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22 December 2010 **SRC 12194-320-23L10**

Mr. Don Howard
Director, Wastes and Decommissioning Division
Canadian Nuclear Safety Commission
280 Slater Street, P.O. Box 1046, Station B
Ottawa, ON K1P 5S9

Dear Mr. Howard:

RE: Submission of CNSC Action No. 10 in Compliance with CNSC Order No. 10-1

I hope this letter finds you well. On July 23, 2010, the Canadian Nuclear Safety Commission (CNSC) issued Order No. 10-1 regarding the deterioration of the Gunnar Mine Site in Northern Saskatchewan. The Order directed that eleven actions and measures be undertaken by the Saskatchewan Research Council (SRC) to secure the Gunnar Mine Site and ensure public safety.

CNSC Action No. 10 ordered that the *'Saskatchewan Research Council shall submit a waste management plan for the temporary storage of all wastes, including demolition waste, which will be generated by the activity described in Item 11 below, to Mr. Don Howard, the Director, Wastes and Decommissioning Division, of the Canadian Nuclear Safety Commission, by no later than January 31, 2011.'*

In compliance with CNSC Action No. 10, please find appended a waste management plan for the temporary storage of all wastes, including demolition waste from buildings and structures that are being taken down on the Gunnar Mine site, as part of Order 10-1.

We trust that this submission will meet the requirements of the Order and would appreciate any recommendations that can be offered as detailed plans are being developed to carry out work on the Gunnar Mine site in a safe and timely manner.

Sincerely,

Tamara Yankovich
Remediation Project Manager
Environment and Forestry
Saskatchewan Research Council

CC: Mr. Claude David, CNSC
Mr. Colin Morrish, Saskatchewan Labour
Mr. George Bihun, Saskatchewan Environment
Mr. Joe Muldoon, SRC

Saskatchewan Research Council

Gunnar Mine Rehabilitation Project
Waste Management Plan

Report

Environment

Saskatchewan Research Council

Gunnar Mine Rehabilitation Project
Waste Management Plan

Prepared by:

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Project Number:

60159939

Date:

December, 2010

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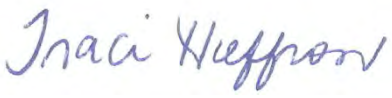

Traci Heffron, P.Eng.

Report Reviewed By:

Tom Jacklin, P.Eng., M.Eng

Executive Summary

This Waste Management Plan has been developed to meet the requirement *to 'submit to Mr. Don Howard, the Director, Wastes and Decommissioning Division, of the Canadian Nuclear Safety Commission, by no later than January 31, 2011, a waste management plan for the temporary storage of all wastes generated by item 11 demolition, during the year 2011, for* the Gunnar Mine Site, as specified in Commission Order 10-1 issued by the Canadian Nuclear Safety Commission (CNSC) on July 23, 2010.

The waste disposal strategy has to align with the Environmental Impact Statement (EIS), which has not been issued and approved at the time of this report. Key considerations from the EIS include the following:

- The final waste disposal solution would include only one permanent storage cell or landfill location
- The location of the permanent storage cell cannot be decided until the EIS is complete. Two decommissioning options affect this decision for final waste disposal:
  - Option 1 - Disposal in a dedicated landfill
  - Option 2 - Co-disposal of demolition debris in Gunnar Pit

Therefore this waste management strategy proposed is outlined as follows:

1. Abate designated substances and hazardous building materials.
2. Ship designated and hazardous substances off-site for destruction or to a permanent approved landfill. This avoids the need to construct a lined landfill on site for these "designated wastes".
3. Render the dock warehouse and a portion of the maintenance building structurally safe for the temporary storage of asbestos-containing-materials (ACM).
4. Temporarily store asbestos wastes as follows.
   a) Store bagged ACM within the dock warehouse.
   b) Store large plastic wrapped piping and process vessels within the maintenance building. This portion of the maintenance building should not be demolished in 2011.
   c) Store stacked external ACM sheeting in the maintenance building.
5. Store temporarily clean, abated demolition debris at the temporary storage cell location on the mill and acid plant footprints.
6. Provide a temporary cover for the demolition debris in the temporary storage cell.

The non-hazardous demolition debris will require a large, accessible disposal area. The current approach is to select the mill and acid plant foundations for a temporary storage cell. The storage of waste would be such that this could become the permanent repository upon finalization of the EIS and decommissioning license.

Prior to any demolition of structures, hazardous building materials and related components, including ACMs and leachable lead wastes will require removal. ACMs generally include mechanical insulation on pipes and chimneys, transit board, and fire asbestos core doors. ACMs that are painted are to be tested and containerized separately for off-site disposal. Vermiculite insulation contained within the inter-module wall cavities is considered asbestos-containing (>1% asbestos); however, due to its friable nature should be removed in a manner consistent with a friable asbestos abatement practices.

Other designated substances and hazardous materials, including Polychlorinated Biphenyls (PCBs), batteries and vanadium pentoxide, will require containerization for off-site disposal or recycling in accordance to the Transportation of Dangerous Goods Act and Saskatchewan regulation requirements. PCB in paint products

considered hazardous were present in the acid plants, mine, dry, mill lab area and headframe. Segregation of these materials in these areas is required during demolition, along with disposal to a permitted facility.

Temporary Storage Cell

The temporary storage cell has a preliminary estimate of the total capacity of 110,000 m^3. For estimating purposes, 80% of the total capacity is assumed to be waste and 20% is waste rock cover material. The 83,000 m^3 of capacity available for waste is essentially the same as the waste volume estimated. An average intermediate cover thickness of 1 m is recommended.

One storage cell is proposed, covering the footprints of the mill and acid plant buildings; this location would minimize haul distances, eliminate the need to remove the foundation and backfill the vertical rock cuts. Completion of and approval for the detailed design of the storage cell would be required prior to construction.

All of the potentially radioactive materials would be placed in the Mill lean to area. No hazardous wastes or bulk chemicals would be placed in the storage cells. Crushed waste rock or other suitable borrow material is required for the temporary storage cells and use as grading material. An estimate of 88,000 m^3 of borrow materials is required.

The demolition debris from 2010 has been temporarily secured; no relocation of this waste is proposed in 2011.

Waste Handling

All ACM products would be temporarily stored on-site. All other designated substances and hazardous wastes would be taken off-site to a licensed disposal facility. Selected bulk chemicals and substances may be neutralized on-site for disposal as inert debris. Where bulk chemicals cannot be neutralized onsite, they will be shipped offsite as non-hazardous wastes.

Waste transport and disposal will be conducted in accordance with applicable federal and provincial regulations.

List of Abbreviations and Units

Sv = Sievert
mSv = milliSieverts, one thousandth of a Sievert, or 0.001 Sv
uSv = microSieverts or one millionth of a Sievert, or 0.000 001 Sv
Bq = Bequerel, stands for disintegrations per seconds
Bq/g = Bequerel per gram
Bq/L = Bequerel per litre

m = meter
mm = millimetre or 0.001 m
km = kilometre or 1,000 m
m^3 = cubic metres
m^2 = square metres
ha = hectare, measurement of area with one hectare equals 10,000 m^2

U_3O_8 = Uranium Oxide

^oC = degrees Celsius
s = seconds
h = hours
h/a = hours per annum
L = litre
tonnes = SI measure of weight equal to 1,000 kilograms (slightly different from one ton)
mg/L = milligrams per litre
ug/L = micrograms per litre
mg/g = milligrams per gram

ACM = Asbestos Containing Material
ALARA = As Low As Reasonably Achievable
CEPA = Canadian Environmental Protection Act
CNSA = Canadian Nuclear Safety Act
CNSC = Canadian Nuclear Safety Commission
DPM = Disintegrations per Minute
EIS = Environmental Impact Statement
HAZWOPER = The Hazardous Waste Operations and Emergency Response Standard
MSDS = Material Safety Data Sheet
NSCA = Nuclear Safety and Control Act
OH&S = Occupational Health & Safety
PCB = Polychlorinated Biphenyl
PPE = Personal Protective Equipment
RPP = Radiation Protection Plan
SCMR = Surface Coating Materials Regulation
SKOH&SA = Saskatchewan Occupational Health and Safety Act
SKOH&SR = Saskatchewan Occupational Health and Safety Regulations
SOR = Statutory Orders and Regulations
SRC = Saskatchewan Research Council
TDGR = Transportation of Dangerous Goods Regulation
TCLP = Toxicity Characteristic Leaching Procedure
UN Number = United Nations Number

GLOSSARY

ALARA - "As Low As Reasonably Achievable", a basic concept of radiation protection, frequently mentioned in regulations, that exposure to ionizing radiation and releases of radioactive materials should be reduced as far below regulatory limits as is reasonably achievable considering economic, technological, and societal factors, among others; ALARA is not an enforceable dose limit.

counts per minute - the quantity of ionizing radiation detected by a particular ionizing radiation survey instrument; depending on the instrument's sensitivity and efficiency, the number of counts reported may be a smaller or larger fraction of the amount of radiation actually present.

dpm - disintegrations per minute: the number of atoms of a radioactive substance decaying (emitting ionizing radiation and changing to another substance) per minute,

free release - a term used by various US agencies (i.e. NRC, EPA, and DOE) which originally meant decontamination of radioactively contaminated material to a level that would allow "unrestricted use" according to the public's perception of that term.

friable - means material that, when dry, is or can be crumbled, pulverized or powdered by hand pressure.

hazardous substance - means a substance designated in section 3 of E10.2 Hazardous Substance and Waste Dangerous Good Regulation (e.g. asbestos, lead, PCBs).

isotopes - forms of the same element whose nuclei have the same number of protons, but different numbers of neutrons, e.g., uranium-234, uranium-235, and uranium-238.

(cleanup for) unrestricted use - the term "cleanup for unrestricted use" is usually literally interpreted by the public to mean the thorough and complete cleanup of a site, i.e. there will be no harm to the user's health no matter how intensively a property or facility is used after the cleanup.

uranium - the heaviest naturally occurring (metal) element in the earth's crust, exists as three isotopes in the following percentages by weight: U-238, 99.283%; U-234, 0.0054%; and U-235, 0.711%; by radioactivity: U-238, 48%; U-234, 50%; and U-235, 2%

waste dangerous good - means a substance with the characteristics described in subsection 4(4) of E10.2 Hazardous Substance and Waste Dangerous Good Regulation (e.g. waste oil, is in a quantity greater than 0.01% by mass including in Division 2 of Class 9 as defined in the Dangerous Goods Transportation Regulations).

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1. Introduction

1.1 Overview

The Saskatchewan Research Council (SRC), on behalf of the Governments of Canada and Saskatchewan, has been asked to manage the rehabilitation of the former Gunnar Mine site, located on the north shore of Lake Athabasca in northern Saskatchewan (Figure 1).

The proposed project involves demolition of existing buildings, facilities and structures; appropriate disposal of materials resulting from demolition; installation of an appropriate cover on all or a portion of the exposed mill tailings; rehabilitation of existing waste rock piles; rehabilitation of additional risk(s), as warranted; general site clean-up and revegetation, as required; and appropriate monitoring during and after rehabilitation. The general layout of the site facilities is shown in Figures 2 and 3.

This Waste Management Plan has been developed to meet the requirement *to submit to Mr. Don Howard, the Director, Wastes and Decommissioning Division, of the Canadian Nuclear Safety Commission, by no later than January 31st, 2011, a waste management plan for the temporary storage of all wastes generated by item 11 demolition, during the year 2011, for* the Gunnar Mine Site, as specified in Commission Order 10-1 issued by the Canadian Nuclear Safety Commission (CNSC) on July 23, 2010.

This Waste Management Plan is a subset of the decommissioning plans for the former Gunnar Mine and includes all work to temporarily store all demolished buildings, clean up debris and wastes generated during the demolition process.

This document is organized into the following sections:

- Section 1: Introduction
- Section 2: Regulatory Considerations
- Section 3: Waste Metrics
- Section 4: Temporary Storage of Waste Materials
- Section 5: Summary and Recommendations
- Appendix A: Tables
- Appendix B: Materials Safety Data Sheet

1.2 Scope and Objectives

The end condition is to demolish the unsafe buildings and structures and temporarily store or dispose of waste/debris into two waste streams. Those designated and hazardous wastes will be packaged and shipped offsite; and inert demolition debris/wastes will be stored in temporary storage cell onsite. The temporary storage cells proposed are designed in such a way that they could become part of a long-term storage solution in the final decommissioning plan.

1.3 Waste Management Strategy

Waste management is an integral component of decommissioning of the Gunnar Mine site and of the Cleanup of Abandoned Northern Sites (CLEANS) project. Waste management at Gunnar aims to reduce waste through recovery, re-use and recycling, as appropriate; and through encouraging efficient utilization of resources. The overall approach at Gunnar also aims to promote best practice disposal of waste products both on-site through appropriate waste disposal areas and off-site through awarding waste disposal contracts to environmentally responsible companies that bring best value to the program.

The waste disposal strategy has to align with the EIS, which has not been issued and approved at the time of this report. Key considerations from the EIS include the following:

- The final waste disposal solution would include only one permanent storage cell.
- The location of the permanent storage cell cannot be decided until the EIS is complete. Two decommissioning options affect this decision for final waste disposal:
  - Option 1 - Disposal in a dedicated landfill; and
  - Option 2 - Co-disposal of demolition debris in Gunnar pit.

The waste management strategy proposed in this report is outlined as follows:

1. Abate designated substances and hazardous building materials.
2. Ship designated and hazardous substances off-site for destruction or to a permanent approved landfill. This avoids the need to construct a lined landfill on-site for these “designated wastes”.
3. Render the dock warehouse and a portion of the maintenance building structurally safe for storage of ACM.
4. Temporarily store asbestos wastes as follows.
   d) Store bagged ACM within the dock warehouse.
   e) Store large plastic wrapped piping and process vessels within the maintenance building. This portion of the maintenance building should not be demolished in 2011.
   f) Store stacked external ACM sheeting in the maintenance building.
1. Store temporarily clean abated demolition debris at the temporary storage cell location on the mill and acid plant footprints.
2. Provide a temporary cover for the demolition debris.

The non-hazardous demolition debris will require a large accessible disposal area. The current approach is to select the mill and acid plant foundations for a temporary storage cell. The storage of waste would be such that this could become the permanent repository upon finalization of the EIS and decommissioning licence.

2. Regulatory Considerations

Regulations pertaining to hazardous materials and substances fall into two primary groups. Occupational exposures are governed by the provincial Occupational Health and Safety (OH&S) Acts and Regulations, while waste classification and disposal are governed by both provincial and federal acts and regulations.

Other federal legislation that may apply to hazardous material and substances includes, but is not limited to, Transport of Dangerous Goods Act and the Nuclear Safety and Control Act

Further information on regulations pertaining to demolition was provided in the Demolition Plan (in compliance with Item 8 of Commission Order 10-1) and as part of the Environmental Impact Statement (EIS) due to be submitted for regulatory review in December 2010. The web-links to the pertinent Acts and Regulations are provided in Section 6 below.

Relevant references for this waste management plan include the following:

- The Environmental Management and Protection Act, 2002 Chapter E-10.21
- The Hazardous Substances and Waste Dangerous Goods Regulations Chapter E-10.2 Reg 3,
- The PCB Waste Storage Regulations being Chapter E-10.2 Reg 6

The relevant abridged sections of these documents are described in the sections that follow.

2.1 Regulatory Requirements

Regulatory considerations are described in detail in the OH&S, Inventory of Hazardous Substances and Materials and Structural Safety Reports (AECOM 2010a,b,c). Those requirements specific to waste management are provided in the following table and we refer the reader to the other documents for additional information. A summary of the various regulatory applications, permits and plans that are required are shown in Table 2-1.

Table 2-1 Regulatory Applications, Permits and Plans Required

Governing Regulation(s)	Application, Permit or Plan Required	Comment
• Occupational Health and Safety Act, 1993 (SKOHSA), and the Occupational Health and Safety Regulations, 1996 (SKOHSR) • Policy on the Disposal of Friable Waste Asbestos (EPB 269) • Saskatchewan's Environmental Management and Protection Act, 2002 (EMPA,2002)	• Notification of High Risk Asbestos Abatement • Demolition Plan Amendment • Biological Monitoring Plan • HAZWOPER Health and Safety Plan	• The notification form will be submitted at least 14 days before work is to commence • Develop Health and Safety Plan to ensure obligations are covered under the Act and regulations. • Develop training on policies, procedures, hazard assessments, hazardous materials handling (HAZWOPER), asbestos abatement/safety and radiation safety as required. • Conduct biological monitoring for asbestos and lead.
• Saskatchewan's Environmental Management and Protection Act, 2002 (EMPA,2002) • Construction/Demolition Waste Recycling and Disposal (EPB172/1M/03) • Sections 130 and 250 of The Urban Municipality Act • Chapter E-10.2 Reg 4 The Municipal Refuse Management Regulations	• Building Permit or Demolition Permit or Permission to Demolish • Permit to Establish a Waste Disposal Ground • Permit to Operate an Industrial Effluent Works	• Applies to effluent works regulated by the Ministry of Environment, for the collection, containment, storage, transmission, treatment or disposal of industrial waste.
• PCB Waste Storage Regulation E-10.2 Reg 6 21/89	• Storage of PCB materials	• Ensure safe temporary storage of PCB waste materials
• SOR/2000-203, Radiation Protection Regulations • Sections 84 and 85 of Part VI of the SKOHSR, which covers General Health Requirements • Radiation Health and Safety Act (1985) and the Radiation Health and Safety Regulations	• Radiation Protection Plan	• Develop safe work practices and procedures to handle, use, store and dispose of radioactive substances • Ensure that these procedures are implemented • Conduct biological monitoring for radiation
• E-10.2 Reg 3 - The Hazardous Substances and Waste Dangerous Goods Regulations	• Permit to construct and operate a temporary storage site for hazardous materials and	• Approval to temporally store site hazardous materials and substances

Governing Regulation(s)	Application, Permit or Plan Required	Comment
	substances	
• C-12.1 Reg 1 - The Clean Air Regulations	• Burning Permit	• Permit to burn combustible paper and abated wood materials recovered during demolition
• Transportation of Dangerous Goods Act, 1992 (1992, c. 34) • Transportation of Dangerous Goods Regulations has been consolidated to include SOR/2008-34 (Amendment 6).	• Hazardous waste manifests	• manifesting under Dangerous Goods Transportation legislation, treatment or disposal at approved sites using approved methods only
• Bill C-45 OH&S Criminal Code Legislation	• All the above	• Ensure provisions are in place for awareness of hazardous materials, informing workers of the nature and degree of the effects to their health or safety of any chemical substance or biological substance to which the workers are exposed in the course of their work; provide the workers with adequate training with respect to work procedures and processes; and instruct in the proper use of any personal protective equipment required by these regulations

2.2 Applicable Provincial Regulations and Guidelines/Protocols

Wastes shipped south to approved disposal sites will need to be characterized according to the receiving site's host Provincial requirements. In the case of Alberta the wastes must be characterized according to the Alberta User Guide for Waste Managers (Alberta User guide). Saskatchewan does not have an equivalent guide; however, the Alberta User Guide is also useful in the Saskatchewan context.

Not all materials designated as hazardous in Saskatchewan are considered hazardous in Alberta and the waste generator/hauler is directed to the Alberta User Guide for additional guidance. Aside from PCBs and vanadium pentoxide, only minor amounts of designated and hazardous substances require to be shipped off-site for disposal. Further discussion on regulatory considerations for various waste types is provided for the following groups of wastes:

- Asbestos
- PCB-containing and Painted Materials
- Lead-amended Paint Products
- Catalyst – Vanadium Pentoxide
- Chemicals – Solid
- Liquid Wastes and Sump Water
- Other Chemical Wastes including hydrocarbons
- Radionuclides (low level radioactive wastes (LLRWs))

2.3 Transportation of Hazardous Waste

The onus is on the proponent (SRC) to ensure that waste is classified and disposed of properly. This may require the use of a disposal company that will take the hazardous waste to an approved waste transfer or disposal facility within or outside of Saskatchewan.

Hazardous waste and hazardous recyclable material imports and exports are managed by Environment Canada (tracking) and Transport Canada (transportation safety).

Storage and disposal of hazardous wastes in Saskatchewan is governed by The Environmental Management and Protection Act, 2002 and the following regulations:

- The Hazardous Substances and Waste Dangerous Goods Regulations (for waste storage),
- The Municipal Refuse Management Regulations (which prohibit the disposal of hazardous wastes to municipal landfills), and
- The Environmental Spill Control Regulations (which specify requirements for spill response and remediation).

Manifesting

Manifesting of hazardous waste shipped within Saskatchewan is not required by Saskatchewan Ministry of Environment. Manifesting is required by the federal government for hazardous waste and hazardous recyclable material shipped into or out of a province.

Provincial Identification Numbers

Provincial Receiver (Consignee) Identification Numbers are now the same as the Operation Identification number issued pursuant to The Hazardous Substances and Waste Dangerous Goods Regulations. Provincial Generator (Consignor - SRC) Identification Numbers are based on date. Generators can determine these generator numbers themselves without having to contact the Ministry. Please note that Environment Canada does not issue Waste Generator Numbers. The Provincial Generator Identification Number is used on the Federal Movement Documents.

Designated substances and hazardous waste is expected to be shipped south via barge, likely to Fort McMurray, Alberta, and thus, resulting in interprovincial shipments. The expected destinations for hazardous waste treatment and disposal are located in Alberta.

Additional considerations for transportation of dangerous goods include the following requirements:

- Classification
- Packaging
- Safety marks
- Handling, loading and unloading
- Reporting of Dangerous Occurrences/Accidents
- Documentation

No transportation off-site of low level radioactive waste (LLRW) is proposed.

2.3.1 Transportation of Painted ACM

This section applies for the transport of painted ACM materials that have to be shipped off-site.

Transport of ACM/Waste Asbestos is governed by Transport of Dangerous Goods regulations (TDGR). Friable asbestos material will require suitable packaging for transport as a Dangerous Good, such as double bagging and sealing within containers. Packaging requirements for non-friable ACM are not as strict, as it does not meet the criteria for inclusion as a dangerous good. Specifically, non-friable ACM material does not meet the criteria for inclusion in Schedule 1 (free asbestos) or the toxic substance Class 6.1 criteria (“included if dust or mist is likely to be produced in a transport accident and it’s LC50

(inhalation) is less than or equal to 4 mg/L or SOR/2008-34”). Asbestos ’not fixed in a natural or artificial binder material or included in a manufactured product‘, i.e. friable asbestos, is a Class 9 Dangerous Good with a UN number of UN2212 or UN2590 (Schedule 3, TDGR including SOR/2008-34 (Amendment 6)).

3. Waste Metrics

3.1 Types of Wastes and Classifications

All inert demolition debris will be stored on-site in a suitable temporary storage cell until decisions are made in the EIS and CNSC Decommissioning Licence Application for final disposal/storage. The demolition contactor will need to confirm with the individual landfill for more detailed inquires on pre-acceptance analytical requirements, acceptable/prohibited waste streams, or waste treatment criteria. Designated substances would likely be disposal to landfills either in Saskatchewan or Alberta. Therefore demolition debris, including designated materials and substances, will be characterized using the following guidance:

> *Saskatchewan – All waste accepted for storage and/or disposal must be classified as a non-dangerous good according to the Transportation of Dangerous Goods Regulations (Clear Language Edition). In addition, all waste accepted for disposal must be solid as defined by Paint Filter Test but may be accepted at the landfill for stabilization prior to disposal.*
>
> *Alberta - All waste accepted for disposal must be classified according to Alberta Environment Waste Control Regulation and Alberta User Guide for Waste Managers (User Guide). In addition, all waste accepted for disposal must be solid as defined by Paint Filter Test but may be accepted at the landfill for stabilization prior to disposal.*

Waste groupings applied for the Gunnar demolition project are described as follows:

3. Demolition Wastes
4. Designated Substances and Materials
    a) Asbestos-Containing Materials (ACMs)
    b) PCB-Containing and Painted Materials
    c) Lead Painted Materials
    d) Spent Catalyst – Vanadium Pentoxide
    e) Chemicals – Solid i.e. Magnesium oxide and Calcium hydroxide)
    f) Liquid Wastes and Sump Water
    g) Other Chemical Wastes
    h) Low-Level Radioactive Wastes (LLRWs)

3.2 Demolition Wastes

An estimate of the total bulked volume of structures and buildings is needed to estimate the capacity required to temporarily store the materials at the site. The outside dimensions of all of the main structures were estimated in the field or by scaling from recent air photos. Volumes of walls, roof and internal volumes were all estimated by factoring. The wall volumes were factored based on whether they were wood (2 x 4, etc.), cindercrete block or structural steel. The roof volumes were factored according to whether they were wood gable, wood-frame or steel beams. The internal volumes of each building were factored based on whether there are internal walls, stairways and knowledge of the contents of each particular building. Table A in Appendix A lists the outside dimensions, factors used for wall volumes, roof volumes and internal volumes, and the total volumes of each component of each building.

This method of estimation provides a reasonable accuracy considering the level of effort to inventory the facilities on-site to improve the accuracy.

The estimated demolished volume of all the buildings and their internal contents is between 80,000 and 90,000 m^3, as calculated in Tables 3-1 and 3-2. Additional information is provided in Table A in Appendix A.

Table 3-1 2010 Summary of Estimated Demolition Volumes

Buildings	Estimated Volume (m^3)
Bunkhouses (4)*	1,500
Cabins (East of Headframe)	200
Cabins (West of Marina)	10
Curling Rink	85
Married Quarters (2)	3,600
Mine Manager's Residence	350
School	1,400
Miscellaneous	110
Beached Barges (2)	550
TOTAL	**7,805**

Notes: Bracketed number indicates number of buildings in group

** A fifth bunkhouse float that had been taken down in the past was also covered with clean local material.*

The 2010 demolition work was mostly demolished in place and these wastes have been covered with a thin layer of local material within the footprint of each of the structures; this applies to all but the curling rink, wooden barge and beached barge, which were demolished and transferred to the east waste rock dump for temporary storage.

Table 3-2 Summary of Estimated Demolition Volumes

Buildings	Estimated Volume (m^3)
Acid Plant (2)	4,500
Geology/Mine Dry	1,100
Headframe	6,700
Maintenance Building (9)	5,000
Mill Building	48,600
Powerhouse	450
Surge Bin and Fine Crush Waste Bin	750
Community Center (3)	6,900
Pumphouse	30
Sewage Treatment Plant	125
Acid Storage Tanks	1,145
Freshwater Storage Tank	373
Miscellaneous	2,500
TOTAL	**78,173**
Structures Deferred for Temporary ACM storage	
Dock Warehouse	1,220
Maintenance Building (3)	1,700

Notes: Bracketed number indicates number of buildings in group

Of this volume the dock warehouse and a portion of the maintenance building would be made safe for temporary storage of ACM. This would reduce the 2011 demolition waste by approximately 3,000 m^3. Thus the 2011 demolition is estimated at 78,000 m^3.

The wall and roof volume is estimated to be about 15% of the total demolished volume. The internal volumes of the mill, acid plant and head-frame are expected to comprise the majority of the volume for disposal. Many of the components of the crushing, grinding, thickening, leaching, filtration and precipitation circuits are still in place in the mill. These materials and components are estimated to comprise 40 to 50% of the total demolished volume that will require disposal.

3.3 Designated Substances and Materials

Table 3-3 provides a summary of the estimated volumes of designated substances and materials.

Table 3-3 Estimated Volumes of Designated and Hazardous Substances

Building	Chemical/Material	Unit of Measure
Acid Plant	Elemental Sulphur	5 m^3
	Vanadium Pentoxide	300 - 25 gallon barrels
Mill Building	Magnesium oxide	15,000 kg
	Calcium hydroxide	5,000 kg
Maintenance Shops	Portland Cement	16,500 kg
	Coloured Concrete	275 kg
	Sodium Hydroxide (Caustic Soda)	440 L
	Carbon Tetrachloride	30 L
	Petroleum Products	100 L
Community Center	Ammonia Hydroxide	20 L
	Ethyl Acetate	20 L

Table 3-4 provides a summary of the estimated areas and lengths of asbestos wastes.

Table 3-4 Estimated Quantities of Asbestos Wastes

Building	Rigid Asbestos (m^2)	Spray on Friable Asbestos (m^2)	Other Friable Asbestos (m)
Acid Plant	3,662	-	643
Dock Warehouse	-	44	-
Geology/Mine Dry	625	1,583	107
Headframe	3,263	3,751	66
Maintenance Building and Warehouses	8,362	93	834
Mill Building	16,904	242	907
Powerhouse	-	-	220
Surge Bin and Fine Crush Waste Bin	3,508	1,385	30
Freshwater Pumphouse/Sewage Treatment Plant	109	-	6
Community Centre	279	8,617	210
Utilidors	-	-	3,811
Total	**36,712**	**15,715**	**6,834**

Notes: Additional asbestos wrapped vessels in the Mill, Acid Plants and Powerhouse.

3.4 Designated Waste Types

3.4.1 Asbestos

Asbestos is one of the largest and highest priority hazards on the Gunnar Mine site. Waste disposal is regulated by the Hazardous Substances and Waste Dangerous Goods Regulations, Saskatchewan Environment, April 1989 E-10.2 Reg 3 amended 63/ 2000. Part XXIII of the SKOH&SR details the requirements for identification, processes for working with asbestos and removal of waste. It also states the requirements for warning workers of health risks, proper training, and medical examinations. Further details on the OH&S requirements for asbestos are detailed in the OH&S Regulations.

Disposal of Waste Asbestos in Saskatchewan is controlled under the following policies, acts and regulations:

- Policy on Disposal of Friable Waste Asbestos (EPB 269 March 2004).
- Saskatchewan's Dangerous Goods Transportation Act and Regulations (DGTA/R), pertaining to the handling, offering for transport, transportation and receipt of friable waste asbestos.
- Saskatchewan's Environmental Management and Protection Act, 2002 EMPA,2002) with respect to The Municipal Refuse Management Regulations pertaining to the receipt and disposal of the waste asbestos.
- Saskatchewan's OH&S Act and Regulations, pertaining to the protection of employees in the workplace and employees involved in the removal of asbestos.

These Guidelines define Waste Asbestos as "asbestos that is no longer useable for its intended purpose and is intended for storage, recycling or disposal. It includes any type of material with greater than 1% asbestos by weight. Note that this includes both friable and non-friable types of ACM.

Projects that will result in the disturbance of ACMs including vermiculite must satisfy the regulatory requirements under the Canada Labour Code - Part III. In addition, the Canadian OH&S Regulations, Part X - Hazardous Substances would be applicable to ACMs.

All asbestos waste is proposed to be temporarily stored on-site pending decisions on decommissioning options as part of the EIS and Licensing Application. Ultimately, asbestos waste will be disposed of on-site in an engineered landfill.

3.4.2 PCB-containing Equipment and Painted Materials

Because of their environmental and health effects, the manufacture, importation and re-use of Polychlorinated Biphenyls (PCBs) have been both federally and provincially regulated.

The Federal PCB Regulations SOR/2008-273 specify manufacturing, importation, end-of-use dates, storage, labelling and releases. Provincial environment departments regulate disposal and Transport Canada regulates transportation of dangerous goods. The PCB Regulations stipulate that liquids containing more than 2 parts per million (ppm) of PCBs or a solid containing more than 50 mg/kg is considered a PCB-containing material. Under TDG Regulations, any material containing greater than 0.01% by weight (100 ppm) of PCBs is considered a dangerous good. The Provincial PCB Waste Storage Regulation E-10.2 Reg 6 21/89 is more stringent than the Federal counterpart. The PCB Regulations stipulate that liquids containing more than 2 parts per million (ppm) of PCBs or a solid containing more than 5 mg/kg is considered a PCB containing material.

Once PCB-containing materials have been identified, then they must be disposed of at an approved facility. PCB waste may be disposed of at the Swan Hills Treatment Centre, Swan Hills, Alberta.

All PCBs stored prior to disposal must be done so in accordance with the PCB Waste Storage Regulations, Chapter E-10.2 Reg. 6, as amended by Saskatchewan Regulations April 21, 1989.

All PCB-containing equipment and painted materials waste is proposed to be packaged and shipped off-site for disposal, as described in the sections below.

3.4.2.1 PCB in Paints and Window Caulking

Paint finishes and window caulking suspected to contain PCBs were analyzed for PCB content. The testing focused primarily on exterior paints, as PCBs were added to paints and coatings as a plasticizer to prevent peeling and increase durability in the past.

A detailed table of PCB samples, locations and results of analysis is provided in the report entitled "*Inventory of Hazardous Substances and Materials, AECOM Sept 2010*" (AECOM 2010b).

Exterior paints and window caulking were tested for PCB content and all results were below the regulatory limit for solids, as specified in the Federal PCB Regulations (50 ppm); however, several samples were greater than the provincial criteria of 2 mg/kg. Thus, PCB in paint products considered hazardous were present in the acid plants, mine, dry, mill lab area and headframe. Segregation of these materials in these areas is required during demolition, along with disposal to a permitted facility.

3.4.2.2 PCBs in Equipment and Light Ballasts

PCBs are generally associated with electrical equipment, such as transformers and capacitors. Between 1977 and 1981, manufacturers of this type of equipment in Canada discontinued the use of PCBs in production.

On the Gunnar site, there are fluorescent light ballasts that contain PCBs. There is an estimated 500 fixtures present on-site, with over half located in the community center and the remainder in the school and maintenance complex (those ballasts in the school were removed and stored temporarily under lock and key as part of the 2010 demolition). Ballasts were also identified in the dock warehouse, beached barge and the mine dry.

Based on the age of the Gunnar Mine site, the results of the sampling completed and the type of ballasts observed, it is assumed that all ballasts on-site contain PCBs and that they should be removed and segregated prior to building demolition. Handlers must have appropriate hazardous waste training, wear protective clothing and follow Material Safety Data Sheet (MSDS) procedures for handling the materials. The ballasts should be placed into containers that are meant for shipping PCBs and marked accordingly. Ballasts should be shipped off-site to a hazardous waste treatment facility for disposal or destruction.

Table 3-5 provides a summary of the Inventory of Items in Interim PCB Storage at the conclusion of the 2010 work. These are located in a small, locked building near the ventilation raise and mill.

Table 3-5 Inventory of Items in Interim PCB Storage

Contents & Size	Qty	Description
2 drums	79	PCB ballasts
25 KVA	3	Westinghouse Transformer
15KVA	1	Pioneer Electric Transformer
25 KVA	1	Pioneer Electric Transformer
9 KVA	1	Empty Transformer Case
25 KVA	1	Pioneer Electric - Transformer
2 L case	1	Sola constant wattage ballast
45 KVA	1	Pioneer Electric - Transformer
25 KVA	1	Pioneer Electric - Transformer
2 L	1	Small Sola Lighting Transformer

3.4.3 Metals in Paint

Paint finishes were measured for lead, mercury and arsenic content. This included interior architectural paints, exterior coating and structural steel primer. A detailed table of metal samples, locations and results of analysis is provided in the report entitled "*Inventory of Hazardous Substances and Materials, AECOM Sept 2010*" (AECOM 2010b). Building materials that were coated with lead paint were tested for the purposes of waste characterization. This included materials such as wood, concrete and drywall. Lead paint was common throughout all structures as lead was commonly used as a paint pigment in the 1950s.

Painted material that leaches lead in a concentration equal to or greater than 5 mg/L when subjected to the Toxic Characteristic Leaching Procedure (TCLP) test is deemed hazardous. The TCLP test for leachable lead seeks to reproduce the worst conditions that could be encountered in a landfill where the painted debris is subjected to full immersion under highly acidic conditions. Samples collected and subjected to the test include both paint and substrate.

Previously, classification of leachable lead hazardous waste was not regulated under the Canadian Environmental Protection Act (CEPA), and thus, defaulted to the federal TDG Act and Regulation under Guideline for the General Management of Hazardous Waste. These regulations were amended in 2008 (Amendment 6 - SOR/2008-34) so that materials with toxic leachate are no longer classified under TDG. Instead, movement of leachable lead waste is now regulated by Environment Canada (EC) under the following two regulations: Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (1999, 2005 amendment), and Interprovincial Movement of Hazardous Waste and Hazardous Recyclable Material Regulations (1999, 2002 amendment). Both EC documents specify a criterion for lead leachate at 5 mg/L, which was the same criterion previously specified under the TDG Regulations.

Materials with TCLP test results exceeding 5 mg/L are, thus, both provincially and federally hazardous and can be disposed of/destroyed only in approved facilities, such as the Swan Hills Treatment Facility in Alberta. On many northern project sites, on Federal land administered by the Department of National Defence (DND) or Indian and Northern Affairs Canada (INAC), painted materials with leachable concentrations of less than 5 mg/L are designated non-hazardous and are generally landfilled on-site, or if no appropriate landfill site was available, transported off-site for disposal (painted components that exceed the relevant Federal or Provincial criteria, but are not considered hazardous, shall be collected and disposed in an on-site engineered landfill).

There are no total lead criteria as a disposal limit in Saskatchewan.

Of those samples collected as part of the 2010 Hazardous Inventory (AECOM 2010b), one lead paint sample failed the leachability test and is considered hazardous. The lead paint observed on the barge window frames and doors exceeded the guideline of leachability for lead and would be classified as a hazardous substance. No other samples exceeded guideline criteria. For materials where it was not practical to collect paint and substrate (i.e., structural steel), paint scrape samples were collected and several samples contained high concentrations of metals (lead, mercury, arsenic, chromium, manganese, titanium, uranium and zinc). Generally, only the loose, easy-to-remove paint flecks are abated from structural steel. The balance of lead-amended paint products can be managed as demolition waste.

3.4.4 Chemicals – Solid

An on-site chemical inventory is provided in the report entitled "*Inventory of Hazardous Substances and Materials, AECOM Sept 2010*" (AECOM 2010b). The following Table 3-6 outlines the location, chemical name, approximate quantity and hazards associated with the solid chemicals identified on-site.

Table 3-6 Chemical Inventory

Location	Chemical Name	Approximate Quantity	Suggested Temporary Waste Storage or Waste Handling Procedure
Top of Waste Rock; Maintenance Building	Batteries	30	Ship off-site
East side of Acid Plant	Elemental Sulphur	5 m^3	Neutralize on site
Acid Plant	Vanadium Pentoxide Pellets (Dry)	300 – 25 Gallon Barrels	Ship off-site
Dock Warehouse	Freon	Unknown – Refrigeration units may contain Freon	Capture and render freon-free
Mill Building	Magnesium oxide	15 Pallets – Bag Form	Neutralize and dispose on site
Mill Building	Calcium hydroxide	5 Pallets – Bag Form	Neutralize and dispose on site
Maintenance Shops	Portland Cement	20 Pallets – Bag Form	Neutralize and dispose on site
Maintenance Shops	Master Builders Coloured Concrete *	6 – 100 lb Bags	Neutralize and dispose on site
Maintenance Shops	Sodium Hydroxide (Caustic Soda)	11 – 40 L Barrels	Neutralize and dispose on site

** The label on the bags was faded, this material is assumed to be coloured concrete*

All materials should be handled in accordance with OH&S and TDG Regulations if being transported off-site.

3.4.4.1 Spent Catalyst – Vanadium Pentoxide

There are 300 – 25 gallon barrels of vanadium pentoxide catalyst within the two Acid Plants. In addition, there are some amounts of catalyst in small piles located outside the Acid Plants. The catalyst is believed to have been spent. The spent catalyst containing vanadium pentoxide is regulated provincially as a designated hazardous substance and was recently reviewed at the federal level (http://gazette.gc.ca/rp-pr/p1/2010/2010-09-18/pdf/g1-14438.pdf#page=27) and not declared as a designed substance under CEPA. Thus, provincial regulations apply for disposal (likely either in Alberta or Saskatchewan), while TDG rules apply as a Class 6.1 poisonous material and Class 9.3 waste product.

One sample was collected of the material in the stored catalyst drums located in the Acid Plant. Laboratory results indicated a vanadium concentration of 24,000 m/kg; while no TCLP analysis was

conducted, it is believed that this sample would leach more than 100 mg/L, which would classify it as a Class 9.3 Dangerous Good.

3.4.5 Sump Water in Mill Containment Areas

Table 3-7 below lists liquid samples that were taken in the mill from either containment vessels or sump-like structures. All observed containment vessels or sump-like structures were partially full during the August 2010 site visit. Results for all samples contained low-level metal concentrations. Uranium concentrations are shown in the table below, as well as activity concentrations of radionuclide U-238.

Table 3-7 Liquid Sampling

Sample ID	Sample Location	Comment	Uranium (µg/L)	U-238 (µg/L)
MILL-03	Containment vessel	3 m x 3 m containment area, water with yellowish tinge, no odour or sheen	240	238
MILL-04	Containment vessel	10 m x 8 m containment area, water around wooden clarifier tank, clear, no odour or sheen	793	786
MILL-05	Containment vessel	Undefined area as the containment vessels appears to continue underneath the building, access via stairs, clear, no odour or sheen	1,420	1,406

Liquid sump water from containment areas could be used as a wetting agent as part of asbestos abatement.

3.4.6 Other Chemical Wastes

Table 3-8 below lists other liquid chemical samples that were taken and their suggested temporary waste storage or waste handling procedure.

Table 3-8 Other Chemical Wastes

Location	Chemical Name	Approximate Quantity	Suggested Temporary Waste Storage or Waste Handling Procedure
Maintenance Shops	Carbon Tetrachloride	30 L (Partial 45 Gallon Barrel: approximately 20% full)	Ship off-site
Community Center	Ammonia Hydroxide	20 L	Neutralize on site
Community Center	Ethyl Acetate	20 L	Neutralize on site
Maintenance Shops	Sulpha Salts	1 container 8 L	Ship off-site
Maintenance Shops	Chromium Intensifier	3 glass containers 6 L	Ship off-site
Maintenance Shops	Unknown	1 plastic container	Ship off-site
Maintenance Shops	Ammonium Hydroxide	1 L	Ship off-site
Maintenance Shops			Ship off-site
Maintenance Shops	Rockwood (brand)	1 pail 5 gal	Ship off-site
Maintenance Shops	Unknown	1 L	Ship off-site
Maintenance Shops	Unleaded Gas	10 L	Ship off-site
Maintenance Shops	Jet B Anti-Icing Additive	10 L	Ship off-site

Location	Chemical Name	Approximate Quantity	Suggested Temporary Waste Storage or Waste Handling Procedure
Maintenance Shops	Keystone Specialized Lube	1 L	Ship off-site
Maintenance Shops	Unknown	40 L	Ship off-site
Maintenance Shops	Caterpillar gear oil 80W90	2 L	Ship off-site
Maintenance Shops	Esso diesel	2 L	Ship off-site
Maintenance Shops	Rockwood (wet)	5 L	Ship off-site
Maintenance Shops	Jet B (marking) likely used oil	100 L	Ship off-site
Maintenance Shops	Unknown	3 L	Ship off-site
Maintenance Shops	Green Lubricant	50 L	Ship off-site
Maintenance Shops	Used Oil	50 l	Ship off-site
Maintenance Shops	Cloverdale Architectural	20 L	Ship off-site
Maintenance Shops	Used oil	20 L	Ship off-site
Maintenance Shops	Used oil	10 L	Ship off-site
Maintenance Shops	76 Dextron 3 Super ATF	5 L	Ship off-site
Maintenance Shops	Used Oil	2x 20 L	Ship off-site
Maintenance Shops	Unknown	2x 20 L	Ship off-site
Maintenance Shops	Duralube Heavy Duty Grease	1 10 L	Ship off-site
Maintenance Shops	Flintcote	5x5 gal	Ship off-site
Maintenance Shops	Saniclean	5 gal	Ship off-site
Maintenance Shops	Unknown	5 gal	Ship off-site
Maintenance Shops	Unknown	5 gal (blue label)	Ship off-site
Maintenance Shops	Discarded Fire Extinguishers	5	Dispose on-site
Top of Waste Rock Pile	Batteries	30	Ship off-site

3.4.6.1 Hydrocarbons Barrels

There are between 8,000 and 10,000 empty steel barrels in various locations around the site. The majority of the barrels are 25 gallon drums, of which over half are stored in a pile near the acid plant on the waste rock pile or behind the acid plant on the bedrock outcrop, or amongst debris on-site. There are also a large number in various locations scattered on the waste rock pile.

In addition, there are also 45 gallon drums (less than 100) concentrated in areas around the fish processing plant and its support buildings (cabins, etc.) as well as in other production buildings. All barrels were checked for contents and were either empty (with the exception of five) or had minor amounts of precipitation contained within. Two barrels that had contents were opened and sampled using barrel thieves. The three other barrels that had contents could either not be opened or had insufficient quantities to sample. The following Table 3-6 outlines their location, description, analyses, and results.

Table 3-9 Barrel Sampling

Location	Comments	Sample No. and Analyses	Results
South-west corner of Dock Warehouse	45 Gallon drum, hydrocarbon odour, approximately ¼ full, blue-green color	FPB-01: Analysed for total petroleum hydrocarbons and metals	Found to contain pure petroleum products in the C_7-C_{16} range, which is typically for kerosene- or diesel-range petroleum products
Inside Maintenance Shop	45 Gallon drum with black and yellow strips, hydrocarbon odour, approximately ½ full (Photo 36)	MB-02: Analysed for total petroleum hydrocarbons and metals	Found to contain pure petroleum products in the C_7-C_{16} range, which is typically for kerosene- or diesel-range petroleum products
Inside Acid Plant East Side	45 Gallon drum, approximately ½ full, could not be opened	Sample not obtained	NA
Inside Mill Building (Parts Room)	45 Gallon drum, approximately ½ full, could not be opened	Sample not obtained	NA
Wooden Shack South-east of Barge	45 Gallon drum, not enough liquid to sample, hydrocarbon odour	Sample not obtained	NA

The barrels that were unable to be opened at the time of sampling should be opened prior to demolition and their contents confirmed to ensure proper disposal.

Waste oils, fuels and other petroleum products identified in barrels should be removed and taken off-site for disposal at a permitted facility. Residual hydrocarbons are present in the following structures:

- Tank at tank farm
- Residual sludges in tanks in basement of powerhouse and tank attached to pumphouse
- Residual hydrocarbons in piping

The basement of the power house contains a number of steel fuel tanks used when the power house was in service. The main tank room is 3.6 m wide and 50 m long and contains: 14 - tanks: each 3.6 m long and 1.2 m in diameter (12 insulated and 2 not insulated 4, 076 L), and two tanks: 1.8 m long x 1.2 m diameter (not insulated 2,036 L). The tanks are arranged end to end along the entire length of the room. The tank are insulated what appears to be 25 mm to 50 mm ACM insulation. A second room is located in the extreme west end of the powerhouse and contains 2 - asbestos insulated tanks each 4.8 m long and 1.2 in diameter (5,472 L).

According to the Gunnar Storey (1957), 10 tanks were identified as expansion tanks on the diesel generating and vacuum pump systems. In addition a 40,000 L cooling water tank “A”, 40,000 l hot water tank “B” and 6,000 l ethylene glycol tank “C” were noted. In addition, there may have been tanks connected to the fuelling systems to heat the fuel (to reduce viscosity and allow more efficient pumping) for the diesel engines in the power house. The fuel was prepared for diesel engine use by heating and centrifuging Bunker B fuel. This processed fuel was stored in the powerhouse tanks; it is not clear where these tanks were located. Inspections conducted by SRC in October 2010, indicated that the tanks are for the most part empty, but some may contain up to 10 cm of oil sludge along the tank bottoms. In an attempt to get samples of the tank contents, brass valves (1”diam.) on the bottom the tanks were opened but no fluid was discharged. Samples of oil sludge were obtained from two tanks through open bungs on the top of the tank. This material will have to be removed from the tanks and disposed of in accordance with provincial waste regulations.

3.4.7 General Site Debris

There are numerous other small buildings, utilidors, tailings lines and miscellaneous scrap (including 8,000 empty barrels) that can be dozed into piles and removed to the temporary storage cell on the waste rock pile.

3.5 Low-Level Radiological Waste

There were measurable levels of surface contamination and measurable gamma radiation fields in the mill, mill lean-to, and the headframe that would exceed action levels during demolition.

The demolition debris resulting from the deconstruction of the ore hoppers, support features, and with interior areas of the headframe, mill lean-to and packaging area in the mill near the mill lean-to would be considered low-level radioactive waste (LLRW).

Gamma radiation exposure rates in the packaging area of the mill exceeded 10 μSv/hr, while total surface contamination levels exceeded 20,000 Bq/100 cm^2. The remaining areas of the mill did not have any elevated gamma exposure rates. However, surface radiation contamination was widespread throughout the mill building, ranging from 170 Bq/100 cm^2 to 21,000 Bq/100 cm^2.

During the August 2010 radiological assessment, the AECOM survey technician observed what appears to be “yellowcake” on the floor and wall in the mill and mill lean-to. This identification is based on visual observations and radiation measurements.

The headframe contained several large ore bins. Surface contamination levels under these tanks exceeded the free-release criteria, ranging from 160 Bq/100 cm^2 to 2,900 Bq/100 cm^2

The total radioactivity (activity) in the demolition waste cannot be accurately calculated, but can be estimated by comparison to volumes of waste rock and tailings, as gamma readings are somewhat similar. The total volume of LLRW obtained by summing the reported volumes of the different waste types given in Table 3-7 is 2,000 m^3. The total inventory of tailings and waste rock containing radionuclides is estimated to be of the order of 5,500,000 m^3; Thus the LLRW component of demolition is approximately 0.04 % of the inventory in tailings and waste rock.

Table 3-10 Estimated Volume of LLRW

Buildings	Estimated Volume (m^3)
Headframe	1,000
Mill lean-to	500
Packaging area in the mill	500
Mill process equipment	0
TOTAL	**2,000**

Notes: Bracketed number indicates number of buildings in group

Appropriate contamination control and radiological exposure controls should be used when handling these ore hoppers, support features, and when working with interior areas of the headframe, mill lean-to and packaging area in the mill near the mill lean-to. Such controls would include surveillance monitoring of personnel involved in the dismantlement or demolition of structures in these areas and surveillance of waste materials generated from the area. Continuous air sampling for airborne radioactivity should be conducted while working in this area and appropriate PPE should be worn.

4. Temporary Storage of Waste Material

For demolition debris placed in the storage cell, it would be important to place the material in lifts. As a lift is placed, the dozer and truck traffic provide repeated loading and compaction. These lifts would start at 3 m, but would compact to varying degrees depending on the type of debris. After a lift is complete, a cover of locally available clean rock fill would be levelled over the area and the process repeated. This is typical of municipal landfilling practice. The idea of this is to remediate and keep the landfill area tidy on a regular basis, but this also has the effect of stabilizing the landfill and, depending on the cover materials available, would seal off the pile and minimize the generation of leachate. The other advantage of shallow lifts is safety; the trucks and dozers would not have to contend with major sinkholes and high ledges if the material is compacted and levelled regularly.

When comparing the cost of alternative temporary storage locations, the most significant differentiating factors would be the haulage and whether or not the waste material had to be moved (i.e., double handling); assuming that all other site conditions are similar. The number of haulage units required would increase to keep pace with the cleanup as the landfill is moved further from the main Mill area. Other costs with respect to final cover would also be similar. In addition, it is desirable that the temporary location could become the long term disposal site, following approval of the Gunnar EIS

The location of the proposed temporary storage cell is illustrated in Figure 4.

4.1 Temporary Storage Cell Concept

The mill storage cell would occupy the area along the toe of the bedrock ridge north of the mill and would encompass the mill and acid plant sites. The roof and walls of the mill would be dismantled and placed around the structure. Likewise, the ore bins and tanks would be dismantled and stacked in and around the mill. The following structures/items would be placed in the mill storage cell:

- Mill and contents
- Ore bins, crusher area and conveyors
- Remains of the Powerhouse
- Tailings line
- Empty concentrate drums
- Any utilidors in the immediate vicinity of the mill
- Acid Plant buildings and contents
- Condenser block
- 2 Acid tanks
- Water Tower
- Any utilidors in the immediate vicinity of the plant

The estimated capacity in the temporary storage cell is 115,000 m^3 and there is estimated be 78,000 m^3 of waste from the above listed structures. The total daily and intermediate cover is estimated to require approximately 53,000 m^3. The storage cell is bermed to contain waste/debris and the cover designed to tie into the outside edge of the berms. The minimum slope is 5% and maximum slope of the storage cell is 4:1 extending approximately from the 219 m elevation contour up to the 242 m contour, as shown on Figures 5 and 6. The maximum thickness of waste would be 10 m. The final configuration of the cover for the storage cell will be determined once the actual volumes of waste are placed.

The majority of materials placed in this storage cell would require little to no haul, lessening effort and cost. It would be more or less *in situ* disposal with the structures being dismantled and flattened as much

as necessary to ensure minimal collapse or subsidence over time. All hazardous substances and materials would be removed prior to storage.

The acid plant demolition would occupy the area along the toe of the bedrock ridge north of the acid plant. It is essentially on the site of the acid plant. The roof and walls of the acid plant would be dismantled and placed around the structure. Likewise, the internal contents would be dismantled and stacked in and around the plant.

The storage cell layout is designed to be flexible and adjustments to the grading for the intermediate cover would be conducted once confirmation of the scope of the 2011 demolition and expected volumes of the waste materials generated is conducted. A detailed design of the cover and run-on control systems would need to be completed.

4.2 Borrow Materials

A thickness of 1 m of intermediate cover is proposed for the backfill and cover of the headframe, community centre, power plant and maintenance building. Intermediate cover is also required as part of the landfilling operations to fill voids and assist with waste placement and compaction as the cells are constructed. Intermediate cover should be placed at a ratio of 1 part cover to 4 parts waste as the lifts are developed. A capping of intermediate cover 1 m in thickness should be placed on the temporary storage cell. A thickness of 1 m of cover is proposed for all demolished foundation footprints including the headframe, community centre, power plant, mine dry and maintenance building.

Approximately 88,500 m^3 of borrow material is required to support demolition efforts. Table 4-1 provides a summary of the estimated volumes of materials required for berms, backfill and intermediate cover.

Table 4-1 Estimated Volume of Construction Materials

Task	Estimated Volume (m^3)
Berm along storage cell	8,500
Intermediate cover (2 m thick area	33,000
Intermediate cover placed with waste (ratio 4:1)	20,000
Backfill and cover of other structures (i.e. headframe, community centre, maintenance buildings)	20,000
Intermediate cover for 2010 demolition locations	7,000
TOTAL	**88,500**

The temporary storage cell site will require cover material for the following reasons:

- Provide a protective cover to reduce infiltration and minimize migration of contaminants;
- Minimize the public safety hazard;
- Reclaim the storage cell site(s) to a suitable landscape compatible with the existing land use.; and
- ACM will be stored separately within the dock warehouse and maintenance building. However, if the temporary storage cell becomes permanent, then the ACM would be transferred to the storage cell for disposal. A final cover would be installed as part of decommissioning. In this situation, the cover would be to keep the asbestos wastes from becoming airborne;

Native materials and waste rock are present in the area but deposits of native materials are thin and not plentiful, and, therefore, cannot be extracted without creating substantial surface area disturbance. The

use of tailings for cover material is not an option because the tailings are fine, contain low levels of radioactivity and have wind erosion issues associated with them. The following provides a description of the native materials and the waste rock sources.

Native Materials

Native soils are scarce in the area. Fine lacustrine silts and clay deposits occur in the lower topographic depressions but these are often saturated or contain permafrost. Silt is often unsuitable for re-use as a construction material.

There are also sand deposits around the airstrip located just north of the mine but the air strip is still used by outfitters on the lake and the strip may be valuable to keep in operation during the decommissioning process. This material is proposed to be used as part of decommissioning of the tailings and waste rock areas once decisions have been reached within the EIS.

Waste Rock

There is approximately 2.7 million m^3 of waste rock stockpiled along the east side of the Gunnar site. Accounts of the geology of the hanging wall materials indicate that this material is primarily granitic gneiss and it is, therefore, anticipated that the waste rock will not be acid-generating. There is no mention of sulphides in the granite gneiss or in the ore body. Minor amounts of calcium carbonate are present in small veins and blebs. Several samples of the waste rock have been tested and found to have a net neutralizing potential. Seeps around the base of the pile are slightly acidic to neutral in pH. The waste rock is generally well graded from a medium sand to boulder-sized material. The location and abundance of this material makes it a very convenient source for covering the stockpiled wastes. The waste rock is easily loaded and the haul distances are short, making it the most economical option for covering the wastes. The use of waste rock also eliminates the need to create additional environmental disturbances. The non-acid generating nature of this material has been confirmed from acid-base accounting tests.

The waste rock should be screened for gamma levels and selected areas utilized for crushing for use in demolition. Daily cover could contain somewhat higher levels, while the backfill, intermediate and final cover should be utilized as a gamma shield, should have low levels of gamma radiation.

Most of the waste rock is suitably graded for easy handling by loaders and shaping with dozers. Crushing and screening is anticipated. Should large amounts of oversized boulders become problematic, they could be removed by loading the material through a coarse grate (grizzly).

For the purposes of demolition, daily and intermediate cover will be derived from three areas: fills at the school yard and tank farm and the northern portion of the waste rock dump. Fills, which largely comprise large waste rock boulders, would be crushed to appropriate sizes for use in the storage cell construction and as grading materials.

4.3 Suitability and Reuse of Waste Rock

Samples of the waste rock piles were previously recovered as part of the 1985 investigation (BBT, 1986) and 2004 investigations, to determine the potential for acid rock drainage (ARD) and metals leaching potential.

The geochemical data for the reference rock pieces indicate that the granite samples are generally similar in chemistry while the mafic horneblende gneiss is more siliceous and contains significantly higher amounts of iron and magnesium at the expense of alumina and the alkali and alkaline earth elements (CaO, K2O, Na2O). The pink/red-orange hornblende granite is relatively aluminous, calcic, and sodic, at

the expense of silica, and also contains minor amounts of carbonate. A comparison of the waste rock data with the reference piece data shows an overall agreement indicating that the waste rock materials are composed of these rock types in varying fragment sizes.

The trace element data from these waste rock samples show moderately elevated values for only a few elements, primarily U and Pb. The U contents are between 106 mg/kg and 253 mg/kg. The -0.5" size-fraction materials (253 mg/kg and 184 mg/kg) contain nearly double the amount present in the +0.5" size-fraction materials (120 mg/kg and 106 mg/kg). All of these values are significantly higher than the amounts of U present in the reference piece samples (5 mg/kg to 23 mg/kg). The sulphur contents of all of these waste rock samples are low, all being < 0.10 wt% and most being <0.06 wt%. Thus there does not appear to be much of an acid generation potential for these materials. The carbonate contents of these samples are variable from 0.4 to 2.2 wt% CO_2 (C expressed as CO_2). Thus the potential for base neutralization by these materials appears to exceed their acid generation potential.

Based on this work the waste rock should be suitable for re-use as an intermediate grading material.

4.4 Site Restoration Plan

Only grading to render the site safe will be completed as part of the demolition work. Any additional site restoration including topsoil and re-vegetation is part of the EIS and site decommissioning and thus not part of this waste management plan.

4.4.1 Grading and Additional Fill Materials

There were numerous areas identified that require grading and possibly addition of fill material. These areas generally consist of concrete foundations and/or piles of buried or partially buried, non-hazardous debris that will be covered with additional fill material and shaped to blend in with the natural terrain and promote positive drainage. These areas are identified on the drawings.

4.5 Temporary Storage Cell Design Basis

The assessment of the overall risks posed by the temporary storage cell was assessed qualitatively based on the types and characterization of demolition wastes and debris inputs. There are three main types of waste designated for storage:

- Clean inert debris
- ACM waste
- Lead and PCB-amended Paint Products
- Designated substances and materials

In 2011 ACM will be stored separately within the dock warehouse and maintenance building. However, if the temporary storage cell becomes permanent, then the ACM would be transferred to the storage cell for disposal. A final cover would be installed on the temporary storage cell as part of decommissioning. Thus the following comments apply if ACM is added to the temporary storage cell at a later date during the transition to permanent storage

Storage of clean inert debris in unlined temporary storage cells has much precedent and there should be no permitting issues. In addition, there is no reason why ACM cannot go into an unlined storage cell, other than it is commonly co-disposed into municipal landfills which are often lined. As the final decision has not been made for a permanent storage site for the Gunnar EIS, it is proposed to place ACM waste in

two areas for temporary storage: 1) bagged friable waste would be stored inside the dock warehouse once it has been rendered structurally safe; and 2) large oversize asbestos wrapped piping and process equipment would be stored inside a portion of the maintenance warehouse once it had been rendered structurally safe.

The third group of wastes are those building products that are painted with lead and PCB-amended paints. For these materials, all hazardous wastes (e.g. those painted products that contain concentrations of leachable lead and/or PCBs) will be segregated, packaged and transported south to a permitted disposal site.

The risks and proposed mitigation measures for the temporary storage cell are discussed below. The available data strongly suggests that the temporary storage cell will not generate gases and/or odours commonly associated with municipal solid waste temporary storage cells (e.g. methane and carbon dioxide) as there will be no putrescible material entering the temporary storage cell. The locations of former solid waste landfills are not known, and may lie within the waste rock areas; if identified these areas would be managed as part of site decommissioning..

A qualitative assessment of the potential risks associated with the temporary storage cell identified the following:

1. Possibility of a release of fibres from bagged ACMs if one or more were to tear (this would apply if the temporary cell was to become permanent);
2. Erosion, bioturbation, anthropogenic or other disturbance of the final cover to expose bagged materials;
3. Unauthorised access to ACMs by humans (this would apply if the temporary cell was to become permanent); and,
4. Inadvertent development of the temporary storage cell area (i.e. digging into the waste after placement), exposing workers and/or inhabitants to asbestos (this would apply if the temporary cell was to become permanent).

The key risk associated with the temporary storage cell is the exposure of humans to asbestos fibres (this would apply if the temporary cell was to become permanent). The exposure could be caused by a number of different factors, but the human health impact would be the same. There are no significant risks identified to ecological receptors from the asbestos waste via a groundwater or surface water pathway.

The ACM waste will be double-bagged at the asbestos abatement stage. Burial of ACM waste is the standard industry practice (this would apply if the temporary cell was to become permanent). ACMs will be encased in two industry standard 6 mil plastic bags prior to deposition in the temporary storage cell. The bagged wastes will be deposited directly in the prepared temporary storage cell area from the haul trucks to minimize waste handling and the potential opportunities for exposure. When the temporary storage cell is complete, a cover will be placed on the temporary storage cell in accordance with the permit requirements and best practice.

The nature of the waste material entering the temporary storage cell is not expected to generate gases commonly associated with municipal solid waste streams, odours or leachate.

Drainage for the temporary storage cell will be controlled through the use of ditches and drains and in addition, the slopes of the temporary storage cell will be designed to maximize surface water runoff which will help reduce erosion and precipitation infiltration.

During the operational life of the temporary storage cell, it will be an open temporary storage cell. When the filling is completed, and the temporary storage cell closed, a barrier will be erected around the temporary storage cell site perimeter (e.g. a natural barrier) to prevent access. The surface of the

temporary storage cell will be covered with a minimum of 1 m of suitable, nominally compacted locally available borrow material. Proper signage would be put in place to prevent accidental excavation.

The potential impact on surface or groundwater quality from the temporary storage cell is the most significant potential environmental risk posed by the development of this temporary storage cell.

If the non-hazardous building products that contain residues of lead amended paints come into contact with water infiltrating through the surface of the temporary storage cell, the water quality of nearby surface water and/or groundwater may be affected. This is considered unlikely as the results of the leachability (TCLP) were all very low, even on samples that contained the highest total concentrations of lead.

However, the potential risks can be mitigated in several ways:

- Surface water drainage will be managed to minimize entry of water into the temporary storage cell waste material;
- Surface water run-off from the temporary storage cell will be diverted to a settlement area to allow the suspended solids to settle prior to discharge;
- Dust suppression measures such as wetting down the work area will be utilized; and,
- The temporary storage cells are being designed as part of the decommissioning of the Gunnar site and as such a permanent cap would be installed as part of the long-term closure of these facilities.

4.6 Site Monitoring of Wastes

Monitoring of wastes including supplemental characterization, and classification will be ongoing during demolition. Inspections and supplemental sampling will be conducted to provide guidance to the demolition contractor. During demolition work, a full-time waste inspector will be present on site to document work and ensure all wastes are being handled in keeping with regulatory requirements and best practices. Site monitoring during demolition will consist of the following tasks:

Inspection

During the hazardous building materials abatement and demolition work, and when the temporary storage cells are operational, daily inspections will be conducted by a representative of SRC's project management team. The inspections will include site security, observations of leachate breakouts, health and safety concerns, plant and equipment safety and other observations of unusual occurrences. If the storage cells are not utilized for extended periods, for example if demolition work is in progress and materials are not prepared for landfill disposal, or if work has ceased for the winter season, the inspection frequency will be reduced. Periodic inspections will also be conducted by a geotechnical engineer, to confirm that the cover material is placed appropriately and that slope stability is not a concern. Supplemental sampling for designated materials will be conducted periodically as necessary to confirm disposal options with the demolition contractor.

Slope Stability

Assuming that the slope of the final cover will be a maximum of 4H:1V, slope instability is not anticipated to occur in the temporary storage cells, although local, small-scale erosion and ravelling on the landfill slopes may occur. It is recommended that the slopes of the completed storage cells be monitored monthly during 2011 and bi-annually thereafter by a representative of SRC's project management team. Inspection of the slopes should also be carried out after unusually intensive precipitation events. In addition, surface water run-off will be managed through the installation of a ditch on the upgradient side of the landfill. A geotechnical engineer will be contacted immediately if any indication of slope instability is observed so that appropriate corrective measures can be applied.

Dust and Air Emissions Control Methods and Equipment

Dust transport and discharge of airborne particulate beyond the limits of the work area can potentially become a nuisance to human health and/or the environment, recognizing that the Gunnar mine site is remote. The demolition contractor will have to specify the dust control measures protective of worker safety and the environment as part of work procedures. These details will be developed in the Health and Safety Plan and Radiation Protection Program (RPP). A health physicist will be on site to monitor the RPP (including total ambient gamma does emissions) and a member of SRC H&S team will provide oversight of the asbestos abatement and HAZWOPER program. Radiological (i.e. gamma radiation) action levels will be developed as part of the RPP for worker safety and environmental protection.

Groundwater Monitoring

No groundwater monitoring is proposed for the storage cells either in the short-term or longer-term, should these become permanent storage locations.

Surface Water Diversion

Site preparation for the temporary storage cell consists of construction of ditches to divert surface water run-on from areas uphill from the undeveloped portion of the site. These ditches will convey flow around the perimeter of the storage cell. The ditches will have to be designed to convey the 1:100 year storm event and will typically range from 0.35 m to 0.5 m in depth with a 0.5 m base width and 2H:1V side slopes.

Equipment Cleaning/ Decontamination

All equipment used within the active deconstruction zone around LLRW will have to go through a cleaning/decontamination facility.

Record Keeping

All designated substances and hazardous materials including asbestos and LLRW will be tracked throughout the demolition work and reported as part of the record of 2011 demolition activities. Designated wastes will be monitored and calculated on a daily or weekly basis using techniques such as truckload counts and bed fill height measurements. Surveyors will be employed on a periodic basis to layout the temporary storage cell, to delineate stockpile dimensions and to conduct quantity measurement for payment.

Records of monitoring events and associated technical and/or laboratory data will be kept on file with the Site Owner (SRC in Saskatoon).

5. Summary and Recommendations

This Waste Management Plan has been developed to meet the requirement *to 'submit to Mr. Don Howard, the Director, Wastes and Decommissioning Division, of the Canadian Nuclear Safety Commission, by no later than January 31, 2011, a waste management plan for the temporary storage of all wastes generated by item 11 demolition, during the year 2011, for* the Gunnar Mine Site, as specified in Commission Order 10-1 issued by the Canadian Nuclear Safety Commission (CNSC) on July 23, 2010.

The waste disposal strategy has to align with the EIS, which has not been issued and approved at the time of this report. Key considerations from the EIS include the following:

- The final waste disposal solution would include only one permanent storage cell or landfill location
- The location of the permanent storage cell cannot be decided until the EIS is complete. Two decommissioning options affect this decision for final waste disposal
  - Option 1 - Disposal in a dedicated landfill
  - Option 2 - Co-disposal of demolition debris in Gunnar Pit

The waste management strategy proposed is outlined as follows:

1. Abate designated substances and hazardous building materials.
2. Ship designated and hazardous substances off-site for destruction or to a permanent permitted landfill. This avoids the need to construct a lined landfill on site for these "designated wastes".
3. Render the dock warehouse and a portion of the maintenance building structurally safe for storage of ACM.
4. Temporarily store asbestos wastes as follows.
   a) Store bagged ACM within the dock warehouse.
   b) Store large plastic wrapped piping and process vessels within the maintenance building. This portion of the maintenance building should not be demolished in 2011.
   c) Store stacked external ACM sheeting in the maintenance building.
5. Store temporarily clean abated demolition debris at the temporary storage cell location on the mill and acid plant footprints.
6. Provide a temporary cover for the demolition debris.

The non-hazardous demolition debris will require a large accessible disposal area. The proposed approach is to select the mill and acid plant foundations for a temporary storage cell. The storage of waste would be such that this could become the permanent repository upon finalization of the EIS and decommissioning license. This approach is desirable as it reduces costs (by handling materials only once) and reduces potential hazards for worker safety.

Prior to any demolition of structures, hazardous building materials and related components, including ACMs and leachable lead wastes will require removal. ACMs generally include mechanical insulation on pipes and chimneys, transit board, and fire asbestos core doors. ACMs that are painted are to be tested and containerized separately for off-site disposal. Vermiculite insulation contained within the inter-module wall cavities is considered asbestos-containing (>1% asbestos); however, due to its friable nature should be removed in a manner consistent with a friable asbestos abatement practices.

Other designated substances and hazardous materials, including PCBs, batteries and vanadium pentoxide, will require containerization for off-site disposal or recycling in accordance to TDG Act and Saskatchewan regulation requirements.

Non-hazardous wastes from any demolition activities will include unpainted wood and metal construction materials and concrete in foundations debris. If cutting torches will be used to dismantle structural steel

components painted with a paint tested and shown to contain elevated lead or PCB levels, the paint must be removed from the surface in the areas to be cut.

All hazardous materials identified at the site will be collected and transported off site, in accordance with the Transportation of Dangerous Goods Act (TDGA) (TC 2002) and Regulations, and the CEPA Inter-provincial Movement of Hazardous Waste Regulations (SOR/2002-301), to a licensed hazardous waste disposal facility.

To reduce the volume of potential demolition and debris waste requiring off-site transport and disposal, untreated, unpainted wood waste and combustible materials could be burned on site. This material is likely to be confined to plywood sheeting and internal framing timber of demolished buildings. The overall volume of this type of waste is likely to be low relative to the volume of concrete and painted material, but would result in cost and time savings to the project. A provincial or local burn permit is likely to be required. Ash generated from burning operations should be collected and disposed of in the storage cell.

5.1 Temporary Storage Cell

The temporary storage cell has a preliminary estimate of a total capacity of 110,000 m^3. For estimating purposes, 80% of the total capacity is assumed to be waste and 20% is waste rock cover material. The 83,000 m^3 of capacity available for waste is essentially the same as the waste volume estimated. An average intermediate cover thickness of 1 m is recommended.

One storage cell is proposed covering the footprints of the mill and acid plant buildings; this location would minimize haul distances, eliminate the need to remove the foundation and backfill the vertical rock cuts.

All of the potentially LLRW would be placed in the Mill area to provide segregation. No bulk hazardous wastes or bulk chemicals would be placed in the storage cells except for ACM, and non-hazardous amended paint products, etc. (see section 4.6). Crushed waste rock or other suitable borrow material is required for the temporary storage cells and use as grading material. An estimate of 88,500 m^3 of borrow materials is required.

The demolition debris from 2010 has been secured; no relocation of this waste is proposed in 2011. The long-term plan would be to relocate the 2010 debris into the permanent storage cell location. This is part of the EIS and a final decision on this would be made later in 2011.

5.2 Waste Handling

In 2011, all ACM products would be temporarily stored on-site. All designated substances and hazardous wastes would be taken off-site to a licensed disposal facility. Selected bulk chemicals and substances may be neutralized on-site for disposal as inert debris. Where bulk chemicals cannot be neutralized onsite they will be shipped offsite as non-hazardous wastes.

Waste transport and disposal will be conducted in accordance with applicable federal and provincial regulations.

6. References

AECOM Canada Ltd., Saskatchewan Research Council - Gunnar Mine Rehabilitation Project, Occupational Health & Safety Assessment, August 2010a.

AECOM Canada Ltd., Saskatchewan Research Council – Gunnar Mine Rehabilitation Project, Inventory of Hazardous Materials and Substances, September 2010b.

AECOM Canada Ltd., Saskatchewan Research Council – Gunnar Mine Rehabilitation Project, Occupational Health and Safety Assessment, September 2010c.

AECOM Canada Ltd., Saskatchewan Research Council – Gunnar Mine Rehabilitation Project, Demolition Plan, October 2010d.

Canadian Environmental Protection Act. 1999. Canadian Department of Justice, 1999, c.33.
http://laws.justice.gc.ca/en/C-15.31/index.html

Canada Labour Code. 1985. Canadian Department of Justice, R.S. 1985 c. L-2
http://laws.justice.gc.ca./en/L-2/

The Occupational Health & Safety Regulations, 1996
http://www.qp.gov.sk.ca/documents/English/Regulations/Regulations/O1-1R1.pdf

Canada Labour Code (R.S., 1985, c. L-2)
http://laws.justice.gc.ca/eng/L-2/20100830/page-0.html?rp2=HOME&rp3=SI&rp1=labour%20code&rp4=all&rp9=cs&rp10=L&rp13=50#idhit1

Canadian Environmental Protection Act, 1999 (1999, c. 33)
http://laws.justice.gc.ca/eng/C-15.31/20100830/page-0.html?rp2=HOME&rp3=SI&rp1=Canadian%20Environmental%20Protection%20Act&rp4=all&rp9=cs&rp10=L&rp13=50#idhit1

General Nuclear Safety and Control Regulations (SOR/2000-202)
http://laws.justice.gc.ca/eng/SOR-2000-202/20100830/page-0.html?rp2=HOME&rp3=SI&rp1=Nuclear%20Substances%20and%20Radiation%20Devices%20Regulations&rp4=all&rp9=cr&rp10=L&rp13=50#idhit1

Notification of High Risk Asbestos Process
http://www.lrws.gov.sk.ca/adx/aspx/adxGetMedia.aspx?DocID=691,94,88,Documents&MediaID=838&Filename=notification-high-risk-asbestos-process-form.pdf

Nuclear Safety and Control Act (1997, c. 9)
http://laws.justice.gc.ca/PDF/Statute/N/N-28.3.pdf

Nuclear Substances and Radiation Devices Regulations (SOR/2000-207)
http://laws.justice.gc.ca/eng/SOR-2000-207/20100830/page-0.html?rp2=HOME&rp3=SI&rp1=Nuclear%20Substances%20and%20Radiation%20Devices%20Regulations&rp4=all&rp9=cr&rp10=L&rp13=50#idhit1

Packaging and Transport of Nuclear Substances Regulations (SOR/2000-208
http://laws.justice.gc.ca/eng/SOR-2000-208/20100830/page-0.html?rp2=HOME&rp3=SI&rp1=Packaging%20and%20Transport%20of%20Nuclear%20Substances%20Regulations&rp4=all&rp9=cr&rp10=L&rp13=50#idhit1

PCB Regulations, SOR/2008-273, Canadian Environmental Protection Act.

Radiation Protection Regulations (SOR/2000-203)
http://laws.justice.gc.ca/PDF/Regulation/s/sor-2000-203.pdf

Saskatchewan Uranium Mines and Mills Exclusion Regulations (SOR/2001-115)
http://laws.justice.gc.ca/PDF/Regulation/S/SOR-2001-115.pdf

Surface Coating Materials Regulations, SOR/2005-109, Hazardous Products Act.

Transportation of Dangerous Goods Act, 1992 (1992, c. 34)
http://laws.justice.gc.ca/PDF/Statute/T/T-19.01.pdf

Transportation of Dangerous Goods Regulations have been consolidated to include SOR/2008-34 (Amendment 6).
http://www.tc.gc.ca/eng/tdg/clear-tofc-211.htm

The Hazardous Substances and Waste Dangerous Goods Regulations, Environmental Management and Protection Act, Saskatchewan Environment, 1989.

The Occupational Health & Safety Act, 1993 (includes amendments that came into force October 1, 2007)
http://www.qp.gov.sk.ca/documents/English/Statutes/Statutes/O1-1.pdf

The Occupational Health & Safety Regulations, 1996
http://www.qp.gov.sk.ca/documents/English/Regulations/Regulations/O1-1R1.pdf

The PCB Waste Storage Regulations" Chapter E-10.2 Reg. 6, as amended by Saskatchewan Regulations April 21, 1989.

The Radiation Health and Safety Act, 1985
http://www.qp.gov.sk.ca/documents/English/Statutes/Statutes/R1-1.pdf

The Radiation Health and Safety Regulations, 2005
http://www.qp.gov.sk.ca/documents/English/Regulations/Regulations/R1-1r2.pdf

Uranium Mines and Mills Regulations (SOR/2000-206)
http://laws.justice.gc.ca/PDF/Regulation/S/SOR-2000-206.pdf

Figures

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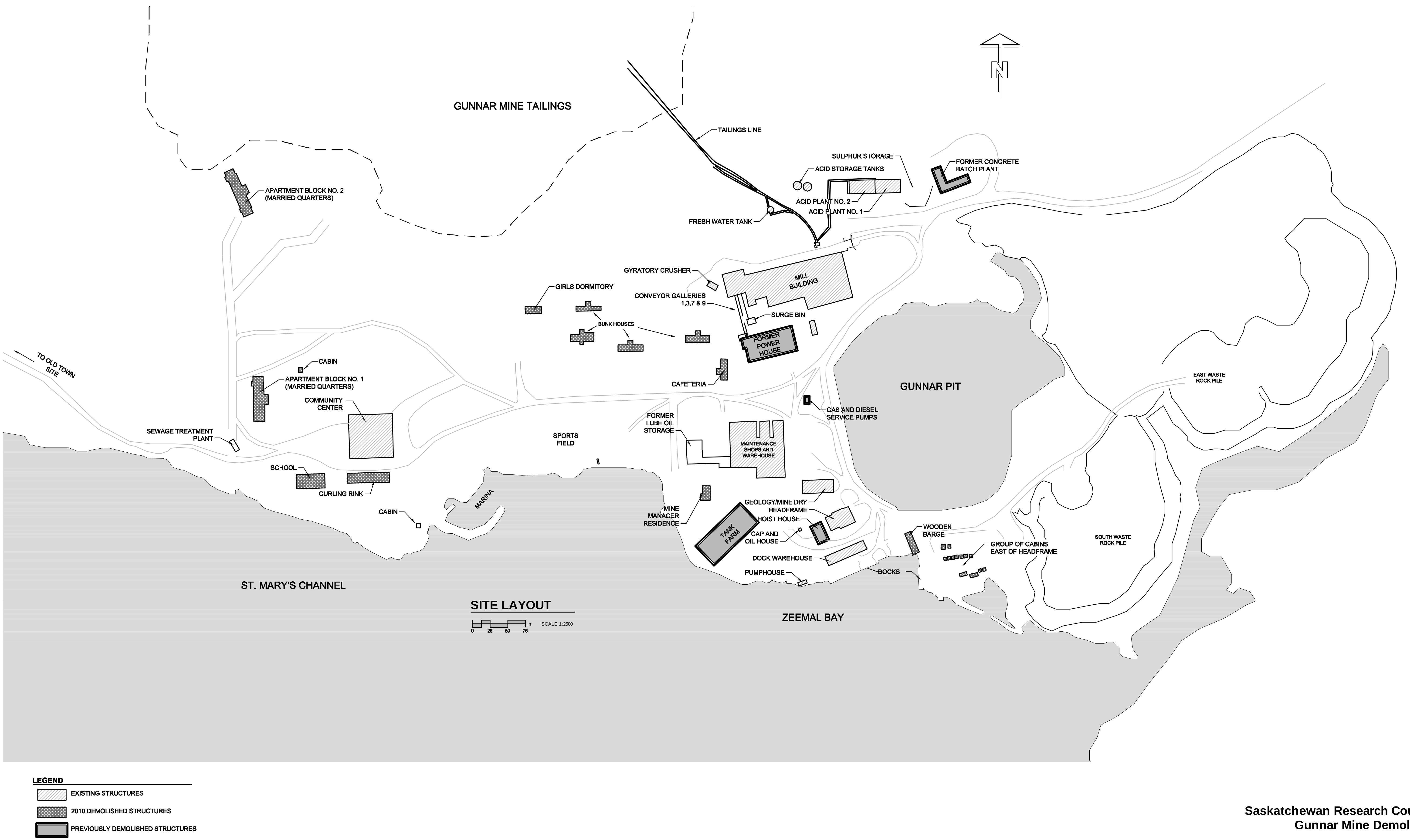
AECOM

Saskatchewan Research Council
Gunnar Mine Demolition
Demolition Plan

Site Location Plan

Figure 1



AECOM

Saskatchewan Research Council
Gunnar Mine Demolition

General Site Layout

Figure 2

GUNNAR TAILINGS
TAILINGS LINE
FRESH WATER TANK
ACID STORAGE TANKS
ACID PLANT NO. 2
ACID PLANT NO. 1
SULPHUR STORAGE
FORMER CONCRETE BATCH PLANT
GYRATORY CRUSHER
MILL BUILDING
CONVEYOR GALLERIES 1,3,7 & 9
SURGE BIN
POWER HOUSE
GIRLS DORMITORY
BUNK HOUSES
CAFETERIA
GAS AND DIESEL SERVICE PUMPS
GUNNAR PIT
EAST WASTE ROCK PILE
FORMER LUBE OIL STORAGE
MAINTENANCE SHOPS AND WAREHOUSE
SPORTS FIELD
MARINA
GEOLOGY/MINE DRY
MINE MANAGERS RESIDENCE
HEADFRAME
HOIST HOUSE
TANK FARM
WOODEN BARGE
GROUP OF CABINS EAST OF HEADFRAME
SOUTH WASTE ROCK PILE
CAP AND OIL HOUSE
DOCK WAREHOUSE
DOCKS
ST. MARY'S CHANNEL
PUMPHOUSE
ZEEMAL BAY

0 30 60 m
SCALE 1:3000

LEGEND

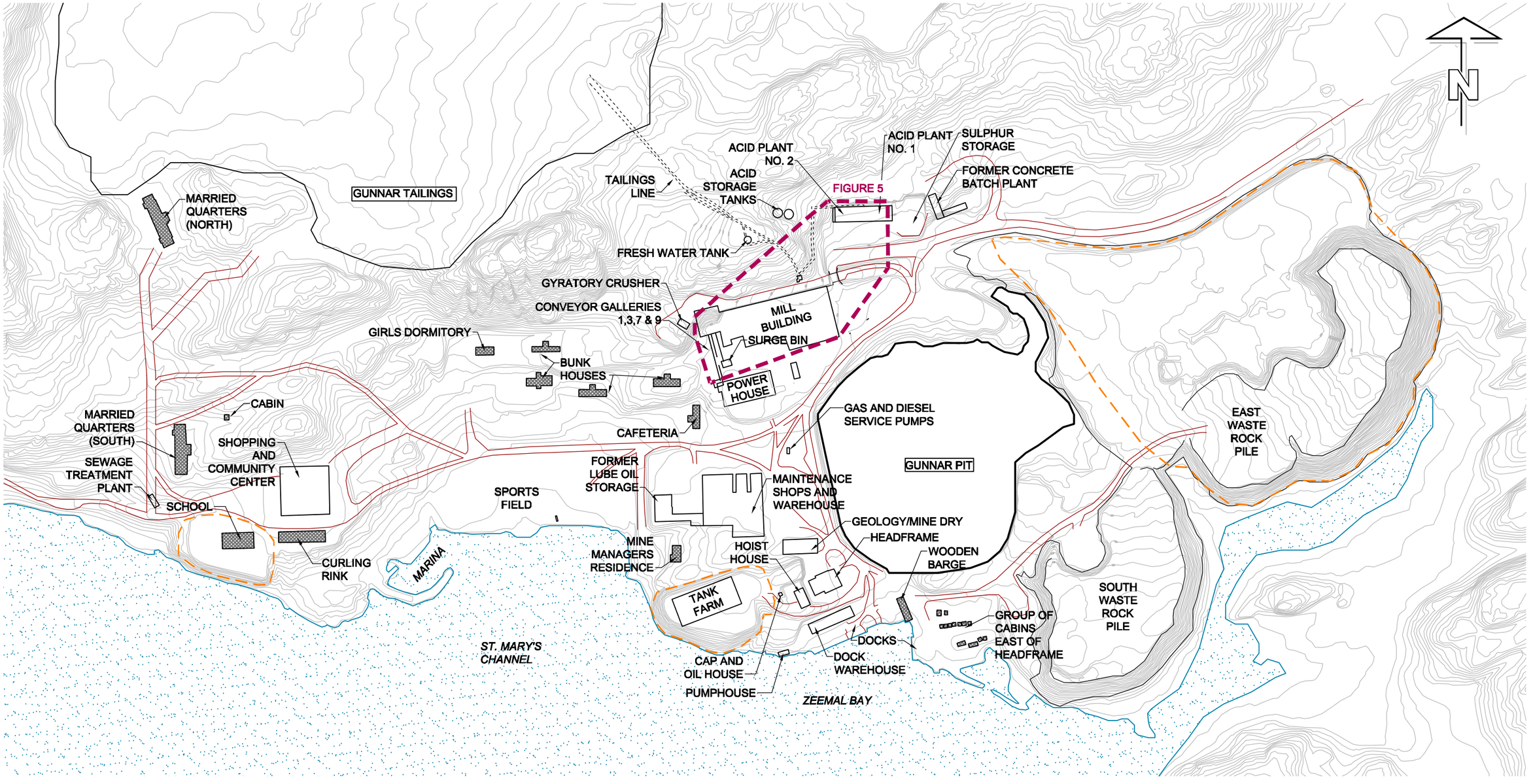
- EXISTING STRUCTURES
- PREVIOUSLY DEMOLISHED STRUCTURES
- 2010 DEMOLISHED STRUCTURES

AECOM

Saskatchewan Research Council
Gunnar Mine Demolition

Central Site

Figure 3



LEGEND

- EXISTING STRUCTURE
- 2010 DEMOLISHED STRUCTURE
- PREVIOUSLY DEMOLISHED STRUCTURE
- POTENTIAL BORROW SOURCES

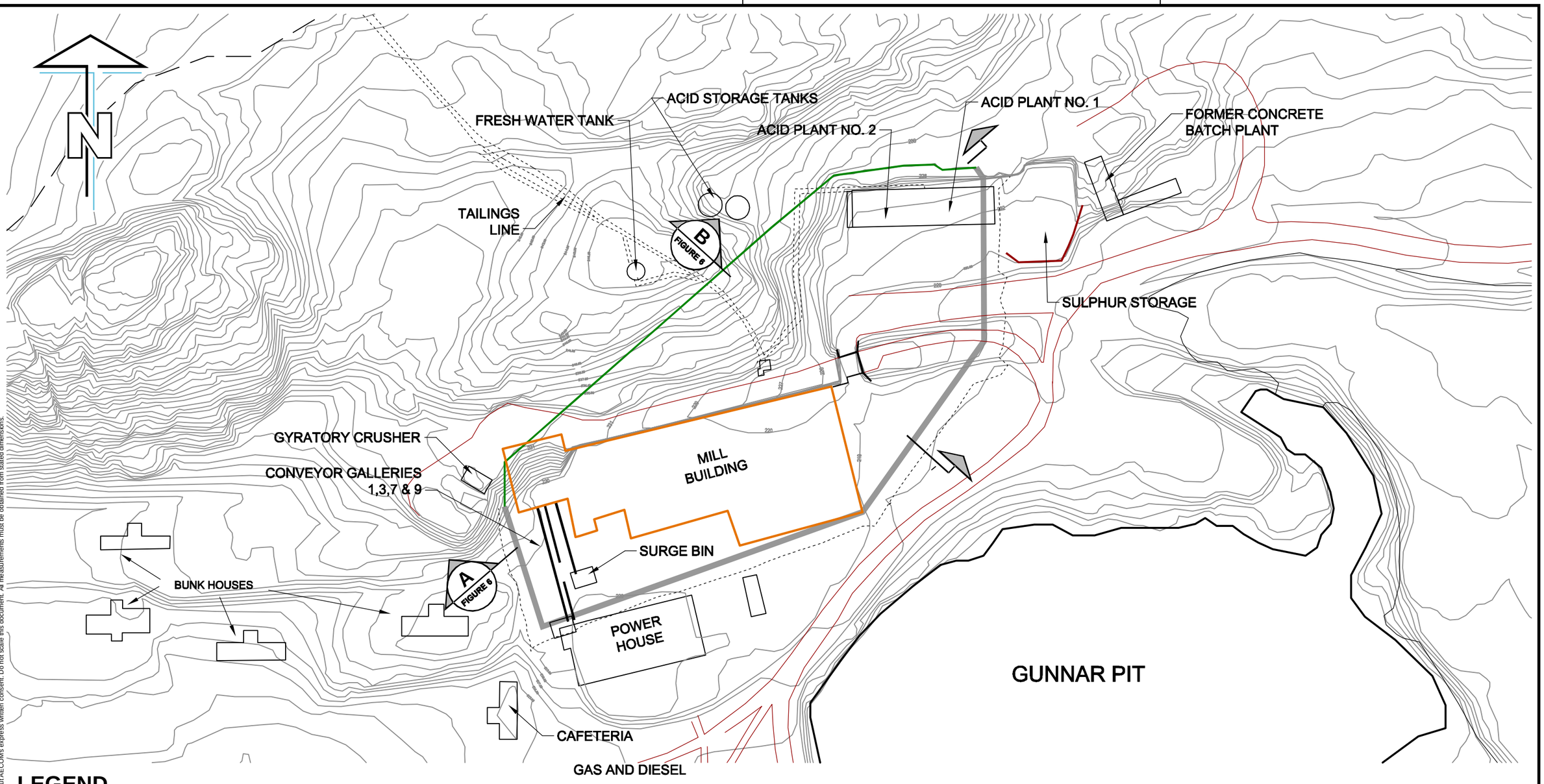
0 50 100 m SCALE 1:5000

Saskatchewan Research Council
Gunnar Mine Demolition
Demolition Plan

Site Plan

Figure 4

AECOM



LEGEND

- LANDFILL BOUNDARY
- 3.0 m WIDE CONTAINMENT BERM
- TOE OF BERM
- BUILDING FOUNDATION
- 220 1.0 m CONTOUR

0 20 40 m SCALE 1:2000

Saskatchewan Research Council
Gunnar Mine Demolition
Demolition Plan

Temporary Storage Cell 1

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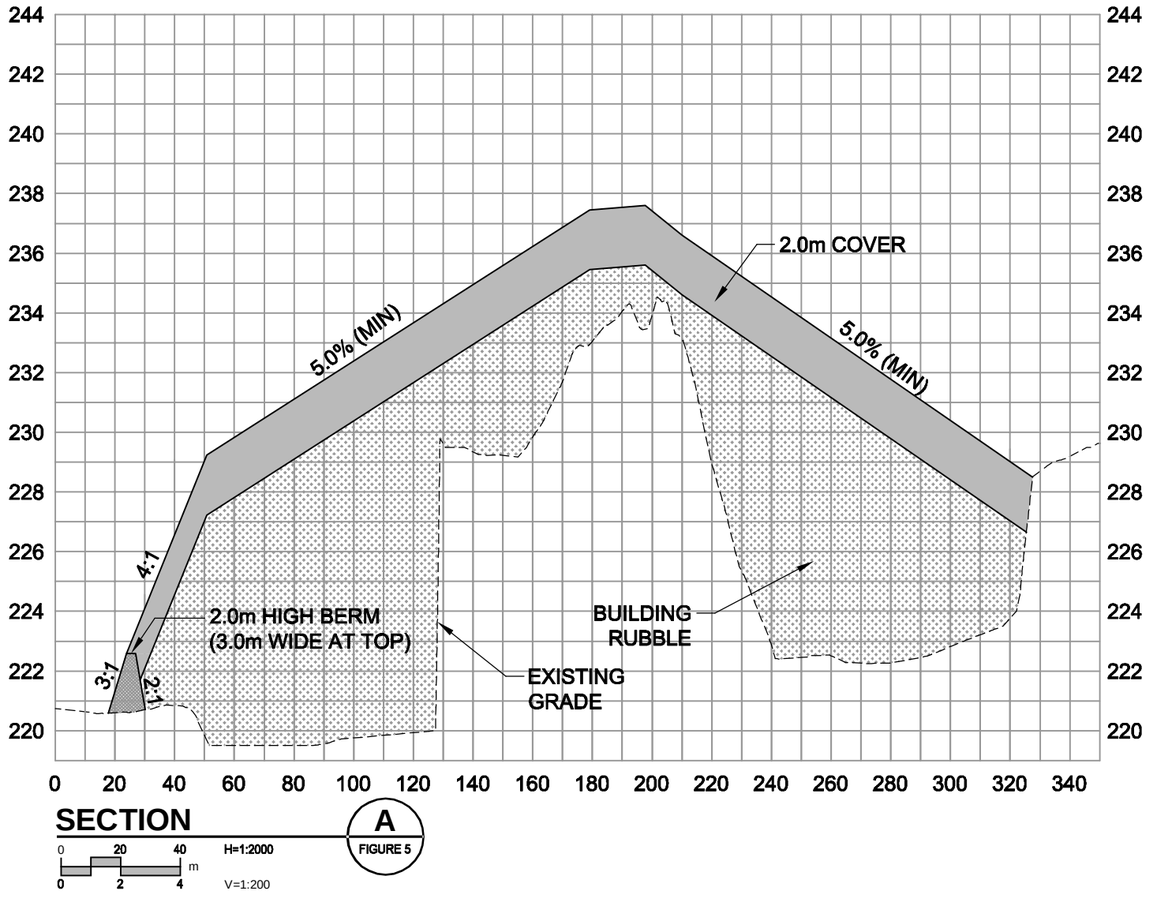
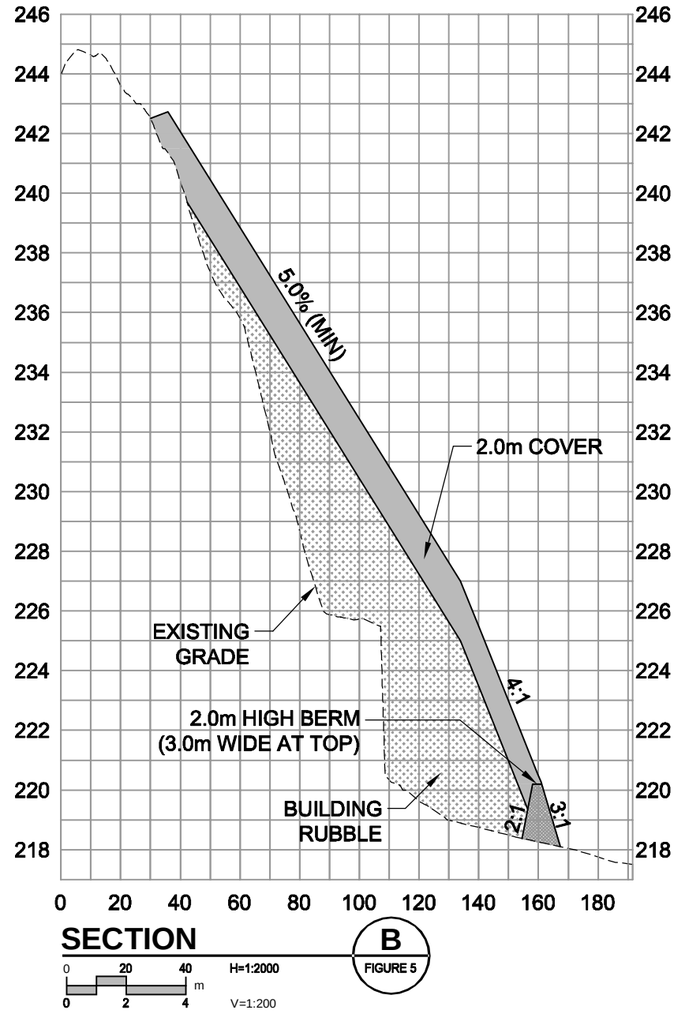
Figure 5





Saskatchewan Research Council
Gunnar Mine Demolition
Demolition Plan

Temporary Storage Cell 1
Sections
Figure 6

AECOM

Appendix A

Tables

Table A
Building Volume Estimates

Building	Height (m)	Building Footprint (m^2)	Exterior Wall/Roof Area (m^2)	Wall/Roof/Concrete Thickness (m)[1]	Building Volume (m^3)	Internal Volume (% of Total) [2]	Internal Volume (m^3)
2010 Demolition							
Bunkhouses							
Bunkhouse (Northwest)							
Building	7	246	610	0.15	1,599	0.20	320
Gable Roof			246	0.30			
Foundation				0.30			
Bunkhouse (Southwest)							
Building	7	431	716	0.15	2,802	0.20	560
Gable Roof			431	0.30			
Foundation				0.30			
Bunkhouse (Central)							
Building	7	338	642	0.15	2,197	0.20	439
Gable Roof			338	0.30			
Foundation				0.30			
Bunkhouse (East)							
Foundation	1	412		0.30	412	0.20	82
Cabins East of Head-frame							
Buildings	3	361		0.15	1,083	0.20	217
Curling Rink							
Building	1	837		0.30	837	0.10	84
Beached Barge	2	334			668	0.80	534
Married Quarters							
Married Quarters (North)							
Building	7	1,115	1,131	0.15	7,248	0.25	1,812
Flat Roof			1,115	0.25			
Foundation				0.30			
Married Quarters (South)							
Building	7	1,079	1,153	0.15	7,014	0.25	1,753
Flat Roof			1,079	0.25			
Foundation				0.30			
Mine Manager's Residence							
Building	7	261	468	0.20	1,697	0.20	339
Roof			261	0.20			
Foundation				0.30			
School							
Building	7	871	809	0.25	5,662	0.25	1,415
Roof			871	0.20			
Foundation				0.30			
2010 TOTAL					**31,217**		**8,000**

Building	Height (m)	Building Footprint (m^2)	Exterior Wall/Roof Area (m^2)	Wall/Roof/Concrete Thickness (m)[1]	Building Volume (m^3)	Internal Volume (% of Total) [2]	Internal Volume (m^3)
2011 Demolition							
Acid Plant							
Acid Plant No.1							
Building 12		612	1,006	0.20	7,344	0.30	2,203
Roof			612	0.20			
Foundation				0.30			
Acid Plant No.2							
Building 12		637	1,237	0.20	7,644	0.30	2,293
Roof			637	0.20			
Foundation				0.30			
Dock Warehouse							
Building	7	951	1,065	0.15	6,182	0.20	1,236
Roof			1,124	0.15			
Foundation				0.30			
Geology/Mine Dry							
Building	6	892	732	0.25	5,349	0.20	1,070
Roof			967	0.20			
Foundation				0.30			
Head-frame							
Building	24	825	4,006	0.20	19,800	0.35	6,930
Roof			1,227	0.20			
Foundation				0.30			
Maintenance Shop and Warehouses							
Building	9	5,254	3,885	0.20	44,659	0.15	6,699
Roof			5,676	0.20			
Foundation				0.30			
Mill							
Building	15	9,130	27,610	0.20	136,950	0.35	47,933
Building Roof			9,355	0.20			
Conveyor Galleries	2		1,539	0.20	3,078	0.20	616
Foundation				0.30			
Powerhouse							
Building	1	2,160		0.30	2,160	0.20	432
Surge Bin and Fine Crush Waste Bin							
Surge Bin and Fine Crush Waste Bin	39	126	2,489	0.20	4,914	0.15	737
Surge Bin and Fine Crush Waste Bin Roofs			126	0.20			
Foundation				0.30			
Former Girl's Dormitory							
Building	1	233		0.30	233	0.20	47
Cafeteria							
Building	1	323		0.30	323	0.20	65

Table A
Building Volume Estimates

Building	Height (m)	Building Footprint (m^2)	Exterior Wall/Roof Area (m^2)	Wall/Roof/Concrete Thickness (m)[1]	Building Volume (m^3)	Internal Volume (% of Total) [2]	Internal Volume (m^3)
Community Center							
Building	9	3,836	2,479	0.18	34,524	0.20	6,905
Gable Roof			3,960	0.50			
Foundation				0.30			
Pumphouse							
Building	2	71		0.20	142	0.20	28
Sewage Treatment Plant							
Building	7	127	331	0.15	826	0.15	124
Roof			127	0.25			
Other Structures							
Acid Storage Tank (2 tanks)	10	229			2,290	0.25	1,145
Former Concrete Mixing Plant	1	551		0.30	551		
Freshwater Tank	20	75			1,490	0.25	373
Tailings Line	1	537			269	0.75	201
Tanks at the Tank Farm (1 tank)	6	100			600	0.10	60
Utilidors	0.50	5,000			2,500	0.75	1,875
Mine Ventilation and Air Heating Unit	8	155			1,159	0.20	232
2011 TOTAL					**281,827**		**81,000**
PROJECT TOTAL					**313,043**		**89,000**

NOTES:

[1] - Assumptions used for wall and roof thicknesses were obtained from WaterMark Consulting Ltd - Gunnar Demolition Strategy, 2005. Concrete thickness was assumed to be 0.30m.

[2] - Assumptions used for internal volume percentages were obtained from WaterMark Consulting Ltd - Gunnar Demolition Strategy, 2005

Structure	Major Components[1]	Demolition Waste Temporary Disposal			
		Temporary Storage Cell 1	Designated Materials On-Site Storage	Designated Materials – On-Site Disposal	Hazardous Materials – Containerize for Off-Site Disposal
Acid Plant	Structural steel members	X			
	Steel, concrete, plastics, treated or painted wood	X		X	
	Paper, untreated/ unpainted cardboard and Combustible Wooden Waste	X			
	Asbestos		X		
	Designated Waste Material including elemental sulphur, approximately 300 barrels of vanadium pentoxide pellets			X	X
Dock Warehouse	Structural steel members	X			
	Steel, concrete, plastics, treated or painted wood	X			
	Paper, untreated/ unpainted cardboard and Combustible Wooden Waste	X			
	Asbestos		X		
	Designated Waste Material including PCB containing fluorescent light ballasts, refrigeration units may contain freon				X
Geology/Mine Dry	Structural steel members	X			
	Steel, concrete, plastics, treated or painted wood	X			
	Paper, untreated/ unpainted cardboard and Combustible Wooden Waste	X			
	Asbestos		X		
	Designated Waste Material including PCB containing fluorescent light ballasts				X
Head-frame	Structural steel members	X			
	Steel, concrete, plastics, treated or painted wood	X			

Structure	Major Components[1]	Demolition Waste Temporary Disposal			
		Temporary Storage Cell 1	Designated Materials On-Site Storage	Designated Materials – On-Site Disposal	Hazardous Materials – Containerize for Off-Site Disposal
	Paper, untreated/ unpainted cardboard and Combustible Wooden Waste	X			
	Asbestos		X		
Maintenance Building and Warehouse	Structural steel members	X			
	Steel, concrete, plastics, treated or painted wood	X			
	Paper, untreated/ unpainted cardboard and Combustible Wooden Waste	X			
	Asbestos		X		
	Designated Waste Material including PCB containing fluorescent light ballasts, 6 – 100 lb bags of colored concrete, 11 – 40 L barrels of sodium hydroxide, 30 L of carbon tetrachloride			X	X
	20 pallets of Portland cement			X	
Mill Building including Conveyor galleries	Structural steel members	X			
	Steel, concrete, plastics, treated or painted wood	X			
	Paper, untreated/ unpainted cardboard and Combustible Wooden Waste	X			
	Asbestos		X		
	Designated Waste Materials including 15 pallets of magnesium oxide, 5 pallets of calcium hydroxide			X	
	Yellowcake				X
Powerhouse	Steel, concrete, plastics, treated or painted wood	X			
	Paper, untreated/ unpainted cardboard and Combustible Wooden Waste	X			
	Asbestos		X		

Structure	Major Components[1]	Demolition Waste Temporary Disposal			
		Temporary Storage Cell 1	Designated Materials On-Site Storage	Designated Materials – On-Site Disposal	Hazardous Materials – Containerize for Off-Site Disposal
Surge Bin and Fine Crush Waste Bin	Structural steel members	X			
	Steel, concrete, plastics, treated or painted wood	X			
	Asbestos		X		
Cabins (west of marina)	Paper, untreated/ unpainted cardboard and Combustible Wooden Waste	X			
Cafeteria	Steel, concrete, plastics, treated or painted wood	X			
	Paper, untreated/ unpainted cardboard and Combustible Wooden Waste	X			
	Asbestos		X		
Community Center	Structural steel members	X			
	Steel, concrete, plastics, treated or painted wood	X			
	Paper, untreated/ unpainted cardboard and Combustible Wooden Waste	X			
	Asbestos		X		
	Designated Waste Material including PCB containing fluorescent light ballasts, ammonia hydroxide, ethyl acetate			X	X
Pumphouse	Steel, concrete, plastics, treated or painted wood	X			
	Paper, untreated/ unpainted cardboard and Combustible Wooden Waste	X			
	Asbestos		X		
Sewage Treatment Plant	Steel, concrete, plastics, treated or painted wood	X			
	Paper, untreated/ unpainted cardboard and Combustible Wooden Waste	X			
	Asbestos		X		
Acid Storage Tanks	Steel, concrete, plastics, treated or painted wood	X			

Structure	Major Components[1]	Demolition Waste Temporary Disposal			
		Temporary Storage Cell 1	Designated Materials On-Site Storage	Designated Materials – On-Site Disposal	Hazardous Materials – Containerize for Off-Site Disposal
Concrete Mixing Plant	Steel, concrete, plastics, treated or painted wood	X			
	Asbestos		X		
Docks	Paper, untreated/ unpainted cardboard and Combustible Wooden Waste	X			
Freshwater Storage Tank	Steel, concrete, plastics, treated or painted wood	X			
Tailings Line	Paper, untreated/ unpainted cardboard and Combustible Wooden Waste	X			
Tank at the Tank Farm	Steel, concrete, plastics, treated or painted wood	X			
Utilidors	Paper, untreated/ unpainted cardboard and Combustible Wooden Waste	X			
	Asbestos		X		
Other Demolition items	Barrels	X			
	Transformers				X
	Lead Plated Telephone Lines				X
	Other miscellaneous debris piles scattered over the site	X			