Nunavut Impact Review Board Project Specific Information Requirements for the Proposed North Pole River Access Road, Repulse Bay, NU

FINAL

Prepared for:
Hamlet of Repulse Bay
Repulse Bay, NU

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Executive Summary

The Hamlet of Repulse Bay (the Hamlet) needs to develop granular resource sites to allow for municipal road construction and other community projects. Four granular deposits have been identified northwest of the Hamlet and a preliminary design for a road to access these sites was designed by FSC Architects and Engineers in 2002. The Project in question involves the construction of a 7.68 km long road to the North Pole River to access and develop these granular resource sites. Secondarily, the access road will improve public access to the North Pole River, which is frequented by community members. The Hamlet requested Nunami Jacques Whitford Limited (NJWL) to complete an environmental survey of the proposed access road to the North Pole River and obtain, on behalf of the Hamlet, all required permits and approvals.

The proposed access road does not extend beyond the Hamlet's municipal boundary, however a project proposal needs to be prepared and submitted to the Nunavut Impact Review Board (NIRB) for screening. NJWL has prepared the NIRB project proposal and this Project Specific Information Requirement (PSIR) to facilitate the NIRB screening process. Authorization from the Nunavut Water Board is also required as the access road will cross seven water bodies, including six streams and the drainage area between an unnamed freshwater lake and the marine Tariuraq Inlet. An application and supplementary questionnaire have been prepared and submitted to the NWB for approval.

The Project area is located within the Wager Bay Plateau ecoregion of the Northern Arctic ecozone and in the continuous permafrost region. Terrain is primarily large bedrock outcrops and hills, interspersed by valleys and lowlands. Bedrock outcrops are typically unvegetated, though valley bottoms and other low-lying and depressional areas are vegetated as soil and moisture have accumulated. Lichens were the dominant species across the Project area however grass and sedge species were also prevalent, as were purple saxifrage, Arctic white heather and mountain avens. Only a few wildlife species were observed during the environmental survey, including Arctic ground squirrel, Canada geese, common raven, ptarmigan, gulls, Lapland longspur and other unidentified songbird species. Wildlife sign (scat, tracks) was noted at several locations throughout the Project area, belonging to Arctic fox, caribou, geese, and sandhill crane. Two fish species, a ninespine stickleback and unidentified juvenile salmonid, were also observed in two waterbodies along the Project route.

The population of Repulse Bay was estimated at 748 in 2006. The economy of Repulse Bay is largely traditional and many residents engage in traditional hunting and fishing. Species typically harvested by Repulse Bay residents include caribou, Arctic fox, wolf, polar bear, ringed seals, narwhal, beluga and Arctic char. Recorded archaeological sites in the Project area are predominantly associated with the modern coastline, reflecting the maritime focused economic and settlement patterns of the residents. Earlier sites further inland may also be present as evidence indicates that in the past, the coast most likely extended further inland, and inland water bodies in the vicinity of the proposed route may have been seasonally targeted by Precontact and Contact Period culture groups. At least three sites with the potential for multiple features were identified by the accompanying Elder Sata Kidlapik and Hamlet Foreman Roland Tungilik; these were within the recommended 30-metre buffer, as were numerous inuksuit along the proposed route.

The Project route is presently marked by survey stakes. A well-used ATV trail is also present along the majority of the Project route; this existing trail leads to the North Pole River and has not been constructed or improved. Construction and operation of the proposed access road has the potential to interact with identified valued environmental components (VECs), including permafrost, hydrology and water quality, vegetation, terrestrial wildlife, fisheries, the local economy and traditional land use, and heritage

resources. Without mitigation, negative impacts may occur on several of these VECs during road construction and/or operation. Positive impacts are anticipated on some VECs however, including permafrost and hydrology (by removing direct impacts from ATV traffic), and local economy (by creating jobs during construction and operation).

Presently, ATV traffic on the existing trail appears to have negatively affected permafrost as several areas along the trail have rutted and muddy conditions, indicating ground thaw. Use of heavy equipment during road construction could exacerbate this effect and create a larger impact area. Vegetation within the Project footprint (approximately 69.12 km^2) will be covered by granular materials during road construction; potentially having a negative effect on biodiversity and the natural vegetation community. Vegetation can also be affected by increased dust during road operations. Impacts to wildlife during road construction and/or operation may include habitat loss, sensory disturbance (i.e. habitat avoidance), and potentially increased mortality arising from vehicle collisions and increased harvest. Fisheries and water quality can be negatively affected by an increase in sedimentation and the potential introduction of deleterious substances (including dust). Stream hydrology and streambeds have been impacted by the existing ATV trail as stream crossing improvements (e.g. culverts or bridges) have not been installed and ATV traffic traverses directly on the streambeds; hydrology may be further altered during the course of culvert installation if not completed properly.

Mitigation measures for heritage resources have not been identified in this PSIR as a heritage resource impact assessment (HRIA) will be completed in early summer 2009, prior to construction. Findings and recommendations of the HRIA will be forwarded on to the appropriate agencies once complete. Mitigation will follow standard procedures and be consistent with the Heritage Resources Act of Nunavut.

Mitigation measures to protect the other identified VECs from potential negative impacts due to road construction or operation have been identified. These include:

- The end dump method of construction will be applied. This eliminates the need for construction equipment to travel on the existing ground surface and prevents against direct impacts to terrain, permafrost and vegetation loss. Furthermore, this method will minimize the area of disturbance by confining all site preparation and construction activities to the road alignment, minimizing the number of vehicles required, and restricting heavy equipment to the constructed portions of the road.
- Limiting or halting construction activities if an animal or evidence of migrating caribou cows and/or calving is present within the Project area.
- Restriction of vehicle speeds on the access road to facilitate protection of wildlife species.
- In-stream activities will be restricted to periods of low or no flow and occur within the Fisheries and Oceans Canada (DFO) recommended in-water construction timing window for the Repulse Bay area. This will mitigate potential impacts to stream hydrology, water quality, fish and fish habitat.
- Clean material and equipment will be used for all in-stream work and regular equipment inspections for leaks, cracks and weak hoses will be performed. This will guard against the introduction or release of a deleterious substance. An emergency spill kit will always be kept on-site with working equipment and, in the event of spill, the Spill Prevention and Response Plan will be immediately initiated.
- Culvert riprap will be hand placed, or where boulders are too large, riprap will be slowly and deliberately placed by machinery. This construction practice will serve to reduce sediment suspension and dispersion. Downstream suspended sediments levels (total suspended solids/turbidity) will also be monitored. This will help ensure effects from sediment on water quality, fish populations and habitat are mitigated. Silt fences near adjacent waterbodies will also

be installed and vegetated banks will be retained to protect the downstream waterbodies from increased sedimentation.

- Other mitigation measures identified in the DFO Operational Statements for In-Water Construction Timing Windows and Culvert Maintenance (for road operations) will also be applied; this includes limiting the removal of shoreline vegetation, and operating all heavy equipment and machinery on land.
- A Dust Management Plan for the North Pole River Access Road will be implemented during road operations to reduce the amount of dust generated from off-road, light vehicle and heavy equipment traffic.

Several cumulative effects between access road operation and future granular resource site (quarry) development were also identified. Negative impacts may further be observed to vegetation and wildlife, including vegetation habitat loss from excavation of granular materials, reduced habitat quality from increased dust, and further wildlife sensory disturbance resulting from increased heavy equipment use during quarry operation. Positive cumulative effects may be experienced by the Repulse Bay economy due to the creation of employment opportunities.

Overall, the assessment of the interactions of the Project with VECs of the physical, biological and socio-economic environments concluded that, with the identified mitigation measures, adverse environmental effects of the Project will be not significant on identified VECs in the Repulse Bay area. Positive effects may be observed on several VECs within the Project area and Hamlet of Repulse Bay.

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Abbreviations

ATV ..... All-Terrain Vehicle
CCME ..... Canadian Council of Ministers of the Environment
COSEWIC ..... Committee on the Status of Endangered Wildlife In Canada
CSP ..... Corrugated Steel Pipe
DDT ..... Dichloro-Diphenyl-Trichloroethane
DFO ..... Fisheries and Oceans Canada
GN-CGS ..... Government of Nunavut Department of Community and Government Services
GN-CLEY ..... Government of Nunavut Department of Culture, Language, Elders and Youth
GPS ..... Global Positioning System
HRIA ..... Heritage Resources Impact Assessment
HTO ..... Hunters and Trappers Organization
KIA ..... Kivalliq Inuit Association
NIRB ..... Nunavut Impact Review Board
NJWL ..... Nunami Jacques Whitford Limited
NLCA ..... Nunavut Land Claims Agreement
NTS ..... National Topographic System
NWB ..... Nunavut Water Board
OS ..... Operational Statement
PSIR ..... Project Specific Information Requirement
SARA ..... Species at Risk Act
VEC ..... Valued Environmental Component

1 Introduction

The Hamlet of Repulse Bay (the Hamlet) requested Nunami Jacques Whitford Limited (NJWL) to complete an environmental survey of a proposed access road to the North Pole River (the Project). This access road will specifically allow the Hamlet to access and develop identified granular resource sites. Secondarily, it will improve public access to the North Pole River, which is frequented by community members.

The Hamlet of Repulse Bay is located at the south-western end of the Melville Peninsula at the Rae Isthmus (66° 31' N, 86° 14' W) in the Kivalliq Region of Nunavut. Four granular deposits have been identified northwest of the Hamlet and a design for an access road to these sites was prepared by FSC Architects and Engineers (2002). The proposed access road is 7.68 km long, will be constructed of granular materials and measure approximately 6 metres wide, with additional width for increased shoulders and culverts in some areas. Road construction will follow the typical cut and fill method, utilizing granular materials from road cuts and the Hamlet's existing granular source. The Hamlet began construction of the road in 2007 however construction ceased after 2.9 km were constructed.

The proposed access road does not extend beyond the Hamlet's municipal boundary, however a project proposal needs to be prepared and submitted to the Nunavut Impact Review Board (NIRB) for screening. NJWL has prepared the NIRB project proposal and this Project Specific Information Requirement (PSIR) to facilitate the NIRB screening process.

Further, as several water bodies are crossed by the access road, authorization is required from the Nunavut Water Board (NWB) before construction can begin. An application and supplementary questionnaire have been prepared and submitted to the NWB for approval. Since the project is sponsored by the Hamlet and within municipal boundaries a land use authorization is not required from the Government of Nunavut Community and Government Services (GN-CGS). NJWL will respond to questions and information requests from the NIRB and NWB on behalf of the Hamlet. The Hamlet will need to apply for approval of any quarries accessed by the proposed road that may be developed in the future.

1.1 Objectives

The objectives of the environmental survey conducted by NJWL were to:

- collect data on the terrain, wildlife and vegetation along the proposed route;
- collect detailed information on water courses crossed or potentially impacted by the proposed development; and
- identify any heritage resources potentially impacted by the proposed development;
- submit an application for project approval to the NIRB and the NWB; and,
- respond on behalf of the Hamlet to questions and information requests from the NWB.

2 General Project Information Requirements

2.1 Project General Information

(5) The Hamlet of Repulse Bay needs to develop granular resource sites to allow for municipal road construction and other community projects. Four granular deposits have been identified northwest of the Hamlet and a preliminary design for a road to access these sites was designed by FSC Architects and Engineers in 2002. The Project in question involves the construction of a 7.68 km long road to the North Pole River to access these granular resource sites. The access road will be constructed of granular materials and measure approximately 6 metres wide, with additional shoulder and culvert space in some portions. The proposed route, potential granular resource sites and area of environmental investigation are identified on Figure 1 in **Appendix A**; photographs of the Project area are located in **Appendix B.**

(6) Alternatives to the Project, and viable technical and economic alternatives for carrying out the Project, have been considered. The alternative to the Project is to not construct the proposed road and not develop the identified granular resources in the future. This is not considered feasible; however, as the Hamlet requires these granular resources to support future municipal projects and community economic growth initiatives. Alternative means of carrying out the Project focused on constructing the proposed road in an alternate location to access the identified granular resources. This option is also not considered feasible as the cost of locating and designing a new route would be prohibitive as the Hamlet and GN-CGS have already completed route design, environmental survey and permit applications for the present routing. The proposed Project routing was developed by FSC in 2002 based on field study considering ease of construction, minimizing construction and maintenance costs and avoiding environmentally sensitive areas. An assessment of the environmental effects of project alternatives was not undertaken as there was not considered a practicable alternative to the proposed route.

(7) Project completion is expected to occur in August 2010. A field based heritage resource impact assessment (HRIA) of the proposed route is scheduled for completion prior to construction in 2009. An HRIA was recommended following a site file search through the Government of Nunavut Department of Culture, Language, Elders and Youth (GN-CLEY) and review of heritage resources of the Repulse Bay area during NJWL's environmental survey. Pending results of the HRIA, construction should begin in late summer 2009 and continue into the summer of 2010.

(8) The lands affected by the Project are Municipal Lands located inside the municipal boundary of the Hamlet of Repulse Bay. (NLCA Section 14.1.1). Applicable legislation includes the Nunavut Land Claims Act, the Nunavut Waters and Surface Rights Tribunal Act, Fisheries Act, Commissioner's Lands Act and Regulations, Heritage Resources Act and Regulations, Environmental Protection Act and Spill Contingency Planning and Reporting Regulations.

(9) Approvals, permits & licenses required to conduct the project: The Project will require a water licence from the NWB. It has been confirmed with GN-CGS that a land use permit will not be required. An archaeological permit will be required from the GN-CLEY to conduct the HRIA in the summer of 2009.

2.2 DFO Operational Statement Conformity

(10) Fisheries and Oceans Canada (DFO) Operational Statements (OS) which apply to the Project include:

- In-Water Construction Timing Windows (DFO 2008)
- Culvert Maintenance (DFO 2008)

(11) These OS' are designed to protect the fish and fish habitat of fish-bearing waters when carrying out specific in-water activities. The Project will cross several water bodies and in-water work will be unavoidable. During construction of the Project, measures to protect fish and fish habitat detailed in the applicable DFO OS' will be met; see **Appendix D** for the signed statement of confirmation. Some of these measures include limitations on the timing of in-water construction activities, the protection of the downstream environment from increased sedimentation, the protection of stream banks from erosion and prevention of the release of deleterious substances into water bodies.

2.3 Transportation

(12) The proposed route originates from an existing municipal road running northeast from the Hamlet. Presently, approximately 2.9 km of the beginning portion of the proposed access road has been constructed. The Project site will be accessed using this existing municipal road and constructed portions of the new road as it is completed; all supplies for road construction will be brought along existing access roads and the new access road as it progresses. The existing road and proposed access road route is illustrated in Figure 1 in **Appendix A**.

(13, 14, 15) An airstrip will not be used to access the Project site or bring materials to the Project site; these sections are not applicable.

2.4 Camp Site

(16, 17, 18) A camp will not be set up during Project activities. All Project personnel will be local residents or be accommodated in the Hamlet; therefore, these sections are not applicable.

2.5 Equipment

(19) Equipment required for the construction of the Project includes:

- Dozer – transporting and arranging loads of granular material for road construction
- Haul/Dump trucks – transporting loads of granular material for road construction
- Grader – grading and contouring of the constructed road surface
- Pick-up truck – crew transportation
- Corrugated steel pipe (CSP) – used for drainage culverts when crossing water bodies and design culverts for general drainage along the Project route.

(20) Digital photos of equipment: Not available

2.6 Water

(21, 22, 23) The Project route crosses several water bodies, including six (6) streams and a bouldery area which separates a freshwater lake draining into a marine Inlet; the unnamed freshwater lake drains into the marine Tariuraq Inlet at this location (S. Kidlapik, *pers. comm.*). Water will not be withdrawn from these water bodies during the Project and these sections are not applicable.

(24) During construction, surface water will be monitored during in-stream works only. Turbidity and total suspended solids will be monitored downstream of all water crossings with potential fish presence. Groundwater in the Project area will not be monitored as the Project does not involve excavations.

2.7 Waste Water and Solid Waste

(25) Waste generated during the Project may include, but not be limited to:

- Waste oil
- Domestic waste from workers daily activities

All waste generated during the Project will be disposed of at approved locations in the municipal solid waste disposal facility.

(26) The Project will only include the use of the municipal solid waste facility; its location is illustrated in Figure 1 in **Appendix A**. A land farm is not required.

2.8 Fuel

(27) Fuel use during the Project is estimated in Table 2.1. All fuel used will originate from the municipal tank farm; no fuel will be stored along the Project route.

Table 2.1 Estimated fuel use during construction of the proposed North Pole River Access Road, Repulse Bay, NU

Type of Fuel	Quantity	Method of Storage	Containment
Diesel	10,000 litres	Existing Municipal Bulk Storage Fuel Facility	Lined Berm Containment Cell
Gasoline	1000 litres	Same	Same

(28) Secondary containment is provided within the lined bermed storage area of the municipal tank farm which meets the CCME Code for above – ground storage fuel storage tanks

(29) Fuel will be transferred through the fuel transfer station at the bulk fuel facility.

2.9 Chemicals & Hazardous Materials

(30) Chemicals and hazardous materials used during the Project are estimated in Table 2.2. All chemicals and hazardous materials used will be stored at an approved location, either within the bulk fuel storage facility or within the Hamlet Garage.

Table 2.1 Estimated chemical and hazardous material use during construction of the proposed North Pole River Access Road, Repulse Bay, NU

Type of Fuel	Quantity	Method of Storage	Containment
Oil and Lubricants	200 litres	5 litre pails	In lined berm storage area

(31) Secondary containment will include lined berm storage area.

(32) Chemicals will be transferred via a hand pump into equipment within the garage during servicing.

2.10 Workforce & Human Resources/Socio-Economic Impacts

(33) The Project will be constructed using local employment and equipment. Local employment will include those individuals presently employed by the Hamlet of Repulse Bay and hiring of other residents,

knowledgeable in the use of required heavy equipment. Where possible, training of local Inuit beneficiaries will occur for operation of heavy equipment.

(34, 35) The Project is expected to be completed over two summer construction periods (2009 and 2010) and operate 12 hours a day, five days a week (Monday to Friday). Workers will be transported from the Hamlet to the advancing Project site via passenger vehicle and will be transported back to the Hamlet at the end of each work day.

2.11 Public Involvement/Traditional Knowledge

(36, 37, 38) Parties most affected by this Project include the Hamlet of Repulse Bay and the Naujaat Hunters and Trappers Organization (HTO). During NJWL site visit to Repulse Bay in June 2008, consultation occurred with members of the Hamlet of Repulse Bay and the Naujaat HTO. GN-CGS consulted with the Hamlet regarding the route during the preparation of the road design in 2002. The project is fully supported by the Hamlet. Elders will be consulted and involved in the HRIA conducted during summer 2009. NJWL is not aware of any concerns of residents with the project or its proposed location.

(39) Local knowledge was informally collected by NJWL during their 2008 visit to Repulse Bay. NJWL was accompanied by the Hamlet foreman (Mr. Roland Tungilik) and a local Elder (Mr. Sata Kidlapik) during their environmental survey and local knowledge of the Project area was obtained. Traditional knowledge will be collected and incorporated into the forthcoming HRIA.

Information regarding wildlife and plant species, fish presence, and possible heritage sites was incorporated into the overall assessment and provided excellent background about the Project area.

(40) Future consultation is expected to occur during the HRIA.

3 Project Specific Information

3.1 Project Information

(1, 2) In 2002, FSC Architects and Engineers conducted a field survey to identify the proposed route illustrated in Figure 1. The typical road cross-section and culvert detail are presented in Figure 2 in **Appendix A**.

(3, 4) The proposed road is being constructed to access four previously identified granular resource sites. When one or more of the granular sites are developed, trucks and equipment will travel the road to enable granular resource extraction for use in the community. Granular resource activity will primarily occur during summer months. The road will also be accessible by the public year-round and will be travelled by passenger vehicles, ATVs and snowmobiles.

(5) Regular maintenance on the road will occur during the snow free season in association with maintenance of other roads in the Hamlet. The road will not be maintained or ploughed in the winter for vehicle access.

3.2 All-Weather Road

(6) As stated previously the road will be constructed following the standard cut and fill method. Granular material will be placed over bedrock and surface soils to provide a smooth, safe and low maintenance driving surface. Material depth is expected to be 0.3 – 0.5 m over bedrock and 0.5 m or greater over soil areas. Material will be end-dumped along the leading edge of the advancing road to eliminate direct contact with existing terrain and prevent terrain damage. The addition of material over the existing surface will also provide additional insulation to protect underlying permafrost.

(7) Construction materials (type and sources): As illustrated in the typical cross section presented in Figure 2, the road bed will be constructed with general granular material, surfaced with a finer processed gravel. Material will be provided from road cuts into the bedrock and from the Hamlet's existing granular source

(8) Construction will occur during the summer months and will follow the standard cut and fill approach where higher grades will be cut down and lower grades will be filled. The end dump method of construction will be used where granular road bed material is end dumped off the leading edge of the advancing roadway.

(9) Water crossings and future granular deposits are illustrated on Figure 1 in **Appendix A**. Refuelling will occur at the Hamlet's bulk fuel storage facility.

(10) The road will be regulated by the Hamlet in accordance with local bylaws and territorial legislation.

(11) A dust management plan for the operation of the access road had been developed and will be implemented.

4 Existing Environmental Conditions

4.1 Physical Environment

The Hamlet of Repulse Bay and Project area are located within the Wager Bay Plateau ecoregion of the Northern Arctic ecozone. The region is characterized by broad sloping uplands, plains and valleys (EC 2005). Bedrock geology consists primarily of Archaen and early Proterozoic rocks with undifferentiated gneisses, granites and metasediments (Okulitch 1991).

Much of the Project area is covered by large bedrock outcrops and hills, interspersed by valleys and lowlands. Bedrock outcrops observed during the environmental survey were unvegetated, except in depressions where soil has accumulated. Cobble, gravel and sandy substrates typically occurred on the tops of small hills and on steeper slopes; these sites were dry with little to no standing water. Wet areas occurred within valley bottoms, on flatlands and shallow slopes (up to 5°) where standing and running water from snow melt and streams were present. These areas appeared to have greater soil development and cobbles and boulders were generally interspersed throughout the area.

Large scale surficial geology mapping of the Repulse Bay area indicates the rugged highlands and uplands of the Project area are pre-quaternary Archean rocks (Dredge 1994). Dredge (1994) also indicates that non-glacial blankets (>1 m) and veneers (<1 m) of offshore and sub-littoral deposits comprise the remaining surficial geology of the Project area. These stratified sand and silt deposits are spread among the undulating bedrock outcrops, have few ice-rafted boulders, and may be gravelly near the surface in some areas. Roche mountonées (whalebacks), generally trending in northwest-southeast direction, are also present within the Project area; however, are more prevalent northeast of the Project area.

Permafrost is continuous throughout the region and Project area, implying the area is underlain by 90 to 100% permafrost (EC 2005). Soils are classified primarily as orthic turbic cryosols (CLBRR 1996). This mineral soil type has permafrost within 2 m of the surface and generally show marked evidence of cryoturbation (i.e. patterned ground; Agriculture and Agri-Food Canada 1998). An organic layer is present at the surface of this mineral soil (up to 15 cm thick) and is developed from mosses and woody materials in an intermediate state of decomposition (Agriculture and Agri-Food Canada 1998).

The Project route is presently marked by survey stakes. An ATV trail is also present along the majority of the Project route; this existing trail leads to the North Pole River and has not been constructed or improved. ATV traffic on this trail appears to have affected permafrost and several areas along the trail have rutted and muddy conditions, indicating ground thaw. Furthermore, stream crossing improvements (e.g. culverts or bridges) have not been installed and ATV traffic traverses directly on the streambed.

4.2 Biological Environment

4.2.1 Vegetation

Generally the Wager Bay Plateau ecoregion is characterised by a discontinuous cover of tundra vegetation, including dwarf birch (*Betula glandulosa*), willow (*Salix* spp.), northern Labrador tea (*Ledum groelandicum*), avens species (*Dryas* spp.) and ericaceous shrubs (e.g. *Vaccinium* spp.; EC 2005). Willows and sedge dominate in wet areas of this ecoregion.

As part of the environmental survey, vegetation of the Project area was examined. NJWL's visit took place in June so the vegetation survey was completed at an early time in the growing season; as a result many species were difficult to distinguish due to the lack of vegetative growth. Snow cover was also present in many areas along the proposed route, including at the foot of many slopes, along north-facing slopes, and in other areas with less sun exposure (e.g. shaded by overtopping hills).

Overall, the Project area is dominated by bedrock outcrops with vegetation largely restricted to low-lying and depressional areas where soil and moisture have accumulated.

Lichens were the dominant species across the Project area, being found on high dry sites, bedrock depressions, and along the banks of streams and ponds. Purple saxifrage (*Saxifraga oppositifolia*) and Arctic white heather (*Cassiope tetragona*) were also prevalent throughout the Project area and occurred in several habitat types.

As noted, dry sites along the Project area were primarily located at the tops of small hills, on sandy soils, and on steep slopes. Lichens comprised a large percentage of the vegetation community in these sites (up to 60%). Other species found on these dry sites included moss, purple saxifrage, Arctic white heather, mountain avens (*Dryas integrefolia*), moss campion (*Silene acaulis*), bearberry (*Arctostaphylos* spp.), dwarf fireweed (*Chamerion latifolium*), some willows, including net-veined willow (*Salix reticulata*), and grass and sedge species.

Grass and sedge species were the dominant cover in wet lowland and depressional areas, and along the banks of streams and ponds. Lichens were also present in these areas though to a lesser degree. Other vegetation species found in these lowland sites included moss, purple saxifrage, mountain avens, cottongrass (*Eriophorum* spp.), water sedge (*Carex aquatilis*), woolly lousewort (*Pedicularis lanata*), nodding campion (*Silene uralensis*), and several willow species, including Alaska willow (*Salix alaxensis*), net-veined willow and others unidentified.

Table 4.1 lists all vegetation species identified during NJWL's environmental survey of the Project area. Each species' territorial conservation ranking is provided. No vegetation species identified during the environmental survey are given rankings by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) or under the *Species at Risk Act* (SARA). It should be noted that the vegetation survey conducted during the environmental survey was not exhaustive and additional species may be present in the Project area.

Table 4.1 Vegetation species identified along the proposed route for the North Pole River road, Repulse Bay, NU

Common Name	Scientific Name	Territorial Ranking[1]
Bog rosemary	*Andromeda polifolia*	Secure
Bearberry spp.	*Arctostaphylos spp.*	Secure
Water sedge	*Carex aquatilis*	Secure
Fragile-seed sedge	*Carex membranacea*	Secure
Sedge spp.	*Carex spp.*	-
Arctic white heather	*Cassiope tetragona*	Secure
Mouse-ear chickweed	*Cerastium arcticum*	Secure
Dwarf fireweed	*Chamerion latifolium*	Secure
Mountain avend	*Dryas integrifolia*	Secure
Common horsetail	*Equisetum arvense*	Secure
Tall cotton-grass	*Eriophorum angustifolium*	Secure
Arctic cotton-grass	*Eriophorum scheuchzeri*	Secure
Club-moss spp.	*Lycopodium spp.*	-
Mountain sorrel	*Oxyria digyna*	Secure
Capitate lousewort	*Pedicularis capitata*	Secure
Woolly lousewort	*Pedicularis lanata*	Secure
Lousewort spp.	*Pedicularis spp.*	-
Alpine bistort	*Persicaria vivipara*	Secure
Lapland rosebay	*Rhododendron lapponicum*	Secure
Alaska willow	*Salix alaxensis*	Secure
Arctic willow	*Salix arctica*	Secure
Net-veined willow	*Salix reticulata*	Secure
Willow spp.	*Salix spp.*	-
Snow saxifrage	*Saxifraga nivalis*	Secure
Purple saxifrage	*Saxifraga oppositofolia*	Secure
Prickly saxifrage	*Saxifraga tricuspidata*	Secure
Moss campion	*Silene acaulis*	Secure
Nodding campion	*Silene uralensis*	Secure
Campion spp.	*Silene spp.*	-
Starwort spp.	*Stellaria spp.*	-
False asphodel	*Tofieldia pusilla*	Secure
Bilberry	*Vaccinium uliginosum*	Secure
Mountain cranberry	*Vaccinium vitis-idaea*	Secure
Horsehair lichen spp.	*Bryoria spp.*	-
Green reindeer lichen	*Cladina mitis*	-
Cladonia lichen spp.	*Cladonia spp.*	-
Green beard lichen	*Usnea spp*	-
White worm lichen	*Thamnolia subuliformis*	-
Curled snow lichen	*Flavocetraria nivalis*	-
Mushroom spp.	-	-
Moss spp.	-	-

[1] Territorial ranking data from *Wild Species 2005: The General Status of Species in Canada* (CESCC 2006)

4.2.1.1 Rare Plant Species

Rare plant species were not identified during NJWL's environmental survey of the Project area. However rare plant species may be present. A rare plant can be defined as a species that, because of its biological characteristics or because it occurs at the edge of its main range, exists in low numbers or in very restricted areas (Lucas and Synge 1978). McJannet *et. al.* (1995) list approximately 20 plant species identified as rare in Nunavut (the Inuit Settlement Region of the Northwest Territories at the time of publication); Table 4.2 lists these species and habitat where they have been known to occur.

It should be noted that accurate locations of the following rare plant species within Nunavut could not be determined due to the limited accuracy within the source documents and inherent in the original and historical records. Original sightings of several species occurred prior to the development of accurate positioning systems (e.g. GPS), therefore have resulted in a larger possible area for that species location today. Vascular plant species are also likely under recorded in the region due to the limited vegetation surveys completed and the likelihood that completed surveys did not thoroughly document species location. The following Table then indicates which species are known or expected to occur in Nunavut, based on nearest known location and/or habitat required. Due to the paucity of data available for rare plants in Nunavut, a list specific to the Repulse Bay area could not be developed. Rare plant species included in Table 4.2 were not observed during the environmental survey.

Table 4.2 Rare plant species known or expected to occur within the Nunavut Territory

Common Name	Scientific Name	Habitat[1,2,3]	Nearest Location	SARA Listing
Alpine Bartsia	*Bartsia alpina*	Moderately well drained areas with high organic content; sunny, grassy slopes[1]	Near Iqaluit & Kimmirut, NU	-
Snowbed sedge	*Carex rufina*	Wet stony places, often by the edge of ponds or on snow beds[1]	Near Arviat, NU	-
Tufted hair grass	*Deschampsia alpina (Deschampsia cespitosa* ssp. a*lpina)*	Calcareous rocks and gravel (decomposed schist, granite and limestone); with low organic content[1]	West end of Meta Incognita Peninsula	-
Norwegian Whitlow-grass	*Draba norvegica*	Imperfectly drained moist areas, river terraces; calcareous rocks, gravel with low organic content[1]	Southhampton Island, Baffin Island, west of Arviat	-
Northern fescue	*Festuca vivipara* ssp. *Glabra*	Imperfectly drained moist areas; tundra turf, gravel, and moist herb mats[1]	Near Alert, NU	-
Moor rush	*Juncus stygius* spp. a*mericanus*	Wet margins of bogs and marly seepages[2]	At Hudson Bay, near Nunavut / Manitoba border	-
Highland Rush	*Juncus trifidus*	Seepage slopes, or dry, gravel, sand. On Baffin Island occurs on springy or sandy slopes, or sheltered sandy sites, often in iron-rich sands on the Beekman Peninsula[1]	Baffin Island (3 locations)	-

Common Name	Scientific Name	Habitat[1,2,3]	Nearest Location	SARA Listing
Northern Mudwort	*Limosella aquatica*	Wet, muddy, or sandy pond margins[2]	Near Chesterfield Inlet	-
Drummond Bluebell	*Mertensia drummondii*	Substrates: ridges; dry; gravel, sand[1]	Victoria Island, Coronation Gulf area	-
Porsild's Bryum	*Mielichhoferia macrocarpa*	Sites constantly moist during growing season with complete desiccation during the winter season; grows in cracks and cliffs of calcareous rock, limestone, basalt, sandstone, and shale[3]	One location on Ellesmere Island	-
Gray's Point-vetch	*Oxytropis podocarpa*	Imperfectly drained, or moderately well drained hummocks and tundra; acidic, or calcareous; gravel, sand[1]	Southampton Island, Baffin Island	-
Muskeg Lousewort	*Pedicularis macrodonta*	Bogs and marshes[2]	Near Arviat, NU	-
Fowler Knotweed	*Polygonum fowleri* spp. *hudsonianum* (*Polygonum caurianum* spp. *hudsonianum*)	Gravelly pond margins and lake shores[2]	Near Arviat, NU	-
Blunt-leaf Pondweed	*Potamogeton obtusifolia*	Shallow lakes and ponds[2]	Near Baker Lake, NU	-
Dwarf Alkali Grass	*Puccinellia pumila (Puccinellia kurilensis)*	Imperfectly drained moist areas; halophytic; sand, silt; in poorly drained sand or on wet mud at the seashore[1]	Southampton Island, Baffin Island, near Chesterfield Inlet	-
Arctic Alkali Grass	*Puccinellia poacea* (though are taxonomic challenges and is possibly *Puccinellia arctica*, which is secure in the NT)	Alkaline, salt or carbonate encrusted soil, may be the dominant grass in the immediate vicinity; hummocks, stream banks, river terraces, lake shores, slopes, seashore; dry, moderately well drained; sand, silt, clay (of flood plains)[1]	Ellesmere Island	-
Allen Buttercup	*Ranunculus allenii*	Wet tundra[2]	Baffin Island (3 locations)	-
Felt-leaf willow	*Salix silicicola*	Near Athabasca occurs on large, open, active sand dunes, and as scattered individuals or small patches on shallow shifting sands of gravel flats; sometimes on the broad sandy beaches and beach terraces of Lake Athabasca. Nothing known about habitat at Pelly Lake, NU.[3]	Pelly Lake, NU	Special Concern, Schedule 1

Common Name	Scientific Name	Habitat[1,2,3]	Nearest Location	SARA Listing
Cushion Saxifrage	*Saxifraga eschscholtzii*	Calcareous rocks, particularly gravel, in crevices, and on rocky ledges[1]	Near Resolute, NU	-
Roseroot Stonecrop	*Rhodiola rosea (Sedum rosea)*	Dry tundra, slopes, talus ridges, moist cliffs; imperfectly drained moist areas, or on seepage slopes; rocks, gravel, till; with low organic content; typically occur in crevices or among mats of moss, often near shores, and sometimes in rather rich substrates[1]	Baffin Island (3 locations)	-
Eelgrass spp.	*Zostera marina*	Sheltered tidal flats[2]	Near Arviat, NU	-

4.2.2 Wildlife

Due to the elusive nature of many wildlife species, few species were actually observed during NJWL's environmental survey of the Project area. Wildlife species observed were primarily avifauna, including Canada geese (*Branta canadensis*), common raven (*Corvus corax*), ptarmigan (*Lagopus* spp.), gulls (*Larus* spp.), Lapland longspur (*Calcarius lapponicus*) and other unidentified songbird species; one mammal, the Arctic ground squirrel (sik siks; *Spermophilus parryii*), was also observed. Wildlife signs were noted at several locations throughout the Project area; this included Arctic fox (*Vulpes lagopus*), caribou, and unidentified geese scat, as well as caribou and sandhill crane tracks. Two unidentified fish species were also observed in two waterbodies along the Project route.

As few wildlife species were actually observed during NJWL's environmental survey, the following sections detail wildlife species that are known or expected to occur in the Repulse Bay area. If a species is known or expected to occur in the Repulse Bay area, it is assumed they may also occur within the Project area. Each species status under territorial conservation ranking is provided, as well as any rankings by the COSEWIC and SARA.

4.2.2.1 Terrestrial Mammals

As previously mentioned, the Arctic ground squirrel was the only terrestrial mammal observed during NJWL's environmental survey. Evidence of Arctic fox and caribou use of the area were also noted. There are an estimated 24 terrestrial mammalian species are known or expected to occur in the Repulse Bay area, with all of the species being non-migratory or resident to Nunavut. These species are listed in Table 4.3. As this Project is a terrestrial project, marine mammals were not considered.

No terrestrial mammal species occurring in the Repulse Bay area are listed under SARA, however three (3) species, the Wolverine (*Gulo gulo*; the Western Population), Grizzly Bear (*Ursus arctos*) and Polar Bear (*Ursus maritimus*), are nationally ranked as Special Concern by COSEWIC. Of these species, the Grizzly Bear and Polar Bear are also territorially ranked as Sensitive (CESCC 2006). Barren-ground Caribou (*Rangifer tarandus groelandicus*) herds of the Repulse Bay area are territorially ranked as Secure and have not been nationally ranked however there has been growing concern over their population as many herds have reported declines throughout the range.

Wolverines are found throughout Nunavut and the population has been estimated at 2000 to 2500 individuals. Wolverines utilize a variety of habitats; though have specific denning habitats, including boulders, under deadfall or in snow tunnels on the tundra (COSEWIC 2003). Similarly, Grizzly Bear are found over much of Nunavut and confirmed observations have been reported from the Repulse Bay area. Little is known on the population size or population trend of Grizzly Bears in Nunavut, but the population has been roughly estimated between 800 and 2000 bears (COSEWIC 2002). Grizzly Bears are known as habitat generalists and, depending on the season, can be found in bedrock habitats, wetland areas with good cover, eskers, and mesic and mat tundra sites (Gau 1998).

Polar bears of the Foxe Basin subpopulation can be found within the Repulse Bay area; this subpopulation has been estimated at 2100 to 2300 bears. Their habitat is closely associated with that of ring seal and sea ice (COSEWIC 2008). In the summer, Polar Bears of the Foxe Basin subpopulation tend to concentrate on Southampton Island and along the Wager Bay coastline, though can also be found on the islands and coastal regions throughout the Foxe Basin area (COSEWIC 2008).

Barren-ground Caribou of the Wager Bay herd are principally found in the Repulse Bay area, typically during their migration in spring through fall; caribou of the Wager herd tend winter southwest of Wager Bay. Barren-ground Caribou of the Lorillard herd have also been tracked into the Repulse Bay area in spring and summer though their range typically remains south of Wager Bay year-round (DoE 2005). Both of these herds are part of the Northeast Mainland caribou, which also includes the Melville and Ahiak herds.

Residents from Repulse Bay harvest Barren-ground Caribou and caribou sign (scat and tracks) was recorded at several locations in the Project area. Mr. Kidlapik reported that caribou are usually present within the Project area during spring, however they were not observed during the environmental survey.

Communities within the range of the Northeast Mainland caribou herds have reported general declines in the caribou health and numbers, and a significant decline in caribou from 1983 estimates was noted in 1995 following aerial surveys (DoE 2005). Subsequent surveys from 1999 to 2004 have been completed and population estimates for the Wager herd stand at 28,128 (± 5962) individuals in 2004 and 12,155 (± 3697) individuals for the Lorillard herd in 2003 (DoE 2005). Population estimates during the latest survey were interrelated due to the discovery that both herds move into and out of each other's range.

Table 4.3 Terrestrial mammal species known or expected to occur in the Repulse Bay area[1]

Common Name	Scientific Name	Migration Habit	Rankings		
			Territorial	COSEWIC	SARA
Arctic fox	*Alopex lagopus*	Resident	Secure	-	-
Arctic grey wolf	*Canis lupus arctos*	Resident	-	Data Deficient	-
Northern grey wolf	*Canis lupus occidentalis*	Resident	Sensitive	Not at Risk	-
Northern collared lemming	*Dicrostonyx groenlandicus*	Resident	Secure	-	-
Victoria collared lemming	*Dicrostonyx kilangmiutak*	Resident	Secure	-	-
Richardson's collared lemming	*Dicrostonyx richardsoni*	Resident	Secure	-	-
Collared lemming	*Dicrostonyx torquatus*	Resident	-	-	-
Wolverine	*Gulo gulo*	Resident	Sensitive	Special Concern	-
Hoary bat	*Lasiurus cinereus*	Resident	Undetermined	-	-
Brown lemming	*Lemmus trimucronatus*	Resident	Secure	-	-
Arctic hare	*Lepus arcticus*	Resident	Secure	-	-
Tundra vole	*Microtus oeconomus*	Resident	Undetermined	-	-

Common Name	Scientific Name	Migration Habit	Rankings		
			Territorial	COSEWIC	SARA
Meadow vole	*Microtus pennsylvanicus*	Resident	Secure	-	-
Ermine	*Mustela erminea*	Resident	Secure	-	-
Least weasel	*Mustela nivalis*	Resident	Secure	-	-
American mink	Mustela vision	Resident	Undetermined	-	-
Muskox	*Ovibos moschatus*	Resident	Secure	-	-
Barren-ground caribou	*Rangifer tarandus groenlandicus*	Migratory / Resident	Sensitive	-	-
Barren-ground shrew	*Sorex ugyunak*	Resident	Undetermined	-	-
Arctic ground squirrel	*Spermophilus paryii*	Resident	Secure	-	-
Red squirrel	*Tamiasciurus hudsonicus*	Resident	Undetermined	-	-
Grizzly bear	*Ursus arctos*	Resident	Sensitive	Special Concern	-
Polar bear	*Ursus maritimus*	Migratory / Resident	Sensitive	Special Concern	-
Red fox	*Vulpes vulpes*	Resident	Secure	-	-

[1] Known or Expected to Occur data and Territorial rankings from *Wild Species 2005: The General Status of Species in Canada* (CESCC 2006)

4.2.2.2 Avifauna

An estimated 44 avian species are known or expected to occur in the Repulse Bay area; these species are listed in Table 4.4. Only six (6) species are recognized as non-migratory or resident to Nunavut while the remaining 38 species either breed or migrate through the Repulse Bay area (Cornell 2008).

A single species, the Peregrine Falcon (*Falco peregrinus anatum/tundrius*), is listed as of Special Concern under both COSEWIC and the SARA. The Peregrine Falcon *anatum/tundrius* was originally listed as two separate subspecies, however new genetic evidence now shows they are the same (ENR 2007). The Peregrine Falcon had undergone a dramatic decline in population between the 1950s and 1970s, primarily resulting from increased egg mortality from the eggshell thinning effect of pesticides (e.g. DDT). Since the mid-1970s however, the number of nesting pairs has increased and COSEWIC down-listed the Peregrine Falcon from Threatened to Special Concern in early 2007 (COSEWIC 2007); it was also taken off of the SARA registry and down listed.

The Peregrine Falcon breeds in Nunavut and the Repulse Bay area. Exact habitat use or requirements in the Repulse Bay area are unknown, however near Rankin Inlet, it has been reported to nest in south- or southwest-facing vertical coastal cliffs (Court *et al.* 1988a) or in rocky bluffs in inland tundra areas (Court *et al.* 1988b). Similarly, the number of nesting pairs in the Repulse Bay are unknown but 22 were reported from the Rankin Inlet area in 2000, and over 400 nest sites have been reported in Nunavut as a whole (COSEWIC 2007). Small mammals, including lemmings and juvenile Arctic ground squirrels, can make up an important portion of a Peregrine Falcon's diet however they have also been shown to consume ptarmigans, shorebirds and small songbirds in tundra areas (COSEWIC 2007).

Table 4.4 Avifauna known or expected to occur in the Repulse Bay area

Common Name	Scientific Name	Migration Habit	Rankings		
			Territorial	COSEWIC	SARA
Known to Occur					
Spotted sandpiper	*Actitis macularius*	Migratory	Undetermined	-	-
American pipit	*Anthus rubescens*	Migratory	Secure	-	-
Canada goose	*Branta canadensis*	Migratory	Secure	-	-
Rough-legged hawk	*Buteo lagopus*	Migratory	Secure	Not at Risk	-
Lapland longspur	*Calcarius lapponicus*	Migratory	Secure	-	-
Baird's sandpiper	*Calidris bairdii*	Migratory	Secure	-	-
Semipalmated sandpiper	*Calidris pusilla*	Migratory	Sensitive	-	-
Common redpoll	*Carduelis flammea*	Migratory	Secure	-	-
Semipalmated plover	*Charadrius semipalmatus*	Migratory	Secure	-	-
Long-tailed duck	*Clangula hyemalis*	Migratory	Secure	-	-
Common Raven	*Corvus corax*	Resident	Secure	-	-
Horned Lark	*Eremophila alpestris*	Migratory	Secure	-	-
Peregrine falcon	*Falco peregrinus anatum/ tundrius*	Migratory	Secure	Special Concern	No Status
Pacific loon	*Gavia pacifica*	Migratory	Secure	-	-
Red-throated loon	*Gavia stellata*	Migratory	Secure	-	-
Rock ptarmigan	*Lagopus mutus*	Resident	Secure	-	-
Herring gull	*Larus argentatus*	Migratory	Secure	-	-
Iceland gull / Thayer's gull	*Larus glaucoides / Larus thayeri*	Migratory	Secure	-	-
Glaucous gull	*Larus hyperboreus*	Migratory	Secure	-	-
Snowy owl	*Bubo scandiacus (Nyctea scandiaca)*	Resident	Secure	Not at Risk	-
Snow bunting	*Plectrophenax nivalis*	Migratory	Sensitive	-	-
Common eider	*Somateria mollissima*	Migratory	Sensitive	-	-
Arctic tern	*Sterna paradisaea*	Migratory	Secure	-	-
Expected to Occur					
Greater white-fronted goose	*Anser albifrons*	Migratory	Secure	-	-
Brant	*Branta bernicla*	Migratory	Secure	-	-
Sanderling	*Calidris alba*	Migratory	Sensitive	-	-
Dunlin	*Calidris alpina*	Migratory	Secure	-	-
White-rumped sandpiper	*Calidris fuscicollis*	Migratory	Secure	-	-
Pectoral sandpiper	*Calidris melanotos*	Migratory	Secure	-	-
Hoary redpoll	*Carduelis hornemanni*	Resident / Migratory	Secure	-	-
Snow goose	*Chen caerulescens*	Migratory	Secure	-	-
Ross's goose	*Chen rossii*	Migratory	Secure	-	-
Tundra swan	*Cygnus columbianus*	Migratory	Secure	-	-
Gyrfalcon	*Falco rusticolus*	Resident	Secure	Not at Risk	-
Yellow-billed loon	*Gavia adamsii*	Migratory	Secure	Not at Risk	-
Sandfill crane	*Grus canadensis*	Migratory	Secure	-	-
Willow ptarmigan	*Lagopus lagopus*	Resident	Secure	-	-
Red phalarope	*Phalaropus fulicarius*	Migratory	Sensitive	-	-

Common Name	Scientific Name	Migration Habit	Rankings		
			Territorial	COSEWIC	SARA
American golden plover	*Pluvialis dominica*	Migratory	Sensitive	-	-
King eider	*Somateria spectabilis*	Migratory	Sensitive	-	-
Long-tailed jaeger	*Stercorarius longicaudus*	Migratory	Secure	-	-
Parasitic jaeger	*Stercorarius parasiticus*	Migratory	Secure	-	-
Pomarine jaeger	*Stercorarius pomarinus*	Migratory	Secure	-	-
Sabine's gull	*Xema sabini*	Migratory	Secure	-	-

[1] Known to Occur data from Species Access Canada database (CBIF 2005); data sources from the Canadian Museum of Nature Bird Collection and the Northwest Territories and Nunavut Bird Checklist (2001)

[2] Expected to occur data from habitat range information from Cornell University (2008)

[3] Territorial rankings obtained from *Wild Species 2005: The General Status of Species in Canada* (CESCC 2006)

4.2.3 Fisheries

The Project route crosses six (6) streams (CRS-2, CRS-3, CRS-4, CRS-5, CRS-6 and CRS-7) and a small bouldery area which separates a freshwater lake and a marine inlet (CRS-1). This area naturally contained large rocks and boulders and water from the unnamed freshwater lake drained to the marine Tariuraq Inlet here. Five (5) small lakes are also present within the Project area, located adjacent to the proposed access road.

The previously constructed portion of the access road crosses two water bodies (CRS-1 and CRS-2). Culverts were not installed at CRS-1; however one culvert has been installed at CRS-2 (see **Appendix B** for photographs). The existing ATV trail to the North Pole River currently crosses four of the six water bodies (CRS-3, CRS-4, CRS-5 and CRS-6). CRS-3 and CRS-6 are crossed by this ATV trail at the proposed access road crossing site while CRS-4 and CRS-5 are crossed downstream of the access road crossing sites. CRS-7 is also crossed by a different, less used ATV trail, upstream of the proposed access road crossing site. However, as stream crossing improvements have not been installed at any trail crossing, effects to the streambeds from ATV travel are apparent. Flow areas have been widened and the stream beds have been altered by the ATV crossings.

As NJWL environmental survey was completed during the spring melt (freshet), all six streams had relatively high flow. Based on information received from the accompanying Elder, and stream flow and water depth during the freshet, three of these six streams are expected to be ephemeral and flow during the freshet or significant precipitation events only; these ephemeral streams (CRS-2, CRS-4 and CRS-7) are indicated on Figure 1 in **Appendix A**. The remaining three streams (CRS-3, CRS-5 and CRS-6) are expected to flow throughout the ice-free season though freeze to bottom during winter. Because of this, these three streams are not expected to be fish-bearing; however, they drain from lakes which may contain fish and suitable fish habitat. The CRS-3 stream drains into the marine environment of Repulse Bay, approximately 700 m downstream of the crossing site. The CRS-5 stream connects with the drainage of the CRS-4 stream, and flows into Repulse Bay, approximately 1,100 m downstream of the CRS-5 crossing site. These streams therefore drain into marine fish habitat. CRS-6 drains into a large lake with a short stream (approximately 130 m) to the marine habitat of Repulse Bay; it was not confirmed if this lake contains fish. Additionally, the outlet lake of the CRS-7 stream may contain fish however this could not be verified.

During NJWL's environmental survey, fish were observed in two water bodies, including one small lake adjacent to the proposed route and the small pond which drains at CRS-2 (see Figure 1). The small lake appeared to contain an unidentified stickleback species and an unidentified juvenile fish species; the small pond at CRS-2 contained an unidentified stickleback species. The unidentified stickleback is likely a ninespine stickleback (*Pungitius pungitius*) as they are reportedly the only stickleback species present in

Nunavut (CESCC 2006). The unidentified juvenile fish species appeared to be a salmonid though could not be differentiated between an Arctic char (*Salvelinus alpinus*) or lake trout (*Salvelinus namaycush*) juvenile. As mentioned, fish may also be present in the small lake which CRS-7 drains into (S. Kidlapik, *pers. comm.*) and possibly in the outlet lake of CRS-6; this was not confirmed during NJWL's environmental survey.

A comprehensive fisheries assessment was not completed during NJWL's environmental survey and only two fish species were actually observed. Lake trout and Arctic char are known to be present in several lakes in the Repulse Bay area (CBIF 2005, KIA 2007, S. Kidlapik, *pers. comm.*) though due to the relative paucity of data on freshwater fish species in the area, freshwater fish known or expected to occur within Nunavut are provided. As the Project area does not cross any marine water bodies, only freshwater fish species were examined.

An estimated 24 freshwater fish species are known or expected to occur within Nunavut. Four species are listed as Sensitive within Nunavut, including Arctic cisco (*Coregonus autumnalis*), least cisco (*Coregonus sardinella*), Arctic char (*Salvelinus alpinus*) and Arctic grayling (*Thymallus arcticus*). No species are listed by COSEWIC or given status under SARA.

Table 4.5 Freshwater fish known or expected to occur within Nunavut

Common Name	Scientific Name	Rankings		
		Territorial	COSEWIC	SARA
Longnose sucker	*Catostomus catostomus*	Undetermined	-	-
White sucker	*Catostomus commersonii*	Undetermined	-	-
Cisco	*Coregonus artedii*	Secure	-	-
Arctic cisco	*Coregonus autumnalis*	Sensitive	-	-
Lake whitefish	*Coregonus clupeaformis*	Secure	-	-
Broad whitefish	*Coregonus nasus*	Secure	-	-
Least cisco	*Coregonus sardinella*	Sensitive	-	-
Slimy sculpin	*Cottus cognatus*	Undetermined	-	-
Spoonhead sculpin	*Cottus ricei*	Undetermined	Not at Risk	-
Lake chub	*Couesius plumbeus*	Undetermined	-	-
Northern pike	*Esox lucius*	Secure	-	-
Goldeye	*Hiodon alosoides*	Undetermined	-	-
Burbot	*Lota lota*	Secure	-	-
Capelin	*Mallotus villosus*	Not Assessed	-	-
Fourhorn sculpin (freshwater form)	*Myoxocephalus quadricornis*		-	-
Deepwater sculpin	*Myoxocephalus thompsonii*	Undetermined	Not at Risk	-
Rainbow smelt	*Osmerus mordax*	Undetermined	-	-
Yellow perch	*Perca falvescens*	Not Assessed	-	-
Trout-perch	*Percopsis omniscomaycus*	Undetermined	-	-
Round whitefish	*Prosopium cylindraceum*	Undetermined	-	-
Ninespine stickleback	*Pungitius pungitius*	Secure	-	-
Arctic char	*Salvelinus alpinus*	Sensitive	-	-
Dolly varden	*Salvelinus malma*	Undetermined	-	-
Lake trout	*Salvelinus namaycush*	Secure	-	-
Arctic grayling	*Thymallus arcticus*	Sensitive	-	-

[1] Known to occur data from Species Access Canada database (CBIF 2005); data sources from the Canadian Museum of Nature Fish Collection

[2] Expected to occur data and Territorial rankings from *Wild Species 2005: The General Status of Species in Canada* (CESCC 2006)

4.3 Socioeconomic Environment

4.3.1 Local Economy and Traditional Land Use

The population in Repulse Bay was estimated at 748 in 2006, an increase of approximately 22.2% from 2001 (StatsCan 2007). The unemployment rate was reported at 34.5%, up from 28% in 2001, with the sales and service sector being the primary occupation type of the total experienced labour force in Repulse Bay, providing approximately 31% of employment (StatsCan 2007). Occupations in the retail trade, educational and business services are the second and third greatest occupation types in Repulse Bay, retaining approximately 15% and 11% of the total experienced labour force, respectively (StatsCan 2007). Occupations listed as 'other services' employ the greatest amount of the total experience labour force in Repulse Bay at 35%.

The economy of Repulse Bay is largely traditional and many residents engage in traditional hunting and fishing. Repulse Bay is also known for its carvings in bone, ivory and stone. Residents have formed the Aivilik Arts Society to help promote and market Repulse Bay carvings. Tourism opportunities in Repulse Bay include outfitter hunting for caribou, wildlife watching, and access to Ukkusiksalik National Park. Wildlife viewing opportunities include narwhal (*Monodon monoceros*) and other marine mammals, as well as the hundreds of birds that nest on cliffs north of the community.

According to the Kivalliq Inuit Association (KIA), the Project area is located in a high density area of Inuit harvesting (KIA 2007). Species typically harvested by Repulse Bay residents include caribou, Arctic fox, wolf and polar bear (NWMB 2004). Marine mammals, including narwhal and beluga (*Delphinapterus leucas*) are also harvested, though ringed seals (*Pusa hispida*) make up the largest proportion of the marine mammal harvest. Arctic char are also an important species harvested by residents; an average of 4283 fish are harvested annually for both subsistence and local commercial sale (NWMB 2004).

4.3.2 Heritage Resources

Site File Search

A site file search was completed through the GN-CLEY, for the project area, covering the 1:50,000 NTS map sheets 46L/9 and 46L/10. A total of 19 previously recorded archaeological sites were included in the site data provided by GN-CLEY. The majority of previously recorded archaeological sites in the vicinity of the proposed development have been recorded in the vicinity of the modern shoreline. There are no recorded sites within 1.5 kilometres of the identified route, which may be a result of the lack of sites or a lack of previous archaeological surveys in the vicinity of the proposed development.

Regional Site Database

The earliest known archaeological sites in the study area, in the vicinity of the modern community of Repulse Bay, have been attributed to Pre-Dorset occupations. Pre-Dorset is a late form of the Arctic Small Tool Tradition that was centered around a core area of northern Hudson Bay, Hudson Strait and Foxe Basin, dating to approximately 1700 to 800 B.C. (McGhee 1990:37). Faunal remains recovered from Pre-Dorset sites in the core area indicate that seal and walrus were the most important animal resources; however, caribou, fish and bird remains have also been recovered in Pre-Dorset sites (McGhee 1990:47). In the study area, Pre-Dorset occupations are evidenced at two sites. The first is a possible (but unconfirmed) pre-Dorset site consisting of two possible tent rings and the second is an intact Pre-Dorset/Neoeskimo site that includes nine tent rings, six caches, one blind, a flake scatter consisting of "greenstone", white chert and whitish-pink chert, and two unidentified stone features (GN-CLEY). Both

sites are located more than four kilometres southeast of the proposed development and will not be impacted.

No sites attributed to Dorset occupations were identified in the vicinity of the proposed development during the file search.

The next group of sites, identified in the area, are attributed to Thule occupations. Thule sites generally date to approximately A.D. 1000-1600. Thule people moved from Alaska to the east across the Arctic as far as Greenland in what is considered to be a relatively rapid expansion. It has been postulated that this occurred at a time of general climatic warming and that Thule groups may have followed the course of large baleen whales (McCartney 1977; McGhee 1990:83-102), migrating eastward to their summer feeding grounds in Amundsen Gulf and the Beaufort Sea. Evidence from Thule sites suggests that the range of such target species as bowhead whales was wider than current ranges suggest. While whale hunting represented a large part of Thule subsistence, seal, walrus, caribou, musk-oxen, waterfowl, birds and fish were also taken (McGhee 1990:83-102).

The Naujan Site is the 'type-site' on which the Thule culture was originally defined and is considered to be one of the most important archaeological sites in the New World Arctic. According to the site data provided by GN-CLEY, the "Naujan Site represents the 'classic' stage of Thule culture and dates approximately to A.D. 1200." The site was recorded and partially excavated by Mathiassen in 1922, who recorded 20 house features (both sod and whale bone), graves, caches and a kayak stand. The site was revisited in 1981 by Morrison and in 1987 by Bertulli and again in 2004 by Rowley who rerecorded the location of each feature with a Global Positioning System (GPS) and excavated at House 20. Since first being recorded in 1922, the evidence of the existence of some features, including graves and kayak stands, has apparently disappeared (GN-CLEY). Located to the east of the hamlet of Repulse Bay, the Naujan Site is approximately 4.5 kilometres distant from the eastern most extent of the proposed road and will not be impacted.

Evidence of Thule occupation in the area is also seen at two other sites, both originally recorded by Mathiassen. The first site, a campsite and burial containing evidence of Precontact and Post Contact Period Thule/Inuit remains, is located on the west end of an island to the south and east of the Hamlet of Repulse Bay. The features recorded at the site included caribou row, cairns, tent rings, boat stands, meat caches, graves, kayak caches, oil caches, fish drying rocks, hunting blinds and inuksuit. Human remains and grave goods were recovered from the graves at this site. The second site is also a campsite and burial consisting of a massive tent ring, possibly a qaggiq or communal house and modern grave site with a number of partially destroyed caches of unknown affiliation. Mathiassen classified the site as a Thule summer camp and also noted the presence of additional tent rings, caches and kayak stands (GN-CLEY). Both sites are located more than five kilometres southeast of the proposed development and will not be impacted.

Five additional sites in the area are all recorded as Post Contact Inuit sites. Inuit culture is believed to have developed out of Thule culture around A.D. 1660-1850 (McGhee 1990:103). In the area of Melville Peninsula, historic Inuit Groups that followed a different way of life than their Thule ancestors were recorded as Iglulingmiut and were dependent upon subsistence resources of the area, such as walrus and caribou (McGhee 1990:109). Typical features recorded at these sites include a qaggiq, Contact Period and possibly Precontact Period tent rings, kayak stands, caches, stone caches, and inuksuit (GN-CLEY). One of the sites appears to be the remains of an historic Aivilingmiut (a southern subgroup of Iglulingmiut) summer camp. These sites are located between 2.5 and 5.5 kilometres southeast of the proposed development and will not be impacted.

A sixth Post Contact Period site, the Aivilik site, is a large winter village consisting of 400 stone tent rings, kayak rests, meat caches, meat platforms, and graves. According to the site data provided by GN-CLEY

this site was the principal village, in historic times, of the Aivilik Eskimo or Aivilingmiut. This site is located approximately 3.5 kilometres south of the proposed development and will not be impacted.

Another five sites have all been previously recorded in the area but have not been assigned to a specific culture group or time period, either due to lack of research or lack of available diagnostic data. Typical features recorded at these sites include a burial, a possible qaggiq, tent rings, an oblong stone erection (measuring 5 metres by 6 metres) with a large stone in the centre, a cairn, kayak stands and meat caches (GN-CLEY). These sites are located between two and nine kilometres south and southeast of the proposed development and will not be impacted.

Fort Hope is recorded as being 15.5 kilometres west of the western extent of the proposed development (GN-CLEY). Fort Hope was the base established by Arctic explorer John Rae. Rae overwintered at Fort Hope in 1846-1847, using the location as a base to chart over 600 miles of territory (McGoogan 2001). Rae also visited Repulse Bay during this time; therefore, it is possible that evidence of his travels through the region may be present in the vicinity of the proposed development. Based on the proximity of the development to Repulse Bay, there is also the potential to impact other evidence of Historic Period exploration and inland travel through the region.

Sea Level Changes in the Region

The results of the regional site file search for the project area indicate that there is a rich record of archaeological sites in the vicinity of the proposed road. The known archaeological sites in vicinity are relatively closely associated with the coast, mostly on high points above the modern coastline. The proposed development is inland, relative to the modern coast. However, research conducted on the western side of Melville Peninsula indicates that deglaciation in the area occurred at about 6900 years ago and that relative sea level at that time was 144 metres above present levels (Dredge 1991). In addition, "[r]aised marine deposits indicate that the coastline has been emerging since deglaciation due to postglacial isostatic rebound. . . ." (Dredge 1991:63). Some portions of the proposed development are 150 metres to 250 metres above the present sea level, while others are only 50 metres to 100 metres above the present sea level (NTS Map 46L/9). The proposed development crosses at least two areas of foreshore sand flats and comes into proximity of two others that, at present, extend inland (NTS Map 46L/9).

Two fossil finds are noted on the Surficial Geology map within proximity to the project area. One of these fossil finds, which is further inland than the proposed project, is a shell deposit that has been dated to 6760 +/- 100 years ago (Dredge 1994).

This information indicates that from 6900 years ago to the present, the coastline has been receding from the now inland location of the proposed road. Therefore, there is the potential to find earlier sites that would be associated with culture groups camping on or near the coast to access abundant marine prey species.

Preliminary Consultation Results

Personnel from Nunami Jacques Whitford Ltd. have already conducted some field survey of the proposed development area for the vegetation and wildlife component of the project. The survey team was accompanied by Sata Kidlapik, a local Elder, and Roland Tungilik, Hamlet foreman. Sata Kidlapik was asked if the community had any specific heritage resource concerns. Sata Kidlapik felt that any graves or tent rings along the proposed development would be of concern. At least two tent rings, at different locations, one potential grave or cache site, and one possible meat cache site were identified by Sata Kidlapik and Roland Tungilik during the environmental survey, all within approximately 10 metres to 15 metres of the proposed road (Photo plates 1 to 5 in **Appendix C**). A number of inuksuit were also

identified within the 30 metre buffer zone on either side of the proposed road. The age and/or cultural affiliations of the features/sites indicated by Sata Kidlapik are currently unknown.

Heritage Resource Potential

The recorded archaeological sites in the project area are predominantly associated with the modern coastline. These sites reflect the maritime focused economic and settlement patterns of the residents. Evidence indicates that the coast, in the past, most likely extended further inland, indicating the potential to find older beach ridges and, therefore, earlier sites further inland. In addition, inland water bodies and waterways in the vicinity of the proposed development may have supported fish species and/or attracted land mammals and bird species that would have been seasonally targeted by Precontact and Contact Period culture groups. At least three sites with the potential for multiple features were identified by Sata Kidlapik and Roland Tungilik, within the recommended 30-metre buffer along the proposed route, along with numerous inuksuit.

A desktop examination of the project area by Dr. Lisa Bohach of FMA Heritage Inc., determined that there were no palaeontological concerns with respect to the proposed development.

5 Identification of Impacts and Proposed Mitigation Measures

(1) Potential impacts of the Project on the valued environmental components (VECs) of the physical, biological and socio-economic environments of the Project area are listed in Table 5.1. Proposed mitigation measures for the potential impacts are described below (2, 3, 4, 5, 6) and outlined in Table 5.2. Decommissioning activities have not been considered as the proposed road is planned to be a permanent feature.

5.1 Physical VECs

5.1.1 Permafrost

Access Road Construction

Construction of the Project can have a negative impact on permafrost as the use of heavy equipment for material transportation and material placement and ongoing travel can disturb the surface soil layer, enabling warming and melting of the upper permafrost layer. The existing ATV trail (along or near the proposed road route) appears to have had an effect on the permafrost as rutting and muddy conditions are present throughout the trail. The use of heavy equipment during road construction could exacerbate this effect and create a larger impact area as equipment is forced around muddy conditions.

To mitigate this potential effect the end dump method of construction will be applied where road material is dumped off the leading edge of the advancing road, eliminating the need for construction equipment to travel on the existing ground surface. The constructed road bed will provide a stable driving surface which will prevent direct impact to terrain and insulate underlying permafrost during operations. Furthermore, the area affected by road construction will be minimized; this will include confining all site preparation and construction activities to the road alignment, minimizing the number of vehicles required, and restricting heavy equipment (e.g. dump trucks, crew trucks) to the constructed portions of the road. Therefore with mitigation, adverse environmental effects of road construction on permafrost are considered not significant (see Table 5.1).

Access Road Operation

During access road operation, traffic will primarily be travelling on the new access road and not directly on surrounding terrain. However as the access road will be used by ATVs, some off-road travel to surrounding areas is likely. This will be discouraged and/or limited by the Hamlet as off-road travel can further impact permafrost in the surrounding area.

Additionally, while construction and operation of the proposed access road are expected to have a not significant adverse environmental effect on permafrost in the Project footprint, it may actually create a positive effect on permafrost in the impacted areas of the existing trail as traffic is diverted to the road and impacted areas will be not be subject to further use and may begin to stabilize. Therefore overall, adverse environmental effects arising from the operation of the access road would be considered not significant.

5.1.2 Hydrology / Water Quality

Access Road Construction

Impacts to stream hydrology and water quality during road construction can arise during the placement of granular material, the use of heavy equipment, and culvert installation. Impacts may include altered stream hydrology, the release of and/or increase in downstream sediments, and the deposition of deleterious substances (e.g. fuel spills). Two existing ATV trails have affected five of six streams along the Project route as proper stream crossings have not been constructed resulting in ATV traffic directly in the streambeds.

Hydrology impacts may occur during culvert installation, including the placement of granular materials around culvert material. Culvert installation will be restricted to periods of low or no flow to mitigate potential impacts to hydrology. Permanent alteration of the stream channel is not required for the installation of culverts. Any impact to hydrology will be temporary and short-term: stream hydrology is unlikely to be negatively affected over the long-term. Installation of culverts may result in a minor positive effect on stream hydrology as traffic will be expected to use the constructed stream crossings rather than travelling within the streambeds. Removal of ongoing disturbance from ATV crossings may result in the restoration of natural or near natural stream flow patterns.

The primary methods of mitigation against negative impacts to water quality include restricting in-stream work to periods of low or no flow and minimizing the introduction of deleterious substances into water bodies. Activities to reduce the potential for a release of a deleterious substance involves the use of clean equipment and clean granular material, regular equipment inspection, installation of silt fences and retention of vegetated banks. An emergency spill kit will be kept on-site with working equipment and, in the event of spill, the Spill Prevention and Response Plan (**Appendix D**) will be immediately initiated. Many of these mitigation strategies are also detailed in DFO's OS' for timing windows; this will be adhered to for in-stream works to help mitigate any effect on hydrology and downstream water quality (see Appendix C for signed statements of confirmation).

Thus following mitigative measures, adverse environmental effects on hydrology and water quality arising from road construction are considered not significant (see Table 5.1).

Access Road Operation

Operation of the access road may have negative impact on water quality due to increased dust in the Project area and as-needed culvert maintenance; potential effects include increased turbidity/total suspended solids and heavy metals. This will be mitigated with effective dust control procedures outlined in the dust management plan developed for the operation of the access road (see **Appendix F**) and the DFO OS' for Culvert Maintenance. Access road operation is not expected to negatively impact stream hydrology, though as previously mentioned, may have a slight positive effect by removing the ongoing disturbance from ATV crossings with the installation of culverts at all stream crossings.

Overall with mitigation, adverse environmental effects from the operation of the access road on stream hydrology and water quality are considered not significant.

TABLE 5.1 - IDENTIFICATION OF ENVIRONMENTAL IMPACTS ARISING FROM CONSTRUCTION AND OPERATION OF THE NORTH POLE RIVER ACCESS ROAD, REPULSE BAY, NU

		ENVIRONMENTAL COMPONENTS	PHYSICAL	designated environmental areas (ie. Parks, Wildlife Protected areas)	ground stability	permafrost	hydrology/ limnology	water quality	climate conditions	eskers and other unique or fragile landscapes	surface and bedrock geology	sediment and soil quality	tidal processes and bathymetry	air quality	noise levels	other VEC:	other VEC:	other VEC:	BIOLOGICAL	vegetation	wildlife, including habitat and migration patterns	birds, including habitat and migration patterns	aquatic species, incl. habitat and migration/spawnin	wildlife protected areas	other VEC:	other VEC:	other VEC:	SOCIO-ECONOMIC	archaeological and cultural historic sites	employment	community wellness	community infrastructure	human health	other VSEC
PROJECT ACTIVITIES																																	
CONSTRUCTION	Transportation of workers					M														M	M	M							N	P		P		
	Transportation of granular fill					M														M	M	M							N	P		P		
	Placement of granular fill					P	M	M												N									N	P		P		
	Use of heavy equipment					M	M	M												N	M	M							N	P		P		
	Culvert installation						M	M															M							P		P		
																				M	M	M	M							P		P		
OPERATION	General operation					P		M												M	M	M	M							P		P		
	Traffic (light & heavy vehicles)							M													M	M												
	Maintenance						M	M															M							P				
	Dust						M	M												M			M											
DECOMMISSIONING	None - not applicable																																	

Notes: Please indicate in the matrix cells whether the interaction causes an impact and whether the impact is:

P *Positive*
N *Negative and non-mitigatable*
M *Negative and mitigatable*
U *Unknown*
If no impact is expected then please leave the cell blank

5.2 Biological VECs

5.2.1 Vegetation

Access Road Construction

Project development will have a total footprint of approximately 69.12 km^2 (7.68 km road length by 9 m wide road base). Vegetation within the Project route will be covered by granular materials as a result of road construction.

The removal of the vegetation community will have minor negative effect on biodiversity and natural vegetation communities. The primary method of mitigation against loss of native vegetation communities and associated biodiversity is to minimize the area of disturbance; mitigation activities described for permafrost in the above section will be employed to help to minimize the area of native vegetation disturbed and therefore the potential loss of biodiversity.

Access Road Operation

Operation of the access road may have negative impact on the habitat quality and productivity of vegetation due to increased dust in the Project area (see Table 5.1). Increased dust cover on vegetation can cause increased heat absorption and reduced transpiration. Dust effects to vegetation during road operation will be mitigated with effective dust control procedures outlined in the dust management plan developed for the operation of the access road (see **Appendix F**).

5.2.2 Wildlife

Access Road Construction

Direct effects to wildlife (avifauna and mammals) are expected to be minimal as most wildlife species are mobile and are not likely to suffer mortality or injury due to direct contact with construction equipment or materials during placement. However if wildlife are encountered during Project construction, activities will be halted until the animal has moved away from the project footprint. It may also be necessary to limit or avoid construction activities if evidence of migrating caribou cows and/or calving is present within the Project area. Any wildlife encountered during Project construction will not be harassed and all wildlife fatalities, if any, will be immediately reported to the local Wildlife Officer.

Other impacts to wildlife species includes habitat loss and sensory disturbance (i.e. habitat avoidance) arising from construction and operation activities. The Project area consists of land that has been subject to a moderate level of human use as a result of its proximity to the community and its use as access to the North Pole River. Evidence of several migratory and resident wildlife species, including caribou, Arctic fox, Arctic ground squirrel, Canada geese, common raven, ptarmigan, sandhill crane and songbirds, were observed within the Project area during the environmental survey despite of the area's use by residents.

The Project will result in a minor amount of habitat loss. The Project area does provide habitat for several migratory wildlife species, however due to the small amount of habitat lost, direct habitat loss due to the Project is considered not significant. Habitat of similar quality is available for wildlife in the immediate surrounding areas.

Peregrine falcon nests may be present in the Project area however interaction with these nests is not expected as nests are typically located on rocky bluffs and cliffs, and the Project route is not located in these areas. However if any Peregrine falcon or other raptor nests are encountered during Project construction, these nests will remain undisturbed and will be reported to the local Wildlife Officer.

Sensory disturbance that might occur during Project construction may be mitigated by limiting the timing and duration of construction to non-critical periods (e.g. late May to early July for nesting avifauna). Construction during non-critical life stages will reduce or eliminate any potential negative environmental effects on wildlife that use the Project and surrounding areas. As a result of construction and operation, wildlife that may currently use the immediate Project route may avoid the area; however, similar habitat is available adjacent to the Project area.

Overall with mitigation, adverse environmental effects to wildlife arising from the construction of the access road are considered not significant (see Table 5.1).

Access Road Operation

Further sensory disturbance may occur during road operation as increased heavy equipment and light vehicle traffic in the area may cause permanent avoidance by some wildlife species. As mentioned, the area has been subject to a moderate level of human use and several wildlife species were observed in the Project despite its use. Some wildlife avoidance of the Project area during road operation will be unavoidable however restriction of speeds and the road's primary use in summer will mitigate against long-term wildlife avoidance.

An increase wildlife mortality resulting from collisions with vehicles can also occur during access road operations. Vehicle-wildlife collisions, specifically with small mammals and small avifauna (e.g. Arctic ground squirrels, songbirds), may increase due to road traffic and road operation. Road kills to larger mammals, such as caribou and wolves, can be mitigated by limiting traffic speeds and giving wildlife the right of way. The new road is expected to be under the same municipal laws and regulations as the rest of the Hamlet roads, however these kind of regulations are generally not applied. The new access road will be frequented by ATV traffic as well as some heavy equipment during quarry operation. To reduce the potential for wildlife road kills, these restrictions may need to be placed on the new road and particularly enforced during times of the year when evidence of caribou and other wildlife are present in and adjacent to the Project area.

During operation the access road will provide the improved access to the Project area and the North Pole River, potentially resulting in increased access to harvest wildlife. It is expected that the HTO and residents will monitor resource harvesting activity and implement any necessary controls.

Following these mitigative measures, adverse environmental effects of access road operation on wildlife are considered not significant.

5.2.3 Fisheries

Access Road Construction

Three streams (CRS-3, CRS-5 and CRS-6) have been identified as potentially draining from fish habitat; CRS-3 and CRS-5 also drain into the marine habitat of Repulse Bay. Two water bodies adjacent to the access road were observed to contain fish, including ninespine stickleback and an unidentified salmonid juvenile; a third and fourth water body of which CRS-6 and CRS-7 drain into may also contain fish though this was not confirmed during the environmental survey.

As mentioned in the preceding discussion on Hydrology and Water Quality, effects to water bodies and fish habitat during construction may arise from sedimentation during culvert installation and other depositions of deleterious substances. The mitigation measures described above (restriction to periods of low or no flow, clean equipment, etc) will mitigate effects to fish or other aquatic life and fish habitat in streams and adjacent water bodies during construction.

Stream flow is expected to be negligible in three of the six streams during construction activities (after the freshet), however low water flow is anticipated in the remaining three streams. A temporary dam to hold back water will be installed to provide sufficient time for culvert installation in these streams. However if a temporary dam will not work under the encountered flow conditions, a temporary channel diversion may need to be built. At the CRS-1 crossing site, it would not be feasible to construct a temporary dam or diversion channel during culvert installation. In this case and during flow diversion in other channels, the water body will be monitored downstream of culvert installations for sediment levels (turbidity/total suspended solids) during all flow diversion and in-stream construction, and where some water flow is still present.

Culvert riprap (rock cobble 150 mm – 300 mm; FSC 2002) will be hand placed during culvert installation to reduce sediment suspension and dispersion and bank damage; where boulders are too large for hand placement, the slow and deliberate placement by machinery will be applied. This construction practice, along with monitoring downstream suspended sediments levels should be sufficient to ensure effects from sediment on fish populations and habitat are mitigated. If sediment values do exceed allowable criteria (as per CCME 2007 guidelines), boulders/riprap placement can be slowed down or temporarily halted to further reduce sediment suspension. If allowable criteria cannot be met by slowing rock placement, sedimentation control measures (e.g. silt curtains) will be utilised to further protect the downstream environment.

Silt fences will also be installed up-shore of the five small lakes adjacent to the Project route to protect water quality and potential fish habitat within. Two fish species were observed within a small lake adjacent to the existing ATV trail and proposed road route (see Figure 1 in **Appendix A**). One species is likely a ninespine stickleback as they are reportedly the only stickleback species present in Nunavut (CESCC 2006). The unidentified juvenile fish species appeared to be a salmonid though could not be differentiated between an Arctic char or lake trout juvenile. As mentioned, fish may also be present in a second small lake which CRS-7 drains into (S. Kidlapik, *pers. comm.*); this was not confirmed during NJWL's environmental survey. With mitigation, sedimentation is not anticipated to have a significant or permanent effect on fish and aquatic life in water bodies along the access road route.

Controlling downstream sedimentation and other mitigation measures outlined in the DFO OS' identified in Section 2.2 will be met during culvert installation. These include limiting the removal of shoreline vegetation, operating all heavy equipment and machinery on land, using clean equipment, materials and performing regular equipment inspections, and having an emergency spill kit available on-site. Any installed sediment control measures will also be inspected on a regular basis to ensure proper function.

Construction of the Project is expected to be completed over two summer seasons and any sedimentation effects on fish and aquatic life are expected to be temporary and short-term. With mitigation, adverse environmental effects on fisheries from road construction are anticipated to be not significant and temporary in duration.

Access Road Operation

The new access road will provide improved access to the North Pole River and other fishing locations. It is expected that local authorities will monitor fishing activity and implement controls to preserve populations if necessary.

Increased dust arising from access road operation could also negatively impact fish habitat in the Project footprint through increased sedimentation and reduced water quality. Culvert maintenance activities may also increase downstream sediment. These effects will be effectively mitigated with dust control procedures identified for the access road (see **Appendix F**) and the compliance with the DFO OS' for

Culvert Maintenance. With mitigation, adverse environmental effects from road operation on fisheries would then be considered not significant (see Table 5.1).

5.3 Socioeconomic VECs

5.3.1 Local Economy and Traditional Land Use

Access Road Construction

Construction of the Project will have a positive effect on the Repulse Bay economy by creating jobs for Repulse Bay residents as equipment operators, foremen and other construction personnel. The road will also add to the inventory of roads requiring annual maintenance, potentially contributing to a need for increased employees at the Hamlet (see Table 5.1).

Access Road Operation

The construction and operation of the road will also have a positive effect on community infrastructure as it will provide access to granular resources needed for community development.

Project completion results in a new road which can be used by all residents to access the North Pole River, an area frequented by community members. Development of the Project will also provide easier access to land beyond the Project area. Land beyond the new road ranges from rock outcrop to rolling tundra and access to this land will also be improved following Project completion. Vehicular traffic (e.g. passenger cars, trucks) will increase on the new access road however is not expected to affect access to areas beyond the road. ATVs or snowmobiles will be required to access land outside of the road; this land is presently accessible from the existing trail and use of this land is not expected to significantly increase as a result of Project completion.

The impact of the project on community wellness and human health is expected to be positive, but negligible, as it will enable additional people to get on the land and pursue traditional activities. Overall, adverse effects from access road operation on the local economy and traditional land use are considered not significant; road operation may result in positive effects to local economy and traditional land use.

5.3.2 Heritage Resources

Access Road Construction & Operation

Project activities during access road construction may impact heritage resource sites along the road. Increased human presence along a defined route associated with the Project development also has the potential to disturb archaeological resources should people travel off-road to access other areas such as fishing lakes.

To identify potential resources that may be impacted by construction and operation, a Heritage Resources Impact Assessment (HRIA) will be conducted along the proposed road and the identified granular deposits in 2009, prior to construction. This is particularly important due to the lack of previous studies conducted in this inland region, which is considered to have high potential for the occurrence of archaeological and historic sites.

A permit application for an HRIA will be submitted prior to March 31, 2009 and work is expected to be completed prior to the summer 2009 construction season. The HRIA program will consist of visual inspection of targeted areas along the proposed route and identified granular deposits. Selection of target areas would be based on available NTS maps and aerial mosaics. Target areas would consist of

topographic features/areas considered most likely to contain surface and subsurface archaeological sites, with a focus on ancient beach ridges. Information regarding traditional use will be considered as a part of this study, including locational and contextual information. A meeting with the community members will also be held to apprise them of the archaeological program and request their assistance with the field component, including input regarding any proposed mitigative strategies, known site locations and regional land use patterns. The participation of community members in the field program will ensure that community values and concerns are represented in site evaluation, interpretation, and appropriate mitigation.

Mitigation will follow standard procedures and be consistent with the Heritage Resources Act of Nunavut.

THE NUNAVUT IMPACT REVIEW BOARD
SCREENING PART 2 FORMS

TABLE 5.2 - MITIGATION AND MONITORING DURING CONSTRUCTION & OPERATION OF THE NORTH POLE RIVER ACCESS ROAD, REPULSE BAY, NU

	PROPOSED MITIGATION MEASURE	IMPLEMENTATION SCHEDULE	RESIDUAL IMPACTS	PROPOSED MONITORING SCHEDULE	REPORTING SCHEDULE
IMPACTS (IDENTIFIED IN TABLE 5.1)					
Transportation of workers	• Minimize spatial extent of granular material placement and activity • Regular inspection of all equipment for leaks • Limit duration of construction period • Avoid critical periods (e.g. bird breeding season)	Summer 2009 & 2010	None	None	
Transportation of granular fill	• Minimize spatial extent of granular material placement and activity • Regular inspection of all equipment for leaks • Limit duration of construction period • Avoid critical periods (e.g. bird breeding season)	Summer 2009 & 2010	None	None	
Placement of granular fill	• Minimize spatial extent of granular material placement and activity • Regular inspection of all equipment for leaks • Utilizing clean equipment and granular material to protect against deposition of deleterious substances • Limit duration of construction period • Avoid critical periods (e.g. bird breeding season) • If in-stream for culvert installation, water quality monitoring for turbidity/TSS; implementation of controls to augment construction activities if large changes are evident	Summer 2009 & 2011	None	During in-stream construction activities; Summer 2009 & 2010	As required by NIRB and/or NWB
Use of heavy equipment	• Minimize spatial extent of granular material placement and activity • Regular inspection of all equipment for leaks • Utilizing clean equipment and granular material to protect against deposition of deleterious substances • Limit duration of construction period • Avoid critical periods (e.g. bird breeding season)	Summer 2009 & 2012	None	During in-stream construction activities; Summer 2009 & 2010	
Culvert installation	• Restriction of in-stream works to periods of low or no flow • Utilizing clean equipment and granular material to protect against deposition of deleterious substances • Regular inspection of all equipment for leaks • Installation of silt fences • Retention of vegetated banks • Slow and deliberate placement of boulders/riprap to reduce sediment suspension and dispersion • Water quality monitoring for turbidity/TSS; implementation of controls to augment construction activities if large changes are evident	Summer 2009 & 2013	None	During in-stream construction activities; Summer 2009 & 2010	As required by NIRB and/or NWB
Operation	• Dust control procedures to minimize dust effects on vegetation habitat quality • Discourage and/or limit access to any potential areas of suitable wildlife habitat found adjacent to the Project route	Summer 2009 & 2014	• Increased wildlife mortality due to potential in increased collisions and hunting pressure	None	
Traffic (light & heavy vehicles)	• Dust control procedures to minimize dust effects on vegetation habitat quality • Discourage and/or limit access to any potential areas of suitable wildlife habitat found adjacent to the Project route	Summer 2009 & 2015	• Increased wildlife mortality due to potential of increased collisions	None	
Maintenance	• Conformation to DFO Operation Statement for Culvert Maintenance • Minimize spatial extent of granular material placement and activity	Summer 2009 & 2016	None	None	
Dust	• Hamlet of Repulse Bay municipal Dust Management Program	Summer 2009 & 2010	None	None	

Note: Residual impacts refers to those impacts that remain after mitigation has been implemented.

6 Cumulative Effects

From the NIRB Guide #2, *Guide to Terminology and Definitions*, a cumulative effect is described as "…an impact on the biophysical and socio-economic environment that results from the incremental effects of a development when added to other past, present and reasonably foreseeable future developments, regardless of what agency or person undertakes such other developments. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time". From this definition, cumulative effects of the access road construction and operation have been assessed and the following key questions considered:

- Are there Project-related adverse environmental effects?
- Do identified Project-related adverse environmental effects overlap with (i.e. act in combination with) those of other existing projects and activities? This can be established through characterization of the existing baseline conditions of the VEC, reflecting any overlapping cumulative environmental effects of present projects or activities.
- What is the contribution of the Project to those overlapping cumulative environmental effects of present projects, if any?
- Do the combined Project and cumulative environmental effects of present projects or activities overlap with those of any approved or proposed projects that will be carried out?

These questions are answered for each VEC to the extent that they are applicable within the environmental effects investigation conducted in Section 5. Those VECs which may have cumulative effects from access road construction and/or operation and known previous, current or reasonably foreseeable future developments are considered below.

6.1 Physical VECs

6.1.1 Permafrost

Within the Project area, there are no known previous or current developments which might affect the permafrost within the Project area, the Repulse Bay area or geographic region during access road construction or operation.

Future quarry operation may have a negative effect on permafrost within the footprint of each quarry site as material is excavated, exposing underlying permafrost to thaw. However, overall effects to permafrost from road construction or operation are anticipated to be positive and quarry operation effects will not act cumulatively with those from road construction or operation. A separate mitigation plan should be developed to protect permafrost from degradation with each quarry footprint; this may include an evaluation of the terrain and depth to permafrost prior to quarry site operation.

6.1.2 Hydrology / Water Quality

Within the Project area, there are no known previous or current developments which might affect the hydrology within the Project area, the Repulse Bay area or geographic region during access road construction or operation.

The planned quarry operations adjacent to the Project area can have a negative effect on water quality resulting from increased dust during quarry operations. Increased dust can have a cumulative effect with

dust arising from road operation. A dust management plan may need to be developed for quarry-specific activities as quarry dust management is not included in the Hamlet's current dust management practices.

6.2 Biological VECs

6.2.1 Vegetation

Within the Project area, there are no known previous or current developments which might affect the vegetation within the Project area, the Repulse Bay area or geographic region during access road construction or operation. However during future quarry operation, effects to vegetation may include habitat loss from excavation of granular materials, and reduced habitat quality and productivity from increased dust in the quarry areas. These effects are in addition to those mitigated for during road construction and operations.

Habitat lost from development of the granular sites would be restricted the sites' footprint, however the aerial extent of the granular site footprints were unavailable at the time of report production. The removal of the vegetation community during quarry operation will be unavoidable and will have negative cumulative effect on biodiversity and natural vegetation communities. However, minimizing the area of disturbance required for quarry operations will help protect against the loss of biodiversity and natural vegetation communities in the access road and quarry area. An evaluation of vegetation and habitat within the quarry areas prior to development may be warranted, as well as the establishment of a revegetation program during abandonment of quarry sites to mitigate against permanent loss of biodiversity and natural vegetation communities.

Increased dust resulting from quarry operation will negatively affect habitat quality and productivity of vegetation in the surrounding area and have a cumulative effect with dust arising from road operation. A dust management plan may need to be developed for quarry-specific activities as quarry dust management is not included in the Hamlet's current dust management practices.

6.2.2 Wildlife

Within the Project area, there are no known previous or current developments which might affect the wildlife within the Project area, the Repulse Bay area or geographic region during access road construction or operation. However further sensory disturbance to wildlife species may result from the increased use of heavy equipment at future quarry sites during operations. The Project and granular site areas have been subject to a moderate level of human use, though the increased and prolonged use of heavy equipment may result in wildlife avoidance of these areas during operation of the quarry sites. This may have a negative cumulative effect on local biodiversity, and native wildlife communities.

To minimize negative cumulative effects from operation of the new road and quarry sites, mitigation measure may include, but not be limited to, evaluation of wildlife habitat within the granular sites' footprint, restriction on the timing of excavation, and development of wildlife management plans. These effects relate to the Repulse Bay area only and are not anticipated to significantly affect habitat and biodiversity of other areas in the Kivalliq region.

6.2.3 Fisheries

Within the Project area, there are no known previous or current developments which might affect the wildlife within the Project area, the Repulse Bay area or geographic region during access road construction or operation.

Future quarry development might affect small lakes present within the granular sites' footprint; however the footprints were unavailable at the time of this report. Prior to quarry development, an evaluation of water bodies for potential fish and fish habitat should be completed within and adjacent to each quarry footprint. Quarry specific mitigative measures could then be developed.

6.3 Socio-Economic VECs

6.3.1 Local Economy and Traditional Land Use

Within the Project area, there are no known previous or current developments which might affect the Repulse Bay economy or traditional land use within the Project area, the Repulse Bay area or geographic region during access road construction or operation. Future development of the quarry sites may affect the economy of Repulse Bay as employment opportunities would be created. This would have a positive effect on the Repulse Bay economy, producing a positive cumulative effect with Project effects on the local economy. These effects relate to Repulse Bay only and will not affect the economies of nearby communities in the Kivalliq region.

6.3.2 Heritage Resources

Within the Project area, there are no known previous or current developments which might affect heritage resources within the Project area, the Repulse Bay area or geographic region during access road construction or operation. However as quarry footprints were unavailable at the time of this report, a review of heritage and archaeological resources within and adjacent to each quarry footprint should be conducted prior to quarry development. Quarry specific mitigative measures could then be developed to protect any heritage or archaeological finds within.

7 Supporting Documentation

Supporting documentation includes:

- Appendix A: Drawings, including the proposed access road route (Figure 1) and road cross sections and culvert detail (Figure 2)
- Appendix B: Photographs of the access road project area
- Appendix C: Heritage resource photo plates
- Appendix D: DFO Statement of Confirmation
- Appendix E: Spill Contingency and Response Plan
- Appendix F: North Pole River Access Road Dust Management Plan

8 Summary and Conclusions

The assessment of the interactions of the Project with VECs of the physical, biological and socio-economic environments concluded that adverse environmental effects of the Project on VECs in the Repulse Bay area will be not significant. Table 8.1 summarizes the potential effects associated with the Project and mitigation measures identified.

Table 8.1 Summary of Potential Environmental Effects

Valued Environmental Component	Potential Effect Positive (P) or Adverse (A)	Mitigation Measures	Cumulative Effect
Permafrost	• Change in permafrost (A, P)	• Minimize spatial extent of granular material placement and activity • Use end dump method to avoid direct interaction between terrain and equipment during construction. • Road operation is expected to prevent further permafrost degradation and allow stabilization in areas on ATV trail presently impacted	Unknown
Hydrology / Water Quality	• Change in surface water quantity and flow (A) • Changes to surface water quality in Project area (A)	• Compliance to DFO Operational Statements • Restriction of in-stream works to periods of low or no flow • Culvert installation may improve stream hydrology through removing direct disturbance from ATVs • Utilizing clean equipment and granular material to protect against deposition of deleterious substances • Regular inspection of all equipment for leaks • Installation of silt fences • Retention of vegetated banks • Monitoring and adaptive management during in-stream works	Not Significant
Vegetation	• Habitat loss (A) • Change in native vegetation community (A) • Change in habitat quality (A)	• Minimize spatial extent of granular material placement and activity • Limit duration of construction period • Dust control procedures to minimize dust effects on vegetation habitat quality	Not Significant
Wildlife	• Habitat loss (A) • Sensory Disturbance (A)	• Minimize spatial extent of granular material placement and activity • Limit duration of construction period	Not Significant

Valued Environmental Component	Potential Effect Positive (P) or Adverse (A)	Mitigation Measures	Cumulative Effect
		• Avoid critical periods (e.g. bird breeding season) • Discourage and/or limit access to any potential areas of suitable wildlife habitat found adjacent to the Project route • Local control in harvesting activity if populations decline	
Fisheries	• Changes to surface water quality in Project area (A) • Introduction of deleterious substances (A)	• Compliance to DFO Operational Statements • Minimize spatial extent of granular material placement and activity • Limit duration of construction period • Slow and deliberate placement of boulders/riprap to reduce sediment suspension and dispersion • Hand placement of in-stream boulders during culvert installation to reduce sediment suspension and dispersion • Restriction of in-stream works to periods of low or no flow • Utilizing clean equipment and granular material to protect against deposition of deleterious substances • Regular inspection of all equipment for leaks • Installation of silt fences up-shore of Project construction activities on all adjacent waterbodies • Water quality monitoring for turbidity/TSS; implementation of controls to augment construction activities if large changes are evident	Not Significant
Local Economy & Traditional Use	• Change to economy (P) • Change to traditional land use (P)	• Mitigation not required as all potential effects are considered positive	Significant (Positive)
Heritage Resources	• Change to heritage sites (A)	• Carry out Heritage Resource Impact Assessment and implement necessary mitigations (avoidance through re-outing or salvage where re-routing not practical).	Unknown

The Hamlet of Repulse Bay will be required to obtain permits and authorization from the Nunavut Water Board and Nunavut Impact Review Board to construct the Project. The approval of the Project will benefit the Hamlet of Repulse Bay by providing a granular material source for future municipal projects and support community development initiatives.

9 Closure

This report has been prepared by Nunami Jacques Whitford Limited for the sole benefit of the Hamlet of Repulse Bay for submission to the Nunavut Impact Review Board (NIRB). The report may not be relied upon by any other person or entity, other than for its intended purposes, without the express written consent of Nunami Jacques Whitford Limited and the Hamlet of Repulse Bay.

This report was undertaken exclusively for the purpose outlined herein and is limited to the scope and purpose specifically expressed in this report. This report cannot be used or applied under any circumstances to another location or situation or for any other purpose without further evaluation of the data and related limitations. Any use of this report by a third party, or any reliance on decisions made based upon it, are the responsibility of such third parties. Nunami Jacques Whitford Limited accepts no responsibility for damages, if any, suffered by any third party because of decisions made or actions taken based on this report.

Nunami Jacques Whitford Limited makes no representation or warranty with respect to this report, other than the work was undertaken by trained professional and technical staff in accordance with generally accepted engineering and scientific practices current at the time the work was performed. Any information or facts provided by others and referred to or used in the preparation of this report were assumed by Nunami Jacques Whitford Limited to be accurate. Conclusions presented in this report should not be construed as legal advice.

The information provided in this report was compiled from a field survey and existing documents and data provided by the Hamlet of Repulse Bay and by applying currently accepted industry standards and principles. This report represents the best professional judgment of Nunami Jacques Whitford Limited personnel available at the time of its preparation. Nunami Jacques Whitford Limited reserves the right to modify the contents of this report, in whole or in part, to reflect any new information that becomes available. If any conditions become apparent that differ substantially from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein.

This report has been prepared by a team of Nunami Jacques Whitford Limited professionals on behalf of the Hamlet of Repulse Bay and the Government of Nunavut Community and Government Services. If representatives of the Hamlet of Repulse Bay or Government of Nunavut Community and Government Services have questions or concerns about this report, please contact the undersigned.

Respectfully submitted,

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Environmental Scientist

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Project Manager & Senior Reviewer

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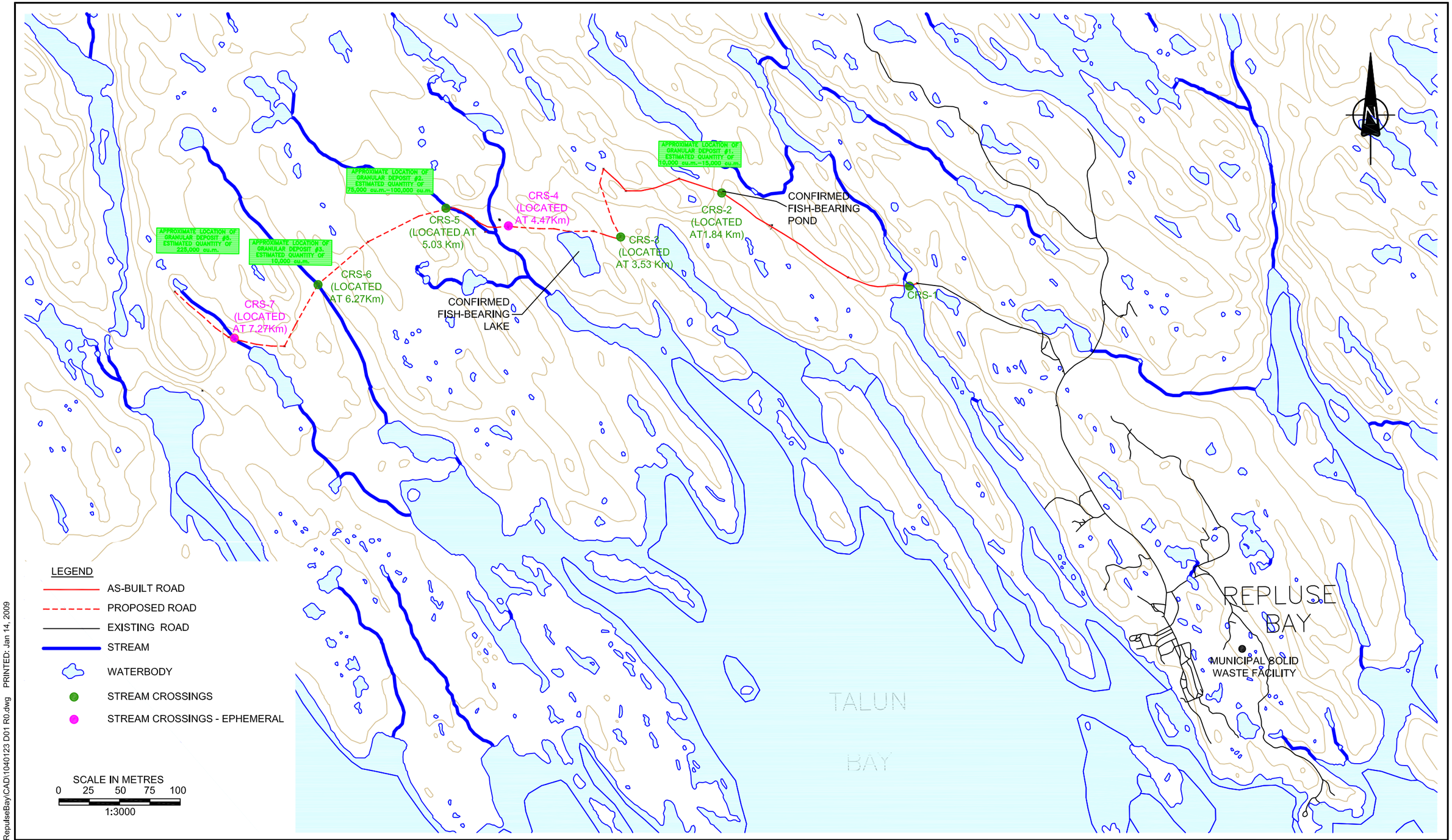
Appendix A Drawings



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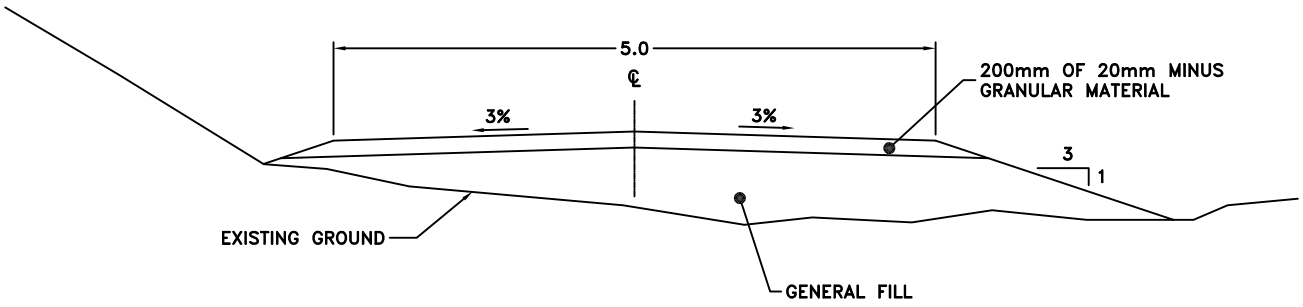
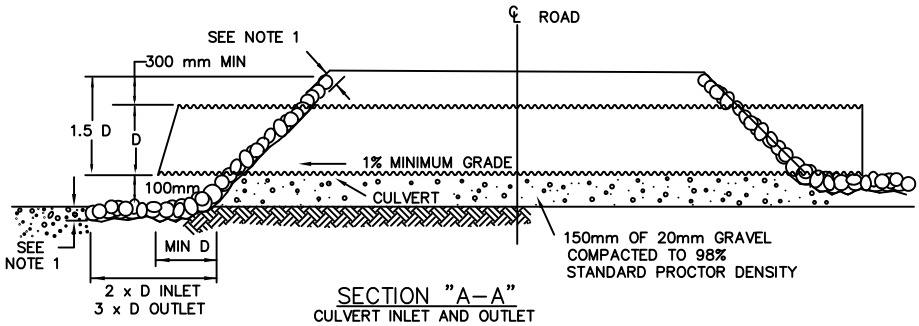


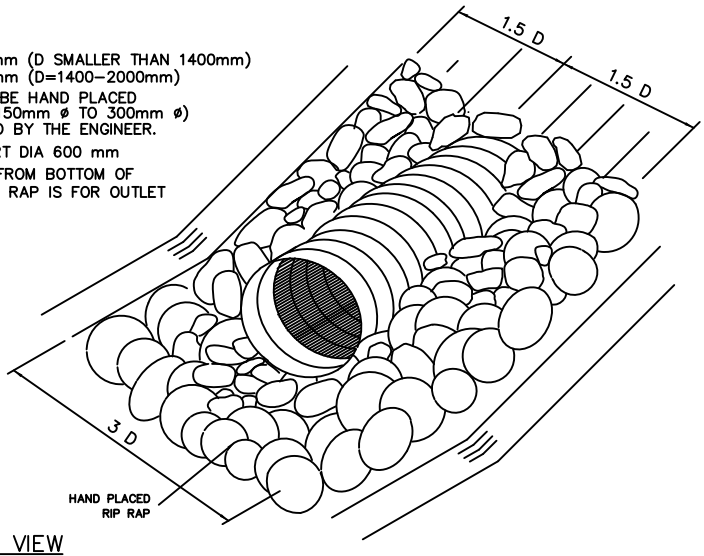
TYPICAL ROAD SECTION



SECTION "A–A"
CULVERT INLET AND OUTLET

NOTE:

1. THICKNESS 300mm (D SMALLER THAN 1400mm)
   THICKNESS 600mm (D=1400–2000mm)
2. RIP RAP SHALL BE HAND PLACED
   ROCK COBBLE (150mm ø TO 300mm ø)
   OR AS SPECIFIED BY THE ENGINEER.
3. MINIMUM CULVERT DIA 600 mm
4. 100 mm DROP FROM BOTTOM OF
   CULVERT TO RIP RAP IS FOR OUTLET
   END ONLY



ISOMETRIC VIEW
CULVERT INLET AND OUTLET

TYPICAL CULVERT DETAIL

ROAD CROSS SECTION AND CULVERT DETAIL REPULSE BAY, NU	Job No.: 1040123 Scale: N.T.S. Date: 07-Jan-09 Dwn. By: SS	Dwg. No.: 2	Jacques Whitford AXYS
Client: HAMLET OF REPULSE BAY	App'd By:		

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