Underground Stabilization - Waste Management Plan

Preparation Date: December 13, 2012
Effective Date of Plan: Date of licence issuance

1.0 Introduction

1.1 Project Proponents and Summary

Aboriginal Affairs and Northern Development Canada (AANDC) is applying for a Type B water licence to undertake underground stabilization work on behalf of the Giant Mine Team consisting of AANDC and the Government of the Northwest Territories (GNWT), supported by the federal department of Public Works and Government Services Canada (PWGSC). While AANDC will ultimately be responsible for compliance with any water licence issued, the proposed deconstruction work will be conducted by private sector contractors procured through PWGSC.

The proposed underground stabilization work will mitigate the potential for failure of the underground stopes and chambers and migration of arsenic trioxide stored underground through the following actions:

- Repairing and reinforcing bulkheads;
- Increasing the support under arsenic trioxide chamber crown pillars by backfilling voids with lightly cemented tailings paste; and
- Stabilizing non-arsenic trioxide filled chambers by backfilling with waste rock, surface sourced materials such as quarried rock, or lightly cemented tailings paste.

1.2 Project Location and Site Description

The Giant Mine Site (the Site) is located approximately five kilometres (km) north of Yellowknife along Highway 4 (Ingraham Trail) as depicted in Figure 1. The Site is considered to include everything within the boundaries of the former lease (Figure 2) that was in place during the operational period of the mine (i.e. Lease L-3668T, now designated as Reserve R662T). Two impacted areas immediately outside the lease area are also considered to be part of the site. They are the Giant Mine "Townsite", which was removed from the surface lease in 1999, and an area of historic tailings deposition along the shore of North Yellowknife Bay.

The Giant Mine is an abandoned mine that produced gold from 1948 until 2004, although from 1999 to 2004, gold ore was shipped off site for processing. The on-site processing of ore that occurred until 1999 created 237,000 tonnes of arsenic trioxide dust as a by-product. The arsenic trioxide dust, which is soluble in water, is stored underground in fifteen purpose-built chambers and mined out stopes. In addition to these features, other typical mining infrastructure exits on site including four tailings storage areas, eight open pits, 35 openings to the underground, and over 100 buildings. Project infrastructure is shown on Figure 3. Baker Creek flows through the length of the lease area and into Great Slave Lake.

The Site is currently under care and maintenance as the Giant Mine Remediation Project (GMRP) undergoes environmental assessment (EA0809-001). Care and maintenance activities adhere to the conditions set out in former Water Licence N1L2-0043 as much as possible.

Figure 1 – Location of Giant Mine and Surrounding Features

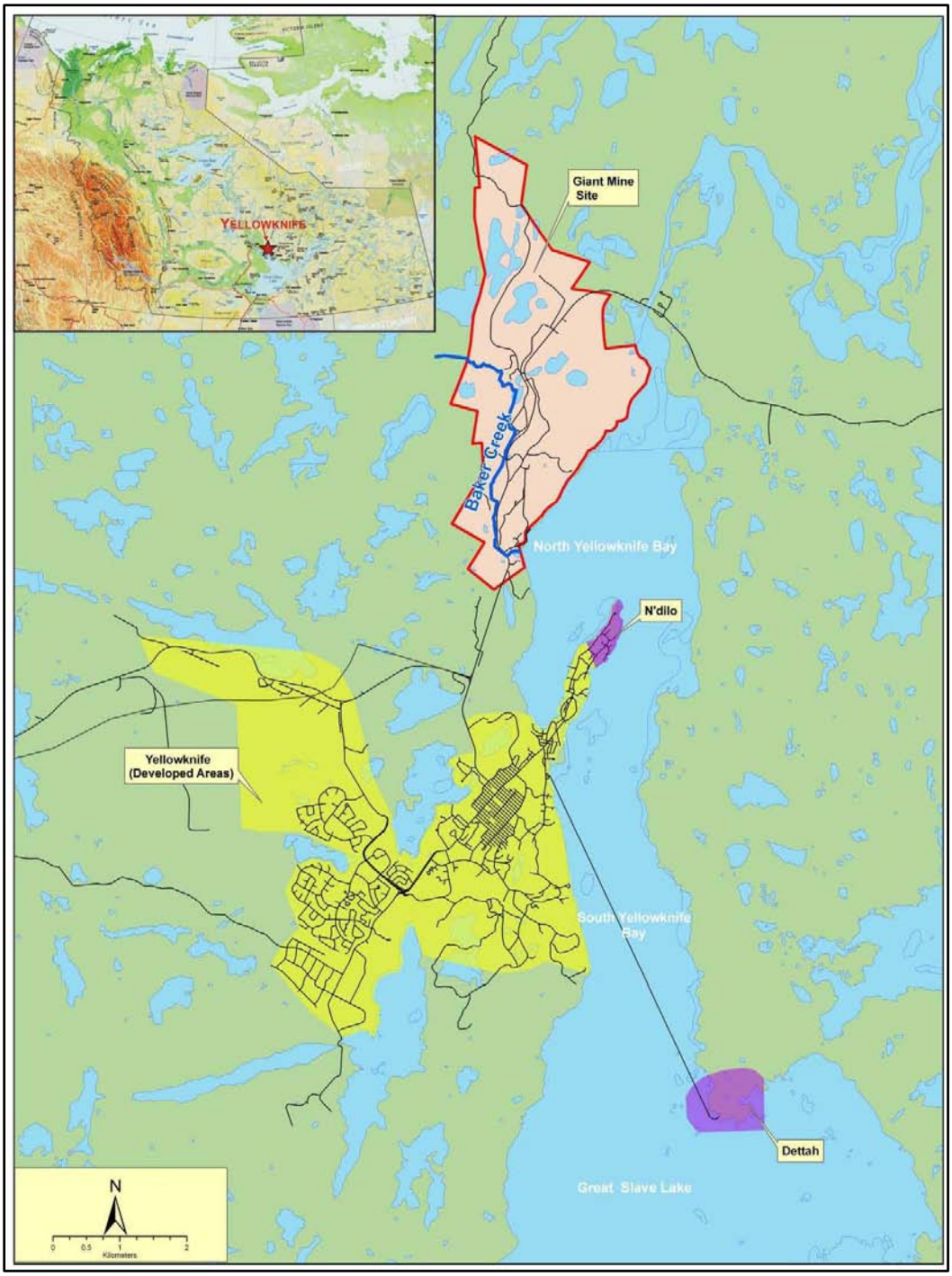


Figure 2 – Giant Mine Lease Boundary

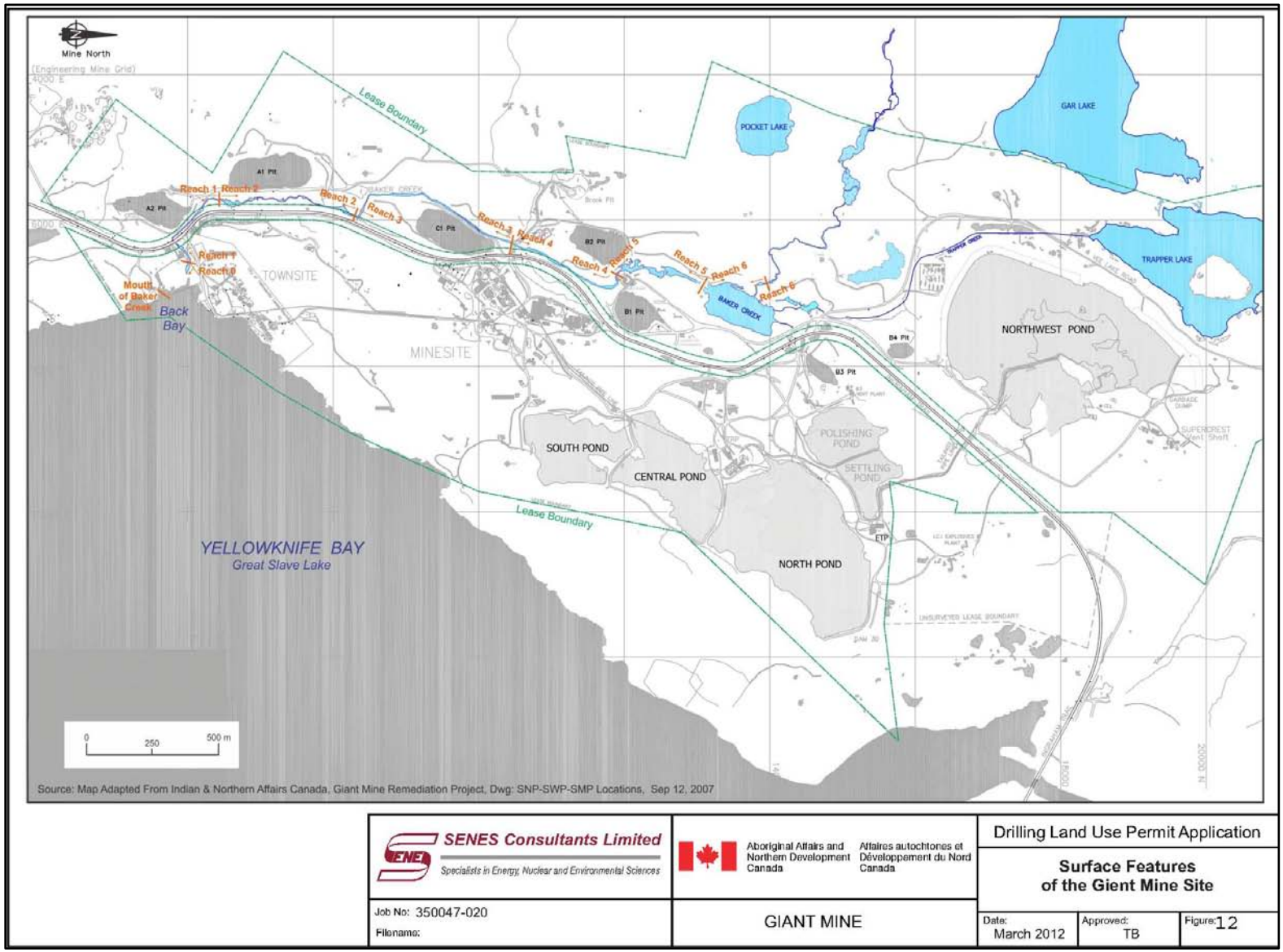
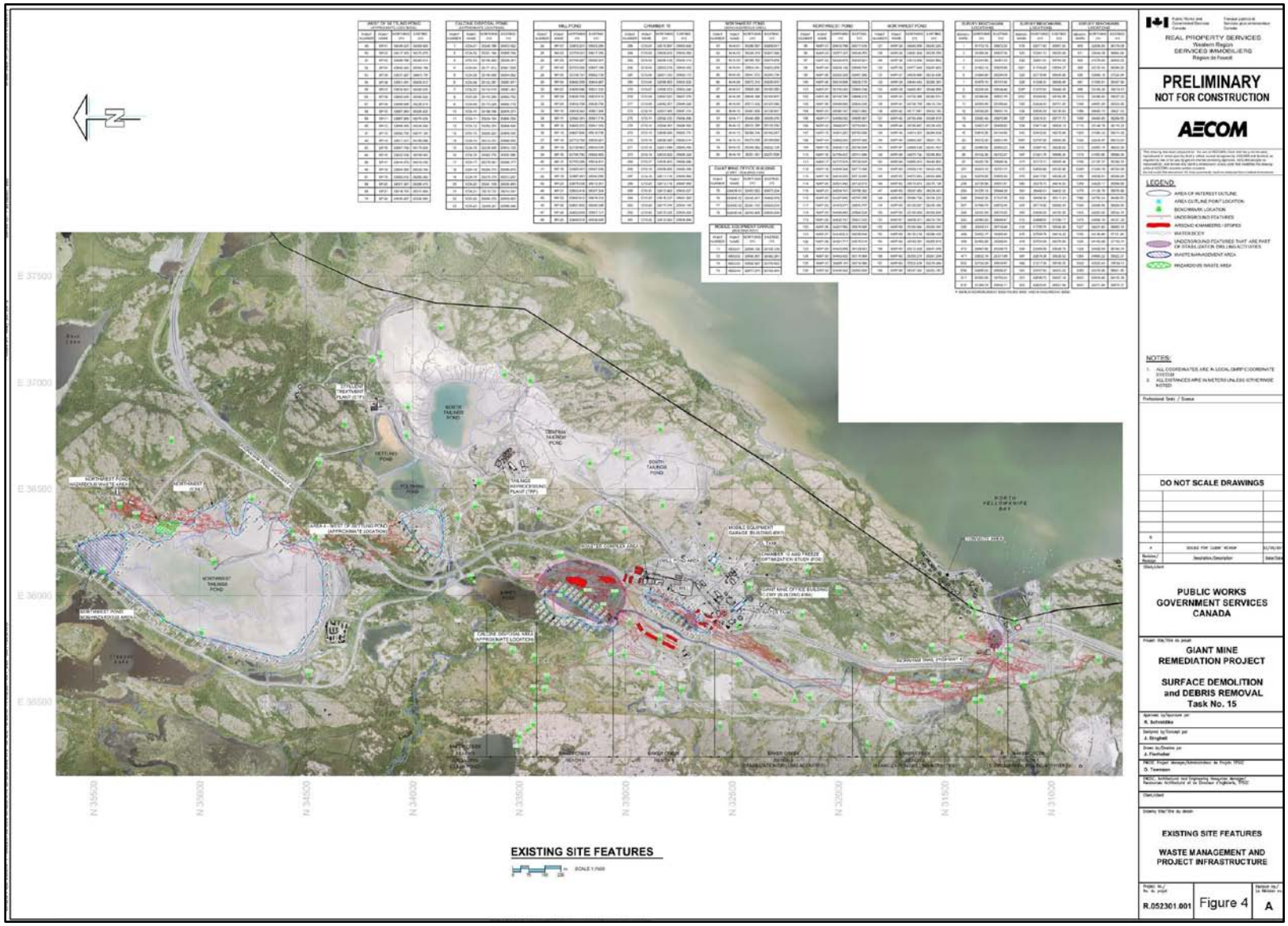


Figure 3 – Project Infrastructure



1.3 Environmental Policy and Legislative Framework

All work carried out at the Giant Mine is being implemented within a framework of federal and territorial policies and guidelines. The most pertinent of these are as follows:

Federal Legislation, Policies and Guidelines

- Contaminated Sites Environment, Health and Safety Policy prepared by Aboriginal Affairs and Northern Development Canada (April 13, 2006)[1]
- A Federal Approach to Contaminated Sites prepared by the Contaminated Sites Management Working Group (November 1999)[2]
- Northern Affairs Program Contaminated Sites Management Policy prepared by Aboriginal Affairs and Northern Development Canada (August 20, 2002)[3]
- Transportation of Dangerous Goods Act and Regulations;
- Canadian Environmental Protection Act:
    - Export and Import of Hazardous Waste and Hazardous Recyclable Materials Regulation
    - Interprovincial Movement of Hazardous Waste
    - Controlled Products Regulations
    - PCB Regulations
    - Ozone Depleting Substances Regulations
- Health Canada/Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS)
- Canada Labour Code Part II - Occupational Health and Safety

Territorial Legislation, Policies and Guidelines

- Government of the Northwest Territories Policy 53.01, Environment and Natural Resources Establishment Policy (March 29, 2005)[4]
- Government of the Northwest Territories Guideline for the General Management of Hazardous Waste in the NWT (February 1998)[5]
- Government of the Northwest Territories Guideline for Contaminated Site Remediation (November 2003)[5]
- Environmental Protection Act:
    - Spill Contingency Planning and Reporting Regulations
    - Guideline for Ambient Air Quality

[1] Referenced Policy can be found using the following link: http://www.aadnc-aandc.gc.ca/eng/1100100035307
[2] Referenced document can be found using the following link: http://publications.gc.ca/collections/Collection/EN40-611-2000E.pdf
[3] Referenced policy can be found using the following link: http://www.aadnc-aandc.gc.ca/eng/1100100034643
[4] Referenced policy can be found using the following link: http://www.enr.gov.nt.ca/_live/documents/content/53_01_Establishment_Policy.pdf
[5] Referenced guidelines can be found using the following link: http://www.enr.gov.nt.ca/_live/pages/wpPages/Waste_Management_Program_publications.aspx

    - Guideline for the General Management of Hazardous Waste
    - Used Oil and Waste Fuel Management Regulations
    - Guideline for the Management of Waste Solvents
- Northwest Territories Mine Health and Safety Act

Taking into consideration the policies and documents noted above, the guiding principles applied to the Giant Mine Remediation Project are as follows:

- Within the Northern Contaminated Sites Program the health and safety of employees and protection of the environment are an overriding priority. Management is committed to doing everything possible to prevent injuries and to maintain a healthy environment;
- Meeting the overall AANDC objective to contribute to a safer, healthier, sustainable environment for Aboriginal peoples and northern residents by striving to preserve and enhance the ecological integrity of the environment;
- Meeting federal and AANDC policy requirements and legal obligations regarding the management of contaminated sites; and
- Providing a scientifically valid, risk management based framework for setting priorities, planning, implementing and reporting on the management of contaminated sites.

In addition to the general principles described above, the federal government has developed a comprehensive framework to guide the management of federal contaminated sites. Beginning in 1995, the federal government recognized the need for an efficient and consistent approach to dealing with contaminated sites. As a result, the Contaminated Sites Management Working Group (CSMWG) was established to promote common approaches to management and remediation of contaminated sites. This working group now operates under the Federal Contaminated Sites Action Plan (FCSAP) which serves as the framework under which all activities at the Giant Mine are implemented.

FCSAP is a cost-shared program that helps federal custodians to address contaminated sites for which they are responsible. The primary objective of this program is to address the risks that federal contaminated sites pose to human health and the environment and to reduce the associated financial liability. The program has the complementary objectives of supporting other socioeconomic outcomes, such as training and employment of Canadians and promotion of innovative technologies. Under FCSAP, each contaminated site progresses through a systematic procedure that leads from assessment through to remediation planning, remediation and, eventually, long term monitoring.

1.4 Purpose, Scope and Objectives of the Waste Management Plan

Appropriate waste management is key to minimizing impacts of a development on the environment and human health and safety, which is AANDC's overriding policy for work undertaken at the Giant Mine site. This waste management plan, which will become effective upon issuance of the water licence, details the guiding principles and procedures for waste management that will be adhered to during the proposed underground stabilization work.

The proposed waste management procedures align with the procedures currently utilized in the care and maintenance (C&M) program for the Site. The C&M program was founded on AANDC's commitment to adhere to the conditions set out in former Water Licence N1L2-0043 to the extent possible, including the umbrella waste management policy that all wastes are to remain on site unless they can be recycled or disposed of at appropriate facilities at this time.

Since all wastes will remain on site unless they can be recycled, minimizing the amount of waste generated and reusing and recycling wastes wherever possible are very important. The proposed underground stabilization work will generate some wastes that must be disposed of, and secure locations and disposal methodologies that don't interfere with remediation options currently undergoing environmental assessment have been selected.

2.0 Waste Types and Management

2.1 Waste Types

The waste types that may be generated during the underground stabilization work are described below. An inventory of all wastes generated, including those stored at the Mobile Equipment Garage in preparation for off-site recycling and disposal and those wastes transported to the Northwest Pond Non-Hazardous Waste Area will be maintained. In May 2010, the Giant Mine Remediation Project was assigned Hazardous Waste Receiver Registration Number NTR000125 and, in 2012, Hazardous Waste Generator Number NTG505 by the GNWT.

The locations of waste management infrastructure are identified in Figure 3 and UTM coordinates are provided in Section 2.2 below.

1. Domestic refuse – Due to the close proximity of Yellowknife, a camp does not need to be established. This will limit domestic refuse to lunch remnants (food and paper or plastic food containers) brought to the site on a daily basis by crew members which will be temporarily disposed of in specially designated garbage bins located within the main office building only. This segregation is necessary to reduce the wildlife attractant potential of the domestic refuse. The refuse in the bins will be collected regularly and permanently disposed of in the Northwest Pond Non-Hazardous Waste Area for immediate burial, as is currently done for all domestic refuse generated on the Site during care and maintenance operations (Figure 3).

2. Sewage and greywater – Crew members will use the washing and toilet facilities located at the Giant Mine office building (C-Dry). Sewage and grey water will be managed using the system currently in place under the care and maintenance program which involves directing the waste into the underground water management system. The sewer and grey water will be pumped into the underground system through a pipeline that is accessed at the UBC Portal. The waste water will then be pumped back to the surface through the main underground dewatering line on the 750 level and discharged into the Northwest Pond.

3. Spilled tailings or tailings paste – Any tailings spilled during transport or stockpiling or tailings paste spilled during paste manufacture or delivery to the underground workings will be scooped up and either returned to the source tailings pond or deposited into one of the larger, empty underground chambers that require backfill.

4. Mine development rock – Rock excavated in the underground workings to access bulkheads will remain underground as it will be used to bulk fill the non-arsenic chambers and stopes.

5. Bleed water from tailings paste – Minor quantities of bleed water from the tailings paste may be generated as the tailings paste "cures" following completion of the backfill process. This bleed water will be captured by the existing underground management system (see Section 3.0 below) and directed to the Northwest Tailings Pond (Figure 3) before being treated in the existing Effluent Treatment Plant.

6. Excess constituent water within tailings – Water that collects at the excavation sites or excess water that needs to be removed from the tailings to successfully manufacture paste will be directed to other areas of the source tailings ponds.

7. Used oil, lubricants, antifreezes, solvents, drained and rinsed chemical containers, and drained oil pails – Very little of this waste is expected to be generated during the underground stabilization work. However, if for unexpected reasons, any used oils or lubricants are generated during this work, they will be drained into steel and plastic drums called "lube cubes". Any waste antifreezes or solvents that are generated during this work will be stored separately from the waste oils in drums placed on pallets. The lube cubes and drums will be labelled appropriately and stored on-site in an area northwest of the Mobile Equipment Garage (Figure 3). Drained and rinsed chemical containers and drained oil pails will be stockpiled within the Mobile Equipment Garage or other empty building. When a sufficient volume of products has been collected, usually once or twice a year, a recycling contractor inventories and retrieves the containers for off-site recycling in compliance with appropriate GNWT policies and regulations.

8. Spent non-hazardous consumables – Any cement, paper, clean wood, plastics, rubber waste, steel waste, or used air filters that are generated during the underground stabilization work will be collected regularly and permanently disposed of in the Northwest Pond Non-Hazardous Waste Area (Figure 3), as is currently done for all such waste generated on the Site during care and maintenance operations. Only non-hydrocarbon contaminated wastes are disposed of in the Northwest Pond Non-Hazardous Waste Area.

9. Materials exposed during tailings excavation – Excavation of tailings may expose items such as barrels, wood and scrap metal. Non-hazardous materials will be disposed of in the Northwest Pond Non-Hazardous Waste Area (Figure 3). Deleterious materials such as hydrocarbon contaminated materials will be containerized with appropriate labels and stored on-site in an area northwest of the Mobile Equipment Garage (Figure 3). Hazardous or potentially hazardous

materials will be containerized, clearly labelled and stored on pallets in the Northwest Pond Hazardous Waste Area (Figure 3). The final disposal of the hazardous or potentially hazardous materials will be carried out in accordance with any applicable hazardous materials regulations and any conditions set in a Type A licence issued following completion of environmental assessment EA0809-001.

10. Used oil filters and oily rags – Since used oil filters and oily rags are contaminated with hydrocarbons, any such items that are generated during the work will be collected and stored in drums on-site in an area northwest of the Mobile Equipment Garage (Figure 3) for future off-site disposal in accordance with the main Type A licence that will be issued following completion of environmental assessment EA0809-001.

11. Hydrocarbon contaminated soils - Any soil that becomes contaminated as a result of hydrocarbon spills will be stored in sealed drums that are clearly labeled as hydrocarbon contaminated soil. Drums will be stored upright, placed four to a pallet, and transported to an area northwest of the Mobile Equipment Garage (Figure 3). These soils will ultimately be treated or disposed of along with all other similarly contaminated soils during implementation of the Remediation Plan for the Site, which is currently undergoing environmental assessment. The Emergency Spill Response Plan identifies the procedures for responding to hydrocarbon spills, including the need to set criteria for determining when clean up of a spill is considered complete (dependent on location of spill). For larger spills this may involve soil and/or water sampling for comparison against specific standards (e.g., GNWT Industrial Standards).

12. Arsenic contaminated materials – In the event of an arsenic sludge spill (includes arsenic in dust or powder form), arsenic contaminated materials such as contaminated soils or snow and disposable clothing (e.g., Tyvek suites and latex gloves) will be placed in sound, sealed, clearly labelled steel drums that will be securely strapped on pallets for storage in the Northwest Pond Hazardous Waste Area (Figure 3). The final disposal of these materials will be carried out in accordance with any applicable hazardous materials regulations and any conditions set in a Type A licence issued following completion of environmental assessment EA0809-001. The GNWT industrial standard for arsenic in soil (340 mg/kg) will be considered when setting criteria for determining when clean up of an arsenic sludge spill is considered complete.

2.2 Waste Management Infrastructure

The infrastructure required for the waste management system is described below and shown on Figure 3. Electronic mapping is currently based on a unique grid system called the Giant Mine Remediation Grid System but plans are being developed to convert to a more standard system. AANDC commits to providing electronic data in accordance with the MVLWB's *Standards for Geographic Information Systems (GIS) Submissions* when it becomes available.

1. Northwest Pond Non-Hazardous Waste Area (UTM Zone 11V, 636209.750 mE and 6935448.28 mN) – A disposal site for non-hazardous waste has been operated at the north end of the

Northwest Tailing Pond since the pond was commissioned in 1987. Food wastes, paper, wood, plastics, rubber and steel waste, and used air filters are placed in the Northwest Pond Non-Hazardous Waste Area.

While tailings disposal was active, the waste was covered with tailings discharged from the Mill. Shortly after the Mill shutdown and tailings were no longer produced, the accumulated waste was pushed out onto the dry tailings to form a berm, effectively creating a landfill site contained by Dam 22B on the north side and the circumference of the berm on the south side. Exposed wastes are regularly leveled and capped with waste rock.

Seepage from the Northwest Pond and remediation of this area are discussed under the section on the Northwest Pond Hazardous Waste Area below.

2. Northwest Pond Hazardous Waste Area (UTM Zone 11V, 636333.20 mE and 6935194.37 mN) – A hazardous waste area located at the west end of the Northwest Tailings Pond was designated by the previous mine operator for hazardous waste handling soon after the tailings pond was commissioned in 1987. Initially, the area was designated as a disposal site for wastes such as asbestos containing materials and arsenic contaminated materials. The arsenic contaminated materials included steel process equipment with arsenic scale, used bags from the arsenic trioxide baghouse, and personal protective equipment. The waste materials were initially dumped at the site, without the intent of recovery for disposal elsewhere. At some point in the early 1990's, the function of the site changed from disposal to storage, after which, sealed drums of waste were placed upright on solid ground so that they could be easily recovered later. This practice remains in effect today.

   From 2000 through 2004, a substantial clean up of this site was completed in several phases. Drums of waste that were not originally marked with the type of contained waste were opened and inspected. Several waste samples were collected and analysed. Drums containing arsenic contaminated materials (principally baghouse bags, clothing, and scale cleaned from process equipment), were placed in plastic over-pack containers, stacked on pallets at a new site nearby, and covered with plastic. Damaged and corroded drums containing arsenic contaminated materials were also collected and placed in over-pack containers. Asbestos containing materials were also identified and collected in this process. An asbestos disposal landfill was created nearby by excavating a trench in dry tailings in the Northwest Pond, placing the waste in the trench, and backfilling it with tailings.

   Remedial options for the Northwest Pond and associated hazardous and non-hazardous waste areas will be implemented under the Remediation Plan for the Site, which is currently undergoing environmental assessment.

   At this time, water within the Northwest Pond seeps directly into the underground workings where it is captured by the underground water management system, treated using the existing

water treatment facility and pumped back to the Northwest Pond. Any water seeping through Dam 22B is captured on the downstream side of the dam, sampled to monitor chemistry and pumped directly back to the pond. Pumped water volumes are monitored using a flow metre. Additional monitoring of the facility includes annual inspections of the tailings dams and five year dam safety reviews.

3. Mobile Equipment Garage Laydown Area (UTM Zone 11V, 636176.41 mE and 6932596.05 mN) – The large, accessible space located to the northwest of the Mobile Equipment Garage is being used as a laydown area for storing liquid and solid waste materials until they are either taken off site for recycling or until final disposal methods are approved through the Type A licensing process to occur following completion of environmental assessment EA0809-001. Storage containers are appropriately labelled and inventoried. In the event of a spill, the procedures described in the Emergency Spill Response Plan provided under Tab XX in the application package will be followed.

3.0 SITE WATER MANAGEMENT

3.1 UNDERGROUND MINE WATER

The underground mine workings form a network of connected voids, including horizontal drifts, inclined raises, vertical shafts, ramps, chutes and ore stopes to a total depth of 610 m below the surface. In addition, many thousands of exploration drill holes intersect the workings, creating an extensive drainage system for the rock in the mine area. Although the mine workings have been partially flooded, the continued dewatering of the mine draws groundwater towards the workings, thereby preventing the escape of contaminated mine water from the Site.

The major sources of water entering the underground mine include runoff flowing into the open pits, seepage from Baker Creek, seepage from the tailings containment areas, infiltration through soils and bedrock in the mine area and inflow from groundwater into the underground mine workings. Of the tailings containment areas, the Northwest Tailings Pond is the principal source of seepage into the mine. Several of these sources are controlled by climatic conditions, and the total inflow to the mine varies greatly during the year.

All water entering the mine, including any bleed water from the tailings paste, ultimately drains into the main dewatering system located at the area known as Supercrest, in the northern part of the mine. Most of the water is handled by gravity flow through ditches in the main drifts, as well as the ramps, raises and drainage holes that connect the main drifts. In areas where drainage by gravity is not possible, small sumps and pumps transfer water to the gravity drainage system, where it is fed to the Supercrest area via the 750 Level pipe system.

Drainage from the southern part of the mine includes major inflows originating from the A2, A1 and C1 Pits during the freshet and heavy rainfall periods. Drainage from the northern part of the mine includes

a large inflow of water from the Northwest Pond, which flows throughout the year, and seepage from other areas that increases significantly during the freshet, and when the water level in Baker Creek is high. In the C-Shaft area, flows from the ditches are directed through drainage holes and drainage pipes to the open shaft where it cascades down into the flooded mine below. At Supercrest, a portion of the seepage from the Northwest Pond drains directly into another dewatering sump on the 750 Level.

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Currently, water is pumped from the 750 Level Supercrest sump directly to surface and is discharged into the Northwest Pond.

3.2 SURFACE WATER

3.2.1 Contaminated Water Storage

The tailings containment areas, including the South, Central, North and Northwest Tailings Ponds, are used to store contaminated water from surface locations and the underground workings before it is treated. Minewater is pumped from the 750 Level of the underground working to the Northwest Tailings Pond throughout the year and, historically, minewater has also been pumped to the South Tailings Pond via C-Shaft, during periods of high mine inflow in the spring and summer. Small volumes of water are also returned to the Northwest Tailings Pond from the seepage collection system at Dam 22B, and to the South Pond from Dam 11. Dam 3C seepage is pumped back into the North Tailings Pond. Apart from pumped discharges from the mine and the dam seepage collection systems, the tailings ponds also receive inputs of water from direct precipitation and runoff. Losses of water from the ponds include diffuse seepage through and under the dams, seepage into the mine workings, and evaporation.

In accordance with the former Water Licence N1L2-0043, a minimum of 0.5 m of freeboard is maintained at the lowest water retaining structures in the tailings containment areas to provide emergency water storage for extreme precipitation events, and to prevent overtopping of the dams due to wave action. Operating under these conditions, the maximum storage capacity of the Northwest Tailings Pond is approximately 900,000 m^3. South Tailings Pond has been almost completely filled with tailings, and little capacity remains for water storage. A decant pipeline carries water by gravity flow from the South Tailings Pond directly to the North Tailings Pond. The inlet to the pipeline lies just above the minimum tailings elevation, so that the pond is almost empty when the pipeline is drained. When the South Tailings Pond was accepting minewater discharge, a small pond developed to provide the hydraulic gradient required to push water through the pipeline to the North Tailings Pond. The pond volume was typically less than 20,000 m^3.

The level of the North Tailings Pond is controlled to minimize the potential for seepage of contaminated water into the adjacent Polishing Pond. The total capacity of the North Tailings Pond, to the maximum operating level, is approximately 160,000 m^3. However, the water reclaim system in use at the North Tailings Pond does not reach the deepest part of the pond and, as a result, only about 70,000 m^3 of the total pond capacity can be actively used.

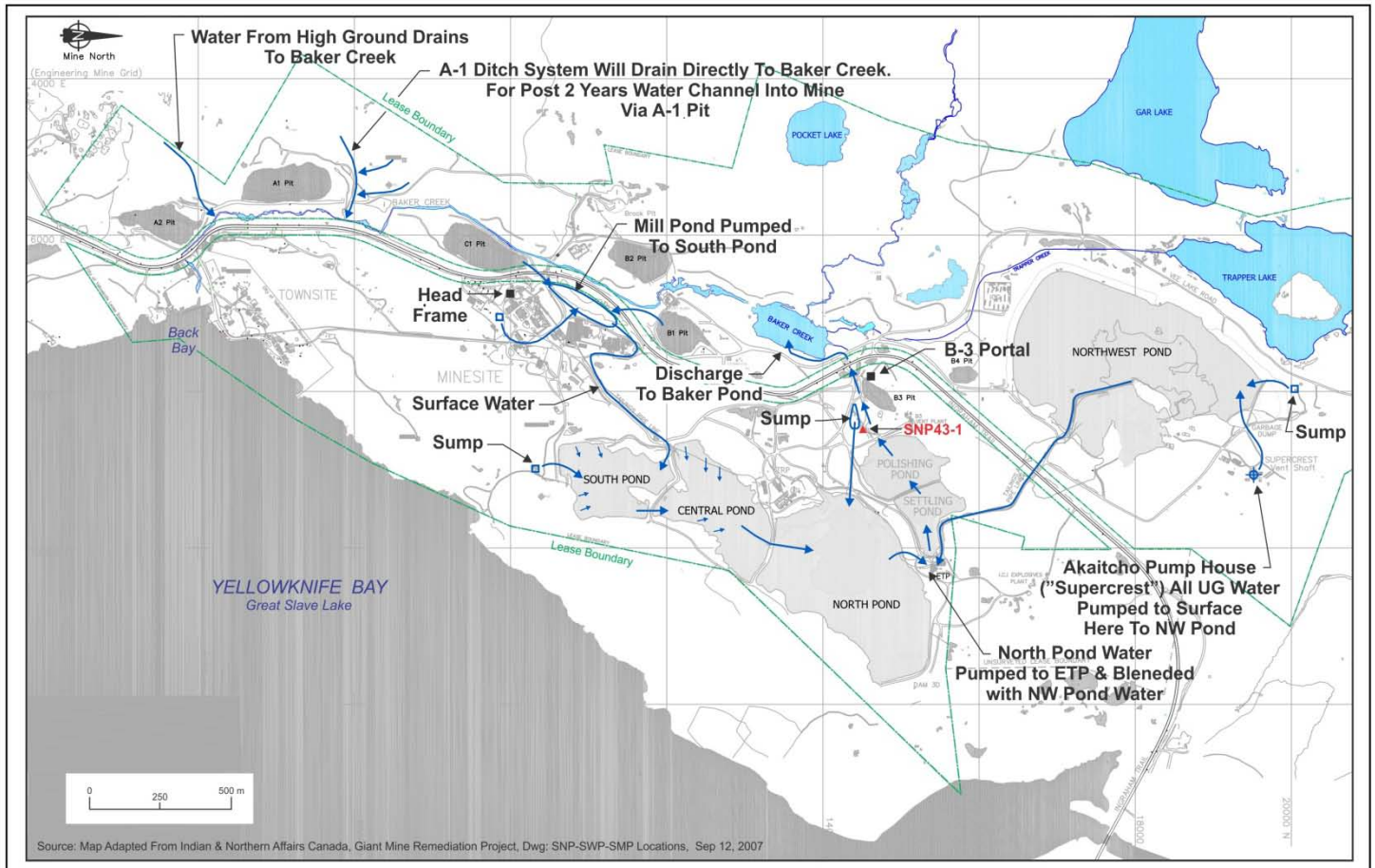
3.2.2 Water Treatment and Discharge

Water is reclaimed from the Northwest Pond and North Tailings Pond for treatment in the Effluent Treatment Plant (ETP) during the open water season, usually from July through September, but this can be extended to June through October. The ETP consists of a primary and secondary circuit. The primary circuit consists of three agitating tanks in series and is fully automated; under normal operating conditions only this circuit is operated. A backup or secondary circuit consists of three agitator tanks in series, with the middle tank bypassed and is operated manually. Influent water from the Northwest Pond and North Tailings Pond is normally blended to optimize reagent consumption. The overflow from the last of the three tanks in each circuit, containing water and precipitates, drains through a short pipeline to the north end of the Settling Pond.

The Settling Pond provides quiescent conditions to allow precipitates to settle out of the water. The Settling Pond is separated from the downstream Polishing Pond by a permeable rock-fill dyke, which retains precipitates within the Settling Pond, while allowing the clarified water to seep through. Settling efficiency is greatly improved by the addition of flocculent in the ETP. Efficient settling within the pond reduces the build-up of precipitates on the upstream face of the dyke, thus reducing the hydraulic gradient required across the dyke to push water from the Settling Pond to the Polishing Pond. A larger hydraulic gradient would encourage the infiltration of precipitates to the Polishing Pond, which could result in unacceptably high concentrations of arsenic in the final effluent. The potential for this effect limits the maximum practical treatment rate to approximately 7,000 m^3 per day.

The Polishing Pond has a large capacity (230,000 m^3) and residence time of approximately one month. The Polishing Pond provides the last opportunity for settling any precipitates carried over from the Settling Pond. The Polishing Pond also allows some mixing of the water, smoothing out variations in the water quality, and allowing brief ETP process upsets to occur without producing water that is unacceptable for discharge. In the event of more lengthy treatment problems, the large capacity of the Polishing Pond also allows an opportunity to contain water that does not meet the effluent quality criteria (Table 1) at SNP Station 43-1 (Figure 4) and, if necessary, to pump the water back to the ETP for retreatment. Final effluent is discharged through a siphon line from the south end of the Polishing Pond to a drainage ditch south of the B3 Pit. The treated water drains through a series of culverts under mine access roads and Highway 4 prior to discharging into Baker Creek (Baker Pond).

Figure 4 – Mine Water Management System



SENES Consultants Limited Specialists in Energy, Nuclear and Environmental Sciences	Aboriginal Affairs and Northern Development Canada / Affaires autochtones et Développement du Nord Canada	Water Licence Application For Roaster Complex Deconstruction and Underground Stabilization **Minewater Management**
Job No: 350047-020 Filename:	GIANT MINE	Date: November 2012 / Approved: TB / Figure: 4