ROBERTS BAY AND IDA BAY
ABANDONED MINE SITES
GEOTECHNICAL ASSESSMENT IN SUPPORT OF THE SITE REMEDIATION PROGRAM

Submitted to:

Public Works and Government Services Canada

Environmental Services, Northern Contaminated Sites
Edmonton, AB

Submitted by:

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EXECUTIVE SUMMARY

AMEC Earth & Environmental, a division of AMEC Americas Limited (AMEC) was retained by Public Works and Government Services Canada (PWGSC) on behalf of the Department of Indian and Northern Affairs Canada (INAC) to undertake a geotechnical and geochemical assessment at the former Roberts Bay and Ida Bay silver mine sites located approximately 115 kilometers southwest of Cambridge Bay, Nunavut. The purpose of this report is to summarize geotechnical information for the mine workings, evaluate site access alternatives, provide a site survey, and present recommendations for the remediation program.

A site survey was completed for Roberts Bay and Ida Bay mine sites, using survey-grade GPS equipment. Data was referenced in UTM coordinates, and control points were installed at the site for future referencing. Site topography was generated with 0.5 m interval contour lines and was provided in both hard copy and electronic format.

Mine openings were inspected and detailed evaluation and measurements were completed in order to provide feasible remedial measures and to minimize safety hazards at the site. The evaluation included two adits and a capped vent raise at Roberts Bay, and one adit and one exploration trench at Ida Bay.

Various alternatives for access to the site were evaluated, including potential beach/barge landing and floatplane access form either Roberts Lake or Melville sound, as well as winter roads, ice roads, and aerial access.

Based on the site investigations and assessments presented in this report, the main conclusions and recommendations for the preparation of the remediation alternatives are as follows:

- A detailed site plan and topographic survey was prepared and is available to be used as a base plan for the remediation program;
- General terrain topography is characterized by low laying morphological features, with maximum elevation difference of 48 m being identified at Roberts Bay mine site, between the site and Roberts Lake water level. The distance between Roberts Bay and Ida Bay mine sites, measured along a proposed winter access road is approximately 6.2 km long;
- During the short open-water season, suitable float plane access was identified along the shorelines of both Roberts Lake and Melville Sound. Suitable barge access was identified at Ida Bay, but not from Roberts Lake, the latter being a land locked body of water;
- Use of overland winter roads and ice roads is recommended for undertaking remedial work, to minimize any additional impact to the surrounding environment;

- For connecting Roberts Bay and Ida Bay mine sites, an all weather access road is not recommended. Rather, a winter road would be more suitable for transport of materials and equipment between the two sites;
- Use of ice roads is recommended for transport of equipment and materials, provided a strict monitoring program is in place;
- Use of helicopter is recommended for both transport of personnel and materials (including debris, equipment to be disposed of site, etc), as well as in emergency situations;
- The mine openings were all partly flooded. Some were partly backfilled. Side walls were found to be stable; however collapse of the adit backs could become a potential problem if not properly addressed. Controlled blasting of the adit backs, followed by backfilling with non-acid generating materials are the preferred alternative for a safe remediation of all three main mine openings;
- Recommendations were made for additional kinetic testing of various waste rock piles, to evaluate their suitability as construction material for remediation alternatives. Results have shown that the waste rock is non-acid generating and therefore could be used to cover and reshape the landfill site, reinforce the tailings pond berm, and backfill mine openings.

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1.0 INTRODUCTION

AMEC Earth & Environmental, a division of AMEC Americas Limited (AMEC) was retained by Public Works and Government Services Canada (PWGSC) on behalf of the Department of Indian and Northern Affairs Canada (INAC) to undertake a geotechnical assessment of the main geomorphological features located at the former Roberts Bay and Ida Bay mine sites in Nunavut, including, but not limited to, the waste rock dumps, tailings pond, mine openings, adits, and access roads to and from the adjacent waters. A site survey was also requested and required detailed contour mapping of the project area and control points to be established.

The properties are located approximately 115 kilometers southwest of Cambridge Bay, Nunavut, and are located within the ORO claim region. During August 2005, a team of engineers, scientists and field technicians from AMEC, Earth Tech, EBA Engineering, and AECOM-UMA Engineering, together with representatives of PWGSC and INAC, visited the Roberts Bay and Ida Bay Mine Sites to investigate site conditions and obtain samples of waste rock, tailings, soil, water, and vegetation for analyses in order to prepare the remediation plan for the mine sites. The objectives of the geotechnical investigation were to:

- Review existing information and perform a site reconnaissance;
- Conduct a detailed assessment of the mine openings (shafts, adits, caps);
- Evaluate access roads and potential landing locations for float planes;
- Complete a site survey of the two mine sites and the surrounding areas, including access roads and main geomorphological features in the area;
- Make recommendations for feasible remediation alternatives; and
- Provide support for the geochemical assessment and characterization of tailings and mine waste rock.

The work related to the latter objective mentioned in the list above was completed and the findings were included in the geochemical assessment program, the report being submitted under a separate cover. Within the context of preparing site remediation plans for the mine sites, the geotechnical work was conducted at the same time with other tasks, such as geochemical investigations, environmental site assessment and human health risk assessment for the sites. Data was shared among the various teams conducting these investigations.

The purpose of the current document is to summarize the findings of the site reconnaissance program, present the geotechnical data collected at the location of both abandoned mine sites, and include recommendations with regards to the site rehabilitation. It is understood that all documents prepared for this work will be used collectively in preparation of remediation plans for both mine sites.

2.0 SITE DESCRIPTION

2.1 Location

Roberts Bay and Ida Bay abandoned silver mines are located approximately 68° 10' 45" N by 106° 33' 29" W about 115 kilometers southwest of Cambridge Bay, Nunavut. The location of the mine sites are indicated on Sheet 1 of 4 (Appendix A).

2.2 Background Information

The Roberts Bay mine site was first staked by the Roberts Mining Company Ltd. in 1964. Silver was discovered at Roberts Bay in 1965. A silver showing was subsequently discovered and staked at Ida Bay in 1966. Exploration of the Ida Bay and Roberts Bay silver showings was conducted by the Hope Bay Silver Syndicate between 1967 and 1972 where exploration activities included trenching, drilling, mapping, and geophysical surveys.

Mining equipment was mobilized to Ida Bay by Hope Bay Mines Ltd. (formerly Hope Bay Mining Co.) in 1973, yielding over 10,000 ounces of high grade silver. The Roberts Bay deposit produced 10 tons of hand sorted ore with highest grades of 4,863 oz/ton (approximately 15%).

In 1974 Hope Bay Mines Ltd. entered into a joint venture with Van Silver Explorations Ltd. and Reako Explorations to upgrade the Roberts Bay mine. A small 50-75 ton/day mill was constructed at the Roberts Bay site and yielded a total of 74,500 ounces of silver until operations ceased in 1975. Further exploration continued at the leases throughout the 1980's and 1990's. In 1997 the Roberts Mining Lease was surrendered and in 1998 the ground was re-staked as the ORO 5 claim.

Rescan Environmental Services Ltd. performed a preliminary assessment of the sites for PWGSC in September 2003.

2.3 Regional Geology

The Roberts Bay and Ida Bay abandoned silver mine lie within the Hope Bay Volcanic Belt, to the north of the Slave Geological Province. The rocks are Archean in age and are members of the Yellowknife Supergroup. The volcanic belt has a width of approximately 15 km and a length of approximately 80 to 100 km, extending from Ida Bay in a south direction. The belt is flanked on either side by pink and grey granite and granodiorite intrusives (Photo 1, Fig. B1, Appendix B).

The rocks in this belt are dominantly mafic to felsic lavas and tuffs, primarily basalts and andesites that have undergone metamorphism to greenschist facies. Intrusives such as granite and granodiorite with quartz veins are common throughout the volcanic belt. Along the margins, at the contact of the volcanics with granite, there are both structural and metamorphic deformations such as faulting and folding.

Both the Roberts Bay and Ida Bay silver mineralization is primarily structurally controlled. The primary structural trend of the ore body is east-west, and dipping to the north with veins and faults containing the economic deposits of silver, copper, lead and zinc ore minerals.

Total production from the two mine sites was reported to be greater than 74,500 and 10,000 ounces of high grade silver from Roberts Bay and Ida Bay mines, respectively. Grades were as high as 4,863 oz/t.

3.0 SITE RECONNAISSANCE

3.1 Roberts Bay Mine Site

3.1.1 General Observations

The Roberts Bay abandoned silver mine is located approximately 1 km north of Roberts Lake. (see Figure 1). A trail leads from the lakeshore of Roberts Lake to the mine site following the crest of a basaltic ridge. The mine site itself is located on and between two basaltic ridges, which run north-south. The site between the ridges occurs on a subtle crest primarily sloping southward and draining between the ridges into Roberts Lake. Parts of the mine site are located north of the crest, potentially draining to the north and subsequently westward into Melville Sound. The low areas between the basaltic ridges are underlain with a coarse textured glacial till with permafrost found about 1.2 to 1.5 m below surface.

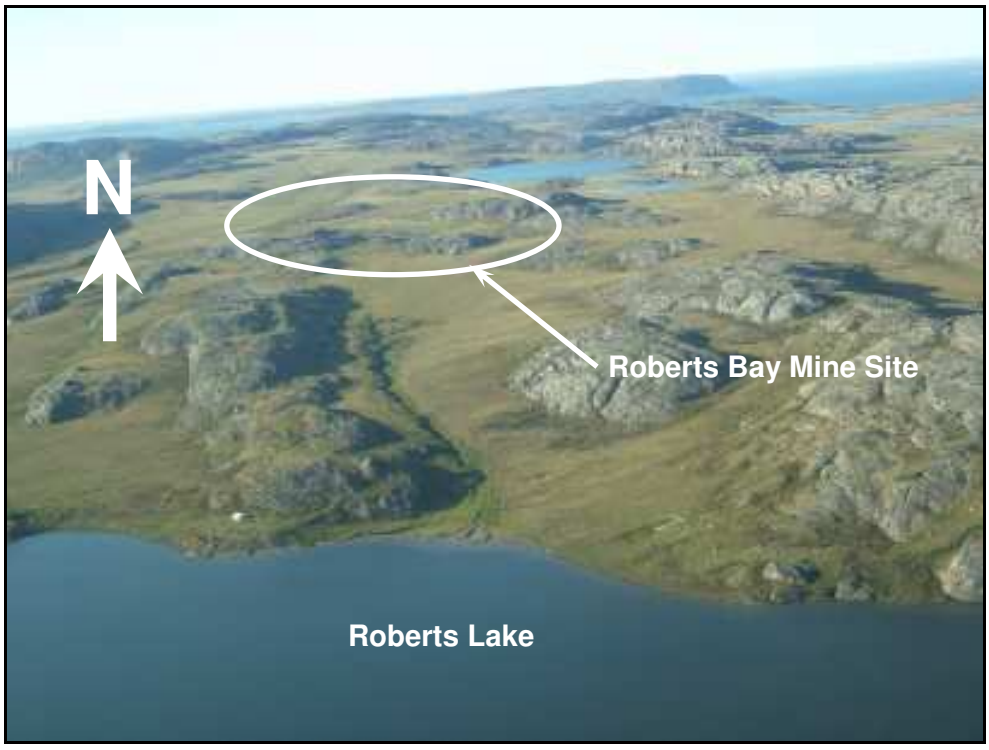


Figure 1: Roberts Bay mine site with Roberts Lake in the forefront. Aerial view looking north.

3.1.2 Main Geotechnical Mining Features

Due to the abandonment of the mine site, most of the infrastructure was left in place and could be observed around the site (Photo 2 and 3, Figure B2, Appendix B). Aside from the equipment and the remaining buildings (presented under a separate cover), the following main mine workings and features remaining at the site were identified (Figure 2):

- Waste rock piles. Waste rock was used all around the site in the construction of berms, roads, mine and mill yard, storage areas, pads, and containment areas. Waste rock is comprised mainly of black, fine grained mafic volcanics with occasional quartz veins and stringers. Limited visible sulphides are locally concentrated on fracture surfaces and within quartz. Trace amounts of oxidation staining on the waste rock were observed. In general, the waste rock is composed of blasted rock fragments, irregular in shape and ranging in size from sand and gravel size to cobbles and occasional boulders (up to 0.5 m). The total estimated volume of waste rock stored at the site is approximately 2,900 m^3. The estimated average size (d_{50}) of all waste rock at Roberts Bay mine site is approximately 50 to 75 mm. The waste rock piles appear to be fairly stable, with slope angle close to the angle of repose or flatter (1H:1V to 1.75H1V). In general, the waste rock was placed in low lying areas or used around facilities. The most prominent waste rock dump is centrally located at Roberts Bay mine site, just south of the shop and mine yard, and measures approximately 6 m in height (Photos 4 and 5, Figure B3, Appendix B). Upon visual evaluation, there was no indication of erosional activity, irregular settlement or consolidation;

- Mine openings. Two adits and a capped vent raise were identified at Roberts Bay mine site. Both adits were left open and partially blocked with waste rock (Photos 6 to 11, Figures B4 to B6, Appendix B). The vent raise appears to be recently concrete capped. Detailed information on the mine openings is presented in Section 5;

- Waste rock berms. Waste rock was used to provide containment and berm support for the landfill site, the fuel bladder, and the tailings pond (Photos 12 to 14, Figures B7 and B8, Appendix B). In general, berms were fairly small in height, low lying, and ranging from 0.5 m at the fuel bladder to 3 to 4 m at the tailings pond;

- Tailings pond. The tailings pond was observed to be fairly small in size, approximately 40 m in diameter (Photos 15 to 19, Figures B8 to B10, Appendix B). The pond was built on the west side of the site, using a wraparound rockfill berm against a ridge (hillside type of impoundment). The total volume of the tailings pond was estimated at approximately 1800 m^3. The berm appears to have been built using local borrow material and rockfill. The presence of a thin polyethylene liner was observed on the upstream slope (Photo 17). The liner was fairly shallow, which suggests that the berm did not effectively contain the decant water. Furthermore, tailings were found downstream of the berm, approximately 20 m to the west of the containment berm. Samples were taken and the confirmation of tailings was based on geochemical testing (samples RBTP-08U and RBTP-08L). At the time of the site reconnaissance, the berm freeboard was measured to be approximately 1.5 m, but the extent of the decant water appears to have risen in the past to near crest level of the berm. From the information available, and noticing that two different types of materials were used for berm construction (local borrow and, on a small area, waste rock), it is most likely that more than one overtopping or a tailings spill occurred at the site, and that efforts had been made to repair the containment system. Tailings material contained over 91% fines fraction (silts and clays) to the south, while the areas to the west and east were classified as sandy materials with only 16% and 30% fines content, respectively. Five tailings samples (three of which were Shelby tubes) were collected from within the

tailings pond area for geotechnical and geochemical testing. Vegetation was observed to grow on the north side of the tailings pond within the area submerged by the ponded water;

- Surface ponds and drainage ditches. A series of surface ponds and drainage ditches were observed to be spread throughout the site without a proper design or clearly defined purpose (Photos 20 and 21, Figure B11, Appendix B). Drainage was mainly overland towards low level areas or the mine openings;

- Site roads. Roads at the site were located along ridges or high points along rock outcrops (Photos 5, 22, and 23, Figures B3 and B12, Appendix B). In addition, only three roads were built using waste rock, which provided access to the powder magazine, Adit #2, and a short portion of the road leading to Ida Bay;

It was also noted that waste rock was used around the mine site in the construction of platforms, berms, and access roads.

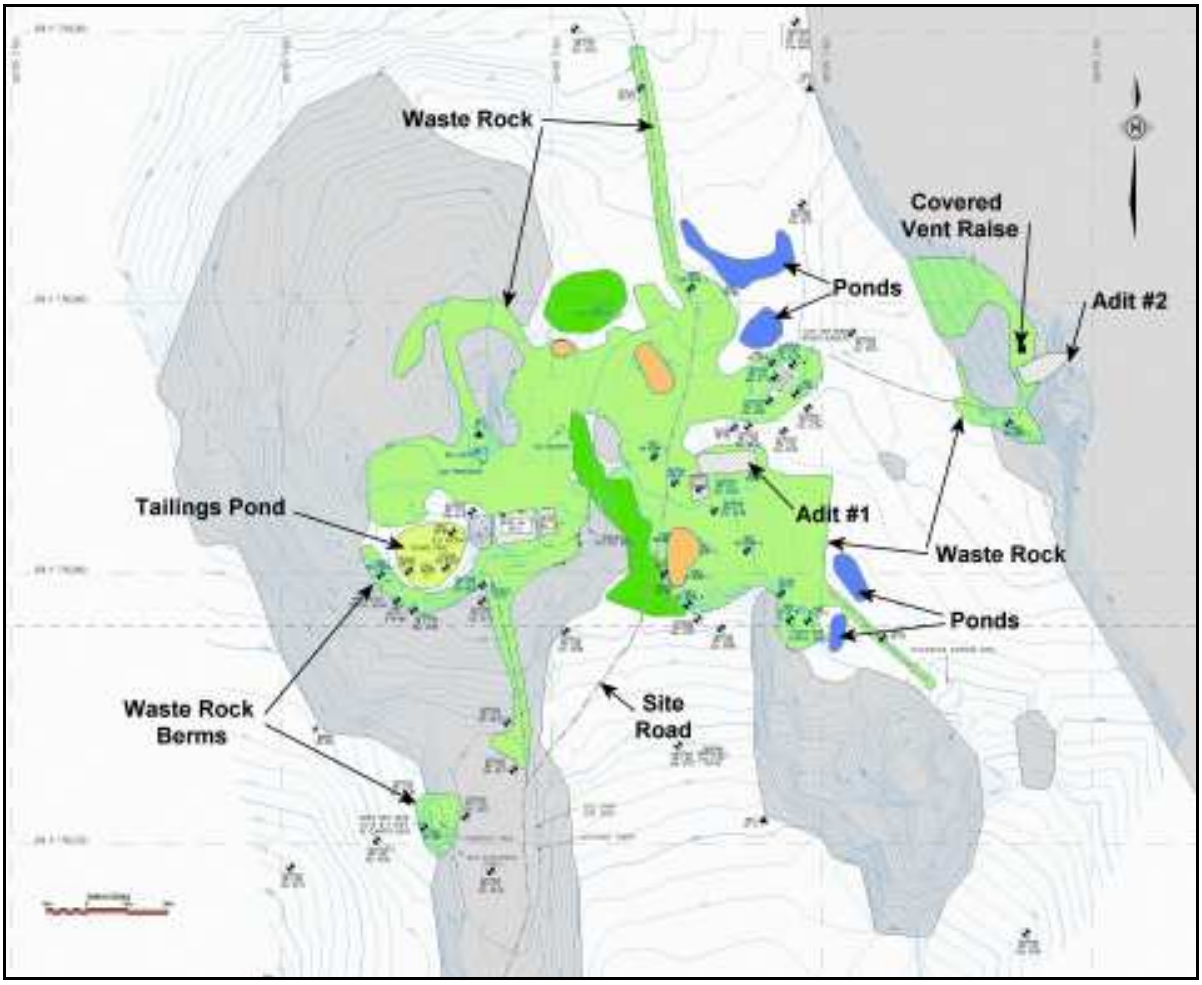


Figure 2: Location of main geotechnical features at Roberts Bay mine site.

3.1.3 Safety Issues

During the site reconnaissance, several safety hazards were identified at Roberts Bay, related to the following:

- Adit #1 was partially backfilled and it was surrounded by a chain link fence, however the measures were poorly implemented and openings in the fence were observed;
- Adit #2 was also partially closed off but is still fully accessible by wildlife or the public from the east. Both adits require immediate attention and a permanent closure solution;
- The vent raise was concrete capped and there were no major safety concerns associated with this structure; however, detailed information related to the design or construction of the concrete cap was not available at this time;
- Additional safety hazards relate to the presence of old structures, wood debris, equipment, and hazardous and non-hazardous material disposed or left in place at the site.

3.2 Ida Bay Mine Site

3.2.1 General Observations

The Ida Bay mine site is located on the north shore of Ida Bay on the Melville Peninsula adjacent to Melville Sound about 6.2 km north of the Roberts Bay site (Figure 3; Sheet 1 of 4, Appendix A). The area is located on a basaltic outcrop with north/south striking ridges. Adjacent to the outcrop are low-lying marshes underlain by coarse textured glacial till. The site drains towards the southeast and east directly into the Melville Sound, which is part of the Arctic Ocean water system.

3.2.2 Main Geotechnical Mining Features

The Ida Bay Mine appears to have been operated as an annex to the Roberts Bay Mine with no milling operations performed on-site. Hand picked ore from the Ida Bay Mine was either transported overland to Roberts Bay or shipped off-site for processing. The prominent features remaining at the abandoned mine site are the following (Figure 4):

- Waste rock piles. Four main waste rock piles were identified at Ida Bay, having a total estimated volume of 2,500 m^3 (Photos 24 and 25, Figure B13, Appendix B). The waste rock piles are all located in the vicinity of the adit, and is dominated by black fine-grained basalt containing small amounts of pyrite in fractures and thin veins of quartz and pink granite (Photos 26 and 27, Figure B14, Appendix B). The composition of the waste rock from across the site was essentially similar. There is no visible oxidation staining, and all waste rock materials are well consolidated with stable slopes. The waste rock pile closer to the north shore extends into the marine waters and could be partially covered by seawater at high tide. The waste rock piles were of small size, with a maximum height of 4 m, and slopes at the angle of repose were observed to be fairly stable;

Figure 3: Ida Bay mine site. Aerial view looking northwest.

- Mine openings. There was only one adit, a vent raise and an exploration trench at Ida Bay. The adit was not fenced and was partly submerged. The vent raise was small in size but open. The exploration trench was approximately 1 m deep and 5 to 8 m long. These features are shown in Photos 28 to 31, Figures B15 and B16, in Appendix B. Detailed information on the mine openings is presented in Section 5.

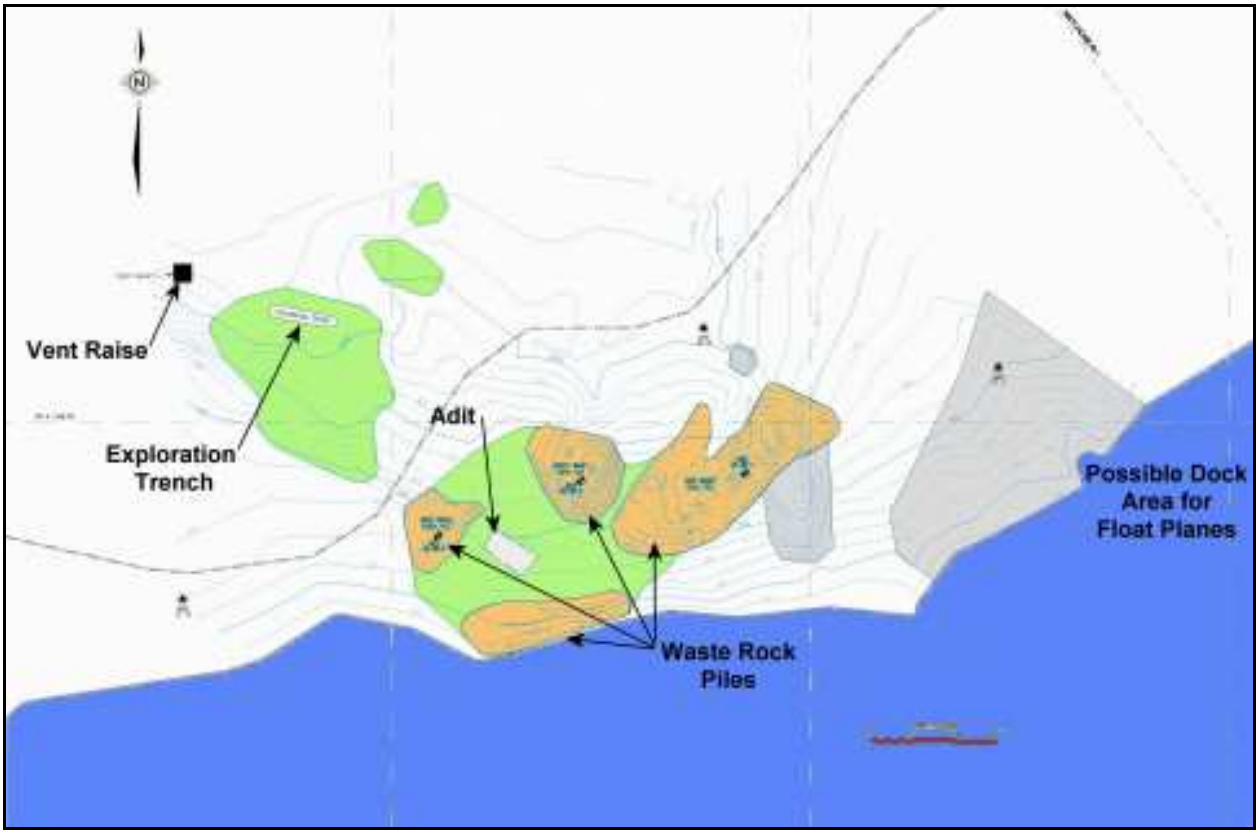


Figure 4: Location of main geotechnical features at Ida Bay mine site.

3.2.3 Safety Issues

During the site reconnaissance, the following safety hazards were identified at Ida Bay mine site:

- The adit was left open and was not fenced. At the crown, the adit had an opening behind the timber structure, showing signs of instability, and will require a permanent closure solution;
- The vent raise, although small in size, presents a hazard for both wildlife and the public. The vent raise will require immediate attention and a permanent closure solution;
- The exploration trench will have to be reshaped and/or backfilled and leveled to grade.

4.0 TOPOGRAPHIC SURVEY

During the site reconnaissance program, a detailed topographic survey was completed, using survey-grade Global Positioning System (GPS) equipment. The equipment used was a Trimble 5800 Real Time Kinematic (RTK) system, with a relative accuracy of +/-20mm + 1 ppm (Photo 32, Figure B17, Appendix B). The base station was located on control point 10 for the Roberts Bay portion and control point 16 for the Ida Bay survey, as shown on Sheets 3 and 4 (Appendix A). These locations were relative high ground locations that afforded suitable radio contact for the base to rover correction transmissions. The two sites were connected by continuous survey and referenced with additional monuments for future coordinate re-establishment. Data reduction was completed in the office, compiling in excess of 1600 points. The coordinate system is UTM Zone 13N, using NAD 83. The sheets presented in Appendix A are drawn at a 1:500 scale for ease of manipulation. Contour lines were generated every 0.5 m.

The survey included the following features:

- Access road from Roberts Lake to Roberts Bay mine site;
- Roberts Bay mine site, workings, and adjacent areas (valley, etc.);
- Access road connecting Roberts Bay to Ida Bay mine sites; and
- Ida Bay mine site, workings, shoreline, and former camp site.

The survey achieved the following goals:

- Provided a detailed topographic map of the two project areas. The maps were used in the current project to locate topographic features and mine reference points, and will become the reference map (base map) for the detailed engineering stage of the remediation plan;
- Provided information related to distance, areas, and volume calculations for roads, mine workings, and terrain analysis;
- Established tie-in points (using 30” rebar) across the site for future references;
- Data can be used, where necessary, to provide a 3D view, fly-over presentation, or scale model of the mine sites;
- Final remediation alternatives can be simulated in a 3D model for presentation purposes.

The topographic survey and data reduction was compiled and stored on a CD in a .dwg format files (AutoCad V. 2000), and is included in Appendix C.

5.0 ASSESSMENT OF MINE OPENINGS

5.1 Roberts Bay Mine Site

5.1.1 Adit #1

Adit #1 is centrally located at the Roberts Bay mine site (Figure 2, and sheet 2 of 4, Appendix A) and is oriented in an east-west direction. Figure 5 presents a plan view, a front view of the entrance, and a longitudinal cross section through the adit and the ramp. The ramp is approximately 5 to 7 m wide, 15 to 18 m long and slopes at 5H:1V.

At the time of the site reconnaissance, the adit was 1/3 filled with water and the access ramp was partly blocked by debris. A portion of the adit entrance was boarded and backfilled. A timber structure supported the back of the adit, which was measured to be approximately 1.5 m thick. The adit back appeared to be overburden material supported by the timber structure within the adit. The adit entrance (the opening) was estimated to measure approximately 2.2 to 2.5 m in height.

Adit #1 was at one time covered by a tubular tent-like steel structure, anchored in the rock, and left in place. Textile cover material has been destroyed over time. The adit entrance was observed to have rock slopes that were fairly steep, blocky in nature, and relatively stable. Rock joints were observed to follow an orthogonal pattern, with the main joint set dipping at 20 to 30 degrees to the west Several blocks of rock, 0.6 by 0.4 by 0.5 m in size, were found to be in an unstable position. The north wall of the ramp was partly covered by fine grained (overburden) material.

5.1.2 Adit #2

Adit #2 is located on a ridge on the east side of the Roberts Bay mine site (Sheet 2 of 4, Appendix A) and is oriented in an east-west direction, similar to Adit #1. Figure 6 presents a plan view, a front view of the entrance, and a longitudinal cross section through Adit #2 and the ramp. Adit #2 is not a true adit but rather an adit – shaft combination. The entrance is fairly steep, measuring approximately 9 to 10 m in length, 4 m wide, and sloping at 10H:1V at the far end, and 1H:4V closer to the entrance.

At the time of the site reconnaissance, the adit was not filled with water. The steep portion of the ramp was partly blocked by debris, the entrance was partly backfilled, and a deformed and unstable timber structure was supporting the adit back. The adit structure, approximately 1 m thick, appeared to be made of overburden material supported by the timber structure farther inside the adit. Stability problems with the entrance to the adit and cave-ins of the rock and overburden surrounding the shaft were observed. The adit entrance (the opening) was estimated to measure approximately 2.5 m in height.

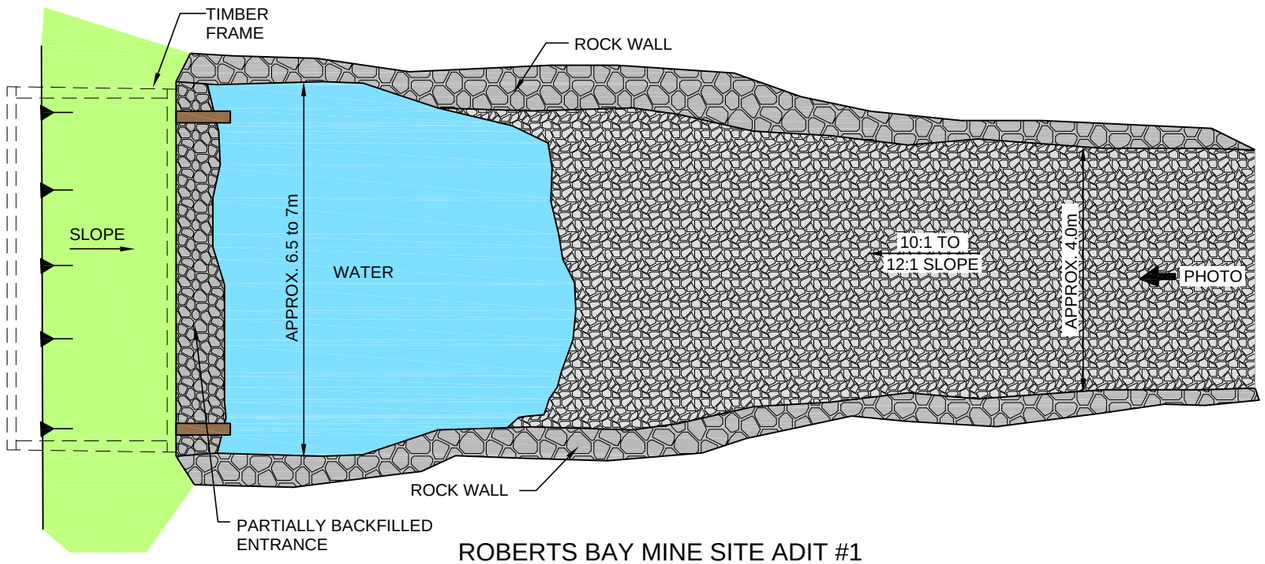
The adit entrance was observed to consist of fairly steep side slopes up to 6 m above the floor of the entrance and comprised of rock with a blocky structure. Rock joints were observed to have variable orientations. Several blocks of rock up to 1 m by 1m in dimension were noted to

be in an unstable position, mainly on the north side wall. Adit #2 was partly fenced, but is still accessible to wildlife and the public.

5.1.3 Capped Vent Raise

A concrete capped vent raise was identified at Roberts Bay Mine site, on the same eastern ridge and just 6 to 8 m to the north of the edge of Adit #2 (see Sheet 2 of 4, Appendix A; Photo 11, Figure B6, Appendix B). The concrete cap measured approximately 1.5 m by 1.5 m in plan view, and was 20 cm thick. It appeared that the concrete cap was installed on top of a concrete ring.

The concrete was found to be in good shape, with no fissures or fractures. However, no construction drawings were found related to the concrete cap, and therefore the reinforcement and strength of the concrete cap are unknown at this time.



ROBERTS BAY MINE SITE ADIT #1

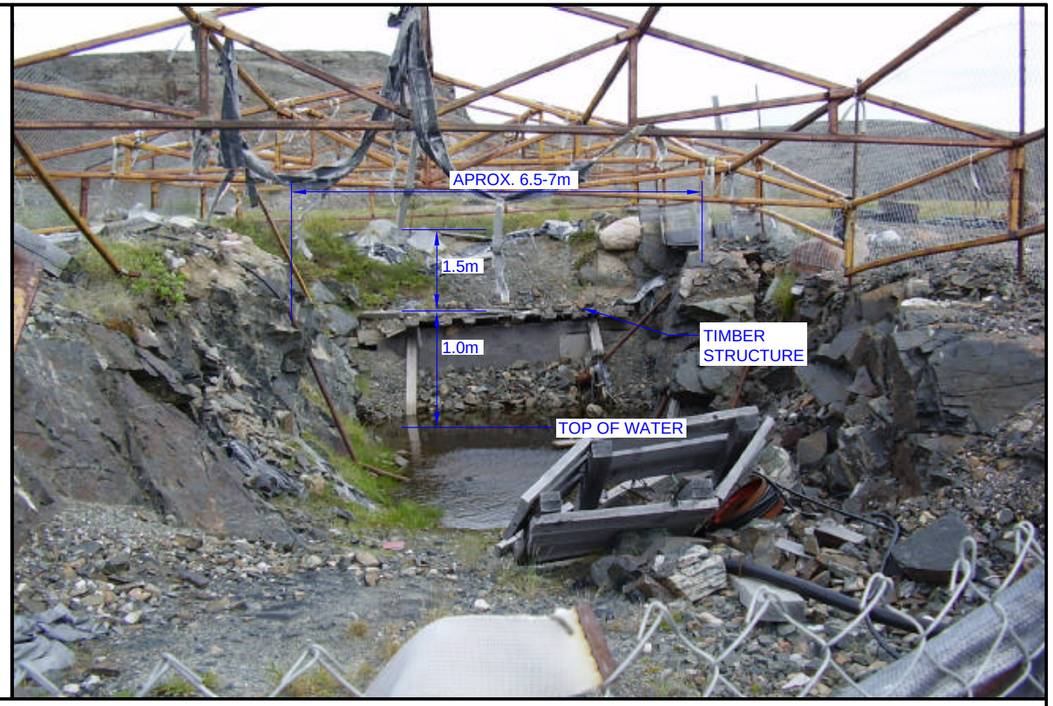
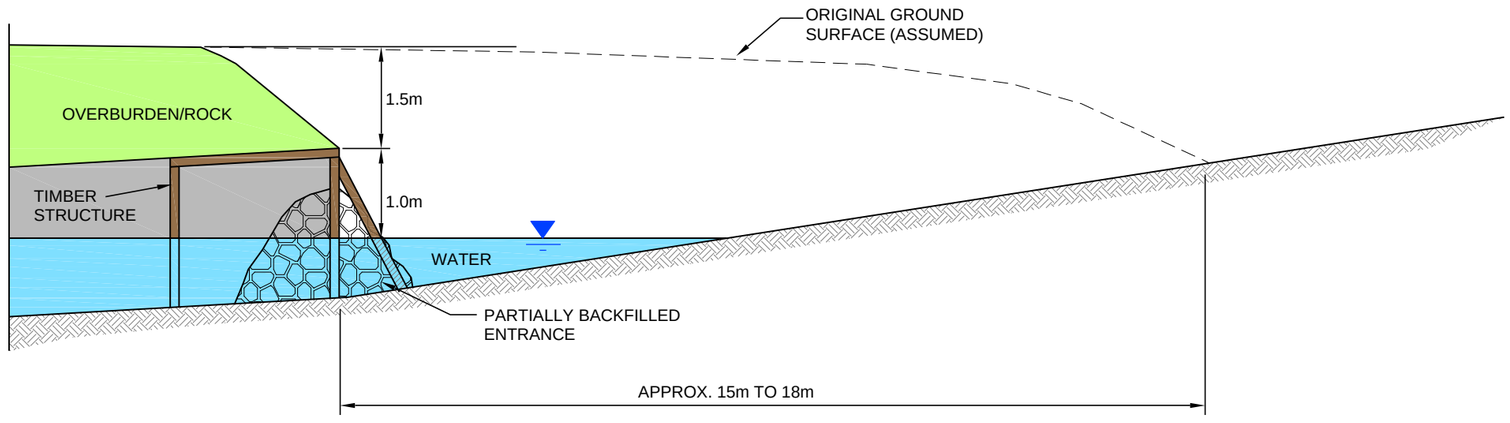


PHOTO LOOKING AT ADIT ENTRANCE



ROBERTS BAY MINE SITE ADIT #1 LONGITUDINAL SECTION

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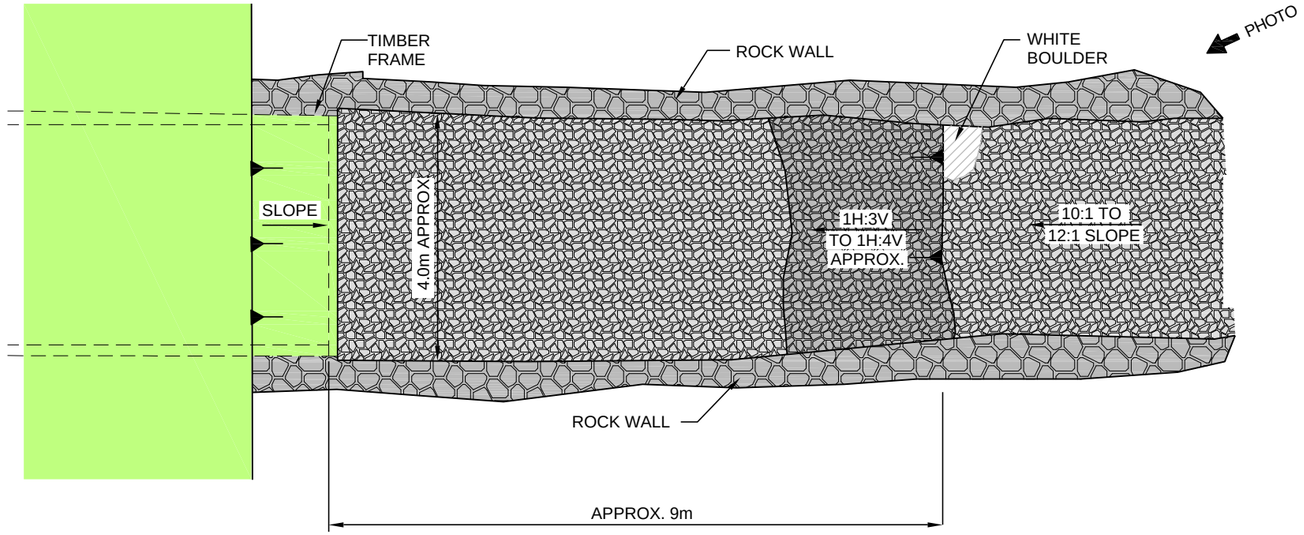
CHK'D BY: CP
DATUM:
PROJECTION:
SCALE: AS SHOWN

PROJECT: ROBERTS BAY AND IDA BAY MINE SITE REMDIATION

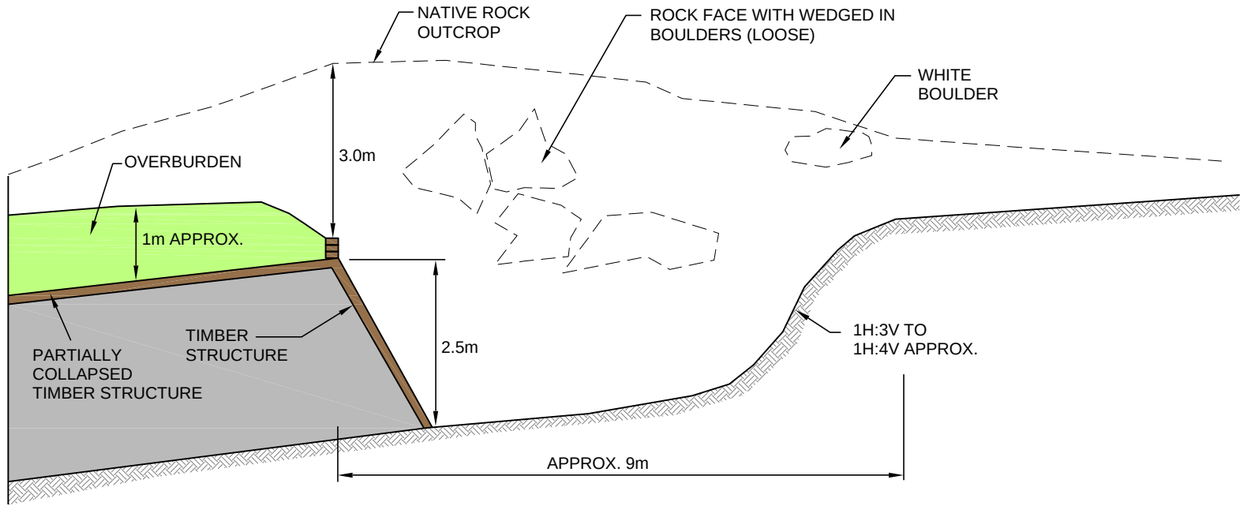
TITLE: ROBERTS BAY MINE SITE ADIT #1 PLAN AND SECTION

DATE: JAN. 2007
PROJECT NO: WX15131-3000
REV. NO.: A
FIGURE No. FIGURE 5



ROBERTS BAY MINE SITE ADIT #2

PHOTO LOOKING AT ADIT ENTRANCE



ROBERTS BAY ADIT #2 MINE SITE LONGITUDINAL SECTION

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CHK'D BY: CP
DATUM: -
PROJECTION: -
SCALE: AS SHOWN

PROJECT: ROBERTS BAY AND IDA BAY MINE SITE REMDIATION

DATE: JAN. 2007
PROJECT NO: WX15131-3000
REV. NO.: A
FIGURE No. FIGURE 6

TITLE: ROBERTS BAY MINE SITE ADIT #2 PLAN AND SECTION

5.2 Ida Bay Mine Site

5.2.1 Ida Bay Adit

Ida Bay Adit is located approximately 30 m away from the north shore of Ida Bay mine at Melville sound (Sheet 4 of 4, Appendix A) and is oriented in a north-south direction. Figure 7 presents a plan view, a front view of the entrance, and a longitudinal cross section through the adit and the ramp. The ramp is approximately 5.5 m wide, 15 m long and slopes at 2.5H:1V (overall slope).

At the time of the site reconnaissance, the adit was half filled with water. The adit entrance was not backfilled and a timber structure supported the adit back, which was measured to be approximately 1.8 m thick and comprised of overburden. A hole was observed in the back of the adit, and it appeared unstable.

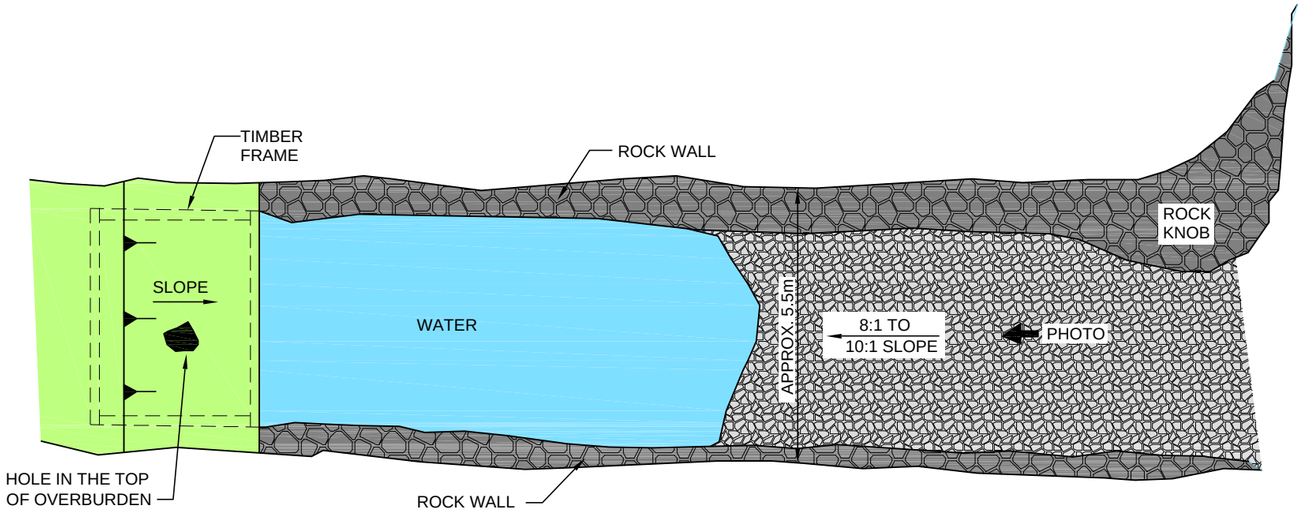
The adit entrance (the opening) was estimated to measure approximately 3.0 to 3.5 m in height with side slopes that were observed to be comprised of fairly steep, blocky and stable rock. Rock joints were observed to dip around 32º and strike 68º to the north. Thick veins (8 to 9 cm) of quartz and reddish pink granites alternating with green and gray coloured granitic rocks were observed on the rock faces of the side walls. Overhanging boulders were noted at the entrance.

Ida Bay Adit was neither fenced nor backfilled or blocked.

5.2.2 Exploration Trenches and Vent Raise

A shallow exploration trench was present at Ida Bay mine site (Sheet 4 of 4), located to the southeast side of the site. The trench was oriented in a northeast – southwest direction, and measured approximately 1 m deep and 8 to 10 m long. Additional smaller trenches extended in the same direction within its vicinity.

A vent raise, measuring less than 0.5 m in diameter was left open within the trench.



IDA BAY MINE SITE ADIT PLAN

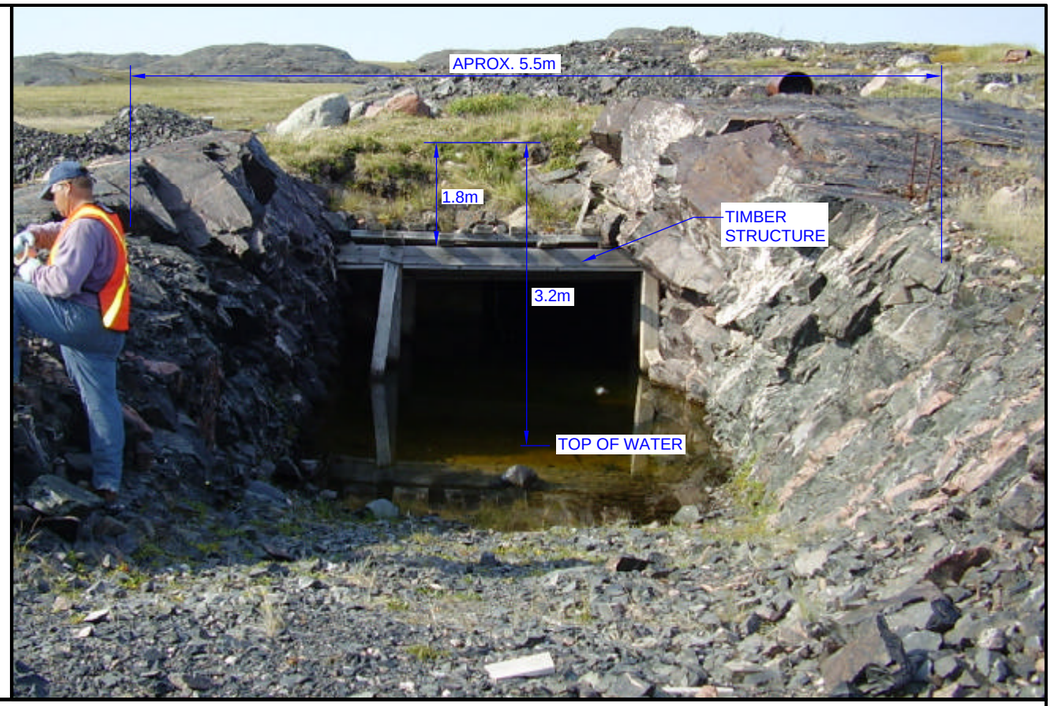
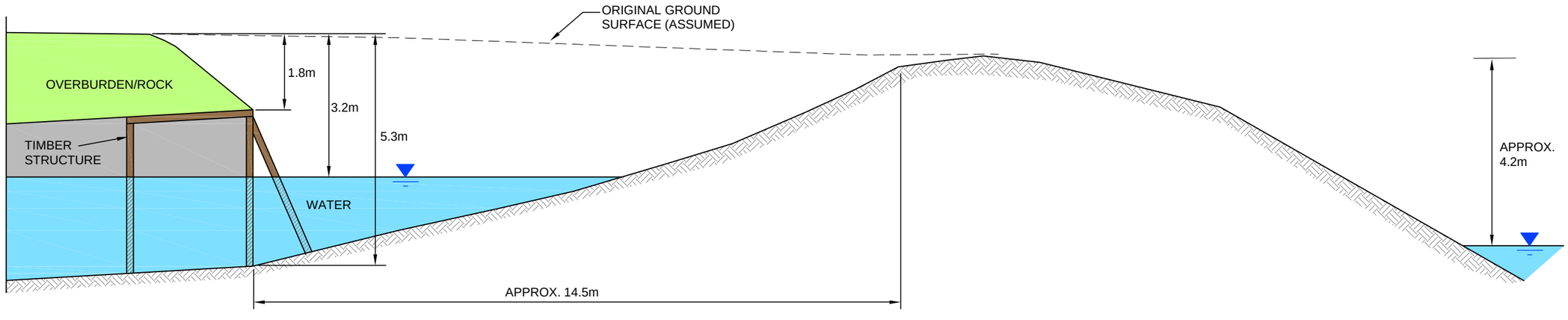


PHOTO LOOKING AT ADIT ENTRANCE



IDA BAY MINE SITE ADIT LONGITUDINAL SECTION

CLIENT: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA	DWN BY: SM	PROJECT: ROBERTS BAY AND IDA BAY MINE SITE REMDIATION	DATE: JAN. 2006
	CHK'D BY: CP		PROJECT NO: WX15131-3000
AMEC Earth & Environmental 2227 Douglas Road, Burnaby, B.C., V5C 5A9 Tel. 604-294-3811 Fax 604-249-4664	DATUM: -	TITLE: IDA BAY MINE SITE ADIT PLAN AND SECTION	REV. NO.: A
	PROJECTION: -		FIGURE No. FIGURE 7
	SCALE: AS SHOWN		

6.0 SITE ACCESS

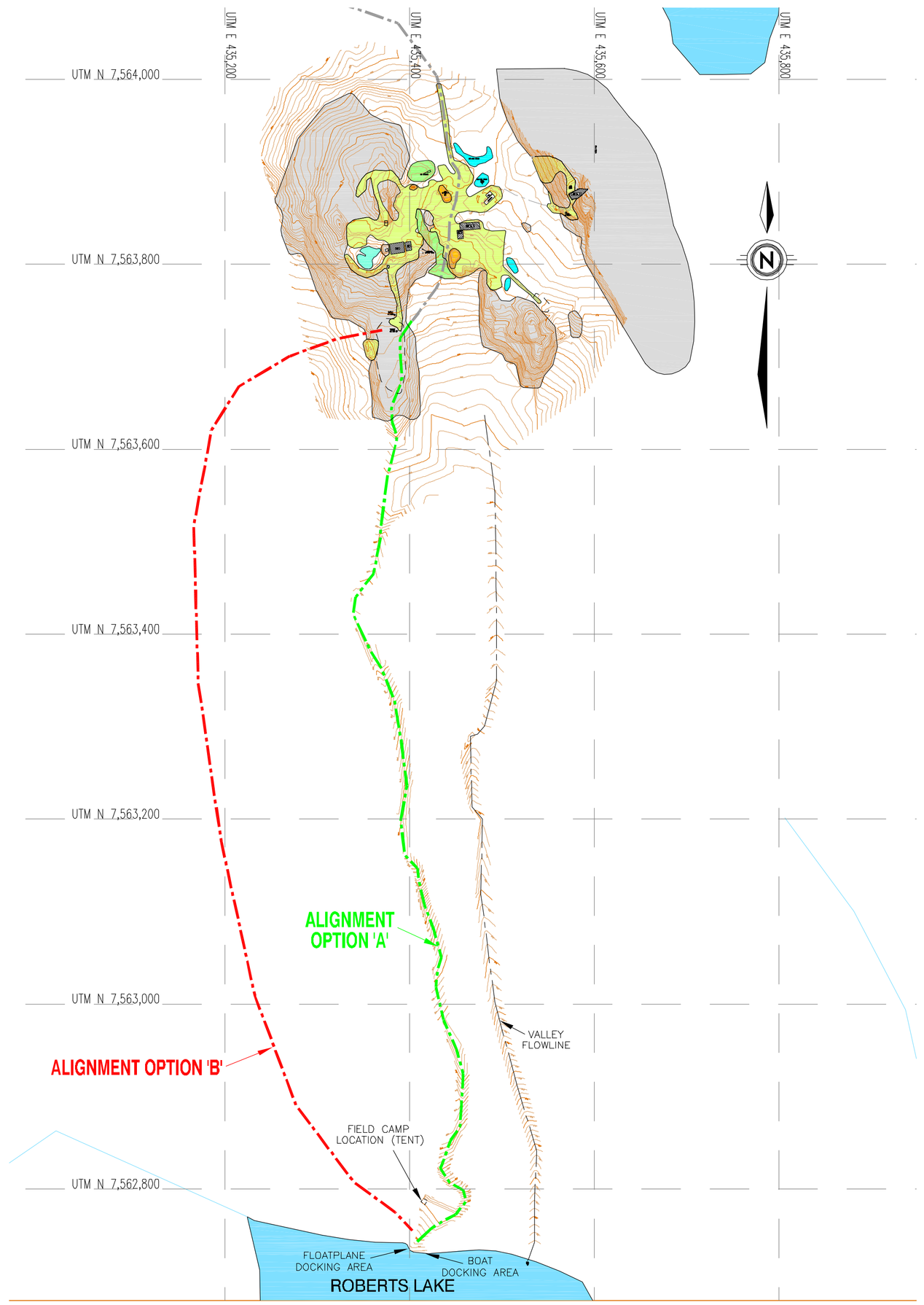
6.1 Access Roads

Roberts Bay and Ida Bay mine sites are located in a remote arctic environment, approximately 115 km southwest of Cambridge Bay, Nunavut. Overland access roads to the mine sites are nonexistent.

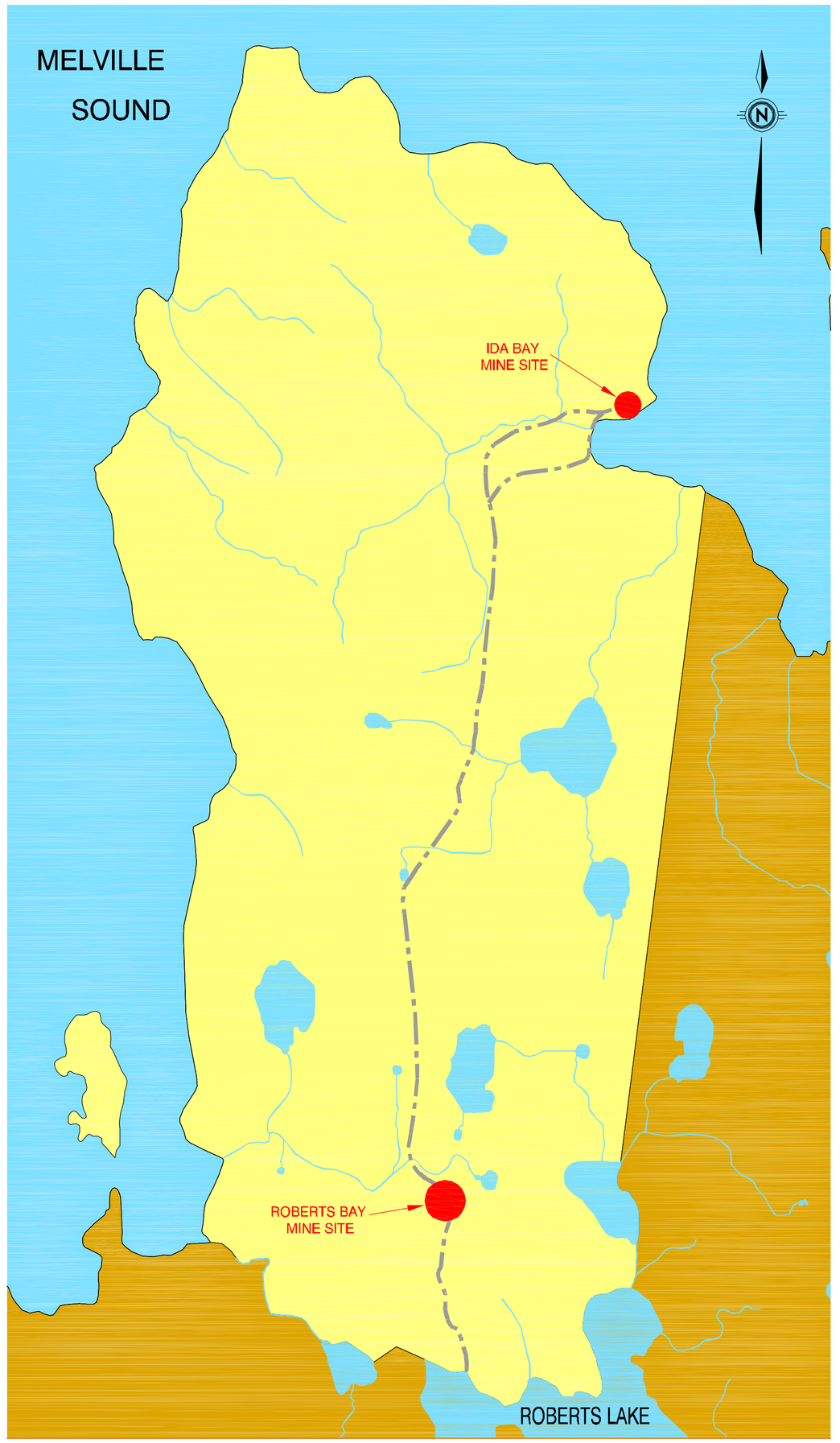
The Roberts Bay abandoned silver mine is located approximately 1 km north of Roberts Lake. A road leads from the lakeshore to the mine site following the crest of a basaltic ridge. The mine site itself is located atop a series of basaltic outcrops with mine waste rock used to level areas of the site for mine surface infrastructure. The resulting waste rock pad varies in thickness from a thin veneer to upwards of 2 metres, as dictated by local topography. The road from Roberts Lake to the Roberts Bay Mine Site was constructed, where necessary, using both esker and waste rock materials. Where fill material is not present, the road crosses over existing outcrops. This road alignment, presented in Figure 8 (Alignment A), is fairly rough and provides limited access to the mine site. The road was made mainly for all terrain vehicle access (ATVs) and snowmobiles with small size trailers or similar equipment. Heavy construction equipment would not be able to use this road due to several steeply graded sections, narrow width, limited ground clearance, and tight curves across the ridge.

Adjacent to the site are a series of low-lying marshes underlain by glacial till, all of which slope to the south and drain towards Roberts Lake. Basalt ridges were identified in the lowlands surrounding the immediate project area. Alternative alignments (e.g., Alignment B, Figure 8) are technically feasible provided a road base is constructed to ensure proper vehicle support in softer areas. Where necessary, geogrid reinforcement underlying the road base fill material may be required, and can be removed once the remediation program is completed and the fill material is excavated.

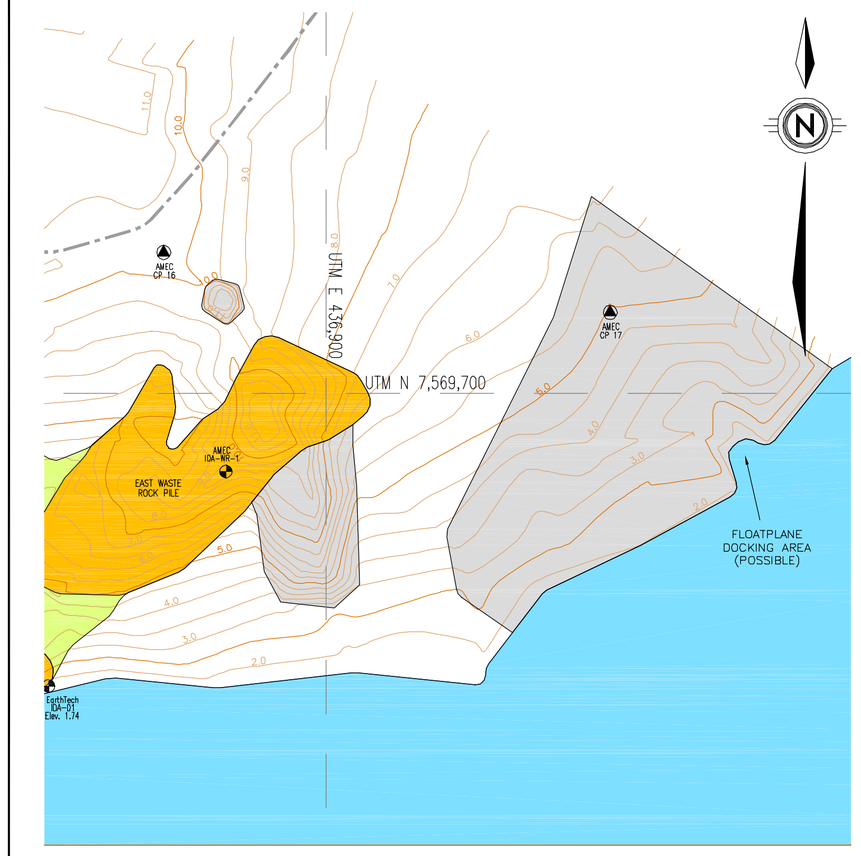
An overland access road connecting Roberts Bay to Ida Bay mine sites is feasible. However, due to the presence of soft ground in low lying areas, the uneven and rough nature of the terrain, potential costs associated with the volumes of fill placement and removal, and the inherent disturbance of a pristine and untouched environment associated with the construction of this road (over 6.2 km long) make this alternative less desirable.



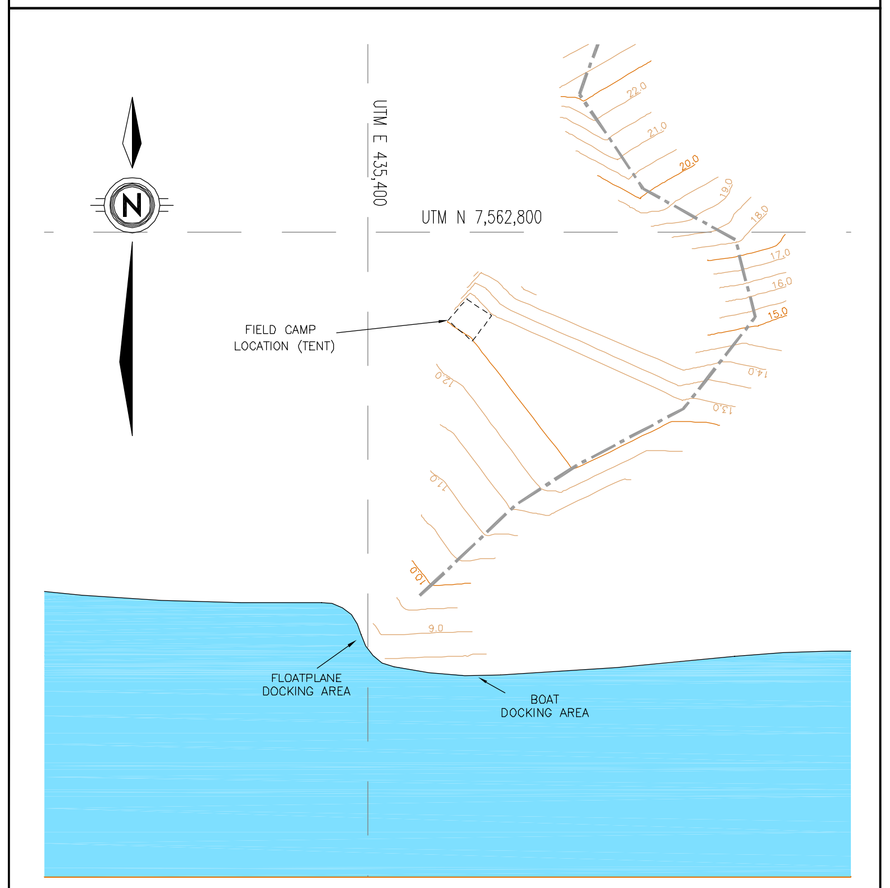
ROBERTS BAY MINE
ACCESS ALIGNMENT OPTIONS
NOT TO SCALE



LOCATION PLAN
NOT TO SCALE



IDA BAY - FLOAT PLANE ACCESS
NOT TO SCALE



ROBERTS BAY - FLOAT PLANE ACCESS
NOT TO SCALE

NOTES:

1. ALL UNITS ARE IN METERS UNLESS OTHERWISE NOTED.
2. COORDINATE SYSTEM USED IS UTM - ZONE 13 N, NAD83

SURVEYED	BY	DATE
	AMEC Land Surveys Limited	Aug 2005

LEGEND:

- WASTE ROCK PILE
- ROCK OUTCROP
- EXISTING (ROUGH) TRAIL
- WASTE ROCK AREA
- OVERBURDEN AREA
- CONCRETE AREA

NO.	REVISION	DATE	BY	CK'D	APP'D
.	.	.	.	.	.

R.E.T.
REGISTERED ENGINEERING TECHNOLOGIST
BRENT CAMPBELL
11923
ALBERTA

SIGNED: BRENT CAMPBELL
DATED: December 20, 2006

SCALE	AS SHOWN
DATE	MARCH 2006
SURVEYED	B.A.C.
DRAWN	B.A.C.
CHECKED	C.P.
APPROVED	B.A.C.

CLIENT NAME	PUBLIC WORKS AND GOVERNMENT SERVICES CANADA
PROJECT NAME	ROBERTS BAY & IDA BAY MINE SITE REMEDIATION
DRAWING TITLE	ROBERTS BAY & IDA BAY MINE SITE ACCESS OPTION OVERVIEW
PROJECT NUMBER	ALS050052
DWG. NO.	ALS050052-REV1
FIGURE	8

AMEC Land Surveys Limited

6.2 Open Water Access

Roberts Lake is a land-locked body of water and hence, it is not accessible by barge or boats. Open water access and transport at Roberts Bay mine site could only be done through Melville Sound and Ida Bay mine site.

An unloading area for a barge from Melville Sound to Ida Bay mine site was identified and located approximately 100 m to the northwest from the mine site. The shoreline at this location presents a steep drop in profile. The shore is mainly bare rock outcrops, so landing and transport on shore would be simpler. The landing point is estimated to be around 7 or 8 m wide. The depth of water could not be measured, but is expected to be in excess of 2 m at a distance of 2 to 3 m from shoreline. When selecting a barge, careful consideration should be given to the draft requirements under a full load. In addition, tidal water elevations should be monitored and coordinated with the requirements of maximum draft under full load. Barge landing should be avoided at a low tide level (Photos 33 to 36, Figures B17 to B19, Appendix B).

6.3 Ice Roads

Ice roads have been used in the past in the area, connecting the mine sites to Cambridge Bay (approximately 116 km long). Based on previous experience of local contractors, ice roads can be used in late winter and early spring, but not beyond mid-April.

Ice roads are an effective alternative to the use of barges for the transport of equipment and materials. Ice roads are high maintenance, and close monitoring of ice roads is of paramount importance to ensure safety of workers and equipment.

6.4 Air Access

Currently, there are no air strips present at any of the two mine sites. It is most likely that an air strip will not be built for remediation purposes. Access by air would be limited to the following alternatives:

- Float plane. This is a feasible alternative (Photo 37, Figure B19, Appendix B), which could be used to bring supplies and personnel to the site during open water season (June 15 to September 15). Float plane landing points are envisaged at Roberts Lake, approximately 1 km south of Roberts Bay mine site, and at the proposed docking location on the north shore of Ida Bay mine site at Melville Sound. Float plane access from Roberts Lake could be fairly limited. The depth of water in Roberts Lake is sufficient for landing; however, the shoreline presents a rugged terrain that is not suitable for boats or floatplanes requiring a large draft under full load. The shoreline at Roberts Lake is fairly shallow, sloping at a gentle angle to the water. Float plan landing on Melville Sound, along the north shore at Ida Bay mine site is feasible provided that

float planes land at the preferred barge landing location, where a steep shore and deep waters were identified. Eastern shoreline at Ida Bay is fairly shallow and access is limited;

- Helicopter. A helicopter pad could be easily prepared at both mine sites (Photo 38, Figure B20, Appendix B). There is limited or no vegetation at the sites, and low lying terrain morphology provides good opportunity and visibility for helicopter landing and take off. The pad would have to be built on a waste rock pad built on solid ground, or directly on a flat area adjacent to the mine site. This could be a very efficient way of accessing the site without any major disturbance to the environment. Helicopter access could be considered for emergency situations, for transport of supplies, personnel, and also removal of material form the site (debris, equipment, etc.).

7.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the site investigations and assessments presented in this report, the main conclusions and recommendations for the preparation of the remediation alternatives are as follows:

- A detailed site plan and topographic survey was prepared and is available to be used as a base plan for the remediation program;
- General terrain topography is characterized by low lying morphological features, with maximum elevation difference of 48 m being identified at Roberts Bay mine site, between the site and Roberts Lake water level. The distance between Roberts Bay and Ida Bay mine sites, measured along a proposed winter access road is approximately 6.2 km long;
- During the short open-water season, suitable float plane access was identified along the shorelines of both Roberts Lake and Melville Sound. Suitable barge access was identified at Ida Bay, but not from Roberts Lake, the latter being a land locked body of water;
- Use of overland winter roads and ice roads is recommended for undertaking remedial work, to minimize any additional impact to the surrounding environment;
- Use of ice roads is recommended for transport of equipment and materials, provided a strict monitoring program is in place;
- Use of helicopter is recommended for both transport of personnel and materials (including debris, equipment to be disposed of off-site, etc.), as well as in emergency situations;
- The mine openings were all partly flooded. Some were partly backfilled. Side walls were found to be stable, however back collapse could become a potential problem if not properly addressed. Controlled blasting of the adit backs, followed by backfilling with non-acid generating materials are the preferred alternative for a safe remediation of all three main mine openings;
- Recommendations are made for additional kinetic testing of various waste rock piles, to evaluate their suitability as construction material for remediation alternatives. If acceptable, non-acid generating waste rock could be used to cover and reshape the landfill site, reinforce the tailings pond berm, and backfill mine openings.

8.0 CLOSURE

The findings and recommendations presented in this report were based on the results of field and laboratory investigations, combined with an interpretation of test results and information from previous reports. If conditions are encountered that appear to be different from those shown and described in this report, or if the assumptions stated herein are not in keeping with the proposed project, this office should be notified in order that the recommendations can be reviewed and adjusted, if necessary.

Soil conditions, by their nature, can be highly variable across a site. The placement or removal of fill material and other prior construction activities on a site can contribute to the variability, especially near surface. A contingency should always be included in any construction budget to allow for the possibility of variation in soil conditions, which may result in modification of the design and construction procedures.

This report was prepared exclusively for Public Works and Government Services Canada and their agents, for the proposed remediation project as described in the report. The data and recommendations provided herein should not be used for any other purpose, or by any other parties, without review and advice from qualified engineering personnel. The findings and recommendations of this report were prepared in accordance with generally accepted professional engineering principles and practice. No other warranty, expressed or implied, is given.

This report was prepared by Dr. Caius Priscu, P.Eng and Dr. Jim Warren, P.Ag, P.Geo. The site survey and preparation of drawings was completed by Mr. Brent Campbell of AMEC Land Surveys Limited. Senior review was provided by Mr. Larry Connell, P.Eng and Mr. Stuart Anderson, P.Eng. If you have any questions or comments regarding this work, please do not hesitate to contact Dr. Caius Priscu.

Respectfully submitted,

AMEC Earth & Environmental
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9.0 REFERENCES

Rescan Environmental Services Ltd. (Rescan) 2003. Preliminary Assessment of Roberts Bay and Ida Bay Abandoned Mine Sites, Nunavut, Canada. Report prepared for Public Works and Government Services Canada, September 2003.

APPENDIX A

Site Survey Sheets

APPENDIX B

Photographic Record

APPENDIX C

CD-ROM – Topographic Survey Information