | | | | | | | | |
| | | | 78 | | | | | | | | | | | |
| | | | 80 | | | | | | | | | | | |
| | | | 82 | | | | | | | | | | | |
| | | | 84 | | | | | | | | | | | |
| | | | 86 | | | | | | | | | | | |
| | | | 88 | | | | | | | | | | | |
| | | | 90 | | | | | | | | | | | |
| | | | 92 | | | | | | | | | | | |
| | | | 94 | | | | | | | | | | | |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 96 | | | | | | | | | | | |
| | | | 98 | | | | | | | | | | | |
| | | | 100 | 100-116 Red brown (7.5YR5/5) fine sand with silt and minor gravel, structureless, wet, loose (till). | SP-SM | | | | | | | | | |
| | | | 102 | | | | | | | | | | | |
| | | | 104 | Silt increases with depth. | | | | | | | | | | |
| | | | 106 | | | | | | | | | | | |
| | | | 108 | | | | | | | | | | | |
| | | | 110 | | | | | | | | | | | |
| | | | 112 | | | | | | | | | | | |
| | | | 114 | | | | | | | | | | | |
| | | | 116 | 116-118 Brown (7.5YR4/4) silty clay with sand, massive, wet, firm. | CL | | | | | | | | | |
| | | | 118 | 118+ Brown (7.5YR5/4) silty sand with gravel, massive, wet. | SM | | | | | | | | | |
| | | | 120 | E.O.B. @ 120'. | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☐ Underground Tanks ☐ Other ☐ _____

**MONITORING WELL CONSTRUCTION**
Form 4400-113A Rev. 4-90

| | | |
|---|---|---|
| **Facility/Project Name**<br>Crandon Mining Company | **Local Grid Location of Well**<br>115299.21 ft. ☒ N. ☐ S. 2286062.48 ft. ☒ E. ☐ W. | **Well Name**<br>CMC-02R |
| **Facility License, Permit or Monitoring Number**<br>_____ | **Grid Origin Location**<br>Lat. _____ Long. _____ or | **Wis. Unique Well Number / DNR Well Number**<br>_____ |
| **Type of Well** Water Table Observation Well ☑ 11<br>Piezometer ☐ 12 | **St. Plane** _____ ft. N, _____ ft. E. | **Date Well Installed**<br>09 / 08 / 94<br>m m / d d / y y |
| **Distance Well Is From Waste/Source Boundary**<br>_____ ft. | **Section Location of Waste/Source**<br>NE 1/4 of NE 1/4 of Sec. 32 T. 35 N. R. 13 ☒ E. ☐ W. | **Well Installed By: (Person's Name and Firm)**<br>Jon Anderson<br>NorthStar |
| **Is Well A Point of Enforcement Std. Application?**<br>☐ Yes ☐ No | **Location of Well Relative to Waste/Source**<br>u ☐ Upgradient s ☐ Sidegradient<br>d ☐ Downgradient n ☐ Not Known | |

A. Protective pipe, top elevation 1770.35 ft. MSL
B. Well casing, top elevation 1770.15 ft. MSL
C. Land surface elevation 1697.6 ft. MSL
D. Surface seal, bottom 1696.6 ft. MSL or 1.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☑
SM ☑ SC ☐ ML ☐ MH ☐ CL ☑ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☑ No

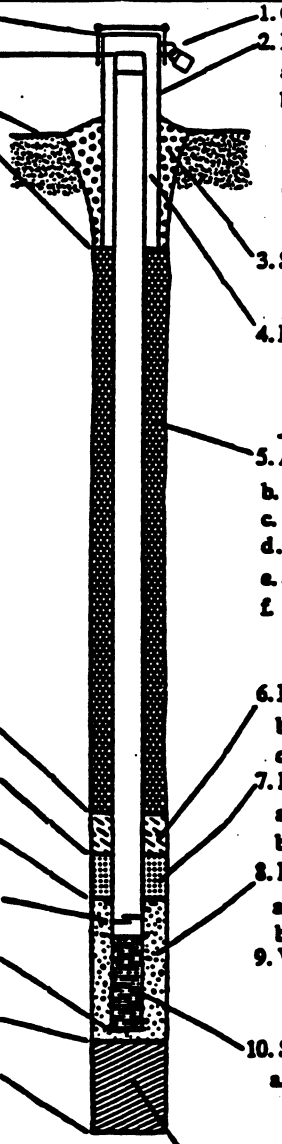
14. Drilling method used: Rotary ☐ 50
Hollow Stem Auger ☐ 41
Rotasonic Other ☐

15. Drilling fluid used: Water ☑ 02 Air ☐ 01
Drilling Mud ☐ 03 None ☐ 99

16. Drilling additives used? ☐ Yes ☐ No
Describe _____

17. Source of water (attach analysis):
_____

E. Bentonite seal, top 1696.6 ft. MSL or 1.0 ft.
F. Fine sand, top 1604.6 ft. MSL or 93.0 ft.
G. Filter pack, top 1602.6 ft. MSL or 95.0 ft.
H. Screen joint, top 1597.6 ft. MSL or 100.0 ft.
I. Well bottom 1582.6 ft. MSL or 115.0 ft.
J. Filter pack, bottom 1578.6 ft. MSL or 119.0 ft.
K. Borehole, bottom 1577.6 ft. MSL or 120.0 ft.
L. Borehole, diameter 8.0 in.
M. O.D. well casing 2.38 in.
N. I.D. well casing 1.87 in.



1. Cap and lock? ☑ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 7.0 ft.
c. Material: Steel ☑ 04 Other ☐ _____
d. Additional protection? ☐ Yes ☐ No
If yes, describe: _____
3. Surface seal: Bentonite ☑ 30 Concrete ☐ 01 Other ☐ _____
4. Material between well casing and protective pipe: Bentonite ☐ 30 Annular space seal ☐ Other ☐ _____
5. Annular space seal: a. Granular Bentonite ☐ 33
b. _____ Lbs/gal mud weight ... Bentonite-sand slurry ☐ 35
c. 10.8 lbs/gal mud weight ..... Bentonite slurry ☑ 31
d. _____ % Bentonite ..... Bentonite-cement grout ☐ 50
e. 14.6 Ft³ volume added for any of the above
f. How installed: Tremie ☑ 01 Tremie pumped ☐ 02 Gravity ☐ 08
6. Bentonite seal: a. Bentonite granules ☐ 33
b. ☐ 1/4 in. ☐ 3/8 in. ☐ 1/2 in. Bentonite pellets ☐ 32
c. 3/8" Bentonite Chips Other ☑
7. Fine sand material: Manufacturer, product name & mesh size
a. Badger Mining BB#7
b. Volume added 0.6 ft³
8. Filter pack material: Manufacturer, product name and mesh size
a. Red Flint Filter #3
b. Volume added 5.8 ft³
9. Well casing: Flush threaded PVC schedule 40 ☐ 23 Flush threaded PVC schedule 80 ☑ 24 Other ☐ _____
10. Screen material: PVC
a. Screen type: Factory cut ☑ 11 Continuous slot ☐ 01 Other ☐ _____
b. Manufacturer Northern Air
c. Slot size: 0.010 in.
d. Slotted length: 15.0 ft.
11. Backfill material (below filter pack): None ☑ 14 Other ☐ _____

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature _____ Firm F & VD

Please complete both sides of this form and return to the appropriate DNR office listed at the top of this form as required by chs. 144, 147 and 160, Wis. Stats., and ch. NR 141, Wis. Ad. Code. In accordance with ch.144, Wis Stats., failure to file this form may result in a forfeiture of not less than $10, nor more than $5000 for each day of violation. In accordance with ch. 147, Wis. Stats., failure to file this form may result in a forfeiture of not more than $10,000 for each day of violation. NOTE: Shaded areas are for DNR use only. See instructions for more information including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

# MONITORING WELL DEVELOPMENT

Form 4400-113B Rev. 4-90

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☐ Underground Tanks ☐ Other ☐ _____

| Facility/Project Name | County Name | Well Name |
|---|---|---|
| Crandon Mining Company | Forest | CMC-02R |

| Facility License, Permit or Monitoring Number | County Code | Wis. Unique Well Number | DNR Well Number |
|---|---|---|---|
| _____ | __ | | |

1. Can this well be purged dry? ☑ Yes ☐ No

2. Well development method

| | |
|---|---|
| surged with bailer and bailed | ☐ 41 |
| surged with bailer and pumped | ☐ 61 |
| surged with block and bailed | ☐ 42 |
| surged with block and pumped | ☐ 62 |
| surged with block, bailed and pumped | ☐ 70 |
| compressed air | ☐ 20 |
| bailed only | ☑ 10 |
| pumped only | ☑ 51 |
| pumped slowly | ☐ 50 |
| Other _____ | ☐ |

3. Time spent developing well: 100 min.

4. Depth of well (from top of well casing): 123.0 ft.

5. Inside diameter of well: 1.87 in.

6. Volume of water in filter pack and well casing: 10.4 gal.

7. Volume of water removed from well: 24.0 gal.

8. Volume of water added (if any): NA gal.

9. Source of water added: _____

10. Analysis performed on water added? ☐ Yes ☐ No
(If yes, attach results)

| | Before Development | After Development |
|---|---|---|
| 11. Depth to Water (from top of well casing) | a. 104.24 ft. | Dry ft. |
| Date | b. 09/30/94 (mm/dd/yy) | 10/06/94 (mm/dd/yy) |
| Time | c. 8:00 ☑ a.m. ☐ p.m. | 14:30 ☐ a.m. ☑ p.m. |
| 12. Sediment in well bottom | None inches | None inches |
| 13. Water clarity | Clear ☐ 10 Turbid ☒ 15 | Clear ☐ 20 Turbid ☒ 25 |
| (Describe) | Lt brown | Lt brown |
| Fill in if drilling fluids were used and well is at solid waste facility: | | |
| 14. Total suspended solids | _____ mg/l | _____ mg/l |
| 15. COD | _____ mg/l | _____ mg/l |

16. Additional comments on development:
Well bailed dry twice and pumped dry twice.

Well developed by: Person's Name and Firm

Name: Erik Silvola / Scott Janssen

Firm: Foth & Van Dyke

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: [signature]

Print Initials: E A S

Firm: Foth & Van Dyke

NOTE: Shaded areas are for DNR use only. See instructions for more information including a list of county codes.

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Monitoring Well Installation | | CMC-02P |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling<br>Dan Tinnancour | 03/10/94<br>MM/DD/YY | 03/22/94<br>MM/DD/YY | 6" Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | 105.6' MSL | 1697.9' MSL | 5-7/8" |

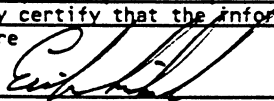
Boring Location
State Plane 115306.8 N, 2286077.3 E S/C/N Lat
NE 1/4 of NE 1/4 of Section 32, T 35 N, R 13 E Long

Local Grid Location (if applicable)
Feet ___ N ___ S Feet ___ E ___ W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | 0-0.5 Dk brown (7.5YR2/2) organic topsoil, mod. med. blocky structure, frozen, frost to 1.2'. | OL | | | | | | | | | |
| | | | -- 2 | | | | | | | | | | | |
| | | | -- 4 | | | | | | | | | | | |
| 1 | 12 | 5/13<br>4/8 | -- 6 | Sample 6-8 Brown (7.5YR5/4) silty sand with gravel, weak med blocky structure, damp, sl. firm, locally oxidized (till). | SM | | | | | | | | | |
| | | | -- 8 | | | | | | | | | | | |
| | | | -- 10 | | | | | | | | | | | |
| 2 | 0 | 14/15<br>18/22 | -- 12 | Sample 11-13 No recovery on rock, cobble and boulder, drill to 15', must advance casing. | -- | | | | | | | | | |
| | | | -- 14 | | | | | | | | | | | |
| 3 | 0 | 50<br>f.3 | -- 16 | Sample 16-18 Pound rock, boulder 16-17.5, gravel and cobbles 17.5-26. | -- | | | | | | | | | |
| | | | -- 18 | | | | | | | | | | | |
| | | | -- 20 | | | | | | | | | | | |
| | | | -- | Boulder at 21'. | | | | | | | | | | |
| | | | -- 22 | Boulders and cobbles 22-26. | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature  Firm Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 24 | | | | | | | | | | | |
| 4 | 2 | 50 f.4 | 26 | Sample 26-28 Brown (7.5YR5/4) med sand with gravel, structureless, damp, loose, boulders and cobbles 26-30. | SP-GP | | | | | | | | | |
| | | | 28 | | | | | | | | | | | |
| | | | 30 | | | | | | | | | | | |
| 5 | 7 | 50/50 f.2 | | Sample 31-33 As above, less gravel. | SP | | | | | | | | | |
| | | | 32 | | | | | | | | | | | |
| | | | | Drill boulders 33-36. | | | | | | | | | | |
| | | | 34 | | | | | | | | | | | |
| | | | 36 | | | | | | | | | | | |
| 6 | 6.5 | 54/50 f.3 | 38 | Sample 37-39 Brown (2.5YR5/4) silty sand with gravel, weak med. blocky structure, damp, sl. firm (till). | SP-SM | | | | | | | | | |
| | | | | Boulder drill 39 to 46. | | | | | | | | | | |
| | | | 40 | | | | | | | | | | | |
| | | | 42 | | | | | | | | | | | |
| | | | 44 | | | | | | | | | | | |
| 7 | 0 | 50 f.2 | 46 | Sample 46-48 No recovery - boulder. | -- | | | | | | | | | |
| | | | 48 | | | | | | | | | | | |
| | | | 50 | | | | | | | | | | | |
| 8 | 0 | 50 f.2 | | 51-53 No recovery - boulders. | -- | | | | | | | | | |
| | | | 52 | | | | | | | | | | | |
| | | | 54 | | | | | | | | | | | |
| 9 | 7 | 25/39 50f.2 | 56 | Sample 56-58 Brown (7.5YR5/5) med.-coarse sand with gravel, structureless, damp, loose (outwash). | SP | | | | | | | | | |
| | | | 58 | | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-02P

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 0 | 50 f.1 | -- 62 | Sample 61-63 No recovery - boulder. | -- | | | | | | | | | |
| 11 | 0 | 100 f.1 | -- 66 -- 68 | Sample 66-68 No recovery. | -- | | | | | | | | | |
| 12 | 5 | 68/100 f.2 | -- 70 -- 72 -- 74 | Sample 71-73 Brown (10YR5/5) med. sand with gravel and cobbles, structureless, damp, loose (outwash). | SP | | | | | | | | | |
| 13 | 7 | 39/46 100f.1 | -- 76 -- 78 -- 80 | Sample 76-78 Brown (10YR3/3) med.-coarse sand, structureless, damp, loose (outwash). | SP | | | | | | | | | |
| 14 | 6 | 42/100 f.3 | -- 82 -- 84 -- 86 -- 88 -- 90 | Sample 81-83 As above with gravel, wet. | SP | | | | | | | | | |
| | | | | Boulder 86-88. | -- | | | | | | | | | |
| 15 | 3 | 100f.3 | -- 92 -- 94 -- 96 | Sample 91-93 Red brown (5YR5/4) fine sand with gravel, structureless, wet (outwash). | SP | | | | | | | | | |
| | | | | Boulder 95-98. | | | | | | | | | | |

| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 98 | | | | | | | | | | | |
| | | | 100 | | | | | | | | | | | |
| 16 | 11 | 36/82 50f.2 | 102 | Sample 101-103 Red brown (5YR5/5) fine sand with silt and minor gravel, structureless, damp, loose (till). | SP-SM | | | | | | | | | |
| | | | 104 | | | | | | | | | | | |
| | | | 106 | Boulder 106-108 No sample. | -- | | | | | | | | | |
| | | | 108 | | | | | | | | | | | |
| | | | 110 | | | | | | | | | | | |
| 17 | 3 | 35/50 f.5 | 112 | Sample 111-113 As above, wet. | SM | | | | | | | | | |
| | | | 114 | | | | | | | | | | | |
| 18 | 13 | 8/11 50f.2 | 116 | Sample 116-118 Brown (7.5YR4/4) silty clay with sand, massive, damp, v. firm, minor gravel (till). | CL | | | | | | | | | |
| | | | 118 | | | | | | | | | | | |
| | | | 120 | | | | | | | | | | | |
| 19 | 3 | 50f.2 | 122 | Sample 121-123 Brown (7.5YR5/4) silty sand with gravel, massive, damp, sl. firm (till). | SM | | | | | | | | | |
| | | | 124 | | | | | | | | | | | |
| | | | 126 | Boulder 126-128.5 | -- | | | | | | | | | |
| | | | 128 | | | | | | | | | | | |
| | | | 130 | | | | | | | | | | | |
| 20 | 7 | 39/100 f.1 | 132 | Sample 131-133 As above. | SM | | | | | | | | | |

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-02P

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- 134 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 21 | 3 | 100 f.2 | -- 136 | Sample 136-138 As above. | SM | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 138 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 140 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 22 | 16 | 25/42 51/50 | -- | Sample 141-143 As above. | SM | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 142 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 144 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 23 | 7 | 36/100 f.1 | -- 146 | Sample 146-148 As above. | SM | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 148 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 150 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 24 | 7 | 36/100 f.2 | -- | Sample 151-153 As above. | SM | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 152 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | 153-156 Boulder. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 154 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 156 | Boulder 156-159. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 158 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 160 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 25 | 5 | 54/100 f.2 | -- | Sample 161-163 Brown (7.5YR5/4) silty sand with gravel, cobbles & boulders, massive, wet, firm (till). | SM | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 162 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 164 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 26 | 5 | 24/100 f.1 | -- 166 | As above, 166-168. Color red brown (5YR5/4). | SM | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 168 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-02P

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 170 | | | | | | | | | | | |
| 27 | 1 | 100f.5 | | Sample 171-173 As above. | SM | | | | | | | | | |
| | | | 172 | | | | | | | | | | | |
| | | | 174 | | | | | | | | | | | |
| 28 | 1 | 100f.1 | 176 | Sample 176-178 Brown (7.5YR6/4) fine-med sand with gravel, structureless, wet, loose (outwash). | SP | | | | | | | | | |
| | | | 178 | | | | | | | | | | | |
| | | | 180 | | | | | | | | | | | |
| 29 | 2 | 150f.5 | | Sample 181-182 As above. | SP | | | | | | | | | |
| | | | 182 | | | | | | | | | | | |
| | | | 184 | | | | | | | | | | | |
| 30 | 1 | 100f.3 | 186 | Sample 186-188 As above, more gravel. | SP-GP | | | | | | | | | |
| | | | 188 | | | | | | | | | | | |
| | | | 190 | | | | | | | | | | | |
| 31 | 5 | 100/ 200f.4 | | Sample 191-193 As above. | SP-GP | | | | | | | | | |
| | | | 192 | | | | | | | | | | | |
| | | | 194 | | | | | | | | | | | |
| | | | 196 | | | | | | | | | | | |
| | | | 198 | | | | | | | | | | | |
| | | | | E.O.B. @ 199'. | | | | | | | | | | |
| | | | 200 | | | | | | | | | | | |
| | | | 202 | | | | | | | | | | | |
| | | | 204 | | | | | | | | | | | |
| | | | 206 | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Monitoring Well Installation | | CMC-03 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling<br>Chuck Blunt | 03/24/94<br>MM/DD/YY | 03/24/94<br>MM/DD/YY | 8" Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | Dry | 1705.2' MSL | 7-7/8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 113560.1 N, 2286745.3E S/C/N<br>NE 1/4 of SW 1/4 of Section 32, T 35 N, R 13 E | Lat<br>Long<br>Feet ___ N S Feet ___ E W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | Blind drill - see boring log CMC-03P. | | | | | | | | | | |
| | | | -- 2 | | | | | | | | | | | |
| | | | -- 4 | | | | | | | | | | | |
| | | | -- 6 | | | | | | | | | | | |
| | | | -- 8 | | | | | | | | | | | |
| | | | -- 10 | | | | | | | | | | | |
| | | | -- 12 | | | | | | | | | | | |
| | | | -- 14 | | | | | | | | | | | |
| | | | -- 16 | | | | | | | | | | | |
| | | | -- 18 | | | | | | | | | | | |
| | | | -- 20 | | | | | | | | | | | |
| | | | -- 22 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-03

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- 24 | | | | | | | | | | | |
| | | | -- 26 | | | | | | | | | | | |
| | | | -- 28 | | | | | | | | | | | |
| | | | -- 30 | | | | | | | | | | | |
| | | | -- 32 | | | | | | | | | | | |
| | | | -- 34 | | | | | | | | | | | |
| | | | -- 36 | | | | | | | | | | | |
| | | | -- 38 | | | | | | | | | | | |
| | | | -- 40 | | | | | | | | | | | |
| | | | -- 42 | | | | | | | | | | | |
| | | | -- 44 | | | | | | | | | | | |
| | | | -- 46 | | | | | | | | | | | |
| | | | -- 48 | | | | | | | | | | | |
| | | | -- 50 | | | | | | | | | | | |
| | | | -- 52 | | | | | | | | | | | |
| | | | -- 54 | | | | | | | | | | | |
| | | | -- 56 | | | | | | | | | | | |
| | | | -- 58 | | | | | | | | | | | |
| | | | -- 60 | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-03

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- 62 | | | | | | | | | | | |
| | | | -- 64 | | | | | | | | | | | |
| | | | -- 66 | | | | | | | | | | | |
| 1 | 0 | 70 | -- 68 | Sample 68-70 No recovery - pound boulder. | -- | | | | | | | | | |
| 2 | 7 | 162 f.8 | -- 70 | Sample 69.5-71.5 Brown (7.5YR5/5) silty sand with gravel, massive, damp, hard, wet in bottom 3" at ~70' (till). | SM | | | | | | | | | |
| | | | -- 72 | | | | | | | | | | | |
| | | | -- 74 | | | | | | | | | | | |
| 3 | 2.5 | 68 f.3 | -- 76 | Sample 76-78 As above, wet. | SM | | | | | | | | | |
| | | | -- 78 | | | | | | | | | | | |
| | | | -- 80 | | | | | | | | | | | |
| | | | -- 82 | | | | | | | | | | | |
| | | | -- 84 | | | | | | | | | | | |
| | | | -- 86 | E.O.B. @ 86'. | | | | | | | | | | |
| | | | -- 88 | | | | | | | | | | | |
| | | | -- 90 | | | | | | | | | | | |
| | | | -- 92 | | | | | | | | | | | |
| | | | -- 94 | | | | | | | | | | | |
| | | | -- 96 | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

# WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Form 3300-5W 11-89

All abandonment work shall be performed in accordance with the provisions of Chapters NR 111, NR 112 or NR 141, Wis. Admin. Code, whichever is applicable. Also, see instructions on back.

## GENERAL INFORMATION

(1) Well/Drillhole/Borehole Location

County: Forest

NE 1/4 of SW 1/4 of Sec. 32 ; T. 35 N. R. 13 [X] E [ ] W

(If applicable) Gov't Lot ____ Grid Number ____

Grid Location ____ ft. [ ] N. [ ] S. ____ ft. [ ] E. [ ] W.

Civil Town Name: Lincoln

Street Address of Well: NA

City, Village: NA

(2) FACILITY NAME

Original Well Owner (If Known): Crandon Mining Company

Present Well Owner: Crandon Mining Company

Street or Route: 7 North Brown Street, 3rd Floor

City, State, Zip Code: Rhinelander, WI 54501-3161

Facility Well No. and/or Name (If Applicable): CMC-03

WI Unique Well No.: _ _ _ _ _ _

Reason For Abandonment: Redrilled to deepen well

Date of Abandonment: 04/04/94

## WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drillhole/Borehole Construction Completed On

(Date) 03/24/94

[X] Monitoring Well
[ ] Water Well
[ ] Drillhole
[ ] Borehole

Construction Report Available? [X] Yes [ ] No

Construction Type:
[X] Drilled [ ] Driven (Sandpoint) [ ] Dug
[ ] Other (Specify)

Formation Type:
[X] Unconsolidated Formation [ ] Bedrock

Total Well Depth (ft.) 86 (From groundsurface) Casing Diameter (ins.) NA

Casing Depth (ft.) NA

Was Well Annular Space Grouted? [ ] Yes [X] No [ ] Unknown
If Yes, To What Depth? ____ Feet

(4) Depth to Water (Feet) NA

| | | | |
|---|---|---|---|
| Pump & Piping Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Liner(s) Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Screen Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Casing Left in Place? | [ ] Yes | [X] No | |

If No, Explain: Drilled out

| | | |
|---|---|---|
| Was Casing Cut Off Below Surface? | [X] Yes | [ ] No |
| Did Sealing Material Rise to Surface? | [X] Yes | [ ] No |
| Did Material Settle After 24 Hours? | [ ] Yes | [X] No |
| If Yes, Was Hole Retopped? | [ ] Yes | [ ] No |

(5) Required Method of Placing Sealing Material
[X] Conductor Pipe-Gravity [ ] Conductor Pipe-Pumped
[ ] Dump Bailer [ ] Other (Explain)

(6) Sealing Materials
[ ] Neat Cement Grout
[ ] Sand-Cement (Concrete) Grout
[ ] Concrete
[ ] Clay-Sand Slurry
[ ] Bentonite-Sand Slurry
[X] Chipped Bentonite

For monitoring wells and monitoring well boreholes only
[ ] Bentonite Pellets
[ ] Granular Bentonite
[ ] Bentonite - Cement Grout

| (7) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks Sealant or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| 3/8" chipped bentonite | Surface | 86' | 2 50-lb bags | |
| | | | | |
| | | | | |
| | | | | |

(8) Comments: 2" PVC filled with hole plug and drilled out to deepen well

(9) Name of Person or Firm Doing Sealing Work
WTD Environmental Drilling

Signature of Person Doing Work: [signature] Date Signed: 7-13-94

Street or Route: 101 Alderson Box 89 Telephone Number: (715) 359-7090

(10) FOR DNR OR COUNTY USE ONLY

Date Received/Inspected | District/County

Reviewer/Inspector

Follow-up Necessary

3.5-12-33

## REASONS FOR WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Wis. Adm. Code (NR 111, NR 112, & NR 141) requires well owners to permanently abandon unused wells/drillholes/boreholes on their property. The reasons for this requirement are:

- To prevent contamination from entering the well/drillhole/borehole at the surface or through corroded well casings and moving downward to an aquifer used by other wells, and
- To prevent vertical movement of water between different geologic formations of differing water quality.

Most licensed well drillers and pump installers have the equipment, knowledge and experience needed to permanently abandon wells/drillholes/boreholes. We recommend that these licensed contractors be hired to do this work.

## PROCEDURE

1. Remove any pump, pump piping, debris or other obstacles that could interfere with the sealing operation. In most situations the well casing should be left in place. When the casing is removed it should be pulled during the abandonment process so the drillhole does not collapse.
2. The sealing material must be placed with a conductor (tremie) pipe either by pumping or by gravity, (except when approved chipped bentonite is used according to written department instructions and restrictions).
3. The bottom end of the conductor pipe must initially reach the bottom of the well and must be kept submerged in the sealing material as it is placed.
4. Unconsolidated formation wells should be sealed with the materials listed in item (6) on the form. When clay or sodium benonite slurry is used to fill wells, the top 20 feet must be sealed with neat cement grout, concrete grout, concrete, or bentonite chips. Bedrock formation wells should be filled with neat cement grout, concrete grout, concrete or bentonite. chips. Monitoring wells must be filled with the materials specified by NR 141, Wis. Adm. Code.
5. Fill the entire well column from the bottom to the top with the required sealing material.
6. When using concrete or cement grout, any standing water in the hole will be forced out by the concrete or cement grout (it is more dense) resulting in an entire column of cement to seal the well. The sealing material must flow at the surface with the same consistency as it is being pumped in.
7. The casing may be cut off several feet below the ground surface.
8. To abandon flowing wells, the flow must be stopped or greatly reduced. This can be accomplished by extending the well casing to an elevation higher than the artesian head, or inserting a seal or packer in the casing. Once the flow has been stopped or reduced, the well can be abandoned the same as other wells.
9. For a municipal well, information regarding drillhole diameter and depths and geologic formations should be submitted on a separate sheet.
10. For use of alternative methods and materials, especially for deep, multi-formation wells contact DNR.

## TEMPORARY ABANDONMENT

- A well may be temporarily abandoned if it is planned to place the well back in service within a time specified by administrative rule.
- Temporary abandonment is accomplished by threading or welding a watertight cover to the casing or by filling the well with a clean clay slurry and then placing a cover over the well.
- If the well is not placed back into service, it should be permanently abandoned unless a written extension is granted by DNR.

## REPORT TO DNR

The Well/Drillhole/Borehole Abandonment Form 3300-5W, on the front, must be completed by the owner (or agent) and submitted to the appropriate DNR district office or delegated county office within 30 days.

**This form is authorized by chapters 144, 147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10.00 nor more than $5,000.00 for each violation. Fined not less than $10.00 or more than $100.00 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss. 144.99 and 162.06, Wis. Stats.**

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Monitoring Well Installation | | CMC-03R |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling<br>Dan Tinnancour | 03/31/94<br>MM/DD/YY | 04/04/94<br>MM/DD/YY | 6" Mud Rotary |

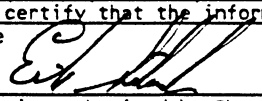
| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | Dry | 1705.2' MSL | 5-7/8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 113560.1 N, 2286745.3 E S/C/N<br>NE 1/4 of SW 1/4 of Section 32, T 35 N, R 13 E | Lat<br>Long |
| | Feet ___ N ___ S Feet ___ E ___ W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | Blind drill. See CMC-03P. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 2 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 4 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 6 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 8 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 10 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 12 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 14 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 16 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 18 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 20 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 22 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature  Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-03R

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- 24 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 26 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 28 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 30 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 32 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 34 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 36 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 38 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 40 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 42 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 44 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 46 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 48 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 50 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 52 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 54 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 56 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 58 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 60 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |

| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 62 | | | | | | | | | | | |
| | | | 64 | | | | | | | | | | | |
| | | | 66 | | | | | | | | | | | |
| | | | 68 | | | | | | | | | | | |
| | | | 70 | | | | | | | | | | | |
| | | | 72 | | | | | | | | | | | |
| | | | 74 | | | | | | | | | | | |
| | | | 76 | | | | | | | | | | | |
| | | | 78 | | | | | | | | | | | |
| | | | 80 | | | | | | | | | | | |
| | | | 82 | | | | | | | | | | | |
| | | | 84 | | | | | | | | | | | |
| | | | 86 | | | | | | | | | | | |
| | | | 88 | | | | | | | | | | | |
| | | | 90 | | | | | | | | | | | |
| 1 | | 56/100 f.4 | 92 | Sample 92-94 Brown (7.5YR5/6) med. sand with gravel, minor silt, wet, sl. hard (till). | SP-SM | | | | | | | | | |
| | | | 94 | | | | | | | | | | | |
| | | | 96 | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-03R

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 98 | E.O.B. @ 98'. | | | | | | | | | | |
| | | | 100 | | | | | | | | | | | |
| | | | 102 | | | | | | | | | | | |
| | | | 104 | | | | | | | | | | | |
| | | | 106 | | | | | | | | | | | |
| | | | 108 | | | | | | | | | | | |
| | | | 110 | | | | | | | | | | | |
| | | | 112 | | | | | | | | | | | |
| | | | 114 | | | | | | | | | | | |
| | | | 116 | | | | | | | | | | | |
| | | | 118 | | | | | | | | | | | |
| | | | 120 | | | | | | | | | | | |
| | | | 122 | | | | | | | | | | | |
| | | | 124 | | | | | | | | | | | |
| | | | 126 | | | | | | | | | | | |
| | | | 128 | | | | | | | | | | | |
| | | | 130 | | | | | | | | | | | |
| | | | 132 | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

# WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Form 3300-5W 11-89

All abandonment work shall be performed in accordance with the provisions of Chapters NR 111, NR 112 or NR 141, Wis. Admin. Code, whichever is applicable. Also, see instructions on back.

## GENERAL INFORMATION

(1) Well/Drillhole/Borehole Location

County: Forest

NE 1/4 of SW 1/4 of Sec. 32 : T. 35 N. R. 13 [X] E [ ] W

(If applicable) Gov't Lot _____ Grid Number _____

Grid Location _____ ft. [ ] N. [ ] S., _____ ft. [ ] E. [ ] W.

Civil Town Name: Lincoln

Street Address of Well: NA

City, Village: NA

(2) FACILITY NAME

Original Well Owner (If Known): Crandon Mining Company

Present Well Owner: Crandon Mining Company

Street or Route: 7 North Brown Street, 3rd Floor

City, State, Zip Code: Rhinelander, WI 54501-3161

Facility Well No. and/or Name (If Applicable): CMC-03R

WI Unique Well No.: _ _ _ _ _ _

Reason For Abandonment: Redrill to deepen well

Date of Abandonment: 04/27/94

## WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drillhole/Borehole Construction Completed On

(Date) 04/04/94

[X] Monitoring Well
[ ] Water Well
[ ] Drillhole
[ ] Borehole

Construction Report Available? [ ] Yes [ ] No

Construction Type:
[X] Drilled [ ] Driven (Sandpoint) [ ] Dug
[ ] Other (Specify) _____

Formation Type:
[X] Unconsolidated Formation [ ] Bedrock

Total Well Depth (ft.) 98 Casing Diameter (ins.) NA
(From groundsurface)

Casing Depth (ft.) NA

Was Well Annular Space Grouted? [ ] Yes [X] No [ ] Unknown
If Yes, To What Depth? _____ Feet

(4) Depth to Water (Feet) NA

| | | | |
|---|---|---|---|
| Pump & Piping Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Liner(s) Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Screen Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Casing Left in Place? | [ ] Yes | [X] No | |

If No, Explain: Drilled out

| | | |
|---|---|---|
| Was Casing Cut Off Below Surface? | [X] Yes | [ ] No |
| Did Sealing Material Rise to Surface? | [X] Yes | [ ] No |
| Did Material Settle After 24 Hours? | [ ] Yes | [X] No |
| If Yes, Was Hole Retopped? | [ ] Yes | [ ] No |

(5) Required Method of Placing Sealing Material
[X] Conductor Pipe-Gravity [ ] Conductor Pipe-Pumped
[ ] Dump Bailer [ ] Other (Explain)

(6) Sealing Materials
[ ] Neat Cement Grout
[ ] Sand-Cement (Concrete) Grout
[ ] Concrete
[ ] Clay-Sand Slurry
[ ] Bentonite-Sand Slurry
[X] Chipped Bentonite

For monitoring wells and monitoring well boreholes only
[ ] Bentonite Pellets
[ ] Granular Bentonite
[ ] Bentonite - Cement Grout

| (7) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks Sealant or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| 3/8" chipped bentonite | Surface | 98 | 2 bags | |
| | | | | |
| | | | | |
| | | | | |

(8) Comments: 2" PVC filled with hole plug and drilled out to deepen well

(9) Name of Person or Firm Doing Sealing Work
WTD Environmental Drilling

Signature of Person Doing Work: [signature] Date Signed: 7-13-94

Street or Route: 101 Alderson Box 89 Telephone Number: (715) 359-7090

(10) FOR DNR OR COUNTY USE ONLY

Date Received/Inspected: _____ District/County: _____

Reviewer/Inspector: _____

Follow-up Necessary: _____

3.5-12-39

## REASONS FOR WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Wis. Adm. Code (NR 111, NR 112, & NR 141) requires well owners to permanently abandon unused wells/drillholes/boreholes on their property. The reasons for this requirement are:

- To prevent contamination from entering the well/drillhole/borehole at the surface or through corroded well casings and moving downward to an aquifer used by other wells, and
- To prevent vertical movement of water between different geologic formations of differing water quality.

Most licensed well drillers and pump installers have the equipment, knowledge and experience needed to permanently abandon wells/drillholes/boreholes. We recommend that these licensed contractors be hired to do this work.

## PROCEDURE

1. Remove any pump, pump piping, debris or other obstacles that could interfere with the sealing operation. In most situations the well casing should be left in place. When the casing is removed it should be pulled during the abandonment process so the drillhole does not collapse.
2. The sealing material must be placed with a conductor (tremie) pipe either by pumping or by gravity, (except when approved chipped bentonite is used according to written department instructions and restrictions).
3. The bottom end of the conductor pipe must initially reach the bottom of the well and must be kept submerged in the sealing material as it is placed.
4. Unconsolidated formation wells should be sealed with the materials listed in item (6) on the form. When clay or sodium benonite slurry is used to fill wells, the top 20 feet must be sealed with neat cement grout, concrete grout, concrete, or bentonite chips. Bedrock formation wells should be filled with neat cement grout, concrete grout, concrete or bentonite. chips. Monitoring wells must be filled with the materials specified by NR 141, Wis. Adm. Code.
5. Fill the entire well column from the bottom to the top with the required sealing material.
6. When using concrete or cement grout, any standing water in the hole will be forced out by the concrete or cement grout (it is more dense) resulting in an entire column of cement to seal the well. The sealing material must flow at the surface with the same consistency as it is being pumped in.
7. The casing may be cut off several feet below the ground surface.
8. To abandon flowing wells, the flow must be stopped or greatly reduced. This can be accomplished by extending the well casing to an elevation higher than the artesian head, or inserting a seal or packer in the casing. Once the flow has been stopped or reduced, the well can be abandoned the same as other wells.
9. For a municipal well, information regarding drillhole diameter and depths and geologic formations should be submitted on a separate sheet.
10. For use of alternative methods and materials, especially for deep, multi-formation wells contact DNR.

## TEMPORARY ABANDONMENT

- A well may be temporarily abandoned if it is planned to place the well back in service within a time specified by administrative rule.
- Temporary abandonment is accomplished by threading or welding a watertight cover to the casing or by filling the well with a clean clay slurry and then placing a cover over the well.
- If the well is not placed back into service, it should be permanently abandoned unless a written extension is granted by DNR.

## REPORT TO DNR

The Well/Drillhole/Borehole Abandonment Form 3300-5W, on the front, must be completed by the owner (or agent) and submitted to the appropriate DNR district office or delegated county office within 30 days.

**This form is authorized by chapters 144, 147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10.00 nor more than $5,000.00 for each violation. Fined not less than $10.00 or more than $100.00 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss. 144.99 and 162.06, Wis. Stats.**

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Monitoring Well Installation | | CMC-03RR |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling<br>Mike Mueller | 04/19/94<br>MM/DD/YY | 04/27/94<br>MM/DD/YY | 6" Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | 112.6' MSL | 1705.2' MSL | 5-7/8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 113563.6 N, 2286751.7 E S/C/N Lat<br>NE 1/4 of SW 1/4 of Section 32, T 35 N, R 13 E Long | Feet ___ N/S Feet ___ E/W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0 | Blind drill. See CMC-03P. | | | | | | | | | | |
| | | | 2 | | | | | | | | | | | |
| | | | 4 | | | | | | | | | | | |
| | | | 6 | | | | | | | | | | | |
| | | | 8 | | | | | | | | | | | |
| | | | 10 | | | | | | | | | | | |
| | | | 12 | | | | | | | | | | | |
| | | | 14 | | | | | | | | | | | |
| | | | 16 | | | | | | | | | | | |
| | | | 18 | | | | | | | | | | | |
| | | | 20 | | | | | | | | | | | |
| | | | 22 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

| Signature | Firm |
|---|---|
| | Foth & Van Dyke |

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-03RR

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- 24 | | | | | | | | | | | |
| | | | -- 26 | | | | | | | | | | | |
| | | | -- 28 | | | | | | | | | | | |
| | | | -- 30 | | | | | | | | | | | |
| | | | -- 32 | | | | | | | | | | | |
| | | | -- 34 | | | | | | | | | | | |
| | | | -- 36 | | | | | | | | | | | |
| | | | -- 38 | | | | | | | | | | | |
| | | | -- 40 | | | | | | | | | | | |
| | | | -- 42 | | | | | | | | | | | |
| | | | -- 44 | | | | | | | | | | | |
| | | | -- 46 | | | | | | | | | | | |
| | | | -- 48 | | | | | | | | | | | |
| | | | -- 50 | | | | | | | | | | | |
| | | | -- 52 | | | | | | | | | | | |
| | | | -- 54 | | | | | | | | | | | |
| | | | -- 56 | | | | | | | | | | | |
| | | | -- 58 | | | | | | | | | | | |
| | | | -- 60 | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-03RR

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 62 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 64 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 66 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 68 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 70 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 72 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 74 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 76 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 78 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 80 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 82 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 84 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 86 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 88 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 90 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 92 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 94 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 96 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-03RR

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 98 | | | | | | | | | | | |
| | | | 100 | | | | | | | | | | | |
| | | | 102 | | | | | | | | | | | |
| 1 | 4 | 109 f.4 | 104 | Sample 103-105 Red brown (5YR5/4) silty sand with gravel & cobbles, massive, v. damp to wet, firm (till). | SM | | | | | | | | | |
| | | | 106 | | | | | | | | | | | |
| 2 | -- | -- | 108 | Boulder 107-109.5 | -- | | | | | | | | | |
| | | | 110 | Boulder 109.5-110 | | | | | | | | | | |
| | | | 112 | | | | | | | | | | | |
| 3 | 5 | 50/100 | 114 | Sample 113-115 Brown (10YR7/4) med. to coarse sand with gravel, damp-v.damp, massive, wet, compact (outwash). | SP | | | | | | | | | |
| | | | 116 | | | | | | | | | | | |
| 4 | 13 | 29/38 70 | 118 | Sample 118-120 As above, less gravel, wet. | | | | | | | | | | |
| | | | 120 | | | | | | | | | | | |
| | | | 122 | | | | | | | | | | | |
| | | | 124 | | | | | | | | | | | |
| | | | 126 | | | | | | | | | | | |
| | | | 128 | E.O.B. @ 128'. | | | | | | | | | | |
| | | | 130 | | | | | | | | | | | |
| | | | 132 | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Monitoring Well Installation | | CMC-03P |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling<br>Chuck Blunt | 03/11/94<br>MM/DD/YY | 03/22/94<br>MM/DD/YY | 8" Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | 113.79' MSL | 1705.2' MSL | 7-7/8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 113560.1 N, 2286745.3 E S/C/N Lat<br>NE 1/4 of SW 1/4 of Section 32, T 35 N, R 13 E Long | ___ Feet N/S ___ Feet E/W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2 | 0-1 Dk brown (7.5YR2/2) organic topsoil, mod. med. blocky structure, frozen. | OL | | | | | | | | | |
| | | | 4 | 1-3 Brown (7.5YR5/4) silty clay with sand and gravel, mod med. blocky structure, damp, soft. | CL-ML | | | | | | | | | |
| 1 | 16 | 5/5<br>5/5 | 6 | Sample 5-7 Brown (7.5YR4/4) silty sand with gravel, weak, fine blocky structure, wet, loose (till). | SM | | | | | | | | | |
| | | | 8 | | | | | | | | | | | |
| 2 | 12 | 4/3<br>3/5 | 10 | Sample 10-12 Brown (7.5YR4/4) fine sand with gravel, structureless, wet, loose (outwash). | SP | | | | | | | | | |
| | | | 12 | | | | | | | | | | | |
| | | | 14 | | | | | | | | | | | |
| | | | 16 | | | | | | | | | | | |
| 3 | 6 | 4/3<br>3/5 | 18 | Sample 15-17 Brown (7.5YR5/4) silty sand with gravel and boulders, structureless, damp, loose (till). | SM | | | | | | | | | |
| 4 | 17 | 10/20<br>40/50 | 20 | Sample 20-22 Brown (7.5YR5/4) fine sand with silt and gravel, massive, compact, damp, firm (till). | SP-SM | | | | | | | | | |
| | | | 22 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 24 | | | | | | | | | | | |
| 5 | 15 | 35/44<br>38/50 | 26 | Sample 26-28 Brown (10YR5/5) silty sand with gravel, massive, damp, compact (till). | SM | | | | | | | | | |
| | | | 28 | | | | | | | | | | | |
| 6 | 17 | 35/40<br>45/50 | 30 | Sample 30-32 As above. | SM | | | | | | | | | |
| | | | 32 | | | | | | | | | | | |
| | | | 34 | | | | | | | | | | | |
| 7 | 13 | 16/21<br>27/3 | 36 | Sample 35-37 As above, less silt. | SP-SM | | | | | | | | | |
| | | | 38 | | | | | | | | | | | |
| | | | 40 | | | | | | | | | | | |
| 8 | 3 | 44/50<br>50/50 | 42 | Sample 41-42 Brown (10YR5/5) med sand and gravel, structureless, damp, loose (outwash). | SP | | | | | | | | | |
| | | | 44 | | | | | | | | | | | |
| 9 | 0 | 50/50 | 46 | Sample 45-47 No recovery - drilling gravel and cobbles. | -- | | | | | | | | | |
| | | | 48 | | | | | | | | | | | |
| 10 | 0 | 50/50 | 50 | Sample 50-52 No recovery. | -- | | | | | | | | | |
| | | | 52 | | | | | | | | | | | |
| | | | 54 | | | | | | | | | | | |
| 11 | 0 | 21/24<br>75 | 56 | Sample 55-57 Rock in shoe. Silty sand? | SM? | | | | | | | | | |
| | | | 58 | | | | | | | | | | | |
| 12 | 4 | 3/100<br>f.3 | 60 | Sample 60-62 Brown (7.5YR4/5) silty sand w/gravel, v.fine blocky structure, damp, loose (till). | SM | | | | | | | | | |

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-03P

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- 62 | | | | | | | | | | | |
| | | | -- 64 | | | | | | | | | | | |
| 13 | 1 | 26/50 | -- 66 | Sample 65-67 As above. | SM | | | | | | | | | |
| | | | -- 68 | | | | | | | | | | | |
| 14 | 0 | 50f.0 | -- 70 | Sample 70-72 No recovery - pound boulder. | -- | | | | | | | | | |
| | | | -- 72 | | | | | | | | | | | |
| | | | -- 74 | | | | | | | | | | | |
| 15 | 2 | 50f.2 | -- 76 | Sample 75-77 Brown (7.5YR5/4) silty sand with gravel, massive, wet (till). | SM | | | | | | | | | |
| | | | -- 78 | | | | | | | | | | | |
| | | | -- 80 | Boulder 80-82. | -- | | | | | | | | | |
| | | | -- 82 | | | | | | | | | | | |
| | | | -- 84 | | | | | | | | | | | |
| 16 | 0 | 75f.0 | -- 86 | Sample 85-87 No recovery. Boulder. | | | | | | | | | | |
| | | | -- 88 | | | | | | | | | | | |
| 17 | 5 | 75f.5 | -- 90 | Sample 90-92 Lt. brown (10YR7/3) med-coarse sand with gravel, structureless, wet, loose (outwash). | SP | | | | | | | | | |
| | | | -- 92 | | | | | | | | | | | |
| | | | -- 94 | | | | | | | | | | | |
| 18 | 1 | 75f.1 | -- 96 | Sample 95-97 Brown (7.5YR4/4) sand with minor silt, too little to describe -- mostly sluff. | SP-SM | | | | | | | | | |

| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 98 | | | | | | | | | | | |
| 19 | 4 | 100f.5 | 100 | Sample 100-102 Brown (7.5YR5/5) silty sand with gravel, massive, wet, firm (till). | SM | | | | | | | | | |
| | | | 102 | | | | | | | | | | | |
| | | | 104 | | | | | | | | | | | |
| 20 | 3 | 100f.3 | | Sample 105-107 Brown (7.5YR5/4) fine-med. sand with minor silt and gravel, structureless, wet (outwash). | SP | | | | | | | | | |
| | | | 106 | | | | | | | | | | | |
| | | | 108 | | | | | | | | | | | |
| 21 | 1 | 41/50 f.1 | 110 | Sample 110-112 As above. | SP | | | | | | | | | |
| | | | 112 | | | | | | | | | | | |
| | | | 114 | | | | | | | | | | | |
| 22 | 2 | 35/75 | | Sample 115-117 As above. | SP | | | | | | | | | |
| | | | 116 | | | | | | | | | | | |
| | | | 118 | | | | | | | | | | | |
| 23 | 1 | 100f.5 | 120 | Sample 120-122 As above. | SP | | | | | | | | | |
| | | | 122 | | | | | | | | | | | |
| | | | 124 | | | | | | | | | | | |
| 24 | 1 | 75f.4 | | Sample 125-127 As above. | SP | | | | | | | | | |
| | | | 126 | | | | | | | | | | | |
| | | | 128 | | | | | | | | | | | |
| 25 | 1 | 45/50 f.3 | 130 | Sample 130-132 As above. | SP | | | | | | | | | |
| | | | 132 | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-03P

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- 134 | | | | | | | | | | | |
| 26 | 18 | 45/50 50 | -- 136 | Sample 135-137 Red brown (5YR5/4) fine-med sand stratified with lt. brown (7.5YR7/3) fine sand and red brown fine silty sand lenses, structureless, wet, soft (outwash). | SP | | | | | | | | | |
| | | | -- 138 | | | | | | | | | | | |
| 27 | 19 | 45/45 50 | -- 140 | Sample 140-142 As above to 141.5. | SP | | | | | | | | | |
| | | | -- 142 | 141.5-142 Red brown (5YR5/5) silt, weakly stratified, massive, wet to damp, firm (lacustrine). | ML | | | | | | | | | |
| | | | -- 144 | | | | | | | | | | | |
| 28 | 7 | 35/75 | -- 146 | Sample 145-147 Red brown (5YR5/4) silty clay (145-145.4) and massive, wet, firm. 145.4-145.6 Brown (7.5YR5/6) silt with sand layers, massive, wet, firm. | CL ML SP | | | | | | | | | |
| | | | -- 148 | 145.6+ Brown (10YR7/4) med-coarse sandy structureless, wet, loose, oxidized, stratified (outwash). | | | | | | | | | | |
| 29 | 7 | 45/50 | -- 152 | Sample 150-152 Orange brown (5YR5/8) silty sand with gravel, massive, wet, firm to hard, highly oxidized (till). | SM | | | | | | | | | |
| | | | -- 154 | | | | | | | | | | | |
| 30 | 6 | 25/50 | -- 156 | Sample 155-157 As above. | SM | | | | | | | | | |
| | | | -- 158 | | | | | | | | | | | |
| 31 | 6 | 50/50 f.2 | -- 162 | Sample 160-162 As above. | SM | | | | | | | | | |
| | | | -- 164 | | | | | | | | | | | |
| 32 | 6 | 100f.5 | -- 166 | Sample 165-167 Red brown (5YR5/4) silty sand with gravel, wet, massive (till). | SM | | | | | | | | | |
| | | | -- 168 | | | | | | | | | | | |

| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 33 | 6 | 100f.5 | 170 | Sample 170-172 As above. | SM | | | | | | | | | |
| | | | 172 | | | | | | | | | | | |
| | | | 174 | | | | | | | | | | | |
| 34 | 3 | 100f.3 | 176 | Sample 175-177 Lt. brown (10YR7/4) med. sand with gravel, structureless, wet, loose (outwash). | SP | | | | | | | | | |
| | | | 178 | | | | | | | | | | | |
| 35 | 5 | 100f.5 | 180 | Sample 180-182 Red brown (5YR4/4) silty clay with sand and gravel, massive, damp, very hard (till). | CL-GC | | | | | | | | | |
| | | | 182 | | | | | | | | | | | |
| | | | 184 | | | | | | | | | | | |
| 36 | 3 | 150f.2 | 186 | Sample 186-188 Brown (10YR7/5) fine-med sand with gravel, structureless, wet, loose (outwash). | SP | | | | | | | | | |
| | | | 188 | | | | | | | | | | | |
| 37 | 5 | 150f.5 | 190 | Brown (10YR7/6) med. coarse sand with gravel, minor silt, structureless, damp, loose, oxidized. | SP | | | | | | | | | |
| | | | 192 | | | | | | | | | | | |
| | | | 194 | | | | | | | | | | | |
| 38 | 0.5 | 150f.1 | 196 | Sample 195-197 As above. | SP | | | | | | | | | |
| | | | 198 | | | | | | | | | | | |
| 39 | 1 | 250f.1 | 200 | Sample 199-201 As above. | SP | | | | | | | | | |
| | | | 202 | E.O.B. @ 201'. | | | | | | | | | | |
| | | | 204 | | | | | | | | | | | |
| | | | 206 | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Monitoring Well Installation | | CMC-04 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling<br>Mike Mueller | 03/07/94<br>MM/DD/YY | 03/10/94<br>MM/DD/YY | 6" Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | 93.3' MSL | 1683.9' MSL | 5-7/8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 111448.5 N, 2285112.2 E S/C/N Lat<br>SW 1/4 of SE 1/4 of Section 32, T 35 N, R 13 E Long | ___ Feet ___ N/S ___ Feet ___ E/W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | 0-7 Dk brown (7.5YR2/2) organic top-soil, frozen weak fine blocky structure. | OL | | | | | | | | | |
| | | | -- 2 | | | | | | | | | | | |
| 1 | 11 | 3/4<br>4/4 | -- | 3-5 Brown (7.5YR5/4) silty sand with gravel and cobbles, mod med blocky structure, damp, loose (till). | SM | | | | | | | | | |
| | | | -- 4 | | | | | | | | | | | |
| | | | -- 6 | | | | | | | | | | | |
| 2 | 17 | 2/2<br>1/1 | -- 8 | Sample 8-10 As above, wet at -8.8'. | SM | | | | | | | | | |
| | | | -- 10 | | | | | | | | | | | |
| | | | -- 12 | | | | | | | | | | | |
| 3 | 6 | 1/1<br>2/2 | -- | Sample 13-15 As above. | SM | | | | | | | | | |
| | | | -- 14 | | | | | | | | | | | |
| | | | -- 16 | | | | | | | | | | | |
| 4 | 13 | 1/2<br>2/1 | -- 18 | Sample 18-20 As above, wet. | SM | | | | | | | | | |
| | | | -- 20 | | | | | | | | | | | |
| | | | -- 22 | | | | | | | | | | | |
| 5 | 8 | 4/6<br>12/26 | -- | Sample 23-25 As above. | SM | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 24 | | | | | | | | | | | |
| | | | 26 | | | | | | | | | | | |
| 6 | 12 | 6/7<br>10/11 | 28 | Sample 28-30 As above. | SP | | | | | | | | | |
| | | | 30 | | | | | | | | | | | |
| | | | 32 | | | | | | | | | | | |
| 7 | 0 | 5/5<br>5/5 | | Sample 33-35. No recovery, all blow-up. | -- | | | | | | | | | |
| | | | 34 | | | | | | | | | | | |
| | | | 36 | | | | | | | | | | | |
| 8 | 16 | 8/11<br>13/18 | 38 | Sample 38-40 Lt. brown (10YR7/3) fine to med sand, structureless, damp - loose (outwash). | SP | | | | | | | | | |
| | | | 40 | | | | | | | | | | | |
| | | | 42 | | | | | | | | | | | |
| 9 | 15 | 20/26<br>31/35 | | Sample 43-45 As above. | SP | | | | | | | | | |
| | | | 44 | | | | | | | | | | | |
| | | | 46 | | | | | | | | | | | |
| | | | | 47-50 Drill cobbles and boulders. | | | | | | | | | | |
| | | | 48 | | | | | | | | | | | |
| 10 | 4 | 112f.6 | 50 | Sample 50-52 Brown (7.5YR6/3) sandy gravel with cobbles, structureless, damp, loose (outwash). | GP | | | | | | | | | |
| | | | 52 | | | | | | | | | | | |
| 11 | 5 | 63/<br>100f.1 | | Sample 53-58 Brown (10YR7/3) med-coarse sand with gravel, weak, med blocky structure, damp, sl. firm (outwash). | SP-GP | | | | | | | | | |
| | | | 54 | | | | | | | | | | | |
| | | | 56 | | | | | | | | | | | |
| 12 | 15 | 37/44<br>28/28 | 58 | Sample 58-60 Brown (7.5YR5/5) med.-coarse sand with gravel and silt, damp, weak, fine blocky structure, sl. firm, oxidized, weak lamination (outwash). | SP | | | | | | | | | |
| | | | 60 | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-04

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 62 | | | | | | | | | | | |
| 13 | 24 | 20/30<br>23/61 | 64 | Sample 63-65 Brown (7.5YR6/4) silty sand with gravel and clay, massive, damp, very firm, oxidized, mottled, weak lamination (till). | SM-SP | | | | | | | | | |
| | | | 66 | | | | | | | | | | | |
| 14 | 23 | 22/29<br>31/39 | 68 | Sample 68-70 As above. | SM | | | | | | | | | |
| | | | 70 | | | | | | | | | | | |
| | | | 72 | | | | | | | | | | | |
| 15 | 14 | 26/36<br>72 | 74 | Sample 73-75 Red brown (5YR5/4) silty sand with gravel, weak, med. blocky structure, v. damp, firm (till). | SM | | | | | | | | | |
| | | | 76 | | | | | | | | | | | |
| 16 | 12 | 35/65 | 78 | Sample 78-80 As above. | SM | | | | | | | | | |
| | | | 80 | | | | | | | | | | | |
| | | | 82 | | | | | | | | | | | |
| 17 | 21 | 23/31<br>42/68 | 84 | Sample 83-85 As above to 83.3.<br>83.3-85 Brown (7.5YR5/8) med-coarse sand with gravel, weak, med platy structure, damp, loose, oxidized with layers of silty fine sand (outwash). | SM-SP | | | | | | | | | |
| | | | 86 | | | | | | | | | | | |
| 18 | 4 | 100f.5 | 88 | Sample 88-90 As above. | SM-SP | | | | | | | | | |
| | | | 90 | | | | | | | | | | | |
| | | | 92 | | | | | | | | | | | |
| 19 | 20 | 13/23<br>38/36 | 94 | Sample 93-95 As above to 93.5.<br>93.5-95 Brown (7.5YR5/6) fine med sand with minor silt, structureless, damp to wet, loose silt lense 93.8-94.2 (outwash). | SP<br>ML | | | | | | | | | |
| | | | 96 | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-04

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20 | 20 | 12/22<br>26/29 | -- 98<br>-- 100<br>-- 102 | Sample 98-100 Red brown (5YR5/5) silty sand with gravel, massive, damp, sl. firm (till). | SM | | | | | | | | | |
| 21 | 20 | 9/12<br>26/27 | -- 104<br>-- 106 | Sample 103-105 As above.<br>Wet with fine sand layer 103.5-104.5. | SM/<br>SP | | | | | | | | | |
| 22 | 10 | 23/63 | -- 108<br>-- 110<br>-- 112<br>-- 114<br>-- 116<br>-- 118<br>-- 120<br>-- 122<br>-- 124<br>-- 126<br>-- 128<br>-- 130<br>-- 132 | Sample 108-110 Brown (7.5Y5/6) fine-med sand with silt, structureless, wet loose, oxidized (outwash).<br>E.O.B. @ 113'. | SP | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Monitoring Well Installation | | CMC-SB-05 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling<br>Dan Tinnancour | 03/02/94<br>MM/DD/YY | 03/02/94<br>MM/DD/YY | 6" Air Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | Dry | 1656.9' MSL | 5-7/8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 111541.2 N, 2283490. E S/C/N<br>SE 1/4 of SW 1/4 of Section 32, T 35 N, R 13 E | Lat<br>Long<br>Feet ___ N S Feet ___ E W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2 | | | | | | | | | | | |
| | | | 4 | Boulder. | | | | | | | | | | |
| | | | | E.O.B. @ 4.5'. | | | | | | | | | | |
| | | | 6 | Abandon 4 bags H.P. | | | | | | | | | | |
| | | | 8 | | | | | | | | | | | |
| | | | 10 | | | | | | | | | | | |
| | | | 12 | | | | | | | | | | | |
| | | | 14 | | | | | | | | | | | |
| | | | 16 | | | | | | | | | | | |
| | | | 18 | | | | | | | | | | | |
| | | | 20 | | | | | | | | | | | |
| | | | 22 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources

# WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Form 3300-5W 11-89

abandonment work shall be performed in accordance with the provisions of Chapters NR 111, NR 112 or NR 141, Wis. Adm. Code, whichever is applicable. Also, see instructions on back.

## GENERAL INFORMATION

(2) FACILITY NAME

Well/Drillhole/Borehole Location

County: Forest

Original Well Owner (If Known): Crandon Mining Company

SE 1/4 of SW 1/4 of Sec. 32 ; T. 35 N; R. 13 [X] E [ ] W

Present Well Owner: Crandon Mining Company

(If applicable) Gov't Lot _____ Grid Number _____

Street or Route: 7 North Brown Street, 3rd Floor

Grid Location _____ ft. [ ] N. [ ] S., _____ ft. [ ] E. [ ] W.

City, State, Zip Code: Rhinelander, WI 54501-3161

Civil Town Name: Lincoln

Facility Well No. and/or Name (If Applicable): CMC-SB-05

WI Unique Well No.: _ _ _ _ _ _

Street Address of Well: NA

Reason For Abandonment: Drill refusal

City, Village: NA

Date of Abandonment: 03/02/94

## WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drillhole/Borehole Construction Completed On

(Date) 03/02/94

[ ] Monitoring Well
[ ] Water Well
[ ] Drillhole
[X] Borehole

Construction Report Available? [ ] Yes [ ] No

Construction Type:
[X] Drilled [ ] Driven (Sandpoint) [ ] Dug
[ ] Other (Specify) _____

Formation Type:
[X] Unconsolidated Formation [ ] Bedrock

Total Well Depth (ft.) 4.5 Casing Diameter (ins.) NA
(From groundsurface)

Casing Depth (ft.) NA

Was Well Annular Space Grouted? [ ] Yes [ ] No [ ] Unknown
If Yes, To What Depth? _____ Feet

(4) Depth to Water (Feet) NA

| | | | |
|---|---|---|---|
| Pump & Piping Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Liner(s) Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Screen Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Casing Left in Place? | [ ] Yes | [X] No | |

If No, Explain _____

| | | |
|---|---|---|
| Was Casing Cut Off Below Surface? | [ ] Yes | [ ] No |
| Did Sealing Material Rise to Surface? | [X] Yes | [ ] No |
| Did Material Settle After 24 Hours? | [ ] Yes | [X] No |
| If Yes, Was Hole Retopped? | [ ] Yes | [X] No |

(5) Required Method of Placing Sealing Material
[X] Conductor Pipe-Gravity [ ] Conductor Pipe-Pumped
[ ] Dump Bailer [ ] Other (Explain)

(6) Sealing Materials
[ ] Neat Cement Grout
[ ] Sand-Cement (Concrete) Grout
[ ] Concrete
[ ] Clay-Sand Slurry
[ ] Bentonite-Sand Slurry
[X] Chipped Bentonite

For monitoring wells and monitoring well boreholes only
[ ] Bentonite Pellets
[ ] Granular Bentonite
[ ] Bentonite - Cement Grout

| (7) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks Sealmt or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| 3/8" chipped bentonite | Surface | 4.5 | 4 bags | |
| | | | | |
| | | | | |
| | | | | |

(8) Comments: _____

(9) Name of Person or Firm Doing Sealing Work
WTD Environmental Drilling

Signature of Person Doing Work: [signature] Date Signed: 7-13-94

Street or Route: 101 Alderson Box 89 Telephone Number: (715) 359-7090

(10) FOR DNR OR COUNTY USE ONLY

Date Received/Inspected: _____ District/County: _____

Reviewer/Inspector: _____

Follow-up Necessary: _____

## REASONS FOR WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Wis. Adm. Code (NR 111, NR 112, & NR 141) requires well owners to permanently abandon unused wells/drillholes/boreholes on their property. The reasons for this requirement are:

- To prevent contamination from entering the well/drillhole/borehole at the surface or through corroded well casings and moving downward to an aquifer used by other wells, and
- To prevent vertical movement of water between different geologic formations of differing water quality.

Most licensed well drillers and pump installers have the equipment, knowledge and experience needed to permanently abandon wells/drillholes/boreholes. We recommend that these licensed contractors be hired to do this work.

## PROCEDURE

1. Remove any pump, pump piping, debris or other obstacles that could interfere with the sealing operation. In most situations the well casing should be left in place. When the casing is removed it should be pulled during the abandonment process so the drillhole does not collapse.

2. The sealing material must be placed with a conductor (tremie) pipe either by pumping or by gravity, (except when approved chipped bentonite is used according to written department instructions and restrictions).

3. The bottom end of the conductor pipe must initially reach the bottom of the well and must be kept submerged in the sealing material as it is placed.

4. Unconsolidated formation wells should be sealed with the materials listed in item (6) on the form. When clay or sodium benonite slurry is used to fill wells, the top 20 feet must be sealed with neat cement grout, concrete grout, concrete, or bentonite chips. Bedrock formation wells should be filled with neat cement grout, concrete grout, concrete or bentonite. chips. Monitoring wells must be filled with the materials specified by NR 141, Wis. Adm. Code.

5. Fill the entire well column from the bottom to the top with the required sealing material.

6. When using concrete or cement grout, any standing water in the hole will be forced out by the concrete or cement grout (it is more dense) resulting in an entire column of cement to seal the well. The sealing material must flow at the surface with the same consistency as it is being pumped in.

7. The casing may be cut off several feet below the ground surface.

8. To abandon flowing wells, the flow must be stopped or greatly reduced. This can be accomplished by extending the well casing to an elevation higher than the artesian head, or inserting a seal or packer in the casing. Once the flow has been stopped or reduced, the well can be abandoned the same as other wells.

9. For a municipal well, information regarding drillhole diameter and depths and geologic formations should be submitted on a separate sheet.

0. For use of alternative methods and materials, especially for deep, multi-formation wells contact DNR.

## TEMPORARY ABANDONMENT

- A well may be temporarily abandoned if it is planned to place the well back in service within a time specified by administrative rule.
- Temporary abandonment is accomplished by threading or welding a watertight cover to the casing or by filling the well with a clean clay slurry and then placing a cover over the well.
- If the well is not placed back into service, it should be permanently abandoned unless a written extension is granted by DNR.

## REPORT TO DNR

The Well/Drillhole/Borehole Abandonment Form 3300-5W, on the front, must be completed by the owner (or agent) and submitted to the appropriate DNR district office or delegated county office within 30 days.

**This form is authorized by chapters 144, 147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10.00 nor more than $5,000.00 for each violation. Fined not less than $10.00 or more than $100.00 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss. 144.99 and 162.06, Wis. Stats.**

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Monitoring Well Installation | | CMC-05 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling<br>Dan Tinnancour | 03/02/94<br>MM/DD/YY | 03/10/94<br>MM/DD/YY | 6" Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | 66.3' MSL | 1656.9' MSL | 5-7/8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 111541.2 N, 2283490. E S/C/N<br>SE 1/4 of SW 1/4 of Section 32, T 35 N, R 13 E | Lat<br>Long<br>Feet ___ N S Feet ___ E W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | 0-.5 Dk brown (7.5YR2/2) organic topsoil, frozen, weak, fine blocky structure. | OL | | | | | | | | | |
| | | | -- 2 | .5- Brown (7.5YR7/3) fine-med sand with gravel, cobbles, boulders, frozen to 1.2', structureless, wet, loose (till). | SP | | | | | | | | | |
| | | | -- 4 | | | | | | | | | | | |
| 1 | 14 | 11/13<br>6/7 | -- 6 | Sample 6-8 As above with minor silt. | SP | | | | | | | | | |
| | | | -- 8 | | | | | | | | | | | |
| | | | -- 10 | | | | | | | | | | | |
| 2 | 12 | 4/6<br>6/8 | -- | Sample 11-13 As above. | SP | | | | | | | | | |
| | | | -- 12 | | | | | | | | | | | |
| | | | -- 14 | | | | | | | | | | | |
| | | | -- | Boulder 14.5. | | | | | | | | | | |
| 3 | 5 | 21/21<br>26/35 | -- 16 | Sample 16-18 Brown (10YR7/4) fine-med. sand with gravel, structureless, damp, loose (outwash). | | | | | | | | | | |
| | | | -- 18 | | | | | | | | | | | |
| | | | -- 20 | | | | | | | | | | | |
| 4 | 11 | 18/32<br>21/5 | -- | Sample 21-23 As above. | SP | | | | | | | | | |
| | | | -- 22 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Eric Hass

Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 24 | | | | | | | | | | | |
| 5 | 6 | 11/50 f.3 | 26 | Sample 26-28 As above. | SP | | | | | | | | | |
| | | | 28 | | | | | | | | | | | |
| | | | 30 | | | | | | | | | | | |
| 6 | 2 | 50f.4 | | Sample 31-33 As above. | SP | | | | | | | | | |
| | | | 32 | | | | | | | | | | | |
| | | | 34 | | | | | | | | | | | |
| 7 | 4 | 50f.3 | 36 | Sample 36-38 Brown (10YR7/3) fine sand, structureless, dry, loose (outwash). | SP | | | | | | | | | |
| | | | 38 | | | | | | | | | | | |
| | | | 40 | | | | | | | | | | | |
| 8 | 16 | 32/36 50f.4 | 42 | Sample 41-43 Brown (7.5YR5/4) silty sand with gravel, weak, med. blocky structure, damp, sl. firm (till). | SP-SM | | | | | | | | | |
| | | | 44 | | | | | | | | | | | |
| 9 | 4 | 50f.4 | 46 | Sample 46-48 Red brown (5YR5/4) silty sand with gravel, weak, med blocky structure, damp, sl. firm (till). | SM | | | | | | | | | |
| | | | 48 | | | | | | | | | | | |
| | | | 50 | | | | | | | | | | | |
| 10 | 8 | 46/50 f.4 | | Sample 51-53 As above. | SM | | | | | | | | | |
| | | | 52 | | | | | | | | | | | |
| | | | 54 | | | | | | | | | | | |
| 11 | 3 | 50 f.3 | 56 | Sample 56-58 As above. | SM | | | | | | | | | |
| | | | 58 | | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-05

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 | 8 | 50/50 f.2 | -- 62 | Sample 61-63 Brown (2.5YR5/8) med. sand with gravel, structureless, wet, loose, oxidized (outwash). | SP | | | | | | | | | |
| | | | -- 64 | | | | | | | | | | | |
| 13 | 8 | 68/50 f.2 | -- 66 | Sample 66-68 Red brown (5YR5/4) silty sand with gravel, weak med. blocky structure, damp to wet, firm (till). | SM | | | | | | | | | |
| | | | -- 68 | | | | | | | | | | | |
| | | | -- | Boulder 69-72.5. | SM | | | | | | | | | |
| | | | -- 70 | | | | | | | | | | | |
| | | | -- 72 | | | | | | | | | | | |
| 14 | 16 | __/68 76/50 f.2 | -- 74 | Sample 73-75 As above, wet, sl. firm. | SM | | | | | | | | | |
| | | | -- 76 | | | | | | | | | | | |
| | | | -- 78 | | | | | | | | | | | |
| | | | -- | E.O.B. @ 79'. | | | | | | | | | | |
| | | | -- 80 | | | | | | | | | | | |
| | | | -- 82 | | | | | | | | | | | |
| | | | -- 84 | | | | | | | | | | | |
| | | | -- 86 | | | | | | | | | | | |
| | | | -- 88 | | | | | | | | | | | |
| | | | -- 90 | | | | | | | | | | | |
| | | | -- 92 | | | | | | | | | | | |
| | | | -- 94 | | | | | | | | | | | |
| | | | -- 96 | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Monitoring Well Installation | | CMC-06P |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling<br>Chuck Blunt | 03/03/94<br>MM/DD/YY | 03/10/94<br>MM/DD/YY | 8" Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | 75.6' MSL | 1666.5' MSL | 7-7/8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 112380.3 N, 2283011.5 E S/C/N Lat<br>SE 1/4 of SW 1/4 of Section 32, T 35 N, R 13 E Long | Feet ___ N / S ___ Feet ___ E / W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | 0-1 Dk brown (7.5YR2/1) organic top-soil, frozen, weak, fine blocky structure. | OL | | | | | | | | | |
| | | | -- 2 | 1-19 Brown (7.5YR4/4) silty gravelly sand with cobbles and boulders, w., med. blocky structure, damp, loose (till). | SP | | | | | | | | | |
| | | | -- 4 | | | | | | | | | | | |
| 1 | 12 | 3/3<br>6/6 | -- | Sample 5-7 As above. | SP | | | | | | | | | |
| | | | -- 6 | | | | | | | | | | | |
| | | | -- 8 | | | | | | | | | | | |
| | | | -- 10 | Boulder 16". | | | | | | | | | | |
| 2 | 17 | 4/4<br>8/10 | -- | Sample 11-13 As above, less gravel. | SP | | | | | | | | | |
| | | | -- 12 | | | | | | | | | | | |
| | | | -- 14 | | | | | | | | | | | |
| 3 | 15 | 13/12<br>14/20 | -- | Sample 15-17 As above. | SP | | | | | | | | | |
| | | | -- 16 | | | | | | | | | | | |
| | | | -- 18 | | | | | | | | | | | |
| 4 | 12 | 10/20<br>18/25 | -- 20 | Sample 20-22 Brown (10YR7/4) fine-med. sand with gravel, damp, soft, loose, weak lamination (outwash). | SP | | | | | | | | | |
| | | | -- 22 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature] Firm Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- 24 | | | | | | | | | | | |
| 5 | 15 | 12/30<br>35/34 | -- 26 | Sample 25-27 As above. | SP | | | | | | | | | |
| 6 | 12 | 18/21<br>19/24 | -- 30<br>-- 32<br>-- 34 | Sample 30-32 As above. | SP | | | | | | | | | |
| 7 | 13 | 29/50<br>50/48 | -- 36<br>-- 38 | Sample 35-37 Brown (7.5YR5/4) fine-med. sand with gravel, structureless, damp, loose (outwash). | SP | | | | | | | | | |
| 8 | 12 | 25/45<br>50/48 | -- 40<br>-- 42<br>-- 44 | Sample 40-42 Brown (7.5YR4/4) silty sand with gravel, weak, fine, blocky structure, damp, firm (till). | SM | | | | | | | | | |
| 9 | 8 | 75/20<br>f.3 | -- 46<br>-- 48 | Sample 45-47 As above. | | | | | | | | | | |
| 10 | 15 | 40/50<br>55f.4 | -- 50<br>-- 52<br>-- 54 | Sample 50-52 Brown (7.5YR5/4) silty sand with gravel, weak med. blocky structure, damp, sl. firm, sl. oxidized (till). | SM | | | | | | | | | |
| 11 | 2 | 30/48<br>48/50 | -- 56<br>-- 58 | Sample 55-57 As above, rock in shoe. | SM | | | | | | | | | |
| 12 | 0 | 30/40<br>50f.1 | -- 60 | Sample 60-62 No recovery. | -- | | | | | | | | | |

| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 13 | 9 | 13/30<br>50/47 | 62 | Sample 62-64 As above. | SM | | | | | | | | | |
| | | | 64 | | | | | | | | | | | |
| 14 | 7 | 20/28<br>43/47 | | Sample 65-67 As above. | SM | | | | | | | | | |
| | | | 66 | | | | | | | | | | | |
| | | | 68 | | | | | | | | | | | |
| 15 | 0 | 30/30<br>40/50 | 70 | Sample 70-72 No recovery - rock in shoe. | -- | | | | | | | | | |
| 16 | 4 | 20/44<br>50f.3 | 72 | Sample 72-74 As above. | SM | | | | | | | | | |
| 17 | 0 | 50f.0 | 74 | Sample 74-76 No recovery. | -- | | | | | | | | | |
| | | | | Drill boulders 75-80. | | | | | | | | | | |
| | | | 76 | | | | | | | | | | | |
| | | | 78 | | | | | | | | | | | |
| 18 | 18 | 21/31<br>35/41 | 80 | 80-82 Brown (7.5YR5/4) silty sand with gravel, mod. med. blocky structure, damp, sl. firm, oxidized (till). | SM | | | | | | | | | |
| | | | 82 | | | | | | | | | | | |
| | | | 84 | | | | | | | | | | | |
| 19 | 12 | 34/38<br>50f.0 | | Sample 85-87 Red brown (5YR5/4) silty sand with gravel, mod. med. blocky | SM | | | | | | | | | |
| | | | 86 | structure, wet, sl. firm (till). | | | | | | | | | | |
| | | | 88 | | | | | | | | | | | |
| 15 | 13 | 24/42<br>49/50 | 90 | Sample 90-92 As above, wet. | SM | | | | | | | | | |
| | | | 92 | | | | | | | | | | | |
| | | | 94 | | | | | | | | | | | |
| 16 | 18 | 44/50<br>50/50 | | Sample 95-97 As above. | SM | | | | | | | | | |
| | | | 96 | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-06P

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 98 | | | | | | | | | | | |
| 17 | 12 | 24/50 f.5 | 100 | Sample 100-102 As above. | SM | | | | | | | | | |
| | | | 102 | | | | | | | | | | | |
| | | | 104 | | | | | | | | | | | |
| 18 | 14 | 20/36 47/50 | 106 | Sample 105-107 As above, sl. less gravel. | SM | | | | | | | | | |
| | | | 108 | | | | | | | | | | | |
| 19 | 12 | 15/45 50f.4 | 110 | Sample 110-112 Red brown (5YR5/4) silty sand with gravel, weak med. blocky structure, damp-wet, firm (till). | SM | | | | | | | | | |
| | | | 112 | | | | | | | | | | | |
| | | | 114 | | | | | | | | | | | |
| 20 | 11 | 42/50 f.4 | 116 | Sample 115-117 As above. | SM | | | | | | | | | |
| | | | 118 | | | | | | | | | | | |
| 21 | 17 | 33/43 48/50 | 120 | Sample 120-122 As above. | SM | | | | | | | | | |
| | | | 122 | | | | | | | | | | | |
| | | | 124 | | | | | | | | | | | |
| 22 | 8 | 25/45 50 | 126 | Sample 125-127 As above. | SM | | | | | | | | | |
| | | | 128 | | | | | | | | | | | |
| 23 | 10 | 32/58 | 130 | Sample 130-132 As above. | SM | | | | | | | | | |
| | | | 132 | | | | | | | | | | | |

| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 134 | | | | | | | | | | | |
| 24 | 10 | 47/50 | | Sample 135-137 As above. | SM | | | | | | | | | |
| | | | 136 | | | | | | | | | | | |
| | | | 138 | | | | | | | | | | | |
| 25 | 16 | 21/34 50 | 140 | Sample 140-142 Brown (7.5YR5/8) med.-coarse sand, structureless, wet, loose, oxidized (outwash). | SP | | | | | | | | | |
| | | | 142 | | | | | | | | | | | |
| | | | 144 | | | | | | | | | | | |
| 26 | 3 | 49/50 | | Sample 145-147 As above. | SP | | | | | | | | | |
| | | | 146 | | | | | | | | | | | |
| | | | 148 | | | | | | | | | | | |
| 27 | 10 | 47/50 | 150 | Sample 150-152 As above. | SP | | | | | | | | | |
| | | | 152 | E.O.B. @ 152'. | | | | | | | | | | |
| | | | 154 | | | | | | | | | | | |
| | | | 156 | | | | | | | | | | | |
| | | | 158 | | | | | | | | | | | |
| | | | 160 | | | | | | | | | | | |
| | | | 162 | | | | | | | | | | | |
| | | | 164 | | | | | | | | | | | |
| | | | 166 | | | | | | | | | | | |
| | | | 168 | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Monitoring Well Installation | | CMC-07 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling<br>Chuck Blunt | 03/25/94<br>MM/DD/YY | 03/28/94<br>MM/DD/YY | 6" Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | 34.5' MSL | 1626.9' MSL | 5-7/8" |

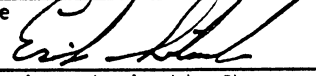
Boring Location
State Plane 114389.2 N, 2282896.0 E S/C/N Lat
SW 1/4 of nw 1/4 of Section 32, T 35 N, R 13 E Long

Local Grid Location (if applicable)
___ Feet ___ N ___ S ___ Feet ___ E ___ W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0 | 0-1.2 Dk brown (7.5YR3/2) organic topsoil, weak, fine blocky structure, frozen. | OL | | | | | | | | | |
| | | | 2 | | | | | | | | | | | |
| | | | 4 | | | | | | | | | | | |
| 1 | 1 | 18/24<br>20/31 | | Sample 5-7 Brown (7.5YR4/4) silty sand with gravel, weak med. blocky structure, damp, sl. firm (till). | SM | | | | | | | | | |
| | | | 6 | | | | | | | | | | | |
| | | | 8 | | | | | | | | | | | |
| | | | 10 | | | | | | | | | | | |
| 2 | 16 | 15/15<br>20/20 | | Sample 11-13 As above. | SM | | | | | | | | | |
| | | | 12 | | | | | | | | | | | |
| | | | 14 | | | | | | | | | | | |
| 3 | 8 | 20/16 | | Sample 15-17 As above. | SM | | | | | | | | | |
| | | | 16 | | | | | | | | | | | |
| | | | 18 | | | | | | | | | | | |
| 4 | 20 | 35/45<br>45/41 | 20 | Sample 20-22 Brown (7.5YR5/5) med. sand with gravel, minor silt, structureless, damp, loose (till). | SP | | | | | | | | | |
| | | | 22 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature  Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-07

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 24 | | | | | | | | | | | |
| 5 | 4 | 57<br>f.5 | 26 | Sample 25-27 Brown (7.5YR5/4) silty sand with gravel, massive, wet, sl. firm (till). | SM | | | | | | | | | |
| | | | 28 | | | | | | | | | | | |
| 6 | 1 | 28/20<br>21/26 | 30 | Sample 30-32 As above. | SM | | | | | | | | | |
| | | | 32 | | | | | | | | | | | |
| | | | 34 | | | | | | | | | | | |
| 7 | 20 | 21/30<br>35/50 | 36 | Sample 35-37 Brown (7.5YR4/4) silty sand with gravel, massive, damp, slightly firm (more sand 35-36, wet) (till). | SM | | | | | | | | | |
| | | | 38 | | | | | | | | | | | |
| 8 | 21 | 12/18<br>12/12 | 40 | Sample 40-42 Red brown (5YR5/6) fine-med sand, minor silt and gravel with coarse sand lense. | SP | | | | | | | | | |
| | | | 42 | 40.8-41.3 Structureless, wet, loose (outwash). | | | | | | | | | | |
| | | | 44 | | | | | | | | | | | |
| 9 | 22 | 25/25<br>21/30 | 46 | Sample 45-47 As above, fine sand with silt, wet. | SP | | | | | | | | | |
| | | | 48 | | | | | | | | | | | |
| 10 | 16 | 20/49<br>50 | 50 | Sample 50-52 As above, more silt. | SM | | | | | | | | | |
| | | | | E.O.B. @ 50'. | | | | | | | | | | |
| | | | 52 | | | | | | | | | | | |
| | | | 54 | | | | | | | | | | | |
| | | | 56 | | | | | | | | | | | |
| | | | 58 | | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

Route to:
Solid Waste
Emergency Response
Wastewater
Haz. Waste
Underground Tanks
Water Resources
Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Monitoring Well Installation | | CMC-SB-08A |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling<br>Dan Tinnancour | 02/24/94<br>MM/DD/YY | 02/24/94<br>MM/DD/YY | 4.25" ID<br>Hollow-Stem Auger |

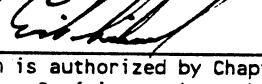
| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | Dry | 1662.5' MSL | 8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 117115.9 N, 2278213.6 E S/C/N<br>SE 1/4 of SW 1/4 of Section 30, T 35 N, R 13 E | Lat<br>Long<br>Feet ___ N S Feet ___ E W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | 0-.3 Dk brown (7.5YR2/1) organic top-soil, weak, fine blocky structure, frozen. | OL | | | | | | | | | |
| | | | -- 2 | .3-2.5 Brown (7.5YR4/4) silty clay with sand and gravel, mod. med. blocky structure, damp, soft. | CL-ML | | | | | | | | | |
| | | | -- 4 | 2.5- Brown (7/5YR5/4) silty sand with gravel clay, mod. med. blocky structure, damp, soft, weakly oxidized (till). | SM-ML | | | | | | | | | |
| 1 | 20 | 6/6<br>6/7 | -- 6 | Sample 5-7. As above. | | | | | | | | | | |
| | | | -- 8 | | | | | | | | | | | |
| | | | -- | Boulder 9-10 | | | | | | | | | | |
| 2 | 7 | 9/50<br>f.2 | -- 10 | Sample 10-12 As above, less silt & clay. Boulder 10.8-11. | SM-SP | | | | | | | | | |
| | | | -- 12 | Boulder 11.5-13. | | | | | | | | | | |
| 3 | | | -- 14 | Boulder 14+. Augers walk and bend - can't get rod down. | | | | | | | | | | |
| | | | -- 16 | E.O.B. @ 15'. | | | | | | | | | | |
| | | | -- 18 | Abandon 6 - 50-lb bags holeplug. Redrill CMC-SB-08B. | | | | | | | | | | |
| | | | -- 20 | | | | | | | | | | | |
| | | | -- 22 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature  Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources

# WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Form 3300-5W 11-89

All abandonment work shall be performed in accordance with the provisions of Chapters NR 111, NR 112 or NR 141, Wis. Admin. Code, whichever is applicable. Also, see instructions on back.

## (1) GENERAL INFORMATION

Well/Drillhole/Borehole Location

County: Forest

SE 1/4 of SW 1/4 of Sec. 30; T. 35 N; R. 13 [X] E [ ] W

(If applicable) _____ Gov't Lot _____ Grid Number

Grid Location _____ ft. [ ] N. [ ] S., _____ ft. [ ] E. [ ] W.

Civil Town Name: Lincoln

Street Address of Well: NA

City, Village: NA

## (2) FACILITY NAME

Original Well Owner (If Known): Crandon Mining Company

Present Well Owner: Crandon Mining Company

Street or Route: 7 North Brown Street, 3rd Floor

City, State, Zip Code: Rhinelander, WI 54501-3161

Facility Well No. and/or Name (If Applicable): CMC-SB-08A

WI Unique Well No.: _ _ _ _ _ _

Reason For Abandonment: Drill refusal

Date of Abandonment: 02/24/94

## WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drillhole/Borehole Construction Completed On

(Date) 02/24/94

[ ] Monitoring Well
[ ] Water Well
[ ] Drillhole
[X] Borehole

Construction Report Available? [ ] Yes [ ] No

Construction Type:
[X] Drilled [ ] Driven (Sandpoint) [ ] Dug
[ ] Other (Specify) _____

Formation Type:
[X] Unconsolidated Formation [ ] Bedrock

Total Well Depth (ft.) 15 (From groundsurface)

Casing Diameter (ins.) NA

Casing Depth (ft.) NA

Was Well Annular Space Grouted? [ ] Yes [X] No [ ] Unknown

If Yes, To What Depth? _____ Feet

(4) Depth to Water (Feet) _____

| | | | |
|---|---|---|---|
| Pump & Piping Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Liner(s) Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Screen Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Casing Left in Place? | [ ] Yes | [X] No | |

If No, Explain _____

| | | |
|---|---|---|
| Was Casing Cut Off Below Surface? | [ ] Yes | [ ] No |
| Did Sealing Material Rise to Surface? | [ ] Yes | [X] No |
| Did Material Settle After 24 Hours? | [ ] Yes | [X] No |
| If Yes, Was Hole Retopped? | [ ] Yes | [X] No |

(5) Required Method of Placing Sealing Material
[X] Conductor Pipe-Gravity [ ] Conductor Pipe-Pumped
[ ] Dump Bailer [ ] Other (Explain)

(6) Sealing Materials
[ ] Neat Cement Grout
[ ] Sand-Cement (Concrete) Grout
[ ] Concrete
[ ] Clay-Sand Slurry
[ ] Bentonite-Sand Slurry
[X] Chipped Bentonite

For monitoring wells and monitoring well boreholes only
[ ] Bentonite Pellets
[ ] Granular Bentonite
[ ] Bentonite - Cement Grout

| (7) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks Sealant or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| 3/8" chipped bentonite | Surface | 15 | 6 bags | |
| | | | | |
| | | | | |
| | | | | |

(8) Comments: _____

(9) Name of Person or Firm Doing Sealing Work
WTD Environmental Drilling

Signature of Person Doing Work: [signature] Date Signed: 7-13-94

Street or Route: 101 Alderson Box 89 Telephone Number: (715) 359-7090

(10) FOR DNR OR COUNTY USE ONLY

Date Received/Inspected: _____ District/County: _____

Reviewer/Inspector: _____

Follow-up Necessary: _____

3.5-12-69

## REASONS FOR WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Wis. Adm. Code (NR 111, NR 112, & NR 141) requires well owners to permanently abandon unused wells/drillholes/boreholes on their property. The reasons for this requirement are:

- To prevent contamination from entering the well/drillhole/borehole at the surface or through corroded well casings and moving downward to an aquifer used by other wells, and
- To prevent vertical movement of water between different geologic formations of differing water quality.

Most licensed well drillers and pump installers have the equipment, knowledge and experience needed to permanently abandon wells/drillholes/boreholes. We recommend that these licensed contractors be hired to do this work.

## PROCEDURE

1. Remove any pump, pump piping, debris or other obstacles that could interfere with the sealing operation. In most situations the well casing should be left in place. When the casing is removed it should be pulled during the abandonment process so the drillhole does not collapse.
2. The sealing material must be placed with a conductor (tremie) pipe either by pumping or by gravity, (except when approved chipped bentonite is used according to written department instructions and restrictions).
3. The bottom end of the conductor pipe must initially reach the bottom of the well and must be kept submerged in the sealing material as it is placed.
4. Unconsolidated formation wells should be sealed with the materials listed in item (6) on the form. When clay or sodium benonite slurry is used to fill wells, the top 20 feet must be sealed with neat cement grout, concrete grout, concrete, or bentonite chips. Bedrock formation wells should be filled with neat cement grout, concrete grout, concrete or bentonite. chips. Monitoring wells must be filled with the materials specified by NR 141, Wis. Adm. Code.
5. Fill the entire well column from the bottom to the top with the required sealing material.
6. When using concrete or cement grout, any standing water in the hole will be forced out by the concrete or cement grout (it is more dense) resulting in an entire column of cement to seal the well. The sealing material must flow at the surface with the same consistency as it is being pumped in.
7. The casing may be cut off several feet below the ground surface.
8. To abandon flowing wells, the flow must be stopped or greatly reduced. This can be accomplished by extending the well casing to an elevation higher than the artesian head, or inserting a seal or packer in the casing. Once the flow has been stopped or reduced, the well can be abandoned the same as other wells.
9. For a municipal well, information regarding drillhole diameter and depths and geologic formations should be submitted on a separate sheet.
10. For use of alternative methods and materials, especially for deep, multi-formation wells contact DNR.

## TEMPORARY ABANDONMENT

- A well may be temporarily abandoned if it is planned to place the well back in service within a time specified by administrative rule.
- Temporary abandonment is accomplished by threading or welding a watertight cover to the casing or by filling the well with a clean clay slurry and then placing a cover over the well.
- If the well is not placed back into service, it should be permanently abandoned unless a written extension is granted by DNR.

## REPORT TO DNR

The Well/Drillhole/Borehole Abandonment Form 3300-5W, on the front, must be completed by the owner (or agent) and submitted to the appropriate DNR district office or delegated county office within 30 days.

**This form is authorized by chapters 144, 147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10.00 nor more than $5,000.00 for each violation. Fined not less than $10.00 or more than $100.00 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss. 144.99 and 162.06, Wis. Stats.**

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Monitoring Well Installation | | CMC-SB-08B |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling<br>Dan Tinnancour | 02/24/94<br>MM/DD/YY | 02/24/94<br>MM/DD/YY | 4.25" ID Hollow-Stem True Spin |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | Dry | 1662.5' MSL | 8" |

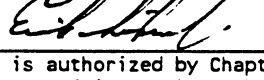
Boring Location
State Plane 117115.9 N, 2278213.6 E S/C/N Lat
SE 1/4 of SW 1/4 of Section 30, T 35 N, R 13 E Long

Local Grid Location (if applicable)
___ Feet ___ N S ___ Feet ___ E W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | 0-15 Blind drill. See CMC-SB-08A log. | | | | | | | | | | |
| | | | -- 2 | | | | | | | | | | | |
| | | | -- 4 | | | | | | | | | | | |
| | | | -- 6 | | | | | | | | | | | |
| | | | -- 8 | | | | | | | | | | | |
| | | | -- 10 | | | | | | | | | | | |
| | | | -- 12 | | | | | | | | | | | |
| | | | -- 14 | | | | | | | | | | | |
| 1 | 20 | 8/9<br>9/11 | -- 16 | Sample 15-17 Brown (7.5YR5/4) silty sand with gravel and clay, weak med. blocky structure, damp, sl. firm (till). | SM-ML | | | | | | | | | |
| | | | -- 18 | | | | | | | | | | | |
| 2 | 0 | 50<br>f.1 | -- 20 | 20+ Boulder cobbley gravelly sand. No recovery, boulder. | SP | | | | | | | | | |
| | | | -- 22 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature  Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 24 | | | | | | | | | | | |
| 3 | 16 | 11/13 | | Sample 25-27 Brown (10YR5/5) gravelly | SP | | | | | | | | | |
| | | 15/17 | | med. -coarse sand, structureless, damp, | | | | | | | | | | |
| | | | 26 | loose (outwash). | | | | | | | | | | |
| | | | | 27+ Cuttings gravel and cobbles. | GP | | | | | | | | | |
| | | | | Boulder at 27. | | | | | | | | | | |
| | | | 28 | | | | | | | | | | | |
| 4 | 18 | 10/10 | 30 | Brown (10YR7/4) fine-med. sand, struc- | SP | | | | | | | | | |
| | | 11/11 | | tureless, damp, loose (outwash). | | | | | | | | | | |
| | | | 32 | Boulder at 32'. | | | | | | | | | | |
| | | | | 10' Truespin auger twisted off in hole. | | | | | | | | | | |
| | | | 34 | | | | | | | | | | | |
| | | | | E.O.B. @ 35'. | | | | | | | | | | |
| | | | 36 | | | | | | | | | | | |
| | | | | Abandon - 14 50-lb bags holeplug. | | | | | | | | | | |
| | | | | Redrill CMC-08. | | | | | | | | | | |
| | | | 38 | | | | | | | | | | | |
| | | | 40 | | | | | | | | | | | |
| | | | 42 | | | | | | | | | | | |
| | | | 44 | | | | | | | | | | | |
| | | | 46 | | | | | | | | | | | |
| | | | 48 | | | | | | | | | | | |
| | | | 50 | | | | | | | | | | | |
| | | | 52 | | | | | | | | | | | |
| | | | 54 | | | | | | | | | | | |
| | | | 56 | | | | | | | | | | | |
| | | | 58 | | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

# WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Form 3300-5W 11-89

All abandonment work shall be performed in accordance with the provisions of Chapters NR 111, NR 112 or NR 141, Wis. Admin. Code, whichever is applicable. Also, see instructions on back.

## (1) GENERAL INFORMATION

Well/Drillhole/Borehole Location

County: Forest

SE 1/4 of SW 1/4 of Sec. 30 ; T. 35 N. R. 13 [X] E [ ] W

(If applicable) _____ Gov't Lot _____ Grid Number

Grid Location _____ ft. [ ] N. [ ] S. _____ ft. [ ] E. [ ] W.

Civil Town Name: Lincoln

Street Address of Well: NA

City, Village: NA

## (2) FACILITY NAME

Original Well Owner (If Known): Crandon Mining Company

Present Well Owner: Crandon Mining Company

Street or Route: 7 North Brown Street, 3rd Floor

City, State, Zip Code: Rhinelander, WI 54501-3161

Facility Well No. and/or Name (If Applicable): CMC-SB-08B

WI Unique Well No.: _ _ _ _ _ _

Reason For Abandonment: Drill refusal

Date of Abandonment: 02/24/94

## WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drillhole/Borehole Construction Completed On

(Date) 02/24/94

[ ] Monitoring Well
[ ] Water Well
[ ] Drillhole
[X] Borehole

Construction Report Available? [ ] Yes [ ] No

Construction Type:
[X] Drilled [ ] Driven (Sandpoint) [ ] Dug
[ ] Other (Specify) _____

Formation Type:
[X] Unconsolidated Formation [ ] Bedrock

Total Well Depth (ft.) 35 Casing Diameter (ins.) NA
(From groundsurface)

Casing Depth (ft.) NA

Was Well Annular Space Grouted? [ ] Yes [ ] No [ ] Unknown
If Yes, To What Depth? _____ Feet

(4) Depth to Water (Feet) NA

| | | | |
|---|---|---|---|
| Pump & Piping Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Liner(s) Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Screen Removed? | [ ] Yes | [ ] No | [X] Not Applicable |
| Casing Left in Place? | [ ] Yes | [X] No | |

If No, Explain _____

| | | |
|---|---|---|
| Was Casing Cut Off Below Surface? | [ ] Yes | [ ] No |
| Did Sealing Material Rise to Surface? | [ ] Yes | [X] No |
| Did Material Settle After 24 Hours? | [ ] Yes | [X] No |
| If Yes, Was Hole Retopped? | [ ] Yes | [X] No |

(5) Required Method of Placing Sealing Material
[X] Conductor Pipe-Gravity [ ] Conductor Pipe-Pumped
[ ] Dump Bailer [ ] Other (Explain)

(6) Sealing Materials
[ ] Neat Cement Grout
[ ] Sand-Cement (Concrete) Grout
[ ] Concrete
[ ] Clay-Sand Slurry
[ ] Bentonite-Sand Slurry
[X] Chipped Bentonite

For monitoring wells and monitoring well boreholes only
[ ] Bentonite Pellets
[ ] Granular Bentonite
[ ] Bentonite - Cement Grout

| (7) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks Sealant or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| 3/8" chipped bentonite | Surface | 28 | 14 bags | |
| | | | | |
| | | | | |
| | | | | |

(8) Comments: _____

(9) Name of Person or Firm Doing Sealing Work
WTD Environmental Drilling

Signature of Person Doing Work: [signature] Date Signed: 7-13-94

Street or Route: 101 Alderson Box 89 Telephone Number: (715) 359-7090

(10) FOR DNR OR COUNTY USE ONLY

Date Received/Inspected: _____ District/County: _____

Reviewer/Inspector: _____

Follow-up Necessary: _____

3.5-12-73

## REASONS FOR WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Wis. Adm. Code (NR 111, NR 112, & NR 141) requires well owners to permanently abandon unused wells/drillholes/boreholes on their property. The reasons for this requirement are:

- To prevent contamination from entering the well/drillhole/borehole at the surface or through corroded well casings and moving downward to an aquifer used by other wells, and
- To prevent vertical movement of water between different geologic formations of differing water quality.

Most licensed well drillers and pump installers have the equipment, knowledge and experience needed to permanently abandon wells/drillholes/boreholes. We recommend that these licensed contractors be hired to do this work.

## PROCEDURE

1. Remove any pump, pump piping, debris or other obstacles that could interfere with the sealing operation. In most situations the well casing should be left in place. When the casing is removed it should be pulled during the abandonment process so the drillhole does not collapse.
2. The sealing material must be placed with a conductor (tremie) pipe either by pumping or by gravity, (except when approved chipped bentonite is used according to written department instructions and restrictions).
3. The bottom end of the conductor pipe must initially reach the bottom of the well and must be kept submerged in the sealing material as it is placed.
4. Unconsolidated formation wells should be sealed with the materials listed in item (6) on the form. When clay or sodium benonite slurry is used to fill wells, the top 20 feet must be sealed with neat cement grout, concrete grout, concrete, or bentonite chips. Bedrock formation wells should be filled with neat cement grout, concrete grout, concrete or bentonite. chips. Monitoring wells must be filled with the materials specified by NR 141, Wis. Adm. Code.
5. Fill the entire well column from the bottom to the top with the required sealing material.
6. When using concrete or cement grout, any standing water in the hole will be forced out by the concrete or cement grout (it is more dense) resulting in an entire column of cement to seal the well. The sealing material must flow at the surface with the same consistency as it is being pumped in.
7. The casing may be cut off several feet below the ground surface.
8. To abandon flowing wells, the flow must be stopped or greatly reduced. This can be accomplished by extending the well casing to an elevation higher than the artesian head, or inserting a seal or packer in the casing. Once the flow has been stopped or reduced, the well can be abandoned the same as other wells.
9. For a municipal well, information regarding drillhole diameter and depths and geologic formations should be submitted on a separate sheet.
10. For use of alternative methods and materials, especially for deep, multi-formation wells contact DNR.

## TEMPORARY ABANDONMENT

- A well may be temporarily abandoned if it is planned to place the well back in service within a time specified by administrative rule.
- Temporary abandonment is accomplished by threading or welding a watertight cover to the casing or by filling the well with a clean clay slurry and then placing a cover over the well.
- If the well is not placed back into service, it should be permanently abandoned unless a written extension is granted by DNR.

## REPORT TO DNR

The Well/Drillhole/Borehole Abandonment Form 3300-5W, on the front, must be completed by the owner (or agent) and submitted to the appropriate DNR district office or delegated county office within 30 days.

**This form is authorized by chapters 144, 147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10.00 nor more than $5,000.00 for each violation. Fined not less than $10.00 or more than $100.00 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss. 144.99 and 162.06, Wis. Stats.**

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Monitoring Well Installation | | CMC-08 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling<br>Dan Tinnancour | 02/25/94<br>MM/DD/YY | 03/01/94<br>MM/DD/YY | 8" Air Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | 76.9' MSL | 1662.5' MSL | 7-7/8" |

Boring Location
State Plane 117115.9 N, 2278213.6 E S/C/N
SE 1/4 of SW 1/4 of Section 32, T 35 N, R 13 E
Lat
Long

Local Grid Location (if applicable)
Feet ___ N ___ S Feet ___ E ___ W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0 | 0-35 Blind drill. See CMC-SB-08B log. | | | | | | | | | | |
| | | | 2 | | | | | | | | | | | |
| | | | 4 | | | | | | | | | | | |
| | | | 6 | | | | | | | | | | | |
| | | | 8 | | | | | | | | | | | |
| | | | 10 | | | | | | | | | | | |
| | | | 12 | | | | | | | | | | | |
| | | | 14 | | | | | | | | | | | |
| | | | 16 | | | | | | | | | | | |
| | | | 18 | | | | | | | | | | | |
| | | | 20 | 20-30 2'-3' alternating layers of fine med. sand and gravel with cobbles. | | | | | | | | | | |
| | | | 22 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 24 | | | | | | | | | | | |
| | | | 26 | | | | | | | | | | | |
| | | | 28 | | | | | | | | | | | |
| | | | 30 | | | | | | | | | | | |
| | | | 32 | | | | | | | | | | | |
| | | | 34 | | | | | | | | | | | |
| | | | | Boulders 35-40. Sample as soon as through boulder. | | | | | | | | | | |
| | | | 36 | | | | | | | | | | | |
| | | | 38 | | | | | | | | | | | |
| | | | 40 | | | | | | | | | | | |
| 1 | 6 | 30/50 f.4 | 42 | Sample 41-43 Brown (7.5YR7/4) med.-coarse sand with gravel, structureless, damp, loose, locally oxidized, with gravelly sand lenses (outwash). | SP | | | | | | | | | |
| | | | 44 | | | | | | | | | | | |
| 2 | 3 | 50f.3 | 46 | Sample 46-48 Brown (7.5YR5/4) silty sand with gravel, weak, med. blocky structure, damp, firm, oxidized (till). | SM | | | | | | | | | |
| | | | 48 | | | | | | | | | | | |
| | | | 50 | | | | | | | | | | | |
| 3 | 1 | 50f.1 | 52 | Sample 51-53 Blowup, brown fine silty sand with gravel. As above. | SM | | | | | | | | | |
| | | | 54 | | | | | | | | | | | |
| 4 | 5 | 50 f.5 | 56 | Sample 56-58 Brown (7.5YR5/5) med. sand with gravel and silt, structureless, wet, loose (outwash). | SP | | | | | | | | | |
| | | | 58 | | | | | | | | | | | |
| | | | 60 | Boulder 60-61.5. | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-08

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 4 | 22/72 f.5 | 62 | Sample 62-65 Brown (7.5YR4/4) silty sand with gravel, slightly layered, massive, wet, firm (outwash). | SM | | | | | | | | | |
| | | | 64 | | | | | | | | | | | |
| 6 | 8 | 22/50 f.4 | 66 | Sample 66-68. | | | | | | | | | | |
| | | | | 66-66.5 Brown silty sand with gravel. | SP | | | | | | | | | |
| | | | | 66.5-67 Grey (2.5Y7/2) silty sand (laminated), structureless, massive | SM | | | | | | | | | |
| | | | 68 | wet, oxidized, outwash. | | | | | | | | | | |
| | | | 70 | | | | | | | | | | | |
| 7 | | 42/63 75f.3 | 72 | Sample 71-73 Brown (2.5YR5/6) fine sand with gravel, structureless, wet, oxidized, minor silt (outwash). | SP | | | | | | | | | |
| | | | 74 | | | | | | | | | | | |
| | | | | E.O.B. @ 75'. | | | | | | | | | | |
| | | | 76 | | | | | | | | | | | |
| | | | 78 | | | | | | | | | | | |
| | | | 80 | | | | | | | | | | | |
| | | | 82 | | | | | | | | | | | |
| | | | 84 | | | | | | | | | | | |
| | | | 86 | | | | | | | | | | | |
| | | | 88 | | | | | | | | | | | |
| | | | 90 | | | | | | | | | | | |
| | | | 92 | | | | | | | | | | | |
| | | | 94 | | | | | | | | | | | |
| | | | 96 | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Monitoring Well Installation | | CMC-08P |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling<br>Mike Mueller | 04/16/94<br>MM/DD/YY | 04/18/94<br>MM/DD/YY | 6" Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | 69.5' MSL | 1662.5' MSL | 5-7/8' |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 117107.1 N, 2278200.2 E S/C/N Lat<br>SE 1/4 of SW 1/4 of Section 30, T 35 N, R 13 E Long | Feet ___ N / S Feet ___ E / W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | Blind drill to 73'. See CMC-08. | | | | | | | | | | |
| | | | -- 2 | | | | | | | | | | | |
| | | | -- 4 | | | | | | | | | | | |
| | | | -- 6 | | | | | | | | | | | |
| | | | -- 8 | | | | | | | | | | | |
| | | | -- 10 | | | | | | | | | | | |
| | | | -- 12 | | | | | | | | | | | |
| | | | -- 14 | | | | | | | | | | | |
| | | | -- 16 | | | | | | | | | | | |
| | | | -- 18 | | | | | | | | | | | |
| | | | -- 20 | | | | | | | | | | | |
| | | | -- 22 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature] Firm Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-08P

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | Soil Properties: mois cont | Soil Properties: liqu limi | Soil Properties: plas limi | Soil Properties: p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- 24 | | | | | | | | | | | |
| | | | -- 26 | | | | | | | | | | | |
| | | | -- 28 | | | | | | | | | | | |
| | | | -- 30 | | | | | | | | | | | |
| | | | -- 32 | | | | | | | | | | | |
| | | | -- 34 | | | | | | | | | | | |
| | | | -- 36 | | | | | | | | | | | |
| | | | -- 38 | | | | | | | | | | | |
| | | | -- 40 | | | | | | | | | | | |
| | | | -- 42 | | | | | | | | | | | |
| | | | -- 44 | | | | | | | | | | | |
| | | | -- 46 | | | | | | | | | | | |
| | | | -- 48 | | | | | | | | | | | |
| | | | -- 50 | | | | | | | | | | | |
| | | | -- 52 | | | | | | | | | | | |
| | | | -- 54 | | | | | | | | | | | |
| | | | -- 56 | | | | | | | | | | | |
| | | | -- 58 | | | | | | | | | | | |
| | | | -- 60 | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-08P

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 62 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 64 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 66 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 68 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 70 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 72 | | | | | | | | | | | |
| 1 | 14 | 25/32 | -- | Sample 73-75 | | | | | | | | | | |
| | | 50/100 | -- | 73-73.4 Red brown (5YR5/5) silty sand | SP-SM | | | | | | | | | |
| | | | -- | with gravel, weak med. blocky structure, | | | | | | | | | | |
| | | | -- 74 | wet, firm. | | | | | | | | | | |
| 2 | 17 | 26/33 | -- | 73.4- Brown (7.5YR5/5) fine sand with | SP | | | | | | | | | |
| | | 40/43 | -- | silt and gravel, massive, wet, sl. firm. | | | | | | | | | | |
| 3 | 0 | 100 | -- | 75-77 Red brown (5YR5/4) silty fine | SM | | | | | | | | | |
| | | | -- 76 | sand with gravel, massive, wet, firm | | | | | | | | | | |
| | | | -- | (till). | | | | | | | | | | |
| 4 | | | -- | Sample 77-79 No recovery, found rock. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 78 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | Sample 79-81 | | | | | | | | | | |
| | | | -- | 79-79.7 As above. | SM | | | | | | | | | |
| 5 | 20 | 20/41 | -- 80 | 79.7-79.9 Weathered granodiorite base | SM | | | | | | | | | |
| | | 84/85 | -- | of sample, weathered hematite clast | | | | | | | | | | |
| | | | -- | Sample 81-83 As above with weathered | SM | | | | | | | | | |
| | | | -- | sandstone and mafic clast (till). | | | | | | | | | | |
| | | | -- 82 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 6 | 0 | 100 | -- | Sample 83-85 No recovery - pound rock. | -- | | | | | | | | | |
| | | f.3 | -- | | | | | | | | | | | |
| | | | -- 84 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 7 | 0 | 100/.2 | -- | Sample 85-87 No recovery. | -- | | | | | | | | | |
| | | | -- | Boulder 85-86.5. | | | | | | | | | | |
| | | | -- 86 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 8 | 14 | 25/26 | -- | Sample 87-89 Red brown (5YR5/4) silty | SM | | | | | | | | | |
| | | 100f.2 | -- | sand with gravel, massive, wet, firm | | | | | | | | | | |
| | | | -- 88 | (till). | | | | | | | | | | |
| | | | -- | Boulder 88.3-89.1. | | | | | | | | | | |
| 9 | 7 | 23/60 | -- | Sample 89.1-91.1 As above (till). | SM | | | | | | | | | |
| | | f.3 | -- | Boulder (89.9-90.5) granite. | | | | | | | | | | |
| | | | -- 90 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 10 | 16 | 21/23 | -- | Sample 91-93 As above (till). | SM | | | | | | | | | |
| | | 31/56 | -- | | | | | | | | | | | |
| | | | -- 92 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 11 | 20 | 20/17 | -- | Sample 93-95 As above, till, less | SM | | | | | | | | | |
| | | 16/30 | -- | consolidated. | | | | | | | | | | |
| | | | -- 94 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 12 | 13 | 20/22 | -- | Sample 95-97 As above (till). | SM | | | | | | | | | |
| | | 40/58 | -- | | | | | | | | | | | |
| | | | -- 96 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 13 | 1 | 21/24 | -- | Sample 97-99 Rock in shoe. | -- | | | | | | | | | |
| | | 23/39 | -- | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-08P

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- 98 | | | | | | | | | | | |
| 14 | 17 | 13/18<br>20/28 | -- | Sample 99-101 As above. | SM | | | | | | | | | |
| | | | -- 100 | | | | | | | | | | | |
| 15 | 14 | 21/28<br>32/29 | -- | Sample 101-103 As above, cl. sandier. | SM | | | | | | | | | |
| | | | -- 102 | | | | | | | | | | | |
| 16 | 14 | 17/16<br>27/29 | -- | Sample 103-105 As above. | SM | | | | | | | | | |
| | | | -- 104 | | | | | | | | | | | |
| 17 | 19 | 23/17<br>18/28 | -- | Sample 105-107 As above (till). | SM | | | | | | | | | |
| | | | -- 106 | | | | | | | | | | | |
| 18 | 17 | 15/32<br>100 | -- | Sample 107-107.6 Red (2.5YR5/5) silty sand to sandy clay, massive, damp, firm (massive saprolite). | SM/ SC | | | | | | | | | |
| | | | -- 108 | Sample 107.6-107.8 Green silty sand to silty clay, massive, damp, (massive saprolite). | | | | | | | | | | |
| | | | -- 110 | Sample 107.8+ Green weathered mafic fragments (sericitic schist) (structured saprolite). | | | | | | | | | | |
| | | | -- 112 | | | | | | | | | | | |
| | | | -- 114 | E.O.B. @ 113.5'. | | | | | | | | | | |
| | | | -- 116 | | | | | | | | | | | |
| | | | -- 118 | | | | | | | | | | | |
| | | | -- 120 | | | | | | | | | | | |
| | | | -- 122 | | | | | | | | | | | |
| | | | -- 124 | | | | | | | | | | | |
| | | | -- 126 | | | | | | | | | | | |
| | | | -- 128 | | | | | | | | | | | |
| | | | -- 130 | | | | | | | | | | | |
| | | | -- 132 | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Monitoring Well Installation | | CMC-09 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling<br>Chuck Blunt | 03/29/94<br>MM/DD/YY | 03/30/94<br>MM/DD/YY | 6" Mud Rotary |

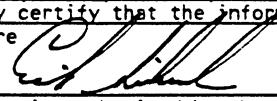
| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | 78.3' MSL | 1653.5' MSL | 5-7/8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 116258.8 N, 2274907.3 E S/C/N<br>SW 1/4 of SE 1/4 of Section 25, T 35 N, R 12 E | Lat<br>Long |
| | ___ N / S Feet<br>___ E / W Feet |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Nashville |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | 0-0.6 Dk brown (7.5YR2/2) organic topsoil, weak, med. blocky structure, frozen. | OL | | | | | | | | | |
| | | | -- 2 | | | | | | | | | | | |
| | | | -- 4 | | | | | | | | | | | |
| 1 | 11 | 12/16<br>14/15 | -- 6 | Sample 5-7 Brown (7.5YR5/4) silty sand with gravel, cobbles, weak med. blocky structure, damp, sl. firm (till). | SM | | | | | | | | | |
| | | | -- 8 | | | | | | | | | | | |
| 2 | 16 | 21/31<br>25/29 | -- 10 | Sample 10-12 As above with fine sand lense 11-11.2. | SM | | | | | | | | | |
| | | | -- 12 | | | | | | | | | | | |
| | | | -- 14 | | | | | | | | | | | |
| 3 | 4 | 6/8<br>12/30 | -- 16 | Sample 15-17 As above. | SM | | | | | | | | | |
| | | | -- 18 | | | | | | | | | | | |
| 4 | 15 | 21/20<br>20/50 | -- 20 | Sample 20-22 As above. | SM | | | | | | | | | |
| | | | -- 22 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature  Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-09

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- 24 | | | | | | | | | | | |
| 5 | 15 | 20/30 40/50 | -- -- 26 | Sample 25-27 As above, slightly less silt. | SM | | | | | | | | | |
| | | | -- 28 | | | | | | | | | | | |
| | | | -- 30 | Boulders 30-35. | | | | | | | | | | |
| | | | -- 32 | | | | | | | | | | | |
| | | | -- 34 | | | | | | | | | | | |
| 6 | 17 | 49/35 38/50 | -- -- 36 | Sample 35-37 As above. | SM | | | | | | | | | |
| | | | -- 38 | | | | | | | | | | | |
| 7 | 20 | 25/45 45/50 | -- 40 -- -- | Sample 40-42 Brown (10YR9/4) med. sand with gravel, damp, structureless, loose, weak stratification (outwash). | SP | | | | | | | | | |
| | | | -- 42 | | | | | | | | | | | |
| | | | -- 44 | | | | | | | | | | | |
| 8 | 8 | 23/33 60 | -- -- 46 | Sample 45-47 As above. | SP | | | | | | | | | |
| | | | -- 48 | | | | | | | | | | | |
| 9 | 12 | 28/92 50f.2 | -- 50 -- -- | Sample 50-52 Brown (2.5YR5/4) fine sand with minor silt, structureless, damp, loose (outwash). | SP | | | | | | | | | |
| | | | -- 52 | | | | | | | | | | | |
| | | | -- 54 | | | | | | | | | | | |
| | | | -- 56 | | | | | | | | | | | |
| 10 | 16 | 20/35 50 | -- -- 58 | Sample 57-59 As above. | SP | | | | | | | | | |
| 11 | 16 | 30/50 50 | -- 60 -- | Sample 60-62 As above, wet. | SP | | | | | | | | | |

| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 62 | | | | | | | | | | | |
| | | | 64 | | | | | | | | | | | |
| 12 | 11 | 30/50 | 66 | Sample 65-67 Brown (10YR6/5) med. sand with gravel, structureless, damp, loose, oxidized (outwash). | SP | | | | | | | | | |
| | | | 68 | | | | | | | | | | | |
| 13 | 14 | 35/50<br>50 | 70 | Sample 70-72 As above. | SP | | | | | | | | | |
| | | | 72 | | | | | | | | | | | |
| | | | 74 | | | | | | | | | | | |
| 14 | 17 | 24/40<br>50 | 76 | Sample 75-77 As above, wet. | SP | | | | | | | | | |
| | | | 78 | | | | | | | | | | | |
| 15 | 14 | 22/38<br>50 | 80 | Sample 80-82 As above, wet. | SP | | | | | | | | | |
| | | | 82 | | | | | | | | | | | |
| | | | 84 | | | | | | | | | | | |
| | | | 86 | | | | | | | | | | | |
| | | | 88 | | | | | | | | | | | |
| | | | 90 | E.O.B. @ 90'. | | | | | | | | | | |
| | | | 92 | | | | | | | | | | | |
| | | | 94 | | | | | | | | | | | |
| | | | 96 | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

Route to:
Solid Waste
Emergency Response
Wastewater
Haz. Waste
Underground Tanks
Water Resources
Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Monitoring Well Installation | | CMC-09P |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling<br>Mike Mueller | 04/01/93<br>MM/DD/YY | 04/15/94<br>MM/DD/YY | 6" Mud Rotary |

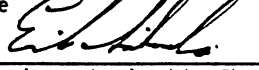
| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | 76.9' MSL | 1653.3' MSL | 5-7/8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 116258.8 N, 2274914.7 E S/C/N<br>SW 1/4 of SE 1/4 of Section 25, T 35 N, R 12 E | Lat<br>Long |
| | Feet ___ N S Feet ___ E W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | Blind drill to 83.8. See boring log CMC-09. | | | | | | | | | | |
| | | | -- 2 | | | | | | | | | | | |
| | | | -- 4 | | | | | | | | | | | |
| | | | -- 6 | | | | | | | | | | | |
| | | | -- 8 | | | | | | | | | | | |
| | | | -- 10 | | | | | | | | | | | |
| | | | -- 12 | | | | | | | | | | | |
| | | | -- 14 | | | | | | | | | | | |
| | | | -- 16 | | | | | | | | | | | |
| | | | -- 18 | | | | | | | | | | | |
| | | | -- 20 | | | | | | | | | | | |
| | | | -- 22 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature  Firm Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- 24 | | | | | | | | | | | |
| | | | -- 26 | | | | | | | | | | | |
| | | | -- 28 | | | | | | | | | | | |
| | | | -- 30 | | | | | | | | | | | |
| | | | -- 32 | | | | | | | | | | | |
| | | | -- 34 | | | | | | | | | | | |
| | | | -- 36 | | | | | | | | | | | |
| | | | -- 38 | | | | | | | | | | | |
| | | | -- 40 | | | | | | | | | | | |
| | | | -- 42 | | | | | | | | | | | |
| | | | -- 44 | | | | | | | | | | | |
| | | | -- 46 | | | | | | | | | | | |
| | | | -- 48 | | | | | | | | | | | |
| | | | -- 50 | | | | | | | | | | | |
| | | | -- 52 | | | | | | | | | | | |
| | | | -- 54 | | | | | | | | | | | |
| | | | -- 56 | | | | | | | | | | | |
| | | | -- 58 | | | | | | | | | | | |
| | | | -- 60 | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-09P

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- 62 | | | | | | | | | | | |
| | | | -- 64 | | | | | | | | | | | |
| | | | -- 66 | | | | | | | | | | | |
| | | | -- 68 | | | | | | | | | | | |
| | | | -- 70 | | | | | | | | | | | |
| | | | -- 72 | | | | | | | | | | | |
| | | | -- 74 | | | | | | | | | | | |
| | | | -- 76 | | | | | | | | | | | |
| | | | -- 78 | | | | | | | | | | | |
| | | | -- 80 | | | | | | | | | | | |
| | | | -- 82 | | | | | | | | | | | |
| | | | -- | Begin geocore 83.8-89.5. | | | | | | | | | | |
| 1 | 2 | -- | -- 84 | Brown (7.5YR7/4) med.-coarse sand with gravel, structureless, wet, loose (outwash). | SP | | | | | | | | | |
| | | | -- 86 | | | | | | | | | | | |
| 2 | 5 | -- | -- 88 | Core 87.5-91.5 As above. | SP | | | | | | | | | |
| | | | -- 90 | | | | | | | | | | | |
| 3 | 6 | -- | -- 92 | 91.5-96.5 Brown (7.5YR5/6) med. sand with silt and gravel, massive, wet (till). | SP-SM | | | | | | | | | |
| | | | -- 94 | | | | | | | | | | | |
| | | | -- 96 | | | | | | | | | | | |
| 4 | 5 | -- | -- | 96.5-101.5 Dk brown (7.5YR4/4) sandy clay with gravel and cobbles, massive, damp, very dense (till). | SC-CL | | | | | | | | | |

| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- 98 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 100 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 5 | 16 | -- | -- | 101.5-109.5 As above. | SC-CL | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 102 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 104 | | | | | | | | | | | |
| 6 | 00 | -- | -- | 104.5-109.5 No return. | -- | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 106 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 108 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 7 | 0 | -- | -- | 109.5-113.5 No return. | -- | | | | | | | | | |
| | | | -- 110 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 112 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 8 | 0 | -- | -- | 113.5-116 No return. | | | | | | | | | | |
| | | | -- 114 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 9 | 56 | -- | -- 116 | 116-121 Brown (5YR5/4) silty sand with gravel, massive, damp, sl. firm, clast of quartzite, granite, etc. (till). | SM | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 118 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 120 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 10 | 5 | -- | -- | 121-126 As above, granite, sandstone, metamorphite clasts. | SM | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 122 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 124 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 11 | 10 | -- | -- 126 | 126-131 Rock - gneiss, metavolcanic plug core barrel. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 128 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 130 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 12 | 3 | -- | -- | 131-136 Rock granitic plugging core barrel. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 132 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |

| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- 134 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 13 | 1 | | -- 136 | 136-137 Plug barrel rock. | | | | | | | | | | |
| | | | -- | Red (2.5YR5/4) silty sand. | | | | | | | | | | |
| | | | -- | Only ~1" in core. | | | | | | | | | | |
| 14 | 21 | | -- | 137-139 Red (2.5YR5/4) silty sand with | SM | | | | | | | | | |
| | | | -- 138 | gravel and cobbles, massive, wet, sl. | | | | | | | | | | |
| | | | -- | firm, granitic, meteovolcanic clasts | | | | | | | | | | |
| | | | -- | (till). | | | | | | | | | | |
| | | | -- | 139-141 No return. | | | | | | | | | | |
| | | | -- 140 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 15 | 0 | | -- | 141-146 No return. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 142 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 144 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 146 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 16 | 14 | 27/32 | -- | Split spoon sample 147-149. Red | SM- | | | | | | | | | |
| | | 50f.4 | -- | (2.5YR5/4) silty sand-silty clay with | SC | | | | | | | | | |
| | | | -- 148 | gravel, weakly med. blocky structure, | | | | | | | | | | |
| | | | -- | damp to wet, firm, oxidized with meta- | | | | | | | | | | |
| | | | -- | volcanic and igneous clasts (till). | | | | | | | | | | |
| 17 | 10 | 23/80 | -- | Sample 149-151 Red brown (2.5YR5/5) | CL- | | | | | | | | | |
| | | f.2 | -- 150 | silty clay with sand with gravel, mod. | ML | | | | | | | | | |
| | | | -- | med. blocky structure, damp, very firm, | | | | | | | | | | |
| | | | -- | oxidized (till). | | | | | | | | | | |
| 18 | 16 | 44/63 | -- | Sample 151-153 Brown (5YR4/4) silty | SM | | | | | | | | | |
| | | 100.f | -- 152 | fine sand, structureless, wet, soft. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 19 | 12 | 57/60 | -- | Sample 153-155 As above, massive, damp. | SM | | | | | | | | | |
| | | 46/73 | -- | | | | | | | | | | | |
| | | | -- 154 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 20 | 15 | 23/24 | -- | Sample 155-157 As above. | SM | | | | | | | | | |
| | | 36/53 | -- | | | | | | | | | | | |
| | | | -- 156 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 21 | 21 | 32/37 | -- | Sample 157-159 Yellow brown (10YR1/5) | SP | | | | | | | | | |
| | | 27/36 | -- | coarse sand with gravel, massive, wet, | | | | | | | | | | |
| | | | -- 158 | sl. firm (outwash). | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 22 | 13 | 27/36 | -- | Sample 159-161 Red (2.5YR4/4) silty | CL | | | | | | | | | |
| | | 25/100 | -- | clay with weathered hematic schist, | | | | | | | | | | |
| | | | -- 160 | remnant rock structure, damp, hard, | | | | | | | | | | |
| | | | -- | (massive saprolite). | | | | | | | | | | |
| | | | -- | Sample 161-163 | | | | | | | | | | |
| 23 | 7 | 83/100 | -- | 161-161.2 As above. | — | | | | | | | | | |
| | | f.3 | -- 162 | 162.2-163 Red and white weathered | | | | | | | | | | |
| | | | -- | hematic sericitic schist (structured | | | | | | | | | | |
| | | | -- | saprolite). | | | | | | | | | | |
| 24 | 3 | 105 | -- | Sample 163-165 As above. | | | | | | | | | | |
| | | f.2 | -- 164 | Spoon refusal, cuttings as above, | | | | | | | | | | |
| | | | -- | (structured saprolite). | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 166 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | Cuttings as above. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 168 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | E.O.B. @ 168.5'. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Monitoring Well Installation | | CMC-10 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling<br>Dan Tinnancour | 03/30/94<br>MM/DD/YY | 03/30/94<br>MM/DD/YY | 6" Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | 35.8' MSL | 1621.1' MSL | 5-7/8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 116056.6 N, 2278575.4 E S/C/N<br>SW 1/4 of SE 1/4 of Section 32, T 35 N, R 13 E | Lat<br>Long<br>Feet ___ N S Feet ___ E W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Nashville |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | Blind drill. See CMC-10P. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 2 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 4 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 6 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 8 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 10 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 12 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 14 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 16 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 18 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 20 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 22 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-10

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 24 | | | | | | | | | | | |
| | | | 26 | | | | | | | | | | | |
| | | | 28 | | | | | | | | | | | |
| | | | 30 | | | | | | | | | | | |
| 1 | 12 | 36/100 f.5 | 32 | Sample 31-33 Brown (10YR6/9) fine med. sand, structureless, damp, loose, stratified with layers of coarse sand, minor gravel (outwash). | SP | | | | | | | | | |
| | | | 34 | | | | | | | | | | | |
| 2 | 16 | 92/100 100f.1 | 36 | Sample 36-38 As above, weak stratification, wet, loose. | SP | | | | | | | | | |
| | | | 38 | | | | | | | | | | | |
| | | | 40 | | | | | | | | | | | |
| | | | 42 | | | | | | | | | | | |
| | | | 44 | | | | | | | | | | | |
| | | | 46 | | | | | | | | | | | |
| | | | 48 | | | | | | | | | | | |
| | | | 50 | E.O.B. @ 50'. | | | | | | | | | | |
| | | | 52 | | | | | | | | | | | |
| | | | 54 | | | | | | | | | | | |
| | | | 56 | | | | | | | | | | | |
| | | | 58 | | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Monitoring Well Installation | | CMC-SB-10P |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling<br>Mike Mueller | 02/24/94<br>MM/DD/YY | 02/26/94<br>MM/DD/YY | 8" Air Rotary |

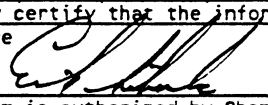
| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | 34.1' MSL | 1621.1' MSL | 7-7/8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 116656.6 N, 2278575.4 E S/C/N Lat<br>NE 1/4 of NW 1/4 of Section 31, T 35 N, R 13 E Long | ___ Feet N/S ___ Feet E/W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | 0-.4 Dk brown (7.5YR3/4) organic top- | OL | | | | | | | | | |
| | | | -- | soil, weak, fine, blocky structure, | | | | | | | | | | |
| | | | -- | frozen. | | | | | | | | | | |
| | | | -- | .4-1.8 Brown (7.5YR4/4) silty clay with | ML- | | | | | | | | | |
| | | | -- 2 | sand and gravel, damp, soft, mod. med. | CL | | | | | | | | | |
| | | | -- | blocky structure. | | | | | | | | | | |
| 1 | 21 | 96 | -- | 1.8-3 Brown (7.5YR5/4) silty sand with | SM | | | | | | | | | |
| | | 55 | -- | gravel, massive damp (till). | | | | | | | | | | |
| | | | -- 4 | Boulder 3-4. | | | | | | | | | | |
| | | | -- | Sample 4-6 As above with minor clay. | SM- | | | | | | | | | |
| | | | -- | | ML | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 6 | Boulder 6-8 | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 8 | | | | | | | | | | | |
| | | | -- | Intermittant boulders. | | | | | | | | | | |
| 2 | 3 | 10/7 | -- | Sample 8.5-10.5 As above, very damp. | SM- | | | | | | | | | |
| | | 6/12 | -- | | ML | | | | | | | | | |
| | | | -- 10 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 12 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| 3 | 1 | 7/6 | -- | Sample 13.5-15.5 As above, gravel in | SM- | | | | | | | | | |
| | | 6/6 | -- 14 | shoe. | ML | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 16 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 18 | | | | | | | | | | | |
| 4 | 11 | 10/9 | -- | Sample 18.5-20.5 (18.5-19) as above. | SP- | | | | | | | | | |
| | | 8/9 | -- | 19-20.5 Lt. brown (10YR6/3) gravelly | GP | | | | | | | | | |
| | | | -- | fine-med. sand, dry, hard, structureless | | | | | | | | | | |
| | | | -- 20 | (outwash). | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 22 | | | | | | | | | | | |
| | | | -- | 23.5-25.5 Sample - Boulder. | -- | | | | | | | | | |
| | | | -- | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature  Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-SB-10P

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 14 | 3/6<br>67 | 24 | 23.5-25.5 Brown (10YR7/4) fine-med. sand, structureless, damp, loose (outwash). | SP | | | | | | | | | |
| | | | 26 | | | | | | | | | | | |
| | | | 28 | | | | | | | | | | | |
| 6 | 16 | 3/7<br>12/20 | 30 | As above. | SP | | | | | | | | | |
| | | | 32 | | | | | | | | | | | |
| | | | 34 | 33.5-35.5 Brown (10YR7/4) med. sand with gravel, structureless, wet, loose (outwash). | SP | | | | | | | | | |
| | | | 36 | | | | | | | | | | | |
| 7 | 6 | 50<br>f.6 | 38 | Sample 37-39 Brown (10YR7/4) med. sand with gravel, structureless, wet, loose (outwash). | SP | | | | | | | | | |
| | | | 40 | Casing twisted off | | | | | | | | | | |
| | | | 42 | E.O.B. @ 42'. | | | | | | | | | | |
| | | | | Abandon 2/26/94 w/43 bags holeplug. | | | | | | | | | | |
| | | | 44 | | | | | | | | | | | |
| | | | 46 | | | | | | | | | | | |
| | | | 48 | | | | | | | | | | | |
| | | | 50 | | | | | | | | | | | |
| | | | 52 | | | | | | | | | | | |
| | | | 54 | | | | | | | | | | | |
| | | | 56 | | | | | | | | | | | |
| | | | 58 | | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

# WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Form 3300-5W 11-89

All abandonment work shall be performed in accordance with the provisions of Chapters NR 111, NR 112 or NR 141, Wis. Admin. Code, whichever is applicable. Also, see instructions on back.

## (1) GENERAL INFORMATION

Well/Drillhole/Borehole Location

County: Forest

NE 1/4 of NW 1/4 of Sec. 31 ; T. 35 N. R. 13 ☒ E ☐ W

(If applicable) Gov't Lot _____ Grid Number _____

Grid Location _____ ft. ☐ N. ☐ S., _____ ft. ☐ E. ☐ W.

Civil Town Name: Nashville

Street Address of Well: NA

City, Village: NA

## (2) FACILITY NAME

Original Well Owner (If Known): Crandon Mining Company

Present Well Owner: Crandon Mining Company

Street or Route: 7 North Brown Street, 3rd Floor

City, State, Zip Code: Rhinelander, WI 54501-3161

Facility Well No. and/or Name (If Applicable): CMC-SB-10P

WI Unique Well No.: _ _ _ _ _ _

Reason For Abandonment: Drill refusal

Date of Abandonment: 02/26/94

## WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drillhole/Borehole Construction Completed On

(Date) 02/24/94

☐ Monitoring Well
☐ Water Well
☐ Drillhole
☒ Borehole

Construction Report Available? ☐ Yes ☐ No

Construction Type:
☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) _____

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft.) 42 Casing Diameter (ins.) 8
(From groundsurface)

Casing Depth (ft.) 42

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown
If Yes, To What Depth? _____ Feet

(4) Depth to Water (Feet) 33'

| | | | |
|---|---|---|---|
| Pump & Piping Removed? | ☐ Yes | ☐ No | ☒ Not Applicable |
| Liner(s) Removed? | ☐ Yes | ☐ No | ☒ Not Applicable |
| Screen Removed? | ☐ Yes | ☐ No | ☒ Not Applicable |
| Casing Left in Place? | ☐ Yes | ☒ No | |

If No, Explain _____

| | | |
|---|---|---|
| Was Casing Cut Off Below Surface? | ☐ Yes | ☒ No |
| Did Sealing Material Rise to Surface? | ☐ Yes | ☒ No |
| Did Material Settle After 24 Hours? | ☐ Yes | ☒ No |
| If Yes, Was Hole Retopped? | ☐ Yes | ☐ No |

(5) Required Method of Placing Sealing Material
☒ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☐ Dump Bailer ☐ Other (Explain)

(6) Sealing Materials
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☐ Bentonite-Sand Slurry
☒ Chipped Bentonite

For monitoring wells and monitoring well boreholes only
☐ Bentonite Pellets
☐ Granular Bentonite
☐ Bentonite - Cement Grout

| (7) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks Sealant or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| 3/8" chipped bentonite | Surface | 42 | 43 bags | |
| | | | | |
| | | | | |
| | | | | |

(8) Comments: _____

(9) Name of Person or Firm Doing Sealing Work: WTD Environmental Drilling

Signature of Person Doing Work: [signature] Date Signed: 7-13-94

Street or Route: 101 Alderson Box 89 Telephone Number: (715) 359-7090

(10) FOR DNR OR COUNTY USE ONLY

Date Received/Inspected: _____ District/County: _____

Reviewer/Inspector: _____

Follow-up Necessary: _____

3.5-12-94

## REASONS FOR WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Wis. Adm. Code (NR 111, NR 112, & NR 141) requires well owners to permanently abandon unused wells/drillholes/boreholes on their property. The reasons for this requirement are:

- To prevent contamination from entering the well/drillhole/borehole at the surface or through corroded well casings and moving downward to an aquifer used by other wells, and
- To prevent vertical movement of water between different geologic formations of differing water quality.

Most licensed well drillers and pump installers have the equipment, knowledge and experience needed to permanently abandon wells/drillholes/boreholes. We recommend that these licensed contractors be hired to do this work.

## PROCEDURE

1. Remove any pump, pump piping, debris or other obstacles that could interfere with the sealing operation. In most situations the well casing should be left in place. When the casing is removed it should be pulled during the abandonment process so the drillhole does not collapse.
2. The sealing material must be placed with a conductor (tremie) pipe either by pumping or by gravity, (except when approved chipped bentonite is used according to written department instructions and restrictions).
3. The bottom end of the conductor pipe must initially reach the bottom of the well and must be kept submerged in the sealing material as it is placed.
4. Unconsolidated formation wells should be sealed with the materials listed in item (6) on the form. When clay or sodium benonite slurry is used to fill wells, the top 20 feet must be sealed with neat cement grout, concrete grout, concrete, or bentonite chips. Bedrock formation wells should be filled with neat cement grout, concrete grout, concrete or bentonite. chips. Monitoring wells must be filled with the materials specified by NR 141, Wis. Adm. Code.
5. Fill the entire well column from the bottom to the top with the required sealing material.
6. When using concrete or cement grout, any standing water in the hole will be forced out by the concrete or cement grout (it is more dense) resulting in an entire column of cement to seal the well. The sealing material must flow at the surface with the same consistency as it is being pumped in.
7. The casing may be cut off several feet below the ground surface.
8. To abandon flowing wells, the flow must be stopped or greatly reduced. This can be accomplished by extending the well casing to an elevation higher than the artesian head, or inserting a seal or packer in the casing. Once the flow has been stopped or reduced, the well can be abandoned the same as other wells.
9. For a municipal well, information regarding drillhole diameter and depths and geologic formations should be submitted on a separate sheet.
10. For use of alternative methods and materials, especially for deep, multi-formation wells contact DNR.

## TEMPORARY ABANDONMENT

- A well may be temporarily abandoned if it is planned to place the well back in service within a time specified by administrative rule.
- Temporary abandonment is accomplished by threading or welding a watertight cover to the casing or by filling the well with a clean clay slurry and then placing a cover over the well.
- If the well is not placed back into service, it should be permanently abandoned unless a written extension is granted by DNR.

## REPORT TO DNR

The Well/Drillhole/Borehole Abandonment Form 3300-5W, on the front, must be completed by the owner (or agent) and submitted to the appropriate DNR district office or delegated county office within 30 days.

**This form is authorized by chapters 144, 147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10.00 nor more than $5,000.00 for each violation. Fined not less than $10.00 or more than $100.00 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss. 144.99 and 162.06, Wis. Stats.**

State of Wisconsin
Department of Natural Resources

Route to:
Solid Waste
Emergency Response
Wastewater
Haz. Waste
Underground Tanks
Water Resources
Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company<br>Monitoring Well Installation | | CMC-10P |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| WTD Environmental Drilling<br>Mike Mueller and Pat | 02/26/94<br>MM/DD/YY | 03/03/94<br>MM/DD/YY | 8" air, 8" mud<br>6" mud rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | 35.4' MSL | 1620.8' MSL | 5-7/8" |

Boring Location
State Plane 116046.9 N, 2278514.2 E S/C/N Lat
SW 1/4 of SE 1/4 of Section 32, T 35 N, R 13 E Long

Local Grid Location (if applicable)
___ Feet ___ N ___ S ___ Feet ___ E ___ W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Lincoln |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- | Blind drill 0-43. See borelog CMC-SB-10P. | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 2 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 4 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 6 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 8 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 10 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 12 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 14 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 16 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 18 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 20 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- 22 | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |
| | | | -- | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm
Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each volation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-10P

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 24 | | | | | | | | | | | |
| | | | 26 | | | | | | | | | | | |
| | | | 28 | | | | | | | | | | | |
| | | | 30 | | | | | | | | | | | |
| | | | 32 | | | | | | | | | | | |
| | | | 34 | | | | | | | | | | | |
| | | | 36 | | | | | | | | | | | |
| | | | 38 | | | | | | | | | | | |
| | | | 40 | | | | | | | | | | | |
| | | | 42 | | | | | | | | | | | |
| 1 | 0 | 50 f.1 | | Sample 43-45 No recovery, cobbles. | | | | | | | | | | |
| | | | 44 | | | | | | | | | | | |
| | | | | Drilling boulders 45-58. | | | | | | | | | | |
| | | | 46 | | | | | | | | | | | |
| | | | 48 | | | | | | | | | | | |
| 2 | 0 | 50 f.0 | | Sample 49-51 No recovery. | | | | | | | | | | |
| | | | 50 | | | | | | | | | | | |
| | | | 52 | | | | | | | | | | | |
| | | | 54 | | | | | | | | | | | |
| | | | 56 | | | | | | | | | | | |
| 3 | 14 | 23/21 35/57 | 58 | Sample 58-60 Grey-brown (10YR5/2) poorly sorted gravel with coarse sand, structureless, wet, loose (outwash). | GP | | | | | | | | | |
| | | | 60 | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-10P

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -- 62 | | | | | | | | | | | |
| 4 | 13 | 39/37<br>63/47 | -- 64 | Sample 63-65 As above, slightly more sand. | GP-SP | | | | | | | | | |
| | | | -- 66 | | | | | | | | | | | |
| 5 | 8 | 27/64 | -- 68 | Sample 68-70 As above, more sand. | SP-GP | | | | | | | | | |
| | | | -- 70 | Drill boulders 70' to 78'. | | | | | | | | | | |
| | | | -- 72 | | | | | | | | | | | |
| | | | -- 74 | | | | | | | | | | | |
| | | | -- 76 | | | | | | | | | | | |
| 6 | 17 | 23/31<br>63f.4 | -- 78 | Sample 78-80 Red brown (2.5YR4/6) silty sand with gravel, massive, damp-wet, firm, locally oxidized (massive saprolite). | SP-SM | | | | | | | | | |
| 7 | 17 | 12/26<br>69f.3 | -- 80 | 80-82 As above with minor coarse sand 81-81.3. | SP-SM | | | | | | | | | |
| 8 | 16 | 30/26<br>23f.2 | -- 82 | 82-84 As above, slightly more silt, minor clay, weathered rock in base of sample. | SM | | | | | | | | | |
| 9 | 16 | 14/28<br>26/37 | -- 84 | 84-85 As above, grading to more silt and clay. | SM | | | | | | | | | |
| 10 | 15 | 22/32<br>66 | -- 86 | 85-86 Red brown (2.5YR4/6) sandy clay with silt and weathered rock, massive, damp, very hard (massive saprolite). | CL | | | | | | | | | |
| 11 | 20 | 13/26<br>28/33 | -- | 86-88 Less clay more silt, otherwise as above with weathered rock. | ML-CL | | | | | | | | | |
| 12 | 0 | 50f.0 | -- 88<br>-- 90 | 88-90 Red brown (2.5YR4/6) silty fine sand with gravel, structureless, wet, sl. loose (massive saprolite).<br>90-92 No recovery, boulder. | -- | | | | | | | | | |
| 13 | 16 | 14/22<br>28/32 | -- 92 | 92-94 Red brown (2.5YR5/6) silty clay with sand and gravel, mod. fine blocky structure, damp, v. hard (massive saprolite). | CL-ML | | | | | | | | | |
| 14 | 15 | 10/20<br>17/27 | -- 94 | 94-96 As above. | | | | | | | | | | |
| 15 | 20 | 12/18<br>27/36 | -- 96 | 96-98 As above, increase in clay, more weathered rock, hematic with remnant structure (massive saprolite). | CL | | | | | | | | | |

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-10P

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE no. | SAMPLE rec (in) | blow counts | depth in feet | Soil/rock description and geologic origin for each major unit | USCS | graph log | well diagr | PID/ FID | Soil Properties: Std pen | mois cont | liqu limi | plas limi | p 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | 23 | 10/10 | 98 | Sample 98-100 | | | | | | | | | | |
| | | 10/21 | | 98.5-98.5 Clay. | — | | | | | | | | | |
| | | | | 98.5-100 Weathered bedrock, hematic, remnant structure as above, with minor | | | | | | | | | | |
| 17 | 14 | 10/40 | 100 | clay from weathering (structured | | | | | | | | | | |
| | | 50f.2 | | saprolite). | | | | | | | | | | |
| | | | | E.O.B. @ 101.5'. | | | | | | | | | | |
| | | | 102 | | | | | | | | | | | |
| | | | 104 | | | | | | | | | | | |
| | | | 106 | | | | | | | | | | | |
| | | | 108 | | | | | | | | | | | |
| | | | 110 | | | | | | | | | | | |
| | | | 112 | | | | | | | | | | | |
| | | | 114 | | | | | | | | | | | |
| | | | 116 | | | | | | | | | | | |
| | | | 118 | | | | | | | | | | | |
| | | | 120 | | | | | | | | | | | |
| | | | 122 | | | | | | | | | | | |
| | | | 124 | | | | | | | | | | | |
| | | | 126 | | | | | | | | | | | |
| | | | 128 | | | | | | | | | | | |
| | | | 130 | | | | | | | | | | | |
| | | | 132 | | | | | | | | | | | |

# Appendix 3.5-13

## Logs for WTD Environmental Drilling, Inc., Northstar and Total Drilling 1994 Saprolite Investigation Boring

**CMC-10PP**
**CMC-11P**
**CMC-12-P**
**CMC-13P**
**CMC-14P**
**CMC-0WA-1**
**CMC-OWA-1R**
**CMC-OWA-2**
**CMC-OWA-3**
**CMC-OWA-4**
**CMC-OWA-5**
**CMC-PWA**
**CMC-PWAR**
**CMC-PWB**

State of Wisconsin | Route to: | SOIL BORING LOG INFORMATION

Department of Natural Resources | Solid Waste | Haz. Waste | Form 4400-122 | 7-91

Emergency Response | Underground Tanks

Wastewater | Water Resources

Other



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| CMC - Saprolite Investigation | | CMC-10PP |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| North Star - John Anderson | MM/DD/YY | MM/DD/YY | 6" Rotasonic |
| WTD - Chuck Blunt | 10/12/94 | 10/18/94 | 6" Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | | 1619.68 | 6" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plan 116050.24N, 2278600.21E S/C/N Lat | ____ N ____ E |
| NE1/4 of NW1/4 of Section 31, T35N, R13E Long | Feet ____ S Feet ____ W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Nashville |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0 | 0-0.8 Dark brown (7.5YR3/3) organic topsoil, mod., med. blocky structure, damp to wet, sticky, soft. | OL | | | | | | | | | |
| | | | 2 | 0.8-5 Brown (7.5YR3/4) silty sand with clay, gravel, and cobbles, mod., med. coarse blocky structure, damp, sl. firm (till). | SM | | | | | | | | | |
| | | | 4 | | | | | | | | | | | |
| | | | 6 | 5-13 As above with slight increase in clay. | | | | | | | | | | |
| | | | 8 | | | | | | | | | | | |
| | | | 10 | | | | | | | | | | | |
| | | | 12 | | | | | | | | | | | |
| | | | 14 | 13-25 Brown (7.5YR4/2) gravelly sand, structureless, damp, loose, minor cobbles (outwash). | SP | | | | | | | | | |
| | | | 16 | | | | | | | | | | | |
| | | | 18 | | | | | | | | | | | |
| | | | 20 | | | | | | | | | | | |
| | | | 22 | | | | | | | | | | | |
| | | | 24 | | | | | | | | | | | |
| | | | 26 | 25-31 Brown (7.5YR4/3) fine sand with minor silt, weak, fine platy structure, dry, soft, (lacustrine). | SP | | | | | | | | | |
| | | | 28 | | | | | | | | | | | |
| | | | 30 | | | | | | | | | | | |
| | | | 32 | 31-42 Brown (7.5YR4/3) gravelly sand, med.-coarse, structureless, wet, loose (outwash). | SP | | | | | | | | | |
| | | | 34 | | | | | | | | | | | |
| | | | 36 | | | | | | | | | | | |
| | | | 38 | | | | | | | | | | | |
| | | | 40 | | | | | | | | | | | |
| | | | 42 | | | | | | | | | | | |
| | | | 44 | 42-55 Grey (10YR5/1) gravelly, cobbly sand with silt, v. weak, coarse, blocky structure, wet, sl. firm (till). | SP-SM | | | | | | | | | |
| | | | 46 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

| Signature | Firm |
|---|---|
| Ed Stuhr | Foth & Van Dyke 3.5-13-1 |

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory.

Penalties: Forfeit not less than $10 nor more then $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 48 | | | | | | | | | | | |
| | | | 50 | | | | | | | | | | | |
| | | | 52 | | | | | | | | | | | |
| | | | 54 | | | | | | | | | | | |
| | | | 56 | 55-65.5 Brown (7.5YR7/3) gravelly med. to coarse sand with cobbles, structureless, wet, loose (outwash). | SP | | | | | | | | | |
| | | | 58 | | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | |
| | | | 62 | | | | | | | | | | | |
| | | | 64 | | | | | | | | | | | |
| | | | 66 | 65.5-72 Brown (7.5YR4/4) silty clay with sand, gravel, and cobbles, massive, damp, sl. firm-firm, minor incorporation of massive saprolite (till). | CL-SC | | | | | | | | | |
| | | | 68 | | | | | | | | | | | |
| | | | 70 | | | | | | | | | | | |
| | | | 72 | 72-80 Brown (7.5YR5/5) silty sand with gravel and cobbles, massive, damp-wet, sl. firm, minor saprolite content <10% (till). | SM | | | | | | | | | |
| | | | 74 | | | | | | | | | | | |
| | | | 76 | | | | | | | | | | | |
| | | | 78 | | | | | | | | | | | |
| | | | 80 | 80-86 Red brown (10R5/6) silty sand with clay, cobbles, and gravel, massive, damp, firm, minor saprolite content <30% (till). | SM-SC | | | | | | | | | |
| | | | 82 | | | | | | | | | | | |
| | | | 84 | | | | | | | | | | 44.7 | CMC-10PP 85-87 |
| | | | 86 | 86-97 Red (10R4/6) silty to sandy clay with gravel and cobbles, massive, damp-wet, firm, saprolite content 30%-40% (till). | SC | | | | | | | | | |
| | | | 88 | | | | | | | | | | | |
| | | | 90 | | | | | | | | | | | |
| | | | 92 | | | | | | | | | | | |
| | | | 94 | | | | | | | | | | | |
| | | | 96 | | | | | | | | | | | |
| | | | 98 | 97-103.5 Dark red (10R4/4) lean clay (massive saprolite) with angular clasts, massive, wet, v. firm-stiff, minor yellow jarosite. | SC-SM | | | | | | 35 | 12 | 48.2 | CMC-10PP 95-97 |
| | | | 100 | | | | | | | | 20 | 4 | 47.1 | CMC-10PP 97-100 |
| | | | 102 | 102-103.5 Predominantly jarosite with zones (fractures) with hematic massive saprolite). | CL | | | | | | | | 53.1 | CMC-10PP 102-104 |
| | | | 104 | 103.5-104.5 Yellow weathered bedrock (jarosite) structured saprolite. | | | | | | | | | 42 | CMC-10PP 104-106 |
| | | | 106 | 104.5-105.5 Red weathered bedrock (hematic) structured saprolite. | | | | | | | | | 49.6 | CMC-10PP 106-108 |
| | | | 108 | 105.5-108.5 Yellow brown weathered bedrock (structured saprolite). | | | | | | | | | | |
| | | | 110 | 108.5+ Red weathered bedrock (structured saprolite). | | | | | | | | | | |
| | | | | E.O.B. @ 110' | | | | | | | | | | |

State of Wisconsin | Route to: | SOIL BORING LOG INFORMATION

Department of Natural Resources | Solid Waste | Haz. Waste | Form 4400-122 | 7-91

Emergency Response | Underground Tanks

Wastewater | Water Resources

Other



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| CMC - Saprolite Investigation | | CMC-11P |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| North Star - John Anderson<br>WTD - Chuck Blunt | MM/DD/YY<br>09/27/94 | MM/DD/YY<br>10/15/94 | 8" Rotasonic, 6" Rotasonic,<br>6" Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | | 1643.48 | 6" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plan 116228.68N, 2275939.77E S/C/N Lat<br>SW1/4 of SW1/4 of Section 30, T35N , R13E Long | ____ N ____ E<br>Feet ____ S Feet ____ W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Nashville |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0 | 0-5 Brown (7.5YR4/4) silty sand with clay and gravel, mod., med. blocky structure, damp, sl. firm (till). | SM-ML | | | | | | | | | |
| | | | 2 | | | | | | | | | | | |
| | | | 6 | 5-10 Brown (7.5YR5/4) silty sand with gravel, structureless, damp, soft (till). | SM | | | | | | | | | |
| | | | 8 | | | | | | | | | | | |
| | | | 10 | 10-15 Brown (7.5YR5/5) med. sand with silt and gravel (12-13 silty sand lense), structureless, damp, loose (till). | SP-SM | | | | | | | | | |
| | | | 12 | | | | | | | | | | | |
| | | | 14 | | | | | | | | | | | |
| | | | 16 | 15-20 As above, sl. oxidized. | SP-SM | | | | | | | | | |
| | | | 18 | | | | | | | | | | | |
| | | | 20 | 20-26 As above, sl. finer. | SP-SM | | | | | | | | | |
| | | | 22 | | | | | | | | | | | |
| | | | 24 | | | | | | | | | | | |
| | | | 26 | 26-30 Brown (2.5YR5/6) fine-med. sand with gravel, structureless, dry, loose (outwash/ | SP | | | | | | | | | |
| | | | 28 | poss. ice marginal). | | | | | | | | | | |
| | | | 30 | 30-34 As above, bottom 1" sand, compact. | SP | | | | | | | | | |
| | | | 32 | | | | | | | | | | | |
| | | | 34 | | | | | | | | | | | |
| | | | 36 | 36-40 Brown (7.5YR5/5) fine-med. sand with silt and gravel, structureless, damp, loose | SP-SM | | | | | | | | | |
| | | | 38 | (till). | | | | | | | | | | |
| | | | 40 | 40-44 As above. | SP-SM | | | | | | | | | |
| | | | 42 | | | | | | | | | | | |
| | | | 44 | 44-48 Lt. brown (10YR7/4) fine sand with gravel, structureless, dry, loose (outwash). | SP | | | | | | | | | |
| | | | 46 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature | Firm: Foth & Van Dyke 3.5-13-3

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory.

Penalties: Forfeit not less than $10 nor more then $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 48 | 48-50 Brown (10YR6/4) fine-med. sand with gravel, structureless, damp, loose (outwash). | SP | | | | | | | | | |
| | | | 50 | 50-53 As above. | SP | | | | | | | | | |
| | | | 52 | | | | | | | | | | | |
| | | | 54 | 53-55 As above. | SP | | | | | | | | | |
| | | | 56 | 55-65 As above, sand med. coarse (outwash). | SP | | | | | | | | | |
| | | | 58 | | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | |
| | | | 62 | | | | | | | | | | | |
| | | | 64 | | | | | | | | | | | |
| | | | 66 | 65-68 As above, wet. | SP | | | | | | | | | |
| | | | 68 | 68-70 Brown (7.5YR4/4) silty sand with gravel and clay, massive, damp, firm. | SM | | | | | | | | | |
| | | | 70 | 70-75 Red brown (7.5YR6/4) silty sand with gravel, oxidized, massive, damp, firm (till). | SM | | | | | | | | | |
| | | | 72 | | | | | | | | | | | |
| | | | 74 | | | | | | | | | | | |
| | | | 76 | 75-80 As above. | SM | | | | | | | | | |
| | | | 78 | | | | | | | | | | | |
| | | | 80 | 80-85 As above, not as oxidized. | SM | | | | | | | | | |
| | | | 82 | | | | | | | | | | | |
| | | | 84 | | | | | | | | | | | |
| | | | 86 | 85-95 As above. | SM | | | | | | | | | |
| | | | 88 | | | | | | | | | | | |
| | | | 90 | | | | | | | | | | | |
| | | | 92 | | | | | | | | | | | |
| | | | 94 | | | | | | | | | | | |
| | | | 96 | 95-100 As above. | SM | | | | | | | | | |
| | | | 98 | | | | | | | | | | | |
| | | | 100 | 100-105 Brown (7.5YR4/4) silty sand with gravel and clay, massive, dry, hard (till). | SM | | | | | | | | | |
| | | | 102 | | | | | | | | | | | |
| | | | 104 | | | | | | | | | | | |
| | | | 106 | 105-115 Red brown (2.5YR6/4) silty sand with gravel, cobbles, oxidized, massive, dry, hard (till). | SM | | | | | | | | | |
| | | | 108 | | | | | | | | | | | |
| | | | 110 | | | | | | | | | | | |
| | | | 112 | | | | | | | | | | | |
| | | | 114 | | | | | | | | | | | |
| | | | 116 | 115-125 As above. | SM | | | | | | | | | |
| | | | 118 | | | | | | | | | | | |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 120 | | | | | | | | | | | |
| | | | 122 | | | | | | | | | | | |
| | | | 124 | | | | | | | | | | | |
| | | | 126 | 125-127 As above. | SM | | | | | | | | | |
| | | | 128 | 127-136 Red (2.5YR4/4) clayey sand with silt and gravel, massive, damp, v. stiff (till). | SC | | | | | | | | | |
| | | | 130 | | | | | | | | | | | |
| | | | 132 | | | | | | | | | | | |
| | | | 134 | | | | | | | | | | | |
| | | | 136 | 136-137 Brown (7.5YR5/5) silty gravel with sand, structureless, wet, loose (ice marginal). | GM-SM | | | | | | | | | |
| | | | 138 | 137-140 Brown (7.5YR5/4) silty sand with gravel, massive, wet, soft (ice marginal). | SM | | | | | | | | | |
| | | | 140 | 140-145 Brown (7.5YR5/5) silty sand with gravel, structureless, wet, loose (ice marginal). | SM-SP | | | | | | | | | |
| | | | 142 | | | | | | | | | | | |
| | | | 144 | | | | | | | | | | | |
| | | | 146 | 145-148 As above. | SM-SP | | | | | | | | | |
| | | | 148 | 148-152 Red (10R5/4) silty sand with clay and massive, damp, firm (till). | SM-SC | | | | | | | | | |
| | | | 150 | | | | | | | | | | | |
| | | | 152 | 152-155 Brown (10YR7/4) med.-coarse sand with minor gravel, oxidized, structureless, | SP | | | | | | | | | |
| | | | 154 | wet, loose (outwash). | | | | | | | | | | |
| | | | 156 | 155-163 As above, sand is finer at base. | SP | | | | | | | | | |
| | | | 158 | | | | | | | | | | | |
| | | | 160 | | | | | | | | | | | |
| | | | 162 | | | | | | | | | | | |
| | | | 164 | 163-165 Red (10Y4/6) silty clay with sand and gravel, massive, damp, v. firm (till). | CL | | | | | | | | | |
| | | | 166 | 165-166.5 As above. | | | | | | | | | | |
| | | | 168 | 166.5-168.5 Red (10Y5/5) firm med. sand with minor silt, structureless, wet, loose. | SP | | | | | | | | | |
| | | | 170 | 168.5-169.5 Red (10R4/4) silty sand with gravel and clay, massive, damp-wet, firm, minor massive saprolite <10% (till). | SM-SC | | | | | | | | | |
| | | | 172 | 169.5-170 Fine-med. red sand lense. | | | | | | | | | | |
| | | | 174 | 170-175 Red till as above. | | | | | | | | | | |
| | | | 176 | 175-197 Blind drill due to casing loss and recovery. | | | | | | | | | | |
| | | | 178 | | | | | | | | | | | |
| | | | 180 | | | | | | | | | | | |
| | | | 182 | | | | | | | | | | | |
| | | | 184 | | | | | | | | | | | |
| | | | 186 | | | | | | | | | | | |
| | | | 188 | | | | | | | | | | | |
| | | | 190 | | | | | | | | | | | |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 192 | | | | | | | | | | | |
| | | | 194 | | | | | | | | | | | |
| | | | 196 | | | | | | | | | | | |
| | | | 198 | 197-205 Red (10R4/4) lean clay (massive saprolite) with angular clasts, massive, damp, v. firm to hard, slightly reworked, minor jarosite. | CL SC | | | | | | 27 | 13 | 33.1 | CMC-11P 198-200 |
| | | | | | | | | | | | 24 | 7 | 51.1 | CMC-11P 200-205 |
| | | | 200 | | | | | | | | | | | |
| | | | 202 | | | | | | | | | | | |
| | | | 204 | | | | | | | | | | | |
| | | | 206 | 205-208.5 Grey (2.5Y6/0) heavy clay, illite (massive saprolite). | CL | | | | | | 30 | 13 | 61.5 | CMC-11P 205-207 |
| | | | | | | | | | | | | | 34.7 | CMC-11P 207-211 |
| | | | 208 | 208.5-210.5 Dark grey (2.5Y4/0) clay illitic with mixed hematic massive saprolite and jarosite. | CG | | | | | | | | 56.6 | CMC-11P 211-212 |
| | | | 210 | | | | | | | | | | | |
| | | | 212 | 210.5-212.5 Red (10R4/4) lean clay (massive saprolite) massive, damp, stiff, minor jarosite. | CL | | | | | | | | | |
| | | | 214 | 212.5+ Weathered bedrock, highly weathered sericitic schist with quartz, illitie (structured saprolite). | | | | | | | | | | |
| | | | 216 | E.O.B. @ 215' | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

Route to:
Solid Waste
Emergency Response
Wastewater
Haz. Waste
Underground Tanks
Water Resources
Other

# SOIL BORING LOG INFORMATION

Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| CMC - Saprolite Investigation | | CMC-12P |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| North Star - John Anderson<br>WTD - Chuck Blunt | MM/DD/YY<br>10/05/94 | MM/DD/YY<br>10/13/94 | 6" Rotasonic<br>8" Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | | 1647.97 | 8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plan 116478.66N, 2276322.76E S/C/N<br>SW1/4 of SW1/4 of Section 30, T35N, R13E | Lat<br>Long |
| | ____ N ____ E<br>Feet ____ S Feet ____ W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Nashville |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0 | Blind drill 0 to 178' with 8" mud rotary. Begin rotasonic drilling at 178'. | | | | | | | | | | |
| | | | 178 | 178-184 Brown (7.5YR4/3) silty sand with gravel and clay, small pyr[illegible]ains evenly distributed, minor jarosite, distorted micro laminations, massive, damp-wet, sl. firm, minor massive saprolite <25% (till). | SC | | | | | | | | 41.3 | CMC-12P 178-181 |
| | | | 180 | | SC | | | | | | | | 41.6 | CMC-12P 181-184 |
| | | | 182 | | | | | | | | | | | |
| | | | 184 | 184-188 As above with more sand from 185-186. | SC | | | | | | 20 | 7 | 42.4 | CMC-12P 184-185 |
| | | | 186 | | | | | | | | 32 | 13 | 42.7 | CMC-12P 185-187 |
| | | | 188 | 187-196 Orange (10R5/8) silty clay with angular clasts, slightly reworked (massive saprolite >90%) strong hematite and illite c[illegible]onents, trace jarosite (massive saprolite). | CL | | | | | | | | | |
| | | | 190 | 190-196 As above, jarosite increases. | | | | | | | | | 54.1 | CMC-12P 191-196 |
| | | | 192 | | | | | | | | | | | |
| | | | 194 | | | | | | | | | | | |
| | | | 196 | 196-199 As above. | CL | | | | | | | | 50.0 | CMC-12P 196-199 |
| | | | 198 | | | | | | | | | | | |
| | | | 200 | 199+ Dark grey massive sulfide (structured saprolite) dominantly pyrite and chalcocite with minor sphalerite, galena and chalcopyrite, some hematite and lithic clasts, apparently from secondary migration. | | | | | | | | | | |
| | | | 202 | | | | | | | | | | | |
| | | | 204 | 204-205 Fresh pyrite. | | | | | | | | | | |
| | | | 206 | E.O.B. @ 205' | | | | | | | | | | |
| | | | 208 | | | | | | | | | | | |
| | | | 210 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more then $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin | Route to: | SOIL BORING LOG INFORMATION

Department of Natural Resources | Solid Waste | Haz. Waste | Form 4400-122 | 7-91

Emergency Response | Underground Tanks

Wastewater | Water Resources

Other



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| CMC - Saprolite Investigation | | CMC-13P |

| Boring Drilled by (Firm name and name of crew chief) | Date Started MM/DD/YY | Date Completed MM/DD/YY | Drilling Method |
|---|---|---|---|
| WTD - Larry Erdman | 09/27/94 | 10/03/94 | 8" Mud Rotary<br>Wireline Core HQ |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | | 1684.43 | 8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 116352.22N, 2276978.90E S/C/N Lat | ____ N ____ E |
| SE1/4 of SW1/4 of Section 30, T35N, R13E Long | Feet ____ S Feet ____ W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Nashville |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0 | Blind drill 0-140'. Drill cuttings retained. Begin HQ core at 140'. | | | | | | | | | | |
| 1 | 6 | | 140 | 140-145 Brown (7.5YR4/4) silty clay with distorted lamination, massive to weak, fine platy structure, wet, soft (lacustrine). | CL | | | | | | | | | |
| | | | 142 | | | | | | | | | | | |
| | | | 144 | | | | | | | | | | | |
| | | | | 145-146 No recovery. | | | | | | | | | | |
| 2 | 0 | | 146 | 146-148 No recovery. | | | | | | | | | | |
| 3 | 0 | | | | | | | | | | | | | |
| 4 | 15 | | 148 | 148-150 Boulder. | | | | | | | | | | |
| 5 | 6 | | 150 | 150-152 Boulder. | | | | | | | | | | |
| 6 | 24 | | 152 | 152-154 Boulders. | | | | | | | | | | |
| 7 | 8 | | 154 | 154-156 Red brown (5YR4/4) silty clay with gravel, massive, damp-wet, firm, minor saprolite <20% (till). | SC-SM | | | | | | | | | |
| 8 | 0 | | 156 | 156-158 No recovery. | | | | | | | | | | |
| 9 | 0 | | 158 | 158-160 No recovery. | | | | | | | | | | |
| 10 | 0 | | 160 | 160-162 No recovery. | | | | | | | | | | |
| 11 | 0 | | 162 | 162-164 No recovery. | | | | | | | | | | |
| 12 | 0 | | 164 | 164-170 No recovery. | | | | | | | | | | |
| | | | 166 | | | | | | | | | | | |
| | | | 168 | | | | | | | | | | | |
| 13 | 24 | | 170 | 170-175 Boulders to 171'. | SM-SC | | | | | | | | | |
| | | | | 171-172 Till as above, slightly more sand, color | | | | | | | | | | |
| | | | 172 | (5YR4/6). | | | | | | | | | | |
| | | | 174 | | | | | | | | | | | |
| 14 | 30 | | | 175-180 As above. | SM-SC | | | | | | | | | |
| | | | 176 | | | | | | | | | | | |
| | | | 178 | | | | | | | | | | | |
| 15 | 20 | | 180 | 180-190 As above with boulders. | SM-SC | | | | | | | | | |
| | | | 182 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

| Signature | Firm |
|---|---|
| | Foth & Van Dyke |

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory.
Penalties: Forfeit not less than $10 nor more then $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 184 | | | | | | | | | | | |
| | | | 186 | | | | | | | | | | | |
| | | | 188 | | | | | | | | | | | |
| 16 | 24 | | 190 | 190-194 As above, slightly more clay, minor jarosite, massive saprolite <25%. | SC-SM | | | | | | 19 | 6 | 33.4 | CMC-13P 192-193 |
| | | | 192 | | | | | | | | 30 | 14 | 60.9 | CMC-13P 199-201 |
| 17 | 20 | | 194 | 194-197 As above, more silt and clay, massive saprolite <35%. | CL | | | | | | | | | |
| | | | 196 | | | | | | | | | | | |
| | | | 198 | 197-200 Red (10R4/8) lean clay (massive saprolite) with angular clasts, jarosite, illite, massive, damp, firm to hard. | CL | | | | | | | | | |
| 18 | 20 | | 200 | 200-202 As above. | | | | | | | | | | |
| 19 | 12 | | 202 | 202-204 As above. | | | | | | | | | | |
| 20 | 0 | | 204 | 204-206 No recovery. | | | | | | | | | | |
| 21 | 0 | | 206 | 206-208 No recc | | | | | | | | | | |
| 22 | 6 | | 208 | 208-210 Recovered clasts of structure saprolite with minor massive saprolite as above. | CL | | | | | | | | | |
| 23 | 6 | | 210 | 210-212 Weathered bedrock (structured saprolite) lesser massive saprolite component, highly weathered and fractured. | | | | | | | | | | |
| 24 | 0 | | 212 | 212-214 No recovery. | | | | | | | | | | |
| 25 | 12 | | 214 | 214-216 No recovery. | | | | | | | | | | |
| 26 | 0 | | 216 | 216-218 No recovery. | | | | | | | | | | |
| 27 | 0 | | 218 | 218-220 No recovery. | | | | | | | | | | |
| 28 | 0 | | 220 | 220-222 No recovery. | | | | | | | | | | |
| 29 | 3 | | 222 | 222-224 Weathered bedrock as above. | | | | | | | | | | |
| 30 | 0 | | 224 | 224-226 No recovery. | | | | | | | | | | |
| 31 | 9 | | 226 | 226-228 Weathered bedrock as above. | | | | | | | | | | |
| 32 | 0 | | 228 | 228-230 No recovery. | | | | | | | | | | |
| 33 | 0 | | 230 | 230-232 No recovery. | | | | | | | | | | |
| 34 | 9 | | 232 | 232-234 Weathered bedrock as above. | | | | | | | | | | |
| 35 | 6 | | 234 | 234-236 Weathered bedrock as above. | | | | | | | | | | |
| | | | 236 | E.O.B. @ 236' | | | | | | | | | | |
| | | | 238 | | | | | | | | | | | |
| | | | 240 | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

Route to:
Solid Waste
Emergency Response
Wastewater
Haz. Waste
Underground Tanks
Water Resources
Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| CMC - Saprolite Investigation | | CMC-14P |

| Boring Drilled by (Firm name and name of crew chief) | Date Started MM/DD/YY | Date Completed MM/DD/YY | Drilling Method |
|---|---|---|---|
| WTD - Jon Weeks | 10/04/94 | 10/07/94 | 6" Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | | 1608.91 | 6" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 115996.51N, 2278987.83E S/C/N Lat | ____ N ____ E |
| NW1/4 of NE1/4 of Section 31, T35N, R13E Long | Feet ____ S Feet ____ W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Nashville |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0 | Blind drill 0-85'. Cuttings retained. Begin split-spoon sampling at 85'. Begin HQ coring at 101'. | | | | | | | | | | |
| 1 | 5 | 100f.5 | 85 | 85-87 Red brown (10R4/4) silty clay (massive saprolite) with angular clasts, hematic, minor | CL | | | | | | | | | |
| 2 | 6 | 100f.5 | 87 | jarosite, massive, damp-wet, sticky (massive saprolite). | | | | | | | | | | |
| 3 | 8 | 49/100 f.4 | 89 | 87-89 As above with increase in angular fragments, poor recovery. | CL-GC | | | | | | | | | |
| 4 | 3 | 100f.2 | 91 | 89-91 As above, minor jarosite, more sand. | CL-SC | | | | | | | | | |
| | | | | 91-93 As above. | CL-SC | | | | | | | | | |
| 5 | 11 | 69/100f.4 | 93 | 93-93.7 As above. | SC-CL | | | | | | | | | |
| | | | | 93.7-94 Red brown (2.5YR4/5) silty clay | CL | | | | | | | | | |
| 6 | 6 | 60/100f.4 | 95 | (massive saprolite), minor jarosite, massive, damp, firm. | | | | | | | | | | |
| 7 | 5 | 100f.5 | 97 | 95-97 As above. | CL | | | | | | | | | |
| | | | | 97-99 As above. | CL | | | | | | | | | |
| 8 | 2 | 100f.3 | 99 | 99-100 As above. | CL | | | | | | | | | |
| 9 | 20 | — | 101 | 100-110 Red weathered bedrock - hematite-quartz-clay rich schist (structured saprolite). | | | | | | | | | | |
| | | | 103 | | | | | | | | | | | |
| | | | 105 | | | | | | | | | | | |
| | | | 107 | | | | | | | | | | | |
| | | | 109 | | | | | | | | | | | |
| | | | | E.O.B. @ 110' | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

| Signature | Firm |
|---|---|
| | Foth & Van Dyke |

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory.
Penalties: Forfeit not less than $10 nor more then $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources

Route to:
Solid Waste
Emergency Response
Wastewater
Haz. Waste
Underground Tanks
Water Resources
Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91

Page 1 of 1

| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| CMC - Saprolite Investigation | | CMC-OWA-1 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started MM/DD/YY | Date Completed MM/DD/YY | Drilling Method |
|---|---|---|---|
| WTD - Jon Weeks | 10/08/94 | 10/10/94 | 8" Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | NA | 1657.55 | |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane _____N, _____E S/C/N Lat | ____ N ____ E |
| SE1/4 of SW1/4 of Section 30, T35N, R13E Long | Feet ____ S Feet ____ W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Nashville |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0 | Blind drill 0-32'. Refusal on cobble layer - abandon borehole. | | | | | | | | | | |
| | | | 2 | | | | | | | | | | | |
| | | | 4 | | | | | | | | | | | |
| | | | 6 | | | | | | | | | | | |
| | | | 8 | | | | | | | | | | | |
| | | | 10 | | | | | | | | | | | |
| | | | 12 | | | | | | | | | | | |
| | | | 14 | | | | | | | | | | | |
| | | | 16 | | | | | | | | | | | |
| | | | 18 | | | | | | | | | | | |
| | | | 20 | | | | | | | | | | | |
| | | | 22 | | | | | | | | | | | |
| | | | 24 | | | | | | | | | | | |
| | | | 26 | | | | | | | | | | | |
| | | | 28 | | | | | | | | | | | |
| | | | 30 | | | | | | | | | | | |
| | | | 32 | E.O.B. @ 32' | | | | | | | | | | |
| | | | 34 | | | | | | | | | | | |
| | | | 36 | | | | | | | | | | | |
| | | | 38 | | | | | | | | | | | |
| | | | 40 | | | | | | | | | | | |
| | | | 42 | | | | | | | | | | | |
| | | | 44 | | | | | | | | | | | |
| | | | 46 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

| Signature | Firm |
|---|---|
| Ed Foth | Foth & Van Dyke |

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory.
Penalties: Forfeit not less than $10 nor more then $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin | Route to: | SOIL BORING LOG INFORMATION

Department of Natural Resources | Solid Waste | Haz. Waste | Form 4400-122 | 7-91

Emergency Response | Underground Tanks

Wastewater | Water Resources

Other



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| CMC - Saprolite Investigation | | CMC-OWA-1R |

| Boring Drilled by (Firm name and name of crew chief) | Date Started MM/DD/YY | Date Completed MM/DD/YY | Drilling Method |
|---|---|---|---|
| Total Drilling - Keith Meyer | 10/15/94 | 10/17/94 | 6" Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | | 1657.55 | 8" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 116229.25N, 2277661.24E S/C/N | Lat |
| SE1/4 of SW1/4 of Section 30, T35N, R13E | Long |
| | Feet ____ N ____ E |
| | Feet ____ S Feet ____ W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Nashville |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0 | 0-138 Blind drill, cuttings retained begin coring at 138' (NQ). | | | | | | | | | | |
| 1 | 2 | | 138 | 138-142 No recovery but clasts indicate till. | | | | | | | | | | |
| | | | 140 | | | | | | | | | | | |
| | | | 142 | Blind drill 142-154, core at 154'. | | | | | | | | | | |
| | | | 144 | | | | | | | | | | | |
| | | | 146 | | | | | | | | | | | |
| | | | 148 | | | | | | | | | | | |
| | | | 150 | | | | | | | | | | | |
| | | | 152 | | | | | | | | | | | |
| 2 | 54 | | 154 | 154-164 Red (10R4/4) silty clay (massive saprolite) with angular clasts, jarosite, hematite, some remnant structured saprolite clasts with white clay, hematite, massive with localized weak, fine platy structure, damp-dry, firm, jarosite increases with depth. | CL | | | | | | | 62 | 23 | 67.7 | CMC-OWA-1 154-156 |
| | | | 156 | | | | | | | | | | | |
| | | | 158 | | | | | | | | | | | |
| | | | 160 | | | | | | | | | | | |
| | | | 162 | | | | | | | | | | | |
| 3 | 62 | | 164 | 164-175 Highly weathered bedrock (structured saprolite), white clay rich schist with quartz, illite, minor jarosite and hematite in fractures, core grades in and out of more competent rock that is highly fractured and highly weathered and altered crumbly rock. | | | | | | | | | | | |
| | | | 166 | | | | | | | | | | | |
| | | | 168 | | | | | | | | | | | |
| | | | 170 | | | | | | | | | | | |
| | | | 172 | | | | | | | | | | | |
| | | | 174 | | | | | | | | | | | |
| 4 | 20 | | 176 | 175-185 Weathered bedrock (structured saprolite). 175-178.5 More competant weathered schist. | | | | | | | | | | |
| | | | 178 | 178.5-180 Highly weathered with hydrous copper sulfide alteration minerals, hematite white clay and minor jarosite. | | | | | | | | | | |
| | | | 180 | 180-181.5 Grades into a more massive saprolite | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature | Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory.

Penalties: Forfeit not less than $10 nor more then $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 182 | assemblage which is well consolidated. | | | | | | | | | | |
| | | | 184 | 182-185 Highly weathered bedrock (structured saprolite) poorly indurated sericitic schist. | | | | | | | | | | |
| 5 | 88 | | 186 | 185-195 Highly weathered bedrock (structural saprolite) were 185-190 less weathered more competent schist. | | | | | | | | | | |
| | | | 188 | | | | | | | | | | | |
| | | | 190 | 190-195 Highly weathered structured saprolite with hematite, white clay, illite, minor jarosite, | | | | | | | | | | |
| | | | 192 | compressed and deformed layering, weak-fine platy structure, dry-damp. | | | | | | | | | | |
| | | | 194 | | | | | | | | | | | |
| | | | 196 | 195-205 Weathered bedrock (structured saprolite) were 195-202 is mainly weathered sl. competent schist with hematite and minor | | | | | | | | | | |
| | | | 198 | jarosite in more weathered fracture zones and 202+ is massive sulfide consisting mainly of | | | | | | | | | | |
| | | | 200 | pyrite with minor galena chalcocite and chalcopyrite. | | | | | | | | | | |
| | | | 202 | | | | | | | | | | | |
| | | | 204 | | | | | | | | | | | |
| | | | 206 | E.O.B. @ 205' | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| CMC - Saprolite Investigation | | CMC-OWA-2 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started MM/DD/YY | Date Completed MM/DD/YY | Drilling Method |
|---|---|---|---|
| Total Drilling - Keith Meyer | 10/18/94 | 10/20/94 | 6" Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | | 1658.74 | 6" |

Boring Location
State Plane 116283.02N, 2277645.76E S/C/N Lat
SE1/4 of SW1/4 of Section 30, T35N, R13E Long

Local Grid Location (if applicable)
____ N ____ E
Feet ____ S Feet ____ W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Nashville |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0 | Blind drill 0-153. Blind drill begin core at 153'. | | | | | | | | | | |
| | | | 152 | | | | | | | | | | | |
| 1 | 0 | | | 153-156 No recovery. | | | | | | | | | | |
| | | | 154 | | | | | | | | | | | |
| 2 | 4.5 | | 156 | 156-161 Red (10R5/3) silty clay (massive saprolite) with angular clasts, abundant yellow jarosite, massive, wet, sticky, lower contact inferred from drilling. | CL | | | | | | | | | |
| | | | 158 | | | | | | | | | | | |
| | | | 160 | | | | | | | | | | | |
| 3 | 0 | | | 161-166 No recovery. | | | | | | | | | | |
| | | | 162 | | | | | | | | | | | |
| | | | 164 | | | | | | | | | | | |
| 4 | 0 | | 166 | 166-170 No recovery. | | | | | | | | | | |
| | | | 168 | | | | | | | | | | | |
| 5 | 42 | | 170 | 170-176 Weathered bedrock (structured saprolite). Red, white, and yellow highly weathered schist, with hematite, illite, jarosite, white clay remnant vertical foliation still evident, damp-wet, sticky to crumbly. | | | | | | | | | | |
| | | | 172 | | | | | | | | | | | |
| | | | 174 | | | | | | | | | | | |
| 6 | 48 | | 176 | 172-173 Red massive saprolite as above with jarosite, entire core is generally structured saprolite with grading of massive saprolite in more weathered zones to fractured competent bedrock in less weathered zones. | | | | | | | | | | |
| | | | 178 | | | | | | | | | | | |
| 7 | 80 | | 180 | 176-181 Weathered bedrock (structured saprolite equivalent) to 177' weathered schist with white clay, quartz, illite, minor jarosite, hematite. | | | | | | | | | | |
| | | | 182 | | | | | | | | | | | |
| | | | 184 | 177+ Massive sulfide, weathered to fresh pyrite, galena, minor chalcocite, chalcopyrite, minor hematite. | | | | | | | | | | |
| | | | 186 | | | | | | | | | | | |
| | | | 188 | 181-191 Massive sulfide as above. | | | | | | | | | | |
| | | | 190 | | | | | | | | | | | |
| | | | 192 | E.O.B. @ 191' | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature] Firm Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory.
Penalties: Forfeit not less than $10 nor more then $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources

Route to:
Solid Waste
Emergency Response
Wastewater
Haz. Waste
Underground Tanks
Water Resources
Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91

Page 1 of 1

| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| CMC - Saprolite Investigation | | CMC-OWA-3 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started MM/DD/YY | Date Completed MM/DD/YY | Drilling Method |
|---|---|---|---|
| Total Drilling - Keith Meyer | 10/17/94 | 10/18/94 | 6" Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | | 1657.82 | 6" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 116218.57N, 2277686.07E S/C/N Lat | ____ N ____ E |
| SE1/4 of SW1/4 of Section 30, T35N, R13E Long | Feet ____ S Feet ____ W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Nashville |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0 | Blind drill 0-129, split-spoon sample screen interval. | | | | | | | | | | |
| 1 | 12 | Air Hammer | 129 | 129-131 Red (10R5/4) silty sand with gravel and clay, [illegible], dense, hard, <20% massive saprolite (till). | SC | | | | | | | | 31.3 | CMC-OWA-3 129-131 |
| | | | 131 | E.O.B. @ 131' | | | | | | | | | | |
| | | | 133 | | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature] Firm Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory.
Penalties: Forfeit not less than $10 nor more then $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources

Route to:
Solid Waste
Emergency Response
Wastewater
Haz. Waste
Underground Tanks
Water Resources
Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91

Page 1 of 1

| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| CMC - Saprolite Investigation | | CMC-OWA-4 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started MM/DD/YY | Date Completed MM/DD/YY | Drilling Method |
|---|---|---|---|
| WTD - Jon Weeks | 10/10/94 | 10/11/94 | 6" Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | | 1661.19' MSL | 6" |

Boring Location
State Plane 116357.71N, 2277607.17E S/C/N Lat
SE1/4 of SW1/4 of Section 30, T35N, R13E Long

Local Grid Location (if applicable)
____ N ____ E
Feet ____ S Feet ____ W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Nashville |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0 | Blind drill 0-120, split-spoon sample screened interval. | | | | | | | | | | |
| 1 | 12 | 10/13 20/20 | 120 | 120-122 Red brown (5YR4/4) silty sand with gravel and clay, massive, damp, firm (till). | SM | | | | | | | | | |
| 2 | 8 | 2/16 19/22 | 122 | 122-124 As above. | | | | | | | | | | |
| 3 | 24 | | 124 | 124-126 As above. | SC | | | | | | | | 34 | CMC-OWA-4 124-126 |
| | | | 126 | E.O.B. @ 126' | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm
Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory.
Penalties: Forfeit not less than $10 nor more then $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources

Route to:
Solid Waste
Emergency Response
Wastewater
Haz. Waste
Underground Tanks
Water Resources
Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91

Page 1 of 1

| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| CMC - Saprolite Investigation | | CMC-OWA-5 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started MM/DD/YY | Date Completed MM/DD/YY | Drilling Method |
|---|---|---|---|
| WTD - Jon Weeks | 10/12/94 | 10/15/94 | 6" Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | | 1648.57' MSL | 6" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 115990.28N, 2277837.12E S/C/N | Lat |
| NE1/4 of NW1/4 of Section 31, T35N, R13E | Long |
| | Feet ____ N ____ S Feet ____ E ____ W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Nashville |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0 | Blind drill 0-125'. Begin split-spoon sampling at 125'. | | | | | | | | | | |
| | | | 120 | | | | | | | | | | | |
| | | | 122 | | | | | | | | | | | |
| | | | 124 | | | | | | | | | | | |
| 1 | 12 | 5/9 | | 125-127 Red brown (5YR4/4) silty sand with clay, massive, damp, firm, minor incorporation of massive saprolite (till). | SC | | | | | | | | | |
| 2 | 24 | 10/14 | 126 | | | | | | | | | | | |
| | | 14/23 | 128 | 127-129 As above. | SC | | | | | | | | 34.7 | CMC-OWA-5 127-129 |
| 3 | 0 | 15/20 | | 129-131 As above. | SC | | | | | | | | | |
| | | 24/24 | 130 | | | | | | | | | | | |
| | | | 132 | E.O.B. @ 132' | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory.
Penalties: Forfeit not less than $10 nor more then $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin | Route to: | SOIL BORING LOG INFORMATION

Department of Natural Resources | Solid Waste | Haz. Waste | Form 4400-122 | 7-91

Emergency Response | Underground Tanks

Wastewater | Water Resources

Other



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| CMC - Saprolite Investigation | | CMC-PWA |

| Boring Drilled by (Firm name and name of crew chief) | Date Started MM/DD/YY | Date Completed MM/DD/YY | Drilling Method |
|---|---|---|---|
| Total Drilling - Keith Meyer | 09/02/94 | 09/25/94 | 10" Mud Rotary<br>6" Air Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | | | 180'-10", 50'-6" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 116169.00N, 2277699.69E S/C/N Lat | ____ N ____ E |
| SE1/4 of SW1/4 of Section 30, T35N, R13E Long | Feet ____ S Feet ____ W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Nashville |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0 | Blind drill 0-230', cutting retained. 0-85 Brown silty sand with gravel (till) mixed with outwash sands and gravels. | SM | | | | | | | | | |
| | | | 10 | | | | | | | | | | | |
| | | | 20 | | | | | | | | | | | |
| | | | 30 | | | | | | | | | | | |
| | | | 40 | | | | | | | | | | | |
| | | | 50 | | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | |
| | | | 70 | | | | | | | | | | | |
| | | | 80 | | | | | | | | | | | |
| | | | 90 | 85-130 Orange silty sand with clay and gravel (till) probably mixed with outwash sands and gravels. | SM-SC | | | | | | | | | |
| | | | 100 | | | | | | | | | | | |
| | | | 110 | | | | | | | | | | | |
| | | | 120 | | | | | | | | | | | |
| | | | 130 | 130-158 Red silty clay with dark angular clasts (massive saprolite). | SC-CL | | | | | | | | | |
| | | | 140 | | | | | | | | | | | |
| | | | 150 | | | | | | | | | | | |
| | | | 160 | 158+ Grey weathered bedrock (structured saprolite). Massive sulfide with white clay. | | | | | | | | | | |
| | | | 170 | | | | | | | | | | | |
| | | | 180 | | | | | | | | | | | |
| | | | 190 | | | | | | | | | | | |
| | | | 200 | | | | | | | | | | | |
| | | | 210 | | | | | | | | | | | |
| | | | 220 | | | | | | | | | | | |
| | | | 230 | E.O.B. @ 230' | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

| Signature | Firm |
|---|---|
| | Foth & Van Dyke |

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory.
Penalties: Forfeit not less than $10 nor more then $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources

Route to:
Solid Waste
Emergency Response
Wastewater
Haz. Waste
Underground Tanks
Water Resources
Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| CMC - Saprolite Investigation | | CMC-PWAR |

| Boring Drilled by (Firm name and name of crew chief) | Date Started MM/DD/YY | Date Completed MM/DD/YY | Drilling Method |
|---|---|---|---|
| Total Drilling - Keith Meyer | 09/29/94 | 10/04/94 | 6" Air Rotary<br>10" Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | | ~1656.8' MSL | 50'-6", 220'-10" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 116183.06N, 2277679.09E S/C/N Lat<br>SR 1/4 of SW 1/4 of Section 30, T35N, R13E Long | Feet ___ N ___ E<br>Feet ___ S ___ W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Nashville |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0 | 0-270 Blind drill cuttings retained.<br>0-2 Dark brown organic topsoil. | OL | | | | | | | | | |
| | | | 5 | 2-4 Brown silty sand with clay. | SC-SM | | | | | | | | | |
| | | | 10 | 4-85 Brown silty sand with gravel (till) mixed with outwash sands and gravels. | SM | | | | | | | | | |
| | | | 85 | 85-130 Brown silty sand with gravel and clay (till) mixed with outwash sands and gravels. | SM-SC | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature] Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory.
Penalties: Forfeit not less than $10 nor more then $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin | Route to: | SOIL BORING LOG INFORMATION

Department of Natural Resources | Form 4400-122 | 7-91

BORING NUMBER: CMC-PWA-R | 

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 120 | | | | | | | | | | | |
| | | | 125 | | | | | | | | | | | |
| | | | 130 | 130-159 Red brown silty sand with gravel and clay (till) mixed with outwash sands and gravels. | SM-SC | | | | | | | | | |
| | | | 135 | | | | | | | | | | | |
| | | | 140 | | | | | | | | | | | |
| | | | 145 | | | | | | | | | | | |
| | | | 150 | | | | | | | | | | | |
| | | | 155 | | | | | | | | | | | |
| | | | 160 | 159-181 Bright red silty clay (massive saprolite) with angular dark colored clasts. | CL | | | | | | | | | |
| | | | 165 | | | | | | | | | | | |
| | | | 170 | | | | | | | | | | | |
| | | | 175 | | | | | | | | | | | |
| | | | 180 | 181-196 Weathered bedrock (structured saprolite) with white clay, hematite, etc. | | | | | | | | | | |
| | | | 185 | | | | | | | | | | | |
| | | | 190 | | | | | | | | | | | |
| | | | 195 | 196+ Weathered bedrock pyrite, white clay, chalcocite (structured saprolite). | | | | | | | | | | |
| | | | 200 | | | | | | | | | | | |
| | | | 205 | | | | | | | | | | | |
| | | | 210 | | | | | | | | | | | |
| | | | 215 | | | | | | | | | | | |
| | | | 220 | Casing set to 220'. | | | | | | | | | | |
| | | | 225 | | | | | | | | | | | |
| | | | 230 | | | | | | | | | | | |
| | | | 235 | | | | | | | | | | | |
| | | | 240 | | | | | | | | | | | |
| | | | 245 | | | | | | | | | | | |
| | | | 250 | | | | | | | | | | | |
| | | | 255 | | | | | | | | | | | |
| | | | 260 | | | | | | | | | | | |
| | | | 265 | | | | | | | | | | | |
| | | | 270 | E.O.B. @ 270' | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste, Emergency Response, Wastewater, Haz. Waste, Underground Tanks, Water Resources, Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| CMC - Saprolite Investigation | | CMC-PWB |

| Boring Drilled by (Firm name and name of crew chief) | Date Started MM/DD/YY | Date Completed MM/DD/YY | Drilling Method |
|---|---|---|---|
| Total Drilling - Keith Meyer | 10/05/94 | 10/09/94 | 6" Air Rotary<br>10" Mud Rotary |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | | ~1616.5' MSL | 10" |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 116040.80N, 2278646.22E S/C/N<br>NE1/4 of NW1/4 of Section 31, T35N, R13E | Lat<br>Long |
| | Feet ___ N ___ S Feet ___ E ___ W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 71 | Nashville |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0 | Blind drill 0-400', cuttings retained. | | | | | | | | | | |
| | | | 5 | 0-85 Brown silty sand with gravel (till) mixed with outwash sands and gravels. | SM | | | | | | | | | |
| | | | 10 | | | | | | | | | | | |
| | | | 15 | | | | | | | | | | | |
| | | | 20 | | | | | | | | | | | |
| | | | 25 | | | | | | | | | | | |
| | | | 30 | | | | | | | | | | | |
| | | | 35 | | | | | | | | | | | |
| | | | 40 | | | | | | | | | | | |
| | | | 45 | | | | | | | | | | | |
| | | | 50 | | | | | | | | | | | |
| | | | 55 | | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | |
| | | | 65 | | | | | | | | | | | |
| | | | 70 | | | | | | | | | | | |
| | | | 75 | | | | | | | | | | | |
| | | | 80 | | | | | | | | | | | |
| | | | 85 | 85-95 Red brown silty sand to silty clay with gravel (till). | SM-SC | | | | | | | | | |
| | | | 90 | | | | | | | | | | | |
| | | | 95 | 95-115 Red silty clay with angular dark clasts (massive saprolite). | CL | | | | | | | | | |
| | | | 100 | | | | | | | | | | | |
| | | | 105 | | | | | | | | | | | |
| | | | 110 | | | | | | | | | | | |
| | | | 115 | 115+ Weathered bedrock (structured saprolite). | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Erik Stelzl Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory.
Penalties: Forfeit not less than $10 nor more then $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 120 | 115-120 Hard, hematic, minor clay minerals. 120-140 Softer, friable, maybe some massive saprolite. | | | | | | | | | | |
| | | | 125 | | | | | | | | | | | |
| | | | 130 | | | | | | | | | | | |
| | | | 135 | | | | | | | | | | | |
| | | | 140 | 140-145 Harder structured saprolite. | | | | | | | | | | |
| | | | 145 | 145-160 Softer, more weathered structured saprolite. | | | | | | | | | | |
| | | | 150 | | | | | | | | | | | |
| | | | 155 | | | | | | | | | | | |
| | | | 160 | 160-180 Harder hematic structured saprolite. | | | | | | | | | | |
| | | | 165 | | | | | | | | | | | |
| | | | 170 | | | | | | | | | | | |
| | | | 175 | | | | | | | | | | | |
| | | | 180 | 180-190 Red silty clay with angular rock fragments (massive saprolite). | | | | | | | | | | |
| | | | 185 | | | | | | | | | | | |
| | | | 190 | 190-205 As above. | | | | | | | | | | |
| | | | 195 | | | | | | | | | | | |
| | | | 200 | | | | | | | | | | | |
| | | | 205 | 205-220 Weathered bedrock (structured saprolite), soft white clay rich schist. | | | | | | | | | | |
| | | | 210 | | | | | | | | | | | |
| | | | 215 | | | | | | | | | | | |
| | | | 220 | 220+ Weathered bedrock (massive sulfide - structured saprolite) pyrite, minor chalcocite, white clay, chlorite. | | | | | | | | | | |
| | | | 225 | | | | | | | | | | | |
| | | | 230 | | | | | | | | | | | |
| | | | 235 | | | | | | | | | | | |
| | | | 240 | 240-250 Increase in white clay. | | | | | | | | | | |
| | | | 245 | | | | | | | | | | | |
| | | | 250 | | | | | | | | | | | |
| | | | 255 | | | | | | | | | | | |
| | | | 260 | | | | | | | | | | | |
| | | | 265 | | | | | | | | | | | |
| | | | 270 | 270-280 Dominantly pyrite and minor chalcocite. | | | | | | | | | | |
| | | | 275 | | | | | | | | | | | |
| | | | 280 | | | | | | | | | | | |
| | | | 285 | | | | | | | | | | | |
| | | | 290 | | | | | | | | | | | |
| | | | 295 | | | | | | | | | | | |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 300 | | | | | | | | | | | |
| | | | 305 | | | | | | | | | | | |
| | | | 310 | | | | | | | | | | | |
| | | | 315 | | | | | | | | | | | |
| | | | 320 | | | | | | | | | | | |
| | | | 325 | | | | | | | | | | | |
| | | | 330 | | | | | | | | | | | |
| | | | 335 | | | | | | | | | | | |
| | | | 340 | | | | | | | | | | | |
| | | | 345 | | | | | | | | | | | |
| | | | 350 | | | | | | | | | | | |
| | | | 355 | | | | | | | | | | | |
| | | | 360 | | | | | | | | | | | |
| | | | 365 | | | | | | | | | | | |
| | | | 370 | | | | | | | | | | | |
| | | | 375 | | | | | | | | | | | |
| | | | 380 | | | | | | | | | | | |
| | | | 385 | | | | | | | | | | | |
| | | | 390 | | | | | | | | | | | |
| | | | 395 | | | | | | | | | | | |
| | | | 400 | E.O.B. @ 400' | | | | | | | | | | |

# Appendix 3.5-13a

## Logs and Abandonment Forms for 1996 TD Drilling, Inc. TMA Borings

State of Wisconsin
Department of Natural Resources

Route to:
☐ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☑ Other: Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Project - TMA Drilling Program | | CMC-TMA-101 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started MM/DD/YY | Date Completed MM/DD/YY | Drilling Method |
|---|---|---|---|
| TD Drilling, Inc.<br>James Meyers | 02/06/96 | 02/06/96 | Dual Tube |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| NA | NA | NA | NA | 1643.64 | 5¾ inches |

Boring Location
State Plane 116701.38 N, 2283073.56 E S/C/N Lat
SE 1/4 of SW 1/4 of Section 29, T35N, R13E Long

Local Grid Location (if applicable)
____ N ____ E
Feet ____ S Feet ____ W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-0 | 0-2 | | | Dk. brown (7.5YR3/4) damp, sandy clay w/minor subangular gravel till | CL | | | | | | | | | Blow counts = rate of penetration min/5' interval |
| DT-1 | 5-7 | 5 | 5 | Brown (7.5YR4/4) wet, silty sand w/5% subround-to-round gravel till | SM | | | | | | | | | |
| DT-2 | 10-12 | 5 | 10 | Strong brown (7.5YR5/6) damp, coarse grained sand w/minor gravel, coarse outwash | SP | | | | | | | | | Bit plugged at 10', frequent plugging slowed penetration |
| DT-3 | 15-17 | 5 | 15 | As above w/increased gravel 5-10%, rounded to subrounded coarse outwash | SP | | | | | | | | | |
| DT-4 | 20-22 | 5 | 20 | As above, grading to medium texture sand w/minor gravel (4.5YR4/6) | SP | | | | | | | | | Rec = sampled interval depth below ground surface (ft) |
| DT-5 | 25-27 | 2.5 | 25 | As above, coarse outwash | SP | | | | | | | | | |
| DT-6 | 30-32 | 3.0 | 30 | Dk. brown (7.5YR4/4) silty sand, fine to medium texture w/gravel angular to subrounded, till | SM | | | | | | | | | |
| DT-7 | 35-37 | 2.0 | 35 | As above, till | SM | | | | | | | | | |
| DT-8 | 40-42 | 4.0 | 40 | As above, grading to fine silty sand, color grading to light yellow brown (2.5YR6/3) due to boulders till | SM | | | | | | | | | |
| DT-9 | 45-47 | 4.0 | 45 | Lt. brown (7.5YR6/3) fine silty sand w/5% angular gravel, boulders, till | SM | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Stephen A. Wood Firm Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory.
Penalties: Forfeit not less than $10 nor more then $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-TMA-101

Route to:

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-10 | 50-52 | 2.3 | 50 | As above w/increased gravel 10-15%, till | SM | | | | | | | | | |
| DT-11 | 55-57 | 2.3 | 55 | Strong brown (7.5YR4/6) medium to coarse textured sand w/10-15% gravel, subangular to rounded coarse outwash | SM | | | | | | | | | |
| DT-12 | 60-62 | 2.3 | 60 | As above w/increased gravel 15-20% | SP-GP | | | | | | | | | |
| DT-13 | 65-67 | 1.3 | 65 | As above, grading to dk. grayish brown (2.5YR4/2) coarse outwash | SP | | | | | | | | | |
| DT-14 | 70-72 | 1.5 | 70 | Brown (7.5YR5/4) fine sand, fine outwash | SP | | | | | | | | | |
| DT-15 | 75-77 | 1.0 | 75 | As above w/gravel, rounded to subrounded 10% fine outwash | SP | | | | | | | | | |
| DT-16 | 80-82 | 1.3 | 80 | As above, grading to stronger brown (7.5YR5/6) and coarser, textured, fine to coarse outwash | SP | | | | | | | | | |
| DT-17 | 85-87 | 1.0 | 85 | Grayish brown (7.5YR5/4) med. to coarse textured sand w/gravel 15% subrounded course outwash | SP | | | | | | | | | |
| DT-18 | 90-92 | 1.0 | 90 | As above, coarse outwash | SP | | | | | | | | | |
| DT-19 | 95-97 | 1.0 | 95 | As above, grading to sandy gravel, coarse outwash | GP | | | | | | | | | |
| DT-20 | 100-102 | 1.0 | 100 | As above, grading to (7.5YR4/2) grayish brown, coarse outwash | GP | | | | | | | | | |
| DT-21 | 105-107 | 1.5 | 105 | As above, grading brown (7.5YR4/4), coarse outwash | SP | | | | | | | | | |
| DT-22 | 110-112 | 1.5 | 110 | Reddish brown (5YR4/6) silty sand med. texture, oxidized till 5-10% subangular gravel | SM-SP | | | | | | | | | |
| DT-23 | 115-117 | 1.5 | 115 | As above w/increased fines and gravel 10-15% grading to brown (7.5YR4/4), till | SM | | | | | | | | | |
| DT-24 | 120-122 | 1.5 | 120 | Yellowish brown (10YR4/6) silty clayey sand, till, washed w/water | SM | | | | | | | | | Water wash to unplug bit and rods. |

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-25 | 125-127 | 2.5 | 125 | Yellowish brown (10YR5/6) coarse sand w/gravel 10-20% coarse outwash | SP | | | | | | | | | |
| DT-26 | 130-132 | 1.5 | 130 | As above grading med. texture gravels, sand coarse outwash | SP | | | | | | | | | |
| DT-27 | 135-137 | 2.0 | 135 | As above | SP | | | | | | | | | |
| DT-28 | 140-142 | 2.0 | 140 | As above | SP | | | | | | | | | |
| DT-29 | 145-147 | 3.8 | 145 | Strong brown (7.5YR4/6) silty sand w/gravel subrounded to angular till | SM | | | | | | | | | |
| DT-30 | 150-152 | 4.0 | 150 | Light brown (7.5YR5/4) med. texture sand w/minor gravel, coarse outwash | SP | | | | | | | | | |
| DT-31 | 155-157 | 3.6 | 155 | As above | SP | | | | | | | | | |
| DT-32 | 160-162 | 3.8 | 160 | 160-175 unweathered bedrock<br><br>Abandoned w/bentonite grout<br>Topped off w/hole plug<br><br>Supplemental Bedrock, AJE Jr. 2/17/96<br><br>160-162 Tan stained weakly weathered "greenstone". Fine grained metatuff. Rare trace pyrite.<br><br>162-177 Mixed tan weakly weathered tuff and grey-green unweathered metatuff. "Greenstone", rare trace pyrite and trace white-clear quartz veinlets.<br><br>No significane sulfides in bedrock. | BR | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

# WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Form 3300-5W 11-89

All abandonment work shall be performed in accordance with the provisions of Chapters NR 111, NR 112 or NR 141, Wis. Admin. Code, whichever is applicable. Also, see instructions on back.

## (1) GENERAL INFORMATION

Well/Drillhole/Borehole Location | County: Forest

SE ¼ of SW ¼ of Sec. 29 ; T. 35 N R. 13 ☑ E ☐ W

(If applicable) _____ Gov't Lot _____ Grid Number

Grid Location: 116701.38 ft. ☑ N. ☐ S., 2283073.56 ft. ☑ E. ☐ W.

Civil Town Name: Lincoln

Street Address of Well: NA

City, Village: NA

## (2) FACILITY NAME

Original Well Owner (If Known): Crandon Mining Company

Present Well Owner: Crandon Mining Company

Street or Route: 7 North Brown Street, 3rd Floor

City, State, Zip Code: Rhinelander, WI 54501-3161

Facility Well No. and/or Name (If applicable): CMC-TMA-101

WI Unique Well No.: _____

Reason For Abandonment: Boring Completion

Date of Abandonment: 02/06/96

## WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drillhole/Borehole Construction Completed On (Date) 02/06/96

☐ Monitoring Well
☐ Water Well
☐ Drillhole
☑ Borehole

Construction Report Available? ☐ Yes ☐ No

Construction Type:
☑ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) _____

Formation Type:
☑ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft.) 162 (From groundsurface) Casing Diameter (ins.) ____

Casing Depth (ft.) ____

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown
If Yes, To What Depth? _____ Feet

(4) Depth to Water (Feet) _____

| | | | |
|---|---|---|---|
| Pump & Piping Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Liner(s) Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Screen Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Casing Left in Place? | ☐ Yes | ☐ No | |

If No, Explain _____

| | | |
|---|---|---|
| Was Casing Cut Off Below Surface? | ☐ Yes | ☐ No |
| Did Sealing Material Rise to Surface? | ☑ Yes | ☐ No |
| Did Material Settle After 24 Hours? | ☑ Yes | ☐ No |
| If Yes, Was Hole Retopped? | ☑ Yes | ☐ No |

(5) Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☑ Conductor Pipe-Pumped
☐ Dump Bailer ☐ Other (Explain)

(6) Sealing Materials — For monitoring wells and monitoring well boreholes only
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☑ Bentonite-Sand Slurry
☑ Chipped Bentonite
☐ Bentonite Pellets
☐ Granular Bentonite
☐ Bentonite - Cement Grout

(7)

| Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks Sealant or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Bentonite Grout/⅜" Hole Plug | Surface | 162 | 2 bags Gel | 150 gallons $H_2O$/100 lb gel |
| | | | 3 bags granular | 150 lb grannular |
| | | | 8 bags H.P. | |
| | | | | |

(8) Comments: Borehole tapped off with ⅜" hole plug after 24 hours.

(9) Name of Person or Firm Doing Sealing Work
Total Drilling - Luisier Drilling
Signature of Person Doing Work Date Signed
Street or Route: 7391 S Porcupine Lake Road
Telephone Number: (414) 829-5690
City, State, Zip Code: Lena, WI 54139

(10) FOR DNR OR COUNTY USE ONLY
Date Received/Inspected | District/County
Reviewer/Inspector
Follow-up Necessary

DNR/COUNTY
3.5-13a-4

State of Wisconsin
Department of Natural Resources

Route to:
☐ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☑ Other: Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company - Crandon TMA Site | | CMC-TMA-102 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started MM/DD/YY | Date Completed MM/DD/YY | Drilling Method |
|---|---|---|---|
| TD Drilling, Inc.<br>James Meyers | 01/23/96 | 02/05/96 | Rotary Mud/Dual Tube |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| NA | NA | NA | NA | 1646.61 | 5⅞ inches |

Boring Location
State Plane 118180.57 N, 2283980.35 E S/C/N Lat
NW 1/4 of SE 1/4 of Section 29, T24N, R13E Long

Local Grid Location (if applicable)
____ N ____ E
Feet ____ S Feet ____ W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS-1 | 12 | Air hammer | 0 | 0-4 Dk. brown (7.5YR4/2) to brown (7.5YR4/4) poorly graded med.-fine texture sand occasional round pebbles | SP | | | | | | | | | Drilled to 140 w/mud rotary. 140 to EOB w/dual tube. |
| SS-2 | 24 | Air hammer | 10 | As above, thin laminations of silty sand, fine outwash | SP | | | | | | | | | |
| SS-3 | 20 | Air hammer | 20 | As above w/coarse gravel lense at 20' & abundant round & angular pebbles, coarse is wet, rest is damp | SP | | | | | | | | | |
| SS-4 | 10 | Air hammer | 30 | Yellow-brown (7.5YR5/4) silty sand w/gravel, massive to weak coarse blocky structure, damp, hard, no evident stratification (till) | SM | | | | | | | | | |
| SS-5 | 16 | Air hammer | 40 | As above w/minor sand inclusions around coarser gravel | SM | | | | | | | | | 2 bags of sample |
| SS-6 | 24 | Air hammer | 50 | As above, dense, slight color change to 7.5YR4/6 dk. yellow-brown, slightly less gravel | SM | | | | | | | | | 2 bags of sample |
| SS-7 | 21 | Air hammer | 60 | As above, very damp, oxidized, more gravel, some cobbles | SM | | | | | | | | | 2 bags of sample |
| SS-8 | 20 | Air hammer | 70 | As above, at base very sandy Drilling much easier from 72-80 | SM SM-SP | | | | | | | | | |
| SS-9 | 24 | Air hammer | 80<br>90 | Lt. brown (7.5YR6/4) gravelly med.-coarse sand w/silt, very damp to wet, dense, structureless, minor oxidation, gravel subrounded to rounded (coarse outwash) Spoon lost down hole | SP | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature] Firm Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory.
Penalties: Forfeit not less than $10 nor more then $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-TMA-102

Route to:

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S-10 | 14 | Air hammer | 100 | Yellow-brown (10YR6/6) fine sandy silt w/fine sand lenses, oxidized, deformed stratification, mod. fine prismatic to platy structure, wet, soft (ice marginal - lacustrine) | ML | | | | | | | | | |
| S-11 | 17 | Air hammer | 100 | 100-101 As above | | | | | | | | | | |
| | | | | 101-102 Brown (7.5YR5/6) fine-coarse sand w/minor silt, weakly stratified, structureless, wet, soft, (coarse outwash) | SP | | | | | | | | | |
| S-12 | 24 | Air hammer | 110 | 110-112 Yellow-brown (7.5YR5/8) silty sand w/gravel, massive, wet, sl. firm, oxidized in sandier portions (till) | SM | | | | | | | | | |
| S-13 | 16 | Air hammer | 120 | Brown (7.5YR4/3) silty sand w/gravel, massive, wet, firm (washed till) | SM-SP | | | | | | | | | |
| S-14 | 18 | Air hammer | 130 | 7.5YR5/8 coarse to med. texture silty sand w/gravel, loose to firm, wet, locally oxidized till, no evident stratification | SM | | | | | | | | | |
| S-15 | 20 | Air hammer | 140 | 7.5YR4/4 dk. brown structureless, loose to firm, weak stratification, med.-coarse texture sand, locally oxidized, w/round pebbles, coarse outwash | SP | | | | | | | | | |
| | | | | Switch to dual tube at 140' | | | | | | | | | | Switch to dual tube at 140'. |
| DT-16 | 145-147 | 1.0 | 145 | As above w/ residual mud | SP | | | | | | | | | Blow counts = rate of penetration min/5' interval. |
| DT-17 | 150-152 | 1.0 | 150 | As above w/residual mud | SP | | | | | | | | | Rec = sample interval depth below ground surface (ft) |
| DT-18 | 155-157 | 1.0 | 155 | As above, clean sample w/o mud, poorly graded, brown (7.5YR5/6) med.-coarse texture sand, ozidized, occasional pebbles, coarse outwash | SP | | | | | | | | | |
| DT-19 | 160-162 | 1.0 | 160 | | | | | | | | | | | |
| DT-20 | 165-167 | 1.0 | 165 | Brown (7.5YR5/6) poorly graded fine texture sand, very few pebbles, round fine outwash | SP | | | | | | | | | |
| DT-21 | 170-172 | 1.0 | 170 | As above, sl. darker brown (7.5YR4/6) | SP | | | | | | | | | |
| DT-22 | 175-177 | 1.0 | 175 | Brown (7.5YR4/6) silty sand w/subangular to subrounded gravel, till | SM | | | | | | | | | |
| DT-23 | 180-182 | 1.0 | 180 | As above, sl. finer sand, sl. less gravel | SM | | | | | | | | | |
| | | | | | | | | | | | | | | Bit plugged at 183' |
| DT-24 | 185-187 | 10 | 185 | Brown (7.5YR4/6) poorly graded med.-texture sand, poorly graded, coarse outwash | SP | | | | | | | | | |

State of Wisconsin | Route to: | SOIL BORING LOG INFORMATION

Department of Natural Resources | Form 4400-122 | 7-91

BORING NUMBER: CMC-TMA-102 | Page 3 of 4

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-25 | 190-192 | 1.0 | 190 | Brown (7.5YR4/6) fine textured silty sand w/infrequent gravel, fine outwash | SM-SP | | | | | | | | | |
| DT-26 | 195-197 | 1.0 | 195 | As above, grading to finer silty sand | SM-SP | | | | | | | | | |
| DT-27 | 200-202 | 1.0 | 200 | Yellowish-brown (10YR5/6) silty clay w/occasional rounded pebbles, ¼", lacustrine | CL | | | | | | | | | |
| DT-28 | 205-207 | 3 | 205 | Yellowish-red (5YR4/6) clayey sand, med. coarse texture and sandy clay w/coarse texture sand w/gravel, subangular, till | SC-CL | | | | | | | | | |
| DT-29 | 210-212 | 3 | 210 | As above, water becoming redder | SC-CL | | | | | | | | | Cyclone plugged at ~210' |
| DT-30 | 215-217 | 3 | 215 | 215-225 Yellowish red (5YR4/6) sandy clay w/fine texture sand, increased angular clasts w/depth, saprolitic till or saprolite, red water at 220 | CL | | | | | | | | | |
| DT-31 | 220-222 | 3 | 220 | As above | CL | | | | | | | | | |
| DT-32 | 225-227 | 2.3 | 225 | Weathered metavolcanic bedrock to 235, cuttings logged by CMC | WBR | | | | | | | | | |
| DT-33 | 230-232 | 2.3 | 230 | As above | WBR | | | | | | | | | |
| DT-34 | 235-237 | 2.3 | 235 | As above | WBR | | | | | | | | | |
| DT-35 | 240-242 | 2.3 | 240 | Weakly weathered metavolcanic bedrock, cuttings logged by CMC | BR | | | | | | | | | |
| DT-36 | 245-247 | 2.3 | 245 | As above | BR | | | | | | | | | |
| DT-37 | 250-252 | 2.3 | 250 | As above | BR | | | | | | | | | |
| DT-38 | 255-257 | 2.3 | 255 | As above | BR | | | | | | | | | |

State of Wisconsin
Department of Natural Resources
BORING NUMBER:

Route to:

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-39 | 260-262 | 2.3 | 260 | As above<br>End of Boring. Abandoned w/bentonite grout Topped off w/hole plug<br><br>Supplemental Bedrock, AJE Jr. 2/17/96<br><br>225-240. Tan to grey-green, weakly weathered to fresh fine grained metatuff "Greenstone". Trace of quartz veinlet chips. No sulfide noted.<br><br>240-260. Fresh grey-green fine grained metatuff. Rare trace pyrite and trace of quartz veinlet chips.<br><br>TD 260. No significant sulfides in bedrock. | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

# WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Form 3300-5W 11-89

All abandonment work shall be performed in accordance with the provisions of Chapters NR 111, NR 112 or NR 141, Wis. Admin. Code, whichever is applicable. Also, see instructions on back.

## (1) GENERAL INFORMATION

Well/Drillhole/Borehole Location | County: Forest

NW ¼ of SE ¼ of Sec. 29 ; T. 35 N R. 13 ☑ E ☐ W

(If applicable) _____ Gov't Lot _____ Grid Number

Grid Location: 18180.57 ft. ☑ N. ☐ S., 2283980.35 ft. ☑ E. ☐ W.

Civil Town Name: Lincoln

Street Address of Well: NA

City, Village: NA

## (2) FACILITY NAME

Original Well Owner (If Known): Crandon Mining Company

Present Well Owner: Crandon Mining Company

Street or Route: 7 North Brown Street, 3rd Floor

City, State, Zip Code: Rhinelander, WI 54501-3161

Facility Well No. and/or Name (If applicable): CMC-TMA-102

WI Unique Well No.: _ _ _ _ _

Reason For Abandonment: Boring Completion

Date of Abandonment: 02/05/96

## WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drillhole/Borehole Construction Completed On (Date) 02/05/96

☐ Monitoring Well
☐ Water Well
☐ Drillhole
☑ Borehole

Construction Report Available? ☐ Yes ☐ No

Construction Type:
☑ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) _____

Formation Type:
☑ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft.) 262 (From groundsurface) Casing Diameter (ins.) ____

Casing Depth (ft.) _____

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown
If Yes, To What Depth? _____ Feet

(4) Depth to Water (Feet) _____

| | | | |
|---|---|---|---|
| Pump & Piping Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Liner(s) Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Screen Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Casing Left in Place? | ☐ Yes | ☐ No | |

If No, Explain _____

| | | |
|---|---|---|
| Was Casing Cut Off Below Surface? | ☐ Yes | ☐ No |
| Did Sealing Material Rise to Surface? | ☑ Yes | ☐ No |
| Did Material Settle After 24 Hours? | ☑ Yes | ☐ No |
| If Yes, Was Hole Retopped? | ☑ Yes | ☐ No |

(5) Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☑ Conductor Pipe-Pumped
☐ Dump Bailer ☐ Other (Explain)

(6) Sealing Materials — For monitoring wells and monitoring well boreholes only
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☑ Bentonite-Sand Slurry
☑ Chipped Bentonite
☐ Bentonite Pellets
☐ Granular Bentonite
☐ Bentonite - Cement Grout

(7)

| Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks Sealant or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Bentonite Grout/⅜" Hole Plug | Surface | 262 | 2 bags Gel | 175 gallons $H_2O$/100 lb Gel |
| | | | 2 Granular | 100 lb Grannular |
| | | | 18 hole plug | |
| | | | | |

(8) Comments: Borehole tapped off with ⅜" hole plug after 24 hours.

(9) Name of Person or Firm Doing Sealing Work
Total Drilling - Luisier Drilling

Signature of Person Doing Work Date Signed

Street or Route: 7391 S Porcupine Lake Road
Telephone Number: (414) 829-5690
City, State, Zip Code: Lena, WI 54139

(10) FOR DNR OR COUNTY USE ONLY

| Date Received/Inspected | District/County |
|---|---|
| Reviewer/Inspector | |
| Follow-up Necessary | |

DNR/COUNTY
3.5-13a-9

State of Wisconsin | Route to: | SOIL BORING LOG INFORMATION

Department of Natural Resources | ☐ Solid Waste ☐ Emergency Response ☐ Wastewater ☐ Haz. Waste ☐ Underground Tanks ☐ Water Resources ☑ Other: Mining | Form 4400-122 | 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Project - TMA Drilling Program | | CMC-TMA-103 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| TD Drilling, Inc.<br>James Meyers | MM/DD/YY<br>02/09/96 | MM/DD/YY<br>02/09/96 | Dual Tube |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| NA | NA | NA | NA | 1706.99 | 5⅞ inches |

Boring Location
State Plane 117253.21 N, 2286081.08 E S/C/N Lat
NE 1/4 of SE 1/4 of Section 29, T35N, R13E Long

Local Grid Location (if applicable)
____ N ____ E
Feet ____ S Feet ____ W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-0 | 0-4 | | | Strong brown (7.5YR4/6) silty sand w/gravel, mottled, 15% gravel subrounded to subangular till | SM | | | | | | | | | Blow counts = rate of penetration min/5′ interval<br><br>Rec = sampled interval depth below ground surface (ft) |
| DT-1 | 5-7 | 1.8 | 5 | Dk. brown (7.5YR4/4) silty sand, med. texture, minor subrounded gravel, till | SM | | | | | | | | | |
| DT-2 | 10-12 | 1.8 | 10 | As above, till | SM | | | | | | | | | |
| DT-3 | 15-17 | 1.8 | 15 | Dk. brown (7.5YR4/4) silty, gravelly sand, coarse texture, 10-15% subrounded gravel, till | SM | | | | | | | | | |
| DT-4 | 20-22 | 1.8 | 20 | Dk. brown (7.5YR3/4) fine, silty sand w/minor gravel, angular, till | SM | | | | | | | | | |
| DT-5 | 25-27 | 5.8 | 25 | Dk. brown (7.5YR3/3) fine, silty sand, till | SM | | | | | | | | | Bit, hose plugging |
| DT-6 | 30-32 | 5.8 | 30 | Boulder, rock cutting sample only | — | | | | | | | | | Bit, hose plugging |
| DT-7 | 35-37 | 5.8 | 35 | As above, till | SM | | | | | | | | | Bit, hose plugging |
| DT-8 | 40-42 | 5.8 | 40 | As above, till | SM | | | | | | | | | Bit, hose plugging |
| DT-9 | 45-47 | 2.5 | 45 | As above w/increased gravel, 5% subrounded | SM | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature | Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory.
Penalties: Forfeit not less than $10 nor more then $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-10 | 50-52 | 2.5 | 50 | As above, till | SM | | | | | | | | | |
| DT-11 | 55-57 | 2.5 | 55 | As above, till | SM | | | | | | | | | |
| DT-12 | 60-62 | 2.5 | 60 | As above, till | SM | | | | | | | | | |
| DT-13 | 65-67 | 2 | 65 | Greyish brown (7.5YR5/2) gravelly, med.-coarse texture sand, coarse outwash | SP | | | | | | | | | |
| DT-14 | 70-72 | 2 | 70 | As above, coarse outwash | SP | | | | | | | | | |
| DT-15 | 75-77 | 2 | 75 | As above, grading to lt. brown (10YR5/3) med. texture sand w/less gravel, 10%, coarse outwash | SP | | | | | | | | | |
| DT-16 | 80-82 | 2 | 80 | Greyish brown (10YR5/2) sandy (coarse texture), gravel | GP | | | | | | | | | |
| DT-17 | 85-87 | 1.5 | 85 | As above | GP | | | | | | | | | |
| DT-18 | 90-92 | 1.5 | 90 | Brown (10YR4/3) med. texture sand w/5-10% subrounded gravel, coarse outwash | SP | | | | | | | | | |
| DT-19 | 95-97 | 1.5 | 95 | As above, coarse outwash | SP | | | | | | | | | |
| DT-20 | 100-102 | 1.5 | 100 | As above, coarse outwash | SP | | | | | | | | | |
| DT-21 | 105-107 | 5 | 105 | Very dk. brown, fine, silty sand, fine outwash | SM | | | | | | | | | Bit plugging |
| DT-22 | 110-112 | 5 | 110 | Lt. olive brown (2YR5/3) fine, silty sand, fine outwash | SM | | | | | | | | | Bit plugging |
| DT-23 | 115-117 | 5 | 115 | As above, grading to med. texture & dk. olive grey (5Y5/2), fine outwash | SP | | | | | | | | | Bit plugging |
| DT-24 | 120-122 | 5 | 120 | As above, fine outwash | SP | | | | | | | | | Bit plugging |

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-25 | 125-127 | 2.3 | 125 | Greyish brown (10YR5/2) med. texture sand w/5% rounded gravel, coarse outwash | SP | | | | | | | | | |
| DT-26 | 130-132 | 2.3 | 130 | As above, grading to med.-fine sand w/5-10% subrounded gravel | SP | | | | | | | | | |
| DT-27 | 135-137 | 2.3 | 135 | Lt. brown (10YR5/3) coarse outwash, as above, coarse outwash | SP | | | | | | | | | |
| DT-28 | 140-142 | 2.3 | 140 | As above | SP | | | | | | | | | |
| DT-29 | 145-147 | 1.8 | 145 | Dk. brown (10YR3/3) silty gravelly sand, 10-15% gravel subrounded to angular, till | SM | | | | | | | | | |
| DT-30 | 150-152 | 1.8 | 150 | As above, till | SM | | | | | | | | | |
| DT-31 | 155-157 | 1.8 | 155 | Yellowish brown (10YR5/4) silty, gravelly sand, till (washed) | SM | | | | | | | | | |
| DT-32 | 160-162 | 1.8 | 160 | As above, till (washed) | SM | | | | | | | | | |
| DT-33 | 165-167 | 2.0 | 165 | Dk. brown (7.5YR4/3) silty sand, med. texture w/gravel 5-10% subrounded to angular, till | SM | | | | | | | | | |
| DT-34 | 170-172 | 2.8 | 170 | As above, grading redder brown (7.5YR3/4), till | SM | | | | | | | | | |
| DT-35 | 175-177 | 3.0 | 175 | As above, till | SM | | | | | | | | | |
| DT-36 | 180-182 | 2.8 | 180 | As above, till | SM | | | | | | | | | |
| DT-37 | 185-187 | 2 | 185 | As above, grading to lighter brown (7.5YR4/3), till | SM | | | | | | | | | |
| DT-38 | 190-192 | 2 | 190 | As above, till | SM | | | | | | | | | |
| DT-39 | 195-197 | 2 | 195 | As above | SM | | | | | | | | | |

State of Wisconsin | Route to: | SOIL BORING LOG INFORMATION

Department of Natural Resources | Form 4400-122 | 7-91

BORING NUMBER: CMC-TMA-103 | Page 4 of 4

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-40 | 200-202 | 2 | 200 | As above, grading to dk. brown (7.5YR4/2), till | SM | | | | | | | | | |
| DT-41 | 205-207 | 1.5 | 205 | Brown (7.5YR4/6) fine sand, fine outwash | SM | | | | | | | | | Very soft |
| DT-42 | 210-212 | 1.5 | 210 | Greyish brown (7.5YR5/3) very coarse sand w/gravel, coarse outwash | SP | | | | | | | | | Very soft |
| DT-43 | 215-217 | 1.5 | 215 | As above, grading to lt. brown (7.5YR5/4) med.-fine texture sand, fine outwash | SP | | | | | | | | | Very soft |
| DT-44 | 220-222 | 1.5 | 220 | Brown (7.5YR5/4) fine sand, fine outwash | SP | | | | | | | | | Very soft |
| DT-45 | 225-227 | 1.5 | 225 | As above, fine outwash | SP | | | | | | | | | Bit plugged twice from 220-240 pulled out twice |
| DT-46 | 230-232 | 1.5 | 230 | As above, fine outwash | SP | | | | | | | | | |
| DT-47 | 235-237 | 1.5 | 235 | As above, fine outwash | SP | | | | | | | | | |
| DT-48 | 240-242 | 1.5 | 240 | As above, fine outwash | SP | | | | | | | | | |
| DT-49 | 245-247 | 3.8 | 245 | Dk. brown (7.5YR4/4) fine, very silty sand w/minor gravel, till | SM | | | | | | | | | |
| DT-50 | 250-252 | 3.8 | 250 | As above, grading to med. texture silty sand w/10% angular gravel, till | SM | | | | | | | | | |
| DT-51 | 255-257 | 3.8 | 255 | As above, till | SM | | | | | | | | | |
| DT-52 | 260-262 | 3.8 | 260 | As above, till | SM | | | | | | | | | |
| | | | | E.O.B. @ 260'<br>Hole abandoned w/bentonite grout<br>Topped off w/hole plug | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

# WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Form 3300-5W 11-89

All abandonment work shall be performed in accordance with the provisions of Chapters NR 111, NR 112 or NR 141, Wis. Admin. Code, whichever is applicable. Also, see instructions on back.

## (1) GENERAL INFORMATION

Well/Drillhole/Borehole Location | County: Forest

NE ¼ of SE ¼ of Sec. 29 ; T. 35 N R. 13 ☑ E ☐ W

(If applicable) _____ Gov't Lot _____ Grid Number

Grid Location: 117253.21 ft. ☑ N. ☐ S., 2286081.08 ft. ☑ E. ☐ W.

Civil Town Name: Lincoln

Street Address of Well: NA

City, Village: NA

## (2) FACILITY NAME

Original Well Owner (If Known): Crandon Mining Company

Present Well Owner: Crandon Mining Company

Street or Route: 7 North Brown Street, 3rd Floor

City, State, Zip Code: Rhinelander, WI 54501-3161

Facility Well No. and/or Name (If applicable): CMC-TMA-103

WI Unique Well No.: _ _ _ _ _ _

Reason For Abandonment: Boring Completion

Date of Abandonment: 02/09/96

## WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drillhole/Borehole Construction Completed On (Date) 02/09/96

☐ Monitoring Well
☐ Water Well
☐ Drillhole
☑ Borehole

Construction Report Available? ☐ Yes ☐ No

Construction Type:
☑ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) _____

Formation Type:
☑ Unconsolidated Formation ☑ Bedrock

Total Well Depth (ft.) 262 (From groundsurface) Casing Diameter (ins.) ____

Casing Depth (ft.) ____

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown
If Yes, To What Depth? _____ Feet

(4) Depth to Water (Feet) _____

| | | | |
|---|---|---|---|
| Pump & Piping Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Liner(s) Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Screen Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Casing Left in Place? | ☐ Yes | ☐ No | |

If No, Explain _____

| | | |
|---|---|---|
| Was Casing Cut Off Below Surface? | ☐ Yes | ☐ No |
| Did Sealing Material Rise to Surface? | ☑ Yes | ☐ No |
| Did Material Settle After 24 Hours? | ☑ Yes | ☐ No |
| If Yes, Was Hole Retopped? | ☑ Yes | ☐ No |

(5) Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☑ Conductor Pipe-Pumped
☐ Dump Bailer ☐ Other (Explain)

(6) Sealing Materials — For monitoring wells and monitoring well boreholes only
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☑ Bentonite-Sand Slurry
☑ Chipped Bentonite
☐ Bentonite Pellets
☐ Granular Bentonite
☐ Bentonite - Cement Grout

(7)

| Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks Sealant or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Bentonite Grout/⅜" Hole Plug | Surface | 262 | 3 bags Gel | 200 gallons $H_2O$/150 lb Gel |
| | | | 4 Granular | 200 lb Grannular |
| | | | 10 hole plug | |
| | | | | |

(8) Comments: Borehole tapped off with ⅜" hole plug after 24 hours.

(9) Name of Person or Firm Doing Sealing Work
Total Drilling - Luisier Drilling

Signature of Person Doing Work Date Signed
Tim Meyers

Street or Route: 7391 S Porcupine Lake Road
Telephone Number: (414) 829-5690

City, State, Zip Code: Lena, WI 54139

(10) FOR DNR OR COUNTY USE ONLY

Date Received/Inspected | District/County

Reviewer/Inspector

Follow-up Necessary

DNR/COUNTY

State of Wisconsin
Department of Natural Resources

Route to:
☐ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☑ Other: Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Project - TMA Drilling Program | | CMC-TMA-104 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started MM/DD/YY | Date Completed MM/DD/YY | Drilling Method |
|---|---|---|---|
| TD Drilling, Inc.<br>James Meyers | 02/08/96 | 02/08/96 | Dual Tube |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| NA | NA | NA | NA | 1719.83 | 5¾ inches |

Boring Location
State Plane 116551.79 N, 2286501.98 E S/C/N Lat
SE 1/4 of SE 1/4 of Section 29, T35N, R13E Long

Local Grid Location (if applicable)
____ N ____ E
Feet ____ S Feet ____ W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-0 | 0-4 | | | Yellowish brown (10YR5/4) sandy clay w/minor subangular gravel, till | CL | | | | | | | | | Blow counts = rate of penetration min/5' interval<br>Rec = sampled interval depth below ground surface (ft) |
| DT-1 | 5-7 | 1.3 | 5 | Brown (7.5YR4/6) silty sand, coarse textured w/abundant gravel, subangular to subrounded, till | SP-SM | | | | | | | | | |
| DT-2 | 10-12 | 1.3 | 10 | As above, grading to finer texture sand w/minor gravel & increased silt, till | SM | | | | | | | | | |
| DT-3 | 15-17 | 1.3 | 15 | Brown (7.5YR4/4) silty sand w/10-15% subangular gravel, till | SM | | | | | | | | | |
| DT-4 | 20-22 | 1.3 | 20 | As above, grading to lighter brown (7.5YR6/4), till | SM | | | | | | | | | |
| DT-5 | 25-27 | 2 | 25 | As above, till | SM | | | | | | | | | |
| DT-6 | 30-32 | 1 | 30 | Lt. brown (7.5(YR6/4) fine sand w/minor silt & gravel, 10-15%, fine outwash, washed till | SP-SM | | | | | | | | | |
| DT-7 | 35-37 | 45 | 35 | As above, grading to grey (7.5YR6/2) fine silt & sand boulder, till | SM | | | | | | | | | Bad bit<br>Replaced bit and sub |
| DT-8 | 40-42 | 3 | 40 | As above, till | SM | | | | | | | | | |
| DT-9 | 45-47 | 3.5 | 45 | As above, till | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

| Signature | Firm |
|---|---|
| | Foth & Van Dyke |

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory.
Penalties: Forfeit not less than $10 nor more then $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-TMA-104

Route to:

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-10 | 50-52 | 3.5 | 50 | Brown (7.5YR5/4) silty sand, fine-med. textured w/minor gravel, till | SM | | | | | | | | | |
| DT-11 | 55-57 | 3.5 | 55 | As above w/boulders, till | SP-SM | | | | | | | | | |
| DT-12 | 60-62 | 4 | 60 | As above w/boulders, till | | | | | | | | | | |
| DT-13 | 65-67 | 1.8 | 65 | Brown (7.5YR4/6) silty sand w/minor gravel, subangular, till | SM | | | | | | | | | |
| DT-14 | 70-72 | 1.8 | 70 | As above, grading to lt. brown (7.5YR4/2) due to boulders, till | SP-SM | | | | | | | | | |
| DT-15 | 75-77 | 2 | 75 | As above (7.5YR4/2) grading to dk. brownish grey, till | SM | | | | | | | | | |
| DT-16 | 80-82 | 1.8 | 80 | As above, grading to lt. greyish brown (7.5YR5/2) due to boulders, till | SP-SM | | | | | | | | | |
| DT-17 | 85-87 | 4.3 | 85 | As above, boulders, till | SP-SM | | | | | | | | | |
| DT-18 | 90-92 | 5 | 90 | Greyish brown (7.5YR5/3), coarse texture sand w/gravel 10-15%, coarse outwash | SP | | | | | | | | | |
| DT-19 | 95-97 | 3 | 95 | As above, coarse outwash | SP | | | | | | | | | |
| DT-20 | 100-102 | 3 | 100 | As above, coarse outwash | SP | | | | | | | | | |
| DT-21 | 105-107 | 2.3 | 105 | As above, coarse outwash | SP | | | | | | | | | |
| DT-22 | 110-112 | 2.3 | 110 | As above, fine-med. texture, coarseoutwash | SP | | | | | | | | | |
| DT-23 | 115-117 | 2.3 | 115 | Brown (7.5YR5/4) silty sand w/gravel minor subangular, till | SM | | | | | | | | | |
| DT-24 | 120-122 | 2.3 | 120 | As above, no sample - boulders | SM | | | | | | | | | |

State of Wisconsin | Route to: | SOIL BORING LOG INFORMATION

Department of Natural Resources | Form 4400-122 | 7-91

BORING NUMBER: CMC-TMA-104 | 

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-25 | 125-127 | 5 | 125 | As above, till, boulder | SM | | | | | | | | | |
| DT-26 | 130-132 | 2 | 130 | Lt. brown (10YR5/3) coarse textured sand w/gravel rounded to subrounded, coarse outwash | SP | | | | | | | | | |
| DT-27 | 135-137 | 2 | 135 | As above, coarse outwash w/increased fine sand | SP | | | | | | | | | |
| DT-28 | 140-142 | 2 | 140 | As above, coarse outwash | | | | | | | | | | |
| DT-29 | 145-147 | 1.5 | 145 | Dk. brown (7.5YR4/4) silty sand w/minor gravel, subangular to angular, till | SM | | | | | | | | | |
| DT-30 | 150-152 | 1.5 | 150 | As above, till | SM | | | | | | | | | |
| DT-31 | 155-157 | 1.5 | 155 | Poor return appears as above, till | | | | | | | | | | Plugging |
| DT-32 | 160-162 | 1.5 | 160 | As above, grading to 7.5YR4/6, till | SM | | | | | | | | | |
| DT-33 | 165-167 | 1.8 | 165 | As above, till | SM | | | | | | | | | |
| DT-34 | 170--177 | 1.8 | 170 | As above, grading to coarse textured silty sand w/gravel, till | SM | | | | | | | | | |
| DT-35 | 175-177 | 1.8 | 175 | As above, till | SM | | | | | | | | | |
| DT-36 | 180-182 | 1.8 | 180 | As above, till | SM | | | | | | | | | |
| DT-37 | 185-187 | 5 | 185 | As above, till | SM | | | | | | | | | |
| DT-38 | 190-192 | 2 | 190 | Lt. brown (7.5YR5/4) fine sand w/minor silt, fine outwash | SP | | | | | | | | | |
| DT-39 | 195-197 | 2 | 195 | As above | SP | | | | | | | | | |

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-40 | 200-202 | 2 | 200 | As above, grading to lighter brown (7.5YR6/4), fine outwash | SP | | | | | | | | | |
| DT-41 | 205-207 | 4.8 | 205 | As above | SP | | | | | | | | | Bit plugged |
| DT-42 | 210 212 | 3 | 210 | Dk. brown (7.5YR4/3) silty sand, med. texture w/minor round to angular gravel, till | SM | | | | | | | | | |
| DT-43 | 215-217 | 3 | 215 | As above, till | SM | | | | | | | | | |
| DT-44 | 220-222 | 3 | 220 | As above, till | SM | | | | | | | | | |
| DT-45 | 225-227 | 5 | 225 | As above, poor recovery, till | SM | | | | | | | | | Bit plugging from 220-240' |
| DT-46 | 230-232 | 5 | 230 | As above, poor recovery, till | SM | | | | | | | | | |
| DT-47 | 235-237 | 5 | 235 | As above, poor recovery, till | SM | | | | | | | | | |
| DT-48 | 240-242 | 5 | 240 | As above, poor recovery, till | SM | | | | | | | | | |
| DT-49 | 245-247 | 3 | 245 | Dk. brown (7.5YR4/4) silty sand w/gravel 5-10% angular, till | SM | | | | | | | | | |
| DT-50 | 250-252 | 3 | 250 | As above, till | SM | | | | | | | | | |
| DT-51 | 255-257 | 3 | 255 | As above, till | SM | | | | | | | | | |
| DT-52 | 260-262 | 3 | 260 | As above, till | SM | | | | | | | | | |
| DT-62 | 265-267 | 5 | 265 | As above w/increased clay, till | SM | | | | | | | | | Bit plugging to end of hole |
| DT-72 | 270-272 | 5 | 270 | As above, grading to strong brown (7.5YR4/6), till | SM | | | | | | | | | |

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-82 | 275-277 | 5 | 275 | Hit bedrock at 272.5, grey-green, saprolite? | BR | | | | | | | | | |
| | | | | 277-278 - metavolcanic unweathered bedrock | | | | | | | | | | |
| | | | | Cuttings logged by CMC | | | | | | | | | | |
| | | | | E.O.B. @ 278' | | | | | | | | | | |
| | | | | Hole abandoned w/bentonite grout | BR | | | | | | | | | |
| | | | | Due to frequent plugging, water used | | | | | | | | | | |
| | | | | at 150 feet | | | | | | | | | | |
| | | | | Topped off w/hole plug | | | | | | | | | | |
| | | | | Supplemental Bedrock, AJE Jr 2/27/98 | | | | | | | | | | |
| | | | | 275-277. Grey-green fine grained probable metatuff. *Greenstone. No sulfides noted in cuttings. Cuttings soft pasty, clay weathered. Possible saprolite? | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

# WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Form 3300-5W 11-89

All abandonment work shall be performed in accordance with the provisions of Chapters NR 111, NR 112 or NR 141, Wis. Admin. Code, whichever is applicable. Also, see instructions on back.

## (1) GENERAL INFORMATION

Well/Drillhole/Borehole Location | County: Forest

SE ¼ of SE ¼ of Sec. 29 ; T. 35 N R. 13 ☑ E ☐ W

(If applicable) _____ Gov't Lot _____ Grid Number

Grid Location: 16551.79 ft. ☑ N. ☐ S., 2286501.98 ft. ☑ E. ☐ W.

Civil Town Name: Lincoln

Street Address of Well: NA

City, Village: NA

## (2) FACILITY NAME

Original Well Owner (If Known): Crandon Mining Company

Present Well Owner: Crandon Mining Company

Street or Route: 7 North Brown Street, 3rd Floor

City, State, Zip Code: Rhinelander, WI 54501-3161

Facility Well No. and/or Name (If applicable): CMC-TMA-104

WI Unique Well No.: _____

Reason For Abandonment: Boring Completion

Date of Abandonment: 02/08/96

## WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drillhole/Borehole Construction Completed On (Date) 02/08/96

☐ Monitoring Well
☐ Water Well
☐ Drillhole
☑ Borehole

Construction Report Available? ☐ Yes ☐ No

Construction Type:
☑ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) _____

Formation Type:
☑ Unconsolidated Formation ☑ Bedrock

Total Well Depth (ft.) 278 (From groundsurface) Casing Diameter (ins.) ____

Casing Depth (ft.) _____

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown
If Yes, To What Depth? _____ Feet

(4) Depth to Water (Feet) _____

| | | | |
|---|---|---|---|
| Pump & Piping Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Liner(s) Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Screen Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Casing Left in Place? | ☐ Yes | ☐ No | |

If No, Explain _____

| | | |
|---|---|---|
| Was Casing Cut Off Below Surface? | ☐ Yes | ☐ No |
| Did Sealing Material Rise to Surface? | ☑ Yes | ☐ No |
| Did Material Settle After 24 Hours? | ☑ Yes | ☐ No |
| If Yes, Was Hole Retopped? | ☑ Yes | ☐ No |

(5) Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☑ Conductor Pipe-Pumped
☐ Dump Bailer ☐ Other (Explain)

(6) Sealing Materials — For monitoring wells and monitoring well boreholes only
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☑ Bentonite-Sand Slurry
☑ Chipped Bentonite
☐ Bentonite Pellets
☐ Granular Bentonite
☐ Bentonite - Cement Grout

(7)

| Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks Sealant or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Bentonite Grout/⅜" Hole Plug | Surface | 278 | 3.5 bags Gel | 175 gallons $H_2O$/160 lb Gel |
| | | | 3 Granular | 150 lb Grannular |
| | | | | |
| | | | | |

(8) Comments: Borehole tapped off with ⅜" hole plug after 24 hours.

(9) Name of Person or Firm Doing Sealing Work
Total Drilling - Luisier Drilling

Signature of Person Doing Work Date Signed

Street or Route: 7391 S Porcupine Lake Road
Telephone Number: (414) 829-5690
City, State, Zip Code: Lena, WI 54139

(10) FOR DNR OR COUNTY USE ONLY

Date Received/Inspected | District/County

Reviewer/Inspector

Follow-up Necessary

DNR/COUNTY

State of Wisconsin
Department of Natural Resources

Route to:
☐ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☑ Other: Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company - Crandon TMA Site | | CMC-TMA-105 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started MM/DD/YY | Date Completed MM/DD/YY | Drilling Method |
|---|---|---|---|
| TD Drilling, Inc.<br>James Meyers | 01/23/96 | 02/09/96 | Rotary Mud/Dual Tube |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| NA | NA | NA | NA | 1704.01 | 5¾ inches |

Boring Location
State Plane 112723.05 N, 2286269.23 E S/C/N Lat
NE 1/4 of NE 1/4 of Section 35, T35N, R13E Long

Local Grid Location (if applicable)
____ N ____ E
Feet ____ S Feet ____ W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS-1 1-3' | 6" | Air hammer | 0 | 1-3' Med. brown (7.5YR5/3) silty sand, blocky structure, abundant round & angular pebbles Late Wis. Till | SM | | | | | | | | | |
| SS-2 10-12 | 8" | Air hammer | 10 | As above, grading to silty, clayey sand | SM | | | | | | | | | |
| SS-3 18-19.5 | 6" | Air hammer | 20 | 18-19.5 as above, brown (7.5YR5/4) silty sand w/gravel, round to subangular mod. med. blocky structure, till | SM | | | | | | | | | |
| SS-4 28-29 | 1.5" | Air hammer | 30 | Appears as above, silty sand w/gravel | SM | | | | | | | | | |
| SS-5 38-39 | 4" | Air hammer | 40 | As above, cobbles preventing advancement of spoon | SM | | | | | | | | | |
| SS-6 50-52 | 6" | Air hammer | 50 | As above, very damp till | SM | | | | | | | | | |
| SS-7 | 2" | Air hammer | 60 | As above, till | SM | | | | | | | | | |
| SS-8 70-72 | 0 | Air hammer | 70 | Pounding cobbles | — | | | | | | | | | |
| SS-9 72-73 | 3" | | | As above, till | SM | | | | | | | | | |
| SS-10 80-82 | 0 | Air hammer | 80 | Pounding cobbles, spoon refusal | — | | | | | | | | | |
| SS-11 82-94 | 0 | | | | | | | | | | | | | |
| SS-12 90-92 | 3" | Air hammer | 90 | As above, much more sand, till | SM-SP | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature] Firm Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory.
Penalties: Forfeit not less than $10 nor more then $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS-13 100-102 | 3" | Air hammer | 100 | Lt. brown (7.5YR6/5) fine-med. sand, poorly graded, w/ minor gravel and minor silt, structureless, wet, loose (coarse outwash) | SP | | | | | | | | | |
| SS-14 110-112 | 18" | Air hammer | 110 | Yellowish red (5YR4/6) silty sand w/gravel, massive, dense, very damp, sl. hard (till) | | | | | | | | | | |
| SS-15 120-122 | 24" | Air hammer | 120 | Strong brown (7.5YR4/6) fine sandy silt, minor clay laminae & some fine lenses, weak med. to fine platey structure, very damp, sl. firm to soft, locally oxidized, bottom spoon (3") fine silt, minor sand w/fine sand lenses (lacustrine) | ML-SM | | | | | | | | | |
| SS-16 130-132 | 8" | Air hammer | 130 | Brown (7.5YR4/4) med. coarse, rounded gravelly sand, structureless, very damp to wet, loose, oxidized (outwash) | ML | | | | | | | | | |
| SS-17 140-142 | 10" | Air hammer | 140 | Strong brown (7.5YR5/6) fine-med. sand w/gravel, structureless, wet, weak stratification (outwash) | SP | | | | | | | | | |
| SS-18 150-152 | 10" | Air hammer | 150 | As above | SP | | | | | | | | | |
| SS-19 160-162 | 9" | Air hammer | 160 | Yellowish red (5YR5/8) silty sand w/gravel, massive, wet, sl. hard (till) | SM-SP | | | | | | | | | |
| SS-20 170-172 | 3" | Air hammer | 170 | As above | SM-SP | | | | | | | | | |
| SS-21 180-182 | 3" | Air hammer | 180 | Brown (7.5YR5/5) fine-med. sand w/silt & gravel, massive, wet, soft (washed till) | SM-SP | | | | | | | | | |
| SS-22 190-192 | 3" | Air hammer | 190 | Brown (7.5YR4/4) silty sand w/gravel, massive, dense, firm (till) | SM-SP | | | | | | | | | |
| SS-23 | 12" | Air hammer | 200 | Brown (7.5YR5/4) med.-coarse sand, structureless-weakly structured, subangular round gravel (coarse outwash) | SP | | | | | | | | | |
| SS-24 | 18" | Air hammer | 210 | As above, with fine sand lense at 211-211.5 (coarse outwash) Switch to dual tube | SP | | | | | | | | | Switched to dual tube at 210 |
| DT-1 | 220-222 | 0.8 | 220 | As above, grading to 7.5YR5/6, fine outwash w/mud | SP | | | | | | | | | Blow counts = rate of penetration min/5' interval |
| DT-2 | 225-227 | 0.8 | 225 | As above, grading to 7.5YR4/6, sl. darker brown, fine outwash | SP | | | | | | | | | Rec = sampled interval depth below ground surface (ft) |
| DT-3 | 230 232 | 0.8 | 230 | As above, grading to sl. darker brown, fine sand (7.5YR4/4), fine outwash | SP | | | | | | | | | |

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-4 | 235-237 | 0.8 | 235 | As above, fine outwash | SP | | | | | | | | | |
| DT-5 | 240-242 | 0.8 | 240 | Dk. reddish brown (5YR3/4) fine silty sand and fine clayey sand w/minor subangular gravel, till | SM | | | | | | | | | |
| DT-6 | 245-247 | 4.8 | 245 | As above, till | SM | | | | | | | | | Plugging to 260' |
| DT-7 | 250-252 | 4.8 | 250 | As above, till | SM | | | | | | | | | |
| DT-8 | 255-257 | 4.8 | 255 | As above, till | SM | | | | | | | | | |
| DT-9 | 260-262 | 6.0 | 260 | As above, till | SM | | | | | | | | | |
| DT-10 | 265-267 | 1 | 265 | As above, w/increased angular gravel, 10%, and grading to med. to coarse texture, silty sand, till | SM | | | | | | | | | |
| DT-11 | 270-272 | 1 | 270 | Dk. reddish brown (5YR3/4), coarse texture, silty sand and gravel, 15% subangular, till | SP-SM | | | | | | | | | |
| DT-12 | 275-277 | 1 | 275 | Missed sample | | | | | | | | | | |
| DT-13 | 280-282 | 1 | 280 | As above, till | SP-SM | | | | | | | | | |
| DT-14 | 285-287 | 2 | 285 | As above, till | SP-SM | | | | | | | | | |
| DT-15 | 290-292 | 2 | 290 | Dk. reddish brown (5YR3/4), silty, clayey sand w.minor gravel, med. texture, till | SM-SC | | | | | | | | | |
| DT-16 | 295-297 | 2 | 295 | As above w/10% subangular to subrounded gravel, till | SM-SC | | | | | | | | | |
| DT-17 | 300-302 | 2 | 300 | 298 - Bedrock, metavolcanic, weathered, cuttings logged by CMC | BR | | | | | | | | | |
| DT-18 | 305-307 | 8 | 305 | Greenish grey metavolcanic bedrock, weakly-moderately weathered, cuttings logged by CMC | BR | | | | | | | | | |

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-19 | 310-312 | | 310 | As above, cutting logged by CMC | BR | | | | | | | | | |
| | | | | E.O.B. @ 312'<br>Hole abandoned w/bentonite grout<br>Topped off w/hole plug<br><br>Supplemental Bedrock, AJE Jr. 2/17/96<br><br>298-302 Tan weakly weathered grey-green fine metatuff. "Greenstone".<br><br>302-312 Grey-green fine grained metatuff. "Greenstone". Trace quartz veinlet chips. No sulfides noted in bedrock. | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

# WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Form 3300-5W 11-89

All abandonment work shall be performed in accordance with the provisions of Chapters NR 111, NR 112 or NR 141, Wis. Admin. Code, whichever is applicable. Also, see instructions on back.

## (1) GENERAL INFORMATION

Well/Drillhole/Borehole Location | County: Forest

NE ¼ of SE ¼ of Sec. 35 ; T. 35 N R. 13 ☑ E ☐ W

(If applicable) _____ Gov't Lot _____ Grid Number

Grid Location: 112723.05 ft. ☑ N. ☐ S., 2286269.23 ft. ☑ E. ☐ W.

Civil Town Name: Lincoln

Street Address of Well: NA

City, Village: NA

## (2) FACILITY NAME

Original Well Owner (If Known): Crandon Mining Company

Present Well Owner: Crandon Mining Company

Street or Route: 7 North Brown Street, 3rd Floor

City, State, Zip Code: Rhinelander, WI 54501-3161

Facility Well No. and/or Name (If applicable): CMC-TMA-105

WI Unique Well No.: _ _ _ _ _ _

Reason For Abandonment: Boring Completion

Date of Abandonment: 02/09/96

## WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drillhole/Borehole Construction Completed On (Date) 02/09/96

- ☐ Monitoring Well
- ☐ Water Well
- ☐ Drillhole
- ☑ Borehole

Construction Report Available? ☐ Yes ☐ No

Construction Type:
☑ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) _____

Formation Type:
☑ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft.) 312 (From groundsurface) Casing Diameter (ins.) ____

Casing Depth (ft.) _____

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown
If Yes, To What Depth? _____ Feet

(4) Depth to Water (Feet) _____

| | | | |
|---|---|---|---|
| Pump & Piping Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Liner(s) Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Screen Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Casing Left in Place? | ☐ Yes | ☐ No | |

If No, Explain _____

| | | |
|---|---|---|
| Was Casing Cut Off Below Surface? | ☐ Yes | ☐ No |
| Did Sealing Material Rise to Surface? | ☑ Yes | ☐ No |
| Did Material Settle After 24 Hours? | ☑ Yes | ☐ No |
| If Yes, Was Hole Retopped? | ☑ Yes | ☐ No |

(5) Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☑ Conductor Pipe-Pumped
☐ Dump Bailer ☐ Other (Explain)

(6) Sealing Materials — For monitoring wells and monitoring well boreholes only
- ☐ Neat Cement Grout
- ☐ Sand-Cement (Concrete) Grout
- ☐ Concrete
- ☐ Clay-Sand Slurry
- ☑ Bentonite-Sand Slurry
- ☑ Chipped Bentonite
- ☐ Bentonite Pellets
- ☐ Granular Bentonite
- ☐ Bentonite - Cement Grout

(7)

| Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks Sealant or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Bentonite Grout/⅜" Hole Plug | Surface | 312 | 4 bags Gel | 220 gallons $H_2O$/200 lb Gel |
| | | | 4 Granular | 200 lb Grannular |
| | | | 22 hole plug | |
| | | | | |

(8) Comments: Borehole tapped off with ⅜" hole plug after 24 hours.

(9) Name of Person or Firm Doing Sealing Work
Total Drilling - Luisier Drilling
Signature of Person Doing Work Date Signed
Kim Wagner
Street or Route: 7391 S Porcupine Lake Road
Telephone Number: (414) 829-5690
City, State, Zip Code: Lena, WI 54139

(10) FOR DNR OR COUNTY USE ONLY
Date Received/Inspected | District/County
Reviewer/Inspector
Follow-up Necessary

DNR/COUNTY

State of Wisconsin
Department of Natural Resources

Route to:
☐ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☑ Other: Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Project - TMA Drilling Program | | CMC-TMA-106 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started MM/DD/YY | Date Completed MM/DD/YY | Drilling Method |
|---|---|---|---|
| TD Drilling, Inc.<br>James Meyers | 02/06/96 | 02/06/96 | Dual Tube |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| NA | NA | NA | NA | 1697.22 | 5¾ inches |

Boring Location
State Plane 116662.99 N, 2283777.34 E S/C/N Lat
SE 1/4 of SW 1/4 of Section 29, T35N, R13E Long

Local Grid Location (if applicable)
____ N ____ E
Feet ____ S Feet ____ W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | Blow counts = rate of penetration min/5' interval |
| DT-1 | 5-7 | 4.3 | 5 | Brown (7.5YR4/6) silty sand, med. textured w/subrounded to subangular gravel, till, very moist, strongly oxidized | SM | | | | | | | | | Rec = sampled interval depth below ground surface (ft) |
| DT-2 | 10-12 | 4.3 | 10 | As above, grading to finer texture sand & lighter brown (7.5YR5/4), damp | SM | | | | | | | | | |
| DT-3 | 15-17 | 4.3 | 15 | As above, grading to darker brown (7.5YR4/6), coarser textured silty sand w/increased subrounded to subangular grabel (till), damp | SM | | | | | | | | | |
| DT-4 | 20-22 | 1.3 | 20 | As above, minor fines, damp | SM-SP | | | | | | | | | |
| DT-5 | 25-27 | 1.3 | 25 | Yellowish brown (10YR4/4), fine textured silty sand w/10-15% subrounded to subangular gravel, damp, washed till | SM | | | | | | | | | |
| DT-6 | 30-32 | 1.3 | 30 | Yellowish brown (10YR5/4) fine textured damp sand w/5-10% rounded to subrounded gravel, fine outwash, damp | SP | | | | | | | | | |
| DT-7 | 35-37 | 2 | 35 | Brown (7.5YR4/6) silty sand, fine to med. textured till, damp | SM | | | | | | | | | |
| DT-8 | 40-42 | 2 | 40 | As above w/5% subrounded to subangular gravel | SM | | | | | | | | | |
| DT-9 | 45-47 | 1.3 | 45 | As above, slightly fine textured sand, 10% gravel | SM | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature] Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory.
Penalties: Forfeit not less than $10 nor more then $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-10 | 50-52 | 1.3 | 50 | As above | SM | | | | | | | | | |
| DT-11 | 55-57 | 1.3 | 55 | As above, w/5% gravel | SM | | | | | | | | | |
| DT-12 | 60-62 | 1.5 | 60 | Lt. brown (7.5YR6/4) fine textured silty sand, damp, occasional ¼" rounded pebbles, fine outwash | SM | | | | | | | | | |
| DT-13 | 65-67 | 2.3 | 65 | As above | SM | | | | | | | | | |
| DT-14 | 70-72 | 2.3 | 70 | As above | SM | | | | | | | | | |
| DT-15 | 75-77 | 2.3 | 75 | As above w/5% predominantly rounded gravel | SM | | | | | | | | | |
| DT-16 | 80-82 | 2.3 | 80 | As above | SM | | | | | | | | | |
| DT-17 | 85-87 | 1.5 | 85 | As above, grading to darker brown (7.5YR5/4) | SM | | | | | | | | | |
| DT-18 | 90-92 | 1.5 | 90 | Yellowish brown (10YR5/4) silty sand, fine texture, oxidized, damp, till | SM | | | | | | | | | |
| DT-19 | 95-97 | 1.5 | 95 | Yellowish brown (10YR5/4) silty sand w/10-15% subrounded to subangular gravel, till | SM | | | | | | | | | |
| DT-20 | 100-102 | 2.3 | 100 | Dark brown (7.5YR4/4), very silty sand (med. texture sand) w/5-10% gravel subrounded to subangular, damp till, oxidized | SM | | | | | | | | | |
| DT-21 | 105-107 | 2.5 | 105 | As above | SM | | | | | | | | | |
| DT-22 | 110-112 | 2.0 | 110 | As above, grading to finer texture silty sand, stronger brown (7.5YR4/6) | SM | | | | | | | | | |
| DT-23 | 115-117 | 2.3 | 115 | As above, grading to coarser texture sand w/10-15% subrounded to angular gravel | SM | | | | | | | | | |
| DT-24 | 120-122 | 2.5 | 120 | As above w/increased silt & clay | SM-SC | | | | | | | | | |

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-TMA-106

Route to:

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-25 | 125-127 | 4 | 125 | Boulder | | | | | | | | | | |
| DT-26 | 130-132 | 2.5 | 130 | Brown (7.5YR5/6) med. texture poorly graded sand w/10% rounded to subrounded gravel, coarse outwash, wet | SP | | | | | | | | | |
| DT-27 | 135-137 | 2.5 | 135 | As above | SP | | | | | | | | | |
| DT-28 | 140 | 2.5 | 140 | As above | SP | | | | | | | | | |
| | | | | E.O.B. @ 140'<br>Hole abandoned w/hole plug | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

# WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Form 3300-5W 11-89

All abandonment work shall be performed in accordance with the provisions of Chapters NR 111, NR 112 or NR 141, Wis. Admin. Code, whichever is applicable. Also, see instructions on back.

## (1) GENERAL INFORMATION

Well/Drillhole/Borehole Location | County: Forest

SE ¼ of SW ¼ of Sec. 29 ; T. 35 N R. 13 ☑ E ☐ W

(If applicable)
_____ Gov't Lot _____ Grid Number

Grid Location
116662.99 ft. ☑ N. ☐ S., 2283777.34 ft. ☑ E. ☐ W.

Civil Town Name
Lincoln

Street Address of Well
NA

City, Village
NA

## (2) FACILITY NAME

Original Well Owner (If Known)
Crandon Mining Company

Present Well Owner
Crandon Mining Company

Street or Route
7 North Brown Street, 3rd Floor

City, State, Zip Code
Rhinelander, WI 54501-3161

Facility Well No. and/or Name (If applicable)
CMC-TMA-106

WI Unique Well No.
_ _ _ _ _

Reason For Abandonment
Boring Completion

Date of Abandonment
02/06/96

## WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drillhole/Borehole Construction Completed On
(Date) 02/06/96

☐ Monitoring Well
☐ Water Well
☐ Drillhole
☑ Borehole

Construction Report Available?
☐ Yes ☐ No

Construction Type:
☑ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) _____

Formation Type:
☑ Unconsolidated Formation ☑ Bedrock

Total Well Depth (ft.) 140 Casing Diameter (ins.) ____
(From groundsurface)

Casing Depth (ft.) _____

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown
If Yes, To What Depth? _____ Feet

(4) Depth to Water (Feet) _____

| | | | |
|---|---|---|---|
| Pump & Piping Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Liner(s) Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Screen Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Casing Left in Place? | ☐ Yes | ☐ No | |

If No, Explain _____

| | | |
|---|---|---|
| Was Casing Cut Off Below Surface? | ☐ Yes | ☐ No |
| Did Sealing Material Rise to Surface? | ☑ Yes | ☐ No |
| Did Material Settle After 24 Hours? | ☑ Yes | ☐ No |
| If Yes, Was Hole Retopped? | ☑ Yes | ☐ No |

(5) Required Method of Placing Sealing Material
☑ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☐ Dump Bailer ☐ Other (Explain)

(6) Sealing Materials — For monitoring wells and monitoring well boreholes only
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☐ Bentonite-Sand Slurry
☑ Chipped Bentonite
☐ Bentonite Pellets
☐ Granular Bentonite
☐ Bentonite - Cement Grout

(7)

| Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks Sealant or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| ⅜" Hole Plug | Surface | 140 | 22 bags | |
| | | | | |
| | | | | |
| | | | | |

(8) Comments: _____

(9) Name of Person or Firm Doing Sealing Work
Total Drilling - Luisier Drilling

Signature of Person Doing Work Date Signed

Street or Route
7391 S Porcupine Lake Road

Telephone Number
(414) 829-5690

City, State, Zip Code
Lena, WI 54139

(10) FOR DNR OR COUNTY USE ONLY

Date Received/Inspected | District/County

Reviewer/Inspector

Follow-up Necessary

DNR/COUNTY

State of Wisconsin
Department of Natural Resources

Route to:
☐ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☑ Other: Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Project - TMA Drilling Program | | CMC-TMA-107 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started MM/DD/YY | Date Completed MM/DD/YY | Drilling Method |
|---|---|---|---|
| TD Drilling, Inc.<br>James Meyers | 02/07/96 | 02/07/96 | Dual Tube |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| NA | NA | NA | NA | 1712.04 | 5¾ inches |

Boring Location
State Plane 114674.04 N, 2286757.54 E S/C/N Lat
SW 1/4 of SW 1/4 of Section 33, T35N, R13E Long

Local Grid Location (if applicable)
____ N ____ E
Feet ____ S Feet ____ W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2-4 | | | Brown (7.5YR4/4) silty sand, coarse textured sand w/15% gravel, rounded, angular & subangular, till 0-42' | SM | | | | | | | | | Blow counts = rate of penetration min/5' interval |
| DT-1 | 5-7 | 1 | 5 | As above | SM | | | | | | | | | Rec = sampled interval depth below ground surface (ft) |
| DT-2 | 10-12 | 1 | 10 | As above w/20-25% gravel | SM | | | | | | | | | |
| DT-3 | 15-17 | 1 | 15 | As above w/increased silt | SM | | | | | | | | | |
| DT-4 | 20-22 | 1 | 20 | As above w/decreased gravel content, subrounded to subangular and fine texture silty sand, till | SM | | | | | | | | | Hose plugged at ~22' |
| DT-5 | 25-27 | 3.5 | 25 | Lighter brown (7.5YR5/4) silty fine sand w/10% gravel, rounded to subangular till | SM | | | | | | | | | |
| DT-6 | 30-32 | 3 | 30 | As above | SM | | | | | | | | | |
| DT-7 | 35-37 | 4 | 35 | As above, med. texture fine sand, lense at ~38' | SM | | | | | | | | | |
| DT-8 | 40-42 | 3.5 | 40 | As above (till), sl. more med. texture sand | SM | | | | | | | | | |
| DT-9 | 45-47 | 1.5 | 45 | Lt brown (10YR6/4) fine sand w/minor silt and minor subrounded to subangular cobbles and gravel fine outwash | SM-SP | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature] Firm Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory.
Penalties: Forfeit not less than $10 nor more then $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-10 | 50-52 | 1.5 | 50 | As above, grading to sl. reddish brown (7.5YR5/6) fine sand w/silt, fine outwash | SM-SP | | | | | | | | | |
| DT-11 | 55-57 | 1.5 | 55 | As above, grading to very fine, very loose sand w/silt, minor gravel, fine outwash | SM-SP | | | | | | | | | |
| | 60-62 | 2.0 | 60 | Boulder, no sample, till? | | | | | | | | | | |
| DT-12 | 65-67 | 2.0 | 65 | Brown (7.5YR4/6) silty sand, fine to med. texture w/minor gravel <5%, subangular, till | SM-SP | | | | | | | | | |
| DT-13 | 70-72 | 2.0 | 70 | As above w/increased gravel, 10%, subangular to angular, till | SM SP | | | | | | | | | |
| DT-14 | 75-77 | 2 | 75 | As above, grading to dk. brown (7.5YR3/4) | SM-SP | | | | | | | | | |
| DT-15 | 80-82 | 2 | 80 | As above | SM-SP | | | | | | | | | |
| DT-16 | 85-87 | 1.8 | 85 | As above | SM-SP | | | | | | | | | |
| DT-17 | 90-92 | 1.8 | 90 | As above | SM-SP | | | | | | | | | |
| DT-18 | 95-97 | 3.0 | 95 | As above, cobble layer drilled w/water (till?) | SP | | | | | | | | | |
| DT-19 | 100-102 | 1.8 | 100 | Dk. brown (7.5YR4/4) silty sand, med. texture w/10-15% gravel, angular to subangular, till | SM | | | | | | | | | |
| DT-20 | 105-107 | 1.5 | 105 | As above w/decreased gravel, 5-10% | SM | | | | | | | | | |
| DT-21 | 110-112 | 1.5 | 110 | As above, till | SM | | | | | | | | | |
| DT-22 | 115-117 | 1.5 | 115 | As above, grading to stronger brown (7.5YR4/6) w/increased gravel, 20-25%, till | SM-GM | | | | | | | | | |
| DT-23 | 120-122 | 1.5 | 120 | As above, till | SM | | | | | | | | | |

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-24 | 125-127 | 1.5 | 125 | Brown (7.5YR5/4) gravelly sand w/silt, rounded to subangular gravel (coarse outwash) | SP | | | | | | | | | |
| DT-25 | 130-132 | 1.5 | 130 | Brown (7.5YR5/4) gravelly sand w/gravel rounded to subangular, coarse outwash | SP | | | | | | | | | |
| DT-26 | 135-137 | 1.5 | 135 | As above, muddy due to water used in wash and remnant material in cyclone | SP | | | | | | | | | |
| DT-27 | 140-142 | 1.5 | 140 | As above (coarse outwash) | SP | | | | | | | | | |
| DT-28 | 145-147 | 1.8 | 145 | Dk. brown (7.5YR4/2), sl. grey silty sand, fine to med. texture w/rounded to angular gravel 5-10%, till | SM | | | | | | | | | |
| DT-29 | 150-152 | 1.8 | 150 | Dk. brown, sl. grey sand w/silty gravel, till | GM | | | | | | | | | |
| DT-30 | 155-157 | 1.8 | 155 | Dk. brown, sl. grey, loose gravelly sand w/minor silt, outwash or sand lense | SP | | | | | | | | | |
| DT-31 | 160-162 | 1.8 | 160 | Brown (7.5YR4/4) silty, clayey sand w/10-15% gravel subrounded to angular (till) | SM | | | | | | | | | |
| DT-33 | 165-167 | 1 | 165 | Lt. brown (7.5YR5/8) sandy gravel subrounded to subangular coarse outwash | GP | | | | | | | | | |
| DT-34 | 170-172 | 1 | 170 | As above, predominantly med. texture sand | SP | | | | | | | | | |
| DT-35 | 175-177 | 1 | 175 | As above, grading to gravelly coarse texture sand, coarse outwash | SP | | | | | | | | | |
| DT-36 | 180-182 | 1 | 180 | As above, predominantly med. texture sand w/gravel, coarse outwash | SP | | | | | | | | | |
| DT-37 | 185-187 | 2.0 | 185 | Sl. reddish brown (7.5YR4/4) silty sand w/gravel, rounded to subangular, till | SM | | | | | | | | | |
| DT-38 | 190-192 | 1.5 | 190 | Light brown (7.5YR5/6) gravelly coarse sand, rounded to subangular (coarse outwash) | SM | | | | | | | | | Drilled very soft |
| DT-39 | 195-197 | 1.5 | 195 | As above, mud from cyclone, rest is coarse outwash | SP | | | | | | | | | Drilled very soft |

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-40 | 200-202 | 1.2 | 200 | As above, coarse outwash | SP | | | | | | | | | Drilled very soft |
| DT-41 | 205-207 | 1.0 | 205 | As above, grading to fine to med. texture sand w/minor gravel, coarse outwash | SP | | | | | | | | | Drilled very soft |
| DT-42 | 210-212 | 1.0 | 210 | As above, grading to med. texture sands, lighter brown (7.5YR5/8) coarse outwash | SP | | | | | | | | | Drilled very soft |
| DT-43 | 215-217 | 1.0 | 215 | Brown (7.5YR4/6) fine sand, fine outwash | SP | | | | | | | | | Drilled very soft |
| DT-44 | 220-222 | 2.0 | 220 | As above, grading to lighter brown (7.5YR5/6), fine outwash | SP | | | | | | | | | Drilled very soft |
| DT-45 | 225-227 | 0.8 | 225 | As above | SP | | | | | | | | | Drilled very soft |
| DT-46 | 230-232 | 0.8 | 230 | Missed sample | — | | | | | | | | | Drilled very soft |
| DT-47 | 235-237 | 0.8 | 235 | As above, fine outwash | SP | | | | | | | | | Drilled very soft |
| DT-48 | 240-242 | 0.8 | 240 | As above | SP | | | | | | | | | Drilled very soft |
| DT-49 | 245-247 | 0.8 | 245 | As above | SP | | | | | | | | | Drilled very soft |
| DT-50 | 250-252 | 0.8 | 250 | As above, grading to ligher brown (7.5YR5/4) | SP | | | | | | | | | Drilled very soft |
| DT-51 | 255-257 | 0.8 | 255 | As above | SP | | | | | | | | | Drilled very soft |
| DT-52 | 260-262 | 0.8 | 260 | As above, fine outwash | SP | | | | | | | | | Drilled very soft |
| DT-53 | 265-267 | 1.3 | 265 | Sl. reddish brown (7.5YR4/4) silty sand w/clay & gravel, subangular, till | SM-SP | | | | | | | | | |
| DT-54 | 270-272 | 1.3 | 270 | As above, till | | | | | | | | | | |

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-55 | 275-277 | 1.3 | 275 | As above, till | SM | | | | | | | | | |
| DT-56 | 280-282 | 1.3 | 280 | As above, till | SM | | | | | | | | | |
| DT-57 | 285-287 | 1.3 | 285 | Brown (7.5YR4/4) med. to coarse texture sand, coarse outwash | SP | | | | | | | | | |
| DT-58 | 290-292 | 1.3 | 290 | Grey weathered bedrock | BR | | | | | | | | | |
| DT-59 | 295-297 | 2 | 295 | Grey weathered bedrock | BR | | | | | | | | | |
| DT-60 | 300-302 | 2 | 300 | Grey weathered bedrock | BR | | | | | | | | | |
| | | | | E.O.B. @ 302'<br>Supplemental Bedrock, AJE Jr 2/17/98<br>290-302 Vfg Soft cuttings. Tan to pale grey-green metasediment, probably argillite. Soft, probably clay weathered. Trace quartz veinlet chips. No sulfides noted.<br>No significant sulfides in bedrock. | | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

# WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Form 3300-5W 11-89

All abandonment work shall be performed in accordance with the provisions of Chapters NR 111, NR 112 or NR 141, Wis. Admin. Code, whichever is applicable. Also, see instructions on back.

## (1) GENERAL INFORMATION

Well/Drillhole/Borehole Location | County: Forest

SW ¼ of NW ¼ of Sec. 33 ; T. 35 N R. 13 ☑ E ☐ W

(If applicable) _____ Gov't Lot _____ Grid Number

Grid Location: 114674.04 ft. ☑ N. ☐ S., 228675.54 ft. ☑ E. ☐ W.

Civil Town Name: Lincoln

Street Address of Well: NA

City, Village: NA

## (2) FACILITY NAME

Original Well Owner (If Known): Crandon Mining Company

Present Well Owner: Crandon Mining Company

Street or Route: 7 North Brown Street, 3rd Floor

City, State, Zip Code: Rhinelander, WI 54501-3161

Facility Well No. and/or Name (If applicable): CMC-TMA-107

WI Unique Well No. _ _ _ _ _ _

Reason For Abandonment: Boring Completion

Date of Abandonment: 02/07/96

## WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drillhole/Borehole Construction Completed On (Date) 02/07/96

☐ Monitoring Well
☐ Water Well
☐ Drillhole
☑ Borehole

Construction Report Available? ☐ Yes ☐ No

Construction Type:
☑ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) _____

Formation Type:
☑ Unconsolidated Formation ☑ Bedrock

Total Well Depth (ft.) 302 (From groundsurface) Casing Diameter (ins.) ____

Casing Depth (ft.) _____

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown
If Yes, To What Depth? _____ Feet

(4) Depth to Water (Feet) _____

| | | | |
|---|---|---|---|
| Pump & Piping Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Liner(s) Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Screen Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Casing Left in Place? | ☐ Yes | ☐ No | |

If No, Explain _____

| | | |
|---|---|---|
| Was Casing Cut Off Below Surface? | ☐ Yes | ☐ No |
| Did Sealing Material Rise to Surface? | ☑ Yes | ☐ No |
| Did Material Settle After 24 Hours? | ☑ Yes | ☐ No |
| If Yes, Was Hole Retopped? | ☑ Yes | ☐ No |

(5) Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☑ Conductor Pipe-Pumped
☐ Dump Bailer ☐ Other (Explain)

(6) Sealing Materials — For monitoring wells and monitoring well boreholes only
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☑ Bentonite-Sand Slurry
☑ Chipped Bentonite
☐ Bentonite Pellets
☐ Granular Bentonite
☐ Bentonite - Cement Grout

| (7) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks Sealant or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Bentonite Grout/⅜" Hole Plug | Surface | 302 | 4 bags Gel | 180 gallons $H_2O$/200 lb Gel |
| | | | 3 Granular | 150 lb Grannular |
| | | | 7 hole plug | |
| | | | | |

(8) Comments: Borehole tapped off with ⅜" hole plug after 24 hours.

(9) Name of Person or Firm Doing Sealing Work
Total Drilling - Luisier Drilling
Signature of Person Doing Work Date Signed
Street or Route: 7391 S Porcupine Lake Road
Telephone Number: (414) 829-5690
City, State, Zip Code: Lena, WI 54139

(10) FOR DNR OR COUNTY USE ONLY
Date Received/Inspected | District/County
Reviewer/Inspector
Follow-up Necessary

DNR/COUNTY
3.5-13a-35

State of Wisconsin
Department of Natural Resources

Route to:
☐ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☑ Other: Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Project - TMA Site | | CMC-TMA-108 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| TD Drilling, Inc. | MM/DD/YY | MM/DD/YY | |
| James Meyers | 02/05/96 | 02/05/96 | Reverse Dual Tube |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| NA | NA | NA | NA | 1660.08 feet MSL | 5¾ inches |

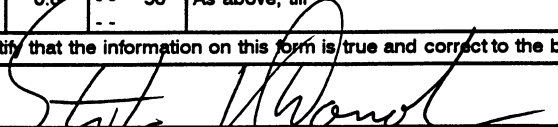
Boring Location
State Plane 114054.81 N, 2283584.73 E S/C/N Lat
NE 1/4 of SW 1/4 of Section 32, T35N, R13E Long

Local Grid Location (if applicable)
____ N ____ E
Feet ____ S Feet ____ W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-1 | 5-7 | 0.8 | 5 | Dk. sl. reddish brown (7.5YR4/4) damp, silty fine, med. texture sand (5%) round & angular gravel, till | SM | | | | | | | | | Blow counts = rate of penetration min/5' interval |
| DT-2 | 10-12 | 0.8 | 10 | As above, till | SM | | | | | | | | | Rec = sampled interval depth below ground surface (ft) |
| DT-3 | 15-17 | 0.8 | 15 | As above, till | SM | | | | | | | | | |
| DT-4 | 20-22 | 0.8 | 20 | As above, grading to sl. finer texture sand & less gravel | SM | | | | | | | | | |
| DT-5 | 25-27 | 0.8 | 25 | As above, till | SM | | | | | | | | | |
| DT-6 | 30-32 | 0.8 | 30 | As above, grading to 5-10% subangular to angular gravel, till | SM | | | | | | | | | |
| DT-7 | 35-44 | 0.8 | 35 | As above, till | SM | | | | | | | | | |
| DT-8 | 40-42 | 0.8 | 40 | As above, till | SM | | | | | | | | | |
| DT-9 | 45-42 | 0.8 | 45 | As above, grading to less gravel, <5%, till | SM | | | | | | | | | |
| DT-10 | 50-52 | 0.8 | 50 | As above, till | SM | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature  Firm Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory.
Penalties: Forfeit not less than $10 nor more then $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-11 | 55-57 | 0.8 | 55 | As above, till | SM | | | | | | | | | |
| DT-12 | 60-62 | 0.8 | 60 | As above, till | SM | | | | | | | | | |
| | | | | E.O.B. @ 60'<br>Hole remained open to bottom of borings<br>Abandoned w/⅜" chipped bentonite | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

# WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Form 3300-5W 11-89

All abandonment work shall be performed in accordance with the provisions of Chapters NR 111, NR 112 or NR 141, Wis. Admin. Code, whichever is applicable. Also, see instructions on back.

## (1) GENERAL INFORMATION

Well/Drillhole/Borehole Location | County: Forest

NE ¼ of SW ¼ of Sec. 32 ; T. 35 N R. 13 ☑ E ☐ W

(If applicable) _____ Gov't Lot _____ Grid Number

Grid Location: 114054.81 ft. ☑ N. ☐ S., 2283584.73 ft. ☑ E. ☐ W.

Civil Town Name: Lincoln

Street Address of Well: NA

City, Village: NA

## (2) FACILITY NAME

Original Well Owner (If Known): Crandon Mining Company

Present Well Owner: Crandon Mining Company

Street or Route: 7 North Brown Street, 3rd Floor

City, State, Zip Code: Rhinelander, WI 54501-3161

Facility Well No. and/or Name (If applicable): CMC-TMA-108

WI Unique Well No.: _ _ _ _ _ _

Reason For Abandonment: Boring Completion

Date of Abandonment: 02/05/96

## WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drillhole/Borehole Construction Completed On (Date) 02/05/96

☐ Monitoring Well
☐ Water Well
☐ Drillhole
☑ Borehole

Construction Report Available? ☐ Yes ☐ No

Construction Type:
☑ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) _____

Formation Type:
☑ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft.) 60 (From groundsurface) Casing Diameter (ins.) ____

Casing Depth (ft.) _____

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown
If Yes, To What Depth? _____ Feet

(4) Depth to Water (Feet) _____

| | | | |
|---|---|---|---|
| Pump & Piping Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Liner(s) Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Screen Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Casing Left in Place? | ☐ Yes | ☐ No | |

If No, Explain _____

| | | |
|---|---|---|
| Was Casing Cut Off Below Surface? | ☐ Yes | ☐ No |
| Did Sealing Material Rise to Surface? | ☑ Yes | ☐ No |
| Did Material Settle After 24 Hours? | ☐ Yes | ☑ No |
| If Yes, Was Hole Retopped? | ☐ Yes | ☐ No |

(5) Required Method of Placing Sealing Material
☑ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☐ Dump Bailer ☐ Other (Explain)

(6) Sealing Materials — For monitoring wells and monitoring well boreholes only
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☐ Bentonite-Sand Slurry
☑ Chipped Bentonite
☐ Bentonite Pellets
☐ Granular Bentonite
☐ Bentonite - Cement Grout

(7)

| Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks Sealant or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| ⅜" Hole Plug | Surface | 60 | 18 bags | |
| | | | | |
| | | | | |
| | | | | |

(8) Comments: _____

(9) Name of Person or Firm Doing Sealing Work
Total Drilling - Luisier Drilling

Signature of Person Doing Work Date Signed

Street or Route: 7391 S Porcupine Lake Road
Telephone Number: (414) 829-5690
City, State, Zip Code: Lena, WI 54139

(10) FOR DNR OR COUNTY USE ONLY

| Date Received/Inspected | District/County |
|---|---|
| | |

Reviewer/Inspector

Follow-up Necessary

DNR/COUNTY

State of Wisconsin
Department of Natural Resources

Route to:
☐ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☑ Other: Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Project - TMA Drilling Program | | CMC-TMA-109 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started MM/DD/YY | Date Completed MM/DD/YY | Drilling Method |
|---|---|---|---|
| TD Drilling, Inc.<br>James Meyers | 02/10/96 | 02/10/96 | Dual Tube |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| NA | NA | NA | NA | 1676.41 | 5¾ inches |

| Boring Location | Local Grid Location (if applicable) |
|---|---|
| State Plane 115523.32 N, 2283474.35 E S/C/N Lat<br>NE 1/4 of NW 1/4 of Section 32, T35N, R13E Long | ____ N ____ E<br>Feet ____ S Feet ____ W |

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-0 | 0-4 | | | Strong brown (7.5YR4/6) silty med. to coarse sand w/10% gravel, subrounded to angular, till | SM | | | | | | | | | Blow counts = rate of penetration min/5' interval<br><br>Rec = sampled interval depth below ground surface (ft) |
| DT-1 | 5-7 | 1.3 | 5 | As above, grading to lighter brown fine textured silty sand (10YR5/4), minor gravel, till (washed till) | SM | | | | | | | | | |
| DT-2 | 10-12 | 1.3 | 10 | As above, lighter brown, med. sand w/gravel, washed till? | SM | | | | | | | | | |
| DT-3 | 15-17 | 1.4 | 15 | Dk. brown (10YR3/4) fine textured silty sand w/minor subrounded to subangular gravel, till | SM | | | | | | | | | |
| DT-4 | 20-22 | 1.5 | 20 | As above, grading to darker brown (7.5YR3/3), till | SM | | | | | | | | | |
| DT-5 | 25-27 | 1.8 | 25 | As above, till | SM | | | | | | | | | |
| DT-6 | 30-32 | 1.8 | 30 | As above, grading to lighter brown (7.5YR4/3) w/increased subangular to subrounded gravel, till | SM | | | | | | | | | |
| DT-7 | 35-37 | 1.8 | 35 | As above, till | SM | | | | | | | | | |
| DT-8 | 40-42 | 1.8 | 40 | As above, grading stronger brown (7.5YR4/4) w/minor gravel, till | SM | | | | | | | | | |
| DT-9 | 45-47 | 1 | 45 | As above, grading lighter brown (7.5YR5/3) w/5% subangular gravel, till - SM | SM | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

| Signature | Firm |
|---|---|
| | Foth & Van Dyke |

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory.
Penalties: Forfeit not less than $10 nor more then $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-10 | 50-52 | 1 | 50 | As above, grading slightly darker brown (7.5YR4/3) till | SM | | | | | | | | | |
| DT-11 | 55-57 | 1 | 55 | As above, till | SM | | | | | | | | | |
| DT-12 | 60-62 | 8 | 60 | As above, till strong brown (7.5YR4/4) | SM | | | | | | | | | Hose plugged |
| DT-13 | 65-67 | 2 | 65 | As above, grading strong brown (7.5YR4/6), till | SM | | | | | | | | | |
| DT-14 | 70-72 | 1 | 70 | As above, till | SM | | | | | | | | | |
| DT-15 | 75-77 | 1 | 75 | As above, till | SM | | | | | | | | | |
| DT-16 | 80-82 | 1 | 80 | As above, till | SM | | | | | | | | | |
| DT-17 | 85-87 | 3 | 85 | Reddish brown (5YR4/4) med. to fine texture silty sand w/5% angular to subangular gravel, till | SM | | | | | | | | | |
| DT-18 | 90-92 | 4 | 90 | As above, grading to minor gravel redder (2.5YR4/4) | SM | | | | | | | | | |
| DT-19 | 95-97 | 4 | 95 | As above, till | SM | | | | | | | | | |
| DT-20 | 100-102 | 4 | 100 | As above, till | SM | | | | | | | | | |
| DT-21 | 105-107 | 2.3 | 105 | As above, grading browner (5YR4/4), till | SM | | | | | | | | | |
| DT-22 | 110-112 | 2.3 | 110 | As above, till | SM | | | | | | | | | |
| DT-23 | 115-117 | 2.3 | 115 | As above, till | SM | | | | | | | | | |

State of Wisconsin | Route to: | SOIL BORING LOG INFORMATION

Department of Natural Resources | Form 4400-122 | 7-91

BORING NUMBER: CMC-TMA-109 | Page 3 of 3

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-24 | 120-122 | 2.3 | 120 | As above, grading to med. texture sand w/gravel,subrounded 5-10% washed till, or outwash? | SP | | | | | | | | | |
| | | | | E.O.B. @ 122'<br>Abandoned w/hole plug | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

# WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Form 3300-5W 11-89

All abandonment work shall be performed in accordance with the provisions of Chapters NR 111, NR 112 or NR 141, Wis. Admin. Code, whichever is applicable. Also, see instructions on back.

## (1) GENERAL INFORMATION

Well/Drillhole/Borehole Location | County: Forest

NE ¼ of NW ¼ of Sec. 32 ; T. 35 N R. 13 ☑ E ☐ W

(If applicable) _____ Gov't Lot _____ Grid Number

Grid Location: 115523.32 ft. ☑ N. ☐ S., 2283474.35 ft. ☑ E. ☐ W.

Civil Town Name: Lincoln

Street Address of Well: NA

City, Village: NA

## (2) FACILITY NAME

Original Well Owner (If Known): Crandon Mining Company

Present Well Owner: Crandon Mining Company

Street or Route: 7 North Brown Street, 3rd Floor

City, State, Zip Code: Rhinelander, WI 54501-3161

Facility Well No. and/or Name (If applicable): CMC-TMA-109

WI Unique Well No.: _ _ _ _ _ _

Reason For Abandonment: Boring Completion

Date of Abandonment: 02/10/96

## WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drillhole/Borehole Construction Completed On (Date) 02/10/96

☐ Monitoring Well
☐ Water Well
☐ Drillhole
☑ Borehole

Construction Report Available? ☐ Yes ☐ No

Construction Type:
☑ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) _____

Formation Type:
☑ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft.) 122 (From groundsurface) Casing Diameter (ins.) ____

Casing Depth (ft.) ____

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown
If Yes, To What Depth? _____ Feet

(4) Depth to Water (Feet) _____

| | | | |
|---|---|---|---|
| Pump & Piping Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Liner(s) Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Screen Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Casing Left in Place? | ☐ Yes | ☐ No | |

If No, Explain _____

| | | |
|---|---|---|
| Was Casing Cut Off Below Surface? | ☐ Yes | ☐ No |
| Did Sealing Material Rise to Surface? | ☑ Yes | ☐ No |
| Did Material Settle After 24 Hours? | ☑ Yes | ☐ No |
| If Yes, Was Hole Retopped? | ☑ Yes | ☐ No |

(5) Required Method of Placing Sealing Material
☑ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☐ Dump Bailer ☐ Other (Explain)

(6) Sealing Materials — For monitoring wells and monitoring well boreholes only
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☐ Bentonite-Sand Slurry
☑ Chipped Bentonite
☐ Bentonite Pellets
☐ Granular Bentonite
☐ Bentonite - Cement Grout

(7)

| Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks Sealant or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| ⅜" Hole Plug | Surface | 122 | 25 bags | |
| | | | | |
| | | | | |
| | | | | |

(8) Comments: _____

(9) Name of Person or Firm Doing Sealing Work
Total Drilling - Luisier Drilling

Signature of Person Doing Work — Date Signed
Ken Mayers

Street or Route: 7391 S Porcupine Lake Road
Telephone Number: (414) 829-5690
City, State, Zip Code: Lena, WI 54139

(10) FOR DNR OR COUNTY USE ONLY

| Date Received/Inspected | District/County |
|---|---|
| | |

Reviewer/Inspector

Follow-up Necessary

DNR/COUNTY

3.5-13a-42

State of Wisconsin
Department of Natural Resources

Route to:
☐ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☑ Other: Mining

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Project - TMA Drilling Program | | CMC-TMA-110 |

| Boring Drilled by (Firm name and name of crew chief) | Date Started | Date Completed | Drilling Method |
|---|---|---|---|
| TD Drilling, Inc.<br>James Meyers | MM/DD/YY<br>02/07/96 | MM/DD/YY<br>02/07/96 | Dual Tube |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| NA | NA | NA | NA | 1691.23 | 5¾ inches |

Boring Location
State Plane 114154.22 N, 2285066.57 E S/C/N Lat
NW 1/4 of SE 1/4 of Section 32, T35N, R13E Long

Local Grid Location (if applicable)
____ N ____ E
Feet ____ S Feet ____ W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | Lincoln |

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-0 | 0-4 | | | Brown (7.5YR4/6) med. sand w/silt (till) | SP SM | | | | | | | | | Blow counts = rate of penetration min/5' interval<br><br>Rec = sampled interval depth below ground surface (ft) |
| DT-1 | 5-7 | 1.5 | 5 | Brown (7.5YR4/4) silty sand w/subangular gravel (till) | SM | | | | | | | | | |
| DT-2 | 10-12 | 1.5 | 10 | Grey brown (7.5YR4/3) silt fine-med. sand w/minor gravel angular to subangular (till) | SP-SM | | | | | | | | | |
| DT-3 | 15-17 | 1.5 | 15 | As above, slightly greyer (7.5YR5/3), slight increase in gravel (5%) angular to subrounded (till) | SP-SM | | | | | | | | | |
| DT-4 | 20-22 | 1.5 | 20 | As above, silt increases (till) | SM | | | | | | | | | |
| DT-5 | 25-27 | 1.5 | 25 | Grading dark brown (7.5YR4/4) as above (till) | SM | | | | | | | | | |
| DT-6 | 30-32 | 2 | 30 | As above, gravel increased to 10% (till) | SM | | | | | | | | | |
| DT-7 | 35-37 | 1.5 | 35 | Sl. reddish dark brown (7.5YR3/4) silty sand w/very little gravel, sand is finer textured than above (till) | SM | | | | | | | | | |
| DT-8 | 40-42 | 3 | 40 | Grey brown (7.5YR4/3) sandy silty gravel w/boulders (till) | GM | | | | | | | | | |
| DT-9 | 45-47 | 3 | 45 | As above (7.5YR6/3) boulder (till) | GM | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Steven M. Wood Firm: Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory.
Penalties: Forfeit not less than $10 nor more then $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin | Route to: | SOIL BORING LOG INFORMATION

Department of Natural Resources | Form 4400-122 | 7-91

BORING NUMBER: CMC-TMA-110 | 

| SAMPLE No. | SAMPLE Rec (ft) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT-10 | 50-52 | 3 | 50 | As above w/boulders and cobbles (till) | GM | | | | | | | | | |
| DT-11 | 55-57 | 2 | 55 | As above, darker brown (7.5YR4/4) (Till) | GM | | | | | | | | | |
| DT-12 | 60-62 | 3 | 60 | As above w/boulders | GM | | | | | | | | | |
| DT-13 | 65-67 | 4 | 65 | As above w/boulders (till) | GM | | | | | | | | | |
| DT-14 | 70-72 | 4 | 70 | As above w/boulders (till) | GM | | | | | | | | | |
| DT-15 | 75-77 | 2 | 75 | Grey brown (7.5YR5/3) med. sand w/minor silt & gravel, angular to subangular (till) | SP-SM | | | | | | | | | |
| DT-16 | 80-82 | 1.5 | 80 | Grey brown (7.5YR5/4) med. coarse sand w/gravel subrounded (c. outwash) | SP | | | | | | | | | |
| DT-17 | 85-87 | 1.5 | 85 | As above, increase in gravel, rounded | SP | | | | | | | | | |
| DT-18 | 90-92 | 1.5 | 90 | As above w/cobbles, color yellow-grey (10YR4/2) (c. outwash) | SP | | | | | | | | | |
| DT-19 | 95-97 | 2 | 95 | Very lt. brown (7.5YR6/4) as above w/cobbles (c. outwash) | SP | | | | | | | | | |
| DT-20 | 100-102 | 1.5 | 100 | Brown (7.5YR4/6) med.-coarse sand w/gravel & minor silt (c. outwash) | SP | | | | | | | | | |
| DT-21 | 105-107 | 1 | 105 | As above (c. outwash) | SP | | | | | | | | | |
| DT-22 | 110-112 | 1.5 | 110 | Dk. brown (7.5YR4/4) silty sand, fine to med. textured w/gravel (15%) subangular (till) | SM | | | | | | | | | |
| DT-23 | 115-117 | 2 | 115 | Brown (7.0YR4/4) silty clayey fine sand w/gravel (till) | SM-SC | | | | | | | | | |
| DT-24 | 120-122 | 1.5 | 120 | As above, sand is slightly coarser (till) | SM | | | | | | | | | |
| | | | | E.O.B. 122<br>Abandoned w/hole plug | | | | | | | | | | |

State of Wisconsin
Department of Natural Resources

# WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Form 3300-5W 11-89

All abandonment work shall be performed in accordance with the provisions of Chapters NR 111, NR 112 or NR 141, Wis. Admin. Code, whichever is applicable. Also, see instructions on back.

## (1) GENERAL INFORMATION

Well/Drillhole/Borehole Location | County: Forest

NW ¼ of SE ¼ of Sec. 32 ; T. 35 N R. 13 ☑ E ☐ W

(If applicable) _____ Gov't Lot _____ Grid Number

Grid Location: 14154.22 ft. ☑ N. ☐ S., 2285066.57 ft. ☑ E. ☐ W.

Civil Town Name: Lincoln

Street Address of Well: NA

City, Village: NA

## (2) FACILITY NAME

Original Well Owner (If Known): Crandon Mining Company

Present Well Owner: Crandon Mining Company

Street or Route: 7 North Brown Street, 3rd Floor

City, State, Zip Code: Rhinelander, WI 54501-3161

Facility Well No. and/or Name (If applicable): CMC-TMA-110

WI Unique Well No.: _ _ _ _ _

Reason For Abandonment: Boring Completion

Date of Abandonment: 02/07/96

## WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drillhole/Borehole Construction Completed On (Date) 02/07/96

- ☐ Monitoring Well
- ☐ Water Well
- ☐ Drillhole
- ☑ Borehole

Construction Report Available? ☐ Yes ☐ No

Construction Type:
☑ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) _____

Formation Type:
☑ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft.) 122 (From groundsurface) Casing Diameter (ins.) ____

Casing Depth (ft.) _____

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown
If Yes, To What Depth? _____ Feet

(4) Depth to Water (Feet) _____

| | | | |
|---|---|---|---|
| Pump & Piping Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Liner(s) Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Screen Removed? | ☐ Yes | ☐ No | ☑ Not Applicable |
| Casing Left in Place? | ☐ Yes | ☐ No | |

If No, Explain _____

| | | |
|---|---|---|
| Was Casing Cut Off Below Surface? | ☐ Yes | ☐ No |
| Did Sealing Material Rise to Surface? | ☑ Yes | ☐ No |
| Did Material Settle After 24 Hours? | ☐ Yes | ☑ No |
| If Yes, Was Hole Retopped? | ☑ Yes | ☐ No |

(5) Required Method of Placing Sealing Material
☑ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☐ Dump Bailer ☐ Other (Explain)

(6) Sealing Materials — For monitoring wells and monitoring well boreholes only
- ☐ Neat Cement Grout
- ☐ Sand-Cement (Concrete) Grout
- ☐ Concrete
- ☐ Clay-Sand Slurry
- ☐ Bentonite-Sand Slurry
- ☑ Chipped Bentonite
- ☐ Bentonite Pellets
- ☐ Granular Bentonite
- ☐ Bentonite - Cement Grout

(7)

| Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks Sealant or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| ⅜" Hole Plug | Surface | 122 | 26 bags | |
| | | | | |
| | | | | |
| | | | | |

(8) Comments: _____

(9) Name of Person or Firm Doing Sealing Work
Total Drilling - Luisier Drilling

Signature of Person Doing Work Date Signed

Street or Route: 7391 S Porcupine Lake Road
Telephone Number: (414) 829-5690
City, State, Zip Code: Lena, WI 54139

(10) FOR DNR OR COUNTY USE ONLY

| Date Received/Inspected | District/County |
|---|---|
| Reviewer/Inspector | |
| Follow-up Necessary | |

DNR/COUNTY

# Appendix 3.5-13b

## Logs for 1996 Soil Gas Probe Installation

State of Wisconsin
Department of Natural Resources

Route to:
☐ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☐ Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company - TMA 93C049 | | CMC-02-SE |

| Boring Drilled by (Firm name and name of crew chief) | Date Started MM/DD/YY | Date Completed MM/DD/YY | Drilling Method |
|---|---|---|---|
| Boart Longyear<br>Mike Nelson | 07/29/96 | 07/31/96 | Rotosonic |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | | 1,705' | 8" (0'-75')<br>6" (75'-115') |

Boring Location
State Plane 114671 N, 2286626 E S/C/N Lat
1/4 of 1/4 of Section , T N, R E Long

Local Grid Location (if applicable)
____ N ____ E
Feet ____ S Feet ____ W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C1 | 60 | | 0 | 0-5 Red brown (7.5YR5/4) SAND w/angular gravel, moist. | SP | | | | | | | | | 1254 Blow counts= rate of drill string approx. min/6" penetration |
| | | 1 | | | | | | | | | | | | |
| | | 1 | 5 | 5-10 Red brown (7.5YR5/4) fine sand w/gravel, moist, subangular to subrounded. | SP/GW | | | | | | | | | 1305 |
| C2 | 120 | 1 | 10 | 10-15 As above w/coarse gravel to fine cobbles, subrounded - subangular 1-3". | GW | | | | | | | | | |
| C3 | 60 | 1 | 15 | 15-20 Red brown (7.5YR5/4) silty fine sand w/10% 10mm subrounded gravel. Till. | SM/SP | | | | | | | | | 1312 |
| | 60 | 1 | 20 | 20-25 Red brown (7.5YR5/4) silty fine sand (subrounded to subangular). 15%. Dry. Till. 10-25 mm gravel. | SM/GM | | | | | | | | | 1330 |
| C4 | 48 | 2 | 25 | 25-30 Red brown (7.5YR5/4) silty fine sand w/ gravel. Minor subrounded fine cobbles. Till. | SM/GM | | | | | | | | | Snapped drill rod 1535 |
| C5 | 60 | 2 | 30 | 30-35 As above, increasing fine subrounded cobbles 40-50mm till. Coarsening w/depth silty matrix. | GM/SM | | | | | | | | | 1550 |
| C6 | 60 | 10 | 35 | 35-40 Brown (10YR6/4) SILT w/trace subrounded gravel, matrix, very fine sand. Fine cobbles @ 40' outwash gray staining. | SM | | | | | | | | | |
| C7 | 60 | 10 | 40 | 40-45 Red brown (2.5YR5/4) silty sand, very fine-grained w/trace 5 mm subangular-subrounded medium sand 5% cobbles at 44.5'. Fine outwash. 44.5-45 Coarse granitic cobbles encountered. | SM | | | | | | | | | 1637 |
| C8 | 60 | 10 | 45 | 45-50 Red brown (5YR5/4) silty very fine-grained sand w/trace 5-10 mm subrounded gravel. | SM | | | | | | | | | 1710 |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Fred Anderson Firm Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory.
Penalties: Forfeit not less than $10 nor more then $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-02-SE

Route to:

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Red brown (5YR5/4) silt lens at 48'. Till. | | | | | | | | | | |
| C9 | 60 | 10 | 50 | 50-55 Red brown (7.5YR5/6) sandy gravel, very fine-grained sand w/subrounded, coarse gravel, cobbles @ 55', well rounded, 15 cm, 5% gravel. | SP | | | | | | | | | 1830 |
| C10 | 60 | 5 | | | | | | | | | | | | 1950 |
| | | | 55 | 55-60 Red brown (7.5YR5/6) vfg SAND w/silt, well sorted, trace 5 mm subrounded gravel grading down into red brown (7.5YR5/6) very | SM/ SW | | | | | | | | | 0750 |
| C11 | 60 | 5 | | fine-grained sand w/fine to medium gravel, subrounded, loose outwash. | | | | | | | | | | |
| | | | 60 | 60-65 Lt. brown (10YR6/4) vfg SAND w/trace subrounded, 2 cm gravel and cobbles 4-6 cm, loose, outwash as above, little fines <5%. | SP/ SM | | | | | | | | | |
| C12 | 60 | 5 | | | | | | | | | | | | 0810 |
| | | | 65 | 65-69.5 Same as above. Fine outwash. | | | | | | | | | | |
| | | | | 69.5-70 Brown (10YR4/4) SAND. Medium to | SW | | | | | | | | | |
| C13 | 60 | 10 | | coarse grained moderately well sorted. Sub-rounded-subangular grains. Wet. | | | | | | | | | | 0825 |
| | | | 70 | 70-74 Lt. brown (10YR6/4) - grey (10YR2/1) well graded SAND and GRAVEL. Subrounded gravel w/subangular sand. Trace well rounded | SW/ GW | | | | | | | | | |
| C14 | 60 | 10 | | cobbles, loose. Till. | | | | | | | | | | 0850 |
| | | | 75 | 74-75 Red (2.5YR4/4) well graded GRAVEL with silt. Angular gravel. Weathering halo around granite. Cobbles (local). $FeO_2$. | GM | | | | | | | | | |
| C15 | 84 | 10 | | 75-83 Red brown (7.5YR5/6) very fine-grained SAND w/medium to coarse subangular gravel. Grey (10YR6/1) zones at 80'. Trace rounded | SP/ GM | | | | | | | | | 0930 |
| | | | 80 | cobbles. Till. Increasing fines to 83'. 0-5%. | | | | | | | | | | |
| | | | | 83-90 Same as above. | | | | | | | | | | |
| C16 | 84 | 10 | 85 | | SP/ SM | | | | | | | | | 0950 |
| | | | 90 | 90-95 Same as above w/moderate density increasing w/depth w/increasing medium subangular gravel. | SP/ SM | | | | | | | | | |
| C17 | 60 | 10 | | | | | | | | | | | | 1020 Drilled hard. 1140 Snapped hub support chain. |
| | | | 95 | 95-96 Same as above. | SM | | | | | | | | | |
| | | | | 96-97 Light grey (10YR2/1) to pale brown silty sand w/angular gravel. Trace biotite granite, well rounded cobbles. | | | | | | | | | | |
| | | | | 97-100 Same as above. | | | | | | | | | | 1430 |
| C18 | 24 | 15 | 100 | 100-105 Red brown (5YR5/4) coarse to very fine-grained subangular sand w/silt, trace subrounded gravel with well rounded and angular cobbles. Till. Loose. | SM/ GM | | | | | | | | | |
| C19 | 96 | 5 | 105 | 105-110 Same as above. | SM | | | | | | | | | 1600 |
| | | | 110 | 110-111 Gray (10YR2/1) very fine-grained coarse, subangular sand w/fine subrounded gravel, Outwash. | SW | | | | | | | | | |
| C20 | 84 | 10 | | 111-112 Red brown (7YR4/6) silty very fine-grained-coarse grained angular sand w/med angular gravel, tr. well rounded cobbles. Till. | SM/ GM | | | | | | | | | 1640 |
| C21 | 48 | 5 | 115 | 112-115 Same as above. Moist. Capillary fringe. | | | | | | | | | | 1657 |
| | | | | E.O.B. @ 115' | | | | | | | | | | ▽ Capillary fringe |

State of Wisconsin
Department of Natural Resources

Route to:
☐ Solid Waste ☐ Haz. Waste
☐ Emergency Response ☐ Underground Tanks
☐ Wastewater ☐ Water Resources
☐ Other

SOIL BORING LOG INFORMATION
Form 4400-122 7-91



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Crandon Mining Company - TMA 93C049 | | CMC-02-NW |

| Boring Drilled by (Firm name and name of crew chief) | Date Started MM/DD/YY | Date Completed MM/DD/YY | Drilling Method |
|---|---|---|---|
| Boart Longyear<br>Mike Nelson | 08/01/96 | 08/02/96 | Rotosonic |

| DNR Facility Well No. | WI Unique Well No. | Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|---|---|
| | | | | 1,709' | 8" (0'-95')<br>6" (95'-104') |

Boring Location
State Plane 116354 N, 2284724 E S/C/N Lat
1/4 of 1/4 of Section , T N, R E Long

Local Grid Location (if applicable)
Feet ____ N ____ E
Feet ____ S Feet ____ W

| County | DNR County Code | Civil Town/City/or Village |
|---|---|---|
| Forest | 21 | |

| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0 | 0-2.5 Brown (10YR4/6) silty CLAY. Trace well-rounded cobbles. | CL | | | | | | | | | |
| C1 | 60 | 1 | | 2.5-5 Brown (10YR4/6) SAND fine-grained to medium, angular, well sorted, outwash, moist, 10% coarse at 4-5'. | SP | | | | | | | | | 0840 |
| | | | 5 | 5-15 Brown (10YR4/6) silty SAND w/gravel, fine-grained, angular sand w/subangular medium gravel w/10% subrounded cobbles. Till. | | | | | | | | | | |
| C2 | 120 | 2.5 | 10 | | | | | | | | | | | 0900 |
| | | | 15 | 15-20 Red brown (7.5YR5/4) silty fine-grained, angular, SAND w/20% subangular medium gravel. Trace well-rounded cobbles. Till. | SM | | | | | | | | | |
| | | | 20 | 20-25 Brown (10YR4/4) fine-grained well-sorted subangular SAND with medium to coarse sub-rounded, trace well-rounded cobbles. Till. | SP | | | | | | | | | |
| C3 | 60 | | | | | | | | | | | | | 0935 |
| | | | 25 | 25-33 Red brown (7.5YR5/4) silty, fine-grained well-sorted, angular sand with medium sub-angular gravel. Trace cobbles, well rounded, till. | SM | | | | | | | | | |
| C4 | 60 | 5 | | | | | | | | | | | | 0945 |
| | | | 30 | 33-35 Brown (10YR4/4) silty fine-grained angular SAND w/10% well rounded to subrounded med. gravel, grading to 95% sand as above. Till. | SM | | | | | | | | | |
| C5 | 60 | 5 | 35 | 35-40 Red brown (7.5YR5/4) fine-grained, well-sorted, angular sand w/med, subangular gravel w/trace well rounded cobbles. Till. 5% silt. | SM/ SP | | | | | | | | | 1015 |
| | | | 40 | 40-45 Red brown (7.5YR5/4) fine-coarse-grained angular sand w/fine to med. subangular gravel. Trace cobbles well rounded 5% silt. Till. | SP/ SM | | | | | | | | | Replace bit. 1020 |
| C6 | 60 | 3 | | Coarse outwash at 44.5'. | | | | | | | | | | |
| | | | 45 | 45-50 Brown (10YR4/4) fine-med angular sand w/med subangular-subrounded gravel. Coarse outwash. | | | | | | | | | | |

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Fred Anderson Firm Foth & Van Dyke

This form is authorized by Chapters 114.147 and 162, Wis. Stats. Completion of this report is mandatory.
Penalties: Forfeit not less than $10 nor more then $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 114.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources
BORING NUMBER: CMC-02-NW

Route to:

SOIL BORING LOG INFORMATION
Form 4400-122 7-91


| SAMPLE No. | SAMPLE Rec (in) | Blow Counts | Depth in Feet | Soil/Rock description and geologic origin for each major unit | USCS | Graph Log | Well Diag | PID/ FID | Soil Properties: Std Pntr | Mst Cont | Liq Lim | Plas Lim | P 200 | RQD/ Comm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C7 | 60 | 5 | | | | | | | | | | | | 1100 |
| | | | 50 | 50-53 Brown (10YR4/4) silty, fine, well-sorted angular SAND w/medium to coarse subrounded gravel. Coarse outwash to fine outwash. | SM/ SP | | | | | | | | | |
| C8 | | 2 | | 53-55 Same as above w/increased silt 5% fine | SM | | | | | | | | | 1115 |
| C9 | | 1 | | subrounded gravel. | | | | | | | | | | 1130 |
| | | | 55 | 55-57 Brown (10YR4/4) coarse angular SAND w/ medium subangular gravel outwash. | SP | | | | | | | | | |
| C10 | 60 | 5 | | 57-60 Brown (10YR6/4) silty, fine to medium SAND w/coarse subrounded gravel. Trace cobbles, subrounded, coarse outwash. | SM/ SP | | | | | | | | | 1210 Replace breaker jaws. |
| C11 | 60 | 1 | 60 | 60-62 Same as above. Coarse outwash. | SP/ SM | | | | | | | | | |
| | | | | 62-63.5 Same as above. | | | | | | | | | | |
| | | | | 63.5-64.5 Red-brown (5.5YR4/4) very fine-grained SAND, well sorted, loose. | SP | | | | | | | | | |
| | | | | 64.5-64.7 Black (10YR6/1) coarse SAND, angular, | SP | | | | | | | | | |
| C12 | 60 | 1 | 65 | well sorted. | SP/ | | | | | | | | | 1450 |
| | | | | 64.7-67 Red-brown (5YR5/4) silty very fine-grained, angular SAND w/angular gravel, angular, coarse outwash. | SM | | | | | | | | | |
| | | | | 67-75 Same as above w/5% well rounded | | | | | | | | | | |
| | | | 70 | cobbles. | | | | | | | | | | |
| C13 | 108 | 5 | | | | | | | | | | | | 1500 |
| | | | 75 | 75-76 Lt. brown (7.5YR4/4) very fine-grained, well sorted, angular SAND, loose. Outwash. 10% fine subrounded gravel. | SP | | | | | | | | | |
| | | | | 76-78 Same as above. | | | | | | | | | | |
| | | | | 78-84 Red brown (5YR5/4) medium-coarse, | SW | | | | | | | | | |
| C14 | 108 | 5 | 80 | subangular SAND w/med to coarse subrounded gravel coarsening w/depth. Very fine-grained, well-sorted subangular SAND. Lt. brown @ 89'. Coarse outwash. Glaciofluvial. | | | | | | | | | | 1530 |
| | | | | 84-90 Brown (10YR5/4) fine-medium sub- | SW | | | | | | | | | |
| | | | 85 | angular SAND w/medium subrounded gravel coarsening to 86'. Coarse outwash. Flurio-stratified. | | | | | | | | | | |
| C15 | 72 | 5 | | | | | | | | | | | | 1600 |
| | | | 90 | 90-95 Brown (10YR5/4) fine to med. SAND w/subrounded medium gravel cobbles at 93'. Fluriostratified coarse outwash. | SW/ GP | | | | | | | | | |
| | | | 95 | 95-96 Same as above w/increasing silt. | SW/ SM | | | | | | | | | |
| | | | | 96-98 Red brown (5YR4/6) silty, very fine-grained | | | | | | | | | | |
| C16 | 48 | 5 | | angular-coarse grained SAND w/coarse sub-rounded gravel. Till. | | | | | | | | | | 1640 |
| | | | | 98-101 Brown (10YR4/6) fine to coarse | SP | | | | | | | | | |
| C17 | 36 | 5 | 100 | subangular SAND w/medium subrounded gravel. Outwash 5-10% gravel. | | | | | | | | | | 1705 |
| | | | | 101-104 Red brown (5YR4/6) silty angular fine-grained coarse SAND w/medium subrounded gravel. Till. | | | | | | | | | | |
| C18 | 12 | 6 | 105 | E.O.B. @ 104'. | | | | | | | | | | 2023 |

# Appendix 3.5-14

## Test Pit Logs

- Golder Associates 1979-1981 Tailings Disposal Site Test Pits
- Soil Testing Services of Wisconsin, Inc. 1980 Plant Site Test Pits (STS-TP-80-1 through 13)
- STS Consultants Ltd. 1983 Soil Absorption Field Test Pits (STS-SAF-1 through 16)
- STS Consultants Ltd. 1984 Tailings Management Area Test Pits (TP-84-1 through 33)
- STS Consultants Ltd. 1985 Mine Refuse Disposal Facility Test Pits (TP-85-1 through 17)
- Foth & Van Dyke and Associates Inc. 1994 and 1995 Soil Absorption Pond Test Pits (Sites A, B, C, D and E)
- Thresher & Son, Inc. February 26, 1996 Technical Memorandum Re: Fragipan Investigation Evaluation Near the Bur Oak Swamp

# Logs for Golder Associates 1979-1981 Tailings Disposal Site Test Pits

GOLDER ASSOCIATES

| Test Pit Logs | Number of Sheets |
|---|---|
| TP-1 | 1 |
| TP-2 | 1 |
| TP-3 | 1 |
| TP-4 | 1 |
| TP-5 | 1 |
| TP-6 | 1 |
| TP-7 | 1 |
| TP-8 | 1 |
| TP-9 | 1 |
| TP-10 | 1 |
| TP-11 | 1 |
| TP-12 | 1 |
| TP-13 | 1 |
| TP-14 | 1 |
| TP-15 | 1 |
| TP-16 | 1 |
| TP-17 | 1 |
| TP-18 | 1 |
| TP-19 | 1 |
| TP-20 | 1 |
| TP-21 | 1 |
| TP-22 | 1 |
| TP-TW-41 | 1 |

APPROX. N110900 ft. (N33802m)
COOR. E2285500 ft. (E696620m)

# TEST PIT LOG TP-1

SHEET 1 OF 1

1680 ft.

SURFACE ELEV. Approx. (512.06m) PROJECT EXXON CRANDON TAILINGS DISPOSAL SITE

DATUM USGS MSL DATE STARTED 11/15/79 DATE COMPLETED 11/16/79

EQUIPMENT John Deere 690 Backhoe

| DEPTH METER FEET | DESCRIPTION | UNIFIED CLASS | REMARKS |
|---|---|---|---|
| .305 | Topsoil and rootmat | PT | |
| 1.0 | Red-brown, fine to coarse SAND, trace to some fine to coarse gravel, trace to some silt, trace clay, occasional cobbles and boulders<br><br>Thin discontinuous clean fine to coarse sand layers at 3.0' | SM | Seep at 3.0' (0.91m) |
| 1.83 | | | |
| 6.0 | Brown, fine to coarse SAND, trace fine gravel, trace silt | SP to SP-SM | Seep at 7.0' (2.13m) |
| 2.13 | | | |
| 7.0 | Red-brown, fine to coarse SAND, trace fine to coarse gravel, trace to some silt, trace clay, occasional cobbles and boulders | SM | Sand cone density at 7.0' (2.13m)<br>$\gamma_d$=138.3 pcf (2216 kg/m$^3$)<br>w%=7.2 |
| 3.09 | | | |
| 10.0 | Brown, fine to coarse SAND, trace to some fine to coarse gravel | SP | |
| 4.88 | | | |
| 16.0 | END OF PIT | | |

Job No. 786085
Scale 1"=2.5'

Golder Associates

Drawn jls
Checked MCB

APPROX. N116000 ft. (N35356m)
COOR. E2285600 ft. (E696650m)

# TEST PIT LOG TP-2

SHEET 1 OF 1

SURFACE ELEV. Approx. 1715 ft. (522.73m) PROJECT EXXON CRANDON TAILINGS DISPOSAL SITE

DATUM USGS MSL DATE STARTED 11/16/79 DATE COMPLETED 11/16/79

EQUIPMENT John Deere 690 Backhoe

| DEPTH METER / FEET | DESCRIPTION | UNIFIED CLASS | REMARKS |
|---|---|---|---|
| .305 | Topsoil and rootmat | PT | |
| 1.0 | Brown, fine to coarse SAND, trace fine to coarse gravel, trace silt, occasional cobbles and boulders | SP to SP-SM | |
| 2.13 | | | Seep at 7.0' (2.13m) |
| 7.0 | Red-brown, fine to coarse SAND, some fine to coarse gravel, some silt, trace clay to fine to coarse gravelly, fine to coarse SAND, some silt, occasional cobbles and boulders | SM | Sand cone density at 8.5' (2.59m) $\gamma_d$=122.4 pcf (1961 kg/m$^3$) $w_i$ = 14.6 |
| 4.57 | | | |
| 15.0 | END OF PIT | | |

Job No. 786085
Scale 1"=2.5'

Golder Associates

Drawn jls
Checked MCG

APPROX. N114200 ft. (N34808m)
COOR. E2282900 ft. (E695827m)

# TEST PIT LOG TP-3

SHEET 1 OF 1

SURFACE ELEV. Approx. 1620 ft. (493.78m) PROJECT EXXON CRANDON TAILINGS DISPOSAL SYSTEM

DATUM USGS MSL DATE STARTED 11/16/79 DATE COMPLETED 11/16/79

EQUIPMENT John Deere 690 Backhoe

| DEPTH METER / FEET | DESCRIPTION | UNIFIED CLASS. | REMARKS |
|---|---|---|---|
| .457 | Topsoil and rootmat | PT | |
| 1.5 / 2.13 | Red-brown, fine to coarse SAND, trace to some silt, trace fine to coarse gravel, trace clay, occasional cobbles and boulders<br><br>Occasional layers of gray-brown SILT, trace fine to coarse sand, trace clay | SP-SM | |
| 7.0 / 2.74 | Brown, fine to coarse SAND, trace fine to coarse gravel, trace silt | SP to SP-SM | Stratified<br><br>Heavy seep at 9.0' (2.74m) |
| 9.0 / 5.18 | Dark brown, fine to coarse SAND, trace fine to coarse gravel, trace silt, occasional cobbles and bouldes | SP | |
| 17.0 | END OF PIT | | |

Job No. 786085
Scale 1"=2.5'

Golder Associates

Drawn jls
Checked [illegible]

APPROX. N113700 ft. (N34655m)
COOR. E2275800 ft. (E693663m)
1620 ft.

# TEST PIT LOG TP-4

SHEET 1 OF 1

SURFACE ELEV. Approx. (493.78m) PROJECT EXXON CRANDON TAILINGS DISPOSAL SYSTEM

DATUM USGS MSL DATE STARTED 11/29/79 DATE COMPLETED 11/29/79

EQUIPMENT John Deere 690 Backhoe

| DEPTH METER / FEET | DESCRIPTION | UNIFIED CLASS | REMARKS |
|---|---|---|---|
| .305 | Black rootmat | PT | |
| 1.0 | Dark brown, fine to coarse SAND, some silt, trace clay, trace organics | SM | |
| .610 | | | Light seep at 2.0'-3.5' (0.61m to 1.07m) |
| 2.0 | Dark brown to black, organic SILT, some clay, some fine sand | OL | |
| 1.07 | | | |
| 3.5 | Brown, fine to coarse SAND, some silt to SILT, some clay, trace fine sand, occasional cobbles<br><br>Pockets of each material appear randomly interlayered with each other | SM to ML | Sand cone density at 5.5'(1.68m)<br>$\gamma_d$=114.6 (1836 kg/m$^3$)<br>w=14.1 |
| 3.66 | | | |
| 12.0 | END OF PIT | | |

Job No. 786085
Scale 1"=2.5'

Golder Associates

Drawn jls
Checked MCE

APPROX. N. 112600 ft. (N34320m)
COOR. E2273700 ft. (E693023m)
1705 ft.

# TEST PIT LOG TP-5

SHEET 1 OF 1

SURFACE ELEV. Approx. (519.68m) PROJECT EXXON CRANDON TAILINGS DISPOSAL SYSTEM

DATUM USGS MSL DATE STARTED 11/29/79 DATE COMPLETED 11/29/79

EQUIPMENT John Deere 690 Backhoe

| DEPTH METER / FEET | DESCRIPTION | UNIFIED CLASS. | REMARKS |
|---|---|---|---|
| .152 | Black to dark brown, fiberous rootmat | PT | |
| 0.5 | Light brown, fine to coarse SAND, some silt, trace clay | SM | |
| .610 | | | |
| 2.0 | Red-brown, fine to coarse SAND, some fine to coarse gravel, some silt, trace clay, occasional cobbles and boulders<br><br>Silt layer, maximum 6" thick at 4.0'<br><br>Pocket of clean sand, some gravel over part of pit, 5' long, 12" thick at 8.0' | SM | Sand cone density at 6.0'(1.83m)<br>$\gamma_d$=110.4 pcf (1769 kg/m$^3$)<br>w%=4.8 |
| 3.35 | | | |
| 11.0 | END OF PIT | | |

Job No. 786085
Scale 1"=2.5'

Golder Associates

Drawn jls
Checked MCC

APPROX. N111100 ft. (N33863m)
COOR. E2270100 ft. (E691926m)

# TEST PIT LOG TP-6

SHEET 1 OF 1

SURFACE ELEV. Approx. 1625 ft. (495.3m) PROJECT EXXON CRANDON TAILINGS DISPOSAL SYSTEM

DATUM USGS MSL DATE STARTED 11/30/79 DATE COMPLETED 11/30/79

EQUIPMENT John Deere 690 Backhoe

| DEPTH METER / FEET | DESCRIPTION | UNIFIED CLASS | REMARKS |
|---|---|---|---|
| .152 | Black, rootmat and topsoil | PT | |
| 0.5 | Brown, fine to coarse SAND, some silt, trace fine gravel to Brown, silty, fine to coarse SAND, gray and orange silt layers at 5.0' | SM | |
| 1.52 | | | Sand cone density at 5.0'(1.52m) $\gamma_d$=118.2 pcf (1894 kg/m$^3$) $w^c$=7.9 |
| 5.0 | Light brown to red-brown, fine to coarse SAND, trace to some fine gravel, trace silt. Pocket of cobbles in part of the pit from 6.5' to 8.0' Pocket of medium to coarse sand over part of the pit from 8.5' to 10.0' | SP to SP-SM | |
| 3.96 | | | |
| 13.0 | END OF PIT | | |

Job No. 786085
Scale 1"=2.5'

Golder Associates

Drawn jls
Checked

APPROX. N115980 ft. (N35351m)
COOR. E2285270 ft. (E696550m)

# TEST PIT LOG TP-7

SHEET 1 OF 1

SURFACE ELEV. *Approx. 1710 ft. (521.21m) PROJECT EXXON CRANDON TAILINGS DISPOSAL SYSTEM

DATUM USGS MSL DATE STARTED 3/12/81 DATE COMPLETED 3/12/81

EQUIPMENT John Deere 410 Backhoe

| DEPTH METER / FEET | DESCRIPTION | UNIFIED CLASS. | REMARKS |
|---|---|---|---|
| .15 / 0.5 | Brown, silty fine to coarse SAND, trace fine to coarse gravel, trace organics | SM | |
| .46 / 1.5 | Brown, silty, fine to coarse SAND, some fine to coarse gravel | SM | |
| | Brown, fine to coarse SAND, some silt, trace clay, occasional cobbles | SP-SM to SM | |
| 1.22 / 4.0 | | | Slow seep at 4.0' (1.22m) |
| | Brown to red-brown, fine to coarse SAND, some silt, trace clay, trace fine to coarse gravel, occasional cobbles and boulders | SM | SA-1, 7.5'-8.5' (2.29m-2.59m): % finer than #200 sieve=20.3% (By field sieve analysis) |
| 3.05 / 10.0 | END OF PIT | | |
| | *Estimated from topographic map | | |

Job No 786085
Scale 1" = 2.5'

Golder Associates

Drawn MRB
Checked

APPROX. N116100 ft. (N35387m)
COOR. I2285570 ft. (E696642m)
1709 ft.

# TEST PIT LOG TP-8

SHEET 1 OF 1

SURFACE ELEV. *Approx. (520.90m) PROJECT EXXON CRANDON TAILINGS DISPOSAL SYSTEM

DATUM USGS MSL DATE STARTED 3/12/81 DATE COMPLETED 3/12/81

EQUIPMENT John Deere 410 Backhoe

| DEPTH METER / FEET | DESCRIPTION | UNIFIED CLASS. | REMARKS |
|---|---|---|---|
| .30 / 1.0 | Brown, silty fine to coarse SAND, trace fine to coarse gravel | SM | |
| | Brown, fine to coarse SAND, some fine to coarse gravel, some silt, occasional cobbles and boulders | SM | Moderate seep at 8.0' (2.44m)<br>SA-1, 9.0'-10.0' (2.74m-3.05m): % finer than #200 sieve=17.4%<br>SA-2, 11.0'-12.0' (3.35m-3.66m): % finer than #200 sieve=17.1% (Both results by field sieve analyses) |
| 3.66 / 12.0 | END OF PIT<br>*Estimated from elevation of adjacent boring G41-J11 | | |

Job No. 786085
Scale 1" = 2.5'

Golder Associates

Drawn MRB
Checked

APPROX. N115960 ft. (N35345m)
COOR. E2284920 ft. (E696444m)

# TEST PIT LOG TP-9

SHEET 1 OF 1

SURFACE ELEV. *Approx. 1707 ft. (520.29m) PROJECT EXXON CRANDON TAILINGS DISPOSAL SYSTEM

DATUM USGS MSL DATE STARTED 3/12/81 DATE COMPLETED 3/12/81

EQUIPMENT John Deere 410 Backhoe

| DEPTH METER / FEET | DESCRIPTION | UNIFIED CLASS. | REMARKS |
|---|---|---|---|
| .30 / 1.0 | Brown, silty fine to coarse SAND, trace fine to coarse gravel, trace organics | SM | |
| 1.07 / 3.5 | Brown, fine to coarse SAND, some fine to coarse gravel, some silt, trace organics, occasional cobbles and boulders | SM | |
| 1.52 / 5.0 | Cobbles and fine to coarse gravel | GP | Heavy seep starting at 4.0' (1.22m) forced abandonment of test pit |
| | END OF PIT | | |
| | *Estimated from topographic map | | |

Job No 786085
Scale 1" = 2.5'

Golder Associates

Drawn MRB
Checked

APPROX. N116080 ft. (N35381m)
COOR. E2284160 ft. (E696212m)

# TEST PIT LOG TP-10

SHEET 1 OF 1

SURFACE ELEV. *Approx. 1695 ft. (516.64m) PROJECT EXXON CRANDON TAILINGS DISPOSAL SYSTEM

DATUM USGS MSL DATE STARTED 3/13/81 DATE COMPLETED 3/13/81

EQUIPMENT John Deere 410 Backhoe

| DEPTH METER / FEET | DESCRIPTION | UNIFIED CLASS | REMARKS |
|---|---|---|---|
| | Brown, silty fine to coarse SAND, trace fine to coarse gravel, trace organics | SM | |
| .61 / 2.0 | | | |
| | Red-brown, fine to coarse SAND, some fine to coarse gravel, some silt | SM | |
| 3.05 / 10.0 | END OF PIT<br>*Estimated from topographic map | | |

Job No. 786085
Scale 1" = 2.5'

Golder Associates

Drawn MRB
Checked

APPROX. N115720 ft. (N35271m)
COOR. E2283900 ft. (E696133m)

# TEST PIT LOG TP-11

SHEET 1 OF 1

SURFACE ELEV. *Approx. 1680 ft. (512.06m) PROJECT EXXON CRANDON TAILINGS DISPOSAL SYSTEM

DATUM USGS MSL DATE STARTED 3/13/81 DATE COMPLETED 3/13/81

EQUIPMENT John Deere 410 Backhoe

| DEPTH METER / FEET | DESCRIPTION | UNIFIED CLASS. | REMARKS |
|---|---|---|---|
| .61 / 2.0 | Brown, silty fine to coarse SAND, trace fine to coarse gravel, trace organics | SM | |
| 3.66 / 12.0 | Brown, fine to coarse SAND, some fine to coarse gravel, some silt, occasional cobbles and boulders | SM | |
| | END OF PIT<br>*Estimated from topographic map | | |

Job No 786085
Scale 1" = 2.5'

Golder Associates

Drawn MRB
Checked

APPROX. N115820 ft. (N35302m)
COOR. E2283800 ft. (E696102m)

# TEST PIT LOG TP-12

SHEET 1 OF 1

SURFACE ELEV. *Approx. 1695 ft. (516.64m) PROJECT EXXON CRANDON TAILINGS DISPOSAL SYSTEM

DATUM USGS MSL DATE STARTED 3/13/81 DATE COMPLETED 3/13/81

EQUIPMENT John Deere 410 Backhoe

| DEPTH METER / FEET | DESCRIPTION | UNIFIED CLASS. | REMARKS |
|---|---|---|---|
| .30 | Brown, silty, fine to coarse SAND, trace fine to coarse gravel, trace organics | SM | |
| 1.0 | | | |
| | Red-brown, fine to coarse SAND, some fine to coarse gravel, some silt, occasional cobbles and boulders | SM | |
| 2.59 | | | |
| 8.5 | END OF PIT<br>*Estimated from topographic map | | |

Job No 786085
Scale 1" = 2.5'

Golder Associates

Drawn MRB
Checked

APPROX. N1115320 ft. (N35120m)
COOR. E2283920 ft. (E696139m)
1674 ft.

# TEST PIT LOG TP-13

SHEET 1 OF 1

SURFACE ELEV. *Approx. (510.24m) PROJECT EXXON CRANDON TAILINGS DISPOSAL SYSTEM

DATUM USGS MSL DATE STARTED 3/13/81 DATE COMPLETED 3/13/81

EQUIPMENT John Deere 410 Backhoe

| DEPTH METER FEET | DESCRIPTION | UNIFIED CLASS. | REMARKS |
|---|---|---|---|
| .30 | Brown, silty fine to coarse SAND, trace fine to coarse gravel, trace organics | SM | |
| 1.0 | | | |
| | Brown, fine to coarse SAND, some fine to coarse gravel, some silt, trace clay | SM | |
| 1.52 | | | |
| 5.0 | | | |
| | Red-brown, fine to coarse SAND, some fine to coarse gravel, some silt | SM | |
| 3.05 | | | |
| 10.0 | END OF PIT | | |
| | *Estimated from topographic map | | |

Job No. 786085
Scale 1" = 2.5'

Golder Associates

Drawn MRB
Checked

APPROX. N114480 ft. (N34894m)
COOR. E2283040 ft. (E695871m)

# TEST PIT LOG TP-14

SHEET 1 OF 1

SURFACE ELEV. *Approx. 1635 ft. (498.35m) PROJECT EXXON CRANDON TAILINGS DISPOSAL SYSTEM

DATUM USGS MSL DATE STARTED 3/13/81 DATE COMPLETED 3/13/81

EQUIPMENT John Deere 410 Backhoe

| DEPTH METER FEET | DESCRIPTION | UNIFIED CLASS. | REMARKS |
|---|---|---|---|
| | | | Topsoil previously removed in this area |
| | Red-brown, fine to coarse SAND, some fine to coarse gravel, some silt, occasional cobbles and boulders | SM | |
| | | | Slight seep at 8.0' (2.44m) |
| 2.74 / 9.0 | Red-brown, fine to coarse SAND, some fine to coarse gravel, some silt, occasional cobbles and boulders with pockets of brown fine to coarse SAND, some silt | SM with SP-SM | |
| 3.05 / 10.0 | END OF PIT<br>*Estimated from topographic map | | |

Job No 786085
Scale 1" = 2.5'

Golder Associates

Drawn MRB
Checked

APPROX. N114860 ft. (N35009m)
COOR. E2282840 ft. (E695810m)

# TEST PIT LOG TP-15

SHEET 1 OF 1

SURFACE ELEV. *Approx. 1643 ft. (500.79m) PROJECT EXXON CRANDON TAILINGS DISPOSAL SYSTEM

DATUM USGS MSL DATE STARTED 3/13/81 DATE COMPLETED 3/13/81

EQUIPMENT John Deere 410 Backhoe

| DEPTH METER / FEET | DESCRIPTION | UNIFIED CLASS. | REMARKS |
|---|---|---|---|
| | Brown, silty fine to coarse SAND, some fine to coarse gravel, trace organics | SM | |
| 1.52 / 5.0 | Brown, fine to coarse SAND, some fine to coarse gravel, some silt, trace clay | SM | |
| 3.05 / 10.0 | END OF PIT<br>*Estimated from topographic map | | |

Job No. 786085
Scale 1" = 2.5'

Golder Associates

Drawn MRB
Checked

APPROX. COOR. N115920 ft. (N35332m) E2284090 ft. (E696191m)

# TEST PIT LOG TP-16

SHEET 1 OF 1

SURFACE ELEV. *Approx. 1683 ft. (512.38m) PROJECT EXXON CRANDON TAILINGS DISPOSAL SYSTEM

DATUM USGS MSL DATE STARTED 3/13/81 DATE COMPLETED 3/13/81

EQUIPMENT John Deere 410 Backhoe

| DEPTH METER FEET | DESCRIPTION | UNIFIED CLASS. | REMARKS |
|---|---|---|---|
| | Red-brown, fine to coarse SAND, some fine to coarse gravel, some silt, occasional cobbles and boulders | SM | |
| 2.44 8.0 | END OF PIT<br><br>*Estimated from topographic map | | |

Job No. 786085

Scale 1" = 2.5'

Golder Associates

Drawn MRB

Checked

APPROX. N113860 ft. (N34705m)
COOR. E2282880 ft. (E695822m)

# TEST PIT LOG TP-17

SHEET 1 OF 1

SURFACE ELEV. *Approx. 1632 ft. (497.43m) PROJECT EXXON CRANDON TAILINGS DISPOSAL SYSTEM

DATUM USGS MSL DATE STARTED 3/14/81 DATE COMPLETED 3/14/81

EQUIPMENT John Deere 410 Backhoe

| DEPTH METER FEET | DESCRIPTION | UNIFIED CLASS. | REMARKS |
|---|---|---|---|
| .30 | Black PEAT | OL | |
| 1.0 | Brown, silty fine to coarse SAND, trace fine to coarse gravel, trace organics | SM | |
| .91 | | | |
| 3.0 | Red-brown, fine to coarse SAND, some fine to coarse gravel, some silt, occasional cobbles and boulders | SM | |
| 3.05 | | | |
| 10.0 | END OF PIT<br>*Estimated from topographic map | | |

Job No. 786085
Scale 1" = 2.5'

Golder Associates

Drawn MRB
Checked

APPROX. N113400 ft. (N34564m)
COOR. E2282860 ft. (E695816m)

# TEST PIT LOG TP-18

SHEET 1 OF 1

SURFACE ELEV. *Approx. 1647 ft. (502.01m) PROJECT EXXON CRANDON TAILINGS DISPOSAL SYSTEM

DATUM USGS MSL DATE STARTED 3/14/81 DATE COMPLETED 3/14/81

EQUIPMENT John Deere 410 Backhoe

| DEPTH METER / FEET | DESCRIPTION | UNIFIED CLASS. | REMARKS |
|---|---|---|---|
| .30 / 1.0 | Brown, silty fine to coarse SAND, some fine to coarse gravel, trace organics | SM | |
| 3.05 / 10.0 | Red-brown, fine to coarse SAND, some fine to coarse gravel, some silt, trace clay, occasional cobbles and boulders | SM | |
| | END OF PIT<br><br>*Estimated from topographic map and elevation of adjacent boring G41-E15 | | |

Job No. 786085
Scale 1" = 2.5'

Golder Associates

Drawn MRB
Checked

PPROX. N112460 ft. (N34278m)
OOR. E2283060 ft. (E695877m)

# TEST PIT LOG TP-19

SHEET 1 OF 1

SURFACE ELEV. *Approx. 1666 ft. (507.80m) PROJECT EXXON CRANDON TAILINGS DISPOSAL SYSTEM

DATUM USGS MSL DATE STARTED 3/14/81 DATE COMPLETED 3/14/81

EQUIPMENT John Deere 410 Backhoe

| DEPTH METER FEET | DESCRIPTION | UNIFIED CLASS | REMARKS |
|---|---|---|---|
| | Brown, silty fine to coarse SAND, trace fine to coarse gravel, trace organics | SM | |
| .91 / 3.0 | | | |
| | Red-brown, fine to coarse SAND, some fine to coarse gravel, some silt, trace clay, occasional cobbles and boulders | SM | Slight seep at 4.0' (1.22m) |
| 1.52 / 5.0 | | | |
| | Red-brown, fine to coarse SAND, trace fine to coarse gravel, trace to some silt | SP-SM | |
| 2.13 / 7.0 | | | |
| | END OF PIT<br><br>*Estimated from topographic map and elevation of adjacent boring G41-E17 | | |

Job No. 786085
Scale 1" = 2.5'

Golder Associates

Drawn MRB
Checked

APPROX. N112200 ft. (N34199m)
COOR. E2285500 ft. (E696620m)

# TEST PIT LOG TP-20

SHEET 1 OF 1

SURFACE ELEV. *Approx. 1685 ft. (519.59m) PROJECT EXXON CRANDON TAILINGS DISPOSAL SYSTEM

DATUM USGS MSL DATE STARTED 3/14/81 DATE COMPLETED 3/14/81

EQUIPMENT John Deere 410 Backhoe

| DEPTH METER / FEET | DESCRIPTION | UNIFIED CLASS. | REMARKS |
|---|---|---|---|
| .30 / 1.0 | Brown, silty fine to coarse SAND, some fine to coarse gravel, trace organics | SM | |
| 2.74 / 9.0 | Red-brown, fine to coarse SAND, some fine to coarse gravel, trace silt, occasional cobbles and boulders | SM | |
| 3.66 / 12.0 | Red-brown, fine to coarse SAND, some fine to coarse gravel, trace silt, occasional cobbles and boulders with pockets of brown, fine to coarse SAND, some fine to coarse gravel, trace to some silt | SP with SP-SM | |
| | END OF PIT<br><br>*Estimated from topographic map and elevation of adjacent boring G41-J17 | | |

Job No. 786085
Scale 1" = 2.5'

Golder Associates

Drawn MRB
Checked

APPROX. N109240 ft. (N33296m)
COOR. E2288320 ft. (E697480m)

# TEST PIT LOG TP-21

SHEET 1 OF 1

SURFACE ELEV. *Approx. 1727 ft. (526.39m) PROJECT EXXON CRANDON TAILINGS DISPOSAL SYSTEM

DATUM USGS MSL DATE STARTED 3/14/81 DATE COMPLETED 3/14/81

EQUIPMENT John Deere 410 Backhoe

| DEPTH METER FEET | DESCRIPTION | UNIFIED CLASS. | REMARKS |
|---|---|---|---|
| 0.30 | Brown, silty fine to coarse SAND, trace fine to coarse gravel, trace organics | SM | |
| 1.0 | Brown, fine to coarse SAND, some fine to coarse gravel, some silt, occasional cobbles and boulders with occasional pockets of brown, fine to coarse SAND, trace to some silt, trace fine to coarse gravel | SP with SP-SM | |
| 3.35 | | | |
| 11.0 | END OF PIT<br><br>*Estimated from elevation of adjacent boring G41-N21 | | |

Job No. 786085
Scale 1" = 2.5'

Golder Associates

Drawn MRB
Checked

APPROX. N107600 ft. (N32796m)
COOR. E2288700 ft. (E697596m)
1682 ft.

# TEST PIT LOG TP-22

SHEET 1 OF 1

SURFACE ELEV. *Approx. (512.67m) PROJECT EXXON CRANDON TAILINGS DISPOSAL SYSTEM

DATUM USGS MSL DATE STARTED 3/14/81 DATE COMPLETED 3/14/81

EQUIPMENT John Deere 410 Backhoe

| DEPTH METER / FEET | DESCRIPTION | UNIFIED CLASS. | REMARKS |
|---|---|---|---|
| .3 | Brown, silty fine to coarse SAND, trace fine to coarse gravel, trace organics | SM | |
| 1.0 | Red-brown, fine to coarse SAND, some fine to coarse gravel, some silt, occasional cobbles and boulders | SM | |
| 1.83 | | | |
| 6.0 | Brown, fine to coarse GRAVEL and fine to coarse SAND, trace to some silt, frequent cobbles and boulders | SP-SM to GP-GM | |
| 3.35 | | | |
| 11.0 | Brown, fine to coarse gravelly, fine to coarse SAND, some silt | SM | |
| 3.66 | | | |
| 12.0 | END OF PIT<br><br>*Estimated from elevation of adjacent boring G41-P24 | | |

Job No. 786085
Scale 1" = 2.5'

Golder Associates

Drawn MRB
Checked

PPROX. N114150 ft. (N34793m)
OOR. E2284250 ft. (E696239m)

# TEST PIT LOG TP-TW-41

SHEET 1 OF 1

SURFACE ELEV. *Approx. 1705 ft. (519.68m) PROJECT EXXON CRANDON TAILINGS DISPOSAL SYSTEM

DATUM USGS MSL DATE STARTED 5/23/81 DATE COMPLETED 5/23/81

EQUIPMENT John Deere 410 Backhoe

| DEPTH METER / FEET | DESCRIPTION | UNIFIED CLASS. | REMARKS |
|---|---|---|---|
| .46 | Dark reddish brown silty, fine to coarse SAND, some fine gravel, trace cobbles | SM | |
| 1.5 / 1.22 | Light brown, fine to coarse SAND, some silt, trace to some fine gravel | SM | Bulk Sample from 2.0' to 3.0' (o.61m-0.91m) |
| 4.0 / 2.44 | Brown, fine to coarse SAND, some silt, some fine to coarse gravel, trace clay, trace cobbles | SM | Bulk Sample from 4.0' to 6.0' (1.22m-1.83m) with cobbles removed |
| 8.0 / 4.88 | Brown and red-brown, silty fine to coarse SAND, some fine to coarse gravel, trace cobbles | SM | |
| 16.0 | END OF PIT<br>*Estimated from topographic map | | |

Job No 786085
Scale 1" = 2.5'

Golder Associates

Drawn JFC
Checked

# Logs for Soil Testing Services of Wisconsin, Inc. 1980 Plant Site Test Pits (STS-TP-80-1 through 13)

LOG OF TEST PIT NO. TP-1

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals U.S.A. | |
| **SITE** | **PROJECT NAME** |
| Crandon Mine Development | Prospecting Project |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS/FT 3 | UNCONFINED COMPRESSIVE STRENGTH TONS FT 2 (1 2 3 4 5); PLASTIC LIMIT %; WATER CONTENT %; LIQUID LIMIT %; STANDARD "N" PENETRATION (BLOWS/FT) (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| SURFACE ELEVATION → | | | | | | | |
| | 1 | S | | | Black sandy silty topsoil (OL) - some roots and stems - moist | | |
| | 2 | S | | | Yellowish brown silty very fine sand (SM) - trace of gravel - moist | | |
| 5 | 3 | S | | | Brown silty very fine to fine sand (SM) - trace of gravel - moist | | |
| 8.5 | 4 | S | | | Reddish brown clayey fine to medium sand (SC) - trace of fine gravel - trace to a little silt - moist | | |

| WATER LEVEL OBSERVATIONS | | | SOIL TESTING SERVICES OF WIS., INC. 540 LAMBEAU STREET GREEN BAY, WIS. 54303 | BORING STARTED | 1-28-80 |
|---|---|---|---|---|---|
| WL | | | | BORING COMPLETED | 1-28-80 |
| WL | UCR | ACR | | RIG | FOREMAN WW |
| WL | | | | DRAWN JFC | APPROVED TWW |
| | | | | JOB - 6736 A | SHEET 1 of 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

LOG OF TEST PIT NO. TP-2

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals U.S.A. | |
| **SITE** | **PROJECT NAME** |
| Crandon Mine Development | Prospecting Project |

| DEPTH ELEVATION | SAMPLE NO. | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS/FT.3 | UNCONFINED COMPRESSIVE STRENGTH TONS FT.² 1 2 3 4 5 · PLASTIC LIMIT % · WATER CONTENT % · LIQUID LIMIT % · STANDARD "N" PENETRATION (BLOWS FT) 10 20 30 40 50 |
|---|---|---|---|---|---|---|---|
| SURFACE ELEVATION → | | | | | | | |
| | 1 | S | | | Black silty sandy topsoil (OL) - trace of roots - moist | | |
| | 2 | S | | | Yellowish brown silty very fine to fine sand (SM) - trace of clay - trace of roots - trace of gravel | | |
| 5 | 3 | S | | | Brown silty clayey very fine sand (SM-SC) - trace of gravel - moist | | |
| 8 | 4 | S | | | Rusty brown silty fine sand (SM) - trace of gravel - with pockets sandy silt and clayey sand | | |

| WATER LEVEL OBSERVATIONS | | | | |
|---|---|---|---|---|
| WL | | | | |
| WL | BCR | ACR | | |
| WL | | | | |

**SOIL TESTING SERVICES**
OF WIS., INC
540 LAMBEAU STREET
GREEN BAY, WIS 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 1-28-80 |
| BORING COMPLETED | | | 1-28-80 |
| RIG | | FOREMAN | WW |
| DRAWN | JPJ | APPROVED | TWW |
| JOB | 6736 A | SHEET | 1 of 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

LOG OF TEST PIT NO. TP-3

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals U.S.A. | |
| **SITE** | **PROJECT NAME** |
| Crandon Mine Development | Prospecting Project |

| DEPTH ELEVATION | SAMPLE NO. | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.3 | UNCONFINED COMPRESSIVE STRENGTH TONS FT.² / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.) |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION | | 1 2 3 4 5 — 10 20 30 40 50 |
| | | | | | Brown silty sandy topsoil (OL) - trace of roots - moist | | |
| | 2 | S | | | Yellowish brown silty very fine sand (SM-ML)- trace of roots - trace of gravel and cobbles - moist | | |
| 5 | 3 | S | | | Yellowish brown fine sand (SP) - with pockets of silty fine sand (SM) - moist - dense | | |
| 6 | | | | | | | |

| WATER LEVEL OBSERVATIONS | | | SOIL TESTING SERVICES OF WIS., INC. 540 LAMBEAU STREET GREEN BAY, WIS. 54303 | BORING STARTED | 1-28-80 |
|---|---|---|---|---|---|
| WL | | | | BORING COMPLETED | 1-28-80 |
| WL | HCR | ACR | | RIG | FOREMAN WW |
| WL | | | | DRAWN JPJ | APPROVED TWW |
| | | | | JOB | SHEET 1 OF 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

LOG OF TEST PIT NO. TP-4

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals U.S.A. | |
| **SITE** | **PROJECT NAME** |
| Crandon Mine Development | Prospecting Project |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT 3 | UNCONFINED COMPRESSIVE STRENGTH TONS FT² / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS FT) |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION → | | 1 2 3 4 5 — 10 20 30 40 50 |
| | 1 | S | | | Black silty sandy topsoil (OL) - some roots - moist | | |
| | 2 | S | | | Yellowish brown silty very fine sand (SM-ML) - trace of gravel trace of roots | | |
| 5 6 | 3 | S | | | Brown fine sand (SP-SM) - trace to a little silt - a little gravel - with irregular layers and pockets of reddish brown silty sandy clay | | |

WATER LEVEL OBSERVATIONS

WL
WL RCR ACR
WL

**SOIL TESTING SERVICES**
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 1-28-80 |
| BORING COMPLETED | | | 1-28-80 |
| RIG | | FOREMAN | WW |
| DRAWN | JPJ | APPROVED | TWW |
| JOB | 8730 A | SHEET | 1 of 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

LOG OF TEST PIT NO. TP-5

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals U.S.A. | |
| **SITE** | **PROJECT NAME** |
| Crandon Mine Development | Prospecting Project |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.3 | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.2 (1 2 3 4 5); PLASTIC LIMIT %; WATER CONTENT %; LIQUID LIMIT %; STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50) |
|---|---|---|---|---|---|---|
| | | | | SURFACE ELEVATION | | |
| | | | | Black silty topsoil (OL) - some roots - moist | | |
| | 2 | S | | Yellowish brown silty very fine sand (SM-ML) - trace of roots - trace of gravel and cobbles - moist | | |
| | 3 | S | | Reddish brown silty fine to medium sand (SM) - a little gravel and cobbles - trace of clay - moist | | |

| WATER LEVEL OBSERVATIONS | | | | |
|---|---|---|---|---|
| WL | | | | |
| WL | BCR | ACR | | |
| WL | | | | |

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 1- -80 |
| BORING COMPLETED | | | 1- -80 |
| RIG | | FOREMAN | WW |
| DRAWN | JPJ | APPROVED | TWW |
| JOB | 8730 A | SHEET | 1 of 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

LOG OF TEST PIT NO. TP-6

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals U.S.A. | |
| **SITE** | **PROJECT NAME** |
| Crandon Mine Development | Prospecting Project |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS/FT.3 | UNCONFINED COMPRESSIVE STRENGTH TONS FT.² (1 2 3 4 5) / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| SURFACE ELEVATION | | | | | | | |
| | 1 | | | | Black silty sandy topsoil (OL) - some roots - moist | | |
| | 2 | S | | | Yellowish brown very fine sandy silt (ML) - trace of gravel - trace of cobbles - moist | | |
| -5 | 3 | S | | | Reddish brown silty fine sand (SM) - trace of clay with pockets of fine sand and clayey sand - moist - dense | | |
| 6.5 | | | | | | | |

| WATER LEVEL OBSERVATIONS | | | | | |
|---|---|---|---|---|---|
| WL | | | | | |
| WL | BCR | ACR | | | |
| WL | | | | | |

**SOIL TESTING SERVICES**
OF WIS., INC
540 LAMBEAU STREET
GREEN BAY, WIS 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 1- -80 |
| BORING COMPLETED | | | 1- -80 |
| DATE | | FOREMAN | WW |
| DRAWN | JTS | APPROVED | TWW |
| JOB | 6736 A | SHEET | 1 of 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

LOG OF TEST PIT NO. TP-7

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals U.S.A. | |
| **SITE** | **PROJECT NAME** |
| Crandon Mine Development | Prospecting Project |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT LBS./FT 3 | UNCONFINED COMPRESSIVE STRENGTH TONS FT · 1 2 3 4 5 · PLASTIC LIMIT % · WATER CONTENT % · LIQUID LIMIT % · STANDARD "N" PENETRATION (BLOWS/FT.) 10 20 30 40 50 |
|---|---|---|---|---|---|---|---|
| SURFACE ELEVATION → | | | | | | | |
| | | | | | Black silty sandy topsoil (OL) - trace of roots - moist | | |
| | 2 | S | | | Brown very fine sandy silt (ML) - trace of cobbles - trace of roots - moist | | |
| 5 | 3 | S | | | Reddish brown silty fine sand (SM) - trace of clay - some gravel - with pockets of clayey sand - moist - dense | | |
| 6 | | | | | | | |

| WATER LEVEL OBSERVATIONS | | | |
|---|---|---|---|
| WL | Dry | | |
| WL | BCR | ACR | |
| WL | | | |

**SOIL TESTING SERVICES**
OF WIS., INC
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 1-28-80 |
| BORING COMPLETED | | | 1-28-80 |
| RIG | | FOREMAN | WW |
| DRAWN | JPJ | APPROVED | TWW |
| JOB | 8736 A | SHEET | 1 of 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

LOG OF TEST PIT NO. TP-8

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals U.S.A. | |
| **SITE** | **PROJECT NAME** |
| Crandon Mine Development | Prospecting Project |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT 3 | UNCONFINED COMPRESSIVE STRENGTH TONS FT² / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS FT) |
|---|---|---|---|---|---|---|---|
| SURFACE ELEVATION | | | | | | | |
| | 1 | S | | | Black silty topsoil (OL) - trace of roots - moist | | |
| | 2 | S | | | Yellowish brown sandy silt (ML) - trace of roots - some gravel - moist | | |
| 5 | 3 | S | | | Reddish brown silty fine sand (SM) - trace of clay - with pockets of fine to medium sand and gravel - some cobbles - moist | | |
| 6.5 | | | | | | | |

UNCONFINED COMPRESSIVE STRENGTH TONS FT² : 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

STANDARD "N" PENETRATION (BLOWS FT) : 10 20 30 40 50

| WATER LEVEL OBSERVATIONS | | | |
|---|---|---|---|
| WL | | | |
| WL | BCR | ACR | |
| WL | | | |

**SOIL TESTING SERVICES**
OF WIS. INC
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 1-29-80 |
| BORING COMPLETED | | | 1-29-80 |
| RIG | | FOREMAN | WW |
| DRAWN | JFJ | APPROVED | TWW |
| JOB | 8730 A | SHEET | 1 of 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

LOG OF TEST PIT NO. TP-9

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals U.S.A. | |
| **SITE** | **PROJECT NAME** |
| Crandon Mine Development | Prospecting Project |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.3 | UNCONFINED COMPRESSIVE STRENGTH TONS/FT. / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.) |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION | | |
| | 2 | S | | | Black silty sandy topsoil (OL) - some roots - moist | | |
| | 3 | S | | | Brown silty very fine to fine sand (SM) - trace of gravel - moist | | |
| 5 6 | | | | | Reddish brown silty fine sand (SM) - trace of clay - some gravel and cobbles - moist | | |

UNCONFINED COMPRESSIVE STRENGTH TONS. FT.: 1 2 3 4 5

PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT %

STANDARD "N" PENETRATION (BLOWS FT.): 10 20 30 40 50

| WATER LEVEL OBSERVATIONS | | |
|---|---|---|
| WL | | |
| WL | UCR | ACR |
| WL | | |

**SOIL TESTING SERVICES**
OF WIS. INC
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 1-29-80 |
| BORING COMPLETED | | | 1-29-80 |
| DWG. | | FOREMAN | WW |
| DRAWN | JDJ | APPROVED | TWK |
| JOB | 8730-A | SHEET | 1 OF 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

LOG OF TEST PIT NO. TP-10

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals U.S.A. | |
| **SITE** | **PROJECT NAME** |
| Crandon Mine Development | Prospecting Project |

| DEPTH ELEVATION | SAMPLE NO. | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.3 | UNCONFINED COMPRESSIVE STRENGTH TONS/FT. / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.) |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION | | 1 2 3 4 5 / 10 20 30 40 50 |
| | 2 | S | | | Black silty topsoil (OL) - trace of roots - moist | | |
| | | | | | Yellowish brown silty very fine sand (SM-ML) - trace of roots - trace of cobbles - moist | | |
| 5 | 3 | S | | | Reddish brown silty fine sand (SM) - a little gravel - with pockets and seams of fine to medium sand - moist | | |
| 7 | | | | | | | |

| WATER LEVEL OBSERVATIONS | | | |
|---|---|---|---|
| WL | | | |
| WL | BCR | | ACR |
| WL | | | |

**SOIL TESTING SERVICES**
OF WIS., INC
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 1-29-80 |
| BORING COMPLETED | | | 1-29-80 |
| RIG | | FOREMAN | WW |
| DRAWN | JPJ | APPROVED | TWW |
| JOB # | 8735 A | SHEET | 1 of 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

LOF OF TEST PIT NO. TP-1

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals U.S.A. | |
| **SITE** | **PROJECT NAME** |
| Crandon Mine Development | Prospecting Project |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT LBS/FT 3 | UNCONFINED COMPRESSIVE STRENGTH TONS FT 2 (1 2 3 4 5) PLASTIC LIMIT % WATER CONTENT % LIQUID LIMIT % STANDARD "N" PENETRATION (BLOWS FT) (10 20 30 40 50) |
|---|---|---|---|---|---|---|
| SURFACE ELEVATION → | | | | | | |
| | 2 | S | | Black silty topsoil (OL) - with some roots - moist | | |
| | 3 | S | | Yellowish brown silty very fine sand (SM-ML) - trace of gravel - trace of roots - moist | | |
| 5 | | | | Brown fine sand (SP) - trace of silt - with pockets of silty fine sand - trace of clay - trace of cobbles - moist | | |

WATER LEVEL OBSERVATIONS

WL

WL BCR ACR

WL

**SOIL TESTING SERVICES**
OF WIS., INC
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 1-29-80 |
| BORING COMPLETED | | | 1-29-80 |
| RIG | | FOREMAN | WW |
| DRAWN | JTJ | APPROVED | TWW |
| JOB | 8736 A | SHEET | 1 of 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

LOG OF TEST PIT NO. TP-12

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals U.S.A. | |
| **SITE** | **PROJECT NAME** |
| Crandon Mine Development | Prospecting Project |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.3 | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.2 (1 2 3 4 5) · PLASTIC LIMIT % · WATER CONTENT % · LIQUID LIMIT % · STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| SURFACE ELEVATION → | | | | | | | |
| | 1 | S | | | Black silty topsoil (OL) - with some very fine sand - trace of roots - moist | | |
| | 2 | S | | | Yellowish brown very fine sandy silt (ML) - trace of roots - moist | | |
| 5 | 3 | S | | | Brown silty fine sand (SM) - trace of gravel - trace of cobbles - trace of clay - moist | | |

WATER LEVEL OBSERVATIONS

WL

WL BCR ACR

WL

**SOIL TESTING SERVICES**
OF WIS., INC
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

| | |
|---|---|
| BORING STARTED | 1- -80 |
| BORING COMPLETED | 1- -80 |
| RIG | FOREMAN WW |
| DRAWN JPJ | APPROVED TWK |
| [illegible] 6730 A | SHEET 1 of 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

LOG OF TEST PIT NO. TP-13

| OWNER | ARCHITECT-ENGINEER |
|---|---|
| Exxon Minerals U.S.A. | |
| **SITE** | **PROJECT NAME** |
| Crandon Mine Development | Prospecting Project |

| DEPTH ELEVATION | SAMPLE NO | TYPE SAMPLE | SAMPLE DIST. | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS/FT.3 | UNCONFINED COMPRESSIVE STRENGTH TONS FT.² / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.) |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION | | 1 2 3 4 5 — 10 20 30 40 50 |
| | 1 | S | | | Black silty sandy topsoil (OL) - with roots and stems - moist | | |
| | 2 | S | | | Yellowish brown very fine sandy silt (ML) - trace of roots - trace of gravel - moist | | |
| 5 | 3 | S | | | Rusty brown silty fine sand (SM) - some gravel - dense | | |
| | 4 | S | | | Reddish brown silty fine sand (SM) - trace of clay - some gravel and cobbles - moist - dense | | |
| 10 | 5 | S | | | Brown fine to medium sand (SP) - trace of silt - some gravel and cobbles - moist - | | |

| WATER LEVEL OBSERVATIONS | | | |
|---|---|---|---|
| W1 | | | |
| W1 | BCR | | ACR |
| W1 | | | |

**SOIL TESTING SERVICES**
OF WIS., INC
540 LAMBEAU STREET
GREEN BAY, WIS 54303

| | | | |
|---|---|---|---|
| BORING STARTED | | | 1-28-80 |
| BORING COMPLETED | | | 1-28-80 |
| RIG | | FOREMAN | WK |
| DRAWN | JPJ | APPROVED | TWC |
| JOB | E736 A | SHEET | 1 OF 1 |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

# Logs for STS Consultants Ltd. 1983 Soil Absorption Field Test Pits (STS-SAF-1 through 16)

STS Job 12692
August, 1983

EXXON MINERALS COMPANY

CRANDON PROJECT

Soil Absorption Field
Soil Profile Descriptions

| Test Pit | Depth cm. | Depth ft. | Profile Descriptions |
|---|---|---|---|
| STS-SAF-1 | 0-3 | 0.0-0.1 | Black silt loam |
| | 3-5 | 0.1-0.4 | Grayish brown loam |
| | 5-57 | 0.4-1.8 | Yellowish brown silt loam with blocky structure |
| | 57-113 | 1.8-3.7 | Brown sandy loam with cobbles and boulders, massive, fragic |
| | 113-165 | 3.7-5.4 | Yellowish red sandy loam with cobbles and boulders, pockets of brown sandy loam with few fine yellowish brown mottles, massive. |
| | 165-419 | 5.4-13.7 | Brown to light yellowish brown medium to coarse sand, occasional strong brown loamy sand laminae (5-15 cm) |
| STS-SAF-2 | 0-3 | 0.0-0.1 | Black loam |
| | 3-5 | 0.1-0.4 | Grayish brown loam |
| | 5-57 | 0.4-1.8 | Yellowish brown silty loam with blocky structure |
| | 57-88 | 1.8-2.9 | Brown sandy loam, massive, fragic |
| | 88-189 | 2.9-6.2 | Reddish brown sandy loam with cobble and boulders, massive |
| | 189-372 | 6.2-12.2 | Brown to light yellowish brown medium and coarse sand |
| STS-SAF-3 | 0-3 | 0.0-0.4 | Very dark gray silt loam |
| | 3-21 | 0.4-0.7 | Dark brown silt loam with blocky structure |
| | 21-52 | 0.7-1.7 | Dark yellowish brown loam with blocky structure |
| | 52-79 | 1.7-2.6 | Yellowish brown loam, massive, fragic |
| | 79-302 | 2.6-9.9 | Brown sandy loam with yellowish red and grayish brown lenticular silt inclusions, cobbles and boulders, grayish brown and yellowish brown mottles below 207 cm, massive |
| | 302-326 | 9.9-10.7 | Yellowish brown coarse loamy sand |
| STS-SAF-4 | 0-3 | 0.0-0.1 | Black loam |
| | 3-15 | 0.1-0.5 | Grayish brown loam |
| | 15-43 | 0.5-1.4 | Yellowish brown silt loam with few to common grayish brown and strong brown mottles |
| | 43-70 | 1.4-2.3 | Brown sandy loam with brown to strong brown mottles, massive, fragic |
| | 70-305 | 2.3-10.0 | Reddish brown sandy loam with cobbles and boulders, grayish brown and yellowish red mottles, massive |
| STS-SAF-5 | 0-3 | 0.0-0.1 | Black silt loam |
| | 3-5 | 0.1-0.4 | Brown silt loam |
| | 5-61 | 0.4-2.0 | Brown to strong brown silt loam |
| | 61-149 | 2.0-4.9 | Reddish brown silt loam and sandy loam, coarse brown and strong brown mottles, massive |
| | 149-262 | 4.9-8.6 | Yellowish brown fine to medium sand |
| | 262-357 | 8.6-11.7 | Yellowish brown loamy coarse sand and gravel with cobbles and boulders |
| STS-SAF-6 | 0-3 | 0.0-0.1 | Black loam |
| | 3-5 | 0.1-0.4 | Grayish brown loam |
| | 5-52 | 0.4-1.7 | Yellowish brown silt loam |
| | 52-110 | 1.7-3.6 | Brown sandy loam, massive, fragic |
| | 110-372 | 3.6-12.2 | Brown to reddish brown sandy loam with cobbles and boulders, common fine sandy loam and loam pockets with coarse yellowish brown and grayish brown mottles, massive |
| | 372-457 | 12.2-15.0 | Yellowish brown loamy coarse sand with gravel seams |
| STS-SAF-7 | 0-3 | 0.0-0.1 | Black loam |
| | 3-9 | 0.1-0.3 | Grayish brown loam |
| | 9-49 | 0.3-1.6 | Yellowish brown silt loam |
| | 49-91 | 1.6-3.0 | Brown sandy loam, massive, fragic |
| | 91-277 | 3.0-9.1 | Brown to reddish brown sandy loam with cobbles and boulders, massive |
| | 277-369 | 9.1-12.1 | Dark yellowish brown coarse sand and gravel |
| STS-SAF-8 | 0-12 | 0.0-0.4 | Black silt loam |
| | 12-25 | 0.4-1.0 | Dark brown silt loam |
| | 25-67 | 1.0-2.2 | Brown silt loam |
| | 67-134 | 2.2-4.4 | Brown silt loam with many coarse brown and yellowish red mottles |
| | 134-335 | 4.4-11.0 | Brown and reddish brown sandy loam with cobbles and boulders, common coarse grayish brown and yellowish brown mottles, massive |

STS Job 12692
August, 1983

## Soil Absorption Field
## Soil Profile Descriptions

| Test Pit | Depth cm. | Depth ft. | Profile Descriptions |
|---|---|---|---|
| STS-SAF-9 | 0-3 | 0.0-0.1 | Black loam |
| | 3-15 | 0.1-0.5 | Grayish brown loam |
| | 15-82 | 0.5-2.7 | Yellowish brown silt loam |
| | 82-101 | 2.7-3.3 | Brown sandy loam, massive, fragic |
| | 101-277 | 3.3-9.1 | Brown to reddish brown sandy loam with cobbles and boulders and a sand seam at 165 to 200 cm, common coarse grayish brown and yellowish red mottles at 100 to 130 cm |
| | 277-334 | 9.1-14.0 | Light yellowish brown medium and coarse sand with occasional fine sand laminae |
| STS-SAF-10 | 0-3 | 0.0-0.1 | Black silt loam |
| | 3-18 | 0.1-0.6 | Grayish brown loam |
| | 18-91 | 0.6-3.0 | Yellowish brown silt loam |
| | 91-122 | 3.0-4.0 | Brown sandy loam, massive, fragic |
| | 122-253 | 4.0-8.3 | Brown to reddish brown sandy loam with cobbles and boulders, occasional sil and sand pockets, with a sand seam from 165 to 215 cm, massive |
| | 253-436 | 8.3-14.3 | Light yellowish brown medium to coarse sand and gravel |
| STS-SAF-11 | 0-3 | 0.0-0.1 | Black loam |
| | 3-15 | 0.1-1.5 | Grayish brown loam |
| | 15-82 | 0.5-1.7 | Yellowish brown silt loam |
| | 82-101 | 2.7-3.3 | Brown sandy loam, massive, fragic |
| | 101-335 | 3.5-11.0 | Brown to reddish brown sandy loam with cobbles and boulders, massive |
| | 335-421 | 11.0-13.8 | Light yellowish brown medium to coarse sand |
| STS-SAF-12 | 0-3 | 0.0-0.1 | Black loam |
| | 3-9 | 0.1-0.3 | Grayish brown loam |
| | 9-49 | 0.3-1.6 | Yellowish brown silt loam |
| | 49-61 | 1.6-2.0 | Brown sandy loam, massive, fragic |
| | 61-213 | 2.0-7.0 | Brown to reddish brown sandy loam with cobbles and boulders, occasional sa inclusions, massive |
| | 213-494 | 7.0-16.2 | Light yellowish brown medium to coarse sand and gravel with occasional fin sand and loamy fine sand seams. |
| STS-SAF-13 | 0-3 | 0.0-0.1 | Black loam |
| | 3-5 | 0.1-0.4 | Grayish brown loam |
| | 5-46 | 0.4-1.5 | Yellowish brown silt loam |
| | 46-73 | 1.5-2.4 | Brown sandy loam, massive, fragic |
| | 73-372 | 2.4-12.2 | Brown to reddish brown sandy loam with cobbles and boulders, few coarse grayish brown and yellowish red mottles from 73 to 100 cm, occasional sand pockets, massive |
| | 372-418 | 12.2-13.7 | Light yellowish brown sand and gravel |
| STS-SAF-14 | 0-3 | 0.0-0.1 | Black loam |
| | 3-9 | 0.1-3.0 | Grayish brown loam |
| | 9-46 | 0.3-1.5 | Yellowish brown silt loam |
| | 46-73 | 1.5-2.4 | Brown sandy loam, massive, fragic |
| | 73-427 | 2.4-14.0 | Brown to reddish brown sandy loam with cobbles and boulders, sand seam at 150 to 200 cm, massive |
| STS-SAF-15 | 0-3 | 0.0-1.0 | Black loam |
| | 3-9 | 0.1-0.3 | Grayish brown loam |
| | 9-43 | 0.3-1.4 | Yellowish brown silt loam |
| | 43-61 | 1.5-2.0 | Brown sandy loam, massive, fragic |
| | 61-335 | 2.0-11.0 | Brown to reddish brown sandy loam with cobbles and boulders, few medium yellowish red mottles, massive |
| STS-SAF-16 | 0-3 | 0.0-0.1 | Black loam |
| | 3-5 | 0.1-0.4 | Grayish brown loam |
| | 5-67 | 0.4-2.2 | Yellowish brown silt loam |
| | 67-98 | 2.2-3.2 | Brown sandy loam, massive, fragic |
| | 98-207 | 3.2-6.8 | Brown to reddish brown sandy loam with cobbles and boulders, massive |
| | 207-350 | 6.8-11.5 | Light yellowish brown medium to coarse sand and gravel with occasional loamy sand laminae |

# Logs for STS Consultants Ltd. 1984 Tailings Management Area Test Pits (TP-84-1 through 33)

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Co., USA | LOG OF: TP-84-1 |
| PROJECT NAME: Crandon Project | ARCHITECT—ENGINEER: |

SITE LOCATION: N 112,913 E 2,283,588 Feet
N 34,416 E 696,039 Meters

SURFACE ELEVATION 1683.25 - ft. 513.06 - Meters

| DEPTH / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT³ |
|---|---|---|---|---|---|---|
| | | | | | Black silty organic topsoil (OL) with roots | |
| 2 | | | | | Light brown silt (ML) with a trace of fine sand and fine gravel | |
| 4 | | | | | Brown fine to medium sand (SM to GM) with a little silt and fine to medium grave, and a trace cobbles (Bag sample from 3' to 3.5') | |
| 6 | | | | | Brown fine to medium sand (SM) with a little fine to medium gravel, trace cobbles and silt | |
| 8 | | | | | Brown fine to medium sand (SM) with some silt, little fine to medium gravel, trace cobbles (Bag sample from 8' - 8.5') | |
| 10 | | | | | | |
| 12 | | | | | Brown fine to medium sand (SM to GM) with a little silt and fine to medium gravel, trace cobbles - saturated (Bag sample from 12' - 12.5') | |
| | | | | | Test Pit advanced to 12.0 feet using backhoe | |

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² — 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

10 20 30 40 50

STANDARD PENETRATION BLOWS / FT. — 10 20 30 40 50

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| WL 10.0' | BORING STARTED 6/6/84 | STS OFFICE | 111 Pfingsten Road Northbrook, Illinois 60062 |
| WL BCR ACR | BORING COMPLETED 6/6/84 | DRAWN BY KJC | SHEET NO. 1 OF 1 |
| WL | RIG Backhoe FOREMAN BP | APP'D BY PAT | STS JOB NO. 23573 |

BL 3-1183

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Co., USA | LOG OF: TP-84-2 |
| PROJECT NAME: Crandon Project | ARCHITECT—ENGINEER |
| SITE LOCATION: N 113,127 E 2,283,560 Feet; N 34,481 E 696,030 Meters | |

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

10 20 30 40 50

STANDARD PENETRATION BLOWS / FT. 10 20 30 40 50

| DEPTH ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT³ |
|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1683.05 - ft. 512.99 Meters | |
| | | | | | Black organic silty topsoil (OL) with a little roots | |
| 2 | | | | | Light brown silt (ML to SM) with some sand, trace fine gravel | |
| 4 | | | | | Brown fine to coarse sand (SM to GM) with a little silt and fine to medium gravel, trace cobbles (Bag sample 3' - 3.5') | |
| 8 | | | | | Brown fine to medium sand (SM) with a little silt, trace fine to medium gravel and cobbles (Bag sample 8' - 8.5') | |
| 12 | | | | | Brown fine to medium sand (SP to SM) with a trace of fine to medium gravel and silt (Bag sample 11'-11.5') | |
| 14 | | | | | Test Pit advanced to 14.0 feet using backhoe | |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU. THE TRANSITION MAY BE GRADUAL.

| | | | |
|---|---|---|---|
| WL Dry | BORING STARTED 6/7/84 | STS OFFICE | 111 Pfingsten Road Northbrook, Illinois 60062 |
| WL BCR ACR | BORING COMPLETED 6/7/84 | DRAWN BY KJC | SHEET NO. 1 OF 1 |
| WL | RIG Backhoe FOREMAN BP | APP'D BY PAT | STS JOB NO. 23573 |

3.5-14-44

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Co., USA | LOG OF: TP-84-3 |
| PROJECT NAME: Crandon Project | ARCHITECT—ENGINEER: |
| SITE LOCATION: N 112,598 E 2,283,690 Feet; N 34,320 E 693,070 Meters | |

SURFACE ELEVATION 1677.12-ft. 511.19-Meters

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

10 20 30 40 50

STANDARD PENETRATION BLOWS / FT. 10 20 30 40 50

| DEPTH ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT³ |
|---|---|---|---|---|---|---|
| | | | | | Black silty organic topsoil (OL) with roots | |
| | | | | | Light brown silt (ML) with a trace of fine sand and gravel | |
| 2 | | | | | Brown fine to coarse sand (SM to GM) with a little to some silt, little fine to medium gravel, cobbles, and boulders (Bag sample from 3' to 3.5') | |
| 4 | | | | | | |
| 6 | | | | | | |
| 8 | | | | | Brown fine to medium sand (SM to GM) with a little silt, fine to medium gravel, trace cobbles (Bag sample from 8 to 8.5') | |
| 10 | | | | | | |
| 12 | | | | | Brown fine to medium sand (SP to SM) with a little fine to medium gravel, trace cobbles and silt (Bag sample from 12.5 to 13.0') | |
| 14 | | | | | Test Pit advanced to 13.0 feet using backhoe | |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION MAY BE GRADUAL.

| | | | |
|---|---|---|---|
| WL Dry | BORING STARTED 6/6/84 | STS OFFICE | 111 Pfingsten Road Norbhrook, Illinois 60062 |
| WL BCR ACR | BORING COMPLETED 6/6/84 | DRAWN BY KJC | SHEET NO. 1 OF 1 |
| WL | RIG Backhoe FOREMAN BP | APP'D BY PAT | STS JOB NO. 23573 |

3.5-14-45

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Co., USA | LOG OF: tp-84-4 |
| PROJECT NAME: Crandon Project | ARCHITECT—ENGINEER |
| SITE LOCATION: N 113,452 E 2,283,577 Feet; N 34,580 E 696,036 Meters | |

| DEPTH ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS/FT³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT² 1 2 3 4 5 / PLASTIC LIMIT % WATER CONTENT % LIQUID LIMIT % 10 20 30 40 50 / STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50 |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1678.12-ft. 511.49-Meters | | |
| | | | | | Black silty organic topsoil (OL) with roots | | |
| | | | | | Light brown silt (ML) with a trace of sand and fine gravel | | |
| 2 | | | | | | | |
| 4 | | | | | Brown fine to medium sand (SM to GM) with a little silt and gravel, trace cobbles and boulders (Bag sample from 3.0 - 3.5') | | |
| 6 | | | | | | | |
| 8 | | | | | Brown fine to coarse sand (SP to GP) with some fine to medium gravel, trace cobbles and boulders (Bag sample from 6 - 6.5') | | |
| 10 | | | | | | | |
| 12 | | | | | Brown fine to medium sand (SM to GM) with some fine to coarse gravel, little silt, trace cobbles (Bag sample from 10-10.5', 11-11.5') | | |
| 14 | | | | | | | |
| 15 | | | | | Test Pit advanced to 15.0 feet using backhoe | | |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| WL Dry | BORING STARTED 6/5/84 | STS OFFICE | 111 Pfingsten Road Northbrook, Illinois 60062 |
| WL BCR ACR | BORING COMPLETED 6/5/84 | DRAWN BY KJC | SHEET NO 1 OF 1 |
| WL | RIG Backhoe FOREMAN BP | APP'D BY PST | STS JOB NO. 23573 |

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Co., USA | LOG OF: TP-84-5 |
| PROJECT NAME: Crandon Project | ARCHITECT—ENGINEER |
| SITE LOCATION: N 112,969 E 2,283,762 feet<br>N 34,433 E 696,092 Meters | |

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² : 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %: 10 20 30 40 50

STANDARD PENETRATION BLOWS / FT.: 10 20 30 40 50

| DEPTH IN ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS /FT³ |
|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1682.07-ft. 512.70-Meters | |
| | | | | | Black organic silty topsoil (OL) with roots | |
| 2 | | | | | Light brown silt (ML) with a trace of fine sand and gravel | |
| 4 | | | | | Brown fine to coarse sand (SM to GM) with a little silt and fine to medium gravel, trace cobbles and boulders (Bag sample from 3 - 3.5') | |
| 6 | | | | | | |
| 8 | | | | | Brown fine to medium sand (SM to GM) with a little silt and fine to medium gravel, trace cobbles (Bag sample from 7 - 7.5') | |
| 10 | | | | | | |
| 12 | | | | | Brown fine to medium sand (SM to GM) with a little fine to medium gravel, trace silt (Bag sample from 11 - 11.5') | |
| 14 | | | | | Test Pit advanced to 14.0 feet using backhoe | |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION MAY BE GRADUAL.

| | | | |
|---|---|---|---|
| WL Dry | BORING STARTED 6/6/84 | STS OFFICE | 111 Pfingsten Road Northbrook, Illinois 60062 |
| WL BCR ACR | BORING COMPLETED 6/6/84 | DRAWN BY KJC | SHEET NO 1 OF 1 |
| WL | RIG Backhoe FOREMAN BP | APP'D BY PAT | STS JOB NO 23573 |

3.5-14-47

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Co., USA | LOG OF: TP-84-6 |
| PROJECT NAME: Crandon Project | ARCHITECT—ENGINEER |
| SITE LOCATION: N 112,598 E 2,283,926 feet<br>N 34,320 E 696,142 Meters | |

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS /FT³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT² 1 2 3 4 5 / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % 10 20 30 40 50 / STANDARD PENETRATION BLOWS / FT. 10 20 30 40 50 |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1675.83-ft. 510.79-Meters | | |
| | | | | | Black organic silty topsoil (OL) with roots | | |
| 2 | | | | | Light brown silt (ML to SM) with some fine sand, trace fine gravel | | |
| 4 | | | | | | | |
| 6 | | | | | Brown fine to medium sand (SM to GM) with a little silt and fine to medium gravel, trace cobbles and boulders - becoming saturated @ 9.0'<br>(Bag sample 3 - 3.5', 7.5-8.0') | | |
| 8 | | | | | | | |
| 10 | | | | | | | |
| 12 | | | | | Brown fine to medium sand (SM to GM) with a little fine to medium gravel, trace silt, cobbles and boulders<br>(Bag sample 10.5 - 11.0') | | |
| 13 | | | | | Test Pit advanced to 13.0 feet using backhoe | | |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION MAY BE GRADUAL.

| | | | |
|---|---|---|---|
| WL Dry | BORING STARTED 6/7/84 | STS OFFICE | 111 Pfingsten Road<br>Northbrook, Illinois 60062 |
| WL BCR ACR | BORING COMPLETED 6/7/84 | DRAWN BY KJC | SHEET NO. 1 OF 1 |
| WL | RIG Backhoe FOREMAN BP | APP'D BY PAT | STS JOB NO. 23573 |

BL 3 1183

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Co., USA | LOG OF: TP-84-7 |
| PROJECT NAME: Crandon Project | ARCHITECT—ENGINEER |
| SITE LOCATION: N 113,188 E 2,283,816 feet<br>N 34,500 E 696,109 Meters | |

| DEPTH / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT LBS/FT³ |
|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1681.38-ft. 512.49-Meters | |
| | | | | | Black silty organic topsoil (OL) with roots | |
| 2 | | | | | Light brown silt (ML) with a trace of sand, gravel and roots (water bearing) | |
| 4 | | | | | Brown medium to coarse sand (SM to GM) with a little silt and gravel, trace cobbles (Bag sample from 3.5-4.0', 6-6.5') | |
| 8 | | | | | | |
| 10 | | | | | Brown fine to medium sand (SP) with a trace silt, cobbles and boulders | |
| | | | | | Brown fine to medium sand (SM to GM) with a little silt and fine to medium gravel, trace cobbles (Bag sample from 11-11.5') | |
| 12 | | | | | Test Pit advanced to 12.0 feet using backhoe | |

UNCONFINED COMPRESSIVE STRENGTH TONS/FT²: 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %: 10 20 30 40 50

STANDARD PENETRATION BLOWS / FT.: 10 20 30 40 50

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION MAY BE GRADUAL.

| | | | |
|---|---|---|---|
| WL Dry | BORING STARTED 6/5/84 | STS OFFICE | 111 Pfingsten Road<br>Northbrook, Illinois 60062 |
| WL BCR ACR | BORING COMPLETED 6/5/84 | DRAWN BY KJC | SHEET NO. 1 OF 1 |
| WL | RIG Backhoe FOREMAN BP | APP'D BY PAT | STS JOB NO. 23573 |

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Co., USA | LOG OF: TP-84-8 |
| PROJECT NAME: Crandon Project | ARCHITECT—ENGINEER |
| SITE LOCATION: N 112,848 E 2,283,916 feet<br>N 34,396 E 696,139 Meters | |

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS/FT³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT² (1 2 3 4 5) / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % (15 20 30 40 50) / STANDARD PENETRATION BLOWS/FT. (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1679.97-ft. 512.06-Meters | | |
| | | | | | Black silty organic topsoil (OL) with roots | | |
| | | | | | Grayish brown clayey silt (CL-ML) with a trace of sand and fine gravel | | |
| 2 | | | | | Brown sandy silt (MLtoSM) with a trace of fine gravel - water bearing | | |
| 4 | | | | | | | |
| 6 | | | | | Brown fine to medium sand (SM to GM) with some fine to coarse gravel, trace silt, cobbles and boulders (Bag sample from 3-3.5', 10-10.5') | | |
| 8 | | | | | | | |
| 10 | | | | | | | |
| 12 | | | | | | | |
| 13 | | | | | Test Pit advanced to 13.0 feet using backhoe | | |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION MAY BE GRADUAL.

| | | | |
|---|---|---|---|
| WL Dry | BORING STARTED 6/5/84 | STS OFFICE | 111 Pfingsten Road Northbrook, Illinois 60062 |
| WL BCR ACR | BORING COMPLETED 6/5/84 | DRAWN BY KJC | SHEET NO. 1 OF 1 |
| WL | RIG Backhoe FOREMAN BP | APP'D BY PAT | STS JOB NO. 23573 |

BL 3 '83

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Co., USA | LOG OF: TP-84-9 |
| PROJECT NAME: Crandon Project | ARCHITECT—ENGINEER: |
| SITE LOCATION: N 113,074 E 2,283,906 Feet; N 34,465 E 696,136 Meters | |

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT³ |
|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1681.38 ft. 512.49 Meters | |
| | | | | | Black organic silty topsoil (OL) - with roots | |
| 2 | | | | | Light gray to brown silt (ML to SM) - with some sand - trace of fine gravel | |
| 4 | | | | | Brown fine to coarse sand (SM) - with some silt - a little fine to medium gravel - trace of cobbles and boulders (bag sample from 3.0 to 3.5') | |
| 6 | | | | | | |
| 8 | | | | | Brown fine to medium sand (SP to SM) - with a little fine to medium gravel - trace of silt (bag sample from 7.5 to 8.0') | |
| 10 | | | | | | |
| 12 | | | | | Brown very fine sand (SM) - with a little silt - trace of fine to medium gravel - trace of cobbles (bag sample from 11.0 to 11.5') | |
| 13.5 | | | | | Test Pit advanced to 13.5 feet using backhoe | |

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² — 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

10 20 30 40 50

STANDARD PENETRATION BLOWS / FT. — 10 20 30 40 50

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION MAY BE GRADUAL.

| | | | |
|---|---|---|---|
| WL Dry | BORING STARTED 6-7-84 | STS OFFICE | 111 Pfingsten Road Northbrook, IL. 60062 |
| WL BCR ACR | BORING COMPLETED 6-7-84 | DRAWN BY KJC | SHEET NO 1 OF 1 |
| WL | RIG Backhoe FOREMAN BP | APP'D BY PAT | STS JOB NO. 23573 |

3.5-14-51

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Co., USA | LOG OF: TP-84-10 |
| PROJECT NAME: Crandon Project | ARCHITECT—ENGINEER |
| SITE LOCATION: N 112,027 E 2,284,008 Feet; N 34,146 E 696,167 Meters | |

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² (1 2 3 4 5)

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % (10 20 30 40 50)

STANDARD PENETRATION BLOWS / FT. (10 20 30 40 50)

| DEPTH / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS / FT³ |
|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1665.47 ft. 507.64 Meters | |
| | | | | | Black organic silty topsoil (OL) - with roots | |
| 2 | | | | | Light brown silt (ML to SM) - with some fine sand - a little fine to medium gravel - trace of cobbles (bag sample from 0.75 to 2.0') | |
| 4 | | | | | Brown fine to medium sand (SM) - with some silt - a little fine to medium gravel - trace of cobbles (bag sample from 3.0 to 3.5') | |
| 6 | | | | | | |
| 8 | | | | | Brown fine to medium sand (SM to GM - with a little silt and fine tomedium gravel (bag sample from 7.0 to 7.5') | |
| 10 | | | | | | |
| 12 | | | | | Brown fine sand (SM) - with a little silt and fine to medium gravel bag sample from 12.0 to 12.5 feet | |
| 12.5 | | | | | Test Pit advanced to 12.5 feet using backhoe | |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN SITU. THE TRANSITION MAY BE GRADUAL.

| | | | |
|---|---|---|---|
| WL Dry | BORING STARTED 6-7-84 | STS OFFICE | 111 Pfingsten Road Northbrook, IL 60062 |
| WL BCR ACR | BORING COMPLETED 6-7-84 | DRAWN BY KJC | SHEET NO. 1 OF 1 |
| WL | RIG Backhoe FOREMAN BP | APP'D BY PAT | STS JOB NO 23573 |

B-3-1183

3.5-14-52

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Co., USA | LOG OF: TP-84-11 |
| PROJECT NAME: Crandon Project | ARCHITECT—ENGINEER |
| SITE LOCATION: N 112,605 E 2,283,499 Feet; N 34,322 E 696,012 Meters | |

SURFACE ELEVATION 1676.98 Ft. 511.14 Meters

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT³ |
|---|---|---|---|---|---|---|
| | | | | | Black organic topsoil (OL) - with roots | |
| | | | | | Light brown silt (ML to SM) with some sand - trace of fine gravel | |
| 2 | | | | | | |
| 4 | | | | | | |
| 6 | | | | | Brown fine to medium sand (SM) - with a little silt and fine to medium gravel - trace of cobbles and boulders (bag samples from 3.0 to 3.5', 8.5 to 9.0', 13.0 to 13.5') | |
| 8 | | | | | | |
| 10 | | | | | | |
| 12 | | | | | | |
| 13.5 | | | | | Test Pit advanced to 13.5 feet using Backhoe | |

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² — 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

10 20 30 40 50

STANDARD PENETRATION BLOWS / FT.

10 20 30 40 50

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| WL Dry | BORING STARTED 6-7-84 | STS OFFICE 111 Pfingsten Road Northbrook, IL. 60062 | |
| WL BCR ACR | BORING COMPLETED 6-7-84 | DRAWN BY KJC | SHEET NO 1 OF 1 |
| WL | RIG Backhoe FOREMAN BP | APP'D BY PAT | STS JOB NO 23573 |

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Co., USA | LOG OF: TP-84-12 |
| PROJECT NAME: Crandon Project | ARCHITECT—ENGINEER |
| SITE LOCATION: N 112,296 E 2,283,729 Feet; N 34,228 E 696,082 Meters | |

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT³ |
|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1671.84 ft. 509.58 Meters | |
| | | | | | Black organic silty topsoil (OL) - with roots | |
| | | | | | Light brown silt (ML to SM) with some fine sand-trace gravel | |
| 4 | | | | | Brown fine to medium sand (SM) - with a little silt and fine to medium gravel - trace of cobbles and boulders | |
| 10 | | | | | Brown fine to medium sand (SM to GM) - with some fine to medium gravel - a little silt - trace of cobbles and boulders (bag samples from 4.0 to 4.5', 7.5 to 8.0') | |
| 14.5 | | | | | Brown fine to medium sand (SM) - with a little silt and fine to medium gravel - trace of cobbles (bag sample from 14.0 to 14.5') | |
| | | | | | Test Pit advanced to 14.5 feet using backhoe | |

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² — 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

10 20 30 40 50

STANDARD PENETRATION BLOWS / FT.

10 20 30 40 50

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION MAY BE GRADUAL.

| | | | |
|---|---|---|---|
| WL Dry | BORING STARTED 6-6-84 | STS OFFICE | 111 Pfingsten Road Northbrook, IL. 60062 |
| WL BCR ACR | BORING COMPLETED 6-6-84 | DRAWN BY KJC | SHEET NO. 1 OF 1 |
| WL | RIG Backhoe FOREMAN BP | APP'D BY PAT | STS JOB NO. 23573 |

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Co., USA | LOG OF: TP-84-13 |
| PROJECT NAME: Crandon Project | ARCHITECT—ENGINEER |

SITE LOCATION: N 112,011 E 2,283,693 Feet; N 34,141 E 696,071 Meters

SURFACE ELEVATION 1663.37 ft. 507.00 Meters

| DEPTH / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS / FT³ |
|---|---|---|---|---|---|---|
| | | | | | Black organic silty topsoil (OL) - with roots | |
| | | | | | Light gray and brown silt (ML to SM) - with some sand - trace of fine gravel | |
| 2 | | | | | | |
| 4 | | | | | Brown fine to medium sand (SM to GM) - with some silt and fine to coarse gravel - trace of cobbles and boulders (bag samples from 4.0 to 4.5', 7.5 to 8.0') | |
| 6 | | | | | | |
| 8 | | | | | | |
| 10 | | | | | Brown fine to medium sand (SM) - with some silt - a little fine to medium gravel - trace of cobbles and boulders (bag sample from 10.5 to 11.0') | |
| 12 | | | | | | |
| 14 | | | | | Test Pit advanced to 14.0 feet using backhoe | |

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² — 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

10 20 30 40 50

STANDARD PENETRATION BLOWS / FT. — 10 20 30 40 50

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| WL Dry | BORING STARTED 6-6-84 | STS OFFICE 111 Pfingsten Road Northbrook, IL. 60062 | |
| WL BCR ACR | BORING COMPLETED 6-6-84 | DRAWN BY KJC | SHEET NO 1 OF 1 |
| WL | RIG Backhoe FOREMAN BP | APP'D BY PAT | STS JOB NO. 23573 |

3.5-14-55

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Co., USA | LOG OF: TP-84-14 |
| PROJECT NAME: Crandon Project | ARCHITECT—ENGINEER |

SITE LOCATION: N 112,326 E 2,283,969 Feet; N 34,237 E 696,155 Meters

SURFACE ELEVATION 1671.43 ft. 509.45 Meters

| DEPTH / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL |
|---|---|---|---|---|---|
| | | | | | Black organic topsoil (OL) - with roots |
| | | | | | Light brown silt (ML) - with a trace of sand and fine gravel |
| 2 | | | | | Brown sandy silt (ML to SM) - with a trace of gravel (bag sample 3.0 to 3.5') |
| 5 | | | | | Brown fine to medium sand (SM to GM) - with some silt and fine to medium gravel - trace of cobbles and boulders (seepage encountered at 6.0 feet) (bag sample from 7.5 to 8.0') |
| 8 | | | | | |
| 10 | | | | | Brown fine to medium sand (SM) - with a little silt and fine to medium gravel - trace of boulders and cobbles (bag sample from 10.5 to 11.0') |
| 12 | | | | | |
| 13 | | | | | Test Pit advanced to 13.0 feet using backhoe |

UNIT DRY WT LBS/FT³

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

10 20 30 40 50

STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION MAY BE GRADUAL.

| | | | |
|---|---|---|---|
| WL | BORING STARTED 6-6-84 | STS OFFICE | 111 Pfingsten Road Northbrook, IL. 60062 |
| WL BCR ACR | BORING COMPLETED 6-6-84 | DRAWN BY KJC | SHEET NO. 1 OF 1 |
| WL | RIG Backhoe FOREMAN BP | APP'D BY PAT | STS JOB NO. 23573 |

3.5-14-56

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Co., USA | LOG OF: TP-84-15 |
| PROJECT NAME: Crandon Project | ARCHITECT—ENGINEER |
| SITE LOCATION: N 112,342 E 2,284,241 Feet<br>N 34,242 E 696,238 | |

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT³ |
|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1689.42 ft. 514.94 Meters | |
| | | | | | Black organic silty topsoil (OL) - with roots | |
| 2 | | | | | Light brown silt (ML) - with a trace of sand and gravel | |
| 4 | | | | | Brown fine to medium sand (SM) - with some silt - a little fine to coarse gravel - trace of cobbles and boulders (bag sample from 3.0 to 3.5') | |
| 8 | | | | | Brown fine to medium sand (SM)-with a little silt and fine to medium gravel - trace of cobbles and boulders (bag samples from 8.5 to 9.0', 13.0 to 13.5') | |
| 12 / 13.5 | | | | | Test Pit advanced to 13.5 feet using backhoe | |

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² — 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

10 20 30 40 50

STANDARD PENETRATION BLOWS / FT. — 10 20 30 40 50

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN SITU. THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| WL Dry | BORING STARTED 6-6-84 | STS OFFICE | 111 Pfingsten Road Northbrook, IL. 60062 |
| WL BCR ACR | BORING COMPLETED 6-6-84 | DRAWN BY KJC | SHEET NO 1 OF 1 |
| WL | RIG Backhoe FOREMAN BP | APP'D BY PAT | STS JOB NO 23573 |

3.5-14-57

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Co., USA | LOG OF: TP-84-16 |
| PROJECT NAME: Crandon Project | ARCHITECT—ENGINEER: |
| SITE LOCATION: N 112,369 E 2,283,513 Feet<br>N 34,250 E 696,016 Meters | |

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² — 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

10 20 30 40 50

STANDARD PENETRATION BLOWS / FT. — 10 20 30 40 50

| DEPTH ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT³ |
|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1667.58 ft. 508.28 Meters | |
| | | | | | Black organic silty topsoil (OL) - with roots | |
| 2 | | | | | Grayish brown silt (ML) - with a trace of sand and fine gravel (becoming light brown at 1.5 feet) | |
| 4 | | | | | Brown fine to medium sand (SM) - with some silt - a little fine to coarse gravel - trace of cobbles and boulders (bag sample from 3.5 to 4.0') | |
| 8 | | | | | | |
| 10 | | | | | Brown fine to medium sand (SM) - with a little silt and fine to coarse gravel - trace of cobbles and boulders (bag samples from 8.0 to 8.5', 14.0 to 14.5') | |
| 12 | | | | | | |
| 14 | | | | | | |
| 14.5 | | | | | Test Pit advanced to 14.5 feet using backhoe | |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION MAY BE GRADUAL.

| | | | |
|---|---|---|---|
| WL Dry | BORING STARTED 6-6-84 | STS OFFICE 111 Pfingsten Road Northbrook, IL. 60062 | |
| WL BCR ACR | BORING COMPLETED 6-6-84 | DRAWN BY KJC | SHEET NO. 1 OF 1 |
| WL | RIG Backhoe FOREMAN BP | APP'D BY PAT | STS JOB NO. 23573 |

3.5-14-58

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Co., USA | LOG OF: TP-84-17 |
| PROJECT NAME: Crandon Project | ARCHITECT—ENGINEER: |
| SITE LOCATION: N 112,060 E 2,283,503 Feet; N 34,156 E 696,013 Meters | |

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS/FT³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT² 1 2 3 4 5 / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / 10 20 30 40 50 / STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50 |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1659.69 ft. 505.87 Meters | | |
| | | | | | Black organic silty topsoil (OL) - with roots | | |
| 2 | | | | | Light brown silt (ML to SM) - with some sand - trace of fine gravel | | |
| 4 | | | | | | | |
| 6 | | | | | Brown fine to coarse sand (SM) - with a little silt and fine to medium gravel - trace of cobbles and boulders (bag sample form 4.5 to 5.0') | | |
| 8 | | | | | | | |
| 10 | | | | | Brown fine to coarse sand (SM to GM) - with a little gravel - trace of silt - trace of cobbles and boulders (bag sample from 9.5 to 10.0') | | |
| 12 | | | | | Light brown fine to medium sand (SM) - with a trace of silt and gravel (bag sample from 12.5 to 13.0') | | |
| 13 | | | | | Test Pit advanced to 13.0 feet using backhoe | | |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN SITU. THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| WL Dry | BORING STARTED 6-7-84 | STS OFFICE | 111 Pfingsten Road Northbrook, IL 60062 |
| WL BCR ACR | BORING COMPLETED 6-7-84 | DRAWN BY KJC | SHEET NO. 1 OF 1 |
| WL | RIG Backhoe FOREMAN BP | APP'D BY PAT | STS JOB NO. 23573 |

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Co., USA | LOG OF: TP-84-20 |
| PROJECT NAME: Crandon Project | ARCHITECT—ENGINEER |

SITE LOCATION: N 114,135 E 2,284,353 Feet
N 34,788 E 696,272 Meters

SURFACE ELEVATION 1707.26 ft. 520.37 Meters

| DEPTH / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT³ |
|---|---|---|---|---|---|---|
| | | | | | Black organic silty topsoil (OL) - with roots | |
| 2 | | | | | Light brown silt (ML to SM) - with some sand - trace of fine gravel | |
| 4 | | | | | | |
| 6 | | | | | | |
| 8 | | | | | Brown fine to medium sand (SM to GM) - with some fine to medium gravel - a little silt - trace of cobbles and boulders (bag sample form 5.0 to 5.5') | |
| 10 | | | | | | |
| 12 | | | | | | |
| 14 | | | | | Brown fine sand (SP to SM) - with a little gravel - trace of silt and cobbles (bag sample from 13.0 to 13.5') | |
| | | | | | Test Pit advanced to 14.0 feet using backhoe | |

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² — 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

10 20 30 40 50

STANDARD PENETRATION BLOWS / FT. — 10 20 30 40 50

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION MAY BE GRADUAL.

| | | | |
|---|---|---|---|
| WL Dry | BORING STARTED 6-8-84 | STS OFFICE | 111 Pfingsten Road Northbrook, IL. 60062 |
| WL BCR ACR | BORING COMPLETED 6-8-84 | DRAWN BY KJC | SHEET NO. 1 OF 1 |
| WL | RIG Backhoe FOREMAN BP | APP'D BY PAT | STS JOB NO. 23573 |

BL 3 1183

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Co., USA | LOG OF: TP-84-21 |
| PROJECT NAME: Crandon Project | ARCHITECT—ENGINEER |
| SITE LOCATION: N 113,426 E 2,284,396 Feet; N 34,572 E 696,285 Meters | |

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS/FT³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT² 1 2 3 4 5 / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % 10 20 30 40 50 / STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50 |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1691.35 ft. 515.52 Meters | | |
| | | | | | Black organic silty topsoil (OL) - with roots | | |
| 2 | | | | | Light brown silt (ML to SM) - with some sand - trace of fine gravel | | |
| 4 | | | | | Brown fine to medium sand (SM) - with a little silt and fine to coarse gravel - trace of cobbles and boulders (bag sample from 2.5 to 3.0') | | |
| 6 | | | | | | | |
| 8 | | | | | Light brown fine sand (SP to SM) - with a trace of silt and fine to medium gravel (bag sample from 8.0 to 8.5') | | |
| 10 | | | | | Brown very fine sand (SM) - with a little silt - trace of fine gravel (bag sample from 9.0 to 9.5') | | |
| 12 | | | | | | | |
| 14 | | | | | Test Pit advanced to 14.0 feet using backhoe | | |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION MAY BE GRADUAL.

| | | | |
|---|---|---|---|
| WL Dry | BORING STARTED 6-8-84 | STS OFFICE | 111 Pfingsten Road Northbrook, IL 60062 |
| WL BCR ACR | BORING COMPLETED 6-8-84 | DRAWN BY KJC | SHEET NO 1 OF 1 |
| WL | RIG Backhoe FOREMAN BP | APP'D BY PAT | STS JOB NO. 23573 |

STS Consultants Ltd

| | |
|---|---|
| OWNER: Exxon Minerals Co., USA | LOG OF: TP-84-22 |
| PROJECT NAME: Crandon Project | ARCHITECT—ENGINEER |

SITE LOCATION: N 112,887 E 2,284,372 Feet; N 34,408 E 696,278 Meters

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² — 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

10 20 30 40 50

STANDARD PENETRATION BLOWS / FT. — 10 20 30 40 50

| DEPTH / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS/FT³ |
|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1685.77 513.82 Meters | |
| | | | | | Black organic silty topsoil (OL) - with roots | |
| | | | | | Grayish brown silt (ML to SM) - with some fine sand - trace of fine gravel | |
| 2 | | | | | | |
| 4 | | | | | Brown fine to medium sand (SM) - with a little silt and fine to medium gravel - trace of cobbles and boulders (bag sample from 3.5 to 4.0') | |
| 6 | | | | | | |
| 8 | | | | | | |
| 10 | | | | | Brown fine to coarse sand (SM to GM) - with some fine to coarse gravel - trace of silt - trace of cobbles and boulders (bag sample from 9.5 to 10.0') | |
| 12 | | | | | Brown fine to medium sand (SM) - with a little silt and fine gravel - trace of cobbles and boulders | |
| | | | | | Brown fine sand (SM) - with a little fine gravel - trace to a little silt (bag sample from 13.0 to 13.5') | |
| 14 | | | | | Test Pit advanced to 14.0 feet using backhoe | |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN SITU. THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| WL Dry | BORING STARTED 6-8-84 | STS OFFICE | 111 Pfingsten Road Northbrook, IL 60062 |
| WL BCR ACR | BORING COMPLETED 6-8-84 | DRAWN BY KJC | SHEET NO. 1 OF 1 |
| WL | RIG Backhoe FOREMAN BP | APP'D BY PAT | STS JOB NO. 23573 |

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Co. USA | LOG OF: TP-84-23 |
| PROJECT NAME: Crandon Project | ARCHITECT—ENGINEER |
| SITE LOCATION: N 111,391 E 2,284,405 Feet; N 33,952 E 696,288 Meters | |

| DEPTH ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS/FT³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT² (1 2 3 4 5) / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % (10 20 30 40 50) / STANDARD PENETRATION BLOWS/FT. (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1093.34 feet 510.28 Meters | | |
| | | | | | Black organic silty topsoil (OL) with roots | | |
| 2 | | | | | Light brown silt (ML to SM) with some sand, trace fine gravel | | |
| 4 | | | | | Brown fine to medium sand (SM) with a little silt and fine to medium gravel, trace cobbles (intermittent pockets of saturated silt) (bag samples from 4 to 4.5') | | |
| 6 | | | | | | | |
| 8 | | | | | | | |
| 10 | | | | | | | |
| 12 | | | | | Brown fine to medium sand (SM) with some silt, little fine to medium gravel, trace boulders and cobbles (bag samples from 11.5 to 12') | | |
| | | | | | Test Pit advanced to 12 feet using backhoe | | |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION MAY BE GRADUAL.

| | | | |
|---|---|---|---|
| WL Dry | BORING STARTED 6-8-84 | STS OFFICE | 111 Pfingsten Road Northbrook, IL. 60062 |
| WL BCR ACR | BORING COMPLETED 6-8-84 | DRAWN BY KJC | SHEET NO 1 OF 1 |
| WL | RIG Backhoe FOREMAN BP | APP'D BY PAT | STS JOB NO. 23573 |

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Co. USA | LOG OF: TP-84-24 |
| PROJECT NAME: Crandon Project | ARCHITECT—ENGINEER: |
| SITE LOCATION: N 111,850 E 2,284,362 Feet; N 34,092 E 696,275 Meters | |

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² — 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

10 20 30 40 50

STANDARD PENETRATION BLOWS / FT.

10 20 30 40 50

| DEPTH ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT LBS / FT³ |
|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1692.82 ft. 515.97 Meters | |
| | | | | | Black organic silty topsoil (OL) with roots | |
| 2 | | | | | Light brown silt (ML to SM) with some sand, trace fine gravel | |
| 4 | | | | | Brown fine to medium sand (SM) with a little silt and fine to medium gravel, trace cobbles and boulders (bag samples from 4 to 4.5', seepage encountered at 5') | |
| 6 | | | | | | |
| 8 | | | | | | |
| 10 | | | | | Brown fine sand (SM) with a little silt and fine gravel, trace cobbles (bag samples from 8 to 8.5') | |
| 12 | | | | | Brown fine sand (SP to SM) with a trace of silt and fine gravel (bag sample from 11 to 11.5') | |
| 14 | | | | | Brown fine sand (SM) with a little silt and fine to coarse gravel, trace of cobbles and boulders. | |
| | | | | | Test Pit advanced to 14 feet using backhoe | |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| WL Dry | BORING STARTED 6-8-84 | STS OFFICE 111 Pfingsten Road Northbrook, IL. 60062 | |
| WL BCR ACR | BORING COMPLETED 6-8-84 | DRAWN BY KJC | SHEET NO. 1 OF 1 |
| WL | RIG Backhoe FOREMAN BP | APP'D BY PAT | STS JOB NO 23573 |

3.5-14-84

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Co. USA | LOG OF: TP-84-30 |
| PROJECT NAME: Crandon Project | ARCHITECT—ENGINEER: |

SITE LOCATION: N 111,326 E 2,283,025 Feet; N 33,932 E 695,807 Meters

| DEPTH / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS /FT³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT² 1 2 3 4 5 / PLASTIC LIMIT % WATER CONTENT % LIQUID LIMIT % 10 20 30 40 50 / STANDARD PENETRATION BLOWS / FT. 10 20 30 40 50 |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1627.03 ft. 496.16 meters | | |
| | | | | | Black organic silty topsoil (OL) with roots | | |
| 2 | | | | | Grayish brown silt (ML) with a trace of sand and fine gravel | | |
| 4 | | | | | Brown fine to coarse sand (SP to SM) with a little fine to coarse gravel, trace silt and cobbles (bag sample from 3 to 3.5', seepage encountered at 5') | | |
| 6 | | | | | | | |
| 8 | | | | | | | |
| 10 | | | | | Brown fine to medium sand (SM) with a little silt and fine to medium gravel, trace cobbles and boulders (bag sample from 8 to 8.5', 13.5 to 14') | | |
| 12 | | | | | | | |
| 14 | | | | | Test Pit advanced to 14 feet using backhoe | | |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION MAY BE GRADUAL.

| | | | |
|---|---|---|---|
| WL Dry | BORING STARTED 6-6-84 | STS OFFICE 111 Pfingsten Road Northbrook, IL., 60062 | |
| WL BCR ACR | BORING COMPLETED 6-6-84 | DRAWN BY KJC | SHEET NO 1 OF 1 |
| WL | RIG Backhoe FOREMAN DP | APP'D BY DET | STS JOB NO. 23573 |

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Co. USA | LOG OF: TP-84-31 |
| PROJECT NAME: Crandon Project | ARCHITECT—ENGINEER |

SITE LOCATION: N 111,283 E 2,283,400 Feet; N 33,919 E 695,982 Meters

SURFACE ELEVATION 1035.10 Ft. 408.38 Meters

| DEPTH / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS/FT³ |
|---|---|---|---|---|---|---|
| | | | | | Black organic silty topsoil (OL) with roots | |
| 4 | | | | | Light brown silt (ML) with a trace of fine sand, gravel, cobbles and boulders | |
| 6 | | | | | Brown fine to medium sand (SM) with some silt, little gravel, trace cobbles and boulders (bag sample from 3 to 3.5') | |
| 8 | | | | | Brown fine to medium sand (SP to GP) with some fine to coarse gravel, little silt, trace cobbles and boulders (bag sample from 7.5 to 8', 14 to 14.5') | |
| 10 | | | | | | |
| 12 | | | | | | |
| 14 | | | | | | |
| 14.5 | | | | | Test Pit advanced to 14.5 feet using backhoe | |

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² — 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

10 20 30 40 50

STANDARD PENETRATION BLOWS / FT. — 10 20 30 40 50

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| WL Dry | BORING STARTED 6-6-84 | STS OFFICE | 111 Pfingsten Road Northbrook, IL., 60062 |
| WL BCR ACR | BORING COMPLETED 6-6-84 | DRAWN BY MJC | SHEET NO ) OF ) |
| WL | RIG Backhoe FOREMAN DP | APP'D BY PAT | STS JOB NO. 23873 |

3.5-14-66

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Co. USA | LOG OF: TP-84-32 |
| PROJECT NAME: Crandon Project | ARCHITECT—ENGINEER: |
| SITE LOCATION: N 111,278 E 2,283,911 Feet; N 33,918 E 696,138 Meters | |

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT LBS./FT³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT² 1 2 3 4 5 / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / 10 20 30 40 50 / STANDARD PENETRATION BLOWS / FT. 10 20 30 40 50 |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1663.91 ft. 507.16 meters | | |
| | | | | | Black organic silty topsoil (OL) with roots | | |
| 2 | | | | | Light brown silt (ML) with a trace of sand and fine gravel | | |
| 4 | | | | | Brown fine to medium sand (SM) with some silt, little fine to coarse gravel, trace cobbles (bag sample 3 to 3.5') | | |
| 6 | | | | | Brown silty fine to medium sand (SM) with a little fine to coarse gravel and cobbles, trace boulders (bag sample 7 to 7.5') | | |
| 10 | | | | | Reddish brown fine sand (SM) with a little silt and gravel, trace cobbles and boulders (bag sample 13.5 to 14') | | |
| 14 | | | | | Test Pit advanced to 14 feet using backhoe | | |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN SITU. THE TRANSITION MAY BE GRADUAL.

| | | | |
|---|---|---|---|
| WL Dry | BORING STARTED 6-6-84 | STS OFFICE | 111 Pfingsten Road Northbrook, IL., 60062 |
| WL BCR ACR | BORING COMPLETED 6-6-84 | DRAWN BY KJC | SHEET NO 1 OF 1 |
| WL | RIG Backhoe FOREMAN BP | APP'D BY PAT | STS JOB NO. 23573 |

STS Consultants Ltd.

| OWNER | LOG OF |
|---|---|
| Exxon Minerals Co. USA | TP-84-33 |
| **PROJECT NAME** | **ARCHITECT—ENGINEER** |
| Crandon Project | |

**SITE LOCATION** N 111,532 E 2,283,527 Feet
N 33,995 E 696,020 Meters

| DEPTH / ELEVATION | SAMPLE NO | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS /FT³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT² 1 2 3 4 5 / PLASTIC LIMIT % WATER CONTENT % LIQUID LIMIT % 10 20 30 40 50 / STANDARD PENETRATION BLOWS / FT. 10 20 30 40 50 |
|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION 1057.84 ft. 505.31 meters | | |
| 2 | | | | | Light brown silt (ML to SM) with some sand, little fine to coarse gravel, trace reddish brown clay (intermittent pockets of brown fine to coarse sand with little silt) (bag sample 0 to 4') | | |
| 4 | | | | | | | |
| 6 | | | | | Brown fine to coarse sand (SM to GM) with some fine to coarse gravel, little silt, trace cobbles and boulders (bag sample from 6 to 8.5') | | |
| 8 | | | | | | | |
| 10 | | | | | | | |
| 12 | | | | | | | |
| 14 | | | | | | | |
| 16 | | | | | | | |
| 16.5 | | | | | Brown fine sand (SM) with a little silt and fine to medium gravel (bag sample from 16 to 16.5') | | |
| | | | | | Test Pit advanced to 16.5 feet using backhoe | | |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION MAY BE GRADUAL.

| | | | |
|---|---|---|---|
| WL Dry | BORING STARTED 6-8-84 | STS OFFICE | 111 Pfingsten Road Northbrook, IL., 60062 |
| WL BCR ACR | BORING COMPLETED 6-8-84 | DRAWN BY KJC | SHEET NO. 1 OF 1 |
| WL | RIG Backhoe FOREMAN BP | APP'D BY PAT | STS JOB NO. 23573 |

# Logs for STS Consultants Ltd. 1985 Mine Refuse Disposal Facility Test Pits (TP-85-1 through 17)

STS Consultants Ltd.

OWNER: Exxon Minerals Company

LOG OF TEST PIT NUMBER: TP-85-1

PROJECT NAME: MRDF Test Pits

ENGINEER:

BEST COPY AVAILABLE

CMC-NOI-69

SITE LOCATION: Crandon Project

WELL INSTALLATION
TOP STANDPIPE EL. +

| DEPTH / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION | | | | | | | |
| | | | | | Boulder | | | | | | | |
| 2 | | | | | Brown fine sandy silt (ML) - trace gravel - mottling - seep at 1.5 feet | | | | | | | |
| 4 | | | | | Brown silty fine to medium sand (SM) - trace gravel | | | | | | | |
| 6 | | | | | | | | | | | | |
| 8 | | | | | Brown fine to medium sand (SP) - trace coarse sand and gravel | | | | | | | |
| 10 | | | | | | | | | | | | |
| 12 | | | | | Brown silty fine to medium sand (SM) - trace gravel and cobbles | | | | | | | |
| 12.5 | | | | | End of Test Pit<br>Test pit advanced by backhoe<br>Backfilled | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | | BCR | | ACR |
|---|---|---|---|---|---|
| WL-T. PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

| | |
|---|---|
| BORING STARTED | 10-23-85 |
| BORING COMPLETED | 10-23-85 |
| RIG | |
| FOREMAN | DK |

STS OFFICE: 540 Lambeau Street, Green Bay, WI 54303

DRAWN BY: JJT | SHEET: 1 OF 1

APP'D. BY: JWK | STS JOB NO.: 14028

BL 5-983

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Company | LOG OF TEST PIT NUMBER: TP-85-2 |
| PROJECT NAME: MRDF Test Pits | ENGINEER: |
| SITE LOCATION: Crandon Project | |

WELL INSTALLATION
TOP STANDPIPE EL. +

SURFACE ELEVATION

| DEPTH / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (cm/sec) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Topsoil with cobbles | | | | | | | |
| 2 | | | | | Brown sandy silt (ML) - little cobbles - trace gravel - mottled-seep at 2.5 ft | | | | | | | |
| 4 | | | | | Brown silty fine to coarse sand (SM) - trace cobbles and gravel - Till | | | | | | | |
| 6 | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | |
| 12 | | | | | End of test pit<br>Test pit advanced by backhoe<br>Backfilled | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | | BCR | | | ACR |
|---|---|---|---|---|---|---|
| WL-T. PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| | |
|---|---|
| BORING STARTED | 10-23-85 |
| BORING COMPLETED | 10-23-85 |
| RIG | |
| FOREMAN | DK |

| | |
|---|---|
| STS OFFICE | 540 Lambeau Street<br>Green Bay, WI 54303 |
| DRAWN BY | JJT |
| SHEET | 1 OF 1 |
| APP'D. BY | JWK |
| STS JOB NO. | 14028 |

BL: 5-863

STS Consultants Ltd.

OWNER: Exxon Minerals Company

LOG OF TEST PIT NUMBER: TP-85-3

PROJECT NAME: MRDF Test Pits

ENGINEER:

SITE LOCATION: Crandon Project

WELL INSTALLATION
TOP STANDPIPE EL. +

| DEPTH / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION | | | | | | | |
| | | | | | Boulder | | | | | | | |
| 2 | | | | | Brown sandy silt (ML) - trace clay and gravel - roots - mottling | | | | | | | |
| 4 | | | | | Brown silty fine to medium sand (SM) - trace gravel and cobbles - Till | | | | | | | |
| 6 | | | | | Brown silty fine to coarse sand (SM) - little cobbles and gravel - Till - seep at 6.0 feet | | | | | | | |
| 8 | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | |
| 13 | | | | | End of test pit<br>Test pit advanced by backhoe<br>Backfilled | | | | | | | |

The stratification lines represent the approximate boundary between soil types, in situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonall

| WL | | BCR | | ACR | |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

| | |
|---|---|
| BORING STARTED | 10-23-85 |
| BORING COMPLETED | 10-23-85 |
| RIG | |
| FOREMAN | DK |

STS OFFICE: 540 Lambeau Street, Green Bay, WI 54303

DRAWN BY: JJT | SHEET 1 OF 1

APP'D. BY: JWK | STS JOB NO. 14028

BL: 5-863

STS Consultants Ltd.

OWNER: Exxon Minerals Company

LOG OF TEST PIT NUMBER: TP-85-4

PROJECT NAME: MRDF Test Pits

ENGINEER

BEST COPY AVAILABLE

SITE LOCATION: Crandon Project

| DEPTH / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL (WELL INSTALLATION, TOP STANDPIPE EL. +; SURFACE ELEVATION) | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 / 79 | | | | | Topsoil - boulder | | | | | | | |
| 2 | | | | | Brown sandy silt (ML) - trace gravel - mottled | | | | | | | |
| 4 | | | | | Brown fine to coarse sand (SM) - little gravel - trace cobbles - Till - seep at 4.0 feet | | | | | | | |
| 6 | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | |
| 13.5 | | | | | End of test pit<br>Test pit advanced by backhoe<br>Backfilled | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

| | |
|---|---|
| BORING STARTED | 10-23-85 |
| BORING COMPLETED | 10-23-85 |
| RIG | |
| FOREMAN | DK |

STS OFFICE: 540 Lambeau Street, Green Bay, WI 54303

DRAWN BY: JJT | SHEET 1 OF 1

APP'D. BY: JWK | STS JOB NO. 14028

BL 5-85J

3.5-14-73

STS Consultants Ltd.

OWNER: Exxon Minerals Company

LOG OF TEST PIT NUMBER: TP -85-5

PROJECT NAME: MRDF Test Pits

ENGINEER:

SITE LOCATION: Crandon Project

| DEPTH / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | WELL INSTALLATION TOP STANDPIPE EL. +<br>SURFACE ELEVATION | | | | | | | |
| | | | | | Topsoil - boulder | | | | | | | |
| 2 | | | | | Brown sandy silt (ML) - trace gravel and cobbles - mottled - seep at 2.5 feet | | | | | | | |
| 4 | | | | | Brown silty fine to coarse sand (SM) - trace clay, gravel and cobbles - Till | | | | | | | |
| 6 | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | |
| 12.5 | | | | | End of test pit<br>Test pit advanced by backhoe<br>Backfilled | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | ACR | |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

| | |
|---|---|
| BORING STARTED | 10-23-85 |
| BORING COMPLETED | 10-23-85 |
| RIG | |
| FOREMAN | DK |

STS OFFICE: 540 Lambeau Street, Green Bay, WI 54303

DRAWN BY: JJT | SHEET: 1 OF 1

APP'D. BY: JWK | STS JOB NO.: 14028

BL 5-83

STS Consultants Ltd

| | |
|---|---|
| OWNER: Exxon Minerals Company | LOG OF TEST PIT NUMBER: TP-85-6 |
| PROJECT NAME: MRDF Test Pits | ENGINEER: |
| SITE LOCATION: Crandon Project | |

WELL INSTALLATION
TOP STANDPIPE EL. +

| DEPTH / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION | | | | | | | |
| | | | | | Topsoil | | | | | | | |
| 2 | | | | | Brown sandy silt (ML) - trace gravel and cobbles | | | | | | | |
| 6 | | | | | Brown silty fine to medium sand (SM) - trace gravel and cobbles - seep at 3.5 feet | | | | | | | |
| 8 | | | | | Brown silty fine to coarse sand (SM) - little gravel, trace cobbles - Till | | | | | | | |
| 10 | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | |
| 13.5 | | | | | End of test pit<br>Test pit advanced by backhoe<br>Backfilled | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

| | |
|---|---|
| BORING STARTED | 10-23-85 |
| BORING COMPLETED | 10-23-85 |
| RIG | |
| FOREMAN | DK |

| | |
|---|---|
| STS OFFICE | 540 Lambeau Street<br>Green Bay, WI 54303 |
| DRAWN BY | JJT |
| SHEET | 1 OF 1 |
| APP'D. BY | JWK |
| STS JOB NO. | 14028 |

BL 5-863

STS Consultants Ltd.

OWNER: Exxon Minerals Company

LOG OF TEST PIT NUMBER: TP-85-7

PROJECT NAME: MRDF Test Pits

ENGINEER:

SITE LOCATION: Crandon Project

| DEPTH / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | WELL INSTALLATION TOP STANDPIPE EL. + _____ | | | | | | | |
| | | | | | SURFACE ELEVATION | | | | | | | |
| | | | | | Topsoil - boulder | | | | | | | |
| | | | | | Brown sandy silt (ML) - trace cobbles and boulders | | | | | | | |
| 4 | | | | | Brown silty fine to coarse sand (SM) - trace gravel and cobbles - Till - seep at 3.0 feet | | | | | | | |
| 8 | | | | | Brown silty fine to coarse sand (SM) - trace gravel, cobbles and boulders - very dense - Till | | | | | | | |
| 13 | | | | | End of test pit<br>Test pit advanced by backhoe<br>Backfilled | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | | BCR | | | ACR |
|---|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| | |
|---|---|
| BORING STARTED | 10-23-85 |
| BORING COMPLETED | 10-23-85 |
| RIG | |
| FOREMAN | DK |

STS OFFICE: 540 Lambeau Street, Green Bay, WI 54303

DRAWN BY: JJT | SHEET: 1 OF 1

APP'D. BY: JWK | STS JOB NO.: 14028

BL: 5-883

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Company | LOG OF TEST PIT NUMBER: TP-85-8 |
| PROJECT NAME: MRDF Test Pits | ENGINEER: |
| SITE LOCATION: Crandon Project | |

WELL INSTALLATION
TOP STANDPIPE EL. +

| DEPTH / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION | | | | | | | |
| | | | | | Topsoil | | | | | | | |
| | | | | | Brown sandy silt (ML) - trace gravel | | | | | | | |
| 2 | | | | | Brown silty fine to coarse sand (SM) - trace cobbles and boulders - Till - seep at 5.0 feet | | | | | | | |
| 4 | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | |
| 10 | | | | | Brown silty fine to coarse sand (SM) - very dense - Till | | | | | | | |
| 12 | | | | | | | | | | | | |
| | | | | | End of test pit<br>Test pit advanced by backhoe<br>Backfilled | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | | BCR | | | ACR |
|---|---|---|---|---|---|---|
| WL-T. PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| | |
|---|---|
| BORING STARTED | 10-23-85 |
| BORING COMPLETED | 10-23-85 |
| RIG | |
| FOREMAN | DK |

| | |
|---|---|
| STS OFFICE | 540 Lambeau Street<br>Green Bay, WI 54303 |
| DRAWN BY | JJT |
| SHEET | 1 OF 1 |
| APP'D. BY | JWK |
| STS JOB NO. | 14028 |

BL: 5-983

3.5-14-77

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Company | LOG OF TEST PIT NUMBER: TP-85-9 |
| PROJECT NAME: MRDF Test Pits | ENGINEER: |
| SITE LOCATION: Crandon Project | |

WELL INSTALLATION
TOP STANDPIPE EL. +

| DEPTH / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION | | | | | | | |
| | | | | | Topsoil - boulder | | | | | | | |
| 2 | | | | | Brown silty fine to coarse sand (SM) - trace gravel, cobbles and boulders - Till - seep at 5.0 feet | | | | | | | |
| 4 | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | |
| 12 | | | | | Brown silty fine to coarse sand (SM) - trace gravel, cobbles and boulders - very dense - Till | | | | | | | |
| | | | | | End of test pit<br>Test pit advanced by backhoe<br>Backfilled | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | ACR | |
|---|---|---|---|---|---|
| WL-T. PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

| | |
|---|---|
| BORING STARTED | 10-23-85 |
| BORING COMPLETED | 10-23-85 |
| RIG | |
| FOREMAN | DK |

| | |
|---|---|
| STS OFFICE | 540 Lambeau Street<br>Green Bay, WI 54303 |
| DRAWN BY | JJT |
| SHEET | 1 OF 1 |
| APP'D. BY | JWK |
| STS JOB NO. | 14028 |

BL 5-85J

STS Consultants Ltd.

OWNER: Exxon Minerals Company

LOG TEST PIT NUMBER: TP-85-10

PROJECT NAME: MRDF Test Pits

ENGINEER:

SITE LOCATION: Crandon Project

WELL INSTALLATION
TOP STANDPIPE EL. +

| DEPTH / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION | | | | | | | |
| | | | | | Topsoil | | | | | | | |
| | | | | | Brown sandy silt(ML) - trace cobbles | | | | | | | |
| 2 | | | | | Brown silty fine to coarse sand (SM) - trace gravel, cobbles and boulders - Till - seep at 4.0 feet - very dense at 13.0 feet | | | | | | | |
| 4 | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | |
| 14 | | | | | End of test pit<br>Test pit advanced by backhoe<br>Backfilled | | | | | | | |

The stratification lines represent the approximate boundary between soil types, in situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL-T. PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

| | |
|---|---|
| BORING STARTED | 10-23-85 |
| BORING COMPLETED | 10-23-85 |
| RIG | |
| FOREMAN | DK |

STS OFFICE: 540 Lambeau Street, Green Bay, WI 54303

DRAWN BY: JJT | SHEET: 1 OF 1

APP'D. BY: JWK | STS JOB NO.: 14028

BL: S-983

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Company | LOG OF TEST PIT NUMBER: TP-85-14 |
| PROJECT NAME: MRDF Test Pits | ENGINEER: |
| SITE LOCATION: Crandon Project | |

| DEPTH / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL (WELL INSTALLATION TOP STANDPIPE EL. +) | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | SURFACE ELEVATION | | | | | | | |
| | | | | | Topsoil - boulder | | | | | | | |
| | | | | | Brown silty fine to coarse sand (SM) | | | | | | | |
| 4 | | | | | Brown silty fine to coarse sand (SM) - trace of gravel, cobbles and boulders - seep at 11.0 feet | | | | | | | |
| 8 | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | |
| 13 | | | | | End of Test Pit<br>Test Pit advanced by backhoe<br>Backfilled | | | | | | | |

The stratification lines represent the approximate boundary between soil types, in situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | | BCR | | ACR |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

| | |
|---|---|
| BORING STARTED | 10-30-85 |
| BORING COMPLETED | 10-30-85 |
| RIG | Backhoe |
| FOREMAN | DK |

| | |
|---|---|
| STS OFFICE | 540 Lambeau Street<br>Green Bay, WI. 54303 |
| DRAWN BY | KJC |
| SHEET | 1 OF 1 |
| APP'D. BY | JWK |
| STS JOB NO | 14028 |

BL 5-86J

STS Consultants Ltd.

OWNER: Exxon Minerals Company

PROJECT NAME: MRDF Test Pits

SITE LOCATION: Crandon Project

LOG OF TEST PIT NUMBER: TP-85-15

ENGINEER:

| DEPTH / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | WELL INSTALLATION TOP STANDPIPE EL. + | | | | | | | |
| | | | | | SURFACE ELEVATION | | | | | | | |
| | | | | | Topsoil | | | | | | | |
| | | | | | Brown silty fine to medium sand (SM)-trace gravel | | | | | | | |
| 2 | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | |
| 6 | | | | | Brown silty fine to coarse sand (SM) - trace of gravel and cobbles - little to some cobbles and boulders at 6.0 to 7.0 feet - seeps at 5.0 and 11.0 feet | | | | | | | |
| 8 | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | |
| 13 | | | | | End of Test Pit<br>Test Pit advanced by backhoe<br>Backfilled | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | | SCR | | | ACR |
|---|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| | |
|---|---|
| BORING STARTED | 10-30-85 |
| BORING COMPLETED | 10-30-85 |
| RIG | Backhoe |
| FOREMAN | DK |

| | |
|---|---|
| STS OFFICE | 540 Lambeau Street<br>Green Bay, WI. 54303 |
| DRAWN BY | KJC |
| SHEET | 1 OF 1 |
| APP'D. BY | JWK |
| STS JOB NO. | 14028 |

BL 5-883

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Company | LOG OF TEST PIT NUMBER: TP-85-16 |
| PROJECT NAME: MRDF Test Pits | ENGINEER: |
| SITE LOCATION: Crandon Project | |

| DEPTH / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | WELL INSTALLATION TOP STANDPIPE EL. + | | | | | | | |
| | | | | | SURFACE ELEVATION | | | | | | | |
| | | | | | Topsoil | | | | | | | |
| | | | | | Brown sandy silt (ML) - trace of gravel and cobbles | | | | | | | |
| 2 | | | | | Brown silty fine to coarse sand (SM) - trace of gravel and cobbles - seep at 4.0 feet | | | | | | | |
| 3 | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | |
| | | | | | End of Test Pit<br>Test Pit advanced by backhoe<br>Backfilled | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL-T. PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

| | |
|---|---|
| BORING STARTED | 10-30-85 |
| BORING COMPLETED | 10-30-85 |
| RIG | Backhoe |
| FOREMAN | DK |

| | |
|---|---|
| STS OFFICE | 540 Lambeau Street<br>Green Bay, WI. 54303 |
| DRAWN BY | KJC |
| SHEET | 1 OF 1 |
| APP'D. BY | JWK |
| STS JOB NO. | 14028 |

BL 5-83

STS Consultants Ltd.

| | |
|---|---|
| OWNER: Exxon Minerals Company | LOG OF TEST PIT NUMBER: TP-85-17 |
| PROJECT NAME: MRDF Test Pits | ENGINEER: |
| SITE LOCATION: Crandon Project | |

WELL INSTALLATION
TOP STANDPIPE EL. +

SURFACE ELEVATION

| DEPTH / ELEVATION | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | STANDARD PENETRATION TEST, N (B/FT) | UNCONFINED COMPRESSIVE STRENGTH, Qp (TONS/FT²) | WATER CONTENT, % | UNIT DRY WEIGHT (LBS/FT³) | LIQUID/PLASTIC LIMIT LL/PL | PERCENT PASSING #200 SIEVE | PERMEABILITY, K (CM/SEC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Topsoil | | | | | | | |
| 2 | | | | | Brown sandy silt (ML) - trace of gravel and cobbles | | | | | | | |
| 4 | | | | | | | | | | | | |
| 6 | | | | | Brown silty fine to coarse sand (SM) - trace of gravel, cobbles and boulders - seep at 7.5 feet | | | | | | | |
| 8 | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | |
| 12.5 | | | | | End of Test Pit<br>Test Pit advanced by backhoe<br>Backfilled | | | | | | | |

The stratification lines represent the approximate boundary between soil types. In situ, the transition may be gradual. Water levels were measured at the times indicated. Water levels may vary seasonally.

| WL | | BCR | | | ACR |
|---|---|---|---|---|---|
| WL-T PIPE | DATE | TIME | WL-T. PIPE | DATE | TIME |
| | | | | | |
| | | | | | |
| | | | | | |

| | |
|---|---|
| BORING STARTED | 10-30-85 |
| BORING COMPLETED | 10-30-85 |
| RIG | Backhoe |
| FOREMAN | DK |

| | |
|---|---|
| STS OFFICE | 540 Lambeau Street<br>Green Bay, WI. 54303 |
| DRAWN BY KJC | SHEET 1 OF 1 |
| APP'D. BY JWK | STS JOB NO. 14028 |

BL-5-863

3.5-14-83

# Foth & Van Dyke and Associates Inc. 1994 and 1995 Soil Absorption Pond Test Pits (Sites A, B, C, D and E)

LOG OF TEST PIT: CMC-TPA-1

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area A

SURFACE ELEVATION:
PIT DEPTH: 11+ feet
DATE: 10/11/94

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-11'+ | | | | 5YR3/4-5/4 | Variegated, but mainly dark reddish brown - reddish brown, sandy loam (SCS). Trace of gravel and silt. Few, reddish brown-brown (5YR3/5-7.5YR4/4) and reddish yellow (7.5YR6/6-8) textural mottles in the lower one half of the layer. Water enters the pit from a thin seam at 7 feet. A haplorthod has developed in the uppoer 5 feet of the layer. Moist-wet, friable-firm soil. Interpreted as a sandy till. Soil is not suitable for the constructin of an absorption pond. | SM | | |

TEST PIT DATA

START DATE: 10/11/94
COMPLETION DATE: 10/11/94
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPA-2

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area A

SURFACE ELEVATION:
PIT DEPTH: 22+ feet
DATE: 10/11/94

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-9' | | | | 5YR3/4-5/4 | Variegated but mainly dark reddish brown - reddish brown, sandy loam (SCS). Trace of gravel and silt. Few, reddish brown-brown (5YR3/4-7.5YR4/4) textural mottles in lower 2 feet of layer. Minimal development of pedogenic horizons. Moist-wet, friable soil. Interpreted as a sandy till. | SM | | |
| | 9-22'+ | 17' | | | 7.5YR5/4 | Brown, sand (SCS). Trace of gravel and silt. Weak coarse geologic layering. Moist, loose soil. Interpreted as glacial outwash. Estimated hydraulic loading rate = 0.8 gpd/sf. | SP | sieve and hydrometer | |

TEST PIT DATA

START DATE: 10/11/94
COMPLETION DATE: 10/11/94
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

3.5-14-86

LOG OF TEST PIT: CMC-TPA-3

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area A

SURFACE ELEVATION:
PIT DEPTH: 19+ feet
DATE: 10/11/94

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-5' | | | | 5YR3/4-5/4 | Variegated, but mainly dark reddish brown-reddish brown, sandy loam (SCS). Trace of gravel and silt. Few, reddish brown-brown (5YR3/4-7.5YRS5/4) textural mottles in the lower foot of the layer. Minimal development of pedogenic horizons. Moist-wet, friable soil. Interpreted as a sandy till. | SM | | |
| | 5-11' | | | | 7.5TR3/4-4/4 | Dark brown, fine loamy sand (SCS). Some silt and a trace of gravel. Moderate, fine geologic layering. Moist, very friable soil. Interpreted as glacial outwash. Estimated hydraulic loading rate = 0.5 gpd/sf. | SP | | |
| | 11-19'+ | 17' | | | 7.5YR3/4-4/4 | Dark brown, loamy sand (SCS). Weak, coarse geologic layering. Moist, loose soil. Interpreted as glacial outwash. Estimated hydraulic loading rate = 0.7 gpd/sf. | SP-SM | Sieve and hydrometer | |

TEST PIT DATA

START DATE: 10/11/94
COMPLETION DATE: 10/11/94
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPA-4

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area A

SURFACE ELEVATION:
PIT DEPTH: 17+ feet
DATE: 10/11/94

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-10.5' | | | | 5YR3/4-5/4 | Variegated, but mainly dark reddish brown-reddish brown, sandy loam (SCS). Trace of gravel and silt. Few, reddish brown-brown (5YR3/4-7.5YR4/4) and reddish yellow (7.5YR6/6-8) textural mottles in the lower half of the layer. Water enters the pit from a thin seam at 5 feet. Minimal development of pedogenic horizons. Moist-wet, friable soil. Interpreted as a sandy till. | SM | | |
| | 10.5-17'+ | | | | 5YR4/4 | Reddish brown, loamy sand-sandy loam (SCS). Some gravel and silt. Moderate coarse geologic layering. Moist, very friable-loose soil. Interpreted as glacial outwash. Estimated hydraulic loading rate = 0.4 gpd/sf. | SM-SP | | |

TEST PIT DATA

START DATE: 10/11/94
COMPLETION DATE: 10/11/94
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPA-5

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area A

SURFACE ELEVATION:
PIT DEPTH: 20+ feet
DATE: 10/11/94

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-10.5' | | | | 5YR3/4-5/4 | Variegated, but mainly dark reddish brown-reddish brown, sandy loam (SCS). Trace of gravel and silt. Few, reddish brown-brown (5YR3/4-7.5YR4/4) and reddish yellow (7.5YR6/6-8) textural mottles in the lower four feet of the layer. Water enters the pit from a thin seam at eight feet. Minimal development of pedogenic horizons. Interpreted as a sandy till. | SM | | |
| | 10.5-20'+ | 20' | | | 5YR4/6 | Yellowish red, loamy sand (SCS). Some gravel and silt. Moderate, coarse geologic layering. Moist, loose soil. Interpreted as a glacial outwash. Estimated hydraulic loading rate = 0.4 gpd/sf. | SM | Sieve and hydrometer | |

TEST PIT DATA

START DATE: 10/ /94
COMPLETION DATE: 10/ /94
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPA-6

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area A

SURFACE ELEVATION:
PIT DEPTH: 16+ feet
DATE: 10/12/94

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-6.5' | | | | 5YR3/4-5/4 | Variegated, but mainly dark reddish brown-reddish brown, sandy loam-loam (SCS). Some gravel and silt. Minimal development of pedogenic horizons. Moist-wet, friable soil. Interpreted as a sandy till. | SM | | |
| | 6.5-13' | | | | 10YR5/4 | Yellowish brown, fine sand (SCS). Trace of gravel and silt. Weak-moderate, coarse geologic layering. Moist, loose soil. Interpreted as glacial outwash. Estimated hydraulic loading rate = 0.6 gpd/sf. | SP | | |
| | 13-16'+ | | | | 10YR5/4 | Yellowish brown, sand (SCS). Trace of gravel and silt. Weak coarse geologic layering. Moist, loose soil. Interpreted as glacial outwash. Estimated hydraulic loading rate = 0.8 gpd/sf. | SP | | |

TEST PIT DATA

START DATE: 10/12/94
COMPLETION DATE: 10/12/94
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:



scope

LOG OF TEST PIT: CMC-TPA-7

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area A

SURFACE ELEVATION:
PIT DEPTH: 17+ feet
DATE: 10/12/94

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-8' | | | | 5YR3/4-5/4 | Variegated, but mainly dark reddish brown-reddish brown, sandy loam-loam (SCS). Some gravel and silt. Minimal development of pedogenic horizons. Interpreted as a sandy till. | SM | | |
| | 8-13.5' | | | | 7.5YR4/4 | Dark Brown, fine-medium sand (SCS). Moderate, medium geologic cross bedding. Moist, loose soil. Interpreted as glacial outwash. Estimated hydraulic loading rate = 0.5 gpd/sf. | SP | | |
| | 13.5-17'+ | | | | 7.5YR4/4 | Dark brown, sand (SCS). Trace of gravel and silt. Weak, coarse geologic layering. Moist, loose soil. Interpreted as glacial outwash. Estimated hydraulic loading rate = 0.8 gpd/sf. | SP | | |

TEST PIT DATA

START DATE: 10/12/94
COMPLETION DATE: 10/12/94
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPA-8

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area A

SURFACE ELEVATION:
PIT DEPTH: 18+ feet
DATE: 10/12/94

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-12' | | | | 5YR3/4-5/4 | Variegated, but mainly dark reddish brown-reddish brown, sandy loam-loam (SCS). Some gravel and silt. Few, reddish brown-brown (5YR3/4-7.5YR4/4) and reddish yellow (7.5YR6/6-8) textural mottles in the lower 7 feet of the layer. Water enters the pit from a thin seam at 6 feet. Minimal development of pedogenic horizons. Moist-wet, friable-firm soil. Interpreted as a sandy till. | SM | | |
| | 12-18'+ | | | | 7.5YR4/4-5YR4/4 | Brown-reddish brown, loamy sand-sandy loam (SCS). Some gravel and silt. Moderate, coarse geologic layering. Moist, very friable-loose soil. Interpreted as glacial outwash. Estimated hydraulic loading rate = 0.4 gpd/sf. | SM | | |

TEST PIT DATA

START DATE: 10/12/94
COMPLETION DATE: 10/12/94
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPA-9

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area A

SURFACE ELEVATION:
PIT DEPTH: 17+ feet
DATE: 10/12/94

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-13' | | | | 5YR3/4-5/4 | Variegated, but mainly dark reddish brown-reddish brown, sandy loam-loam (SCS). Some gravel and silt. Few, reddish brown-brown (5YR3/4-7.5YR4/4) textural mottles in the lower 7 feet of the layer. Water enters the pit from a thin seam at 6 feet. Minimal development of pedogenic horizons. Moist-wet, friable soil. Interpreted as a sandy till. | SM | | |
| | 13-17'+ | 17' | | | 5YR4/4 | Reddish brown, sandy loam-loamy sand (SCS). Some gravel and silt. Moderate, coarse geologic layering. Moist, loose-very friable soil. Interpreted as glacial outwash. Estimated hydraulic loading rate = 0.3 gpd/sf. | SM | sieve and hydrometer | |

TEST PIT DATA

START DATE: 10/12/94
COMPLETION DATE: 10/12/94
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

3.5-14-93

LOG OF TEST PIT: CMC-TPA-10

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area A

SURFACE ELEVATION:
PIT DEPTH: 16+ feet
DATE: 10/12/94

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-11' | | | | 5YR3/4-5/4 | Variegated, but mainly dark reddish brown-reddish brown, sandy loam-loam (SCS). Some gravel and silt. Few reddish brown-brown (5YR3/4.7.5YR4/4) and reddish yellow (7.5YR6/6-8) textural mottles in the lower 6 feet of the layer. Water enters the pit through a thin seam at 6 feet. Minimal development of pedogenic horizons. Moist-wet, very friable-friable soil. Interpreted as a sandy till. | SM | | |
| | 11-16'+ | | | | 5YR4/4 | Reddish brown, loamy sand-sandy loam (SCS). Trace-some gravel and silt. Moderate, coarse geologic layering. Moist, loose-very friable soil. Interpreted as glacial outwash. Estimated hydraulic loading rate = 0.3 gpd/sf. | SM-SP | | |

TEST PIT DATA

START DATE: 10/12/94
COMPLETION DATE: 10/12/94
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

3.5-14-94

LOG OF TEST PIT: CMC-TPA-11

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area A

SURFACE ELEVATION:
PIT DEPTH: 13.5+ feet
DATE: 10/12/94

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-11' | | | | 5YR3/4-5/4 | Variegated, but mainly dark reddish brown-reddish brown, sandy loam-loam (SCS). Some gravel and silt. Few, reddish brown-brown (5YR3/4-7.5YR4/4) textural mottles in the lower 7 feet of the layer. Minimal development of pedogenic horizons. Moist-wet, friable-very friable soil. Interpreted as a sandy till. | SM | | |
| | 11-13.5'+ | | | | 5YR3/4-4/4 | Dark reddish brown-reddish brown sandy loam (SCS). Trace-some gravel and silt. Weak-moderate, coarse geologic layering. Moist, very friable-loose soil. Interpreted as glacial outwash. Estimated hydraulic loading rate = 0.3 gpd/sf. | SM-SP | | |

TEST PIT DATA

START DATE: 10/12/94
COMPLETION DATE: 10/12/94
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPA-12

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area A

SURFACE ELEVATION:
PIT DEPTH: 14+ feet
DATE: 10/12/94

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-10' | | | | 5YR3/4-5/4 | Variegated, but mainly dark reddish brown-reddish brown, sandy loam-loam (SCS). Some gravel and silt. Few reddish brown-brown (5YR3/4-7.5YR4/4) textural mottles in the lower 6 feet of the layer. Water enters the pit through a thin seam at 5 feet. Minimal development of pedogenic horizons. Moist-wet, friable soil. Interpreted as a sandy till. | SM | | |
| | 10-14'+ | | | | 7.5YR4/4 | Brown, sandy loam-loamy sand (SCS). Trace-some gravel and silt. Moderate, coarse geologic layering. Moist, loose-very friable soil. Interpreted as glacial outwash. Estimated hydraulic loading rate = 0.3 gpd/sf. | SM-SP | | |

TEST PIT DATA

START DATE: 10/12/94
COMPLETION DATE: 10/12/94
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPA-13

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area A

SURFACE ELEVATION:
PIT DEPTH: 14+ feet
DATE: 10/12/94

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-5' | | | | 5YR3/4-5/4 | Variegated, but mainly dark reddish brown-reddish brown, loam (SCS). Some gravel and silt. Minimal development of pedogenic horizons. Moist-wet, friable soil. Interpreted as a sandy till. | SM | | |
| | 5-14'+ | | | | 7.5YR4/4 | Strong brown, sand (SCS). Trace of gravel and silt. Weak, coarse geologic layering. Moist, loose soil. Interpreted as glacial outwash. Estimated hydraulic loading rate = 0.8 gpd/sf. | SP | | |

TEST PIT DATA

START DATE: 10/12/94
COMPLETION DATE: 10/12/94
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPA-14

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area A

SURFACE ELEVATION:
PIT DEPTH: 15+ feet
DATE: 10/12/94

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-8' | | | | 5YR4/4-5/4 | Variegated, but mainly dark reddish brown-reddish brown, sandy loam (SCS). Some gravel and silt. Minimal development of pedogenic horizons. Moist-wet, friable-very friable soil. Interpreted as sandy till. | SM | | |
| | 8-15'+ | | | | 7.5YR4/6 | Strong brown, sand (SCS). Trace of gravel and silt. Weak, coarse geologic layering. Moist, loose soil. Interpreted as glacial outwash. Estimated hydraulic loading rate = 0.8 gpd/sf. | SM | | |

TEST PIT DATA

START DATE: 10/12/94
COMPLETION DATE: 10/12/94
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPA-15

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area A

SURFACE ELEVATION:
PIT DEPTH: 15+ feet
DATE: 10/19/94

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-2' | | | | 5YR3/2-3/4 | Variegated, but mainly dark reddish brown, clay loam (SCS). Some gravel and silt. Few, reddish brown-brown (5YR3/4-7.5YR4/4) textural mottles. Moderate development of pedogenic horizons. Moist-wet, friable-firm soil. Interpreted as a clayey till. | SC-CL | | |
| | 2-7.5' | | | | 5YR3/4-5/4 | Variegated, but mainly dark reddish brown-reddish brown, sandy loam-loam (SCS). Some gravel and silt. Few, reddish brown-brown (5YR3/4-7.5YR4/4) textural mottles. Water enters the pit through a thin seam at 2 feet. Minimal development of pedogenic horizons. Moist-wet, friable soil. Interpreted as a sandy till. | SM | | |
| | 7.5-15'+ | 13' | | | 7.5YR4/4-10YR4/4 | Brown-dark yellowish brown , loamy sand (SCS). Trace of gravel and silt. Weak, geologic cross bedding in upper two feet. Weak-moderate, geologic layering below 9.5 feet. Moist, loose soil. Interpreted as glacial outwash. Estimated hydraulic loading rate = 0.6 gpd/sf. | SP-SM | sieve and hydrometer | |

TEST PIT DATA

START DATE: 10/19/94
COMPLETION DATE: 10/19/94
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

3.5-14-99

LOG OF TEST PIT: CMC-TPA-16

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area A

SURFACE ELEVATION:
PIT DEPTH: 11+ feet
DATE: 10/19/94

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-6' | | | | 5YR2.5/1-3/3 | Variegated, black-dark reddish brown, clay loam-sandy clay loam (SCS). Some gravel and silt. Few, reddish brown-brown (5YR3/4-7.54/4) and common, reddish yellow (7.5YR6/6-8) textural mottles. Water enters pit from entire layer. Minimal development of pedogenic horizons. Wet, firm soil. Interpreted as colluvium. | SC-CL | | |
| | 6-11'+ | | | | 5YR3/4-5/4 grading to 5YR5/3-6/2 | Variegated dark reddish brown-reddish brown grading to reddish brown-pinkish gray sandy loam - loam (SCS). Some gravel and silt. Few, reddish brown-brown (5YR3/4-7.5YR4/4) and reddish yellow (7.5YR6/6-8) textural mottles in upper two feet of layer. Wet, firm soil. Interpreted as a sandy till. Soil not suitable for the construction of an absorption pond. | SM | | |

TEST PIT DATA

START DATE: 10/19/94
COMPLETION DATE: 10/19/94
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPA-17

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area A

SURFACE ELEVATION:
PIT DEPTH: 14+ feet
DATE: 10/19/94

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-6' | | | | 5YR3/4-5/4 | Variegated, dark reddish brown-reddish brown, loam (SCS). Some gravel and silt. Few, reddish brown-brown (5YR3/4-7.5YR4/4) textural mottles. Water enters the pit through a thin seam at four feet. Minimal development of pedogenic horizons. Moist-wet, friable soil. Interpreted as a sandy till. | SM | | |
| | 6-11' | | | | 7.5YR4/4 | Brown, sandy loam-loamy sand (SCS). Trace of gravel and silt. Weak, fine geologic layering. Few, reddish brown-brown (5YR3/4-7.5YR4/4) textural mottles in the upper four feet of the layer. Water enters the pit through a thin seam at eight feet. Moist-wet, very friable soil. Interpreted as glacial outwash. | SP-SM | | |
| | 11-14'+ | 13' | | | 7.5YR4/4 | Brown, sand (SCS). Trace of gravel and silt. Weak, coarse geologic layering. Moist, loose soil. Interpreted as glacial outwash. Estimated hydraulic loading rate = 0.8 gpd/sf. | SP | sieve and hydrometer | |

TEST PIT DATA

START DATE: 10/19/94
COMPLETION DATE: 10/19/94
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPA-18

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area A

SURFACE ELEVATION:
PIT DEPTH: 19+ feet
DATE: 10/19/94

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-10' | | | | 5YR3/4-5/3 | Variegated, but mainly dark reddish brown-reddish brown, sandy loam-loam (SCS). Some gravel and silt. Few reddish yellow (7.5YR6/6-8) textural mottles in the upper four feet of layer. Water enters pit through a thin seam at two feet. Minimal development of pedogenic horizons. Moist-wet, friable-firm soil. Interpreted as a sandy till. | SM | | |
| | 10-15' | | | | 7.5YR4/4-10YR4/4 | Brown-dark yellowish brown, loamy sand-sandy loam (SCS). Weak, coarse geologic layering. Moist, loose-very friable soil. Interpreted as glacial outwash. Estimated hydraulic loading rate = 0.6 gpd/sf. | SP-SM | | |
| | 15-19'+ | | | | 7.5YR4/4-10YR4/4 | Brown-dark yellowish brown, sand (SCS). Trace of gravel and silt. Weak, coarse geologic layering. Moist, loose soil. Interpreted as glacial outwash. Estimated hydraulic loading rate = 0.8 gpd/sf. | SP | | |

TEST PIT DATA

START DATE: 10/19/94
COMPLETION DATE: 10/19/94
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPB-1

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area B

SURFACE ELEVATION:

PIT DEPTH: 19+ feet

DATE: 2/10/95

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-6' | | | | 5YR3/4-5/4 | Variegated, but mainly dark reddish brown-reddish brown, loam-clay loam (SCS). Some gravel and silt. Minimal development of pedogenic horizons. Moist, loose soil. Interpreted as a sandy till. | SM-SC | | |
| | 6-12' | | | | 7.5YR5/6 | Strong brown, loam-clay loam (SCS). Some gravel and silt. Moist-wet, firm soil. Interpreted as a sandy till. | SM-CL | | |
| | 12-19'+ | | | | | Variegated, geologically interlayered series of soil including: | | | |
| | 12-14' | | | | | Silt loam-silty clay loam (SCS) | SM-SC | | |
| | 14-16' | | | | | Sandy loam (SCS) | SM | | |
| | 16-19'+ | | | | | Clay loam (SCS) | SC | | |

TEST PIT DATA

START DATE: 2/10/95
COMPLETION DATE: 2/10/95
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPC-1

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area C

SURFACE ELEVATION:

PIT DEPTH: 17+ feet

DATE: 2/10/95

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-5' | | | | 5YR3/4-5/4 | Variegated, but mainly dark reddish brown-reddish brown, sandy loam (SCS). Some gravel and silt. Few, reddish brown-brown (5YR3/4-7.5YR5/4) textural mottles in lower one foot of layer. Moist, wet friable soil. Interpreted as a sandy till. | SM | | |
| | 5-17'+ | | | | 7.5YR5/6 | Strong brown, sandy loam (SCS). Common, 1/2-1 1/2 inch thick layers of reddish brown silty clay loam-clay loam (SCS). Coarse geologic layering. Interpreted as interlayered and clayey outwash. Estimated hydraulic loading rate = 0.2 gpd/sf. | SM | | |

TEST PIT DATA

START DATE: 2/10/95
COMPLETION DATE: 2/10/95
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPC-2

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area C

SURFACE ELEVATION:
PIT DEPTH: 15+ feet
DATE: 2/10/95

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-10.5' | | | | 5YR3/4 | Dark reddish brown, sandy loam (SCS). Some gravel and silt. Minimal development of pedogenic horizons. Moist-wet, friable soil. Interpreted as a sandy till. | SM | | |
| | 10.5-15'+ | | | | 5YR5/4 | Reddish brown, loam (SCS). Some gravel and silt. Weak, coarse geologic layering. Moist-wet, friable soil. Interpreted as reworked sandy outwash. Estimated hydraulic loading rate = <0.2 gpd/sf. | SM | | |

TEST PIT DATA

START DATE: 2/10/95
COMPLETION DATE: 2/10/95
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPD-1

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area D

SURFACE ELEVATION:
PIT DEPTH: 17+ feet
DATE: 2/10/95

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-9' | | | | 5YR3/4-5/4 | Dark reddish brown-reddish brown, sandy loam (SCS). Some gravel and silt. Minimal development of pedogenic horizons. Moist-wet, friable soil. Interpreted as a sandy till. | SM | | |
| | 9-17'+ | | | | 7.5YR5/6 | Strong brown, sandy loam (SCS). Weak, coarse geologic layering. Moist, loose soil. Interpreted as glacial outwash. Estimated hydraulic loading rate = 0.4 gpd/sf. | SM | | |

TEST PIT DATA

START DATE: 2/10/95
COMPLETION DATE: 2/10/95
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPD-2

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area D

SURFACE ELEVATION:
PIT DEPTH: 17+ feet
DATE: 2/10/95

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-10' | | | | 5YR3/4-5/4 | Variegated, but mainly dark reddish brown-reddish brown, sandy loam (SCS). Some gravel and silt. Minimial development of pedogenic horizons. Moist-wet, friable soil. Interpreted as a sandy till. | SM | | |
| | 9-17'+ | | | | 7.5YR5/4 | Strong brown, loam-clay loam (SCS). Moderate, coarse geologic layering. Moist-wet, friable-firm soil. Interpreted as interlayering sandy and clayey outwash. Estimated hydraulic loading rate = 0.2 gpd/sf. | SM-SC | | |

TEST PIT DATA

START DATE: 2/10/95
COMPLETION DATE: 2/10/95
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPD-3

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area D

SURFACE ELEVATION:

PIT DEPTH: 15+ feet

DATE: 2/10/95

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-9' | | | | 5YR5/4 | Reddish brown, sandy loam (SCS). Trace-some gravel and silt. Minimal development of pedogenic horizons. Moist, friable soil. Interpreted as a sandy till. | SM | | |
| | 9-15'+ | | | | 7.5YR5/6 | Strong brown, sandy loam (SCS). Weak, coarse geologic layering. Moist loose-friable soil. Interpreted as glacial outwash. Estimated hydraulic loading rate = 0.4 gpd/sf. | SM-SP | | |

TEST PIT DATA

START DATE: 2/10/95
COMPLETION DATE: 2/10/95
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPD-4

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area D

SURFACE ELEVATION:

PIT DEPTH: 16+ feet

DATE: 2/10/95

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-8' | | | | 5YR5/4 | Dark reddish brown, sandy loam-loam (SCS) Trace of gravel. Minimal development of pedogenic horizons. Interpreted as a sandy till. | SM | | |
| | 8-16'+ | | | | 5YR5/4-7-5YR5/4 | Reddish brown-strong brown loam-clay loam (SCS). Weak, coarse geologic layering. Moist-wet friable soil. Interpreted as fine glacial outwash. Estimated hydraulic loading rate = <0.2 gpd/sf. | SM-SC | | |

TEST PIT DATA

START DATE: 2/10/95
COMPLETION DATE: 2/10/95
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPE-1

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area E

SURFACE ELEVATION:

PIT DEPTH: 14 + feet

DATE: 2/10/95

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-5' | | | | 5YR4/4-5/4 | Variegated but mainly dark reddish brown-reddish brown, sandy loam (SCS). Trace of gravel and silt. Common reddish brown-brown (5YR3/4-7.5Y44/4) textural mottles in lower 2 feet of layer. Minimal development of pedogenic horizons. Moist-wet, loose soil. Interpreted to be a sandy till. | SM | | |
| | 5-14' | 8-9' | | | 7.5YR5/6 | Strong brown sand (SCS). Trace of silt and gravel. Weak, fine geologic layering from 5-7 feet, and weak, coarse geologic layering from 7-14 feet. Moist, loose soil. Interpreted to be glacial outwash. Estimated hydraulic loading rate = 0.8 gpd/sf. | SP | Sieve & Hydrometer | |

TEST PIT DATA

START DATE: 2/10/95
COMPLETION DATE: 2/10/95
LOGGED BY: JET
METHOD: BACKHOE
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPE-2

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area E

SURFACE ELEVATION:
PIT DEPTH: 15 + feet
DATE: 2/10/95

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-14' | | | | 5YR4/4-5/4 | Variegated but mainly dark reddish brown-reddish brown, sandy loam (SCS). Trace of silt and gravel. Minimal development of pedogenic horizons. Moist, loose soil. Interpreted to be a sandy till. Estimated hydraulic loading rate = 0.4 gpd/sf. | SM | | |
| | 14'-15+' | | | | 7.5YR4/2-4/3 | Dark brown, gravelly sandy loam (SCS). Some gravel, trace of silt. Moist, loose soil. Interpreted to to be a gravelly sandy till. Estimated hydraulic loading rate = 0.4 gpd/sf. | SM-GM | | |

TEST PIT DATA

START DATE: 2/10/95
COMPLETION DATE: 2/10/95
LOGGED BY: JET
METHOD: BACKHOE
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPE-3

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area E

SURFACE ELEVATION:
PIT DEPTH: 14 + feet
DATE: 2/10/95

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-4' | | | | 5YR4/4-5/4 | Variegated but mainly dark reddish brown-reddish brown, sandy loam (SCS). Trace of silt and gravel. Few reddish brown-brown (4YR3/4-7.4YR4/4) textural mottles in lower 1 foot of layer. Minimal development of pedogenic horizons. Moist-wet, loose soil. Interpreted to be a sandy till. | SM | | |
| | 4-12' | 8-10' | | | 7.5YR4/6-5/6 | Strong brown, sand (SCS). Trace of gravel and silt. Weak, coarse geologic layering. Moist, loose soil. Interpreted to be glacial outwash. Estimated hydraulic loading rate = 0.8 gpd/sf. | SP | | |
| | 12-14'+ | 12-14' | | | 7.5YR4/4 | Brown, gravelly loamy sand (SCS). Some gravel and trace of silt. Weak, coarse geologic layering. Moist, loose soil. Interpreted to be glacial outwash. Estimated hydraulic loading rate = 0.6 gpd/sf. | SW-SM | | |

TEST PIT DATA

START DATE: 2/10/95
COMPLETION DATE: 2/10/95
LOGGED BY: JET
METHOD: BACKHOE
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPE-4

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area E

SURFACE ELEVATION:
PIT DEPTH: 11 + feet
DATE: 2/10/95

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-4' | | | | 5YR4/4-5/4 | Variegated but mainly dark reddish brown-reddish sandy loam (SCS). Trace of silt and gravel. Minimal development of pedogenic horizons. Moist loose soil. Interpreted to be a sandy fill. | SM | | |
| | 4-11'+ | | | | 5YR5/4 | Reddish brown, sandy loam (SCS). Trace of gravel and silt. Contains layers, 0.5-1 foot thick of dark yellowish brown-yellowish brown (10YR4/6-5/6) gravely sand (SCS), or SP-SM (USCS). Moist, loose soil. Interpreted to be interfingered sandy till and glacial outwash. Estimated hydraulic loading = 0.3 gpd/sf. | SM-ML | | |

TEST PIT DATA

START DATE: 2/10/95
COMPLETION DATE: 2/10/95
LOGGED BY: JET
METHOD: BACKHOE
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPE-5

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area E

SURFACE ELEVATION:
PIT DEPTH: 10 + feet
DATE: 2/10/95

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-5' | | | | 5YR4/4-5/4 | Variegated but mainly dark reddish brown-reddish brown, sandy loam (SCS). Trace of gravel and silt. Minimal development of pedogenic horizons. Moist-wet, loose soil. Interpreted as a sandy till. | SM | | |
| | 5-10'+ | 8-9' | | | 7.5YR4/6-5/6 | Strong brown, sand (SCS). Some gravel and trace of silt. Weak, coarse geologic layering. Moist, loose soil. Interpreted as glacial outwash. Estimated hydraulic loading rate = 0.8 gpd/sf. | SP | Sieve and Hydrometer | |

TEST PIT DATA

START DATE: 2/10/95
COMPLETION DATE: 2/10/95
LOGGED BY: JET
METHOD: BACKHOE
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPE-6

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area E

SURFACE ELEVATION:
PIT DEPTH: 9+ feet
DATE: 2/10/95

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-3' | | | | 5YR4/4-5/4 | Variegated but mainly dark reddish brown-reddish brown, sandy loam (SCS). Trace of silt and gravel. Minimal development of pedogenic horizons. Moist, loose soil. Interpreted to be a sandy till. | SM | | |
| | 3-9' | 8-9' | | | 7.5YR4/6-5/6 | Strong brown, sand (SCS). Trace of gravel and silt. Weak, coarse geologic layering. Moist, loose soil. Interpreted to be glacial outwash. estimated hydraulic loading rate = 0.8 gpd/sf. | SP | Sieve and Hydrometer | |

TEST PIT DATA

START DATE: 2/10/95
COMPLETION DATE: 2/10/95
LOGGED BY: JET
METHOD: BACKHOE
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPE-7

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area E

SURFACE ELEVATION:

PIT DEPTH: 9+ feet

DATE: 2/10/95

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | -0-2.5' | | | | 5YR4/4-5/4 | Variegated but mainly dark reddish brown-reddish brown sandy loam (SCS). Trace of silt and gravel. Minimal development of pedogenic horizons. Moist-wet, loose soil Interpreted to be a sandy glacial till. | SM | | |
| | -2.5-9'+ | 8-9' | | | 7.5YR4/6 | Strong brown, sand (SCS). Trace of gravel and silt. Weak, coarse geologic layering. Interpreted to be glacial outwash. Estimated hydraulic loading rate = 0.8 gpd/sf. | SP | Sieve and Hydrometer | |

TEST PIT DATA

START DATE: 2/10/95
COMPLETION DATE: 2/10/95
LOGGED BY: JET
METHOD: BACKHOE
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPE-8

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area E

SURFACE ELEVATION:
PIT DEPTH: 8+ feet
DATE: 2/10/95

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-1.5' | | | | 5YR4/4-5/4 | Variegated but mainly dark reddish brown-reddish brown, sandy loam-loam (SCS). Trace of silt and gravel. Minimal development of pedogenic horizons. Moist, loose soil. Interpreted to be a sandy till. | SM | | |
| | 1.5-8'+ | 7-8' | | | 7.5YR4/6-5/6 | Strong brown, sand (SCS). Trace of gravel and silt. Weak, coarse geologic layering. Interpreted to be glacial outwash. Estimated hydraulic loading rate = 0.8 gpd/sf. | SP | Sieve and Hydrometer | |

TEST PIT DATA

START DATE: 2/10/95
COMPLETION DATE: 2/10/95
LOGGED BY: JET
METHOD: BACKHOE
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPE-9

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area E

SURFACE ELEVATION:

PIT DEPTH: 8+ feet

DATE: 2/10/95

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-1' | | | | 5YR4/4-5/4 | Variegated but mainly dark reddish brown-reddish brown, sandy loam (SCS). Trace of gravel and silt. Minimal development of pedogenic horizons. Moist-wet, loose soil. Interpreted to be a sandy till. | SM | | |
| | 1-8'+ | 7-8' | | | 7.5YR5/6 | Strong brown, sand (SCS). Trace of gravel and silt. Weak, coarse geologic layering. Interpreted to be glacial outwash. Estimated hydraulic loading rate = 0.8 gpd/sf. | SP | Sieve and Hydrometer | |

TEST PIT DATA

START DATE: 2/10/95
COMPLETION DATE: 2/10/95
LOGGED BY: JET
METHOD: BACKHOE
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPE-10

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area E

SURFACE ELEVATION:
PIT DEPTH: 6+ feet
DATE: 2/10/95

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-4' | | | | 5YR4/4-5/4 | Variegated but mainly dark reddish brown-reddish brown, sandy loam (SCS). Trace of silt and gravel. Minimal development of pedogenic horizons. Moist, loose soil. Interpreted to be a sandy till. | SM | | |
| | 4-6'+ | 5-6' | | | 10YR4/6-5/6 | Dark yellowish brown-yellowish brown, sand (SCS). Trace of gravel and silt. Weak, coarse geologic layering. Moist, loose soil. Interpreted to be glacial outwash. Estimated hydraulic loading rate = 0.8 gpd/sf. | SP | Sieve and Hydrometer | |

TEST PIT DATA

START DATE: 2/10/95
COMPLETION DATE: 2/10/95
LOGGED BY: JET
METHOD: BACKHOE
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPE-11

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area E

SURFACE ELEVATION:
PIT DEPTH: 6+ feet
DATE: 2/10/95

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-1.5' | | | | 5YR4/4-5/4 | Variegated but mainly dark reddish brown-reddish brown, sandy loam-loam (SCS). Trace of gravel and silt. Minimal development of pedogenic horizons. Moist, loose soil. Interpreted to be a sandy till. | SM-ML | | |
| | 1.5-6'+ | 5-6' | | | 7.5YR4/6-5/6 | Strong brown, sand (SCS). Some gravel and a trace of silt. Weak, coarse geologic layering. Moist, loose soil. Interpreted to be glacial outwash. Estimated hydraulic loading rate = 0.8 gpd/sf. | SP | Sieve and Hydrometer | |

TEST PIT DATA

START DATE: 2/10/95
COMPLETION DATE: 2/10/95
LOGGED BY: JET
METHOD: BACKHOE
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPE-12

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area E

SURFACE ELEVATION:
PIT DEPTH: 8+ feet
DATE: 2/10/95

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-3' | | | | 5YR4/4-5/4 | Variegated but mainly dark reddish brown-reddish brown, sandy loam (SCS). Trace of gravel and silt. Minimal development of pedogenic horizons. Moist, loose soil. Interpreted to be a sandy till. | SM | | |
| | 3-8'+ | 7-8' | | | 7.5YR4/6 | Strong brown, sand (SCS). Travel of gravel and silt. Weak, coarse geologic layering. Moist, loose soil. Interpreted to be glacial outwash. Estimated hydraulic loading rate = 0.8 gpd/sf. | SP | Sieve and Hydrometer | |

TEST PIT DATA

START DATE: 2/10/95
COMPLETION DATE: 2/10/95
LOGGED BY: JET
METHOD: BACKHOE
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

LOG OF TEST PIT: CMC-TPE-13

CLIENT: Crandon Mining Company
PROJECT: Absorption Pond Evaluation
PROJECT NUMBER: 93C049
LOCATION: Area E

SURFACE ELEVATION:
PIT DEPTH: 9+ feet
DATE: 2/10/95

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-9'+ | 8-9' | | | 5YR3/4-4/4 | Variegated but mainly dark reddish brown-reddish brown, sandy loam (SCS). Trace of silt and gravel. Minimal development of pedogenic horizons. Moist, loose soil, interpreted to be a sandy till. Estimated hydraulic loading rate = 0.4 gpd/sf. | SP | Sieve and Hydrometer | |

TEST PIT DATA

START DATE: 2/10/95
COMPLETION DATE: 2/10/95
LOGGED BY: JET
METHOD: BACKHOE
CONTRACTOR:

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:

Thresher & Son, Inc. February 26, 1996 Technical Memorandum
Re: Fragipan Investigation Evaluation Near the Bur Oak Swamp

**MEMORANDUM**

**To:** **Jerry W. Sevick, Foth & Van Dyke**
**Don Moe, Crandon Mining Company**

**From:** **John E. Thresher, Jr., Thresher & Son, Inc.**

**Date:** **February 26, 1996**

**re: Fragipan Investigation Evaluation near the Burr Oak Swamp**

On February 7, 1996, Crandon Mining Company (CMC) has conducted an investigation of the soils developed in a drumlin to the east and southeast of the Burr Oak Swamp at the proposed project site to determine if fragipans are present in the soil, and to evaluate their potential influence, if present, on recharge to the swamp (wetland). The area investigated is along the northwestern margin of the proposed tailings management area (TMA). Mr. Chris Carlson with WDNR was present to view the soil profiles for six of the seven test pits.

Seven test pits were dug using a backhoe in the soils across and down the west-facing slope of the drumlin at the locations shown on Drawing No. 1. Detailed descriptions of the test pit soils are contained in the attached appendix.

Fragipans were found in the two pits (CMC-TMA-TP4 and 5) dug at the slope break. Fragipans were not found in the test pits dug upslope and downslope from CMC-TMA-TP4 and 5. Three of the non fragipan-bearing pits (CMC-TMA-TP1, 2 and 6) contained thin layers of soil having a firm soil consistence which differentiated them from the surrounding friable materials. The firm layers do not meet the requirements for a fragipan classification (Witty and Knox, 1989) but appear to be morphologically and spatially related to the fragipan layers. The firm layers lack the high degree of soil consistence required to be classed fragipans.

The fragipan layers were developed in glacial till material. The firm layers in some of the non fragipan-bearing pits were developed in till (CMC-TMA-TP1 and 2) or in both loess and till (CMC-TMC-TP6). The material in which the fragipan and/or firm layers were formed, and the slope position of the fragipans locations are common to other localities (Bridges, 1978 and Franzmeier, et. al., 1989).

A soil survey of Forrest County has recently been completed by others. A preliminary evaluation and correlation of the soils in the county suggests that scattered fragiorthods (spodisols that contain a fragipan) might be found near the eastern end of the proposed Crandon Project site (SCS, personal communication). The soils found at CMC-TMA-TP4

and 5 would be classified as a fragiorthods. The soils found at the other test pits would likely be classified as quartzipsamments (entisols in which >95% of the sand-sized fraction consists of quartz and other resistant minerals) (Buol, et. al., 1989).

No evidence of textural mottling, and no evidence of features related to horizontal flow of water, above either the fragipans or the firm layers was found within the soil record. Whereas fragipans are considered to have lead to the development of such drainage features at other sites, the presence of moderately to strongly developed structures within the fragipan and firm layers at the site enhances internal vertical soil drainage, thereby maintaining well drained conditions within these soils. An empirical relationship between soil texture, structure and consistence, and internal soil drainage, can be found in Wis. Admin. Code ILHR 83, Table 0. Based upon the information contained within this table it would be predicted that the soils evaluated at the site would be well drained, a conclusion which verifies the evaluation performed in the field.

Respectfully submitted,

John E. Thresher, Jr.

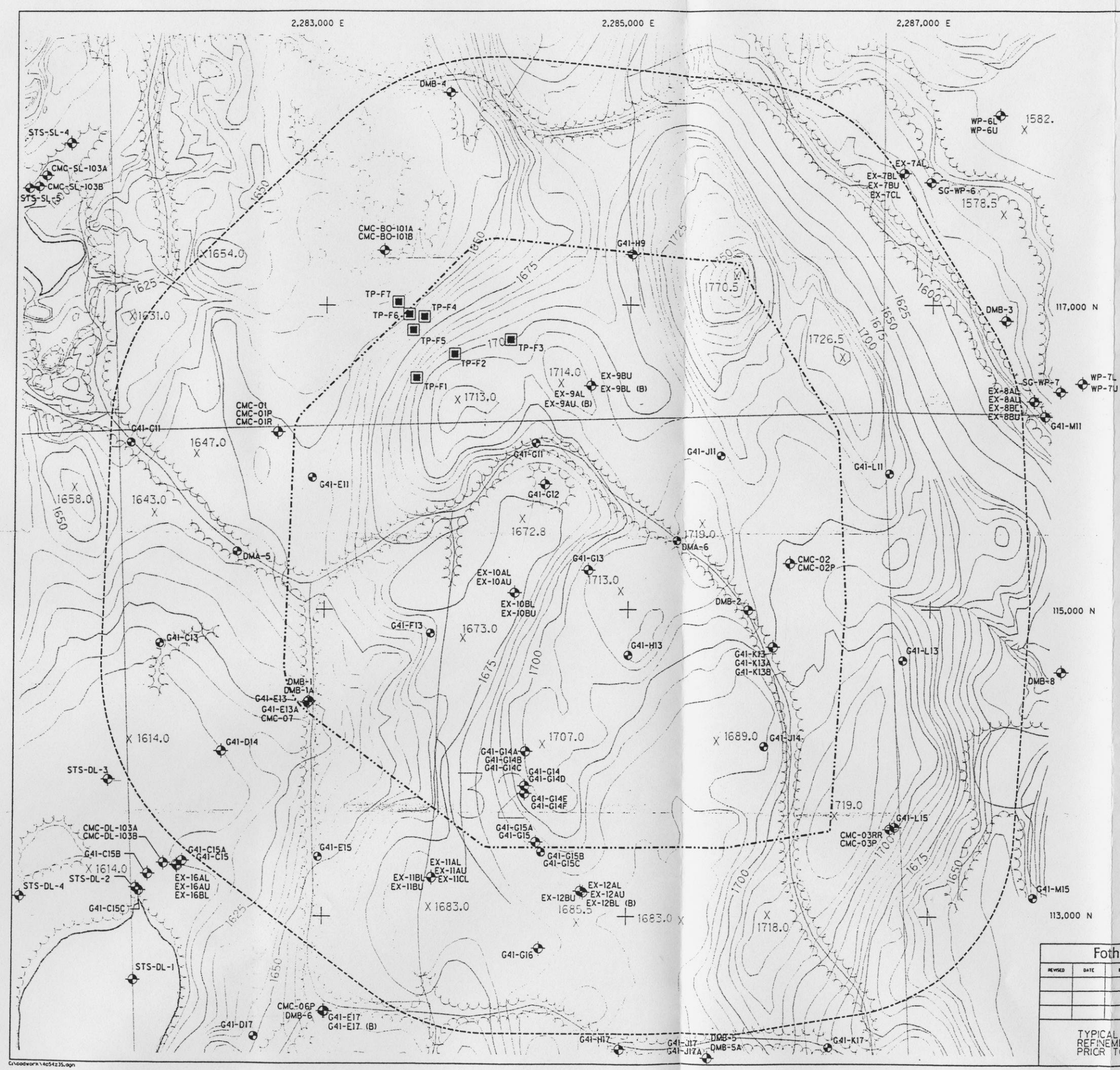
**References**

Bridges, E.M. 1978. *World Soils*. Cambridge University Press. New York, New York.

Buol, S.W., F.D. Hole and R.J. McCraken. 1989. *Soil Genesis and Classification*. Iowa State University Press. Ames, Iowa.

Franzmeier, D.P., L.D. Norton and G.C. Steinhardt. 1989. Fragipan Formation in Loess of the Midwestern United States. in N.E. Smeck and E.J. Ciolkosz, eds. *Fragipans: Their Occurrence, Classification, and Genesis*. SSSA Special Publication No. 24. Soil Science Society of America. Madison, Wisconsin. pp. 69-98.

Witty, J.E. and E.G. Knox. 1989. Identification, Role in Soil Taxonomy, and Worldwide Distribution of Fragipans. in N.E. Smeck and E.J. Ciolkosz, eds. *Fragipans: Their Occurrence, Classification, and Genesis*. SSSA Special Publication No. 24. Soil Science Society of America. Madison, Wisconsin. pp. 1-10.




LEGEND

- LAKES
- STREAMS
- EXISTING ROAD
- —1675— EXISTING CONTOUR
- 1692.0 X SPOT ELEVATION
- SECTION LINE
- PERIMETER OF MINE WASTE SITE (AS PER NR182)
- COMPLIANCE BOUNDARY
- SOIL BORING LOCATION (SEE NOTE 5)
- MONITORING WELL LOCATION (SEE NOTE 5)
- TEST PIT LOCATION (SEE NOTE 5)

NOTES:

1. TOPOGRAPHIC BASE MAP DIGITIZED FROM 1"=1000' SCALE, 5' CONTOUR INTERVAL MAP PREPARED BY AERO-METRIC ENGINEERING, INC., SHEBOYGAN, WISCONSIN. DATE OF PHOTOGRAPHY APRIL 28, 1976.
2. HORIZONTAL DATUM BASED ON WISCONSIN STATE PLANE COORDINATE SYSTEM - NORTH ZONE.
3. VERTICAL DATUM BASED ON MEAN SEA LEVEL DATUM. CONTOUR INTERVAL IS FIVE FEET.
4. COUNTY AND TOWNSHIP LINES DIGITIZED FROM 7.5' SERIES USGS MAPS.
5. SOIL BORING, TEST PIT OR MONITORING WELL NUMBERS ADJACENT TO SYMBOL.

SCALE
0 300' 600'

Crandon Mining Company

Foth & Van Dyke

| REVISED | DATE | BY | DESCRIPTION |
|---|---|---|---|
| | | | |

TYPICAL REPRESENTATION; REFINEMENTS MAY BE MADE PRIOR TO CONSTRUCTION

TITLE: LOCATION OF FRAGIPAN TEST PITS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| SCALE | AS SHOWN | STATE | WISCONSIN | COUNTY | FOREST | | |
| DRAWN BY | GAM | DATE | 3/96 | CHECKED BY | A | DATE | 3/96 |
| APPROVED BY | | DATE | 3/96 | APPROVED BY | A | DATE | 3/96 |
| APPROVED BY | | DATE | 3/96 | CRANDON MINING COMPANY | DEM | DATE | 3/96 |
| DRAWING NO. | A | SHEET OF | | REVISION NO. | C | | |

3.5-14-126

©1996 Foth & Van Dyke and Associates, Inc.

G:\cadwork\4c54235.dgn
02/27/96 GAM

# Appendix 1

## Soil Test Pit Logs

LOG OF TEST PIT: CMC-TMA-TP1

CLIENT: Crandon Mining Company
PROJECT: Fragipan Evaluation
PROJECT NUMBER: 93C049
LOCATION: Tailings Management Area (TMA)

SURFACE ELEVATION: 1688.2 feet msl
PIT DEPTH: 96 inches
DATE: 02/07/96

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-23" | | | | | Variegated, black-dark reddish brown, silt loam (SCS). Some gravel. Moist, friable soil. Weak, medium coarse granular structure. | SM | | |
| | 23-35" | | | | | Variegated, dark reddish brown, silty clay loam (SCS). Trace gravel. Moist soil. Soil consistence mainly friable, but layer contains a few thin, firm layers. Material has moderate, coarse subangular blocky structure. No evidence of textural mottling associated with the firm layers. | CL | | |
| | 35-96+" | | | | | Reddish brown, fine sandy loam (SCS). Trace gravel. Moist, friable soil. Weak, coarse granular structure developed in moderate, coarse geologic layering. | SM | | |

TEST PIT DATA

START DATE: 02/07/96
COMPLETION DATE: 02/07/96
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR: —

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION: —
LATER TIME/DEPTH: —
LATER TIME/DEPTH: —
CAVE IN DEPTH: —

LOG OF TEST PIT: CMC-TMA-TP2

CLIENT: Crandon Mining Company
PROJECT: Fragipan Evaluation
PROJECT NUMBER: 93C049
LOCATION: Tailings Management Area

SURFACE ELEVATION: 1697.5 feet msl
PIT DEPTH: 58 inches
DATE: 02/07/96

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-58+" | | | | | Variegated, black to dark reddish brown, silt loam grading to silty clay loam grading to sandy loam (SCS). Trace gravel. Moist soil. Soil consistence mainly friable, but soil contains two 4" thick layers of firm material (at 22 and 40" depth). Firm layers have strong, coarse angular blocky structure. No evidence of textural mottling associated with these firm layers. No evidence of horizontal water movement over the top of the firm layers. | SM | | |

TEST PIT DATA

START DATE: 02/07/96
COMPLETION DATE: 02/07/96
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR: —

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION: —
LATER TIME/DEPTH: —
LATER TIME/DEPTH: —
CAVE IN DEPTH: —

LOG OF TEST PIT: CMC-TMA-TP3

CLIENT: Crandon Mining Company
PROJECT: Fragipan Evaluation
PROJECT NUMBER: 93C049
LOCATION: Tailings Management Area

SURFACE ELEVATION: 1696.3 feet msl
PIT DEPTH: approx. 60 inches
DATE: 02/07/96

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-60+" | | | | | Variegated, black to dark reddish brown, silt loam grading to silty clay loam grading to sandy loam (SCS). Water seeping into pit from several locations and depths below about 24". Moist to wet, friable soil. Did not enter pit, but soil appears to have some minor soil consistence discontinuities similar to those noted in CMC-TMA-TP2. | SM | | |

TEST PIT DATA

START DATE: 02/07/96
COMPLETION DATE: 02/07/96
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR: —

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION: —
LATER TIME/DEPTH: —
LATER TIME/DEPTH: —
CAVE IN DEPTH: —

LOG OF TEST PIT: CMC-TMA-TP4

CLIENT: Crandon Mining Company
PROJECT: Fragipan Evaluation
PROJECT NUMBER: 93C049
LOCATION: Tailings Management Area

SURFACE ELEVATION: 1665.0 feet msl
PIT DEPTH: 53 inches
DATE: 02/07/96

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-2" | | | | | Black, silt loam (SCS). Moist, friable topsoil. | SM | | |
| | variable 2 to 4-6" | | | | | Light gray, silt loam (SCS). Moist-dry, friable. Developing elluvial (E) horizon. | SM | | |
| | variable 5 to 13-15" | | | | | Dark reddish brown, sandy clay loam (SCS). Moist, very firm to indurated. Hydrous iron oxide cement appears to be dominant cementing agent. Strong, coarse subangular blocky structure. Some of the overlying E horizon Fingers down the margins of the subangular blocks. Classified as a fragipan. No evidence of textural mottling above layer, and no evidence of horizontal movement of water over top of layer. | SM-SC | | |
| | 14-53+" | | | | | Reddish brown, sandy loam (SCS). Moist, friable soil. Weak, coarse granular structure developed in strong, coarse geologic layering. | SM | | |

TEST PIT DATA

START DATE: 02/07/96
COMPLETION DATE: 02/07/96
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR: —

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION: —
LATER TIME/DEPTH: —
LATER TIME/DEPTH: —
CAVE IN DEPTH: —

LOG OF TEST PIT: CMC-TMA-TP5

CLIENT: Crandon Mining Company
PROJECT: Fragipan Evaluation
PROJECT NUMBER: 93C049
LOCATION: Tailings Management Area

SURFACE ELEVATION: 1665.8 feet msl
PIT DEPTH: 65 inches
DATE: 02/07/96

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-15" | | | | | Variegated, black to dark reddish brown, silt loam to silty clay loam (SCS). Moist, friable soil. | SM-CL | | |
| | 15-65+" | | | | | Dark reddish brown, sandy clay loam (SCS). Moist, very firm to indurated. Hydrous iron oxide appears to be the dominant cementing agent. Strong, coarse subangular blocky structure. Classified as a fragipan. No evidence of textural mottling, and no evidence of horizontal movement of water above the layer. | SC | | |

TEST PIT DATA

START DATE: 02/07/96
COMPLETION DATE: 02/07/96
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR: —

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION: —
LATER TIME/DEPTH: —
LATER TIME/DEPTH: —
CAVE IN DEPTH: —

LOG OF TEST PIT: CMC-TMA-TP6

CLIENT: Crandon Mining Company
PROJECT: Fragipan Evaluation
PROJECT NUMBER: 93C049
LOCATION: Tailings Management Area

SURFACE ELEVATION: 1650.0 feet msl
PIT DEPTH: 51 inches
DATE: 02/07/96

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-51+" | | | | | Variegated, black to dark reddish brown, thick silt loam grading to sandy loam (SCS). The silt loam (loess) varies in thickness from 25-33". Soil contains a curviplanar paleoweathering surface approximately 25" below surface. Paleoweathering surface is delineated by occurrence of a few, scattered gravel fragments. Soil is moist and friable above the paleoweathering surface. Below the paleoweathering surface the soil is mainly moist and friable, but a few thin layers of firm material exist immediately below the weathering surface. Firm material has moderate, coarse subangular blocky structure. No evidence of textural mottling and no evidence of horizontal movement of water above the firm layers. | SM-SC | | |

TEST PIT DATA

START DATE: 02/07/96
COMPLETION DATE: 02/07/96
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR: —

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION: —
LATER TIME/DEPTH: —
LATER TIME/DEPTH: —
CAVE IN DEPTH: —

LOG OF TEST PIT: CMC-TMA-TP7

CLIENT: Crandon Mining Company
PROJECT: Fragipan Evaluation
PROJECT NUMBER: 93C049
LOCATION: Tailings Management Area

SURFACE ELEVATION: 1647.0 feet msl
PIT DEPTH: 46 inches
DATE: 02/07/96

| MSL ELEV | DEPTH FR LND SURF | SAMP DEPTH INTERVAL | TYPE | # | MUNSELL COLOR | DESCRIPTION OF MATERIAL | CLASS | LABORATORY TESTS | SAMPLING NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | 0-46+" | | | | | Variegated, black to dark reddish brown to gray, silt loam, silty clay loam and sandy loam (SCS). Moist, friable soil. Highly variable soil texture and structure in pit suggests that some material may be colluvial in origin and that pit may contain soil which has filled in base of a fallen tree. | SM | | |

TEST PIT DATA

START DATE: 02/07/96
COMPLETION DATE: 02/07/96
LOGGED BY: JET
METHOD: Backhoe
CONTRACTOR: —

WATER LEVEL INFORMATION (Datum = SURF)

DEPTH AT COMPLETION: —
LATER TIME/DEPTH: —
LATER TIME/DEPTH: —
CAVE IN DEPTH: —

# Appendix 3.5-15

## Foth & Van Dyke Report Titled
## February 1995 Bedrock Hydrogeology at the Crandon Site[1]

*(Note: This report was submitted to relevant regulatory agencies and others in February 1995. The report has been the topic of a number of discussions between regulatory reviewers and CMC. As a result of those discussions a consensus has been reached regarding some outstanding bedrock hydrogeology issues. Additional issues are still under discussion.)*

[1]*Revised to incorporate minor revisions based on verbal comments received at a March 8, 1995 groundwater modeling meeting with WDNR, et. al.*

Crandon Mining Company

# Bedrock Hydrogeology at the Crandon Site

## Crandon Project
## Crandon, Wisconsin

February 1995

*Prepared by*

**Foth & Van Dyke** Engineers Architects Scientists

Scope ID: 93C049

February 24, 1995

Mr. William Tans
Bureau of Environmental Analysis and Review
Wisconsin Department of Natural Resource
101 South Webster Street, P.O. Box 7921
Madison, WI 53707

Dear Mr. Tans:

Re: Crandon Project - Groundwater Modeling

With this letter Crandon Mining Company is submitting, to the Wisconsin Department of Natural Resources (WDNR) for review and comment, the enclosed document titled *Bedrock Hydrogeology at the Crandon Site* which was prepared by Foth & Van Dyke. The report will be a topic of discussion at our planned March 8, 1995 groundwater modeling meeting. Enclosed with this letter is a proposed agenda for the meeting.

Should you have any questions regarding the enclosed report, please call me at 715-365-1450, or Stephen Donohue of Foth & Van Dyke at 414-497-2500.

Sincerely,

D. E. Moe

Don Moe
*Technical/Permitting Manager*

DM:jcp

Attachment

## Distribution

| No. of Copies | Sent to |
|---|---|
| 1 | Bill Tans<br>Wisconsin Department of Natural Resources<br>Bureau of Endangered Resources<br>101 South Webster Street<br>Madison, WI 53707 |
| 1 | Archie Wilson<br>Wisconsin Department of Natural Resources<br>107 Sutcliff Avenue<br>Rhinelander, WI 54501 |
| 1 | Larry Lynch<br>Wisconsin Department of Natural Resources<br>Bureau of Solid & Hazardous Waste Management<br>101 South Webster Street<br>Madison, WI 53707 |
| 1 | Chris Carlson<br>Department of Geological Sciences<br>Indiana University<br>1005 East 10th Street<br>Bloomington, IN 47405 |
| 1 | Kenneth Bradbury<br>Wisconsin Geological and Natural History Survey<br>3817 Mineral Point Road<br>Madison, WI 53705 |
| 1 | James Krohelski<br>U.S. Geological Survey<br>Water Resources Division<br>6417 Normandy Lane<br>Madison, WI 53719 |
| 1 | U.S. Department of the Interior<br>Bureau of Indian Affairs<br>Robert Jaeger<br>Branch of Natural Resources<br>Ashland, WI 54806-0273 |
| 1 | Forest County Potawatomi<br>Al Milham, Chairman<br>P. O. Box 340<br>Crandon, WI 54520-0340 |

1 Sokaogon Chippewa Community
Arlyn Ackley, Chairman
Mole Lake Band
Route 1, P.O. Box 625
Crandon, WI 54520-0625

1 Menominee Indian Tribe of Wisconsin
John Teller, Chairman-Tribal Council
P.O. Box 910
Keshena, WI 54135-0910

1 Greene, Meyer & McElroy
M. Catherine Condon
1007 Pearl Street, Suite 200
Boulder, CO 80302

1 John Coleman
UW-Madison
B102 Steenbock Library
550 Babcock Drive
Madison, WI 53706

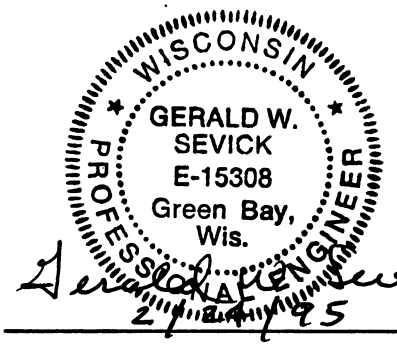
1 USEPA-Air Division (A18J)
David Kee, Director
77 West Jackson
Chicago, IL 60604-3507

1 U.S. Army Corps of Engineers
David L. Ballman, Ecologist
St. Paul District
190 5th Street East
St. Paul, MN 55101

1 U.S. Army Corps of Engineers
Mark Meyers
St. Paul District
190 5th Street East
St. Paul, MN 55101

1 Wisconsin Department of Justice
Laura Sutherland
Public Intervenor's Office
123 West Washington Avenue
Madison, WI 53703

| | |
|---|---|
| 1 | Horsley & Witten<br>Mark Nelson<br>Senior Partner and Senior Hydrogeologist<br>3179 Main Street, Courthouse Square<br>Barnstable, MA 02630 |
| 1 | University of Wisconsin-Milwaukee<br>Dr. Douglas Cherkauer<br>5314 Lydell Avenue<br>Whitefish Bay, WI 53217 |
| 1 | Crandon Mining Company<br>Don Moe<br>7 North Brown Street, Third Floor<br>Rhinelander, WI 54501-3161 |
| 1 | GeoTrans, Inc.<br>Peter Andersen<br>46050 Manekin Plaza, Suite 100<br>Sterling, VA 20166 |
| 2 | Foth & Van Dyke<br>Jerry Sevick, P.E.<br>2737 South Ridge Road<br>Green Bay, WI 54307-9012 |
| 1 | Foth & Van Dyke<br>Stephen Donohue<br>2737 South Ridge Road<br>Green Bay, WI 54307-9012 |




# Bedrock Hydrogeology at the Crandon Site

## *Crandon, Wisconsin*

Prepared for
**Crandon Mining Company**

Prepared by
**Foth & Van Dyke and Associates, Inc.**

Scope ID: 93C049

**February 1995**

3.5-15-6

**Foth & Van Dyke 1995**

2737 S. Ridge Road, P.O. Box 19012, Green Bay, Wisconsin 54307-9012, 414/497-2500, FAX: 414/497-8516

# Bedrock Hydrology Report
# Crandon Mining Company

## Contents


| | | Page |
|---|---|---|
| 1 | Introduction | 1 |
| 2 | Overview of Crandon Mine Plan | 3 |
| 2.1 | Geology | 3 |
| 2.2 | Mine Development and Operation | 3 |
| 2.2.1 | Mine Development | 3 |
| 2.2.1.1 | Phase I Development | 7 |
| 2.2.1.2 | Phase II Development | 7 |
| 2.2.2 | Mine Operations | 8 |
| 2.2.3 | Mine Dewatering and Groundwater Inflow Control | 10 |
| 3 | Bedrock Hydrogeology | 15 |
| 3.1 | Exploration and Delineation Drilling | 15 |
| 3.1.1 | Exploration and Delineation Drilling (1975-1978) | 16 |
| 3.1.2 | Vertical Shaft Related Holes (1977-1982) | 16 |
| 3.1.3 | Metallurgical Pilot Plant Testing (1980) | 17 |
| 3.1.4 | Early Production Area Confirmation (1982) | 17 |
| 3.1.5 | Metallurgical Grindability and Pilot Plant Testing (1985) | 17 |
| 3.1.6 | CMC Confirmation Drilling Program (1993-1994) | 17 |
| 3.1.7 | Summary | 17 |
| 3.2 | Fracture Characterization Studies | 17 |
| 3.3 | Weathering Studies | 25 |
| 3.4 | Gabbro Dike | 33 |
| 3.5 | Packer Test Data & Bulk Hydraulic Conductivity | 33 |
| 3.6 | Down Hole Temperature Logging | 41 |
| 3.7 | Bedrock Water Chemistry | 43 |
| 3.8 | Vertical Head Difference Between the Bedrock and Glacial Deposits | 53 |
| 3.9 | Mine Inflow Characteristics at Other Representative Mine Sites | 58 |
| 3.9.1 | Mine Inflow at Mine Sites Located in the Canadian Shield | 58 |
| 3.9.2 | Bedrock Hydrogeology and Mine Inflow: The Flambeau Mine Site | 59 |
| 3.10 | Area Bedrock Water Supply Use | 64 |
| 3.11 | Summary and Conceptual Model for Lateral Groundwater Flow to the Mine | 64 |
| 4 | Bedrock Groundwater Flow Model | 66 |
| 4.1 | Reconstruction of Two-Dimensional Model | 67 |
| 4.2 | Development of Three Dimensional Model | 67 |
| 4.3 | Refined Representation of Hydraulic Conductivity With Depth | 70 |
| 4.4 | Inclusion of Anisotropy in the Bedrock | 74 |
| 4.5 | Inclusion of Leakage from the Overburden | 74 |
| 4.6 | Summary | 77 |
| 5 | Conclusions | 80 |
| 6 | References | 82 |

Page

## Tables


| | | |
|---|---|---|
| Table 3-1 | Summary of Bedrock/Ore Body Drilling Programs | 16 |
| Table 3-2 | Summary of Fracture Orientation, Shallow Hanging Wall/ Ore Body/Footwall Units | 20 |
| Table 3-3 | Summary of Fracture Orientation, Deep Hanging Wall/ Ore Body/Footwall Units | 22 |
| Table 3-4 | Summary of RQD Data Versus Depth, Hanging Wall/Footwall | 24 |
| Table 3-5 | Crandon Deposit Weathering and Permeability Data | 31 |
| Table 3-6 | Summary Bedrock Permeability Tests | 37 |
| Table 3-7 | Crandon Deposit Down Hole Bedrock Temperature Data (EDCON-1978) Holes 11, 15, 19, 22, 38 and 42 | 44 |
| Table 3-8 | Crandon Deposit Down Hole Bedrock Temperature Data (EDCON-1978) Holes 60, 80, 91, 139 and 155 | 47 |
| Table 3-9 | Bedrock Water Chemistry Data | 52 |
| Table 3-10 | Typical Water Inflow for Precambrian Bedrock Metal Mines | 60 |


## Figures


| | | |
|---|---|---|
| Figure 2-1 | Stratigraphic Column | 4 |
| Figure 2-2 | Generalized Geologic Cross Section | 5 |
| Figure 2-3 | Schematic Longitudinal Section Looking North and Location of Initial Mining Areas | 6 |
| Figure 2-4 | Conceptual Stoping Sequence | 9 |
| Figure 2-5 | Groundwater Interceptor System | 11 |
| Figure 2-6 | Mine Water Control Typical Grout Hole Collar Drilled from the Shaft | 12 |
| Figure 2-7 | Mine Drainage Schematic | 14 |
| Figure 3-1 | Plan Map Showing Drill Hole Trace and Outline of Crandon Formation | 19 |
| Figure 3-2 | General E-W Long Section Through Crandon Formation Showing Hanging Wall Pierce Points | 21 |
| Figure 3-3 | Longitudinal Section Looking North Within the Crandon Formation | 27 |
| Figure 3-4 | E-W Longitudinal Section 200' North of Crandon Formation, Mole Lake Formation | 28 |
| Figure 3-5 | E-W Longitudinal Section 400' North of Crandon Formation, Mole Lake Formation | 29 |
| Figure 3-6 | E-W Longitudinal Section 200' South of Crandon Formation, Sand Lake Formation | 30 |
| Figure 3-7 | Bedrock Geology of the Study Area and Approximate Location of Gabbro Dike | 34 |
| Figure 3-8 | Location of Bedrock Packer and Slug Tests | 36 |
| Figure 3-9 | Bedrock Permeability vs. Depth | 40 |
| Figure 3-10 | Core Holes Used on Down Hole Temperature Surveys | 42 |
| Figure 3-11 | Core Holes Used for Water Chemistry Analysis | 51 |

Page


| | | |
|---|---|---|
| Figure 3-12 | Monitoring Well Location for the Comparison of Bedrock vs. Glacial Hydrographs | 54 |
| Figure 3-13 | Bedrock vs. Glacial Hydrographs | 55 |
| Figure 3-14 | Bedrock vs. Glacial Hydrographs | 56 |
| Figure 3-15 | Bedrock vs. Glacial Hydrographs | 57 |
| Figure 3-16 | Average Groundwater Inflow Rate Below Approximately 1600 Feet | 62 |
| Figure 4-1 | Drawdown in the Bedrock Predicted with Reconstructed Bradbury, et. al. Model | 68 |
| Figure 4-2 | Predicted Inflow Comparisons | 69 |
| Figure 4-3 | Schematic of Mine Seepage Face in 2-D and 3-D | 71 |
| Figure 4-4 | Case 3 Predicted Drawdown in Bedrock | 72 |
| Figure 4-5 | Case 4 Predicted Drawdown in Bedrock | 73 |
| Figure 4-6 | Case 5 Predicted Drawdown in Bedrock | 75 |
| Figure 4-7 | Case 6 Predicted Drawdown in Bedrock | 76 |
| Figure 4-8 | Case 6 Predicted Drawdown in Overburden | 78 |


## Appendices


| | |
|---|---|
| Appendix A | Relevant Material from John D. Smith Engineering Associates Limited (1982) |
| Appendix B | Relevant Material from J.F.T. Agapito & Associates, Inc. (1992) |
| Appendix C | Relevant Material From Rowe (1985) |
| Appendix D | Lambe & Rowe (1980) |
| Appendix E | Weathering Cross Sections Used to Generate Longitudinal Weathering Profiles |
| Appendix F | Log Sheet Summaries Delineating the Duck Lake Gabbro Dike |
| Appendix G | Log Sheet Summaries for Core Hole 155 |
| Appendix H | Relevant Material from Sonderman (1978) |
| Appendix I | Bedrock Water Chemistry Data |
| Appendix J | Water Well Inventory |

# 1 Introduction

On October 20, 1994 Crandon Mining Company (CMC) issued a memorandum (Foth & Van Dyke, 1994) describing the hydrogeologic characteristics of the Precambrian bedrock in the vicinity of the proposed Crandon Project site. The October 1994 memorandum discussed bedrock geology in detail, including:

- depositional and post depositional origin;
- deformation and weathering processes;
- the origin of primary, secondary and tertiary permeability features;
- hydraulic conductivity test results; and
- bedrock water chemistry data.

Based on the information presented in the memorandum it was determined that the majority of the groundwater that would enter the mine workings would be due to percolation from the glacial overburden into weathered bedrock in the immediate vicinity of the workings. As such it was CMC's conclusion that the regional groundwater model could represent the Precambrian bedrock surface as a regional no flow boundary with percolation into the mine being represented by vertical leakance terms in the vicinity of the mine.

On December 6, 1994, consultants for the Wisconsin Department of Natural Resources (WDNR) issued a memorandum (Bradbury, et. al., 1994) in response to the October 20, 1994 memorandum. Based on a simple generic bedrock groundwater model depicting the proposed Crandon mine, WDNR's consultants expressed a concern that CMC's representation of the mine and bedrock could underestimate mine inflow and drawdown in the bedrock and glacial overburden. A concern was also expressed that the data available was not sufficient to support CMC's position that the bedrock outside the ore body is essentially impermeable. It was the opinion of WDNR's consultants that additional hydrologic studies on the Precambrian bedrock, referred to as "bedrock" throughout the remainder of the report, were warranted. Discussions at the January 20, 1995 technical exchange meeting with the WDNR and their consultants did not result in a consensus as to the significance of bedrock flow and bedrock drawdown as they relate to the regional groundwater model and subsequently, how to address these items in that model. It was also apparent at the meeting that a clear understanding of the project's mine development and dewatering plan was needed to assist in resolving this first issue.

It is CMC's opinion that the existing body of data on bedrock hydrogeology at the Crandon Project site is sufficient to support design and permitting work. CMC believes that water entering the mine will be derived from the three sources listed below:

- stored water within the bedrock;
- vertical leakage from the glacial overburden into unsaturated or depressurized regions of the Crandon Formation, and also into the near surface weathered bedrock in the immediate vicinity of the Crandon Formation; and
- lateral movement through fractures in unweathered areas of the hanging and footwall rocks located to the north and south of the Crandon Formation, respectively.

CMC believes that once storage is depleted the greatest majority of the water entering the mine will come from vertical leakage from the glacial overburden, not from lateral movement through the unweathered bedrock. The purpose of this report is to document Crandon Project bedrock hydrogeological data and the analyses which support this belief. The report addresses the concerns of the WDNR and their consultants regarding data sufficiency with respect to bedrock hydrogeology. It is our opinion that the report also provides a framework upon which a methodology can be developed to quantify the significance of lateral flow from the hanging and footwall rocks into the mine, and drawdown in the regional bedrock.

Section 2 of the report presents a brief explanation of the mining plan as it relates to mine development and water management. This discussion is followed in Section 3 by a detailed review of bedrock hydrogeology using the following items:

- sequential delineation drilling programs and resultant stratigraphic interpretations;
- bedrock fracturing studies;
- bedrock weathering studies;
- packer test and slug test data and studies;
- downhole temperature measurements performed to assess temperature distribution in the bedrock;
- bedrock geochemistry data based on site specific and regional sources;
- data on the hydraulic gradient between the bedrock and glacial overburden;
- information related to groundwater flow characteristics at other mine sites located in the Canadian Shield; and
- a review of the use of bedrock in the region as a water supply source.

Section 4 of this report addresses a review of the simple generic bedrock groundwater model developed by WDNR's consultants, and the development of a methodology to quantify the significance of both lateral flow from the hanging wall and footwall rocks into the mine and drawdown in the regional bedrock. Finally, Section 5 contains a series of conclusions that have been reached based on the work discussed in this report.

This document was prepared through the collective efforts of personnel from CMC, Foth & Van Dyke, Thresher and Son, Inc., and GeoTrans, Inc. Individuals that contributed are:

Peter F. Anderson, P.E., Environmental Engineer, GeoTrans, Inc.
Stephen V. Donohue, Groundwater Hydrologist, Foth & Van Dyke
A. J. Erickson, Jr., Geologist, Crandon Mining Company
Don Moe, P.E., Mining Engineer, Crandon Mining Company
Gerald W. Sevick, P.E., Environmetal Engineer, Foth & Van Dyke
John E. Thresher, Jr., Ph. C., Hydrogeologist, Thresher & Son

# 2 Overview of Crandon Mine Plan

## 2.1 Geology

The Crandon deposit, which is composed of two distinct mineralization types, zinc ore and copper ore, is of submarine volcanic origin. The minerals were deposited during the Precambrian era, about 900 to 2,500 million years ago. The deposit was formed at and just below the ocean floor by mineral bearing fluids of volcanic origin. Some of the material deposited by this volcanic system were sulfide minerals which accumulated in low spots on the ocean floor. Continued accumulation of other volcanic materials and sediments occurred which buried the sulfide deposit. Deep burial, 33,000 to 50,000 feet, resulted in lithification and metamorphism which hardened and solidified both the host rock and the sulfide deposit over time. Later, a mountain building phase occurred in the region, tilting the volcanic layers and the deposit to a near vertical position. The deposit may have been covered by younger sediments, however weathering and erosion have removed these later rocks. The more recent geological process which has affected the deposit is related to Pleistocene glaciation which left the bedrock deposit buried under unconsolidated glacial till.

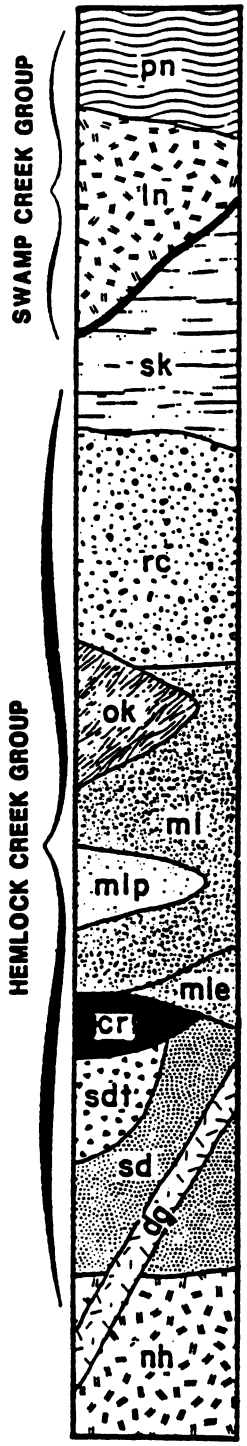
The Crandon ore body is long and tabular with an approximate width of 100 feet, north-south, and a strike length of 4,900 feet, east-west. Based on the current level of drilling, the ore body extends to an approximate depth of 2,200 feet. The ore body is composed of two distinct mineralization types, zinc ore and copper ore. The interpreted geologic stratigraphy and ore body configuration are shown on Figures 2-1 and 2-2 respectively.

The bedrock in the hanging wall and in the footwall of the ore body consists of a series of fragmental volcanic rocks, fine tuffs (solidified volcanic ash), debris flow (ocean floor and volcanic-derived sediments), breccia (blocky, angular particles), lapilli tuffs (gravel sized volcanic material) and flows. Overlying the bedrock is a sequence of unconsolidated glacial sands, clays, and gravels. The rock in contact with the unconsolidated glacial overburden is weathered to varying degrees. The amount of weathering ranges from simple staining to extreme weathering which near the surface reduced the rock to a clay-like material called massive saprolite. The glacial overburden consists of interbedded and co-mingled glacial till, which is material deposited directly by the glacier, and glacial outwash deposited by streams emanating from the glacier. These glacial deposits are found in various thicknesses in the area ranging from 75 feet thick to over 250 feet thick.

## 2.2 Mine Development and Operation

### 2.2.1 Mine Development

Access to the mine will be through a main production/service shaft located north of the ore body. A ventilation shaft will be located east of this main production shaft. Underground lateral development drifts will access the ore body from the main shaft at 300 foot vertical intervals. These level development drifts are designed to provide access to the ore body. The lateral extent of a mine level at a given point in time will depend upon the need for access to mining blocks, ore passes, and ventilation raises. A schematic longitudinal section showing a typical main level plan is shown on Figure 2-3.




**PINE FORMATION ( pn )**
Cherty tuff and argillite.

**LINCOLN FORMATION ( ln )**
Quartz porphyritic rhyolite flows with minor interflow tuff, chert and argillite.

**SKUNK LAKE FORMATION ( sk )**
Predominantly fine to coarse ash chert tuff, some cherty and very minor argillite.

**RICE LAKE FORMATION ( rc )**
Volcanic debris flows ( blocky chloritic and minor siliceous lapilli and breccia size debris ) and eutaxitic ash flows, some chert.

**OAK LAKE FORMATION ( ok )**
Sequence of cherty tuff and sericitic tuff.

**MOLE LAKE FORMATION ( ml )**
Predominantly mafic ash tuff.

PROSPECT MEMBER ( mlp )
Volcanic debris flow consisting of siliceous, lapilli size debris.

EAGLE MEMBER ( mle )
Volcanic greywacke.

**CRANDON FORMATION ( cr )**
Laminated, bedded & replacement sulfides ( zinc ore ) interbedded with pyritic argillite, pyritic felsic tuff and chert.

**SAND LAKE FORMATION ( sd )**
Sequence of fine felsic tuffs and minor felsic debris & lava flows.

TOWNSHIP MEMBER ( sdt)
Volcanic vent breccia affected by multiple stage hydrothermal alteration and sulfide enrichment.

**NASHVILLE FORMATION ( nh )**
Feldspar porphyritic mafic flows.

**DUCK LAKE GABBRO (dg )**
Fresh, 2 pyroxene gabbro.
Cross cuts nh and sd.

MODIFIED AFTER ROWE, 1984

Foth & Van Dyke

| REVISED | DATE | BY | DESCRIPTION |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

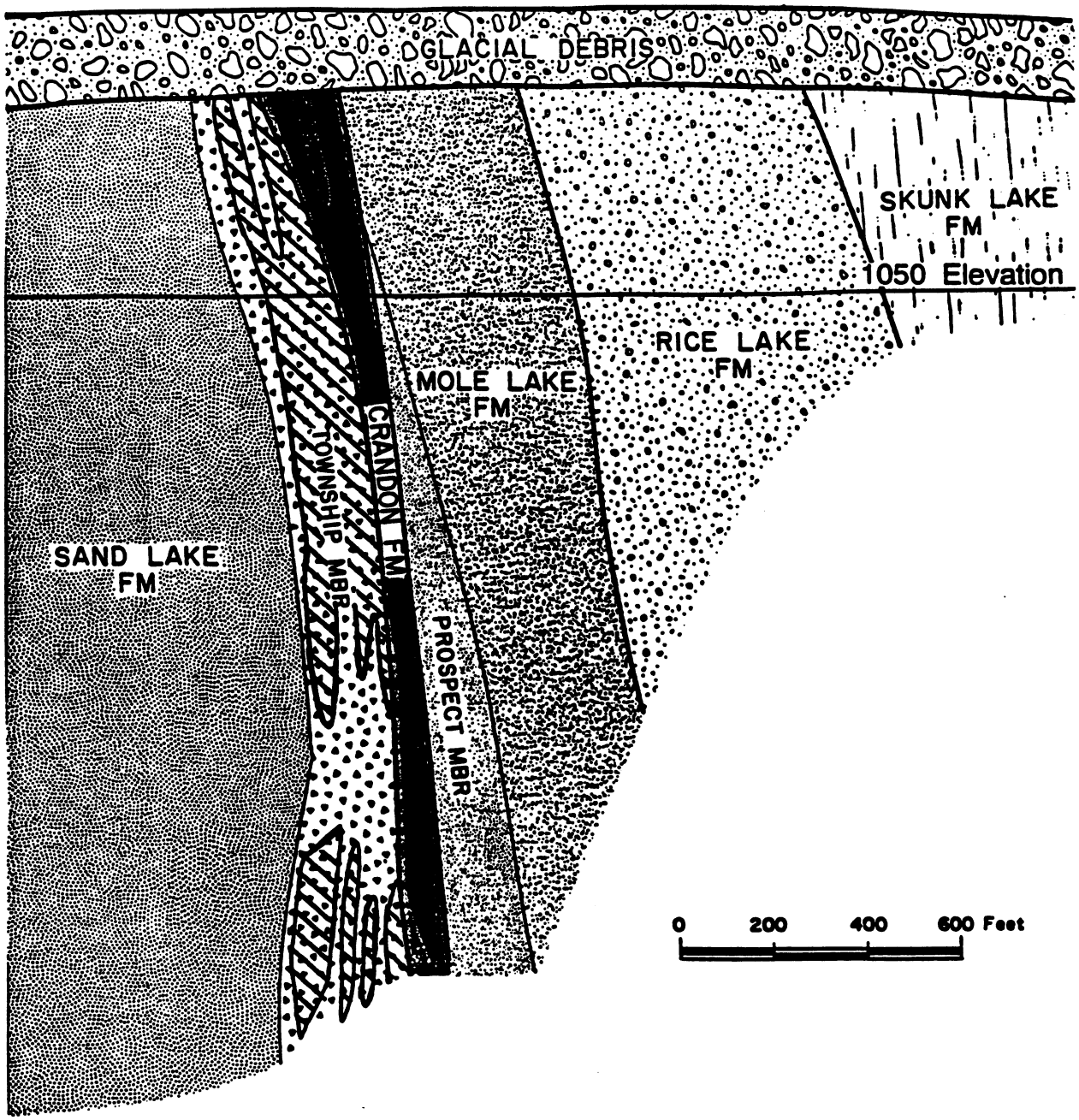
| | | |
|---|---|---|
| CHECKED BY: | JKSI | DATE: FEB.'95 |
| APPROVED BY: | SVDI | DATE: FEB.'95 |
| APPROVED BY: | JWS | DATE: FEB.'95 |

Crandon Mining Company

FIGURE 2-1
STRATIGRAPHIC COLUMN
CRANDON, WISCONSIN

| | | | |
|---|---|---|---|
| Scale: | NO SCALE | Date: | FEBRUARY, 1995 |
| Prepared By: | Foth & Van Dyke | By: | JPR |

**LOOKING WEST**




ZINC ORE

COPPER ORE

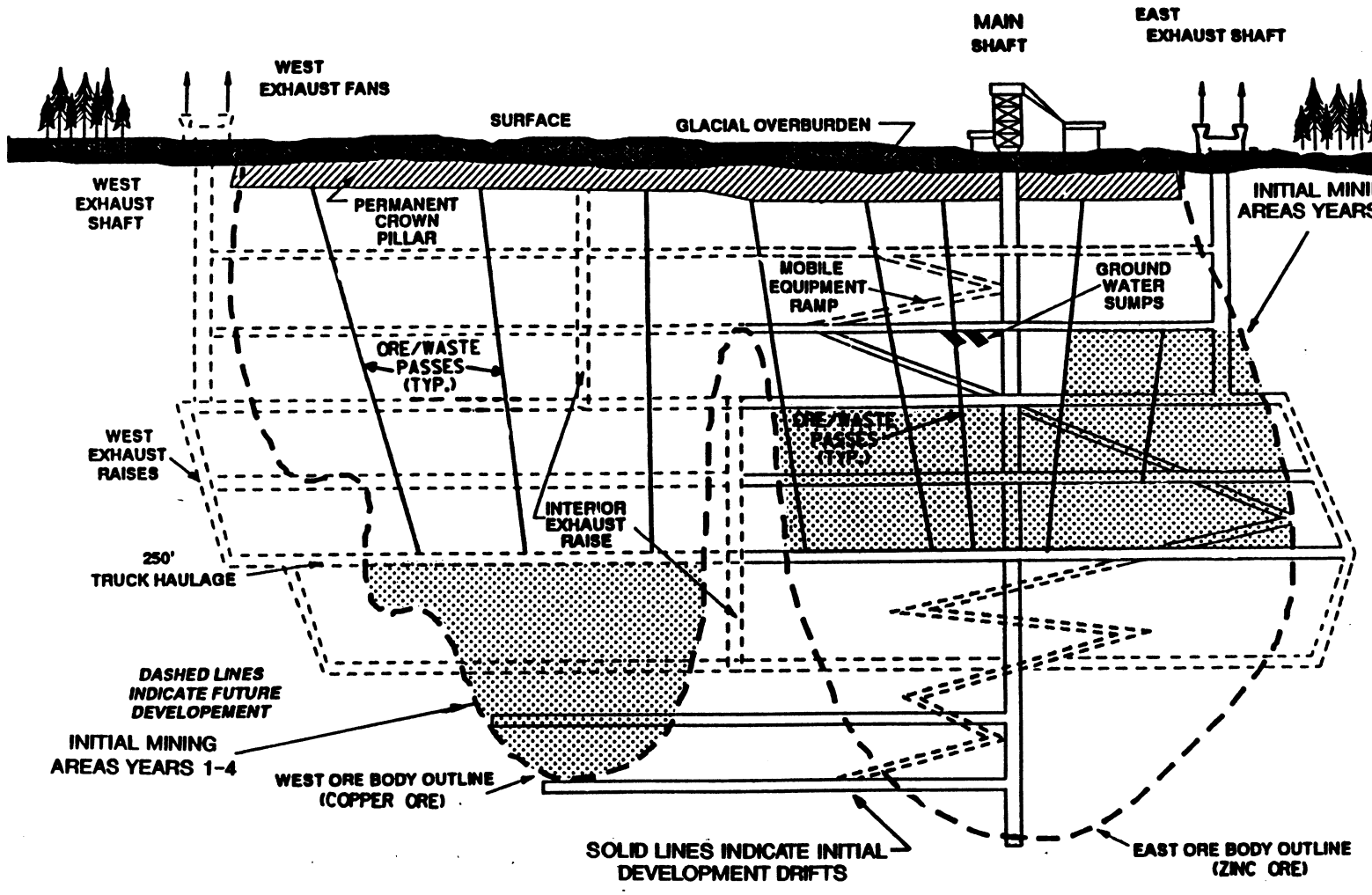
| Foth & Van Dyke | | | | |
|---|---|---|---|---|
| REVISED | DATE | BY | DESCRIPTION | |
| | | | | |
| | | | | |
| | | | | |
| CHECKED BY: | | JKSI | | DATE: 10/18/94 |
| APPROVED BY: | | SVDI | | DATE: 10/18/94 |
| APPROVED BY: | | JWS | | DATE: 10/18/94 |

Crandon Mining Company

**FIGURE 2-2**

GENERALIZED GEOLOGIC CROSS SECTION

| Scale: SEE BAR SCALE | Date: FEBRUARY, 1995 |
|---|---|
| Prepared By: Foth & Van Dyke | By: JRB |




Foth & Van Dyke

| REVISED | DATE | BY | DESCRIPTION |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

| | | |
|---|---|---|
| CHECKED BY: | JKSI | DATE: 2/23/95 |
| APPROVED | SVDI | DATE: 2/23/95 |
| APPROVED | JWS | DATE: 2/23/95 |

Crandon Mining Company

FIGURE 2-3

SCHEMATIC LONGITUDINAL SECTION LOOKING NORTH AND LOCATION OF INITIAL MINING AREAS

Scale: NOT TO SCALE | Date: FEBRUARY, 1995

Prepared By: Foth & Van Dyke | By: JRB

c:\caddwork\3c49f1.dgn

3.5-15-15

93C049 6

A ramp will connect mine levels to allow for movement of equipment, supplies, and personnel throughout the mine. This centrally located decline is also shown schematically on Figure 2-3.

Mine development will be divided into the following phases:

1) Sinking of the main production shaft and the east ventilation shaft. This phase is expected to take 18 months to complete.

2) The development of the underground ore handling and crushing system, the development of the dewatering system and lateral development into the ore horizons. An internal mobile equipment access ramp will connect the main production ore levels. This phase of mine development is expected to take 18 months to complete.

As shown on Figure 2-3, mine development and production will begin on the 600, 900, 1050, 1350, 1,800 and 2,100 levels, which will provide the first three to four years of production at the desired ore grades. These areas have been chosen to avoid initial production from areas of weathered bedrock which are expected to be the primary conduits for water inflow into the mine workings.

### 2.2.1.1 Phase I Development

Phase I development primarily includes simultaneous construction of two vertical shafts in the hanging wall rocks. Each shaft will be concrete lined through the overburden and the weathered subcrop rock. Collar construction through the glacial overburden will include stabilization and hydraulic control by ground freezing or other suitable techniques, followed by the excavation and concrete lining of the shaft into bedrock. If required, at the collar interface of the bedrock and the overburden, inert grout will be pumped under pressure through holes in the collar into the rock and glacial formations to provide a watertight seal. When the collar section of the main shaft and east ventilation shaft are completed, a headframe structure will be erected over each shaft. Conventional shaft sinking by drilling and blasting techniques will then commence at the main shaft and the east shaft concurrently.

During shaft development, it is estimated that the drainage water from both shaft sinkings will be controlled to less than ten gallons per minute (gpm) by grouting. All shaft water will be pumped to the surface water storage ponds.

### 2.2.1.2 Phase II Development

Since the east shaft is smaller than the main shaft, it will be completed sooner. Upon its completion, horizontal level development will begin at the 900 and 1,350 levels simultaneously (Figure 2-3). Initial development will consist of driving a horizontal opening in the hanging wall rock to connect the east shaft to the main shaft. After the two shafts are connected, additional level development can commence to access the ore body.

The underground ore handling facilities will be constructed near the main production shaft during this period. These facilities will consist of: (a) coarse ore and waste rock bins, (b) crusher facilities, (c) ore handling systems, and (d) a loadout facility pocket installation.

### 2.2.2 Mine Operations

Level development from the main production shaft to the stoping areas will be driven at 300 foot vertical intervals. The primary mining method will be blasthole open stoping with delayed backfill. However, other mechanized variations of sublevel mining and cut-and-fill stoping methods may also be used. Stopes (Figure 2-4) will average approximately 300 feet in height by 75 feet along strike and will vary with the width of the ore body. Ore will be drilled in a stoping block, then blasted and removed sequentially from a stope. Top hammer or down-the-hole drills will be used to drill approximately four to six inch diameter blastholes on approximately 12 foot by 12 foot center spacing for production stope blasting. Broken ore will be removed from the drawpoints at the bottom of each stope using mechanized mining equipment which will then transfer the ore to the crushing level below by means of ore pass raises. Primary crushed ore, at a top size of eight inches, will be conveyed to a skip loading pocket and hoisted to the surface.

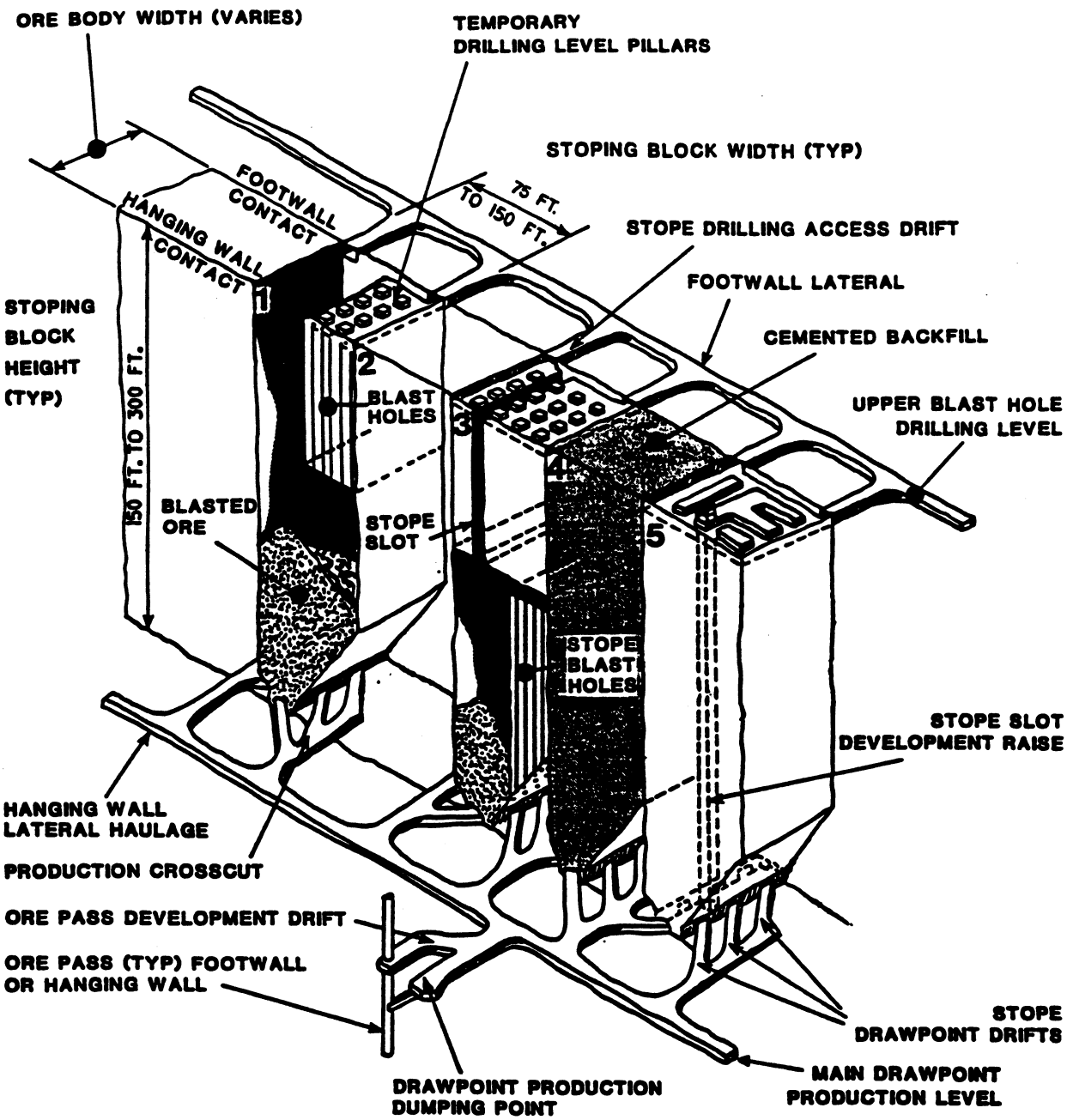
A typical stope will contain approximately 300,000 tons of ore. At a 2,000,000 ton annual production rate, between five and seven stopes will be mined out each year, which exposes less than five percent of the footwall and hanging wall area of the ore body at any one time. Exact production parameters will be based on the grade of the ore in the mined stope; the rock mechanic characteristics of the stoping block; and the potential for inflow of water.

A permanent bridge, or crown pillar, of bedrock directly beneath the glacial overburden will be purposely excluded from mining activity. This bedrock barrier, averaging approximately 100 feet thick along with the routine backfilling of mined out stopes, will maintain surface stability and prevent subsidence of overburden materials.

In the uppermost mine levels where the ore and host rock may have been moderately weakened by surficial weathering, the mechanized cut-and-fill mining method may be employed. This method is commonly used by the industry and involves removal of horizontal lifts of ore of variable thicknesses. The void created by each horizontal mining pass is backfilled prior to mining the next upper lift. Less than 10 percent of the ore body may require use of this mining method.

The planned mining methods provide for backfilling all stopes following ore extraction. These practices, combined with the fact that five to 10 percent of the potentially minable ore will be left in place as pillars throughout the mine, will provide perpetual stability of the mine area bedrock and glacial overburden. Backfilling will also result in the reduction of pathways for water migration as mining progresses.

Mine backfilling will begin with the start of milling operations and after the first stope is depleted. The backfill will consist of mill tailings 10 to 15 micron or greater in size, supplemented with coarse waste rock retained underground. Uncemented tailings backfill will have a hydraulic conductivity on the order of 2.8E-2 ft/day (1.0E-5 cm/sec). The hydraulic conductivity of cemented tailings backfill will be lower. Backfill slurry containing approximately 60 to 70 percent solids will be pumped underground through boreholes fitted with distribution pipes. The backfilling operations will normally be conducted to coincide with the mining schedule.




STOPING BLOCK NO. 1-ACTIVE PRODUCTION-STOPE BLASTING NEARING COMPLETION

STOPING BLOCK NO. 2-ALTERNATE STOPING BLOCK/PILLAR-TO BE MINED AFTER BACKFILLING ADJACENT STOPES

STOPING BLOCK NO. 3-ACTIVE PRODUCTION-INITIAL STAGES OF STOPE BLASTING

STOPING BLOCK NO. 4-DEPLETED STOPE BLOCK-CEMENTED BACKFILL IN PLACE

STOPING BLOCK NO. 5-STOPE BLOCK PARTIALLY DEVELOPED

Foth & Van Dyke

| REVISED | DATE | BY | DESCRIPTION |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

| | | |
|---|---|---|
| CHECKED BY: | JKSI | DATE: 10/18/94 |
| APPROVED BY: | SVDI | DATE: 10/18/94 |
| APPROVED BY: | JWS | DATE: 10/18/94 |

Crandon Mining Company

FIGURE 2-4

CONCEPTUAL STOPING SEQUENCE

| | | | |
|---|---|---|---|
| Scale: | NOT TO SCALE | Date: | FEBRUARY, 1995 |
| Prepared By: | Foth & Van Dyke | By: | JRB |

Waste rock material used in the stope backfilling process will be placed before or during the placement of hydraulic tailings fill. The hydraulically placed fill will flow into, and fill the voids between the rock fragments.

Cement will be added to the backfill when needed to provide stability so that the column of fill will stand unsupported and enable complete removal of the ore in the adjacent stope. Approximately one-third to one-half of the total backfill placed in the mine will contain cement.

### 2.2.3 Mine Dewatering and Groundwater Inflow Control

Groundwater inflow will vary during the different stages of mine construction and operation. The proposed mining plan for the Crandon Project avoids entry into weathered zones during the initial operations, therefore deferring maximum and steady state inflow rates. During the initial operations, groundwater inflow is expected to be minimal and localized, occurring through isolated bedrock fractures that have limited capacity to move water. During this period, exploration holes will be advanced into the weathered bedrock areas to depressurize and dewater them. The water removed in this fashion will primarily be stored water which will be withdrawn at rates that can be effectively managed at the project's wastewater treatment plant. A more detailed description of this process follows.

As mine development progresses upward from the entry position (Figure 2-3), exploratory diamond drilling techniques will be used to identify active water courses prior to advancing the mine face. These techniques will be employed throughout the mine to drain stored water. Flows encountered on the uppermost active mine level will be captured by interceptor drill holes and contained to avoid contamination by mining operations on levels below and to reduce pumping head. A conceptual cross-section of the groundwater interceptor system showing the collection methodology is presented in Figure 2-5. Standard rock grouting techniques, typically using neat cement, may also be used for local inflow control during the early mine years to limit total mine pumpage.

Typically, groundwater interception holes will form conical fans in the weathered rock above the development openings, thus increasing the radius of the openings as line sink drains. As is common practice in other mines, the drill hole collars will be packered and fitted with pipe connections in a manner similar to that illustrated on Figure 2-6.

Groundwater collected from exploration drilling or other drill holes placed specifically for inflow interception will be routed directly to a clean water sump and pump station near the main shaft in the upper mine level. The collected groundwater will typically be pumped to the wastewater treatment plant on the surface. However, a portion of the water may be retained underground for distribution as mine utility water.

Groundwater seepage that is not captured by the interceptor system will infiltrate the mine workings and ultimately be recovered in the main sumps along with the mine potable, utility and backfill drainage water. Normal mine drainage collection will begin on each mine level where groundwater seepage, utility water and backfill drainage will be ditched to small local sumps excavated in the drift wall. Decant water from the local mine level sumps will be piped or drained through boreholes to pairs of collection sumps on each main mine level, and ultimately to the main mine sumps located adjacent to the production shaft at the lowest level.

Foth & Van Dyke

| REVISED | DATE | BY | DESCRIPTION |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

CHECKED BY: JKSI DATE: 2/22/95

APPROVED BY: SVDI DATE: 2/22/95

APPROVED BY: JWS DATE: 2/22/95

Crandon Mining Company

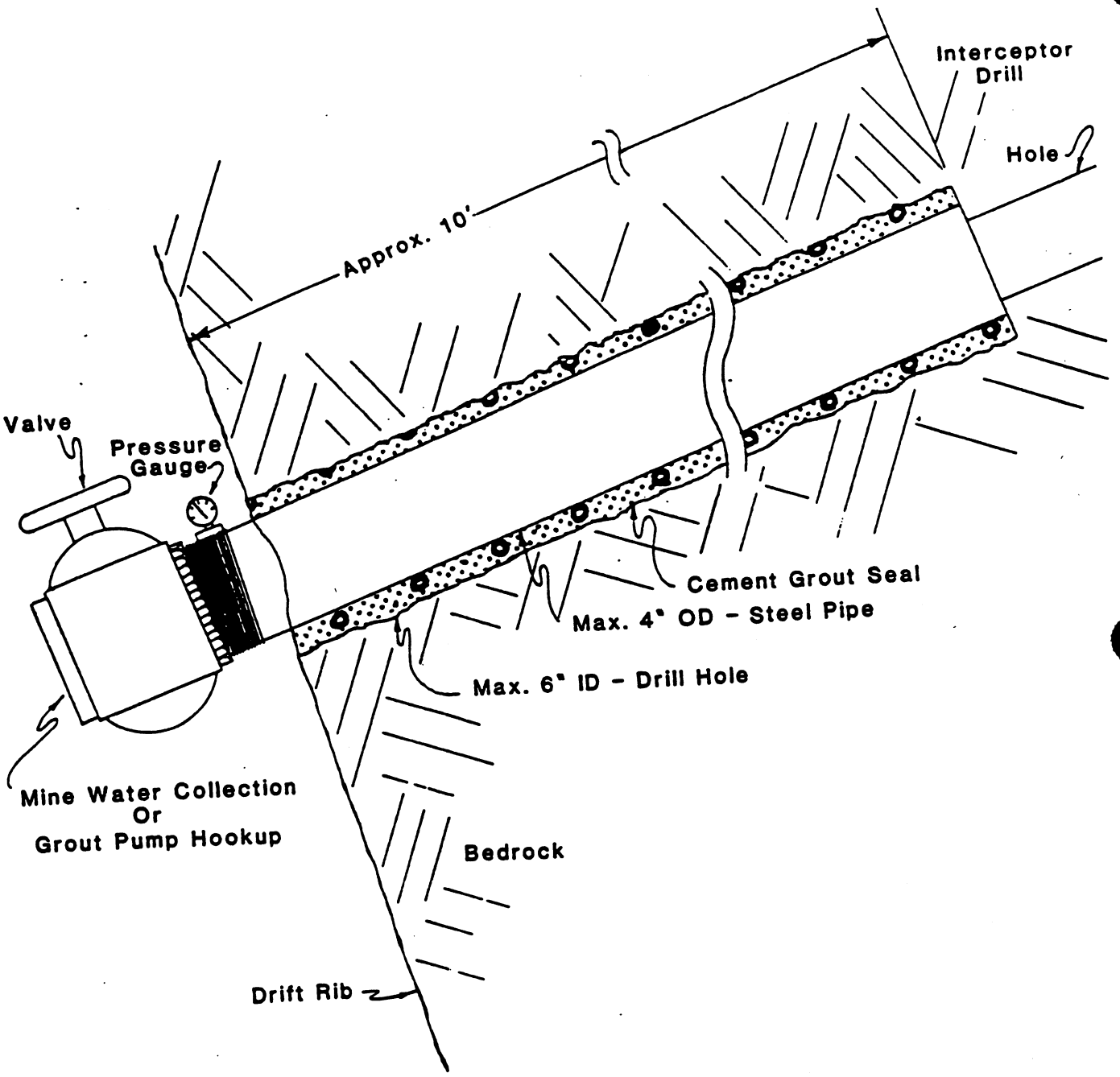
**FIGURE 2-5**

GROUNDWATER INTERCEPTOR SYSTEM
(CONCEPTUAL CROSS SECTION)

Scale: NOT TO SCALE Date: FEBRUARY, 1995

Prepared By: Foth & Van Dyke By: JRB

c:\cadwork\3c49f1.dgn




| Foth & Van Dyke | | | | |
|---|---|---|---|---|
| REVISED | DATE | BY | DESCRIPTION | |
| | | | | |
| | | | | |
| | | | | |
| CHECKED BY: | | JKSI | | DATE: 2/22/95 |
| APPROVED BY: | | SVDI | | DATE: 2/22/95 |
| APPROVED BY: | | JWS | | DATE: 2/22/95 |

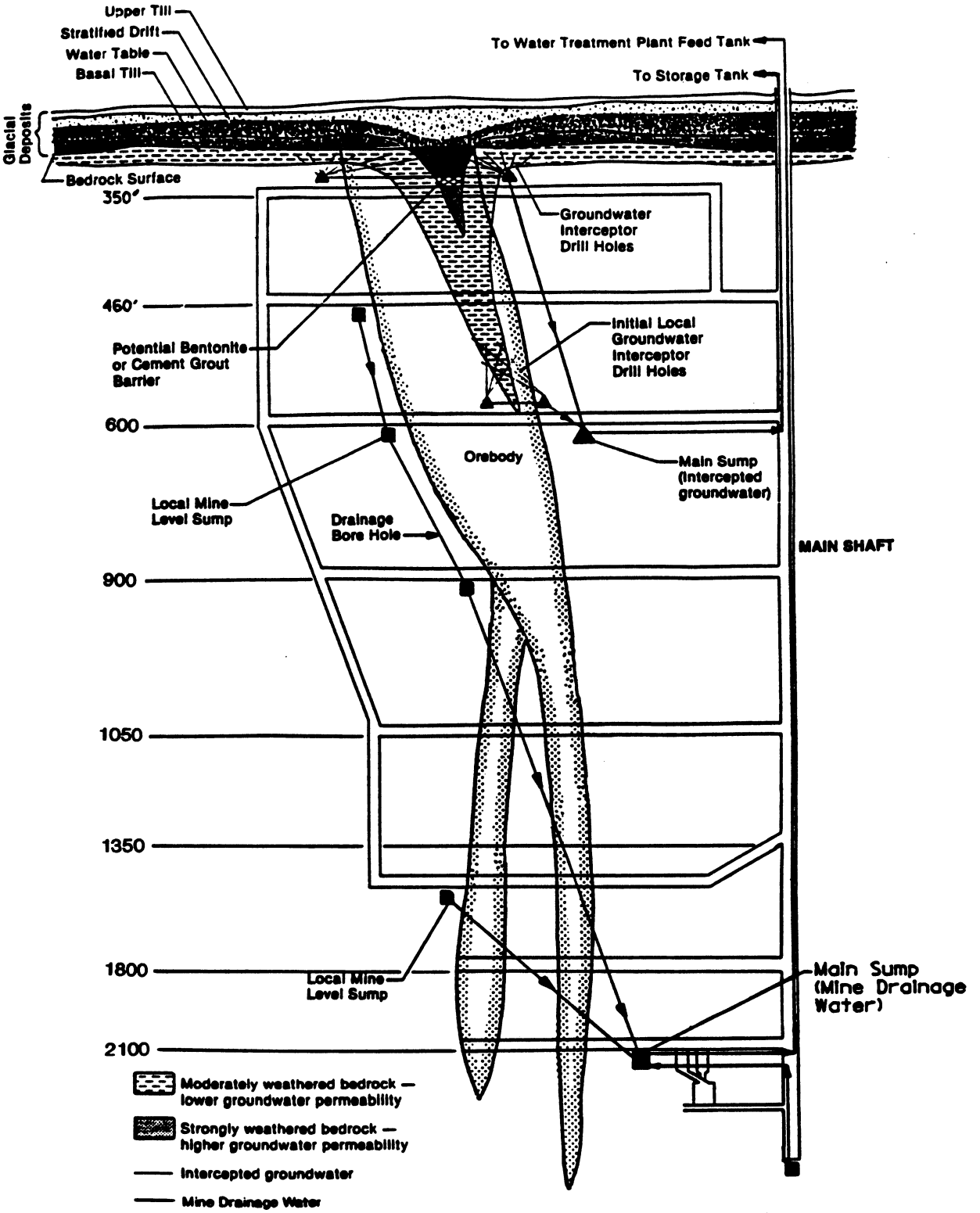
Crandon Mining Company

**FIGURE 2-6**
MINE WATER CONTROL
TYPICAL GROUT HOLE COLLAR
DRILLED FROM THE DRIFT

| Scale: NOT TO SCALE | Date: FEBRUARY, 1995 |
|---|---|
| Prepared By: Foth & Van Dyke | By: JRB |

The main mine sumps and pump station will generally be arranged as indicated on Figure 2-7. Sumps will consist of downgrade excavations in the wall rock adjacent to the pump station. These will function as pumping reservoirs with an outlet end bulkhead containing the pump suction pipes.

The above described mine dewatering and groundwater inflow control methodology represents common mining practice. Each of the methods discussed has been successfully applied in mines around the world. No special or first time applications of new methods are proposed or needed for the Crandon Project.




| Foth & Van Dyke | | | |
|---|---|---|---|
| REVISED | DATE | BY | DESCRIPTION |
| | | | |
| | | | |
| | | | |
| CHECKED BY: | JKSI | DATE: 2/22/95 | |
| APPROVED BY: | SVDI | DATE: 2/22/95 | |
| APPROVED BY: | JWS | DATE: 2/22/95 | |

Crandon Mining Company

**FIGURE 2-7**

MINE DRAINAGE SCHEMATIC

| | | | |
|---|---|---|---|
| Scale: | NOT TO SCALE | Date: | FEBRUARY, 1995 |
| Prepared By: | Foth & Van Dyke | By: | JRB |

# 3 Bedrock Hydrogeology

The Crandon deposit is a typical volcanogenic massive sulfide (VMS) deposit. These types of deposits occur world-wide, and have been well studied in relation to stratigraphy, mineralogy, chemistry, structure/techtonics, petrography/petrology, geometry, etc. Extensive bibliographical documentation of these studies exists. Franklin, et. al. (1972), in a review of such deposits, cites over 550 references. Given this extensive record, the geology, setting and geometry of such deposits and their bedrock environment are well understood. This understanding is fundamental to predicting the hydrologic characteristics of VMSs and their environs. The fundamental understanding of VMS deposits and their environs has served as a basis to allow CMC to accurately characterize the Crandon deposit. This characterization has taken place over a period of 20 years. Data to support the characterization has included extensive bedrock drilling programs totalling approximately 320,000 feet (60 miles) in over 200 holes in the immediate one and one-half square mile area adjacent to the deposit. Additional drilling further removed from the deposit increases the total drilled footage to 340,000 feet (64 miles).

Additional data has been generated through core logging which provided mineralogical, lithological, structural and weathering characteristics. Also, extensive rock mechanics data was collected relating to core recovery, rock quality determination (RQD), fracture frequency, foliation orientation, bedding trends and rock strength indicators. From a hydrologic standpoint, packer testing, pump testing, downhole temperature logging, hydraulic gradient studies and chemical analyses were completed.

All this data allows the development of a clear understanding of the geometry and variability of the geologic features in the bedrock environment of the Crandon deposit as they influence water movement. The combination of this clear understanding of both formation geometry and geology is the basis for the conceptual model of water movement in site bedrock. This conceptual model in turn provides the foundation for the development of a regional model that accurately reflects geologic and hydraulic conditions and allows the development of impact predictions under mining conditions.

The results of the extensive work on the Crandon deposit and its bedrock environment has allowed CMC to thoroughly characterize them as typical, normally zoned, steeply dipping, conformable, correlatable, undeformed, and located in a volcano-sedimentary, greenschist facies metamorphic terrain. There is no significant disruption, displacement, offset or folding of key stratigraphic horizons in either the ore or host rock. A discussion of relevant information relating to the hydrogeology of the Crandon deposit and its bedrock environment is contained in Sections 3.1 through 3.11 below.

## 3.1 Exploration and Delineation Drilling

A series of six separate drilling programs have been conducted at the site with the geologic data obtained from each interpreted at the end of the respective program. Table 3-1 presents a summary of the drilling programs. Holes in the vicinity of the TMA, which is located about one mile southeast of the ore body, and a series of short vertical holes drilled into the gossan over the ore body are not included in the summary. A discussion of the each of the six programs follows.

## Table 3-1

## Summary of Bedrock/Ore Body Drilling Programs
## Crandon Project

| Hole Numbers* | Number of Holes | Date | Purpose |
|---|---|---|---|
| 1 - 198 | 180 | 1975-78 | Exploration delineation |
| 142, 144, 155, 195, 196, 214 | 6 | 1977-82 | Shaft related |
| 209 - 218 | 8 | 1980 | Six inch metallurgical testing |
| 233 - 252 | 20 | 1982 | Production delineation |
| 258 - 261 | 4 | 1985 | Six inch metallurgical testing |
| 262 - 272 | 11 | 1993-94 | Confirmation drilling |
| Total | 229 | | |

* While called out as sequentially numbered programs, on occasion a hole or holes in a sequence was not drilled until later or was not drilled at all.

Prepared by: AJE
Checked by: JWS

### 3.1.1 Exploration and Delineation Drilling (1975-1978)

Holes, 1-198 are the early exploration and delineation drill holes completed into the deposit between 1975 and 1978. Holes 1-60 and 100-121 comprise the original exploration drilling programs which resulted in discovery and verification of the existence of a potentially viable mineral deposit. After about hole 20, it became clear that a significant deposit was present, that the basic geometry was established, and that if the deposit were continuous, perhaps 60 million tons of ore would be available for evaluation. Holes 100-121 provided data to evaluate the potential of near surface supergene enriched material.

Holes 61-99 and 122 to 198 were delineation holes to confirm continuity between more widely spaced holes and to establish the likely limits of the deposit. Early interpretations were confirmed and stratigraphic correlation above, within, and below the Crandon Formation and its contained mineralization, i.e., the Crandon deposit, were established. Successive resource calculations confirmed the original estimates. Further delineation drilling between existing holes intercepted the Crandon Formation hanging wall and ore contacts as projected.

### 3.1.2 Vertical Shaft Related Holes (1977-1982)

Six vertical holes were drilled at various times between 1977 and 1982 to assess ground conditions at potential vertical shaft sites. The holes were not designed to intersect key

stratigraphic horizons. No significant adverse conditions, badly fractured ground or major faults at any trend were intersected in this work.

### 3.1.3 Metallurgical Pilot Plant Testing (1980)

In 1980, eight six inch diameter holes (209, 210, 211, 212, 213, 216, 217, 218) were drilled to provide material for pilot plant metallurgical testing. These holes intersected the Crandon Formation hanging wall and mineralization at the locations projected based on interpretations from earlier drilling (holes 1-198). No significant geologic variations with regard to the location or nature of the mineralization or surrounding rock were noted as a result of this drilling.

### 3.1.4 Early Production Area Confirmation (1982)

The 1982 twenty hole program was designed to confirm the location and nature of planned production stopes outlined by early mine planning. Unmineralized areas to be used for the construction of underground support facilities were also targeted. As with the 1980 program, no geologic variations with regard to the location or nature of the mineralization and surrounding rock were encountered as a result of this program.

### 3.1.5 Metallurgical Grindability and Pilot Plant Testing (1985)

Four holes were drilled in 1985 to provide a large volume of six inch core, 84,000 pounds (42 tons) for grindability and additional pilot plant testing. Intercepts in the zinc ore were made at the locations predicted based on interpretations from the previous drilling work.

### 3.1.6 CMC Confirmation Drilling Program (1993-1994)

This 11 hole program was designed to confirm continuity, grade and geologic conditions in four widely distributed and less densely drilled portions of the deposit. These holes intersected the Crandon Formation and contained mineralization as projected based on earlier work.

### 3.1.7 Summary

CMC's understanding of the fundamental geometry of the Crandon deposit and surrounding bedrock environment is well developed based on the extensive drilling discussed above. The predictability of the deposit as documented through successive drilling programs is a strong factor leading to the conclusion that the deposit and host rock do not have significant disruptions, displacements, offsets, or folding of key stratigraphic horizons.

## 3.2 Fracture Characterization Studies

The porosity of crystalline and metamorphic bedrock, such as that found at Crandon is typically less than two percent. The voids that make up the porosity are minute and not interconnected (Freeze and Cherry, 1979, pg. 158). As such, the primary permeability of the bedrock is less than 2.8E-6 ft/d (1x10-9 cm/s) (Freeze and Cherry, 1979, pg. 158), impermeable in the context of most groundwater problems, including mining. In general, interconnected fractures occur within the bedrock within the upper 100 feet or so, i.e., near surface, giving rise to fracture or secondary permeability near the bedrock surface (Freeze and Cherry, 1979). The source of these secondary permeability features is attributed to changes in stress conditions (Freeze and Cherry, 1979)

caused by events such as glaciation. The widths of these fractures are generally less than one mm (Freeze and Cherry, 1979).

The Foth & Van Dyke bedrock hydrology memorandum (Foth & Van Dyke, 1994) discussed the formation of fractures within the bedrock at the Crandon Project site and noted the preferential east-west orientation of fractures, i.e., secondary permeability features, frequently paralleling bedding planes within the hanging and footwall rocks. In their memo, Bradbury, et. al. (1994) discuss the potential influence of a hypothetical set of north-south fractures which could influence bedrock groundwater movements. They point out that north-south drilling is not the optimum drilling orientation to characterize north-south fractures. Bradbury, et. al. (1994) also infer that more detailed analysis of fracture patterns are warranted to understand the hydrologic system within the bedrock. Both of these issues are addressed below.

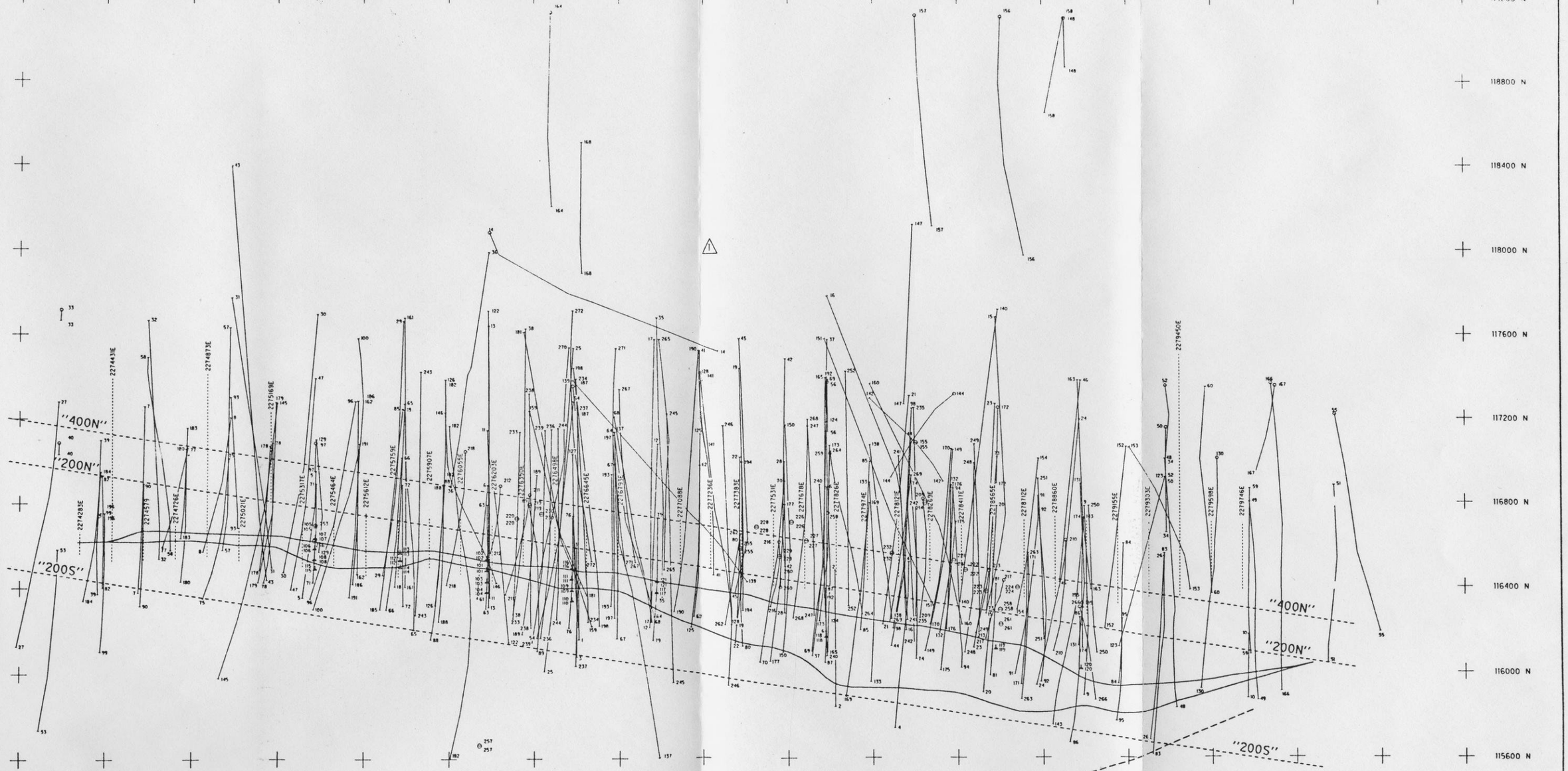
As depicted in Figure 3-1, most Crandon Project drilling core was collected from angle borings which are oriented in a southerly direction. However, the borings tend to gradually deflect to the west and hence follow a westward curving trajectory ranging from due south to S18°W. Hole 144 was drilled southwesterly as part of a possible shaft site evaluation program.

Compared to many mining projects, the Crandon Project has an unusually high number of exploration holes. The Crandon Project has been defined by holes drilled on a roughly 200 foot by 200 foot grid on the longitudinal plan of the ore body. The correlation at geologic horizons between holes in the closely spaced drilling work demonstrates the excellent uninterrupted stratigraphic continuity of the deposit and surrounding rock. This continuity would not be present if north-south fracturing or faulting were present. As indicated in the bedrock hydrology memorandum (Foth & Van Dyke, 1994), and later in this report, north-south trending fractures were the exception rather than the norm.

In addition to the westward curving core holes discussed above, fourteen holes (55, 68, 137, 138, 139, 142, 146, 153, 159, 160, 250, 265, 271, and 272) along the eastern two-thirds of the deposit were either drilled or drifted in a southeasterly direction. The maximum drift was S40°E. These core holes would have intersected any north-south fracture or fault system in the area they traversed. As discussed in more detail below, no north-south fractures were prominent.

The core holes form a drill density of approximately one hole every 20 linear foot along the strike of the ore body. This clearly shows there are very few areas, at most six, each about 50 to 100 feet wide, where any theorized north-south trending pairs of faults or fractures could be present without having been intercepted by one of the many exploration holes. More important than the concept of space available for theorized north-south fracturing are east-west stratigraphic relationships which are discussed below.

The six independent drilling programs were conducted over a 20 year interval. Earlier programs provided factual data on both near surface and deep structure and stratigraphy, particularly the location, trend and continuity of the Crandon Formation hanging wall and footwall contacts, and contained ore zones. Later drilling programs intersected contacts and ore zones at their interpreted locations. This means that there has been no significant north-south fault offsets to the interpreted east-west stratigraphic trends. The drilling density at the site is so extensive along strike, and at depth, that any significant north-south fractures or structural offsets would have been encountered in the drilling programs. Since none were encountered, significant north-south fractures and structural offsets are not likely to exist.




## LEGEND

- CORE HOLE TRACE
- WEATHERING CROSS SECTIONS USED TO GENERATE LONGITUDINAL WEATHERING SECTIONS
- ORE BODY
- LOCATION OF LONGITUDINAL WEATHERING SECTIONS
- DUCK LAKE GABBRO DIKE

0 250 500 1000

BAR SCALE (FEET)

Foth & Van Dyke

| REVISED | DATE | BY | DESCRIPTION |
|---|---|---|---|
| 1 | 4/24/95 | SVDI | ADDED ADDITIONAL CORE HOLES |

| | | |
|---|---|---|
| CHECKED BY: | JKSI | DATE: APR. '95 |
| APPROVED BY: | AJE JR./SVDI | DATE: APR. '95 |
| APPROVED BY: | JWS | DATE: APR. '95 |

**Crandon Mining Company**

FIGURE 3-1

PLAN MAP SHOWING DRILL HOLE TRACE AND OUTLINE OF CRANDON FORMATION, LOCATION OF WEATHERING CROSS SECTIONS, LOCATION OF LONGITUDINAL WEATHERING SECTIONS AND LOCATION OF GABBRO "DIKE"

| | | | |
|---|---|---|---|
| Scale: | 1"=500' | Date: | APRIL, 1995 |
| Prepared By: | Foth & Van Dyke | By: | JRB |

3.5-15-28

93C0049 19

Several fracture analysis studies have been completed as part of mine planning. Two of these studies were completed by John D. Smith Engineering Associates Limited (1982) and J.F.T. Agapito & Associates, Inc. (1992). The relevant portions of their reports are provided in Appendix A and Appendix B, respectively. The Smith (1982) report focused on the crown pillar area between the upper portion of the ore body above the 1,200 foot elevation (465 feet below surface) and below the base of the permanent crown pillar, at approximately 1,450 feet (215 feet below surface).

Figure 3-2 shows the location of the eight holes (236, 237, 238, 239, 244, 245, 246, and 247), analyzed by Smith (1982), and the numerous holes analyzed by Agapito (1992) for fracture orientation within the hanging wall, ore body and footwall units. The analyzed holes are representative of bedrock conditions.

Within the upper bedrock regions, to depth of 1000 feet below surface, five fracture trends, two strong and three less distinct, were identified by Smith (1982). Average attitudes for all fracture sets are listed in Table 3-2. The most prominent is listed as one, with the least prominent listed as five.

## Table 3-2

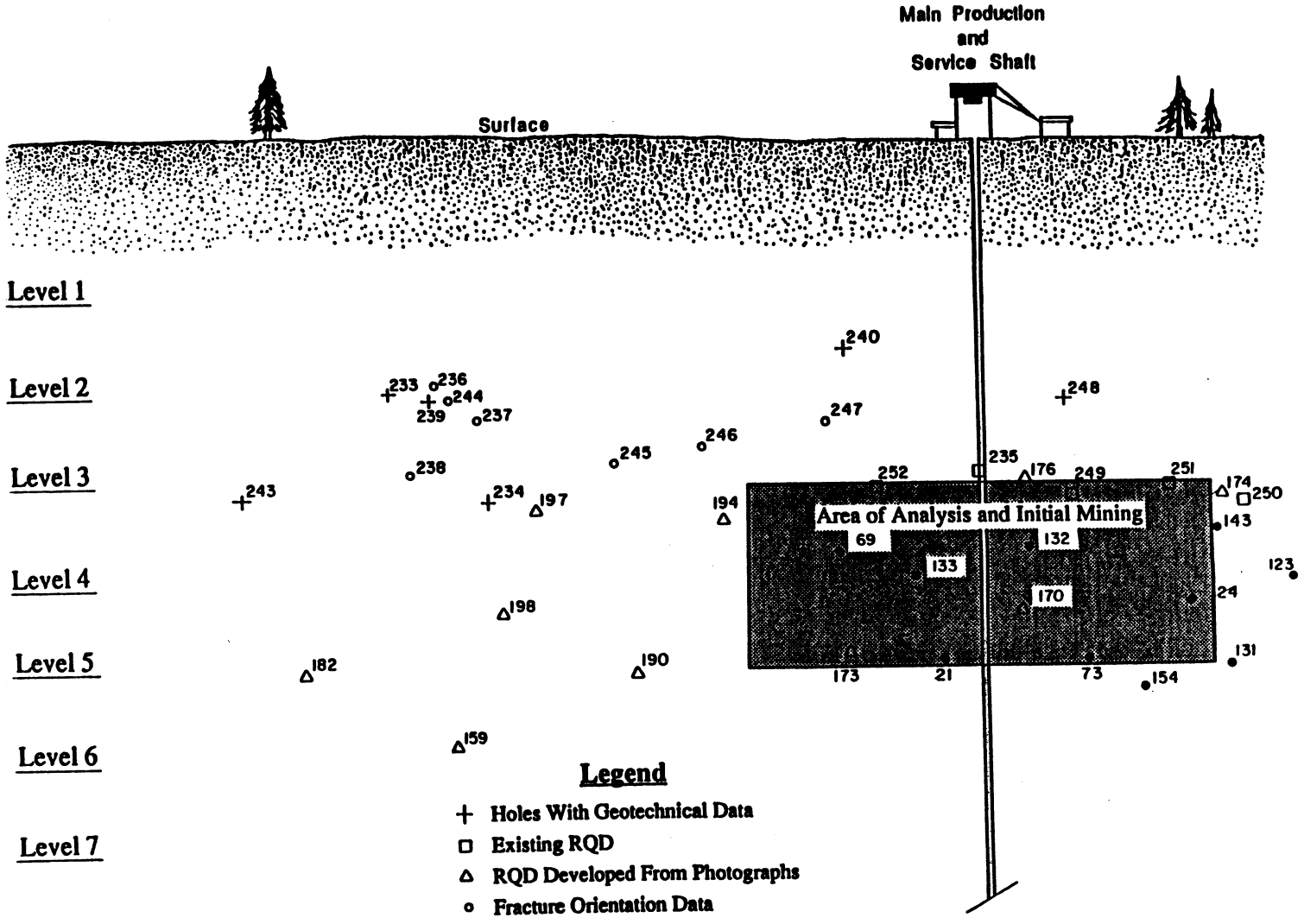
## Summary of Fracture Orientation
## Shallow Hanging Wall/Ore Body/Footwall Units
## Crandon Project

| Number (sets) | Strike Azimuth | Dip |
|---|---|---|
| 1 | 85° (E) | 85° SE |
| 2 | 62° (NE) | 8° SE |
| 3 | 151° (SE) | 81° SW |
| 4 | 140° (SE) | 39° SW |
| 5 | 116° (SE) | 25° NE |

Note: No. 1 equals most prominent fractures, 5 equals least prominent fractures.

Prepared by: AJE
Checked by: SVD1

The fracture patterns presented in Table 3-2 indicate that the predominant fracture trends (1 and 2 above) within the shallow portions (i.e., upper 1,000 feet) of bedrock are oriented in a generally east-west direction. Although not discussed by Smith (1982), observations of the core suggests that the most prominent fractures (i.e., 1 and 2 above) show evidence of weathering such as iron oxide coatings, and therefore would also be the most likely to transmit water while the least prominent (i.e., those running in a southeasterly to northwesterly direction, 3 to 5 above) are tighter fractures and show less evidence of weathering, and therefore would be less likely to transmit water. Although less prominent, interconnected north-south and east-west fractures could give rise to a continuous fracture network through which groundwater will flow.




SOURCE: AGAPITO, 1992

| Foth & Van Dyke | | | |
|---|---|---|---|
| REVISED | DATE | BY | DESCRIPTION |
| | | | |
| | | | |
| | | | |

| | | |
|---|---|---|
| CHECKED BY: | JKSI | DATE: FEB.'95 |
| APPROVED: | SVDI | DATE: FEB.'95 |
| APPROVED: | JWS | DATE: FEB.'95 |

Crandon Mining Company

**FIGURE 3-2**

GENERAL E-W LONG SECTION THROUGH CRANDON FORMATION SHOWING HANGING WALL PIERCE POINTS OF DRILL HOLES USED FOR GEOTECHNICAL ANALYSIS

Scale: AS SHOWN | Date: FEBRUARY, 1995

Prepared By: Foth & Van D | By: JOW

c:\cadwork\4c33f52.dgn
3.5-15-30
93C049 21

Rowe (1985) came to a similar conclusion and noted that the upper bedrock at the Crandon site contained randomly oriented interconnected fractures that could provide a network for lateral movement of groundwater. This observation is consistent with work performed by Summers (1972) who described the depth of interconnected fractures in Precambrian bedrock in the vicinity of Rothschild, Wisconsin as about 100 feet. Based on this, Summers (1972) inferred that water movement to wells would be limited to the upper 100 feet of the bedrock.

More recent rock mechanics work in deeper portions of the Crandon bedrock was carried out by J.F.T. Agapito & Associates, Inc. (1992) to review fracture orientation on a deeper portion of the deposit between the approximate depths of 942 feet to 1,542 feet below surface. Figure 3-2 shows the holes analyzed. The 200 series holes were analyzed as were the data from oriented core in hole 155. Three dominant trends were identified as summarized in Table 3-3.

## Table 3-3

## Summary of Fracture Orientation
## Deep Hanging Wall/Ore Body/Footwall Units
## Crandon Project

| Strike Azimuth | Dip |
|---|---|
| 90° (E) | 10° S |
| 99° (SE) | 47° S |
| 90° (E) | 85° S |

Prepared by: AJE
Checked by: SVD1

The fracture trends identified by Agapito (1992) in the deeper bedrock regions (i.e, below 900 feet) are all oriented preferentially in an east-west direction with the strike paralleling bedding planes within the rock mass. By implication, this would locally result in the east-west permeability being greater than the north-south permeability provided the fractures are continuous. However, as identified by Rowe (1985), fractures at depth within the hanging wall bedrock lack continuity. Rowe (1985) based this conclusion by evaluating fracture distribution in the near vertical prospect shaft hole 214, and in the production shaft pilot hole 155. Both holes are located north of the ore body in typical hanging wall bedrock conditions. The location of the holes and fracture distribution with depth is shown on the figures contained in Appendix C. Even though the holes are relatively close there is considerable variation in fracture intensity at equivalent depths, for both vertical fractures and total fractures. This implies that the fracture sets are not related, nor through going, and thus lack continuity. More importantly, the fracture frequency versus depth plots shown in Appendix C also indicate that at depths greater than 1,200 feet, near vertical fractures are extremely infrequent over long intervals, providing additional evidence suggesting fractures lack continuity at depth.

Lambe and Rowe (1980) also analyzed fracture intensity and the water yielding capacity of hole 214. This work is provided in Appendix D. They identified two sets of fractures in the hole. The first set of fractures was steep 10° to 15° to the vertical core axis corresponding to a dip of 80° to 75°. The second set of fractures was flatter 45° to 75° to the core axis, corresponding to a dip of 45° to 35°. Both sets contain some iron oxide, pyrite and quartz veining, suggesting restricted water movement over geologic time scales. The intensity of the near vertical set of fractures, i.e., fractures per foot, falls off rapidly after 1,085 feet, and total oxidation effectively ends at 1,135 feet. As presented in Appendices C and D, there is a similar trend in total and near vertical fractures in hole 155.

Lambe and Rowe (1980) noted that nine very small fault zones, some with iron oxide, were present in hole 214. The oxidation along the faults/fractures indicate that some oxygenated waters were probably moving in this near surface environment. There is a marked decrease in steep fractures at depths greater than about 1,000 feet, and oxidation is not evident beyond 1,135 feet (Lambe and Rowe, 1980). Steep fractures are rare and generally tight below 1,135 feet.

Two pump tests were also conducted on hole 214. The first test was conducted over an interval from 107 feet to 360 feet, and was able to produce water at a rate of only 0.36 gpm, perhaps derived from a fracture zone at 325 to 345 feet. When a larger interval was tested, 107 feet to 750 feet, water was produced at a slightly higher rate of two gpm indicating that other fracture zones were likely intersected. The low water yielding capacity of the rock in hole 214 suggests restricted water movement within the region tested. The results from hole 214 also serve as an example of the difficulty of performing pump tests within the bedrock surrounding the ore body. It is difficult to conceive how a meaningful pump test, networked with observation wells around a production well, could be conducted if the bedrock yields only several gallons per minute when long intervals are tested as indicated above.

Cumulatively, the work of Lambe and Rowe (1980); John D. Smith Engineering Associates Limited (1982); Rowe (1985); and J.F.T. Agapito & Associates, Inc. (1992) indicate limited water movement in the upper 1,000 feet of fresh bedrock, and even less evidence of water movement below approximately the upper 1,000 feet of fresh bedrock.

Additional insight into fracture patterns with depth can be inferred by examining RQD[1] data. RQD data was collected during the 11 hole recent drilling program conducted by CMC in 1993 and 1994, and in some of the earlier drilling programs.

As discussed in the bedrock hydrology memorandum (Foth & Van Dyke, 1994) RQD is a measure of rock strength and fracturing, irrespective of orientation, in core and is based on the ratio of cumulative length of core in pieces greater than four inches divided by the total length in a core run. It is not a precise measurement of conditions in the rock as the measurements are typically made after the core is removed from the core barrel. As such the core has been subjected to hammering and breaking, first to remove it from the core barrel and then in breaking core into two foot lengths to be placed in core boxes. This procedure tends to open up

[1] RQD is the measurement "rock quality designation". It is the ratio of the sum of recovered core longer than four inches divided by the total core length, expressed as a percent. RQD can provide a measure of open fracture frequency. The higher the RQD, the lower the open fracture frequency.

natural planar features, veinlets, bedding planes, joints, and tight fractures and/or faults. Still the measure has been found useful throughout industry to characterize bedrock, with higher RQD representing longer core lengths and unfractured conditions indicating more of an empirical assessment for ground support requirements for mining, general rock strength and, therefore in crystalline rock, relative permeability.

As discussed in the bedrock hydrology memorandum (Foth & Van Dyke, 1994) RQD increases with an increase in depth from surface in and about the Crandon Formation. This was shown in the early drilling work and confirmed in the 1993-94 eleven hole drilling program. Table 3-4 shows hanging wall and footwall RQD data from this latest drilling program.

## Table 3-4

## Summary of RQD Data Versus Depth Hanging Wall/Footwall Crandon Project

| Hole Number | Dip at Collar | Hanging Wall | | | Footwall | | |
|---|---|---|---|---|---|---|---|
| | | Depth | Drill Depth (feet) From - To | RQD % | Depth | Drill Depth (feet) From - To | RQD% |
| 262 | -65° | Shallow | 355 - 499 | 27 | Moderate | 759 - 944 | 71 |
| 266 | -65° | Shallow | 350 - 467 | 41 | Moderate | 660 - 963 | 87 |
| 263 | -60° | Shallow | 500 - 594 | 51 | Moderate | 891 - 1,169 | 66 |
| 269 | -58° | Moderate | 838 - 952 | 70 | Deep | 1,172 - 1,341 | 86 |
| 264 | -64° | Moderate | 605 - 1,148 | 91 | Deep | 1,387 - 1,565 | 97 |
| 268 | -55° | Moderate | 979 - 1,175 | 68 | Deep | 1,375 - 1,566 | 89 |
| 267 | -64° | Deep | 1,220 - 1,634 | 89 | Deep | 1,744 - 1,844 | 93 |
| 265 | -64° | Deep | 1,639 - 1,942 | 89 | Deep | 2,088 - 2,154 | 91 |
| 270 | -70° | Deep | 1,631 - 2,179 | 90 | Deep | 2,308 - 2,446 | 95 |
| 271 | -70° | Deep | 1,603 - 2,259 | 91 | Deep | 2,366 - 2,506 | 96 |
| 272 | -65° | Deep | 1,366 - 2,360 | 86 | Deep | 2,402 - 2,574 | 94 |

Prepared by: AJE
Checked by: SVD1

The RQD data supports the data obtained from the fracture studies discussed above. At depths above 1,000 feet, the RQD data is variable and relatively low, indicative of a more frequent occurrence of fractures than at depth. Below 1,000 feet, the RQD data is uniformly above 85 percent, which indicates that fracture occurrence is relatively low.

Overall, the fracture orientation studies based on core from numerous core holes suggests the following:

1.) Random fractures, and higher fracture intensity that could be through-going and continuous are limited to near surface regions of the bedrock. The work of Smith (1982), Agapito (1992), Lambe and Rowe (1980), and Rowe (1985) suggests interconnected fractures are limited to approximately the upper 1,000 feet of the bedrock surrounding the ore body.

2.) At depths greater than approximately 1,000 feet, fracture frequency plots, fracture orientation, and evidence of water movement indicate that fractures are discontinuous, are oriented preferentially in an east-west direction, and show little evidence of water movement (J.F.T. Agapito & Associates, Inc., 1992; Lambe and Rowe, 1980; Rowe, 1985, A.J. Erickson Jr., Exxon, personal observation). The data on fracture frequency, orientation and oxidation suggests that below approximately 1,000 feet into the bedrock, fractures are few and lack continuity.

In summary, six different successive drilling programs in the immediate area of the deposit, comprising over 200 holes totaling about 320,000 feet (60 miles), provide data indicating no significant interruption of east-west stratigraphy due to north-south faulting or fracturing. It is acknowledged that north-south drilling is not the optimum way to sample for north-south fractures. However, most of the Crandon Project core holes are not truly north-south but have west trending trajectories. Fourteen holes were drilled or drifted in an easterly direction, and one was drilled southwesterly. Additionally, four vertical holes have been drilled. Multiple fracture study programs completed for the project document a random fracture pattern near the bedrock surface and predominantly east-west trending, south dipping sets of discontinuous fractures below 1,000 feet.

Given all the work performed for the Crandon Project over the past 20 years by numerous experienced, reputable professionals, no credible evidence exists to support the concept of significant north-south faulting or fracturing. The core hole density shown on Figure 3-1 is simply too great to have missed significant north-south fracturing or faulting.

## 3.3 Weathering Studies

The classification of weathering intensity for the project was developed in the 1980s based on oxidation, leaching, argillization and fracturing characteristics. These four parameters were combined into weathering intensity ratings of strong, moderate, weak and low (Rowe, 1984). The ratings characterize ground condition from a rock strength and ground stability point of view and also relate to porosity and permeability. Combined with the fracture characterization studies described above, weathering intensity provides an additional measure of the depth at which lateral movement of water within the Precambrian bedrock is likely to occur under a stressed condition.

For the purpose of this report, only strongly and moderately weathered regions of the bedrock are discussed. Based on observation of the core, only strongly and moderately weathered regions have undergone enough weathering to alter secondary permeability features. Secondary permeability in the weak and low weathered regions of the bedrock are, based on core observation, not likely to have undergone any tertiary enhancement of the bulk permeability of the bedrock.

To aid in the evaluation of potential lateral water movement in the Crandon Project bedrock, four longitudinal vertical sections showing the distribution and limits of either strongly or moderately weathered rocks within and adjacent to the Crandon deposit have been prepared. The sections, illustrated in Figure 3-3 through 3-6, show the extent and depth of strong and moderate weathering intensity units in the ore body, hanging wall and footwall. The hanging wall and footwall sections generally trend east-west (N 79° W), and are located nominally 200 and 400 feet north of the trace of Crandon Formation hanging wall subcrop contact, and 200 feet south of the trace of the Crandon Formation footwall subcrop contact, respectively. Figure 3-1 shows the plan view location of these three longitudinal sections. The ore body section also generally trends east-west (N79°W) along the approximate center of the Crandon Formation.

The sections were prepared by plotting cross-section weathering intensity data from 38 cross-sections to the trace of the longitudinal sections. Thirty six of the sections are contained in Appendix E. Two of the sections exist at a scale much larger than that for the other 36 cross-sections, and therefore are not included in Appendix E.

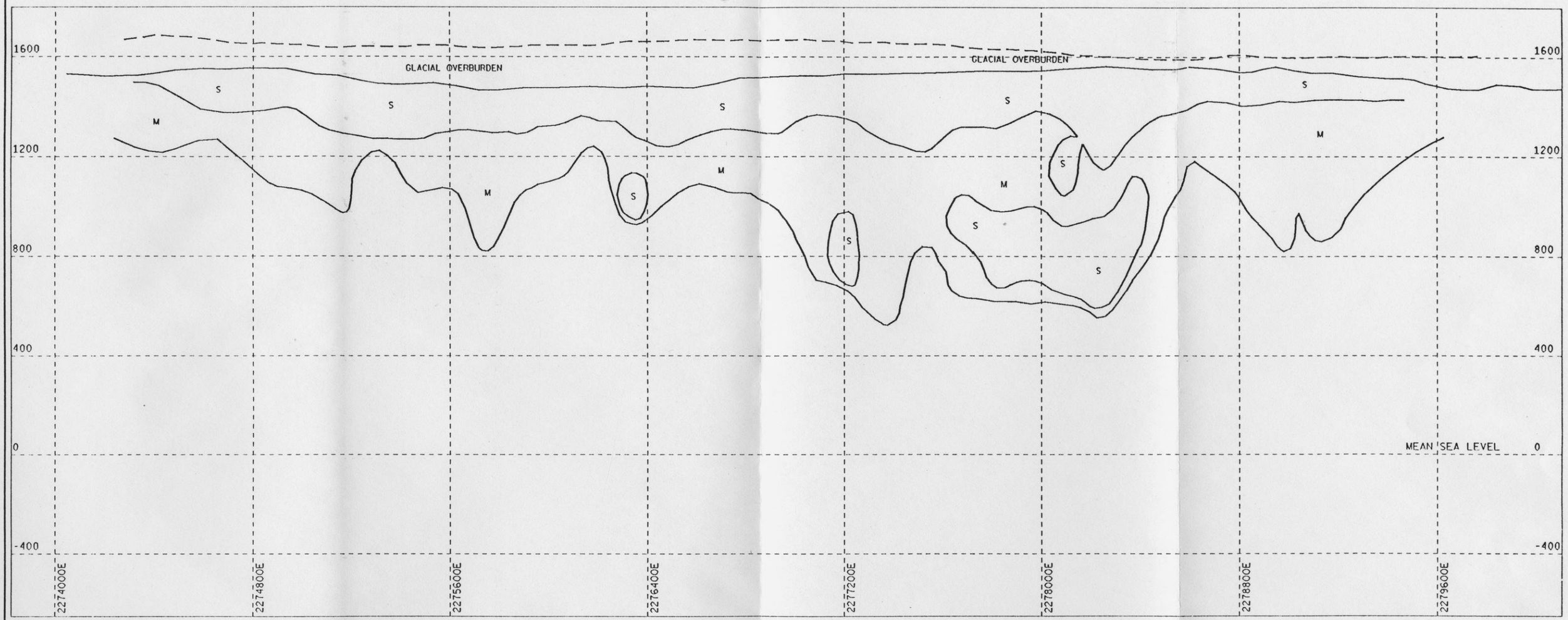
Table 3-5 summarizes weathering and permeability data for the footwall, Crandon Formation, and hanging wall. The following observations can be made based on a review of Table 3-5 and, the weathering sections shown in Figures 3-3 through 3-6:

- The weathering intensity is at its maximum extent within the Crandon Formation itself (Figure 3-3) and extends to a depth of about 1,100 feet.

- Weathering intensity decreases in depth and intensity to the north into the hanging wall away from the Crandon Formation. The depth of moderate weathering intensity on the 200N section (Figure 3-4) averages about 300 feet and has a maximum depth of approximately 800 feet. The depth of moderate weathering intensity on the 400N section (Figure 3-5) averages about 250 feet and has a maximum depth of about 400 feet.

- The decrease in weathering intensity to the north of the deposit in the hanging wall is a reflection of proximity to the massive sulfide mineralization and its near surface oxidation effects.

- The depth of the moderate weathering intensity is less along the 200S projection in the footwall of the deposit (Figure 3-6) where it averages about 250 feet deep and has a maximum of approximately 400 feet. This is a reflection of the intensity of silicification in the rocks and also the lack of intense sulfide mineralization as compared to the Crandon Formation.




## DESTRUCTIVE PROCESS AND WEATHERING INTENSITY RATING

**DESTRUCTIVE PROCESSES:**

| | | |
|---|---|---|
| OXIDATION - | TOTAL: | TOTAL OXIDATION OF ALL SULFIDES |
| | PARTIAL: | PARTIAL OXIDATION OF ALL SULFIDES |
| | TRACE: | TRACES OR SMALL QUANTITIES OF TRANSPORTED AND/OR INDIGENOUS LIMONITE ON FRACTURES OF BEDDING PLANES |
| LEACHING - | STRONG: | >5 VOLUME PERCENT SECONDARY POROSITY |
| | MODERATE: | 2-5 VOLUME PERCENT SECONDARY POROSITY |
| | WEAK: | TRACE - 1 VOLUME PERCENT SECONDARY POROSITY |
| ARGILLIZATION - | STONG: | PERVASIVE STRONG DEVELOPMENT OF CLAY. ROCK SOFT AND BREAKS EASILY. (ROCK EASILY GOUGES WITH NAIL) |
| | WEAK: | WEAK OR PARTIAL CLAY DEVELOPMENT, BUT ROCK DOES NO BREAK EASILY |
| FRACTURING - | STRONG: | > 20 FRACTURES/FOOT |
| | MODERATE: | 5-20 FRACTURES/FOOT |
| | WEAK: | 1-4 FRACTURES/FOOT |

**WEATHER INTENSITY RATING**

| | |
|---|---|
| STRONG: S | STRONG DEVELOPMENT OF TWO OR MORE OF THE DESTRUCTIVE PROCESSES. ROCKS WILL HAVE VERY LOW COMPRESSIVE STRENGTHS AND WORKINGS WOULD HAVE TO BE SUPPORTED AS NEEDED. SECONDARY PERMEABILITY FEATURES HAVE BEEN SIGNIFICANTLY MODIFIED. |
| MODERATE: M | STRONG DEVELOPMENT OF ONE OF THE DESTRUCTIVE PROCCESSES (OR MODERATE DEVELOPMENT OF TWO) AND WEAK TO MODERATE DEVELOPMENT OF AT LEAST ONE MORE. ROCKS MAY OR MAY NOT BE STRONG ENOUGH TO HOLD A BACK, DEPENDING UPON WHICH DESTRUCTIVE PROCESSES HAVE BEEN ACTIVE. STRONG DEVELOPMENT OF ARGILLIZATION OR FRACTURING WOULD MAKE THE ROCK VERY WEAK OR UNSTABLE, WHEREAS STRONG DEVELOPMENT OF OXIDATION OR LEACHING MAY NOT SERIOUSLY AFFECT ITS ABILITY TO HOLD A BACK. SECONDARY PERMEABILITY FEATURES HAVE BEEN SLIGHTLY MODIFIED. |
| LOW: | MODERATE LEACHING WITH ONLY MINOR OTHER EFFECTS. THE COMPRESSSIVE STRENGTH OF THE ROCK IS NOT SERIOUSLY REDUCED. SECONDARY PERMEABILITY FEATURES HAVE UNDERGONE NO OBSERVABLE WEATHERING MODIFICATIONS. |
| WEAK: | WEAK DEVELOPMENT OF LEACHING AND/OR OXIDATION. ROCK STRENGTHS ARE NOT AFFECTED. SECONDARY PERMEABILITY FEATURES HAVE UNDERGONE NO OBSERVABLE WEATHERING MODIFICATIONS. |

0 200 400 800

BAR SCALE (FEET)

Foth & Van Dyke

| REVISED | DATE | BY | DESCRIPTION |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

| | | |
|---|---|---|
| CHECKED BY: | JKSI | DATE: FEB. '95 |
| APPROVED BY: | AJE JR./SVDI | DATE: FEB. '95 |
| APPROVED BY: | JWS | DATE: FEB. '95 |

Crandon Mining Company

FIGURE 3-3

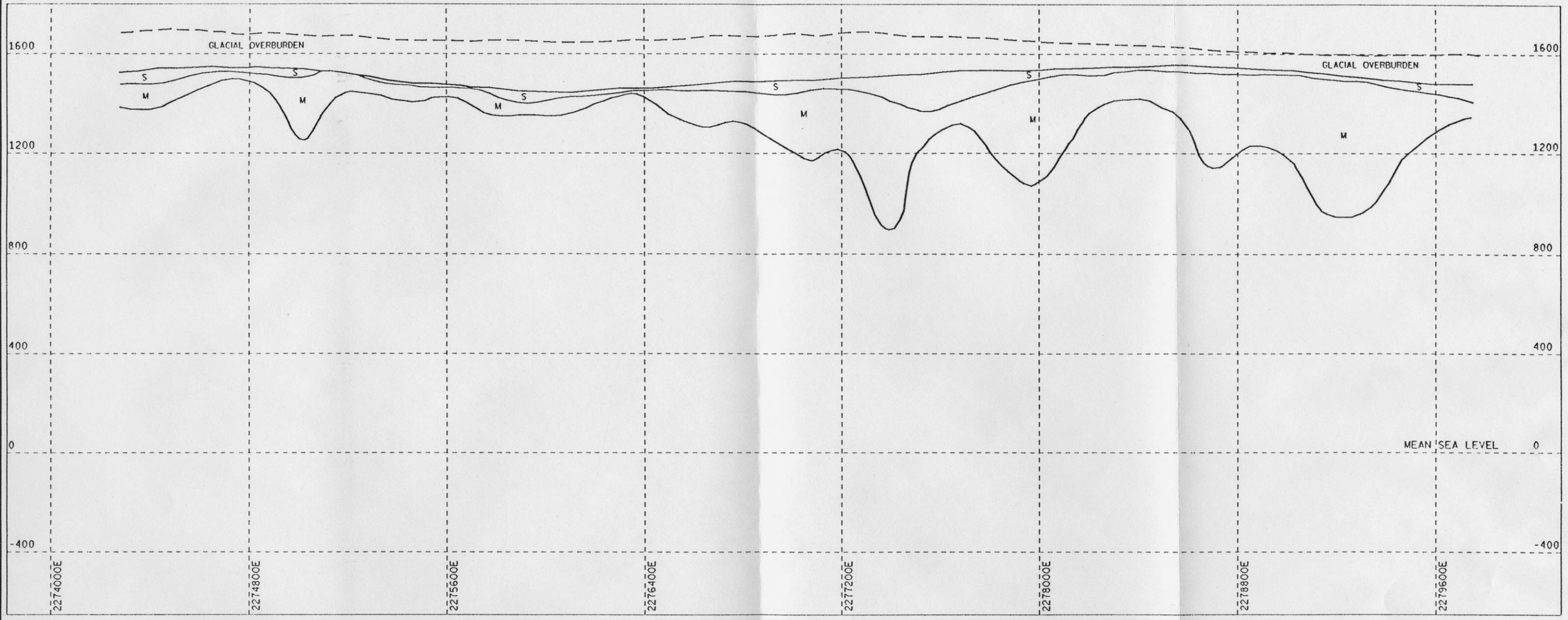
LONGITUDINAL SECTION LOOKING NORTH WITHIN THE CRANDON FORMATION

| | | | |
|---|---|---|---|
| Scale: | SEE BAR SCALE | Date: | FEBRUARY, 1995 |
| Prepared By: | Foth & Van Dyke | By: | AJE JR./JRB |

c:\cadwork\4c33f51.dgn

3.5-15-36

93C049 27




## DESTRUCTIVE PROCESS AND WEATHERING INTENSITY RATING

### DESTRUCTIVE PROCESSES:

| | | |
|---|---|---|
| OXIDATION - | TOTAL: | TOTAL OXIDATION OF ALL SULFIDES |
| | PARTIAL: | PARTIAL OXIDATION OF ALL SULFIDES |
| | TRACE: | TRACES OR SMALL QUANTITIES OF TRANSPORTED AND/OR INDIGENOUS LIMONITE ON FRACTURES OF BEDDING PLANES |
| LEACHING - | STRONG: | >5 VOLUME PERCENT SECONDARY POROSITY |
| | MODERATE: | 2-5 VOLUME PERCENT SECONDARY POROSITY |
| | WEAK: | TRACE - 1 VOLUME PERCENT SECONDARY POROSITY |
| ARGILLIZATION - | STONG: | PERVASIVE STRONG DEVELOPMENT OF CLAY. ROCK SOFT AND BREAKS EASILY. (ROCK EASILY GOUGES WITH NAIL) |
| | WEAK: | WEAK OR PARTIAL CLAY DEVELOPMENT, BUT ROCK DOES NO BREAK EASILY |
| FRACTURING - | STRONG: | > 20 FRACTURES/FOOT |
| | MODERATE: | 5-20 FRACTURES/FOOT |
| | WEAK: | 1-4 FRACTURES/FOOT |

### WEATHER INTENSITY RATING

| | |
|---|---|
| STRONG: S | STRONG DEVELOPMENT OF TWO OR MORE OF THE DESTRUCTIVE PROCESSES. ROCKS WILL HAVE VERY LOW COMPRESSIVE STRENGTHS AND WORKINGS WOULD HAVE TO BE SUPPORTED AS NEEDED. SECONDARY PERMEABILITY FEATURES HAVE BEEN SIGNIFICANTLY MODIFIED. |
| MODERATE: M | STRONG DEVELOPMENT OF ONE OF THE DESTRUCTIVE PROCCESSES (OR MODERATE DEVELOPMENT OF TWO) AND WEAK TO MODERATE DEVELOPMENT OF AT LEAST ONE MORE. ROCKS MAY OR MAY NOT BE STRONG ENOUGH TO HOLD A BACK, DEPENDING UPON WHICH DESTRUCTIVE PROCESSES HAVE BEEN ACTIVE. STRONG DEVELOPMENT OF ARGILLIZATION OR FRACTURING WOULD MAKE THE ROCK VERY WEAK OR UNSTABLE, WHEREAS STRONG DEVELOPMENT OF OXIDATION OR LEACHING MAY NOT SERIOUSLY AFFECT ITS ABILITY TO HOLD A BACK. SECONDARY PERMEABILITY FEATURES HAVE BEEN SLIGHTLY MODIFIED. |
| LOW: | MODERATE LEACHING WITH ONLY MINOR OTHER EFFECTS. THE COMPRESSSIVE STRENGTH OF THE ROCK IS NOT SERIOUSLY REDUCED. SECONDARY PERMEABILITY FEATURES HAVE UNDERGONE NO OBSERVABLE WEATHERING MODIFICATIONS. |
| WEAK: | WEAK DEVELOPMENT OF LEACHING AND/OR OXIDATION. ROCK STRENGTHS ARE NOT AFFECTED. SECONDARY PERMEABILITY FEATURES HAVE UNDERGONE NO OBSERVABLE WEATHERING MODIFICATIONS. |

0 200 400 800

BAR SCALE (FEET)

Foth & Van Dyke

| REVISED | DATE | BY | DESCRIPTION |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

| | | |
|---|---|---|
| CHECKED BY: | JKSI | DATE: FEB. '95 |
| APPROVED BY: | AJE JR./SVDI | DATE: FEB. '95 |
| APPROVED BY: | JWS | DATE: FEB. '95 |

Crandon Mining Company

FIGURE 3-4

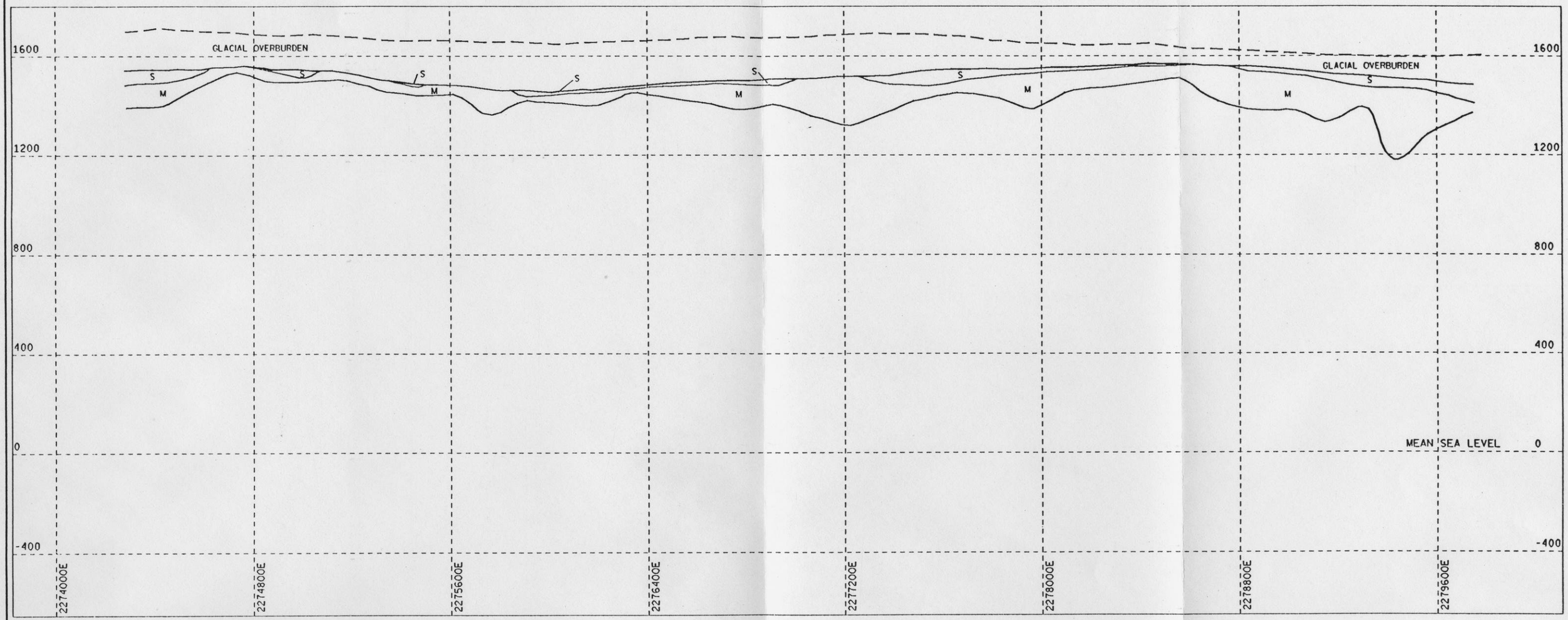
E-W LONGITUDINAL SECTION
200' NORTH OF CRANDON FM HW CONTACT
AT SUBCROP - LOOKING DUE NORTH - MOLE LAKE FM

| | | | |
|---|---|---|---|
| Scale: | SEE BAR SCALE | Date: | FEBRUARY, 1995 |
| Prepared By: | Foth & Van Dyke | By: | AJE JR./JRB |

c:\cadwork\4c33f18.dgn

3.5-15-37

930049 28




## DESTRUCTIVE PROCESS AND WEATHERING INTENSITY RATING

DESTRUCTIVE PROCESSES:

| | | |
|---|---|---|
| OXIDATION - | TOTAL: | TOTAL OXIDATION OF ALL SULFIDES |
| | PARTIAL: | PARTIAL OXIDATION OF ALL SULFIDES |
| | TRACE: | TRACES OR SMALL QUANTITIES OF TRANSPORTED AND/OR INDIGENOUS LIMONITE ON FRACTURES OF BEDDING PLANES |
| LEACHING - | STRONG: | >5 VOLUME PERCENT SECONDARY POROSITY |
| | MODERATE: | 2-5 VOLUME PERCENT SECONDARY POROSITY |
| | WEAK: | TRACE - 1 VOLUME PERCENT SECONDARY POROSITY |
| ARGILLIZATION - | STONG: | PERVASIVE STRONG DEVELOPMENT OF CLAY. ROCK SOFT AND BREAKS EASILY. (ROCK EASILY GOUGES WITH NAIL) |
| | WEAK: | WEAK OR PARTIAL CLAY DEVELOPMENT, BUT ROCK DOES NO BREAK EASILY |
| FRACTURING - | STRONG: | > 20 FRACTURES/FOOT |
| | MODERATE: | 5-20 FRACTURES/FOOT |
| | WEAK: | 1-4 FRACTURES/FOOT |

WEATHER INTENSITY RATING

| | |
|---|---|
| STRONG: S | STRONG DEVELOPMENT OF TWO OR MORE OF THE DESTRUCTIVE PROCESSES. ROCKS WILL HAVE VERY LOW COMPRESSIVE STRENGTHS AND WORKINGS WOULD HAVE TO BE SUPPORTED AS NEEDED. SECONDARY PERMEABILITY FEATURES HAVE BEEN SIGNIFICANTLY MODIFIED. |
| MODERATE: M | STRONG DEVELOPMENT OF ONE OF THE DESTRUCTIVE PROCCESSES (OR MODERATE DEVELOPMENT OF TWO) AND WEAK TO MODERATE DEVELOPMENT OF AT LEAST ONE MORE. ROCKS MAY OR MAY NOT BE STRONG ENOUGH TO HOLD A BACK, DEPENDING UPON WHICH DESTRUCTIVE PROCESSES HAVE BEEN ACTIVE. STRONG DEVELOPMENT OF ARGILLIZATION OR FRACTURING WOULD MAKE THE ROCK VERY WEAK OR UNSTABLE, WHEREAS STRONG DEVELOPMENT OF OXIDATION OR LEACHING MAY NOT SERIOUSLY AFFECT ITS ABILITY TO HOLD A BACK. SECONDARY PERMEABILITY FEATURES HAVE BEEN SLIGHTLY MODIFIED. |
| LOW: | MODERATE LEACHING WITH ONLY MINOR OTHER EFFECTS. THE COMPRESSSIVE STRENGTH OF THE ROCK IS NOT SERIOUSLY REDUCED. SECONDARY PERMEABILITY FEATURES HAVE UNDERGONE NO OBSERVABLE WEATHERING MODIFICATIONS. |
| WEAK: | WEAK DEVELOPMENT OF LEACHING AND/OR OXIDATION. ROCK STRENGTHS ARE NOT AFFECTED. SECONDARY PERMEABILITY FEATURES HAVE UNDERGONE NO OBSERVABLE WEATHERING MODIFICATIONS. |

0 200 400 800

BAR SCALE (FEET)

Foth & Van Dyke

| REVISED | DATE | BY | DESCRIPTION |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

| | | |
|---|---|---|
| CHECKED BY: | JKSI | DATE: FEB. '95 |
| APPROVED BY: | AJE JR./SVDI | DATE: FEB. '95 |
| APPROVED BY: | JWS | DATE: FEB. '95 |

Crandon Mining Company

FIGURE 3-5

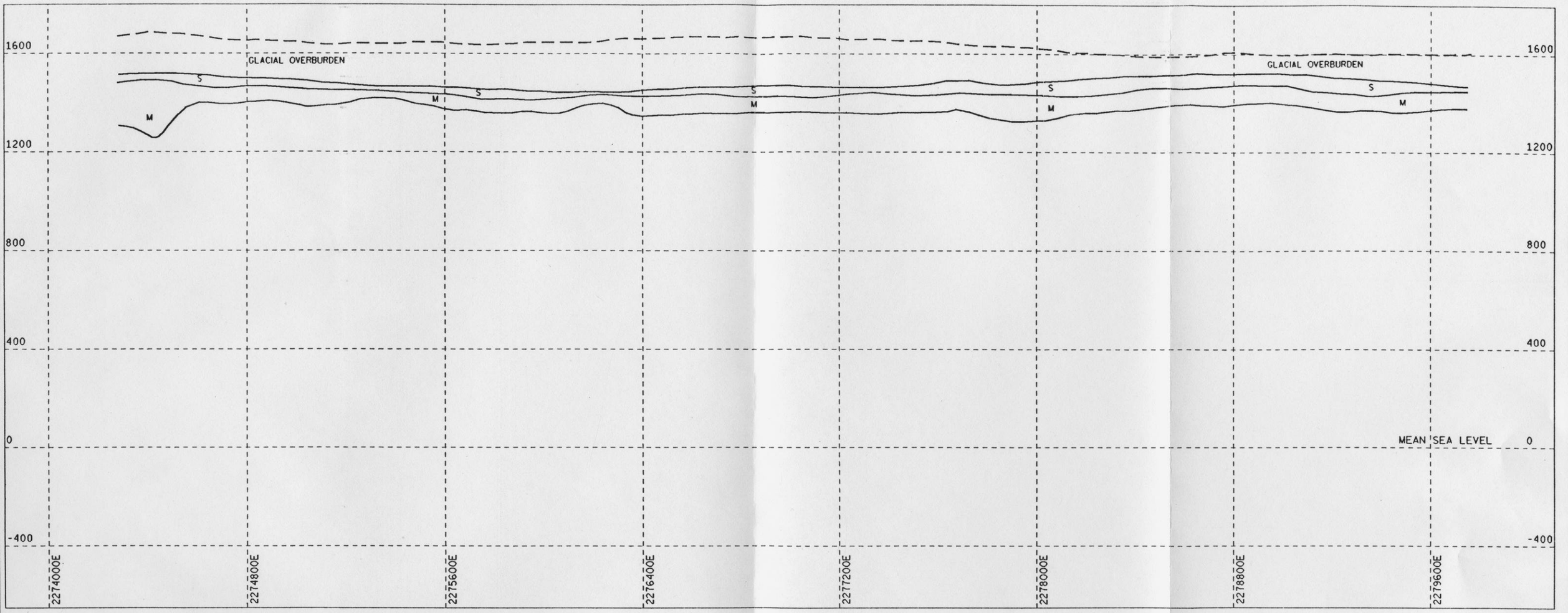
E-W LONGITUDINAL SECTION
400' NORTH OF CRANDON FM HW CONTACT
AT SUBCROP - LOOKING DUE NORTH - MOLE LAKE FM

| | | | |
|---|---|---|---|
| Scale: | SEE BAR SCALE | Date: | FEBRUARY, 1995 |
| Prepared By: | Foth & Van Dyke | By: | AJE JR./JRB |

c:\cadwork\4c33f47.dgn

3.5-15-38

93C049 29




## DESTRUCTIVE PROCESS AND WEATHERING INTENSITY RATING

### DESTRUCTIVE PROCESSES:

| | | |
|---|---|---|
| OXIDATION - | TOTAL: | TOTAL OXIDATION OF ALL SULFIDES |
| | PARTIAL: | PARTIAL OXIDATION OF ALL SULFIDES |
| | TRACE: | TRACES OR SMALL QUANTITIES OF TRANSPORTED AND/OR INDIGENOUS LIMONITE ON FRACTURES OF BEDDING PLANES |
| LEACHING - | STRONG: | >5 VOLUME PERCENT SECONDARY POROSITY |
| | MODERATE: | 2-5 VOLUME PERCENT SECONDARY POROSITY |
| | WEAK: | TRACE - 1 VOLUME PERCENT SECONDARY POROSITY |
| ARGILLIZATION - | STONG: | PERVASIVE STRONG DEVELOPMENT OF CLAY. ROCK SOFT AND BREAKS EASILY. (ROCK EASILY GOUGES WITH NAIL) |
| | WEAK: | WEAK OR PARTIAL CLAY DEVELOPMENT, BUT ROCK DOES NO BREAK EASILY |
| FRACTURING - | STRONG: | > 20 FRACTURES/FOOT |
| | MODERATE: | 5-20 FRACTURES/FOOT |
| | WEAK: | 1-4 FRACTURES/FOOT |

### WEATHER INTENSITY RATING

| | |
|---|---|
| STRONG: S | STRONG DEVELOPMENT OF TWO OR MORE OF THE DESTRUCTIVE PROCESSES. ROCKS WILL HAVE VERY LOW COMPRESSIVE STRENGTHS AND WORKINGS WOULD HAVE TO BE SUPPORTED AS NEEDED. SECONDARY PERMEABILITY FEATURES HAVE BEEN SIGNIFICANTLY MODIFIED. |
| MODERATE: M | STRONG DEVELOPMENT OF ONE OF THE DESTRUCTIVE PROCCESSES (OR MODERATE DEVELOPMENT OF TWO) AND WEAK TO MODERATE DEVELOPMENT OF AT LEAST ONE MORE. ROCKS MAY OR MAY NOT BE STRONG ENOUGH TO HOLD A BACK, DEPENDING UPON WHICH DESTRUCTIVE PROCESSES HAVE BEEN ACTIVE. STRONG DEVELOPMENT OF ARGILLIZATION OR FRACTURING WOULD MAKE THE ROCK VERY WEAK OR UNSTABLE, WHEREAS STRONG DEVELOPMENT OF OXIDATION OR LEACHING MAY NOT SERIOUSLY AFFECT ITS ABILITY TO HOLD A BACK. SECONDARY PERMEABILITY FEATURES HAVE BEEN SLIGHTLY MODIFIED. |
| LOW: | MODERATE LEACHING WITH ONLY MINOR OTHER EFFECTS. THE COMPRESSSIVE STRENGTH OF THE ROCK IS NOT SERIOUSLY REDUCED. SECONDARY PERMEABILITY FEATURES HAVE UNDERGONE NO OBSERVABLE WEATHERING MODIFICATIONS. |
| WEAK: | WEAK DEVELOPMENT OF LEACHING AND/OR OXIDATION. ROCK STRENGTHS ARE NOT AFFECTED. SECONDARY PERMEABILITY FEATURES HAVE UNDERGONE NO OBSERVABLE WEATHERING MODIFICATIONS. |

0 400' 800'
SCALE (FEET)

Foth & Van Dyke

| REVISED | DATE | BY | DESCRIPTION |
|---|---|---|---|
| 1 | 4/29/95 | SVDI | REVISED TITLE |
| | | | |
| | | | |

| | | |
|---|---|---|
| CHECKED BY: | JKSI | DATE: APR. '95 |
| APPROVED BY: | AJE JR./SVDI | DATE: APR. '95 |
| APPROVED BY: | JWS | DATE: APR. '95 |

**Crandon Mining Company**

FIGURE 3-6 1

E-W LONGITUDINAL SECTION
200' SOUTH OF CRANDON FM FW CONTACT
AT SUBCROP - LOOKING DUE NORTH - SAND LAKE FM

| | | | |
|---|---|---|---|
| Scale: | HORIZ. 1"=400'<br>VERT. 1"=400' | Date: | APRIL, 1995 |
| Prepared By: | Foth & Van Dyke | By: | AJE JR./JRB |

c:\cadwork\4c33f49.dgn

3.5-15-39

93C049 30

# Table 3-5

## Crandon Deposit Weathering and Permeability Data
## Crandon Project

| Weathering Intensity Rating | Destructive Agent | Footwall | | | | Crandon Formation | | | | Hanging Wall | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Rock Chemistry | General Pattern | Comments | Permeability | Rock Chemistry | General Pattern | Comments | Permeability | Rock Chemistry | General Pattern | Comments | Permeability |
| Strong:<br><br>Strong development of two or more of the destructive processes, (oxidation, leaching, argillization, or fracturing. Rock will have low compressive strengths and workings would have to be supported at all times. | Acid water due to the breakdown of varying amounts of sulfides during oxidation (i.e., weathering). | Overall siliceous composition in large part due to silicification. Fine pyrite dusting and multi thin quartz, calcite, sulfide veinlets. | Uniform relatively horizontal zone with root like penetrations into underlying moderate zone. | Leaching breaks down sulfides, silicates, and carbonates, alters come to clay. May or may not increase permeability. | Similar throughout strong, moderate, and low zones. Gradual decrease with depth. Argillization tends to plug up porosity developed in leaching and reduces permeability. | Variable with high to low sulfide content, siliceous alteration, tuffs, and argillite units. | Irregular with several deeper spikes, and local isolated areas. | Varied internal stratigraphy controls irregular pattern and types of weathering. High sulfide, strong acid generation. Interbedded units, clay development from silicates. Fracturing. Solutions channel down beds. | Varied but commonly porous with higher permeability. More chlorite rich areas alter to clay with lower permeability.<br><br>255: 8.9x10-4<br>256: 2.5x10-4 | Relatively homogeneous chlorotic tuff with local more siliceous material. | Broad gently undulating. Becomes less pronounced as move north from deposit. | Argillization due to chlorite tends to be pervasive. Little sulfide. Zone becomes deeper as approach Crandon Formation from north due to weathering of Crandon Deposit sulfides. | Near surface weathering and fractures. Clays plug up.<br><br>255: 1.7x10-5 |
| Moderate:<br><br>Strong development of one of the destructive processes (or moderate development of two) and weak to moderate development of at least one more. Rocks may or may not be strong enough to hold a back, depending upon which destructive processes have been active. Strong development of argillization or fracturing would make the rock very weak or unstable, whereas strong development of oxidation or leaching may not seriously affect its ability to hold a back. | Acid water due to the breakdown of varying amounts of sulfides during oxidation (i.e., weathering). | Overall siliceous composition in large part due to silicification. Fine pyrite dusting and multi thin quartz, calcite, sulfide veinlets. | Uniform relatively<br><br>horizontal zone with root like penetrations less abundant into lower zones. | More limited leaching and development of clay. Similar but less intense than above. | Similar throughout strong, moderate, and low zones. Gradual decrease with depth. Argillization tends to plug up porosity developed in leaching and reduces permeability.<br>254: 3.4x10-6 | Variable with high to low sulfide content, siliceous alteration, tuffs, and argillite units. | Irregular broad zone along strike with wider deeper protrusions to depth associated with stronger intensity spikes from above. | As above, with moderate zone adjacent to and surrounds strong weathered areas. Can follow along strike nearer surface. | Varied, moderate to high depending on horizon.<br>66: 1.8x10-5<br>213: 3.4x10-3<br>213: 3.4x10-4<br>213: 2.4x10-3<br>256: 9.8x10-5 | Relatively homogeneous chlorotic tuff with local more siliceous material. | road gently undulating. Becomes less pronounced as move north from deposit. | Argillization due to chlorite tends to be pervasive. Little sulfide. Zone becomes deeper as approach Crandon Fm from north due to weathering of Crandon Deposit sulfides. | Permeability decreases, fewer fractures, some plugging due to clay.<br>66: 1.8x10-5<br>5AL: 1.0x10-7<br>253: 6.4x10-6<br>213: 2.7x10-5 |
| Low:<br><br>Moderate leaching with only minor other effects. The compressive strength of the rock is not seriously reduced. | Acid water due to the breakdown of varying amounts of sulfides during oxidation (i.e., weathering). | Overall siliceous composition in large part due to silicification. Fine pyrite dusting and multi thin quartz, calcite, sulfide veinlets. | Broad open poorly defined areas. | Very limited leaching and alteration effects. | Decreases due to depth and lack of weathering effects.<br><br>66: 9.0x10-6<br>70: 1.2x10-5<br>70: 8.6x10-6<br>254: 7.0x10-6<br>257: 7.6x10-6 | Variable with high to low sulfide content, siliceous alteration, tuffs, and argillite units. | Broad smooth zone below moderate intensity zone. | Not significant at depth below moderate zone. | Moderate to locally lower permeability.<br><br>66: 9.0x10-6<br>70: 1.2x10-5<br>70: 8.6x10-6<br>213: 1.0x10-4 | Relatively homogeneous chlorotic tuff with local more siliceous material. | Broad gentle, not significant zone below moderate zone. | Broad not significant. | Few fractures.<br><br>66: 9.0x10-6<br>70: 1.2x10-5<br>70: 8.6x10-6<br>213: 5.0x10-6<br>213: 2.0x10-5<br>213: 2.2x10-5<br>213: 3.8x10-5 |

Table 3-5, continued

| Weathering Intensity Rating | Destructive Agent | Footwall | | | | Crandon Formation | | | | Hanging Wall | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Rock Chemistry | General Pattern | Comments | Permeability | Rock Chemistry | General Pattern | Comments | Permeability | Rock Chemistry | General Pattern | Comments | Permeability |
| Weak:<br><br>Weak development of leaching and/or oxidation. Rock strengths are not affected. | Acid water due to the breakdown of varying amounts of sulfides during oxidation (i.e., weathering). | Overall siliceous composition in large part due to silicification. Fine pyrite dusting and multi thin quartz, calcite, sulfide veinlets. | Broad open poorly defined areas. | Very limited leaching and alteration effects. | Decreases due to depth and lack of weathering effects.<br><br>91: 1.3x10-5<br>91: 1.9x10-5<br>165: 1.2x10-7 | Variable with high to low sulfide content, siliceous alteration, tuffs, and argillite units. | Broad smooth zone below low intensity zone. | Not significant at depth below low zone. | 91: 1.3x10-5<br>91: 1.9x10-5<br>77: 5.7x10-6<br>165: 5.8x10-7 | Relatively homogeneous chlorotic tuff with local more siliceous material.<br><br>(a) Leakage reported | Broad not significant. | Broad not significant. | 9AL: 2x10-8 F<br>91: 1.3x10-5 e<br>5AU: 2x10-6 w<br>77: 5.7x10-6<br>253: 1.7x10-6 f<br>155: 5.8x10-7 r<br>155: 4.9x10-7 a<br>155: 4.4x10-7 c<br>155: 4.7x10-7 t<br>155: 3.9x10-7 u<br>155: 4.8x10-7 r<br>155: 5.4x10-7 e<br>155: 7.9x10-7 s<br>155: 3.8x10-5<br>155: 6.0x10-5a<br>155: 6.3x10-5a<br>165: 1.4x10-6 |

All permeability values reported in cm/s, multiply by 2834.6 to arrive at value in units of ft/d.

Prepared by: AJE
Checked by: SVD1

## 3.4 Gabbro Dike

Sections 3.2 and 3.3 above discuss fractures and weathering which will tend to direct water flow in the bedrock along more prominent east-west fractures and limited north-south fractures. Another geologic feature exists that will tend to limit north-south flow south of the ore body. This feature consists of a fresh, hard, dense, post ore mineralization, gabbro dike with chilled and commonly welded contacts. Intersected in 18 drill holes, this dike is located south of the ore body as shown on Figures 3-1 and 3-7. Core log summary notes describing the intercept of the dike are provided in Appendix F.

The dike can be traced in an east-northeast trend subparallel to the ore body for nearly 10,000 feet from the Oak Lake area on the west to the east end of the Crandon deposit. Near surface on the east end of the Crandon Formation, the dike is interpreted to be a few feet south of the Crandon Formation while at depth, mean sea level, it is approximately 400 feet south of the ore body in the footwall of the horizon. The dike ranges from 60 feet to 110 feet in true thickness where both the hanging wall and footwall contacts were intersected in nine drill holes. Nine holes were terminated in the dike without fully penetrating the unit. The unit is very distinctive looking. The 18 intercepts have clearly been made in the same geologic unit. Rock similar to those of the Duck Lake gabbro dike have not been encountered elsewhere on the site.

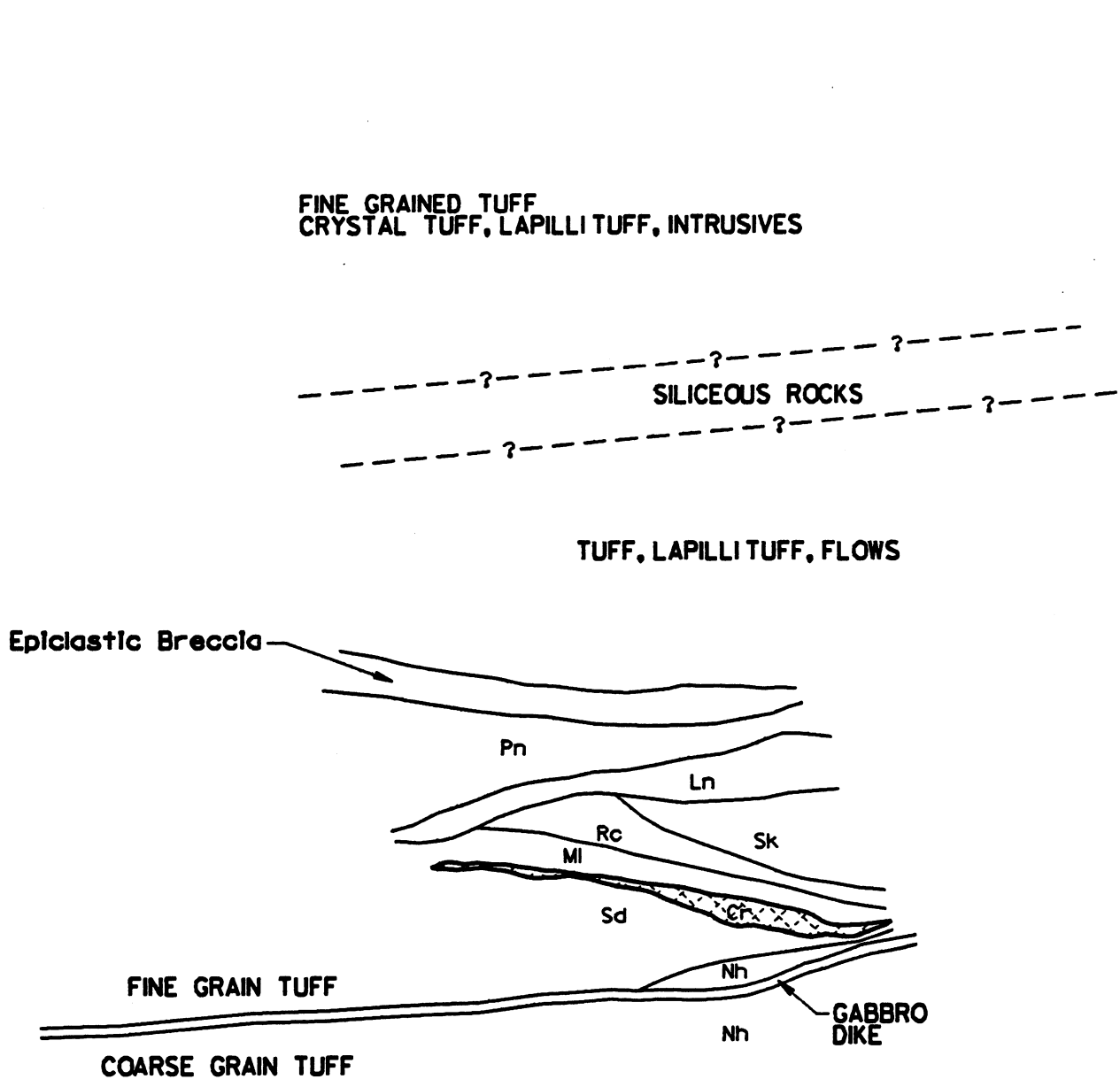
Overall, the dike is fresh and contains no significant faults or large fracture zones. Thin quartz, carbonate, pectolite veinlets with chlorite selvages or hairline chlorite selvages are present which may be tight or slightly opened. The selvages tend to be clean and fresh when opened, although some discoloration can be seen in some fractures nearer surface. Orientations vary with most being from 30° to 70° to the core axis. A few flatter attitudes at 10° to 20° are seen and rare chlorite veinlets parallel to the core have been noted. Most are generally fresh. A few of the nearer surface intersections show a pale dirty brown discoloration in fractures near and along the hanging wall and footwall contact suggesting the near surface channeling of minute amounts of water along the east-west contacts over geologic time scales.

The dike is locally named the Duck Lake gabbro dike. This unit is a typical two pyroxine, fine to at most medium crystalline, fresh, barren, rock. The unit is unmineralized and cuts the Nashville and at least Sand Lake Formations and its contained stringer copper mineralization indicating that it is younger than the Crandon Formation. Contacts with the host rock are chilled and frequently welded although occasionally some thin white calcite quartz veinlets with chlorite selvages are present.

The geologic record shows that the only potential for water movement across this unit would likely be near the surface, in the upper 200 to 300 feet where some fractures have been documented. From a hydrologic perspective, the Duck Lake gabbro dike would form a low flow barrier to lateral south to north water movement into the mine at depths greater than 200 to 300 feet. Bedrock modeling work discussed later in this report has not incorporated the gabbro dike barrier, and thus provides conservative estimates of lateral flow from the bedrock to the mine and resulting drawdown in the bedrock.

## 3.5 Packer Test Data & Bulk Hydraulic Conductivity

Bedrock hydraulic conductivity tests were conducted by Dames & Moore (1978) on six exploration holes (66, 70, 77, 91, 155 and 165) using standard field techniques. The purpose of




| Foth & Van Dyke | | | | |
|---|---|---|---|---|
| REVISED | DATE | BY | DESCRIPTION | |
| | | | | |
| | | | | |
| | | | | |
| CHECKED BY: | JKSI | | DATE: | FEB.'95 |
| APPROVED BY: | SVDI | | DATE: | FEB.'95 |
| APPROVED BY: | JWS | | DATE: | FEB.'95 |

Crandon Mining Company

**FIGURE 3-7**

BEDROCK GEOLOGY OF THE STUDY AREA AND APPROXIMATE LOCATION OF GABBRO DIKE

| | | | |
|---|---|---|---|
| Scale: | NOT TO SCALE | Date: | FEBRUARY, 1995 |
| Prepared By: | Foth & Van Dyke | By: | JOW |

the tests was to estimate the average hydraulic conductivity for relatively thick sections of the bedrock. Many of the tests used a single packer which sealed the hole at a specific depth, with the test performed from that point to the bottom of the hole. Water was pumped from the sealed zone at a low rate and head was monitored over time within the sealed zone. Packer tests were also conducted, in a similar fashion, in hole 213 located near a weathered zone along the ore body hanging wall contact (Landers, 1981). Additional data on bedrock hydraulic conductivity was collected via slug tests on holes 253 through 257 as described by Rowe (1984) and STS Consultants, Ltd. (1984). Figure 3-8 shows the location of all wells and core holes used for bedrock hydraulic conductivity tests.

Cross sections through the ore body, Appendix E, used to develop weathering profiles identify the locations of the packer and slug tests from a vertical perspective. Table 3-5, which summarizes weathering data, also correlates weathering intensity with the permeability data derived from the packer and slug tests. In general the higher hydraulic conductivity data is associated with more strongly and moderately weathered rock within the Crandon Formation, adjacent to the Crandon Formation, and at shallow bedrock depths.

At other geographic locations, similar documentation on decreasing permeability with depth has been established (Summers, 1972). Summers (1972) evaluated the specific capacity of wells open to the Precambrian bedrock in the area around Rothschild, Wisconsin and noted that the specific capacity of these wells was inversely proportional to the thickness of the rock penetrated. Summers also noted that in his study area, that the maximum depth of fracturing that could produce water was limited to the upper 100 feet of the bedrock.

Packer and slug test data discussed in the bedrock hydrology memorandum (Foth & Van Dyke, 1994) contained several minor errors for six holes, EX-5AL and AU, EX-9AL, 165, 253, and 255. Slug test elevations rather than depths were reported for holes EX-5AL and AU and EX-9AL. Permeability values for holes 253 and 255 were reported in meters per second, not centimeters per second. A transposition error was made in reporting feet per day in hole 165.

Corrected hydraulic conductivity data are summarized in Table 3-6. The table includes data from within the Crandon Formation and in the hanging wall and footwall to either side of the Crandon Formation. Figure 3-9 shows a plot of hydraulic conductivity versus depth in bedrock. The data indicate a general pattern of decreasing permeability with depth from core hole locations that did not intersect the Crandon Formation.

With the exception of data from hole 213, highlighted data in Table 3-6 includes results from core holes that do not intersect the ore body. Hole 213 is not highlighted since it intersects a major weathering zone along the hanging wall/Crandon Formation contact and therefore is not representative of the regional bedrock. Data from hole 165 is highlighted even though it intersects the ore body, since it intersects fresh unweathered rock at considerable depth in the Crandon Formation below the lowest mining level and is thus representative of the regional bedrock at depth. The geometric mean hydraulic conductivity based on the highlighted data in Table 3-6 is 3.1x10-3 ft/d (1.1x10-6 cm/s). These values are equivalent to the value of 2.8x10-3 ft/d (1x10-6 cm/s) reported in the bedrock hydrology memorandum (Foth & Van Dyke, 1994). Based on fracture studies described in Section 3.2, the bedrock hydraulic conductivity is likely to be controlled by the more prominent east-west fractures. Thus, it is logical to conclude that the bedrock system is anisotropic with bedrock hydraulic conductivity in a north-south direction being lower than the measured values.

**NOTES:**

1. APPROXIMATE SITE AREA: PART OF SECTION 25 T35N, R12E, TOWN OF NASHVILLE AND PART OF SECTIONS 29, 30 AND 32, T35N, R13E, TOWN OF LINCOLN, FOREST COUNTY, WISCONSIN.
2. TOPOGRAPHIC BASE MAP DIGITIZED FROM 1" = 1000' SCALE, 5' CONTOUR INTERVAL MAP PREPARED BY AERO-METRIC ENGINEERING, INC., SHEBOYGAN, WISCONSIN. DATE OF PHOTOGRAPHY APRIL 28, 1976.
3. HORIZONTAL DATUM BASED ON WISCONSIN STATE PLANE COORDINATE SYSTEM - NORTH ZONE.
4. VERTICAL DATUM BASED ON MEAN SEA LEVEL DATUM. CONTOUR INTERVAL IS 25 FEET.

LEGEND

| | |
|---|---|
| ⚠ 77 | EXPLORATION HOLE / BEDROCK PIEZOMETER USED FOR BEDROCK PERMEABILITY TEST, SYMBOL DENOTES COLLAR LOCATION AT SURFACE |
| 1600 | EXISTING CONTOUR |
| | RIVER/LAKE/WATERWAY |
| x 1677.0 | SPOT ELEVATION |
| | ROADWAY |
| | TRAIL |
| | MARSH BOUNDARY |
| | MARSH |

N

| Foth & Van Dyke | | | |
|---|---|---|---|
| REVISED | DATE | BY | DESCRIPTION |
| ⚠ | 4/24/95 | SVDI | REVISED LEGEND |
| CHECKED BY: | JKSI | DATE: APR.'95 | |
| APPROVED BY: | SVDI | DATE: APR.'95 | |
| APPROVED BY: | JWS | DATE: APR.'95 | |

**Crandon Mining Company**

**FIGURE 3-8**

LOCATION OF BEDROCK PACKER AND SLUG TESTS

| | | | |
|---|---|---|---|
| Scale: | 1" = 750' | Date: | APRIL, 1995 |
| Prepared By: | Foth & Van Dyke | By: | GAM |

c:\cadwork\4c33f7.dgn

3.5-15-45

# Table 3-6

## Summary Bedrock Permeability Tests
## Crandon Project

| Hole # | | Collar Dip | Core Interval Tests | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Drill Depth (ft) | | | Vertical Depth (ft) | | Horz to CrHW (ft) | | Permeability | | Tests(c) | Formations(d) |
| | | | From | To | Thick | From | To | From | To | ft/d | cm/sec | | |
| 1 | EX-9AL | -- | 276.4 | 283.4 | 7 | 276.4 | 283.4 | +1000 | +1000 | 5.7x10-5 | 2x10-8 | HW | Regional PC Bedrock |
| 2 | EX-5AL | -- | 183.9 | 191.9 | 8 | 183.9 | 191.9 | +1000 | +1000 | 2.8x10-4 | 1x10-7 | HW | Regional PC Bedrock |
| 3 | EX-5AU | -- | 160.9 | 167.9 | 7 | 160.9 | 167.9 | +1000 | +1000 | 5.7x10-3 | 2x10-6 | HW | Regional PC Bedrock |
| 4 | 257 | -90 | 246 | 360 | 114 | 246 | 360 | 833 | 833 | 2.1x10-2 | 7.6x10-6 | FW | SL |
| 5 | 254 | -90 | 217 | 315 | 98 | 217 | 315 | 833 | 833 | 9.6x10-3 | 3.4x10-6 | FW | SL |
| 6 | 254 | -90 | 315 | 435 | 120 | 315 | 435 | 98 | 115 | 2.0x10-2 | 7.0x10-6 | FW | SL |
| 7 | 256 | -90 | 167 | 282 | 115 | 167 | 282 | 0 | 0 | 0.71 | 2.5x10-4 | CR | CR |
| 8 | 256 | -90 | 282 | 394 | 112 | 282 | 394 | 0 | 0 | 2.8x10-1 | 9.8x10-5 | CR | CR |
| 9 | 213 | -75 | 144 | 231 | 87 | 139 | 223 | 278 | 223 | 7.7x10-2 | 2.7x10-5 | HW | UML |
| 10 | -- | -- | 231 | 312 | 81 | 223 | 301 | 223 | 177 | 1.4x10-2 | 5.0x10-6 | HW | UML |
| 11 | -- | -- | 312 | 392 | 80 | 301 | 379 | 177 | 128 | 5.7x10-2 | 2.0x10-5 | HW | UML |
| 12 | -- | -- | 392 | 472 | 77 | 379 | 453 | 128 | 79 | 6.2x10-2 | 2.2x10-5 | HW | LML |
| 13 | -- | -- | 472 | 552 | 83 | 453 | 533 | 79 | 30 | 1.1x10-1 | 3.8x10-5 | HW | LML |
| 14 | -- | -- | 552 | 631 | 79 | 533 | 609 | 30 | 26 | 9.6 | 3.4x10-3 | CR | CR |
| 15 | -- | -- | 631 | 724 | 93 | 609 | 699 | 26 | 69 | 9.6 | 3.4x10-3 | CR | CR |
| 16 | -- | -- | 724 | 808 | 83 | 699 | 780 | 69 | 118 | 6.8 | 2.4x10-3 | CR | CR |

3.5-15-46

Table 3-6, continued

| Hole # | | Core Interval Tests | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Collar Dip | Drill Depth (ft) | | | Vertical Depth (ft) | | Horz to CrHW (ft) | | Permeability | | Tests(c) | Formations(d) |
| | | | From | To | Thick | From | To | From | To | ft/d | cm/sec | | |
| 17 | -- | -- | 808 | 879 | 72 | 780 | 849 | 118 | 141 | 2.8x10-1 | 1.0x10-4 | CR | CR |
| 18 | 91 | -75 | 179 | 1415 | 1236 | 175 | 1025 | 635 | 400 | 3.7x10-2(b) | 1.3x10-5(b) | HW/CR/FW | SK/RL/UML/LML/CR/SL |
| 19 | -- | -- | 852 | 1415 | 563 | 735 | 1025 | 145 | 400 | 5.4x10-2(b) | 1.9x10-5(b) | HW/CR/FW | LML/CR/SL |
| 20 | 155 | -90 | 161 | 3050 | 2889 | 161 | 3050 | 836 | 295 | 1.6x10-3 | 5.8x10-7 | HW | SK/RL/UML |
| 21 | -- | -- | 362 | 3050 | 2688 | 362 | 3050 | 771 | 295 | 1.4x10-3 | 4.9x10-7 | HW | SK/RL/UML |
| 22 | -- | -- | 562 | 3050 | 2488 | 562 | 3050 | 715 | 295 | 1.2x10-3 | 4.3x10-7 | HW | SK/RL/UML |
| 23 | -- | -- | 842 | 3050 | 2208 | 842 | 3050 | 656 | 295 | 1.3x10-3 | 4.7x10-7 | HW | RL/UML |
| 24 | -- | -- | 942 | 3050 | 2108 | 942 | 3050 | 633 | 295 | 1.1x10-3 | 3.9x10-7 | HW | RL/UML |
| 25 | -- | -- | 1042 | 3050 | 2008 | 1042 | 3050 | 623 | 295 | 1.4x10-3 | 4.8x10-7 | HW | RL/UML |
| 26 | -- | -- | 1372 | 3050 | 1678 | 1372 | 3050 | 561 | 295 | 1.5x10-3 | 5.4x10-7 | HW | RL/UML |
| 27 | -- | -- | 2102 | 3050 | 948 | 2102 | 3050 | 462 | 295 | 2.2x10-3 | 7.9x10-7 | HW | UML |
| 28 | -- | -- | 2202 | 2215 | 13 | 2202 | 2215 | 442 | 295 | 1.1x10-1 | 3.8x10-5 | HW | RL/UML |
| 29 | -- | -- | 2710 | 2723 | 13 | 2710 | 2723 | 360 | 295 | 1.8x10-1(a) | 6.0x10-5(a) | HW | UML |
| 30 | -- | -- | 2712 | 2725 | 13 | 2712 | 2725 | 360 | 295 | 1.9x10-1(a) | 6.3x10-5(a) | HW | UML |
| 31 | 70 | -65 | 302 | 1334 | 1037 | 275 | 960 | 400 | 480 | 3.4x10-2 | 1.2x10-5 | HW/CR/FW | RL/ML/CR/SL |
| 32 | -- | -- | 552 | 1334 | 782 | 490 | 960 | 200 | 480 | 2.4x10-2 | 8.6x10-6 | HW/CR/FW | UML/LML/CR/SL |
| 33 | 255 | -55 | 252 | 300 | 48 | 183 | 217 | 46 | 0 | 4.8x10-2 | 1.7x10-5 | HW | LML |
| 34 | -- | -- | 300 | 426 | 126 | 217 | 308 | 0 | 92 | 2.5 | 8.9x10-4 | HW/FW/CR | LML/CR |

3.5-15-4/

Table 3-6, continued

| Hole # | | Core Interval Tests | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Collar Dip | Drill Depth (ft) | | | Vertical Depth (ft) | | Horz to CrHW (ft) | | Permeability | | Tests(c) | Formations(d) |
| | | | From | To | Thick | From | To | From | To | ft/d | cm/sec | | |
| 35 | 165 | -70 | 1600 | 2971 | 1371 | 1560 | 2585 | 400 | 590 | 4.0x10-3 | 1.4x10-6 | HW/FW/CR | UML/LML/CR/SL |
| 36 | -- | -- | 2297 | 2971 | 674 | 2150 | 2585 | 23 | 590 | 1.6x10-3 | 5.8x10-7 | HW/FW/CR | LML/CR/SL |
| 37 | -- | -- | 2920 | 2971 | 51 | 2575 | 2585 | 560 | 590 | 3.4x10-4 | 1.2x10-7 | HW/FW/CR | LML/CR/SL |
| 38 | 66 | -65 | 228 | 1078 | 850 | 205 | 750 | 340 | 350 | 5.1x10-2(b) | 1.8x10-5(b) | HW/FW/CR | UML/LML/CR/SL |
| 39 | -- | -- | 402 | 1078 | 676 | 351 | 750 | 230 | 350 | 2.6x10-2(b) | 9.0x10-6 | HW/FW/CR | UML/LML/CR/SL |
| 40 | 253 | -90 | 167 | 258 | 91 | 167 | 258 | 62 | 43 | 1.8x10-2 | 6.4x10-6 | HW | LML |
| 41 | -- | -- | 258 | 375 | 117 | 258 | 375 | 43 | 16 | 4.8x10-3 | 1.7x10-6 | CR | LML/CR |
| 42 | 77 | -70 | 602 | 1049 | 447 | 575 | 930 | 130 | 160 | 1.6x10-2 | 5.7x10-6 | HW | LML/SL |

3.5-15-48

(a) Some leakage around packers on these tests because of open fractures. D&M 4/19/1978, Table 1.

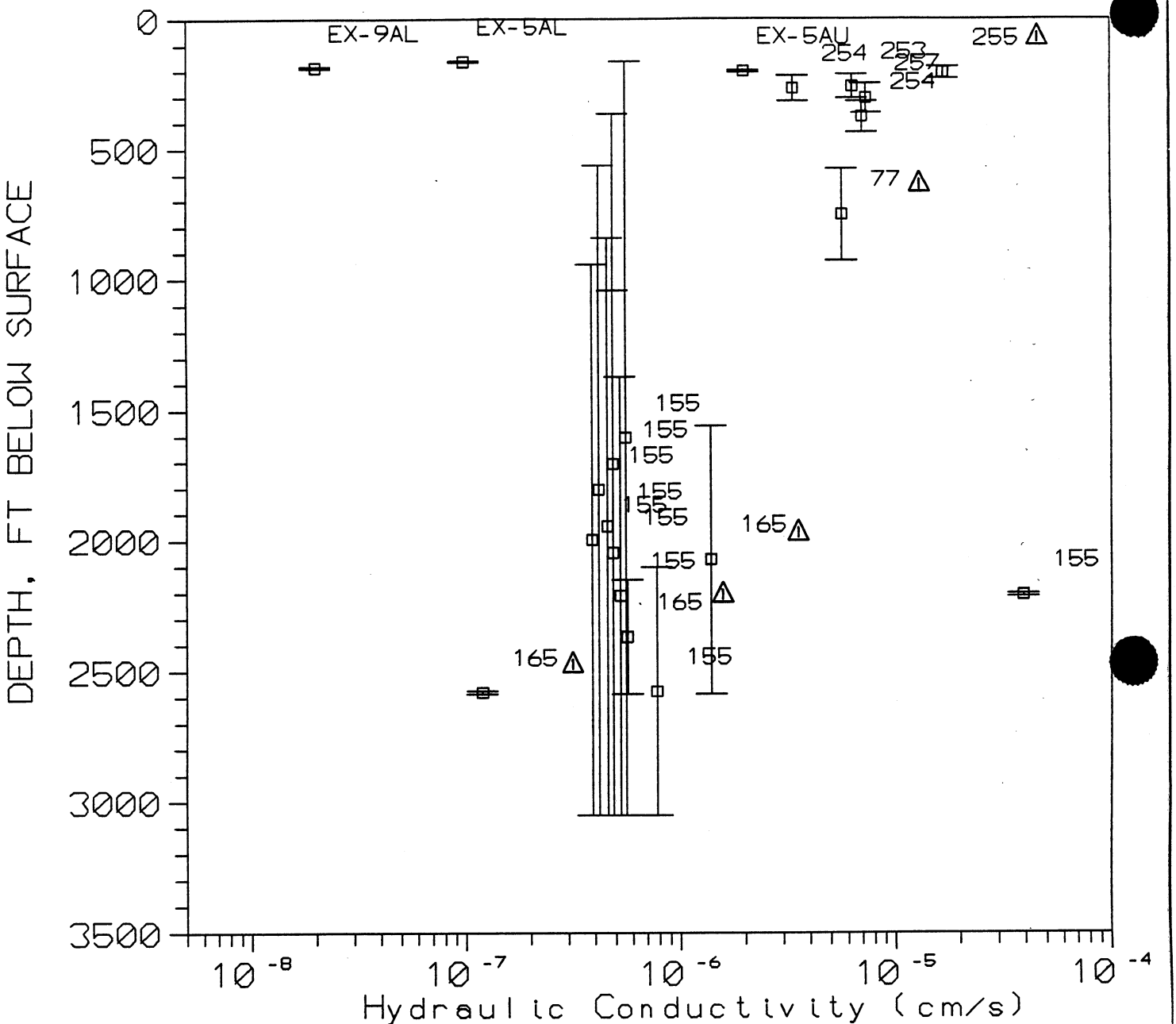
(b) Possible leakage around uncemented casing from overlying glacial material. D&M 4/19/1978, p.7.

(c) HW = Hanging Wall, FW = Footwall, CR = Crandon Formation

(d) SL = Sand Lake Formation, CR = Crandon Formation, UML = Upper Mole Lake Formation, LML = Lower Mole Lake Formation, RL = Rice Lake Formation

Shaded values representative of regional bedrock, unaffected by weathering of Crandon Formation.

Prepared by: AJE
Checked by: SVD1




NOTE: DATA FROM HOLE 155 INTERVALS 2710 - 2723 AND 2712 - 2725 IS NOT INCLUDED DUE TO SUSPECTED PACKER LEAKAGE.

| Foth & Van Dyke | | | |
|---|---|---|---|
| REVISED | DATE | BY | DESCRIPTION |
| 1 | 4/24/95 | SVDI | REVISED INTERVALS ON 165, 77 & 255 |
| | | | |
| | | | |
| CHECKED BY: | SVDI | DATE: APR.'95 | |
| APPROVED BY: | SVDI | DATE: APR.'95 | |
| APPROVED BY: | JWS | DATE: APR.'95 | |

**Crandon Mining Company**

**FIGURE 3-9**
BEDROCK PERMEABILITY VS. DEPTH
CRANDON PROJECT -
BEDROCK PACKER TEST DATA

| Scale: | AS SHOWN | Date: | APRIL, 1995 |
|---|---|---|---|
| Prepared By: | Foth & Van Dyke | By: | JOW |

Given that the mine workings will penetrate a relatively large vertical interval, packer tests conducted over large test intervals provide an estimate of the bulk hydraulic conductivity of the bedrock. Where geologic evidence suggested fracture zones, small test intervals were conducted. An example of this are the tests conducted on hole 155. The core hole summary notes for hole 155 contained in Appendix G indicate evidence of very small fracture zones at about 2,210 feet and 2,715 feet. Examining the packer test results from hole 155 suggest that the majority of permeability associated with this hole is coming from the isolated fracture zones between 2,202 to 2,215 feet, and 2,712 to 2,725 feet. Leakage around the packer was suspected in the zone between 2,712 to 2,725 feet. Based on fracture characterization studies, fractures at these depths within the hanging and footwalls are not likely to be continuous and thus would not be expected to contribute sustained lateral flow to the mine. Furthermore, the fracture zone at 2,712 feet is east-west as indicated in Appendix G.

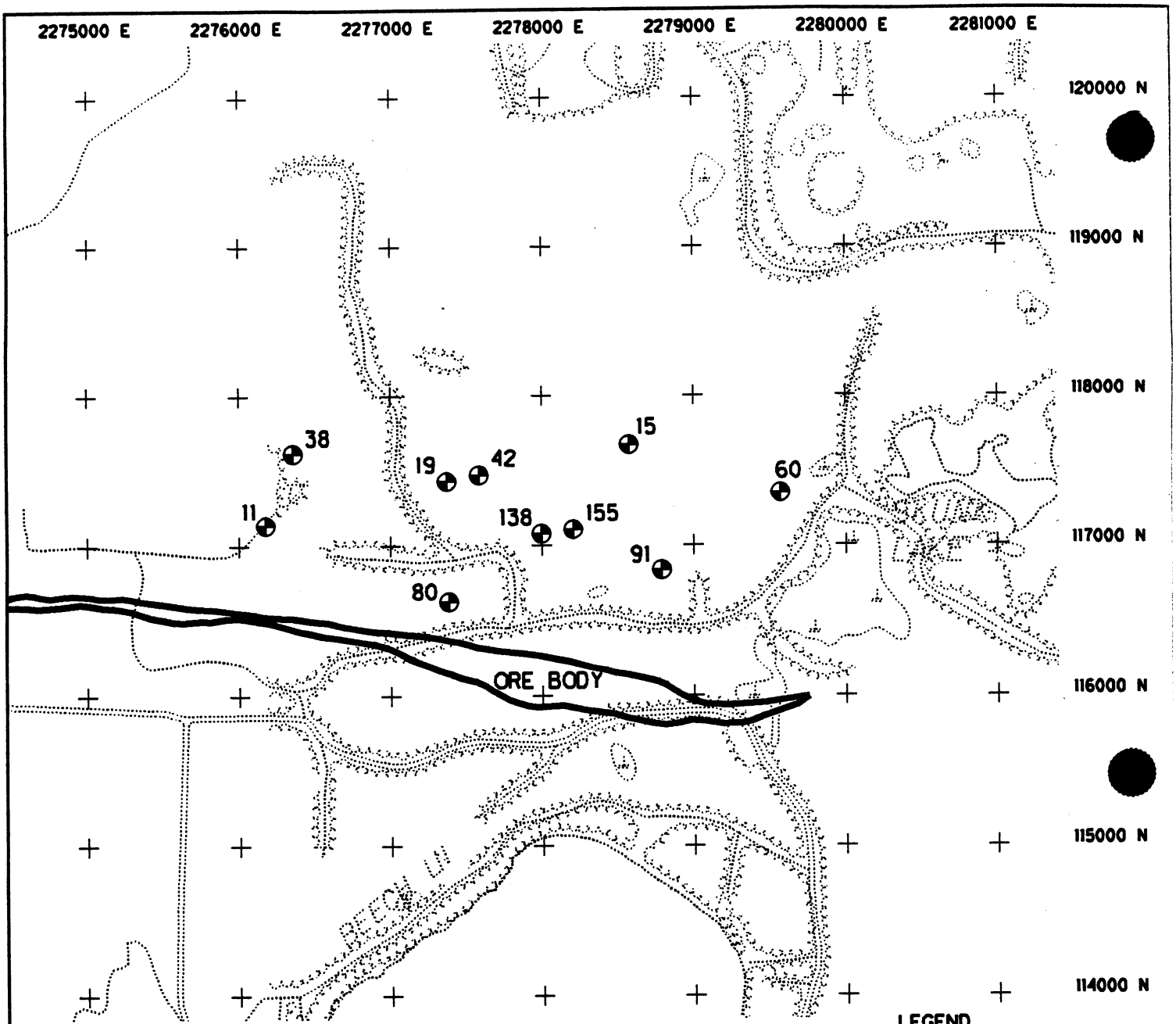
Additional packer test data over shorter intervals would contribute additional information to the data base. However, this is not required since the existing data at the site is sufficient and consistent with data from studies on metavolcanic rocks elsewhere (Raven and Clark, 1993) and Brace, et. al., 1982), which collectively suggest a bedrock permeability in the range of 2.8x10-2 ft/d (1x10-5 cm/s) to 2.8x10-3 ft/d (1x10-6 cm/s).

In summary, the bedrock hydraulic conductivity tests show a general pattern of decreasing permeability with depth and are consistent with data obtained in Precambrian rock elsewhere in similar bedrock (Summers, 1972; Raven and Clark, 1993; Brace, et. al., 1982).

## 3.6 Down Hole Temperature Logging

As part of the early exploration work associated with the Crandon Project, down hole temperature measurements were collected in 11 holes (11, 15, 19, 22, 38, 42, 60, 80, 91, 138, and 155), which are shown on Figure 3-10. These holes are vertical and angled core holes that range in depth from 200 feet to 3,000 feet below land surface. The purpose of this work was to determine the thermal gradient within the bedrock and to measure temperature variations with depth that could be indicative of circulating groundwater. As noted by Keys and Brown (1978), typical natural geothermal gradients range between 0.8°F and 1.1°F per 100 feet of depth. Per Key and Brown (1978), the geothermal gradient and temperature logs may be considerably modified by fluid movement in boreholes and adjacent rocks.

For the Crandon site, down hole temperature measurements were carried out by EDCON in 1978 with analysis by Exxon (Exxon, 1978). Relevant material from this work is provided in Appendix H. The temperature measurements were conducted on holes widely distributed throughout the project area to provide a reasonable data distribution. The logs were again reviewed in 1994 and 1995. Data from the logs is summarized in Tables 3-7 and 3-8. The logs are too voluminous to include in this report, but are available for review at the CMC Rhinelander office.




**NOTES:**

1. APPROXIMATE SITE AREA: PART OF SECTION 25 T35N, R12E, TOWN OF NASHVILLE AND PART OF SECTIONS 29, 30 AND 32, T35N, R13E, TOWN OF LINCOLN, FOREST COUNTY, WISCONSIN.
2. TOPOGRAPHIC BASE MAP DIGITIZED FROM 1" = 1000' SCALE, 5' CONTOUR INTERVAL MAP PREPARED BY AERO-METRIC ENGINEERING, INC., SHEBOYGAN, WISCONSIN. DATE OF PHOTOGRAPHY APRIL 28, 1976.
3. HORIZONTAL DATUM BASED ON WISCONSIN STATE PLANE COORDINATE SYSTEM - NORTH ZONE.
4. VERTICAL DATUM BASED ON MEAN SEA LEVEL DATUM. CONTOUR INTERVAL IS FIVE FEET.

**LEGEND**

- △ 42 — CORE HOLE NUMBER AND COLLAR LOCATION AT SURFACE
- RIVER/LAKE/WATERWAY
- ROADWAY
- TRAIL
- MARSH BOUNDARY
- MARSH

N

Foth & Van Dyke

| REVISED | DATE | BY | DESCRIPTION |
|---|---|---|---|
| △ | 4/24/95 | SVDI | REVISED LEGEND |
| | | | |
| | | | |

| | | |
|---|---|---|
| CHECKED BY: | JKSI | DATE: APR.'95 |
| APPROVED BY: | SVDI | DATE: APR.'95 |
| APPROVED BY: | JWS | DATE: APR.'95 |

**Crandon Mining Company**

**FIGURE 3-10**

CORE HOLES USED ON DOWN HOLE TEMPERATURE SURVEYS

| | | | |
|---|---|---|---|
| Scale: | 1" = 1000' | Date: | APRIL, 1995 |
| Prepared By: | Foth & Van Dyke | By: | GAM |

Examination of the logs and data provided in Tables 3-7 and 3-8 show an extremely regular thermal pattern, indicating little, if any, water movement. The average thermal gradient based on the temperature logs is an increase of approximately 0.81°F per 100 vertical feet. With the exception of several small temperature fluctuations of less than 0.5°F in holes 139 and 155, there were no temperature deflections encountered in the boreholes that would indicate significant circulating fresh water. Significant circulation of fresh water through the fractured bedrock should create widespread temperature fluctuations within the hole and destroy the thermal gradient trends. Alternatively, restricted circulation of water through infrequent fractures would tend to produce small deflections in down hole temperatures, which is what was recorded.

Data from hole 155 shows a slight change in temperature gradient between 2,550 feet and 2,570 feet and below 2,700 feet. However, the change is so subtle that it may be due to a change in thermal conductivity of the rock or very restricted water movement. In hole 155, packer tests in the interval 2,202-2,215 measured hydraulic conductivity in the range of 1.1x10-1 ft/d (3.8x10-5 cm/s). However, the temperature logs show no evidence of temperature deflections at this depth, suggesting circulating water at this depth is likely not occurring. This tends to indicate that the fracture zone between 2,202 and 2,215 feet lacks continuity. There was a small deflection in the log at 2,715 feet, which suggests a minor amount of water at this weak fracture zone.

The log for hole 139 shows some very small changes at about 2,200 feet and between 2,450 feet and 2,600 feet. However, the deflections again are very small and if due to water movement, indicate restricted flow at low rates.

The fracture characterization studies discussed above, indicate that limited circulation of water may take place in the upper 1,000 feet of the bedrock due to higher fracture frequency and more random orientations of the fractures. The temperature measurements indicate that this circulation, if present, is minor since no alteration of the thermal gradient or large water movement are evident. Below the upper 1,000 feet of the bedrock, fracture studies discussed above suggest that circulation of water is not likely taking place. The temperature logs support this interpretation since there is no significant alteration in the thermal gradient.

## 3.7 Bedrock Water Chemistry

During studies conducted by Dame & Moore (1978), water samples were collected for chemical analysis from nine angled core holes (66, 70, 77, 91, 165, 181, 190, 192, and 194) that intersected the Crandon Formation at depths ranging from less than 500 feet to more than 2,400 feet. In addition, samples were collected from core hole 155 which is a vertical hole located approximately 900 feet north of the ore body. The total depth of hole 155 is just over 3,000 feet. The location of the holes are shown in Figure 3-11. Water chemistry data is summarized in Table 3-9. The results from the analysis of the samples are provided in Appendix I.

Water samples were collected from at least one interval in each of the nine angle core holes that intersected the Crandon Formation. Chloride concentration measured in these samples show

Table 3-7

## Crandon Deposit Down Hole Bedrock Temperature Data (EDCON-1978)
## Holes 11, 15, 19, 22, 38 and 42
## Crandon Project

| | Hole No. 11 | | | Hole No. 15 | | | Hole No. 19 | | | Hole No. 22 | | | Hole No. 38 | | | Hole No. 42 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F |
| 1 | 250 | 240 | 52.5 | 200 | 200 | 51.1 | 250 | 260 | 52.1 | 250 | 240 | 52.2 | 250 | 245 | 52.2 | 200 | 200 | 51.6 |
| 2 | 300 | 289 | 52.9 | 250 | 250 | 51.5 | 300 | 305 | 52.5 | 300 | 271 | 52.5 | 300 | 290 | 52.6 | 250 | 249 | 52.0 |
| 3 | 350 | 338 | 53.2 | 300 | 301 | 52.0 | 350 | 350 | 52.9 | 350 | 320 | 52.9 | 350 | 338 | 53 | 300 | 300 | 52.4 |
| 4 | 400 | 380 | 53.6 | 350 | 350 | 52.5 | 400 | 395 | 53.3 | 400 | 362 | 53.2 | 400 | 390 | 53.4 | 350 | 345 | 52.7 |
| 5 | 450 | 430 | 53.9 | 400 | 395 | 52.9 | 450 | 445 | 53.7 | 450 | 410 | 53.6 | 450 | 430 | 53.8 | 400 | 395 | 53.1 |
| 6 | 500 | 476 | 54.3 | 450 | 450 | 53.3 | 500 | 495 | 54.1 | 500 | 451 | 53.9 | 500 | 470 | 54.3 | 450 | 445 | 53.5 |
| 7 | 550 | 521 | 54.7 | 500 | 498 | 53.8 | 550 | 538 | 54.5 | 550 | 500 | 54.2 | 550 | 530 | 54.7 | 500 | 500 | 53.8 |
| 8 | 600 | 565 | 55.1 | 550 | 545 | 54.2 | 600 | 585 | 54.9 | 600 | 550 | 54.5 | 600 | 575 | 55.1 | 550 | 550 | 54.2 |
| 9 | 650 | 602 | 55.4 | 600 | 595 | 54.7 | 650 | 630 | 55.3 | 650 | 570 | 54.9 | 650 | 626 | 55.5 | 600 | 595 | 54.4 |
| 10 | 700 | 649 | 55.8 | 650 | 645 | 55.1 | 700 | 685 | 55.7 | 700 | 620 | 55.3 | 700 | 671 | 55.9 | 650 | 648 | 54.6 |
| 11 | 750 | 696 | 56.2 | 700 | 695 | 55.5 | 750 | 720 | 56.0 | 750 | 661 | 55.6 | 750 | 721 | 56.2 | 700 | 700 | 54.8 |
| 12 | 800 | 745 | 56.5 | 750 | 740 | 55.9 | 800 | 780 | 56.4 | 800 | 695 | 56.0 | 800 | 769 | 56.6 | 750 | 745 | 55.0 |
| 13 | 850 | 775 | 56.9 | 800 | 790 | 56.3 | 850 | 820 | 56.7 | 850 | 722 | 56.3 | 850 | 810 | 57.0 | 800 | 795 | 55.3 |
| 14 | 900 | 811 | 57.2 | 850 | 844 | 56.7 | 900 | 870 | 57.1 | 900 | 759 | 56.6 | 900 | 859 | 57.3 | 850 | 849 | 55.6 |
| 15 | 950 | 854 | 57.5 | 900 | 991 | 57.1 | 950 | 910 | 57.5 | 950 | 799 | 56.9 | 950 | 900 | 57.7 | 900 | 895 | 55.9 |
| 16 | 1000 | 890 | 57.8 | 950 | 945 | 57.5 | 1000 | 945 | 57.8 | 1000 | 830 | 57.2 | 1000 | 945 | 58.1 | 950 | 945 | 56.3 |
| 17 | 1050 | 921 | 58.1 | 1000 | 991 | 57.9 | 1050 | 980 | 58.1 | 1050 | 859 | 57.5 | 1050 | 985 | 58.4 | 1000 | 995 | 56.7 |
| 18 | 1100 | 956 | 58.4 | 1050 | 1040 | 58.3 | 1100 | 1020 | 58.4 | 1100 | 888 | 57.7 | 1100 | 1025 | 58.7 | 1050 | 1045 | 57.0 |

Table 3-7, continued

| | Hole No. 11 | | | Hole No. 15 | | | Hole No. 19 | | | Hole No. 22 | | | Hole No. 38 | | | Hole No. 42 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F |
| 19 | 1150 | 991 | 58.7 | 1100 | 1090 | 58.8 | 1150 | 1060 | 58.7 | 1150 | 915 | 57.9 | 1150 | 1058 | 59 | 1100 | 1095 | 57.4 |
| 20 | 1200 | 1020 | 58.9 | 1150 | 1140 | 59.3 | 1200 | 1090 | 59.1 | 1200 | 945 | 58.2 | 1200 | 1100 | 59.3 | 1150 | 1140 | 57.7 |
| 21 | 1250 | 1050 | 59.1 | 1200 | 1183 | 59.8 | 1250 | 1120 | 59.4 | 1250 | 974 | 58.4 | 1250 | 1129 | 59.6 | 1200 | 1190 | 58.1 |
| 22 | 1300 | 1069 | 59.3 | 1250 | 1235 | 60.2 | 1300 | 1155 | 59.7 | 1300 | 1000 | 58.8 | 1300 | 1160 | 59.8 | 1250 | 1237 | 58.4 |
| 23 | 1350 | 1110 | 59.6 | 1300 | 1285 | 60.7 | 1350 | 1190 | 59.9 | | | | 1350 | 1190 | 60.0 | 1300 | 1285 | 58.7 |
| 24 | | | | 1350 | 1340 | 61.1 | 1400 | 1220 | 60.2 | | | | 1400 | 1218 | 60.3 | 1350 | 1332 | 59.1 |
| 25 | | | | 1400 | 1481 | 61.5 | 1450 | 1245 | 60.4 | | | | 1450 | 1245 | 60.5 | 1400 | 1381 | 59.4 |
| 26 | | | | 1450 | 1436 | 61.9 | 1500 | 1275 | 60.7 | | | | 1500 | 1258 | 60.7 | 1450 | 1430 | 59.7 |
| 27 | | | | 1500 | 1481 | 62.3 | 1550 | 1300 | 60.9 | | | | 1550 | 1289 | 60.9 | 1500 | 1476 | 60.0 |
| 28 | | | | 1550 | 1530 | 62.6 | 1600 | 1330 | 61.1 | | | | 1600 | 1306 | 61.1 | 1550 | 1521 | 60.4 |
| 29 | | | | 1600 | 1579 | 63.0 | 1650 | 1350 | 61.3 | | | | 1650 | 1325 | 61.2 | 1600 | 1570 | 60.7 |
| 30 | | | | 1650 | 1625 | 63.3 | 1700 | 1370 | 61.5 | | | | 1700 | 1340 | 61.4 | 1650 | 1618 | 61.0 |
| 31 | | | | 1700 | 1672 | 63.6 | 1750 | 1390 | 61.6 | | | | | | | 1700 | 1661 | 61.4 |
| 32 | | | | 1750 | 1715 | 63.9 | 1800 | 1410 | 61.8 | | | | | | | 1750 | 1709 | 61.7 |
| 33 | | | | 1800 | 1759 | 64.2 | 1850 | 1430 | 62.0 | | | | | | | 1800 | 1756 | 62.1 |
| 34 | | | | 1850 | 1800 | 64.4 | 1900 | 1445 | 62.2 | | | | | | | 1850 | 1800 | 62.6 |
| 35 | | | | 1900 | 1834 | 64.7 | | | | | | | | | | 1900 | 1845 | 62.9 |
| 36 | | | | 1950 | 1870 | 64.9 | | | | | | | | | | 1950 | 1890 | 63.2 |
| 37 | | | | 2000 | 1900 | 65.1 | | | | | | | | | | 2000 | 1935 | 63.5 |
| 38 | | | | 2050 | 1930 | 65.3 | | | | | | | | | | 2050 | 1980 | 63.9 |
| 39 | | | | 2100 | 1950 | 65.5 | | | | | | | | | | 2100 | 2018 | 64.1 |

Table 3-7, continued

| | Hole No. 11 | | | Hole No. 15 | | | Hole No. 19 | | | Hole No. 22 | | | Hole No. 38 | | | Hole No. 42 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F |
| 40 | | | | 2150 | 1978 | 65.7 | | | | | | | | | | 2150 | 2055 | 64.2 |
| 41 | | | | 2200 | 2000 | 65.8 | | | | | | | | | | 2200 | 2098 | 64.4 |
| 42 | | | | 2550 | 2028 | 66.0 | | | | | | | | | | 2250 | 2137 | 64.5 |
| 43 | | | | 2300 | 2045 | 66.1 | | | | | | | | | | 2300 | 2175 | 64.8 |
| 44 | | | | 2350 | 2066 | 66.3 | | | | | | | | | | 2350 | 2210 | 65.0 |
| 45 | | | | 2400 | 2082 | 66.4 | | | | | | | | | | 2400 | 2244 | 65.3 |
| 46 | | | | 2450 | 2100 | 66.6 | | | | | | | | | | 2450 | 2279 | 65.5 |
| 47 | | | | | | | | | | | | | | | | 2500 | 2314 | 65.7 |
| 48 | | | | | | | | | | | | | | | | 2550 | 2341 | 66.0 |
| 49 | | | | | | | | | | | | | | | | 2600 | 2372 | 66.2 |
| 50 | | | | | | | | | | | | | | | | 2650 | 2400 | 66.3 |
| 51 | | | | | | | | | | | | | | | | 2700 | 2430 | 66.6 |
| 52 | | | | | | | | | | | | | | | | 2750 | 2455 | 66.8 |
| 53 | | | | | | | | | | | | | | | | 2800 | 2470 | 67.1 |
| 54 | | | | | | | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | | | | | | | |
| 56 | | | | | | | | | | | | | | | | | | |
| 57 | | | | | | | | | | | | | | | | | | |
| 58 | | | | | | | | | | | | | | | | | | |

Prepared by: AJE
Checked by: JCP

Table 3-8

## Crandon Deposit Down Hole Bedrock Temperature Data (EDCON-1978)
## Holes 60, 80, 91, 139 and 155
## Crandon Project

| | Hole No. 60 | | | Hole No. 80 | | | Hole No. 91 | | | Hole No. 139 | | | Hole No. 155 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F |
| 1 | 150 | 152 | 51.5 | 300 | 210 | 52.6 | 150 | 145 | 51.1 | Frozen Pen Problems Top 500' | | | 150 | 150 | 51.6 |
| 2 | 200 | 205 | 51.9 | 350 | 245 | 52.9 | 200 | 195 | 51.3 | | | | 200 | 200 | 52.0 |
| 3 | 250 | 251 | 52.2 | 400 | 275 | 53.3 | 250 | 240 | 51.6 | | | | 250 | 250 | 52.5 |
| 4 | 300 | 307 | 52.6 | 450 | 305 | 53.5 | 300 | 290 | 52.0 | | | | 300 | 300 | 53.0 |
| 5 | 350 | 359 | 53.1 | 500 | 345 | 53.7 | 350 | 340 | 52.3 | | | | 350 | 350 | 53.4 |
| 6 | 400 | 410 | 53.5 | 550 | 376 | 54.0 | 400 | 385 | 52.7 | | | | 400 | 400 | 54.0 |
| 7 | 450 | 455 | 53.9 | 600 | 414 | 54.2 | 450 | 425 | 53.0 | | | | 450 | 450 | 54.4 |
| 8 | 500 | 510 | 54.4 | 650 | 445 | 54.5 | 500 | 470 | 53.3 | | | | 500 | 500 | 54.9 |
| 9 | 550 | 560 | 54.8 | | | | 550 | 515 | 53.7 | 550 | 565 | 54.9 | 550 | 550 | 55.3 |
| 10 | 600 | 610 | 55.3 | | | | 600 | 565 | 54.1 | 600 | 619 | 55.2 | 600 | 600 | 55.5 |
| 11 | 650 | 661 | 55.7 | | | | 650 | 595 | 54.5 | 650 | 665 | 55.7 | 650 | 650 | 55.8 |
| 12 | 700 | 711 | 56.1 | | | | 700 | 640 | 54.9 | 700 | 716 | 56.2 | 700 | 700 | 56.2 |
| 13 | 750 | 760 | 56.6 | | | | 750 | 675 | 55.2 | 750 | 770 | 56.6 | 750 | 750 | 56.6 |
| 14 | 800 | 810 | 57.0 | | | | 800 | 710 | 55.7 | 800 | 820 | 57.0 | 800 | 800 | 57.0 |
| 15 | 850 | 858 | 57.4 | | | | 850 | 748 | 55.9 | 850 | 873 | 57.4 | 850 | 850 | 57.5 |
| 16 | 900 | 910 | 57.8 | | | | 900 | 780 | 56.2 | 900 | 926 | 57.8 | 900 | 900 | 57.9 |
| 17 | 950 | 960 | 58.2 | | | | 950 | 815 | 56.6 | 950 | 975 | 58.2 | 950 | 950 | 58.4 |
| 18 | 1000 | 1010 | 58.6 | | | | 1000 | 845 | 56.9 | 1000 | 1029 | 58.6 | 1000 | 1000 | 58.8 |
| 19 | 1050 | 1056 | 59.1 | | | | 1050 | 879 | 57.2 | 1050 | 1075 | 59.0 | 1050 | 1050 | 59.3 |

Table 3-8, continued

| | Hole No. 60 | | | Hole No. 80 | | | Hole No. 91 | | | Hole No. 139 | | | Hole No. 155 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F |
| 20 | 1100 | 1115 | 59.5 | | | | 1100 | 900 | 57.4 | 1100 | 1130 | 59.3 | 1100 | 1100 | 59.7 |
| 21 | 1150 | 1160 | 59.9 | | | | 1150 | 929 | 57.7 | 1150 | 1180 | 59.6 | 1150 | 1150 | 60.0 |
| 22 | 1200 | 1215 | 60.4 | | | | 1200 | 950 | 57.9 | 1200 | 1230 | 60.1 | 1200 | 1200 | 60.4 |
| 23 | 1250 | 1265 | 60.8 | | | | 1250 | 974 | 58.2 | 1250 | 1276 | 60.5 | 1250 | 1250 | 61.0 |
| 24 | 1300 | 1315 | 61.2 | | | | 1300 | 995 | 58.4 | 1300 | 1330 | 60.9 | 1300 | 1300 | 61.4 |
| 25 | 1350 | 1358 | 61.6 | | | | 1350 | 1016 | 58.6 | 1350 | 1381 | 61.3 | 1350 | 1350 | 61.8 |
| 26 | 1400 | 1419 | 62.1 | | | | 1400 | 1038 | 58.8 | 1400 | 1430 | 61.7 | 1400 | 1400 | 62.1 |
| 27 | 1450 | 1470 | 62.4 | | | | | | | 1450 | 1480 | 62.1 | 1450 | 1450 | 62.5 |
| 28 | 1500 | 1521 | 62.8 | | | | | | | 1500 | 1530 | 62.5 | 1500 | 1500 | 62.9 |
| 29 | 1550 | 15571 | 63.2 | | | | | | | 1550 | 1580 | 62.9 | 1550 | 1550 | 63.2 |
| 30 | 1600 | 1625 | 63.6 | | | | | | | 1600 | 1629 | 63.3 | 1600 | 1600 | 63.5 |
| 31 | 1650 | 1674 | 63.9 | | | | | | | 1650 | 1681 | 63.7 | 1650 | 1650 | 63.8 |
| 32 | 1700 | 1727 | 64.3 | | | | | | | 1700 | 1735 | 64.0 | 1700 | 1700 | 64.2 |
| 33 | 1750 | 1778 | 64.6 | | | | | | | 1750 | 1785 | 64.3 | 1750 | 1750 | 64.5 |
| 34 | 1800 | 1820 | 64.9 | | | | | | | 1800 | 1832 | 64.6 | 1800 | 1800 | 64.9 |
| 35 | 1850 | 1876 | 65.3 | | | | | | | 1850 | 1884 | 64.9 | 1850 | 1850 | 65.3 |
| 36 | 1900 | 1920 | 65.6 | | | | | | | 1900 | 1934 | 65.2 | 1900 | 1900 | 65.7 |
| 37 | 1950 | 1965 | 66.0 | | | | | | | 1950 | 1980 | 65.6 | 1950 | 1950 | 66.1 |
| 38 | 2000 | 2012 | 66.4 | | | | | | | 2000 | 2031 | 65.9 | 2000 | 2000 | 66.5 |
| 39 | 2050 | 2055 | 66.7 | | | | | | | 2050 | 2080 | 66.3 | 2050 | 2050 | 66.9 |
| 40 | 2100 | 2105 | 67.0 | | | | | | | 2100 | 2130 | 66.5 | 2100 | 2100 | 67.3 |
| 41 | 2150 | 2149 | 67.4 | | | | | | | 2150 | 2175 | 66.9 | 2150 | 2150 | 67.7 |

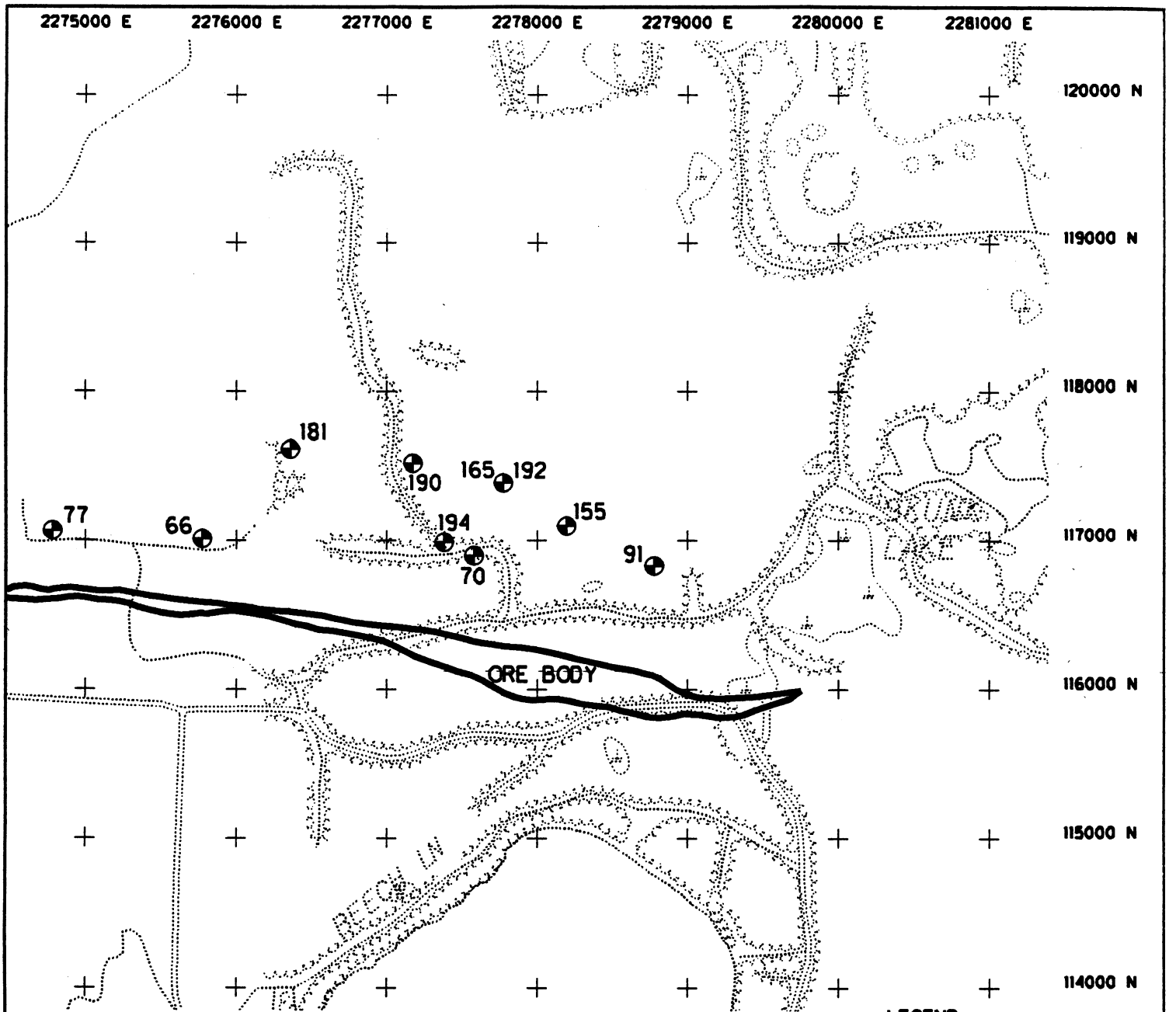
Table 3-8, continued

| | Hole No. 60 | | | Hole No. 80 | | | Hole No. 91 | | | Hole No. 139 | | | Hole No. 155 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F |
| 42 | 2200 | 2190 | 67.7 | | | | | | | 2200 | 2212 | 67.1 | 2200 | 2200 | 68.0 |
| 43 | 2250 | 2235 | 68.0 | | | | | | | 2250 | 2269 | 67.7 | 2250 | 2250 | 68.3 |
| 44 | 2300 | 2275 | 68.3 | | | | | | | 2300 | 2321 | 68.1 | 2300 | 2300 | 68.5 |
| 45 | 2350 | 2320 | 68.7 | | | | | | | 2350 | 2369 | 68.3 | 2350 | 2350 | 68.9 |
| 46 | 2400 | 2360 | 69.0 | | | | | | | 2400 | 2416 | 68.6 | 2400 | 2400 | 69.3 |
| 47 | 2450 | 2400 | 69.2 | | | | | | | 2450 | 2460 | 68.8 | 2450 | 2450 | 69.6 |
| 48 | 2500 | 2440 | 69.5 | | | | | | | 2500 | 2503 | 69.0 | 2500 | 2500 | 69.9 |
| 49 | | | | | | | | | | 2550 | 2550 | 69.1 | 2550 | 2550 | 70.2 |
| 50 | | | | | | | | | | 2600 | 2590 | 69.6 | 2600 | 2600 | 70.5 |
| 51 | | | | | | | | | | 2650 | 2640 | 69.8 | 2650 | 2650 | 71.0 |
| 52 | | | | | | | | | | 2700 | 2690 | 70.1 | 2700 | 2700 | 71.5 |
| 53 | | | | | | | | | | 2750 | 2731 | 70.4 | 2750 | 2750 | 71.8 |
| 54 | | | | | | | | | | 2800 | 2774 | 70.8 | 2800 | 2800 | 72.0 |
| 55 | | | | | | | | | | 2850 | 2810 | 71.0 | 2850 | 2850 | 72.2 |
| 56 | | | | | | | | | | 2900 | 2850 | 71.0 | 2900 | 2900 | 72.5 |
| 57 | | | | | | | | | | 2950 | 2886 | 71.3 | | | |
| 58 | | | | | | | | | | 3000 | 2919 | 71.6 | | | |
| 59 | | | | | | | | | | 3050 | 2957 | 71.8 | | | |
| 60 | | | | | | | | | | 3100 | 2990 | 71.9 | | | |
| 61 | | | | | | | | | | 3150 | 3020 | 72.1 | | | |
| 62 | | | | | | | | | | 3200 | 3051 | 72.4 | | | |
| 63 | | | | | | | | | | 3250 | 3085 | 72.6 | | | |

Table 3-8, continued

| | Hole No. 60 | | | Hole No. 80 | | | Hole No. 91 | | | Hole No. 139 | | | Hole No. 155 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F | Drill Ft | Vertical Ft | °F |
| 64 | | | | | | | | | | 3300 | 3115 | 72.8 | | | |
| 65 | | | | | | | | | | 3350 | 3145 | 72.9 | | | |
| 66 | | | | | | | | | | 3400 | 3171 | 73.1 | | | |

Prepared by: AJE
Checked by: JCP




**NOTES:**

1. APPROXIMATE SITE AREA: PART OF SECTION 25 T35N, R12E, TOWN OF NASHVILLE AND PART OF SECTIONS 29, 30 AND 32, T35N, R13E, TOWN OF LINCOLN, FOREST COUNTY, WISCONSIN.
2. TOPOGRAPHIC BASE MAP DIGITIZED FROM 1" = 1000' SCALE, 5' CONTOUR INTERVAL MAP PREPARED BY AERO-METRIC ENGINEERING, INC., SHEBOYGAN, WISCONSIN. DATE OF PHOTOGRAPHY APRIL 28, 1976.
3. HORIZONTAL DATUM BASED ON WISCONSIN STATE PLANE COORDINATE SYSTEM - NORTH ZONE.
4. VERTICAL DATUM BASED ON MEAN SEA LEVEL DATUM. CONTOUR INTERVAL IS FIVE FEET.

**LEGEND**

- ⚠66 — CORE HOLE NUMBER AND COLLAR LOCATION AT SURFACE
- RIVER/LAKE/WATERWAY
- ROADWAY
- TRAIL
- MARSH BOUNDARY
- MARSH

N

Foth & Van Dyke

| REVISED | DATE | BY | DESCRIPTION |
|---|---|---|---|
| ⚠ | 4/24/95 | SVDI | REVISED LEGEND |
| | | | |
| | | | |

| | | | |
|---|---|---|---|
| CHECKED BY: | JKSI | DATE: | APR.'95 |
| APPROVED BY: | SVDI | DATE: | APR.'95 |
| APPROVED BY: | JWS | DATE: | APR.'95 |

**Crandon Mining Company**

**FIGURE 3-11**

CORE HOLES USED FOR WATER CHEMISTRY ANALYSIS

| | | | |
|---|---|---|---|
| Scale: | 1" = 1000' | Date: | APRIL, 1995 |
| Prepared By: | Foth & Van Dyke | By: | GAM |

# Table 3-9

## Bedrock Water Chemistry Data
## Crandon Project

| Core Hole | Downhole Interval (ft) | Depth[a] (ft) | Chloride (mg/L) | Calcium (mg/L) | Magnesium (mg/L) | Sodium (mg/L) | Potassium (mg/L) |
|---|---|---|---|---|---|---|---|
| 155 | 362-3050 | 362-3050 | 3,700 | NA | NA | NA | NA |
| | 562-3050 | 562-3050 | 4,200 | NA | NA | NA | NA |
| | 842-3050 | 842-3050 | 4,000 | NA | NA | NA | NA |
| | 942-3050 | 942-3050 | 3,600 | 404 | 127 | 1,670 | 25.8 |
| | 1042-3050 | 1042-3050 | 3,300 | NA | NA | NA | NA |
| | 1370-3050 | 1370-3050 | 2,900 | NA | NA | NA | NA |
| | 2102-3050 | 2102-3050 | 2,550 | NA | NA | NA | NA |
| | 2710-3050 | 2710-3050 | 2,100 | NA | NA | NA | NA |
| | 2202-2215 | 2202-2215 | 2,200 | 261 | 75.0 | 1,060 | 18.8 |
| | 2712-2725 | 2712-2725 | 2,250 | NA | NA | NA | NA |
| 66 | 402-1078 | 250-710 | 2 | 38.6 | 19.3 | NA | NA |
| 70 | 302-1334 | 235-935 | 6 | 39.5 | 22.8 | NA | NA |
| | 552-1334 | 470-935 | 8 | 39.1 | 23.4 | NA | NA |
| 77 | 602-1049 | 540-895 | 20 | 34.6 | 20.5 | NA | NA |
| 91 | 852-1415 | 730-1040 | 12 | 42.2 | 22.0 | NA | NA |
| 165 | 2300-2971 | 2120-2455 | 1,900 | NA | NA | NA | NA |
| | 2920-2971 | 2435-2455 | 2,650 | 468 | 185 | 1,090 | 18.8 |
| 181 | 1900-3405 | 1835-3110 | 4,850 | 850 | 221 | 1,810 | 3.5 |
| 190[b] | 1700-2244 | 1340-1795 | 30 | 36.2 | 22.4 | 15.7 | 3.1 |
| 192[b] | 2300-3219 | 2210-2960 | 5,100 | 1,060 | 298 | 2,450 | 50.5 |
| 194 | 800-1584 | 735-1335 | 46 | 34.2 | 20.1 | 21.4 | 3.3 |

NA = Not Analyzed
[a] Vertical depth below ground surface.
[b] Intervals for Holes 190 and 192 were reversed on original laboratory report.

Prepared by: JET
Checked by: SVD1

that water collected above a depth of generally 1,800 feet contained less than 50 mg/l of chloride. Water samples collected below about 1,800 feet contained chloride concentrations ranging from about 2,000-5,000 mg/l. The common alkalis and alkaline earths (sodium, potassium, calcium, and magnesium) were analyzed in most of the collected water samples. Similar to chloride, the concentrations of all of these metals increased significantly below approximately 1,800 feet. As shown in Appendix I, a few additional metals were also analyzed in some of the water samples. In general, the results showed that the concentrations of these metals were low, or below method detection limits above 1,800 feet. Concentrations of the metals were generally greater below 1,800 feet. Collectively, this indicates that meteoric water may circulate in the weathered zones of the Crandon Formation to a depth of about 1,800 feet within the Crandon Formation.

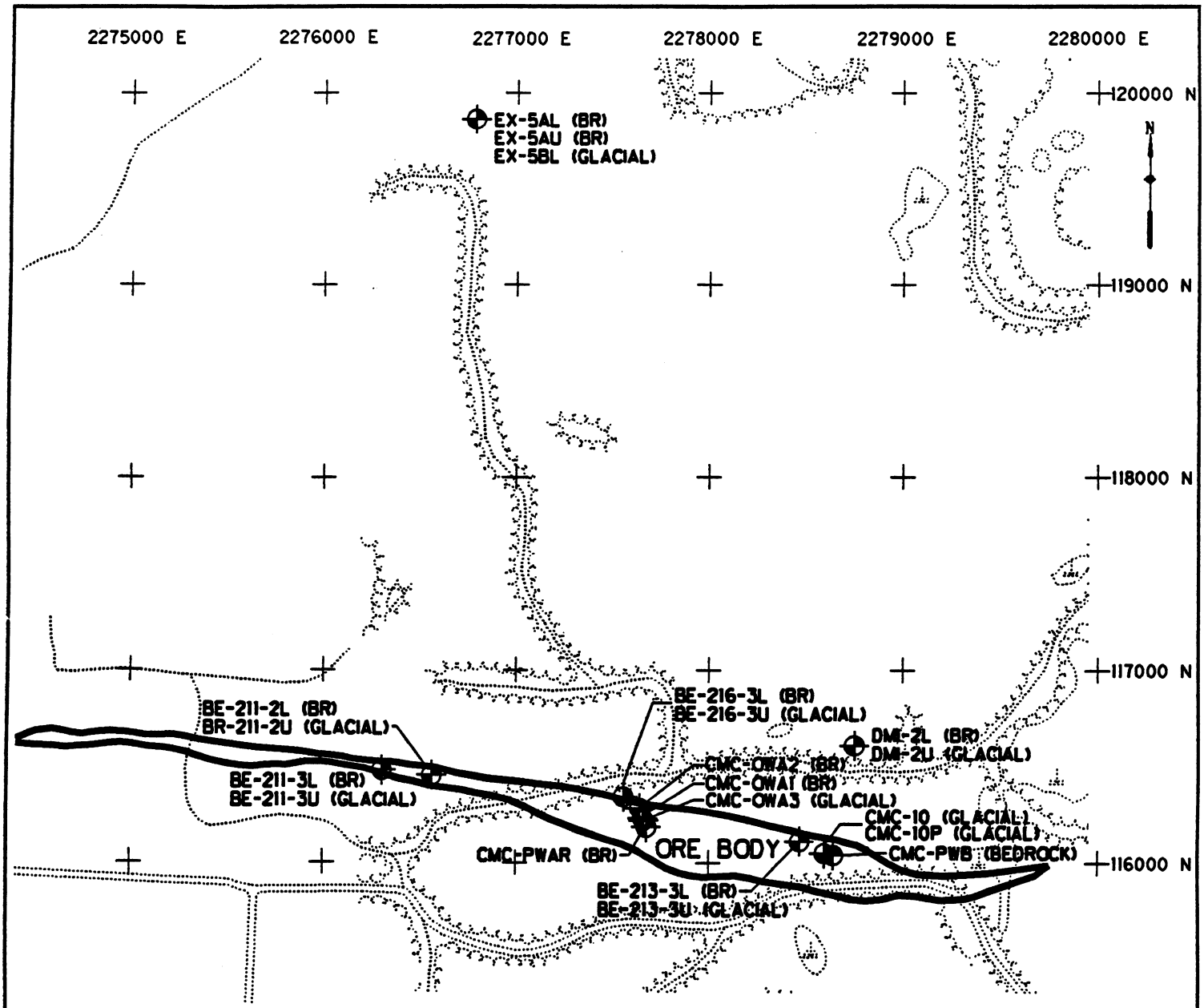
Within the hanging wall, samples were collected from 10 intervals within boring 155. Chloride was measured in all collected samples. The chloride concentration was consistently above 2,000 mg/l from 362 feet to a depth of 3,050 feet. No water samples were collected above 362 feet. The high chloride concentrations indicate that meteoric water is not readily circulating below a depth of 362 feet in the hanging wall.

The fact the saline water was encountered in the hanging wall at shallow depths in hole 155 and that meteoric water is encountered in the Crandon Formation at shallow depths indicates that lateral movement of water between the hanging wall and Crandon Formation is likely restricted. Water chemistry data also suggests that groundwater seeping into the mine workings from the hanging wall and footwall will likely be from pockets of saline connate water contained in, as identified by fracture studies, discontinuous fractures that do not extend to the bedrock surface, and therefore, would not, when drained, induce additional drawdown in the near bedrock surface. This general conclusion is consistent with work reported by Kelly, et. al. (1986), who performed an extensive analysis of saline waters at Precambrian mine sites in the Keweenaw Peninsula of Northern Michigan. Kelly, et. al. (1986) concludes that the saline waters in the Precambrian crystalline rocks are likely to be large fluid inclusions derived from Paleozoic brines that were sealed in the Precambrian rock under relatively high temperatures. Kelly, et. al. (1986) notes that when encountered, these saline waters emerge as seeps or flows that cease in periods ranging from days to years. These types of seeps are consistent with water derived from fractures of limited continuity at depth.

## 3.8 Vertical Head Difference Between the Bedrock and Glacial Deposits

Vertical head differences between bedrock and the Pre- to Early Wisconsinan till were measured at the eight locations shown on Figure 3-12. Hydrographs of the nested wells at the eight locations are shown in Figures 3-13 through 3-15. The hydrographs were developed using data from the Crandon Project hydrologic data base (Crandon Mining Company, 1994). The hydrographs depicted in the figures are for wells screened completely within the upper bedrock or overlying Pre- to Early Wisconsinan till.

With the exception of well nests directly over the ore body, the hydrographs show that over time there is virtually no head difference between the glacial overburden and the bedrock, indicating that there is virtually no flow or very little flow between the bedrock and the glacial overburden. Therefore, it is unlikely that the bedrock is acting as a sink or source of groundwater to the glacial overburden. This is consistent with the conceptual model of limited flow in the bedrock, in which case the water encountered in fractures at shallow bedrock depths would be in hydrostatic equilibrium with the glacial overburden, which is hydraulically connected to the bedrock.




**NOTES:**

1. APPROXIMATE SITE AREA: PART OF SECTION 25 T35N, R12E, TOWN OF NASHVILLE AND PART OF SECTIONS 29, 30 AND 32, T35N, R13E, TOWN OF LINCOLN, FOREST COUNTY, WISCONSIN.
2. TOPOGRAPHIC BASE MAP DIGITIZED FROM 1" = 1000' SCALE, 5' CONTOUR INTERVAL MAP PREPARED BY AERO-METRIC ENGINEERING, INC., SHEBOYGAN, WISCONSIN. DATE OF PHOTOGRAPHY APRIL 28, 1976.
3. HORIZONTAL DATUM BASED ON WISCONSIN STATE PLANE COORDINATE SYSTEM - NORTH ZONE.
4. VERTICAL DATUM BASED ON MEAN SEA LEVEL DATUM. CONTOUR INTERVAL IS 25 FEET.

**LEGEND**

| | |
|---|---|
| BE-213-3L (BR) BE-213-3U (GLACIAL) | MONITORING WELL NUMBER, LOCATION AND COMPARISON |
| | RIVER/LAKE/WATERWAY |
| | ROADWAY |
| | TRAIL |
| | MARSH BOUNDARY |
| | MARSH |

Foth & Van Dyke

| REVISED | DATE | BY | DESCRIPTION |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

| | | | |
|---|---|---|---|
| CHECKED BY: | JKSI | DATE: FEB. '95 | |
| APPROVED BY: | SVDI | DATE: FEB. '95 | |
| APPROVED BY: | JWS | DATE: FEB. '95 | |

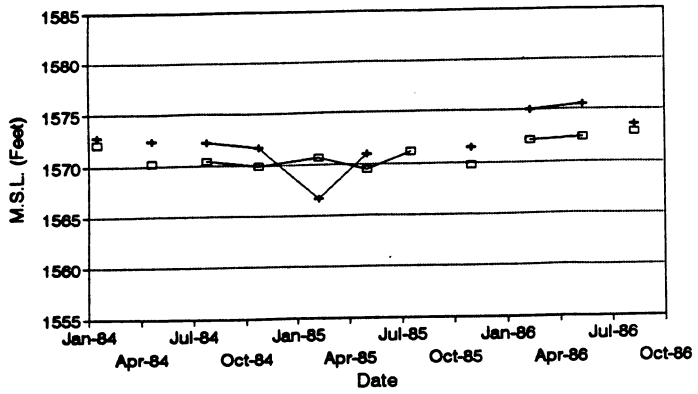
Crandon Mining Company

**FIGURE 3-12**

MONITORING WELL LOCATION FOR THE COMPARISON OF BEDROCK VS. GLACIAL HYDROGRAPHS

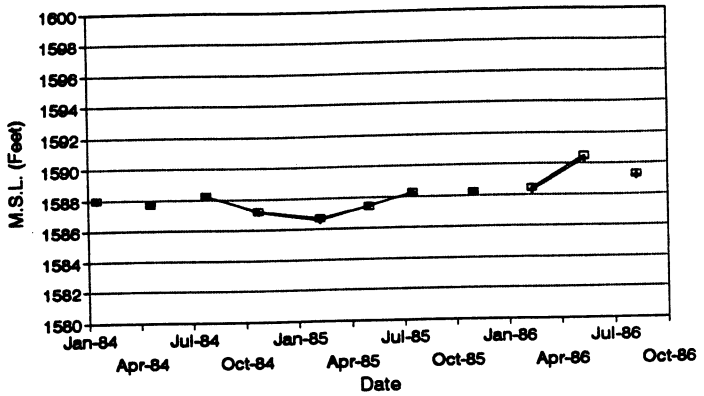
| | | | |
|---|---|---|---|
| Scale: | 1" = 800' | Date: | FEBRUARY, 1995 |
| Prepared By: | Foth & Van Dyke | By: | GAM |

## Groundwater Elevation
### Bedrock vs. Glacial



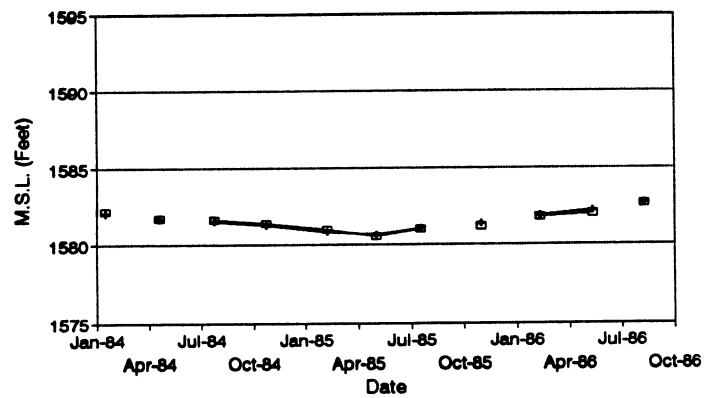

(1) Bedrock Well
(2) Glacial Well

## Groundwater Elevation
### Bedrock vs. Glacial




(1) Bedrock Well
(2) Glacial Well

## Groundwater Elevation
### Bedrock vs. Glacial




(1) Bedrock Well
(2) Glacial Well

| Foth & Van Dyke | | | |
|---|---|---|---|
| REVISED | DATE | BY | DESCRIPTION |
| | | | |
| | | | |
| | | | |
| CHECKED BY: | JKSI | DATE: | FEB.'95 |
| APPROVED BY: | SVDI | DATE: | FEB.'95 |
| APPROVED BY: | JWS | DATE: | FEB.'95 |

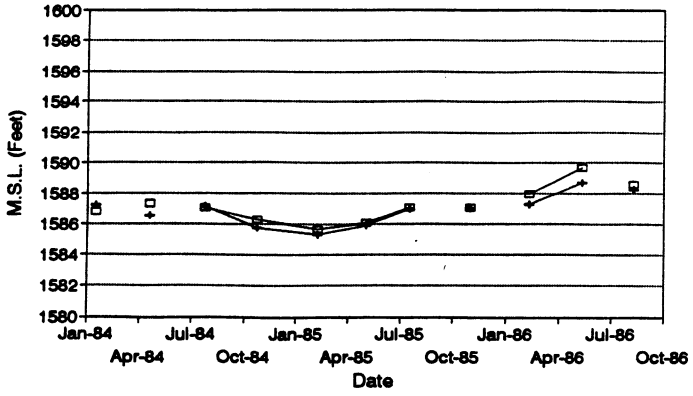
Grandon Mining Company

**FIGURE 3-13**

BEDROCK VS. GLACIAL HYDROGRAPHS

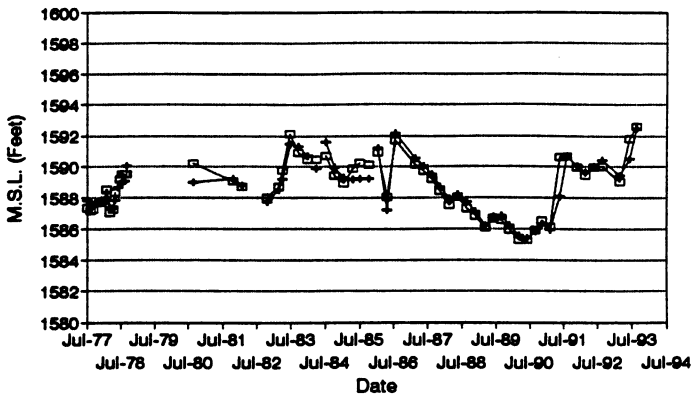
| Scale: | AS SHOWN | Date: | FEBRUARY. 1995 |
|---|---|---|---|
| Prepared By: | Foth & Van Dyke | By: | JOW |

## Groundwater Elevation
### Bedrock vs. Glacial



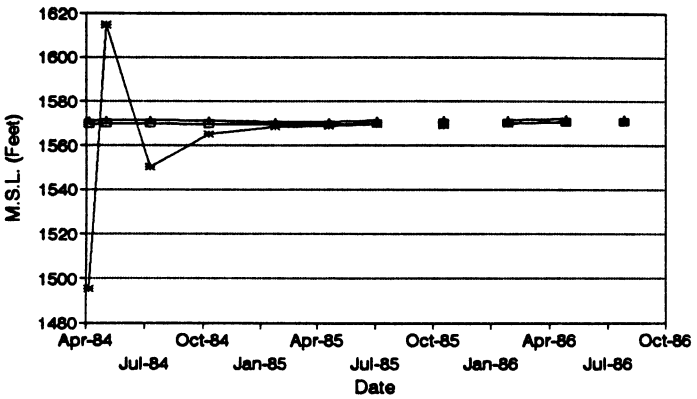

(1) Bedrock Well
(2) Glacial Well

## Groundwater Elevation
### Bedrock vs. Glacial




(1) Bedrock Well
(2) Glacial Well

## Groundwater Elevation
### Bedrock vs. Glacial




(1) Bedrock Well
(2) Glacial Well

| Foth & Van Dyke | | | |
|---|---|---|---|
| REVISED | DATE | BY | DESCRIPTION |
| | | | |
| | | | |
| | | | |

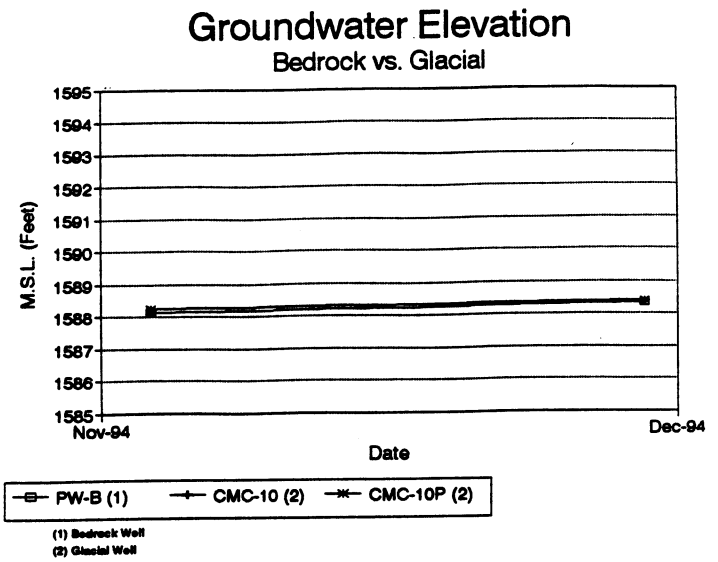
| | | | |
|---|---|---|---|
| CHECKED BY: | JKSI | DATE: | FEB.'95 |
| APPROVED BY: | SVDI | DATE: | FEB.'95 |
| APPROVED BY: | JWS | DATE: | FEB.'95 |

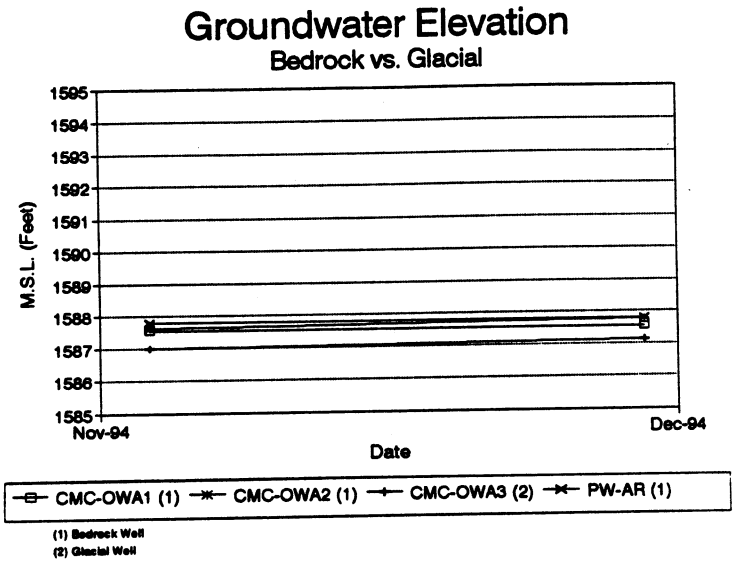
Crandon Mining Company

**FIGURE 3-14**

BEDROCK VS. GLACIAL HYDROGRAPHS

| | | | |
|---|---|---|---|
| Scale: | AS SHOWN | Date: | FEBRUARY, 1995 |
| Prepared By: | Foth & Van Dyke | By: | JOW |




| Foth & Van Dyke | | | | |
|---|---|---|---|---|
| REVISED | DATE | BY | DESCRIPTION | |
| | | | | |
| | | | | |
| | | | | |
| CHECKED BY: | JKSI | | DATE: | FEB.'95 |
| APPROVED BY: | SVDI | | DATE: | FEB.'95 |
| APPROVED BY: | JWS | | DATE: | FEB.'95 |

Crandon Mining Company

**FIGURE 3-15**

BEDROCK VS. GLACIAL HYDROGRAPHS

| Scale: | AS SHOWN | Date: | FEBRUARY, 1995 |
|---|---|---|---|
| Prepared By: | Foth & Van Dyke | By: | JOW |

## 3.9 Mine Inflow Characteristics at Other Representative Mine Sites

The potential for lateral flow into the proposed Crandon mine can also be evaluated by examining inflow characteristics at other mine sites located in broadly similar environments in the Precambrian rock of the Canadian Shield. Such an evaluation will provide qualitative information regarding relative mine inflows for similar mines in similar environments. To develop this qualitative evaluation, the following narrative discusses actual reported mine inflows for underground mines located in the Canadian Shield. Section 3.9.2 presents information pertaining to Wisconsin's only operating metal mine located in Ladysmith, Wisconsin. While this latter mine is an open pit facility, it is constructed in the Canadian Shield and has similar geology to the Crandon Project. Water movement and inflows at this mine should have relevancy to the Crandon situation as discussed below.

### 3.9.1 Mine Inflow at Mine Sites Located in the Canadian Shield

Mines developed in Precambrian metamorphic/crystalline rocks, like those at Crandon, tend to be quite dry. These metamorphic/crystalline rock mines are unlike base and precious metal mines developed in younger Paleozoic and Mesozoic carbonate/clastic sequences, such as located in East Tennessee, Southeast Missouri, Southwest Wisconsin, or those located in Western United States porphyry and sediment host deposits, which can be quite wet.

Bedrock groundwater in the Precambrian deposits tend to be minimal. Small amounts of fracture controlled water is not uncommon, some of which drains off quickly, while others tend to drip small amounts of surface water in more continuous structures. Limited amounts of higher salinity, apparently connate water, are occasionally found. General comments, specific examples, and responses from a questionnaire relating to water inflow in underground mines developed in Precambrian rocks are discussed below.

Lindgren (1993) provides a review of mine inflow at underground mine sites in the Upper Peninsula of Michigan. These mine sites are located in bedrock generally similar to that of the Crandon site. Like the Crandon site, these mines are also covered by saturated glacial overburden.

Lindgren (1993) notes that water decreases with depth in the Late Precambrian, Michigan Native Copper District in the Upper Peninsula of Michigan, and ceases at depths of 1,000 to 1,500 feet. At 3,000 to 5,000 feet, mine waters are almost entirely absent, consisting only of drips.

The Calumet and Hecla Conglomerate mine in the Michigan Native Copper District pumped only 1,200 gpm, from a 5,000 foot deep mine with over 200 miles of workings and three square miles of continuous stopes. Most of that water was caught at shallow depths, but some did escape and flow down the inclined shafts to be picked up at depth. Away from the shafts the workings were dusty (Butler and Burbank, 1929). The Crandon mine will be about 2,000 feet deep and consist of an estimated 15 miles of mine workings. Continuous stoping area may reach 0.3 of a square mile.

The Kingston Conglomerate Mine, also in the Michigan Native Copper District, was in production during the mid 1960s. The mine was approximately 1,200 feet deep, contained about five miles of workings, and had a continuous stoping area of about 0.1 square miles (Weege, et. al., 1972). Only minor amounts of fracture controlled water in bedrock was encountered in this

mine at the Allouez Gap Fault. The mine bedrock was dry, although some water was picked up when underground raises intersected the overlying glacial drift (A.J. Erickson, Jr. personal experience).

Underground copper nickel exploration programs conducted in the 1970s in the Precambrian Duluth Gabbro and underlying Animike meta sediments encountered only minimal amounts of water. On the order of 10 gpm was pumped from the 1,700 foot deep shaft and associated 5,000 feet of workings at the Minnamax Copper-Nickel Project. One structure dripped a small amount, less than several gallons per minute of water when intersected in an exploration drift, and drilling rarely intersected water bearing fractures which drained quickly (A.J. Erickson, Jr. personal experience).

To obtain current information pertaining to mine inflow, CMC issued a questionnaire to randomly selected operating mines in Precambrian bedrock and received replies from 10 facilities. Responses from these 10 mines along with known data from other operating mines has been summarized in Table 3-10. This table shows mine inflow data for typical base and precious metal mines with varied geometrics in Precambrian bedrock. Mines referenced in the table include a broad spectrum of deposit types with host rocks ranging from basic intrusions, basic and intermediate volcanics (flows and pyroclastics), shallow sandstone and conglomerate (including meta conglomerate) to metamorphic greenschist and amphibolite facies rocks. Broadly speaking, the sites summarized in Table 3-10 are similar to Crandon, and therefore provide a benchmark for comparison. The table indicates that low volumes of water, which include that derived from overburden and the bedrock, are present. Mines developed in the types of rocks referenced in the table typically have little groundwater inflow from bedrock fractures.

Additional information on groundwater inflow from bedrock to mines is summarized by Raven and Clark (1993). They summarized mine inflow data below collected from 59 operating mines, located in the Canadian Shield, with openings below approximately 1,600 feet. Figure 3-16 summarizes the work of Raven and Clark (1993) with respect to mine inflow. For mines located in metavolcanic rocks, Raven and Clark (1993) computed inflow below 1,600 feet to be 254 ft3/d (1.3 gpm).

Collectively, the data on groundwater inflow to mines complied by CMC's survey of Canadian Mine sites and Raven and Clark (1993) provide practical operational data that supports the conceptual model that lateral flow from the bedrock to the mine will be minimal and that the majority of inflow will be derived from the glacial overburden in the immediate vicinity of the mine.

### 3.9.2 Bedrock Hydrogeology and Mine Inflow: The Flambeau Mine Site

With respect to the Crandon Project, the Flambeau Mine, although an open pit, is a representative local example of the significance of bedrock hydrologic conditions as it relates to mine inflow.

As part of the *Environmental Impact Report for the Kennecott Flambeau Project* (Foth & Van Dyke, 1989) a number of bedrock hydrogeologic studies were completed. These studies were similar in nature to the bedrock studies that have been completed for the Crandon Project and

## Table 3-10

## Typical Water Inflow for Precambrian Bedrock Metal Mines
## Crandon Project

| | Company/Mine Project | Metals | Host Rock Metamorphisms | Groundwater Inflow (US-GPM) | Attitude | Workings | | | Comments |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Depth (ft) | Extent (miles) | Area (sq. miles) | |
| 1 | Noranda/Geco-Manitouwadge, Ontario | Zn, Cu | Schists-Amphibolite facies | 85 | Steep | 4,300 | NA | 0.2 | Grouting in upper levels. Substantial inflow from quarry. |
| 2 | HBM&S/Ruttan Mine-Leaf Rapids, Manitoba | Cu, Zn | Greenstone-Upper Greenschist facies | <120 | Steep | 3,400 | 30 | 0.25 | |
| 3 | Calahan/Ropes-Marquette, Michigan | Au | Greenstone-Greenschist facies | Minimal | Steep | 1,500 | 3 | <0.1 | 2000 ton/day. Pumping from bottom, 1500, level. |
| 4 | Rio Algom/Stanleigh-Elliot Lake, Ontario | U | Conglomerates-Lower Greenschist facies | 30 | Flat | 4,200 | 100 | 2 | Grouted a vent raise near limestone. Also, geologic structure on 18 level. |
| 5 | Metall/Winston Lake-Schreiber, Ontario | Zn | Greenstone-Greenschist to Amphibolite | 2 | Gentle | 2,300 | NA | 0.1 | --- |
| 6 | Falconbridge/Kidd Creek-Timmins, Ontario | Zn, Cu | Greenstone-Greenschist facies | 242 | Steep | 6,000 | NA | NA | Inflow below 1600 level is 2 GPM. |
| 7 | Falconbridge/Fraser-Sudbury, Ontario | Ni, Cu | Basic Intrusive | 0 | Steep | 3,200 | NA | NA | Grouted fault during shaft sinking. |
| 8 | INCO/Coleman-Sudbury, Ontario | Ni, Cu | Basic Intrusive | 10 | Steep | 3,400 | NA | NA | Two ore bodies: 0-1900 level makes water. 3100-3450 level makes no water. |
| 9 | INCO/Creighton-Sudbury, Ontario | Ni, Cu | Basic Intrusive | 208 | Steep | 3,800 | NA | NA | Water from bottom of open pit and shafts. |

3.5-15-69

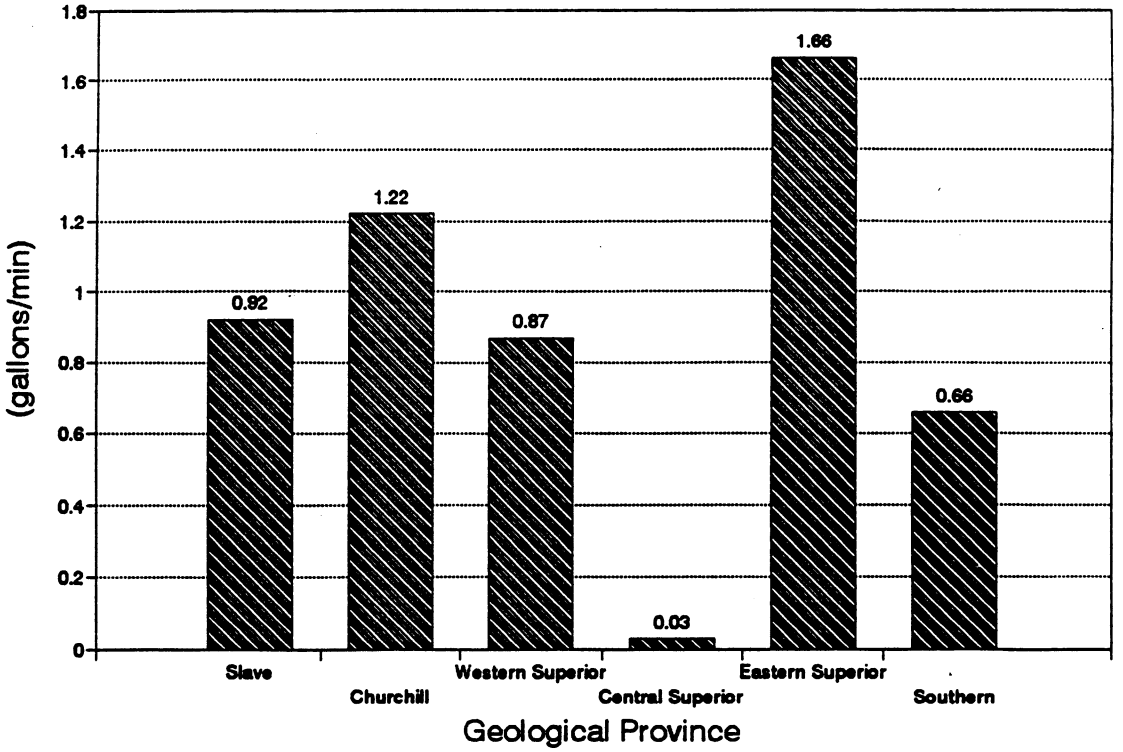
Table 3-10, continued

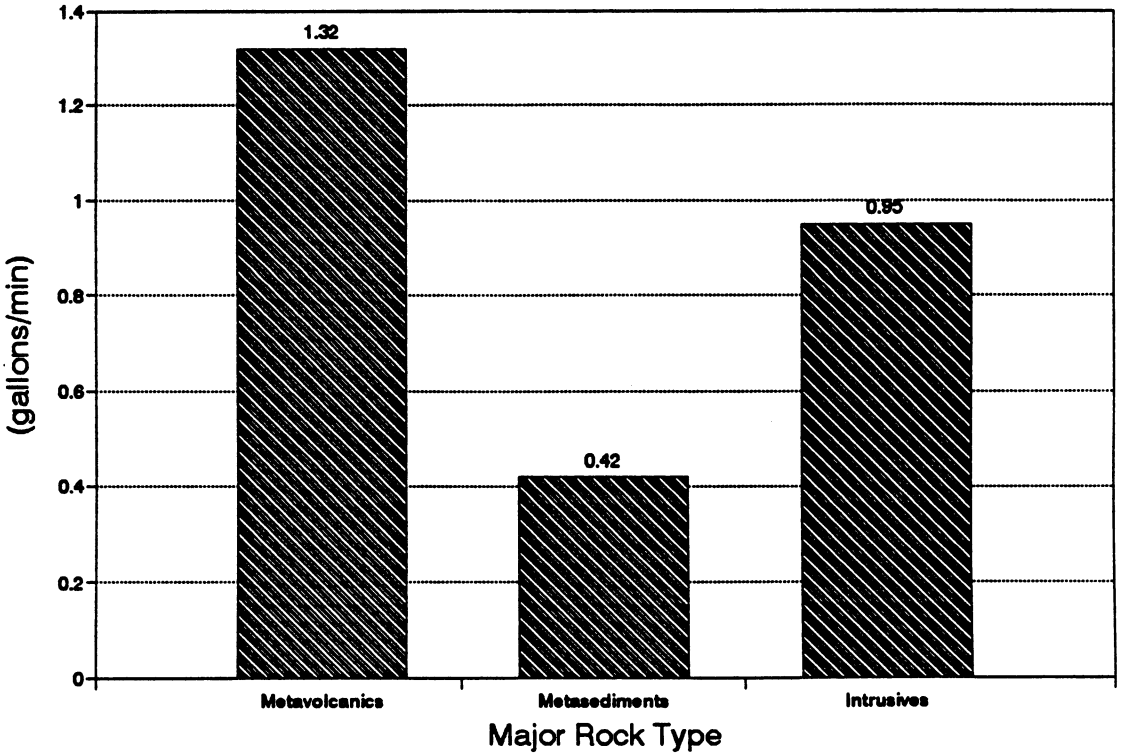
| | Company/Mine Project | Metals | Host Rock Metamorphisms | Groundwater Inflow (US-GPM) | Attitude | Workings | | | Comments |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Depth (ft) | Extent (miles) | Area (sq. miles) | |
| 10 | INCO/Thompson-Thompson, Manitoba | Ni, Cu | Basic Intrusive | 179 | Steep | 4,300 | 5 | <0.1 | Overlying pit bottom clay sealed, but leaks. Ore body, three miles by 30 feet and steep. |
| 11 | AMAX/Minnamax-Babbit, Minnesota | Cu, Ni | Basic Intrusive and slate | Minimal | Flat | 1,700 | App. 1 | 0.1 | Minor water bearing fractures cut in drilling, drained off quickly. |
| 12 | Calumet & Hecla/Kingston-Allouez, Michigan | Cu | Conglomerate-Zeolite facies | <20 | Gentle | 1,200 | 5 | 0.1 | Allouez Gap Fault minor leakage. |
| 13 | Calumet & Hecla/C&H Conglomerate-Calumet, Michigan | Cu | Conglomerate-Zeolite facies | 1,200 | Gentle | 5,000 | 200 | 3.0 | Bedrock dry, dusty. Water collected near surface. Some down inclined shafts and from crushed caved workings. |
| 14 | Copper Range/White Pine-White Pine Michigan | Cu | Shale & Sandstone-Very Low Greenschist facies | 501 | Flat | 1,800 | >100 | 25 | Rock permeability is 7.7E10-10 cm/sec. Flow is in fault zones |
| 15 | CMC/Crandon Project-Crandon, Wisconsin | Zn, Cu | Greenstone-Greenschist Facies | TBD | Steep | 2,300 | Est. 15 | Est. 0.1 | --- |

3.5-15-/0

TBD = To Be Determined
NA = Not available

Prepared by: AJE
Checked by: SVD1




SOURCE: RAVEN AND CLARK, 1993

NOTE: BASED ON 59 MINE SITES IN PRECAMBRIAN ROCK IN CANADA

| Foth & Van Dyke | | | | |
|---|---|---|---|---|
| REVISED | DATE | BY | DESCRIPTION | |
| | | | | |
| | | | | |
| | | | | |
| CHECKED BY: | JKSI | | DATE: FEB. '95 | |
| APPROVED BY: | SVDI | | DATE: FEB. '95 | |
| APPROVED BY: | JWS | | DATE: FEB. '95 | |

Crandon Mining Company

**FIGURE 3-16**

AVERAGE GROUNDWATER INFLOW RATE BELOW APPROXIMATELY 1600 FEET

| Scale: AS SHOWN | Date: FEBRUARY, 1995 |
|---|---|
| Prepared By: Foth & Van Dyke | By: JRB |

consisted of packer tests and bedrock pump tests in the shallow bedrock along the hanging wall and footwall of the Flambeau ore body.

Like the Crandon Project, the Flambeau mine is located in Precambrian greenschist facies metamorphic bedrock. Results from studies on the bedrock at the Flambeau mine determined that limited water movement in the shallow bedrock does occur with slight upward gradients at most locations (WDNR, 1990). Data obtained from packer tests and pump tests indicated that the permeability of the bedrock ranged from 2.2x10-4 ft/d (7.9x10-8 cm/s) to 1.8 ft/d (6.2x10-4 cm/s) with a median value of 3.6x10-2 ft/d (1.3x10-5 cm/s). Like the Crandon Project, higher permeabilities at the Flambeau site are found near the ore body. At the Flambeau site, the higher permeability measurements were within a 20 to 70 foot thick weathered zone on either side of the ore body. In general, the yields in bedrock in the area of the Flambeau site are too low to support domestic family home supplies (WDNR, 1990).

The Flambeau mine is located less than 200 feet from the Flambeau River. Given this fact, one of the key issues regarding the bedrock studies for the project was the amount of water that would flow from the river through the bedrock into the open pit mine. A prevalent assumption on the part of several interested parties during the Flambeau permitting process, was that the open pit would drain the Flambeau River. As both the data and analyses collected during the permitting process and that collected during operation show, this is not the case.

Groundwater modeling studies based on the collected field data indicated that approximately 100 to 150 gpm for normal recharge conditions would flow into the mine. For high recharge conditions, the flow was projected to be about 180 gallons per minute. Approximately 50 gpm of the total inflow was projected to be derived from the adjacent Flambeau River due to seepage through glacial deposits and the bedrock. The modeling results were based on a two-dimensional model incorporating the glacial overburden, Cambrian sandstone, and approximately the first 300 feet of Precambrian rock. To date, groundwater inflow to the open pit is comparable to predicted inflow rates. Inflow to the pit from glacial and bedrock sources averaged 149 gpm in 1993, and 184 gpm in 1994 (Flambeau Mining Company, 1995). The 1994 inflow values correlate with predicted inflow rates for high recharge conditions, since based on precipitation data from the site, high recharge conditions occurred in 1994 (Flambeau Mining Company, 1995).

The Flambeau Project as an open pit mine is a different type of mining project than the proposed underground Crandon mine. However with regard to bedrock hydrogeology, the data from the Flambeau site serves as a useful example for comparison since both are located in similar types of bedrock. Given that the hydrogeologic conditions are similar for both projects, the history of the Flambeau site serves as an example from which several conclusions can be drawn:

- bedrock hydraulic characterization studies, focused on the ore body and immediate hanging wall and footwall rocks, were sufficient to evaluate Flambeau mine inflow from the regional bedrock;

- water movement in the Flambeau Precambrian rock is likely to be limited to weathered regions in the upper part of the bedrock;

- techniques proposed in this report to evaluate, for the Crandon Project, mine inflow from the glacial overburden and bedrock are similar to those applied

successfully at the permitted Flambeau site, and are sufficient to examine the uncertainty in predicted mine inflow rates.

## 3.10 Area Bedrock Water Supply Use

The principle uses of groundwater in Forest and Langlade counties are for municipal and domestic water supplies. Generally the region is sparsely populated. Industries in the area require small volumes of groundwater which in many cases are obtained from the nearest municipal system. When municipal supplies are not available, industrial users rely on local groundwater supplies.

In the mid 1980s a water well inventory in the Crandon Project environmental study area (Mole Lake to the west, Ground Hemlock Lake to the east, Rolling Stone Lake to the south, and Swamp Creek to the north) identified 165 wells, of which 156 were used for domestic purposes and nine for water supplies to various public buildings (Exxon, 1985). At the time groundwater was also used in the vicinity of Mole Lake for irrigation of a potato farm. The water well inventory was based on data available from the WDNR, USGS, and local residents. The locations of the wells inventoried in the mid 1980s are shown on Figure 2.3-11 in Appendix J.

An updated water well inventory is being completed as part of the ongoing environmental studies for the Crandon Project. Preliminary results from the current inventory program, to be published with the project's 1995 *Environmental Impact Report*, indicate that the number of water wells has increased in the area of Rolling Stone Lake and Mole Lake. Preliminary results of the current water well inventory and water well inventory from the mid 1980s indicate that there are no bedrock water supply wells within the environmental study area.

Given that there are no known uses of bedrock water in the vicinity of the Crandon Project, any potential drawdown in the bedrock due to the Crandon Project would not impact domestic bedrock water uses. Additionally, CMC currently owns the majority of land within a one mile radius of the site, limiting future potential uses of groundwater in this area. Outside a one mile radius, future potential uses, like existing uses, will likely be derived from the saturated glacial overburden. Thus, potential drawdown in the bedrock should not pose a concern from the perspective of current and future potential uses.

## 3.11 Summary and Conceptual Model for Lateral Groundwater Flow to the Mine

As described in the *Investigation and Evaluation:Saprolite at the Crandon Site* (Foth & Van Dyke, 1995), the conceptual model for mine inflow for the Crandon Project consists of three components: 1) stored water within the ore body and surrounding bedrock, 2) vertical leakage from the glacial deposits into the bedrock consisting of and surrounding the ore body; and 3) lateral flow of water within the bedrock to the mine workings, with the greatest majority of inflow emanating from the first two components. No single piece of data provides irrefutable information to confirm with certainty that this conceptual model is correct, however the data presented in Section 3 of this report provides check after check that supports and is consistent with a conceptual model of limited lateral flow of water within the bedrock to the mine and limited drawdown within the bedrock. This conclusion is based on the following:

- Extensive drilling programs totalling approximately 320,000 feet (60 miles) of core have shown that major structural offsets that would give rise to significant lateral flow are not present at the Crandon mine site.

- Fracture and rock mechanics studies show a clear pattern of reduced fracture frequency with depth and an increase in RQD. Fracture orientation is preferential to east-west orientation. These parameters are consistent with decreased water flow in the bedrock with depth, with higher east-west than north-south permeabilities.

- Two bedrock pump tests on hole 214 from depths of 107 to 360 feet and 107 to 750 feet yielded low flow from the intersected hanging wall rocks.

- Weathering studies indicate that strong and moderate weathering is most pronounced in the Crandon Formation and is less in the hanging wall and footwall. The weathering is preferentially developed along the east-west trend of the bedrock formations.

- An east-west trending gabbro dike in the footwall will tend to limit the south to north water flow in the bedrock toward the mine.

- Packer test data is consistent with the conceptual model of bedrock water flow being primarily in the weathered zones.

- Temperature logs and geothermal gradients at the site are consistent with a limited flow of water in the bedrock.

- Bedrock water chemistry changes with depth suggesting limited flow at depth.

- Vertical gradients indicate little head difference between the glacial overburden and bedrock.

- Water inflow from other mines in similar geological settings to Crandon show limited water inflow at depth.

Collectively, this information provides strong support for the conceptual model of water movement in the bedrock at Crandon.

# 4 Bedrock Groundwater Flow Model

Bradbury, et. al. (1994) presented results from a simple two-dimensional flow model simulating potential inflow from the bedrock and drawdown in the bedrock from the Proposed Crandon mine. This section is devoted to discussing Bradbury, et. al.'s (1994) model and to developing a methodology for addressing bedrock in the project's regional groundwater flow model. Addressing bedrock as used here refers to the methodology to be used to quantify inflow that moves laterally from the hanging wall and footwall rocks into the mine workings and the resultant drawdown that is induced in the bedrock due to this movement. To prevent confusion, it must be understood that the models discussed in this section are different from the regional groundwater model currently undergoing calibration, and different from the submodel that has been developed to analyze the saprolite pump test (Foth & Van Dyke, 1995).

Bradbury, et. al. (1994) expressed concern with not explicitly including bedrock in the regional groundwater model. Their simulations with a simple model of the bedrock suggested that bedrock could be a significant factor in the regional model. A review of the assumptions used in their model has identified several over-simplifications in the approach which lead to an overestimation of impacts. These include: 1) the use of a 7,000 foot seepage face for the mine opening when it should be 2,000 feet or less, 2) use of a uniform permeability in the bedrock to a depth of 9,000 feet when permeability decreases with depth and based on fracture studies described above lack significant continuity below the upper 1,000 feet of bedrock, and 3) use of a no-flow boundary at the bedrock-overburden contact when leakage will be present. The model used in Bradbury, et. al. (1994), hereafter referred to as the simple bedrock model, was modified by GeoTrans, Inc. to demonstrate the ramifications of various assumptions. The following tasks were performed to evaluate the simple bedrock model and to address the issues raised by the Bradbury, et. al. (1994) model:

- reconstruction of the original two-dimensional simple bedrock model;
- verification of the reconstructed model as representative of that presented in Bradbury, et. al. (1994);
- construction of a three-dimensional version of the simple bedrock model;
- verification of the three-dimensional model as representative of the original two-dimensional simple bedrock model;
- refinement of the vertical representation of the seepage face at the mine opening;
- refinement of the vertical representation of hydraulic conductivity with depth;
- inclusion of the anisotropic nature of the bedrock;
- inclusion of leakage from the overburden in the model; and
- assessment of the sensitivity of these factors on mine inflow, bedrock drawdown, and overburden drawdown, where applicable.

There are significant differences between the results of the simple bedrock model and the simulations with more realistic assumptions. The latter simulations support the methodology described in the *Investigation and Evaluation: Saprolite at the Crandon Site* (Foth & Van Dyke, 1995) for modeling leakage into the bedrock and mine and for assessing the uncertainty associated with lateral flow into the mine from the bedrock.

It should be noted that the simulations discussed here were performed with a simplistic, non-calibrated model. The results provide a better conceptual understanding of mine inflow and the interrelationship of the bedrock with the glacial overburden. More detailed simulations of mine inflow and the impact of mine inflow on the glacial overburden were performed with the calibrated pump-test model discussed in the *Investigation and Evaluation: Saprolite at the Crandon Site* (Foth & Van Dyke, 1995) and will be performed with the calibrated regional groundwater flow model.

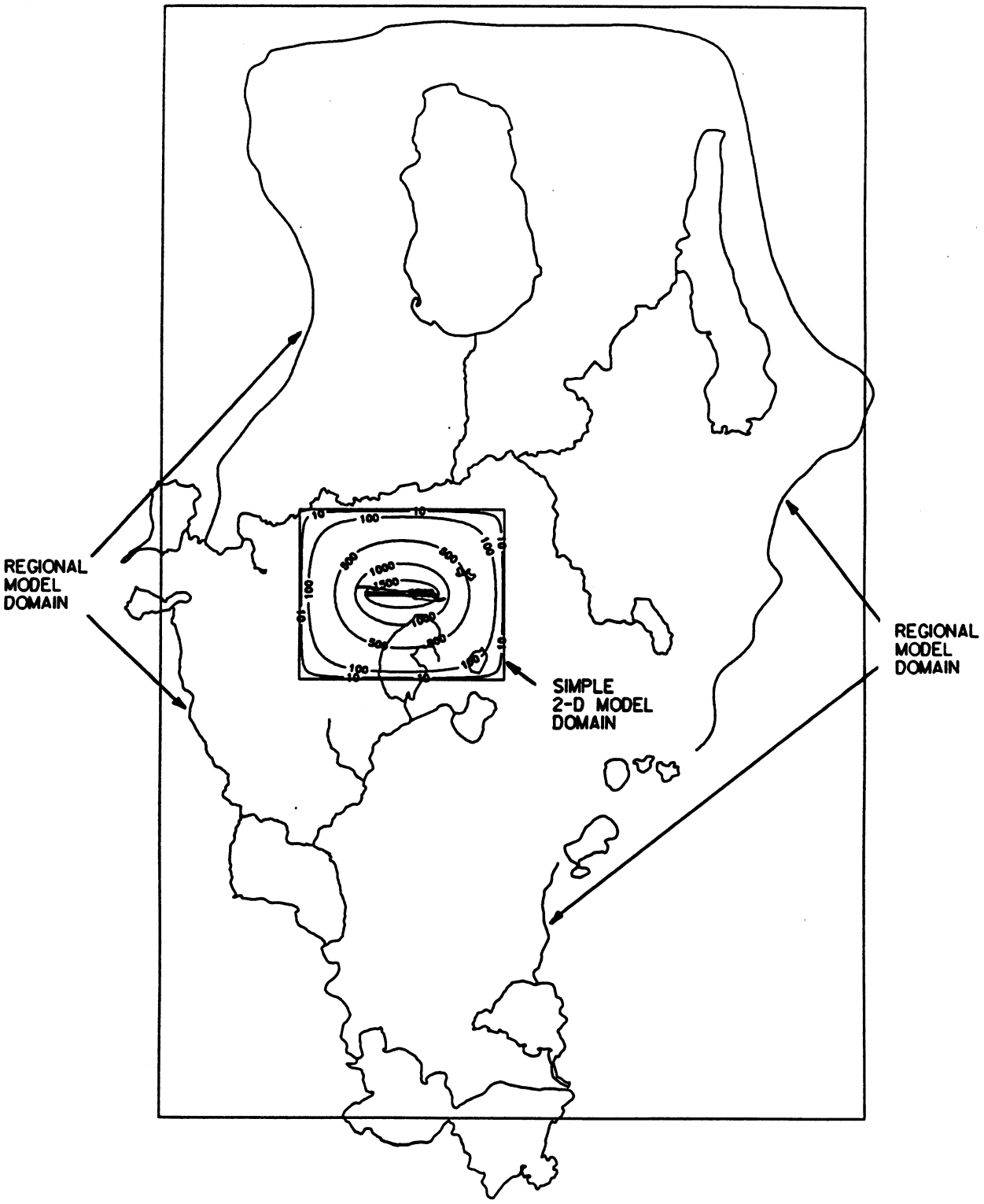
## 4.1 Reconstruction of Two-Dimensional Model

GeoTrans reconstructed the idealized two-dimensional simple bedrock model based on the information provided by Bradbury, et. al. (1994) in their December 6, 1994 memorandum. The model consists of one layer, 100 rows and 120 columns which represents a bedrock block 9,000 feet thick, 10,000 feet wide, and 12,000 feet long. All grid blocks are uniformly 100 feet on a side. A constant head of 0.0 feet was assigned at the model edges. A constant head of -2,000 feet was assigned in the center of the model, row 50 from columns 41 through 80, to simulate an instantaneous lowering of head in the ore body due to dewatering. The model was run in transient mode for 30 years using 30 time steps of 365 days per time step and a storage factor of 0.01. Bradbury, et. al. (1994) used a bedrock hydraulic conductivity of 2.8E-3 ft/d (1E-6 cm/s) and 2.8E-4 ft/d (1E-7 cm/s) for drawdown analyses one and two, respectively.

Figure 4-1 shows the 30 year drawdown simulated with the reconstructed model using a bedrock hydraulic conductivity of 2.8E-3 ft/d (1E-6 cm/s). A comparison of Figure 4-1 with Figure 2 in the Bradbury, et. al. (1994) memo confirms that the reconstructed model accurately reproduces the drawdown calculated in the simple bedrock model. Furthermore, a comparison of simulated mine inflows shows that the reconstructed model accurately reproduces the results of the simple bedrock model. The maximum and 30-year average mine inflow for the reconstructed model are 452,810 ft3/day (2,350 gpm) and 181,785 ft3/day (943 gpm), respectively. These maximum and average mine inflow values are equivalent to the reported values by Bradbury, et. al. (1994) of approximately 385,026 ft3/d (2,000 gpm) and 180,000 ft3/d (935 gpm), respectively. Small differences in mine inflows may be attributed to different time stepping schemes and round off. Figure 4-2 shows the transient mine inflow response of the reconstructed model drawdown analysis presented in Bradbury, et. al. (1994), and demonstrates successful reconstruction of the simple bedrock model.

## 4.2 Development of Three Dimensional Model

After the simple bedrock model was reconstructed and verified as representative of the original simple bedrock, a three-dimensional version of the model was constructed to provide more accurate representation of the seepage face in the mine opening. The three-dimensional model was constructed with four layers. Layer thicknesses for model layers one through four, top to bottom, are 2,100 feet, 400 feet, 500 feet, and 6,000 feet for a total model thickness of 9,000 feet.




SOURCE: GEOTRANS, INC.

| Foth & Van Dyke | | | |
|---|---|---|---|
| REVISED | DATE | BY | DESCRIPTION |
| | | | |
| | | | |
| | | | |

| | | | |
|---|---|---|---|
| CHECKED BY: | JKSI | DATE: | FEB.'95 |
| APPROVED BY: | SVDI | DATE: | FEB.'95 |
| APPROVED BY: | JWS | DATE: | FEB.'95 |

Crandon Mining Company

**FIGURE 4-1**
DRAWDOWN IN THE BEDROCK PREDICTED WITH RECONSTRUCTED BRADBURY et. al. (1994) MODEL

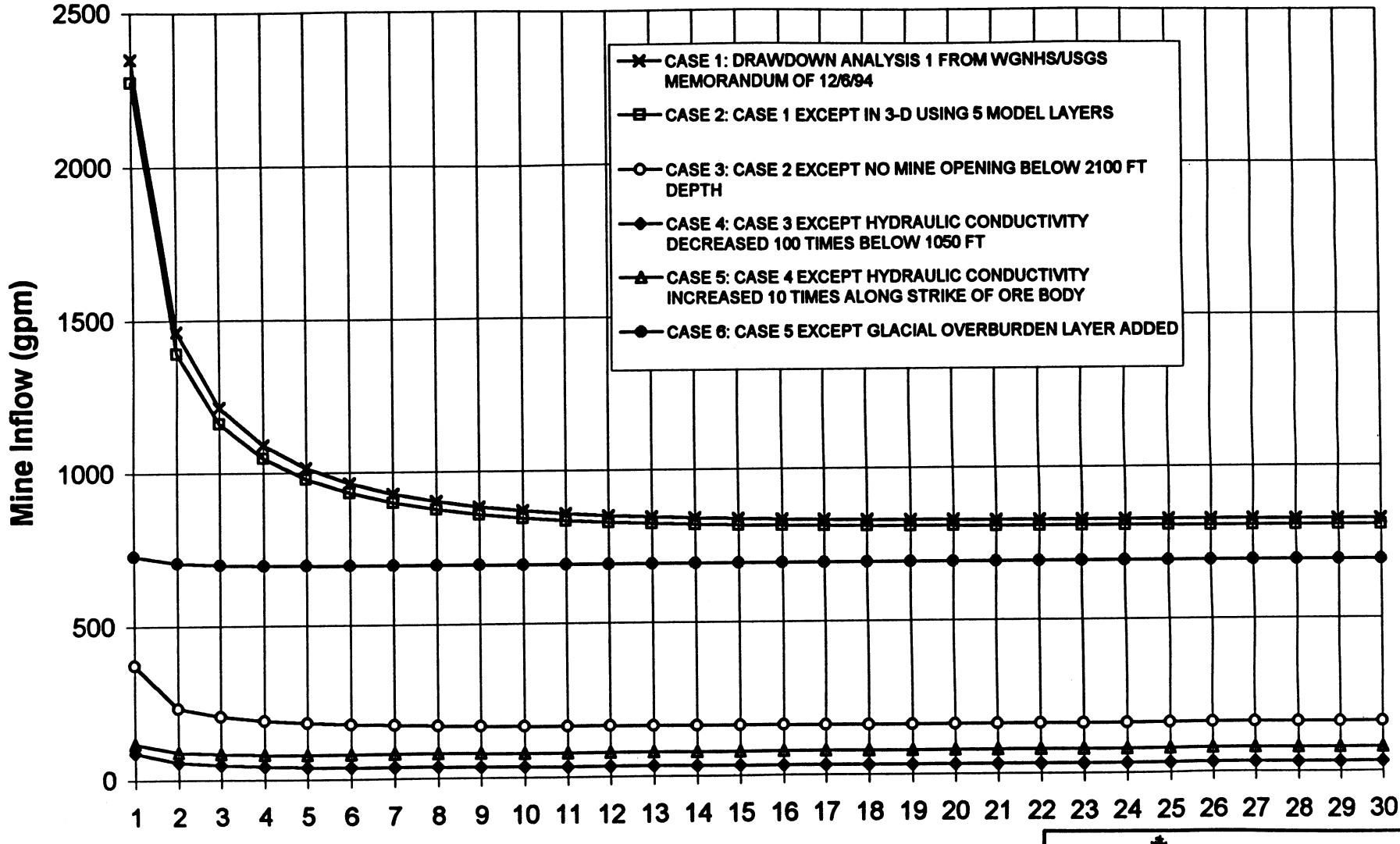
| | | | |
|---|---|---|---|
| Scale: | AS SHOWN | Date: | FEBRUARY, 1995 |
| Prepared By: | Foth & Van Dyke | By: | JOW |

c:\cadwork\4c33f52.dgn

3.5-15-78

93C04969

# USGS MODEL COMPARISONS




SOURCE: GEOTRANS, INC.

Foth & Van Dyke

| REVISED | DATE | BY | DESCRIPTION |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

| | | |
|---|---|---|
| CHECKED BY: | JKSI | DATE: FEB.'95 |
| APPROV[redacted]: | SVDI | DATE: FEB.'95 |
| APPROVE[redacted]Y: | JWS | DATE: FEB.'95 |

Crandon Mining Company

**FIGURE 4-2**

PREDICTED INFLOW COMPARISONS

| | | |
|---|---|---|
| Scale: AS SHOWN | Da[redacted] FEBRUARY, 1995 | |
| Prepared By: Foth & Van D[redacted] | | By: JOW |

Because the model is symmetric, columns 61 through 120 were eliminated to decrease the computational time. All mine inflow values derived from the three-dimensional model were doubled for direct comparison to the two-dimensional model. Constant heads of 0.0 feet were assigned at the three outer model edges in all four layers. A no flow boundary representing the flow line resulting in symmetry was used on the fourth side at the exterior edge of column 60. Constant heads of -2,000 feet were assigned in row 50 from columns 41 through 60 in layers one through four to represent the mine opening. The storage factor of 0.01 was distributed evenly across the 9,000 feet of bedrock (specific storage equaled 1.11E-6 per foot).

The initial run of the three-dimensional model was made to verify the conversion of the two-dimensional model to three-dimensional. Therefore, results of this simulation should compare directly to results of the previous two-dimensional simulation. Figure 4-2 shows that the mine inflow response of the three-dimensional model, Case 2, is essentially the same as the two-dimensional model, Case 1. The maximum and 30-year average mine inflow values for the three-dimensional model are 431,230 ft3/day (2,240 gpm) and 180,000 ft3/day (935 gpm), respectively. By contrast, the same values for the two dimensional model are 452,810 ft3/d (2,350 gpm) and 181,785 ft3/d (943 gpm), respectively.

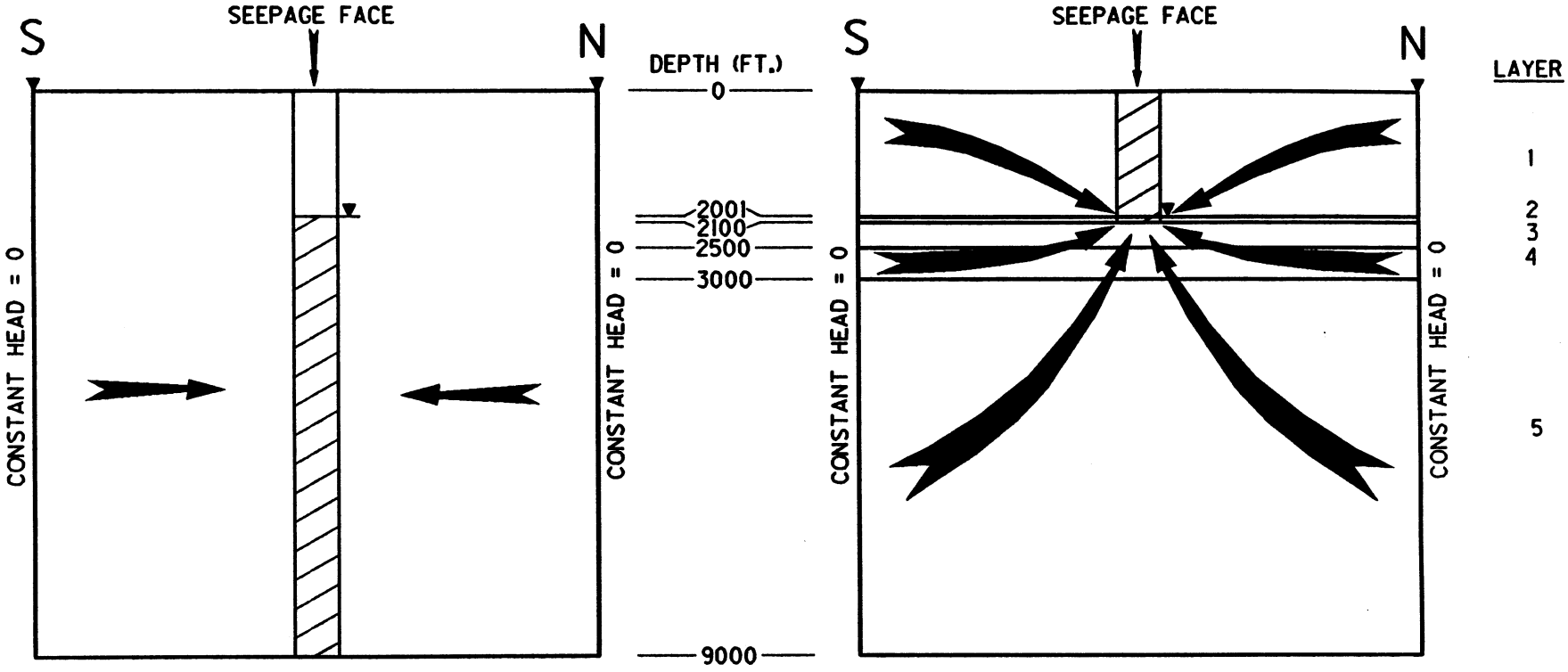
Recognizing that the 2,000 foot mine opening is overestimated in the previous models with a 7,000 foot seepage face, Case 3 was developed in which the constant head cells below -2,100 foot depth (layers two through four) were replaced with active model cells. Figure 4-3 compares the fundamentally different ways that the seepage face is represented in the simple bedrock model and the three-dimensional model of Case 3. The representation of the mine in the two-dimensional simple bedrock model is similar to representing a partially penetrating well as fully penetrating with flow being overestimated through a fully penetrating representation. A three-dimensional representation provides a more accurate estimate of flow to a partially penetrating system. Figure 4-2 illustrates with Case 3 that the reduction of the seepage face with the fully three-dimensional representation decreases the maximum and average mine inflow to 51,209 ft3/day (266 gpm) and 31,765 ft3/day (165 gpm), respectively. Figure 4-4 shows that the extent of the bedrock drawdown has also decreased as a result of the improved discretization of this model.

## 4.3 Refined Representation of Hydraulic Conductivity With Depth

Data presented earlier in this report support a conceptual model of decreased permeability at depth. This differs from the Case 1, 2 and 3 simulations that treated bedrock as uniformly conductive to a depth of 9,000 feet. In order to assess the implications of a decreasing hydraulic conductivity with depth, the upper 2,100 foot model layer of bedrock was subdivided into two model layers of 1,050 foot thickness. Hydraulic conductivities in the upper layer, above 1,050 feet, were assigned to be 2.8E-3 ft/d (1E-6 cm/s), slightly higher than data presented earlier in this report. Hydraulic conductivity of 2.8E-5 ft/d (1E-8 cm/s) was assigned to all layers below 1,050 feet. Vertical leakance terms were recalculated in order to properly represent the interconnection of these two layers. The constant head cell at -2,000 feet was left in layer two while a drain was added in the upper layer, set at elevation -950 feet to allow flow to the mine opening.

Drawdown in the upper part of the bedrock resulting from this simulation is shown in Figure 4-5. The extent of the drawdown is further limited from that of the original simple bedrock model.

c:\cadwork\4c33f52.dgn




## SIMPLE 2-D REPRESENTATION

— ONE MODEL LAYER

— SEEPAGE FACE AT MINE OPENING IS 7000 FEET LONG, REPRESENTED WITH CONSTANT HEAD

## 3-D REPRESENTATION

— 5 MODEL LAYERS

— SEEPAGE FACE AT MINE OPENING INITIALLY 2100 FEET LONG, REPRESENTED WITH A DRAIN IN LAYER 1 AND CONSTANT HEAD IN LAYER 2, DECREASING TO APPROXIMATELY 100 FEET LONG AT STEADY STATE

SOURCE: GEOTRANS, INC.

Foth & Van Dyke

| REVISED | DATE | BY | DESCRIPTION |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

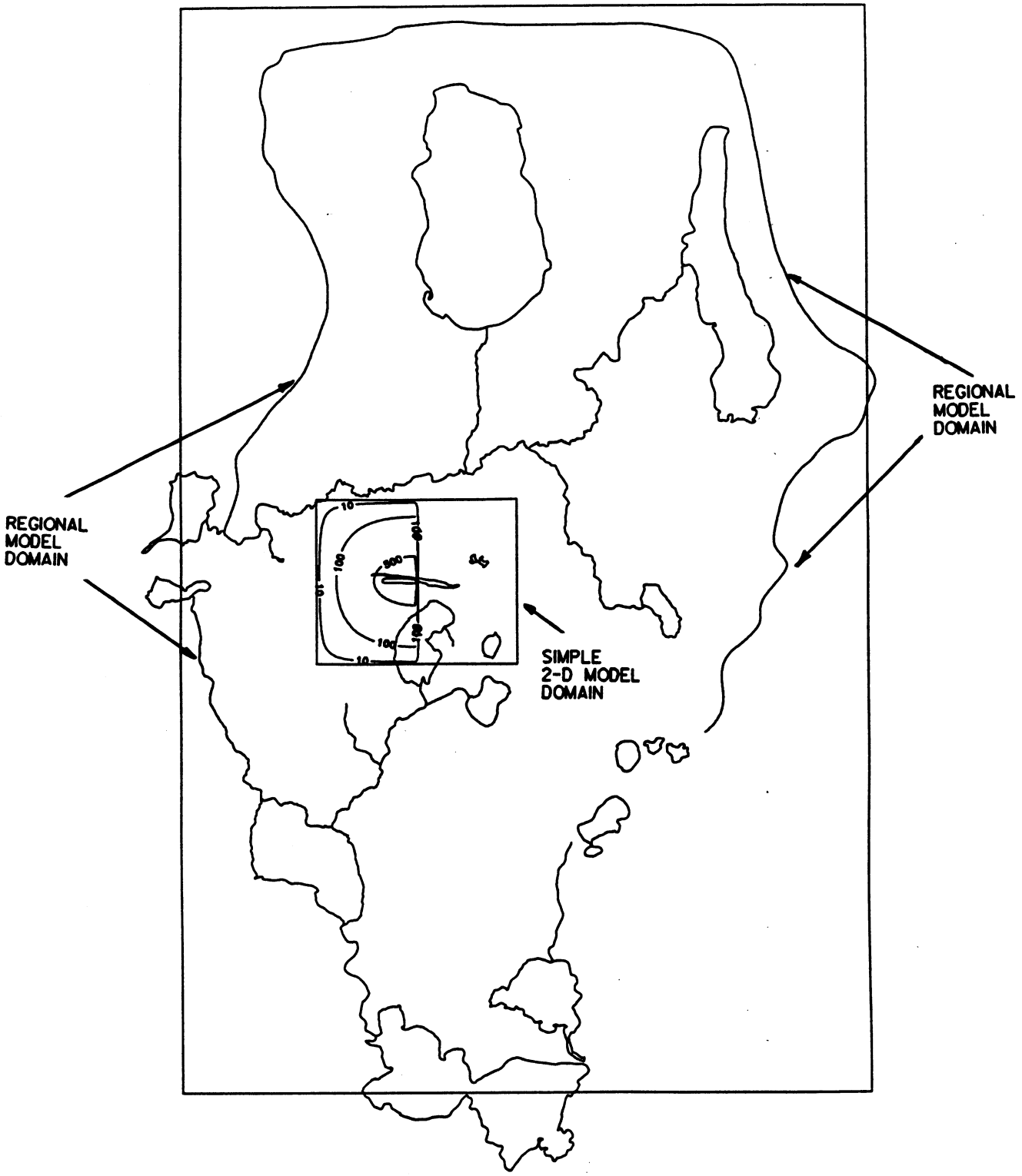
| | | |
|---|---|---|
| CHECKED BY: | JKSI | DATE: FEB.'95 |
| APPROVED BY: | SVDI | DATE: FEB.'95 |
| APPRO[illegible]: | JWS | DATE: FEB.'95 |

Crandon Mining Company

**FIGURE 4-3**

SCHEMATIC OF MINE SEEPAGE FACE IN 2-D VS. 3-D REPRESENTATION OF THE FLOW SYSTEM

| | | | |
|---|---|---|---|
| Scale: | AS SHOWN | Date: | FEBRUARY, 1995 |
| Prepared By: | Foth & Van [illegible] | By: | JOW |




SOURCE: GEOTRANS, INC.

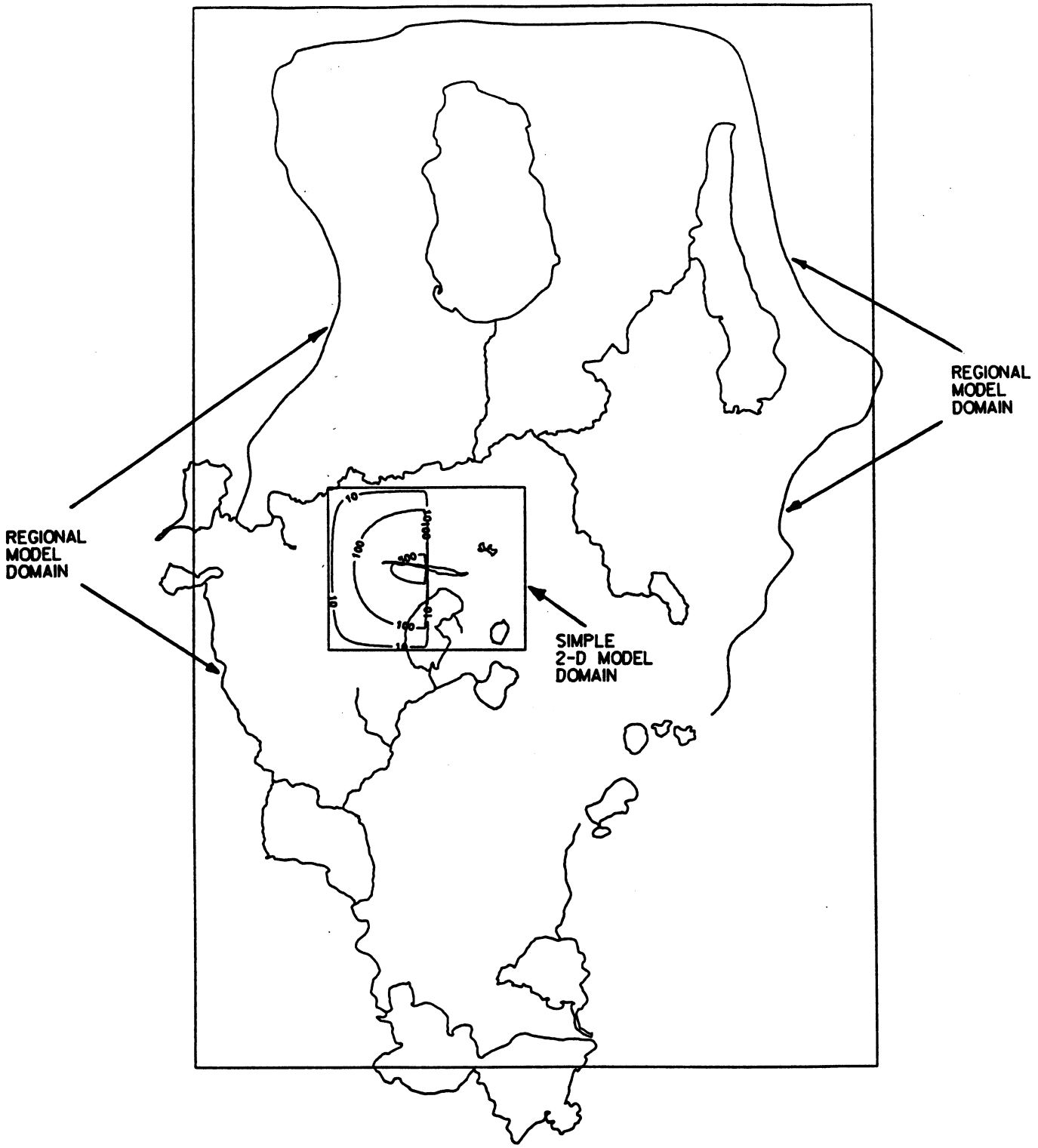
| Foth & Van Dyke | | | |
|---|---|---|---|
| REVISED | DATE | BY | DESCRIPTION |
| | | | |
| | | | |
| | | | |
| CHECKED BY: | JKSI | DATE: | FEB.'95 |
| APPROVED BY: | SVDI | DATE: | FEB.'95 |
| APPROVED BY: | JWS | DATE: | FEB.'95 |

Crandon Mining Company

**FIGURE 4-4**

CASE 3 PREDICTED DRAWDOWN IN BEDROCK

| Scale: | AS SHOWN | Date: | FEBRUARY, 1995 |
|---|---|---|---|
| Prepared By: | Foth & Van Dyke | By: | JOW |




SOURCE: GEOTRANS, INC.

| Foth & Van Dyke | | | |
|---|---|---|---|
| REVISED | DATE | BY | DESCRIPTION |
| | | | |
| | | | |
| | | | |
| CHECKED BY: | JKSI | DATE: | FEB.'95 |
| APPROVED BY: | SVDI | DATE: | FEB.'95 |
| APPROVED BY: | JWS | DATE: | FEB.'95 |

Crandon Mining Company

**FIGURE 4-5**

CASE 4 PREDICTED DRAWDOWN IN BEDROCK

| Scale: | AS SHOWN | Date: | FEBRUARY, 1995 |
|---|---|---|---|
| Prepared By: | Foth & Van Dyke | By: | JOW |

Figure 4-2, Case 4, illustrates that the maximum and average mine inflows decrease to 16,749 ft3/day (87 gpm) and 6,930 ft3/day (36 gpm), respectively.

## 4.4 Inclusion of Anisotropy in the Bedrock

Data presented in this report support the use of a directional component of hydraulic conductivity, or anisotropy, oriented along the strike of the ore body due to preferential fracturing along bedding or foliation planes within the bedrock. Supporting data for anisotropy include boreholes that predominantly intersect east-west fractures, tilted bedding planes oriented parallel to the strike of the ore body, and formation of an elliptical cone of depression during the saprolite pump test (Foth & Van Dyke, 1995).

To assess the effect of anisotropy in the bedrock, hydraulic conductivities along the strike of the ore body were increased by an order of magnitude. Therefore, hydraulic conductivities along model rows (east-west) were specified as 2.8E-2 ft/d (1E-5 cm/s) and hydraulic conductivities along columns were left at their original value of 2.8E-3 ft/d (1E-6 cm/s).

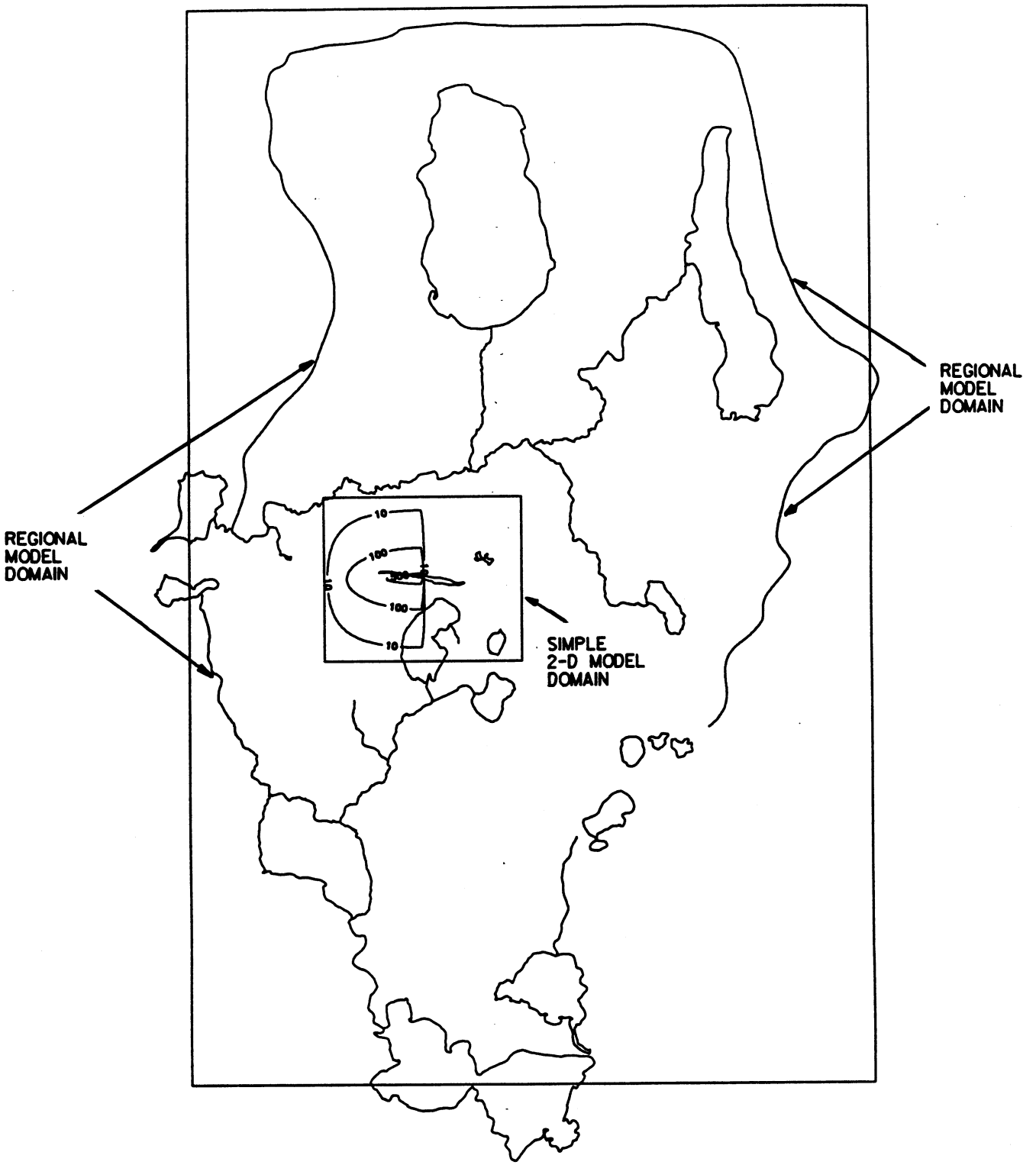
The results of this simulation show that there is a marked change in the shape of the cone of influence (Figure 4-6). Figure 4-2 (Case 5) illustrates that the maximum and average mine inflows are 22,712 ft3/d (118 gpm) and 15,401 ft3/d (80 gpm), respectively.

## 4.5 Inclusion of Leakage from the Overburden

All the prior models have represented the bedrock as a hydrostratigraphic unit that is hydraulically isolated from the overburden. This has been done by the implicit use of a no-flow boundary overlying the model. In this conceptual model, all inflow to the proposed mine comes initially from storage in the bedrock and later from source boundaries placed at some distance from the mine. It has been inferred by some that the bedrock drawdowns modeled in this fashion may create large drawdowns in the overburden. It is incorrect to assume this because leakage from the overburden will offset drawdown in the bedrock as it is a coupled system. In other words, large regional drawdowns in the bedrock might occur if the bedrock is hydraulically isolated from the overburden, however, then there would then be no impact on the overburden. Conversely, a good connection between the bedrock and the overburden would result in significant drawdown in the overburden, however, then bedrock drawdown would be limited.

In order to assess this tradeoff between overburden and bedrock drawdown, another version of the model was constructed with similar properties as the previous model. Included in this model, however, was an upper layer of glacial overburden. This layer was 100 feet thick and had properties of 20 ft/d for hydraulic conductivity and a specific yield of 0.1. The leakance between the overburden and bedrock in most of the model area was computed based on full saturation of the bedrock. However, in the immediate vicinity of the mine, a higher leakance based only on the properties of the massive saprolite and Pre- to Early Wisconsinan Till, was specified to represent the condition of desaturation in the bedrock overlying the mine. Properties of the massive saprolite and till were obtained from the saprolite pump test (Foth & Van Dyke, 1995). Vertical hydraulic conductivities were 0.16 ft/d (5.6x10-5 cm/s) for the till and 0.04 ft/d (1.4x10-5 cm/s) for the massive saprolite.

Drawdown in the upper part of the bedrock resulting from this simulation is shown in Figure 4-7. The extent of the drawdown is limited to the area immediately surrounding the mine and is




SOURCE: GEOTRANS, INC.

| Foth & Van Dyke | | | |
|---|---|---|---|
| REVISED | DATE | BY | DESCRIPTION |
| | | | |
| | | | |
| | | | |

| | | |
|---|---|---|
| CHECKED BY: | JKSI | DATE: FEB.'95 |
| APPROVED BY: | SVDI | DATE: FEB.'95 |
| APPROVED BY: | JWS | DATE: FEB.'95 |

Crandon Mining Company

**FIGURE 4-6**

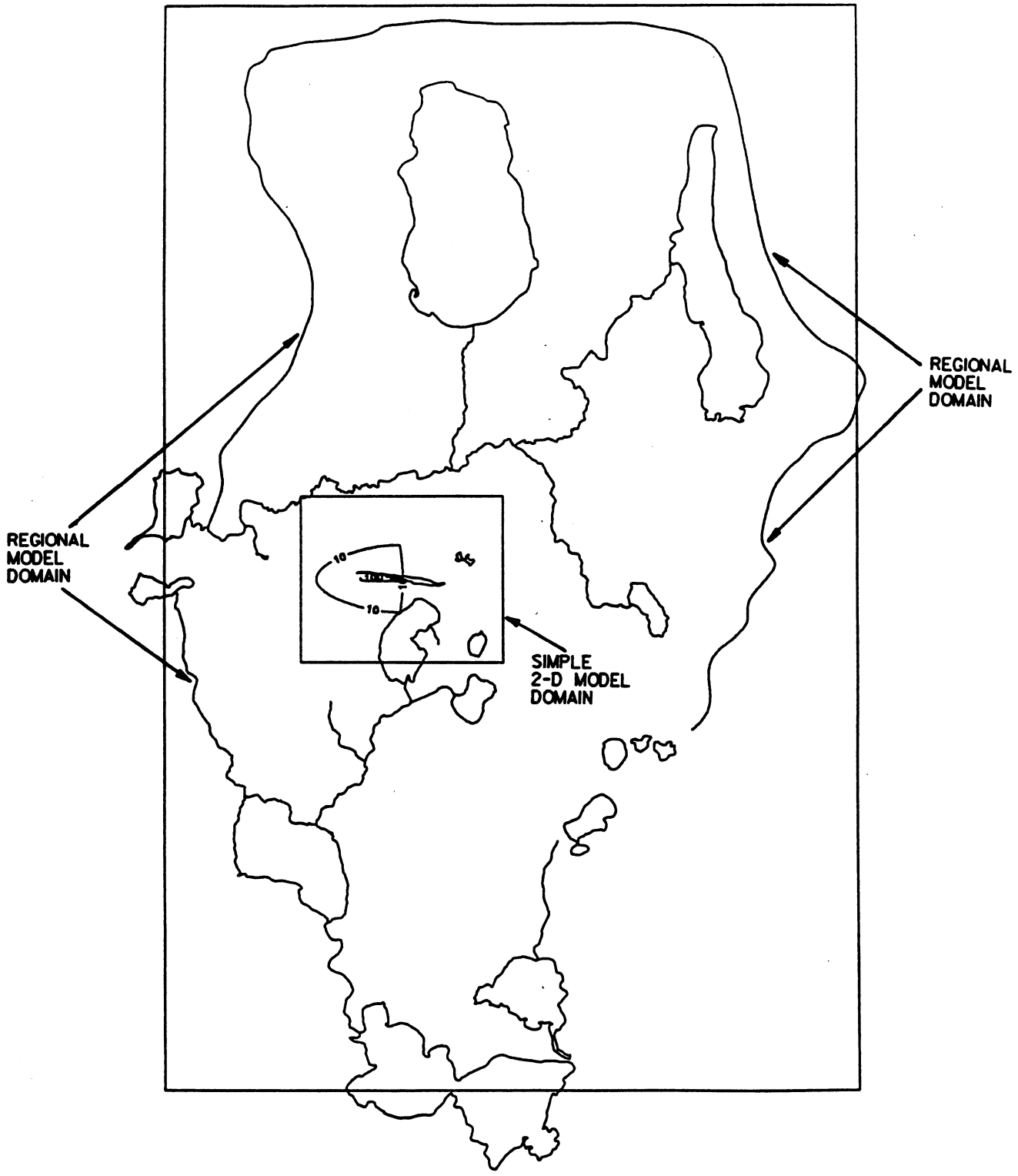
CASE 5 PREDICTED DRAWDOWN IN BEDROCK

| | | | |
|---|---|---|---|
| Scale: | AS SHOWN | Date: | FEBRUARY, 1995 |
| Prepared By: | Foth & Van Dyke | By: | JOW |

c:\cadwork\4c33f52.dgn

3.5-15-83

93C049 75




SOURCE: GEOTRANS, INC.

| Foth & Van Dyke | | | |
|---|---|---|---|
| REVISED | DATE | BY | DESCRIPTION |
| | | | |
| | | | |
| | | | |

| | | | |
|---|---|---|---|
| CHECKED BY: | JKSI | DATE: | FEB.'95 |
| APPROVED BY: | SVDI | DATE: | FEB.'95 |
| APPROVED BY: | JWS | DATE: | FEB.'95 |

Crandon Mining Company

**FIGURE 4-7**

CASE 6 PREDICTED DRAWDOWN IN BEDROCK

| | | | |
|---|---|---|---|
| Scale: | AS SHOWN | Date: | FEBRUARY, 1995 |
| Prepared By: | Foth & Van Dyke | By: | JOW |

unaffected by boundary conditions. This is because leakage from the overburden, Figure 4-8, supplies the majority of mine inflow. Figure 4-2, Case 6, illustrates that the maximum and average mine inflows increase to 140,150 ft3/day (728 gpm) and 123,308 ft3/day (694 gpm), respectively. Analysis of the origin of mine inflow water from this case indicates that initially, virtually all water comes from bedrock storage, however, after one year, less than five percent of the water is derived from the bedrock. Over 30 years, 98 percent of the water originates from the overburden while two percent originates from the bedrock as storage and lateral flow from the boundaries. The results of this simulation clearly demonstrate the dampening effect that overburden leakage has on bedrock contribution and drawdown.

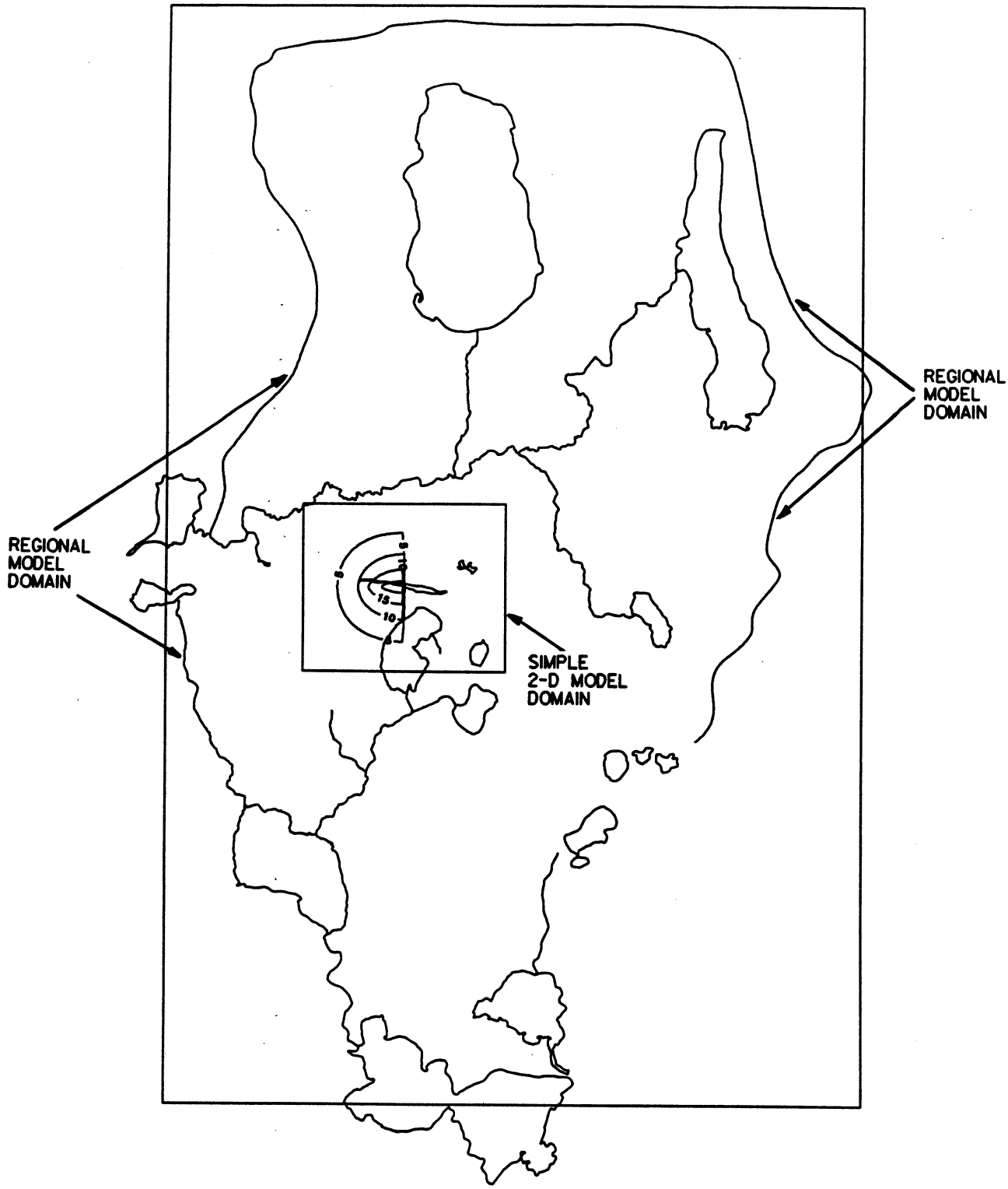
## 4.6 Summary

The simplified two-dimensional model used in the Bradbury, et. al. (1994) bedrock memorandum significantly overestimates mine inflow quantities derived from the bedrock and the extent of bedrock drawdown. Estimates of mine water inflow are reduced by the warranted changes reflected in the following four assumptions: 1) a reduction in the seepage face for the mine; 2) a decrease in the hydraulic conductivity with depth due to decreased fracture permeability and decreased fracture continuity; 3) the addition of the effect of anisotropy resulting from fractures oriented parallel to the strike of the ore body; and 4) incorporation of leakage from the overburden.

Inclusion of more representative conditions in the model shows that lateral bedrock flow is a small component of the overall mine inflow. When vertical leakage is allowed in the model, it is apparent that there is a trade-off between bedrock drawdown and glacial overburden drawdown. Bedrock drawdown is moderated by the amount of leakage from the overburden. The magnitude of the overburden leakage is greatest in the area where desaturated conditions occur beneath the Pre- to Early Wisconsinan Till and massive saprolite immediately above the mine. Over the 30 year life of the mine, only two percent of the mine inflow is derived from the bedrock storage and lateral flow. The major factor that should therefore be considered in a model of mine inflow is vertical leakage through the massive saprolite. Thus, the originally proposed representation of mine inflow in the regional model as a series of one-dimensional vertical leakance terms is appropriate.

An approximation of the size of the limits of vertical leakage has been made with variations on the simple bedrock model. However, the more finely discretized, multiple layer, variable layer thickness, and calibrated pump test model (Foth & Van Dyke, 1995) will provide a better approximation to the size of the vertical leakage zone. This information will be used in the regional groundwater flow model. Although CMC continues to believe that inclusion of a regionally extensive bedrock layer in the regional groundwater flow model will not significantly improve the accuracy of the regional model, sensitivity simulations with the regional model with the bedrock as an active model layer will be conducted in a limited number of regional model predictive simulations. The purpose of these simulations will be to address remaining uncertainty regarding the representation of bedrock in the regional model.

From the analyses in this section of the report, it is apparent that the boundary conditions in the regional model are correct. Even the overestimated area of influence shown in the Bradbury, et. al. (1994) memorandum extends less than halfway to the regional model boundaries (Figure 4-1). This area of influence is reduced considerably when more realistic assumptions are used.




SOURCE: GEOTRANS, INC.

| Foth & Van Dyke | | | |
|---|---|---|---|
| REVISED | DATE | BY | DESCRIPTION |
| | | | |
| | | | |
| | | | |

| | | | |
|---|---|---|---|
| CHECKED BY: | JKSI | DATE: | FEB.'95 |
| APPROVED BY: | SVDI | DATE: | FEB.'95 |
| APPROVED BY: | JWS | DATE: | FEB.'95 |

Crandon Mining Company

**FIGURE 4-8**

CASE 6 PREDICTED DRAWDOWN IN OVERBURDEN

| | | | |
|---|---|---|---|
| Scale: | AS SHOWN | Date: | FEBRUARY, 1995 |
| Prepared By: | Foth & Van Dyke | By: | JOW |

Therefore, development of the regional groundwater flow model should continue with the boundaries currently in the model.

# 5 Conclusions

The data presented in this report indicates that lateral flow within the bedrock is not likely to contribute significant amounts of groundwater to the mine. Therefore, the representation of bedrock in the regional model as described in the *Investigation and Evaluation: Saprolite at the Crandon Site* (Foth & Van Dyke, 1995) is appropriate. The following points summarize the primary conclusions of this report.

- The density of bedrock drill holes and the associated southwest or southeast trending trajectories allow for sufficient evaluation regarding the potential existence of significant north-south trending faults and fractures.

- Based on extensive characterization work, there is no significant disruption, displacement, offset or folding of key stratigraphic horizons in either the Crandon deposit or host rock.

- Fracture studies for the Crandon Project show that interconnected fractures are limited to the near surface bedrock in the hanging wall and footwall surrounding the Crandon Formation. Within the Crandon Formation, interconnected fracture patterns exist to depths of about 1,000 feet.

- Fracture studies show that fractures are most prominent along east-west trending trajectories that nearly parallel the strike of bedding planes. Fractures are least common along north-south trending trajectories.

- Fracture studies show that at depth, after millions of years, there is little evidence of water movement.

- The weathering intensity is at its maximum extent within the Crandon Formation where it extends to a depth of about 1,100 feet.

- Weathering decreases in depth and intensity as one moves north in the hanging wall away from the deposit. This is a reflection of proximity to the massive sulfide mineralization and its attendant near surface oxidation. At the 400N projection weathering is limited to near surface bedrock regions extending to a depth of about 250 feet.

- The depth of the weathering intensity is less along the 200S projection in the footwall of the deposit. This is a reflection of the intensity of silicification in the rocks and also the lack of intense sulfide mineralization as compared to the Crandon deposit. Two hundred feet south of the ore body weathering extends to a depth of about 250 feet.

- A young fresh unweathered gabbro dike, the locally named Duck Lake gabbro dike is likely to form a low permeability barrier immediately south of the ore body. Lateral flow across this formation would likely be limited to the upper 200 to 300 feet where there is some evidence of water movement.

- Packer test data shows that the bulk hydraulic conductivity of the bedrock outside the area of influence of the Crandon Formation is likely to be in the range of 2.8x10-2 ft/d (1x10-5 cm/s) to 2.8x10-3 ft/d (1x10-6 cm/s), and does decrease with depth within the respective formations.

- Down hole temperature surveys indicate a smooth regional thermal gradient and the absence of temperature irregularities suggests limited and infrequent water movement.

- Water chemistry data indicates the potential occurrence of meteoric water to a depth of about 1,800 feet within the ore body. This depth nearly correlates with the depth of random fracture patterns and weathering within the ore body.

- Water chemistry data shows that saline water extends up to approximately 350 feet below the bedrock surface in the hanging wall indicating limited lateral movement of water.

- Hydrographs of wells screened in the bedrock compared to wells screened in the glacial overburden show little evidence of movement of water to or from the bedrock.

- Lateral flow at depth within the Precambrian rock occurs from limited sources of water contained in isolated fractures. Since these fractures are likely discontinuous and unlikely to extend to the bedrock surface, drainage of these waters will not induce drawdown in the near surface bedrock and therefore will not induce additional leakage from the glacial overburden.

- Grouting techniques can be an effective method to control point sources of inflow from the Precambrian crystalline rock.

- Practical experience from many mine sites located in Precambrian crystalline rock show that lateral flow of groundwater from the Precambrian rock is minimal and limited to the near surface regions of the bedrock.

- Refined simulations of flow within the bedrock system show that lateral flow from the bedrock will be a minor component of total mine inflow.

- Groundwater domestic use is generally limited to the glacial overburden. There are no known domestic uses of bedrock groundwater within the immediate vicinity of the mine.

## 6 References


Bradbury, K., Hunt, R., and Krohelski, J., December 1994. Review of Bedrock Hydrogeology at the Crandon Project Site. University of Wisconsin - Extension, Wisconsin Geological and Natural History Survey, Madison, Wisconsin.

Brace, W.F., M.D. Voegle and H.R. Pratt, 1982. *Porosity, Permeability and Their Relationship in Granite, Basalt and Tuff.* Intera Environmental Consultants, Inc.

Butler, B.S. and W.S. Burbank, 1929. *The Copper Deposits of Michigan.* USGS Professional Paper 144.

Crandon Mining Company, December 19, 1994. Crandon Project-Groundwater Modeling (Hydrologic data base provided on disk, addressed to Randy Hunt, USGS).

Dames & Moore, 1978. Results of Permeability Tests and Analysis of Water Samples from Deep Exploration Holes, Crandon Ore Body, Crandon, Wisconsin. CMC-NOI-82

Exxon Minerals Company, April 11, 1978. Correspondence to J. E. Grimes from F.J. Sonderman. Temperature Survey - Crandon.

Exxon Minerals Company, November 1985. *Environmental Impact Report, Crandon Project,* Volume II.

Flambeau Mining Company, 1995. 1994 Annual Report.

Foth & Van Dyke, December 1989. *Environmental Impact Report for the Kennecott-Flambeau Project.*

Foth & Van Dyke, October 20, 1994. Bedrock Hydrogeology at the Crandon Project Site.

Foth & Van Dyke, February 1995. *Investigation and Evaluation: Saprolite at the Crandon Site.*

Franklin, J.M., J.W. Lydan, D.M. Sanguter, 1981. *Volcanic-Associated Massive Sulfide Deposits,* Economic Geology, 75th Anniversary Volume, 1905-1980, pp. 485-627.

Freeze, R.A. and J.A. Cherry, 1979. *Groundwater.* Prentice-Hall, Inc. Englewood Cliffs, NJ.

J.F.T. Agapito & Associates, Inc., November 9, 1992. *Preliminary Evaluation of Blasthole Open Stope Dimensions, 3-5 Level.* Crandon Deposit, pp. 1-3, 22 and 23.

John D. Smith Engineering Associates Limited, August 2, 1982. *Selection of Mining Methods for the Crandon Crown Pillar Based on Rock Mechanics's Considerations.* pp. 7-13.

Kelly, W.C., R.O. Rye, and A. Livnat, 1986. *Saline Mine Waters of the Keweenaw Peninsula, Northern Michigan: Their Nature, Origin and Relation to Similar Deep Waters in Precambrian Crystalline Rocks of the Canadian Shield.* American Journal of Science, Vol. 286, pg. 281-308.

Keys, W.S. and R.F. Brown. *The Use of Temperature Logs to Trace the Movement of Injected Water.* Groundwater, Vol. 16, No. 1, pg. 32-48.

Lambe, R.N. and R.G. Rowe, March 26, 1980. *Summary of Prospect Shaft Pilot Hole 214.*

Landers, R.A., January, 1981. Correspondence to E.R. May, results of Crandon Phase I-mine hydrology tests. CMC-NOI-55

Lindgren, W., 1993. *Mineral Deposits.* McGraw-Hill Book Company, Inc.

Raven, K.G. and I.D. Clark, 1993. *Survey of Geoscientific Data on Deep Underground Mines in the Canadian Shield.* Prepared for the Atomic Energy Control Board, Ottawa, Ontario.

Rowe, R. G., 1984. Bedrock Permeability. Exxon Minerals Company. CMC-NOI-39

Rowe, R.G., 1985. *Deep Hanging Wall Fracturing Report.* CMC-NOI-79

STS Consultants, Ltd., 1984. *Hydrogeologic Study Update for the Crandon Project.* Vol. I. CMC-NOI-27.

Summers, W.K., 1972. *Specific Capacities of Wells in Crystalline Rocks.* Groundwater, Vol. 10, No. 6, pg. 37-47.

Weege, R.J., J.P. Pollock, and Calumet Division Staff, 1972. *The Geology of Two New Mines in the Native Copper District of Michigan,* Economic Geology. Vol. 67, pp. 622-633.

Wisconsin Department of Natural Resources, March 1990. *Final Environmental Impact Statement,* Flambeau Mining Co.-Copper Mine, Ladysmith, Wisconsin.

# Appendix A

## Relevant Material from John D. Smith Engineering Associates Limited (1982)

# SELECTION OF MINING METHODS FOR THE CRANDON CROWN PILLAR BASED ON ROCK MECHANIC'S CONSIDERATIONS

Prepared For

Dynatec Mining Limited

by

John D. Smith, M.Sc.,P.Eng.

August 2, 1982

John D. Smith Engineering Associates Limited

Consulting Mining and Geotechnical Engineers

110 Lakeshore Blvd., Kingston, Ontario, Canada K7M 6R5 Tel. 613 389-5641

August 2, 1982

Mr. Fred Edwards
Manager of Engineering,
Dynatec Mining Limited,
P.O. Box 267,
Richmond Hill, Ontario.
Z4C 4Y2

Re: Selection of Mining Methods For The Crandon Crown Pillar Based On Rock Mechanic's Considerations

Dear Fred:

I present herewith the above noted report in fulfillment of our agreement regarding the Crandon crown pillar mine design study. This work was initiated by a visit to Rhinelander with you on May 26 - 28 to discuss the project with Exxon personnel, examine drill core, and collect the necessary data. Interim meetings were held in your offices on June 17 and July 13 to review progress and make appropriate decisions on future work and scheduling.

The report discusses how the rock strength classification was developed from point load strength measurements done by this company in 1978 - 79 for Exxon Minerals Co. U.S.A. and how this data was integrated with the weathering profiles produced from most of the available core logs by Roger Rowe. The structural data obtained from measurements of features observed in eight core holes out of the twenty N.Q. holes drilled in the 1982 program has been analyzed by a stereonet computer program and results used to discuss rock mass stability. All cumulative rock mechanic's information has been used to discuss suitable mining methods for the various combinations of rock conditions encountered and to suggest appropriate mine geometry.

I appreciate the opportunity to have worked with you and your staff on this most interesting project. I look forward to discussing this report with you after you have had the time to incorporate it into your study.

Respectfully submitted,

John D. Smith, M.Sc.,P.Eng.

JDS:bj

Copy to: R. Hite

(6) Where holes are some distance off section, the contacts have been moved to the weathering limits for colouring purposes.

(7) If better ground is encountered nearer surface than the weathering profiles and guide would indicate, then the lower elevations of the weathering zone have been up-graded.

## STRUCTURAL FEATURES

The conversion of reference measurements between bedding and joints to strike and dip of the joints was described in the report, "Orientation of Structural Features From The Crandon Project 1982 Drilling Program", dated July 27, 1982. These become input data to another program that establishes the families of joints present and their variations, if any, in the different materials of interest.

### SPLOT3 Computer Analysis

Stereographic projections are commonly used by geologists for the presentation and analysis of structural geology data.[1,2] There are two types of projections in common use, the equal area (Lambert or Schmidt projection) and the equal angle (Stereographic or Wulff projection). The equal area type is preferred for statistical interpretation of structural data because, as the name implies, the net is divided into units of equal area.

The SPLOT3 computer program was developed by members of the Dept. of Geological Engineering of Queen's University to statistically analyze poles to planar features using the equal area stereonet. This program converts strikes and dips of planar features to poles and plots them on a stereonet. It then contours these poles to establish concentrations and hence "families" of planar features. The program was modified by Dale Fisher for use on drill core rather than surface mapping along a tape and

JOHN D SMITH, P.Eng.
Designated SPECIALIST
in the class of Rock Mechanics
in the Mining Field
Valid until April 1984
APEO

the data was organized so that bedding, joints, converted data and original oriented data could be run separately or in various combinations. In addition, data from the various holes could be grouped in any combination of holes and into various rock type groups. To reduce the size of the Appendix, the scatter diagrams produced for each combination of data have not been included. The contour plots are presented in each case and the poles representing the families have been identified.

Bedding

Bedding features from all eight holes and all materials in these holes were combined on one stereonet. The result, shown in Appendix A, is two distinct families of bedding, one 094° 85°NE and the other 115°88°NE. When the bedding is split into the different rock types of H.W., massive sulphide, stringer sulphide, and F.W. rocks, it can be seen that the families remain the same, with the exception of the massive sulphide. In this material the 115° az 88°NE dipping family remains the same but the other family has changed to 101°az 87°NE dip. Both families occur in all rock types.

It appears that there are at least two different orientations* to the bedding at this property. A further computer analysis was conducted to determine if both families occurred over the strike length covered by the drill holes. The overlap of the two ore types ends at about section 94120E with only massive sulphide to the east. It was therefore decided to study the features by grouping together all holes to the east of this section and all holes to the west. The results are also shown in Appendix A and clearly indicate that bedding orientation of 095 - 097°az and dip of 89°NE is only found in holes 236, 237, 238, 239 and 244 (stringer sulphide plus massive

*Corred. Westend strikes E-W; Eastend strikes WNW by ESE. Bend in middle

JOHN D. SMITH, P. Eng.
Designated SPECIALIST
in the class of Rock Mech
in the Mining Field
Valid until April 1984
APEO

sulphide overlap). These small changes in strike and dip of bedding will be taken into account in the next section on structural stability.

Joints

Statistical analysis has been done on all joint features recorded from the 8 holes. The stereonet results are presented in Appendix B. The following table summarizes the results obtained from all data, all data from the massive sulphide area split into the four different rock types, and the four zones obtained from the overlap zone west of section 94120E. The joint families are listed in decreasing order of importance from 1 to 5.

All Joint Measurements

| Azim 1 Dip | Azim 2 Dip | Azim 3 Dip | Azim 4 Dip | Azim 5 Dip |
|---|---|---|---|---|
| 085° 85°SE | 062° 8°SE | 151° 81°SW | 140° 39°SW | 116° 25°NE |

Massive Sulphide Area (holes 245,246,247)

| | | | | | |
|---|---|---|---|---|---|
| H.W. | 088 82°SE | 079 12°SE | 133° 78°SW | 144 38°SW | 123 25°NE |
| M.S. | 103 88°SW | 094 44°SW | 140 47°SW | 110 32°NE | 177 55°SW |
| S.S. | 113 12°NE | 130 26°SW | 082 68°SE | 016 83°SE | 146 78°SW |
| F.W. | 020 4°SE | 081 80°SE | 100 24°NE | 160 54°SW | 055 46°SE |

Overlap Area (M.S.+S.S. (holes 236,237,238,239,244)

| | | | | | |
|---|---|---|---|---|---|
| H.W. | 154 45°SW | 111 46°SW | 152 83°SW | 075 34°SE | 011 44°SE |
| M.S. | 055 64°SE | 149 86°SW | 131 43°SW | 167 18°NE | 003 30°NW |
| S.S. | 136 40°SW | 064 78°SE | 179 51°NE | 024 64°NW | 153 79°SW |
| F.W. | 059 80°SE | 152 83°SW | 141 24°SW | 081 86°SE | -- |

When all the data is combined it is clear that two very strong families and three less distinct ones are produced. The H.W. rock east of

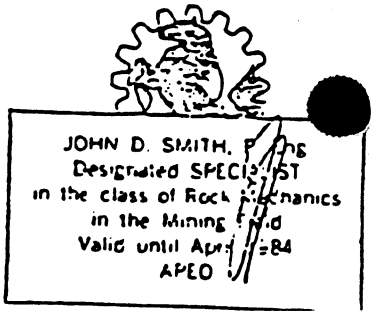
JOHN D. SMITH, P.Eng.
Designated SPECIALIST
in the class of Rock Mech.
in the Mining Field
Valid until 31 DEC 1984
APEO

3.5-15-97

section 94120E has the same joint families with the same relative incidence but when the H.W. stereonet data from the holes west of section 94120E are compared, there are distinct differences. It appears that the rocks in the H.W. have been subjected to different conditions along the strike length of the orebody. These differences continue into the massive sulphide as noted from the table and stereonets, although the number of measurements is low and therefore the degree of confidence in the orientations is therefore reduced. It appears that the stringer sulphides also display different joint families along strike and the same pattern is extended into the F.W. rocks. There is considerable evidence to suggest that the geological environment at the time of ore deposition was different between the eastern and western portions of the orebody. The data suggests that the split could occur at about section 94120E. The strong families at each location and in each rock type will be used in the structural analysis calculations.

Fracture Frequency

The meterage at each fracture in the drill core as reported in the raw data obtained from Exxon was compiled by computer and the frequency of fracturing plotted for each hole at 3m intervals. The plots are presented in Appendix C and are summarized in the following table. The data from this table has been used to produce the following percentages of occurrance for material east and west of section 94120E.




3.5-15-98

## Distribution Of Fractures By Material

| Hole No. | Fracture Frequency: Very High +10 H.W. | Very High +10 Ore | Very High +10 F.W. | High 7 - 10 H.W. | High 7 - 10 Ore | High 7 - 10 F.W. | Moderate 3 - 7 H.W. | Moderate 3 - 7 Ore | Moderate 3 - 7 F.W. | Low 0 - 3 H.W. | Low 0 - 3 Ore | Low 0 - 3 F.W. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Massive Sulphide** | | | | | | | | | | | | |
| 236 | | | | | | | | | | ✓ | ✓ | ✓ |
| 237 | | ✓ | | | | | | ✓ | | ✓ | | |
| 238 | | | | | | | | | | ✓ | ✓ | ✓ |
| 239 | | | | | | | | | | ✓ | ✓ | ✓ |
| 244 | | | | ✓ | | | ✓ | | | | | ✓ |
| 245 | | | | ✓ | | | ✓ | | | | | ✓ |
| 246 | | | | | | | | | | ✓ | ✓ | ✓ |
| 247 | | | | | | | | | | ✓ | ✓ | ✓ |
| **Stringer Sulphide** | | | | | | | | | | | | |
| 236 | | | | | | | | | | ✓✓ | ✓✓ | ✓✓ |
| 237 | | | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 238 | | | | | | | | | | ✓✓✓ | ✓✓✓ | ✓✓ |
| 239 | | | | | | | | | | ✓✓✓✓ | ✓✓✓✓ | ✓✓ |
| 244 | | | | | | | | ✓ | | ✓✓ | ✓ | ✓ |
| 245 | | ✓ | | | | ✓ | | | | ✓ | | |

JOHN D. SMITH, P.Eng
Designated SPECIALIST
in the class of Rock Mechanics
in the Mining Field
Valid until April 1984
APEO

## Incidence of Fracturing

## West of Section 94120E

### Massive Sulphide

| | | | | |
|---|---|---|---|---|
| H.W. | - | high | - | 20% |
| | - | low | - | 80% |
| Ore | - | very high | - | 20% |
| | - | moderate | - | 20% |
| | - | low | - | 60% |
| F.W. | - | moderate | - | 20% |
| | - | low | - | 80% |

### Stringer Sulphide

| | | | | |
|---|---|---|---|---|
| H.W. | - | moderate | - | 8% |
| | - | low | - | 92% |
| Ore | - | moderate | - | 15% |
| | - | low | - | 85% |
| F.W. | - | moderate | - | 8% |
| | - | low | - | 92% |

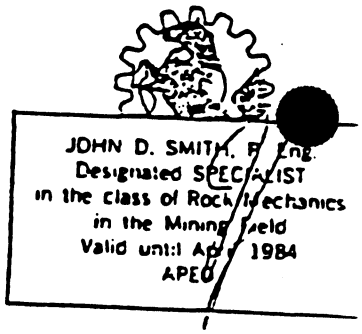
## East of Section 94120E

### Massive Sulphide

| | | | | |
|---|---|---|---|---|
| H.W. | - | high | - | 33% |
| | - | low | - | 67% |
| Ore | - | moderate | - | 33% |
| | - | low | - | 67% |
| F.W. | - | low | - | 100% |

### Stringer Sulphide

| | | | | |
|---|---|---|---|---|
| H.W. | - | low | - | 100% |
| Ore | - | very high | - | 100% |
| F.W. | - | high | - | 100% |




3.5-15-100

It is noted that the H.W. rocks of massive sulphide ore zones generally have low fracture frequency, while the ore in such zones can be locally badly fractured. The frequency of fracturing in the F.W. rocks for massive sulphide is generally low. If these eight holes are representative of the upper portion of the orebody, it would appear that dilution and pillar sloughing should not be significant. The degree of fracturing in the stringer sulphide zones is even less and mining in them should display good ground stability. It is concluded that the incidence of natural rock mass fracturing should not adversely affect crown pillar recovery.

# Appendix B

## Relevant Material from J.F.T. Agapito & Associates, Inc., (1992)

# PRELIMINARY EVALUATION OF BLASTHOLE OPEN STOPE DIMENSIONS 3-5 LEVEL

# CRANDON DEPOSIT

for

Exxon Coal and Minerals Company
Houston, TX

by

C. E. Brechtel
B. F. McGunegle

November 9, 1992

J.F.T. AGAPITO & ASSOCIATES, INC.
715 Horizon Drive, Suite 340, Grand Junction, Colorado 81506
TEL. (303) 242-4220 FAX. (303) 245-9234

FILE MAN .RCM
Sub RP
Sub
Keywords

# 1.0 INTRODUCTION

This report presents the results of the rock mechanics evaluation of blasthole open stope dimensions to support preliminary layout and design studies for mining in the Crandon deposit. Dimensions are given for the area of earliest mining between 3 and 5 levels (between 723- and 123-ft elevation) where the indicated rock quality is high. Transversely oriented open stopes are planned for the majority of the mining in this area but some longitudinal stopes will also be required in areas where the orebody thins. A preliminary review of the rock mechanics data developed during exploratory drilling of the Crandon massive sulfides orebody was performed. The existing data was supplemented by generation of the Rock Quality Designation (RQD) from core photographs, and by examination of the remnants of core from holes located in the portion of the orebody where initial production is planned. Data on fracture orientation was also analyzed to identify joint sets and to estimate the intensity of jointing. Dimensions of blasthole open stopes were then assessed using empirical design methods and limited numerical analysis.

Section 2.0 of this report presents a summary of the results and recommendations for stope dimensions. Section 3.0 discusses the adequacy of the previous rock mechanics studies. In Section 4.0, the existing and supplemental data used as the basis for estimating stable stope dimensions are summarized. The technical approach used to assess stope dimensions is described in Section 5.0, along with the resulting recommended dimensions. Results of the preliminary stress analysis and a comparison of the projected stresses to design rock mass strengths are discussed in Section 6.0. Section 7.0 presents recommendations for further rock mechanics activities to support ongoing mine design.

# 2.0 SUMMARY AND RECOMMENDATIONS—STOPE DIMENSIONS

## 2.1 GEOTECHNICAL SUMMARY

Rock mechanics studies and data, developed during the exploratory drilling of the Crandon project, were reviewed to establish the adequacy of the information to support mine design. Although a substantial amount of data on rock properties, fracture orientations, hydrology and rock quality have been generated, the existing data has been collected in the upper portions (above 3 level) of the orebody where weathering effects have adversely impacted rock quality in some areas. As a result, the indicated variability of rock quality in the upper portion of the ore was not representative of the deeper (3 through 5 levels) part of the ore where the earliest mining is planned and where the majority of the resource occurs.

Additional data on rock quality was generated for the area of earliest mining by reviewing available core photographs and calculating the core RQD. Data on fracture orientation and location in six holes were also analyzed to estimate orientations and densities of the fracture sets. This additional rock quality data and the existing data on rock strength were used to assess stope dimensions to support the development of a preliminary mine layout in the deeper ore between 3 and 5 levels.

Conclusions derived from the data review are listed below.

- Rock quality as indicated by the RQD was relatively high and averaged 83% in the hanging wall and 87% in the massive sulfide and stringer sulfide zones. No correlatable zones of low RQD were recognized between the ten holes reviewed.

- Fracture analysis suggested three fracture sets with dip directions generally to the south and average dips of 10°, 47° and 85°. The sets with low and intermediate dips were estimated to have spacings of 6.2 and 5.8 ft, respectively. The steeply dipping set was estimated to have spacings in the range of 26 ft. The south dipping direction of the fractures primarily impacts hanging wall stability.

- Foliation breaks, oriented roughly parallel to the hanging wall, were observed in the core and have the potential to adversely impact stability.

- Fracture surfaces logged were generally clean, planar and rough. Calcite, quartz and Fe-oxide were observed at relatively low frequency. Slickensiding was noted, but was limited to roughly 7% of the surfaces.

- No evidence of the existence of large weathered zones, which would have a significant effect on rock quality, were detected in holes that penetrated the area of earliest mining (3 through 5 levels). Such zones were indicated in holes above the 3 level.

- Infrequent weathering features were observed, in split remnants of core, as Fe-oxide mud on fractures or faults. These features occurred irregularly at intervals between 50 and 60 ft or greater.

- Faults were reported in the lithology logging, however, no interpretation of their orientation or location has been made at this time. Their potential impact has not been accounted for in the stope dimension analysis.

- Rock compressive strengths were high in the massive sulfides ore and stringer sulfides (stope footwall) averaging 22,200 and 25,570 psi, respectively. The hanging wall rock was weaker and averaged around 11,000 psi.

- Location of the ore boundary with respect to the stratigraphic hanging wall varied between 0 and 62 ft in the holes examined. This variation has the potential to affect hanging wall stability by forming a skin of rock different from the stratigraphic hanging wall on the stope hanging wall. Depending on the lithology of the non-ore rock, the skin may be similar to massive sulfide strength, or in the case of pyritized argillite, it may be weaker rock.

## 2.2 RECOMMENDED DIMENSIONS

### 2.2.1 Transverse Open Stopes

Stope dimensions were evaluated using an empirical design approach proposed by Mathews et al (1980) and based upon back-analysis of 176 case histories in Canadian mines. The analysis was based upon the nominal stope height and length defined in the Project Design Basis Memorandum (Exxon, 1986) as:

4.2.5.3 Fractures— Fracture data was available in several forms. Fracture data from oriented coring for shaft pilot hole no. 155 had been compiled into general orientation trends[1]. Raw data on fractures that had been oriented with respect to bedding was available for holes 236, 237, 238, 239, 244, 245, 246 and 247, shown in Figure 4.2. Further information on overall fracture density was recorded in the core logs. All these data sources were analyzed to establish the trends in orientation and density of fracturing.

Raw data for the 200 Series holes was oriented based upon general notes from R. Rowe and techniques developed by Rosengren (1970), where feature orientation is measured with respect to bedding in the core. When the general orientation of beddings and the hole are both known then the absolute orientation of each fracture can be calculated. The orientation of each feature was calculated with the computer program DIP.

Orientations of sets of fractures were determined for each hole using a computer program, PATCH, which performs a statistical analysis of the orientation data. The results were compared to orientations derived for hole 155 to assure that the assumptions made to orient features in the 200 Series holes appeared valid. This comparison is shown in Figure 4.4, an upper hemisphere stereographic projection of the poles of fracture sets identified for each hole. Figure 4.4 shows clear groupings of the fracture orientations and compares well with the reported observations from hole 155.

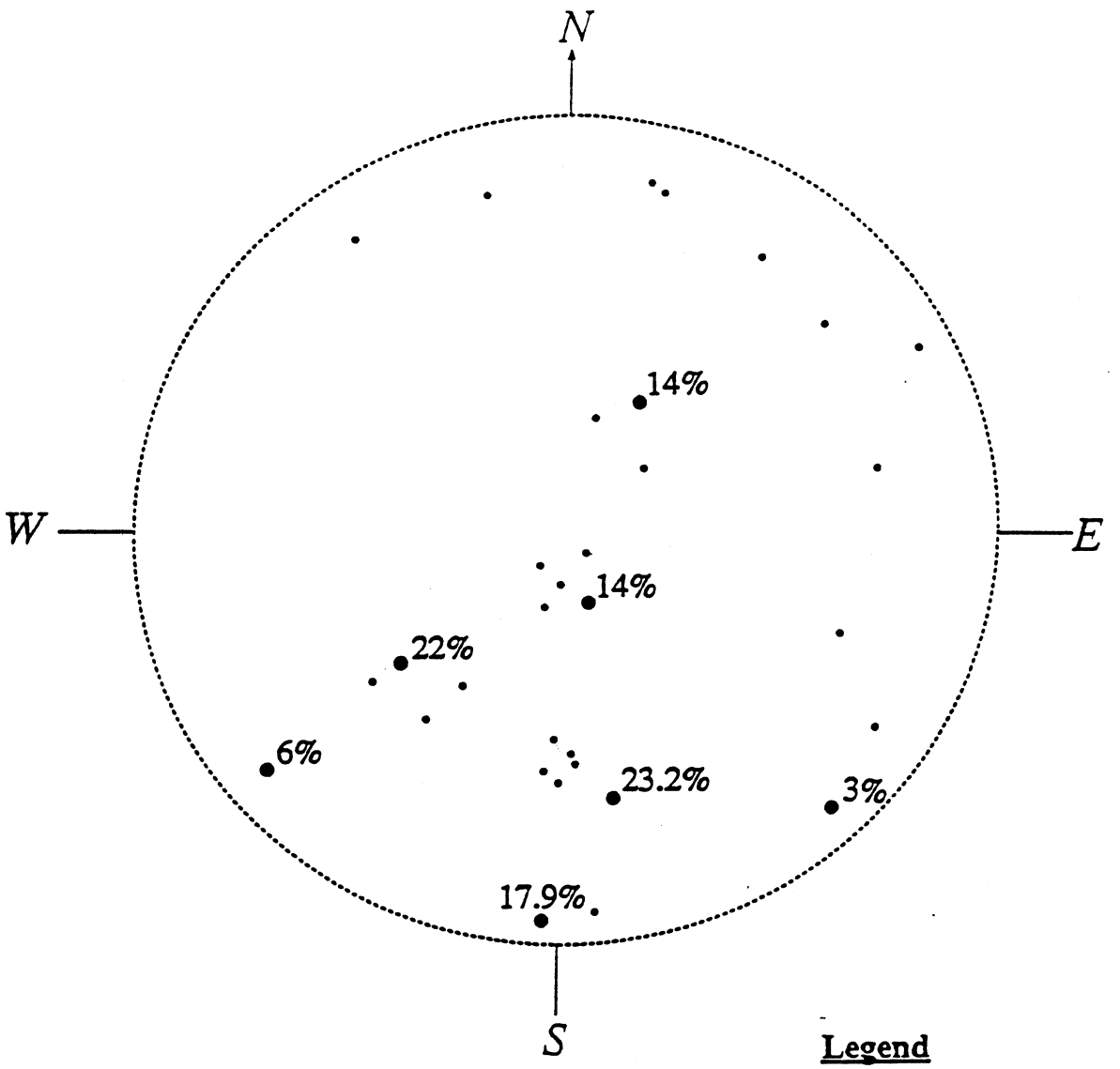
Based upon Figure 4.4, three dominant fracture trends were identified:

- dip direction 180°, dip 10°,
- dip direction 189°, dip 47°, and
- dip direction 180°, dip 85°.

The 200 Series holes were drilled north-south inclined between 40-50°. Any fractures trending north-south would not have been well sampled by the drilling. However, no such orientations were identified in the vertical hole 155 and they are therefore assumed not to

[1] From notes by Mike Maier, Exxon.

# UPPER HEMISPHERE STEREOGRAPHIC PROJECTION OF JOINT POLES




**Legend**

- Joint Sets from Holes 236, 237 238, 244, 245, 246 and 247
- Joint Sets from Hole 155

14% Percentage of Occurrence in Hole 155

**Figure 4.4 Comparison of Joint Set Orientation from Individual Holes**

# Appendix C

## Relevant Material from Rowe (1985)

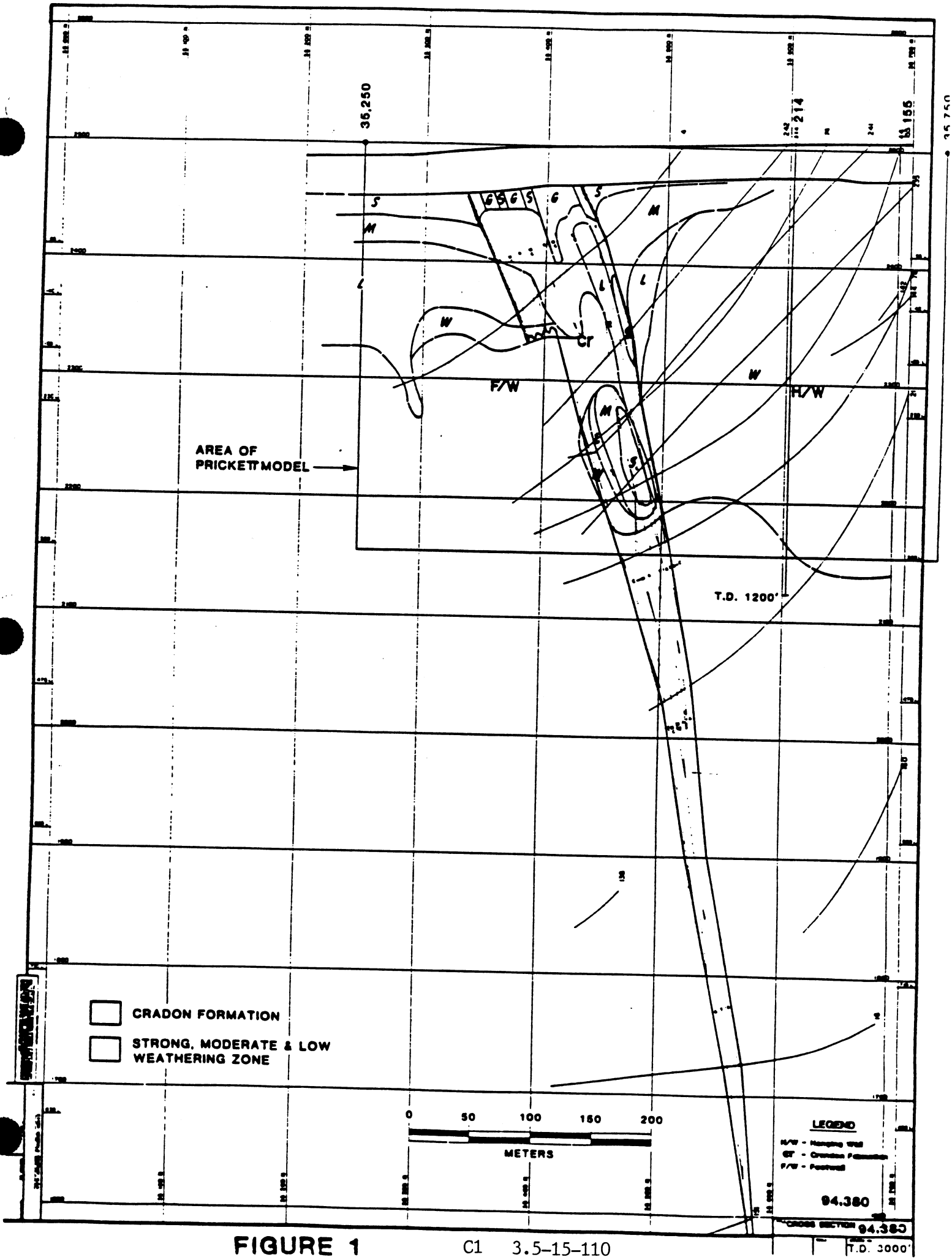
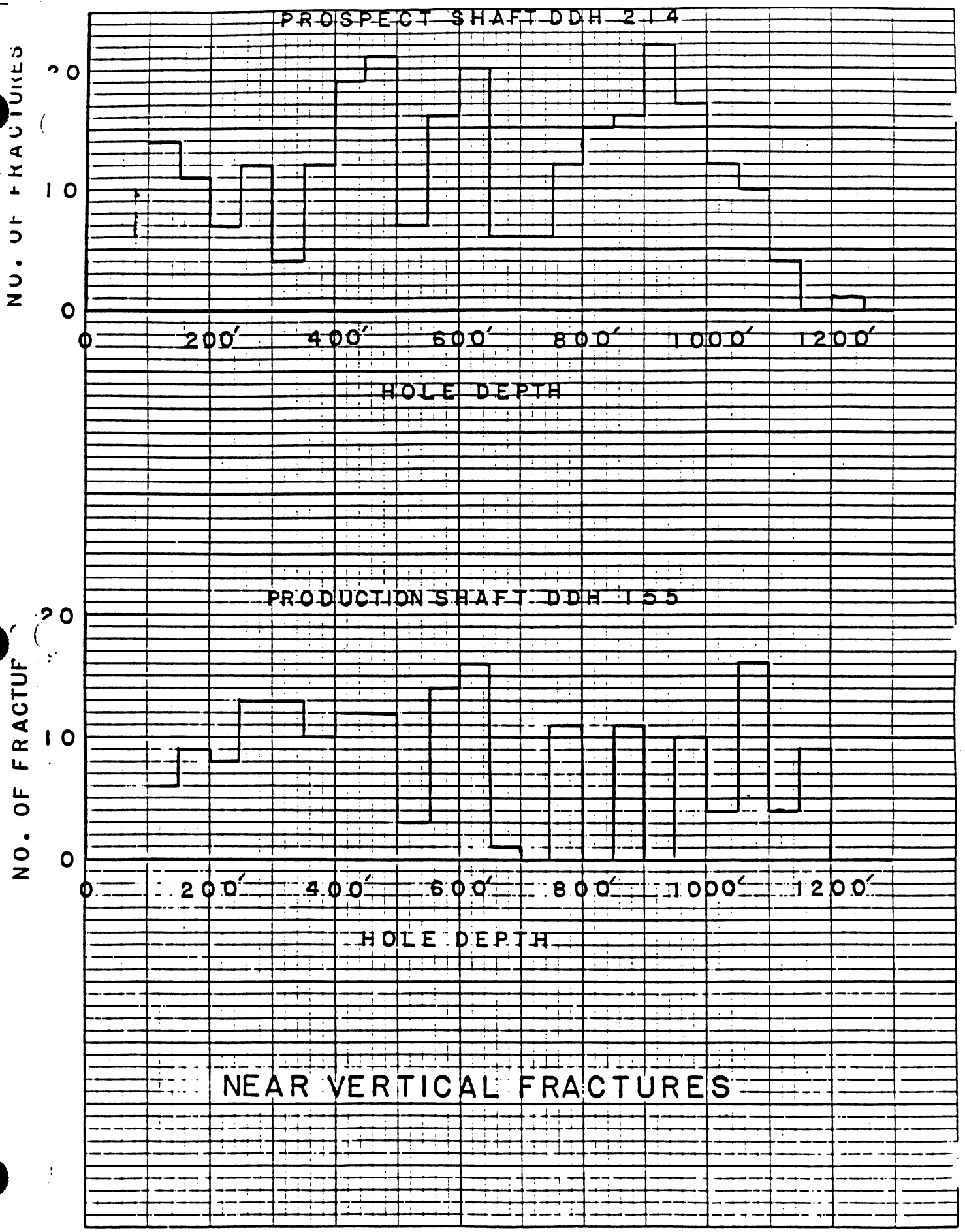
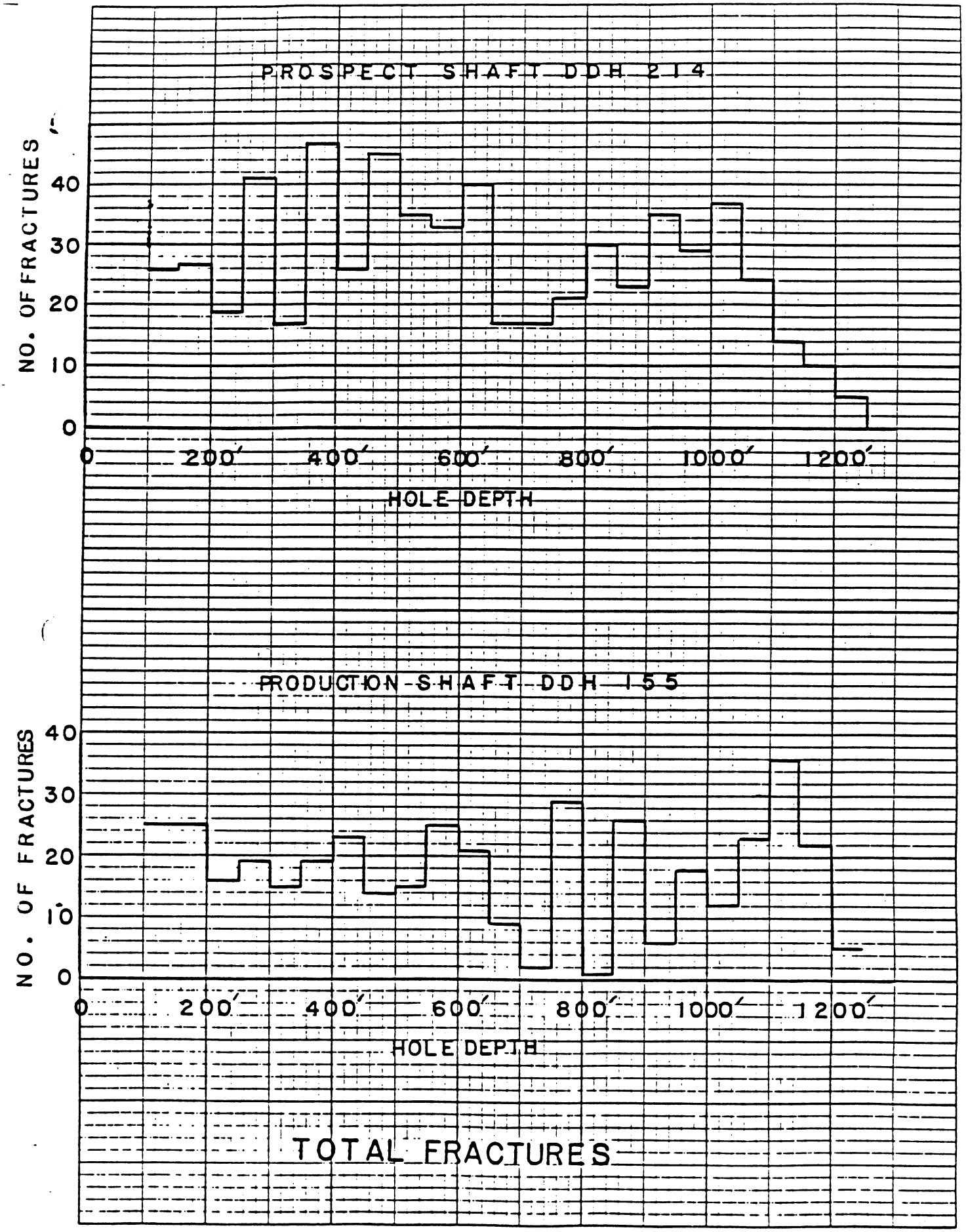

36,250
214
155
AREA OF
PRICKETT MODEL
F/W
H/W
T.D. 1200'
CRADON FORMATION
STRONG, MODERATE & LOW
WEATHERING ZONE
0
50
100
150
200
METERS
LEGEND
94.380
T.D. 3000'

FIGURE 1




3.5-15-111

Figure 2




C3 3.5-15-112 Figure 3

Hole 155 — No. Fractures - Count updated A.J.E. 1/10/9855

| Faults | Ft. | 10°-20° Fx | Total Fx | Fx/ft. | Flt. |
|---|---|---|---|---|---|
| 100/150 - 2 | 1200-1250 | — | 6 | .3 | 0 |
| 150/200 1 | 1250 | 5 | 18 | .7 | 0 |
| 200/250 - 0 | 1300 | 4 (3) | 14 | .6 | 0 |
| 250/300 - 1? | 1350 | 3 | 25 | 1 | 0 |
| 300/350 | | | | | |
| 350/400 - 0 | 1400 | 4 | 16 | .6 | 0 |
| 400/450/ 1 | 1450 | 0 | 4 | .2 | 0 |
| 450/500/1 | 1500 | 0 | 16 | .6 | 0 |
| 500/550/.0 | 1550 | 0 | 18 | .7 | 1 |
| 550/600 -1 | 1600 | 0 | 17 | .7 | 0 |
| 600/650-1 | 1650 | 0 | 4 | .2 | 0 |
| 650 - 700 - 0 | 1700 | 0 | 18 | .7 | 0 |
| 700/750 - 0 | 1750 | 0 | 20 | .8 | 0 |
| 750/ 1 | 1800 | 0 | 27 | 1 | 0 |
| 800/850-0 | 1850 | 0 | 19 | .8 | 0 |
| 850/900-0 | 1900 | 5 | 21 | .8 | 0 |
| 900/950-0 | 1950 | 2 | 25 | 1 | 0 |
| 950 - 1000 - 1 | 2000 | 1 | 21 | .8 | 0 |
| 1000/1050 0 | 2050 | 1 | 21 | .8 | 0 |
| 1050/1100 0 | 2100 | 0 | 8 | .3 | 1 |
| 1100/1150-0 | 2150 | 1 | 15 | .6 | 0 |
| 1150/1200 0 | 2200 | 2 | 20 | .8 | 1 |
| | 2250 | 2 | 30 | 1.2 | 0 |
| | 2300 | 6 | 25 | 1 | 0 |
| | 2350 | 0 | 10 | .4 | 0 |
| | 2400 | 0 | 8 | .3 | 0 |
| | 2450 | 1? | 6 | .2 | 0 |

| | 10°-20° Fx | Total Fx | Fx/ft. | Flt. |
|---|---|---|---|---|
| 2500 | 0 | 9 | .4 | 0 |
| 2550 | 1 | 9 | .4 | 1 |
| 2600 | 0 | 5 | .2 | 0 |
| 2650 | 2 | 10 | .4 | 0 |
| 2700 | 5 | 25 | 1 | 0 |
| 2750 | 1 | 14 | .6 | 0 |
| 2800 | 0 | 12 | .5 | 0 |
| 2850 | 0 | 6 | .2 | 0 |
| 2900 | 0 | 10 | .4 | 0 |
| 2950 | 0 | 14 | .6 | 0 |

∴ At depth slightly less total and no vertical to speak of

∴ Faults: 14 in hole
10 above 1000'
4 below 1000'

∴ All minimal, no major faults

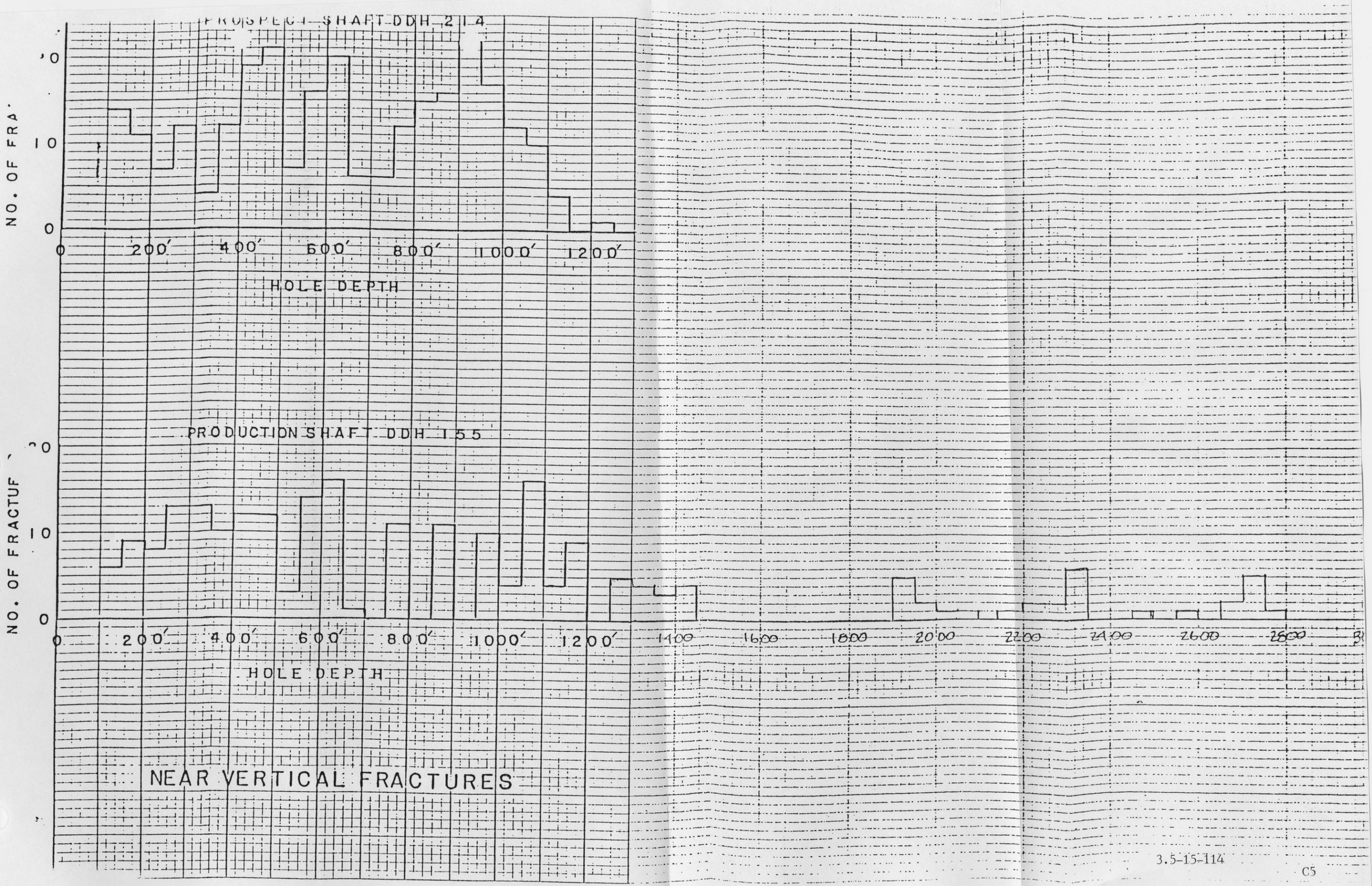

PROSPECT SHAFT DDH 214
NO. OF FRA
20
10
0
0
200'
400'
600'
800'
1000'
1200'
HOLE DEPTH
PRODUCTION SHAFT DDH 155
NO. OF FRACTUF
20
10
0
0
200'
400'
600'
800'
1000'
1200'
1400
1600
1800
2000
2200
2400
2600
2800
HOLE DEPTH
NEAR VERTICAL FRACTURES

Figure 2

PROSPECT SHAFT DDH 214

NO. OF FRACTU..

50
40
30
20
10
0

0 200′ 400′ 600′ 800′ 1000′ 1200′

HOLE DEPTH

PRODUCTION SHAFT DDH 155

NO. OF FRACTURES

40
30
20
10
0

0 200′ 400′ 600′ 800′ 1000′ 1200′ 1400 1600 1800 2000 2200 2400 2600 2800 3

HOLE DEPTH

TOTAL FRACTURES

No. of Fractures →

SHADED VERTICAL ON SAME VSCALE

NOTE: HORIZONTAL EXAGGERATED

FAULT ON LEFT SIDE SAME VSCALE

3.5-15=115

# Appendix D

## Lambe & Rowe, (1980)

MEMORANDUM

Dawson

| TO | SUBJECT | |
|---|---|---|
| E. R. May | Summary of Prospect Shaft Pilot Hole, 214 | |
| FROM | DATE | FILE NO. |
| R. N. Lambe, R. G. Rowe | March 26, 1980 | 550-3 |

This memorandum serves as a preliminary report on the Prospect Shaft Pilot Hole core for use in meeting with J. S. Redpath, scheduled for March 27 and 28, 1980.

Preliminary Conclusions:

Comparison of the core from the Prospect Shaft DDH 214 and the Production Shaft DDH 155, indicates that the prospect shaft core contains 52% more total fractures than the production shaft core, and 40% more near vertical fractures.

Water production on the two pump tests completed indicates 0.36 gallons per minute (0.083 $m^3$/hr), in the interval 360 to 107 ft. (109.72 to 32.61 m), and two gallons per minute (0.454 $m^3$/hr.) in the interval 750 to 107 ft. (228.60 to 32.61 m).

Sulfides are completed oxidized to a depth of 960 ft. (292.61 m), partially oxidized to 1135 ft. (345.95 m), and are less than 0.1% in the remainder of the hole.

Drilling:

The Shaft Pilot Hole, 214, was drilled to a total depth of 1255 ft. (382.52 m), keeping within 8 ft. (2.44 m) of vertical the entire depth. The overburden was rotary drilled and cased to a depth of 89 ft. (27.13 m). Diamond core drilling commenced at the subcrop (89 ft.) using PQ (core diameter 3.27", 83.1 mm) tools to 107 ft. (32.61 m). The hole was cased to 107 ft., and diamond core drilling resumed using HQ (core diameter 2.5", 63.5 mm), to a depth of 1255 ft. A total of seven wedges were used to keep the hole well within the proposed shaft perimeter.

Recovery of the core is excellent, 100% in all but the fault zones where recovery is usually greater than 95%

Stratigraphy:

Three geologic formations were intersected in DDH 214. The Skunk Lake formation consists of interbedded tuffs and chert-silty tuff sequences. The cherty tuffs usually consist of alternating hard siliceous and soft chloritic laminae. It is typically very competent, because of its siliceous character.

A fine laminated tuff encountered at 232 to 343 ft. (70.71 to 104.55 m) is chloritic and exhibits moderate foliation.

FILE MAN MIN
Sub SN
Sub
Keywords Rock Mechan

BE A WINNER EVERYDAY FOR SAFETY

3.5-15-117

Stratigraphy - continued:

The Rice Lake formation from 364 to 928 ft. (110.95 to 282.85 m) consists of an upper tuffaceous sequence from 364 to 530 ft. (110.95 to 161.54 m) a lapilli tuff consisting of angular, soft, chloritic fragments (0.5 to 15 cm) in a light gray, moderately siliceous matrix from 530 to 683 ft. (161.54 to 108.18 m), and a finer lapilli tuff consisting of flattened chlorite fragments (.04 to 3.0 cm) in a relatively soft, chloritic matrix from 683 to 928 ft. (208.18 to 282.85 m).

The remainder of the hole, 918 to 1255 feet (282.85 to 382.52 m) consists of the Mole Lake formation, a sequence of generally chloritic tuffs which become weakly siliceous toward the bottom of the hole.

Faults:

Nine faults or shears have been identified in the core.

- 94.8 to 95.8 ft. (28.90 to 29.20 m), mixed clay, rock fragments and iron oxide gouge
- 102.7 ft. (31.30 m), 1cm clay gouge
- 107.8 to 108.5 ft. (32.86 to 33.07 m), mixed clay and iron oxide gouge
- 325.0 to 345.0 ft. (99.06 to 105.16 m) mixed clay, iron oxide and rock fragment gouge. This zone consists of two undulating, near vertical faults, one, 1 to 5 cm thick, and the second, about 15 cm thick, which wander in and out of the drill core. The true thickness of the zone is probably 1 foot (0.30 m).
- 531.6 ft. (162.03 m) 1cm shear with mixed clay and iron oxide gouge
- 555.4 ft. (169.29 m) < 0.5 cm shear with mixed clay and iron oxide gouge
- 669.8 ft. (204.16 m) 1cm shear with mixed clay and iron oxide gouge
- 771.0 to 775.0 ft. (235.00 to 236.22 m) high angle (≈ 5°) fault, true thickness about 9 cm, mixed rock fragment and clay gouge
- 890.6 to 891.7 ft. (271.45 to 271.79 m) shear at 55°, quartz-sulfide vein with clay gouge

Fractures:

Two prominent sets of fractures were observed in the core. The first set is near vertical, 10 to 15°, and appears to have true spacing of about one per foot. Both indigenous and transported iron oxide is present on the fractures.

Fractures - continued:

Some of the fractures represent oxidized pyrite veins while others appear to be fractures with nil to trace pyrite.

The second set of fractures cuts the core axis at about 45° to 75°. These fractures are typified by quartz veins with slickensides. Iron oxide is most commonly transported, but locally may occur from oxidation of pyrite.

The fracture distribution (near vertical and total) of the prospect and production shaft pilot holes are compared in the attached figure. The near vertical set of fractures in the prospect pilot hole appears to drastically decrease at about 1035 ft. (315.47 m), the depth of total oxidation. This may imply that oxidizing surface waters migrated down the near vertical fracture set.

Water Production:

While all fault zones are potential sources of water, the only significant loss of circulation during drilling occurred at the zone between 325.0 and 345.0 ft. Pumping tests to determine actual flow rates are presently being conducted. Three intervals will be tested: 360 to 107 ft. (109.72 to 32.61 m), 750 to 107 ft. (228.60 to 32.61 m) and 1255 to 107 ft. (382.52 to 32.61 m). Tests on the first interval (360 to 107 ft.), containing the large fracture zone at 325 to 345 ft., over an eight (8) hour period indicate a flow rate of 0.36 gallons per minute (0.083 $m^3$/hr).

The interval from 750 to 107 ft. is producing water at a rate of 2 gallons per minute (0.454 $m^3$/hr.). The results on the last interval should be in by the end of the week.

Oxidation:

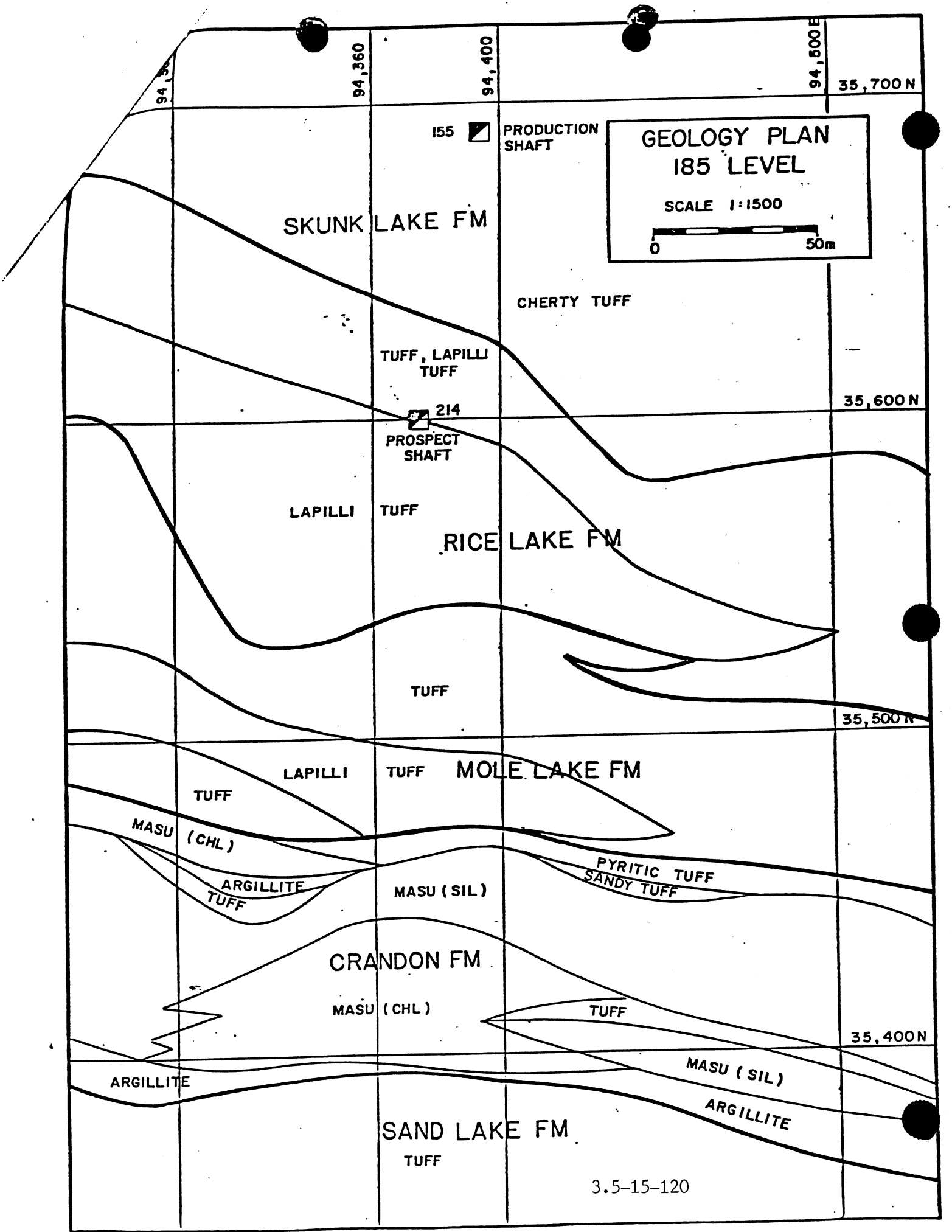
The weathering intensity of the core is weak to a depth of 960 ft. (292.61 m). In this interval all sulfides in fractures and on bedding planes are totally oxidized. Leaching of oxidized sulfides is moderate. In the interval 960 to 1135 ft. (292.61 to 345.95 m) oxidation is partial and leaching weak, as minor pyrite and chalcopyrite are found co-existing with iron oxide. From 1135 ft. to the end of the hole, oxidation is absent. It is estimated that total sulfide content of the rock is less than 0.1%.

RNL/RGR:eaf

Robert N. Lambe and Roger G. Rowe

xc: w/attachments
R. A. Ford
J. E. Grimes
M. K. Lawson
M. R. Smith
P. W. Zimmer

3.5-15-119

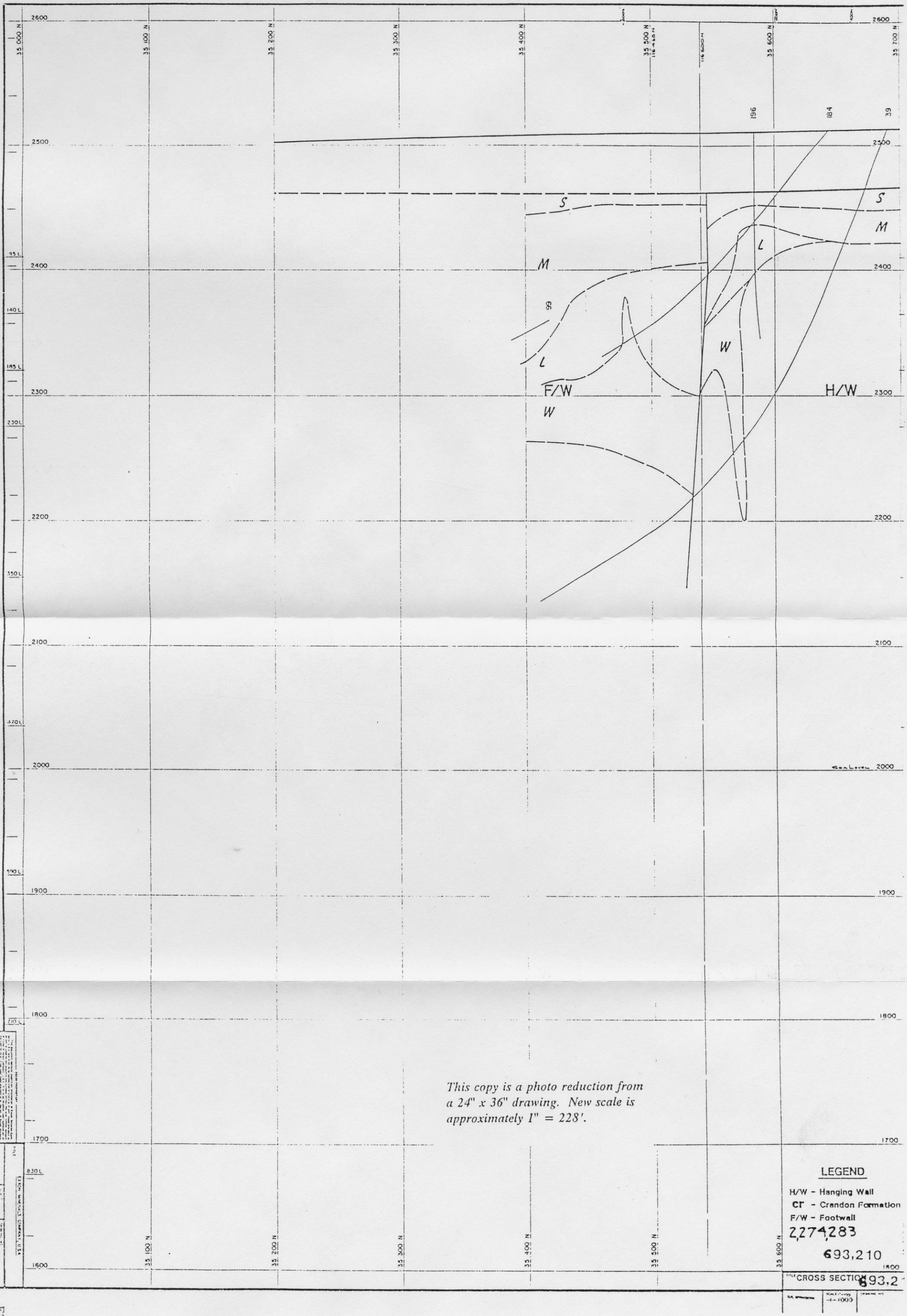

94,360
94,400
94,500E
35,700N
155
PRODUCTION SHAFT
GEOLOGY PLAN
185 LEVEL
SCALE 1:1500
0
50m
SKUNK LAKE FM
CHERTY TUFF
TUFF, LAPILLI TUFF
35,600N
214
PROSPECT SHAFT
LAPILLI TUFF
RICE LAKE FM
TUFF
35,500N
LAPILLI TUFF
MOLE LAKE FM
TUFF
MASU (CHL)
ARGILLITE
TUFF
MASU (SIL)
PYRITIC TUFF
SANDY TUFF
CRANDON FM
MASU (CHL)
TUFF
35,400N
ARGILLITE
MASU (SIL)
ARGILLITE
SAND LAKE FM
TUFF

3.5-15-120

# Appendix E

## Weathering Cross Sections used to Generate Longitudinal Weathering Profiles

## Revised April 26, 1995




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*

LEGEND

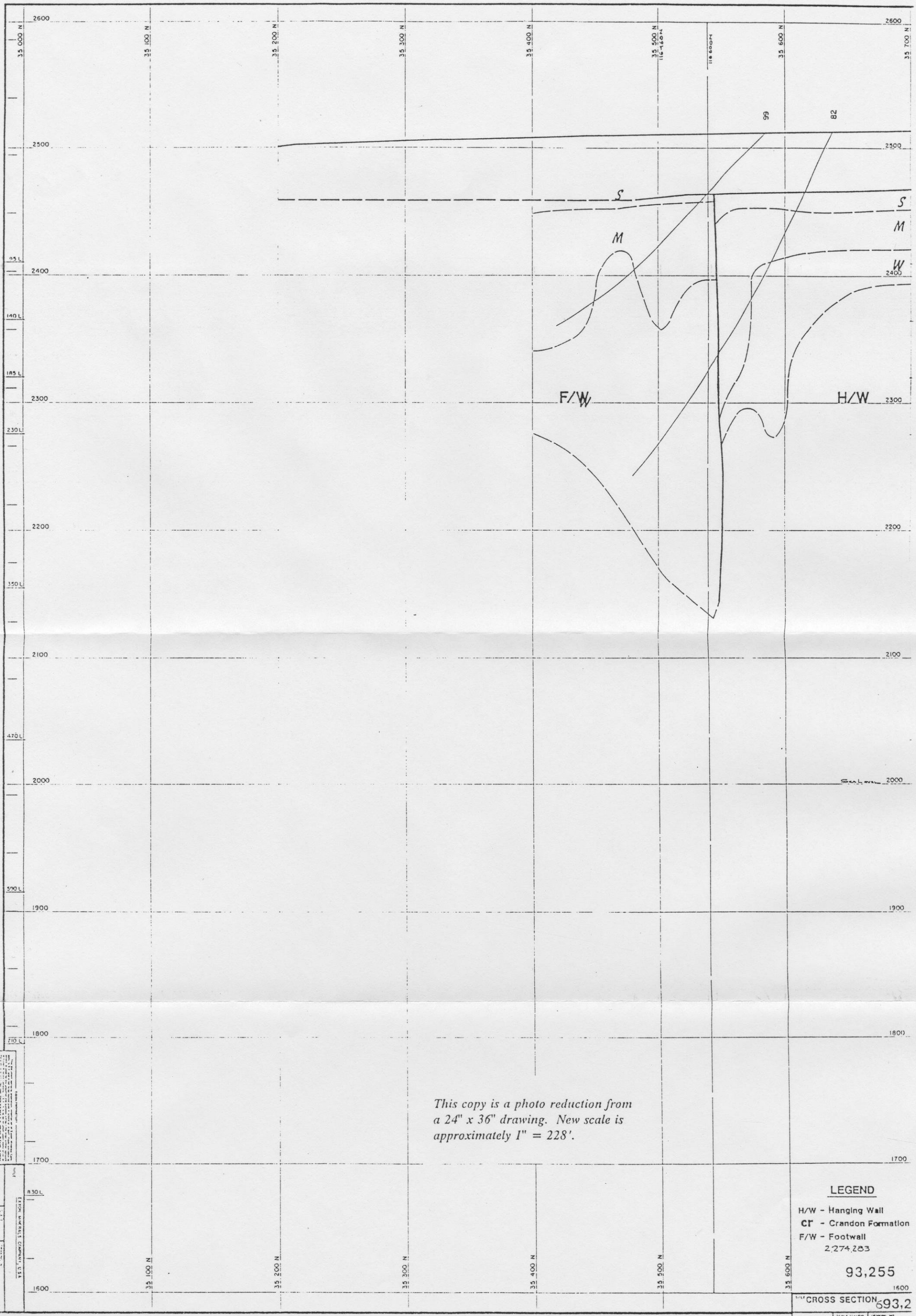
H/W - Hanging Wall
Cr - Crandon Formation
F/W - Footwall

2,274,283

693,210

CROSS SECTION 693,2

E1



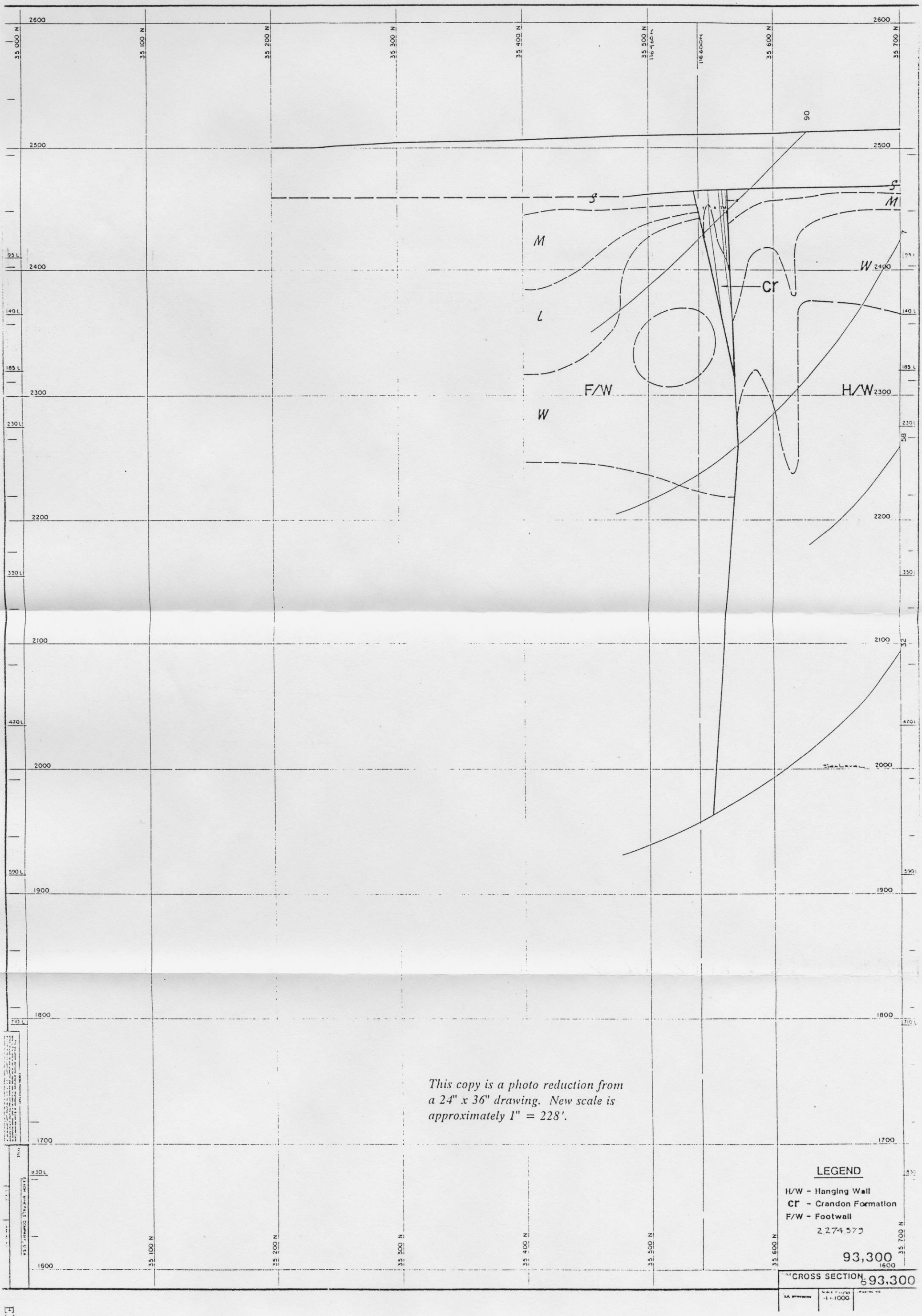

*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*

LEGEND

H/W - Hanging Wall
cr - Crandon Formation
F/W - Footwall
2,274,283
93,255

CROSS SECTION 693,2

E2




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*

LEGEND

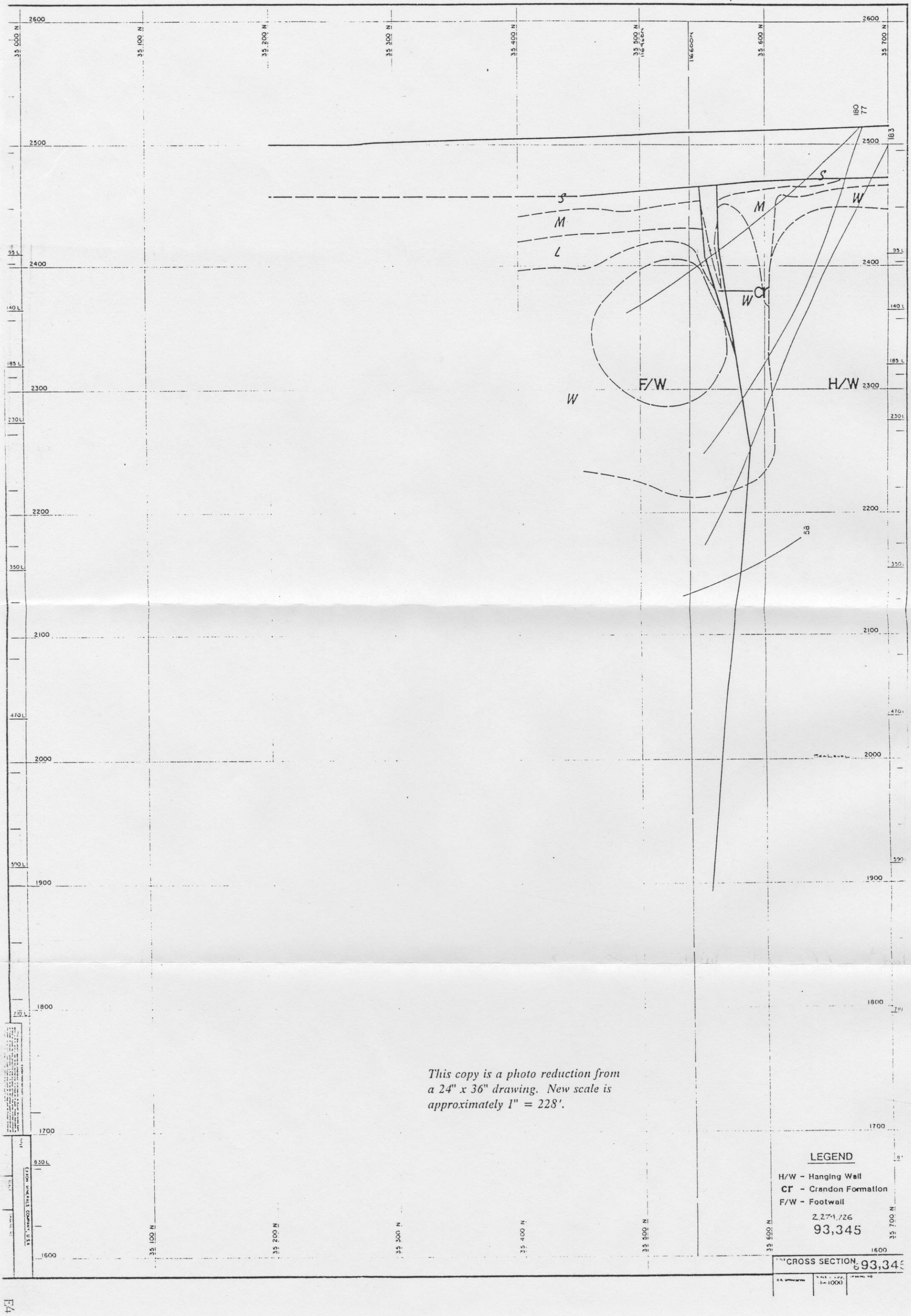
H/W - Hanging Wall
cr - Crandon Formation
F/W - Footwall

2,274,575

93,300

CROSS SECTION 93,300

E3




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*

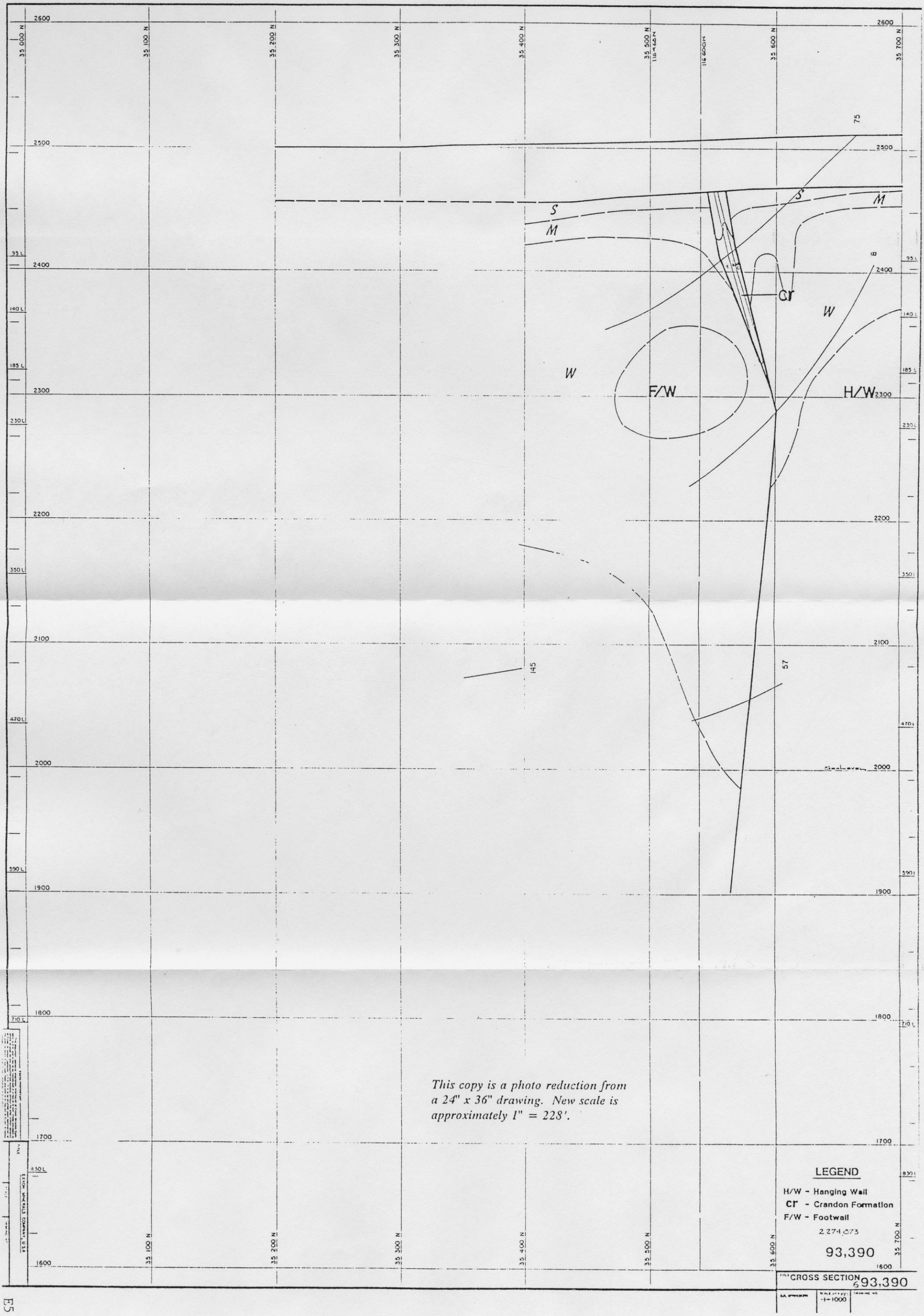
LEGEND

H/W - Hanging Wall
cr - Crandon Formation
F/W - Footwall

2,271,726
93,345

CROSS SECTION 93,345

1" = 1000'




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*

LEGEND

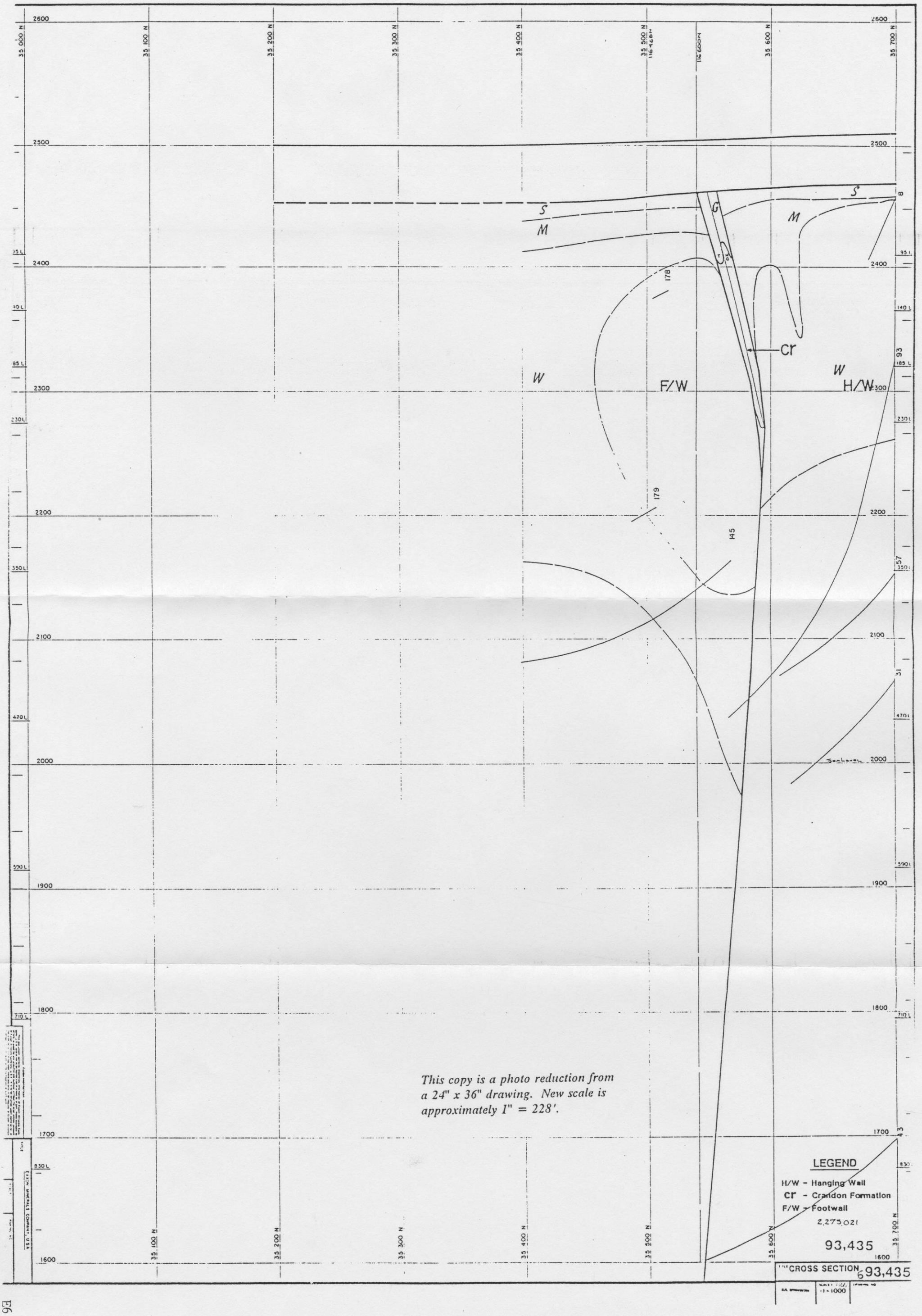
H/W - Hanging Wall
cr - Crandon Formation
F/W - Footwall

2,274,073

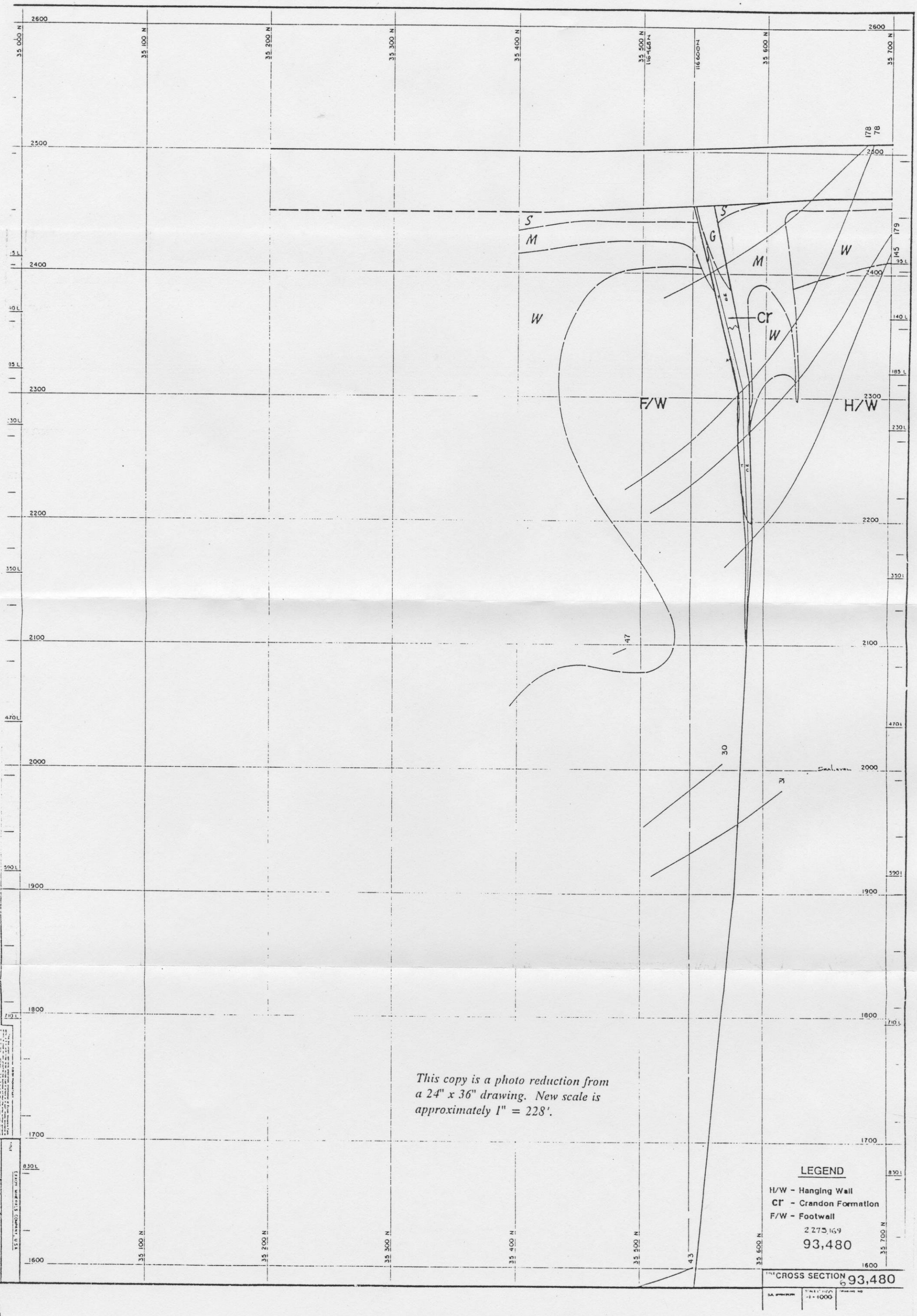
93,390

CROSS SECTION 6 93,390

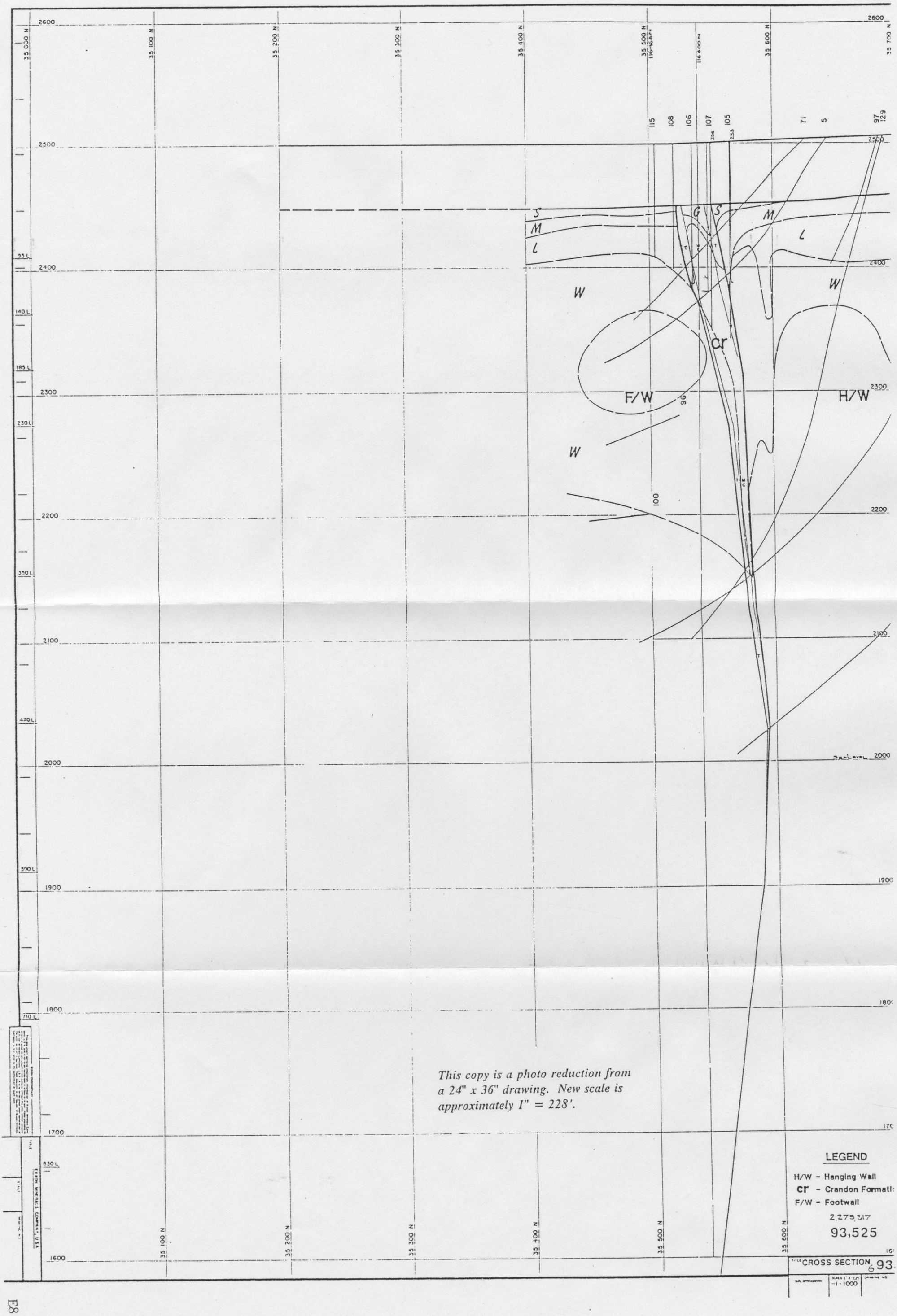
E5




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*


35 000 N
35 100 N
35 200 N
35 300 N
35 400 N
35 500 N
116-66 N
116600N
35 600 N
35 700 N
2600
2500
2400
2300
2200
2100
2000
1900
1800
1700
1600
S
M
G
W
Cr
F/W
H/W
178
78
179
145
47
30
31
43
Sea Level
This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.
LEGEND
H/W - Hanging Wall
Cr - Crandon Formation
F/W - Footwall
2 275,169
93,480
CROSS SECTION 6 93,480

E7




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*

LEGEND

H/W - Hanging Wall
cr - Crandon Formatic
F/W - Footwall

2,275,317
93,525

TITLE CROSS SECTION 6 93

SCALE 1" = 1000'

35 000 N | 35 100 N | 35 200 N | 35 300 N | 35 400 N | 35 500 N | 116 466 E | 116 600 N | 35 600 N

2600 | 2500 | 2400 | 2300 | 2200 | 2100 | 2000 | 1900 | 1800 | 1700 | 1600

95 L | 140 L | 185 L | 230 L | 350 L | 470 L | 590 L | 710 L | 830 L

S
M
L
G
S
M
W
W
F/W
Cr
H/W
L
100
186

Sea Level

*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*

LEGEND

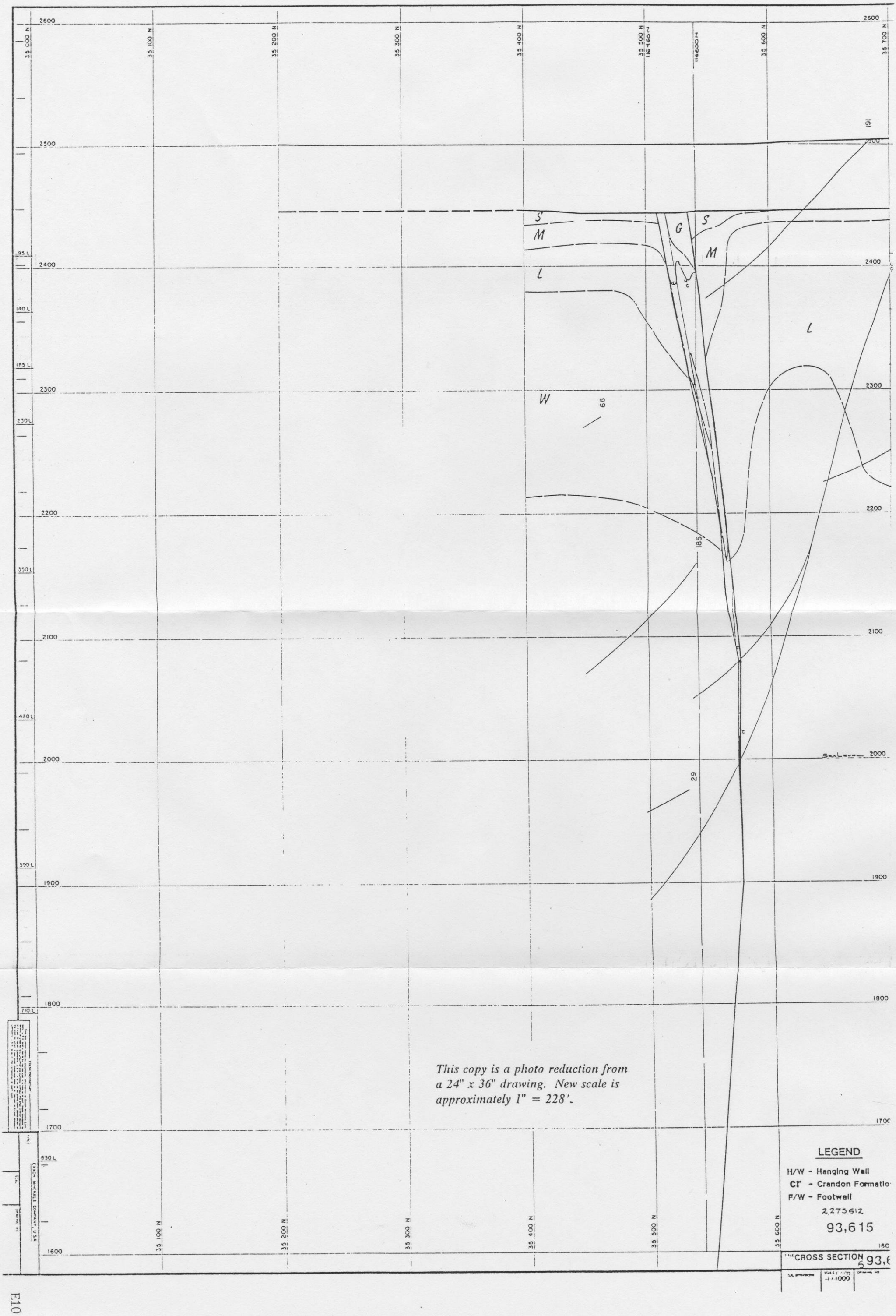
H/W - Hanging Wall
Cr - Crandon Formation
F/W - Footwall

2,275,464

93,570

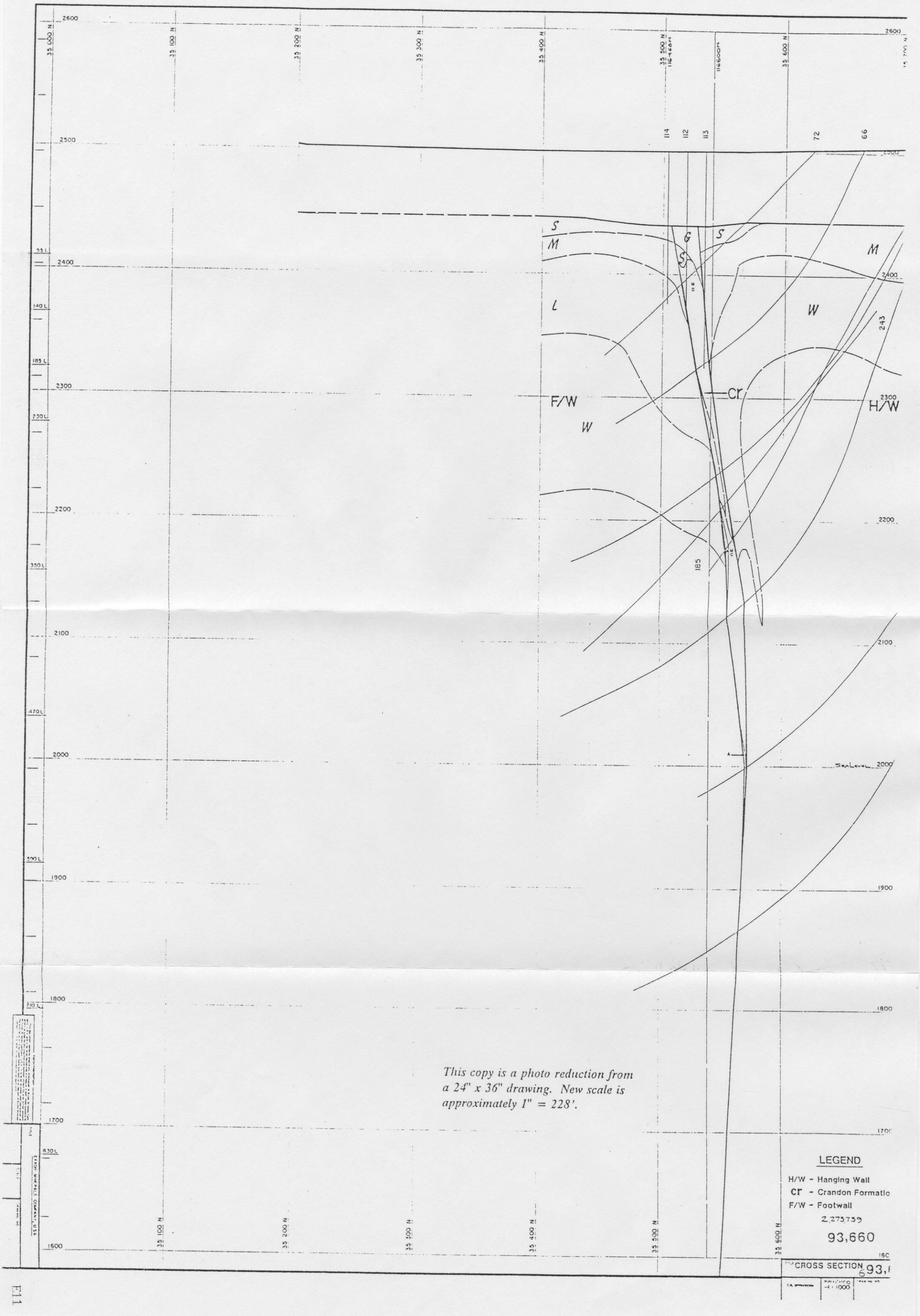
TITLE CROSS SECTION 93,5

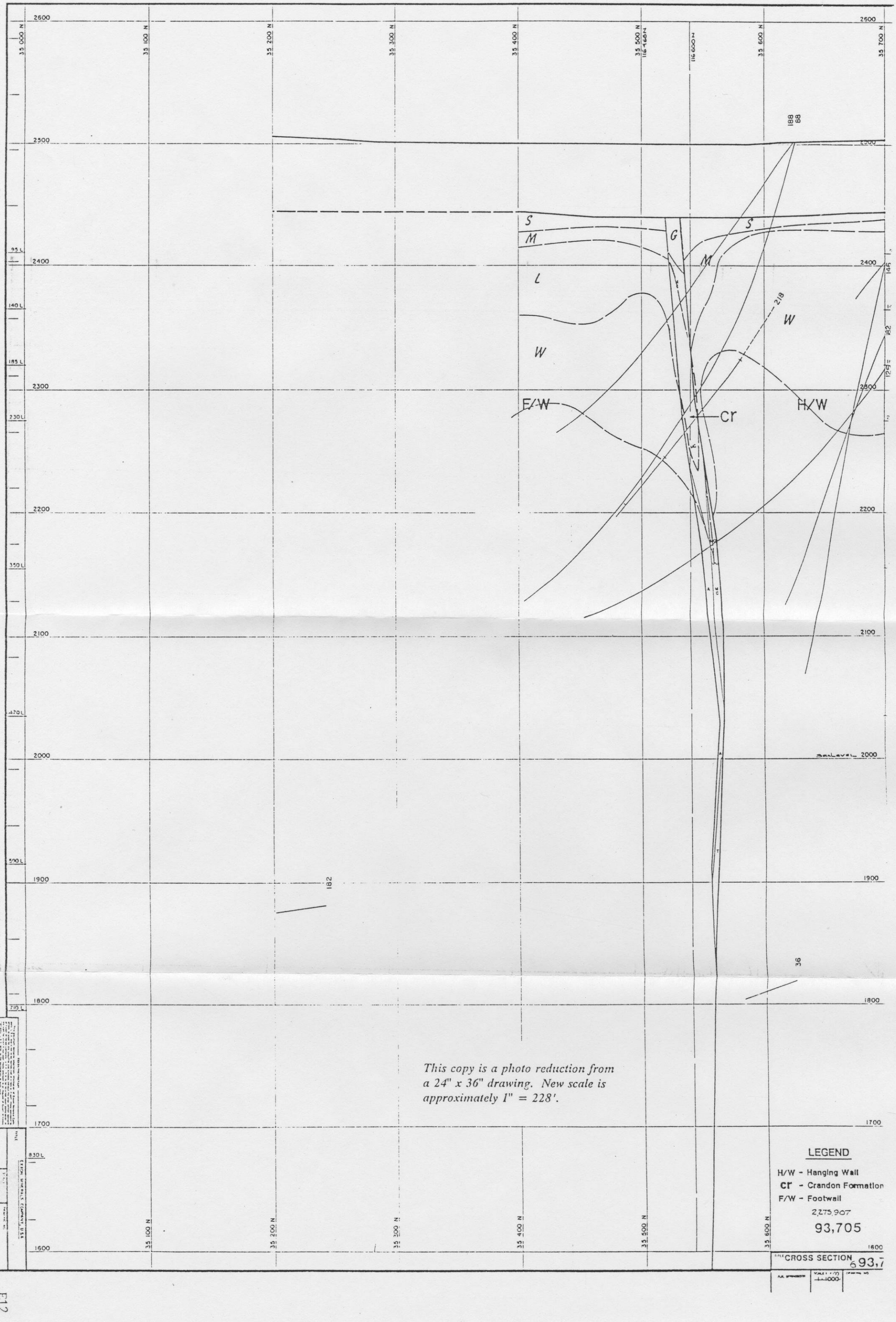
E9




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*

E10


35 000 N
35 100 N
35 200 N
35 300 N
35 400 N
35 500 N
116+60H
116600H
35 600 N
35 700 N
114
112
113
72
66
2600
2500
2400
2300
2200
2100
2000
1900
1800
1700
1600
95 L
140 L
185 L
230 L
350 L
470 L
500 L
710 L
830 L
S
M
G
L
W
F/W
H/W
Cr
243
185
Sea Level
2000
1900
1800
1700
1600
This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately I" = 228'.
LEGEND
H/W - Hanging Wall
cr - Crandon Formatio
F/W - Footwall
2,275,739
93,660
CROSS SECTION 93,6
E11




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*

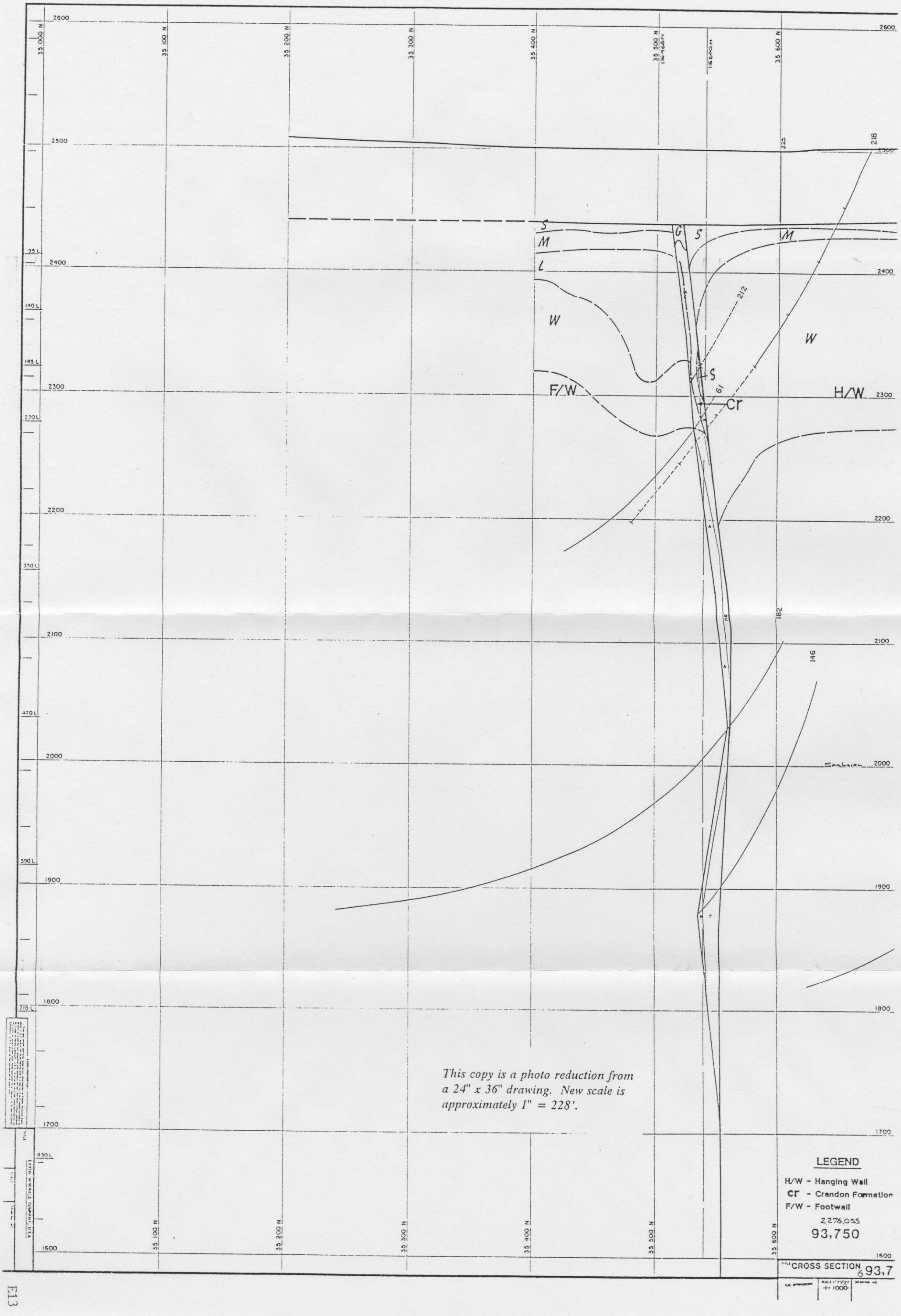
LEGEND

H/W - Hanging Wall
cr - Crandon Formation
F/W - Footwall

2,275,907
93,705

CROSS SECTION 693,7

E12




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*

LEGEND

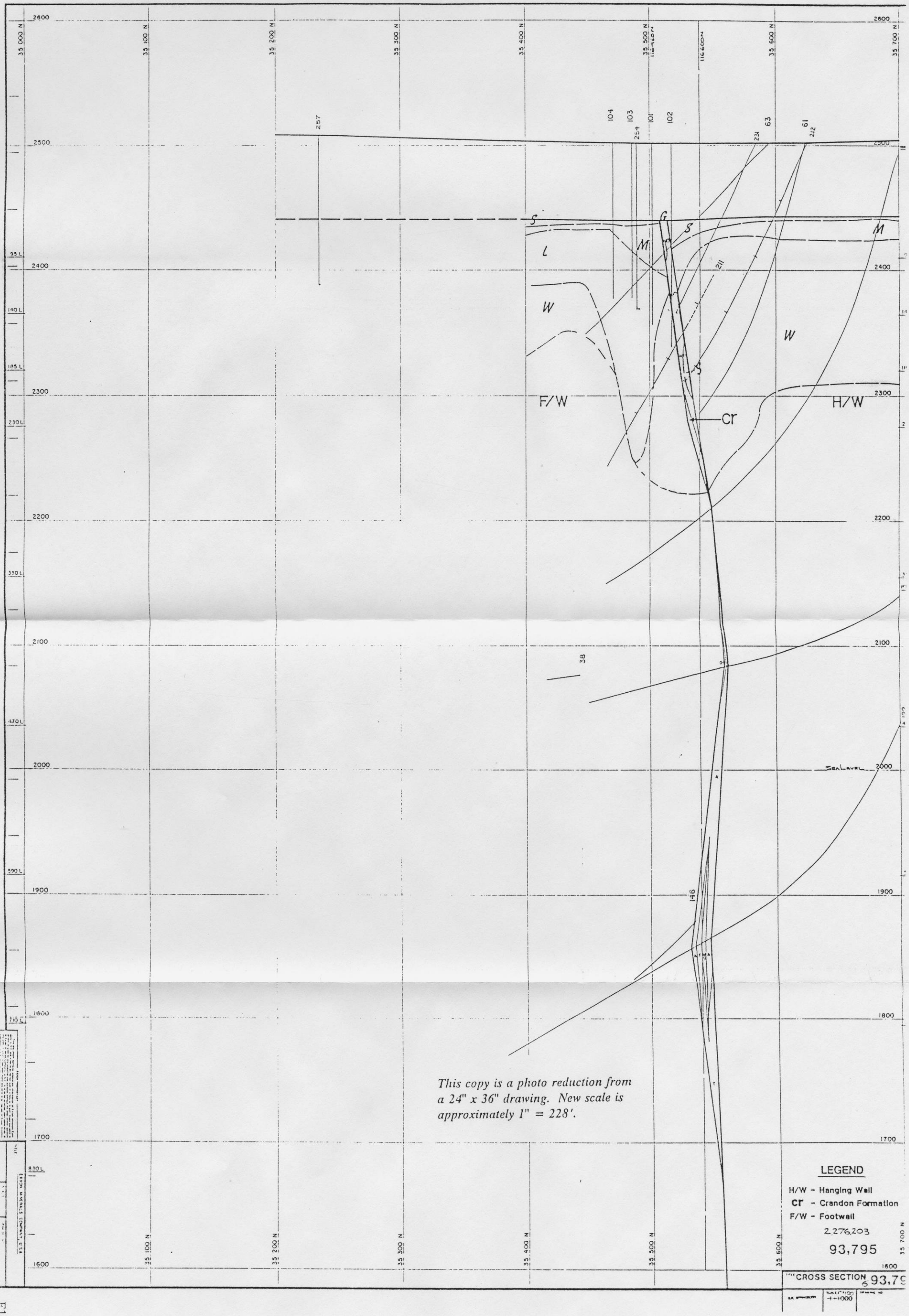
H/W - Hanging Wall
cr - Crandon Formation
F/W - Footwall

2,276,055
93,750

CROSS SECTION 6 93,7

+1000

E13




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*

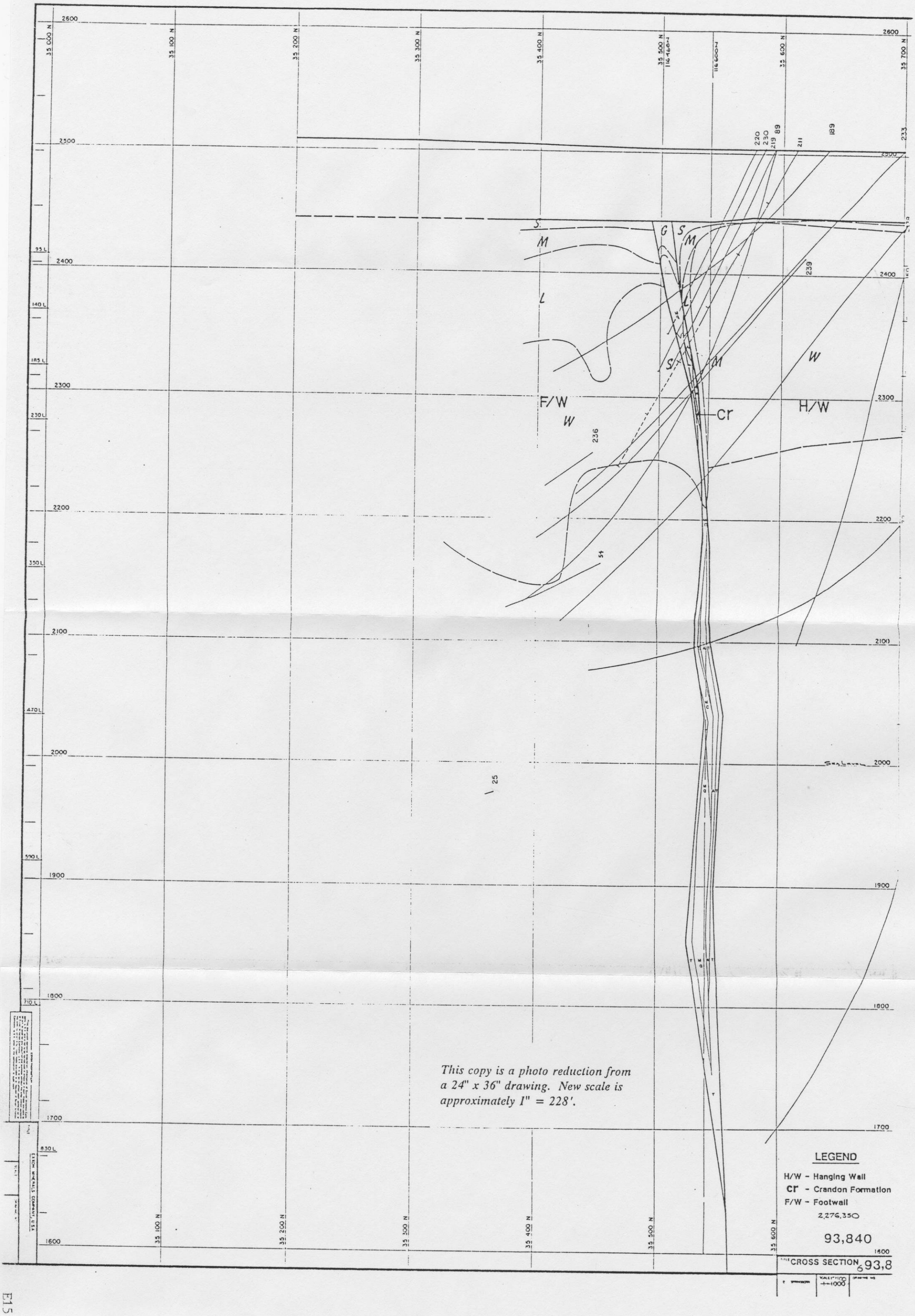
LEGEND

H/W - Hanging Wall
cr - Crandon Formation
F/W - Footwall

2,276,203
93,795

CROSS SECTION 93,795

F14




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*

**LEGEND**

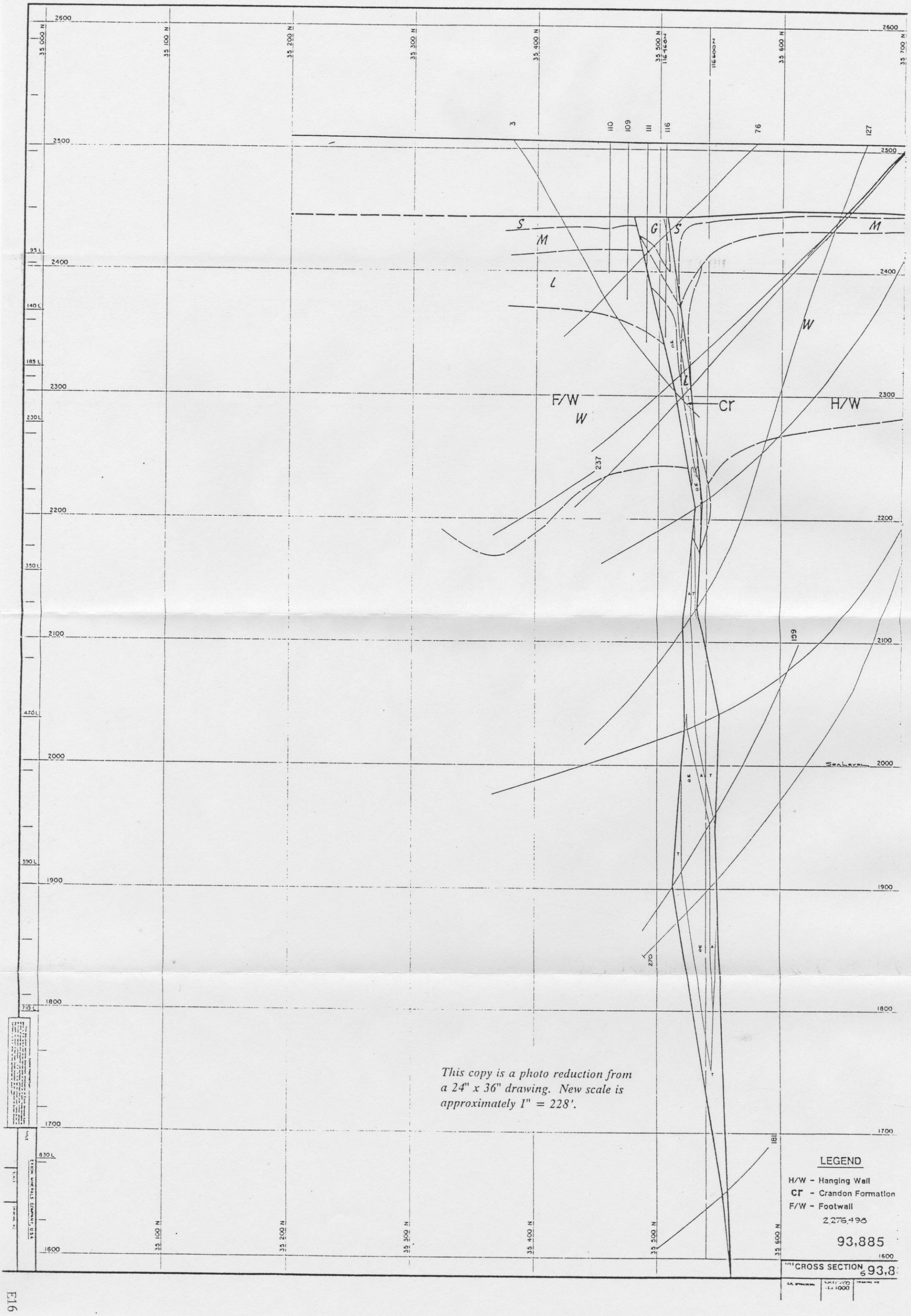
H/W - Hanging Wall
cr - Crandon Formation
F/W - Footwall

2,276,350

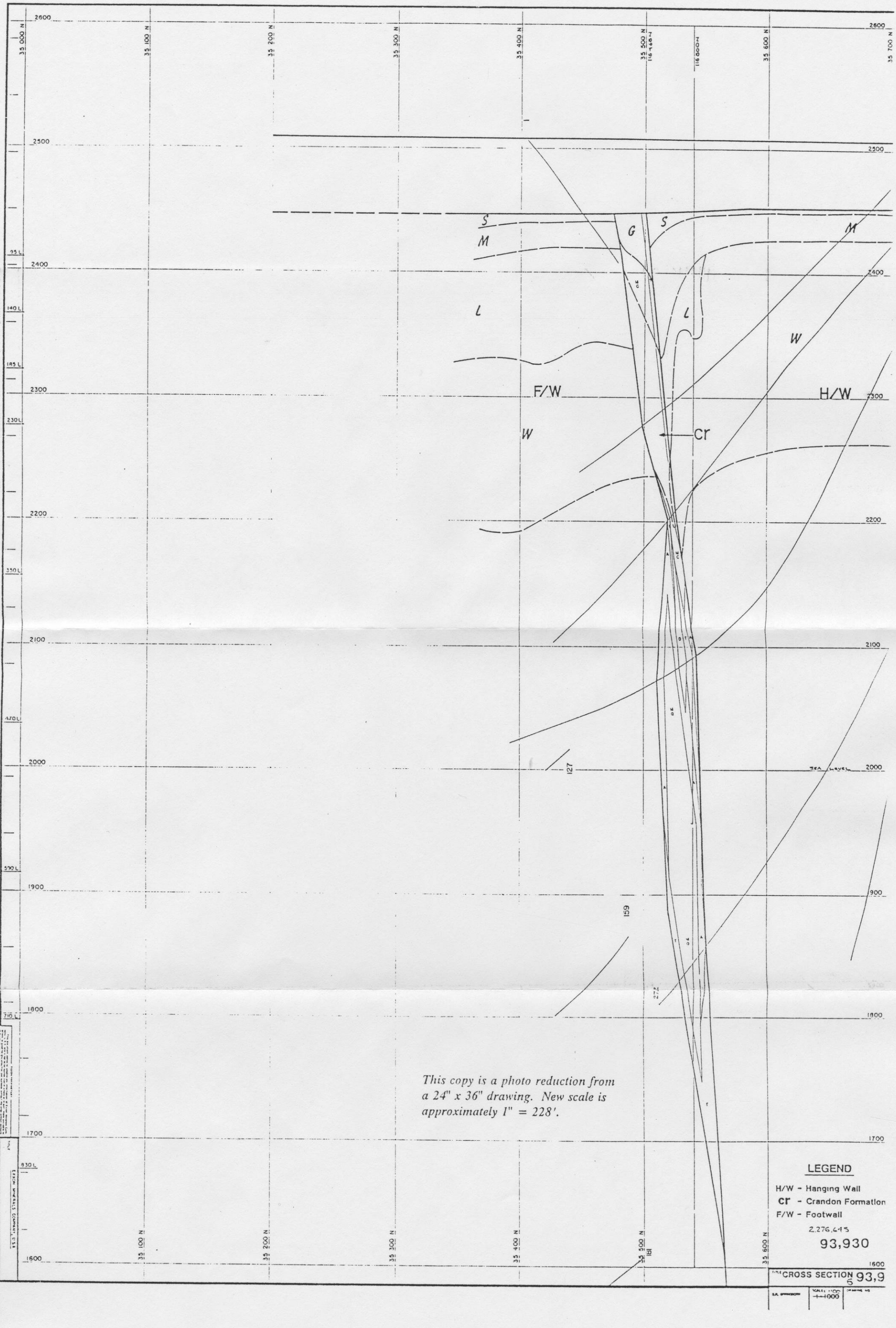
93,840

CROSS SECTION 93,8

E15



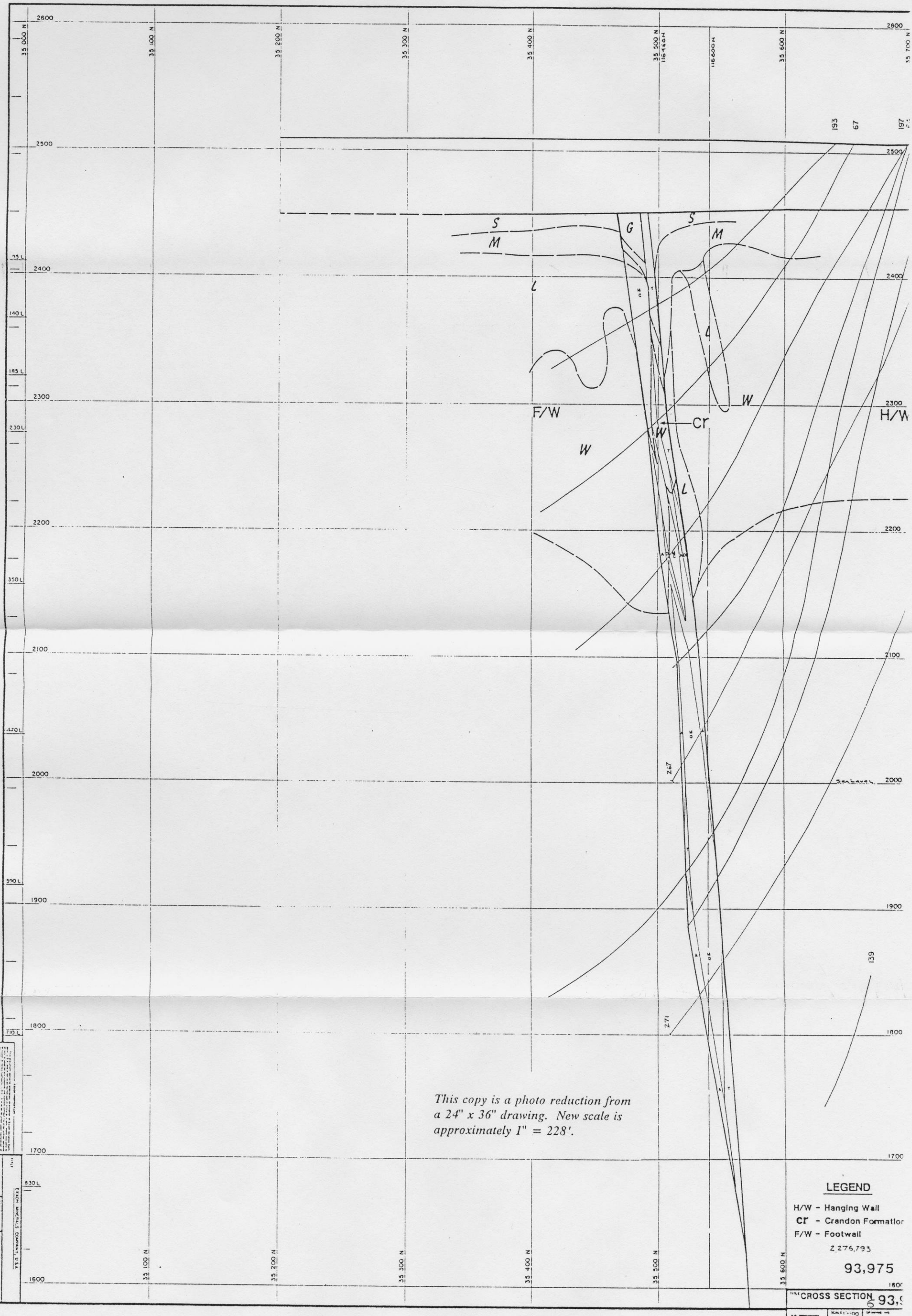

*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*

**LEGEND**

H/W - Hanging Wall
cr - Crandon Formation
F/W - Footwall




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*

LEGEND

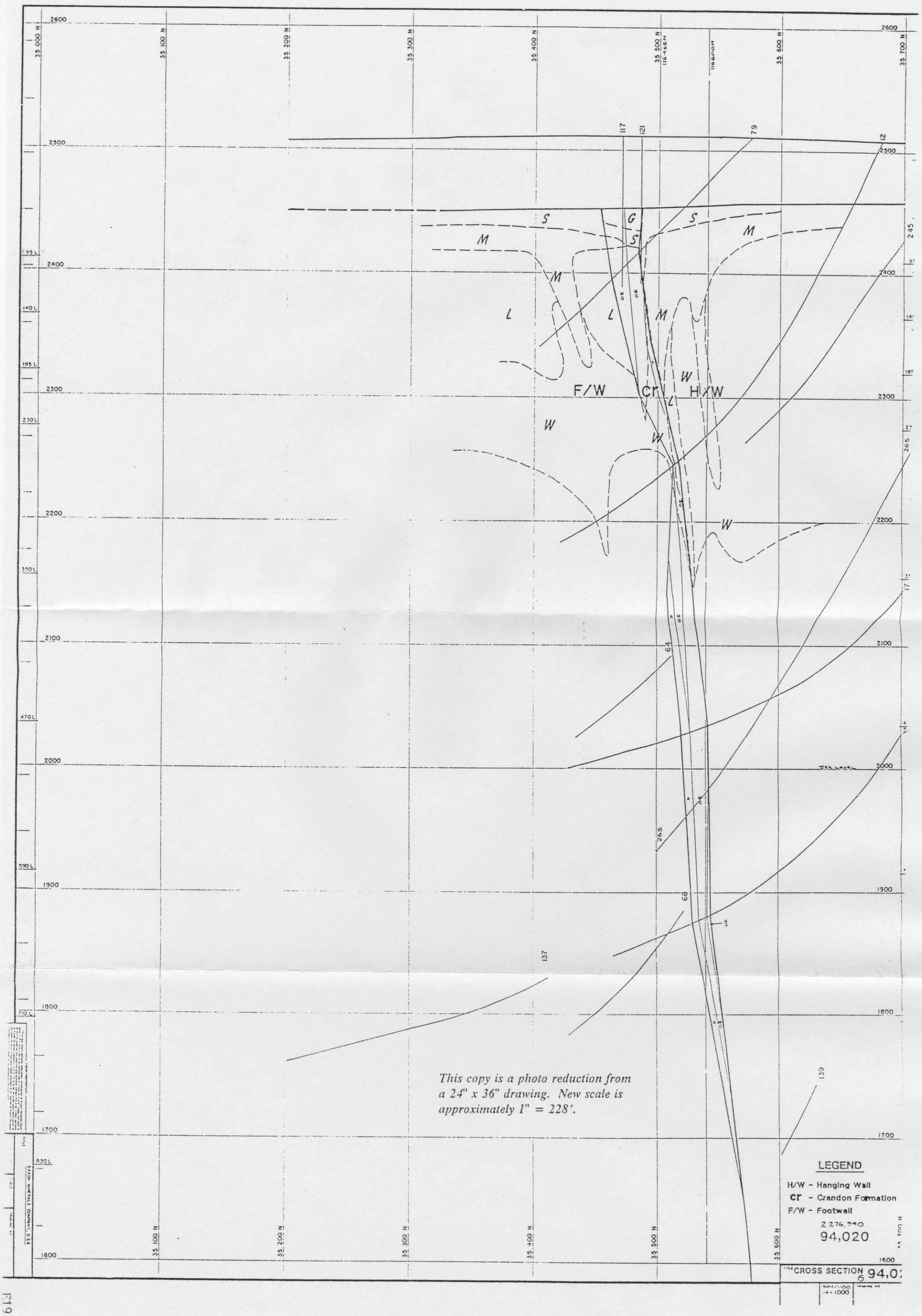
H/W - Hanging Wall
Cr - Crandon Formation
F/W - Footwall

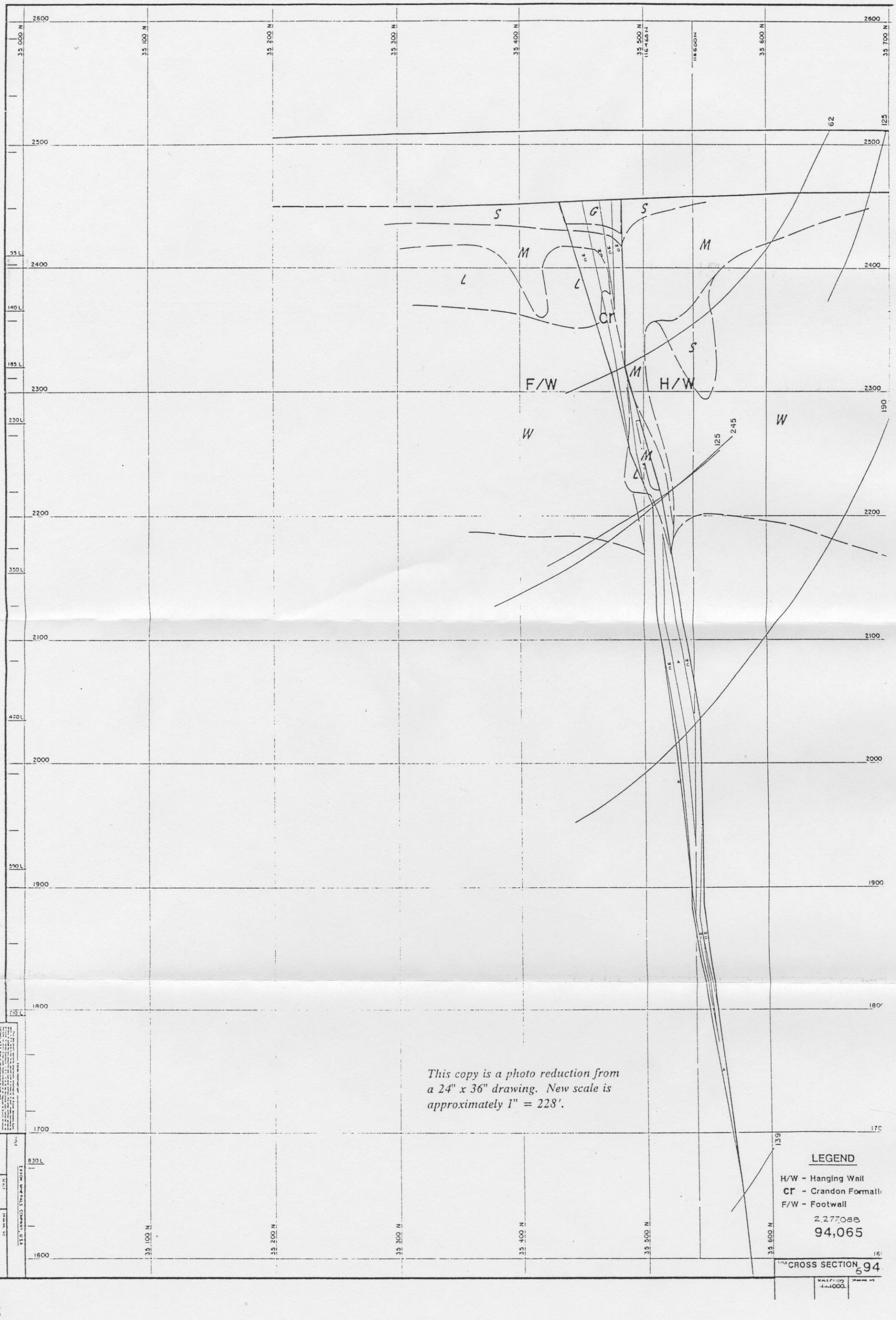
2,276,793

93,975

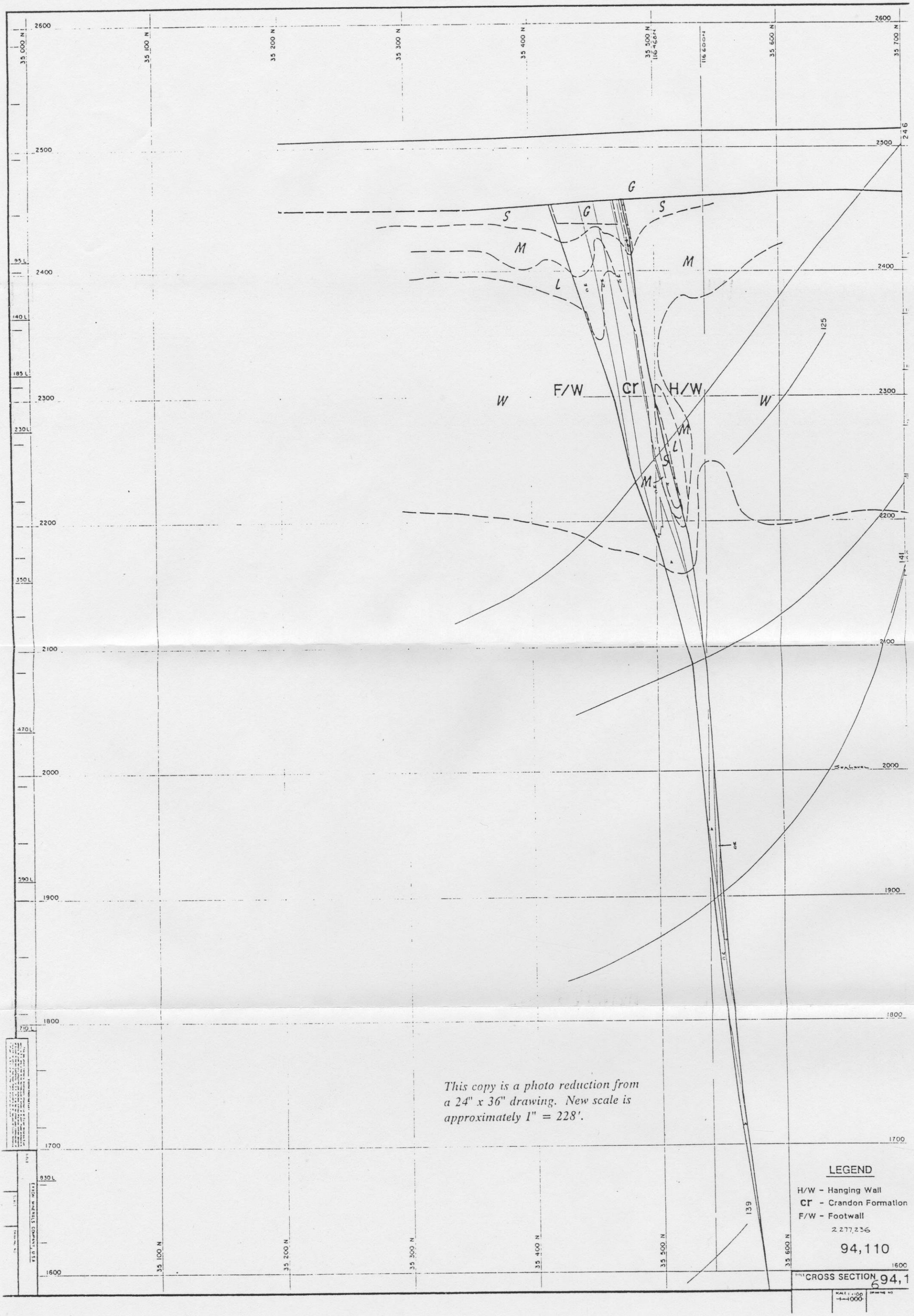
CROSS SECTION 93,9

E18


35 000 N
35 100 N
35 200 N
35 300 N
35 400 N
35 500 N
35 600 N
35 700 N
2600
2500
2400
2300
2200
2100
2000
1900
1800
1700
1600
95 L
140 L
185 L
230 L
350 L
470 L
590 L
710 L
830 L
117
121
79
12
64
265
68
137
139
S
G
M
L
W
F/W
cr
H/W
MEAN SEA LEVEL
This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.
LEGEND
H/W - Hanging Wall
cr - Crandon Formation
F/W - Footwall
2,276,340
94,020
CROSS SECTION 94,0




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*

LEGEND

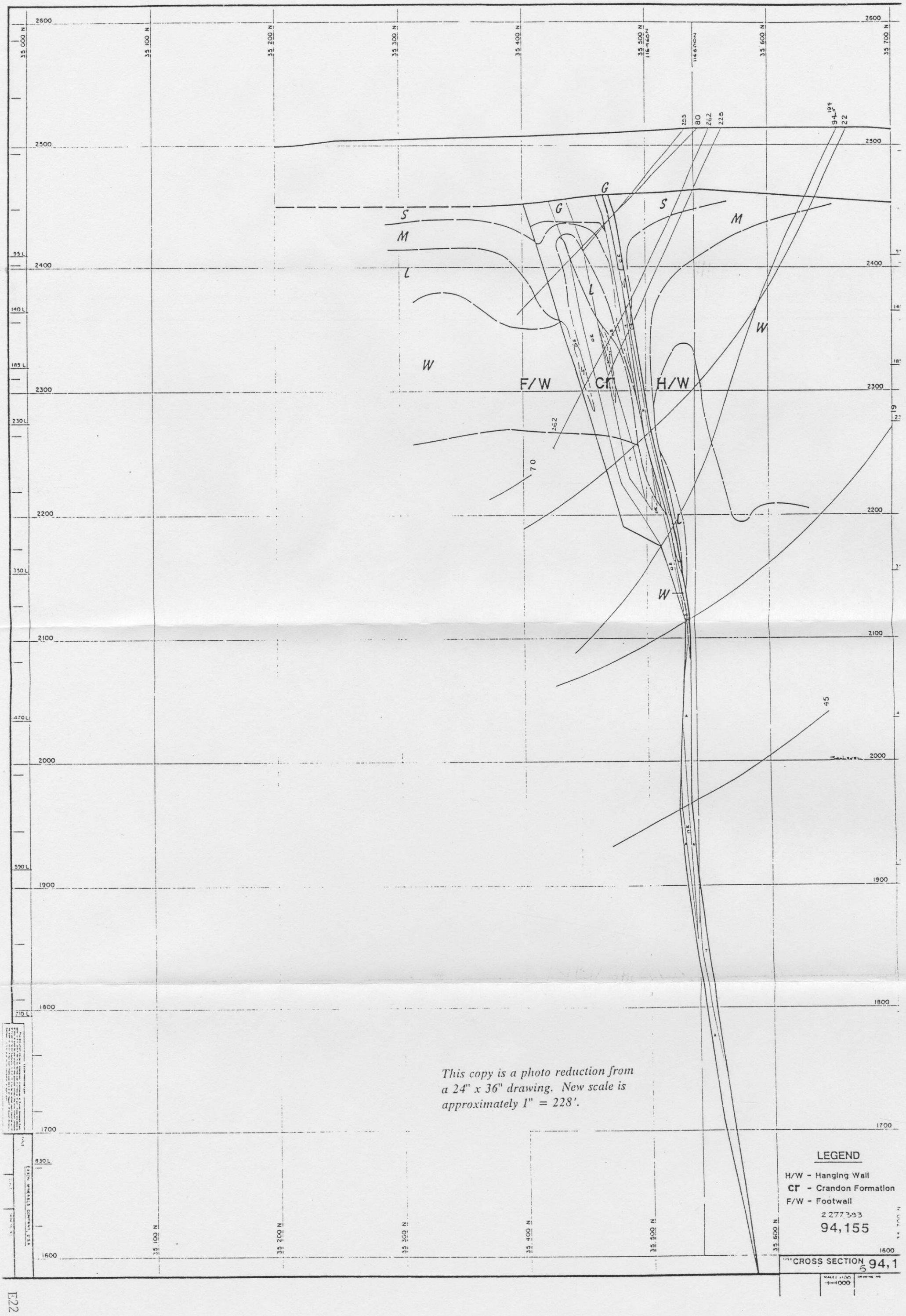
H/W - Hanging Wall
Cr - Crandon Formation
F/W - Footwall

2,277,236

94,110

CROSS SECTION 94,1

E21




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*

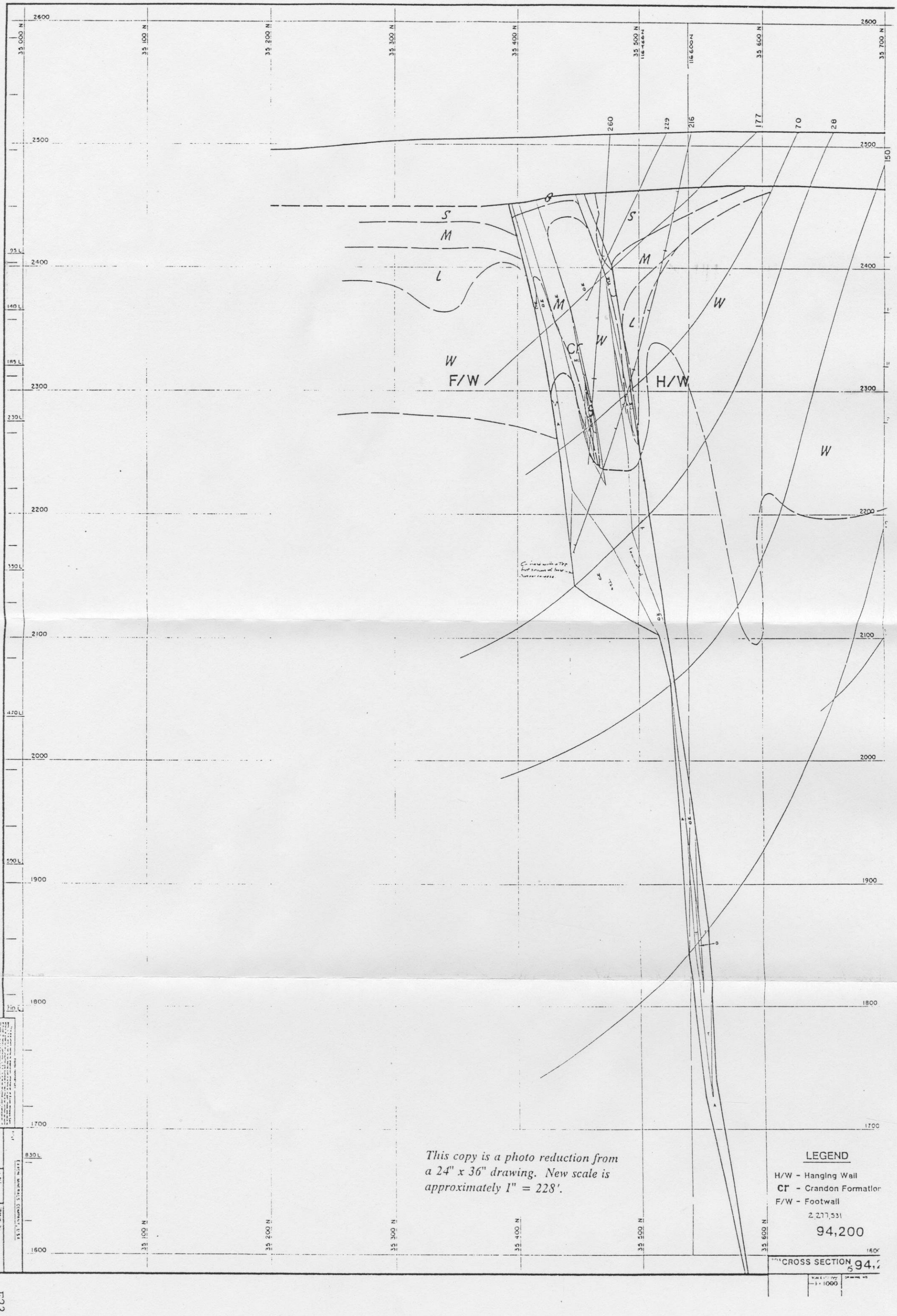
LEGEND

H/W - Hanging Wall
cr - Crandon Formation
F/W - Footwall

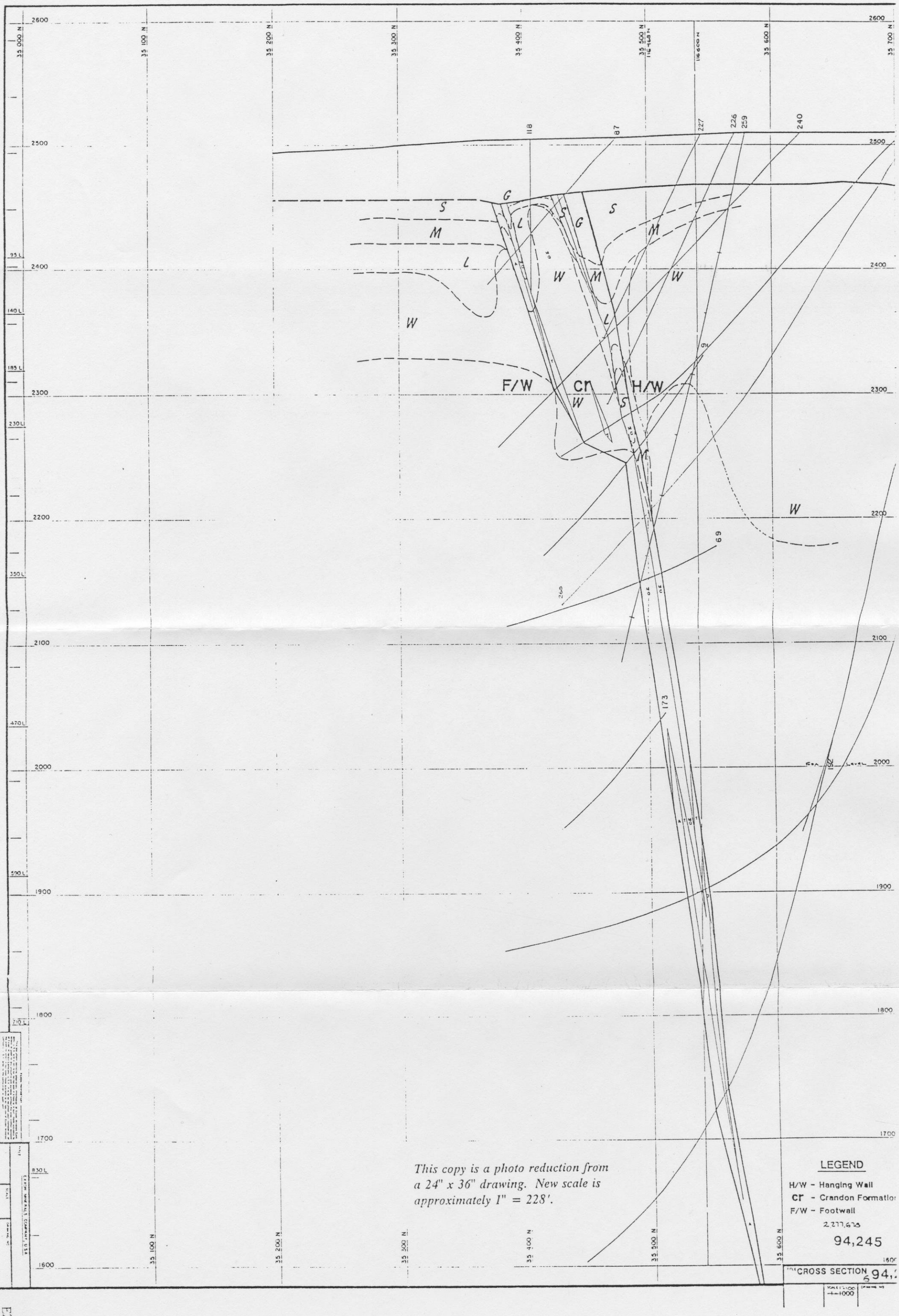
2 277 383
94,155

CROSS SECTION 5 94,1

E22




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*

*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*

LEGEND

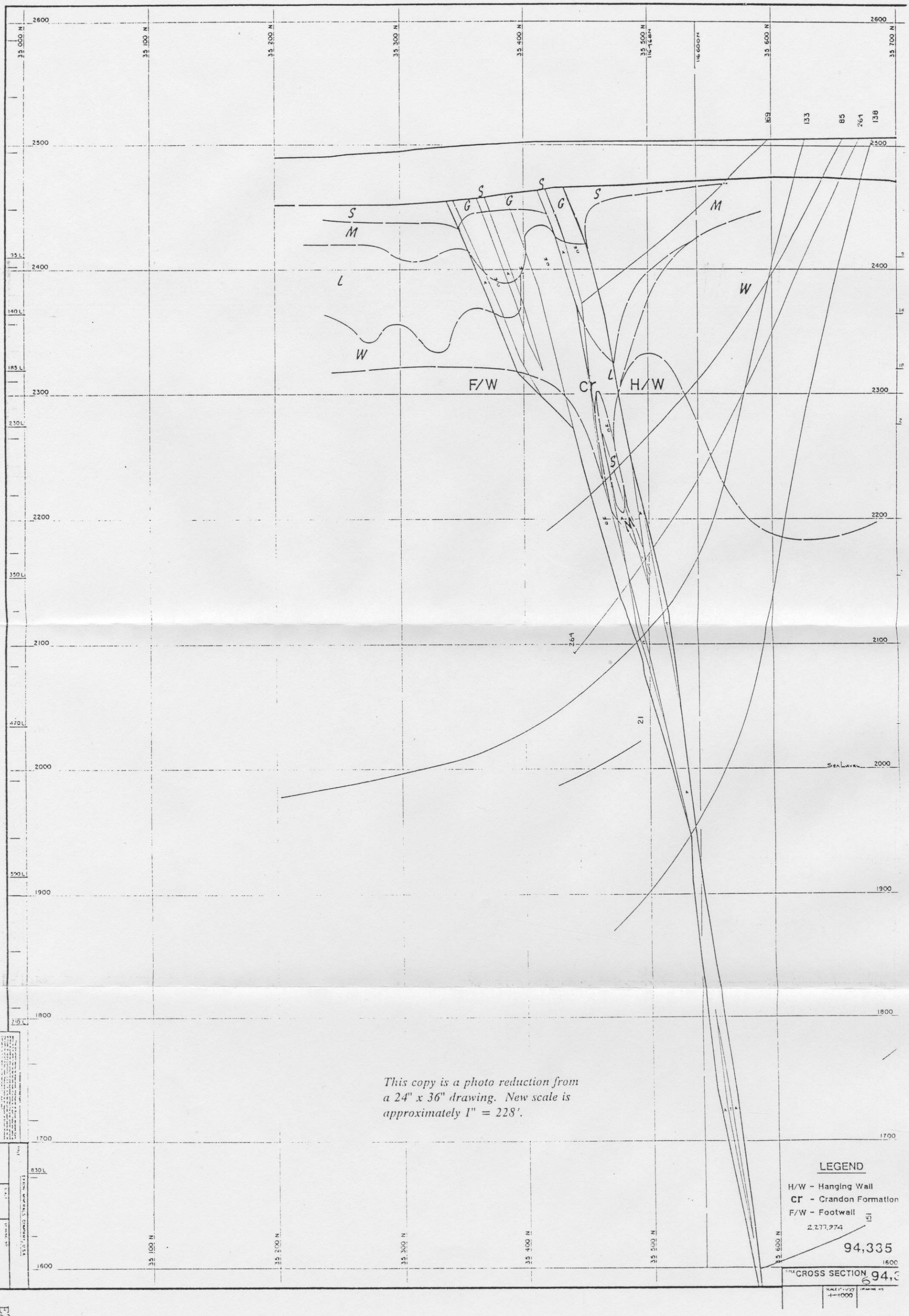
H/W - Hanging Wall
cr - Crandon Formation
F/W - Footwall

2277,826

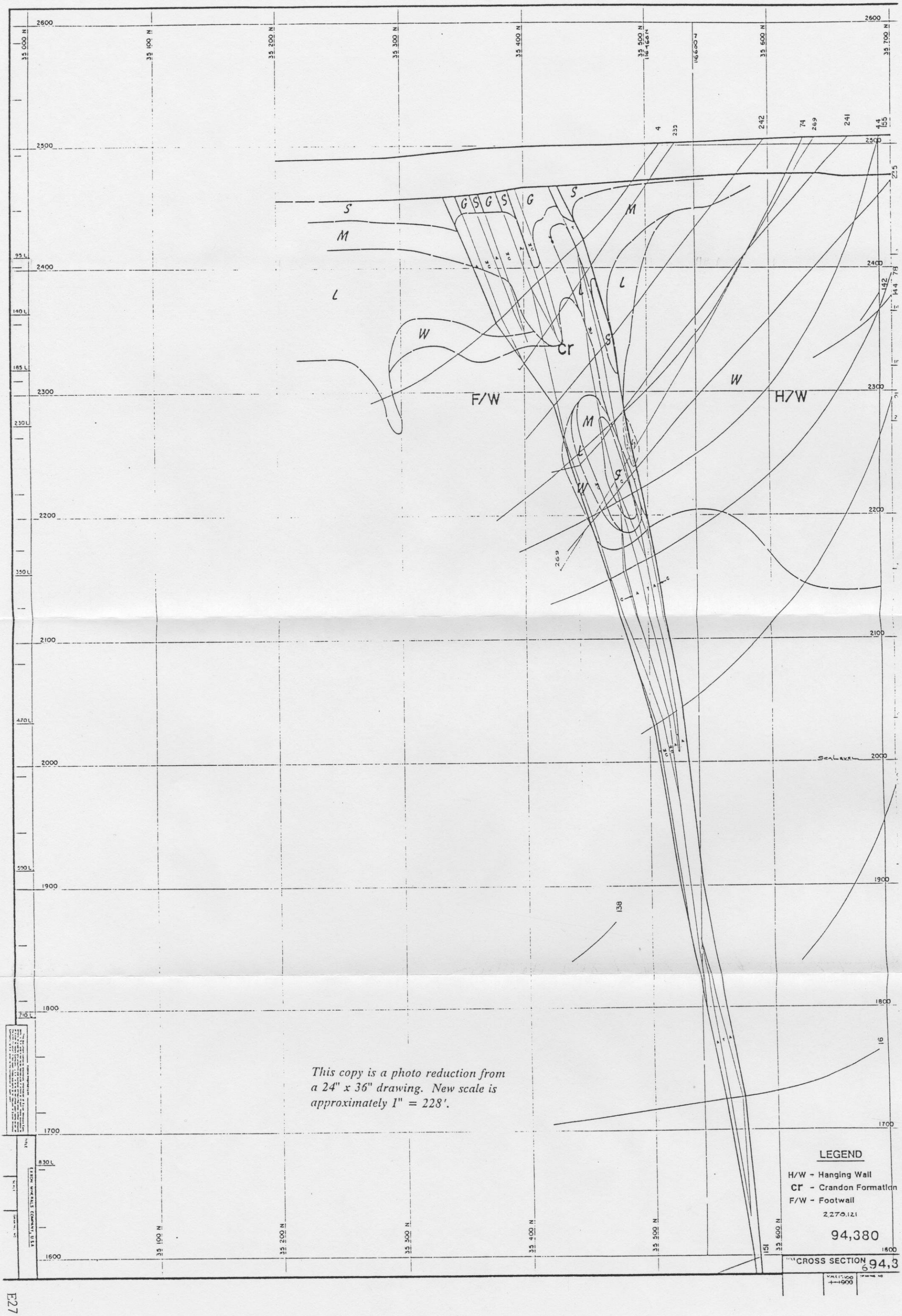
94,290

CROSS SECTION S 94,2

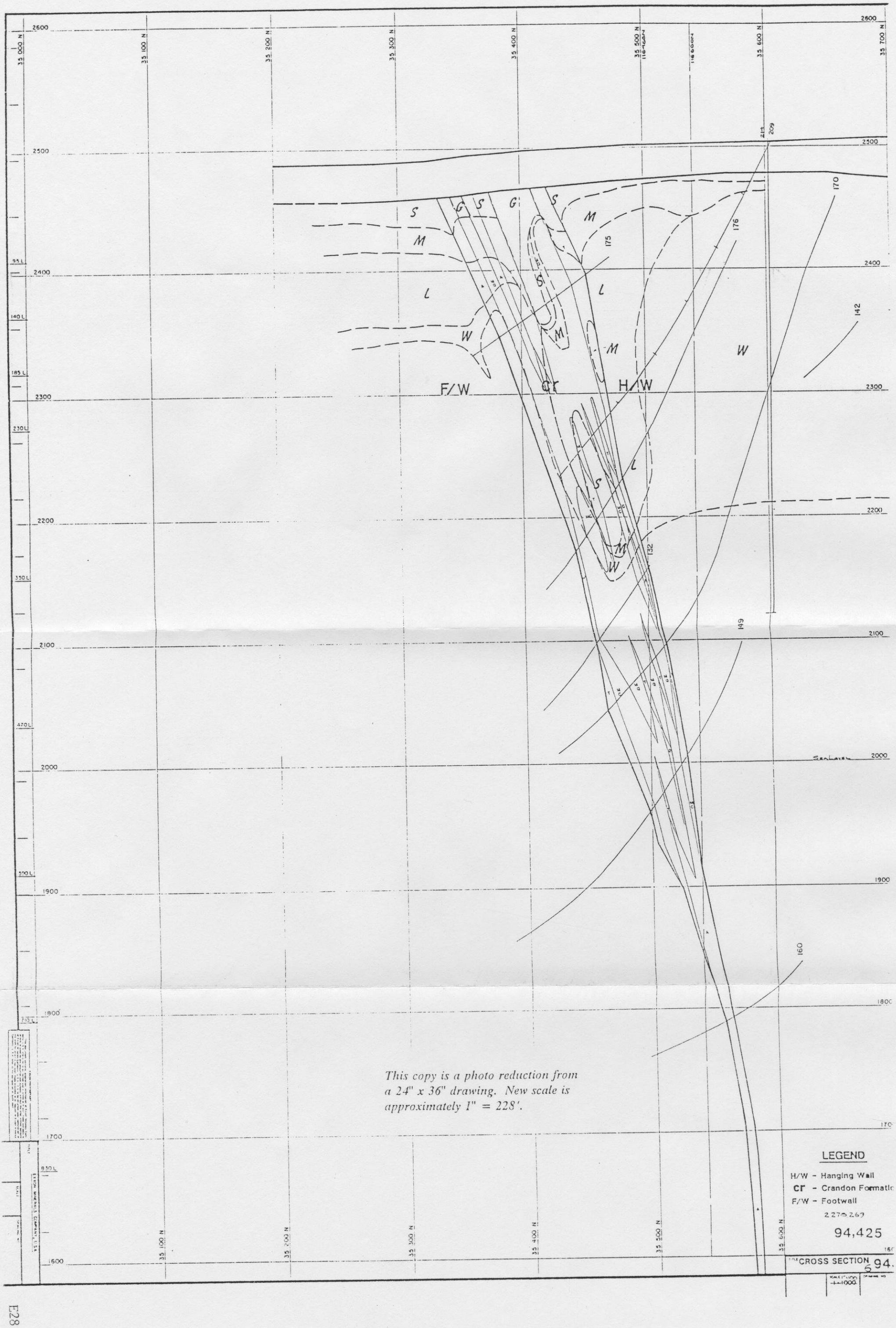
E25




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*


S
M
L
W
Cr
F/W
H/W
G
S
M
L
W
Cr
F/W
H/W
35 000 N
35 100 N
35 200 N
35 300 N
35 400 N
35 500 N
35 600 N
35 700 N
2600
2500
2400
2300
2200
2100
2000
1900
1800
1700
1600
95 L
140 L
185 L
230 L
350 L
470 L
590 L
710 L
830 L
Sea Level
LEGEND
H/W - Hanging Wall
cr - Crandon Formation
F/W - Footwall
2,270,121
94,380
CROSS SECTION 6 94,3
This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.

E27




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*

LEGEND

H/W - Hanging Wall

cr - Crandon Formatic

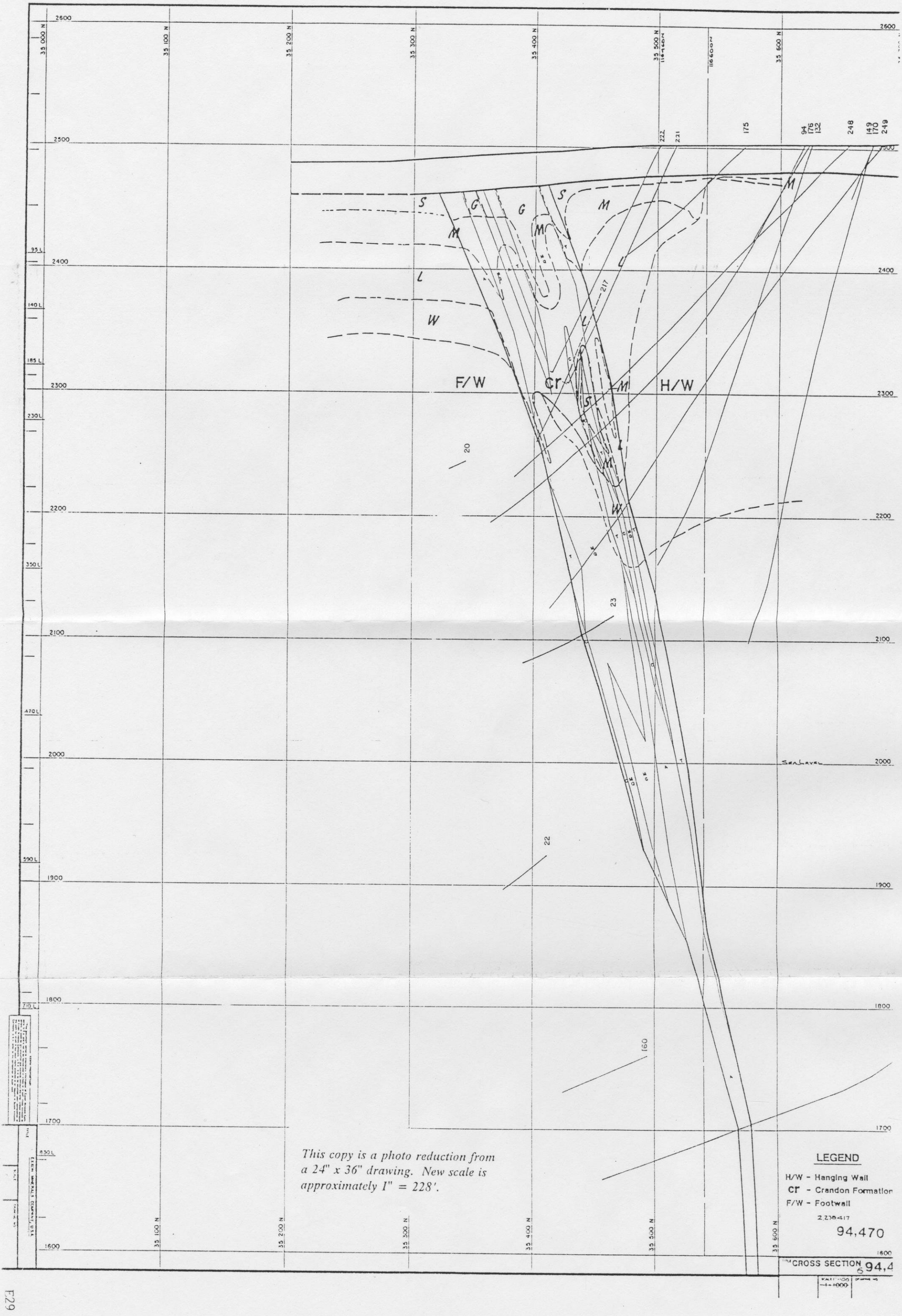
F/W - Footwall

2 270 269

94,425

CROSS SECTION 6 94.

E28




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*

**LEGEND**

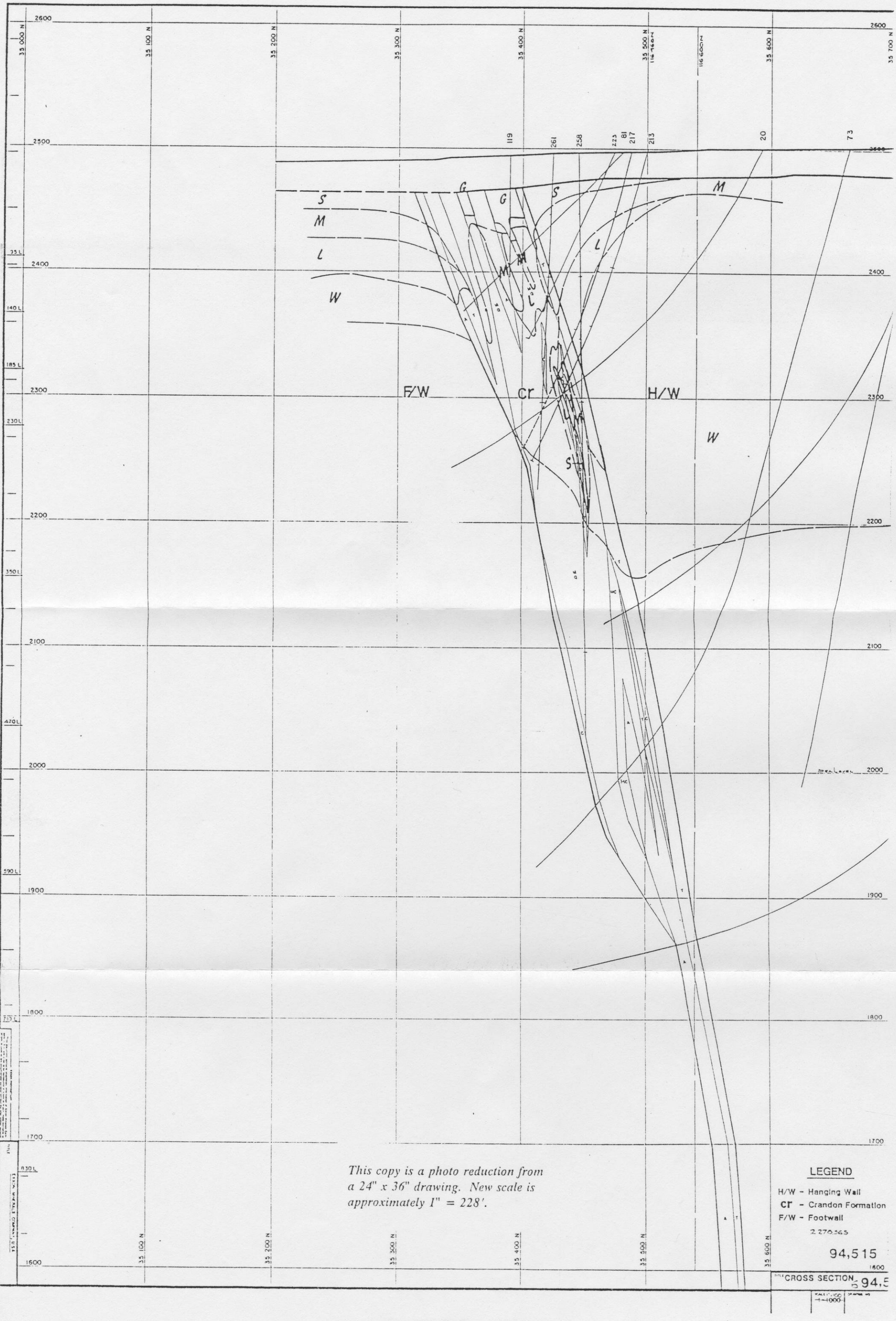
H/W - Hanging Wall
Cr - Crandon Formation
F/W - Footwall

2,270-417

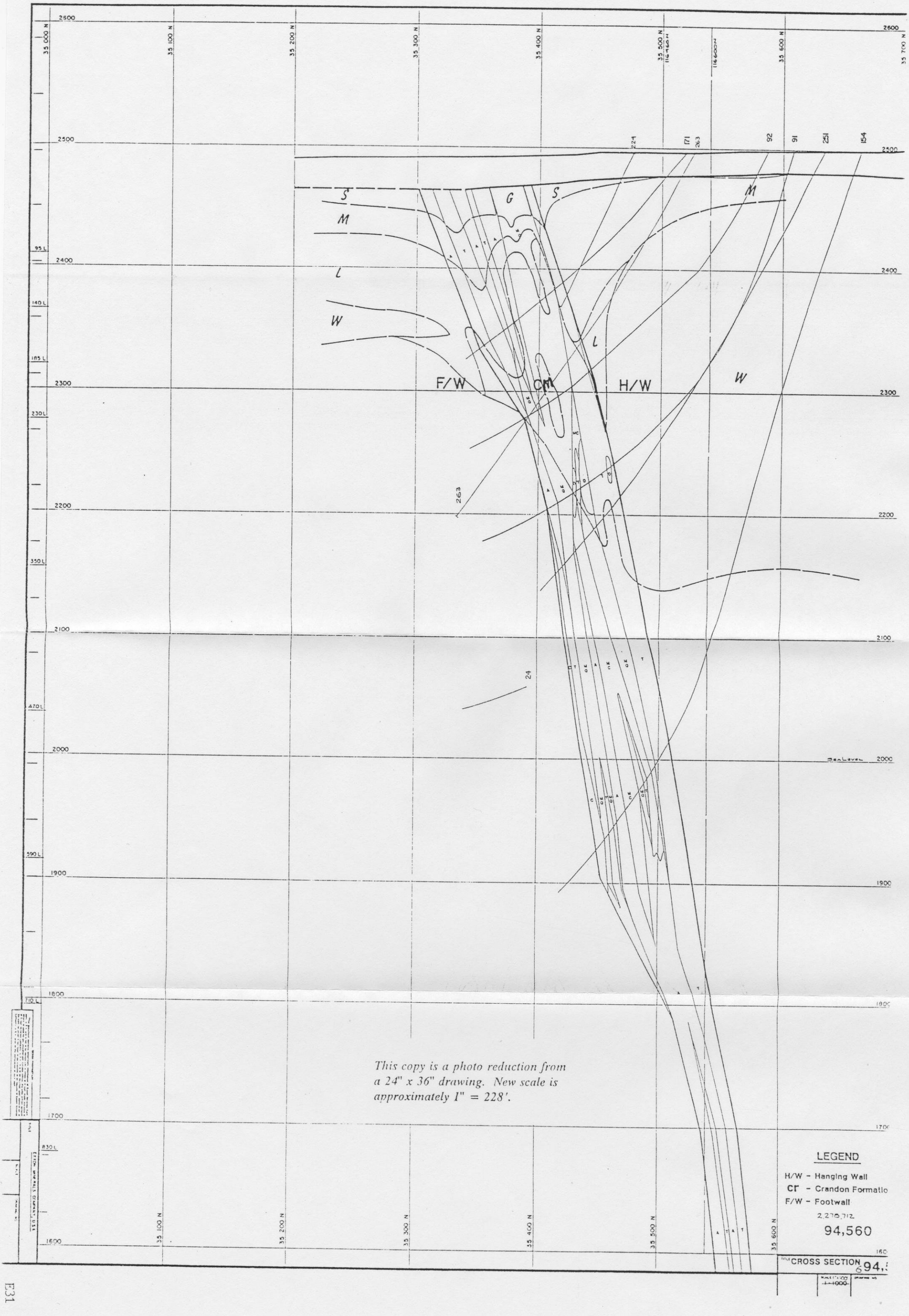
94,470

CROSS SECTION 6 94,4

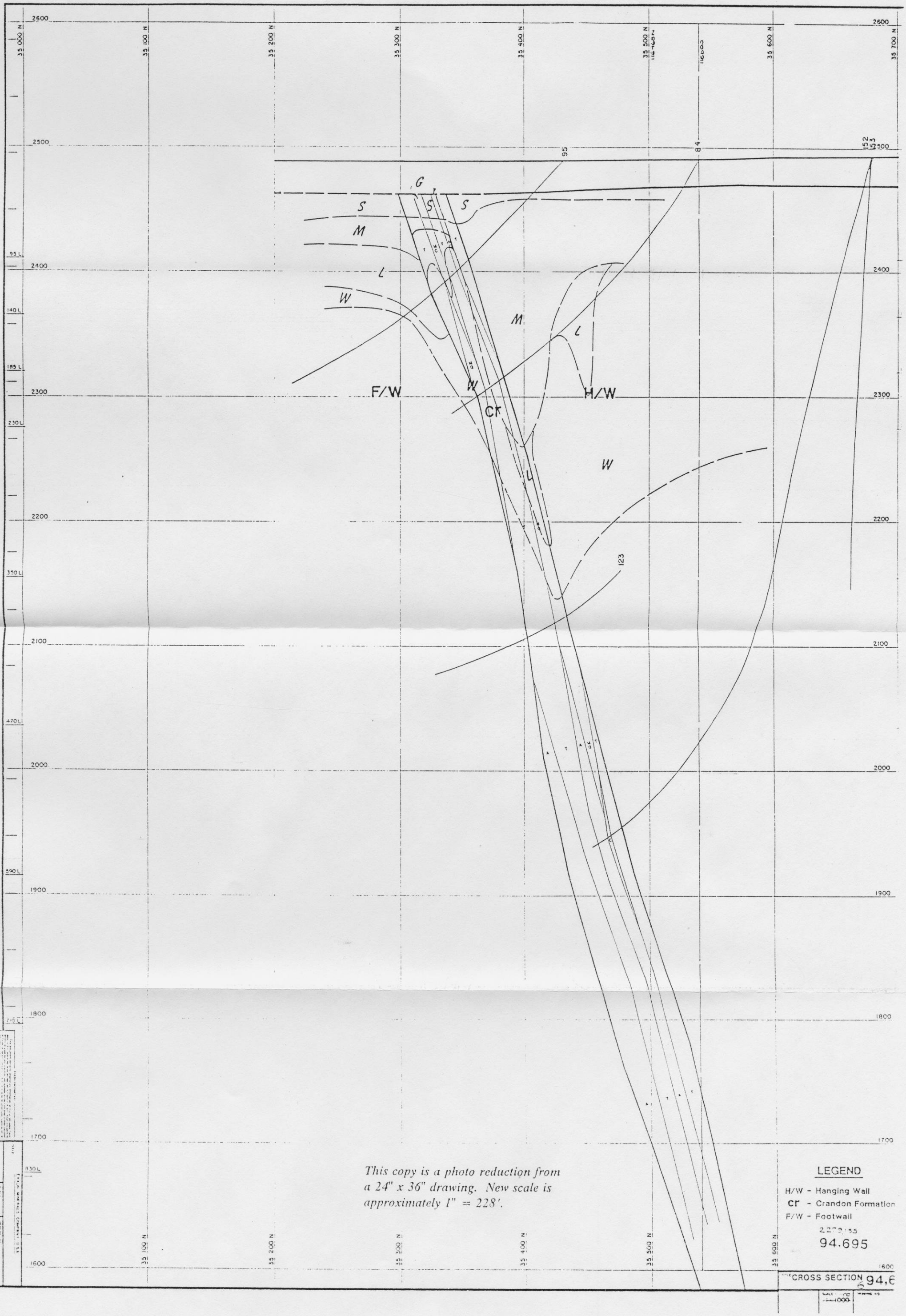
E29




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*

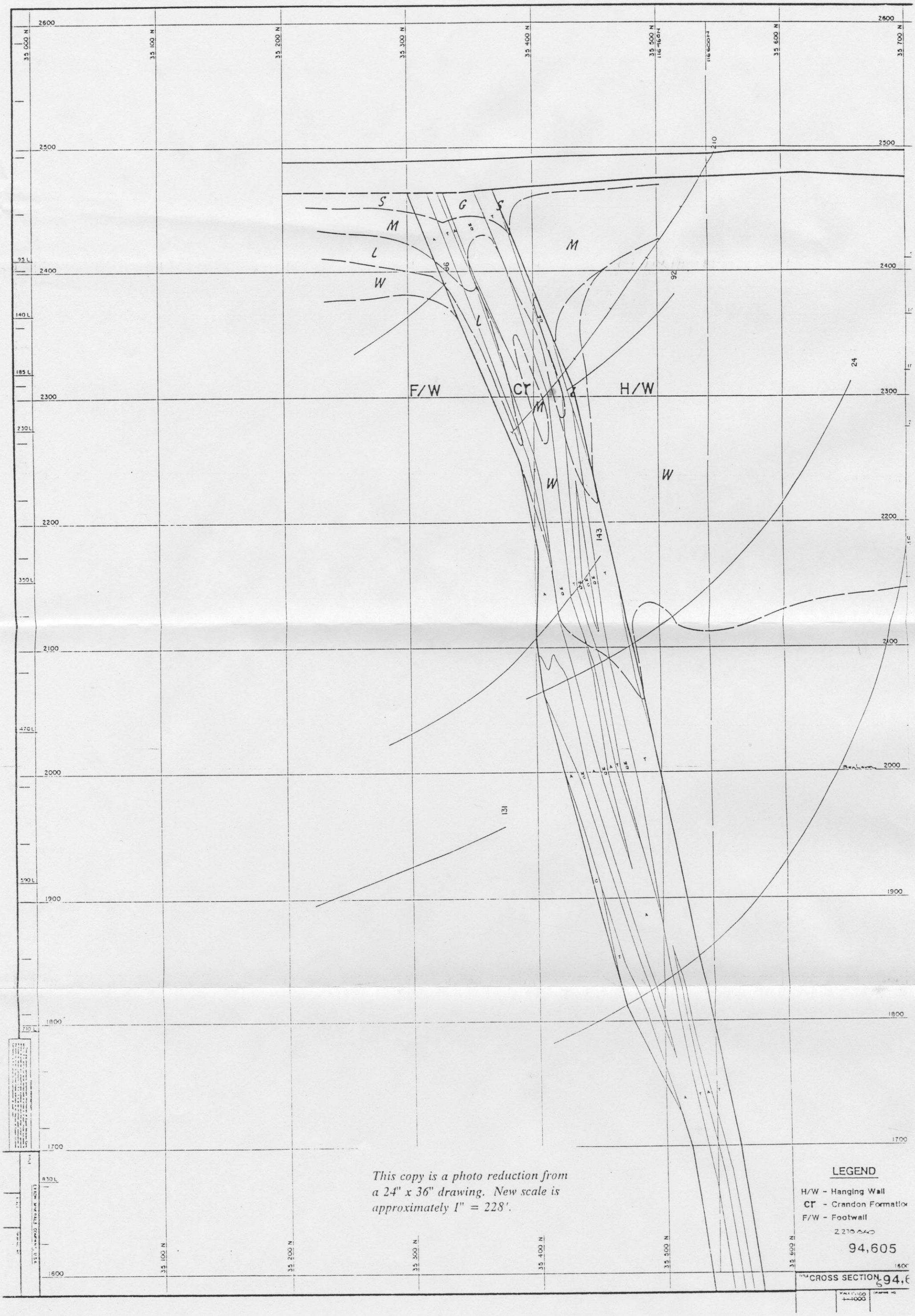
LEGEND

H/W - Hanging Wall
cr - Crandon Formation
F/W - Footwall

94,695

CROSS SECTION 94,6

F32




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*

LEGEND

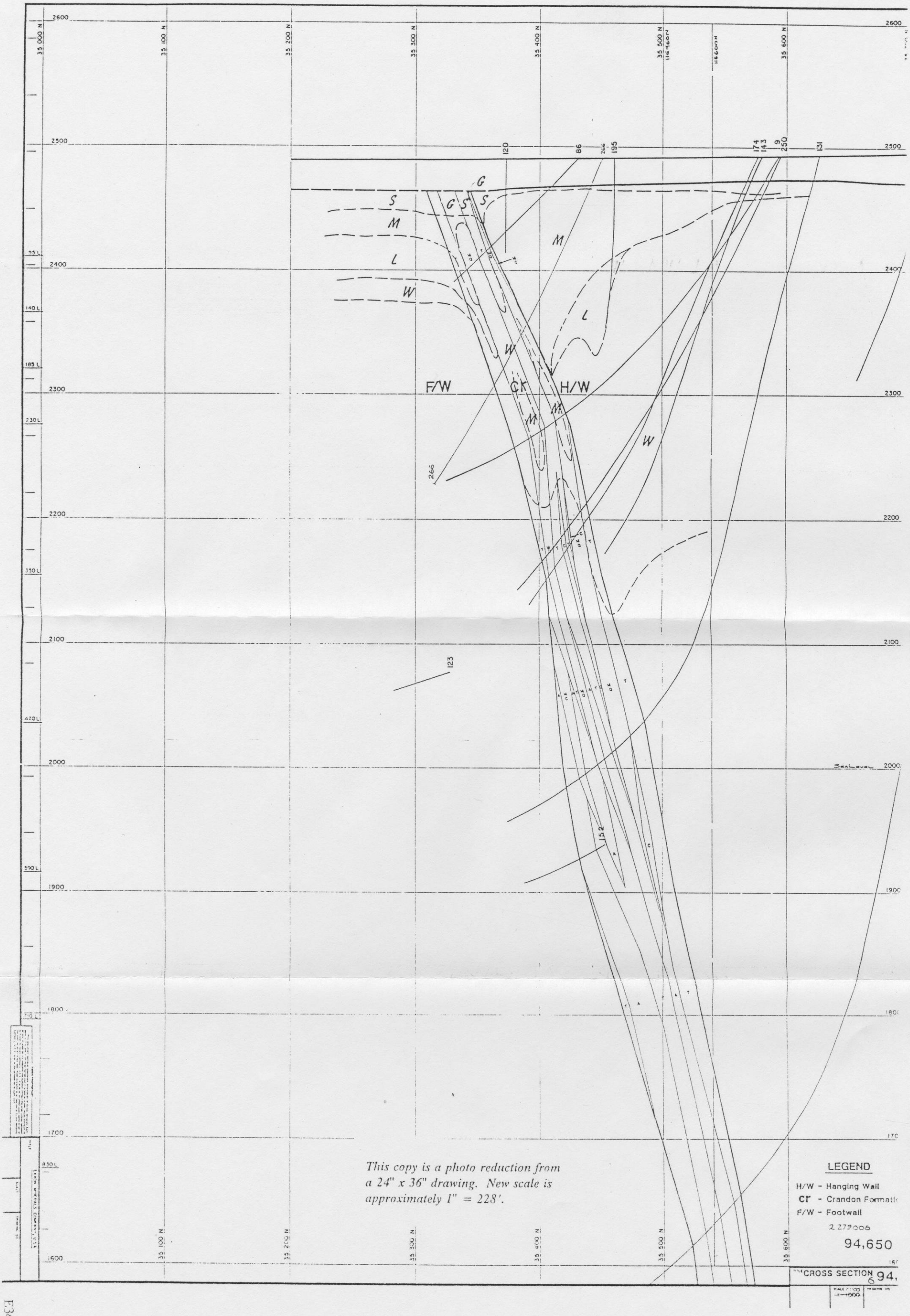
H/W - Hanging Wall
Cr - Crandon Formation
F/W - Footwall

2 270 560

94,605

CROSS SECTION 94,6

E33




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*

LEGEND

H/W - Hanging Wall

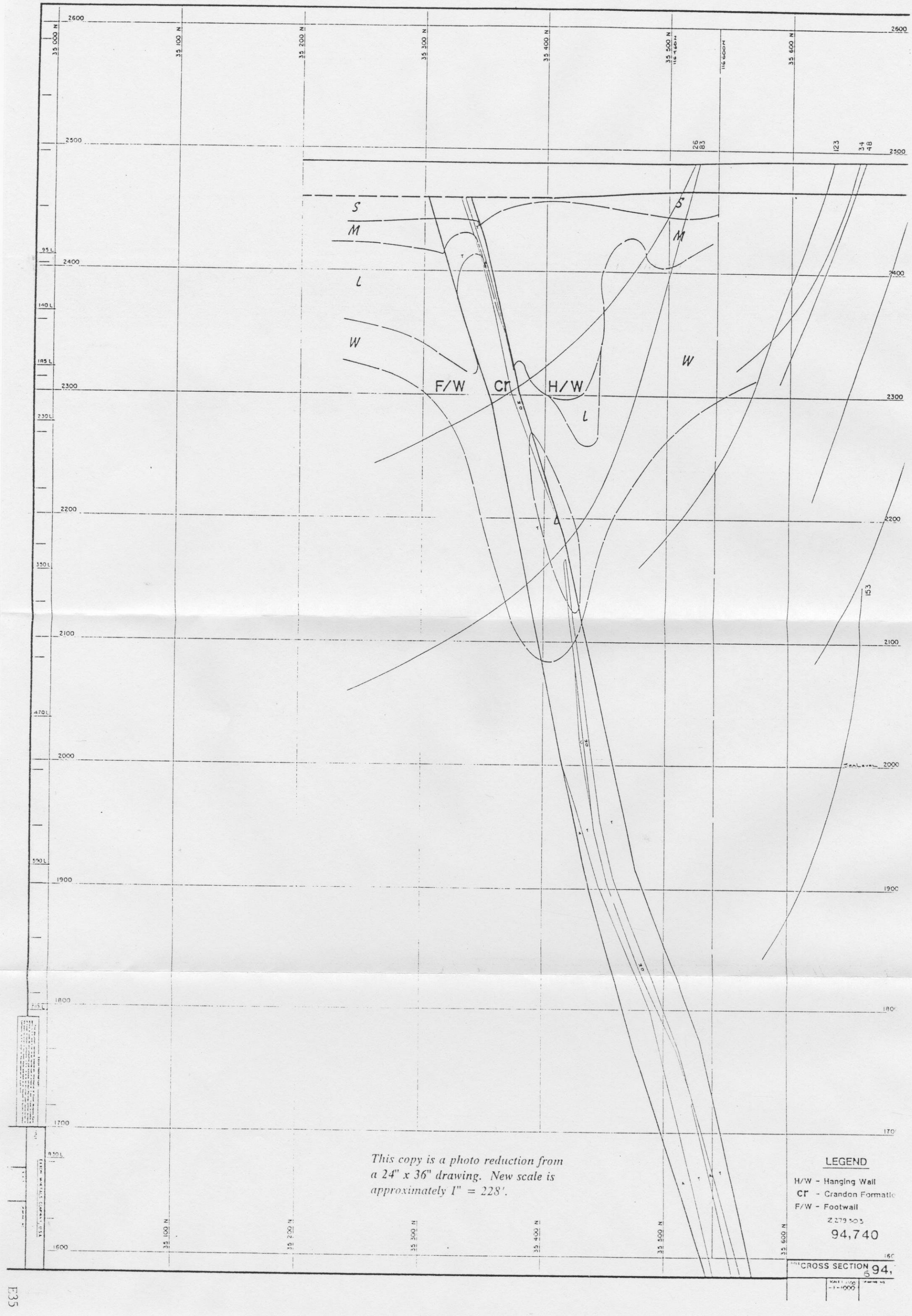
cr - Crandon Formation

F/W - Footwall

2,279,005

94,650

CROSS SECTION 94,650




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*

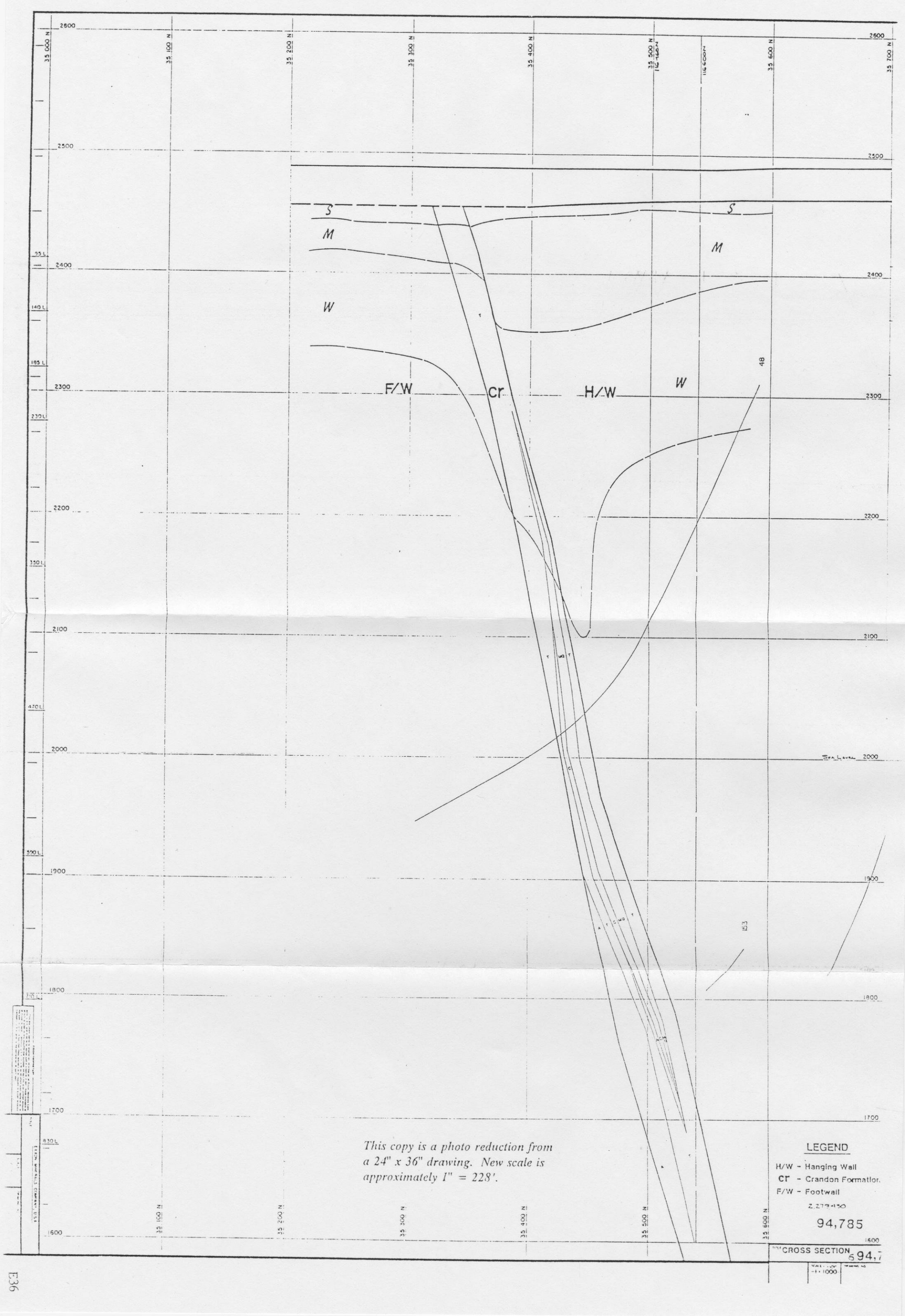
LEGEND

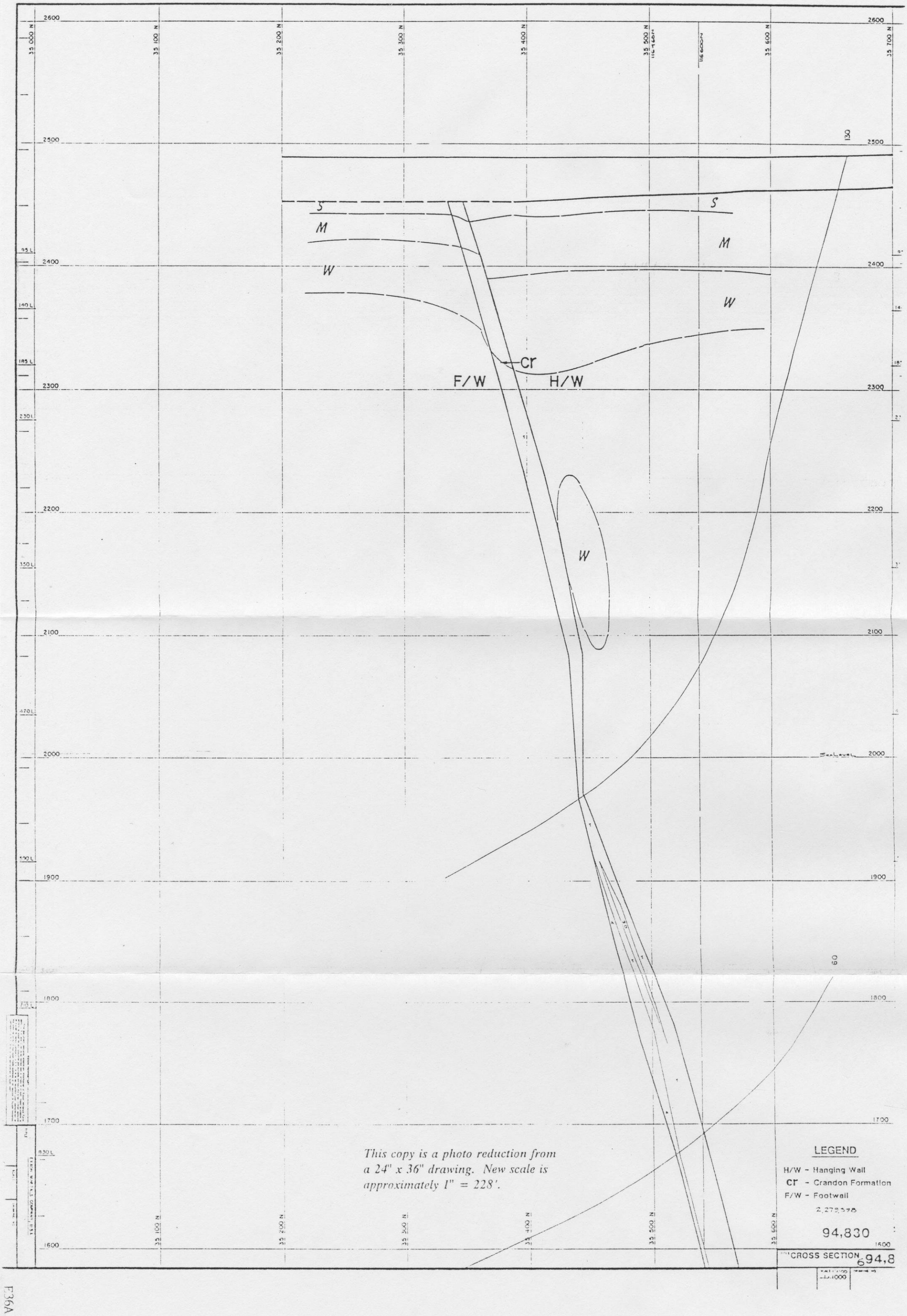
H/W - Hanging Wall
cr - Crandon Formatio
F/W - Footwall

Z 279 503
94,740

CROSS SECTION 94,

E35


35 000 N
35 100 N
35 200 N
35 300 N
35 400 N
35 500 N
35 600 N
35 700 N
2600
2500
2400
2300
2200
2100
2000
1900
1800
1700
1600
95 L
140 L
185 L
230 L
330 L
470 L
590 L
830 L
S
M
W
F/W
Cr
H/W
W
S
M
48
153
Sea Level
This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.
LEGEND
H/W - Hanging Wall
Cr - Crandon Formation
F/W - Footwall
94,785
CROSS SECTION 94,7




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*

LEGEND

H/W - Hanging Wall

Cr - Crandon Formation

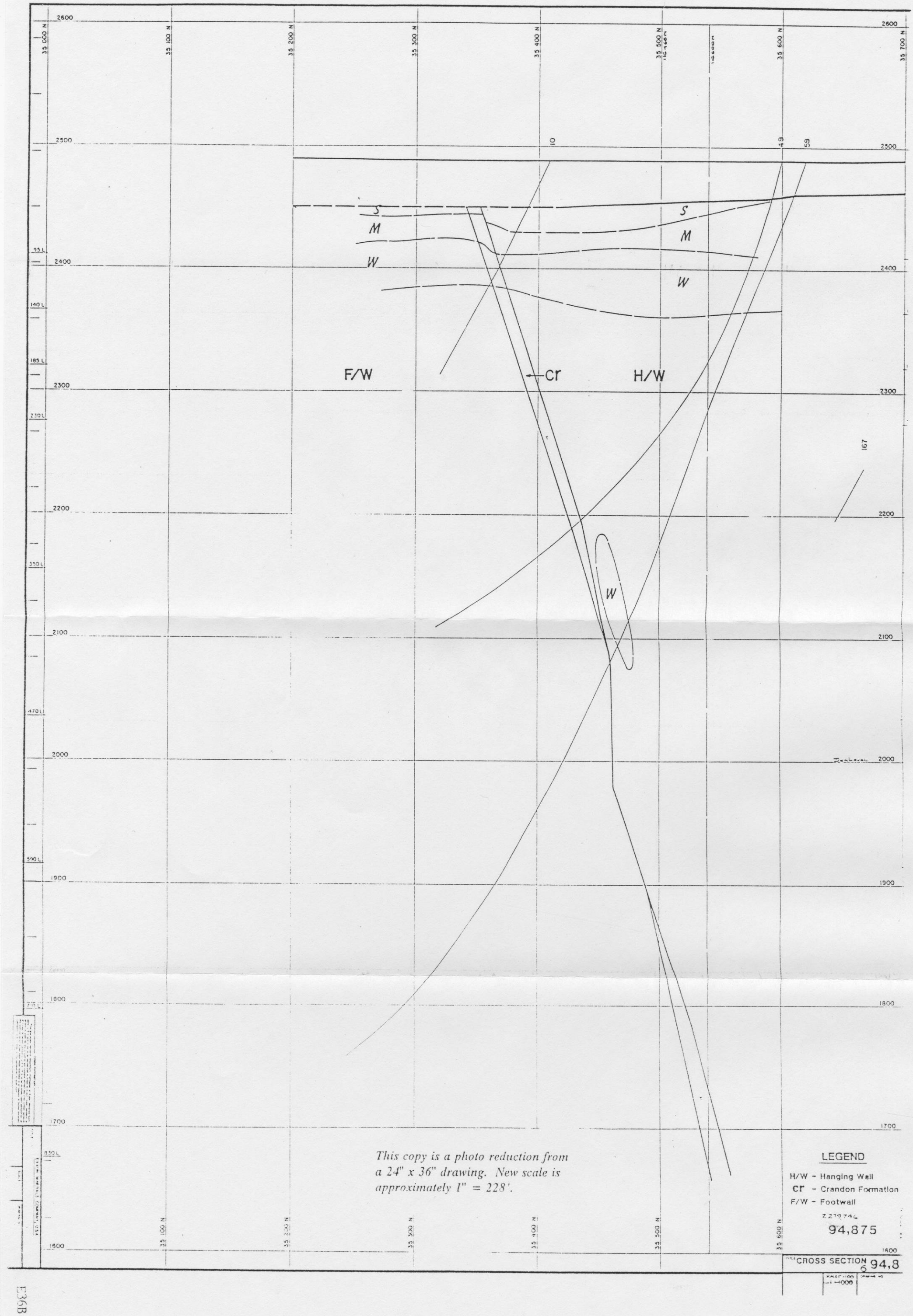
F/W - Footwall

2,278,398

94,830

CROSS SECTION 6 94,8

F36A




*This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.*

LEGEND

H/W - Hanging Wall
cr - Crandon Formation
F/W - Footwall

Z 219,746
94,875

CROSS SECTION 6 94,8

E36B

35 000 N
35 100 N
35 200 N
35 300 N
35 400 N
35 500 N
35 600 N
35 700 N
2600
2500
2400
2300
2200
2100
2000
1900
1800
1700
1600
35 L
140 L
185 L
230 L
350 L
470 L
500 L
830 L
F/W
H/W
LEGEND
H/W - Hanging Wall
cr - Crandon Formatic
F/W - Footwall
Z 272,694
CROSS SECTION 5 94,
This copy is a photo reduction from a 24" x 36" drawing. New scale is approximately 1" = 228'.

E36C

# Appendix F

## Log Sheet Summaries Delineating the Duck Lake Gabbro Dike

| % Rec ROD | Bdd Angle to Core Axis | Vein/Veinlet | Weather Int Super Altn | | Base Metal Mineralization | % Total Sulfide | Metso In Altn | Structu | | Texture Sz-Rd-So | Rock Type(s) Modifier (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|

**CRANDON PROJECT** Coord. _____ N _____ E

Date 1/22/98 Hole No. 163

Collar Elev. _____ By AJEL Scale _____ P _____/_____

Unit Name

Duck Lake Gabbro: - 3672'-3780' 163

Hard, dense, compact with chilled margins FW + HW. Sharp dense welded HWC ± 60-65° to core axis w ~1/16" wht cal peat/dite vnlt.

FWC ± 60-65° to axis. Welded, truncates qtz vnlt. Tr C FW contact.

- Occ 30° hairline vnlt/fracture, unopened with few opened and fresh chl selvage.
- Minor cal, qtz. Generally v. tight 1/4" chl, cal, qtz vnlt with chl sel. pthy opened. Fresh.

No sig. fx, opened or closed, no gouge

No FeOx.

F1

| % Rec RQD | Bdd Angle to Core Axis | Vein/Veinlet | Weather Int Super Altn | | Base Metal Mineralization | % Total Sulfide | Metso Altn | Structure | | Texture Sz-Rd-So | Rock Type(s) Modifier (s) | CRANDON PROJECT | Unit Name |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

Coord. _____ N _____ E
Date 1/17/95 Hole No. 10
Collar Elev. _____ By AJEJV. Scale _____ P ____/____

Duck Lake Gabbro 541-643TD: 10

Hard dense w chilled HW: FW below TD (Split core)
HW prob. 1" $CaCO_3$ vnlt @ 50°(?) with frags chl in $CaCO_3$. Hairline gouge? along edge. No FeOx. Upper 4' of gabbro laced with white $CaCO_3$ vnlts & chl selvages on some. Fe FeOx stain

Upper part of unit to ± 560': chl vnlts discolored in some ($Mn Ox$?) may be near surface weathering. No FeOx

Hairline $CaCO_3$, chl vnlts 20° to 50°, Usually unopened. ± bar zeolite (prehnite?) Occ up to ½"

40° chl, red feld (syenite?) vnlt @ 644'
Some discoloration of chl.
Gab 3-4m. No gouge, No FeOx
No sulfide

Duck Lake Gabbro. 3430-3525' 60
Contact may be @ 3435 or perhaps a thin finger of chilled gab @ 3430' and rock between hornfelsed volcanic.

Hard, dense, chilled HW: FW. FW may be at 3526 or 3524 and unit to 3521(26) - to 3525 hornfelsed basalt.

½" 60° vnlt w chl selvages @ 3524.5, opened

Occ hairline to ½" $CaCO_3$ chl vnlt, generally unopened. Generally 30° to axis. Rare ⊥ and hairline - 2 opened

No gouge, No FeOx, No Sulfide

| % Rec RQD | Bdd Angle to Core Axis | Vein/Veinlet | Weather Int Super Attn | | Base Metal Mineralization | % Total Sulfide | Metso In Attn | Structure | | Texture Sz-Rd-So | Rock Type(s) Modifier (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|

**CRANDON PROJECT** Coord. _____ N _____ E

Date 1/17/95 Hole No. 55/51

Collar Elev. _____ By AWEdv Scale _____ P ____/____

Unit Name

55

Ducklake Gabbro 2549 - TDC 2659

Dense, hard, compact with chilled finer grained HW. FW not seen, hole ID in gabbro. Max xln 3-4mm @ 2642.

Rare hairline thin chl lined vnlt/fract: most unopened. Occ 1/16" carb vnlt w chl selvage, commonly unopened

1' zone carb veining @ 30° to core 2604' welded and unopened. Bleached. Similar 30° to 60° 2" zone @ 2646. Unopened.

No sulfides - no FeOx - No gouge - tight. No fract // core axis.

51

Ducklake Gabbro 2549' - 1764' TD.

Dense, hard compact. Rare thin hairline vnlt. No FeOx no sulfide no gouge, no fract opened.

| % Rec RQD | Bdd Angle to Core Axis | Vein/Veinlet | Weather Int Super Altn | | Base Metal Mineralization | % Total Sulfide | Meteo In Altr | Structure | | Texture Sz-Rd-So | Rock Type(s) Modifier (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|

**CRANDON PROJECT** Coord. _____ N _____ E

Date 1/20/25 Hole No. 83

Collar Elev. _____ By AJE Scale _____ P ____/____

Unit Name

Duck Lake Gabbro. 1576 - 1649'

Sharp irreg 60° welded HW contact chilled HW and

Hard dense competent fresh gabbro. With wt chl joints/fractures slightly more abundant HW and FW.

Occ 10° to 30° hairline chl fracture HW to 1490. Most un-pened, some opened

Frsh 70°, 40° and 10° opened blk chl joints 1490 to FW contact. No gouge, no Fe-Ox, Faint discoloration in chl selvages ± 10' at FW rock.

No faults, no gouge, rare qtz, pectolite ± calcite in H. No Fe-Ox

| % Rec RQD | Bdd Angle to Core Axis | Vein/Veinlet | Weather Int Super Attn | | Base Metal Mineralization | % Total Sulfide | Metso In Attr | Structure | | Texture Sz.Rd.So | Rock Type(s) Modifier (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|

**CRANDON PROJECT** Coord. _____ N _____ E

Date 1/13/95 Hole No. 201

Collar Elev. _____ By AJEJ.. Scale _____ P ____ / ____

Unit Name

Duck Lake Gabbro - 976-1051

Dense, hard with chilled HW and FW contacts. FW welded. HW core broke along contact(?) but no gouge or FeOx. Hairline chl coated "mlts/fract. Some tight, some opened due to core handling. Minor oxidation on core surface post drilling. FW contact probably broken core at contact - no gouge or FeOx

Foliated volcanics in FW at dike, (below 1051) qtz ser schist / with fine to few small patches FeOx. Pyrite fresh no oxidation loc tr cp, pai gn as well. Occ talc chl ser (oil stained from drilling. Wk veining. Distal end of Crandon stringer system with silicification (cht?) overprinting.

Max xl size 3-4mm c 1012. Slightly coarser than hole 1027-1036. Same geologic unit - same dike.

| % Rec RQD | Bdd Angle to Core Axis | Vein/Veinlet | Weather Int Super Altn | | Base Metal Mineralization | % Total Sulfide | Metso In Altn | Structure | | Texture Sz-Rd-So | Rock Type(s) Modifer (s) | CRANDON PROJECT | Unit Name |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

Coord. _____ N _____ E
Date 1/17/25 Hole No. 59/49
Collar Elev. _____ By AJEJ Scale _____ P ____/____

59

Duck Lake Gabbro 2218' - 2300'.

Hard, dense, compact with chilled contacts. HW broken along contact w hairline chl. No FeOx but could have H2O discolor at chlorite/clay (Unit above contact wk py, po? and wk FeOx)

Rare hairline fract - 30-70°, tight with some opened. None // core axis

2240' - 70° 1/8-1/4" chl vnlt w tr CaCO3. No FeOx. salt, discolored

2287 - 60° 1/16-1/4" CaCO3 unit w chl. Tight.

Few hairline chl vnlts opened & discolored

No sulfide, no FeOx no gouge

49

Duck Lake Gabbro 1522-1606 TD.

Hard dense, compact gabbro. Chilled HW. HW contact, 50° 1/8" CaCO3 chl vnlt w discolored chlorite.

Hairline 25° to 50° chl CaCO3 vnlts, unopened and opened some slick on vnlts. - 1/2" CaCO3 qtz, chl w slicks @ 1544', tight. 1/2" Chl CaCO3, 20°, tight @ 1563: 1" Chl, CaCO3, 50°, tight @ 1591 - cut by small slicks

Hard dense. No FeOx, no gouge, tight chlorite fract's have a little bleached halo.

HW unit CaCO3, qtz vnlts w fresh sulfide & discolored chlorite.

| % Rec ROD | Bdd Angle to Core Axis | Vein/Veinlet | Weather Int Super Altn | | Base Metal Mineralization | % Total Sulfide | Mel\so In Altn | Structure | | Texture Sz-Rd-So | Rock Type(s) Modifier (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|

**CRANDON PROJECT** Coord. _____ N _____ E
Date 1/16/95 Hole No. 95/137
Collar Elev. _____ By AJEJ Scale _____ P ____/____

Unit Name

95

Duck Lake Gabbro 8.9-911

Hard, dense, compact gabbro with more intense fracturing at HW and FW contacts. Both HW & FW chilled. Fract sets: 10°, ±30° ±80° commonly opened in upper 15' to ± 839'. Discolored. No good gouge but core weathered thru upper ±15'.

Below ± 839, fresher hard dense gabbro with fresh chl fract's unopened and opened.

FW say ±895 to 911 fract's more commonly opened and discolored. Rare trace in fx/hairline chl vnlt bottom ½".

May have near surface weathering effect at HW & FW contact — masking HW.
No gouge no fault

Duck Lake Gabbro 3267-3328 137

check log on FW fault.

Hard, dense, compact with chilled contacts.

Rare chl selvaged vnlt.
1/4" 70° cal, chl vnlt at contact (HW) with slippage.

Occ hairline chl vnlt, 30° to core generally unopened. Base Lower ±3121 to 3123: 70° chl vnlt opened and faint discoloration, blk min?. Poss weathering at contact?

No faults no gouge, fresh sulfide ±1-2% in FW.

| % Rec RQD | Bdd Angle to Core Axis | Vein/Veinlet | Weather Int Super Altn | | Base Metal Mineralization | % Total Sulfide | Meiso In Altn | Structure | | Texture Sz-Rd-So | Rock Type(s) Modifier (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|

**CRANDON PROJECT** Coord. _____ N _____ E

Date 1/17/25 Hole No. 130/48

Collar Elev. _____ By AJEJr Scale _____ P ____/____

Unit Name

Duck Lake Gabbro. 2306-2334TD 130

Dense, hard, chilled HW.
Occ hairline 20° to 50° chl vnlt.
60° chl vnlt @ 2307 ± 2308, opened, discolored, 1/16 to 1/4" $CaCO_3$, $MnO_x$?
± contorted. (Minor surface effect?)

No sulfide, no gangue, no $FeO_x$

Duck Lake Gabbro. 2165-2214TD 48

Dense, hard, chilled HW.
Rare 30° to 50° chl vnlt, opened to 1/8M. Some discoloration
chl vnlt @ 30°, opened, broken, discolored at (contact?)

No sulfide, no gangue, no $FeO_x$

| % Rec RQD | Bdd Angle to Core Axis | Vein/Veinlet | Weather Int Super Attn | | Base Metal Mineralization | % Total Sulfide | Metso In Attn | Structure | | Texture Sz-Rd-So | Rock Type(s) Modifier (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|

**CRANDON PROJECT** Coord. _____ N _____ E

Date 1/19/05 Hole No. 182, 166

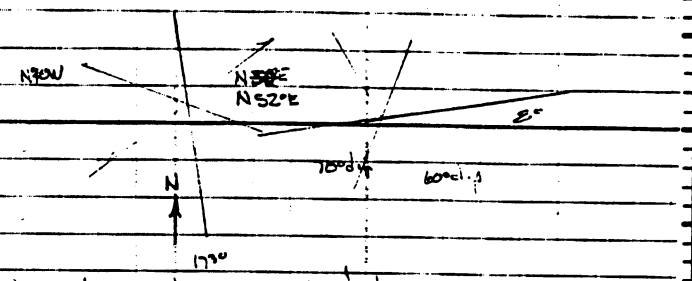
Collar Elev. _____ By AJEJ Scale _____ P _____ / _____

Unit Name

Duck Lake Gabbro: 3001 - 3072' 182

Hole inclined -8° dip bearing 173° this depth

- Dense, hard, chilled HW & FW, Welded contact
- Occ hairline $CaCO_3$ vnlt w chl selvage. most unopened. No evidence $FeOx$ or $H_2O$.
- Max xln size ± 3-4mm @ ± 3053'
- Rare frac w chl ⊥ core axis
- 3/4" cal filled fracture dipping 60° C 3071'

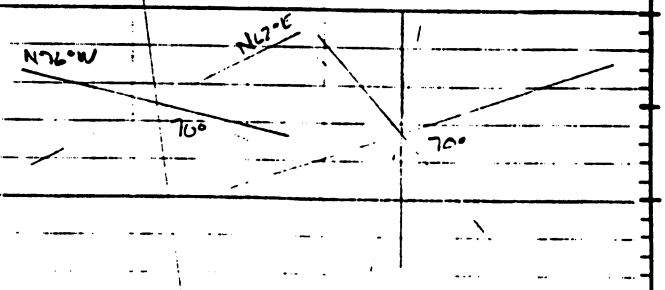



Max possible strike / dip. Azim 52° to 110°

Duck Lake Gabbro: 2688-2769 | 166

Hole inclined: -17° dip Bearing 174° this depth.

- Dense, hard, chilled HW & FW. Welded contact
- Few hairline $CaCO_3$ vnlts to 1/4" vnlt w chl selvages
- 2721 - 4" broken pieces at core w few chl selvages. V wk small fract zones. 60° to 70° chl selvages
- 2725 - 2, 70° hairline to 1/16" chl selvages no fracts (Nothing at 2732)
- 1/4" $CaCO_3$ chl vnlt @ 70° 2734'
- Selvages tight to open. No evidence of $FeOx$ or $H_2O$.
- Rare ⊥ core axis




Max possible strike ~~62°~~ to 104° Azim

62°

| % Rec ROD | Bdd Angle to Core Axis | Vein/Veinlet | Weather Int Super Attn | | Base Metal Mineralization | % Total Sulfide | Metso In Attn | Structure | | Texture Sz-Rd-So | Rock Type(s) Modifier (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|

**CRANDON PROJECT** Coord. _____ N _____ E
Date 1/16/95 Hole No. 123/131
Collar Elev. _____ By AJE/v Scale _____ P ____/____

Unit Name

123

Duck Lake Gabbro 1960-1974 TD

Short section of hard dense compact gabbro w chill at HW. TD before fault. Welded contact @ 80° to core axis.

Rare unopened ±, opened fracture w hairline chlorite selvage 20°-30° to core axis. Tight.

Mag xln. 1-3mm.

No FeOx, no gouge, no significant fracturing

Duck Lake Gabbro 2400'-2530' 131
(Tuff 2440'-2478')

Gabbro dike is bifracated with double chill. - Gabbro 2400' to 2440' - HW ± FW chl
Tuff 2440 to 2478 - (with sulfide)
Gabbro 2478 to 2530 HW ± FW chl

Sharp welded contact @ 70° @ 2400'. 1" int unit ¼" cal, qtz, chl selvage unit w minor slippage on contact. Few stp ± 10-15° chl fract opened and core 90°. Stp are chl up to ⅛" thick.

Tuff here - mm argillite banding w py, ± cp.

Lower gabbro - few hairline 10° to 40° unopened and opened chl selvage/fract 1, 10°, ⅛ to ¼" chl cal unit unopened Sharp, irregular ± 80° FW contact

No FeOx, no gouge, no significant fracture

Both units typical hard, dense, compact

| % Rec ROD | Bdd Angle to Core Axis | Vein/Veinlet | Weather Int Super Altn | | Base Metal Mineralization | % Total Sulfide | Metso In Altn | Structure | | Texture Sz:Rd:So | Rock Type(s) Modifier (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|

**CRANDON PROJECT** Coord. _____ N _____ E

Date 1/16/05 Hole No. 26

Collar Elev. _____ By _____ Scale _____ P _____ / _____

Unit Name

26

Duck Lake Gabbro - 1139 - 1210 TD

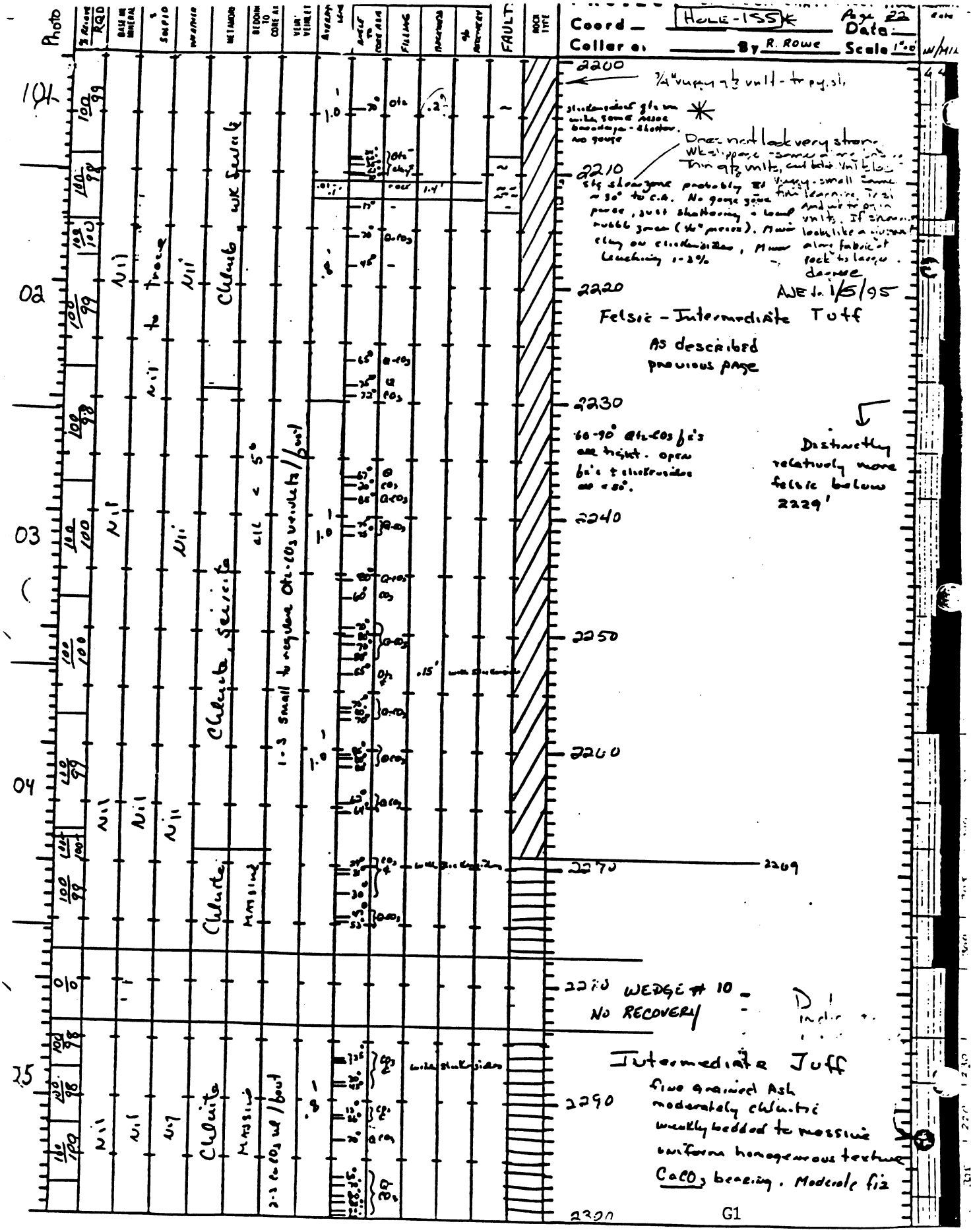
Hard, dense, w chill on HW contact.
Welded contact @ 55° w 3" unit varying.
w tr sulfide.

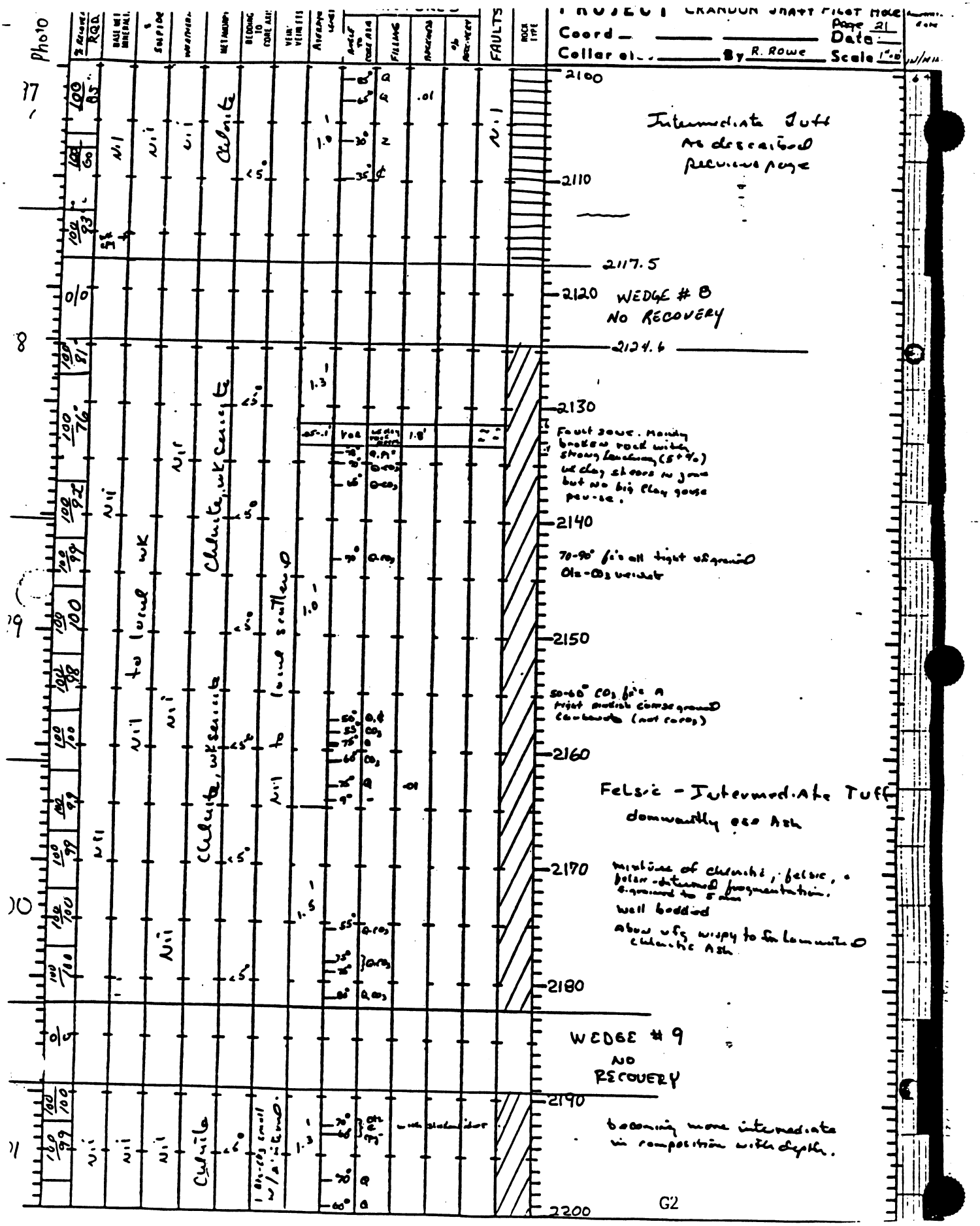
Occ dk chl hairline to ± 1/4" 15° to 40°
chl or col qtz vn'lt. (1@1188, 1/2")
Gen tight, occ opened.

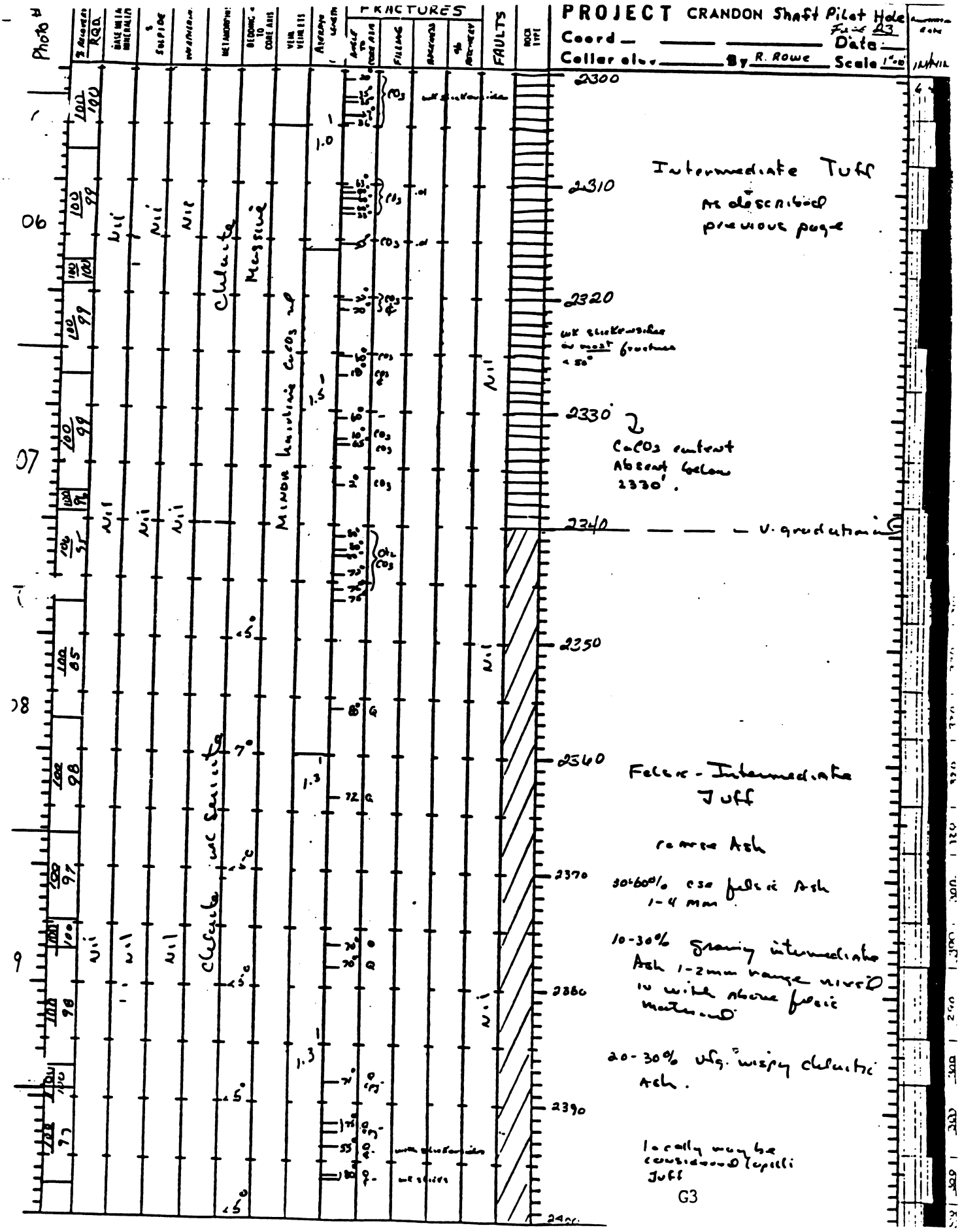
No Fe Ox, no gouge, rare faint
discoloration

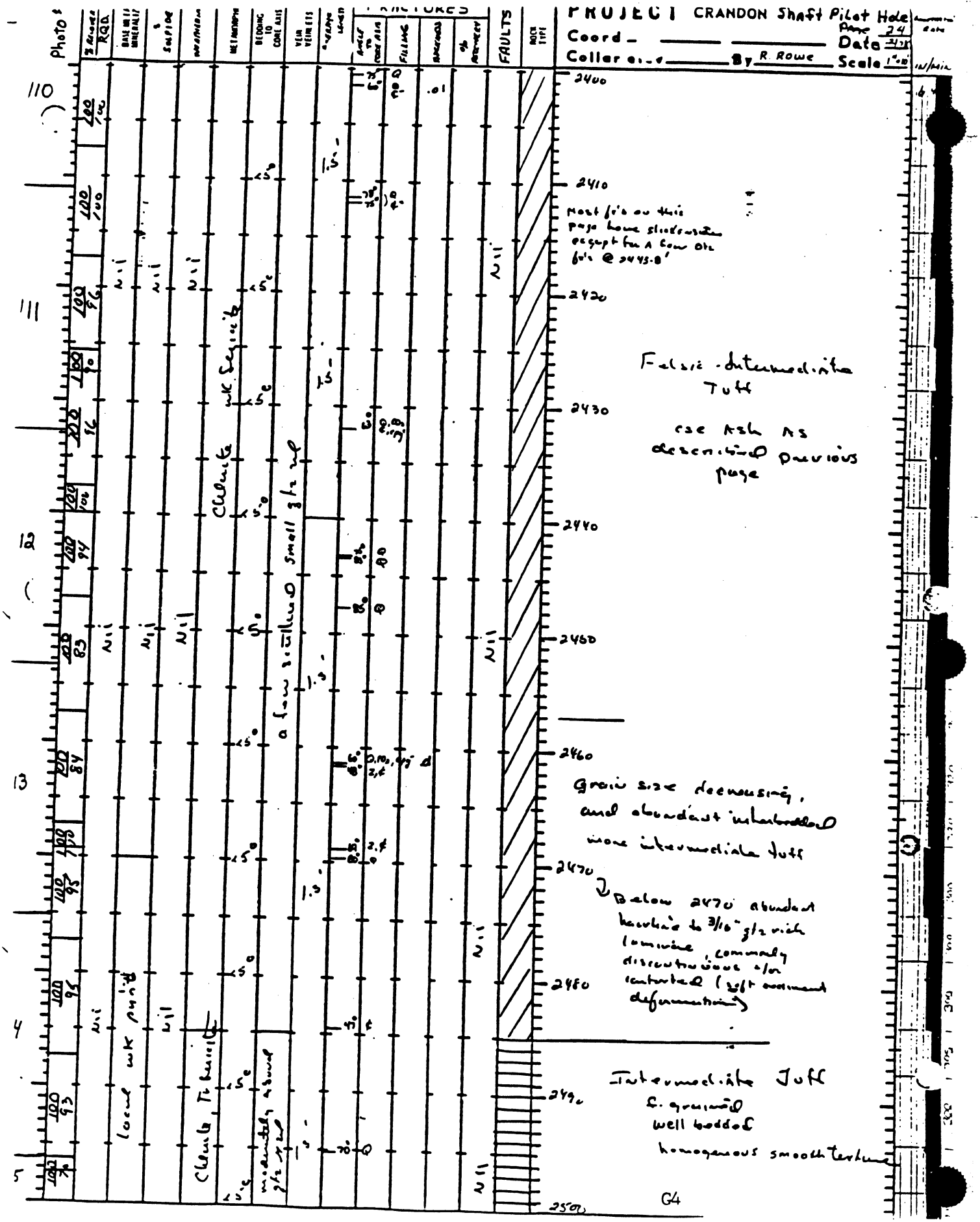
# Appendix G

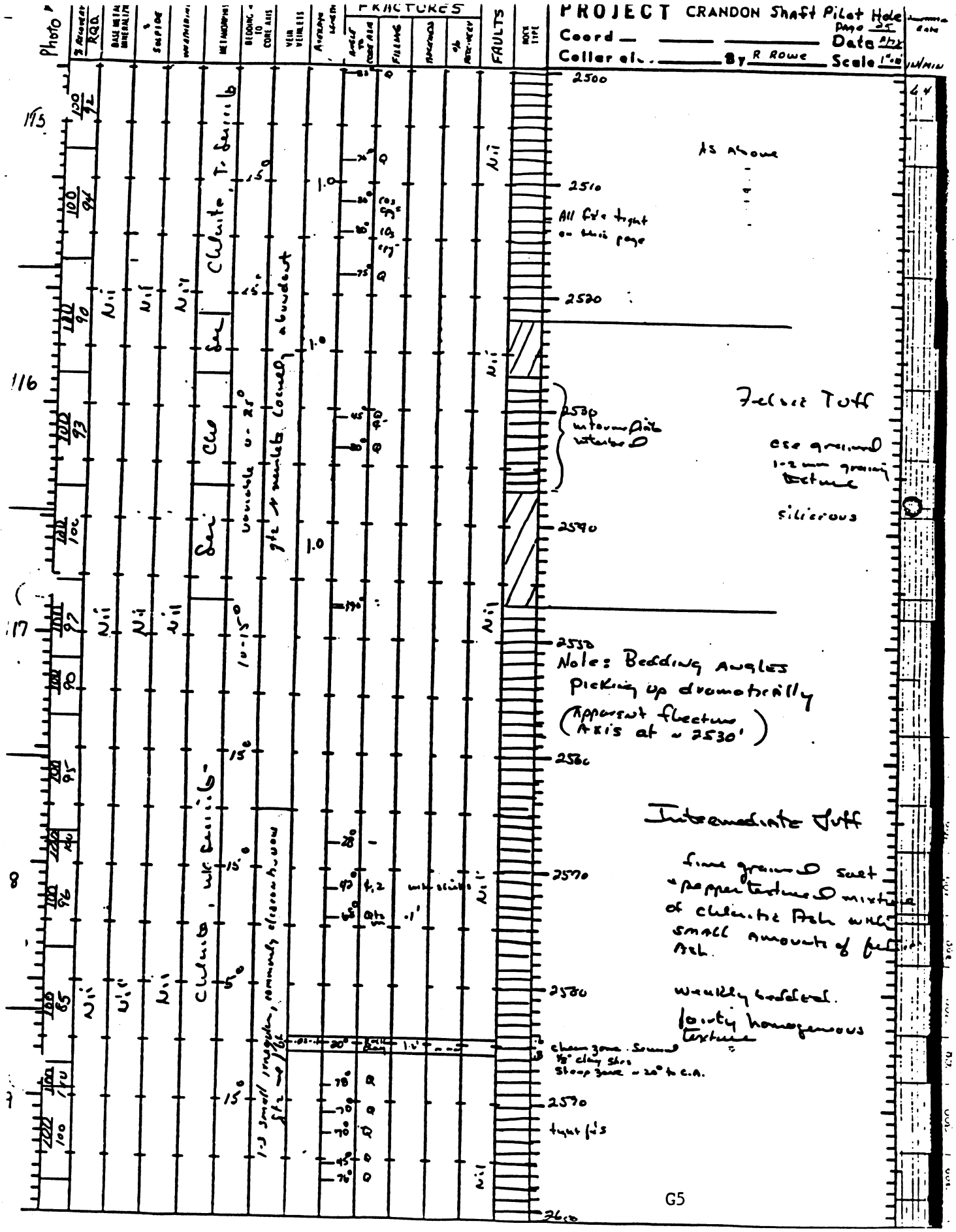
## Log Sheet Summaries for Core Hole 155

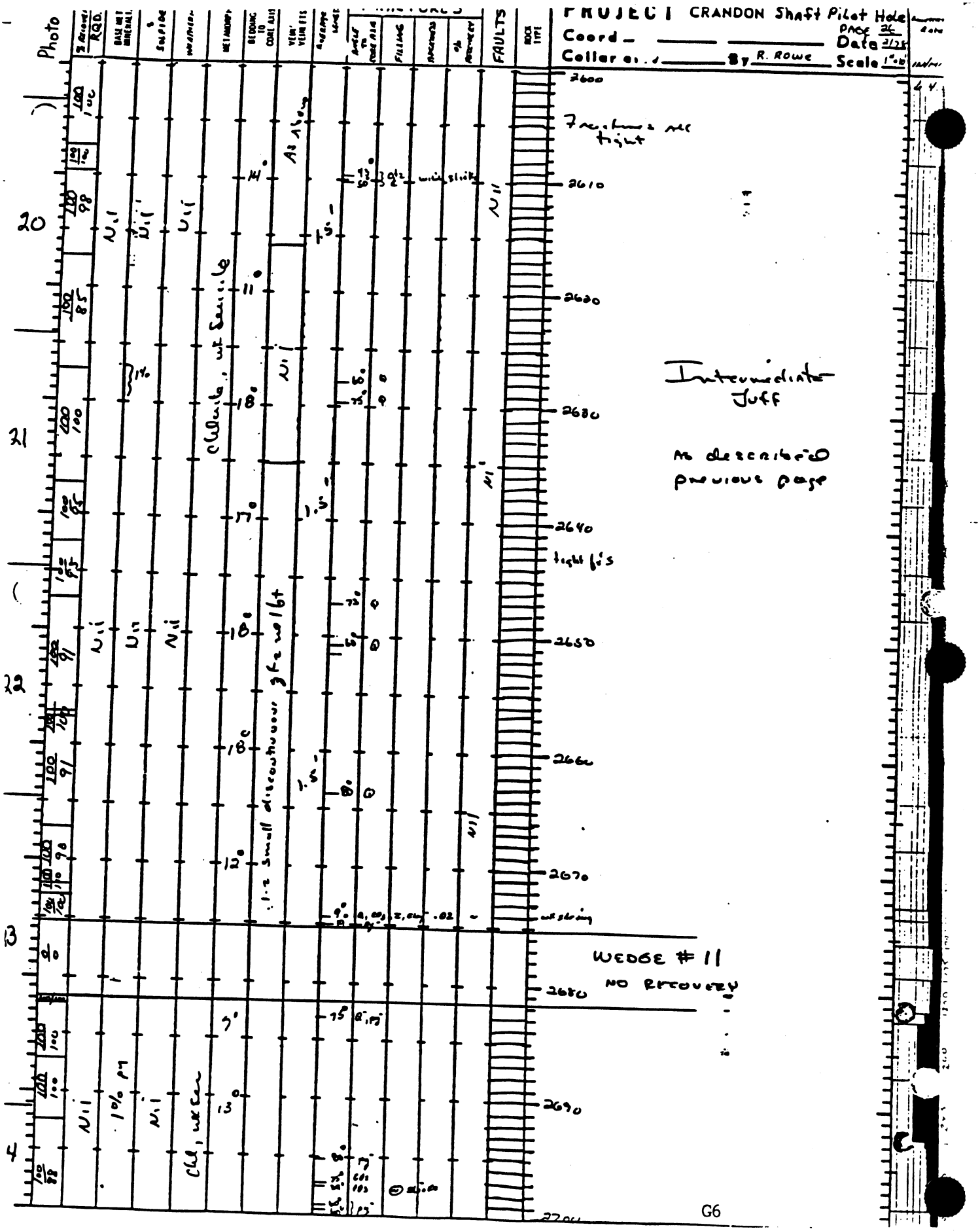

HOLE-155
Page 22
Date
Coord
Collar el
By R. ROWE
Scale 1"=5'
Photo
% Recov RQD
Bas in Mineral
Sulfide
Weathering
Metamorphism
Bedding to Core Axis
Vein Veinlet
Alteration
Angle to Core Axis
Fracturing
% Recovery
FAULT
Rock Unit
2200
2210
2220
2230
2240
2250
2260
2270
2290
Felsic - Intermediate Tuff
As described previous page
AJE 1/5/95
Destructively relatively more felsic below 2229'
2269
WEDGE # 10
NO RECOVERY
Intermediate Tuff
fine grained Ash moderately chloritic weakly bedded to massive uniform homogeneous texture
CaCO3 bearing. Moderate fiz
Clastic sericite
Clastic
Massive
Clastic wk Sericite
01 02 03 04 25
G1

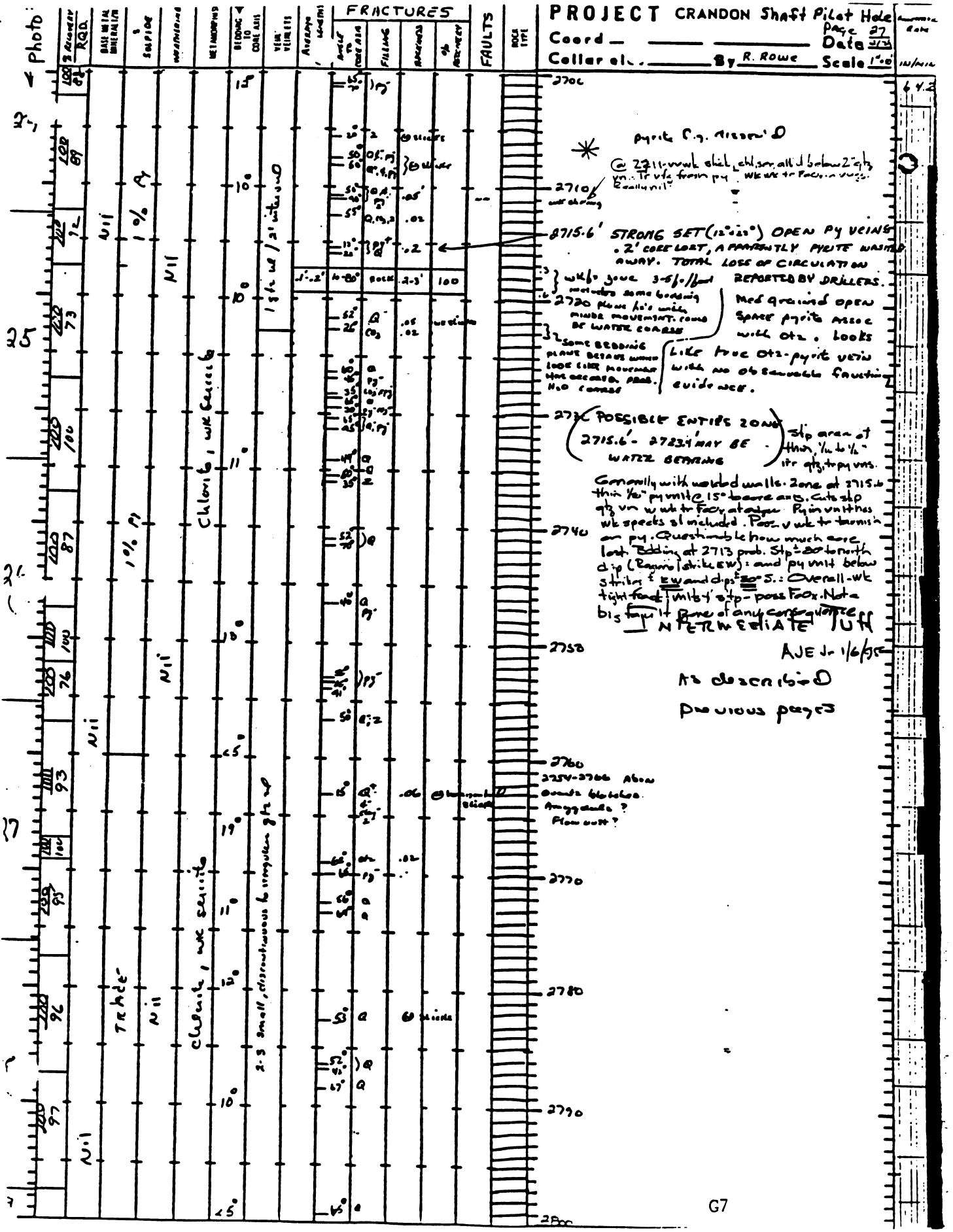

PROJECT CRANDON SHAFT PILOT HOLE
Coord —
Collar el.
By R. Rowe
Page 21
Date
Scale 1"=10'
2100
Intermediate Tuff
Moderately Recovered Argillic Zone
2110
2117.5
2120
WEDGE # 8
NO RECOVERY
2124.6
2130
Fault zone. Mostly broken rock with strong foliation (50°) w/ clay sheets in joints but no big clay gouge zones.
2140
70-90° fe's all tight w/ground Ole-CO3 veinlets
2150
50-60° CO3 fe's & right angle to core ground Carbonate (not core)
2160
Felsic - Intermediate Tuff
dominantly ash
2170
mixture of chlorite, felsic, & felsic-intermed fragments. Ranging to 5 cm
well bedded
Abun wfg wispy to fn laminated chloritic Ash
2180
WEDGE # 9
NO
RECOVERY
2190
becoming more intermediate in composition with depth.
2200
Photo
Chlorite
Chlorite, wk sericite
Chlorite, wk sericite
Chlorite
FAULTS
G2

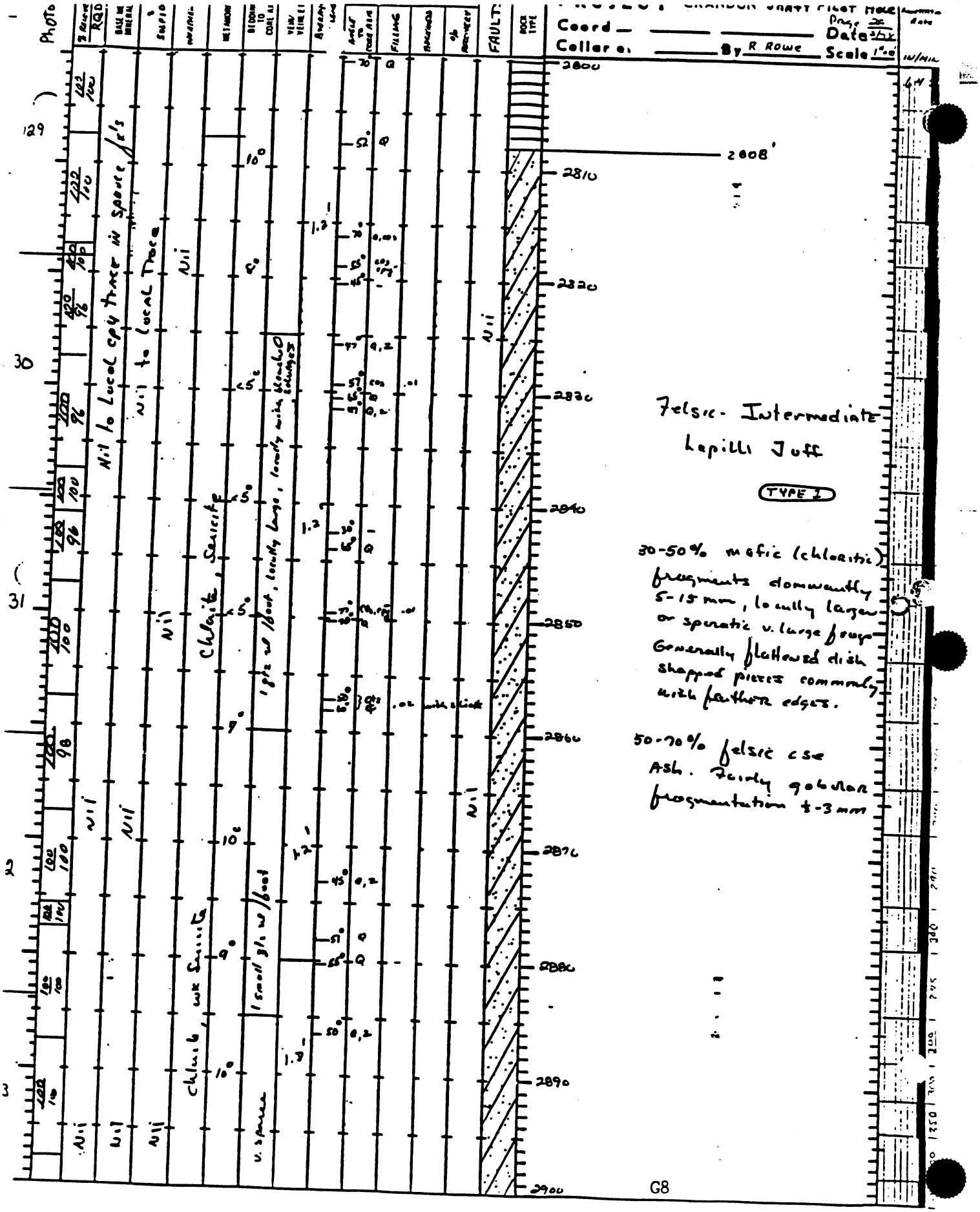

PROJECT CRANDON Shaft Pilot Hole
Coord —
Collar elev —
By R. Rowe
Date —
Scale 1"=10'
FRACTURES
FAULTS
2300
2310
2320
2330
2340
2350
2360
2370
2380
2390
Intermediate Tuff
As described previous page
CaCO3 content Absent below 2330'.
V. gradational
Felsic - Intermediate Tuff
remove Ash
30-60% csa felsic Ash 1-4 mm
10-30% Strongly intermediate Ash 1-2mm range mixed in with above felsic material
20-30% vfg. wispy chloritic Ash.
locally may be considered lapilli Tuff
Photo #
06
07
08
9


PROJECT CRANDON Shaft Pilot Hole
Coord –
Collar elev
By R. Rowe
Page 24
Date 3-93
Scale 1"=10'
FAULTS
2400
2410
2420
2430
2440
2450
2460
2470
2480
2490
2500
Most fo's on this page have slickensides except for A few old fo's @ 2445.8'
Felsic-intermediate Tuff
rare ash as described previous page
Grain size decreasing, and abundant interbedded more intermediate tuff
Below 2470 abundant laminae to 3/16" g/z rich laminae commonly discontinuous w/in contorted (soft sediment deformation?)
Intermediate Tuff
f. grained
well bedded
homogeneous smooth texture
Clouds wk Sericite
a few scattered small g/z xls
Clouds Tr biotite
moderately abund g/z xls
local wk pink
N11
110
111
12
13
4
5


PROJECT CRANDON Shaft Pilot Hole
Page 25
Coord —
Collar el. —
By R Rowe
Date Apr
Scale 1"=10'
FRACTURES
FAULTS
Photo
% Recovery
Rock Type
2500
As above
2510
All fair tight on this page
2520
Felsic Tuff
fine grained
1-2 mm grains
texture
siliceous
2530
intermittent intervals
2540
2550
Note: Bedding Angles
picking up dramatically
(Apparent fleeture
Axis at ~ 2530')
2560
Intermediate Tuff
fine grained suet
"pepper texture" mixture
of chlorite rich with
small amounts of fel
rich.
weakly foliated.
fairly homogeneous
texture
2570
2580
chlor zone. Some
1/8" clay slips
Slump zone ~ 20° to c.a.
2590
tight fols
2600


PROJECT CRANDON Shaft Pilot Hole
Page 35
Coord – ——— ———
Date 2/25
Collar el. ——— By R. Rowe
Scale 1"=10'
Photo
% Recovery RQD
Rock Mineral
% Sulfide
Weathering
Metamorphism
Geologic Contacts
Core Axis
Vein/Veinlets
Fractures
Angle to Core Axis
Filling
Fracture
% Recovery
Faults
Rock Type
2600
2610
2620
2630
2640
2650
2660
2670
2680
2690
2700
Fractures not tight
Intermediate Tuff
As described previous page
tight fr's
WEDGE #11
NO RECOVERY
20
21
22
23
24


PROJECT CRANDON Shaft Pilot Hole
Page 27
Coord —
Date 1/6/95
Collar el. —
By R. Rowe
Scale 1"=10'
FRACTURES
FAULTS
Photo
2700
2710
2720
2730
2740
2750
2760
2770
2780
2790
2800
Pyrite C.g. Alteration
@ 2711 ± wk shist, chl, ser, all d below 2°q/s
STRONG SET (12°-20°) OPEN PY VEINS
.2' CORE LOST, APPARENTLY PYRITE WASHED AWAY. TOTAL LOSS OF CIRCULATION
REPORTED BY DRILLERS.
wk fo joint 3-5 fo/ft
Med grained open space pyrite assoc with otz. Looks like true otz-pyrite vein with no obs. brecciation, faulting evidence.
POSSIBLE ENTIRE ZONE 2715.6' - 2723' MAY BE WATER BEARING
Slip area of thin, ⅛ to ½" itr qtz, tr py vns.
Generally wk altd wkly. Zone at 2715.6 thin ⅛" py vnlt @ 15° to core axis. Cute slip qtz vn wk to foliation at 2720. Py in vnlts has wk specks of included. Poor vnlt to brecciation py. Questionable how much core lost. Bedding at 2713 prob. Slp ± 20° to north dip (Reynolds strike E-W); and py vnlt below striking E-W and dips ± 20° S.: Overall - wk tight fract / vnlts / slip - poss Fox. Note bis fault zone of any consequence
INTERMEDIATE TUFF
AJE Jr 1/6/95
As described
previous pages
2755-2766 Above contact blocky. Amygdaloidal? Flow unit?
Chlorite, wk sericite
2-3 small, discontinuous irregular qtz veinlets
Tr hdr
Clay
1% Py
Nil
G7


Coord —
Collar el:
By R ROWE
Date 2/2/x
Scale 1"=10'
2808'
2800
2810
2820
2830
2840
2850
2860
2870
2880
2890
2900
FAULT
ROCK TYPE
Felsic - Intermediate
Lapilli Tuff
TYPE I
30-50% mafic (chloritic) fragments dominantly 5-15 mm, locally larger or sporatic v. large frags. Generally flattened disk shapped pieces commonly with feather edges.
50-70% felsic ese Ash. Fairly golbular fragmentation ± 3 mm
Nil to Local cpy trace in spots
Nil to Local Trace
Chlorite Sericite
1 pc w/ Boot, locally large, locally with stockwork stringers
Chlorite wk Sericite
1 small pc w/ Boot
v. sparse
Nil

# Appendix H

## Relevant Material from Sonderman (1978)

**(Note: Due to their voluminous nature, the temperature logs referenced in the memorandum are not attached. Tables summarizing the data contained on the logs are included in the *Bedrock Hydrogeology at the Crandon Site* report text.)**

EXXON MINERALS COMPANY, U.S.A.
POST OFFICE BOX 813 · RHINELANDER, WISCONSIN 54501

RECEIVED
APR 14 1978
MINERALS DEPT.

April 11, 1978

File
Permanent Reports
File

MEMORANDUM

TO: J. E. Grimes

FROM: F. J. Sonderman

RE: Temperature Survey - Crandon

Temperature measurements were recorded in ten (10) diamond drill core holes in conjunction with the EDCON survey of the shaft pilot hole (Hole 155).

The holes surveyed (Figure 1) were selected to give a reasonable data point scattering from which a temperature distribution could be projected. A temperature distribution has been plotted on the longitudinal section (Figure 2) showing an extremely regular thermal pattern. Examination of each individual temperature log indicates little, if any, water movement and, therefore, the temperatures are assumed to reflect the thermal conductivity of the surrounding rocks. Hole 139, at depths of 2,040-2,250 and 2,440-2,580, shows evidence of restricted water movement. All other holes show very minor water movement as noted by thermal changes of less than 0.05° F.

Although individual holes show some variation, an average thermal gradient of 0.81° F/100 feet (vertical) has been calculated. There are only insignificant differences in the thermal gradient between hanging wall, ore and foot wall, and there are no differences between areas of stringer and massive mineralization. Plots of these drill holes for each main mine level are attached to this report.

Hole 155: The temperature log for this hole shows a thermal gradient of 0.77° F/100 feet to a depth of 2,650 feet (Figure 3). Between 2,650-2,700 the gradient increases slightly and between 2,700-2,750 the gradient decreases to 0.50° F/100 feet due to the influx of water at approximately 2,715 feet. The net result of the incoming water is the cooling of the thermal column by 0.2° F, and a decrease in the thermal gradient from the 0.77° F/100 feet norm to 0.50°/100 feet below 2,750. However, there is probably little or no change in the actual thermal conductivity of the wall rocks.



AN OPERATING DIVISION OF EXXON COMPANY, U.S.A., A DIVISION OF EXXON CORPORATION

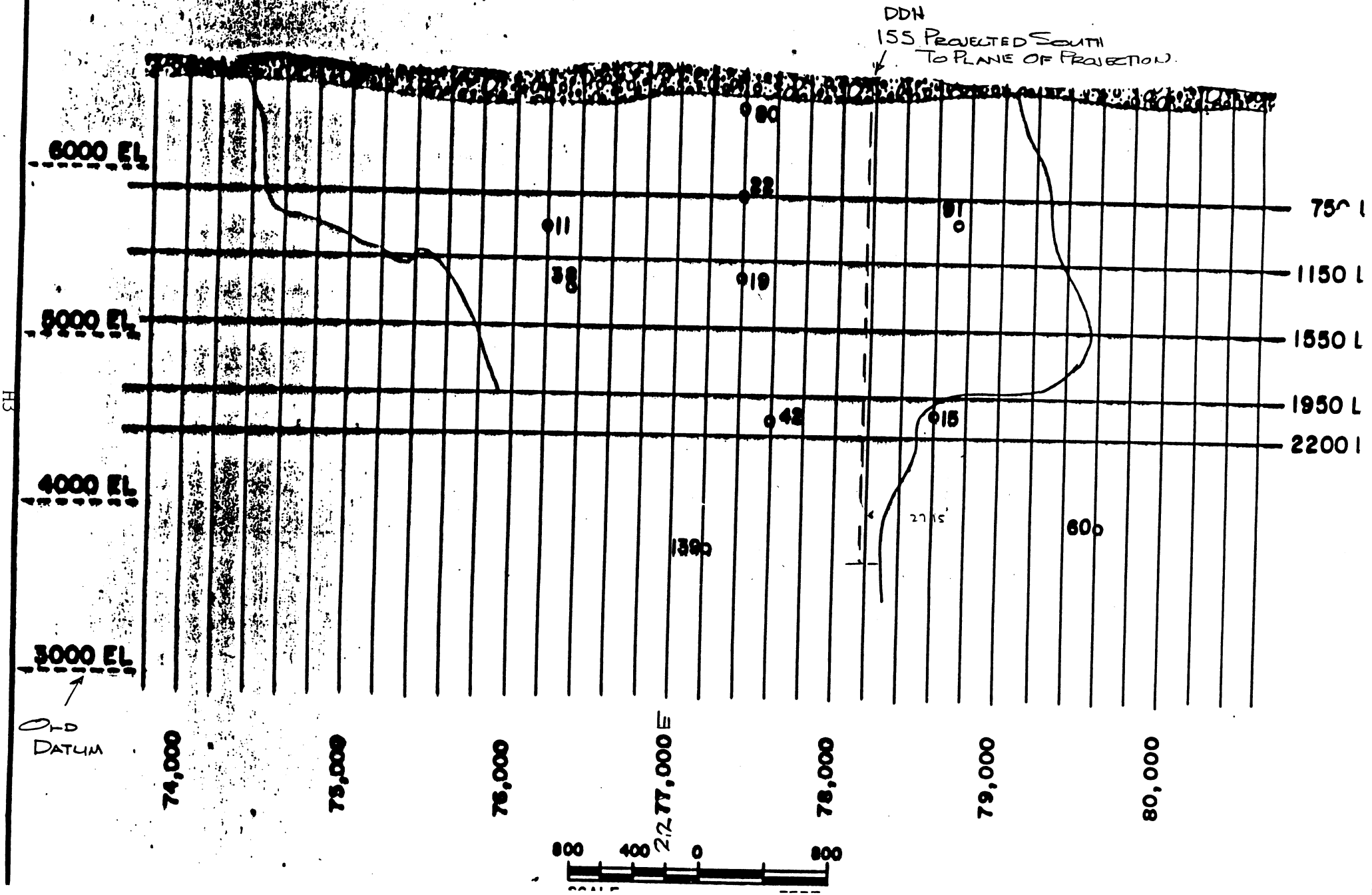
Prints of the EDCON temperature surveys are enclosed for your reference.

Frank J. Sonderman

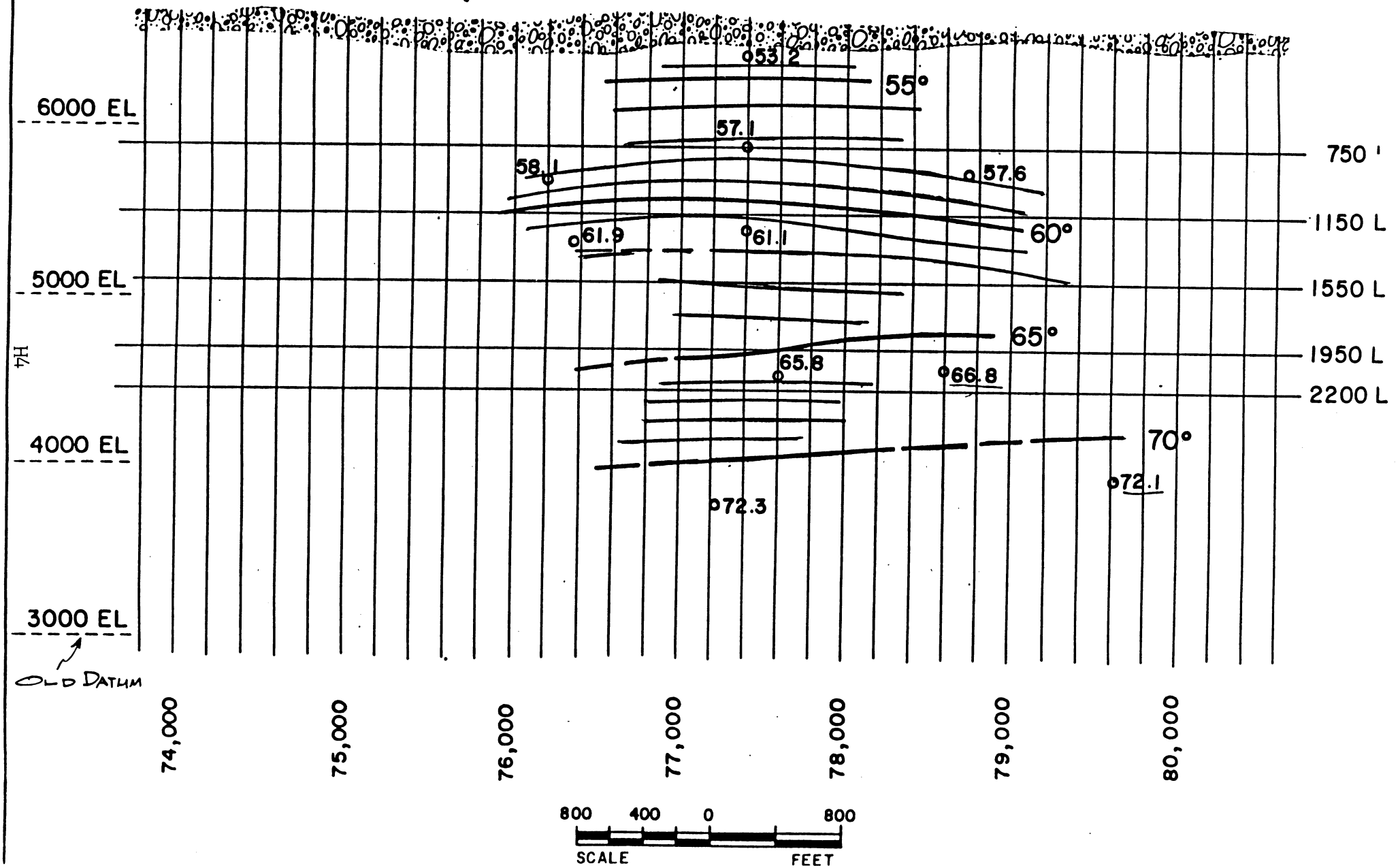
FJS/jfk
Att.

cc: R. L. Bullock
L. D. Hayes
M. K. Lawson
E. R. May
R. L. Russell

# TEMPERATURE SURVEY PROGRAM
# CRANDON MINE



# TEMPERATURE DISTRIBUTION
# CRANDON MINE



BY ... DATE 5-20 SUBJECT DOWN-HOLE TEMPERATURE SHEET NO. ... OF ...
CHKD. BY ... DATE ... SHAFT HOLE 155 JOB NO. AFE 15203
CRANDON MINE

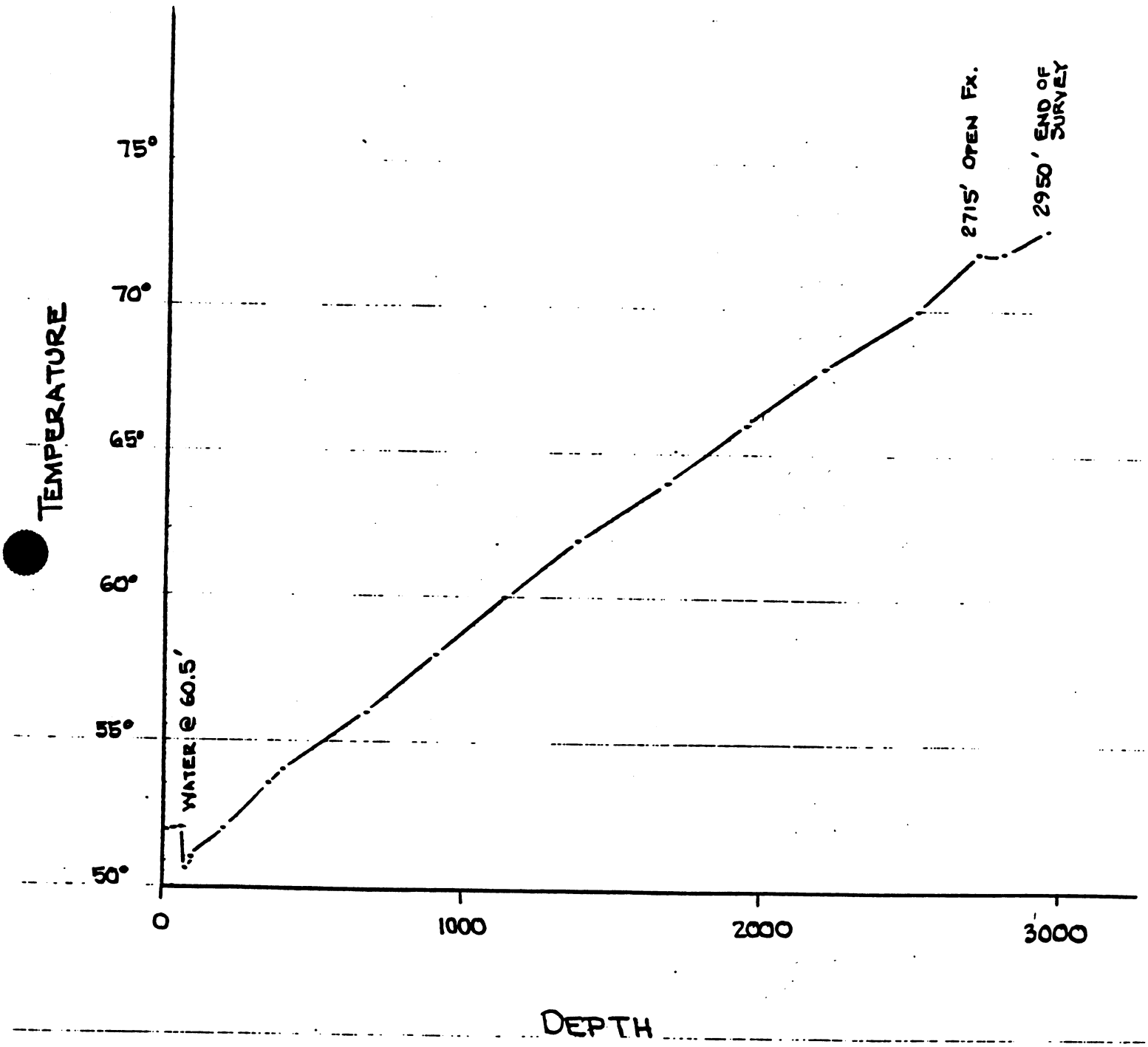





FIGURE 3

# Appendix I

## Bedrock Water Chemistry Data

## Revised April 26, 1995

067

DAMES & MOORE

Route to Pete
copies

1550 NORTHWEST HIGHWAY • PARK RIDGE ILLINOIS 60068 • (312) 297-4120
CABLE: DAVEMORE TELEX 28-3431

July 6, 1978

Exxon Minerals Company, U.S.A.
Post Office Box 326
Crandon, Wisconsin 54520

Attention: Mr. Louis Blair

Gentlemen:

Re: Supplement to Report "Results of Permeability Tests and Analysis of Water Samples for Deep Exploration Holes, Crandon Ore Body, Crandon, Wisconsin", dated April 19, 1978

In accordance to a request by Mr. Frank Sonderman of Exxon Minerals Company, U.S.A., Dames & Moore analyzed additional water samples previously collected under the subject study, and collected water samples from Holes 181, 190, 192 and 194 and had these water samples analyzed. The results of these water analyses are listed in Table 1. The results of this water sampling verifies the existence of brackish water at depth in the bedrock and ore body. The maximum concentration of chlorides was 5,100 milligrams per liter (mg/l) from Hole 192. The chloride concentrations for Holes 181, 190, and 194 were 4850, 30 and 46 mg/l, respectively. The water quality of a particular sample is believed to be dependent upon the depth of the hole and the amount of mixing with water of other quality. This would in turn depend upon the length of open hole, the fractures or permeability patterns of the hole, the amount of foreign water lost in the hole, and the length of the time and amount of water blown from the hole before the sample was collected.

It has been Dames & Moore's pleasure in performing this work for Exxon Minerals Company, U.S.A. If you should have any questions please do not hesitate to contact us.

Very truly yours,

DAMES & MOORE

Dean O. Gregg
Associate

DOG/bh
Enclosure

I1

TABLE 1

RESULTS OF CHEMICAL ANALYSES OF DEEP GROUND WATER SAMPLES

| HOLE NO. | INTERVAL SAMPLES (feet) | SAMPLE DATE TIME | pH | ALKALINITY (mg/l) | CHLORIDES (mg/l) | SODIUM (mg/l) | POTASSIUM (mg/l) | CALCIUM (mg/l) | MAGNESIUM (mg/l) | TOTAL DISSOLVED SOLIDS (mg/l) | $\frac{\text{ANION (me/l)}}{\text{CATION (me/l)}} \times 10$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 155 | 362-3050 | 2/28/78 1315 hr | | | 3700 | | | | | | |
| 155 | 562-3050 | 2/28/78 1559 hr | | | 4200 | | | | | | |
| 155 | 842-3050 | 2/27/78 1700 hr | | | 4000 | | | | | | |
| 155 | 942-3050 | 2/27/78 0715 hr | | | 3600[2] | 1670 | 25.1 | | | | 99.34 |
| 155 | 1042-3050 | 2/26/78 2000 hr | | | 3300 | | | | | | |
| 155 | 1370-3050 | 2/25/78 2010 hr | | | 2900 | | | | | | |
| 155 | 2102-3050 | 2/25/78 0755 hr | | | 2550 | | | | | | |
| 155 | 2202-2214 | 2/23/78 2035 hr | | | 2200[2] | 1060 | 18.8 | | | | 96.98 |
| 155 | 2712-2725 | 2/24/78 0835 hr | | | 2250 | | | | | | |
| 155 | 2710-3050 | 2/22/78 1540 hr | | | 2100 | | | | | | |
| 165 | 2920-2971 | 2/18/78 0128 hr | | | 2650[2] | 1090 | 18.8 | | | | 84.01 |
| 165 | 2300-2971 | 2/19/78 2030 hr | | | 1900 | | | | | | |
| 181 | 1900-3405[3] | 5/02/78 0600 hr | 6.97 | 48.0 | 4850 | 1810 | 33.5 | 850 | 221 | | 98.24 |
| 190 | 1700-2244[a] | 5/18/78 1100 hr | 7.97 | 104.0 | 30 | 15.7 | 3.12 | 36.2 | 22.4 | 250 | |
| 192 | 2300-3219[a] | 4/28/78 1030 hr | 6.99 | 112.0 | 5100 | 2450 | 50.5 | 1060 | 298 | | 78.83[1] |
| 194 | 800-1584[3] | 5/17/78 | 7.83 | 200.0 | 46 | 21.4 | 3.33 | 34.2 | 20.1 | 234 | |

[a] Revised by SVD1 per AJE Jr. Intervals for Holes 190 and 192 were reversed.

[1] Abnormally high cation because of unfilterable brown sediment which went into solution during digestion.
[2] Analyses included in April 19, 1978 report but included here for convenience.
[3] As per Paul Zimmer, Exxon Minerals Company, U.S.A., July 5, 1978 oral communication.

# AQUALAB INC.



ANALYTICAL REPORT

1 June 1978

DAMES & MOORE
1550 Northwest Highway
Park Ridge, IL 60068

Attn: Mr. Dean Gregg

ANALYSIS NO:

28768, 28769, 28770
28771, 28772, 28774
28775, 28776, 28777
28778, 28842, 28843
31252, 31253

SAMPLE DESCRIPTION: Special Groundwater Project; 8837-069

DATE TAKEN: | DATE RECEIVED: | DATE ANALYZED:

| Analysis # | Date Taken | Date Received | Date Analyzed | Description |
|---|---|---|---|---|
| 28768 | 2/27/78 1700 | 3/2/78 | 4/26/78 | Hole 155 at 842' |
| 28769 | 2/27/78 1700 | 3/2/78 | 4/26/78 | Hole 155 at 942' |
| 28770 | 2/26/78 2000 | 3/2/78 | 4/26/78 | Hole 155 at 1042' |
| 28771 | 2/25/78 2010 | 3/2/78 | 4/26/78 | Hole 155 at 1370' |
| 28772 | 2/25/78 0755 | 3/2/78 | 4/26/78 | Hole 155 below 210 |
| 28774 | 2/23/78 2035 | 3/2/78 | 4/26/78 | Hole 155 @ 2202-22 |
| 28775 | 2/24/78 0835 | 3/2/78 | 4/26/78 | Hole 155 @ 2712-27 |
| 28776 | 2/22/78 1540 | 3/2/78 | 4/26/78 | Hole 155 at 2710' |
| 28777 | 2/18/78 0128 | 3/2/78 | 4/26/78 | Hole 165 at 2920' |
| 28778 | 2/19/78 2030 | 3/2/78 | 4/26/78 | Hole 165 at 2300' |
| 28842 | 2/28/78 1315 | 3/2/78 | 4/26/78 | Hole 155 at 362' |
| 28843 | 2/28/78 1559 | 3/2/78 | 4/26/78 | Hole 155 at 562' |
| 31252 | 5/2/78 0600 | 5/2/78 | 5/3/78 | Deep Hole 181 |
| 31253 | 4/28/78 1030 | 5/2/78 | 5/3/78 | Deep Hole 192 |

Stan Jaworski

# AQUALAB INC.

ANALYTICAL REPORT

12 May 1978

ANALYSIS NO:

DAMES & MOORE
1550 Northwest Highway
Park Ridge, IL 60068

Attn: Mr. Dean Gregg

SAMPLE DESCRIPTION: Special Groundwater Project; 8837-069

| DATE TAKEN: | DATE RECEIVED: | DATE ANALYZED: |
|---|---|---|
| | | |

| Analysis No. | Chloride mg/1 | Sodium mg/1 | Potassium mg/1 | Anions (me/1) / Cations (me/1) |
|---|---|---|---|---|
| 28768 | 4000. | --- | --- | --- |
| 28769 | --- | 1670. | 25.8 | 99.34% |
| 28770 | 3300. | --- | --- | --- |
| 28771 | 2900. | --- | --- | --- |
| 28772 | 2550. | --- | --- | --- |
| 28774 | --- | 1060. | 18.8. | 96.98% |
| 28775 | 2250. | --- | --- | --- |
| 28776 | 2100. | --- | --- | --- |
| 28777 | --- | 1090. | 18.8 | 84.01% |
| 28778 | 1900. | --- | --- | --- |
| 28842 | 3700. | --- | --- | --- |
| 28843 | 4200. | --- | --- | --- |

Stan Jaworski

# AQUALAB INC.

## ANALYTICAL REPORT

15 May 1978

ANALYSIS NO:

DAMES & MOORE
1550 Northwest Highway
Park Ridge, IL 60068

Attn: Mr. Dean Gregg

SAMPLE DESCRIPTION: Special Groundwater Project; 8837-069

| DATE TAKEN: | DATE RECEIVED: | DATE ANALYZED: |
|---|---|---|
| | | |

| | | 31252 | 31253 |
|---|---|---|---|
| pH | @ 25°C | 6.97 | 6.99 |
| Alkalinity | mg/1 | 48. | 112. |
| Magnesium | mg/1 | 221. | 298. |
| Sodium | mg/1 | 1810. | 2450. |
| Potassium | mg/1 | 33.5 | 50.5 |
| Chloride | mg/1 | 4850. | 5100. |
| Calcium | mg/1 | 850. | 1,060. |

$$\frac{\text{Anions (me/1)}}{\text{Cations (me/1)}}$$

31252 = 98.24%
31253 = 78.83%

Stan Jaworski

AQUA-AIR INC.

ANALYTICAL REPORT

30 March 1978

ANALYSIS NO: 28835
Location: Hole 66
402' - 1079

DAMES & MOORE
1550 Northwest Highway
Park Ridge, IL 60068

Attn: Mr. Dean Gregg

P.O. # CH 2(

SAMPLE DESCRIPTION: Exxon: Special Groundwater Project; 8837-069

| DATE TAKEN | DATE RECEIVED | DATE ANALYZED |
|---|---|---|
| 3/2/78 2413 | 3/6/78 | 3/20/78 |

| | | | | | |
|---|---|---|---|---|---|
| pH | 8.11 | @ 25°C | Cadmium | <0.001 | mg/l |
| Alkalinity | 142. | mg/l | Copper | 0.015 | mg/l |
| Hardness | 175. | mg/l | Arsenic | 0.017 | mg/l |
| Solids, totdiss | 198. | mg/l | Aluminum | 0.07 | mg/l |
| Conductivity | 289. | umhos | Chromium | <0.001 | mg/l |
| Nitrogen, nitrate | 0.34 | mg/l | Cobalt | 0.01 | mg/l |
| Phosphorus | 0.01 | mg/l | Lead | 0.03 | mg/l |
| Chloride | 2. | mg/l | Mercury | <0.0001 | mg/l |
| Sulfate | 18. | mg/l | Molybdenum | <0.01 | mg/l |
| Iron | 0.02 | mg/l | Nickel | 0.01 | mg/l |
| Manganese | 0.121 | mg/l | Selenium | 0.016 | mg/l |
| Magnesium | 19.3 | mg/l | Calcium | 38.6 | mg/l |
| Zinc | 0.042 | mg/l | Cyanide | <0.001 | mg/l |
| | | | Thallium | <0.25 | mg/l |

Stan S Jaworski

RTE. 20 AT VALLEY LANE • STREAMWOOD, ILLINOIS 60103 • 312•289-3100

AQUALAB INC.

ANALYTICAL REPORT

30 March 1978

ANALYSIS NO: 28836
Location: Hole 70
302'- 1334

DAMES & MOORE
1550 Northwest Highway
Park Ridge, IL 60068

Attn: Mr. Dean Gregg

P.O. # CH 2

SAMPLE DESCRIPTION: Exxon: Special Groundwater Project; 8837-069

| DATE TAKEN | DATE RECEIVED | DATE ANALYZED |
|---|---|---|
| 3/5/78 0615 | 3/6/78 | 3/20/78 |

| | | | | | |
|---|---|---|---|---|---|
| pH | 7.83 | @ 25°C | Cadmium | 0.003 | mg/1 |
| Alkalinity | 156. | mg/1 | Copper | 0.001 | mg/1 |
| Hardness | 193. | mg/1 | Arsenic | 0.004 | mg/1 |
| Solids, totdiss | 188. | mg/1 | Aluminum | 0.10 | mg/1 |
| Conductivity | 295. | umhos | Chromium | <0.001 | mg/1 |
| Nitrogen, nitrate | 0.24 | mg/1 | Cobalt | <0.01 | mg/1 |
| Phosphorus | 0.01 | mg/1 | Lead | 0.03 | mg/1 |
| Chloride | 6. | mg/1 | Mercury | <0.0001 | mg/1 |
| Sulfate | 8. | mg/1 | Molybdenum | <0.01 | mg/1 |
| Iron | 0.03 | mg/1 | Nickel | 0.01 | mg/1 |
| Manganese | 0.090 | mg/1 | Selenium | 0.007 | mg/1 |
| Magnesium | 22.8 | mg/1 | Calcium | 39.5 | mg/1 |
| Zinc | 0.045 | mg/1 | Cyanide | <0.001 | mg/1 |
| | | | Thallium | <0.25 | mg/1 |

Glen S Jaworski

AQUALAB INC.

ANALYTICAL REPORT

30 March 1978

ANALYSIS NO: 28837
Location: Hole 70
552'–133'

DAMES & MOORE
1550 Northwest Highway
Park Ridge, IL 60068

Attn: Mr. Dean Gregg

P.O. # CH 2(

SAMPLE DESCRIPTION: Exxon: Special Groundwater Project; 8837-069

| DATE TAKEN | DATE RECEIVED | DATE ANALYZED |
|---|---|---|
| 3/4/78 2245 | 3/6/78 | 3/20/78 |

| | | | | | |
|---|---|---|---|---|---|
| pH | 7.98 | @ 25°C | Cadmium | 0.009 | mg/1 |
| Alkalinity | 160. | mg/1 | Copper | 0.006 | mg/1 |
| Hardness | 194. | mg/1 | Arsenic | 0.008 | mg/1 |
| Solids, totdiss | 170. | mg/1 | Aluminum | <0.01 | mg/1 |
| Conductivity | 312. | umhos | Chromium | <0.001 | mg/1 |
| Nitrogen, nitrate | 0.15 | mg/1 | Cobalt | <0.01 | mg/1 |
| Phosphorus | 0.08 | mg/1 | Lead | <0.01 | mg/1 |
| Chloride | 8. | mg/1 | Mercury | <0.0001 | mg/1 |
| Sulfate | 16. | mg/1 | Molybdenum | <0.01 | mg/1 |
| Iron | 0.02 | mg/1 | Nickel | 0.01 | mg/1 |
| Manganese | 0.119 | mg/1 | Selenium | 0.009 | mg/1 |
| Magnesium | 23.4 | mg/1 | Calcium | 39.1 | mg/1 |
| Zinc | 0.062 | mg/1 | Cyanide | <0.001 | mg/1 |
| | | | Thallium | <0.25 | mg/1 |

Stan S Jaworski

AQUATRONICS

ANALYTICAL REPORT

30 March 1978

DAMES & MOORE
1550 Northwest Highway
Park Ridge, IL 60068

Attn: Mr. Dean Gregg

ANALYSIS NO: 28837QA *
Location: Hole 70
552'-1334'

P.O. # CH 26

SAMPLE DESCRIPTION: Exxon: Special Groundwater Project; 8837-069

| DATE TAKEN | DATE RECEIVED | DATE ANALYZED |
|---|---|---|
| 3/4/78 2245 | 3/6/78 | 3/20/78 |

| | | | | | |
|---|---|---|---|---|---|
| pH | 7.99 | @ 25°C | Cadmium | 0.008 | mg/l |
| Alkalinity | 160. | mg/l | Copper | 0.005 | mg/l |
| Hardness | 194. | mg/l | Arsenic | 0.009 | mg/l |
| Solids, totdiss | 178. | mg/l | Aluminum | <0.01 | mg/l |
| Conductivity | 310. | umhos | Chromium | <0.001 | mg/l |
| Nitrogen, nitrate | 0.15 | mg/l | Cobalt | <0.01 | mg/l |
| Phosphorus | 0.08 | mg/l | Lead | <0.01 | mg/l |
| Chloride | 8. | mg/l | Mercury | <0.0001 | mg/l |
| Sulfate | 15. | mg/l | Molybdenum | <0.01 | mg/l |
| Iron | 0.02 | mg/l | Nickel | 0.01 | mg/l |
| Manganese | 0.120 | mg/l | Selenium | 0.009 | mg/l |
| Magnesium | 23.4 | mg/l | Calcium | 39.2 | mg/l |
| Zinc | 0.060 | mg/l | Cyanide | <0.001 | mg/l |
| | | | Thallium | <0.25 | mg/l |

* Quality assurance duplicate sample

Glen S Jaworski

AQUA-AIR INC.

ANALYTICAL REPORT

30 March 1978

ANALYSIS NO: 23338
Location: Hole 77
602-1049

DAMES & MOORE
1550 Northwest Highway
Park Ridge, IL 60068

Attn: Mr. Dean Gregg

P.O. # CH 2(

SAMPLE DESCRIPTION: Exxon: Special Groundwater Project; 8837-069

| DATE TAKEN | DATE RECEIVED | DATE ANALYZED |
|---|---|---|
| 3/1/78 1940 | 3/6/78 | 3/20/78 |

| | | | | | |
|---|---|---|---|---|---|
| pH | 7.75 | @ 25°C | Cadmium | 0.004 | mg/1 |
| Alkalinity | 134. | mg/1 | Copper | 0.003 | mg/1 |
| Hardness | 170. | mg/1 | Arsenic | <0.001 | mg/1 |
| Solids, totdiss | 170. | mg/1 | Aluminum | 0.11 | mg/1 |
| Conductivity | 298. | umhos | Chromium | <0.001 | mg/1 |
| Nitrogen, nitrate | <0.05 | mg/1 | Cobalt | <0.01 | mg/1 |
| Phosphorus | 0.01 | mg/1 | Lead | 0.04 | mg/1 |
| Chloride | 20. | mg/1 | Mercury | <0.0001 | mg/1 |
| Sulfate | 2. | mg/1 | Molybdenum | <0.01 | mg/1 |
| Iron | 0.02 | mg/1 | Nickel | <0.01 | mg/1 |
| Manganese | 0.102 | mg/1 | Selenium | <0.001 | mg/1 |
| Magnesium | 20.5 | mg/1 | Calcium | 34.6 | mg/1 |
| Zinc | 0.041 | mg/1 | Cyanide | <0.001 | mg/1 |
| | | | Thallium | <0.25 | mg/1 |

Glen S Jaworski

AQUALAB INC.

ANALYTICAL REPORT

30 March 1978

DAMES & MOORE
1550 Northwest Highway
Park Ridge, IL 60068

Attn: Mr. Dean Gregg

ANALYSIS NO: 28841
Location: Hole 91
852' - 1415'

P.O. # CH 2

SAMPLE DESCRIPTION: Exxon: Special Groundwater Project; 8837-069

| DATE TAKEN | DATE RECEIVED | DATE ANALYZED |
|---|---|---|
| 3/6/78 0405 | 3/6/78 | 3/20/78 |

| | | | | | |
|---|---|---|---|---|---|
| pH | 8.12 | @ 25°C | Cadmium | <0.001 | mg/l |
| Alkalinity | 164. | mg/l | Copper | <0.001 | mg/l |
| Hardness | 196. | mg/l | Arsenic | 0.012 | mg/l |
| Solids, totdiss | 164. | mg/l | Aluminum | 0.02 | mg/l |
| Conductivity | 313. | umhos | Chromium | <0.001 | mg/l |
| Nitrogen, nitrate | 0.15 | mg/l | Cobalt | <0.01 | mg/l |
| Phosphorus | 0.05 | mg/l | Lead | 0.03 | mg/l |
| Chloride | 12. | mg/l | Mercury | <0.0001 | mg/l |
| Sulfate | 5. | mg/l | Molybdenum | <0.01 | mg/l |
| Iron | 0.03 | mg/l | Nickel | 0.01 | mg/l |
| Manganese | 0.146 | mg/l | Selenium | 0.001 | mg/l |
| Magnesium | 22.0 | mg/l | Calcium | 42.2 | mg/l |
| Zinc | 0.048 | mg/l | Cyanide | <0.001 | mg/l |
| | | | Thallium | <0.25 | mg/l |

Stan S Jaworski

AQUA-AIR INC.

ANALYTICAL REPORT

30 March 1978

DAMES & MOORE
1550 Northwest Highway
Park Ridge, IL 60068

Attn: Mr. Dean Gregg

ANALYSIS NO: 28769
Location: Hole 155
942'- 3050'

P.O. # CH 2(

SAMPLE DESCRIPTION: Exxon: Special Groundwater Project; 8837-069

| DATE TAKEN: | DATE RECEIVED: | DATE ANALYZED: |
|---|---|---|
| 2/27/78 1700 | 3/2/78 | 3/20/78 |

| | | | | | |
|---|---|---|---|---|---|
| pH | 7.27 | @ 25°C | Cadmium | 0.012 | mg/1 |
| Alkalinity | 80. | mg/1 | Copper | 0.006 | mg/1 |
| Hardness | 1,532. | mg/1 | Arsenic | <0.001 | mg/1 |
| Solids, totdiss | 6,112. | mg/1 | Aluminum | 0.14 | mg/1 |
| Conductivity | 10,000. | umhos | Chromium | 0.003 | mg/1 |
| Nitrogen, nitrate | <0.05 | mg/1 | Cobalt | 0.02 | mg/1 |
| Phosphorus | 0.01 | mg/1 | Lead | 0.03 | mg/1 |
| Chloride | 3,600. | mg/1 | Mercury | 0.0042 | mg/1 |
| Sulfate | 8. | mg/1 | Molybdenum | <0.01 | mg/1 |
| Iron | 1.15 | mg/1 | Nickel | 0.05 | mg/1 |
| Manganese | 0.526 | mg/1 | Selenium | <0.001 | mg/1 |
| Magnesium | 127. | mg/1 | Calcium | 404. | mg/1 |
| Zinc | 0.144 | mg/1 | Cyanide | <0.001 | mg/1 |
| | | | Thallium | <0.25 | mg/1 |

Stan S Jaworski

AQUALAB INC.

ANALYTICAL REPORT

30 March 1978

DAMES & MOORE
1550 Northwest Highway
Park Ridge, IL 60068

Attn: Mr. Dean Gregg

ANALYSIS NO: 28774
Location: Hole 155
2202-2215'

P.O. # CH 2(

SAMPLE DESCRIPTION: Exxon: Special Groundwater Project; 8837-069

| DATE TAKEN | DATE RECEIVED | DATE ANALYZED |
|---|---|---|
| 2/23/78 2035 | 3/2/78 | 3/20/78 |

| | | | | | |
|---|---|---|---|---|---|
| pH | 7.36 | @ 25°C | Cadmium | 0.007 | mg/1 |
| Alkalinity | 86. | mg/1 | Copper | 0.004 | mg/1 |
| Hardness | 961. | mg/1 | Arsenic | <0.001 | mg/1 |
| Solids, totdiss | 3,524. | mg/1 | Aluminum | 0.48 | mg/1 |
| Conductivity | 6,500. | umhos | Chromium | 0.010 | mg/1 |
| Nitrogen, nitrate | 2.29 | mg/1 | Cobalt | <0.01 | mg/1 |
| Phosphorus | 0.06 | mg/1 | Lead | 0.10 | mg/1 |
| Chloride | 2,200. | mg/1 | Mercury | <0.0001 | mg/1 |
| Sulfate | 5. | mg/1 | Molybdenum | <0.01 | mg/1 |
| Iron | 2.36 | mg/1 | Nickel | 0.05 | mg/1 |
| Manganese | 0.421 | mg/1 | Selenium | <0.001 | mg/1 |
| Magnesium | 75.0 | mg/1 | Calcium | 261. | mg/1 |
| Zinc | 0.051 | mg/1 | Cyanide | <0.001 | mg/1 |
| | | | Thallium | <0.25 | mg/1 |

Glen S Jaworski

RTE. 20 AT VALLEY LANE • STREAMWOOD ILLINOIS 60103 • 312•289-3100

AQUA-ABLE

ANALYTICAL REPORT

30 March 1978

ANALYSIS NO: 28777
Location: Hole 165
2920'-2971'

DAMES & MOORE
1550 Northwest Highway
Park Ridge, IL 60068

Attn: Mr. Dean Gregg

P.O. # CH 2

SAMPLE DESCRIPTION: Exxon: Special Groundwater Project; 8837-069

| DATE TAKEN | DATE RECEIVED | DATE ANALYZED |
|---|---|---|
| 2/18/78 0128 | 3/2/78 | 3/20/78 |

| | | | | | |
|---|---|---|---|---|---|
| pH | 5.89 | @ 25°C | Cadmium | 0.027 | mg/1 |
| Alkalinity | 12. | mg/1 | Copper | 0.269 | mg/1 |
| Hardness | 1930. | mg/1 | Arsenic | 0.004 | mg/1 |
| Solids, totdiss | 5,194. | mg/1 | Aluminum | 5.86 | mg/1 |
| Conductivity | 7,200. | umhos | Chromium | 0.018 | mg/1 |
| Nitrogen, nitrate | <0.05 | mg/1 | Cobalt | 0.04 | mg/1 |
| Phosphorus | 0.02 | mg/1 | Lead | 0.39 | mg/1 |
| Chloride | 2650. | mg/1 | Mercury | 0.0003 | mg/1 |
| Sulfate | <1. | mg/1 | Molybdenum | 0.02 | mg/1 |
| Iron | 77. | mg/1 | Nickel | 0.34 | mg/1 |
| Manganese | 0.306 | mg/1 | Selenium | <0.001 | mg/1 |
| Magnesium | 185. | mg/1 | Calcium | 468. | mg/1 |
| Zinc | 1.46 | mg/1 | Cyanide | 0.003 | mg/1 |
| | | | Thallium | <0.25 | mg/1 |

Glen S Jaworski

# AQUALAB INC.

ANALYTICAL REPORT

12 June 1978

DAMES & MOORE
1550 Northwest Highway
Park Ridge, IL 60068

ANALYSIS NO:
32177
32178

Attn: Mr. Dean Gregg

SAMPLE DESCRIPTION: 32177 deep well 190 32178 deep well 194

| DATE TAKEN: | DATE RECEIVED: | DATE ANALYZED: |
|---|---|---|

| Analysis # | Date Taken | Date Received | Description |
|---|---|---|---|
| 32177 | 5/18/78 1100 | 5/23/78 1630 | deep well 190 |
| 32178 | 5/17/78 1500 | 5/23/78 1630 | deep well 194 |

| | | 32177 | 32178 |
|---|---|---|---|
| Alkalinity | mg/1 | 104 | 200 |
| Calcium | mg/1 | 36.2 | 34.2 |
| Chloride | mg/1 | 30 | 46 |
| Magnesium | mg/1 | 22.4 | 20.1 |
| pH | @25°C | 7.97 | 7.83 |
| Potassium | mg/1 | 3.12 | 3.33 |
| Sodium | mg/1 | 15.7 | 21.4 |
| Solids, totdiss | mg/1 | 250 | 234 |

RTE. 20 AT VALLEY LANE • STREAMWOOD, ILLINOIS 60103 • 312 • 289-3100

# Appendix J

# Water Well Inventory

KEY:

- MAP DESIGNATION OF USGS WELL LOG
- STREAM
- BLACKTOP ROAD

ORE BODY

BASE MAP REFERENCE:

PORTIONS OF THE FOLLOWING U.S.G.S. 7.5 MINUTE SERIES TOPOGRAPHIC QUADRANGLES:

NASHVILLE, WISCONSIN, 1965
CRANDON, WISCONSIN, 1965
LAKE LUCERNE, WISCONSIN, 1965
POST LAKE, WISCONSIN, 1973
MOLE LAKE, WISCONSIN, 1973
ROBERTS LAKE, WISCONSIN, 1973

1 MILE
1000 0 1000 3000 5000 7000 FEET
1 KILOMETER

EXXON MINERALS COMPANY
CRANDON PROJECT

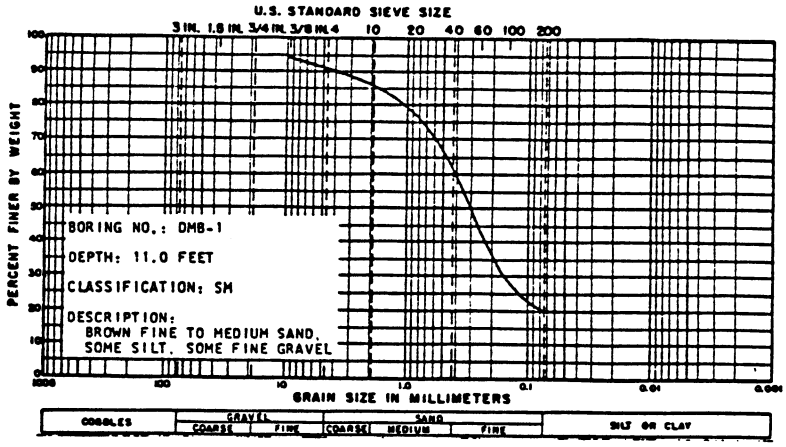
LOCATIONS OF WATER WELLS
IN THE ENVIRONMENTAL STUDY AREA

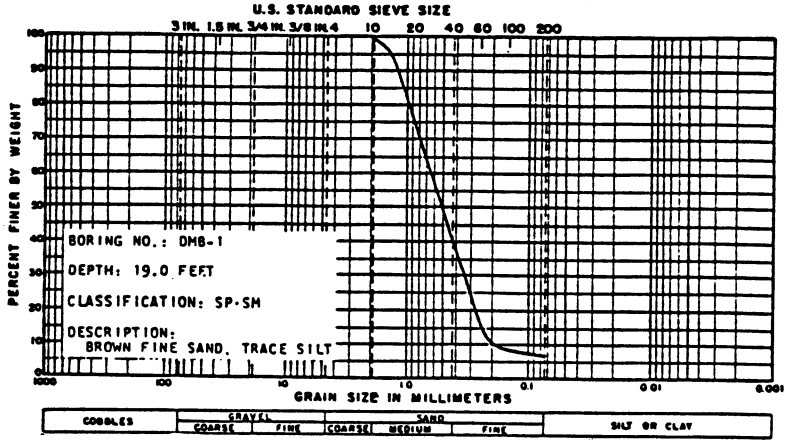
DAMES & MOORE

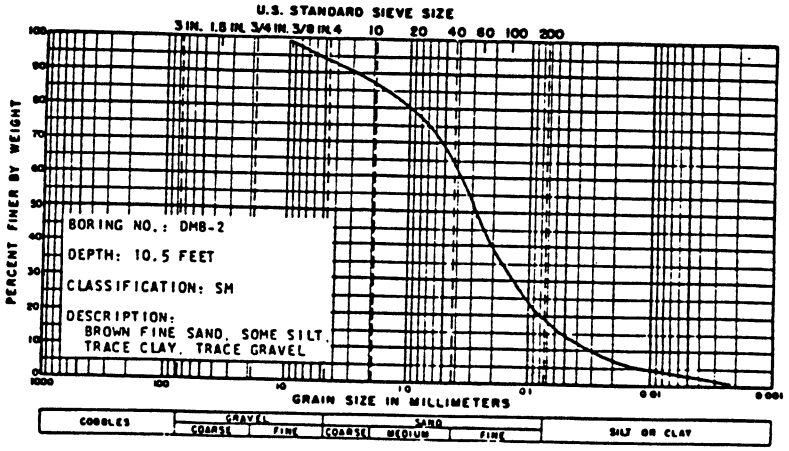
FIG. 2.3-11

# Appendix 3.5-16

## Grain Size Curves from 1977-79 Dames & Moore "DM" Series Borings



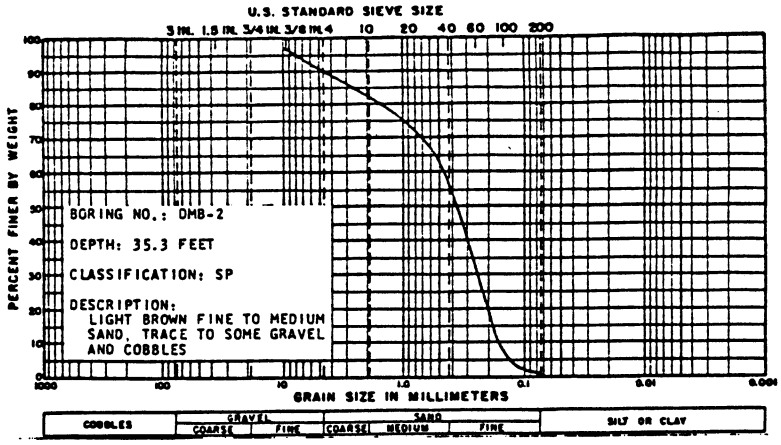



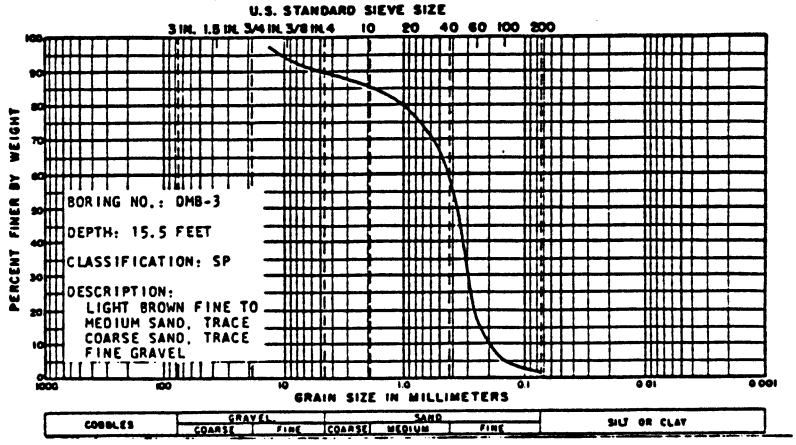



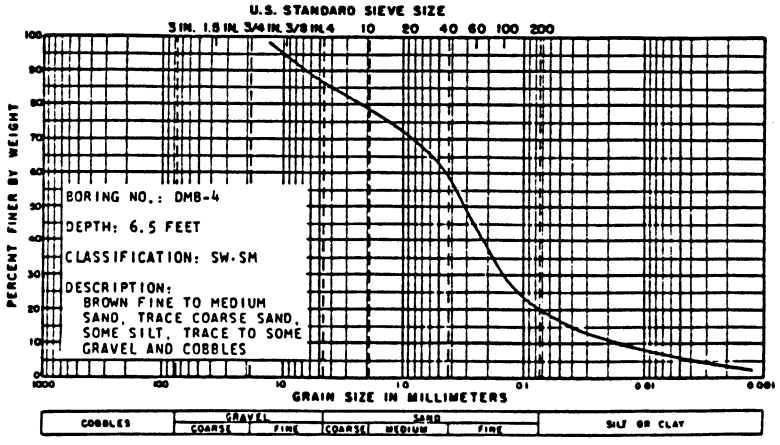

EXXON MINERALS COMPANY, U.S.A.
CRANDON PROJECT

PARTICLE SIZE ANALYSES

DAMES & MOORE | FIGURE A-1



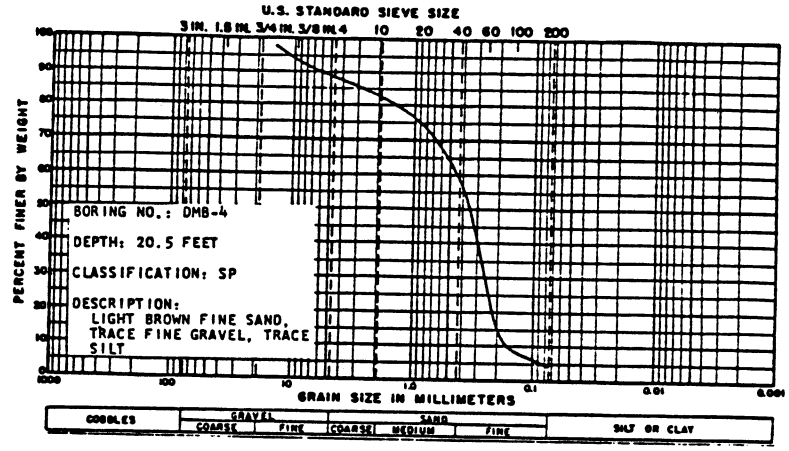



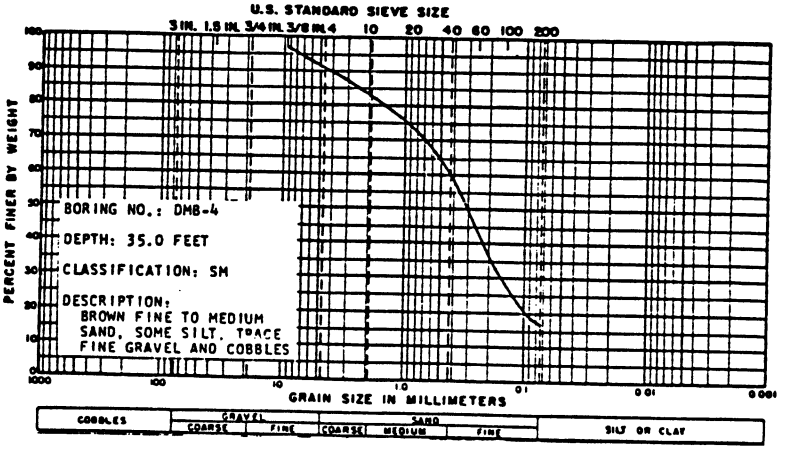



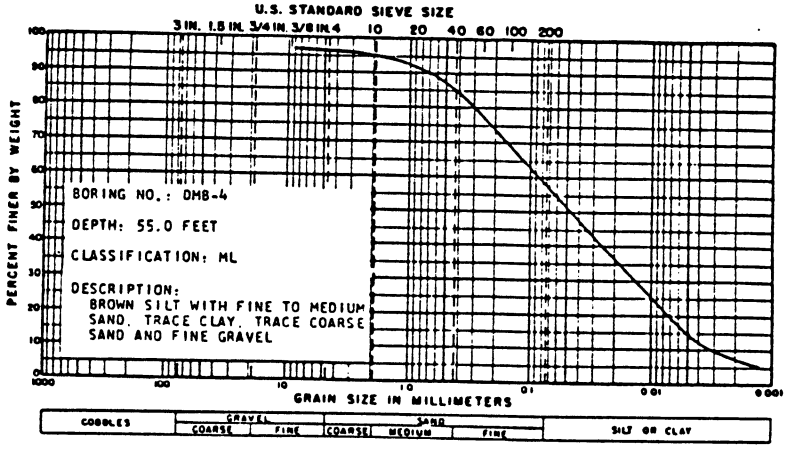

EXXON MINERALS COMPANY, U.S.A.
CRANDON PROJECT

PARTICLE SIZE ANALYSES

DAMES & MOORE | FIGURE A-2



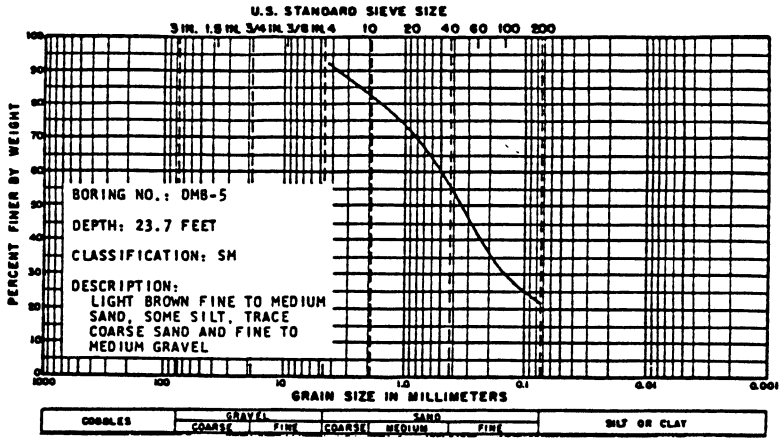



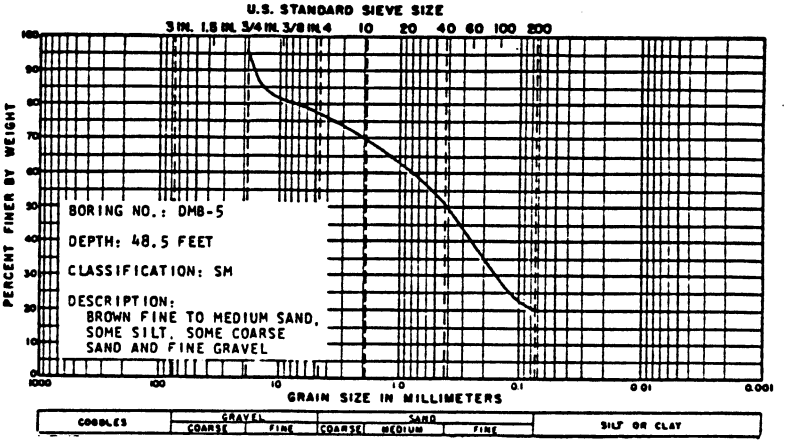



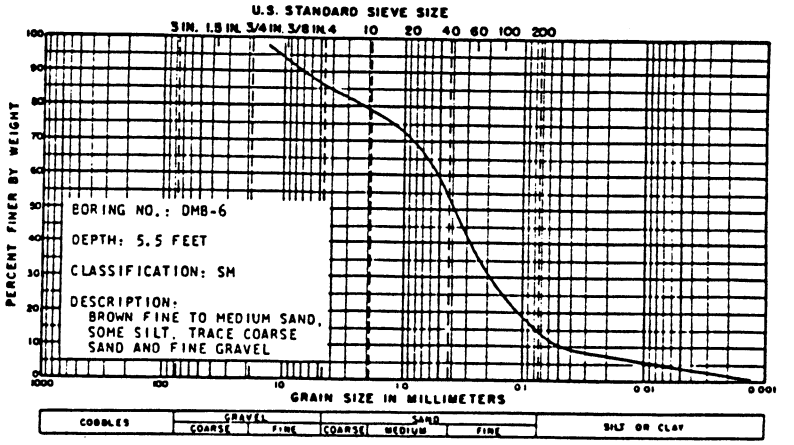

EXXON MINERALS COMPANY, U.S.A.
CRANDON PROJECT

PARTICLE SIZE ANALYSES

DAMES & MOORE | FIGURE A-3



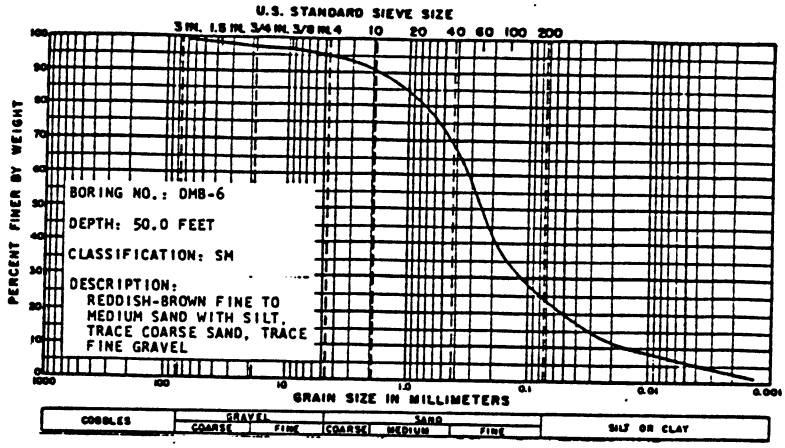



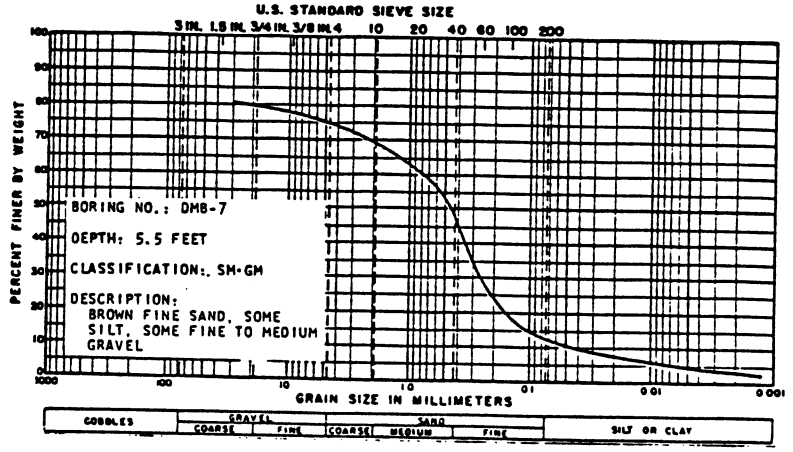



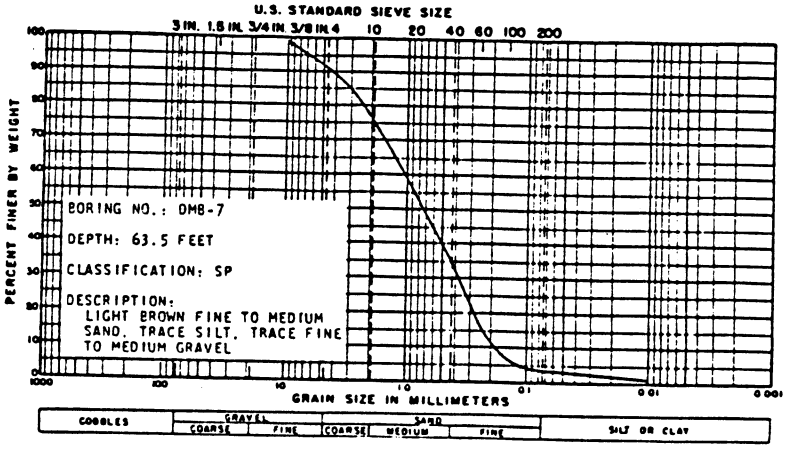

EXXON MINERALS COMPANY, U.S.A.
CRANDON PROJECT

PARTICLE SIZE ANALYSES

DAMES & MOORE | FIGURE A-4



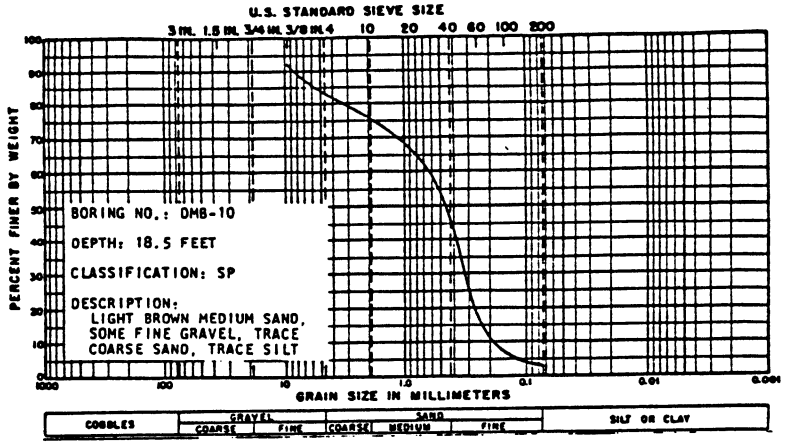



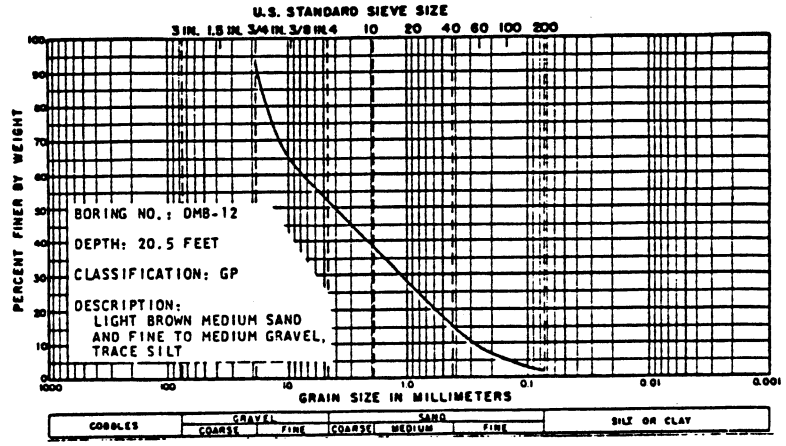



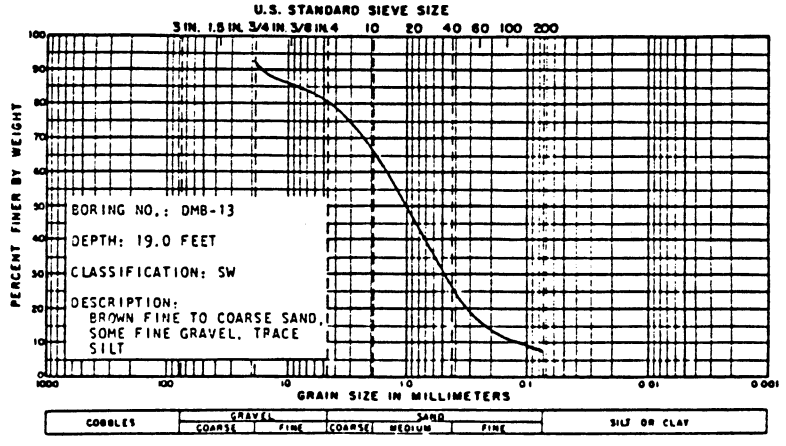

EXXON MINERALS COMPANY, U.S.A.
CRANDON PROJECT

PARTICLE SIZE ANALYSES

DAMES & MOORE | FIGURE A-5



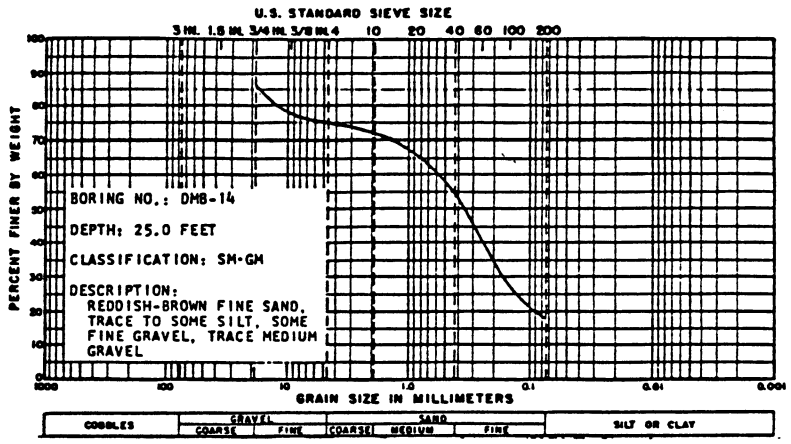



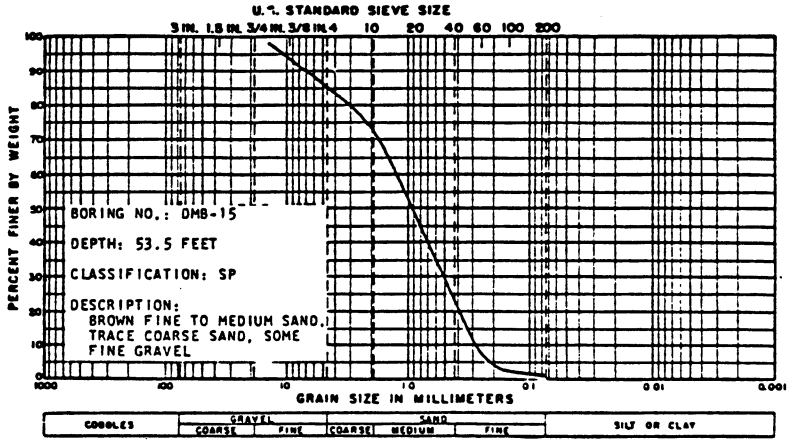



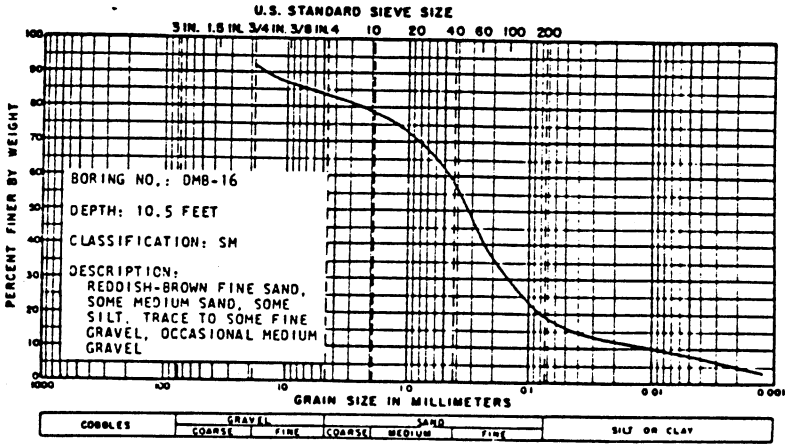

EXXON MINERALS COMPANY, U.S.A.
CRANDON PROJECT

PARTICLE SIZE ANALYSES

DAMES & MOORE | FIGURE A-6



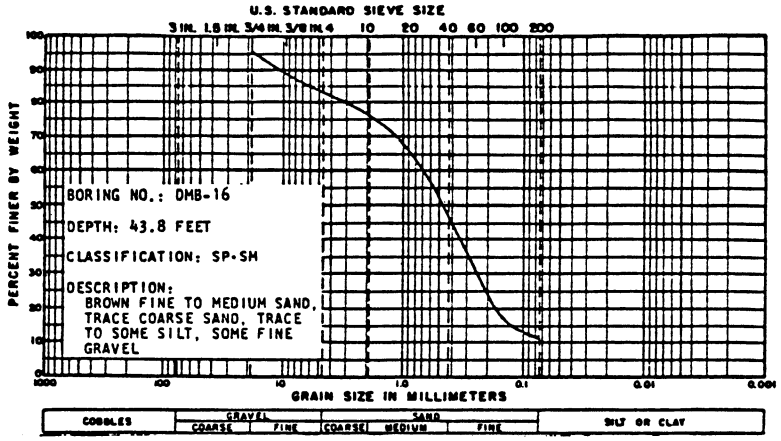



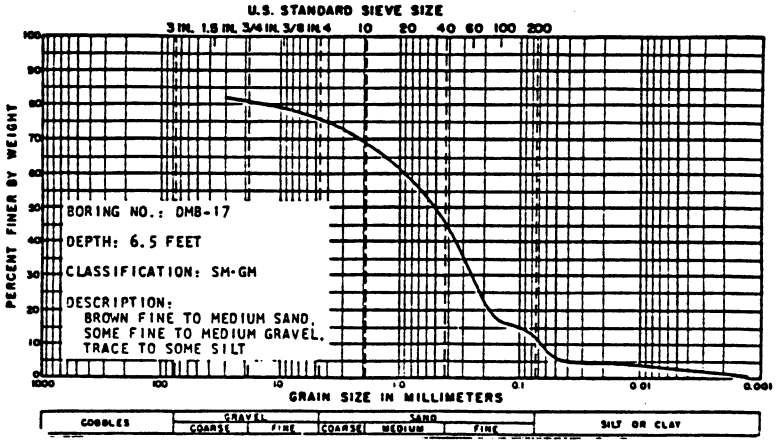



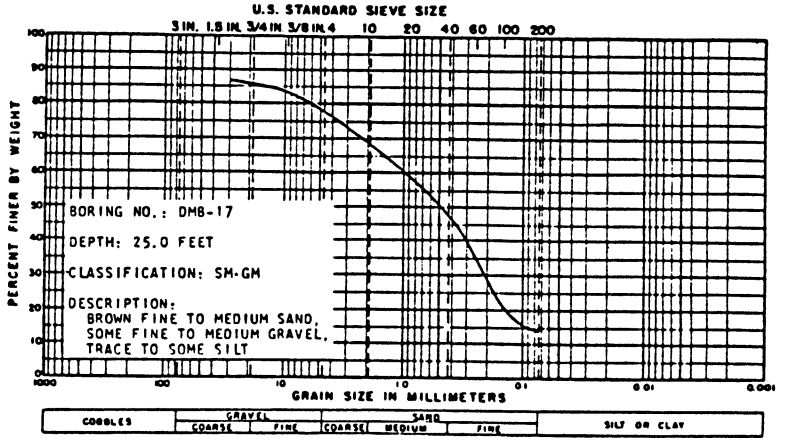

EXXON MINERALS COMPANY, U.S.A.
CRANDON PROJECT

PARTICLE SIZE ANALYSES

DAMES & MOORE | FIGURE A-7



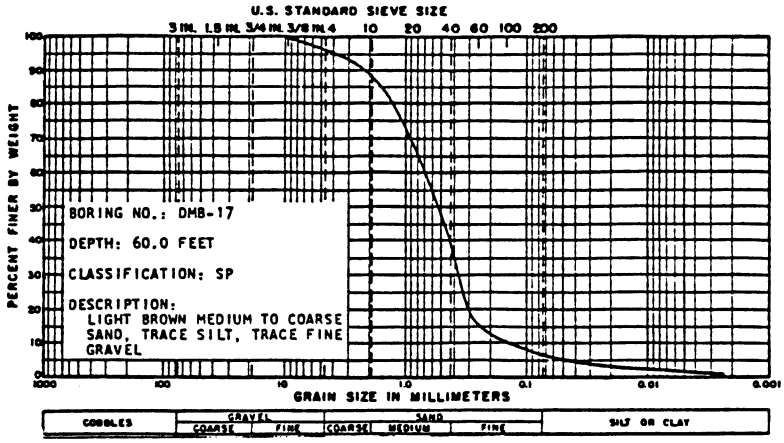



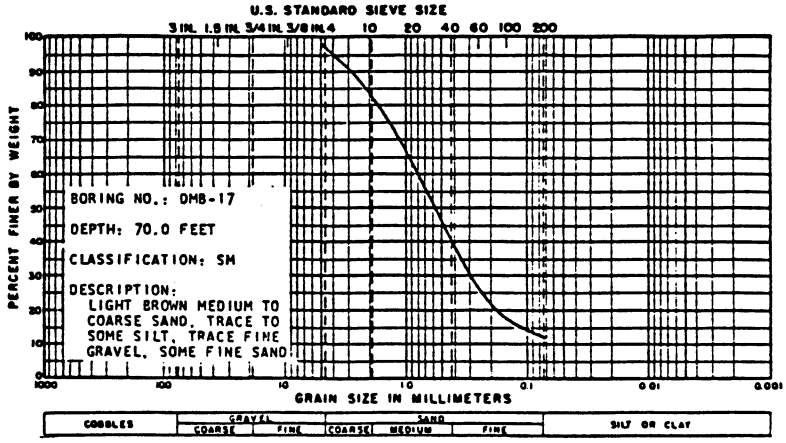



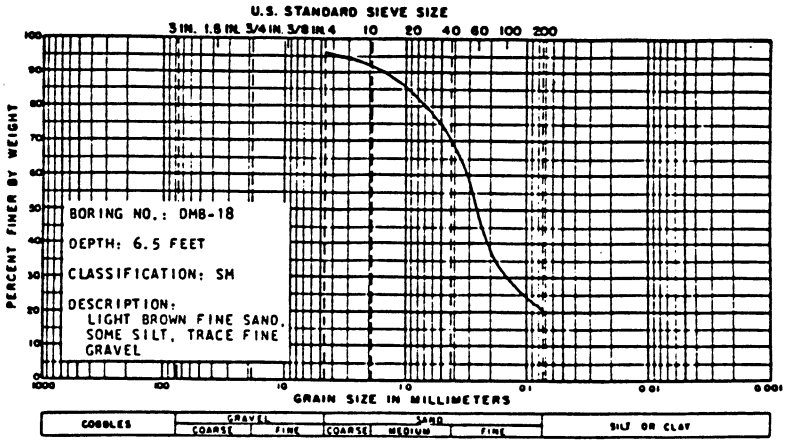

EXXON MINERALS COMPANY, U.S.A.
CRANDON PROJECT

PARTICLE SIZE ANALYSES

DAMES & MOORE | FIGURE A-8



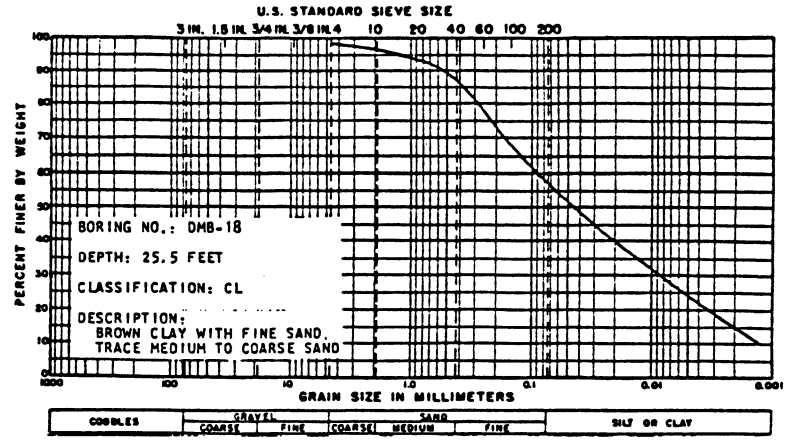



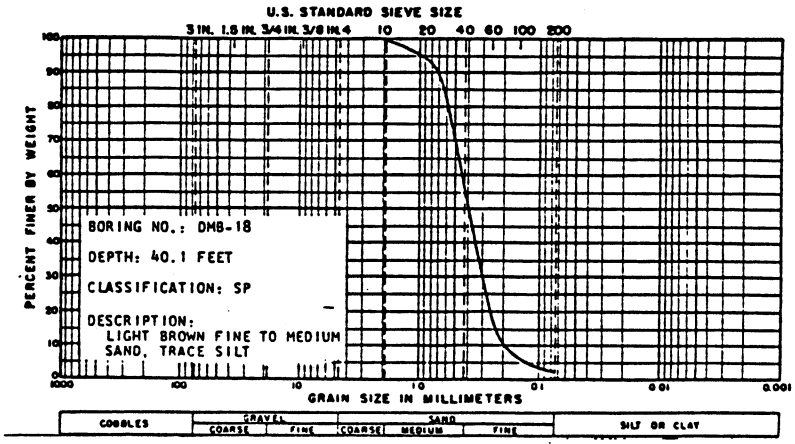



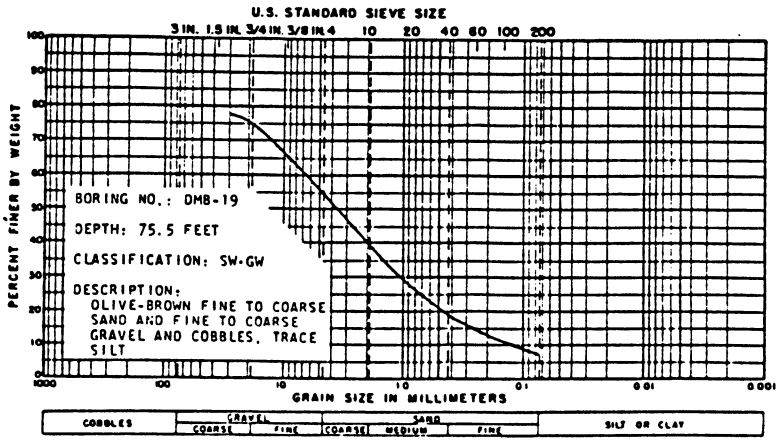

EXXON MINERALS COMPANY, U.S.A.
CRANDON PROJECT

PARTICLE SIZE ANALYSES

DAMES & MOORE | FIGURE A-9



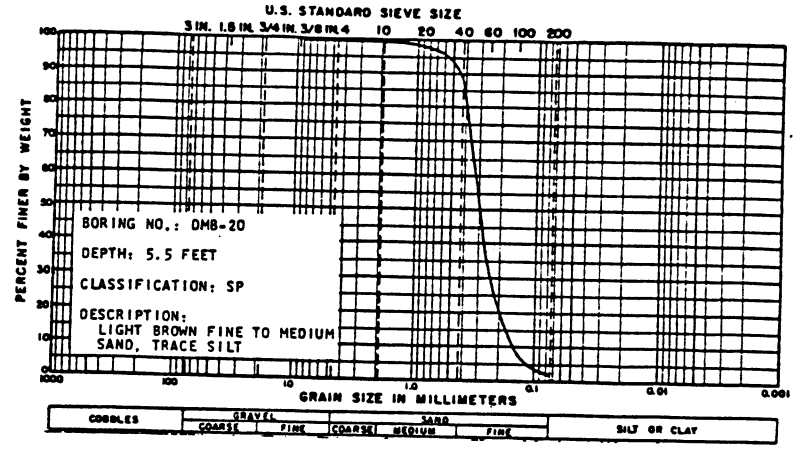



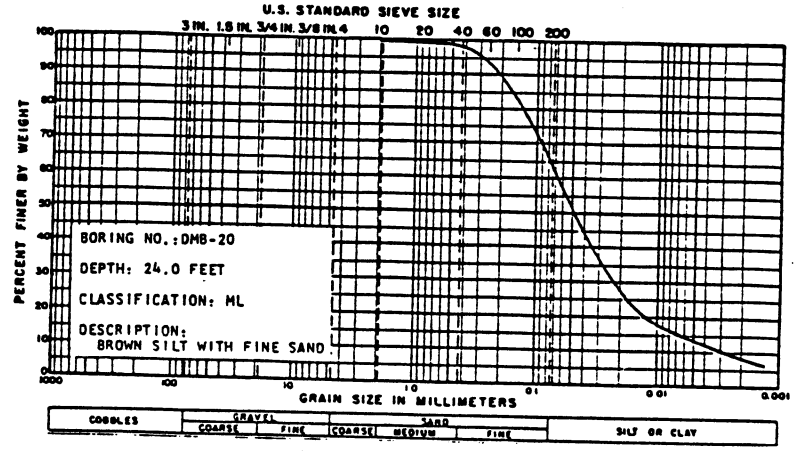



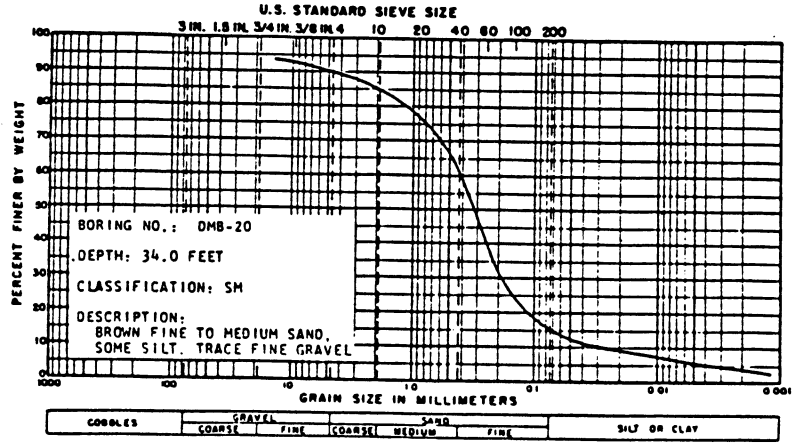

EXXON MINERALS COMPANY, U.S.A.
CRANDON PROJECT

PARTICLE SIZE ANALYSES

DAMES & MOORE | FIGURE A-10



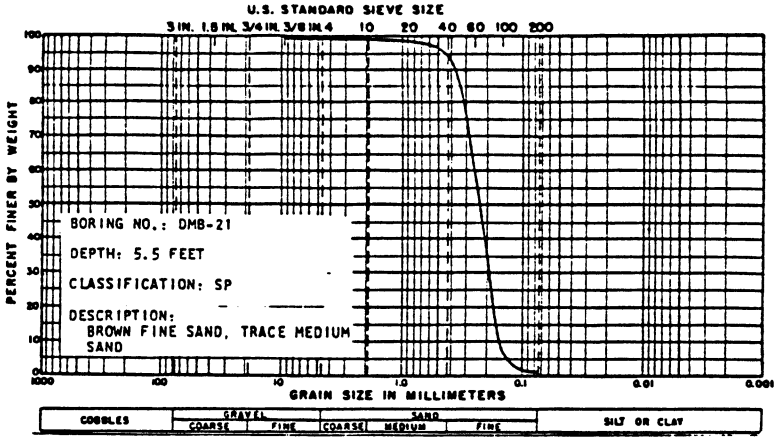



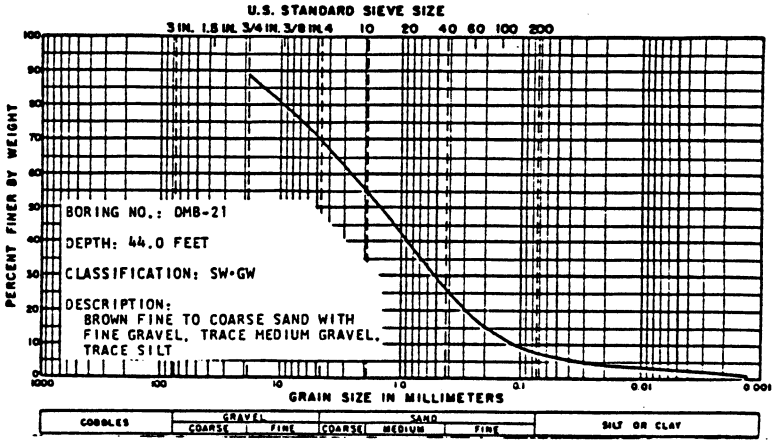



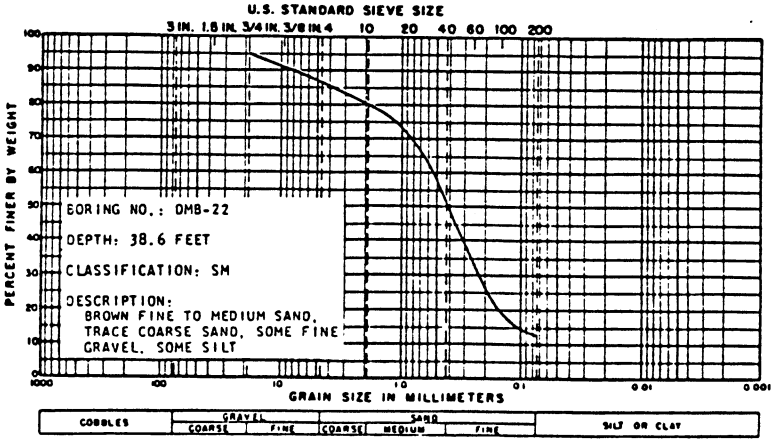

EXXON MINERALS COMPANY, U.S.A.
CRANDON PROJECT

PARTICLE SIZE ANALYSES

DAMES & MOORE | FIGURE A-11



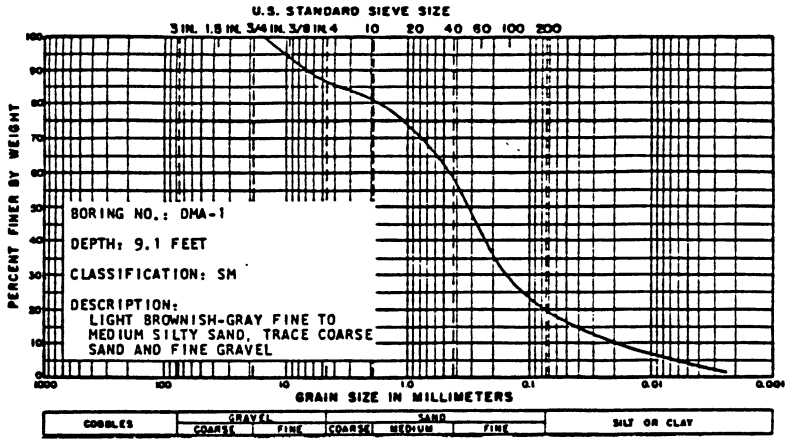



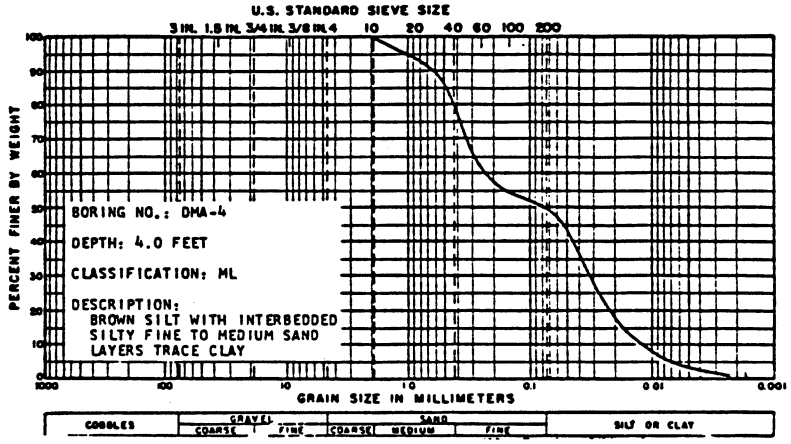



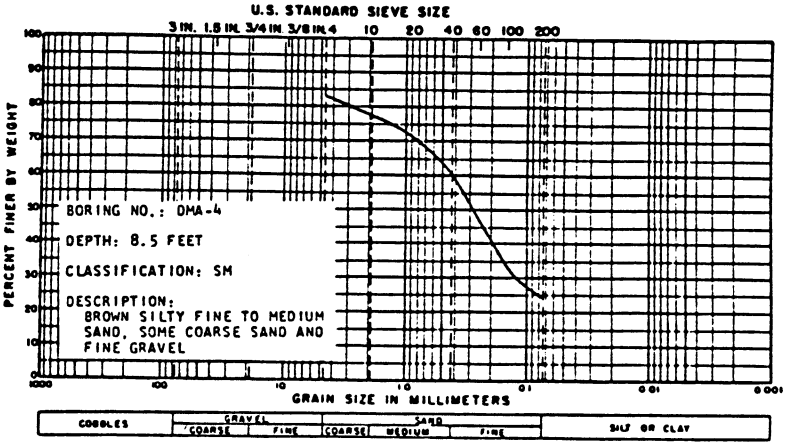

EXXON MINERALS COMPANY, U.S.A.
CRANDON PROJECT

PARTICLE SIZE ANALYSES

DAMES & MOORE | FIGURE A-12



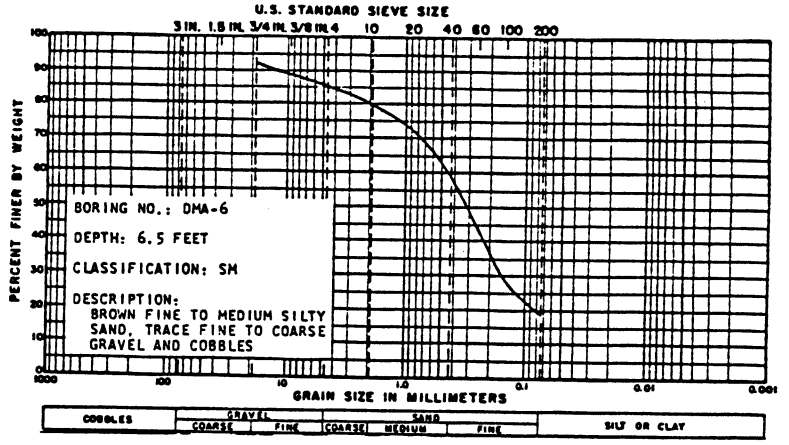



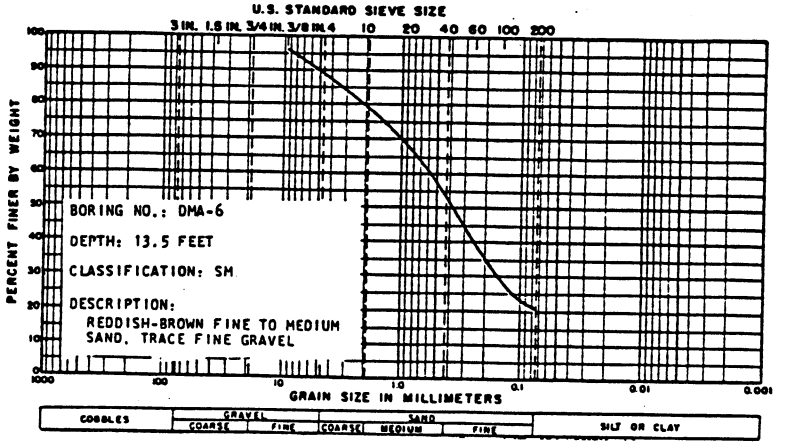



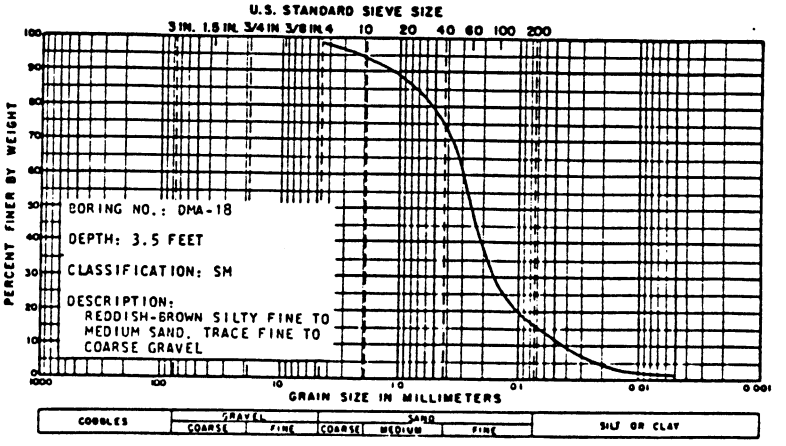

EXXON MINERALS COMPANY, U.S.A.
CRANDON PROJECT

PARTICLE SIZE ANALYSES

DAMES & MOORE | FIGURE A-13



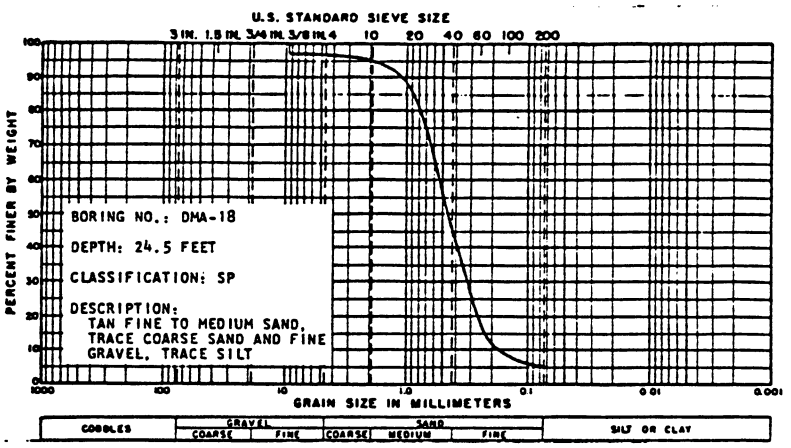



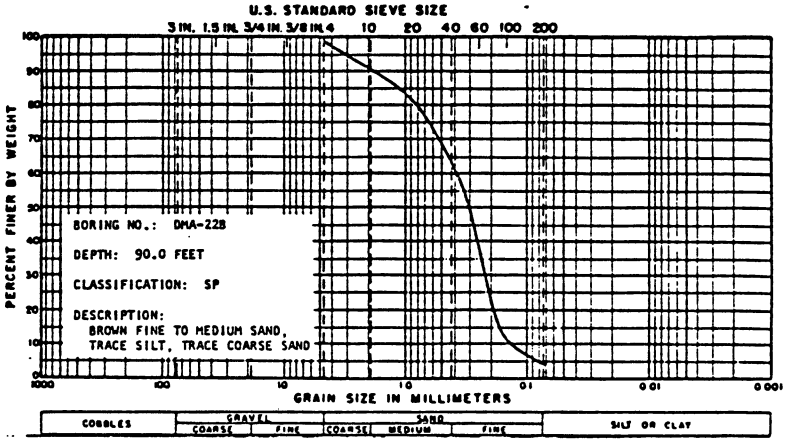




EXXON MINERALS COMPANY, U.S.A.
CRANDON PROJECT

PARTICLE SIZE ANALYSES

DAMES & MOORE | FIGURE A-14

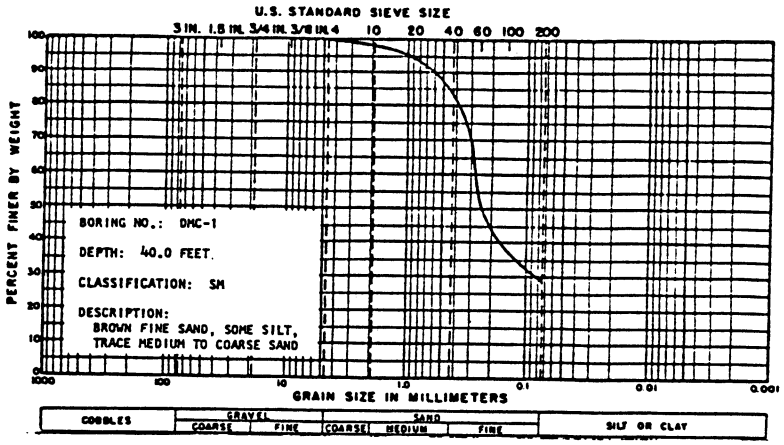


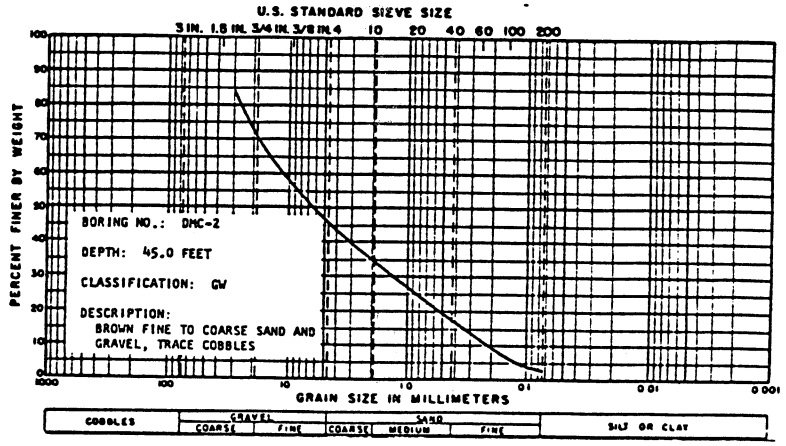



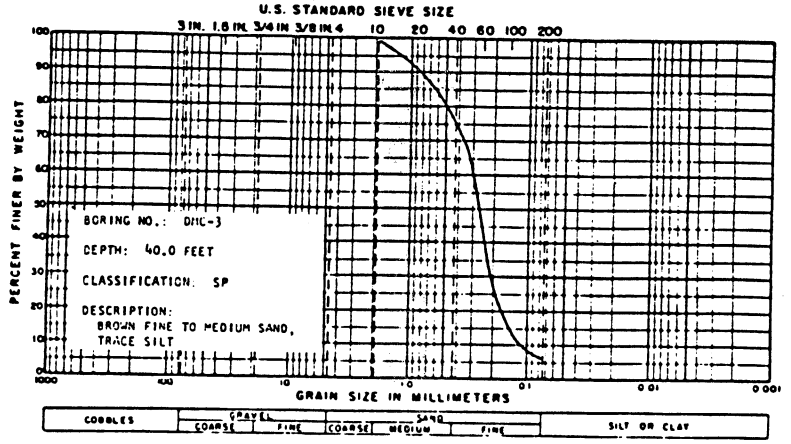

EXXON MINERALS COMPANY, U.S.A.
CRANDON PROJECT

PARTICLE SIZE ANALYSES

DAMES & MOORE | FIGURE A-15



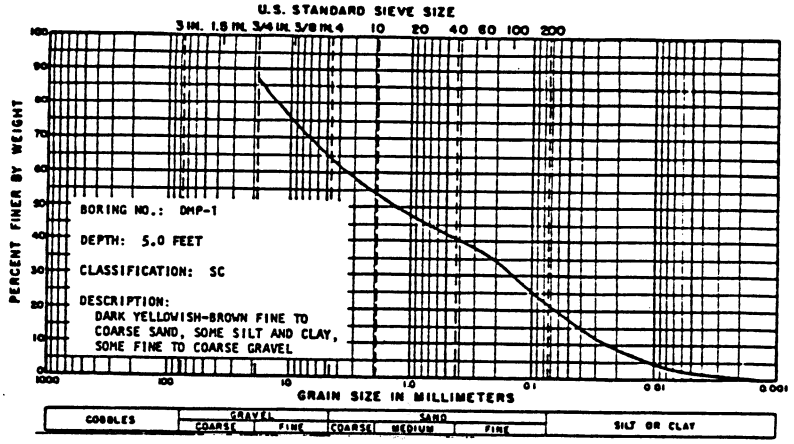



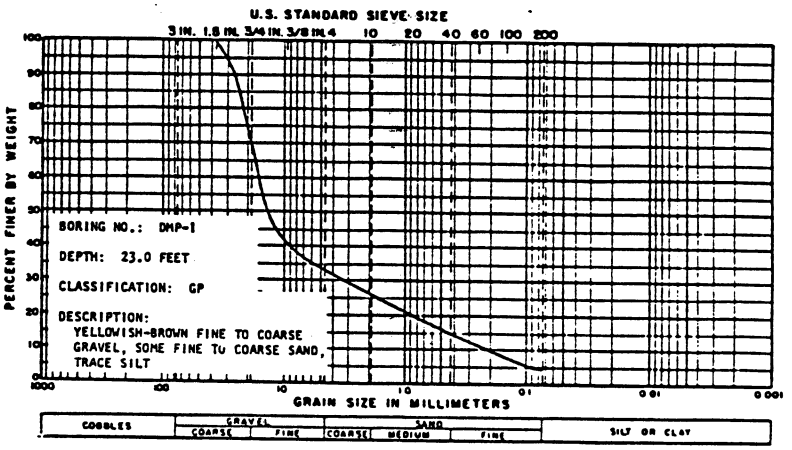



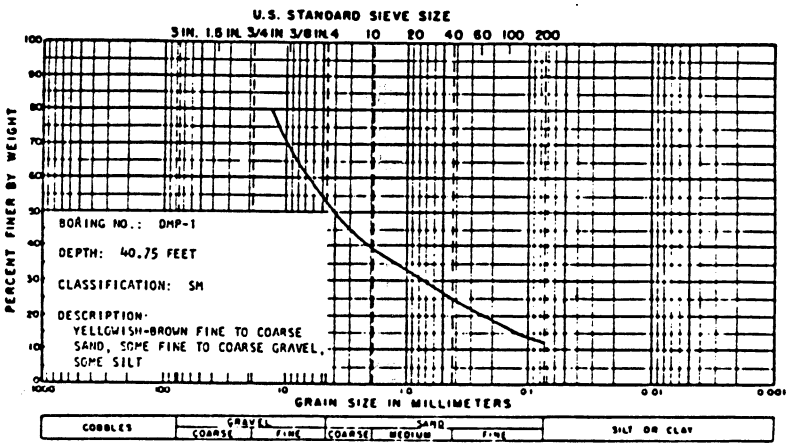

EXXON MINERALS COMPANY, U.S.A.
CRANDON PROJECT

PARTICLE SIZE ANALYSES

DAMES & MOORE | FIGURE A-16



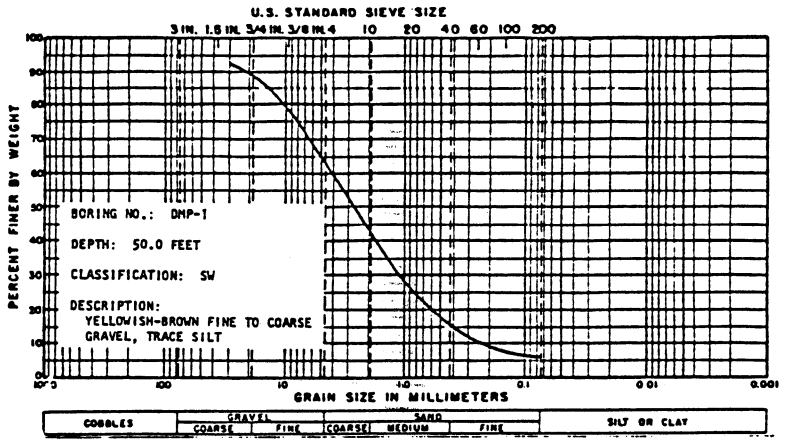



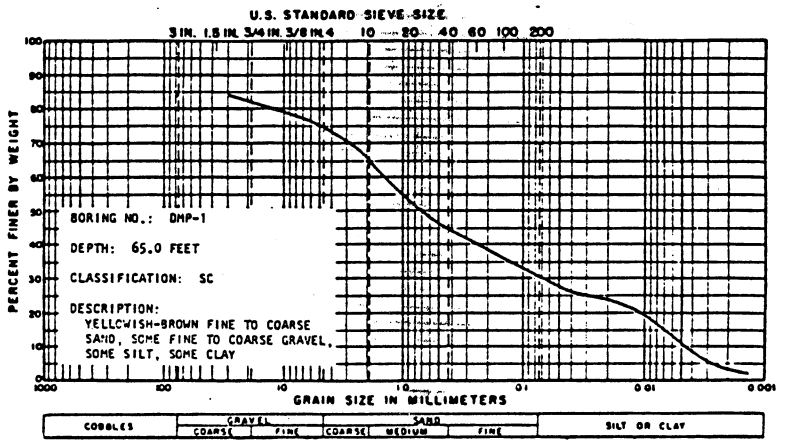



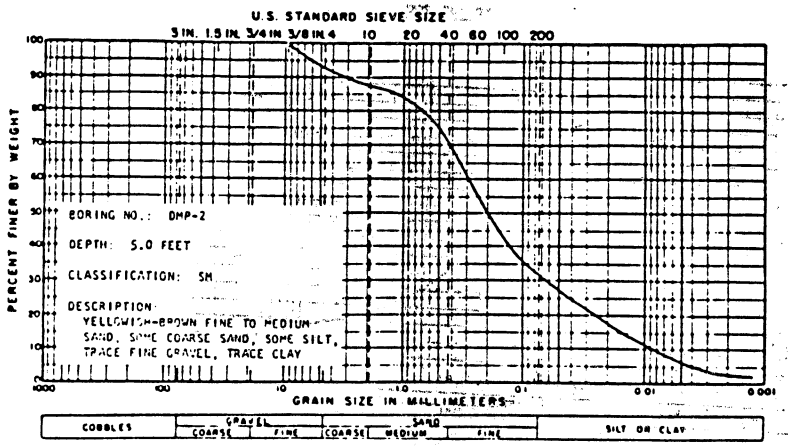

EXXON MINERALS COMPANY, U.S.A.
CRANDON PROJECT

PARTICLE SIZE ANALYSES

DAMES & MOORE | FIGURE A-17



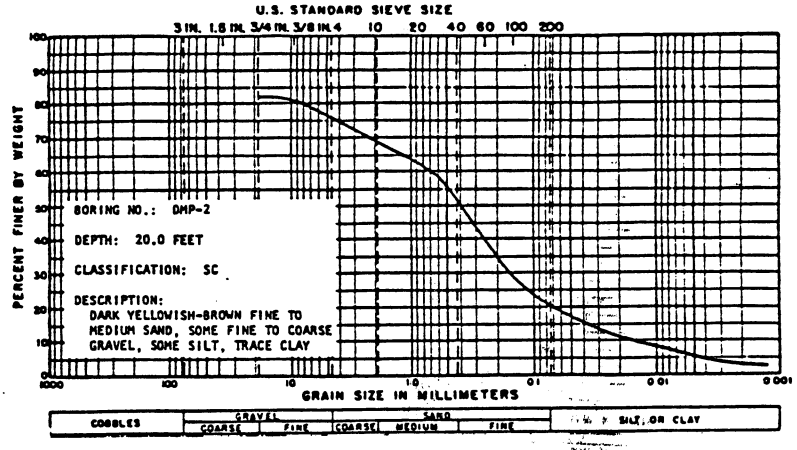



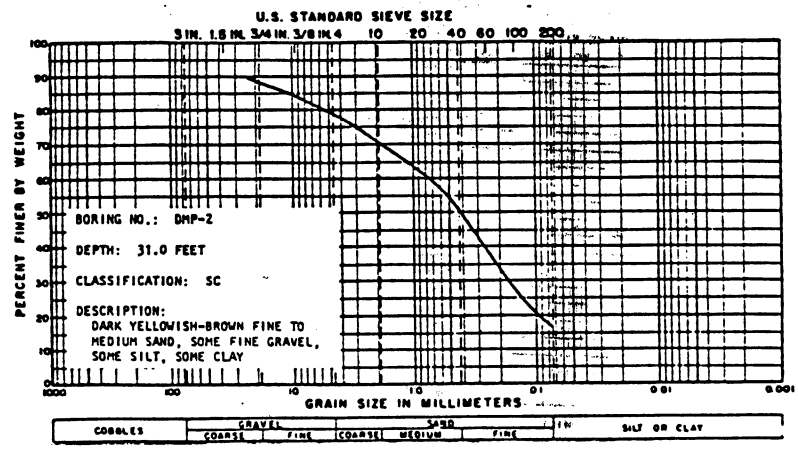



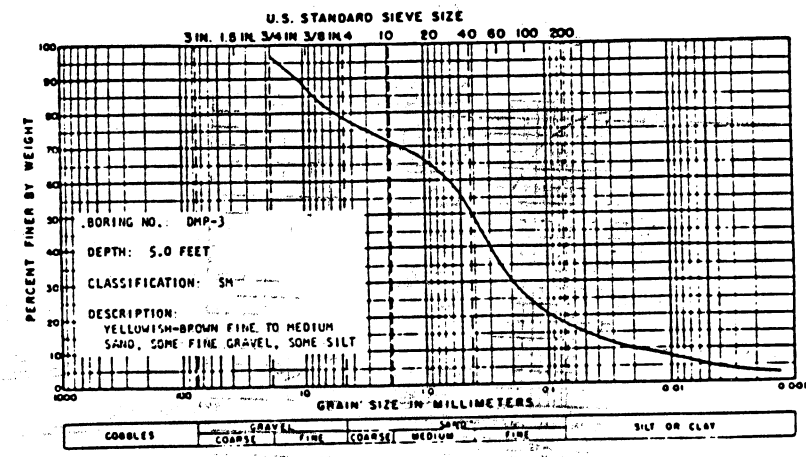

EXXON MINERALS COMPANY, U.S.A.
CRANDON PROJECT

PARTICLE SIZE ANALYSES

DAMES & MOORE | FIGURE A-18




EXXON MINERALS COMPANY, U.S.A.
CRANDON PROJECT

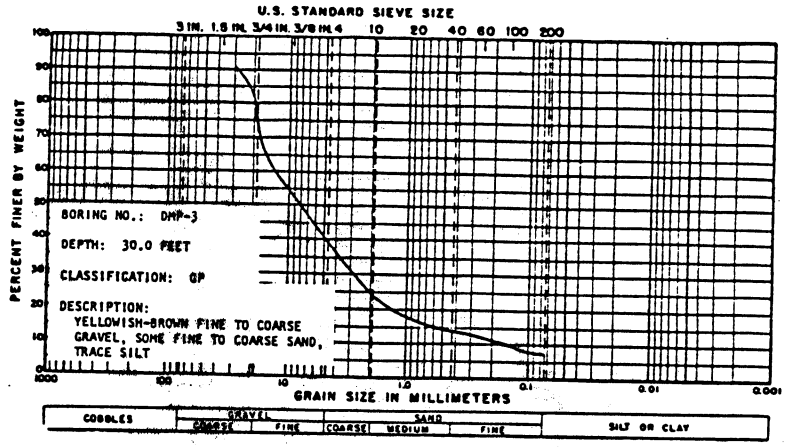
PARTICLE SIZE ANALYSES

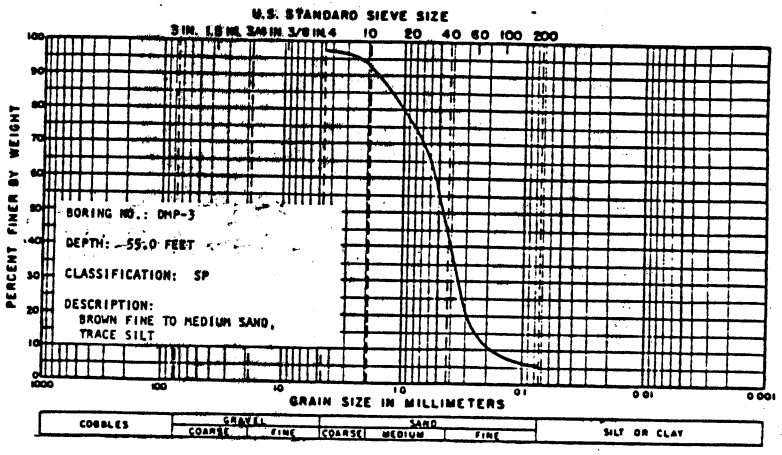
DAMES & MOORE

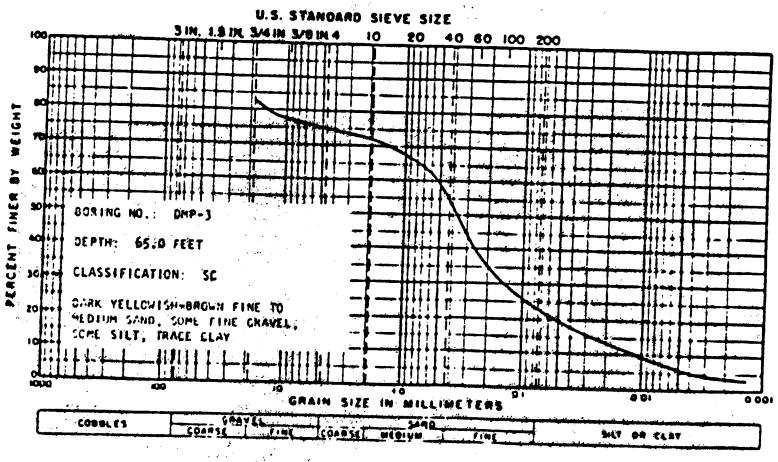
FIGURE A-19

8905448990l

b89054489901a




EXXON MINERALS COMPANY, U.S.A.
CRANDON PROJECT

PARTICLE SIZE ANALYSES

DAMES & MOORE | FIGURE A-20