Water regulatory permit application for the Crandon Project wetland compensation site: 93C049. 1996

Foth and Van Dyke and Associates, Inc.
Green Bay, Wisconsin: Foth and Van Dyke, 1996

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Crandon Mining Company

7 N. BROWN ST., 3RD FLOOR
RHINELANDER, WI 54501-3161

Jerome D. Goodrich, Jr.
PRESIDENT

February 14, 1996

Mr. Michael Hanaway
Wisconsin Department of Natural Resources
P.O. Box 16
Marinette, WI 54143

Mr. David L. Ballman, Ecologist
U.S. Army Corps of Engineers
St. Paul District
190 Fifth Street East
St. Paul, MN 55101

Dear Mr. Hanaway and Mr. Ballman:

Re: Crandon Project - Water Regulatory Permit Application for the Wetland Compensation Site

Crandon Mining Company (CMC) is pleased to file the enclosed document titled *Water Regulatory Permit Application for the Crandon Project Wetland Compensation Site*. This joint state/federal water regulatory permit application provides information for CMC's proposed wetland compensation site located within the Dutchess Creek watershed. The required fee of $300 was issued to the Wisconsin Department of Natural Resources (WDNR) by CMC under a separate cover letter. This application encompasses the following permit and approval requests:

Permit	Fee
Wetland Compensation Site Construction Activities	$300

1) The proposed ditch plugging for the north/south and central east/west ditches, and the removal of the existing culvert discharging the flow of the south east/west ditch into the north/south ditch, as covered by Chapter 30.12(2), Wis. Stats.

2) The proposed rerouting and widening of the stream course from the north/south ditch east in the central east/west ditch and south through the site and then west to the outlet structure in the southwest corner and site grading that would result in topsoil disturbances of more than 10,000 square feet to the banks of navigable waterways as covered by Chapters 30.19(1)(a), (b) and (c) and 30.195, Wis. Stats.

MLD2\93C049\GBAPP\6858\4000

Telephone: (715) 365-1451

FAX: (715) 365-1457

3) Installation of two 42-inch diameter culverts in the north/south ditch as required by Chapters 30.19(1)(a), (b) and (c), and 30.195, Wis. Stats.

4) Relocation of the existing culvert located in the north/south ditch to the east/west ditch as required by Chapters 30.19(1)(a), (b) and (c), and 30.195, Wis. Stats.

5) Dike construction across ditches discharging into Duchess Creek as required by the June 21, 1995 letter from Michael Hanaway of the WDNR which must be permitted as a dam across navigable waters as outlined by Chapter 31.05 Wis. Stats.

This application has been prepared on behalf of CMC by Foth & Van Dyke and Associates Inc. As noted on the attached distribution list, CMC has distributed the document to appropriate state and federal agencies, to local officials, and to various interested parties. It is our understanding that the Wisconsin Department of Natural Resources (WDNR) and the U.S. Army Corps of Engineers (USCOE) will be responsible for distribution of the document to their appropriate staff members.

This application for Chapter 30 and 31, Wis. Stats., permits has been submitted as one document to facilitate a complete presentation of all required information for water regulatory approvals for the wetland compensation site. If you or your staff have any questions regarding the *Water Regulatory Permit Application for the Crandon Project Wetland Compensation Site*, please contact me at (715) 365-1450.

Sincerely,

Jerome D. Goodrich, Jr.
President
Crandon Mining Company

JG:mld2

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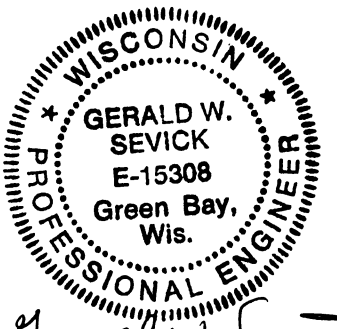

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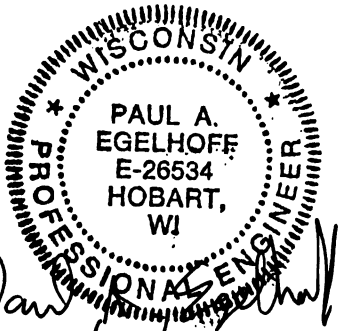

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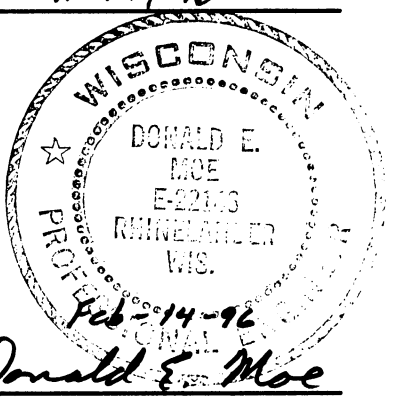

Feb-14-96

Donald E. Moe

Water Regulatory Permit Application for the Crandon Project Wetland Compensation Site

93C049

Prepared for
Crandon Mining Company
7 North Brown Street, 3rd Floor
Rhinelander, Wisconsin 54501-3161

Prepared by
Foth & Van Dyke and Associates Inc.

February 1996

2737 S. Ridge Road, P.O. Box 19012, Green Bay, Wisconsin 54307-9012, 414/497-2500, FAX: 414/497-8516

Crandon Mining Company
Water Regulatory Permit Application for the Crandon Project
Wetland Compensation Site

Executive Summary

Introduction

With this document Crandon Mining Company (CMC) has applied for the necessary permits from the Wisconsin Department of Natural Resources for activities associated with the construction of stream crossings, the installation of culverts and grading in or around navigable waterways at its proposed wetland compensation site. The document describes CMC's construction plans and the methods that will be used to keep environmental impacts to a minimum in these areas.

Construction Activities Near Navigable Water Resources

Construction activities in the area of navigable waterways requiring water regulatory permits include grading, drainage ditch adjustment, culvert installation, and dike construction needed to restore wetland conditions on an approximate 57-acre wetland compensation site on an approximate 129-acre parcel located in Shawano and Oconto counties.

Environmental Protection

The culverts and stream crossings have been designed to allow the free flow of water so that upstream drainage problems will not occur even when waterways are under flood conditions.

During all construction near waterways, CMC will use appropriate practices designed to control dust and prevent runoff and erosion. Depending upon the area involved, these practices would include one or more of the following techniques:

- Diversion dikes, silt fencing, ditches and/or settling basins to collect runoff from disturbed areas.
- Riprap to protect slopes.
- Stockpiling of topsoil for use in replanting graded slopes.
- Mulching and replanting slopes as soon as possible after earth work; applying jute or paper matting to steep slopes where needed to enhance seed germination.
- Watering exposed soil as needed for dust control.

The above techniques are common construction practices that have been successfully applied for years to control erosion, restore construction areas and protect navigable waterways.

Crandon Mining Company
Water Regulatory Permit Application for the Crandon Project
Wetland Compensation Site

Contents

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Figures

(Note: Figures for the Water Regulatory Permit are located at the end of the text, following page 16.)

Appendices

1 Introduction

Crandon Mining Company (CMC) is proposing to develop a wetland compensation site to replace wetlands lost during development of an underground zinc-copper mine in Forest County, Wisconsin. As part of further development of this project, numerous federal, state and local environmental, construction, building and safety permits and approvals need to be obtained. This submittal constitutes the Water Regulatory Permit Application (WRPA) for the wetland compensation site for the Crandon Project. A separate application was submitted in July 1995 (Foth & Van Dyke, 1995) to the United States Army Corps of Engineers (USCOE) and Wisconsin Department of Natural Resources (WDNR) in support of the Crandon Project permitting process for the wetland compensation site. Titled *Section 404 Permit Application - Addendum 1*, this application documents CMC's work to preserve wetlands to the maximum extent possible and details the site selection and development process for the wetland compensation site.

Although mine facilities have been designed to avoid or minimize impacts on wetlands as part of project construction activities, approximately 29.5 acres of wetlands will be either excavated or filled. To compensate, CMC will develop replacement wetlands on a site located in Shawano and Oconto Counties as shown on Figure 1-1. The selected site is in an area that was originally wetlands, but was converted to cropland. The establishment of the compensation site involves reconverting it from cropland back to wetlands.

The WRPA has been prepared in accordance with applicable portions of Chapters 30 and 31, Wis. Stats., and with the comments received from Michael Hanaway of the WDNR in a June 21, 1995, letter (Appendix A). The WRPA outlines the construction and operation of structures (such as culverts) and construction activities adjacent to navigable waters. The material presented in this report is indicative of the type and size of facilities to be developed as part of the wetland compensation site. During final design it is likely that some modification in the engineering and operational details of the facilities and systems will occur.

The WRPA is organized into three sections. The first section is this Introduction. Section 2 contains detailed information concerning project features requiring water regulatory permits. Section 3 contains a list of references. Completed permit application forms are included in Appendix B. Supporting information, including calculations and details, are provided in the remaining appendices.

2 Chapter 30 and 31 Permit Structures and Activities for the Wetland Compensation Site

This section of the WRPA presents the information necessary to address Crandon Project wetland compensation site activities regulated by Chapters 30 and 31, Wis. Stats. Included in Appendix B are completed permit application forms.

In order to perform the modifications described below, CMC will require several Chapter 30 and Chapter 31 permits. The construction of the wetland compensation site generally includes the plugging of existing manmade drainage ditches, removing existing culverts and an outlet structure, and rerouting the ditch flow through a manmade wetland excavated from a prior converted wetland. In order to control the outflow from the wetland an outlet structure will be installed. This outlet structure will be located on the southwestern corner of the compensation site and keyed into a shallow embankment. In order to comply with WDNR Chapter 30 and 31 requirements, the following activities will require permitting:

Chapter 30 Permit Activities

- The proposed ditch plugging for the north/south and central east/west ditches, and the removal of the existing culvert discharging the flow of the south east/west ditch into the north/south ditch, as covered by Chapter 30.12(2), Wis. Stats.

- The proposed rerouting and widening of the stream course from the north/south ditch east in the central east/west ditch and south through the site and then west to the outlet structure in the southwest corner and site grading that would result in topsoil disturbances of more than 10,000 square feet to the banks of navigable waterways as covered by Chapters 30.19(1)(a), (b) and (c), and 30.195, Wis. Stats.

- Installation of two 42-inch diameter culverts in the north/south ditch as required by Chapters 30.19(1)(a), (b) and (c), and 30.195, Wis. Stats.

- Relocation of the existing culvert located in the north/south ditch to the east/west ditch as required by Chapters 30.19(1)(a), (b) and (c), and 30.195, Wis. Stats.

Chapter 31 Permit Activities

- Dike construction across ditches discharging into Duchess Creek as required by the June 21, 1995, letter (Appendix A) from Michael Hanaway of the WDNR which must be permitted as a dam across navigable waters as outlined by Chapter 31.05, Wis. Stats.

2.1 Site Description

A wetland compensation site for the Crandon Project has been located north of Cecil in Shawano County, Wisconsin. As shown on Figure 2-1 the compensation site is located on property which straddles the Oconto-Shawano County line. The southern portion of the property is located in the N1/2, NE 1/4, Section 5, T 27 N, R 17 E, Town of Washington, Shawano County, Wisconsin, and the northern part is located in the S1/2, SE 1/4, Section 32, T 28 N,

R 17 E, Town of Underhill, Oconto County, Wisconsin. The proposed compensation site covers approximately 57 acres. As shown on Figure 2-1 it is located in the approximate center of the 129-acre property boundary.

Current land use is agricultural. The property has been partially drained by construction of several interconnected drainage ditches. A north/south ditch, beginning approximately 0.7 miles to the north of the site and ultimately discharging into Duchess Creek downstream from the site, parallels the western border of the site. Water levels in this ditch are controlled by a stop-log outlet control structure located in the southwest corner of the site (Figure 2-2). Two east/west ditches connected to the north/south ditch exist along the northern and southern boundaries of the area shown in Figure 2-2. A third east/west ditch also connected to the north/south ditch exists in the central portion of the shown area. A single ditch draining agricultural lands to the northwest, also enters the north/south ditch just below the point where the central ditch connects to the north/south ditch.

The proposed site grading plan calls for the excavation of approximately 66,900 cubic yards of soil to provide open water areas and a moisture gradient across the site (Figure 2-3). The proposed excavation will take advantage of the existing topography by focusing on the lowest areas of the site. The eastern third of the central east/west ditch will be filled to prevent water from exiting to the north and east across County Trunk Highway (CTH) R. The north/south ditch will be plugged just to the south of its intersection with the central east/west ditch, but before the ditch draining an area to the northwest drains into the north/south ditch. Surface waters will enter the site through the north/south ditch, flow to the east in the central east/west ditch, flow south through the site and then west to the proposed outlet structure located in the southwest portion of the site. The excess excavated material will be deposited on the eastern two-thirds of the existing agricultural field to the north of the site (Figure 2-3).

There are currently two culverts and one outlet structure on the proposed wetland compensation site as shown on Figure 2-2. The existing culverts and outlet structure will be removed or relocated during wetland compensation site construction. The 32-inch diameter culvert currently located in the north/south ditch will be reused in the central east/west ditch to allow access for maintenance purposes. Also, a pair of 42-inch diameter culverts will be installed in the north/south ditch to allow access to the properties west of the north/south ditch and for maintenance purposes.

The outlet control structure referenced above will initially consist of a three foot wide stop-log weir with a minimum and maximum elevation of 816 and 818.9 feet MSL, respectively (Figure 2-4). With this structure, the water level can be altered by up to 2.9 feet by removing or installing the desired width stop log(s). A 40-foot wide emergency spillway at an elevation of 819.6 feet is also proposed to allow flood waters to exit before potential backwaters reach CTH R. The proposed normal pool elevation is 818.9 feet.

Completed permit application Forms 3500-53 and 3500-10 for the wetland compensation site are provided in Appendix B. Application forms for the site require the current owner, H. Garrity, to be a co-applicant for the permit since at this time the property is currently optioned to CMC. As shown in Appendix B the permit applications have been signed by both CMC and the property owner, H. Garrity.

2.2 Hydrology and Hydraulic Analysis

The wetland compensation site has been designed to direct runoff from storm events through the restored wetland site while allowing compliance with WDNR guidelines. The 100-year flood standard was used to size drainage structures for ditch rerouting, for widening of the channel and for embankment construction across the ditch considered to be a navigable stream by the State of Wisconsin. As part of the *Section 404 Permit Application* (Foth & Van Dyke, 1995) a detailed hydrologic assessment was completed for the proposed project. In addition, an analysis of the wetland compensation site ditch hydraulics has been completed for this permit application. As presented in Appendix C, this analysis estimates that for the proposed design, an increase in backwater elevation of 0.01 to 0.24 feet will occur for the 100-year flood. Although the increases are insignificant in terms of floodplain boundaries or potential flood damage, backwater easements for the Garrity property located upstream (north) of the project site and the V. Ziemer property located west of the project site are required. These easements are included in Appendix D.

2.3 Revegetation

The site was previously a wetland and wetlands nearly surround it. A prevalence of wetland vegetation already exists along the site periphery and in the site ditches. These factors coupled with a site design that provides for the control of water levels between approximately 819.6 MSL and the top of the groundwater surface, which is estimated to be at approximately 817 feet MSL, offer an ideal opportunity for natural revegetation within the approximate 57-acre compensation site.

Water level adjustment has been found to be an effective means of both controlling nuisance vegetation as well as stimulating new vegetative growth (Fredrickson, 1982). As such, the portion of the site below an elevation of approximately 819.6 feet will be allowed to revegetate naturally, relying on the seedbank remaining in the site soils and the adjacent wetlands as a source of plant material.

It is anticipated that construction of the site will be completed by late summer in the year in which it takes place. At the completion of construction the outlet structure will be set to allow maximum flooding during the fall and winter periods. A gradual drawdown is proposed beginning the following May to stimulate germination of the existing seedbank. Water levels will be maintained at approximately 817 feet until germination occurs. At this point water levels will be raised and maintained at adequate depths to preclude terrestrial species, yet not impair the growth of wetland species. The proposed normal pool elevation is 818.9 feet. During the first growing season, this elevation will be maintained based on the growth of the vegetation.

The seedbank, in areas of the site above the elevation where water level adjustment can effectively control invasive plant species (i.e., above 819.6), will be supplemented by seeding (Figure 2-5). A mixture of oats and annual rye will be planted at a rate of 80 and 100 pounds per acre, respectively to establish a temporary cover crop at the completion of construction to control erosion. The following spring, during the maximum drawdown period, these areas will be tilled and reseeded with the wet meadow seed mixture presented in Table 2-1.

Table 2-1

Wet Meadow Seed Mixture

Grasses and Sedges:

- Canada bluejoint grass *(Calamagrostis canadensis)*
- Prairie cord-grass *(Spartina pectinata)*[1]
- Big bluestem *(Andropogon gerardii)*
- Switch grass *(Panicum virgatum)*[2]
- Green bulrush *(Scirpus atrovirens)*
- Fox Sedge *(Carex vuplinoidea)*

Forbs:

- Swamp Milkweed *(Ascelepias incarnata)*
- Angelica *(Angelica atropurpurea)*
- Blue vervain *(Verbena hastata)*
- New England aster *(Aster novae-angliae)*
- Marsh aster *(Aster simplex)*
- Joe-pye weed *(Eupatorium maculatum)*

Source: Eggers, 1992.

Checked by: RFS

The shallow and deep marsh areas will be maintained in the desired condition over time through water level controls. The wet meadow habitat type will not be maintained, but will be allowed to succeed naturally. Based on the existing condition of the surrounding wetlands, this portion of the site will likely be encroached by willows and alders and progress into a shrub swamp over time.

Topsoiled areas outside the 57-acre compensation site will be seeded with prairie seed mix to minimize damage from wind, water, and/or human disturbance. When used along sideslopes, grass seed mixes have a long-term advantage over other revegetation methods in providing locally adapted seed stock with low maintenance requirements (no added water, fertilizer, humus, or cutting needed). In the short-term, this method does not provide quick uniform ground cover as do grass and legume mixtures. However, the grass and legume mixtures compete with native successional vegetation for nutrients, light, moisture, and soil space.

2.4 Construction Schedule

The proposed wetland compensation project will be constructed during the construction phase of the proposed mine site prior to the beginning of mine operations. Construction of the wetland site will begin in the summer and end in late summer or early fall. The current agricultural use of the site will be maintained until construction begins. Although construction will be completed in less than one year, it is anticipated that up to four years will be required to establish a fully functional wetland system.

2.5 Long-Term Use

CMC intends to convey the site to local governments or a private conservatory group and leave the proposed wetland compensation site dedicated in perpetuity for use as a natural conservatory area.

2.6 Erosion Control Practices

Areas that will be disturbed as part of the construction process will be the approximate 57-acre compensation site, and approximate 19-acre area to the immediate north where excess excavated soil will be placed, various locations where culverts or ditch plugs are to be removed or added, and areas used for construction access. Specific erosion control techniques available for application to these areas during construction are presented in this section. These methods were selected based on site specific climatic conditions, soils, and vegetation. Those methods selected for use at the site are outlined in Section 2.7 of this report. The other available methods will be used if site conditions so dictate.

2.6.1 Topsoil Removal and Preservation

The construction plan that has been developed for the project assumes topsoil will generally be salvaged to a depth of one to two feet. It is possible that greater depths of topsoil may be present in some areas of the site, including Markes and Seelyville soil types which commonly include peaty, organic pedons exceeding 50 inches in depth (Gundlach, et al., 1982). Topsoil removal will be conducted to these greater depths if they are encountered. Topsoil material will be stabilized during construction, stored on site, and reused. "Peat humus" can be a valuable material for the generation or sustenance of plant growth. Therefore, if encountered, peat humus will be salvaged during initial stripping activities and used in re-topsoiling of the 57-acre compensation site.

2.6.2 Vegetation, Seeding, Fertilization and Mulching

A healthy establishment of vegetal cover is essential to controlling erosion. Different soil type and slope conditions require different vegetation considerations. Be it temporary or permanent, vegetative stabilization must be established to provide proper erosion control.

2.6.2.1 Species Selection

Species selection for erosion control during the project's construction phase will be dependent upon the proposed exposure period of the area concerned. Where an area is likely to be exposed a temporary cover crop will be seeded with species which exhibit rapid establishment and growth. Examples of such species include oats (*Avena sativa*), rye (*Secale cereale*), and perennial rye grass (*Lolium perenne*) which will be planted at a rate of 80 and 100 pounds per acre, respectively. Vegetative cover will be established as early as possible on these areas so that the soils are stabilized and erosion potential is minimized.

2.6.2.2 Seeding

During the construction phases of the project, seeding will be undertaken using mechanical methods. Specific site characteristics, but primarily slope, will determine which method is selected. The optimum seeding period for legume-based seed mixtures is April to June, whereas the optimum period for grass-based seed mixtures is August and September. Where completion of construction of various facilities does not permit an optimum seeding time, temporary erosion control methods will be used.

2.6.2.3 Mulches and Soil Surface Stabilizers

Numerous types of mulches and soil surface stabilizers can be used when hydro-seeding. Selection will be dependent upon the recommendation of a reclamation specialist, cost and availability.

2.6.2.4 Fertilizer Use

Establishment of forage type plant species for purposes of erosion control may require fertilizer applications to achieve a satisfactory vegetative cover. As major project facilities are constructed and the areas associated with, or adjacent to these facilities are graded and ready for establishment of vegetative cover, soil samples will be taken and analyzed to determine the most appropriate fertilizer application. Each of these areas will also be analyzed (i.e., topography, exposure, drainage and future use) to determine the best seed mixture and practice for seeding.

The proposed seed mixtures that will be most commonly used for temporary erosion control are also composed of species tolerant of low soil fertility. Fertilizer requirements for non-herbaceous vegetation, whether planted directly into subsoils or into topsoil applied over subsoil, will follow the general recommendations for such practice by the USDA-Soil Conservation Service and State of Wisconsin.

2.6.2.5 Vegetative Stabilization

Vegetative stabilization is the general method for short and long-term slope stabilization using selected plant materials. This method is used to reduce short-term erosion and enhance the long-term natural succession revegetation which will control erosion. Table 2-2 lists the general vegetation methods that will be used on site for the various slopes that will be encountered.

When soil pH is less than 5.5 (moderately acidic), seedling establishment may be retarded. To establish a more favorable soil pH, lime or other acceptable soil conditioners can be applied. Some seed requires pretreatment prior to planting. Seed suppliers will be contacted to ascertain this need and to acquire treated seed. Shrubs and trees may be seeded or planted from bare root or potted stock.

Revegetation work will be accomplished between May 1 and September 15 of a given year. Early spring is the most favorable period, just after peak spring runoff. Late fall plantings will require maintenance and further revegetation in the following spring, but a late fall planting with mechanical stabilization is preferable to leaving a site bare over a winter. South-facing slopes will be seeded only in springtime or summer. North-facing slopes may be seeded in fall. Work will be scheduled to minimize the time of exposure of bare soil and partially completed work.

Table 2-2

Application of Vegetation Methods*
Step-by-Step Description of Vegetation Methods

	Site Condition	Operation in Order of Performance
A	Small slopes with gradients as steep as 2:1	Grass and legume seed selection Seedbed preparation, by hand Broadcasting seed, hand labor Straw mulch, hand punching Maintenance Fertilizer
B	Small slopes with gradients as steep as 4:1	Grass and legume seed selection Seedbed preparation by machine Drilling seed Straw mulch by machine Maintenance Fertilizer
C	Small slopes with gradients as steep as 2:1	Grass and legume seed selection Seedbed preparation, some hand labor Hydromulching Hydroseeding, combined with hydromulching Maintenance Fertilizer
D	Slopes with gradients as steep as 2:1	Vegetation plant selection Planting Maintenance Fertilizer
E	Unstable drainageways as steep as 2:1	Grass and legume seed selection Seedbed preparation, some hand labor Broadcasting seed by machine Straw mulch, machine punching Matting in drainageways Maintenance Fertilizer
F	Small slopes as steep as 2:1	Grass and legume seed selection Seedbed preparation, some hand labor Hydroseeding Maintenance Fertilizer

Table 2-3 *(Continued)*

Site Condition	Operation in Order of Performance
G Small slopes as steep as 2:1	Grass and legume seed selection Seedbed preparation, some hand labor Broadcasting seed, by machine Straw mulching, by machine Jute matting Maintenance Fertilizer

* Designations indicate the specific Best Management Practice to use in the sequence in which the work is to be performed, except for fertilizer which is always listed last even though it is to be applied just prior to seeding.

Note: Typical representation, refinements may be made in final design.

Prepared by: BFW
Checked by: JBH1

Source: Engineering-Science, 1980

Topsoil salvaged from the site at the beginning of grading operations will be placed on the finished grade to a depth of four to six inches. Existing vegetation will remain undisturbed where possible. Fertilizer will be applied immediately prior to seeding. Fertilizer of the specified formulation will be applied at the rate specified for conditions as tested at the site. Seeding will be conducted as quickly as possible upon completion of grading at a construction site.

Hydroseeding involves placing seed, fertilizer, a tacking agent and water with a small amount of dyed wood fiber into a tank and agitating the mixture into a uniform slurry which is applied to the site. Broadcast seeding provides an effective method of scattering seed uniformly. If the seed is properly covered with soil and appropriate mulches are applied, germination and establishment are generally better from broadcasted seed than from seed sown by hydroseeding, but not as good as the germination and establishment from drilled seed due to the difficulty of properly covering all of the seed on any but the most ideal sites. On ideal sites, hydroseeding is equally effective in uniformly scattering seed as is broadcasting seed, but is not as good as drilling seed. However, hydroseeding is appropriate to a larger variety of different sites, and it can provide more uniform application rates than broadcasting.

2.6.2.6 Hydromulching

Some soil surfaces can best be protected with the application of a hydromulch most often in conjunction with hydroseeding to provide erosion control. Table 2-2 listed the site conditions where hydromulching should be considered.

Hydromulching is the application of a plant fiber mulch and tacking agent in a slurry with water. Options available with this method which can be used for the project include application of fertilizers, the selected seed mix and, on steeper slopes, either straw or matting. The purpose of hydromulching is to uniformly and economically apply a temporary stabilization material (wood fiber, straw or seed-free hay) and water to a bare slope or other bare area. Hydromulch will be combined with hydroseeding where needed as a revegetation method to provide long-term

stabilization. This method plus topsoil application and vegetative stabilization are the primary erosion control methods for the site. Hydromulching will be applied to areas which are within approximately 200 feet of a road or other area which can be reached by truck.

Hydromulching can be combined with seed and fertilizer as a revegetation method. The mulch will remain up to two years, but loses much of its effectiveness after the first year. Hydromulching will be used only on physically stable slopes (natural angle of repose or less). When seeding is combined with hydromulching, fertilizer of the specified formation will be included at the specified rate.

Plant fiber may be dyed to aid in uniform placement. Dye will not stain concrete or painted surfaces nor injure plant or animal life when applied at the manufacturer's recommended rate. Application of the slurry will proceed until a uniform cover is achieved. To avoid soil erosion, the applicator will not be directed at any one location for a measurable period of time.

Hydromulched slopes will be inspected periodically for damage due to wind, water or human disturbance. Damaged areas will be repaired immediately using either hydromulching at the original specifications or straw mulch.

Hydromulching is an effective method of increasing water retention, and thereby reducing erosion, for six months to one year. Beyond one year the effectiveness diminishes unless combined with hydroseeding. Initial short-term effectiveness results in a 70 to 100 percent reduction in sediment generation from the slope compared to the bare slope. Nutrient reduction, the removal of water transported nutrients from mulch adsorption or enhanced infiltration, is estimated to be 50 to 70 percent for six months. Long-term effectiveness is greatly enhanced when combined with topsoil reapplication.

2.6.3 Jute or Paper Matting

Jute or paper matting is used in some applications for erosion control to provide slope stabilization, erosion control and protection of mulches from wind or water damage.

Jute or paper matting may be used for steeper slopes with topsoil application, hydromulching, and vegetative stabilization. Jute or paper matting can be applied over straw, wood fiber, hydromulch or manure mulches where runoff quantities and velocities from slopes greater than 4:1 exist or where there are large tributary drainages flowing over the site. It may be applied alone as an alternative to straw or wood fiber mulches on flat sites for dust control and seed germination enhancement, but will not be applied alone on slopes greater than 8:1 where runoff quantities are high.

Jute and paper matting are heavy fiber nets which are generally purchased in rolls and are attached to slopes by wired U-shaped staples to provide a uniform covering. This covering protects mulches, provides additional water-holding capacity, and aids in moderating environmental fluctuations near the ground surface, as does a mulch. Greater integrity of a mulched area results from the use of this covering than from any other single method, such as punched straw.

The soil must be reasonably smooth. Gullies and rills must be filled and compacted. Rocks or other obstructions which rise above the level of the soil and mulch must be removed. Slope

stabilization will be used where necessary to achieve the slope design criteria. Application will be as specified below for maximum effectiveness. The details for installation are shown in Figure 2-6. Individual rolls will be applied vertically to the slope. Sides of rolls will overlap at least 4 inches. Rolls will have at least a three foot overlap with the uphill roll overlaying the downhill roll.

Staples will be made of wire 0.091 inches in diameter or greater, U-shaped with legs at least six inches in length and with a one inch crown. Longer staples are required in loose or sandy soils. Staples will be driven perpendicularly into the slope face, and will be spaced approximately five feet apart down the sides and center of the roll. Spacing between staples at the upper end of a roll or at the end overlap of two rolls will not exceed one foot.

Matting will be continued beyond the edge of the mulched or seeded area at least one foot at the sides and three feet at the top and bottom of the area. If existing vegetation or structures mark the boundaries of the area, the matting will be continued into the stable vegetated area or the edge of the structure. The upper end of the matting at the top of the area will be buried in a trench at least eight inches deep. The matting will make uniform contact with the slope face underneath. No "bridging" of rills or gullies is recommended.

Jute or paper matting acts similarly to straw mulch or hydromulch. Sediment reduction for up to six months is 70 to 90 percent, with 40 to 60 percent expected for up to two years. Nutrient reductions are estimated at 50 to 70 percent for six months, and 20 to 50 percent for up to two years.

2.6.4 Diversion Berm

A diversion berm is an earth dike constructed along the bottom of cut or fill slopes to intercept runoff. This method is used to retain overland flow from slopes and reduce downstream erosion.

Diversion berms are used on slopes which may receive runoff from an upslope area, and are generally used during construction to retain runoff from graded or disturbed areas and divert the flow to sedimentation basins. Diversion berms will be placed as needed to intercept runoff from above or below cut and fill slopes to prevent collected runoff from flowing onto slope faces below, thereby reducing downslope erosion. A recommended design is shown in Figure 2-7. The detention area must be able to percolate expected runoff and diverted runoff must not overtop the berm. For grades in excess of two percent or for large flows, the diversion channel will be mechanically stabilized with a riprap lining placed to enhance vegetal cover where erosive velocities might occur.

The diversion berm consists of a trench and a dike. The trench will be constructed using a dozer blade or hand tools to dig below the topsoil layer. The dike will be compacted at regular intervals. Materials for the dike will be free of mulch or organic material. After construction, the faces will be covered with topsoil to promote vegetation cover.

Berms will be inspected after each major storm to locate damaged areas with repairs completed before the next storm. Channel obstructions will be removed.

The effectiveness of this method depends on the size and stabilization of the slope above, and maintenance of the catch basin channel. It is most effective for removing large sediments during the early phases of stabilization.

2.6.5 Sedimentation Basin

A sedimentation basin is a temporary or permanent basin constructed in conjunction with a detention dam. This method is used to trap and store sediment contained in surface runoff and to serve as a flow detention facility for reduction of peak runoff.

Detention structures will be used to temporarily contain storm water to trap sediment in runoff from construction sites. The typical design (Figure 2-8) illustrates a basin to detain construction runoff and sediments and slowly discharge flows to a stabilized area below the basin. Sedimentation basins covered by this control technique will be limited to drainage areas not exceeding 50 acres. Vegetation will be planted on all embankment slopes, borrow areas or any other areas disturbed during construction. An antivortex device will be installed on the top of the standpipe. An antivortex device is a thin, vertical plate normal to the centerline of the dam and firmly attached to the top of the standpipe. A trash rack consisting of reinforcing bars, six inches on center will be welded across the top of the standpipe.

Pipes through embankments will be provided with antiseep collars. All basins will have a minimum of one antiseep collar which is a watertight barrier attached to the pipe blocking all potential flow through the backfilled material and extending to the sides of the pipe trench. The sediment trap will have drain-down perforations to slowly eliminate the entire stored water volume to prevent insect breeding and maintain adequate live storage.

Protection of the embankment and emergency spillway by riprap, vegetation, or other suitable means will be provided. Sedimentation basins will be cleaned when the effective storage capacity of runoff drops below 0.3 inches per acre of drainage area. The elevation corresponding to this level will be determined and given in the detailed design as part of the final landscape design plan.

Areas under the embankment and any structural works will be cleared, grubbed and the topsoil stripped to remove trees, vegetation, roots, or other objectionable material. To facilitate cleanout and restoration, the pool area (measured at the top of the pipe spillway) will be cleaned of brush, trees or other debris. The fill material will be free of roots, woody vegetation, oversized stones, rocks exceeding six inches in diameter, or other objectionable materials. The embankment will be raised and compacted to design elevation. The movement of the hauling and spreading equipment over the fill will be controlled so that the entire surface of each lift will be traversed by not less than one tread track of the equipment or compaction will be achieved through use of a roller.

The standpipe must be rigidly and securely fastened to the barrel and the bottom of the standpipe must be sealed (watertight). The pipe spillway will discharge at ground elevation below the dam. All pipe joints must be securely fastened and watertight. When sediments fill up to 30 percent of the height of the drainage standpipe, the basin will be mechanically cleared and the materials transported to an appropriate storage location.

This method is most effective when the basins are sized for major storms such as the 25-year event. The larger size allows maximum settling of sediments and suspended materials.

2.6.6 Riprap

Riprap involves the use of stabilizing blankets comprised of large rocks placed on a slope or ground surface to be protected from surface water erosion. This method is used to protect banks from erosion, maintain stream capacity, and prevent downstream sedimentation. Riprap will be used as needed to enhance stabilization of emergency spillways, pipe discharges, and in specific locations throughout the project area where flow velocities are such that riprap is deemed necessary to control erosion.

Consideration must be given to sizing of stream crossing structures to handle water flows from the entire contributing drainage area of the given stream or conveyance facility. The location of riprap placement will be determined by the elevation and location of moving water around or next to conveyance structures such as ditches. Trees and other debris must be cleared from the water conveyance structure after major storms to prevent alteration or flow blockage and subsequent loss of facilities. Used with proper design, riprap is very effective in controlling erosion and providing slope stability.

2.6.7 Silt Fence

Silt fencing is often used as a perimeter barrier and to prevent or minimize sheetwash, rills and small gullies from carrying sediment off site. A geofabric, typically woven, embedded into the soil on the bottom and held up by wood or other suitable stakes makes up a common silt fence. This structure, when properly constructed, holds back soils being carried off site in a water stream. Often, silt fences are constructed around the perimeter of a site to protect erosion off-site through overland flow or to redirect the flow of site waters to appropriate facilities, such as runoff basins or straw bale discharge structures. Construction details for a silt fence are shown in Figure 2-9.

2.6.8 Straw Bales

Straw bales are used in drainage channels and ditches to slow runoff and trap sediment. Straw bales are staked in strategic locations to provide a barrier to sediment transport. Used as ditch checks or perimeter downslope protection, this temporary facility can be a valuable tool in controlling erosion. Details for a straw bale installation are shown in Figures 2-10 and 2-11.

The bales may be anchored to the ground with fence posts, steel pins or by other means, particularly in those areas where concentrated runoff may cause excessive erosion. Straw bales may be used in conjunction with fiber fabric in areas where runoff from the construction zone may concentrate.

2.6.9 Sandbag Sediment Barriers and Temporary Diversion Berms

Temporary sediment barriers or diversions can be constructed of sandbags or as described above with the use of straw bales, as needed. Such barriers are built to retain sediment on-site by slowing storm runoff and causing the deposition of sediment at the barrier.

Sandbag barriers do not provide a high degree of filtration but are valuable for emergency control. They can be used only for minor flows and to temporarily control spot failures on slopes where other methods were used or before other methods have been implemented.

Sandbag sediment barriers are used as training berms to direct or divert runoff flows, or as barriers to collect and store runoff from spot failures of other control methods. After every use, sandbag sediment barriers will be inspected, damaged bags replaced, and trapped sediment removed.

Temporary diversion berms are identical to the diversion berm previously described but are constructed during or immediately following storms to prevent sedimentation from small areas where slope failure occurs. Temporary diversion berms are constructed using techniques similar to those described for diversion berms.

2.7 Wetland Compensation Site Construction Procedures

Construction will be accomplished using typical earth moving equipment. As construction begins, clearing and grubbing will be initially conducted. Stumps, if any, and brush will be mulched and stockpiled for land reclamation. Salvageable topsoil will be stockpiled for revegetation of the graded slopes.

Erosion control measures will be used to minimize siltation of the ditch connected to Duchess Creek. A system of silt fencing, ditches, and settling basins will be constructed during site clearing and grubbing operations to collect disturbed area runoff using the procedures outlined in Section 2.6 above. Exposed slopes will be revegetated and mulched as soon as possible after grading. Construction will be performed so that environmental impacts will be minimized.

Erosion control measures will also be used to minimize siltation of wetlands and tributaries. A system of diversion dikes, silt fencing, ditches, and settling basins will be constructed during the grubbing operation to collect disturbed area runoff. Riprap will be used to protect slopes from erosion. Exposed slopes will be revegetated and mulched as soon as possible after grading.

Temporary vegetation will be used to provide interim stability to slopes when weather conditions or construction delays preclude immediate establishment of permanent vegetation. Jute or other erosion matting will be used on steep slopes, where applicable, to enhance seed germination.

During construction water sprays may be used, as needed, to control dust. Most fill material required for drainage facilities will come from on-site excavation elsewhere in the project area. Riprap and aggregate will be hauled to the site from local sources.

3 References

Eggers, 1992. *Compensatory Wetland Mitigation: Some Problems and Suggestions for Corrective Measures*. U.S. Army Corps of Engineers.

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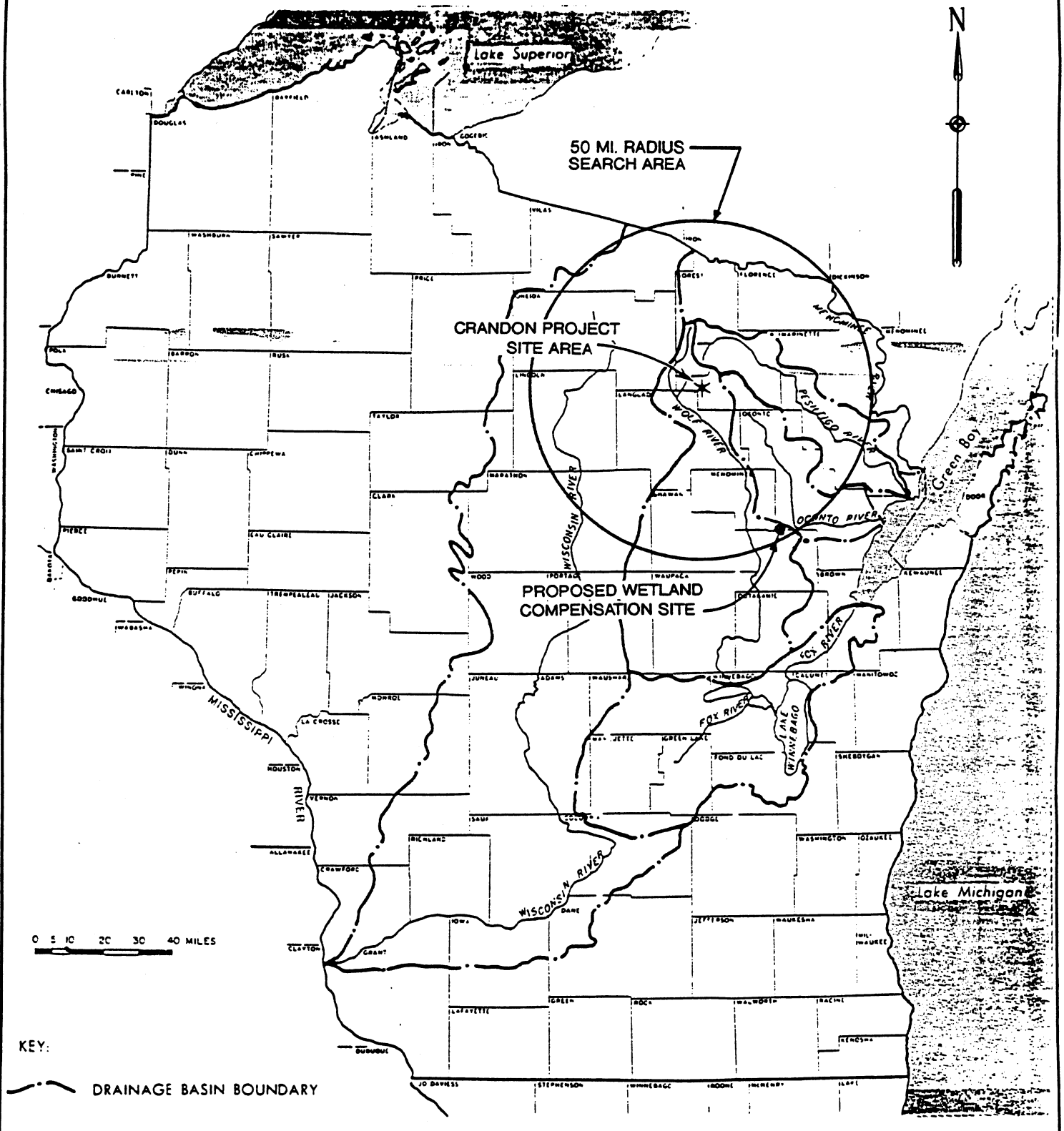
Foth & Van Dyke, July, 1995. *Crandon Project Section 404 Permit Application - Addendum 1.*

Fredrickson, 1982. *Management of Seasonally Flooded Impoundments for Wildlife*. United States Department of the Interior. Fish and Wildlife Service.

Gundlach, et al., 1982. Soil Survey of Shawano County, Wisconsin. United States Department of Agriculture, Washington, D.C.

FIGURES FOR WATER REGULATORY PERMIT APPLICATION



SOURCE: 1985, ENVIRONMENTAL IMPACT REPORT.

Foth & Van Dyke

REVISED	DATE	BY	DESCRIPTION

CHECKED BY:	JKSI	DATE: NOV. '95
APPROVED BY:	RFS	DATE: NOV. '95
APPROVED BY:	GWS	DATE: NOV. '95

Crandon Mining Company

FIGURE 1-1
WETLAND COMPENSATION SITE
REGIONAL LOCATION

Scale:	AS SHOWN	Date:	JANUARY, 1996
Prepared By:	Foth & Van Dyke	By:	KMP

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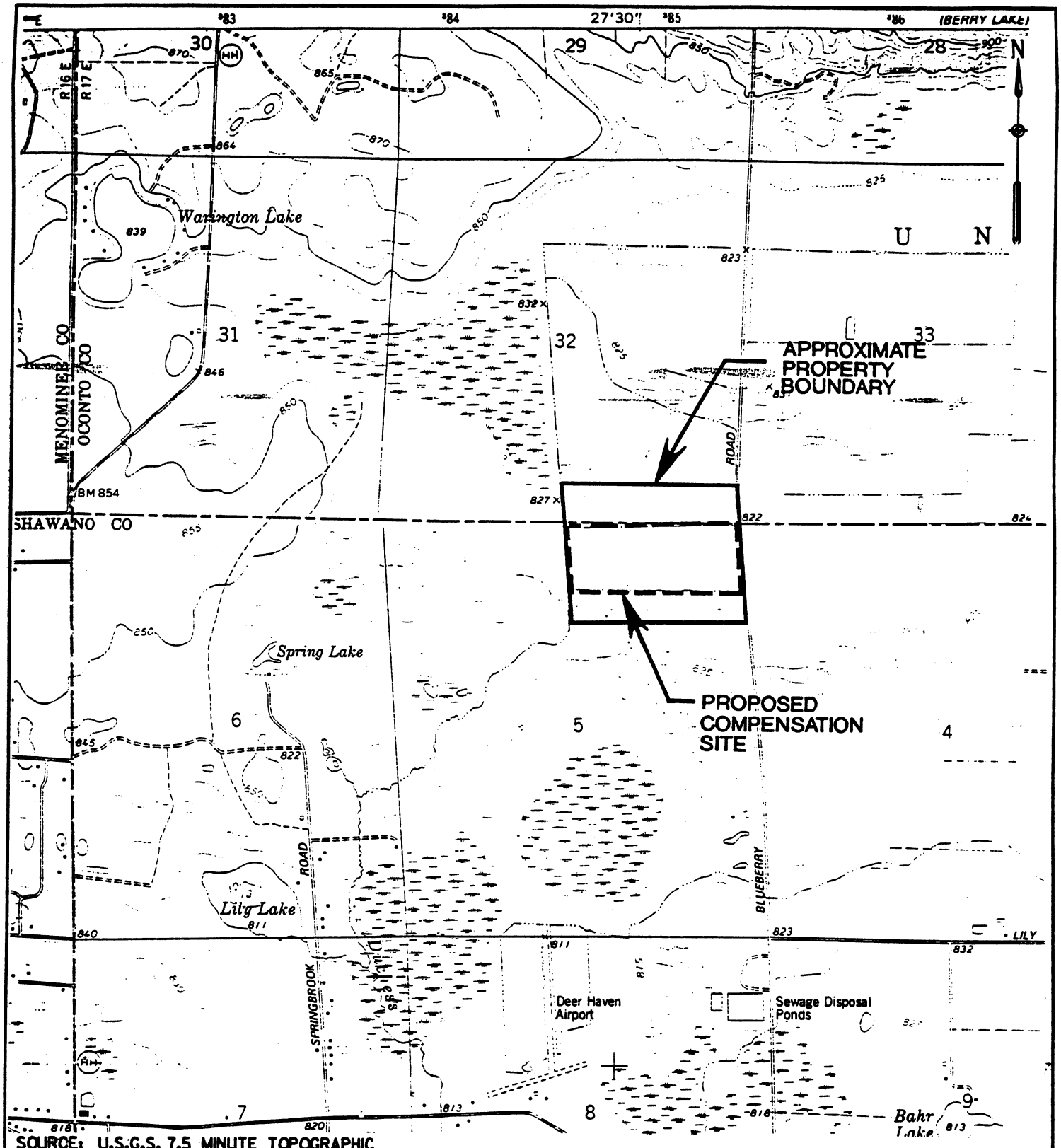

SOURCE: U.S.G.S. 7.5 MINUTE TOPOGRAPHIC QUADRANGLE - CECIL, 1974 OCONTO & SHAWANO COUNTY, WISCONSIN

Foth & Van Dyke

REVISED	DATE	BY	DESCRIPTION

CHECKED BY:	JKSI	DATE: NOV. '95
APPROVED BY:	PAE	DATE: NOV. '95
APPROVED BY:	GWS	DATE: NOV. '95

Crandon Mining Company

FIGURE 2-1
WETLAND COMPENSATION SITE LOCATION

Scale: 0 1000' 2000' Date: NOVEMBER, 1995

Prepared By: Foth & Van Dyke By: JOW

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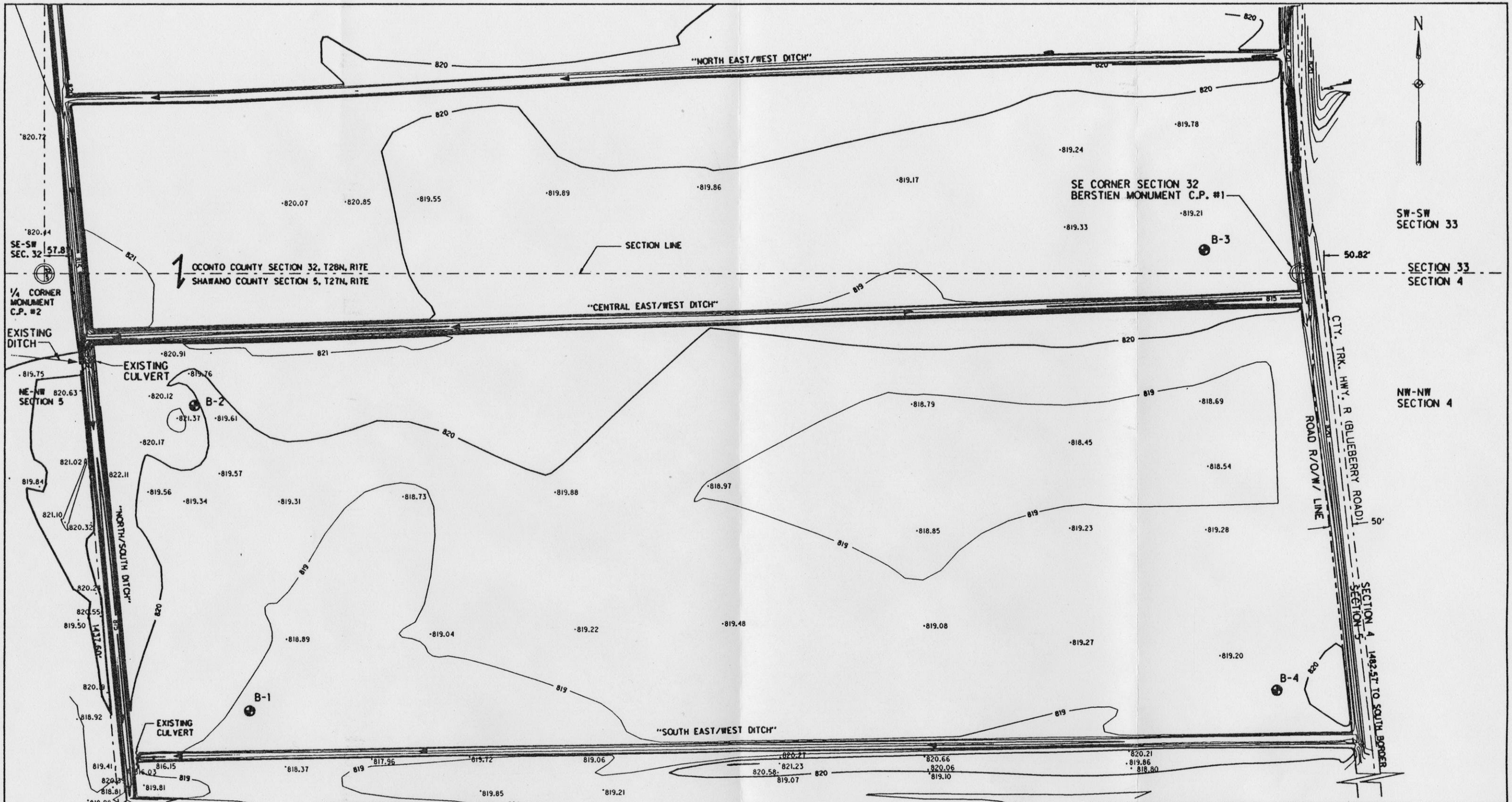

LEGEND

819.04	EXISTING SPOT ELEVATION
815	EXISTING CONTOUR
B-1	SOIL BORING LOCATIONS
	EXISTING SURFACE WATER FLOW
	SECTION LINE
	APPROXIMATE CENTERLINE OF ROAD

SOUTH PROPERTY LINE

NORTH LINE OF SOUTH 660' OF NE 1/4 SECTION 32, T27N, R17E

NOTES:

1. SITE LOCATION: NE 1/4 OF THE NE 1/4, NW 1/4 OF THE NE 1/4, SECTION 5 T27N, R17E, TOWN OF WASHINGTON, SHAWANO COUNTY, AND SE 1/4 OF THE SE 1/4, SW 1/4 OF THE SE 1/4 SECTION 32, T28N, R17E, TOWN OF UNDERHILL, OCONTO COUNTY, WISCONSIN.
2. BASE MAP PREPARED FROM TOPOGRAPHIC SURVEY BY FOTH & VAN DYKE. DATE OF SURVEY - MARCH, 1995.
3. ELEVATIONS BASED OFF OF SPOT ELEVATION FROM 'CECIL' 7.5 MINUTE SERIES USGS MAP (1974). CONTOUR INTERVAL IS ONE FOOT.
4. HORIZONTAL DATUM BASED ON SITE GRID SYSTEM USING SOUTH 1/4 CORNER SECTION 32, T29N, R17E AS 10,000 N , 10,000 E (CP #2) AND THE SE CORNER SECTION 32 AS 10,000 N , 12,663.52 E (CP #1).
5. PROPERTY LINES REPRESENTED ON THIS MAP ARE DERIVED FROM FIELD SURVEY MADE BY FOTH & VAN DYKE DURING MARCH, 1995 USING SECTION BREAKDOWN INFORMATION FURNISHED BY NORDIN & ASSOCIATES, SHAWANO, WISCONSIN.

TYPICAL REPRESENTATION: REFINEMENTS MAY BE MADE PRIOR TO CONSTRUCTION.

Foth & Van Dyke

REVISED	DATE	BY	DESCRIPTION

CHECKED BY:	JKS1	DATE: NOV. '95
APPROVED BY:	RFS	DATE: NOV. '95
APPROVED BY:	GWS	DATE: NOV. '95

Crandon Mining Company

FIGURE 2-2
WETLAND COMPENSATION
SITE EXISTING TOPOGRAPHY

Scale: 0 100' 200' | Date: NOVEMBER, 1995

Prepared By: Foth & Van Dyke | By: JRB2

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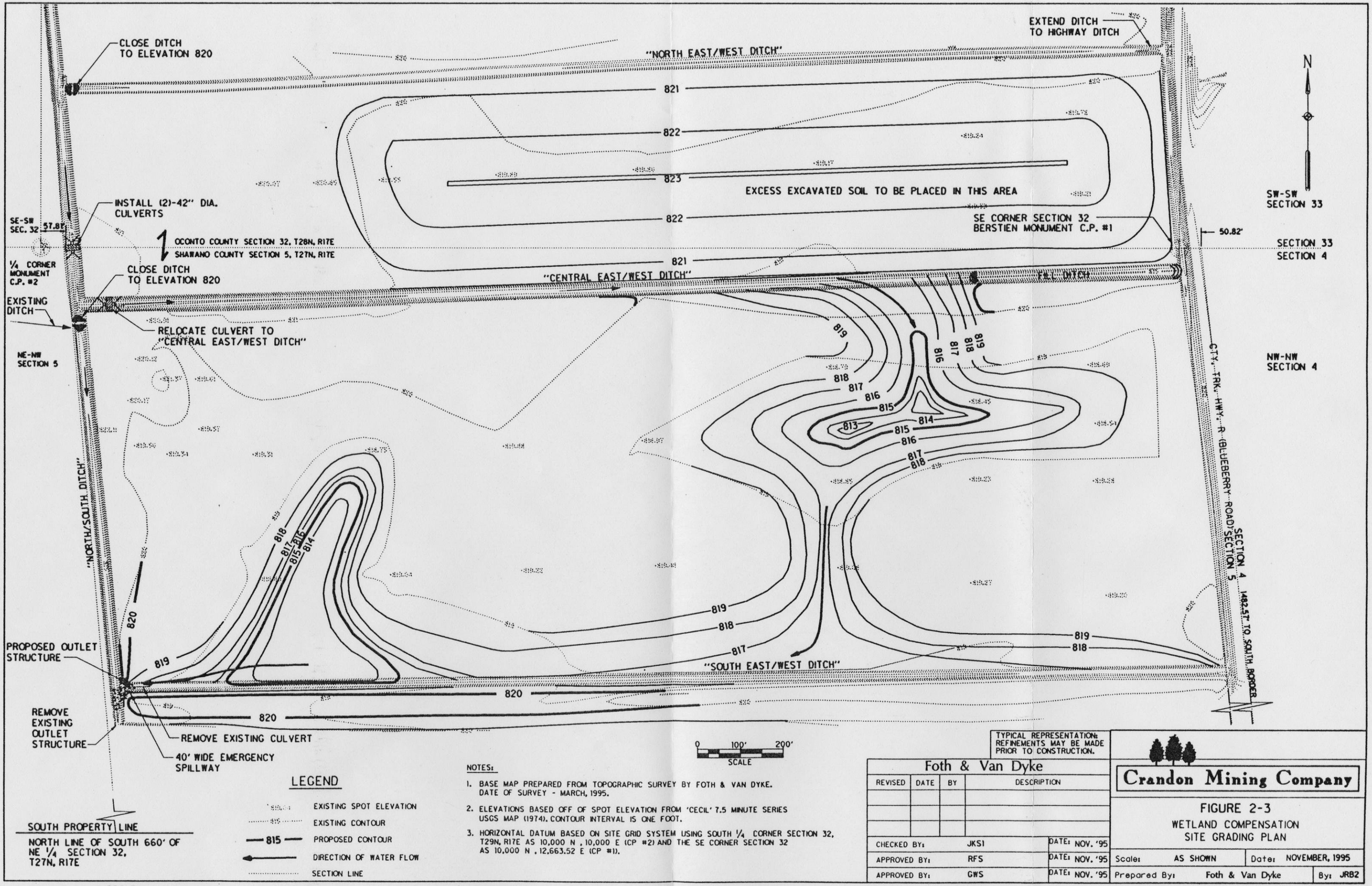

NOTES:

1. BASE MAP PREPARED FROM TOPOGRAPHIC SURVEY BY FOTH & VAN DYKE. DATE OF SURVEY - MARCH, 1995.
2. ELEVATIONS BASED OFF OF SPOT ELEVATION FROM 'CECIL' 7.5 MINUTE SERIES USGS MAP (1974). CONTOUR INTERVAL IS ONE FOOT.
3. HORIZONTAL DATUM BASED ON SITE GRID SYSTEM USING SOUTH 1/4 CORNER SECTION 32, T29N, R17E AS 10,000 N , 10,000 E (CP #2) AND THE SE CORNER SECTION 32 AS 10,000 N , 12,663.52 E (CP #1).

TYPICAL REPRESENTATION: REFINEMENTS MAY BE MADE PRIOR TO CONSTRUCTION.

Foth & Van Dyke

REVISED	DATE	BY	DESCRIPTION

CHECKED BY:	JKS1	DATE: NOV. '95	
APPROVED BY:	RFS	DATE: NOV. '95	
APPROVED BY:	GWS	DATE: NOV. '95	

Crandon Mining Company

FIGURE 2-3
WETLAND COMPENSATION
SITE GRADING PLAN

Scale:	AS SHOWN	Date:	NOVEMBER, 1995
Prepared By:	Foth & Van Dyke	By:	JRB2

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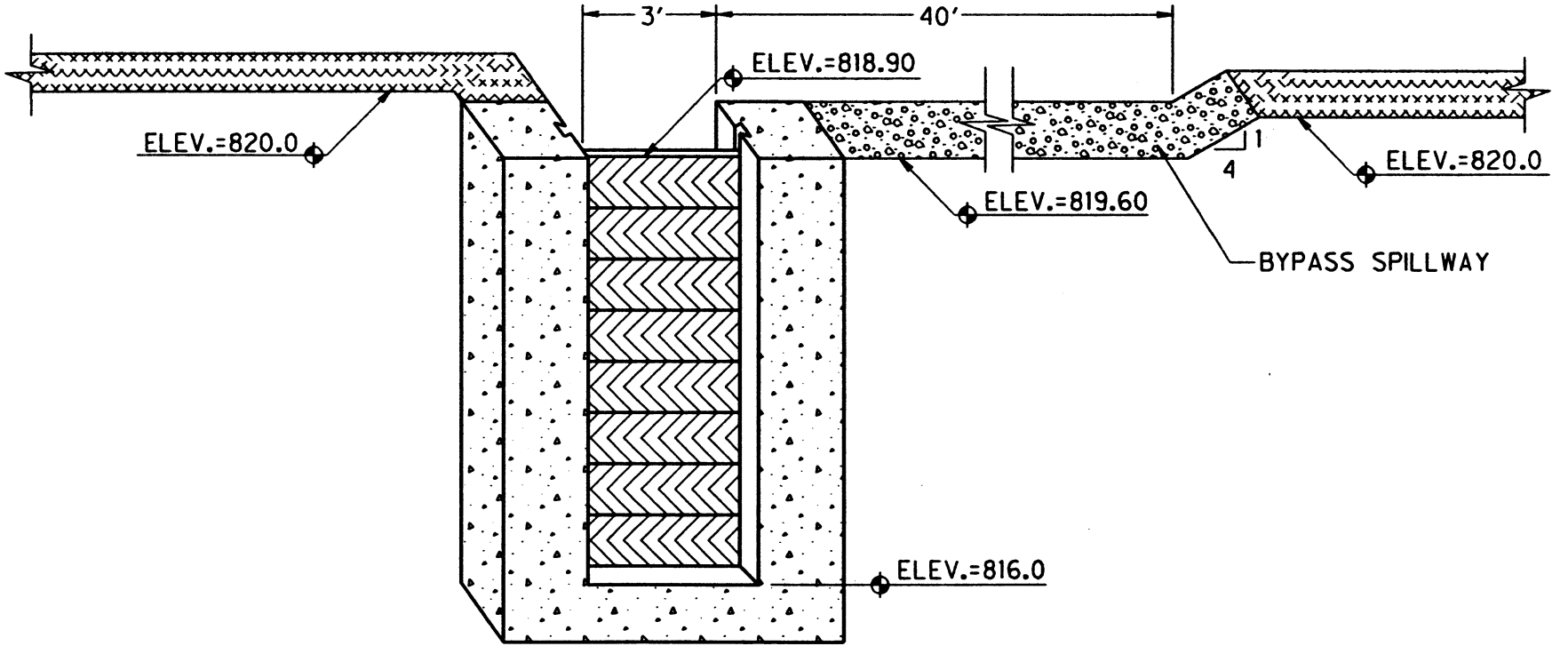

TYPICAL REPRESENTATION: REFINEMENTS MAY BE MADE PRIOR TO CONSTRUCTION.

Foth & Van Dyke

REVISED	DATE	BY	DESCRIPTION

CHECKED BY:	JKSI	DATE: NOV. '95
APPROVED BY:	RFS	DATE: NOV. '95
APPROVED BY:	GWS	DATE: NOV. '95

Crandon Mining Company

FIGURE 2-4
WETLAND COMPENSATION
SITE OUTLET STRUCTURE

Scale:	NOT TO SCALE	Date:	NOVEMBER, 1995
Prepared By:	Foth & Van Dyke	By:	JOW

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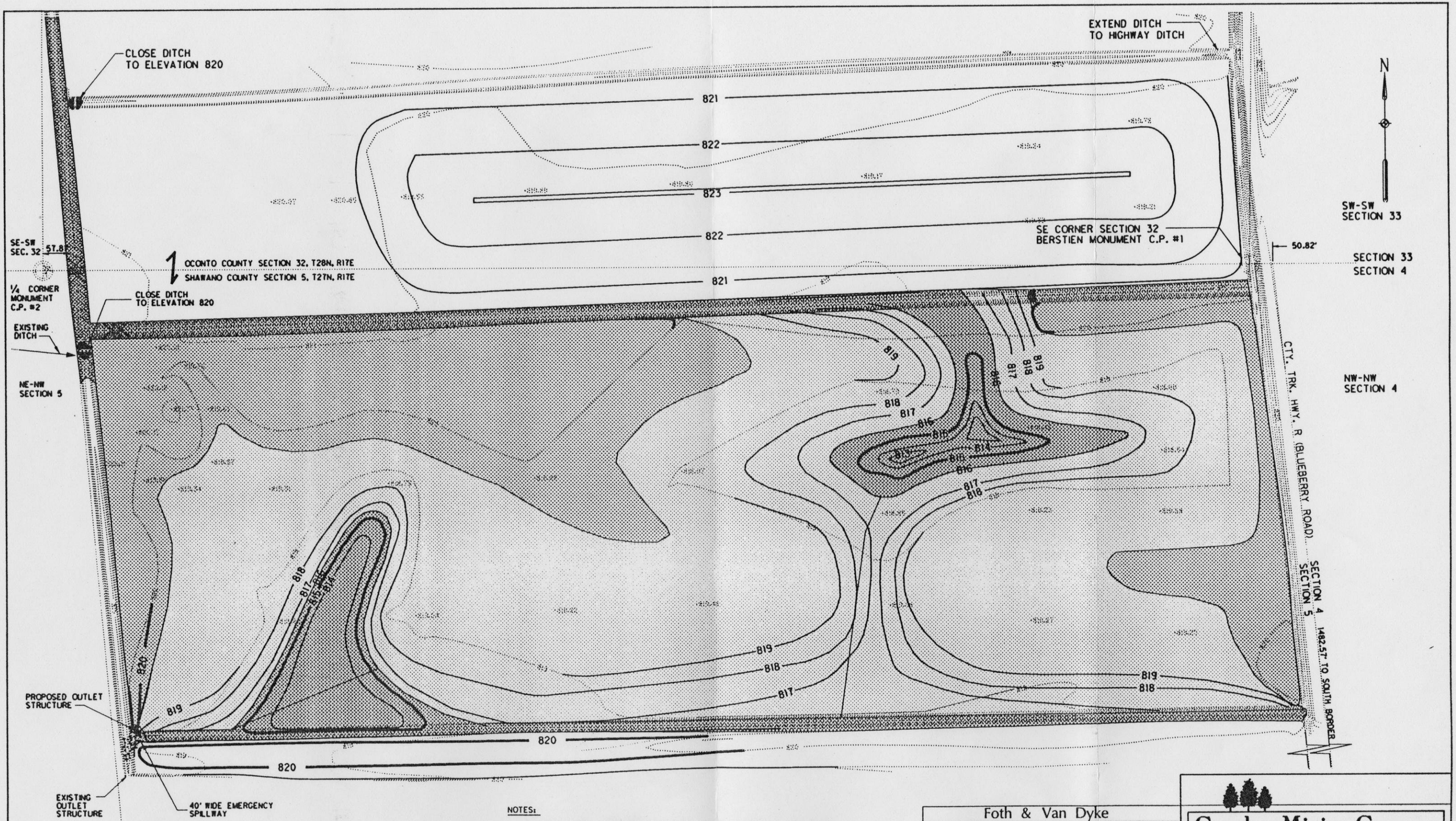

LEGEND

- 819.04 — EXISTING SPOT ELEVATION
- 815 — EXISTING CONTOUR
- 815 — PROPOSED CONTOUR
- DIRECTION OF WATER FLOW
- SECTION LINE
- DEEP MARSH - APPROX. 8 ACRES
- WET MEADOW - APPROX. 13 ACRES
- SHALLOW MARSH - APPROX. 36 ACRES

NOTES:

1. BASE MAP PREPARED FROM TOPOGRAPHIC SURVEY BY FOTH & VAN DYKE. DATE OF SURVEY - MARCH, 1995.
2. ELEVATIONS BASED OFF OF SPOT ELEVATION FROM 'CECIL' 7.5 MINUTE SERIES USGS MAP (1974). CONTOUR INTERVAL IS ONE FOOT.
3. HORIZONTAL DATUM BASED ON SITE GRID SYSTEM USING SOUTH 1/4 CORNER SECTION 32, T29N, R17E AS 10,000 N , 10,000 E (CP #2) AND THE SE CORNER SECTION 32 AS 10,000 N , 12,663.52 E (CP #1).

0 100' 200'
SCALE

Foth & Van Dyke

REVISED	DATE	BY	DESCRIPTION

CHECKED BY:	JKS1	DATE: JAN. '96
APPROVED BY:	RFS	DATE: JAN. '96
APPROVED BY:	GWS	DATE: JAN. '96

Crandon Mining Company

FIGURE 2-5
WETLAND COMPENSATION
SITE VEGETATION PLAN

Scale:	AS SHOWN	Date:	JANUARY, 1996
Prepared By:	Foth & Van Dyke	By:	JRB2

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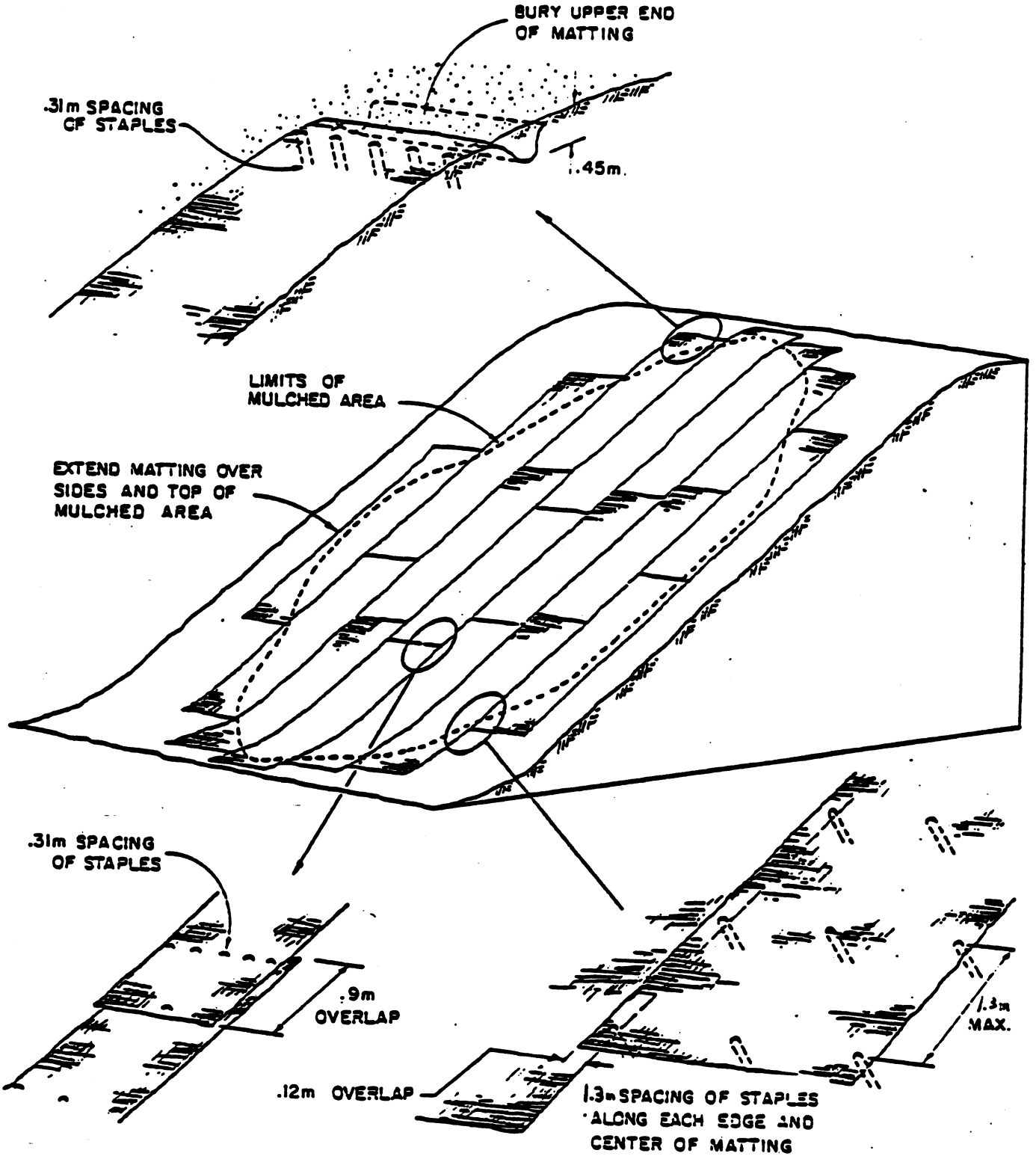

SOURCE:
TAHOE REGIONAL PLANNING AGENCY, 1978

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REVISED	DATE	BY	DESCRIPTION

CHECKED BY:	JKSI	DATE: NOV. '95
APPROVED BY:	JBHI	DATE: NOV. '95
APPROVED BY:	PAE	DATE: NOV. '95

Crandon Mining Company

FIGURE 2-6
JUTE MATTING

Scale:	NOT TO SCALE	Date:	NOVEMBER, 1995
Prepared By:	Foth & Van Dyke	By:	KMP

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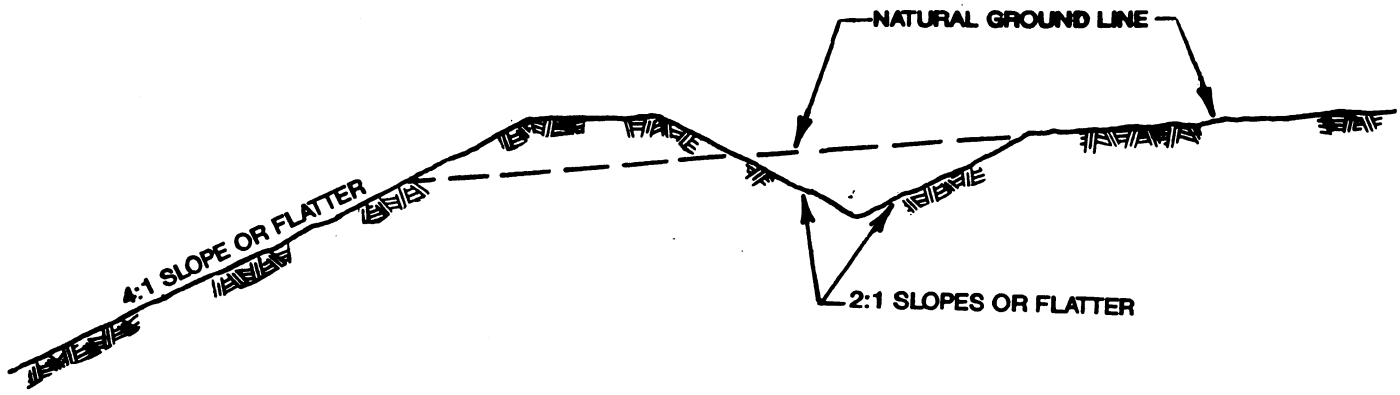

SECTION

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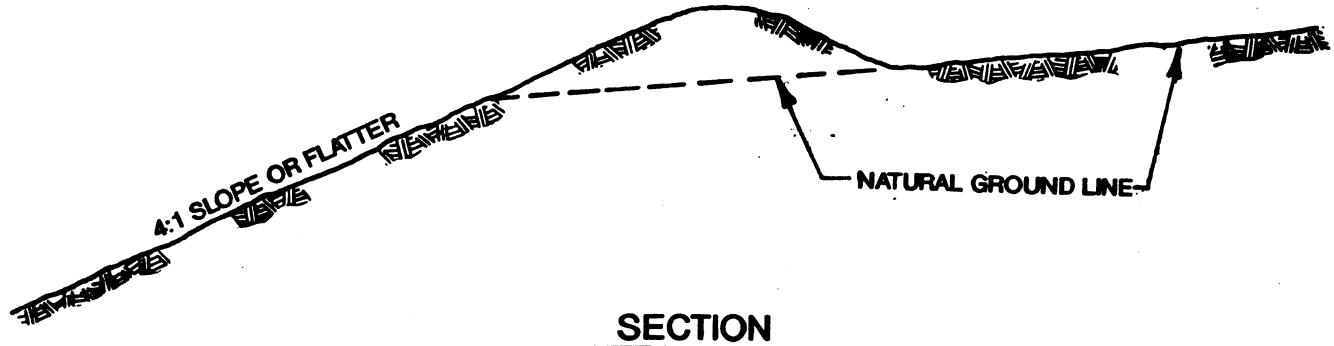

SECTION

NOT TO SCALE

SOURCE:
ENGINEERING SCIENCE, 1980

Foth & Van Dyke				
REVISED	DATE	BY	DESCRIPTION	
CHECKED BY:		JKSI		DATE: NOV. '95
APPROVED BY:		JBHI		DATE: NOV. '95
APPROVED BY:		PAE		DATE: NOV. '95

Crandon Mining Company

FIGURE 2-7

DIVERSION BERM

Scale: NOT TO SCALE	Date: NOVEMBER, 1995	
Prepared By: Foth & Van Dyke		By: KMP

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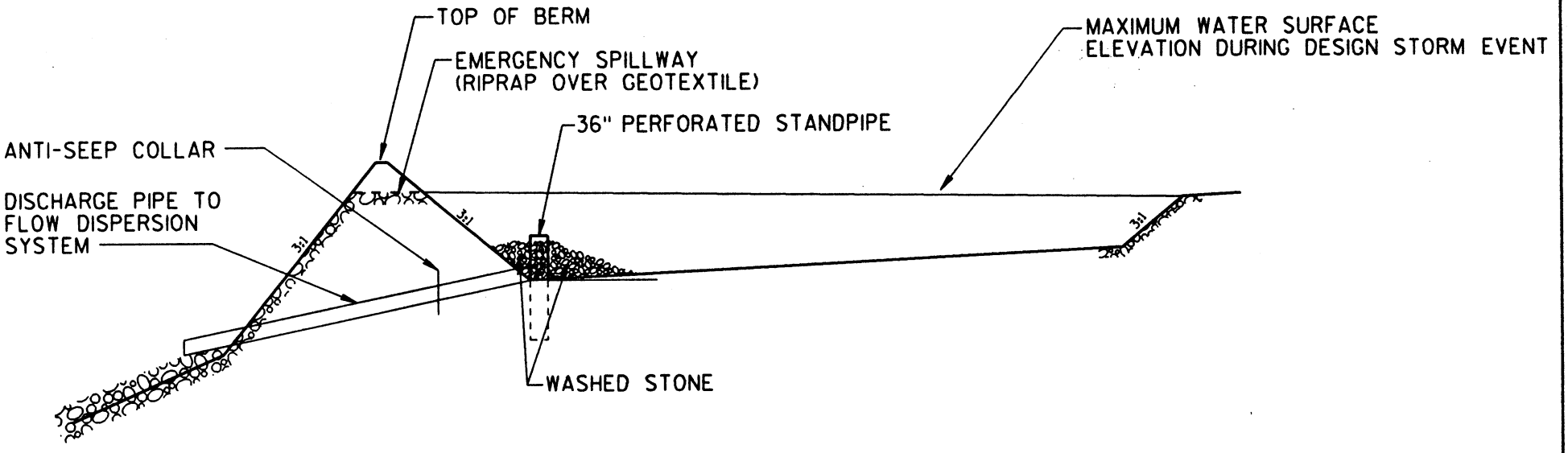


NOTE:
STANDPIPE TO INCLUDE
1) TRASH RACK
2) 9-½" DIA. HOLES PER ROW, ROWS 6" ON CENTER
3) WRAP WITH AKZO ENKADRAIN 9120 OR EQUAL

TYPICAL REPRESENTATION: REFINEMENTS MAY BE MADE PRIOR TO CONSTRUCTION.

Foth & Van Dyke

REVISED	DATE	BY	DESCRIPTION

CHECKED BY:	JKSI	DATE: NOV. '95
APPROVED BY:	JBH	DATE: NOV. '95
APPROVED BY:	PAE	DATE: NOV. '95

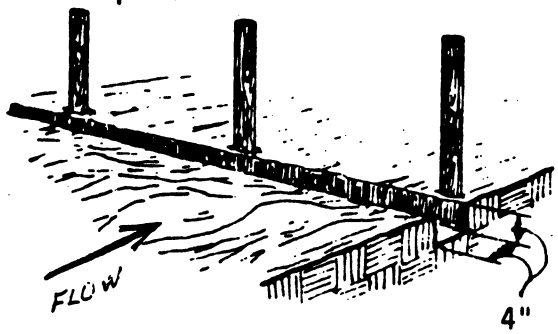
Crandon Mining Company

FIGURE 2-8
TYPICAL RUNOFF BASIN

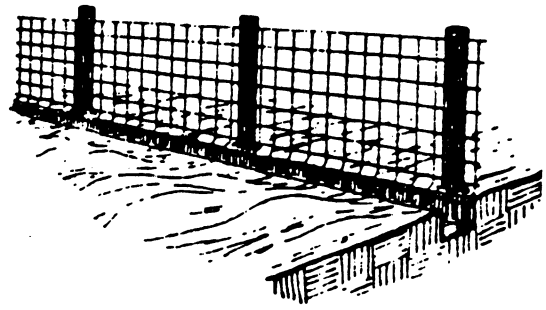
Scale:	NOT TO SCALE	Date:	NOVEMBER, 1995
Prepared By:	Foth & Van Dyke	By:	KMP

93C049

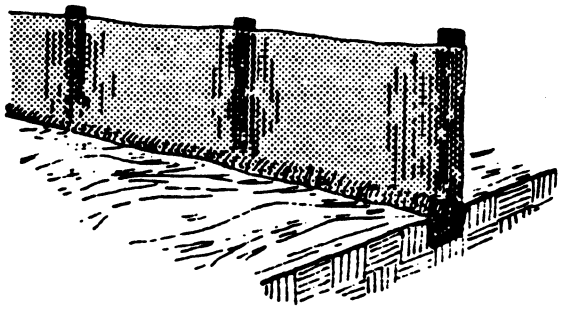
1. Set posts and excavate a 4"x4" trench upslope along the line of posts.



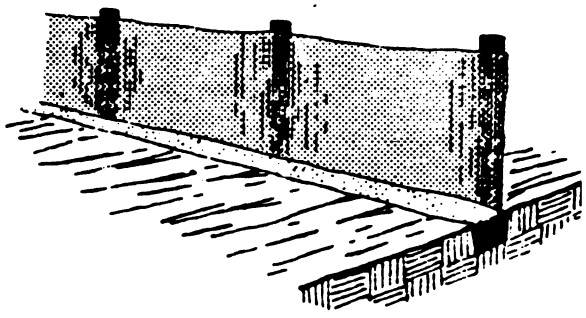
2. Staple wire fencing to the posts.



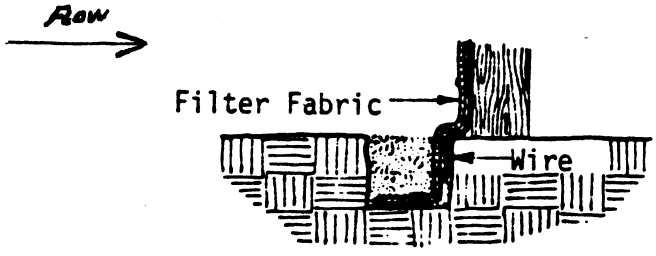
3. Attach the filter fabric to the wire fence and extend it into the trench.



4. Backfill and compact the excavated soil.



Extension of fabric and wire into the trench.



SOURCE:
ADAPTED FROM INSTALLATION OF STRAW AND FABRIC FILTER BARRIERS FOR SEDIMENT CONTROL, SHERWOOD AND WYANT

Foth & Van Dyke

REVISED	DATE	BY	DESCRIPTION

CHECKED BY:	JKSI	DATE: NOV. '95
APPROVED BY:	JBHI	DATE: NOV. '95
APPROVED BY:	PAE	DATE: NOV. '95

Crandon Mining Company

FIGURE 2-9

TYPICAL CONSTRUCTION OF A SILT FENCE

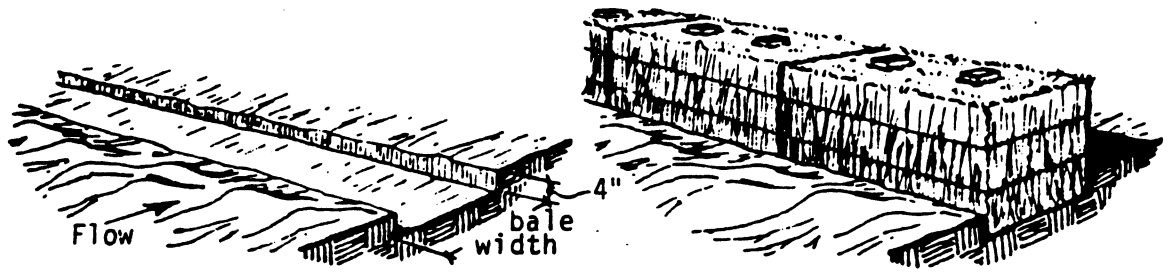
Scale:	NOT TO SCALE	Date:	NOVEMBER, 1995
Prepared By:	Foth & Van Dyke	By:	KMP

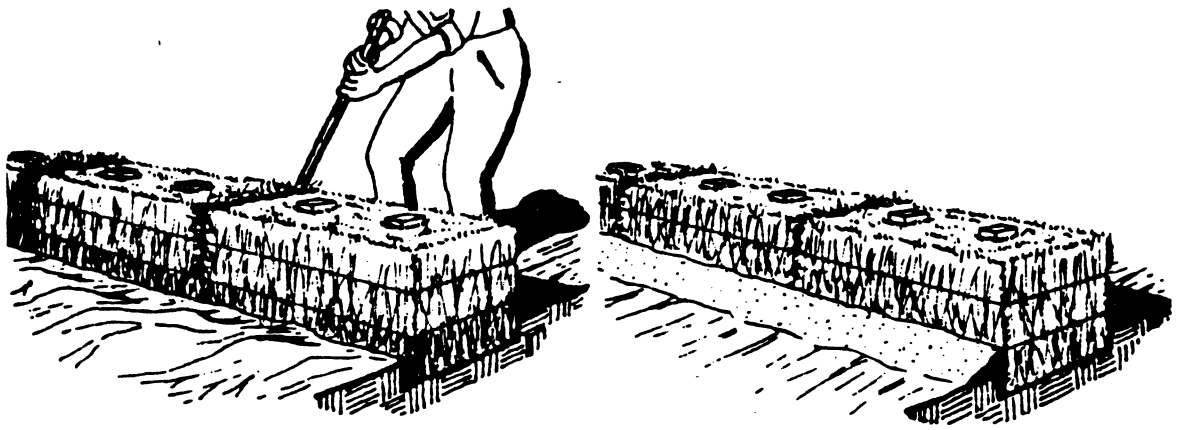
/d3/dl/users/jow/4c62f23.dgn

93C049

1. Excavate the trench.

2. Place and stake straw bales.

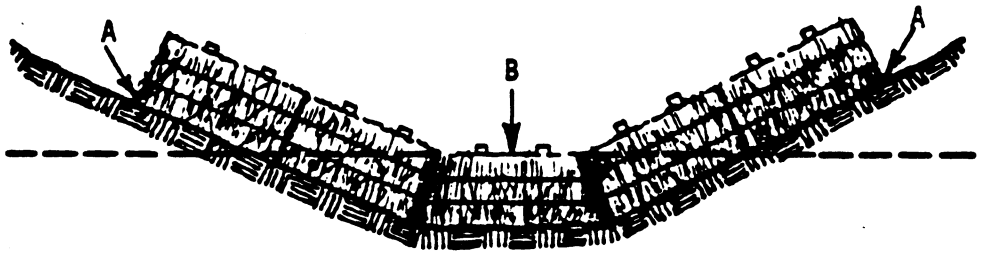




3. Wedge loose straw between bales.

4. Backfill and compact the excavated soil.

CONSTRUCTION OF A STRAW BALE BARRIER



Points A should be higher than point B

PROPER PLACEMENT OF STRAW BALE BARRIER IN DRAINAGE WAY

SOURCE:
ADAPTED FROM INSTALLATION
OF STRAW AND FABRIC FILTER
BARRIERS FOR SEDIMENT CONTROL,
SHERWOOD AND WYANT

Foth & Van Dyke

REVISED	DATE	BY	DESCRIPTION

CHECKED BY:	JKSI	DATE: NOV. '95
APPROVED BY:	JBHI	DATE: NOV. '95
APPROVED BY:	PAE	DATE: NOV. '95

Crandon Mining Company

FIGURE 2-10
TYPICAL CONSTRUCTION
OF A STRAW BARRIER

Scale:	NOT TO SCALE	Date:	NOVEMBER, 1995
Prepared By:	Foth & Van Dyke	By:	KMP

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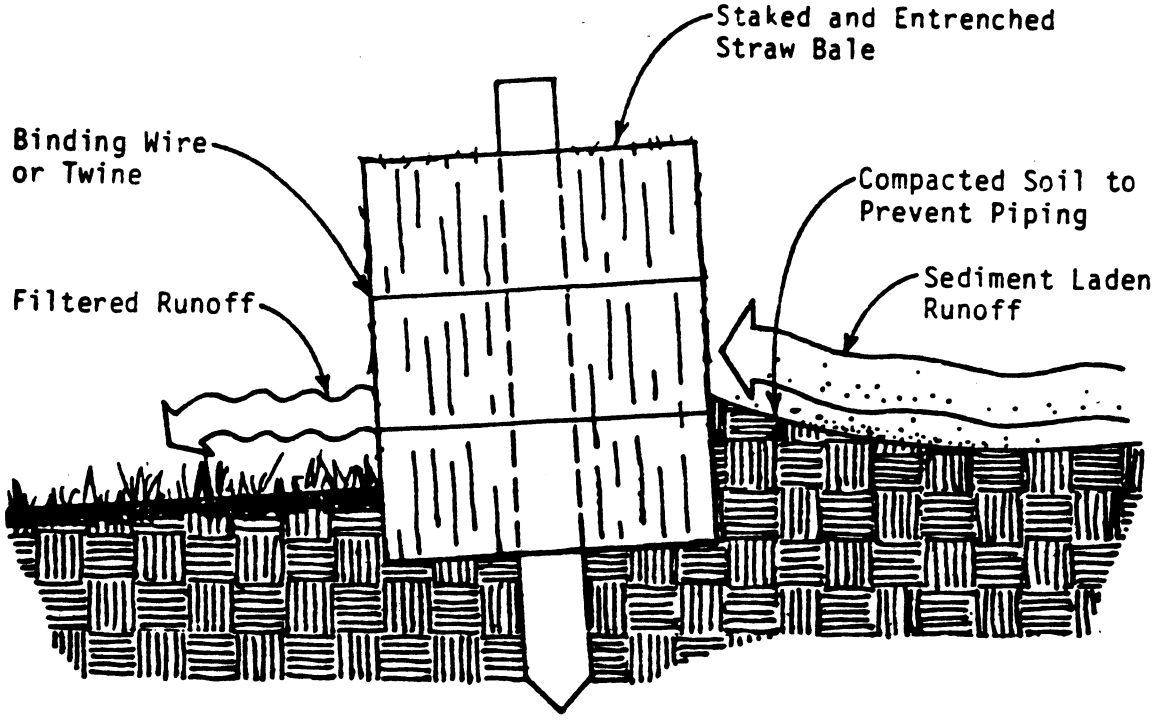


SOURCE:
MICHIGAN SOIL EROSION AND
SEDIMENTATION CONTROL
GUIDEBOOK, 1975

Foth & Van Dyke

REVISED	DATE	BY	DESCRIPTION

CHECKED BY:	JKSI	DATE: NOV. '95
APPROVED BY:	JBHI	DATE: NOV. '95
APPROVED BY:	PAE	DATE: NOV. '95

Crandon Mining Company

FIGURE 2-11
TYPICAL CROSS-SECTION OF A
STRAW BALE INSTALLATION

Scale:	NOT TO SCALE	Date:	NOVEMBER, 1995
Prepared By:	Foth & Van Dyke	By:	KMP

/d3/dl/users/jow/4c62f23.dgn

93C049

Appendix A

WDNR June 21, 1995 Wetland Compensation Site Correspondence

WISCONSIN
DEPT. OF NATURAL RESOURCES

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Marinette Area Office
1636 Industrial Parkway
Box 16
Marinette, Wisconsin 54143
Telephone #: (715)732-5500
Telefax #: (715)732-5540

George E. Meyer, Secretary
William R. Selbig, District Director

June 21, 1995

FOTH & VAN DYKE
ATTN:RONALD STEG
2737 S RIDGE ROAD
PO BOX 19012
GREEN BAY WI 54307-9012

SUBJECT: CRANDON MINING PROJECT MITIGATION SITE
NAVIGABILITY DETERMINATION & CHAPTER 30/31 PERMIT REQUIREMENTS

Dear Mr. Steg:

A site investigation of the Crandon mining project proposed wetland mitigation area was completed on June 20, 1995. The purpose of this investigation was to determine the navigability of the ditches draining this property, and the Chapter 30/31 permit requirements for the mitigation project. Location of the site is in the NE 1/4, of Section 5, T. 27, R. 17, Town of Washington, Shawano County.

These drainage ditches lead directly into Dutchess Creek and are considered an extension of or enlargement of this creek. Duchess Creek is a navigable waterway with stream history depicted on the original survey maps. The drainage ditches are therefore considered navigable, as they are an enlargement of a navigable waterway.

The mitigation work will consist of the plugging of one or several of the ditches, excavation of some deeper areas, and the construction of a dike to create a shallow (up to five foot maximum depth) emergent wetland with adjacent forested wetlands. The dike to be constructed will require a permit to dam navigable waters as required under Chapter 31.05 state statutes, following the hearing notice procedures of Chapter 31.06 state statutes. The formation of the pond/flowage would be included in this permit.

If I can be of further assistance in this matter, please contact me at the above number or address.

Sincerely,

Michael Hanaway

Michael Hanaway
Area Water Management Specialist

cc: Ron Fassbender
Archie Wilson - DNR Rhinelander

Appendix B

Wetland Compensation Site Permit Application Forms

Appendix B-1 **Chapter 30 Permit Application Forms**
(Form 3500-53 and Form 3500-53A With Attachments)

Appendix B-2 **Chapter 31 Permit Application Forms**
(Form 3500-10 With Attachments)

Appendix B-1

Chapter 30 Permit Application Forms
(Form 3500-53 and Form 3500-53A With Attachments)

Wetland Mitigation Site

State of Wisconsin
Department of Natural Resources
(Return to appropriate
DNR District/Area Office)

U.S. Army Corps of Engineer
St. Paul District
190 Fifth Street East
St. Paul, MN 55101-1638

STATE/FEDERAL APPLICATION FOR WATER REGULATORY PERMITS AND APPROVALS
Form 3500-53 Rev. 9-89

PLEASE COMPLETE BOTH PAGES 1 & 2 OF THIS APPLICATION. PRINT OR TYPE. Use of this form is required by the Department for any application filed pursuant to Chapter 30, Wis. Stats. The Department will not consider your application unless you complete and submit this application form.

1. Applicant (Individual or corporate name)	2. Agent/Contractor (firm name)
Crandon Mining Company	Foth & Van Dyke
Address	**Address**
7 North Brown Street, 3rd Floor	2737 S. Ridge Road
City, State, Zip Code	**City, State, Zip Code**
Rhinelander, Wisconsin 54501-3161	Green Bay, Wisconsin 54307-9012
Telephone No. (Include area code)	**Telephone No. (Include area code)**
(715) 365-1450	(414) 497-2500

3. If applicant is not the fee title owner of the property where the proposed activity will be conducted, provide name and address of owner and include letter of authorization from owner. Owner must be the applicant or coapplicant for structure, diversion and channel change activites. A purchaser under a land contract is not considered a riparian owner until property transfer has occurred.

Owner's Name	Address	City, State, Zip Code
Helen Garrity	2165 South Broadway	Green Bay, WI 54304

4. **Is the applicant a business?** [x] Yes [ ] No

If YES, is the permit or approval you are applying for necessary for you to conduct this business in the State of Wisconsin? [x] Yes [ ] No

If YES, please explain why (attach addition sheets if necessary):

See Section 3.2 - Wetland Compensation Site

5. **Project Location**

Address See Section 2

Village/City/Town See Section 2

Waterway _____

County Oconto & Shawano

Govt. Lot _____ **OR** _____ **1/4,** _____ **1/4, of Section** _____

Township _____ **North, Range** _____ **(East)(West)**

6. **Adjoining Riparian (Neighboring Waterfront Property Owner) Information**

Name of Riparian #1	Address	City, State, Zip Code
Helen Garrity	2165 South Broadway	Green Bay, WI 54304
Name of Riparian #2	**Address**	**City, State, Zip Code**
Ziemer, Victor	W. 605 Lake Dr.	Shawano, WI 54166

7. **Project Information (Attach additional sheets if necessary)**

(a) Describe proposed activity (include how this project will be constructed)
Wetland compensation site (see Section 2)

(b) Purpose, need and intended use of project
Wetland compensation for mine development

(c) I have applied for or received permits from the following agencies: (Check x)

[x] Municipal [x] County [x] Wis. DNR [x] Corps of Engineers

(d) Date activity will begin if permit is issued : 1997 **; be completed:** 2002

(e) Is any portion of the requested project now complete?

[ ] Yes [x] No **If yes, identify the completed portion on the enclosed drawings an indicated here the date activity was completed:**

I hereby certify that the information contained herein is true and accurate. I also certify that I am entitled to apply for a permit, or that I am the duly authorized representative or agent of an applicant who is entitled to apply for a permit. Any inaccurate information submitted may result in permit revocation, the imposition of a forfeiture(s) and requirement of restoration.

ATTORNEY-IN-FACT FOR HELEN M. GARRITY, PURSUANT TO THAT CERTAIN DURABLE POWER OF ATTORNEY DATED NOVEMBER 21, 1994. 9-26-95

Signature of Applicant or Duly Authorized Agent	Date Signed
	9/15/95

LEAVE BLANK - FOR RECEIVING AGENCY USE ONLY

Corps of Engineers Process No.	Wisconsin DNR File No.	
Received By	**Date Received**	**Date Application Was Complete**

State of Wisconsin
Department of Natural Resources

FEE FOR WATER REGULATION PERMITS, APPROVALS, DETERMINATIONS, AND HEARINGS
Form 3500-53A Rev. 07-95

PLEASE SEE OTHER SIDE OF THIS FORM FOR APPLICABLE FEE

State law requires that we charge a fee for processing your request to make changes to surface waters and for wetland water quality certification determinations. Each application or request requires the correct permit fee in order for review to begin. **If your project includes several regulated activities you must include payment for the single most costly activity.** If you have questions regarding the appropriate fee, please contact your district or area Water Management Specialist. Fees will be refunded only if the refund is requested before we determine that the application is complete.

Personally identifiable information on this form is not intended to be used for any other purpose.

TO BE COMPLETED BY APPLICANT:

Dam on navigable stream	$300
Permit/Approval Applied for with highest fee (see listing on other side)	Amount enclosed

[signature]	9/15/95
Signature of Applicant	Date Signed
Patrick T Garrity	9/26/95

ATTORNEY-IN-FACT FOR HELEN M. GARRITY PURSUANT TO THAT CERTAIN DURABLE POWER OF ATTORNEY DATED NOVEMBER 21 1994.

LEAVE BLANK - DEPARTMENT OF NATURAL RESOURCES USE ONLY

Fee Received $________ Check Money Order

Received by ________________

EFFECTIVE DATE: July 29, 1995

EXHIBIT C

DURABLE POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS that I, HELEN M. GARRITY, of Green Bay, Brown County, Wisconsin, have made, constituted and appointed, and do hereby make, constitute and appoint my son, JAMES W. GARRITY, of Green Bay, Brown County, Wisconsin, or my son, PATRICK T. GARRITY, of Gillett, Oconto County, Wisconsin, for me and in my name and on my behalf to receive and receipt fo any and all sums of money or payments due or to become due to me to deposit in my name in any bank or banks any and all moneys collected or received by them; to pay any and all bills, accounts, claims and demands now or hereafter payable by me; to draw checks or drafts upon any and all bank accounts or deposits belonging to me; to open or close any bank account in my name; t prepare, sign, and file my federal and state income tax returns and represent me in any tax matters and any controversies of any nature; to accept social security payments and any pension benefits that I may receive; to sell stock; to sell real estate; to negotiate U. S. Government bonds; to take any action, including, but not limited to, the withdrawal of funds from any Individual Retirement Accounts, 401K Plans, profit sharing plans, simplified employee pension plans or self-employment pension plans in my name; to make disclaimers; to complete transfers to revocable living trust; to exercise special powers of appointment; to make any prudent gifts on my behalf of any assets owne.

by me or in any trusts which have been established for my benefit, after due consideration of my needs, assets and anticipate tax considerations, to my attorney-in-fact, to any third persor or persons, and to sign all gift tax returns evidencing said gifts and pay all gift taxes arising out of said gifts; to ente my safe deposit box; and generally to do and perform all matter and things; transact all business; make, execute and acknowledg all contracts, orders, deeds, writings, assurance and instrumer which may be requisite or proper to effectuate any matter or thing appertaining or belonging to me; and generally to act for me without limitation in all matters affecting my assets, business or property, with the same force and effect to all intents and purposes as though I were personally present and acting for myself, hereby ratifying and confirming whatsoever my said attorney shall do by authority hereof.

This Durable Power of Attorney shall remain in full force and effect until and unless I personally revoke it in a written notice delivered to my Attorney in Fact. Any subsequent physic or mental disability, incapacity or incompetency shall not affe this Durable Power or diminish the authority of my Attorney in Fact.

5[illegible]

IN WITNESS WHEREOF, I have hereunto set my hand and seal this 21st day of November, 1994.

Helen M. Garrity SEAL

Helen M. Garrity
Address: 2165 South Broadway
Green Bay, WI 54304
S. S. #: 391-42-0491

STATE OF WISCONSIN)
) SS:
COUNTY OF BROWN)

Personally came before me this 21st day of November, 1994, the above named Helen M. Garrity to me known to be the person wh executed the foregoing instrument and acknowledged the same.

David P. Hanaway
Notary Public, Brown County, WI
My commission is permanent.

DRAFTED BY DAVID P. HANAWAY, ATTORNEY

5[illegible]

STATE OF WISCONSIN)
) ss.
COUNTY OF Shawano)

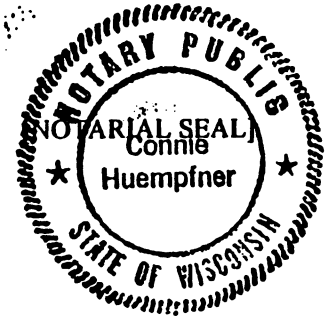
Personally came before me this 29th day of March, 1995, the above-named Helen M. Garrity, to me known to be the person who executed the foregoing instrument and acknowledges the same.

[NOTARIAL SEAL]

Connie Huempfner
Connie Huempfner (Name)
Notary Public, Shawano County, Wisconsin
My commission (is)(expires): June 9, 1996

STATE OF WISCONSIN)
) ss.
COUNTY OF Shawano)

Personally came before me this 29 day of March, 1995, James W. Garrity and Patrick T. Garrity, known to me to be the persons whose names are subscribed as attorneys-in-fact for Helen M. Garrity, and acknowledged that they executed the same as an act for their principal for the purposes therein contained.



[NOTARIAL SEAL]

Connie Huempfner
Connie Huempfner (Name)
Notary Public, Shawano County, Wisconsin
My commission (is)(expires): June 9, 1996

B-7

Appendix B-2

Chapter 31 Permit Application Forms
(Form 3500-10 With Attachments)

State of Wisconsin
Department of Natural Resources

(Return to appropriate DNR District Office)

APPLICATION FOR A PERMIT TO CONSTRUCT, OPERATE, AND MAINTAIN A DAM
Form 3500-10 Rev. 9-88

Use of this form is required by the Department for any application filed pursuant to s. 31.05, Wis. Stats. The Department will not consider your application unless you complete and submit this application form.

Please complete both sides of this application. Print or type.

1. Applicant (Individual or corporate name)	2. Agent/Contractor (Firm name)
Jerome D. Goodrich, Jr., Crandon Mining Company	Foth & Van Dyke and Associates Inc.
Street or Route: 7 North Brown Street, 3rd Floor	Street or Route: 2737 South Ridge Road
City, State, Zip Code: Rhinelander, Wisconsin 54501-3161	City, State, Zip Code: Green Bay, Wisconsin 54307-9012
Telephone Number (Include area code): (715) 365-1450	Telephone Number (Include area code): (414) 497-2500

3. Applicant must submit proof of ownership or an enforceable option to purchase the dam site and at lest 65% of the lands to be flowed or the flowage rights on at least 65% of the land. This does not apply to a person with the power of eminent domain. Please describe ownership and provide pertinent documents.

Owner's Name	Street or Route	City, State, Zip Code
Crandon Mining Company	(address above)	(See Attachment 1 for Option to Purchase)

4. Is the applicant a business? ☒ Yes ☐ No

If yes, is the permit or approval you are applying for necessary for you to conduct this business in the State of Wisconsin? ☒ Yes ☐ No

If it IS necessary, please explain why (attach additional sheets if necessary):

Needed for wetland compensation for mine site development.

5. Project Location

Street/Route: Blueberry Road (CTH R)

Village/City/Town: Washington

Waterway: Tributary to Duchess Creek County: Shawano

Govt. Lot ____ OR NW 1/4, NE 1/4 of Section 5,

Township 27 N, Range 17 (West)(East)

6. Adjoining Riparian (Neighboring Waterfront Property Owner) Information

Name of Riparian #1	Street or Route	City, State, Zip Code
N/A		

Name of Riparian #2	Street or Route	City, State, Zip Code
N/A		

7. A general description of the proposed dam is as follows:

a. State nature of foundation (sand, gravel, clay, or rock) Plugging 36" culvert with native soils

b. Width of stream (bank to bank at dam site) 44.0 feet. c. Height of bank above streambed (at dam site) 4.2 feet.

d. Normal depth of water in stream at dam site 0.8 feet.

e. Operating head (fall of water through dam) 0 feet.

f. Height to which water will be maintained at dam site above the streambed 3.1 feet, or to elevation 818.9 feet.

g. Height of earth fill and abutments of dam above streambed 4.2 feet, or to elevation 820.0 feet.

h. Maximum head of dam 1.1 feet. i. Maximum storage of dam 2.3 acre/feet.

j. General description of dam, gates and spillways. Give overall dimensions and elevations of sills or crests: Dam will consist of filling channel at existing 36" CMP to bank elevation of 820.0 feet. Material used will be suitable native soils. This "dam" is simply a plugging up of an existing ditch to divert water to a wetland. Spillway and outlet structure as shown in Section 2.

k. Description of benchmark to which elevations of dam and water levels have been referred: Using elevation on 7½ minute quadrangle map at the NE corner of Section 5 T27N R17E. EL = 822.0 feet.

8. Preliminary plans of the proposed dam must be submitted with the application. These plans must provide enough details to enable the Department to check the flood capacity and estimate the cost of the dam. If a permit is granted, final plans must be approved by the Department prior to the start of construction. The final plans and specifications must be in sufficient detail so that all material can be assembled without verbal instructions. See Section 2 and supporting figures.

9. The approximate amount of hydraulic power that the proposed dam is capable of developing for 50% of the time is — horsepower and — kilowatts.

Note: If the dam will be capable of developing 50 theoretical horsepower or more available for 50% of the time throughout the year, proposals shall be filed as required by s. 31.09, Wis. Stats. Form of proposals will be furnished on request.

10. The nearest city or village to the proposed dam is the Town of Cecil being 3 miles away. The highway route from said city or village to this dam is as follows:
South on CTH R to Town of Cecil.

11. The nearest existing dam above this site is the dam at N/A known as the _____ Dam, and is _____ miles upstream.

12. The nearest existing dam below this site is the dam at N/A known as the _____ Dam, and is _____ miles downstream.

13. Included as Exhibit A are the names and addresses of all the owners of land that may be affected by construction or operation of this dam, or by any flowage that it may create.
See Exhibit A attached

14. Included as Exhibit B is a map on the scale of not less than 4 inches to the mile, showing the lands that may be affected by the construction, operation, or maintenance of the proposed dam or by any flowage that it may create, and approximately the outline of such flowage, which map indicates the ownership of each tract of land within the flowage. (If the map is larger than 8 1/2" x 13", submit a tracing suitable for copying or 12 copies of the map.)
See Exhibit B attached

15. The applicant is financially capable of constructing, operating, and maintaining the dam for a period of not less than ten years, and will submit proof of such ability as required by s. 31.14, Wis. Stats., by providing
See Attachment 2

16. The applicant will furnish such further information as may be required by the Department.

17. Date activity will commence if permit is issued 1997; be completed perpetual.

18. Is any portion of the requested project now complete? ☐ Yes ☒ No If yes, identify the completed portion on the enclosed drawings and indicate here the date activity was completed:

Signature of Applicant	Date Signed
[signature]	9/15/95

LEAVE BLANK - FOR RECEIVING AGENCY USE ONLY

Wisconsin DNR File No.	Received By	Date Received

Exhibit A

Wetland Compensation Site Permit Application
Form 3500-10

Adjacent Landowners as Referenced in Item 13 of Form 3500-10

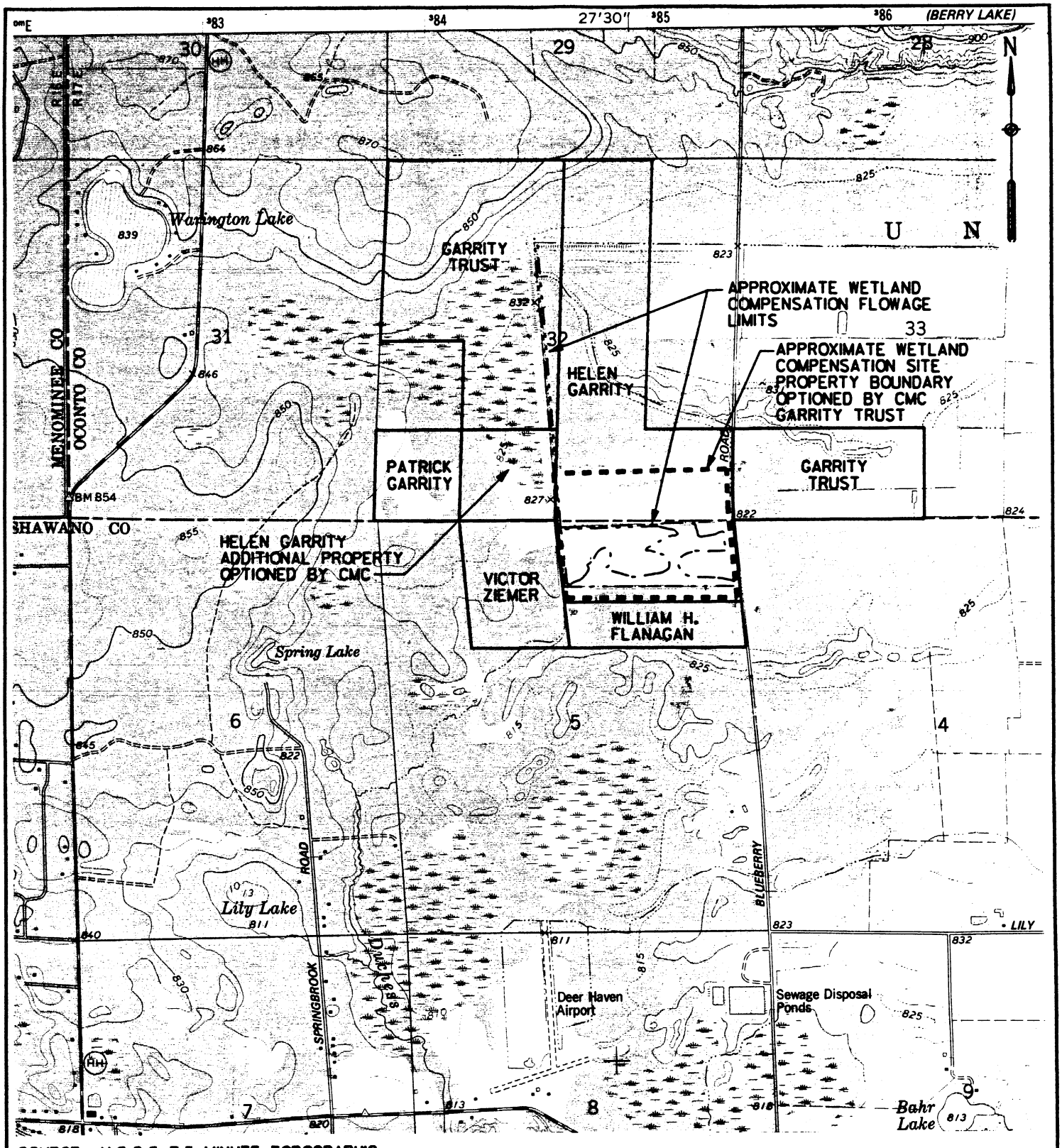
1) **Helen Garrity, 2165 South Broadway, Green Bay, WI 54304**

2) **Victor Ziemer, W6053 Lake Drive, Shawano, WI 54166**

3) **William Flanagan, 26 Sunny Slope Court, Appleton, WI 54914**

Exhibit B

Wetland Compensation Site Map



SOURCE: U.S.G.S. 7.5 MINUTE TOPOGRAPHIC QUADRANGLE - CECIL, 1974
OCONTO & SHAWANO COUNTY, WISCONSIN

Foth & Van Dyke

REVISED	DATE	BY	DESCRIPTION

CHECKED BY:	JKSI	DATE: SEPT.'95
APPROVED BY:	RFS	DATE: SEPT.'95
APPROVED BY:	GWS	DATE: SEPT.'95

Crandon Mining Company

EXHIBIT B

WETLAND COMPENSATION SITE LOCATION
FORM 3500-10

Scale: 0 1000' 2000' | Date: SEPTEMBER, 1995

Prepared By: Foth & Van Dyke | By: JOW

/d3/dl/users/jprl/4c55f9.dgn

93C049

Attachment 1

Option to Purchase Garrity Property

(VOL 663 PAGE 626 OCONTO Co)

473447

REGISTERS OFFICE SS
SHAWANO COUNTY, WI
Received for Record this 13th
day of April A.D. 1995 at 9:30
o'clock A M. AND Recorded in Vol. 798
of Records. Pages 322-336
Marcia Bugler Register
REGISTERS OFFICE

VOL 798 PAGE 322

426836
REGISTER OF DEEDS
OCONTO COUNTY
AT 12:30 O'CLOCK PM

APR 17 1995

Loralee Lasley 38Pd
REGISTER

LAND PURCHASE OPTION

IN CONSIDERATION OF Ten Thousand Eight Hundred and Twelve and 80/100 Dollars ($ 10,812.80) and other good and valuable consideration, receipt of which is hereby acknowledged, the undersigned, Helen M. Garrity, a widow, and James W. Garrity and Patrick T. Garrity, as attorneys - in fact for Helen M. Garrity pursuant to the Durable Power of Attorney dated November 21, 1994, attached hereto as Exhibit C.
("Seller") whether one or more, whose address is 2165 South Broadway
Green Bay, Wisconsin 54304
hereby gives and grants to Crandon Mining Company, a Wisconsin General Partnership ("CMC") consisting of Crandon Mining Company, Inc., Exxon Minerals Development Corporation, Rio Crandon Inc., and Northwoods Resources Inc., whose address is c/o Land Manager, Exxon Coal and Minerals Company, P. O. Box 1314, Houston, Texas 77251-1314, an exclusive and irrevocable option to purchase for a total purchase price of
One Hundred Three Thousand One Hundred Sixty and no/100********** Dollars ($ 103,160.00), the fee simple estate now owned or hereafter acquired by Seller in the following described land (together with any buildings and improvements that may be located thereon) in the Counties of Oconto and Shawano, State of Wisconsin:

OCONTO COUNTY
Township 28 North - Range 17 East (Underhill Township)
Section 32: S2SW4SE4, S2SE4SE4 (except County Road "R")

SHAWANO COUNTY
Township 27 North - Range 17 East (Washington Township)
Section 5: Fractional NE4NE4, except S 660' & except part desc in V580 P43
Fractional NW4NE4, except S 660'

in all containing 128.95 acres, more or less

together with all rights, privileges, easements and appurtenances thereto belonging, but not including any rights reserved unto Grantors in the form of Warranty Deed attached hereto as Exhibit A, all of the foregoing being hereinafter referred to as the "premises."

The primary period of this option shall be for one (1) year from the date hereof. CMC may extend this option for four (4) additional periods of one (1) year each by giving notice to Seller as hereinafter provided prior to the end of the primary period or prior to the end of the prior one-year additional option period, as the case may be, and by paying to Seller in cash or by CMC's check or draft an additional consideration of
Ten Thousand Eight Hundred Twelve and 80/100 ********** Dollars ($ 10,812.80).

The M & I Bank of Cecil
Bank with an address of Cecil, Wisconsin 54111
is hereby designated by Seller as the depository bank, which bank, or any successor thereof, is and shall continue to be the agent of Seller and Seller's successors to receive payment or tender of any amount payable to Seller hereunder. If such bank, or any successor bank, shall fail, liquidate, or be succeeded by another bank, or for any reason fail or refuse to accept any payment due or payable hereunder, payment by CMC shall not be considered late until thirty (30) days after the Seller shall deliver to CMC a recordable instrument providing another bank for payment or tender.

During the initial option period and any extension thereof, CMC shall have the right to enter upon the premises described hereinabove to make, at CMC's expense, such inquiries, inspections, soil tests and borings (including but not limited to core hole borings) as CMC may desire. During the initial period or any extension thereof, CMC agrees to indemnify and hold Seller harmless against all liability for injury to or the death of any persons, or for damage to or loss of any property of third parties, resulting from the operations, acts or omissions of CMC or

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its representatives, agents or assigns on the premises. In the event any such operations cause damage to the premises and CMC fails to purchase the premises, CMC shall reclaim the premises to as nearly its former condition as is reasonably practicable, and to the extent CMC is unable to so reclaim the premises, CMC shall, upon expiration of this option, reimburse Seller for any actual reduction in the value of the premises caused by such operations.

CMC may exercise this option at any time during the primary option period, or any extension thereof, by giving notice to Seller as hereinafter provided. Upon CMC exercising this option by giving such notice, this instrument shall constitute a contract of sale between the parties hereto and the remaining provisions of this instrument shall apply.

1. TITLE: Within thirty (30) days after exercise of this option, Seller shall furnish to CMC any abstracts, title opinions, or title insurance policies relating to the premises in its possession. CMC, at its own expense, may, but is not required to, obtain a title opinion from an attorney selected by CMC, or title insurance, and a plat of an actual ground survey and a metes and bounds description meeting CMC's requirements prepared by a surveyor selected by CMC.

CMC shall promptly examine the foregoing documents, if any, and, if such examination does not show good and marketable title in fee simple in Seller, with only such exceptions as are contemplated by the form of Warranty Deed attached hereto as Exhibit A, CMC shall notify Seller of any defect or encumbrance to which it objects. Upon failure of Seller to eliminate all such defects and encumbrances within thirty (30) days thereafter, CMC may attempt to eliminate same. If Seller is unsuccessful in eliminating all such defects and encumbrances within said period, or if CMC having elected to undertake such elimination, decides to withdraw from such action or is unsuccessful therein, CMC may terminate this contract by giving notice to Seller.

2. CLOSING: The conveyance of the premises shall be by Warranty Deed in the form attached hereto as Exhibit A. Such deed shall convey good and merchantable title to the premises with only such exceptions as are contemplated by such form of Warranty Deed. Such deed shall be delivered and the balance of the purchase price shall be paid at such place, time and date as are designated by CMC, but no later than thirty (30) days after all provisions of Paragraph 1 have been satisfied. In the event such closing date is scheduled between May 1 and October 31, at election of Seller, such closing date may be delayed until the time period of the next following November 1 to April 30 at no additional cost to CMC. At CMC's election, the description used in the deed shall conform to the aforesaid survey of the premises or the title insurance or title opinion. On acceptance of such deed, CMC shall pay to Seller, by check or draft, the total purchase price less any sums chargeable to Seller hereunder, and less the amount necessary to remove any liens and encumbrances subject to which CMC elects to accept title ("final payment"). Seller may elect to receive less than all of the balance of the final payment upon closing and elect to receive the unpaid balance of the final payment in no more than three (3) payments on designated dates within the following three (3) years after closing. Seller shall designate the dates and the amounts of such payments by written notice delivered to CMC not later than ten (10) days before the date of closing. The unpaid balance of the final payment shall not bear interest.

Taxes, rent and other items of current revenue and expense shall be prorated as of the closing date; but all installments of assessments for work commenced or levied prior to that date shall be considered then due and a lien on the premises, and shall be paid by Seller at closing. General taxes shall be prorated on the basis of net general taxes for the year of closing, if known, otherwise on the basis of net general taxes for the preceding year. Possession of the premises shall be delivered to CMC at the time of closing free and clear of all defects, tenancies and encumbrances except those which are accepted by CMC in writing; and Seller shall bear all risks of loss or damage to the premises occurring prior thereto.

At closing, CMC shall grant to Seller, for no additional consideration, a road easement across the premises in the form attached hereto as Exhibit B.

3. NOTICES: Any notice hereunder or under any Warranty Deed given pursuant to this option shall be in writing and shall be deemed given when personally delivered or when a letter is deposited in the mail, with a nationally recognized overnight courier, or a telegram filed with the telegraph company, postage or charges prepaid, and addressed to the party for whom intended at such party's address herein specified, or such other address as may be specified by notice in writing.

4. BROKERAGE: Seller agrees to pay all brokerage charges in connection with this transaction and to save CMC harmless against all claims for such charges.

5. SUCCESSION: This agreement shall bind and inure to the benefit of the parties hereto and their respective heirs, administrators, executors, personal representatives, successors and assigns.

6. SPOUSE: If Seller is married, Seller's spouse joins herein with the intent and purpose of committing to this agreement any interest which he or she has or might obtain in or to the premises and, for all purposes of this agreement, there is hereby released and waived all marital and homestead rights and any statutory estate in and to the premises.

7. EXECUTION OF ADDITIONAL DOCUMENTS: In addition to the Warranty Deed to be executed by Seller in favor of CMC, Seller agrees to execute such other conveyances or documents as may be required by CMC from time to time in order to consummate the passage of title to the interest to be conveyed pursuant to this option.

8. SEVERABILITY: The terms and provisions of this option shall be deemed severable, and if any term or provision of this option or the application thereof to any person or circumstance shall, to any extent, be invalid or unenforceable, the remainder of this option or the application of such term or provision to persons or circumstances other than those as to which it is invalid or unenforceable, shall not be affected thereby, and each term and provision of this option shall be valid and enforceable to the fullest extent permitted by law in a manner so as to effectuate the intent of the parties hereto.

9. NONWAIVER: Failure of either party to enforce any rights or remedies shall not constitute a waiver of the default giving rise to the rights or remedies, nor prevent such parties from exercising the rights or remedies for any subsequent default by the other party.

10. GENERAL: The headings of the paragraphs of this instrument are for convenience only and do not in any way limit, amplify or otherwise affect the provisions herein contained. This instrument constitutes the entire agreement between the parties and may not be changed except by a written document signed by the parties hereto.

11. COUNTERPARTS: This agreement may be executed in any number of counterparts by the parties. Each of the counterparts will be considered an original, and all counterparts will constitute but one and the same instrument.

12. SURVIVAL: The provisions of this option that by their terms cannot be performed prior to the closing date shall survive the closing date and shall not be deemed merged into the Warranty Deed.

EXECUTED this 29 day of March, 1995

SELLER:
Helen M Garrity
Social Security No. 391-42-0491A

Patrick T Garrity
Patrick T. Garrity
Attorney-in-Fact for Helen M. Garrity

James W. Garrity
James W. Garrity
Attorney-in-Fact for Helen M. Garrity

CMC:
CRANDON MINING COMPANY
By: [signature]

WISCONSIN STATUTE 107.25(3) MAY APPLY TO THIS TRANSACTION. THE STATUTE, IF APPLICABLE, PROVIDES THAT SELLER MAY CANCEL THIS INSTRUMENT BY NOTIFYING CRANDON MINING COMPANY BY REGISTERED MAIL ADDRESSED TO ITS ADDRESS STATED ABOVE WITHIN TEN (10) CALENDAR DAYS AFTER THIS INSTRUMENT IS RECORDED.

This instrument prepared by, and after recording should be returned to: Allen T. Johnson, P. O. Box 1314, Houston, Texas 77251-1314.

STATE OF Wisconsin)
) ss.
COUNTY OF Shawano)

Personally appeared before me this 29 day of March 19 95
Helen M Garrity
known to me to be the person(s) whose name(s) (is/are) subscribed to the within instrument and acknowledged that (he/she/they) executed the same for the purposes therein contained.

IN WITNESS WHEREOF, I hereunto set my hand and official seal.

Connie Huempfner
Connie Huempfner
Notary Public, Shawano County,
State of Wisconsin

NOTARY PUBLIC Connie Huempfner STATE OF WISCONSIN

My commission expires: June 9, 1996

STATE OF Wisconsin)
) ss.
COUNTY OF Shawano)

Personally appeared before me this 29 day of March 19 95
James W. Garrity and Patrick T. Garrity, known to me to be the persons whose names are subscribed as attorneys-in-fact for Helen M. Garrity, and acknowledged that they executed the same as an act of their principal for the purposes therein contained.

IN WITNESS WHEREOF, I hereunto set my hand and official seal.

Connie Huempfner
Connie Huempfner
Notary Public, Shawano County,
State of Wisconsin

NOTARY PUBLIC Connie Huempfner STATE OF WISCONSIN

My commission expires: June 9, 1996

STATE OF WISCONSIN)
) ss.
COUNTY OF ONEIDA)

Personally came before me this 10th day of April, 1995 the above named J. D. Goodrich Jr., as President of Crandon Mining Company, a Wisconsin General Partnership, to me known to be such person and officer who executed the foregoing instrument on behalf of Crandon Mining Company and acknowledged the same.

IN WITNESS WHEREOF, I hereunto set my hand and official seal.

Carolyn C. LaVake
Carolyn C. LaVake
Notary Public, Vilas County
State of Wisconsin

LAVAKE - NOTARY PUBLIC - STATE OF WISCONSIN

My commission expires: April 5, 1998

J:\AT\JCrandon\LdPurOpt

EXHIBIT A

WARRANTY DEED

This Deed, made between _____
_____,
("Grantors"), whether one or more, whose address is _____
_____,
and Crandon Mining Company, a Wisconsin General Partnership consisting of Crandon Mining Company, Inc., Exxon Minerals Development Corporation, Rio Crandon Inc., and Northwoods Resources, Inc. ("Grantee") whose address is c/o Land Manager, Exxon Coal and Minerals Company, P. O. Box 1314, Houston, Texas 77251-1314,

WITNESSETH: that Grantors for the sum of _____
_____ Dollars ($_____) and other good and valuable consideration received by Grantors hereby convey to Grantee the following described real estate ("premises") in _____ County, Wisconsin:

together with any and all rights, hereditaments and appurtenances thereto, including without limitation because of enumeration, rights in public highways, private roads, public accesses, rights of reverter, reservations, and equitable rights to enforce restrictive covenants, together with any other interests therein or rights thereto except as hereinafter reserved.

This (is) (is not) homestead property.

The mineral estate associated with the premises is not conveyed by this Deed.

Grantors warrant to Grantee that the title is good, indefeasible in fee simple and free and clear of encumbrances, except municipal and zoning ordinances, recorded easements for utilities serving the premises, recorded building and use restrictions and covenants and general taxes levied in the year of closing, and except that Grantors do not hereby transfer the mineral estate.

TO HAVE AND TO HOLD the above-described land and premises, together with all and singular the rights and appurtenances thereto in anywise belonging, unto Grantee, its successors and assigns, forever, subject to the reservations, exceptions, covenants, conditions, restrictions, terms, and provisions hereinabove set forth, and subject thereto, Grantors hereby bind themselves, their heirs, successors, and assigns, to warrant and forever defend the title to said premises unto Grantee, its successors and assigns, against all persons lawfully claiming the same or any part thereof.

EXECUTED THIS ____ day of _____, 199__.

Grantors

_____

_____

This instrument prepared by, and after recording should be returned to: Allen T. Johnson, P. O. Box 1314, Houston, Texas 77251-1314.

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EXHIBIT B

ROAD EASEMENT

This Easement, made this _____ day of _____, 1995, between _____,("Grantor"), whose address is _____, and Patrick T. Garrity, ("Grantee"), whose address is _____.

WITNESSETH: CMC grants, bargains, sells and conveys to Grantee a personal non-exclusive road easement in Section _____, Township _____, Range _____, in _____ County, Wisconsin, as shown on Exhibit 1 attached hereto ("Easement Area") for the sole purpose of Grantee moving his farm equipment to and from his land east of and contiguous to the Easement Area to his land west of the Easement Area.

Grantee shall have the rights granted herein, but only insofar as any activities within the Easement Area do not interfere in any way with existing or subsequent uses to which Grantor, or those to whom Grantor has or may give usage rights, may put such Easement Area.

This Easement is subject to all existing conveyances, surface leases, easements, rights-of-way, licenses, agreements or other encumbrances affecting the surface or subsurface of the Easement Area.

Grantor makes no warranties or representations concerning title to or possession of the Easement Area.

The term of this easement shall be for a period beginning with the date hereof and continuing so long as Grantee continues, without cessation for more than three hundred sixty-five (365) consecutive days, to use the Easement Area for the purposes herein stated, unless terminated prior thereto in the manner provided below.

In the event Grantee's activities and use of the Easement Area result in damage to the road or fences, crops, gates, livestock, culverts, cattle guards, buildings or other improvements of Grantor, its lessees or assigns located on the Easement Area, Grantee shall within thirty days after such damage occurs, at Grantor's election, repair or pay Grantor, its lessees or assigns the cost of repairing said damage to the condition as nearly as practical to that existing prior to such use by Grantee, and any hazard caused by Grantee's use, shall be marked or barricaded by Grantee and proper steps taken by Grantee for the immediate repair thereof.

Grantee shall use the Easement Area solely for the purpose set forth in this Easement. The use of the Easement Area by Grantee and all of Grantee's activities in and about the Easement Area, shall be performed and conducted in a careful, safe and workmanlike manner.

Grantee shall save, indemnify, and hold Grantor, its affiliates and its officers, directors, employees, agents, lessees, successors and assigns harmless from and against any and all costs, claims, demands, suits or causes of actions, obligations, liabilities, or responsibilities for bodily injury, death, loss or damage to property or liability of any kind arising directly or indirectly out of Grantee's access or activities upon the Easement Area. No additional risk or liability shall be assumed or incurred by Grantor by reason of the granting of this easement.

Grantee acknowledges that absolutely no representations are made as to the condition which will be encountered in the Easement Area, and that **GRANTOR'S EASEMENT AREA IS ACCESSED AND USED AT THE SOLE RISK OF GRANTEE**, and that Grantee assumes all risk of bodily injury, death, loss or damage to property arising from or due to any cause (including latent or patent defects in the Easement Area).

Grantee shall comply with Grantor's rules for the Easement Area concerning security, safety and welfare of persons in the Easement Area as set out below:

A. Firearms or other offensive weapons are considered contraband and their possession in the Easement Area is prohibited. No hunting is allowed in the Easement Area.

B. Any oil, chemical or hazardous substance spill that may occur in the Easement Area shall be immediately reported to Grantor.

C. The misuse of legitimate drugs or the use, possession, sale or distribution of illicit or unprescribed controlled drugs or alcoholic beverages in the Easement Area is prohibited.

Grantee shall keep the title to the Easement Area free and clear of all liens, claims or encumbrances of any nature resulting from or attributable to Grantee's activities in or about the Easement Area.

In the event of any default by Grantee in its obligations hereunder, Grantor may deliver to Grantee written notice specifying the default. If the default remains uncorrected for a period of thirty days after delivery of the notice, this Easement shall then terminate.

Upon any termination of this Easement, Grantee shall restore and reclaim the Easement Area to as good a condition as existed prior to this Easement and Grantee shall release and quitclaim its interest in and to the Easement Area back to Grantor.

The rights granted to Grantee under this Easement shall be personal to Grantee and shall not be assigned. All such rights terminate on Grantee's death. This easement shall be binding upon and shall inure to the benefit of Grantor and its successors and assigns.

All notices given hereunder shall be in writing and shall be deemed properly given upon delivering the same personally to the party to be notified, or upon mailing the notice by registered or certified mail to the party to be notified, at such party's address set forth above, or such other address as the party to be notified may have previously designated by written notice to the other party.

IN WITNESS WHEREOF, the above parties have executed this Easement as of the day and year first written above.

Grantor: Grantee:

By: _____ By: _____

This instrument prepared by, and after recording should be returned to: Allen T. Johnson, P. O. Box 1314, Houston, Texas 77251-1314.

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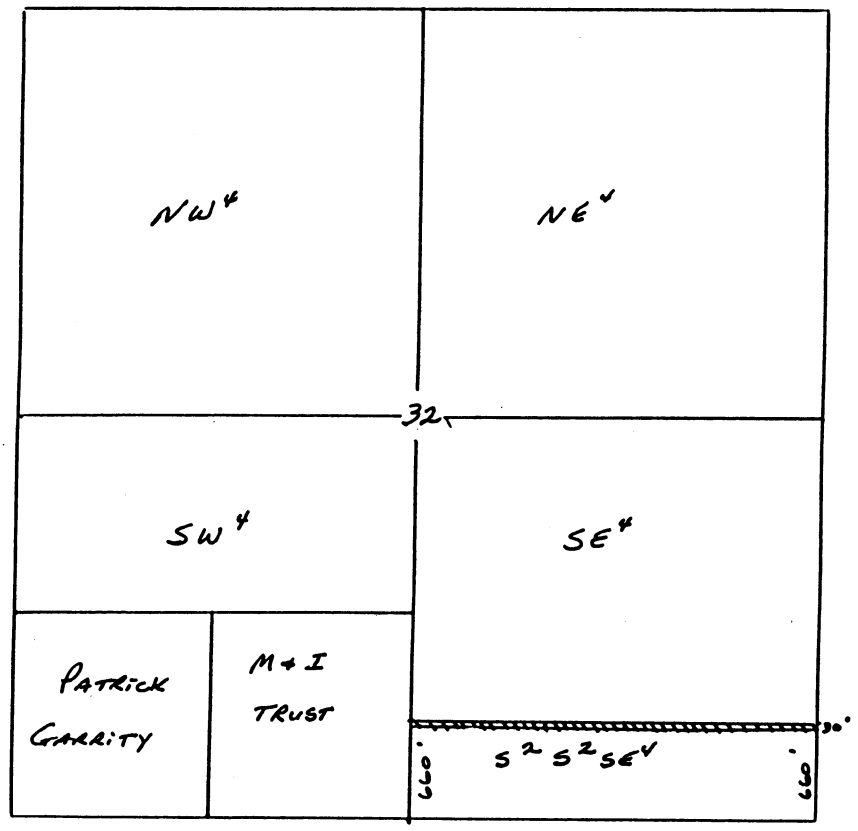
EXHIBIT 1
to
EXHIBIT B

ROAD EASEMENT

Dated _____, 199__

From: _____
To: _____

The easement is located in Township 28 North, Range 17 East, Section 32, and is platted as follows:



Scale: 1000'

Initialed for Identification

_____

_____

EXHIBIT C

DURABLE POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS that I, HELEN M. GARRITY, of Green Bay, Brown County, Wisconsin, have made, constituted and appointed, and do hereby make, constitute and appoint my son, JAMES W. GARRITY, of Green Bay, Brown County, Wisconsin, or my son, PATRICK T. GARRITY, of Gillett, Oconto County, Wisconsin, for me and in my name and on my behalf to receive and receipt for any and all sums of money or payments due or to become due to me; to deposit in my name in any bank or banks any and all moneys collected or received by them; to pay any and all bills, accounts, claims and demands now or hereafter payable by me; to draw checks or drafts upon any and all bank accounts or deposits belonging to me; to open or close any bank account in my name; to prepare, sign, and file my federal and state income tax returns and represent me in any tax matters and any controversies of any nature; to accept social security payments and any pension benefits that I may receive; to sell stock; to sell real estate; to negotiate U. S. Government bonds; to take any action, including, but not limited to, the withdrawal of funds from any Individual Retirement Accounts, 401K Plans, profit sharing plans, simplified employee pension plans or self-employment pension plans in my name; to make disclaimers; to complete transfers to a revocable living trust; to exercise special powers of appointment; to make any prudent gifts on my behalf of any assets owned

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by me or in any trusts which have been established for my benefit, after due consideration of my needs, assets and anticipated tax considerations, to my attorney-in-fact, to any third person or persons, and to sign all gift tax returns evidencing said gifts and pay all gift taxes arising out of said gifts; to enter my safe deposit box; and generally to do and perform all matters and things; transact all business; make, execute and acknowledge all contracts, orders, deeds, writings, assurance and instruments which may be requisite or proper to effectuate any matter or thing appertaining or belonging to me; and generally to act for me without limitation in all matters affecting my assets, business or property, with the same force and effect to all intents and purposes as though I were personally present and acting for myself, hereby ratifying and confirming whatsoever my said attorney shall do by authority hereof.

This Durable Power of Attorney shall remain in full force and effect until and unless I personally revoke it in a written notice delivered to my Attorney in Fact. Any subsequent physical or mental disability, incapacity or incompetency shall not affect this Durable Power or diminish the authority of my Attorney in Fact.

55967

IN WITNESS WHEREOF, I have hereunto set my hand and seal this 21st day of November, 1994.

+ Helen M Garrity (SEAL)
Helen M. Garrity
Address: 2165 South Broadway
Green Bay, WI 54304
S. S. #: 391-42-0491

STATE OF WISCONSIN)
) SS:
COUNTY OF BROWN)

Personally came before me this 21st day of November, 1994, the above named Helen M. Garrity to me known to be the person who executed the foregoing instrument and acknowledged the same.

David P. Hanaway
Notary Public, Brown County, WI
My commission is permanent.

DRAFTED BY DAVID P. HANAWAY, ATTORNEY

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STATE OF WISCONSIN)
) ss.
COUNTY OF Shawano)

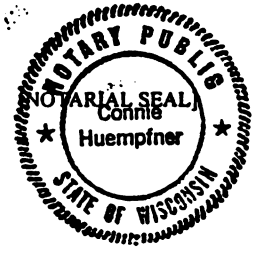
Personally came before me this 29th day of March, 1995, the above-named Helen M. Garrity, to me known to be the person who executed the foregoing instrument and acknowledges the same.

[NOTARIAL SEAL]

Connie Huempfner
Connie Huempfner (Name)
Notary Public, Shawano County, Wisconsin
My commission (is)(expires): June 9, 1996

STATE OF WISCONSIN)
) ss.
COUNTY OF Shawano)

Personally came before me this 29 day of March, 1995, James W. Garrity and Patrick T. Garrity, known to me to be the persons whose names are subscribed as attorneys-in-fact for Helen M. Garrity, and acknowledged that they executed the same as an act for their principal for the purposes therein contained.



[NOTARIAL SEAL]

Connie Huempfner
Connie Huempfner (Name)
Notary Public, Shawano County, Wisconsin
My commission (is)(expires): June 9, 1996

ASSIGNMENT

IN CONSIDERATION of Ten Dollars ($10.00) and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the undersigned, Helen M. Garrity, a widow, and James W. Garrity and Patrick T. Garrity, as attorneys-in-fact for Helen M. Garrity pursuant to the Durable Power of Attorney dated November 21, 1994, attached hereto as Exhibit A, (together, "Seller"), hereby assign to Patrick T. Garrity all of Seller's right, title and interest in and to any purchase price that may become payable pursuant to that certain Land Purchase Option dated March 29, 1995 between Seller and Crandon Mining Company (the "Option").

The Option relates to the following described real property in the Counties of Oconto and Shawano, in the State of Wisconsin:

OCONTO COUNTY

Township 28 North - Range 17 East (Underhill Township)
Section 32: S2SW4SE4, S2SE4SE4 (except County Road "R")

SHAWANO COUNTY

Township 27 North - Range 17 East (Washington Township)
Section 5: Fractional NE4NE4, except S 660' & except part described in V580 P43
Fractional NW4NE4, except S 660'

The foregoing assignment does not include Seller's right to receive option payments pursuant to the Option, including the original option payment of $10,812.80, and any additional option payment of $10,812.80.

This Assignment shall be binding upon Seller and Seller's heirs, successors and assigns, and shall inure to the benefit of the said Patrick T. Garrity, and his heirs, successors and assigns.

IN WITNESS WHEREOF, the undersigned have duly executed this instrument as of the 29 day of March, 1995.

Helen M. Garrity
Helen M. Garrity

James W. Garrity
James W. Garrity
Attorney-in-Fact for Helen M. Garrity

Patrick T. Garrity
Patrick T. Garrity
Attorney-in-Fact for Helen M. Garrity

✓This instrument was prepared by Attorney Blaine R. Renfert. After recording it should be returned to Allen T. Dawson, P.O. Box 1314, Houston, Texas 77251-1314.

STATE OF WISCONSIN)
) ss.
COUNTY OF Shawano)

Personally came before me this 29th day of March, 1995, the above-named Helen M. Garrity, to me known to be the person who executed the foregoing instrument and acknowledges the same.

[NOTARIAL SEAL] NOTARY PUBLIC Connie Huempfner STATE OF WISCONSIN

Connie Huempfner
Connie Huempfner (Name)
Notary Public, Shawano County, Wisconsin
My commission (is)(expires): June 9, 1996

STATE OF WISCONSIN)
) ss.
COUNTY OF Shawano)

Personally came before me this 29 day of March, 1995, James W. Garrity and Patrick T. Garrity, known to me to be the persons whose names are subscribed as attorneys-in-fact for Helen M. Garrity, and acknowledged that they executed the same as an act for their principal for the purposes therein contained.

[NOTARIAL SEAL] NOTARY PUBLIC Connie Huempfner STATE OF WISCONSIN

Connie Huempfner
Connie Huempfner (Name)
Notary Public, Shawano County, Wisconsin
My commission (is)(expires): June 9, 1996

Attachment 2

Financial Assurance Information

CMC will accept financial responsibility for the dam construction, operation and maintenance and will submit proof of such ability as required by s. 31.14, Wisconsin Statutes, as outlined within Section 3.0 of its May 1995 Mine Permit Application. Financial assurance responsibility will be established for the wetland compensation site for a total of $29,000 including the annual maintenance cost, cost of repairs for damage from the 100-year flood and up front repair costs. The requirements for financial assurance and the cost estimate for the wetland compensation site are attached for documentation,

A. Cost Estimate for Financial Assurance

	Item	Unit	Quantity	Unit Cost	Cost
1)	Annual Maintenance • Tree cutting • erosion repair • inspection • mowing	LS	1	$ 1,000	$ 1,000
2)	Repair for 100-Year Flood • repair scour downstream • remove sediments deposited • revegetate disturbed areas	LS	1	$10,000	$10,000
3)	Up Front Repair Cost • remove outlet structure • rebuild embankment • install outlet structure • revegetate disturbed areas	LS	1	$10,000	$10,000

B. Calculate Financial Responsibility per WDNR Chapter 31 Requirements

Financial Responsibility in dollars = (Annual Maintenance Cost) * (Inflation Factor of 15.937) +

(Cost of Damage in 100-Year Flood) * (Probability of Flood Occurrence (0.10)) * (Inflation Factor of 2.594) +

Up Front Repair Cost

Financial Responsibility = ($1,000 * 15.937) + ($10,000 * 0.10 * 2.594) + $10,000
= $28,531 ≈ $29,000

FINANCIAL RESPONSIBILITY CAN BE DEMONSTRATED IN THE FOLLOWING WAYS:

1. A trust or escrow account. Proper legal arrangements must be made to ensure that the money is there,and that it cannot be diverted to other persons or uses without Departmental consent. Escrow funds can only be used for maintaining the structural integrity of a dam, including work on the embankment and spillway structures. The interest earned on the escrow account cannot be used to offset the inflation factor in the calculation of financial responsbility. If the escrow fund is used to make repairs, a recalculation of the escrow fund amount should be made.

2. A surety bond, payable to the Department. The bond provides money to the Department to have necessary work done if the owner defaults.

3. An insurance policy, naming the Department as beneficiary. The premium msut be paid for at least 10 years and must not be cancellable or assignable to another beneficiary without the Department's consent.

4. A first mortgage on other property of the prospective owner has been used and would be acceptable with proper legal arrangements. A certified appraisal of the property to ensure that its value is high enough may be required. A second mortgage is not acceptable.

5. An irrevocable letter of credit by an insured lender to the prospective owner under ch. 405, Statutes.It is unlikely that such a letter would be issued. The Banking Commission has indicated that issuing a letter of credit for longer than one year is not a good banking procedure. A letter for a period of less than 10 years would not, by itself, provide enough assurance of financial capability.

Assets must be conservatively estimated. If land around the flowage is listed as an asset, the value should be based on no flowage being present. Assets subject to loss in case of dam failure, such as generating equipment, must be adequately insured and should not be a basis for establishing financial responsibility.

The dollar amount for the required financial responsibility can be calculated as follows:

$$\text{Financial Responsibility in dollars} = (\text{Annual Maintenance Cost}) \times (\text{Inflation Factor 1}) + (\text{Cost of Damage in 100 year flood}) \times (\text{Probability of Flood Occurrence}) \times (\text{Inflation Factor 2}) + \text{Up Front Repair Cost}$$

Inflation Factor 1= 15.937
Inflation Factor 2= 2.594
Probability of Flood Occurrence = .10

Estimates for annual maintenance cost, cost of damage in 100 year flood and up front repairs cost shall be prepared by a registered professional engineer.

Appendix C

Wetland Compensation Site Hydrology/Hydraulic Analysis

Foth & Van Dyke
Memorandum

September 22, 1995

TO: Jerry Sevick

CC: Don Moe, Crandon Mining Company
Master File

FR: Mike Liebman MCL
Steve Birr SPB

RE: Crandon Project - Wetland Compensation Site Hydrology Hydraulics Analysis

Introduction

A wetland compensation site for the Crandon Project has been located north of Cecil, in Shawano County, Wisconsin. This memorandum discusses the effect of the proposed ditch routing and wetland creation in terms of floodplain modifications and associated regulatory requirements. This information may be incorporated into the water regulatory permit application as supporting documentation so that permitting for this project may be obtained.

Hydrology

The drainage basins tributary to the north-south flowing ditch were modeled with the USGS SCS hydrologic forecasting model, TR-55. This model developed flow estimates at the south end of the site of 692 cfs for a 100-year storm event. Upstream of the proposed site, flow estimates were modeled to be 365 cfs. Still farther upstream, flows diminish as the drainage basin area contributing runoff decreases. The hydrology documentation is included in Appendix A of this memorandum.

Hydraulics

The hydraulics analysis for the evaluation was conducted using the Corps of Engineers computer backwater program HEC-2. Because of the flat nature of the lands to be studied, detailed field survey was used to develop cross sections for use in the HEC-2 program. Where survey stopped, USGS topographic mapping was used to extend cross sections to available contour intervals. The existing conditions were modeled with results shown in Appendix B. Cross section locations and existing condition floodway limits are detailed in contour mapping on Figure 1A. It should be noted that the north-south ditch flows north and east upstream of the basin divide, so the hydraulic evaluation in this area is pertinent only to show possible backwater effects along this upstream reach.

The proposed condition includes several changes from the existing condition model. At cross section 10.26, as flow approaches the compensation site, a berm set at an elevation of 820.00 feet will be placed across the ditch where a 36 inch CMCP now exists. The 36 inch CMCP will be removed under proposed conditions. This berm will divert smaller storm events to the east and through the created wetland site. During the 100-year storm event, however, overtopping will occur and a portion of flow will be diverted down the existing north-south ditch.

Also modeled was the inclusion of twin 42 inch CMCP's at cross section 10.30. These culverts will act as a stream crossing to give landowner access. The culverts are set at the existing flowline and include approximately 2.5 feet of cover.

Another change from existing conditions was to model the proposed excavation on the created wetland site. Cross sections 10.26 and 10.18 extend across the site area and detail the proposed excavated areas. Finally, several structures presently exist immediately downstream from the site. These include a four foot wide stop-log weir structure and a 48-inch CMCP. These structures will also be removed under proposed conditions.

Findings

The accompanying Table 1 lists the results of this hydraulic evaluation for the 100-year flood. A comparison between the existing and proposed conditions shows a small increase (0.01 to 0.24 feet) in the 100-year flood backwater elevations to beyond the basin divide. Although these small increases would require backwater easements if infringing on a different riparian, the magnitude of the increases are insignificant in terms of floodplain boundaries or potential flood damage.

For the lessor, more frequent rainfall event flows, the normal pool elevation will be nearly three feet higher than existing conditions. For a one inch storm, for instance, nearly three feet of additional backwater (820.3 versus the existing 817.5) will occur just upstream of the dam/diversion. This difference dissipates as you move upstream and remains confined within the banks of the north/south ditch. In relation to Blueberry Road, these smaller "floods" will remain from two to three feet below the top of road, whereas the 100-year flood will generally be very near the top of road for both existing and proposed conditions.

Appendix C includes cross sections and floodway limits for the proposed conditions along with HEC2 results which are summarized in Table 1.

Summary

As the HEC-2 results in Appendix B and Appendix C indicate, the proposed berming of the north-south ditch to divert flow into the wetland site causes only minor additional flood backwaters along upstream reaches. With backwater easements, or other legal arrangements, this project may be permitted from a floodplain management standpoint.

SRB:lrm

TABLE 1

CRANDON MINING COMPANY

WETLAND MITIGATION SITE: SHAWANO CO.

FOTH AND VAN DYKE: 93C049.29

SECTION NO.	EXISTING ELEVATION	PROPOSED ELEVATION	DIFFERENCE
9.80	820.20	820.20	0.00
9.90	820.21	820.21	0.00
9.95	820.21	820.22	0.01
9.99	820.21	820.23	0.02
10.10	820.18	820.20	0.02
10.18	820.71	820.47	-0.24
10.26	821.03	820.60	-0.43
10.27	821.03	821.08	0.05
10.28	821.17	821.41	0.24
10.29	821.50	821.61	0.11
10.30	821.59	821.61	0.02
10.31	821.68	821.68	0.00
10.37	822.05	822.03	-0.02
10.45	822.17	822.15	-0.02
10.55	822.48	822.47	-0.01
10.68	822.71	822.70	-0.01
10.77	822.88	822.87	-0.01
10.87	823.02	823.02	0.00
10.93	823.09	823.09	0.00
10.99	823.24	823.24	0.00
11.00	824.77	824.77	0.00
11.02	824.78	824.78	0.00

Appendix "A"

QTR-55 Hydrology

TR-55 TABULAR HYDROGRAPH METHOD
Type II Distribution
(24 hr. Duration Storm)

Executed: 08-06-1995 10:02:03
Watershed file: --> SHAWHEC .WSD
Hydrograph file: --> SHAWHEC .HYD

CRANDON MINING COMPANY
FOTH AND VAN DYKE 93C049
WETLAND COMPENSATION: SHAWANO COUNTY 5/95
100-YR STORM EVENT

>>>> Input Parameters Used to Compute Hydrograph <<<<

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input	Ia/p used
WETLAND	157.02	79.0	0.50	0.10	5.00	2.80	.11	.10
UPLAND NORTH	30.30	80.0	0.30	0.75	5.00	2.89	.1	.10

* Travel time from subarea outfall to composite watershed outfall point.
Total area = 187.32 acres or 0.2927 sq.mi
Peak discharge = 365 cfs

WARNING: Drainage areas of two or more subareas
differ by a factor of 5 or greater.

>>>> Computer Modifications of Input Parameters <<<<<

Subarea Description	Input Values Tc (hr)	Input Values * Tt (hr)	Rounded Values Tc (hr)	Rounded Values * Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p Messages
WETLAND	0.61	0.10	0.50	0.10	No	--
UPLAND NORTH	0.21	0.83	0.30	0.75	No	--

* Travel time from subarea outfall to composite watershed outfall point.

TR-55 TABULAR HYDROGRAPH METHOD
Type II Distribution
(24 hr. Duration Storm)

Executed: 08-06-1995 10:02:03
Watershed file: --> SHAWHEC .WSD
Hydrograph file: --> SHAWHEC .HYD

CRANDON MINING COMPANY
FOTH AND VAN DYKE 93C049
WETLAND COMPENSATION: SHAWANO COUNTY 5/95
100-YR STORM EVENT

>>>> Summary of Subarea Times to Peak <<<<

Subarea	Peak Discharge at Composite Outfall (cfs)	Time to Peak at Composite Outfall (hrs)
WETLAND	343	12.5
UPLAND NORTH	57	12.8
Composite Watershed	365	12.5

TR-55 TABULAR HYDROGRAPH METHOD
Type II Distribution
(24 hr. Duration Storm)

Executed: 08-06-1995 10:02:03
Watershed file: --> SHAWHEC .WSD
Hydrograph file: --> SHAWHEC .HYD

CRANDON MINING COMPANY
FOTH AND VAN DYKE 93C049
WETLAND COMPENSATION: SHAWANO COUNTY 5/95
100-YR STORM EVENT

Composite Hydrograph Summary (cfs)

Subarea Description	11.0 hr	11.3 hr	11.6 hr	11.9 hr	12.0 hr	12.1 hr	12.2 hr	12.3 hr	12.4 hr
WETLAND	11	15	21	35	55	96	173	271	332
UPLAND NORTH	2	2	3	4	4	5	6	8	13
Total (cfs)	13	17	24	39	59	101	179	279	345

Subarea Description	12.5 hr	12.6 hr	12.7 hr	12.8 hr	13.0 hr	13.2 hr	13.4 hr	13.6 hr	13.8 hr
WETLAND	343	298	236	182	111	74	55	45	38
UPLAND NORTH	22	34	46	57	54	41	27	18	12
Total (cfs)	365	332	282	239	165	115	82	63	50

Subarea Description	14.0 hr	14.3 hr	14.6 hr	15.0 hr	15.5 hr	16.0 hr	16.5 hr	17.0 hr	17.5 hr
WETLAND	34	29	25	23	20	18	16	14	14
UPLAND NORTH	9	7	6	5	4	4	4	3	3
Total (cfs)	43	36	31	28	24	22	20	17	17

Subarea Description	18.0 hr	19.0 hr	20.0 hr	22.0 hr	26.0 hr
WETLAND	13	11	10	8	0
UPLAND NORTH	3	2	2	2	0
Total (cfs)	16	13	12	10	0

TR-55 TABULAR HYDROGRAPH METHOD
Type II Distribution
(24 hr. Duration Storm)

Executed: 08-06-1995 10:02:03
Watershed file: --> SHAWHEC .WSD
Hydrograph file: --> SHAWHEC .HYD

CRANDON MINING COMPANY
FOTH AND VAN DYKE 93C049
WETLAND COMPENSATION: SHAWANO COUNTY 5/95
100-YR STORM EVENT

Time (hrs)	Flow (cfs)	Time (hrs)	Flow (cfs)
11.0	13	14.8	30
11.1	14	14.9	29
11.2	16	15.0	28
11.3	17	15.1	27
11.4	19	15.2	26
11.5	22	15.3	26
11.6	24	15.4	25
11.7	29	15.5	24
11.8	34	15.6	24
11.9	39	15.7	23
12.0	59	15.8	23
12.1	101	15.9	22
12.2	179	16.0	22
12.3	279	16.1	22
12.4	345	16.2	21
12.5	365	16.3	21
12.6	332	16.4	20
12.7	282	16.5	20
12.8	239	16.6	19
12.9	202	16.7	19
13.0	165	16.8	18
13.1	140	16.9	18
13.2	115	17.0	17
13.3	98	17.1	17
13.4	82	17.2	17
13.5	73	17.3	17
13.6	63	17.4	17
13.7	56	17.5	17
13.8	50	17.6	17
13.9	46	17.7	17
14.0	43	17.8	16
14.1	41	17.9	16
14.2	38	18.0	16
14.3	36	18.1	16
14.4	34	18.2	15
14.5	33	18.3	15
14.6	31	18.4	15

TR-55 TABULAR HYDROGRAPH METHOD
Type II Distribution
(24 hr. Duration Storm)

Executed: 08-06-1995 10:02:03
Watershed file: --> SHAWHEC .WSD
Hydrograph file: --> SHAWHEC .HYD

CRANDON MINING COMPANY
FOTH AND VAN DYKE 93C049
WETLAND COMPENSATION: SHAWANO COUNTY 5/95
100-YR STORM EVENT

Time (hrs)	Flow (cfs)	Time (hrs)	Flow (cfs)
18.6	14	22.4	9
18.7	14	22.5	9
18.8	14	22.6	8
18.9	13	22.7	8
19.0	13	22.8	8
19.1	13	22.9	8
19.2	13	23.0	8
19.3	13	23.1	7
19.4	13	23.2	7
19.5	12	23.3	7
19.6	12	23.4	6
19.7	12	23.5	6
19.8	12	23.6	6
19.9	12	23.7	6
20.0	12	23.8	6
20.1	12	23.9	5
20.2	12	24.0	5
20.3	12	24.1	5
20.4	12	24.2	4
20.5	12	24.3	4
20.6	11	24.4	4
20.7	11	24.5	4
20.8	11	24.6	4
20.9	11	24.7	3
21.0	11	24.8	3
21.1	11	24.9	3
21.2	11	25.0	2
21.3	11	25.1	2
21.4	11	25.2	2
21.5	10	25.3	2
21.6	10	25.4	2
21.7	10	25.5	1
21.8	10	25.6	1
21.9	10	25.7	1
22.0	10	25.8	0
22.1	10	25.9	0
22.2	10		
22.3	9		

TR-55 TABULAR HYDROGRAPH METHOD
Type II Distribution
(24 hr. Duration Storm)

Executed: 08-06-1995 10:02:57
Watershed file: --> SHAW100 .WSD
Hydrograph file: --> SHAW100 .HYD

CRANDON MINING COMPANY
FOTH AND VAN DYKE 93C049
WETLAND COMPENSATION: SHAWANO COUNTY 5/95
100-YR STORM EVENT

>>>> Input Parameters Used to Compute Hydrograph <<<<

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input	Ia/p used
WETLAND	157.02	79.0	0.50	0.10	5.00	2.80	.11	.10
UPLAND NORTH	30.30	80.0	0.30	0.75	5.00	2.89	.1	.10
AGRICULTURAL	104.68	80.0	0.30	0.00	5.00	2.89	.1	.10
UPLAND SOUTH	52.34	80.0	0.50	0.10	5.00	2.89	.1	.10

* Travel time from subarea outfall to composite watershed outfall point.
Total area = 344.34 acres or 0.5380 sq.mi
Peak discharge = 692 cfs

WARNING: Drainage areas of two or more subareas
differ by a factor of 5 or greater.

>>>> Computer Modifications of Input Parameters <<<<<

Subarea Description	Input Values Tc (hr)	Input Values * Tt (hr)	Rounded Values Tc (hr)	Rounded Values * Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p Messages
WETLAND	0.61	0.10	0.50	0.10	No	--
UPLAND NORTH	0.21	0.83	0.30	0.75	No	--
AGRICULTURAL	0.28	0.00	0.30	0.00	No	--
UPLAND SOUTH	0.61	0.10	0.50	0.10	No	--

* Travel time from subarea outfall to composite watershed outfall point.

TR-55 TABULAR HYDROGRAPH METHOD
Type II Distribution
(24 hr. Duration Storm)

Executed: 08-06-1995 10:02:57
Watershed file: --> SHAW100 .WSD
Hydrograph file: --> SHAW100 .HYD

CRANDON MINING COMPANY
FOTH AND VAN DYKE 93C049
WETLAND COMPENSATION: SHAWANO COUNTY 5/95
100-YR STORM EVENT

>>>> Summary of Subarea Times to Peak <<<<

Subarea	Peak Discharge at Composite Outfall (cfs)	Time to Peak at Composite Outfall (hrs)
WETLAND	343	12.5
UPLAND NORTH	57	12.8
AGRICULTURAL	320	12.2
UPLAND SOUTH	118	12.5
Composite Watershed	692	12.3

TR-55 TABULAR HYDROGRAPH METHOD
Type II Distribution
(24 hr. Duration Storm)

Executed: 08-06-1995 10:02:57
Watershed file: --> SHAW100 .WSD
Hydrograph file: --> SHAW100 .HYD

CRANDON MINING COMPANY
FOTH AND VAN DYKE 93C049
WETLAND COMPENSATION: SHAWANO COUNTY 5/95
100-YR STORM EVENT

Composite Hydrograph Summary (cfs)

Subarea Description	11.0 hr	11.3 hr	11.6 hr	11.9 hr	12.0 hr	12.1 hr	12.2 hr	12.3 hr	12.4 hr
WETLAND	11	15	21	35	55	96	173	271	332
UPLAND NORTH	2	2	3	4	4	5	6	8	13
AGRICULTURAL	9	13	19	56	111	211	320	320	217
UPLAND SOUTH	4	5	7	12	19	33	60	93	114
Total (cfs)	26	35	50	107	189	345	559	692	676

Subarea Description	12.5 hr	12.6 hr	12.7 hr	12.8 hr	13.0 hr	13.2 hr	13.4 hr	13.6 hr	13.8 hr
WETLAND	343	298	236	182	111	74	55	45	38
UPLAND NORTH	22	34	46	57	54	41	27	18	12
AGRICULTURAL	134	93	69	54	38	31	27	24	22
UPLAND SOUTH	118	103	81	63	38	26	19	15	13
Total (cfs)	617	528	432	356	241	172	128	102	85

TR-55 TABULAR HYDROGRAPH METHOD
Type II Distribution
(24 hr. Duration Storm)

Executed: 08-06-1995 10:02:57
Watershed file: --> SHAW100 .WSD
Hydrograph file: --> SHAW100 .HYD

CRANDON MINING COMPANY
FOTH AND VAN DYKE 93C049
WETLAND COMPENSATION: SHAWANO COUNTY 5/95
100-YR STORM EVENT

Composite Hydrograph Summary (cfs)

Subarea Description	14.0 hr	14.3 hr	14.6 hr	15.0 hr	15.5 hr	16.0 hr	16.5 hr	17.0 hr	17.5 hr
WETLAND	34	29	25	23	20	18	16	14	14
UPLAND NORTH	9	7	6	5	4	4	4	3	3
AGRICULTURAL	20	17	16	15	13	11	10	9	9
UPLAND SOUTH	12	10	9	8	7	6	5	5	5
Total (cfs)	75	63	56	51	44	39	35	31	31

Subarea Description	18.0 hr	19.0 hr	20.0 hr	22.0 hr	26.0 hr
WETLAND	13	11	10	8	0
UPLAND NORTH	3	2	2	2	0
AGRICULTURAL	9	8	6	6	0
UPLAND SOUTH	4	4	3	3	0
Total (cfs)	29	25	21	19	0

TR-55 TABULAR HYDROGRAPH METHOD
Type II Distribution
(24 hr. Duration Storm)

Executed: 08-06-1995 10:02:57
Watershed file: --> SHAW100 .WSD
Hydrograph file: --> SHAW100 .HYD

CRANDON MINING COMPANY
FOTH AND VAN DYKE 93C049
WETLAND COMPENSATION: SHAWANO COUNTY 5/95
100-YR STORM EVENT

Time (hrs)	Flow (cfs)	Time (hrs)	Flow (cfs)
11.0	26	14.8	54
11.1	29	14.9	52
11.2	32	15.0	51
11.3	35	15.1	50
11.4	40	15.2	48
11.5	45	15.3	47
11.6	50	15.4	45
11.7	69	15.5	44
11.8	88	15.6	43
11.9	107	15.7	42
12.0	189	15.8	41
12.1	345	15.9	40
12.2	559	16.0	39
12.3	692	16.1	38
12.4	676	16.2	37
12.5	617	16.3	37
12.6	528	16.4	36
12.7	432	16.5	35
12.8	356	16.6	34
12.9	298	16.7	33
13.0	241	16.8	33
13.1	206	16.9	32
13.2	172	17.0	31
13.3	150	17.1	31
13.4	128	17.2	31
13.5	115	17.3	31
13.6	102	17.4	31
13.7	93	17.5	31
13.8	85	17.6	31
13.9	80	17.7	30
14.0	75	17.8	30
14.1	71	17.9	29
14.2	67	18.0	29
14.3	63	18.1	29
14.4	61	18.2	28
14.5	58	18.3	28
14.6	56	18.4	27

TR-55 TABULAR HYDROGRAPH METHOD
Type II Distribution
(24 hr. Duration Storm)

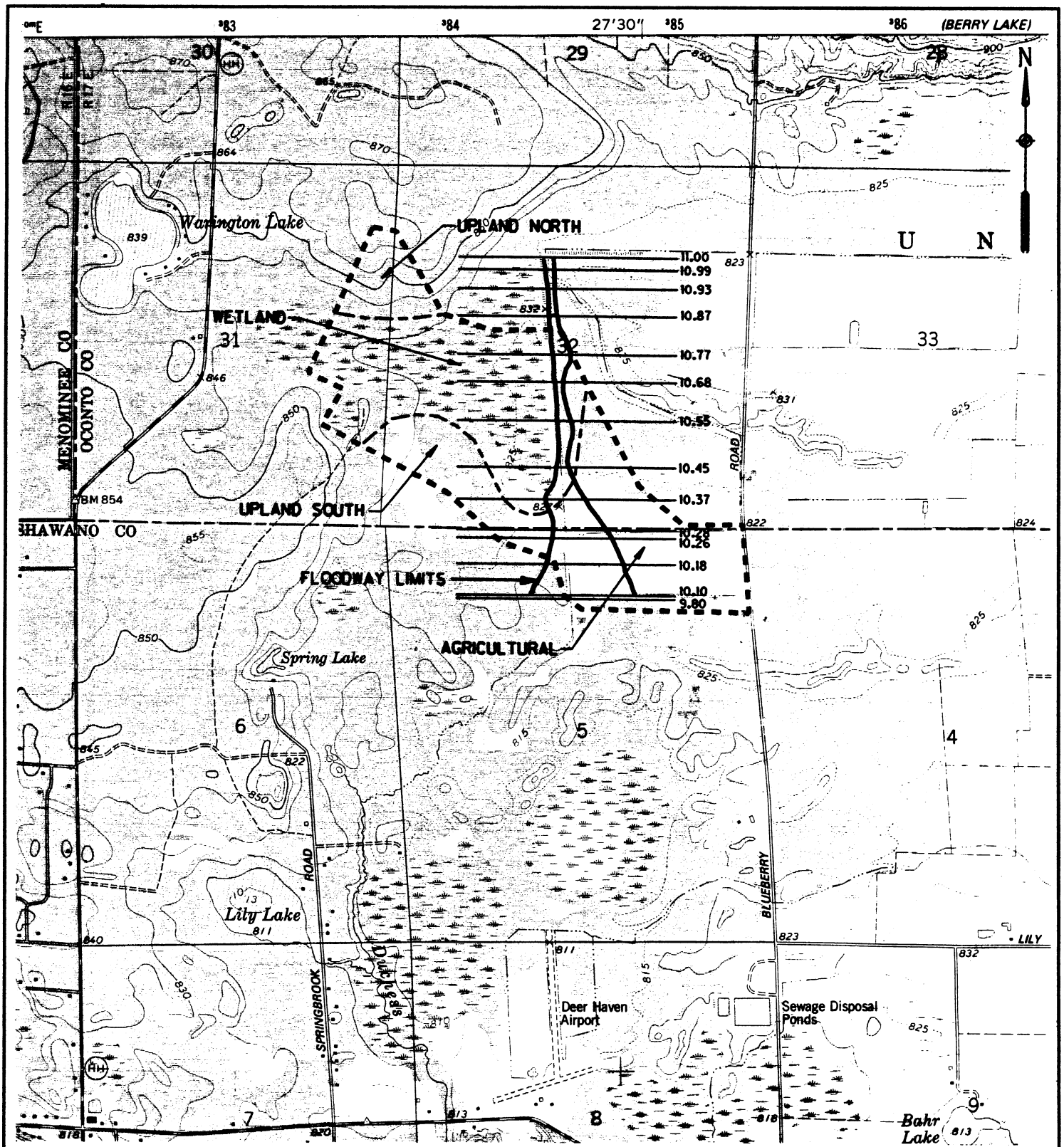
Executed: 08-06-1995 10:02:57
Watershed file: --> SHAW100 .WSD
Hydrograph file: --> SHAW100 .HYD

CRANDON MINING COMPANY
FOTH AND VAN DYKE 93C049
WETLAND COMPENSATION: SHAWANO COUNTY 5/95
100-YR STORM EVENT

Time (hrs)	Flow (cfs)	Time (hrs)	Flow (cfs)
18.6	27	22.4	17
18.7	26	22.5	17
18.8	26	22.6	16
18.9	25	22.7	16
19.0	25	22.8	15
19.1	25	22.9	15
19.2	24	23.0	14
19.3	24	23.1	14
19.4	23	23.2	13
19.5	23	23.3	13
19.6	23	23.4	12
19.7	22	23.5	12
19.8	22	23.6	11
19.9	21	23.7	11
20.0	21	23.8	10
20.1	21	23.9	10
20.2	21	24.0	10
20.3	21	24.1	9
20.4	21	24.2	9
20.5	20	24.3	8
20.6	20	24.4	8
20.7	20	24.5	7
20.8	20	24.6	7
20.9	20	24.7	6
21.0	20	24.8	6
21.1	20	24.9	5
21.2	20	25.0	5
21.3	20	25.1	4
21.4	20	25.2	4
21.5	20	25.3	3
21.6	19	25.4	3
21.7	19	25.5	2
21.8	19	25.6	2
21.9	19	25.7	1
22.0	19	25.8	1
22.1	19	25.9	0
22.2	18		
22.3	18		

Appendix "B"

HEC2: Existing Conditions



SOURCE: U.S.G.S. 7.5 MINUTE TOPOGRAPHIC QUADRANGLE - CECIL, 1974
OCONTO & SHAWANO COUNTY, WISCONSIN

Foth & Van Dyke

REVISED	DATE	BY	DESCRIPTION

CHECKED BY:	JKSI	DATE: SEPT.'95
APPROVED BY:	MDL	DATE: SEPT.'95
APPROVED BY:	GWS	DATE: SEPT.'95

Crandon Mining Company

FIGURE 1A
WETLAND COMPENSATION SITE
EXISTING FLOODWAY LIMITS

Scale: 0 1000' 2000' Date: SEPTEMBER, 1995

Prepared By: Foth & Van Dyke By: JRB2

```
**********************************************
*  HEC-2 WATER SURFACE PROFILES              *
*                                            *
*  Version   4.6.2;  May 1991                *
*                                            *
*  RUN DATE    18SEP95     TIME   14:07:13   *
**********************************************
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```
**************************************
*  U.S. ARMY CORPS OF ENGINEERS      *
*  HYDROLOGIC ENGINEERING CENTER     *
*  609 SECOND STREET, SUITE D        *
*  DAVIS, CALIFORNIA 95616-4687      *
*           (916) 756-1104           *
**************************************
```

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X     X  XXXXXXX   XXXXX              XXXXX
X     X  X        X     X           X     X
X     X  X        X                       X
XXXXXXX  XXXX     X          XXXXX    XXXXX
X     X  X        X                  X
X     X  X        X     X            X
X     X  XXXXXXX  XXXXX              XXXXXXX
```

1

THIS RUN EXECUTED 18SEP95 14:07:13

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**************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
**************************************
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T1  CRANDON MINING COMPANY                      FOTH & VAN DYKE   93C049.29
T2  WETLAND COMPENSATION SITE                   SEPTEMBER 1995
T3  NORTH-SOUTH DITCH STUDY                     FILE: CMCSHAW

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

                2                           .0005                                 820.23

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

                        -1


QT        1       692
NC      .04       .04      .050        .3        .5
X1      9.8         9      9984     10012         0         0         0
X3                                   9100                10600
GR   819.57      7450   819.47      9984    815.44      9994    814.93     10000    815.44     10007
GR   817.51     10012      820     10050       820     10240       820     10750

X1      9.9         8      9984     10012        10        10        10
X3                                   9100                10600
X4        1    815.44      9994
GR   819.57      7450   819.47      9984    814.93     10000    815.44     10007    817.51     10012
GR      820     10050      820     10240       820     10750
```

48 " CMCP

SC	1.024	0.5	2.9	1500	4	4	30	2.3	814.93	814.93
X1	9.95				30	30	30			
X2			2	818.93	819.47					
X3				9100		10600				

2: 2 FT. STOP LOG WEIR STRUCTURE

X1	9.99	10	9984	10012	10	10	10		.05	
X3				9100		10600				
GR	819.57	7450	819.47	9984	815.44	9994	815.93	9998	815.93	10002
GR	815.44	10007	817.51	10012	820	10050	820	10240	820	10750
X1	10.1	8	9986	10015	20	20	20			
X3				9120		10600				
X4	1	815.77	9991							
GR	820.99	8000	819.58	9986	814.20	10000	815.94	10007	819.87	10015
GR	820	10050	820	10240	820	10750				

1

NC	.08	.08	.08	.1	.3					
X1	10.18	7	9981	10014	443	443	443			
X3				9250		10420				
X4	3	819	9560	820	9900	815.7	9992			
GR	818.85	8300	820.50	9981	814.14	10000	815.01	10006	818.98	10014
GR	820	10080	825	12030						
NC				.3	.5					
X1	10.26	6	9979	10023	407	407	407			
X3				9400		10200				
X4	1	816.16	9993							
GR	820	8000	820.39	9979	815.81	10000	816.45	10007	819.68	10023
GR	825	11800								

36 " CCP

SC	1.013	0.5	2.9	800	3	3	25	3.1	816.12	815.81
X1	10.27				25	25	25			
X2			2	818.81	820.39					
X3				9400		10200				
NC				.1	.3					
X1	10.28	6	9981	10026	80	80	80		-.06	
X3				9500		10200				
X4	1	816.35	9992							
GR	819.0	8250	821.41	9981	814.44	10000	816.11	10007	820.94	10026
GR	825	11700								
X1	10.29				40	40	40		.06	
X3				9500		10200				
X1	10.30				20	20	20		.06	
X3				9500		10200				
X1	10.31				20	20	20		.03	
X3				9500		10200				

FLOW REDUCED (NOT INCLUDING UPLAND SOUTH AND AGRICULTURAL AREAS)

QT	1	365								
X1	10.37	7	9981	10017	365	365	365			
X3				9700		10300				
X4	1	815.56	9992							
GR	820.00	8000	820.5	9981	815.04	10000	816.16	10007	820.79	10017
GR	825	11700	830	13700						
NC	.045	.045	.05							
X1	10.45	6	9987	10020	444	444	444			
X4	1	816.58	9993							
GR	825.00	9900	820.73	9987	815.08	10000	816.39	10010	822.21	10020
GR	825	11700								

1

X1	10.55	6	9983	10019	554	554	554			
X3				9820		10220				
X4	1	816.55	9993							
GR	820.00	8000	821.28	9983	815.97	10000	816.74	10009	822.96	10019
GR	825	11600								

FLOW REDUCED BY HALF

QT	1	180								
X1	10.68	7	9985	10022	685	685	685			
X3				9550		10700				
X4	1	817.05	9995							
GR	825	9260	822.54	9985	816.80	10000	817.19	10008	824.22	10022
GR	825	11700	830	13900						
X1	10.77	6	9988	10017	460	460	460			
X3				9750		11000				
X4	1	817.71	9994							
GR	825	9350	821.76	9988	817.59	10000	817.91	10007	824.45	10017
GR	825	11800								

FLOW REDUCED BY HALF

QT	1	90								
X1	10.87	6	9982	10014	520	520	520			
X4	1	818.44	9994							
GR	825.00	9460	823.01	9982	818.26	10000	818.37	10007	824.03	10014
GR	830	12550								
X1	10.93	6	9983	10016	320	320	320			
X4	1	818.51	9996							
GR	825.00	9670	824.04	9983	817.53	10000	818.35	10005	825.09	10016
GR	830	12900								
NC				.3	.5					
X1	10.99	4	9982	10015	305	305	305			
X3				9920		10080				
X4	2	825.00	9600	819.41	10000					
GR	825	7100	824.13	9982	824.60	10015	830	12100		

36 " CCP

SC	1.013	0.5	2.9	160	3	3	18	3.1	819.47	819.41
X1	11.00				18	18	18			
X2			2	822.41	824.60					
X3				9920		10080				

```
NC                                          .1          .3
  DITCH FALLING TO THE NORTH (AWAY FROM D/S)
  SO SHOULD HAVE NO FLOW
QT        1          1
X1    11.02          5       9983       10022         150         150         150
X3                                        9920                   10080
X4        1     819.16       9995
GR      825       7100     823.56       9983      819.27       10006      824.02       10022         830       11975
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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

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*PROF 1

CCHV=     .300 CEHV=     .500
*SECNO 9.800
3280 CROSS SECTION      9.80 EXTENDED       .20 FEET


3470 ENCROACHMENT STATIONS=     9100.0   10600.0  TYPE=      1  TARGET=     1500.000
     9.800      5.27    820.20       .00    820.23    820.22       .02       .00       .00    819.47
     692.0     420.4     181.3      90.3     630.9     111.3     165.6        .0        .0    817.51
       .00       .67      1.63       .55       .040      .050      .040      .000    814.93   9100.00
   .000505        0.        0.        0.         0         0         6       .00   1500.00  10600.00


*SECNO 9.900
3280 CROSS SECTION      9.90 EXTENDED       .21 FEET


3470 ENCROACHMENT STATIONS=     9100.0   10600.0  TYPE=      1  TARGET=     1500.000
     9.900      5.28    820.21       .00       .00    820.22       .02       .00       .00    819.47
     692.0     421.1     179.8      91.0     635.4     111.4     168.5        .2        .3    817.51
       .00       .66      1.61       .54       .040      .050      .040      .000    814.93   9100.00
   .000495       10.       10.       10.         0         0         0       .00   1500.00  10600.00


SPECIAL CULVERT

SC  CUNO      CUNV      ENTLC      COFQ      RDLEN      RISE      SPAN     CULVLN     CHRT      SCL      ELCHU      ELCHD
     1         .024       .50      2.90    1500.00      4.00      4.00      30.00        2        3     814.93     814.93

CHART  2 - CORRUGATED METAL PIPE CULVERT
SCALE  3 - PIPE PROJECTING FROM FILL
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5130, EGIC=  984.78..MAY BE TOO LARGE IF INLET CONTROLS.
5135, EGOC=  914.57 ..MAY BE TOO LARGE IF OUTLET CONTROLS.
*SECNO 9.950
5155, 20 TRIALS OF QWEIR NOT ENOUGH; POSSIBLY INVALID
FINAL QWEIR + QCULV =       700. DOES NOT EQUAL ACTUAL Q =       692.


SPECIAL CULVERT INLET CONTROL + WEIR FLOW, EG =    820.21
5150, EG OF   820.21 LESS THAN XEG OF   820.22
3280 CROSS SECTION      9.95 EXTENDED       .21 FEET

1
   18SEP95      14:07:13                                                                    PAGE    6

    SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     L-BANK ELEV
    Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
    TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
    SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

SPECIAL CULVERT

     EGIC      EGOC       H4     QWEIR     QCULV       VCH     ACULV     ELTRD     WEIRLN
   984.78    914.57      .00      609.      91.     1.589      12.6    819.47     1500.


3470 ENCROACHMENT STATIONS=     9100.0   10600.0  TYPE=      1  TARGET=     1500.000
     9.950      5.28    820.21       .00       .00    820.22       .01       .00       .00    819.47
     692.0     422.3     177.4      92.3     642.9     111.7     173.5        .8       1.4    817.51
       .01       .66      1.59       .53      .040      .050      .040      .000    814.93   9100.00
   .000479       30.       30.       30.         1         0         0       .00   1500.00  10600.00


*SECNO 9.990
3280 CROSS SECTION      9.99 EXTENDED       .11 FEET


3470 ENCROACHMENT STATIONS=     9100.0   10600.0  TYPE=      1  TARGET=     1500.000
     9.990      4.72    820.21       .00       .00    820.23       .02       .01       .00    819.52
     692.0     427.6     177.1      87.2     596.3     102.7     142.6       1.0       1.7    817.56
       .02       .72      1.72       .61      .040      .050      .040      .000    815.49   9100.00
   .000631       10.       10.       10.         0         0         0       .00   1500.00  10600.00


*SECNO 10.100
3280 CROSS SECTION     10.10 EXTENDED       .18 FEET


3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =   .49


3470 ENCROACHMENT STATIONS=     9120.0   10600.0  TYPE=      1  TARGET=     1480.000
    10.100      5.98    820.18       .00       .00    820.30       .12       .02       .05    819.58
     692.0     219.4     404.0      68.6     256.8     113.4     109.8       1.4       2.4    819.87
       .02       .85      3.56       .62      .040      .050      .040      .000    814.20   9135.47
   .002612       20.       20.       20.         2         0         0       .00   1464.52  10600.00
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CCHV=     .100 CEHV=     .300
*SECNO 10.180
1
   18SEP95      14:07:13

    SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     L-BANK ELEV
    Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
    TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
    SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST


3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =  2.40


3470 ENCROACHMENT STATIONS=     9250.0   10420.0  TYPE=      1  TARGET=     1170.000
    10.180      6.57    820.71       .00       .00    820.71       .01       .40       .01    820.50
     692.0     495.1     141.6      55.3     980.4     141.4     176.9      10.4      15.5    818.98
       .23       .50      1.00       .31      .080      .080      .080      .000    814.14   9250.00
   .000455      443.      443.      443.         2         0         0       .00   1104.75  10354.75


CCHV=     .300 CEHV=     .500
*SECNO 10.260

3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =   .50


3470 ENCROACHMENT STATIONS=     9400.0   10200.0  TYPE=      1  TARGET=      800.000
    10.260      5.22    821.03       .00       .00    821.05       .03       .33       .01    820.39
     692.0     249.7     282.5     159.8     401.3     155.5     191.4      20.0      24.4    819.68
       .32       .62      1.82       .83      .080      .080      .080      .000    815.81   9400.00
   .001832      407.      407.      407.         2         0         0       .00    800.00  10200.00


SPECIAL CULVERT

SC  CUNO      CUNV      ENTLC     COFQ      RDLEN     RISE      SPAN      CULVLN    CHRT      SCL       ELCHU     ELCHD
     1          .013      .50      2.90     800.00      3.00      3.00     25.00      3         1       816.12    815.81

CHART  3 - CONCRETE PIPE CULVERT; BEVELED RING ENTRANCE
SCALE  1 - (A) SMALL BEVEL = 0.042D

5130, EGIC= 1105.84..MAY BE TOO LARGE IF INLET CONTROLS.
5135, EGOC= 1071.17 ..MAY BE TOO LARGE IF OUTLET CONTROLS.
*SECNO 10.270

SPECIAL CULVERT INLET CONTROL + WEIR FLOW, EG =    821.04
5150, EG OF   821.04 LESS THAN XEG OF   821.05
SPECIAL CULVERT

     EGIC      EGOC       H4      QWEIR     QCULV       VCH      ACULV     ELTRD     WEIRLN
   1105.84   1071.17       .00       629.       67.     1.811       7.1    820.39       800.


3470 ENCROACHMENT STATIONS=     9400.0   10200.0  TYPE=      1  TARGET=      800.000
    10.270      5.22    821.03       .00       .00    821.05       .03       .00       .00    820.39
```

692.0	250.4	281.8	159.8	402.9	155.6	191.9	20.4	24.8	819.68
.33	.62	1.81	.83	.080	.080	.080	.000	815.81	9400.00
.001818	25.	25.	25.	2	0	0	.00	800.00	10200.00

1

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

CCHV= .100 CEHV= .300
*SECNO 10.280

3265 DIVIDED FLOW

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .49

3470 ENCROACHMENT STATIONS= 9500.0 10200.0 TYPE= 1 TARGET= 700.000

10.280	6.79	821.17	.00	.00	821.37	.20	.26	.05	821.35
692.0	56.2	627.7	8.1	87.8	165.9	17.9	21.3	26.0	820.88
.34	.64	3.78	.45	.080	.080	.080	.000	814.38	9500.00
.007662	80.	80.	80.	0	0	0	.00	521.35	10147.55

*SECNO 10.290

3470 ENCROACHMENT STATIONS= 9500.0 10200.0 TYPE= 1 TARGET= 700.000

10.290	7.06	821.50	.00	.00	821.60	.10	.22	.01	821.41
692.0	140.9	514.1	37.0	207.6	178.1	61.9	21.7	26.6	820.94
.34	.68	2.89	.60	.080	.080	.080	.000	814.44	9500.00
.004106	40.	40.	40.	2	0	0	.00	700.00	10200.00

*SECNO 10.300

3470 ENCROACHMENT STATIONS= 9500.0 10200.0 TYPE= 1 TARGET= 700.000

10.300	7.09	821.59	.00	.00	821.68	.09	.08	.00	821.47
692.0	148.7	503.6	39.7	218.3	179.1	65.8	21.9	26.9	821.00
.34	.68	2.81	.60	.080	.080	.080	.000	814.50	9500.00
.003866	20.	20.	20.	2	0	0	.00	700.00	10200.00

*SECNO 10.310

3470 ENCROACHMENT STATIONS= 9500.0 10200.0 TYPE= 1 TARGET= 700.000

10.310	7.15	821.68	.00	.00	821.75	.08	.07	.00	821.50
692.0	165.4	481.0	45.6	242.1	181.3	74.4	22.1	27.2	821.03
.35	.68	2.65	.61	.080	.080	.080	.000	814.53	9500.00
.003386	20.	20.	20.	0	0	0	.00	700.00	10200.00

1

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 10.370

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 2.12

3470 ENCROACHMENT STATIONS= 9700.0 10300.0 TYPE= 1 TARGET= 600.000

10.370	7.01	822.05	.00	.00	822.06	.00	.30	.01	820.50
365.0	163.9	135.6	65.5	447.6	179.4	258.5	27.9	32.7	820.79
.55	.37	.76	.25	.080	.080	.080	.000	815.04	9700.00
.000211	365.	365.	365.	3	0	0	.00	600.00	10300.00

*SECNO 10.450

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .53

10.450	7.09	822.17	.00	.00	822.24	.07	.16	.02	820.73
365.0	15.5	349.5	.0	21.1	158.5	.0	33.3	36.1	822.21
.61	.73	2.20	.00	.045	.050	.000	.000	815.08	9957.66
.000763	444.	444.	444.	2	0	0	.00	62.28	10019.93

*SECNO 10.550

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.54

3470 ENCROACHMENT STATIONS= 9820.0 10220.0 TYPE= 1 TARGET= 400.000

10.550	6.51	822.48	.00	.00	822.51	.02	.26	.01	821.28
365.0	140.5	224.5	.0	204.9	161.0	.0	36.8	37.7	822.96
.75	.69	1.39	.00	.045	.050	.000	.000	815.97	9820.00
.000321	554.	554.	554.	2	0	0	.00	198.24	10018.24

*SECNO 10.680

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .47

3470 ENCROACHMENT STATIONS= 9550.0 10700.0 TYPE= 1 TARGET= 1150.000

10.680	5.91	822.71	.00	.00	822.74	.03	.23	.00	822.54
180.0	.5	179.5	.0	4.2	134.1	.0	40.7	39.9	824.22
.89	.12	1.34	.00	.045	.050	.000	.000	816.80	9935.17
.000361	685.	685.	685.	2	0	0	.00	83.82	10018.99

1

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV

TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 10.770

3470 ENCROACHMENT STATIONS= 9750.0 11000.0 TYPE= 1 TARGET= 1250.000

10.770	5.29	822.88	.00	.00	822.89	.02	.16	.00	821.76
180.0	48.9	131.1	.0	121.6	104.8	.0	42.7	41.7	824.45
1.01	.40	1.25	.00	.045	.050	.000	.000	817.59	9769.17
.000324	460.	460.	460.	1	0	0	.00	245.42	10014.59

*SECNO 10.870

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .64

10.870	4.76	823.02	.00	.00	823.04	.01	.14	.00	823.01
90.0	.0	90.0	.0	.0	102.0	.0	44.6	43.3	824.03
1.18	.00	.88	.00	.045	.050	.000	.000	818.26	9978.29
.000198	520.	520.	520.	2	0	0	.00	34.47	10012.76

*SECNO 10.930

10.930	5.56	823.09	.00	.00	823.11	.02	.07	.00	824.04
90.0	.0	90.0	.0	.0	89.3	.0	45.3	43.6	825.09
1.27	.00	1.01	.00	.000	.050	.000	.000	817.53	9985.21
.000268	320.	320.	320.	1	0	0	.00	27.55	10012.75

CCHV= .300 CEHV= .500

*SECNO 10.990

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .40

3470 ENCROACHMENT STATIONS= 9920.0 10080.0 TYPE= 1 TARGET= 160.000

10.990	3.83	823.24	.00	.00	823.30	.05	.17	.02	824.13
90.0	.0	90.0	.0	.0	49.3	.0	45.8	43.8	824.60
1.31	.00	1.83	.00	.000	.050	.000	.000	819.41	9985.38
.001680	305.	305.	305.	2	0	0	.00	25.70	10011.08

1

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

SPECIAL CULVERT

SC	CUNO	CUNV	ENTLC	COFQ	RDLEN	RISE	SPAN	CULVLN	CHRT	SCL	ELCHU	ELCHD
	1	.013	.50	2.90	160.00	3.00	3.00	18.00	3	1	819.47	819.41

CHART 3 - CONCRETE PIPE CULVERT; BEVELED RING ENTRANCE

SCALE 1 - (A) SMALL BEVEL = 0.042D

*SECNO 11.000

SPECIAL CULVERT OUTLET CONTROL + WEIR FLOW EG = 824.78

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 2.96

SPECIAL CULVERT

EGIC	EGOC	H4	QWEIR	QCULV	VCH	ACULV	ELTRD	WEIRLN
826.55	827.35	1.48	36.	55.	.814	7.1	824.60	160.

3470 ENCROACHMENT STATIONS= 9920.0 10080.0 TYPE= 1 TARGET= 160.000

11.000	5.36	824.77	.00	.00	824.78	.01	1.48	.00	824.13
90.0	11.4	78.0	.6	36.0	95.8	6.3	45.9	43.8	824.60
1.32	.32	.81	.10	.045	.050	.045	.000	819.41	9920.00
.000192	18.	18.	18.	0	0	0	.00	160.00	10080.00

CCHV= .100 CEHV= .300

*SECNO 11.020

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 2.28

3470 ENCROACHMENT STATIONS= 9920.0 10080.0 TYPE= 1 TARGET= 160.000

11.020	5.62	824.78	.00	.00	824.78	.00	.00	.00	823.56
1.0	.2	.7	.1	76.1	152.6	39.2	46.6	44.4	824.02
11.23	.00	.00	.00	.045	.050	.045	.000	819.16	9920.00
.000000	150.	150.	150.	2	0	0	.00	160.00	10080.00

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THIS RUN EXECUTED 18SEP95 14:07:14

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

H-SOUTH DITCH STUDY

SUMMARY PRINTOUT TABLE 150

SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
9.800	.00	.00	.00	814.93	692.00	820.20	.00	820.22	5.05	1.63	907.76	307.91

	9.900	10.00	.00	.00	814.93	692.00	820.21	.00	820.22	4.95	1.61	915.36	311.04
	9.950	30.00	819.47	818.93	814.93	692.00	820.21	.00	820.22	4.79	1.59	928.09	316.35
	9.990	10.00	.00	.00	815.49	692.00	820.21	.00	820.23	6.31	1.72	841.60	275.59
*	10.100	20.00	.00	.00	814.20	692.00	820.18	.00	820.30	26.12	3.56	479.96	135.39
*	10.180	443.00	.00	.00	814.14	692.00	820.71	.00	820.71	4.55	1.00	1298.75	324.55
*	10.260	407.00	.00	.00	815.81	692.00	821.03	.00	821.05	18.32	1.82	748.12	161.66
	10.270	25.00	820.39	818.81	815.81	692.00	821.03	.00	821.05	18.18	1.81	750.37	162.30
*	10.280	80.00	.00	.00	814.38	692.00	821.17	.00	821.37	76.62	3.78	271.60	79.05
	10.290	40.00	.00	.00	814.44	692.00	821.50	.00	821.60	41.06	2.89	447.55	108.00
	10.300	20.00	.00	.00	814.50	692.00	821.59	.00	821.68	38.66	2.81	463.14	111.29
	10.310	20.00	.00	.00	814.53	692.00	821.68	.00	821.75	33.86	2.65	497.79	118.93
*	10.370	365.00	.00	.00	815.04	365.00	822.05	.00	822.06	2.11	.76	885.47	251.57
*	10.450	444.00	.00	.00	815.08	365.00	822.17	.00	822.24	7.63	2.20	179.66	132.11
*	10.550	554.00	.00	.00	815.97	365.00	822.48	.00	822.51	3.21	1.39	365.91	203.68
*	10.680	685.00	.00	.00	816.80	180.00	822.71	.00	822.74	3.61	1.34	138.32	94.79
	10.770	460.00	.00	.00	817.59	180.00	822.88	.00	822.89	3.24	1.25	226.40	99.98

1

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	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	10.870	520.00	.00	.00	818.26	90.00	823.02	.00	823.04	1.98	.88	102.02	64.00
	10.930	320.00	.00	.00	817.53	90.00	823.09	.00	823.11	2.68	1.01	89.33	54.94
*	10.990	305.00	.00	.00	819.41	90.00	823.24	.00	823.30	16.80	1.83	49.28	21.96
*	11.000	18.00	824.60	822.41	819.41	90.00	824.77	.00	824.78	1.92	.81	138.05	64.94
*	11.020	150.00	.00	.00	819.16	1.00	824.78	.00	824.78	.00	.00	267.89	147.91

1

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H-SOUTH DITCH STUDY

SUMMARY PRINTOUT TABLE 150

SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH

	9.800	692.00	820.20	.00	.00	-.03	1500.00	.00
	9.900	692.00	820.21	.00	.01	.00	1500.00	10.00
	9.950	692.00	820.21	.00	.00	.00	1500.00	30.00
	9.990	692.00	820.21	.00	.00	.00	1500.00	10.00
*	10.100	692.00	820.18	.00	-.03	.00	1464.52	20.00
*	10.180	692.00	820.71	.00	.53	.00	1104.75	443.00
*	10.260	692.00	821.03	.00	.32	.00	800.00	407.00
	10.270	692.00	821.03	.00	.00	.00	800.00	25.00
*	10.280	692.00	821.17	.00	.14	.00	521.35	80.00
	10.290	692.00	821.50	.00	.33	.00	700.00	40.00
	10.300	692.00	821.59	.00	.09	.00	700.00	20.00
	10.310	692.00	821.68	.00	.09	.00	700.00	20.00
*	10.370	365.00	822.05	.00	.38	.00	600.00	365.00
*	10.450	365.00	822.17	.00	.11	.00	62.28	444.00
*	10.550	365.00	822.48	.00	.32	.00	198.24	554.00
*	10.680	180.00	822.71	.00	.22	.00	83.82	685.00
	10.770	180.00	822.88	.00	.17	.00	245.42	460.00
*	10.870	90.00	823.02	.00	.15	.00	34.47	520.00
	10.930	90.00	823.09	.00	.07	.00	27.55	320.00
*	10.990	90.00	823.24	.00	.15	.00	25.70	305.00
*	11.000	90.00	824.77	.00	1.53	.00	160.00	18.00
*	11.020	1.00	824.78	.00	.01	.00	160.00	150.00

1

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SUMMARY OF ERRORS AND SPECIAL NOTES

WARNING SECNO= 10.100 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 10.180 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 10.260 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 10.280 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

```
WARNING SECNO=     10.370  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=     10.450  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=     10.550  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=     10.680  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=     10.870  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

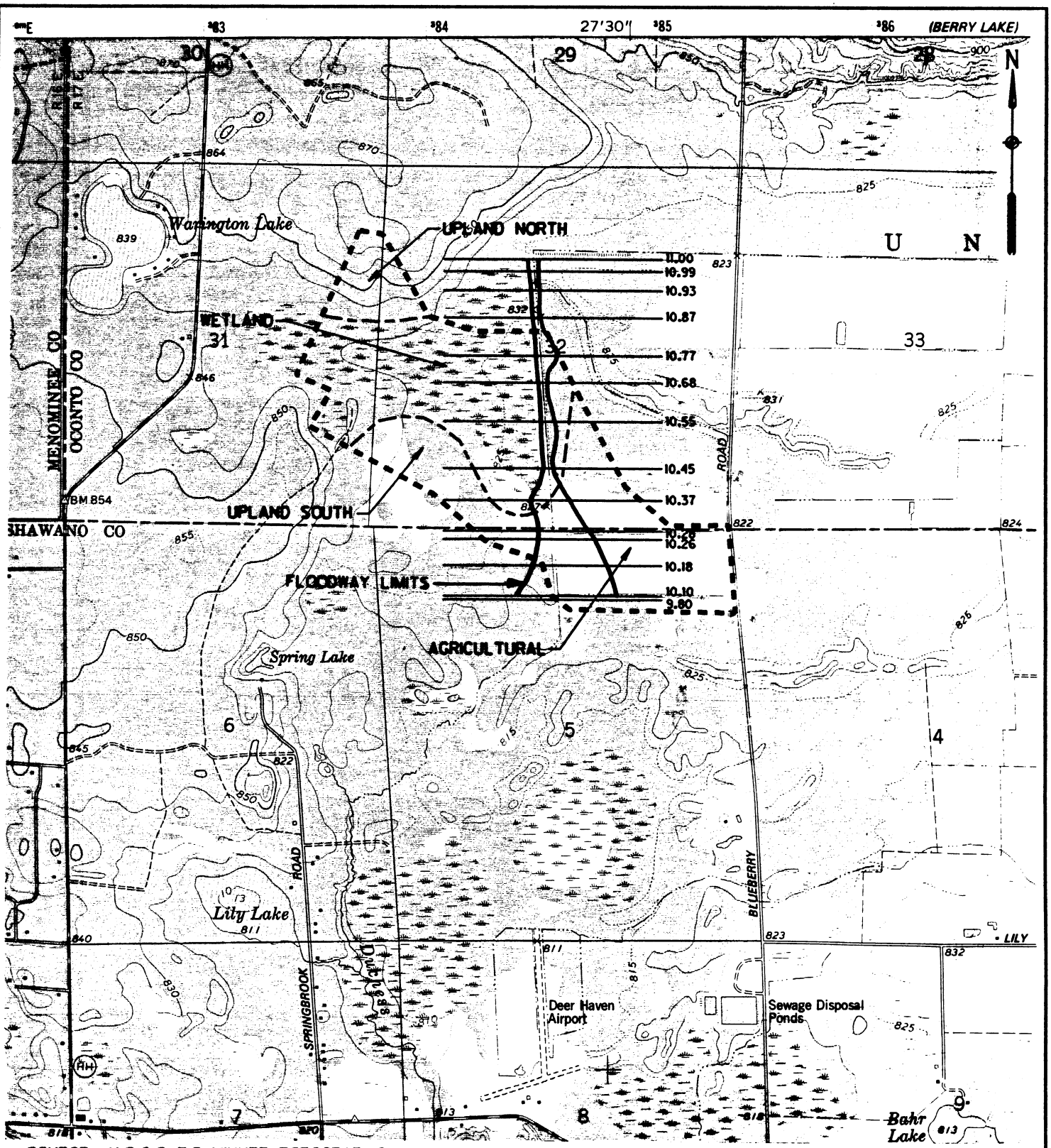
WARNING SECNO=     10.990  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=     11.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=     11.020  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
```

Appendix "C"

HEC2: Proposed Conditions



SOURCE: U.S.G.S. 7.5 MINUTE TOPOGRAPHIC QUADRANGLE - CECIL, 1974
OCONTO & SHAWANO COUNTY, WISCONSIN

Foth & Van Dyke

REVISED	DATE	BY	DESCRIPTION

CHECKED BY:	JKSI	DATE: SEPT.'95
APPROVED BY:	MDL	DATE: SEPT.'95
APPROVED BY:	GWS	DATE: SEPT.'95

Crandon Mining Company

FIGURE 1B

WETLAND COMPENSATION SITE
PROPOSED FLOODWAY LIMITS

Scale: 0 1000' 2000' Date: SEPTEMBER, 1995

Prepared By: Foth & Van Dyke By: JRB2

```
1*****************************************
*  HEC-2 WATER SURFACE PROFILES           *
*                                         *
*  Version   4.6.2;  May 1991             *
*                                         *
*  RUN DATE    18SEP95    TIME   14:40:09  *
*****************************************
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*****************************************
*  U.S. ARMY CORPS OF ENGINEERS           *
*  HYDROLOGIC ENGINEERING CENTER          *
*  609 SECOND STREET, SUITE D             *
*  DAVIS, CALIFORNIA 95616-4687           *
*          (916) 756-1104                 *
*****************************************
```

```
X     X  XXXXXXX   XXXXX              XXXXX
X     X  X        X     X            X     X
X     X  X        X                  X
XXXXXXX  XXXX     X          XXXXX   XXXXX
X     X  X        X                  X
X     X  X        X     X            X
X     X  XXXXXXX  XXXXX              XXXXXXX
```

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THIS RUN EXECUTED 18SEP95 14:40:09

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*************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
*************************************
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```
T1  CRANDON MINING COMPANY                      FOTH & VAN DYKE   93C049.29
T2  WETLAND COMPENSATION SITE                   SEPTEMBER 1995
T3  NORTH-SOUTH DITCH FLOOD STUDY: PROPOSED     FILE: CMCSHAWP

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

                2                             .0005                                 820.23

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

                        -1


QT        1       692
NC      .04       .04      .050        .3        .5
X1      9.8         9      9984     10012         0         0         0
X3                                   9100                10600
GR   819.57      7450    819.47      9984    815.44      9994    814.93     10000    815.44     10007
GR   817.51     10012       820     10050       820     10240       820     10750

X1      9.9         8      9984     10012        10        10        10
X3                                   9100                10600
X4        1    815.44      9994
GR   819.57      7450    819.47      9984    814.93     10000    815.44     10007    817.51     10012
GR      820     10050       820     10240       820     10750
```

```
   REMOVE 48" CMCP

X1      9.95                                        30        30        30
X3                                9100                       10600
   REMOVE   STOP LOG WEIR STRUCTURE

X1      9.99        10      9984     10012        10        10        10                 .05
X3                                9100                       10600
GR    819.57      7450    819.47      9984    815.44      9994    814.93      9998    814.93     10002
GR    815.44     10007    817.51     10012       820     10050       820     10240       820     10750

X1      10.1         8      9986     10015        20        20        20
X3                                9120                       10600
X4         1    815.77      9991
GR    820.99      8000    819.58      9986    814.20     10000    815.94     10007    819.87     10015
GR       820     10050       820     10240       820     10750
1
    18SEP95      14:40:09                                                                          PAGE    2


NC       .08       .08       .08        .1        .3
X1     10.18         7      9981     10014       443       443       443
X3                                9250                       10420
X4         8       819      8500       819      9300     815.0      9380       815      9440     818.0
X4      9500       819      9560       820      9900     815.7      9992
GR    816.60      8300    820.50      9981    814.14     10000    815.01     10006    818.98     10014
GR       820     10080       825     12030

NC                                      .3        .5
   BERMING DITCH TO 820.0 FT
X1     10.26         6      9979     10023       407       407       407
X3                                9400                       10200
X4         1    820.00      9993
GR       820      8000    820.39      9979    820.00     10000    820.00     10007    820.00     10023
GR       825     11800
   36 " CCP   REMOVED

X1     10.27                                        25        25        25
X3                                9400                       10200

X1     10.28         6      9981     10026        80        80        80                -.06
X3                                9500                       10200
X4         1    816.35      9992
GR     819.0      8250    821.41      9981    814.44     10000    816.11     10007    820.94     10026
GR       825     11700

X1     10.29                                        40        40        40                 .06
X3                                9500                       10200
   ADD CULVERT CROSSING

SC     2.024       0.5       2.9       700       3.5       3.5        20       2.3     814.5     814.5
X1     10.30                                        20        20        20
X2                             2     818.0    820.94
X3                                9500                       10200

X1     10.31                                        20        20        20                 .03
X3                                9500                       10200

NC                                      .1        .3
```

QT	1	365								
X1	10.37	7	9981	10017	365	365	365			
X3				9700		10300				
X4	1	815.56	9992							
GR	820.00	8000	820.5	9981	815.04	10000	816.16	10007	820.79	10017
GR	825	11700	830	13700						
NC	.045	.045	.05							
X1	10.45	6	9987	10020	444	444	444			
X4	1	816.58	9993							
GR	825.00	9900	820.73	9987	815.08	10000	816.39	10010	822.21	10020
GR	825	11700								

X1	10.55	6	9983	10019	554	554	554			
X3				9820		10220				
X4	1	816.55	9993							
GR	820.00	8000	821.28	9983	815.97	10000	816.74	10009	822.96	10019
GR	825	11600								
FLOW REDUCED BY HALF										
QT	1	180								
X1	10.68	7	9985	10022	685	685	685			
X3				9550		10700				
X4	1	817.05	9995							
GR	825	9260	822.54	9985	816.80	10000	817.19	10008	824.22	10022
GR	825	11700	830	13900						
X1	10.77	6	9988	10017	460	460	460			
X3				9750		11000				
X4	1	817.71	9994							
GR	825	9350	821.76	9988	817.59	10000	817.91	10007	824.45	10017
GR	825	11800								
FLOW REDUCED BY HALF										
QT	1	90								
X1	10.87	6	9982	10014	520	520	520			
X4	1	818.44	9994							
GR	825.00	9460	823.01	9982	818.26	10000	818.37	10007	824.03	10014
GR	830	12550								
X1	10.93	6	9983	10016	320	320	320			
X4	1	818.51	9996							
GR	825.00	9670	824.04	9983	817.53	10000	818.35	10005	825.09	10016
GR	830	12900								
NC				.3	.5					
X1	10.99	4	9982	10015	305	305	305			
X3				9920		10080				
X4	2	825.00	9600	819.41	10000					
GR	825	7100	824.13	9982	824.60	10015	830	12100		
36 " CCP										
SC	1.013	0.5	2.9	160	3	3	18	3.1	819.47	819.41
X1	11.00				18	18	18			
X2			2	822.41	824.60					
X3				9920		10080				

```
NC                                        .1          .3
  DITCH FALLING TO THE NORTH (AWAY FROM D/S)
QT        1          1
X1    11.02          5       9983       10022         150         150         150
X3                                       9920                   10080
X4        1     819.16       9995
GR      825       7100     823.56       9983      819.27       10006      824.02       10022         830       11975
```


SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

```
*PROF 1

CCHV=     .300 CEHV=     .500
*SECNO 9.800
3280 CROSS SECTION      9.80 EXTENDED       .20 FEET


3470 ENCROACHMENT STATIONS=     9100.0   10600.0  TYPE=      1  TARGET=     1500.000
     9.800      5.27    820.20       .00    820.23    820.22       .02       .00       .00    819.47
     692.0     420.4     181.3      90.3     630.9     111.3     165.6        .0        .0    817.51
       .00       .67      1.63       .55      .040      .050      .040      .000    814.93   9100.00
   .000505        0.        0.        0.         0         0         6       .00   1500.00  10600.00


*SECNO 9.900
3280 CROSS SECTION      9.90 EXTENDED       .21 FEET


3470 ENCROACHMENT STATIONS=     9100.0   10600.0  TYPE=      1  TARGET=     1500.000
     9.900      5.28    820.21       .00       .00    820.22       .02       .00       .00    819.47
     692.0     421.1     179.8      91.0     635.4     111.4     168.5        .2        .3    817.51
       .00       .66      1.61       .54      .040      .050      .040      .000    814.93   9100.00
   .000495       10.       10.       10.         0         0         0       .00   1500.00  10600.00


*SECNO 9.950
3280 CROSS SECTION      9.95 EXTENDED       .22 FEET


3470 ENCROACHMENT STATIONS=     9100.0   10600.0  TYPE=      1  TARGET=     1500.000
     9.950      5.29    820.22       .00       .00    820.24       .01       .01       .00    819.47
     692.0     423.1     175.5      93.3     649.0     111.9     177.6        .8       1.4    817.51
       .01       .65      1.57       .53      .040      .050      .040      .000    814.93   9100.00
   .000466       30.       30.       30.         0         0         0       .00   1500.00  10600.00
```

*SECNO 9.990
3280 CROSS SECTION 9.99 EXTENDED .13 FEET

3470 ENCROACHMENT STATIONS= 9100.0 10600.0 TYPE= 1 TARGET= 1500.000

9.990	5.25	820.23	.00	.00	820.24	.02	.01	.00	819.52
692.0	415.2	190.4	86.4	609.6	111.6	151.4	1.1	1.7	817.56
.02	.68	1.71	.57	.040	.050	.040	.000	814.98	9100.00
.000552	10.	10.	10.	0	0	0	.00	1500.00	10600.00

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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 10.100
3280 CROSS SECTION 10.10 EXTENDED .20 FEET

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .48

3470 ENCROACHMENT STATIONS= 9120.0 10600.0 TYPE= 1 TARGET= 1480.000

10.100	6.00	820.20	.00	.00	820.31	.10	.02	.04	819.58
692.0	228.7	386.6	76.7	273.6	113.9	121.2	1.4	2.4	819.87
.02	.84	3.39	.63	.040	.050	.040	.000	814.20	9120.00
.002353	20.	20.	20.	2	0	0	.00	1480.00	10600.00

CCHV= .100 CEHV= .300
*SECNO 10.180

3265 DIVIDED FLOW

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 4.23

3470 ENCROACHMENT STATIONS= 9250.0 10420.0 TYPE= 1 TARGET= 1170.000

10.180	6.33	820.47	.00	.00	820.47	.00	.15	.01	820.50
692.0	606.1	69.2	16.7	1377.4	133.4	105.7	12.2	15.0	818.98
.30	.44	.52	.16	.080	.080	.080	.000	814.14	9250.00
.000131	443.	443.	443.	2	0	0	.00	1003.83	10260.10

CCHV= .300 CEHV= .500
*SECNO 10.260

3235 SLOPE TOO STEEP, EXCEEDS .10

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .04

3470 ENCROACHMENT STATIONS= 9400.0 10200.0 TYPE= 1 TARGET= 800.000

10.260	.60	820.60	.00	.00	820.73	.13	.20	.07	820.39
692.0	402.9	96.6	192.5	158.2	23.9	63.2	20.9	23.5	820.00
.34	2.55	4.03	3.05	.080	.080	.080	.000	820.00	9400.00
.106184	407.	407.	407.	3	0	0	.00	800.00	10200.00

1

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 10.270

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 4.65

3470 ENCROACHMENT STATIONS= 9400.0 10200.0 TYPE= 1 TARGET= 800.000

10.270	1.08	821.08	.00	.00	821.10	.02	.33	.03	820.39
692.0	463.9	59.0	169.1	433.2	44.8	147.3	21.1	23.9	820.00
.34	1.07	1.32	1.15	.080	.080	.080	.000	820.00	9400.00
.004902	25.	25.	25.	5	0	0	.00	800.00	10200.00

*SECNO 10.280

3470 ENCROACHMENT STATIONS= 9500.0 10200.0 TYPE= 1 TARGET= 700.000

10.280	7.03	821.41	.00	.00	821.52	.11	.38	.05	821.35
692.0	128.0	531.5	32.5	190.3	176.4	55.6	22.1	25.3	820.88
.35	.67	3.01	.58	.080	.080	.080	.000	814.38	9500.00
.004523	80.	80.	80.	4	0	0	.00	700.00	10200.00

*SECNO 10.290

3470 ENCROACHMENT STATIONS= 9500.0 10200.0 TYPE= 1 TARGET= 700.000

10.290	7.17	821.61	.00	.00	821.68	.07	.15	.01	821.41
692.0	174.4	468.8	48.8	255.6	182.6	79.2	22.5	25.9	820.94
.36	.68	2.57	.62	.080	.080	.080	.000	814.44	9500.00
.003143	40.	40.	40.	1	0	0	.00	700.00	10200.00

SPECIAL CULVERT

SC	CUNO	CUNV	ENTLC	COFQ	RDLEN	RISE	SPAN	CULVLN	CHRT	SCL	ELCHU	ELCHD
	2	.024	.50	2.90	700.00	3.50	3.50	20.00	2	3	814.50	814.50

CHART 2 - CORRUGATED METAL PIPE CULVERT
SCALE 3 - PIPE PROJECTING FROM FILL

5130, EGIC= 887.91..MAY BE TOO LARGE IF INLET CONTROLS.
5135, EGOC= 859.80 ..MAY BE TOO LARGE IF OUTLET CONTROLS.
*SECNO 10.300

SPECIAL CULVERT INLET CONTROL + WEIR FLOW, EG = 821.62
5150, EG OF 821.62 LESS THAN XEG OF 821.68
1

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

SPECIAL CULVERT

EGIC	EGOC	H4	QWEIR	QCULV	VCH	ACULV	ELTRD	WEIRLN
887.91	859.80	.00	505.	187.	2.544	19.2	820.94	700.

3470 ENCROACHMENT STATIONS= 9500.0 10200.0 TYPE= 1 TARGET= 700.000

10.300	7.17	821.61	.00	.00	821.68	.07	.00	.00	821.41
692.0	176.9	465.4	49.7	259.4	182.9	80.6	22.8	26.3	820.94
.36	.68	2.54	.62	.080	.080	.080	.000	814.44	9500.00
.003076	20.	20.	20.	2	0	0	.00	700.00	10200.00

*SECNO 10.310

3470 ENCROACHMENT STATIONS= 9500.0 10200.0 TYPE= 1 TARGET= 700.000

10.310	7.21	821.68	.00	.00	821.74	.06	.06	.00	821.44
692.0	186.5	452.3	53.2	274.5	184.3	86.1	23.0	26.6	820.97
.36	.68	2.45	.62	.080	.080	.080	.000	814.47	9500.00
.002833	20.	20.	20.	0	0	0	.00	700.00	10200.00

CCHV= .100 CEHV= .300
*SECNO 10.370

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.90

3470 ENCROACHMENT STATIONS= 9700.0 10300.0 TYPE= 1 TARGET= 600.000

10.370	6.99	822.03	.00	.00	822.04	.00	.29	.01	820.50
365.0	163.4	137.4	64.2	441.3	178.6	252.2	28.9	32.0	820.79
.57	.37	.77	.25	.080	.080	.080	.000	815.04	9700.00
.000219	365.	365.	365.	3	0	0	.00	600.00	10300.00

*SECNO 10.450

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .53

10.450	7.07	822.15	.00	.00	822.22	.07	.17	.02	820.73
365.0	15.1	349.9	.0	20.6	158.0	.0	34.3	35.4	822.21
.62	.73	2.22	.00	.045	.050	.000	.000	815.08	9958.01
.000773	444.	444.	444.	2	0	0	.00	61.90	10019.90

1

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 10.550

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.54

3470 ENCROACHMENT STATIONS= 9820.0 10220.0 TYPE= 1 TARGET= 400.000

10.550	6.50	822.47	.00	.00	822.50	.02	.27	.01	821.28
365.0	139.6	225.4	.0	203.1	160.6	.0	37.7	37.1	822.96
.76	.69	1.40	.00	.045	.050	.000	.000	815.97	9820.00
.000326	554.	554.	554.	2	0	0	.00	198.22	10018.22

*SECNO 10.680

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .47

3470 ENCROACHMENT STATIONS= 9550.0 10700.0 TYPE= 1 TARGET= 1150.000

10.680	5.90	822.70	.00	.00	822.73	.03	.23	.00	822.54
180.0	.4	179.6	.0	3.8	133.8	.0	41.7	39.3	824.22
.90	.12	1.34	.00	.045	.050	.000	.000	816.80	9937.53
.000363	685.	685.	685.	2	0	0	.00	81.45	10018.98

*SECNO 10.770

3470 ENCROACHMENT STATIONS= 9750.0 11000.0 TYPE= 1 TARGET= 1250.000

10.770	5.28	822.87	.00	.00	822.89	.02	.16	.00	821.76
180.0	48.4	131.6	.0	120.2	104.6	.0	43.6	41.0	824.45
1.03	.40	1.26	.00	.045	.050	.000	.000	817.59	9770.46
.000328	460.	460.	460.	1	0	0	.00	244.12	10014.58

*SECNO 10.870

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .64

10.870	4.76	823.02	.00	.00	823.03	.01	.14	.00	823.01
90.0	.0	90.0	.0	.0	101.8	.0	45.6	42.6	824.03
1.19	.00	.88	.00	.000	.050	.000	.000	818.26	9979.60
.000199	520.	520.	520.	2	0	0	.00	33.15	10012.75

1

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

```
*SECNO 10.930
    10.930      5.56    823.09      .00      .00    823.11      .02      .07      .00    824.04
     90.0        .0      90.0       .0       .0      89.2       .0     46.3     42.9     825.09
     1.28       .00      1.01      .00     .000      .050     .000     .000   817.53    9985.22
  .000269       320.     320.      320.        1         0        0      .00    27.53   10012.75


CCHV=     .300 CEHV=     .500
*SECNO 10.990

3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =   .40


3470 ENCROACHMENT STATIONS=     9920.0   10080.0  TYPE=      1  TARGET=      160.000
    10.990      3.83    823.24      .00      .00    823.29      .05      .17      .02    824.13
     90.0        .0      90.0       .0       .0      49.2       .0     46.7     43.0     824.60
     1.32       .00      1.83      .00     .000      .050     .000     .000   819.41    9985.39
  .001690       305.     305.      305.        2         0        0      .00    25.67   10011.07


SPECIAL CULVERT

SC  CUNO      CUNV      ENTLC     COFQ      RDLEN     RISE      SPAN      CULVLN    CHRT      SCL       ELCHU     ELCHD
     1         .013       .50      2.90     160.00     3.00      3.00      18.00     3         1       819.47    819.41

CHART  3 - CONCRETE PIPE CULVERT; BEVELED RING ENTRANCE
SCALE  1 - (A) SMALL BEVEL = 0.042D

*SECNO 11.000

SPECIAL CULVERT OUTLET CONTROL + WEIR FLOW EG =    824.78

3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =  2.97

SPECIAL CULVERT

     EGIC      EGOC       H4      QWEIR     QCULV      VCH      ACULV     ELTRD     WEIRLN
   826.55    827.34     1.49        36.       55.      .814       7.1    824.60        160.


3470 ENCROACHMENT STATIONS=     9920.0   10080.0  TYPE=      1  TARGET=      160.000
    11.000      5.36    824.77      .00      .00    824.78      .01     1.49      .00    824.13
     90.0       11.4      78.0       .6     36.0      95.8       6.3     46.8     43.1     824.60
     1.33        .32       .81      .10     .045      .050      .045     .000   819.41    9920.00
  .000192       18.       18.       18.        0         0         0      .00   160.00   10080.00


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   18SEP95      14:40:09                                                                  PAGE   11


    SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     L-BANK ELEV
    Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
    TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
    SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST
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CCHV= .100 CEHV= .300
*SECNO 11.020

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 2.28

3470 ENCROACHMENT STATIONS= 9920.0 10080.0 TYPE= 1 TARGET= 160.000

11.020	5.62	824.78	.00	.00	824.78	.00	.00	.00	823.56
1.0	.2	.7	.1	76.1	152.6	39.2	47.5	43.6	824.02
11.24	.00	.00	.00	.045	.050	.045	.000	819.16	9920.00
.000000	150.	150.	150.	2	0	0	.00	160.00	10080.00

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THIS RUN EXECUTED 18SEP95 14:40:10

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

H-SOUTH DITCH FLOOD STUD

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	9.800	.00	.00	.00	814.93	692.00	820.20	.00	820.22	5.05	1.63	907.76	307.91
	9.900	10.00	.00	.00	814.93	692.00	820.21	.00	820.22	4.95	1.61	915.36	311.04
	9.950	30.00	.00	.00	814.93	692.00	820.22	.00	820.24	4.66	1.57	938.43	320.70
	9.990	10.00	.00	.00	814.98	692.00	820.23	.00	820.24	5.52	1.71	872.71	294.49
*	10.100	20.00	.00	.00	814.20	692.00	820.20	.00	820.31	23.53	3.39	508.69	142.64
*	10.180	443.00	.00	.00	814.14	692.00	820.47	.00	820.47	1.31	.52	1616.53	603.68
*	10.260	407.00	.00	.00	820.00	692.00	820.60	.00	820.73	1061.84	4.03	245.33	21.24
*	10.270	25.00	.00	.00	820.00	692.00	821.08	.00	821.10	49.02	1.32	625.31	98.83
	10.280	80.00	.00	.00	814.38	692.00	821.41	.00	821.52	45.23	3.01	422.42	102.89
	10.290	40.00	.00	.00	814.44	692.00	821.61	.00	821.68	31.43	2.57	517.36	123.44
	10.300	20.00	820.94	818.00	814.44	692.00	821.61	.00	821.68	30.76	2.54	523.00	124.76

	10.310	20.00	.00	.00	814.47	692.00	821.68	.00	821.74	28.33	2.45	544.92	130.02
*	10.370	365.00	.00	.00	815.04	365.00	822.03	.00	822.04	2.19	.77	872.07	246.43
*	10.450	444.00	.00	.00	815.08	365.00	822.15	.00	822.22	7.73	2.22	178.59	101.26
*	10.550	554.00	.00	.00	815.97	365.00	822.47	.00	822.50	3.26	1.40	363.72	202.08
*	10.680	685.00	.00	.00	816.80	180.00	822.70	.00	822.73	3.63	1.34	137.66	94.47
	10.770	460.00	.00	.00	817.59	180.00	822.87	.00	822.89	3.28	1.26	224.80	99.38

1

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	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	10.870	520.00	.00	.00	818.26	90.00	823.02	.00	823.03	1.99	.88	101.85	63.85
	10.930	320.00	.00	.00	817.53	90.00	823.09	.00	823.11	2.69	1.01	89.20	54.84
*	10.990	305.00	.00	.00	819.41	90.00	823.24	.00	823.29	16.90	1.83	49.17	21.89
*	11.000	18.00	824.60	822.41	819.41	90.00	824.77	.00	824.78	1.92	.81	138.08	64.96
*	11.020	150.00	.00	.00	819.16	1.00	824.78	.00	824.78	.00	.00	267.92	147.93

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H-SOUTH DITCH FLOOD STUD

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	9.800	692.00	820.20	.00	.00	-.03	1500.00	.00
	9.900	692.00	820.21	.00	.01	.00	1500.00	10.00
	9.950	692.00	820.22	.00	.02	.00	1500.00	30.00
	9.990	692.00	820.23	.00	.00	.00	1500.00	10.00
*	10.100	692.00	820.20	.00	-.02	.00	1480.00	20.00
*	10.180	692.00	820.47	.00	.26	.00	1003.83	443.00
*	10.260	692.00	820.60	.00	.13	.00	800.00	407.00
*	10.270	692.00	821.08	.00	.48	.00	800.00	25.00
	10.280	692.00	821.41	.00	.33	.00	700.00	80.00
	10.290	692.00	821.61	.00	.20	.00	700.00	40.00
	10.300	692.00	821.61	.00	.00	.00	700.00	20.00

	10.310	692.00	821.68	.00	.07	.00	700.00	20.00
*	10.370	365.00	822.03	.00	.35	.00	600.00	365.00
*	10.450	365.00	822.15	.00	.12	.00	61.90	444.00
*	10.550	365.00	822.47	.00	.32	.00	198.22	554.00
*	10.680	180.00	822.70	.00	.23	.00	81.45	685.00
	10.770	180.00	822.87	.00	.17	.00	244.12	460.00
*	10.870	90.00	823.02	.00	.15	.00	33.15	520.00
	10.930	90.00	823.09	.00	.07	.00	27.53	320.00
*	10.990	90.00	823.24	.00	.15	.00	25.67	305.00
*	11.000	90.00	824.77	.00	1.53	.00	160.00	18.00
*	11.020	1.00	824.78	.00	.01	.00	160.00	150.00

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SUMMARY OF ERRORS AND SPECIAL NOTES

WARNING SECNO= 10.100 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 10.180 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO= 10.260 PROFILE= 1 SLOPE TOO STEEP
WARNING SECNO= 10.260 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 10.270 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 10.370 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 10.450 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 10.550 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 10.680 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 10.870 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 10.990 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 11.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 11.020 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

Appendix D

Backwater Easement

BACKWATER EASEMENT

AGREEMENT made this 27 day of September, 1995, between Helen M. Garrity, a Widow, and James W. Garrity and Patrick T. Garrity, as attorneys-in-fact for Helen M. Garrity pursuant to that certain Durable Power of Attorney dated November 21, 1994, whose address is 2165 South Broadway, Green Bay, Wisconsin 54304, hereinafter referred to as "Garrity," and Crandon Mining Company, a general partnership formed under the laws of the State of Wisconsin and consisting of Crandon Mining Company, Inc., Exxon Minerals Development Corporation, Rio Crandon Inc. and Northwoods Resources Inc., whose address is c/o Land Manager, Exxon Coal and Minerals Company, P. O. Box 1314, Houston, Texas 77251-1314, hereinafter referred to as "CMC."

RECITALS:

A. Garrity owns certain lands described as the "Garrity Lands" on Exhibit A (the "Garrity Lands"), which Garrity Lands include a portion of the unnamed tributary of Duchess Creek shown on Exhibit B (the "Tributary").

B. Garrity owns certain additional lands described as the "CMC Lands" on Exhibit A (the "CMC Lands"), and has granted or intends to grant to CMC one or more options to purchase the CMC Lands.

C. CMC wishes to use the CMC Lands as a wetlands mitigation site, which will involve increasing the normal pool (elevation) of the Tributary, and increasing the regional flood (100-year flood) elevation of the Garrity Lands.

D. CMC has requested that Garrity provide this Backwater Easement to satisfy the requirements of Chapter NR 116 of the Wisconsin Administrative Code, and to facilitate Wisconsin Department of Natural Resources approval of CMC's proposed wetlands mitigation project.

NOW, THEREFORE, in consideration of Ten Dollars ($10.00) and other good and valuable consideration, the parties hereby agree as follows:

1. Grant of Easement. Garrity grants and conveys to CMC a non-exclusive backwater easement upon the Garrity Lands, including the right permanently or temporarily to increase the normal pool (elevation) of the Tributary by up to three feet (3'), and increase the

regional flood (100-year flood) elevation of the Garrity Lands by up to one-quarter foot (.25'), in connection with the wetlands mitigation project to be conducted on the CMC Lands.

CMC shall not be liable for any costs or damages resulting from the exercise of its rights hereunder.

2. No Interference. Garrity shall not at any time alter the surface elevation of the Garrity Lands or the drainage of water on or from the Garrity Lands in such a manner as to materially interfere with such wetlands mitigation project. It is agreed that Garrity shall have the right to draw drainage water from the Tributary as needed for irrigation of Garrity Lands. Also, Garrity shall have the right to pump excess water from irrigation ditches serving Garrity Lands into the Tributary.

3. Binding Effect. This Backwater Easement, the rights created by this Backwater Easement, and the terms and conditions of this Backwater Easement shall be covenants running with the CMC Lands and the Garrity Lands, shall not be personal to Garrity or CMC, and shall be binding upon, inure to the benefit of and be enforceable by, the parties hereto and their respective heirs, personal representatives, successors and assigns, including without limitation all subsequent owners of the CMC Lands and the Garrity Lands.

4. Modification; Waiver. This Backwater Easement may not be amended, annulled, waived or modified except in writing and by unanimous agreement of the then owners of the CMC Lands and the Garrity Lands, and the holders of any options thereon.

IN WITNESS WHEREOF, the undersigned have duly executed this instrument, or cause it to be duly executed, as of the date first set forth above.

Helen M. Garrity

Helen M. Garrity

James W. Garrity

James W. Garrity, as Attorney-in-Fact

Patrick T. Garrity

Patrick T. Garrity, as Attorney-in-Fact

Crandon Mining Company

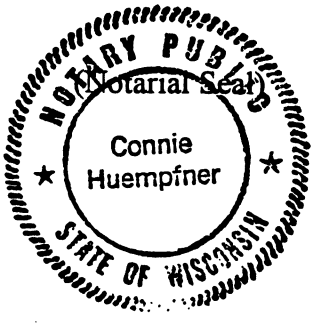
By: _____

J. D. Goodrich, Jr., President

WISCONSIN STATUE 107.25(3) MAY APPLY TO THIS TRANSACTION. THE STATUTE, IF APPLICABLE, PROVIDES THAT GARRITY MAY CANCEL THIS INSTRUMENT BY NOTIFYING CRANDON MINING COMPANY BY REGISTERED MAIL ADDRESSED TO ITS ADDRESS STATED ABOVE WITHIN TEN (10) CALENDAR DAYS AFTER THIS INSTRUMENT IS RECORDED.

STATE OF WISCONSIN)
) SS.
COUNTY OF Shawano)

Personally came before me this 29th day of September, 1995, the above-named Helen M. Garrity, to me known to be the person who executed the foregoing instrument and acknowledges the same.

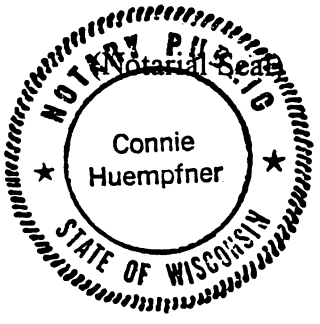


Connie Huempfner

Connie Huempfner
Notary Public, Shawano County,
Wisconsin.
My commission (~~is~~)(expires): June 9, 1996

STATE OF WISCONSIN)
) SS.
COUNTY OF Shawano)

Personally came before me this 29 day of September, 1995, the above-named James W. Garrity, to me known to be the person who executed the foregoing instrument and acknowledges the same.

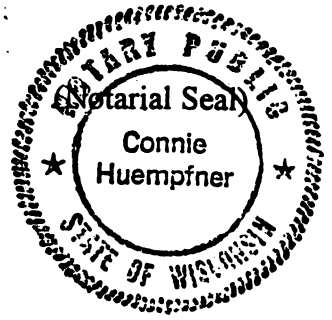


Connie Huempfner

Connie Huempfner
Notary Public, Shawano County,
Wisconsin.
My commission (~~is~~)(expires): June 9, 1996

STATE OF WISCONSIN)
) SS.
COUNTY OF Shawano)

Personally came before me this 29th day of September, 1995, the above-named Patrick T. Garrity, to me known to be the person who executed the foregoing instrument and acknowledges the same.



Connie Huempfner

Connie Huempfner
Notary Public, Shawano County,
Wisconsin.
My commission (is)(expires): June 9, 1996

STATE OF WISCONSIN)
) SS.
COUNTY OF ONEIDA)

Personally came before me this 6th day of ~~September~~ October, 1995, the above-named J. D. Goodrich, Jr., to me known to be the President of Crandon Mining Company, and to me known to be the person who executed the foregoing instrument and acknowledges the same.

(Notarial Seal)

Carolyn C LaVake

Carolyn C LaVake
Notary Public, Vilas County,
Wisconsin.
My commission (is)(expires): 4/5/98

This instrument was drafted by Attorney Blaine R. Renfert of Foley & Lardner. After recording, it should be returned to Allen T. Johnson, P. O. Box 1314, Houston, Texas 77251-1314.

EXHIBIT A
TO
BACKWATER EASEMENT

Garrity Lands

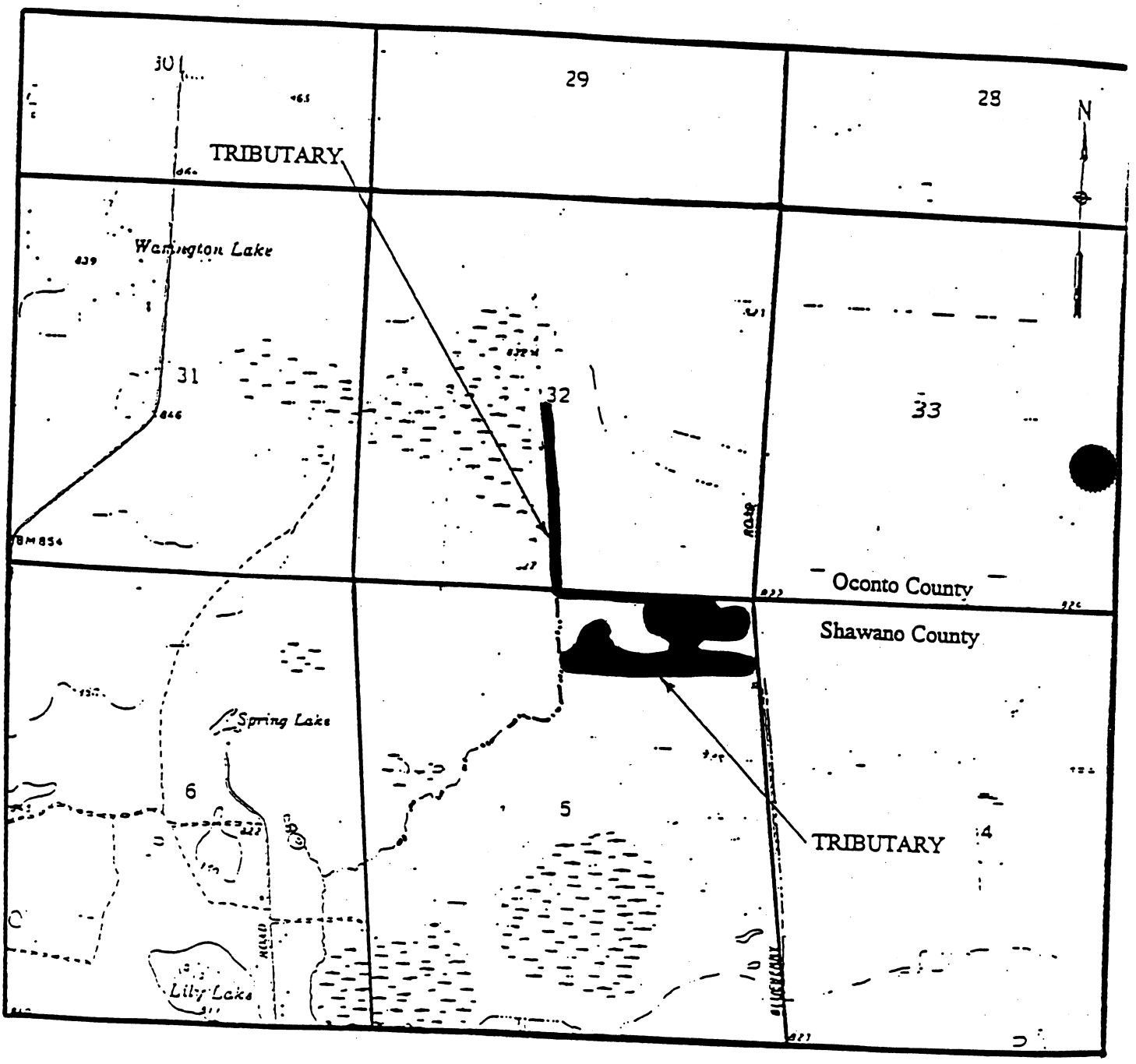
Oconto County, Wisconsin
Township 28 North - Range 17 East
Section 32: N1/2 S1/2 SE1/4
NW1/4 SE1/4
S1/2 NE1/4

CMC Lands

Shawano County, Wisconsin
Township 27 North - Range 17 East
Section 5: Fractional N1/2 NE1/4, except South 660'

Oconto County, Wisconsin
Township 28 North - Range 17 East (Underhill Township)
Section 32: S1/2 S1/2 SE1/4 (except County Road "R")
SE1/4 SW1/4

EXHIBIT B
TO
BACKWATER EASEMENT



R 17 E

BACKWATER EASEMENT

AGREEMENT made this 30TH day of ~~September~~ OCTOBER, 1995, between Victor W. Ziemer, whose address is N6047 State Highways 47 and 55, Shawano, Wisconsin 54166, hereinafter referred to as "Ziemer," and Crandon Mining Company, a general partnership formed under the laws of the State of Wisconsin and consisting of Crandon Mining Company, Inc., Exxon Minerals Development Corporation, Rio Crandon Inc., and Northwoods Resources Inc., whose address is c/o Land Manager, Exxon Coal and Minerals Company, P. O. Box 1314, Houston, Texas 77251-1314, hereinafter referred to as "CMC."

RECITALS:

A. Ziemer owns certain lands described as the "Ziemer Lands" on Exhibit A (the "Ziemer Lands"), which Ziemer Lands include a portion of the unnamed tributary of Duchess Creek shown on Exhibit B (the "Tributary").

B. CMC has obtained or intends to obtain, one or more options to purchase the lands described as the "CMC Lands" on Exhibit A attached hereto (the "CMC Lands").

C. CMC wishes to use the CMC Lands as a wetlands mitigation site, which will involve increasing the normal pool (elevation) of the Tributary, and increasing the regional flood (100-year flood) elevation of the Ziemer Lands.

D. CMC has requested that Ziemer provide this Backwater Easement to satisfy the requirements of Chapter NR 116 of the Wisconsin Administrative Code, and to facilitate Wisconsin Department of Natural Resources approval of CMC's proposed wetlands mitigation project.

NOW, THEREFORE, in consideration of Ten Dollars ($10.00) and other good and valuable consideration, the parties hereby agree as follows:

1. Grant of Easement. Ziemer grants and conveys to CMC a non-exclusive backwater easement upon the Ziemer Lands, including the right permanently or temporarily to increase the normal pool (elevation) of the Tributary by up to three feet (3'), and increase the regional flood (100-year flood) elevation of the Ziemer Lands by up to one-quarter foot (.25'), in connection with the wetlands mitigation project to be conducted on the CMC Lands.

CMC shall not be liable for any costs or damages resulting from the exercise of its rights hereunder.

2. No Interference. Ziemer shall not at any time alter the surface elevation of the Ziemer Lands or the drainage of water on or from the Ziemer Lands in such a manner as to materially interfere with such wetlands mitigation project.

3. Binding Effect. This Backwater Easement, the rights created by this Backwater Easement, and the terms and conditions of this Backwater Easement shall be covenants running with the CMC Lands and the Ziemer Lands, shall not be personal to Ziemer or CMC, and shall be binding upon, inure to the benefit of and be enforceable by the parties and their respective heirs, personal representatives, successors and assigns, including without limitation all subsequent owners of the CMC Lands and the Ziemer Lands.

4. Modification; Waiver. This Backwater Easement may not be amended, annulled, waived or modified except in writing and by unanimous agreement of the then owners of the CMC Lands and the Ziemer Lands, and the holders of any options thereon.

5. Spouse. If Ziemer is married, Ziemer's spouse joins herein with the intent and purpose of committing to this agreement any interest which she has or might obtain in or to the premises and, for all purposes of this agreement, there is hereby released and waived all marital and homestead rights and any statutory estate in and to the premises.

IN WITNESS WHEREOF, the undersigned have duly executed this instrument, or caused it to be duly executed, as of the date first set forth above.

Victor W. Ziemer

Spouse

Crandon Mining Company

By: J. D. Goodrich, Jr., President

WISCONSIN STATUE 107.25(3) MAY APPLY TO THIS TRANSACTION. THE STATUTE, IF APPLICABLE, PROVIDES THAT ZIEMER MAY CANCEL THIS INSTRUMENT BY NOTIFYING CRANDON MINING COMPANY BY REGISTERED MAIL ADDRESSED TO ITS ADDRESS STATED ABOVE WITHIN TEN (10) CALENDAR DAYS AFTER THIS INSTRUMENT IS RECORDED.

STATE OF WISCONSIN)
) SS.
COUNTY OF SHAWANO)

Personally came before me this 30TH day of ~~September~~ OCTOBER, 1995, the above-named Victor W. Ziemer and DELORES ZIEMER to me known to be the person(s) who executed the foregoing instrument and acknowledge(s) the same.

(Notarial Seal)

Jean M Brandt

JEAN M. BRANDT

Notary Public, SHAWANO County, Wisconsin.
My commission (is)(expires): 6-20-99

STATE OF WISCONSIN)
) SS.
COUNTY OF ONEIDA)

Personally came before me this 31st day of ~~September~~ October per, 1995, the above-named J. D. Goodrich, Jr., to me known to be the President of Crandon Mining Company, and to me known to be the person who executed the foregoing instrument and acknowledges the same.

(Notarial Seal)

Carolyn C LaVake

Carolyn C. LaVake

Notary Public, Vilas County, Wisconsin.
My commission (is)(expires): 4/5/98

This instrument was drafted by Attorney Blaine R. Renfert of Foley & Lardner. After recording, it should be returned to Allen T. Johnson, P. O. Box 1314, Houston, Texas 77251-1314.

EXHIBIT A
TO
BACKWATER EASEMENT

Ziemer Lands

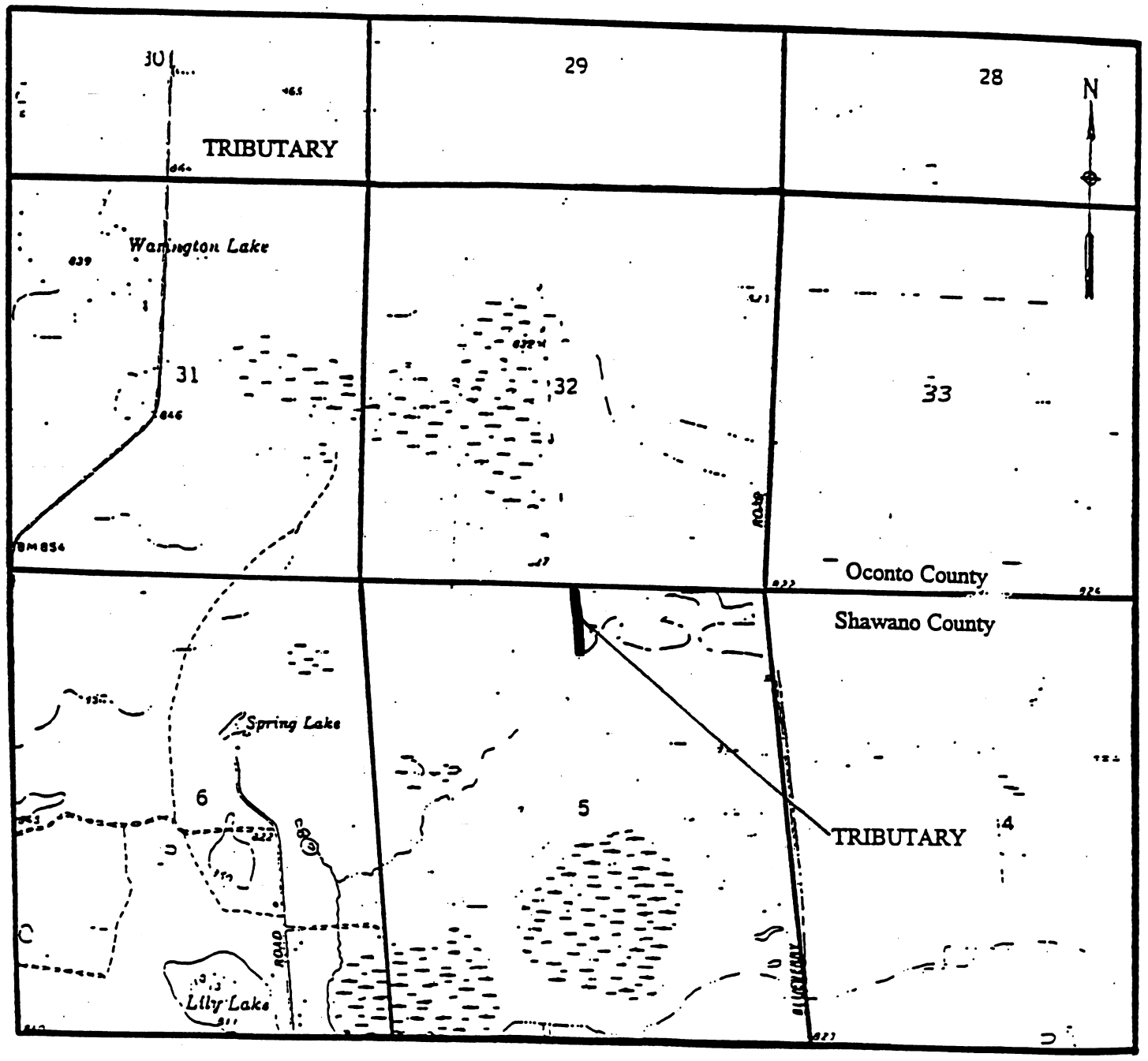
Shawano County, Wisconsin
Township 27 North - Range 17 East
Section 5: Fractional NE1/4 NW1/4

CMC Lands

Shawano County, Wisconsin
Township 27 North - Range 17 East
Section 5: Fractional N1/2 NE1/4, except South 660'

Oconto County, Wisconsin
Township 28 North - Range 17 East
Section 32: S1/2 S1/2 SE1/4 (except County Road "R")
SE1/4 SW1/4

EXHIBIT B
TO
BACKWATER EASEMENT



AGREEMENT FOR
ROAD EASEMENT

AGREEMENT made this 30TH day of ~~September~~ OCTOBER, 1995, between Crandon Mining Company, a general partnership formed under the laws of the State of Wisconsin and consisting of Crandon Mining Company, Inc., Exxon Minerals Development Corporation, Rio Crandon Inc., and Northwoods Resources Inc., whose address is c/o Land Manager, Exxon Coal and Minerals Company, P.O. Box 1314, Houston, Texas 77251-1314, hereinafter referred to as "CMC," and Victor W. Ziemer, whose address is N6047 State Highways 47 and 55, Shawano, Wisconsin 54166, and Burt Huntington, whose address is RT. 4 BOX 12 SHAWANO, WIS 54166 hereinafter referred to as "Ziemer/Huntington."

RECITALS:

A. Pursuant to the terms of a Land Purchase Option dated March 29, 1995, CMC has an option to purchase certain lands being Section 32: S2SW4SE4, S2SE4SE4 (except County Road "R"), Township 28 North, Range 17 East, Oconto County, Wisconsin, and Section 5: N2NE4 (except south 660'), Township 27 North, Range 17 East, Shawano County, Wisconsin, hereinafter referred to as "Tract 1."

B. Pursuant to the terms of a Land Purchase Option dated ~~September~~ OCTOBER ~~30~~ September 29, 1995, CMC has an option to purchase certain land being Section 32: SE4SW4, Township 28 North, Range 17 East, Oconto County, Wisconsin, hereinafter referred to as "Tract 2."

C. Pursuant to the terms of a Backwater Easement dated ~~September 30~~ OCTOBER September 29, 1995, CMC has an easement on certain land being Section 32: S2NE4, NW4SE4, and N2S2SE4, Township 28 North, Range 17 East, Oconto County, Wisconsin, hereinafter referred to as "Tract 3."

D. Pursuant to the terms of a Backwater Easement dated OCTOBER 30, 1995, CMC has an easement on certain land being Section 5: Fractional NE4NW4, Township 27 North, Range 17 East, Shawano County, Wisconsin, hereinafter referred to as "Tract 4."

E. CMC plans to use Tract 1, Tract 2, Tract 3 and Tract 4 as part of a wetlands mitigation project, hereinafter referred to as "Wetlands Mitigation Project".

F. In the event CMC exercises its options to purchase Tract 1 and Tract 2, Ziemer/Huntington wishes to obtain a road easement across Section 32: S2S2SE4 (except County Road "R"), and SE4SW4, Township 28 North, Range 17 East, Oconto County, Wisconsin, hereinafter called "Tract 5," for access to certain land Victor W. Ziemer owns being Section 5: Fractional NE4NW4, Township 27 North, Range 17 East, Shawano County, Wisconsin, hereinafter referred to as "Tract 6," and access to certain land Burt Huntington owns being Section 5: Fractional NW4NW4, Township 27 North, Range 17 East, Shawano County, Wisconsin, hereinafter referred to as "Tract 7."

NOW, THEREFORE, in consideration of Ten Dollars ($10.00) and other good and valuable consideration, the parties hereby agree as follows:

1. Grant of Easement. In the event CMC exercises its options to purchase Tract 1 and Tract 2, CMC agrees to grant to Ziemer/Huntington a non-exclusive road easement across Tract 5 being a ten foot wide strip of land the centerline of which is described as:

> Commencing at the southeast corner of Section 32, Township 28 North, Range 17 East; thence North 3° 07' 16" East 430 feet along the east line of Section 32 to the point of beginning;
>
> thence North 89° 16' 50" West 2,600 feet;
>
> thence South 2° 35' 11" East 351.38 feet to a point on the south line of said Section 32, Township 28 North, Range 17 East that lies 100.70 feet South 87° 31' 05" East from the south one-quarter corner of said Section 32 and the terminus of this ten foot wide easement and being subject to any part now used or previously acquired for public right-of-way.

2. Use of Easement. Ziemer/Huntington shall have a perpetual non-exclusive use of a dirt road on the easement only for purposes of access between County Road "R" and Tract 6 and Tract 7 for pedestrian and vehicular access for purposes of hunting and other incidental uses on Tract 6 and Tract 7. Use of the road shall be in accordance with all applicable laws and regulations including those pertaining to CMC's Wetlands
Mitigation Project on Tract 1, Tract 2, Tract 3 and Tract 4. In the event that Ziemer/Huntington causes damages to such road, Ziemer/Huntington shall reimburse CMC for its actual cost of repairing such damages.

3. Binding Effect. The terms and conditions of the easements shall be covenants running with Tracts 1, 2, 3, 4, 5, 6 and 7 shall not be personal to Ziemer/Huntington or CMC, and shall be binding upon and inure to the benefit of and be enforceable by the parties hereto, and all subsequent owners of Tracts 1, 2, 3, 4, 5, 6 and 7.

4. Counterparts. This agreement may be executed in any number of counterparts by the parties. Each of the counterparts will be considered an original, and all counterparts will constitute but one and the same instrument.

IN WITNESS WHEREOF, the undersigned have duly executed this instrument, or caused it to be duly executed, as of the date first above set forth.

Victor W. Ziemer

Crandon Mining Company

Burt Huntington

By _____
J. D. Goodrich, Jr., President

WISCONSIN STATUE 107.25(3) MAY APPLY TO THIS TRANSACTION. THE STATUTE, IF APPLICABLE, PROVIDES THAT ZIEMER/HUNTINGTON MAY CANCEL THIS INSTRUMENT BY NOTIFYING CRANDON MINING COMPANY BY REGISTERED MAIL ADDRESSED TO ITS ADDRESS STATED ABOVE WITHIN TEN (10) CALENDAR DAYS AFTER THIS INSTRUMENT IS RECORDED.

STATE OF WISCONSIN)
) SS.
COUNTY OF SHAWANO)

Personally came before me this 30TH day of ~~September~~ OCTOBER, 1995, the above-named Victor W. Ziemer to me known to be the person who executed the foregoing instrument and acknowledges the same.

(Notarial Seal)

Jean M. Guandt

JEAN M. GUANDT

Notary Public, SHAWANO County, Wisconsin.
My commission (is)(expires): 6-20-99

STATE OF WISCONSIN)
) SS.
COUNTY OF SHAWANO)

Personally came before me this 30TH day of OCTOBER, 1995, the above-named ~~Burt~~ Gilbert Huntington to me known to be the person who executed the foregoing instrument and acknowledges the same.

(Notarial Seal)

Jean M. Guandt

JEAN M. GUANDT

Notary Public SHAWANO County, Wisconsin.
My commission (is) (expires) 6-20-99

STATE OF WISCONSIN)
) SS.
COUNTY OF ONEIDA)

Personally came before me this 31st day of ~~September~~ October, 1995, the above-named J. D. Goodrich, Jr., to me known to be the President of Crandon Mining Company, and to me known to be the person who executed the foregoing instrument and acknowledges the same.

(Notarial Seal)

Carolyn C. LaVake

Carolyn C. LaVake
Notary Public, Vilas County, Wisconsin.
My commission (is)(expires): 4/5/98

This instrument was drafted by and after recording should be returned to Allen T. Johnson, P. O. Box 1314, Houston, Texas 77251-1314.

Crandon Mining Company

7 N. BROWN ST., 3RD FLOOR
RHINELANDER, WI 54501-3161

Jerome D. Goodrich, Jr.
PRESIDENT

October 25, 1995

Mr. Victor W. Ziemer
Mr. Bert Huntington
N6047 State Highways 47 and 55
Shawano, WI 54166

Re: Wetlands Mitigation Site
Shawano County, Wisconsin

Dear Messrs. Ziemer and Huntington:

As you have discussed with Ken Collison, Crandon Mining Company is considering establishing a wetlands mitigation site northeast of your properties in Shawano County. The plan includes an easement for your use of a road on properties we may acquire for access to your properties. You have asked if Crandon Mining Company would also put a cable across the eastern end of the road and post the road against trespassing.

Crandon Mining Company is willing to put such a cable across the road and post it against trespassing if we acquire the properties and if there are no legal restrictions against it. We do not, however, want to assure that the cable will always be in place and locked or will otherwise preclude access to the road and we cannot, of course, make any commitments for these facilities to be maintained should Crandon Mining Company in the future sell any of the properties.

We trust this letter sufficiently addresses your concerns and we appreciate your cooperation with respect to this matter.

Sincerely,

Telephone: (715) 365-1451

FAX: (715) 365-1457

AGREEMENT FOR
ROAD EASEMENT

AGREEMENT made this 2th day of October 1995, between Crandon Mining Company, a general partnership formed under the laws of the State of Wisconsin and consisting of Crandon Mining Company, Inc., Exxon Minerals Development Corporation, Rio Crandon Inc., and Northwoods Resources Inc., whose address is c/o Land Manager, Exxon Coal and Minerals Company, P.O. Box 1314, Houston, Texas 77251-1314, hereinafter referred to as "CMC", and Patrick T. Garrity, whose address is 10291 Quarterline Road, Gillett, Wisconsin 54124, hereinafter referred to as "Garrity."

RECITALS:

A. Pursuant to the terms of a Land Purchase Option dated March 29, 1995, Helen M. Garrity, hereinafter referred to as "H. Garrity," has granted CMC an option to purchase certain lands being Section 32: S2SW4SE4, S2SE4SE4 (except County Road "R"), Township 28 North, Range 17 East, Oconto County, Wisconsin, and Section 5: N2NE4 (except South 660'), Township 27 North, Range 17 East, Shawano County, Wisconsin, hereinafter referred to as "Tract 1."

B. Pursuant to the terms of a Land Purchase Option dated September 29, 1995, H. Garrity has granted CMC an option to purchase certain land being Section 32: SE4SW4, Township 28 North, Range 17 East, Oconto County, Wisconsin, hereinafter referred to as "Tract 2."

C. Pursuant to the terms of a Backwater Easement dated September 29, 1995, H. Garrity has granted CMC an easement on certain land being Section 32: S2NE4, NW4SE4, and N2S2SE4, Township 28 North, Range 17 East, Oconto County, Wisconsin, hereinafter referred to as "Tract 3."

D. CMC plans to use Tract 1, Tract 2 and Tract 3 as part of a wetlands mitigation project, hereinafter referred to as "Wetlands Mitigation Project".

E. In the event CMC exercises its options to purchase Tract 1 and Tract 2, Garrity wishes to retain a road easement across Section 32: S2S2SE4 (except County Road "R"), and SE4SW4, Township 28 North, Range 17 East, Oconto County, Wisconsin, hereinafter referred to as "Tract 4" for access to certain land Garrity owns being Section 32: SW4SW4, Township 28 North, Range 17 East, Oconto County, Wisconsin, hereinafter referred to as "Tract 5."

NOW, THEREFORE, in consideration of Ten Dollars ($10.00) and other good and valuable consideration, the parties hereby agree as follows:

1. Grant of Easement. In the event CMC exercises its options to purchase Tract 1 and Tract 2, CMC agrees to grant to Garrity a non-exclusive road easement across Tract 4 being a ten foot wide strip of land the centerline of which is described as:

Commencing at the southeast corner of Section 32, Township 28 North, Range 17 East; thence North 3° 07' 16" East 430 feet along the east line of Section 32 to the point of beginning;

thence North 89° 16' 50" West 2,600 feet;

thence South 2° 35' 11' East 351.38 feet to a point "A" on the south line of said Section 32, Township 28 North, Range 17 East that lies 100.70 feet South 87° 31' 05" East from the south one-quarter corner of said Section 32 and the terminus of this ten foot wide easement and being subject to any part now used or previously acquired for public road right-of-way.

Also: Part of the SW4 SE4, Section 32, Township 28 North, Range 17 East, described as follows:

Beginning at the south one-quarter corner of said Section 32, Township 28 North, Range 17 East; thence South 87° 31' 05" East 95.68 feet along the south line of Section 32 to the west line of the above described ten foot wide easement; thence North 2° 35' 11" West 50.20 feet along the west line; thence North 87° 31' 05" West parallel with the south line of said Section 32 to the west line of the SW4SE4.

Also: Part of the SE4SW4, Section 32, Township 28 North, Range 17 East, described as follows:

Beginning at the point 50.20 feet north of the South line of said SE4SW4, Section 32, Township 28 North, Range 17 East, thence westerly parallel to the South line of said SE4SW4 (as measured at right angles to the south line of said SE4SW4) to the West line of said SE4SW4.

2. Use of Easement. Garrity shall have a perpetual non-exclusive use of a dirt road on the easement only for purposes of moving Garrity farm equipment and pedestrian and vehicular access for purposes of hunting and other incidental uses between County Road "R" and Tract 5. Use of the road shall be in accordance with all applicable laws and regulations including those pertaining to CMC's Wetlands Mitigation Project. In the event that Garrity causes damages to such road, Garrity shall reimburse CMC for its actual costs of repairing such damages.

3. Binding Effect. The terms and conditions of the easements shall be covenants running with Tracts 1, 2, 3, 4 and 5, shall not be personal to Garrity or CMC, and shall be binding upon and inure to the benefit of and be enforceable by the parties hereto, and all subsequent owners of Tracts 1, 2, 3 4 and 5.

IN WITNESS WHEREOF, the undersigned have duly executed this instrument, or caused it to be duly executed, as of the date first above set forth.

Patrick T. Garrity

Crandon Mining Company

J. D. Goodrich, Jr., President

WISCONSIN STATUE 107.25(3) MAY APPLY TO THIS TRANSACTION. THE STATUTE, IF APPLICABLE, PROVIDES THAT GARRITY MAY CANCEL THIS INSTRUMENT BY NOTIFYING CRANDON MINING COMPANY BY REGISTERED MAIL ADDRESSED TO ITS ADDRESS STATED ABOVE WITHIN TEN (10) CALENDAR DAYS AFTER THIS INSTRUMENT IS RECORDED.

STATE OF WISCONSIN)
) SS.
COUNTY OF Shawano)

Personally came before me this 2th day of ~~September~~ October, 1995, the above-named Patrick T. Garrity, to me known to be the person who executed the foregoing instrument and acknowledges the same.

(Notarial Seal)
NOTARY PUBLIC
Connie
Huempfner
STATE OF WISCONSIN

Connie Huempfner

Connie Huempfner
Notary Public, Shawano County,
Wisconsin.
My commission~~(is)~~(expires): June 9, 1996

STATE OF WISCONSIN)
) SS.
COUNTY OF ONEIDA)

Personally came before me this 16th day of ~~September~~ October, 1995, the above-named J. D. Goodrich, Jr., to me known to be the President of Crandon Mining Company, and to me known to be the person who executed the foregoing instrument and acknowledges the same.

(Notarial Seal)

Carolyn C. LaVake

Carolyn C. LaVake
Notary Public, Vilas County,
Wisconsin.
My commission (is)(expires): 4/5/98

This instrument was drafted by and after recording should be returned to Allen T. Johnson, P. O. Box 1314, Houston, Texas 77251-1314.

ASSIGNMENT

IN CONSIDERATION of Ten Dollars ($10.00) and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the undersigned, Helen M. Garrity, a widow, and James W. Garrity and Patrick T.Garrity, as attorneys-in-fact for Helen M. Garrity pursuant to that certain Durable Power of Attorney dated November 21, 1994, hereinafter referred to as "Seller," hereby assigns to Patrick T. Garrity, hereinafter referred to as "Garrity," all of Seller's right, title and interest in and to any purchase price that may become payable pursuant to that certain Land Purchase Option dated September 29, 1995, between Seller and CMC, covering Section 32: SE4SW4 , Township 28 North, Range 17 East, Oconto County, Wisconsin, hereinafter referred to as the "Option."

This Assignment does not include Seller's right to receive option payments pursuant to the Option, including the original option payment of $3,200.00, and any additional option payment of $3,200.00.

This Assignment shall be binding upon Seller and Seller's heirs, successors and assigns, and shall inure to the benefit of Garrity, and his heirs, successors and assigns.

CMC shall be entitled to rely on this Assignment in making payment of the purchase price pursuant to the Option, without investigation or inquiry.

IN WITNESS WHEREOF, the undersigned have duly executed this instrument, or caused it to be duly executed, as of September 22, 1995.

Helen M. Garrity

James W. Garrity, as Attorney-in-Fact

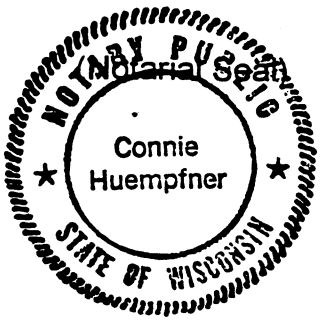
Patrick T. Garrity, as Attorney-in-Fact

This instrument was prepared by and after recording should be returned to Allen T. Johnson, P. O. Box 1314, Houston, Texas 77251-1314.

j:\ATJ\CRANDON\DOC7.DRAFT2

STATE OF WISCONSIN)
) SS.
COUNTY OF Shawano)

Personally came before me this 29th day of September, 1995, the above-named Helen M. Garrity, to me known to be the person who executed the foregoing instrument and acknowledges the same.

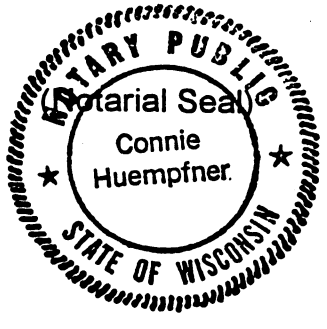


Connie Huempfner

Connie Huempfner
Notary Public, Shawano County,
Wisconsin.
My commission ~~is~~)(expires): June 9, 1996

STATE OF WISCONSIN)
) SS.
COUNTY OF Shawano)

Personally came before me this 29th day of September, 1995, the above-named James W. Garrity, to me known to be the person who executed the foregoing instrument and acknowledges the same.



Connie Huempfner

Connie Huempfner
Notary Public, Shawano County,
Wisconsin.
My commission ~~is~~)(expires): June 9, 1996

STATE OF WISCONSIN)
) SS.
COUNTY OF Shawano)

Personally came before me this 29th day of September, 1995, the above-named Patrick T. Garrity, to me known to be the person who executed the foregoing instrument and acknowledges the same.

Connie Huempfner

Connie Huempfner
Notary Public, Shawano County, Wisconsin.
My commission (is)(expires): June 9,1996

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