

## TECHNICAL MEMORANDUM

**DATE** 7 April 2021

**Reference No.** 1663724-285-TM-Rev1-48000

**TO** Lou Kamermans, Senior Director of Sustainable Development  
Baffinland Iron Mines Corporation

**CC**

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### PRELIMINARY SUMMARY OF 2020 NARWHAL MONITORING PROGRAMS

This technical memorandum has been prepared to provide preliminary results of the 2020 narwhal monitoring programs undertaken in support of the Mary River Project (the Project). Detailed monitoring results, including methodologies, will be provided to the NIRB and the Marine Environment Working Group (MEWG) as part of Baffinland's annual reporting process. Possible influencing factors on the 2020 results are discussed herein and potential adaptive management measures have been proposed for consideration.

## 1.0 INTRODUCTION

Key interim 2020 monitoring results indicate: i) narwhal abundance in Eclipse Sound was statistically lower than previous years; ii) recorded sounds from Baffinland icebreaking were 10-20 dB lower than modelled, which results in 120 dB exposure durations that are 60-90% lower than predicted; and iii) noise emissions of a non-vessel based, anthropogenic, impulsive sound source were detected in the RSA during the 2020 early shoulder and open-water season, which was consistent with the type of noise generated by impact pile driving. Consistent with Baffinland's approach towards adaptive management as described in the draft Adaptive Management Plan (June 2020), the following actions are recommended:

- 1) A review of potential causal factors of the decreased narwhal abundance in Eclipse Sound observed in 2020
- 2) Identification of follow-up monitoring programs for narwhal at the Project level (for implementation in 2021)
- 3) Identification of additional follow-up monitoring programs for narwhal at a regional level

Despite the limited information available to reliably attribute the primary causal factors, recognizing the value of the Eclipse Sound narwhal stock to the residents of Pond Inlet, the following precautionary approach is advisable for the 2021 shipping season:

- 4) Identification and implementation of precautionary Project-based operational mitigations for shoulder season shipping in light of unknown and/or unmitigated cumulative activities continuing to occur in 2021

This memo also includes preliminary investigations related to the four actions above, and Golder recommends these be developed further in collaboration with relevant parties.

Based on a preliminary review, potential causal factors of the 2020 decreased narwhal abundance in Eclipse Sound include acoustic disturbance from 2020 icebreaking operations, acoustic disturbance from impact pile driving in Pond Inlet associated with the Small Craft Harbour (SCH) construction project, and increased killer whale presence in the Regional Study Area (RSA).

Golder recommends additional Project-related monitoring be undertaken by Baffinland; in particular, aerial based surveys in 2021 to obtain an abundance estimate for the Eclipse Sound summer stock, as well as instrumentation of narwhal with satellite tags during early season ice conditions to fill data gaps associated with narwhal interactions with icebreaking.

Potential longer-term regional-based narwhal monitoring studies, which could inform how narwhal use of Eclipse Sound is influenced by regional factors, are also recommended to investigate potential non-Project influences on Eclipse Sound narwhal (e.g., abundance surveys of the Baffin Bay regional narwhal population, drone-based aerial photogrammetry to estimate body condition). These would be founded on local Inuit knowledge and implemented collaboratively between Baffinland, the community of Pond Inlet and respective regulatory agencies.

## 2.0 BACKGROUND

The Mary River Project is an operating iron ore mine located in the Qikiqtani Region of North Baffin Island, Nunavut, owned and operated by Baffinland Iron Mines Corporation (Baffinland). Baffinland is currently operating in the Early Revenue Phase (ERP) of the Project and is authorized to transport 4.2 Mtpa of ore by truck to Milne Port for shipping through the Northern Shipping Route using chartered ore carrier vessels. A Production Increase Proposal (PIP) to ship 6.0 Mtpa from Milne Port was approved twice, for two two-year periods spanning 2018–2021.

In 2020, Baffinland's shipping operations occurred over an 88-day period. The first Project vessel to enter the Regional Study Area (RSA) in 2020 was the icebreaker MSV *Botnica* on 21 July while escorting two ore carriers and two tugs to Milne Port. The last vessel to exit the RSA in 2020 was the MSV *Botnica* on 16 October while escorting one ore carrier and two tugs out of the RSA. In 2020, a total of 5.5 million tonnes of ore was shipped via 72 return ore carrier voyages and cargo/fuel was delivered to port via eight vessels, for a total of 80 vessels calling to Milne Port in 2020. This is 22 less vessels than the total of 102 vessels (82 ore carriers, 20 freight ships and fuel tankers) that called to Milne Port in 2019. The shipping activities that occurred in 2020 were within those described in the PIP Extension Request (2019), including shipping between July 15 and October 15, approximately.

To better understand potential short-term, long-term and cumulative effects of vessel noise on narwhal and other marine mammals in the RSA, Baffinland has implemented a number of follow-up monitoring programs since 2013 aimed at evaluating the potential effects of Project vessel noise on marine mammals (Table 1).

**Table 1: Baffinland Marine Mammal Monitoring Programs Undertaken in RSA (2006--2020)**

Marine Mammal Monitoring Program	Baseline						ERP (4.2 MPTA)			ERP (6 MPTA)		
	2006	2007	2008	2010	2013	2014 <sup>1</sup>	2015 <sup>1</sup>	2016	2017	2018	2019	2020
Bruce Head shore-based study	-	-	-	-	X	X	X	X	X	-	X	X
Passive acoustic monitoring	-	-	-	-	-	X	X	-	-	X	X	X
Ship-based Observer (SBO) program	-	-	-	-	X	X	X	-	-	X	X	-
Aerial surveys – cetaceans	X	X	X	-	X	X	X	X <sup>2</sup>	-	-	X	X
Aerial surveys - pinnipeds	X	X	X	-	-	X	-	-	-	-	-	-
Narwhal tagging study	-	-	-	-	-	-	-	X	X	-	-	-

1. 2014 included baseline data collection and initial evaluation of EEM protocol. 2015 was first year of EEM post dock construction (ERP)

2. DFO 2016 aerial survey data analyzed by Baffinland.

Hyphen (-) = no monitoring data collected that year

### 3.0 2020 MARINE MAMMAL MONITORING PROGRAMS – PRELIMINARY RESULTS

In 2020, the following marine mammal monitoring programs were undertaken by Baffinland between July and September:

- Marine Mammal Aerial Survey Program (MMASP)
- Bruce Head Shore-based Monitoring Program
- Passive Acoustic Monitoring (PAM) Program

#### 3.1 Marine Mammal Aerial Survey Program

**High-level Summary:** Two different marine mammal aerial surveys were performed in 2020. A reconnaissance survey was initially run during the early shoulder season (Leg 1) to collect data on the presence/absence and distribution of marine mammals in the RSA specific to available ice conditions at that time of year. A systematic aerial-based transect survey was then conducted during the open-water season (Leg 2) to obtain abundance estimates of the Eclipse Sound and Admiralty Inlet narwhal summer stocks. Results from the Leg 1 survey indicated that prior to the start of icebreaking in 2020, few narwhal had progressed into Milne Inlet due to a large consolidated ice field present in Western Eclipse which appeared to impede southbound access. Narwhal were largely concentrated within this ice field amongst several prominent ice leads when icebreaking began. This differed from 2019, when more narwhal had progressed into Milne Inlet prior to the start of icebreaking due to lighter ice conditions that year. In both years, narwhal were also present in northern Navy Board Inlet and east of Pond Inlet prior to the start of icebreaking. Results from the Leg 2 survey indicated that: i) narwhal abundance in

*Eclipse Sound was statistically lower in 2020 than observed in previous years when aerial surveys were conducted (i.e., 2013, 2016 and 2019), and ii) the combined narwhal abundance in Eclipse Sound and Admiralty Inlet was similar in 2020 to that observed in previous years (2013 and 2019). These results suggest either a potential displacement of a portion of the Eclipse Sound stock to the Admiralty Inlet summering ground during the summer of 2020, a potential displacement of these animals to another area (e.g., Eastern Baffin Bay summering ground), or a potential decrease in the Eclipse Sound summer stock.*

The following section provides additional details on both aerial surveys undertaken by Baffinland in 2020.

In 2020, marine mammal aerial surveys were conducted in the North Baffin region during the early shoulder season from 10 to 22 July (Leg 1) and during the open-water season from 20 August to 1 September (Leg 2). The objectives of the Leg 1 surveys were to better understand the relative abundance and distribution of narwhal in the RSA prior to and during initial shipping and icebreaking operations in the RSA. The objectives of the Leg 2 surveys were to obtain abundance and density estimates of marine mammals in the RSA during the open-water season including an annual abundance estimate for the Eclipse Sound and Admiralty Inlet narwhal summer stocks. The aerial survey design combined visual line-transect sampling (i.e., conventional distance sampling methods) with high-resolution aerial photographic surveys. The photographic surveys were flown in high density areas of marine mammals which would otherwise be too difficult for the visual observers to get an accurate count. This method results in a greater degree of survey accuracy compared to visual line-transect sampling alone because a more robust estimate can be obtained through the photographic survey component.

### **Leg 1 (Early Shoulder Season)**

During Leg 1, narwhal were primarily concentrated in Baffin Bay, Pond Inlet, Eclipse Sound and Navy Board Inlet. Prior to the icebreaker's first entry in the RSA, open water was present throughout Baffin Bay, Pond Inlet, and the central and northern portions of Navy Board Inlet; while Eclipse Sound was covered by extensive sea ice including a large, consolidated ice field that extended from the bottom of Navy Board Inlet to approximately 25 km east of Pond Inlet (Figure 1). Several prominent leads in the consolidated ice field were occupied by large numbers of narwhal, including many mother/calf pairs. Prior to the start of icebreaking, few narwhal had progressed into Milne Inlet, presumably due to impeded southbound access created by the consolidated ice field. This differed from 2019, when more narwhal had progressed into Milne Inlet prior to the start of icebreaking due to lighter ice conditions that year. In both years, narwhal were also present in northern Navy Board Inlet and east of Pond Inlet prior to the start of icebreaking



**Figure 1: Satellite image of RSA on 12 July 2020 (left) and 21 July 2020 (right) showing changing ice conditions in the RSA between the start of aerial surveys and the first day of shipping (Source: Zoom Earth; <https://zoom.earth>).**

### **Leg 2 (Open Water Season)**

During Leg 2, narwhal in the RSA were primarily concentrated in Milne Inlet South / Koluktoo Bay and Tremblay Sound. The abundance estimate for the combined Eclipse Sound and Admiralty Inlet stocks was 36,044 narwhal (Coefficient of Variation (CV) = 0.12, 95% confidence interval (CI) of 28,267–45,961; Table 2) based on aerial surveys conducted on 28–29 August 2020. This estimate is within the range of the 2013 Fisheries and Oceans Canada (DFO) estimate for the combined Eclipse and Admiralty stocks of 45,532 narwhal (CV = 0.33, 95% CI of 22,440–92,384; Doniol-Valcroze et al. 2015) (Z-test = 0.61,  $p = 0.2726$ ) and the 2019 Baffinland estimate for the combined Eclipse and Admiralty stocks of 38,771 (CV = 0.12, 95% CI of 30,667–49,016; Golder 2020) (Z-test = 0.42,  $p = 0.3366$ ) (Table 2).

For Eclipse Sound stock alone, the abundance estimate was 5,018 narwhal (CV = 0.03, 95% CI of 4,736–5,317; Table 2) based on the aerial survey conducted on 29 August 2020. This estimate is statistically lower than the 2016 DFO estimate of 12,039 narwhal (CV = 0.23, 95% CI of 7,768–18,660; Marcoux et al. 2019) (Z-test = 2.53,  $p = 0.0057$ ), the 2013 DFO estimate of 10,489 narwhal (CV = 0.24, 95% CI of 6,342–17,347; Doniol-Valcroze et al. 2015) (Z-test = 2.17,  $p = 0.0150$ ), and the 2019 Baffinland estimate of 9,931 narwhal (CV = 0.05, 95% CI of 9,009–10,946; Golder 2020) (Z-test = 9.53,  $p < 0.0001$ ) (Table 2).

For the Admiralty Inlet stock alone, the abundance estimate was 31,026 narwhal (CV = 0.14, 95% CI of 23,406–41,126; Table 2) based on the aerial survey conducted on 28 August 2020. This estimate is within the range of the 2013 DFO estimate of 35,043 narwhal (CV = 0.42, 95% CI of 14,188–86,553; Doniol-Valcroze et al. 2015) (Z-test = 0.26,  $p = 0.39$ ) and the 2019 Baffinland estimate of 28,746 narwhal (CV = 0.15, 95% CI of 21,545–38,354; Golder 2020) (Z-test = 0.37,  $p = 0.36$ ) (Table 2).

**Table 2: Historical Abundance Estimates for Eclipse Sound and Admiralty Inlet Narwhal Summer Stocks**

Stock	Year	Abundance	CV	95% CI	Source
Eclipse Sound	2013	10,489	0.24	6,342–17,347	Doniol-Valcroze et al. 2015
Eclipse Sound	2016	12,039	0.23	7,768–18,660	Marcoux et al. 2019
Eclipse Sound	2019	9,931	0.05	9,009–10,946	Golder 2020
Eclipse Sound	2020	5,018	0.03	4,736 – 5,317	Golder 2021a
Admiralty Inlet	2013	35,043	0.42	14,188-86,553	Doniol-Valcroze et al. 2015
Admiralty Inlet	2019	28,746	0.15	21,545-38,354	Golder 2020
Admiralty Inlet	2020	31,026	0.14	23,406-41,126	Golder 2021a
Eclipse & Admiralty	2013	45,532	0.33	22,440–92,384	Doniol-Valcroze et al. 2015
Eclipse & Admiralty	2019	38,771	0.12	30,667–49,016	Golder 2020
Eclipse & Admiralty	2020	36,044	0.12	28,267–45,961	Golder 2021a

### 3.2 Bruce Head Shore-based Monitoring Program

**High-level Summary:** 2020 shore-based monitoring at Bruce Head detected fewer narwhal than previous years and this aligns with aerial survey findings of a statistically lower abundance of narwhal in Eclipse Sound in 2020 than previous years (i.e., 2013, 2016 and 2019). The narwhal calf ratio observed at Bruce Head in 2020 was consistent with pre-shipping levels, despite year-over-year increases in shipping from 2014 to 2019. Multiple observations of nursing in the Bruce Head area in 2020 offers some evidence that females with dependent young continue to carry out critical life functions in the presence of vessel traffic during the open-water season. The following provides additional details on the Bruce Head Shore-based Monitoring Program.

Shore-based monitoring of narwhal along the Northern Shipping Route has been undertaken over a six-year period at Baffinland’s Bruce Head field station (2014–2017; 2019–2020). The objective of the Bruce Head Shore-based Monitoring Program is to investigate narwhal response to shipping activities in Milne Inlet. During the open-water season, visual survey data were systematically collected on the relative abundance and distribution (RAD) and the group composition and behaviour of narwhal. Additional data were collected on environmental conditions and anthropogenic activities (e.g., shipping and hunting activities) to distinguish between the potential effects of Project-related shipping activities and confounding factors that may also affect narwhal behaviour. In 2020, data were also collected via Unmanned Aerial Vehicles (UAVs or drones) to evaluate observer detection performance and to further assess narwhal response to vessel traffic.

Relative abundance of narwhal in the Bruce Head study area, inferred from sighting rate (no. of narwhal per hour - corrected for effort), was shown to be relatively constant between 2014 and 2019, despite a gradual increase in iron ore shipping during this period (Golder 2021b, in press). In 2020, relative abundance of narwhal in the Bruce Head study area was lower compared to previous monitoring years. Based on an integrated analysis of all survey years combined, the effect of year was shown to be marginally significant ( $p = 0.058$ ), largely due to the influence of the 2020 results. Of note, the number of narwhal observed in the study area, standardized by effort (narwhal/hour), were 101.4 narwhal/hour in 2014, 98.2 narwhal/hour in 2015, 178.0 narwhal/hour in 2016, 121.8 narwhal/hour in 2017, 126.7 narwhal/hour in 2019, and 47.5 narwhal/hour in 2020 (Table 3).

The lower relative abundance of narwhal observed in 2020 in the Bruce Head study area is consistent with findings from the 2020 aerial survey (significant decrease in 2020 Eclipse Sound abundance estimate). Results from the 2020 behavioural and group composition study components are consistent with existing impact predictions in the FEIS in that ship noise effects on narwhal will be limited to temporary, localized avoidance behaviour.

**Table 3: Annual Comparison of Narwhal Relative Abundance at Bruce Head**

Survey component	Survey year					
	2014	2015	2016	2017	2019	2020
Extent of shipping season	08 Aug–03 Sep	03 Aug–04 Sep	28 Jul–03 Sep	02 Aug–17 Oct	18 Jul–30 Oct	05 Jul–15 Oct
Survey period	03 Aug–05 Sep	29 July–05 Sep	30 July–30 Aug	31 July–29 Aug	06 Aug–01 Sep	07 Aug–01 Sep
No. of active survey days	23	29	27	26	26	26
No. of observer hours (total)	103.2	148.7	159.3	97.3	151.5	193.0
Average daily survey effort (h)	7.8	10.8	11.9	6.2	11.1	13.6
No. of completed RAD surveys	166	313	311	109	169	206
No. of vessel transits recorded during RAD	7	13	24	22	41	42
No. of RAD surveys with >1 vessel transiting	2	0	3	4	11	3
No. of vessel transits during survey period	13	22	47	59	75	56
No. of vessel transits during shipping season	13	22	56	154	240	188
No. of narwhal (total) recorded during RAD	10,463	14,599	28,309	11,831	19,200	9,047
No. of narwhal standardized by effort (narwhal/h)	101.4	98.2	178.0	121.8	126.7	47.5

Note: RAD = relative abundance and distribution

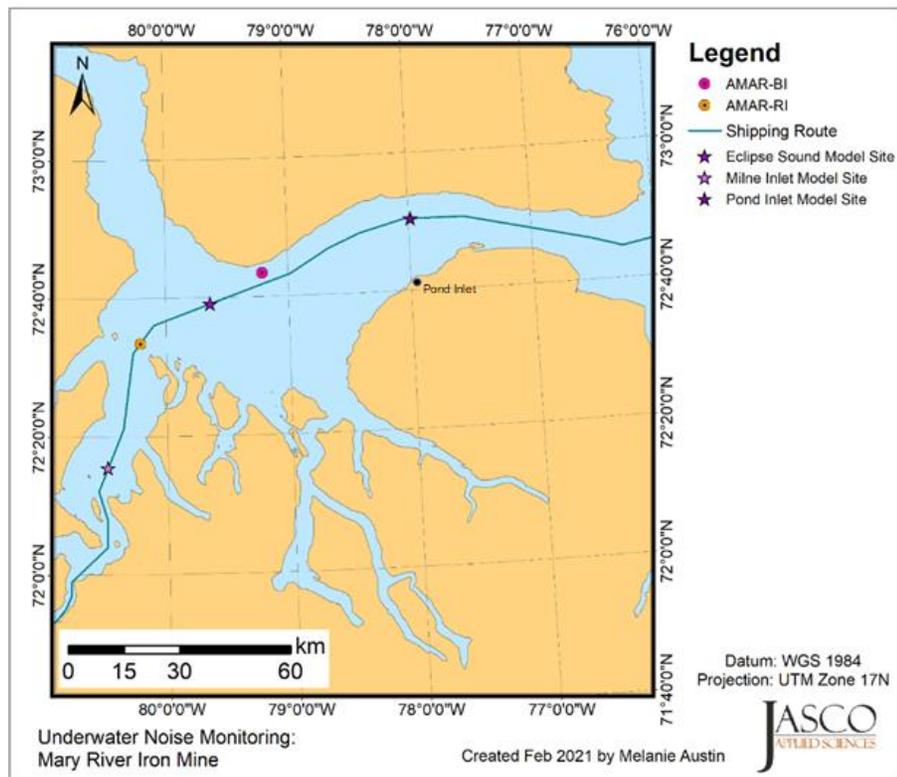
Similar to previous years, calves were observed during most sampling days and mean annual proportion of calves observed in 2020 (11.3%) was higher than three of the previous years (2014 = 10.7%, 2016 = 10.5%, 2017 = 9.5%), but lower than 2015 and 2019 when a mean annual proportion of 12.9% and 11.6% was recorded, respectively. This suggests that calf presence (calving success) at Bruce Head is still occurring at a rate that is consistent with pre-shipping conditions, despite year-over-year increases in shipping in the RSA.

Focal follow surveys undertaken during the Bruce Head program observed nursing by a calf or yearling during two of the 16 surveys conducted in the presence of vessels. This finding offers some evidence that females with dependent young continue to carry out critical life functions such as nursing in the presence of vessel traffic. The two nursing events occurred at distances of 4.25 km and 9.08 km from the vessel, respectively.

### 3.3 Passive Acoustic Monitoring During Icebreaking Operations

**High-level Summary:** Underwater sounds from active Project-related icebreaking were successfully obtained in Eclipse Sound in 2020. To facilitate collection of this information, the captain of the icebreaker was requested to travel a pre-determined route directly over the underwater recording stations, which would allow for the collection of icebreaking related underwater sound in close proximity to underwater noise recorders. Results indicate sound levels from active icebreaking are 10 to 20 dB lower than what was predicted (using analogous sound sources from other regions), and per-transit exposure durations at a level of 120 dB re 1  $\mu$ Pa are thus 60-90% lower than predicted. The 2020 PAM program also detected sequences of impulsive sound in July and August 2020 that is consistent with the type of impulsive noise generated by impact pile driving (see further details in Section 4.2). Additional relevant details on the passive acoustic monitoring program during icebreaking operations are provided below.

Two underwater acoustic recorders were deployed along the Northern Shipping Route on 29 Sep 2019 to record sound generated from the icebreaker MSV *Botnica* during the late shoulder season (Figure 2). One acoustic recorder was deployed in Eclipse Sound, near the southwest end of Bylot Island, and the other was deployed in northern Milne Inlet near Ragged Island. To extend their battery life, the recorders were programmed to stop recording through the winter, from 12 Oct 2019 to 17 Jul 2020, so they could continue to record noise from icebreaker transits during the 2020 'early shoulder' season. Underwater noise was analyzed for a total of 17 one-way transits of the MSV *Botnica* in Eclipse Sound (8 in the 2019 late shoulder season and 9 in the 2020 early shoulder season) and 18 one-way transits in northern Milne Inlet (7 in the 2019 late shoulder season and 11 in the 2020 early shoulder season). All transits recorded during the 2019 fall shoulder season occurred in open-water (0/10 ice concentration). Transits recorded during the 2020 early shoulder season included both open-water and ice-covered conditions, with ice concentrations ranging between 0/10 and 9/10. During the analyzed transits, the MSV *Botnica* either transited alone or with 1 to 4 other vessels in escort (including ore carriers and tugs).



**Figure 2: Location of acoustic recorder stations (AMAR-BI and AMAR-RI) deployed along the Northern Shipping Route during the 2019 late shoulder season and 2020 early shoulder season. Also shown are the acoustic modelling location selected for the marine mammal effects assessment.**

Sound pressure levels (SPLs) were recorded during each of the analyzed icebreaker transits, both with and without vessels under escort. Two standard metrics of vessel noise emissions, radiated noise levels and monopole source levels, were estimated for each transit of the MSV *Botnica*. Also computed was the 90th percentile distance between the MSV *Botnica* and the recorder at which sound levels exceeded the 120 dB re 1  $\mu$ Pa disturbance threshold, and the corresponding exposure duration. Although the MSV *Botnica* was shown to periodically generate high intensity sound while transiting through ice, findings suggest that these periods are brief and intermittent (i.e., on the order of minutes or less). Furthermore, the spatial extent of the noise field and the duration of exposure associated with disturbance effects (>120 dB re 1 uPa RMS) was shown to increase by only a small amount when additional vessels were added to the convoy, and when ice concentration increased, but by no more than the variability observed of the MSV *Botnica* in varying conditions on its own.

The results of this analysis were also compared with modelling estimates that were calculated as part of the icebreaking assessment (Golder 2019a) and confirmed that the assumptions used in the acoustic modeling led to overestimates of the real sound levels experienced by narwhal, as the modelling was intentionally conservative. Results demonstrated that the measured per-transit noise exposure periods exceeding 120 dB re 1  $\mu$ Pa were approximately 80-90% lower than modelling estimates when the icebreaker was actively breaking ice (3/10 to 9/10), and > 60% lower than modelled estimates when the icebreaker was traveling in open water. Based on the acoustic modelling results of shoulder season shipping, a stationary narwhal in Eclipse Sound was predicted to

experience sounds  $\geq 120$  dB re 1  $\mu$ Pa for between 0.7 and 9.5 hours per vessel transit, dependent on transit scenario and ice concentration (Quijano et al. 2019), while measured exposure durations have since been shown to range between only 0.17 and 1.08 hours (Austin and Dofher 2021, in press). The maximum exposure duration calculated  $\geq 120$  dB re 1  $\mu$ Pa (i.e., 1.08 hours) occurred on 22 July 2020 during which time the MSV *Botnica* was transiting at 7.3 knots through 9/10 ice concentration with no vessels in escort.

### 3.4 Discussion of Results

Results from the 2020 aerial survey indicated: i) narwhal abundance in Eclipse Sound was statistically lower in 2020 than in previous aerial survey years carried out in the RSA (2013, 2016 and 2019), and ii) the combined narwhal abundance in Eclipse Sound and Admiralty Inlet was similar in 2020 to that observed in previous years. These results suggest either potential displacement of a portion of the Eclipse Sound stock to the Admiralty Inlet summering ground during the summer of 2020, a potential displacement of these animals to another area (e.g., Eastern Baffin Bay summering ground), or a potential decrease in the Eclipse Sound summer stock.

Results from the 2020 shore-based monitoring at Bruce Head detected fewer narwhal than previous years and this aligns with aerial survey findings of a statistically lower abundance of narwhal in Eclipse Sound in 2020 compared to previous survey years (i.e., 2013, 2016 and 2019). The narwhal calf ratio observed at Bruce Head in 2020 was consistent with pre-shipping levels, despite year-over-year increases in shipping from 2014 to 2019. Multiple observations of nursing in the Bruce Head area in 2020 offers some evidence that females with dependent young continue to carry out critical life functions in the presence of vessel traffic.

Results from the 2020 PAM program indicated that underwater sounds from active Project-related icebreaking are lower than what was predicted, demonstrating that the acoustic modelling undertaken in the effects assessment was conservative. The 2020 PAM program also detected sequences of impulsive sound in July and August 2020 consistent with the type of impulsive noise generated by impact pile driving (see further details in Section 4.2).

In consideration of the above findings, it is evident that a lower number of narwhal were observed in the Eclipse Sound summer stock area during 2020 that requires further investigation. Consequently, Baffinland has committed to applying adaptive management and implementing additional mitigation measures to its 2021 shipping operations while the potential cause of the decline is being investigated. The following sections discuss the potential contribution of the Project relative to the observed findings in balance with other potential contributing factors.

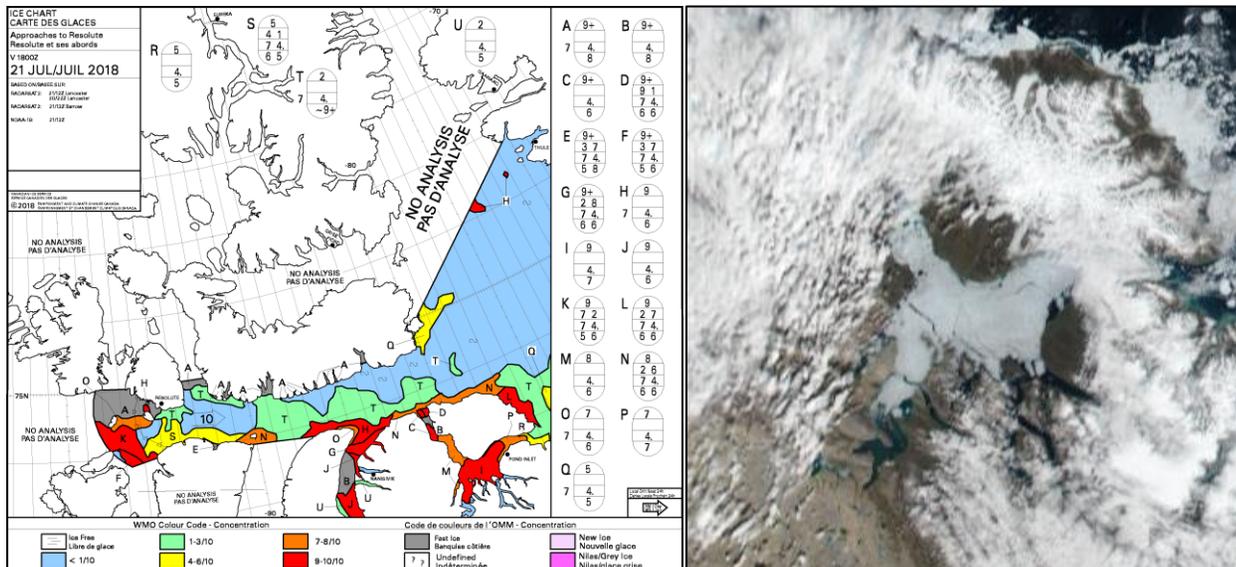
## 4.0 POTENTIAL CONTRIBUTING FACTORS TO 2020 FINDINGS

The activities summarized below are considered potential contributors to the lower observed number of narwhal in Eclipse Sound in 2020. At present, it is understood that these may have acted independently, or in a cumulative or additive manner. The information presented herein is considered preliminary and further desktop analysis and information collection is required to appropriately determine potential causes of the 2020 narwhal abundance observation. Baffinland proposes to undertake the development of this material, as per the AMP (see Section 5.0), in collaboration with applicable parties through the MEWG and dedicated discussions with DFO and other responsible parties related to the authorization of works associated with the Pond Inlet SCH construction project.

## 4.1 Icebreaking Activities

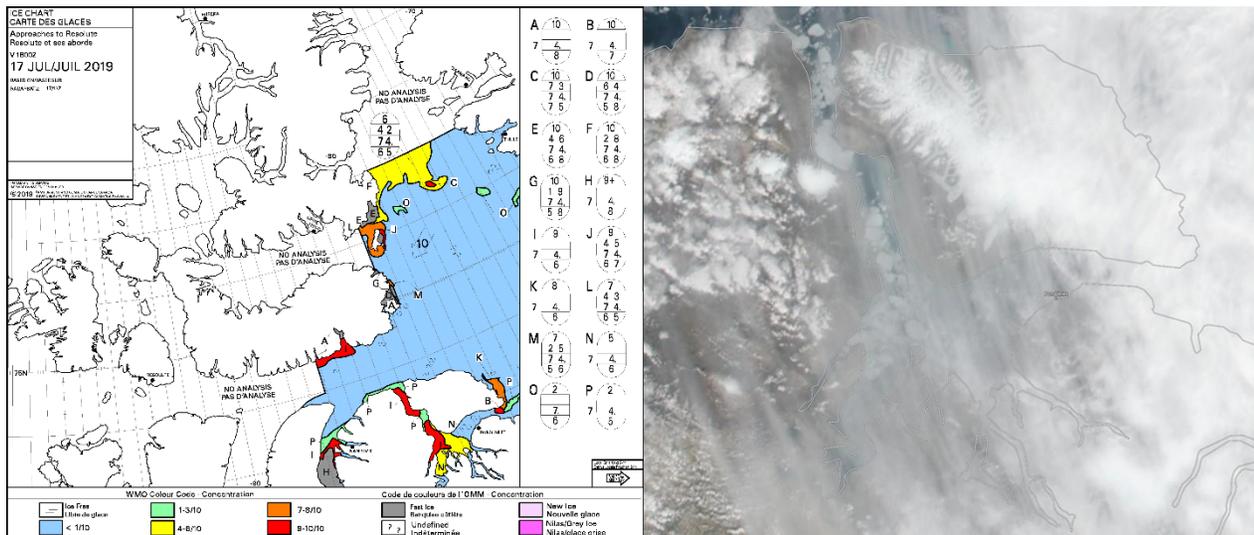
**High-level Summary:** Project icebreaking is considered a possible contributing factor to the observed decrease in Eclipse Sound narwhal summer stock in 2020. In 2020, narwhal numbers in the RSA were significantly lower than that observed in 2019 and compared to previous survey estimates. Ice conditions in 2020 were more concentrated in the RSA compared to 2019, but less concentrated compared to 2018. Similarly, more icebreaking took place in the RSA in 2020 (22 h) than 2019 (11 h), but substantially less than 2018 (56 h). In 2020, narwhal were largely concentrated in several prominent ice leads present within a large, consolidated ice field in western Eclipse Sound during the first day of icebreaking, and therefore occurred in a more clumped distribution when they were first exposed to icebreaking compared to 2019 when animals were more widely distributed in the RSA during their initial icebreaking exposure. During its first transit in the RSA in 2020, the MSV Botnica (escorting two carriers and two tugs) transited in close proximity to the leads where narwhal were confirmed to be holding.

Baffinland has undertaken icebreaking operations during the shipping shoulder seasons since 2018. In 2018, the MSV Botnica (icebreaker) first entered the RSA on 21 July (the last day land-fast ice remained in the RSA was 19 July). Regional ice conditions on 21 July included 9-10/10 ice concentrations throughout Milne Inlet North and Eclipse Sound, with 7-8/10 concentrations in Navy Board Inlet and east of Pond Inlet (Figure 3). A consolidated ice field of 9-10/10 ice concentrations persisted in Eclipse Sound / Milne Inlet North until 28 July, resulting in a total of eight days in which Project icebreaking took place in heavy ice conditions ( $\geq 9/10$ ) along a portion of the Northern Shipping Route, with no restrictions in place in 2018 on the number of icebreaker transits allowed per day. Overall, sea ice was highly concentrated in the RSA when icebreaking began in 2018 compared to the 2019 and 2020 seasons (see Attachment 1 for yearly comparison of daily ice charts from 12 to 22 July).



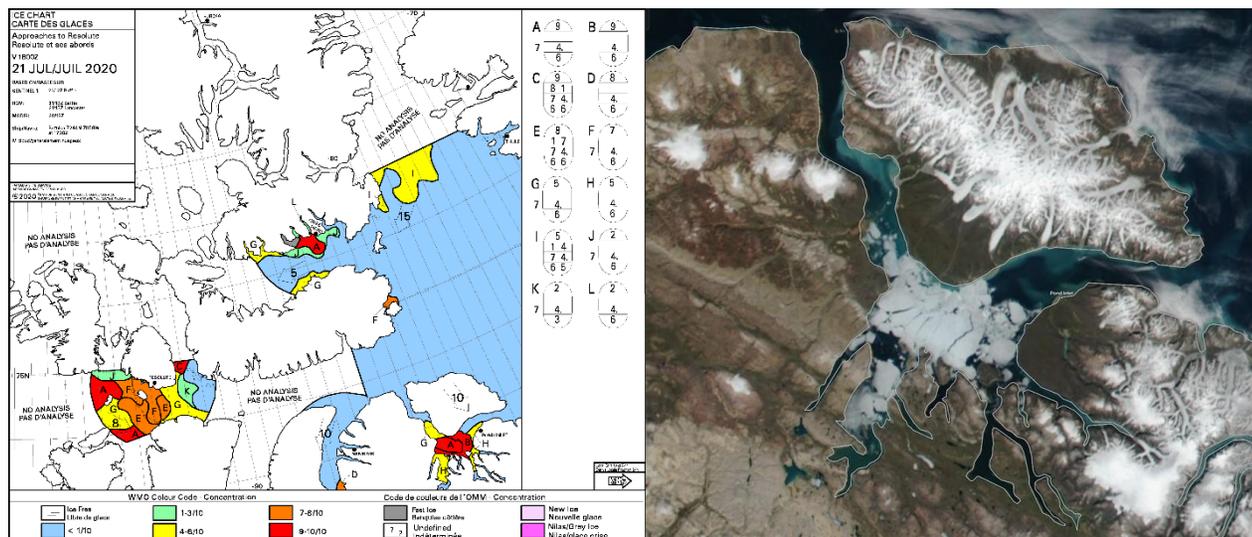
**Figure 3: Ice chart for 21 July 2018 (left; Canadian Ice Service) and satellite image for 20 July 2018 (right; Zoom Earth) showing ice concentrations in Eclipse Sound on the first day of icebreaking in RSA.**

In 2019, the first MSV *Botnica* transit in the RSA was on 17 July (the last day land-fast ice remained in the RSA was 11 July). Regional ice conditions on 17 July included 4-6/10 ice concentrations throughout Milne Inlet North and the majority of Eclipse Sound, with open water in Milne Inlet South and Pond Inlet (Figure 4). A consolidated ice field of 9-10/10 ice concentrations persisted in Western Eclipse Sound, south Navy Board Inlet and north Tremblay Sound until 20 July, resulting in a total of 3 days in which part of the Northern Shipping Route was transited through heavy ice conditions ( $\geq 9/10$ ) (limited to one transit per day in these areas). Overall, sea ice in the RSA was in an advanced stage of break-up when icebreaking began in 2019 compared to the 2018 and 2020 seasons (Attachment 1).



**Figure 4: Ice chart for 17 July 2019 (left; Canadian Ice Service) and satellite image for 16 July 2019 (right; Zoom Earth) showing ice concentrations in Eclipse Sound on the first day of icebreaking in RSA.**

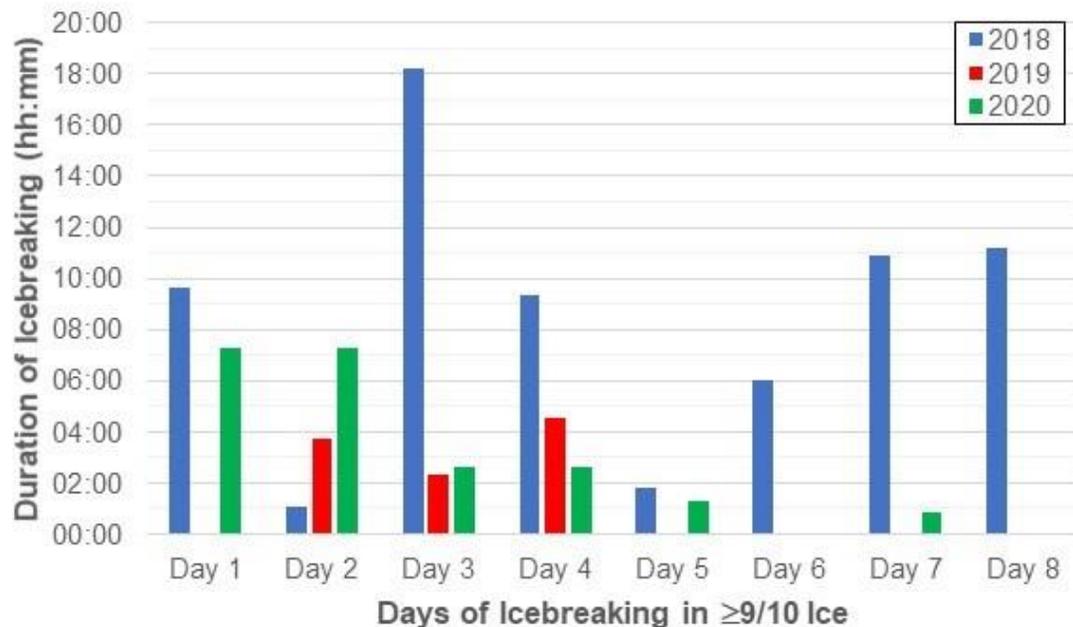
In 2020, the first icebreaker transit in the RSA was on 21 July (the last day land-fast ice remained in the RSA was 17 July). Regional ice conditions on 21 July included 9-10/10 ice concentrations throughout Eclipse Sound, with 4-6/10 ice concentrations in Milne Inlet North, Tremblay Sound, and southern portion of Navy Board Inlet (Figure 5). A consolidated ice field of 9-10/10 concentrations persisted in Eclipse Sound until 26 July, resulting in a total of six days in which part of the Northern Shipping Route was transited through heavy ice conditions ( $\geq 9/10$ ) (limited to one transit per day in these areas). Overall, sea ice was more concentrated in the RSA in 2020 compared to 2019 when icebreaking began, and less concentrated compared to 2018 ice conditions during initial icebreaker operations (Attachment 1). Slightly more icebreaking occurred in 2020 than 2019, primarily because the icebreaker was required to transit through more extensive heavy ice conditions in order to pass directly over the two JASCO hydrophone stations at Bylot Island and Ragged Island for the purpose of acquiring acoustic recordings of active icebreaking in 9-10/10 ice. Normally, the MSV *Botnica* would adhere to its standard practice of actively avoiding heavy ice conditions during transits along the shipping corridor unless these areas could not be safely avoided. This is therefore considered a one-off event for the purpose of filling an imperative data gap related to icebreaker and icebreaking escort operational noise in the RSA.



**Figure 5: Canadian Ice Service chart for 21 July 2020 (left) and satellite image for 21 July 2020 (right) showing ice concentrations in Eclipse Sound on first day of icebreaking in RSA.**

Narwhal distribution differed between 2019 and 2020 due to the different ice conditions in the study area. When aerial surveys began in July of 2019 and 2020, the floe edge had already largely broken up with most of the ice situated in Eclipse Sound, Milne Inlet North, and the lower part of Navy Board Inlet. The difference in narwhal distribution occurred in the ice-covered portions of the RSA. In 2019, the remaining sea ice present in the RSA when icebreaking started was fragmented into a loose pack ice formation allowing narwhal to disperse throughout the area somewhat evenly. In 2020, sea ice present in the RSA at the start of icebreaking was largely intact (i.e., large, consolidated ice field) with a few ice leads running through it. As a result, narwhal were highly concentrated in the ice leads in Eclipse Sound, forming a more clumped distribution compared to 2019. Narwhal distribution in the Baffin Bay and Pond Inlet strata was similar between 2019 and 2020 with narwhal dispersed throughout the open water areas.

Icebreaking was quantified to allow for a comparison between years. As noted above, icebreaking in heavy ice conditions ( $\geq 9/10$  ice cover) occurred over eight days in 2018, three days in 2019, and six days in 2020 (Figure 6). The longest duration of heavy icebreaking in a single day was 18 h and 14 min in 2018, 4 h and 32 min in 2019, and 7 h and 16 min in 2020 (Figure 6). The total duration of icebreaking for the combined days in heavy ice conditions was double in 2020 compared to 2019 (~22 and 11 hours, respectively; Figure 6), and five times greater in 2018 compared to 2019 (~56 and 11 hours, respectively; Figure 6). The total distance travelled by the MSV *Botnica* in heavy ice conditions was 764.8 km in 2018, 131.4 km in 2019, and 226.5 km in 2020. A reduction in the level of icebreaking in 2019 and 2020 was, in part, due to changes in ice conditions in those years, but also a result of the introduction of icebreaker transit restriction mitigations following the 2018 shipping season. Some of the icebreaking that occurred in 2020 was also to satisfy the monitoring requirements to record icebreaker sound levels over the JASCO acoustic recorders.



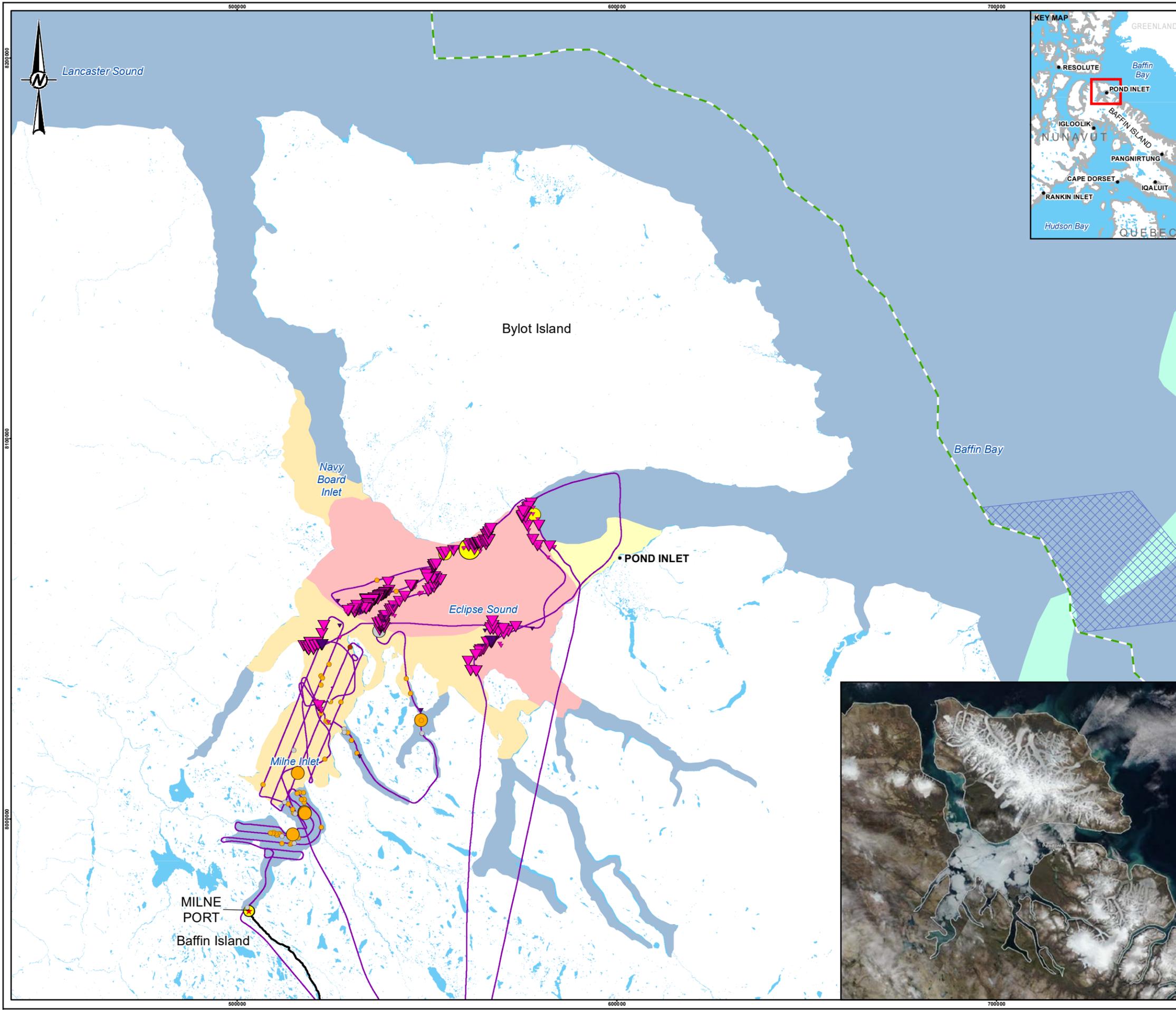
**Figure 6: Daily duration of icebreaking in  $\geq 9/10$  ice concentrations presented by year (2018-2020).**

Note: Day 1 represents the first day of icebreaking in the RSA each year.

Narwhal response to icebreaking during the late spring was studied in Lancaster Sound during the 1980s (Finley et al. 1990). This involved an icebreaker approaching and breaking landfast ice enroute to the Nanisivik mine in Admiralty Inlet. Narwhal response to this activity included their initial displacement from the floe edge in response to the approaching ship (at estimated received levels of 94–105 dB re 1 $\mu$ Pa in the 20–1,000 Hz band), with some narwhal returning to the floe edge 1–2 days later and engaging in normal diving and foraging behaviour in the presence of the icebreaker and while being exposed to louder noise levels than the initial exposure (as high as 120 dB in the same band (Finley et al. 1990). Possible explanations to the overt response included 1) animals might have felt trapped along the ice edge as the ships approached, 2) a lack of familiarity or experience with icebreaker noise in the High Arctic during late spring, and/or 3) long-range sound propagation conditions in surface waters at that time of year. The fact that narwhal later returned to the area of disturbance when noise levels were higher than those to which they initially reacted suggests this initial reaction may have been a startle response and that some level of habituation or tolerance may have occurred (LGL and Greeneridge 1986). This type of response was not observed during icebreaking for the 2019 MMASP. In 2019 narwhal abundance increased after icebreaking activities were underway with an initial abundance of 5,793 narwhal (CV=0.23) on 15–16 2019 July prior to Baffinland vessel in the RSA to 15,591 narwhal (CV=0.19) on 21–22 July 2019 after Baffinland vessels entered the RSA (Golder 2020).

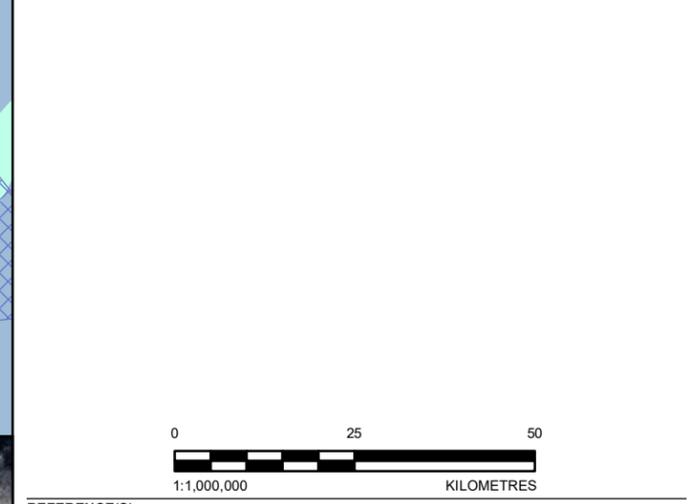
In 2020, the MSV *Botnica* (escorting two carriers and two tugs) transited through a large, consolidated ice field in North Milne/West Eclipse on 21 July which included several narrow ice leads occupied by large numbers of narwhal (including mother/calf pairs). Narwhal were confirmed to be ‘holding’ in these leads prior to the first icebreaker transit in the RSA (Figure 7). Based on the AIS vessel tracking data, the icebreaker appeared to have transited in close proximity to one of the leads upon its initial entry through the ice field (Figure 8). The following

day, narwhal relative abundance increased from 2.21 animals/km (from 21 July 2020) to 4.25 animals/km in leads in Eclipse Sound (on non-systematic transects) and decreased from 0.16 animals/km (on 21 July 2020) to 0.02 animals/km in Milne Inlet (systematic transects) after the icebreaker transited the RSA. This is further supported by the noticeable shift in narwhal distribution from 21 to 22 July 2020 where narwhal appeared to move from the 4-6/10 ice area in north Milne Inlet to the 9-10/10 ice in Eclipse Sound (Figures 8 and 9).



**LEGEND**

- COMMUNITY
- ★ MILNE PORT
- MARINE MAMMAL SPECIES OBSERVATIONS (GROUP SIZE)
- BEARDED SEAL
  - 1
- BOWHEAD WHALE
  - ▼ 1
  - ▼ 2-10
  - ▼ 10+
- HARP SEAL
  - 2-10
  - 10+
- NARWHAL
  - ▼ 1
  - ▼ 2-10
  - ▼ 10+
- RINGED SEAL
  - 1
  - 2-10
- UNIDENTIFIED CETACEAN
  - ▼ 1
- UNIDENTIFIED SEAL
  - 1
  - 2-10
- AERIAL SURVEY TRACK
- MILNE INLET TOTE ROAD
- ▨ 40 km BUFFER ZONE
- - - NUNAVUT SETTLEMENT AREA BOUNDARY
- WATERBODY
- ICE CONCENTRATION
  - < 1/10
  - 1-3/10
  - 4-6/10
  - 7-8/10
  - 9-10/10



**REFERENCE(S)**  
 MILNE PORT INFRASTRUCTURE DATA BY HATCH, JANUARY 25, 2017, RETRIEVED FROM KNIGHT PIESOLD LTD. FULCRUM DATA MANAGEMENT SITE MAY 19, 2017. ICE CONCENTRATION OBTAINED FROM CANADIAN ICE SERVICE, GOVERNMENT OF CANADA. DAILY ICE CHARTS – APPROACHES TO RESOLUTE BAY, ACCESSED NOVEMBER 3, 2020. HYDROGRAPHY, POPULATED PLACE, AND PROVINCIAL BOUNDARY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.  
 PROJECTION: UTM ZONE 17 DATUM: NAD 83

CLIENT  
**BAFFINLAND IRON MINES CORPORATION**

PROJECT  
**MARY RIVER PROJECT  
 2020 MARINE MAMMAL AERIAL SURVEYS**

TITLE  
**ECLIPSE SOUND LEG 1 SURVEY 7 - JULY 20, 2020**

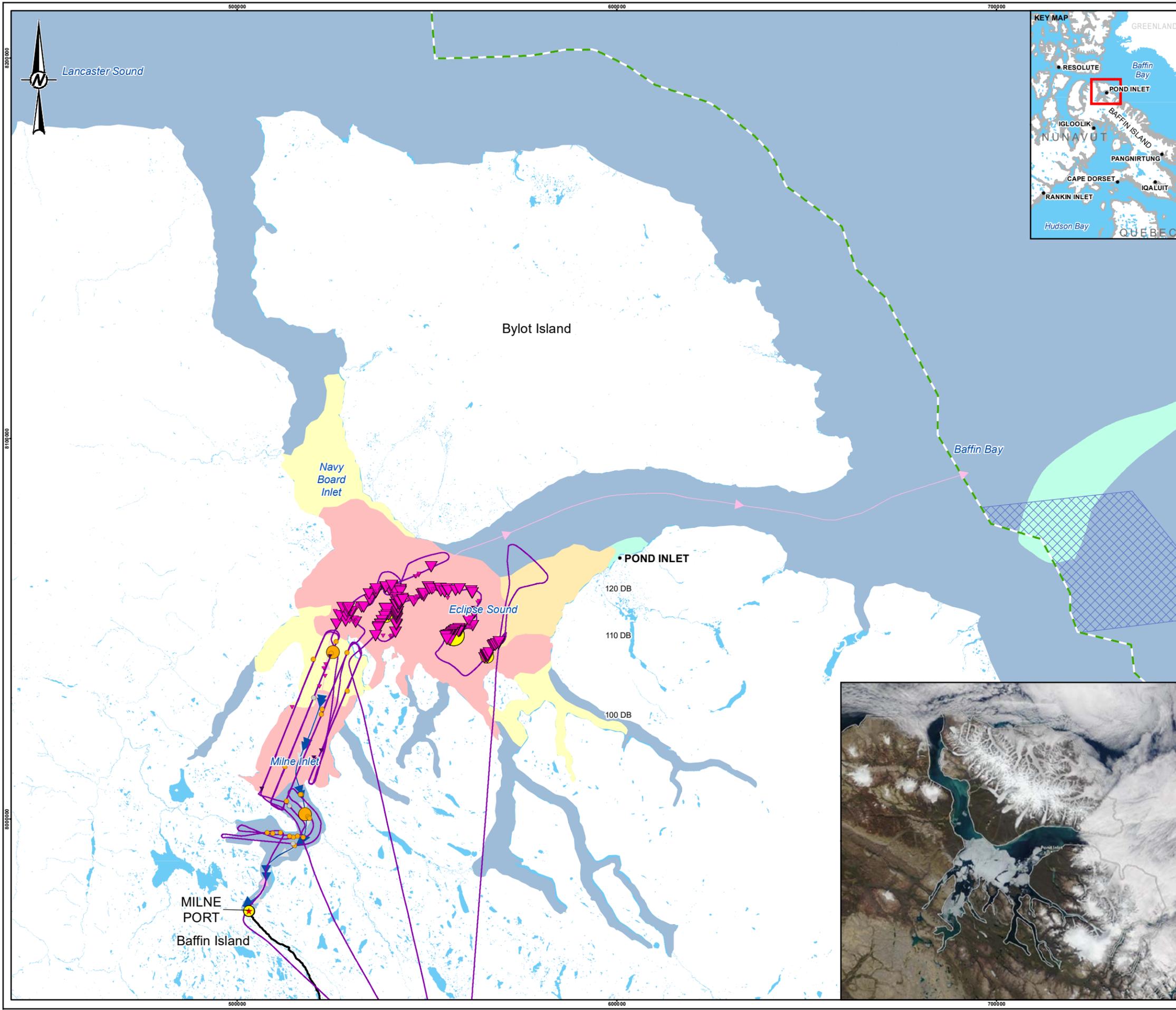
CONSULTANT	YYYY-MM-DD	2021-04-01
DESIGNED	TT	
PREPARED	AA	
REVIEWED	PR	
APPROVED	PR	

PROJECT NO. 1663724 CONTROL 48000 REV. 0 FIGURE 7



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**LEGEND**

- COMMUNITY
- ★ MILNE PORT
- MARINE MAMMAL SPECIES OBSERVATIONS (GROUP SIZE)**
- BOWHEAD WHALE**
  - ▽ 1
- HARP SEAL**
  - 2-10
  - 10+
- NARWHAL**
  - ▽ 1
  - ▽ 2-10
  - ▽ 10+
- RINGED SEAL**
  - 1
  - 2-10
- UNIDENTIFIED SEAL**
  - 1
- AERIAL SURVEY TRACK
- MILNE INLET TOTE ROAD
- PROJECT VESSEL SHIP TRACKS**
  - ▶ BULK (ORE) CARRIER
  - ▶ ICEBREAKER (BOTNICA)
  - ▶ SERVICE VESSEL
  - ⊠ 40 km BUFFER ZONE
  - NUNAVUT SETTLEMENT AREA BOUNDARY
  - WATERBODY
  - ICE CONCENTRATION**
    - < 1/10
    - 1-3/10
    - 4-6/10
    - 7-8/10
    - 9-10/10

**REFERENCE(S)**

MILNE PORT INFRASTRUCTURE DATA BY HATCH, JANUARY 25, 2017, RETRIEVED FROM KNIGHT PIESOLD LTD. FULCRUM DATA MANAGEMENT SITE MAY 19, 2017. ICE CONCENTRATION OBTAINED FROM CANADIAN ICE SERVICE, GOVERNMENT OF CANADA. DAILY ICE CHARTS – APPROACHES TO RESOLUTE BAY. ACCESSED NOVEMBER 3, 2020. HYDROGRAPHY, POPULATED PLACE, AND PROVINCIAL BOUNDARY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED. SOUND CONTOURS OBTAINED FROM JASCO APPLIED SCIENCES (30 MARCH 2021) BASED ON SOUND LEVELS REPORTED IN ADVISIAN (2021) FOR PILE DRIVING ON 22 JULY 2020. PROJECTION: UTM ZONE 17 DATUM: NAD 83

CLIENT  
**BAFFINLAND IRON MINES CORPORATION**

PROJECT  
**MARY RIVER PROJECT**  
**2020 MARINE MAMMAL AERIAL SURVEYS**

TITLE  
**ECLIPSE SOUND LEG 1 SURVEY 9 - JULY 22, 2020**

CONSULTANT  
**GOLDER**

YYYY-MM-DD	2021-04-01
DESIGNED	TT
PREPARED	AA
REVIEWED	PR
APPROVED	PR

PROJECT NO. 1663724 CONTROL 48000 REV. 0 FIGURE 9



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Additional information regarding narwhal behavioural responses to icebreaking has been yielded from Baffinland's 2018 tagging study (Golder 2020b). In August 2018, two narwhal (NW21 and NW22) were live captured in the RSA, instrumented with satellite telemetry tags and high-resolution dive tags, and released back to the ocean for the purpose of monitoring their daily movements in relation to fluctuating ice conditions in the RSA and in response to icebreaking operations and ship traffic along the Northern Shipping Route during the shipping season. Both NW21 and NW22 were shown to remain in the vicinity of the Northern Shipping Route for extended periods during the 2018 fall shoulder season, despite being exposed to thickening ice conditions and regular icebreaking activities during the late shoulder season. Although the location data associated with NW21 were not of sufficient resolution to assess fine scale movements of this animal in relation to icebreaker movements, it was evident from the daily narwhal tracks that exposure to icebreaker and ship traffic during this time did not result in any large-scale displacement of either narwhal from the RSA. In general, NW22 had multiple close encounters with the icebreaker and all vessel types throughout the fall shoulder season and did not appear to actively avoid icebreaking operations and associated vessel traffic as the season progressed. Of the total narwhal-vessel interaction events recorded for NW22 in 2019, 25 of these events occurred in relation to icebreaking transits undertaken by the MSV *Botnica* and one event occurred in relation to icebreaking transits by the CCGS *Terry Fox*. The distance between NW22 and an icebreaker during active transits (CPA < 54.4 km) ranged between 0.84 km and 52.97 km. Throughout the 19-day study period, NW22 remained within the modelled '120 dB disturbance' zone of the icebreaker (54.4 km) for 47.4% of the time.

NW22 interacted more closely with the MSV *Botnica* (with vessels in escort) toward the latter part of the late shoulder season (see Figure 13 in Golder 2019b). This finding may indicate possible habituation of the animal to icebreaking operations. It may also indicate that both the icebreaking vessel and animal were utilizing the path of least resistance (i.e., area with the least ice present) as the ice becomes increasingly dense later in the fall shoulder season. It is also possible that increasing ice concentration restricts movements by the animal, causing it to rely more heavily on the path created by icebreaking operations.

NW22 made regular crossings across the bow and the stern of all vessel types during the 2018 fall shoulder season (see Figure 14 in Golder 2019b). However, NW22 did not cross behind the stern of the *Botnica* (with vessels in escort) for a period of 4.5 hours following an active transit. As sound generated from vessels is known to radiate asymmetrically, with sound levels from the stern aspect typically being highest (Arveson and Vendittis 2000; McKenna et al. 2012), this finding may signify the animal's attempt to avoid the noisiest aspect of the vessel. However, the gap may also be due to data scarcity during the 2018 fall shoulder season (limited to one tagged animal). In addition, given the characteristics of sound that are generated from icebreaking operations and the way in which sound propagates under ice, the interpretation of the 4.5 h gap of crossing behind the stern of the vessel is not straightforward. It is also important to note that this result is based on a very limited dataset (a single animal over the course of 19 days), and further data collection and analysis is required to further evaluate this potential avoidance response.

Although this study does offer some preliminary evidence of narwhal behavioural responses to icebreaking; it is important to note that the results are based exclusively on narwhal behaviour to icebreaking during the late shoulder season, when ice conditions are considerably lighter than ice conditions present during the early shoulder season (i.e., when icebreaking would involve thick, first year ice). Results should thus be interpreted with caution.

Available IQ regarding the effects of icebreaking on narwhal is primarily based on historical observations of narwhal near the now decommissioned Nanisivik Mine in Arctic Bay which involved icebreaking operations between May and November.

*“The ship track was used by narwhal to migrate in because the ship was opening up the ice. But when the ice breaker came in the narwhals would scatter. After the ice breaker came in and things calmed down, the narwhal came back in. It had a very temporary impact.”* [p.216 of JPCS 2019]

*“We didn’t see any decrease year to year. We didn’t notice any changes in the population or abundance of narwhal. There were no drastic changes to the numbers.”* [p.216 of JPCS 2019]

*“Ice breaking was always a concern. Early on we thought it was scaring away the narwhal. It turned out the ship was creating access for narwhal, and we used more than our quota. Real problems? No.”* [p. 215 of JPCS 2017]

*“In the past, with Nanisivik, animals would flee to shore when the ship came. Eventually they got used to the ship and wouldn’t flee.”* [p. 223 of JPCS 2019]

## 4.2 Construction Noise from Small Craft Harbour in Pond Inlet

**High-level Summary:** Preliminary analysis of underwater noise recordings collected by JASCO Applied Sciences (JASCO), on behalf of Baffinland, in Eclipse Sound during the 2020 early shoulder and open-water seasons has identified anomalous sounds, similar in nature to sounds generated by pile driving (and different than sounds generated by vessels). These impulsive sounds are not thought to be natural in origin and according to available construction monitoring reports (Advisian 2021), they correspond in time with impact pile driving that occurred in Pond Inlet as part of the 2020 Small Craft Harbour (SCH) construction project. A preliminary review of available construction monitoring reports by Golder indicates that the pile driving emitted high-energy impulsive noise to the marine environment during a 52-day period (8 July to 28 August) that corresponded with the typical timing of narwhal spring migratory movements into Eclipse Sound. The construction monitoring report from 2020 (Advisian 2021) indicates that impact driving methods were employed for pile installation instead of vibratory methods originally proposed by the proponent, that underwater noise/overpressure thresholds were exceeded during active impact pile driving, and that mitigation measures were not implemented to minimize adverse effects of impact pile driving noise on marine mammals in the RSA.

Construction of the SCH project in Pond Inlet has occurred during each open-water season since 2018, with construction anticipated to be completed in 2021 (Advisian 2021). The SCH project is permitted under DFO Fisheries Authorization (FAA) No. 17-HCAA-00551 (DFO 2020a) and No. 19-HCAA-01020 (DFO 2020b), issued to the Government of Nunavut – Community and Government Services (GN-CGS) as lead proponent of the SCH Project. The lead contractor for the project is Tower Arctic Ltd. (Tower Arctic). Construction activities for the project in 2020 took place during the open-water and shoulder season periods (10 June through 25 October). Advisian’s 2020 construction monitoring report is included herein as Attachment 2 (Advisian 2021). In-water construction works undertaken in 2020 included impact pile driving, vibratory pile driving, dredging and placement of rock/fill in the marine environment. Pile driving occurred from 8 July through 7 October 2020 (Advisian 2021), over a 12-hour daily period. The location of the pile driving undertaken at the SCH site in 2020 is depicted in Figure 10.



**Figure 10: Aerial imagery of Pond Inlet shoreline showing location of pile driving in 2020 (extracted from Advisian 2021).**

Marine construction activities generate both impulsive and non-impulsive (continuous) noise underwater that have the potential to result in adverse effects on marine mammals, ranging from hearing impairment to acoustic disturbance effects including avoidance behaviour, displacement and/or acoustic masking. Impact pile driving in particular can introduce high-energy impulsive noise to the underwater acoustic environment, in which low-frequency components of the emitted noise can be transmitted over long distances with potential to disrupt the behavior of marine mammals at ranges of many kilometers (Tougaard et al. 2009; Brandt et al. 2011) and have the potential to induce hearing impairment at close range (Madsen et al. 2006). As part of the FAA for the SCH construction in Pond Inlet, a Construction Environment Management Plan (CEMP) was developed by Tower Arctic which included a number of mitigation commitments to manage adverse impacts from the planned pile driving activities on marine mammals and fish (Tower Arctic 2020). This included the following:

- Both pile types proposed for installation in 2020 (39 x 760 mm circular piles and 600 sheet piles) will be driven with a vibratory pile driver (ex. 44B model) and exceptionally a conventional hammer or a diesel hammer will be used. Systematically, if a hammer is used to pile a 760 mm circular pile, a bubble curtain will be put in place around the pile to reduce the overpressure and the activity will occur during daylight conditions only (to allow for visual monitoring of marine mammals).
- A soft start for pile driving will be implemented slowly over a 10 min period to ensure mammals and fish have sufficient time to leave the area. Soft start procedures will be implemented at the start of every piling event and every time piling has been interrupted for at least 30 min.
- A 500-m marine mammal exclusion zone (EZ) will be set up around the pile driving activity. Marine Mammal Observers (MMOs) will be employed to monitor the presence of marine mammals in the defined EZ for pile driving where there is potential for pile driving noise to exceed the underwater noise auditory threshold for marine mammals of 160 dB re 1 $\mu$ Pa. The exclusion zone will be initially set at 500 m, with in-situ underwater

noise monitoring to be conducted at the onset of the construction activity to verify the exclusion zone based on the underwater noise auditory threshold. The construction activity will be suspended if a marine mammal enters the exclusion zone and will not restart until 30 minutes after it is last observed or it is seen leaving the exclusion zone.

- Ensuring underwater pressure and noise levels will not exceed 30 kPa at 10 m and 160 dB re 1  $\mu$ Pa for vibratory pile driving, which also defines the outer limit of the exclusion zone. The monitoring of the underwater noise will begin right after the soft start period. The purpose is to confirm the size of the exclusion zone initially set at 500-m in compliance with the CEMP. Measurements will be carried out starting at a 500 m mark offshore from the work site. Depending on the SPL<sub>RMS</sub> dB (re 1 $\mu$ Pa) results, subsequent measurements will be made either further offshore or inshore in order to define the location of the 160 dB (re 1 $\mu$ Pa) threshold.
- Acoustic compliance monitoring will be implemented during the following pile driving activities:
  - Impact driving of 760 mm circular piles
  - Vibratory driving of 760 mm circular piles
  - Impact driving of sheet piles
  - Vibratory driving of sheet piles
- Acoustic measurements will be taken at the beginning of each new activity listed above. Additional measurements will be taken if the work method changes or if conditions such as weather and tide stage change significantly with respect to the initial measurements. A follow up measurement will be taken once a week at the perimeter of the exclusion zone.
- If construction is to occur during the iced-season, in-air sound levels shall not exceed the in-air acoustic threshold of 100 dB re 20 $\mu$ Pa when pinnipeds are observed on the ice during construction activities.

Typically, in order to avoid and/or minimize adverse effects of high-energy pile driving noise on marine mammals, marine piling projects optimize the use of a vibratory hammer for pile installation<sup>1</sup>, as this generates lower energy, non-impulsive noise unlike impact pile driving. Although a vibratory hammer was to be used as the primary method for pile installation during the SCH project (Tower Arctic 2020), based on follow-up reporting by Advisian (2021), a vibratory hammer was not mobilized to site until 28 August 2020, seven weeks after the start of the piling program. Piles were therefore installed using an impact hammer for the initial 52-days of the 2020 SCH construction project (8 July to 28 August).

Several non-compliance events occurred during the 2020 SCH pile driving program and were reported to DFO (Advisian 2021). This included exceedances of underwater noise/overpressure thresholds during active pile driving, absence of real-time acoustic monitoring during pile driving<sup>2</sup>, failure to deploy bubble curtains during

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<sup>1</sup> Noting however that piles installed with a vibratory hammer are typically still driven in the final stage with an impact hammer to seat the pile into the overburden and to determine the pile's load-bearing capacity.

<sup>2</sup> Acoustic monitoring of pile driving in 2020 was limited to a total of four days out of 23 days of pile driving based on information presented in Advisian (2021)

impact pile driving, failed application of soft-start procedure during pile driving, failure to implement adaptive management for pile driving, and failure to meet general monitoring requirements as prescribed in the CEMP (Tower Arctic 2020) and the FAA (DFO 2020).

One example of a non-compliance event during active pile driving was described as follows. On July 22, measured overpressure readings during active impact pile driving were shown to exceed the 30 kPa threshold a total of five times (Advisian 2021). This was noted as a potential underestimate, as hydrophone monitoring was not undertaken during all pile driving events that day because the EM was also having to undertake active marine mammal monitoring duties (acoustic monitoring was discharged to an on-site engineer that did not have the appropriate noise monitoring experience). This was identified as a non-compliance event for not performing real-time monitoring of the applicable thresholds during active pile driving, and a non-compliance event for not meeting the Environmental Procedure construction specification (Advisian 2018), which states that an EM must have no other roles on the Project and must be appropriately qualified to undertake the prescribed monitoring. On July 23, Tower Arctic attempted to set up a bubble curtain around the wetted pile to mitigate for the observed overpressure exceedances the previous day. However, the bubble curtain was determined to be not functional and therefore could not be used as a mitigation tool on that day (or on any subsequent day in 2021). In the absence of a bubble curtain, Tower Arctic subsequently made the decision to reduce the drop height of the impact hammer by 50% at the start of pile driving. In theory, reduction of the hammer height would generate lower overpressure. However, on-site Advisian Engineers reported that the contractor returned to a full height drop following initial application of this soft-start procedure (after confirming overpressure levels were no longer being exceeded during the half-height drop) (Advisian 2021). Soft-start procedures are intended to displace animals from the sound source area to avoid potential for acoustic injury. Advisian submitted a letter to DFO on 05 August 2020 summarizing details of this non-compliance event under the 'Duty to Notify' permit requirement (Advisian 2021).

JASCO's 2020 passive acoustic monitoring program detected sequences of impulsive sound in acoustic data collected during July and August 2020 near Bylot Island (M. Austin, pers. comm., March 22, 2021). While the origin of this impulsive noise has not yet been confirmed, these sounds are not thought to be natural in origin and they correspond in time with impact pile driving that occurred at the SCH site in Pond Inlet. The nature of the sound is consistent with the type of impulsive noise that is generated by impact pile driving or by seismic acquisition surveys (i.e., air gun surveys). The recorded impulses occurred at a regular rate of repetition and were within the frequency range of impact pile driving noise; however they did not contain the high frequency energy (> 600 Hz) that pile driving impulses typically exhibit when recorded at close range. This finding may indicate that the impulses originated at a long distance from the recorder, given that higher sound frequencies are quickly attenuated over long distances. The Bylot Island acoustic recorder is approximately 42 km from Pond Inlet. If the impulses did originate at Pond Inlet, this would indicate that pile driving noise from the construction of the SCH traveled over distances of tens of kilometers, and that the resulting noise field generated by this activity likely extended across Eclipse Sound during the narwhal migratory period in Eclipse Sound and in areas overlapping with established calving/nursing grounds for the Eclipse Sound narwhal stock.

The 2020 Construction Season Annual Report (Advisian 2021) presents only one day of acoustic monitoring results for an impact pile driving event on 13 July 2020 (Figure 11). This event was also detected at JASCO's acoustic recorder at Bylot Island on 13 July 2020 (Figure 12). Overpressure monitoring undertaken by the contractor indicated that impact pile driving resulted in a peak pressure that extended up to 37 kPa (measured at

10 m from the pile), equivalent to a peak Sound Pressure Level ( $SPL_{peak}$ ) of 211 dB re 1  $\mu Pa^3$ , noting that the report does not specify actual  $SPL_{peak}$  or root-mean-square SPL ( $SPL_{rms}$ ) values at 10m from the pile (Advisian 2021). Assuming a 10 dB offset between  $SPL_{peak}$  and  $SPL_{rms}$ , which is a reasonable assumption for impact pile driving impulses, sound level “contours” were approximated using a simple spreading loss assumption with range-dependent propagation loss coefficients that yielded an  $SPL_{rms}$  at 42 km that matched JASCO’s measured value of 100 dB re 1  $\mu Pa$  ( $SPL_{rms}$ ) for the pile driving noise recorded at Bylot Island. The estimation also accounted for sound absorption using an in-water attenuation coefficient calculated at 1 kHz. The resulting sound level contours (which are circular due to this simplified and rough approximation) are presented in Figure 13 in relation to ice conditions and narwhal sightings recorded on 13 July 2020.

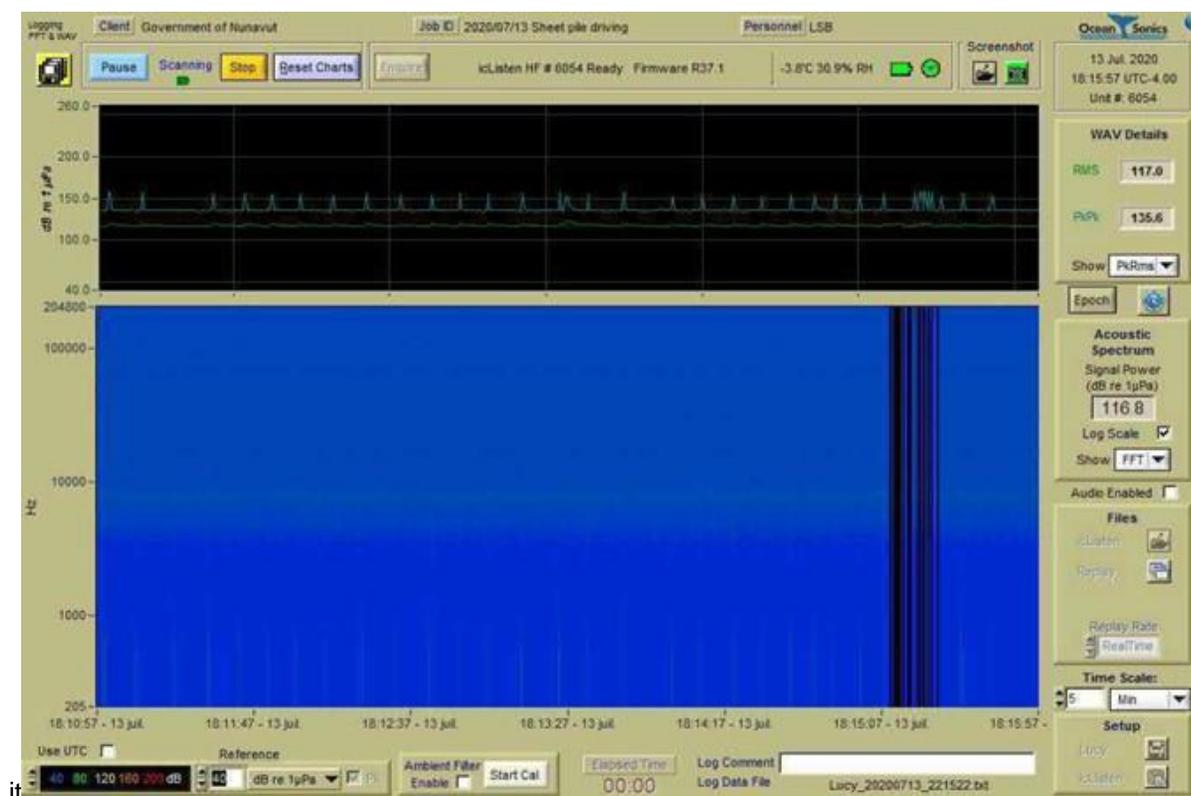
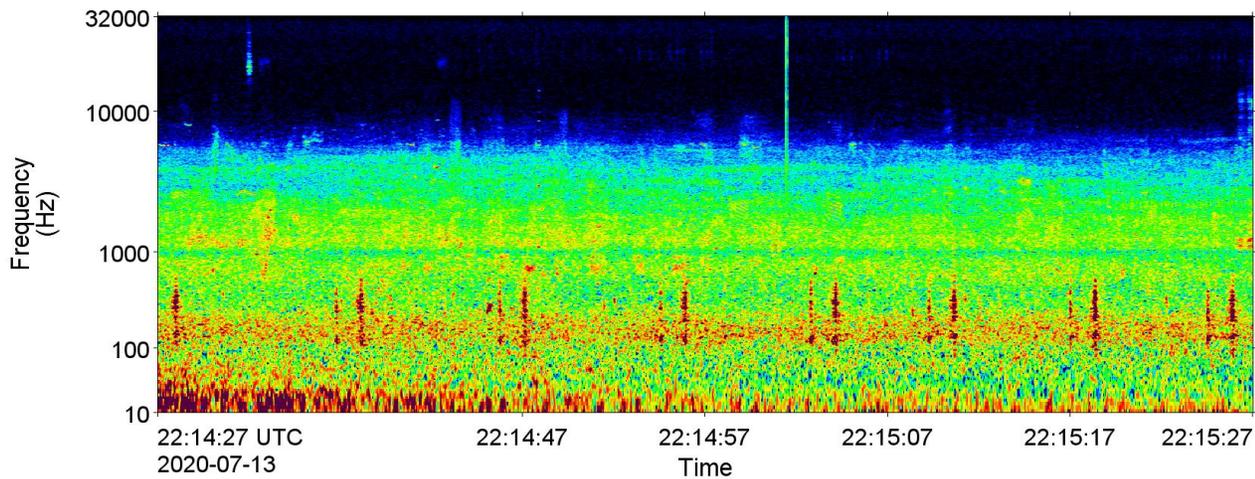
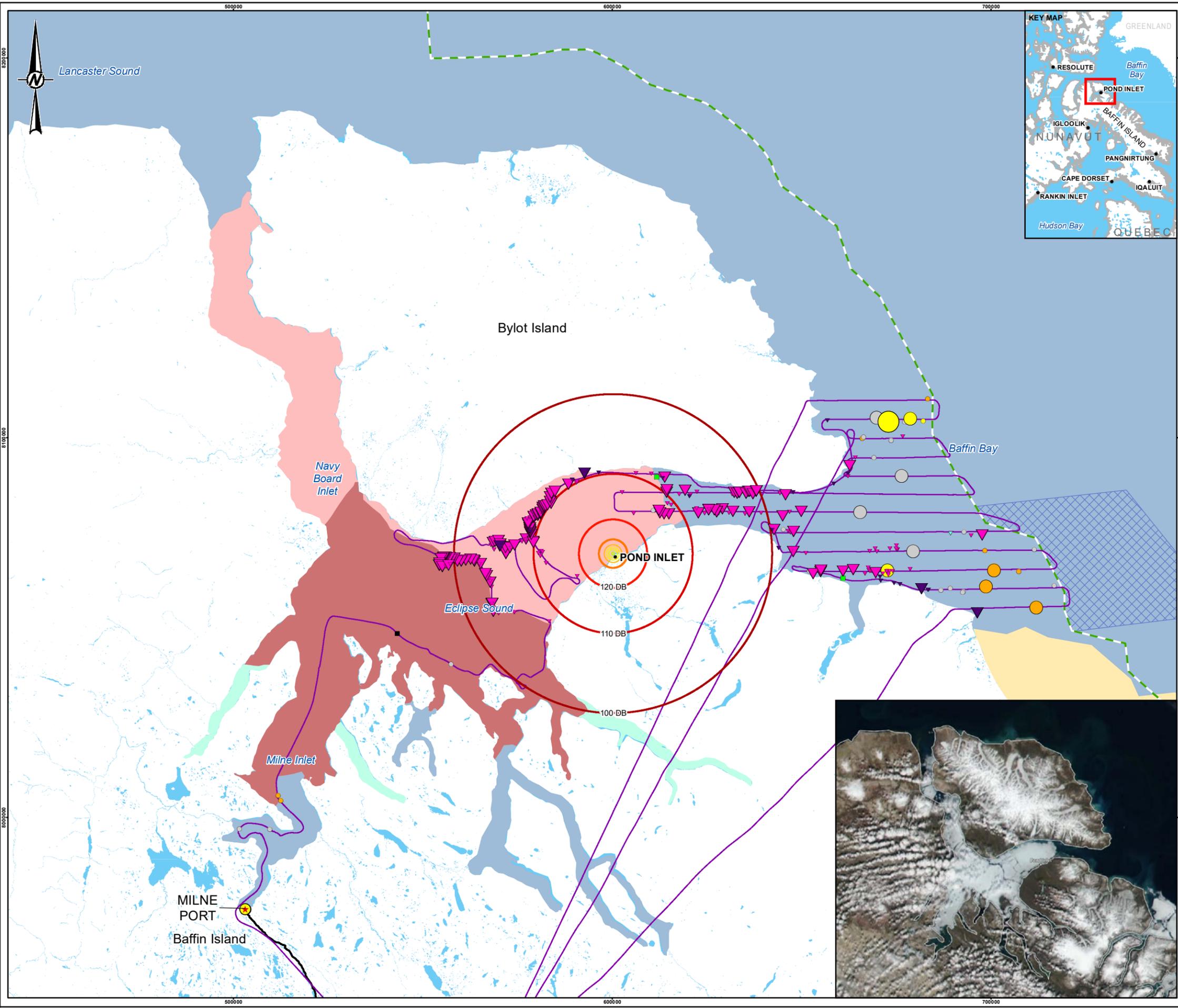


Figure 11: Spectrogram of impact pile driving of sheet piles on 13 July 2020 recorded at 400 m from source (extracted from Advisian 2021).

<sup>3</sup> We note that 37 kPa exceeds the permitted threshold of 30 kPa at 10m, and that no mitigation was put into place to mitigate these impact pile driving sounds and exceedances.



**Figure 12: Spectrogram of impact pile driving of sheet piles on 13 July 2020 recorded at JASCO acoustic recorder station located off southwest corner of Bylot Island (42 km from source).**



**LEGEND**

- COMMUNITY
- ★ MILNE PORT
- MARINE MAMMAL SPECIES OBSERVATIONS (GROUP SIZE)
- BELUGA
  - ▽ 1
- BOWHEAD WHALE
  - ▽ 1
  - ▽ 2-10
  - ▽ 10+
- HARP SEAL
  - 1
  - 2-10
  - 10+
- NARWHAL
  - ▽ 1
  - ▽ 2-10
  - ▽ 10+
- POLAR BEAR
  - 1
- RINGED SEAL
  - 1
  - 2-10
- WALRUS
  - 1
- UNIDENTIFIED SEAL
  - 1
  - 2-10
- AERIAL SURVEY TRACK
- MILNE INLET TOTE ROAD
- ▨ 40 km BUFFER ZONE
- - - NUNAVUT SETTLEMENT AREA BOUNDARY
- WATERBODY
- ICE CONCENTRATION
  - < 1/10
  - 1-3/10
  - 4-6/10
  - 7-8/10
  - 9-10/10
  - LANDFAST ICE
- PILE DRIVING SOUND CONTOURS
  - 100 dB
  - 110 dB
  - 120 dB
  - 130 dB
  - 140 dB
  - 150 dB
  - 160 dB
  - 170 dB

0 25 50  
1:1,000,000 KILOMETRES

**REFERENCE(S)**  
 MILNE PORT INFRASTRUCTURE DATA BY HATCH, JANUARY 25, 2017, RETRIEVED FROM KNIGHT PIESOLD LTD. FULCRUM DATA MANAGEMENT SITE MAY 19, 2017. ICE CONCENTRATION OBTAINED FROM CANADIAN ICE SERVICE, GOVERNMENT OF CANADA. DAILY ICE CHARTS – APPROACHES TO RESOLUTE BAY. ACCESSED NOVEMBER 3, 2020. HYDROGRAPHY, POPULATED PLACE, AND PROVINCIAL BOUNDARY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED. SOUND CONTOURS OBTAINED FROM JASCO APPLIED SCIENCES (30 MARCH 2021) BASED ON SOUND LEVELS REPORTED IN ADVISIAN (2021) FOR PILE DRIVING ON 22 JULY 2020. PROJECTION: UTM ZONE 17 DATUM: NAD 83

CLIENT  
**BAFFINLAND IRON MINES CORPORATION**

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PROJECT  
**MARY RIVER PROJECT  
 2020 MARINE MAMMAL AERIAL SURVEYS**

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TITLE  
**ECLIPSE SOUND LEG 1 SURVEY 2 - JULY 13, 2020**

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CONSULTANT	YYYY-MM-DD	2021-04-01
DESIGNED	TT	
PREPARED	AA	
REVIEWED	PR	
APPROVED	PR	

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PROJECT NO.	CONTROL	REV.	FIGURE
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The closest distance between the SCH site in Pond Inlet and the opposing shoreline on Bylot Island is approximately 22 km. As per Figure 13, it appears that the noise field generated by impact pile driving in 2020 extended across Eclipse Sound at sound levels likely audible to narwhal. Monitoring results at JASCO's Bylot Island acoustic recorder suggest that the range of audibility of the pile driving noise might have extended beyond this distance. Based on the timing of impact pile driving in 2020 in relation to the narwhal migratory period, and the assumption that Eclipse Sound narwhal are likely naïve to this type of noise source due to the rare occurrence of impulsive noise in the RSA (from pile driving or otherwise), it is possible that a portion of the exposed stock may have been experienced disturbance to the point of large-scale displacement from the RSA.

No direct studies have been conducted on the effects of impulsive noise sources on narwhal, but there are several examples in the literature where this has been reported for other arctic marine mammal species. Significantly lower number of beluga were observed at distances up to 20 km from active seismic operations (Miller et al. 2005; Southall et al. 2007). This corresponded with an unexpectedly higher number of belugas observed at distances in the 30 to 40 km range from the source, suggesting behavioral avoidance of the seismic pulsive noise at distances up to 20 km and displacement of these animals to further distances (Miller et al. 2005). Several reports have reported strong behavioral responses by bowhead whales to airgun pulses (Richardson et al. 1995; Blackwell et al. 2010). High-energy impulsive noise generated by seismic surveys undertaken in Baffin Bay in 2008 and 2009 were linked to narwhal entrapment events in Greenland and Canada in these years (Heide-Jørgensen et al. 2013) with the authors postulating that long-range noise emissions from the impulsive noise may have interrupted the outmigration of narwhal in Eclipse Sound, prompting the animals to remain on their summering grounds later in the season than they would normally, and resulting in entrapment events due to the rapid onset of land-fast ice formation at that time of year.

Avoidance behaviour from impulsive noise exposure has also been reported in several temperate toothed whale species. For example, harbour porpoise are known to demonstrate strong avoidance responses to pile driving up to distances of 20 km from the source (Dähne et al. 2013). Bailey et al. (2010) reported behavioural disturbance in bottlenose dolphin up to 50 km from pile driving activities, as well as auditory injury at distances up to 100 m from the source.

Evidence from the literature demonstrates that ringed seal appear to be fairly tolerant of pile driving noise, with little to no reaction observed in this species following repeated exposure (Blackwell et al. 2004). Ringed seals in the Prudhoe Bay region often tolerated exposure to high received levels (180–190 dB re 1µPa rms) of low-frequency sound pulses from airgun arrays, with little evidence of changes in behavior and no more than localized avoidance (Harris et al. 2001; Moulton and Lawson 2002).

Available IQ indicates that narwhal movement and distribution in the RSA may have been affected by nearshore construction activities. One interview participant of the Tusaqtavut Study (QIA 2019) described construction works at the SCH in Pond Inlet as a potential reason why narwhal are observed less in the area.

*"In the summer we do work on our new offshore thing out there {Pond Inlet harbour expansion}, and since there was construction there, the narwhal could hear the rocks being dumped in the ocean from the dock, and for that reason, the narwhal didn't come by the community."* (P08-05-Feb19, interpreted from Inuktitut) (QIA 2019).

### 4.3 Increased Killer Whale Presence

**High-level Summary:** *Increased killer whale presence in the RSA is considered a possible contributing factor to the observed decrease in Eclipse Sound narwhal summer stock in 2020 given the potential of increased narwhal mortality, narwhal population decline, or a range contraction as suggested by Lefort et al. (2020).*

Understanding confounding effects such as the presence of predators in a system is important when assessing movement behaviour of cetaceans in relation to vessel traffic. Killer whales (*Orcinus orca*), for example, are well known to prey on narwhal and may affect narwhal space use patterns (Campbell et al. 1988; Cosens and Dueck 1991; Golder 2021a). In one report by Laidre et al. (2006), an attack was observed in which multiple narwhal were killed by a pod of killer whales over six hours. In the immediate presence of killer whales, narwhal moved slowly, travelling in very shallow water close to shore, and in tight groups at the surface (Laidre et al. 2006). Once the attack commenced, narwhal dispersed widely (approximately doubling their normal spatial distribution), beached themselves in sandy areas, and shifted their distribution away from the attack site. Normal (pre-exposure) behaviour was said to resume shortly (<1h) after the killer whales departed the area (Laidre et al. 2006). Another study used satellite telemetry data to track both predator (killer whale) and prey (narwhal) movements in Admiralty Inlet (Breed et al. 2017); with results demonstrating narwhal strongly altered their behaviour in the presence of killer whales (within approximately 100 km), and behavioural responses extending well beyond the discrete predation events.

Killer whales were observed in the RSA in 2020 in higher numbers than in 2019. In 2020, the highest count of killer whales recorded at one time was 67 animals on 26 August from the Bruce Head observation platform, compared to 15 killer whales on 29 August in 2019 (Golder 2021b). The earliest record of killer whale presence in the RSA in 2019 was 10 whales reported on 22 July based on aerial surveys conducted in Baffin Bay (Golder 2020). In 2020, the earliest record of killer whale presence in the RSA was 10 whales reported on 18 August in Eclipse Sound by a Pond Inlet community member (C. Matthews, pers. comm., 10 March 2021).

In 2020, as part of DFO's community-based killer whale data collection program, sightings of killer whales were reported by the community on 18 August (10 whales in Eclipse Sound East), 26 August (10 whales in South Milne Inlet), 28 August (20–25 whales in Pond Inlet) and 4 September (11 whales in Pond Inlet) (C. Matthews, pers. comm., 10 March 2021). Golder's aerial survey confirmed sightings of killer whales on 26, 27, and 29 August 2020 (Golder 2021a). The sighting on 27 August included a narwhal herding event where over 200 narwhal were chased by a group of ~30 killer whales into Fairweather Bay (along the western shore of Milne Inlet North) with confirmation of at least four narwhal kills including two calves, one adult female and one adult male.

Lefort et al. (2020) estimated that killer whales in the Canadian Arctic (with an estimated population size of  $163 \pm 27$  animals) could consume >1,000 narwhal during their seasonal residency period in Arctic waters. Increased presence of killer whales in areas associated with decreased seasonal sea ice cover may result in increased narwhal mortality, narwhal population declines, and a range contraction as narwhal's southern range boundary shifts poleward into areas with greater sea ice cover (Lefort et al. 2020). A systematic comparison between narwhal and killer whale abundances across years is not possible because reliable abundance estimates for killer whale are not available. However, 2020 aerial surveys demonstrated an increase in animal detection rate for killer whale in 2020 (0.0045 animals/km) compared to 2019 (0.0010 animals/km). It is unclear to what extent killer whale presence may have contributed to lower narwhal numbers observed in Eclipse Sound in 2020, either by direct removal (i.e., hunting and feeding) and/or via seasonal displacement, but an increase in killer whale

numbers in the RSA was apparent in 2020 and available IQ indicates that killer whales are likely to influence narwhal distribution and abundance in the RSA.

*"And one of the other reasons that we see now is that there is a whole lot more killer whales coming to Pond Inlet area, like lots of them; and again, I was talking about earlier that there's different factors involved in narwhals not migrating to Pond Inlet area as they used to, and I believe this is one of them as well. The killer whales two years ago stayed in Milne area all summer and kept the narwhals away from that area; and again, they're killers, they'll just kill."* [p.13, 06-Feb-19, p. 141 of QIA 2019]

*"Yeah. Also for the last five years we've had a problem with killer whales, they're here all the time now. Last summer they came ... where the narrows are, three days later seven more and they keep adding. And HTO decided let's count how many killer whales are there now and how many narwhals has been killed by killer whales. So we went right there, right here somewhere here, yeah. We went right there. And the killer whales were hunting over there, over there somewhere, yeah... Yeah. And we come, there were over 100 killer whales and they were teaching their young ones how to kill, narwhals."* [p.07, 05-Feb-19, p. 142 of QIA 2019]

*"I've personally hasn't observed them, though killer whales seem to be increasing every year here."* [p. 18 of NWMB 2016]

*"Since I was a boy there were always narwhal down near Padlavik on the water, since then there seem to be fewer and there are always narwhal and there are always killer whales now every summer. The narwhal would try to get away from the killer whales, not just narwhal, other species like seals. The narwhal seem to be fewer in pods now every year according to my knowledge. There used to be lots before there were noise pollution and there does not seem to be too much change in narwhal to my knowledge."* [p. 36 of NWMB 2016]

*"Yes..that is being mentioned more often now as they come every year now. They just go through here very fast, I've seen them where they can be as fast as the boats."* [p. 47 of NWMB 2016]

*"They seem to be increasing. There are smaller ones now but there are some that are huge. The smaller ones also come here now along with others they are bothering the narwhal, perhaps all the marine mammals as big as bowhead. I observed them when they were going after bowheads down at the point, they would surface among them and here I was going near them as they don't go after boats. We know that now maybe they are dangerous I don't know."* [p. 51 of NWMB 2016]

*"Perhaps its been two years they are late by more than a week that's what I've noticed when they should have arrived they haven't arrived yet." [Why?] "Killer whales, when people start seeing killer whales some don't make it here". "There are more now, they are seen more often and they are close, the killer whales seem to be coming closer that are seen"* [p.66 of NWMB 2016].

*"We can't really say how much narwhals have been affected by shipping during the summer. I can't say for certain whether you can see any more narwhals when there are ships in the area. Recently this past summer, as I was on my way home after teaching the younger generation about the procedures, we travelled by helicopter to Milne Inlet to refuel. There were some killer whales near the vicinity of Milne Inlet and there was a dead narwhal carcass floating. One orca had a narwhal in its mouth. One killer whale slammed a narwhal. Killer whales are very fast. Narwhals are more afraid of killer whales than ships. Narwhals don't seem to mind ships. Once ships are in the area they sometimes disperse, but once the ships have passed they return to the area. The ship that had teeth that was painted on the hull, the narwhals were maybe scared of that ship. Maybe they assumed the narwhal would be bitten by that ship. Those were my observances."* [p. 183 of JPCS 2019]

## 4.4 Other Potential Factors to 2020 Findings

Other potential factors that may have contributed to the lower observed number of narwhal in Eclipse Sound in 2020 include direct or indirect effects of climate change on narwhal including, but not limited to, associated changes in predator/prey dynamics and subsequent effects on narwhal fitness or energy reserves prior to their arrival on the summer grounds, as further supported by Inuit hunter feedback and available IQ.

*“Harvesters pay close attention to the health of whales. In recent years, hunters have observed that narwhal and beluga have become more scattered and thinner. Hunters think the change in behaviour is linked to lack of access to fish at floe edges, and more energy being spent by whales on travelling and hunting for food.” [p. 42 of QIA 2018]*

A detailed investigation into this potential factor is beyond the scope of the present report but should be considered in conjunction with the potential contributing factors discussed above.

## 5.0 ADAPTIVE MANAGEMENT RESPONSE

### 5.1 Approach

As part of the development of a tiered approach towards adaptive management in the draft Marine Monitoring Plan (Baffinland 2021), Baffinland has suggested a series of criteria that must be met to pass the ‘High Risk’ threshold. These criteria include:

- *Confirmed<sup>4</sup> Moderate severity behavioural responses (Severity Score 5 and 6) that persists for a set time beyond the acoustic detection period) as described in moderate risk column*

#### **AND/OR**

- *Confirmed High severity responses (Severity Score 7 to 10). This would include:*
  - *Severe and or sustained (long-term) avoidance of disturbance zone area*
  - *Outright panic, obvious flight or freeze response, stampede, or stranding events that can be directly linked to shipping*

#### **AND**

- *(iii) >25.0% decrease in calving rate (proportion of immatures) relative to pre-Phase 2 shipping dataset*
- **AND/OR**
- *(iv) >25.0% decrease in stock size (abundance)<sup>5</sup> relative to 2019 aerial survey abundance*

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<sup>4</sup> Confirmed that the Risk Status / Threshold trigger has been observed in at least two consecutive annual monitoring programs, whether during the regular monitoring schedule or confirmed through a specialized target study.

<sup>5</sup> Eclipse Sound summer stock

The results of the 2020 Marine Mammal Aerial Survey Program and Bruce Head Shore-based Monitoring Program indicate the following criteria component has been met:

- “>25.0% decrease in stock size (abundance) relative to 2019 aerial survey abundance.”

Without corresponding confirmation of a moderate or high severity behavioural response in narwhal to shipping activities, it is appropriate to further investigate the potential sources of the observed stock decline in 2020 and confirm whether prolonged moderate or high severity behavioural responses are observed in 2021.

Despite the existence of uncertainty with respect to the cause of the observed effect in 2020, and only part of the suggested High Risk threshold criteria being met, it is advisable for Baffinland to implement mitigation actions in 2021 to lower the potential of its activities contributing to the same effect in 2021 while continuing to investigate other potential contributors to changes in the narwhal population.

To address the uncertainty that exists as to the cause of the 2020 decline in abundance of the Eclipse Sound narwhal summer stock abundance, as established in Section 4 of this memo, Golder recommends that a ‘High Action Development Plan’ be developed by Baffinland in consultation with relevant parties and that it include the following elements:

- 1) Baffinland implementation of an interim mitigation response for 2021 icebreaking operations in light of unknown and/or unmitigated cumulative activities continuing to occur in 2021.
- 2) Baffinland monitor and evaluate the efficacy of the high action response for 2021 icebreaking in consultation with relevant parties.
- 3) That investigations continue as to the potential cause of the lower narwhal abundance observed in 2020 alongside the above actions.
- 4) Baffinland, in consultation with relevant parties, determine the need for the implementation of interim mitigation beyond 2021, based on the results of 2021 monitoring programs and the results of any additional investigations (by Baffinland or other responsible parties) into other sources of cumulative impacts. To this effect, consideration should be given to the potential role of 2020 construction activities in Pond Inlet on changes in narwhal distribution and abundance in the RSA, particularly with respect to the potential impacts of pile driving noise on narwhal migratory movements in Eclipse Sound.

To assist the responsible parties with their understanding of the potential causes of the 2020 abundance change, preliminary information has been compiled (see Section 4.0) and the desktop investigations identified in Section 5.3 are recommended to better characterize and understand all contributing factors. Given the regional nature of some of the causal factors, Golder recommends that additional desktop investigation be developed with oversight and input from the responsible parties and include IQ and community involvement (as per below).

To assist Baffinland and the responsible parties in identifying an appropriate operational response for avoiding or mitigating effects to narwhal, Golder has identified several mitigation options for consideration (Section 5.4).

## 5.2 IQ and Community Involvement

As per Section 1.5 of the draft Adaptive Management Plan (draft AMP) (June 2020), IQ and community involvement in environmental management are critical to the identification and understanding of potential environmental effects. Adaptive management is also anticipated to benefit from formal Inuit oversight, whether direct or indirect through various levels of involvement in the Environmental Management System (EMS) (e.g. participation in monitoring programs, environmental working groups, public engagements, etc.).

The draft AMP anticipates that IQ will be integrated along with western science into project planning, operation and monitoring and that accountable feedback mechanisms will exist for IQ to inform, change and improve the Project.

Therefore, Golder recommends that Inuit Organizations identify how IQ is best integrated into the adaptive measures identified here, how communities would prefer to be involved and potential community-based monitoring programs that Inuit feel are relevant to the 2020 narwhal monitoring results and which could inform adaptive management of the Project. At a minimum, Baffinland will ensure there is a process outside of the MHTO's participation in the MEWG to contribute to the development of the High Action Development Plan.

## 5.3 Desktop Investigation

### 5.3.1 Regional Sea Ice Conditions

Procurement of detailed remote sensing imagery will provide a more accurate representation of sea ice conditions on an annual scale that can be compared to annual shipping and icebreaking activities. The following information would provide a greater understanding of how narwhal distribution is affected by differences in sea ice conditions:

- Total ice cover of ice field (km<sup>2</sup>) in Eclipse Sound from time landfast ice is gone to <3/10 ice concentration
- Temporal persistence of ice leads
- Range in size of ice floes (max diameter and area (km<sup>2</sup>))

This information is likely to provide a more accurate representation in terms of how long sea ice persists in Eclipse Sound during ice break-up and may be used to refine the proposed mitigation measures related to seasonal ice concentrations.

### 5.3.2 Construction Noise from Small Craft Harbour in Pond Inlet

Assuming relevant Parties are willing to share a detailed schedule of 2020 construction activities for the SCH site in Pond Inlet, Baffinland will commission JASCO to isolate all potential 'impulsive noise source' data from the 2020 PAM dataset and characterize the resultant sound levels from impact pile driving as part of this activity. If Baffinland is provided with raw data from the SCH Project, the resultant sound fields (noise contours) can be modelled and depicted in spatial plots/figures, along with distance estimates to the corresponding behavioural thresholds.

Golder understands that impact pile driving at the SCH in Pond Inlet is planned for the 2021 summer season, although details on the magnitude, timing and duration of this program is presently unknown. As this information becomes available, Golder recommends Baffinland re-evaluate in discussions with the MEWG what project monitoring may or may not be appropriate for the 2021 shipping season.

### 5.3.3 Increased Killer Whale Presence

It is Baffinland's understanding that DFO currently implements a community-based killer whale sightings program in both Arctic Bay and Pond Inlet that Baffinland hopes to build upon for addressing this critical data gap in the RSA. Underwater acoustic data collected from the Bruce Head, Bylot Island and Ragged Island recorders in 2020 will be used to identify seasonal occurrence and location of killer whales in the RSA to supplement the available 2020 sightings record (combined DFO/community and Baffinland sightings). This will help identify the earliest arrival of killer whales in the RSA for comparative purposes to previous years, to inform how killer whales may have influenced narwhal space use patterns at the time of the 2020 aerial surveys.

## 5.4 Enhanced Mitigation

### 5.4.1 Project Level

This section provides options for enhanced mitigation at the Project level for implementation during the 2021 shipping season. The additional mitigation being put forward is specifically designed for managing impacts on narwhal from Project icebreaking, even if the underlying causal factor(s) for the observed decrease in narwhal abundance in Eclipse Sound is presently unknown. This precautionary approach will allow for a concurrent investigation of potential causal factors of the observed change while adjusting shipping operations to further manage impacts from icebreaking on narwhal in the RSA.

Additional mitigation measures proposed for 2021 include the following:

#### OPTION 1:

- No icebreaker transits will occur in the RSA when ice concentrations of  $> 6/10$  cannot be avoided along the shipping route.
- A maximum of two icebreaker transits (with escorted vessels) will occur per day (24-h period) where ice concentrations  $\leq 6/10$  but  $\geq 4/10$  cannot be avoided along the shipping route.
- When a continuous sailing route of uninterrupted ice concentrations of  $3/10$  or less is available between the entrance of Pond Inlet and Milne Port, then icebreaker transits in the RSA will proceed according to the normal shipping schedule.

Biological Rationale for Option 1: This is the most conservative mitigation biologically because it effectively eliminates icebreaking assuming vessels will still adhere to the primary mitigation of avoiding ice floes in low to moderate ice conditions as safe navigation allows. Based on the last three years of ice conditions, the time between initial ice break-up and when ice concentrations along the shipping route offer  $\leq 6/10$  is approximately 10-14 days.

## OPTION 2:

- No icebreaker transits will occur in the RSA when ice concentrations of 9/10 or greater cannot be avoided along the shipping route.
- A maximum of one icebreaker transit (with escorted vessels) will occur per day (24-h period) where ice concentrations of  $> 6/10$  (but  $< 9/10$ ) cannot be avoided along the shipping route.
- A maximum of two icebreaker transits (with escorted vessels) will occur per day (24-h period) where ice concentrations  $\leq 6/10$  but  $\geq 4/10$  cannot be avoided along the shipping route.
- When a continuous sailing route of uninterrupted ice concentrations of 3/10 or less is available between the entrance of Pond Inlet and Milne Port, then icebreaker transits in the RSA will proceed according to the normal shipping schedule.

Biological rationale for Option 2: This would completely avoid impacting narwhal in leads, as the leads are unlikely to exist in 9/10 or greater ice concentrations. This would also minimize icebreaking noise, as it would eliminate breaking of thickest ice over a continuous period. Based on last three years of ice conditions, the time between initial ice break-up and when ice concentrations along the shipping route offer  $\leq 9/10$  is no longer than 9 days.

## OPTION 3:

- No icebreaker transits will occur in the RSA when ice concentrations of 9/10 or greater cannot be avoided along the shipping route, unless the following conditions can be met:
  - Confirmation of 'sufficient narwhal absence' in ice leads in the annually recurring consolidated ( $\geq 9-10/10$ ) ice field in Eclipse Sound. This would include all ice leads occurring within 20 km on either side of the shipping lane as this distance corresponds with the worst-case 120 dB disturbance zone range for icebreaker noise based on 2020 field measurements.
  - Confirmation of 'sufficient narwhal absence' in the adjacent floe edge area fronting the annually recurring consolidated ice field in Eclipse Sound. This would include a 20 km zone on the east side of the ice field as this corresponds with the worst-case 120 dB disturbance zone range for icebreaker noise based on 2020 field measurements.
  - That "confirmation of" be determined in direct consultation with DFO, Inuit and Baffinland (via daily meetings to discuss observed ice conditions, sighting/detection rates and narwhal distribution relative to ice conditions)
  - That "sufficient narwhal absence" be defined in collaboration with DFO and Inuit organizations through development of a threshold or trigger. Golder can present options for consideration for a threshold/ratio that can be rapidly obtained through a Leg 1 survey. For example, a threshold of 0.25 narwhal/km represents a reasonable threshold for this purpose as this value would not constitute an 'aggregation' of narwhal, and would be 10x lower than the narwhal detection rate observed in ice leads in 2020 and lower than the narwhal detection rate observed in open-water or low/moderate ice conditions (i.e., systematic transect grid surveys) in 2019 and 2020.

- A maximum of one icebreaker transit (with escorted vessels) will occur per day (24-h period) where ice concentrations of  $> 6/10$  cannot be avoided along the shipping route (also assuming adherence to above bullet).
- A maximum of two icebreaker transits (with escorted vessels) will occur per day (24-h period) where ice concentrations  $\leq 6/10$  but  $\geq 4/10$  cannot be avoided along the shipping route.
- When a continuous sailing route of uninterrupted ice concentrations of  $3/10$  or less is available between the entrance of Pond Inlet and Milne Port, then icebreaker transits in the RSA will proceed according to the normal shipping schedule.

Biological rationale for Option 3: This would minimize impacting narwhal in ice leads, given it would be confirmed they are not there in large numbers. The extent of the survey effort is based on existing behavioural thresholds derived from field measurements (acoustic monitoring data). Note, based on what we have observed in 2019 and 2020, there is a moderate to high probability that narwhal be present in the leads or along the outer edge of the ice field in numbers exceeding the yet-to-be developed threshold.

#### **OPTION 4:**

- No icebreaker transits will occur in the RSA when ice concentrations of  $9/10$  or greater cannot be avoided along the shipping route, unless the following conditions can be met:
  - Confirmation of 'sufficient narwhal presence' in Milne Inlet (south of the consolidated ice field) either via aerial surveys or Bruce Head shore-based monitoring.
  - That "confirmation of" be determined in direct consultation with DFO, Inuit and Baffinland (via daily meetings to discuss observed ice conditions, sighting/detection rates and narwhal distribution)
  - That "sufficient narwhal presence" be defined in collaboration with DFO and Inuit organizations through development of a threshold or trigger. Golder can present options for consideration but this is somewhat challenging as it would require a biologically relevant sighting rate would be, which is presently unknown.
- A maximum of one icebreaker transit (with escorted vessels) will occur per day (24-h period) where ice concentrations of  $> 6/10$  cannot be avoided along the shipping route (also assuming adherence to above bullet).
- A maximum of two icebreaker transits (with escorted vessels) will occur per day (24-h period) where ice concentrations  $\leq 6/10$  but  $\geq 4/10$  cannot be avoided along the shipping route.
- When a continuous sailing route of uninterrupted ice concentrations of  $3/10$  or less is available between the entrance of Pond Inlet and Milne Port, then icebreaker transits in the RSA will proceed according to the normal shipping schedule.

Biological rationale for Option 4: This would indicate that a 'sufficient' number of narwhal were able to clear the ice field in Western Eclipse and enter the deeper fjord areas of Milne Inlet. Operational limitation as there is some indication that narwhal prefer to remain in areas of ice cover (i.e., Eclipse Sound) as long as it remains present (i.e., narwhal may not elect to travel to Milne Inlet South until early August irrespective of icebreaking/shipping operations because this area is generally ice-free for most of July).

#### **OPTION 5:**

- Project vessels do not enter the RSA until 2 weeks after land-fast ice has initially fractured (as per Hamlet of Pond Inlet recommendation).

Biological rationale for Option 5: Based on historical ice conditions, it is unlikely that ice concentrations > 6/10 will persist much longer than two weeks following initial break-up (e.g., since icebreaking began in 2018, the maximum number of days that elapsed between initial break-up and the time when ice concentrations > 6/10 no longer existed along the shipping route was 10 to 14 days, and no longer than 9 days for  $\geq 9/10$  ice concentrations). This option therefore is very similar in function to Option 1.

### **5.4.2 Regional Level**

To be determined by the responsible authority based on results from the 2020 SCH construction program in Pond Inlet (Advisian 2021).

## **5.5 Follow-up Monitoring**

### **5.5.1 Project Level**

Baffinland icebreaking cannot be ruled out as a contributing cause of the observed decrease in Eclipse Sound narwhal numbers in 2020 (i.e., potential displacement event). To better understand potential short-term, long-term and cumulative effects of icebreaker noise on narwhal during the early shoulder season, Golder recommends that Baffinland implement the following follow-up monitoring programs in 2021:

- 2021 Marine Mammal Aerial Survey Program (Leg 1 and Leg 2) (pending community consultation)
- 2021 Bruce Head Shore-based Monitoring Program (pending community consultation)
- 2021 Passive Acoustic Monitoring Program (pending community consultation)

In 2021, Baffinland also intends to prioritize planning for a 2022 early shoulder season narwhal tagging study to be designed in consultation with the MHTO, DFO and MEWG.

## 5.5.2 Regional Level

Potential longer-term regional-based narwhal monitoring studies, which could inform how regional factors may influence narwhal use of Eclipse Sound, are recommended to investigate potential non-Project influences on Eclipse Sound narwhal (e.g., abundance surveys of the Baffin Bay regional narwhal population, killer whale tracking studies; drone-based aerial photogrammetry to estimate narwhal body condition). These would be founded on local Inuit knowledge and implemented collaboratively between Baffinland, the community of Pond Inlet and the respective regulatory agencies.

Although it is the proponent's responsibility to monitor for the potential effects of its project activities on the Eclipse Sound narwhal stock, Baffinland is not best situated to investigate and/or collect data on external sources of potential impacts on Eclipse Sound narwhal that may act in a cumulative or additive manner with Project-related impacts (e.g., SCH pile driving program in Pond Inlet). To that end, Baffinland remains committed to contributing to regional monitoring initiatives that take place within the RSA by either carrying out a portion of the monitoring / investigation directly, or supporting others through financial support (i.e. community based monitoring) and/or in kind support (i.e. government research). Additional discussion is required with relevant parties on this subject before more detailed planning can occur.

## 6.0 SUMMARY

- Results from the 2020 aerial survey indicate: i) narwhal abundance in Eclipse Sound was statistically lower in 2020 than in previous aerial survey years undertaken in the RSA (2013, 2016 and 2019), and ii) the combined narwhal abundance in Eclipse Sound and Admiralty Inlet was similar in 2020 to that observed in previous years (2013 and 2019). These results suggest either potential displacement of a portion of the Eclipse Sound stock to the Admiralty Inlet summering ground during the summer of 2020, a potential displacement of these animals to another area (e.g., Eastern Baffin Bay or Somerset summering ground), or a potential decrease in the Eclipse Sound summer stock.
- Results from the 2020 shore-based monitoring at Bruce Head indicate fewer narwhal than previous years and this aligns with aerial survey results indicating a lower abundance of the Eclipse Sound summer stock in 2020. However, narwhal calf ratio (i.e., a proxy for reproductive success) was shown to remain consistent with pre-shipping conditions, despite year-over-year increases in shipping in the RSA from 2014-2019. Multiple observations of nursing in the Bruce Head area in 2020 offers some evidence that females with dependent young continue to carry out critical life functions in the presence of vessel traffic during the open-water season.
- Results from the 2020 passive acoustic monitoring program indicate sound levels from active icebreaking are 10 to 20 dB lower than what was predicted (using analogous sound sources from other regions), and per-transit exposure durations at a level of 120 dB re 1  $\mu$ Pa are thus 60-90% lower than predicted, demonstrating that the acoustic modelling undertaken in the effects assessment is conservative. The 2020 PAM program also detected sequences of impulsive sound in July and August 2020 that is consistent with the type of impulsive noise generated by impact pile driving.

In consideration of the above findings, it is evident that there was a statistically significant decrease in the abundance of the Eclipse Sound narwhal stock in 2020 that requires further investigation. Potential contributing factors considered in this report included acoustic disturbance effects from icebreaking, acoustic disturbance effects from impact pile driving in Pond Inlet, and increased killer whale presence in the RSA. A preliminary analysis of these factors is as follows:

- Project icebreaking is considered a possible contributing factor to the observed decrease in Eclipse Sound narwhal summer stock in 2020. Longer periods of icebreaking occurred in 2018 and 2020, compared to 2019 when the ice was in a later stage of break-up. Lower numbers of narwhal in the RSA were also recorded through aerial surveys or reported by the community in 2018 and 2020, compared to 2019. In 2020, narwhal were concentrated in the ice leads in the western portion of Eclipse Sound, forming a more clumped distribution compared to 2019. During its first transit in the RSA in 2020, the MSV Botnica (escorting two carriers and two tugs) transited in close proximity to the leads where narwhal were confirmed to be holding. Narwhal distribution in the RSA during the 2018 early shoulder season is unknown as no aerial surveys were flown that year.
- Construction noise in Pond Inlet during the 2020 summer is considered a possible contributing factor to the observed decrease in the Eclipse summer stock in 2020. A preliminary analysis of underwater noise recordings in Eclipse Sound in 2020 has identified anomalous sounds, similar in nature to sounds generated by impact pile driving (and different than sounds generated by vessels). These impulsive sounds are not thought to be natural in origin and they correspond in time with impact pile driving which occurred in Pond Inlet as part of the 2020 SCH construction project. Additional effort is required to fully characterize the pile driving noise at Pond Inlet including the extent of the noise fields projecting in Eclipse Sound. A preliminary analysis by Golder indicates that the pile driving in Pond Inlet emitted high energy impulsive noise to the marine environment during a 52-day period that corresponded with the narwhal migration into Eclipse Sound. Acoustic compliance monitoring indicated that the permitted acoustic injury threshold of 30kPa was exceeded at 10m from the source, and that no mitigation was put into place to mitigate these impact pile driving sounds and exceedances.
- Increased killer whale presence in the RSA is considered a possible contributing factor to the observed decrease in Eclipse Sound narwhal summer stock in 2020 given the potential of increased narwhal mortality, narwhal population decline, or a range contraction as suggested by Lefort et al. (2020). Additional effort is required to determine the extent and timing of killer whale presence in the RSA in 2020 and how this may be linked to the observed lower number of narwhal that year.
- Commensurate with Baffinland's recommended tiered adaptive management thresholds, preliminary 2020 monitoring suggests a 'High Risk' threshold has potentially been triggered, and one of the identified response actions is implementation of precautionary Project-based operational mitigation measures. The proposed additional mitigation being put forward aim to avoid and/or further minimize impacts on narwhal from Project icebreaking, even if the underlying causal factor(s) for the observed decrease in narwhal abundance in Eclipse Sound is unconfirmed. This precautionary approach will allow for a simultaneous investigation of potential causal factors of the observed change while adjusting current shipping operations to reliably manage impacts from icebreaking on narwhal in the RSA.

To better understand potential short-term, long-term and cumulative effects of icebreaker noise on narwhal during the early shoulder season, Baffinland will implement the following follow-up monitoring programs starting in 2021:

- 2021 Aerial Survey Program
- 2021 Bruce Head Shore-based Monitoring Program
- 2021 Passive Acoustic Monitoring Program

Baffinland also intends to prioritize in 2021 planning for a 2022 early shoulder season narwhal tagging study to be designed in consultation with the MHTO, DFO and MEWG.

To better understand potential cumulative effects on narwhal, potential longer-term regional-based narwhal monitoring studies, which could inform how regional factors influence narwhal use of Eclipse Sound, are recommended to investigate potential non-Project influences on Eclipse Sound narwhal (e.g., abundance surveys of the Baffin Bay regional narwhal population, killer whale tracking studies; drone-based aerial photogrammetry to estimate narwhal body condition). These would be founded on local Inuit knowledge and implemented collaboratively between Baffinland, the community of Pond Inlet and respective regulatory agencies.

## 7.0 CLOSURE

We trust the above meets your present requirements. If you have any questions or require additional information, please contact the undersigned.

### Golder Associates Ltd.



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*Marine Biologist*



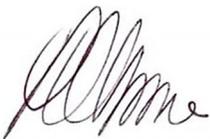
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Attachments: Attachment 1: Daily Ice Charts for Period of 12-22 July (2018, 2019 and 2020)  
Attachment 2: Pond Inlet Project – 2020 Construction Season Annual Report

[https://golderassociates.sharepoint.com/sites/11206g/deliverables \(do not use\)/issued to client\\_for/wp/1663724-285-tm-rev1-48000/1663724-285-tm-rev1-48000-narwhal abundance memo-07apr\\_21.docx](https://golderassociates.sharepoint.com/sites/11206g/deliverables%20(do%20not%20use)/issued%20to%20client_for/wp/1663724-285-tm-rev1-48000/1663724-285-tm-rev1-48000-narwhal%20abundance%20memo-07apr_21.docx)

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**ATTACHMENT 1**

**Daily Ice Charts for Period of  
12-22 July (2018, 2019 and 2020)**

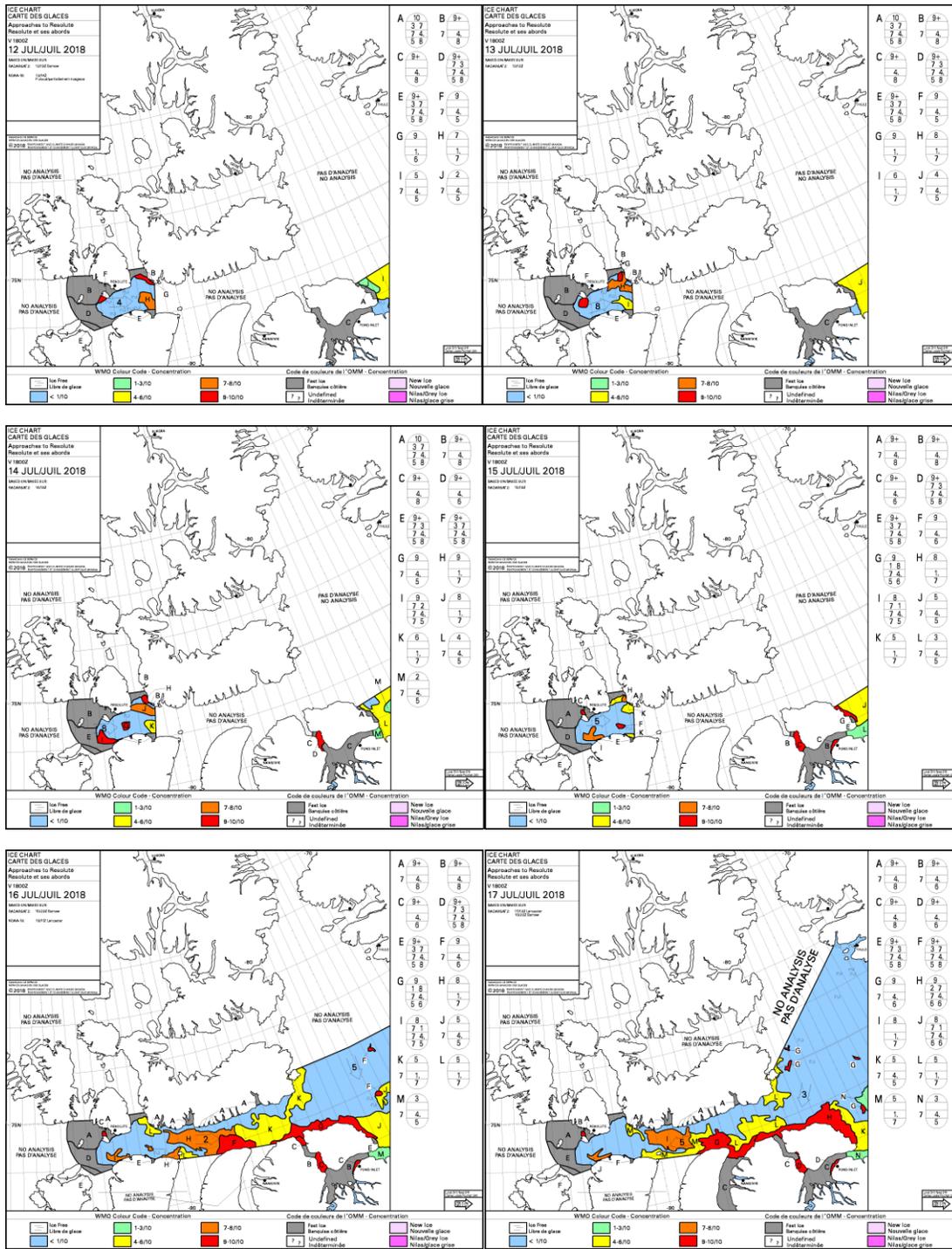


Figure A1: Daily Ice Conditions in Regional Study Area (RSA) – July 12 to 17, 2018.

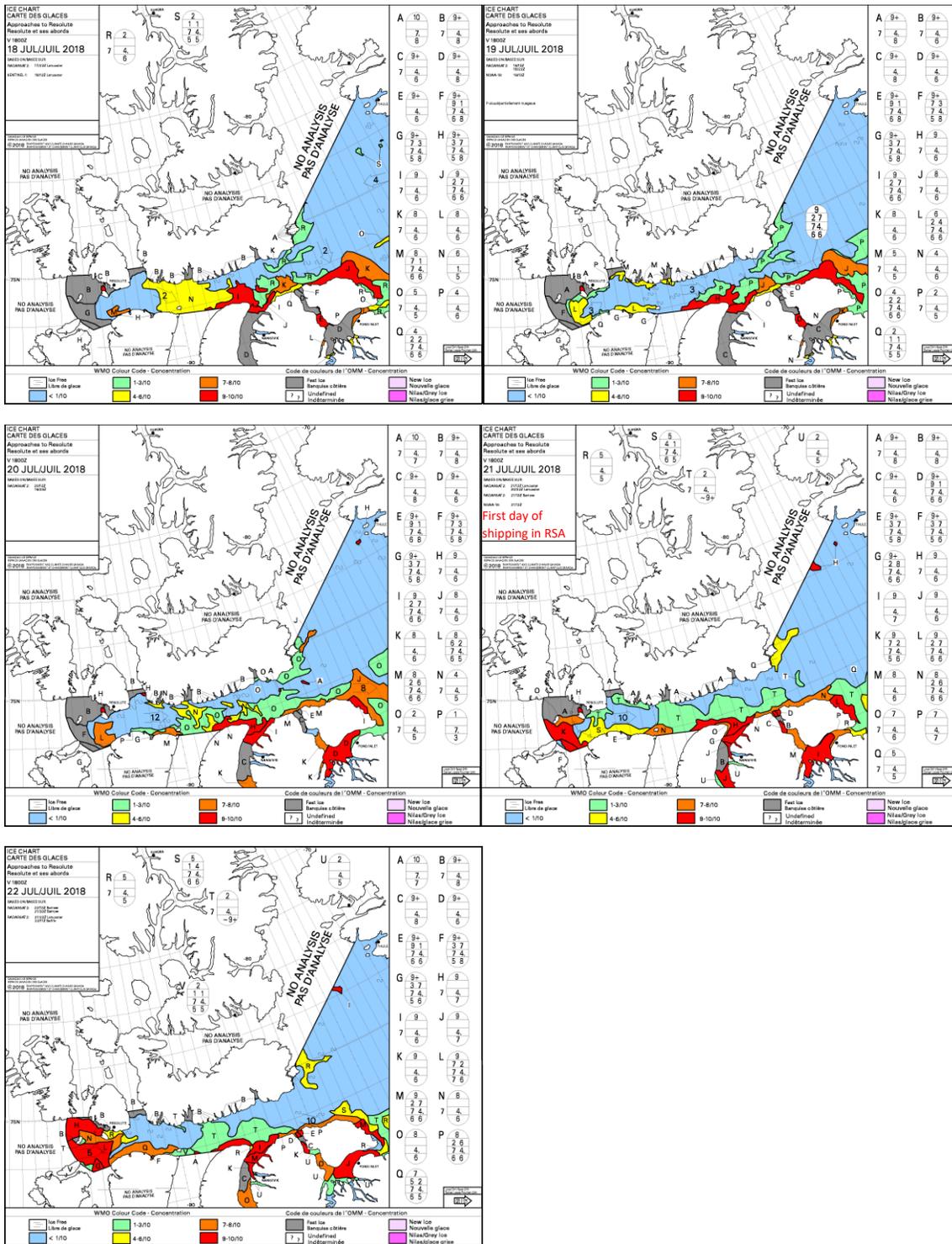


Figure A2: Daily Ice Conditions in RSA – July 18 to 22, 2018.

Note: First day of shipping/icebreaking in 2018 was July 21.

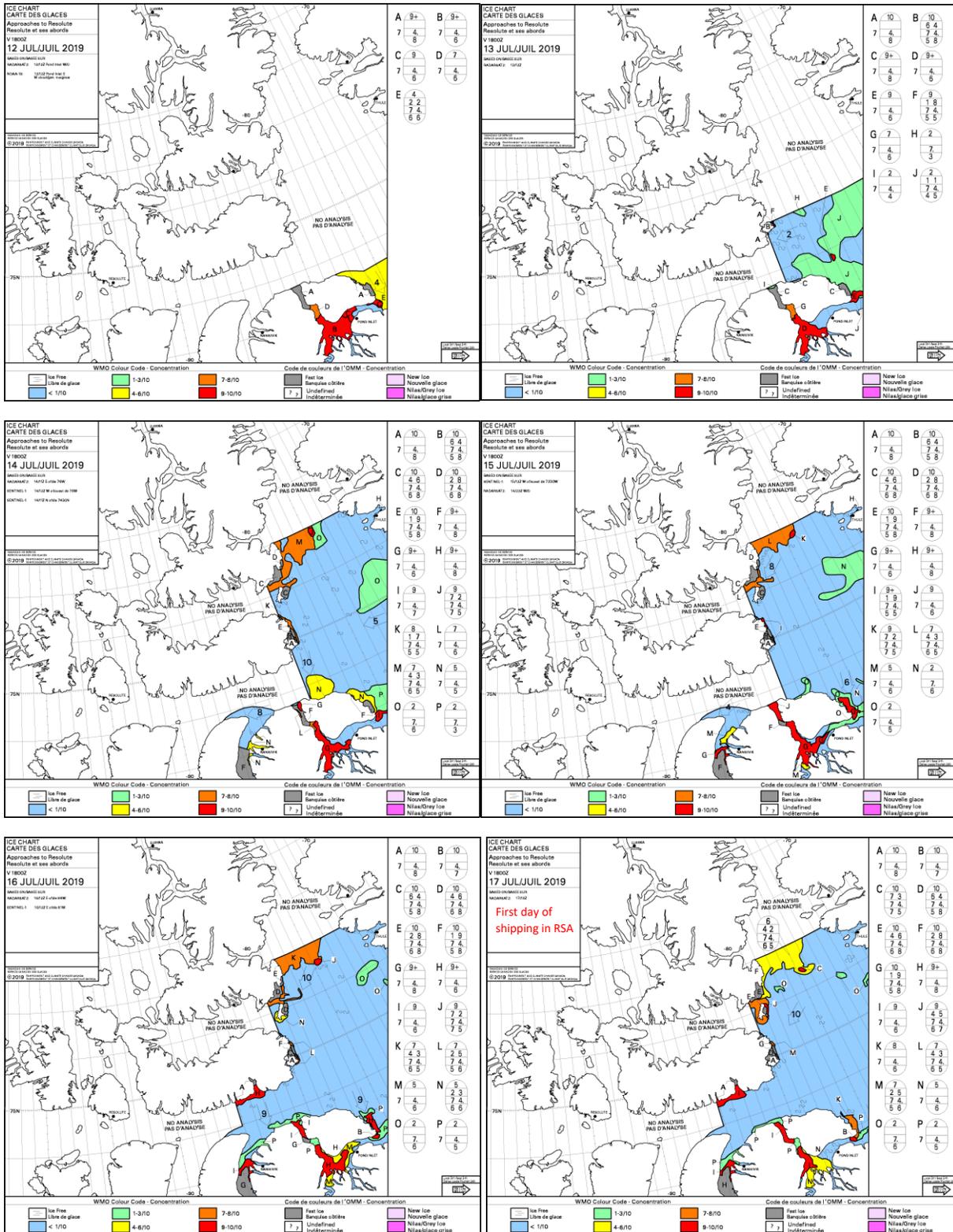


Figure A3: Daily Ice Conditions in RSA – July 12 to 17, 2019.

Note: First day of shipping/icebreaking in 2019 was July 17.

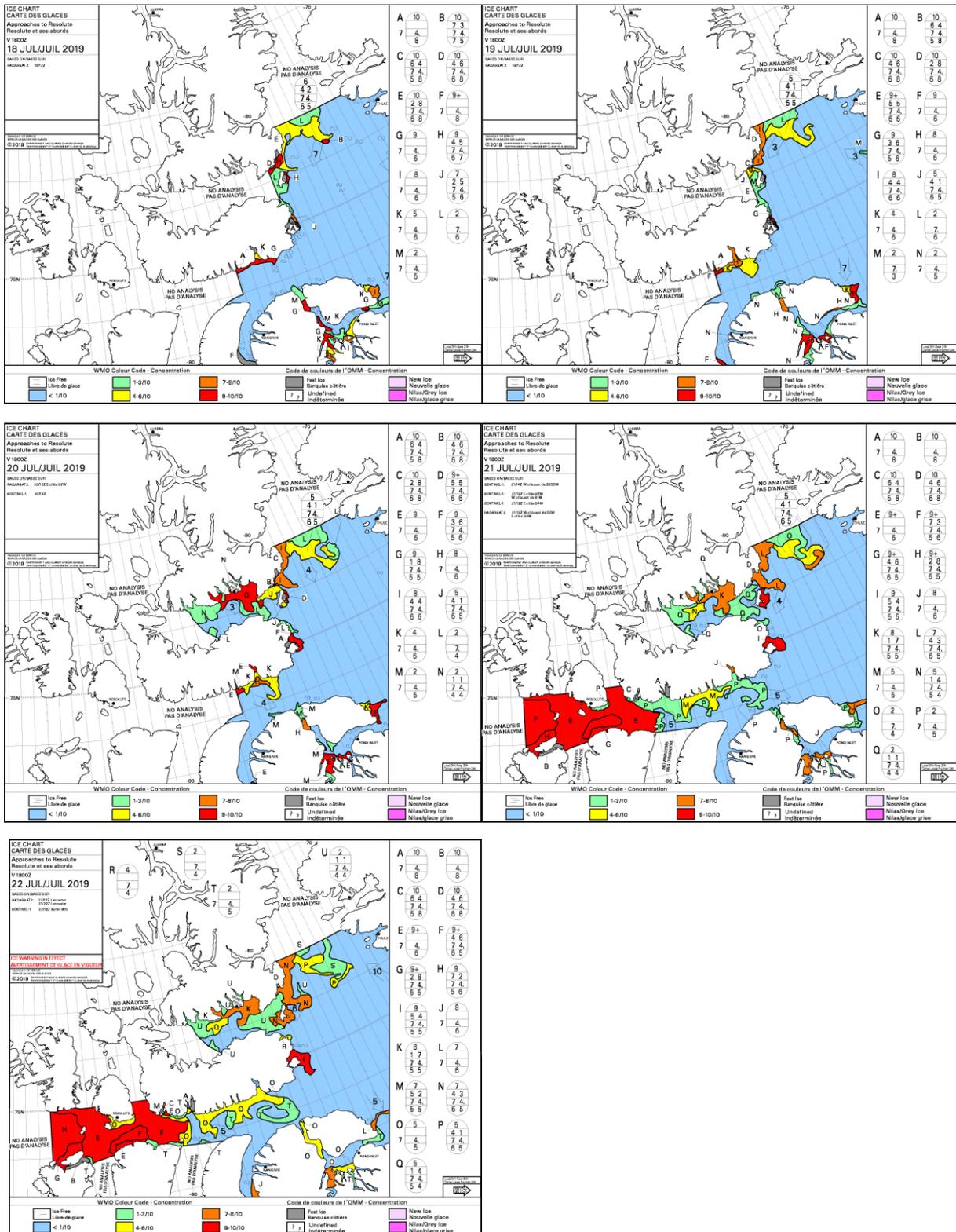


Figure A4: Daily Ice Conditions in RSA – July 18 to 22, 2019.

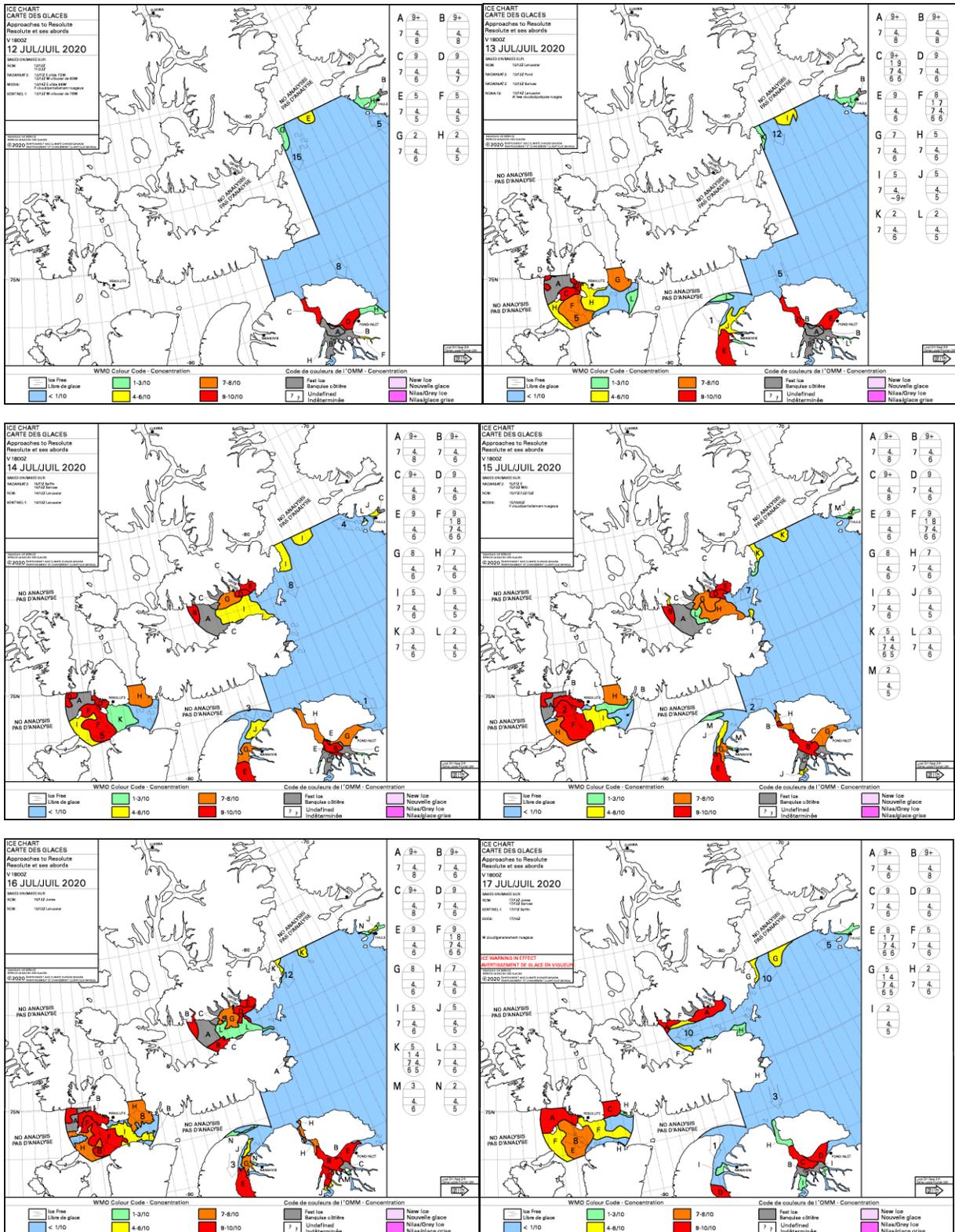


Figure A5: Daily Ice Conditions in RSA – July 12 to 17, 2020.

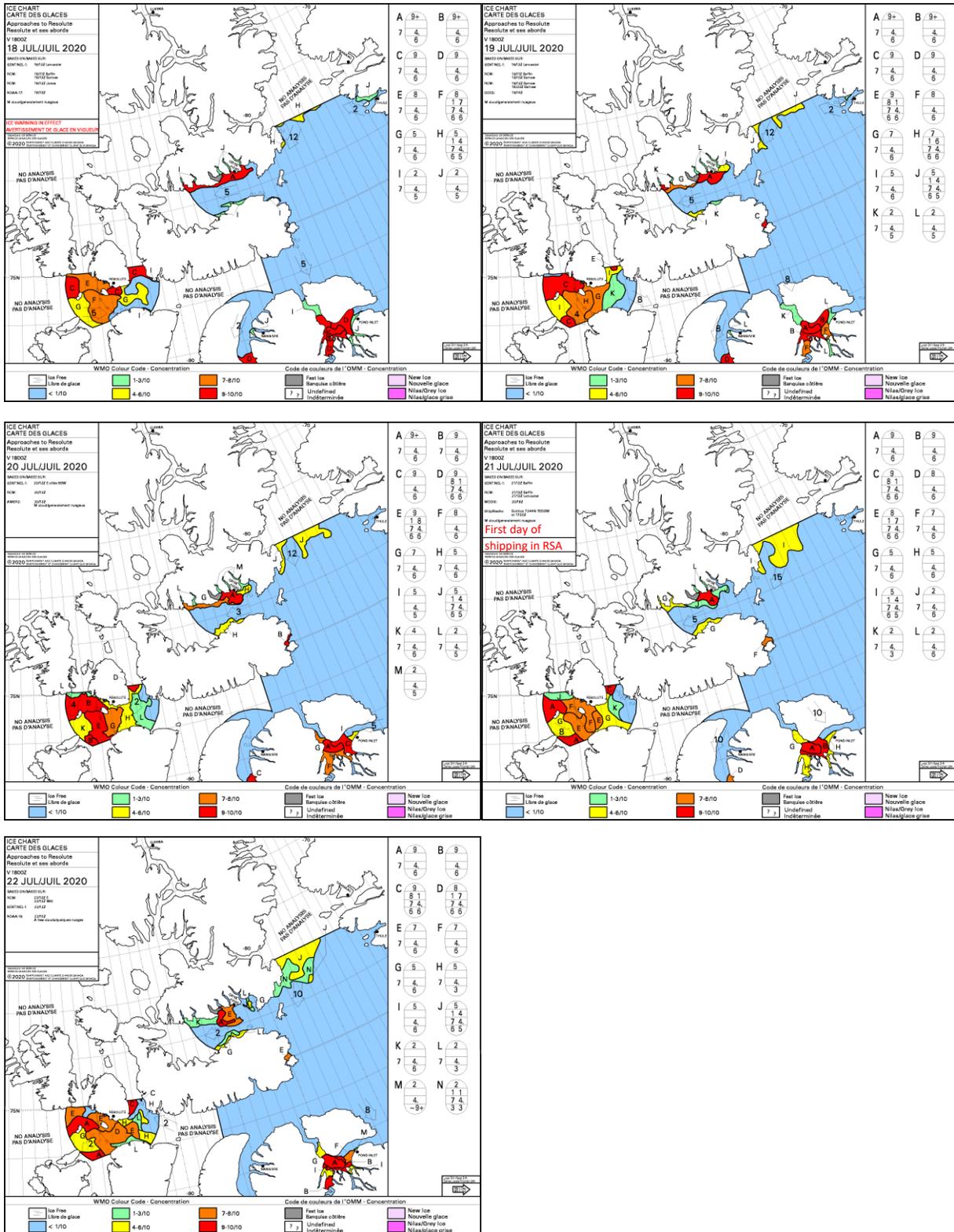


Figure A6: Daily Ice Conditions in RSA – July 18 to 22, 2020.

Note: First day of shipping/icebreaking in 2020 was July 21.

**ATTACHMENT 2**

**Pond Inlet Project – 2020 Construction  
Season Annual Report**



# Pond Inlet Project – 2020 Construction Season Annual Report

**Fisheries Act Authorization Nos: 17-HCAA-00551 / 19-HCAA-01020**

**Prepared for Fisheries and Oceans Canada**

30 January 2021

307071-01148

**Advisian**  
Worley Group

[advisian.com](http://advisian.com)

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Rev	Description	Author	Review	Advisian approval	Revision date
0	Issued for Use	 L. Borden / P. Stastny	 V. Burdett-Coutts	 R. Crompton	30-Jan-21

307071-01148-01-EN-REP-0007\_R0.docx

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- Appendix 4 Demonstrative NAVWARN**
- Appendix 5 Compliance Turbidity**
- Appendix 6 Compliance Acoustics**

## Abbreviations and Acronyms

Acronym/Abbreviation	Definition
ANFO	Ammonium Nitrate and Fuel Oil
CCME	Canadian Council of Ministers of the Environment
CEMP	Construction Environmental Monitoring Plan
CCG	Canadian Coast Guard
CGS	Community and Government Services
CIRNAC	Crown-Indigenous Relations and Northern Affairs Canada
CWP	Contractor Work Plan
DFO	Fisheries and Oceans Canada
DG	Dangerous Good
DoE	Department of Environment
EDT	Economic Development and Transportation
EI	Environmental Inspector
EM	Environmental Monitor
EZ	Exclusion Zone
FAA	<i>Fisheries Act</i> Authorization
FFHPP	Fish and Fish Habitat Protection Plan
GN	Government of Nunavut
HTO	Hunters and Trappers Organization
HWL	High Water line
HHWL	High high water line
MMO	Marine Mammal Observer
MP	Management Plan
NIRB	Nunavut Impact Review Board
NPC	Nunavut Planning Commission
NRCan	Natural Resources Canada
NRI	Nunavut Research Institute

Acronym/Abbreviation	Definition
NWB	Nunavut Water Board
PSPC	Public Services and Procurement Canada
PWGSC	Public Works and Government Services Canada
QEP	Qualified Environmental Professional
RA	Regulatory Authority
ROV	Remote Operated Vehicle
SCH	Small Craft Harbour
SEC	Sediment and Erosion Control
SRP	Spill Response Plan
TA	Tower Arctic
WQG	Water Quality Guideline

## Permit Conditions Table of Concordance

The Fisheries and Oceans Canada (DFO) - Fisheries Act Authorization (FAA) permit conditions (17-HCAA-00551 [issued April 23, 2018] and 19-HCAA-01020 [Issued October 1 2019]) are provided in Table A. Mitigation measures taken from the Project Construction Environmental Management Plan (CEMP) (Tower 2018a) relevant to the marine environment (Condition 2.2) are provided in Table B. The conditions and CEMP mitigations are referenced to the relevant sections in the report for descriptions.

Table A Project Fisheries Act Authorization Permit Condition Reference List

FAA-17-HCAA-00551 Permit 1 No.	FAA 19-HCAA-01020 Permit 2 No.	Condition	Report Section
2.0	2.0	Conditions that relate to measures and standards to avoid and mitigate serious harm to fish.	This report, Table A, Table B
2.1	2.1	Sediment and Erosion Control: Sediment and erosion control measures must be in place and shall be upgraded and maintained, such that release of sediment is avoided at the location of the authorized work, undertaking, or activity.	Section 5.7
2.1.1	2.1.1	Rock or fill materials used for in-water construction shall be free of fines.	Section 5.4
2.2	---	List of measures and standards to avoid and mitigate serious harm to fish. Described below and as set out in the Proponent's Pond Inlet Marine Infrastructure - Small Craft Harbour, Fisheries and Oceans Canada - Fisheries Act Authorization Supplemental Report for Application, dated April 9, 2018, or any subsequent versions (hereafter referred to as the "Pond Inlet Application") (17-HCAA-00551).	Section 5, Table A, Table B
---	2.2	List of measures and standards to avoid and mitigate serious harm to fish. Described below and as set out in the Proponent's Pond Inlet Marine Infrastructure - Small Craft Harbour, Fisheries and Oceans Canada - Fisheries Act Authorization Supplemental Report for Application, dated April 9, 2018, or any subsequent versions (hereafter referred to as the "Pond Inlet Application") (19-HCAA-01020).	Section 5, Table A, Table B
2.2.1	2.2.1	In-water construction activities shall be undertaken as outlined in the Pond Inlet Application to minimize the potential for stress related behaviour, or death of, fishes and marine mammals.	Relevant sections as outlined in Table A, Table B

FAA-17-HCAA-00551 Permit 1 No.	FAA 19-HCAA-01020 Permit 2 No.	Condition	Report Section
2.2.1.1	2.2.1.1	Marine mammal exclusion zones around construction activities shall be established and monitored as outlined in the Pond Inlet Application.	Section 5.5.1, Table 5-3 for marine mammal exclusion zones (EZ) for construction
2.2.1.2	2.2.1.2	Underwater pressure and noise levels shall not exceed the thresholds of 30 kPa at 10 m and 160 dB re 1 $\mu$ Pa, respectively, when conducting vibratory pile driving.	Section 3.8, Sections 5.6.2 (Marine mammals), 5.6.3 (Fish)
2.2.1.3	2.2.1.3	If construction is to occur during the iced-season, in-air sound levels shall not exceed the in-air acoustic threshold of 100 dB re 20 $\mu$ Pa when pinnipeds are observed on the ice during construction activities.	Does not apply to the 2020 construction year. There was no iced-season construction
2.2.2	2.2.2	Project-related vessels shall be operated as outlined in the Pond Inlet Application to minimize the potential for negative interactions with marine mammals.	Section 3.8
2.3	2.3	Contingency Measures: Described below, and as set out in the Pond Inlet Application, shall be put in place if monitoring required in Condition No. 3 indicates that the measures and standards to avoid and mitigate serious harm to fish are not successful.	See Section 6 for adaptive management measures implemented or under discussion
2.3.1	2.3.1	Work shall cease if a marine mammal enters an exclusion zone and shall not recommence until 30 minutes after it was last observed or 30 minutes after it is seen leaving the exclusion zone.	Section 5.5
2.3.2	2.3.2	If dead fishes or marine mammals are observed, works shall be suspended as outlined in the Pond Inlet Application and DFO shall be notified within 48 hours. No work shall be recommenced until approved by DFO.	Does not apply to the 2020 construction year. No dead fish or marine mammals were observed
2.3.3	2.3.3	If underwater noise levels exceed the threshold (160 dB re 1 $\mu$ Pa), additional mitigation measures, such as the installation of bubble curtains and/or expansion of marine mammal exclusion zone, shall be implemented and DFO shall be notified.	Section 5.6, Section 6.2 (Adaptive management), Section 7.1.1 (Non-compliance)

FAA-17-HCAA-00551 Permit 1 No.	FAA 19-HCAA-01020 Permit 2 No.	Condition	Report Section
2.3.4	2.3.4	Work shall be suspended if pinnipeds are exposed to in-air sound levels above the threshold (100 dB re 20 µPa) and DFO shall be notified. No work shall be recommenced until approved by DFO.	Does not apply to the 2020 construction season. No construction activity occurred that required in-air sound monitoring
2.4	2.4	Dates by which these measures and standards shall be implemented: Measures and standards to avoid and mitigate serious harm to fish shall be implemented prior to the commencement of construction activities and maintained for the duration of construction.	Section 5
3.0	3.0	Conditions that relate to monitoring and reporting of measures and standards to avoid and mitigate serious harm to fish.	This report
3.1	3.1	Monitoring of avoidance and mitigation measures: The Proponent shall monitor the implementation of avoidance and mitigation measures referred to in Section 2 of this authorization and provide an annual report to DFO, by January 31, 2019, 2020, and 2021, and summarizing whether the measures and standards to avoid and mitigate serious harm to fish were conducted according to the conditions of this authorization.  This shall be done by (see 3.1.1 and 3.1.2 below)	This report
3.1.1	3.1.1	Demonstration of effective implementation and functioning. Providing dated photographs and monitoring reports to demonstrate effective implementation and functioning of mitigation measures and standards described above to limit the serious harm to fish to what is covered by this authorization.	This report, Figure 2-3 for Google Earth imagery. Appendix 2 for SCH progress photos
3.1.2	3.1.2	Contingency Measures: Providing details of any contingency measures that were followed, to prevent impacts greater than those covered by this authorization in the event that mitigation measures did not function as described.	See Section 6 for adaptive management measures implemented or under discussion

Table B Construction Environmental Management Plan Mitigation Measures for the Marine Environment

Activity	CEMP Table	CEMP Reference	CEMP Mitigation Category	Mitigation	Report Section
Placement of Rock/Fill	Table 3-8	MC01	Marine Construction Management Measures	The contractor will prepare a Monitoring Plan for the Project that includes requirements during dredging and placement of quarry material. This will include allowable levels of Turbidity/Total Suspended Solids (TSS) and marine mammal monitoring requirements.	Revision 8 of Tower's MP was provided to GN-CGS on 24/06/2020 and provided to DFO 25/06/2020.  Revision 9 of Tower's MP is under review and will be provided to DFO when finalized prior to the 2021 construction season. Advisian's review of the MP will also be provided.
	Table 3-8	MC02	Marine Construction Management Measures	Measures to reduce sediment mobilization during in-water activities shall be used by the contractor when TSS/turbidity exceeds Canadian Council of Ministers of the Environment (CCME) water quality guidelines for protection of aquatic life (the water quality guidelines).	Section 5.4
	Table 3-8	MC03	Marine Construction Management Measures	Prior to construction, contractor will communicate with HTO to obtain information relevant to the current marine mammal sightings before the onset of construction practices that could result in disturbance or injury.	Observed marine mammals during the construction work is available in the wildlife log (see Tower's EOS checklist, Appendix 3).
	Table 3-8	MC18	Marine Construction Management Measures	Rock material used for in-water construction will be free of material that would result in exceedances of the water quality guidelines outside the work area.	Section 5.4

Activity	CEMP Table	CEMP Reference	CEMP Mitigation Category	Mitigation	Report Section
	Table 3-8	MC19	Marine Construction Management Measures	An Environmental Monitor (EM) will be present during all in-water construction activities to monitor for stress related behaviours or for fish kills. If observed, adaptive management will be implemented or, if necessary, stop-work will be implemented until effective mitigation measures are in place.	Section 5.1; there were no fish kills observed and no need to implement contingency measures in the 2020 construction season
Sheet Piling for Fixed Wharf Construction	Table 3-8	MC02	Marine Construction Management Measures	Measures to reduce sediment mobilization during in-water activities shall be used by the contractor when TSS/turbidity exceeds CCME water quality guidelines for protection of aquatic life (the water quality guidelines).	Section 5.4
	Table 3-8	MC03	Marine Construction Management Measures	Prior to construction, contractor will communicate with HTO to obtain information relevant to the current marine mammal sightings before the onset of construction practices that could result in disturbance or injury.	Observed marine mammals during the construction work is available in the wildlife log (see Tower's EOS checklist, Appendix 3)
	Table 3-8	MC04	Marine Construction Management Measures	Soft-start procedure shall be implemented for pile driving that could generate underwater noise above auditory thresholds for marine mammals.	Section 5.6

Activity	CEMP Table	CEMP Reference	CEMP Mitigation Category	Mitigation	Report Section
	Table 3-8	MC05	Marine Construction Management Measures	Vibratory piling equipment shall be used to reduce noise effects to community and marine fauna, where possible. A monitoring program shall be developed to verify that underwater noise levels are less than 30 kPa at 10 m from the piling activity for the protection of fish.	Section 2.4, Section 5.6 (Monitoring summary), See Section 7.4.2 of MP (Tower 2020b)
	Table 3-8	MC06	Marine Construction Management Measures	Additional mitigation measures, e.g. bubble curtains, shall be required for pile driving if the underwater noise auditory thresholds are exceeded.	Section 5.6, Section 6.2 (Adaptive management), Section 7.1.1 (Non-compliance)
	Table 3-8	MC07	Marine Construction Management Measures	Pile driving shall be conducted within hours as agreed with the Hamlet.	Section 2.4
	Table 3-8	MC09	Marine Construction Management Measures	Marine Mammal Observers (MMO) will be employed to monitor for the presence of marine mammals in a defined marine mammal exclusion zone. During the open-water season, the exclusion zone will be initially set at 500 m, with in-situ underwater noise monitoring to be conducted at the onset of in-water works to verify the exclusion zone based on the underwater sound auditory threshold of 160 dB re 1 µPa. Communication with construction teams and reporting of data will be included.	Section 5.5.1, Section 5.6.2.2 (acoustic monitoring summary)

Activity	CEMP Table	CEMP Reference	CEMP Mitigation Category	Mitigation	Report Section
	Table 3-8	MC11	Marine Construction Management Measures	Prior to construction, stop-work conditions shall be specified. Such conditions will include exceedance of underwater noise thresholds for the protection of fish or sighting of a marine mammal within the exclusion zone by the MMO. Work must not re-start until the marine mammal has moved out of the exclusion zone.	No stop works required in 2020 construction season, see Section 7.2.3 of MP (Tower 2020b) for details on stop work procedure.
	Table 3-8	MC19	Marine Construction Management Measures	An EM will be present during all in-water construction activities to monitor for stress related behaviours or for fish kills. If observed, adaptive management will be implemented or, if necessary, stop-work will be implemented until effective mitigation measures are in place.	Section 5.1. There were no fish kills observed and no need to implement contingency measures in the 2020 construction season
Installation of Float Strings (Inner Harbour)	Table 3-8	MC02	Marine Construction Management Measures	Measures to reduce sediment mobilization during in-water activities shall be used by the Contractor when TSS/turbidity exceeds CCME water quality guidelines for protection of aquatic life (the water quality guidelines).	Not relevant to 2020 construction, there was no activity associated with float strings
	Table 3-8	MC19	Marine Construction Management Measures	An EM will be present during all in-water construction activities to monitor for stress related behaviours or for fish kills. If observed, adaptive management will be implemented or, if necessary, stop-work will be implemented until effective mitigation measures are in place.	Not relevant to 2020 construction, there was no activity associated with float strings

Activity	CEMP Table	CEMP Reference	CEMP Mitigation Category	Mitigation	Report Section
Light - Illumination of Project Site	Table 3-8	MC16	Marine Construction Management Measures	The area of sea that is artificially illuminated shall be minimized.	Section 5.2
Dredging for Fixed Wharf Navigation Channel	Table 3-8	MC01	Marine Construction Management Measures	The contractor will prepare a Monitoring Plan for the Project that includes requirements during dredging and placement of quarry material. This will include allowable levels of turbidity/TSS and marine mammal monitoring requirements.	Section 5.4, see Section 7.1 of the MP (Tower 2020b) for details on turbidity monitoring. Section 6.1 (Adaptive management)
	Table 3-8	MC02	Marine Construction Management Measures	Measures to reduce sediment mobilization during in-water activities shall be used by the contractor when TSS/turbidity exceeds CCME water quality guidelines for protection of aquatic life (the water quality guidelines).	Section 5.4 (Turbidity monitoring), Section 6.1 (Adaptive management)
	Table 3-8	MC03	Marine Construction Management Measures	Prior to construction, contractor will communicate with HTO to obtain information relevant to the current marine mammal sightings before the onset of construction practices that could result in disturbance or injury.	Observed marine mammals during the construction work is available in the wildlife log (see Tower's EOS checklist, Appendix 3).
	Table 3-8	MC08	Marine Construction Management Measures	Mechanical dredging methods shall be used, which result in lower levels of underwater noise compared to hydraulic methods.	Section 2.5.

Activity	CEMP Table	CEMP Reference	CEMP Mitigation Category	Mitigation	Report Section
	Table 3-8	MC19	Marine Construction Management Measures	An EM will be present during all in-water construction activities to monitor for stress related behaviours or for fish kills. If observed, adaptive management will be implemented or, if necessary, stop-work will be implemented until effective mitigation measures are in place.	Section 5.1. There were no fish kills observed. Section 5.6.3.
	Table 3-8	MC10	Marine Construction Management Measures	An MMO will be present during dredging, dredge disposal, and in-water placement of fill material to monitor for presence of marine mammals. The MMO will monitor for stress related behaviours to marine mammals. If observed, adaptive management will be implemented or, if necessary, stop-work will be implemented until effective mitigation measures are in place.	Section 5.5. No adaptive management measures were necessary, and no stop works occurred during the 2020 construction season.
	Table 3-8	MC12	Marine Construction Management Measures	If construction is to occur during the iced-season, the in-air sound levels will be measured, and pinnipeds monitored on the ice. In the absence of Canadian guidelines, the United States in-air acoustic threshold for non-harbour seal pinnipeds of 100 dB re 20 µPa rms will be adopted. The construction activity will be suspended if the seals are exposed to noise levels above the threshold.	Not relevant to 2020 construction season, no dredging during the iced season.
	Table 3-6	BL05	Blasting Measures	Prior to blasting occurring, warning must be issued in affected area using loud signalling devices.	Section 3.1

Activity	CEMP Table	CEMP Reference	CEMP Mitigation Category	Mitigation	Report Section
	Table 3-6	BL06	Blasting Measures	Blast mats shall be used as needed to prevent physical damage from flying rock and suppress dust.	Section 3.1. Note, blasting is not near the marine environment or fish bearing watercourses
	Table 3-6	BL07	Blasting Measures	Dust suppressants and/or watering shall be used to reduce dust generation from blasting to acceptable levels.	Section 3.1. Note, blasting is not near the marine environment or fish bearing watercourses
	Table 3-6	BL08	Blasting Measures	No blasting shall occur in-water.	Not relevant to Pond Inlet, the Quarry is >5 km from the marine environment and not near fish bearing watercourses
	Table 3-6	BL12	Blasting Measures	Screening and crushing equipment shall be located on stable ground, at a location with ready access to stockpiles.	Section 3.1. Note, blasting is not near the marine environment or fish bearing watercourses
	Table 3-3	TF07	Road Traffic and Transport Mitigation and Monitoring Measures Summary	Suitable dust suppressants (non-toxic and biodegradable) to reduce dust generation to acceptable levels shall be used. Dust suppressants will be in accordance with the Government of Nunavut, Department of Sustainable Development, Environmental Protection Service, and Environmental Guideline for Dust Suppression.	Section 5.9

Activity	CEMP Table	CEMP Reference	CEMP Mitigation Category	Mitigation	Report Section
Haul Road Construction Creek Crossings	Table 3-9	To be in Updated CEMP	Wildlife Mitigation and Monitoring Measures Summary	The contractor will confirm in the 2018 Construction Summary Report for the first FAA (Permit No. 17-HCAA-00551) that the creeks crossed (described in Section 3.2.2.2 of the first FAA application (Advisian 2017) location in Figure 1-1 were not fish bearing, and that fish passage culverts were not required to be installed.	Addressed during the haul road construction in the 2018 construction season. Watercourses are not fish bearing, and DFO fishery biologists have visited the site in 2018 (Andrea Doherty/William Glass) and 2019 (Andrea Doherty, Steve Cho) to confirm.

# 1 Introduction

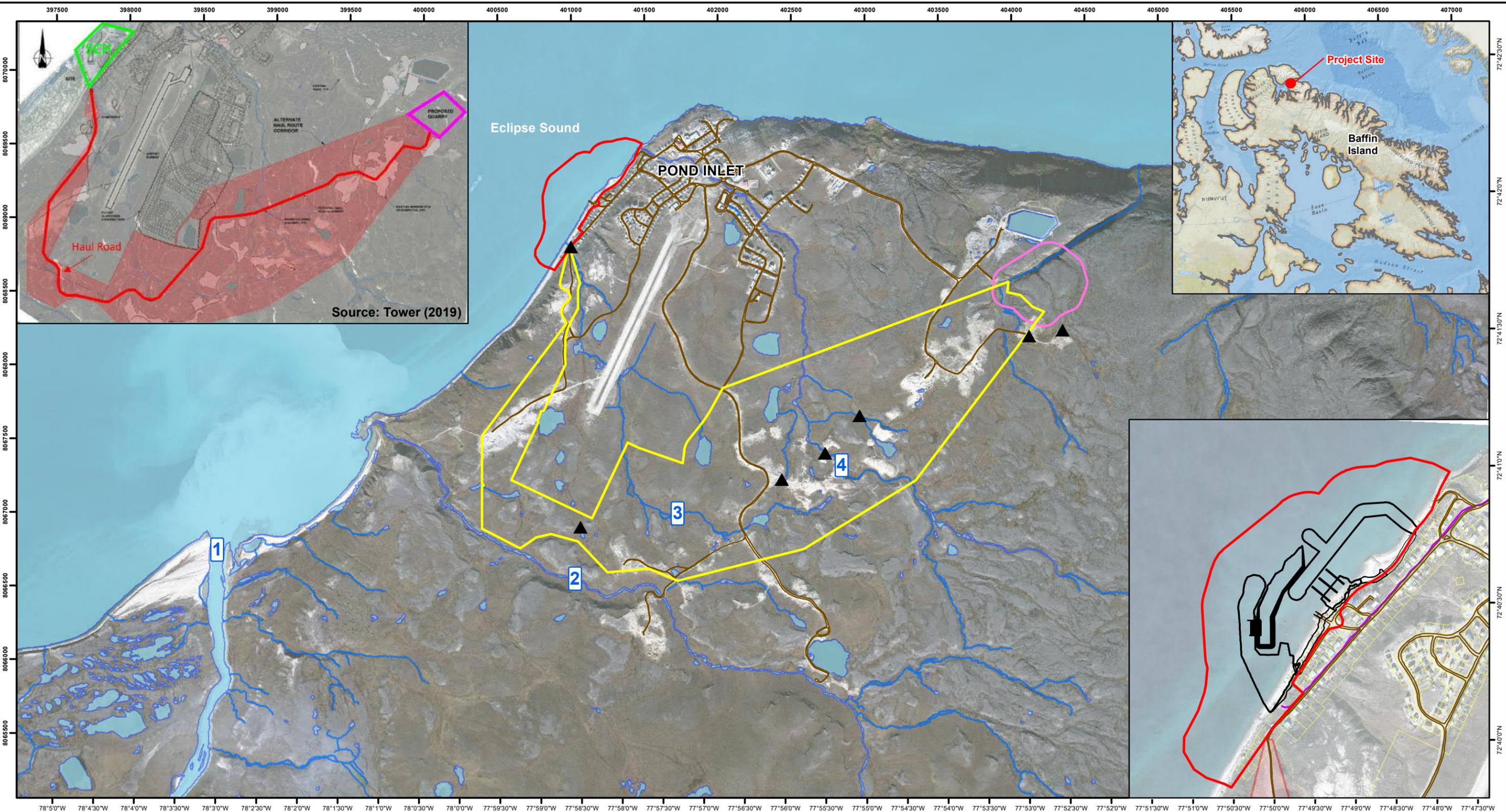
## 1.1 Background

Construction of the marine facility infrastructure project in Pond Inlet has been underway through three open-water seasons, and was initiated in 2018. Construction of this facility is ongoing and is currently planned for completion in 2021. Led by the Government of Nunavut - Community and Government Services (GN-CGS), ownership and responsibility will transfer to the GN - Economic Development and Transportation (EDT) once operational. Construction activities take place during the open-water season, generally commencing in June and finishing in late October. Tower Arctic Ltd. (Tower) was selected as the contractor for the Project and began construction during the open-water season of 2018. All necessary municipal, territorial and federal permits were in place prior to the start of the 2018 construction season (see Section 1.4), with the exception of CIRNAC LUP which was approved in 2019.

Pond Inlet is located on the northern shore of Baffin Island in Eclipse Sound (72° 42.125'N°, 77° 57.766'W) (Figure 1-1). The permanent components of the Project include two new breakwaters, a fixed small craft wharf (fixed wharf), a boat launch ramp (existing), small craft floating docks, a sealift landing ramp, and a laydown area to be used for sealift storage, boat storage, and parking (the Project) (Figure 1-2, Figure 1-3). The quarry is located approximately 5 km south-east of the SCH (see Figure 1-1), and a temporary haul road was constructed in 2018 to link the project site to the Quarry (Tower 2019) (see inset in Figure 1-1).

This report provides a summary of the 2020 construction season for the Project which meets the requirement as detailed in Condition 3.3 (Table A above). The Table of Concordance (Table B above) reflects compliance with the Construction Environmental Management Plan (CEMP) mitigations.

FILE LOCATION: \\WorleyParsons.com\CA\Data\YVR\30707101148\_GON\_NVMain\fra10\_Eng\16\_Geomatics\01\_Mxd\DFC\_Construction\_Summary\_Reports\2020\Figure-1-1\_2021-01-12\_PI\_Project\_Location.mxd



Source: Tower (2019)

**Legend**

- ▲ Culvert Installation (Tower, 2019)
  - Gravel Road
  - Waterbody
  - Water Course
- Study Areas**
- Small Craft Harbour
  - Haul Road
  - Quarry

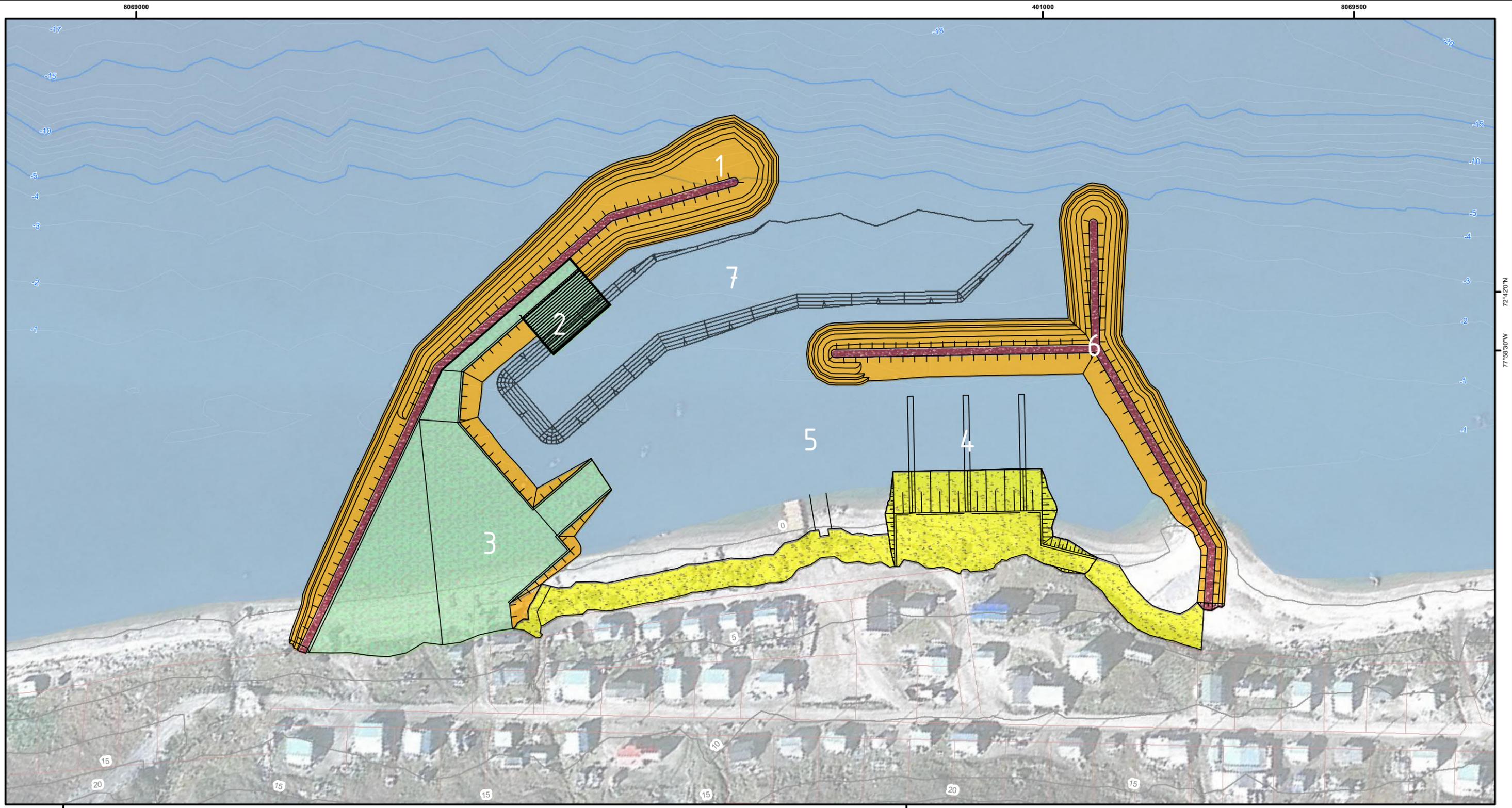
- Watercourses**
- 1 Salmon River
  - 2 Salmon Creek
  - 3 Southern Creek
  - 4 Northern Creek



Note:  
 - Coordinate System: NAD 1983 UTM Zone 18N  
 - Basedata from Government of Nunavut, 2016

GOVERNMENT OF NUNAVUT POND INLET PROJECT 2020 CONSTRUCTION SEASON ANNUAL REPORT			
<b>SMALL CRAFT HARBOUR PROJECT LOCATION AT POND INLET</b>			
	Date: 12-JAN-21	Drawn by: KR	Edited by: KR
	Project No. 307071-01148		App'd by: VB
		FIG No. 1-1	REV 0
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**Legend**

- Proposed SCH Layout
- Bathymetry (5m Intervals)
- Bathymetry (1m Intervals)
- Contours (5m Intervals)
- Property Lot
- Gravel Beach
- Breakwater
- Fill or Cut Side Slope
- Vehicle Area
- Harbour

**Features**

- 1 West Breakwater
- 2 Fixed Wharf
- 3 Sealift Laydown and Ramp
- 4 Sea Float
- 5 Inner Harbour
- 6 East Breakwater
- 7 Dredge Pocket

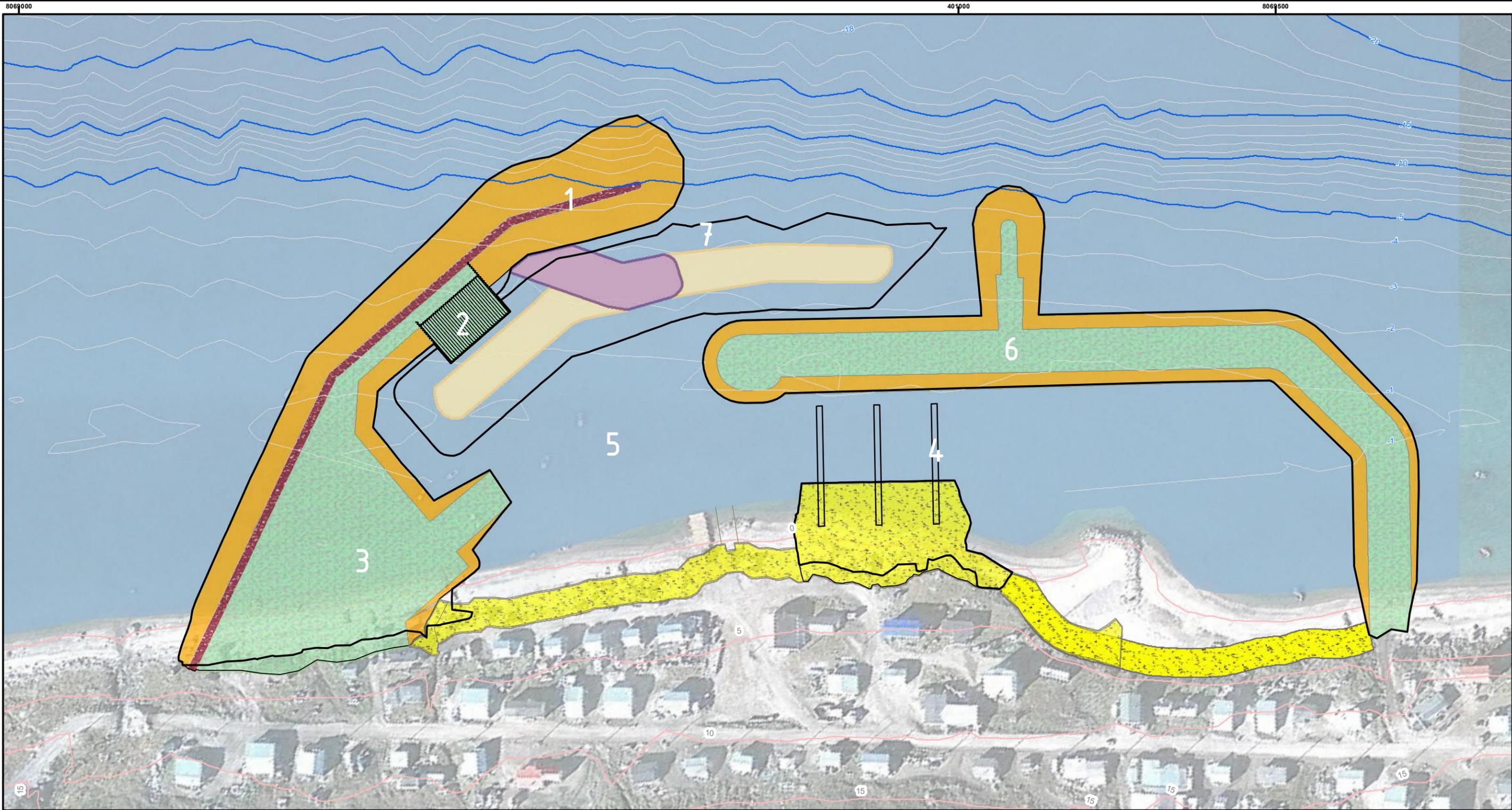


Note:  
 - Coordinate System: NAD 1983 UTM Zone 18N  
 - Basedata from Google Earth, 2010. Location is approximate.

GOVERNMENT OF NUNAVUT POND INLET PROJECT 2020 CONSTRUCTION SEASON ANNUAL REPORT <b>SMALL CRAFT HARBOUR GENERAL ARRANGEMENT</b> (PERMITTED UNDER DFO FAA NO. 17-HCAA-00551)			
Date: 12-JAN-21	Drawn by: KR	Edited by: KR	App'd by: VB
Project No. 307071-01148		FIG No. <b>1-2</b>	
		REV 0	
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**Legend**

— Contour (5m Intervals)

— 5m Interval

— 1m Interval

**Temporary Causeway**

— 2018 Temporary Causeway

— 2019 Planned Extension

— Gravel Beach

— Breakwater

— Fill or Cut Side Slope

— Vehicle Area

— Harbour

**Features**

1 West Breakwater

2 Fixed Wharf

3 Sealift Laydown and Ramp

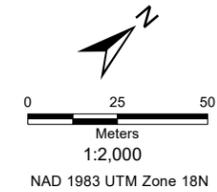
4 Sea Float

5 Inner Harbour

6 East Breakwater

7 Dredge Pocket

Note:  
Basedata from Google Earth, 2010. Location is approximate.



GOVERNMENT OF NUNAVUT POND INLET PROJECT 2020 CONSTRUCTION SEASON ANNUAL REPORT <b>SMALL CRAFT HARBOUR GENERAL ARRANGEMENT</b> <b>(PERMITTED UNDER DFO FAA NO. 19-HCAA-01020)</b>			
Date: 12-JAN-21	Drawn by: KR	Edited by: KR	App'd by: VB
 <b>Advisian</b> Worley Group		Project No. 307071-01148	REV 0
		<b>1-3</b>	
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## 1.2 Authorized Footprints

The Project footprints as authorized under the two DFO FAAs (17-HCAA-00551, 19-HCAA-01020) (DFO 2018, 2019a) are depicted in Table 1-1. The components of the SCH are described in Table 1-2. The majority of construction, including the design of the east breakwater, is as permitted under the first FAA (17-HCAA-00551). The exception to this is the footprint of the temporary causeway, which is as permitted under the second FAA (19-HCAA-01020).

Table 1-1 Project Authorized Footprints

Permit No.	Destruction (m <sup>2</sup> )	Temporary Destruction (m <sup>2</sup> )	Permanent Alteration (m <sup>2</sup> )	Figure Reference	Permit Issue	Permit Expiry
17-HCAA-00551	23,660	0	2,860	Figure 1-2	23/04/2018	01/12/2021
19-HCAA-01020	6,662	6010	443	Figure 1-2	01/10/2019	01/12/2021

Table 1-2 Project Components and details of Modifications Due to 19-HCAA-01020

Facility Component	Modifications Due to 19-HCAA-01020	Design to be constructed
East Breakwater	Breakwater was extended approximately 100 m to the east and has a driveable surface	17-HCAA-00551
West Breakwater	No changes	
West breakwater temporary causeway	Temporary causeway will be constructed within the dredge footprint to facilitate dredging to be conducted with land-based equipment. Temporary destruction is described in the second FAA (6,010 m <sup>2</sup> ) (19-HCAA-01020) (DFO 2019a)	19-HCAA-01020
Inner Harbour	Previously 2.5 ha, will be increased to 3.5 ha	17-HCAA-00551
Float Pad	No changes	
Float Strings	No changes	
Sealift Laydown and Ramp	No changes	
Dredging approach channel	No changes, but temporary causeway fill will be removed during dredging and the and material used as fill for the west breakwater prior.	
Fixed Wharf	No changes	
Gravel surfacing	No changes	

## 1.3 Regulatory Compliance

The GN and Tower have maintained compliance with all permit conditions, although several issues with non-compliance occurred during the 2020 construction season. There were two adaptive management measures and five non-compliances relevant to the DFO FAA permits (see Section 6, 7). The Tower Monitoring Plan (MP) Rev 8 (Tower 2020b) was utilized for the 2020 construction season. Due to concerns with turbidity and overpressure monitoring a revision of the MP was required. Tower was required to adapt compliance monitoring requirements for these two parameters as stated in agreements made through email correspondence. Agreements for alternative monitoring for turbidity were made on September 23 (Week 17) (Advisian 2020h) and for overpressure October 7 (Week 18) (Advisian 2020g). Revision 9 of the MP (Tower 2020c) was submitted to CGS on October 14 (Week 19) and is currently under review by Advisian. Review of Rev 9 MP will occur in February 2021 and DFO will be informed if Rev 9 of the MP is approved. However, another revision will be required to describe how compliance monitoring will be performed in shoulder seasons. Shoulder season is defined as conditions when ice may influence the ability to safely deploy a vessel. There will be an approved MP in place prior to the start of the 2021 construction season. DFO will be provided with a copy of the approved MP. MP Rev 8 will be referenced throughout this report (Tower 2020b).

## 1.4 Permits

### 1.4.1 Existing Permits

Permits pertinent to the Project are summarized in Table 1-3.

### 1.4.2 2020 Permits

Two amendment requests were submitted to DFO-FFHPP for the respective FAAs (17-HCAA-00551, 19-HCAA-01020) for schedule extensions into 2021. The 19-HCAA-01020 authorization was also prioritized for an amendment of additional infill to close off the temporary causeway around the wharf (see Section 2.2.2.2 for description) that was required during the 2020 construction season. The amendment requests were submitted to DFO-FFHPP by Advisian on August 20 (Advisian 2020c, 2020d). DFO approved amendments to 19-HCAA-01020 on September 22 (DFO 2020b) and 17-HCAA-00551 on November 24 (DFO 2020a).

In regard to the request for infill around the Fixed Wharf (see Section 2.2.2.3), Tower erroneously submitted an application for an emergency FAA to DFO-FFHPP on October 9, 2020 (Week 18). Advisian became aware of the situation by email on October 13, 2020 and contacted DFO-FFHPP (Steve Cho) to address steps that were required to align with the appropriate regulatory requirements (Advisian 2020i). It was agreed that Tower would request the application be withdrawn, and DFO concluded the works would not result in a HADD and would be removed in the 2021 construction season (DFO 2020c). Consequently, Tower's amendment application was retracted on October 14 (Tower 2020g).

Table 1-3 Project Permits

Regulatory Authority	Permit Type	Permit #	Issued	Expiry	Permit Holder
<b>Federal</b>					
Transport Canada	Approval (Notice of Works)	8200-2017-600071	30/02/2018		GN
Natural Resources Canada (NRCAN)	Explosive Magazine Permit	U300112/E	21/06/2018	21/06/2021	TA
Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC)	Land Use Permit	N2019X0012	06/06/2019	14/08/2023	GN
DFO	FAA	17-HCAA-00551	23/04/2019	01/12/2021	GN
		19-HCAA-01020	01/10/2019		
Public Services and Procurement Canada (PSPC)	License of Occupation	17XN030	07/05/2018	07/05/2023	GN
<b>Territorial</b>					
NIRB	Screening decision	17XN030	02/10/2017		GN
Nunavut Water Board (NWB)	Water License	8BW-PIM1821	23/07/2018	22/07/2021	TA
Nunavut Research Institute (NRI)	Research Permit (field work associated with baselines and FAA)	02 06020R-M	01/07/2020	31/12/2020 (re-issued annually)	GN
<b>Municipal</b>					
Hamlet of Pond Inlet	Pre-Development Permit	0711	27/07/2018		GN
Hamlet of Pond Inlet	Quarry Permit	0-27-2020-01	27/02/2020	27/02/2021	TA

## 1.5 Regulatory Inspections

Due to COVID-19 travel restrictions, CIRNAC and the GN were the only regulatory authorities to conduct a site inspection during the 2020 construction season. Details of regulatory inspection visits over the past three construction seasons are outlined in Table 1-4.

Table 1-4 Regulatory Inspections for the Project for the 2018, 2019 and 2020 Construction Seasons

Year	Regulatory Authority	Personnel Attending	Title	Construction Week	Date
2018	DFO	Andrea Doherty	Senior Biologist	Pre-Construction	August 26 to 29
		William Glass	Senior Fish and Fish Habitat Protection Biologist		
2019	DFO	Andrea Doherty	Senior Biologist	Pre-Construction	September 25 to 27
		Steve Cho	Fish and Fish Habitat Protection Biologist		
2020	CIRNAC	Joseph Monteith	Resource Environmental Manager	Week 11	August 20
2020	GN	Daniel Inuarak	Environmental Protection Officer	Week 14	September 9

## 1.5.1 DFO Meetings

### 1.5.1.1 On Site

No on-site meetings with DFO occurred in 2020 due to COVID-19 travel restrictions.

### 1.5.1.2 Offsite

Monthly meeting between DFO, CGS, Tower and Advisian occur to ensure DFO is aware of concerns related to FAA.

## 2 Construction Activities

Construction activities to be undertaken for the Project are described in this section. In-water activities to be performed are presented in Table 2-1. Supporting construction activities are described in Section 3.

### 2.1 Construction Status

The 2020 construction season was underway from June 10 to October 25, 2020 for a total of 20 weeks of construction. In-water works, final winterization and demobilization were completed on October 25, 2020. A NAVWARN was issued for the duration of in-water works (see Appendix 4). Construction weeks were defined by Tower’s Environmental Monitor (EM) schedule which runs typically from Monday to Sunday of a given week (see Appendix 1). Construction activities planned for Pond Inlet are summarized in Table 1-2. Construction activity status at the end of 2020 is provided in Table 2-1. Progress imagery, as was completed for the 2019 construction season, is not available through aerial photos as there were no drone surveys performed in 2020 and Google Earth has not updated Pond Inlet since 2016. The latest drone image taken on October 9, 2019 has been marked to identify 2020 construction progress (see Figure 2-1). The 2021 construction season will include completion of drilling and blasting, the fixed wharf, dredging, inner harbor construction, gravel surfacing and the installation of floats.

Monitoring associated with construction is summarized in Section 5, adaptive management measures in Section 6 and non-compliance events associated with 2020 construction are summarized in Section 7.

Table 2-1 Pond Inlet Construction Status for the 2020 Open-Water Season

Activity	Component	Construction Status					Permit Design Percent Basis
		Start Date	Construction Week	Finish Date	Construction Week	% Complete	
Infill	West breakwater	July 6, 2020	5	October 24, 2020	20	70%	17-HCAA-00551
	Temporary causeway	July 18, 2020	6	September 13, 2020	14	100%	19-HCAA-01020
	East Breakwater	July 26, 2020	7	October 24, 2020	20	70%	17-HCAA-00551
	Laydown & Sealift Ramp	September 14, 2020	15	October 3, 2020	17	60%	17-HCAA-00551
	Float Pad	Not started				0%	17-HCAA-00551
Pile Driving	Fixed Wharf	July 8, 2020	6	October 7, 2020	18	70%	17-HCAA-00551
Dredging	SCH	August 19, 2020	11	September 28, 2020	17	15%	17-HCAA-00551

Activity	Component	Construction Status					Permit Design Percent Basis
		Start Date	Construction Week	Finish Date	Construction Week	% Complete	
Inner Harbour	SCH	Not started				0%	17-HCAA-00551
Gravel surfacing	SCH – Inner Harbour	Not started				0%	17-HCAA-00551
Floats and float strings	SCH – Inner Harbour	Materials on site. Construction not started				0%	17-HCAA-00551
Haul Road Construction	Haul Road Construction	No 2020 construction activity. Was largely complete in the 2019 construction				100%	17-HCAA-00551
Blasting, Drilling	Quarry	June 17, 2020	2	September 17, 2020	15	70%	17-HCAA-00551
Rock Crushing	Quarry	June 17, 2020	2	September 30, 2020	17	90%	17-HCAA-00551

## 2.2 Infill

Infill activity is one of the primary construction activities for the Pond Inlet SCH during the 2020 construction season.

The SCH is composed of the construction of two breakwaters, a fixed wharf, upgrades to an existing boat launch ramp, small craft floats, a sealift landing ramp, and a laydown area to be used for sealift storage, boat storage and parking (see Figure 1-2, Figure 1-3). 2020 construction included infill at the west breakwater, temporary causeway, east breakwater and laydown. Progress imagery is provided in Figure 2-2.

A photo panel to depict representative photos of SCH infill activity is provided in Photo 2-1.

### 2.2.1 Permanent Components

Infill for permanent components of the Pond Inlet SCH is permitted under FAA 17-HCAA-00551 (DFO 2020a).

#### 2.2.1.1 West breakwater

Infill activity at the west breakwater occurred intermittently from July 6 (Week 5) to October 24 (Week 20). Infill occurred mostly during 24-hour shifts, occurring in in-water tidal conditions.

#### 2.2.1.2 East Breakwater

Infill for the east breakwater occurred from July 26 (Week 7) to October 24 (Week 20). Prior to infill construction of the east breakwater, a temporary access was built from July 20 to 26 (Week 7) for trucks to drive to the east breakwater. Infill included placement of armour stones for slope protection, and general

infill to build out the breakwater core. Rocks from removal of the temporary causeway during dredging were frequently used for infill to make the core for east breakwater.

### 2.2.1.3 Laydown and Sealift ramp

Infill for the laydown and sealift occurred from September 14 (Week 15) to October 3 (Week 17). In most cases, sand from dredging activity was used to infill the laydown. There was no progress on the sealift ramp in the 2020 construction season; core material was partially installed in the 2018 season.

### 2.2.1.4 Float Pad

There was no progress on the float pad in the 2020 construction season. This will be completed during the 2021 construction season.

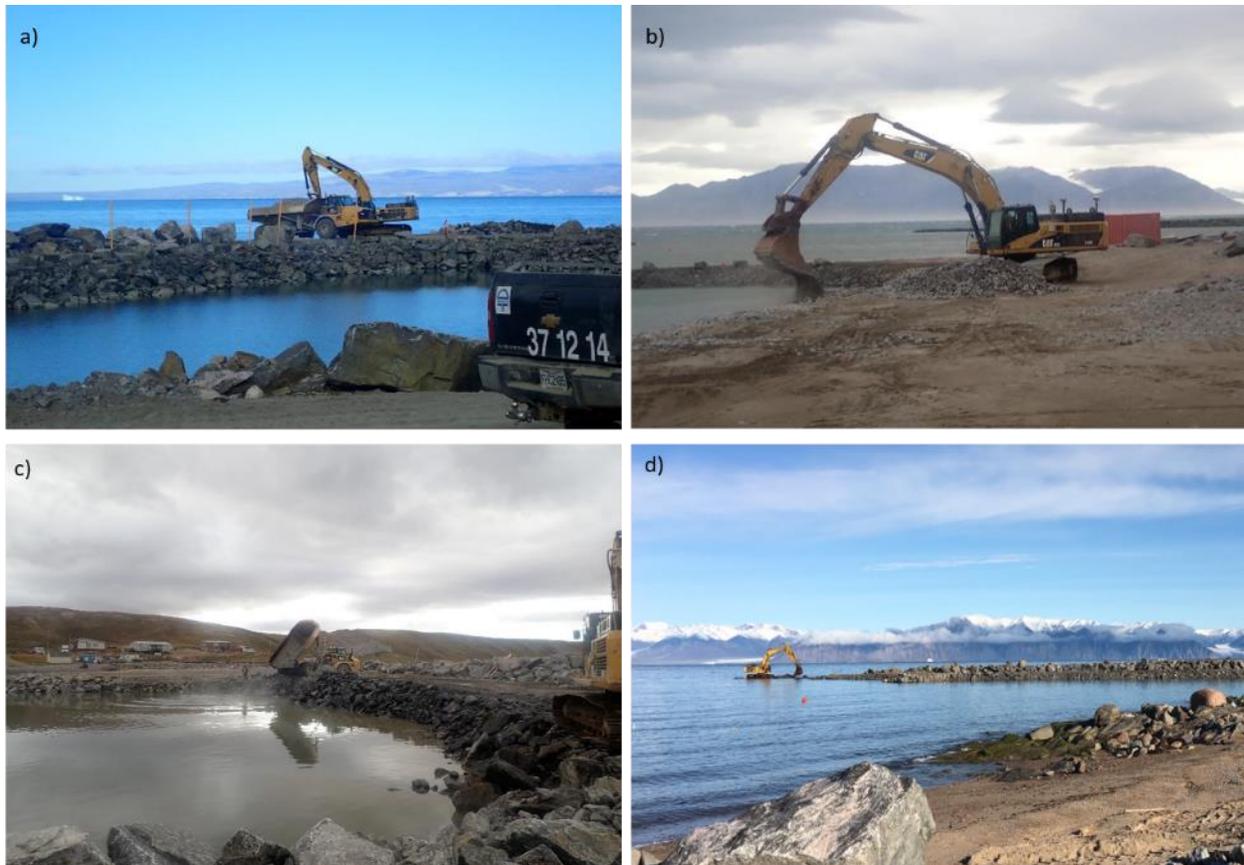


Photo 2-1 SCH – Representative Infill Construction – 2020 Construction Season: a) west breakwater, August 4 (Week 9); b) laydown, August 17 (Week 11); c) unloading removed fill from temporary causeway, August 19 (Week 11); d) east breakwater, September 2 (Week 13)

Source: a) to c) Advisian Engineering Photos, d) Respective Tower EM Weekly Photos

## 2.2.2 Temporary Components

Temporary infill at the causeway and fixed wharf are permitted under DFO FAA 19-HCAA-01020 (DFO 2020b). The temporary components are shown in Figure 2-2. The infill status at the end of 2020 construction is shown in Figure 2-3. Throughout the season, the temporary causeway expanded and retracted in size due to construction requirements for dredging and pile driving activities.

A photo panel to depict infill of temporary components is provided in Photo 2-2.

### 2.2.2.1 Temporary Causeway

The temporary causeway will be a maximum of 7,900 m<sup>2</sup> as described in the FAA application (Advisian 2019). As of the end of construction in 2020 (October 25) the temporary causeway is estimated to be 4,600 m<sup>2</sup> with portions already removed as part of the dredging works (see Figure 2-3). The temporary causeway is planned for full removal before the end of 2021 construction; the aggregate will be repurposed as infill for the west or east breakwater and or the sealift ramp laydown.

As the work progressed, the temporary causeway was differentiated into two components during construction discussions.

#### Causeway around fixed wharf

The temporary causeway around the fixed wharf was primarily in place by the end of the 2019 season. The causeway was built around the southern and eastern walls. In 2020, Tower proposed to add a section of the temporary causeway around the northern wall of the wharf and expand the width of the east of the wharf within the dredge footprint (see Figure 2-1). The request for this work was received by Advisian on July 17 (Week 6) (Tower 2020d). After communication between Advisian and Tower about additional information, Advisian responded on July 21 that the widening of the causeway is already permitted under the DFO FAA (19-HCAA-01020) (DFO 2019a); however, the addition of a new section on the northern wall of the wharf would require further communication with DFO.

Tower added the infill to extend the width of the eastern causeway on July 21 (Week 7). Tower did not proceed with adding a section along the northern wall. Advisian's understanding is the purpose of the request for additional infill to the temporary causeway was for crane access but Tower adapted its methodology to allow for pile driving from the centre of the fixed wharf instead of around the perimeter.

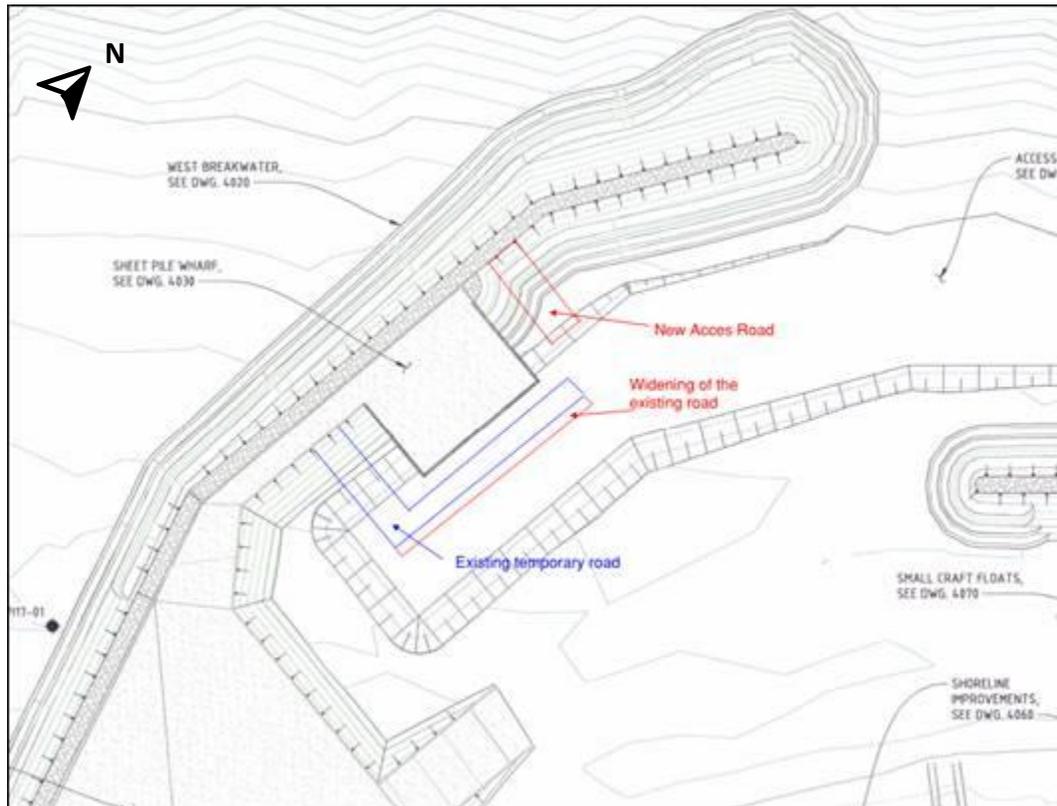


Figure 2-1 Tower Request for Expansion of the Temporary Causeway

Source: Tower (2020d), north arrow added by Advisian

### **Dredging causeway**

In 2019 the temporary dredging causeway was partially completed (Advisian 2020b). The dredging causeway was built out from July 18 (Week 6) to September 13 (Week 14) to allow dredging to commence in 2020. Once infill was completed, dredging started on the east end and working backwards, removing the temporary dredging arm as equipment moved westward. As dredging is not yet completed, part of the dredging causeway remains in place. Figure 2-3 shows the extent of the dredging causeway that remained in place at the end of the 2020 construction season.

#### **2.2.2.2 Enclosure of the Fixed Wharf**

On August 5 (Week 9), Tower proposed to close the area around the fixed wharf by infilling the remaining opening in order to prevent serious harm to fish during impact pile driving activities (Tower 2020e). Advisian engaged DFO the same day. On August 7, DFO advised that a *Fisheries Act* amendment was necessary and would include the footprint of the infill to close the gap between the temporary causeway arms and mitigation measures for fish salvage.

As per the amendment to the DFO FAA (19-HCAA-01020) (DFO 2020b), the enclosure of the fixed wharf will result in the temporary loss of the seabed fronting the fixed wharf (1,020 m<sup>2</sup> of fish habitat) until end of construction in 2021. As a component to the amendment to FAA 19-HCAA-01020, Tower was required to salvage fish from the enclosed wharf. Fish salvage is further described in Section 5.7.

Infill to enclose the small gap between the two temporary causeway extensions surrounding the fixed wharf was completed on October 3 (Week 17). The higher high water line (HHWL) for Pond Inlet is 2.5 m and the enclosure was topped to an elevation of only 1.8 m CD. On October 8 Tower raised the elevation to 2.1 m, which is still 0.4 m below the HHWL (Tower 2020f); see Photo 2-2, Panel C for depiction on October 3 (Week 17). GN-CGS and Advisian are awaiting information from Tower to describe what measures (if any) will be undertaken in 2021 to address the matter. In addition, Tower has been asked why the situation occurred given the predictability and knowledge of tide height.

### **2.2.2.3 Infill around Fixed Wharf**

Infill around the fixed wharf was proposed by Tower as “wharf winterizing” and consisted of backfilling around the sheet pile wall of the fixed wharf to support it (see Section 1.4.2 for permitting details). The temporary infill occurred on October 23 and 24, 2020. Type 1 and Type 2 fill was infilled on both the inner and outer sides of the sheet pile wall, leaving minimal water (described by Tower as a really small pool) in the enclosure until removal of the infill in the 2021 construction season.



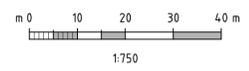
Photo 2-2 Development of Temporary Components – 2020 Construction Season: a) start of 2020 construction season, July 9 (Week 5); b) dredging causeway, September 30 (Week 17); c) water breaching the fixed wharf enclosure, October 3 (Week 17); d) subsequent elevation raise of enclosure, October 10 (Week 18); e) infill around fixed wharf, October 24 (Week 20); f) end of 2020 construction season, October 25 (Week 20)

Source: a) b) c) d) e) Advisian Engineering Photos, f) Respective Tower EM Weekly Photos



- LEGEND:**
- PSPC PARCEL BOUNDARY (LICENSE OF OPERATION)
  - - - HHWL: 2.5m CHART DATUM
  - - - HHWL PRE CONSTRUCTION: 2.5m CHART DATUM
  - - - LLWL PRE CONSTRUCTION: 0.2m CHART DATUM
  - - - LLWL: 0.2m CHART DATUM
  - TEMPORARY CAUSEWAY AROUND FIXED WHARF
  - TEMPORARY DREDGING CAUSEWAY
  - ENCLOSURE OF FIXED WHARF
  - INFILL AROUND FIXED WHARF

PLAN  
1:750



REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
A	26-JAN-21	ISSUED WITH REPORT	JLC	-	VBC	-	HGK	-		

D SHEET	SCALE	SHOWN	ENGINEERING AND PERMIT STAMPS (As Required)
			 <b>PRELIMINARY</b> DO NOT USE FOR CONSTRUCTION Last Saved: Jan. 27/21 2:56pm
WORLEYPARSONS PROJECT No			
307071-0114.8			

CUSTOMER

\*This drawing is prepared for the use of the contractual customer of Worley Canada Services Ltd. and Worley Canada Services Ltd. assumes no liability to any other party for any representations contained in this drawing.\*

**Advisian**  
Worley Group

**POND INLET SMALL CRAFT HARBOUR PROJECT  
GENERAL ARRANGEMENT  
DRONE IMAGERY  
OCTOBER 9, 2019**

DRG No	FIGURE 2-2	REV	A
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## 2.3 Inner Harbour

There was no construction activity associated with establishing the inner harbour in 2020. Establishment of the inner harbour will require completion of the east breakwater and removal of rocks and boulders from the seabed. Boulder removal will be limited by the equipment reach of land-based equipment as there is no marine equipment for the Project. Inner harbour construction is planned for completion in 2021.

## 2.4 Pile Driving

Pile driving occurred for construction of the fixed wharf from July 8 (Week 5) to October 7 (Week 18), over a 12-hour period. Pile driving was conducted using an impact hammer until a vibratory hammer was mobilized to site on August 28 (Week 12) and used for pile driving starting August 31 (Week 13). The vibratory hammer was demobilized from site on September 30 (Week 17), and the impact hammer was used one last time on October 7 (Week 18). The piles were not driven to their required depths in the 2020 season; this will be addressed during the 2021 construction season. Pile driving occurred as planned under the first FAA (17-HCAA-00551) (DFO 2018, 2019a). A representative photo for pile driving in the 2020 construction season is provided Photo 2-3.

Several non-compliance events and one adaptive management procedure occurred during pile driving and were reported to DFO (see Section 6.2 and 7.1.1).

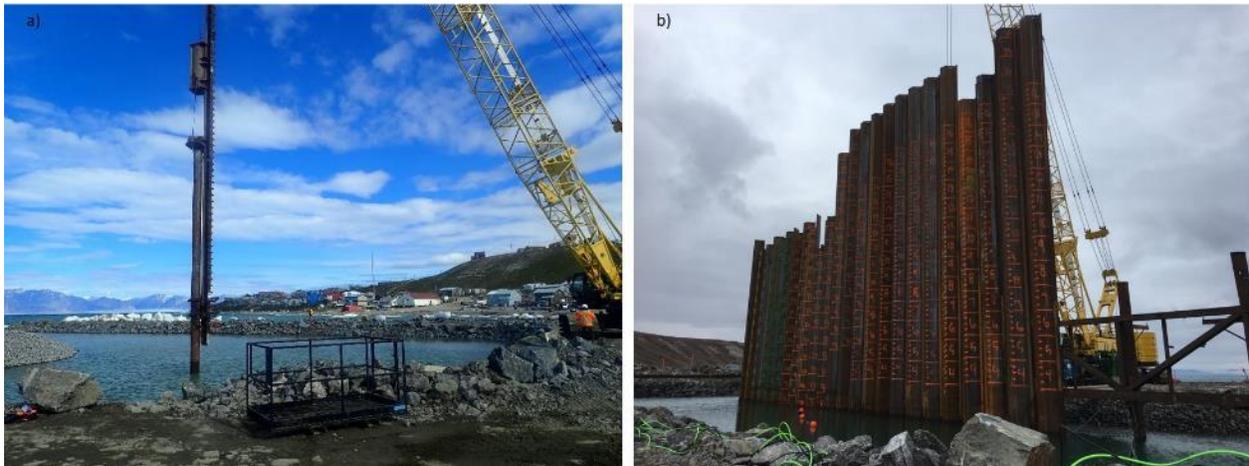


Photo 2-3 SCH - Representative Pile Driving Construction - 2020 Construction Season: a) Falsework Piles, July 8 (Week 5); b) Fixed Wharf, September 10 (Week 14)

Source: a) Advisian Engineering Photo, b) Respective Tower EM Weekly Photos

## 2.5 Dredging

Dredging occurred intermittently from August 19 (Week 11) to September 28 (Week 17), over periods of either 12- or 24h. Dredging occurred as planned under the first FAA (17-HCAA-00551) (DFO 2019a); however, discussions around compliance are currently ongoing due to the elevation of the dredging arm being below the HWL, which results in equipment reach issues and subsequently with the operation of equipment in water (see Section 7.1.1.5 for non-compliance details).

A representative photo panel for dredging in the 2020 construction season is provided in Photo 2-4.



Photo 2-4 SCH – Representative Dredging Activity – 2020 Construction Season: a) end of west breakwater, September 19 (Week 14); b) end of temporary causeway, September 30 (Week 17)

Source: a) Respective Tower EM Weekly Photos, b) Advisian Engineering Photo

## 2.6 Installation of Small Craft Floats

There was no construction activity associated with establishing the small craft floats in 2020. Activities associated with establishing the float system will require installation of a mooring system, floats and the transition structures to shore, which is planned for completion in 2021.

## 2.7 Gravel Surfacing

There has been no construction activity associated with gravel surfacing of the beach through the first three construction seasons. Gravel surfacing will be done in 2021, likely following the completion of the east breakwater.

## 2.8 Haul Road Construction

Construction of the haul road was completed in the 2018 construction season. Tower is responsible for maintenance and repair of the haul road during Project construction. A stability assessment of haul road culverts was conducted by Tower on June 8 (Week 1), 16 and 21 (Week 2). Erosion preventative measures were added to one water crossing and water quality monitoring was conducted on June 25 (Week 3) and July 2 (Week 4).

## 3 Supporting Construction Activities

Supporting activities that occurred upland to facilitate construction are described in this section. The majority of the supporting construction activities do not occur near the marine environment and do not have concerns for compliance with the FAAs. This information is provided to enable a complete description of Project construction. The exception to this is for some of the details discussed in Section 3.5.

### 3.1 Blasting

Throughout the 2020 construction season there were 17 blasts; the first on June 29 (Week 4) and the last on September 17 (Week 15). Blasting events occurred at 18:15, with the exception of two blasts during Week 9 that took place at 18:30. Blasts were advertised on social media and on the Tower website in advance of the blast. Blasting took place in the quarry, which is in excess of 5 km from the marine environment therefore there is no associated monitoring pertinent to the marine environment (see Figure 1-1). Representative photos of blast activity are provided in Photo 3-1.



Photo 3-1 Quarry – Representative Blast Activity - 2020 Construction Season: a) loading explosives, June 30 (Week 4); b) post blast, July 5 (Week 4); c) blast prep, August 7 (Week 9); d) blast prep, August 9 (Week 9)

Source: Advisian Engineering Photos

### 3.2 Drilling

Drilling was performed from June 29 (Week 4) to July 15 (Week 6). Drilling is being performed in the same area as the blasting.

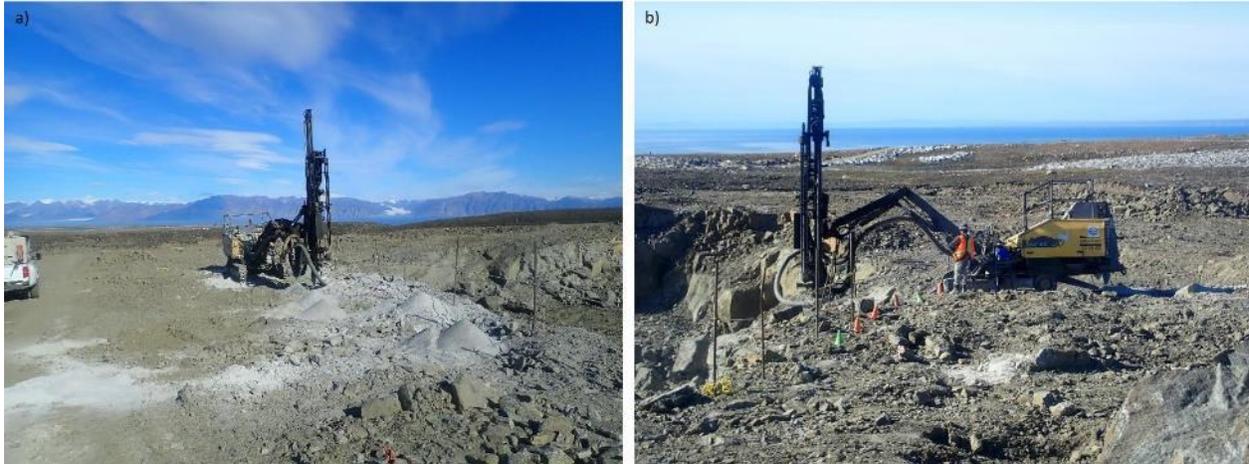


Photo 3-2 Representative Drilling Activity – 2020 Construction Season: a) August 9 (Week 9); b) August 11 (Week 10)

Source: Advisian Engineering Photos

### 3.3 Rock Crushing

Rock crushing occurred intermittently from June 17 (Week 2) to September 30 (Week 17), over a 12- or 24-hour schedule at the stockpile area. A demonstrative photo of rock crushing activity is provided in Photo 3-3.



*Photo 3-3 Rock Crushing Activity – 2020 Construction Season a) September 20 (Week 5)*

Source: Respective Tower EM Weekly Photos

### **3.4 Stockpiling**

The stockpiled material is being maintained primarily within the quarry and along the haul road closer to the work site, with some minor aggregate piles in the yard Laydown (Photo 3-4). The temporary stockpile area at the SCH consisted of Type 2 fill, armor stones and fines used for road maintenance in the yard laydown. It was small and was largely placed the same day it is hauled. The location of the quarry stockpile area is provided in Figure 3-1.



*Photo 3-4 Temporary Stockpile at the Laydown – 2020 Construction Season*

Source: Advisian Engineering Photo



Figure 3-1 Stockpiling Area for the Project

Source: Figure 8-2 of Tower (2020b)

## 3.5 Rock Transport

### 3.5.1 Haul road to SCH

The haul road was used throughout the construction season for hauling rocks from the quarry to the SCH. A demonstrative photo of the haul road and rock truck material delivery is provided in Photo 3-5.

### 3.5.2 SCH Foreshore

A temporary access road was constructed from July 20 to 26 (Week 7) to enable trucks to haul rock materials to the east breakwater. In order to enable construction of the road, Canadian Coast Guard (CCG) Emergency Response sea cans were moved to the south-east corner of the laydown yard. This was a non-compliance of the *Fisheries Act* as it resulted in a temporary infill below the HWL that was not described or permitted through the FAAs (17-HCAA-00551, 19-HCAA-01020). The intention of the infill was to provide a suitable flat area for the sea cans near the foreshore but not in the way of construction works (see Section 7.1.1.4 for non-compliance).



Photo 3-5 Representative Rock Truck Activity: a) rock truck loading in quarry, July 14 (Week 6); b) Unloading rock truck, July 18 (Week 6); c) unloading rock truck, July 31 (Week 8); d) front end loader maintaining haul road, August 3 (Week 9)

Source: Advisian Engineering Photos

## 3.6 Fuel Management

Fuel for the Project was provided through the use of Tower's own fuel truck. Diesel and gasoline were stored in a 500 L fuel storage tank within the laydown area. A fuel transfer secondary containment can be seen in Photo 3-6. This tank is well in excess of 31 m from the marine environment or a freshwater watercourse (see Figure 3-2). Tower has developed a Fueling Plan (Tower 2018b) as one of their Contractor Work Plans (CWPs) which identifies procedures and mitigation measures required for fuelling.

### 3.6.1 Land-Based

Land-based equipment fuelling was performed with the use of a fuel truck in a designated fuelling area near the maintenance garage. This area is well in excess of 31 m (>400 m) from the marine environment or a freshwater watercourse (see Figure 3-2).

### 3.6.2 Marine-Based

Mitigations relevant to fueling near the marine environment are in the CEMP (Tower 2018a) and were communicated to DFO in the first FAA Application (Advisian 2018b). Refueling of some equipment in close proximity to the marine environment is required. This is a standard construction activity requirement for activities occurring within the marine environment. Sufficient and standard mitigation measures are in place (e.g. secondary containment) to confirm that effects to the marine environment are minimized. However, there was a non-compliance of NIRB permit Condition 9 and of Tower’s own Fueling Plan (Tower 2018b) for not using appropriate measures while fueling, which resulted in a small spill near the marine environment (see Section 5.10, Table 5-6, Item 14 for discussion on the spill).



Figure 3-2 Dangerous Goods and Fuel Storage Area

Source: Figure 8-5 Tower (2020b)



Photo 3-6 Fuel Management – Laydown Fueling July 2 (Week 4)

Source: Respective Tower EM Weekly Photos

### 3.7 Spill Response

Tower developed a Spill Response Plan (SRP) as one of their CWP's (Tower 2018c).

Tower's sequence of events to be followed in the event there is a spill are outlined below:

1. Verify surrounding conditions and control the leak.
2. Containment of the spilled product.
3. Inform the supervisor.
4. Recover contaminated material.
5. File environmental/investigation report.

Four general spill response stations were established, with smaller kits available in all vehicles and equipment (see Figure 3-3). Spill reporting for the 2020 construction season are further described in Section 5.4.

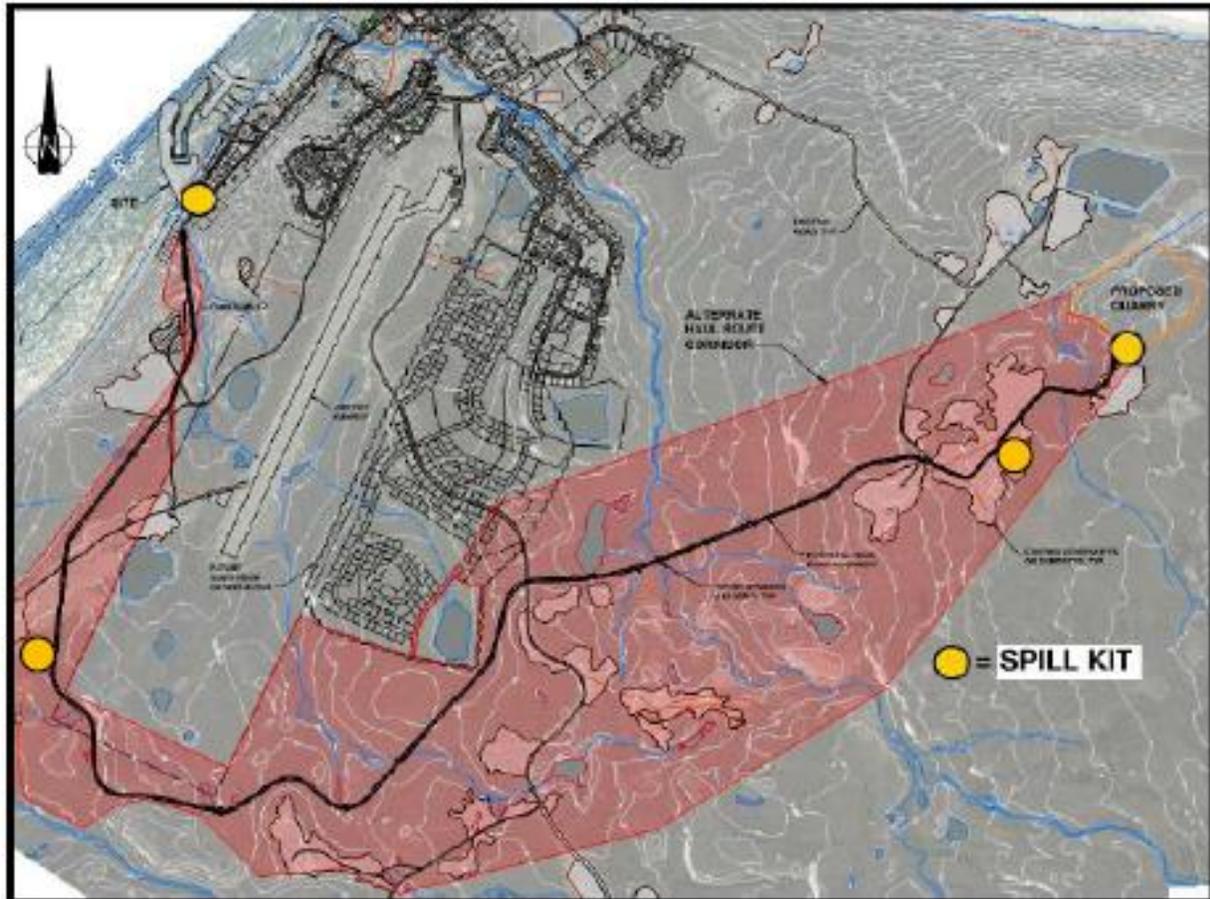


Figure 3-3 Spill Response Plan

Source: Taken from Appendix D of Tower (2018c)

### 3.8 Sealift Delivery

Certain key construction materials for the 2020 construction season arrived on site by sealift August 28, 2020 (Photo 3-7), including:

- Vibratory hammer
- Replacement excavator track

Storage of items delivered by sealift is within the contractor laydown area and on the landward portion of the SCH footprint above the HWL.



*Photo 3-7 Sealift Delivery of Construction Items: a) NEAS sealift barge unloading, August 28 (Week 12); b) NEAS and NSI sealifts, August 29 (Week 12)*

Source: Advisian Engineering Photos

### 3.9 Equipment

A summary of equipment used in the 2020 construction season is provided in Table 3-1.

Table 3-1 2020 Construction Equipment

Equipment Type	Number	Associated Activity
Light truck	6	Maintenance
Rock truck	5	Transport of rocks
Tower light	7	General construction
Generator	6	General construction
Excavator 345	3	Infill
Bulldozer	2	Infill
Compactor	1	Crushing
160 T crane (Kobelco – Yellow)	1	Dredging, pile driving
Sky lift track	1	Drilling, blasting, crushing
Front end loader	1	Drilling, blasting, crushing
Drill	1	Aggregate production
Telehandler	2	General construction
Crusher (primary) and screen	3	Aggregate production
Refuelling truck	1	General construction
Ammonium Nitrate and Fuel Oil (ANFO) truck	1	Drilling, blasting, crushing
Passenger bus	1	General construction

Source: Advisian Engineers

### 3.10 Dangerous Goods Storage

No dangerous goods (DGs) were received during the 2020 construction season. Tower is storing their DGs in the garage area and has a separate storage for the explosives. Locations of these storage areas is provided in Figure 3-4.

As per Tower’s Week 20 end of season (EOS) checklist, hazardous wastes will be shipped south for disposal as there are no approved facilities in Pond Inlet. This will occur the end of Project construction.



Figure 3-4 Tower’s Dangerous Goods Storage areas, Contractor Laydown and Haul Road to Quarry

Source: Figure 1-3 in Tower MP, Rev.5 Tower (2020a)

## 4 Construction Shutdown

The end of the 2020 construction season was October 25, 2020. The EM demobilized from the site on October 23, two days prior to completion of in-water works (Section 5.1). As stated in Tower’s Week 20 report, the engineer present on site conducted environmental monitoring tasks on October 24 and 25. However, no details on monitoring or construction shutdown during the final two days of construction have been provided to GN-CGS at the time of writing this report. Some photos provided for Week 20, the final construction week, are provided in Photo 4-1. Tower’s EOS checklist is provided in Appendix 2.



Photo 4-1 Winterization and site shut down: a) stockpile equipment, October 25 (Week 20); b) infill around fixed wharf, September 24 (Week 16); c) Quarry, October 22 (Week 20)

Source: Respective Tower EM Weekly Photos

## 5 Monitoring Summary

### 5.1 Environmental Monitoring

Environmental monitoring of the construction site is a contractual requirement from GN-CGS to Tower for the duration of in-water works. The contractual commitments from GN-CGS require that the EM be an ‘applied scientist or technologist who is registered and in good standing with an appropriate professional organization or shall have equivalent post-secondary education and experience’ and that the EM ‘has no other role on the contractor’s team other than the environmental monitoring’. This contractual requirement was not met when the EM demobilized from site two days prior to completion of in-water works and assigned an engineer to fulfill EM duties. Early demobilization resulted in a non-compliance of the MP and the Contract (Section 7.1.2.1).

Three EMs were on site throughout the 2020 construction season (Table 5-1), with Olivier Bédard-Richard assuming the role of Environmental Coordinator (EC), a non-contractual role developed by Tower. On-site EMs were provided by SNC Lavalin (SNC) as a sub-contract to Tower with the EMs reporting to the Tower EC. Advisian functions as the environmental inspector (EI) to oversee compliance requirements of Tower on behalf of GN-CGS. This role is undertaken by Victoria Burdett-Coutts, with support in 2020 from Petra Stastny, Niamh Ryan, Carmen Wu and Laura Borden. Charlotte Mougeot (SRM Consulting) functions as a regulatory advisor to GN-CGS to further confirm regulatory compliance requirements.

The construction activities as describe in Section 2 and 3 relative to the types of monitoring that were required are summarized in Table 5-2 with summaries for each monitoring type provided in this section. Methodology carried out by Tower for each of the monitoring types can be observed in the respective section of the MP (Tower 2020b).

Table 5-1 The Project Environmental Personnel

Name	Organization	Role
Olivier Bédard-Richard	Tower	Environmental Coordinator
Louis Simon Banville		Environmental Monitor
Sara Dubosq		Environmental Monitor
Emma Charbonneau		Environmental Monitor
Victoria Burdett-Coutts	Advisian	Environmental Inspector
Petra Stastny		Environmental Inspector Support
Carmen Wu		Environmental Inspector Support
Laura Borden		Environmental Inspector Support
Charlotte Mougeot	SRM Consulting	Regulatory Advisor

Table 5-2 2020 Monitoring Requirements for Construction Activities in Pond Inlet

Construction activity	General	Turbidity	MMO	Acoustic (Fish)	Acoustic (Marine Mammal)	Sediment and Erosion Control	Dust Control
Infill	Y	Y	Y	N	N	N	N
Pile driving	Y	N	Y	Y	Y	N	N
Dredging	Y	Y	Y	N	N	N	N
Blasting	Y	N	N	N	N	N	Y
Drilling	Y	N	N	N	N	N	Y
Rock Crushing	Y	N	N	N	N	Y	Y
Stockpiling	Y	N	N	N	N	Y	Y
Fuel Management	Y	N	N	N	N	N	N
Spill Response	Y	N	N	N	N	N	N
Rock/Sediment Transport	Y	N	N	N	N	Y	Y

## 5.2 Construction Site

The construction site facilities were kept in a tidy condition by Tower throughout the construction year. This is evidenced by the 2020 construction season photos from the Tower EMs, and the Advisian construction contract management.

## 5.3 Equipment Inspections

Equipment is required to be routinely inspected for leaks, cracked hoses and other conditions that may result in spills (Tower 2020b). Equipment was inspected and documented upon arrival on site, and periodically throughout the construction season as indicated in Tower weekly reports. However, inspection details and maintenance records were not provided to GN-CGS, despite multiple requests due to the high frequency of spills reported throughout the 2020 construction season (see Section 5.9). Further to this, Tower has stated their adaptive management for the use of equipment in-water is an enhanced inspection program. The operation of equipment in-water is currently under discussion and is considered a non-compliance or at least not best practice (see Section 7.1.1.5). Operation of equipment in and near the marine environment heightens the need to ensure equipment are routinely inspected and spills in the marine environment are mitigated effectively.

## 5.4 Turbidity

Turbidity monitoring was carried out for the construction activities as outlined in Table 5-2. As recommended in the CEMP (Tower 2018a) and as per Tower's MP Rev 9 (Tower 2020c), the EM is to conduct a compliance monitoring campaign at the beginning of each new construction activity and visual monitoring of turbidity plumes thereafter until they exceed the compliance distance of 100 m from the

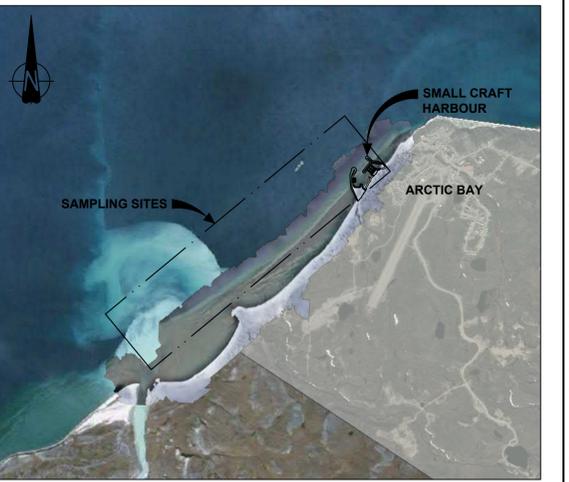
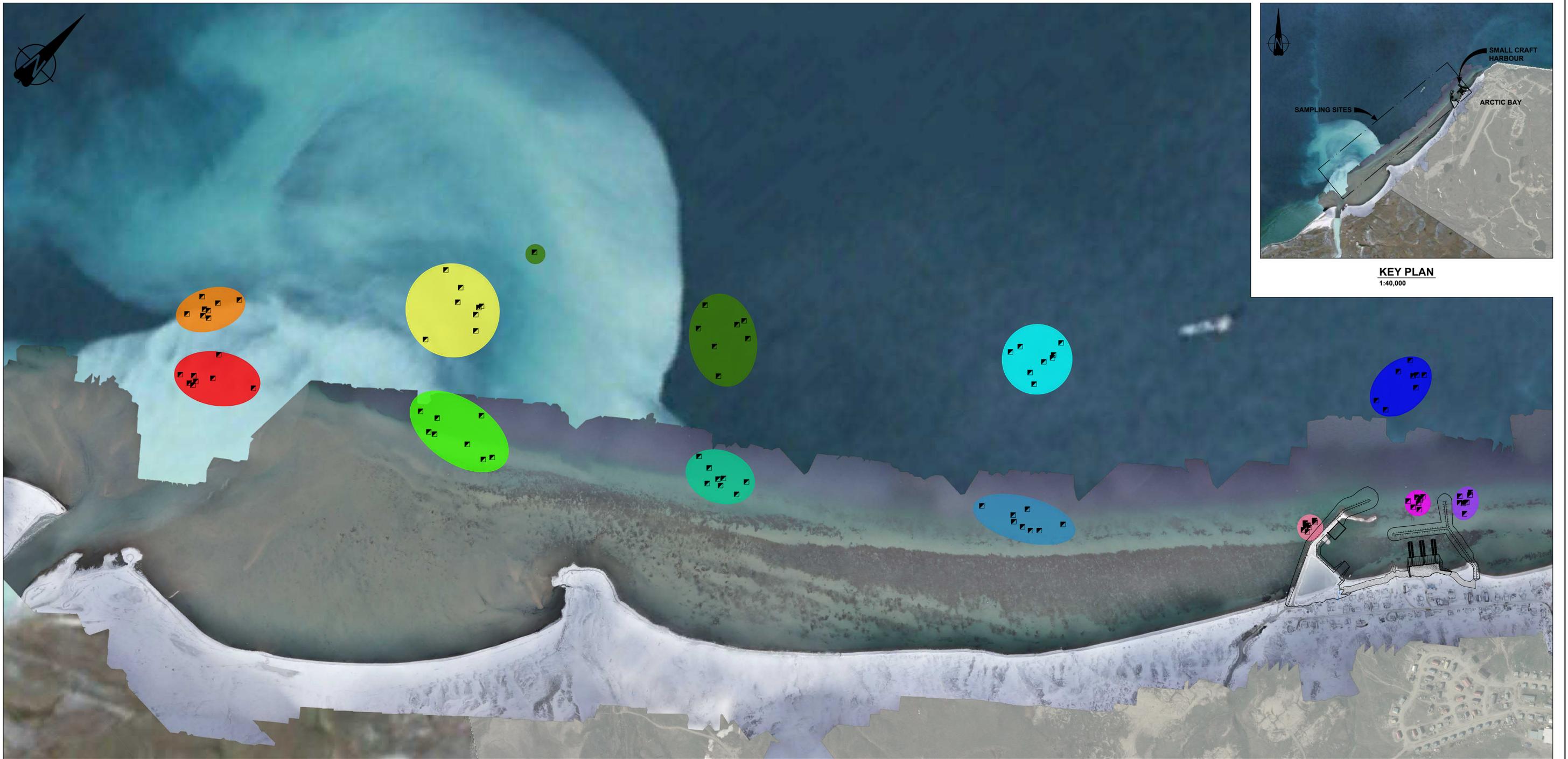
construction activity. Weekly confirmatory sampling and additional background sampling were included in the modified method for turbidity monitoring, which was accepted on September 23 (Week 17) (Advisian 2020h); turbidity monitoring prior to this date was carried out in accordance with Tower's MP Rev 8 (see Section 1.3 of Tower (2020b)).

When conducting compliance monitoring, turbidity NTUs need to be compared between 'impacted' and 'background' sites relative to the Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines (WQG) for the protection of aquatic life (CCME 1999) as detailed below.

- Clear flow – Turbidity (nephelometric unit [NTU]) Allowance Over Background ("Induced" Turbidity): maximum increase of 8 NTU from background levels for a short-term exposure (e.g. 24-hour period). Maximum average increase of 2 NTU from background levels for a longer-term exposure (e.g. 30-day period).
- High flow or turbid waters – Turbidity (NTU) Allowance Over Background ("Induced" Turbidity): maximum increase of 8 NTUs from background levels at any one time when background levels are between 8 and 80 NTUs. Should not increase more than 10% of background levels when background is > 80 NTUs.

The Salmon River, an important anadromous Arctic char river, is approximately 5 km west of the SCH, and is a source of naturally highly turbid water depending on the tide and current (Photo 5-1). As informed by Tower's weekly EM reports, there were several instances during Week 13 and Week 14 when turbidity generated by the Salmon River coincided with plumes generated by construction activity. As a result, it was sometimes difficult for the Tower EM to distinguish construction turbidity from natural turbidity. However, it is Advisian's opinion that with effective background sampling the runoff from the Salmon River should not hinder accurate compliance sampling during construction-generated plumes. This is because CCME guidance is based on thresholds relative to background. To better understand the turbidity effects of the Salmon River, Advisian undertook a three-day turbidity monitoring program from September 29 to October 3 (Week 17). There were 12 sites selected from the mouth of the Salmon River to immediately east of the SCH (see Figure 5-1). Sampling at each site was performed and repeated eight times to capture differences in turbidity over different tidal regimes. A summary of the Salmon River turbidity monitoring program will be provided to DFO in separate document.

Due to ongoing concerns regarding turbidity monitoring during the 2020 construction season and multiple exceedance events, adaptive management was implemented with a revision to the turbidity section of the MP during the construction season (see Section 6.1).



**KEY PLAN**  
1:40,000

**PLAN**  
1:5000

**LEGEND:**

- SITE 1
- SITE 2
- SITE 3
- SITE 4
- SITE 5
- SITE 6
- SITE 7
- SITE 8
- SITE 9
- SITE 10
- SITE 11
- SITE 12
- SAMPLING LOCATION

**NOTES:**

1. DRONE IMAGERY DATED, OCTOBER 2019.

REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	QAR	REF DRAWING No	REFERENCE DRAWING TITLE
A	29-JAN-21	ISSUED WITH REPORT	JLC	-	VBC	-	RJC	-		

D SHEET SCALE SHOWN

**Oneway**  
to zero harm

WORLEY PROJECT No  
307071-0114.8

ENGINEERING AND PERMIT STAMPS (As Required)

**PRELIMINARY**

DO NOT USE FOR CONSTRUCTION

Last Saved: Jan. 29/21 10:19am

CUSTOMER



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Building Nunavut Together  
Nunavutluuqatiginginiq  
Bâtir le Nunavut ensemble

"This drawing is prepared for the use of the contractual customer of Worley Canada Services Ltd. and Worley Canada Services Ltd. assumes no liability to any other party for any representations contained in this drawing."

**Advisian**  
Worley Group

POND INLET MARINE INFRASTRUCTURE  
TURBIDITY MONITORING PROGRAM  
SITES

DRG No

FIGURE 5-1

REV  
A

### 5.4.1 Visual

Turbidity plumes due to construction when observed varied between 20 m and 210 m and lasted between 1 hour to <7 hours. Construction activities that resulted in turbidity plumes were either infill or dredging. While both activities occurred on a 24 hour schedule, the EM was present to monitor turbidity for all activities with the exception of October 21 (Week 20) when dismantling of the dredging access occurred during the night and no EM was on site to monitor for turbidity. It has generally been accepted that compliance monitoring for turbidity can only be performed in the day shift. A non-compliance event occurred when no monitoring was conducted during infill operations on October 7 (Week 18) due to the EM prioritizing acoustic monitoring for pile driving activities (Section 7.1.2.2).

A photo of representative turbidity plumes during in-water construction at the SCH is provided in Photo 5-2.



*Photo 5-1 Turbidity Plume generated by the Salmon River July 31, 2020 (Week 8)*

Source: Advisian Engineering Photo

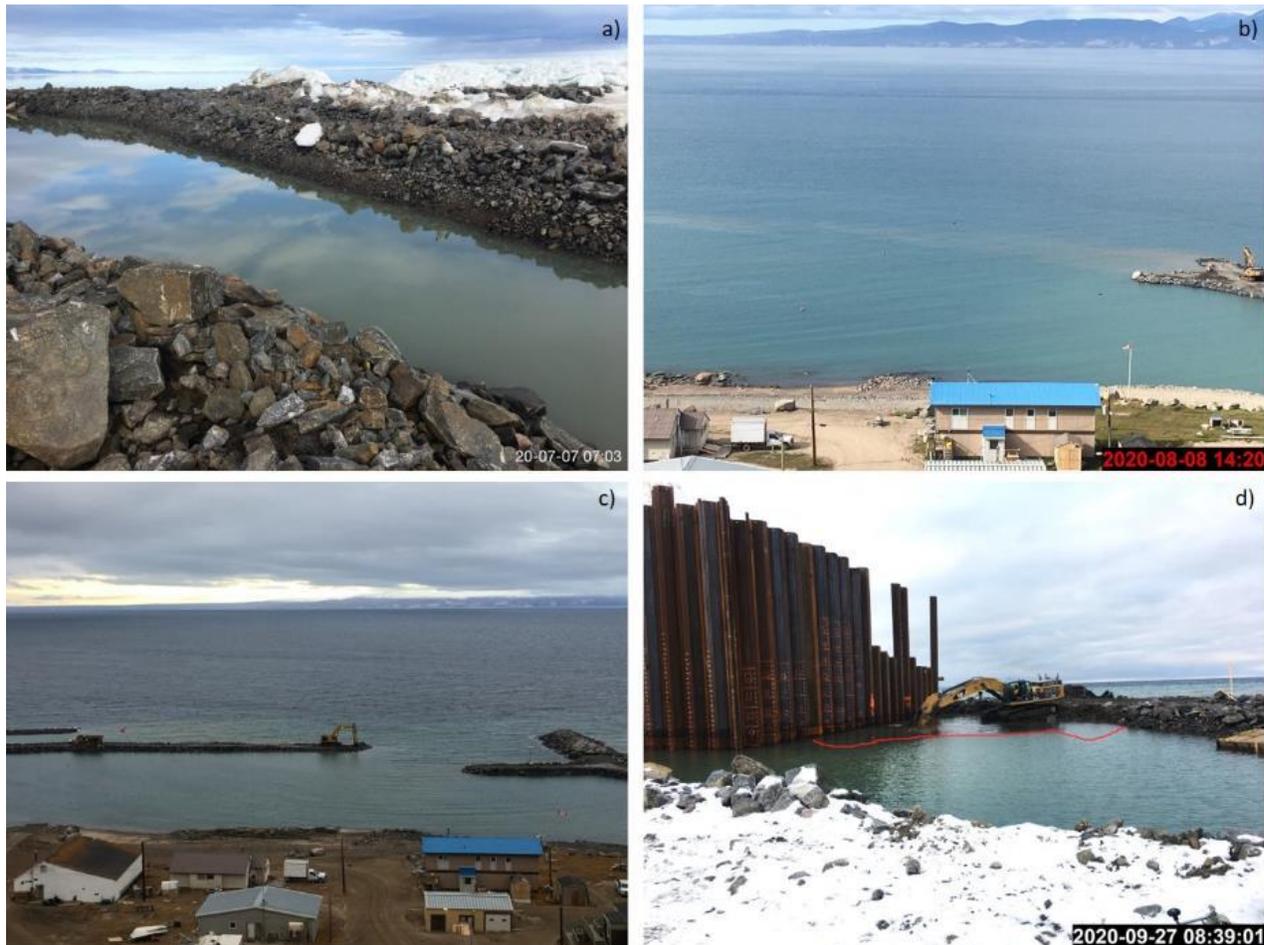


Photo 5-2 Representative Turbidity Plume Photos – 2020 Construction Season: a) SCH in-water infill plume, July 6 (Week 5); b) east breakwater in-water infill plume, September 16 (Week 15); c) west breakwater plume, September 16 (Week 15); d) fixed wharf infill plume, September 27 (Week 16)

Source: Respective Tower EM Weekly Photos

## 5.4.2 Compliance

There were 27 compliance campaign events conducted throughout the 2020 construction season from July 6 (Week 5) to October 4 (Week 17). During compliance monitoring events there were an average of five compliance samples collected 30-100 m down-current of the construction activity and an average of two background samples collected 25 m up-current. Samples were collected over the course of each day as tidal conditions changed.

As per Tower's reporting there were two exceedance events. The first occurred in July 13 (Week 6), when an increase of 48.8 NTU was recorded. It was Tower's opinion that this was due to high variability of natural turbidity generated by the Salmon River. Background sampling on July 14 showed that turbidity ranged from 8.1 NTU to 81.1 NTU over a two-hour period, potentially explaining the exceedance during in-water infill on July 13. A second exceedance of 14 NTU was recorded on August 8 (Week 9) at 30m downstream of the construction activity, however sampling at 80 m down-current of the plume was

compliant. As per the MP (Tower 2020b), compliance monitoring samples are to be collected 100 m down-current of construction activity, thus no non-compliance was reported due to initial sampling distance and subsequent compliant sample further down-current.

To establish natural variability, background sampling was conducted on July 29 (Week 8) and September 23 (Week 16) when no construction activities were occurring. Turbidity ranged from 0.59 NTU to 49.8 NTU, with turbidity highest at the water’s surface.

Compliance monitoring was not performed as frequently as discussed in the revised turbidity plan (Section 6.1) due to the focus on overpressure monitoring. Improvements to turbidity monitoring for the 2021 construction season are discussed in Section 5.12.

Turbidity compliance monitoring results have been requested from Tower in the EOS checklist (Commitment No. 157, see Appendix 3) but have not been provided at the time of this report. Individual turbidity reports can be provided upon request (see Appendix 5 for demonstrative turbidity report).

## 5.5 Marine Mammal Observations

Marine Mammal Observations for construction were carried out for the construction activities as outlined in Table 5-2. MMOs were either the EM, dedicated MMOs or equipment operators, which was determined by construction activity (see Table 5-3). As per Condition 31 of the GN’s NIRB permit, the dedicated MMOs were locally available people and are familiar with local species. The Tower EM trained the dedicated MMOs in procedures to be followed when marine mammals were observed in proximity to the construction site (see Appendix 3 of Tower (2020b)). Observations of marine mammals are provided in Table 5-4, which was informed by the Tower weekly reports.

The location of the MMOs relative to each construction activity can be found in Section 7.2.2 of the MP (Tower 2020b).

### 5.5.1 Exclusion Zones

EZs are required to minimize negative effects to marine mammals and the distances used for the Project as summarized from the MP (Tower 2020b) are provided in Table 5-3.

There were no marine mammals within the construction EZs during active construction work, as per Tower’s EM weekly reports (see Table 5-4).

Table 5-3 Marine Mammal Observer and Exclusion Zone Size by Construction Activity Type

Category	Activity Type			
	In-water Infill	Out-of-Water Infill	Dredging	Pile Driving
Exclusion Zone (EZ) (m)	20	10	20	500 m (adapted as per acoustic program)
MMO	Equipment operator	Equipment operator	Dedicated MMO	Dedicated MMO

Source: Table 7-2 in Tower (2020b)

## 5.5.2 Infill and Dredging

Infill and dredging activities were performed and monitored by the MMO concurrently due to their close proximity and the use of dredge material for infill. As informed by Tower weekly reports, there were five marine mammal observations during in-water infill/dredging activities from October 1 to 4 (Week 17) (see Table 5-4). In each instance, there were 10 to 20 harp seals observed no closer than 25 m from the work site, thus outside the EZ for that activity.

## 5.5.3 Pile Driving

There were 14 observations of marine mammals during pile driving activities. Species observed included ring seals, bearded seals, narwhals and killer whales. For all observations, species were observed either outside the EZ or within the exclusion zone but at a time when no pile driving was occurring.

Table 5-4 Tower's Annual Summary of Marine Mammal Sightings

Week #	Date	Activity	Duration of observation (minutes)	Observed species	Distance from the work area (m)	EZ (Size)	# of species observed	Comment on animal (s) behaviour
7	23-Jul-20	sheet pile driving (inactive)	4	Ring seal	70	500	1	Normal, passing by
7	23-Jul-20	sheet pile driving (inactive)	2	Ring seal	30	500	1	Normal, passing by
13	4-Sep-20	Pile driving (inactive)	1	Bearded seal	100	500	1	Escaping narwhals
13	4-Sep-20	Pile driving (inactive)	10	Narwhals	400	500	2 groups	Escaping orcas
13	4-Sep-20	Pile driving (inactive)	5	Orca	300	500	1 group	Escaping boats
13	4-Sep-20	Pile driving (inactive)	2	Narwhals	500	500	1 group	Escaping boats
13	5-Sep-20	Pile driving (inactive)	1	Bearded seal	500	500	1	Normal
13	5-Sep-20	Pile driving (inactive)	2	Bearded seal	100	500	1	Normal

Week #	Date	Activity	Duration of observation (minutes)	Observed species	Distance from the work area (m)	EZ (Size)	# of species observed	Comment on animal (s) behaviour
13	5-Sep-20	Pile driving (inactive)	1	Seal	900	500	1	Normal
14	13-Sep-20	pile driving	11:12	Narwhals	2000	500	1 group	Normal
15	15-Sep-20	pile driving (inactive)	2	Ring seal	150	500	1	Normal
15	15-Sep-20	pile driving (inactive)	1	Ring seal	400	500	1 group	Normal
15	15-Sep-20	pile driving (inactive)	2	Ring seal	250	500	1 group	Normal
15	18-Sep-20	pile driving (inactive)	2	Ring seal	400	500	1 group	Normal
16	26-Sep-20	pile driving	na	Narwhals	200	20	~10	Escaping killer whale (information from locals)
17	1-Oct-20	in water infill/dredging	6 hours	harp seal	never <40 m east from east breakwater	20	~10	Normal, passing by
17	2-Oct-20	in water infill/dredging	6 hours 12 minutes	harp seal	never <25 m north from work	20	15-20	Normal, passing by
17	2-Oct-20	in water infill/dredging	1 hour 32 minutes	harp seal	never <60 m north from the work	20	10 to 12	Normal, passing by
17	3-Oct-20	in water infill/dredging	na	harp seal	never <80 m east	20	na	Normal, feeding
17	4-Oct-20	in water infill/dredging	na	harp seal	> 100 m north	20	15	Normal, feeding

Source: Tower EM Weekly Reports

## 5.6 Pile Driving

A summary of pile driving activity is provided in Section 2.4 with a summary of monitoring details obtained from Tower's EM weekly reports provided below. During the 2020 construction season there were no underwater sound exceedances (marine mammals, 160 dB re 1  $\mu$ Pa rms threshold, Condition No. 2.2.1.2), however there were five overpressure exceedances (fish, 30 kPa threshold, Condition No 2.2.1.2) for DFO FAA permits 17-HCAA-00551 and 19-HCAA-01020.

Non-compliances are discussed in Section 7.1.1, and adaptive management that resulted from discussions with DFO are discussed in Section 6.2.

### 5.6.1 Soft Start

Soft start measures for impact hammer pile driving were used during the 2020 construction season to install the piles. As per the MP (Tower 2020b) soft start procedures are implemented slowly over a 10-minute period to ensure marine mammals and fish has enough time to leave the area. Soft start procedures were implemented every time work was interrupted for at least 30 minutes and at the start of each day.

### 5.6.2 Marine Mammals

#### 5.6.2.1 Visual

Summarized in Section 5.5.3.

#### 5.6.2.2 Acoustics – Underwater Sound

Acoustic monitoring began on July 8 (Week 5) during the first day of sheet pile driving. The driving of sheet piles and circular piles were considered distinct activities. There were four monitoring events throughout the 2020 construction season. Peak underwater sound levels during sheet pile driving were 132.77 to 153.34dB re 1  $\mu$ Pa rms. Three days of monitoring were conducted for circular pile driving, with a peak recording of 155.1 dB re 1  $\mu$ Pa rms. Tower did not report baseline acoustic sound conditions nor did they identify the time pile driving occurred. The majority of acoustic data files have been provided with the exception of Week 6. When time is recorded, it is relatively easy to extract baseline conditions from data files.

### 5.6.3 Fish

#### 5.6.3.1 Visual

There were no observations of dead or injured fish during pile activity.

#### 5.6.3.2 Acoustics – Overpressure

Overpressure acoustic monitoring associated with pile driving activity began on July 10 (Week 5), during circular pile driving. The driving of sheet piles and circular piles were considered distinct activities. There were 19 monitoring events throughout the 2020 construction season, which included 23 days of pile driving.

Five exceedances of FAA Condition 2.2.1.2 were recorded on July 22 (Week 7), with a peak recording of 37 kPa. Adaptive management was implemented on July 22 (Section 6.2) and a total of three non-compliance events were reported to DFO (Section 7.1.1)

Acoustic compliance monitoring results have been requested from Tower in the EOS checklist (Appendix 3) but have not been provided at the time of this report. Individual acoustic reports can be provided upon request (see Appendix 6 for demonstrative acoustic report).

Table 5-5 *Hydrophone Monitoring Duration*

Activity	Overpressure Hydrophone Recording Period
Impact driving of 406 mm circular piles	Continuous
Impact driving of sheet piles	Continuous

Source: Tower MP, Table 7-2 (Tower 2020b)

## 5.7 Fish Salvage

As a component to the amendment to FAA 19-HCAA-01020 (Section 1.4.2) Tower was required to salvage fish from the enclosure of the fixed wharf (Section 2.2.2.2). The Pond Inlet community was notified of the requirement to salvage fish (See Figure 5-2). Four community members were employed to fish the enclosure and provide their opinion on the presence of fish. Fish were salvaged on October 3, 4 (Week 17) and October 8 (Week 18). The third day of salvaging was added due to only a half day of salvaging completed on October 3, as well as issues concerning elevation of the infill relative to the HHWL that were addressed on October 8 (see Section 2.2.2.2). On October 4 and 8 (Weeks 17, 18), having caught zero fish, all fishers indicated they believe there were no fish remaining in the enclosure.

**Pond Inlet Marine Infrastructure Project-Tower Arctic**  
October 3 at 7:14 AM · 🌐

**Public Notice - Enclosure of the Wharf Area**

Take note that the area around the wharf will be closed today to reduce the risk of causing adverse effects on fish.

Once closed, two days will be spent to remove the remaining fish. Arctic Char and Arctic Sculpin are expected to potentially be in this area. The method chosen is to fish in the enclosure with rods and reels for a minimum of 2 consecutive days. Any live captures will be released outside of the enclosure.

For more information please meet the project manager at Tower Arctic Office (blue seacan) near the West breakwater.

Tower Arctic Team

2 Likes      8 Shares

Like      Comment      Share

Write a comment...

Figure 5-2 Community Notice for Fish Salvaging and Wharf Enclosure

Source: Tower Week 18 EM Report

## 5.8 Sediment and Erosion Control

Sediment and erosion control (SEC) is required in monitoring of culverts of the haul road, however this did not take place near fish bearing watercourses or waterbodies. Therefore, no SEC measures were implemented during the 2020 construction season for the protection of fish habitat.

## **5.9 Dust Suppression**

There was no record of dust suppression in the weekly reports during construction. However, as stated in the MP (Tower 2020b), the EM is required to visually monitor dust produced during rock transport along the haul road, which is presumed to have occurred. As this activity took place away from the marine environment and fish bearing water courses, this is not relevant to the mandate of DFO.

## **5.10 Spill Reporting**

A summary of spills reported by Tower throughout the 2020 construction season is provided in Table 5-6. Spill reports were developed and submitted to the GN – Department of Environment (DoE) and to GN-CGS once they were observed and noticed. Timelines on spill reporting was immediate.

The high frequency of spill occurrence was discussed between GN-CGS, Advisian and Tower during the 2020 construction season and a request by GN-CGS for equipment inspection records was sent to Tower on August 10 (Week 10) (GN-CGS 2020) to confirm that inspections were happening as required. However, Tower did not provide inspection records, instead outlining the cause of the 15 spills that occurred in Pond Inlet up to August 27, 2020. Tower outlined intentions to reduce spill frequency by highlighting required spill prevention measures during construction toolbox meetings.

Table 5-6 Spill Reporting

Year	Occurrence No.	Construction Week	Date	Location	Spill Report No.	Summary	Spill Tray Used During Operations?	Corrective Action
2019	1	1	October 8, 2019	Quarry	19-414	Approximately 5 L of hydraulic fluid leaked from an excavator (Komatsu 650) due to a failure in the seal to the hydraulic line.		<p>Absorbent pads were placed on the ground under the leak. The mechanical team was notified and immediately began repairs.</p> <p>On inspection, only half of the spilled volume was on the ground, with the remaining half on the engine surface and absorbent pads. The excavator was cleaned and moved from the spill site.</p> <p>The contaminated soil and absorbent pads were removed to a Quatrex bag and stored at the laydown area.</p>
2020	1	4	July 2, 2020	Garage	2020-202	3L of hydraulic oil was noted on the ground beneath a rock truck due to an issue with the fitting seal on the hydraulic hose.	Not stated in report	<p>Absorbent sheets were placed under the leak immediately upon notice of the leak.</p> <p>The truck 'will be' cleaned, moved, and the contaminated soils to be recovered using a shovel.</p> <p>The contaminated soil and absorbent sheets 'will be' stored at the maintenance laydown inside of a Quatrex bag.</p>

Year	Occurrence No.	Construction Week	Date	Location	Spill Report No.	Summary	Spill Tray Used During Operations?	Corrective Action
	2	4	Unknown occurrence date. Date of report is July 3, 2020	SCH	2020-203	1L of hydrocarbon was observed as stains on nearby rocks near the generator	Not stated in report	Sheets were placed inside the generator and monitoring will be done to identify an origin. Absorbent sheets were used to clean the pool.  Stained rocks will be shoveled and stored at the maintenance laydown inside a Quatrex bag along with the absorbent sheets.
	3	6	July 16, 2020	Stockpile	2020-222	40L of hydraulic oil was leaking from the hydraulic hose of a Komatsu 650 (approximately 5 m <sup>2</sup> of contaminated area)	Not stated in report	Absorbent sheets were placed under the leak immediately. Truck will be cleaned and moved, and the contaminated soils will be recovered using a shovel.  Absorbent sheets and contaminated soils will be stored at the maintenance laydown inside a Quatrex bag.
	4	6	July 17, 2020	Stockpile	2020-223	30L of hydraulic oil was leaking from the hydraulic hose of the quarry drill 7702 on the side of the boom (approximately 6 m <sup>2</sup> of contaminated area)	Not stated in report	Absorbent sheets were placed under the leak immediately. Once the drill was repaired, it was cleaned and moved, and the contaminated soils will be recovered using a shovel.  Absorbent sheets and contaminated soils will be stored at the maintenance laydown inside a Quatrex bag.

Year	Occurrence No.	Construction Week	Date	Location	Spill Report No.	Summary	Spill Tray Used During Operations?	Corrective Action
	5	8	July 30, 2020	Quarry	20-20247	0.3L of fuel was spilled from the spout of a safety can due to mishandling of can.	Not stated in report	Contaminated soil was recovered and stored at the maintenance laydown inside a Quatrex bag. The contaminated soil will be shipped at a registered receiver during the demobilization process.
	6	9	August 6, 2020	Haul Road	20-20261	Unknown amounts (later verified as 120L) of hydraulic oil leaked from a hydraulic hose breakage on the rock truck over 550m of the haul road. The spill started close from the creek located at these coordinates: 72°40'45.47"N, 77°59'26.63"W.	Not stated in report	Absorbent sheets and spill trays were placed under the truck, and adsorbents were placed to recover the spilled oil on the water of the creek.  The truck must be moved to know the quantity of spilled oil, but must be repaired first.
	7	9	August 7, 2020	Stockpile	20-20263	2L of hydraulic oil was spilled due to mishandling during O-ring maintenance on an excavator	Yes	Contaminated soil was recovered
	8	9	August 7, 2020	Stockpile	20-20264	0.1L of hydraulic oil leaked from a hose in the crusher.	Not stated in report	Absorbent sheets were placed under the crusher. Contaminated soil was recovered.
	9	9	August 7, 2020	Laydown	20-20266	5L of diesel was spilled during refuelling of the welder.	Not stated in report	All contaminated soil was collected.

Year	Occurrence No.	Construction Week	Date	Location	Spill Report No.	Summary	Spill Tray Used During Operations?	Corrective Action
	10	10	August 10, 2020	Quarry	20-20274	2L of hydraulic oil was spilled from the excavator during maintenance of an O-ring.	No	Absorbent pad layers were in place. All contaminated soil was removed.
	11	10	August 15, 2020	Quarry	20-20277	10L of hydraulic oil was spilled from the excavator due to a disconnected hose during maintenance.	Not stated in report	Absorbent sheets were placed to collect the oil and all contaminated soil has been removed.
	12	11	August 20, 2020	SeaCan at stockpile area, West access road around quarry	20-20281	5L of fuel was spilled. Multiple small spills were detected, but unknown source. Likely due to one pickup truck but investigations are ongoing to identify the vehicle.	Not stated in report	The contaminated soil which is a mix of sediments and rocks was totally recovered using the proper equipment. Some pickups had a maintenance in the past week and as we didn't find any with leaking issue yesterday, we assume that it was older spills that weren't spotted when it happened.
	13	11	August 22, 2020	Stockpile	20-20283	1L of fuel was spilled during refuelling of a truck.	Not stated in report	Contaminated soil was recovered and disposed in the proper area.
	14	14	September 8, 2020	Laydown at East Breakwater	20-20317	0.9L of fuel was spilled due to mishandling of a fueling gun during refueling.	Not stated in report	Contaminated soil and rocks were recovered and stored in Quatrex bags in the maintenance laydown area.  Contaminated soil will be shipped at a registered receiver during demobilization processes.

Year	Occurrence No.	Construction Week	Date	Location	Spill Report No.	Summary	Spill Tray Used During Operations?	Corrective Action
	15	14	Unknown occurrence date. Date of report is September 8, 2020	Garage	20-20318	0.5L of fuel and hydraulic oil was observed in front of the garage (unknown source or cause).	Not stated in report	Contaminated soil was recovered and stored in Quatrex bags in the maintenance laydown area.  Contaminated soil will be shipped at a registered receiver during demobilization processes.
	16	14	September 9, 2020	Wharf Area	20-20333	Unknown amount (later verified as 2L) of antifreeze were observed spilling under the crane	Not stated in report	Mechanics were called in for repairs on the crane where the droplets were forming.  Absorbent layers were placed to collect the antifreeze under the crane. Contaminated rocks were recovered and stored in Quatrex bags.
	17	14	September 13, 2020	Quarry Area	20-20335	1.5L of hydraulic oil was spilled due to mishandling during the replacement of the hydraulic hose (PC650).	Not stated in report	Contaminated soil was recovered and stored in Quatrex bags.  Operators and mechanics were told to use more pads and light when working on machinery during the nighttime.
	18	16	September 21, 2020	Laydown Breakwater West	20-20346	4L of transmission/drive train oil was spilled from a PC800 due to a mechanical issue (malfunction with the excavator). Reported only a few drops of oil spilled to the ground.	Yes, after the break occurred	Absorbent layers and yellow pan were placed immediately to collect the oil and contaminated soil were recovered and stored in Quatrex bags in the maintenance laydown area.  Contaminated soil will be shipped at a registered receiver during demobilization processes.

Year	Occurrence No.	Construction Week	Date	Location	Spill Report No.	Summary	Spill Tray Used During Operations?	Corrective Action
	19	16	September 27, 2020	Haul Road	20-20360	2L of unknown substance was spilled from a drill due to disconnected hose during maintenance.	No	Contaminated soil was recovered and stored in Quatrex bags in the maintenance laydown area.  Contaminated soil will be shipped at a registered receiver during demobilization processes.
	20	17	September 28, 2020	Temporary Dredging Access	20-20365	1L of bio hydraulic oil was spilled from the PC650 excavator's "plastic quick connect" while excavator was operating. Approximately 2m from the HWL.	Yes, after the break occurred	The operator immediately stopped work and put pan and absorbent layers where the oil was spilling.  Contaminated soil has been recovered and stored at the maintenance laydown inside a Quatrex bag. The contaminated soil will be shipped at a registered receiver during the demobilization process.
	21	17	September 29, 2020	Shoreline	20-20376	0.5L of motor oil was found under a pick-up truck. Approximately 30m from the HWL.	Not stated in the report	The pickup is being checked by the mechanic. A reminder to the workers to check their vehicle will be done during the next toolbox meeting.

Year	Occurrence No.	Construction Week	Date	Location	Spill Report No.	Summary	Spill Tray Used During Operations?	Corrective Action
	22	17	September 30, 2020	Shoreline	20-20369	0.5L of undefined material was discovered along the shoreline. No known source or cause (both Tower and non-Tower vehicles are parked in the area)	Not stated in the report	<p>Tower arctic vehicles that park in this area has been checked, no issue was found.</p> <p>Contaminated soil was recovered and stored in Quatrex bags in the maintenance laydown area.</p> <p>Contaminated soil will be shipped at a registered receiver during demobilization processes.</p>
	23	17	October 4, 2020	Stockpile	20-20381	2L of hydraulic oil was spilled from a WA500 loader. While placing snow chains on the loader, the chains broke and caught and disconnected the hose. Operator immediately stopped work.	Not stated in report	<p>Contaminated soil was recovered and stored in Quatrex bags in the maintenance laydown area.</p> <p>Contaminated soil will be shipped at a registered receiver during demobilization processes.</p>
	24	18	October 5, 2020	Garage	20-20384	A hose that didn't show any sign of damages nor old age broke and 1L of motor oil spilled on the ground.	Not stated in report	<p>Contaminated soil has been recovered and stored at the maintenance laydown inside a Quatrex bag. The contaminated soil will be shipped at a registered receiver during the demobilization process.</p>

Year	Occurrence No.	Construction Week	Date	Location	Spill Report No.	Summary	Spill Tray Used During Operations?	Corrective Action
	25	18	October 10, 2020	Garage	20-20392, 20-20393 and 20-20394	A spill of fuel has been found near the fuel tank by the environmental monitor. The source of the spill is not known, but seems it did happen during the fueling of equipment.	The EM has no information if the spill tray was used or not during the fuelling as required in the fuelling procedure	Contaminated soil has been recovered and stored at the maintenance laydown inside a Quatrex bag. The contaminated soil will be shipped at a registered receiver during the demobilization process.

Source: Tower EM Weekly Reports

## 5.11 Waste Management

All garbage, debris, scrap metal, discarded machinery and parts, barrels and kegs, buildings and building materials, were required to be removed to an approved landfill or disposal facility (Tower 2020b). Debris was collected when necessary on site and transported to the Hamlet landfill.

Disposal of DGs consisted of contaminated material from the various spills (Table 5-6). These materials were stored in an appropriate manner on site and as indicated in the EOS will be shipped south for disposal as Pond Inlet does not have an approved facility (Appendix 3).

## 5.12 Recommendations

### 5.12.1 2020

The following recommendations were discussed with GN-CGS, Advisian and Tower following the 2019 construction season (Table 5-7). These recommendations remain for 2021 environmental monitoring reporting.

Table 5-7 Summary of 2019 Recommendations

Recommendation	Status	Implementation
A summary table with turbidity data.	Not received at the time of this report	Unknown at this time
A summary table that identifies the name of MMOs, the activity they were monitoring, the duration of time that they worked, and an indication of whether or not they were a dedicated MMO.	Not received at the time of this report	Unknown at this time
A separate table specific for pile driving with the details as above, but including duration of time that the activity occurred.	Not received at the time of this report	Unknown at this time
Underwater acoustic monitoring protocol for the 2020 impact pile installation schedule be determined in advance of the construction schedule.		Implemented
The use of consistent units for acoustic data collection for comparison throughout the field season.		Implemented
A table to track pile driving information, which would include: <ul style="list-style-type: none"> <li>the data being collected relevant to pile types and the number of piles;</li> <li>details on the length of time required to install a pile relative to the length of time the underwater acoustic data were collected; and</li> <li>data collection parameters such as distance from sound source, construction activity and other potential sound sources to facilitate tracking (e.g. sealift delivery/arrival) of</li> </ul>	Not received at the time of this report	Unknown at this time

Recommendation	Status	Implementation
underwater sound levels as the Project moves through the 2020 construction schedule.  The table should include details of the monitoring relative to the MP commitments.		
Appropriate justifications when weather variables impact appropriate background monitoring location for turbidity monitoring.	Details provided in weekly EM reports	Implemented

### 5.12.2 2021

The following recommendations were discussed for the 2020 construction season and will apply to 2021 construction:

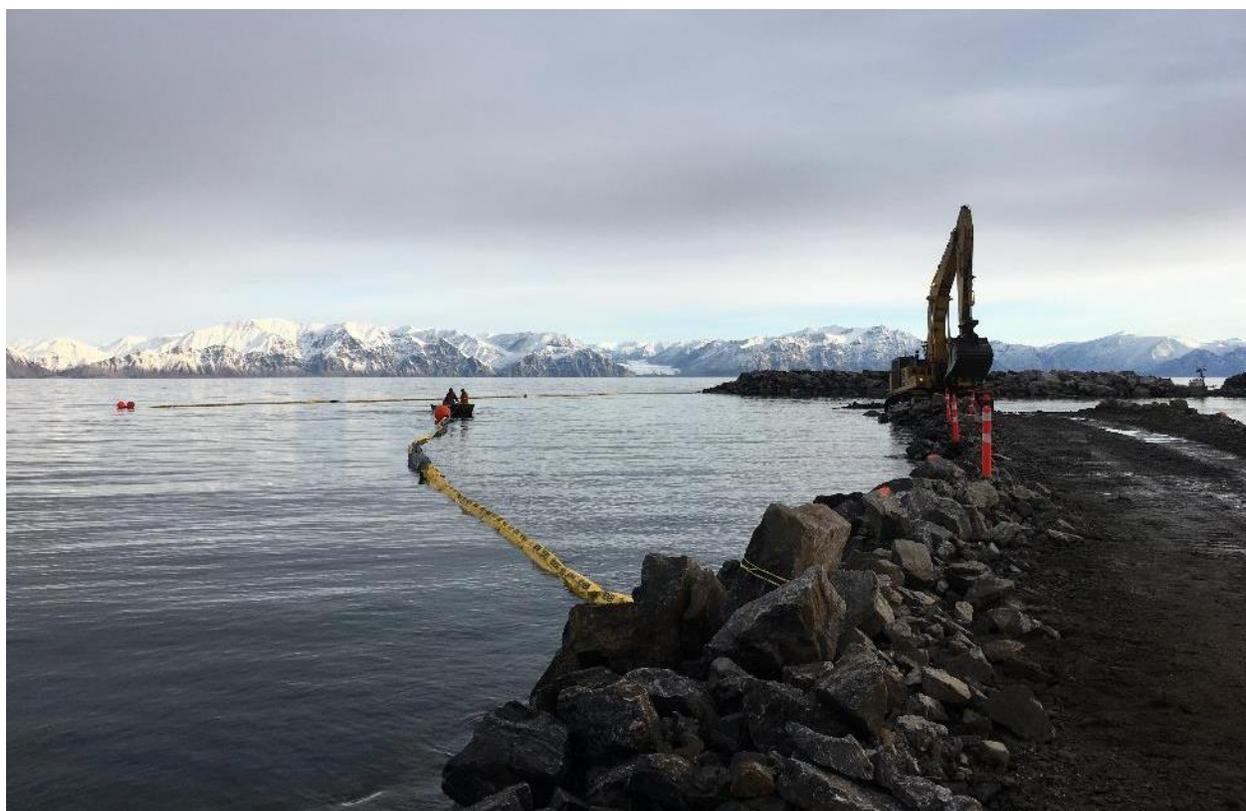
- Improved spill reporting, with increased focus on training construction workers about proper spill prevention during toolbox meetings (Tower 2020h), which would include:
  - The mandatory use of a spill tray for the handling and the storage of hazardous products and during fuel transfers
  - The obligation to inspect the vehicles and equipment before use
- Conduct baseline acoustic data collection prior to construction activity to establish ambient noise level over a two-day period, as described Section 7.3.3.3 of the MP (Tower 2020b).
- Include start and stop times for pile driving in acoustic data files for analysis.

## 6 Adaptive Management

### 6.1 Turbidity

A turbidity curtain was installed prior to the start of dredging activities, which began on August 19 (Week 11). This was a preventative measure undertaken by Tower due to the likelihood of turbidity exceedances associated with dredging given the nature of the location of dredging. The curtain remained in place for the duration of dredging activity. See Photo 6-1 and Figure 6-1.

A revised turbidity monitoring plan was implemented during the construction season due to exceedances that occurred on July 13 (Week 6) and difficulty distinguishing turbidity associated with construction activity and Salmon River runoff. Revisions included an increase to the number of background samples taken during different tide and wind conditions and the implementation of a confirmatory sampling twice per week to ensure visual monitoring is compliant. The revised plan was accepted on September 23 (Week 17) and was to be implemented for Weeks 17 to 20. However, no confirmatory or compliance sampling was conducted after Week 17 due to lack of turbidity plumes during visual monitoring.



*Photo 6-1 Turbidity Curtain for Dredging – Installed August 19, 2020 (Week 11)*

Source: Respective Tower EM Weekly Photos

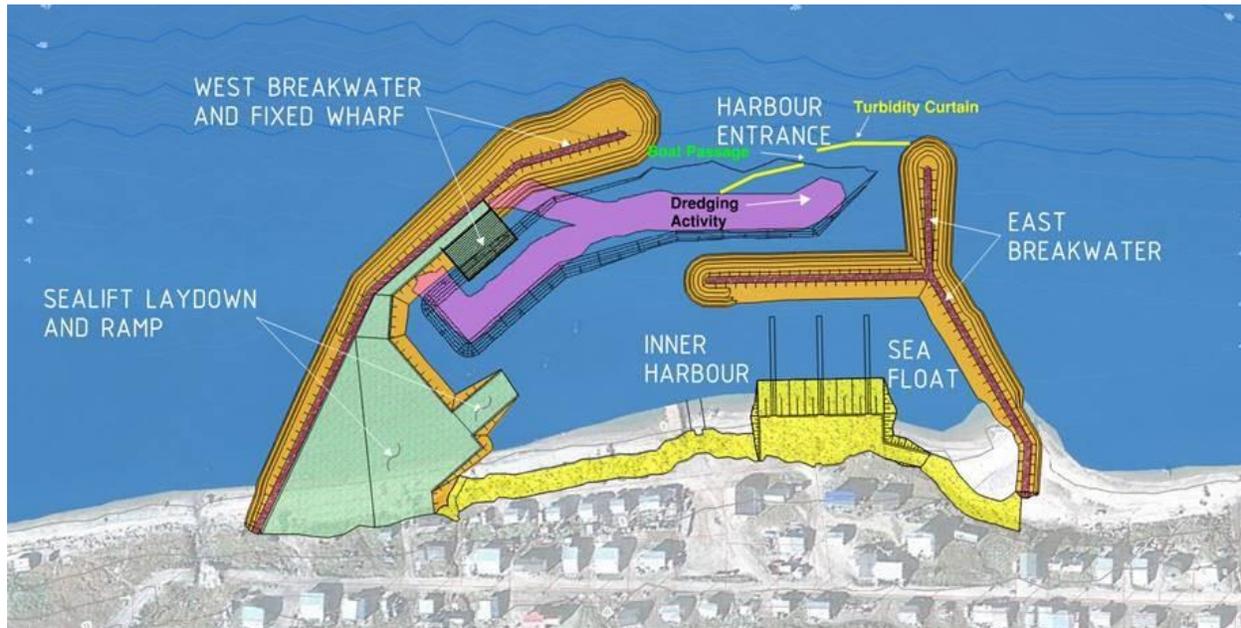


Figure 6-1 Turbidity Curtain Schematic

Source: Tower Week 18 EM Report

## 6.2 Acoustic Monitoring

Adaptive management was implemented following several exceedances to the overpressure threshold on July 22 (Week 7) during pile driving (see Section 5.6.2.2). On July 23, Tower attempted to implement the use of a bubble curtain, however there were issues with the design of the curtain. Tower's solution was to reduce the size of the bubble curtain. Ultimately the bubble curtain was not installed during pile driving and instead it was agreed between Advisian and Tower's EM that Tower would implement a longer soft start procedure and that the impact hammer drop height would be reduced by 50%. However, during pile driving on July 23, Advisian on-site staff noticed that the drop height was not reduced as agreed upon. Advisian engaged the Tower EM on the failure to implement adaptive management. Tower provided the explanation that acoustic measurements taken at the beginning of pile driving did not show overpressure so they returned to full height hammer use.

The failure of Tower to implement the agreed upon adaptive management resulted in a non-compliance that was reported to DFO, as detailed in Section 7.1.1.3.

## 7 Non-Compliance

### 7.1 2020

#### 7.1.1 DFO FAA

##### ***7.1.1.1 Absence of Real-Time Monitoring Overpressure During Pile Driving***

The MP (Tower 2020b) dictates that the EM will perform real-time monitoring of overpressure in order to determine the necessity of a bubble curtain.

For the first three days of circular pile driving in Pond Inlet (July 8–10, Week 5), a number of issues with overpressure monitoring were identified that had compounded in non-compliance of the MP (Tower 2020b) and a near-miss for non-compliance with the FAA. On July 8, the InstanTel overpressure hydrophone was deployed at a distance of 10 m from circular pile driving with an impact hammer. Real-time monitoring of the overpressure hydrophone was not performed as the EM chose to monitor underwater noise at the perimeter of the EZ instead. At the end of the day, it was discovered that the InstanTel overpressure hydrophone did not trigger and thus no measurements were recorded. Pile driving activities were not halted while the EM worked through alternative options, a bubble curtain was not employed, and GN-CGS and Advisian were not engaged by Tower. On July 9 and 10, Tower made the decision to use the Ocean Sonics hydrophone at a 10m distance in lieu of the InstanTel hydrophone, with a post-processing script applied to convert dB to kPa. Post-processing the data did not meet the requirement for real-time monitoring. The data provided by converting Ocean Sonics recordings to kPa showed that for July 10 the maximum recorded overpressure was 11.8 kPa, thus there was no evidence of serious harm to fish as a result of circular pile driving activities. A replacement InstanTel overpressure hydrophone was shipped from Iqaluit to Pond Inlet and arrived on July 11, 2020. This was the equipment that was utilized on the next day of pile driving, July 13, 2020.

This non-compliance was reported to DFO by Advisian on July 14, 2020 (Advisian 2020e).

##### ***7.1.1.2 Overpressure Exceedances and EM Procedure***

On July 22 (Week 7) the overpressure during impact pile driving of sheet piles exceeded the 30 kPa limit a total of five times. The InstanTel Minimate Pro overpressure hydrophone was not being diligently monitored, as the duty of monitoring the equipment had been passed to the engineer while the EM acted as an MMO. This was a non-compliance of the MP (Tower 2020b) for not performing real-time monitoring of fish thresholds, and a non-compliance of Section 2.3.1 of the Environmental Procedure construction specification (Advisian 2018a), which states that an EM must have no other roles on the Project and must be appropriately qualified.

On July 23 Tower took steps to begin setting up the bubble curtain, however the bubble curtain was not functional. After verbal discussion with the Advisian on-site EI representative (located at the time in Iqaluit), Tower made the decision to reduce the height of the impact hammer by 50% at the start of subsequent pile driving. In theory, reduction of the hammer height would generate lower overpressure. However, on-site Advisian Engineers noted that a return to full height drop was employed following soft start procedures.

Advisian submitted a letter to DFO summarizing the non-compliance under the Duty to Notify on August 5 (Advisian 2020a). Tower wrote a response letter and submitted it to DFO on August 13 (Week 10).

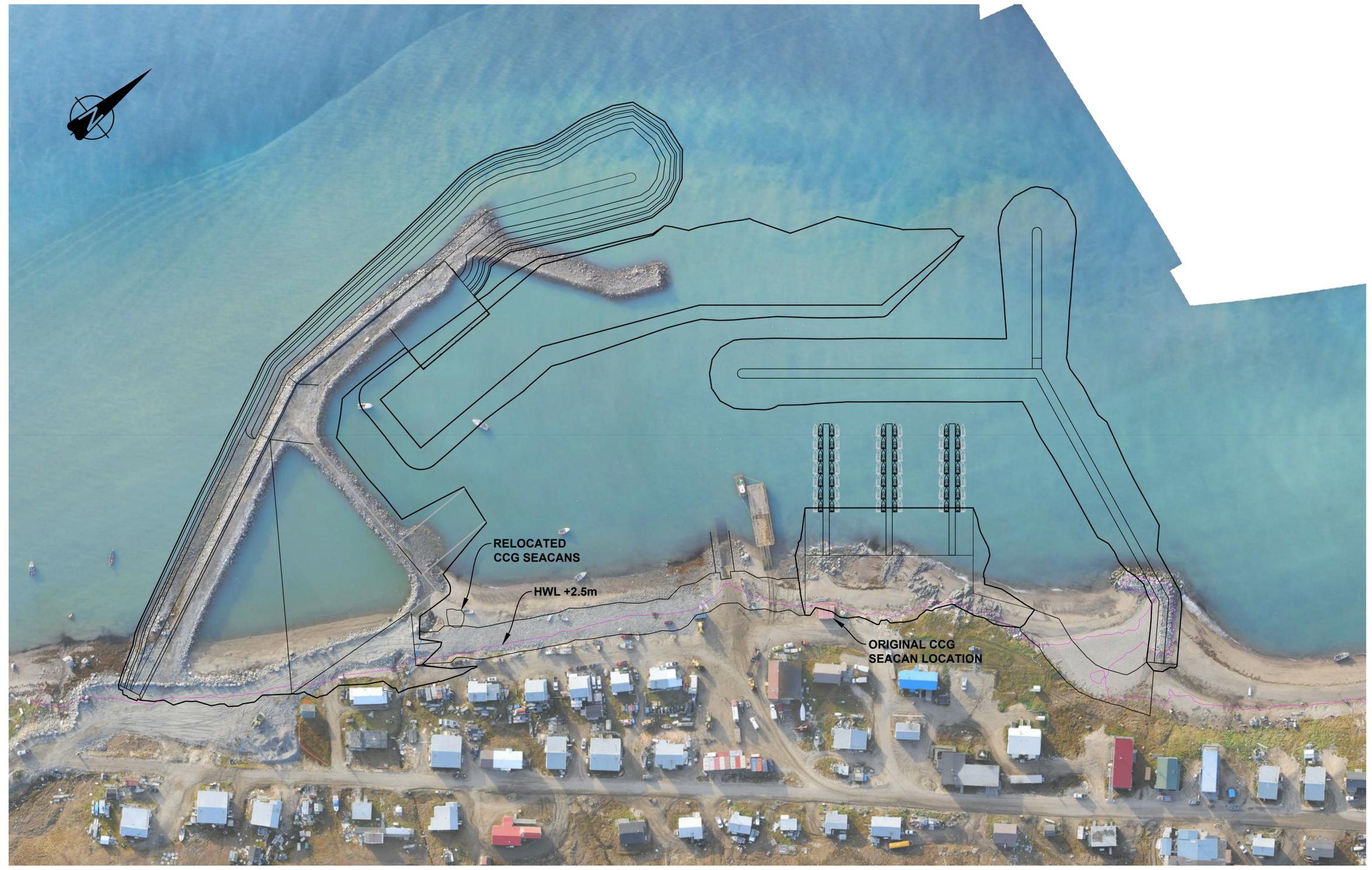
On September 17 Tower presented information to Advisian that showed discrepancies between the three hydrophones on site in Pond Inlet, indicating that the equipment used to monitor overpressure during the July 22 exceedance (the InstanTel Minimate Pro) had been set with a high sensitivity and was showing an overpressure level roughly two times higher than the actual overpressure. The issue was rectified after discussion with the equipment supplier and programming new settings into the hydrophone. Advisian forwarded Tower's information to DFO on September 29 (Week 17) (Advisian 2020f).

### **7.1.1.3 Not Employing Adaptive Management for Pile Driving**

Non-compliance of MP identified by Advisian on July 23 (Week 7) when Tower failed to implement the agreed upon adaptive management of operating the hammer at half height during pile driving. Advisian informed Tower that this was a demonstration of failure to employ and follow an adaptive management plan. Tower explained that the decision was based on overpressure data that showed overpressure of 8–10 kPa, thus they returned to full height operation. It is the opinion of Advisian and GN-CGS that decisions made counter to agreed adaptive management plans need to be agreed upon with the GN-CGS team before they are actioned. Advisian reinforced that better communication of adaptive management plans have to be put in place in the future.

### **7.1.1.4 Unauthorized infill and Sea-Can Movement**

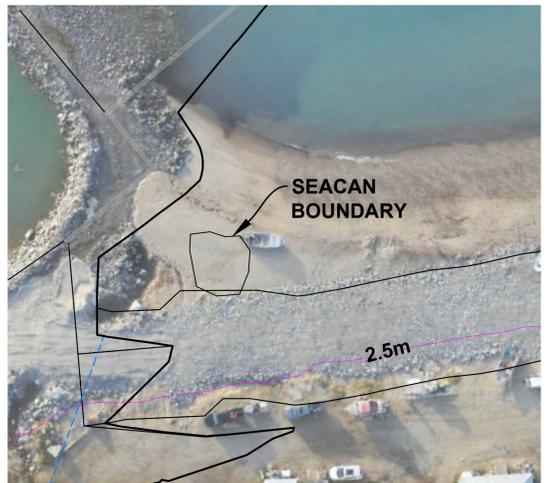
On July 23 (Week 7) Tower moved sea-cans belonging to CCG emergency response as they were blocking access for the construction of the SCH haul road (see Section 3.5.1). While GN-CGS and Advisian do not disagree with the requirement to move the sea cans, it should not have occurred without engagement and approval from CCG, the owners of the sea-cans. Further, the location chosen for the relocation resulted in an unauthorized infill, as the placement was below the HWL and outside of the permitted Project footprint. The Advisian EI, Victoria Burdett-Coutts, observed the placement on September 27, 2020 (Photo 7-1). Advisian communicated with Tower to inform them of the requirement to discuss all matters of infill outside of what is permitted prior to any construction activity. DFO was informed of the non-compliance on October 9 (Week 18). Tower moved the sea cans back to their original location on October 29, 2020 (post-construction). Tower is responsible, by Contract, to ensure construction is completed in compliance with the applicable regulations, permits and legislation. While this infill was a small one, education letters on this topic were issued by DFO in 2019 (see Section 7.2.1.1).



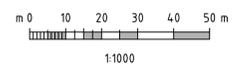
**PLAN**  
1:1000



**PHOTO - CCG SEACANS**  
NTS



**PLAN - SEACAN LOCATION**  
1:500



REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
A	28-JAN-21	ISSUED WITH REPORT	JLC	-	VBC	-	HGK	-		

D SHEET	SCALE	SHOWN	ENGINEERING AND PERMIT STAMPS (As Required)
			<p><b>PRELIMINARY</b> DO NOT USE FOR CONSTRUCTION Last Saved: Jan. 28/21 2:16pm</p>
<p>WORLEYPARSONS PROJECT No 307071-0114.8</p>			

CUSTOMER

\*This drawing is prepared for the use of the contractual customer of Worley Canada Services Ltd. and Worley Canada Services Ltd. assumes no liability to any other party for any representations contained in this drawing.\*

**Advisian**  
Worley Group

**POND INLET MARINE INFRASTRUCTURE  
ECLIPSE SOUND - SCH  
DRONE IMAGERY  
SEPTEMBER 9, 2019**

DRG No \_\_\_\_\_ REV A

USER NAME: jennifer.coppendale LOCATION: U:\YVR\307071\0114.8\_G01\_NV\MARINFRA\1\DRAWINGS\15\_1\_AND\_E\02\_MARINE\01\_SKETCHES\307071-0114.8\_PL\_CGS-SEACANLOCATION.DWG  
 PLOT DATE & TIME: 28/12/2021 2:17:08 PM  
 SAVE DATE & TIME: 28/12/2021 2:16:16 PM



Photo 7-1 *Unauthorized Infill*

Source: Advisian

### **7.1.1.5 Equipment in Water Activity**

In late August, Advisian Engineering staff notified Tower engineers and Project Manager of the potential issue with their construction approach which resulted in equipment operating in water. On September 30 (Week 17) it was documented during an Advisian EI visit that Tower was using excavators directly in the water, which is a deviation from BMPs (Photo 7-2). This topic was not mentioned in Tower's weekly reports or monthly discussions with DFO. Advisian informed DFO of the non-compliance on October 2, 2020. Discussions are ongoing with DFO, Advisian, GN-CGS and Tower to determine whether DFO Conservation and Protection (C&P) will initiate an investigation. As Tower does not have suitable equipment reach to prevent their equipment from working in water, this practice is intended to continue for dredging activities in 2021.

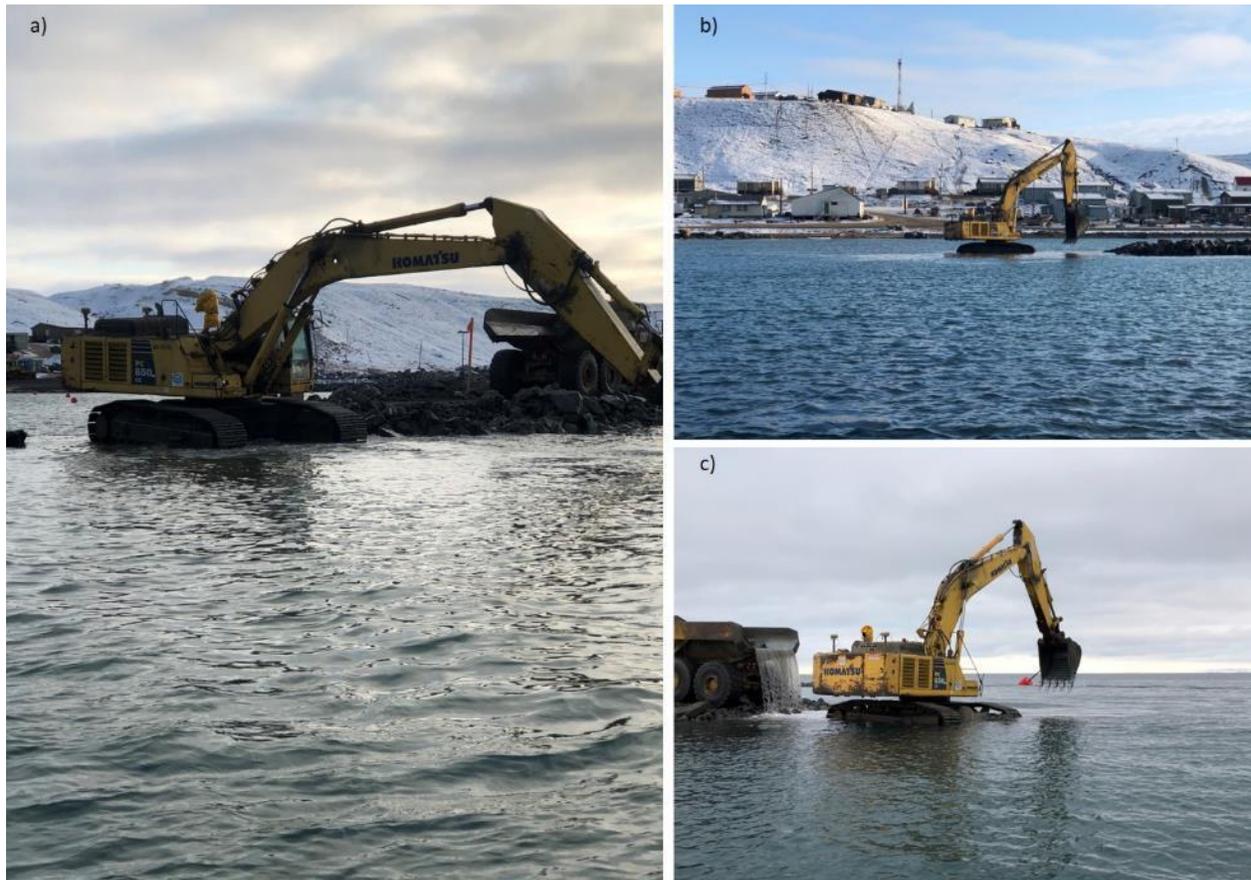


Photo 7-2 Equipment in Water: a) and b) September 30 (Week 17); c) October 1 (Week 17)

Source: Advisian

## 7.1.2 Monitoring Plan

### 7.1.2.1 Early Demobilization of EM

Advisian became aware, though Tower's Week 23 report, that the EM demobilized from site two days prior to the completion of in-water works. This is a non-compliance of the MP (Tower 2020b), and is described in Section 5.1.

### 7.1.2.2 Lack of Turbidity Monitoring During Infill Activity

It was documented in Tower's Week 18 report that turbidity monitoring was not conducted during infill activities on October 7 (Week 18). Tower explained that the EM prioritized overpressure monitoring for sheet pile driving as they could not conduct the two tasks simultaneously. It was also stated that infill activity that day was armour rock placement, which causes minimal sediment runoff. However, as indicated in Section 7.1.2.2 of the MP (Tower 2020b), visual monitoring of plumes during in-water infill is to start no more than an hour after construction activities commence. GN-CGS and Advisian will confirm Tower understands the need to meet all monitoring requirements during construction in the 2021 season and plans must be made to accommodate this requirement.

### **7.1.2.3 Near-Water Refueling and not Utilizing Spill Tray**

On September 8 (Week 14) there were two observed occurrences of near water fueling which were non-compliant with Tower's Pond Inlet Fueling Plan (Tower 2018b), NIRB Permit condition No. 9 and Tower MP (Section 9.6 of Tower (2020b)). The failure to use spill trays or other mitigation techniques was discussed with Tower during the weekly EM meeting September 15 (Week 15). Tower stated that they will ensure enough spill trays are available on site and that the construction team is reminded again that workers must always use spill trays.

## **7.2 2019**

### **7.2.1 DFO FAA**

#### **7.2.1.1 Education Letters**

An education letter was issued to GN-CGS on 13 September 2019 in regard to the 2018 temporary unauthorized infill (DFO 2019b). The letter acknowledged the occurrence of the temporary unauthorized infill, the expectations for its removal before the end of the 2020 construction season and reminded GN-CGS of relevant sections of the *Fisheries Act* for 'Duty to Notify' and 'Duty to Take Corrective Measures'. A similar letter was issued to Tower.

GN-CGS has taken the following measures:

- Construction plans and schedules provided by Tower are communicated to their environmental support team (Victoria Burdett-Coutts – Advisian, Charlotte Mougeot – SRM Consulting) well in advance of construction.
- Monthly meetings have been established between the Project Team (DFO, GN-CGS, Tower, Advisian).

## 8 References

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- Advisian. (2020f). RE: FW: Pond Inlet Overpressure Monitoring Equipment Sensitivity. Email correspondence from ADV(VB-Coutts) to DFO(SCho) dated September 29, 2020 3:39 AM.
- Advisian. (2020g). RE: Pond Inlet MP Over Pressure - document review of overpressure monitoring plan. Email correspondence from ADV(PStastny) to TA(OB-Richard) dated October 7, 2020.
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- Tower. (2020h). RE: Spill report - causes of spills in 2020. Email communication from TA(OB-Richard) to GN-CGS(JMcDonnell) sent August 27, 2020.



**Appendix 1    Tower Construction Weeks**

## Appendix 1 – Pond Inlet Environmental Monitoring Construction Weeks for 2020

Week No.	Date Range
1	6/8/2020 to 6/14/2020
2	6/15/2020 to 6/21/2020
3	6/22/2020 to 6/28/2020
4	6/29/2020 to 7/5/2020
5	7/6/2020 to 7/12/2020
6	7/13/2020 to 7/19/2020
7	7/20/2020 to 7/26/2020
8	7/27/2020 to 8/2/2020
9	8/3/2020 to 8/9/2020
10	8/10/2020 to 8/16/2020
11	8/17/2020 to 8/23/2020
12	8/24/2020 to 8/30/2020
13	8/31/2020 to 9/6/2020
14	9/7/2020 to 9/13/2020
15	9/14/2020 to 9/20/2020
16	9/21/2020 to 9/27/2020
17	9/28/2020 to 10/4/2020
18	10/5/2020 to 10/11/2020
19	10/12/2020 to 10/18/2020
20	10/19/2020 to 10/25/2020



**Appendix 2    Construction Progress Photos**



## Appendix 2 – Pond Inlet Seasonal Construction Progress

**Photo 1 Week 4 (05/07/2020)**



**Photo 2 Week 4 (06/07/2020)**



**Photo 3 Week 9 (04/08/2020)**



**Photo 4 Week 10 (11/08/2020)**



**Photo 5 Week 11 (08/23/2020)**



**Photo 6 Week 13 (01/09/2020)**



**Photo 7 Week 15 (14/09/2020)**



**Photo 8 Week 16 (24/09/2020)**



**Photo 9 Week 17 (04/10/2020)**



**Photo 10 Week 18 (05/10/2020)**



**Photo 11 Week 19 (18/10/2020)**



**Photo 12 Week 20 (10/22/2020)**





**Appendix 3    Week 20 EOS Checklist**

	<b>Name:</b>	Sara Dubosq						
	<b>Inspection period:</b>	End of season						
	<b>Location:</b>	Pond Inlet Marine Infrastructure Project's Components						
	<b>Nature of work:</b>	Inwater infill, maintenance of Haul road, Quarry operation, Blasting, wharf construction						
	Element to verify		Respect of requirement					Comment
			Compliant	Non-Compliant	On-going	Opportunity for improvement	NA	
Commitment #	<b>Administrative</b>							
1	CIRNAC 35, 36, 37	Maintain a copy of the permit and its application on site and provided to federal or provincial officials. The permit must be kept on hand at all times. Work crews should be familiar with and adhere to the conditions: - Display a copy of CIRNAC permit in a conspicuous plan in each campsite established for this land use operation. - Display the permit number on all vehicles and equipment.	x					Permits issued for the projects are filed in a binder in the EM's office. In addition, TA's staff have access to the permit via the local server and E-Builder.  Workers are familiar with permit conditions via the site safety training, the TA's SSE board, the monthly SSE meeting and every morning toolbox meeting. Vehicles and equipment have been identified with the LUP.
2	NIRB Hamlet PI Quarry 50	Maintain a copy of the Project Terms and Conditions and permits on site at all times.  Obtain a permit NRCan Explosive transport, storage and use.  Obtain a Nunavut Water Board Liscence (water crossings).	x					Permits in a binder at the office.
3	CIRNAC 1	The Permittee shall not conduct this land use operation on any land(s) not designated in the accepted application, unless otherwise authorized in writing by the Engineer.	x					
4	CIRNAC 4	Field Supervisor shall contact or meet with a Land Use Inspector at the Department of Crown-Indigenous Relations and Northern Affairs Canada, phone number (867) 975-4289, at least 48 hours prior to the commencement of this land use operation.	x					Done through Email : to aadnc.landsmining.aandc@canada.ca on June 3, 2020.
5	CIRNAC 5	Field Supervisor shall provide notification of commencement of the land use operation within 10 days, to the Engineer at the Iqaluit office of the Department of Crown-Indigenous Relations and Northern Affairs Canada, either by emailing aadcc.landsmining.aandc@Canada.ca or by telephone at phone number (867) 975-4283.	x					Done through Email : to aadnc.landsmining.aandc@canada.ca on June 3, 2020.
6	CIRNAC 6	Provide locations of the following activities, if applicable, related to the project within 10 days of establishment (campsite, fuel caches, airstrip, drill laydown area and quarry locations) to the Land Use Inspector and Engineer.	x					Done through email : Darlene Brown from CIRNAC sept 6th 2019.
7	CIRNAC 7	Provide in writing to the Engineer, at least forty-eight (48) hours prior to commencement of this land use operation, the following information: a) person(s) in charge of the field operation to whom notices, orders and reports may be served; b) alternates; c) indirect methods of contacting above person(s)	x					Done through Email : to aadnc.landsmining.aandc@canada.ca on June 3, 2020.
8	CIRNAC 8	Notify a Land Use Inspector at least 10 days prior to the completion of the land use operation of: a) a plan for removal or storage of equipment and materials; b) when final clean-up and restoration of the lands used will be completed.			x			
9	CIRNAC 9	Submit an annual report by March 30th of each year of permitted activities including a technical summary of activities undertaken for the year, a table and maps showing camp locations, air strip and landing locations, drilling locations, fuel caches, locations of activities conducted, backfilled sumps, work plan for the following year, progressive reclamation undertaken.			x			
10	CIRNAC 10	Submit to the Engineer and the Land Use Inspector a Spill Contingency Plan for use during the construction and operation of the winter road, 10 days prior to the commencement of activity.	x					Done through Email : to aadnc.landsmining.aandc@canada.ca on June 3, 2020.
11	CIRNAC 34	It is required to immediately notify the Engineer of the transfer/sale of property/assets authorized under this permit upon completion of transaction.					x	
12	CIRNAC 38	Abide by and comply with all applicable lawful rules, acts, regulations, and by-laws of Canada, Nunavut, and any Municipal or regulatory body or authority having jurisdiction, the Nunavut Land Claim Agreement, and all other agreements, permits, licenses, and other instruments whatsoever related to the project.	x					
13		Transmit CEMP and Spill contingency anf Emergency Management Plans to NIRB.	x					

	Element to verify		Respect of requirement					Comment
			Compliant	Non-Compliant	On-going	Opportunity for improvement	NA	
14	NWB B4	The Licensee shall, within ninety (90) days of completion of construction activities, submit to the Board for review a Construction Summary Report that includes stamped as-built plans and drawings, explanation for any deviation from construction drawings, and consideration of construction and field decisions and their effects on the performance of engineered facilities.			x			
15	NWB B3	The Licensee shall submit to the Board for review and acceptance, for-construction drawings stamped and signed by an Engineer, at least thirty (30) days prior to the construction of any dams, dykes or structures intended to contain, withhold, divert or retain Water or Wastes.					x	
16	NIRB MO-3	Submit a comprehensive report to NIRB at the completion of construction activities and prior to operations (activities, characterization of dredged material and mitigation as required, reasons for installation of silt fences if required, wildlife log with notes on species and behavior, mitigation activities and stop work events and outcome, discussion with regulators about wildlife and updated procedures, spills and responses, how compliance with conditions).			x			
17	DFO 3.1	Provide an annual report to DFO, by January 31, 2019, 2020, and 2021, and summarizing whether the measures and standards to avoid and mitigate serious harm to fish were conducted according to the conditions of this authorization.			x			Monitoring report will be submitted to DFO on January 31, 2021.
18	DFO 3.1.1 DFO 3.1.2	Demonstration of effective implementation and functioning: Providing dated photographs and monitoring reports to demonstrate effective implementation and functioning of mitigation measures and standards to limit the serious harm to fish to what is covered by this authorization. Provide details of any contingency measures that were followed, to prevent impacts greater than those covered by this authorization in the event that mitigation measures did not function as described.	x					Monitoring report will be submitted to DFO on January 31, 2021.
19	Hamlet PI Quarry 4, 48	Contact or meet with the authorized Departmental representative at least 48h prior to the commencement of quarry operation and provide the authorized Departmental representative with the following information: persons in charge of field operation, alternates and their contact information.					x	This condition is not present in the permit issued on February 27, 2020.
20	Hamlet PI Quarry 5	Advise the authorized Departmental representative at least 10 days prior to the completion of the quarry operation regarding: his plans for removal or storage of equipment and materials and when final clean-up and restoration of the lands used will be completed.			x			
21	Hamlet PI Quarry 49	Provide authorized Departmental representative 14 days prior to completion of land use, a statement indicating when reclamation measures commenced or will commence and when completion of clean-up and restoration is expected. Within 14 days following completion of the land use, a brief report on the final clean-up and restoration of the lands for review and approval.			x			
22	DFO 1 Hamlet PI Quarry	All permits are valid for the duration of the associated work (DFO December 1, 2020, Hamlet PI Quarry June 28, 2019)	x					The DFO's amended FAA issued on September 22, 2020, cover construction activities until December 1, 2021.  The quarry permit issued on February 27, 2020, cover the quarry's activities until February 27, 2021.
23	NWB 2	The Licensee shall notify the NWB of any changes in operating plans or conditions associated with this project at least thirty (30) days prior to any such change.	x					No changing plan anticipated.
24	NWB E2	The Licensee shall notify the Board and the Inspector at least ten (10) days prior to the construction or installation of any of the Water crossings associated with the Project.					x	No new construction or installation of water crossing on the haul road
25	NWB Part H	Under Part H of the Nunavut Water Board permit, concerning the water crossings for the haul road, some conditions are present in case of any facilities need to be reclaimed. These conditions dictate that an eventual reclamation would be done in an appropriate manner. No facilities is yet to be reclaimed.					x	Haul road will be transferred to the Hamlet after the project.

	Element to verify	Respect of requirement					Comment
		Compliant	Non-Compliant	On-going	Opportunity for Improvement	NA	
<b>Hazardous Materials Measures</b>							
26	HM01.	Ensure staff are trained and qualified to safely handle the hazardous waste and materials.	x				WHIMIS for all workers
27	HM02. NIRB 8 NWB C10, G2	Hazardous waste, fuel and materials shall be stored a minimum 31 m distance from high water mark of any waterbody or identified sensitive environmental area (as identified through permitting, during pre-construction surveys [if required] or by the EI or EM).	x				No HazMat observed not respecting this condition.
28	HM03.	A suitable container, based on the properties of the waste or materials to be stored, shall be selected: hazardous materials shall be stored in their original containers, where possible, or in containers specially manufactured for the purpose of storing a specific hazardous waste or materials.	x				All new Hazardous Materials stored in original containers in seacan Hazardous waste material storage has been improved through the 2020 season (see weekly reports 09, 14, 18).
29	HM04.	Containers used for hazardous waste and materials shall not be used for non-hazardous waste types.	x				No non-hazardous substances have been observed stored in seacans previously used for hazardous one.
30	HM05. NIRB 10.	All hazardous waste and materials shall be stored on a firm working surface that is impervious to leaks.	x				Hazardous waste material storage has been improved through the 2020 season (see weekly reports 09, 14, 18).
31	HM06. NIRB 7. CIRNAC 27, 33	All hazardous waste and materials shall be stored within a container which has at least 10% more capacity than the total volume of substances to be stored, and is inaccessible to wildlife.	x				Hazardous waste material storage has been improved through the 2020 season (see weekly reports 09, 14, 18).
32	HM07. NIRB 10.	Drainage into and from the storage area shall be controlled, and/or suitable secondary containment implemented, to prevent spills or leaks from leaving the site and to prevent run-off from entering the site.	x				No drainage or chance of runoff from or to the maintenance laydown. Spill trays are placed under hazardous waste containment to prevent spills or leaks.
33	HM08.	Containers shall be sound, sealable and not damaged or leaking.	x				On July 22, a leaked ontainer has been identified. The container was in a seacan so no spill has been reported. Other than this event, no leak or damaged container has been observed.
34	HM09. Hamlet PI Quarry 33	Containers shall be closed and sealed at all times, except while materials are being added or removed.	x				No left open containers observed on site, hazardous material disposal area is in a seacan.
35	HM10.	All hazardous waste and materials shall be classified and labelled – containers must be clearly labelled to identify their contents according to requirements of the WHMIS and the relevant Transport Authority.	x				All containers observed were labelled with the original label. All waste containers (Quatrex) are identified.
36	HM11.	All hazardous waste and materials containers shall be accompanied by the Material Safety Data Sheet (MSDS) or have the MSDS on file available.	x				MSDS in file at the laydown.
37	HM12.	Incompatible waste and materials shall be stored in a manner that contact, in the event of a spill or accidental release, is not possible (i.e. corrosive materials must be kept away from flammable materials).	x				Minor reminders were done a few times during the season (incompatible compressed gas too close), the situation was corrected right away.
38	HM13.	Containers shall be placed so that each can readily and easily be inspected for signs of leakage, corrosion or deterioration. Leaking, corroded or deteriorated containers shall immediately be removed and their contents transferred to a sound container.	x				Dangerous good at TA's garage site and explosive storage are accessible and can be easily inspected.
39	HM14.	Inspections of the hazardous waste and materials management shall be performed and recorded at least weekly.	x				The hazardous waste and materials has been inspected each week.
40	HM15. NIRB 52 CIRNAC 24, 25	A registered hazardous waste carrier shall be used to transport the waste to a registered receiver or hazardous waste management facility if disposal is required.				x	All hazardous wastes will be shipped back in south for disposal, no approved facility in Pond Inlet.
41	HM16. NIRB 10	Shipping of all dangerous goods shall be registered with Government of Nunavut as detailed in Table 4-1 and appropriate shipping documents shall accompany all movements of dangerous goods.	x				No new hazardous material arrived this year.
42	HM17. NIRB 10	Records are to be maintained indicating the type and quantity of waste being stored along with the date, type and quantity of hazardous waste or material brought into or removed from the facility.	x				The quantity of hazardous material is recorded when the material arrived on site. No hazardous waste or material has been removed from the site since the beginning of the project.

	Element to verify	Respect of requirement					Comment	
		Compliant	Non-Compliant	On-going	Opportunity for improvement	NA		
43	HM18.	Any open source of ignition, open flame, hot works and smoking is prohibited in the hazardous waste and materials storage area. All designated smoking areas shall have appropriate fire proof containers for waste.	x					No open source of ignition, open flame, hot works and smoking has been observed in the hazardous waste and materials storage area.
44	HM19.	Engines will be shut off and smoking shall be prohibited during fueling.	x					Mentioned in site induction.
45	HM20. NIRB 9 Hamlet PI Quarry 26	During transfer of petroleum products, a trained person must be in attendance for the entire duration of the operation. Refueling of all equipment must occur a minimum of 31 m away from the high water mark of any water body, unless otherwise authorized by the Nunavut Water Board. Reasonable precautions shall be taken to avoid the discharge of petroleum products onto land or into water (i.e. Fuel transfers must be stopped prior to overflowing to leave room for expansion, refuelling system inspection).				x		NPC authorized the project to refuel on the breakwaters, following the Fuelling Plan. The record of spills showed that the method of fuelling needs to be reminded on a regular basis.
46	HM21. NWB G7 CIRNAC 32	Hydrocarbon contaminated soils shall be removed and treated on site or transported to an approved disposal site for treatment.	x					Contaminated soils are stored in a Quatrex bag and will be shipped to an approved disposal site during the demobilization operation.
47	HM22. NIRB 29 Hamlet PI Quarry 24	The Contractor shall not deposit, nor permit the deposit of any fuel, chemicals, or wastes (including waste water) into any marine waters or within 31 meters of the HWL.	x					No such storage was observed.
48	WW01.	Staff shall be trained on sorting and storage requirements of specific wastes or materials that will be reused; or are prohibited from disposal in the non-hazardous waste system.	x					Mentioned in site induction and reminded during toolbox meetings.
49	CIRNAC 28, 31	Permittee shall not allow petroleum products or chemicals to spread to surrounding lands or into water bodies.	x					Spill Response Plan in place if an incident occurs, spill kits are in all machines and in sensitive area (breakwaters). Spill prevention topics were discussed during the site induction and the Toolbox meetings.
50	Hamlet PI Quarry 34	The Permittee shall mark all fuel containers with the Permittee's name.	x					No fuel stored at Quarry.
51	Hamlet PI Quarry 32	The Permittee shall report in writing to the authorized Departmental representative the location and quantity of all petroleum fuel cache within ten (10) days after the establishment of any such caches.	x					No fuel stored at Quarry.
<b>Spill Prevention and Response Measures</b>								
52	NIRB 22.	ensure that appropriate spill response equipment and clean-up materials (e.g., shovels, pumps, barrels, drip pans, and absorbents) are readily available during any transfer of fuel or hazardous substances, at all fuel storage sites, and at all refuelling stations at vehicle maintenance areas and at drill sites	x					Spill kits available at each working area, extra supply available at maintenance laydown, spill kits are in all machines and in sensitive area (breakwaters).
53	SP04. Hamlet PI Quarry 25, 26, 30 NWB C8	Hydraulic, fuel, and lubrication systems of equipment near watercourses and sensitive habitats shall be inspected periodically to ensure that the systems are in good condition and free of leaks.	x					Mechanical crew does spot check maintenance on all equipment on a daily basis, internally TA has maintenance program for equipment.
54	SP02. NWB G6	Spill kits shall be readily available, and will be appropriate to the type and amount of hazardous and waste materials anticipated for the Project. Standard spill kits typically contain absorbent booms, socks, pads, waste bags and ties, and personal protective equipment (PPE) such as gloves and goggles. Further details on the contents of the spill kits will be provided in the SPRP by the successful Contractor.	x					Drum spill kits were available at the Quarry area, the TA's garage area and the SCH. At the SCH, additional floating booms were available. Smaller spill kits were available in each mobile equipment. The spill kits content were regularly inspected in order to make sure the materials are available.
55	SP06.	Routine inspections of equipment for leaks, cracked hoses and other conditions that may result in spills shall be undertaken. The Contractors shall ensure external equipment surfaces are free of oil, diesel and other potential contaminants prior to use.	x					Performed by EM, mechanics and operators.
56	SP01. Hamlet PI Quarry 29	All workers shall be trained in the spill prevention, response and about the spill response plan requirements during site induction and subsequent toolbox talk sessions.	x					presented in site induction and reminded during toolbox meetings
57	Hamlet PI Quarry 31 NWB G4, G5 Cirnac 26	Spills shall be reported according to the Spill Contingency Planning and Reporting Regulations (R-068-93) and magnitudes of the events. (24-Hour Spill Report Line by calling 1-867-920-8130). Report all spills in accordance with instructions contained in the NT-NU spill report.	x					All spill has been reported, Government inspectors visited the site to check the soil recovery. They were satisfied by the management of the spill's recovery.

	Element to verify	Respect of requirement					Comment
		Compliant	Non-Compliant	Ongoing	Opportunity Improvement	NA	
<b>Non-Hazardous Waste and Wastewater Measures</b>							
58	WW02.	Where possible, materials shall be re-used, reduced and/or recycled to minimize waste generated.	x				Mentioned in site induction
59	WW03.	Install barriers to prevent vehicle interaction at waste storage areas.	x				No waste storage area large enough that it would need protection.
60	WW04. Hamlet PI Quarry 27	Waste shall be segregated in clearly marked waste containers applicable to the end use (e.g. landfill waste categories used by the Hamlet; i.e. wood waste).	x				Identified containers were placed at the Laydown and at the stockpile (report 11).
61	WW05. NIRB 06. CIRNAC 14	Domestic waste containers shall be kept closed (e.g. equipped with lids, covers / tarps over skips) at all times except when bins are being emptied or filled, to prevent scavenging by wildlife and domestic animals, as well as to control odour.	x				All domestic wastes are stored in wood box, or inside the lunch room.
62	NIRB 06.c Hamlet PI Quarry 8 Hamlet PI Quarry 28	keep all garbage and debris in bags placed in a covered metal container or equivalent until disposed of at an approved facility. All such wastes shall be kept inaccessible to wildlife at all times.	x				no garbage or debris observed outside that could attract wildlife
63	WW06.	Containers and tanks are to be in good condition (no rusting or apparent structural defects).	x				All observed containers appeared to be in good condition.
64	WW07.	Tanks or vessels must be able to withstand the pressure expected by the stored waste, taking into account factors such as temperature fluctuations.	x				Mentioned in site induction.
66	WW08.	All waste shall be stored in plastic bags while conducting marine work to prevent waste being released into the water.					x No waste storage over water.
67	WW09.	Waste shall not be deposited in, or placed on land or ice, under any conditions where the waste may enter Arctic waters.	x				No waste storage over water.
68	WW10. Hamlet PI Quarry 12 CIRNAC 16	Daily site cleaning (housekeeping practices) and routine inspections shall be completed to ensure materials are correctly sorted and placed in the proper bins and that the area is kept clean and tidy at all times.	x				All observed sites are clean, without debris on the ground. Regular reminders were done during Toolbox meetings about housekeeping practices.
69	WW11.	Vehicle washing areas for haul trucks, if required, shall be contained separately and shall be provided with an oil water separator sized to expected flows and conditions.					x
70	WW012. Hamlet PI Quarry 3, 44, 45 NIRB 34 NWB D1, D3	All garbage, scrap metal, fuel, machinery parts, barrels and kegs, building material and equipment shall be removed upon abandonment and completion of the construction activities.			x		
71	WW013. NIRB 35 NWB H2 CIRNAC 11	All clean-up and restoration of the lands used shall be completed prior to the end of each field season and/or completion of site construction/expiry of the permit.			x		
72	Hamlet PI Quarry 13	A layer of coarse gravel on top of will be placed on top of the reclaimed quarry site to prevent wind from moving dust and fines to other locations.			x		
73	Hamlet PI Quarry 6 Hamlet PI Quarry 7 Hamlet PI Quarry 46 Hamlet PI Quarry 47	Clean-up and restoration of lands affected by Quarry operation will be completed prior to permit expiry date (June 28th 2019), including stabilizing and re-vegetating all disturbed areas to pre-disturbed state. The obligation with respect to clean up and restoration only ceases upon possession of a letter of clearance from the Director, Community & Government Division.			x		The quarry operations will be completed in 2021.
74	NWB D2	The Licensee shall locate areas designated for temporary Waste disposal at a minimum distance of thirty-one (31) metres from the ordinary High Water Mark of any water body such that the quality, quantity or flow of water is not impaired	x				No waste storage close to any streams.

	Element to verify	Respect of requirement					Comment	
		Compliant	Non-Compliant	On-going	Opportunity for improvement	NA		
75	NWB D4	The Licensee shall backhaul and all Waste generated through the course of the operation to a licensed Waste disposal site in the Municipality of Pond Inlet.	x					Non hazardous wastes were disposed to the municipal landfill.
76	NWB D5	The Licensee shall provide to the Board, documented authorization from all communities in Nunavut receiving Waste from the Coral Harbour Airport Community Road Washout Rehabilitation Project prior to the backhauling any Waste.					x	
77	NWB D6	The Licensee shall maintain records of all Waste backhauled and records of confirmation of proper disposal of backhauled Waste. These records shall be made available to an Inspector upon request.			x			Hamlet waste disposal is free of access, so no receipt are emitted. But they are waste categories which have been respected by TA.
78	CIRNAC 3, 23	Remove from Territorial lands all garbage, debris, scrap metal, discarded machinery and parts, barrels and kegs, buildings and building materials, to an approved landfill or disposal facility (approved by a Land Use Inspector).	x					
<b>Traffic Measures</b>								
79	TF01.	Consult and coordinate with existing road service providers in the Hamlet. Road use shall not disrupt the delivery of community services and will be done in consultation with the Hamlet administration.	x					Haul road has been constructed to avoid such thing. Road near the garage should stay free of equipment in order to prevent traffic issue. Traffic management has been discussed during the Toolbox meeting.
80	TF02.	A traffic awareness campaign concerning road safety, particularly for children and teens shall be implemented in the community.	x					Safety signs have been placed to inform the community of the presence of heavy equipment and construction sites. Public information sessions have been held to inform the community on safety topics.
81	TF03.	Project specific speed limits shall be set for the haul route, not greater than limits specified by the Hamlet (to be agreed). Speed limits will be set such that community safety is maintained and for the control of dust mobilization.	x					Some issues about traffic speed inside the hamlet were raised during the public information session of October 19. The message was transmitted to the workers to respect the speed limit during the following toolbox meeting
82	TF04.	Road use timing restrictions shall be adhered to (to be agreed with Hamlet administration).	x					The Hamlet allow the project to use the roads during day and night shifts.
83	TF05.	Traffic control measures shall be implemented at intersections along the haul road route, as required. This may include the use of a traffic monitor.	x					No traffic monitor, signage is in place
84	TF06.	Appropriate roadway construction materials, which will not require significant dust management efforts during use, shall be selected.	x					Available material was taken, no dust observed yet, dust suppressant is available.
85	TF07.	Suitable dust suppressants (non-toxic and biodegradable) to reduce dust generation to acceptable levels shall be used. Dust suppressants will be in accordance with the Government of Nunavut, Department of Sustainable Development, Environmental Protection Service, and Environmental Guideline for Dust Suppression.	x					Available on site (calcium).
86	TF08.	Proactive maintenance shall be undertaken to address problem areas of the road which may produce significant dust.	x					Maintenance of the road was done through the construction season
87	TF09.	Haul road shall be maintained and repaired immediately if damaged. Undertaking regular grading and compacting to remove potholes.	x					Maintenance of the road was done through the construction season
88	TF10.	Regular inspection and maintenance of water control features (i.e. culverts) shall be undertaken during construction.	x					Done weekly during the melting season, and once after water courses were frozen
89	TF11.	Consultation with the sealift companies and Hamlet administration shall be undertaken to minimize obstructing access to the existing sealift during SCH construction.	x					
90	WL09.	Escape routes for wildlife on access roads shall be provided (where possible), particularly during winter (i.e. avoid creating continuous berms of snow adjacent to roads that restrict wildlife).	x					Not an issue, road bank are not steep enough, some snowmobile cross passage were made along the road.

	Element to verify	Respect of requirement					Comment
		Compliant	Non-Compliant	Ongoing	Opportunity for improvement	NA	
<b>Vehicle and Equipment Use Measures</b>							
91	VE01.	Drivers will be properly trained and licensed. Personnel shall be encouraged to drive defensively and courteously.	x				Mentioned in site induction.
92	VE02.	All vehicles shall have adequate lighting so they can be easily seen.	x				All vehicles equipped with proper lighting.
93	VE03.	Combustion emissions sources (machinery) and staging areas for vehicles and heavy duty machinery shall be located away from sensitive receptors.	x				No sensitive receptors close to the maintenance laydown, where most of the equipment are stored. The excavator PC800 and the crane are parked on the shoreline behind the laydown (so 31 m away from the water)
94	VE04.	Construction equipment shall be sized correctly for the task and in compliance with any Hamlet road restrictions.	x				
95	VE05.	A regular maintenance program for Project vehicles and equipment shall be implemented to ensure construction equipment is in good working order.	x				Mechanical crew do routine inspection, the hours of running time is recorded and recall for maintenance is automatic.
96	VE06.	When existing local facilities are not available for refuelling, onshore equipment and vehicles must be serviced and refuelled at least 15 m away from sensitive habitats unless secondary containment is used; preferably over an impermeable surface (e.g. drip trays). Drip pans and / or other protective devices shall also be used to prevent spills of petroleum products and other potentially hazardous liquids (e.g. antifreeze) during servicing.	x				Servicing is done over water-tight surface, workers responsible for refuelling is aware of this requirement.
97	VE07. NIRB 21.	Reving of engines on mobile or stationary machines shall be limited and equipment not in use shall be shut down (restrict idling).	x				Mentioned in site induction
98	VE08. NIRB 21.	Gas or diesel engine exhausts shall be fitted with noise mufflers, where available.	x				
99	VE09.	The use of horns, bells, hooters, or other audible signals on mobile equipment shall be limited, while maintaining safe operation.	x				Used for safety of operation
100	VE10.	Ongoing visual assessments of the potential for dust generation and combustion emissions shall be conducted (during work and/or when machinery is operating) to determine requirement for the implementation of dust suppression measures.	x				
101	VE11.	Equipment (including material stockpiles and vehicle parking areas) shall be located as far as practical from residences or sensitive wildlife features (or habitats). If the noise source is directional, equipment will be orientated to minimize propagation in critical directions.	x				Not an issue at the maintenance laydown, no stockpiling at the SCH.
102	VE12.	When offshore equipment and marine vessels are refueled through a floating hose, Contractor will ensure that all hoses and equipment are in good working order, appropriate spill containment and clean-up equipment is available, and personnel are trained in refueling and spill response procedures.				x	No offshore equipment.
103	VE13. NIRB 19. Hamet PI Quarry 22 NWB C12 CIRNAC 21, 22	Equipment or vehicles shall not be moved unless the ground surface is in a state capable of fully supporting the equipment or vehicles without rutting or gouging. Overland travel of equipment or vehicles must be suspended if rutting occurs.	x				Not an issue at any of the project's components.
104	NWB C7	Machinery is not permitted to travel up the stream bed and fording of any Water body is to be kept to a minimum and limited to one area and a one-time event. Equipment used should be well cleaned and free of oil and grease and maintained free of fluid leaks.	x				No fording of any water body (freshwater) has been observed.

	Element to verify		Respect of requirement					Comment
			Compliant	Non-Compliant	On-going	Opportunity for Improvement	NA	
105	CIRNAC 2	a) The permittee shall offset vehicle travel in areas without snow covered surface. b) The permittee shall confine the line to a maximum of 10 m unless otherwise authorized in writing by the land use inspector.					x	NA, given the area covered by the LUP.
106	CIRNAC 13	Only the type, size and number of equipment that is listed in the accepted application may be used, unless otherwise authorized in writing by the Land Use Inspector.				x		The crawler crane is not present in the list. The equipment list shall be updated and provided to CIRNAC through the 2020 Annual Report.
<b>Marine Traffic Control Measures</b>								
107	MT01.	Construction vessels will keep to pre-defined work areas and routes that will not interfere with sealift deliveries and to minimize the impact on existing traffic and navigation.	x					The small boat was moored in the SCH area. No interference with sealift operations and community boating occurred.
108	MT02.	Clear communication protocols or procedures for vessels working in the area will be established.	x					A Job Safety Analysis is completed by the workers prior the usage of the small boat.
109	MT03.	Communication protocols will be established to notify the community of marine activities, including ongoing consultation with the community and HTO and Notice to Shipping.	x					Communication is made through TA website, TA project facebook page, community meetings
110	MT04.	All delivery of construction equipment will occur through existing sealift shipments.	x					NEAS was the sealift supplier.
111	MT05.	A permit or approval will be issued by Transport Canada under the Navigation Protection Act, which will include notification and communication protocols for marine users to be aware of potential navigation interferences.	x					
112	MT06.	Construction vessels will be appropriately marked in accordance with regulations administered by Transport Canada.	x					
113	MC13.	Project-related vessels shall maintain vigilance for marine mammals, document sightings, and employ minimum distances and best practices if within 100 m of any marine mammals. Collisions or any injured or distressed marine mammal must be reported immediately to the CA/EI and DFO.	x					workers whos use the boat and are well aware to maintain vigilance for marine mammals
114	MC14.	Rapid acceleration of vessels shall be avoided.	x					Boat operator are aware to avoid rapid acceleration
115	MC15.	Vessels must follow the guidance for marine mammals and protected areas as outlined in the most recent Notice to Mariners published by the Canadian Coast Guard.	x					
116	TC 1 TC 2 TC 3 TC 4 TC 5	Signs stating Construction Ahead must be legible from a minimum distance of 100 m, be marked with retro-reflective material, be visible from all points of marine approach and display black ettering on a yellow or orange background.				x		issues with the buoys have been observed during the 2020 season (refer to weekly reports 12 and 14)
117	TC 6 TC 7 TC 8 TC 9	Cautionary buoy (yellow) must be lit with a yellow flashing light from dusk to dawn during periods of restricted visibility, must be marked with retro reflective material, must be placed at each end of the work and at the end of the works that is farthest from the nearest bank or shore.				x		issues with the buoys have been observed during the 2020 season (refer to weekly reports 12 and 14)
118	TC 10	All dredged material must be deposited above the high water mark	x					Project is planned to fill the laydown area with the dredged material
119	TC 11	Navigational aids and markings must be maintained in accordance with the attached Site Drawing 307071-01148-01-MA-DGA-4001. (General arrangement)			x			Must comply when construction is complete and before operation starts.

	Element to verify	Respect of requirement					Comment
		Compliant	Non-Compliant	On-going	Opportunity for Improvement	NA	
<b>Blasting Measures</b>							
120	NIRB 23	Quarry/pit facilities will be located so as to avoid all recreational sites and public use areas, and to protect unique geographical features and natural aesthetics	x				Quarry site has been agreed between the GN and the Hamlet prior the construction started.
121	BL01.	Construction should be initiated prior to the arrival of migratory birds (breeding season mid-May to mid-August) such that the quarry and surrounding area becomes unattractive for nesting. A pre- construction survey shall be conducted by the EM to identify all sensitive wildlife features, e.g. active bird nests, wildlife dens and wildlife foraging or traveling nests, if blasting commences within this window.	x				2020 season started late due to Covid 19 (mid-June). A pre-construction wildlife survey was done from June 6th and 8th and the first blast happened on June 17th.
122	BL02.	Blasting shall be restricted to hours as agreed with the Hamlet.	x				2020 blasting occurred during between small window: 6:00pm to 6:30pm
123	BL03.	A notification protocol with input from the local community and other stakeholders for advance notification of planned substantial noise-causing activities shall be implemented.	x				Blasting Notices were posted on the Pond Inlet Public Services Announcement and HTA community Facebook page the day before blasting is scheduled to occur. Notices were also posted on or sent to: <ul style="list-style-type: none"> <li>• Nav Canada</li> <li>• Nunavut Government/Pond Inlet Hamlet</li> <li>• Tower Artic Pond Inlet Marine Infrastructure Project Facebook Page</li> <li>• First Air/ Canadian North</li> </ul>
124	BL04.	Buffers or exclusion zones shall be implemented, in the event a sensitive species or feature (e.g. nest) is identified, to ensure wildlife are not disturbed.	x				No nest observed around the Quarry site in the pre-construction wildlife survey.
125	BL05.	Prior to blasting occurring, warning must be issued in affected area using loud signaling devices.	x				As stated in the blasting procedure.
126	BL06.	Blast mats shall be used as needed to prevent physical damage from fly rock and suppress dust.	x				Available on site.
127	BL07.	Dust suppressants and/or watering shall be used to reduce dust generation from blasting to acceptable levels.	x				
128	NIRB 28	Use water or other non-toxic and biodegradable additives for dust suppression as necessary to maintain ambient air quality without causing water to pool or runoff.	x				Dust has not been an issue so far.
129	BL08. Hamlet PI quarry 38	No blasting shall occur in water or within 15 meters of any water body of water that is not completely frozen to the bottom.	x				No water bodies around the Quarry
130	Hamlet PI quarry 1 Hamlet PI quarry 11	Quarry operation is carried out only on lands designated in the accepted application, unless otherwise approved in writing by an authorized Departmental representative. The NIRB will be notified of any changes.	x				No operation is planned outside of the footprint covered by the permit.
131	BL09.	Quarry and pit boundaries shall be clearly staked and flagged so they remain visible to other land users.	x				Safety perimeter is in place around the open pit.
132	BL10. Hamlet PI Quarry 15 NWB C5 CIRNAC 17	Natural drainage, flooding or channel diversion shall not be obstructed or affected by quarry/pit access, stockpiles, or other structures or facilities. Corrective measures to mitigate impacts will be implemented.	x				Stockpiling will be made in the crusher area, close to the garage or within the Quarry footprint, no material will be stored in a way to obstruct drainage.
133	BL11. Hamlet PI Quarry 14 NWB 110	An undisturbed 31 m buffer zone shall be maintained between the periphery of quarry sites and the high water mark of any water body that is of an adequate distance to ensure erosion control.	x				No water bodies around and near the Quarry.
134	BL12.	Screening and crushing equipment shall be located on stable ground, at a location with ready access to stockpiles.	x				

	Element to verify		Respect of requirement					Comment
			Compliant	Not Compliant	Ongoing	Opportunity for Improvement	NA	
<b>Sediment and Erosion Control Measures</b>								
135	Hamlet PI Quarry 21	Adopt measures as required to control erosion by surface disturbance.	x					
136	Hamlet PI Quarry 18	Excavation and stockpiling are only carried out in designated areas.	x					Either on the Quarry footprint, at the Crusher area or close to the garage
137	NIRB 20 Hamlet PI Quarry 17 NWB I9	Implement suitable erosion and sediment suppression measures on all areas before, during and after conducting activities in order to prevent sediment from entering any waterbody	x					improvements were done in 2020, following some runoff observation.
138	DFO 2.1.1	Rock or fill materials used for in-wafer construction shall be free of fines	x					DFO authorized the use of the design's planned aggregates. Turidity monitoring has been conducted in order to comply with the CCME guideline.
139	SE01. NWB C1	Perimeter controls shall be applied to act as a barrier, preventing sediment from reaching surrounding water courses (i.e. sediment/silt fence).				x		Improvements were done in 2020 (refer to environmental weekly reports 1-4, 6, 11, 13) after that runoff occurred. Following some stability issues observations, some improvement will possibly be necessary in 2021. To be monitored and assessed when the Haul Road will be used (CS04 and CS07 see weekly report 20).
140	SE02.	Temporary sediment control measures shall be applied at the base of soil stockpiles.	x					No sediment runoff from stockpiles
141	SE03.	Soil stockpile storage areas shall be constructed to prevent sediment from entering waterways (i.e. contour soil stockpiles and bulk material stockpiles to reduce erosion potential).	x					No sediment runoff from stockpiles
142	SE04.	Sediment control measures shall be applied at the base of exposed slopes (i.e. silt fence) to minimize conveyance of sediment to a waterbody.	x					
143	Hamlet PI quarry 9	Slope the sides of excavations and embankments except in solid roche to 2:1 unless approved in writing by a land use inspector.	x					No issue observed
144	SE05. NWB E7	Road surfaces shall be stabilized and controlled runoff channels created.				x		Improvements were done in 2020 (refer to environmental weekly reports 1-4, 6, 11,13) after that runoff occurred. Following some stability issues observations, some improvement will be necessary in 2021, to be monitored and assess next year (CS04 and CS07 see weekly report 20).
145	SE06.	Water quality in potentially impacted water bodies shall be monitored for sediment run-off. If visual monitoring identifies sediment run-off, turbidity will be measured and compared to the Canadian Council of Ministers of the Environment (CCME) guidelines for the protection of aquatic life (the water quality guidelines).				x		Turidity monitoring has been conducted in order to comply with the CCME guideline.
146	SE07. NWB C11, E9	Material shall be stockpiled in such a way that debris/sediments will not enter the marine environment and 31 metres above the ordinary High Water Mark of any Water body(road). Material will not be stockpiled on the ice.	x					No stockpiling within 31 m of HWL.
147	SE08.	Haul road embankments shall be constructed to a suitable thickness (1 to 1.5 m) before a surface course is applied in order to limit disturbance to thermal regime.	x					Not seems to be an issue at the sections of the Haul road that were constructed by Tower
148	SE09.	The Contractor shall consider haul road design alternatives that allow for a reduction in grade, and minimizes watercourse crossings and disturbance to riparian areas.	x					Initially 11 water crossings were expected to be needed, by optimizing the road location it was brought down to 7. in 2020, 2 new water crossings were checks for potential runoff
149	SE11. CIRNAC 18	Sediment and erosion control measures shall be implemented as soon as possible after vegetation removal in riparian areas.					x	
150	Hamlet PI Quarry 20	Ensure that a minimum undisturbed buffer zone of at least 100 m between the proposed quarry operation and any public road or navigable waterways, unless otherwise approved in writing.	x					No road of navigable waterway within 100m of Quarry
151	Hamlet PI Quarry 22	The Permittee shall establish vegetation on all areas stripped of vegetation during this quarry operation unless otherwise approved in writing by the authorized Departmental representative.			x			To be confirmed by the end of project, how the Hamlet expect the reclamation to be done

	Element to verify	Respect of requirement					Comment	
		Compliant	Non-Compliant	On-going	Opportunity for improvement	NA		
152	NWB C2, E8	No removal of any material from below the ordinary High Water Mark of any Water body unless authorized.	x					No observation that this was done during Haul Road construction
153	NWB C9 CIRNAC 20	To minimize impacts on surface drainage, the Licensee shall prepare all sites in such a manner as to prevent rutting of the ground surface.	x					During week 7, temporary path for the truck to the east breakwater along the shoreline was built to prevent rutting along the beach. No rutting observed on the Haul Road.
154	NWB E5	The Licensee shall ensure that all fill material used for the project is from an approved source, shall be free of all contaminants, and shall be characterized and confirmed to not possess acid generating potential or metal leaching properties prior to its use, with results and assessment to be submitted within the annual reporting requirements of Part B, Item 1.	x					The material used is from the local quarry and is free of contaminants. Geologist report is available in the 2018 NWB annual report.
155	CIRNAC 19	Insulate the ground surface beneath all structures and facilities associated with this land use operation to: a) prevent the ground from settling and/or eroding; b) prevent the melting of permafrost	x					The thickness of the Haul Road is sufficient to maintain permafrost.
<b>Marine Construction Management Measures</b>								
156	MC01.	The Contractor will prepare a Monitoring Plan for the Project shall be developed that includes requirements during dredging and placement of quarry material. This will include allowable levels of Turbidity/Total Suspended Solids (TSS) and marine mammal monitoring requirements.	x					Two updated monitoring plans were provided by TA (rev. 8 on June 19th and rev. 9 on October 14th). Rev. 9 has not been approved by CGS.
157	MC02.	Measures to reduce sediment mobilization during in-water activities shall be used by the Contractor when TSS/turbidity exceeds Canadian Council of Ministers of the Environment (CCME) water quality guidelines for protection of aquatic life (the water quality guidelines).	x					Turbidity monitoring has been conducted. Additional mitigation measure (silt curtain) has been placed in a preventive way during dredging activity.
158	NIRB 32	implement suitable erosion and sediment suppression measures on all areas before, during and after conducting activities in order to minimize turbidity plumes from the work site into the waterbody including the installation of silt screens.	x					Mitigation measure (silt curtain) has been placed in a preventive way during dredging activity.
159	NIRB 33	construction shall be carried out during periods when wind, wave and tidal conditions minimize the dispersion of silt and sediment from the work site	x					
160	MC03.	Prior to construction, contractor will communicate with HTO to obtain information relevant to the current marine mammal sightings before the onset of construction practices that could result in disturbance or injury.	x					Observed marine mammals during the construction work is available in the wildlife log.
161	MC04.	Soft-start procedure shall be implemented for pile-driving that could generate underwater noise above auditory thresholds for marine mammals.	x					Soft-start procedure has been implemented during pile driving activity.
162	MC05. DFO2.2.1.2	Vibratory piling equipment shall be used to reduce noise effects to community and marine fauna, where possible. A monitoring program shall be developed to verify that underwater noise levels are less than 30 kPa @ 10 m from the piling activity for the protection of fish.	x					Impact driving method has been mainly used. Overpressure exceedances has been monitored during week 7. During week 12, it has been realized that the exceedances were caused by the too high sensitivity of an equipment.

	Element to verify		Respect of requirement					Comment
			Compliant	Non-Compliant	On-going	Opportunity for improvement	NA	
163	MC06. DFO 2.3.3	Additional mitigation measures, e.g. bubble curtains or exclusion zone expansion, shall be required for pile driving if the underwater noise auditory thresholds are exceeded, DFO shall be notified if such measures are implemented.	x					DFO has been informed of the use of a bubble curtain during impact pile driving.
164	MC07.	Pile driving shall be conducted within hours as agreed with the Hamlet.					x	
165	MC08.	Mechanical dredging methods shall be used, which result in lower levels of underwater noise compared to hydraulic methods.	x					
166	MC09. DFO2.2.1.1 DFO2.2.1.2	MMOs will be employed to monitor for the presence of marine mammals in a defined marine mammal exclusion zone. During the open-water season, the exclusion zone will be initially set at 500 m, with in-situ underwater noise monitoring to be conducted at the onset of in-water works to verify the exclusion zone based on the underwater sound auditory threshold of 160 dB re 1µPa. Communication with construction teams and reporting of data will be included.	x					A log is available of when MMOs were onsite relative to construction activity being performed.
167	MC10.	An MMO will be present during dredging, dredge disposal and in-water placement of fill material to monitor for presence of marine mammals. The MMO will monitor for stress related behaviours to marine mammals. If observed, adaptive management will be implemented or, if necessary, stop work will be implemented until effective mitigation measures are in place.	x					A log is available of when MMOs were onsite relative to construction activity being performed.
168	MC11. DFO 2.3.1 DFO 2.3.2	Prior to construction, stop-work conditions shall be specified. Such conditions will include exceedance of underwater noise thresholds for the protection of fish, or sighting of a marine mammal within the exclusion zone by the MMO. Work must not re-start until conditions are met : 30 minutes after the marine mammal was last observed, 30 minutes after it is seen leaving the exclusion or with DFO approval in case a dead fish or marine mammal are observed (DFO shall be notified within 48 hours).	x					Stop-work conditions are stated in the TA's Monitoring Plan. A log is available of when MMOs were onsite relative to construction activity being performed.
169	MC12. DFO2.3.4 DFO2.2.1.3	If construction is to occur during the iced-season, the in-air sound levels will be measured and pinnipeds monitored on the ice. In the absence of Canadian guidelines, the United States in-air acoustic threshold for non-harbour seal pinnipeds of 100 dB re20µPa rms will be adopted. The construction activity will be suspended if the seals are exposed to noise levels above the threshold.					x	
170	MC13. DFO 2.2.2	Project-related vessels shall maintain vigilance for marine mammals, document sightings, and employ minimum distances and best practices if within 100 m of any marine mammals. Collisions or any injured or distressed marine mammal must be reported immediately to the CA/EI and DFO.	x					
171	MC14. DFO 2.2.2	Rapid acceleration of vessels shall be avoided.	x					
172	MC15. DFO 2.2.2	Vessels must follow the guidance for marine mammals and protected areas as outlined in the most recent Notice to Mariners published by the Canadian Coast Guard.					x	
173	MC16.	The area of sea that is artificially illuminated shall be minimized.	x					Tower lights on the breakwater if night activity occurred.
174	MC17.	Water-based equipment or machinery shall be located and secured in such a way as to prevent grounding in identified sensitive habitats.					x	No water-based equipment or machinery.
175	NIRB 31	implement measures designed to minimize disturbance to seabed sediments and benthic communities and marine wildlife when carrying out project activities within the marine environment.	x					MMO in place, turbidity monitoring, no work outside of the footprint of the project.
176	MC18.	Rock material used for in-water construction, will be free of material that would result in exceedances of the water quality guidelines outside the work area.	x					Turbidity has been monitored and managed during in water infill placement according to the Monitoring Plan rev. 8.
177	MC19. NIRB 30. DFO 3.1	An EM will be present during all in-water construction activities to monitor for stress related behaviours or for fish kills. If observed, adaptive management will be implemented or, if necessary, stop-work will be implemented until effective mitigation measures are in place.	x					During the 2020 season, EM were on site from June 30 to October 23. In water activities have been performed from July 6 and October 25.
178	MC20.	All lubricants and hydraulic fluids used on equipment that will be working below the high water level will be biodegradable and non-toxic.	x					All equipment that worked below the high-water level used biodegradable oil.

	Element to verify		Respect of requirement					Comment
			Compliant	Non-Compliant	On-going	Opportunity for Improvement	NA	
179	MC21.	All Project marine construction vessels and equipment shall be clean and free of marine fouling to avoid the introduction of invasive species.	x					No construction vessel.
180	WW08. NIRB 29	All waste shall be stored in plastic bags while conducting marine work to prevent waste being released into the water.	x					No marine-based activities and no waste storage on the breakwater.
<b>Stream</b>								
181	NWB 11, 12, 16, 19 SE10. TF10.	The Licensee shall monitor all activities/haul road/water crossings for signs of erosion and shall implement and maintain sediment and erosion control measures prior to the undertaking to prevent entry of sediment into any Water body and to ensure watercourse crossings structural integrity and hydraulic function. Including a digital photographic record of the water crossing before, during, and after the completion of construction activities.				x		June21 - Culvert 4, Stability: installation of rip rap to create a sedimentation basin and restoration of the sediment barrier. July 16th - Culvert 3, runoff and stability: sediment fence already in place was moved closer to the watercourse and a canal was dug to divert the discharge above that same fence on July 18th afternoon August 23rd - Culvert 3 - Runoff: At the moment choice has been made to avoid any intervention because that would have created even more runoff (as the curtain was still full of water). Correction was done later. August 31st - Culvert 3, Runoff: the silt fence was put back in place and strengthened. Following some stability issues observations, some improvement will be necessary in 2021, to be monitored and assess next year (CS04 and CS07 see weekly report 20).
182	NWB 13	The Licensee shall determine the GPS co-ordinates (in degrees, minutes and seconds of latitude and longitude) of the location where the watercourse crossing (culverts) are located.	x					Available in Nunavut Water Board (NWB) Annual Report 2018, produced by TA
183	NWB 14, E6, E12, 17, 18, 112	The Licensee shall, during periods of flow, conduct water quality testing immediately upstream and downstream of the water crossings, any significant water seeps in contact with the road and any significant seeps originating from borrow pits or rock quarries prior to construction, weekly during the construction and monthly upon completion. All surface runoff or discharges impacted by construction activities associated with the Project, where flow may directly or indirectly enter Water, shall not exceed value presented in the permit for TSS, Oil and grease and pH. All samples preservation and handling shall be conducted according to Standard Methods for the Examination of Water and Wastewater and analyze in a laboratory accredited according to ISO/IEC Standard 17025				x		June21 - Culvert 4, Stability: installation of rip rap to create a sedimentation basin and restoration of the sediment barrier. July 16th - Culvert 3, runoff and stability: sediment fence already in place was moved closer to the watercourse and a canal was dug to divert the discharge above that same fence on July 18th afternoon August 23rd - Culvert 3 - Runoff: At the moment choice has been made to avoid any intervention because that would have created even more runoff (as the curtain was still full of water). Correction was done later. August 31st - Culvert 3, Runoff: the silt fence was put back in place and strengthened. Following some stability issues observations, some improvement will be necessary in 2021, to be monitored and assess next year (CS04 and CS07 see weekly report 20)
184	NWB 15	The Licensee shall monitor water quality runoff and/or discharge from the borrow pits and quarry sites, during blasting activities, during periods of flow and following significant precipitation events, on a monthly basis, for the parameters mention in the permit				x		Water accumulation in the quarry needed to be pumped out, a runoff happened during week 8. The water was discharged in a ground depression that the water present can reach a watercourse. The pump discharge was quickly redirected towards a depression where the sediments can settle before reaching any watercourses .
185	NWB E11	The Licensee shall not excavate and/or remove material from the quarry/borrow area beyond a depth of one (1) metre above the ordinary High Water Mark or above the groundwater table, to prevent contamination of groundwater.	x					

	Element to verify	Respect of requirement					Comment
		Compliant	Non-Compliant	On-going	Opportunity for Improvement	NA	
<b>Wildlife Measures</b>							
186	NIRB 46 NIRB 47	The Proponent should review the Government of Nunavut's booklet on Bear Safety, which can be downloaded from this link: <a href="http://gov.nu.ca/sites/default/files/bear_safety__reducing_bear-people_conflicts_in_nunavut.pdf">http://gov.nu.ca/sites/default/files/bear_safety__reducing_bear-people_conflicts_in_nunavut.pdf</a> .	x				
187	WL01. NIRB 15 Hamlet P1 Quarry 43	A zero-tolerance policy regarding the harassment, disturbance and feeding of wildlife, whilst working on the Project, is implemented and communicated through the induction process.	x				Mentioned in site induction, reminders were done to workers in tool box session.
188	WL02.	The EM shall be on site as required to assess the presence of wildlife (including Species at Risk) and determine potential impacts to construction activities.	x				Reminder was made to workers to declare any wildlife observation, those observations are logged in Wildlife Observation Database.
189	WL03. NIRB 16 NIRB 49	All workers shall be trained in relation to the wildlife (particularly species at risk) expected to occur in the area, including traditional knowledge, as well as on measure to protect wildlife, through site induction and tool box sessions. <a href="http://www.sararegistry.gc.ca/virtual_sara/files/policies/EA%20Best%20Practices%202004.p">http://www.sararegistry.gc.ca/virtual_sara/files/policies/EA%20Best%20Practices%202004.p</a>	x				Included in site induction
190	WL04. NIRB 48	Polar bear sightings shall be reported immediately to the EM and CA/EI so that appropriate actions are taken. (report to Conservation officer of Iqaluit 867-924-6235) <a href="http://www.bearsmart.com/play/safety-in-polar-bear-country/">http://www.bearsmart.com/play/safety-in-polar-bear-country/</a> (...)	x				Included in site induction. No observation reported during the 2020 season.
191	WL05.	Sightings of wildlife species, with particular attention to species at risk, shall be recorded on a wildlife sighting form (including recording the time, date, location, activity, and proximity to workers).	x				Reminded in toolbox session to all workers.
192	WL06.	Wildlife sightings shall be tracked in order to respond appropriately to emerging trends.	x				Reported wildlife observations have been provided through the weekly reports.
193	WL07.	Food, food waste, and other attractants shall be handled, stored and disposed of safely to avoid attracting and habituating animals.					Domestic wastes were stored in garbage located in lunch rooms, offices or outside closed wood box. The quantity of wastes was limited since the wastes were regularly shipped to the Hamlet's landfill.
194	WL08.	Speed limits will be implemented and enforced on all roadways and wildlife will be given the right-of-way so as not to chase, weary, harass or injure animals on the road.	x				Mentioned in site induction
195	WL11.	A pre-construction wildlife sweep shall be conducted to identify all sensitive wildlife features, e.g. active bird nests, wildlife dens and wildlife foraging or traveling.	x				A pre-construction wildlife survey was done from June 6th and 8th. No sensitive wildlife observed nor signs of presence.
196	WL12.	Work site boundaries shall be flagged to prevent inadvertent loss or alteration of habitat outside of the designated Project footprint.				x	An unauthorized infill performed by Tower Arctic on July 22, the infill has been removed on October 29.
197	WL13.	Lighting shall be limited to the extent required to provide a safe work site and shielded and directed to reduce diffusion outside of the work area.	x				
198	WL14.	In the event caribou are sighted, protection measures implemented will follow those outlined in Appendix I of the North Baffin Regional Land Use Plan.	x				
199	NIRB 18	minimize activities during periods when birds are particularly sensitive to disturbance such as migration, nesting and moulting	x				A pre-construction wildlife survey was done from June 6th and 8th and wildlife log was also done during the construction season. No bird breeding, nesting or moulting activities were observed.
200	WL15. DFO 2.2.5	If fish are encountered in creeks during haul road construction, they will be salvaged from the area and returned downstream. Adaptive management measures will be implemented for any further construction in or about that creek.	x				None of the stream crossing the haul road are fish bearing.

	Element to verify		Respect of requirement					Comment
			Compliant	Non-Compliant	On-going	Opportunity for Improvement	NA	
201	WL16. NIRB 5 Hamlet PI Quarry 16, 19 NWB C4, E14	The Contractor shall not construct within, abstract water from or disturb any stream, lakebed or the banks of any definable water course unless written permission is given by GN and an authorization is obtained from the Nunavut Water Board and the DFO	x					No authorization has been necessary during the 2020 season since no construction activity has been performed in a water course.
202	BL04. NIRB 17 Hamlet PI Quarry 42	Buffers or exclusion zones shall be implemented, in the event a sensitive species or feature (e.g. nest) is identified, to ensure wildlife are not disturbed. Buffer of 250 metres within sensitive areas for quarry site	x					None observed in the pre-construction wildlife survey neither during the construction season and therefore no buffer zones were established or needed.
203	SE12 DFO 2.2.3 DFO 2.2.4 Hamlet PI Quarry 41 NWB C3	Culverts and /or other drainage features (sized appropriately) shall be installed at water crossings and in lowland areas to avoid ponding and to maintain flow and fish passage.	x					Culverts are sized appropriately to the stream that the haul road crosses.
204	NIRB 14. Hamlet PI Quarry 37 CIRNAC 29	Ensure that there is no damage to wildlife habitat in conducting this operation	x					During the pre-construction wildlife survey no habitat has been observed close to any of the project components, only some feeding ground for birds at around 100 m to 200 m from the haul road.
205	NWB C6, E13	In-stream activity will be limited to either no-flow or low-flow Water periods. In stream activity is prohibited during fish migration.					x	No in-stream activity during season 2020
206	Hamlet PI Quarry 39, 40	The Permittee shall ensure compliance with the Fisheries Act	x					No fish bearing watercourse close to the quarry.
<b>Bird Measures</b>								
207	BR01.	Activities and infrastructure will be sited away from nests and roosts that will be protected by prohibited entry buffers based upon government or biologist recommended setback distances. Any nest that is disturbed will result in immediate notification to ECCC and the Government of Nunavut.	x					No nest was observed in pre-construction wildlife survey, neither during the 2020 work season.
208	BR02.	Construction activities will not begin until the area has been surveyed for migratory birds and nests (in a non-intrusive manner).	x					A pre-construction wildlife survey was done from June 6th and 8th and wildlife log was also done during the construction season.
209	BR03.	Nest monitoring may be periodically required to determine efficacy of setbacks and buffers.	x					No nest was observed in pre-construction wildlife survey which was performed from June 6th and 8th, neither during the 2020 work season.
210	BL01.	Construction should be initiated prior to the arrival of migratory birds (breeding season mid-May to mid-August) such that the quarry and surrounding area becomes unattractive for nesting. A pre- construction survey shall be conducted by the EM to identify all sensitive wildlife features, e.g. active bird nests, wildlife dens and wildlife foraging or traveling nests, if blasting commences within this window.	x					2020 season started mid-June and the first blast occurred on June 17. A pre-construction wildlife survey was done from June 6 to 8 and no sensitive feature has been observed (refer to weeks 1 to 4 EM report). A wildlife log was done along the 2020 work activity.
211	WL01. CIRNAC 30	A zero-tolerance policy regarding the harassment, disturbance and feeding of wildlife shall be implemented.	x					The policy is mentioned in site induction.
212	WL10.	Appropriate mitigation measures will be implemented in the event large congregations of wildlife and birds occur in the Project Area.	x					No large congregation of birds around any components for 2020.

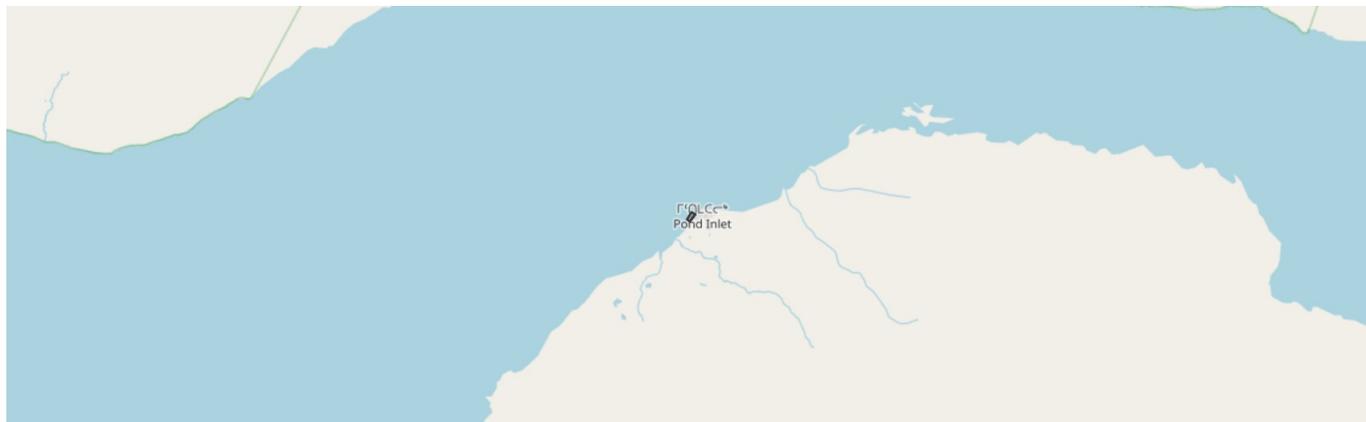
	Element to verify	Respect of requirement					Comment
		Compliant	Non-Compliant	On-going	Opportunity for improvement	NA	
<b>Vegetation Measures</b>							
213	VG01.	Working areas shall be inspected prior to clearing to confirm the absence of rare plants by the environmental monitor.	x				No rare plants observed, mentioned in site induction.
214	VG02.	Vehicle and equipment mobilized to site shall be inspected to ensure they are clean and free of soil, invasive plants and/or their seeds.	x				Done before mobilization at Pond Inlet.
215	VG03.	All personnel shall be trained through the induction and subsequent toolbox talk session on the risk of damaging or disturbing vegetation and sensitive communities.	x				Mentioned in site induction.
216	VG04.	Monitoring of disturbed areas for potential weed infestations shall occur on a regular basis by the environmental monitor.	x				
<b>Cultural, Heritage and Archaeological Measures</b>							
217	CH01. Hamlet PI Quarry 2, 35	If historical or palaeontological features (e.g. stone features, stone tools, modified bone, fossils) not previously recorded are identified within the construction footprint during construction, the measures outlined in the Archaeological Resource Discovery Protocol shall be implemented. Quarry operation :follow Discovery Protocol and notify the Heritage Director, Department of Culture, Language, Elders and Youth (CLEY), of the location of the site.	x				None found yet.
218	CH02.	All workers shall be briefed regarding the potential negative effects of construction activities to archaeological and palaeontological resources and shall be familiar with this CEMP, including the Archaeological Resource Discovery Protocol.	x				Mentioned in site induction.
219	CH03.	If potential human remains are found within the footprint during construction, the measures outlined in the Archaeological Resource Discovery Protocol shall be implemented.	x				
220	CH04.	Project personnel shall be prohibited from collecting any archaeological or palaeontological materials.	x				Mentioned in site induction.
221	Hamlet PI Quarry 36	Follow all terms and conditions for the protection and restoration of archaeological resources as outlined by the Department of Culture, Language, Elders and Youths (CLEY)	x				None found yet.
<b>Community issues</b>							
222	CI01.	A dedicated emergency responder shall be provided for the Project and an emergency medi-vac plan will be in place for the construction workforce.	x				
223	CI02.	Contractor employees shall be required to sign a Code of Conduct governing behaviour on the Project and during recreational hours to reduce the likelihood of negative social effects on the community.	x				Done at induction.
224	CI03.	Contractor shall implement a cultural awareness program for all staff to promote understanding and respect for local residents.	x				Mentioned in site induction.
225	CI04.	The Project shall impose a zero tolerance policy for alcohol and illicit drug possession or use.	x				Mentioned in site induction, code of conduct.
226	CI05.	Contractor shall work with the local hotels and Hamlet to determine available bed space and develop a plan for housing workers, maximize use of hotel space but leaving sufficient reserve for normal community needs.	x				No availability at hotels
227	CI06.	The Project shall implement an on-site fire response plan to reduce impacts to local fire services. Project staff shall be trained in the use of fire suppression aids.	x				Site induction.
228	CI07.	A dedicated fuel truck shall be used to meet Project fuel requirements, if fuel supplies in the Hamlet are insufficient.	x				One dedicated fuel truck.

	Element to verify		Respect of requirement					Comment
			Compliant	Non-Compliant	On-going	Opportunity for improvement	NA	
229	CI08.	Ongoing communication and consultation, as agreed with the Hamlet administration and the HTO, will inform hunters, fishers, cruise ship operators and outfitters during construction to minimize access restrictions and maintain safety.	x					Due to health protocols related to COVID-19, communication with the Hamlet and with the residents was done via radio ads, Facebook posting, posters and a newsletter. An in-person public meeting was held on October 19 with health precautions in place.
230	MT03.	Communication protocols will be established to notify the community of marine activities, including ongoing consultation with the community and HTO and Notice to Shipping.	x					Communication is made through TA website, TA project Facebook page, community meetings.
231	NIRB 36	Engage with local residents regarding planned activities and should solicit available Inuit Qaujimaningit and information regarding current recreational and traditional use of the project area. Posting of translated notices and direct engagement with groups and individuals prior to undertaking project activities is strongly encouraged.	x					
232	NIRB 36	Prepare and submit approach to CGS and dates	x					
233	NIRB 37	Ensure that project activities do not interfere with Inuit Wildlife harvesting or traditional land use activities.	x					Access to water will be kept during construction.
234	CI09.	Access to the existing boat ramp shall be maintained until the new ramp is constructed to allow continuing access to water.	x					
235	NIRB 38	To the extent possible, hire local people and access local services.	x					
236	NIRB 39	Ensure that access to work areas is controlled and restricted to construction personnel (includes posing of signs noting hazards).	x					At the entry of project components.
237	NIRB 40	Discuss potential implications of the project on on-land and marine traffic with Hamlet, applicable territorial and federal government agencies and local facility users before the start of the project.	x					The community has been consulted through the public information session held prior the construction activities started. Territorial and Federal government agencies were consulted during the NIRB screening process and the authorizations obtention process.
238	BL03.	A notification protocol with input from the local community and other stakeholders for advance notification of planned substantial noise-causing activities shall be implemented.	x					



**Appendix 4    Demonstrative NAVWARN**

Navigational Warnings (NAVWARNs) replace Notices to Shipping (NOTSHIPS) and shall be construed as Notices to Shipping



*ID* NW-A-0115-20

*Date* 2020-08-27 22:12 UTC To 2020-11-16 00:00 UTC

*Status* Cancelled

*Title* Marine works

*Cancel* NW-A-0114-20

*Areas* Shipping Safety Control Zone 13

*Categories* Marine Works (Other)

*Description* Marine infrastructure construction works in Pond Inlet until 160000 UTC, NOV 2020. Area is marked by 4 points and bounded by:

72 42.018N 077 58.903W

72 41.930N 077 58.390W

72 41.631N 077 59.109W

72 41.722N 077 59.508W

*Position* Centroid : 72° 41.829'N 077° 58.966'W

*Charts* 7212(WGS84)



**Appendix 5 Compliance Turbidity**

### 3.5 Turbidity monitoring

In water infill was carried out on July 6th and 7th for the crane pad. Visual monitoring was conducted throughout the activity and background/compliance samples were taken on July 6th and 7th, with a sampling pole and a bottle because there were still a too many blocks of ice in the area for the boat to maneuver safely. No plume was observed and no exceedance was measured.

Table 3-3: Results for turbidity monitoring

# sample	Date/Hour	Type of sampling	Location	Results (NTU)	Tide	Depth in meters (sample/total)	
200706_1	July 6th/ 8:40 AM	Background	60 m down current	31.8	Mid-ebb	1/2	
	July 6th/ 8:44 AM	<b>Start of in water infill</b>					
200706_2	July 6th / 9:30 AM	Compliance	80 m down current	31.3	Mid-ebb	1/2	
200706_3	July 6th / 15:26 PM	Background	25 m up current	25.8	Rising tide	1/2	
200706_4	July 6th / 15:36 PM	Compliance	60 m down current	28.6	Rising tide	1/2	
	July 6th / 17:00 PM	<b>End of in water infill</b>					
	July 7th/ 13:00 AM	<b>Start of in water infill</b>					
200707_1	July 7th/ 13:30 AM	Compliance	80 m down current	25.8	High tide	1/2	
200707_2	July 7th/ 13:39 AM	Compliance	60 m down current	24.6	High tide	1/2	
200707_3	July 7th/ 13:46 AM	Background	25 m up current	36.6	High tide	1/2	
200707_4	July 7th/ 16:00 AM	Compliance	80 m down current	28.7	Mid-ebb	1/2	
200707_5	July 7th/ 16:11 AM	Compliance	60 m down current	28.6	Mid-ebb	1/2	
200707_6	July 7th/ 16:18 AM	Background	25 m up current	32.9	Mid-ebb	1/2	
	July 7th / 17:00 PM	<b>End of in water infill</b>					

Figure 3.1 Samples locations for July 6th



Figure 3.2 Samples locations for July 7th



#### 3.5.3 Sediment and erosion control

No new issue has been observed during the period covered by this report. See section 3.6 and Appendix B for more details.



### 3.5 Turbidity monitoring

2020/08/17: No turbidity monitoring, work in the laydown area

2020/08/18: No turbidity monitoring, work in the laydown area

2020/08/19: Resloping of the west breakwater and laydown

2020/08/20: Dredging with a turbidity curtain in place (refer to pictures: *SCH\_GlobalView\_West\_20200823*, *SCH\_TurbidityCurtainsInstall01\_20200819*, *SCH\_TurbidityCurtainsInstall02\_20200819* and *Turbidity curtain location Pond Inlet Inner Harbour 20200820* ). This mitigation measure has been placed in a preventive way. The water column at this place is between 1 m and 2.5 m. The turbidity curtain height was around 2 m.

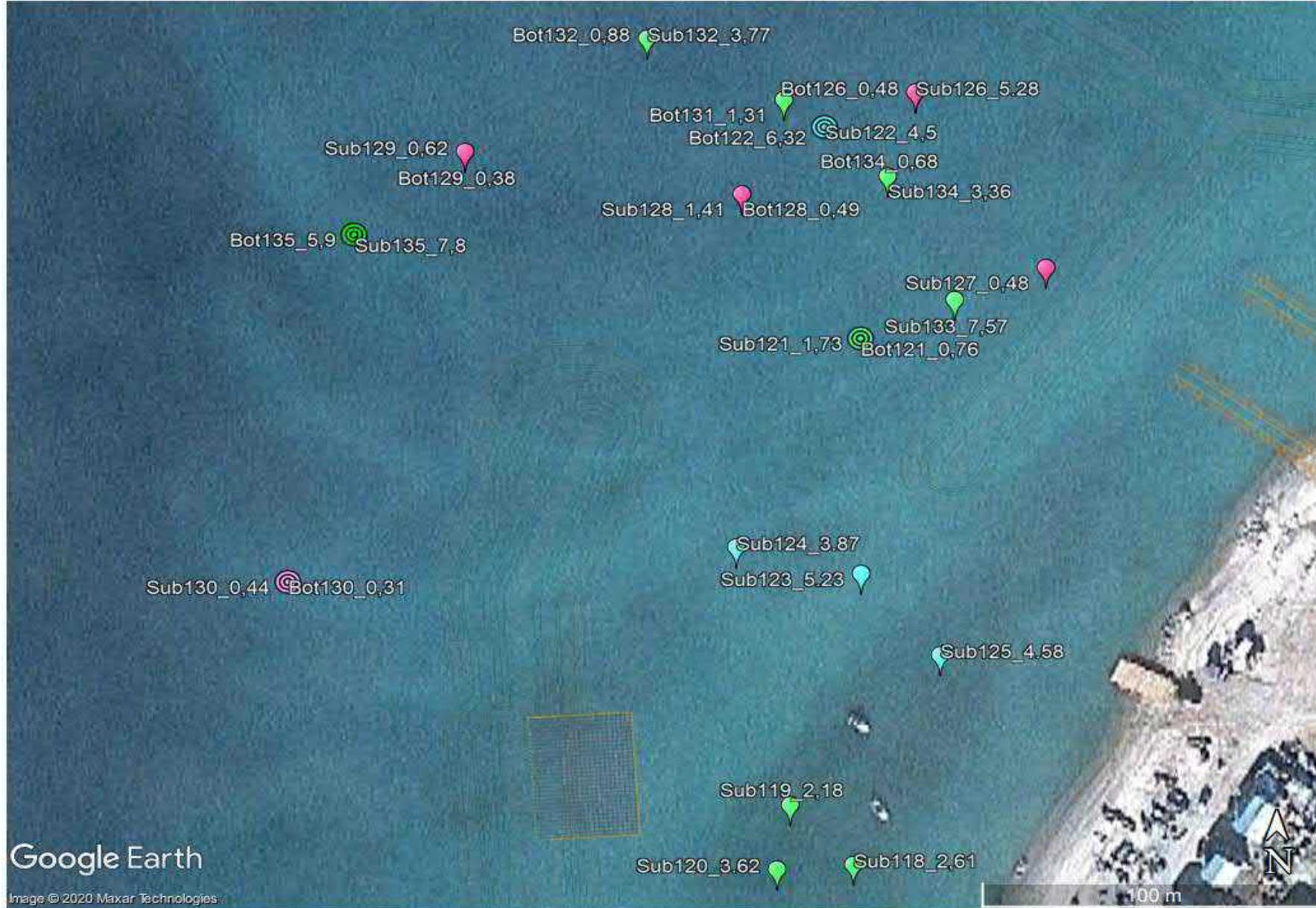
2020/08/21: Resloping of the west breakwater and in water infill for the dredging access

2020/08/22: Some rocks were moved in the laydown area, turbidity was visually verified (as the river water was not interfering)

2020/08/23: Resloping and in water infill of the west breakwater : Visual verification

Table 3-3: Results for turbidity monitoring

Point #	Date	Time	Coordinates		Distance from work approximatly	Surface Turbidity [NTU] (first centimeters below surface)	Sub Surface Turbidity [NTU] (1m below surface)	Mid depth Turbidity [NTU]	Bottom Turbidity [NTU] (1m above bottom)	Plume	Total water depth [m]	TIDE [Ebb, Rise, Low , High]	Boat Drift direction	In water infill details
118	8/19/2020	13:23	72°41'45.82"N	77°58'56.14"O	about 70m downstream	n.a.	2.61	n.a.	n.a.	NO	3	HT	x	Resloping of the west breakwater and laydown
119	8/19/2020	13:25	72°41'46.45"N	77°58'58.16"O	about 70m downstream	n.a.	2.18	n.a.	NO	3	HT	x		
120	8/19/2020	13:28	72°41'45.77"N	77°58'58.58"O	about 50m downstream	n.a.	3.62	n.a.	NO	3	HT	x		
121	8/19/2020	13:35	72°41'51.61"N	77°58'55.90"O	Background	n.a.	1.73	n.a.	0.76	na	4	HT	x	
122	8/20/2020	17:30	72°41'53.85"N	77°58'57.05"O	Background	n.a.	4.5	n.a.	6.32	na	7	ET	x	Dredging and resloping with a turbidity curtain
123	8/20/2020	17:21	72°41'48.90"N	77°58'55.89"O	about 100m downstream	n.a.	5.23	n.a.	n.a.	NO	2	ET	x	
124	8/20/2020	17:20	72°41'49.18"N	77°58'59.88"O	about 100m downstream	n.a.	3.87	n.a.	n.a.	NO	2	ET	x	
125	8/20/2020	17:15	72°41'48.04"N	77°58'53.37"O	about 100m downstream	n.a.	4.58	n.a.	n.a.	NO	2	ET	x	
126	8/21/2020	11:11	72°41'54.00"N	77°58'54.15"O	about 100m downstream	n.a.	5.28	n.a.	0.48	NO	4	RT	x	west breakwater/ dredging accesses
127	8/21/2020	11:15	72°41'52.14"N	77°58'49.98"O	about 100m downstream	n.a.	1.47	n.a.	n.a.	NO	2	RT	x	
128	8/21/2020	11:19	72°41'52.92"N	77°58'59.70"O	about 100m downstream	n.a.	1.41	n.a.	0.49	NO	4.5	RT	x	
129	8/21/2020	11:24	72°41'53.37"N	77°59'8.55"O	about 100m downstream	n.a.	0.62	n.a.	0.38	NO	11	RT	x	
130	8/21/2020	11:31	72°41'49.03"N	77°59'14.20"O	Background	n.a.	0.44	n.a.	0.31	na	11	RT	x	
131	8/22/2020	14:22	72°41'53.92"N	77°58'58.36"O	about 100m downstream	n.a.	7.77	n.a.	1.31	NO	8	HT	NE	west breakwater/ dredging accesses
132	8/22/2020	14:29	72°41'54.57"N	77°59'2.73"O	about 100m downstream	n.a.	3.77	n.a.	0.88	NO	14	HT	NE	
133	8/22/2020	14:33	72°41'51.80"N	77°58'52.90"O	about 100m downstream	n.a.	7.57	n.a.	n.a.	NO	1	HT	NE	
134	8/22/2020	14:44	72°41'53.11"N	77°58'55.04"O	about 100m downstream	n.a.	3.36	n.a.	0.68	na	16	HT	NE	
135	8/22/2020	14:50	72°41'52.71"N	77°59'12.09"O	Background	n.a.	7.8	n.a.	5.9	NO	6	HT	NE	





**Appendix 6 Compliance Acoustics**



## UNDERWATER ACOUSTIC MEASUREMENT

Tower Arctic Ltd  
Project #: 21808

<b>Environmental monitor's name</b>	<b>Date (yyyy-mm-dd)</b>	<b>Period</b>
Louis Simon Barville	2020-07-13	18:05:31 to 18:13:57
<b>Description of work</b>	<b>Description of mitigation measures</b>	
Sheet pile driving	Area is almost completely confined by the temporary accesses.	

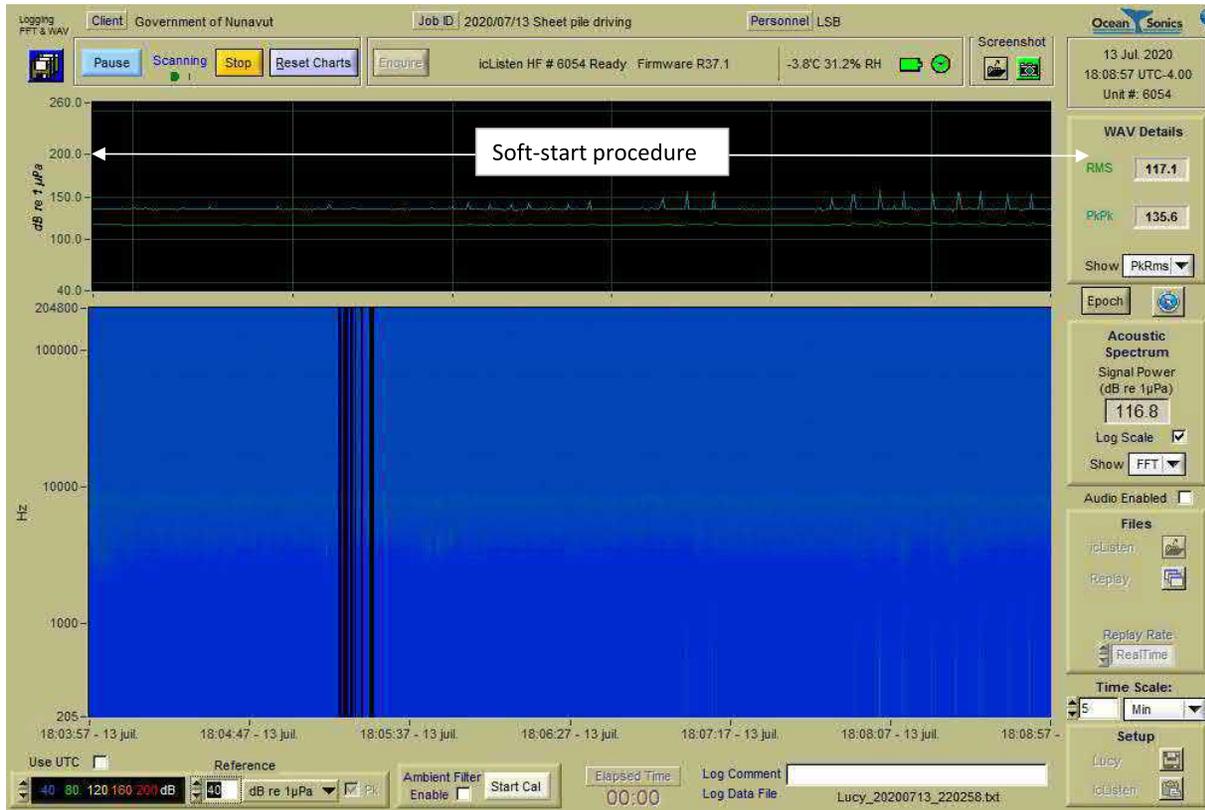
Results											
Underwater noise						Marine conditions		Weather conditions			
Duration	Initial position		Final position		Data	SPL rms	Tide	Water depth (m)	Temperature (T°C)	Wind condition	
	X	Y	X	Y							
8:26 minutes	72°41'58.98"	77°58'49.51"	72°41'58.98"	77°58'49.51"	Data_20200713_220531	<b>132.77 dB re 1 µPa rms.</b>	1.6	20	10	Light breeze	
<b>Notes</b>											
						Hydrophone set at 400 north from the sheet pile driving.					
						<p>The data obtained during underwater sound monitoring for sheet pile driving has been merged into a 8,26 minutes sound file. The soft-start procedure was recorded at the beginning.</p> <p>Monitored frequency range : 0 to 204 kHz. The break-ups in recording are caused by the too high amount of data transmitted in real-time to the computer. This error in recording is also responsible for the aberration at 400s in the last graph below. After testing confirmed that assumption since this problem did not appeared at 102 kHz and lower.</p>					
Instrumentation											
<b>Hydrophone:</b>	icListen HF S/N6054 Firmware v2.2.09					<b>Depth:</b>	15				

Completed by : Louis Simon BarvilleDate : 2020-07-21



# UNDERWATER ACOUSTIC MEASUREMENT

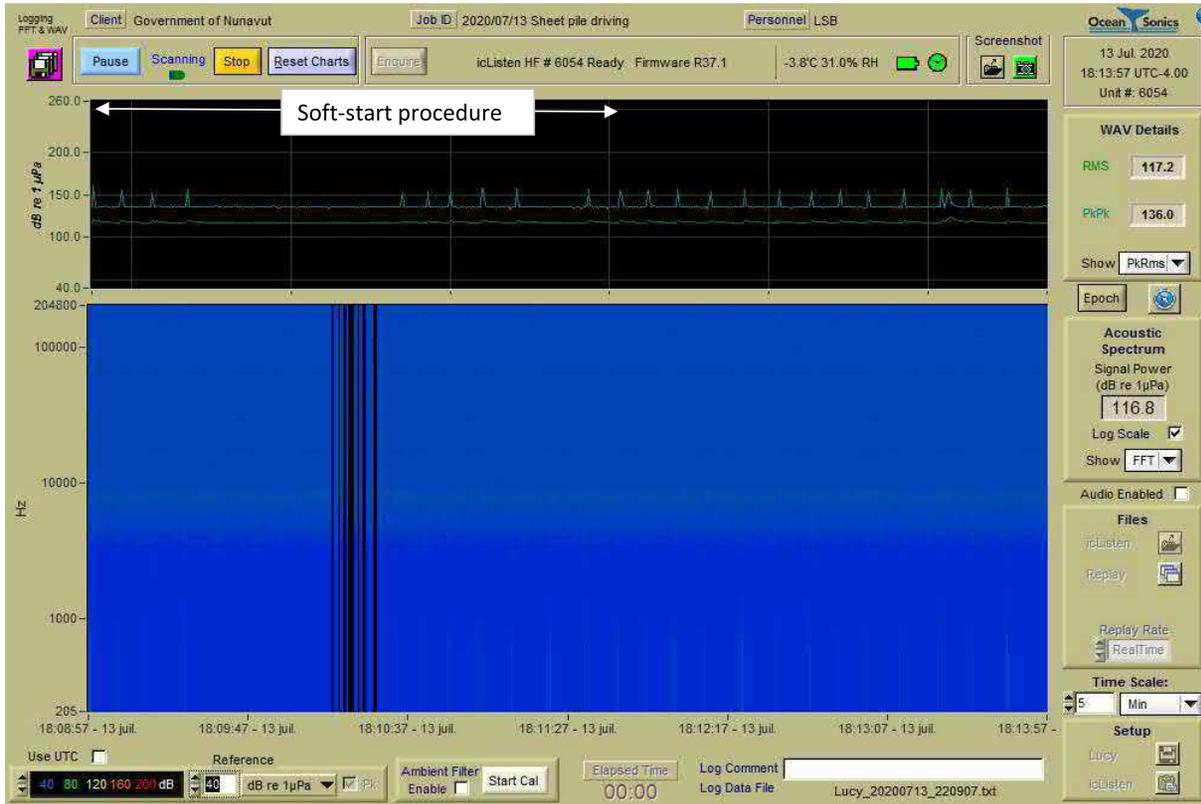
Tower Arctic Ltd  
Project #: 21808





# UNDERWATER ACOUSTIC MEASUREMENT

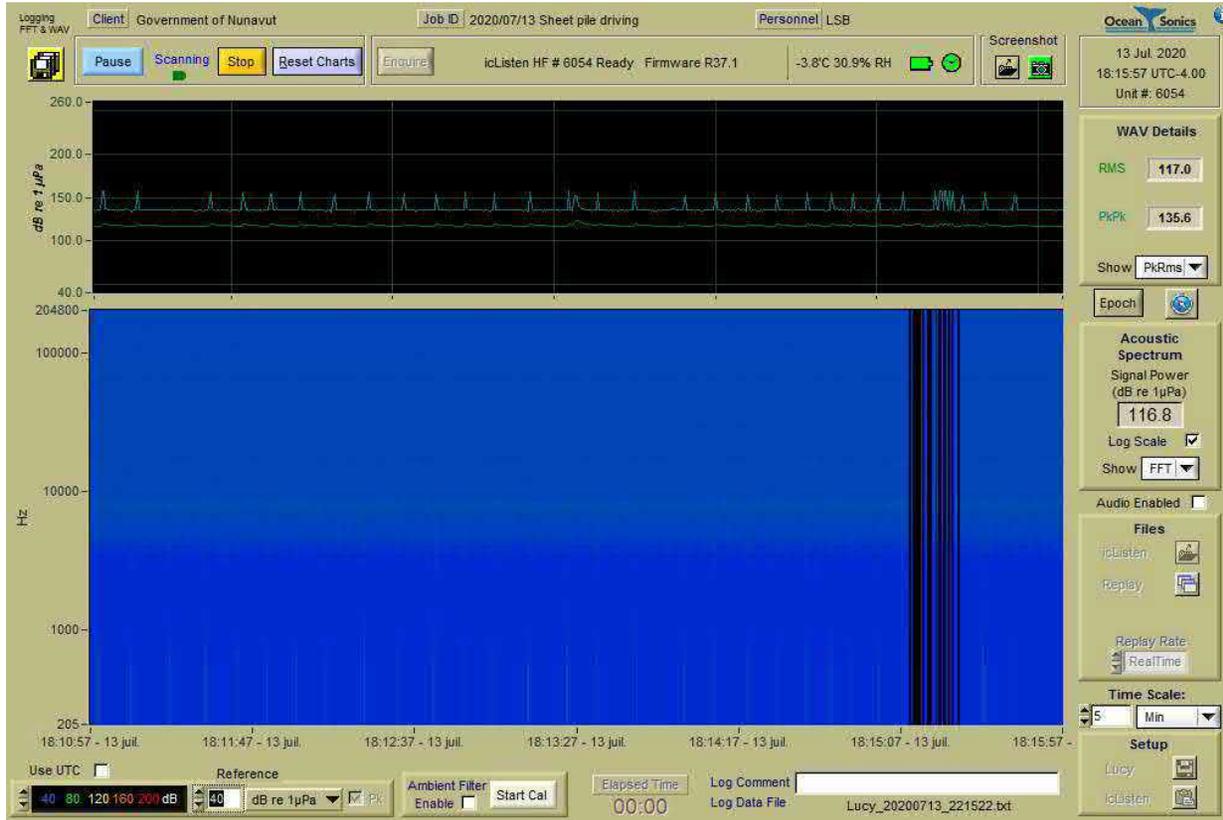
Tower Arctic Ltd  
Project #: 21808





# UNDERWATER ACOUSTIC MEASUREMENT

Tower Arctic Ltd  
Project #: 21808





# UNDERWATER ACOUSTIC MEASUREMENT

Tower Arctic Ltd  
Project #: 21808

