APPENDIX 3.IV

Waste Management Plan

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FIGURES

3.IV.1 INTRODUCTION

Management of wastes will be guided by human health and safety, and environmental responsibility. The plan will meet the requirements of legislation and guidelines of the Northwest Territories and, as appropriate, the Government of Canada, in the context of the operating licences and permits administered by the Wek'èezhìı Land and Water Board.

3.IV.1.1 Objectives

The governing objective of the General Waste Management Plan is to minimize the potential for adverse effects to the environment, including land, water, air, vegetation, wildlife, and habitats. The plan is designed with consideration of social factors such as visual impacts, current and future land usage and the public interest.

3.IV.1.2 Scope

The scope of this General Waste Management Plan includes the wastes resulting from the operation of the mine, Mineral Processing Plant (Plant), and living quarters. Specific management plans have also been established for key waste streams from the mine complex which should be referenced for those aspects. They include:

- Mine Rock Management Plan (Appendix 3.I);
- Co-Disposal Facility Management Plan (Appendix 3.II);
- Water Management Plan (Appendix 3. III);
- Hazardous Substances Management Plan (Appendix 3.V); and
- Air Quality Effects Monitoring Program (Section 10.9 and Section 18).

This General Waste Management Plan is based on the principles of the 4Rs of waste management, namely: reduce, reuse, recycle, and recover. The underlying object of the 4Rs is to reduce the quantity of unusable waste materials that must be disposed. In addition to the 4Rs, diversion of substances that have the potential for adverse environmental impacts will be implemented, whether or not these substances fall within the scope of the 4Rs.

On-site disposal of solid non-hazardous waste materials will only be undertaken at locations approved in, and in accordance with the conditions of, the operating licenses. To the extent practical, on-site waste disposal will be discouraged. Wastes produced will be handled, stored, and transported or disposed in an acceptable and responsible manner.

3.IV.2 WASTE MANAGEMENT POLICIES

The 4Rs principles will govern the waste management practices at the NICO Project, as they have during the exploration phases. The 4Rs are not equal; however, as recycling tends to garner most of the attention in waste management strategies as it diverts volume from disposal sites. However, it is properly considered the third level and essentially deals with materials that could not be addressed in the first 2 levels, namely reduction and reuse. The following summaries are presented in the order of hierarchy in the 4Rs.

3.IV.2.1 Reduction of Wastes

Source reduction is a primary means of minimizing wastes and it makes business sense. The purchasing department will continually try to source supplies that minimize packaging (e.g., bulk purchasing) and involve packaging that is returnable, re-usable, or recyclable. In addition to packaging, non-hazardous materials will be preferred and purchased over those that might generate hazardous wastes.

3.IV.2.2 Reuse of Materials

Where possible, the potential for reuse of materials that might otherwise be considered waste will be investigated. For instance, wood form-work may be useful for other construction, or containers used to bring in new materials could be used to contain similar materials being recovered for recycling (e.g., new oil and waste oil). A construction and plant parts laydown area will be established to use as a source of spare parts.

3.IV.2.3 Recycling of Materials

Fortune will be establishing a material sorting facility at the NICO Project to centralize and facilitate source separation and processing of waste streams. In this facility, plastics, metals, glass, e-waste (electrical/electronic materials), and paper products will be segregated and packaged for shipment to receivers for recycling off-site.

To facilitate the separation process at this centralized material sorting facility, separation of waste classes will be practised at the sources of the waste (working and living areas) through the use of designated containers. Separate containers will be located in convenient locations in the accommodations complex, service complex, the Plant, underground shops, and other facilities for point-of-origin sorting of domestic waste. Large containers will be located at each major facility to separately collect burnable materials, and recyclable materials such as scrap metal, timber, tires, and unsalvageable equipment.

In addition to the general recyclable waste types identified above, items that will be segregated for off-site removal include:

- lead-acid batteries;
- oil filters;
- paint residues;
- auto parts;
- automotive fluids;
- empty drums; and
- alkaline and similar batteries.

Some of these are further addressed in the Hazardous Substances Management Plan (Appendix 3.V).

When sufficient quantities of separated materials are collected they will be compacted and/or bailed, put on pallets, or in crates and shipped to the appropriate receiver.

3.IV.2.4 Recovery

The recovery of energy from wastes is the fourth level of waste minimization. The mine site will be dependent on imported energy (primarily diesel) at substantial cost; therefore, energy realized from waste materials can make business sense by reducing imported energy needs and reducing waste shipments.

Perhaps the greatest potential for energy recovery from waste is from used oil and contaminated diesel. Fortune intends to use these fuel sources for heating fuel. Fortune may also recover heat from the incinerator and electrical generators to heat buildings and processes.

3.IV.2.5 Incineration

Incineration is required to destroy food and other domestic wastes through high temperature combustion. Most food waste generated will be from the kitchen and dining area in the camp complex. However, food wastes will also be generated in lunch rooms in the mine facilities. These additional food wastes will be collected in bins, animal resistant as necessary, at these locations.

Office wastes, primarily paper and cardboard packaging, may also incinerated if it is not feasible to recycle them. Other wastes that will be incinerated include used absorbents, oily rags, soiled paper and cardboard, non-recyclable hydrocarbon-based plastics, and foams.

Types of wastes that are not appropriate for incineration include hazardous wastes, metal, glass, liquid wastes, chlorinated plastics (such as PVC), concrete, ceramics, radioactive materials (such as smoke detectors), pressurized containers, electronics, drywall, and tires. When encountered, inappropriate waste material will be removed from the incinerator feed.

A comprehensive incinerator management procedure will be developed in conjunction with the manufacturer's operation and maintenance manual. The general assumptions and operations for the incinerator are summarized below.

These incinerator feed waste materials will be collected each day and processed as a mixture. The characteristics of this waste have been assumed as follows:

- moisture content up to 30 percent (%);
- density of 160 to 240 kilograms (kg) per cubic metre; and
- average heat value of 9900 to 14 300 BTU/kg.

Based on 2 to 3 kg of solid waste generated per person daily, the incinerator will need to handle up to 838 kg/day during construction and 420 kg/day of waste during operations. The proposed incinerator model can handle 340 to 500 kg per batch; therefore, during construction the incinerator will have to process more than one batch per day.

The incinerator operates in 2 stages. The first stage is the general burn of the waste materials and the second stage completes the burn of the combustion gases to yield carbon dioxide and water. In the first stage, a diesel fired burner elevates the temperature of a primary combustion chamber to ignite the waste. Once the chamber reaches a temperature of 650 to 850 degrees Celsius, the burn process will be self-fuelling and the burner will shut off. The burner will turn on periodically, and as necessary when the temperature drops. In the second stage,

combustion gases from the first stage are cleansed by further combustion at 1000 degrees Celsius utilizing a separate high output burner to maintain the required temperature. This stage is augmented by use of a blower which creates turbulence in the chamber to mix the gases and oxygenate them.

Incineration of the solid waste should reduce the volume by approximately 90% and the residual ash will be non-hazardous, non-leaching and essentially inert. Entrained metals and glass (which will have been separated from the incinerator feed to the extent possible prior to combustion) will remain intact after incineration and will either be recycled (if possible) or sent for disposal in the Co-Disposal Facility (CDF).

3.IV.2.6 Solid Waste Disposal

Despite all efforts at reduction, reuse, recycling, and recovery, a quantity of waste material will ultimately have no use or value and will require disposal on-site. Fortune has investigated the possibility of diverting this final waste to an off-site receiver, such as the Yellowknife Landfill, but these options are not viable at this time. Solid non-hazardous wastes will be managed in accordance with territorial regulations and good practice.

Typically, these waste materials are deposited in a designated sanitary landfill facility and buried on-site. These non-hazardous solid waste materials will be incorporated for disposal within the CDF for the Mine Rock and tailings. In principle, the concept is similar to that of a landfill in which waste is buried, but instead of disturbing additional land area, the waste materials will be within, and the cover material would be comprised of, Mine Rock and tailings. In addition to eliminating additional land disturbance for this purpose, it also centralizes waste disposal for monitoring purposes.

Waste material deposited in this manner would include incinerator ash and other non-combustible, otherwise non-useful, waste materials, such as construction waste. Wind-borne wastes, such as paper, plastic film, and foam packaging, will not be disposed without immediate cover to avoid litter in the surrounding area.. These types of materials, which cannot be diverted by recycling, may also be incinerated.

The locations in which solid wastes are deposited in the CDF will be inspected regularly, similar to a conventional landfill. Records of the inspections will be retained.

3.IV.3 IDENTIFICATION OF WASTE TYPES

The following identifies potential waste streams by type of waste produced. It does not include waste streams addressed by specific management plans identified in previous sections.

3.IV.3.1 Domestic Refuse

Domestic refuse includes primarily materials deposited in garbage cans in the living quarters and office/lunch room areas (i.e., paper, food wastes, beverage containers). To the extent practical and enforceable, this material will be subject to source separation to facilitate recycling and/or other appropriate handling, as described below for individual waste types. However, it is unlikely that 100% compliance will be achieved, so this waste stream will be expected to contain some or all of the materials listed and will, therefore, require waste sorting at the material sorting facility.

3.IV.3.2 Construction Materials

Construction materials may include concrete, wood, metal, plastics or insulation. This waste stream will be most voluminous during the construction of the mine infrastructure, but will persist throughout operations resulting

from maintenance and modifications. To the extent practical, construction materials will be source segregated to facilitate both reuse and recycling. Non-hazardous construction materials with no use or value will be placed in the CDF.

3.IV.3.3 Metals

Metals are valuable materials that will be recovered to the extent possible for recycling purposes. In particular, steel, copper, and aluminum may be separated on-site for off-site shipping. Unsegregated metals will also be shipped off-site to a metals sorting facility.

3.IV.3.4 Putrescible Materials

Putrescible materials include food scraps and other readily rotting materials. This waste stream will be segregated for incineration to prevent attracting wildlife.

3.IV.3.5 Plastics, Foams, and Rubber

Plastics, foams, and rubber materials will be segregated to the extent possible in accordance with standardized recycling codes. Plastics are anticipated from food and liquid containers as well as packing materials. Foams will be generated primarily from packaging. Rubber will be generated from tires, conveyors, and hoses.

3.IV.3.6 Sewage Sludge

Sewage sludge results from the treatment of sewage wastes. This material will be incinerated and the ashes placed within the CDF.

3.IV.3.7 Incinerator Ash

Incinerator ash will result primarily from the combustion of putrescible materials (primarily food wastes), sewage sludge, as well as some other combustible materials (e.g., paper, wood, oily rags, plastic films.). Small quantities of other materials disposed with these waste sources will also inevitably find their way into the incinerator. The incinerator ash will not to be hazardous and, therefore, is suitable for placement within the CDF.

3.IV.3.8 Electrical/Electronic Materials

Also known as e-waste, this material includes electronic items, such as computers and audio/visual equipment, as well as electrical components such as switches and transformers. These items typically contain a mix of metals and other materials which can be recovered at specialized facilities. These items will be segregated for off-site recycling.

3.IV.3.9 Paper and Cardboard

Paper from offices and other sources, and cardboard primarily from packaging will be source segregated to the extent possible to facilitate recycling. Soiled paper and cardboard will be incinerated.

Air filters on most engines are designed for single usage. They are classified as non-hazardous and are generally comprised of combustible material; therefore, it is expected to be acceptable for incineration. If not, then these will be added to the waste to be deposited in the CDF.

3.IV.4 SPECIFIC WASTES MANAGEMENT PROCEDURES

3.IV.4.1 Petroleum Products

Petroleum products, primarily diesel, and lubricating oils, will be used in large quantities for fuel (electrical generation and mobile equipment) and for lubricating equipment.

Fuel will generally be stored in bulk in tanks, and stores will be cycled appropriately. However, small quantities of fuel may become out-dated for their intended use, such as aviation fuel. Since these fuels are quite similar in nature to diesel, they will be mixed with bulk diesel fuel, if appropriate, or used in other diesel or kerosene powered equipment.

Used lubricating oil will be generated during maintenance of mobile equipment and diesel electric generators, as well as other equipment. This oil will be collected in appropriate containers and stored in designated storage containers, in a secured location within the tank farm, for transportation to an off-site receiver or possible use as a heating energy source. If quantities of used oil exceed the demand for it on-site, excess used oil will be shipped off-site for recycling.

Oil and fuel filters generated from engine maintenance contain residues of petroleum. The filters will be drained as practical to collect the used petroleum. The resultant used filters will be collected in drums in the maintenance areas and then transferred to the material sorting facility. In the material sorting facility, the filters will be further drained then crushed to reduce the volume and placed into drums again. Full drums of crushed filters will be transported off-site to a licensed recycler.

3.IV.4.2 Solvents, Antifreeze, and Other Chemicals

The mine site will not be a large generator of chemical wastes. The main chemical wastes and disposal methods are discussed below.

Glycols are used for antifreeze in the cooling systems of engines and the heat exchange medium in the camp heating system. Spent antifreeze with glycol will be stored in bulk containers for transportation off-site to a licensed receiver.

Acids are used in lead-acid batteries and as such are generated as waste with used batteries. In preparation for recycling of the lead and plastic housing of the batteries, the acid will be drained into appropriate containers for transportation off-site to a licensed receiver. This preparation process will be undertaken in the material sorting facility. After draining the acid from spent lead-acid batteries, as described above, the drained acid will be placed on a shipping pallet and sealed for shipment off-site to a recycler.

Petroleum based liquid solvents are used to degrease machine and automotive equipment parts for servicing. This liquid will be reused until it no longer functions as needed, whereupon it will be collected for recycling by an off-site receiver. Steam jets and detergent can also be used for degreasing. These liquids will require petroleum separation and recovery for off-site recycling, and the water will be treated for safe release or reuse in the process. Chlorinated solvents are not proposed to be used at the NICO Project.

3.IV.4.3 Process Plant Equipment

Conveyor belts wear and will require replacement periodically generating waste materials. Where practical, used conveyor belts may be employed in other areas of the site, for instance as protective coverings on floors, loading

docks, weather coverings, etc. Ultimately, the used conveyor belts will come to a useful limit and require disposal. If a receiver will accept this material for recycling, we plan to ship the conveyor material off-site for this purpose. If no receiver is available, the used conveyor material may be disposed in the CDF. Such material could also be useful for covering light materials as interim cover on waste in the CDF.

3.IV.4.4 Metals

Scrap metal is generated during construction and maintenance processes and comprises both ferrous and non-ferrous types. The generation of scrap metal is minimized by prompt maintenance of equipment. Salvageable parts and scrap metal will be used for on-site needs and projects. Scrap metal will be segregated at source and placed in designated bins.

Many of the metal parts from heavy equipment can be sent back to the supplier for reconditioning and reuse. The large and complex nature of the equipment makes these parts suitable for reconditioning and suppliers have exchange plans for reuse of components.

Used metal automotive parts that cannot be reused will be cleaned of petroleum residues, collected, and shipped off-site as quantities warrant.

Although rechargeable batteries (nicad, lithium, etc.) minimize generation of single use batteries as waste, they too have a finite life span. As these batteries reach the end of their useful life, they will be collected for shipment off-site for recycling.

3.IV.4.5 Plastics

Plastics are ubiquitous for shipping containers, from foods to petroleum and other industrial substances, in sizes from small bottles to 205 litre drums and 1500 litre totes. To the extent possible, substances will be ordered in bulk quantities in large, reusable containers that will be shipped back to the supplier, used for other purposes on-site, or recycled. Some smaller plastic containers, for instance food packaging and plastic films, may be incinerated.

3.IV.4.6 Aerosol Cans

Pump type bottles will be preferred over aerosol cans. This approach will be used in the cleaning of the camp where refillable spray bottles will be used for cleaning fluids, rather than aerosols.

Aerosol cans will be collected separately for off-site shipment to a licensed receiver. If practical, Fortune may consider an aerosol handling unit to empty the cans and collect the aerosol propellant for separate handling and off-site shipping.

3.IV.4.7 Paints

Paint will be used in limited quantities as part of maintenance and new construction projects. Once paint cans are completely used they will be allowed to dry before being sent to the CDF for disposal. If quantities of paint are unused, the oil-based and water-based (latex) paints will be consolidated separately for shipment to a licensed receiver.

Specialty coatings, primarily 2 component epoxies, may also be used on-site. Residual coating materials will be collected and sent off-site to a licensed receiver.

3.IV.4.8 Tires

Tires are used on all motor vehicles and most mobile mine equipment. The terrain is demanding on tires and diminishes tire life. Tires that can be repaired will be repaired on-site. Tires that reach the end of their life will be collected for shipment to an off-site receiver. Some tires may also be used for other purposes on-site, such as for protective barriers.

3.IV.4.9 Vehicles

Regular maintenance optimizes the life of equipment and vehicles. However, when vehicles and equipment reach the end of their service lives, they will be driven or hauled to off-site recyclers.

3.IV.4.10 Electrical Equipment

Electrical equipment includes generators, transformers, switches, controllers, and distribution lines. In most cases, this equipment is maintained and kept in service. If it must be replaced, the used equipment will be either stored as a source of parts or shipped to an off-site receiver.

3.IV.4.11 Refrigerants

Refrigerants will be collected from equipment in accordance with legislative requirements and stored for reuse or shipped off-site to a receiver.

3.IV.4.12 Petroleum Impacted Soils

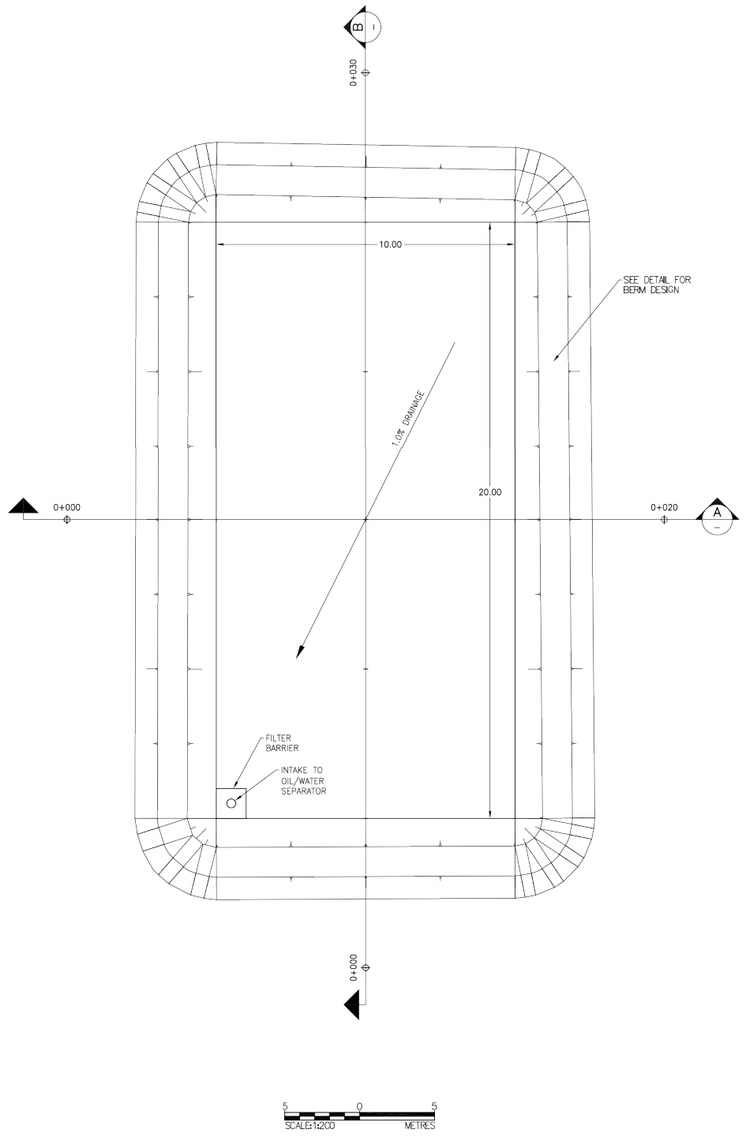
Although Fortune will take precautions to prevent spills and contain leaks, accidental spillage at a large industrial site handling large quantities of petroleum must be anticipated. Such occurrences will be subject to assessments to develop methods to avoid future similar accidental spills, such as improvements to maintenance, handling, and secondary containment.

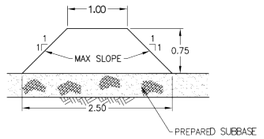
Affected soil will be excavated and placed in an actively managed landfarm. During the summer months, the soil will be tilled to aerate the soil and distribute moisture and nutrients, and between tilling efforts the soil will be left in wind rows. The soil will be screened to remove large rocks which inhibit tilling of the soil in the landfarm. The soils will be sampled for analysis on a regular basis to monitor remediation progress. The objective will be to remediate the soils to an acceptable level using natural microbiological processes. A schematic design drawing for the landfarm is provided as Figure 3.IV.4-1.

The process may be accelerated by the addition of nutrients to stimulate microbial action. For this purpose, the use of waste ammonium nitrate will be examined as a means of reducing waste from that source and improving performance of the landfarm.

An oil-water separator and discharge water polishing system will be created to handle excess runoff and remove free phase petroleum. The separated water may be used as a moisture source for the landfarm during the summer. Excess water will be directed to the process water or effluent treatment system streams, as appropriate. It will not be released directly to the environment.

Hydrocarbon spills can affect snow as well as soil. Contaminated snow will be taken to the landfarm for storage.





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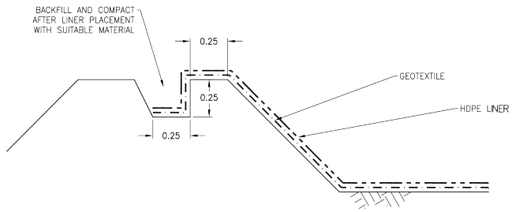

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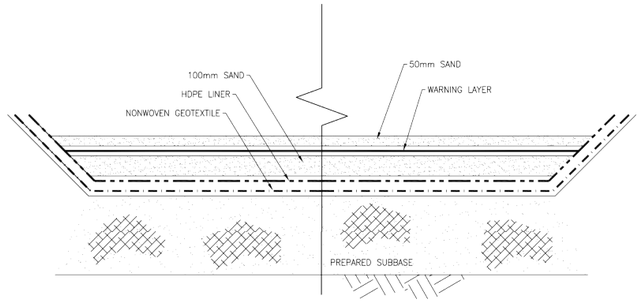
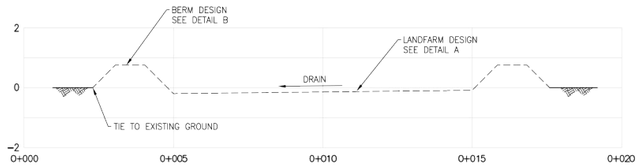


3 DETAIL - LINER PLACEMENT
NTS



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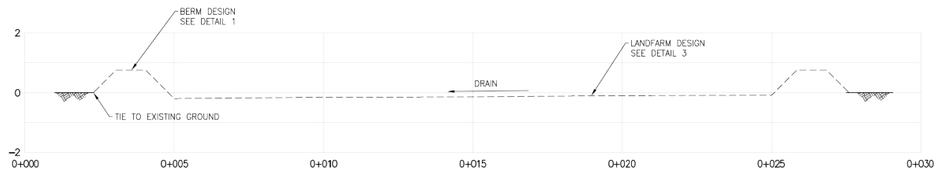

B SECTION
SCALE:1:100 METRES

NOTES

1. ALL DIMENSIONS ARE IN METRES, UNLESS OTHERWISE NOTED.
2. DIMENSIONS OF LANDFARM ARE CONCEPTUAL. ACTUAL DIMENSIONS AND LOCALIZATION OF LANDFARM TO BE DETERMINED BY FIELD ENGINEER.
3. SUBGRADE TO BE GRADED TO FORM A UNIFORM BASE FREE OF ROCK THAT WOULD DAMAGE THE HDPE LINER DURING PLACEMENT AND OPERATION. PROOF ROLLING WITH COMPACTOR PRIOR TO PLACEMENT OF SUBBASE MATERIAL TO IDENTIFY SOFT AREAS. SOFT AREAS TO BE REMOVED AND REPLACED WITH SUITABLE FILL MATERIAL AS DIRECTED BY FIELD ENGINEER. IT IS THE RESPONSIBILITY OF THE FIELD ENGINEER TO INSPECT THE PREPARED SUBGRADE PRIOR TO PLACEMENT OF SUBBASE MATERIAL AND CONFIRM THAT ALL EFFORTS ARE MADE TO ACHIEVE AN ACCEPTABLE BASE.
4. SUBBASE MATERIAL TO CONSIST OF COMPACTED SAND OR SUITABLE ALTERNATIVE MATERIAL APPROVED BY THE FIELD ENGINEER. ALL SHARP GRAVEL AND COBBLE MATERIAL IS TO BE REMOVED. SUBBASE MATERIAL IS TO BE INSPECTED BY THE FIELD ENGINEER PRIOR TO PLACEMENT OF GEOTEXTILE.
5. GEOTEXTILE IS TO BE NONWOVEN, OF STANDARD THICKNESS, WITH 30cm OF OVERLAP.
6. LINER MATERIAL IS TO BE 80mil HDPE, WITH WELDED SEAMS.
7. PROTECTIVE SAND LAYER WITHIN THE LANDFARM AREA TO BE INSPECTED BY THE FIELD ENGINEER. ALL SHARP GRAVEL AND COBBLES TO BE REMOVED.
8. WARNING LAYER IS TO BE ORANGE PLASTIC SNOW FENCING.
9. HEAVY EQUIPMENT IS NOT TO BE USED WITHIN THE LANDFARM.
10. LANDFARM MUST NOT BE CONSTRUCTED OVER ICE-RICH PERMAFROST.
11. ANY ALTERNATIVE MATERIALS FOR CONSTRUCTION OF BERM (e.g. WOOD FRAMING, USED TIRES) TO BE INSPECTED AND APPROVED BY THE FIELD ENGINEER.

THIS DRAWING MAY HAVE BEEN REDUCED. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"X34" FORMAT DRAWINGS

NOT TO SCALE

FORTUNE MINERALS LIMITED
NICO DEVELOPER'S ASSESSMENT REPORT

TITLE

CONCEPTUAL LAND FARM DESIGN

Golder Associates
Edmonton, Alberta

PROJECT	09.1373.1004.9000		FILE No.	E-WM-013-CAD	
DESIGN	CW	10/05/05	SCALE	AS SHOWN	REV. 0
CADD	GMF	12/05/11			
CHECK	JG	12/05/11			
REVIEW	JG	12/05/11			

FIGURE: 3.IV.4-1

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3.IV.5 REFERENCES

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