PART 5

DETAILED PROJECT DESCRIPTION

5.1 INTRODUCTION

Larger scale aspects of the proposed wharf expansion project have been reviewed in previous sections. In this and the following sections the proposed project will be discussed on the smaller scale of the the SBT footprint and the lagoon areas..

5.2 PROJECT COMPONENTS

The proposed project includes the following on-site and off-site components:

- construction of a 1.84 Ha sheet pile and fill wharf on the existing SBT site
- construction of a rip-rap breakwater along the southeast side of the wharf, primarily for provision of aquatic (barnacle-*fucus*) habitat
- dredging of sediment for a distance of about 65 meters normal to the front of the wharf to a design depth of minus 40 feet (12.2 meters) chart datum. Dredgeate will be placed behind the sheet wall as fill.
- replacing the existing 2 foot culvert to the Lagoon under the Hyder road with two 6 foot/2 meter ones to restore full tidal flushing (see Appendix 6).
- extraction of gravel from the bed of the Bear River to use as fill behind the sheet wall
- possibly, the conversion of a portion of an existing log sort yard (such as the Brown Bear Trucking yard on Highway 37A north of Stewart) to a truck staging area and container freight station for storage and sorting of containers.

5.3 DATUMS AND TIDE CHARACTERISTICS AT STEWART

Prior to providing descriptions of the above components of the project, a brief discussion of local survey datums is provided to minimize potential confusion regarding elevations. Tidal ranges are described in terms of the datums.

There are two datums in common use at Stewart:

1) the geodetic datum of the Geodetic Survey of Canada (GSC), used for the town grid and other terrestrial applications.

2) the chart datum (CD) used by the Canadian Hydrographic Survey (“CHS”) for marine applications. In Canada (but not the US) chart datum is lower low

water large tide (LLWLT). This is effectively the lowest elevation attained by the local tide.

The relationship between the two datums is illustrated on Figure 5-1 on the next page.

Swan Wooster (1985) provides a summary of tidal characteristics in its report, however these differ from CHS data and are not adopted herein. Swan Wooster's tidal characteristics are also shown on Figure 5-1.

The CHS chart datum is adopted for this report. Chart datum was established from CHS benchmark 85960 on the concrete wall across the Hyder road from SBT. Chart datum is 13.577 meters below this BM (see Figure 5-1).

From Figure 5-1, the large tide tidal range at Stewart is 8.000 meters. As the MSL is at 3.756 meters the tide is asymmetric. Stewart has a mixed tide.

A summary of tidal nomenclature used by CHS is placed in Appendix 3.

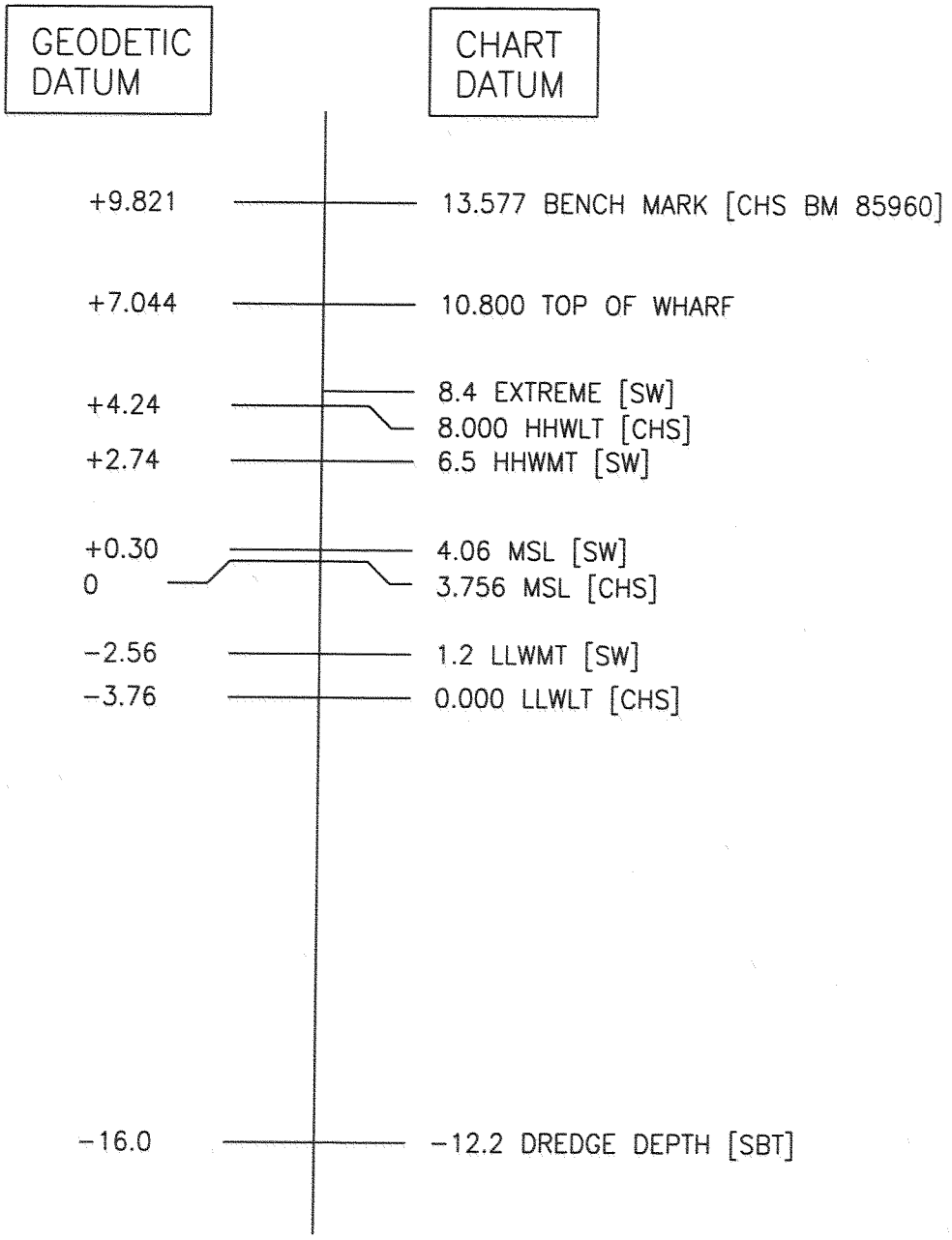
5.4 PUBLISHED MAPPING

Marine chart 3794 shows the major features and bathymetry of Stewart harbor (as of 1963) with Chart Datum vertical and North American Datum 1927 for horizontal at a scale of 1:12,000. A portion of this marine chart was copied for the base map presented as Figure 2-1 (with a scale change).

Depths near the mouth of the Bear River on chart 3794 are no longer correct. Those near SBT are still reasonably valid.

There is no good quad map of Stewart or Stewart harbor. Quad Sheet 103 O/16 (1:50000) is based on 1955-1956 air photos and is not colored. The SBT footprint is not shown on the quad sheet as it was constructed after the photos were taken.

A reasonably good overview map with significant environmental information is presented in G.L. Williams & Associates Ltd. (1995). A copy is placed as Drawing 01 in Appendix 1. Note the proposed wharf expansion project is located in the "yellow" habitat classification [per the *Port of Stewart Environmental Management Plan* (1995)].



LARGE TIDE RANGE – 8m
MEAN TIDE RANGE – 5.3m

SOURCES: CANADIAN HYDROGRAPHIC SURVEY [CHS]
SWAN–WOOSTER (1985) [SW]

S. GRAHAM ENGINEERING AND GEOLOGY INC. DELTA, B.C.
5128 – 2ND AVENUE, DELTA, BC V4M 1C8 TEL/FAX: (604)943–8500

TIDE CHARACTERISTICS AT STEWART

DESIGNED BY:	DATE:	REV.:
DRAWN BY:	DWG. No.: FIGURE 5-1	
CHECKED BY:		

5.5 LOCAL SURVEYS

Available mapping was augmented with local marine and terrestrial surveys.

5.5.1 CHS Marine Survey

Local bathymetric data were obtained from a CHS survey done in 1996 at the request of the Stewart Port Development Committee.[1] Since the proposed wharf project is not located near the mouths of the Bear nor Salmon Rivers (and is thus not subject to rapid sedimentation), the quality of the 1996 CHS depth data in the project area is considered to be still good.

The CHS survey is based upon chart datum. Chart datum was established from CHS benchmark 85960 on the concrete wall across the Hyder road from SBT. Chart datum is 13.577 meters below this BM (see Figure 5-1).

5.5.2 Survey of the Wharf Area

A terrestrial survey of the footprint of the proposed wharf was performed for SBT by McElhanney Associates of Terrace BC in August-September, 1999. McElhanney surveyed the wharf site to low tide, so there is an overlap between the CHS and McElhanney survey data.

The McElhanney elevation data were based upon both the GSC BM on the border monument and the CHS BM on the concrete wall. McElhanney used chart datum. For horizontal control McElhanney used the Town Grid, which is just the UTM location on NAD 27.

The McElhanney survey information is shown in Drawing 02 (Appendix 1). This shows topography and existing conditions. The western ore storage shed is missing in the drawing.

Digital files of both the CHS and McElhanney maps were available, but the CHS chart was based on specialty software and could not be loaded into AutoDesk drafting programs. Accordingly, a contour map of the project area, shown as Drawing 03, was composed by hand by combining the contour data on paper copies of the CHS chart and the McElhanney survey at a common 1:2000 scale. The agreement of elevations in the common zone of low to high tide was good.

Since the McElhanney and CHS maps have different contour intervals, the contour interval varies on Drawing 03.

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[1] CHS Field Sheet 1301540, August 1996, Stewart Harbour (*sic*), 1:2000

The contours for LLWLT, MSL, HHWLT and the design dredge depth (-12.2 m CD) are highlighted with red contours on Drawing 03.

5.5.3. Survey of the Lagoon

The lagoon was a part of the brackish marsh which was alienated by a realignment of the Hyder Road from the remainder of the extensive marsh in the northwest part of Stewart harbor. A photo of the lagoon is presented as Figure 2-12; a photo of the marsh across the Hyder road is presented as Figure 2-11. It is intended to use the lagoon for habitat compensation (described in Section 6.7).

The lagoon was surveyed by McElhanney Associates for Stewart Bulk Terminals in May 2000 using chart datum. The survey is presented as Drawing 04 in Appendix 1.

To assist in placing the two major components of the project in perspective, thumbnail views of the wharf and lagoon components of the project are shown in proper locations and orientations, and at the same scale, in Drawing 05. The lagoon is about 1500 meters to the north of the wharf, and is of a comparable size.

5.6 DESCRIPTION OF THE WHARF COMPONENT

The wharf is the major component of the project.

It is proposed to construct a 1.84 Ha. wharf[2] on the north side of the existing SBT footprint, being comprised of a sheet pile wall, backfill, and a concrete cap [see Drawings 06 (plan), 07[3] (typical section), and 09 (cross-sections), Appendix 1].

The basic wharf configuration is shown in Drawing 06. A sheet pile wall is proposed to be constructed so that the fenders on the wharf align with those on the existing berthing structure for the bulk loader. This will allow a ship to approach the wharf without undue difficulty, and to tie against either structure for the best loading or unloading position (see Drawing 10).

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2 Of which about 1.26 Ha is fill below HHWLT and the remainder is on existing higher ground

3 This drawing was adapted from Dwg #9 in Lauga & Associates Consulting Ltd., "Stewart Port Development Business Plan", 1995, copyright. The construction design for this project will be similar, but not identical.

The area of the wharf is determined by practical criteria. It will abut into the hillside on the northwest. It will merge with the typical existing topography of the SBT footprint to the southwest and south. To the northeast it extends seaward to the line defined by the existing berthing structure. It is bounded on the southeast by the "red/yellow" habitat zone boundary. (This boundary is discussed later in section 6.4.2.3).

The zone behind the sheet wall will be filled with a combination of material dredged in front of the wharf for ship access, and gravel from the Bear River. As shown on Drawing 03 this zone between MSL and HHW is narrow, except to the west of the former AMH ferry ramp. The zone between MSL and LLW is wider (typically 30 meters, up to 60 meters). The length of affected shoreline is about 184 meters.

[The option of founding the wharf on open piles has not been pursued for cost[4] and geotechnical reasons. The sediments in the project area are thought to be deep, soft and subject to liquefaction[5]. This geology is likely not suitable for an open pile foundation. The existing government wharf is founded on open piles, and its load capacity is not adequate for most purposes, including heavy vehicle access. No other structure founded on piles in Stewart harbor is still operational.]

The elevation of the top of the wharf is (provisionally) 10.80 meters (see Figure 5-1 and Drawing 09), which is 2.80 meters above HHWLT.

In Drawing 08 the relevant contours from Drawing 03 have been added to the basic wharf configuration presented in Drawing 06. Sections A -A', B - B', C - C' and D - D', as shown in plan on Drawings 06 and 08, are presented as cross-sections in Drawing 09. These are vertically exaggerated.

There will be an electric mobile crane structure on the wharf to unload containers and general cargo. The remaining wharf area will be used for cargo storage and truck access. Some dredging is required (from zero to about 65 meters away from the face of the wharf) to achieve the design depth of -40 feet chart datum. This is proposed to be done with a

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4 The unit cost of a pile structure is estimated to be $3000 per m^2, or $37.8 million for the 1.26 Ha over tidal land. The cost of the sheet pile and fill structure is estimated to be about $6 million.

5 Swan Wooster (1985, p.16) states: "One of the sites considered for the proposed development is adjacent to the existing Granduc terminals [now SBT]. Soils in this area are thought to have a compressible clayey silt layer below the sand and gravel delta. This could lead to excessive settlement problems and also suggests the possibility of a liquifaction failure of the delta face when subjected to a heavy earthquake".

clamshell bucket from the wharf face while the wharf is under construction. The dredged material would be placed in the wharf cavity as fill. The area to be dredged is shown in Drawing 10[6]. Section B - B' on Drawings 08 and 09 shows a section view across the dredged zone.

A container ship is shown at the wharf on Drawings 10 and 11. The design container ship is 650 feet (198 meters) long and 100 feet (33 meters) wide with a maximum draught of forty feet (12.2 meters). This ship would have a mass of about 40,000 DWT.[7] It can be seen in Drawing 11 that this ship extends beyond the wharf, but the central part of the ship where the cargo is placed can be accessed from the wharf with a mobile rotating crane. It can be seen that the length of the proposed wharf is less than optimal to berth and unload a container vessel; however a larger size is precluded by environmental criteria.

As shown in Drawings 06 and 29 a barge ramp will be installed in the face of the wharf to allow barges to be unloaded at most stages of the tide. The barge ramp is located so as not to hinder access to the Northland Dock. The barge ramp could be modified to permit side access to a small cruise ship.

The existing bulk loader would continue to function as it does now.

5.7 DESCRIPTION OF THE RIP RAP SECTION

Rip-rap is to be placed against an indentation in the southeast side of the wharf, as shown in Drawings 06 and 09. The purposes of the rip rap are to facilitate fish passage and to provide barnacle-*Fucus* habitat. While it will assist in dispersing wave energy, a breakwater is not required in SBT sheltered location.

To minimize impacts on the intertidal mud habitat (see Drawing 17) the rip-rap will be laid at the maximum possible slope (about 1.5 to 1; or about 34 degrees).

A cross-section across the rip-rap is shown in Drawing 09 (line D- D')

The rip-rap will be sized during design, but is intended to be coarse and porous. Sourcing is discussed in section 5.9.

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[6] The bottom sediments in the dredge zone were investigated for contamination. This is described in Part 8.

[7] See Swan Wooster, 1985, pp 16 and 18.

5.8 DESCRIPTION OF THE GRAVEL EXTRACTION COMPONENT

It is proposed to fill the zone behind the sheet wall with river gravel extracted from the bed of the Bear River on Soucie Construction's lease. It is estimated that up to 88,500 cubic meters of gravel will be required (depending on the volume of local dredgeate available in front of the wharf.

The area of extraction, extraction procedure, environmental mitigation, and restoration procedure for gravel extraction in the Bear River are described in the section 9 permit application submitted each year to the Water Management Branch of BC Environment prior to winter extraction.

5.9 DESCRIPTION OF THE QUARRY COMPONENT

Rock will be quarried from an existing quarry site just to the north west of the Highway 37A bridge (see Drawing 19) and transported to the SBT wharf by truck. In this case use of larger diameter quarried rock will be limited to riprap and, possibly, provision of support of local zones in the fill.

Information on quarry haul rates is provided in section 9.17, page 9-57

5.10 DESCRIPTION OF THE LAGOON COMPONENT

The second major component of the project is restoration of the lagoon along the west side of the Hyder road (see Figure 2-12) to pre-existing brackish marsh habitat (see Figure 2-11) by reintroducing full tidal flushing. This is described in more detail in sections 6.4.3, 6.6, 6.7.1, and 7.3

As shown in Drawings 01 and 05, the lagoon is located about 1.5 Km from the SBT footprint, so that construction at the lagoon can be done independently of that at the wharf.

As shown in Figure 5-2 (next page)[8], cross-section B - B of Drawing 04, and Drawing 12 (in Appendix 1), the lagoon is currently flushed by a 2 foot (610 mm) diameter culvert with an invert elevation of 5.059 meters CHS on the ocean side. The pipe is thus placed above MSL (see Figure 5-1), so that limited tidal exchange occurs only during a portion of the flood tide, and fish access is minimal.

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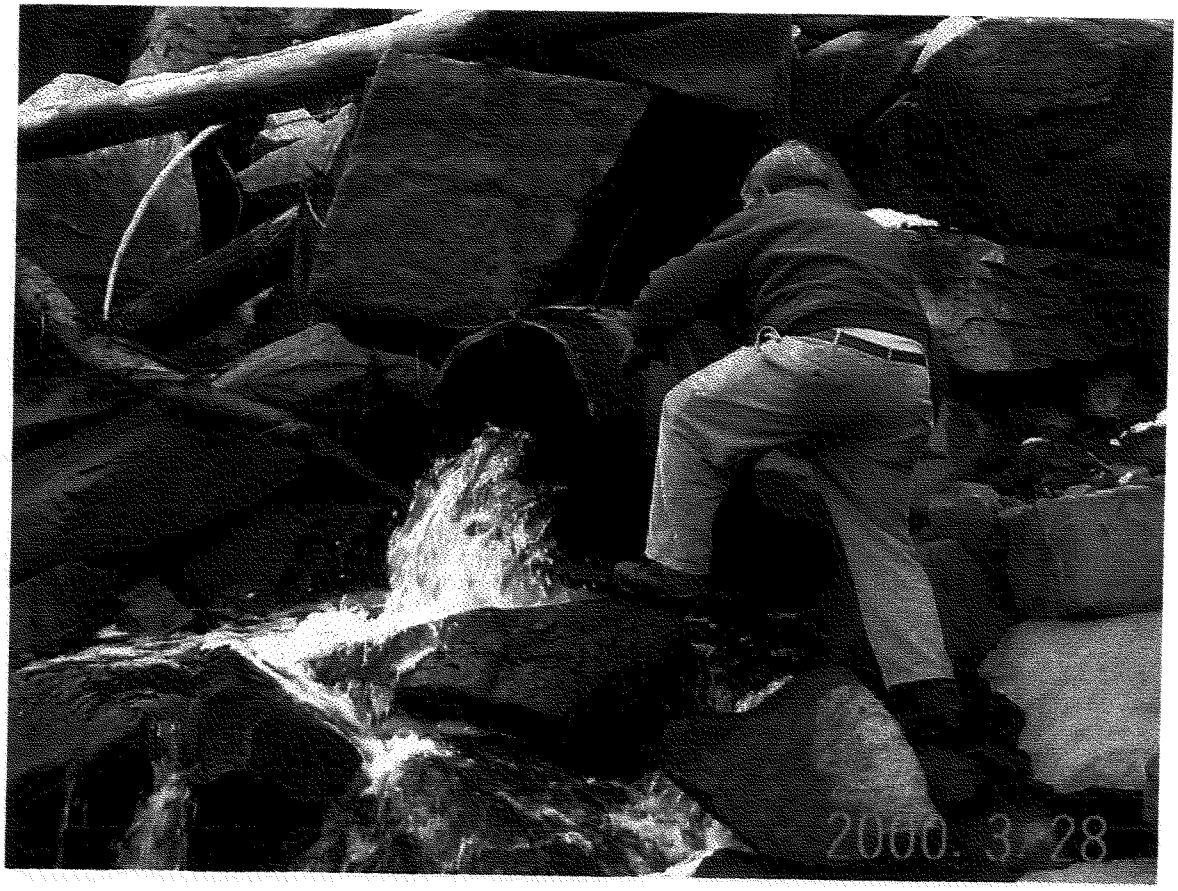
[8] The photo shows the end of the culvert on the ocean (east) side of the Hyder Road.

FIGURE 5-2

VIEW OF CULVERT TO LAGOON UNDER HYDER ROAD



Inflow and outflow from the end of the culvert in the lagoon are shown in Figure 5-3 on the day of a relatively large tide.[9] It can be seen that the discharge is modest. Tidal hydraulics of the lagoon are described in section 7.3 and Appendix 6.

The existing culvert is to be removed and replaced by two larger ones (6 feet or 2 meters diameter) which will allow full tidal flushing of the lagoon, as shown in Drawing 12, and Figures A6-1 and A6-2. On the east side of the Hyder road a channel lined with rip-rap will direct the flow into the first tidal channel on the marsh. This design was developed by MOT and has been reviewed and approved by DFO (see Appendix 6).

There are some metal wastes (mostly car parts) in the lagoon. Those that can be removed with a winch without undue cost during the course of construction will be.

The Hyder road will be closed to replace the culvert. This will impact SBT operations, Canada Customs, the unincorporated settlement of Hyder AK, and the Premier Mine (now closed). MOT at Stewart has stated it must approve a traffic management plan[10] before work can be done on the Hyder road.

A road closure plan will be developed with MOT prior to construction. The Hyder Community Association has been contacted and asked to provide its comments and suggestions to the consultant. Homestake Mines, Canada Customs, and the District of Stewart will also be consulted.

The road closure plan will include sufficient notice and advertising, having the road closed for as short a time as possible, and provisions for providing emergency services. The road work will likely be done on a weekend well outside the tourist season.

The construction will be done by Soucie Construction Ltd. at no cost to the Province.

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9 Specifically, May 6, 2000, which had the largest tidal range of the month. The tidal range at Prince Rupert during the day was 19.3 feet (5.88 meters). The tidal range within the lagoon was 7 3/4 inches (19.7 cm). It can be seen in Figure 5-3 (falling tide) that the water level in the lagoon did not reach the top of the culvert.

10 Phone call with Randy Grelson, MOT, Stewart, 29 May 2000. MOT will coordinate with BC Hydro since there is a Hydro line of the ROW. See section 9.8.7

Figure 5-3

VIEWS OF CULVERT IN THE LAGOON AT INFLOW AND OUTFLOW

5.11 DESCRIPTION OF OFFSITE WORK AREA COMPONENT

As the SBT footprint will be relatively small, even after the wharf expansion is constructed, an offsite staging and storage area may be required in time. Activities in this area could include organizing and queuing trucks for container pickup and drop-off, sorting of containers, and storage of containers and break-bulk cargo.

As flat land is scarce in the valley at Stewart the number of potential locations for an offsite work area is limited. Examples include the Brown Bear Trucking yard on Highway 37A about 300 meters north of the bridge, and a smaller former log sort yard behind the dump. While not as convenient, there is abundant flat land in the Meziadin valley and a transfer/storage facility could also be located there. This would allow pickups and drop-offs without a requirement to go over the Bear Pass.

As there is no immediate need for a secondary work area this project component has not be investigated in detail. All of these options involve the use of existing industrial land and do not impose an incremental environmental impact.

5.12 PROJECT OPTIONS CONSIDERED

5.12.1 Options Analysis

An important component of the CEAA process is an options analysis. In this section the analysis is done at the scale of the immediate project footprint.

The proposed design evolved through an iterative process The purpose of this section is to briefly present the major design options considered for the project to date, and describe how the proposed design was arrived at.

The design configuration of a project of this type results from environmental, physical, financial and logistic criteria. If a comprehensive approach is taken, the final project configuration is a tradeoff. In this project logistic goals have been compromised in order to maintain environmental quality and strictly adhere to Federal aquatic habitat policies. Nevertheless, as a local firm SBT is pleased to present a proposed project configuration which it considers to be logistically and commercially viable while maintaining high environmental standards.

5.12.2 Space Requirement and Availability for Wharf

From Drawing 03 the existing working area on the SBT footprint is about 2.28 Ha. About 6090 m^2 of this is occupied by buildings. The two ore storage buildings, which are dedicated to specific clients' bulk ore, cover about 5900 m^2. Thus there is only about 1.67 Ha available for other cargo, truck access, loading, and so forth.

From Drawing 06 the proposed wharf expansion will increase the working area to about 3.83 Ha, an increase of about 68%. Excluding the buildings, the remaining working area will be about 3.23 Ha.

Space requirements for increasing volumes of ore and concentrate shipments have exceeded the readily-available space at SBT, as shown in Figure 2-16 (page 2-31). There is no room for a substantial increase in ore shipments (from Kemess mine, for instance), in break bulk mode, nor for other bulk cargo(such as gravel), nor for general cargo and containers.

Containers

Westmar Consultants Inc., a marine design firm in North Vancouver which designs and constructs marine facilities, has provided the following guidelines for space requirements for a container wharf:[11]

> "*for a large terminal, you would expect about 5000 to 6000 TEUs (per year) per acre, but this depends on issues like how the containers are handled and how high the containers are stacked.'*
>
> *'for a smaller terminal like Stewart would have, you should probably be looking at something more in line with 3000 to 4000 TEUs (per year per acre).*"

Converting the second guideline to common units[12] the 4.5 acre (1.84 Ha) wharf surface should be able to process about 8,000 to 10,500 containers per year. According to SBT's cargo projections (Table 2-5 and Figure 2-20) this flux will be attained within 1 to 2 years[13]. The foregoing analysis assumes all the wharf surface area is used for container cargo; however it is intended to use it for barge cargo and some break-bulk cargo as well.

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[11] Steve Yee P.Eng, informal email of 30 November 2001 12:52.

[12] At 1.7 TEUs per container and 2.4698 acres per hectare

[13] Using the Westmar guideline, a 10 acre wharf would be required for the 20 year container flux estimate in Table 2-5.

5.12.3 Review of Major Options Considered for Wharf

The wharf project, which was registered in the CEAA process in 1996, has been modified several times in response to agency requests. A summary of the major layout options is presented in this section.

The initial layout option was for the largest wharf area that could be accommodated with a reasonable interpretation of DFO's habitat compensation criteria. This maximum area option is shown in Drawing 13. The total (pink plus green) wharf area of this configuration is about 4.156 Ha (about 2.26 times bigger than the current proposed option shown in Drawing 06).

The maximum area option involved replacing some red-coded habitat with red-coded compensation habitat at a 2:1 ratio; however it was not acceptable to DFO as DFO's policy is that red-coded habitat cannot be destroyed.

A second option was the layout shown by the red-striped area w ith some protective rip rap placed on the southeast wall, as shown in Drawing 14. The advantage of this configuration is that a design ship could berth and be unloaded without any requirement for dredging. The area of this wharf configuration is about 2.74 Ha. The southeast boundary of this wharf configuration roughly follows the line of transition from mudflat to marsh vegetation on the Salmon River delta. This layout avoided destruction of most marsh vegetation

The second option was also not acceptable to DFO because, on the basis of a detailed field inspection, the habitat boundary (per Drawing 03 from the Port of Stewart Environmental Management Plan (1995)) was determined to lie to the northwest of the southeast wharf wall, as shown in Drawing 14.

The third option, shown in Drawing 32, followed a field prescription by DFO. The southeast side of the wharf was pulled back to a red-yellow line which had been defined in the field by DFO and the project fisheries consultant in light of information provided by G.L. Williams & Associates Ltd., which had prepared the Port of Stewart Environmental Management Plan for the District of Stewart in 1995. DFO requested that rip rap be placed against the southeast wall to facilitate fish passage and to provide barnacle-*Fucus* and unconsolidated rock habitat.

A drawback of the third option is that some dredging is required to berth a ship (as shown in Drawing 10). A study (presented in Part 8) was required to investigate the sediment chemistry of the dredgeate.

Because the third option entailed a severe reduction in wharf area and required dredging, a fourth option considered was construction of an extension on piles (as shown in Drawing 15) in order to permit a ship to be berthed without a requirement for dredging. DFO indicated that it would authorize an apron extension on piles over the shallow Subtidal

habitat zone (see Drawings 16 and 17). This option has not been pursued because (1) the sediment investigation indicated that dredging would likely be acceptable to Environment Canada, (2) the limited width of the extension (about 40 m) does not provide for good logistics, and (3) concerns about the stability, constructability and cost of an open pile structure.

As option 4 is the only way the wharf could be enlarged after the proposed expansion project (Drawing 06), it may be revisited in the future if wharf space is urgently required; but it is not under consideration at this time.

Subsequently DFO requested that option 3 be revised so that no rip rap extend past the red-yellow line. In response the layout was changed to that shown in Drawings 06 and 09 (the fifth, and current, option). The rip rap section extends to LLWLT.

5.12.4 Summary

Several options have been considered for the wharf layout on the SBT site footprint. SBT would have preferred to construct a larger wharf, but the configuration and size of the proposed wharf (Drawing 06) is determined primarily by environmental constraints. The wharf essentially utilizes all the available yellow-zoned habitat. This will be compensated for in full by opening the lagoon to full tidal flushing (see Part 6).

5.13 SCHEDULE

A provisional schedule is provided on Figure 5-4. It is emphasized that the Proponent does not have control of the assessment and permitting processes, and thus cannot reliably predict their progress and outcomes.

Two independent constraints on the schedule are fish windows, and the CEAA and BCEAA processes.

Fish Windows

There are two fish windows which affect the schedule:

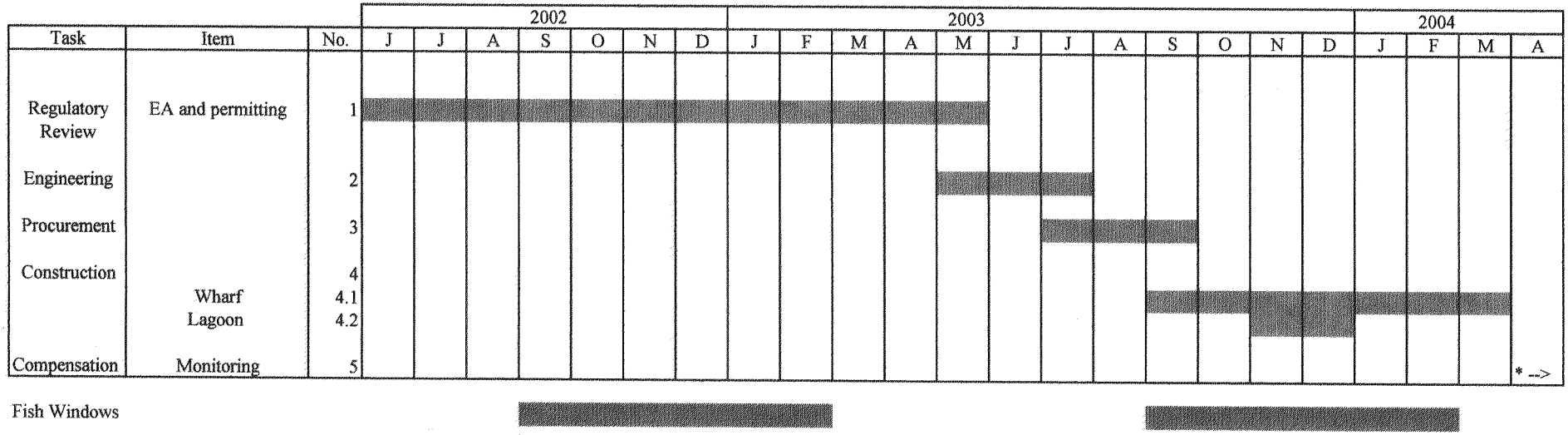
1) gravel can be extracted from the Bear River from January 1 to March 20

2) construction can occur at the SBT wharf site and lagoon outside the fry period -- late winter to early spring (March 1 to September 1)

SBT WHARF EXPANSION PROJECT SCHEDULE

(Tentative, As of June 01, 2002)

Figure 5-4



BCEAA

There is a time limit on the BCEAA process. If it is assumed that the project committee decides to refer the application to the Minister at the end of the stage 1 review, then a maximum allowable time is about 165 days. If the application is delivered to EAO about June 07, 2002 then a Ministerial decision should be in hand on or before 19 November 2002.

If the project goes beyond a stage 1 review then it would be suspended pending a re-evaluation of the feasibility.

CEAA

There is no time limit to the CEAA process. This project was registered with CEAA in 1996 and a screening report was presented to the Responsible Agency (DFO) in February 2002. Upon receipt of the screening report DFO referred the project to the BC EAO which, in turn, agreed to lead the environmental assessment review process through the harmonization agreement.

Thus, if BCEAA accepts the application, then it proceed according the BCEAA schedule described above. This is assumed in the schedule.

Permits

Permits and authorizations can be obtained after release from CEAA and BCEAA. At this time SBT does not propose to proceed with acquisition of permits and authorizations until the project has cleared the environmental assessment process.

Again, the Proponent does not control the rate of the permitting process. Environmental permits in NW B.C. typically take 3 months to a year to obtain. Six months is used as an estimate for the schedule.

If permits cannot be obtained, then the project would not proceed. The schedule assumes permits can be obtained within 6 months, or by 18 May 2003.

The following permits will be required. This list may not be complete.

- authorization from DFO Habitat Branch
- section 9 permits from the Water Management Branch of BC Environment for the lagoon culvert

- Canadian Coast Guard authorization[14]
- Lands Branch authorization or license for lagoon
- Lands Branch authorization for quarrying (in order to recover royalty)
- MOT permit for road work (includes Hydro ROW issue). A traffic plan is required
- Environment Canada ocean dumping permit if ocean dumping is planned[15]
- CSR soil relocation permit from BC Environment
- building and other permits may be required from the District of Stewart

Engineering and Procurement

Detailed engineering will proceed as required to obtain permits. Once all permits are in hand then remaining engineering will be done and procurement will proceed.

Wharf Construction

Construction will occur during the first fish window (Labor Day to March 1) after all permits are obtained

If the environmental assessment process and permit acquisition proceed expeditiously, then this could be the winter of 2002. If they proceed at a medium rate then the construction would likely occur in the winter of 2003. If permitting proceeds slowly then construction would occur in the winter of 2004 or later, although it is also likely that the delay and cost of permitting to that time would lead to a project suspension.

Lagoon Construction

Since the lagoon is off the wharf site, the construction schedule for the replacement of the lagoon culvert is not tied to that of the wharf. The time constraints are the fry-stage fish window, and avoiding closure of the Hyder road during tourist season.

It is likely that the lagoon construction will require a s.9 Water Management Branch permit. These permits can take up to a year to obtain. Thus the Lagoon work will not likely be done at the same time as the wharf.

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[14] John Mackie, personal comm.

[15] At this time it is not. It is proposed to place dredgeate behind the sheet wall.

5.14 VARIATIONS ON THE SCHEDULE

The schedule presented in section 5.13 is considered to be neither liberal nor conservative.

A particular problem with this project is the coordination of the environmental assessment schedule with the fall/winter fish window. Delays in having the project accepted for CEAA review mean that it will be difficult to construct this winter (per Figure 5-4). However it would be in the interests of the proponent, potential users of the facility in the resource industries of northwestern B.C. and the socioeconomic prospects of the residents of Stewart and Hyder to not have the facility construction and availability delayed a year.

The Proponent wishes to construct during this winter's fish window and would be able to do so if the paperwork at the permitting stage could be expedited. An optimistic schedule is presented in Figure 5-5. As there is a financial risk in incurring permitting and engineering expenses before the outcome of the environmental assessment is known, there would have to be coordination and communication between the Proponent, permitting agencies and EAO by early July to assess the risk.

In the schedule depicted in Figure 5-5 the lagoon construction would occur in September 2003. This timing is based on three reasons (1) the Lagoon culvert work is completely separable from the wharf work, (2) the culvert replacement work involves repaving the Hyder road; asphalt should be placed during warm weather, and (3) it is assumed, on the basis of experience, that a Water Management Branch section 9 permit would not likely be available in an expedited manner.

FIGURE 5-5

SBT WHARF EXPANSION PROJECT SCHEDULE - OPTIMISTIC

(Tentative, As of June 01, 2002)

Figure 5-5

Task	Item	No.	2002 J	J	A	S	O	N	D	2003 J	F	M	A	M	J	J	A	S	O	N	D	2004 J	F	M	A
Regulatory Review	EA and permitting	1																							
Engineering		2																							
Procurement		3																							
Construction		4																							
	Wharf	4.1																							
	Lagoon	4.2																							
Compensation	Monitoring	5										-->							-->						
Fish Windows																									

PART 6

AQUATIC ECOLOGY -
ENVIRONMENTAL APPRAISAL AND MITIGATION

6.1 ENVIRONMENTAL APPRAISAL OF AQUATIC ECOLOGY - INTRODUCTION

An environmental assessment of the aquatic ecology of the lands affected by the proposed wharf expansion project is presented in section 6. The assessment includes a description of the existing aquatic environment, a discussion of potential impacts, and a discussion of mitigation measures proposed. The mitigation is based upon procedures developed in the Fraser River region to meet DFO's policy of no net loss of aquatic habitat.

Impacts to aquatic ecology and fish are emphasized in section 6. This presentation format has been adopted for the convenience of DFO and provincial agencies with an interest in ecological effects. Social, economic and other nonaquatic environmental impacts are addressed in Part 4. Hydrotechnical aspects are addressed in Part 7.

A description of the Stewart area, including economic and demographic information, is presented in Part 2. A description of the engineering aspects of the project is presented in Part 5.

6.2 STUDY AREA DESCRIPTION

The study area consists of two separate areas, as shown on Drawing 05 (in Appendix 1). The wharf expansion site is located on the foreshore property of Stewart Bulk Terminals Ltd., which is situated on the west side of Stewart harbor, Stewart, BC. See Drawing 01 and Figures 2-1 (page 2-3) and 2-8 (page 2-21).

The existing bulk loading terminal consists of a 2 ha area of fill located on the northern edge of the Salmon River delta where it meets the upland. (See Drawings 01 and 02). An aerial conveyor connects the terminal with a wood-piling berth situated in deeper water off the edge of the mudflat (see Figure 2-15). Closer to the north end of the terminal, a short causeway and ramp lead to a float formerly used by the Alaska Marine Highway ("AMH") ferry (see Figure 2-10).

The preferred site for the proposed wharf is along the foreshore of the existing bulk terminal footprint from the top of existing fill to approximately 40 feet below local chart datum and from the shore below the Hyder road a point about 184 meters to the southeast. The general configuration in plan of the proposed wharf is shown in Drawing 06, and in section on Drawing 09.

To provide habitat compensation for the wharf it is proposed to reintroduce full tidal exchange to the "Lagoon" located about 1300 meters to the north along the Hyder road. The location of the lagoon is shown in Drawings 01 and 05, and Figure 2-1; a photo of the lagoon is presented in Figure 2-12. The lagoon was cut off from the rest of the brackish

marsh at the head of the Canal by a road realignment. It now has tidal minimal exchange and relatively fresh water.

6.3 SCOPE OF WORK

The scope of the ecological work conducted by R.U. Kistritz Consultants Ltd. for this environmental assessment consisted of:

- assisting in developing a preferred project (see Parts 3 and 5)
- identifying existing habitat resources
- assessing the potential impacts on this habitat due to the proposed container wharf and Lagoon modifications
- recommending mitigation and compensation options

The guiding principle is to achieve a no-net-loss of aquatic habitat, and to identify any possible enhancement opportunities that may be practical to incorporate into the project design.

A site reconnaissance was undertaken by Ron Kistritz R.P.Bio. during low tide on July 17 and 18, 1999. Intertidal habitats were identified, characterized, photographed, and measured.

McElhanney Associates surveyed elevations of the tidal flats in August 1999. The biophysical information obtained on site was conveyed to the survey plan of the study area in order to measure the various habitat areas.

Another site visit was undertaken on March 27-29, 2000 in order to discuss environmental concerns and issues with Tom Pendray (DFO, Smithers).

The lagoon was surveyed by McElhanney Associates on May 1-2, 2000. See Drawing 04.

Another site visit was undertaken on May 4-7, 2000, to obtain consensus with Tom Pendray on the location of the red-yellow habitat classification boundary at the project site (see Drawing 01). During that site visit a fish inventory was undertaken at the Hyder road lagoon to determine if juvenile salmonids were present.

The last site visit was undertaken on July 25-28, 2000 to observe plant, fish and bird characteristics during the summer season, and to take soil samples of the proposed dredge zone.

Physical Studies

In addition to the foregoing some physical environmental phenomena were also observed and measured. As noted both the wharf and lagoon areas were surveyed. Soil samples were taken in the proposed dredge zone in front of the wharf and analyzed. Water temperature and salinity measurements were taken. Tidal exchange in the lagoon was measured. Tidal velocities in the vicinity of the proposed wharf were measured.

Background Information and Liaison

Available information was collected (see References, Part 11) and reviewed. The project was discussed with the usual regulatory agencies, the District of Stewart, the Hyder Community Association, and local persons and organizations. However no formal public meeting has been held to date, pending submission of this environmental assessment to DFO.

Gary Williams RP Bio was engaged to provide input regarding his project in 1995-1996 to develop environmental zoning for Stewart Harbor (see References, Part 11; and Drawing 01). The proposed project is consistent with Mr Williams' zoning concepts and the DFO/District of Stewart zoning agreement.

6.4 DESCRIPTION OF EXISTING HABITAT

6.4.1 Environmental Management Plan

General habitat classifications were designated for Stewart harbor in 1995 in connection to the development of the Port of Stewart's *Environmental Management Plan*[1] (see Drawing 01). On the basis of this *Plan*, the major habitat units in the harbor are (1) the Bear River channel, its western and central estuarine areas, (2) the Salmon River channel and its estuary, and (3) the Portland Canal shoreline on the east side of the harbor and between the Salmon and Bear Rivers.

6.4.2 Wharf Expansion/Rip Rap Component Area

6.4.2.1 *Background*

The wharf expansion component study area is situated in the Salmon River estuary habitat unit, and touches the habitat unit that makes up the shoreline between the Salmon and Bear River estuaries. According to the *Environmental Management Plan*, the predominant habitat of the study area is designated **yellow** (moderately productive). Habitat toward the

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[1] G. L. Williams and Associates, 1995a, 1995b

Salmon River estuary is designated as **red** (highly productive), and that along the shoreline between the Salmon and Bear Rivers as **green** (low productivity)[2]. See Drawing 01.

The study area is dominated by yellow-coded habitat, which signifies that caution must be exercised in proceeding with development plans, and only when mitigation and compensation measures are satisfactory to ensure no-net-loss of productive capacity.

6.4.2.2 *Salmon River Estuary*

The sensitivity of the study area is primarily due to its proximity to the Salmon River estuary. The Salmon River supports a dominant run of chum salmon that begins its spawning migration in early July. A dominant run of pink salmon in August, and a smaller run of coho salmon, follow in the fall. Chinook and sockeye salmon are found only incidentally in the river[3]. The marshes and tidal flats of the Salmon River estuary provide important and productive rearing habitat for the juvenile salmon that enter the Portland Canal in early spring and summer. The Salmon River delta is also an important feeding and resting area for various waterfowl and shorebirds.

6.4.2.3 *Results of Site Reconnaissance*

The study area is primarily in a transitional (yellow-coded) zone that supports a gradient of habitat from the low productive green-coded shoreline along the Hyder road to the highly productive red-coded tidal flats south of the study area. The location of the red-yellow habitat classification boundary was determined to be a straight line from the outer edge of the SBT fill slope to the outer dolphin of the overhead conveyor (Figure 6-1)[4]. This boundary location separates the relatively undisturbed foreshore and mudflat habitat from the more disturbed habitat associated with the existing SBT foreshore.

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2 The wharf footprint covers only green- and yellow-coded habitat.

3 Pers comm. State of Alaska Dept. of Fish & Game

4 Following information and general criteria received from Gary Williams & Associates, the location of the line corresponding to Williams' criteria was set in the field during a site visit by DFO. The line was defined by stakes (as shown in Figure 6-1), which were subsequently located by survey using a total station. The southeast side of the wharf, as shown in Drawings 26 and 27, is set along the red-yellow boundary.

Figure 6-1

FIELD SITING OF WILLIAMS' RED-YELLOW HABITAT BOUNDARY

On the basis of our field work, the study area's shoreline supports some productive habitat that includes estuarine marsh, moderately productive habitat consisting of *Fucus* growths and mudflats, and low productive habitat including various rock substrates and subtidal areas. The distribution of marine habitat zones in the vicinity of the proposed wharf project is shown in Drawing 16.

The footprint of the wharf and rip rap is superposed on the aquatic habitat distribution in Drawing 17. The areas (in plan) of each habitat unit to be covered by the structures are also shown on Drawing 17. A summary of the areas of impacted aquatic habitat is provided in Table 6-1.

A description of each of the aquatic habitat units is given below:

6.4.2.3.1 Estuarine Marsh

A mid to low marsh has developed on the tidal flats between the Hyder road and the AMH ramp causeway. This marsh is dominated by *Carex lyngbyei*, *Potentilla pacifica*, in association with *Deschempsia cespitosa*, and *Plantago marina*. Patches of low marsh vegetation also occur on either side of the aerial conveyor.

This community is dominated by *Carex lyngbyei*, *Eleocharis spp*., and *Triglochin maritimum*. South of the aerial conveyor the tidal marsh continues in a patchy network until the main front of the contiguous marsh is met at the very south end of the SBT footprint. Tidal marsh communities are highly productive habitat types because they provide a rich and diverse benthic invertebrate community. A total of 616.0 m^2 of estuarine marsh lies under the footprint of the proposed wharf and riprap.

6.4.2.3.2 Barnacle and Fucus Community

Stable slope material supports a barnacle and *Fucus* community near the upper end of the midlittoral zone. Those areas that support a barnacle and *Fucus* community are relatively highly productive because they support large numbers of small invertebrates.

The total area of barnacle-*Fucus* community under the footprint of the proposed wharf and rip rap is estimated to be 2112.3 m^2.

Table 6-1

Aquatic Habitat Areas Under Wharf Structure

Habitat Areas Under Structures		
Type	Number on Dwg	Area
Terrestrial	1	5,787.4
Estuarine Marsh	3 + group 1	616.0
Fucus Community	4	2,112.3
Unconsolidated Rock	2 + 5	2,457.5
Intertidal Mudflat	6 + 11	4,586.6
Shallow Subtidal	7+12	3,338.4
Total		18,898.2
Total Marine Habitat		13,110.8

Habitat Areas Under Wharf		
Terrestrial	1	5,787.4
Estuarine Marsh	3 + group 1	616.0
Fucus Community	4	2,112.3
Unconsolidated Rock	2 + 5	2,457.5
Intertidal Mudflat	6	4,109.5
Shallow Subtidal	7	3,282.5
Total		18,365.2
Total Marine Habitat		12,577.8

Habitat Areas Under Rip Rap		
Terrestrial	1	0.0
Estuarine Marsh	group 2	0.0
Fucus Community	4	0.0
Unconsolidated Rock	2 + 5	0.0
Intertidal Mudflat	11	477.1
Shallow Subtidal	12	55.9
Total		533.0
Total Marine Habitat		533.0

Notes:

All areas are in square meters
Groups 1 & 2 refer to estuarine marsh outliers
See Drawing 43-17 for area number locations

6.4.2.3.3 Unconsolidated Rock

Most of the SBT footprint's fill slope consists of cobble-gravel sized rock with diameter equal to or greater than 64 mm and less than 256 mm for cobble, or equal to or greater than 2 mm and less than 64 mm for gravel. Because this shoreline material is relatively mobile there are few opportunities for algal growth or other attached marine organisms. Therefore this habitat type is considered to have a low productive capacity, especially in estuarine locations.

Certain locations of the fill slope have been stabilized with boulder and rip rap. This material is also located along the slope below the Hyder road and the slope of the ferry causeway. Zones that are predominantly boulder-rip rap consist of unconsolidated material with a diameter greater than 256 mm.

The area of unconsolidated rock habitat lying below HHWLT (8.0 m chart datum) beneath the proposed wharf and rip rap footprint is 2,457.5 m^2.

6.4.2.3.4 Intertidal Mudflat

Most of the intertidal area below the fill slope consists of mudflat (see Figure 6-1). On the basis of long-term observations[5] the mudflat is actively accreting along its foreslope. Intertidal mudflat areas are moderately productive because they support benthic invertebrates, especially bivalves and annelids.

The area of intertidal mudflat habitat beneath the footprint of the proposed wharf and rip rap is 4,586.6 m^2.

6.4.2.3.5 Shallow Subtidal

The delta foreslope forms the seabed of the subtidal area in front of the SBT footprint. It is assumed that the substrate is comprised of silt and fine-grained material similar to that which exists on the intertidal mudflat. Subtidal areas support low to moderate productivity depending on depth below chart datum. Shallower areas (<4 m below chart datum) are more productive since they support algal communities, if water clarity permits, and bivalves.

The area of shallow subtidal habitat beneath the footprint of the proposed wharf and rip rap is 3,282.5 m^2.

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[5] Pers. comm.- Al Soucie, owner of SBT

6.4.3 Lagoon Component Area

The Lagoon[6] is a former tidal marsh area which was isolated from the Bear River estuary when the Hyder road was realigned and upgraded (date not known, but estimated to be the early 1970s). It presently consists of a 23,467 m^2 +/- freshwater marsh and pond complex with a 966 m shoreline perimeter (436 m along the Hyder Road to the east, and 530 m along the old roadway to the west). A photograph of the Lagoon is presented as Figure 2-12 (page 2-25); another, taken from the air, is placed on the next page as Figure 6-2. A drawing of the Lagoon in plan, based on a survey conducted for this project, is presented as Drawing 04.

Fish and water quality characteristics of the Lagoon were previously investigated by David Bustard and Associates (1993)[7]. Bustard's study found the Lagoon to be dominated by threespine stickleback (Gasterosteus aculeatus), with minor use by coho salmon and char.

R.U. Kistritz Consultants Ltd. assessed the water quality, fish, aquatic habitat, riparian vegetation and birds frequenting the Lagoon in two field studies in May and July, 2000. A copy of Kistritz' report[8] is placed in Appendix 11.

Kistritz found the Lagoon to contain large numbers of small stickleback; no other fish species were captured. The aquatic habitat consisted of submerged aquatic macrophytes, low marsh and high marsh. Only a few birds, all ducks, were observed in the Lagoon over a period from May to August 2000. See the original report in Appendix 11 for details. Kistritz' observations were generally consistent with Bustard's.

The hydrotechnical characteristics of the Lagoon are discussed in Part 7.

6.4.4 Dredge Component Area

As shown in Drawing 08 the area in front of the proposed wharf will be dredged to a depth of minus forty feet (-12.2 m) chart datum to allow ships to be berthed. Dredging is required because the wharf cannot be extended past the red-yellow habitat boundary into deeper water.

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6 Also known as "the freshwater pond"

7 David Bustard and Associates, "Fisheries and water quality assessment of a salt water lagoon at Stewart". Report prepared for the Ministry of Transportation and Highways, Smithers, BC. July, 1993. Copy placed in this report as Appendix 10.

8 R.U. Kistritz Consultants Ltd., "Aquatic Habitat Inventory of Hyder Road Lagoon, Stewart Bulk Terminals, Stewart, BC", August 2000, 6 pp plus drawings.

Figure 6-2

VIEW OF THE LAGOON FROM THE AIR

Plate 5. Estuarine habitat isolated by road to Hyder, now exists as a stagnant lagoon.

Photo taken from a helicopter at low elevation looking south. The lagoon is to the right of the road.

Source: Williams, G.L., 1995b. Bear River Estuary Shoreline Habitat Classification,. Final Report

As it was under water the substrate in the dredge area was not investigated, except for the soil chemistry investigation (see Part 8). It is hypothesized that the subtidal habitat unit (see Drawing 17) extends across the dredge zone. This unit is characterized by fine silts and clays (see Figure 2-15, page 2-30), likely underlain by sand and gravel.[9]

The subtidal unit appears to be devoid of macrophytes. It was not sampled for benthic organisms.

The area to be dredged, in plan, is calculated as 6333 m^2, from Drawing 08. The estimated volume to be dredged is 29,000 m^3.

6.4.5 Gravel Extraction Component Area

About 88,500 m^3 of backfill is required behind the sheetwall to form the wharf. This material will be obtained from the dredgeate extracted from the front of the wharf and from gravel extracted from the bed of the Bear River. (Some larger quarried rock may be added to obtain a suitable particle distribution). Thus, depending on suitability of the dredgeate for use as backfill[10], a volume of between 59,500 m^3 and 88,500 m^3 of gravel will be required for backfill.

The gravel will be obtained from the Soucie Construction lease on the Bear River as part of its annual extraction operation. The location of the Soucie lease is shown in Drawing 18.

The bed of the Bear River consists of alluvial gravel (with about 10% sand). The lower Bear River carries about 300,000 m^3 of sediment per year[11], on the average, which is resulting in aggradation of the bed.

The Bear River experiences an annual flow cycle with a pronounced freshet in late spring and a low flow in mid winter when most of the surface water in its basin is frozen. Extraction of gravel takes place in mid winter when the flowing river occupies only about 50 feet of the (approximately) 750 foot wide channel width in the Soucie lease area.

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[9] A soil core was taken to a depth of three feet at the water's edge in the wharf expansion area during a monthly low tide in July 2000. Only fine sediments were encountered to that depth.

[10] Dredgeate, if any, which is geotechnically unsuitable but uncontaminated may be placed in the Portland Canal under the aegis of an ocean disposal permit (to be issued by Environment Canada).

[11] Hay & Company, *Bear River Estuary, Hydrology & Geomorphology,* prepared for the District of Stewart, December 1984.

Williams[12] (1995) provided the following habitat overview of the Bear River channel:

> The Bear River Channel provides migration routes for adult salmon (primarily coho and chum) migrating to upstream spawning grounds from early August to the end of December ...., and for juveniles moving downstream to marine waters in April and May. There may be some juvenile coho rearing in the side channels in periods of low discharge, but most the rearing occurs in tributary streams.
>
> The Bear River is classified as low productivity habitat below the [Highway 37A] bridge, except during adult salmon runs extending between early August and late December when it is rated as having high productivity

Kistritz[13] (2001) investigated the benthic invertebrate community of the lower Bear River from the mouth near the Arrow Dock upstream into the freshwater zone by the Tercon Infill[14]. Kistritz noted that spawning potential is limited by the mobile bed, but benthic invertebrates colonize the active channel during the lower flow period.

A summary of the benthic invertebrate count based on a composite of Surber samples at the most upstream station is given in Table 6-2. This provides information the species present and their relative abundances. The sampling station was located about 900 meters downstream of the south boundary of the Soucie lease. Both locations lie in the freshwater habitat zone of the lower Bear River. The total number of benthic organisms decreases markedly above the tidal zone, and becomes dominated by *Insecta* (especially larvae of *Plecoptera*, *Cloeoptera* and *Diptera*) in the freshwater zone. For further details, see R.U. Kistritz Consultants Ltd., 2001.

Gravel extraction occurs from the dry and frozen bed, and not from the wetted perimeter of the Bear River channel.

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[12] G.L. Williams & Associates Ltd., *Bear River Estuary, Shoreline Habitat Classification, Final Report*, Report prepared for the District of Stewart and DFO, 1995

[13] R.U. Kistritz Consultants Ltd., *Aquatic Habitat Study of the Gravel Lease Extension in The Bear River Estuary, Stewart, BC,* Report prepared for the District of Stewart, September 2001, 8 pp + Appendices

[14] The most upstream point in Kistritz' survey was about 900 m downstream of the south boundary of the Soucie lease. Both lie in the freshwater habitat zone of the lower Bear River.

Table 6-2

Benthic Invertebrate Count in Freshwater Sample on Bear River

Station No.	Distance Upstream of Arrow Dock	OLIGOCHAETA	CRUSTACEA (Copepods & Amphipods)	INSECTA (mostly freshwater)	NEMATODA	Total Organisms	Total Taxa
8	1042	72	10	900	7	1007	16

Notes: Source is field data from July 2001 presented in R,U. Kistritz Consultants Ltd., 2001
Station 8 is most upstream station (near Tercon Infill), located in freshwater zone

6.4.6 Quarry Component Area(s)

Quarrying will be required to obtain material for the rip rap structure, and possibly for larger sized rock to produce a stable backfill.

The location of an existing quarry about 1000 feet northeast of the Highway 37A bridge, is shown in Drawing 19. This quarry lies on Crown land and is in occasional use for local purposes.

6.5 ENVIRONMENTAL IMPACT APPRAISAL

6.5.1 Wharf/ Rip Rap Component and Dredge Component

6.5.1.1 *Description of Works*

The basic wharf configuration, as shown in Drawings 08 and 09, includes

1) a sheet pile wall backfilled with clean gravel. Per Table 6-1 this structure will cover about 13,111 m^2 of existing marine habitat. All habitat units are impacted.

2) a flexible rip rap breakwater placed in an indentation on the southeast wall of the wharf cover about 533.0 m^2 in plan. Two marine habitat units are impacted.[15]

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[15] It is noted that there is no engineering requirement for the rip rap structure; it is included to provide *Fucus* community habitat compensation and to assist fish passage. The impact of this structure could be avoided by not building it; however, as shown in Table 6-3, replacement *Fucus* habitat is required.

3) in addition, dredging of an area of about 6,333 m^2 (in plan, see Drawing 08) will be required to achieve the design depth of 12.2 meters below chart datum in the zone along the face of the wharf. The dredgeate material would be backfilled behind the sheet pile wall.

The existing bulk loader structure and its operation would remain unmodified.

6.5.1.2 *Environmental Impacts*

6.5.1.2.1 Wharf and Rip Rap Footprints

The proposed wharf footprint (as shown in Drawing 08) would affect 344 meters of existing shoreline (at HHWLT) from the base of the Hyder road towards the existing bulk loader structure. The total footprint area of the proposed wharf would be about 18,365 m^2. Within this footprint, 31.5% is above the higher high water large tide level (8.00 m), 50.6% is intertidal zone, and the remaining 17.9% is shallow subtidal zone[16].

The proposed rip rap structure does not affect any shoreline at the HHWLT elevation. The total footprint area (in plan) is about 533.0 m^2. Within this footprint, 0% is above the higher high water large tide level (8.00 m), 89.5% is intertidal zone, and the remaining 10.5% is shallow subtidal zone.

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The intertidal zone supports some estuarine marsh, a *Fucus*-barnacle community, rocky substrate, and mudflat (see Drawing 17). The amount of habitat lost underneath the development footprint is summarized in Table 6-1 on page 6-8.

6.5.1.2.2 Subdtidal Unit in Dredge Area

The subtidal unit in the dredge area has not been drilled to determine its stratigraphy, but anecdotal information (from SBT) based on maintenance dredging in front of the bulk loading structure is that the stratigraphy consists of surficial fine silts overlying sand and gravel outwash deposits. The biota in the surficial sediment of the dredge area will be severely impacted by excavation since the sediment will be excavated and placed as backfill behind the sheet wall (and some may be disposed of in the Portland Canal at depth).

[16] From Table 6-1.

6.5.1.2.3 Herring Spawning

Impacts to herring spawning are briefly discussed[17].

There is some historical evidence of herring spawn activity in Stewart harbor. Spawning herring can use *Fucus*; however, in the spring of 2000, herring spawn was observed on the nearby government dock pile structure (see Figure 2-10 and Figure 6-3). The piles probably provided a more stable surface and better water circulation than the nearby *Fucus* vegetation that is growing on a silty-gravel surface

Herring spawn was observed in April 2000 on the piles of the government wharf. SBT reports anecdotally that this is common.

Herring spawn was also observed in lesser quantities on the four piles to the immediate south of the government wharf which lie in the footprint of the proposed wharf (see Drawings 02 and 08).

Herring spawn was not observed in significant quantities on the Unconsolidated Rock habitat unit of the SBT study area.

The government wharf is owned by the Federal government. The proposed project does not involve any disturbance to the government wharf. Herring spawning on this structure should not be affected. The construction schedule (see Figure 5-4) avoids work during the spawning season. No additional mitigation is proposed or required.

The four piles to the immediate south of the government wharf will be removed for the wharf expansion project, so they will not longer be available for herring spawning. This is a small relative loss as there are about 100 piles under the government wharf (see Figure 2-10). Further, the proposed breakwater may provide a medium for additional herring spawning (as it will be more stable than the existing Unconsolidated Rock habitat unit). If so then there would be a net gain in local habitat for herring spawn.

6.5.1.2.4 Rare and Endangered Species

No rare or endangered species are known to frequent the wharf/rip rap component area on a permanent or temporary basis.

Some salmon species are considered to be endangered in parts of the US. Salmon do not spawn in the wharf/rip rap component area. Impacts of construction are mitigated by avoiding the fry escapement period from March through June (see Figure 5-4).

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[17] At DFO's request, per its letter of March 31, 2000 (placed in Appendix 8).

Figure 6-3

PHOTO OF PILES (MARCH 1999)

6.5.2 Lagoon Component

6.5.2.1 *Summary of Impacts*

The following impacts are expected to occur in the Lagoon area:

- the habitat of the Lagoon will change from a fresh/brackish water one to Estuarine Marsh as full tidal exchange is reintroduced
- the stickleback fish population will be substantially reduced, other species characteristic of the estuarine marsh will replace them
- the rocks along the west side will become Unconsolidated Rock marine habitat
- part of the bed of the Lagoon will be covered with rip rap for energy dissipation. This should become barnacle-*Fucus* habitat, except possibly in the zones of greater shear stress
- part of the estuarine marsh on the east side of the Hyder road where the culverts discharge will be covered with rip rap for energy dissipation. This should become barnacle-*Fucus* habitat, except possibly in the zones of greater shear stress
- there will be some construction-related disturbance, including local sediment generation
- traffic will be affected as the Hyder road will have to be temporarily closed. (This is discussed in section 5.10)

6.5.2.2 *Rip Rap at Lagoon*

As shown in Figures A6-1 and A6-2 in Appendix 6 it is proposed to place rip rap for energy dissipation at both ends of the new culverts under the Hyder road to restore tidal flushing of the Lagoon. The rip rap on the west end of the culvert (in the Lagoon) will cover about 515.2 m^2 of existing fresh water marsh. The rip rap pad on the eastern side will cover about 31.7 m^2 of existing Estuarine Marsh habitat.

This rip rap will be at EL 2.7 to 3.5 (approx.) chart datum. Per Figure 6-4 it is ascribed to be barnacle-*Fucus* compensation habitat at this elevation.

6.5.2.3 *Rare and Endangered Species*

No rare or endangered species are known to frequent the lagoon component area on a permanent or temporary basis.

Some salmon species are considered to be endangered in parts of the US. Our investigation indicates salmon do not currently spawn in the lagoon component area. The habitat should be more favorable for salmon after the lagoon is opened to full tidal

flushing. Impacts of construction are mitigated by avoiding the fry escapement period from March through June (see Figure 5-4).

6.5.3. Gravel Extraction Component

The extraction of gravel for this project will be done in conjunction with annual extraction of gravel from the bed of the Bear River under permit. It will increase the magnitude of the disturbance, but the environmental impact is expected to remain minimal since the work is done in the dry in midwinter.

6.5.4 Quarry Component

Quarrying for this project will expand the footprint of the existing quarry area. This area has degraded terrestrial habitat. The extent of this degraded habitat will be slightly larger. The quarrying is done under permit. The Stewart region is sparsely settled and the proportion of the area impacted by quarrying is very small.

6.5.5 Offsite Work Area Component

Due to the small size of the wharf footprint, an offsite work area may be required in time for such activities as container storage and sorting, truck parking and scheduling, and so forth. This would be done at an existing industrial area such as the Brown Bear Trucking log sort yard on the Highway 37A above the town. These are existing disturbed areas with minimal habitat value and no incremental impacts are anticipated.

6.5.6 Other Potential Impacts

The only other potential impacts to natural habitat which can be foreseen are those typically associated with the transportation industry. Increased truck traffic will have the potential for accidents and fuel spills. Similarly, there are risks of spills and accidents in the shipping industry. These transportation-related risks are mitigated by regulations and industry practices since they are costly.

6.5.7 Downstream Environmental Impacts

Since this project represents a build-out of the site as far as fill-related footprint enlargement is concerned, there is little opportunity for downstream development. DFO has indicated that the wharf could be extended eastward over the subtidal zone on piles (as shown on Drawing 15), however such an expansion is not economic in the near term. Further its geotechnical feasibility would have to be confirmed.

6.6 ENVIRONMENTAL MITIGATION

6.6.1 Wharf and Rip Rap Component

Construction activities would be timed to avoid intertidal construction during spring outmigration of juvenile salmonids. That period is generally from early March to late June. The Department of Fisheries and Oceans would define the valid authorization period. See the proposed project schedule [Figure 5-4 (page 5-17)].

All materials (e.g., old piles, dredgeate) removed from the construction site would be disposed in a safe and approved manner. It is proposed to place the dredgeate behind the wharf as fill, except some may be removed for ocean disposal if this is permitted by Environment Canada.

Sediment and erosion control measures would be implemented during construction to minimize introduction of sediment into the marine environment.

The mitigation measures would be summarized in a written *Environmental Management Plan* presented to the contractor.

The rip rap structure is being installed solely for environmental purposes Impacts could be avoided by not installing the structure, but it is assumed that DFO is of the view that it will result in a net benefit. Some mitigation is afforded by constructing the breakwater to the greatest practical slope, thereby minimizing its footprint.

The aquatic habitat loss will be compensated by opening up the Lagoon to tidal flushing. Hydrotechnical details are presented in Part 7 and Appendix 6.

6.6.2 Subtidal Unit in Dredge Area

The Subtidal habitat unit in the dredge area will be impacted by dredging. After completion of dredging the exposed surface should be recolonized by benthic organisms. The surface available for colonization should be slightly greater than the pre-dredge surface due to the excavation. Thus the project should result in a slight net gain in subtidal habitat after the dredge area has been recolonized by benthic organisms.

It is noted in Appendix 9 that DFO has never required compensation for subtidal habitat losses in the Fraser estuary. As DFO Fraser River estuary compensation practice is the methodology applied to this project, consistency requires that loss of subtidal habitat not be included in the habitat balance presented in Table 6-3.[18]

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[18] As well, Subtidal habitat replacement is not required for the port of Stewart according to the Port of Stewart Environmental Management Plan (1995, p 20).

However, if other approaches are used to account for the same physical changes then it can be demonstrated that the Subtidal habitat unit is fully compensated for in the proposed project. To avoid confusion this alternative approach is presented in Appendix 12.

6.6.3 Lagoon Component

After restoration of full tidal exchange the existing fresh to brackish aquatic habitat in the Lagoon will be replaced by the salt marsh habitat such as exists across the Hyder Road (and which formerly existed in the Lagoon). The salt marsh habitat is considered to be of higher value.

Construction impacts would be mitigated by the same measures as for the wharf expansion. Sediment and erosion control measures would be implemented during construction to minimize introduction of sediment into the marine environment. An *Environmental Management Plan* will be prepared for the contractor.

A general design for the culvert enlargement was developed by MOT and was authorized by DFO (see Appendix 6, Figures A6-1,2)[19]. This involves replacement of the existing 24 inch culvert by two six foot diameter culverts. Erosion induced by the larger discharges is mitigated by placement of rip rap near both ends of the pipe. At the west end of the culverts a 515.2 m^2 rip rap mat is placed on the bed of the Lagoon at elevations 2.8 to 3.4 m. (Following Figure 6-4 this would replace freshwater habitat with barnacle-*Fucus* habitat). At the east end of the culverts about 31.7 m^2 of rip rap is placed over Estuarine Marsh for energy dissipation. The MOT design may be altered at the Authorization stage to accommodate some changes requested by DFO at an agency meeting.

MOT will require a plan to be prepared and approved to mitigate traffic impacts and preserve public safety. MOT will include BC Hydro in the preparation and review of the plan. This is discussed in sections 5.10 and 9.8.7.

6.6.4 Gravel Extraction Component

Gravel extraction from the Bear River occurs each year under a Water Management Branch section 9 permit. This project would not change the requirement for an annual extraction plan to minimize environmental impact to be developed and approved. The procedure used includes the following mitigation measures:

- extraction occurs only during the fish window from Jan 1 to about March 20

See Appendix 9)

[19] See pages A6-8,9

- a berm is placed along the channel of the flowing river to keep it out of the working area
- gravel is excavated so as to avoid creating depressions in which fish could be stranded
- usual precautions are taken to minimize the risk of fuel spills

As the average annual bedload carried by the Bear River exceeds the maximum extraction volume by about 4 times the mining area is remediated naturally. There is an incidental benefit of a temporary lower aggradation rate of the river bed which reduces the increasing flood risk.

6.6.5 Quarry Component

Since the quarry site has been previously used, extraordinary mitigation measures are not required. No impacts to aquatic habitat will be incurred by quarrying. Terrestrial habitat at the quarry sites are impacted and of low value.

It is proposed to do most of the quarrying in the fall of 2002 before snowfall. There are no habitat windows to consider.

6.7 HABITAT COMPENSATION

6.7.1 Wharf and Rip Rap Component

The proposed compensation plan is to replace the lost habitat from the wharf and rip rap footprints with like habitat proximate to the proposed development in an area suitable for the growth and propagation of estuarine marsh.

As shown in Drawing 17 there are five marine habitat zones impacted by the proposed wharf expansion/breakwater development. Ideally the compensation scheme would replace the area of each habitat zone with like habitat; however it is difficult to achieve an exact balance. Where tradeoffs occur the objective is to maximize the areal extent of the more valuable habitat types -- estuarine marsh and barnacle-*Fucus*

6.7.1.1 *Net Habitat Balance Approach*

Habitat compensation focuses in restoring habitat that includes estuarine marsh and barnacle-*Fucus* growth, which represent the most productive habitats of the study area. Habitat compensation would be achieved with the following replacement ratios:

- Unconsolidated Rock at 1:1 wherever possible above 5.0 m chart datum
- Estuarine Marsh at 2 (replaced) to 1(lost) between 3.5 to 4.0 m elevation
- Barnacle-*Fucus* at 1:1 on stable rip rap slopes between elevations 3.5 to 1.5 m
- Mudflat at 1:1 wherever possible below 3.5 m elevation, **or** Estuarine Marsh replacing Mudflat at 0.5 (replaced) to 1 (lost)
- Subtidal habitat loss is not included in the balance scheme and is not explicitly compensated for.[20]

This compensation scheme is illustrated in Figure 6-4 on the next page.

The rationale for this compensation balance scheme is that it has been developed by DFO for use in the Fraser River estuary (see Appendix 9). As no comparable site-specific methodology had been developed for the north coast, this compensation scheme was explicitly included in the *Port of Stewart Environmental Management Plan* (1995, p.20, copy placed in Appendix 9) for application to the Port of Stewart.

6.7.1.2 *Proposed Compensation Method*

The proposed methodology for habitat compensation consists of (1) reinstating tidal action in the freshwater "Lagoon" on the west side of the Hyder road, and (2) placing rip rap on the southeastern side of the wharf to replace local barnacle-*Fucus* habitat.

The Lagoon is a former tidal marsh area which was isolated from the Bear River estuary when the Hyder road was realigned and upgraded (date not known, but estimated to be the early 1970s). It presently consists of a 23,467 m^2 +/- freshwater marsh and pond complex with a perimeter of about 966 m (436 m along the Hyder Road to the east, and 530 m along the old roadway to the west).

Photographs of the Lagoon are presented as Figures 2-12 and 6-2. A plan drawing of the Lagoon based on a survey conducted for this project is presented as Drawing 04.

Tidal reactivation and flushing would be achieved by installing new culverts across the Hyder road. There are several precedents where this type of restoration technique has been used with successful results (Kistritz *et al*., 1990; Macdonald *et al*., 1990; Tutty *et al*.,

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[20] This exclusion is consistent with DFO policy on the Fraser River estuary and is done in Part 6 to remain consistent and to avoid setting a precedent. See Appendices 9 and 12.

FIGURE 6–4

ILLUSTRATION OF NET HABITAT BALANCE COMPENSATION APPROACH

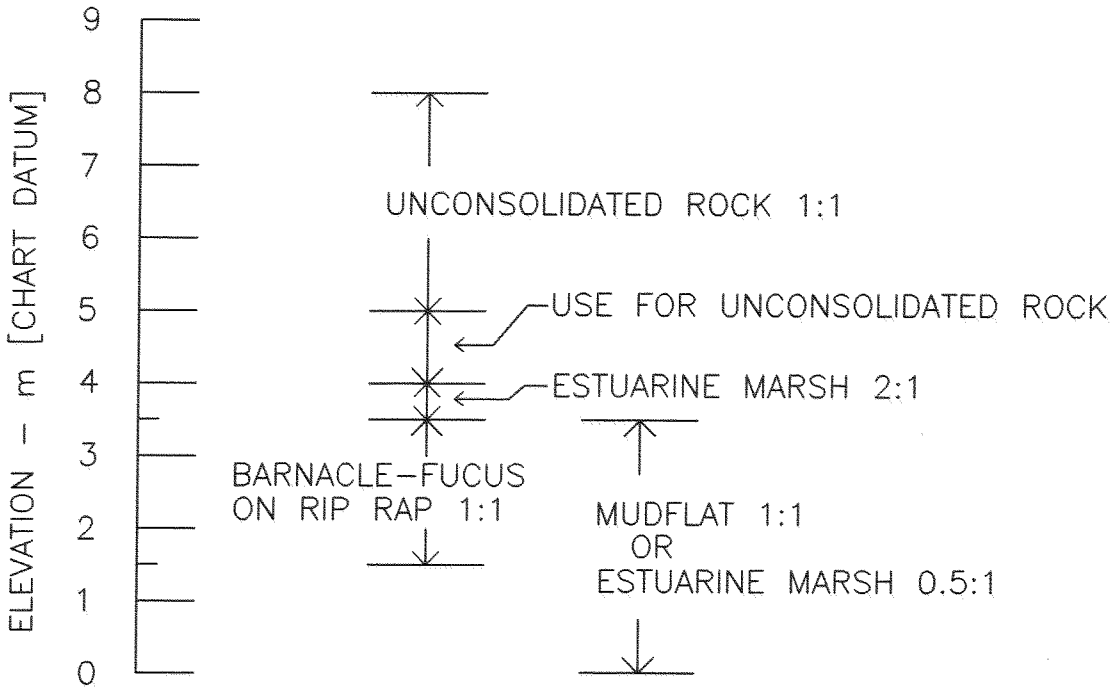

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ILLUSTRATION OF NET HABITAT BALANCE COMPENSATION APPROACH		
DESIGNED BY: S.G.	DATE: January 06, 2002	REV.: 1
DRAWN BY: G.H./SCL	DWG. No.: FIGURE 6–4	
CHECKED BY:		

1983; and Mitchell, 1982)[21]. Monitoring studies of tidal marsh-slough reclamation projects in other coastal locations of the Pacific Northwest showed that dike removal, channel excavation, and culvert installations can achieve a net gain in productive juvenile salmon habitat.

Regarding Figure 2-12 note that the west shore of the Lagoon is bare rip-rap from a former road bed, and would revert to the Unconsolidated Rock unit if salt water were reintroduced. An allowance for an additional 1543 m^2 (= 436 m * 3m * 1.18) of this unit is made in the habitat balance calculations for this reversion. (The bed of the new road on the west side would likely have some habitat value as well, but this is not included [conservatively] in the calculation as it is mostly gravel).

In summary, the proposed habitat compensation scheme has the following attributes:

- it restores lost habitat
- it has greater productivity
- it improves flushing the of Lagoon, which should result in better water quality
- it will result in greater species diversity
- it will have improved access for rearing by juvenile salmon

6.7.1.3 *Other Compensation Options*

Three compensation options, including use of the Lagoon, were presented in the draft environmental assessment[22]. Upon review of these options by DFO, and discussions, it was determined that the Lagoon option was preferred and it was recommended to include only that one in the final environmental assessment in order to simplify and clarify the report.

6.7.1.4 *Habitat Balance Calculations*

Habitat balance calculations for habitat compensation using the Lagoon are presented in Table 6-3 on the next page. These calculations follow the procedure used in the Lower Fraser River which are also adopted the Port of Stewart Environmental Management Plan.

Estuarine Marsh is lost under the footprints of the wharf and rip rap breakwater, and under the rip rap for energy dissipation at the east end of the culverts under the Hyder road.

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[21] See Part 11, References.

[22] R.U. Kistritz Consultants Ltd. and S. Graham Engineering and Geology Inc., *Part 4, Feasibility Study of Proposed Container Wharf, Environmental Appraisal and Mitigation*, September 2000.

Table 6-3

Marine Habitat Balances Based on Maximizing Estuarine Marsh

Habitat Type	Location	Dr Gain	Cr Loss	Bal Net	Goal	Variation	Rplcment Ratio Gain/Goal	Comment
Estuarine Marsh Unit 3	Under wharf Under rip rap by wharf On east end of culvert rip rap Compensation area	11,810	616 0 32 0	11,162	1,295	10,514	200%	Goal is 2:1 Transfer excess to credit for Intertidal Mudflat
Barnacle & *Fucus* Unit 4	Under wharf Under rip rap by wharf On wharf rip rap 1.5 to 3.5 m On west end of culvert rip rap On east end of culvert rip rap	98 515 32	2,112 0	-1,467	2,112	-1,467	31%	Goal is 1:1 Goal could be attained by placing 1,467 m^2 of rock on the lagoon bed Rip rap at culvert ends is at elevation 2.8 to 3.8m +/-
Unconsolidated Rx Units 1, 2, 5	Under wharf >5m Under rip rap >5m On rip rap >4 m Lagoon road bed, > 4m	80 1,543	2,474 0	-851	2,474	-851	66%	Goal is 1:1 Goal could be attained by placing 851 m^2 of rock in lagoon bed above 3.5 m EL
Intertidal Mudflat Units 6, 8, 10	Under wharf Under rip rap Compensation area Estuarine Marsh Comp	0 10,514	4,110 477	n/a	2,293	8,221	458%	Replace at 0.5:1 after 2X goal for estuarine marsh is met
Shallow Subtidal Units 7, 9, 11	Under wharf Under rip rap Compensation area	0	3,283 56	-3,338	0	0	100%	Goal is 0:1 Not to be compensated

Note : All values are square meters

Note in Table 6-3 that Estuarine Marsh habitat unit loss is substantially overcompensated for (11,810 m^2 replacement for 648 m^2 lost). Even using a conservative 2:1 compensation ratio there is an excess of 10,514 m^2 of this more valuable habitat unit.

On the other hand only 31% of the lost barnacle-*Fucus* habitat is compensated (at a 1:1 ratio). This occurs primarily because only a 2 meter strip of the rip rap breakwater is attributed to barnacle-*Fucus* habitat (per Figure 6-4).[23] (The area of the entire rip rap indentation in the wharf, in plan, is about 533 m^2, which is about 25% of the area of lost barnacle-*Fucus* habitat. If the barnacle-*Fucus* biota utilize a greater depth range of the breakwater than 2 meters, then the variation from the compensation goal for this habitat unit will be reduced). Rip rap placed at the ends of the new culverts under the Hyder road is at an elevation that is attributed to barnacle-*Fucus* habitat. However all the rip rap comprising the old road bed along the east side of the Lagoon is attributed to the Unconsolidated Rock habitat unit as it lies above elevation 4.0 m chart datum (per Figure 6-4).

A greater amount of compensation habitat could be produced by laying the rock in the wharf indentation at a lower slope between the 1.5 and 3.5 meter elevations (chart datum), but this would cover additional intertidal mudflat.[24] Additional barnacle-*Fucus* habitat could also be created by excavating a part of the bed of the Lagoon and placing rip rap there. However this would replace the productive Estuarine Marsh habitat and is not considered a superior alternative. (This is discussed further in Appendix 12).

The Unconsolidated Rock habitat unit loss is 66% compensated for. It could be completely compensated for if 851 m^2 of the Lagoon bottom above 4.0 m EL were filled with rip rap (see Appendix 12). It is not proposed to do this as the Estuarine Marsh habitat is more valued than the Unconsolidated Rock habitat.

No new Intertidal Mudflat habitat will be created for compensation so, per Figure 6-4, all loss of Intertidal Mudflat will be compensated for by new Estuarine Marsh habitat at a ratio of 0.5:1. With this habitat substitution there is more than sufficient excess Estuarine Marsh habitat to meet the compensation goal for lost Intertidal Mudflat habitat.

It is not proposed to compensate for loss of Shallow Subtidal habitat in order to be consistent with DFO's policy on the Fraser River (see Appendix 9) and the Port of Stewart Environmental Management Plan.

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[23] This is augmented by a factor of 1.18 to account for the exposed surface on a 32 degree slope. Only the rip rap breakwater and the east road bed in the Lagoon have slope corrections applied to them in the calculations.

[24] The proponent has no objection to a variation in slope to increase barnacle-*Fucus* compensation habitat.

(In its letter of 31 March 2000[25] DFO suggests (p.4) that compensation for lost Subtidal habitat be addressed. The approach and assumptions used to develop the habitat balance presented in Table 6-3 preclude compensating for the Shallow Subtidal unit. However another approach can be taken which demonstrates how both Unconsolidated Rock and Subtidal units can be fully compensated for. To avoid confusion this discussion is presented in Appendix 12).

6.7.1.5 *Summary*

In summary it is possible to implement a mitigation and compensation program for aquatic habitat that meets the DFO habitat no-net-loss policy, and also results in an enhanced marine habitat. The habitat compensation at the Hyder Road Lagoon would restore estuarine habitat back to its historic levels. This would provide additional rearing capacity for juvenile salmonids originating from the Bear and Salmon River system as well as smaller tributaries such as Rainy Creek.

6.7.2. Compensation for Other Components

Compensation for other project components has been discussed in sections 6.5 and 6.6; but is briefly reiterated here in consideration of the report format.

6.7.2.1. *Lagoon Component*

There is no suitable opportunity to replace the existing fresh/brackish water habitat in the Lagoon. As the Lagoon appears only to support a local population of 3-spine stickleback, it is regarded as a stranded habitat which has no significant function in the marine system. Its loss is not included in the marine habitat balance because it is not marine habitat.

6.7.2.2 *Dredge Component*

No habitat is lost in the dredge area so there is no explicit compensation provided.

The existing benthic habitat will be severely disturbed and/or partially destroyed on a one-time basis by dredging. The disturbed area will be recolonized and recover in time.

It is shown in Appendix 12 that it is possible to devise a habitat balance which compensates dredge area losses with excess Estuarine Marsh habitat

[25] A copy is placed in Appendix 8

6.7.2.3. *Gravel Extraction Component*

Compensation is not required for the gravel extraction component because 1) it is an ongoing permitted activity, 2) the wetted channel is not affected, and 3) the mining activity is naturally remediated by bedload transport during the subsequent freshet.

6.7.2.4 *Quarry Component*

Compensation is not required for the quarry component because it does not occur in aquatic habitat. It occurs on existing quarry areas with degraded terrestrial habitat.

6.8 FISH PASSAGE

Small fish risk higher mortality while passing around the deep water at the face of the wharf as they travel along the shoreline.

Fish passage risk is mitigated by (1) placing rip rap in an indentation in the southeast wharf wall to the LLWHT point (see Drawings 06 and 09), and (2) suspending baskets of gravel along the wharf face over the remaining zone of deeper water. The latter technique is novel and its efficacy will be confirmed by monitoring for a period of 5 years.

Drawings 33 through 36 show the tray system for fish passage.

PART 7

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HYDROTECHNICAL INVESTIGATIONS

7.1 INTRODUCTION

The proposed wharf expansion project will affect the flow of water in two areas: 1) the vicinity of the wharf footprint, and 2) the vicinity of the lagoon. Hydrotechnical investigations were performed in these 2 areas and results are presented in this section.

7.2 EFFECTS ARE LOCAL

As noted in Part 5.3, the Large Tide at Stewart has an amplitude of 8.0 meters (26.2 feet). The tidal prism in Stewart harbor is immense. As shown in Figure 2-1 the wharf and Lagoon project components are a tiny proportion of the area in Stewart harbor, and they do not lie in the path of the main component of tidal flow. They would not have any significant, nor measurable, effect upon the main circulation or tidal exchange characteristics of Stewart harbor. Their effects upon flow characteristics would be only local.

7.3 HYDRAULIC CHARACTERISTICS OF THE LAGOON

7.3.1 Physical Characteristics

The geometry of the Lagoon was surveyed for this project (see Drawing 04) in order to accurately measure areas, volumes, depths and so forth.

Some relevant geometric and physical properties are:

- surface area is 23,467 m^2 +/- (5.8 acres)
- maximum length is about 378 m, maximum width is about 96 m
- 966 m perimeter (436 m along the Hyder Road to the east, and 530 m along the old roadway to the west)
- contained by the old roadway bed on west (rip rap shore) and new Hyder road bed on east (gravel/sand shore)
- bottom elevation varies from 3.4 to 6.5 m approx chart datum
- typical bottom elevation is 4.5 to 5.5 m
- the outlet is a 24 inch diameter CSP culvert. Invert elevations are 5.059 m (16.598 ft) on the east and 5.471 m (17.949 ft.) on the west (in the lagoon). The culvert length is about 27 meters (89 feet). There is a slight curvature to the CSP under the road due to settlement.
- As the Large Tide range is 0.0 m to 8.0 m (Figure 5-1) at Stewart, the ocean side of the culvert with invert elevation 5.059 m only captures a portion of the tidal cycle (see Figure 5-2 on page 5-11).
- water quality measurements by Kistritz on May 4, 2000 were pH of 7.0 and conductivity > 2000 uS. The salinity regime can be described as brackish. There was evident freshwater inflow from the hillside on the west side of the Lagoon.

- water quality measurements by Bustard on July 03/04, 1993 (see Appendix 10, page 5) were consistent with those of Kistritz (above). In mid-summer no freshwater inflow was observed. pH ranged from 7.3 to 8.1, surface DO ranged from 10.8 to 13.0 mg/L, conductivity ranged from 2.14 to 3.35 mS.

7.3.2 Tidal Range and Flushing

The tidal range in the Lagoon was observed on May 06, 2000. On this date the tidal range at the Prince Rupert gage (Stewart's is almost the same) was HW of +20.3 ft and LW of +1.0 ft. This was the second largest range of the month (the largest range, on May 05, was 0.7 ft greater). Of this about 3.7 feet of tidal range occurred above the culvert invert elevation of 16.6 feet and was thus available to the Lagoon.

The corresponding water surface variation in the Lagoon was 7 3/4 inches (0.646 ft).

Thus the tidal range in the Lagoon was 18% of that of the ocean [= 0.65 / (20.3-16.6)] above the culvert invert, and only 6% of the entire tidal range [= 0.65 / (20.3 - 10.2)] on the other side of the Hyder road. [The elevation of the marsh on the other side of the Hyder road is about 10.2 ft (3.1 m) (see Drawing 04)].

Photos of the end of the culvert in the Lagoon taken near peak inflow and outflow on this date are presented in Figure 5-3 on page 5-12. Note in the upper (outflow) photo that the top of the culvert was not wetted during the previous high tide.

The amount of water exchanged per tidal cycle is thus estimated to be:

$$\text{Volume} = \text{area} * \text{tidal range} \qquad (7\text{-}1)$$

$$= 23{,}467\ m^2 * 0.197\ m = 4{,}619\ m^3 \qquad (7\text{-}2)$$

or

$$= 252{,}597\ ft^2 * 0.646\ ft = 163{,}135\ ft^3 \qquad (7\text{-}3)$$

$$= 3.745\ \text{acre-ft} \qquad (7\text{-}4)$$

If the typical bed elevation of the Lagoon is estimated to be 5.0 m chart datum, and the water surface level in the lagoon at mid tide is 5.956 m [1] (19.541 ft), then the typical volume of the Lagoon is estimated to be 23,467 m^2 * (5.956 - 5) m = 22,434 m^3. The exchange ratio is then:

$$E_R = \text{Vol of Tidal Prism} / \text{Typical Volume} \qquad (7\text{-}5)$$

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[1] The invert elevation of the culvert is 5.471 m (Drawing 04). The water surface ranged from 1" to 8 3/4" below the top of the culvert, so the mid tide would be 4 7/8" below the top of the 24" culvert.

$$= 4{,}619\ m^3 / 22{,}434\ m^3 \qquad 7\text{-}6$$

$$= 20.6\% \qquad 7\text{-}7$$

Thus the proposed compensation project involves raising the tidal exchange ratio of the Lagoon from 20% to 100%.

7.3.3 Rationale for Design

Information was requested from MOT on the design and rationale for the 24" culvert placed under the Hyder road realignment, and from DFO regarding its review of the proposed design. Neither agency could provide the information requested. Thus the government's rationale for changing the Lagoon from a marine to a fresh water body is not known.

7.3.4 Basis for Proposed Culvert Design

The proposed culvert design was developed by MOT's engineering department for a proposed project to widen the Hyder road in 1993. This project did not proceed. MOT proposed to reintroduce full tidal flushing to the Lagoon as habitat compensation, nothwithstanding that MOT had cut off tidal flushing in the first instance.

As its road widening project did not proceed, MOT offered access to the compensation habitat to Stewart Bulk Terminals:

> "The habitat improvements discussed in this document were originally intended to replace habitat loss as a result of a Ministry project. This project however will no be proceeding in the near future and it would seem appropriate that your proposal be able to take advantage of the opportunity which currently exists in this regard."[2]

MOT ran an in-house computer program to determine the culvert size required for full tidal flushing. A design, shown in Figures A6-1 and A6-2 in Appendix 6, was developed which involved installation of 2 six foot diameter culverts with rip rap placed at both ends for energy dissipation.

DFO reviewed this design (see pages A6-8,9) and responded that "[I]n terms of data requirements, you [MOTH] have provided us with everything that we [DFO] need to draft up an authorization and compensation agreement.....The authorization pursuant to Section 35(2) of the Fisheries Act should follow shortly with a draft compensation agreement."

Thus, since this design is acceptable to MOT and DFO, the Proponent also accepts it for presentation in this environmental assessment.

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[2] Letter from R.A. Fredricksen (MOTH) to Al Soucie (SBT), November 06, 1996; see page A6-2 of Appendix 6.

The 1993 MOT culvert size study was not done by a professional engineer; however the person who performed it has subsequently been registered as a professional engineer in BC. Mr Gooding P.Eng has reviewed his study for this project and has sealed it. The sealed report is placed in Appendix 6.

DFO[3] stated that it would prefer some modification to the rip rap energy dissipator design to enhance fish habitat characteristics. These modifications are relatively minor in nature and will be incorporated into a final design during the DFO Authorization stage.

7.3.5 Summary

The proposed project will replace a 24 inch culvert with 2 six foot diameter culverts. This should increase the tidal exchange rate in the Lagoon from 20% to 100%. The hydraulic design was prepared by MOT and has been reviewed and approved by DFO.

7.4 TIDAL FLOW IN THE VICINITY OF THE PROPOSED WHARF

7.4.1 Rationale for the Field Study

A field study of tidal flow and currents in the vicinity of the proposed wharf was conducted on July 23 and July 27, 2000.

This study was undertaken in response to point 7 (page 4) of DFO's letter responding to the draft environmental assessment[4] (see Appendix 8):

> "The discussion covers the issue of habitat compensation for the proposed fill areas, but does not discuss other issues such as possible impacts of the proposed structure in fish migration, possible impacts on herring spawning, **or possible changes to currents in the harbour.**" [Bold added].

7.4.2 Methodology

The study was done by placing several numbered rubber balls in the water in the vicinity of the proposed wharf. From time to time a small inflatable boat approached a floating ball and its location was measured by a total station on the shore shooting to a prism in the

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[3] Meeting on April 15, 2002

[4] S. Graham Engineering and Geology Inc. and R.U. Kistritz Consultants Ltd., "Description of Proposed Container Wharf at Stewart Bulk Terminals, Stewart BC, and Initial Environmental Appraisal", prepared for Stewart Bulk Terminals Ltd., January 2000.

boat. The small inflatable boat allowed measurements to be taken in the shallow water near the SBT footprint and the adjacent Salmon delta.

Some of the rubber balls were lost.

The field work was done on the afternoons of July 23 and July 27, 2000. As shown on Figures 7-1 and 7-2, there was a flood tide in the afternoon of July 23, 2000 and an ebb tide on the afternoon of July 27, 2000. The balls were placed in the water during flood tide on July 23, and at slack before ebb on July 27, 2000.

The field work went well on July 23, 2000 and good results were obtained. On July 27 there was a wind up the canal from the south which appeared to delay the start of ebb tide. The wind picked up and squall conditions existed from time to time, which made work in a small boat dangerous. Thus on July 27 good data were obtained only at slack before ebb and later just at the beginning of flood.

7.4.3 Results of July 23, 2000 Field Study

Results of the July 23, 2000 flood tide study are presented on Drawing 20 and Table 7-1. Five balls were set out behind the bulk loader, and four were tracked from 66 to 107 minutes during the period of strong flood tide.

Irrespective of the start point all the balls tended to follow a common trajectory and ended up in similar locations about 350 to 450 m to the north. There was no major component of flow to the west, and the trajectories did not cross the footprint of the proposed wharf or riprap.

Typical speeds were 2 to 5.8 meters/minute (3.3 to 9.7 cm/s; 0.1 to 0.3 fps).

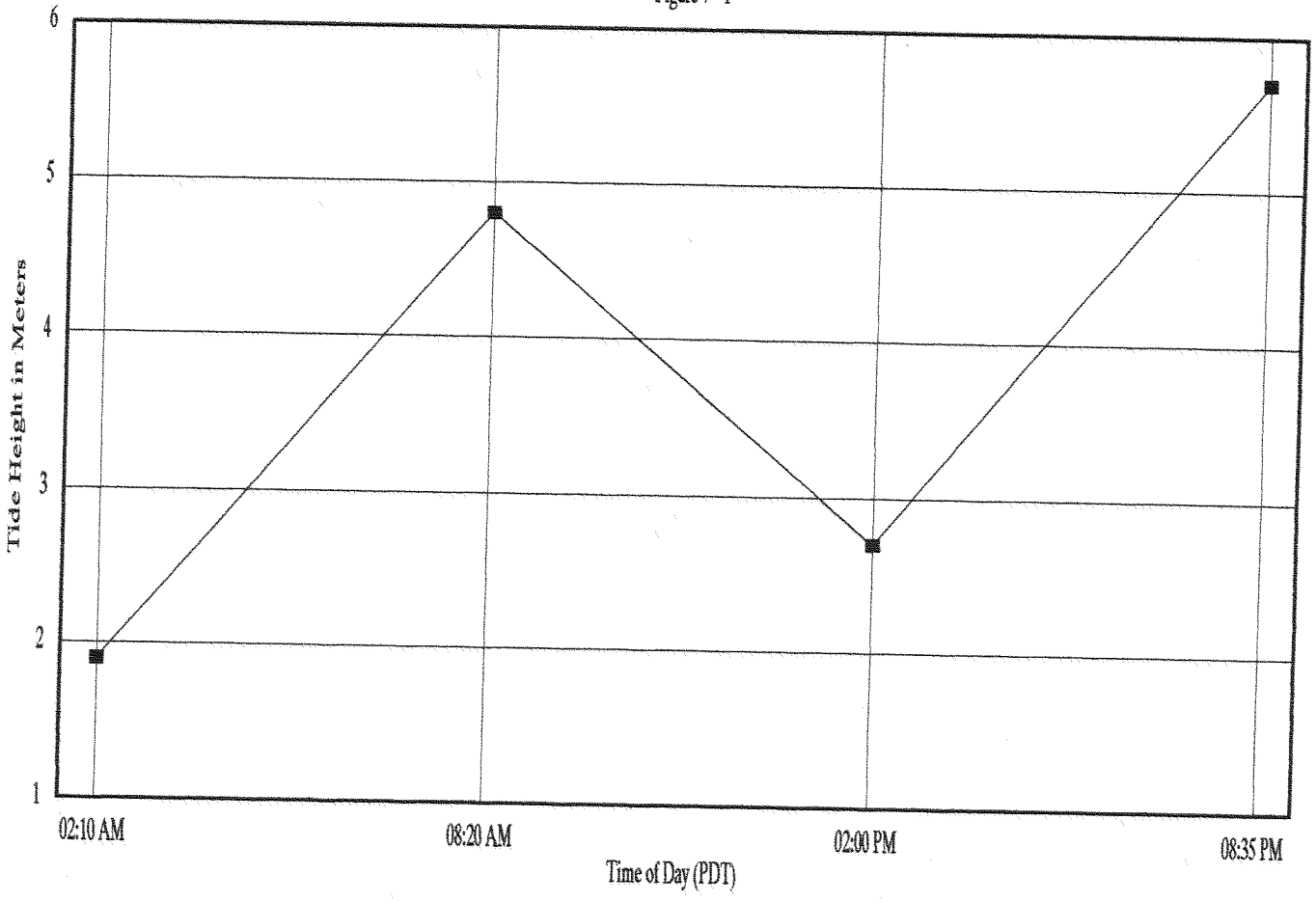
It is concluded that flood tide streams around the semicircular footprint with the area to the north of the SBT footprint being a backwater filled by lateral flow. Construction of the wharf footprint as shown in Drawing 20 would not affect the major pattern of local flood flow. The zone just to the north of wharf remains relatively quiescent during flood tide.

Figure 7-1

Prince Rupert Tide - 23 July 2000

Prince Rupert Tide – 23 July 2000

Figure 7-1



Prince Rupert Tide – 27 July 2000

Figure 7-2

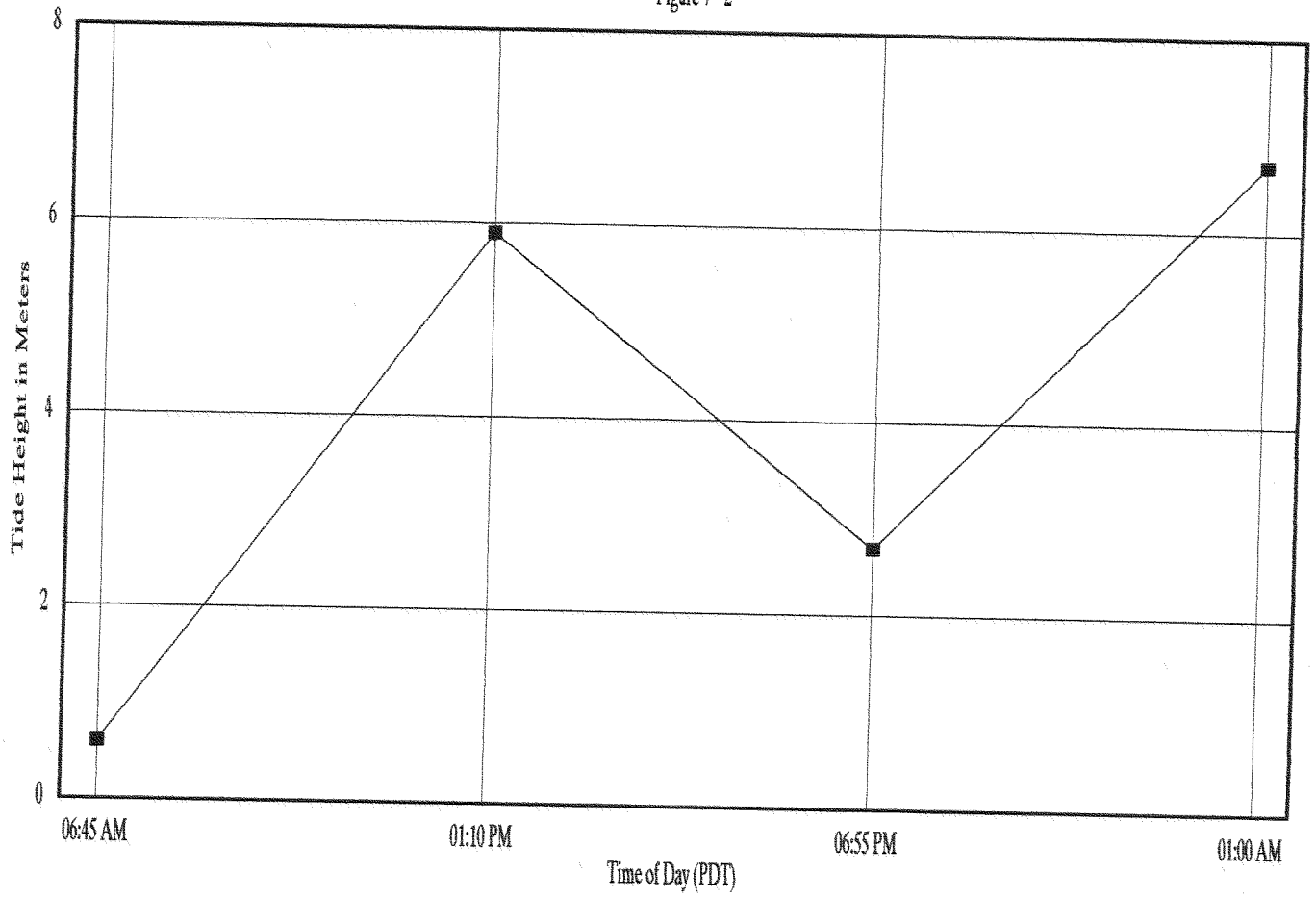


Table 7-1

Particle Speeds on July 23, 2000

No	Ball No.	Time PDT
1	5	2:50p
2	4	2:54p
3	5	2:56p
4	3	3:00p
5	4	3:12p
6	2	3:15p
7	2	3:27p
8	4	3:38p
9	5	3:41p
10	1	3:47p
11	5	4:05p
12	4	4:08p
13	2	4:08p
14	1	4:19p
15	1	4:29p
16	2	4:35p
17	5	4:37p
18	1	4:43p
19	1	4:53p

No	Ball No.	Time PDT	Minutes Since Noon	Time Difference -min-	Cum. Time -min-	Distance -m-	Cum Distance -m-	Speed -m/min-	Comment
1	1	3:47p	227		0		0		
2	1	4:19p	259	32	32	65.44	65.44	2.05	
3	1	4:29p	269	10	42	18.72	84.16	1.87	
4	1	4:43p	283	14	56	80.44	164.60	5.75	
5	1	4:53p	293	10	66	42.97	207.57	4.30	
6	2	3:15p	195		0		0.00		
7	2	3:27p	207	12	12	60.91	60.91	5.08	
8	2	4:08p	248	41	53	214.73	275.64	5.24	
9	2	4:35p	275	27	80	99.28	374.92	3.68	
10	3	3:00p	180						Ball lost
11	4	2:54p	174		0		0.00		
12	4	3:12p	192	18	18	54.45	54.45	3.03	
13	4	3:38p	218	26	44	146.35	200.80	5.63	
14	4	4:08p	248	30	74	145.08	345.88	4.84	
15	5	2:50p	170		0		0.00		
16	5	2:56p	176	6	6	10.83	10.83	1.81	
17	5	3:41p	221	45	51	183.16	193.99	4.07	
18	5	4:05p	245	24	75	97.41	291.40	4.06	
19	5	4:37p	277	32	107	151.89	443.29	4.75	

7.4.4 Results of July 27, 2000 Field Study

Results of the July 27, 2000 flood tide study are presented on Drawing 21 and Table 7-2. Eight balls were set out at the log boom on the Yacht Club boundary about 250 m to the north of the SBT foreshore. Three were lost and and five were tracked from 26 to 231 minutes over ebb tide. The balls were placed in the water at slack before ebb. Due to bad weather they were located and measured about 200 to 230 minutes later. Thus only about 2/3 of the full 345 minute duration of ebb on this tide was measured.

The movement of the balls was likely affected by strong winds from the south.

As shown on Table 7-2 typical average speeds during ebb are about 1 meter/minute, whereas average flood tides were 4 to 5 meters per minute. Accepting a variance due to differences in measurement periods and field conditions, it can still likely be concluded that ebb tides are slower.

As shown on Drawing 21, ebb tide trajectories are not deflected from the east shore until the SBT footprint is approached. In this respect the ebb flow resembles a potential flow field (likely because the water is deeper during the first part of the tide).

On this basis the effect of the wharf upon the ebb flow field can be estimated. The southward flow will be deflected more strongly by the normal boundary (the wharf face) than is currently the case and will veer around the wharf in the fashion shown by the yellow/orange lines on Drawing 21. This will likely lead to a period of flow separation near the corner of the wharf, as shown in Drawing 21.

7.4.5 Effects on Fish

A summary of likely effects by the currents upon fish is given below:

- The piles under the Federal wharf will remain in a quiescent backwater in both flood and ebb tide. There should be no significant effect upon herring spawning there.
- only the local tidal discharge will be affected. There would be no effect on gross flows in the harbor. Fish passage would remain unaffected
- flood flow is deflected away from the project area by the semicircular SBT footprint. There would not likely be any significant effect to fish movement during flood tide (all fish sizes)

Table 7-2

Particle Speeds on July 27, 2000

No	Ball No.	Time PDT	Comment
1	1	12:39p	
2	2	12:43p	
3	3	12:46p	
4	4	12:48p	
5	5	12:50p	
6	6	12:54p	flooding
7	7	12:58p	
8	8	1:00p	
9	1	1:11p	
10	2	1:13p	
11	3	1:17p	
12	6	1:20p	
13	1	4:38p	
14	2	4:42p	
15	3	4.44p	
16	8	4:46p	flooding
17	7	4:49p	flooding

No	Ball No.	Time PDT	Minutes Since Noon	Time Difference -min-	Distance	Speed -m/min-	Comment
1	1	12:39p	39	0			
2	1	1:11p	71	32	17.18	0.54	
3	1	4:38p	248	216	160.01	0.74	
4	2	12:43p	43	0			
5	2	1:13p	73	30	1.06	0.04	
6	2	4:42p	282	209	210.72	1.01	
7	3	12:46p	46	0			
8	3	1:17p	77	31	22.26	0.72	
9	3	4.44p	284	207	233.76	1.13	
10	4	12:48p	48				Ball lost
11	5	12:50p	50				Ball lost
12	6	12:54p	54	0			
13	6	1:20p	80	26	28.11	1.08	Ball lost
14	7	12:58p	58	0			
15	7	4:49p	289	231	54.99	0.24	flooding
16	8	1:00p	60	0			
17	8	4:46p	286	226	9.53	0.04	flooding

- ebb flow near the east shore would be deflected to the east more strongly by the wharf face than it is now by the semicircular shoreline. There would likely be a period of separated flow near the wharf corner during ebb tide. This separated flow would hinder the passage of small fish around the corner of the wharf.

  On the other hand the wharf and rip rap would provide a sheltered zone on the east side during peak ebb flow. The shelter would be enhanced by the rip rap and by branches and other materials placed against the wharf face near the corner. Small fish would be able to travel to the north during slack water and flood tide.

  The effect and impact of the ebb flow disturbance will be mitigated by the rip rap structure since this will absorb flow energy, provide a curved boundary to direct the flow, and provide shelter to smaller fish.

PART 8

SEDIMENT CHEMISTRY IN DREDGE ZONE

8.1 INTRODUCTION

A field investigation of the sediment chemistry in the dredge zone in front of the proposed wharf expansion (see Drawing 08) was undertaken to determine the chemical characteristics of the dredgeate.

It is proposed to place the dredgeate behind the sheet pile wall as fill. In the event that a portion of the dredgeate has undesirable geotechnical properties (as fill material) then it is proposed to dispose of it in the Canal under the aegis of an Environment Canada ocean disposal permit.

The purpose of the sediment investigation was to ascertain if ocean disposal is an option for disposal of the dredge material, and to comply with a DFO request that the chemical characteristics of the proposed dredge material be described.

8.2 SUMMARY OF FIELD INVESTIGATION

A stand alone summary report of the sediment investigation is placed in Appendix 7.

Briefly, sediment samples were taken in 9 polygons in the dredge zone (see Drawing 22) according to a field plan that had been pre-approved by the Ocean Disposal Control Program at Environment Canada ("EC"). A single core sample was also taken near the proposed location of the wharf face. The samples were analyzed by ASL labs in Vancouver according to EC dredge sample protocols. The results are presented in section 8.3

8.3 RESULTS

The results of the field investigation are presented below:[1]

The interim guidelines for sediment quality for ocean disposal[2] are:

Total Metals

Cd	T- Cd	0.6	mg/Kg	upper limit
Pb	T-Pb	500	mg/Kg	upper limit
Hg	T-Hg	0.75	mg/Kg	upper limit

[1] They are copied from Appendix 7.

[2] Environment Canada, "Interim Contaminant Testing Guidelines for Ocean Disposal (Pacific and Yukon Region) for Dredged Material, April 1991.

PAHs

Total PAHs	2.5	mg/Kg	upper limit

The AVS/SEM test is a measure of toxicity. Values below 1 micromole per dry gram indicate acceptable results.

All nine polygons had cadmium levels in the range 0.9 to 1.1 mg/Kg, which is above the ocean dumping limit. However EC accepted the cadmium values, which are just above the EC criterion, as being background. This means they are not an issue of concern and would not preclude ocean disposal if such is requested[3]

PAH values in polygons 1 (114 mg/Kg), 2 (20.8 mg/Kg), and 7 (27.4 mg/Kg) exceed ocean disposal criteria. These higher PAH values are likely related to creosoted piles in these polygons. Ocean disposal of sediment in these polygons would not be permitted.

All other parameter results did not exceed the ocean dumping criteria.

Toxicity tests were below the AVS/SEM criterion of 1.0 micromole per dry gram for all polygons, except polygon 7 where the value of 1.0 was at the criterion. This indicates the surficial sediments are not toxic.

The core soil sample had a Cd-T concentration of 4.2 mg/Kg, which exceeds the ocean disposal criterion. Other parameters did not exceed the respective criteria. The AVS/SEM value was 3.0, indicating toxic conditions. The core sample was not located in the dredge zone.

8.4 MEETING SUMMARY

The results were reviewed with EC at a meeting on Sept. 11, 2000.

The following conclusions were arrived at the meeting:

1. EC accepted the data as credible with good QA.

2. EC accepted the cadmium values, which are just above the EC ocean disposal criterion, as being background. This means they are not an issue of concern and would not preclude ocean disposal if such is requested
3. Higher PAH values in polygons 1, 2 and 7 would preclude sediments in these polygons from being permitted for ocean disposal. It would have to be disposed of on land or behind the sheet wall.

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[3] Meeting with Dixie Sullivan, EC, Sept 11, 2000.

4. EC has no formal jurisdiction if ocean disposal is not selected, but DFO will regulate the dredging. DFO will likely rely on technical advice on dredging from EC. EC has taken note of the data, and will take no action until (1) it receives an ocean dumping application, or (2) receives a CEAA referral from DFO

8.5 TRANSPORT CANADA STUDY

Golder Associates (2001) performed a sediment chemistry study on the Northland Dock property for Transport Canada in conjunction with the latter's port divestiture program. The field work was done in September 2000.

Sediments in the dredge area had Cu and As above the Level II criterion[4], and Ni and Zn above the Level 1 criterion. Cd data are not presented. Elevated Cu values were comparable with background.

Elevated PAH concentrations were found near the pilings.

The results are thus generally comparable with those of the SBT sediment chemistry study.

8.6 APPLICATION OF THE CONTAMINATED SITE REGULATION

The Contaminated Site Regulation (BC Reg. 375/96) pursuant to the Waste Management Act is used to regulate contaminated sites in BC.

The scope of work for this environmental report does not include any work prepared in conjunction with the CSR. Specifically, no site profile is presented. It is also to be determined whether the dredge zone is covered by the WMA as it may be Federal property.

Similarly, if the dredgeate is to be deposited above MSL or HHWLT, it needs to be determined if the CSR applies to the disposal location.

The CSR attributes liability for contaminated sites. No attribution of liability is offered in this report. However, it appears that slight PAH contamination is associated with creosoted piles on the Federal wharf and an old pile structure in polygon 7 which was likely associated with the Federal wharf.

According to Schedules 4 and 5 of the CSR the sediment samples collected in the dredge

[4] BCE 1999 Draft Marine Sediment Quality Criteria

zone and the core sample do not exceed the industrial/commercial criteria in the CSR.

Parameter concentrations of sediment samples collected in the dredge zone would not appear to trigger a requirement for a soil relocation agreement (Schedule 7). Concentrations of Cd-T and Pb-T in the core sample would appear to trigger a requirement for a soil relocation agreement (Schedule 7).

In summary, reiterating this review is not a site profile and should not be relied upon or considered definitive, it appears that the dredge site is not contaminated according to the definition of the CSR .It is recommended that it be determined if the CSR applies to this site. If so, a soil relocation agreement may be required to place the dredgeate behind the sheet pile. SBT should avoid accepting liability for the existing chemical properties of any sediment.

PART 9

MISCELLANEOUS ITEMS

9.1 INTRODUCTION

Part nine includes miscellaneous items required for a CEAA environmental screening studies, as well as those incremental items required by the BC EAA, and some responses to specific requests for information made at agency meetings. These are presented in no particular order.

9.2 ABORIGINAL/FIRST NATIONS INTEREST AND ISSUES

This information is required by the BC Environmental Assessment Act.

9.2.1 First Nations Government Contacts

The Proponent is not aware of any interest by a First Nation in the proposed lands to be affected (that is, the foreshore of the SBT footprint and the Lagoon).

There is a small Nisga'a Indian Reserve on the mountainside across the Bear River from the Stewart townsite. This land is uninhabitable. The project does not affect this Nisga'a IR.

SBT leases the foreshore from Land and Water BC. The Lagoon is Crown land also controlled by Land and Water BC..

The BC Environmental Assessment Office advised that the site is in the traditional territories of the Nisga'a and the Tsimshian nations. (It is at the extremity of the Tsimshian land claim area.)

The land lies in the traditional area of the Nisga'a nation. There is a comprehensive land claim settlement with the Nisga'a nation. Neverthless the Nisga'a Lisims government was provided with an executive summary from the draft EA report and asked to comment. It provided a letter stating no concern. This is placed on the next page. The Nisga'a Lisims government has also been sent a copy of the archeological report (see section 9.2.2).

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Nisga'a
Lisims
Government

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NEW AIYANSH, B.C.
V0J 1A0
PHONE (250) 633-3000
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1-866-633-0888

March 26, 2002

Steve Graham
President
S. Graham Engineering and Geology Inc.
46 Parkgrove Crescent
Delta, B. C. V4L 2G3

Dear Mr. Graham:

Re: Stewart Bulk Terminals Wharf Project

Your letter of March 15 to Collier Azak has been referred to me for response.

Thank you for giving us an opportunity to review the *Detailed Environmental Assessment of a Proposed Wharf at Stewart Bulk Terminals, Stewart, B.C.* We note that the project is located at some distance from the Nisga'a Nation's property, and that significant attempts are being made to replace and enhance habitat values.

Although we would appreciate being informed about the progress of this project, we currently have no concerns.

Sincerely,

NISGA'A LISIMS GOVERNMENT

Diane Cragg
Lands Manager, Registrar of Land Titles

Cc: Collier Azak, Director of Lands and Resources, NLG

The Tsimshian Tribal Council (TTC) was contacted several times[1] but has been nonresponsive to date. The TTC may decide to comment during the Application review stage.

One of the owners of SBT is aboriginal.

9.2.2 Archeological Overview Assessment

An archeological overview assessment (AOA) was prepared for the project by I.R. Wilson Consultants Ltd. of Victoria BC. This firm has North Coast experience. A copy of the AOA is placed in this report as Appendix 5 .

The executive summary of the AOA is quoted below:

> "...The project area is located along the northwest shore of Stewart Harbour in Stewart, B.C. The AOA involved a background search of pertinent archaeological and traditional land use documents as well as an examination of geological and impact history of the study area. The results of this AOA show the entire study area has a low potential of identifying intact archaeological deposits, It is therefore recommended that no further archaeological work be undertaken regarding this project."

9.3 MALFUNCTIONS AND ACCIDENTS

SBT is an operating terminal with experience in preventing and mitigating accidents and malfunctions. The expansion of the terminal, and associated increase in traffic and mass of cargo, will entail a corresponding increase in the probability of an accident occurring.

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[1] A letter requesting comment, if any, with the Executive Summary of the draft EA was mailed on March 15, 2002 to the TTC office in Prince Rupert.

A copy of March 15th letter and the Executive Summary of the draft report, as well as the archeological report, were presented to Deborah Jeffrey, President of the TTC, by A. Burton MP during her meeting with Mr Burton in Ottawa. These documents had been faxed to Mr Burton.

An email reminding the TTC that it could comment was sent on May 10, 2002.

An original copy of the AOA was sent by Expresspost on 13 May 2002. CPC confirmed delivery.

SBT has taken the following steps to minimize the environmental impact of malfunctions and accidents:

- no hazardous goods are accepted at the terminal
- the small fuel storage tank on site is self-containing (see Figure 9-1, next page)
- the fuel storage tank associated with the former mine owner has been removed
- a 20,000 gallon tank of fresh water is kept on site for immediate fire suppression
- most metal ore and concentrate is stored in the dry in dedicated buildings

Introduction of a container mode is expected to result in a net reduction of environmental risk. This is because the ore/concentrate currently transported and stored in bags (see Figure 2-16, page 2-31) will be switched to the more secure container mode. On the other hand there will be a greater variety of cargo going through the port.

There has been a reduction of accidental risk because of the closing of the AMH ferry service, particulary since SBT had little control over the goods being transported by the AMH ferry. This will be offset by the risk of an accident associated with the new barge ramp. Again, this risk will be mitigated by forbidding dangerous cargo and by careful operations procedures.

There will be no change in the risk associated with the bulk loader. SBT has never had a significant spill from the bulk loader operation[2]. Risk is minimized by careful operation and proactive maintenance.

The probability of a ship accident will increase proportionately with ship visits, however the chance of a significant accident will remain low since:

- all marine safety measures (tugs, pilots) are adhered to in transiting the Canal
- the port is sheltered, with a minimal fetch
- the soft bottom provides good anchorage
- ships are not fueled in the port
- at most only two ships are in port at a time
- cargoes (wood, ore) are not soluble. Ore is not flammable.

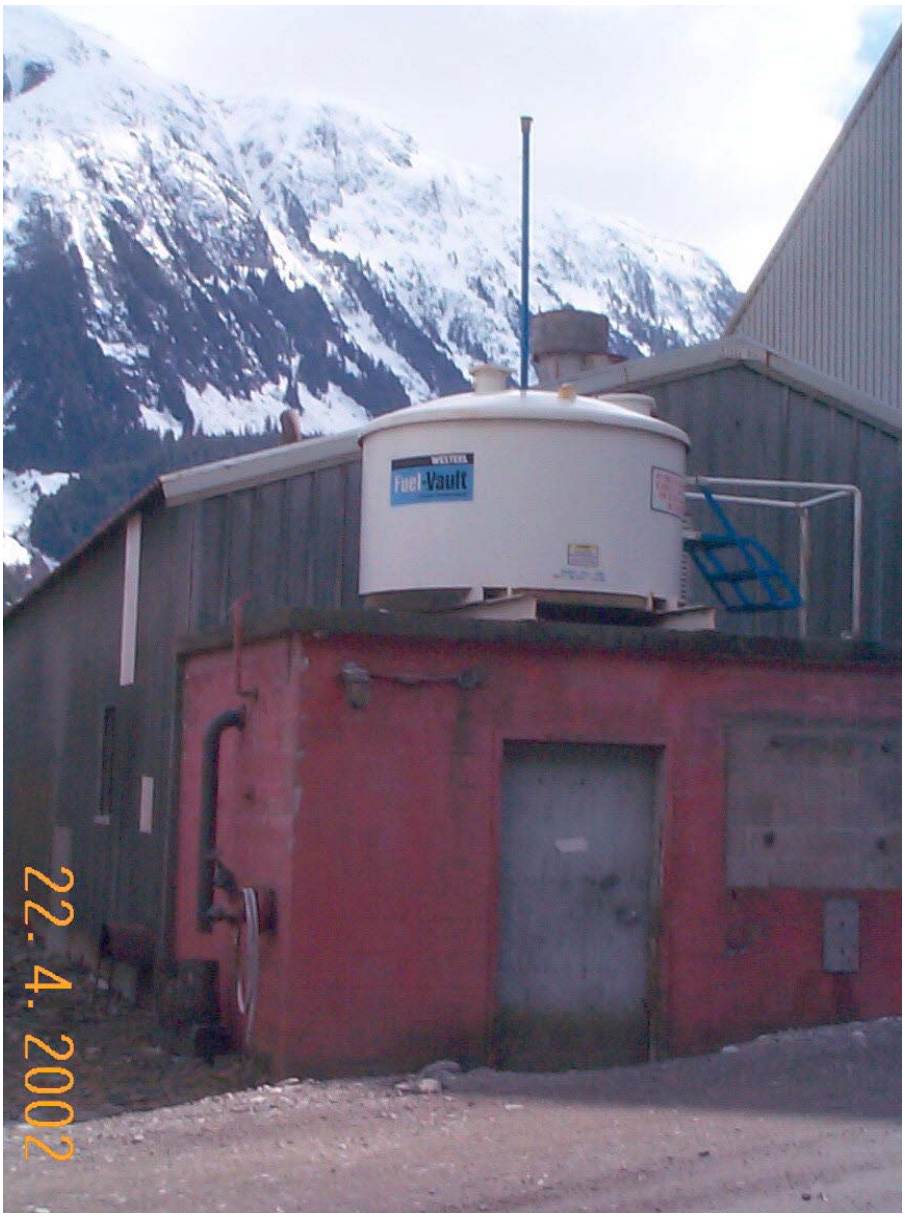
---

[2] This is one reason why SBT has been selected to handle the valuable gold ore and concentrate

Figure 9-1

Spill-Proof Fuel Storage Tank on Wharf Site

Spill-Proof Fuel Storage Tank on Wharf Site



Similarly the probability of a truck accident will increase proportionately with truck traffic. The major risk area is the Hyder road. SBT proposes to mitigate this risk by upgrading the access to the SBT site, and providing offroad parking across the road from its site. If deemed appropriate on the basis of experience, a signal may be installed at the SBT access and operated on a continuous or seasonal basis. Since trucks would not carry dangerous cargo to SBT, the major risk would be a fuel spill associated with a truck accident. The volume of fuel spilled would be limited by the truck fuel tank size.

Risk

Risk can be defined as the probability of an occurrence in combination with its environmental consequences. The risk at SBT is high for the case of a spill of a liquid or soluble solid substance since the high value habitats of the Salmon River delta and the Bear River delta are nearby, and large tidal range would disperse the spill quickly. For this reason SBT does not handle dangerous liquids, fuel, oil, or soluble solid materials.

The residual risk of spills from ship or truck accidents is not considered to be significant, and standard clean up and containment measures are proposed for mitigation. SBT will also monitor fish passage and bird use in the wharf area during the initial operations period. It will thus know which species might be affected were a spill to occur.

Summary

In summary SBT operations pose a low risk to the environment because the cargos handled are not amenable to environmental transport. The risk of accident and malfunction will increase proportionately with port traffic, but the environmental risk will remain low.

9.4 FOLLOW UP

SBT proposes to perform the following monitoring studies for follow-up:

1) the transition of the Lagoon from freshwater/brackish habitat to estuarine marsh will be monitored on an annual basis for 5 years by a qualified consultant

2) the efficacy of the fish passage structures along the wharf face will be monitored on an annual basis for 5 years by a qualified consultant

3) use of both the wharf area and the lagoon by birds will be monitored on a monthly basis for a period of 2 years by a local birdwatcher, and an annual report will be prepared for CWS by the local birdwatcher and a qualified consultant.

4) the monitoring results will be incorporated into the emergency contingency plan.

Details of the proposed monitoring programs will be incorporated into the DFO Authorization.

9.5 EFFECTS TO THE UNITED STATES

SBT is located about 3/16 mile from the US border. It is situated on the northern part of the perimeter of the delta of the Salmon River, which debouches at Hyder AK. The State of Alaska and US government have long-standing salmon enhancement projects on this river. SBT's site is closer to the unincorporated village of Hyder AK than it is to Stewart BC. Hyder residents obtain some services in Stewart. As well, the former mines (Granduc and Premier) above Stewart were accessed by the Hyder road, which veers back into Canada after crossing through Alaska.

A summary of expected effects on the US is presented below:

- there will be an increase in traffic on the Hyder road, both during construction and otherwise. This will require greater caution in driving to Stewart. However there is not expected to be an increase in truck traffic past the SBT access, so traffic in Hyder should not be affected. [It is noted that industrial traffic passed through Hyder when the mines were operating, so current traffic levels are lower than past ones.]

- employment generated by the project should boost the local economy. The local economy includes Hyder

- the bottled water facility in Hyder is eager to use the SBT wharf to ship product. There will be an economic boost to this manufacturing facility.

- the barge terminal will make shipment of goods to Hyder by barge feasible. This may reduce costs of servicing Hyder.

- Hyder may be cut off for a brief period while the culverts under the Hyder road to the Lagoon are replaced. The Proponent will liaise with the Hyder Community Association to minimize the impact of this closure

- restoration of the Lagoon as estuarine habitat will increase the available habitat for salmon in the area. This should augment the efforts to increase and improve salmon habitat in the Salmon River basin by Alaska and US agencies.

- since littoral sediment transport on the delta is to the north, the project is not expected to have any effect on the sediment budget at the Hyder dock area.

In summary the project is expected to have positive economic effects to Hyder. Adverse environmental impacts are not considered to be significant.

9.6 RARE AND ENDANGERED SPECIES

This is discussed in section 6.5.1.2.4.

9.7 SUSTAINABILITY OF RENEWABLE RESOURCES

The project does not, in general, utilize or consume renewable resources (the exception being fuel for construction and for transportation). Some habitat is destroyed by construction, but this is compensated with replacement habitat. Thus it is concluded that there is no significant impact upon the sustainability of renewable resources.

9.8 SUMMARY OF AGENCY CONTACTS

There have been formal and informal discussions with local government and senior government agencies to date. These are summarized in this section. Further opportunity for agency contact will occur during the agency referral stage.

9.8.1 District of Stewart

SBT presented the project concept to the District of Stewart in 1996. Council passed a resolution of support for the project on May 2, 1996 (see Appendix 4). At EAO's request SBT requested the District Council to reiterate its resolution of support in April 2002 and June 2002. At its meetings of May 13, 2002 and June 10, 2002 there was no motion made by the District council to reiterate its resolution of support.

A copy of the Executive Summary of the pre-application report "Detailed Environmental Assessment of a Proposed Wharf at Stewart Bulk Terminals, Stewart B.C." was mailed to the District on March 15, 2002.

A loan copy of the pre-application report "Detailed Environmental Assessment of a Proposed Wharf at Stewart Bulk Terminals, Stewart B.C." was left at the District's office in March- April 2002.

A loan copy of the draft application report [this document] was delivered by hand to the mayor at a meeting on June 10, 2002.

Public information sessions were held in Stewart on April 21 and 22, 2002.

The project consultant met with the District Administrator, the Mayor, and a Councilor at the District office on April 22, 2002

On 05 May 2002 letters/emails were sent to the District Council requesting a reiteration of the motion of support passed on May 2, 1996, and offering to give a presentation to Council at a convenient time.

At its meeting of May 13, 2002 District Council requested the project consultant to give a presentation to Council at the earliest opportunity. Mr Dan Soucie of SBT and project consultant S. Graham P.Eng had a meeting with the mayor and three councilors on June 10, 2002. It was agreed that no formal minutes of the meeting be taken. Accordingly no summary of concerns and responses is presented herein.

No motion was made at the May 13, 2002 and June 10, 2002 District Council meetings to reiterate or reaffirm the motion of support of May 02, 1996. Council indicated it wished to review the project, as described in the EA Application, prior to making a decision on support.

The District of Stewart does not have any permitting authority on this project; however it is desirable to obtain the cooperation and support of the District.

The District owns both the Arrow Dock and the Northland Dock, as well as land on which the log sort and log drop operations occur; thus the District has an interest in harbor operations and development.

The District and DFO entered into a five year “Port of Stewart Environmental Management Plan” agreement on 12 February 1996. This agreement expired on 12/2/2001, but it is known that DFO has expressed an interest in renewing it. This agreement essentially allowed the District to issue approvals on projects which were in compliance with habitat sensitivity zoning.

To our knowledge this management plan procedure was never used while it was in effect. DFO and BC Environment have continued to directly regulate projects in Stewart irrespective of the management plan agreement.

This environmental report has been prepared to comply with the information required in the Port of Stewart Environmental Management Plan agreement. The proposed aquatic mitigation corresponds with the requirements set out in the Environmental Management Plan, notwithstanding that it has expired.

As the Environmental Management Plan agreement had not been used for managing a project, and as it expired during the course of preparing the environmental assessment report for this project, the Proponent has registered the project in the regular CEAA process

with DFO as the Responsible Authority. It is expected that DFO and the BC EAO will place the District of Stewart on the harmonized referral list and consult with the District during the Application review.

9.8.2 DFO

DFO was contacted in 1996 regarding the proposed project. It agreed to be the Responsible Authority in the CEAA process. A project description and initial environmental appraisal was submitted to DFO in January 2000 (see references, Part 11). DFO provided its comments on March 31, 2000 (see Appendix 8).

DFO made a site visit in May 2000 to discuss the project. A DFO representative attended the agency meeting held by BC EAO at Victoria on April 4, 2002. Separate meetings were held at DFO HQ on April 15, 2002 and May 17, 2002.

DFO Habitat Branch issues have dealt with habitat preservation and compensation, and fish passage. The project has been substantially revised to accommodate DFO's comments and concerns.

9.8.3 Canadian Coast Guard

The Coast Guard is part of DFO, however it did not appear to have received a reference with regard to this project. Coast Guard attended the 15 April 2002 meeting at DFO HQ. A subsequent meeting with CCG was held on May 3, 2002 at DFO HQ.

CCG issues raised dealt with harbor vessel traffic and management, mooring, navigation access, and subtidal land leases.

9.8.3.1 *Vessel Management*

Current levels of ship use at SBT were described in section 2.6. In 1999 twenty-two ships and 9 barges were loaded at SBT. From Table 2-5 the maximum vessel traffic to SBT is estimated to reach 180 ships per year (at 100 containers per ship) [or about 3.5 ships per week], and 45 barges per year.

Currently the port of Stewart is also visited by ships for log exports. The two firms providing the logs are All West Trading and Timber Baron Contracting. It is estimated that 8 to 10 log export ships arrive in the Port of Stewart each year. Logs are also placed onto self-loading barges for Canadian and US mills.

The Federal government is unilaterally withdrawing from providing port and marine services at smaller ports, including Stewart. It is understood that the Port of Stewart has been deproclaimed by Transport Canada with the intention that the District of Stewart will assume port management authority. However it is also understood that the District of

Stewart has not yet established an operational port management and there is no harbor master in place.

In the interim vessel traffic to the Port of Stewart[3] is currently (unofficially) managed by various shipping agents in Prince Rupert.

Harbor congestion can be avoided by (1) scheduling ships' ports of call, (2) having a ship's operation slowed en route to the port or pilot station, (3) mooring at McIntyre Bay on the north end of the Queen Charlotte Islands, where there is no moorage charge[4], and/or (4) mooring at the Port of Prince Rupert where there is excess capacity, but harbor charges. Thus no new mooring areas are required for the SBT wharf project.

The shipping agent/customs broker would be aware of barges with raw logs going to the US, but might not be aware of barges going to Canadian destinations. However mooring barges is not problematic because of their limited draft.

It is the Proponent's view that traffic to the Port of Stewart can be managed for the foreseeable future in the same manner as it is now, however SBT does see the utility of a formal port users group being set up to coordinate vessel arrivals in Stewart harbor.

The issue of port vessel management was also discussed with the CCG[5]. On review of bathymetric charts of the harbor, the CCG was determined that there are no additional suitable mooring sites in Canadian waters, so increased vessel traffic will have to be accommodated by scheduling.

9.8.3.2 *Mooring Requirements*

As shown on the following two pages the Pacific Pilotage Authority (PPA) considers Stewart to have one moorage, so the capacity of the port is one ship at moorage (either waiting to load at SBT or loading logs) and one berthed at SBT. At current use levels there is no requirement for ships to moor to access SBT.

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[3] Except log export barges to Canadian ports, which do not require a customs broker

[4] Should McIntyre Bay be used by a vessel waiting to enter into Stewart, Revenue Canada Customs can force a boarding for clearance into Canada. There is a potential high cost involved for this clearance as a helicopter will be required for transport to/from the vessel from Prince Rupert plus any charges that Revenue Canada Customs may charge for its time

[5] Meeting with Colin Parkinson at DFO HQ, May 3, 2002

As noted in section 9.8.3.1, above, additional moorage is available at McIntyre Bay on the Queen Charlotte Islands and at the Port of Prince Rupert on an as required basis. There is no need to provide additional moorage as part of the SBT wharf project.

Barges have a shallow draft and can be temporarily moored in shallower parts of the harbor. There may be a commercial opportunity to moor barges to the Northland Dock on an as required basis.

9.8.3.3 *Navigational Access*

Navigation access is the responsibility of the CCG and the PPA. The PPA considers that two ships can be in the Port of Stewart at one time (one moored and one at SBT). While it would have to be confirmed with the PPA, it appears that a third smaller ship could be berthed at the Northland Dock as well if there is sufficient depth in front of it. This has not been determined since the Northland Dock has not been used in many years.

The District of Stewart has a long standing subtidal lease (# D.L. 7184) in shallower water to the northeast of the proposed SBT wharf (see Drawing 25). This lease is used to store booms of logs for export from time to time. The SBT wharf project would not interfere with this lease as it is too shallow for larger vessels. However a commercial opportunity might arise for its use for barge moorage.

The proximity of the proposed SBT wharf project with the Northland Dock has the potential to create navigational access problems, but it is the view of the proponent that these can be avoided by cooperation. As well some modifications have been made to the project design to reduce potential access problems.

The Northland Dock has not been used in many years, so the issue of access to it is a nonproblem at present. However the Northland Dock has recently been transferred to the

PETER RILEY
Operations Manager

GWN

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Fax: (250) 624-5855
E-Mail: nicson@kaien.net

PPA
PACIFIC PILOTAGE AUTHORITY

Facsimile
TRANSMITTAL

To: Peter Riley
G.W. Nickersons

Fax: (250) 624-5855

Re: Port of Stewart
Date: May 10, 2002
Pages: 2, including this cover sheet.

Dear Peter:

Please find attached a chartlet indicating the anchorage presently available in Stewart. The channel shallows to the North East of the anchorage turning circle shown on the chartlet, which pushes any other proposed anchorage into water in excess of 50 fathoms This is too deep to safely anchor a vessel.

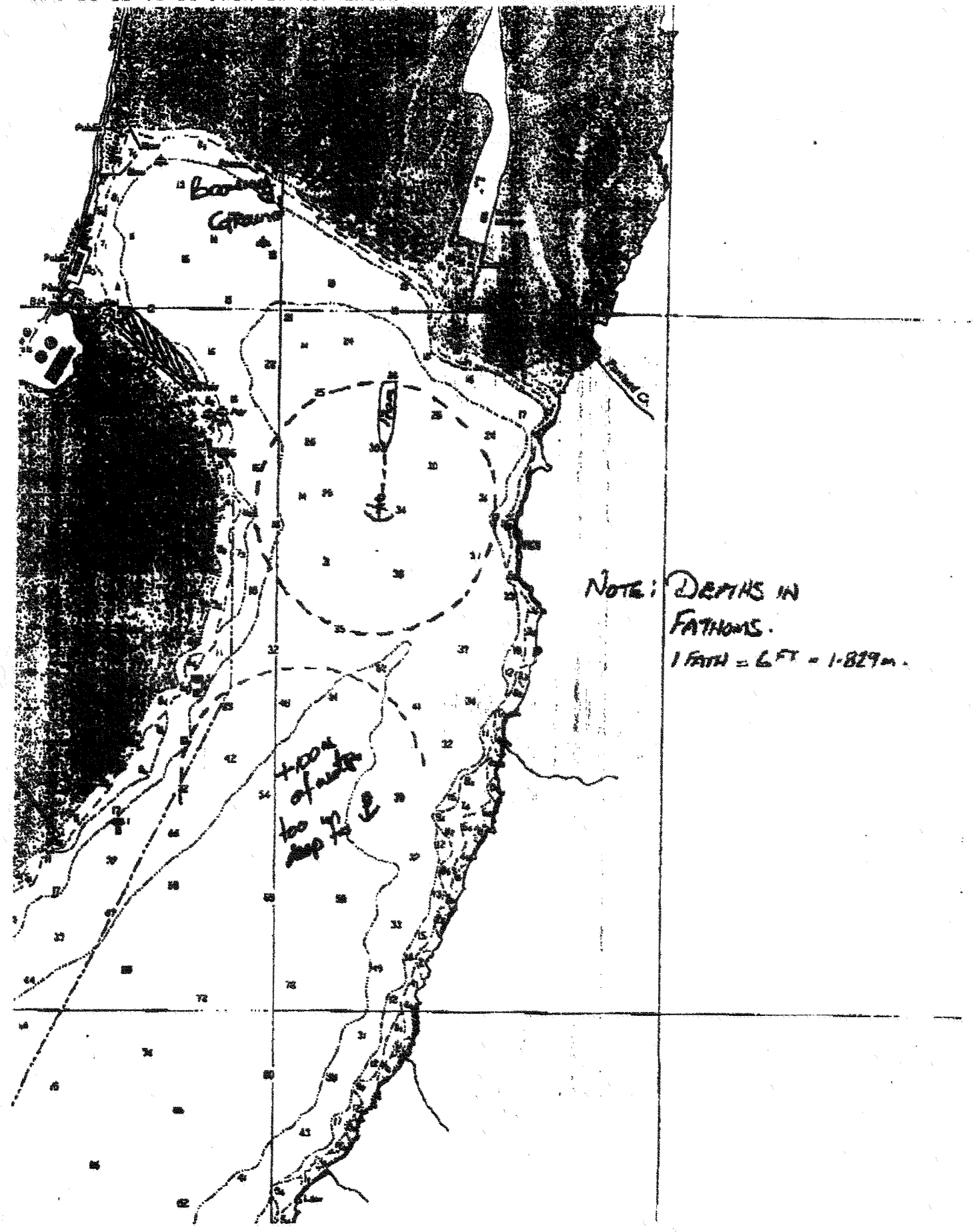
The ideal for Stewart at the present time is therefore one vessel at anchor and one vessel alongside.

Regards

KGO

From the desk of...
Captain Kevin Obermeyer
Vice President Marine Operations
Pacific Pilotage Authority
1000 - 1130 West Pender Street.
Vancouver, B.C., V6E 4A4

604-666-6771
Fax: 604-666-1647



NOTE: DEPTHS IN FATHOMS.
1 FATH = 6 FT = 1.829 m.

District of Stewart. The District has not yet developed a plan for its use, but one may involve refurbishing the structure. The SBT project has been developed so as to enhance and maintain access to the Northland Dock so as not to preclude development options for it.

In the first instance the access to the Northland Dock will be substantially improved by the dredging required for the SBT project, as shown in Drawing 10. Larger vessels could approach the Northland Dock if the dredged channel were not in use. However, since the area in front of the northern half of the Northland Dock will not be dredged[6] there will still be limited utility at low tide except, possibly, for barges and smaller boats. A commercial opportunity may arise for mooring barges and tugs against the Northland Dock.

As shown in Drawings 10 and 28 there will still be substantial and adequate high tide access to the Northland Dock at existing depths when ships or barges are tied to the SBT wharf. Both the largest and smallest design barges are shown in Drawing 28. The larger barge is based on an upper size of those used in the Alaska coastal fleet; the smaller barge is typical of those used for wood transport along the BC coast.

Nevertheless the access to both docks can be enhanced if the owners keep each other advised of anticipated vessel traffic and cooperate.

9.8.3.4 *Subtidal Land Leases (Water Lots)*

As shown in Figure 2 the footprint of the SBT wharf is on SBT's water lot D.L. 4198 Block D[7]. Until recently (2002) Public Works Canada held the lease to the immediate north of it (D.L. 4198 Block A). It is understood that, as part of the transfer process of the Northland Dock (a.k.a. the Federal wharf) Public Works Canada has cancelled its lease of D.L. 4198 Block A and this has reverted to BC Assets and Lands. The District of Stewart has applied to lease D.L. 4198 Block A .

Note in Drawing 31 that D.L.4198 Block A has a triangular extension to the east which lies in front of the proposed SBT wharf[8]. The area of land referred to is highlighted in Drawing 31.

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6 and since, according to some locals, a barge sank there

7 This is referred to as Block B in some reports and drawings. Given the adjacent land is Block A, this is likely correct. However McElhanney prepared Drawing 2 for this project and, as such, it is relied upon to be correct.

8 It is understood that the old Premier Dock was located in this triangle. This structure no longer exists.

As shown in Drawing 30 the triangular portion of Block A lies in the proposed dredge area in front of the SBT wharf; and both barges (Drawing 29) and ships (Drawing 30) tied to the SBT wharf would float over the triangular part of Block A (as defined in Drawing 31). Thus the triangular portion of Block A could potentially cause difficulties with the operation of the proposed SBT wharf. For this reason SBT has requested Land and Water BC not to transfer this portion of Block A to the District of Stewart, but to designate it as a navigational reserve under Provincial control.

As noted in section 9.8.3.3. the District of Stewart has a long standing subtidal lease (# D.L. 7184) (see Drawing 25) in shallower water to the northeast of the proposed SBT wharf. This lease is used to store booms of logs for export from time to time. The SBT wharf project would not interfere with this lease as it is too shallow for larger vessels

SBT does not object to the transfer of the portion of Block A under the Northland Dock footprint nor D.L. 6689 to the District of Stewart.

9.8.4 Environment Canada

SBT has consulted with Environment Canada in two areas: (1) sediment chemistry, and (2) birds.

9.8.4.1 *Sediment Chemistry*

DFO referred SBT to Environment Canada to deal with sediment chemistry issues. The Proponent performed a field study of sediment chemistry (see Part 8 and Appendix 7).

Transport Canada performed a sediment chemistry study in September 2000 as part of the Northland Dock transfer[9]. The results (PAH contamination near the Northland Dock and high background levels of heavy metals) were similar to those of the SBT study for which the field work was done in July 2000.

9.8.4.2. *Birds*

The discussion on impacts to birds appears in section 9.12 on page 9-41

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[9] Golder Associates, Regional Harbours and Ports, *Stage II Preliminary Site Investigation, Stewart B.C.*, prepared for Transport Canada, Pacific Region, Vancouver, May 03, 2001.

9.8.5 Ministry of Water Land and Air Protection[10]

BC Environment has limited jurisdiction since the project lies in marine waters. The Water Management Branch was contacted by email[11] but has not responded. It is likely that a s.9 permit is required for the culvert at the Lagoon, but not for dredging in salt water.

A soil relocation permit may be required to move the dredgeate behind the sheet pile wall under the Contaminated Sites Regulation.

Referral to BC Environment will be done by EAO as part of the EA process.

9.8.6 Land and Water BC

The Proponent requested clarification on ownership of the Lagoon from the Ministry of Transportation (MOT) and from Land and Water BC. Mr Fredericksen of MOT's Smithers office (9 March 2000) said that the old abandoned road on the west side of the Lagoon is still Crown Land with an exclusion for a road. The new (existing) Hyder road is a Section 4 road which MOT owns[12] from shoulder to shoulder only. The road slopes and other land are Crown Land.

Ian Smythe of Land and Water BC (formerly BC Lands, formerly BCAL) in Smithers said (9 March 2000) that the Lagoon is Crown Land. He said Land and Water BC would support the Lagoon restoration project if a letter of no objection from DFO were received.

9.8.7 Ministry of Transportation (MOT)[13]

MOT offices in Smithers and Stewart were contacted by phone. Ray Fredericksen (Smithers) (8 March 2000) said that a MOT permit is required for the culvert upgrade. He said MOT is more than prepared to provide Soucie Construction with a permit if DFO agrees.

Randy Grelson (Stewart) (29 May 2000) sent information about previous MOT work on the Lagoon (see Appendix 6). MOT will require a traffic plan for the culvert replacement.

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[10] Commonly referred to as BC Environment irrespective of official name

[11] Email to Gord Wolfe, WMB, Smithers, May 17, 2002

[12] Verb changed from "controls" to "owns" per email from Steve Uyesugi of MOT on 23 May 2002.

[13] Formerly called the Ministry of Transportation and Highways (MOTH)

The traffic plan will need to address Hydro concerns as there is a hydro line the MOT right of way.

Mr Grelson requested DFO put him on the CEAA referral list.

MOT was recontacted in May 2002 at EAO's request. The response[14] was:

> Yes, the Ministry is agreeable to the installation of larger culverts to effect tidal flushing in the lagoon. A proposal to conduct these works must be submitted for permit approval prior to installation. The proposal must address reconstruction of the highway impacted by this culvert installation, guarantee all highway works for a period of one year as well as address all traffic concerns.

The MOT permit application will be made after the environmental assessment stage.

9.9 SUMMARY OF PUBLIC CONTACTS

Two local stakeholder groups have been contacted to date:

9.9.1. Bear River Salmon Enhancement Society

The Proponent's consultants discussed the project with Donelda Partridge and other members of the Bear River Salmon Enhancement Society during field visits in 1999 and 2000. The Bear River Salmon Enhancement Society assisted in collecting information on bird use of the Lagoon and field information on fish (see Appendix 11). It is requested that DFO place the Bear River Salmon Enhancement Society on its referral list.

9.9.2 The Stewart Yacht Club

The Proponent's consultant met with Mr Don Nelson of the Stewart Yacht Club on 08 May 2000. At that time the Yacht Club wanted the Hyder road widened to install a boat launch, but the Yacht Club did not have funding in hand for the proposed boat launch project.

The Yacht Club was interested in (1) having SBT include the boat launch in its project scope, and/or (2) using some of excess compensation to be created in the Lagoon for it. SBT's position was that it would not include the boat launch in the project scope, but had

[14] Email from Steve Uyesugi, May 23, 2002

no objection to DFO allocating compensation habitat in excess of SBT's requirement (see Appendix 12) to the boat launch project.

Since that time a boat launch has been built on the Arrow Dock, so the boat launch on the Hyder road may no longer be a project of interest to the Yacht Club.

Mr Dan Soucie of SBT met with Don Nelson in May 2002 at Stewart to explain that a boat launch is not proposed to be included in the project.

9.9.3 Public Information Sessions

Two information sessions were held at the preapplication stage on Sunday April 21, 2002 and Monday April 22, 2002 in a vacant store on the main street of Stewart. A total of ten persons attended over the two days. The project was described individually to all persons by S. Graham P.Eng, a project consultant. Questions were answered verbally. Visitors were asked to sign a petition to support the project if they wished to, and all did.

Notices of the public information sessions were posted in prominent places in Stewart on Wednesday April 17, 2002 and remained posted until April 22.

Photos of the information available at the public meeting are shown below:

9.9.4 Border Times

The press release shown on the next page was published in the *Border Times*, the local newspaper, on the front page of its 30 April 2002 edition.

9.9.5. CFTK

There is no local radio or TV station in Stewart. Cathy Brooks of radio-TV station CFTK in Terrace requested information on the project. This was provided on May 28, 2002. It is not known what was aired.

9.10 PROPOSED PUBLIC CONSULTATION PROGRAM

A public consultation program will be developed in association with the EAO. The scope of the proposed program includes:

1. Placing 1 copy of the comprehensive study report in the Stewart library (located in the town high school)

2. Placing a notice in the *Border Times* which briefly describes the project, states where the Application report can be read, and invites written or emailed comments to the EAO.

$1.00

THE BORDER

Steve Graham
46 Parkgrove Crescent
Delta BC V4L 2G3

SERVING STEWART, B.C. AND HYDER, AK. Volume IV Issue 177 30 April, 2002

WHARF PROJECT PROPOSED AT STEWART BULK TERMINALS

Press Release
April 24, 2002

Stewart Bulk Terminals Ltd. Is proposing to build a 1.85 Ha (4.5 acre) wharf at its Stewart site this fall and winter. The wharf will be capable of handling containers and break bulk cargo from ships up to 50,000 DWT, as well as barges. This will allow SBT, which handles only bulk ore and concentrate at this time, to offer a full range of port services .

The wharf has been in the planning stage for several years while environmental studies were done. It will enter the formal provincial and federal environmental assessment processes next month and come out of them in September. The fish window for construction is from September to March 1, 2003.

The proposed wharf will be constructed using a sheet pile wall and fill. This technique is appropriate for the soft soils of the Salmon River delta. The zone just to the north of the wharf will be dredged, and the spoil will be placed behind the sheet wall for fill. The size of the wharf has been limited by environmental constraints, and fisheries mitigation features are being incorporated into the design. These include a rip rap face on the south east side, and shelter structures to be attached to the rip rap face.

The project has been designed to be in full compliance with the Stewart Harbour Environmental Management Plan. Compensation habitat is to be provided by installing a larger culvert under the Hyder road to the lagoon so that full tidal flushing is reintroduced. This will allow the higher quality salt marsh habitat to re-establish in the lagoon

Economic benefits will accrue during both the construction and operation stages. About 20 to 40 direct jobs, mostly local, will be created during construction. Using Port of Vancouver criteria it is estimated that, at full capacity, about 96 man-years of direct employment and 223 man-years of total employment will be created per year. This includes trucking and port services.
While the capacity of the wharf is quite limited by size, this level of economic activity will help to stabilize Stewart and Hyder's economy.

Because SBT will have the capability of handling almost all types of cargo it will be available to support other resource industry initiatives in the region, particularly those induced by the Stewart Omenica resource road.

A public information session will be held in Stewart in early June as part of the environmental assessment process. Public comment, including letters of support, is solicited by SBT during the assessment process.

For information contact S. Graham, 604-943-8500 (phone/fax), or stevegraham@dccnet.com

Onewayout.net

PUBLIC ANNOUNCEMENT

Our internet service will be interrupted for approximately 20 minutes commencing at about 4:30 pm. on Tuesday, April 30, 2002. This interruption is for technical adjustments to our Router.

3. Placing a notice in the *Border Times* of a public information session. Holding a walk-in public information session with poster displays. The project environmental consultants will be available for questions. Forms will be available for visitors to make written comments.

4. Project consultants will make an oral presentation to the Bear River Salmon Enhancement Society. The presentation will be open all interested persons.

5. Loan copies of the draft Application report have been provided to the District of Stewart for its review. The Proponent and project consultant attended a meeting with mayor and council on June 10, 2002 to provide information and answer questions.

Any formal comment received by the Proponent or its agents will be forwarded to EAO . It is assumed that EAO will manage the public registry for this project.

For purposes of CEAA the Proponent is prepared to accept and respond to public comments in both official languages.

9.11 CUMULATIVE EFFECTS

A discussion of cumulative environmental impacts is required for CEAA. Agency personnel specified at least two different formats for presentation of a cumulative effects analysis, so two are presented. The first approach is a discussion of cumulative impacts over time; the second is a tabular methodology.

9.11.1 Chronology of Cumulative Effects

This approach has been specified by BC EAO and DFO.

Cumulative environmental effects are described in three parts:

1) those accruing from development occurring before the proposed wharf project
2) the major impacts accruing from the proposed wharf project
3) impacts that are reasonably foreseeable of occurring in the future (in an incremental sense) as a result of the proposed wharf project

Previous Development

There are no baseline descriptions or data of the area prior to settlement by Europeans. Aboriginal claims indicate the area was frequented on an occasional basis by the Nisga'a and Tsimshian tribes from farther down the Canal for hunting and fishing. It may also have been accessed overland by the Tahltan, although this would have involved travel over the glaciers.

There are no records of permanent settlements by aboriginals. Thus the site likely resembled other undisturbed parts of the edge of the Portland Canal. That is, there was a very steep slope into the canal without a habitable littoral. Over time the delta of the Salmon River expanded to reach its present extent.

Around the turn of the 20th century the towns of Hyder AK and BC were built on piles on the Salmon River delta to serve mines up the Salmon valley. The original federal wharf (built by the BC government in 1909) was located near the NW corner of the SBT site (near the remnants of the Premier wharf).

About 1918-1920 the Premier Dock was built at the northwest end of the proposed SBT wharf and a road was built from Hyder to the Premier Dock. The road was extended to Stewart in the same period. The towns were then supplied by coastal freighter from the Premier Dock until about 1963. Remnants of the Premier Dock remain.

The Premier Dock would have affected the littoral and nearshore areas; however there is insufficient documentation of the structure or existing situation to describe it with any certainty.

The Hyder road, which has been constructed by cut and sidecasting, would have covered the shoreline with blasted rock, destroyed littoral and adjacent terrestrial habitat, and provided an easier, but busier, passage for larger animals between the Salmon and Bear River valleys.

According to Powers (1998) there appears to be some evidence that the Hyder road bed was constructed with mine waste as well as with the local granodiorite. Copper from the mine waste may be leaching from the road bed into the Canal.

The Hyder Road was realigned across the tidal flats about 1963-1964 thereby alienating the existing freshwater pond. This resulted in a reduction of estuarine marsh habitat.

In 1964/1965 the Federal government and Granduc Mines exchanged foreshore lots. About 1964 the existing SBT site was created for the Granduc mine project by extracting gravel from the Salmon River and placing it on the northern edge of the Salmon River delta. This destroyed underlying marsh and mudflat habitat. A bulk loader was constructed in the adjacent subtidal zone to complement the capability of the nearby Premier Dock. The hillside behind was blasted to create a base for an oil storage tank farm.

At the same general time the new Federal wharf (a.k.a. the Northland Dock) was built to the immediate north in Block A, D.L. 4198. This dock served the Northland Navigation coastal ferry (about 300' long), as well as fuel barges. Later the AMH ferry berthed against it while unloading to the SBT site via a ramp.

In the same period the Arrow Dock was constructed on the other side of Stewart harbor. It is understood that this project was constructed by the Province in support of the Cassiar mine project. The causeway to the dock has caused aggradation and instability in the Bear River, and increased the local flood risk in the channel above. It prevented river sediments from traveling westward at the mouth. This has allowed higher quality estuarine marsh to become established west of the causeway. (In this respect there likely has been a substantial improvement in habitat in Stewart harbor since the dikes were built, but, unless dike maintenance is continued, it may be lost in the medium term.) The Arrow Dock may also have affected fish passage in its vicinity. The interactive effect with the Northland and Granduc projects would be diminished by the fact that the Arrow Dock is about 1.08 Km away.

Note however that in the late 1960s there were three active marine terminals in Stewart harbor, while in the early 1990s there was essentially none. (Habitat studies performed for the District of Stewart in 2001 indicated sufficient natural recovery around the Arrow Dock that DFO stated it would apply its policies on existing habitat for redevelopment.) Enhancement of SBT to a full service terminal only partially returns marine traffic in Stewart harbor to its previous levels.

The highway reached Stewart in 1972, and the Northland stopped serving the town in 1976 when the Federal subsidy ended. Since then the Northland Dock has had only occasional

use. Some siltation has occurred, and a barge sank off the north end. (Anecdotally, the rate of siltation has substantially decreased since the Hyder boat basin was installed. It appears to be acting as a littoral sediment transport trap.)

During the period when the mines were in operation at least two large oil spills occurred, and there appear to have been minor hydrocarbon releases as well. As a result the general area of the SBT and Northland Dock sites has hydrocarbon contamination.

About the mid sixties the original townsites of Hyder AK and BC fell into final decay. Only piles now remain and the estuarine marsh has recovered the former town site.

The Northland Dock was constructed on piles at the base of the the road fill. As such it would have had a more benign impact on fish habitat than a fill structure. There would have had to have been dredging to attain a navigable depth for a 300 foot ship. The piles were creosoted, and it is known that this has caused modest PAH contamination of the nearby subtidal sediments.

The Hyder Road has continued to be widened over the years, mainly by continued blasting and sidecasting. A small boat facility was established on floats north of the Northland Dock, with some parking along the widened road and foot access established over the sidecast zone.

In summary there has been substantial disturbance of the littoral zone between Hyder and Stewart in the past 100 years. The earliest structures (the towns of Hyder AK and BC and the Premier Dock) have now almost completely disappeared. The second phase of structures built in the 1960s is now nearing the end of its life cycle. The Northland Dock will either have to be refurbished or left to decay as habitat. The oil storage tank farm has been removed. The Hyder road and the SBT site have been maintained, but the SBT site will have to be upgraded to remain economic (thus, the proposed project).

The sidecast rock along the littoral has been recolonized by marine growth, so it may have similar habitat value to the pre-existing rock face; however it may be impacted by leachate from the roadbed. The Northland Dock supports herring spawn, but the adjacent subtidal and intratidal benthos are likely adversely affected by PAH from the creosote. The SBT footprint remains fairly sterile due to industrial activity, and the freshwater lagoon supports a less abundant ecosystem in comparison with the former estuarine marsh on the site. In summary there has likely been a modest improvement in habitat quality since the construction episode of the mid-1960s, but the major impacts of that period remain.

Since about 1918 then the west side of the Portland Canal north of Hyder (that is, the Canadian part of the west side) has been substantially disturbed by road construction and by construction of marine facilities. Overall the major net impact has been the removal of productive aquatic habitat at the SBT footprint for the Grand Duc mining project by private interests and in the freshwater lagoon by the Provincial government.

The objective is to minimize the impacts during the third 40-year development cycle.

Proposed Development

In the historical context described above the major impacts of the proposed SBT wharf project will be destruction of some aquatic habitat of medium-level value by fill, and the return of the lagoon from lower-value habitat to its previous higher-value estuarine marsh status. This should result in an increase in productive habitat according to criteria currently in use.

There will be a short-term adverse impact to the dredge area, but this should recover to better condition after PAHs in the surficial sediment are removed. However in the longer term the area will likely be recontaminated from the remaining creosote on the piles of the Northland Dock.

As the geographical extent of the proposed development is limited by environmental constraints, no other direct follow-on local development or impacts are expected.

Future Development

The existence of a port facility in Stewart could induce development and associated environmental impacts both in the local area and in the port's hinterland.

Additional economic activity in Stewart would be welcomed as the economy and population have declined since 1990-1995. This activity would have little impact on habitat since substantial excess infrastructure exists. Some air and water pollution might occur, but this would likely be less than previous levels since a water treatment plant now serves the town, and it is unlikely that the past peak population of 5000 will be reattained in the medium term..

The proposed port facilities might induce resource-based economic activity as far as Mackenzie if the proposed Stewart-Omenica road is built. The environmental impacts of these activities will have to be assessed as they arise as their scopes are readily predictable.

Unless DFO habitat policies change, additional port facilities to serve increased economic demand will have to be constructed either in the Arrow Dock area or in Alaska. Thus additional impacts to the local marine environment are not foreseen in the medium term.

Notes

Some historical information in this section was provided by A. Burton, former mayor of Stewart. Some historical information also appears in the report "Environmental Baseline Study, Environmental Audit, Stewart Public Wharf Facility", 1998, prepared for Transport Canada by Powers Environmental Services.

In this section “medium term” refers to the next 40 year construction cycle (2002-2042 approximately).

9.11.2 Tabular Presentation

An analysis of cumulative environmental effects is presented in Tables 9-1A , 9-1B and 9-2 on the following pages. This format was prescribed by DFO.

9.12 BIRDS

As discussed in section 6.4.3. R.U. Kistritz Consultants Ltd. assessed the water quality, fish, aquatic habitat, riparian vegetation and birds frequenting the Lagoon in two field studies in May and July, 2000. A copy of Kistritz’ report[15] is placed in Appendix 11.

To supplement the observations a local birder was engaged to make observations of the Lagoon. From Kistritz’ report (p.4, Appendix 11) “[T]welve observations made by BRSES between May 11 and August 10, 20000 indicated that the lagoon is relatively unused by aquatic birds. Only one pair of mallards and three wood ducks were observed over this time period”.

Following discussions with the Canadian Wildlife Service (at Delta BC) on avian impacts, SBT has agreed to do the following additional work with respect to avian impacts:

(1) existing information has been requested from agencies in BC and Alaska. Upon receipt of this information, it will be reviewed and a summary of relevant information prepared for the CWS.

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[15] R.U. Kistritz Consultants Ltd., “Aquatic Habitat Inventory of Hyder Road Lagoon, Stewart Bulk Terminals, Stewart, BC”, August 2000, 6 pp plus drawings.

Table 9-1

Cumulative Impact Assessment

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Table 9-1

Cumulative Impact Assessment

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Table 9-1

Cumulative Impact Assessment

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Table 9-1

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Table 9-1

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Table 9-1

Cumulative Impact Assessment

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Table 9-2

CUMULATIVE IMPACT ASSESSMENT
SUMMARY OF NONZERO SIGNIFICANT RESIDUAL EFFECTS

Type	SRE	Description	Other Activities Contributing to CE	Mitigation and Monitoring	Significance of Cum Effect	Rationale
VEC	1	Benthic habitat - loss Construction [Wharf]	Might be affected by future boat lauch at Yacht Club. However boat launch is not likely to occur in the medium term.	Project not imminent. Project would trigger CEAA , and require study and mitigation	0	No project
			Might be affected by future Arrow Dock upgrade However Arrow Dock upgrade is not likely to occur in the medium term	Project not imminent. Project would trigger CEAA and BCEAA under existing regs, and require study and mitigation	0	No project
			Might be affected by future Northland Dock upgrade. However upgrade is not likely to occur in the medium term	Project not imminent. Project would trigger CEAA and possibly BCEAA under existing regs, and require study and mitigation	0	No project
VEC	1	Benthic habitat - dredging Construction (Wharf]	Might be affected by future Northland Dock upgrade. However upgrade is not likely to occur in the medium term	Project not imminent. Project would trigger CEAA and possibly BCEAA under existing regs, and require study and mitigation	0	Unique
				Project removes contaminated sediment produced by Northland Dock	-2	Improvement
			Hyder boat basin maintenance	no new habitat removed at Hyder	0	
VEC	1	Water quality - siltation Construction (Wharf and Lagoon]	No other coincident projects Hyder project ends before SBT starts	None in addition to that for SBT project	0	
VEC	1	Fish passage Operations [Wharf]	Longshore fish passage may be hindered by combination of SBT wharf and Hyder wharf projects.	Projects are far enough apart that each can be mitigated separately. Monitoring program could include both projects. Hyder project has continous sloping shoreline for basin, and other components are on floats.	2	Two low impact projects combined
VEC	1	Water quality Operations	Spills at other port facilities. There are no other operational ones at present	None in additional to that proposed at SBT	0	Unique
VEC	1	Birds Operations	Movement of export logs in harbor	Birds are accustomed to export log and ship activity. No action in addition to that proposed for SBT	0	Accustomed
VSC	2	Truck traffic Construction [Wharf]	None	None in additional to that proposed at SBT Done in winter outside of tourist season Temporary	0	Unique
VSC	1	Navigation - increased traffic Operations	Log exports	Set up port users cttee to coordinate harbor usage	0	Traffic still relatively low
VSC	2	Navigation - Northland Dock access Operations	Northland Dock has not been used for about 30 years; recently transferred to District of Stewart. Land issues.	Dredging will improve access to Northland Dock	0	Improvement Not operational
				SBT barge ramp moved to improve access	0	Not operational
				Sufficient room to north for other vessel access	0	Not operational
				Need to coordinate to minimize interference	0	Not operational
VSC	1	Truck traffic Operations	Substantial recent reduction in traffic due to closure of mines and loss of 3/4 of population since 1990	None in addition to that proposed for SBT	0	Below long-term value
			Stewart Omenica road project could increase truck traffic to Stewart	Considered desirable. Project involves road upgrades and construction to standards	0	Project still conceptual

Significance Criteria : 0 - none, 1 - low, 2 - moderate, 3 - high, 4 - unknown
SRE - Significance of Residual Effect

(2) a draft monitoring plan will be developed and forwarded to the CWS for review. The objective of the monitoring plan will be to undertake a seasonal inventory of birds present at the lagoon and in the general vicinity of the wharf after the project is constructed and operational. The bird inventory will focus on the general area around the wharf site as well as major intertidal habitat units in the estuary such as marsh, mudflat, and shallow subtidal. The monitoring will commence once the wharf and lagoon construction is completed.

Lights and Night Operations

During an agency meeting the issue of installation of lighting was raised. The existing SBT facility has lights. These are operated as required during the loading of ships with concentrate since it is SBT's policy to load continuously when a ship is at berth to minimize turnaround time. Thus, birds are accustomed to the SBT facility being lit.

Lighting will be installed on the new wharf and it will be operated as required. (Note that there is an extreme variation in the length of daylight with season at Stewart's latitude). Thus there will be more lighting at the site, but its operating pattern will not change. Also, since only one ship can be berthed at a time, the lighting on the wharf will not operate at the same time as that on the bulk loader (except possibly during daytime in midwinter).

9.13 MEDICAL SERVICES

Medical resources and services available to the project in the town of Stewart include a local hospital with 2 doctors, an emergency room and 3 acute care beds. Patients requiring additional services are airlifted out .

The hospital administration is of the view that the local hospital could handle a construction project employing up to 40 persons[16]. For example the Stewart hospital handled Red Mountain mining project, and, 2 years ago, handled an MVA with 9 people.

9.14 CLIMATE

Stewart is located in the Maritime Coastal Western Hemlock (CWHwh1) biogeoclimatic zone. The mean annual precipitation at Stewart is 2052 mm (80.78") with the months of October, November and December each averaging approximately 310 mm. There are 214 days per year with measurable precipitation, on the average

[16] Telephone call with Linda Hyde, Hospital CEO, 1 May 2002.

Mean annual rainfall is 1390 mm with October being the wettest month with an avcerage of 334 mm, and July the driest with 61 mm. The remainder of the annual precipitation falls as snow, usually resulting in a substantial accumulation.

The mean daily temperature is a bout 5.2 degrees C (41 F). The maximum mean daily temperature is 9.7 degrees C (49.5 F) and the minimum mean daily temperature is 0.7 degrees C (33 F). The mean daily maximum temperature in July is 20.9 degrees C (69.6 F) and the mean daily minimum temperature in January is minus 8.3 degrees C (17 F).[17]

Thus Stewart has cool wet climate with a slight Mediterranean character.

Local mountain ranges direct winds along the axial component of the canal. The major wave generating fetch is to the south; however SBT is sheltered from these waves by the delta of the Bear River.

9.15 NATURAL HAZARDS

The Stewart area has several types of natural hazard. Some which may affect the project are described below.

9.15.1 Avalanches

Avalanches are common due to the large amount of snowfall the area receives. Avalanches occasionally close Highway 37A during the winter (typically 2 or 3 times each season). This will affect truck access to the port.

There are several avalanche chutes along the east side of Stewart harbor. There are anecdotal accounts of large avalanches setting up waves in the harbor which have affected marine traffic. Fortunately, SBT is on the opposite side of the harbor and not seriously affected by these occurrences.

9.15.2 Floods

The Bear River is flashy with a serious flood risk in late fall and during spring freshet. The flood risk is increasing due to aggradation and inability to obtain regulatory approval to maintain the dike system.

Fortunately SBT is not subject to flooding by either the Bear River or Salmon River. A major dike breach in Stewart could affect the ability of trucks to reach the port.

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[17] Sailing Directions, British Columbia Coast (North Portion), Volume II, Eleventh Editions, Department of Fisheries and Oceans, Sidney, B.C., 1987

9.15.3 Earthquakes

Stewart is in a major seismic zone. Fortunately there have been no major recorded local earthquakes, but the period of settlement has been very short in geologic terms. One advantage to the proposed fill structure is that it is less susceptible to earthquake damage than a pile or concrete structure. As river gravel will be used for interior fill the risk of liquefaction is minimized.

9.15.4 Tsunamis

Stewart is susceptible to a tsunami, particularly if the locus of the earthquake is directly offshore of the mouth of the Canal. (There was anecdotally little effect from the 1964 Anchorage earthquake).

Fortunately SBT lies on the north side of the Salmon delta and is thus partially protected. There is no reflective boundary at the head of the Canal so the wave energy would dissipate as the wave traveled inland.

There would also be some warning time depending on the distance of the earthquake locus from Stewart.

However a tsunami could cause damage to SBT and to shipping in the port. However little can be done about it as the occurrence is not predictable nor mitigatable.

9.15.5 Snow

Snow can accumulate to depths of over 20 feet in Stewart and can thus be a serious inconvenience. Snow removal maintenance is required to keep roads open and prevent some structures from collapsing. This is a routine activity in Stewart and does not pose a significant risk.

9.17 AIR QUALITY ISSUES

Air quality was briefly discussed in section 4.7. During agency reviews it was requested that additional information be provided on truck and ship emissions.

9.17.1 Ambient Air Quality

Being located in a sparsely settled remote location the air quality in Stewart is typically good; however no specific data have been found to confirm this. Environment Canada's website[18] indicates there is no air quality monitoring station at Stewart. Environment Canada's for-fee information service was contacted and the respondent said that she was unaware of any historical air quality information for Stewart. A search of the National Weather Service website for Hyder AK air quality data also produced no results.

Townspeople report that there used to be some haze in winter from burning of wood for heat, but this is no longer observed with the current low population.

The high mountains on both sides of the Canal and townsite would constrain air movement, but air flow in the axial direction of the valley is unconstrained. The stability conditions of the atmosphere are not known, but some local instability is observed in winter when the water in the Canal is warmer than the surrounding glacier field.

In summary no air quality data for Stewart have been obtained, but there is no reason not to conclude that the ambient air quality is very good and that substantial assimilative capacity exists.

It can also be reasonably concluded that the air quality has improved since the local mines shut down and the population has decreased from a peak of about 10,000 at the turn of the century to about 600 today.

9.17.2. Air Emissions From Trucks

Emissions from trucks are generally not an issue of concern to the environmental regulatory agencies in BC; in fact diesel emissions from trucks are tested by ICBC (a financial crown corporation). For instance the Vancouver Sun[19] reports that approximately 23,000 heavy-duty diesel trucks are registered in the Lower Mainland. Of these 17 (seventeen) trucks were tested by ICBC from November 2001 to May 2002. Eight failed. (In comparison, Ontario requires all 200,000 heavy-duty trucks in the Province to be tested annually for diesel emissions).

Also in comparison, Terminal Systems Inc., the operator the new Deltaport container terminal in Delta B.C., estimates there to be 1350 to 1500 semitrailer trips to and from Deltaport each business day. (The environmental assessments for Deltaport did not include detailed air quality analyses notwithstanding the project is located in an impacted airshed.)

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[18] http://www.weatheroffice.pyr.ec.gc.ca/wxhealth/airquality/default_e.html

[19] Vancouver Sun, May 14, 2002, "Testing of truck diesel fumes gears down", p. A11

Existing and predicted traffic induced by the SBT project was described in section 4.6. To summarize:

- existing truck traffic in Stewart is estimated to range from 100 to 400 trucks per day. This includes basal ore traffic plus variable forestry-related traffic.

- at full capacity it is estimated the Stewart wharf will handle 11,000 containers per year. Using a factor of 1.5 for induced truck trips, the maximum number of incremental truck trips is estimated to be 16,500 trips (about 45 per day, or about 3.8 per hour). This is about 3% of the existing traffic going to Deltaport.

- further, it is anecdotally known that many trucks going to Deltaport are older and being used on this run for the remainder of their useful lives. Most of the container runs are sourced or delivered locally. In comparison it is expected that most new traffic to the SBT wharf will come from well outside the Bear River valley and will likely be carried by newer less-polluting vehicles

- during construction it is estimated that 5850 to 8850 truckloads of fill will be taken from the Bear River to the project site. This will involve about 65 to 98 truckloads per day, or about 5 to 8 truckloads per hour, over a three month period. Thus this will be of the same order as the full-capacity operational traffic.

From the above it can be concluded that heavy duty diesel emissions are not a regulatory concern in the more impacted Lower Mainland region, and thus would be even less of a concern in northern BC. The induced traffic to the Stewart project would only be about 3% of that to Deltaport, which lies in a more impacted airshed with less assimilative capacity.

At capacity the SBT wharf will generate about 45 return truck trips per day, which is about a 20 percent increase over the typical number of existing truck trips (250 +/-) into Stewart.

On a comparative basis then, it is concluded that diesel truck emissions induced by the project will not generate a significant impact.

Mass Loadings

It is possible to calculate some estimates of mass loadings using unit loadings for heavy duty diesel vehicles supplied to this project by the GVRD. See Table 9-3 on the next page.

Table 9-3

Estimates of Atmospheric Loadings From Diesel Truck Traffic During Operations and Construction

Estimates for inbound and outbound trucks are made by assuming the stretch from Bitter Creek to SBT affects local air quality, that a truck covers this distance twice per container, and that a truck does not stand with its engine running. The existing case uses 250 truck trips per day, while an additional 45 truck trips per day are assumed for the case of full wharf operations. Total loading would be the sum of the two.

For the construction phase it is assumed each truck trip is an 8 mile return trip from the Bear River gravel mining site to the SBT wharf, and that there will be 80 trucks per day during the fill operation. It can be seen that air quality impacts due to diesel trucks increase over existing emissions from transport trucks by about 13% during construction, but this period lasts only a few weeks.

9.17.3 Air Emissions from Ships

A discussion of emissions from ships was requested at an agency meeting. This topic will also be analyzed on a comparative basis.

Marine Traffic at Stewart - Historic Context

The flux of marine traffic to Stewart has varied in the recent past. Ore shipments from SBT resumed about 1997, which generates about 20 ship visits per year. However the AMH ferry service to Hyder discontinued in 2000, which removed on visit per week during the warmer months. As shown in Figure 2-6 raw log exports have been volatile. This sector will likely increase as log exports substitute for pulp and paper production in the region.

Recreational boat traffic is modest due to the small, and declining, population.

Looking farther back, the coastal supply ship was discontinued when the highway system reached Stewart, and the vessel and barge traffic to serve the mines no longer exists. Thus current and projected marine traffic may still be less than historic peak traffic

VPA

To gage the general policy on the issue in BC the environment department of the Vancouver Port Authority was contacted. It stated that the VPA had no policies or concerns about marine vessel emissions at this time, and is just beginning to look at the issue. VPA suggested contacting Environment Canada and Alaska.

Alaska

The State of Alaska Department of Environmental Conservation ("DEC") and the Port of Juneau were contacted regarding ship emissions. It is anecdotally known that Alaska has concerns about liquid and air wastes from cruise ships and has begun to impose and enforce environmental regulations on that industry.

The impact of the summer cruise ship traffic upon the Alaskan town of Skagway is illustrated in Figures 9-2 and 9-3 on the two following pages[20]. It can be seen that Alaska's concerns are for a case that is different from Stewart's. The three cruise ships shown in Figure 9-3 would carry about 9,000 people (eighteen times the population of Stewart). In contrast cargo ships at Stewart pose a very minor demand on local infrastructure and environmental assimilative capacity, and can be powered down while in port.

The Port of Juneau reports that air emissions from cruise ships are a concern and that steps are being taken to minimize impacts. Cruise ships in port are required to turn off engines and use a shore-based power supply. According to Carolyn Morehouse[21] of the State of Alaska Department of Environmental Conservation, the DEC has started a regulatory program on marine emissions. At present, ship emissions, tested by an opacity scanner[22], are required to be less than 20%.

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20 The relative environmental impact of the proposed SBT wharf project can be appreciated in a comparison of Figure 9-2 and Drawing 01. Being at the head of fjords, Stewart and Skagway have similar geographic settings. Most of Skagway's foreshore is developed into a full-service port, while most of Stewart's is zoned as a high-quality estuarine marsh. The proposed project at Stewart is quite modest in comparison to the port development at Skagway.

21 Associate Engineer, Commercial Passenger Vessel Environmental compliance Program, State of Alaska

22 This is the same screening method used by ICBC for diesel truck emissions in the Lower Mainland

Figure 9-2

Photo (1) of Cruise Ship Traffic at the Port of Skagway

Source: Skagway promotional web site

Figure 9-3

Photo (2) of Cruise Ship Traffic at the Port of Skagway

Photos by JOHN O. LUMPKIN/ASSOCIATED PRES

Cruise ships are moored in the deep, glacier-carved harbour in Skagway awaiting the return of thousands of passengers.

Ms Morehouse also emailed a summary of the regulatory situation which is copied into a footnote below.[23]

Thus it can be concluded that the State of Alaska has a greater regulatory interest in diesel ship emissions than does British Columbia. This is germane insofar as the Port of Stewart is near the border and the border bisects the Portland Canal. On the other hand the Port of Vancouver's Deltaport terminal lies only a few hundred yards from the border, and all of VPA's emissions go into a transborder airshed. Thus it is not reasonable to expect greater concern or regulation to apply at Stewart than at Vancouver.

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[23] The State of Alaska has a visible emission standard only. The EPA has exempted them from the Clean Air Act as nonroad activity. There is some movement by the EPA to required emission standards identical to Marpol's Annex VI categories. This Annex has not been ratified by the United States nor enough of the other counties to go into effect.

We do not do source testing. ADEC doesn't have information on the engine manufacturer's or types.

Here is a little more info on the EPA stuff.

On April 30, 2002, EPA signed proposed emission standards for new Category 3 marine diesel engines (ships at or above 30 liters per cylinder - typically ocean-going vessels such as container ships, tankers, bulk carriers and cruise ships). The proposal comes following a January 2001 settlement agreement binding EPA to propose a NOx emission standard for C3 marine diesel engines by April 30, 2002. The settlement also calls upon EPA to invite public comment on whether C3 engines installed on foreign flagged vessels that come into U.S. territorial waters should be subject to such standards. EPA's C3 marine proposal includes only Tier 1 NOx standards (to begin in 2004), which would be equivalent to the NOx emission standards negotiated under the International Convention on the Prevention of Pollution from Ships (also known as MARPOL); such standards, however, would result in little, if any, additional emissions benefit in the U.S., since U.S. ships already meet this standard. Disappointingly, the proposal lacks definitive Tier 2 emission standards and, instead, simply requests comments on a Tier 2 program that would reduce emissions somewhere in the range of 30 to 80 percent. EPA is under court order to take final action on this rulemaking by January 31, 2003. The proposal is attached. Further information should be available shortly on EPA's web sites at www.epa.gov/otaq/whatsnew.htm and www.epa.gov/otaq/marine.htm and http://www.epa.gov/otaq/marine.htm> .

Comparison of Marine Traffic

Some readily-available data on marine traffic at the ports of Vancouver, Juneau and Stewart are presented in Table 9-4.

It can be seen that VPA has no official concern about marine emissions even though it may receive about six times more ships per year than the Port of Juneau (which does have concerns). In comparison the forecast full capacity scenario for the SBT wharf is about 5% of the ship arrivals at the Port of Vancouver. Thus if the Port of Vancouver, which lies in an otherwise impacted airshed, has no official concern about diesel marine emissions then impacts at the Port of Stewart, which lies in a pristine airshed, are not considered significant at a level of 5% of the Port of Vancouver's.

. Environment Canada

Environment Canada provided a very recent report[24] on marine emission levels in the Vancouver area. This may be the first step toward implementation of a marine vessel air quality policy and regulation. Some information in this report can be applied to Stewart.

The pollutants considered in the Environment Canada study were:

Criteria

- CO
- NO x (speciated)
- SO x (speciated)
- PM
- VOCs

[24] Levelton Engineering Ltd., *Marine Vessel Air Emissions in the Lower Fraser Valley for the Year 2000, Final Report*, prepared for the GVRD and Environment Canada, Pacific and Yukon Region, February 02, 2002.

Table 9-4

Comparison of Shipping Activity at Selected Ports

	Vancouver 2001	Juneau 2001	Stewart Current	Stewart Future	Stewart Future % of Vancouver
Total	2820		31	143	5.1%
Cruise	332	539	0	10	3.0%
Ore			22	40	
Log Export			9	18	
Container			0	75	1.6%

Notes:

In 2001 41 cruise ships used Juneau for a total of 539 arrivals
VPA did not have ship/arrival data; assume value is for arrivals
Port of Juneau does not inventory traffic at private wharves
Ore shipments at Stewart are 1999 data
Typically 8 to 10 log export ships moor in Stewart per year
Assumes a small cruise ship tour is established which visits Stewart
Assumes Stewart Omenica road generates mine and forest cargo
Assumes log exports increase relative to pulp and paper production
Assumes about 100 containers loaded per visit and 50 unloaded for a total of 18,700 TEUs. VPA container flux in 2000 was 1.15 million TEUs. Ratio is 1.6%.
Future case is full capacity of wharf

Inhalable and fine particulate

- PM_{10} and $PM_{2.5}$

Greenhouse gases

- CO_2
- CH_4 and its CO_2 equivalent emissions
- N_2O and its CO_2 equivalent emissions
- Ammonia (NH_3)

[The air pollution scenario for a ship entering Stewart harbor is as follows. In section 9.8.3.1 it is noted that only one ship at a time will be able to enter Stewart harbor and only two ships can be in the harbor at one time. Any excess traffic will be slowed en route or moored near Prince Rupert or the QCI. Upon approaching Stewart harbor the ship is slowed to a stop. It either moors off the Arrow Dock (to take on raw logs for export, or to wait to go to SBT) or is moved directly by a tug to the SBT bulk loader. A ship is generally powered by onboard generators while taking on raw logs (so it has electrical power). Ships at the bulk loader also turn their engines off and are powered by onboard generators, as required. Turnaround time at the bulk loader is almost always less than one day, while raw log export ships are moored for about 3 days.

This harbor use scenario generates relatively little air pollution since the ships' engines are turned off while in port. Emissions are created by tugs, in-harbor maneuvering, and on board generators. The air pollution potential is capped by the fact that, at most, only two ships can be in the harbor at one time.

Estimates of mass loadings for the Port of Stewart have been calculated using the emission factors and other methodology in the Levelton (2002) report in Tables 9-5, 9-6 and 9-7. The assumptions are that ships are not under full power while in the port, and that the design ship is 45,000 DWT.

Emission factors are presented on a per ship basis in Tables 9-5 and 9-6 so that total emissions for selected scenarios can be calculated for either the short term (0, 1 or 2 ships in the port) or the longer term (for example, annual loadings using vessel visit values in Table 9-4).

Table 9-5

Estimates of Emissions for Maneuvering a Vessel at Stewart Harbor

45,000 DWT Bulk Carrier

Pollutant	Emission Factor g/KWh	Power HP	Power KW	Total Time hours	Engine Load Factor	Total Kg
CO	3.7	11,159	8325	4	0.2	24.6
NO x	18.6	11,159	8325	4	0.2	123.9
SO x	2.1	11,159	8325	4	0.2	14.0
VOC	0.02	11,159	8325	4	0.2	0.13
PM	1.4	11,159	8325	4	0.2	9.3
CO2	682	11,159	8325	4	0.2	4,542
CH4	0.04	11,159	8325	4	0.2	0.27
N20	0.29	11,159	8325	4	0.2	1.9
NH3	0.35	11,159	8325	4	0.2	2.3

45,000 DWT Container Vessel

Pollutant	Emission Factor g/KWh	Power HP	Power KW	Total Time hours	Engine Load Factor	Total Kg
CO	3.7	35,250	26297	4	0.2	77.8
NO x	18.6	35,250	26297	4	0.2	391.3
SO x	2.1	35,250	26297	4	0.2	44.2
VOC	0.02	35,250	26297	4	0.2	0.42
PM	1.4	35,250	26297	4	0.2	29.5
CO2	682	35,250	26297	4	0.2	14,347
CH4	0.04	35,250	26297	4	0.2	0.84
N20	0.29	35,250	26297	4	0.2	6.1
NH3	0.35	35,250	26297	4	0.2	7.4

45,000 DWT Passenger Vessel

Pollutant	Emission Factor g/KWh	Power HP	Power KW	Total Time hours	Engine Load Factor	Total Kg
CO	3.7	301,573	224973	4	0.2	665.9
NO x	18.6	301,573	224973	4	0.2	3347.6
SO x	2.1	301,573	224973	4	0.2	378.0
VOC	0.02	301,573	224973	4	0.2	3.60
PM	1.4	301,573	224973	4	0.2	252.0
CO2	682	301,573	224973	4	0.2	122,746
CH4	0.04	301,573	224973	4	0.2	7.20
N20	0.29	301,573	224973	4	0.2	52.2
NH3	0.35	301,573	224973	4	0.2	63.0

Source: Levelton (2002) methodology for 45,000 DWT design ship

Table 9-6

Estimates of Per Vessel Dockside Emissions at SBT Wharf

45,000 DWT Bulk Carrier

Pollutant	Emission Factor Kg/Mg	Diesel Use Mg	Emission Factor Kg/Mg	Fuel Oil Use Mg	Total Kg
CO	4.7	1.3	4.7	10.7	56.4
NO x	53.4	1.3	53.4	10.7	641
SO x	2.6	1.3	49	10.7	528
VOC	2.0	1.3	2.0	10.7	24
PM	6.3	1.3	6.3	10.7	76
CO2	3146	1.3	3681	10.7	43,477
CH4	0.18	1.3	0.4	10.7	5
N20	1.18	1.3	0.09	10.7	2
NH3	0.006	1.3	0.006	10.7	0

45,000 DWT Container Ship

Pollutant	Emission Factor Kg/Mg	Diesel Use Mg	Emission Factor Kg/Mg	Fuel Oil Use Mg	Total Kg
CO	4.7	4.1	4.7	12.3	77.1
NO x	53.4	4.1	53.4	12.3	876
SO x	2.6	4.1	49	12.3	613
VOC	2.0	4.1	2.0	12.3	33
PM	6.3	4.1	6.3	12.3	103
CO2	3146	4.1	3681	12.3	58,175
CH4	0.18	4.1	0.4	12.3	6
N20	1.18	4.1	0.09	12.3	6
NH3	0.006	4.1	0.006	12.3	0

Passenger vessel data not applicable since cruise ships at Vancouver are much larger than those that would use Stewart

Source: Levelton (2002) methodology for 45,000 DWT design ship

Table 9-7

Estimates of Tugboat Emissions at the Port of Stewart
at Full Capacity of SBT Wharf

Each Tug Boat

Pollutant	Emission Factor g/KWh	Power HP	Power KW	Operation Time h/yr	Power Load %	Total Per Year Mg
CO	1.6	978	730	4000	0.6	2.8
NO x	12	978	730	4000	0.6	21.0
SO x	0.55	978	730	4000	0.6	1.0
VOC	0.5	978	730	4000	0.6	0.9
PM	0.2	978	730	4000	0.6	0.35
CO2	757	978	730	4000	0.6	1,326
CH4	0.05	978	730	4000	0.6	0.09
N20	0.02	978	730	4000	0.6	0.04
NH3	0.01	978	730	4000	0.6	0.02

Source: Levelton (2002) methodology

Tugboat emission estimates were presented on an annual per-tug basis in Levelton(2002). Currently tugs are brought to Stewart for each ship visit to SBT (a very expensive process). With the expected increase in port volume it is planned to station one tug at Stewart full time. The annual emission estimate for a tug stationed in Stewart on a per tug basis is presented in Table 9-7.

9.18 QUARRY HAUL RATES

At the EAO agency meeting on 04 April 2002 DFO requested information on quarry haul rates.

Speed

Trucks carrying rip rap from the quarry to the SBT site (a distance of 3.53 miles following the truck route) will travel at or less than the posted speed limit of 30 mph.

Mass

The rip rap will be transported in 20 (metric) ton trucks, as shown below:

As the time of travel from the quarry to the site is 3.53 miles/30 mph = 0.118 hours, the trucks return to the quarry empty, and the load and dump time per cycle might be 20 minutes, the mass rate is estimated to be 20 Mg/(0.118 hour*2+20 min/60 min/hr) = 35 Mg/hr

As the total mass of rip rap required for the wharf is estimated to be 4600 metric tons, about 230 twenty ton truckloads would be required.

Force

The force flux corresponding to a mass flux of 35 Mg/hr is 5.74 KN/s. This corresponds to about 39 short tons per hour.

Assumptions

The foregoing calculations assume 30% porosity and a specific gravity of 2.65 (for granodiorite). They apply on a per-truck basis. The values should be multiplied by the number of trucks available. This is likely to be two.

PART 10

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10.1 REFERENCES

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