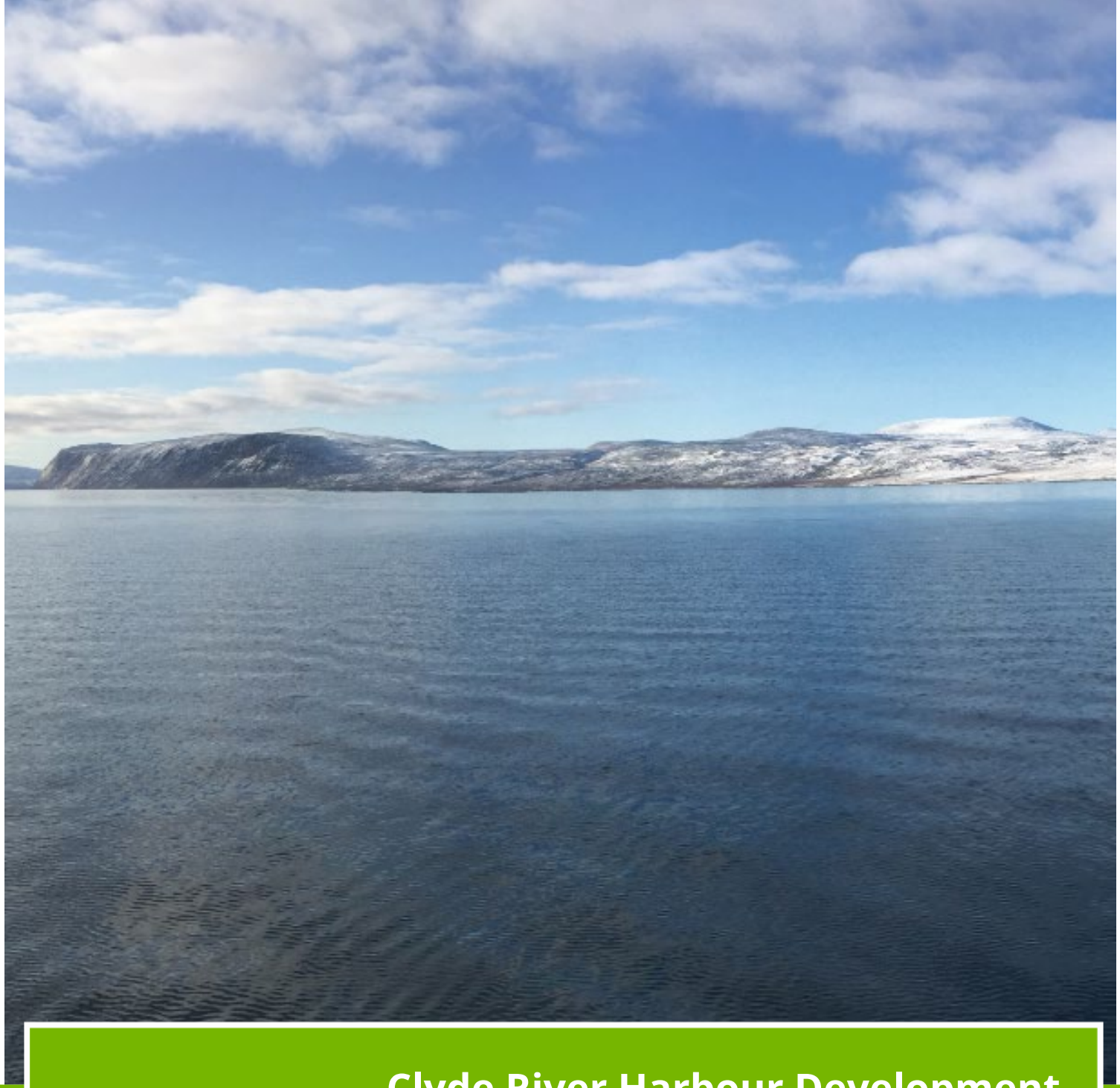

# Clyde River Harbour Development

## Project Proposal

CANADRILL

CBCL

200235.00 • August 2021

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| 002 | Final Report | Loretta Hardwick | August 13, 2021 | Amanda Coldham |
| 001 | Draft Report | Kevin Bezanson | July 23, 2021 | Loretta Hardwick |
| **Issue or Revision** | | **Reviewed By:** | **Date** | **Issued By:** |



Report: 200235.00

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# Chapter 1 Introduction

## 1.1 Project Overview

Fisheries and Oceans Canada – Small Craft Harbours (DFO-SCH) is proposing to construct a small craft harbour in Clyde River, Nunavut (the Project). The primary objective of the Project is to establish a commercial fishing harbour in the hamlet of Clyde River, and provide safe and accessible facilities for community members pursuing their livelihoods in the local area.

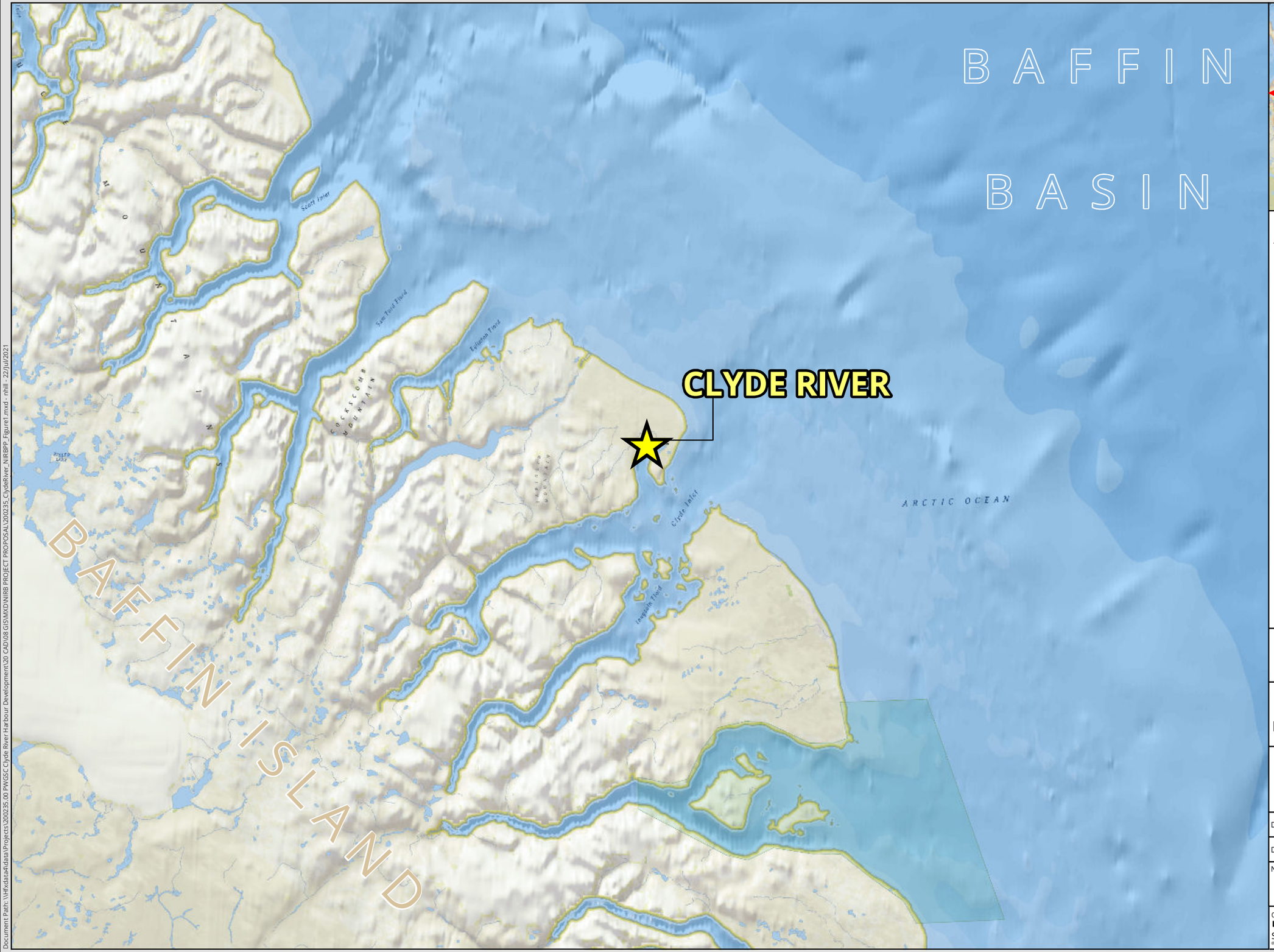
The Project is a coastal infrastructure project that consists of the modification of existing infrastructure at the community sealift and the construction of a new small craft harbour. Permanent components of the small craft harbour include new breakwaters, a shoreline revetment, new fixed wharf, floating docks, community boat launch, new laydown area, mooring bollard, harbour lighting, power to the fixed wharf, and aids to navigation. Construction of the new small craft harbour involves marine-based activities (i.e., marine construction, dredging of material from the harbour bottom) and quarrying rock from an existing community quarry. Dredged materials may be reused as fill during construction or disposed of at sea. Rock sourced from the community quarry will be used during construction. Rock will be hauled from the quarry partially via an existing road through the hamlet. During construction, a river crossing structure on the haul road at the river north of the quarry will be required, able to support fully loaded rock trucks.

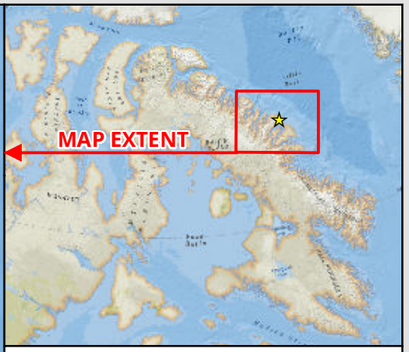
## 1.2 Project Location

The Project will be located at Clyde River, Nunavut (Figure 1.1). The footprint of the small craft harbour will fall partially within the upland, tidal zone, and seabed area along the shoreline of Patricia Bay to the southwest of the hamlet of Clyde River. The new small craft harbour is proposed to be located west side of the existing sea lift ramp and the quarry is located to the east of Clyde River (Figure 1.2). The haul route connects the quarry to the hamlet.

The Project will be carried out in the Qikiqtaaluk Region, in the North Baffin Planning Region. Current land use at the location for the small craft harbour falls into the following categories:

- Commercial harvesting
- Marine-based activities
- Transportation




Project Location

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CLYDE RIVER HARBOUR
DEVELOPMENT PROJECT PROPOSAL

## Project Location

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| DATE: 2021-07-22 | PROJ N°: 200235 | FIGURE: 1.1 |
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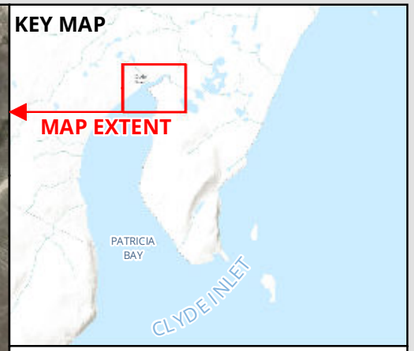
KEY MAP




LEGEND

- Haul Route
- SHC Location
- Disposal At Sea Location
- Quarry Location

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CLYDE RIVER HARBOUR
DEVELOPMENT PROJECT PROPOSAL

# Project Components

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The seabed is federal Crown land under the administration and control of Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC). The shore is Commissioners land under the administration and control of the Nunavut Department of Community and Government Services. DFO-SCH is currently in the process of acquiring the property from the Government of Nunavut and CIRNAC. The acquisition will be finalized before commencing construction.

The existing quarry is on lands administered and controlled by the Municipality of Clyde River and the surrounding land abutting the quarry is administered and controlled by the Nunavut Department of Community and Government Services.

## 1.3 Regulatory Framework

The project is located in the Nunavut Settlement Area (NSA) which is governed under the *Agreement between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in Right of Canada* (the Nunavut Land Claims Agreement or NLCA) and the *Nunavut Planning and Project Assessment Act* (NPPAA). Projects proposed in the NSA are sent to the Nunavut Planning Commission (NPC) for review to determine whether they conform with the established land use plan, in this case the North Baffin Regional Land Use Plan. The NPC determines conformity, after which the proposal is referred to the Nunavut Impact Review Board (NIRB) to screen the proposal and decide if an environmental review is required. DFO-SCH submitted a preliminary project proposal to the NPC on June 10, 2021. On June 22, 2021, the NPC issued their determination that the Project conforms with the land use plan and referred the Project to the NIRB for screening.

The purpose of this Project Proposal document is to provide the information required by the NIRB to complete the screening. The report was prepared in accordance with the requirements outlined in the NIRB (2020) Proponent's Guide.

Further regulatory approvals can be obtained only after the NIRB screening has been completed and the project has been released from further review. Construction of the harbour in Clyde River is expected to require several approvals, authorizations, and permits. Table 1.1 presents a list of approvals, permits, authorizations, and licenses that are expected to be required for construction of the Project, after the Nunavut Planning Commission completes a review of the Project proposal to determine conformity with the North Baffin Regional Land Use Plan.

During the NIRB screening, government and non-government organisations will be provided the opportunity to review and comment on the Project proposal. In addition to the regulatory agencies identified in Table 1.1, several agencies with interests or mandates to manage or advise on wildlife and marine issues will be invited to participate in the NIRB screening process; these include the Nunavut Wildlife Management Board (NWMB), Nunavut Marine Council (NMC), Nunavut Tunngavik Inc. (NTI), and Qikiqtaaluk Wildlife

Board (QWB). On August 10, 2021, information packages were sent to these organisations to inform them of the Project and invite them to provide input or request more information on the proposed project.

**Table 1.1 List of approvals, permits, authorizations and licences that are expected to be required**

| Approval / Permit / License /Authorization | Regulatory Authority | Associated Component or Activity |
|---|---|---|
| *Fisheries Act* Authorization | Fisheries and Oceans Canada (DFO) | Dredging, infilling, marine construction, river crossing |
| Approval under *Canadian Navigable Waters Act* | Transport Canada | Dredging, infilling, marine construction, river crossing |
| Disposal at Sea Permit under the *Canadian Environmental Protection Act, 1999* | Environment and Climate Change Canada (ECCC) | At sea disposal of dredged material, if required |
| Type B Water License | Nunavut Water Board (NWB) | Water use for construction, river crossing, creek diversion |
| Explosives License | Government of Nunavut Workers Safety & Compensation Commission (WSCC) | Quarrying (acquisition and storage of explosives) |
| Explosives License | Natural Resources Canada | Quarrying |
| Quarrying Permit | Municipality of Clyde River | Quarrying |
| Land Use Permit Commercial / Industrial Land Lease | Municipality of Clyde River | Quarrying/hauling, camp location, new river crossing |
| Land Use Permit | Government of Nunavut | River crossing |

## 1.4 Proponent Information

DFO-SCH is the owner of the Project. Canadrill-CBCL Joint Venture (Canadrill-CBCL), as the consultant, has been retained by Public Services and Procurement Canada (PSPC) on behalf of DFO-SCH to provide support to DFO-SCH during the regulatory review process, detailed design, and construction of the proposed small craft harbour in Clyde River, Nunavut. DFO-SCH will retain ownership and maintenance responsibilities upon completion of the Project.

**Table 1.2 Application contact information**

| | |
|---|---|
| **Applicant:** | Fisheries and Oceans Canada – Small Craft Harbours (DFO-SCH)<br>501 University Crescent<br>Winnipeg, Manitoba R3T 2N6 |
| **Applicant Contact:** | Eleanor McEwan, P.Eng.<br>Senior Project Engineer<br>Winnipeg, Manitoba R3T 2N6<br>Phone: (204) 984-1102<br>Email: eleanor.mcewan@dfo-mpo.gc.ca |
| **Consultant Representative:** | Canadrill-CBCL Joint Venture<br>1505 Barrington Street<br>Suite 901 – Maritime Centre<br>PO Box 606<br>Halifax, NS B3J 2R7 |
| **Consultant Representative Contact:** | Loretta Hardwick, M.Sc.<br>Regulatory and Environmental Lead<br>CBCL Limited<br>Phone: (343) 552-2235<br>Email: lhardwick@cbcl.ca |

# Chapter 2 Public Participation and Engagement

## 2.1 Engagement

Community engagement activities were conducted as part of a feasibility study conducted by DFO-SCH for this Project (Advisian, 2020). This included three trips to the community (November 2018, May 2019, and November 2019) to build a rapport with the community, to understand community needs and desires, and to share concepts for the harbour design. Meetings were held with the Council, the Nangmautaq Hunters and Trappers Association (HTA) and the local Qikiqtani Inuit Association (QIA) representatives. Feedback received related to local conditions, water and ice access, existing facilities, design input, the quarry, and the safety of the haul road, among other topics.

DFO-SCH refined the harbour layout options and presented the update in February 2020. A meeting was held with the Council and Nangmautaq HTA and an open house was held to obtain feedback from the community. Feedback included questions on whether the sealift ramp would be accessible during construction, the river crossing options to get to and from the quarry, and the effects of blasting on fish in the lake, among others.

Building on the community engagement work from the feasibility study, an initial engagement trip by the Canadrill-CBCL team was held in Clyde River the week of September 29, 2020, with the following objectives:

- Introduce the Canadrill-CBCL Team to the Hamlet and Nangmautaq HTA of Clyde River.
- Identify key players and establish a relationship between the Canadrill-CBCL Team and the community.
- Present the proposed harbour layout and field programs to the community stakeholders and provide answers to questions.
- Better understand the context of the small craft harbour in the community of Clyde River.
- Collect field data and Inuit Qaujimajatuqangit (IQ).

A second engagement trip by the Canadrill-CBCL team was held in Clyde River the week of February 19, 2020, with the following objectives:

- Provide an update on the status of the design and the proposed harbour layout.
- Provide an update on the results of the field studies and investigations.
- Discuss the plans for upcoming field studies and investigations.
- Introduce the options being considered for the river crossing.

- Present the schedule for upcoming activities and future community consultations.
- Review responses to previous, and record any new, community questions and concerns.
- Continue to build relationship between the Canadrill-CBCL Team and stakeholders in the community and better understand the context of the small craft harbour in the community of Clyde River.
- Continue the collection of field data and IQ.

The engagement tools and approaches used during the engagement trips to Clyde River included:

- Structured presentations and discussions with the Hamlet, Nangmautaq HTA, QIA members
- Meetings with knowledge holders to gather information on IQ
- Discussions with the Mayor of Clyde River
- Drop in visits with the RCMP and Conservation Officer
- Ad hoc conversations with people from Clyde River

## 2.2 Summary of Issues and Concerns

The following subsections provide a summary of the issues and concerns expressed during the two community engagement sessions held by Canadrill-CBCL team in Clyde River on September 2020 and February 2021 (Canadrill-CBCL, 2020a; Canadrill-CBCL, 2021a) along with the community feedback obtained during the feasibility study community engagement sessions in November 2018 and May 2019.

### 2.2.1 Safety and Security

- Traffic along the haul road was a primary concern as trucks transporting armour stone from the quarry to the small craft harbour site will pass through the hamlet, where there is a school and children. Community members would like to consider the safest option used for transport and expressed the need for safety monitors.
- Breakwater could be dangerous for children; they may play on it and be out of sight from adults.
- Adolescents may access the harbour at night, and the need for a night watchman was indicated.
- Boulders along the shoreline are dangerous and hazardous; community members would like to see these removed during the project to improve safety and navigation.
- RCMP expressed security concerns with workers coming into Clyde River and requested to be notified of who is coming and going.
- Dust in the community is a concern during construction.

### 2.2.2 Small Craft Harbour

- Community members asked about the small craft harbour lifespan, and maintenance and costs associated with the harbour.
- Community members questioned if the navigation light colours could be changed and if there would be electrical access at the harbour.
- The small craft harbour will likely not be used during the winter months.
- Prefer 24-hour construction and would like the opportunity to hire local community to complete construction.
- Prefer that the existing community harbour will continue to be used even after the new harbour is built.
- Agreement that the design will protect the boats from the western and southern winds (Chinooks).
- Agreement regarding the location of the sealift outside of the main harbour.
- Concerns over potential disposal at sea, and land disposal is considered more favourable, though the area is very deep which is a positive.

### 2.2.3 River Crossing

- Members of the community indicated the current river crossing is not stable.
- It was noted that river crossing design must allows for the passage of fish.
- An alternative river crossing was considered favourable and safer.

### 2.2.4 Quarry and Haul Route

- Suggested hauling across the beach if needed.
- Consider other options for transportation of rock aggregate, such as barging across or alternative routes rather that using the existing route.

### 2.2.5 Exposure to Waves, Wind, Tides and Ice

- Seasonal variation in tidal fluctuations and wind events need to be considered in the harbour design and the floating docks need to be strong enough to protect moored boats. Harvesters and fishermen often adjust their schedules to the tidal range.
- Boat owners and the mayor expressed that the harbour should provide protection for boats during times of the year when waves and winds are high. Currently, boats are damaged and have to be removed when waves come from the south.
- Prevailing winds in the winter are northwest; there are prevailing east winds in the Spring.
- Sediment is brought by westerly and southern waves.
- There are no problems accessing ice in the winter.
- The harbour must be designed with climate change in mind (stronger winds and tides).
- Community members would like a tide indicator.

### 2.2.6 Harvesting

- Community members were interested if fishing/harvesting can be done from the breakwater, and if construction would impact the current clam harvesting practices.
- Negative impacts of construction on marine mammals, especially from noise, were expressed by the community and the mayor; efforts to reduce noise during construction need to be taken.
- Wildlife officer noted that the river crossing is used by the community to fish for Arctic char; consultation with the community about river crossing construction and placement is essential.
- The small craft harbour will create more places for fishing than the current breakwater which will provide more opportunity to harvest and fish for community members who do not have a boat.
- Fishing is done along the shoreline.

### 2.2.7 Employment

- Community members expressed that local hiring should be a priority for construction projects and related support (e.g., catering for the construction crew).

## 2.3 Future Engagement

Additional community outreach is planned, including meetings with the council and Nangmautaq HTA and a community open house, scheduled for September 2021. Meetings will include project updates, details on any upcoming field programs and presentation of design progress. Feedback will be sought with the intention of considering feedback in the design as the project progresses.

A meeting with members of the Hamlet Council, Nangmautaq HTA, QIA and Guardians is planned for September 2021. The objectives of the meeting will be as follows:

- Provide an update on the status of the design
- Present the results of the River Crossing Options Analysis
- Collect input on potential locations for a temporary contractor camp
- Collect input on the proposed quarry expansion
- Present the schedule for upcoming activities and future community consultations
- Review responses to previous questions
- Record all questions and concerns

An IQ Session is also planned for September 2021 to continue to get input from local knowledge holders as the project progresses, as well as to provide updates on the project including the small craft harbour design, geotechnical program, the Phase III ESA, river crossing options and also follow up on previous concerns raised. CBCL will work with the Nangmautaq HTA to invite knowledge holders, preferably the same as those that were present in the first two IQ workshops.

# Chapter 3 Local Traditional Knowledge

## 3.1 Traditional Knowledge Gathering

During the feasibility study, two design workshops were held in November 2018 and May 2019 with members of the Nangmautaq HTA, and two additional workshops took place with active Inuit hungers and fishers in Clyde River during May 2019 and November 2019 (Advisian, 2020). Important land use and resource locations were plotted on a map to convey various fishing, hunting, harvesting locations in Patricia Bay during the sessions. In respecting the rights and privacy of Inuit knowledge holders, the map was not included in this report.

Members of the Canadrill-CBCL travelled to Clyde River during September 2020 and February 2021 to participate in meetings and engagement activities. The trips provided Canadrill-CBCL the opportunity to engage knowledge holders for collection and evaluation of IQ and traditional knowledge in relation to the Project during IQ workshops. IQ sessions performed by Advisian and Canadrill-CBCL followed a similar format. These workshops were structured to offer a platform to knowledge holders to express comments and concerns, to enhance Canadrill-CBCL's understanding of the interconnectedness between the land and community, and to access baseline data on the local environmental that may not be accessible otherwise.

The intent of the IQ workshops for the small craft harbour Project was to work with identified knowledge holders within the community to:

- Gain insight into the historical and current use of the coastal area surrounding the small craft harbour.
- Gather information about local habitats and wildlife resources.
- Have a greater understanding of the relationship between people and place.
- Gather information regarding weather, ocean currents and wave patterns.
- Gain insight as to why certain activities, places or resources are important to Inuit culture and identity.
- Take this information into consideration during the design of the small craft harbour.

IQ is the unified and holistic system of beliefs, knowledge, principles, and values that encompass Inuit cultural identity. This knowledge system is historically rooted in an in-depth understanding that Inuit have of the natural environment that places emphasis on the interconnectedness of people and place. Increasing recognition is being placed on this comprehensive understanding of local environments as a means of gaining a more complete understanding of the use and value of an area. The incorporation of IQ into

western science knowledge systems can contribute to knowledge of local biodiversity and ecological processes, which can in turn advance sustainable resource management and development.

The Canadrill-CBCL Team worked closely with the Nangmautaq HTA to identify and invite knowledge holders to participate in the first face-to-face IQ workshop held during the week of September 28, 2020. The knowledge holders that were invited to participate in the workshop were selected based on their knowledge and harvesting experiencing surrounding the area of the small craft harbour. The format of the workshops was a roundtable discussion with maps and aerial photographs situated in the centre of the table, used to help guide discussions. Participants were encouraged to indicate important locations on maps as they were sharing their knowledge.

Information was gathered on the state of the local environment, historical and current use, and small craft harbour needs and aspirations during the first workshop. A second workshop occurred on February 22, 2021, in which IQ knowledge holders were re-engaged. The intent was to focus on concept design.

The following subsections outline the main comments expressed by knowledge holders during the September 2020 and February 2021 workshops.

### 3.1.1 Small Craft Harbour

- Sedimentation at the proposed small craft harbour is from shoreline erosion.

### 3.1.2 Exposure to Waves, Wind and Tides and Ice

- Regarding climate change, knowledge holders indicated that they have not noticed any substantial changes, though fish do periodically relocate to other lakes and then return.
- Icebergs rarely enter Patricia Bay.
- Ice entrapment typically clears out by the spring/summer, and it was noted that ice conditions during the time of the workshop and prior were very thin relative to normal.
- No glaciers near Clyde River, but glacier melt can create stronger currents in rivers in areas where there are glaciers.

### 3.1.3 Harvesting

- A description was provided of the main fish and marine mammal species harvested near the community.
- Harvesters are unlikely to butcher their catch at the small craft harbour to avoid attracting polar bears.
- Certain species may avoid the area during construction, such as the Narwhal, but they will return following construction.
- There are no harvesting sites directly in the footprint of the harbour; species that are harvested, such as Arctic char are considered very mobile and travel on the other side of the bay from the small craft harbour site.

- Clam harvesting will not be impacted.

The IQ findings are summarized and based on only a small number of workshops and, therefore, do not fully represent the intensity and extent of Inuit use and resource of the Project or the surrounding region.

## 3.2 Integration into Design and Assessment

IQ knowledge shared during the two IQ workshops facilitated by the Canadrill-CBCL team, along with the initial engagement as part of the feasibility study, was integrated into the design of the Project whenever possible.

Comments raised around fishing and harvesting in the harbour were addressed to allow these activities to resume at the existing harbour during construction when viable. Extensive feedback concerning the influence of wind direction, tidal strength, seasonal storms and interaction with ice on the proposed small craft harbour was integrated into the design of the breakwaters to safeguard boats from enduring damage due to extreme environmental conditions. The expressed aspiration to allow fishing to safely occur from the breakwaters was also incorporated into the design.

Additionally, comments regarding relocating the river crossing along the haul route were also taken into consideration as the existing river crossing is unlikely to be used due to concerns expressed about the integrity of the existing bridge structure. Concerns over disposal at sea were considered, and the ability to use dredged material for beneficial use as fill material in the upland region of the harbour were also addressed in the design.

IQ was integrated into this assessment to evaluate the impact of construction activities on socio-economic components and freshwater and marine species and their habitat in particular since knowledge holders provided key information regarding these topics. The safety concerns articulated during the IQ workshops and community consultations are addressed through the planning of mitigation measures to avoid potential adverse effects of the Project construction on health and safety.

# Chapter 4 Project Description

## 4.1 Purpose and Scope

As part of the creation of the Tallurutiup Imanga National Conservation Area and the Inuit Impact and Benefit Agreement, the Government of Canada, through DFO-SCH, are committed to establishing a commercial fishing harbour in the community of Clyde River, Nunavut. As with most small craft harbour facilities, the primary function of the Project is to provide safe and accessible facilities to access the water for the community to purse the local livelihood, including marine fish and mammal harvesting, and provide infrastructure needed to develop commercial fisheries.

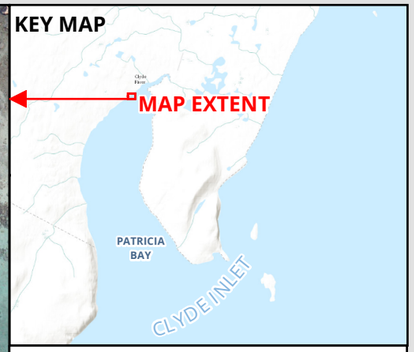
The current use of the project site as a fishing harbour does not meet the needs of the community; there are issues associated with vessel damage, equipment loss, safety, overcrowding, extensive sedimentation, logistical conflicts during sealift operations, and other general inefficiencies. Currently, the project site is used as access for fishing and marine mammal harvesting. The Project will provide safe access to land and sea to meet current and future needs, taking into consideration climate change. The intent is to enhance the local facilities for the benefit of both its direct users and the broader community.

## 4.2 Project Components

The proposed Project consists of the following key physical components (Figure 4.1):

- Two large breakwater structures, which provide a sheltered basin for vessel mooring
- A revetment along the shoreline
- A set of two lines of floating docks, with the ability to expand to four lines of floating docks, within the basin
- A community boat launch
- A new fixed wharf structure accessible via a road on the breakwater crest
- A retrofit of the existing sealift to maintain and enhance the existing accessibility
- A laydown area for storage of materials and goods
- A new mooring bollard to facilitate offloading of fuel to the adjacent tank farm
- Harbour lighting along the breakwater access road, fixed wharf and floating dock landing area, and electrical service on the fixed wharf
- Navigation aids along the breakwaters, as required

KEY MAP




LEGEND

Project Layout

- Access Road
- Breakwater
- Community Boat Launch
- Fixed Wharf
- Floating Docks
- Sea Lift
- Service Area

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CLYDE RIVER HARBOUR DEVELOPMENT PROJECT PROPOSAL

# Small Craft Harbour Location

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| DATE: 2021-08-13 | PROJ N$^{O}$: 200235 | FIGURE: 4.1 |
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Coordinate System: NAD 1983 UTM Zone 19N
Units: Meter

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## 4.3 Construction

In addition to the physical components of the Project, the following activities will be carried out during construction:

- Establishment of temporary construction work camp
- Establishment of temporary construction staging, laydown, and storage areas
- Installation of a new culvert on the west side of the small craft harbour, and possibly a new culvert to the east, depending on the haul road location
- Haul road and river crossing upgrades
- Quarrying (drilling, blasting, excavation)
- Dredging and disposal of dredged material
- Pile driving
- Infilling
- Potential beach grading west of the small craft harbour
- Utility pole and lighting installation

Rock and gravel required to construct the small craft harbour will be sourced from the quarry. The proposed quarry is an existing quarry located approximately 5 km by road from the small craft harbour site. The existing quarry will need to be expanded to provide the required volume of rock for the Project; the boundary of the quarry expansion will be within the quarry area identified in the feasibility study and shown on Figure 1.2. The haul road from the quarry crosses a watercourse and the existing bridge will require upgrades, or a new crossing will be required. Infilling will be carried out to establish the small craft harbour facilities and expand the upland area for the small craft harbour laydown area. Dredging will be required to at least -5.0 m Chart Datum (CD) at the fixed wharf, entrance channel, and turning circle to accommodate larger vessels. Dredging will also be required to a depth of -1.5 m CD at the floating docks to accommodate vessels at low tide. Dredged material will be reused for infilling, if the material is appropriate for such reuse; dredged material that cannot be reused at the site will be disposed of at sea.

### 4.3.1 Access/Transportation

Personnel will arrive via air transportation. Equipment and materials will be transported to the site via a combination of marine and air transportation. All air transportation will use the existing airport at Clyde River. Marine transportation will use the existing sealift. Transportation of personnel and equipment or materials from the airport to the Project Area will use the existing road.

### 4.3.2 Personnel and Accommodations

During construction, it is estimated that there will be 25 to 30 personnel required. Construction personnel will be required during the open-water season and those that are not residents of Clyde River will depart for the winter. During the active construction seasons, personnel will be onsite over a period of approximately 130 days for a total of 390 construction days per person over the course of the four-year construction phase.

Because commercial accommodations in Clyde River are limited, it is expected that the contractor will establish a temporary work camp to accommodate personnel during construction. One potential work camp location has been identified by the community and will be further discussed with the community during the September 2021 visit. Water will be required primarily for cooking and consumption at the work camp and to a lesser degree at the construction site. It is estimated that approximately 6 $m^3$ per day will be required during construction. Water is not required during the winter shut-down periods. Greywater and sewage (human waste) will be collected from the work camp site in a wastewater truck and transported to the municipal wastewater treatment facility.

### 4.3.3 Schedule

The Project is expected to be a four-year project where physical work would commence in 2022. Year one work (2022) may include, but is not limited to, staging materials and equipment, temporary work camp set up, construction of a river crossing, and potentially some blasting of rock material. In 2023, active construction will be carried out during the open-water seasons to 2025, with construction shut down over the winter seasons.

### 4.3.4 Equipment and Materials

Equipment and materials required during construction of the Project will be determined by the contractor; however, the following sections provide an estimate of the equipment and materials that are likely to be required, based on the schematic design of the Project, the Project location, and experience with similar Projects.

Table 4.1 provides a summary of the types and quantities (units) of equipment that is estimated to be used during construction of the Project, along with the size (weight or dimensions) and proposed use.

**Table 4.1 Estimate of Equipment Use During Project Construction**

| Type | Units | Description | Size (m) | Use |
|---|---|---|---|---|
| Drilling rig | 2 | 5 ton | 5.5 x 2.3 | Quarrying |
| Excavator | 5 | 30 - 40 ton | 4 x 3.5 | Quarrying, material handling, excavating |
| Rock truck | 4 | 35 ton articulating | 11.1 x 4.2 | Transporting quarried rock |
| Transport truck | 2 | 40 tons | 16 x 2.9 | Transporting equipment and materials |
| Front end loader | 3 | 966 - 988 | 7.5 x 2.5 | Material loading and handling |
| Compactor | 1 | 20 ton | 6.2 x 2.5 | Work surface and road compaction |
| Bulldozer | 1 | D8 | 3.2 x 2.7 | Work surface and road levelling |
| Grader | 1 | 140 ton | 10.1 x 2.5 | Work surface and road grading |
| Spud barge/ derrick | 1 | 20m x 50m deck with 150 ton crane | 20 x 50 | Dredging, transporting material and equipment |
| Material scow | 2 | 500 cubic metre | 47 x 11 | Dredging and disposal of dredged material |

| Type | Units | Description | Size (m) | Use |
|---|---|---|---|---|
| Tug | 1 | 1000 - 1500 horsepower | 14.85 x 5.8 | Transport and movement of marine equipment |
| Work boat | 2 | 50 - 500 horsepower | 9.75 x 2.9 | Transport and movement of marine equipment and personnel |
| Pick-up truck | 3 | 3/4 ton | 4.8 x 1.9 | Transport and movement of equipment and personnel |
| Fuel/service truck | 1 | 10 ton | 13 x 2.5 | Transport fuel from Government of Nunavut Petroleum Products Division dispensers to mobile equipment |
| Water truck | 1 | 10 ton | 9.5 x 2.5 | Transport water from municipal water to work camp and construction site |
| Wastewater truck | 1 | 10 ton | 9.5 x 2.5 | Transport wastewater from work camp and construction site to municipal wastewater treatment facility |
| Telehandler/ forklift | 1 | 5 ton | 6.2 x 2.6 | Material and equipment loading, handling, and movement |
| Rough terrain crane | 1 | 80 ton | 14.5 x 7.9 | Material and equipment loading, handling, and movement |
| Rock Crusher for quarry | 1 | 125 ton | 14.6 x 4.2<br>14.3 x 4.2<br>17 x 3.6 | Portable jaw crusher, cone and screening plant for the manufacturing of aggregate |

Table 4.2 provides a summary of the types and quantities (units and volume) of fuel that is estimated to be used during construction of the Project, along with the proposed storage and use.

**Table 4.2 Estimate of Fuel Use During Project Construction**

| Fuel | Storage Method / Container Volume | Number of Containers | Total Volume ($m^3$) | Use |
|---|---|---|---|---|
| Diesel | Fuel will be dispensed on a daily basis from existing facilities in Clyde River. | n/a | 3,800 | Mobile equipment, remote generators and heaters. |
| Gasoline | Fuel will be dispensed on a daily basis from existing facilities in Clyde River. | n/a | 140 | Small work boats, small generators and ATVs. |
| Propane | 100-lb (25 gallon) compressed gas tanks | 10 | 1 | Camp use (heating, cooking, refrigeration) |
| Acetylene | 4 $m^3$ compressed gas cylinder | 10 | 40 | Metal cutting and welding torches |

Table 4.3 provides a summary of the types and quantities (units and volume) of hazardous materials and chemicals that are estimated to be used during construction of the Project, along with the proposed storage and use.

**Table 4.3 Estimate of Hazardous Materials and Chemicals Use During Project Construction**

| Chemical / Material | Storage Method / Container Volume | Number of Containers | Total Volume | Use |
|---|---|---|---|---|
| Oils and lubricants | 22.7-L (5-gallon) supplier containers | 10 | 227 L (50 gallons) | Maintenance of mobile equipment |
| Paint | 4.5-L (1-gallon) supplier containers | 10 | 45 L (10 gallons) | Painting wharf hardware and miscellaneous components |
| Explosives | To be determined. Storage and handling will be in accordance with licence, certificate or permit issued under the Explosives Act and Regulations | | | Quarrying |

### 4.3.5 Waste

Table 4.4 provides a summary of the types and quantities (units and volume) of waste that is estimated to be generated during construction of the Project, along with the method of disposal.

**Table 4.4 Estimate of Waste Production and Disposal During Project Construction**

| Waste Type | Associated Project Activity | Projected Amount Generated | Method of Disposal |
|---|---|---|---|
| Hazardous | Construction | 100 L | Package, sealed and transported south in shipping containers for disposal in accordance with applicable regulations |
| Combustible wastes | Camp | 2 tonnes | Municipal landfill |
| Non-Combustible wastes | Camp | 0.5 tonnes | Municipal landfill |
| Greywater | Camp | 800 $m^3$ | Collected in wastewater truck and transported to municipal wastewater treatment facility |
| Sewage (human waste) | Camp | 1,500 $m^3$ | Collected in wastewater truck and transported to municipal wastewater treatment facility |
| Overburden (organic soil, waste material, tailings) | Quarrying | Negligible | Stockpiled at quarry |
| Marine sediment | Dredging | 12,000 $m^3$ | Infilling and/or disposal at sea |

## 4.4 Operation and Maintenance

The small craft harbour is part of the DFO-SCH program, and upon completion of the Project, DFO-SCH will retain the structure as an asset. Future maintenance and some operational components will be the responsibility of DFO-SCH. Generally, a local harbour authority is formed to work on behalf of DFO-SCH. Some of the tasks carried out by the authority include identification and reporting known issues with the harbour, and end of season operational tasks such as removal of the floating docks from the water prior to freeze up. Maintenance activities may include regular above and below water inspections, replacement of anchor chains and float connections, repair of riprap slopes from ice action, occasional repair of ramp surfaces, sounding surveys/or sweeping to check for boulders, and re-grading of gravel driving surfaces, parking areas and boat ramps (Advisian, 2020).

## 4.5 Alternatives Considered

In addition to the Project description information provided in this document, to complete the screening of the Project Proposal the NIRB requires information on alternatives considered. The following sections provide a summary description of the alternatives considered during the feasibility study and design of the small craft harbour.

### 4.5.1 Small Craft Harbour

The concept for the small craft harbour at Clyde River has been developed through consultation with community residents, DFO-SCH, PSPC, sealift operators, the fuel re-supply company, and prospective small craft harbour users. As part of the feasibility study, three small craft harbour layout options were developed based on local knowledge and community consultation. The existing ramp and sealift area were proposed as the small craft harbour location in all three options (Advisian, 2020). The community selected the preferred layout that best suited their needs, and this layout was used as the starting point for the design of the small craft harbour by Canadrill-CBCL.

Through a Coastal Study, discussions with stakeholders, and Schematic Design work, two alternate layouts were developed for the site. Alternative 1 was presented to the stakeholders and received favourable comments. During the Coastal Study work, Alternative 1 was further optimized and modified in consideration of comments from the sealift companies, and on this basis, Alternative 2 was developed. The Schematic Design Report (Canadrill-CBCL, 2021c) recommended to proceed to the design development phase using Alternative 2.

### 4.5.2 Dredged Material Use

Marine sediment in the footprint of the small craft harbour will be dredged and reused during construction. The dredged material is proposed to be placed as fill material on the uplands portion of the site. However, it may be necessary to dispose of the material at sea if the dredge materials are not suitable for use during construction. If necessary, the

dredge materials will be transported to a disposal at sea site in Patricia Bay. Environment and Climate Change Canada (ECCC) has indicated that there is no active disposal at sea site in the vicinity of Clyde River; therefore, the Project requires the establishment of a new disposal at sea site under the ECCC disposal at sea regulations. The proposed Clyde River disposal at sea site is located about 700 m to the south of the small craft harbour; the disposal at sea location was determined based on technical feasibility, proximity to the dredge site, comparative water depth and community consultation (Advisian, 2020).

### 4.5.3 Quarry

There are six existing quarries in Clyde River. The feasibility study determined that Quarry 5 is the only viable alternative (Advisian 2020). Quarry 5 located south of the airport and approximately 5 km by road from the small craft harbour site was identified as the only practical source of rock for construction aggregates and breakwater components for the small craft harbour (Advisian, 2020). The quality and quantity of the rock at the quarry is adequate for the Project. However, it is likely that the quarry will need to be expanded to meet the volume of rock needed.

### 4.5.4 Haul Road

Potential haul road routes were identified as part of the feasibility study and were determined based on the preferred active quarry site located approximately 5 km east of the community (Advisian, 2020). The proposed haul road will be used to haul material from the quarry to the small craft harbour site and makes use of existing roads. The proposed haul road connects the quarry to the main road leading to the community airport, and then it travels through the community to the small craft harbour site.

At the request of the community, an alternate haul route was explored that would branch off the airport road and run parallel to the shoreline between the beach and housing to avoid running directly through the community (Advisian, 2020). The area of the alternate route is comprised of sandy deposits with some low grasses. There is no existing road along the shoreline, and this alternative would require the installation of two culverts (Advisian, 2020).

### 4.5.5 River Crossing

Approximately halfway between the quarry and the airport road, the proposed haul road crosses a river (north of the quarry). There is an existing bridge over the river at the haul road crossing. The existing bridge on the haul road does not have the capacity for rock trucks, and an alternate river crossing is needed. Canadrill-CBCL carried out a River Crossing Options Analysis (Canadrill-CBCL, 2021c) to investigate options to transport material from the quarry to the small craft harbour site. Two potential river crossing sites were identified for this study: the existing bridge site and the ford crossing. An alternate option considered was to barge the material across Patricia Bay to the small craft harbour site.

The following options were considered as part of this study:

- Option 1 - Reconstruction and widening of the existing bridge structure
- Option 2 - A new panel bridge structure adjacent to the existing bridge structure
- Option 3 - A low profile crossing at the ford location consisting of a series of culverts
- Option 4 - Hauling and stockpiling material using the existing bridge
- Option 5 - Hauling and stockpiling material using the frozen river as a crossing
- Option 6 - Barging material to eliminate a river crossing

Design considerations were made for each option in terms of hydraulic, civil, structural, environmental, and permitting requirements. Based on the design considerations, approximate costs were estimated. Advantages and disadvantages of each of the options were analyzed based on the following factors: complexity, environmental impacts, public perception and acceptance, safety concerns, maintaining a river crossing, impact on project schedule, maintenance, and cost. The low-profile crossing at the ford location, was found to be the most cost effective and will be discussed with the community during the September 2021 site visit.

# Chapter 5 Existing Bio-physical Environment

## 5.1 Atmospheric

### 5.1.1 Air Quality

There is no air quality monitoring data available for the Project Area. There are no large industrial or commercial operations that would impact Clyde River besides the quarry and the airport, which are only used intermittently. Air quality is typical of a northern, remote coastal area. Ground level ozone, aerosol particles such as black carbon and sulphates, along with polycyclic aromatic hydrocarbons (PAHs), can be transported to the Arctic region from other emission sources outside of the Arctic such as mid-latitude locations in Europe, Asia and North America (Nunami Stantec, 2018). Vehicles (all-terrain, snowmobiles, etc.), aircraft, and marine vessels and boats lead to localized air emissions. Small thermal power generating stations are also sources for emissions. Particulates may be present due to generation of dust along the gravel roads by vehicles, however, this is managed by the Municipality. Ambient air quality is only monitored in few locations in Nunavut, including Iqaluit, where air quality is generally considered good most of the time (IQ Air, 2021).

Due to the northern latitude of the hamlet, the average temperature in Clyde River in July, which is the warmest month, is 5.0°C with a daily maximum of 8.8°C (ECCC, 2021), followed by August with an average daily temperature of 4.3°C and daily maximum of 7.3°C. The coldest month in Clyde River is February when temperatures reach a daily maximum of -25.7°C. The daily average temperature in February is -29.9°C (ECCC, 2021).

Winds generally prevail from the northwest to west throughout the year (Canadrill-CBCL 2021). Historical extreme storm distribution shows that the September storms are the most extreme on record (Canadrill-CBCL 2021). During the winter, the highest wind speeds occur most frequently from the northwest, with the lowest wind speeds occurring most frequently from the southeast during the summer months (Advisian, 2020). Average monthly wind speeds range between 12 and 18 km/hour (Nunami Stantec, 2018).

### 5.1.2 Ambient Noise

Noise data specific to the Project Area was not available. Noise levels in Clyde River are presumed to be typical of a small remote hamlet as there are no major continuous industrial operations that generate noise. Airborne noise is generated by both natural and anthropogenic sources. Natural sources include wind, waves, ice movements (e.g., cracking and grinding), mammals, and birds. Anthropogenic sources include vehicles (all terrain vehicles, snowmobiles, etc.), boats, planned construction, non-industrial machinery,

aircrafts and when required, and blasting at the quarry. The anthropogenic sources may emit noise intermittently, though noise declines with distance from the source. Given the size and remoteness of the hamlet, the most dominant source of airborne noise would be from natural sources, particularly during stormy or excessively windy days. Noise during summer months when the Bay is mostly ice free is expected to be louder than winter months, as ice tends to reduce the sounds generated from waves, though few studies have been conducted to validate this impression.

Typical airborne noise measurements are 20 A-weighted decibels (dBA) in a wilderness area where there is minimal noise to between 50 and 70 dBA in townsites during the day, to greater than 120 dBA close to an aircraft during take off (Nunami Stantec, 2018).

### 5.1.3 Ambient Light

Clyde River experiences 24-hours of daylight from late May to end of July/ early August. In the winter months, the hamlet experiences only a few hours of twilight and almost complete darkness (Advisian, 2020).

There are two floodlights situated on the east side of the existing harbour site that are used during the winter months. There is no existing exterior lighting along the haul route, apart from in the hamlet, and there is no exterior lighting present at the quarry.

## 5.2 Terrestrial

### 5.2.1 Soils and Terrain

The Project Area is surrounded by broad flat plains and is glacially scoured with a number of small lakes and streams. The Clyde River community is located at the base of the Baffin Mountains which form part of the Arctic Cordillera Mountain range. The town and airport areas of Clyde River have been reported to be built upon thick, terraced, raised marine and glaciomarine sandy sediments, underlain by a saline permafrost (Smith et al., 2015). The area to the southeast of the community is in the foothills of the mountains and includes rolling hills (Advisian, 2020). The Project is located in Ecoregion 6 – Baffin Island Coastal Lowlands within the Arctic Cordillera Ecozone (Advisian, 2020).

A geotechnical field program of subsurface conditions was conducted by Canadrill in September and October 2020 at the quarry site, along the beach (shoreline) of the proposed small craft harbour, and out into the harbour within the new small craft harbour footprint. Native soils throughout these areas were primarily composed of silty sand to sand with silt that was compacted very densely, with trace shell fragments encountered within the upper zone of the native soils further offshore. A zone of very dense sand with no obvious signs of cobbles, boulders or frozen soils was encountered in offshore areas. Along the shore at the Harbour, permafrost was measured to a depth of 1.5 m (Canadrill, 2021).

Bedrock at the quarry was predominantly composed of granitic gneiss, granite, and granodiorite. Boreholes were drilled at four locations to a depth of 12.0 mbg along the beach where 14 core samples were collected. Soils were comprised of silty sand and silty sand with gravel at varying depths ranging from surface to depth. No bedrock was encountered. At the harbour site, boreholes were advanced to depths between 4.4 and 30.2 mbg at 18 different sample locations. Soil stratigraphy was mostly sand with silt to sand, and silty sand to sandy silt at shallower depths. Some locations were embedded with gravel containing silt and sand and gravel containing only sand. Till was predominantly seen below surface at depths between 2.59 m and 30.23 m at six of the sample locations (Canadrill, 2021).

BluMetric Environmental Inc. completed an integrated Phase I and II Environmental Site Assessment of the harbour site in August 2020 which identified three areas of potential environmental concern with associated contaminants of concern (COCs) including metals, petroleum hydrocarbons, volatile organic compounds and polycylic aromatic hydrocarbons (PAHs) (BluMetric, 2021). A search of the Nunavut Spills Database revealed several petroleum related spill records in the vicinity of the site, with four records at the Tank Farm and one record at the Power Plant (both of which are directly adjacent to the northern boundary of the site). These included diesel fuel and/or lube oil spills of varying quantities (between 114 L and 5,500 L). One spill of diesel fuel (60 L) at Lot 10 was also directly adjacent to the northern boundary of the site.

Subsequent to the Phase I and Phase II, Canadrill-CBCL completed a Phase III ESA and Remedial Options Analysis of the harbour site. The Phase III ESA included the collection of upland and harbour soil/sediment samples to delineate previously reported Phase II detection of inorganics and metals. Petroleum hydrocarbons (PHCs) were found in the upland samples. Other parameters were reported below applicable guidelines. A Remedial Options Analysis has been prepared to address options on how to manage the contaminated soil in the upland region (Canadrill-CBCL, 2021e).

### 5.2.2 Vegetation

The Project is located in Ecoregion 6 – Baffin Island Coastal Lowlands within the Arctic Cordillera Ecozone (Advisian, 2020). It is not located within or near any ecologically or biologically significant areas (Figure 5.1) The Baffin Coastal Lowlands is sparsely vegetated with mixed low-growing herbs and shrubs including moss, herbaceous tundra communities than higher elevation Ecoregions within the Arctic Cordillera Ecozone. Specifically, the Baffin Coastal Lowlands has sparse vegetation cover of mixed low-growing herbs and shrubs, including moss, Purple Mountain Saxifrage (*Saxifraga oppositifolia L.),* avens (*Dryas* spp.), Arctic willow (*Salix Arctica* Pall.), bog sedges (*Kobresia* spp.), sedges (*Carex* spp.), and Arctic poppy (*Papaver* spp.). Wet sites were typically up to 60% cover of wood rushes (*Luzula* spp.), wire rushes (*Juncus* spp.), and saxifrages (*Saxifraga* spp. and *Micranthes* spp.), along with nearly continuous cover of mosses (ESWG, 1995; Advisian, 2020). Other species that could be present within the Arctic Cordillera Ecozone include crustose lichens, cotton grasses (*Eriophorum* spp.), Moss Campion (*Silene acaulis* [L.] Jacq.), Arctic White Mountain

Heather (*Cassiope tetragona* [L.] D. Don), Alpine Mountain Sorrel (*Oxyria digyna* [L.] Hill), and Bog Blueberry (*Vaccinium uliginosum*) (Advisian, 2020).

In August 2019, an ecological land classification survey was performed by Advisian and a local Inuit field assistant to identify and prepare an inventory of vegetation communities within the area as part of the feasibility study. The survey area included the proposed small craft harbour site, the Clyde River townsite within approximately 200 m of the shoreline, along the haul road within 100 m of either side of the road, and around the quarry site. Fifty-four vegetation species were identified, including five shrub, 16 graminoid, 13 forb, 11 bryophite and nine lichen species though none of the species identified were species at risk (SAR) or considered invasive. Vegetation was grouped into communities based on similar characteristics. These communities, listed from most dominant to least dominant community, were titled Disturbed Human-Caused, followed by Upland Dwarf Shrub, Wetland Graminoid-Moss Drainage, Coastal Shoreline and Flats, and Open Water (Advisian, 2020).

The small craft harbour site, haul road, and quarry site all fall within the Disturbed Human-Caused community where no vegetation is present. The alternate river crossing route may have some vegetation along it, which is likely classified as Upland Dwarf Shrub. The Upland Dwarf Shrub community is predominantly located on the east side of the harbour on either side of the haul road and surrounding the quarry, which is characterized by dwarf shrubs dispersed among frost-eroded rocky outcrops along with mossy drainage areas. Vegetated areas between rocks were dominated by white Arctic Mountain Heather (*Cassiope tetragona* [L.] D. Don), Entireleaf Mountain-avens (*Dryas integrifolia* Vahl), Arctic Willow, Snowbed Willow (*Salix herbacea* L.), and Bog Blueberry. Forbs were sparse but included species such as Alpine Mountain Sorrel, Nodding Saxifrage (*Saxifraga cernua* L.), and Pygmy Saxifrage (*Saxifraga hyperborea* R. Br.). Graminoids were also sparse and predominantly included Alpine Sweetgrass *(Anthoxanthum monticola* [Bigelow] Veldkamp), and Northern White Rush (*Juncus albescens* [Lange] Fernald). Bryophytes predominantly included Racomitrium Moss (*Racomitrium lanuginosum* [Hedw.] Brid.) and lichen cover predominantly consisted of Witch's Hair Lichen (*Alectoria ochroleuca* [Hoffm.] A. Massal.) and snow lichens (*Flavocetraria* spp.) (Advisian, 2020).

No traditional terrestrial plant uses specific to the Project Area were identified and no vegetation species at risk have been recorded in the area (Advisian, 2020).

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Qausuittuq National Park Of Canada
Nanuit Itillinga NWA
Nirjutiqarvik NWA
Prince Leopold Island Bird Sanctuary
Bylot Island Bird Sanctuary
Sirmilik National Park Of Canada
Ninginganiq NWA

CLYDE RIVER

Baffin Bay
Baffin Basin
Jones Sound
Lancaster Sound
Barrow Strait
Prince Regent Inlet
Gulf of Boothia
BAFFIN ISLAND
NUNAVUT

## KEY MAP

MAP EXTENT

## LEGEND

- Important Bird Area
- Migratory Bird Sanctuary
- National Wildlife Area
- Tallurutiup Imanga / Lancaster Sound NCMA
- Protected Area or National Park
- Ecologically & Biologically Significant Area
- Project Location

CBCL

CLYDE RIVER HARBOUR DEVELOPMENT PROJECT PROPOSAL

**Ecologically And Biologically Significant Areas**

| | | |
|---|---|---|
| DATE: 2021-07-23 | PROJ N°: 200235 | FIGURE: 5.1 |
| DRAWN BY: SF | CHECKED BY: AC | APPROVED: LH |

NOTES:

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SCALE: 1:4,000,000 @ 11 X 17

Coordinate System: WGS 1984 UTM Zone 19N
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### 5.2.3 Wildlife and Habitat

The onshore harbour area is part of the terrestrial environment and consists of a relatively flat, compacted sand parking area for the existing community sealift and boat launch. The parking area also functions as a temporary storage and stockpiling location for equipment, building supplies, and shipping containers. Terrestrial flora is absent from the area. Terrestrial mammals likely migrate through the open parking area, and structures and buildings on the beach may provide cover for small mammals and weasels. Although the habitat may be suitable for birds that nest on bare or gravelly ground, it is unlikely that birds would nest near the small craft harbour study area due to the frequent presence of tied up dogs and human activity (Advisian, 2020). During low tide, the intertidal zone may provide some foraging opportunities for some mammals, and birds that are tolerant of human activity, such as ravens or gulls. However, due to human activity and disturbance, the small craft harbour study area is generally of low habitat value for terrestrial wildlife (Advisian, 2020).

The habitat at the quarry site and haul road site consists of rocky outcrop areas with some sparse dwarf shrubs, and some wetland and graminoid-moss dominant areas (Advisian, 2020). While these habitat features may provide some protection and thermal cover for small mammals, the habitat is generally of low quality (Advisian, 2020). The habitat at the quarry may be suitable for nesting birds; however, the habitat value is reduced as the quarry is actively in use and this would likely discourage birds from using this as nesting habitat (Advisian, 2020).

In August 2019, Advisian conducted a terrestrial wildlife baseline study. The survey areas included the proposed quarry site and the haul road plus a 100 m buffer; incidental observations outside of the study area were also recorded. Terrestrial wildlife identified or detected during this survey were lemming species (likely Peary Land Collared Lemming (*Dicrostonyx groenlandicus*) based on habitat) and Polar Bear (*Ursus maritimus*). For the purpose of this report, Polar Bears will be further discussed in section 5.4.3 Marine Mammals.

As terrestrial mammals can be difficult to detect with limited surveys, Advisian also conducted a desktop review using range maps, habitat requirements, aerial imagery, and IQ to identify mammals that may possibly occur in the quarry and haul road areas. Species identified that may occur at the haul road and quarry sites include Brown Lemming (*Lemmus trimucronatus*), Peary Land Collared Lemming, Arctic Hare (*Lepus Arcticus*), Arctic fox (*Alopex lagopus*), Red Fox (*Vulpes vulpes*), Baffin Island Wolf (*Canis lupus manningi*), Wolverine (*Gulo gulo*), Ermine (*Mustela ermine*), and Barren-Ground Caribou (*Rangifer tarandus groenlandicus*).

Based on vegetation surveys and IQ, the species that are likely to occur at the haul road and quarry site were further refined (Advisian, 2020). The small mammals that are likely to occur include Brown Lemming, Peary Land Collared Lemming, and Ermine. It is possible

that the area could support one pair or family unit of either Red Fox or Arctic Fox. The occurrence of Wolverine is unlikely, and if present, would likely be transient.

In August 2019, Advisian conducted a migratory and marine bird field survey consisting of visual observations and a series point counts along the shoreline at the small craft harbour site. Twelve bird species were detected, including Common Raven (*Corvus corax*), Glaucous Gull (*Larus hyperboreus*), Iceland Gull (*Larus glaucoides*), Snow Bunting (*Plectrophenax nivalis*), Baird's Sandpiper (*Calidris bairdii*), Black Guillemot (*Cepphus grille*), goose sp. (*Chen* sp.), Lapland Longspur (*Calcarius lapponicus*), loon sp. (*Gavia* sp.), Northern Fulmar (*Fulmarus glacialis*), owl sp. (*Bubo* sp.), and ptarmigan sp. (*Lagopus* sp.) (Advisian, 2020).

Two rounds of bird surveys were completed by Canadrill-CBCL in Clyde River, Nunavut in September 2020, at six locations in the Project study area (Canadrill-CBCL, 2020c). Birds detected during this survey were Common Raven, Glaucous Gull, gull sp. and duck sp. Glaucous Gull was the most observed species. An incidental observation of a Gyrfalcon (*Falco rusticolus; white morph*) was also made in town.

No nesting or nesting behaviour was detected in either the 2019 or 2020 field study (Advisian, 2020; Canadrill-CBCL, 2020c); however, both surveys were conducted outside the regional breeding season (ECCC, 2018), so the absence of breeding behaviours does not preclude the potential for birds to nest in the area.

In the feasibility study, Advisian identified 56 bird species that may be present in the Project area (Advisian, 2020). Based on habitat, these 11 species were considered likely to nest during the breeding season: American Pipit (*Anthus rubescens*), Arctic Tern (*Sterna paradisaea*), Baird's Sandpiper (*Calidris bairdii*), Common Raven, Common Redpoll (*Acanthis flammea*), Hoary Redpoll (*Acanthis hornemanni*), Horned Lark (*Eremophila alpestris*), Northern Wheatear (*Oenanthe oenanthe*), Purple Sandpiper (*Calidris maritim*), Rock Ptarmigan (*Lagopus muta*), and Snow Bunting. IQ information about egg harvesting indicated that nesting areas near the hamlet also include Eider Duck (*Somateria* spp*.),* Snow Goose (*Chen caerulescens*) and Canada Goose (*Branta canadensis*) (Advisian, 2020).

### 5.2.4 Species at Risk and Species of Conservation Concern

Species listed under Schedule 1 of the *Species at Risk Act* (SARA) as Threatened, Endangered, or Extirpated are considered federally protected species at risk. Those not listed under Schedule 1 of SARA, but which are designated by COSEWIC or listed as S3 or higher in Nunavut, are considered species of conservation concern (SoCC).

Threatened or Endangered species may occur within the Project area but were not identified during field studies conducted in 2019 or 2020 (Advisian, 2020; Canadrill-CBCL, 2020c). While several species at risk may occur in the Project area, habitat values are generally low and are not considered to provide critical habitat for these species. A list of wildlife, marine and migratory birds that may occur in the small craft harbour area, and their likelihood of occurrence were identified as part of the feasibility study produced by

Advisian (2020). The identified species at SAR/SoCC are outlined in Table 5.1, along with their likelihood of occurrence in the project area during the construction period.

**Table 5.1 SAR/SoCC with the potential to occur in the Project area during the construction period (Source: Advisian, 2020)**

| Species Name | Scientific Name | COSEWIC | SARA | Nunavut Rank[1] | Likelihood of Occurrence in the Project Area |
|---|---|---|---|---|---|
| Vegetation | | | | | |
| Porsild's Bryum | *Haplodontium macrocarpum* | Threatened | Threatened | NR | Low |
| Migratory Birds | | | | | |
| Buff-breasted Sandpiper | *Calidris subruficollis* | Special Concern | Special Concern | S3 | Possible |
| Ivory Gull | *Pagophila eburnean* | Endangered | Endangered | S1 | Possible |
| Peregrine Falcon | *Falco peregrinus* | Not at Risk | Special Concern | S4 | Low |
| Red Knot rufa subspecies | *Calidris canutus rufa* | Endangered | Endangered | S2 | Possible |
| Red-necked Phalarope | *Phalaropus lobatus* | Special Concern | Special Concern | S3 | Low |
| Ross's Gull | *Rhodostethia rosea* | Threatened | Threatened | S1 | Unlikely |
| Terrestrial Mammals | | | | | |
| Wolverine | *Gulo* | Special Concern | Special Concern | S3 | Unlikely |
| Barren-ground Caribou | *Rangifer tarandus groenlandicus* | Threatened | Not listed (under consideration for addition) | S4 | Unlikely |

[1] Nunavut Territorial Rank: S1=critically imperilled, S2=imperilled, S3=Vulnerable, S4=apparently secure, NR = not ranked

## 5.3 Freshwater

### 5.3.1 Surface Water Resources

The Project is located on the eastern shore of Baffin Island. Surrounding the hamlet of Clyde River there are several small lakes and connecting streams. The main river in the Project area flows northeast around the hamlet, passes through some lakes to the southeast of the community airport, and then discharges into Patricia Bay to the east of the hamlet. Drainage to the community is provided through minor streams that pass through the hamlet and into Patricia Bay.

Information obtained by Advisian for the feasibility study through desktop study and field studies indicate four small creeks drain into the Clyde River foreshore from small thermokarst lakes to the north of the community. One of these creeks is within the small craft harbour site; it flows south through the community to a road crossing with a culvert and then empties into Patricia Bay (Advisian, 2020). There are five creeks between the small craft harbour site and the airport. Two of these creeks, running approximately north to south, pass through culverts beneath the existing airport road, which is part of the proposed haul road (Advisian, 2020). The section of the proposed haul road that connects the quarry to the airport road will cross the main river in the Project area. The quarry location is situated approximately 500 m from the nearest river and a similar distance to the nearest lake; there is a small drainage area next to quarry that runs northeastward towards the river.

### 5.3.2 Freshwater Fish and Fish Habitat

Desktop and in person IQ reviews were completed as part of the feasibility study and ongoing community engagement and consultation sessions held in September 2020 and February 2021. Wildlife and land use sessions were attended by Inuit hunters and fishers with extensive knowledge of local harvesting areas and through the combined knowledge important anadromous species and harvesting areas were identified. Arctic Char (*Salvelinus alpinus*) were identified as a focal species that is present in the Clyde River/Clyde Inlet and the freshwater lakes (*Nilattarvik* and *Iqalulik*) and river near the community.

The proposed river crossing was identified as important area for harvesting and passage of Arctic Char. Arctic Char use the river for downstream migrations following the ice melt, and upstream migrations to spawning and overwintering habitats in August and September (NCRI, 2014). Char migrate to suitable spawning and overwintering habitats that are typically found in lakes and streams pools with gravel bottoms, minimal flows, and depths over 1.0 m (Scott and Scott, 1988).

Creeks identified in the small craft harbour Study Area and Haul Road Area were not field assessed for freshwater fish. However, based on desktop review, these creeks either do not lead to larger freshwater courses or are shallow and likely to be dry at times (Advisian, 2020). Consequently, they are unlikely to provide valuable freshwater fish habitat.

## 5.4 Marine

### 5.4.1 Marine Water and Sediments

A marine water quality survey was conducted by Advisian in August 2019. Four sample locations were selected to give a broad overview of marine water quality in the vicinity of the proposed small craft harbour and disposal at sea sites (Advisian, 2020). Marine water quality was found to be consistent across sample locations and depth profiles (Advisian,

2020). At all sample locations, metal concentrations were below the respective Canadian Council of Ministers of the Environment (CCME) guidelines (Advisian, 2020). Dissolved metal concentrations were comparable to total concentrations, indicating the metals are typically not bound to solids, and pH, hardness, alkalinity, total organic carbon (TOC), total suspended solids (TSS), sulphur, and metal concentrations were consistent across shallow and deep samples (Advisian, 2020).

Marine sediment sampling was conducted in August 2019 (Advisian) and September 2020 (Canadrill-CBCL). Sediment in the proposed dredge area was found to be predominantly composed of coarse-grained sand with lesser amounts of gravel, and scattered patches of cobble and boulder (Advisian, 2020). Contaminants in sediment samples collected in the small craft harbour study area were less than the 'National Action List' as identified in the Disposal at Sea Regulations under the *Canadian Environmental Protection Act* (CEPA). No samples exceeded Canadian Council of Ministers of the Environment (CCME) Probable Effect Levels (PELs); however, one sample at the community sealift ramp exceeded Interim Sediment Quality Guidelines for the Protection of Aquatic Life for arsenic and copper (Advisian, 2020). Sediment in the proposed disposal at sea site was found to be predominantly coarse-grained sand with lesser amounts of gravel (Canadrill-CBCL, 2020b). The analytical results of the sediment samples collected from the Clyde River disposal at sea site indicated that no exceedances were reported with respect to Disposal at Sea Regulations, CCME sediment quality guidelines and CCME soil quality guidelines; in some cases, detection limits of PAHs exceeded the most conservative guidelines (Canadrill-CBCL, 2020b).

### 5.4.2 Marine Fish and Fish Habitat

Patricia Bay occurs in a coastal embayment of Clyde Inlet, which connects to the Davis Strait, on the eastern coast of Baffin Island. The area features a polar climate and is situated north of the Arctic Circle. Open water season in the bay begins in mid-July when the winter ice breaks-up and remains ice free through the summer months until freeze up in mid-October. Benthic habitats in Patricia Bay are predominantly fine sediment (sand) mixed with lesser amounts of gravel and occasional patches and clusters of ice rafted and glacially deposited boulder substrates. Predominantly sandy benthic habitats are to be expected in the area since the main source of fine sediment in the area comes from the Clyde River.

The Project Footprint occurs in two relatively small areas in Patricia Bay:

- Small Craft Harbour Study Area – The small craft harbour study area is centred around the existing community sealift ramp and encompasses the proposed footprint of the small craft harbour, including the backshore, intertidal, and subtidal zones affected by construction.
- Disposal at Sea Study Area – The disposal at sea study area encompasses a 110-hectare area in deeper water in Patricia Bay identified as a potential disposal location for dredged sediment.

Field surveys were conducted during the open water season in August 2019 (Advisian, 2020) and September 2020 (Canadrill-CBCL, 2021b) to characterize and describe fish and fish habitat and document the existing marine environment in Patricia Bay.

The intertidal shoreline is part of the marine environment and primarily consists of a shallow sloped sandy beach with occasional patches of mixed gravel, cobble, and boulders in the Project Area. Benthic habitat in the intertidal area is considered low quality. The upper and mid-intertidal zones consist primarily of coarse sand and limited algal wrack, whereas substrates in the lower intertidal area are coarse sand with patches and narrow bands of gravel, cobble, and boulder. A low boulder wall runs parallel to shore along the beach from west to east through the lower intertidal zone. Infrastructure constructed in the intertidal shoreline is limited and consists of the existing community sealift and boat launch, as a small, sheltered area for landing boats.

Benthic habitats in the subtidal small craft harbour study area are considered low to moderate quality. The area is generally flat with little relief and primarily consisted of sand with small, patchy clusters of gravel, cobble, and boulders in the area. Boulders are also present in a low wall running parallel to shore through the lower intertidal/shallow subtidal zone. Clusters of boulders provide a limited amount of hard substrate for the recruitment and attachment of flora and fauna in the area. Limited infrastructure exists in the subtidal area. The existing community sealift and boat launch extend into the subtidal harbour area, and a small, sheltered area for anchoring/tying up boats is located adjacent to the east side of the community sealift.

Benthic habitats observed in the disposal at sea study area are considered low quality. Substrates were predominantly sand with occasional clusters of boulder and cobble at depths between 35 and 53 metres.

Flora in the lower intertidal and subtidal zones of the small craft harbour area is limited due to the low available rocky substrate and seasonal ice scour and crushing in shallow water. Species observed included trace (0 to 10%) to moderate (25 to 50%) abundances of rock weed (*Fucus* sp.), sour weed (*Desmarestia* sp.), sea colander (*Agarum clathratum*), sugar kelp (*Saccharina latissima*), brown sea hair (*Dictyosiphon* sp.), bootlace weed (*Chorda filum*), and a filamentous brown algae. Thin layers of drifting filamentous and macrofloral algal debris observed in the shallow subtidal zone may constitute a form of mixed filamentous and decomposing drift algae which persists in areas with low bottom currents. IQ sessions in the community identified an edible kelp (*Alaria esculenta*) and a hollow stemmed kelp (*Fucus evanescens*) as species harvested in shallow intertidal and subtidal waters in Patricia Bay for use as food additives. Rockweed observed in the small craft harbour area may be hollow stemmed kelp; the small size and lack of reproductive features on the observed specimens prevented identification to species. Edible kelp, however, was not observed in the small craft harbour area.

Fauna observed on bottom in the small craft harbour area includes truncate softshell clams (*Mya truncata*), green sea urchins (*Strongylocentrotus droebachiensis*), Brittle Stars (*Ophiopholis aculeata*), sea stars (*Leptasterias polaris*, *Urasterias linckl*), and whelks (*Buccinum undatum*, *Buccinum* sp.). Truncate clams were observed in infrequent (10 to 25%) to moderate abundance (25 to 50%) in sandy sediments and constitute the most frequently observed invertebrate in the small craft harbour area. Truncate clams are an important food source in the community; however, they are not generally harvested in the small craft harbour area. Other invertebrates in the subtidal area were observed in trace to infrequent quantities and are common in nearshore environments in northern Canada (NCRI, 2014; Kent et al., 2015; Heywood et al., 2018; Brown et al., 2011; Nozères et al., 2019).

Amphipods (*Gammarus setosus*) were observed in low abundance in the intertidal zone and in shallow subtidal areas, and marine copepods were the predominant planktonic species observed in the small craft harbour area. One plankton species observed in abundance, *Pseudocalanus minutus*, is abundant on Arctic shelves and considered to be a key grazer in shelf waters (Hopcraft, 2009). These amphipods and copepods are likely important forage for pelagic finfish in Patricia Bay, including anadromous Arctic char foraging during open water, and Arctic cod. Infauna identified during benthic invertebrate community sampling included an abundance of marine clams, ostracods and polychaetes. These benthic invertebrates are likely important forage for benthivorous finfish in Patricia Bay.

The only finfish observed in the small craft harbour Study Area were juvenile and adult sculpin (*Myoxocephalus* sp.). Although they could not be definitively identified to species, the observed sculpin appeared to be shorthorn sculpin, which were previously identified as an important forage and bait species in Clyde River (NCRI, 2014; Advisian, 2020). Sculpin are an important food and bait species in the community. The relatively low abundance and mix of juvenile and adults suggest the area likely functions as rearing habitat for juveniles and foraging and migration habitat for adults. Similar habitats (sand and occasional boulders) are present throughout Patricia Bay; consequently, the area is considered important but not limited, and may provide moderate quality habitat for sculpin.

Rocky substrates suitable for the attachment of algae were limited in the disposal at sea area; trace (0 to 10%) quantities of an encrusting red algae (*Corallina* sp.) were observed on available boulder and cobble substrates. Occasional attached algae were observed in trace quantities (0 to 10%) on boulders, including sea colander and two species of red algae (possibly *Coccotylus* sp. and *Dilsea* sp.). No species harvested in the community were observed in the disposal at sea area; furthermore, the range of depths in the area far exceed those in which community members can harvest algae.

Two species of brittlestars were the most abundant invertebrates in the disposal at sea Study Area. *Amphipholis squamata* and *Ophiopholis aculeata* were observed in trace (0 to 10%) to moderate (25 to 50%) abundances, and provide forage for benthivorous species,

including sculpin. Other invertebrates were observed in trace quantities (0 to 10%) attached to boulder and cobble substrate or buried in sandy sediment. Species observed included sea cucumbers (*Psolus* sp.), crinoids (*Heliometra glacialis*), chitons (*Tonicella* sp.), soft corals (*Alcyonium* sp.), sunstars (*Solaster* sp.), anemone (*Urticina* sp.), lyre crab (*Hyas* sp.), and sea spider (*Nymphon* sp.). These species are commonly found in nearshore environments in northern Canada (NCRI, 2014; Kent et al., 2015; Heywood et al., 2018; Brown et al., 2011; Nozères et al., 2019). Marine copepods, including *P. minutus*, were the predominant planktonic species found in the disposal at sea area. These copepods likely provide valuable foraging opportunities for pelagic finfish in Patricia Bay, including Arctic char and Arctic cod.

Finfish observed on bottom in the disposal at sea study include a small number of juvenile and adult sculpin (*Myoxocephalus* sp. and *Triglops* sp.), and one small shanny (*Stichaeus* sp.). Sculpin are an important species in the community; however, the small number observed in the disposal at sea suggest the area likely provides low quality foraging and migratory habitat.

The community did not identify the small craft harbour or disposal at sea study areas as important areas during IQ workshops in 2019 and 2020. Focal species identified during the workshop include Arctic char, Arctic cod, sculpin, and truncate softshell clams. Arctic char and Arctic cod were not observed during habitat surveys. Sculpin and truncate softshell clams were observed in both study areas; each species was more abundant in the small craft harbour study area. The community also noted that the small craft harbour and disposal at sea areas are not important clam harvesting areas.

### 5.4.3 Marine Mammals

Marine mammals may occupy the waters of Patricia Bay year-round; however, most occur during the open water season from mid-July to mid-October. The waters around Clyde River are seasonally important for marine mammals and for Inuit harvesting. Information about seasonally important marine mammals and inter-annual variability was obtained through IQ workshops, for example, Narwhal numbers have fluctuated in recent years, walrus are seen less frequently, and bowhead whales have become more common (Advisian, 2020).

No marine mammal field studies were conducted. However, a polar bear was observed during the 2019 terrestrial field surveys (Advisian, 2020), and narwhal (*Monodon Monoceros*) was observed in Patricia Bay in September 2020 during the environmental field surveys and again in October 2020 during a community consultation program.

A list of marine mammals that may occur in the small craft harbour site, and their likelihood of occurrence, were identified as part of the feasibility study produced by Advisian (2020) and are outlined in Table 5.2, along with their potential occupancy window. Local knowledge about occurrence, seasonality and habitat use of marine mammals obtained through IQ workshops provided valuable information as well.

**Table 5.2 Marine mammals occurring in Patricia Bay (Source: Advisian, 2020)**

| Common Name | Scientific Name | Population | Potential Occupancy Window |
|---|---|---|---|
| Beluga Whale | *Delphinapterus leucas* | Eastern High Arctic / Baffin Bay Population | Open water season |
| Narwhal | *Monodon monoceros* | Baffin Bay Population | Open water season |
| Bowhead Whale | *Balaena mysticetus* | Eastern Canada / West Greenland Population | Open water season |
| Arctic Ringed Seal | *Pusa hispida* | Canadian Arctic Population | Year-round |
| Bearded Seal | *Erignathus barbatus* | | Open water season |
| Walrus | *Odobenus rosmarus* | Central-Low Arctic Population | Open water season |
| Polar Bear | *Ursus maritimus* | Baffin Bay Population | Year-round |
| Killer Whale | *Orcinus orca* | Northwest Atlantic / Eastern Arctic Population | Open water season |
| Harp Seal | *Pagophilus groenlandicus* | | Open water season |
| Hooded Seal | *Cystophora cristata* | Davis Strait Population | Open water season |

### 5.4.4 Species at Risk and Species of Conservation Concern

Species listed under Schedule 1 of SARA as Threatened, Endangered, or Extirpated are considered federally protected species at risk. Those not listed under Schedule 1 of SARA, but which are designated by COSEWIC or listed as S3 or higher in Nunavut, are considered SoCC.

DFO's aquatic species at risk critical habitat and distribution mapping tool is intended to provide an overview of species distribution and critical habitats within all Canadian waters; however, the tool does not currently cover the entire northern Canadian Arctic, including Clyde River. Regardless, the mapping tool was queried, but it did not identify critical habitat, residences, or species at risk in Clyde River (DFO, 2019).

Threatened or Endangered species may occur within the Project Area but were not identified during field studies conducted in 2019 or 2020 (Advisian, 2020; Canadrill-CBCL, 2020c). A Polar Bear was observed during the 2019 terrestrial field surveys (Advisian, 2020), and Narwhal was observed in Patricia Bay in September 2020 and October 2020. A list of marine fish and marine mammals that may occur in the small craft harbour site, and their likelihood of occurrence, were identified as part of the feasibility study produced by Advisian (2020) and the SAR/SoCC identified are outlined in Table 5.3, along with their likelihood of occurrence during open water season.

**Table 5.3 SAR/SoCC with the potential to occur in the Project Area (Source: Advisian, 2020; Government of Canada, 2020)**

| Species Name | Scientific Name | COSEWIC | SARA | Nunavut Rank[1] | Likelihood of Occurrence in Project Area |
|---|---|---|---|---|---|
| Marine Fish | | | | | |
| Lumpfish | *Cyclopterus lumpus* | Threatened | No Status (under consideration) | NR | Unlikely |
| Northern Wolffish | *Anarhichas denticulatus* | Threatened | Threatened | NR | Unlikely |
| Spotted Wolffish | *Anarhichas minor* | Threatened | Threatened | NR | Unlikely |
| Thorny Skate | *Amblyraja radiata* | Special Concern | No Status (under consideration) | NR | Unlikely |
| Marine Mammals | | | | | |
| Atlantic Walrus (Central/Low Arctic population) | *Odobenus rosmarus* | Special Concern | No Status (under consideration) | S3 | Possible |
| Arctic ringed seal | *Pusa hispida* | Special Concern | No Status (under consideration) | NR | Possible |
| Beluga Whale (Eastern High Arctic/Baffin Bay population) | *Delphinapterus leucas* | Special Concern | No Status | NR | Possible |
| Bowhead Whale (Eastern Canada-West Greenland population) | *Balaena mysticetus* | Special Concern | No Status (under consideration) | NR | Possible |
| Killer Whale (Northwest Atlantic/ Eastern Arctic population) | *Orcinus orca* | Special Concern | No Status (under consideration) | NR | Possible |
| Narwhal | *Monodon monoceros* | Special Concern | No Status | NR | Possible |
| Polar Bear | *Ursus maritimus* | Special Concern | Special Concern | S3 | Possible |

[1] Nunavut Territorial Rank: S1=critically imperilled, S2=imperilled, S3=Vulnerable, S4=apparently secure, NR = not ranked

# Chapter 6 Existing Socio-economic and Cultural Environment

The community of Clyde River is located on Patricia Bay and is surrounded by the Baffin Mountains which form a portion of the Arctic Cordillera mountain range. The hamlet is supplied by sealift throughout the shipping season and is accessible via air travel from Iqaluit, Nunavut. The existing harbour is located on the western edge of the community which is utilized for boat anchorage, truck and trailer parking for harbour users, and bulk container storage.

## 6.1 Population and Language

The community has a population of 1,053 residents (Statistics Canada, 2017b), most of which are Inuit (approximately 96%). The median age in Clyde River is 22 years old, and individuals classified as young with children aged 0 to 14 represent over a third of the total population (35.2% or 370 individuals). Inuktitut is the language that is most widely used, followed by English (Advisian, 2020).

## 6.2 Education and Employment

In 2016, of the total population ≥ 15 years, 15.3% or 105 individuals had a secondary school diploma, or equivalent, as their highest educational attainment and 20.4% or 140 individuals held a postsecondary certificate, diploma, or degree. Of the 140 individuals with post-secondary education, 14.3% or 20 individuals, held apprenticeship or trade certifications and 14.3% or 20 individuals graduated from a University with a bachelor level degree or higher. In the census results 435 individuals (63.5%) held no certificate, diploma, or degree (Advisian, 2020).

The area has been occupied by indigenous peoples for many years and fishing, hunting, trapping, and gathering are the main industries that support its livelihood mixed with wage-based activities (Municipality of Clyde River 2021, Advisian 2020). Fishing, hunting, and gathering are also considered cultural activities that include customary resource sharing practices. Fishing and hunting—including for Arctic char, ringed seal, and Narwhal—currently occur at the existing harbour. Clam harvesting also occurs there. Caribou, ptarmigan, snow geese, and Canada geese are hunted in the upland areas away from the town site and the quarry. Figure 4.1 represents the local fishing, hunting, and

gathering areas of the community and was originally created in collaboration with knowledge holders during an IQ workshop in 2019 conducted by Advisian. Other employment includes by the Ilisaqsivik Society, the largest employer in Clyde River, which offers a variety of part-time and casual jobs (Advisian, 2020). The Society is a not-for-profit Inuit organization devoted to promoting community wellness. Educational services, public administration and health care are the other industries that provide employment in the hamlet (Statistics Canada, 2017b).

## 6.3 Housing and Community Infrastructure

The Hamlet of Clyde River extends northeast of the proposed small craft harbour footprint along the shoreline and sprawls northwest into the upland area for approximately 1 km. There are approximately 288 private dwellings in the hamlet, of which 250 were occupied by their usual residents. Water for the town is supplied by Water Lake, which is located approximately 1.5 km from the town.

Amenities in the hamlet include the Quluag School, an arena, a community hall, a church, a health centre, a fire hall, a small hotel, and the Clyde River Airport. The school is approximately 650 m northeast of the proposed small craft harbour location. Approximately 75 m northeast across the street of the school is the Health Centre which is the nearest hospital to the Project Area. The community hall and airport are an estimated 60 m and 3.5 km northeast of the proposed small craft harbour location, respectively. The quarry, which is south of the airport, sources the community with armour rock used as construction aggregates and breakwater components (Advisian, 2020). The existing unpaved haul route that connects the quarry and the town site is sited across mainly undeveloped land. The haul road is also used by residents of the community to access hunting spots via snow mobile or all-terrain vehicles.

## 6.4 Transportation

There are no major roadways west of the harbour location with the exception of a small trail that is approximately 200 m long, used by ATVs, snowmobiles, and off-road vehicles.

There are typically around 75 resident boats within the harbour, some of which are no longer in use (Advisian, 2020). During the summer at the existing harbour site, resident boats are either anchored in the water, behind the breakwater, or are stored on shore above the highwater marker since the harbour site is small and often frequented by harsh strong southerly wind and waves. During the winter, most of the boats are stored on shore and near the ramp. Sealift provides residents with their annual cargo of goods and materials needed for the year between August and September. The roads in Clyde River are composed mostly of gravel with no walkways. On land, transportation occurs by all-terrain vehicles, snow machines, cars, and trucks (Advisian, 2020).

## 6.5 Archaeological and Cultural Historic Resources

An Archaeological Impact Assessment (AIA) was completed in 2019 by Advisian for the harbour site, quarry, and haul road. There were no archaeological sites identified that could potentially be impacted by Project development during the AIA. There were also no culturally important sites identified by knowledge holders during IQ workshops (Advisian, 2020; Canadrill-CBCL, 2020; Canadrill-CBCL, 2021a).

# Chapter 7 Potential Environmental Effects and Mitigation Measures

This chapter presents the evaluation of potential environmental effects of the Project and discusses how each of the environmental effects will be mitigated through the implementation of mitigation measures. The initial screening was conducted to identify potential interactions between Project components and activities, as described in Chapter 4, and the existing environment, which is described in Chapters 5 and 6. The subsections that follow provide a description of the potential environmental effects and outline mitigation measures to avoid or reduce potential adverse environmental effects.

The potential interactions between the Project and the existing environment, organized as Valued Components (VC), are presented in Table 7.1. Interactions are identified in Table 7.1 as positive (P) or negative (N). In some cases, the interaction may include both positive and negative aspects. Potential interactions that could lead to measurable positive and/or adverse environmental effects are identified for the following VC sub-components:

- Air quality
- Ambient noise levels
- Ambient light
- Surface water Resources (hydrology/water quality)
- Freshwater fish & fish habitat
- Permafrost
- Soils and terrain
- Vegetation
- Wildlife and habitat, including SAR
- Tidal and Bathymetry
- Marine water and sediments
- Marine fish and fish habitat, including SAR
- Marine mammals, including SAR
- Employment
- Community Infrastructure
- Human Health and safety
- Community Wellness/ Traditional Use of Land

No interactions that could lead to measurable positive and/or adverse environmental effects are identified for the following VC sub-components; therefore, potential

environmental effects are considered not significant for these and they are not further evaluated:

- Climate conditions
- Ground stability
- Environmentally sensitive areas
- Archaeological and heritage resources

Where an effect was identified, mitigation measures were determined. Mitigation measures can be implemented through changes to engineering design, construction planning and other specific measures. Potential adverse environmental effects will be mitigated and managed through the implementation of a Construction Environmental Management Plan (CEMP). The CEMP details the environmental protection requirements and mitigation measures that will be adhered to on the Project site and provides a framework for the development and implementation of safe and environmentally responsible practices to reduce environmental effects of the Project. The CEMP provides an overall strategy and guidance for compliance and relevant environmental legislation and policies, as well as compliance with terms and conditions of permits and approval obtained. Construction personnel will be trained in the requirements of the CEMP and advised of the regulatory requirements and conditions for the Project construction. Mitigation measures are outlined in the following sections; however, further detail can be found in the CEMP.

**Table 7.1 Potential interactions between Project Activities and the Environment**

| Project Components and Activities | Valued Components | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Atmospheric | | | | Freshwater | | Marine | | | | | | Terrestrial | | | | | Socio-economic & Cultural | | | | |
| | Climate Conditions | Air Quality | Ambient Noise Levels | Ambient Light | Surface water Resources (Hydrology / Water Quality) | Freshwater Fish & Fish Habitat | Tidal and Bathymetry | Marine Water Quality | Marine Sediment | Marine Fish & Fish Habitat | Marine Mammals | Designated Environment Areas Environmentally Sensitive Areas | Permafrost | Soils & Terrain | Ground Stability | Vegetation, including SAR | Wildlife & habitat including migratory birds & SAR | Employment & Business Opportunities | Community Infrastructure | Human Health & Safety | Archaeological & Heritage Resources | Community Wellness / Traditional Use of Lands |
| Construction | | | | | | | | | | | | | | | | | | | | | | |
| Establishment of a temporary construction work camp | | M | M | | | | | | | | | | | | | | | | P/M | M | | |
| Establishment of temporary construction staging, laydown, and storage areas | | M | M | | | | | | | | | | | | | | | | P | M | | |
| Culvert Installation at small craft harbour | | M | M | | M | M | | | | | | | | | | | | | | M | | |
| Haul road and river crossing upgrades | | M | M | | M | M | | | | | | | M | M | | M | M | | P | P/M | | |
| Dredging and disposal of dredged material | | M | M | | M | M | M | M | M | M/N | M/N | | | | | | M | | | M | | |
| Quarrying (drilling, blasting, excavation) | | M | M | | M | M | | | | | | | M | M | | M/N | M | P | P | M | M | |
| Transportation of armour stone from quarry | | M | M | | | | | | | | | | | M | | M | M | | M | M | | |
| Construction of breakwaters and boat launch at Small craft harbour | | M | M | | | | | M | M | P/M/N | M | | | | | | | | P | P/M | | |
| Small craft harbour pile driving | | M | M | | | | | M | M | M | M | | | | | | | | | M | | |
| Small craft harbour infilling | | M | M | | | | | M | M | M/N | M | | | | | | | | | M | | |
| Beach grading west of the small craft harbour | | | | | | | | | | | | | M | M | | | | | | | | |
| Floating dock, mooring bollard installation and sea lift retrofitting | | M | M | | | | | M | M | M | M | | | | | | | | | M | | |
| Small craft harbour utility pole, lighting installation, and navigation aids | | M | M | | | | | | | | | | | M | | | M | P | P | P/M | | |
| Post-construction | | | | | | | | | | | | | | | | | | | | | | |
| Decommissioning of temporary construction work camp | | | M | | | | | | | | | | | | | | | | P | P | | |
| Restoration of laydown and storage areas | | M | M | | | | | | | | | | | | | | | | P | | | |
| Operation of small craft harbour | | | | P/N | | | M | | | | | | | | | | | P | P | P | | P |

Legend: [*Blank*] = No Effect; [P] = Potential Positive Environmental Effect; [M]= Negative and mitigable, [N] = Potential non-mitigatable negative (Adverse) Environmental Effect, [U]= Unknown

## 7.1 Atmospheric

The Atmospheric Environment VC includes air quality, ambient noise, and ambient light. The Atmospheric Environment was selected as a VC because Project activities can alter existing air quality and lead to changes to ambient noise and ambient light.

### 7.1.1 Air Quality

Adverse effects to air quality are anticipated to occur as a result of air emissions associated with land-based and marine-based activities during construction of the Project. Both land-based and marine-based activities can affect air quality by increasing emissions of critical air contaminants (CAC), such as CO, $SO_2$, $NO_2$, NO, $NO_x$, and $PM_{2.5}$, and dust (particulates). Construction activities that could result in changes to air quality are identified in Table 7.1. These activities will require the use of fuel-based equipment (e.g., drilling rigs, excavators, transport trucks, work boats), which will result in CAC emissions. These activities will also contribute to the generation of dust emissions, particularly during the use of the haul road, quarrying, and stockpiling of dredged and infill material.

Fumes from fuel-base equipment will be managed by using appropriately sized haul trucks in order to minimize the frequency and number of trips needed to transport excavated materials off site (e.g., dredged material, armour stone). Anti-idling of heavy machinery and vehicles is anticipated to be encouraged whenever possible.

Use of rumble strips at the harbour can reduce tracking fines onto the roads, which contributes to airborne dust. Dust that is created during construction activities will be managed by applying calcium chloride or water, which are acceptable means of dust suppression for municipalities in Nunavut.

Although the quarry is existing, it is not in continuous use. Dust emissions from quarrying will increase in the vicinity of the quarry over the construction period; however, the changes to air quality as a result of blasting will be localised to the quarry site.

With mitigation, changes in air quality from construction activities are not anticipated to extend beyond the Project area. Adverse effects to air quality due to construction activities are expected to be intermittent, short term to medium term, and not significant.

### 7.1.2 Ambient Noise

Changes to ambient noise are anticipated to occur during construction as a result of noise and vibration emissions associated with the use of land-base and marine-based activities during the construction of the Project. Increased noise levels may impact sensitive receptors such as wildlife, freshwater and marine fish, and humans. Construction activities that could result in changes to ambient noise are identified in Table 7.1.

Sources of noise include drilling, blasting, construction equipment, and vehicle traffic. Sound intensity from construction equipment can range upwards of 90 dBA within approximately 15 m of the source, which is comparable to sound levels associated within an urban, commercial, or industrial environment (U.S. Department of Transportation Federal Transit Administration, 2006; U.S. Department of Transportation Federal Highway Administration, 2017). These sources could emit noise for short durations with noise effects dissipating with distance from the source.

Noise and vibration emissions generated during construction will vary based on the activity being performed. For example, drilling and blasting will produce higher emissions than soil excavation and dredging. Although construction could take up to four years, construction will not occur during winter months, and noise levels will be at ambient levels during this time.

To reduce noise and vibration levels generated from construction activities, mitigation measures include limiting blasting and pile-driving activities to daytime hours to limit impacts to sensitive receptors and muffling heavy machinery and vehicles. Once construction activities are complete and the small craft harbour is operational, noise levels will return to typical levels for Clyde River. Effects to ambient noise levels are anticipated to be short-term to medium term, reversible, and not significant.

### 7.1.3 Ambient Light

There will be one scheduled power outage associated with the interconnection of the new overhead line that can affect some QEC customers for a few hours. The new overhead line extension is not located in populated area and will not affect any public activities. Overall, changes to ambient light are not anticipated to occur during construction, which will occur between May and November when the area experiences almost complete daylight. Ambient light during the winter season is minimal as the area experiences almost total darkness, however, construction will not be occurring at this time.

During operations, while there is existing lighting along the access of the harbour, lighting will be amplified after the installation of the LED floodlights along the breakwater access road and the wharf. There will also be navigation lighting to support the design, safety, and operation of the facility located at the end of each breakwater.

Effects to ambient light at the harbour are long term and will extend to the operations phase of the Project. Appropriate lighting at the harbour and navigation aids will reduce safety risks and therefore have a positive impact but could also be considered a nuisance to the community during the winter months.

## 7.2 Terrestrial

### 7.2.1 Permafrost

The geotechnical investigation determined the depth of permafrost (1.5 m) along the shoreline. Care must be exercised to prevent degradation of the materials and the potential for differential settlement. To mitigate potential adverse impacts to permafrost, construction specifications will emphasize requirements to avoid over-excavating.

When considering operational impacts, the wave climate at Clyde River has been demonstrated to be relatively mild, and therefore rapid wave driven erosion along the shoreline, which could expose permafrost, is unlikely.

Negative effects to permafrost as a result of construction can be mitigated. Long term effects from operation of the small craft harbour on permafrost are not expected.

### 7.2.2 Soils and Terrain

The Project is anticipated to interact with soil quality and quantity during construction activities. Impacts to soil and terrain will be limited to the Project Area. There may be impacts to soils within the Project Area through earthworks, erosion, sedimentation and inadvertent spills and releases, however their effects can be mitigated. The removal of rocks and boulders that could come into contact with the fuelling line to the west of the proposed small craft harbour will occur.

Rock will be blasted and removed from the quarry, though it is intended for beneficial use to construct the breakwaters. Blasting will be managed by the application of a blasting management plan. There will be additional disturbance to soils and terrain due to an increase in size of the pit at the quarry, and elevation changes at the small craft harbour site. Though the soil in this area is mostly composed of silt and sand with little to no organic matter.

Excavations may disturb existing permafrost conditions. Care will be exercised to prevent degradation of the materials and the potential for differential settlement, an erosion and sediment control plan will also be followed.

Dredged/excavated material from the seabed will be dewatered through drainage on shore, prior to being used for additional fill. The footprint for dewatering will be behind the preconstructed revetment slope at the small craft harbour site and will be restored to design grade when construction is complete. A sediment and erosion control plan will be implemented for the duration of the construction.

To minimize adverse impacts to soil from inadvertent release, all vehicles and equipment will be equipped with a spill kit able to contain a potential spill. A spill prevention, contingency, and emergency response plan will be implemented. Soils impacted via spills

and releases will be handled and disposed of in accordance with applicable environmental regulations and legislation. A waste management plan will be in place and waste materials will be disposed of in an environmentally acceptable manner, and in compliance with all local and territorial laws and regulations. Any new material used for construction will be clean and free of contamination. Material will be handled and stored in a manner prevent release of hazardous or contaminated materials.

Some level of disturbance to soils and terrain is unavoidable during construction due to the earthworks required, however, adverse effects can be minimized. Significant long-term adverse effects to soil and terrain are not expected.

### 7.2.3 Vegetation

Since there is little to no vegetation occurring at the small craft harbour site and the quarry, effects of construction and post-construction activities on vegetation is unlikely. Vegetation on either side of the haul road may be impacted by inadvertent equipment or vehicle spills and releases. As part of the haul route improvements, vegetation within the riparian zone of Clyde River may be impacted by construction activities though the area of impact will be minor and localized. In the areas where the culvert construction is proposed to the east and west of the current harbour, there are short grasses adjacent to the existing culverts which will be removed during the replacement activities.

To mitigate equipment or vehicle leaks to vegetation on the haul road, and during construction of the improved haul route, equipment and vehicles should be inspected for spills or leaks regularly. Additionally, if equipment brought in from other areas is used at the site locations, all equipment should be cleaned to remove invasive species prior to arriving at the Project Area.

Some vegetation may be removed during earth works; however, the area of removal is anticipated to be marginal, and is not likely to impact SAR or SoCC. Inadvertent adverse effects to vegetation are mitigatable and are not considered significant.

### 7.2.4 Wildlife and Habitat

The Project activities will result in the loss and alteration of terrestrial habitat at the small craft harbour site and quarry sites. The habitat value of the small craft harbour site is considered low; it is currently used by the community, and dogs frequent the beach, which likely deters wildlife and nesting birds. Similarly, the habitat value at the quarry is considered low, and wildlife and nesting birds are likely discouraged from using this site when the quarry is active. Therefore, the effects of habitat alteration and loss at the small craft harbour and quarry sites on terrestrial wildlife and birds is considered minimal.

Marine construction activities in the intertidal zone will result in the loss and alteration of foraging habitat for some mammals and birds and may result in some avoidance

behaviour. However, due current human activity in the area, the value of this habitat is low. Therefore, the impacts of habitat loss and alteration in this area are considered minimal. It is unlikely that large mammals, will occupy the small craft harbour site, quarry, or haul road sites given that most large mammals have large home ranges, are wide ranging, tend to avoid human development, and are more likely be passing through. Therefore, the loss or alteration of habitat is not expected to negatively impact these species.

The small craft harbour, haul road, and quarry sites are already subject to human activity, so the effects of habitat avoidance due to noise and general activity on terrestrial wildlife during construction are considered minimal. However, increased vehicle activity may disturb foraging and nesting migratory birds along the haul road.

Increased traffic, equipment, construction activity, blasting, and fuel or contaminant spills have the potential to increase injury and mortality rates in terrestrial wildlife, as well as nesting birds, nestlings, and eggs. Additionally, there is the potential for increased human-wildlife interactions due to improper waste management or food storage. The noise from blasting has the potential to cause habitat avoidance behaviour in mammals and birds. The impact is expected to be larger on birds, as it may cause avoidance of foraging habitat or nest abandonment.

Mitigation measures to decrease mortality and injury on terrestrial wildlife include implementing and enforcing vehicle speed limits, storing food and waste containers in a manner that does not attract wildlife, implementing a zero-tolerance regarding the harassment, disturbance and feeding of wildlife, and reporting and tracking wildlife sightings.

Mitigation measures to reduce the negative effects on migratory birds include situating activities and infrastructures away from bird nests and roosts, timing blasting outside of migratory bird breeding season (where possible), avoiding large congregations of foraging birds and restricting activities where they occur, and surveying the area for migratory birds before beginning construction activities and implementing buffers or exclusions zones if a sensitive species or feature (e.g. nest) is identified to eliminate disturbance. It is anticipated that injury and mortality to birds can be avoided with these mitigation measures.

### 7.2.5 Species at Risk and Species of Conservation Concern

Potential construction/operation impacts and mitigation measures for species at risk are covered in the section for their related components: Vegetation and Wildlife and Habitat. Refer to Sections 7.2.2. and 7.2.3.

Specific mitigation measures pertaining to species at risk include:

- All workers shall be trained in relation to the wildlife (particularly species at risk) expected to occur in the area, including traditional knowledge, through site induction and toolbox sessions.

- In the event caribou are sighted, protection measures implemented will follow those outlined in Appendix I of the North Baffin Regional Land Use Plan.

## 7.3 Freshwater

### 7.3.1 Surface Water Resources (Hydrology and Water Quality)

The installation of culverts at the river crossing may raise the water level above the exposed rock level on the riverbank during very high flow events. Although sparse, the vegetation above this level may be adversely affected by the higher-grade level, possibly leading to an increase in erosion in this part of the river. The culverts for the river crossing will be installed and removed each construction season to mitigate the effects flooding and increased riverbank erosion due to ice jamming during the spring ice breakup.

A surface water drainage channel in the western portion of the Project site will be redirected to allow surface water runoff west of the small craft harbour. The existing culvert for this drainage will be removed and a new culvert will be installed in the redirected drainage flow path. This drainage only collects water during rainfall events and snow melt; the replacement culvert will have the capacity for a 100-year storm event.

Blasting at the quarry has the potential to increase sediment loading in drainage from the quarry site to the river. An erosion and sediment control plan will be implemented to mitigate these effects.

### 7.3.2 Freshwater Fish and Fish Habitat

The quarry location is situated approximately 500 m away from the nearest river and a similar distance to the nearest lake. From the Fisheries and Oceans Canada (DFO) Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters (Wright and Hopky, 1998), for a 100 kg charge blasting in rock, the minimum distance from a fish bearing water body must exceed 51 m. As the blasting required for the harbour will be to construct armour stone, it is expected that charges smaller than 100 kg will be used. Additionally, the blasting design will minimize the size of the charge while using a dispersed blast pattern, which produces the least powerful noise and vibrations. This further isolates fish and fish habitat from the blasting at the quarry. Blasting at the quarry is sufficiently setback from freshwater environments to adhere to recommended guidelines for the protection of fish, fish habitat, and spawning habitats (Wright and Hopky, 1998).

The installation of culverts at the river crossing has the potential to affect fish and fish habitat in the river and terrestrial vegetation on the riverbanks. In particular, the installation of culverts at the river crossing may impact migrating Arctic char in August and September.

To mitigate the effects on migrating Arctic char, culverts will be sized and embedded to allow for fish passage. The river crossing will be installed and removed each construction season. When possible, the installation and removal of culverts will take place outside of the char migration in August/September. However, if the river crossing must be installed during the char migration period, the construction will be staged to maintain fish passage for the duration of the installation.

## 7.4 Marine

### 7.4.1 Tidal and Bathymetry

Dredging, infilling and potential disposal at sea during construction will lead to changes in bathymetry in Patricia Bay, though effects are expected to be localized and marginal with very minimal sediment transport expected per year. In general, the Patricia Bay region at Clyde River has a mild wave and hydrodynamic climate, and relatively coarse sediment, which leads to limited sediment transport. The predicted longshore sediment transport regime demonstrates that sediment transport along the shoreline is relatively uniform and stable (Canadrill-CBCL, 2021d).

The new small craft harbour will disrupt longshore transport from south to north, and therefore, the shoreline directly adjacent to the southern breakwater is anticipated to grow seawards by approximately ~10 m per year. This deposit is likely to slow down in the future during operation of the small craft harbour, as a new coastline equilibrium is established, and sediment bypass rates begin to increase. The wave climate at Clyde River has been demonstrated to be relatively mild, and therefore rapid wave driven erosion along the shoreline is unlikely (Canadrill-CBCL, 2021d).

Results of 2021 hydrodynamic modelling completed by Canadrill-CBCL indicate that current magnitudes during peak ebb and flood tide are expected to remain relatively low throughout the small craft harbour footprint, where peak ebb and flood tidal currents generate eddies around the heads of the proposed breakwaters that reach depth averaged velocities of up to 0.2 m/s. Overall, there will be no negative effects to tidal conditions in the Bay as a result of the Project.

### 7.4.2 Marine Water and Sediments

In-water construction activities have the potential to temporarily affect water quality and increase turbidity and total suspended sediment (TSS) in the harbour. Construction activities have the potential to temporarily resuspend sand into the water column in the small craft harbour area. Dredging for the Project requires the removal of predominantly sandy sediment in the small craft harbour area, and construction includes the placement of material on bottom. Dredging and the placement of materials both interact with the bottom and can result in the resuspension of sediment. However, the suspended materials will predominantly consist of coarse-grained sand, which is expected to quickly settle out of

the water column. Furthermore, the activities in which sediment may be resuspended occur intermittently during construction. Dredging is the major Project activity that may temporarily resuspend sediment. Following the completion of dredging, resuspension of sediment will occur intermittently during the placement of materials on bottom. Effects to marine water quality are considered low in magnitude and limited in duration during construction.

Contaminated soils exist at the current small craft harbour site due to its use as a community harbour; construction activities may disturb contaminated soil and transport contaminants into the marine environment.

An erosion and sediment control plan will be implemented to control the movement of suspended and contaminated sediment as a result of the Project construction. Turbidity levels in Patricia Bay will be monitored during construction.

Marine water quality may be impacted by equipment or vehicle leaks during construction of the small craft harbour. To mitigate equipment or vehicle leaks into the marine environment during construction equipment should be inspected daily for leaks, emergency spill kits will be kept on site, equipment will be refueled in a manner that reduces the risk of leaks and spills, hazardous materials will be stored in a safe and secure location that limits the potential for leaks, and contaminant spills will be immediately reported to the appropriate regulatory authorities.

### 7.4.3 Marine Fish and Fish Habitat

Dredging and infilling at the small craft harbour site will result in the permanent alteration and loss of marine fish habitat. Dredging will remove sandy material from the intertidal and shallow subtidal habitat in the small craft harbour area and infilling during construction of the breakwaters and revetment further impact the sandy intertidal and shallow subtidal marine habitat. The habitat loss occurs where structural fill materials, armour stone, and new infrastructures displaces existing marine habitats.

The new footprint of the small craft harbour breakwater will provide an increase in rock habitat, as the post-construction substrate on the exterior surfaces of the breakwaters and revetment will consist primarily of rock (armour stone). Additionally, the dredged areas in the vicinity of the floating docks and fixed wharfs are expected to remain predominantly sandy. The predominant intertidal and shallow subtidal habitats observed to the north and south of the small craft harbour area feature a similar composition of sand in the upper to mid-intertidal zone and sand with occasional boulders in the lower intertidal and subtidal habitats. The alteration of habitat in the small craft harbour area affects a relatively small portion of predominantly sandy intertidal and subtidal habitat along the shoreline of Patricia Bay. Therefore, the construction of the small craft harbour is expected to have minimal impact on the overall availability of these habitats, which are common in Patricia Bay, and minimal effects on fish habitat in Patricia Bay.

If disposal at sea is needed, the disposal of dredged materials has the potential to alter predominantly sandy habitat in the deeper waters of the proposed disposal at sea area. The dredged materials are predominantly uncontaminated sand and will be placed on bottom in an area with predominantly sandy substrate. The disposal of dredged sediment is expected to have a minimal impact in the disposal at sea area.

Accidental mortalities of sessile marine organisms, such as clams, associated with the proposed dredging and disposal activities will be limited to the geographic extent of the Project footprint and duration of the Project construction activities. Generally, the proposed location of the small craft harbour at the existing sealift and boat ramp and the disposal at sea in deeper water in the Clyde River Inlet is expected to have minimal impact on fish resources and fish habitat.

The underwater noise and instantaneous pressure changes that can occur during pile driving and dredging can increase the risk behavioural changes in fish. Behaviour changes to increased noise and vibration include avoidance, (Slotte et al., 2004; Nedwell and Mason, 2012), startle responses (Wardle et al., 2001; McCauley et al., 2003), and physiological stress. Underwater noise due to dredging, placement of materials, and pile driving is expected to cause some fish to avoid habitats nearest the construction area.

Mitigation measures to reduce the effects of in-water construction noise on marine fish and invertebrates include implementing soft-start procedures for pile-driving that could generate underwater noise above auditory thresholds, and using vibratory piling equipment, where possible, to reduce noise effects to community and marine fauna. An aquatic acoustic monitoring program will be established by the contractor to verify that underwater noise levels generated from in-water construction activities, specifically pile driving, are less than 30 kPa at 10 m from the activity. If underwater noise levels exceed the guidance threshold, a stop-work order may be imposed.

### 7.4.4 Marine Mammals

Underwater noise may affect marine mammals migrating and foraging in Patricia Bay during construction of the small craft harbour. Marine mammals may be affected by the noise generated from pile driving; the temporary increase in underwater noise levels in Patricia Bay can elicit behavioural disturbance, masking, and physiological stress, and may cause temporary or permanent hearing threshold shifts. Noise levels in the bay are expected to cause some mammals to temporarily retreat from or avoid the area (Ellison et al., 2012); however, this avoidance may reduce the potential risk of injury to these animals.

The risk of injury to mammals is highest in the construction area and decreases with increasing distance from the site. Temporary threshold shifts (TTS) in hearing can occur due to exposure to high sound levels, or repeated exposure, and results in temporary hearing loss. TTS is reversible; however, the temporary loss can become permanent if sufficient time to recover hasn't occurred prior to subsequent exposures. The potential for

TTS due to pile driving occurs near the construction site, and behavioural disturbance extends out into Patricia Bay.

The risk of deadly vessel collisions with marine mammals is unlikely to increase as a result of increased vessel traffic in the harbour during construction. Marine mammals only temporarily occupy the harbour during migration and foraging activities. The risk of vessel strikes is generally low due to their infrequent and temporary presence in the harbour. Further, vessel strikes at speeds lower than 15 knots substantially decrease the likelihood of mortality (Vanderlaan and Taggart, 2007). Vessels that may be used for the Project are not expected to require sustained speeds in excess of 15 knots.

Other effects on marine mammals include a reduction in prey availability, which may leave the construction area during construction activities, and temporary alteration of foraging habitat due to dredging and infilling.

The effects on marine mammals are considered negative but can be mitigated. Marine mammal monitoring will occur throughout construction; if marine mammals are found in near the small craft harbour area during construction, then operations that could negatively impact them will be suspended until they have moved to alternative habitats in Patricia Bay. Activities that may require suspension include dredging and pile driving in the area of the new small craft harbour. To mitigate the effects of vehicle collisions on marine mammals, project-related vessels shall maintain a vigilance for marine mammals, document marine mammal sightings, and employ minimum distances when sighted.

Mitigation measures to reduce the effects of in-water construction noise on marine mammals include implementing soft-start procedures for pile-driving that could generate underwater noise above auditory thresholds for marine mammals and using vibratory piling equipment, where possible, to reduce noise. An aquatic acoustic monitoring program will be established by the contractor to verify that underwater noise levels generated from in-water construction activities, specifically pile driving, are less than 30 kPa at 10 m. If underwater noise levels exceed the guidance threshold, a stop-work order may be imposed.

### 7.4.5 Species at Risk and Species of Conservation Concern

Potential construction/operation impacts and mitigation measures for species at risk are covered in the section for their related components: Marine Fish and Fish Habitat and Marine Mammals. Refer to Sections 7.4.2 and 7.4.3.

It was noted during the community consultations that the in-water construction noise and blasting may cause the Narwhal to avoid the small craft harbour site. However, residents of the hamlet have indicated they do not think the effects will be permanent.

## 7.5 Socio-economic

The Socio-economic Environment VC considers potential impacts of the Project to the health and livelihood of the local community. This VC includes the following subcomponents that could be affected by changes to the environment as a result of site preparation, construction, and operation (as per Table 7.1):

- Employment and business opportunities
- Community infrastructure
- Human health & safety
- Archaeological & heritage resources
- Community wellness/Traditional use of land

Overall, members of the community including knowledge holders have responded favourably to the proposed improvements to the small craft harbour and feedback has been widely positive as there will be many benefits associated with its implementation. Positive effects will be most realized following post-construction, during operation of the small craft harbour. The Project will provide safe access to land and sea to meet current and future needs, taking into consideration climate change. The intent is to enhance the local facilities for the benefit of both its direct users and the broader community. The Project will also support the developing commercial fisheries. There is anticipated to be positive effects to economic conditions, infrastructure and services, land use, navigation, fisheries, human health and safety, and traditional use of lands once the small craft harbour is operating.

Construction activities will be carried out primarily in the marine environment and the Project Area is adjacent to the Town; therefore, there could be potential interactions between atmospheric VCs and human health. Additionally, impacts to the marine VC that affect fish and fish habitat could also affect fisheries.

### 7.5.1 Employment and Business Opportunities

During operation of the small craft harbour, there is increased potential for employment & business opportunities as it will support developing commercial fisheries in the region. The Project construction contract will be in accordance with Article 24 of the NLCA to promote Inuit benefits and employment.

Construction activities associated with the small craft harbour can displace recreational and commercial fisheries within the harbour through loss of access and fish and mammal avoidance of the area during in-water works. Boat access will be permissible though may be inconvenienced during construction. Fishing in the bay, away from the construction area, is not anticipated to be interrupted by the Project. The community has indicated that blasting can cause harmful effects to Arctic char populations in Clyde River. Adverse effects will be mitigated (see Section 7.1.2).

Construction activities may be able to provide an opportunity for employment of local Inuit residents through the procurement of local services, including site preparation, equipment servicing, and other construction support services. However, specialized positions could be difficult to employ locally so it will be expected that much of the labour force(s) will be hosted from outside of the community. Temporary workers would be able to contribute to the local economy.

Use of the quarry to supply rock material for construction will yield positive benefits to the local economy, as this aspect of construction will involve the local community via operation of the quarry.

Fishing opportunities will be greatly enhanced once the small craft harbour is operational. The increase in capacity for boat storage would allow for growth in the number of fishing vessels in the future. Negative effects to fishing during construction activities will be resolved once construction is complete. Fish are anticipated to make a return to the area at this time (Canadrill-CBCL, 2021).

The Project does not anticipate having negative effects to employment and business opportunities.

### 7.5.2 Community Infrastructure

The overarching function of the new harbour is to provide safe access to land and sea to meet current and future needs for the community of Clyde River. The intent is to enhance the local facilities for the benefit of both its direct users and the broader community. By rebuilding the small craft harbour, residents will be able to safely store their boats, reducing the potential for damage caused by extreme weather conditions. The proposed upgrades to the haul road will lead to infrastructure enhancements.

There will be no effect to the existing harbour and boat launch during construction, as access by current users will be permitted to continue throughout the duration of construction, except during times when there are possible safety risks.

In addition to positive effects to infrastructure and services as a result of the new small craft harbour, there are some negative effects that are anticipated during construction. Increased truck traffic volumes along the haul route, through town and around the harbour is anticipated. To manage traffic and mitigate any potential damage or degradation to local infrastructure, a traffic management plan has been prepared. The Contractor will also be required to repair / replace any damaged infrastructure (i.e., culverts, roadways, ditching) that was caused by their activities.

The development of a temporary construction work camp would alleviate increased pressure on local accommodations during construction. However, the demand for additional supplies, resources, and services, including fuel and food, during construction could put added pressure on the hamlet's resources. This excess demand during

construction will be considered prior to construction to ensure demand can be met without straining the community's supplies, resources, and services.

It is expected that there will be a minimal amount of construction waste produced on the site. The majority of waste that would be expected would be from having the additional construction workers in the community generating typical household waste such as organic waste, and package waste (e.g., pallets, plastics, crates). Shipping fuel and oils would likely be the source of non- typical waste that could not be disposed of in a typical manner at the community landfill. Fuel and oil drums would need to be removed from the community. A waste reduction and management plan will be created to manage construction waste.

Given the mitigations described, the Project does not anticipate having residual negative effects on the hamlet's infrastructure and services.

### 7.5.3 Human Health and Safety

Positive effects to human health and safety are associated with the operation of the small craft harbour and upgrades to the haul road and river crossing. The small craft harbour will enhance safety for the community by offering resident boats shelter from harsh weather and tidal conditions, allow separate mooring areas for large vessels such as sealifts, and fishing/ recreational boats that will reduce congestion and prevent collisions. Cordoning sealift areas will provide faster unloading and increase safety for the public. There will also be improved stabilized features for onshore fishing via the breakwaters.

Adverse effects to human health and safety are related to changes to the atmospheric environment (air quality and noise), increased traffic, expected increased interest by the community in construction activities particularly children and youth, and an increase in the number of non-resident workers who will visit the area.

As indicated in section 7.1.1, dust suppression will occur via the use of calcium chloride or water to minimize airborne dust migration from the Project area. Construction is anticipated to occur 24 hours, 7 days a week though contractors will be mindful of noise during construction activities to minimize sleep disturbance to the community. The community has expressed support for 24-hour construction to reduce overall construction time.

To manage traffic and mitigate any potential health and safety hazards, a traffic management plan has been prepared. Roads that are expected to be shared between pedestrians, public traffic and rock trucks will employ the use of signage, convoys, and escort vehicles. These measures would provide both a visual warning for other vehicles and pedestrians using the road as well as monitor potential material falling out of trucks. Additionally, speed limits will be in place and all vehicle and equipment operators will be trained.

Steps to promote safety will take a collaborative approach. During the next community engagement session scheduled for September 2021, the topic of safety, including the installation of construction fencing, will be discussed to solicit additional feedback from the community on how to further protect and enhance safety precautions.

All construction activities have the potential to affect human health and safety (Table 7.1), though adverse effects are mitigatable and will be minimized. Significant adverse effects on local and regional traffic and health and safety are not anticipated.

### 7.5.4 Community Wellness/Traditional Land Use

Traditional land use activities such as fishing, clamming, Narwhal, and seal harvesting intersect the small craft harbour (Figure 4.1). Various birds have been spotted around the quarry and may nest there, and snow goose hunting occurs east of the existing haul road to the river. Hunting, gathering, and fishing supply the community with sustenance and income to support its wellness and livelihood. These activities are also important cultural activities.

Fishing activities will still be able to occur in the small craft harbour, apart from the areas under construction. Fish and marine mammals may vacate the area during drilling and in-water works, however are expected to return upon completion of construction activities according to IQ and community knowledge articulated during the 2020/2021 IQ workshops (Canadrill-CBCL, 2020; Canadrill-CBCL, 2021a).

Negative effects to traditional land use are reversible and are not considered significant.

### 7.5.5 Archaeological and Cultural Historic Resources

The existing quarry will need to be expanded to provide the volume of rock required for the Project. Prior to the quarry expansion, an archeological survey will be conducted in the areas that are within 100 m of the quarry expansion boundary and were not previously surveyed. If any archaeological sites are discovered, a 30-m buffer will be implemented during construction to conserve the site.

# Chapter 8 Residual and Cumulative Effects

## 8.1 Summary of Residual Environmental Effects

There may be some negative residual environmental effects that will remain despite mitigation measures, predominantly with respect to ambient light, air quality, noise, marine water and sediments, marine fish and fish habitat and marine mammals, however, no residual effects are predicted to be significant.

### 8.1.1 Atmospheric

Residual effects to the atmospheric environment are expected to be small in magnitude for air quality and moderate with respect to ambient noise. These effects are intermittent and reversible, occurring only while construction is occurring and will return to baseline levels following completion of construction. Although there will be effects to ambient light that cannot be mitigated and will be long term, lighting at the harbour and navigation aids will reduce safety risks and are therefore considered positive during operation.

### 8.1.2 Terrestrial

Residual effects to terrestrial habitat and wildlife include both temporary effects during construction and permanent effects. Temporary alteration to foraging habitat will occur in the intertidal small craft harbour area due to marine construction activities, and permanent loss of habitat will occur at the quarry site due to expansion. Sensory disturbance from blasting noise may cause avoidance or abandonment of habitat by terrestrial wildlife and birds at the quarry site. Adverse effects of the Project on birds and wildlife are generally anticipated to be reversible.

Excavation and earthworks of the soil is expected to create long term changes throughout the lifecycle of the small craft harbour and the quarry, though adverse effects are likely to be reversible. Some vegetation may be removed during earthworks; however, the area of removal is anticipated to be marginal, and is not likely to impact SAR or SoCC flora.

### 8.1.3 Marine

Residual effects to marine fish and fish habitat include both temporary effects during construction and permanent effects. Temporary marine habitat loss and habitat alteration will occur in the small craft harbour and disposal at sea sites due to dredging and infilling but is expected to return to baseline conditions after construction. Permanent loss of marine habitat will occur in the small craft harbour area due to infilling and the footprint of

the new small craft harbour infrastructure. However, the new footprint of the small craft harbour breakwater will increase the amount of rock habitat and is a positive residual effect. Underwater noise emissions are anticipated to adversely affect fish, and accidental mortality and injury to marine fish and invertebrates may occur during marine construction activities. Incidental mortality may occur, and individual mortalities are irreversible; however, it is highly unlikely that there will be impacts that affect the productivity of fish and marine mammals in the region. The conditions that cause the effects are reversible and noise emissions will return to baseline conditions following the completion of Project components that generate noise emissions.

Residual effects to marine mammals from drilling and dredging are temporary and intermittent. Foraging habitat will be temporarily altered and may be avoided due to noise from in-water construction activities. The effect of noise is reversible and will return to baseline conditions following the completion of construction.

### 8.1.4 Socio-economic

Added pressure on the community's supplies, resources, and services will be considered before pursuing construction. There may be a minor obstruction to fishing and navigation during construction, however, any negative effects that cannot be mitigated (such as temporary avoidance of an area during construction) will be short term. Effects to the socio-economic environment, and all of the valued components, will be positive in the long-term.

## 8.2 Potential Cumulative Environmental Effects

Past, present, and future Projects in Patricia Bay and around Clyde River were investigated to determine if there is potential for the residual adverse effects of the Project to interact with the residual environmental effects of other Projects and activities, resulting in cumulative environmental effects.

Large Projects that are planned or underway in the vicinity of Clyde River are hundreds of kilometres away from Patricia Bay, including the Baffin Mary River mine in Milne Inlet. The nearest shipping route is approximately 400 km north of Clyde River. Other regional historical Projects that have occurred in the region are predominantly scientific research-based and are intermittent or temporary in nature, with the exception of the Airside Rehabilitation project.

The Clyde River Airport Airside Rehabilitation project occurred in 2019 and required material from the quarry during construction. As heavy equipment mobilization was necessary to access the quarry, and transportation between the quarry and the construction site occurred, a ford was established to cross the main river. There are presently residual disturbances of this development on the river at the ford crossing. Similar heavy equipment is required to be mobilized to the quarry during construction of the current Project and crossing by fording the river is required again starting in 2022. To

support natural drainage and allow fish passage of Arctic char to occur during this time, culverts will be installed at this location while construction takes place. As discussed in previous sections of this document, the culverts will be removed at the end of the construction period each year. The installation and removal of the culverts will be staggered with the Arctic char runs to minimize potential interactions. The ford crossing will be restored upon completion of construction. Positive cumulative effects are expected as a result of the temporary culvert installation through optimizing fish passage in a previously obstructed area. Additionally, positive cumulative effects can be predicted as the ford crossing area will be restored following construction.

There is no spatial or temporal overlap with the environmental effects of other projects that are known to be planned or underway in the region. The residual adverse effects of the Project are restricted to the Project area and are limited to the construction period. Conditions are expected to return to similar to baseline after construction and therefore there are no expected adverse cumulative environmental effects.

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# APPENDIX A

## Photo Log

# Appendix A: Photo Log

Photo 1: Clyde River Hamlet and Existing Harbour.

Photo 2: Existing Harbour and Sealift from shoreline.

Photo 3: Existing Sealift at Harbour in Clyde River.

Photo 4: Proposed Location of the SCH to the West (left) of the Existing Harbour and Sealift.

Photo 5. Proposed location of the SCH to the west (left) of the Existing Harbour and Sealift. Existing Power poles providing light for the existing harbour are visible on the right.

Photo 6: Existing Bridge on Haul Road to Quarry East of Clyde River.

Photo 7: Existing Quarry (Quarry 5) East of Clyde River.

Photo 8: Former River Ford Crossing on Haul Road to Quarry East of Clyde River