Appendix V5-10D

2009 Marine Fish and Fish Habitat Baseline Report, Hope Bay Belt Project

Hope Bay Mining Limited

2009 Marine Fish and Fish Habitat Baseline Report, Hope Bay Belt Project

NEWMONT NORTH AMERICA

Rescan Engineers & Scientists

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March 2010

2009 Marine Fish and Fish Habitat Baseline Report, Hope Bay Belt Project

March 2010
Project #1009-002-08

Prepared for:

NEWMONT™
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Hope Bay Mining Limited

Prepared by:

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Vancouver, British Columbia

Executive Summary

Rescan™
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Executive Summary

Environmental baseline studies were conducted by Rescan Environmental Services Ltd. (Rescan) in 2009, on behalf of Hope Bay Mining Ltd. (HBML), for the Hope Bay Belt Project. The Hope Bay Belt Property is located approximately 125 km southwest of Cambridge Bay, Nunavut, on the south shore of Melville Sound.

The purpose of the 2009 overall environmental program was to conduct compliance monitoring for the Doris North Project, as well as to conduct baseline work to support potential future development in the belt.

The primary objective of the 2009 marine fish and fish habitat work was to collect baseline marine data on the nearshore fish community, macrobenthos community and fish habitat at two potential marine infrastructure sites: a dry cargo/module dock (Barge Site) and a deep water/unloading dock (Port Site) in Roberts Bay. Nearshore fish and macrobenthos communities were also sampled at a reference site located in a bay east of Roberts Bay.

Shoreline habitat was assessed at the proposed barge site and the proposed port site in Roberts Bay. Cobble and boulder dominated the littoral substrate at the proposed barge site. The proposed port site was dominated by cobble, gravel and fines but bedrock was the dominant substrate type at the proposed site of infrastructure development. The reference site was chosen to have similar substrates to both the proposed barge and port sites.

Biological sampling occurred during two periods: early August and late August/early September. Floating and sinking gillnets, long lines, beach seines and minnow traps were used to capture pelagic and demersal fish of a wide range of body sizes. Crab traps were used to sample large-bodied invertebrates (e.g., crabs, isopods), but they also captured fish. A total of eleven fish species were captured in Roberts Bay, including Arctic char, Arctic flounder, Arctic shanny, capelin, Greenland cod, longhead dab, ninespine stickleback, Pacific herring, saffron cod, starry flounder and sculpins of the genus *Myoxocephalus*. Six of those species were captured at the reference site. Saffron cod and Pacific herring were the dominant species at the proposed barge and port sites, and sculpins dominated the reference site.

Taxonomic analysis of Pacific herring stomach contents produced similar results for Roberts Bay and the Reference Bay. At both locations, the numerically dominant prey item was Decapoda. Prey taxa of secondary importance in Roberts Bay included Mysidacea, Amphipoda and Copepoda, in decreasing order of importance. In the Reference Bay, prey taxa of secondary importance were Amphipoda, Mysidacea and fish eggs.

The macrobenthos community of Roberts Bay and the Reference Bay were sampled concurrently with the fish community. Macrobenthos belonging to six different taxa were captured in the Project area including: Asteroidea (sea stars); Bivalvia (clams and mussels); Isopoda (isopods); Echinoidea (sea urchins); Gatropoda (snails) and Decapoda (crabs). The proposed port site had the most diverse macrobenthos community, followed by the reference site. Macrobenthos were sparse at the proposed barge site, most likely due to its shallow waters and greater amounts of fine substrate. Jellyfish were observed at all three sites, but only in the late sampling period.

A review of available historical fish and fish habitat data for Roberts Bay was also conducted. Comparisons of the 2009 results with results from Roberts Bay from 2000 to 2007 were largely qualitative due to differences among years in gear types and sampling locations. A total of 18 species of fish have been captured over the last decade; the additional species captured prior to 2009 included banded gunnel, Arctic cisco, least cisco, lake trout, lake whitefish and an unknown species of flounder. Saffron cod was the most abundant species in most years. Relatively high numbers of capelin and Pacific herring were caught in 2003 and 2007 due to a focus in those two years on intercepting along-shore fish migrations. Sampling in 2009 caught more pelagic and bentho-pelagic species because more sampling effort was expended with gillnets in offshore areas than in previous years.

Acknowledgements

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Acknowledgements

This report was prepared for Hope Bay Mining Ltd. by Rescan Environmental Services Ltd. The 2009 marine fish and fish habitat fieldwork was conducted by Maria Sotiropoulos (M.Sc.), Glenn Wagner (Ph.D., R.P.Bio.), Kirsten MacKenzie (M.Sc., R.P.Bio.) and François Landry (M.Sc., R.P.Bio.). Bathymetry surveys were conducted by Brock Stables (M.Sc.) with the assistance of Maria Sotiropoulos. The report was written by Maria Sotiropoulos with support from Kirsten MacKenzie, and reviewed by François Landry, Michael McGurk (Ph.D., R.P.Bio.) and Deborah Muggli (M.Sc., Ph.D., R.P.Bio.). The Hope Bay Belt Project was managed by Deborah Muggli.

Rescan staff were assisted in the field by Tannis Bolt, Aaron Halushka, Janet Kadlun, Darcy Kanayok, Stephen Kuhoktak, Wynter Kuliktana, Irvin Kuptana, Ben Putuquq and Clarence Klengenberg. Brian Coad of the Canadian Museum of Nature provided identification and verification of two fish species captured in the Project area.

Extensive support was provided by the Newmont Environment and Social Responsibility (ESR), Health, Safety and Loss Prevention (HSLP) Department, and camp management, as well as Great Slave Helicopters, Braden Burry Expediting, and Nuna Logistics.

Citation:

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2009 MARINE FISH AND FISH HABITAT BASELINE REPORT, HOPE BAY BELT PROJECT

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1. Introduction

1. Introduction

The Hope Bay Belt Property is located approximately 125 km southwest of Cambridge Bay, Nunavut, on the south shore of Melville Sound (Figure 1-1). The nearest communities are Omingmaktok (75 km to the southwest of the property), Cambridge Bay, and Kingaok (Bathurst Inlet; 160 km to the southwest of the property).

The property consists of a greenstone belt running in a north/south direction, approximately 80 km long, with 3 main gold deposit areas. The Doris and Madrid deposits are located in the northern portion of the belt, and the Boston deposit is located in the southern end. The northern portion of the property consists of several watershed systems that drain into Roberts Bay, and a large river (Koignuk River) that drains into Hope Bay. Watersheds in the southern portion of the belt ultimately drain into the upper Koignuk, which drains into Hope Bay.

Newmont Mining Corporation (Newmont) acquired the property in 2008, and initially decided to consider the property as a whole to evaluate various options for responsible, long-term development of the belt. However, as of the fall of 2009, Hope Bay Mining Ltd. (HBML), a fully owned subsidiary of Newmont, has decided to proceed with developing the already-permitted Doris North Project, which consists of a 2 year underground gold mine in the north end of the belt.

The environmental baseline program conducted in 2009 was based on the plan to develop multiple deposits in the belt, as indicated in Figure 1-2. The 2009 program was also based on HBML's priorities as of early 2009, which included regulatory compliance with the existing Doris North Project permits and licences. Baseline programs for ecosystem mapping, vegetation, soils, and socio-community were deferred to 2010. Baseline work was primarily focused on the north end of the belt in 2009.

Results from the 2009 environmental baseline program are being reported in a series of reports, as follows:

- 2009 Hydrology Baseline Report;
- 2009 Meteorology Baseline Report;
- 2009 Freshwater Baseline Report;
- 2009 Freshwater Fish and Fish Habitat Baseline Report;
- 2009 Marine Baseline Report; and
- 2009 Marine Fish and Fish Habitat Baseline Report.

In addition, baseline information obtained during 2009 was used to generate various compliance reports as specified in the Doris North Project Certificate (e.g., the Wildlife Monitoring and Mitigation Program Report), the Doris North Type A Water Licence, and the Doris North Roberts Bay Jetty Fisheries Authorization. Archaeology work was also conducted in 2009 and is being reported separately.

PROJECT # 1009-002-01 ILLUSTRATION # a23708w May 21 2009

Figure 1-1

Hope Bay Belt Project Location

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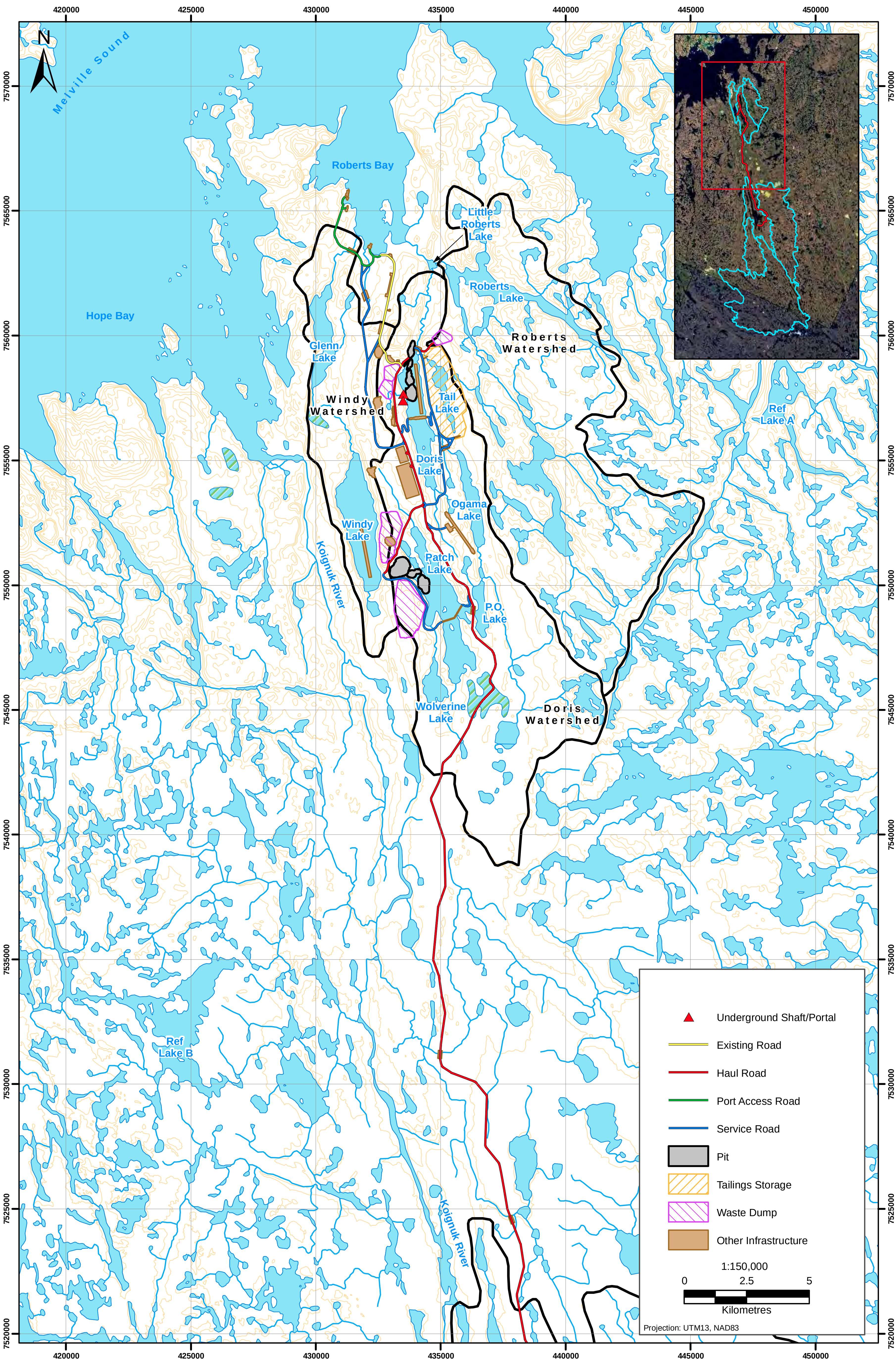

Figure 1-2

NEWMONT. The Gold Company

Site Layout Options Considered for 2009 Baseline Program

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The objective of the 2009 marine fish and fish habitat work was to collect baseline marine data on the nearshore fish community, macrobenthos community and fish habitat at two potential marine infrastructure sites: a dry cargo/module dock (Barge Site) and a deep water/unloading dock (Port Site) in Roberts Bay. Nearshore fish and macrobenthos communities were also sampled at a reference site located in a bay east of Roberts Bay. This report also includes a brief review of historical data on fish and fish habitat collected in Roberts Bay since baseline studies began in 2000.

2. Methods

2. Methods

2.1 SAMPLING LOCATIONS

Sampling in Roberts Bay was conducted at two potential marine infrastructure sites. The proposed sites include a dry cargo/module dock (Barge Site) and a deep water/unloading dock (Port Site) (Figure 2.1-1). In addition, a reference site was established in Reference Bay based on two criteria: (1) the site has similar habitat as the two potential infrastructure sites (i.e., similar substrate and depth); and (2) the site will not be impacted by future mining activities.

2.2 FISH HABITAT

Habitat surveys of the three sites were conducted by walking along the shoreline and delineating habitat units based on the dominant type of littoral zone substrate. Substrate types were divided into the following size classes: bedrock (>4,000 mm), boulder (256 to 4,000 mm), cobble (64 to 256 mm), gravel (2 to 64 mm), fines (0 to 2 mm). Within each habitat unit, substrate composition was recorded as a percent coverage (e.g., 70% cobble, 20% gravel and 10% fines) and the length of each unit was measured. Ground and aerial photographs were taken to illustrate various types of habitat units. In the office, a combination of field notes and photographs were used to create habitat maps.

2.3 FISH COMMUNITY

2.3.1 Sampling Frequency

The potential marine infrastructure sites in Roberts Bay and the reference site in Reference Bay were sampled for 2 to 4 days during two sampling periods: early-August and late-August/early-September (referred to as Early and Late sampling, respectively). Each site was sampled using a combination of six different types of fishing gear to cover a wide range of fish sizes, life history stages and water depths. Table 2.3-1 shows the sampling dates and effort for the three sites.

Table 2.3-1. Sampling Dates and Effort for Fish Community Surveys in Roberts Bay and Reference Bay, Hope Bay Belt Project, 2009

Location	Site	Set Dates	Number of GNF	Number of GNS	Number of LL	Number of BS	Number of MT	Number of CT
Roberts Bay	Proposed Barge Site	July 29 to 31, August 11	10	6	4	8	24	11
Roberts Bay	Proposed Barge Site	August 21, 23 and 26	6	9	3	7	29	15
Roberts Bay	Proposed Port Site	August 1 to 3	3	6	3	7	20	15
Roberts Bay	Proposed Port Site	August 22 and 29, September 3	6	9	4	9	20	10
Reference Bay	Reference Site	August 8 to 10	6	6	6	8	36	10
Reference Bay	Reference Site	September 4 to 5	3	6	2	3	20	10

Note:
GNF = Floating Gillnet; GNS = Sinking Gillnet; LL = Long line; BS = Beach Seine; MT = Minnow Trap; CT = Crab Trap.

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Figure 2.1-1

Sampling Sites for Fish and Fish Habitat Studies, Hope Bay Belt Project, 2009

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2.3.2 Sampling Gear

2.3.2.1 General

All sampling was done from an aluminum 5.8 m-long boat with a 70-horsepower outboard engine. The UTM of each gear set was recorded with a handheld GPS. Depths at which gear was fished were recorded with a depth sounder. The times of installation and retrieval of each gear were recorded.

2.3.2.2 Gillnets

A combination of floating and sinking gillnets were used to capture fish of a wide range of body sizes that move along the water surface (i.e., pelagic) and sea bottom (i.e., demersal), respectively.

Each monofilament index gillnet gang consisted of six panels, ranging from 25 mm to 89 mm stretched mesh. Each gillnet gang was tied in the following order: Panel 1 – 25 mm; Panel 2 – 76 mm; Panel 3 – 51 mm; Panel 4 – 89 mm; Panel 5 – 38 mm; and Panel 6 – 64 mm. Each panel measured 15.2 m long by 2.4 m deep for an area of 36.6 m^2 and a total area of 218.88 m^2 per gang.

Sinking index gillnets consisted of an upper (or "float") line with small buoys that allowed the net to float in the water column. The lower (or "lead") line was weighted and rested along the bottom. Floating index gillnets were similar to sinking gillnets but the lead line lacked weight, allowing the net to float at the surface.

Gillnets were randomly set perpendicular and parallel to shore for approximately one hour to minimize mortality of fish. Set times were extended if initial catches were low. Figures 2.3-1 to 2.3-6 display the position of floating and sinking gillnets.

2.3.2.3 Long Lines

A long line was used to capture actively-feeding fish. It was 17 m long and rigged with 7 hooks clipped onto the line at 2.5 m intervals. Each hook was attached to the main line with a short, secondary line and buoy. Hooks were baited with pieces of raw fish. At both ends, the main line was weighted with lead weights. Once set, the long line sat in the water column in a concave position. Hooks closer to the weighted ends sat lower in the water column than those in the middle, which floated near the surface. Floats were attached by rope to both weighted ends of the long line to mark the location of the gear.

Long lines were randomly set perpendicular and parallel to shore for an initial period of two hours, set times were extended if catch was low. Figures 2.3-1 to 2.3-6 display the position of long line sets in Roberts Bay and Reference Bay.

2.3.2.4 Beach Seines

The beach seine was used to capture fish of small and medium sizes that live in shallow water near the shore. The seine was 12 m long, 2 m deep with 2 mm-wide mesh. One end of the seine was held on the shoreline while the other end was walked out and drawn in a horseshoe shape so that it enveloped a portion of the shoreline (Plate 2.3-1). The two ends were then quickly drawn onto the beach keeping the lead line on the sea bottom and forcing fish into the bunt of the seine. A series of 2 to 3 seine hauls were conducted at each site. Figures 2.3-7 to 2.3-12 show the locations of beach seines in Roberts Bay and Reference Bay.

PROJECT # 1009-002-08 GIS # HB-06-032c January 17, 2010

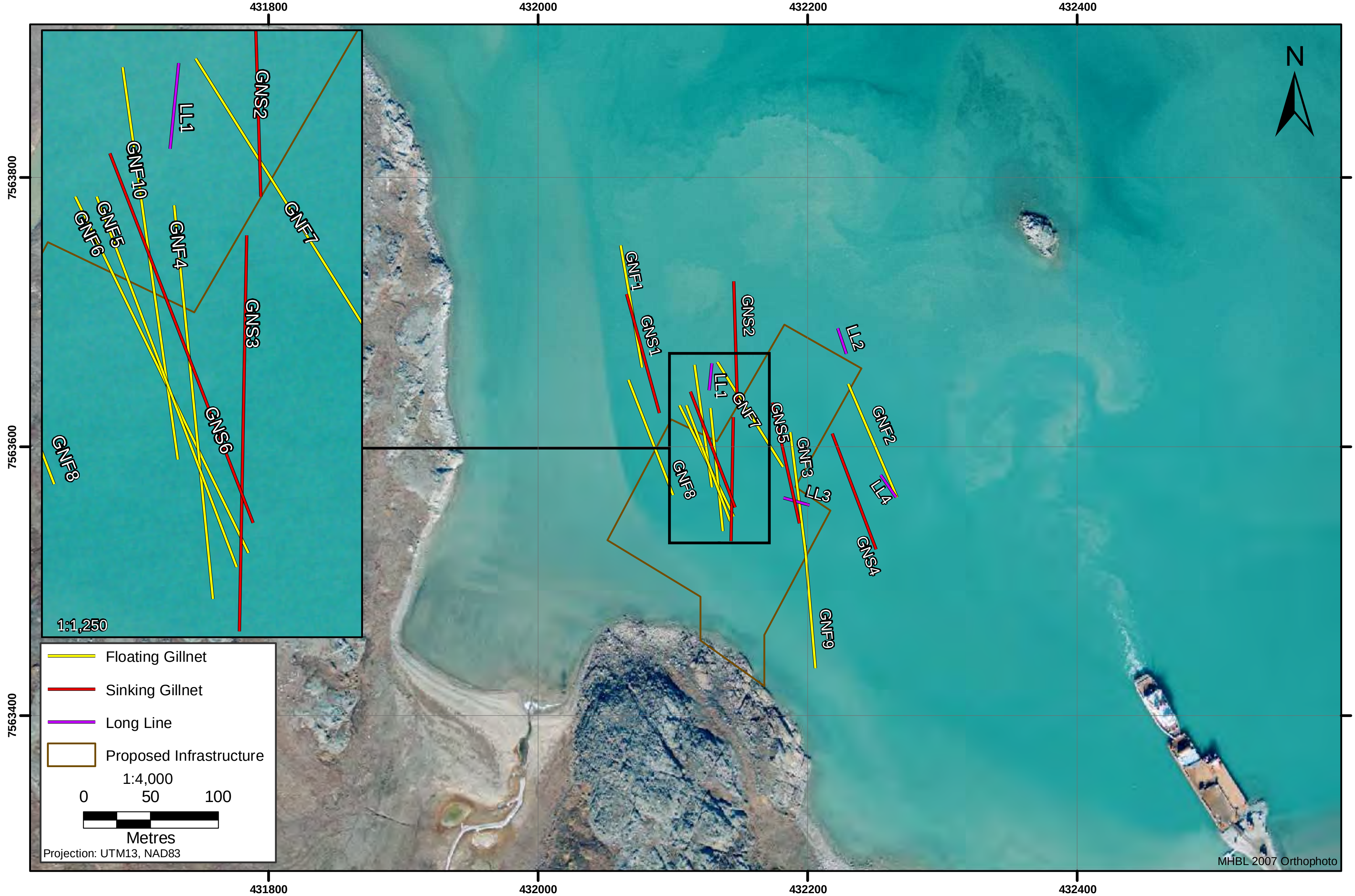

Figure 2.3-1

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Gillnet and Long Line Locations During the Early Sampling Survey of the Fish Community at the Proposed Barge Site in Roberts Bay, Hope Bay Belt Project, 2009

Figure 2.3-1

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PROJECT # 1009-002-08 GIS # HB-06-032a January 17, 2010

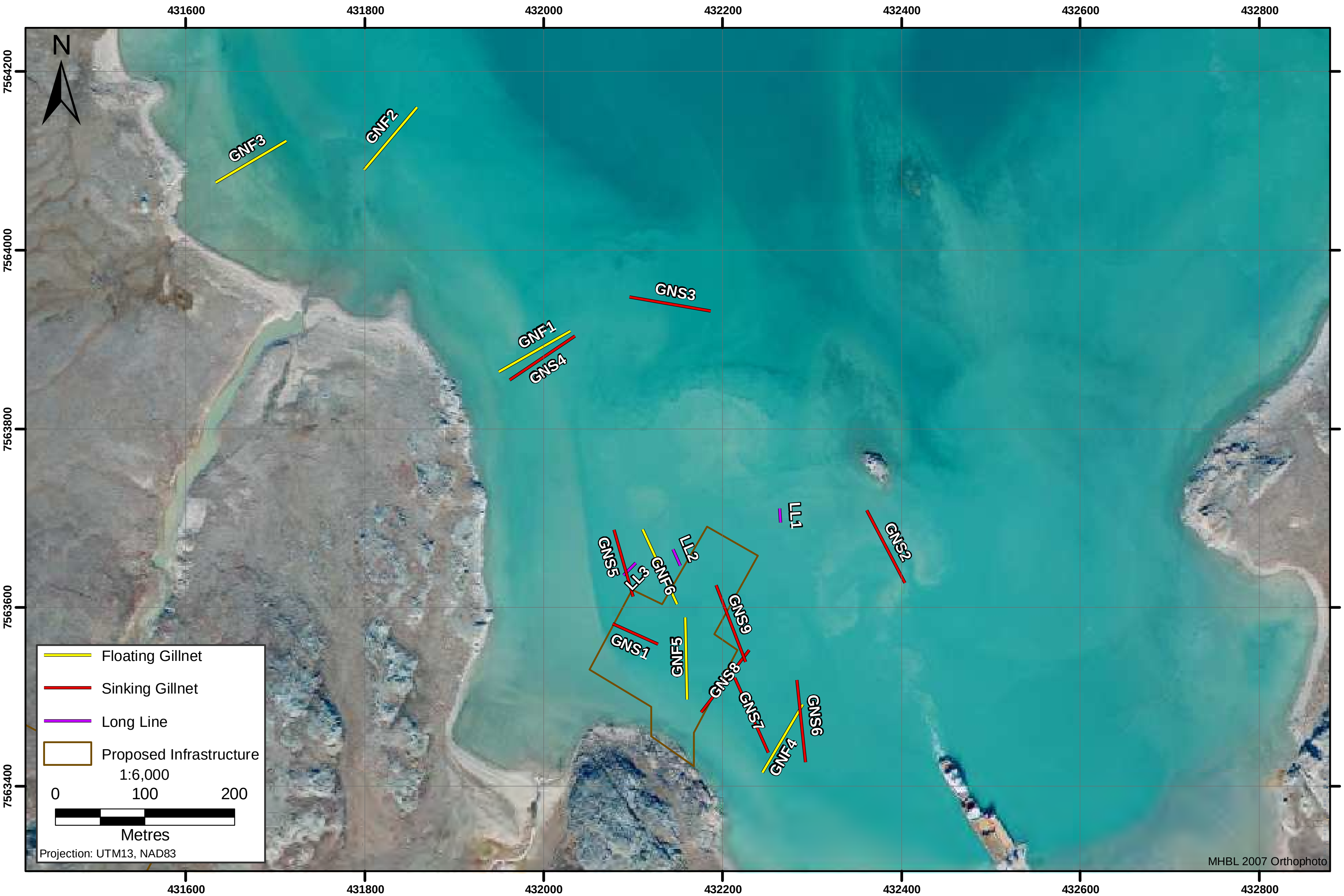

Figure 2.3-2

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Gillnet and Long Line Locations During the Late Sampling Survey of the Fish Community at the Proposed Barge Site in Roberts Bay, Hope Bay Belt Project, 2009

Figure 2.3-2

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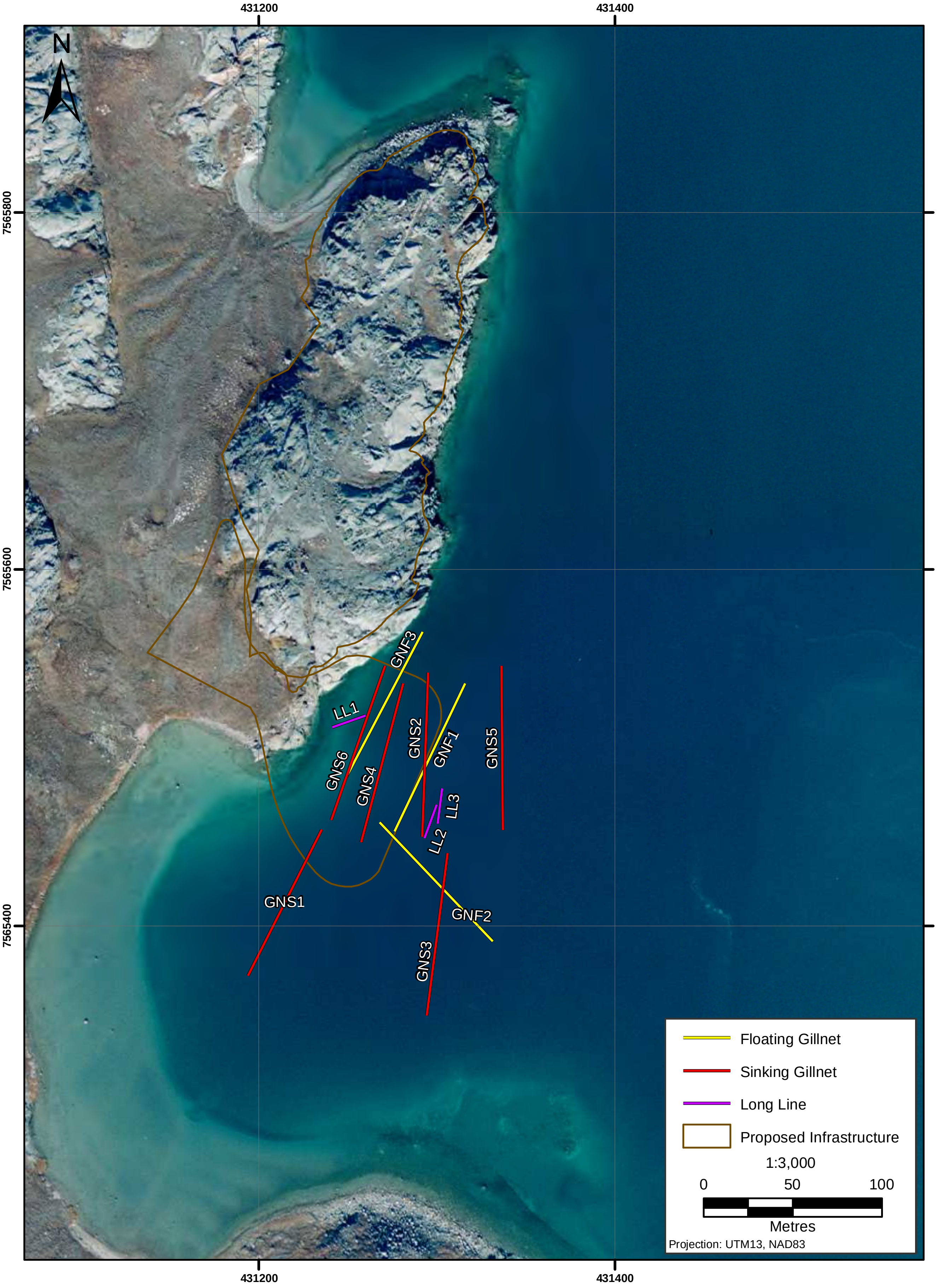

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Gillnet and Long Line Locations During the Early Sampling Survey of the Fish Community at the Proposed Port Site in Roberts Bay, Hope Bay Belt Project, 2009

Figure 2.3-3

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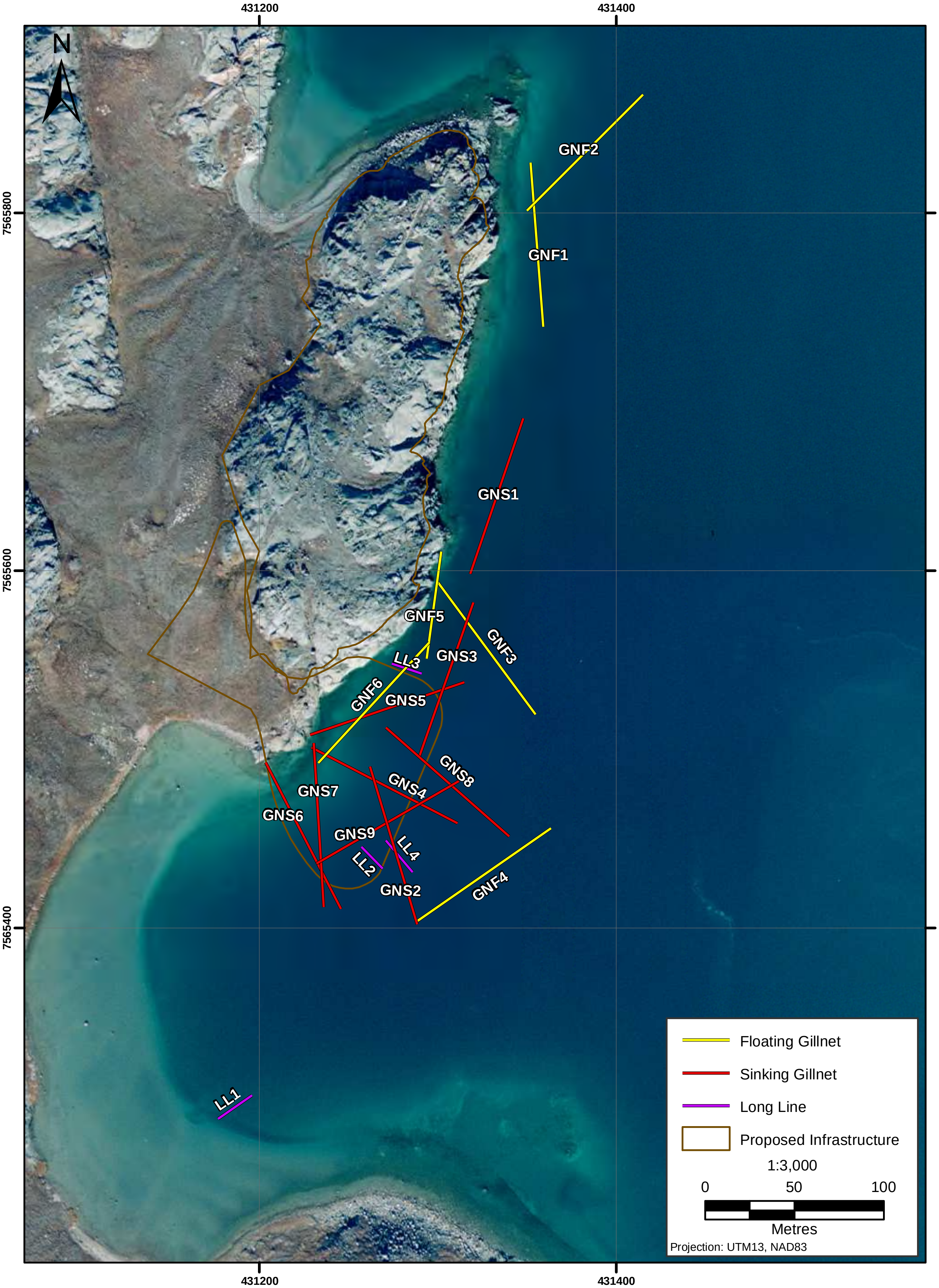

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Gillnet and Long Line Locations During the Late Sampling Survey of the Fish Community at the Proposed Port Site in Roberts Bay, Hope Bay Belt Project, 2009

Figure 2.3-4

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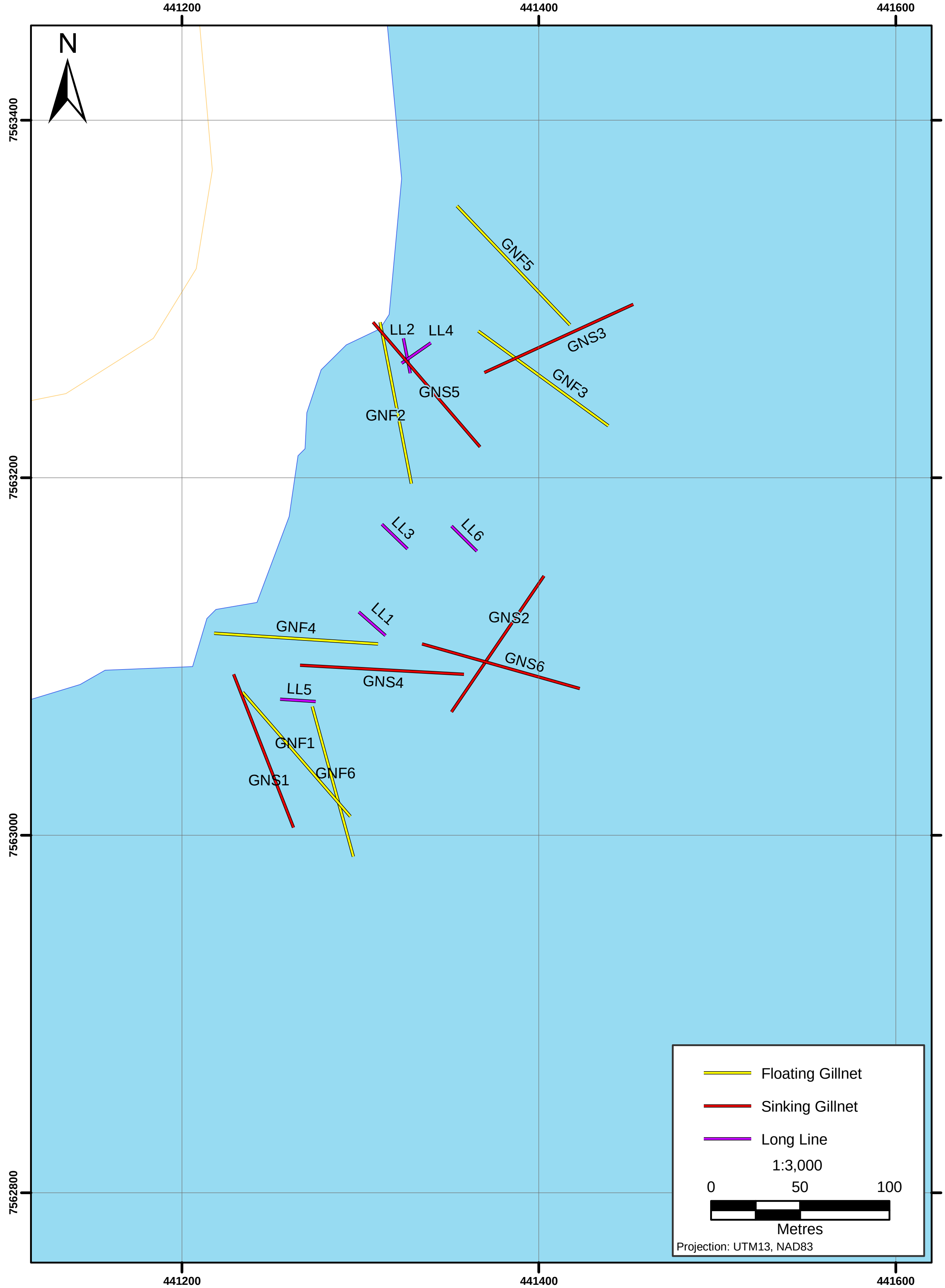
PROJECT # 1009-002-08 GIS # HB-06-032k January 18, 2010



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Gillnet and Long Line Locations During the Early Sampling Survey of the Fish Community at the Reference Site in Reference Bay, Hope Bay Belt Project, 2009

Figure 2.3-5

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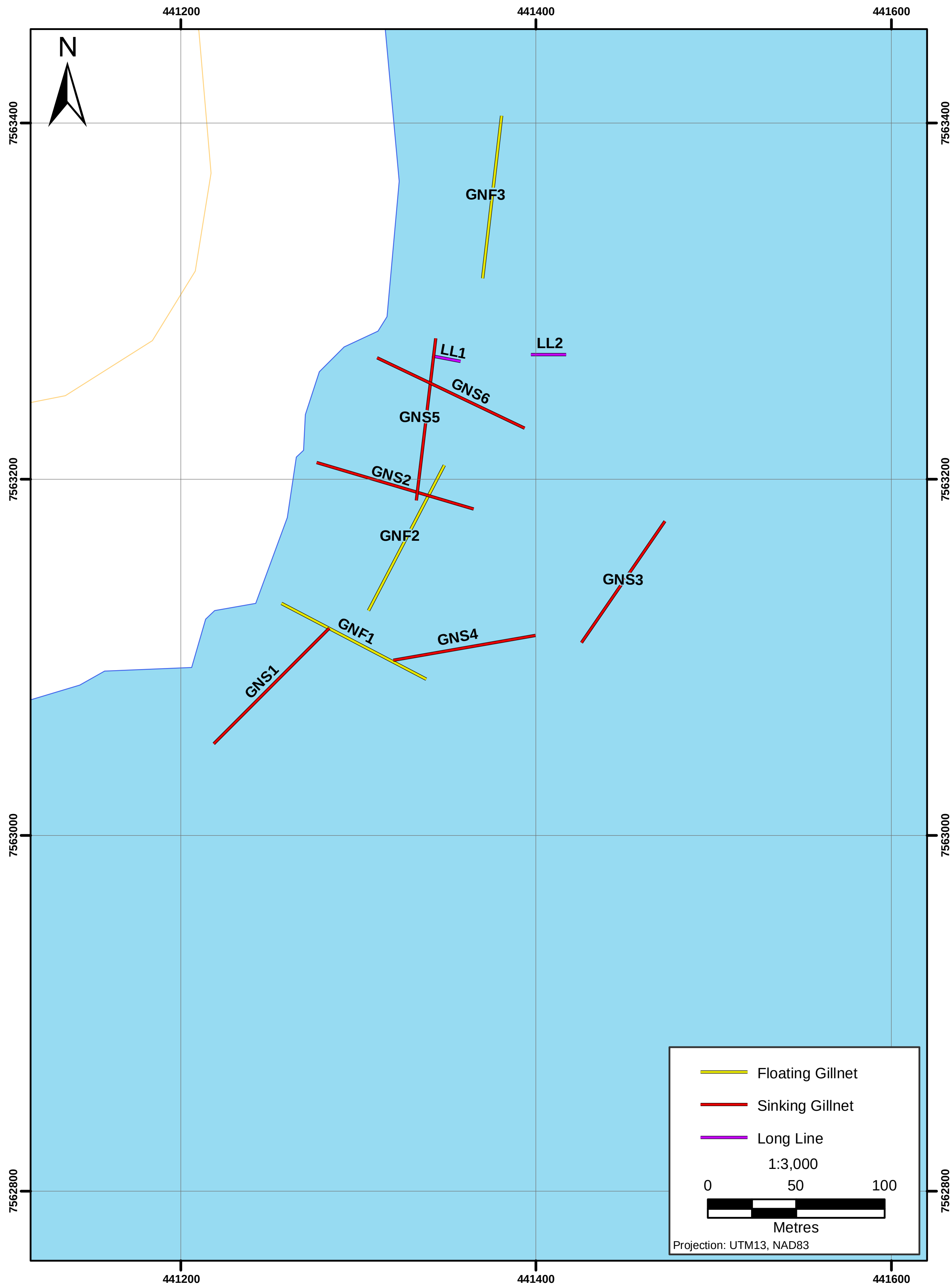

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Gillnet and Long Line Locations During the Late Sampling Survey of the Fish Community at the Reference Site in Reference Bay, Hope Bay Belt Project, 2009

Figure 2.3-6

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Plate 2.3-1. A beach seine set at the reference site in Reference Bay, Hope Bay Belt Project, 2009.

2.3.2.5 Minnow Traps

Minnow traps were used to sample juvenile fish and small adult fish. They consisted of two 6.3 mm galvanized metal mesh cylinders measuring 42 cm long and 23 cm in diameter. The cylinders were locked together using a clip attached to a rope and buoy. Each minnow trap was baited with a small amount of dry, commercial crab bait.

Minnow traps were placed along the shoreline of each port site in Roberts Bay and at the reference site in Reference Bay (Figures 2.3-7 to 2.3-12). Traps were left to soak overnight and retrieved the following day.

2.3.2.6 Crab Traps

Crab traps were used to sample large-bodied invertebrates (e.g., crabs, isopods), but they also captured fish. A crab trap consisted of a collapsible, spring-loaded rectangular stainless steel frame with mesh netting and two gate style entrances. When open, the trap measured 30 cm by 42 cm by 80 cm. A bait box was attached within the interior of the trap. Each trap was attached to a rope and buoy and baited with a piece of raw fish and a small amount of dry crab bait.

Traps were placed in the deeper waters of each site in Roberts Bay and Reference Bay (Figures 2.3-7 to 2.3-12). Traps were left to soak overnight and retrieved the following day.

2.3.3 Sample Processing

Captured fish were immediately placed in a water-filled plastic tub to keep them alive until they could be processed and released.

All fish were assigned a unique sample number, identified to species, measured for fork length to the nearest 1 mm, with a measuring board and weighed to the nearest 0.1 g with an electronic balance. A photograph of at least one member of each fish species was taken. Fish were also sampled for ageing structures. Scales were collected with forceps below the posterior margin of the dorsal fin on the left side of the fish. Two to three rays of the left pelvic fin were collected with clippers. Otoliths were only collected from incidental mortalities. Aging structures were placed in envelopes, labelled with the site, date, species and sample number and shipped to North Shore Environmental Services of Thunder Bay, ON, for analysis.

Age was estimated by counting the number of annuli (or yearly rings) from each structure. Scales were attached to plastic fiches and annuli were counted with a microfiche reader. The fin rays were air-dried and then mounted in a 50:50 epoxy medium. Microsections were cut using a Beuler Isomet diamond saw and mounted on slides and annuli were counted with a compound microscope. Otoliths were air-dried, cracked and passed over a flame to increase the visibility of annuli. Otoliths were then mounted in Plasticine and immersed in oil for better inspection using a compound microscope. When more than one structure was used for aging, the one with the highest confidence in the annuli count was used.

Pacific herring was the fish species selected during the early sampling period for detailed diet analysis. A subset of stomach samples were collected from each of the three sampling sites, preserved in formalin and sent to Applied Technical Services of Victoria, BC, for detailed taxonomic analysis of their contents.

Live fish were immediately released back into the water.

2.4 MACROBENTHOS COMMUNITY

Macrobenthos were sampled concurrently with the fish community. Refer to Section 2.3 for sampling dates, locations and descriptions of sampling gear. Captured macrobenthos were immediately placed in a water-filled plastic tub to keep them alive until they could be processed and released. Macrobenthos were identified to species or the next lowest taxon, measured for length to the nearest 1 mm with a ruler and weighed to the nearest 0.1 g with an electronic balance. Due to differences in body morphology, length measurements were different between groups (Table 2.4-1). Once processed, a photograph of at least one representative of each group was taken. All macrobenthos were immediately released back into the water.

Table 2.4-1. Measurements Taken of Macrobenthos Collected in Roberts Bay and Reference Bay, Hope Bay Belt Project, 2009

Macrobenthos	Measurements
Crabs	Carapace width
Isopods	Total length
Sea Stars	Maximum length -from one arm tip to another
Sea Urchins	Diameter of test

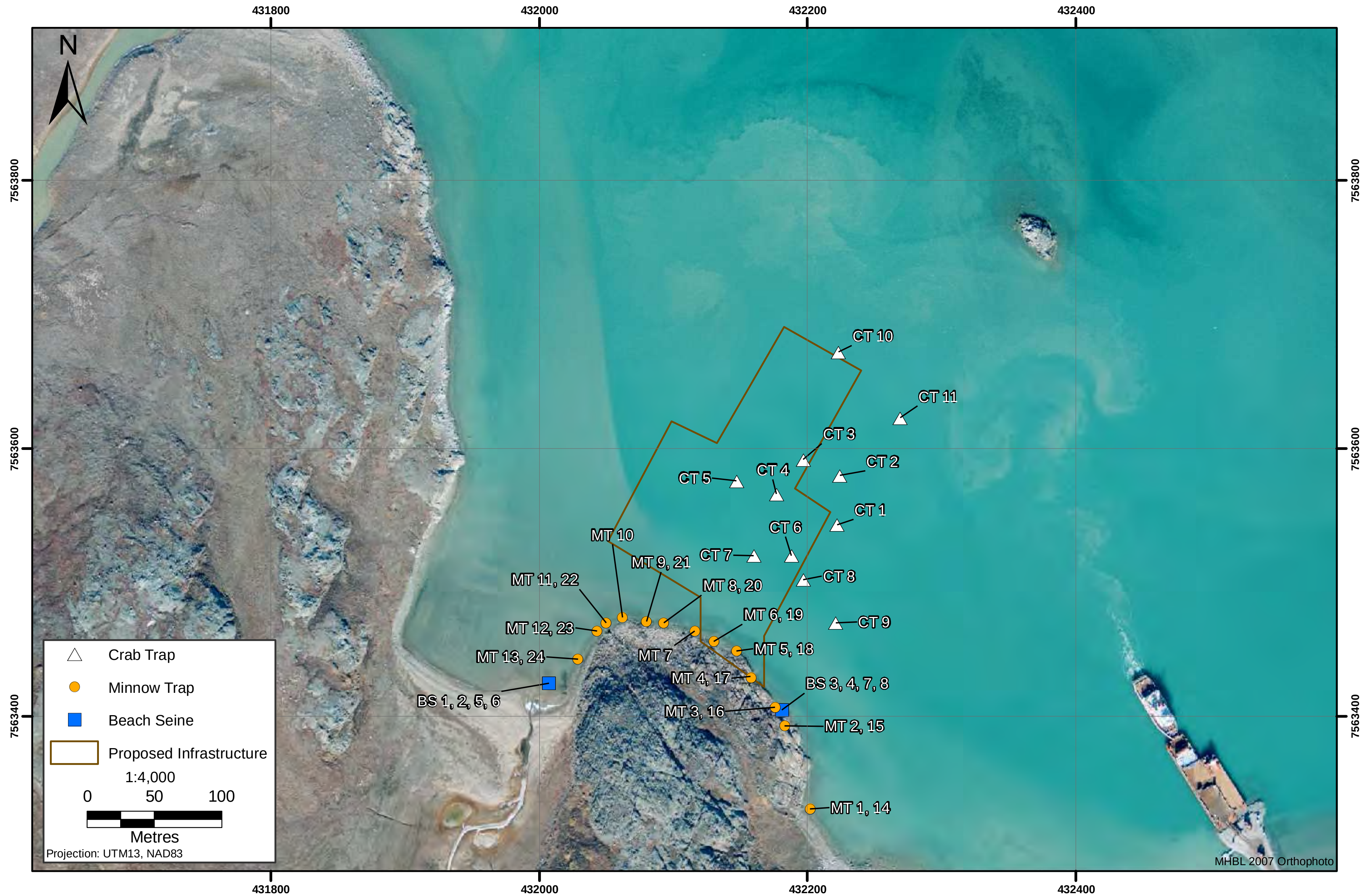

Figure 2.3-7

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Beach Seine, Minnow Trap and Crab Trap Locations During the Early Sampling Survey of the Fish Community at the Proposed Barge Site in Roberts Bay, Hope Bay Belt Project, 2009

Figure 2.3-7

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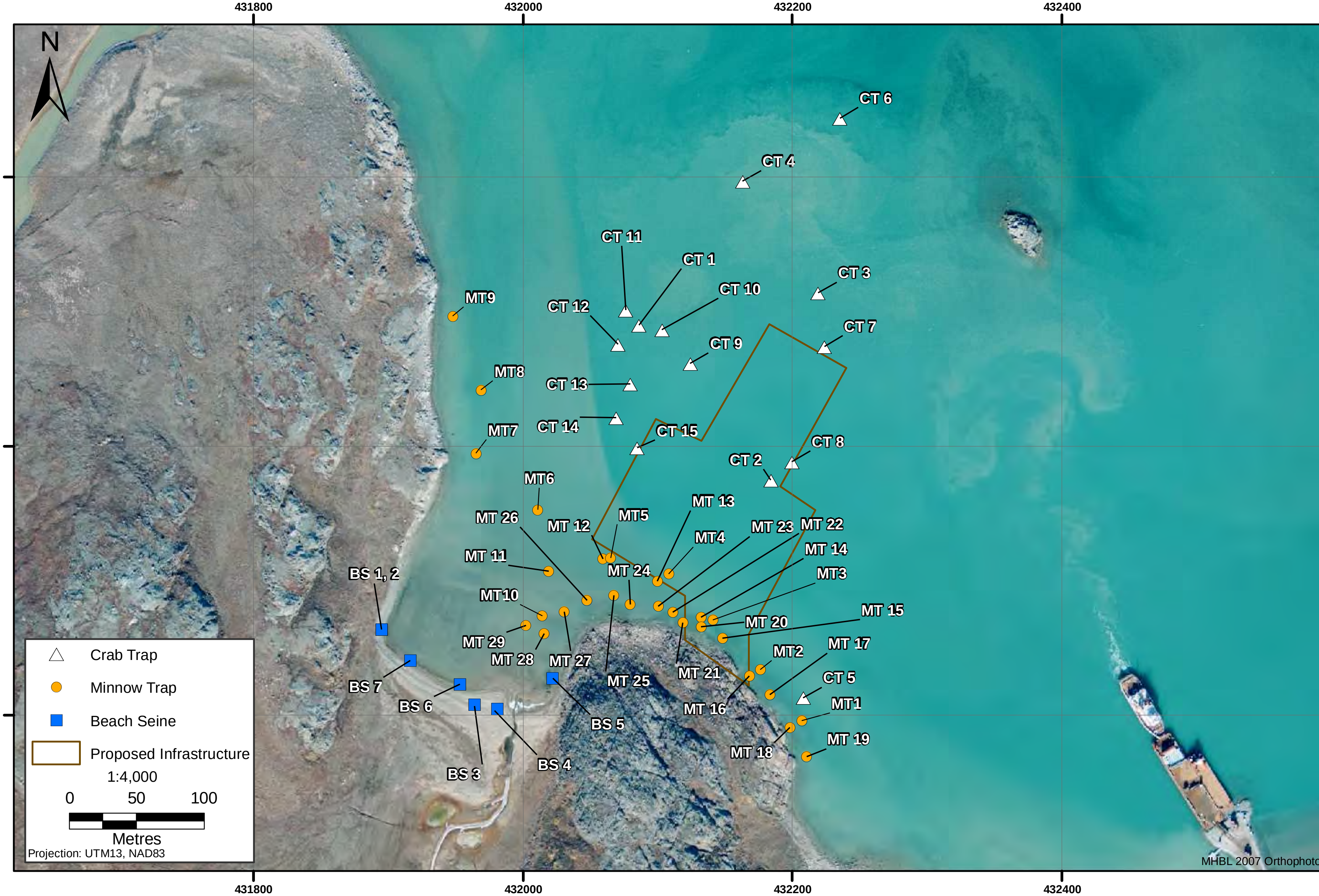

Figure 2.3-8

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Beach Seine, Minnow Trap and Crab Trap Locations During the Late Sampling Survey of the Fish Community at the Proposed Barge Site in Roberts Bay, Hope Bay Belt Project, 2009

Figure 2.3-8

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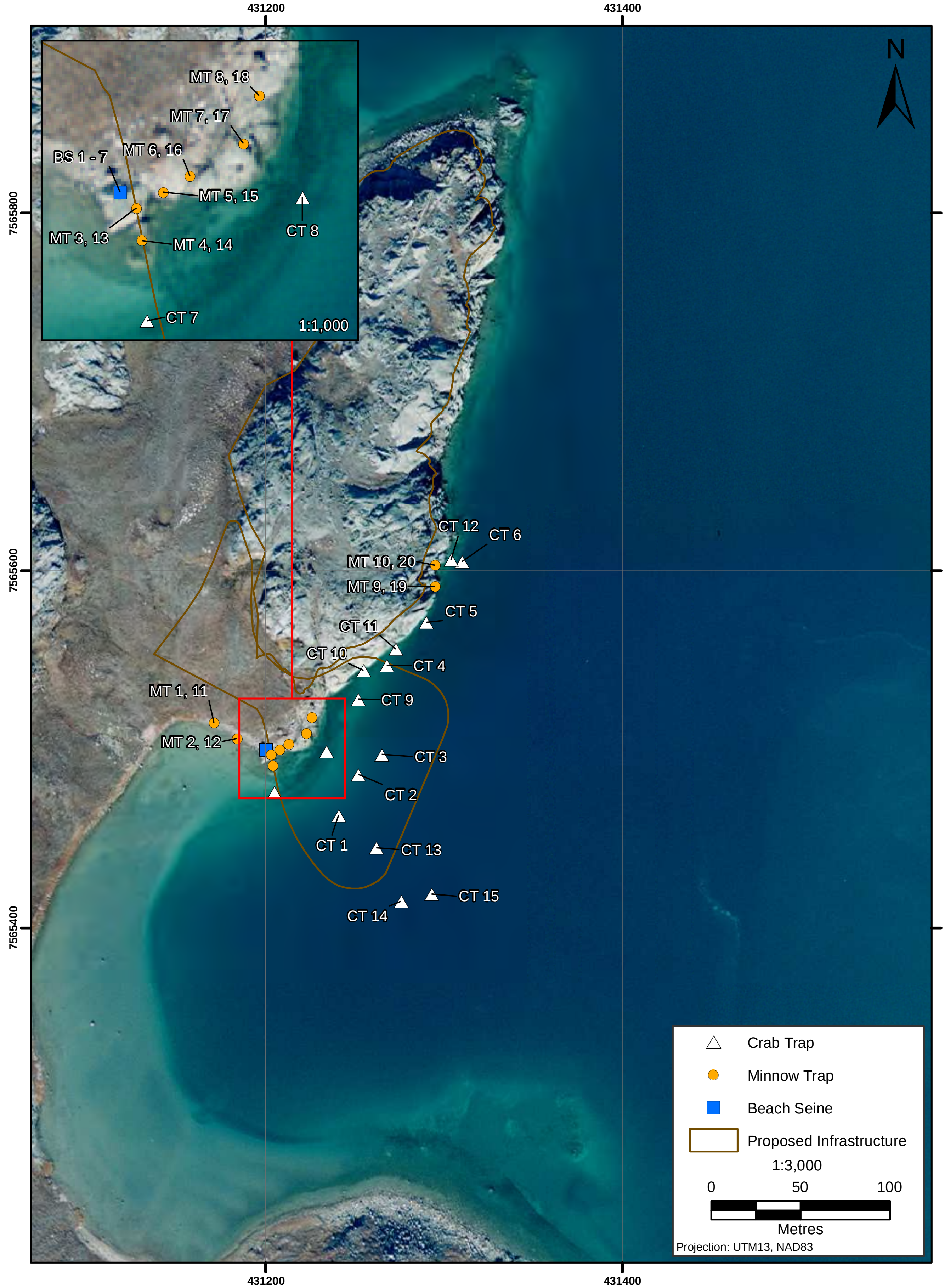

Beach Seine, Minnow Trap and Crab Trap Locations During the Early Sampling Survey of the Fish Community at the Proposed Port Site in Roberts Bay, Hope Bay Belt Project, 2009

Figure 2.3-9

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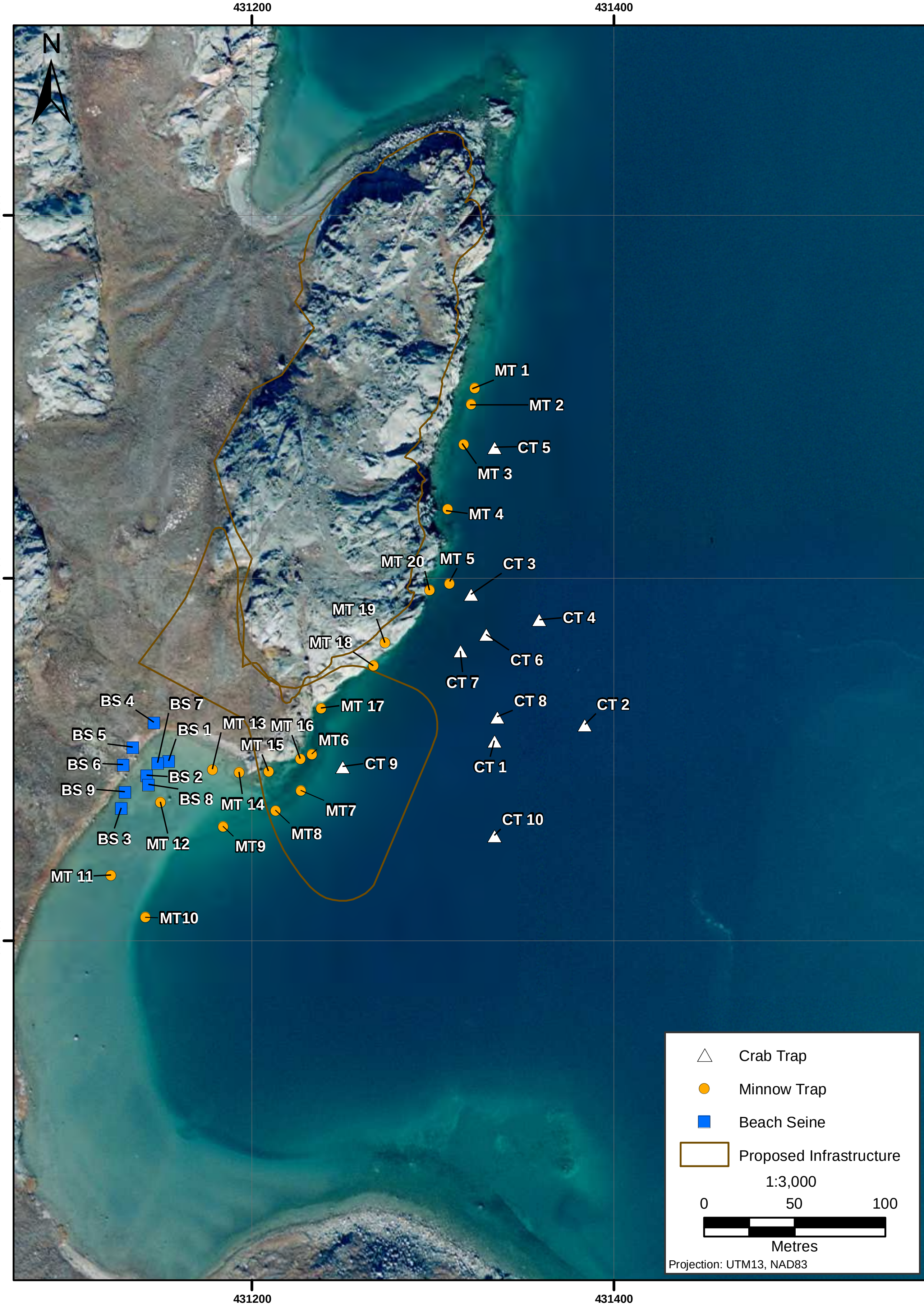

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Beach Seine, Minnow Trap and Crab Trap Locations During the Late Sampling Survey of the Fish Community at the Proposed Port Site in Roberts Bay, Hope Bay Belt Project, 2009

Figure 2.3-10

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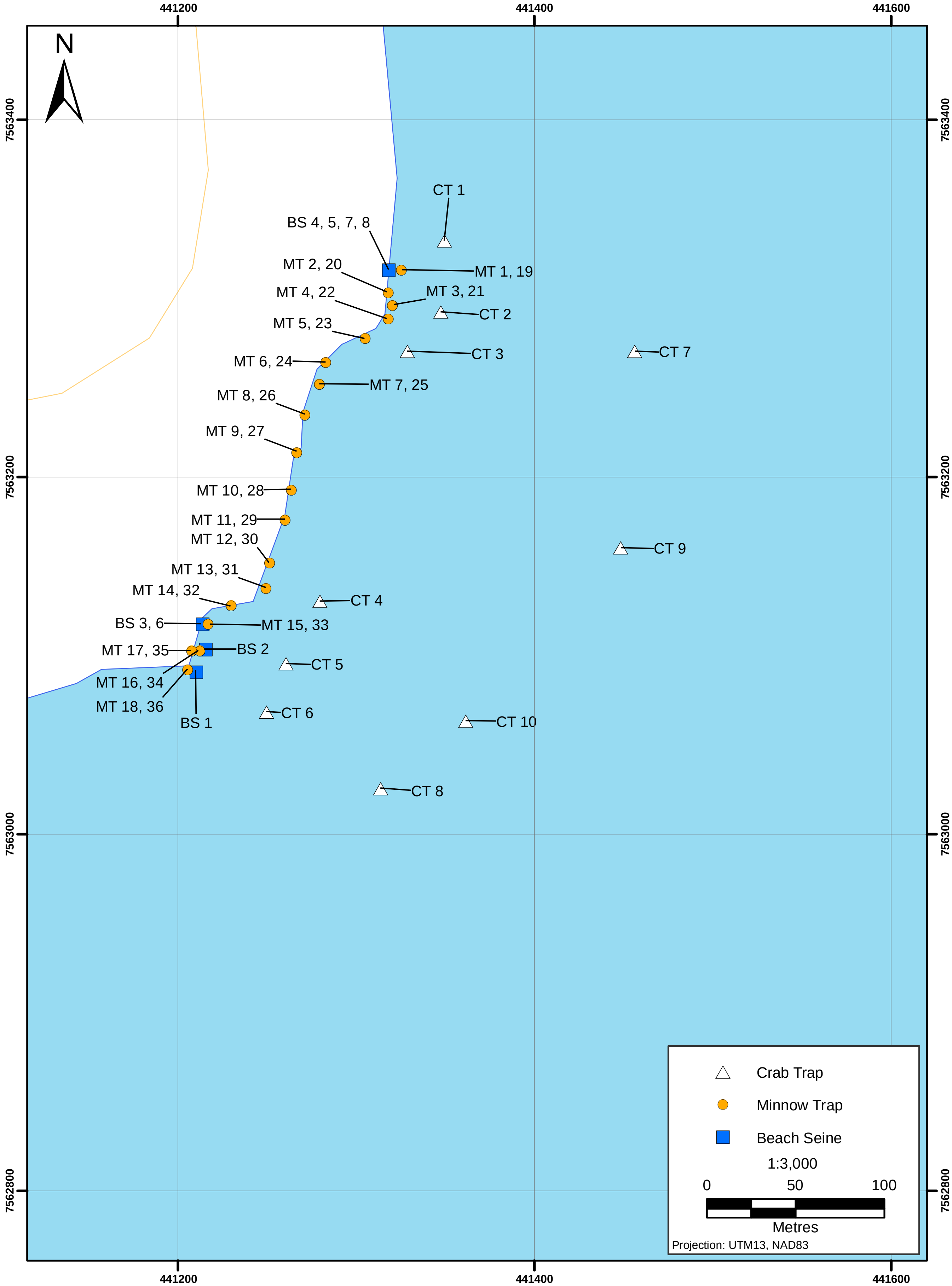

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Beach Seine, Minnow Trap and Crab Trap Locations during the Early Sampling Survey of the Fish Community at the Reference Site in Reference Bay, Hope Bay Belt Project, 2009

Figure 2.3-11

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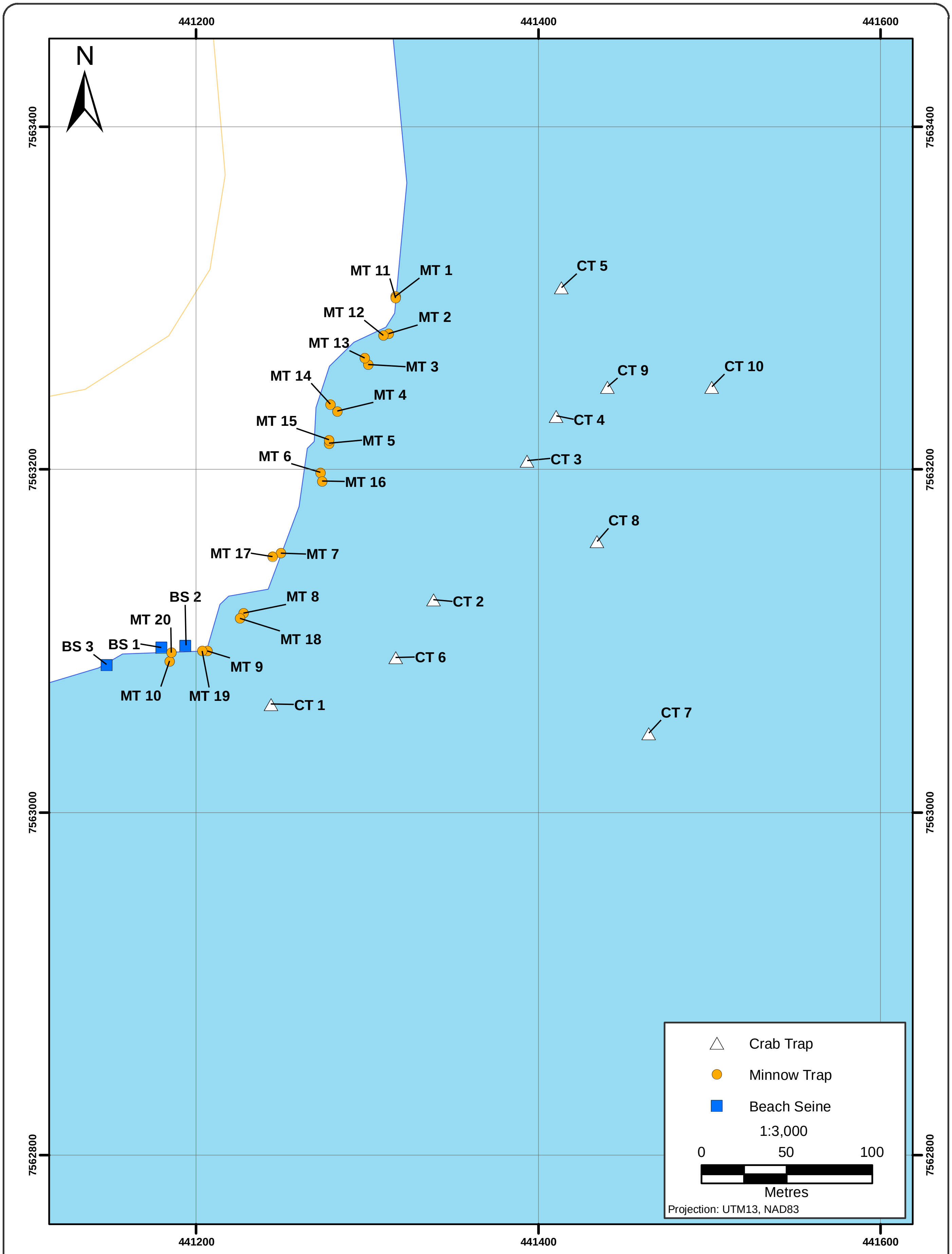

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Beach Seine, Minnow Trap and Crab Trap Locations During the Late Sampling Survey of the Fish Community at the Reference Site in Reference Bay, Hope Bay Belt Project, 2009

Figure 2.3-12

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2.5 DATA ANALYSIS

Fish communities were characterized using catch-per-unit-effort (CPUE), relative abundance, lengths, weights and ages.

CPUE was defined as the number of fish captured per sampling device per unit time. For gillnets, CPUE was the number of fish caught per 100 m^2 of net per hour or

CPUE = number of fish caught per net x (100 m^2/ total net area) / set time (hr)

For long lines, CPUE was the number of fish caught per hook per hour or

CPUE = number of fish caught per long line / number of hooks / set time (hr)

For beach seines, CPUE was the number of fish caught per area seined or

CPUE = number of fish caught / total area seined (m^2)

For minnow traps and crap traps, CPUE was the number of fish caught per trap per 24 hours or

CPUE = number of fish x [24 (hrs)/ set time (hrs)]

Length-frequency distributions of fish were used to show the distribution of fish among size classes. Length-frequencies were shown only for sample sizes greater than eight (Johnson et al. 2007).

Condition and weight-length regressions are indicators of the relative health of fish within a water body. Condition was based on the following formula from Ricker (1975):

$$Condition\ (g/mm^3) = weight\ (g) \times 10^5 / length^3\ (mm)$$

Weight was multiplied by a factor of 10^5 to avoid fractional values, and a weight-length exponent of 3 was assumed to apply to all species of fish.

Weight-length relationships were calculated for fish species captured in significant numbers (i.e., ≥9). Logarithmic transformations were performed on the data prior to conducting the regression in order to normalize the data and homogenize the variances – the two prerequisites of parametric statistics.

$$ln(weight) = ln(a) + b[ln(length)]$$

where *a* is a coefficient and *b* is the slope of the regression.

Length-age relationships were described with the von Bertalanffy growth model (Ricker 1975):

$$L_t = L_\infty (1 - exp(-K(t - t_0)))$$

where L_t = length (mm) at age t (years), L_∞ = asymptotic length (mm) (i.e., length at infinite age), K = growth rate ($year^{-1}$) and t_0 = age (years) at L = 0 mm. For some species, the age ranges were too narrow to allow estimation of a realistic value of t_0; in those cases t_0 was fixed at zero years and only L_∞ and K were estimated.

Statistics were conducted according to Zar (1984) using the SYSTAT library of computer programs (SYSTAT 2006).

All linear regressions were reported with the appropriate sample size (n), coefficient of determination (r^2, the fraction of variation in the independent parameter that was explained by the dependent parameter) and probability (P) of Type I error. All r^2 for linear or non-linear regressions were not adjusted for the degrees of freedom of the regression.

2.6 QA/QC

A quality assurance and quality control program (QA/QC) was included in the design of this study. The program included the use of chain of custody forms, taxonomic and laboratory QA/QC procedures and data review. Field notes were transcribed onto electronic spreadsheets and all transcriptions were compared with field notes to correct transcription errors. Some length, weight and age data were plotted against each other (e.g., weight-length regressions and length-age plots) to identify outliers that may have resulted from transcription errors. If errors could not be corrected, then those data were excluded from analysis.

3. Results and Discussion

3. Results and Discussion

3.1 FISH HABITAT

Shoreline habitat of the potential marine infrastructure sites in Roberts Bay was assessed in late August. Detailed habitat data for each site are presented in Appendices 3.1-1 and 3.1-2. Shoreline habitat at the site in the Reference Bay was not surveyed do to logistic constraints, but observations were made during fish community surveys.

A total of 686 m of shoreline littoral habitat was surveyed at the proposed barge site in Roberts Bay (Plate 3.1-1). Of this distance, 51% was composed of cobble, 15% of boulder, 15% of gravel, 14% fines and 5% bedrock (Figure 3.1-1). An outlet to a stream was present within the surveyed area. The dominant substrate was sand and gravel, likely carried down by the stream. At the proposed area for infrastructure development (habitat units 8 to 10), cobble and boulder dominated the shoreline. Substrate offshore of the littoral zone was dominated by fines with small patches of cobble and/or boulder. Water depths at the area of potential infrastructure development ranged from 0.2 m (near shore) to 10.0 m in open water.

Plate 3.1-1. Aerial view of shoreline habitat at the proposed barge site in Roberts Bay, Hope Bay Belt Project, 2009.

At the proposed port site in Roberts Bay, a total of 985 m of shoreline habitat was surveyed, including the bay area to the southwest of the site (Plate 3.1-2). Of this distance, 46% was composed of bedrock, 27% of cobble, 12% of gravel, 12% of fines and 2% of boulder (Figure 3.1-2). At the proposed location for infrastructure development (habitat units 15 and 16), all shoreline substrate was composed of bedrock. Offshore substrate (Habitat Unit 17) was dominated by fines, similar to the proposed barge site. Water depths at the site of potential infrastructure development ranged from 0.4 m near shore to 26.0 m in open water.

Plate 3.1-2. Aerial view of shoreline habitat at the proposed port site in Roberts Bay, Hope Bay Belt Project, 2009.

Shoreline habitat at the reference site in Reference Bay was predominantly cobble and bedrock with fines dominant offshore. Water depths ranged from 0.3 m near shore to 30.0 m off shore.

3.2 FISH COMMUNITY

3.2.1 Community Composition

Data on the location, setting and retrieval times, and summary catch for all gear used are shown in Appendices 3.2-1 to 3.2-6. Biological data for fish are shown in Appendix 3.2-7.

The Roberts Bay sites showed a more diverse fish community than the Reference Bay site. Eleven fish species were captured in Roberts Bay and six species in Reference Bay (Table 3.2-1 and Plates 3.2-1 to 3.2-10). A few flounder were not identified to species in the field. This group, labelled as unknown flounder (FL) in this report, was comprised of Arctic flounder and longhead dab. Sculpin were not identified to species and therefore grouped under their genus name, *Myoxocephalus* sp.

The majority of the 11 fish species are marine in habitat preference, but some, like the Arctic flounder and starry flounder, are known to enter low-salinity habitats (Walters 1955). Others, which are known to be strictly marine fish species have been captured in freshwater systems, likely a result of the fish remaining in areas of tidal influence (i.e., in the salt wedge underneath the surface freshwater layer). Two species are exceptions to this rule. Arctic char are anadromous, meaning they spawn and rear in freshwater but migrate to the sea to forage (Scott and Crossman 1973). Ninespine stickleback have three life-history types: freshwater, brackish and anadromous (Arai and Goto 2005). The sticklebacks captured in this study followed either an anadromous or brackish water life history.