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Exxon Minerals Collection

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RESPONSES TO DNR COMMENTS ON CHAPTER 1
OF
THE ENVIRONMENTAL IMPACT REPORT

Exxon Minerals Company
Crandon Project

Chapter 1.0

SECTION 1.1 GENERAL DESCRIPTION

SECTION 1.1.1, ACTION REQUESTED OF THE DNR

Comment No. 1

Paragraph number 5) calls for the Department to coordinate with federal agencies to "insure" that the Department's EIS will be "responsible to the needs of the federal agencies". While we will continue to coordinate with the federal agencies and to be responsive to their needs, we cannot guarantee that our EIS will meet all those needs or that the EIS will necessarily satisfy all federal NEPA requirements. However, we have expressed our desire and willingness to incorporate federal agency NEPA concerns into the state EIS and thus avoid the necessity of a separate federal EIS. As of now, we see no reason that this goal cannot be met based on the discussions we have had with the involved federal agencies.

Response:

Comment acknowledged.

Comment No. 2

Paragraph 6) requests that the Department inform the Applicant after NR 150.10 interagency procedure has been completed. This procedure will be ongoing throughout the permitting process and will not be completed until after the master hearing.

Response:

While interagency coordination will be an on-going process and will not be completed until after the master hearing, the interagency coordination required to identify issues to be addressed by the DNR's draft EIS should terminate before the final EIS. The Applicant would like to receive notice of all agencies contacted prior to the draft EIS and whether the agency has agreed to let the Department's EIS fulfill any NEPA or WEPA EIS requirements the agency may have.

Comment No. 3

It should be made clear that the project sponsor for these permit applications is the Exxon Corporation and not the Exxon Minerals Company.

Response:

The permit applications do clearly state that the applicant is Exxon Corporation.

Comment No. 4

Review of the EIR and permit applications would be expedited by providing a contact person and telephone number of each of the consultants listed in Table 1.1-1 and by allowing direct and unencumbered communications between the Department and the consultants. Please let us know as soon as possible of your response to this suggestion.

Response:

In a meeting with the Bureau of Environmental Impact on June 21, 1983, Exxon agreed that free and open communication between Exxon and the DNR and, where appropriate, Exxon's consultants is a desirable goal. However, it is very important that Exxon remain the central focus of communications because the Crandon Project is an Exxon project and not a consultant's project. The testimony that is delivered at any hearings and the commitments associated with it will be Exxon's and not the contractor's. For this reason, it is imperative that Exxon be completely informed and a part of communications between the DNR and the consultants.

Exxon has been and will continue to facilitate and consider any specific recommendations from the DNR regarding their understanding of the Crandon Project. For example, we will be pleased to arrange for any requested information requirements between the DNR and Exxon or its consultants regarding the Crandon Project. Exxon will also consider completely, any suggestions as to how the communications process might be improved.

SECTION 1.1.2, LOCATION OF PROPOSED ACTION

Comment No. 5

The land associated with the proposed surface water discharge pipeline corridor in Sections 32, 33, and 34 of T35N, R12E should be described as Exxon controlled land.

Response:

Comment acknowledged. In the revised EIR, the land area associated with the proposed surface water discharge pipeline corridor in Sections 32, 33, and 34 of T35N, R12E will be included in the description of land controlled by Exxon. This area which is under easement totals approximately 15 ha (37 acres).

Comment No. 6

Figure 1.1-2 should show the water discharge pipeline route, access road, and the rail spur as being within the Project site.

Response:

Comment acknowledged. In the revised EIR, Figure 1.1-2 will be modified to include the water discharge pipeline route, access road, and railroad spur within the Project site.

Comment No. 7

Figure 1.1-3 should specifically identify land ownership for the "small tract areas" surrounding Little Sand Lake and Deep Hole Lake.

Response:

Land ownership for the small tract areas surrounding Little Sand Lake and Deep Hole will be designated on a new figure that will be included in the revised EIR.

Comment No. 8

The lands identified on Figure 1.1-3 as owned by Connor under a mining lease east of the project area and lands owned by Mihalko under land purchase option in Langlade County should be addressed in terms of their relationships to the proposed project. What will be done with these lands if the project is permitted?

Response:

Exxon has under lease and option several parcels of land within Wisconsin. The EIR clearly identifies the lands within the Project site boundary and their ownership status. Typically, during exploration and project development, much more land is leased and optioned than ultimately is used for the project in operation. After the Crandon Project is in operation, parcels of land under lease or option will be reevaluated as to their continued use and/or disposition.

Comment No. 9

NR 182.07(1)(h) prohibits construction or operation of a mine waste disposal site within 200 feet of property lines. At least one non-Exxon owned parcel is within 200 feet of the proposed disposal area. Exxon should state their intent to purchase this parcel or request a variance from this locational criteria.

Response:

The land in question is under a mining lease and the need to convert part of the mining lease into fee ownership or apply for a variance will be decided in the future and prior to the Master Hearing notice period.

Comment No. 10

Figure 1.1-3 does not identify ownership of the NE NW, SW NW, W 1/2 SW of Section 2 and the NW NW, Section 11 of T34N, R12E, Langlade County. These are State of Wisconsin Trust Lands.

Response:

Comment acknowledged. Figure 1.1-3 of the EIR will be revised and ownership of the NE NW, SW NW, W 1/2 SW of Section 2 and the NW NW of Section 11, T34N, R12E, Langlade County will be designated as State of Wisconsin Trust Lands.

SECTION 1.1.3.1.3 USES AND OUTLOOK FOR RECOVERED METALS

Comment No. 11

The information detailing the U. S. metals production was derived from 1978 data. Statistics through 1981 are currently available in the Minerals Yearbook (Bureau of Mines, 1982) and should be used.

Response:

Subsection 1.1.3.1.3 will be revised in the EIR to comply with the request of providing currently available statistics:

Each of the economically recoverable metals in the Crandon ore is important to the economic viability of the Project. The metals, in order of importance, are zinc, copper, silver, lead, and gold. No other elements found in the ore are economic to recover; however, because of refining and environmental control practices, cadmium will also be recovered from zinc concentrate in the electrolytic smelting process. This smelting process will not be completed at the Crandon Project site.

The following subsections include a discussion of the benefits of recovery of each of the metals mentioned above, except cadmium. The primary sources of the information were Minerals Facts and Problems, Bureau of Mines (1980), and the 1981 Bureau of Mines Minerals Yearbook.

Zinc - Among nonferrous metals, zinc ranks third in domestic tonnage consumed, behind aluminum and copper. Its physical properties of corrosion resistance, machineability, relatively low melting point, and solubility in copper make it an important industrial metal for a number of applications. The primary markets for zinc and zinc components are in galvanizing, brass, die cast components for autos and appliances, batteries, and tire manufacture.

According to the latest available data of the U. S. Bureau of Mines, world zinc mine production in 1981 was 5.8 M t (6.4 million short tons). U.S. mine production was 312,000 t (344,000 short tons), some 5.3 percent of the total. The Crandon Project is expected to produce about 175,000 t (193,000 short tons) per year of zinc metal in concentrate form, making it one of the world's 10 largest mines in terms of annual zinc metal production. On world standards, however, the mine represents only a 3 percent expansion of production.

United States mine production of zinc covers only 30 percent of total U. S. demand. The remainder is covered by imports of zinc metal and concentrate, primarily from Canada, but also from Europe, Mexico and South America. The Crandon Project would directly or indirectly displace some of these imports, and thereby reduce U.S. foreign dependence for this important mineral.

The U.S. Bureau of Mines projects that U.S. demand for primary zinc will grow at a rate of about 1.6 percent per year through the year 2000. Such a growth rate would bring the demand to a level of 1.65 M t (1.82 million short tons) per year by the year 2000. At such a level, the Crandon Project would supply about 9 percent of total U.S. demand. Even though the U.S. zinc supply is substantial, there is a need for development of additional zinc mines in the U. S. to meet current and future needs.

Copper - Copper's physical properties, high electric and thermal conductivity, ability to be drawn into fine wires, malleability, high corrosion resistance, and appearance make it an important industrial metal. The principal end uses of copper are in electric wiring, telecommunications, plumbing and heating tubes, automotive radiators, valves and fittings, and household appliance components.

According to the U.S. Bureau of Mines, world mine production of copper in 1981 was approximately 8.2 M t (9.0 million short tons). The U.S. produced about 19 percent of the total, or 1.54 M t (1.70 million short tons). The Crandon Project is estimated to produce about 40,000 t/y (44,000 short tons per year) of copper metal when full production is achieved. As such, it represents about 3 percent of U.S. supplies and less than 1 percent of total world supply. While copper is an important source of revenue to the Project, the effect of the Project on the world market will be far smaller than for zinc.

According to the U. S. Bureau of Mines, in 1981 the U.S. imported about 20 percent of its primary copper needs in the form of metal or concentrates. The Project will help reduce this import dependence, directly or indirectly. While the tonnage impact is not as great as zinc, the monetary benefit to the U.S. balance of payments, attributed to Crandon's concentrate production, is approximately the same size.

The U.S. Bureau of Mines estimates that the demand for primary copper will grow at the rate of 2.4 percent per year through the year 2000. By then, demand should be 70 percent higher than in 1978. Clearly, considerable additional U.S. production capacity will have to be added if the country is to avoid increased dependence on imports of this important industrial commodity.

Silver - The pattern of consumptive use of silver has changed drastically since World War II. Whereas consumption for coinage has declined, the use of silver as an industrial commodity has increased. Silver continues to maintain its position as a precious metal used in jewelry and silverware. Progressively, silver has become a useful, if not critical, industrial product with the principal uses being in the electrical and electronics industries as a conductor, as a widely used constituent of brazing alloys in general industry, and in photographic and x-ray film.

Over half of world silver output is produced as a by-product of copper, lead, and zinc mining, with the remainder attributable to mines which principally produce silver metal. Total free world industrial consumption of silver in recent years has been 990 to 1050 M g (350 to 370 million ounces) per year, with corresponding production being 709 to 765 M g (250 to 270 million ounces). Accordingly, the typical short-fall in free world production of about 284 M g (100 million ounces) is from above ground stocks in the form of reprocessed film and coinage, investment bullion, jewelry, and silverware.

Mine production in the U.S. represents about 11 percent of western world consumption. In a typical year, the Crandon Project would produce approximately 6.8 M g (2.4 million ounces) of silver in all concentrates, most of which is ultimately recovered in smelting and refining.

Crandon represents an important source of newly mined silver in the U.S., amounting to about 6 percent of 1981 domestic mine production. Demand in the U.S. for primary silver according to the U.S. Bureau of Mines may more than double by the year 2000. Accordingly, the U.S. can support larger increases in silver production.

Lead - The major applications for lead are storage batteries, pigments and chemicals, as an anti-knock additive to gasoline (still widely used outside the U.S.), cable sheathing, and in materials for the construction and metal working industries.

According to the U.S. Bureau of Mines, world mine production of lead in 1981 was approximately 3.4 M t (3.7 million short tons). The U.S. produced about 13 percent of this total, or 446,000 t (491,000 short tons). The Project's anticipated lead production of 11,000 t/y (12,320 short tons per year) represents an increase of about 2 percent in U.S. mine production and far less than 1 percent in total world production. Lead does, however, contribute to Project economics.

Gold - The Crandon Project expects to produce in all concentrates about 2.6 percent of U.S. mine production of gold and less than 0.1 percent of world-wide mine production.

According to U.S. Bureau of Mines' figures, U.S. demand for fabricated gold from primary sources has varied in recent years, from 11.82 M g (3.8 million ounces) to 3.1 M g (1.0 million ounces). In 1981, demand was 3.73 M g (1.2 million ounces). U.S. mine production was about 3.11 M g (1.0 million ounces) annually between 1978 and 1980, then increased to 4.35 M g (1.4 million ounces) in 1981. The U.S. Bureau of Mines forecasts that demand will grow by about 75 percent by the year 2000, indicating that there is a need for major increases in U.S. gold production capacity.

Comment No. 12

Previous discussions with Exxon indicated that cadmium would be recovered as a smelting by-product. Is this no longer viable? Are there any other marketable smelting by-products besides gold and silver?

Response:

There are no other marketable smelting by-products besides silver and gold. The ore does not contain economic quantities of minor metals as is characteristic of some other base metal ores produced in the world. For example, there is no smelter recovery for antimony, arsenic, barium, tin, or tellurium.

Comment No. 13

The description of the relative importance of the various metals obtained from this mine should be clarified with a tabular display of relative abundance and relative economic worth of each metal.

Response:

The attached table compares the relative abundance and economic worth of the various metals from the Crandon Project. The market value column reflects the market price applied to the total production. It does not reflect the costs of producing the product or any costs for smelting or refining. Therefore, these values in no way indicate profit or profitability to the Project.

Comment No. 14

It is possible that the Crandon project could displace some marginal U.S. zinc production rather than reduce imports. Also, the U.S. has considerable unused copper capacity now. The need for a strong domestic mining industry, the uncertainties of foreign supplies, and the length of time required to develop new mines could be cited as reasons for the Crandon project.

Response:

Crandon Project production is expected to contribute to help meet an increase in U.S. demand when the Project begins operation. Since the U.S. is a net importer of a major portion of its zinc consumption, any incremental production will potentially reduce the effects of dependence on imports. A marginal U.S. producer will survive or fail depending on their ability to compete in a world market rather than with any particular increment of production such as from the Crandon Project.

Crandon concentrates will compete with other domestic concentrates for existing U.S. smelter capacity on a ton for ton basis. Whereas there is no assurance that any specific U.S. zinc smelter will remain operating by the year 1990, it is reasonable to assume that the following plants will continue in operation.

<u>Company</u>	Zinc Refinery
	<u>Location</u>
ASARCO	Texas
AMAX	Illinois
Jersey-Miniere	Kentucky
St. Joe	Pennsylvania

Table for Response to Comment No. 13

RELATIVE ECONOMIC IMPORTANCE OF METALS FOR THE CRANDON PROJECT
(Typical Year of Operation)

Metal	Units	Metal Recovered Into Respective Concentrate	Smelter ^a Primary Recovery		1982 Chase Econometrics Metal Price	1982 k\$ Market Value	% Market Value of Each Metal
			%	lbs(k) or oz.			
Zinc	k lbs.	376,119	96	361,074	.356 \$/lb.	128,542	56.2
Copper	k lbs.	93,307	98	91,440	.705 \$/lb.	64,465	28.2
Lead	k lbs.	17,083	93	15,887	.267 \$/lb.	4,241	1.9
Silver	oz	2,405,000 ^b	90	2,165,000	7.608 \$/oz.	16,471	7.2
Gold	oz	36,000 ^b	90	32,000	445. \$/oz.	14,240	6.2

^aDoes not include secondary smelter recoverable, such as recovery of cadmium in zinc concentrate from zinc refinery sludge.

^bContained metal in all concentrates.

Assuming zinc concentrates will be available from other mines in the U.S. at a level consistent with that of the last 3 years, there should be sufficient U.S. facilities for treating Crandon concentrates, as well as that from other U.S. producers, without a negative effect upon existing marginal U.S. production.

Much of the U.S. zinc concentrate production has a relatively high zinc content compared with many other world-wide sources. For example, most Tennessee mines produce a zinc concentrate averaging 65 percent zinc, whereas Crandon's averages 55 percent zinc. Accordingly, they should be competitive in vying to fill the domestic zinc refinery capacity.

The need for a strong domestic mining industry is pointed out by the recent Presidential Commission to Establish a Domestic Mining Policy. See response to comment No. 11 for metal production, consumption and import/export statistics. These data indicate the need for a domestic mining project such as Crandon.

SECTION 1.1.3.2, STATUTORY OBLIGATIONS

Comment No. 15

The WPDES Permit Application was not submitted with the EIR and has not been submitted as of this date. Also, preliminary wastewater treatment engineering plans have not yet been provided. Plans for the reclaim water ponds must be included in both of these submittals.

Response:

The WPDES Permit Application was submitted to the DNR in September 1983. Plans for the wastewater treatment plant will be submitted at a later date. Plans for the reclaim water ponds are included with this submittal.

Comment No. 16

Table 1.1-2 has the following errors or deficiencies:

Federal Obligations - Only two federal permits are listed. Please provide a comprehensive list of all federally required actions in this section regardless of the agency or objective of the regulation. Also, the "operating license" listed for 33 U.S.C. 1344 reads "Dredge or fill permits for activities in or impacting navigable streams or wetlands". This authority actually addresses discharge of dredged or fill material.

Response:

The following is a supplemental list of potential federal permits required to begin construction:

<u>STATUTORY OBLIGATION</u>	<u>ADMINISTERING AGENCY</u>	<u>ACTIVITY</u>	<u>ACTION</u>
42 USC 300 h et seq	EPA	Possible well injection of ground water, placement of backfill sands below groundwater aquifer.	Issue Class V permit

33 USC 1321	EPA	Spill prevention control and counter measure plan (40 CFR 1127)	Have plan on file before operations begin.
49 USC 1348	FAA	Registration with FAA of a structure that will exceed 200 feet above ground level	Determine that headframe is not an air navigational obstruction.
16 USC 470F	Advisory Council on Historic Preservation	Monitors actions of federal government which may involve sites having buildings, structures, or objects eligible for inclusion in the National Register.	Coordinate with U.S. Army Corps of Engineers
18 USC 843	Bureau of Alcohol, Tobacco and Firearms	Explosives user permit.	Issue permit

Many federal programs that would otherwise be applicable are administered by the state. It is assumed that the state will remain or become qualified to administer the following federal programs: National Pollution Discharge Elimination System; Resource Conservation and Recovery Act Solid Waste Disposal programs; Clean Air Act -- non-PSD aspects; and Safe Drinking Water Act.

Comment No. 17

Non-DNR Related Wisconsin Statutory Obligations - The requirement to obtain plan approval by DILHR for the private sewage system is the only non-DNR state obligation listed. The statutory citation for this approval is erroneously characterized as s. 144.20, Wis. Stats. The correct citation is s. 145.20, Wis. Stats. Also, s. 147.02 Wis. Stats., is cited as a statutory obligation and DNR is listed as an administering agency. While DNR will coordinate with DILHR on the sewage system plans, no DNR permit is required and DNR is not an administering agency.

Response:

Comment acknowledged. The permit requirements are initially established in s. 145.19, and the EIR will be revised accordingly.

Comment No. 18

Other non-DNR related state statutory obligations certainly exist. Please provide a comprehensive list of non-DNR Wisconsin statutory actions, including PSC approval of power supply facilities.

Response:

See the attached table for Wisconsin Department of Industry, Labor and Human Relations actions. A similar list will be prepared for the Department of Health and Social Services and the Department of Transportation. The Department of Industry, Labor and Human Relations currently has under review the attached list of possible regulations applicable to the Crandon Project.

Comment No. 19

DNR-Related Statutory Obligations - The authority governing placement of structures on the bed of navigable waters is cited as s. 30.12(2)(a), Wis. Stats. This section has recently been revised by the Wisconsin Legislature and the appropriate citation is now s. 30.12, Wis. Stats.

Response:

Comment acknowledged and the EIR will be revised accordingly.

Comment No. 20

For placement of riprap, s. 31.12(2)(d), Wis. Stats. is cited. This apparently was intended to cite s. 30.12(2)(d). As mentioned above, this section has recently been revised and the appropriate citation for a riprap permit is s. 30.12(3), Wis. Stats.

Response:

Comment acknowledged and the EIR will be revised accordingly.

Comment No. 21

Plan approval for the wastewater treatment system under s. 144.04, Wis. Stats., will also encompass the water reclaim ponds.

Response:

Comment acknowledged and the EIR will be revised accordingly.

Comment No. 22

As indicated above, the reference to a s. 147.02, Wis. Stats, permit for the private sewerage system is erroneous.

Response:

Comment acknowledged and the EIR will be revised accordingly.

Comment No. 23

Under air emission, s. 144.392, Wis. Stats. is cited. Both s. 144.391 and s. 144.392 should be cited.

Response:

Comment acknowledged and the EIR will be revised accordingly.

(TABLE FOR RESPONSE TO COMMENT NO. 18)

PERMITS REQUIRED TO BEGIN CONSTRUCTION OF THE CRANDON PROJECT

Statutory Obligation	Administering Agency	Activity	Action
<u>FEDERAL</u>			
33 U.S.C. 1344	U.S. Army Corps of Engineers	Dredge or fill permits for activities in or impacting navigable streams or wetlands	Permit issuance
30 U.S.C. 801 et seq	Dept. of Labor Mine Safety & Health Administration	File legal identity report	
42 U.S.C. 300 h et seq	EPA	Possible well injection of ground water, placement of backfill sands below groundwater aquifer.	Issue Class V permit
33 U.S.C. 1321	EPA	Spill prevention control and counter measure plan (40 CFR 112.7)	Have plan on file before operations begin
49 U.S.C. 1348	FAA	Registration with FAA of a structure that will exceed 200 feet above ground level	Determine that head-frame is not an air navigational obstruction
16 U.S.C. 470F	Advisory Counsel on Historic Preservation	Monitors actions of federal government which may involve sites having buildings, structures, or objects eligible for inclusion in the National Register	Coordinate with U. S. Army Corps of Engineers

(TABLE FOR RESPONSE TO COMMENT NO. 18)

PERMITS REQUIRED TO BEGIN CONSTRUCTION OF THE CRANDON PROJECT

Statutory Obligation	Administering Agency	Activity	Action
18 U.S.C. 843	Bureau of Alcohol, Tobacco and Firearms	Explosives user permit	Permit issuance

Many federal programs that would otherwise be applicable are administered by the state. It is assumed that the state will remain or become qualified to administer the following federal programs: National Pollution Discharge Elimination System; Resource Conservation and Recovery Act Solid Waste Disposal programs; Clean Air Act -- non-PSD aspects; Safe Drinking Water Act.

STATE

Wis. Stat. 23.11	DNR	EIR submittal	Determine adequacy
Wis. Stat. 30.12	DNR	Placement of structures	Permit issuance
1-13 Wis. Stat. 30.12	DNR	Placement of riprap	Permit issuance
Wis. Stat. 144.855(2)	DNR	Diversion of surface water	Permit issuance
Wis. Stat. 30.19(1)(c)	DNR	Grading of banks	Permit issuance
Wis. Stat. 30.20(1)	DNR	Dredging	Permit issuance
Wis. Stat. 31.23	DNR	Bridges	Permit issuance
Wis. Stat. 86.07	Dept. of Transportation	Permit to connect mine access road to State Highway 55 and to run water discharge pipeline underneath Highway 55	Permit issuance

(TABLE FOR RESPONSE TO COMMENT NO. 18)

PERMITS REQUIRED TO BEGIN CONSTRUCTION OF THE CRANDON PROJECT

Statutory Obligation	Administering Agency	Activity	Action
Wis. Stat. 28.11(11)	DNR - Forest County	Withdrawal of land within project site boundary from County forest status	Approval of withdrawal application filed on December 2, 1980 with DNR
Wis. Stat. 101.15	DILHR	Mine Shaft sinking, hoisting and ventilation of underground workings	Review mining activities and issue all applicable permits (see letters dated May 3, 1983 and August 30, 1983 between DILRHR and Exxon for a more specific listing of required approvals)
1-14 Wis. Stat. 101.12	DILHR	Surface Building plans, blasting procedures	Review and approve applicable construction procedures and building plans and issue applicable permits
Wis. Stat. 145.02	DILHR	Plumbing and fire protection	Review and approve plans and issue applicable permits
Wis. Stat. 144.025(2)(e)	DNR	High capacity wells	Permit issuance
Wis. Stat. 144.04	DNR	Waste water treatment system	Plan approval

PERMITS REQUIRED TO BEGIN CONSTRUCTION OF THE CRANDON PROJECT

Statutory Obligation	Administering Agency	Activity	Action
Wis. Stat. 145.19, 145.20, 147.02	DILHR, Forest County and DNR	Private sewage system	Permit issuance (county) and review and approve final plans (DILHR DNR)
Wis. Stat. 144.392, 144.391	DNR	Air emission	Permit issuance
Wis. Stat. 144.44, 144.46	DNR	Mine Waste Feasibility Report, Plan of Operation	Approval
Wis. Stat. 144.85	DNR	Mining	Permit issuance
Wis. Stat. 59.971	Forest County, DNR	Placement of mining structures in shoreland/wetland zoning districts	Adopt Shoreland zoning ordinances in accordance with NR115; approve the placement of such structures in the zoning districts
Wis. Stat. Chap. 147	DNR	Water discharge	Permit issuance
Wis. Stat. Chap. 162	DNR	Potable water supply	Review and approve final plans

LOCAL

The Town of Lincoln has a zoning ordinance. It is expected that the Town of Nashville will have an ordinance relating to mining.

Comment No. 24

For the mine waste feasibility report and plan of operation s. 144.44, Wis. Stats. is cited. Since it may be necessary to obtain a waiver under s. 144.44, from separation distance requirements, this should include a reference to s. 144.46, Wis. Stats., to recognize the availability of such variances.

Response:

Comment acknowledged and the EIR will be revised accordingly.

Comment No. 25

When citing s. 144.85, Wis. Stats., Exxon indicates the administering agency as "DNR-Mining Permit", with blanks under the "Activity" heading and the "Action" heading. Under the "Administering Agency" heading, only DNR should be listed. Under the "Activity" heading "Mining" should be listed. Under the "Action" heading, we presume the request to be for "permit issuance".

Response:

Comment acknowledged and the EIR will be revised accordingly.

Comment No. 26

The reference to DNR and Forest County action regarding shoreland and flood plain zoning contains a number of errors. Section 54.471, Wis. Stats., is an erroneous citation and should read s. 59.971. Section 144.46, Wis. Stats., refers to separation distances of solid waste disposal facilities from navigable waters, and does not apply to the pipeline route. This reference should be dropped. Also, the shoreland (not shoreline) and flood plain zoning activity is local in nature and should not reference the DNR as an administering agency. Finally, the "Activity" and "Action" items appear to be transposed. The requested action is apparently the obtaining of necessary zoning and permits.

Response:

Comment acknowledged and Table 1.1-2 of the EIR will be amended as regards Shoreland and Flood Plain zoning as follows:

<u>STATUTORY OBLIGATION</u>	<u>ADMINISTERING AGENCY</u>	<u>ACTIVITY</u>	<u>ACTION</u>
59.971	Forest County	Placement of mining structures in shoreland/wetland zoning districts.	Adopt Shoreland zoning ordinances in accordance with NR 115; approve the placement of such structures in the zoning districts.

Comment No. 27

In addition to the mining permit under s. 144.85, Wis. Stats., Exxon must also receive formal authorization to commence mining under s. 144.86(3), Wis. Stats. Also, Exxon may need to acquire approvals for one-time disposal of wood ash, construction debris and waste wood. If arrangements cannot be made to dispose of mill refuse and other nontailings wastes in an existing landfill, it may also be necessary to pursue development and Department approval of a solid waste landfill pursuant to s. 144.44 Wis. Stats.

Response:

Comment acknowledged.

Comment No. 28

Local Obligations - In addition to the town ordinances governing activities within the town boundaries, Exxon will have to comply with certain County ordinances. As mentioned above, the pipeline will have to conform with all Forest County shoreland and flood plain ordinances or be granted variances from incompatible restrictions. The outfall structure and all stream crossings would also be subject to these ordinances. In addition, we expect that delineation of the ordinary high water marks of Duck Lake, Deep Hole Lake, Skunk Lake, and Little Sand Lake may place other project facilities within the 1,000 foot shoreland zoned area.

Response:

Comment acknowledged. Also, see response to comment No. 26.

SECTION 1.1.3.3, PROJECT SCHEDULES

Comment No. 29

The present schedule fails to consider activities which must occur or be initiated prior to the start of construction. A pre-construction plan and schedule must be provided to identify those activities and to establish a more realistic time frame for the start of construction. This plan and schedule should include but not be limited to the following items:

1. Implementation of the various monitoring plans.
2. Corporate analysis of permit conditions and decision to proceed with a project.
3. Completion of required land acquisition including county forest lands.
4. Satisfactory legal and physical resolution of predicted private water supply problems.
5. Compliance with other post-permitting regulatory requirements, and as requirements for environmental mitigation.

Response:

1) A discussion of the monitoring programs for ground water, surface water, aquatic ecology, air quality and terrestrial ecology is presented in the Mine Permit Application, Section A-Item 15. The schedule for implementation of the monitoring program and the frequency of sample collection and the locations to be sampled are also discussed. The monitoring programs for the above disciplines will be initiated approximately 6 to 12 months prior to construction.

2) The Corporate analysis of permit conditions and evaluation of the decision to proceed with the Project is an ongoing process. The proposed DNR permit conditions will be known during the Master Hearing.

The Corporate analysis will remain current throughout the Master Hearing process.

3) Land required to proceed with the Project not already owned by Exxon is currently under option. The options can be exercised and title transferred to Exxon within 90 days of notice of exercise of the option. Construction can begin immediately upon permit issuance on land already under lease or owned by Exxon.

4) The legal-statutory framework to satisfactorily resolve water supply problems is in-place. Monitoring of water wells that may be impacted by mine related activities will begin at least one year before construction.

5) Scheduling of post-permitting activities will be described in greater detail as the operation phase of the mine draws to a close.

Comment No. 30

Figure 1.1-4 which indicates projected peak manpower requirements, must be supported by detailed employment needs by job category in Sections 1.3.3.1 and 1.4.2. Manpower requirements must be broken down by year, and must be accompanied by the assumptions and data used to derive the projections.

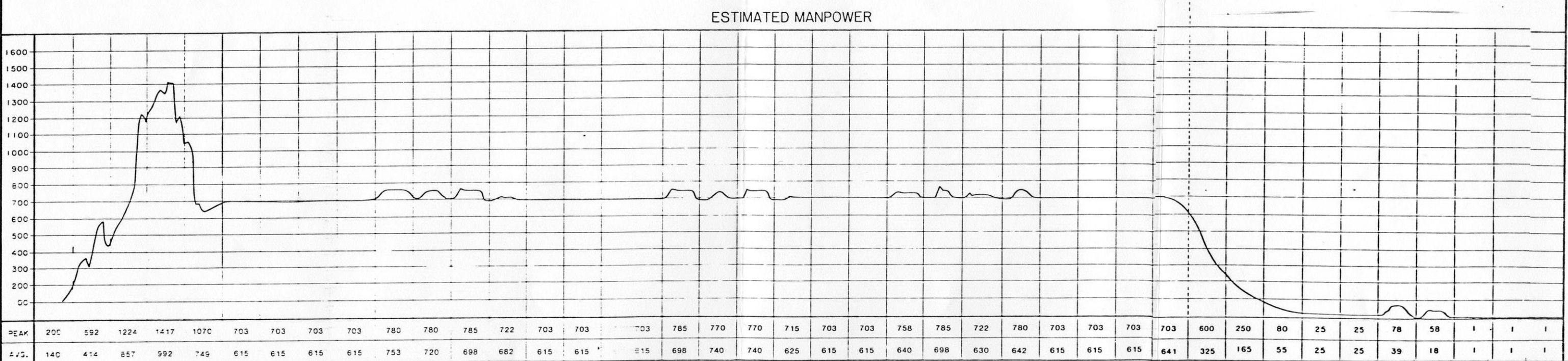
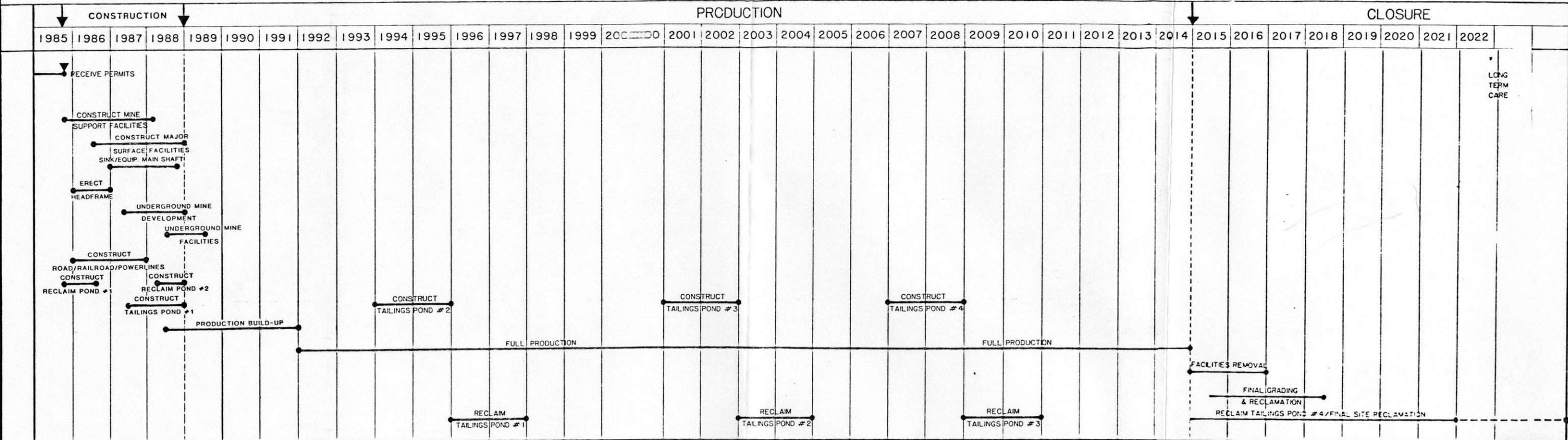
Response:

Exxon's new manpower projections consistent with the current execution philosophy are reflected in the attached Project schedule. Response to comments No. 30, 31, and 154 are based upon these new projections shown in Figures 1.1-4, Revision 1 (attached) and figures accompanying response to comment No. 154. The new information reflects current planning; however, it is subject to changes in their inherent dependency on market conditions, permitting factors, and Exxon's corporate decision process.

Exxon has determined that the time to develop the main shaft and install the hoisting equipment can be shortened by 6 months.

Current execution philosophy takes advantage of a "run of mine" production period (12 months) prior to completion of the underground primary crusher. Two stopes will be operated during this time with uncrushed ore hoisted from

EXXON MINERALS COMPANY
CRANDON PROJECT
SCHEDULE



NOTE:
THE CONSTRUCTION START DATING DATE IS BASED UPON THE EXPECTED DATE OF PERMIT ISSUANCE AND THE DURATION OF SCHEDULED ACTIVITIES MAY VARY. THE ACTUAL CONSTRUCTION START DATE WILL VARY DEPENDING UPON PERMIT ISSUANCE AND ECONOMIC CONDITIONS.

EXXON MINERALS COMPANY
CRANDON PROJECT

PROJECT SCHEDULE

1 9-83 CS GENERAL

DATE: 10/82

FIGURE 1.1-4

the ventilation air intake shaft and from a temporary skip loading station in the main production shaft located above the crusher station.

This ore will be stockpiled on surface until operation of the concentrator starts. This moves the start-up of mill facilities ahead by 6 months, giving a total Project schedule shortening of 1 year from the schedule previously submitted.

A condensed schedule for the Crandon Project is presented in Figure 1.1-4, Revision 1. This schedule illustrates schedule durations and interrelationships of major activities. The estimated manpower requirements required for each Project phase are presented, with further detail of employment needs given in subsections 1.3.3.1 and 1.4.2. Please refer to the response to comment No. 154 for these figures, the detailed manpower projections and the basis for development of these figures.

Comment No. 31

The EIR seems to indicate three different levels of manpower requirements. Figure 1.1-4 indicates a maximum of less than 1,450 workers. In comparison, for the most likely scenario in Table 4.2-25 in 1989, there would be 1,080 construction workers and 580 operations workers for a total of 1,660 employees. Figure 1.3-15 apparently shows a maximum of about 1,450 construction workers for 1989 which would indicate a total work force for that year of over 2,000. Justification of these critical projections is essential since review of the literature relevant to large growth projects shows that estimates of manpower requirements are often too low ("Social Economic Impacts of Power Plants", Denver Research Institute and Brown, Bortz and Coddington prepared for the Electric Power Research Institute, Palo Alto, California, 1982, and "Chronic Under Projecting of Work Forces at Nuclear Power Plants", Robert B. Braid, Oak Ridge National Laboratory, Oak Ridge, Tennessee, 1980).

Response:

Figure 1.1-4, Revision 1 (attached to the response to comment No. 30) is a condensed version of information presented in response to comment No. 154. This curve indicates a maximum peak of 1,417 workers occurring in July 1988. The composition of the peak work force is 126 workers employed in construction of the shaft and underground facilities, 466 Exxon employees, and 825 workers engaged in construction of the surface facilities. Detailed breakdowns by job category also are presented in the response to comment No. 154 for the figures. The Exxon employees constitute operations, maintenance, technical, administration, and construction management for the mine and surface facilities. Therefore, the peak manpower of 1,417 reflects construction workers and operations personnel.

The projections for Exxon employees are based on current organization charts and job classification requirements throughout Project life. The figures reflect the combined needs of the construction phase and build-up of operations personnel. They have been checked for consistency and reasonableness with actual personnel requirements for other mining industry operations and other Exxon projects.

The build-up of the construction work force for shaft, underground, and surface facilities is based upon the Project schedule, required crew mixes for construction tasks, and a detailed calculation of estimated manhours. This estimate has been developed using historical Exxon information. They reflect Exxon's philosophy of project execution and required manning levels. This is an important aspect as we traditionally impose rigorous standards upon contractors for the maintenance of safety, quality, and cost/schedule control which typically increases their staffs. Only by reflecting our own historical information can this concept be interjected into our manpower projections and thereby reflect realistic personnel requirements.

SECTION 1.1.3.4, PROJECT FACILITIES AND EQUIPMENT COSTS

Comment No. 32

Table 1.1-3 should be significantly expanded to cover construction and operation costs of major project components. This includes individual cost estimates for mine equipment, mill equipment, and for major elements of the pollution control facilities (tailings pond liner, reclaimed ponds, water treatment units, etc.). Cost figures of all taxable capital equipment and improvements are also necessary. Justification or documentation for cost estimates must be provided.

Response:

The disclosure of all the cost data covering the construction and operation of the Project components would require a degree of disclosure that could work to its economic disadvantage and that of the Company. Exxon is willing to discuss with the DNR those specific areas in which additional cost information may be required by either Wisconsin Statutes or regulation.

SECTION 1.1.3.5, RELATED GOVERNMENTAL PLANS AND GOALS

Comment No. 33

This section must address the relationship of the proposal to lands entered under various governmental programs such as County Forest lands, Forest Crop Law lands, and Woodland Tax Law lands.

Response:

State, county, city, town or village public lands in the environmental study area are shown on Figure 2.9-7 in EIR Section 2.9. Lands in the environmental study area entered into the Woodland Tax Law and the Forest Crop Law programs are identified in Section 2.9, Figure 2.9-2. County Forest lands associated with Project facilities will be acquired by Exxon by exercising land purchase options. These include Forest County lands in Sections 29 and 30, T35N, R13E (EIR Figure 1.1-3).

Lands entered under the Forest Crop Law that were purchased by Exxon have been withdrawn from the provisions of this law. Any additional lands under Forest Crop Law contract that are acquired by Exxon for the Project will be removed from the provisions of this contract. This includes the Forest County lands in Sections 29 and 30, T35N, R13E which are under an Exxon land purchase option (EIR Figure 1.1-3).

There are no Woodland Tax Law lands associated with the proposed Project facilities.

Comment No. 34

Describe development, recreation, transportation, resource, and educational plans for Antigo, Rhinelander, Oneida and Langlade Counties, the Nicolet National Forest, and the three local Native American communities.

Response:

The following statements will be incorporated into the revised EIR subsection 1.1.3.5:

The Langlade County development plan in the City of Antigo Comprehensive Plan (NCWRPC, final draft, August 1983) contains statements regarding the proposed Project. Discussion with local governmental agencies indicates the following developments or development plans:

Recreation:

Langlade County has a 5-year recreational program. This program is currently devoted to improvement of the Langlade County Fairgrounds. Outdoor recreational activities are being evaluated and expanded as necessary through local governments in cooperation with the private sector (K. Given, Antigo area Chamber of Commerce).

Transportation:

Highway "A" the main route from Antigo to SH 55 near the Project, will be maintained and reconstructed during the next few years. Highway "55" is considered a "scenic route" through Langlade County and the Wisconsin Department of Transportation indicates that this road will not be rebuilt or upgraded until demand exists.

The Langlade County Airport is in a 6-year development plan. Currently the Airport Commission is attempting to acquire land for a cross-wind runway extension of an existing runway. Construction will not be considered until needs justify the expansion.

The recently abandoned Chicago and Northwestern Railroad right-of-way is under study for potential use as a long-term utility development corridor by the City of Antigo.

Resources:

Langlade County and Antigo are in a reforestation program to establish 7500 trees on a 4-ha (10-acre) tract on the site of the former landfill.

The Antigo Waste Processing and Recycling Center is now completed and accepting waste products from Langlade and parts of Shawano and Marathon counties.

Education:

The Antigo Board of Education Capital Improvement Plan includes the construction of a high school auditorium on current school acreage followed by a multi-year program which includes complete remodeling of the existing high school facilities.

The Oneida County Long-Range Plan (NCWRPC, in revision), the Rhinelander Comprehensive Development Plan (Rhinelander Mining Impact Committee, in final draft), and the Downtown Rhinelander Improvement Association Development Plan (J. Allen, in final draft) each present goals related to the proposed Project:

Recreation:

The Oneida County Forestry and Outdoor Recreation Committee has developed long-range plans which include expansion of outdoor recreational activities on Oneida County Forest lands.

The Wisconsin Northwoods Tourism Region 2 recently announced the establishment of an annual Snowmobile Festival to be held in January of each year.

Transportation:

The downtown Rhinelander traffic pattern will be improved by the development of the abandoned Chicago and Northwestern Railway corridor which was recently purchased by the City of Rhinelander.

A long-range proposal to provide a Highway 8 by-pass around Rhinelander will ultimately affect traffic in the Rhinelander-southern Oneida County area.

Current plans are to improve the taxiway at the Rhinelander-Oneida County Airport.

Resources:

The Oneida County Forestry and Outdoor Recreation Committee long-range plans include timber sales and reforestation for total resource management. The same type of long-range management plan is in effect for the Northern Highland and American Legion forests in Oneida County.

Education:

The Rhinelander K-12 School District has developed a 5-year capital expenditure plan which provides improvement to all schools in the district including the construction of a new K-6 or double K-6 school in the Town of Pelican.

The Nicolet National Forest Land Use Plan is mentioned on EIR page 1.1-20. The plan will not be available in 1983.

The two Native American Communities in the Project area have each submitted OEDP plans and updates annually. Discussions with the two communities do not indicate major developments during the short-term. The Mole Lake Chippewa Community continues to develop a shopping complex on the reservation and the Forest County Potawatomi recently received approval to develop a heavy construction trades program for their community.

Comment No. 35

Describe the 1981 State Comprehensive Outdoor Recreation Plan for Region 2 supply-demand-needs assessment of outdoor activities and the issues developed for Region 2. Discuss tourism activities, goals and objectives established for the area by the Department of Development-Division of Tourism, and Governor's Council of Tourism Reports.

Response:

A review of the 1981 State Comprehensive Outdoor Recreation Plan supply-demand-needs assessment for outdoor recreational activities indicates that for all activities, only a minor percentage of the state-wide need occurs in Region 2. Data developed in the course of preparing the Exxon Minerals' Socioeconomic Report entitled, "Current Conditions Report," confirm the basic needs assessment for outdoor activities identified in the 1981 State plan. Discussions with the Forest, Langlade and Oneida County Chambers of Commerce indicate that the responsibility for meeting the recreational needs has been a primary function of each local governmental jurisdiction in cooperation with the local private sector. Also, in Region 2 many outdoor recreational activities are preferred to be in undeveloped or in the lesser developed areas.

Tourism goals and objectives have been established for Region 2 by the Wisconsin Department of Development (Wisconsin Tourism Industry Study, [March 1983]) and the Governor's Blue Ribbon Task Force on Tourism (final report, 1982). These studies are more recent than the 1981 Comprehensive Outdoor Recreational Plan cited by the DNR. Recommendations based on the Wisconsin Tourism Industry Study by the Department of Development apply equally to Region 2. The study contained recommended action on several levels:

- 1) Information: Facilities availability; sight-seeing opportunities;
- 2) Lake Access: Better public access for water related activities;
- 3) Financing: State funding availability to local tourism areas;
- 4) Marketing: Maintenance of existing markets and attraction of untapped markets; and
- 5) Education: Providing operators with information on which to make decisions related to facilities improvement.

SECTION 1.1.3.6, REQUIREMENTS FOR GOVERNMENT SERVICES

Comment No. 36

Governmental workloads have been or will be increased in areas such as job service, facility inspection, environmental inspection, revenue, employee training, planning, and impact funding.

Response:

As noted in the EIR, operations of the Crandon mine/mill facilities will require minimal additional services. The following comments will be added to the end of subsection 1.1.3.6 in the revised EIR:

At the State level, governmental service requirements in the areas of facility inspection (DILHR, DHSS, DNR) and environmental inspections (DNR) will be increased to the extent required to meet current laws and administrative regulations. However, it is anticipated that the types of inspections necessary will not increase the overall workload or require additional staff.

The decision to treat the Project property as "Manufacturing" for assessment purposes has not required the Department of Revenue's Bureau of Property Tax to increase the manpower required for proper evaluation and tax computation. Under current conditions, any anticipated workload increase should not have a major effect on the overall manpower of the Bureau of Property Tax. Other Department of Revenue Bureaus may also experience brief increases in administrative effort due to the Project; however, no shift in the total workload is expected.

State planning agencies (i.e., DOE, DOA, DOR) have had to consider the potential of mining in the development of near-term and long-range plans. Because these plans were being developed for numerous other purposes, the mining aspects have added only minimal amounts of effort. If the Project proceeds into the construction phase, State agencies may be required to provide a limited increase in manpower assigned to the planning effort for the Crandon Project and its effect on the long-range plans.

The Mining Investment and Local Impact Fund Board, created as a result of the 1977 tax laws, has continued to require one full time staff person. Manpower levels for planning administrative requirements should not increase as a result of the development of the Project, according to discussions with Elizabeth Kohl, Executive Secretary of the Board.

According to Eugene Voss, Director of the Job Service Office in Rhinelander, current administrative functions utilizing computerized data availability will enable the Job Service to handle any Project development with a minimal increase of staff time.

With the exception of possible DILHR involvement on a minimal scale, governmental services for employee training will not be necessary under current plans. Exxon Minerals Company will conduct or retain outside contractors for all training required for permanent staff.

Comment No: 37

There is no sludge disposal site in Forest County at this time. The disposal site for sludge must be identified and described to assess potential demands on government services.

Response:

The sewage treatment system was designed in accordance with Wisconsin Administrative Code Section ILHR 83 as well as U.S. Department of Health, Education, and Welfare "Manual of Septic Tank Practice." The total liquid capacity of the septic tank is 223.3 m³ (59,000 gallons). This will provide one-day liquid retention time and allow for 49.2 m³ (13,000 gallons) of sludge storage. This system will require sludge removal once or twice a year. It is anticipated that sludge removal and disposal will be handled by a licensed private contractor.

Comment No. 38

Disposal of refuse in a landfill in the Town of Nashville may be a significant service demand on the township. At this time, there appear to be no sites of sufficient capacity for the disposal of these wastes. Also, preliminary discussions with Town officials indicate that they may not accept Exxon refuse at the Town landfill. A new site in the Town of Nashville would take several years to develop and be approved. Exxon must describe the additional waste loading expected from the mine, mill and increased local population and must specifically identify and describe the disposal area. These comments also apply to the one-time disposal of ash, wood waste and construction debris.

Response:

Plans for the exact disposal area or areas for refuse from the Crandon Project have not been finalized. The potential for disposal in sites in the Town of Nashville is still being evaluated. However, if the volume of Project wastes cannot be handled by local township landfill operations, either more distant landfills (Antigo, Oneida), private contract landfills or a landfill at the Project site will have to be used.

Estimates of the amount of refuse generated during construction are provided under the heading "Solid Wastes" in EIR subsection 1.3.5.1. The highest estimate of 9.1 t (10 short tons) per week was during the summer of construction phase years 3 and 4. Salvageable material would consist of shipping containers, scrap metal, wood framing, wire spools, and other such material, some of which would be returned to suppliers. That which cannot be salvaged or returned, plus administration office and labor force wastes (paper, boxes, lunch bags), will be disposed in a landfill.

Slash and unmerchantable timber will be burned or disposed at an on-site or off-site landfill facility.

Refuse generated during operation is characterized in EIR subsection 1.4.8.3, under the heading "Refuse." Estimates of the percentage of various waste categories are as follows:

<u>Waste Type</u>	<u>Volume Percentage</u>
Paper and garbage	75
Plastic	5
Wood	5
Metal	10
Miscellaneous	5
	<u>100</u>

Based on evaluations of similar industrial operations, we estimate the total volume of unsalvageable waste during operation to be approximately 2.3 t (2.5 short tons) per year per employee. Assuming 800 employees, the estimated annual waste generated would be approximately 1815 t (2000 short tons).

The increase in the local population as well as the estimate of resultant refuse generated from this increase is not available at this time.

Comment No. 39

Details on the available on-site fire suppression equipment, the manpower training proposal, and anticipated needs for fire protection must be provided along with existing fire fighting capability of nearby municipalities in order to adequately evaluate the total fire suppression capability. Also, the Soo Line Railroad is responsible for 4-5 fires per year in the area. How many additional fires would be expected annually from the increased rail traffic associated with the mine operation?

Response:

Fire protection will be provided to meet all pertinent codes and regulations. The degree of protection provided in any facility area will be based on its occupancy and its content of combustibles. Individual systems design and the selection of specific equipment items will be addressed during the detailed engineering phase.

At this time, the conceptual design provides for a fire-water tank with a capacity of 1,900 m³ (500,000 gallons). This tank will be located on the north side of the mine/mill site approximately 200 m (656 feet) east of the mill building. The water source for the fire-water system is assumed to be either treated water from the treatment plant, uncontaminated mine water or well water. The fire-water tank will be full at all times.

Two fire-water pumps (one electric and one emergency diesel) for supply and a jockey-pressurizing pump will be provided to distribute fire water through a pipe loop (see Attachment No. 1 [Drawing DBM-1-C-001]). This loop passes in close proximity to all principal surface facilities. A second, subsidiary loop will surround the concentrator building. Fire hydrants will be provided at close intervals, either mounted directly on the loop or on short branch lines. The emergency diesel pump will be activated in the event of a power outage at the pump station.

Automatic fire and/or smoke detection and alarm equipment will be installed in all facilities. A fire truck will be garaged in the northwest corner of the services building. Hand-held and Halon 1211-type fire extinguishers will be located where needed. Every vehicle will carry at least one dry chemical unit.

Apart from the handling of flammable fuels and certain reagents, the operations of crushing, concentrating and product load-out are not potential fire risks. This is particularly true in the concentrator building where all processes are wet with the exception of fine ore crushing.

Information on fire protection capability of nearby municipalities is presented in EIR subsection 2.10.4.2 (pp. 2.10-118 and 2.10-119; Table 2.10-71). More detailed information on fire protection facilities, equipment and vehicles, number of firemen, salary and operating expenditures, key fire insurance ratings, service area and planned modifications for the local cities and service centers, where available, is given in EIR Appendix 2.10A, Table 2.10A-5.

We are not able to respond to the question concerning estimates of additional fires associated with increased rail traffic. This question should be addressed by the Soo Line Railroad. However, the only additional rail traffic will be from the main track to the mine/mill site. The frequency of rail traffic on the existing main rail line is not expected to increase.

Comment No. 40

Why is it anticipated that outside law enforcement assistance would be required? The level of law enforcement assistance required by the project must be described along with the capabilities of nearby law enforcement units and any additional equipment or manpower needs.

Response:

Subsection 1.1.3.6, Requirements for Governmental Services - The statement questioned in the DNR's comment appeared in this subsection. Inadvertently the word not was omitted. Therefore, the EIR will be revised to state: It is not anticipated that outside law enforcement assistance would be required.

Comment No. 41

Please discuss the need for upgrading town or county roads for use prior to the completion of the access road or during the mine operation.

Response:

The revised construction schedule (to be included in the revised EIR) indicates completion of the access road within the first year of construction. The railroad will be completed within 15 months from start of construction so that heavy loads can be delivered by rail. Therefore, Exxon does not anticipate the need to upgrade (enlarge or expand) the existing local roads.

SECTION 1.1.3.7, PROPOSED CHANGES IN LAND CLASSIFICATION

Comment No. 42

Forest County - Forest County shoreland zoning permits and/or approvals may be required for the proposed access road and railroad crossings, the discharge structure, and other facilities located within 1,000 feet of a lake's ordinary high water mark. Specific plans should be provided to the Forest County Zoning Administrator for determinations of necessary permits and approvals.

Response:

Comment acknowledged and the EIR will be revised accordingly. Also see response to comment No. 26.

Comment No. 43

Forest County is also in the process of developing and adopting a county flood plain ordinance. Upon adoption of the ordinance, additional county zoning permits and/or approvals may be required.

Response:

Comment acknowledged. Also see response to comment No. 26.

Comment No. 44

Town of Lincoln - The Town of Lincoln has recently adopted a town zoning ordinance. Under this ordinance, the mine/mill site, tailings ponds, and a portion of the reclaimed water ponds are located in areas that are zoned "forestry". A zoning change to "mining" would be required prior to development of any facilities at proposed locations in the Town of Lincoln.

Response:

Comment acknowledged and the EIR will be revised accordingly.

Comment No. 45

Town of Nashville - The Town of Nashville is in the process of adopting a town zoning ordinance. Exxon should identify any necessary zoning changes required if and when an ordinance is adopted.

Response:

Comment acknowledged.

SECTION 1.1.3.8, RELATIONSHIP OF THE PROPOSED PROJECT TO OTHER SIMILAR PROJECTS

Comment No. 46

Please discuss the potential for processing ore from other deposits at the Crandon mill, and the general legal requirements which would apply if other ore was processed. Describe the effect implementation of the proposal would have on the technical and economic feasibility of the development of other ore bodies in the region.

Response:

As stated in the EIR, the Project is designed to process only the ores which are known to occur in the Crandon deposit.

Recent reports in the press have indicated the existence of other mineral occurrences in the region. Exxon is in no position to judge as to whether any of these occurrences are economic to mine or whether they are compatible with the facilities designed for the Crandon Project. Further, the intentions of the owners of these mineral rights are unknown.

Comment No. 47

This section should also indicate that this would be the first mine in Wisconsin to be initiated under the existing regulations and the first sulfide ore body developed.

Response:

Comment acknowledged and the EIR will be revised to include the statement: The Crandon Project will be the first massive sulfide mine developed in Wisconsin under the existing state regulations.

SECTION 1.2, DESCRIPTION OF FACILITIES

Comment No. 48

Neither this section of the EIR or the Mining Permit Application contains the requisite level of engineering detail necessary for an adequate environmental and regulatory review. The two volumes of the Ralph M. Parson Report approached the level of detail which will be required. Unfortunately, the Parson's Report only covered portions of the complex and was outdated at the time of its transmittal to the Department. Mr. Hansen's letter of November 18, 1981 assured us that "an additional phase of engineering studies is presently being planned." The results of those studies are necessary for our evaluation.

Response:

The level of engineering detail contained in the EIR and the Mine Permit Application are generally felt to be adequate to allow the DNR to assess the Crandon Project impacts. In some design aspects, a total release of engineering detail could jeopardize Exxon's competitiveness in the minerals business. However, Exxon will continue to respond to specific questions and areas of concern -- (see also response to comment No. 4).

Comment No. 49

This section should include a small scale map or scale drawing showing all of the major Project facilities. A base map such as USGS Planimetric Quadrangle sheet could be used.

Response:

A small scale figure showing all the Project facilities is attached.

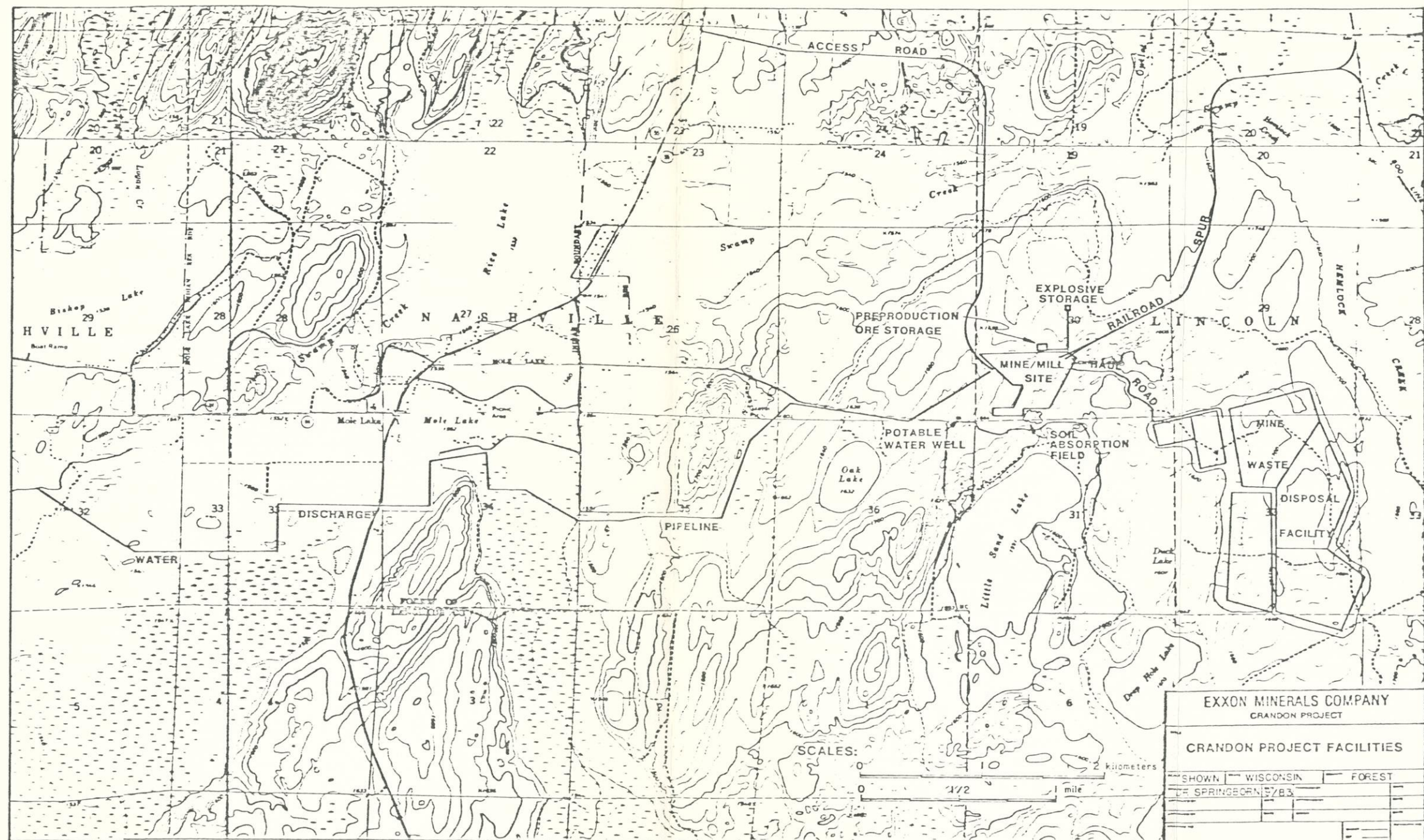
Comment No. 50

Include a description of the proposed pilot plant in this and subsequent sections.

Response:

A pilot plant has been proposed as a means of training mill personnel and determining optimum operating and control parameters for the full scale plant. This pilot plant has not yet been designed; however, it would essentially be a very small version of the full scale plant and would process one to two tons of ore per hour when operating.

The current plans are to house the pilot plant in a portion of the core storage building. The current estimated building area requirement is 372 m² (4000 square feet). Tailings from the pilot plant would be retained temporarily in a small lined pond. Sometime after startup of the full scale plant and the establishment of a permanent tailings pond,



(FIGURE FOR RESPONSE TO COMMENT NO. 49)

the lined tailings storage pond for the pilot plant would no longer be needed and the existing contents would be moved by truck to the permanent location. The small pond would then be reclaimed. A small water reclaim pond will also be provided and would be removed once the operation of the pilot plant ceases.

This pilot plant would be run intermittently prior to and during the startup of the full scale plant and as needed thereafter.

Comment No. 51

This section also lacks any description of the aesthetics features of the surface facilities.

Response:

The discussion of aesthetic features of the surface facilities for the Crandon Project are provided in EIR subsection 4.2.9.2, Aesthetics, and the reports referenced in this subsection. This subsection provides an evaluation of the visibility of Project facilities from local vantage points as well as a discussion of mitigative options available to reduce visual impacts.

Comment No. 52

The acreage cited for the area of the surface facilities should include the railroad, access road and discharge pipeline corridors.

Response:

The following surface areas for the facilities will be included in Chapter 4.0, Table 4.0-1 of the revised EIR:

Facility	Corridor		Construction Limits		Corridor		Construction	
	Width		Width (Avg.)		Area		Area	
	m	feet	m	feet	ha	acres	ha	acres
Access Road	60*	200	30	100	30	74	15	37
Railroad Spur	60	200	30	100	26	64	18	45
Rock Haul Road/ Slurry Transport/ Reclaim Water	60	200	40	131	6	15	4	10
Excess Water Discharge Line	15	50	6	20	15	37	6	15

*Includes 30 m (100 feet) for road and 30 m (100 feet) for powerline.

SECTION 1.2.2, VENTILATION SHAFTS

Comment No. 53

Describe the shaft surface discharge structure, fan size, noise suppression, air quality controls, and access roads. Exxon had previously indicated that the fans would be located underground in order to reduce ambient noise levels. Why were the fans moved to the surface?

Response:

Fans will be located on the surface of the east and west exhaust shafts. Preliminary design includes a 90° elbow at the shaft collar, with a horizontally mounted fan or fans attached to another 90° elbow, which is directly coupled to a vertical evase for ultimate discharge to the atmosphere. Physical dimensions of the discharge evases can be found in Table C-1 of the "Air Permit Application Appendices." Fan sizes were addressed in subsection 1.4.2.3, Ventilation and Mine Air Heating of the EIR. Present design indicates that each discharge shaft fan installation will convey approximately 350 m³/s (.75 M cfm) of air.

Noise suppression at each of these installations was determined unnecessary by modeling (see EIR Section 4.2). However, to mitigate any undesirable noise emanations and possible resultant impacts, the discharges will be directed vertically to achieve maximum dampening and dispersion.

Description of air quality controls can be found in the Air Permit Application, subsection 2.2.1, Mine-Construction and Operation. Location and routing of access roads to and from each exhaust shaft are presented in Attachment No. 2 (Plot Plan drawing No. 051-1-G-001).

Location of mine exhaust fan installations at the surface is necessary to assure maximum reliability and operability of essential switchgear and electronic components. The Mine Safety and Health Administration (MSHA) recommends location of main fans on the surface and addresses that issue in draft proposal 30 CFR 58-21, Subsection 58.21-2 (U) Mine Categories. Therefore, surface main fan installations were designed for maximum assurance of a safe and reliable ventilation system for those working underground. Also, for reasons described earlier, minimum impact to surrounding communities will remain a high priority during final design and equipment acquisition.

SECTION 1.2.1.2.3, DRIFTS

Comment No. 54

Describe in detail the mining plan as it relates to the control of surface subsidence. Describe controls to prevent the piping of overburden materials into the mine.

Response:

The mining methods and stope sequences planned for extraction of the Crandon orebody were selected to control mine area rock mass stability and preclude surface subsidence. A permanent bridge or "crown pillar" of bedrock directly beneath the glacial overburden will be purposely excluded from mining activity. This bedrock barrier will maintain surface stability and prevent piping of overburden materials into active mine workings.

Beneath the orebody crown pillar, stoping methods and sequences will be arranged to maintain local rock mass integrity and avoid disturbance of the crown pillar. All mining methods planned (refer to EIR subsection 1.4.2.1) provide for backfilling of stopes immediately following ore extraction. Depletion of reserves will generally proceed from depth and the orebody extremities toward the surface, with mining directly below the permanent crown pillar planned for the final third of the mine life. These practices, combined with the fact that approximately 8 percent of the mineable ore will be left in place as pillars throughout the mine, will assure perpetual stability of the mine area bedrock surface and glacial overburden (refer to EIR subsection 1.5.1).

SECTION 1.2.1.2.9, MINING EQUIPMENT

Comment No. 55

How will large equipment be taken underground?

Response:

All mine structural materials, machinery, and mobile equipment will enter the mine through the main production/service shaft. The service hoist and cage are designed to accommodate the heaviest and largest mechanical components required to construct and operate the mine. A load of 28,100 kg (31 tons) can be suspended from the drawbar inside the cage, in a free space 7.9 m (26 feet) high, 2.7 m (9 feet) wide, and 5.3 m (17 feet) long. The larger mobile mining vehicles will, for example, be separated at the center articulation joint for transport underground.

SECTION 1.2.1.2.10, ORE TRANSPORT FACILITY

Comment No. 56

The dust control system on the primary crusher and related ore handling facilities is not adequately described. Where will the ducts and dust collection hoods duct to? A drawing showing the crusher, dust collection system and any other control devices should be included.

Response:

The dust collection system consists of ducting from the throat of the gyratory crusher, from the discharge of the vibratory feeder, from the discharge of the picking belt conveyor, and from the discharge of the crusher delivery conveyor to a multiple installation of bag type dust collectors, as shown schematically in a J. S. Redpath drawing No.

050.2.113.M.051 contained in Attachment No. 3. The system is powered by a 50 hp exhaust fan moving $7.27 \text{ m}^3/\text{s}$ (15,400 cubic feet per minute) at 12 1/2 inches WG. This fan will discharge air into the exhaust air system of the mine. Dust from the collectors will be transported by a screw conveyor to a closed container, which can then be transported to the top of a backfill stope for disposal or, alternatively, emptied into the loading pocket. Drawings No. 050.2.111.S.007, 008 and 009 in Attachment No. 3 show the equipment in detail.

Water mists at each of the feeders above the crusher, above the crusher throat, at the discharge of the feeder below the crusher, at the discharge of the picking belt conveyor, and at the discharge of the crusher delivery conveyor will suppress potentially fugitive dust at these points. This system, together with a conveyor belt fire suppression system, is shown schematically on drawing No. 050.2.113.M.050 in Attachment No. 3.

SECTION 1.2.1.2.12, SANITATION FACILITIES

Comment No. 57

Provide further details on the underground sanitation facilities including the ventilation, transportation, and disposal of sanitary waste. Discuss any waste preservation chemicals which would be used and the compatibility of chemically treated waste with the surface septic system.

Response:

Mine sanitation facilities will be provided in the vicinity of shops and other permanent installations, and within walking distance of active areas on the mining levels. Rock wall cut-outs in well ventilated drifts will be bulkheaded for privacy. Chemical toilets typical of those used at surface construction sites or large public events will be installed on a prepared floor. The sanitation stations will be equipped with permanent lighting, wash water, and required supplies.

Sanitation units will be serviced as demanded by local use frequency. Containerized waste will be transported to surface in the mine cage for disposal in the plant septic system. The formaldehyde and perfume used in the chemical toilet control solutions will be in dilute concentrations compatible with the septic treatment system.

SECTION: 1.2.1.2.13, WATER SUPPLY

Comment No. 58

Provide a plan for potable water supply testing and reaction to unsafe samples.

Response:

Most of the potable water will come from a fresh water well and should not require pretreatment. The testing program has not been developed, but will comply as appropriate with Chapters NR 108 and 109. The testing scheme will be provided to the DNR prior to construction.

SECTION 1.2.1.2.14, FUEL HANDLING AND STORAGE

Comment No. 59

Describe the surface handling facilities for the fuel pipelines running to underground fuel storage tanks and any spill contingency plans.

Response:

Fuel oil to supply the needs of surface and underground vehicles, the emergency power generators, and other plant equipment will be delivered to the mine/mill site by tank truck. Fuel will be off-loaded through a pumphouse adjacent to the two 60 m³ (15,000 gallons) bulk fuel oil storage tanks. These tanks will be located within dikes sized to contain the fuel oil in the event of a spill, tank leakage, or rupture. The attached plot plan and fuel oil storage plan (Attachments No. 4 and 5, respectively) from work recently completed by Raymond Kaiser Engineers show the arrangement of these facilities. Final engineering work may provide some additional refinement or optimization to this arrangement and/or some of the details, but basic concepts are not expected to change.

Fuel oil will be distributed from the bulk storage pumphouse by buried pipelines to surface use locations. Fuel allocated for underground use will first be pumped to a pair of 12-m³ (3,000-gallon) capacity measuring tanks on surface adjacent to the underground delivery borehole (also shown on Attachments No. 4 and 5). These tanks will be contained by a dike with sufficient capacity to contain the contents of the tanks. Valves controlling the filling and emptying of these tanks will be interlocked with the receiving tanks in the underground fuel stations. Filling will not be possible unless the borehole delivery valve is closed. Discharge from the measuring tanks will only be possible when an underground receiving tank of greater capacity is empty (refer to EIR subsection 1.2.1.2.14, Fuel Handling and Storage).

Both the bulk fuel oil storage and underground delivery measuring tank facilities will be constructed and operated in accordance with the Wisconsin Administrative Codes. Spill prevention, countermeasure and control plans will be provided prior to construction and issuance of permits.

SECTION 1.2.1.2.16, MINE DRAINAGE

Comment No. 60

Considerably more detail is necessary for the mine inflow control systems. Describe the grouting proposal including methods, number and location of surface boreholes, and documentation of the effectiveness of this measure. Provide an analysis of the economic and technical considerations which will control the extent of grouting. When does Exxon intend to decide if grouting is economically and technically feasible and therefore part of the proposed mine operation?

Response:

Site geohydrologic conditions will limit the flow of ground water into the Crandon mine to a steady state rate of approximately $0.118 \text{ m}^3/\text{s}$ (1870 gallons per minute) as documented in the Prickett Associates' report entitled "Ground Water Inflow Model for the Proposed Crandon Mine," December 1982 (previously provided to the DNR). A layer of relatively impermeable glacial till and/or clay-rich weathered bedrock retards ground water entry over much of the mine area. The inflows forecast to occur will be primarily in areas where overburden aquifer sands are in contact with porous weathered rock at the orebody subcrop. The ground water impact modeling presented in EIR Appendix 4.1A reflects these flow mechanics of the site geohydrology, in that only partial desaturation of the aquifer above the mine is forecast.

Any artificial controls applied to reduce the inflow would, of course, lessen environmental effects and reduce mine drainage and water treatment and discharge costs. Potential mine inflow control techniques were investigated by Klohn Leonoff Consulting Engineers as described in their June 1982 report entitled "Crandon Project Mine Water Control Plan - Alternative Evaluation and Preliminary Engineering" (previously provided to the DNR). Although site geotechnical programs and hydrologic computer modeling were incomplete at the time of this study, the regime flow mechanisms had been identified.

The Crandon site geohydrologic regime is relatively simple, predictable, and easily monitored. Saturated glacial overburden with definitive surface water discharge boundaries constitutes the aquifer, exclusively recharged by infiltrating precipitation. In the absence of pumping stress, the bedrock is functionally excluded from the ground water system. Development of the mine will, however, induce flow from the overburden aquifer through weathered bedrock courses not throttled by impermeable materials at the orebody subcrop. With this simple source - throttle - receptor type of geohydrologic regime in mind, two basic inflow control strategies were evaluated by Klohn Leonoff:

- 1) Reduction of source ground water over the mine area.
- 2) Alteration of mine inflow path permeability.

Ground water source reduction techniques studied included surface well field overburden dewatering, underground drainage gallery overburden dewatering, and aquifer flow restriction methods like slurry trenching and vertical

grout curtains. The overburden dewatering methods would require removal of more than twice as much ground water to achieve a marginal reduction of the mine inflow, and were therefore rejected on the basis of increased environmental effects. Aquifer flow restriction methods are impractical at the Crandon site due to the extensive overburden depth. Method details and cost estimates are presented in the Klohn Leonoff report.

Mine inflow path permeability reduction methods evaluated included primarily cement and bentonite grouting techniques. Chemical grouting was eliminated as environmentally unsound, and long-term freezing of the saturated overburden was shown uneconomical. Of the grouting methods described by Klohn Leonoff, the plan to place bentonite grout in the high inflow areas of the orebody subcrop was most practical and potentially effective. In essence, this plan artificially creates flow resistant material similar to that which occurs over most of the mine area. Preliminary engineering plans and a cost estimate for this subcrop grouting plan are presented in the Klohn Leonoff report.

During mine final engineering, further site tests can be conducted to confirm active steady state mine inflow courses and verify the proposed bentonite grouting technique. The extent of any inflow control program instituted will be determined by the potential for lessened environmental effects in balance with reduced mine drainage and water treatment and discharge costs.

Comment No. 61

Provide additional details including cross-sections and drawings of the groundwater interceptor system. Discuss why water intercepted within the bedrock, even though at a shallow depth, can be considered "clean." The mine dewatering will create a drawdown of the aquifer in the area, thus introducing oxygen to a previously anaerobic environment. This may substantially change the chemical characteristics of the groundwater. How will the interceptor system water be protected from contamination?

Response:

Ground water inflow to the Crandon mine will be localized (see response to comment No. 60 with respect to Prickett Associates' study), occurring predominantly where weathered bedrock water courses are in contact with the overburden aquifer at the subcrop. The intensity and lateral extent of the bedrock weathering diminishes with depth. Initial mine production has been planned for the 230 to 350 m stope horizon, a position that is below the majority of the weathered zones. Thus, ground water inflows to mine workings during the early years of the mine life are expected to be very localized.

Exploratory diamond drilling techniques will be employed to identify active water courses prior to advance of the mine face. Flows encountered on the uppermost mine level will be captured in interceptor drill holes and contained to avoid contamination by the mining processes at levels below. Mine water control drifts will be developed ahead of production entry in the upper mine areas to maintain the ability to intercept ground water prior to contamination. Ultimately the ground water interceptor system would

function as shown on the conceptual Mine Inflow Control cross-section (see attached figure). Cement rock grouting may be used for local inflow control or diversion.

As the mine progresses upward from the initial 230 m level entry position, the required mine water control drifts will simply be normal production access drifts developed prematurely and dedicated for exploration and interception of ground water. The exploration diamond drill holes in fact become part of the ground water interception system. As is common practice in other mines, the diamond drill hole collars will be packed and fitted with pipe connections.

Ground water collected from exploration drilling, or other drill holes placed specifically for inflow interception, will be piped directly to a clean water sump and pump station near the main shaft on the 230 m mine level. With the exception of ground water inflow diverted for mine utility water use, discharge from this segregated ground water system will be pumped to surface through a separate pipe column in the main shaft.

Mine inflow intercepted, contained, and discharged by this system is expected to remain near ambient ground water quality, except for possible transient effects during orebody storage depletion and initial flushing pore volumes. In the steady state, partially saturated flow conditions will exist in the weathered bedrock water courses. Some oxygen may then be introduced to this previously anaerobic environment, but its effects are expected to be minor. The oxidation and leaching potential of the water courses is already limited by the extensive pre-glaciation weathering, and the residence time for further ground water flow will be of a duration which can be measured in hours or days.

Comment No. 62

Describe contingency measures available for mine inflows in excess of 2,000 gallons per minute.

Response:

The predicted steady state rate of uncontrolled ground water inflow to the proposed Crandon mine is $0.118 \text{ m}^3/\text{s}$ (1870 gallons per minute) (see response to comment No. 60 with respect to Prickett Associates' study). For the purposes of site area impact modeling, a stress of $0.126 \text{ m}^3/\text{s}$ (2,000 gallons per minute) was employed, representing a contingency of 7 percent. Since, during mine development and operation, all practical efforts will be made to control and reduce this rate of ground water inflow, it is highly unlikely that flows in excess of $0.126 \text{ m}^3/\text{s}$ (2,000 gallons per minute) will ever be experienced.

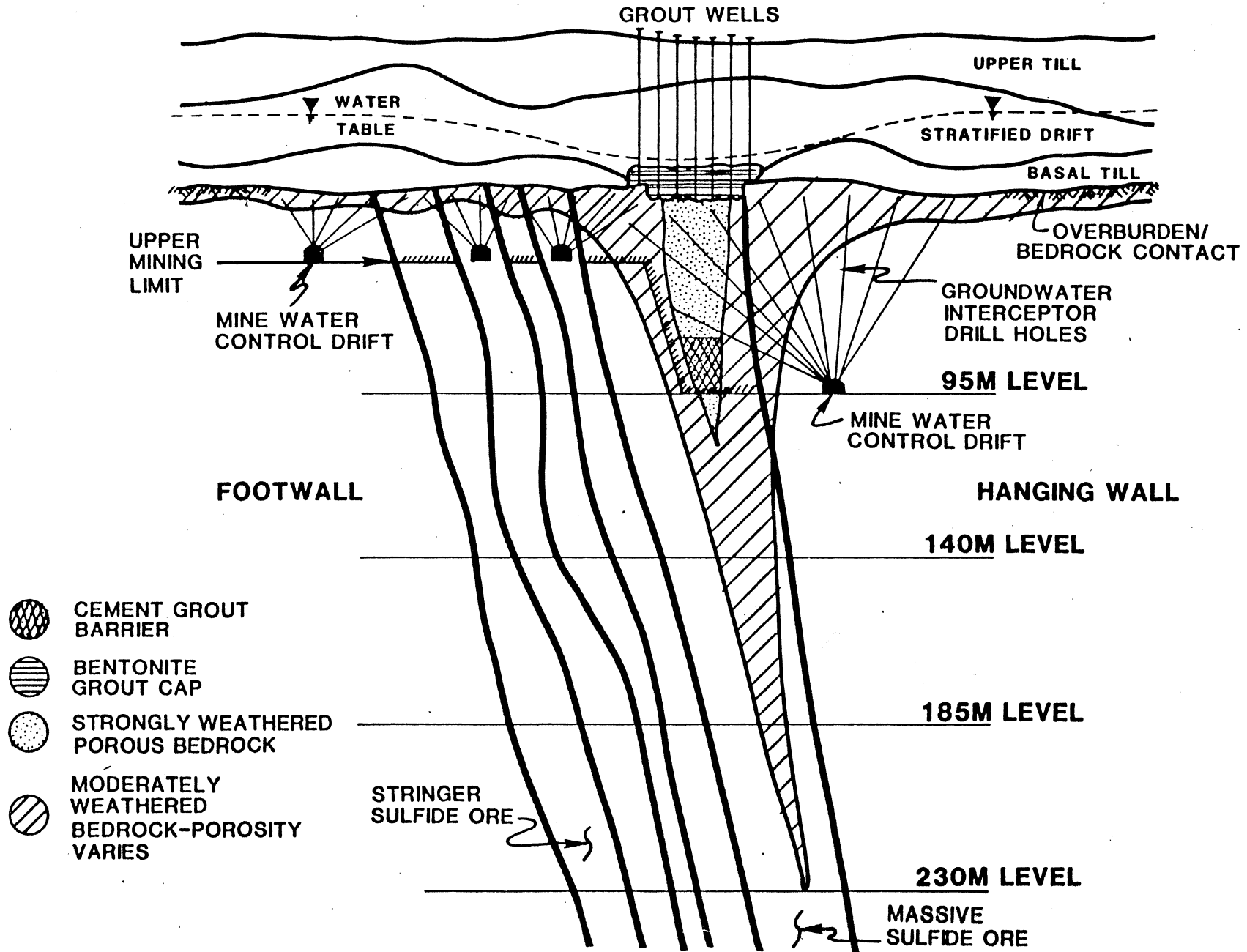
However, the disruptive effects of excess mine water are well known and prudent mine plans will therefore include contingency measures. For the Crandon mine there will be several excess inflow contingency options.

EXXON MINERALS CO.

GRANDON PROJECT

MINE INFLOW CONTROL METHODS

(CONCEPTUAL X-SECTION)



First, the excess inflow could be controlled by surface source pumping or inflow path grouting as described in the Kohn Leonoff mine water control methods study (see response to comment No. 60). Secondly, mine pumping systems have been designed for the conservative maximum inflow of 0.126 m³/s (2,000 gallons per minute) employed for site impact modeling, including pumps and shaft columns. Surface surge storage capacity will exist in the reclaim and tailing ponds for temporary handling of excess inflow. The total freeboard volume in reclaim pond R1 alone, for example, is 309,000 m³ (250 acre-feet), or enough for surge of 0.063 m³/s (1,000 gallons per minute) excess mine pumpage and discharge for over 50 days.

Comment No. 63

This section implies that grouting could reduce inflow by 1,000 gallons per minute and that the groundwater interceptor system would also collect 1,000 gallons per minute. What is the theoretical maximum effectiveness of both systems?

Response:

Mine inflow control grouting and uncontaminated ground water interception methods will be employed to the limit of technical achievability and economic feasibility. EIR subsection 1.2.1.2.16 suggests that the practical limits may approach 50 percent for inflow control, and a 50 percent interception rate in the absence of inflow control. Theoretically, inflow control by grouting could be 100 percent effective with application of unlimited resources, and similarly ground water interception success could be greater than stated in the EIR.

Given the geotechnical uncertainties which will remain until mine development begins, a non-numerical statement of intent may be best. There is environmental and economic motivation to reduce the inflow of ground water to the mine, and to avoid mine contamination of as much of the uncontrolled mine inflow as possible.

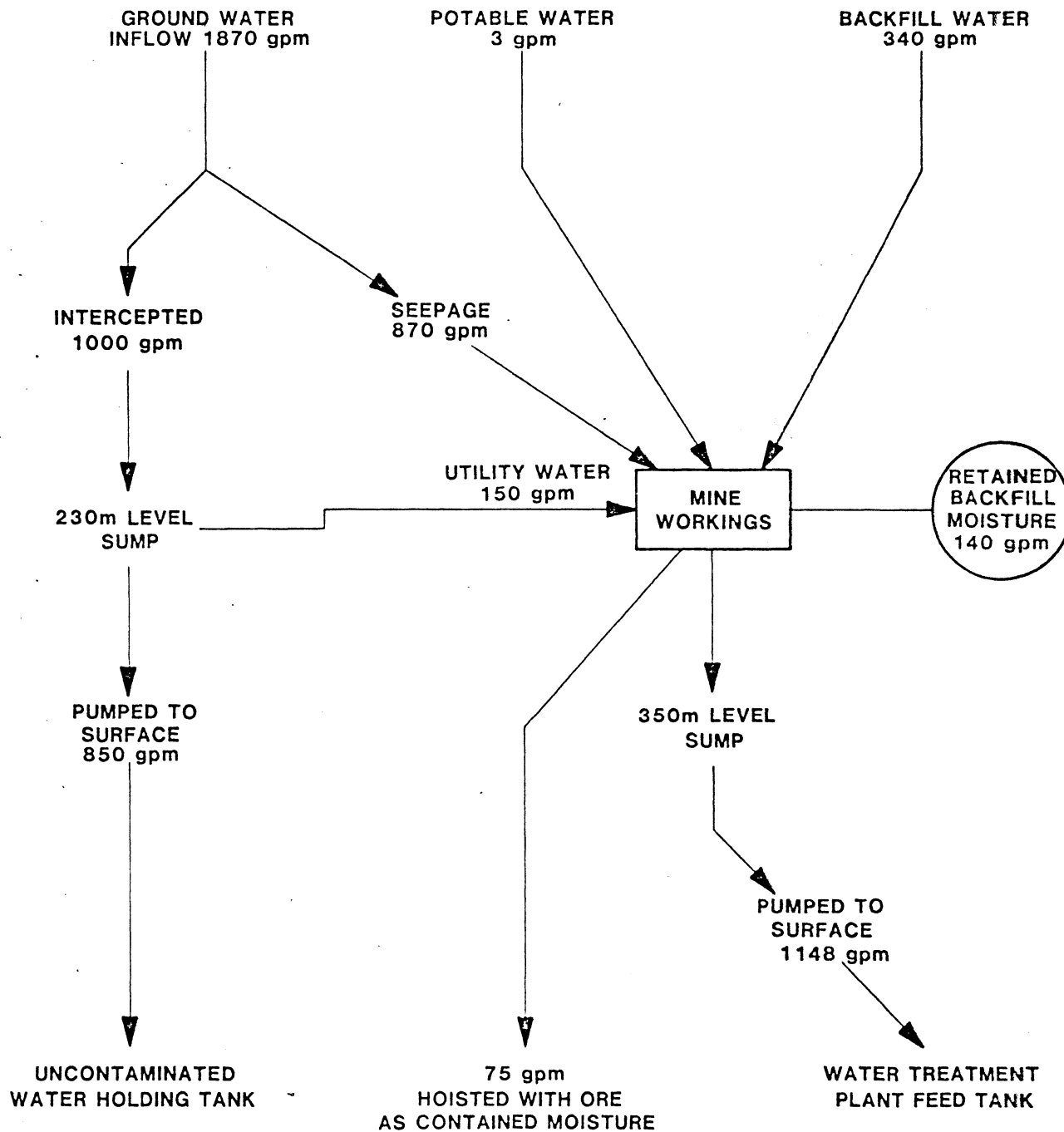
The measurable effectiveness of one system may very well depend upon the success of the other. Reduced mine inflow by grouting might, for example, eliminate flow in a water course amenable to interception. Environmental protection and mine operability will be best served by a practical combination of these proposed techniques.

Comment No. 64

This section should indicate where water from the two collection systems will be routed.

Response:

Discharge from the totally segregated ground water interceptor and mine operations drainage systems will exit the mine in separate main shaft pump columns (see attached figure). The uncontaminated ground water will be directed to a surface storage tank prior to discharge or, if needed, used as mill process make-up water. Mine drainage effluent will be routed to the water treatment plant feed tank for treatment prior to discharge.



(FIGURE FOR RESPONSE TO COMMENT NO. 64)

EXXON MINERALS COMPANY			
CRANDON PROJECT			
MINE DRAINAGE SCHEMATIC			
DATE	STATE	COUNTY	TOWNSHIP
NONE	WISCONSIN		FOREST
PROJECT	DATE	APPROVED BY	DATE
DR SPRINGBORN	9/83		
APPROVED BY	DATE	APPROVED BY	DATE
APPROVED BY	DATE	APPROVED BY	DATE

Comment No. 65

Describe the groundwater collection sumps within the mine and disposition of the settled solids removed from the sump.

Response:

Ground water inflow to the proposed Crandon Mine will be collected in two separate systems. First, an uncontaminated ground water interceptor system will be installed on the uppermost mine level (see also response to comment No. 134)

Ground water seepage that is not contained by the interceptor system will infiltrate the mine workings and ultimately be recovered in the normal mine local level drainage system sumps and piped or drained to the main mine water sumps. These main mine water sumps and pump stations will be located near the main shaft on the 350 m and 780 m levels, and will also receive backfill seepage and used mine utility water.

Normal mine drainage collection will begin on each mine level where flows will be directed to small local sumps excavated in the drift wall. Decant water from the local mine level sumps will be piped or drained through boreholes to the main 350 m or 780 m level sumps. The main sumps will consist of downgrade excavations in the wallrock adjacent to the pump stations. A bulkhead containing the pump station suction pipes will be constructed at the sump outlet.

Since the normal local level mine drainage system pumps will be specified for "dirty" water, the main level sumps will function primarily as pumping reservoirs. However, some settling of solids is expected in the local level and main mine drainage sumps. For this reason, pairs of sumps with front-end loader access will be provided at each mine level transfer point and at the main mine drainage facilities. One sump at each location will then be operated while the other is cleaned. Sump solids will be transported to mined stopes and combined with regular stope backfill.

In the event that additional settling capability is required, a segment of the mine area adjacent to each normal local level mine drainage pump room will be reserved for excavation of a vertical cone settler. Solids discharged from the base of the conical settler would be similarly transported to depleted stopes as backfill.

SECTION 1.2.2, MILL

Comment No. 66

Provide plans and specifications for any equipment used for the storage or distribution of hazardous materials including spill detection and control facilities.

Response:

The plans and specifications for equipment, storage and distribution of hazardous materials, including spill detection and control, will be completed during final engineering. See response to comment No. 70 for available details on design of reagent handling and mixing facilities.

SECTION 1.2.2.1, ORE HANDLING

Comment No. 67

Will there be any need for exterior ore surge piles in the event of system failure? Will there be any surface storage of low grade ores other than at the mine waste disposal facility? How will the preproduction ore laydown area be prepared?

Response:

Study of alternatives for preproduction ore storage has continued since submittal of the EIR. While the EIR proposed preproduction ore storage in the mine waste disposal facility, the current plan proposes storage at the north edge of the mine/mill area. Additional planning of the management of the mine backfill sands has eliminated the need for a temporary backfill sands storage facility allowing the preproduction ore storage area to be located in its place. This ore storage facility would be lined, and drainage will be collected and transported to the plant water treatment system. The liner would be protected either through a separate cover or through careful placement of the initial cover of preproduction ore. Recovery of ore would be managed to leave this protective cover in place throughout the life of the facility.

While this storage facility is planned for the preproduction ore, it could also be maintained (or reactivated) and used as an ore surge storage area.

Comment No. 68

Are the waste waters generated in the ore handling facility and the contaminated runoff generated on the preproduction ore and waste rock storage areas accounted for in the water balance? Provide calculations showing the volume of runoff generated in the 10-year, 24-hour storm event.

Response:

The entire ore handling facility from the mine headframe through coarse ore storage, crushing, fine ore storage, and grinding is completely covered. All conveyor galleries are covered. There will be no contaminated water runoff from the ore handling facility. Any drainage water collected in the coarse ore storage facility will be pumped to the grinding circuits.

The preproduction ore storage area is now planned for the 3.2-ha (8-acre) area just north of the rail tracks (previous backfill storage area). Surface water runoff from this ore storage area will be collected in a 5600-m³ (1,479,520-gallon) sump designed to accommodate the precipitation volume in the area from a 25-year, 24-hour storm event. Water that accumulates in this sump will be pumped to the water treatment plant feed tank.

A 15.6-ha (38.6-acre) area will be allocated in the MWDF area to hold waste rock. A sump will be provided to collect runoff from this area; it will be sized to accommodate a 10-year, 24-hour storm event in addition to one years worth of average net precipitation gain. If necessary, water from this sump will be pumped to reclaim pond R1. The sump will be designed for a capacity of 40,000-m³ (10.6-million gallons).

Calculations

- a) Preproduction Ore Storage; 8-acre; 25-year, 24-hour storm event; 4.2 inches (0.35 ft) of rain

$$8\text{-acre} \times \frac{43,560 \text{ ft}^2}{\text{acre}} \times 0.35 \text{ ft} \times \frac{7.48 \text{ gal}}{\text{ft}^3} = 912,321 \text{ gal}$$

Therefore, the sump near the preproduction ore pile will be sized for 5600-m³ (1,479,520-gallon) capacity which is more than adequate. This water could be pumped to the treatment plant over a 2-week period at a rate of 10.3 m³/h (45 gallons per minute).

- b) Waste Rock Storage; 38.6-acre; 10-year, 24-hour storm event, 3.6 inches (0.30 ft) of rain

$$38.6\text{-acre} \times \frac{43,560 \text{ ft}^2}{\text{acre}} \times 0.30 \text{ ft} \times \frac{7.48 \text{ gal}}{\text{ft}^3} = 3,773,098 \text{ gal}$$

Allowance for 1-year of average net gain in precipitation over evaporation (7.41 inches or 0.62 ft)

$$38.6\text{-acre} \times \frac{43,560 \text{ ft}^2}{\text{acre}} \times 0.62 \text{ ft} \times \frac{7.48 \text{ gal}}{\text{ft}^3} = 7,797,735 \text{ gal}$$

Total requirement of 11.6 million gallons.

The sump near the waste rock storage area will be sized for approximately 40,000 m³ (10.6 million gallon) capacity which is close to the total calculated requirement of 43,800 m³ (11.6 million gallons). This water will be pumped, as necessary, to reclaim pond R1 which has a design volume of 898,938 m³ (237,500,000 gallons), including 308,856 m³ (81,600,000 gallons) of freeboard volume.

SECTION 1.2.2.4, ORE TREATMENT

Comment No. 69

The discussion of the dewatering and storage of thickened concentrate needs elaboration. There is some potential for SO₂ formation and emission from the concentrates during storage. In addition, sulfide mineral concentrates have potential for spontaneous combustion which requires some residual moisture content and control. Please clarify if the concentrates will be stored and located as a filter cake or in some other form.

Response:

The final flotation concentrates produced in the concentrating process will contain 25 to 35 percent solids by weight (i.e., 75 to 65 percent by weight water). These slurries will be pumped to respective concentrate thickeners as the first step in the dewatering process. Overflow from the zinc concentrate thickener will be sent to a tank for direct recycle to zinc flotation. Overflow from the copper concentrate thickener will be sent to the reclaim pond. Overflow from the lead concentrate thickener will be sent to the tailing thickener to take advantage of the added lime for metal precipitation. The thickened underflows from each concentrate thickener will contain 55 to 60 percent solids by weight and will be further dewatered using semi-continuous pressure filters. Laboratory tests on pilot plant concentrates have shown that these types of filters can produce concentrate filter cakes with residual moisture levels of 8 to 12 percent by weight. Filtrate from the filters will be recycled to the concentrate thickeners. Moisture levels much below 8 percent cannot be achieved by filtration. There will be no drying of concentrates using gas-fired kilns.

The cake discharge from the filters is friable, can be transported on a conveyor, and is non-dusting in nature. The filter cake will be loaded directly into railcars or can be stored beneath the filters, if required. At moisture levels of 8 percent, the concentrates will not undergo spontaneous combustion to yield sulfur dioxide.

SECTION 1.2.2.5, REAGENT STORAGE AND MIXING

Comment No. 70

Provide detailed plans and specifications for this facility and its equipment with an emphasis on spill control, containment and emission control. Describe the segregation of noncompatible reactive reagents, dusts, vapors, and gases.

Response:

Detailed design of the reagent storage and mixing facilities will be completed during final engineering. Preliminary drawings of these facilities are presented in Attachment No. 6 (Drawings No. 051-6-G-008 and 051-6-G-009). These facilities are described as follows:

Reagent Facilities Description

The reagents are received by either truck or railcar; there are three unloading areas:

- 1) Lime, soda ash, and sulfuric acid will be received on the inside plant track immediately north of the filter area shown on drawing No. 051-6-G-009, which will also be used intermittently to handle lead concentrate cars. These reagents are used in the water treatment plant and the track and storage tanks for lime and soda ash are shown on drawing No. 051-6-G-008.
- 2) Sulfur dioxide, frothers, and sodium dichromate will be received on a railroad spur entering the center of the mill building (drawing No. 051-6-G-009). Sulfur dioxide is used directly in the process and there is no intermediate storage. The frothers and sodium dichromate storage tanks are contained in a bermed area with blind sumps which may be used to return spillage to the respective tank by pump. The frothers and sodium dichromate are pumped from the storage tanks to intermediate mix tanks in the reagent preparation building (drawing No. 051-6-G-009). From the mix tanks, these reagents and most others are pumped to the day tanks above the control room. The reagent preparation tanks are isolated by berms and blind sumps. Overflows and the floor drains for the day tanks drain to the reagent preparation area blind sumps.
- 3) Drums, bags, and returnable bins will be delivered by truck at a loading dock at the front of the reagent storage building. These bagged and drummed reagents will be mixed to make solutions in the reagent preparation area using the mix tanks. The solutions will then be pumped to the respective day tank.

The berms that are shown in the reagent storage, mixing, and day tank areas are provided to isolate noncompatible or dissimilar reagents. Similar reagents such as all xanthates will be contained together since they are chemically and functionally compatible. Noncompatible reagents will be isolated spatially as well as with berms. Sodium cyanide is therefore not unloaded or stored near acids nor will acids be stored near strong caustics. The berms will be designed to contain a total spill from a single tank of similar reagents. The blind sumps will generally be used to return spilled reagents to their respective tank.

Dusts will be minimal in the reagent preparation building. Personal breathing protection will be provided as needed for workers in these areas. The reagent dusts encountered will primarily be in the lime and soda ash unloading, slaking and mixing areas. Drawing No. 051-6-G-008 shows this area and indicates the dust collectors used. There is an insertable dust collector provided with the unloading and storage silos in both cases.

Gases will be removed from the enclosed reagent preparation area by a ventilation system. The reagent preparation area and the day tank area will be equipped with alarms for hydrogen sulfide and hydrogen cyanide.

The reagents which are particularly noncompatible include sulfur dioxide, sodium cyanide and sodium sulfide. To avoid the mixing of sulfurous acid (results when SO₂ contacts water) with these or other reagents, SO₂ will be stored outside the concentrator building in two tanks. The liquid SO₂ will then be piped into the SO₂ distribution system.

Frother compounds that have fairly high vapor pressure (e.g., MIBC) will be stored in a tank outside and pumped in as needed for mixing.

Special Criteria

The attached table shows storage capacities, shipping mode, and other reagent receiving and storage data. The following criteria will be included in the reagent area design.

- o Adequate ventilation.
- o Sodium cyanide will be received in 1362 kg (3000 pound) Flo-Bins™ which are returnable.
- o Storage and mixing requirements for each reagent have been determined. Where feasible, the preferred system will be a mixing tank and a day tank. The day tanks merely store mixed reagents for distribution to the flotation circuit. Suggested capacity of the day tank is 32 hours of operation.
- o Maximum storage for xanthate solutions is 4 days. All xanthate mixing and storage tanks will have sloping bottoms with drains for cleaning at the low point. Solution removal for process use will be at a height of 15.2 cm (6 inches) above the point where the sloping bottom begins.
- o Xanthate tanks will have a forced air exhaust to remove any carbon disulfide.
- o All reagents received in solid form will have mixing and storage tanks designed like xanthate tanks.
- o Explosion-proof motors, light fixtures and conduit will be used.
- o Emergency eye wash, shower facilities, and other necessary first aid equipment will be included in the reagent area design.
- o Special consideration will be given to materials selection for each reagent system to guard against corrosion.

(Table for response to comment No. 70.)

REAGENT RECEIVING AND STORAGE DATA

Page 1 of 2

Chemical	Receive By	Monthly Consumption (Pounds)	Shipment Size	Unit Size	Form	Storage Capacity
Sulfur Dioxide SO ₂	Tank car	205,000	60,000 or 100,000 lb	30 ton	Liquid	150,000 lb
Copper Sulfate CuSO ₄ ·5H ₂ O	Railcar	216,300	100,000 lb minimum	100 lb bag	Granular	300,000 lb
Sodium Cyanide NaCN	Truck	13,200	36,000 lb	3,000 lb	Briquette	36,000 lb
Dowfroth 250	Truck	18,100	40,000 lb	Truck	Liquid	50,000 lb
Sodium Sulfide Na ₂ S·9H ₂ O	Railcar	150,200	80,000 lb minimum	400 lb drum	60% Flake	230,000 lb
Xanthates	Truck	42,100	40,000 lb	300 lb drum	Pellet	63,000 lb
Zinc Sulfate ZnSO ₄ ·7H ₂ O	Truck	36,000	24,000 lb minimum	50 lb bag	Granular	54,000 lb
CMC-7LT	Truck	16,900	25,200 lb minimum	50 lb bag	Powder	30,000 lb
Sodium Dichromate Na ₂ Cr ₂ O ₇ ·H ₂ O	Truck	30,100	78,000 lb minimum	8000 gal	Liquid	12,000 gal
	Tank car	(8000 gal)				

Note: Ton in this table is short ton (2000 lb).

(Table for response to comment No. 70 [continued].)

Page 2 of 2

Chemical	Receive By	Monthly Consumption (Pounds)	Shipment Size	Unit Size	Form	Storage Capacity
Sodium Silicate Na_2SiO_3	Tank car	90,100	117,000 lb (10,000 gal)	10,000 gal	Liquid	15,000 gal (175,500 lb)
Carbon	Railcar	48,100	24,000 lb minimum	50 lb bag	Powder	75,000 lb
MIBX	Tank car	24,100	40,000 lb minimum 6,000 gal	6000 gal	Liquid	12,000 gal
Lime CaO	Rail	1,100,000	190,000 lb minimum	Railcar	Pebble	2,640,000 lb
Soda Ash Na_2CO_3	Railcar	523,000	200,000 lb minimum	Railcar	Powder	750,000 lb
Sulfuric Acid H_2SO_4	Truck	76,300	45,000 lb	Tanker	Liquid	67,500 lb
HMP	Truck	6,500	No minimum	100 lb bag	Granular	7,000 lb
Flocculant	Truck	31,200	34,000 lb minimum	Tanker	Liquid	40,000 lb

Note: Ton in this table is short ton (2000 lb).

- o Sodium dichromate will be received by tanker truck in a saturated liquid form (69 percent sodium dichromate by weight). Adequate inline heating will be provided to prevent freezing in winter conditions. Sodium dichromate could also be received in solid form if necessary.
- o In addition, the reagent distribution to the plant processes has been described in the response to comment No. 183. Further information concerning the nature of these reagents is provided in response to comment No. 186 and the responses to comments No. 71 and 72.

Comment No. 71

Many of the reagents will be hazardous materials. Exxon will be required to comply with NR 181 and RCRA in regards to storage and disposal of these materials. How long will storage of chemicals and reagents not meeting specifications be necessary before disposal? The facility may require a hazardous waste storage license. Please provide a mass balance study to indicate the reagents used and their expected concentrations in the various waste systems.

Response:

Reagent handling and storage will meet MSHA and other appropriate regulations. Reagent storage is discussed in more detail in EIR subsection 1.4.3.7, Reagent Receiving, Storage, and Use, and in the response to comment No. 70.

Chemicals or reagents that do not meet specifications will be returned to the vendor if they cannot be used in the mill. A list of expected mill reagents is presented in EIR Table 1.2-5, in subsection 1.2.2.5. The expected concentration of reagents in the streams exiting the mill cannot be calculated because of the following:

- 1) Reagents will chemically interact among themselves and with the ore slurry, and thus will be precipitated, adsorbed on ore surfaces, or chemically altered. For example, copper sulfate is added to activate the surface of the zinc sulfide mineral, sphalerite, by formation of copper sulfide. Thus free or elemental copper is no longer present in solution.
- 2) Most flotation reagents, except lime and sulfuric acid which are used for pH control, are added at "starvation" concentrations. This is not done just to be economical, but to achieve the desired selectivity in the preferential flotation of one sulfide mineral versus another. The net result of this is that very little reagent that is initially added in a particular mill circuit is left in solution.
- 3) Different reagents are added to different circuits within the mill, as indicated in Figure 4 in Section VII, "Crandon Water Balance" from the CH2M Hill Phase III Water Management Study Report, December 1982 (previously provided to the DNR). There is also extensive recycle internal to mill circuits and between mill circuits. This makes reagent mass balance and concentration calculations nearly impossible.

However, to put the concentration of reagents in the streams exiting the mill into perspective, keeping fully in mind the above mentioned severe limitations, let us consider the mill as a single big mixing tank. Water, 1,340 m³/h (5900 gallons per minute); ore, 398 t/h (439 short tons per hour); and all the reagents are being added together, enabling one to mathematically calculate the average concentration in the water/slurry streams exiting the mill. Four different streams exit the mill as depicted in EIR Figure 1.4-18, "Overall Water Balance - Mature Operations"; copper concentrate thickener overflow, 66 m³/h (290 gallons per minute); lead concentrate thickener overflow 13 m³/h (57 gallons per minute); lead feed thickener overflow 13.5 m³/h (59 gallons per minute); and zinc tailings 1,169 m³/h (5146 gallons per minute). All of these streams directly or indirectly (via tailings pond) go to the reclaim pond.

Reagent consumption as kilograms per tonne of mill feed is given in Table 3.17 "Reagent Types and Estimated Quantities for Use in Production of Concentrate" in the Mine Waste Disposal Facility Feasibility Report, page 3-35. The water to ore ratio as feed to the mill is 1340 m³/h (5900 gallons per minute) to 398 t/h (439 short tons per hour) or 3.36 m³ (806 gallons per short ton) of water per tonne of ore. Thus for each 1.0 kg of reagent per tonne of mill feed (2.2 pounds per short ton), the streams exiting the mill will on the average contain 0.3 kg/m³ or 300 mg/l (ppm) of reagent assuming no adsorption of reagents on mineral surfaces.

To illustrate this further, bearing in mind the above mentioned limitations of this approach, for example, sodium ethyl xanthate is added at a dosage rate of 0.03 kg/t (0.06 pounds per short ton). Thus the mill effluent would on the average contain 0.01 kg/m³ or 10 ppm as a maximum concentration assuming no interaction with the ore slurry. Zinc is added as zinc sulfate hydrate, ZnSO₄·7H₂O, at the rate of 0.06 kg/t (0.12 pounds per short ton). Thus the effluent would contain 20 ppm of zinc sulfate hydrate, which equates to 4 ppm of zinc (again, assuming no other interactions take place).

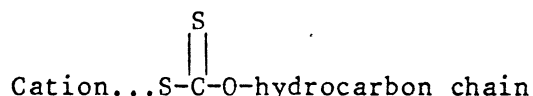
Comment No. 72

Table 1.2-5 describes "typical" reagents. Will other unlisted reagents be required? Some of the reagents listed in Tables 1.2-5 and 1.2-6 are not adequately described chemically. Please define xanthates, flocculents, dewatering aid, and "other xanthates."

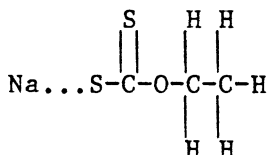
Response:

The reagents shown in Tables 1.2-5 and 1.2-6 of the EIR are essentially the reagents that have been used in the process development testing for the Crandon Project. These reagents are "typical" in the sense that they are commonly used in the treatment of ores of this type. If pilot plant and actual plant testing shows other reagents to be more beneficial to the process, they might be incorporated into the process.

The xanthates are a group of flotation collectors which have the following general chemical structure:



For example, sodium ethyl xanthate is one of the xanthates used for Crandon ore:



Xanthates with different hydrocarbon chains that might be used include potassium amyl-xanthate and sodium isopropyl xanthate. "Other xanthates" which have commonly been used in treating similar ores might be tested in the pilot plant and ultimately used in the flotation process.

Flocculents are generally organic polymers which are commonly used to flocculate fine suspended ore particles so that they settle faster in thickeners and thus enhance clarity in the thickener overflow. They are generally used in extremely low dosages, typically 15 to 50 g/t (0.03 to 0.1 pound per short ton of ore). Although a particular polymer has not been identified for use at Crandon, the polymer used would be one of the flocculents in general use by mining and other industries. A typical polymer is a polyacrylamide.

Dewatering aids are chemicals usually used to lower the surface tension of water and/or flocculate mineral particles so that they can be filtered more easily. The mining industry uses these chemicals to aid in filtration of concentrates. They are generally similar chemically to those reagents used by car washes during rinse cycles to prevent hard water spots. A particular dewatering agent has not been identified for Crandon, nor has the absolute need for a dewatering aid been established.

SECTION 1.2.2.6, CONCENTRATOR CONTROL ROOM

Comment No. 73

All remote environmental monitoring equipment should be described here or under the appropriate section.

Responses:-

The concentrator control room will not have any connections to remote environmental monitoring equipment. Any such equipment will be monitored in the environmental laboratory in the concentrator building. The specifics of any such design will be related to the Monitoring and Quality Assurance Plan and completed with final design engineering.

The response to comment No. 96 provides additional information about the environmental laboratory facilities.

SECTION 1.2.2.8, TAILING THICKENING

Comment No. 74

Provide details and diagrams describing the equipment, overflow rates, separation efficiencies, etc.

Response:

Thickeners are basically sedimentation or settling devices. A dilute slurry is fed at the center feed well of a large circular vessel. The solids settle towards the bottom while clear water overflows along the periphery of the vessel. The settled solids are withdrawn from the bottom of the vessel as a thick slurry. The feed rate, diameter of the vessel, and flocculents, if used, are all factors that affect the performance of the thickener. Generally, thickeners are easy to operate and are not mechanically complex.

For the Crandon Project, we estimate the feed stream will contain an average of 3667 t/d (4043 short tons per day) of solids with a total pulp volume of 1993 m³/h (8777 gallons per minute). The solids content in the feed slurry will be 7.3 percent by weight. After settling, we estimate the thickener underflow to contain 55 percent solids by weight at a flow rate of 172 m³/h (756 gallons per minute). The thickener underflow is collected in a sump and transported by pipeline to the MWDF.

The thickener overflow at 1822 m³/h (8022 gallons per minute) contains a small amount of solids, approximately 100-1000 ppm by weight. A portion of this water is recycled to the backfill cyclone process directly (as make-up water) and the remainder is recycled via the reclaim ponds.

SECTION 1.2.2.9, CONCENTRATE HANDLING AND LOAD OUT

Comment No. 75

Provide information regarding the design of the covered railcars and/or trucks to be used for concentrate shipping.

Response:

The railcars to be used to transport concentrate are open top, rectangular cars commonly called gondola cars. They have a steel bed and sides which will completely contain the concentrate without spillage. After loading, the cars will be covered with a plastic cover made especially for this application. These covers are commonly used for this application. Trucks will not normally be used; however, if they are required, they probably would be 18.1-t (20-short ton) semi-trailer type dump trucks covered with plastic similar to that mentioned above.

Comment No. 76

Approximately eight days production storage for each concentrate is specified here while on page 1.4-5 and in Table 1.4-2, ten-day storage is indicated. Which figure is correct? The planned eight- or ten-day storage capacity does not allow much flexibility in the event of extended storage

transportation or market problems. What alternatives are available other than mill shutdown?

Response:

The correct figure is 2 days storage for copper and zinc and 10 days for lead concentrate and the EIR will be revised accordingly. Earlier plans called for a total of 10 days storage with 2 days in bins and 8 days on the floor beneath the bins.

Discussions with officials from the Soo Line Railroad indicate that the history of rail service in the area has been extremely reliable. Therefore, the probability of an extended transportation problem occurring is low. The 2-days storage capacity available for copper and zinc concentrates along with storage capacity in available railcars should be adequate to prevent shutdown of the plant during the day or two that the railroad cannot supply cars due to a weather-related problem. Currently, there is an oversupply of gondola cars and this situation is not expected to change in the near future.

Severe market problems would likely force a temporary shutdown of the Project regardless of the amount of storage capacity available.

If railcar availability were to become a problem and the planned concentrate storage capacity was inadequate, more covered storage area would be planned and a permit application for the Project site would be made.

SECTION 1.2.2.10, SPILL CONTROL FACILITIES

Comment No. 77

Where could recovered reagents be disposed?

Response:

There should be no disposal of reagents. Recovered reagents will be collected in such a manner to assure that they can still be used as intended. Reagent storage and preparation facilities will be designed with the criteria that any spills are to be contained for recovery and use.

SECTION 1.2.2.12, BACKFILL TRANSPORT, STORAGE AND RECLAIM

Comment No. 78/79

Provide detailed plans and specifications for the backfill storage area, including the bottom liner, water decant system, ancillary facility, and backfill recovery equipment. Construction of the storage area will also need to be addressed. Describe how backfill sands will be reslurried, how the liner will be protected, and how the equipment listed on Table 1.2-4 will be used.

Will surge tanks be provided for containing the contaminated run-off prior to use in the backfill preparation facility? If not, run-off could become highly contaminated while residing in the backfill pile. Would this affect its use in backfill preparation?

Response:

It was originally the intention to store a total of approximately 150,000 t (168,000 short tons) of cycloned tailings sands on a pad located immediately north of the mine/mill site. Cyclone sandfill material would be routed to this storage area when the mine is unable to accept backfill for any reason. Sands would be reclaimed from the storage area as stopes become available for backfilling.

A reappraisal of the mine plan and the stope development sequence has indicated that there is no longer a need to provide large volume surge storage capacity for backfill sands. As a result, this facility has been eliminated and all backfill material handling will be totally within the confines of the concentrator building.

Under the present concept, cycloned tailing sands produced continuously during the milling operation will be mixed with a cement slurry and pumped directly into the mine. Storage capacity for a total of approximately 18,000 t (20,000 short tons) of backfill sands will be provided in concrete storage bunkers. Reclaim from the bunkers will be by monitor jets which will wash the sands into a pump sump. A pump will transfer the sand-slurry to a repulping tank for settling, adjustment of percent solids, and direct transfer to the mine. Decant water from the repulping tanks will be pumped to the monitor jets providing a totally closed no-loss system.

It is now the intention to utilize the area previously designated for storage of backfill sands as an area for storage of preproduction ore. During the 18-month period prior to mill start-up, a maximum of 1,000,000 t (1,120,000 short tons) of uncrushed ore will be accumulated in the storage area. This material will be fully consumed during the early years of mill operation.

The storage area will be cleared and grubbed and then rough graded to provide drainage toward the northwest. The area will be lined with a bentonite modified soil mixture protected by a layer of crushed waste rock.

A ditch will be provided to collect rainwater runoff from the stockpile and to conduct the water to a concrete sump. The ditch and sump will be sized to provide sufficient storage capacity to retain the full storm runoff, based upon a one in 25-year storm developing 106.7 mm (4.2 inches) of rainfall in 24 hours. A pump will return the runoff water to the plant process water system or to the water treatment plant as appropriate.

SECTION 1.2.2.13, CONCRETE BATCH PLANT

Comment No. 80

Describe plans for concrete preparation prior to completion of the permanent batch plant. Discuss the quantity of aggregate needed during various construction and operation phases and the availability of suitable aggregate on-site and off-site. Could waste rock or reclaimed cobbles be used? Will the batch plant include aggregate crushing, screening and washing facilities? If so, describe the disposal of aggregate wash water. Why will the batch plant be needed after the mill is constructed?

Response:

Preliminary studies have indicated that concrete requirements during the construction phase will probably be obtained through a local supplier who would erect a temporary batch plant within the confines of the mine/mill site. Aggregate supply for the concrete would be the responsibility of the concrete supplier. Based on the quantities of aggregate required, the supplier would probably set up a gravel plant as close to the mine/mill site as he could arrange.

During the construction phase a total of approximately 38,000 m³ (50,000 cubic yards) of concrete will be poured. This volume of concrete will require an almost similar quantity of aggregates. A peak daily rate of approximately 600 m³/d (783 cubic yards per day) is estimated for a limited period in 1987.

During operations the requirements for concrete decrease to approximately 1700 m³/y (2,200 cubic yards per year) and a maximum daily requirement of approximately 23 m³/d (30 cubic yards per day). It is now anticipated that no permanent batch plant will be required and concrete will be trucked from an off-site supplier.

SECTION 1.2.3, WASTE DISPOSAL FACILITY

Comment No. 81

The feasibility report states that the waste disposal facilities will cover 500 acres including the embankments while this section indicates that the four tailing ponds will have a total surface area of 500 acres inside the pond crests. What is the total area of the ponds as measured from the outside toe of the dikes?

Response:

The total surface area of the four tailing ponds within their crests is approximately 161.2 ha (403 acres). The total area of the ponds to the outside toe of the dikes is approximately 202.2 ha (505 acres).

SECTION 1.2.3.1, WASTE ROCK TRANSPORT AND STORAGE

Comment No. 82

Will surge piles be needed for waste rock and preproduction ore during the construction phase? Will roads at the dump sites contain high sulfide materials which could be released by traffic? Will the large diameter waste rock contain enough fines to adequately fill the voids between rocks and prevent piping of cover material in the pile? Will surface crushing of waste rocks be required to provide riprap material during the construction phase? Will the haul road be directly on top of the liner?

Response:

Surge piles will not be required for either waste rock or preproduction ore in the MWDF. Waste rock will be delivered and placed directly into the storage area at the MWDF. Preproduction ore will be stockpiled at the mine/mill site.

Haul roads at the dump sites (MWDF) will be constructed from crushed rock product obtained from an off-site supplier and will not contain high sulfide concentrations.

Large diameter waste rock up to 0.6 m (2 feet) in diameter will only be produced during the first 3 years of mine development after which time underground crushing will be employed, limiting maximum waste rock size to 152 mm (6 inches) in diameter or less. The larger diameter waste rock will be placed at the base of the waste rock disposal area and subsequently overlain with the finer crushed waste rock. The predicted waste rock gradation when compared to the average gradation of the local till is such that a piping ratio of less than five can be calculated. The piping ratio is

$$\frac{D_{15} \text{ (filter)}}{D_{85} \text{ (protected soil)}}$$

where D_{15} is the sieve size opening in mm which 15 percent of the mass of the filter (waste rock) passes through and D_{85} is the sieve size opening which 85 percent of the mass (till) passes in a standard gradation test (Cedergren, H.R., 1977, Seepage, Drainage and Flow Nets, John Wiley and Sons, p. 181). Large hydraulic gradients within the till cover are not anticipated; consequently, piping should not be a problem.

Surface crushing of waste rock will not be required to produce rip-rap during construction. Rip-rap will be developed from uncrushed waste rock.

Haul roads will not be constructed directly on top of liners. All liner areas in the MWDF will be suitably protected by the overlying drainage blanket layer and till filter zone.

SECTION 1.2.3.2, WASTE ROCK DISPOSAL AND PREPRODUCTION OR TEMPORARY STORAGE

Comment No. 83

Specifically discuss how the integrity of the liner will be protected during placement and reclamation of materials. How will the preproduction ore be separated from the waste rock and removed without damage to the liner?

Response:

Placement of waste rock in the MWDF will be on a prepared surface composed of the underdrain system and liner. Rock placement should not affect the liner which will be adequately protected by the overlying drainage and filter zones.

Waste rock to be temporarily stored in the MWDF will be in the upper portions of the pile as shown on Figure 1.2-10 of the EIR and should not impact the liner during waste rock recovery.

Continuing study of mine/mill operations has eliminated the need for mine backfill stockpiling. Preproduction ore will now be stockpiled in the mine/mill area rather than the MWDF.

SECTION 1.2.3.3, TAILING TRANSPORT

Comment No. 84

Provide detailed plans and specifications for the construction, operation, and maintenance of the transport system. (1)Describe the specifications (ASTM, etc.) which the High Density Polyethylene (HDPE) pipes should meet. (2)Indicate the types of pipe strength and pressure ratings which will be selected and (3)what types of trenching or backfill conditions will be used. Describe items such as resistance to crushing for a design overburden and live load, soil types used for trench and backfill, (4)resistance to collapse in a vacuum situation, and (5)ability to resist damage either from blockage by settled solids or by pipe freezing. (6)Discuss the pipeline installation, leak detection and repair, necessity for redundant pipe, and storage or disposition of water drained from the pipe during normal pump maintenance or loss. (7)Describe measures which will be taken to prevent groundwater contamination in the event of a pipeline failure. (8)Specify capacity for each pump for each of three pipeline systems.

Response:

- (1) The pipe will be fabricated from an extra-high molecular weight high density polyethylene. This material has been selected on the basis of its resistance to abrasion and corrosion. It is not attacked by chemicals in the soil and it does not support the growth of, and is not affected by, algae, bacteria and fungi.

Typically, for the HDPE pipe envisaged, the physical properties of the material would be tested according to the following ASTM procedures:

Density: ASTM D 1505
Tensile Strength: ASTM D 638
Impact Strength: ASTM D 256
Hardness: ASTM D 2240
Long-Term Strength: ASTM D 2837
Stress Life Testing: ASTM 1598

- (2) The pipe material will be high density polyethylene rated for 1725 kpa (250 psi) internal design pressure. In drawing No. 051-1-PSI-002, (see report "Tailing Slurry and Solution Transport Pipeline Systems" by Pipeline Systems Incorporated 1982; previously provided to the DNR), the hydraulic gradients proposed for the system are identified. It can be seen, especially in the case of the tailing transport line that the rated allowable pressure is well above the expected pipeline pressures. For the tailings line, it is proposed to use a wall thickness of 36.8 mm (1.45 inches) and an internal diameter of 199 mm (7.85 inches).

Inspection of the hydraulic gradient data for the other pipe systems shows that, in each case, the pipe is specified to sustain an operating pressure considerably in excess of the expected pressure.

- (3) Tailings pipelines and other pipes handling process water will be buried at a depth of 1.83 m, (6 feet) below ground to avoid damage by freezing or external hazards.

The trench will be generally as shown in the pipeline installation sketch shown in the report by PSI, Inc. The trench will be over-excavated by 150 mm (6 inches). The trench volume below the pipes will be backfilled with sand, gravel or other select material to support the pipe. Generally, the pipe bed material will be free of rock greater than 12 mm (0.5 inch) in size and will contain no jagged or soft rock.

After the pipe has been laid, it will be surrounded with compacted sand, gravel, or other select material and then backfilled with glacial till derived from trench excavation. Backfill will be compacted to about 85 percent Proctor density (ASTM 698).

When a pipe is buried, it is subjected to external loads such as soil pressure and the pressure of surface loads. The performance limits due to internal pressure are related simply to hoop tension in the pipe wall. The performance limit due to external pressure could be wall crushing, wall buckling, or ring deformation depending on the applied loads, and the physical properties of the soil and the pipe. These aspects of pipe design will be considered in final engineering.

Instrument cable will be buried with the pipe. The cable will be used as a metal source for pipeline locating instruments.

- (4) Because the tailings ponds embankment berms are at a higher elevation than the pumping station and the discharge of tailings to the lower depths of the ponds could create a vacuum in the tailings line, a vacuum breaker will be installed at the high point of the pipeline on the tailings pond berm.

- (5) Because the pipeline is buried it will not be vulnerable to deliberate or accidental damage from humans, vehicles or machines. The depth of burial below the frost-line excludes the possibility of freezing. Rodent attack is unlikely at the 1.83 m (6 feet) depth.

Slurry characteristics determined by laboratory penetrometer testwork show that the solids are "soft-settling." In this test procedure a sample of tailing solids and water is prepared and allowed to settle for 24 hours. A penetrometer is placed on the solid-liquid interface. Weights are added to the penetrometer until the tip penetrates the solids and reaches the bottom of the containing vessel. The weight required to achieve penetration under standard conditions is a measure of the resistance of the settled solids to re-slurrying after a pipeline shutdown.

The results of the tests indicated that if the pipeline is shutdown during an emergency, the solids are soft-settling and can reslurry when the pipeline is restarted. During scheduled shutdowns of the pipeline, the solids will be flushed out with water prior to shutdown.

In the event of a sudden blockage of the pipeline, the slurry pumps will not be able to develop the pressure required to rupture the line. The increase in pipeline pressure and decreasing flowrate would activate alarms and the pipeline would be shutdown.

- (6,7) The pipe will be received in 11.6 m (38 feet) lengths. All pipe will be inspected for damage on site. Sections of pipe with cuts or gouges will be cut out and rejected.

Each piece of pipe will be fusion butt welded to form a continuous pipeline from the pumping station in the mine/mill site to the discharge point.

Butt fusion welding involves heating both ends of the pipes to be joined, making contact between the two molten ends and joining them together under pressure. The operation is performed using commercially available equipment designed for this purpose. The equipment is easily transported and may be used at any point along the pipeline during the installation of new pipe or the repair of old pipe. The joint which is formed is stronger than the pipes it joins.

A similar technique will be used to install the reclaim water, thickener overflow water, and decant water pipelines from the tailings ponds.

Buried pipelines are inherently safer than pipelines laid on the surface. They are silent in operation and not visible. Typically, vegetation covers the trenched area within 2 years.

In the event of a pipeline breakage, flowrate monitoring equipment would warn the operator to shutdown the pipeline system. Such an event could be cause for a complete plant shutdown. For the case of a pipeline break at the lowest elevation in the pipeline route the contents of the pipe would drain to the low point. The contents of about a 650 m (2133 feet) length of line would leak from the pipeline. This is equal to a volume of 20.3 m^3 (5363 gallons) of slurry. Because of the low elevation heads, the rate of leakage would be low and little solid material would escape.

Clean-up would require excavation around the leak and the water and tailings would be pumped to the MWDF. Repair would involve the removal of the damaged pipe and welding in new pipe using portable butt welding equipment. The repaired pipeline would be leak tested using water before backfilling and returning the pipeline to normal service.

Spare plastic pipe would be retained in storage for repair purposes.

Pipeline leaks in conventional flanged or mechanically coupled pipelines typically occur at the flanges or in areas of the pipe where sudden changes in direction are necessary. The use of welded plastic pipe eliminates the flange or other connections and reduces the possibility of leakage. Typically, HDPE pipe can be cold bent to a minimum radius of 25 times the pipe diameter. This allows gradual direction changes to be made and reduces the possibility of pipe wall erosion and minimizes the potential for leaks.

(8) The current anticipated capacities of the pumps are as follows:

Tailings slurry pumps	185.2 m ³ /h* (815 gallons per minute)
Reclaim water pumps	1153 m ³ /h (5,077 gallons per minute)
Thickener overflow pumps	1030 m ³ /h (4,535 gallons per minute)

*Includes gland seal water

SECTION 1.2.3.4, TAILINGS DISPOSAL

Comment No. 85

Waste Volumes - More detail is needed on the carbonate sludge and the potential effect it will have when pumped to the tailings ponds. Will the calcium carbonate fines occupy 1 million m³ or will it fill voids which exist in the tailings? Also, why does the Golder Report No. 11 recommend 3 feet of freeboard versus the 5 feet required in the NR 182.11(1)(q)?

Response:

The carbonate sludge is a very fine flocculant precipitate and will have no adverse effect when pumped with the tailings to the ponds. The most recent estimate of calcium carbonate sludge is 250,000 m³ (327,000 cubic yards) as presented in Table 3.1 of the Mine Waste Disposal Facility Feasibility Report. It is expected that the sludge will fill some of the existing voids in the tailings and their actual required storage volume would be somewhat less. However, a conservative estimate of 1 million m³ (800 acre-feet) was used to assure adequate disposal design volume for the MWDF for the carbonate sludge and also for the lesser volume of reclaim pond sludge to be disposed in the tailings pond at completion of operations.

NR 182.11 (1)(q) states that "Sufficient freeboard measured from the...crest shall...contain the 100-year, 24-hour rainfall event... or a minimum of 5 feet...". Golder Report No. 11 calculated the 100-year, 24-hour rainfall event and maximum wind generated waves expected for the ponds. These calculations indicated that a 0.9 m (3-foot) freeboard was sufficient to prevent overtopping of waves for the 100-year, 24-hour rainfall event and accompanying high winds. As such, their recommendation meets the requirements of NR 182.11 (1) (q). However, regardless of the regulation

interpretation, based on the normal maximum tailings pond water levels, freeboard ranges from 2.35 to 3.65 m (7.7 to 12.6 feet).

Comment No. 86

Mine Waste Disposal Facility Location - The discussion of the MWDF location is not correct with regard to water users. There are several users downgradient of the disposal site.

Response:

There are approximately 25 private water wells and 21 Exxon owned residential water wells with the area of hydrological influence from the Crandon Project. Since the MWDF is located over a ground water high, all of these wells would be downgradient from the MWDF. However, all of them lie outside of the compliance boundary and should not be impacted by the MWDF. (See EIR Chapter 4.0, Sections 4.2 and 4.3 and Appendix 4.1A).

Comment No. 87

Soil attenuation should be addressed in greater detail by describing the contaminants likely to be found in the tailings and those which are likely to be attenuated.

Response:

Soil attenuation is specifically addressed in D'Appolonia's Soil Attenuation Study - Final Report, November 1982 (previously provided to the DNR). This report includes information on the attenuation of chemical constituents in tailings leachate from Crandon pilot plant tailings with Crandon site till and drift soils. The tailings leachate composition is given in Table A-3 "Projected MWDF Tailings Pond Seepage Chemistry" in Appendix 4.1A of the EIR. This table is based on the results summarized in Table 3.5-"Summary of pH 2 Leachate, Spiked, Target, Predicted MWDF Tailings Leachate Chemistry, Drinking Water Standards" of the D'Appolonia Soil Attenuation Study. A discussion of tailings leachate preparation was presented in Section 3.2 "Leachate Synthesis, Testing, and Stability," pages 3.9 through 3.15.

The extent to which chemical constituents present in tailings leachate are attenuated is summarized in D'Appolonia's Soil Attenuation Study. Table EX.1 "General Mobility of Leachate Constituents," Page EX.7 of Volume 1. More detailed information is also presented in Table 3.20 "Comparison of Retardation Factors (Rd) Determined by Constant pH Sorption and pH Controlled Permeate Column Tests" of the above mentioned report.

The impact of tailings seepage to ground water is modeled and discussed in subsection 6.6.1, "Groundwater Impacts", pages A58 through A68 of Appendix 4.1A of the EIR. The conclusion of this study was that sulfate was the only chemical constituent of concern because of its relatively high initial concentration in the tailings pond, 2000 ppm, (in chemical equilibrium with gypsum in tailings) and little expected retardation. All other chemical constituents in the tailings leachate were not of concern because of relatively low concentrations (near or below EPA drinking water standards, and/or high retardation factors).

Contaminant transport modeling would indicate that sulfate may enter the stratified drift and move laterally with the ground water after several hundred years, but the average steady state concentration along the compliance boundary is anticipated to be less than the EPA drinking water standards for sulfate or any other chemical constituent.

Comment No. 88

Why does the MWDF design call for 4:1 inside slopes and 3:1 outside slopes when the outside slopes will have to remain stable over a longer period of time?

Response:

The 3:1 outside slopes of the MWDF are conservatively flat for stability and for maintainability. The glacial till soils to be used in the embankments are excellent construction soils and could be placed at steeper slopes if desired. The 3:1 outside slopes were chosen with aesthetic consideration for the reclaimed facility. The 4:1 inside slopes have been chosen primarily for construction considerations of the bentonite-modified soil liner and other seepage control system layers. With these flat slopes, conventional equipment can construct the seepage control system readily and meet required quality control objectives.

Comment No. 89

Provide more detail on the accesses to the MWDF from both the mill and the Woodlawn Siding.

Response:

The attached figures depict the routes from the Woodlawn Siding area to the MWDF and from the mine/mill area to the MWDF.

Comment No. 90

Seepage Control System - As we have indicated to you in the past, we have a number of concerns regarding the feasibility, reliability, and effectiveness of your proposed seepage control system. These issues will be discussed further in the review of your Mine Waste Disposal Facility Feasibility Report.

Response:

Comment acknowledged.

SECTION 1.2.3.5, WATER TREATMENT WASTE DISPOSAL

Comment No. 91

What are the potential market locations for the sodium sulfate? How and with what frequency would it be transported to its destination? Where would the sodium sulfate be disposed if a suitable market is not available?

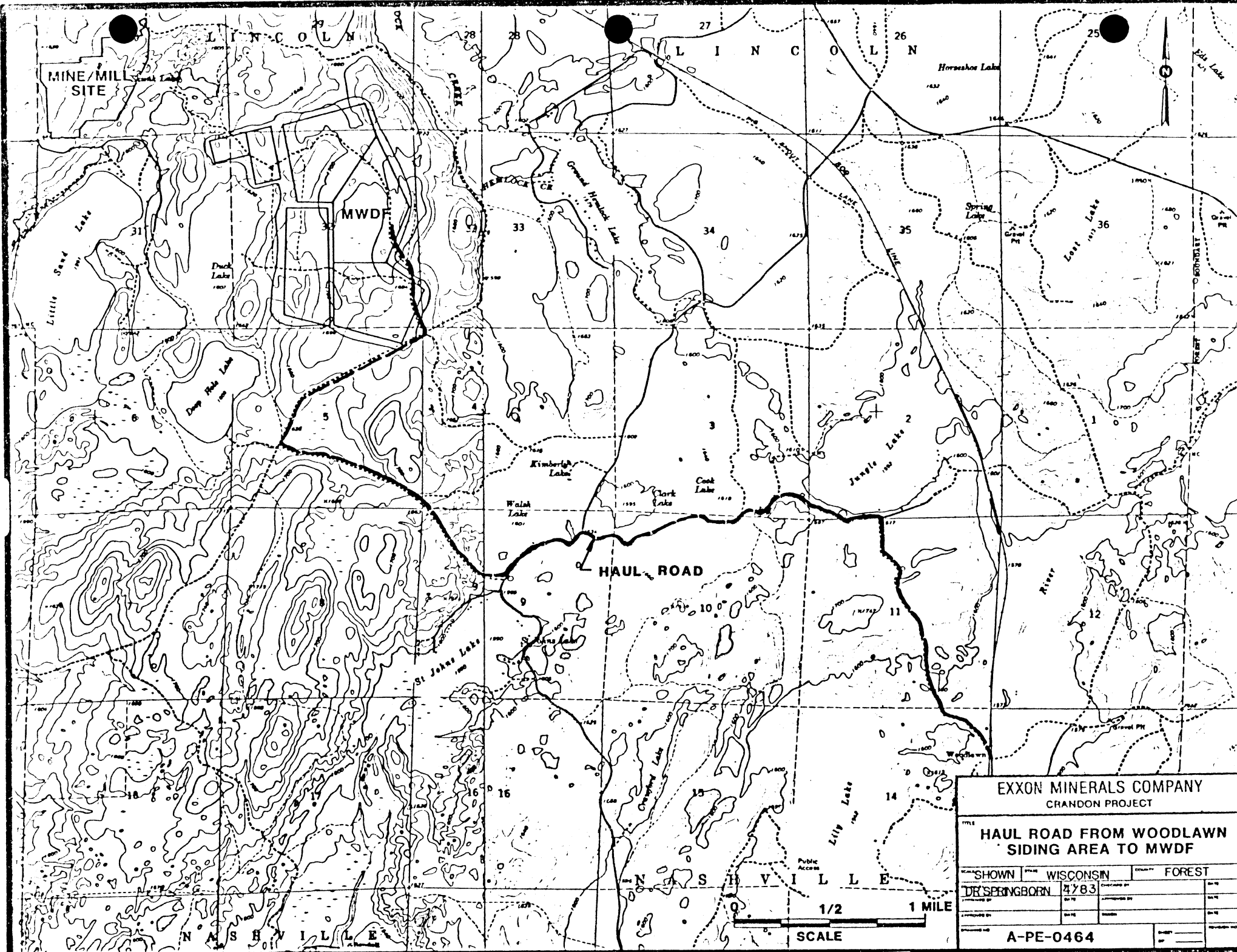
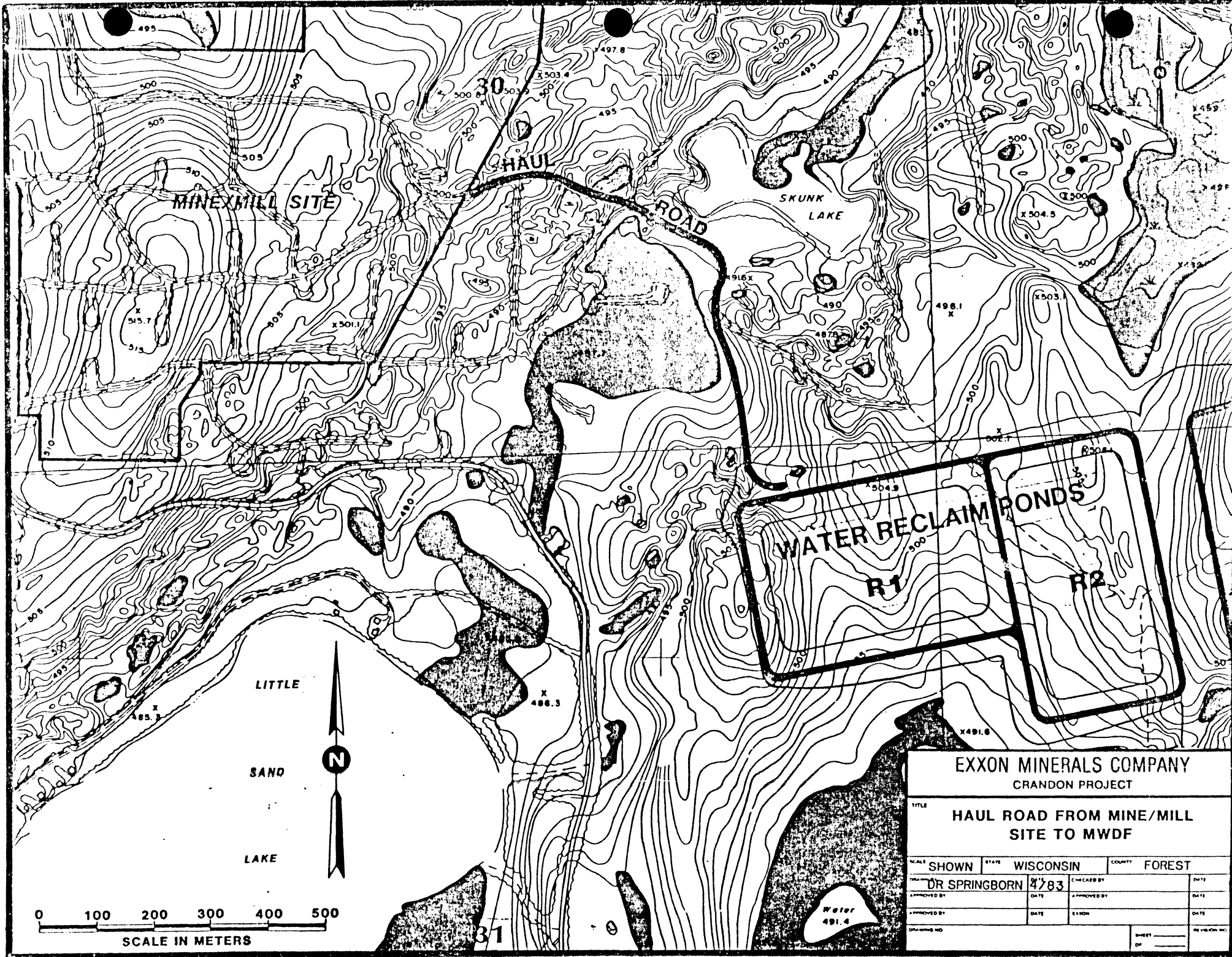


FIGURE FOR RESPONSE TO COMMENT NO. 89)

1-67



(FIGURE FOR RESPONSE TO COMMENT NO. 89)

A-DE-0970

Response:

Sodium sulfate, or salt cake as it is commercially known, is consumed by Kraft pulp and paper mills. Wisconsin has three Kraft pulp mills which consume a total of 29 t/d (32 short tons per day) of salt cake, based on a telephone survey.

Wisconsin Kraft Pulp Mills

<u>Company</u>	<u>Location</u>	<u>Salt Cake Consumption (t/d)</u>
Mosinee	Mosinee	3
Nekoosa	Nekoosa	4
Thilmany	Kaukauna	22*

* 27 t/d (30 short tons per day) of Copeland sulfate (80% Na_2SO_4 , 20% Na_2CO_3) equivalent to 22 t/d (24 short tons per day) of pure Na_2SO_4 .

An additional 20 t/d (22 short tons per day) of salt cake is projected to be consumed by the states of Minnesota and Michigan, and the Canadian provinces of Manitoba and Ontario.

The production of crystallized sodium sulfate from the water treatment plant will range from 0 to 14 t/d (0 to 15.4 short tons per day) depending on the percentage of water being treated by the reverse osmosis/vapor compression evaporation (RO/VCE) units. The frequency of transportation of salt cake to Kraft pulp mills would depend upon the mode of transportation and location of the mill. Assuming approximate 23 t (25 short ton) shipments, then approximately semi-weekly shipments would be required.

Prior to sodium sulfate crystallization (removal of soluble impurities), the nearly saturated sulfate solution exiting the VCE unit is lime neutralized and then clarified to remove insoluble impurities (heavy metals). This post treatment of the VCE brine ensures a marketable salt cake or a non-hazardous secure landfill disposal option.

SECTION 1.2.3.6, RECLAIM POND SLUDGE

Comment No. 92

Describe the method and frequency of sludge removal. Discuss the effect of sludge removal on the reclaim pond liner. Specifically characterize the reclaim pond sludge composition. Discuss the effect of disposing the sludge in the top layers of the tailings ponds and the effects this will have upon placement of final cover.

Response:

A conservative projection of 100,000 m³ (131,000 cubic yards) of reclaim pond sludge has been made for the life of the Project. This estimate is based on the water flow rate passing through the two pond system, the suspended solids in the water, the total Project time, and a sludge density. This volume of sludge can be held in the system with no effect on the operation of the reclaim ponds. Overall it is approximately 8.5 percent of the total operating volume. Divided evenly between the two ponds it would amount to approximately 0.6 m (2 feet) of sediment on the pond bottom.

There will be some difference in the sludges between the two ponds. Reclaim pond R2, the first pond to receive the tailings pond decant and underdrain water, will have sludge predominately of tailings and CaCO₃ precipitates, while reclaim pond R1 will have a predominance of gypsum precipitates from the pH adjustment step between the two ponds. There may also be some metal hydroxide precipitates in pond R1 from pH adjustment.

Aside from the conservative sludge estimates, the operation of the tailings pond decant system offers a degree of control on the clarity of the water returned to the reclaim ponds. Some additional ponding with increased retention time in the tailing ponds could reduce suspended solids in the decant water.

If it would ever be necessary, there are suitable sludge removal methods that would not damage the pond liner while still allowing continued pond operation. A small floating suction dredge with depth control on the suction head could be used. In practice, a small depth of sludge (0.3 m [1.0 foot]) would not be removed to maintain an additional layer over the liner. Specific disposal details for the sludge have not been determined, but are not expected to present any problems. If the estimated 100,000 m³ (131,000 cubic yards) of sludge were distributed evenly over the final tailings surface of pond T4, the depth of sludge would be approximately 0.25 m (0.8 foot). Since there are no crucial timing constraints on reclamation of pond T4, there will be ample time for proper management of the sludge through drying or blending with tailings or cover soil. The sludge could also be incorporated into the thick till grading layer planned as the first step in reclamation of the tailings pond.

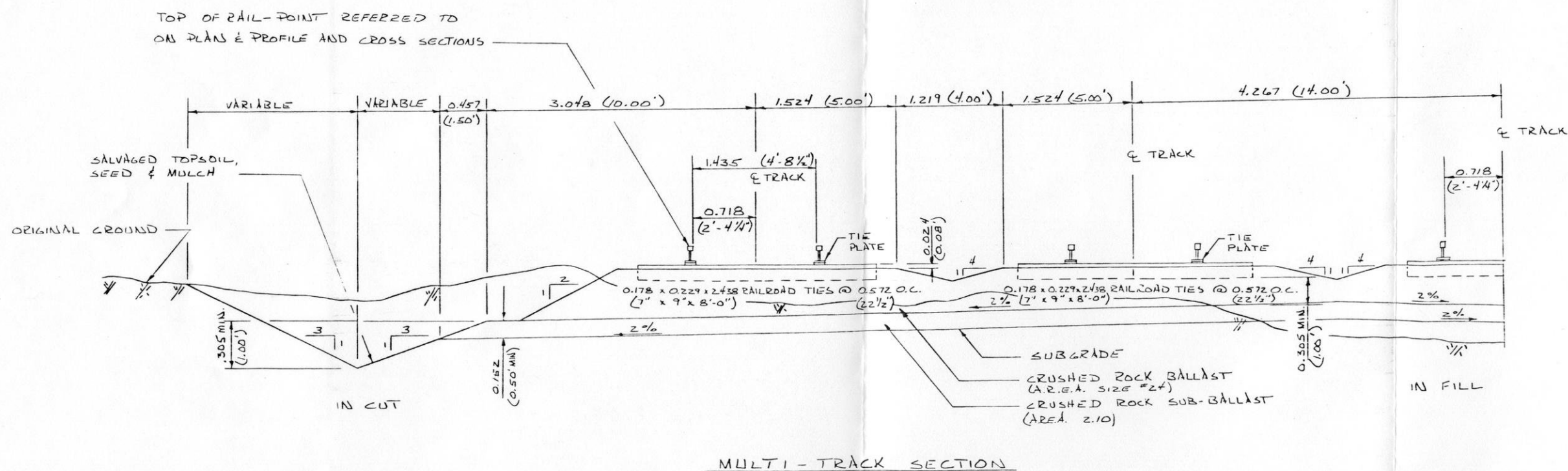
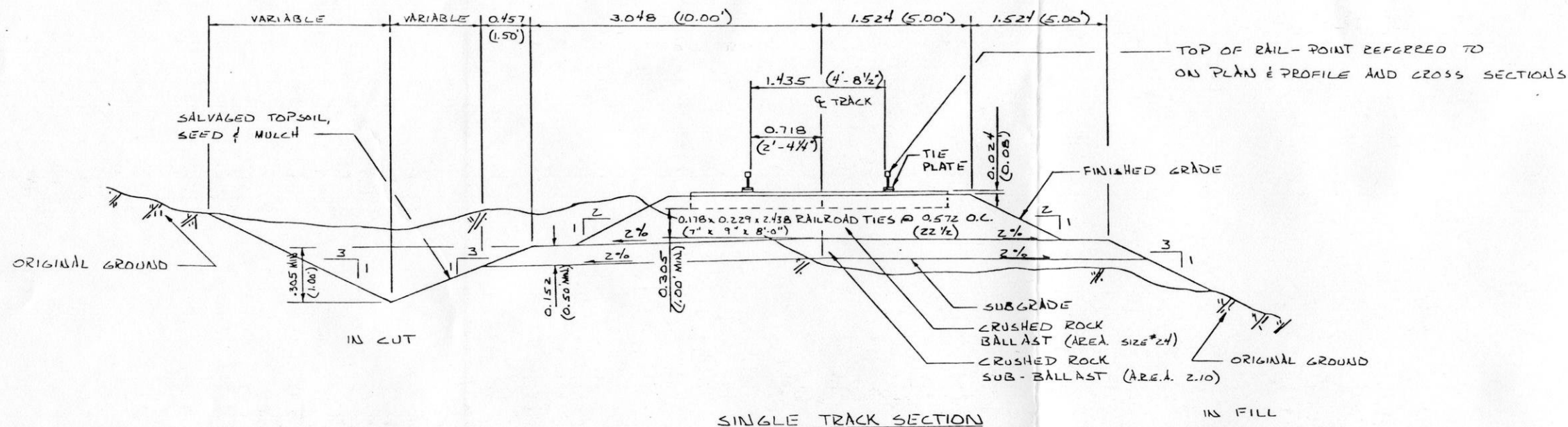
SECTION 1.2.4.1, RAIL SPUR

Comment No. 93

Discuss right-of-way maintenance as it relates to aesthetics, erosion control, and the prevention of railroad initiated fires. Provide cross-sectional design drawings detailing the physical dimensions of the right-of-way and proposed rail structures.

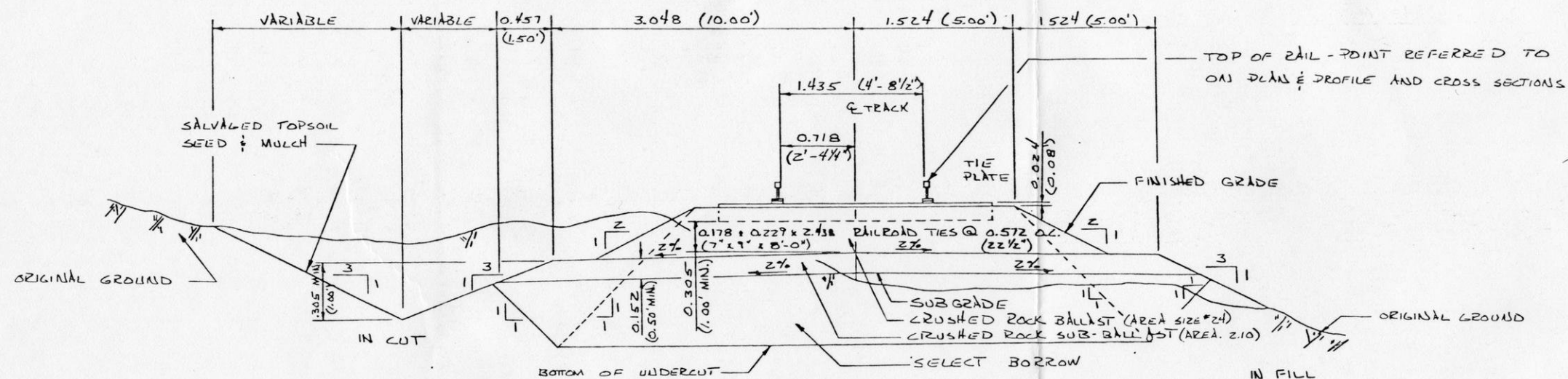
Response:

The attached drawings, taken from the set of preliminary engineering drawings for the railroad spur, provide details of the railroad cross-section and the structure crossing Swamp Creek.



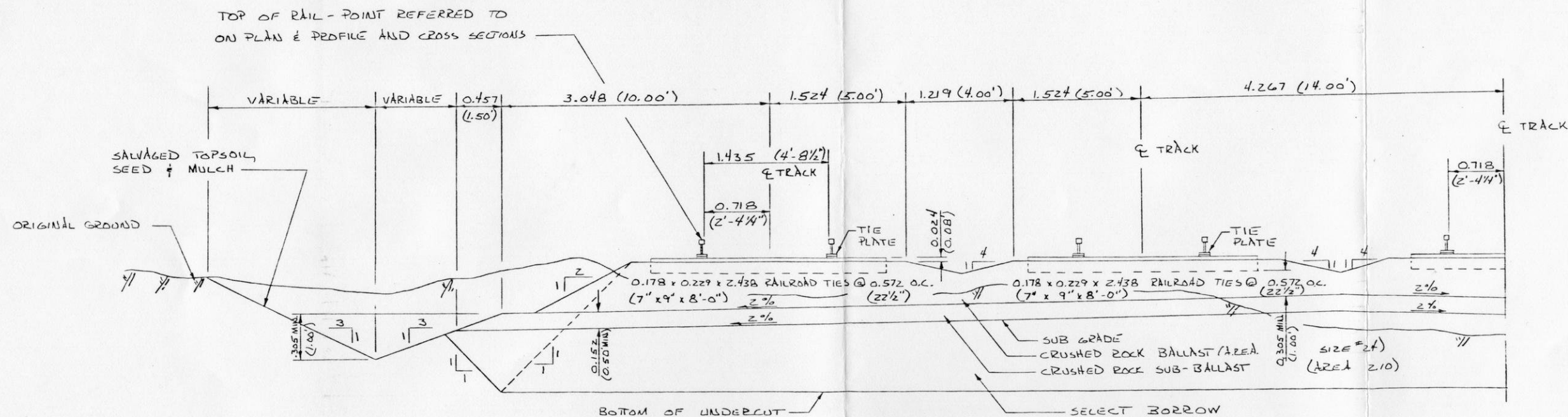
(FIGURE FOR RESPONSE TO COMMENT NO. 93)

EXXON MINERALS COMPANY CRANDON PROJECT			
TITLE TYPICAL SECTIONS			
SCALE NONE	STATE WISCONSIN	COUNTY FOREST	
DRAWN BY M. J. D.	DATE 11-91	CHECKED BY J. M. D. R. W.	DATE 12-91
APPROVED BY J. D.	DATE 2-91	APPROVED BY J. D.	DATE 2-91
EXXON PROJECT NO. 3-75 0314		SHEET OF	



SINGLE TRACK SECTION UNDERCUT (E.B.S.)

NOTE: DEPTH OF UNDERCUT IS EQUAL TO 60% OF THE MAXIMUM DEPTH OF FROST PENETRATION (1.20m or 3.90' BELOW SUBGRADE) OR ACTUAL DEPTH OF FROST SUSCEPTIBLE SOILS WHICHEVER IS LESS, IN BOTH SINGLE AND MULTI-TRACK SECTIONS.



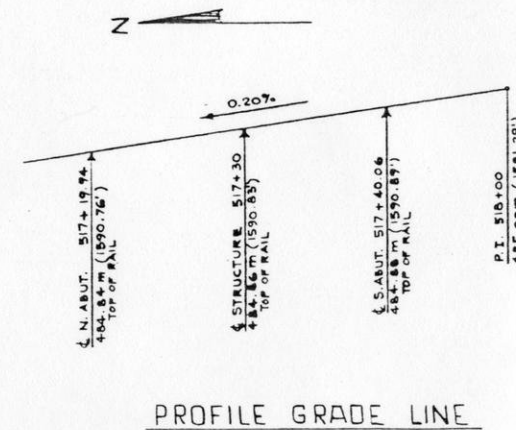
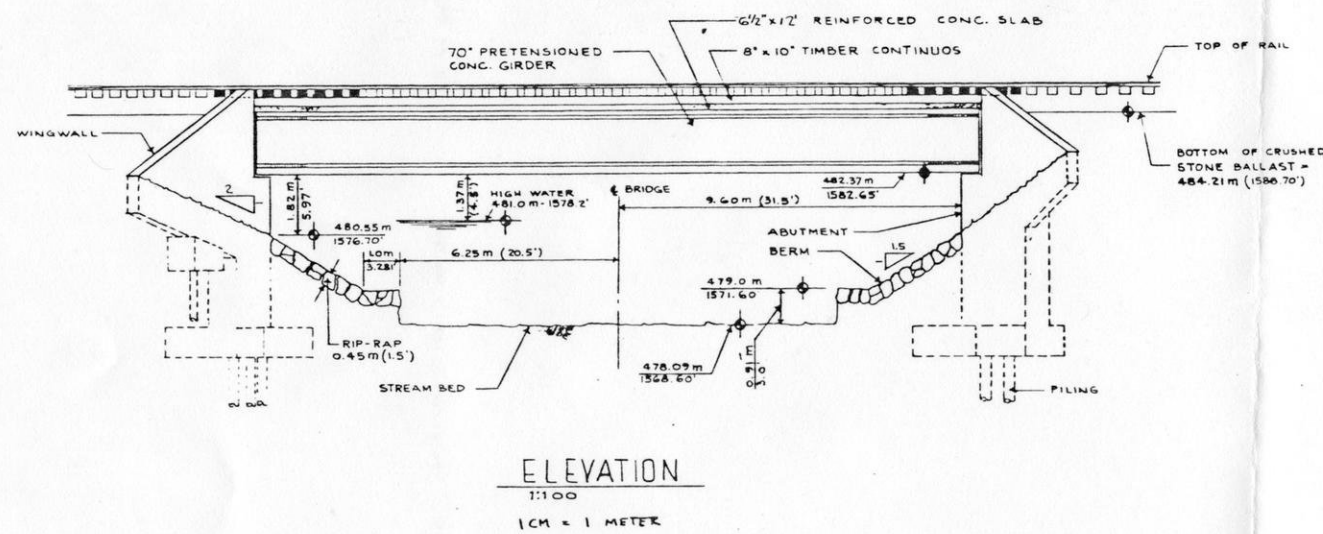
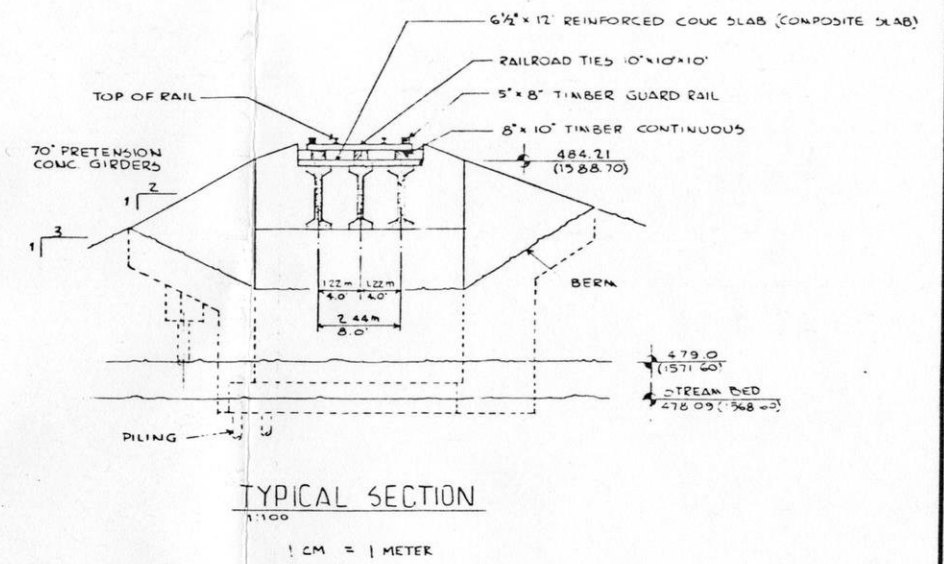
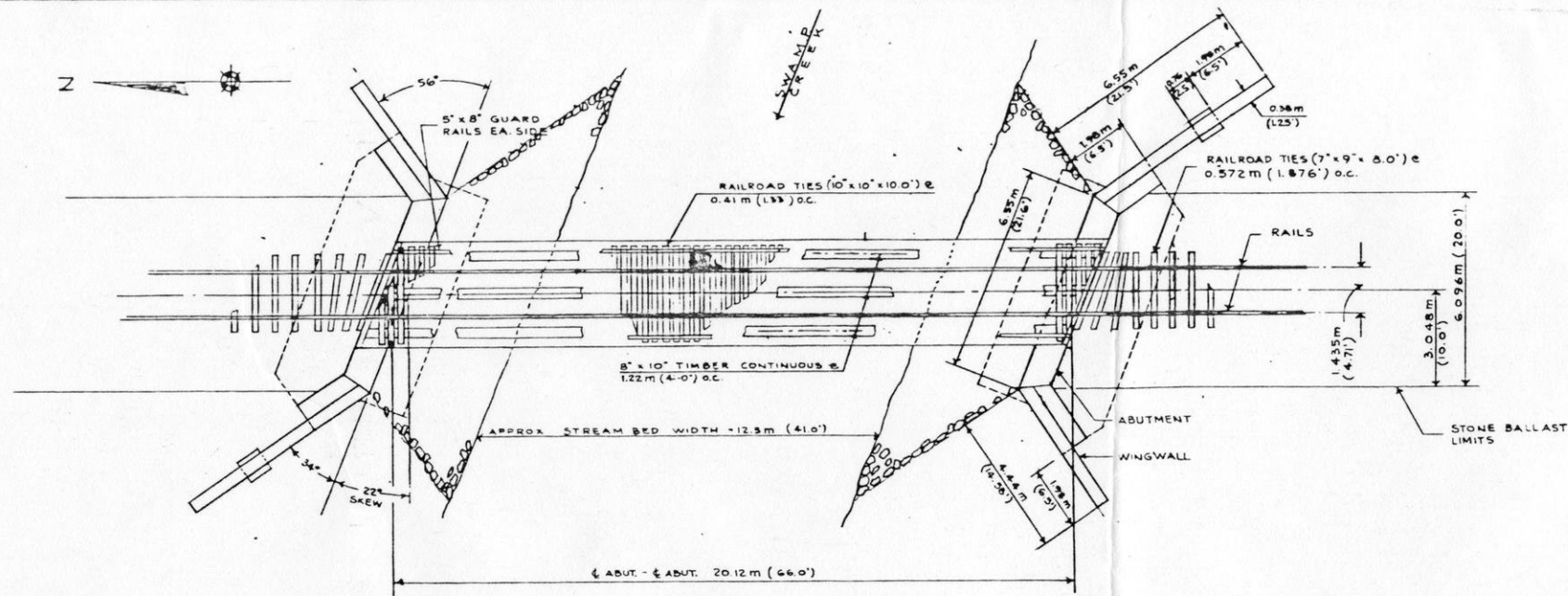
MULTI-TRACK SECTION UNDERCUT (E.B.S.)

(FIGURE FOR RESPONSE TO COMMENT NO. 93)

EXXON MINERALS COMPANY
CRANDON PROJECT

TYPICAL SECTIONS

SCALE	DATE	STATE	COUNTY
NONE	7-30-81	WISCONSIN	FOREST
DESIGNED BY	CHECKED BY	DATE	DATE
M.S.O.	J.M.M.	7-30-81	12-81
APPROVED BY	DATE	DATE	DATE
D.R.W.	12-81	12-81	3-81
3-PE-0315			



(FIGURE FOR RESPONSE TO COMMENT NO. 93)

EXXON MINERALS COMPANY CRANDON PROJECT			
TITLE GENERAL PLAN SWAMP CREEK BRIDGE			
SCALE AS SHOWN	STATE WISCONSIN	COUNTY FOREST	
DESIGNED BY H.W.	DATE 11-81	CHECKED BY W.A.T., K.A.E.	DATE 12-81
APPROVED BY K.A.E.	DATE 12-81	APPROVED BY	DATE
APPROVED BY	DATE	EXXON	DATE
DRAWING NO. B-PE-0331			SHEET OF

Normal railroad maintenance practices will be followed for the railroad spur line. Because the spur line will be new and will receive relatively little use, maintenance will primarily relate to control of vegetation in the right-of-way. The ballast section will be kept free of vegetation altogether, either through use of approved chemical herbicides or other means. Undesirable weeds or brush within other areas of the right-of-way will be controlled by mowing or through use of approved chemical herbicides or other means.

Comment No. 94

Figure 3.4-7 does not show the proposed siding location as indicated in this section.

Response:

The reference to the figure showing the railroad siding locations should have been Chapter 3, Figure 3.4-8 instead of Chapter 3, Figure 3.4-7.

SECTION 1.2.4.2, ACCESS ROAD

Comment No. 95

Provide cross-sectional design drawings detailing the right-of-way and structures. Describe the road surface material. Will there be any limitations of access to this road by the general public and/or adjacent landowners?

Response:

The attached drawings, taken from the set of preliminary engineering drawings for the access road, provide details of the road cross-section and the structure crossing Swamp Creek. As the cross-section indicates, bituminous concrete is planned for the road pavement. The agreements with the landowners from whom right-of-way was secured are not uniform with regard to road access. Some agreements contain access rights, while others do not. The access road will be posted as a private road leading to the Exxon mine; however, no gates or guards are planned at the State Highway 55 intersection.

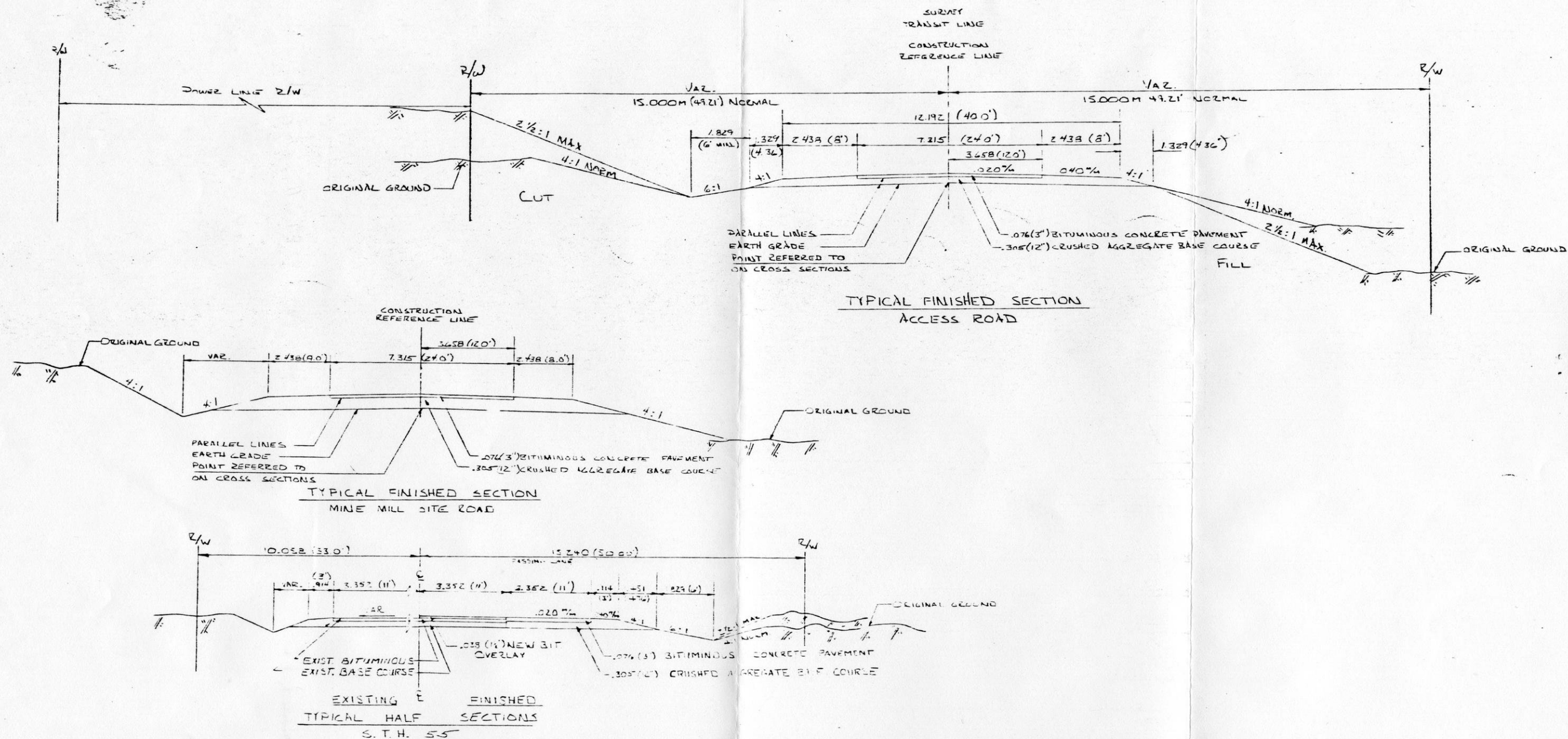
SECTION 1.2.4.4, ADMINISTRATION BUILDING

Comment No. 96

Will a separate environmental laboratory be provided?

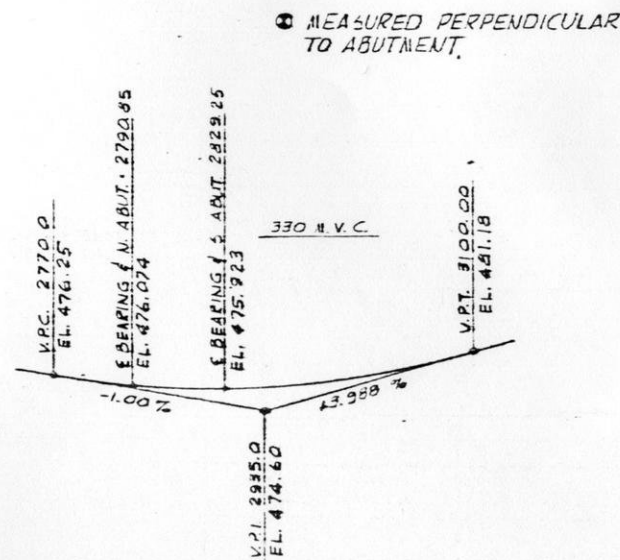
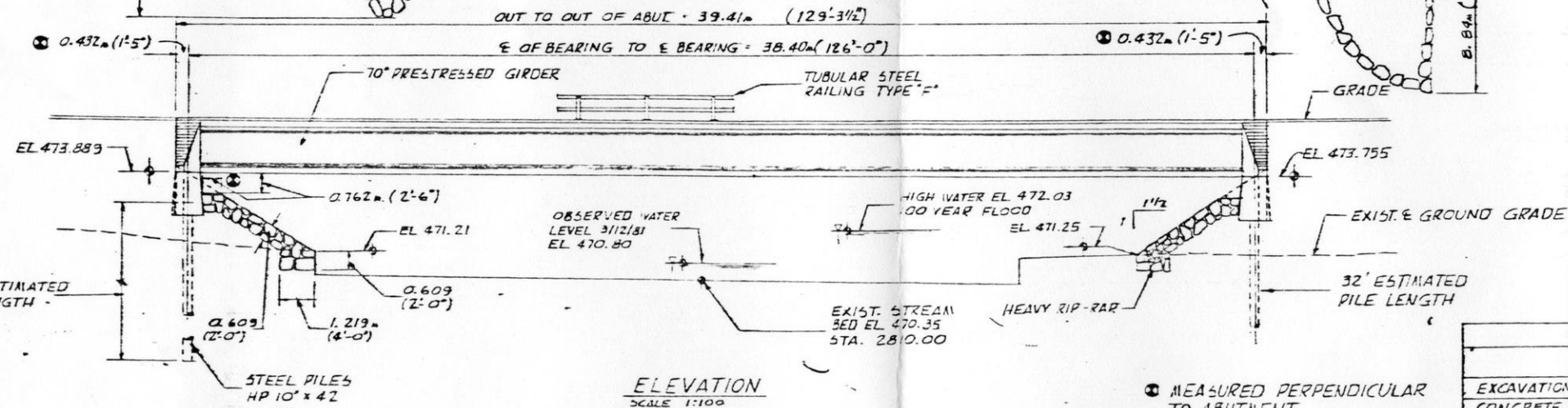
Response:

The main environmental laboratory will be located in the concentrator building. Environmental analyses related to monitoring programs will be performed in this laboratory or by outside laboratories under contract.



(FIGURE FOR RESPONSE TO COMMENT NO. 95)

EXXON MINERALS COMPANY, U.S.A.	
GRANDON PROJECT	
TITLE	
TYPICAL SECTIONS	
REVISION	DATE
1	8-18-91
2	7-15-92
DESCRIPTION	
TYPICAL SECTION - ACCESS ROAD	
SCALE	DATE
1" = 10'	8-18-91
APPROVED BY	DATE
DESIGNED BY	DATE
CHECKED BY	DATE
051-15-1-002	



TOTAL ESTIMATED QUANTITIES					
BID ITEMS	UNIT	N. ASBT	S. ASBT	SUPER	TOTAL
EXCAVATION FOR STRUCTURES	L.S.				
CONCRETE MASONRY	C.M.F.	92.8(56)	92.8(56)	91.5(11)	246.3(56)
PRESTRESSED CONC GIRDER 70"	L.M.F.	—	—	255.6(35)	255.6(35)
HIGH STRENGTH BAR STEEL REINFG	L.B.S.	(BY FINAL DESIGN)			
BEARING PADS	L.S.				
STEEL PILING DELIVERED AND DRIVEN 4" 10" x 42 ; 32"	L.M.F.	115800	91500	—	212300
HEAVY RIP-RAP	C.M.F.			—	2064 (210)
TYPE "F" STEEL RAILING	L.M.F.	—	—	784 (259)	784 (259)

(FIGURE FOR RESPONSE TO COMMENT NO. 95)

EXXON MINERALS COMPANY CRABOON PROJECT					
TITLE SIVAMP CREEK BRIDGE GENERAL PLAN					
SCALE	AS SHOWN	STATE	WISCONSIN	COUNTY	FOREST
DESIGNED BY	W. L. Y.	DRAWN BY	W. L. Y.	CHECKED BY	W. L. Y.
APPROVED BY	22W	DATE	8/6/72	PROJECT NO.	KAE
DATE	7-1	BY	W. L. Y.	REVISION	1-1

SECTION 1.2.4.5, COMBUSTIBLE STORAGE BUILDINGS

Comment No. 97

Construction, operation, safety and fire protection of the combustible storage building will also have to meet federal, state and local requirements.

Response:

Comment acknowledged and a statement will be added to subsection 1.2.4.5 of the revised EIR that the construction, operation, safety and fire protection of the combustible storage building will meet federal, state and local requirements.

SECTION 1.2.4.6, SANITARY WASTE FACILITIES

Comment No. 98

What will the peak flow to the sanitary treatment system be? What is the basis for the 31.9 gallons per minute average flow value? Provide documentation for these figures.

Response:

A peak hourly flow rate of $14.5 \text{ m}^3/\text{h}$ (64 gallons per minute) has been estimated. Estimates for sanitary wastewater flows are developed in the Phase III Water Management Study by CH2M Hill (previously provided to the DNR).

Comment No. 99

Discuss the effect of having drainage from the absorption field in close proximity to the mine. Estimate the land area needed and available for land spreading of sludge. Discuss the availability of a commercial sludge disposal facility and the anticipated volumes and frequency of sludge disposal. Discuss the potential for needing sludge storage during winter months. Describe the separation of laboratory and other chemical wastes from this system.

Response:

There should be no effect of having the absorption field in close proximity to the mine. The mine workings closest to the surface will be over 100 m (328 feet) below ground level.

As stated in the response to comment No. 37, the sewage treatment system will have 49.2 m^3 (13,000 gallons) of sludge storage capacity and will require sludge removal once or twice per year. However, if the entire septic tank of approximately 223.3 m^3 (59,000 gallons), which includes 49.2 m^3 (13,000 gallons) of sludge, is emptied, the sludge field required is less than 2 ha (5 acres), assuming an application rate of $0.11 \text{ m}^3/9.3 \text{ m}^2$ (30 gallons per 100 square feet). Although land area is

available for on-site disposal, Exxon does not currently plan to develop such an area. These volumes will be handled by a licensed private contractor.

Initially, pumping might be more frequent to avoid winter sludge disposal problems (if winter disposal is prohibitive for the private contractor); however, with some operating experience a sludge pumping schedule could be established to avoid winter disposal.

Drainage from all laboratory and mill facilities, with the exception of sanitary wastes, will flow to the reclaim pond as shown on EIR Figure 1.4-18 and will not be mixed with sanitary sewer waste.

Comment No. 100

Describe the size and location of the sludge absorption field.

Response:

There is no sludge absorption or disposal field planned for the Project. A soil absorption field to dispose of the septic tank effluent is proposed. The size of the field will depend upon siting location and field percolation rates; however, it will be in the range of 0.4 to 1.2 ha (1 to 3 acres). Additional details of the sanitary wastewater system are included in the Phase III Water Management Study by CH2M Hill (previously provided to the DNR). Further studies have been completed to prepare permit applications for a soil absorption field; this permit was submitted to DILHR in September 1983.

SECTION 1.2.4.7, POWER SUPPLY FACILITIES

Comment No. 101

Please provide plans for the substation which detail measures taken to suppress transformer and emergency generator noise. Describe the location and construction techniques for site underground and above-ground distribution system. Describe the above ground structures which will be utilized.

Response:

The substation area is shown on drawing No. 051-1-E-002 in Attachment No. 7. This drawing is a general arrangement indicating relative space allocations. A detailed drawing will not be available until final engineering is complete.

No special noise suppression measures have been taken to alleviate noise from transformers or generator sets. The noise emitted is well within the EPA guidance limits at the property boundary. All transformers are manufactured in compliance with NEMA standards and will comply with the 77 dBa at 1 m (3.3 feet) OA/FA operation maximum of the NEMA standard.

The two 2500 kW generators and one 1000 kW generator are housed in a concrete block building and after the powerhouse is installed will operate

only in an emergency. The two large generators will produce 103 dBA at 1 m (3.3 feet). The smaller generator will produce 95 dBA at 1 m (3.3 feet). The building will absorb some of the sound transmitted from the generators. Ear protection will be required within the generator station as a safety requirement. The generators will be fitted with spark arresting silencers on the exhaust.

At the center of the substation area a point source noise will be less than the 96 dBA that was used in the noise model which indicated levels at the Project boundary were within EPA guidance limits. Therefore, no abatement procedures are required.

Drawing No. 051-1-E-002 also indicates the relative locations for all major substations in the surface facilities, except for the substations associated with the headframe and hoist drive system which are located on the lower floor of the headframe. The outdoor substations consist of a high voltage switch, mineral oil filled power transformers, and secondary main circuit breakers. The secondary circuit breakers in turn feed the appropriate motor control centers located in the process areas. The outdoor substations will be mounted on concrete pads. The areas will be fenced as required by code.

Power is supplied from the main substation through an underground electrical duct system buried within 1.2 m (4 feet) of the ground surface with manholes at points required for pulling cables. The power for the MWDF is also supplied underground to the edge of the facility boundary where it is converted to an overhead 13.8-kV powerline. This powerline transverses the pipeline route to the MWDF and then around the facility to supply power for the pumps.

A communications duct system is also shown on drawing No. 051-1-E-002. This system provides telecommunication, data, and intercom routes throughout the Project surface facilities.

The static VAR compensator is located adjacent to the compressor house. This compensator is required for production hoist operation. It consists of capacitor banks, reactors, and transformers required to adjust for VAR differences during hoist cycling.

SECTION 1.2.4.8, FUEL STORAGE DISTRIBUTION

Comment No. 102

Will the area within containment dikes be lined or paved to prevent spills from reaching groundwater? Will collection and treatment of runoff from the fuel oil storage area and the tank loading area be provided? Describe the quantity of runoff and the type of treatment proposed. Provide a map showing the location of on-site fuel distribution pipelines. Provide specifications for pipeline construction, particularly in areas of potential earth settling or mine subsidence.

Response:

The area within the containment dikes surrounding the bulk fuel storage facility will be lined with an elastomeric membrane to prevent spills and contaminated runoff from reaching ground water. Any minor spills, washdown or runoff from this area will be transferred to the industrial wastewater sewage system. (This system also collects washdown and runoff from around the shops and other areas of potential oil/grit contamination.) Precipitation collected within the containment berms would not normally be contaminated in any way since the fuel storage and handling systems are totally enclosed and sealed. In such case the precipitation would simply be permitted to flow off into the surrounding area.

The design of the industrial wastewater sewage system will be finalized during detailed engineering. The system will be provided with an oil/water separator to remove oily contaminants. This contaminant material will be transferred to a holding tank for eventual removal from the site. The clear water will be pumped to the reclaim pond.

Sufficient surge capacity will be provided within the system for storage of total storm runoff for eventual treatment, based upon a one in 25-year storm developing 106.7 mm (4.2 inches) of rainfall in 24 hours and a 'C' factor (runoff/rainfall) of 0.90. The surge capacity may be provided in sumps or in holding tanks.

The fuel distribution system is confined to a single line, approximately 200 m (656 feet) long, from the bulk fuel storage tanks to the fuel tanks located at the fuel delivery borehole to the mine. No settlement is expected along this pipeline route. The pipeline specification would be C.S. Sch. 40 welded at joints.

SECTION 1.2.4.10, POTABLE WATER FACILITIES

Comment No. 103

The Department has not yet received an application for a high capacity well approval. This application will need to include all proposed groundwater withdrawals on the property.

Response:

Comment acknowledged. Applications for high capacity well permits will be filed in 1983.

Comment No. 104

The EIR indicates that a chlorinator treatment system will be provided if necessary. We recommend that such a system be installed on a standby basis. It would have to be approved by the Public Water Supply Section. Chemical treatment or additions to the well or the total water supply pumped from the well for the purpose of quality control, when the additions are made ahead of the pressure tank or reservoir, will require approval from the Department.

Response:

Comments acknowledged and recommendations will be followed.

Comment No. 105

The potable water well and distribution piping must be in compliance with NR 112 and H62, respectively. If the mine is approved and a potable water distribution system is constructed, we recommend that Exxon periodically inspect cross-connections and sample the distribution system and wells for bacteriological quality.

Response:

Comments acknowledged and recommendations will be followed.

SECTION 1.2.4.11, WATER TREATMENT FACILITIES

Comment No. 106

Provide details of the surge tank for the "uncontaminated" water. Discuss the monitoring program and how the necessary treatment will be determined.

Response:

The maximum volume of uncontaminated mine water is expected to be about 227.1 m³/h (1000 gallons per minute). The tank that will receive this water will have a capacity of 1,893 m³ (500,000 gallons).

As water is pumped from this tank to the excess water discharge tank, it will be continuously monitored for pH, turbidity, and conductivity. Although details of the monitoring program are not yet developed, periodic samples of this water will be obtained for chemical analyses.

If this water is intercepted at ground water quality (see EIR Table 2.3-8), it should not require treatment. However, if it is determined that the quality of the intercepted ground water is such that the total effluent being discharged to Swamp Creek will not meet WPDES effluent limits on a long-term basis, appropriate treatment technology will be used.

Comment No. 107

Provide the details of the water discharge pipeline as requested under Section 1.2.3.3 for the tailings transport pipeline.

Response:

At the current stage of project engineering the water discharge pipeline is expected to be constructed of 0.36 m (14-inch) diameter high density polyethylene (HDPE) pipe and buried a minimum of 1.5 m (5 feet) below ground to beneath the frost line. The exact size and wall thickness of the pipeline will be determined later.

Because the depth of the trench will be excavated in glacial till, blasting will not be required and all excavation can be by backhoe or trenching machine. The trench volume in the pipeline zone will be backfilled with sand or gravel or other select material and the remaining trench volume will be backfilled with till. During construction, exposed areas with potential for runoff of sediments will be controlled with straw bale sediment traps. Seeding and reestablishment of vegetation will follow shortly after trench backfilling.

General HDPE pipe characteristics are discussed in the response to comment No. 84. Current engineering calculations show that HDPE pipe rated at 250 psi internal design pressure would be well above expected pipeline pressures.

The water discharge pipeline should not experience vacuum conditions because vacuum breakers will be installed prior to operation.

Blockage of the pipeline due to settled solids will not be a problem because solids in the discharge water will normally be less than 20 mg/l. Settling due to periodic pipeline shutdown will be flushed out with start-up.

The depth that the pipeline will be buried will preclude pipeline freezing.

The pipe will be received in 11.6 m (38 feet) lengths. All pipe will be inspected for damage on-site. Sections of pipe with cuts or gouges will be removed and rejected.

Each piece of pipe will be fusion butt welded to form a continuous pipeline from the pumping station on the mine/mill site to the discharge point.

Butt fusion welding involves heating both ends of the pipes to be joined, making contact between the two molten ends and joining them together under pressure. The operation is performed using commercially available equipment designed for this purpose. The equipment is easily transported and may be used at any point along the pipeline during the installation of new pipe or the repair of old pipe. The joint which is formed is stronger than the pipe it joins.

Buried pipelines are inherently safer than pipelines laid on the surface. They are silent in operation and not visible. Typically, vegetation covers the trenched area within 2 years.

In the event of a pipeline breakage, flowrate monitoring equipment would warn the operator to shutdown the pipeline system.

Clean-up and removal of spilled water will not be necessary due to the good quality of the treated discharge. Repair of the pipeline will involve the removal of the damaged pipe and welding in new pipe using portable butt-welding equipment. The repaired pipeline would be leak tested using water before backfilling and returning the pipeline to normal service.

Spare plastic pipe will be stocked for repair purposes.

Pipeline leaks in conventional flanged or mechanically coupled pipelines typically occur at the flanges or in areas of the pipe where sudden changes in direction are necessary. The use of welded plastic pipe eliminates the flange or other connections and reduces the possibility of leakage. Typically, HDPE pipe can be cold bent to a minimum radius of 25 times the pipe diameter. This allows gradual direction changes to be made and minimizes the possibility of leaks.

Current plans call for use of three pumps in the system. Two 110 hp pumps and one 170 hp pump. During normal operation (discharge less than 2,000 gallons per minute) one of the 110 hp pumps will be used with the other for standby operation. During maximum discharge (3,000 gallons per minute), all three pumps would be used.

Comment No. 108

What is the estimated scale of Figure 1.2-18? Indicate a "low water" level on the section drawing and define high and low levels.

Response:

EIR Figure 1.2-18 is a conceptual drawing and is not to scale. A detailed drawing has been provided with the water regulatory permit submitted to the DNR for the discharge structure. "High Water Level" and "Normal Water Level" have been estimated on the drawings. The high water elevation was identified by debris on the bank or change in vegetation and represents the elevation where the water level was for a sufficient period of time to leave a discernible mark. We did not estimate the low water elevation in the permit application, but that information will be added as a response to DNR comments on the application.

SECTION 1.2.4.12, RECLAIM WATER PONDS

Comment No. 109

Provide engineering plans and specifications for these ponds and ancillary facilities.

Response:

Additional detail of the preliminary design of the reclaim water ponds is presented in Chapter 9 of the "System Development" report by Golder Associates (previously provided to the DNR). Full size copies of the drawings from the report are included in Attachment No. 8. Basic material and construction specifications are included as notes on the drawings.

Comment No. 110

Specify the thickness of the synthetic liner and discuss the compatibility of the liner with the wastewater. Provide evidence to that this wastewater will not degrade the membrane. Discuss potential ice and frost damage to

the pond liner, dams, and ancillary facilities. Discuss potential gas formation below the membrane liner. Provide details of the discharge and pump points to assure that movement of water will not erode the blanket or expose and rip the liner.

Response:

At the current stage of design, the synthetic liner has been described as a 0.091-mm (36-mil) thick Hypalon or HDPE (High Density Polyethylene). A comprehensive data compilation on a variety of liner types including discussions on chemical compatibility with stored wastes is provided in "Evaluation of Prospective Common Liners, Crandon Project, Waste Disposal System, Project Report 6.2" dated December 1981 prepared by Golder Associates (previously provided to the DNR).

The entire synthetic liner will be covered by a 0.46-m (1.5-foot) protective cushion of sand, and along the slope in the water edge zone an additional 0.30 m (1.0 foot) of till transition material and 0.91 m (3.0 feet) of rock slope protection will be provided. For an estimated freezing index at the Project site of 1500 degree-days, a maximum depth of frost penetration of 1.4 m (4.6 feet) was determined (Corps of Engineers EM-1110-345-306). Consequently, frost penetration to the liner is not anticipated. Frost effects on the outer shell and crest of the embankments will not affect embankment performance. Final design of the water reclaim system will have protection against ice damage.

The sand cushion specified to underlie the synthetic liner will be carbonate free. The underlying bentonite modified till underliner may be composed of carbonate tills. However, leakage through the synthetic liner is expected to be minimal. This combined with the low permeability of the bentonite modified till should minimize the potential for gas development. In the event gas does develop, a venting system to relieve gas pressure could be installed into the underlying sand cushion.

Comment No. 111

Explain why a double-liner system is needed. The design illustrated seems inconsistent with published geomembrane liner design guidelines as it includes no provision for leak detection or collection of the liquid that leaks through the membrane and collects on the soil bentonite liner. If the second liner has the capacity to collect liquids, there should be some mechanism to either remove them or at least detect their presence.

Response:

A double liner system concept has been developed as a precautionary safety feature. In the unlikely event the primary synthetic liner system develops a leak, the backup underliner (bentonite modified till liner) will impede leakage towards the underlying aquifer. Potential leakage through a

properly installed synthetic liner is anticipated to be relatively small, thereby imposing minimal head on the underliner and consequently minimal seepage loss through the total system.

A leak detection system or collection system for potential leakage has not been considered at this time because of: (1) the minimal quantity of leakage anticipated and (2) the limited impact this leakage would have if in fact it could penetrate the underliner.

Consideration will be given during final design to incorporate a leakage detection and removal system.

Comment No. 112

Provide the rationale for the location of the reclaim ponds, and discuss the factors influencing the ponds' siting. Is there an advantage to placing the ponds such that water may flow back to the mill under gravity flow? The reclaim water pond combined with the mine waste disposal facility appear to significantly reduce Duck Lake watershed. The resultant loss of water flow through the lake and wetland complex must be thoroughly addressed in Section 4.1.4.1.2.

Response:

Throughout the extended siting study, the reclaim water ponds were considered along with the MWDF tailings ponds. Various MWDF and reclaim pond layouts were reviewed including some layouts with separated reclaim and tailings ponds. As a result of the studies, it was concluded that separated facilities probably would lead to overall greater impacts. Since the reclaim ponds have to be shallow compared to the tailings ponds, a relatively flat ground area was preferred for their location, design, and construction. In Site 41, the area north of Duck Lake met that criterion. Another factor considered was the purpose of the reclaim ponds as water holding and transfer ponds between the MWDF and the mill. A location between the two facilities would minimize the water handling systems. However, unless the reclaim ponds are very close to the mill area, the available elevation differentials are not great enough to overcome pipe friction flow losses. If gravity flow were to be utilized in one direction, it would mean higher differential elevation heads in the other direction. Although the overall system would be simpler, total power requirements and energy use would be similar. Therefore, considering the available topography and siting considerations, there is no advantage to relocating the reclaim ponds to facilitate gravity flow to the mill.

Resulting impacts from the siting of the reclaim ponds north of Duck Lake are addressed in Chapter 4 of the EIR.

Provide detailed information on the mechanisms by which the reclaim ponds will function in the treatment of organics, thiosulfates, and polythionates. Give examples of the concentrations of these chemicals and breakdown products. Include analytical work conducted at other mining installations which utilize reclaim ponds for water treatment purposes. Discuss the potential of deeper portions of the reclaim pond becoming anaerobic and resulting in reducing conditions and the generation of hydrogen sulfide and the effect this would have on treatment of water and generation of noxious odors.

Response:

The reclaim ponds serve three main functions:

- 1) Settling and retention of fine particulates from water decanted from the tailings pond and the tailings thickener overflow;
- 2) Provides surge capacity for the water management system; and
- 3) Promotes oxidation, evaporation and degradation of:
 - a. thiosulfates and other polythionates,
 - b. organic compounds; such as residual collectors and frothers, and
 - c. cyanide (see also response to comment No. 191)

Operationally, the first two are the most important. Oxidation, evaporation, and degradation efficiency of thiosalts and organic compounds is seasonal. In the winter months the rate of these processes is reduced but not eliminated. The tailings pond with a shorter retention time also allows similar oxidation, evaporation, and degradation for approximately 10 percent of the total mill water that is sent to the reclaim pond.

Summarized in the attached table is information concerning expected operation of the Crandon reclaim ponds and what has been observed at other mines. Thiosalts are generated during the milling of pyritic ore by the interaction of air, metal sulfides and SO_2 , a reagent added during the milling.

For the Crandon Project, water from the reclaim pond is recycled to the mill, 90 percent being returned directly, the remainder being treated essentially for sulfate removal to control gypsum scaling in the mill. None of the reclaim pond water will be routinely discharged to the environment.

Contaminated mine water does not initially contain thiosalts. Once backfilling has started, water seeping from the stopes may eventually contribute as much as 25-30 percent of the contaminated water being pumped from the mine.

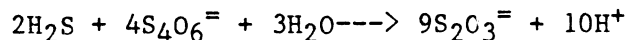
(Table For Response To Comment No. 113)

RECLAIM POND OPERATION

CHEMICALS	INFLUENT CONCENTRATION (ppm)	BREAKDOWN PRODUCTS	DOMINANT MECHANISM OF REMOVAL
<u>Thiosalts</u> $S_2O_3^{2-}$, $S_3O_6^{2-}$, $S_4O_6^{2-}$	<300	SO_4^{2-}	Biological oxidation
<u>Cyanide</u>	<0.1	SCN^- , CNO^- , CO_2	Photodecomposition (UV), Evaporation (Volatilization)
<u>Organic</u>			
o Collectors Xanthates R-O-CS ₂ M	<1	(ROCS ₂) ₂	Photodecomposition (UV), Evaporation (Volatilization)
o Frothers MIBC (CH ₃) ₂ CHCH ₂ CH(OH)CH ₃	<10	(CH ₃)CHCH ₂ C(O)CH ₃ CO ₂	Evaporation
Fine Particulates	<100	Not applicable	Sedimentation

The reclaim ponds were designed for oxidation and thus have an average depth of less than 6 m (20 feet). It is unlikely that the deeper portions of the pond will go anaerobic.

In the unlikely event that hydrogen sulfide is generated at depth, it would not get to the surface of the pond before reacting with polythionates and being oxidized to thiosulfates.



The unlikely presence of trace concentrations of hydrogen sulfide in recycled reclaim pond water would not be detrimental to the water treatment process, because it would be oxidized during the lime/soda ash treatment.

Comment No. 114

Discuss the pond's fertility and the potential for algae and weed growth with resulting operational and sludge disposal problems. Describe the effect of extremely cold temperatures on the treatment efficiency.

Response:

There will be a potential for algae and weed growth in the reclaim ponds. However, this is considered in the design of the mill water treatment system.

Reclaim pond treatment efficiency will be reduced during winter conditions. This will primarily be reflected in a decrease in the pond's ability to allow oxidation of thiosulfate and other polythionates to sulfate. However, this also is accounted for in the design of the mill water treatment system, and like algae, will not reduce the plant's capability to sufficiently treat the process water.

Comment No. 115

What is meant by adequate retention time in the reclaim ponds? How will this be achieved if one of the ponds is taken out of service? Please explain why the storage volumes for each pond are the same but the dimensions of the ponds are different.

Response:

On the basis of fine particulate sedimentation and surge capacity, any reclaim pond retention time in excess of a week should be adequate. Organic and thiosalt removal requires more time and is dramatically affected by seasonal temperature changes. If one reclaim pond is temporarily removed from service, reducing the retention time from approximately 44 to 22 days, there should be no long-term detrimental effect.

The operating storage volume of the two reclaim ponds is similar, but the total volume of reclaim pond R1 is greater because of a greater overall pond depth which provides additional freeboard in the pond.

Provide information on how "the reclaim ponds and the tailings ponds will provide surge capacity for the water management system." The reclaim ponds will apparently be filled to capacity during normal operation. Describe the effect of surge water storage on consolidation of tailings, operation of the underdrain system and stability of the dikes. How long could the mine or mill continue operation in the event of an extended water treatment plant shutdown?

Response:

When the water level in the reclaim ponds is at the maximum normal operating level, there is water surge (storage) capacity in the ponds in the pond freeboard depth. Reclaim ponds R1 and R2 have a design freeboard of 2.59 m (8.5 feet) and 0.91 m (3.0 feet), respectively, above maximum operating water level. Approximately 1.55 m (5.1 feet) of the freeboard in reclaim pond R1 will hold 14 days of water flow at a rate of $0.158 \text{ m}^3/\text{s}$ (2500 gallons per minute). The reclaim ponds freeboard is designed to contain the volume of the probable maximum precipitation (PMP) event including the water from the largest tailing pond (T4). The preferred operating practice will be to keep the water level in the pond below the maximum level so that surge capacity is available without infringing on the freeboard allowance. In Section 3.0 of the "Miscellaneous Details and Analyses" report by Golder Associates, additional pond freeboard information is presented.

The surge capacity in each of the tailing ponds, above highest normal water levels, is in all cases greater than required from a storm and wave run-up standpoint. In an emergency, if the surge capacity in the reclaim ponds was not sufficient, the tailing ponds could be used to store water.

To use the tailing ponds storage capacity and maintain low seepage rates, pumping of the underdrains would continue with underdrain water circulated back to the tailing ponds. Then, depending upon the rate of decant water pumping, water level in a tailings pond could be increased to accommodate surge storage requirements. As the ponded water depth is increased there is an increase in the underdrain flow rate, but it can be accommodated as a result of the design of the underdrain pumping system. If the underdrains were not pumped, they would flood; while this would temporarily increase seepage, it would not affect the integrity of the facility, nor change the stability analysis of the embankments.

Tailings deposited underwater would have a slightly lower density (approximately 10 percent less) than the previously deposited tailings. However, the overall tailings volume change within the pond would be negligible.

Tailing pond T1 has the smallest surge capacity of the four ponds. Its lowest surge capacity (at completion of tails deposition) is approximately $660,000 \text{ m}^3$ (535 acre-feet) from the tailings surface to a level surface 0.91 m (3 feet) below the pond crest. Surge capacity within the 0.91 m (3 feet) freeboard height is approximately $300,000 \text{ m}^3$ (244 acre-feet). At a water flow rate of $0.158 \text{ m}^3/\text{s}$ (2500 gpm), these volumes represent 48 and 22 days of surge capacity, respectively. The total minimum surge capacity (i.e., tailings pond T1 and reclaim pond R1 water storage) would be approximately 84 days at a $0.158 \text{ m}^3/\text{s}$ (2500 gallons per minute) flow rate.

Comment No. 117

Provide details on the removal of the reclaim pond sludge and liner protection. Describe a contingency plan in the event of liner failure and discuss the feasibility of repairing Hypalon after vulcanization.

Please provide adequate documentation for the above discussions.

Response:

The response to comment No. 92 provides information on the build-up of sludge in the water reclaim ponds and the proposed one-time handling of it at the completion of the Project. As noted in that response, although not anticipated for the Crandon Project, there are methods of sludge removal that could be used in an operating pond that would not damage the liner.

As noted in response No. 111, the bentonite modified till underliner, although it is part of the pond design, is a precautionary or contingency measure against leakage from the primary synthetic liner system.

In addition to the seepage control system design, the basic contingency measure available for repair to the water reclaim ponds would be to drain the pond and perform the necessary liner repairs. There is flexibility in the water management system to allow operations to continue with one water reclaim pond.

Although it is not envisioned that any other contingency measure would be necessary, it would be possible to apply some of the same contingency measures suggested for the tailings ponds, such as pumping of the ground water system, to the water reclaim ponds.

The engineering study and water reclaim pond design work to date has identified two potential membrane liners for the ponds. Chlorosulfonated polyethylene (CSPE) (more commonly known by DuPont's tradename "Hypalon") and high density polyethylene (HDPE) have been suggested as potential liners. The liner choice will be made during the final engineering effort based on additional study and the latest available information. Suggested repair procedures would be considered in the choice of liner, but if repairs are completed in an empty pond, no difficulty would be expected for either type of liner.

SECTION 1.2.4.14, SHOP, GARAGE, WAREHOUSES

Comment No. 118

Where will drainage of the southside unloading dock be routed?

Response:

The revised design incorporates the shops, garage, warehouse, offices and change rooms into a single building known as the Services Building (see Attachment No. 4). This building is located in the same general area as were the shops and warehouse in previous layouts shown in

the EIR. The off-loading and outside areas adjacent to the shops are located to the north and northwest of this building. Spills, grit or other contamination which might occur in these areas will be routed and handled through the industrial wastewater treatment system (see also response to comment No. 102).

SECTION 1.2.4.15, OTHER WATER FACILITIES

Comment No. 119

In addition to the fueling station drainage, what other waste streams will be routed to the oil water sewer system? What is the volume of water which will flow through the oily water sewer system. Discuss the compatibility of the oil water waste stream with the reclaim ponds and water treatment systems.

Response:

The 1 ha (2.48 acre) area in front of the shops and warehouse and the 0.25 ha (0.62 acre) equipment and material laydown area southeast of the headframe will also drain into the oily water sewer system. The volume of water which will flow through the oily water sewer system is only that from precipitation runoff. For a 1.25 ha (3.1 acre) area this is approximately an annual average of 1.1 m³/h (5 gallons per minute). The oily water sewer system is designed to separate the immiscible oil from water. Once separated, the oil-free water stream then flows to the reclaim pond. There is no incompatibility of this 1.1 m³/h (5 gallons per minute) oil-free water stream with the 1135+ m³/h (5000+ gallons per minute) water feeding the reclaim ponds or the mill process recycle water treatment system.

Comment No. 120

What approved off-site disposal area will be used for oil particle disposal? What is the estimated volume which would be produced? How will the oil be removed and stored prior to disposal? Describe the methods and frequency of waste oil transportation. If the oil particles have a flashpoint under 140°F, they are classified as hazardous waste and would need to be disposed of at an approved hazardous waste site.

Response:

Subsection 1.2.4.15 in the EIR will be revised to state that waste oil will be collected and shipped with other waste lubricants to a reprocessing facility. The estimate of the volume of waste oil is not currently available and, therefore, frequency of shipment to reprocessing facilities is unknown. However, we anticipate collecting waste oil in oil/water separators and storing waste oil in drums until transported off-site by contractor to a reprocessing facility. We do not anticipate having waste oil with a flashpoint under 140°F.

SECTION 1.3; CONSTRUCTION

Comment No. 121

In this section, Exxon states that "the construction sequence is realistic for this stage of planning. The actual sequence is subject to optimization along with equipment and techniques, during final engineering." This statement illustrates the tentative nature of the construction schedule and the general lack of engineering and scheduling details presented in this chapter. The further statement that "the schedule for construction will be . . . sequenced to assure the availability of all environmental protection systems well in advance of the need date" does not satisfy our need for a critical review prior to action on the mining permit application.

Response:

The construction sequence submitted identifies the approximate durations and sequencing of only the principal construction activities since the present level of engineering does not enable development of a fully detailed control schedule. The final schedule to be used for field control during the construction phase cannot be completed prior to completing detailed or final engineering.

In all scheduling activities, time has been provided to sequence the construction and installation of environmental protection systems and/or devices so that these facilities will be ready and operational as needed.

Some of the more important facilities are as follows:

- 1) Necessary portions of the water treatment facility will be completed prior to the completion of shaft sinking (after shaft collar construction).
- 2) Construction of impoundments and reclaim ponds to capture potentially contaminated surface water drainage from temporary construction service areas.
- 3) Completion of the sewage treatment facility prior to main mine/mill facilities (i.e., within first year).
- 4) Early completion of the services building (offices), and warehouse (shops) to minimize the need for temporary contractor facilities.
- 5) Early completion of the railroad spur to permit delivery of bulk and heavy equipment items to the mine/mill site with minimum impact on highway traffic.
- 6) Installation of dust collectors, noise suppressors and similar devices prior to systems testing, and full startup operation.

Comment No. 122

This section also states that the construction technologies are "... well established and readily quantifiable." Please provide documentation and quantification of the technologies to be employed in constructing the tailings ponds' and reclaim ponds' liners.

Response:

Throughout the preliminary design of the MWDF, consideration has been given to the constructability of the MWDF. This is reflected in various features such as the embankment slopes, the slope benches, and the layer thickness for the seepage control system. As the preliminary engineering neared completion, Johnson Brothers Corporation (through INDECO) of Minneapolis, Minnesota prepared construction methods and planning studies for the proposed design. Johnson Brothers is a large contractor with an extensive background in heavy civil construction. They are experienced in construction of these types of facilities and offered valuable input in finalizing the preliminary design. Results of their construction planning studies are presented in the "Construction of Waste Disposal Facilities" report by INDECO (previously provided to the DNR). Additional general quality control considerations for the MWDF are presented in the Exxon paper "Construction Aspects" (also previously provided to the DNR).

SECTION 1.3.1.1, MINE/MILL SITE PREPARATION

Comment No. 123

The clearing of trees and shrubs during periods of snow cover is preferable because the wildfire hazard is minimized, salvage wood increases in volume and value because logs are protected from dirt, and the lack of leaves reduces the slash volume.

Response:

Comment acknowledged.

Comment No. 124

Commercial whole tree chipping contractors and the sale of chips for fuel or pulp should be investigated as an alternative to burning. The burial of stumps under a one-time disposal permit may also be an alternative. A license for a wood burning site from the Department may be necessary.

Response:

Comment acknowledged.

Comment No. 125

Please provide a grading plan for all disturbed areas showing interim and final grades along with earth material balances. If negative balances are derived, specify the source of imported fill and/or topsoil. If positive balances are found, specify the use or disposal of surplus material.

Include in the plans the specifics of the runoff and erosion control program and further describe the scheduling relationship between grading and runoff control. Calculate anticipated maximum runoff volumes from each stormwater collection area and maximum flow rates in major collection ditches. Provide plans for all temporary and permanent stormwater impoundments, specifying design capacity, detention times, control structures, overflow pipes, weirs, energy dissipators, and surface stabilization materials or methods. Define and differentiate between short-term and long-term erosion control measures. Use of short-term measures for a long period of time may actually aggravate erosion due to the need for frequent maintenance.

Response:

The three attached civil drawings (Attachment No. 9) indicate the grading plans for final grades superimposed on existing topography in the site area.

As described in the EIR, the site will be cleared, grubbed, and rough graded as necessary which will be one of the initial activities in the construction schedule. Since there is no phasing to this work, there will be no interim conditions for any length of time.

The storage area for the salvaged topsoil, (estimated at 53,500 m³ [70,000 cubic yards]), is shown on the east side of the mine/mill area. Earthwork calculations for the mine/mill area indicate a net excess of 70,700 m³ (92,400 cubic yards) of material in addition to the topsoil stockpile. This excess material will be utilized in the construction of the MWDF.

Erosion control will be developed as necessary with the rough grading. To the extent possible, the two permanent surface drainage basins will be used for runoff control (see drawings No. 051-1-C-001 and 051-1-G-002 in Attachment No. 9). The basin areas will be excavated first with grading work generally progressing outward from the basins. Where portions of the storm drainage system are not installed concurrently with the rough grading, separate provision for runoff and erosion control will be made. These provisions will consist of temporary siltation basins or hay or straw bale ditch retention checks.

Graded areas not scheduled for immediate development would be revegetated with a temporary ground cover following the grading work to reduce siltation from runoff erosion. As an area is subsequently developed, any portions of the final storm drainage system not installed with the initial site work would first be installed for the area before beginning other construction. At that point, runoff would be controlled by the final system, although some hay or straw bale ditch checks might still be used to prevent downstream siltation of the system. Development of the site in this manner will reduce the need for short-term temporary erosion control measures. The long-term control will be through the final surface water drainage system.

The three civil drawings include a culvert schedule which presents the water flow rates in the ditches and culverts, for a 10-year, 24-hour storm. Runoff coefficients and tributary areas are included with the other drawing data.

Except for two small extremities of the mine/mill area (the road to the underground fuel delivery borehole at the southwest and the explosive storage area at the northeast), all surface water will be directed to surface drainage basins No. 1 and No. 2. The drainage basins are sized for a 25-year, 24-hour storm, with pond depth allowance for sediment accumulation and maintenance of freeboard. Runoff in the preproduction ore storage area, which is now located where the backfill sands were originally designated to be stored, is collected and pumped as needed to the water treatment plant feed tank. As shown on the drawing, drainage is also collected separately from three other small areas in the central portion of the mine/mill site. This water is directed to the reclaim pond.

Typical drainage inlets for paved areas and for ditches, and details of the surface drainage basins are included with the drawings.

Comment No. 126

Would upgrading existing roads involve partial filling of wetlands along the right-of-way of the Little Sand Lake Road? If so, would the extent of filling be the same as those used for the calculations in Table 3.4-3 for road access alternate E?

Response:

Upgrading Little Sand Lake Road to approximately the same standards as the new proposed access road would require partial removal and filling of wetlands along the route. Assuming right-of-way for widening could be obtained, and assuming the existing roadway centerline location in the wetlands areas was maintained, then approximately 0.5 ha (1.2 acres) of existing wetland would be removed and filled, assuming a construction limit width of 27.4 m (90 feet). If the upgraded roadway was realigned to keep the widened area to one side then the required wetland area could be reduced.

SECTION 1.3.1.2, TEMPORARY FACILITIES

Comment No. 127

Modifications of previously granted high capacity well approvals will be required prior to the use of existing wells for drinking water purposes. The use of several strategically located wells should be considered in order to minimize the need for tank trucks and potable water dispensers.

Response:

Comment acknowledged. A high capacity well application(s) will be filed in 1983. The suggestion of using multiple wells will be considered.

Describe the existing electrical power transmission lines and discuss the extent to which the existing system could be modified and used to reduce the need for on-site power generation.

Response:

As stated in the CPCN application to construct the Venus to Exxon Line X-76, a 24.9 kv power transmission line is currently located along Sand Lake Road adjacent to the Exxon mine/mill site. This powerline would be able to provide service to the construction phase of the Project for less than 6 months. After this time period, requirements indicate a need for supplemental electrical power. After the 18th month of the construction phase even a separate 24.9 kv powerline from the Venus substation to the mine/mill site is insufficient for the load. The cost of a separate 24.9 kv line to the mine/mill site would be prohibitive when there is no apparent need for the power after 18 months.

To eliminate the need for on-site power generation, Exxon is working with Wisconsin Public Service Corporation on a plan to accelerate approval of the CPCN application so that construction of the 115 kv powerline can begin upon issuance of mining and other DNR-approved permits.

SECTION 1.3.1.3, ACCESS ROAD CONSTRUCTION

Comment No. 129

Please provide a summary of organic deposits on the access road and railroad (Section 1.3.1.9) corridors along with estimates of the total amounts of marsh materials to be excavated. What is the estimated volume of waste wood and the likely destination for off-site disposal.

Response:

As part of the preliminary engineering work completed for the access road and the railroad spur, soil samples were collected along the centerlines at 30 m (98 feet) intervals. Material logs of these auger holes are attached (Attachment No. 10). The plan and profile sheets from the preliminary engineering drawings for the road and railroad are also included in Attachment No. 10. The auger sample locations are shown on these plan and profile sheets. Material quantities were also estimated by Foth and Van Dyke as a part of their engineering work. Marsh excavation for the access road is estimated to be approximately 4800 m³ (6275 cubic yards) while for the railroad spur it is estimated to be approximately 12,700 m³ (16,700 cubic yards).

A Forest Inventory and Timber Appraisal Study for the Crandon Project by Edward F. Steigerwaldt and Sons estimated timber resources recoverable during access road and railroad spur construction (report previously provided to DNR). By adjusting their estimates to include cleared areas for the access road and spur, and applying percentage waste factors, the amount of wood wastes from timber harvesting were estimated. Using a factor

(TABLE FOR RESPONSE TO COMMENT NO. 129)

WASTE WOOD FROM ROAD AND RAILROAD CLEARING
STEIGERWALDT DATA

Access Road

<u>Acres</u>	<u>Cords</u>	<u>Board Feet</u>
75	550	12,157
(Revise cleared area to 37 acres)		
37/75	272	5,997
Air dry tons	476	11.2
Waste at 65%*	309	7
Total: 316 Tons		

Railroad Spur

<u>Acres</u>	<u>Cords</u>	<u>Board Feet</u>
74	676	40,709
(Revise cleared area to 45 acres)		
45/74	411	24,755
Air dry tons	719	46.4
Waste at 65%*	467	30
Total: 497 Tons		

Notes: Cord - 128 ft³
Wood Volume - 80 ft³
Air dry weight (hardwoods) - 3500 lbs/cord (1.75 tons per cord)
Air dry weight (hardwoods) - 45 lbs/ft³ (0.0225 tons/ft³)

* Contained in a Dames and Moore Study for WPSC on wood availability in this area of Wisconsin. (65% represents culls, branches, and tops normally left in the field after harvest - stumps would increase the percentage.)

of 65 percent waste (culls, branches, and tops) on an air dry weight basis, the following approximate waste quantities were estimated:

Access road - 320 tons
Railroad spur - 500 tons

The calculations leading to these totals are presented in the attached table. Stumps removed during grubbing would increase these totals.

The disposal options of burning, chipping, and burial (landfill), as suggested in the EIR, are still considered appropriate.

Comment No. 130

Please describe the road surfacing process and material. Specify the total amount of road base material which will be brought in.

Response:

The proposed access road consists of a 0.076-m (3-inch) bituminous concrete pavement underlain by a 0.305-m (12-inch) crushed aggregate base. An estimated quantity of 56,700 t (62,500 short tons) of crushed aggregate base material is required for the access road.

SECTION 1.3.1.4.2, SHAFTS AND COLLAR

Comment No. 131

Provide details on the soil freezing process including well design, brine containment, and waste brine disposal. What type of brine will be used? How large will the holes be and how will they be spaced? How much area will be affected by the soil moisture freezing? What diameter will the total excavation actually be?

Response:

The plan for development of the Crandon Mine includes construction of four vertical shafts:

- 1) Main production and service shaft - 7.3 m (24 feet) finished diameter;
- 2) Intake air shaft - 5.5 m (18 feet) finished diameter;
- 3) East exhaust air raise - 6.1 m (20 feet) finished diameter; and
- 4) West exhaust air raise - 6.1 m (20 feet) finished diameter.

Each shaft will have a concrete lined collar through the glacial overburden and weathered subcrop rock. Collar construction will include stabilization and hydraulic control by ground freezing, followed by excavation and concrete lining within the protective frozen soil cylinder.

The stabilized ice wall is formed by closed circuit circulation of a cooling fluid (calcium chloride brine) through a circular pattern of vertical pressure-tested steel cased boreholes (114-152 mm [4 1/2 - 6 inches] diameter) containing inner 38-mm (1 1/2-inch) down-flow tubes. Monitor boreholes are also provided to measure ground water levels, ground temperatures, and for detection of brine leakage. With this temporary ground stabilization method no foreign materials are introduced to the ground water regime or surrounding soils.

Freezing system design, e.g., number of freeze holes, hole spacing, and required ice wall thickness, is contingent upon the geohydrologic conditions of each site. Preliminary designs for the Crandon shaft collars have been prepared by Ground/Water Technology, Inc. of Denville, New Jersey. Site design details are shown on the four figures included in Attachment No. 11.

Once excavation and lining of the shaft collars is complete, the protective ice walls and the surrounding soils will be allowed to thaw. Abandonment of the freeze pipes will include:

- 1) Removal of brine for off-site disposal by the freezing contractor;
- 2) Clean water flushing of freeze pipes;
- 3) Mechanical perforation of freeze pipe casings at the soil-rock interface and at the hole bottom; and
- 4) Displacement of freeze pipe flushing water with 1:1 neat cement grout delivered from the surface.

Ground freezing is an established shaft collar construction technique for sites with saturated or unstable soils. For additional technique and application details the reader is referred to:

1. Sanger, F. J. 1968, Ground Freezing in Construction. - Journal of the Soil Mechanics and Foundations Division, A. S. C. E. Vol. 94, No. SMI. Proc. Paper 5743. January, 1968.
2. Sanger, F. J. and Sayles, F. H. 1978, Thermal and Rheological Computations for Artificially Frozen Ground Construction. - International Symposium on Ground Freezing. March, 1978. Bochum.
3. Maishman, D. 1982, Ground and Water Control by Freezing - The Application in Shaft Construction. - University of Wisconsin, Extension Course on Shaft Design and Construction. January, 1982.

What is the projected volume of water that will be generated during the shaft construction? The water treatment facility will not be completed until approximately one year following commencement of main shaft and air shaft construction. Waste rock and preproduction ore storage runoff will also go to reclaim pond No. 1. While reclaim pond No. 1 should be completed within three months after the start of the main shaft and eight months after the start of the air shaft construction, where will the water be stored during the three- and eight-month period when this pond is not in service?

Response:

During development of the main production and intake air shafts, water will enter the excavations from three sources: 1) Precipitation; 2) Ground water seepage; and 3) Utility water supply.

All shaft drainage will be pumped to surface storage ponds prior to treatment and discharge as required.

Precipitation gains over the total area of the shafts will be less than $0.07 \text{ m}^3/\text{h}$ (0.3 gallons per minute). Construction plans provide for control of surface runoff around the shaft excavations. Therefore, the effects of precipitation drainage on shaft development are negligible.

Ground water seepage into the shaft excavations will vary from 0 to $3.4 \text{ m}^3/\text{h}$ (0 to 15 gallons per minute) in each shaft, and is estimated to average $0.9 \text{ m}^3/\text{h}$ (4 gallons per minute) (Dames and Moore, April 19, 1978, pumping tests of shaft pilot hole No. 155). During collar excavation and lining, the freezeway methods to be employed will negate ground water influx. When sinking begins in bedrock, ground water quantity will vary with depth, fracture intensity, and reservoir source (overburden aquifer or connate bedrock water). Shaft construction specifications will require rock grouting any time ground water inflow to the excavation exceeds $3.4 \text{ m}^3/\text{h}$ (15 gallons per minute) in sections not yet permanently lined with concrete.

Utility or process water consumption during shaft development will vary from zero to $1.4 \text{ m}^3/\text{h}$ (0 to 6 gallons per minute) during different shaft sinking operations. The nominal average use is estimated to be $0.45 \text{ m}^3/\text{h}$ (2 gallons per minute).

Once intake air shaft sinking is complete (EIR Figure 1.3-9, Construction Schedule) and mine level development begins, shaft drainage water will constitute only a small part of the estimated total mine inflow. Until that time, approximately 18 months after the start of shaft sinking, all mine water will be pumped to a surface sedimentation pond prior to treatment and discharge. During this 18-month period an estimated 18925 m^3 (5,000,000 gallons) of water will be pumped from the shaft excavations. Reclaim pond R1, and a small transfer pond at the construction site, will be available to receive the shaft construction water when sinking in bedrock begins (EIR Figure 1.3-9). Only 3.2 percent of reclaim pond

R1's 590,460 m³ (156,000,000 gallons) normal operating capacity will be required to store the estimated 18925 m³ (5,000,000 gallons) of shaft excavation drainage, discounting any treatment and discharge which will be available as an option 10 months after shaft construction begins.

Comment No. 133

Provide calculations showing that the storage volume will be adequate to handle construction wastewater before the surface water treatment systems are completed. What contingency measures are available if the volume is not sufficient?

Response:

Reclaim pond R1 has a volume of 590,460 m³ (156,000,000 gallons) to the normal water level (NWL). Also, the pond has 2.6 m (8.5 feet) of freeboard above the NWL which could hold 309,000 m³ (81,600,000 gallons) if necessary. This volume of storage capacity is far in excess of the estimated necessary storage capacity prior to completion of the required portions of the wastewater treatment and excess water discharge system.

Until the treatment plant and discharge system are ready, an approximate total volume of only 18,925 m³ (5,000,000 gallons) of mine associated water will have been stored in reclaim pond R1.

The only other water that requires storage or treatment during that period is runoff from the waste rock storage pad. The waste rock area has its own temporary retention pond with one year of storage capacity (39,000 m³ [10,300,000 gallons]). This temporary pond will be pumped as necessary to reclaim pond R1 prior to completion of tailing pond T1. It will have less than one year of use prior to completion of the necessary water treatment and discharge facilities. All other construction wastewater is uncontaminated surface runoff and will be directed through silt control retention basins or ditches for direct discharge to existing surface water drainage.

With this degree of excess capacity in reclaim pond R1, there are no additional contingency storage measures planned.

SECTION 1.3.1.4.3, UNDERGROUND DEVELOPMENT

Comment No. 134

Describe in detail the construction of the groundwater interceptor system. Describe the temporary water containment and pumping facilities.

Response:

Subsequent to any mine inflow controls which may be applied, a residual ground water seepage interception program will be instituted. Its purpose will be to intercept and contain ground water inflow before any contamination by exposure to mine operations is possible. To accomplish this, interception must occur above the active mine workings.

Initial mine production has been planned for the 230 to 350 m stope horizon, a position at the base of the weathered bedrock ground water inflow courses. Thus, seepage into the mine workings during the early years of the mine is expected to be very localized. Exploratory diamond drilling techniques will be employed to identify active water courses prior to advance of the mine face.

The specific design of the ground water interceptor system will begin during preoperational underground exploration. Conceptually, water encountered on the uppermost mine level will, where possible, be captured in interceptor drill holes and contained to avoid contamination. In most cases, as the mine progresses upward from the initial 230 m level, access for interceptor drilling will be provided by premature development of production drifts temporarily dedicated for mine inflow control. Otherwise, specific mine water control drifts will be developed as required by identification of any area of concentrated seepage. Ultimately, the ground water interceptor system would function as shown on the conceptual Mine Inflow Control cross-section (figure attached). Cement rock grouting may be used for local inflow control or diversion.

Actual ground water collection will be from exploration or interception drill holes developed from the access and mine water control drifts. These holes will be typically arranged in a conical fan above the drifts, increasing the effective radius of the adit as a line sink drain. As is common mine practice, each water producing hole collar will be sealed and equipped with a pipe manifold.

Collected ground water from the interceptor drill holes will be piped through the drifts to the separate clean water sump and pump station. This facility will be located on the 230 m mine level near the main shaft, and will be developed at the start of mining prior to interception of potential ore deposit weathered zone water courses.

The clean water surge sumps on the 230 m level will consist of downgrade excavations in the wallrock adjacent to the pump station. A bulkhead containing the pump station suction pipes will be constructed at the outlet of the sumps. Twin sumps will be provided for ease of maintenance and reserve capacity.

Clean water sump discharge will be pumped up the main shaft in a dedicated pipeline. A bank of stand-by pumps and a second main shaft discharge pipeline will be provided to avoid system interruption. At the surface, the intercepted ground water pipeline will be routed directly to the uncontaminated water holding tank.

Comment No. 135

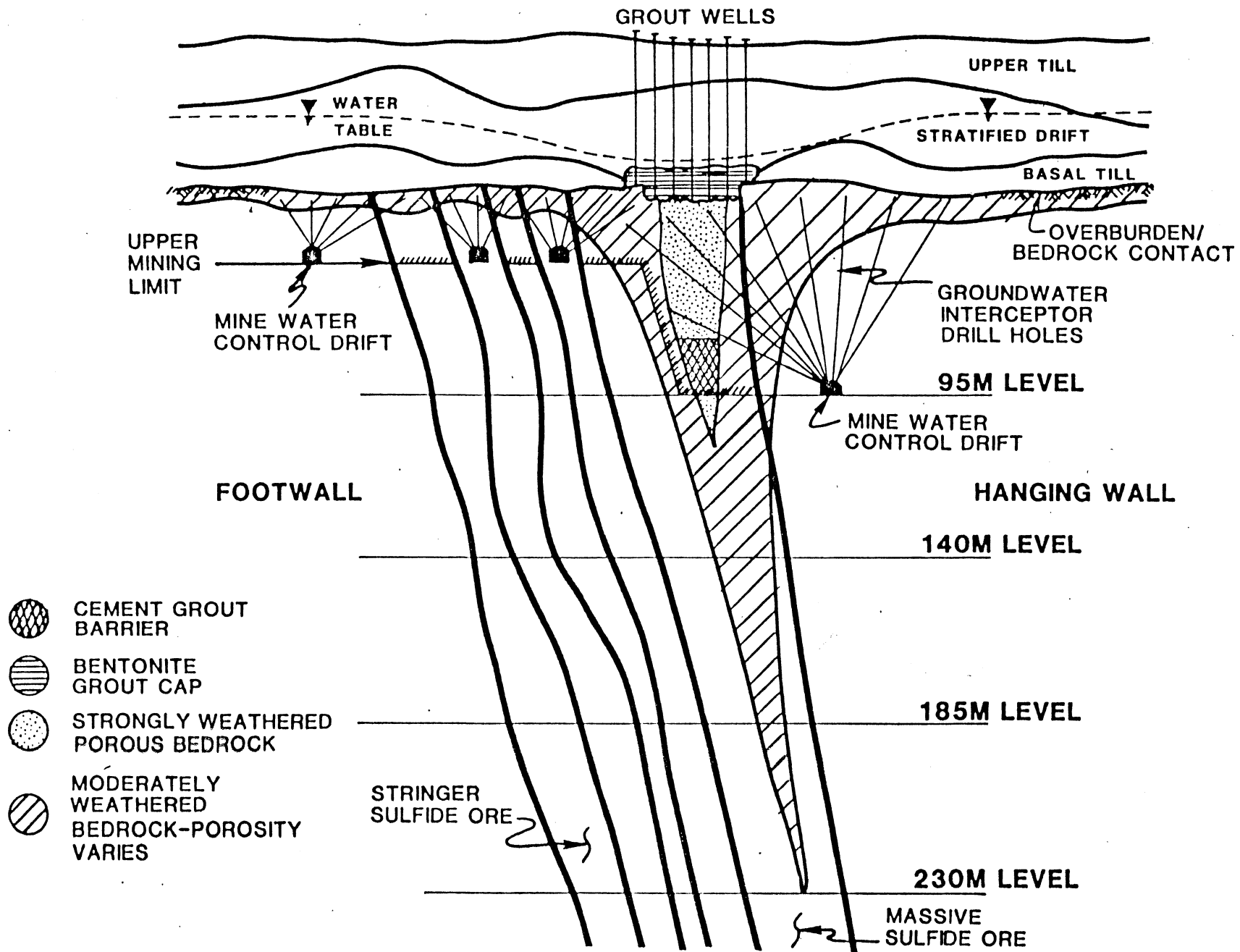
Describe in detail the placement of the grouting and indicate approximately how much of the ore body-unconsolidated deposits interface would be grouted.

EXXON MINERALS CO.

CRANDON PROJECT

MINE INFLOW CONTROL METHODS

(CONCEPTUAL X-SECTION)



Response:

The extent to which bentonite grouting from surface or underground cement grouting will be applied is dependent upon technical achievability and economic considerations. Actual grout placement locations will be determined during the mine final engineering and initial mine development periods as additional geotechnical investigations are completed. Potential mine inflow control methods, and related technical references, are described in the response to comment No. 61.

Comment No. 136

Discuss contingency measures for inflows of more than 2,000 gallons per minute during construction.

Response:

Ground water inflow to the mine will not occur in major quantities until mine level development intersects the orebody weathered zones (Prickett, December 1982). Mining plans provide for construction of the intercepted ground water and normal mine drainage sumps and pump stations at the very start of underground development. These facilities are located near the main shaft, exterior to the orebody weathered zones. They will, therefore, be available for full capacity duty prior to mining entry into any areas of potential ground water seepage.

Consequently, the contingency measures described in the response to comment No. 62 will apply throughout the mine construction and operations periods.

SECTION: 1.3.1.4.4, WASTE ROCK AND PREPRODUCTION ORE

Comment No. 137

Discuss the affect of operating the equipment transporting waste rock and preproduction ore on the liner integrity.

Response:

Waste rock haulage to the MWDF will be performed using end dump trucks in the 35-ton size range. Spreading and grading would be by tractor (i.e., CAT D-7). The operation of either of these types of equipment on the 0.92 m (3 feet) thickness of drain and filter material overlying the liner will not jeopardize liner integrity or performance capability.

Truck tire pressures of 70 psi acting at the filter layer surface should be reduced to less than 10 percent at the level of the liner. Track pressures of a typical D-7 would only be 10 psi and be similarly reduced at the liner depth. Consequently, traffic during waste rock placement should have no effect on the liner. In practice, the traffic areas will also receive a layer of rock to provide yet another protective layer which would further reduce effects at the liner level.

Preproduction ore will not be stockpiled in the MWDF. An area at the mine/mill site is now designated for stockpile of preproduction ore.

SECTION 1.3.1.6, MINE WASTE DISPOSAL FACILITY AND RECLAIM POND SITE PREPARATION

Comment No. 138

What characteristics will determine if topsoil is "suitable"? Provide descriptions of topsoil stockpiling quantities, location and method of protection.

Response:

Throughout the EIR, for all construction areas where earthwork or grading is required, the general statement has been made "... where suitable topsoil is encountered it will be salvaged, stockpiled, and reused." Suitable topsoil is meant to include easily distinguishable humus-bearing soils suitable to the sustenance of plant life.

After clearing and grubbing operations, suitable topsoils will be identified during initial earthwork operations. Guidelines, procedures, and specifications will be developed by Exxon and its consultants to allow field personnel and equipment operators to make judgments as to what topsoils are worth saving. The guidelines and judgments will account for soil quality, depth, and areal extent. General specifications used by the Wisconsin Department of Transportation for topsoil salvage and reuse will be tailored to the Crandon Project. Experienced field personnel will be utilized who can make these judgments, because it is not the type of procedure which can be rigidly defined.

Based on experience to date, from development of drill site areas and other minor site work, there is limited suitable topsoil in the area. After clearing and grubbing operations are completed, there may not be major quantities of topsoil available to salvage.

It would not be cost-effective to stockpile and handle the topsoils twice if they are only marginally better soils than subsoils. However, if the timing and scheduling of operations allow (such as the stripping materials of one area going directly to the reclamation of another), then even the marginally better topsoils could be reused.

Stockpile storage volumes and area are addressed in the INDECO report "Construction of Waste Disposal Facilities" (previously provided to the DNR). While these estimates are total volumes, if some topsoils were segregated, overall area requirements would remain essentially the same. Runoff from stockpile areas will be controlled and directed to sedimentation ponds or through straw bales and no other protection is anticipated to be necessary. However, if a stockpile was to remain over an extended period and there was a potential for erosion, temporary vegetation would be established.

SECTION 1.3.1.7, MINE WASTE DISPOSAL FACILITY AND RECLAIM POND CONSTRUCTION

Comment No. 139

Considerably more information is needed on the construction techniques and the quality assurance and quality control measures referred to for construction of the liners and underdrain system. It has not yet been demonstrated that the tailings pond liner, drainage layer, and filter layer, as a total structure, will work. All Exxon-sponsored studies related to the liner systems should be submitted to the Department for evaluation. Also, please provide documentation from other facilities which have successfully used these or similar construction procedures.

Response:

As proposed, the liner will be developed from processed till (soil material larger than 3/4 inches removed) mixed with bentonite. This mixture would be "blended" and moisture conditioned to a uniform consistency using a batch system similar to that used in the concrete industry; transported to the liner construction area by truck; dumped, spread and compacted. However, further study is planned for other methods of liner construction including in-situ mixing techniques to assess facility performance variability.

An example of one method of quality control to evaluate as constructed field permeability is provided in Attachment No. 12. A high degree of quality control, as far as constant mixture of liner components (i.e., till, bentonite and water), can easily be provided using the automated batching system proposed.

Techniques for spreading a processed aggregate in constructing the underdrain layer would be similar to those used in highway construction with special considerations developed to protect the underlying liner. Grade control and soil material quality assurance methods are well established. Drainage performance characteristics of the underdrain system can be established either in large scale laboratory tests or from in-situ field measurement (i.e., determination of the in-situ permeability of base and subbase soil materials; Report No. FHWA-RD-79-88 May, 1979).

The combination of liner, drainage and filter layers is not new technology and has been successfully used in landfill site development. The following list includes several sites where either similar concepts, in part or in total, have been implemented, are under construction, or have recently been designed:

<u>SITE</u>	<u>LOCATION</u>	<u>TYPE OF WASTE</u>	<u>STATUS</u>
Oaks Sanitary Landfill	Montgomery Co., MD	Municipal waste	Under construction
Key Lake	North Saskatchewan	Uranium tailings	Construction complete, operations just beginning
Crystal Lake Landfill	McHenry Co., IL	Municipal waste	Operating
Landfill No. 2	Virginia Beach, VA	Municipal waste	Under construction
Hawkins Point	Baltimore, MD	Hazardous waste	Designed
Loudoun Co. Landfill	Loudoun Co., VA	Municipal waste	Designed

To date, all Exxon sponsored studies related to the underdrain system have been submitted to the DNR including:

- 1) General Properties of Common Liners, Crandon Project, Project Report 6.1, Golder Associates, December 1981.
- 2) Evaluation of Prospective Common Liners, Crandon Project, Waste Disposal System, Project Report 6.2, Golder Associates, December 1981.
- 3) Geotechnical Review, Crandon Project Waste Disposal System, Project Report 2, Vols. 1-3, Golder Associates, October 1981.
- 4) Parametric Seepage Rate Estimates, Crandon Project, Waste Disposal System, Project Report 3.1, Golder Associates, March 1982.
- 5) Underdrain Review, Crandon Project, Waste Disposal System, Project Report 3.2, Golder Associates, March 1982.
- 6) Laboratory Testing Programs, Crandon Project, Waste Disposal System, Project Report 5, Golder Associates, May 1982.

Comment No. 140

How long will it take to actually put a liner in place? How will the earliest constructed areas be protected from erosion and any other potentially damaging forces? How will a uniform 6-inch layer of bentonite modified soil be placed and held on slopes?

Response:

A final detailed construction schedule for facility development has not been prepared for either the reclaim or tailing ponds. That effort would be part of the Plan of Operations. The report by INDECO, "Construction of Waste Disposal Facilities" (previously provided to the DNR), included an estimated schedule for installation of the liner in each pond. These timeframes were based on processing equipment capacities and placement rates and the appropriate manpower to complete construction.

Liner construction in the reclaim ponds, including the bentonite modified till underliner, lower cushion, synthetic liner and overlying protective cushion, was estimated at approximately 4 months for each pond.

Liner construction for each of the tailing ponds will occur in 3 or 4 stages with each stage being completed ahead of the pond filling rate. The benches on the inside pond embankment were included in the design to accommodate this staged construction. However, in the INDECO study it was assumed that the entire liner for each pond would be installed at one time. For the tailing ponds this period ranged from 4 to 6 months including installation of the liner, underdrain, filter, and rock protection of the inside embankments.

To avoid environmental or other damage to the liner or underdrain, the seepage control system will be developed sequentially within the pond area as opposed to constructing the entire liner, then underdrain, then filter.

Construction areas developed initially will be subject to environmental effects including erosion. Precautions to protect the surrounding environment will include proper routing of potential surface water drainage and location of siltation ponds. Any damage to the previously constructed segments as a result of erosion and other potentially damaging forces will require repair and/or reconstruction. In almost all cases it is expected that any damage which would occur, would be to the top filter and repairs would be no different than any other construction that might require some interim regrading.

Bentonite modified soil will be placed and compacted on proposed 4H:1V pond side slopes using conventional construction techniques such as scrapers or belly dump trucks. The soil will be spread to a uniform thickness using tractors or motorgraders prior to compaction in order to provide the proper final design thickness of 0.15 m (0.5 feet). Stability during and after placement is not perceived to be a problem.

Comment No. 141

When will the bentonite modified soil be hydrated? Is the 6-inch thickness wet or dry? How will the liner be protected from dehydration? What particle size of bentonite will be used?

Response:

It is planned to partially hydrate the till soil prior to mixing with the bentonite. Additional water may be added during mixing (i.e., pugmill-batch process) to bring the soil to or slightly above optimum moisture content. A final hydration step will be performed in the field after the underdrain layer is placed over the liner. Water percolating from the construction of the underdrain and filter layers and normal infiltration will prevent liner dehydration. The detail of these steps will be provided in the Plan of Operations for the MWDF.

The 6-inch thickness defined for the liner is a compacted layer thickness at a moisture content between optimum and 2 percent above optimum. At this time, a bentonite product similar to Volclay-Saline Seal 100 manufactured by American Colloid Company has been assumed for preliminary design. American Colloid suggests a dry fineness for this product with 90 percent minimum passing a No. 12 mesh and 18 percent maximum passing a No. 200 mesh.

Comment No. 142

Will the wetlands under the MWDF be excavated during construction. What affect will leaving the wetland soils in place have upon the liner construction and stability and the dike integrity? How will excavated organic soils be disposed?

Response:

All wetland deposits (peats, mucks, and other organics) will be removed from the MWDF area. Most of the deposits are in the pond bottom areas and are 5 to 10 m (16 to 33 feet) higher in elevation than the bottom grade of the pond and would be removed in pond excavation. Those wetlands in the embankment areas would also be removed completely, down to firm subsoils prior to any embankment construction.

Based on estimated wetland material depths and areas, an approximate volume of 253,000 m³ (331,000 cubic yards) of material would be removed. Of the total estimated excavation for the MWDF (13,600,000 m³ [17,800,000 cubic yards]), this wetland material represents about 2 percent. The excavated organic materials will be used as top dressing on embankments and other areas where vegetation is to be established.

Comment No. 143

Provide drawings and describe the batching and mixing plant and the screening plant including processes, quality control, and waste products.

Response:

The construction methods study and planning by INDECO (see response to comment No. 122) included a review of material processing requirements. Basic process descriptions and equipment requirements are included in the INDECO report "Construction of Waste Disposal Facilities" (previously provided to the DNR). During the course of INDECO's study, various equipment manufacturers were contacted to provide assurance that proposed processes could be efficiently accomplished. The attached process

flowsheets (Attachment No. 13) from Universal Engineering Corporation depict an equipment set capable of providing all required soil materials by processing of the glacial till. Equivalent systems could be provided by other manufacturers.

In Universal Engineering Corporations system, flowsheets No. 1 and No. 2 are dry processes to prepare liner material and cushion material. The only water used is in flowsheet No. 3 showing the process to prepare the underdrain material. Brief process descriptions are included with the flowsheets.

Water requirements in flowsheet No. 3, for the underdrain material preparation are primarily related to the volume rate of material handled and its fines content. The necessary rate of material handled depends on the scheduled need for facilities. The total water requirement is expected to be in the $0.25 - 0.38 \text{ m}^3/\text{s}$ (4000 - 6000 gallons per minute) range. Actual makeup water is only in the range of $0.03 - 0.04 \text{ m}^3/\text{s}$ (400 - 600 gallons per minute) to account for water loss with the materials removed from the process. There would be a settling pond associated with the process, however, small high capacity clarifiers would be used first to keep the pond size to a minimum. The clarifiers and settling pond would remove the finest material (-200 mesh size), with the clarifier underflow pumped to the pond. After completion of a construction phase the fines would be removed from the pond and used in the liner mix or another appropriate use. The first phase of construction (preparing the waste rock storage area) will determine much of the system sizing requirements because there will be less opportunity to spread out the material processing during that phase. Based on these needs a settling pond to contain all the fines (-200 mesh) removed during the first phase of construction would be in the range of 0.8 to 1.6 ha (2 to 4 acres) with a depth of 3 to 4.6 m (10 to 15 feet). In this underdrain material preparation process the -40 mesh fraction of till is removed but does not have to be wasted, as it can be used in place of straight till in other applications. As indicated above, with the reuse of the settled fines, there are no unused materials produced from the classifying or processing operations.

The batching and mixing operations are also accomplished through the use of conventional equipment. The attached manufacturers' data (Attachment No. 13) are typical of the type of equipment that would be used to first batch the bentonite clay with the glacial till and then mix the fractions.

Quality control procedures will be planned in detail for the Plan of Operations; however, general quality control aspects for this type of procedure are included in the Exxon paper "Construction Aspects" (previously provided to the DNR).

Comment No. 144

Describe the route for hauling bentonite from the Woodlawn Siding and the need for new road construction and/or upgrading. What, if any, modifications will be necessary for the existing Woodlawn siding facility?

Response:

The figure provided with the response to comment No. 89 shows the bentonite haul route from the Woodlawn Siding facility to the MWDF.

In developing the Construction Plan, INDECO reviewed necessary upgrading for the siding and haul route. Grading only will be required at the siding while approximately 4.8 km (3 miles) of the route (of a 9.6 km [6-mile] total) will require grading and compaction. The upgrading would be accomplished in approximately one week.

Comment No. 145

Figures 1.3-3 through 1.3-8 indicate that two tailings ponds will be under construction simultaneously while the project schedules show that only one pond will be constructed at a time. This contradiction should be clarified. Please provide full size plan sheets of these figures.

Response:

EIR Figures 1.3-3 through 1.3-8 are simplified figures of the MWDF configuration at each of the six main construction stages. The ponds are constructed sequentially and each stage is from 2-4 years in duration. The next pond in sequence is constructed early in its stage and the previous pond is reclaimed in the latter part of the stage. The detail of this scheduling is presented in the INDECO report "Construction of Waste Disposal Facilities" (previously provided to the DNR). Full size drawings from that report, which were used to prepare the EIR figures, are included in Attachment No. 14.

Comment No. 146

Additional comments and questions on the reclaim ponds and tailings ponds construction were forwarded to you under the respective permit reviews.

Response:

Comment acknowledged.

SECTION 1.3.1.8, PIPELINE CONSTRUCTION

Comment No. 147

Provide construction and design details for all pipelines. Indicate where and why the tailings and reclaim ponds pipelines will be buried. Describe installation of any monitoring systems designed to detect pipeline leaks or failures.

Response:

The reasons for burying the tailings and reclaim ponds pipelines are included in the response to comment No. 84. The monitoring system proposed to be installed to detect pipeline leaks or failures is shown in the process

flow diagrams in the report by PSI, Inc. The pipeline route has been identified in EIR Figure 1.2-13, "Waste Disposal Facility Pipeline Route and Haul Road" and is further described in the report by PSI, Inc. Construction and design details have also been described in the response to comment No. 84. See the response to comments No. 84, 107 and 188 for further details.

SECTION 1.3.1.33, WATER SUPPLY

Comment No. 148

Please indicate the location and construction details of the water supply well(s). As noted earlier, any well which is used as a potable water supply must be in conformance with NR 112. We recommend a regular program for testing the bacteriological quality of the wells, tank trucks, and work area water dispensers. Due to the possibility of contaminated backflow through the temporary construction water system, we also recommend that a distinction be made between construction water and potable water wells.

Response:

The proposed location of the water supply well is approximately 250 m (820 feet) due west of the southwest corner of the mine/mill site. Construction of the potable water supply well will be in accordance with NR 112 requirements. Other comments regarding testing and construction details are acknowledged and will be incorporated into our planning.

Details of well construction will be included in the high capacity well permit applications which will be submitted in 1983. The general well construction presented below is proposed:

The well will be cased and screened with continuous slot, pipe size, stainless steel screen. The amount of screen and casing in the well and their relative position will depend upon the formations encountered in the drilling. A gravel pack will be placed around the screen and continued for the entire saturated thickness of the aquifer above the screen. Above the gravel pack a top seal of cement grout will extend to the surface. After placing the gravel pack, the well will be pumped, surged and otherwise developed until it is essentially a sand free well.

Comment No. 149

The estimated peak demand for water of 45.3 cubic meters per day appears conservative. Please provide the data used for this estimate.

Response:

Earlier estimates of a peak demand for water of 45.3 m³/d (12,000 gallons per day) were too conservative. Water use will peak during the first year of construction and will be used for supplying human needs, sprinkling of site roads as required, compaction for fill and for use in concrete

production. The heaviest water use will occur from June to November 1986, with an estimated peak demand of 326 m³ (86,129 gallons) per day. This peak consumption is estimated as follows:

	<u>m³/day</u>	<u>(gallons per day)</u>
Compaction	225	59,445
Batch Plant	60	15,852
Road Sprinkling	40	10,568
Human consumption	1	264
Total	326	86,129

Average water demand for the first year will be less, depending on the amount of rainfall, moisture content of the soil being compacted, and the rate of concrete production. Water use during the remainder of the construction phase will be considerably less than the peak demand that occurs during the first year.

SECTION 1.3.1.13, SANITARY FACILITIES

Comment No. 150

This section states the sewage treatment facilities will be completed during the first year of construction; Figure 1.3-9 shows the facilities as scheduled for completion during construction year 2. Please indicate the actual expected completion date. Provide calculations and estimated flows for both the chemical toilets and the temporary septic tank systems before and after completion of the permanent treatment facilities. Describe the volumes, method and frequency of transportation, and the likely disposition of sewage hauled off-site. Provide a description of the temporary septic tank. Is Exxon proposing a holding tank or a septic tank and drainage field.

Response:

The permanent septic tank and soil absorption field will be installed as soon as possible and should be available within 6 months after start of Project construction. Portable toilets will be used throughout the site from initial construction until sewer lines and permanent restrooms are constructed. If Exxon or a contractor utilizes a restroom/shower trailer, a temporary sewage holding tank will be used for that facility.

A licensed septic tank pumping contractor will be used to service the portable toilets (and the holding tank if there is one) as necessary. Prior to installation of the permanent septic tank and soil absorption field, the licensed contractor will haul the sewage off-site for disposal. After installation, he will transfer sewage to the permanent facilities.

With portable toilets there is approximately 0.015 m³ (4 gallons) of sewage generated per person per week. With a restroom/shower trailer approximately 0.19 m³ (50 gallons) of sewage is generated per person per day. During the first 6 months of construction, assuming a peak work force of 400 people with 50 having access to a restroom shower trailer, approximately 53 m³ (14,000 gallons) of sewage would be generated weekly.

Assurances have been received from licensed septic tank pumping contractors that this type of arrangement and their service would be satisfactory. We have not attempted to determine where they have sewage disposal capabilities.

SECTION 1.3.2, CONSTRUCTION SCHEDULE

Comment No. 151

As mentioned under Section 1.1.3.3, a preconstruction schedule is needed which would include the mitigation or resolution of impacts to private water supplies. Other impacts of construction which could be reduced by revising the construction schedule include the following:

1. Reduce damage to town roads by the completion of permanent rail and road facilities prior to the start of major on-site activities.
2. Phase the construction schedule to eliminate the need for on-site electrical generation.
3. Reduce impacts to wetlands and surface waters by the early completion, stabilization, and revegetation of key erosion and runoff control facilities. This may take as much as two growing seasons to accomplish depending on the stabilization techniques used.
4. Reduce activities during high seasonal population periods by placing more emphasis on winter activities.

Please provide discussions of these and other mitigative measures in the appropriate sections of Chapter 3.

Response:

- 1) Exxon plans to begin construction of the permanent access road and railroad spur into the Project site as early as possible after receipt of permits and Exxon Corporation's approval to proceed with the Project. We do not plan to complete the road and railroad before beginning site clearing, grading and construction of permanent facilities. Delaying construction of the permanent facilities would be impractical and result in a 12-18 month lengthening of the construction schedule. We plan to complete the road and railroad as soon as possible to allow access of construction personnel and material and equipment deliveries.

- 2) Exxon currently plans to complete the installation of permanent electric power facilities as soon as practical after powerline right-of-way and permit approvals. The current schedule shows permanent power available within months after the start of Project surface facilities construction. This greatly reduces the need for temporary power generators thereby reducing on-site noise and air emissions.
- 3) Exxon's site clearing and grading plans include the building of water runoff and control facilities to minimize the amount of suspended solids reaching the existing surface waters and wetlands. We also plan to revegetate cleared areas immediately to minimize erosion and control runoff. We believe that the majority of this revegetation will need only one growing season to adequately control soil erosion. See Section 2.0 in Attachment D (Reclamation Plan) to the Mining Permit Application for further details.
- 4) Exxon's construction plan includes performing construction activities throughout the calendar year, including the winter months. This minimizes the total construction period thereby reducing the duration of any construction-related environmental and social impacts. However, certain activities like surface grading, excavation and concrete placement will be hampered by the cold and snow. This requires construction of as many as possible of the temporary and permanent buildings during the first year to allow mostly inside activities to progress during the second and third winter seasons.

The construction schedule outlined in the above comments represent our current plan. While the basic philosophy of the construction plan (see response to comment No. 121) is not expected to change, details of the plan are likely to change as additional engineering is completed.

Comment No.: 152

Please list and discuss factors which could extend the construction period and describe the likelihood of delays. These factors should include inclement weather, labor problems, unavailability of required equipment and supplies, design or engineering modifications, and other factors you may identify.

Response:

Many factors have potential for extending the construction schedule. These factors include: inclement weather, labor problems, equipment/material deliveries, design modifications, approval of construction by the regulatory agencies, and higher mine water inflows than anticipated.

Inclement weather may cause problems and schedule delays only during the first winter. We will have most work areas under temporary or permanent cover by the second winter which will allow the inside work of equipment and material installation to proceed without delay.

Labor availability, strikes or disruptions may impact construction activities and schedule. To overcome this problem we intend to utilize local subcontractors to the maximum extent possible. We will expect all contractors to have well defined personnel recruiting and retention programs in advance of construction to hire and retain competent workers. We also plan to provide contractor coordination services to minimize jurisdictional disputes.

Equipment and material deliveries may delay installation and thereby extend the schedule. We will have in place a well defined procurement and expediting plan which will minimize delays in ordering and securing delivery of equipment and materials. We will identify those pieces of equipment which have long delivery times and will place the purchase orders well in advance to avoid schedule impacts.

Design modifications will occur as construction progresses. We will minimize delays by having an engineering office on-site to make field changes to construction drawings.

Approval of facilities design and construction by the regulatory agencies could delay construction activities. We plan to work closely with the appropriate agencies, keeping them informed in advance, to minimize schedule changes.

Higher mine water inflows than anticipated may impact the mine development schedule. We will constantly monitor the mine water inflow and probe ahead of development headings to identify sources of excess water flow. If excess water flows are identified, we will inject cement grout to seal the leaking areas ahead of excavation. These plans are discussed in the response to comments No. 134 through 136.

Comment No. 153

Please describe the construction schedule for the backfill sand storage area, pilot plant and training facility, and the water discharge pipeline and outlet structure.

Response:

Exxon's current Project plan has eliminated the backfill sand storage area. We now plan to have a few days of storage in reclaim tanks and sand storage bunkers within the mill building.

We plan to erect the pilot plant and training facility early in the construction period to verify process metallurgy, train concentrator operations personnel, and continue early development of control systems. This facility should be operational before construction of the concentrator begins.

We plan to construct the water discharge pipeline and outlet structure while erecting the first section of the water treatment plant and reclaim pond R1. This will allow treatment and discharge of water before the mine shaft sinking reaches subsurface levels containing potentially contaminated water.

SECTION 1.3.3.1, MANPOWER

Comment No. 154

As previously indicated, projected manpower requirements must be accompanied by detailed employment needs by job category over the construction period. The data and assumptions used as a basis for Figure 1.3-15 are needed.

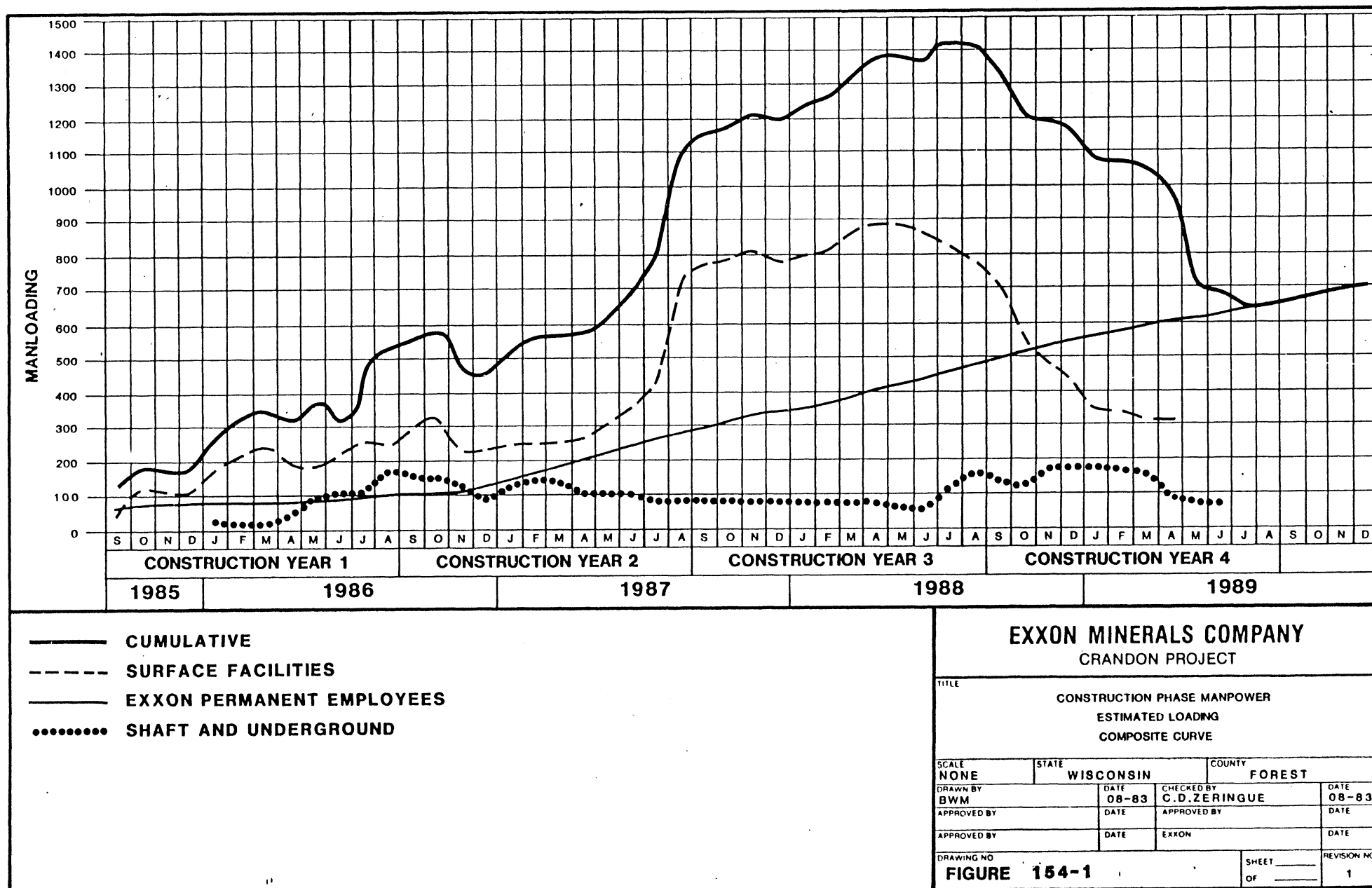
Response:

A composite curve illustrating total manpower requirements during construction and into the production phase is given in Figure 154-1 (attached). This curve depicts manpower requirements for three major areas: shaft and underground facilities, Exxon permanent employees, and surface facilities. Figure 154-2 (attached) presents the total manpower requirements for each area by month. Assumptions used for the development of each major area follows:

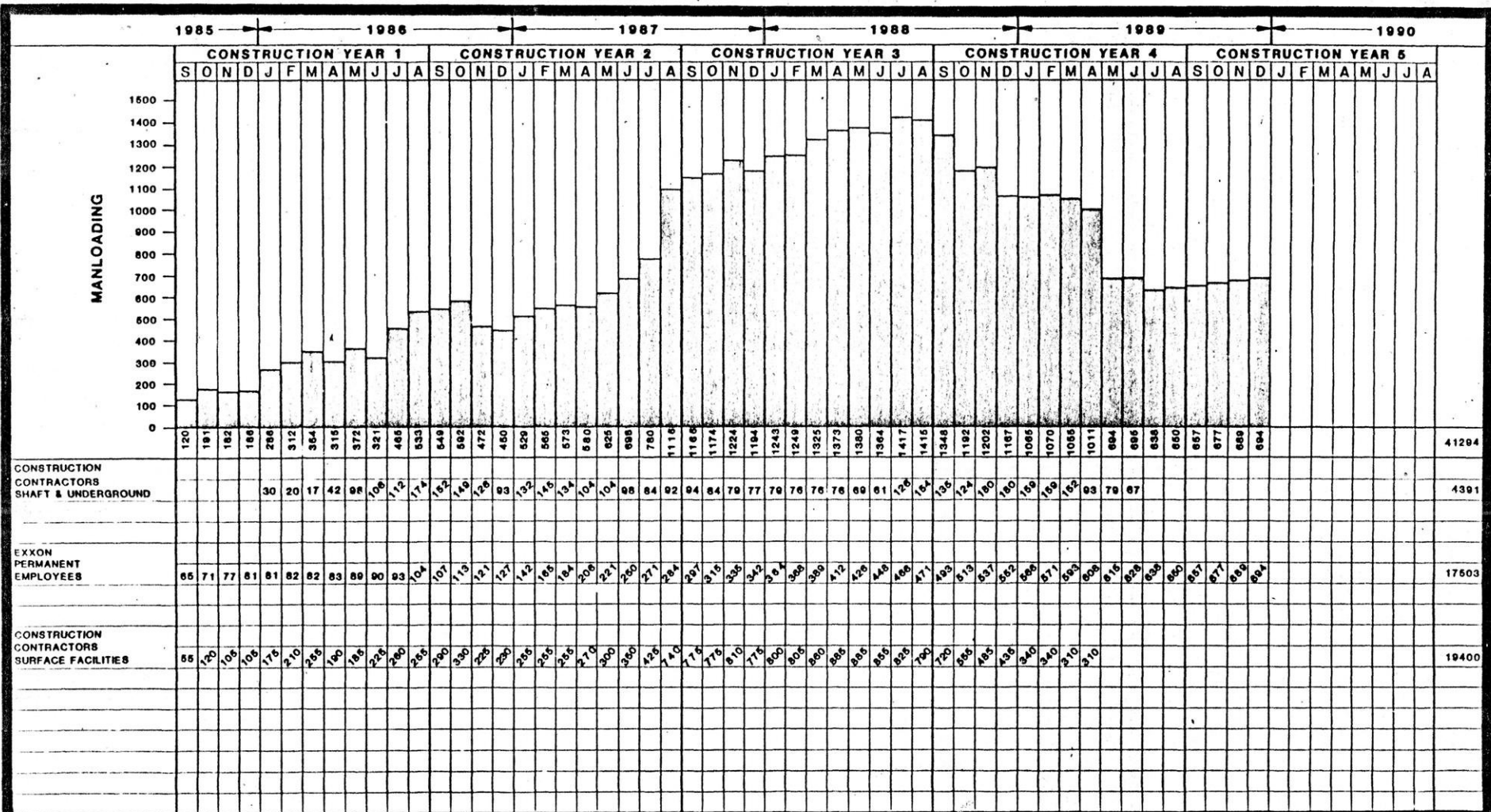
- 1) Contractor Construction Manpower - the detailed construction manpower requirements by craft for the shaft and underground facilities are shown on Figure 154-3 (attached). Activities include sinking the main and ventilation shafts, headframe erection, development of the rail haulage drift, and development of the underground crushing station including equipment installation. Manpower assessments were developed for each activity based upon contractor estimates for construction of the headframe, main shaft sinking, and intake air shaft sinking. These estimates evaluate crew sizes based upon shift requirements and schedule demands. The remainder of the activities are developed similarly through analysis of each construction task, determination of required equipment and materials, and development of crews for each task.
- 2) Exxon Permanent Employees (see Figure 154-4 [attached]). Exxon permanent employees who will be involved in operations, maintenance, and technical support for the mine and mill facilities are included in Figure 154-4. These personnel will be engaged in underground mine development work and prestart-up of the surface production facilities. They will also fulfill construction management requirements for administration of various contracts for surface and underground work prior to mine and mill start-up. During start-up many of these people will assume their permanent positions as operations, maintenance, and technical support staff. Positions were first identified on an overall Crandon Project organization chart. All positions were then staged through the construction phase, and into the production phase, to meet schedule demands for mine/mill start-up, construction management requirements, and reasonable rates for effective employee assimilation and training.
3. Contractor Construction Manpower - Surface Facilities (see Figure 1.3-15 Revised [attached]). Contractor manpower will be engaged in the construction of the railroad, access roads, tailing pond T1, reclaim ponds R1 and R2, and all other surface facilities. These include coarse ore storage, fine ore crushing, concentrator building and all facilities therein, services building, water treatment plant, plant water systems,

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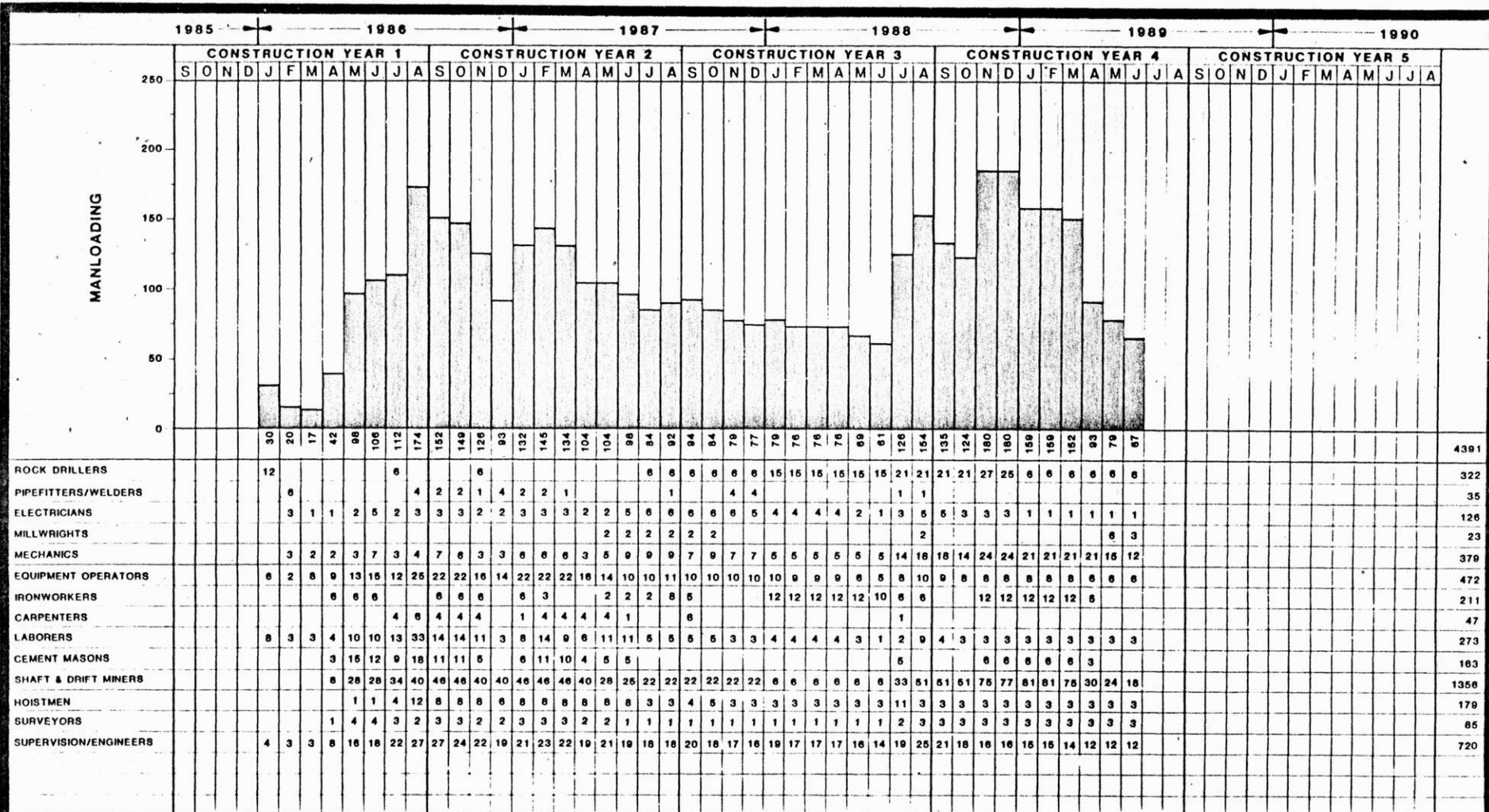


(FIGURE FOR RESPONSE TO COMMENT NO. 154.)



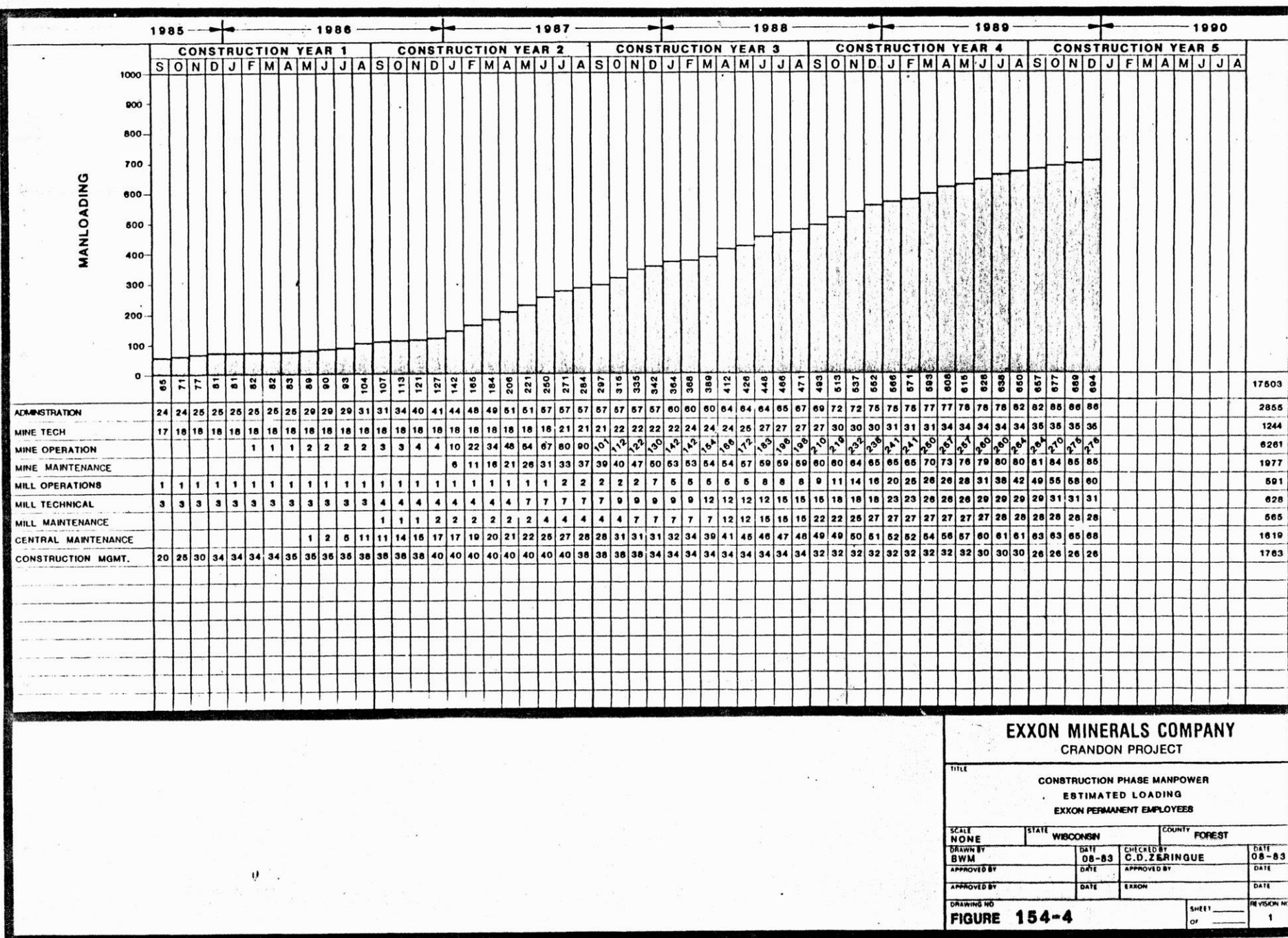
EXXON MINERALS COMPANY CRANDON PROJECT

TITLE			
CONSTRUCTION PHASE MANPOWER COMPOSITE HISTOGRAM ESTIMATED LOADING			
SCALE NONE	STATE WISCONSIN	COUNTY FOREST	
DRAWN BY BWM	DATE 08-83	CHECKED BY C.D. ZERINGUE	DATE 08-83
APPROVED BY	DATE	APPROVED BY	DATE
APPROVED BY	DATE	EXXON	DATE
DRAWING NO FIGURE 154-2			SHEET OF 1



EXXON MINERALS COMPANY CRANDON PROJECT			
TITLE CONSTRUCTION PHASE MANPOWER CONSTRUCTION CONTRACTORS SHAFT & UNDERGROUND FACILITIES			
SCALE	STATE	COUNTY	
NONE	WISCONSIN	FOREST	
DRAWN BY	DATE	CHECKED BY	DATE
BWM	08-83	C.D. ZERINGUE	08-83
APPROVED BY	DATE	APPROVED BY	DATE
APP. #1: B	DATE	EXXON	DATE
DRAWING NO	SHEET		REVISION NO
FIGURE 154-3	OF		1

(FIGURE FOR RESPONSE TO COMMENT NO. 154.)



(FIGURE FOR RESPONSE TO COMMENT NO. 154.)

main substation and electrical distribution, yard piping systems, all in-plant roads and parking areas, and all other ancillary surface facilities.

Material requirements were prepared from conceptual engineering drawings for such items as excavation, concrete, structural steel, piping, and painting, etc., and used to derive the estimated field manhours. Equipment installation manhour estimates were obtained from the vendors with manhour estimates and costs for field representation during installation and startup. A productivity adjustment was included to account for Crandon Project specifics and to reflect actual manhours to be expended on-site. An analysis was then completed for the areas of construction, the construction schedule, and the Project contracting plan. A determination of equipment and materials necessary for each task was generated, and manpower curves, developed for each skill classification. These curves were checked against historical curves for peak manpower requirements, duration of peak, phased entry into the Project and total scheduled duration.

The contractor estimates, organization charts, and engineering drawings are based on preliminary engineering which inherently lacks the degree of detail necessary for precise construction material quantity determinations. As these quantities govern the manpower computations, it is anticipated actual manpower requirements during construction will deviate from our present projections. This is particularly true with respect to any one specific craft or in any one specific area. However, in the aggregate we expect the overall manning requirements will track the present curve within acceptable limits. We believe the location of the manpower peaks and valleys can be predicted with reasonable accuracy.

SECTION 1.3.3.3, FUEL AND ENERGY

Comment No. 155

What are the multiplier units on the yearly use figures in Table 1.3-5? How will fuel be stored on-site prior to completion of the bulk fuel storage area?

Response:

The average yearly use of diesel fuel, gasoline, and natural gas presented in Table 1.3-5 should be multiplied by 1,000. The estimates for electrical power are correct as shown. A new table will be included in the revised EIR.

During the construction phase, before the bulk fuel storage area is completed, any on-site fuel storage will be in the tanker trailers in which the fuel is delivered to the site.

SECTION 1.3.3.4, FUEL AND ENERGY

Comment No. 156

What are the units of numbers in the table presented in the text of this section? What assumptions were used to derive these numbers?

Response:

The units in the table are number of vehicles making a round trip to the Project site per day. The employee automobiles were estimated by assuming 2.6 people traveling together in a car and that 80 percent of the workforce would travel by private automobile. In developing the estimate, it was assumed that a bus transportation system would develop and that 20 percent of the workforce would use the bus service. With 20 to 30 people per bus, approximately 10 buses would be used for the peak travel periods. Buses, in addition to the private autos, account for all transportation of the workforce.

Staff automobiles are for Exxon and contractor construction management personnel and were estimated at 1.0 person per car. The service trucks and delivery trucks are estimates based on the size and type of the project. These estimates were developed by Exxon with input from various contractors regarding employee levels and automobile occupancy.

Additional construction planning and scheduling work may require an adjustment in these estimates. However, the methodology used to generate the numbers would not be changed.

SECTION 1.3.4, LANDSCAPE PLAN

Comment No. 157

Figures 1.3-16 and 17 should include the backfill sands and explosives storage areas along with the tailings slurry and haul road corridor.

Response:

Comment acknowledged. EIR Figures 1.3-16 and 1.3-17 will be revised to include all Project facilities north of the main mine/mill complex. Facilities in this area that will be included in the landscape plan and the phasing of this plan are the preproduction ore storage area (formerly the mine backfill storage area) and associated road, explosives storage area and associated road, and the north sediment retention basin.

The portion of the slurry pipeline and haul road corridor not developed for Project facilities will be seeded with grasses and/or legumes following year 2 of the construction phase. With the exception of periodic maintenance in the corridor to minimize invasion of trees and shrubs, no additional landscape treatments are proposed for this area. Therefore, these facilities have not been included in the landscape plan for the mine/mill site.

Comment No. 158

Please provide a discussion of the screening process used to select suitable plantings. Birch and balsam fir may not be appropriate species because of high incidence of disease and insect problems.

Response:

The following criteria were employed in the screening and selection of suitable plantings for application in the mine/mill site landscape plan:

- 1) Woody species selected had to be indigenous to the site area and compatible with the final reclamation plan.
- 2) Herbaceous species used to provide rapid stabilization of slopes and prevention of erosion could be either indigenous or nonindigenous to the site area.
- 3) Plant species for specific areas in the mine/mill site were selected based on their ecological characteristics and known adaptability to the projected environmental conditions, such as slope, exposure, soil type and soil moisture, that will be created at the completion of Project construction.

Comment acknowledged and we will re-evaluate the use of birch and balsam fir as species for inclusion in the landscape plan.

Comment No. 159

What is the "open water" indicated in the northeast corner of the mill site?

Response:

The open water area in the northeast corner of the mine/mill site is a deciduous swamp having some open water. This wetland is less than 0.1 ha (0.25 acre) in size and is located approximately 152 m (500 feet) northwest of wetland F116. This wetland is designated but not numbered on Figure 4.3-1E of the August 1982 Wetlands Assessment Report prepared by Normandeau Associates, Inc. and Interdisciplinary Environmental Planning, Inc (previously provided to the DNR).

SECTION 1.3.5.1, MINE/MILL SITE, RECLAIM PONDS AND MINE WASTE DISPOSAL FACILITY DEVELOPMENT; AIR EMISSIONS

Comment No. 160

This section should include estimates of emissions from mine construction. Also, estimates of emissions from several air contaminant sources previously mentioned are not included in Tables 1.3.6 and 7. Provide estimates for: 1) the burning of stumps and brush, 2) a temporary on-site diesel powered generator, 3) the existing gravel access roads, 4) wind erosion from the mine waste disposal facility stockpiles, and 5) the screening and stacking plant used to produce materials for the liner and underdrain.

Response:

Estimates for air contaminant emissions during mine construction are provided in the Air Permit Application (see Table 2.1), and will be provided in this section of the amended EIR. Estimates of the air emissions from the listed sources in the DNR comment are included in Tables 1.3-6, 1.3-7 and 1.4-9 of the EIR, with the exception of stump and brush burning. The following estimates are provided in the order mentioned in the DNR comment.

		t/y	(short tons per year)
1) Intermittent stump and brush burning:	TSP	16.7	(18.37)
	NO	3.9	(4.32)
	CO	137.2	(151.3)
	HC	23.5	(25.94)
		kg/h	(Pounds per hour)
2) Emergency diesel powered generators:	TSP	6.5	(14.3)
	SO ₂	6.0	(13.2)
	NO _x	90.2	(199.0)
	CO	19.4	(42.8)
	HC	7.2	(15.9)
		t/y	(short tons per year)
3) Gravel access roads:	TSP	21.709	(23.93)
4) Wind erosion from stockpiles:	TSP	5.062	(5.58)
5) Screening and batching plant:	TSP	0.95	(1.048)

Comment No. 161

Noise Emissions - Provide the data, analyses, and assumptions utilized to generate the figures in Table 1.3-8. Discuss measures by which Exxon is proposing to control noise emanations.

Response:

The results presented in Table 1.3-8 following page 1.3-30 of the EIR were the product of a Ralph M. Parsons study (Exxon I.D. No. 21083 - titled Noise Contours and Back-Up Data for Construction Noise Analysis) completed in September 1982 and later forwarded to the DNR as supportive information to our EIR submittal. Inspection of this document will answer questions regarding data analyses and assumptions utilized.

Control of noise emanations from the MWDF will be achieved by limiting the noisiest activities to daylight hours, 5 days a week, and during the warmer months of the year when outside activities are possible. As stated in the EIR, construction generated noises will decrease as the mine shafts and the containment areas of the MWDF are deepened. All equipment capable of producing loud (> 100 dBA at 1 m) noise emanations will receive special attention during their selection to assure that the equipment selected results in acceptable noise levels.

Comment No. 162

Solid Wastes - It appears the solid waste disposal facility in the Town of Nashville will have to be upgraded to handle the amount of waste projected to be generated from the site construction. Please provide more detail on the types of wastes expected to be generated along with estimates of the amount of each type of waste.

Response:

See response to comment No. 38.

Comment No. 163

Erosion Control - Include a discussion of the water discharge pipeline corridor. Describe the handling, treatment and discharge of contaminated water during the construction period. What water treatment equipment will be required during the construction period? Describe the locations, dimensions, construction schedules, and specifications for the "influent surge system". Describe the specifications and duration of use of the temporary lined holding pond and include it on Figures 1.3-10 through 14. Describe the chemical characteristics of the contaminated water.

Response:

The water discharge pipeline corridor is shown on EIR Figure 1.1-2. The corridor is approximately 9.8 km (6.1 miles) long and has a nominal width of 15.0 m (49.2 feet). The actual width of the corridor that will be disturbed during pipeline installation is estimated to be 6.0 m (19.7 feet) which results in a total estimated disturbed area of 5.9 ha (14.5 acres). Approximately 75 percent of the route length is across high ground which will present no special construction difficulties. Trench excavation, pipe laying, and backfilling will be completed in sections to avoid having open trenches for extended periods.

Installation of pipe through the wetland areas will require additional precautions. Muck and organic soil conditions as well as season of the year will determine the most effective equipment to use. To the extent possible, the wetland mucks will be kept separate from the subsoils as they are excavated and placed along the trench. The soils will be backfilled later in the original sequence, i.e., subsoils will be backfilled before the mucks. In areas where there is potential for erosion, the materials will be contained with silt fences (filter fabrics) or other equivalent methods. Because of the nature of wetland soils, wider disturbed areas will result in the wetlands. Lighter equipment and swamp mats will probably be used unless a winter time construction schedule is determined to be beneficial. Selection of a contractor with appropriate experience and prior satisfactory results on other similar projects will be an important criterion.

During construction, four sources of contaminated water are currently identified: (1) the mine including ground water inflow and utility water, (2) surface water runoff from a 1.45-ha (3.6-acre) equipment laydown area near the main mine shaft, (3) surface water runoff from a 3.24-ha (8.0-acre) preproduction ore storage area located on the north edge of the mine/mill area (previous backfill sands storage area), and (4) surface water runoff from an 15.6-ha (38.6-acre) waste rock storage area in the MWDF.

For the first one-third of the construction phase (approximately 18 months), there will be no contaminated water from mine shaft sinking because there will not be any contact with mineralized rock. Through this first phase, waters from the mine shaft and the equipment laydown area will be routed through sedimentation ponds for discharge as surface water drainage. The sedimentation ponds will either be temporary or possibly one or two of the ponds will be used which will become a part of the mine/mill area final surface water drainage system.

Runoff from the waste rock storage area at the MWDF is handled in a temporary, membrane lined pond located on the west side of the waste rock area. This temporary pond is sized to hold the volume of one years net precipitation gain plus one 10-year, 24-hour storm. If the temporary pond approaches its capacity, the water will be pumped to reclaim pond R1.

After there is contact with mineralized rock, the mine and equipment laydown area waters are transported to water reclaim pond R1. As the required portions of the water treatment plant are completed, the water in reclaim pond R1 will be treated and discharged as necessary. Water from the preproduction ore storage area will be transported to the water treatment plant feed tank. The portion of the plant required for treatment of this water will include lime precipitation, filtration and pH adjustment. The capacity of the water treatment plant feed tank is approximately 3800 m³ (1,000,000 gallons). The EIR figures, showing this tank being completed in construction year 2 are correct.

The temporary pond in the MWDF area is described more fully in the INDECO report "Construction of Waste Disposal Facilities" (previously provided to the DNR).

See Appendix B (Design Criteria-Water Management Program) of Appendix F of CH2M Hill's Phase III Water Management Study (previously provided to the DNR) for mine and surface drainage water quality.

Comment No. 164

How can the maximum effluent flow rate during the third year of construction be 2,000 gallons per minute when the mine water inflow alone is estimated at 2,000 gallons per minute at this time?

Response:

The unmitigated steady state rate of ground water inflow to the proposed Crandon Mine is estimated to be 0.118 m³/s (1870 gallons per minute) (Prickett, December 1982). During the third year of mine construction the mine drainage rate may approach 0.126 m³/s (2,000 gallons per minute) for

several months because of the combined effects of unmitigated inflow and depletion of water stored in the orebody weathered zones. This depletion of stored water is non-repetitive and will be of short duration.

Any excess mine drainage effluent experienced at this time would be stored in the surface reclaim ponds prior to eventual mill use or treatment and discharge. Pond design has included capacity specifications which will allow management of the mine/mill water balance and control of the surface water discharge rate.

As described in the response to comment No. 62, it is unlikely that ground water inflow, even in combination with the orebody depletion of storage water will ever exceed $0.126 \text{ m}^3/\text{s}$ (2,000 gallons per minute) because of the inflow rate limiting control techniques proposed for application during Project development (see the response to comment No. 61).

Comment No. 165

Describe the discharge location from sedimentation ponds and the use of other sediment traps such as silt fences made of geotextiles.

Response:

Sedimentation ponds will be used to collect surface water runoff from areas with high erosion potential, including the mine/mill site and MWDF. Any discharge from these facilities will be to surface drainages. Release points from MWDF ponds are shown on EIR Figures 1.3-3 through 1.3-8. Ponds associated with the mine/mill site are shown on Figure 3.3 of the Mine Permit Application, Section D, Reclamation Plan. Refinements to the mine/mill site are in progress and these refinements will be shown on a subsequent revision to EIR Figure 1.3-10. This figure will show the location and discharge points of mine/mill site sedimentation ponds.

Silt fences (i.e., geotextiles, cloth, straw bales) will be used, as needed, on cut and fill slopes with a high erosion potential and which do not respond to conventional erosion control practices and slope stabilization. This would primarily be channels subject to high flow velocities where conventional hay and straw mulching fails to stabilize the soil long enough for vegetation to reestablish.

Comment No. 166

Include the temporary pond used to store runoff from the waste rock embankment on the appropriate figures. Provide the dimensions and design criteria for this pond. What figures were used to derive the net annual precipitation gain estimate of 7 inches? What will the chemical characteristics of this contaminated runoff be? Discuss the effect of the contaminated water and bacterial activity on the liner's integrity.

Response:

The temporary pond used to store surface water runoff from the waste rock storage area will be identified on EIR Figure 1.3-3. The pond is presently shown on EIR Appendix 1.2A, Figure 9-5. Final design details are not available at this stage of Project development; however, pond layout and

preliminary design data are included in the Indeco report "Construction of Waste Disposal Facilities" (previously provided to the DNR). Design criteria are also provided in subsections 9.1.4, and 9.2.2 of EIR Appendix 1.2A.

The estimated net annual precipitation gain of 7 inches was derived by subtracting the average yearly lake evaporation rate from the average yearly precipitation. Since this temporary pond will be lined, infiltration was assumed to be negligible. The closest location to the Project site area for which long-term evaporation rates are available is the station at Rainbow Reservoir in north-central Oneida County. Data from this station indicate an average pan evaporation rate from May through October of 608.6 mm (23.96 inches). To extrapolate these data to an annual lake evaporation rate, CH2M HILL examined the Climatic Atlas of the United States, published by the National Oceanic and Atmosphere Administration of the U.S. Department of Commerce. This reference indicates that for the regional area of the Project, May to October evaporation is approximately 80 percent of the annual total. It also indicates that, for this same regional area, lake evaporation is 78 percent of pan evaporation. Therefore,

$$\frac{608.6}{0.80} \times 0.78 = 593.4 \text{ millimeters} = \text{average annual lake evaporation}$$

$$\frac{23.96}{0.80} \times 0.78 = 23.36 \text{ inches} = \text{average annual lake evaporation}$$

Annual rainfall is estimated at 781.56 mm (30.77 inches). Subtraction of evaporation gives 188.2 mm (7.41 inches) of net precipitation. For general Project design this was assumed to be 7 inches.

The exact chemical characteristics of surface water runoff from the waste rock can not be determined until operation. However, based on leach tests conducted on waste rocks, a water quality projection was made. This is shown in Appendix C of "Design Criteria - Water Management Program" contained in Appendix F, Volume 3, "Phase III Water Management Study," CH2M Hill, 1982. Data presented in EIR Appendix 1.2A, Table 3.4 show that waste rocks are not classified as hazardous waste according to U.S. EPA extraction procedure tests.

As stated in EIR Appendix 1.2A, this pond is temporary and will only be used for 3 years. The exact type of liner to be used will be determined during final design. Use of the proper liner can virtually eliminate microbiological attack and be resistant to inorganic chemicals. The choice of liner will be based on manufacturers' recommendations for containment of wastes with the composition expected in surface water runoff from the waste rock storage area.

SECTION 1.4.1, SCHEDULE

Comment No. 167

This section describes a steady state production phase of 26 years. Please provide a discussion of temporary mine shutdowns (both short and long-term), the potential causes of shutdown, and the ramifications of these shutdowns on schedules, operations and pollution control facilities.

Response:

Temporary mine/mill shutdowns should be defined as those periods during which actual mine and/or surface plant operations cease, but all facilities are maintained in start-up readiness. During such periods mine water pumping, water treatment, MWDF underdrain pumping and reclamation, and similar activities would be uninterrupted. The mine life would simply be extended in real time by an amount equal to the length of the temporary shutdown.

A variety of events and situations could lead to the temporary suspension of operations for durations of from one day to several years. Short shutdowns, (i.e., one month or less) might be caused by weather extremes, equipment failure, or planned facilities maintenance or modification. A cessation of up to 3 to 6 months might result from a labor dispute, either local or by an essential supplier or carrier. Suspension of operations for periods greater than 6 months would most likely be caused by economic conditions such as severely depressed metal prices. Necessary pollution control and monitoring equipment would be operated during these periods to assure compliance with all applicable permit conditions. The ultimate ramification of such events is the extension in time of mine and facility operations and reclamation.

Comment No. 168

Please provide the actual design capacity for concentrate storage and contingency plans should additional storage be necessary.

Response:

Refer to the response to comment No. 76.

SECTION 1.4.2.4, MINE AND BACKFILL DEWATERING

Comment No. 169

Provide all data, methods and assumptions used to calculate groundwater seepage into the mine. Describe in detail the operation of the groundwater interceptor system and the continuing grouting of the ore body and the interface with the unconsolidated deposits.

Response:

Data, methods and assumptions used to calculate ground water seepage into the mine are presented in the "Ground Water Inflow Model for the Proposed Crandon Mine" (Chapter 3.0, subsection 3.1.5, pp. 16 and 17 and

subsection 3.2.2, pp. 18 through 35), prepared by Thomas A. Prickett and Associates and Appendix 4.1A, "Hydrologic Impact Assessment" (Chapter 3.0, pp. A-12 through A-23 and Chapter 4.0, pp. A-24 through A-37), prepared by D'Appolonia, Inc. Both of these reports were submitted to the DNR.

The mine water interceptor system is described in the response to comment No. 134.

Comment No. 170

Describe contingency plans for inflows in excess of 2,000 gallons per minute.

Response:

The excess inflow contingency measures applicable during the mine operating life are described in the response to comment No. 62.

SECTION 1.4.2.5, WASTE ROCK

Comment No. 171

Describe the continued use of waste rock as riprap on the sides of the tailings ponds. Provide estimates of the quantities of waste rock for each destination.

Response:

Use of waste rock as MWDF embankment slope facing is described in subsection 1.2.3.2 of the EIR. Additional details are presented with the preliminary engineering drawings accompanying the MWDF Feasibility Report. Of the total waste rock disposed at the MWDF, approximately 897,000 m³ (1,173,000 cubic yards) are used as slope protection. This volume is used in the four tailing ponds and two water reclaim ponds. The estimated rock quantity per pond is included on Plan Sheet 4 of the MWDF Feasibility Report.

SECTION 1.4.2.6, BACKFILL HANDLING UNDERGROUND

Comment No. 172

Please explain why backfill may have to be supplemented by glacial sand and why tailings fines cannot be used in its place. Golder Report 11 indicates that fines from the soil screening process may be disposed of within the mine as backfill. If soil fines can be used, why aren't tailings fines suitable? If glacial sands are required, what would be the source of the material?

Response:

Backfill which is placed hydraulically must be free draining to prevent a buildup of hydrostatic head which would present a serious safety hazard. Laboratory testing of Crandon coarse tailings has shown that backfill possessing this free draining characteristic can contain only a small

percentage of -20 μm particles. The exact percentage that can be tolerated is a function of rate of placement, slurry density, and stope size, as well as the size distribution of the +20 μm fraction.

When the tailings have been classified to remove the fine fraction, a projected deficit of approximately 300 t/d (331 short tons per day) of backfill will exist. This deficit will, in general, be made up from waste rock coming from development drifts in the mine, thus eliminating the need to hoist this fraction of the waste to the surface. Glacial sands will not be used based on current plans.

Comment No. 173

Discuss the kind and amount of cement required to stabilize the backfilled stopes and the thickness of rock which will be left on the sides and bottoms for each stope. Discuss the sulfide resistance of the cement and how the cement will function with a predominantly sulfide aggregate.

Response:

Cement is sometimes added to the backfill to provide stability so that it will stand unsupported to enable removal of the ore in the adjacent stope. On average, the ratio of cement to tailings sand will be about 1:15. Ratios as rich as 1:5 may be used in specific situations where higher structural strength is desired, such as the formation of a floor of fill on which to operate mobile equipment.

As an alternative to making the fill in a stope self-supporting by adding cement, the fill may be retained in place by leaving a rib pillar of rock between the fill and the adjacent stope. This pillar would have a minimum thickness of 10 percent of the hanging wall to footwall width of the stope, or 3 m (10 feet), whichever is greater. The decision to add cement or to leave a pillar of rock will be based on economics, considering the value of the ore and the cost of cement. It is expected that about one-third of the total fill placed in the mine will contain cement.

Laboratory testing of backfill samples using both normal and sulfate-resistant Portland cement showed no strength differences over the periods of up to 90 days the samples were allowed to cure. Further testing will be conducted in the underground mine when more tailings are available from plant operation. Long-term cement deterioration is not expected to be a problem. If cement deterioration is found to be an important factor in a fill's self-support capability, the economic decision will be made to use additional cement, change the type of cement, or delete cement and retain an ore pillar.

Comment No. 174

Discuss the sizes of waste rock hauled directly from headings to stopes and the possibility of voids in the backfill.

Response:

Waste rock from development headings will be within a size range from sand grains to 600 mm (24 inches) pieces. Two-thirds to three-quarters will probably be in the range of 150 to 450 mm (6 to 18 inches). When this material is used as stope backfill, it will be placed before or during the placement of hydraulic tailings fill. The hydraulically placed fill will flow into and fill the interstices between the rock fragments.

It is also common practice to place coarse sand in the throat of each stope drawpoint, just behind the fill bulkhead to act as a filter and prevent the finer tailings sand from plugging the filter cloth on the bulkhead. This sand could be supplied by local sand and gravel operations or from the processing plant to produce the underdrain material for the MWDF.

SECTION 1.4.2.7, WATER BALANCE

Comment No. 175

Please define what constitutes mine "process" water which will be collected and discharged to the surface water treatment system. How much mine process water will be generated and transported to the surface? Are the 200 gallons per minute of processed water accounted for in the maximum mine pumping rate?

Response:

As stated in subsection 1.4.2.7 of the EIR, mine "process" water is simply water used for drilling and dust suppression. The source of this water is the uncontaminated mine seepage sumps. After use, this "process" water drains to the contaminated water collection sumps. (This is what is meant by being used in closed circuit.) This water is, of course, accounted for in the water pumped from the mine.

SECTION 1.4.3.1, COARSE ORE TRANSPORT AND FINE CRUSHING

Comment No. 176

Provide plan and elevation drawings of the crushing circuits (secondary and tertiary) showing the configurations of crushing and conveying equipment, dust collection points, duct and air pollution control equipment.

Response:

See drawing No. 051-5-G-005 in Attachment No. 15.

SECTION 1.4.3.2, GRINDING AND FLOTATION

Comment No. 177

Provide additional discussion on the grinding and floating processes with diagrams and photographs. Discuss in general terms the use of reagents such as frothers and collectors.

Response:

A concentrator is a facility in which ore is separated into concentrates and tailings. Concentrates contain the valuable minerals that were in the ore, and tailings are the materials rejected after the valuable minerals have been removed.

To produce concentrates, it is necessary to liberate the various minerals from the host rock and from each other so that the valuable minerals can be separated from the waste components. Liberation will be achieved by crushing and grinding the ore to a size at which the valuable minerals will be discrete particles which can be separated from each other.

The sulfide mineral particles will be separated from the ore slurry by a selective flotation process. Selective flotation is the process in which specific sulfide mineral particles adhere to air bubbles, float to the surface of the ore slurry and form a froth which collects on the top of the slurry. The froth is then removed from the slurry.

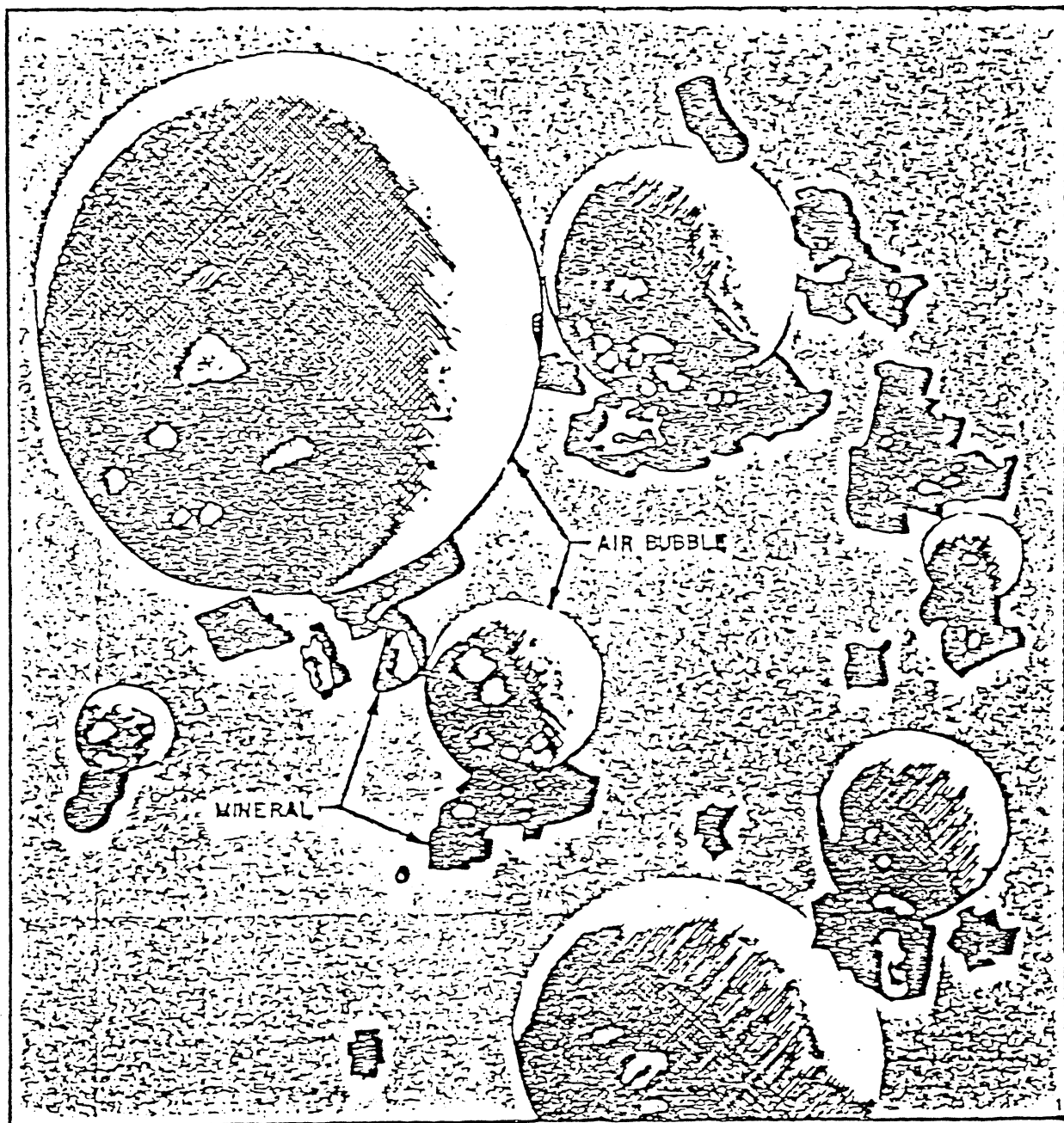
By the use of various reagents, the mineral may be made either to adhere to an air bubble or to remain in the water. The use of these chemical reagents permits the separation and recovery of the zinc, copper, and lead sulfides as separate concentrates from the gangue minerals. Figure 1 (attached) is an illustration derived from a high speed photograph showing mineral adhering to air bubbles.

Collectors and frothers used in each of the flotation circuits are generally added ahead of the first stages of flotation and as needed in subsequent stages of flotation. Collectors are those reagents added to the ore-water slurry that attach to the desired mineral particles thereby imparting a hydrophobic, or air-avid, surface to the mineral particles. These particles then attach to air bubbles and rise to the top of the flotation cell to form a froth. Frothers are added for the purpose of altering the surface tension of the slurry such that stable, mineralized froths can form on the top of the flotation cell and be removed.

The flotation process will be performed in flotation machines similar to that shown in Figure 2 (attached). The ground ore, in a slurry with water, comes from the grinding circuit. Reagents will be added and the slurry passes into the first cell of the flotation machine.

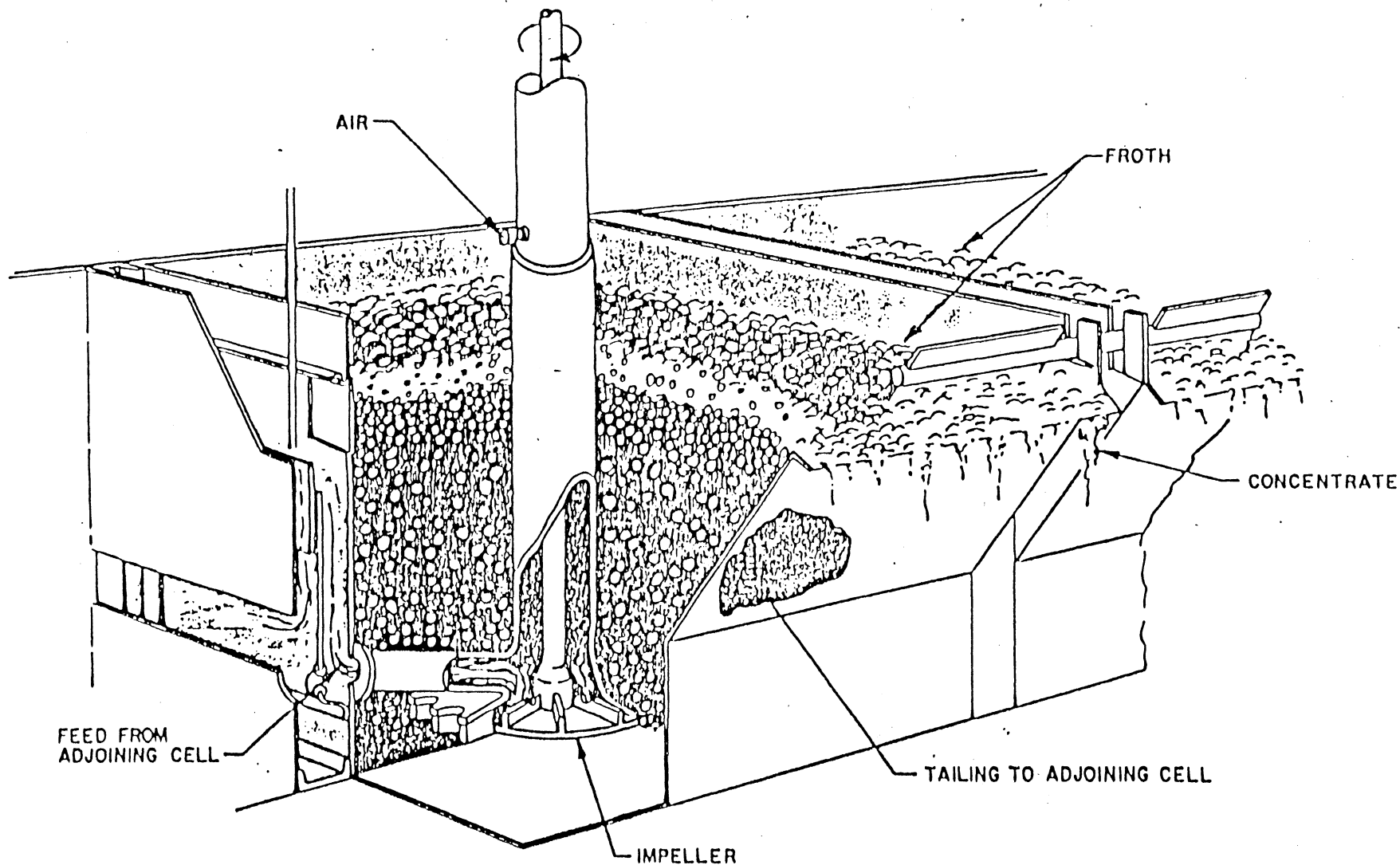
In the flotation machine, air will be introduced into the bottom through an impeller. The very fine air bubbles will be distributed thoroughly through the slurry of ore and water. When an air bubble encounters a mineral particle that has been treated with the proper reagent, that particle adheres to the bubble and will be transported with the froth to the top of

(FIGURE FOR RESPONSE TO COMMENT NO. 177.)



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FIGURE 1 -- High speed photograph of mineral particles adhering to air bubbles.



(FIGURE FOR RESPONSE TO COMMENT NO. 177.)

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FIGURE 2 -- Flotation cell mechanism showing slurry feed to the cell, mineral laden froth (concentrate), and tailing product.

the machine. A particle that has not adsorbed the proper reagent will not adhere to an air bubble. This particle then remains in the water and will be carried out with the water and form the tailing. The mineral collecting with the froth will form the concentrate.

By use of proper reagents and the appropriate arrangement of the flotation machines, separations will be made between the various sulfide minerals and tailings. This results in the production of concentrates of zinc, copper, and lead, and a tailings waste product.

In the process of liberation and separation of minerals from the ore, the mill/concentrator will include the following activities:

- 1) Crushing and ore storage;
- 2) Grinding and classification;
- 3) Flotation;
- 4) Concentrate handling;
- 5) Mine backfill preparation;
- 6) Tailings disposal;
- 7) Reagent preparation; and
- 8) Process control.

Crushing and Ore Storage

The first stage of crushing, to nominally minus 150 mm (6 inches) will be done underground in the mine. The ore will be hoisted to the surface. The mine will produce two ores: a zinc-copper-lead ore (massive) and a copper-zinc ore (stringer). The hoisted ore will be delivered by feeders from an ore bin in the headframe to a conveyor belt which will deliver the ore to the coarse ore storage facility, where the two ores will be stored separately.

The purpose of the coarse ore storage building is to provide surge capacity between the mine and the concentrator, and to provide a supply of ore for the operation of the concentrator over the 2 days of the week during which ore is not hoisted from the mine.

Coarse ore will be reclaimed through a series of feeders onto conveyor belts which will transport the ore to the fine crushing plant. A schematic flowsheet of the crushing and ore storage system for the proposed Crandon concentrator is presented in Figure 3 (attached).

Crushing will occur in three stages. Each stage will be equipped with a machine suitable for crushing a particular size of rock. As mentioned earlier, the first stage of crushing will occur underground in a gyratory crusher. Gyratory crushers are effective in crushing ore from several feet in diameter to approximately 150 mm (6 inches) or less. The next stage

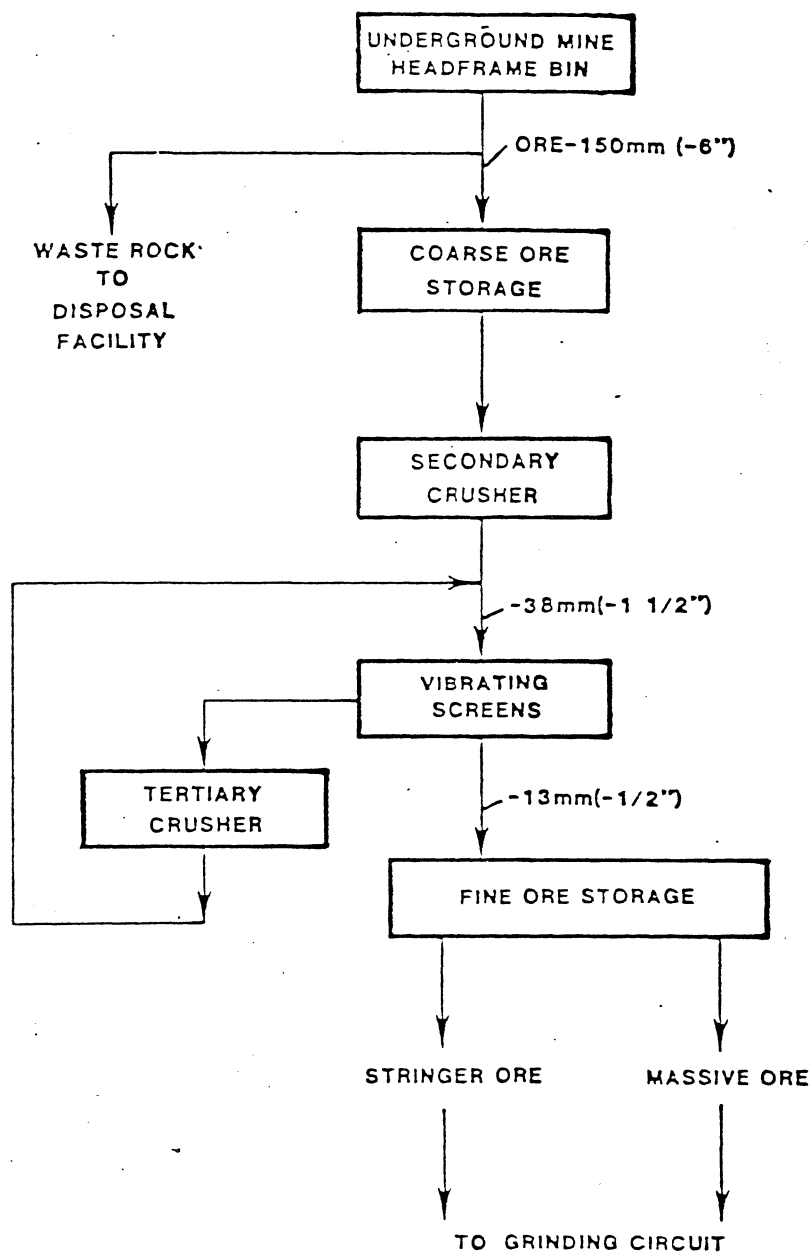


FIGURE 3 -- Schematic flowsheet of the crushing and ore storage system for the proposed Crandon concentrator.

requires a cone crusher, which will crush from approximately 150 mm (6 inches) to about 38 mm (1.5 inches). The final stage involves a shorthead cone crusher which crushes from 38 mm (1.5 inches) to about 13 mm (0.5 inches). A vibrating screen will be placed between the second and third stage of crushing to remove the fine ore. This will allow the third stage crusher to operate more efficiently. Figure 4 (attached) is a cutaway view of a cone crusher.

The crushed and screened ore will be conveyed to one of two sets of fine ore bins. Massive and stringer ores will be crushed and stored separately, and will be processed individually.

Grinding and Classification

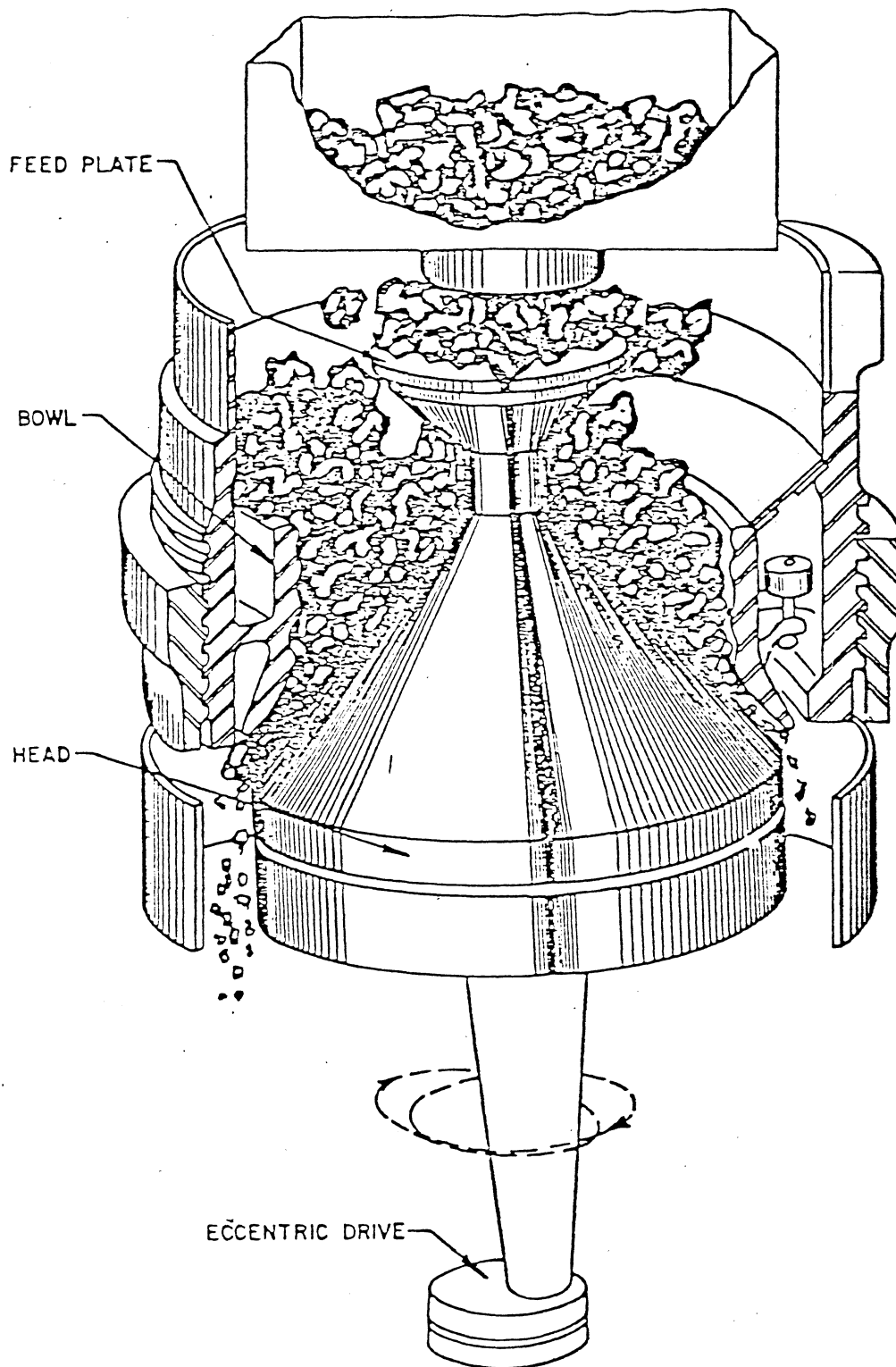
The two ores will be crushed separately and placed in separate fine ore bins for storage ahead of fine grinding. The finely crushed ore will be removed from each fine ore bin and sent to a separate grinding circuit for each ore type. Figure 5 (attached) contains a schematic flowsheet of the proposed concentrator and includes all the unit operations that will take place in the concentrator.

The operation of the grinding circuits will be identical for each ore. The crushed ore will be fed by a conveyor belt into a rod mill where water will be added and the ore will be ground. A rod mill is a large horizontal cylinder lined with heavy steel liners and filled with grinding rods approximately 51 to 76 mm (2 to 3 inches) in diameter and slightly shorter than the length of the mill. The mill will be rotated by means of an electric motor and the rods tumble as the mill rotates. As the ore and water pass through the mill, the ore will be crushed between the tumbling rods to a particle size approximately the consistency of coarse sand. Because rod mills will not efficiently grind the ore to the necessary particle size for complete mineral liberation, an additional stage of grinding will be required.

The rod mill discharge will be pumped to a cyclone classifier in the ball mill grinding circuit. A cyclone classifier separates particles based on their size. The ore slurry will be pumped into the cyclone under pressure which causes the mineral slurry to rotate and the coarse particles will pass to the outside of the cyclone and will be collected at the bottom, while the finer particles will tend to collect towards the center and pass through the top of the cyclone. Figure 6 (attached) contains a cutaway drawing of a cyclone. The coarse particles from the bottom of the cyclone will be directed to a ball mill for further grinding.

The slurry containing the coarse particles from the cyclone classifier will be ground in a ball mill. A ball mill is very much like a rod mill in that it is a horizontal rotating cylinder lined with heavy steel liners and rotated by an electrical motor. The ball mill will be filled with alloy steel balls ranging in size from approximately 6 mm (0.25 inch) in diameter to a maximum of about 51 mm (2 inches). As the mill rotates and the slurry of ore and water passes through the mill, the impact and abrasion of the

(FIGURE FOR RESPONSE TO COMMENT NO. 177.)

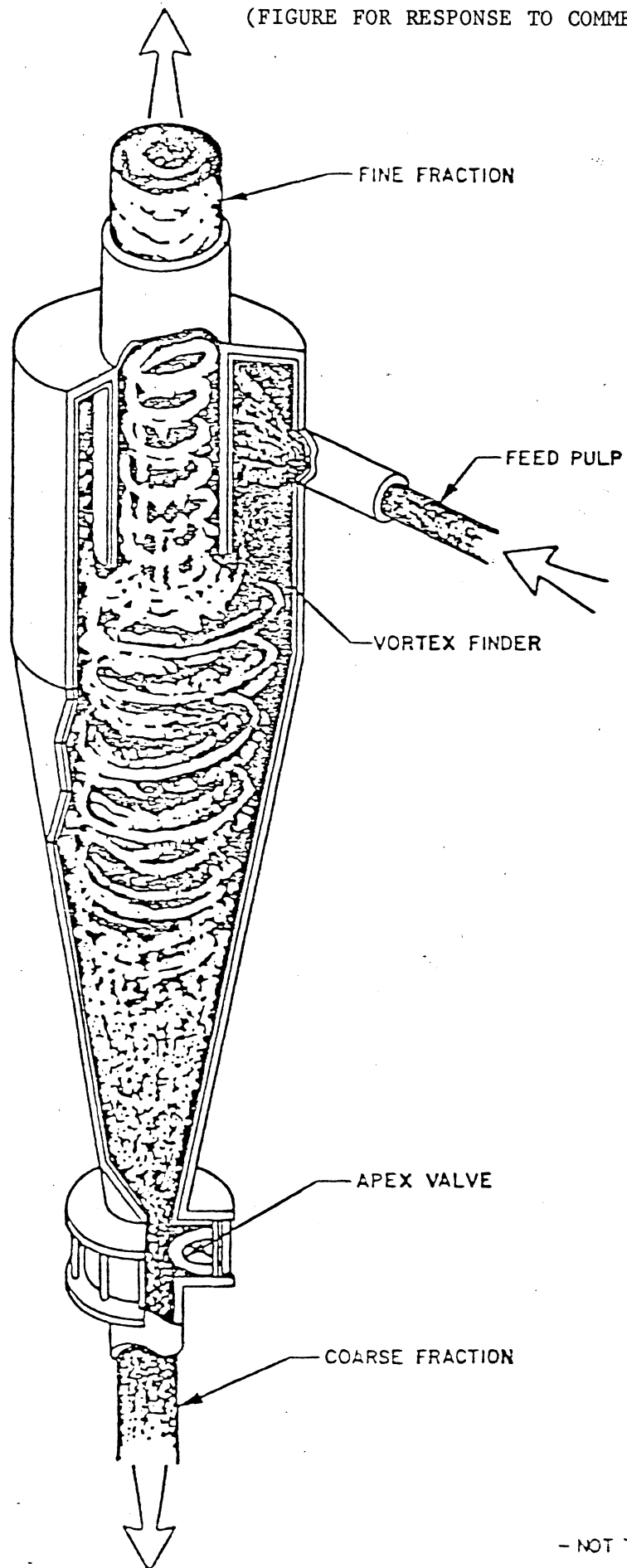


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FIGURE 4 -- Cut-away view of a cone crusher.

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FIGURE 6 -- Cut-away view of a cyclone classifier.

balls falling on the mineral particles will cause them to break and result in ore size reduction and liberation. The discharge from the ball mill also will be pumped to the cyclone classifier, where the fine particles will be removed and the coarse particles recycled to the ball mill.

Flotation

The slurry from the cyclone overflow will pass to an aeration step in which the slurry will be conditioned with reagents and air to prepare it for the flotation of the sulfide minerals. The aerators will consist of large slurry tanks containing agitator mechanisms which serve to dispense air into the slurry. Products from the aerator will be fed to the respective flotation circuits. The aerator for the massive ore will precede the bulk copper-lead flotation of the massive ore, and the stringer aerator will precede the copper flotation of the stringer ore.

- Copper-Lead, and Lead Flotation Circuits

After grinding, aeration, and conditioning with reagents, the massive ore slurry will be fed into the distributor feeding several banks of flotation machines. This flotation step will produce copper-lead rougher concentrate which requires further processing. The tailings from the copper-lead rougher flotation will pass to a scavenger flotation step in which additional copper and lead minerals will be recovered by flotation. The tailings from the copper-lead scavenger circuit will contain zinc from the massive ore and will be pumped to the zinc circuit.

The copper-lead rougher and scavenger concentrate will be pumped to a regrind circuit containing a ball mill and cyclone classifier. Upon regrinding of the concentrate, the copper minerals will be separated from the lead minerals by another step of flotation. The copper concentrate will then be pumped to the combined copper cleaning circuit for the stringer ore. The lead tailing will then be pumped to a lead circuit to produce a lead concentrate.

- Copper Flotation

After grinding, aeration, and conditioning with reagents, the stringer ore will be subjected to flotation for the production of a copper concentrate and a tailing containing recoverable zinc. The copper flotation circuit will be similar to the massive copper-lead circuit containing roughing and scavenger steps.

The copper rougher and scavenger concentrate will be reground and then, together with the copper concentrate produced in the copper-lead circuit of the massive ore flotation process, will be cleaned in a separate step. This cleaning will result in the production of a final copper concentrate.

• Zinc Flotation

The feed to the zinc flotation circuit will consist of the following two tailing products:

- 1) Stringer ore scavenger tailing;
- 2) Massive ore copper-lead scavenger tailing.

The total zinc flotation circuit feed will be conditioned with reagents and directed to zinc flotation. Zinc rougher and scavenger concentrates will be produced.

The zinc rougher and scavenger concentrate will be reground prior to cleaning. The regrind circuit will consist of a ball mill and cyclones operating in closed circuit. Following regrinding, the concentrate will be cleaned four times to produce a final zinc concentrate. The zinc scavenger tailing will pass to the backfill preparation circuit.

Concentrate Handling

In the process described above, the zinc, copper, and lead minerals will have been concentrated and separated. The step remaining will be to separate the concentrates from the water that accompanies them in the processing to facilitate storing and shipping of the concentrate.

The dewatering process will occur in two steps. First, the froth will pass to a thickener where the solids will be allowed to settle. The thickened concentrates will be further dewatered by means of a filter, resulting in a filter cake containing approximately 8 to 12 percent moisture. The filtered concentrates will be transported by belt conveyors to a concentrate storage and loadout facility. Concentrate shipment will be by rail.

Backfill Systems

The underground mining method used for extracting ore, termed sublevel open stoping, uses backfill to stabilize the peripheral in-place rock after the ore is mined. The backfill material to be used is a combination of the coarse fraction of the mill tailing and cement. A cyclone classification process will be used to recover the coarse fraction of the mill tailing. This process is shown in Figure 7 (attached).

The mine backfill will use all the coarse fractions of the mill tailing. The coarse tailing will be mixed with cement (as required) and water and will be pumped to the mine as backfill. The fine fraction of the mill tailing will be too fine for use as mine backfill and will be pumped to the tailing pond as waste.

The backfill preparation plant will include two sets of pumps and three cyclone clusters to recover the coarse fraction from the mill tailing, storage tanks for the coarse tailing, a cement storage tank with feeder, a batch mixing tank, and pumps to deliver the prepared backfill mix to the

(FIGURE FOR RESPONSE TO COMMENT NO. 177.)

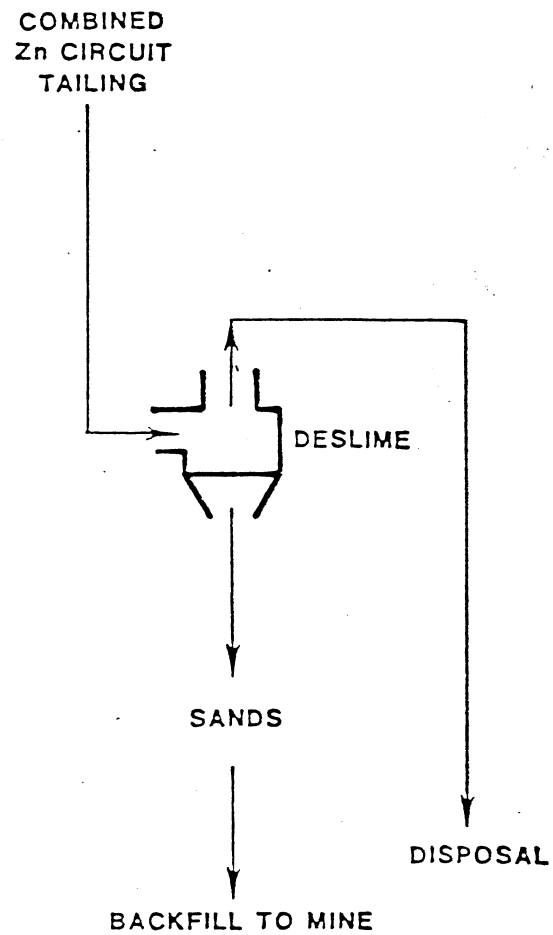


FIGURE 7 -- Schematic flowsheet of tailing desliming step for mine backfill.

mine. The backfill preparation area will also include temporary storage bunkers for backfill and storage when, for short periods of time, the mine cannot accept backfill (see also response to comment No. 179 for a more complete description).

Fine Tailing Thickening

The fine fraction of the final mill tailing will be pumped to a tailing thickener located outdoors. The thickened underflow will be pumped to the tailings pond. A portion of the clarified thickener overflow water will be recycled to the backfill preparation facility, while the remainder will be pumped directly to the reclaim pond.

SECTION 1.4.3.3, CONCENTRATE HANDLING AND SHIPPING

Comment No. 178

Provide a detailed description of the physical characteristics of the concentrates.

Response:

The following information summarizes the physical characteristics of the three concentrates.

	<u>Copper</u>	<u>Lead</u>	<u>Zinc</u>
Specific gravity	4.21	4.14	4.06
Color	brassy	black	brassy
Approximate % Moisture	9	9	8
Particle Size	90% -25µm	90% -25µm	90% -25µm

SECTION 1.4.3.4, SURFACE BACKFILL SYSTEM

Comment No. 179

Provide additional information on the operation of the mine backfill storage and preparation plant. Describe how the backfill sand will be recovered and prepared for replacement into the mine while maintaining a sufficient level of quality to assure stability of the backfilled stopes.

Response:

The process flow diagram No. DBM-6-L-009 in Attachment No. 16 illustrates the method of storing and handling cycloned sands for mine backfill. The following is a brief description of the process. The cycloned sands are pumped from the desliming cyclones directly to a "repulping tank." The system described here for repulping from the repulping tank is similar to that used successfully at other operating mining properties.

The lower part of the repulping tank is shaped to a cone and fitted with a nozzle and jet system to permit repulping to the highest percent solids consistent with pumpability. At other operations this has been approximately 70 percent.

To deliver sand to the mine, the nozzle/jet system is activated and the repulping tank discharge valve is opened. A density controller in the discharge line maintains the required percent solids.

Cement is added to the system by injection of the cement slurry directly into the tailings slurry feed line to the mine. The variable speed drive of the rotary feeder at the discharge of the cement bin is controlled by a mass totalizer in the tailings slurry line, thus assuring the correct cement/sands ratio (assumed 6 percent by weight).

Limited surge storage of cycloned tailings sands is provided in horizontal concrete storage bunkers. A total of six such bunkers provides sufficient capacity for the storage of approximately 18,000 t (20,000 short tons) of cycloned tailings sands (approximately 4 days of mill production). These bunkers are located inside and adjacent to the fine ore crushing area.

The tailings sands are reclaimed from the bunker using monitor jets to wash the material into a collecting launder and sump. A sand reclaim pump delivers the sand slurry at 30 to 60 percent solids to a second repulping tank for density adjustment. The cement slurry is then injected into the delivery line to the mine as before.

High quality backfill mixture is assured by the two desliming cyclones placed in series and the precise density control and sands/cement ratio control which can be achieved with the system proposed.

SECTION 1.4.3.6, WATER BALANCE

Comment No. 180

The tailings ponds and reclaim ponds should be included in Figure 1.4-10. Do the numbers and this figure represent maximum flows in each stream? If not, please show the maximum flows expected.

Response:

EIR Figure 1.4-10 is a water balance for the mill and related process facilities and was not meant to depict the whole Crandon complex. A detailed overall water balance for the mine, mill, tailings and reclaim ponds is presented on EIR Figure 1.4-18 in subsection 1.4.5. The flow rates listed on EIR Figure 1.4-10 or 1.4-18 were used for preliminary design. Maximum flow rates for water treatment and discharge are addressed in the WPDES Permit Application. Sizing of the unit process operations in the water treatment facility is commented on in Sections VIII "Conceptual Design Basis" of Volume 2 of the CH2M Hill's Phase III Water Management Study (previously provided to the DNR). Maximum and minimum flow rates for all streams will be assessed in final engineering.

Comment No. 181

What will be the source of the fresh water required for the mill process start-up? What will be the source of the standby water?

Response:

Mine water stored in reclaim ponds R1 and R2 will be used as a source of water for mill start-up. Standby water required during mill start-up or mature operation will be from the reclaim pond or high-capacity well.

Comment No. 182

Please provide the data, methods, assumptions and model used to derive the water balance.

Response:

The basis for the water balance for the mill and related facilities, as depicted on EIR Figure 1.4-10, is primarily the CH2M Hill Report Phase III Water Management Study (previously provided to the DNR). Sections IV-Site Water Sources, V-Site Water Use, and VI-Water Losses from Site contain the data and assumptions for the water balance.

To a large extent, the ore tonnage through the mill defines mill process water requirements. Processes such as grinding and flotation in the mill and related facilities operate at optimum percent solids. A water and solids material balance is presented in Figure 4 "Mill Water Balance-Mature Operation," Section VII-Crandon Water Balance of the Phase III Water Management Study. A more detailed material balance inside the mill facility is given in Figure 2 "Metallurgical and Material Balance for 9,555 DMTPD Capacity" in Section V-Site Water Uses. A general description of the operation of a mill is given in Chapter 1 of the EIR, subsection 1.4.3, Mill Operations and in the response to comment No. 176.

SECTION 1.4.3.7, REAGENT RECEIVING, STORAGE & USE

Comment No. 183

Provide a diagram illustrating how and where various reagents are introduced into the flotation process.

Response:

The addition points for the various reagents are shown in the attached Figures 1, 2 and 3. Generally, these reagents are added as aqueous solutions or slurries through steel or plastic pipe to the addition points in the flotation and grinding process. Whenever possible, the supply pipes are extended below the surface of the ore slurry stream.

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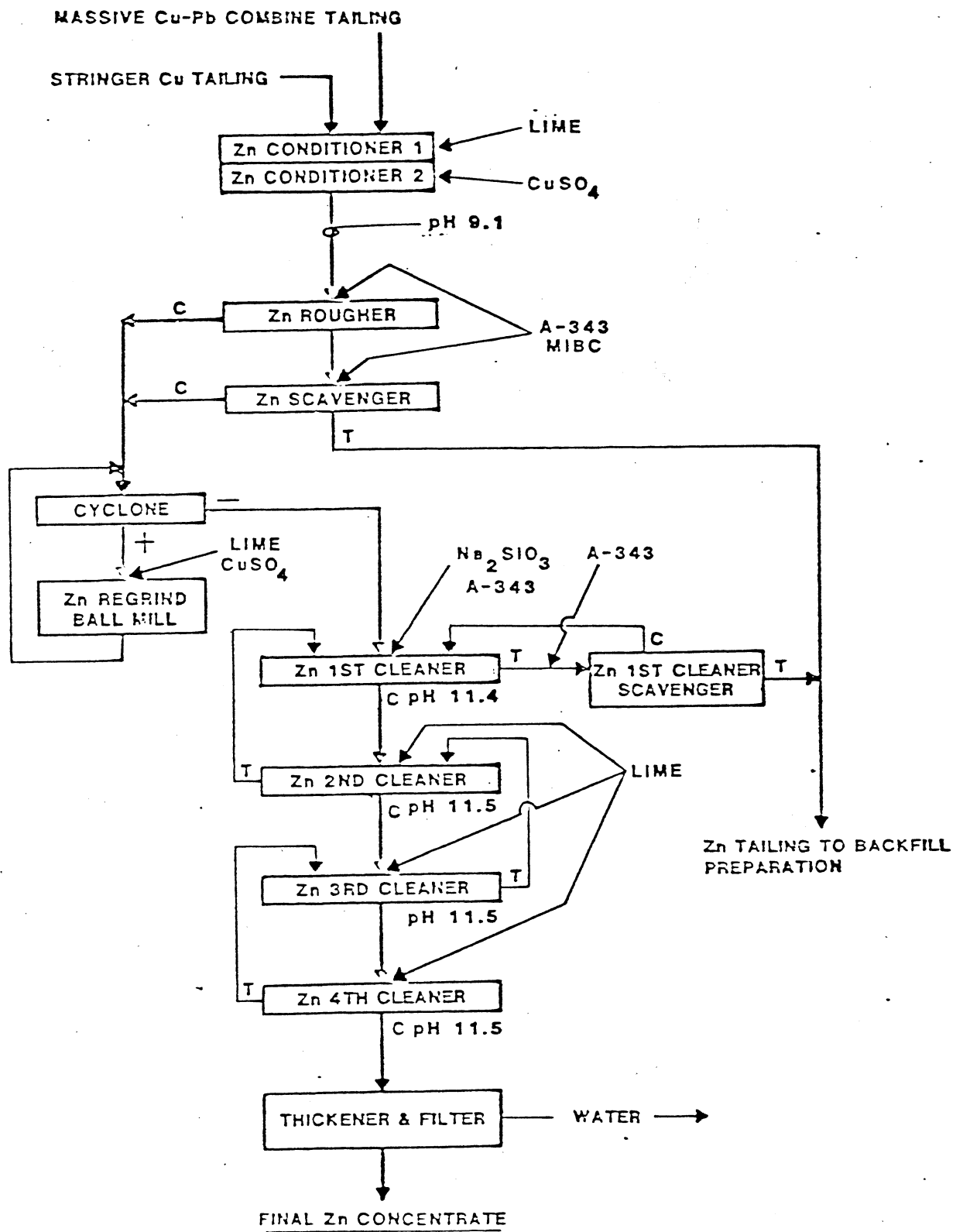
graph TD
    MO[MASSIVE ORE] --> RM[ROD MILL]
    L1["LIME  
ZnSO4 : NaCN"] --> RM
    L1 --> C1[CYCLONE]
    H2SO3[H2SO3] --> C1
    pH73["pH 7.3"] --> C1
    C1 --> BM[BALL MILL]
    BM --> CR1[Cu-Pb ROUGHER 1]
    AC[AERATOR/CONDITIONER] --> CR1
    MIBC["A-325/A-350  
MIBC"] --> CR1
    CR1 -- T --> CR2[Cu-Pb ROUGHER 2]
    MIBC --> CR2
    CR2 -- T --> CSP[Cu-Pb SCAVENGER]
    MIBC --> CSP
    CSP -- T --> ZC[TO ZINC CIRCUIT]
    CSP -- C --> C2[CYCLONE]
    C2 --> CRBM[Cu-Pb REGRIND BALL MILL]
    ZN["ZnSO4 : NaCN"] --> CRBM
    CRBM --> CPC[Cu-Pb CLEANER CONDITIONER]
    A325["A-325/A-350"] --> CPC
    CPC --> CC[Cu-Pb CLEANER]
    CC -- C --> C3[Cu-Pb CLEANER SCAVENGER]
    A325 --> C3
    C3 -- T --> ZC
    C3 -- C --> PC1[Pb CONDITIONER 1]
    PC1 --> TH1[THICKENER]
    W1[WATER] --> TH1
    TH1 --> PC2[Pb CONDITIONER 2]
    ZN2["ZnSO4 : NaCN : LIME"] --> PC2
    PC2 --> PR[Pb ROUGHER]
    MIBC2["A-325/A-350  
MIBC"] --> PR
    PR -- C --> P1C[Pb 1ST CLEANER]
    P1C -- C --> P2C[Pb 2ND CLEANER]
    P2C --> TH2[THICKENER & FILTER]
    W2[WATER] --> TH2
    TH2 --> FPC[FINAL Pb CONCENTRATE]
    C4[Cu-Pb SEP H] --> CC2["Cu CONC  
TO STRINGER  
Cu CLEANER CIRCUIT"]
  
```

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The flowchart illustrates the hydrometallurgical process for copper extraction from stringer ore. The process begins with **STRINGER ORE** entering a **ROD MILL**. **Na₂S LIME** is added to the stream before it enters a **CYCLONE**. The underflow from the cyclone goes to a **BALL MILL**, while the overflow is sent to an **AERATOR/CONDITIONER**. The aerator also receives **H₂SO₃** and is maintained at **pH 7.4**. The output of the aerator is split: one stream goes to **Cu ROUGHER 1**, and the other goes to a **CYCLONE** that receives overflow from the ball mill. The underflow from this cyclone goes to a **Cu REGRIND BALL MILL**, which then feeds into the **Cu CONDITIONER**. The **Cu CONDITIONER** receives **H₂SO₃** and is maintained at **pH 6.7**. The output of the conditioner is split: one stream goes to **Cu 1ST CLEANER**, and the other goes to a **CYCLONE** that receives overflow from the regrind ball mill. The underflow from this cyclone goes to a **Cu 2ND CLEANER**. The **Cu 2ND CLEANER** receives **H₂SO₃ (pH 6.0)** and **Na₂SiO₃**. The output of the 2nd cleaner is split: one stream goes to **Cu 3RD CLEANER**, and the other goes to a **CYCLONE** that receives overflow from the 3rd cleaner. The underflow from this cyclone goes to a **Cu 1ST CLEANER**. The **Cu 3RD CLEANER** receives **H₂SO₃ pH 6.0** and **Na₂SiO₃**. The output of the 3rd cleaner is split: one stream goes to **THICKENER & FILTER**, and the other goes to a **CYCLONE** that receives overflow from the 3rd cleaner. The underflow from this cyclone goes to a **Cu 1ST CLEANER**. The **THICKENER & FILTER** receives **WATER** and produces the **FINAL Cu CONCENTRATE**. The **MASSIVE CIRCUIT Cu CONCENTRATE FROM Cu-Pb SEPARATION** is added to the **Cu 1ST CLEANER**. The **Na₂S LIME** is added to the **CYCLONE** that receives overflow from the ball mill. The **Na₂SiO₃** is added to the **Cu 2ND CLEANER** and the **Cu 3RD CLEANER**. The **H₂SO₃** is added to the **AERATOR/CONDITIONER**, **Cu CONDITIONER**, **Cu 1ST CLEANER**, **Cu 2ND CLEANER**, and **Cu 3RD CLEANER**. The **pH 7.4** is maintained in the **AERATOR/CONDITIONER**. The **pH 6.7** is maintained in the **Cu CONDITIONER**. The **pH 6.0** is maintained in the **Cu 1ST CLEANER**, **Cu 2ND CLEANER**, and **Cu 3RD CLEANER**. The **Na₂S LIME** is added to the **CYCLONE** that receives overflow from the ball mill. The **Na₂SiO₃** is added to the **Cu 2ND CLEANER** and the **Cu 3RD CLEANER**. The **H₂SO₃ (pH 6.0)** is added to the **Cu 1ST CLEANER**, **Cu 2ND CLEANER**, and **Cu 3RD CLEANER**. The **MASSIVE CIRCUIT Cu CONCENTRATE FROM Cu-Pb SEPARATION** is added to the **Cu 1ST CLEANER**. The **WATER** is added to the **THICKENER & FILTER**. The **FINAL Cu CONCENTRATE** is the final product.

FIGURE 3

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COMBINED ZINC FLOTATION FLOWSHEET



Comment No: 184

What will be done with reagents in damaged containers? How will nonreturnable reagent containers be disposed?

Response:

EIR Table 1.4-4, "Typical Reagent Use, Consumption Rate, and Storage" in subsection 1.4.3.7, indicates that those reagent chemicals used in bulk quantities are received by tank car, railcar, or truck. If these bulk shipment "containers" are damaged, which would interfere with the use of the reagent, the shipper would be contacted to either repair the "container" or arrange for its return. The railroad will not accept cars or other containers damaged in any way which makes them unsafe to transport.

Chemicals/reagents received in drums, bags or small containers, if damaged to the point of not being useable, would be returned to the vendor. For example, sodium cyanide is received in specially designed containers (Flo-Bin™) owned and provided by a vendor. If these were damaged they would be returned to the vendor.

Nonreturnable reagent containers such as bags, would be disposed in a licensed solid waste facility. Fiber drums are returnable and reusable.

SECTION 1.4.3.9, LUBRICATION

Comment No. 185

What type of storage facility will be available for waste oil and grease?

Response:

Waste oil and grease will be retained in drums or holding tanks pending removal off-site. This material may be sold for reuse.

SECTION 1.4.3.10, SPILLS AND ODORS

Comment No. 186

Describe the reagents and odors which may need to be exhausted through the atmosphere. Discuss the odors' nature, frequency, duration and intensity of odors. Discuss the potential of generation of hydrogen sulfide and other odors from the concentrator and if possible mechanisms for control.

Response:

The list of reagents to be used in the concentrator is presented in Table 1.4-4 of the EIR. Of these, the xanthates may produce a noticeable odor in the immediate flotation area, within the concentrator building. The odors from this source will dissipate rapidly inside the building and will not be discharged by the building's heating and ventilation systems in detectable amounts to the atmosphere.

EIR subsection 1.4.3.7, Reagent Receiving Storage and Use, will be revised as follows: Liquid sulfur dioxide will be added directly as needed to the ore slurries. It will rapidly dissolve to form sulfurous acid and will not be emitted as SO₂ to the atmosphere. All odors produced will occur for short periods (10 minutes or less) and almost exclusively during reagent mixing. Control of odor generation will be affected by proper and safe handling and mixing of reagents and immediate capture and containment of all spills.

Comment No. 187

Where would spilled reagents be disposed of if necessary?

Response:

There should be no disposal of reagents. Recovered reagents will be collected in such a manner to assure that they can still be used as intended. Reagent storage and preparation facilities will be designed with the criteria that any spills are to be contained for recovery and use. Also, see the response to comment No. 70.

SECTION 1.4.4.2, TAILINGS SLURRY AND WATER TRANSPORT SYSTEMS

Comment No. 188

Describe any leak detection system and proposed facilities or actions designed to prevent groundwater contamination in the event of a pipeline failure. What inspection, maintenance and replacement procedures are planned?

Response:

Leak detection systems and actions designed to prevent ground water contamination in the event of a pipeline failure are described in the response to comment No. 84.

The pipeline corridor will be visually inspected by periodically walking along the route. Physical inspection of pipe materials is best conducted at the pump station during scheduled maintenance. Physical measurements of pipe wall thickness will be completed routinely. If necessary, flanged pipe test spools can be inserted into the pipelines at selected intervals and in easily accessible locations.

Spare plastic pipe will be stored on-site so that it is available for repairs when required. Repairs to HDPE pipelines are expected to be needed infrequently and the pipeline life in slurry service is expected to be longer than would be anticipated for pipelines constructed of alternative materials. For water service, the life of HDPE pipe is expected to be longer than would be expected for carbon steel pipe.

SECTION 1.4.4.3, MINE WASTE DISPOSAL PONDS

Comment No. 189

Describe a "suitable" water depth in the tailings pond. Provide details on how the slurry discharge into the ponds will be conducted in order to prevent degradation of the filter and drainage layers.

Response:

The development of the pond water pool is dependent on the permeability of the exposed filter area embankment slope and the rate of decant pumping. These considerations are presented in the paper "Tailing Ponds Water Clarification Pools" (previously provided to the DNR). From that study it appeared that pond depths of approximately 5.0 m (16.4 feet) would be maintained. A barge mounted pump system is planned to decant water from the tailings pond.

Waste rock will be used as necessary at the slurry discharge point to protect the filter and drain layer from erosion. A rock layer of a few feet will cover the filter/layer in the area of the slurry discharge. Regular inspection and maintenance of the protective waste rock will ensure that erosion of the underlying layers does not occur.

Comment No. 190

This section should also describe operation of the seepage control systems during both short and long-term mine shutdowns.

Response:

Operation of the seepage control system will be maintained during Project shutdowns. While the volume rate of underdrain pumping is not great, it is important to remove water entering the underdrain to minimize the water head on the liner. This assures that seepage through the liner will be minimized. These flows will normally be pumped to the water reclaim ponds. Water treatment and discharge facilities will be operated during plant shutdowns to handle mine inflow and other water streams, such as the reclaim water return. However, there is excess capacity in the reclaim pond system for storage of additional water should it be necessary. Also, although it is not anticipated, it would be possible to recirculate underdrain water within the tailings pond. This would increase the tailings pond water volume, and increase the total water pumped from the underdrain, but would maintain the minimal tailings pond seepage rates.

SECTION 1.4.5.1, WATER RECLAIM SYSTEM

Comment No. 191

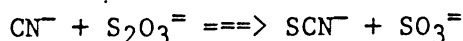
Provide additional detail on the operation and the maintenance of the reclaim ponds. Describe specifically the chemical constituents the ponds are designed to control. Describe the chemical and physical characteristics of the water going into and out of both ponds. Please be more specific than "trace" and "small amounts". Provide data to support the projected treatment which will occur in the ponds. Provide data which will support the expected cyanide reduction due to treatment in the ponds.

Response:

Details on the operation and maintenance of the reclaim ponds are provided in responses to comment No. 109 through 117, particularly No. 113. Relevant portions will not be repeated here.

The chemical composition change projected to occur across the reclaim pond is presented in the CH2M Hill Phase III Water Management Study, Volume 3, Appendix E, "Model Printout - Mature Operations (reclaim pond influent is column heading No. 117, effluent is column heading No. 118). This report was previously provided to the DNR. Essentially the projected difference between reclaim pond influent and effluent is that the total organic carbon (TOC) is reduced by 90 percent and that the thiosalts are reduced by 90 percent in summer and 10 percent in winter.

Cyanide is degraded during ponding by such mechanisms as: volatilization, photodecomposition, oxidation, biodegradation, and precipitation/adsorption. The first two, volatilization and photodecomposition, are thought to be the most important mechanisms. Thus, in the absence of an ice cover, cyanide concentration is found to decrease during ponding. This is documented in the literature for Dome mines in Ontario, where from degradation mechanisms alone, the cyanide concentration in a gold mill effluent was decreased from 68.7 to 0.08 mg/l (99.9 percent) for the period April through September. Cyanide is also reported to react with reduced sulphur species (thiosulfates) to produce thiocyanate, as follows:



The following are supporting references:

Schmidt, J. W., et. al., Natural Degradation of Cyanides in Gold Mill Effluents, Presentation for Cyanide and Gold Mining Industrial Seminar, January 22-23, 1981, Ottawa, Ontario.

Ingles, J. C. and Scott, J. S., Overview of Cyanide Treatment Methods, Presentation at the Cyanide and Gold Mining Seminar, January 22, 1981, Ottawa, Ontario.

Luthy, R. G. and Bruce, Jr., S. G., Kinetics of Reaction of Cyanide and Reduced Sulphur Species in Aqueous Solution, Environmental Science and Technology, 13, December 1979, 1481-1487.

Comment No. 192

How will anaerobic decomposition affect the thionate oxidation process? Provide data to demonstrate the compatibility of the liner materials with the chemical characteristics of the water.

Response:

As stated in the response to comment No. 115, it is not expected that the reclaim pond will go anaerobic. As documented in the response to comment No. 113, thiosalts are effectively biodegraded in reclaim ponds. The anaerobic decomposition products of thiosulfate would be to change the relative proportion of one polythionate species to another (i.e., $S_3O_6^{=}$ vs. $S_4O_6^{=}$).

The compatibility of reclaim pond water with synthetic liner materials is discussed in "Evaluation of Prospective Common Liners, Crandon Project, Waste Disposal System, Project Report 6.2", dated December 1981 prepared by Golder Associates (previously given to the DNR).

Comment No. 193

While the volume of the reclaim ponds will provide surge capacity when both ponds are in operation, what will happen if one of the ponds is taken out of service.

Response:

Reclaim pond R1 has a depth of 8.7 m (28.5 feet) and reclaim pond R2 a depth of 7.0 m (23.0 feet). Maximum normal operating water level for both ponds will be maintained at 6.1 m (20 feet). With this water volume and the planned flow rates, water will be retained in the pond system for the desired time. The freeboard capacity of the ponds serves a number of purposes including: 100-year, 24-hour storm and wave runup, probable maximum precipitation (PMP) for 6 hours (including the volume of water from the largest tailing ponds), or 2 weeks of excess water system discharge flow (at 2500 gallons per minute) if that water had to be returned and held in the reclaim ponds. All of these events can be accommodated singularly, but not simultaneously. The system is designed as a two pond system and shutdown of a pond is not planned or anticipated. If for some unexpected reason that became necessary, a change in operating procedures would be required. If process flow rates were to be maintained, then a reduced retention time would have to be accepted and, if reclaim pond R2 was the remaining pond, then a lower water operating depth would be necessary to maintain sufficient freeboard capacity.

SECTION 1.4.5.2, WATER TREATMENT SYSTEM

Comment No. 194

(1) While the maximum flow of contaminated groundwater is shown in Figure 1.4-17, the other flow values given are average. Please provide maximum flows for each of the processes shown in this figure. What are the flow values for the "brine" "condensate" and "reverse osmosis permeate". (2) The area for "discharge to environment" shows two flow blocks. Since one is labeled Maximum, is the other Average? (3) What is the projected maximum which could be recycled back to the mill? (4) Provide a discussion of factors which could prevent recycle of water to the mill. (5) What effect would elimination of the recycle to the mill have on the projected maximum discharge flow?

Response:

(1) Typical and maximum flow rates for the water treatment plant are shown in the CH2M Hill, "Phase III Water Management Study", Volume 3, Figures 26 through 29. Average flow rates are presented in EIR Figure 1.4-17. The total flow rate of reverse osmosis permeate, and condensates from the evaporator and crystallizer will range from 194.6 to 396.9 m³/h (857 to 1749 gallons per minute).

(2) The "discharge to environment" line in EIR Figure 1.4-17 indicates a flow rate of 202.3 m³/h (892 gallons per minute) as an average if there is no uncontaminated mine water entering the discharge. The discharge volume of 429.4 m³/h (1892 gallons per minute) includes the 202.3 m³/h (892 gallons per minute) of treated water and a maximum of 227.1 m³/h (1000 gallons per minute) of uncontaminated mine water. A total volume of 624 m³/h (2,749 gallons per minute) could be discharged under the following situation:

- mill is shutdown and no treated recycle water is needed
- water treatment plant continues to operate at normal capacity
- uncontaminated mine water flow is at 227.1 m³/h (1000 gallons per minute).

(3) The projected volume of treated water to be recycled to the mill is 194.6 m³/h (857 gallons per minute). Examination of EIR Figure 1.4-10 indicates that all process requirements are met by recycling untreated and treated water.

(4) Water would not be recycled to the mill from the treatment facility if the mill were shutdown (i.e., for maintenance).

(5) Elimination or reduction of the treated water recycled to the mill would simply add a corresponding volume to the discharge. This assumes that the treatment plant is operating at its normal capacity.

Comment No. 195

Will the treatment system be designed to accommodate full treatment of the "uncontaminated" mine water? What measures will be available if the mine inflow exceeds the expected 2,000 gallons per minute?

Response:

The treatment plant will not be designed to treat the "uncontaminated" mine water, which could be up to a maximum of 227.1 m³/h (1000 gallons per minute). If this water is intercepted at ground water quality (see EIR Table 2.3-8), it should not require treatment. However, if it is determined that this water does require treatment on a long-term basis, appropriate water management and treatment technology would be used. Also, see the response to comment No. 106 for additional information on this subject. A discussion of total mine inflow potential is presented in the response to comment No. 62.

Comment No. 196

What are the projected wastewater characteristics going into each of the treatment systems? What are the projected treatment system effluent characteristics? Exxon does not need the effluent limits to derive this information.

Response:

The projected water analysis of the three principal influent streams and the corresponding effluent for water treatment and monitoring systems are documented in the CH2M Hill Phase III Water Management Study, Volume 3, Appendix E "Model Printout Mature Operations" (previously provided to the DNR). The particular columns in the computer printout which correspond to the influent and effluent stream composition for each identifying stream and its treatment system are identified below:

<u>STREAM</u>	<u>INFLUENT*</u>	<u>TREATMENT</u>	<u>EFFLUENT*</u>
Uncontaminated mine water	1	none	1
Contaminated mine water	69	lime-soda softening	207
Reclaim pond water Recycle to mill	118	lime-soda softening RO/VCE	209

*Computer print-out column number

The WPDES Permit Application will provide information on chemical composition of influent and effluent water on the treatment system for discharge.

SECTION 1.4.5.2, WATER TREATMENT SYSTEM

Comment No. 197

(1) Under what circumstances would or would not the "uncontaminated" mine water go through the water treatment system? (2) Assuming all "uncontaminated" mine water would need to be treated, how long could the mine and mill continue to operate in the event of a treatment system failure?

Response:

(1) The "uncontaminated" mine water (or intercepted ground water) would be treated appropriately if necessary. If the discharge water quality does not meet WPDES effluent limits, and the source is the "uncontaminated" mine water, appropriate water management and/or treatment technology would be used. For example, if the problem was deemed to be short-term, the "uncontaminated" mine water could be temporarily pumped to the reclaim ponds. However, if the problem is expected to be long-term, the "uncontaminated" mine water would receive appropriate treatment.

(2) Assuming that the total water pumped out of the mine is 530 m³/h (2335 gallons per minute) and that none of it can be disposed, and that 194.6 m³/h (857 gallons per minute) are still required as make up in the mill, the remaining 335.6 m³/h (1478 gallons per minute) would be pumped to the reclaim ponds if the treatment plant was completely shutdown. Assuming 310,950 m³ (82,153,000 gallons) of available freeboard volume (75 percent of total freeboard) in two reclaim ponds, the mine and mill could continue to operate for 39 days before this freeboard volume is used up. This still leaves freeboard for the 100-year, 24-hour storm and allowance for wave run-up. In addition, there is freeboard volume available in the operating tailing pond that could be used to store additional water. However, it is highly unlikely that the treatment plant would be totally shutdown for extended periods of time.

Contaminated water from mine	1335 gpm
Uncontaminated	<u>1000 gpm</u>
	2335

Less water needed in mill	<u>857</u>
	1478 gpm

Freeboard available 82,153,000 gal (75 percent of total)

82,153,000 gal
1478 gal/min = 55,584 min or about 39 days

SECTION 1.4.6, OVERALL WATER BALANCE

Comment No. 198

The overall water balance provided was for "mature" operation. When will the mine/mill complex become "mature"? Provide a discussion of the water balance over the start up, development, operation, and closure of the mine.

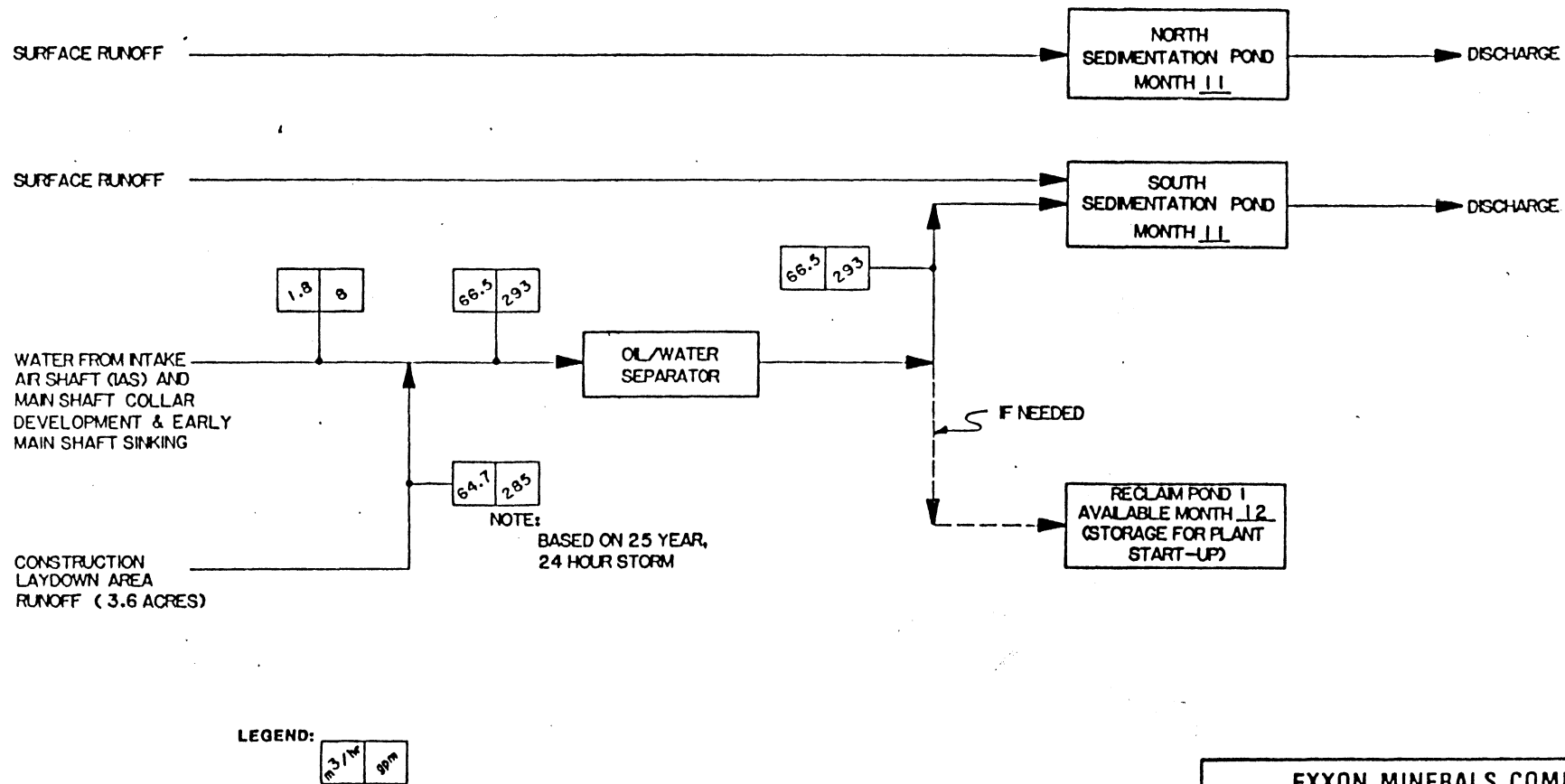
Response:

"Mature" operation of the mine/mill complex begins when the mine and mill have both reached their normal operating capacity. This is currently expected to occur in 1991.

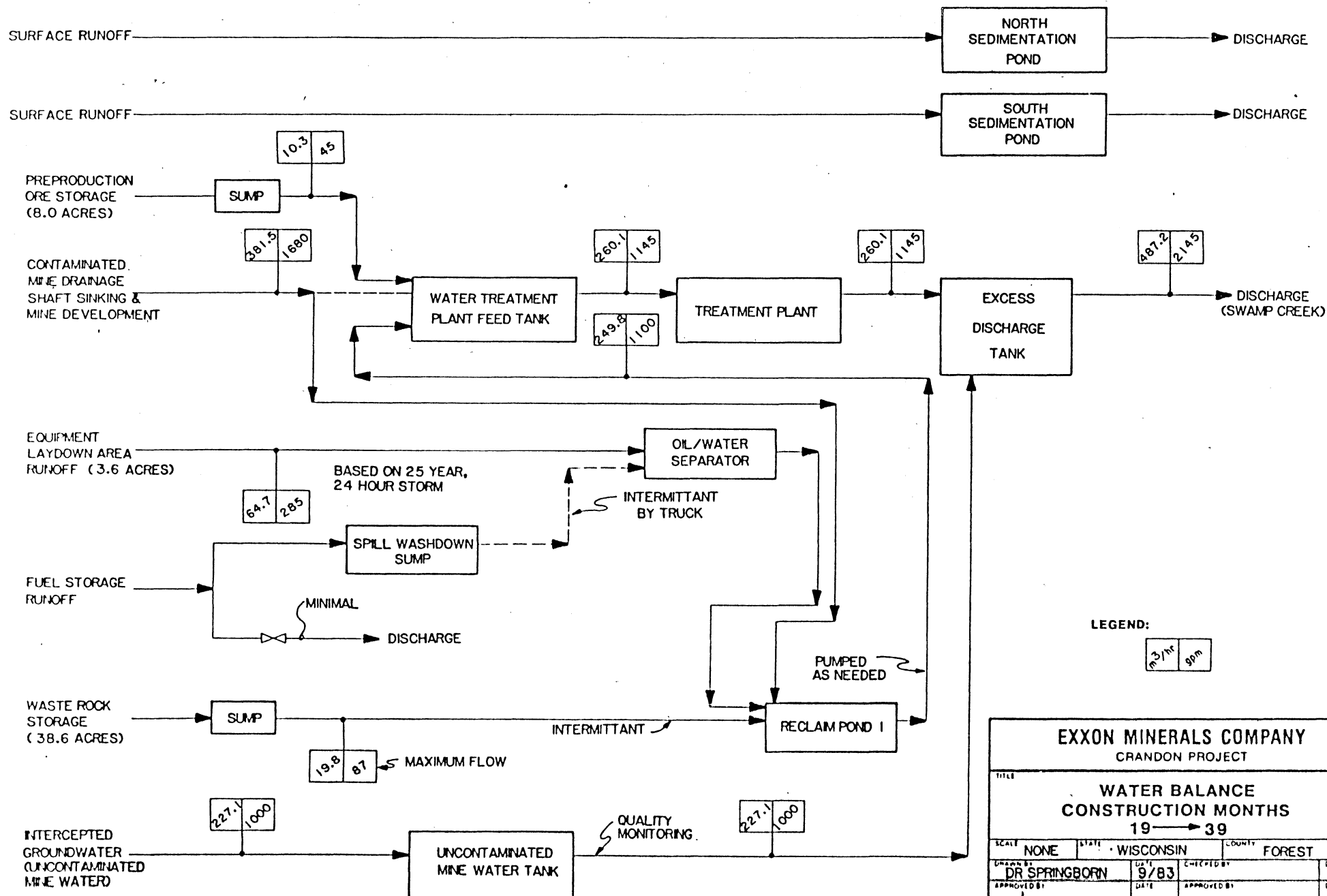
Water balances for construction, start-up, and mine closure cannot be accurately shown because they represent periods when conditions will change continuously. However, Figures 1 and 2 (attached) show conceptually how water will be handled during these periods; volumes shown on these figures are the flow rates currently being considered in the design.

Figure 1 shows the balance for the first 18 months of actual construction. The north and south sedimentation ponds would be constructed early and will remain in use throughout the life of the Project as part of erosion control system; they will serve to remove sediments from surface runoff and control the direction and rate of discharge of the runoff. Water from the intake air shaft sinking and main shaft collar development will be collected and sent to the oil/water separator near the northwest corner of the south sedimentation pond. Water from the separator will flow into the south sedimentation pond. During this same period, allowance has been made to collect runoff from a 1.45-ha (3.6-acre) area designated "Construction Laydown Area." There is potential for oil contamination in this water and it will also go to the oil/water separator. The flow rate shown is 64.7 m³/h (285 gallons per minute) which is equivalent to a 25-year, 24-hour storm event. The flow rate from this area is more likely to average about 1.3 m³/h (5.7 gallons per minute) over the year.

Figure 2 shows how water will be handled during construction months 19 through 39. Again both sedimentation ponds are available to receive surface runoff from the Project site. Runoff from the preproduction ore storage area will be collected in an adjacent sump and pumped directly to the water treatment plant feed tank or, alternatively, it could go to the reclaim pond if necessary. The runoff volume shown in Figure 2 of 10.3 m³/h (45.2 gallons per minute) assumes collection of runoff from a 25-year, 24-hour storm and pumping that volume to the treatment plant over a 14-day period. The contaminated water from mine shaft sinking and mine development will reach a peak flow rate of about 382 m³/h (1680 gallons per minute) and then decrease to 227.1 m³/h (1000 gallons per minute) or less. This water will be sent to the reclaim pond and pumped to the water treatment plant feed tank as necessary. It should be noted that the peak flow of contaminated mine water of 382 m³/h (1680 gallons per minute) occurs before significant quantities of uncontaminated mine water (intercepted ground water) are encountered. Therefore, as stated in response to comment No. 164, the total water flow from the mine should not exceed 454.2 m³/h (2000 gallons per minute). Storage in the reclaim pond will provide water needed for mill startup. Water from the equipment laydown area will continue to be treated by an oil/water separator and pumped to the reclaim pond. Runoff from the fuel storage areas will be discharged in a controlled manner by opening a valve to allow collected precipitation to drain. If a



EXXON MINERALS COMPANY			
CRANDON PROJECT			
TITLE			
WATER BALANCE			
CONSTRUCTION MONTHS			
1 → 18			
SCALE	NONE	STATE	WISCONSIN
COUNTY	FOREST		
DRAWN BY	DR. SPRINGBORN	DATE	8/83
CHECKED BY		DATE	
APPROVED BY		DATE	
APPROVED BY		DATE	
DESIGNED BY		DATE	
FIGURE 1			SHEET
			OF



small fuel spill occurs, the spill and wash down water will be collected in a blind sump. The contents of the sump will be pumped into a tank truck and hauled to the oil/water separator; water effluent then goes to the reclaim pond. Runoff collected from the waste rock storage area will be pumped to the reclaim pond and stored for use as process water during plant startup. The volume shown is the water volume that accumulates during a 10-year, 24-hour storm event and is pumped to the reclaim pond over a 30-day period.

The mill is currently expected to start processing ore 40 months after the start of construction. A water balance for early operation is shown in Figure 3 (attached) and is a balance for milling a maximum of 5750 t/d (6340 short tons per day) of massive ore. Although minor revisions are expected to be made to this balance as a result of on-going engineering, the important point is that the handling of process water and mine water will be the same as for mature operation. The ore throughput during start-up will be increasing gradually during this period and water flows to and from the tailing pond and reclaim ponds will be increasing until they approach the volume flow rates for the mature operation of the mill.

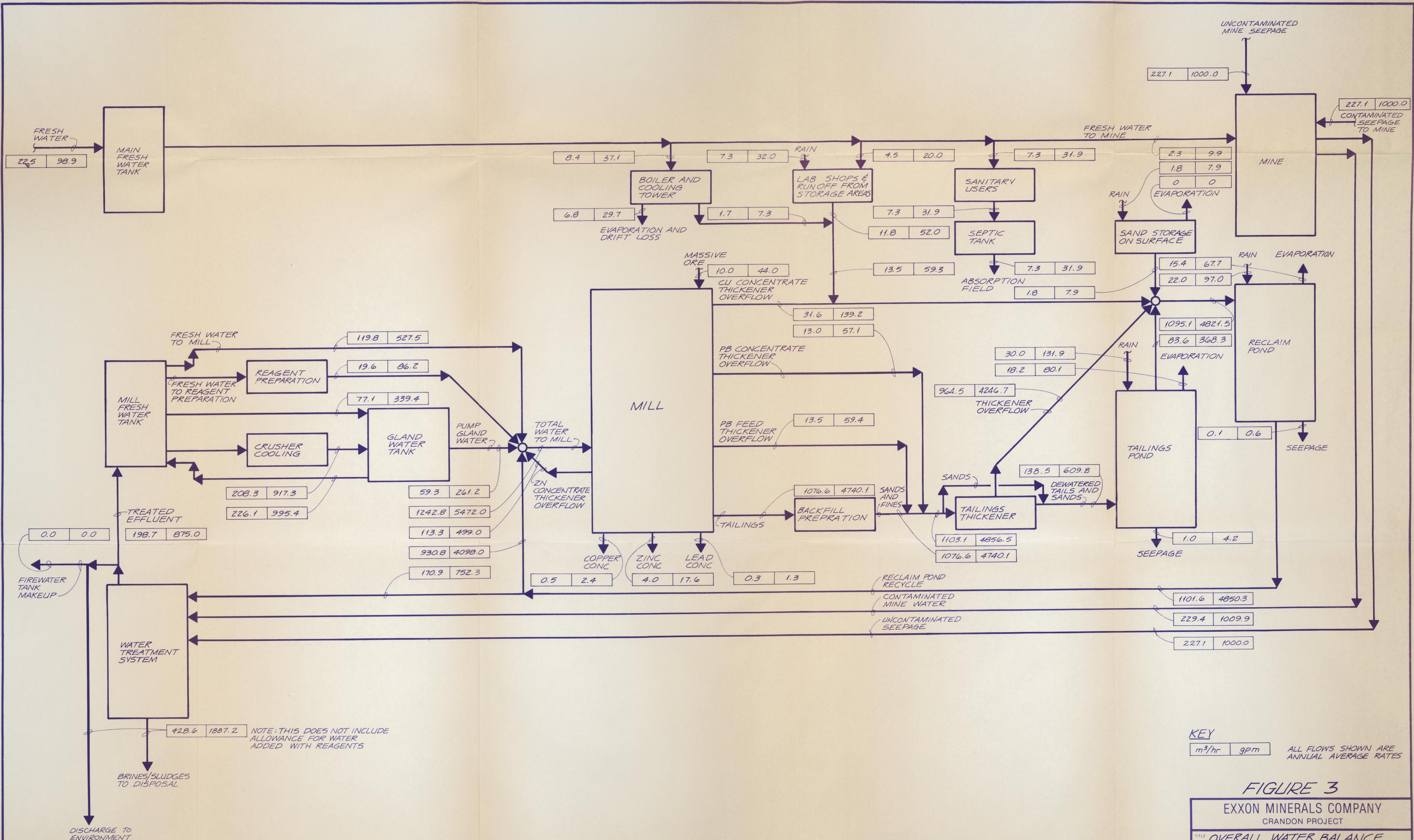
It would be premature to develop a water balance for the closure of the Project, but the concepts can be discussed. Water will continue to be pumped from the mine until all salvageable equipment has been removed and mine closure operations have been completed. Contaminated water pumped from the mine will continue to be treated. Water coming from the tailings area will be retained in the reclaim ponds. Water will be pumped from the reclaim ponds at a controlled rate to the treatment plant, treated, and discharged. The treatment plant will continue to operate during the reclamation period as long as there is contaminated water requiring treatment prior to discharge.

Comment No. 199

- (1) This section states that the average amount of water expected to be discharged will be up to 1893 gallons per minute. (2) Section 1.4.5.4 indicates that this figure is the maximum flow to be discharged.
(3) Please specify the maximum flow to be discharged.

Response:

- (1) The discharge volume shown in EIR subsection 1.4.6, Figure 1.4-18 includes 202.8 m³/h (893 gallons per minute) of treated water and an allowance for a maximum of 227.1 m³/h (1000 gallons per minute) of uncontaminated mine water. This gives a total discharge flow rate of 429.9 m³/h (1893 gallons per minute).
- (2) Subsection 1.4.5.4 addresses "Water Treatment Wastes" and not excess water discharge volume.
- (3) The maximum effluent volume has been determined with the following assumptions:



ASSUMED MAXIMUM
VOLUME FLOW RATES

<u>SOURCE</u>	<u>m³/h</u>	<u>(gallons per minute)</u>
Uncontaminated Mine Water	272.5	(1200)
Contaminated Mine Water	348.6	(1535)
Treated Reclaim Pond Water	60.2	(265)
Total	681.3	(3000)

These assumptions include 272.5 m³/h (1200 gallons per minute) as the maximum flow rate of uncontaminated mine water. Contaminated mine water also includes 272.5 m³/h (1200 gallons per minute) and 76.1 m³/h (335 gallons per minute) of backfill drainage (and some excess potable water). An allowance was made to keep treating some water from the reclaim pond with the assumption that it would all be discharged (i.e., the mill is not operating and recycle is not needed). Under this unlikely set of assumed circumstances, the maximum discharge volume is estimated to be 681.3 m³/h (3000 gallons per minute).

Comment No. 200

The maximum flow rate previously provided to the Department by Exxon of 3.34 cubic feet/second was used to develop preliminary effluent limits for Swamp Creek. This is substantially less than the apparent anticipated maximum flow. Final effluent limits will be based on maximum flow rate. Thorough documentation of the estimated maximum flow rate will be necessary.

Response:

The discharge rate of 0.119 m³/s (1,893 gallons per minute) presented represents the estimated average. Documentation of the projected flow rates is provided in Sections IV through VII of the "Phase III-Water Management Study", December 1982, prepared by CH2M Hill (previously provided to the DNR). The maximum effluent volume is presented in the response to comment No. 199.

SECTION 1.4.7, OPERATIONS TRAFFIC

Comment No. 201

What was the basis for assuming 1.25 persons per vehicle? Please provide estimates of vehicle miles traveled. Quantify by type the truck traffic throughout the operation phase including trucks removing materials from the site.

Response:

For various studies of potential traffic effects from the Crandon Project, vehicle occupancy rates ranging from 1.0-2.0 people per vehicle have been used. The 1.25 persons per vehicle used for the operations traffic is conservative in predicting increased traffic. If 1.25 people/vehicle were assumed, the estimated daily mileage would be approximately 33,300 daily vehicle miles.

The trucks to and from the site will consist of panel trucks for small supplies, dump trucks for various wastes, and tank trucks for fuel hauling. Truck traffic anticipated during operations is presented in the attached listing.

SECTION 1.4.8.2, TREATMENT OF SANITARY WASTES

Comment No. 202

Provide the basis for the average daily flow rate of 32 gallons per minute. The Wisconsin Administrative Code referenced in Figure 1.4-20 should be H 63.14 rather than H 63.10.

Response:

A per capita flow rate of 0.19 m³/d (50 gallons per day) has been used for estimating sanitary wastewater. The total sewage flow was based on a conservatively high project workforce of approximately 890 people. Additional detail on sanitary wastewater quantity is presented in CH2M Hill's Phase III Water Management Study, Volume I - Section VI (previously provided to the DNR).

The comment on the code reference correction is acknowledged.

SECTION 1.4.8.3, WASTE

Comment No. 203

This discussion of waste disposal is very general and does not substantially add to previous sections. Please discuss in detail the production, transport and disposal (including off-site disposal) of all waste materials.

Response:

The type and quantity of refuse expected are discussed in the response to comment No. 38. The exact location where refuse will be disposed has not been determined. However, the disposal site will be one that is licensed and operated under procedures approved by the State of Wisconsin.

SECTION 1.4.8.4, FUELS AND OTHER ENERGY REQUIREMENTS

Comment No. 204

The CPCN application estimates the peak electrical demand level at 37 mw while the EIR indicates a demand between 40 and 45 mw. Please resolve this discrepancy and provide a detailed electric load forecast, including a detailed list of equipment with electrical load data which comprise the mine energy requirements (including lighting, heating, etc.)

Response:

EIR subsection 1.4.8.4 includes a statement that the Project has a 40-45 mw load. This is the connected load not the demand load. The demand load was projected to be 37 mw with a 15 percent variation to allow for revisions

(LISTING FOR THE RESPONSE TO COMMENT NO. 201)

OPERATIONS TRUCK TRAFFIC

<u>Item</u>	<u>Nominal Trucks per day</u>	<u>Actual Frequency</u>	<u>Truck</u>
1) Mill balls @ 1.9 lb short ton ore 19,000 lb day	0.50 trucks/day	1 truck/2 days	Semi/Flatbed Trailer
2) Liners @ 65,000 lb/month	0.07 trucks/day	2 trucks/month	Semi/Flatbed Trailer
3) Explosives @ 7,000 lb/day	0.20 trucks/day	1 truck/week	Semi/Closed Trailer
4) Fuel oil 1,400,000 gal/year	1.00 truck/day	1 truck/day	Tanker
5) Gasoline 45,000 gal/year	0.03 trucks/day	1 truck/month	Tanker
6) Sodium sulfate (remove from site) @ 15 short tons/day (Maximum)	1.00 trucks/day	1 truck/day	Dump
7) All process reagents and water treatment supplies that will be delivered by truck	0.60 trucks/day	1 truck/day	Tankers Flatbed/ Closed Trailer
8) Operating supplies, drill steel, rock bolts, tires, timber, etc.	0.50 trucks/day	1 truck/2 days	Flatbed/ Closed Trailer
9) Scrap metal, rubber (remove from site)	0.03 trucks/day	1 truck/month	Dump
10) Waste oil, hydraulic fluid (remove from site)	0.03 trucks/day	1 truck/month	Flatbed
11) Replacement equipment and machinery parts	0.50 trucks/day	1 truck/2 days	Flatbed
12) Refuse, garbage, solid waste (remove from site)	0.50 trucks/day	1 truck/2 days	Dump
13) Sanitary sludge (remove from site)	0.07 trucks/day	1 truck/2 weeks	Panel
14) Office supplies	0.50 trucks/day	1 truck/2 days	Panel
15) Food, drink, vendor supply	1.00 trucks/day	1 truck/day	Panel
16) Concrete	<u>1.00 trucks/day</u>	1 truck/day	Mixer
average	7.53 trucks/day (8 trucks per day)		

during detailed engineering. Recent revisions have lowered the demand load estimate to 32 mw with a 10 percent variation. Data for the 32 mw demand load are based on current engineering, major equipment sizing with diversity factors, and allowances for miscellaneous equipment for the Project. A list of the equipment or projections in determining the load forecast will be provided in the revised EIR.

SECTION 1.4.9, POLLUTION CONTROL, EMISSIONS AND EFFLUENTS

Comment No. 205

Discuss the disposition of all air pollution control nonrecyclable dusts and sludges.

Responses:

There are no dusts and sludges which will be nonrecyclable from the air pollution control equipment. All concentrates will be recovered for shipment and other dusts and sludges will be recycled to the process streams.

Comment No. 206

Please provide a description of the separate burnt pebble lime facility in Section 1.2, including plan elevation drawings of process equipment and air pollution control equipment.

Response:

Detailed engineering of this facility is not complete. However, the design criteria specify that the dust associated with unloading, transferring, and slaking the lime will be adequately contained by use of a dust collector(s). See Attachment No. 6 to the response to comment No. 70 for drawings of the lime facility.

SECTION 1.4.10, OPERATIONS PERSONNEL

Comment No. 207

Please provide a detailed account by job category of operations workers including the hiring schedule by year to indicate work force buildup. Discuss the job categories which could be filled locally, and provide a detailed discussion on Exxon's hiring policies. Provide an estimate of the minimum and maximum number of positions filled locally, and the basis for those estimates. Discuss any contracts or agreements at other Exxon operations which could impact employment opportunities at the Crandon mine.

Response:

Table 1 (attached) gives an account of the employment categories of operations workers along with an annual hiring schedule. It is very difficult at this time to estimate with precision the number of operations workers which will be hired locally (local hires are defined as residents of the socioeconomic report local study area). The actual number will depend on many factors, some of which are listed below.

(TABLE 1 FOR RESPONSE TO COMMENT NO. 207)

EXXON EMPLOYMENT CATEGORIES
CRANDON PROJECT

EMPLOYMENT CATEGORY	PROJECT PHASES (NO. OF PERSONNEL AT YEAR-END)									TOTAL
	PRECONSTRUCTION		CONSTRUCTION				OPERATION			
	BASE YEAR	ADDITIONAL PERSONNEL OVER BASE YEAR								
	1983	1984	1985	1986	1987	1988	1989	1990	1991	
Administration	22	(6)	--	25	16	18	11	--	--	86
Mine Technical	--	--	--	18	4	8	5	--	--	35
Mine Operations	--	--	--	4	126	108	37	24	--	299
Mine Maintenance	--	--	--	--	50	15	20	11	--	96
Mill Operations	--	--	--	1	6	9	44	3	--	63
Mill Technical	--	--	--	4	5	9	13	(5)	--	26
Mill Maintenance	--	--	--	2	5	20	1	2	--	30
Central Maintenance	--	--	--	17	14	20	17	--	--	68
Construction Mgmt.	--	--	6	34	(6)	(2)	(6)	(26)	--	0
Total New Additional	--	(6)	6	105	220	205	142	9	0	
TOTAL	22	16	22	127	347	552	694	703	703*	703

*This number maintained throughout Project life.

- 1) Local unemployment rates at the time of hiring.
- 2) The availability of required skills in the local labor force.
- 3) The willingness of local workers to accept employment at the Project.
Mining is new to the area, and it is difficult to estimate how the local labor force will view underground employment.
- 4) Level of locally trained technical school graduates.

Based on the job requirements estimated for the Project, it is possible to make some general judgements on the local hiring picture. Table 2 (attached) gives a summary of the estimated educational requirements and projected hiring schedule for the Project work force; and Table 3 (attached) presents a summary of the estimated educational requirements of the Project work force and the number of employees which might be hired locally.

As stated above, these percentages are estimates and must not be treated as commitments on the part of Exxon. They represent the number of local hires which could be achieved given current plans for the Project.

It is Exxon's policy to hire qualified candidates without regard to age, race, creed, color, sex, handicap, national origin, or ancestry. With respect to employment at the Crandon Project, Exxon is committed to hiring local people preferentially to the extent allowed by applicable laws and by the necessary skill requirements. Furthermore, Exxon will request construction contractors to give preference to hiring local people, including Native Americans, among equally qualified candidates, to the extent allowed by law. This policy has been communicated to the local communities during various meetings, as well as through written correspondence between Exxon management and local community leaders and their representatives.

Exxon has no contracts or agreements at other Exxon operations which could impact employment opportunities at the Crandon Project.

SECTION 1.5.1, FACILITIES REMOVAL

Comment No. 208

Concrete and masonry waste material used as fill will need to be disposed of in accordance with solid waste requirements.

Response:

Reclamation plans in the mine/mill area include the removal of all concrete and masonry to approximately 0.5 m (1.6 feet) below final proposed grades. Deeper concrete and masonry would be left in place; however, large expanses of concrete (such as floor slabs or pits) would be broken up before covering to permit normal infiltration of precipitation. Following solid waste disposal requirements, a one-time disposal permit would be applied for to utilize the disposal concrete and masonry as reclamation fill in the mine/mill area. A minimum 0.5 m (1.6 feet) soil cover would also be provided in these fill areas.

(TABLE 2 FOR RESPONSE TO COMMENT NO. 207)

PROJECTED HIRING SCHEDULE BASED ON EDUCATION LEVEL
FOR THE CRANDON PROJECT

YEAR	<u>EMPLOYEE EDUCATIONAL REQUIREMENTS</u>			TOTAL NEW HIRES
	COLLEGE	VOTECH	HIGH SCHOOL	
Present (1983 Year-End)	16	3	3	—
	<u>Additional Personnel Required Over 1983 Year-End</u>			
1984	(6)	0	0	(6)
1985	6	0	0	6
1986	45	15	45	105
1987	5	22	193	220
1988	11	36	158	205
1989	7	20	115	142
1990	(25)	4	30	9
1991	0	0	0	0
TOTALS	59	100	544	703

(TABLE 3 FOR RESPONSE TO COMMENT NO. 207)

NUMBER OF EMPLOYEES TO BE HIRED LOCALLY FOR THE CRANDON PROJECT

EDUCATIONAL REQUIREMENTS*	TOTAL	LOCAL HIRES	
		%	NO.
College	59	18	10
Vocational/Technical	100	37	37
High School	544	69	375
TOTAL	703	60	422

*These represent actual degrees or equivalent.

Please provide us with the documentation supporting the conclusion that "the proposed mining practices would have a negligible affect on surface topography."

Response:

The original ground surface above the proposed Crandon mine will be maintained by a permanent bridge or "crown pillar" of bedrock left undisturbed above the mine workings. Mining methods and practices contributing to the stability of the protective crown pillar are described in Chapter 1.0, response to comments No. 54 (Subsidence Control) and No. 173 (Stabilized Mine Backfill), and in Chapter 3.0, response to comment No. 22 (Mining Methods).

The selection of mining methods for preservation of the crown pillar was based on a suite of physical testing programs including soil mechanics, rock mechanics, and mine backfill. These studies determined the soil characteristics, rock mass strengths, inherent rock stresses, and backfill properties such as density, compaction, and percent cement addition necessary for a structurally safe mine design.

John D. Smith Engineering Associates Limited, mine rock mechanics specialists, prepared a summary report, "Evaluation of Surface Effects" in April 1982. Their analysis integrated all the related test work and described and quantified potential subsidence mechanisms:

- 1) Overburden Compaction - Because of the consolidated nature of the glacial overburden, partial dewatering of these soils will result in little additional compaction and resultant subsidence.
- 2) Gross Rock Failure - Mine stope dimensions, methods, development sequences, and backfilling practices have been designed to preclude failure of the crown pillar or rock surrounding the ore deposit during and after normal mine operations. Maintenance of the surface is contingent on the stability of the bedrock subcrop.
- 3) Backfill Compression - Long-term, post-operation, rock failure mechanisms investigated included rotational failure of the hanging wall, wedge failure of the hanging wall, and crown pillar collapse. Each of these failure modes is related to backfill compressibility and placement practices. The properties are such that with proper placement, particularly beneath the crown pillar, the bedrock surrounding the mine workings should remain perpetually stable.

The summary conclusion of all subsidence evaluations is that the combined effects of any bedrock/soil movements will result in less than 0.15 m (6 inch) maximum change in surface elevations over the ore deposit. Gradational deflections of this magnitude distributed through glacial overburden of varying thickness will have a negligible effect on surface topography or land use.

Comment No. 210

What types of equipment would likely be left underground? No equipment which may pose a threat to groundwater will be allowed to remain underground.

Response:

As mining areas are systematically depleted and levels abandoned throughout the mine life, installed facilities and materials will be salvaged for reuse when practicable. Abandonment of any mine area will also include removal of any equipment or material containing chemical agents or other decay-prone substances. Similarly, at final mine closure all materials and equipment with residual value or with potential for ground water contamination will be reclaimed prior to inundation and shaft sealing. Items which may remain underground include pipelines, electrical switchgear, haulage track, shaft and crusher station steel, and obsolete machine parts.

Comment No. 211

It is extremely doubtful that the hydraulic gradient will be restored to that which existed prior to the beginning of mining. It is also doubtful that "no flow through the mine workings will be possible." Some flow through fractures will occur.

Response:

Simulations of the impacts of mining operations show that within 3 years after cessation of mining the potentiometric surface of the main aquifer will return to nearly original pre-mining elevation and configuration. These simulations are based upon the current ground water recharge rates and aquifer configuration. This being the case, the pre-mining gradients will also be restored at approximately the same rate.

Ground water quality and potentiometric data developed during the environmental baseline studies indicate that there is no active, measurable vertical interaction between the water in the orebody and the water in the overlying glacial material. Furthermore, exploratory drilling has shown the rock around the orebody to be virtually impermeable. Fractures that were encountered in the boreholes were virtually all sealed with secondary mineralization and/or weathered clay minerals. Therefore, when mining operations have terminated and the mine is sealed, it is expected that the hydrologic regime will return to its pre-mining condition.

Comment No. 212

Please state specifically whether all shafts and galleries of the mine will be filled prior to flooding. Discuss contingency measures available should the mine cause ground water degradation after closure.

Response:

Mine backfill consisting of development waste rock and prepared mill tailings will be universally placed in ore extraction areas (stopes) to

maintain perpetual mine area rock mass and overburden stability. Access drifts and shafts developed exterior to the orebody will not be filled prior to mine closure, except as described for those openings extending to surface.

Site geotechnical investigations and hydrologic studies (Dames and Moore, Golder Associates, D'Appolonia, Prickett) have concluded that the bedrock is not now and at mine closure will not be a functional component of the Project area geohydrologic regime. This conclusion is based upon the absence of major bedrock fracturing now, and the premise that planned mining methods will not disturb the rocks adjacent to the ore deposit and the overburden. Possible convective ground water flow through zones of orebody weathering should have less potential after mining than for baseline conditions, since some of the water flow paths will have been replaced with less permeable backfill or will have been sealed by grouting. Any such water flows would be so small compared to the transient volume of the glacial overburden aquifer that their presence would likely be undetectable. If a measurable impact were to occur, bentonite grouting of the overburden/bedrock interface could be used to control such an excursion.

Comment No. 213

This section should include permanent abandonment of water wells on the property.

Response:

The potable water supply well(s) at the surface facilities site will be plugged and abandoned, in accordance with applicable state regulations, upon cessation of mining activities.