Long Island
Log Transfer Facility

Remediation Plan

Prepared for

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1.0 Executive Summary

Port Frederick is a fjord located on the northern end of Chichagof Island, Alaska. The mouth of the fjord opens into Icy Straits, which separates Chichagof Island from the mainland. The fjord is guarded by a prominent headland on the northeast and mountainous terrain to west. The Long Island Log Transfer Facility (LTF) is located inside the mouth of Port Frederick on the north side of Long Island near the eastern shore of the fjord. The surrounding land features are dominated by rocky islands, sea cliffs, protected bays, and sheltered tidal flats and marshes (Figure 1.1).

During log transfer operations at the Long Island LTF bark debris entered the water and accumulated on the sea floor via the following practices:

- Log transfer to and from the water
- Raft construction, towing, and log movement within bundles

The U.S. Environmental Protection Agency's (USEPA's) General Permits for log transfer facilities and Alaska's corresponding Certificates of Reasonable Assurance, require LTF Operators to submit proposed remediation plans if continuous coverage by bark and wood debris on the ocean bottom exceeds both 1.0 acre and a thickness of 10 cm at any point. Recent bark monitoring surveys conducted in the vicinity of the Long Island LTF have determined that the amount of bark debris on the sea floor is greater than the 1-acre and 10-cm criteria. Consequently, a remediation assessment was performed to evaluate site information and determine feasible remedial action objectives (RAOs) and remediation approaches for the site.

Three types of RAOs were considered:

- RAOs with physical endpoints (e.g., reduce continuous bark to less than 1 acre)
- RAOs with implementation endpoints (e.g., implementation of best operating practices)
- RAOs with biological endpoints (e.g., colonization by certain species)

The RAO selected for the Long Island LTF includes both an implementation and a physical endpoint. The implementation endpoint will be achieved during the current operating cycle of the LTF. When this operating cycle ends in 3 to 5 years, a physical endpoint will be achieved. Measures of success were established for both the implementation and the physical endpoints.

Remedial measures considered for the site include best management practices (BMPs), dredging technologies, capping technologies, and natural recovery. Using guidance from the Alaska Department of Environmental of Environmental Conservation (ADEC), screening criteria identified viable technologies for the Long Island LTF that would achieve both the implementation and the physical endpoints specified in the RAO. Technologies that were retained for the development of remedial alternatives include monitored natural recovery, mechanical dredging, thick capping, thin capping, and mounding.

The selected remedial alternatives include the use of additional BMPs and facility improvements to further reduce the quantity of bark and wood debris that will enter the water during the current LTF operating cycle, and monitored natural recovery processes to achieve the required physical endpoint once the current operating cycle at the LTF concludes. Natural recovery processes (i.e., erosion, dispersal, decomposition, deposition of sediment) have been observed to occur at the Long Island LTF and are expected to continue, further reducing the area of continuous coverage by bark and wood debris in the future.

2.0 Site Characterization

This section provides information related to the operating history of the Long Island Log Transfer Facility (LTF) (Section 2.1), the physical and biological features of the LTF and its vicinity, and the results of recent dive surveys that have been completed at the LTF (Section 2.2).

2.1 OPERATING HISTORY

The Huna Totem Corporation (HTC) applied for the initial permits to construct the Long Island LTF during 1982. An overview of the operations of the Long Island LTF is provided in Section 2.1.1. The historical operation of the LTF from late 1983, when operations began, to 2002 is described in Section 2.1.2. The current operation of the facility including a discussion of the economic environment in which it operates is provided in Section 2.1.3. The anticipated future operations at the LTF are described in Section 2.1.4.

2.1.1 Overview of the Long Island LTF

The Long Island LTF consists of upland (log sort yard) and marine areas (refer to Figures 2.1.and 2.2). The Long Island Sort Yard and LTF is characterized as follows and described in more detail in Section 2.1.2.5:

- The existing upland sort yard is approximately 22 acres in size.
- The LTF and Rafting Tidelands area totals approximately 60 acres. This area is currently owned by the State of Alaska, and is permitted under the Alaska Department of Natural Resources Tideland Lease Number “ADL 102830 (ATS 1274)”. This tideland lease “ADL 102830 (ATS 1274)” and the tidelands surrounding Long Island (ATS 1567) are currently in the process of being transferred to the City of Hoonah.
- The Ship Mooring Tidelands area is approximately 19 acres. This area is owned by the City of Hoonah, and is permitted under the City of Hoonah’s Tideland Permit Number 0002.

2.1.2 Historical Operation

This section provides the historical information required in ADEC’s Guidance for the Preparation of Remediation Plans (ADEC 2002a).

2.1.2.1 Years of Operation and Source of Logs

Anecdotal information suggests that commercial operation of the Long Island LTF began in late 1983 (Doig 2003a). Since that time the HTC, Sealaska, and the U.S. Forest Service (USFS) have sent logs through the LTF. Whitestone Logging Company (Whitestone) has continuously operated the LTF for these organizations since 1983; HTC from 1983 to 1987, the USFS from

1987 to 1994, and Sealaska Timber Corporation (STC) has sent logs (some of which originated from lands purchased from HTC in 1994) through the LTF since 1995.

2.1.2.2 Estimated Timber Volumes Transferred

A total of approximately 500 million board feet (MMBF) of timber has flowed over the Long Island LTF since 1983 (Wilson 2003a). The approximate volume transferred each year is summarized on Figure 2.3.

2.1.2.3 Dates of Facility Construction and Modification

The HTC received the initial U. S. Army Corp of Engineers (USACE) permit (071-OYD-2-810435) to construct the Long Island LTF, including the access roads to the facility, on June 18, 1982. The HTC requested that the USACE issue an after-the-fact permit modification "to construct a designated log boom area and retain a 165-foot log skid" in 1983. The ADEC issued a Certificate of Reasonable Assurance (CRA) that the after-the-fact modification request will be in compliance with Section 401 of the Clean Water Act (CWA) "provided that accumulated bark and wood debris be cleaned up daily from the top of the steel skid entry system (elevation 30 feet) and mean high water (13.9 feet), and be disposed of at an approved upland site." This CRA was issued on August 7, 1984. The USACE issued a permit modification to the HTC for this after-the-fact modification on September 6, 1984.

A second modification to this permit was issued by the USACE on September 4, 1986. This modification allowed "the placement of three log ship mooring buoys northwest of the existing log transfer facility" (refer to Figure 2.2).

A tidelands lease (ADL 102830) between the Alaska Department of Natural Resources (ADNR) and HTC for the marine portion of the LTF contained in Alaska Tidelands Survey 1274, was executed on November 1, 1985.

The original design of the facility remained unchanged from the time it became operational in 1983 until 1998 when substantial improvements to site operations and drainage were installed. These improvements (described in more detail in Section 2.1.2.5) substantially reduced the volume of surface water runoff that entered Port Frederick.

2.1.2.4 Transfer Methods and Modifications

The planned physical dimensions of the proposed three-rail log skid installed at the Long Island LTF are included in the September 6, 1984 modification to the USACE permit for the Long Island LTF. An as-built drawing of the log skid currently present at the LTF is included as Figure 2.4. A photo of the log skid taken in June 2003 is included as Figure 2.5.

A barge bulkhead is located on the western portion of the LTF (refer to Figure 2.6). A bulkhead access road joins the bulkhead to the log sort yard. The use of the barge bulkhead has been limited to the transfer of equipment and operating supplies to and from docked barges.

The existing design and location of the bulkhead only allows ramp barges and other barges with shallow drafts to berth. Floyd Snider McCarthy, Inc. (FSM) has not identified any reports of logs being transferred to barges at this bulkhead. Historically, large loads of log bundles have been transported from the Long Island LTF via barge. These barges (refer to Figure 2.7) were more than 300 feet long by 70 feet wide with drafts exceeding 16-feet and were capable of transporting up to 1 MMBF of pulp wood logs (T & C Barges 2003). The log bundles were rafted to the barge where a log grapple would pick up the floating log bundles from the water and deposit them on the barge. The deeper draft of these large barges kept them away from near-shore areas of the LTF.

2.1.2.5 Operational Practices and Modifications

The existing upland sort yard is approximately 22 acres in size. The operation of the sort yard is described in the Pollution Prevention Plan (PPP) for the facility (Sealaska 2001) and is illustrated on Figure 2.8. Trucks deliver logs to the sort yard at the truck unloading area (A.) Unloaded logs are temporarily stored in the unscaled surge pile. A front-end loader moves the loose logs in the surge pile to the scale bays (B.) where logs are rolled out for scaling. The scaling crew determines the grade and species of the logs, and marks any additional reworking to be performed on the logs. After scaling, the logs are moved to the sort circle area (C.) where similar grades of logs are grouped into sort circles. When enough logs of a particular grade are collected in a sort circle, the pile of sorted logs is moved to the banding area (D.) where groups of similar grade logs are banded together with cables to create log bundles. From the banding area the log bundles are moved to bundle storage (E.). When the demand for more logs arises, the log bundles are moved from bundle storage to the log skid (F.) with a front-end loader and slid into the water down the log skid (G.). Once in the water, the log bundles are lashed together into rafts and moved to a water storage area.

The current layout and drainage features of the sort yard reflect the substantial modifications constructed in 1998. Sealaska and HTC spent approximately $270,000 to improve the drainage features of the site, construct Sumps 2 and 3 at the south end of the facility, and expand the size of Sump 1 at the north end of the facility. The southern two-thirds of the facility now drain to Sumps 2 and 3. A current photo of the sort yard is included as Figure 2.9.

Prior to the 1998 upgrade, most of the site drainage flowed to the north into a smaller settling pond where Sump 1 is now located and eventually to Port Frederick. Some site drainage flowed to the west to forest land (refer to Figure 2.10). The 1998 modifications substantially reduced the volume of stormwater discharged to the Sound by diverting run-on from adjacent lands away from the sort yard, and by re-grading the sort yard to direct more than half of the surface water flow to the south and east away from the sound. Additionally, the log scaling and sorting operations moved further from the water.

The LTF and Rafting Tidelands area totals approximately 60 acres. A portion of this area is shown on Figure 2.11. The normal operation of the LTF ramp (log skid) and the log storage area is summarized below (Sealaska 2001):

- Log bundles are transferred from the upland sort yard into the receiving water via the 3-rail log skid shown on Figures 2.4 and 2.5.
- During transfer operations, a front-end loader of similar size to a Caterpillar 988-B is used to move a log bundle onto the steel tubes at the top of the log skid.

- Next, another log bundle is placed on the steel tubes at the top of the ramp and is used to nudge the first bundle down the ramp to the water's edge where the tide floats the bundles off the steel tubes.
- Once the bundles are in the water, a boom boat transports them to the rafting area where they are assembled into rafts.
- In an effort to minimize the retention time of logs in the water, the rafts are towed to the existing Log Raft Storage Area. The log raft storage area functions as a temporary holding/staging area for log rafts that are pending the arrival of the log exporting ship. In addition, log rafts from The West Port Frederick LTF are towed to and stored at the Long Island Log Raft Storage Area prior to being loaded onto a ship for export.
- In the rafting and storage areas, the bundles float at all phases of the tide. The period of storage for the rafts generally does not exceed 6 weeks.
- Operating practices state that all logs deposited on the tidelands during a "float-off" log transfer operation are removed daily.
- Bark and wood debris are removed from the transfer ramp, adjacent tidelands, and the upland sort yard routinely.

The Ship Mooring Tidelands area is approximately 19 acres. A photo of the mooring buoys is provided as Figure 2.12. Normal operations in this area are described below (Sealaska 2001):

- After the ship is secured to all three buoys in the mooring location the log rafts are towed and positioned alongside the ship for loading.
- The logs are transferred from the water to the export ship by a self-contained crane with slings.
- Log transfer from Port Frederick onto the export ship occurs in waters at least 60 feet deep at MLLW.

2.1.2.6 Relation of Historical Operation to the Existing Deposits of Bark and Wood Debris

A total of approximately 500 MMBF of timber has flowed over the Long Island LTF since 1983 (Wilson 2003a). Figure 2.3 shows the approximate volumes transferred each year during the operation of the LTF. Approximately 40 percent of all of the timber transferred at the Long Island LTF was transferred from 1984 to 1987. Since the late 1980s, the volume of timber transferred per year has declined. More recently, the volume of timber transferred peaked at about 40 MMBF in 1996, and remained greater than 25 MMBF per year from 1997 to 1999. Since calendar year (CY) 2000 the timber transferred has remained in the range of approximately 20 MMBF per year.

Recent dive surveys conducted between CY 2000 and CY 2002 measured an area of continuous bark coverage and wood debris that has fluctuated between 2.9 and 5.5 acres, with results from the most recent survey (conducted in the fall of CY 2002) indicating approximately 3.5 acres of continuous bark coverage (refer to Section 2.3). Based on these results, it does not appear that the area of continuous bark coverage has been increasing progressively since CY

2000. It is likely that the current area of continuous bark coverage results from historical log transfer activities, particularly during periods of higher transfer rates prior to the facility modifications constructed in 1998.

2.1.3 Current Operations

The current operations of the Long Island LTF and their impact on the local community are summarized in this section.

2.1.3.1 Type of Logs Transferred

The forests in the Hoonah area comprise a mixture of tree types. Logging practices harvest from this mixture of trees, transferring them through the Long Island LTF. The "typical" mix of trees harvested in the Hoonah area includes (Kleinhenz 2003a):

- Pulp wood – about 10 percent
- Low to medium grade hemlock – about 60 percent
- High grade hemlock – about 4 percent
- Low to medium grade spruce – about 25 percent
- High grade spruce – about 1 percent

The pulp wood and low to medium grade hemlock comprise more than 70 percent of the wood volume harvested, yet the sale of this wood does not recover the cost of harvesting it as discussed below.

2.1.3.2 Economic Performance of the Long Island LTF

The operation of the Long Island LTF includes a variety of fixed and variable costs. A cost "break even" analysis for the facility is included as Figure 2.13 (Kleinhenz 2003a). This figure relates the economic return that is provided by each of the tree species that traverse the facility. Although more than 70 percent of the volume of logs transferred consists of low to medium grade hemlock and pulpwood, the market price for these logs does not support their harvest. These low-value trees are harvested at the same time as the higher-grade hemlock and spruce trees. This practice allows the forest floor to regenerate more quickly than if the low-grade trees were left as litter on the forest floor and ensures that cut timber is utilized to the maximum practical extent.

The economic return realized from the sale of higher-grade hemlock and spruce logs tends to offset the economic costs associated with processing lower grade logs. This offset is tenuous and depends on the market price of logs. In the current timber market, the economic performance of the LTF is marginal (Kleinhenz 2003c).

Sealaska, HTC, and the USFS realize that ADEC may wish to further evaluate the economic performance of the Long Island LTF. Sealaska is ready to provide the more specific financial information used to prepare Figure 2.13 once a confidentiality agreement with ADEC has been agreed to.

2.1.3.3 Economic Impact of the Long Island LTF

The harvest of approximately 20 MMBF per year of timber has significant direct and indirect economic effects on the City of Hoonah and its vicinity. These impacts have been quantified by the McDowell Group and are summarized here (McDowell Group 2001).

Hoonah is a first class city of approximately 860 residents (in CY 2000) with an economy based on commercial fishing, seafood processing, timber harvesting, and governmental services. This total does not include the population of the Whitestone Logging Camp located near the Long Island LTF. The logging camp had a population of 118 persons in 1999. During 1999 Whitestone (STC's logging contractor and the Operator of the LTF) was the largest employer in the Hoonah area with an annual average employment of 99 persons. The next largest employers were the Hoonah City Schools (67 persons), Hoonah Cold Storage (35 persons), and the City of Hoonah (21 persons). The total annual employment in the Hoonah area was 365 persons in 1999 with Whitestone (and Sealaska) providing about 27 percent of the jobs that year.

During CY 2000, logging and LTF-related employment (full- and part-time jobs) in the Hoonah area totaled 130 workers. Employment in ship loading peaked at 63 workers, while Whitestone employment peaked at 64 workers. The McDowell Group estimates that personal income in Hoonah totaled about $17.5 million in CY 2000 and that Sealaska-based timber harvest activity accounted for about 20 percent of this total, or about $3.4 million. This share of the income in Hoonah was exceeded only by an estimated total of about $4.4 million in government transfer payments.

Since 1990, the volume of timber annually harvested from the Tongass has dropped from about 470 MMBF to 146 MMBF in 2000, a 70 percent reduction. The Tongass forest product industry's direct employment of approximately 600 people (in CY 2000) is nearly 1900 jobs less than the 1990 level, when logging, sawmill, and pulp mill employment totaled 2,500 jobs.

The "break even" nature of the logging business associated with the Long Island LTF makes the continued operation of this facility problematical. Reduced logging or the cessation of logging would have significant consequences to the Hoonah community. Hoonah's economy is more diverse than the economy in other native communities in Southeast Alaska. Nonetheless, the loss of about 20 percent of the personal income in the City of Hoonah (plus additional secondary losses of income) would have a significant impact on the local economy. Population loss would be expected, certainly from the Whitestone Logging Camp, but also from the out-migration of Hoonah residents.

2.1.4 Future Operations

This section provides the information related to the anticipated future operations at the Long Island LTF, as required in ADEC's Guidance for the Preparation of Remediation Plans (ADEC 2002a).

2.1.4.1 Years of Operation and Operators

Sealaska projects that it will continue logging and operate the Long Island LTF for the next 3 to 5 years. Sealaska will have harvested its available forest lands in the Hoonah area served by the Long Island LTF within this time period (Kleinhenz 2003b). The USFS harvest over the next decade is expected to consist of about 75 percent hemlock, 20 percent spruce, and 5 percent cedar.

2.1.4.2 Expected Timber Volumes to be Transferred

Sealaska expects to harvest from 75 to 100 MMBF from its lands and purchased timber rights over the next 3 to 5 years. This harvest is expected to consist of the species volumes discussed in Section 2.1.3.1. The USFS estimates that it will authorize a total harvest of about 25 MMBF from its lands over the next decade or about 2.5 MMBF per year (Wilson 2003b). Given these usage projections, it is expected that the area of continuous sediment coverage by bark and wood debris would begin to decline when the Sealaska harvest ceases in CY 2006 to 2008.

2.1.4.3 Transfer Methods

It is expected that market conditions will continue to dictate that the large majority of the logs transferred at the LTF will leave Alaska via ship. Sealaska, HTC, and the USFS plan to continue to apply the BMPs identified in the General Permit and implement additional BMPs to further reduce the volume of bark and wood debris that reaches Port Frederick as logs are transferred from the sort yard to awaiting ships. These improved BMPs are discussed in Section 3.3.2.

2.1.4.4 Operational Practices

The current operational practices in the sort yard, at the shoreline, and in loading ships were discussed in Section 2.1.2.5. It is expected that the operational practices at the sort yard and the shoreline will be modified to further reduce the quantity of bark and wood debris that enters Port Frederick (refer to Section 3.4.).

2.1.4.5 Dates of Facility Modification

Sealaska, HTC, and the USFS will implement the additional BMPs discussed in Section 3.3.2 once ADEC agrees that this implementation will allow Sealaska, HTC, and the USFS to continue to operate the Long Island LTF.

2.2 SITE DESCRIPTION

This section describes the geographic and landscape setting, physical oceanography, ecological setting, and human uses of Port Frederick and the Hoonah vicinity.

2.2.1 Geographic and Landscape Setting

Port Frederick is a fjord located on the northern end of Chichagof Island, Alaska. The mouth of the fjord opens into Icy Straits, which separates Chichagof Island from the mainland. The fjord is guarded by a prominent headland on the northeast and mountainous terrain to west. The Hoonah LTF is located inside the mouth of Port Frederick on the north side of Long Island near the eastern shore of the fjord (Figure 1.1). The surrounding land features are dominated by rocky islands, sea cliffs, protected bays, and sheltered tidal flats and marshes.

The receiving environment at the LTF is protected inner coastal habitat with very low tidal currents, and relatively shallow (less than 60-foot depth) flat bathymetry. Maximum currents in the Hoonah Coastal Management District are 1 to 3 knots, with higher velocities occurring where tidal waters funnel through narrow passages during large tidal swings. Northeast of the LTF, a shallow channel separates Long Island from a small island. West of the LTF, the local bathymetry slopes gradually for about 0.25 miles to depths of about 100 feet MLLW before dropping steeply into the main fjord. The area east and south of the LTF is a shallow bay fringed by sheltered tidal flats.

2.2.2 Physical Oceanography

Tidal- and wave-induced currents at and near LTFs can have a significant impact on deposited woody debris. This can occur by redistributing existing deposits of woody debris or by transport and deposition of fresh sediment on the existing woody debris. Both of these processes affect the potential for natural recovery to occur. Knowledge of physical oceanography in this region is scarce and is based largely on studies of other locations conducted from the 1960s through 1995 (Appendix A). Consequently, statements regarding the circulation within Port Frederick and its effects on sediment are based on best professional judgment.

Port Frederick appears to have the typical bathymetric features of a fjord. The fjord is a 400- to 500-foot deep basin with a relatively shallow 250-foot sill at its mouth.[1] Port Frederick is oriented in a northeast-southwest direction with a long fetch of unobstructed open water running 14 statute miles from the narrows near Midway Rock in the south to Pinta rock at its mouth. Long Island and the LTF are located about 4.5 miles from the mouth of the fjord.

Several small streams flow into Port Frederick and are expected to provide the primary source of freshwater. However, the watershed area is small in relation to the surface area of the bay, so that exchange induced by freshwater outflow at the surface is expected to be small. Tidal currents are also expected to be small especially in the deeper water. Estuarine circulation is expected to be positive, with surface outflow and deep-water inflow (City of Hoonah 1997). The expected small freshwater flows will result in relatively small surface outflow. Any balancing inflow would be distributed over a relatively large depth, resulting in minimal deep-water velocity.

The northeast-southwest orientation of Port Frederick may be conducive to funneling the south and southeasterly winds that predominate in Southeast Alaska. Although the facility is located at

[1] NOAA Chart 17302_1.

the northeast end of the sound, the effect of waves is expected to be minimal because of the protection provided by Game Point and Long Island. Also, the local shoreline and promontories to the north and east probably provide protection from Taku winds (strong, east and northeast winds), which periodically occur in the winter.

2.2.3 Ecological Setting

The Hoonah Coastal Management Plan provides a summary of habitats and aquatic resources in the vicinity of the Long Island LTF (City of Hoonah 1997). The aquatic and nearshore ecosystem at the north end of Port Frederick consists of the following kinds of habitat:

- Deep fjordic estuary
- Rocky islands and sea cliffs
- Exposed coast and shoreline
- Sheltered tidal flats and wetlands

Estuarine circulation is driven by the discharge of local rivers and streams in the vicinity of Hoonah as well as other locations throughout the length of Port Frederick. Diverse communities of marine plankton, benthic invertebrates, pelagic and bottom-dwelling fishes, and marine mammals are common throughout the fjord.

Observations of the marine community near the Long Island LTF in winter indicate that it is comprised of up to nine species of macrophytic algae, 27 species of epibenthic macroinvertebrates, and three species of bottom-dwelling fishes or their eggs, all of which were present in low to moderate abundances (Sempert 2000b; Sempert 2001; Haggitt Consulting 2003). Areas east and west of the area of 100 percent bark coverage, were also surveyed in March 2000 (Sempert 2000a). The bottom in these areas consists primarily of silty sand and shell debris intermixed with reef-like rock outcroppings. Predominant fauna in this area were bivalve mollusks, their predators (the starfish *Pycnopodia helianthoides*), and numerous species of decorator, Tanner, and King crabs.

2.2.4 Human Uses

According to the Hoonah Coastal Management Plan human uses include activities associated with:

- **The local timber economy** – Timber harvest, log sorting and transfer, in-water log storage, and marine transportation.
- **Fisheries** – Commercial, recreational, and subsistence fishing; fish and seafood processing; vessel operations, maintenance, and moorage.
- **Recreation** – A public use recreation area surrounds Long Island.
- **Marine transportation** – Alaska Marine Highway ferries and terminal; barge services to the City of Hoonah and other locations in Port Frederick.

2.3 SITE INVESTIGATION INFORMATION

2.3.1 Dive Survey Methods and Results

Three dive surveys were conducted in the water surrounding the Long Island LTF to determine the amount of bark debris coverage of the sea floor. The dive surveys were conducted using radial and parallel transects; though a radial transect survey was only conducted in March 2000.

The radial transect survey followed ADEC's general guidance for conducting bark surveys (ADEC 2000). The divers established an entry point at the location where the logs entered the water and then followed a series of transects each radiating from the point of entry and spaced 30-degrees apart. A total of 7 transects were surveyed with observations spaced at 5 m (16.5-foot) intervals. A total of 149 observations comprise the survey with 11 to 28 observations taken along each transect, depending on its orientation and length.

Parallel transects were established perpendicular to the shoreline. Methods of observation in each of the parallel transect surveys were the same for the three survey years. Observations were spaced at approximately 30-foot intervals along each transect, beginning at the shoreline and extending seaward until bark cover became insignificant or until a depth of 60 feet MLLW was reached. Visual or photographic observations at each sample point consisted of water depth, debris depth, percent cover by debris, debris composition and character, substrate type, species present and relative abundance, current direction and strength, visibility and presence of operation debris.

The dive survey results determined an area of continuous bark debris coverage ranging from 2.9 to 5.5 acres since March 2000 (Table 2.1). Additional observations of biota and bottom conditions in the vicinity of the LTF are summarized in Sections 2.2.3 and 2.3.2.

2.3.1.1 March 2000 Dive Survey

On March 24 and 25, 2000, radial and parallel transect surveys were conducted to determine the local areas of continuous and discontinuous coverage by bark debris. The radial transect survey was conducted as described above.

The parallel transect survey was conducted in areas peripheral to the LTF to determine the outer perimeter of bark deposition (Sempert 2000a, 2000b). Two parallel transects were established at the eastern boundary of the facility and two transects were established at the western boundary of the facility. These transects flanked the main wood debris area, which was surveyed using radial transects as described above.

These surveys investigated the sediments located within approximately 400 feet of the log skid. The depth of bark coverage varied from less than 1 inch up to 39 inches (2.5 to 99 cm). Subsequent surveys confirm this general depositional area of 100 percent cover, but indicated that the amount of wood debris within this area may be diminishing.

2.3.1.2 April 2001 Dive Survey

A dive survey using parallel transects was conducted in the vicinity of the LTF and in peripheral areas on April 18 and 19, 2001 to assess continuous and discontinuous coverage by bark debris within the total area encompassed by the facility (Sempert 2001). Eleven parallel transects were established across the site. Intervals between transects were 150 feet for those within the bark debris area, and 300 feet for those east and west of the main bark debris area.

This survey indicated that the main depositional area is confined to approximately 300 to 400 feet from either side of the LTF log skid. Observations of 100 percent cover with bark debris depths up to 24 inches (60 cm) were limited to this area. Also, the pattern of bark deposition in this survey indicated a net longshore transport to the west. Stations west of the log skid showed a gradient of diminishing cover and the depth of bark debris diminishing to insignificant accumulations along Transect 8, which is located about 1,000 feet west of the log skid (Sempert 2001).

2.3.1.3 March 2002 Dive Survey

A dive survey using parallel transects was conducted in the vicinity of the LTF and in peripheral areas on March 29 and 30, 2002 to assess continuous and discontinuous coverage by bark debris within the total area encompassed by the facility (Diversified Diving Service 2002). Seven parallel transects were established across the site, spaced equally at 150-foot intervals.

Similar to the results in the April 2001 survey, the March 2002 survey indicated that the area of 100 percent cover ranges from 300 to 400 feet on either side of the log skid with bark debris depths up to 36 inches (91 cm).

2.3.1.4 December 2002 Dive Survey

A dive survey using parallel transects was conducted in the vicinity of the LTF and in peripheral areas on December 2, 2002 to assess continuous and discontinuous coverage by bark debris within the total area encompassed by the facility (Haggitt Consulting 2003). Seven parallel transects were established across the site, spaced equally at 150-foot intervals.

The results of this survey indicated that the wood debris footprint is slightly smaller than that observed in 2001. The main depositional area with stations of 100 percent cover is within 300 feet from either side of the log skid with maximum bark debris depths ranging from 16 to 18 inches (40 to 45 cm), which is much shallower than that observed in the previous surveys. Photographic observations taken in December 2002 indicate that the most recently deposited wood material is located directly in front of the LTF log skid. Observations of wood debris to either side of the log skid show the presence of degraded and decomposing wood material. This information suggests that bark debris is probably dispersed by physical processes after its initial deposition and that mechanisms of decomposition and decay are probably active throughout the site.

2.3.2 Nature and Condition of Bottom

A rocky exposed shoreline occurs to either side of the LTF. Subtidally, the native bottom material consists of silty sand and gravel mixed with rock and shell debris. The generally coarse nature of the native substratum indicates that local current velocities may be sufficient to erode finer and lighter material, particularly in shallow areas that are subject to disturbance by storms or strong local tidal currents. As indicated in Section 2.3.1, physical processes probably disperse bark debris after its initial deposition and mechanisms of wood decomposition and decay are probably active throughout the site.

2.3.3 Reliability of Information

The reliability of the available information for the Long Island LTF is uncertain due to major concerns regarding the accuracy and precision of the dive surveys. In general, dive surveys are conducted with only approximate bearings and distances between stations, which is difficult to verify with differential GPS. Therefore, because the survey results are not reproducible, the accuracy and precision of the diver survey methodology is questionable. Dive surveys conducted at different times by different entities are likely to yield different results, particularly because of the subjectivity in identifying bark or wood debris after prolonged periods of decomposition.

The results of the 2000, 2001, and 2002 surveys suggest that the footprint of continuous cover is variable and may be decreasing. Even though the surveys were variable in their methods and techniques, the resulting information (area of continuous bark debris coverage from approximately 2.9 to 5.5 acres) suggests that the area of continuous cover is sufficiently large to justify development of a remediation plan. The data also suggest that the amount of bark debris may be decreasing even with continuing use of the LTF. Consequently, the remediation plan should consider continued monitoring of the site under revised operating conditions (additional BMPs) that may reduce the amount of wood debris entering the water.

2.3.4 Response to ADEC Questions

ADEC's guidance for remediation plans states that the results of site investigations must be able to answer two questions (ADEC 2002a):

- How does the zone of deposit (ZOD) fit into the overall setting (characteristics of the water body inside the ZOD versus outside the ZOD) so ecological impacts can be addressed?
- What will be the net environmental benefit of an active cleanup (Certificate of Reasonable Assurance 13(b)(iii))?

Responses to the issues raised by these questions are provided below.

2.3.4.1 Characteristics of the Water Body Inside the ZOD versus Outside the ZOD

The ZOD resides in a protected area near the mouth of Port Frederick. The ZOD is located near the head of a small bay that is fringed by tidal flats. Several small creeks discharge through the tidal flats located southeast and southwest of the Long Island LTF.

A relatively shallow channel exists within the ZOD between the LTF log skid and a small island approximately 750 feet north of the LTF. The generally coarse bottom within the ZOD indicates that this channel may facilitate higher than expected current velocities, particularly during periods of high winds or extreme tides. Observations of relatively rapid bark dispersal and changes in the depth of bark debris suggest that natural processes of current erosion over time could restore the benthic habitat to a condition similar to that in other locations in Port Frederick. Processes of erosion and natural succession within the ZOD are discussed further in Section 3.0, Remediation Assessment.

2.3.4.2 What Will be the Net Environmental Benefit of Active Cleanup?

ADEC defines net environmental benefit as the difference between the relative merits of various cleanup alternatives to achieve a given RAO. A net environmental benefit assessment includes a time component – the longer it takes to meet the RAO, the lower the net environmental benefit. ADEC identifies Section 10(b)(iii) of the CRA as the basis for evaluating net environmental benefit (ADEC 2002a). CRA Section 10(b)(iii) states that a remediation plan should evaluate the environmental impacts caused by bark and wood debris, and those caused by methods to reduce continuous coverage. These kinds of comparisons are provided below in Section 3, Remediation Assessment.

Assuming the continued operation of the facility for the next 3 to 5 years, the remediation assessment indicates that substantial net environmental benefits could be gained through some combination of BMPs and natural attenuation processes. Implementing BMPs should greatly reduce the rate at which wood debris is deposited in the ZOD, with the expectation that rates of natural attenuation will gradually diminish the wood-debris footprint to acceptable levels in the next few years or soon after LTF operations cease.

Active remediation via dredging and capping would have a much lower net environmental benefit because such activities would destroy the benthic community in the short-term and may not provide a measurable long-term benefit. Although dredging could remove wood debris in the short-term, continued operation of the facility could add small amounts of wood debris to the bottom, which may effectively reverse or neutralize some or all of environmental benefits of wood debris removal (refer to Section 3.3.4). Also there may be environmental costs associated with disposal of dredge material. Under current USACE guidance, wood debris could qualify for open water disposal (USACE et al. 2000); however, open-water disposal[2] of wood debris would probably cause moderate organic enrichment of the sea floor and associated disturbance to the benthic community. Upland disposal of dredged material usually requires dedication of land, which in non-urban settings such as Southeast Alaska may have relatively

[2] Under current USACE guidance, wood debris could qualify for open-water disposal. For example, in Puget Sound, the USACE permits open-water disposal of sediments containing up to 25 percent organic matter.

high intrinsic ecological value. Under such circumstances, disposal of dredged material would represent a trade-off of one set of ecological values for another, which would diminish the overall ecological benefit of the dredging option.

Capping wood debris would initially eradicate any existing benthic community, and would result in new substrate that could be re-colonized by benthic organisms. However, the new substrate is likely to differ in composition from the coarse native material in the vicinity of the LTF, and, therefore, would be likely to produce a benthic community that is dissimilar from that in the native material. Also, some or all of the environmental benefits of capping may be effectively neutralized by accrual of small amounts of wood debris during continued LTF operations. Thus, it is uncertain whether the net environmental benefit of a capping or dredging alternative would be any greater than that for the BMP and natural attenuation alternative (refer to Section 3.3.3).

3.0 Remediation Assessment

This section provides an assessment of the information contained in Sections 1.0 and 2.0 to develop remediation alternatives that could be implemented at the Long Island LTF. Section 3.1 begins with the selection of the appropriate remedial action objective (RAO) for the Long Island LTF (Section 3.1). Section 3.2 presents the remediation technologies that could potentially be implemented at the Long Island LTF. In Section 3.3, site-specific information, performance of the remediation technologies at other similar sites, and other criteria are used to screen the remediation technologies to identify those most appropriate for the Long Island LTF. The technologies that remain viable at the conclusion of the screening process are combined into a preferred alternative in Section 3.4, which is further evaluated in Section 3.5.

3.1 REMEDIAL ACTION OBJECTIVE

A RAO is a site-specific remediation objective that will allow the Operator to comply with the requirements of USEPA’s General NPDES Permit and the ADEC CRA. The RAO must be defined before potential remediation alternatives can be identified and evaluated for a LTF site. A RAO may have:

- A physical endpoint (e.g., reduce continuous bark coverage to less than 1 acre)
- An implementation endpoint (e.g., implementation of BMPs)
- A biological endpoint (e.g., colonization by certain species in a given time frame)

ADEC also requires that an RAO includes a measure of success, which identifies how to measure the success of the RAO (e.g., with dive surveys for physical endpoints) and when to expect achievement of the RAO.

The selected RAO for the Long Island LTF is discussed in the following sections.

3.1.1 Remedial Action Objective

The RAO identified for the Long Island LTF includes two endpoints: physical and implementation. The physical endpoint is to reduce the extent of continuous bark and wood debris coverage to less than 1 acre and less than 10 cm deep at any point in the ZOD. The implementation endpoint is to implement additional BMPs in CY 2003 to reduce the volume of bark and wood debris entering the ZOD during the current operating cycle of the LTF. It is anticipated that the RAO will be achieved within 2 to 10 years after the conclusion of the current LTF operating cycle in CY 2006 to 2009 (Section 3.3.5).

3.1.2 Measure of Success

The procedures to measure the success of the RAO will be included in a quality assurance and quality control plan, approved by ADEC, which will ensure that the existing and proposed additional BMPs are implemented as described in this remediation plan.

Annual dive surveys will monitor the area of continuous coverage during the next 3- to 5-year operating cycle. It is anticipated that within 2 to 10 years after the conclusion of this operating cycle, total continuous bark coverage will be less than 1 acre. The Operator/Permit Holder will prepare a monitoring plan that will define progressive rates of decline in bark or wood debris coverage over time. If monitoring determines that the measure of success is not being achieved, actions defined in the monitoring plan will be implemented to bring the site into compliance with the General Permit and State Certification.

The CY 2001 and 2002 dive surveys identified the eastern portion of the area of bark coverage as an area that has received recent accumulations of silt, much of which could be associated with detritus generated by wood decomposition (refer to Section 2.3). These surveys also provide evidence that the bark is probably dispersed by physical processes after its initial deposition, and that mechanisms of decomposition and decay are probably active throughout the site. This is circumstantial evidence of the natural processes (i.e., physical sediment deposition, dispersal, and decomposition of bark deposits) that are likely to continue at the LTF. It is likely that these processes will reduce the area of continuous coverage over time, once operations at the LTF cease in CY 2006 to 2009. The relatively near-term end of the current operating cycle at the LTF, together with this evidence of ongoing natural recovery, supports the development of an RAO with a near-term implementation endpoint and a longer-term physical endpoint that is expected to be achieved within 2 to 10 years of the end of the current operating cycle for the LTF.

3.2 DISCUSSION OF REMEDIAL TECHNOLOGIES

The purpose of this section is to identify the technologies being considered for remediation of bark-covered sediments at the Long Island LTF. Included are descriptions of the available technologies to remediate bark and wood debris and an overview of how each proposed technology might be used at the Long Island LTF. Technologies discussed in the following sections include: BMPs, dredging, capping, and monitored natural recovery and mitigation processes.

3.2.1 Best Management Practices

Any future log transfer activities at Long Island LTF would need to comply with BMPs that limit bark and wood debris deposition. These BMPs include:

- Methods of log handling, transfer, and movement
- General housekeeping practices
- Site design

The pre-1985 General Permit required that a set of BMPs be implemented within 6 months of the effective date of the permit (USEPA 2000a). In addition, the Alaska Timber Task Force (ATTF) created operational guidelines that must be followed by all existing LTFs. The BMPs required by the General Permit also satisfy the guidelines proposed by the ATTF. The effectiveness of BMPs in controlling bark and wood debris deposition due to any future log transfer at the site may be enhanced by the natural deposition of silt and/or the dispersal of bark by currents. The BMPs identified in the pre-1985 General Permit and incorporated in the Pollution Prevention Plan for the Long Island LTF (Sealaska 2001) are indicated below.

BMPs required by the approved permit for the Long Island LTF include:

1. Log bundles shall be placed into the receiving waters only at the discharge point(s) specified in the Section 404 permit.
2. No in-water bundling of logs shall occur.
3. Log rafts, logs, and log bundles that have been transferred to the receiving water shall remain floating at all times and shall not be allowed to rest on or touch the bottom.
4. Rafting and/or storage shall be in water at least 40 feet deep at mean lower low water (MLLW), in an area with currents strong enough to disperse wood debris.
5. Logs or log bundles shall be moved out of the log raft make-up and storage areas at the earliest possible time to minimize the retention time of logs in the water.
6. The log transfer device shall be operated to minimize the discharge of petroleum and lubricating products into receiving waters.
7. Solid waste shall not be deposited in or adjacent to waters of the United States, including wetlands and marine tidelands. Solid waste includes cables, metal bands, used equipment, machinery, vehicle or boat parts, metal drums, appliances, and other debris.
8. The speed of log bundles entering receiving waters shall not exceed 3 feet per second.
9. No in-water sorting of logs shall occur.
10. All logs deposited on the tidelands during float-off log transfer operations shall be removed on a daily basis.
11. Bark and wood debris that accumulate at the log transfer device and on adjacent tidelands shall be removed daily, to the maximum extent achievable.
12. Bark and wood debris that accumulate in upland traffic flow areas shall not be allowed to enter fresh waters, wetlands, marine waters, or tidelands. This debris shall be removed and disposed of on a regular basis such that the debris, or its leachate, shall not enter marine waters.

Additional BMPs that may be applicable at the LTF are identified and evaluated in Section 3.3.

3.2.2 Monitored Natural Recovery

Natural remediation consists of non-anthropogenic chemical, physical, and biological processes that collectively reduce ecological impacts by altering the concentration, mobility, and bioavailablity of pollutants introduced to the environment.

Recovery of the benthic community from disturbance by bark and wood debris occurs dynamically and is facilitated by one or more of several mechanisms, including removal of bark and woody debris by physical processes (e.g., currents), burial of wood debris by new sediment deposits (natural capping), or decomposition of the wood and bark by wood-boring organisms and microbial communities. Although these processes are well understood, their rates are highly dependent on site-specific conditions and are not easily predicted. Consequently, recovery of benthic communities could take place over a few years or may require several decades. These physical, chemical, and microbial processes alter and prepare the sedimentary environment for colonization by benthic organisms over time through the process of natural recovery.

The results of the dive surveys conducted from CY 2000 to 2002 have indicated that natural recovery by erosion, dispersion, and degradation is occurring at the Long Island LTF (Section 2.3.1). This natural recovery process is expected to reduce the area of continuous coverage by bark and wood debris to less than 1 acre within 2 to 10 years of the end of the current operating cycle of the facility. Subtidally, the native bottom material consists of silty sand and gravel mixed with rock and shell debris. The generally coarse nature of the native substratum indicates that local current velocities may be sufficient to erode finer and lighter material, particularly in shallow areas that are subject to disturbance by storms or strong local tidal currents. This theory is supported qualitatively by the following evidence:

- Relative rapid seasonal or inter-annual changes in the depth of bark debris.
- Relative rapid seasonal or inter-annual changes in the lateral extent of the area of 100 percent cover.
- Qualitative changes in the appearance of wood debris with younger material appearing in the center of the 100 percent cover area, and older material appearing to either side of the 100 percent cover area.
- The presence of wood boring organisms that play a significant role in degradation of wood material.

Dive surveys indicate that the main depositional area was confined to approximately 400 feet from either side of the LTF log skid in 2000, and has contracted to within 300 feet from either side skid by 2002. The surveys also indicate that the maximum depth of wood material in the area of 100 percent cover has declined from nearly 100 cm to 45 cm in recent years. These observations, together with the presence of wood boring organisms, indicate that natural recovery by erosion, dispersion, and degradation mechanisms may be significant in combination with BMPs and lower rates of log transfer.

Natural recovery by deposition also seems to be a likely outcome for the Long Island LTF. The deposit of fresh non-wood sediments at the eastern edge of the area of continuous bark coverage was reported during the most recent dive survey conducted in December 2002 (Haggitt Consulting 2003).

3.2.3 Dredging Technologies

The removal or excavation of bottom sediments from a water body, commonly called dredging, is a routine process. The most common purpose of dredging operations is to remove large volumes of subaqueous sediments as efficiently as possible within a specified operational and environmental restriction (Palermo and Hayes 1992). The materials dredged offshore from LTFs consist primarily of bark and wood debris. Dredging involves active disturbance of the sea floor to dislodge sediment by mechanically penetrating, grabbing, raking, cutting or by hydraulically dislodging material using plain suction or suction and rotary cutting. Once the sediment is dislodged, it is transported to the water surface mechanically (e.g., by clamshell) or hydraulically (e.g., by pipe slurry).

Dredged materials can be disposed of on land, subaqueously by placement in deep water, in nearshore locations, or in confined aquatic disposal (CAD) facilities. If mechanical dredging is utilized and the disposal site is upland, a method for transporting sediment from the barge to shore must be developed. If bottom depth and dredge crane reach allow, sediment may be transported to land or directly into waiting trucks with the dredge bucket. When dredging hydraulically, material is transferred by pipeline with discharge to a dewatering barge or an upland diked disposal cell. Another method, which is dependent upon the depth at the Long Island LTF bulkhead, involves the dredge butting up against the bulkhead and extending a ramp. A front-end loader can then load waiting trucks with dredged material from the barge. Dump trucks would then transport the material to a stockpile/dewatering area.

Land based equipment can also be used to remove bark and wood debris located in shallow depths adjacent to the LTF slide or bulkhead. Transportation and disposal costs may depend upon the weight of material. When mechanically dredging gravity settling will occur on the barge. Additional dewatering on land is typically conducted to further reduce the amount of water in dredged material for transport and disposal. Dewatering will decrease the weight of dredge material and consequently decrease shipping and disposal costs. Permitting may be required to return drained water to Port Frederick or to allow infiltration into the ground.

3.2.4 Capping Technologies

After natural recovery, in-place capping is the most straightforward and least intrusive of sediment remedial techniques. Capping material, typically a clean sand, or silty to gravelly sand, is placed on top of sediments. The appropriate type of capping material is usually determined during the design phase of the project after selection of a remediation technology. Capping material is generally brought to the site by barge and put in place using a variety of methods, depending upon the selected remedial action alternative. Capping material at remote sites like Long Island may need to be manufactured on-site from local rock material, given the high transportation costs that may be incurred to provide capping material from distant locations. Alternative sources of capping material will be evaluated if capping is carried forward as a technology in Section 3.3. The goal of capping the underwater bark-covered area at Long Island would be to isolate and contain the bark debris, and provide a substrate conducive to repopulation by local biota. The issues generally associated with in-place capping are:

1. Obtaining an appropriate cap thickness over the entire sediment area.
2. Placing the capping material without displacing the bark and wood debris.
3. Maintaining long-term cap integrity.
4. Elevation of the bottom that may affect local navigation.

Capping falls into three general categories: thick capping, thin capping, and mounding.

3.2.5 Mitigation Alternatives

ADEC'S Remediation Decision Framework document includes in-kind mitigation as one of the sediment remediation technologies that could be considered by an Operator when preparing a remediation plan for an LTF (ADEC 2002a). The Operator would have to present convincing information that "in-kind" mitigation at an off-site location would be in the best interest of the state. "In-kind" mitigation is some remediation activity within the marine waters of the state that provides an environmental benefit to the state that equals or exceeds the benefit provided by the remediation of the LTF. The feasibility of both in-kind and out-of-kind mitigation alternatives that might be considered for the Long Island LTF is summarized below.

3.2.5.1 Options Using Sealaska or HTC Leaseholds and/or Property

Many of these options call for the payment of a fixed fee by the LTF Operator. The fixed fee can cap the liability of Sealaska and/or HTC. These include:

- **Mitigation Banking** – In mitigation banking, continued use of facility is exchanged by purchasing "credits" in a "bank" of land(s) with similar environmental functions and values that will be preserved via advanced compensation for unavoidable impacts. This is usually done in advance of development. For the Long Island LTF, this may be done in advance of continued use of the LTF. There is no currently known benthic community mitigation bank in Southeast Alaska that has been established for this purpose.
- **Conservation Easement** – This form of mitigation involves retained ownership (title) and use of land, except for specific rights relinquished under the easement. For example, the Operator may retain right of passage and use of dock facilities, but would relinquish the right to log transfer and storage, enabling the natural recovery of the bottom sediments. There would probably be some requirement for continued monitoring or restoration. Environmental economics may be important in evaluating this approach based on property valuations or possible conservation "tax incentives."
- **Trust** – This mitigation option could relinquish full title and ownership to the state, or could retain the facility but give a cash contribution to a trust fund to be used by a resource agency to purchase and/or restore similar properties or other kinds of property as consistent with other environmental priorities. This could tie into Alaska's Clean Water Actions (ACWA) plan for restoration of "high priority" waters. Some combination of environmental restoration or monitoring may be included in the trust. Environmental economics may be important in evaluating this approach based on property valuations or possible conservation "tax incentives."
- **Endowment** – This mitigation alternative is similar to a trust. It relinquishes full title and ownership in exchange for no further action at the LTF. Alternatively, it could pay "endowment" fees with monies to be used as the state sees fit for recovery or preservation of other similar sites, or for use on other high priority environmental conservation or research needs as the state decides. This could tie into Alaska's Clean Water Actions (ACWA) plan for restoration of "high priority" waters.
- **Site Restoration at Sealaska or HTC** – This is similar to the above alternatives, but the landowner would retain current properties and would pay for and manage restoration at other sites. For example, Sealaska or HTC could create eelgrass beds

in herring spawning areas, create an estuarine salt marsh habitat, or restore a stream. This approach would also require short-term monitoring to ensure that restoration goals are achieved.

3.2.5.2 Options Using Non-Sealaska and/or HTC Property

Options that involve property owned by others involve some form of restoration. Restoration implies that actions would have to be taken to "improve" the environment. Sealaska and/or HTC would incur costs as these actions and the monitoring of the effects of these actions occurred. Two options may be feasible:

- **Alternative Site Restoration** – This alternative is similar to those listed above for Sealaska property. Sealaska and/or HTC retain current properties, and pay for and manage restoration at sites owned by the state. For example, Sealaska or HTC could create eelgrass beds in herring spawning areas, create an estuarine salt marsh habitat, or restore a stream in off-site areas. Site restoration would also include a limited period of verification monitoring to ensure that restoration goals were met and that the restored area was self-sustaining.
- **Conservation Easement** – This mitigation approach requires the purchase of easements for other similar properties. Some monitoring or restoration might also be undertaken for this approach. Environmental economics may be important in evaluating this approach based on property valuations or possible conservation "tax incentives".

3.3 SCREENING OF REMEDIAL TECHNOLOGIES

The approach used to screen the list of potential remedial technologies is discussed in Section 3.3.1. This approach is then used to screen potential BMP technologies that could be used to achieve the near-term implementation endpoint of the RAO (Section 3.3.2), additional capping (Section 3.3.3), dredging (Section 3.3.4), natural recovery (Section 3.3.5), and mitigation (Section 3.3.6) remedial technologies that could be used to achieve the longer-term physical endpoint of the RAO. A comparison of the capping, dredging, and natural recovery technologies is provided in Section 3.3.7.

3.3.1 Approach to Screening Alternatives

The screening process is modeled after ADEC's guidance in 18 AAC 75.325 (ADEC 2002b) and the USEPA CERCLA process. The purpose of screening is to eliminate technologies that are not feasible to apply, or will not be effective in achieving the RAO. The RAO selected for the Long Island LTF contains both an implementation and a physical endpoint (refer to Section 3.1). The initial focus will be on implementing BMPs to reduce to the maximum practicable extent the amount of bark and wood debris that can enter Port Frederick during the final 3- to 5-year operating cycle for this facility (refer to Section 2.1.4). It is expected that natural sedimentation and/or dispersal provided by the currents in the area, together with these additional BMPs, will reduce the area of continuous coverage once the current operating cycle has concluded.

The use of additional BMPs and rigorous quality control to ensure that these new and existing BMPs are effective, is the presumptive remedy for achieving the initial implementation endpoint of the RAO. A wide variety of potential BMPs is available. Each of these potential BMPs must be screened (refer to Section 3.3.2) to eliminate measures that are not feasible or will not be effective in achieving the implementation endpoint of the RAO. This screening approach is depicted on Figure 3.1.

The first step in the screening process is to identify the physical conditions at the site that limit or support the implementation of particular technologies. Since the Long Island LTF site is a marine site, this criterion immediately screens out technologies that can only be applied on the land. Other site conditions like water depth, bottom slope, and rocky substrate below the bark and wood debris will limit the number of technologies that can be implemented.

The second step is to identify the characteristics of the bark and wood debris that limit the effectiveness or feasibility of a technology. For bark and wood debris and associated sediments, characteristics like the thickness of the bark and wood debris deposits, the physical properties of the bark and wood debris (density, shear strength, settling characteristics) and the chemical properties of the bark and wood debris (pore water results) are important.

The BMPs, dredging, capping, and monitored natural recovery technologies discussed in Section 3.2 are judged to be appropriate technologies for discussion for the remediation of the Long Island LTF. Given the availability of upland disposal sites in close proximity to the Long Island LTF, the upland disposal alternative for dredged materials was carried forward for evaluation. The more complex and expensive nearshore disposal and CAD alternatives for dredged bark and wood debris were excluded, since they were judged to provide similar environmental benefits but were more costly to implement than the upland disposal alternative.

It is assumed that the physical and chemical properties of the dredged sediments will permit dewatering on the barge and that additional uplands dewatering may be required, but that additional upland dewatering agents will not be required.

The BMPs, dredging, capping, and natural recovery alternatives were evaluated further to asses their implementability, reliability, cost-effectiveness, short- and long-term effectiveness, and compliance with laws and regulations. These evaluation factors are defined below:

- **Implementability** – Implementability analysis for a remediation measure must include consideration of constructability (ability to build, construct, or implement the technology under actual site conditions), and the time required for the technology to achieve the required level of performance. For Long Island, the gradual bottom slope, shallow depth, hydrodynamic forces (currents, wave action, propeller wash, storm surge), sediment physical characteristics (shear strength, density), road access to possible disposal sites, uplands topography, naturally occurring sedimentation and dispersal of bark and wood debris by currents, and proximity to Juneau are important site conditions to consider. Important site constraints at Long Island include the depth of bark deposits, bark and wood debris characteristics (size, degree of decomposition), and presence of logs, banding cables, and other manmade debris.
- **Reliability** – This evaluation criterion should "identify the level of technology development, performance record, and inherent construction, operation and maintenance problems of each technology considered. Technologies that are

unreliable, perform poorly or are not fully demonstrated should be eliminated" (USEPA 1985).

- **Cost-effectiveness** – Evaluation of the cost-effectiveness of potential remedial technologies should be conducted as the next step in the remediation measure evaluation process. If two technologies judged to be equally reliable have significantly different associated costs, the more expensive measure can be screened out in this step.
- **Short- and Long-term Effectiveness** – The next step is to evaluate the short- and long-term effectiveness of each alternative.
  - Short-term Effectiveness – This criterion addresses the short-term risks to remediation workers and the impacts posed to the environment during implementation of an alternative, the potential effects on workers during the remedial action, the potential environmental effects of the remedial action, and the time until protection is achieved.
  - Long-term Effectiveness – Alternatives are assessed for their long-term effectiveness along with the degree of certainty that the alternative will be a successful and permanent solution. The assessment includes long-term reliability, the magnitude of residual impacts, the residuals remaining at the conclusion of the remedial activities, and the adequacy and reliability of controls such as containment systems and institutional controls.
- **Compliance with Laws and Regulations** – The final step is to ensure that the measure complies with federal and state laws and regulations and the GP.

3.3.2 Screening of BMPs

The BMPs that were judged to be potentially applicable to the Long Island LTF are discussed in Section 3.3.2.1. These potential BMPs are screened in Section 3.3.2.2 and those judged to be implementable, reliable and cost-effective are identified.

3.3.2.1 BMPs That Could Potentially be Used at the Long Island LTF

BMPs that could potentially be used at the Long Island LTF are described below. The advantages and disadvantages of each potential BMP are listed in Table 3.1.

3.3.2.1.1 Debarking

Debarking consists of removing a significant portion of the bark from the logs prior to their entering the water. Debarking can be done both mechanically and hydraulically.

<u>Mechanical Debarking</u>

Debarking of logs can be done by a variety of mechanical methods. Three methods are described below.

- **Drum Debarking:** The debarker consists of a large, rotating drum that is filled with tree stems. As the wood tumbles in the drum, the stems rub against one another continually, literally rubbing the bark off each other. The drum debarking method tends to be gentler on the wood than some kinds of mechanical debarking and is effective with crooked stems that might cause problems for other systems. Drum debarkers also can process high volumes; they are fed a half a truckload or more at a time. They can hold and process large quantities of wood continuously while most systems process one log at a time. In winter when the wood is frozen this system tends to reduce the quality of wood. Drum debarking for an LTF that handles 20 MMBF per year like the Long Island LTF would cost between $600,000 and $1,000,000. This type of system would require a power supply of 450 to 750 horsepower (www.progressindustries.com).

- **Ring Debarking:** Ring debarkers are preferred in colder weather when logs come into the yard frozen. Straight, larger sized logs are debarked using a system such as a Nicholson ring debarkers. Ring debarkers typically remove the bark from the logs one log at a time and can process logs at a rate of 140 feet per minute to 450 feet per minute. The slower system has a capital cost of approximately $200,000 and the high-speed system has a capital cost of approximately $375,000. Power demands for these systems range from 225 to 400 horsepower (www.nicholsonmfg.com).
- **Chain Flail Debarker:** Portable or stationary debarking systems. They can be used with or without loader at a maximum log feed rate of approximately 125 feet per minute. The smaller system has feed dimensions of 23 feet high by 48 feet wide and a capital cost of approximately $240,000. The larger system can handle logs up to 35 inches in diameter and has a capital cost of approximately $340,000. This system requires a power supply of 300 to 350 horsepower (www.petersonpacific.com).

Drum Debarker
www.progressindustries.com

Ring Debarker
www.nicholsonmfg.com

Chain Flail Debarker
www.petersonpacific.com

Hydraulic Debarking

Hydraulic pressure can be used to reduce the amount of bark on logs by spraying each log with water from high-pressure hoses, forcing the bark off the logs.

3.3.2.1.2 Barging

Barging is a commonly used practice at many LTFs in Southeast Alaska (Chittenden 2003), though the practice is generally used to transport logs from an LTF to a mill site. Logs are loaded onto a barge from the shoreline of the LTF (e.g., docks and bulkheads) using log shovels or log loaders, and the barge transports the logs to the mill. The use of this type of barging depends on current market economics, and the demand for smaller volumes of wood at Southeast Alaska mills (since these mills are usually unable to store a large inventory of logs).

The use of barges to transfer logs from shore to ship (for transport to Canada or more distant locations) has never been used at the Long Island LTF (Doig 2003a). Barging at the Long Island LTF would comprise loading logs onto the barge from the shore and barging them out to a ship located about ¼ mile off-shore. The logs would then be loaded from the barge to the ship via pre-set slings. Because this type of barging could be implemented at the Long Island LTF, it has been included as a potential BMP. A barge could berth at a bulkhead (either new or existing), or a ramp could be extended from the shoreline to a barge that is anchored off-shore.

<u>Barging Using a New or Existing Bulkhead</u>

Barging using a new or existing bulkhead would load logs onto barges with log shovels or log loaders. The existing bulkhead at the Long Island LTF is in poor condition and may not be structurally sound enough to support a barging operation (Kleinhenz 2003c). Building a new bulkhead would allow a full range of barge access to the LTF.

<u>Barging Without a Bulkhead</u>

Without a bulkhead, a barge would anchor close enough to shore for an extendable ramp to run from the barge to the shore. Loaders would drive down to the ramp to load logs onto the barge. A barge with a ramp is available from T&C Barges. This barge has dimensions of 242 feet by 60 feet by 16 feet and has usable deck space of approximately 200 feet by 60 feet. The ramp for this barge is 20 feet wide by 50 feet long (T&C Barges 2003).

3.3.2.1.3 Alter the Existing Log Skid

The existing log skid does not ensure that the entry velocity is less than 3 feet per second under all operating conditions. Under certain climatic and operational conditions (cold, icy, wet) bundles may enter the water at a rate greater than 3 feet per second. Entry velocities greater than 3 feet per second can cause increased agitation to the log bundles and promote bark loss. This criterion is considered to be a required BMP by the Pre-1985 General Permit for LTFs.

<u>Add Friction</u>

Ridges or bumps could be added to the existing log skid to provide greater friction as the logs descend to the water. The addition of a fourth or more rail skid(s) would also provide additional friction. This would decrease the velocity of the log bundles entering the water. Enough friction could be added to require pushing to move the log bundles down the skid during all weather conditions. This potential BMP is expected to cost approximately $10,000 (± 25 percent).

<u>Adjust Grade of Log Skid</u>

Currently, the existing log skid has a 14 percent grade from the sort yard to the water (Figure 2.4). A reduction in the grade is expected to create a lower entry velocity and reduce the amount of bark loss as the bundles enter the water. Various methods can be used to accomplish this, including:

- Extend the log skid further into land, keeping the top at same elevation and excavating further back into land.
- Extend the log skid further out into bay and keep the in-water end at same elevation.
- A combination of the above approaches.

<u>Build New Log Skid with In-water Ends that Float</u>

Floating pontoons could be placed at the in-water end of the log skid, with hinges placed on the land end. The in-water end of the log skid will rise and lower with the tide while the land end will remain fixed. This system could provide a means of transferring logs into the water with a reduced entry velocity. The logs would be loaded onto the log skid at high tide when the log skid is at a reduced grade with the in-water ends at their highest elevation. As the tide goes out the in-water end with the pontoons will lower and the land end will remain in its fixed position increasing the grade and the bundles will gradually slide down the ramp and enter the water. The log skid would be designed to have a maximum grade of 10 percent at low tide.

<u>Add a Net Between the Log Skid Rails</u>

A net could be placed between the rails of the existing or new log skid. The net would collect the bark debris that results from placing log bundles on the log skid and pushing them into the water. The cost of this modification is estimated to be approximately $10,000 (± 25 percent).

<u>Add a Flat Lay-down Area at the Top of Existing Log Skid</u>

The flat area at the top of the log skid could be expanded. The existing or additional new rails would be extended to include this flat area. Log bundles would first be placed on the flat area, and then pushed into the sloping portion of the skid. It would be less difficult to collect bark from the flat area than from the sloping area of the skid. The cost of this modification is estimated to be approximately $10,000 (± 25 percent).

<u>Add Paving or Wear Surface Between Log Skid Rails</u>

A modification to the above approach would be to retain the existing log skid (or add a new skid) and pave or provide wear surface between the log skid rails. This approach would facilitate cleanup of bark deposited between the log skid rails. The cost of installing wearing surfaces between the log skid rails is estimated to be approximately $25,000 (± 25 percent).

3.3.2.1.4 Modify Existing Ramp to Allow Direct Placement of Logs in Water

If the existing log skid is removed from the ramp, it may be possible for loaders to use the ramp to drive down and directly deposit the logs in the water. Depending on the existing ramps structural capability, modifications to the ramp (e.g., addition of wear plates or road surface) may be necessary. The capital cost to upgrade the existing ramp to allow loaders to use the ramp to drive down and directly deposit logs in the water is estimated to be approximately $50,000 to $100,000 (± 25 percent), assuming that additional subgrade would be required and that wearing surface would be installed.

The existing equipment at the Long Island LTF consists of one Wagner 120 and two Caterpillar 980 loaders capable of moving the log bundles created at the LTF. Sealaska judges that the age and capacity of this equipment will prohibit its use to place log bundles (of the current size) directly in the water (Kleinhenz 2003c).

The cost of purchasing used loaders that are appropriate for managing the log bundles created at the Long Island LTF, the Caterpillar 988B (Doig 2003a), is approximately $50,000 to $60,000 each (Caterpillar/Roskelli 2003). This estimate is for loaders that are approximately 20 years old, but that are expected to have a remaining useful life of 5 years (the maximum expected duration of operations at the LTF).

The overall estimated cost of modifying the existing ramp to allow drive-down operation and the direct placement of logs in the water is $150,000 to $220,000 (± 25 percent).

3.3.2.1.5 Build a New Drive-down Ramp

A new ramp (at the existing location or to the west near the bulkhead ramp) could be built leading down to the water. This would allow the loaders to drive down to the water and place the logs directly in the water without use of a log skid. Three potential ramp designs and associated costs (± 25 percent) are shown below.

- Shot Rock Ramp – At grades above 10 percent there may be difficulty maintaining the ramp and it may be necessary to use a concrete surface ramp (Dunham 2003a).

Shot Rock	$25,000 to $75,000
Skid	$50,000
Total	$75,000 to $125,000

- Concrete Surface Ramp (Dunham 2003a).

75 Wheelplanks (@$2,250 each)[3]	$168,750
Ramp Subgrade	$25,000 to $75,000
Skid	$50,000
Total	$210,000 to $260,000

- Concrete Log Ramp – Concrete logs approximately 2 ½ feet W x 2 ½ feet H x 24 feet L are connected together by I-bolts. A ramp like this exists at Tonka and is expected to cost approximately the same as a concrete surface ramp (Chittenden 2003).

[3] August 2002 price quote for wheelplanks.

3.3.2.1.6 Use Crane to Lower Bundles Into the Water

An A-frame crane could be used to lower the bundles into the water from the existing bulkhead or a new bulkhead. This method could control the rate of entry velocity and reduce the amount of bark loss that occurs.

3.3.2.1.7 Use Helicopter to Move Bundles

A helicopter could be used to move bundles from the bundling area and place the logs directly in the water or on the ship. Typically, helicopters are only used in roadless areas to move logs from logging site to trucks on nearby roads. Placing logs directly in the water by helicopters has been done at the Deere Island Timber Sale (TS) (Wrangell Ranger District) and at the Beck Channel TS (Wrangell Ranger District), but not frequently (Dunham 2003b).

3.3.2.1.8 Build Conveyor Belt

A large conveyor belt could be constructed either on the existing ramp or a new ramp. Bundles would be placed onto belt and slowly be lowered at a velocity of less than 3 feet per second into the water. The belt would have ample friction so bundles could not slide down at greater velocities. The conveyor belt system will be hydraulically sealed so no oils or greases enter the water. At the in-water end of the belt a safety net would catch bark debris that falls off logs as they enter the water and the bundle rights itself. This net would be cleaned out periodically.

3.3.2.1.9 Place Bundles on Tideland

The bundles could be placed by a loader (that has driven down a ramp) on the tideland itself at periods of low tide, and float away as the tide came in. With this BMP the loader would never put the logs directly into the water, but rather onto the sand and let the incoming tide float the bundles away. This approach would be used in conjunction with drive down ramp alternatives. This BMP could significantly affect operations at the LTF.

3.3.2.1.10 Use Dry Dock System

A dry dock could be used to lower logs into the water at controlled entry velocities. In this system a loader would place bundles of logs on the dock and when the dock was full, water would fill the ballast and the dock would lower itself and the logs into the water. Once the dock was lowered, the logs would be transported to the storage area. When the logs are out of the dock, the water will be pumped from the ballast and the dock will rise out of the water in preparation for more logs to be loaded onto it. Bark debris on the dock would be collected and disposed of, each time the dock is raised up.

3.3.2.1.11 Endless Chain

This system consists of two metal ramps with chains in place of the log skid. The bundles are placed on the chains, which have metal teeth that stick into the logs. The chain and logs are then lowered at a rate specified by the machine operator. The machine is completely gravity operated with a gear that prevents the chains from moving above a certain speed (e.g., 3 feet per second). An endless chain system was used at the Kidco LTF from the early 1980s to the early 1990s with limited success (Doig 2003a).

Endless Chain [4]

3.3.2.1.12 Additional BMPs

The following BMPs can be used individually or in conjunction with any of the above-mentioned BMPs.

Clean Log Entry Area at Periods of Low Tide

The area of log entry (e.g., log skid, ramps) should be cleaned of all bark and wood debris at each low tide. Over time this routine maintenance will reduce amount of bark and wood debris that enters the water. Unfortunately, large cobbles located in the area directly below the log skid reduce the effectiveness of this BMP by preventing efficient removal of debris in between the cobbles by large-scale mechanical equipment.

Use Backhoe to Remove Bark

A backhoe could be used in the area of log deposition at the end of the log skid periodically to remove bark accumulation from both land and water. Unfortunately, large cobbles located in the area directly below the log skid reduce the effectiveness of this BMP as well.

Use Net to Capture Bark Debris

A net could be placed underneath the log storage area and the loading area to catch bark and woody debris before it hits the sea floor. The net would be periodically emptied and bark debris would be brought to the upland rock pit near the LTF for disposal. The net would theoretically prevent bark accumulation on the sea floor.

Breakwater Around Area Where Log Bundles Enter the Water

A log boom could be constructed around the rafting area to reduce the agitation experienced by log bundles stored in the water (refer to Figure 3.2). This BMP is expected to reduce the

[4] Source: Tim Chittenden, USFS

amount of bark that is loosened from bundles in this area and eventually depositing on the subsurface. The installation of this breakwater is expected to cost approximately $20,000 (± 25 percent).

<u>Seasonal Variations</u>

During spring tree sap loosens up the bark and it tends to fall off more easily, in the fall there is less moisture in the tree and the bark becomes tighter and tends to stay on the log longer. This variation may be used to reduce the amount of bark loss in the water in different ways including:

- Minimize time (to the maximum practical extent) that logs remain floating in the water.
- Plan the majority of loading to occur at a period when more bark tends to fall off (spring) in the uplands to minimize the amount of bark that is deposited in the water.
- Or since bark stays on the log during transfer to water during the fall, plan the majority of bundle transfers during the fall so more bark will remain on the log while the log is in the water.
- Minimize time logs spend in the sort yard to the maximum extent practical to minimize logs drying out and bark loosening.

<u>Open Log Boom During Winter Months</u>

To disperse bark once it has been deposited, the log boom could be opened during winter months when rafts are not present and logs are not being stored in the water. Opening the log boom during the winter months may aid natural flushing of bark debris from the subsurface when rafts are not present. This BMP would aid natural recovery processes by aiding the dispersal of bark once it has been deposited. The cost of implementing this BMP is expected to be low.

3.3.2.2 Results of the BMP Screening Process

Each BMP identified above was screened in accordance with the criteria shown in Figure 3.1. The results of this screening process are shown below.

3.3.2.2.1 Implementability

Implementability includes the availability of the BMP, the measure's constructability, logistical feasibility, operation and maintenance issues, its acceptance by ADEC and other technology-specific factors. The following BMPs were screened out at this step:

- **Tidal Variations** – It was judged that relying on tides alone to float logs would significantly impact operations (costs) at the LTF.
- **Seasonal Variations** – It was determined that moving log bundles into the water according to the season was inconsistent with this LTFs need to move log bundles based upon market requirements. Similarly, it was determined that minimizing the time logs remain in the sorting yard and the time logs spend in the rafting area was inconsistent with this LTF's need to move log bundles based upon market

requirements. Being very responsive to market conditions is particularly important, given the break-even nature of operations at the LTF (refer to Section 2.1.3.2).

All of the other potential BMPs were carried forward to the reliability step of the screening process.

3.3.2.2.2 Reliability

Reliability criteria include an assessment of whether the BMP has been demonstrated to be effective in areas with similar conditions (Southeast Alaska), its effectiveness at keeping bark and wood debris from the water, its performance record, and its ability to perform at the required quality control standards. Technologies that are unreliable, perform poorly, or are not fully demonstrated were eliminated. The following BMPs were determined to be unreliable and were screened out.

- **Debarking (mechanical and hydraulic) – debarking has been used at various locations** in Southeast Alaska and has not been successful. In these LTFs this process has been discontinued (Chittenden 2003). Problems such as leaching of tannins and the potential fire danger resulting when the bark removed, is placed in a rock pit or landfill have occurred.
- **Build new rails with ends that float** – This technology has been tried on the 12-Mile TS. It worked acceptably when deep water is near-shore but will not function well in a shallow-water location like Long Island (Dunham 2003b).
- **Using a helicopter to move bundles** – No documentation has been found that shows that this BMP is effective at reducing the quantity of bark and woody debris that enters the water.
- **Build a conveyor belt** – FSM/Integral has not identified any LTF in Southeast Alaska that has used this log entry method.
- **Using a dry dock system** – FSM/Integral has not identified any LTF in Southeast Alaska that has used this log entry method.
- **Using a net to capture bark debris** – FSM/Integral has not identified any LTF in Southeast Alaska that has used this log entry method.
- **Add a net between the log skid rails** – The net would likely become entangled with log bundles. The reliability of this potential BMP was judged to be low.
- **Clean log entry area at periods of low tide.** Large cobbles located in the log entry area will limit the effectiveness of this BMP.
- **Use backhoe to remove bark.** Large cobbles located in the log entry area will limit the effectiveness of this BMP.

3.3.2.2.3 Cost-effectiveness

The remaining BMPs were divided into two categories, BMPs that could reduce the amount of bark entering the water and BMPs that could remove existing bark from the log skid water entry area. The BMPs that could reduce the amount of bark entering the water were further classified according to their potential effectiveness at reducing the quantity of bark entering the water. BMPs that would remove similar quantities of bark were compared to one another.

Those BMPs judged to be effective at reducing the quantity of bark entering the water were further divided into the following groups:

- BMPs that use mechanical means to transfer logs to the water
- BMPs that use gravity to transfer logs to the water
- BMPs that reduce surface turbulence at the bottom of the skid
- BMPs that increase the collection of bark released in the skid area

The cost to construct, implement, operate and maintain each BMP was estimated and given a cost rating of low to high. BMPs with similar effectiveness and higher costs were screened out at this step.

BMPs that Reduce the Quantity of Bark Entering the Water

- The BMP judged to be most effective is:
  - Barging – high cost; particularly given the current economic environment (refer to Section 2.1.3.2) and the current clients that are served by the LTF (transport by ships is required)
- The BMPs judged to be moderately effective that use mechanical means to transfer logs to water:
  - Endless chain – moderately high to high cost
  - Modify existing ramp for loaders to drive down – moderate to high cost
  - Use crane to move bundles – high cost
  - Build new ramp without log skid – high cost
- The BMPs judged to be moderately effective that use gravity to transfer logs to water:
  - Add friction – relatively low cost
  - Adjust grade of log skid – moderately high to high cost
- The BMP judged to be low to moderately effective that reduces surface turbulence at the bottom of the skid:
  - Breakwater around log entry area – relatively low cost
- The BMPs judged to be low to moderately effective that increases the collection of bark released from logs in the log skid area:
  - Develop a flat lay-down area at top of skid – low to moderate cost
  - Pave or provide wear surfaces between skid rails – moderate cost

BMPs that Remove Bark from Entry Area

- Open log boom during winter months – low cost

Technologies that were judged to be equally reliable were compared. For instance, if two technologies were judged to be equally reliable and effective in keeping bark out of the water, but Technology A costs significantly more to implement than Technology B, Technology A may be screened out by this criterion.

Assessment of Cost-effectiveness: BMPs that Reduce the Quantity of Bark Entering the Water

For moderately effective BMPs that use mechanical means to transfer logs to water, the endless chain, using the crane to move the bundles to water and building a new ramp without log skid; were screened out due to their higher costs. Modifying the existing ramp was selected as the most cost-effective BMP in this group. However, the cost of implementing this alternative was judged to be too high (approximately $150,000 to $220,000, ± 25 percent), given the precarious financial condition of the LTF (refer to Section 2.1.3.2).

For moderately effective BMPs that use gravity to transfer logs to water, adjusting the grade of the log skid was screened out due to its higher costs. Adding friction remained as the most cost-effective BMP in this group.

For BMPs judged to be low to moderately effective that reduce surface water turbulence; the placement of a log breakwater near the skid – water entry area was retained as a potential BMP.

For BMPs judged to be low to moderately effective at reducing the quantity of bark entering the water, the development of a flat lay-down area at the top of the log skid was judged to provide a tangible benefit at a lower cost than paving between the log skid rails.

Barging is the most effective BMP that remained up to this point in the screening process. However, Sealaska has concluded that loading logs directly from the shore onto a barge for transfer to a ship is not economically feasible at this location (Kleinhenz 2003c). Sealaska attributes this to the limited size of the existing sort yard. Ships carry approximately 3.8 to 4.0 MMBF, with some exceptions. Depending on the individual transaction, either whole or partial cargoes will be shipped at any one time. It is advantageous to ship a full cargo from one port because travel to multiple ports requires more time and higher costs for stevedoring, pilots, ship-tending, etc.

For the operation of a sort yard to proceed smoothly, a steady flow of logs into and out of the sort yard is necessary. Storing logs in the sort yard infringes on the operating areas, as well as incurring additional costs for “high decking” to maximize storage capacity. Typically, the higher grade/sorts of logs sell the easiest, so quantities of low-grade logs are held in inventory until a sale is arranged. In addition, Sealaska has determined that the extra time needed to have a ship wait in the mooring spot to accommodate the unloading of several barge loads of log bundles, would cost approximately $15,000 to $20,000 per day and would make the barge loading operation difficult and economically infeasible (Kleinhenz 2003c). Sealaska judges that it is more operationally and economically feasible to sort the logs into bundles and place them into the receiving water where they can be rafted by similar sort-types (Kleinhenz 2003c). Therefore, barging has been screened out as a potential BMP during the remaining 3- to 5-year operating cycle of the LTF.

The USFS is prepared to require that log volumes traversing the site (if any) after the current operating cycle ends in CY 2006 to 2009, be transferred from the land to barges, using the existing Long Island bulkhead or an improved bulkhead. The use of barging at the conclusion of the current operating period will substantially reduce the amount of bark and wood debris entering the water, and reduce the time required for natural recovery to reduce the area of continuous coverage to less than 1 acre and 10 cm in depth at any point.

Assessment of Cost-effectiveness: BMPs that Remove Bark from Entry Area

Opening the log boom during the winter months was judged to be a cost-effective BMP that will proceed in the screening process.

Summary of the Cost-effectiveness Screening Process

The BMPs proceeding to the next step in the screening process are:

- Add enough friction to the log skid to require pushing to place log bundles in the water
- Add a flat lay-down area at the top of the log skid
- Add a breakwater to shelter the log bundle entry area
- Open the log boom during the winter months

3.3.2.2.4 Short- and Long-term Effectiveness

Short-term effectiveness addresses the short-term risks that are associated with the implementation of the alternative, the potential effects on workers during operation of the BMP, the potential environmental effects of implementing the BMP and the time until the RAO is reached. All four BMPs were judged to have minimal short-term effects, so were not screened out.

Long-term effectiveness is based on an assessment of whether the BMP will provide a successful and permanent way to achieve the RAO. In order be effective in the long-term, the BMP must reduce the quantity of bark entering the water; by reducing the entry velocity of the log bundles. Adding friction to the log skid to reduce the entry velocity of the log bundles cannot consistently guarantee that the entry velocity will be less than 3 feet per second. Low temperatures and large amounts of precipitation may form ice on the skid rendering the additional friction BMP less effective during rainfall or icing events. Enough additional friction (e.g., more rails or more rail bumps) will be added to require that pushing bundles down the skid will be required even during rainfall or icing events. The goal of this approach is to maintain a bundle entry velocity less than 3 feet per second year round.

The addition of a flat lay-down area at the top of the skid should allow additional bark debris to be collected, and reduce the amount of debris entering Port Frederick.

The addition of a breakwater near the bundle entry area will reduce turbulence at the surface, and is expected to reduce the amount of bark discharged to the water column at this location.

Opening the log boom during winter months may assist in the dispersal of bark debris in the water column in the rafting area.

3.3.2.2.5 Compliance with Laws and Regulations

All BMPs must be compliant with federal and state laws and regulations and the General Permit. The four BMPs discussed in Section 3.3.2.2.4 are judged to be compliant with laws and regulations in that they will achieve the near-term implementation endpoint of the RAO for this LTF.

3.3.2.2.6 Selection of the Preferred BMPs

The following BMPs are judged to be the preferred additional BMPs for the Long Island LTF:

- Add enough friction to the log skid to require pushing to place log bundles in the water
- Add a flat lay-down area at the top of the log skid
- Add a breakwater to shelter the log bundle entry area
- Open the log boom during the winter months

3.3.3 Evaluation of Capping Technologies

Three potential capping technologies were discussed in Section 3.2.4; thick capping, thin capping and mounding. A screening evaluation for these three capping technologies is provided in this section.

3.3.3.1 Implementability

The success of thick or thin capping is highly dependent on the structural strength and density of the bark and wood debris to be capped. If the bark and wood debris has sufficient shear strength and density, then a cap can be successfully supported by the bark and wood debris and will provide a complete cover that isolates the bark and wood debris. The density of the bark and wood debris to be capped should be greater than or equal to that for the capping material so that an integral isolation cap of consistent thickness is constructed and maintained. If both density and shear strength of the bark and wood debris are not sufficient, migration of cap material through the bark and wood debris can occur, with bark and wood debris moving up through the cap material and returning to the bark and wood debris/water surface. Mounding is not dependent upon shear strength of underlying bark and wood debris, as the mounds are typically created from rocks that do not require underlying shear strength support. The rocks or other materials used for mounding will sink through any low density material that may be present and reach an equilibrium state, with additional rocks in the mound extending above the bark and wood debris surface.

The shear strength of the debris-covered bark and wood debris at Long Island is not currently known. A determination that sediment shear strength is adequate to support a cap should be made prior a decision to proceed with thick or thin cap placement.

Thick and thin capping, or mounding can limit barge access depths. This may be an issue in the nearshore bulkhead area. If capping material were placed in this area, berthing depths could be reduced to critical levels.

Absent bark and wood debris shear strength information for Long Island, thick and thin capping, and mounding are considered implementable. Mounding could be used if shear strength is not adequate for a thick or thin cap, whereas thick or thin capping could be employed if it is found that the shear strength of Long Island bark and wood debris is sufficient to support a cap.

3.3.3.2 Reliability

Thick or thin caps can deteriorate due to erosive forces, bioturbation, and lack of adequate shear strength and density of underlying sediments (low shear strength can lead to slope failure in graded areas and localized debris movement/cap breach in flat or graded areas). Inadequate underlying sediment density can lead to thick or thin cap material settling through and displacing wood debris. Due to the relatively flat bathymetry at Long Island, slope failure may be less likely than localized debris movement/cap breach.

Measures that can help prevent thick or thin cap failure and maintain cap integrity include cap monitoring, armoring, and replenishment. In addition, thick or thin cap placement using diffusers or sluicing with a high-pressure hose off the deck of a barge into the water helps dissipate the energy with which cap material impacts the wood debris layer. A more uniform cap layer is achieved with a minimum of bottom sediment resuspension/displacement, when compared to split hull barge placement. Increased uniformity of cap material reduces the probability of localized sediment movement/cap breach. Properly placed caps that are monitored and armored or replenished as necessary have shown good reliability. In February 2001, wood and bark containing sediments in the Marine Operable Unit of the Ketchikan Pulp Company Project in Ketchikan, Alaska, were successfully capped with clean sand (USEPA 2001a).

Absent physical and chemical sediment data for Long Island, capping is considered reliable.

3.3.3.3 Cost-effectiveness

The cost of capping the Long Island LTF will depend on the thickness of the capping layer, the type of capping material, the availability of capping materials, and other site-specific factors. The cost elements that would be part of a rough order of magnitude (ROM) cost estimate (± 25 percent) for capping at Long Island are summarized in Table 3.2.

This estimate assumes that 1.5 feet of capping material will be placed over 2.5 acres of the bark and wood debris at the site. The total ROM cost estimate for this capping scenario is $300,000 to $480,000 (± 25 percent). The estimate is very sensitive to the cost of the capping material. The cost of manufacturing capping material on-site, or barging capping material from Juneau or another location may be very high.

Thick capping will be more expensive than thin or mound capping, due to the additional capping material that will have to be created on-site or barged to the site and the additional placement time required to deposit additional capping material. Thin capping allows for some isolation of sediments and improved habitat at a lower cost than thick capping. Mounding allows for some isolation of sediment, potential habitat improvement, and placement over low shear strength or low-density sediments, at a cost potentially lower than thick capping. For these reasons, thick and thin capping, and mounding are carried forward as potential remedial technologies.

3.3.3.4 Short- and Long-term Effectiveness of Capping Technologies

Short-term effectiveness in isolating wood debris and creating new benthic habitat is judged to be good for thick and thin capping, assuming wood debris demonstrates adequate shear strength and cap material is placed using low impact energy methods (e.g., diffusers or sluicing). Mounding creates new habitat; the type and quality of this habitat would be determined after discussion with ADEC. Short-term impacts from thick or thin capping will include increased turbidity and disturbance of the benthic biota that has colonized the continuous bark area. Microorganisms that decompose wood and bark debris would likely be disturbed and would take time to recover. All capping types will resuspend sediments, leading to BOD/COD in the water column that could lead to short-term depletion of DO concentrations. Suspended sediments have the capacity to travel off-site. Long-term effectiveness of thick or thin capping will depend upon maintenance and monitoring of the cap, and the amount and type of ongoing log transfer operations at the facility. Mounding, if composed of rocks, would not be affected by the hydrodynamic forces that could erode thick or thin caps and would therefore not likely require as much maintenance or monitoring. Long-term effectiveness is judged to be adequate, and short-term effects may be controlled with cap application systems (e.g., sluicing of thick or thin cap material onto sediments) and/or barriers to water column movement of suspended particulates.

3.3.3.5 Compliance with Federal and State Laws and Regulations, and the General Permit

Cap placement can potentially impact water quality with decreased DO, turbidity, and chemical recontamination. Turbidity monitoring during cap placement would determine the amount of impact, if any, to the environment during cap placement. It is likely that a USACE Section 10/404 Permit and an ADEC 401 Water Quality Permit will be required. The USACE has issued previous permits for construction work at the Long Island LTF (USACE 1982). It is assumed that the use of the engineering controls described above will enable the capping of the sediments in Long Island to be compliant with federal and state laws and the General Permit.

Summary of results of screening process – Capping is retained as a potential remedial technology that could be used to achieve the longer-term physical endpoint specified in the RAO (refer to Section 3.1). This technology is compared to dredging and natural recovery technologies in Section 3.3.7.

3.3.4 Screening of Dredging Technologies

Dredging is generally conducted by two general methods: hydraulic and mechanical dredging. As these technologies are significantly different, they will be compared to the screening factors separately in this section.

3.3.4.1 Hydraulic Dredging

Implementability and Cost-effectiveness – Constructability is an essential part of an evaluation of implementability. Hydraulic dredging is considered constructible, as the technology has been employed widely for other dredging projects at the water depths and bottom slopes similar to those at the Long Island LTF. Cables, tires, logs, long strips of bark, tree limbs can all lead to clogging of conduit and/or the inability of hydraulic dredges to remove debris. In order to remove all debris, hydraulic dredging would have to be supplemented with mechanical dredging or another method of large-scale debris removal.

Hydraulic dredging removes substantially more water (along with the sediment) than mechanical dredging. As a result, hydraulic dredging will require more sediment dewatering time and cost more than mechanical dredging.

Since wood debris and manmade debris could clog the hydraulic dredge, and hydraulic dredging will cost more than mechanical dredging (due to increased dewatering costs) this technology is rejected based on implementability and cost-effectiveness concerns.

Summary of results of Screening Process – Hydraulic dredging is rejected as a potential remediation measure for the Long Island LTF.

3.3.4.2 Mechanical Dredging

Implementability – Mechanical dredging is considered constructible, as the technology has been employed widely for other dredging projects at water depths and bottom slopes similar to those at the Long Island LTF. Mechanical dredges are a proven means of removing bark debris (FSI 2000). They were used to remove wood sediments at the Ketchikan Pulp facility for many years (Doig 2003a). Dredges with associated barges are available in the Hoonah area out of Juneau, Alaska. Shallow areas (100 percent coverage extends to -8 feet MLLW) may have to be dredged from the water during high tides, or from the land (e.g., backhoe or other similar equipment) during periods of low tide.

Reliability – This technology is well developed. Mechanical dredging with an appropriately chosen bucket can handle large debris and manmade debris. This technology has been used to successfully dredge bark debris in past (FSI 2000; USEPA 2001).

Cost-Effectiveness – The cost of dredging depends on hauling and disposal costs, permitting costs (e.g., results of elutriate tests), dredging efficiency, and equipment costs (tug, barge, crane, trucks for debris transport, front-end loader for upland truck loading, positioning system). Overdredging and the cost associated with handling the water removed with dredged material are additional costs. The primary cost elements that would be a part of a rough order of magnitude (ROM) cost estimate (± 25 percent) for dredging at the Long Island LTF are summarized in Table 3.3.

The total ROM cost estimate for dredging 3200 cubic yards (cy) of material at the Long Island LTF is $320,000 to $520,000 (± 25 percent).

Short- and Long-term Effectiveness of Mechanical Dredging – Dredging may create short-term impacts to site workers and water quality exceedances including increases in total suspended solids (TSS), reduction of dissolved oxygen (DO), and increases in turbidity. Dredging-induced sediment suspension can be reduced by limiting bucket deployment and retrieval speed to 2 feet per second (fps), eliminating stockpiling of material on the bottom, having on-barge controls to limit sediment return to water, bucket pause at the surface to release excess water, using a finish bucket to perform cleanup dredging, and having "ecology blocks" and hay bales to filter water settling out of dredged material available on the barge. Dredging will destroy any benthic biota that have recolonized sediment-covered bark debris.

Silt curtains can be used to reduce the impacts of dredging on the local marine environment, by confining resuspended sediments to the inside of the curtain.

Since dredging results in permanent removal of the debris, the long-term effectiveness at reducing bark coverage is judged to be excellent.

Compliance with Federal and State Laws and Regulations, and the General Permits – The ADEC has not established a coordinated approach to permitting dredging or capping activities at LTF sites. The approach utilized in Washington “bundles up” various permits into a Joint Aquatic Resources Application (JARPA). This application includes a “hydraulic projects approval” from the Department of Fish and Game, a shoreline “substantial development, conditional use, variance or exemption” from the Local Government for compliance with the Shoreline Management Act, “floodplain management permits and/or critical areas ordinances reviews” by Local Government, a Section 401 (of the Clean Water Act) water quality certification from Washington State Department of Ecology (Ecology), a US Army Corp of Engineers (USACE) Section 10 permit, a USACE Section 404 (of the Clean Water Act) permit including an Endangered Species Act (ESA) consultation as applicable, with the U. S. Fish and Wildlife Service (USFWS) and/or the National Marine Fisheries Service (NMFS), and an aquatic resources use authorization from the Department of Natural Resources. The USACE has issued previous permits for construction work at the Long Island LTF (USACE 1982).

Although there are numerous permits required, it is anticipated that water quality issues related to turbidity require the most attention to ensure compliance. It is assumed that dredging could be conducted in a way that was compliant with federal and state laws and regulations and the General Permit.

Summary of Results of Screening Process – Mechanical dredging is retained as a potential remedial technology. As discussed above, dewatering of dredged sediments on the barge, followed by upland disposal of dewatered sediments will be assumed. Dredging is compared to capping and natural recovery technologies in Section 3.3.7.

3.3.5 Screening of Natural Recovery Technologies

3.3.5.1 Implementability

Processes of natural recovery do not require special technologies for implementation. However, the implementability of natural recovery as a remedial measure is dependent on site-specific conditions. At the Long Island LTF, physical processes of siltation, wood degradation, and wood dispersal have been documented to be occurring (Haggitt Consulting 2003). Thus, natural recovery is considered implementable for this LTF, and would likely consist of some combination of these processes (refer to Section 2.3).

3.3.5.2 Reliability

Natural recovery processes can be sensitive to continued environmental disturbance associated with natural phenomena (e.g., storms, floods), human influences (e.g., ship or barge traffic, prop scour), and continued operations of the LTF. Where past operational practices are modified to reduce or eliminate the amount of bark debris entering the water, the natural recovery alternative can be highly reliable, particularly where physical factors (e.g., sedimentation, erosion) facilitate the rate of recovery. Where decisions are made to implement natural recovery, an adaptive management plan, monitoring program, and contingency plan are developed to verify reliability of the approach and to implement corrective actions or alternative approaches if necessary. Natural recovery for Long Island is considered a reliable alternative because the amount of timber that will be handled at the site will decline to very low levels once the current LTF operating cycle ends in CY 2006 to 2009; and because natural processes of erosion, sedimentation, dispersion, and degradation are likely to effectively eliminate much of the existing debris, which will facilitate the rate of recovery.

The USFS is prepared to require that log volumes traversing the site (if any) after the current operating cycle ends in CY 2006 to 2009, be transferred from the land to barges, using the existing Long Island bulkhead or an improved bulkhead. The use of barging at the conclusion of the current operating period will substantially reduce the amount of bark and wood debris entering the water, and reduce the time required for natural recovery to reduce the area of continuous coverage to less than 1 acre and 10 cm in depth at any point.

3.3.5.3 Cost-effectiveness

Costs for the monitored natural recovery alternative based on an RAO using a physical endpoint as described in Section 3.1 would be limited to the costs for conducting annual diver surveys to ensure that the recovery milestones are being met.

For the Long Island LTF, the most likely approach would involve continued monitoring over several years using the same diver surveys of bark and wood debris coverage as have been conducted previously. Costs for this kind of approach would be in the range of $5,000 to $10,000 per survey (including out-of-water administrative costs) until the RAO was achieved. Assuming that milestone objectives can be demonstrated in three sampling events, cost for this kind of approach could be approximately $15,000 to $30,000. These costs could vary substantially depending on the actual rate of natural recovery (dispersion, decomposition, sedimentation). The remedial action objectives could be met with fewer sampling events, which would result in proportional cost savings or alternatively, additional monitoring events may be required which would result in a proportionate cost increase.

3.3.5.4 Short-term and Long-term Effectiveness of Natural Recovery

The natural recovery alternative would involve minor safety hazards to vessel and crew, scientific personnel, and divers during sampling. Other than collecting discrete sediment samples, the natural recovery approach is non-invasive and, therefore, will not cause short-term environmental impacts. Natural recovery will take longer than dredging or capping to reduce the area of continuous coverage. However, the net environmental benefit should not be diminished substantially in comparison with other alternatives (e.g., dredging) whose remedial action includes destruction of the existing benthic community. The natural recovery alternative should be effective in the long term assuming that the amount of timber that will be handled at the site will be much lower than in the past and that operational practices at the LTF are projected to greatly decrease the volume of timber and bark debris entering the water. Natural recovery processes anticipated for the site include continued degradation of wood debris by the invertebrate and microbial communities, dispersal of the finer degraded debris, and, possibly burial of coarser material by natural sedimentation.

3.3.5.5 Compliance with Federal and State Laws and Regulations, and the General Permit

FSM/Integral judge that the use of the monitored natural recovery as described above will result in a reduction in the continuous coverage of bark and wood debris to an area less than 1 acre in the Long Island LTF and will be compliant with federal and state laws and the General Permit.

3.3.5.6 Summary of the Results of Screening Process

Monitored natural recovery is retained. Natural recovery is compared to capping and dredging technologies in Section 3.3.7.

3.3.6 Mitigation

A number of mitigation alternatives were discussed in Section 3.2.5. FSM/Integral do not currently have enough information about local environmental and economic conditions to thoroughly evaluate this alternative. This alternative could be developed to provide positive net environmental benefits to the State of Alaska. This alternative can be developed in the future if Sealaska, HTC, the USFS, and ADEC wish to pursue this approach.

3.3.7 Comparison of Capping, Dredging, and Natural Recovery Technologies

The capping and dredging technologies discussed in Sections 3.3.3 and 3.3.4 directly reduce the area of continuous coverage by bark and wood debris at the time that the capping and dredging technologies are applied. The natural recovery approach is expected to achieve the same result, but over a longer time period.

3.3.7.1 Summary of Comparison

Dredging would provide both the greatest short-term impacts to the environment and the greatest long-term environmental benefit among the capping, dredging and natural recovery technologies. Although dredging could remove wood debris in the short-term, continued operation of the facility could add small amounts of wood debris to the bottom, which may effectively reverse or neutralize some or all of environmental benefits of wood debris removal. The long-term environmental benefit of dredging is high since it directly removes bark and wood debris from the marine environment, though the cost of dredging at the Long Island LTF is considerable, ranging from $320,000 to $520,000.

Capping would also provide short-term impacts to the environment. Capping would isolate the bark and wood debris by placing 1.5 feet of sand on top of the bark and wood debris (assuming that the shear strength of the bark and wood debris would allow this). The long-term environmental benefit of capping is judged to be less high than the benefit provided by dredging, since isolation of bark and wood debris is judged to be less permanent than the removal and dispersal of bark and wood debris. Capping wood debris would initially eradicate the benthic community, and would result in new substrate that could be re-colonized by benthic organisms. However, the new substrate is likely to differ in composition from the coarse native material in the vicinity of the LTF, and, therefore, would be likely to produce a benthic community that is dissimilar from that in the native material. Also, some or all of the environmental benefits of capping may be effectively neutralized by accrual of small amounts of wood debris during continued operations of the facility. Capping is expected to cost from $ 300,000 to $480,000 at the Long Island LTF.

Natural recovery, via continued decomposition, erosion, and dispersion of degraded material by marine currents, and possible localized siltation and burial of coarser material, is also expected to decrease the area of continuous coverage of bark and wood debris at the LTF. The time frame required for this to occur is expected to be in the 2- to 10-year range, once operations at the LTF cease in CY 2006 to 2009, although these processes may be effective following implementation of the additional BMPs selected in Section 3.3.2. The cost of implementing natural recovery is expected to be low when compared to the cost of dredging and capping.

The current timber market conditions and the marginal financial performance of the Long Island LTF (refer to Section 2.1.3) precludes the expenditure of from $ 300,000 to $500,000 during the remaining 3 years of the current LTF operating cycle or at the conclusion of this operating cycle. If these expenditures were required before the current operating cycle ends, the LTF would be shut down and the persons employed there would be laid off (Kleinhenz 2003d).

At the conclusion of the current operating cycle, only incidental quantities of wood will transit the LTF (refer to Section 2.1.4). The USFS will require that this wood be placed in barges, therefore, very little bark and wood debris is expected to enter the water. Dredging could still be implemented. Capping and natural recovery via localized siltation would both provide a new sediment cover for the bark and wood debris. The currents at the facility are also likely to disperse bark debris that remains uncovered by natural sedimentation. Capping would achieve this result immediately but at considerable cost. Natural recovery is expected to take approximately 2 to 10 years to reduce the area of continuous coverage to less than 1 acre, but at low cost. Since the next significant (more than 5 MMBF per year) operating cycle of the Long Island LTF is expected to be more than 2 to 10 years after the conclusion of the current operating cycle, natural recovery is selected as the approach to achieve the physical endpoint identified in the RAO (Kleinhenz 2003d).

3.4 DESCRIPTION OF THE PROPOSED REMEDY

The RAO selected for the Long Island LTF contains both an implementation and a physical endpoint (refer to Section 3.1). The initial focus will be on implementing additional BMPs to reduce to the maximum practicable extent the amount of bark and wood debris that can enter Port Frederick during the final 3- to 5-year operating cycle for this facility (refer to Section 2.1.4). It is expected that natural sedimentation and or dispersal provided by the currents in the area together with these additional BMPs will reduce the area of continuous coverage. The additional BMPs selected for implementation at the Long Island LTF include:

- Adding friction to the log skid so that log bundles must be pushed into the water.
- Adding a flat lay-down area at the top of the log skid to collect bark that is dislodged when the log bundles are placed on the skid.
- Add a breakwater around the rafting area to reduce turbulence when logs enter the water.
- Open log boom during the winter months to assist with the dispersal of bark that may be present in the rafting area.
- Clean the log entry area at periods of low tide.

At the conclusion of the current operating cycle, natural recovery processes including the natural sedimentation and/or dispersal provided by currents flowing from the east of the LTF are expected to reduce the area of continuous coverage to less than 1 acre within an approximate 2- to 10-year time frame.

3.5 EVALUATION OF THE PROPOSED REMEDY

3.5.1 Performance Evaluation Criteria

The proposed remedy for the Long Island LTF is the implementation of additional BMPs during the remaining 3 to 5 years of the current operating cycle and monitored natural recovery once the current operating cycle ends. This remedy is evaluated further in Sections 3.5.2 for the following factors in terms of the feasibility of application and effectiveness in achieving the short-term and longer-term goals of the RAO (refer to Section 3.1):

- Overall protection of the environment
- Implementability
- Reliability
- Compliance with laws, regulations, and other permits
- Effectiveness in achieving the RAO
- Time required to achieve the RAO
- Cost of implementation.

The considerations associated with each of these factors are similar to those listed in Section 3.3 for individual remedial technologies and are summarized below. These considerations must be assessed to comply with ADEC requirements.

- **Overall Protection of the Environment**. This evaluation criterion is used to measure how an alternative will eliminate or reduce adverse effects on the environment consistent with the use of the ZOD.

- **Implementability.** Includes the availability of the technology, the measure's constructability, logistical feasibility, and other technology-specific factors.
- **Reliability.** Includes the level and scale of technology development, performance record, and inherent construction, operation and maintenance issues. Technologies that are unreliable, perform poorly, or are not fully demonstrated should be eliminated.
- **Compliance.** Includes compliance with federal and state laws and regulations, and the GPs.
- **Effectiveness.** Includes effectiveness in achieving the RAO:
  - <u>Short-term impacts to the environment.</u> This criterion addresses the short-term risks to remediation workers and the impacts posed to the environment during implementation of an alternative, the potential effects on workers during the remedial action, the potential environmental effects of the remedial action, and the time until protection is achieved.
  - <u>Long-term impacts to the environment.</u> Alternatives are assessed for their long-term effectiveness along with the degree of certainty that they will be a successful and permanent solution. The assessment includes long-term reliability, the magnitude of residual impacts, the residuals remaining at the conclusion of the remedial activities, and the adequacy and reliability of controls such as containment systems and institutional controls.
- **Time required to Achieve RAO.** Includes the time expected for remediation to be completed is assessed. The time frame must be reasonable when considering
  1. The effects to the environment
  2. Practicability of achieving a shorter remediation time frame
  3. Current use of the site and the resources that may be impacted by releases from the site
  4. Potential future uses of the site, and the potential effects to resources that future releases from the site may cause
- **Cost of implementation.** This criterion addresses the costs associated with the alternative These should include:
  1. Direct capital costs (i.e., construction, equipment, land, services)
  2. Indirect capital costs (i.e., engineering, supplies, contingency)
  3. Long-term monitoring costs, operation and maintenance costs
  4. Total net present value of the alternative

3.5.2 Evaluation of BMPs and Monitored Natural Recovery Processes

3.5.2.1 Overall Protection of the Environment

The combination of additional BMPs and natural recovery will create a new habitat for the benthic organisms and minimize the future deposition of bark and wood debris on the sediments during the remaining 3 to 5 years of the current operating cycle of the LTF. Natural recovery processes, due to deposition and/or dispersal of sediments by currents from the east of the LTF, are expected to continue in the future and become more effective once operations at the LTF cease in CY 2006 to 2009. This alternative is expected to achieve the implementation endpoint of the RAO rapidly and the physical endpoint of the RAO within 2 to 10 years, once operations at the LTF cease in CY 2006 to 2009.

3.5.2.2 Implementability

BMPs for Pre-1985 and Post-1985 LTFs, which were developed by ATTF are considered implementable as discussed in Section 3.3.1.1. Additional BMPs for future use at the Long Island LTF (discussed in Section 3.3.2) are also anticipated to be implementable.

Processes of natural recovery do not require special technologies for implementation.

3.5.2.3 Reliability

The combination of BMPs and monitored natural recovery is considered a reliable alternative for the Long Island LTF. The BMPs anticipated for future use at Long Island have been demonstrated to be effective at other LTFs in Alaska. These BMPs would help control, but not eliminate future bark deposition during the remaining years of the current operating cycle. The future use of the Long Island LTF is projected to be much less than in the past (refer to Section 2.1.4). This reduced future use and the USFS requirement that future operators use barging as the log transfer method, will significantly limit the amount of bark deposition. Natural recovery is already occurring at Long Island LTF (refer to Section 2.3), as documented in recent dive surveys (Diversified Diving Service 2002; Haggitt Consulting 2003). The surveys documented both the deposition of sediment provided by currents flowing from the east of the LTF and the erosion, dispersion and decomposition of bark and wood debris. Natural recovery is therefore considered a reliable alternative for Long Island for the following reasons:

- The amount of timber that will be handled at the site in the future will be much less than in the past. The current operating cycle is expected to end in CY 2006 to 2009.
- The operational practices (additional BMPs) at the LTF are projected to greatly decrease the volume of bark and wood debris entering the water during the remaining period of this operating cycle
- The ongoing natural recovery processes (siltation, dispersion, erosion, decomposition) processes will continue to reduce the area of continuous coverage of bark debris.
- The USFS requirement that future operators use barging as the log transfer method will reduce the time frame necessary for the bark coverage to decline to less than 1 acre.

Natural recovery processes can be sensitive to continued environmental disturbance associated with natural phenomena (e.g., storms, floods), human influences (e.g., ship or barge traffic, prop scour), and continued operations of the LTF. Dive surveys will continue to be conducted at the LTF to identify the area of continuous coverage by bark. These surveys will measure the effects of these natural phenomena (if any), and the effects of the future operations at the site.

3.5.2.4 Compliance with Federal and State Laws and Regulations, and the General Permit

The BMPs comply with all state and federal laws and regulations and GPs. The additional BMPs that will be put in place at the Long Island LTF will comply with the implementation endpoint established by the RAO for the Long Island LTF during the remaining period of the current operating cycle.

The continued use of the monitored natural recovery processes occurring at the site together with the implementation of the proposed BMPs will reduce the quantity of the new bark coverage at the LTF during the current operating cycle, and allow the area of continuous coverage by bark to decline once the current operating cycle ends. This outcome will comply with the physical endpoint established for the LTF once the current operating cycle ends.

3.5.2.5 Effectiveness in Achieving the RAO

The short-term effectiveness of combining BMPs with natural recovery is judged to be high at the Long Island LTF. Overall, there is little additional risk to site workers. During monitoring of natural recovery, there are minor safety hazards to vessel and crew, scientific personnel, and divers during sampling. Other than collecting discrete sediment samples, the natural recovery approach is non-invasive and, therefore, will not cause short-term environmental impacts.

The long-term effectiveness of combining BMPs with natural recovery relies upon the rate at which sediments deposited by currents from the east bury the bark and wood debris or the rate at which other ongoing erosion, dispersal, and decomposition processes continue and the degree of compliance with BMPs that is achieved during the current operating cycle. Dive surveys will be conducted to measure the area of continuous bark coverage over time. These surveys will define the relationship between LTF operating practices and the natural recovery processes (during the current operating cycle) and natural recovery processes alone once the current operating cycle ends.

3.5.2.6 Time Required to Achieve the RAO

The implementation of additional BMPs (refer to Section 3.3.2) will be complete within 5 months of ADEC's approval of this remediation plan (Kleinhenz 2003d). This implementation confirmed by appropriate quality control procedures, will achieve the implementation endpoint specified in the RAO.

Once the current operating cycle ends, it is expected to take 2 to 10 years for the natural recovery processes at the LTF to reduce the area of continuous coverage to less than 1-acre. Dive surveys will be used to monitor progress.

3.5.2.7 Cost of Implementation

The additional BMPs selected for implementation at the Long Island LTF include:

- Adding friction to the log skid so that log bundles must be pushed into the water.

- Adding a flat lay-down area at the top of the log skid to collect bark that is dislodged when the log bundles are placed on the skid.
- Add a breakwater around the rafting area to reduce turbulence when logs enter the water.
- Open log boom during the winter months to assist with the dispersal of bark that may be present in the rafting area.

The cost associated with the implementation of these BMPs at the Long Island LTF is expected to total approximately $40,000. The main costs for the monitored natural recovery (natural sedimentation) alternative would be associated with monitoring the natural recovery processes. Monitoring would involve annual dive surveys, which would cost from $5,000 to $10,000 each (including out-of-water administrative costs).

3.5.2.8 Summary of Evaluation of the Proposed Remediation Alternative

The proposed remedy combines the use of additional BMPs and natural recovery (erosion, dispersal, decomposition, sedimentation) to reduce the existing continuous bark and wood debris coverage and to minimize new bark deposition during future operation at Long Island LTF. The BMPs and natural recovery alternative is considered implementable, as this alternative does not require any untested technologies for implementation. BMPs have been found to be effective in reducing bark deposition at other LTFs in Alaska (refer to Section 3.3.2). Natural recovery is also considered reliable since these processes have the potential to reduce the existing bark coverage. This alternative would comply with federal and state laws and the GPs. The short-term effectiveness of this alternative is high, since BMPs can be implemented rapidly.

There is little additional risk to site workers during the implementation of this alternative. Only minor risks would be present during monitoring (dive surveys) of natural recovery. The long-term effectiveness is dependent on the rate of the natural recovery processes. The majority of the costs would be involved in implementing the BMPs.

3.6 PROPOSED REMEDIATION PLAN

This entire document comprises the remediation plan for the Long Island LTF. The site conditions present at the LTF are discussed in Section 2. The preferred remediation alternative is the implementation of additional BMPs and monitored natural recovery. The BMPs envisioned are described in Section 3.3.2. Monitored natural recovery processes are discussed in Section 3.2.3. The proposed remediation alternative is described in detail in Section 3.4. The additional BMPs and monitored natural recovery will achieve both the implementation and physical endpoints in the RAO that has been established for the Long Island LTF (Section 3.1).

3.6.1 How Will BMPs and Monitored Natural Recovery Achieve the RAO?

The RAO includes both a short-term implementation endpoint and a longer-term physical endpoint. Dive surveys conducted in accordance with ADEC Guidance will be used as the performance measure for the preferred alternative. Annual dive surveys will be conducted until log transfer operations cease at the LTF. The annual surveys will ensure that the combination of enhanced BMPs and natural recovery processes are sufficient to begin to reduce the area of continuous bark coverage to values less than 3.5 acres. Bi-annual surveys will be conducted at the LTF at the conclusion of the current operating cycle to monitor the continued progress of the natural recovery processes present at the site until the area of continuous bark coverage has decreased to less than 1 acre.

3.6.2 Description of the Monitoring Program

For the Long Island LTF, the most likely monitoring approach would involve continued periodic monitoring over several years using the same type of dive surveys of bark and wood debris coverage as have been conducted previously (Haggitt Consulting 2003). A quality control plan (QCP) will be developed to ensure that existing BMPs and the additional BMPs proposed in this remediation plan are implemented as required by the operating permit for the Long Island LTF. Progress of the natural recovery process will be monitored by bi-annual dive surveys conducted in accordance with ADEC Guidance. Annual dive surveys will be conducted until log transfer operations cease at the end of the current operating cycle at the LTF. The annual surveys will ensure that the combination of enhanced BMPs and natural recovery processes are sufficient to reduce the area of continuous bark coverage as this operating cycle concludes.

3.6.2.1 Contingency Plan if the RAO is Not Achieved

The Contingency Plan will describe how ADEC and Sealaska, HTC, and the USFS will implement a contingency planning process should either the additional BMPs or the natural recovery alternative not perform as expected. Progress towards the RAO would be judged on specific milestones that could be met through a natural recovery alternative. If progress towards these milestones is absent or slow, then several measures may be taken to help achieve the RAO objectives. An assessment of compliance with and effectiveness of BMPs could be completed first, providing information valuable to determine what additional measures might help achieve the RAO. This could include monitoring of LTF operations to determine specific sources of bark deposition. Also, additional monitoring may be required to verify that the rate of sedimentation, erosion, dispersal, or decomposition is sufficient to facilitate natural recovery within the timeframe selected for recovery.

***Additional remediation measures to achieve the RAO*.** Enhanced monitoring of LTF operations and discussions with the LTF Operator could increase compliance with BMPs that are not being followed. An education system for LTF workers could help ensure BMPs are followed. Identified sources of bark debris could be addressed with new BMPs. Several options are available if natural recovery processes are present but occurring too slowly. One option would be to document progress towards the recovery milestone and extend the expected date of recovery. Another option would be to facilitate the natural recovery process through an alternative approach.

Additional remediation alternative if additional measures do not work. If education of operators and new BMPs are not effective enough to accomplish the RAO, additional measures could include dredging, capping, or limits on board feet transferred to water at the site. If BMPs are sufficient, but the rate of recovery is too slow, a thin-layer capping approach with compatible material could be used to facilitate recovery of the sea floor to a more natural state.

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Long Island
Log Transfer Facility

Remediation Plan

Tables

Table 2.1
Summary of Areal Cover (acres) by Bark Debris in the Vicinity of the Long Island LTF

Survey Year	Transect Method	Survey Area	Continuous Cover	Discontinuous Cover
2000	Radial	4.4	2.9	1.4
	Parallel	16.5	--[a]	--
	Combined	20.9	2.9	1.4
2001	Parallel	13.1	4.8	8.3
2002 – March	Parallel	9.3	5.5	2.5
2002 – December	Parallel	8.4	3.5	4.9

Notes

a There was no area of contiguous 100 percent cover between the parallel transects.

Sources: Sempert (2000a,b;2001), Haggitt Consulting (2003); Diversified Diving Service (2002)

Table 3.1
Advantages and Disadvantages of Potential BMPs

BMP	Advantages	Disadvantages
Mechanical Debarking	• Minimal bark is present on the logs after processing, therefore minimal bark will enter the water. • The volume and weight of each log will be reduced allowing for a greater number of logs to be placed on each ship.	• Logs must be debarked before they are bundled, this will cause an increase in manpower and time necessary to prepare the logs for sale. • Significant capital costs. • Requires the use of an on-site diesel generator. Generator has air emissions and requires diesel fuel and diesel storage. Significant operating costs (fuel, maintenance, labor) are associated with this. • The removed bark must be disposed of properly. • This method has been tried in Southeast Alaska and has been discontinued. Problems such as leaching of tannins and potential fire danger resulting when the bark removed is placed in a rock pit or landfill have come to light (Chittenden 2003).
Hydraulic Debarking	• Minimal bark is present on the logs after processing, therefore minimal bark will enter the water. • The volume and weight of the logs will be reduced allowing for a greater number of logs to be placed on each ship.	• Requires significant amounts of manpower for each log. • Time to prepare logs for sale will increase. • Runoff from high-pressure hoses will have to be contained and possibly treated and disposed. • Requires the use of an on-site diesel generator. Generator has air emissions and requires diesel fuel and diesel storage. Significant operating costs (fuel, maintenance, labor) are associated with this. • The removed bark must be disposed of properly. • Problems such as leaching of tannins and potential fire danger resulting when the bark removed is placed in a rock pit or landfill have come to light (Chittenden 2003).

BMP	**Advantages**	**Disadvantages**
Barging Using a New Bulkhead	• Barging would eliminate or reduce the amount of time logs spent in the water and eliminate or reduce the amount of bark and wood debris entering the water. • A backhoe or similar equipment could be used to clean bark and wood debris from water near bulkhead. • The existing ramp or road to the existing bulkhead could be used.	• Capital costs for a new Native Log Stringer (NLS) Split Level bulkhead would be between $200,000 and $250,000 and the bulkhead would need to be replaced every 15 years. A new concrete split-level bulkhead would cost approximately $325,000 to $375,000 (Dunham 2003). • Barging could reduce stevedoring jobs associated with the operation of the LTF. • For every log sort, the upland sort yard storage area will need to be large enough to store one barge load per sort type (to reduce processing costs). Sealaska asserts that this facility's sort yard staging area is not large enough to accommodate this type of storage capacity. (Kleinhenz 2003c) • Sealaska judges that it is more operationally and economically feasible to sort the logs into bundles and place them into the receiving water where they can be rafted by similar sort types (Kleinhenz 2003c). * According to Sealaska, storing bundles in rafts on the tidelands makes it more feasible to market individual log bundles to customers. Many times, customers like to individually inspect and select the logs they are purchasing. If the logs were stored on a barge instead of the tidelands, it would be more difficult to market the product to customers (Kleinhenz 2003c). * Sealaska asserts that it costs approximately $15,000 - $20,000 per day to have the ship wait in the mooring spot (Notice of Intent). The extra time needed to load the ship from a barge would ultimately make the ship loading operation difficult and economically infeasible (Kleinhenz 2003c). • The transfer of logs from the barge to the ship increases safety issues for workers, as two large metal vessels must be adjacent to each other for extended periods of time.

BMP	**Advantages**	**Disadvantages**

Barging Using the Existing Bulkhead	• Barging would eliminate or reduce the amount of time logs spent in the water and eliminate or reduce amount of bark and wood debris entering the water.
	• A backhoe or similar equipment to clean bark and wood debris from water near bulkhead.
	• A new bulkhead would not have to be constructed.
	• The existing ramp or road to the existing bulkhead could be used.
		• Modifications will be necessary at the existing bulkhead.
		• Only ramp-type barges could be used at this bulkhead.
		• Barging would reduce stevedoring jobs and could hurt the Hoonah economy.
		• For every log sort, the upland sort yard storage area will need to be large enough to store one barge load per sort type. Sealaska asserts that this facility's sort yard staging area is not large enough to accommodate this type of storage capacity (Kleinhenz 2003c).
		• Sealaska judges that it is more operationally and economically feasible to sort the logs into bundles and place them into the receiving water where they can be rafted by similar sort types (Kleinhenz 2003c).
		  ∗ According to Sealaska, storing bundles in rafts on the tidelands makes it more feasible to market individual log bundles to customers. Many times, customers like to individually inspect and select the logs they are purchasing. If the logs were stored on a barge instead of the tidelands, it would be more difficult to market the product to customers (Kleinhenz 2003c).
		  ∗ Sealaska asserts that it costs approximately $15,000 - $20,000 per day to have the ship wait in the mooring spot (Notice of Intent). The extra time needed to load the ship from a barge would ultimately make the ship loading operation difficult and economically infeasible (Kleinhenz 2003c).
		• The transfer of logs from the barge to the ship increases safety issues for workers, as two large metal vessels must be adjacent to each other for extended periods of time.

BMP	Advantages	Disadvantages
Barging Without a Bulkhead	• Barging would eliminate or reduce the amount of time logs spent in the water and eliminate or reduce amount of bark and wood debris entering the water. • A new bulkhead would not have to be constructed or the existing bulkhead would not have to be repaired. • The existing ramp or road to the existing bulkhead may be used.	• Modifications may be necessary to the existing ramp or road to the existing bulkhead to be able to handle loading of barge. • Barging would reduce stevedoring jobs and could hurt the Hoonah economy. • For every log sort, the upland sort yard storage area will need to be large enough to store one barge load per sort type. Sealaska asserts that this facility's sort yard staging area is not large enough to accommodate this type of storage capacity (Kleinhenz 2003c). • Sealaska judges that it is more operationally and economically feasible to sort the logs into bundles and place them into the receiving water where they can be rafted by similar sort types (Kleinhenz 2003c). ∗ According to Sealaska, storing bundles in rafts on the tidelands makes it more feasible to market individual log bundles to customers. Many times, customers like to individually inspect and select the logs they are purchasing. If the logs were stored on a barge instead of the tidelands, it would be more difficult to market the product to customers (Kleinhenz 2003c). ∗ Sealaska asserts that it costs approximately $15,000 - $20,000 per day to have the ship wait in the mooring spot (Notice of Intent). The extra time needed to load the ship from a barge would ultimately make the ship loading operation difficult and economically infeasible (Kleinhenz 2003c). • The transfer of logs from the barge to the ship increases safety issues for workers, as two large metal vessels must be adjacent to each other for extended periods of time.
Add Enough Friction to Require Pushing to Put Logs in Water	• The entry velocity would be decreased and bark loss as logs enter water would decline. • Less expensive capital costs for installation and maintenance than other moderately effective alternatives.	• No datum is available that would prove that this BMP would consistently reduce the entry velocity to less than 3 feet per second. • Cycle time of placing logs in water may increase. Bundles will require pushing and more oversight by loader operator to ensure they enter water. • Degradation of drive-down portion of ramp. Heavy machines will use a portion of the ramp on each cycle to push bundles down.

BMP	**Advantages**	**Disadvantages**
Adjust Grade of Log Skid: Extend Log Skid Further Back into Land	• The entry velocity would be decreased and bark loss would be expected to decline. • Potentially avoids in-water permitting issues associated with the rebuilding of the ramp. • The existing rails could be re-used; additional rails may be necessary due to increased length.	• Construction costs judged to be moderate to high. • Potentially reduces the upland area available for storing log bundles. • No datum is available that would prove that this BMP would reduce the entry velocity to less than 3 feet per second. • Cycle time of placing logs in water may increase. Bundles would have a longer way to travel to enter water. Bundles may require more pushing and more oversight by loader operator than is currently required to ensure they enter water. • May require modification of existing stormwater system due to upland grade change.
Adjust Grade of Log Skid: Extend Log Skid Further into Bay	• The entry velocity would be decreased and bark loss would be expected to decline. • The existing rails could be re-used; additional rails may be necessary due to increased length.	• Construction costs judged to be moderate to high. • In-water permitting will be required. • No datum is available that would prove that this BMP would reduce the entry velocity to less than 3 feet per second. • Cycle time of placing logs in water may increase. Bundles would have a longer way to travel to enter water. Bundles may require more pushing and more oversight by loader operator than is currently required to ensure they enter water.
Build New Log Skid with In-water Ends that Float	• The entry velocity may be decreased and bark loss would decline.	• The amount of timber that could be loaded onto the rails may be reduced since the bundles may not move down ramp until periods of low tide. This may restrict the amount of log bundles that can be put on the ramp during periods of high tide. • Capital costs to build new rails may be high. • In-water permitting may be required. • No datum is available that would prove that this BMP would reduce the entry velocity to less than 3 feet per second. • This is a new approach and has never been attempted in Southeast Alaska.

BMP	**Advantages**	**Disadvantages**
Modify Existing Ramp to Allow Drive-down of Log Bundles to Water	• The entry velocity could be controlled by the loader operator and could be consistently less than 3 feet per second. • Bark loss would be reduced since minimized agitation would occur from logs entering water. • Relatively inexpensive capital costs if the existing ramp does not have to be redesigned and re-constructed.	• The existing ramp may need to be modified, e.g. addition of skids, grade change, paving, the addition of nets, or the addition of floats, or the addition of shot rock. Any change to the ramp could involve significant changes to the upland sort yard. Changing the ramp grade would require lowering the sort yard elevation and subsequently defeat the nearby sumps and drainage structures (Kleinhenz 2003c). • Cycle time will increase since the loader may have to travel further and lower the bundles at a slower rate than is currently used. • In-water permitting may be required if modifications to the in-water end of the ramp are needed.
Build New Ramp without Log Skids	• The entry velocity would be controlled by the loader operators and could be consistently less than 3 feet per second. • Bark loss would be minimized since minimal agitation would occur from logs entering water.	• Initial capital investment judged to be high. • In-water permitting may be required. • Cycle time could increase since the loader may have to travel further and lower the bundles at a slower rate than is currently used.
Use Crane to Move Bundles	• The entry velocity would be controlled by the crane operator and could be constantly less than 3 feet per second. • Bark loss would be reduced since minimal agitation would occur from logs entering water.	• An A-frame crane would have to be purchased (large initial capital costs). • A new bulkhead will have to be built or the existing bulkhead will have to be modified to support the A-frame. This is a large capital investment. • Loaders would still have to bring bundles to crane and then the crane would have to transfer the bundle from the bulkhead to the water. This will increase the cycle time of the log transfer.

BMP	Advantages	Disadvantages
Use Helicopter to Move Bundles	• The entry velocity would be controlled by the helicopter operator and could be controlled at less than 3 feet per second. • Bark loss may occur on land during preparation for transport of logs by helicopter and reduce the amount of bark loss in water.	• Costs of helicopter operation are high, health and safety risks to employees increase. • Cycle time may greatly increase due to large amount of time required for connection of bundles to helicopter. • Not presently used to move sort yard sized log bundles
Build Conveyor Belt	• The entry velocity would be controlled by the conveyor belt and would be constantly less than 3 feet per second. • Minimal bark loss would occur due to reduced entry velocities • Cycle time could decrease since loader would place logs on belt and belt would lower the bundles without assistance from loader.	• Capital costs could be high. • This technology has not been used in this area before and no datum can be found to prove its effectiveness. • Maintenance on system may be high due to inclement weather conditions in this area.
Place Bundles on Tideland	• Log bundle entry velocity would be eliminated reducing associated bark loss • This can be used in conjunction with drive down methods	• Quantity of logs deposited in water may be reduced depending on how much tideland is available at low tide. • A new ramp may have to be constructed to allow loaders to drive down into tideland. • Bark loss may increase depending on magnitude of wave action at entry point.
Use Dry Dock System	• Entry velocity would be controlled reducing associated bark loss	• Initial capital cost would be very high, similar to a new bulkhead, possibly more. • This technology has not been used in this area before and no datum can be found proving its effectiveness. • Cycle time to transfer log bundle from sort yard to water and return for another log bundle would increase depending on how large the dry dock is.

BMP	Advantages	Disadvantages
Endless Chain	• Entry velocity would be controlled by machine to be less than 3 feet per second. This velocity can result in minimal bark loss upon entry to water. • Ramps can be at steeper grades since the rate of entry is controlled by the machine. • Cycle time to transfer log bundle from sort yard to water and return to sort yard may be reduced, the loader has to place the bundle and the machine will lower the bundle on its own.	• Expensive to install and maintain (Doig 2003a; Kleinhenz 2003c) • May require lots of maintenance, after every sale the chains need to be removed and stored in grease (Chittenden 2003). • Log bundles do not always remain on chain and may roll down and enter water at greater than design velocities.
Clean Log Entry Area at Periods of Low Tide	• Minimal cost associated with this BMP. • Bark accumulation would be reduced.	• Manpower and time would have to be taken to clean area. • Additional permitting for “dredging” may be necessary. • Large cobbles located in the log entry area will reduce the effectiveness of this BMP.
Use Backhoe to Remove Bark at Low Subtidal Depths	• Bark accumulation would be reduced. • Minimal maintenance associated with periodic cleaning.	• Bundle deposition would have to cease while backhoe is in operation • A drive down ramp is required. • Additional permitting for “dredging” may be necessary. • Large cobbles located in the log entry area will reduce the effectiveness of this BMP.
Use Net to Capture Bark Debris between Skids or below Low Rafting Area	• Bark would be prevented from accumulating on seafloor. • It would not affect current operations.	• This technology has not been used in Southeast Alaska before, and no datum can be found proving its effectiveness. • Operation and maintenance of this BMP may prove difficult and costly. It may require divers and increase the health and safety risks of LTF employees. • Costs are unknown for this technology.

BMP	Advantages	Disadvantages
Seasonal Variations	• Bark would be prevented from accumulating on seafloor.	• Most log sales are conducted according to the market requirements. Planning movement of logs according to the seasons will be detrimental to business. • Effective operating season is already limited due to the “herring window” of April 15 to May 31 of each year (Kleinhenz 2003c).
Add Breakwater Around Log Bundle Entry Area	• Relatively low cost and readily implementable. • Wave action at log bundle discharge point would be reduced.	• Contribution of bark deposition from log agitation in the rafting area may not be large and the benefit from preventing this, therefore, may not be large. • Effectiveness of BMP relies on indirect effects (reducing wave action, which may reduce bark accumulation under the rafting area).
Open Rafting Area Log Boom During Winter Months	• Dispersal of some bark accumulated on the seafloor may occur. • Low cost and readily implementable.	• Can only be implemented seasonally and when no or a few log rafts are present. • Increase of turbulence at the surface may not increase currents at the bottom locations where bark debris accumulates. • The BMP would disperse already accumulated bark (i.e., it is not a preventative practice).
Add Bundle Lay-down Area at Top of Skids	• Relatively low cost • More practical location to collect bark dislodged when bundles are placed on the skids.	• Adjustment to site drainage may be required. • Potential increase in bundle transfer to water cycle time.
Provide Wear Surface Between Skids	• Eases collection of bark dislodged on the skids. • Reduces wear on ramp subgrade.	• Does not address structural strength issues related to the existing ramp. • Low to moderate cost.

Table 3.2
ROM Cost Estimate for Capping

Cost Element	Estimated Quantity	Estimated Unit Price	Estimated Cost	Key Assumptions
Mobilization/Demobilization	1	Lump Sum	$20,000	Barge, dredge available in Southeast Alaska
Pre/Post Dredging Surveys	1	Lump Sum	$20,000	Chemical/biological survey not required
Capping	6,050 cy	$30 – $60/cy	$180,000 – $360,000	2.5 acres capped to 1.5 feet, sand manufactured on-site or imported by barge
Engineering Design	1	Lump Sum	$20,000	Includes work plans, specifications, drawings
Environmental Project Management	1	Lump Sum	$40,000	Includes management plans (SAP, QAPP, HASP), permitting
Construction Management	1	Lump Sum	$20,000	On-site coordination, QC
		Total	$300,000 – $480,000	

Notes:

cy cubic yards
ROM rough order of magnitude (± 25 percent)

Table 3.3
ROM Cost Estimate for Mechanical Dredging

Cost Element	Estimated Quantity	Estimated Unit Price	Estimated Cost	Key Assumptions
Mobilization/Demobilization	1	Lump Sum	$20,000	Barge, dredge available in Southeast Alaska
Pre/Post Dredging Surveys	1	Lump Sum	$20,000	Chemical/biological survey not required
Dredging	8,066 cy	$10 – $15/cy	$80,000 – $120,000	2.5 acres dredged to depth of 2 feet
Off-load to Shore	8,066 cy	$10 – $15/cy	$80,000 – $120,000	1 acre dredged to depth of 2 feet
Dewatering	8,066 cy	$0 – $10/cy	$0 – $80,000	No cost if dewatering on barge is effective
Transport and Disposal	8,066 cy	$5 – $10/cy	$40,000 – $80,000	Rock pit available in Long Island vicinity
Engineering Design	1	Lump Sum	$20,000	Includes work plans, specifications, drawings
Environmental Project Management	1	Lump Sum	$40,000	Includes management plans (SAP, QAPP, HASP), permitting
Construction Management	1	Lump Sum	$20, 000	On-site coordination, QC
		Total	$320,000 – $520,000	

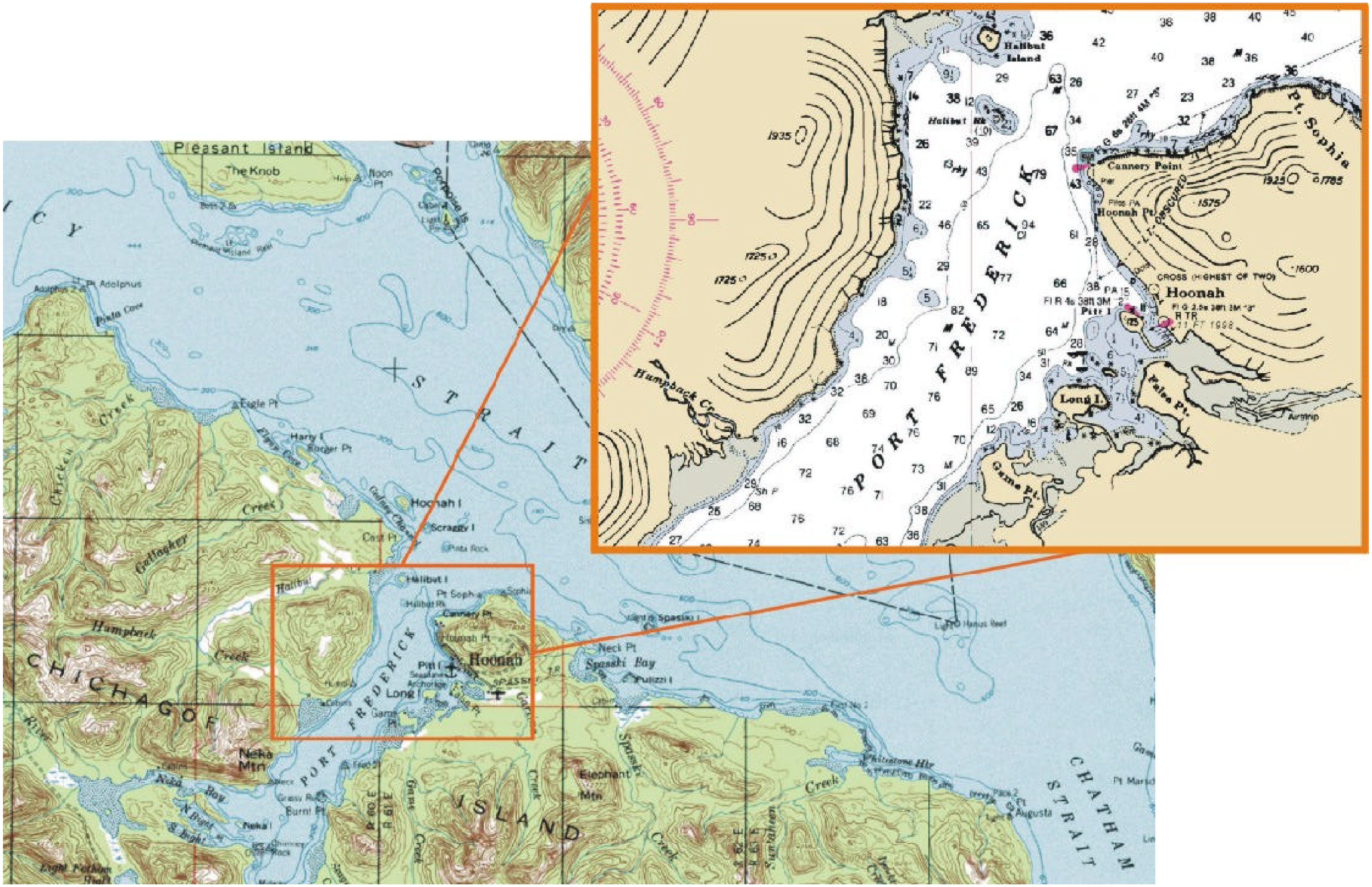
Notes:

cy cubic yards
ROM rough order of magnitude (± 25 percent)

Long Island
Log Transfer Facility

Remediation Plan

Figures



Source: Brian Kleinhenz, Sealaska

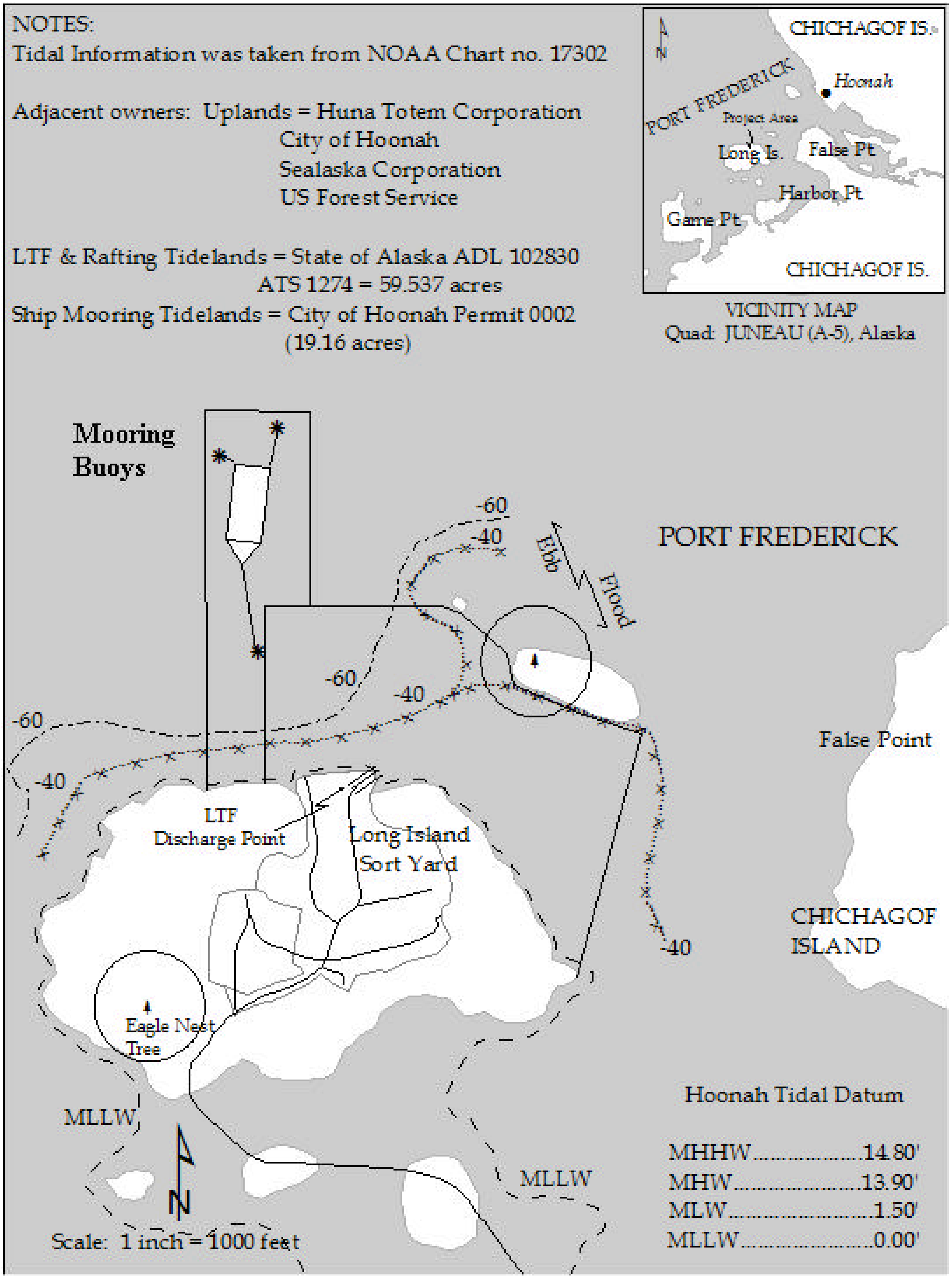
Floyd Snider McCarthy, Inc.	**Long Island** **Log Transfer Facility**	Figure 1.1 Port Frederick and Local Bathymetry in the Vicinity of the Long Island LTF

Source: Whitestone Logging Company (2000)

Floyd Snider McCarthy, Inc.

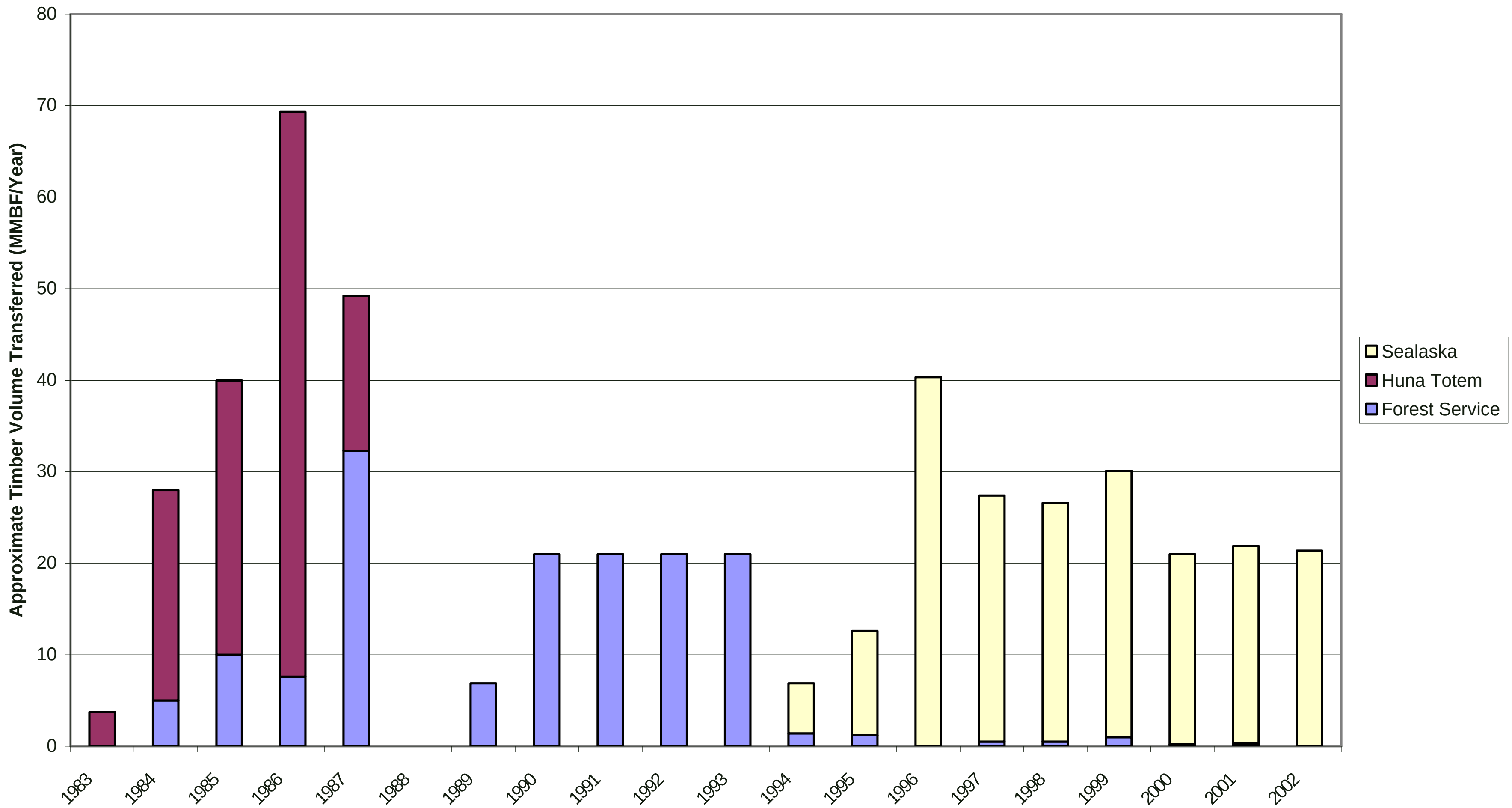
Long Island
Log Transfer Facility

Figure 2.1
Aerial Photo of Facility



Source: Brian Kleinhenz, Sealaska

Floyd Snider McCarthy, Inc.	**Long Island Log Transfer Facility**	Figure 2.2 Plan View and Vicinity Map



Source: Dunham 2003, Doig 2003b

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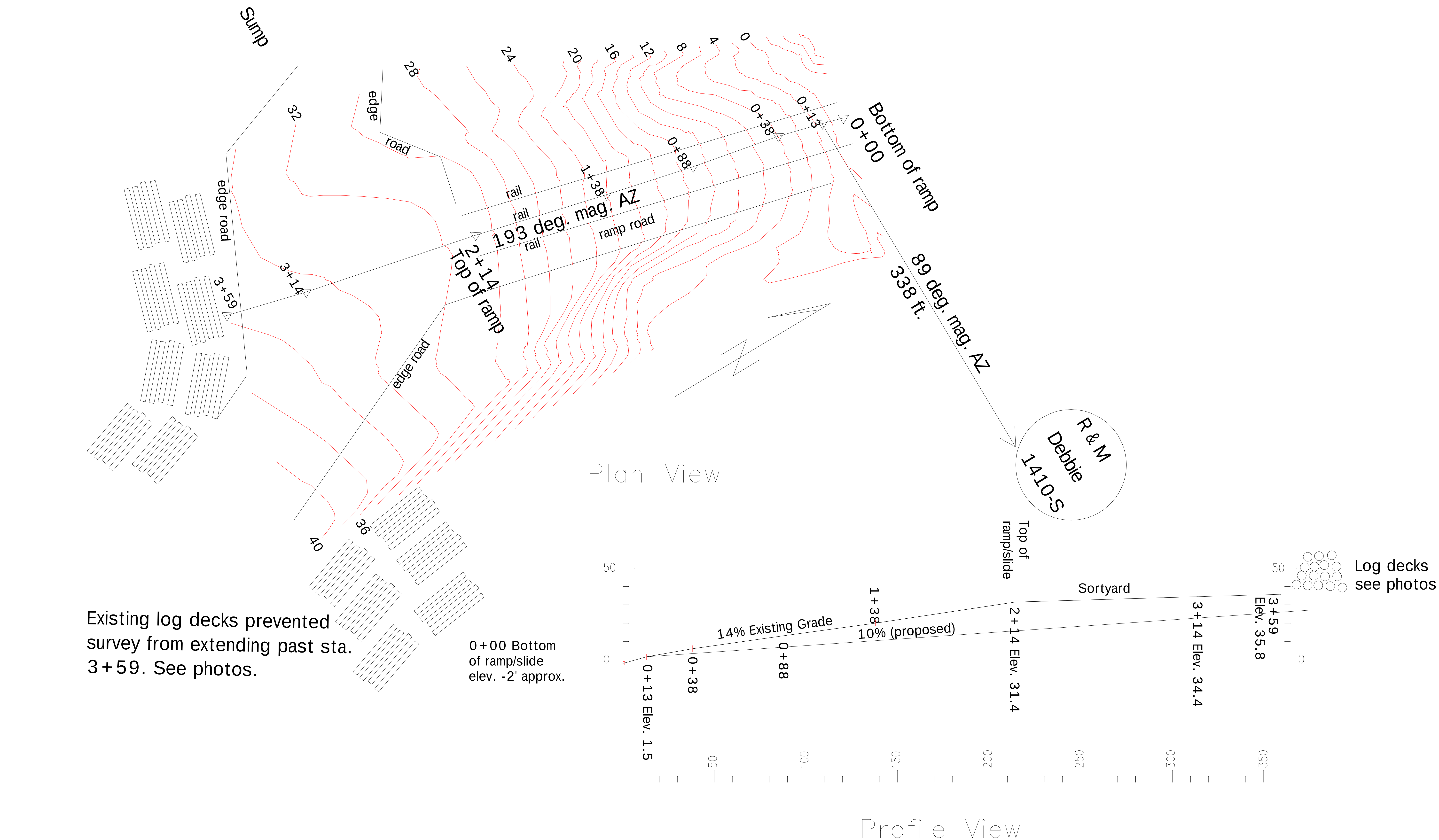
Long Island
Log Transfer Facility

Figure 2.3
Approximate Timber Volume Transferred
Over the Long Island LTF 1982 to 2002



Floyd Snider McCarthy, Inc.
Strategy & Technical Solutions for Contaminated Properties

Long Island
Log Transfer Facility

Figure 2.4
As-built Drawing of Long Island LTF Log Skid Ramp
Source: TONGASS Engineering & Recreation

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Long Island
Log Transfer Facility

Figure 2.5
Photo of Log Skid
June 2003

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Long Island
Log Transfer Facility

Figure 2.6
Photo of Bulkhead
June 2003

Source: www.t&cbarges.com

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Long Island
Log Transfer Facility

Figure 2.7
Photo of Log Barge – Ocean Bear

Source: Brian Kleinhenz, Sealaska

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Log Transfer Facility

Figure 2.8
Drainage and Current Operation of the Log Yard

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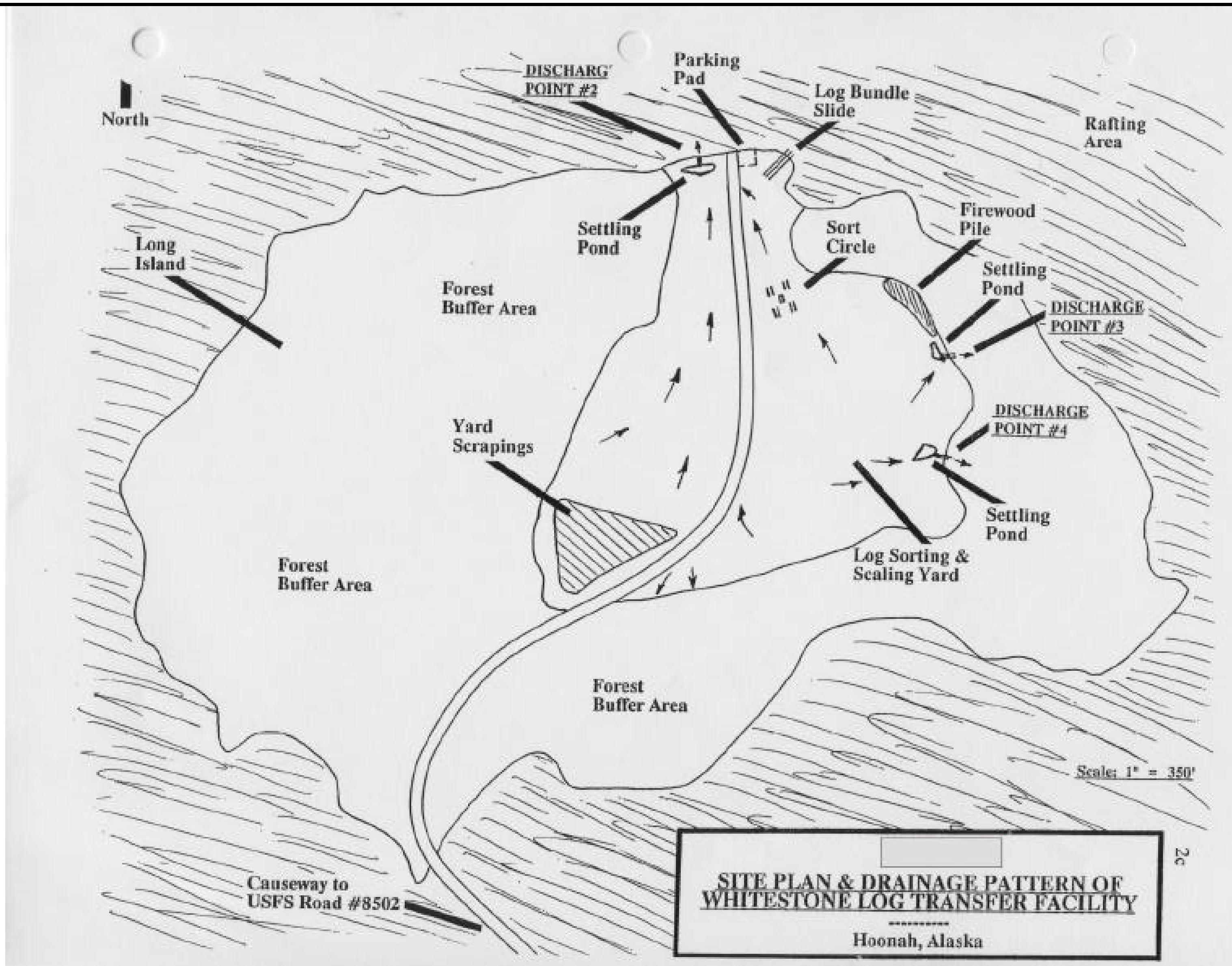
Long Island
Log Transfer Facility

Figure 2.9
Current Photo of Sort Yard
June 2003



Source: Brian Kleinhenz, Sealaska

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Log Transfer Facility

Figure 2.10
Sort Yard Prior to 1998

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Log Transfer Facility

Figure 2.11
Photo of Log Rafting Areas
June 2003

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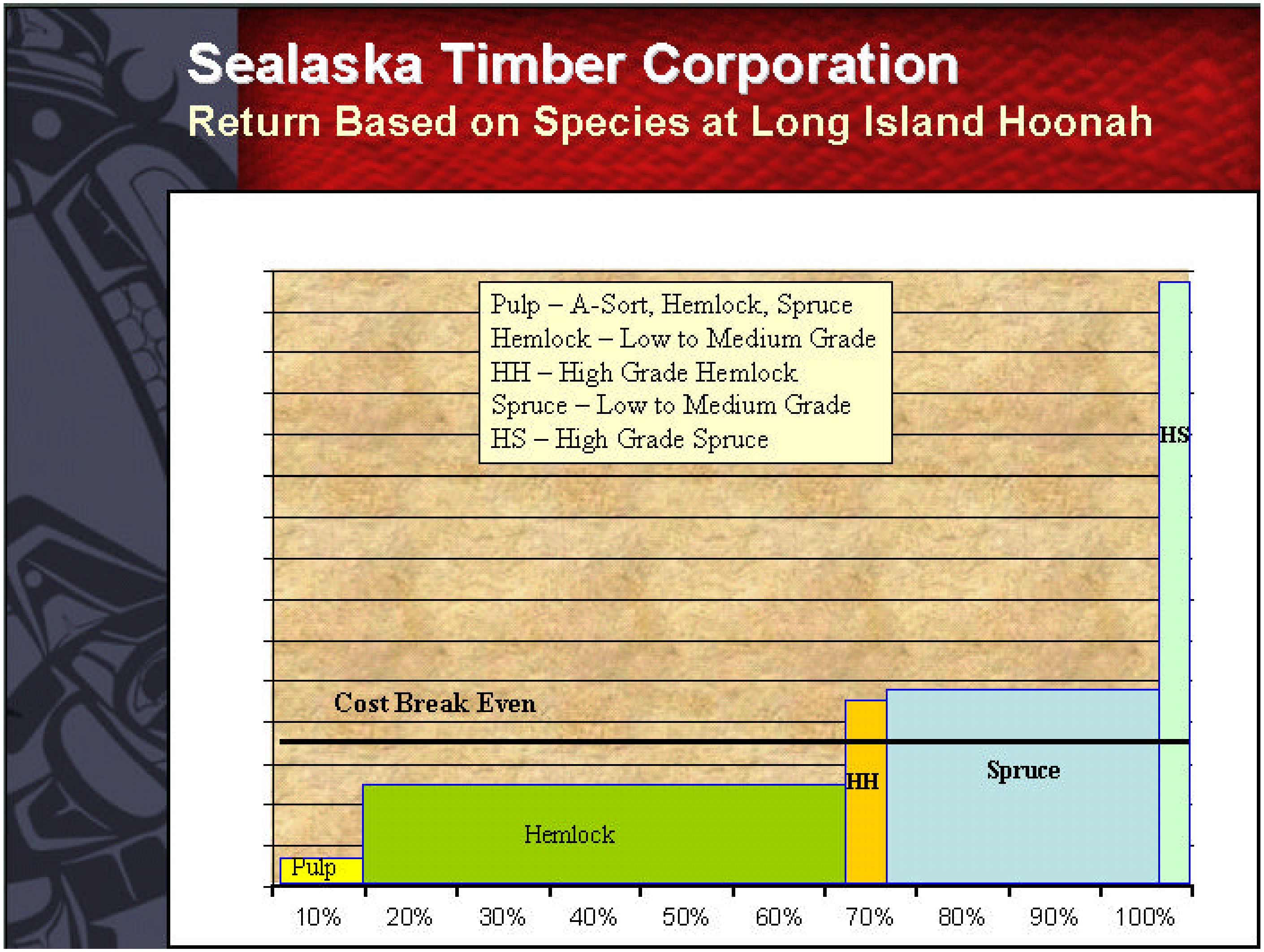
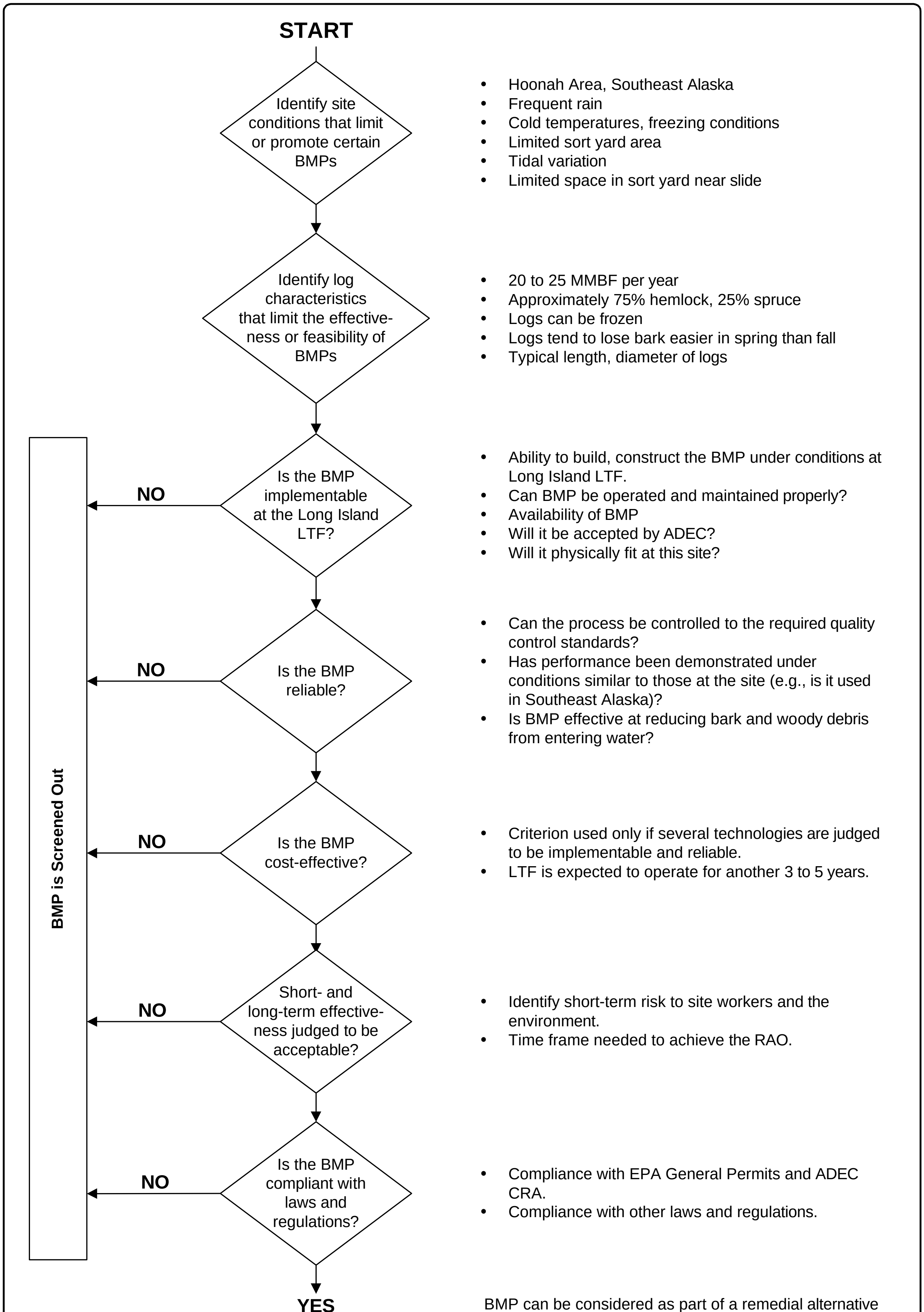
Long Island
Log Transfer Facility

Figure 2.12
Photo of Ship Mooring Buoys
June 2003



Source: Brian Kleinhenz, Sealaska

Floyd Snider McCarthy, Inc.	**Long Island** **Log Transfer Facility**	Figure 2.13 Cost "Break Even" Analysis



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Strategy & Technical Solutions for Contaminated Properties

Long Island Log Transfer Facility

Figure 3.1
BMP Screening Process for Sealaska Long Island LTF

Source: Brian Kleinhenz, Sealaska

Floyd Snider McCarthy, Inc.

Long Island
Log Transfer Facility

Figure 3.2
Location of Proposed
Log Boom Breakwater

Long Island
Log Transfer Facility

Remediation Plan

Appendix A

Physical Oceanography Overview

GENERAL COMMENTS

The tidal and wave induced currents at and near the log transfer facilities (LTFs) can have a significant impact on deposited woody debris. This can occur by redistributing existing deposits of woody debris or by transport in of fresh sediment and depositing that on the existing woody debris. Both of these processes affect the potential for natural recovery to occur.

Review of the existing oceanographic studies literature for Southeast Alaska reveals that little work has been done in this region. The work that has been performed is largely site specific and was done from the 1960s through 1995. Before examining the available literature, some general comments can be made in regard to the tidal and wave induced currents.

Tidal currents are created by diurnal variations in the ocean surface due to the gravitational pull from the moon and the sun. In Southeast Alaska, a semidiurnal tide is typical with high high, low high, high low, and low low water surface elevations. The geographic features of a region greatly affect the timing and magnitude of tide. Open bays allow greater water exchange between the inner and outer regions, so that little attenuation of tidal range occurs between the two regions. Coves and channels with restricted opening (smaller cross sectional area) reduce the possible rate of water exchange. This attenuates the tidal range in the interior regions, but it can increase the current velocity, as the water surface slope becomes steeper. This can be particular pronounce in channel constrictions, and can even generate tidal rapids.

Wave induced currents are created by the local meteorology. The seasonal and storm wind directions and magnitudes can be altered by the local topography. The fjords and mountains in Southeast Alaska to create localized channeled winds that deviate strongly from the directions of the regional scale winds (Whitney 1995). The wave height and resulting bed shear stress is a function of the fetch and water depth: longer fetches produce larger waves with a given wind and as waves approach shallow water regions.

A final comment on sources of fresh sediment is also appropriate. The presence of nearby stream or rivers can provide a source of fresh sediment that can be deposited over woody debris. This sediment could be transport to a site via the current generating mechanisms discussed above. If a stream is immediately adjacent to the site, it could carry fresh sediment that deposits directly on the site.

Whitney (1995) provides a descriptive overview of currents and climatic conditions in Southeast Alaska. The Pacific sub arctic gyre and an associated Alaskan current produce a northward circulation at the surface through the Inland Passage of Southeast Alaska. Fjords might have local surface outflow generated by freshwater runoff from tributaries. The winds in the region are predominately from the south and southeast, with speeds of 5 to 35 knots. The mountains and fjords can create localized channel winds. During winter, the Taku winds from the north and east can occur with speeds from 30 to 70 knots.

DEEP CHANNELS AND INLETS

Several reports on deep channel inlets and bays of Southeast Alaska are available. The results are summarized below.

A modeling and data collection study of Smeaton Bay and its tributary Wilson Arm (east of Ketchikan, Alaska) was done to examine impacts from a proposed mine (Kowalik and Findikakis, 1985). The depths in these channels range from 100 to about 300 m, with exterior and interior sills dividing the channels into basins. The tidal range is from 2 to 6 m, which produces most of the current energy, though density currents can be important during certain periods. Freshwater inflow in Wilson Arm is small (60 m^3/s) relative to the tidal prism. The general density pattern during summer is for low salinity surface water to produce a strong pycnocline in the upper 25 to 40 m. A typical circulation pattern is during the summer is for inflow through the pycnocline down to about 75 m. Between about 100 m and to sill depth is an outflow to occurs throughout the year. Also during summer are intermittent periods of deep-water renewal to spill over the sill and producing up-fjord currents along the bottom. This is correlated with upwelling over the Gulf of Alaska. During winter the inflow in the upper layers and outflow down to sill depth also occurs but without deep-water renewal. The regional winds in winter lead to down welling in the Gulf of Alaska, lowering the high-density water outside the channel. Bottom currents are generally low except during periods of bottom water renewal when density currents up to 45 cm/s.

A study of Boca de Quadra (southeast of Ketchikan, Alaska) by Nebert and Burrell (1981) showed similar results for Boca de Quadra as seen at Smeaton Bay. That is, the flow pattern is reversed over what is expected for typical fjordal estuaries, with surface inflow and bottom outflow of the entrance sill. The small influence of freshwater inflows on fjordal circulation in Boca de Quadra and Smeaton Bay is suggested to be due to the relatively small watershed areas in relation to the fjord's surface area.

A study to determine the season characteristics of Muir Inlet (west of Juneau, Alaska) was made by Matthews and Quinlan (1975). It has a maximum depth of 318 m and the entrance sill depth is 62 m. The inlet has formed with the retreat of glaciers over the past 100 years, and it has a glacier at its head (Muir Glacier). It has diurnal tide range of 5 m. Muir Inlet has peak runoff during the summer months which leads to heterogeneity of the water column. This also produces nearly continuous deepwater renewal that produces a homogeneous water column by late winter. The melting from the Muir Glacier is continuous, but periods of runoff mask the effects of glacial melting.

SMALLER BAYS

Some reports on smaller bays are also available. The results are discussed below.

A study by Bruce, McLain, and Wing (1977) examined the characteristics of the Auke Bay over an eight-year period. Auke Bay is a relatively small bay located along the channels of the inside passage of southeast Alaska (northwest of Juneau, Alaska). The bay has a maximum depth of 100 m with average depth around 50 m. The spring tidal range is about 6 m. Stratification of surface waters is induced beginning in April by low salinity water and solar heating. This peaks in August, and by September, cooling air temperatures and wind mixing from fall storms breaks down the stratified water column. By winter, the water column is homogenous.

A paper of Traitors Cove (north of Ketchikan, Alaska) by McLain (1968) presented results from surveys of this relatively shallow water body. It has two basins produced by a constriction. The maximum depth in the outer basis is 130 m and in the inner basin 46 m. The outer sill depth is 55 m. The constriction has a depth 1 to 2 m below mean low water, which produces large currents during tidal changes. The constriction also reduces the tidal range in the inner basin. Traitors Cove's circulation pattern is typical in that freshwater inflows generally produce outflow at the surface and inflow in the bottom waters. The constriction completely mixes inflowing water to the inner basin. This mixing reduces the salinity of the bottom water of the inner basin slightly in comparison with the bottom water of the outer basin. During flood conditions surface waters flowed up-fjord, and during ebb, surface water flowed down-fjord.

The report by Wallen and Wood (1971) examined several water bodies in Southeast Alaska of which the Port Snettisham and Endicott Arm discussions are somewhat relevant. For Port Snettisham, the depth at the entrance is about 260 m and the arm depth gradually decreases up to the river delta. No sills or basins are present. They describe Port Snettisham as a positive estuary, with surface outflow and balancing deep-water inflow. The Speel River introduces freshwater to the system. For the Endicott Arm, there are three sills and three basins. The sill depths are 22 m at the entrance, 96 m at the middle sill, and 73 m at up sill near the Arm's head. Maximum depths in the basins range from 295 m to 205 m. The Dawes Glacier occupies the head of the Arm. Endicott Arm shows a negative estuarine structure during summer at the entrance, and possibly at the head.

WATER QUALITY

Water quality studies were made of four water bodies in Southeast Alaska (Gastineau Channel, Fritz Cove, Silver Bay, and Ward Cove) by FWPCA (July 1966). These studies were limited in scope to provide water quality characteristics at the time of sampling and do not provide annual or seasonal characteristics.

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