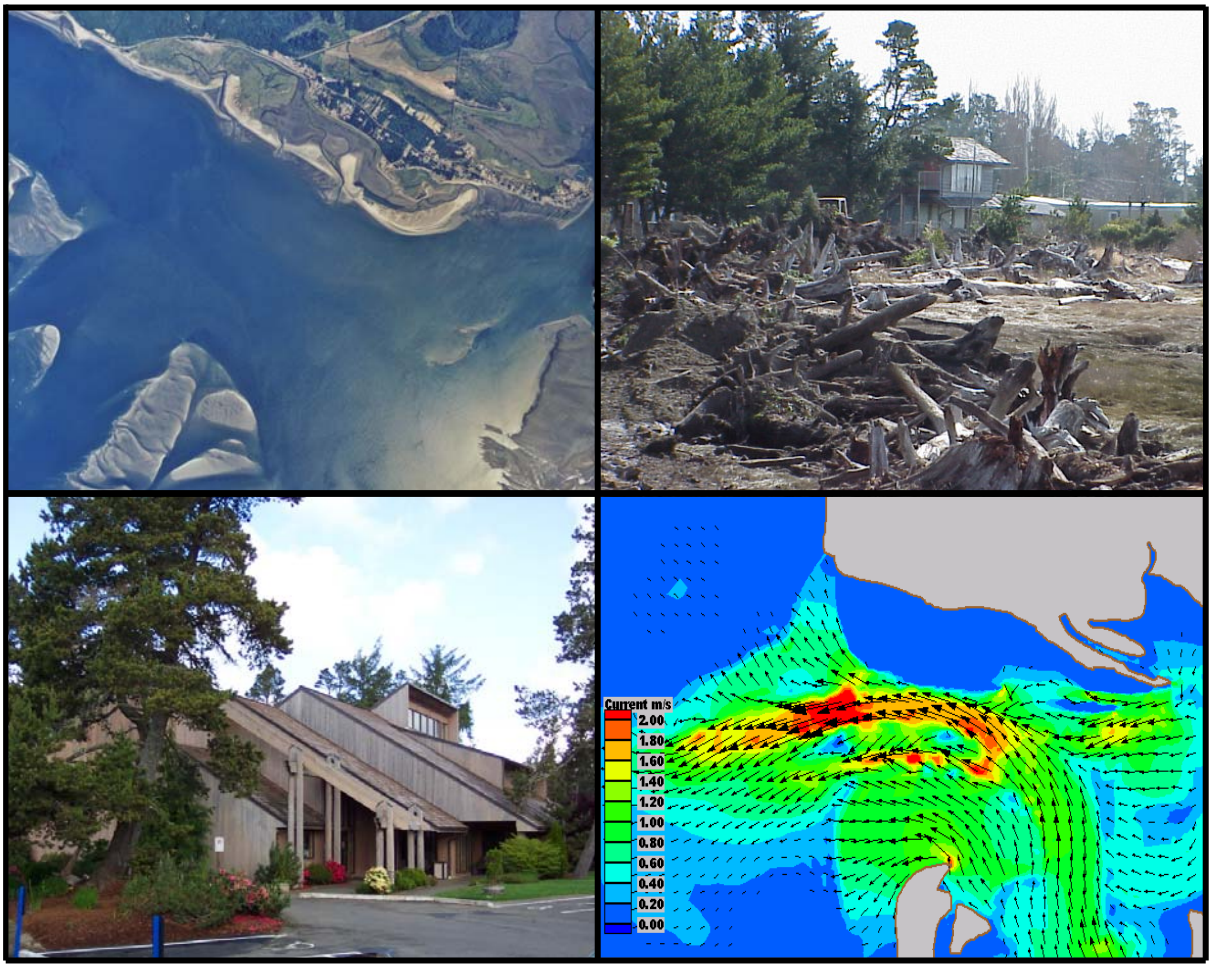
FINAL POST-AUTHORIZATION DECISION DOCUMENT
and FINAL ENVIRONMENTAL ASSESSMENT

Shoalwater Bay Shoreline Erosion, Washington

FLOOD AND COASTAL STORM DAMAGE REDUCTION

Shoalwater Bay Indian Reservation



US Army Corps
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Seattle District

July 2009

Errata Page

Shoalwater Bay Shoreline Erosion, Washington
Final Post-Authorization Decision Document and Final Environmental Assessment
Flood and Coastal Storm Damage Reduction
Shoalwater Bay Indian Reservation
July 2009

Revisions to the Final Post-Authorization Decision Document and Final Environmental Assessment for the Shoalwater Bay Shoreline Erosion, Washington, Flood and Coastal Storm Damage Reduction Project are as stated below. This Errata Page is to be inserted for reference behind the front cover of the document.

1. Final Decision Document, Paragraph 4.4, Real Estate Requirements, Subparagraph 4.4.4, Proposed Non-Standard Estates (Page 118). Subparagraph 4.4.4 is revised by replacing the existing text with the following:

The following non-standard easement estate is proposed over the privately owned tidelands for this Project:

PERPETUAL BERM/DUNE EASEMENT

A perpetual and assignable easement and right-of-way in, on, over and across the land described in Schedule A to construct, operate, maintain, patrol, repair, renourish, and replace an off-shore berm or dune and appurtenances thereto, including the right to borrow and/or deposit fill, together with the right to trim, cut, fell and remove therefrom all trees, underbrush, obstructions, and other vegetation, structures, or obstacles within the limits of the easement, and the right to plant and maintain vegetation; reserving however, to the grantor(s), (his) (her) (its) (their) (heirs), successors and assigns all such rights and privileges as may be used without interfering with or abridging the rights and easements hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

The following non-standard easement estate is proposed for the DNR-owned tidelands for this Project:

BERM/DUNE EASEMENT

An assignable easement and right-of-way in, on, over and across the land described in Schedule A for as long as the Shoalwater Bay Shoreline Erosion, Washington, Flood And Coastal Storm Damage Reduction Project, Shoalwater Bay Indian Reservation (PWI 013725) remains an authorized Federal project, to construct, operate, maintain, patrol, repair, renourish, and replace an off-shore berm or dune and appurtenances thereto, including the right to borrow and/or deposit fill, together with the right to trim, cut, fell and remove therefrom all trees, underbrush, obstructions, and other vegetation, structures, or obstacles within the limits of the easement, and the right to plant and maintain vegetation; reserving however, to the grantor, the

State of Washington, all such rights and privileges as may be used without interfering with or abridging the rights and easements hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

If there are any outstanding third party interests such as public roads, and highways, public utilities, railroads, and pipelines, the Sponsor must clear or subordinate any third party interests that could interfere with the project. DNR does not grant perpetual easements, but has tentatively agreed to grant a berm/dune easement for as long as the Project remains an authorized Federal Project.

2. Final Decision Document, Section 7, Findings and Conclusions (page 144). Paragraph 7.2, Conclusions, is revised by inserting the following standard disclaimer as a new paragraph following the existing text:

The recommendations contained herein reflect the information available at this time and current Department policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for implementation funding.

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-3755

REPLY TO
ATTENTION OF

FINAL POST-AUTHORIZATION DECISION DOCUMENT
and
FINAL ENVIRONMENTAL ASSESSMENT

Shoalwater Bay Shoreline Erosion, Washington

FLOOD AND COASTAL STORM DAMAGE REDUCTION

Shoalwater Bay Indian Reservation

July 2009

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http://www.nws.usace.army.mil/ers/doc_table.cfm

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14. ABSTRACT
The study was conducted in accordance with Section 545 of the Water Resources Development Act (WRDA) of 2000, as amended by Section 5153 of WRDA 2007. Section 545(a) of WRDA 2000 directed the Secretary of the Army to conduct a study to determine the feasibility of providing coastal erosion protection for the tribal reservation of the Shoalwater Bay Indian Tribe in the State of Washington. The interagency investigation conclusively demonstrated that (1) erosion of the natural barrier dune on Graveyard Spit has reached a critical stage and (2) modest engineering solutions are technically feasible to significantly reduce coastal erosion and the risk to the Shoalwater Reservation from flooding and coastal storm damage. The report identifies restoration of the eroded 12,500 foot-long barrier dune as the most appropriate long-term solution to coastal erosion, flooding, and storm damage problems affecting the Shoalwater Bay Indian Reservation. This plan is a complete solution to identified problems, is cost effective, is environmentally acceptable, and will improve the economic and social conditions of the Shoalwater Bay Indian Tribe. Sand to restore the barrier dune will be dredged from an aquatic borrow site in Willapa Bay.

15. SUBJECT TERMS
Willapa Bay, Washington; coastal erosion; shoreline erosion; coastal storm damage reduction; flood damage reduction; barrier dunes; storm-generated waves; Shoalwater Bay Indian Tribe.

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EXECUTIVE SUMMARY

The Shoalwater Bay Shoreline Erosion, Washington, study was conducted in accordance with Section 545 of the Water Resources Development Act (WRDA) of 2000, as amended by Section 5153 of WRDA 2007. Section 545(a) of WRDA 2000 directed the Secretary of the Army to conduct a study to determine the feasibility of providing coastal erosion protection for the tribal reservation of the Shoalwater Bay Indian Tribe (Shoalwater Tribe) in the State of Washington. Section 545(b) provides that the Secretary shall construct and maintain a project at Federal expense if the Secretary determines that the project: (a) is a cost-effective means of providing coastal erosion protection; (b) is environmentally acceptable and technically feasible; and (c) will improve the economic and social conditions of the Shoalwater Tribe.

In accordance with Section 545(a), the investigation of the coastal processes at Willapa Bay affecting the Shoalwater Bay Indian Reservation (Shoalwater Reservation) has been completed. The interagency investigation conclusively demonstrated that (1) erosion of the natural barrier dune on Graveyard Spit has reached a critical stage and (2) modest engineering solutions are technically feasible to significantly reduce coastal erosion and the risk to the Shoalwater Reservation from flooding and coastal storm damage. If no action is taken, the Shoalwater Tribe will incur total loss of remaining subsistence habitat in the North Cove embayment and is under immediate and growing threat of severe damage to tribal facilities and infrastructure due to storm wave attack and flooding. Erosion of Graveyard Spit has significantly compromised its historical function as a storm barrier for the Shoalwater Reservation. Without prompt action, the Shoalwater Reservation will incur increasingly frequent and severe flood and coastal storm damage to Tribal facilities, infrastructure, and subsistence habitat alike.

The Shoalwater Tribe is a Federally recognized Tribe. The U.S. Army Corps of Engineers (Corps), as an agency within the Federal government, has consulted with the Shoalwater Tribe on a government-to-government basis throughout the planning process for the proposed project. The Shoalwater Tribe's efforts to preserve their land and heritage have been carefully considered by the Corps, and the proposed project has the full support of the Shoalwater Tribe and the Bureau of Indian Affairs.

The Shoalwater Reservation was established in 1866 by Executive Order of President Andrew Johnson. The Shoalwater Reservation is located on the Tokeland Peninsula on the north shore of the entrance to Willapa Bay, a very large estuarine system on the Pacific Ocean coast of Washington. Willapa Bay is approximately 28 miles north of the mouth of the Columbia River and 12 miles south of the entrance to Grays Harbor. The Shoalwater Reservation is slightly greater than one-square mile in area and consists of 440 acres of uplands and 700 acres of important tide flat and intertidal habitat in North Cove. All Reservation land is tribally owned, and is bounded by steep natural hillsides to the east and north and by Willapa Bay to the south.

The immediate effect of erosion of the barrier dune on Graveyard Spit is increased exposure of the Shoalwater Tribe's North Cove embayment to damaging wave energy during coastal storm events. The erosion and storm wave overtopping of the barrier dune has in-filled North Cove with sand and large woody debris and significantly degraded tide flat and intertidal habitat in the embayment. North Cove no longer sustains tribal subsistence shellfish beds, and native plant populations have diminished. This has resulted in a lost opportunity for subsistence shellfish gathering and significantly reduced harvest of culturally significant native plant species for tribal crafts and ceremonial use.

The increased wave energy in North Cove has, in turn, led to an increase in the severity and frequency of flooding and erosion of Shoalwater Reservation uplands during storm events which occur during periods of extreme water levels. The upland flooding and shoreline erosion is due to increased wave height in the North Cove embayment which is the direct result of storm waves overwashing the eroded barrier dune on Graveyard Spit that fronts the Shoalwater Reservation.

Winter storms in 1998-1999 caused two breaches to form in the barrier dune, resulting in storm wave run-up and flooding of shoreline areas where tribal development is concentrated. To provide partial protection to the Tribal Center, a 1,700-foot-long shoreline flood berm was constructed in 2001 by the Corps. In December 2007, a 300 foot extension of the flood berm was constructed by the Corps. Six of the twelve extreme water levels recorded since 1973 have occurred since 1999. Coastal storms that coincided with these extreme water levels in March 1999, December 2001, February 2006, and December 2007 resulted in significant erosion and storm wave overtopping of the barrier dune, some erosion of the shoreline, and flooding of tribal uplands. These events have created a growing sense of urgency on the part of the Shoalwater Tribe for implementation of long-term coastal erosion protection and storm damage reduction measures.

A wide array of alternative plans were formulated and evaluated against identified problems and opportunities, and planning objectives and criteria. Four alternative plans, plus the No Action alternative, were carried forward for detailed evaluation: sea dike (Alternative 4), sea dike to Reservation boundary (Alternative 4a), barrier dune restoration (Alternative 6), and barrier dune restoration with flood berm extension (Alternative 7). Each plan would provide a technically feasible solution to identified coastal erosion and storm damage problems. The sea dike alternatives were found to have the highest initial construction and annualized cost, and are not environmentally acceptable. The barrier dune with flood berm extension alternative will require expensive mitigation of unavoidable wetland impacts associated with the flood berm extension, and has higher initial construction and annualized costs than barrier dune restoration (Alternative 6).

Barrier dune restoration (Alternative 6) is the most appropriate long term solution to the coastal erosion and resulting storm damage problems affecting the Shoalwater Reservation. Alternative 6 will afford effective coastal erosion protection and storm damage reduction to the entire Shoalwater Reservation. With a total first cost for initial construction of $9,827,000, periodic nourishment/monitoring every five years at a cost of $4,512,000, a total present value of

$25,882,000, and a total average annual cost of $1,336,000, Alternative 6 best satisfies planning objectives and criteria, and meets all criteria specified in the WRDA 2000 Section 545 conditional project authorization.

Barrier dune restoration is a cost effective means of providing coastal erosion protection and storm damage reduction, is environmentally acceptable, and is technically feasible. By reducing coastal erosion and related coastal storm damage problems, Alternative 6 will improve the economic and social conditions of the Shoalwater Bay Indian Tribe. Barrier dune restoration will significantly reduce flooding and coastal storm damage to Tribal uplands, as well as prevent further degradation of the 700-acre North Cove embayment subsistence tide flat and intertidal habitat. Alternative 6 is fully consistent with the Corps' environmental operating principles, and will be environmentally sustainable. Implementation of the project will improve the quality of life for present and future generations of Shoalwater Bay Tribal members. This is a vitally important project to a remotely located Native American community in a highly vulnerable location along the Washington coast.

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FINAL ENVIRONMENTAL ASSESSMENT

(Bound at end of this report)

APPENDIX 1 – ENGINEERING ANALYSIS AND DESIGN

(Bound separately)

INTERAGENCY PROJECT DELIVERY TEAM

An interagency team under direction of the U.S. Army Corps of Engineers, Seattle District, and in consultation with the Shoalwater Bay Indian Tribe, conducted comprehensive studies to determine the technical feasibility of, and to formulate alternative plans for, providing coastal erosion protection to the Shoalwater Bay Indian Reservation at Willapa Bay, Washington. The interagency team included the following entities:

Project Management, Preparation of Decision Document and Environmental Assessment:

- U.S. Army Corps of Engineers, Seattle District

Technical Studies, conducted under direction of Seattle District:

- U.S. Army Corps of Engineers, Seattle District
- U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi
  - Coastal and Hydraulics Laboratory
  - Environmental Laboratory
- U. S. Geological Survey interagency team
  - Coastal and Marine Geology Program, Menlo Park, California
  - Delft Hydraulics, Netherlands
  - Rutgers University, Institute of Coastal and Marine Services
- Washington Department of Ecology, Lacey, Washington
  - Coastal Monitoring and Analysis Program
- Shoalwater Bay Indian Tribe: Tribal Council and staff

Agency Technical Reviews:

- U.S. Army Corps of Engineers, Alaska District (Draft and Final Decision Document)
- U.S. Army Corps of Engineers, Walla Walla District (Cost and Schedule)

ABBREVIATIONS AND ACRONYMS

ACES	Automated Coastal Engineering System (Corps of Engineers)
ADCIRC	ADvanced CIRCulation numerical model
ASA(CW)	Assistant Secretary of the Army for Civil Works
BE	Biological Evaluation
BIA	Bureau of Indian Affairs, U.S. Department of the Interior
BLM	Bureau of Land Management, U.S. Department of the Interior
CAR	Fish and Wildlife Coordination Act Report
CERT	Community Emergency Response Team
CHL	Coastal and Hydraulics Laboratory, located at ERDC
Corps	U.S. Army Corps of Engineers
CY	Cubic yard
CZMA	Coastal Zone Management Act
DMMP	Dredged Material Management Program
DNR	Washington Department of Natural Resources
EA	Environmental assessment
Ecology	Washington Department of Ecology
EL	Elevation
EO	Executive Order
EOP	Environmental Operating Principle
ERDC	U.S. Army Engineer Research and Development Center, Vicksburg, MS
ESA	Endangered Species Act
FWCA	Fish and Wildlife Coordination Act
GIS	Geospatial information system
HQUSACE	Headquarters, U.S. Army Corp of Engineers, Washington, D.C.
H	Horizontal
HTRW	Hazardous, toxic and radiological waste
LERD	Lands, Easements, rights-of-way, and dredged material disposal areas
LLUP	Limited Land Use Permit
MAT	Maximum Astronomical Tide
MHHW	Mean higher high water
MHW	Mean High Water
MLLW	Mean lower low water
MOA	Memorandum of Agreement
NEPA	National Environmental Policy Act 1969
NMFS	National Marine Fisheries Service, NOAA
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Survey
O&M	Operation and Maintenance
P&S	Plans and specifications
PED	Preconstruction engineering and design
PDT	Project delivery team

ABBREVIATIONS AND ACRONYMS (continued)

PL	Public Law
SBEACH	(Storm-induced BEAch CHange) numerical model
Shoalwater Reservation	Shoalwater Bay Indian Reservation
Shoalwater Tribe	Shoalwater Bay Indian Tribe
SLR	Sea level rise
SR	State Route
STA	Station
STWAVE	Steady-State Spectral Wave Numerical Model
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
V	Vertical
WDOT	Washington Department of Transportation
WRDA	Water Resources Development Act

CONVERSION FACTORS: NON-SI TO SI UNITS OF MEASUREMENT

The Metric System, a system of units used for physical measurements, is called the International System of Units, and its units are called SI units. Non-SI units of measurement used in this report can be converted to SI units as follows:

Multiply (non-SI Unit)	By	To Obtain (SI Unit)
Acres	4,046.873	square meters
cubic yards	0.7645549	cubic meters
Feet	0.3048	meters
Inches	2.54	centimeters
miles (U.S. statute)	1.609347	kilometers
Pounds	4.5359×10^2	grams
Tons	1.016×10^3	kilograms
square miles	2,589,998	square meters

SECTION 1: INTRODUCTION

1.1 Study and Project Authorization

The Shoalwater Bay Shoreline Erosion, Washington, study was conducted in accordance with Section 545 of the Water Resources Development Act (WRDA) of 2000 (Public Law 106-541), as amended by Section 5153 of WRDA 2007 (Public Law 110-114). Section 545 of WRDA 2000, as amended, authorized a study and authorized a project, subject to Secretarial approval, for coastal erosion protection and ecosystem restoration for the tribal reservation of the Shoalwater Bay Indian Tribe. The complete text of Section 545 of WRDA 2000, as amended, is as follows:

SEC. 545. WILLAPA BAY, WASHINGTON.

(a) STUDY. - The Secretary shall conduct a study to determine the feasibility of providing coastal erosion protection and ecosystem restoration for the tribal reservation of the Shoalwater Bay Tribe on Willapa Bay, Washington.

(b) PROJECT. -

(1) IN GENERAL. - Notwithstanding any other provision of law (including any requirement for economic justification), the Secretary shall construct and maintain a project to provide coastal erosion protection and ecosystem restoration for the tribal reservation of the Shoalwater Bay Tribe on Willapa Bay, Washington, at Federal expense, if the Secretary determines that the project -

(A) is a cost-effective means of providing erosion protection and ecosystem restoration;

(B) is environmentally acceptable and technically feasible; and

(C) will improve the economic and social conditions of the Shoalwater Bay Tribe.

(2) LANDS, EASEMENTS, AND RIGHTS-OF-WAY.- As a condition of the project, described in paragraph (1), the Shoalwater Bay Tribe shall provide lands, easements, rights-of-way, and dredged material disposal areas necessary for implementation of the project.

(NOTE: For purposes of this Act, the term Secretary means the Secretary of the Army)

This authorization was also amended by the FY 2002 Energy and Water Development Appropriations Act, Public Law 107-66. Title I, Construction General, provided "… That all studies for the project shall be cost shared in the same proportion as the construction implementation costs." (i.e., at 100 percent Federal cost).

1.2 Study Purpose and Scope

1.2.1 Coastal Erosion Protection

The study documents ongoing coastal erosion problems affecting the Shoalwater Bay Indian Reservation (Shoalwater Reservation) and describes the formulation and evaluation of the most appropriate and effective plan to provide effective, long-term, coastal erosion protection to the Shoalwater Reservation, in partial response to the WRDA project authorization. The goal of the project is to reduce coastal erosion and the resulting flooding and coastal storm damage to the Shoalwater Reservation and to the Shoalwater Bay Indian Tribe (Shoalwater Tribe). Accomplishment of this goal will enhance the quality of life for tribal members by reducing flood and storm damage risk to both human life and tribal facilities and infrastructure.

The scope of the investigation was to formulate and evaluate a plan that meets the following criteria, pursuant to criteria specified in the project authorization:

- ***Is technically feasible;***
- ***Is a complete solution to the identified problems;***
- ***Is a cost-effective means of providing coastal erosion protection and thus flood and coastal storm damage reduction;***
- ***Is environmentally acceptable; and***
- ***Will improve the economic and social conditions of the Shoalwater Bay Indian Tribe.***

1.2.2 Ecosystem Restoration

Ecosystem restoration was not added as a project purpose until the original authorization contained in Section 545 of WRDA 2000 was amended by Section 5153 of WRDA 2007 on November 10, 2007. The alternative plans presented in this report were thus formulated to address only coastal erosion protection and related flood and coastal storm damage reduction. Due to the imminent danger to the continued existence of the Shoalwater Reservation from winter coastal storms, the project will be implemented to only address coastal erosion protection. There will be no irreversible commitment of resources in implementing the project for coastal erosion protection which would foreclose ecosystem restoration opportunities. Barrier dune restoration is, in fact, a prerequisite for consideration of ecosystem restoration opportunities in the Tribe's North Cove embayment. A separate study will be conducted to formulate an ecosystem restoration plan with the objective to restore degraded ecosystem structure, function, and dynamic processes to a less degraded, more natural condition within the boundaries of the Shoalwater Reservation. This report will be prepared in accordance with applicable guidance and submitted for approval by the Secretary.

1.3 Project Location

The project area is located on the north side of the entrance to Willapa Bay, a large estuarine system located on the southwest Pacific Ocean coast of the State of Washington, in Pacific County (see **Figure 1.1,** located at the end of Section 1). Willapa Bay is the second largest bay on the Pacific coast of the United States after San Francisco Bay. Willapa Bay is approximately 28 miles north of the mouth of the Columbia River and 12 miles south of the entrance to Grays Harbor. The bay has an area of 109 square miles at mean higher high water (MHHW) elevation and 62 square miles at mean lower low water (MLLW). Its spring or diurnal range tidal prism is more than 10^{10} cubic feet, making it one of the largest of all inlets of the continental United States. The magnitude of the tidal prism is produced by the broad bay area and relatively large tidal range (approximately 7 feet). The Willapa Bay entrance is about 6 miles wide between Cape Shoalwater on the north and Leadbetter Point on the south. Willapa Bay has served ocean-going vessels for nearly two centuries, but passage in and out of the bay has always been treacherous due to intense waves and currents at its unstructured entrance. The Willapa River is its principal tributary and enters from the east, and the Naselle River enters the bay at its southerly end. Willapa Bay has a southerly arm 19 miles long and an easterly arm 12 miles long. Both arms have numerous shoals and tide flats, with intervening channels formed by the discharge of tributary streams. The south arm is separated from the Pacific Ocean by a sandy peninsula (Long Beach Peninsula) having an average width of 1 ½ miles and elevations ranging up to 40 feet above MLLW and is terminated at its northern end by Leadbetter Point. Cape Shoalwater, bordering the bay's entrance channel on the north, consists of sand dunes adjacent to an eroding shoreline, wooded sand ridges about 40 feet high in the central part, and relatively low ground to the east.

1.4 Shoalwater Bay Indian Reservation and Tribe

1.4.1 Reservation Establishment and Federal Trust Responsibility

The Shoalwater Reservation was established by Executive Order of President Andrew Johnson on September 22, 1866. Note that the State of Washington was not admitted into the Union until 1889. The complete text of the 1866 Presidential Executive Order reads as follows:

Shoalwater Reserve

[In Puyallup Agency; area, one-half square mile; occupied by Shoalwater and Chehalis.]

Executive Mansion, *September 22, 1866.*

Let the tract of land as indicated on the within diagram be reserved from sale and set apart for Indian purposes, as recommended by the Secretary of the Interior in his letter of the 18th instant, said tract embracing portions of sections 2 and 3 in township 14 north, range 11 west, Washington Territory.

Andrew Johnson.

It was not until 1971 that the Shoalwater Tribe became Federally recognized. The Shoalwater Tribe rejected the Indian Reorganization Act in 1934, but their descendents gained Federal recognition on March 10, 1971. Shortly thereafter, the Shoalwater Tribe adopted a constitution and elected a tribal council. In 1999, they became a self-governance tribe. A five-member elected tribal council governs the Tribe. All land is tribally owned; there have been no individual allotments of reservation land to tribal members.

As noted by the Bureau of Indian Affairs in an August 18, 2008 letter to the U.S. Army Corps of Engineers, Seattle District Commander (see **Exhibit 2** at end of report), as trustees for the Shoalwater Tribe, it is the Federal Government's responsibility to ensure that Tribal needs are met to the fullest extent allowed under law. The Corps has consulted with the Shoalwater Tribe on a government-to-government basis throughout the planning process for the proposed project. In a letter dated July 30, 1999, Joseph W. Westphal, Assistant Secretary of the Army (Civil Works), assured the Shoalwater Tribe that a concerted effort would be made to assist the Shoalwater Tribe in finding and implementing a possible solution to the coastal erosion and environmental problems affecting their reservation.

1.4.2 Tribal Membership and Origins

The Shoalwater Bay Indian Tribe is small, but has been increasing in population over the past decade. The Tribe currently has 315 enrolled members and a service area population of 1,148 (other Native Americans, but not Shoalwater Bay Tribal members, who live within certain distances and make up a service area). The annual tribal budget is approximately $2.5 million. The Shoalwater Tribe is a Federally recognized Tribe, and the Corps has extensively consulted with them on a government-to-government basis throughout the formulation of this project. The Shoalwater Tribe has been an active participant in plan formulation and evaluation. Tribal leadership contributed to the initial identification and evaluation of alternative plans. Tribal biological and cultural resources staff have supported field surveys and provided documentation in support of the analyses of environmental and cultural effects of the proposed action. The Shoalwater Tribe has also maintained an active dialogue with the adjacent non-reservation community, hosted community meetings and forums on the project, and has conducted mailings to affected parties with information on the project.

Shoalwater Tribe members are the offspring of peoples who inhabited the Willapa Bay and Grays Harbor areas (Note that at the turn of the 20th century what is now called Willapa Bay was known as Shoalwater Bay). Those peoples subsisted on fish, clams, oysters and sea animals since time immemorial. After the Shoalwater Reservation was established in 1866, the non-treaty Indians of Shoalwater Bay continued to make their living by fishing, crabbing and oystering, selling their surplus to canneries much the same as non-Indians. Today's tribal members consist of persons (and their descendents) whose names appeared on the official eligible voters list which was prepared for the purpose of the Indian Reorganization Act.

Leslie Sapir [1] cites Curtis [2] in stating that the villages on the north side of Willapa Bay were Salish or Shoalwater Salish, and included: Hlímŭmi near North Cove, Mónĭlŭmsh at Georgetown, and Númoïha'nhl at Tokeland. Verne Ray [3] lists village Number 30 as: na·ˈmst'cat's which was located between Tokeland and North Cove and was a village occupied principally during the winter and that at that time (in 1938) it was called Georgetown. Hajda [4] places the project area within the traditional territory of the Lower Chehalis, a subdivision of the Southwestern Coast Salish speaking people. Hajda states that in the early 1830s, a malaria epidemic (as cited by Boyd [5]) devastated the Lower Columbia River and adjacent area populations and resulted in changes of group compositions. The surviving Chinook and Lower Chehalis in Willapa Bay became a bilingual population (as cited by Swan [6]) that was known as Shoalwater Bay Indians. The Lower Chinook were eventually totally replaced by Lower Chehalis (as cited by Ray [7]). A small reservation was established in 1866 for the Lower Chehalis, Chinooks, and others living in the area that came to be called the Georgetown Reservation and then later the Shoalwater Bay Indian Reservation.

1.4.3 Reservation Location and Description

The Shoalwater Reservation is located on the north shore of Willapa Bay in Pacific County, Washington, between Cape Shoalwater and Toke Point. The Shoalwater Reservation is bounded by steep natural hillsides to the east and north and Willapa Bay to the south (**Figure 1.2**). The Shoalwater Reservation is slightly greater than one-square mile in area and consists of 440 acres of uplands and 700 acres of marine salt marsh and tidal flat habitats. The original Reservation encompassed only 335 acres of uplands. In January 1977, the Office of the Solicitor, U.S. Department of the Interior, issued a favorable Opinion declaring that the Shoalwater Reservation includes the tidelands to the south of the Reservation within its present east and west boundaries and that the southern boundary of the Reservation is located at the low water mark of the bay. The 1977 Opinion reversed a 1962 Opinion of the Regional Solicitor in Portland, Oregon to the contrary. The 1977 Opinion resulted in adding some 700 acres to the Reservation, and made it possible for the Shoalwater Tribe to pursue aquaculture projects as part of their overall economic development strategy. In recent years, the Tribe has acquired an additional 105 acres of uplands which are to be held in Trust, thus increasing the size of their tribal uplands to approximately 440 acres.

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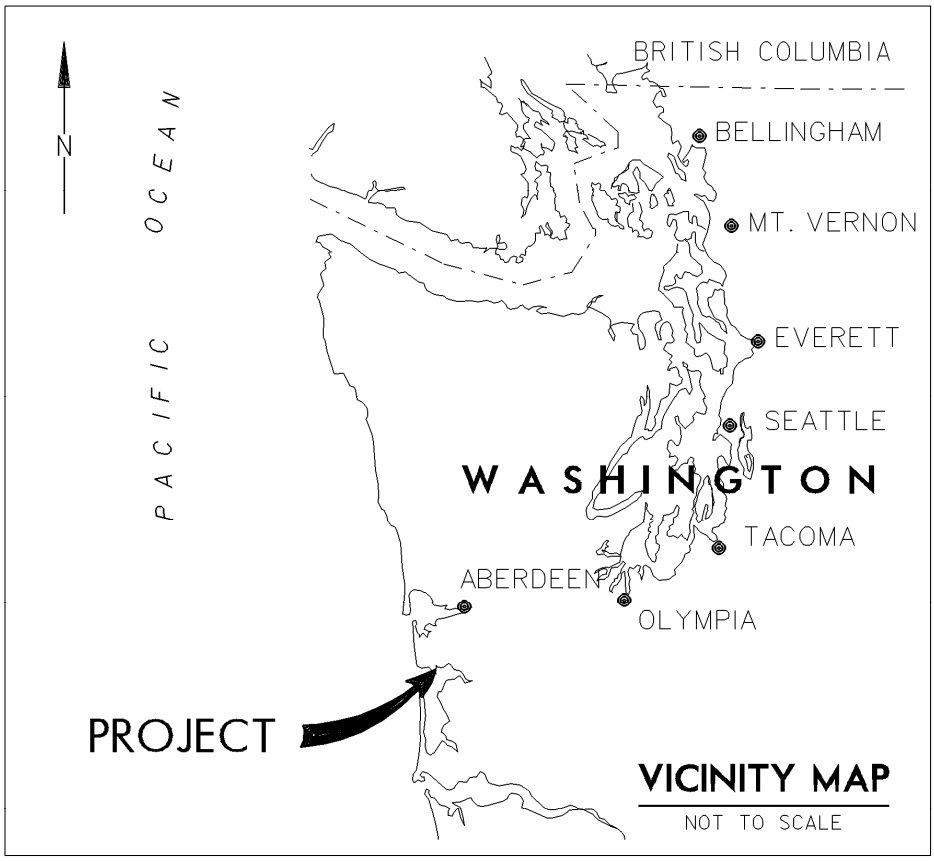
[1] Leslie Spier, "Tribal Distribution in Washington," General Series in Anthropology 3 (Menasha, Wisconsin, 1936), 30.
[2] Edward S. Curtis, The North American Indian, ed. Frederic W. Hodge, Volume IX (Norwood, MA : Plimpton Press, 1930), 6-7, 173. Reprinted: New York: Johnson Reprint, 1970.
[3] Verne F. Ray, Lower Chinook Ethnographic Notes (Seattle: University of Washington, 1938), 41.
[4] Yvonne P. Hajda, "Southwestern Coast Salish," Northwest Coast Handbook of North American Indians, eds. William C. Sturtevant and Wayne Suttles, Smithsonian Institution, Volume 7 (Washington, D.C.: GPO, 1990), 514.
[5] R. T. Boyd, "The Introduction of Infectious Diseases Among the Indians of the Pacific Northwest." (Seattle: Unpublished Ph.D. dissertation, Department of Anthropology, University of Washington, 1985).
[6] James G. Swan, The Northwest Coast; or Three Years Residence in Washington Territory, (New York, 1857), 211. Reprinted: Fairfield, WA: Ye Galleon Press, 1989.
[7] Ray, 30.

The 440 acre upland portion of the Reservation is primarily a steep wooded hillside along the northeast edge of the Reservation boundary, with a narrow strip of low elevation land extending along the shoreline, interspersed with wetlands. State Route 105 traverses this narrow strip of land, parallel to the shoreline and below the hillside. Due to limited availability of developable land, virtually all tribal development is clustered along the shoreline. Consequently, virtually all tribal facilities and infrastructure are at very serious and increasing risk coastal storm damage and flooding due to shoreline erosion and storm-generated ocean wave attack at extreme high tide.

The steep topography of a significant portion of tribal uplands severely limits the land upon which tribal facilities and infrastructure can be built. Developable land is relatively low-lying and immediately adjacent to the shoreline. Well-maintained tribal facilities and housing have been constructed by the Shoalwater Tribe, to support the growing needs of the tribal community. The Tribe has made significant investments in both infrastructure and facilities to serve the needs of current and future generations of tribal members. Despite its very small land base, the Tribe has a modern Tribal Center, a Wellness Center which opened in 2005 (tribal health clinic and programs, dental services, massage therapy, and office space for a doctor and nurse), a Learning Resources Center which opened in 2003 (library, education administrative offices, computer lab, and activity room), and a gymnasium which opened in 2002. The Shoalwater Tribe has one business enterprise, a small casino. The tribal cemetery is located across the road from the Tribal Center. The U.S. Post Office branch which serves the Reservation and the adjacent non-Indian community is located nearby. Modern housing has been constructed, and streets, walkways and parking areas have been improved. Tribal facilities are open to, and extensively utilized by, non-Indian residents of the adjacent Tokeland Peninsula residents. There is a strong sense of community between the Shoalwater Tribe and their Pacific County neighbors. See **Section 3.1.1.1** for a comprehensive inventory of tribal land use, structures, and facilities.

The Shoalwater Tribe relied heavily, both historically and in recent times, on the diversity and productivity of the 700 acres of intertidal habitat and tide flats in the North Cove embayment. The barrier dune on Graveyard Spit afforded protection to the Cove from winter storm wave attack. The Shoalwater Tribe harvested shellfish, on which, along with ocean fisheries, they relied heavily for subsistence food supply. In addition, tribal members harvest local native plant species from the North Cove embayment for tribal crafts and ceremonial use.



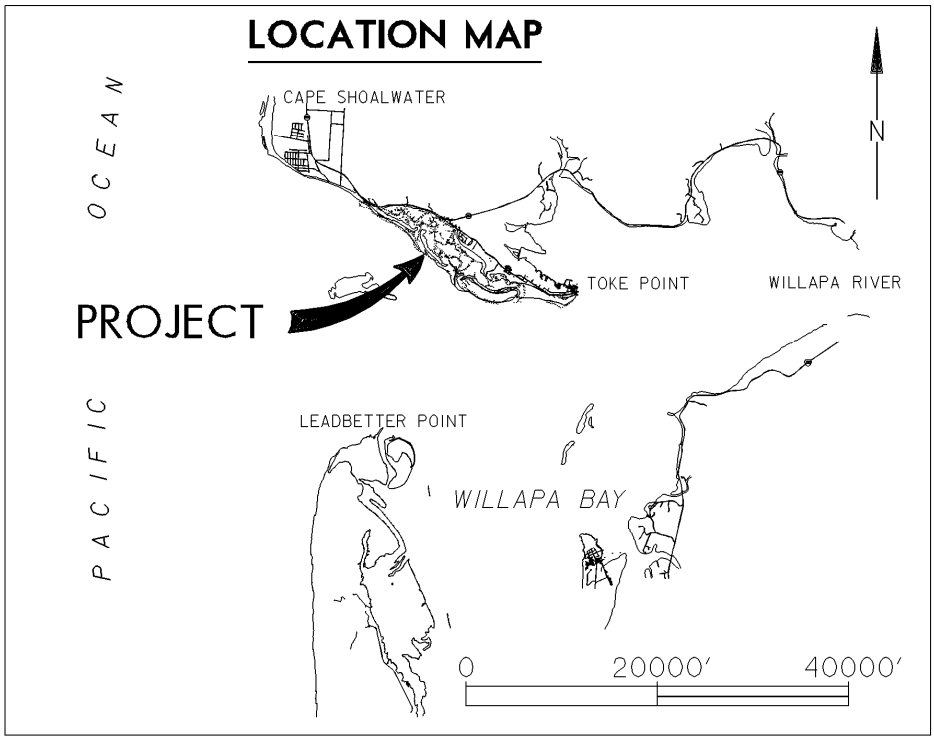


Figure 1.1 Project Vicinity and Location

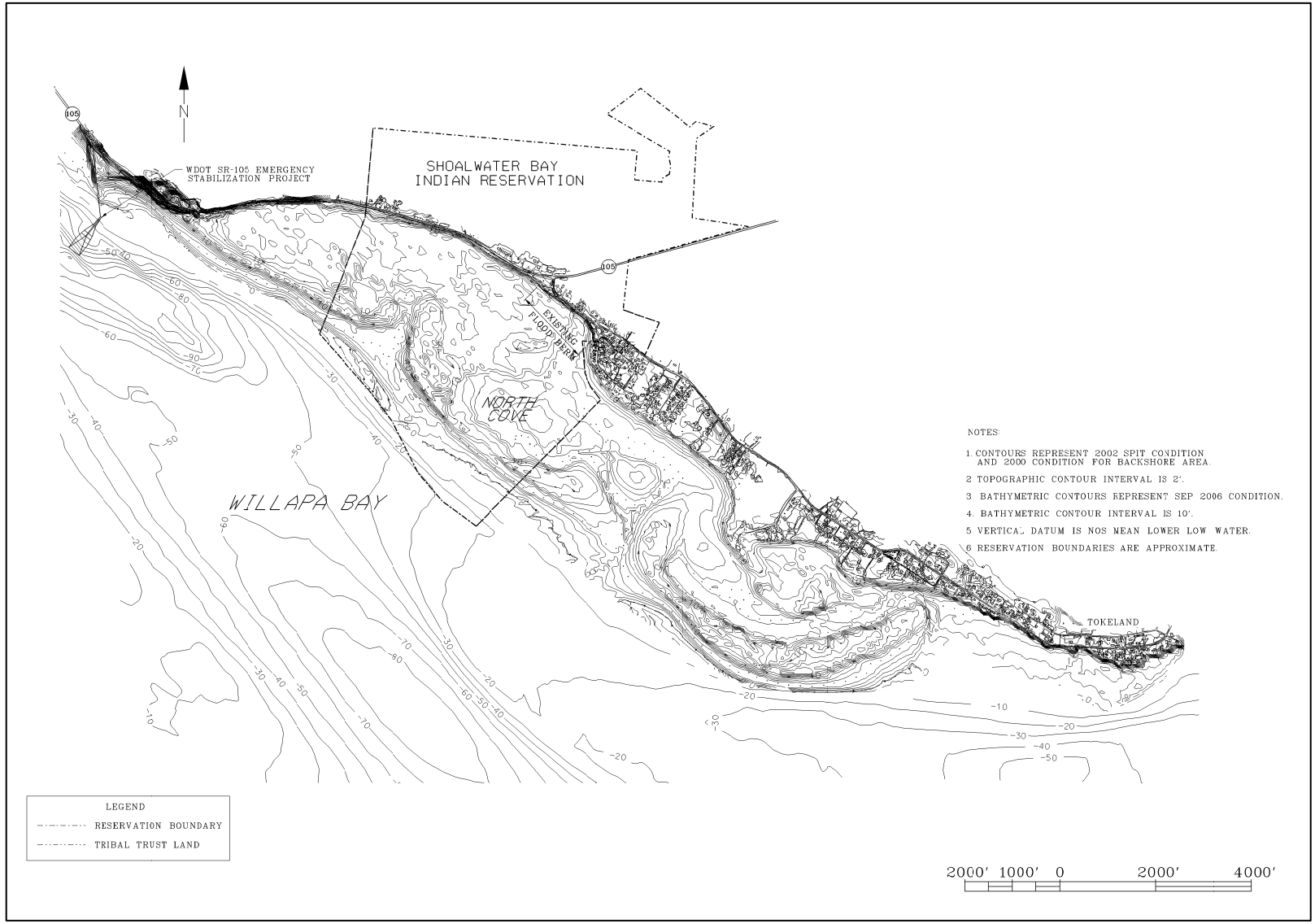


Figure 1.2 Shoalwater Bay Indian Reservation

SECTION 2: PRIOR STUDIES, REPORTS AND EXISTING WATER PROJECTS

2.1 Prior Studies and Reports

There are a number of pertinent prior studies and reports, both by the Corps and other agencies, pertaining to coastal erosion and navigation at Willapa Bay[8]. They include the following:

Year	Study or Report
2004	U.S. Geological Survey. Shoalwater Bay Tribe Erosion Study Report. As-yet unpublished draft Scientific Investigation Report, December 2, 2004, Menlo Park, CA, 362 pages. Prepared in cooperation with Washington Department of Ecology. Study funded by U.S Army Corps of Engineers, Seattle District.
2002	U.S. Army Corps of Engineers, Engineer Research and Development Center. Study of Navigation Channel Feasibility, Willapa Bay, Washington: Report 2, Entrance Channel Monitoring and Study of Bay Center Entrance Channel. ERDC/CHL TR-00-6 Report 2.
2002	U.S. Geological Survey. Large-Scale Cycles of Holocene Deposition and Erosion at the Entrance to Willapa Bay, Washington: Implications for Future Land Loss and Coastal Change. Prepared for the Southwest Washington Coastal Erosion Study in cooperation with the Washington Department of Ecology and the U.S. Army Corps of Engineers. Open File Report 02-46.
2000	U.S. Army Corps of Engineers, Engineer Research and Development Center. Study of Navigation Channel Feasibility, Willapa Bay, Washington. ERDC/CHL TR-00-6.
1996-2000	**Southwest Washington Coastal Erosion Study**. U.S. Geological Survey and Washington Department of Ecology, joint sponsors and directors. Conceived as a result of the recognition by public officials of a lack of basic understanding of coastal processes and shoreline changes along the southwest Washington coast. Study area extended from Tillamook Head, Oregon to Point Grenville, Washington, referred to as the Columbia River littoral cell, and including Willapa Bay. Numerous scientific reports, papers, and related products were developed.
1975	U.S. Army Corps of Engineers, Seattle District. Willapa River and Harbor Navigation Project, Washington, Environmental Impact Statement – Revised.
1972	U.S. Army Corps of Engineers, Seattle District. Willapa River and Harbor Navigation Project, Washington, Final Environmental Impact Statement.
1971	U.S. Army Corps of Engineers, Seattle District. Feasibility Report: Navigation and Beach Erosion, Willapa River and Harbor and Naselle River, Washington.

[8] The term "Willapa Harbor" is used in various congressional authorizations and in reports of the Corps of Engineers and is synonymous with "Willapa Bay".

Year	Study or Report (continued)
1967	U.S. Army Corps of Engineers, Committee on Tidal Hydraulics. Willapa Bay, Washington.
1967	U.S. Army Corps of Engineers, Seattle District. Willapa River and Harbor (Navigation) and Cape Shoalwater (Erosion), Washington, Feasibility Studies Plan of Survey.
1967	U.S. Army Corps of Engineers, Seattle District. Record of Public Hearing Held at Raymond, Washington 26 March 1967, Review of Reports: Willapa River and Harbor and Naselle River, Washington, and Cape Shoalwater, Washington.
1967	U.S. Army Corps of Engineers, Committee on Tidal Hydraulics. Study of Erosion at Cape Shoalwater. Report prepared by committee members Dwain Hogan, Chief, Tidal Hydraulics Unit, Seattle District, and Eugene Richey, Associate Professor of Civil Engineering, University of Washington.
1966	State of Washington Department of Conservation. Considerations for the Temporary Arresting of the Erosion at Cape Shoalwater, Washington. Report by Erosion Advisory Committee composed of four professors at University of Washington, with advisors and consultants from the Corps' Seattle District, North Pacific Division, and Coastal Engineering Research Center.
1956	U.S. Army Corps of Engineers, Seattle District. Review of Reports on Willapa River and Harbor, Washington.

2.2 Existing Water Projects

2.2.1 Willapa River and Harbor and Naselle River Navigation Project

The Willapa River and Harbor and Naselle River, Washington, project was authorized by the River and Harbor Act of July 27, 1916 and modified by subsequent Acts. The project includes about 26 miles of channel from the mouth of Willapa Bay through the Willapa River forks, 2,800 feet of the Palix River-Bay Center channel, and nine miles of Naselle River upstream of the U.S. Hwy 101 Bridge. The project was completed in 1958. Project features are not in close proximity to the Shoalwater Reservation, and thus are not believed to have any bearing on identified problems. Project features include the following:

- Channel over the bar at mouth of Willapa Bay, -26 ft MLLW and at least 500 ft wide;
- Channel -24 ft MLLW and 200 ft wide from deep water in Willapa Bay to the foot of Ferry Street at South Bend, Washington, thence 300 ft wide to the westerly end of the Narrows, thence 250 ft wide to the forks of the Willapa River at Raymond, WA;
- Channel -24 ft MLLW and 150 ft wide up the South Fork of the Willapa River and up the North Fork of the Willapa River;
- Channel -10 ft MLLW and 40 ft wide from deep water in Palix River to Bay Center, WA, dock, with widening at the shoreward end to provide a small mooring basin;

- Entrance channel -15 ft MLLW and 100 ft wide and a mooring basin 15 ft deep, 340 ft wide and 540 ft long adjacent to the port wharf at Tokeland, WA;
- Entrance channel at Nahcotta, WA, 10 ft deep and 200 ft wide, and a mooring basin -10 ft MLLW, 500 ft wide and 1,150 ft long, protected by a rubble mound breakwater about 1,500 ft long; and
- Removal of snags, piles and other obstructions in the navigable channel of the Naselle River between Naselle and the mouth.

The Corps discontinued maintenance dredging of the 26-foot channel over the bar in 1976 due to inadequate economic benefits. Since 1976, no maintenance dredging has been required along the Federal river channel leading up from Willapa Bay to port facilities located at Raymond, Washington. Federal maintenance dredging for shallow draft navigation continues at Willapa Bay for facilities at such locations as Toke Point, Bay Center, and Nahcotta.

2.2.2 March 2001 Emergency Flood Berm Constructed by Corps

A March 3, 1999 storm caused significant flooding of the Shoalwater Reservation, and resulted in the initiation of an emergency flood protection planning process by the Corps' Seattle District Emergency Management Branch. Subsequently, in March 2001, a 1,700-foot-long riprap flood berm segment, with a top elevation of +17 feet MLLW, was constructed along a small portion of the Shoalwater Reservation shoreline under the Corps' Flood Control and Coastal Emergency (FC&CE) authority. While this segment of flood berm has provided a degree of protection to the Tribal Center from direct wave attack, the structure fails to address habitat destruction in the 700 acre North Cove embayment caused by storm wave overwash of the eroded barrier dune, nor flooding of Reservation uplands resulting from the continued deterioration of the eroded barrier dune on Graveyard Spit.

2001 emergency flood berm, looking east

2001 emergency flood berm, looking west

2.2.3 December 2007 Emergency Flood Berm Extension

A severe storm, with sustained winds of 50 mph and gusts in excess of 100 mph, hit the Washington coast the weekend of December 1-3, 2007. In response to a November 30, 2007 Shoalwater Tribal Council emergency declaration, the Corps constructed an additional 300 feet of shoreline flood berm to provide interim protection to essential facilities on the Shoalwater Reservation. Emergency construction was initiated on December 1, extending the 2001 emergency shoreline flood berm in a northwesterly direction, tying into high ground at the shoulder of State Route 105 (see photos below). Low spots on the 2001 flood berm (the result of natural settlement) were also filled, restoring these areas to their original +17 feet MLLW elevation. In addition, the Corps' Seattle District provided sand bags and technical assistance to the Shoalwater Tribe.

The December 2007 storm, and the resulting storm surge, created the potential for serious flooding of the Shoalwater Reservation, particularly in light of the continued erosion of the Graveyard Spit barrier dune since the previous winter storm season. The brunt of the storm hit the coast on December 1-2, with a high tide of +13.4 feet MLLW (predicted high tide of +8.4 feet MLLW plus 5 foot storm surge). By December 3, the winds were decreasing, but the storm surge reached a maximum of 5.5 feet. Due to the direction of sustained winds and less than extreme high tide, the Shoalwater Reservation experienced only minor flooding. Residential property damage immediately to the east of the Shoalwater Reservation was evident, however, due to wave run-up and overtopping of the shoreline from wind-driven waves that attack the shoreline.

December 2007 flood berm extension (photos taken December 5, 2007)

December 2007 flood berm construction, looking east (left photo) and looking west (right photo)

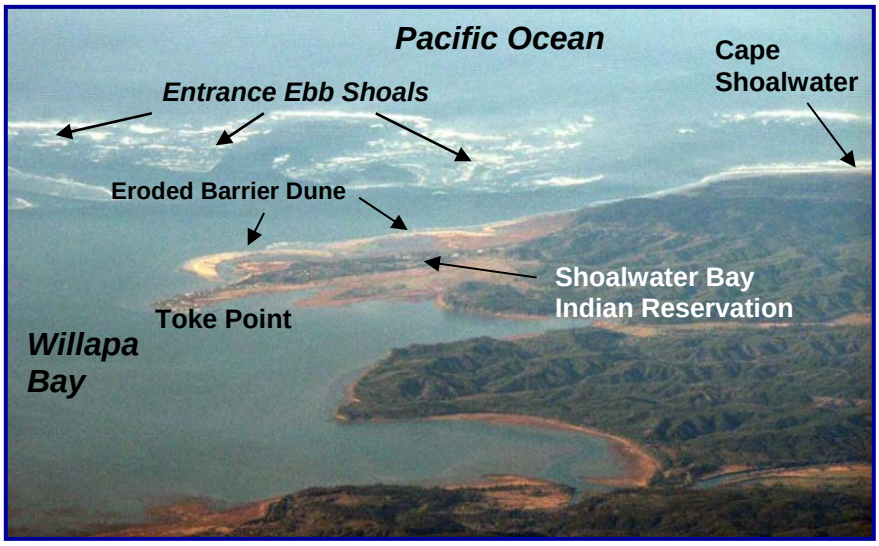
Large woody debris accumulation in North Cove adjacent to flood berm – December 5, 2007

SECTION 3: PLAN FORMULATION

3.1 Water and Related Land Resources Problems and Opportunities

3.1.1 Existing Conditions

The northern shoreline of Willapa Bay, specifically Cape Shoalwater to the west of the Shoalwater Reservation (see **Figure1.1, Vicinity and Location Map**), was notorious during most of the 20th century for its rapid erosion. The massive tidal flow of the northernmost Willapa channel, combined with energetic ocean waves resulted in an actively eroding coast. The north shoreline of Willapa Bay inshore (east) of the extensive ebb shoals which extend north of Leadbetter Point to Cape Shoalwater largely stopped migrating north by 1985.



Oblique aerial photo of project area

The historical trends of primary concern in this project involving the Shoalwater Reservation are related to the evolution of the spits and dune system fronting the Shoalwater Reservation and Tokeland Peninsula (see **Figures 3.1(a), 3.1(b), and 3.2. – Note: figures are located at end of Section 3**). These spits formed the genesis of the North Cove embayment and have historically defined the physical and environmental setting in which the Shoalwater Reservation was established and has evolved. As Cape Shoalwater to the west rapidly eroded during the early part of the 20th century, the main spit, which became known as Graveyard Spit[9], retreated landward to the north-northeast. The reason for this long-term shoreline retreat is now documented to be directly related to the northerly migration of the northern Willapa channel. By 1985, the Willapa channel encountered erosion-resistant Pleistocene terrace deposits exposed at

[9] The origination of the name "Graveyard Spit" is unknown, but does not refer to an actual graveyard or burial ground.

the base of State Route (SR) 105, and its northerly migration at this location essentially halted. In fact, since that time, the Willapa channel thalweg has migrated slightly to the south.

The alignment and geometry of the northern Willapa channel thalweg has been relatively stable since the mid-1980's, indicating that future large-scale spit erosion due to channel migration is unlikely. The reason for changes to Graveyard Spit in the last two decades is attributable to the interruption of the natural littoral transport of sand from the west, and Graveyard Spit has become lower and narrower due to natural erosion. Reasons for interruption of the littoral supply of sand are not completely understood, but are considered to be related to diminished supply of sediment passing dams on the Columbia River, thereby diminishing the sediment supply in the Columbia River littoral cell which extends from Tillamook Head, Oregon, to Point Grenville, Washington. There is no evidence that the longshore transport of sediment that naturally nourished the barrier dune system on Graveyard Spit will be reestablished.

The Graveyard Spit barrier dune position stabilized by 1985, but began narrowing due to decreased longshore transport of sediment. Storm-generated ocean waves were, however, effectively blocked by the dune. The dune served its natural purpose of sheltering and protecting both the subsistence intertidal habitat in the Shoalwater Tribe's North Cove embayment and tribal uplands alike.

As illustrated on **Figure 3.2**, a continuous, partially vegetated, barrier dune existed on Graveyard Spit in 1994. By the mid-1990's, however, erosion of Graveyard Spit had begun to significantly compromise its historical function as a storm barrier for the Shoalwater Reservation. By the late 1990s, Graveyard Spit was increasingly subject to storm overwash under elevated water conditions. Winter storms in 1998-1999 caused a breach to form in the barrier dune. A March 3, 1999 storm, with a high tide elevation of +13.61 feet MLLW, resulted in flooding of Shoalwater Reservation uplands. This galvanized Tribal leadership to seek assistance, resulting in the WRDA 2000 project authorization. The Polaroid photos below are the only known record of the March 3, 1999 coastal storm event that flooded the Shoalwater Reservation uplands.

Upland flooding on Shoalwater Reservation due to storm- generated ocean waves – March 3, 1999

Upland flooding on Shoalwater Reservation due to storm-generated ocean waves – March 3, 1999

Storm-generated ocean waves under elevated water conditions continue to erode and overwash the barrier dune, exposing the Shoalwater Reservation to increasing wave energy and a corresponding increase in frequency and severity of flooding of uplands and erosion of the shoreline. By 2003, the barrier dune had narrowed and lowered significantly. Two well-defined breaches, which alter longshore transport of sediment, are evident in the 2003 photo shown on **Figure 3.2**. As evidenced by the 2006 photo, significant overwash of the barrier dune continues. July 2008 aerial flight mapping data clearly shows that dune crest elevation is less than mean high water in many areas along the length of the barrier dune.

As described in **Section 1.4.3**, the Shoalwater Reservation is very small, totaling some 1,140 acres. Of this total, 700 acres is marine intertidal habitat in the North Cove embayment, as illustrated in **Figure 1.2**. Tribal community, commercial and residential land uses and transportation are located within the 440 acres of Reservation uplands. Existing conditions relative to the Shoalwater Reservation's North Cove embayment intertidal habitat and the uplands are discussed in the following paragraphs.

There are 700 acres of marine intertidal habitat, representing 61 percent of the entire Shoalwater Reservation, located in the North Cove embayment. This area, which includes approximately 5,000 linear feet of the barrier dune, was traditionally used by Tribal members for subsistence fishing and shellfish food gathering and as a source of native plants for religious and ceremonial use. Erosion and storm wave overwash of the Graveyard Spit barrier dune has resulted in a near total loss of the habitat that supported this subsistence food gathering resource. This tideland portion of the Shoalwater Reservation, which previously provided rich harvests of shellfish, is non-productive today. Infilling with sand and debris from storm overwash of the barrier dune has accelerated dramatically since the March 3, 1999 coastal storm which resulted in the WRDA 2000 project authorization. The dune elevation has decreased with each passing year, resulting in near complete loss of shellfish habitat in North Cove. The Shoalwater Tribal Council has advised that once productive shellfish beds in North Cove have been totally obliterated due to storm overwash of the barrier dune. Erosion of the Reservation shoreline from wave run-up at extreme water levels has also contributed to the infilling and loss of habitat.

Culturally, the shellfish and fish in this intertidal region have been a source of traditional subsistence foods upon which Tribal members depend for their health and dietary welfare. The intertidal marine habitat provides the last of the culturally traditional foods the Tribe utilizes, which are healthy choices in light of the Tribal members' propensity for diabetes and other illnesses. Additionally, "sweetgrass" found in the intertidal wetlands is both culturally and spiritually important to the Tribe; it is used extensively in religious ceremonies, for basket weaving, mats, and other woven crafts, and for traditional clothing and hats. Today, marsh plants dominate much of the intertidal areas of North Cove. Species present include beach grass, sedges, rushes, *Salicornia sp.*, and the invasive exotic salt marsh grass *Spartina alternaflora*.

The 440 acres of Reservation uplands consists of a narrow strip of low elevation land paralleling the shoreline, backed by a steep forested hillside along the northeast edge. The narrow band of developable uplands is adjacent to the shoreline and is extensively interspersed with wetlands, and is traversed by State Route (SR) 105 and Old Tokeland Road. Many of these

upland freshwater wetlands were reportedly formed after the State of Washington constructed SR-105 in the 1950s. The forested hillside, upland wetlands, SR-105, and Old Tokeland Road combined represent approximately 300 acres, leaving approximately 140 acres upon which the entire Shoalwater Reservation's land use development is restricted.

The Shoalwater Tribe has been extremely proactive in implementing building codes, environmental ordinances, and emergency plans to address the challenges that their vulnerability to coastal storms and flooding have provided. Three of four emergency backup generators were placed in service in 2008. The generators adjacent to the Wellness Center and at the Tribal Social and Family Services Center have been flood-proofed by installing them on elevated platforms. There is also a new emergency back-up generator at the Tribal water supply treatment center and pumping plant, and a back-up generator is also located at the Tribal Casino. More than 30 Tribal and non-Native community members form an Emergency Management team in accordance with Community Emergency Response Team (CERT) Program standards, and have been trained to react to disaster relief issues. A community emergency evacuation complex is in the early stages of development out of harms way near the top of the steep hillside along the northeast Reservation boundary. It is accessible from SR-105 by a narrow gravel road cut through the hillside. A 20-foot shipping container has been placed on a small flat area on the hillside, and has been stocked with emergency supplies, including blankets and food. The Reservation water supply tank is also located along the access road, as is one residential dwelling. Topography, wetlands, and acreage limitations seriously constrain opportunities for Reservation land use development that is out of the coastal storm and flood zone. The Tribe's Emergency Management team closely monitors coastal weather conditions. They routinely coordinate with the National Weather Service and the Corps' Seattle District's Emergency Management Branch, meteorologist, and coastal engineering staff. Earthquake/ tsunami drills are routinely conducted by the Tribe, in coordination with State agencies.

3.1.1.1 Inventory of Reservation Land Use, Structures, and Facilities

A summary inventory of structures and facilities on the Shoalwater Reservation, by land use category, is presented in **Table 3.1** below. Reservation land use consists of tribal community, tribal commercial, tribal residential, and non-tribal public infrastructure. The predominant land use category is that of Tribal community. Virtually all Tribal offices and functions are located in a very new complex that includes the Tribal Community Center. The Tribal Community Center houses offices for administration of Tribal government and Tribal elders lunch program. Tribal police are co-located in the Community Center building. The Tribal Wellness Center serves three groupings of people: Shoalwater Bay Tribal members; other Native Americans, but not Shoalwater Bay Tribal members; and non-Native persons who have designated the Wellness Center for their medical care and who are served as third-party patients. Patient numbers for the Wellness Center include 2,500 medical patients, 2,000 dental patients, and 200+ mental health patients. Located near the Wellness Center are the Tribal Education Center and Library, Tribal Court, Tribal Social and Family Services, Tribal Counseling Facility, and the Tribal Cultural Repository Building. Flood-proofed emergency back-up generators are

Table 3.1 Summary Inventory of Reservation Land Use, Structures, and Facilities

LAND USE / STRUCTURE AND FACILITY NAME	QUANTITY
Land (Uplands)	440 Acres
Marine (Intertidal)	700 Acres
TOTAL SHOALWATER RESERVATION	**1,140 Acres**
TRIBAL COMMUNITY **	
Tribal Community Center / Tribal Police	1
Tribal Cemetery	1
Tribal Court	1
Tribal Education Center & Library	1
Tribal Wellness Center (Medical / Dental / Mental Health)	1
Tribal Social and Family Services	1
Tribal Counseling / Interview Facility	1
Tribal Cultural Repository Building	1
Tribal Gymnasium and Assembly Hall	1
Tribal Emergency Backup Generators	4
Tribal Water Storage Tank	1
Tribal Water Treatment / Pump House	1
Tribal Storage and Maintenance	2
Emergency Evacuation Complex (under development)	1
Tribal Environmental Complex	1
• Office Buildings	2
• Laboratory Buildings	2
• Storage and Maintenance Building	1
TRIBAL COMMERCIAL **	
Tribal Casino Complex	1
Tribal Recreational Vehicle Park	1
Tribal Businesses (privately owned and operated)	14
TRIBAL RESIDENTIAL **	
Single Family Residence (includes 6 outside Reservation)	36
Duplex Family Residence	12
Mobile Home Residence	4
PUBLIC INFRASTRUCTURE	
State Highway 105 (State of Washington)	----------
Old Tokeland Road (Pacific County)	----------

** Note: All facilities include septic systems

located at the Tribal Social and Family Service Building, Tribal Wellness Center, Tribal Casino, and the Water treatment/pump house facility. The Tribal cemetery is considered to be the cultural center of the Shoalwater Reservation, and is located across Old Tokeland Road from the Tribal Community Center.

There is very limited Tribal commercial activity on the Shoalwater Reservation. The Shoalwater Bay Casino is located on SR-105 at its intersection with Old Tokeland Road. The casino is the Shoalwater Tribe's primary source of Tribal funding for operation of the Wellness Center, Tribal government, and social programs. The casino has about 25,000 visitors annually, and does not generate large revenues for the Tribe. An adjacent small recreational vehicle park for casino patrons was installed in 2006. Both are operated as Tribal commercial enterprises. In addition, there are 14 privately owned and operated Tribal businesses located along SR-105, including two small convenience stores, and 12 seasonal fireworks stands. Seven fireworks stands are permanent structures and are included in the structure inventory; five are temporary structures removed at the end of the fireworks season.

Tribal residential development is limited, and efforts are underway to provide additional housing. Presently, there are 36 single family residences, six duplex family residences, and four mobile home residences. Two small parcels of land in nearby Tokeland have been purchased by the Tribe for development of additional housing; six single family residences have already been developed on one site. Due to limited buildable space for on-Reservation housing, some Tribal members reside in non-Tribal housing outside the Shoalwater Reservation.

Non-Tribal public infrastructure which traverses the Reservation includes SR-105 and Old Tokeland Road. SR-105 is maintained by the Washington Department of Transportation, and Old Tokeland Road is maintained by Pacific County.

On **Table 3.2**, individual at-risk Shoalwater Reservation structures and facilities have been inventoried. Each is assigned an inventory number. For each structure or facility, the following information has been compiled: elevation in feet above mean lower low water (MLLW), distance from the shoreline, square footage, and number of floors. Photos of Tribal community, commercial, and representative residential structures are presented on the pages immediately following **Table 3.2**. Inventory numbers that are highlighted on **Table 3.2** have corresponding photos shown on the pages immediately following the table.

Table 3.2 Physical Inventory of At-risk Structures and Facilities

Inventory Number	Structure Name / Function	Elevation Above MLLW (feet)	Distance from Shoreline (feet)	Area (square feet)	Number of Floors
1	Tribal Business (Fireworks Stand)	15.0	131	400	1
2	Tribal Business (Fireworks Stand)	16.5	283	572	1
3	Tribal Business (Convenience Store) / Single Family Residence	17.3	334	4,020	1
5	Single Family Residence	19.0	412	1,593	1
7	Tribal Business (Fireworks Stand)	15.6	282	450	1
8	Vacant Single Family Residence	16.2	343	240	1
9	Vacant Single Family Residence	16.2	343	1,260	1
10	Single Family Residence	16.0	220	1,110	1
11	Single Family Residence	26.0	372	2,077	1
12	Mobile Home Residence	15.2	220	1,240	1
13	Tribal Business (Fireworks Stand)	16.3	169	528	1
14	Tribal Business (Fireworks Stand)	16.0	177	375	1
15	Tribal Business (Fireworks Stand)	15.8	183	240	1
16	Single Family Residence	17.2	225	2,038	1
17	Single Family Residence	17.0	220	2,038	1
18	Single Family Residence	17.0	220	2,038	1
19	Single Family Residence	17.0	220	2,038	1
20	Water Treatment, Pump House, Back-up Generator	14.2	245	608	1
21	Single Family Residence	14.2	397	1,764	1
23	Single Family Residence	13.9	361	4,272	2
24	40 foot shipping container	15.0	308	400	1
25	40 foot shipping container	14.5	328	400	1
26	40 foot shipping container	14.5	338	400	1
27	Tribal Business Storage	15.3	287	1,377	1
28	Tribal Business (Convenience Store)	15.3	273	1,856	1
29	Tribal Gaming (Regulators) Office	13.4	422	2,040	1
30	Tribal Casino Administrative Office	14.8	418	938	1
31	Tribal Casino Administrative Office	14.8	435	2,240	1
32	Tribal Casino and emergency back-up generator	14.9	358	13,033	1
33	Bus Shelter	17.4	287	182	1
33a	Casino Septic Field	14.6	260	45,000	-----
34	Single Family Residence	17.0	190	1,484	1
36	Single Family Residence	16.8	277	2,405	1
37	Single Family Residence	15.1	366	2,073	1
38	Single Family Residence	16.0	364	1,624	1
39	Single Family Residence	16.7	272	1,932	1
40	Single Family Residence	16.7	185	1,504	1
42	Single Family Residence	14.9	375	1,036	1

Table 3.2 Physical Inventory of At-risk Structures and Facilities (continued)

Inventory Number	Structure Name / Function	Elevation Above MLLW (feet)	Distance from Shoreline (feet)	Area (square feet)	Number of Floors
43	Single Family Residence	13.0	501	1,312	1
44	Tribal Business (Fireworks Stand)	14.0	114	612	1
45	Mobile Home Residence	15.9	310	800	1
47	Single Family Residence	15.9	303	1,344	1
49	Mechanical Repairs Building for Tribal Fishing Boats and Gear	15.0	388	1,517	1
50	Mobile Home Residence	13.7	506	900	1
51	Single Family Residence	16.0	154	700	1
52	Single Family Residence	16.1	151	2,340	1
54	Mobile Home Residence	15.9	306	720	1
55	Mobile Home Residence	15.7	306	720	1
60	Single Family Residence	18.1	244	1,960	1
61	Single Family Residence	18.0	224	1,548	1
62	Single Family Residence	17.3	289	1,952	1
63	Single Family Residence	18.4	381	1,575	1
64	Single Family Residence	18.4	420	1,914	1
65	Single Family Residence	17.9	420	2,020	1
66	Single Family Residence	18.0	405	1,526	1
67	Single Family Residence	18.1	315	1,932	1
69	Tribal Community Center / Tribal Police	16.4	153	8,837	2
71	Tribal Education Center and Library	17.4	260	3,564	1
72	Tribal Court	15.7	105	1,736	1
73	Tribal Social and Family Services	15.1	163	1,296	1
74	Emergency Back-up Generator (Flood-proofed)	15.1	163	204	-----
75	Tribal Cultural Repository Building	14.6	276	782	1
76	Tribal Counseling / Interview Facility	14.6	276	800	1
77	Tribal Warehouse/Maintenance Building	14.6	276	1,650	1
83	Tribal Wellness Center	16.0	463	8,474	2
83a	Emergency Back-up Generator (Flood-proofed)	17.2	460	200	-----
84	Duplex Family Residence	17.3	710	2,223	1
85	Duplex Family Residence	17.5	720	2,223	1
86	Tribal Gymnasium and Assembly Hall	15.4	707	9,600	1
87	Gymnasium Storage Building	15.4	860	1,128	1
88	Duplex Family Residence	13.5	1032	2,324	1
89	Duplex Family Residence	13.6	1117	2,324	1
90	Duplex Family Residence	13.3	1213	2,324	1
91	Duplex Family Residence	12.9	1301	2,324	1
92	Tribal Recreational Vehicle Park & Casino Parking	13.6	90	56,000	-----
93	Tribal Cemetery	14.3	462	65,000	-----

Tribal Community Center (Inventory # 69)

Tribal Wellness Center (Inventory # 83)

Tribal Education Center & Library (Inventory # 71)

Tribal Court (Inventory # 72)

Tribal Social and Family Services (Inventory # 73)

Flood-proofed Emergency Backup Generator (Inventory # 74)

Tribal Cultural Repository Building (Inventory # 75)

Tribal Counseling / Interview Facility (Inventory # 76)

Tribal Warehouse / Maintenance Building (Inventory # 77)

Tribal Casino, including administrative offices (Inventory # 29, 30, 31, 32); Bus shelter (Inventory #33); Recreational Vehicle Park (Inventory # 92). Note December 2007 emergency flood berm construction in foreground and large woody debris deposited by coastal storm

Gymnasium and Assembly Hall (Inventory # 86)

Tribal Water Treatment, Pump House, and Back-up Generator (Inventory # 20)

Emergency Backup Generator (Behind Wellness Center) (Inventory # 83a)

Casino Septic Field, Tribal Business (Convenience Store), and Housing (Inventory # 33a, 28, 21 / 23)

Tribal Business (Convenience Store) (Inventory # 3)

Tribal Business (Fireworks Stand) (Inventory # 2)

Tribal Businesses (Fireworks Stands) (Inventory # 14, 15)

Single Family Residences (Right Side of Photo) (Inventory # 16, 17, 18, 19)

Single Family Residence (Inventory # 16)

Single Family Residence (Inventory # 34)

Single Family Residence (Inventory # 37

Single Family Residence (Inventory # 60)

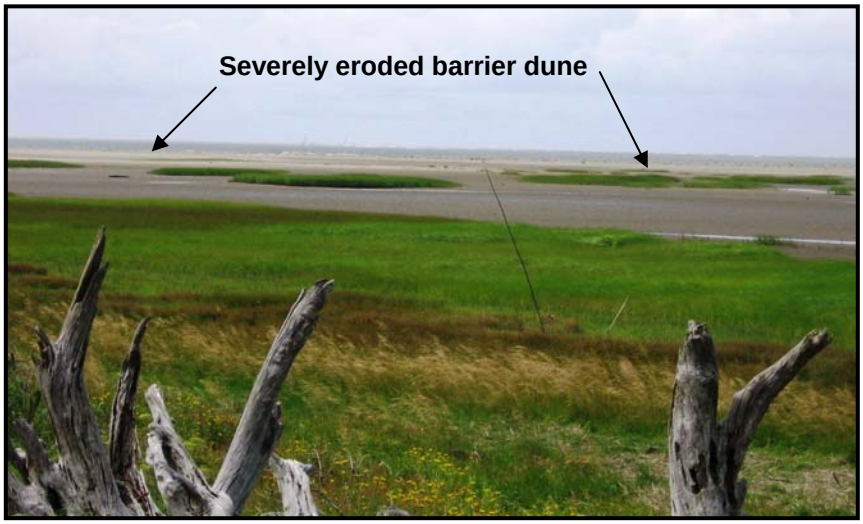
Single Family Residence (Inventory # 23)

Duplex Residences (Inventory # 84, 85)

Duplex Residences (Inventory # 88, 89, 90, 91)

The Shoalwater Tribe recognizes that they must comprehensively address the serious and growing issue of loss of their Reservation lands and habitat to coastal erosion due to Pacific Ocean storms. In recent decades, they witnessed considerable coastal erosion, damage, and loss along the Washington coast, particularly in an area to the west of the Shoalwater Reservation known as Cape Shoalwater. Since the early 1990s, the Tribe has noticed erosion and lowering of the barrier dune on Graveyard Spit that has historically protected the Reservation from Pacific Ocean storms. The ongoing erosion has taken on a new importance for the Tribe in that the protective sand dunes and storm wave barrier that previously protected the Tribe's reservation lands have now been eroded, and there is less and less protection with each passing coastal storm event. Protecting their land and heritage is the quest the Tribe initiated in 1999 when they approached Congress and the office of the ASA(CW) for assistance from the Federal Government in addressing coastal erosion problems. The Tribe's objective has been to implement a long-term solution before a coastal storm event results in devastation of their small coastal Reservation.

To date, major coastal storm damage has been inflicted on the sensitive habitat in the North Cove embayment, and resulted in shoreline erosion and upland flooding. As noted above, shellfish beds have been smothered by sand washed from the protective dune into the Cove and periodically covered with large woody debris carried over the eroded dune by storm waves. The reservation shoreline has been eroded by wave attack, and wave run-up has flooded the shoreline, including the Tribal Community Center grounds, recreational vehicle park and casino parking lot, and portions of Old Tokeland Road. This flooding – including March 1999, February 2006, and December 2007 – has thus far resulted in nuisance flooding and disruption of vehicle traffic. During these events, there was still sufficient dune elevation on Graveyard Spit to attenuate some wave energy, thereby reducing the wave height at the shoreline. The extensive modeling performed by the Corps' Coastal and Hydraulics Laboratory confirms, however, that the severity of storm wave attack will increase significantly as the barrier dune continues to erode. The next coastal storm event, if it occurs at an extreme water elevation of 13.00 feet MLLW or higher (see **Table 3.2**), is expected to result in very serious damage to property and possible risk to life and limb. If transportation is disrupted due to flooding, emergency response will be compromised as well.



Eroded barrier dune, with Willapa Bay in background and North Cove embayment in foreground (at low tide)

North Cove embayment at extreme high tide following coastal storm – February 6, 2006. Note flooding of uplands

Water and debris on non-Reservation uplands adjacent to Shoalwater Tribe governmental complex – February 4, 2006

Debris on non-Reservation uplands adjacent to Shoalwater Tribe governmental complex – February 4, 2006

3.1.2 Future Without-Project Conditions

The future without-project condition is the most likely condition expected to exist on the Shoalwater Reservation in the future in the absence of a water resources project. The future without-project condition constitutes the benchmark against which all alternative plans were evaluated. To understand and document future without-project conditions relative to the Shoalwater Reservation, comprehensive scientific investigations of the coastal processes at Willapa Bay were conducted by an interagency team which included the Corps' Seattle District; the Corps' Coastal and Hydraulics Laboratory (CHL) at the U.S. Army Engineer Research and Development Center (ERDC); U.S. Geological Survey's Coastal and Marine Geology Program (USGS); and Washington Department of Ecology's Coastal Monitoring and Analysis Program.

Investigations were conducted by an interdisciplinary team of coastal and hydraulic engineers, coastal geologists, and oceanographers working in the context of an interagency collaborative planning process. The CHL and USGS investigations were essentially separate, but complementary. **Complete documentation of the investigations conducted as part of the study is found in Appendix 1 to this report, entitled *Engineering Analysis and Design*:**

- Problem Identification and Study Approach (**Chapter 1 of Appendix 1**)
- Geologic Framework (**Chapter 2 of Appendix 1**)
- Geomorphic Cycles (**Chapter 2 of Appendix 1**)
- Shoreline Evolution (**Chapter 2 of Appendix 1**)
- Tidal Circulation (**Chapter 3 of Appendix 1**)
- Wave Analysis (**Chapter 3 of Appendix 1**)
- Waves, Currents and Sediment Transport (**Chapter 3 of Appendix 1**)
- Recent Bathymetric Changes (**Chapter 3 of Appendix 1**)
- Shoreline and Dune Erosion – SBEACH Analysis (**Chapter 3 of Appendix 1**)
- Storm Inundation Analysis (**Chapter 3 of Appendix 1**)
- Alternatives Analysis (**Chapter 4 of Appendix 1**)
- Sand Borrow Sites and Beneficial Use (**Chapter 5 of Appendix 1**)
- Incorporating Sea Level Change (**Chapter 6 of Appendix 1**)

These comprehensive investigations clearly document that the coastal erosion processes, driven by Willapa Channel migration, have undergone a profound change over time. The northward migration of the North Willapa Channel has slowed and reversed its course, sparing the last of the eroded barrier dune on Graveyard Spit. From the mid-1980's to the present, the slope of the north bank of the channel has been constant and has remained in a fixed position. This strongly suggests that the channel encountered the erosion-resistant Pleistocene Terrace deposits that have been documented in borings by the State of Washington. The North Willapa Channel west of North Cove has widened and deepened, such that the increasing cross-sectional area of the channel results in weakening the current and thereby reducing current-induced erosion. The incident wave climate at Willapa Bay is severe, with storm wave heights exceeding 23 feet. However, the ebb shoals extending north from Leadbetter Point substantially attenuate

incident waves in the interior of the bay. The tide level modulates waves within the bay, with more wave energy penetrating the bay at high tide levels and less at low tide levels.

Rather than attempting to turn aside the advance of the North Willapa Channel (which was briefly investigated), engineering solutions to protect the Shoalwater Reservation will need only to address the erosion of Graveyard Spit and resulting flooding caused by locally generated storm waves which occur under elevated water conditions. Sophisticated wave studies, including the collection of field data and numerical modeling by CHL, concluded that these waves are relatively small by coastal engineering standards. However, storms which coincide with elevated water levels will continue to contribute to natural erosion of the barrier dune, with increasing flooding and erosion of tribal uplands lands and damage to Tribal infrastructure. As described in **Section 2.2.3 of Appendix 1**, changes in storm paths and frequency, as well as increased wave heights and altered wave directions during El Niños are likely factors that alter erosion patterns in Willapa Bay. Dramatic increases in shore flood damage have been attributed to significantly higher waves coincident with El Niños, as well as unusually high winter sea levels. Evidence has been found of repeated increases in monthly sea level on the order of 0.7 to 1.0 feet for several months during El Niño events. Graveyard Spit barrier dune breaches and storm overwash into North Cove seems to be strongly dependent on processes promoted by El Niños. Thus, El Niño years suggest time periods associated with reduction in the barrier dune reliability.

Future without project conditions are characterized in the context of the following: barrier dune, storm-generated waves, shoreline erosion, upland flooding, physical and infrastructure impacts, environmental impacts, and social/cultural impacts. Future without project conditions are described below.

3.1.2.1 Barrier Dune

Graveyard Spit will continue to exist as a thin and fragmented landform that is anchored and aligned by the underlying consolidated and erosion-resistant Pleistocene substrate. In contrast to historic conditions, this fragile line of barrier dunes no longer receives sand supply from the eroding beach plain to the west, due to interruption of the longshore transport of sediment. The lack of sand supply means that Graveyard Spit will remain in very low relief under the expected future without-project condition. In this condition the barrier dune crest elevation will continue to erode to approximately mean high water and to move landward into North Cove. Graveyard Spit's historical function as a storm wave barrier for the Shoalwater Reservation is greatly diminished. Storm-generated ocean waves at extreme water elevations will expose the Shoalwater Reservation to more frequent and severe wave energy and a corresponding increase in destruction of subsistence habitat in the North Cove embayment, shoreline erosion, flooding of uplands, and loss of a sense of tribal community and viability.

The transformation of Graveyard Spit barrier dune between 1994 and 2006 is illustrated by **Figure 3.2**. The continuous barrier dune that existed in 1994 has narrowed and lowered due to decreased sand supply and is increasingly subject to storm overwash. Breaches have formed and altered local longshore transport of sediment. Storm overwash will become more and more

frequent. The eroded barrier dune provides ever diminishing protection to the Shoalwater Reservation from storm-generated waves.

Even if the frequency of extreme maximum tides remains constant, narrowing and lowering of the dune profile will continue. The wave protection previously afforded by the barrier dune will further diminish, leaving the Tribal community increasingly vulnerable to winter storms. Serious flooding of Shoalwater Reservation uplands and adjoining lands will occur at increasingly frequent intervals. Equally important is the fact that infilling of North Cove with sand due to storm wave overwash of the eroded barrier dune will accelerate, resulting in total loss of the once-productive habitat of this portion of the Shoalwater Reservation.

3.1.2.2 Storm-generated Waves

The level of storm wave protection provided by the eroded barrier dune system was jointly evaluated by the Coastal and Hydraulics Laboratory and Seattle District. The steady-state spectral wave (STWAVE) numerical model used in previous Willapa Bay studies was selected for the wave simulations. CHL used the STWAVE model to simulate the March 3, 1999 storm assuming that the barrier dune was eroded to the elevation of the surrounding land (+8 feet MLLW). Since extreme water levels are often associated with low atmospheric pressure events, extreme water levels are almost always accompanied by storm wave conditions. A numerical wave model was used to evaluate wave heights along the Tokeland Peninsula shoreline for the with and without dune conditions for a storm and extreme +13.61 feet MLLW water level that occurred on March 3, 1999. The model results indicate that the 1999 storm probably generated waves at the Tokeland Peninsula shoreline that were approximately 1.5 feet high. This severe wind storm occurred at a very high tide, causing significant flooding of tribal uplands and facilities and associated shoreline erosion, and posed a significant threat to life and property. The wave model was also used to simulate the same storm assuming that the dune was eroded to the elevation of the surrounding land (+8 feet MLLW). **Model results indicate that, without the protection of the barrier dune, wave heights at the Shoalwater Reservation shoreline will more than double to as much as 3.3 feet.**

High water elevations exceeding about +13 feet MLLW occurred 12 times in the last 35 years, and elevations at or above +13 feet MLLW have occurred six times since 1999 (see events in bold/blue lettering in **Table 3.3**). Even if the frequency of extreme water levels remains constant, lowering and narrowing of the barrier dune due to erosion will continue. The wave protection once afforded by the dune will continue to diminish, and flooding of the Shoalwater Reservation and adjoining lands due to storm wave overtopping during periods of high water elevation will occur at increasingly frequent intervals**.**

The Shoalwater Reservation is under immediate and growing threat of severe damage to Tribal facilities, infrastructure, and subsistence habitat due to storm wave attack and flooding. As the barrier dune continues to erode, the result will be significantly greater wave run-up and overtopping of Reservation uplands with each successive extreme storm event. Graveyard Spit has eroded to the point that it provides little if any wave attenuation, with the full force of the 3.3 feet storm-generated waves attacking and overtopping the shoreline. The little remaining North

Cove intertidal habitat is being in-filled with sand and is being transformed to high salt marsh. In short, loss of the Graveyard spit dune elevation will increase wave heights at the shoreline (increased storm damage) and increase overwash into North Cove (increased habitat destruction).

Table 3.3 Toke Point Highest Tides, 1973 Through December 2007

TOTAL WATER ELEVATION (FEET, MLLW)	MAX SURGE ELEVATION (FEET)[1]	% ANNUAL OCCURRENCE OF SURGE	DATE
14.41	5.0	5.6	November 14, 1981
14.07	**4.4**	**18.9**	**February 4, 2006**
13.87	-	-	December 11, 1973
13.61	**5.1**	**4.5**	**March 3, 1999**
13.41	**5.3**	**3.0**	**December 3, 2007**
13.36	-	-	December 3, 1982
13.23	**3.8**	**54.3**	**December 1, 2001**
13.21	**3.3**	**>100**	**January 2, 2003**
13.16	-	-	January 27, 1983
13.09	-	-	February 7, 1978
12.97	-	-	January 18, 1973
12.95	**2.8**	**>100**	**January 29, 1999**

[1] Dash indicates missing hourly water elevation data

3.1.2.3 Shoreline Erosion

Shoreline erosion will increase under future without project conditions. Reservation uplands are increasingly vulnerable to storm-generated ocean waves and shoreline erosion due to diminished dune protection. The March 3, 1999 storm caused severe flooding and resulted in the initiation of an emergency flood protection planning process. As a result, in March 2001, the Corps constructed a segment of riprap flood berm with a top elevation of +17 feet MLLW along 1,700 feet of the Shoalwater Reservation shoreline. The riprap flood berm was extended in length by 300 feet in December 2007. While this flood berm segment has provided a significant measure of protection from direct wave attack to that portion of tribal uplands and a reduction in potential shoreline erosion, the structure fails to address erosion caused by overtopping of the adjacent unprotected shoreline areas.

The SBEACH (Storm-induced BEAch CHange) numerical model was utilized to estimate the amount of erosion to the Reservation uplands under the assumption that Graveyard Spit is allowed to continually erode. Historic storm conditions from the past 20 years were used to relate storm return interval to cross-sectional area of shoreline eroded above mean high water. The unprotected regions of shoreline to the north and south of the existing shoreline flood berm have the largest potential for erosion. Model results indicate a 2% annual storm event (50 year

return interval) has the potential to erode 50 – 80 ft^2 of upland area per linear foot of shoreline in these areas, or a maximum of 30 ft shoreline recession. Shoreline erosion, particularly where flood berm has been constructed, is not expected to be as significant in the future. However, model results indicate as wave heights on the shoreline increase the volume of water overtopping the flood berm will have greater potential to erode areas behind the structure.

3.1.2.4 Upland Flooding

Under future without project conditions, storm-generated ocean waves that coincide with extreme water levels will flood the Shoalwater Reservation uplands with increasing frequency and severity because the eroded barrier dune has effectively lost its capability to effectively dissipate wave energy. Topographic mapping data from July 2008 confirm that the dune crest elevation is within 1 to 2 feet of mean high water along the length of Graveyard Spit. Upland flooding is calculated using the current dune configuration from the most recent topographic data in July 2008.

The wave analysis performed by CHL is extended to compute inundation depth (i.e. flooding depth) during high water levels from extreme high tides, storm surge, wave setup, and wave run-up to assess the flooding threat to the structures and facilities on the Shoalwater Reservation. Inundation depth is computed as the maximum water surface elevation produced by either static water or dynamic water. Low-lying regions with structures at greater distances from the shoreline will only typically be flooded by ponding water (i.e. static water). However, structures close to the shoreline will be more exposed to dynamic waver level changes which would result from wave run-up and overtopping. High velocity flooding from wave run-up, overtopping, or overland wave propagation is capable of carrying debris inland and thereby poses greater potential for structure damage. High velocity flooding also poses a significant risk to the health and safety of people and animals.

The likelihood of high water level events (or probability of occurrence) can be described statistically utilizing historic storm wave and water level data. Extreme storm surges and extreme high tides occur during the same winter months; therefore it is probable both occur at the same time. A detailed statistical analysis on the joint occurrence of high tides and storm surge is discussed in the Engineering Analysis and Design Appendix. A range of storm scenarios were analyzed in the inundation model to investigate the flooding risk to the Shoalwater Reservation shoreline and nearby structures and infrastructure. The 50%, 2%, and 1% annual storm surge occurrence is simulated in the model to occur at both a highly probable tide elevation and an extreme tide elevation. Mean higher high water (MHHW) and maximum astronomical tide (MAT) are utilized respectively. The definitions of MHHW and MAT are:

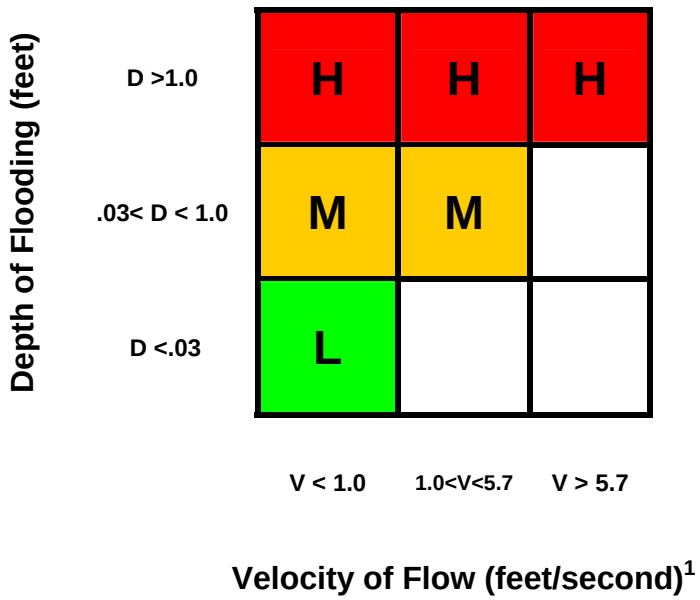
- **Mean Higher High Water (MHHW)**. The average of the higher high water height of each tidal day observed over the 18.6 year Tidal Datum Epoch (i.e., 1983-2001). This is 8.9 feet at the Toke Point tidal gage.
- **Maximum Astronomical Tide (MAT).** The maximum tidal height occurring each year during a spring tide. This is 11 feet above mean lower low water (MLLW) at the Toke Point tidal gage.

Figure 3.3 shows the location of the flood potential maps for the Shoalwater Reservation shoreline and upland region. **Figures 3.4 and 3.5** depict model simulation results of future without-project flooding depth for the March 3, 1999 storm. This is the storm of record for the Shoalwater Reservation.

3.1.2.5 Shoalwater Reservation Structure and Infrastructure Impacts

The model computes flooding depth under future without project conditions for each structure inventoried in **Table 3.2**. Flooding depth is a function of the proximity to the shoreline and the structure's first floor elevation and adjacent grade. The degree of flooding simulated in the inundation model is related to the computed flooding depth using the following classification:

Shoalwater Reservation Risk Assessment



Level of Risk	Significance of Risk
High (H)	Depth of flooding in structures above one foot causes significant damage to structure and contents
Medium (M)	Flood depths inside structures up to one foot can cause damage to structure or contents
Low (L)	Nuisance flooding with no flooding in structures, with still water that poses no life safety threat

[1] Note: flow velocity is a function of flood depth; therefore high velocity flows can only occur with sufficient depth.

Table 3.4 identifies the flood and storm damage threat for each Shoalwater Reservation structure and major infrastructure for a storm equivalent to the March 3, 1999 storm. The March 1999 storm is the storm of record, and coincided with a total water elevation of 13.61 feet MLLW. Thus, the model simulation reflects an observed event (storm of record), rather than a hypothetical event. As described above, the three categories of flood and storm damage threat identified in **Table 3.4** are: "Low risk" (color coded green), "Medium risk" (color coded yellow), and "High risk" (color coded red). The color scheme correlates to that used on **Figures 3.4 to 3.7** located at the end of this section. **Tables 3.5 and 3.6** quantify the structures exceeding a low level of risk for the 50%, 2%, and 1% annual storm surge occurrence rates during a tide elevation of MHHW and MAT, respectively. For a 2% annual storm surge at MAT, 92% of the structures inventoried are classified with medium or high flooding risk.

The barrier dune on Graveyard Spit was severely eroded during the March 3, 1999 storm event, yet still provided significant wave attenuation at that point in time. It has progressively eroded since that time. Following the December 3, 2007 event, erosion had effectively lowered the elevation of the barrier dune to its minimum elevation along its central portion, leaving the Shoalwater Reservation in an extremely vulnerable situation with respect to future storm surge events. In its present eroded state, the barrier dune provides little wave energy attenuation, such that future storm surge events will result in larger wave heights on the Shoalwater Reservation shoreline, with higher potential for flood and storm damage from high velocity flow and structural damage from debris. Photos below illustrate the volume of debris that accumulates during a single storm surge event. Similar woody debris accumulation is displayed in photos on pages 25, 44, and 45.

Woody debris carried ashore by December 3, 2007 storm surge event

Table 3.4 Future Without-Project Coastal Flood and Storm Damage Risk (March 3, 1999 storm)

Inventory Number	Structure Name / Function	Elevation Above MLLW (feet)	Distance from Shoreline (feet)	Flood and Storm Damage Risk
1	Tribal Business (Fireworks Stand)	15.0	131	High
2	Tribal Business (Fireworks Stand)	16.5	283	High
3	Tribal Business (Convenience Store) / Single Family Residence	17.3	334	Medium
5	Single Family Residence	19.0	412	Low
7	Tribal Business (Fireworks Stand)	15.6	282	High
8	Vacant Single Family Residence	16.2	343	High
9	Vacant Single Family Residence	16.2	343	High
10	Single Family Residence	16.0	220	High
11	Single Family Residence	26.0	372	Low
12	Mobile Home Residence	15.2	220	High
13	Tribal Business (Fireworks Stand)	16.3	169	High
14	Tribal Business (Fireworks Stand)	16.0	177	Low
15	Tribal Business (Fireworks Stand)	15.8	183	High
16	Single Family Residence	17.2	225	Low
17	Single Family Residence	17.0	220	Low
18	Single Family Residence	17.0	220	Medium
19	Single Family Residence	17.0	220	Medium
20	Water Treatment, Pump House, Back-up Generator	14.2	245	Medium
21	Single Family Residence	14.2	397	Medium
23	Single Family Residence	13.9	361	Low
24	40 foot shipping container	15.0	308	Low
25	40 foot shipping container	14.5	328	Low
26	40 foot shipping container	14.5	338	Low
27	Tribal Business Storage	15.3	287	Low
28	Tribal Business (Convenience Store)	15.3	273	Low
29	Tribal Gaming (Regulators) Office	13.4	422	Medium
30	Tribal Casino Administrative Office	14.8	418	Low
31	Tribal Casino Administrative Office	14.8	435	Medium
32	Tribal Casino and emergency back-up generator	14.9	358	Low
33	Bus Shelter	17.4	287	High
33a	Casino Septic Field	14.6	260	Medium
34	Single Family Residence	17.0	190	High
36	Single Family Residence	16.8	277	High
37	Single Family Residence	15.1	366	High
38	Single Family Residence	16.0	364	Medium
39	Single Family Residence	16.7	272	Medium
40	Single Family Residence	16.7	185	High

Table 3.4 Future Without-Project Coastal Flood and Storm Damage Risk (March 3, 1999 storm)(continued)

Inventory Number	Structure Name / Function	Elevation Above MLLW (feet)	Distance from Shoreline (feet)	Flood and Storm Damage Risk
42	Single Family Residence	14.9	375	Medium
43	Single Family Residence	13.0	501	Medium
44	Tribal Business (Fireworks Stand)	14.0	114	High
45	Mobile Home Residence	15.9	310	Low
47	Single Family Residence	15.9	303	Low
49	Mechanical Repair Building for Tribal Fishing Boats & Gear	15.0	388	Low
50	Mobile Home Residence	13.7	506	Medium
51	Single Family Residence	16.0	154	Low
52	Single Family Residence	16.1	151	Medium
54	Mobile Home Residence	15.9	306	Low
55	Mobile Home Residence	15.7	306	Low
60	Single Family Residence	18.1	244	Low
61	Single Family Residence	18.0	224	Low
62	Single Family Residence	17.3	289	Low
63	Single Family Residence	18.4	381	Low
64	Single Family Residence	18.4	420	Low
65	Single Family Residence	17.9	420	Low
66	Single Family Residence	18.0	405	Low
67	Single Family Residence	18.1	315	Low
69	Tribal Community Center / Tribal Police	16.4	153	Medium
71	Tribal Education Center and Library	17.4	260	Low
72	Tribal Court	15.7	105	High
73	Tribal Social and Family Services	15.1	163	High
74	Emergency Back-up Generator (Flood-proofed)	15.1	163	High
75	Tribal Cultural Repository Building	14.6	276	High
76	Tribal Counseling / Interview Facility	14.6	276	High
77	Tribal Warehouse/Maintenance Building	14.6	276	High
83	Tribal Wellness Center	16.0	463	Low
83a	Emergency Back-up Generator (Flood-proofed)	17.2	460	Low
84	Duplex Family Residence	17.3	710	Low
85	Duplex Family Residence	17.5	720	Low
86	Tribal Gymnasium and Assembly Hall	15.4	707	Low
87	Gymnasium Storage Building	15.4	860	Low
88	Duplex Family Residence	13.5	1032	Medium
89	Duplex Family Residence	13.6	1117	Medium
90	Duplex Family Residence	13.3	1213	Medium
91	Duplex Family Residence	12.9	1301	Medium

Table 3.4 Future Without-Project Coastal Flood and Storm Damage Risk (March 3, 1999 storm)(continued)

Inventory Number	Structure Name / Function	Elevation Above MLLW (feet)	Distance from Shoreline (feet)	Flood and Storm Damage Risk
92	Tribal Recreational Vehicle Park & Casino Parking	13.6	90	High
93	Tribal Cemetery	14.3	462	Low
----	State Route 105 traversing the Shoalwater Reservation	15.0 – 16.5	150	High
----	Old Tokeland Road	15.0 – 15.5	100	High
----	Shipping Container with Emergency Supplies (on hillside)	N/A	N/A	None
----	Single Family Residence (on hillside)	N/A	N/A	None
----	Tribal Environmental Complex (north, along SR-105)	N/A	N/A	None
----	Single Family Residence (outside Reservation, in Tokeland)	N/A	N/A	Low
----	Single Family Residence (outside Reservation, in Tokeland)	N/A	N/A	Low
----	Single Family Residence (outside Reservation, in Tokeland)	N/A	N/A	Low
----	Single Family Residence (outside Reservation, in Tokeland)	N/A	N/A	Low
----	Single Family Residence (outside Reservation, in Tokeland)	N/A	N/A	Low
----	Single Family Residence (outside Reservation, in Tokeland)	N/A	N/A	Low

Table 3.5 Percentage of Structures at Flooding Risk for Storm Surge Event Frequency Occurring at Mean Higher High Water (MHHW)

Flood and Storm Damage Risk	50% Annual Occurrence	2% Annual Occurrence	1% Annual Occurrence
Low	**85**	**17**	**12**
Medium	**7**	**40**	**35**
High	**8**	**43**	**53**

Table 3.6 Percentage of Structures at Flooding Risk for Storm Surge Event Frequency Occurring at Maximum Astronomical Tide (MAT)

Flood and Storm Damage Risk	50% Annual Occurrence	2% Annual Occurrence	1% Annual Occurrence
Low	**9**	**8**	**8**
Medium	**35**	**12**	**12**
High	**56**	**80**	**80**

3.1.2.6 Environmental Impacts

The erosion and breaching of the barrier dune has resulted in a severe degradation of the habitat diversity and productivity of the Shoalwater Reservation's North Cove shallow water embayment. Storm-generated waves at elevated water conditions will overwash the eroded dune with increasing frequency, resulting in continued infilling of the tide flats and intertidal habitat with sand eroded from the dune. Due to storm overwash and the resulting infilling of North Cove with sediment and large woody debris, the habitat in the cove will likely be transformed almost entirely into high salt marsh within an additional storm season or two. Shallow interior channels and tide flats will largely cease to exist, with significantly less tidal flushing in North Cove. There has been a near total loss of intertidal habitat that previously supported Tribal subsistence food gathering (fish and shellfish). North Cove was the Shoalwater Tribe's source of traditional subsistence foods for their health and dietary welfare. The significance of this loss is magnified by the fact that these diminishing dietary elements were healthy choices in light of Tribal members' propensity for diabetes and other illnesses not traditionally found in their native diet. As long as storm-generated waves continue to overwash the barrier dune, there will be no opportunity to consider or implement an ecosystem restoration plan in the cove.

In addition, continued degradation of the North Cove habitat means that tribal members will be less and less successful in harvesting local native plant species traditionally used for tribal crafts and for cultural and spiritual uses. The diversity and productivity of North Cove for collection of native plant species continues to be degraded such that it is under continuing threat of total loss.

The stark reality, according to tribal members, is that the degraded habitat in North Cove no longer supports the subsistence harvest of fish and shellfish. Shellfish species that have disappeared from the cove include Pacific razor clam (*Siliqua patula)*, Pacific oyster (*Crassostrea gigas*), Olympic oyster (*Ostrea conchaphila*), littleneck clam (*Protothaca staminea*), and basket cockle (*Clinocardium nuttalli*). Ongoing erosion and overwash of the

barrier dune, accompanied by deposition of sand and debris in the North Cove embayment, continues to aggrade the tidal flats in North Cove that were once productive sites for marine fish and shellfish species, birds (eagles, herons, and pelicans), and a wide variety of flora and fauna. This conversion has been, and will continue to be, a significant environmental loss to the Shoalwater Tribe. The 700 acre North Cove represents two-thirds of the Reservation. The habitat in the cove will be completely transformed into high salt marsh, consisting of beachgrass, sedges and rushes, glasswort and other salt marsh succulents, as well as smooth cordgrass (*spartina alternaflora*), an invasive non-native species. A well coordinated *spartina* eradication program in North Cove by the State of Washington and Shoalwater Tribe appears successful.

Under future without project conditions, with a severely eroded barrier dune, there will be no possibility of formulating and implementing ecosystem restoration of the North Cove embayment. Section 5153 of WRDA 2007 amended Section 545 of WRDA 20007 by adding ecosystem restoration as a project purpose. Unless, and until, the storm wave protection previously afforded by Graveyard Spit is restored, it will be impossible and impracticable to implement and sustain any ecosystem restoration measures in North Cove.

3.1.2.7 Social and Cultural Impacts

Under future without project conditions, there will be significant adverse social and cultural impacts to the Shoalwater Tribe due to increasingly frequent and severe coastal storm damage resulting from storm-generated ocean waves. If a long-term solution is not implemented soon, the Shoalwater Tribe will be faced with two unfortunate choices: either abandon their ancestral home or stay and endure increasingly severe coastal storm damage. Both scenarios will have significant adverse impact on the culture and social fabric of the Shoalwater Tribe (see Exhibit 3, Shoalwater Bay Indian Tribe letter dated July 9, 2008).

To the Shoalwater Tribe, a vital part of being a Tribe is “place” and “place” has a vitally important meaning to the people of the Shoalwater Bay Indian Tribe --- it is their true identity. For them, “place” is this same coastal area that has been both their physical and spiritual home, and that of their ancestors, for as far back as their story goes. The Shoalwater Reservation was established by Presidential Executive Order in 1866, prior to Washington statehood. To the Shoalwater Tribe, their Reservation is rich with the souls and spirits of their ancestors, and walking away from these souls is not an option. Relocation is foreign to the Shoalwater Tribe’s idea of being a people (see also Tribal Council statement in Section 3.3.2.3).

Staying and sustaining a viable and vibrant Tribal community will become increasingly difficult – if not impossible – as the frequency and severity of storm damage increases under the future without project condition. The result, over time, is likely to be a disbanding of the community, as storm damages mount to the point that governmental functions and individual tribal families are forced to relocate to avoid the disruptive effects of increasingly frequent and severe coastal storm flooding and damage. The result will be a once-thriving community that becomes scattered as Tribal members are dispersed. More than likely, they will be forced to locate in a variety of areas, distant from one another. This is a foreign principle to both the Shoalwater Tribe’s idea of being a people and to their meaning of “place”. The Tribe

acknowledges that the loss of "place" amounts to a loss of culture, a loss of spiritual foundation, and a loss of community.

3.1.3 Specific Problems and Opportunities

- The barrier dune on Graveyard Spit that historically protected the Shoalwater Reservation from storm wave attack and flooding has been severely eroded and is increasingly subject to storm wave overwash. Shoreline erosion and flooding of tribal uplands is increasing in frequency as the winter storm wave protection provided by the barrier dune is further diminished due to erosion.
- A significant reduction in sediment (sand) supply in the littoral transport system has resulted in the gradual and progressive narrowing, lowering, and breaching of the barrier dune, and overwash.
- Due to significantly diminished dune protection, the Shoalwater Reservation uplands, which total only 440 acres, are increasingly vulnerable to shoreline erosion and flooding associated with storm-generated ocean waves due to erosion of the barrier dune, particularly during periods of elevated water conditions.
- The productive subsistence shellfish growing and harvesting habitat of North Cove, representing 700 acres (61 percent) of the Shoalwater Reservation, is rapidly being lost to in-filling with sand due to storm waves overwashing the eroding barrier dune and depositing sand in the North Cove embayment.
- The Shoalwater Tribe is making significant investments in infrastructure and facilities to better serve the needs of its growing population. Tribal uplands, upon which development must take place, exist only as a narrow band of land along the shoreline, including State Route 105 which traverses the Reservation.
- Measures to reduce coastal erosion and associated flood and coastal storm damage are both technically feasible and environmentally acceptable. The implementation of appropriate measures will significantly contribute to the Shoalwater Tribe's ongoing efforts to improve economic and social conditions for present and future generations of tribal members, by preventing further shoreline erosion and flooding of tribal uplands and preventing further degradation and loss of intertidal habitat in the North Cove embayment, which has provided important supplemental subsistence shellfish food supply.

3.2 Planning Objectives and Constraints

3.2.1 Planning Objectives

- Reduce coastal erosion so as to protect the very small Shoalwater Bay Indian Reservation from storm wave attack, flooding, and erosion of tribal uplands and damage to structures and infrastructure during coastal storms that coincide with extreme water levels.

- Protect the habitat of the North Cove embayment from further degradation due to storm wave overwash of the Graveyard Spit barrier dune, thereby providing the opportunity for future ecosystem restoration of the previously productive Tribal shellfish beds and native plant species for Tribal subsistence and cultural uses.

3.2.2 Planning Constraints

- Avoid unanticipated, and potentially adverse, consequences to the hydrodynamics and ecology of Willapa Bay.
- Minimize environmental impacts and associated mitigation costs attributable to any alternative plan.
- Avoid inducing flooding and storm wave attack to the adjacent non-tribal community on the Tokeland Peninsula.

3.3 Alternative Plans

3.3.1 Measures That Address Problems and Opportunities

A wide array of measures was considered to address identified coastal erosion problems and opportunities, as well as planning objectives and constraints. Before initiating any coastal engineering work on alternative measures and plans, a major effort was expended to understand the geology, geomorphology, and hydraulics of Willapa Bay and the Willapa Bay entrance (see **Paragraph 3.1.2**). The comprehensive interagency studies and modeling led to some unexpected findings that paved the way for a straightforward engineering solution that is technically feasible, cost effective, environmentally acceptable, and will improve the economic and social conditions of the Shoalwater Tribe. Measures were formulated in concert with the findings of the comprehensive studies and modeling conducted by the Corps' Seattle District in cooperation with the Coastal and Hydraulics Laboratory at ERDC, the U.S. Geological Survey's Coastal and Marine Geology Program, and Washington Department of Ecology's Coastal and Marine Geology Program.

Measures to address problems and opportunities were formulated in close consultation with the Shoalwater Bay Tribal Council, and with significant input from affected Federal, state and local resource and regulatory agencies and the affected Tokeland Peninsula community. Collectively, alternative plans represent a reasonable range of alternatives under NEPA. A wide range of alternative plans, in addition to the no-action alternative, was formulated and evaluated. The alternative plans evaluated to protect the Shoalwater Reservation from coastal erosion and storm damage are listed in **Table 3.7** and described in the following paragraphs.

Table 3.7 Alternative Plans Evaluated and Screened

Type of Measure	Alternative Number	Name of Alternative
No Action	Alternative 1	No Action
Non-structural	Alternative 2a	Floodplain Fill / Flood Proof Structures
	Alternative 2b	Relocate Shoalwater Reservation
Hydraulic Modification	Alternative 3a	Toke Point Training Dike
	Alternative 3b	North Channel Training Dike
	Alternative 3c	Ellen Sands Training Dike
	Alternative 3d	SR-105 Training Dike Modification
Protective Structures	Alternative 4	Sea Dike
	Alternative 4a	Sea Dike to Reservation Boundary
	Alternative 5	Shoreline Revetment
	Alternative 6	Barrier Dune Restoration
	Alternative 7	Barrier Dune Restoration with Flood Berm Extension

3.3.1.1 Alternative 1, No Action

Alternative 1, the No Action alternative, assumes that no measures will be undertaken to address the ongoing erosion of the barrier dune located on Graveyard Spit, which fronts the Tokeland peninsula. This alternative also recognizes that, although the northern migration of the North Willapa Channel has halted seaward of the Shoalwater Reservation, tidal currents and, to a greater extent, storm-generated ocean waves will continue to overwash and thus lower and narrow the barrier dune which has afforded protection to the Shoalwater Reservation (see **Figures 3.1(a), 3.1(b), and 3.2**). Material that erodes from the dune will continue to be carried into the inter-tidal area behind the dunes, eventually filling and significantly altering the ecosystem in what remains of the North Cove embayment. Continued narrowing and lowering of the dune will expose the Shoalwater Reservation shoreline to increasing shoreline erosion (though not particularly significant) and increasing frequency of flooding of uplands due to storm-generated ocean wave overwash during periods of elevated water conditions.

3.3.1.2 Alternatives 2a and 2b, Nonstructural Measures

a. Alternative 2a, Floodplain Fill / Flood Proof Structures. Alternative 2a will raise the elevation of low-lying Shoalwater Reservation uplands above flood elevation. This may be accomplished in combination with flood proofing of structures to raise the first floor above flood elevation and to avoid the effects of storm-generated wave energy as the shoreline is overtopped. This measure will not, however, address erosion of the barrier dune located on Graveyard Spit and its adverse impact on tribal subsistence intertidal habitat in the 700 acre portion of the North Cove embayment located within the Shoalwater Reservation. Filling the floodplain will prevent upland flooding due to storm wave overtopping during periods of high tides. Fill material will be imported and all structures and infrastructure will be raised accordingly. The Shoalwater Reservation shoreline will require armoring to prevent storm wave attack from eroding the fill material. The small upland portion of the Shoalwater Reservation will, in effect, become like an island, rising above the surrounding landscape. Flood proofing structures will raise ground floor elevations above predicted flood elevations, thereby reducing damages to structures and contents.

b. Alternative 2b, Relocate Shoalwater Reservation. Alternative 2b includes finding and acquiring suitable real estate and relocating the entire Shoalwater Bay Indian Reservation completely out of harms way. This alternative would also include relocating the tribal cemetery and cultural resources recovery of a well documented village site that will otherwise be exposed to storm wave attack and flooding. Relocation of the Shoalwater Reservation will require significant effort to find and purchase property that is comparable and fully meets the needs of the Shoalwater Tribe.

3.3.1.3 Alternatives 3a, 3b, 3c, and 3d, Hydraulic Modification

For many years, modifying the tidal ebb flow in Willapa Bay has been suggested as a possible way to turn back the clock and arrest, if not reverse, the northward migration of the main (northernmost) Willapa channel and the resultant erosion of the North Cove shoreline. The idea of redirecting the ebb flow of the Willapa entrance was an appealing concept for reducing the threat posed by the encroaching northernmost channel. The Shoalwater Tribe proposed that training structures, or dikes, be investigated as a possible remedy for controlling the extreme erosion and resulting storm-generated ocean wave along the Shoalwater Reservation shoreline. The purpose for these structures would be to deflect the high current away from the shore, or to divert the flow in the North Channel such that it opens and maintains the Middle Channel to the open ocean.

Four representative training structure locations (Alternatives 3a, 3b, 3c, and 3d) were modeled by the Corps' Coastal and Hydraulics Laboratory at ERDC (see **Appendix 1, Section 3.1**, for detailed modeling discussion). The four locations were selected for analysis because they are the closest to tribal lands, thereby having the greatest potential to deflect the current away from the shoreline. The ADvanced CIRCulation (ADCIRC) numerical model was chosen by the Corps' Coastal and Hydraulics Laboratory to simulate the long-wave hydrodynamic

processes in Willapa Bay. The ADCIRC modal can accurately replicate tidally-driven currents and wave run-up levels induced by winter storms. The dimensions and orientation of the structures were adjusted until an obvious change in the flow regime of the northernmost Willapa Channel, if any, occurred.

3.3.1.4 Alternatives 4, 4a, 5, 6, and 7, Protective Structures

Comprehensive studies, including sophisticated computer modeling by the Corps' Coastal and Hydraulics Laboratory at ERDC, have found that the erosion processes, driven by channel migration, have undergone a profound change. The northward migration of the Willapa Channel has stabilized, sparing the eroded dune on Graveyard Spit. Thus, engineering solutions will not have to attempt to turn aside the advance of the Willapa Channel, but will only have to address the continued erosion of the dune and the flooding caused by storm generated waves which overtop the dune and attack the Shoalwater Reservation shoreline. Wave studies, including the collection of field data and numerical modeling, determined that while these waves were capable of continuing to erode the dune and cause flooding, they are relatively small by coastal engineering standards. The protective structures described below were formulated and designed to address the wave induced flooding that takes place during storm events that coincide with elevated water conditions.

a. Alternative 4, Sea Dike. Alternative 4, sea dike, is a large armor stone structure to replace the storm wave protection that was once afforded by the eroded barrier dune system on Graveyard Spit. The sea dike will be constructed along the crest of the eroded barrier dune. Through engineering modeling and design, it was determined that in order to reliably shelter the Shoalwater Reservation from wave and storm surges originating from the south/southwest (the primary storm track of extreme events), the sea dike is required to extend beyond the Reservation boundary to function properly. The structure will provide protection to the Shoalwater Reservation from high water and storm wave events in addition to providing a stable inlet into the North Cove embayment, thereby restoring the sediment transport pattern that existed prior to breaching of the Graveyard Spit barrier dune. By necessity, the sea dike will provide incidental storm wave protection to portions of the North Cove embayment and shoreline adjacent, but external, to the Reservation. Sand will be excavated to make way for the dike armor stone, and the excavated sand will be re-graded over the stone and planted with native vegetation. The sea dike itself will be designed to prevent it from being overtopped by storm-generated ocean waves and thus prevent further wave attack and habitat loss in the North Cove embayment. The sea dike will also protect Shoalwater Reservation uplands from storm wave attack, flooding, and shoreline erosion.

A variation of the sea dike (Alternative 4a) will be constructed along the footprint of the eroded dune within the Shoalwater Reservation boundary and then extended northward toward the shoreline through the intertidal area of the North Cove embayment. The alternative would minimize the incidental shoreline erosion and storm damage reduction to areas outside the Shoalwater Reservation.

b. Alternative 5, Shoreline Revetment. Alternative 5, shoreline revetment, is a riprap and armor rock structure along the existing shoreline to protect Shoalwater Reservation uplands and thus provide protection from coastal flooding due to wave run-up and shoreline overtopping during periods of extreme high tides. The revetment is porous, allowing water to filter through after the wave energy has been dissipated. The revetment is designed for wave conditions that would result as the existing barrier dune erodes and lowers to the elevation of the surrounding intertidal area (approximately +8 feet MLLW). The structure will tie into high ground at both ends, so as to prevent back flooding of the Shoalwater Reservation caused by storm-generated wave overtopping of the low-lying shoreline. Structures of this design have been used successfully along the Washington coast, at Grays Harbor in particular. Revetment stone will be brought to the construction site by truck, and access to the site will be along the structure itself. Sand will be excavated to make way for the revetment stone. The excavated sand will be re-graded over the revetment and planted with native vegetation.

c. Alternative 6, Barrier Dune Restoration. Severe erosion of the barrier dune that extends southward on the remnants of Graveyard Spit is exposing the Shoalwater Reservation to increased flooding from storm-generated ocean waves during periods of extreme high tides. Alternative 6, barrier dune restoration, will restore the storm wave protection that was once afforded by the dune.

This alternative will restore the eroded dune with sand dredged from a nearby borrow source, such as the adjacent Willapa Bay North Channel. Like the sea dike, the dune will be constructed along the alignment of the existing dune crest. The available footprint on Graveyard Spit will place an upper limit on the width and height of the restored dune, and thus the interval of time before periodic nourishment is required. The dredged sand will be graded and planted with native vegetation to stabilize the restored dune, thereby extending the interval before periodic nourishment is required.

d. Alternative 7, Barrier Dune Restoration with Flood Berm Extension. As described in Paragraphs 2.2.2 and 2.2.3, a total of 2,000 feet of riprap flood berm was constructed by the Corps +in March 2001 and December 2007 along a small portion of the Shoalwater Reservation shoreline. Extending the existing riprap flood berm along the shoreline will significantly extend the interval between periodic nourishment cycles of a restored barrier dune on Graveyard Spit. A low profile flood berm, however, is not feasible as a stand-alone alternative, unlike the shoreline revetment (Alternative 5) described above. Rather, a flood berm would work in conjunction with barrier dune restoration to provide a complete solution to the coastal erosion problems confronting the Shoalwater Tribe. If, for any reason, the barrier dune is seriously eroded and/or breached, the flood berm extension will provide secondary protection from storm-generated ocean wave run-up, overtopping, and flooding of the shoreline of the Shoalwater Reservation until periodic nourishment of the barrier dune is accomplished. The flood berm is a porous structure constructed of graded riprap, to allow water to filter through after the wave energy has been dissipated. The 1,700-foot-long flood berm segment constructed by Corps in 2001, and extended 300 feet in December 2007, has been very effective in this regard. However, a shoreline flood berm, alone, is not a complete solution to identified problems because it relies

on some wave attenuation by the barrier dune to assure that storm generated waves do not overtop the shoreline and flood tribal facilities and infrastructure.

3.3.2 Screening of Alternative Plans

Alternative plans were evaluated and screened in consideration of five discrete criteria listed below. Criteria 1 through 4 represent evaluation criteria typically utilized in evaluating Corps water resources projects. Note that criteria 1, 3, 4 and 5 are also specified in the project authorization (see **Paragraph 1.1** for authorization language):

1) ***Effectiveness***: Is it technically feasible (feasible from an engineering standpoint).
2) ***Completeness***: Is it a complete solution to the identified problem(s).
3) ***Efficiency***: Is it a cost effective means of providing coastal flood and storm damage reduction measures. (Note that the authorization directs that no economic analysis is to be conducted. For this project, efficiency or cost effectiveness refers to the least cost means of providing coastal flood and storm damage reduction measures).
4) ***Acceptability***: Is it environmentally acceptable and, thus, capable of being implemented from a regulatory permitting standpoint.
5) ***Social effects***: Will it improve the economic and social conditions of the Shoalwater Bay Indian Tribe, and is it acceptable to the Shoalwater Bay Indian Tribe.

Note that, as described in **Paragraph 1.2**, alternative plans were formulated and evaluated to identify the most appropriate and effective plan to provide long-term coastal erosion and flood and coastal storm damage reduction to the Shoalwater Reservation. This plan formulation is a partial response to the current project authorization. In order to address and restore the seriously degraded ecosystem in the Shoalwater Tribe's North Cove embayment, a separate ecosystem restoration study will need to be conducted to formulate an ecosystem restoration plan for North Cove. Ecosystem restoration features will be necessary to restore productive use of the North Cove embayment by the Shoalwater Tribe for their subsistence and cultural uses. **Table 3.8** summarizes the results of the screening-level evaluation of alternative plans for coastal erosion and storm damage reduction. A discussion and summary of the screening evaluation for each alternative plan follows.

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Table 3.8 Summary of Preliminary Screening-level Alternatives Evaluation

Alternative	Preliminary Screening Results					Carry Forward for Further Evaluation?
	Effectiveness	Completeness	Efficiency	Environmental Acceptability	Tribal Acceptability	
Alternative 1, No Action	**Does not address identified problems**	Does not address identified problems adversely affecting the Shoalwater Bay Indian Reservation	Not applicable	No induced environmental impacts	Not acceptable to Shoalwater Tribe; will result in more frequent and increasingly serious erosion and flooding due to storm events at high tide, as well as complete loss of subsistence shellfish habitat in North Cove	**Yes, per NEPA guidelines**
Alternative 2a, Floodplain Fill / Flood Proof Structures	**Partially addresses problems associated with tribal uplands**; does not address continued loss of North Cove intertidal habitat which represents 67 percent of the Reservation	Not a complete solution; would protect only Reservation uplands and/or elevated structures, but not continued loss of North Cove intertidal habitat	Very high cost	Not acceptable; extensive mitigation required for filling of reservation uplands wetlands and alteration of natural drainage patterns. Induce flooding of adjacent non-reservation lands	Not acceptable to Shoalwater Tribe; filling floodplain and/or raising structures protects only tribal uplands and or elevated structures. Will result in a complete loss of subsistence shellfish habitat in North Cove	No
Alternative 2b, Relocate Shoalwater Reservation	**Does not address identified problems**	Does not protect the Shoalwater Reservation	Extremely high cost	----------	Not acceptable to Shoalwater Tribe. The idea of relocation is alien to the Shoalwater Bay people. It s neither their desire, nor their request. It is a foreign principle to their idea of being a people.	No
Alternative 3a, Toke Point Training Dike	**Not technically feasible;** would have little, if any, beneficial effect in addressing identified problems	Not a complete solution; additional measures required to fully address identified problems	----------	----------	----------	No
Alternative 3b, North Channel Training Dike	**Not technically feasible;** would have little, if any, beneficial effect in addressing identified problems, with potential for serious unintended adverse effects in Willapa Bay	Not a complete solution; additional measures required to fully address identified problems	----------	----------	----------	No
Alternative 3c, Ellen Sands Training Dike	**Not technically feasible;** would have little, if any, beneficial effect in addressing identified problems, with potential for serious unintended adverse effects in Willapa Bay	Not a complete solution; additional measures required to fully address identified problems	----------	----------	----------	No
Alternative 3d, SR-105 Training Dike Modification	**Not technically feasible;** would have little, if any, beneficial effect in addressing identified problems	Not a complete solution; additional measures required to fully address identified problems	----------	----------	----------	No
Alternative 4, Sea Dike	**Technically feasible** means of fully addressing identified problems	**Would provide a complete solution** to identified erosion problems	Very high construction cost	Not acceptable; extensive mitigation required due to placement of very large armor stone; potential for unintended redirection of currents and disruption of sediment flow in and near the project area	Not favored by Shoalwater Tribe; incompatible with interior of Willapa Bay which has no jetties or similar massive rock structures	**Yes**
Alternative 4a, Sea Dike to Reservation Boundary	**Technically feasible** means of fully addressing identified problems	**Would provide a complete solution** to identified erosion problems	Very high cost	Not acceptable; extensive mitigation required due to placement of large armor stone; would adversely impact tidal flushing and circulation in the North Cove embayment	Not favored by Shoalwater Tribe; incompatible with interior of Willapa Bay which has no jetties or similar massive rock structures	**Yes**
Alternative 5, Shoreline Revetment	**Addresses only problems associated with Tribal uplands**; does not address continued loss of North Cove intertidal habitat which represents 67 percent of the Reservation	Not a complete solution; would protect only tribal uplands, but not continued loss of North Cove intertidal habitat	Not evaluated	Likely; would require mitigation for unavoidable wetland impacts	Not acceptable to Shoalwater Tribe; protects only tribal uplands. Complete loss of subsistence shellfish habitat in North Cove. Creates a visual barrier and physical obstacle to North Cove embayment	No
Alternative 6, Barrier Dune Restoration	**Technically feasible** means of fully addressing identified problems	**Would provide a complete solution** to identified erosion problems	Likely to be cost effective	Yes, but would require mitigation for any unavoidable wetland impacts	Acceptable to Shoalwater Tribe, if required periodic nourishment of barrier dune can be assured at all times to protect tribal lands from future storm wave attack.	**Yes**
Alternative 7, Barrier Dune Restoration with Flood Berm Extension	**Technically feasible** means of fully addressing identified problems	**Would provide a complete solution** to identified erosion problems	Likely to be cost effective	Yes, but would require mitigation for any unavoidable wetland impacts	Acceptable to Shoalwater Tribe. Flood berm serves as a second line of defense should the barrier dune become severely eroded before periodic nourishment	**Yes**

3.3.2.1 Alternative 1, No Action

Alternative Description. Under the No Action alternative, no steps are taken to address identified problems and opportunities. The no action alternative will result in an increasing frequency and severity of flood and coastal storm damage to Shoalwater Reservation lands and infrastructure due to coastal erosion and storm-generated ocean waves. Further loss of Graveyard Spit barrier dune elevation will exacerbate flooding and storm damage of low- lying tribal uplands, structures, and infrastructure. Material that is eroded from the dunes due to storm overwash will continue to be carried into the intertidal area behind the dunes and, together with large woody debris, will eventually obliterate what remains of the North Cove embayment intertidal habitat.

Discussion and Summary. The No Action alternative will not reduce the coastal erosion and storm damage threat to the Shoalwater Reservation uplands, nor halt loss of North Cove habitat. This alternative does not address any of the identified screening criteria. However, per NEPA guidelines, this alternative was carried forward for comparative purposes.

3.3.2.2 Alternative 2a, Floodplain Fill / Flood Proof Structures

Alternative Description. This alternative will raise the elevation of the 400-acre low-lying Shoalwater Reservation uplands above coastal storm flood elevation by filling the floodplain. It will also involve flood proofing of individual structures and infrastructure by elevating them above predicted flood elevations. A combination of floodplain fill and flood proofing of structures is possible as a means to address coastal storm damage problems affecting Shoalwater Reservation uplands.

Discussion and Summary. Raising the elevation of Shoalwater Reservation uplands and/or structures is only a partial solution to identified problems. A 400-acre floodplain fill will prevent flooding of Shoalwater Reservation uplands and structures due to storm-generated ocean waves that coincide with extreme high tides. Floodplain fill will encounter severe environmental obstacles related to filling of extensive wetlands found throughout the 400-acre Reservation uplands, and alteration of drainage patterns. Armoring the elevated shoreline will be required to prevent erosion of the fill material. This, too, will result in extensive wetland impacts.

Flood proofing structures alone does not address storm damage to Tribal uplands and transportation infrastructure. Issues of concern include velocity of flood waters resulting from wave attack, deposition of large woody debris, loss of access within the Reservation, and emergency response during and after a storm event.

This alternative is not a complete solution to identified coastal erosion problems affecting the Shoalwater Reservation. Filling the floodplain and/or elevating structures and infrastructure does not address two-thirds of the small Reservation (i.e., the loss of 700 acres of Tribal shellfish and fish habitat in North Cove resulting from infilling with sand and debris). There is also a significant potential for induced flooding and storm damage to adjoining non-reservation

residential development resulting from filling the floodplain within Reservation boundaries. This alternative is socially and culturally unacceptable to the Shoalwater Tribe. Alternative 2a does not satisfy the criteria set forth in the project authorization and was not carried forward for further evaluation.

3.3.2.3 Alternative 2b, Relocate Shoalwater Reservation

Alternative Description. This alternative includes finding and acquiring suitable real estate and relocating the entire Shoalwater Bay Indian Reservation completely out of harms way. This alternative would also include relocating the tribal cemetery and cultural resources recovery of a well documented village site that will otherwise be exposed to storm wave attack and flooding.

Discussion and Summary. Relocation of the tribe from their historic reservation land – if it were determined to be the only practicable alternative – would be very costly, as it is roughly estimated to exceed 100 million dollars. More importantly, relocation of the Shoalwater Reservation would have significant social, cultural, and spiritual costs and impacts to the Shoalwater Tribe. This alternative is not responsive to the WRDA authorization, which is to determine the feasibility of providing coastal erosion protection for the Shoalwater Reservation.

The following is a response from the Shoalwater Bay Tribal Council, in their effort to articulate the Tribe's position on the issue of relocation from their ancestral trust lands. This statement was approved and submitted by the Shoalwater Bay Tribal Council in October 2008:

> *Part of being a Tribe is "place" and "place" has a vitally important meaning to the people of the Shoalwater Bay Indian Tribe --- it is our true IDENTITY. For us "place" is this same coastal area that has been both our physical and spiritual home, and that of our ancestors, for as far back as our story goes.*
>
> *Among most communities, not just the Shoalwater Bay Tribe, a person's awareness of place occupies a major component of that individual's identity, meaning, and sense of belonging. The significance of place is particularly vital to the Shoalwater Bay Indian Tribe. Our Tribal Members recognized the importance of this critical element of community even as we were asked in the 1860's to depart the shoals of the Bay; we refused to leave this place.*
>
> *In times long ago our people moved to avoid death or disease, but in those times our homelands were significantly larger; they ranged from what today is Grays Harbor to the mouth of the Columbia River and any location that we wished was available to us. Those choices were drastically reduced when we were forced to choose and the Federal Government conceded and "allowed us by Executive Order" to make the current Reservation our home. We did not choose a village, but a place of special importance where neighboring tribes would gather as family to trade and form unions between tribal families at the summer's end. These unions were of the soul and the spirit creating new families. Many chose to settle*

their spirit here at the sunset of their lives, thus this place is rich with the souls and spirits of our peoples past, those who have walked on – they are still present, and they continue to renew our strength. We cannot walk away from these souls; it is not an option.

Thus it is that the idea of relocation is alien to the Shoalwater Bay people. It is neither our desire, nor our request. In fact, it is a foreign principle to our idea of being a people.

Giving up these lands of our Reservation would, by definition, mean we would be disbanding the community, and our community would thus be scattered and destroyed because members would be dispersed and more than likely would locate in a variety of areas, distant from one another. And, what would we do with our ancestors? Would we move them both physically and spiritually?

The members of the Shoalwater Bay Tribe are well aware of the stories, many tragic, of other Tribes' experiences of relocation by the U.S. Government. We believe relocation would mean leaving our Elders and abandoning our Elders' spirits. We have no comfort that the non-Native community can understand this from our Native American perspective.

Both written historical documentation and Tribal oral tradition tell the story that this coastal region is the area that the Shoalwater Bay Tribe clung to, and chose not to move from, even when encouraged and pressured to do so. To agree to be relocated now would be a betrayal of our ancestors who struggled to remain in this location.

The Tribe fought for and understood that the Water Resources Development Act of 2000 (WRDA 2000) made no reference to relocation of the Tribe. Indeed, the Federal Government, as Trustee, authorized the Corps of Engineers to seek a solution that would protect the Tribe and its Reservation; not seek a decision that would disconnect our Tribal Members from one another.

The Shoalwater Bay Tribal leadership understands that non-Natives may view relocation as an option, but for the Shoalwater Bay Indian Tribe relocation is not an option. This coastal area is our home; this land is protected by our Elders. Our original request, and the Federal authorization, seeks to protect these Reservation lands now because these lands are our identity as the people of the Shoalwater Bay Indian Tribe.

For the compelling reasons stated above, the alternative plan to relocate the Shoalwater Reservation was not carried forward for further development and evaluation.

3.3.2.4 Alternative 3a, Toke Point Training Dike

Alternative Description. Alternative 3a is located west of the Shoalwater Reservation at Toke Point, and would extend as much as 2,050 feet into the northernmost Willapa channel (see **Figure 3.8** for training dike locations). The structure would be constructed of very large armor rock, and would have the appearance of a jetty projecting from shore. The intended function of the training dike is to deflect the high current away from the shore, thereby reducing or preventing further erosion of Graveyard Spit and its barrier dune system.

Discussion and Summary. Alternative 3a was found to have a minimal impact, at best, on current in the vicinity of the Shoalwater Reservation, and therefore would have minimal impact on preventing erosion along Graveyard Spit and North Cove. Alternative 3a is not technically feasible, nor would it be a complete solution to identified problems. Computer modeling was not able to verify any beneficial effect in reducing the flood and coastal storm damage threat to the Shoalwater Reservation. It was further determined that even if hydraulic modification were technically feasible, additional measures, including protective structures such as those measures described in the following paragraphs, would still be required to reduce storm wave overtopping of the eroded barrier dune and flooding of the Shoalwater Reservation during periods of high tides. For these reasons, this alternative was not carried forward for further evaluation.

3.3.2.5 Alternative 3b, North Channel Training Dike

Alternative Description. This alternative would extend directly across North Cove and Graveyard spit and into the northernmost Willapa Channel (see **Figure 3.8** for location). The structure length is 12,800 feet and extends 7,800 feet into the channel.

Discussion and Summary. Modeling indicates that the structure reduces the peak ebb current along the western extent of Graveyard Spit, and, to a lesser extent, at the eastern end of the spit. Current velocity along the eastern end of Graveyard Spit is reduced during flood tide, whereas a small reduction in current is found to the west. Two consequences, however, are the creation of a gyre (a circular or spiraling current) on the lee-side of the structure, and impediment of sediment transported along the shore. Although the gyre is weaker than the main current, the spiraling gyre will still suspend the sediment along the shore, and transport it into deeper water. With the structure preventing movement of sediment along the shore, the area being eroded by the gyre is not replenished, leading to a loss in land. This same process can be see by comparing aerial photographs of the shore before and after the SR-105 dike was constructed. Including reasons stated for alternative 3a, this alternative was not carried forward for further evaluation.

3.3.2.6 Alternative 3c, Ellen Sands Training Dike

Alternative Description. This alternative is located along the northern reach of the Nahcotta Channel (see **Figure 3.8** for location), and is oriented so that the ebb current is deflected in a westerly trajectory, away from the Shoalwater Reservation shoreline. The structure has an overall length of 16,200 feet, and extends 950 feet into the northern reach of the Nahcotta Channel. A further extension lengthened the dike to 19,000 feet, with only a minimal effect in the vicinity of North Cove.

Discussion and Summary. Initial modeling showed strong current flowing around the eastward end of the dike, raising the potential for the strong current to scour a new channel across the Ellen Sands and also to undermine the foundation of the structure. Consequently, subsequent testing was conducted with the structure extending across low-lying Ellen Sands to high ground. The structure has an overall length of 16,200 feet, and extends 950 feet into the channel. At this length, the dike would have minimal impact on current along Graveyard Spit. The dike was extended such that it extended completely across the channel and terminated on a sandbar. Total length for this dike was 19,000 feet. This increased length still showed a minimal effect in the vicinity of Graveyard Spit and North Cove. For the same reasons stated for alternative 3a, this alternative was not carried forward for further evaluation.

3.3.2.7 Alternative 3d, SR-105 Training Dike Modification

Alternative Description. This alternative training dike is located at the same position as the SR-105 dike (see **Figure 3.8** for location). The structure extends 2,350 feet into the North Channel, or approximately to the center of the channel thalweg. A second experiment lengthened the dike to 3,000 feet. The structure would be constructed of very large armor rock, and would have the appearance of a jetty projecting from shore. The intended function of the training dike is to deflect the high current away from the shore, thereby reducing or preventing further erosion of Graveyard Spit and its barrier dune system.

Discussion and Summary. The structure at this location reduces the peak flood current velocity along the western extent of the North Cove area, but a minimal change in current is noted along the eastern end of Graveyard Spit. Because the dike resides to the west of North Cove and Graveyard Spit, current in the vicinity of the Shoalwater Reservation was not affected during the ebb flow. Increased current caused by reducing the conveyance of water flowing past the dike is expected to induce the formation of a scour hole at the toe of the dike, requiring regular maintenance to prevent the dike from slumping into the scour hole. For the same reasons stated for alternative 3a, this alternative was not carried forward for further evaluation.

3.3.2.8 Alternative 4, Sea Dike

Alternative Description. The sea dike is a 12,500-foot-long rock structure located on Graveyard Spit that is intended to replace the storm wave protection that was once afforded by the eroded dune system on Graveyard Spit. To prevent storm wave overtopping, the structure has a top elevation of +20 feet MLLW, a top width of 14 feet, and a side slope of 1V on 2H (**Figure 3.9**). The dike requires approximately 213,000 tons of underlayer rock and quarry stone and 203,000 tons of armor stone, and is constructed along the crest of the eroded barrier dune. Approximately 200,000 CY of sand is excavated to make way for the dike stone. The excavated sand is re-graded over the dike, and planted with native vegetation to stabilize the sand.

The dike stone is brought to the construction site by truck. Access to the site requires construction of a 1-mile-long haul road from SR-105. The haul road will be removed at the completion of construction. While the sea dike itself is designed to resist erosion by waves and currents, the sand covering the rock on the seaward side of the dike will erode, and will require replacement on a periodic basis. The maintenance requirement for the sand covering the seaward face of the dike is assumed to be 100,000 CY at two-year-intervals. Replacement of 50 percent of the dike armor stone will be required at 25-year intervals.

Discussion and Summary. Alternative 4 does not allow for adaptive management over the life of the project. The sea dike alignment is fixed at the time of construction, and cannot easily accommodate even a minor change in the channel location. The sea dike alternative assumes, based on analysis and interpretation of available data, that the northward migration of the Willapa channel has halted seaward of the Shoalwater Reservation. The fact that the dike alignment is fixed at the time of construction, and cannot easily accommodate even a minor change in the channel location, is a major disadvantage of this alternative. Any further channel encroachment would undermine and ultimately destroy the dike. This is a major disadvantage to the long-term integrity and efficient function of this alternative, and does not provide any opportunity for adaptive management. Given this caveat, the sea dike is technically feasible and would provide a complete solution to the coastal erosion and resulting storm damage problems affecting the Shoalwater Reservation; this alternative was carried forward for further evaluation.

3.3.2.9 Alternative 4a, Sea Dike to Reservation Boundary

Alternative Description. Alternative 4a, sea dike to Reservation boundary, is a variation of the Alternative 4 sea dike described above in Paragraph 3.3.2.8. It is an attempt to configure a structure that provides little, if any, incidental coastal erosion and related storm damage reduction to the adjacent Tokeland Peninsula shoreline to the east of the Shoalwater Reservation. It is a 7,000-foot-long rock structure to replace the wave protection to the Shoalwater Reservation that was once afforded by the eroded dune system on Graveyard Spit. To prevent storm wave overtopping, the structure has a top elevation of +20 feet MLLW, a top width of 14 feet, and a side slope of 1V on 2H (**Figure 3.10**). The sea dike originates along the footprint of the eroded dune on Graveyard Spit within the Shoalwater Reservation boundary. In order to

reliably shelter the Shoalwater Reservation from wave and storm surges originating from the south/southwest (the primary storm track of extreme events), alternative 4a extends northward toward the shoreline through the intertidal area in the North Cove embayment. The sea dike requires approximately 120,000 tons of underlayer rock and quarry stone and 114,000 tons of armor stone. Approximately 112,000 CY of sand is excavated to make way for the dike stone. The excavated sand is regraded over the dike, and planted with native vegetation to stabilize the sand.

Discussion and Summary. Alternative 4a does not allow for adaptive management over the life of the project. The sea dike alignment is fixed at the time of construction, and cannot easily accommodate even a minor change in the channel location. The sea dike alternative assumes that, based on analysis and interpretation of available data, the northward migration of the Willapa channel has halted seaward of the Shoalwater Reservation. The fact that the dike alignment on Graveyard Spit is fixed at the time of construction, and can't easily accommodate even a minor change in the channel location, is a major disadvantage of this alternative.

Additionally, the eastern portion of Graveyard Spit outside the reservation boundary will be allowed to continually erode from storm overtopping events. As this portion of the spit erodes, larger waves will reach the portion of the sea dike extending toward the shoreline and likely necessitate larger armor stone, increased footprint, and higher crest elevation to withstand the increase in the forcing environment in the future. There are also potential adverse impacts to the shoreline immediately adjacent to those protected by the sea dike. Numerical wave modeling results indicate a shortened sea dike will increase the magnitude and extent of inundation to areas immediately adjacent to the shorelines protected by the sea dike.

Finally, that portion of the sea dike that extends toward the shoreline will adversely impact tidal circulation within the North Cove embayment. In order to protect the Shoalwater Reservation shoreline from flooding and erosion damage, the sea dike will cut off many of the intertidal channels connecting the western and eastern portion of North Cove, with significant adverse environmental consequences. This will likely preclude efforts to restore the ecosystem in North Cove that has resulted from previous infilling during storm overwash events.

These are all major disadvantages to the long-term integrity and efficient function of this alternative. Given these caveats, the sea dike is technically feasible and would provide a complete solution to the coastal erosion and resulting storm damage problems affecting the Shoalwater Reservation; this alternative was carried forward for further evaluation.

3.3.2.10 Alternative 5, Shoreline Revetment

Alternative Description. The shoreline revetment alternative consists of constructing an 8,470-foot-long rock structure to provide protection to tribal uplands from coastal erosion and flooding due to wave run-up and overtopping of the shoreline during coastal storms that coincide with elevated water conditions. The revetment is designed for wave conditions that will result once the barrier dune erodes and lowers to the elevation of the surrounding inter-tidal area (approximately +8 feet MLLW). The revetment has a top elevation of +21 feet MLLW, a top

width of 8 feet, and a side slope of 1V on 1.5H (**Figure 3.11**. Construction of the revetment requires placing approximately 55,000 tons of graded riprap and 64,000 tons of armor stone along the existing shoreline. The revetment is a porous structure designed to dissipate wave energy, and the graded riprap is the underlayer/filter material for the overlying armor stone. The graded riprap and revetment stone are brought to the construction site by truck, and access to the site is along the structure itself. Approximately 24,000 CY of sand is excavated to make way for the revetment stone. The excavated sand, along with approximately 40,000 CY of imported sand, is re-graded to cover the rock on the seaward side of the revetment. The graded sand is then planted with native vegetation.

Discussion and Summary. The revetment protects only the upland portion of the Shoalwater Reservation and does not address the loss of subsistence intertidal habitat in North Cove. Material that is eroded from the barrier dune will continue to be carried into the inter-tidal area behind the dune, eventually filling in what remains of North Cove and resulting in a total loss of shallow intertidal habitat within this portion of the Shoalwater Reservation. In order to afford the level of upland flood and coastal erosion protection required, the revetment will create a significant visual and physical barrier to the Shoalwater Tribe and adjacent non-Tribal community alike.

Though technically feasible, the revetment does not provide a complete solution to identified problems and fails to fully meet the criteria specified in the project authorization. A revetment will provide protection only to the upland portion of the Shoalwater Reservation, and no protection to the North Cove embayment intertidal habitat. The footprint of the revetment will also displace high value Category I wetlands located along the entire shoreline. The physical and visual barrier created by the revetment is not acceptable to either the Shoalwater Tribe or its neighbors. For these reasons, the revetment alternative was not carried forward for further evaluation.

3.3.2.11 Alternative 6, Barrier Dune Restoration

Alternative Description. The dune restoration alternative is intended to rebuild the severely eroded dune system on Graveyard Spit with sand dredged from a nearby source. The restored dune is 12,500-feet-long, with a top elevation of +25 feet MLLW, a top width of 20 feet, and a side slope of 1V on 5H (**Figure 3.12**). Like the sea dike, the restored dune is constructed along the crest of the existing dune. The initial dune restoration requires approximately 600,000 CY of sand dredged from the entrance to Willapa Bay. The dredged sand is graded and planted with native vegetation to stabilize the sand and thereby extend the interval between periodic nourishment needed to replace naturally eroded sand.

Discussion and Summary. Under this alternative, the restored barrier dune will again be capable of providing protection to the Shoalwater Reservation from storm waves. The available footprint on Graveyard Spit limits the maximum dune elevation and top width that can be achieved. Sand used to restore the dune is sacrificial, and the dune will erode to the point that storm waves overtop the structure. Therefore, maintaining the dune to its design dimensions will be critical; the dune cannot be allowed to erode to a point that waves overtop the structure,

placing the Shoalwater Reservation at renewed risk of shoreline erosion and flooding. The dune is not intended to address any further channel migration or even erosion (or accretion) of the lower beach, below +6 feet MLLW. The dune alignment can easily be readjusted to the most effective alignment on Graveyard Spit when periodic nourishment is required. Utilizing a borrow source adjacent to the northern portion of the Willapa Bay North Channel is proven to be a feasible and cost efficient means for construction and renourishment of the barrier dune. Dredging the overwashed sediments within North Cove was investigated, but determined to be operationally inefficient and disruptive to the biological community due to the large footprint required to obtain the required volume of sand (600,000 CY).

Alternative 6 is technically feasible and will provide a complete solution to the coastal erosion and related storm damage problems affecting the Shoalwater Reservation. The barrier dune alternative also lends itself to adaptive management over the life of the project. In addition, this alternative offers few, if any, environmental obstacles, and is very acceptable to state, federal and local resource and regulatory agencies, and the Shoalwater Tribe. For these reasons, the barrier dune restoration alternative was carried forward for further evaluation.

3.3.2.12 Alternative 7, Barrier Dune Restoration with Flood Berm Extension

Alternative Description. Alternative 7, barrier dune restoration and flood berm extension, combines restoration of the eroded Graveyard Spit barrier dune system with the extension of an existing low-profile riprap flood berm along the shoreline (**Figure 3.13**). The barrier dune restoration element in this alternative is identical to alternative 6 described above.

The flood berm extension has a combined length of 8,470 feet long, with a top elevation of +17 feet MLLW, a top width of 16 feet, and a side slope of 1V on 1.5H. The flood berm generally follows the same alignment as the shoreline revetment (alternative 5). A 1,700-foot-long section of flood berm was constructed in 2001 by the Corps, and extended 300 feet in December 2007. Under alternative 7, the existing riprap flood berm is extended northward 4,000 feet and southward 2,770 feet for a total length of 8,770 feet, providing a continuous protective structure along the shoreline. The flood berm requires approximately 60,000 tons of graded riprap and 29,000 tons of core material which serves as the underlayer/filter for the overlying riprap. The flood berm is intentionally porous; allowing water to filter through after the wave energy is dissipated. Excavated sand and soil is re-graded over the face of the riprap flood berm and planted with native vegetation.

Discussion and Summary. The restored barrier dune in alternative 7 provides primary protection to the entire Shoalwater Reservation from storm waves. The added presence of the flood berm, however, allows considerable erosion of the barrier dune before periodic nourishment of the dune is required. The flood berm feature ensures that tribal uplands are protected from wave run-up and flooding if the eroded barrier dune is breached or overtopped prior to periodic nourishment being performed. The backup protection provided by the flood berm allows considerable flexibility in the periodic nourishment schedule for the dune restoration. Alternative 7 is technically feasible and would provide a complete solution to the coastal erosion and related storm damage problems affecting the Shoalwater Reservation. This

alternative, particularly the barrier dune restoration, lends itself to adaptive management over the life of the project. In addition, barrier dune restoration offers few, if any, environmental obstacles, and is very acceptable to state, federal and local resource and regulatory agencies, and the Shoalwater Tribe. The flood berm extension impacts wetlands along the shoreline, and alignment of the flood berm to avoid or minimize wetland impacts was evaluated. This alternative plan was also evaluated to determine if the combination of barrier dune restoration and flood berm extension is more efficient than alternative 6 described above. For these reasons, the barrier dune restoration with flood berm extension alternative was carried forward for further evaluation.

3.4 Presentation and Evaluation of Final Array of Alternative Plans

Four alternative plans, in addition to the No Action alternative, were carried forward for further development and evaluation. The four plans in the final array of alternative plans are: sea dike (Alternative 4), sea dike extending to Reservation boundary (Alternative 4a), barrier dune restoration (Alternative 6), and barrier dune restoration with flood berm extension (Alternative 7).

For each alternative plan in the final array, the preliminary design was refined and cost estimates for construction, maintenance, and/or periodic nourishment were prepared. A life cycle cost economic evaluation was performed to determine the most cost effective (i.e., for this project, least cost) plan. Further environmental and social evaluation was also performed, including conducting community meetings with the tribal and non-tribal community and a public meeting coinciding with public release of the draft report in March 2007. Meetings and extensive coordination with local, state, and Federal resource and regulatory agencies were also conducted. The degree of environmental acceptability of each plan in the final array was assessed, as well as the nature of social effects of each plan on the Shoalwater Bay Indian Tribe. Each plan is described and the results of a detailed evaluation are presented in the following paragraphs.

3.4.1 Alternative 4, Sea Dike

The sea dike is a 12,500-foot-long rock structure that will restore the storm-generated ocean wave protection to the Shoalwater Reservation that was once afforded by the eroded dune system on Graveyard Spit. In order to fully protect the Shoalwater Reservation, the sea dike will also afford incidental protection to approximately 6,500 linear feet of shoreline located to the east of the Shoalwater Reservation. The sea dike has a top elevation of +20 feet MLLW, a top width of 14 feet, and a side slope of 1V on 2H (see **Figure 3.9**). The dike requires approximately 213,000 tons of underlayer and quarry stone, and 203,000 tons of armor stone, and is constructed along the crest of the eroded Graveyard Spit dune. The dike stone is brought to the construction site by truck. Access to the site thus requires construction of up to a one-mile-long haul road from SR-105. The haul road is removed at the completion of dike construction. Approximately 200,000 CY of sand is excavated to make way for the dike stone,

and the excavated sand is re-graded over the completed dike and planted with native dune grass to stabilize the sand from wind erosion.

While the sea dike itself is designed to resist erosion by waves and currents, the sand covering the rock on the seaward side of the dike will naturally erode over time, and will thus require periodic replacement. The maintenance requirement for the sand covering the seaward face of the dike is assumed to be 100,000 CY at two-year intervals. Replacement of 50 percent of the dike armor stone will be required at 25-year intervals.

The initial construction and life cycle cost of the sea dike is highest of the four technically feasible alternative plans. Equally important, the armor rock sea dike is not environmentally acceptable to state or federal resource agencies, and also not supported by the Shoalwater Tribe. There is concern that potential for unintended redirection of currents and disruption of sediment flow in and near the project area. From an aesthetic standpoint, the sea dike will loom as a detached breakwater, very much out of place in Willapa Bay.

3.4.2 Alternative 4a, Sea Dike to Reservation Boundary

Alternative 4a, sea dike to the Reservation boundary, is a variation of the Alternative 4 sea dike described in Paragraph 3.4.1. The structure is configured to minimize the degree of incidental coastal erosion and related storm damage reduction to the adjacent Tokeland Peninsula shoreline to the east of the Shoalwater Reservation. In order to fully protect the Shoalwater Reservation, incidental protection will still be afforded to approximately 2,000 linear feet of adjacent shoreline located to the east of the Shoalwater Reservation. Alternative 4a is a 7,000-foot-long rock structure to replace the wave protection to the Shoalwater Reservation that was once afforded by the eroded dune system on Graveyard Spit. To prevent storm waves from overtopping the sea dike, the structure has a top elevation of +20 feet MLLW, a top width of 14 feet, and a side slope of 1V on 2H (**Figure 3.10**). The sea dike will originate along the footprint of the eroded dune on Graveyard Spit within the Shoalwater Reservation boundary. In order to protect large southwesterly waves and storm surges from attacking the Shoalwater Reservation shoreline, the sea dike will extend at an angle northward toward the shoreline through the intertidal area in the North Cove embayment. The structure requires approximately 120,000 tons of underlayer rock and quarry stone and 114,000 tons of armor stone. The dike stone is brought to the construction site by truck. Access to the site thus requires construction of up to a one-mile-long haul road from SR-105; the haul road is removed at the completion of dike construction. Approximately 112,000 CY of sand is excavated to make way for the dike stone. The excavated sand is regraded over the completed dike, and planted with native vegetation to help stabilize the sand.

While the sea dike itself is designed to resist erosion by waves and currents, the sand covering the rock on the seaward side of the dike will naturally erode over time, and will thus require periodic replacement. The maintenance requirement for the sand covering the seaward face of the dike is estimated to be 50,000 CY at two-year intervals. Replacement of 50 percent of the dike armor stone will be required at 25-year intervals.

The eastern portion of Graveyard Spit outside the reservation boundary will be allowed to continually erode from storm overtopping events. As this portion of the spit erodes, larger waves will reach the portion of the sea dike that extends toward the shoreline and likely necessitate larger armor stone, increased footprint, and higher crest elevation to withstand the increase in the forcing environment in the future. There are also potential adverse impacts to the shoreline immediately adjacent to those protected by the sea dike. Numerical wave modeling results indicate a shortened sea dike will increase the magnitude and extent of inundation to areas immediately adjacent to the shorelines protected by the sea dike.

Finally, that portion of the sea dike that extends toward the shoreline will adversely impact tidal circulation within the North Cove embayment. The dike will cut off many of the intertidal channels connecting the western and eastern portion of North Cove, with significant adverse environmental consequences. The dike will likely preclude efforts to restore the ecosystem in North Cove resulting from previous infilling due to storm overwash. These are all major disadvantages to the long-term integrity and efficient function of this alternative. For these reasons, this alternative was not carried forward for further evaluation.

The initial construction and life cycle cost of this alternative is second highest of the four technically feasible alternative plans. Equally important, the armor rock sea dike is not environmentally acceptable to state or federal resource agencies, and is not supported by the Shoalwater Tribe. There is real concern that the sea dike will result in unintended redirection of currents and disruption of sediment flow in and near the project area. From an aesthetic standpoint, the sea dike will loom as a detached breakwater, very much out of place in Willapa Bay.

3.4.3 Alternative 6, Barrier Dune Restoration

Narrowing and lowering of the barrier dune that extends southward on Graveyard Spit has exposed the Shoalwater Reservation to increased flooding due to storm wave run-up and overtopping of the shoreline. The barrier dune restoration alternative is intended to rebuild and maintain the severely eroded dune system with sand dredged from a nearby borrow source in Willapa Bay. To fully protect the Shoalwater Reservation, the restored barrier dune is 12,500-feet-long. Like the sea dike, the dune restoration is constructed along the crest of the eroded barrier dune, and will afford incidental protection to approximately 6,500 linear feet of adjacent shoreline located to the east of the Shoalwater Reservation. To prevent storm waves from overtopping the restored dune, the structure has a top elevation of +25 feet MLLW, a top width of 20 feet, and a side slope of 1V on 5H (see **Figure 3.12**). The dune restoration requires approximately 600,000 CY of dredged sand. The dredged sand is graded and planted with native dune grass, to extend the periodic nourishment interval by stabilizing sand from wind erosion.

Although the migration of the Willapa channel has halted, other littoral process will not be altered. Natural erosion of sand by storm waves will continue, and the restored barrier dune will require periodic nourishment to avoid compromising the coastal storm damage protection to the Shoalwater Reservation. The cost of mobilizing a large dredge to the project site is a major consideration, and the lowest life-cycle cost for this alternative plan is obtained by maximizing

the interval between required periodic nourishment. The available footprint on Graveyard Spit for dune restoration places an upper limit on the width and height of the restored dune, and thus the interval of time before periodic nourishment is required. For this reason, the initial dune restoration dimensions maximize the volume of sand that can be placed within the available footprint on Graveyard Spit during both initial construction and subsequent periodic nourishment. Smaller dune configurations were considered, but would not be robust enough to maintain storm wave protection to the Shoalwater Reservation with a reasonable degree of confidence. Smaller dune configurations would have a slightly lower initial construction cost, but would require periodic nourishment more frequently than the five year intervals attained with the proposed design, resulting in a significantly higher overall life cycle cost. The estimated five year periodic nourishment interval is the best that can be achieved, given the relatively small plan area on Graveyard Spit.

Periodic nourishment requirements for the dune restoration were estimated by using topographic surveys from 2000, 2002, and 2008 to analyze sand loss. Figure 3.1 (a) shows the onset of dune overwash from 2000 to 2002. During this time period, the annual erosion of sediment from the dune above +6 ft MLLW was 50,000 CY/year. Figure 3.1 (b) shows elevation change from 2000 to 2008. Over this time period the existing dune footprint from 2000 has been completely eroded. The average erosion rate over this time period was 125,000 CY/year above the +6ft MLLW elevation. The rate of erosion increased exponentially as condition of the dune worsened. The sediments eroded since 2000 have primarily deposited into North Cove and formed a wider lower crest dune. This analysis indicates the erosion rates will increase as interval of the time between periodic nourishments increase.

For both initial construction and periodic nourishment, the sand will be pumped from a nearby borrow source in Willapa Bay by a large pipeline dredge. A similar construction process was successfully carried out by the Washington State Department of Transportation for the SR-105 Emergency Stabilization Project located to the west of the project. For the SR-105 project, some 350,000 CY of dredged sand was dredged and pumped approximately 7,000 feet. Utilizing a borrow source adjacent to the northern portion of the Willapa Bay North Channel is proven to be a feasible and cost-efficient means for construction and periodic nourishment of the barrier dune. Dredging the overwash sediments with North Cove was investigated, but determined to be operationally inefficient and disruptive to the biological community due to the large areal footprint required to obtain the required volume of sand free of fine-grained sediment.

The restored barrier dune will restore the historical storm wave protection to the Shoalwater Reservation. However, maintaining the restored dune to its design dimensions is critical, and the dune cannot be allowed to erode to a point that storm waves overtop the structure and place the Shoalwater Reservation at renewed risk of erosion and flooding due to wave run-up and overtopping of the shoreline. For this reason, the periodic nourishment requirement is 250,000 CY at estimated five-year-intervals. The dune alignment on the spit can be readjusted to the most effective alignment on Graveyard Spit each time periodic nourishment is required.

3.4.4 Alternative 7, Barrier Dune Restoration with Flood Berm Extension

The dune restoration and flood berm extension alternative combines restoration of the severely eroded barrier dune system on Graveyard Spit with an extension of a shoreline flood berm that was constructed in 2001 and 2007 by the Corps to provide interim protection to a small portion of the Shoalwater Reservation shoreline. The dune restoration portion of alternative 7 is identical to the alternative 6 barrier dune restoration described above in paragraph 3.4.3. In addition to barrier dune restoration, the 2001/2007 flood berm is extended along the shoreline northward 4,000 feet and southward 2,770 feet (see **Figure 3.13**). When the 4,000-foot-long north flood berm extension and 2,770-foot-long south flood berm extension are combined with the existing flood berm, a continuous shoreline protective structure with a total length of 8,470 feet is formed. In protecting the Shoalwater Reservation, this alternative would also provide incidental protection to approximately 6,500 linear feet of adjacent shoreline located to the east of the Shoalwater Reservation.

The 4,000-foot-long northward extension of the flood berm utilizes a design that is similar to the existing flood berm. The flood berm is constructed of graded riprap with a top elevation of +17 feet MLLW, a top width of 16 feet, and a side slope of 1V on 1.5H. The north flood berm extension requires approximately 35,000 tons of graded riprap and 14,000 tons of core (i.e., underlayer/filter) material. The initial gradation for both the riprap and underlayer/filter material was calculated using the Corps' Automated Coastal Engineering System (ACES). They were slightly altered based on the Corps' Seattle District office past experience and constructability. The core material serves as the underlayer/filter for the overlying riprap. The flood berm is porous by design, allowing water to filter through the structure after the wave energy is dissipated. The flood berm is not intended, nor required, to be a levee that keeps elevated water levels from flooding interior lowlands. Nor will the structure be subjected to continuous or even frequent wave attack. Wave attack, when it occurs, will be over a 3-4 hour period, perhaps once or twice annually, and only if the barrier dune is severely eroded prior to renourishment. All construction materials are brought to the construction site by truck, and access to the site is along the structure itself. Approximately 15,000 CY of sand and soil is excavated to make way for construction of the flood berm. The excavated sand and soil is re-graded over the flood berm and planted with native vegetation as an environmental and esthetic feature.

The 2,770-foot-long south flood berm extension utilizes the same design as the north flood berm extension. It is constructed of graded riprap with a top elevation of +17 feet MLLW, a top width of 16 feet, and a side slope of 1V on 1.5H. The south flood berm extension requires approximately 25,000 tons of graded riprap and 15,000 tons of underlayer/filter material. Approximately 10,000 CY of sand and soil is excavated to make way for the underlayer/filter material and riprap. All construction materials for the southward extension are brought to the construction site by truck, and access to the site is along the structure itself. The excavated sand and soil is re-graded over the face of the flood berm and planted with native vegetation as an environmental and esthetic feature.

The restored barrier dune will provide primary protection from storm wave attack. Extension of the flood berm allows considerable erosion of the barrier dune before periodic

nourishment is required. Periodic nourishment of the barrier dune will require 500,000 CY of sand at 10-year-intervals. Maintenance of the flood berm will require replacement of 25 percent of the riprap at 25-year intervals, and replacement of 5,000 CY of the sand and soil covering the seaward face of the riprap flood berm extension at 25-year-intervals. The backup protection provided by the flood berm allows significant flexibility in the periodic nourishment schedule for the barrier dune restoration, allowing the periodic nourishment interval to double to 10 years as opposed to five years if the barrier dune restoration-only alternative were implemented. This flexibility alleviates concerns regarding availability and timing of funding for periodic nourishment of the barrier dune, scheduling and availability of dredging equipment, and the short four-month-long dredging window (July through October) at Willapa Bay. Thus, if the barrier dune has eroded to the point that it is overtopped and/or breached during a winter storm event, the flood berm alleviates concern about wave run-up, overtopping, and flooding of tribal uplands during the time period until periodic nourishment of the dune can be accomplished.

Extension of the flood berm both to the north and to the south of the existing flood berm will result in extensive wetland impacts. Mitigation of unavoidable wetland impacts will be required. The footprint of the flood berm will permanently impact 7.01 acres of category 1 (highest quality) estuarine wetlands, out of a total 8.08 acre flood berm footprint. There will also be temporary wetland impacts associated with construction. Adverse impacts cannot be avoided. Adoption of an equally effective alternative (Alternative 6, barrier dune restoration) will avoid wetland impacts, and thus ensure compliance with NEPA, the Clean Water Act, and the Coastal Zone Management Act. The cost of wetland mitigation will result in a significant cost increase in this alternative verses the cost of Alternative 6. In addition, preparation of an environmental impact statement is considered likely. Because this alternative would effectively reduce storm damage to the Shoalwater Reservation, it was carried forward for more detailed analysis.

3.5 Comparison of Alternatives

The results of the comparison of alternatives are presented in **Table 3.9** below. Items considered include initial construction cost, periodic nourishment and operation & maintenance (O&M) intervals, compatibility of plans with the U.S. Army Corps of Engineers Environmental Operating Principles, public and environmental acceptability, and the views of the Shoalwater Bay Indian Tribe.

A detailed cost estimate was developed for each of the four plans that comprise the final array of alternative plans. Cost estimates were developed in the Corps' Micro-Computer Aided Cost Estimating System (M-CACES) format. Dredging estimates for Alternatives 6 and 7 were developed using the U.S. Army Corps of Engineers Dredge Estimating Program. For the following reasons, an annualized life-cycle cost analysis approach was selected to evaluate alternative plans:

- **The project is exempt from any requirement for economic analysis.** The project is to be economically justified through its efficiency and cost effectiveness (i.e., least cost

means) of providing flood and coastal storm damage reduction measures.

- **The four alternative plans provide a comparable level of benefit to the Shoalwater Bay Indian Tribe.** That is, each plan affords effective flood and coastal storm damage reduction to Shoalwater Reservation uplands and facilities, as well as to subsistence intertidal habitat in North Cove embayment.

The economic decision criteria for alternative plans was quantified using a life-cycle cost analysis which includes all upfront capital costs, interest during construction, plus all future costs for periodic nourishment/monitoring (continuing construction) and operation and maintenance (O&M) expected to be incurred over the 50-year period of analysis. Costs for each alternative reflect a constant price level (March 2009). Future costs were converted to present worth value using the Fiscal Year 2009 Federal discount rate (4.625 percent). Sums of all upfront and discounted future costs were annualized over the 50-year period of analysis.

For comparison, summary cost data for the four alternative plans is shown in **Table 3.10** below. Alternative 6 has the lowest total average annual costs. Alternative 6 is thus the most cost effective (least cost) long-term solution to providing effective coastal erosion protection and associated coastal storm damage reduction to the Shoalwater Bay Indian Reservation.

- **Alternative 4, Sea Dike.** Initial construction will require two years, with dike armor stone maintenance after 25-years. Sand cover maintenance will be required every two years.
- **Alternative 4a, Sea Dike to Reservation Boundary.** Initial construction will require two years, with dike armor stone maintenance after 25-years. Sand cover maintenance will be required every two years.
- **Alternative 6, Barrier Dune Restoration.** Initial construction will occur in one construction season. Stabilizing vegetation will be planted the following year. Periodic nourishment is expected to be required every five years, including replanting of stabilizing vegetation.
- **Alternative 7, Barrier Dune Restoration with Flood Berm Extension.** Construction of the barrier dune restoration will occur in one construction season, followed by construction of the flood berm extension and planting of stabilizing vegetation on the barrier dune the following year. Periodic nourishment of the barrier dune restoration is expected to be required at ten-year intervals, including replanting of stabilizing vegetation. Maintenance of the flood berm includes riprap replacement at year 25.

Table 3.9 Comparison of Alternatives for Final Array of Alternative Plans

Alternative	Average Annual Costs [1]	Periodic Nourishment and Maintenance Intervals	Environmental Operating Principles	Public and Environmental Acceptability	Views of Shoalwater Bay Indian Tribe
Alternative 4, Sea Dike	$2,092,000	• Armor stone: 25 years • Sand cover: 2 years	Massive rock structure not environmentally compatible with natural system in Willapa Bay. Plan does not lend itself to adaptive management.	Not acceptable to state and Federal resource agencies. Extensive mitigation required. Non-compliance with NEPA, CZMA and Clean Water Act.	Tribe does not support this plan for the same reasons cited by state and Federal resource agencies.
Alternative 4a, Sea Dike to Reservation Boundary	$1,595,000	• Armor stone: 25 years • Sand cover: 2 years	Massive rock structure not environmentally compatible with natural system in Willapa Bay. Plan does not lend itself to adaptive management.	Not acceptable to state and Federal resource agencies. Extensive mitigation required. Non-compliance with NEPA, CZMA and Clean Water Act.	Tribe does not support this plan for the same reasons cited by state and Federal resource agencies.
Alternative 6, Barrier Dune Restoration	$926,000	• Periodic Nourishment: 5 years, on average • Planting: 5 years • Baseline monitoring: years 2-5 • Long term monitoring: 3 years after periodic nourishment	Dune requires periodic nourishment at five year intervals, followed by replanting of native vegetation to stabilize sand from wind erosion. Solution mimics nature.	Dune restoration is very acceptable to state and Federal resource agencies. Soft solution lends itself to adaptive management. No wetland impacts and thus no mitigation required.	Tribe supports this plan. Their concern is that periodic nourishment be accomplished as necessary to maintain effective storm damage reduction.
Alternative 7, Barrier Dune Restoration with Flood Berm Extension	$1,377,000	Dune Restoration: • Periodic nourishment: 10 years on average. • Planting: 10 years • Baseline monitoring: years 2-5 • Long term monitoring: 3 years after periodic nourishment Flood Berm Extension: • Berm riprap: 25 years • Sand/soil cover: 25 years • Planting: 25 years	Flood berm extension extends dune periodic nourishment interval to 10 years. Flood berm extension would blend with the environment, as has the existing flood berm.	Flood berm would fill seven acres of Category 1 wetlands, requiring extensive mitigation for wetland impacts. Non-compliance with NEPA, CZMA, and Clean Water Act.	Tribe supports this plan. The flood berm would provide a second line of defense against upland flooding should the dune become severely eroded prior to periodic nourishment.

[1] For comparative purposes only – does not include contingency; planning, engineering and design; or construction management, but includes lands and damages, initial construction, operation and maintenance (O&M), and periodic nourishment/monitoring.

Table 3.10 Summary Cost Data for Final Array of Alternative Plans [1]

Alternative	Initial Construction Cost [2] (Net Present Value)	O&M and/or Periodic Nourishment [2] (Net Present Value)	Annualized Initial Construction Cost	Annualized O&M and/or Periodic Nourishment Cost	Average Annual Costs
Alternative 4, Sea Dike	$21,543,000	$18,954,000 (O&M)	$1,113,000	$979,000 (O&M)	$2,092,000
Alternative 4a, Sea Dike to Reservation Boundary	$12,122,000	$18,767,000 (O&M)	$626,000	$969,000 (O&M)	$1,595,000
Alternative 6, Barrier Dune Restoration	$6,655,000	$11,288,000 (periodic nourishment and monitoring)	$343,000	$583,000 (periodic nourishment and monitoring)	$926,000
Alternative 7, Barrier Dune Restoration with Flood Berm Extension	$16,631,000	$345,000 (O&M) $9,891,000 (periodic nourishment and monitoring)	$859,000	$7,000 (O&M) $511,000 (periodic nourishment and monitoring)	$1,377,000

[1] Does not include contingency; planning, engineering & design; or construction management, but includes lands and damages, initial construction, operation and maintenance (O&M), and periodic nourishment/monitoring.
[2] Includes interest during construction.

3.6 Selection of the Final Plan

Alternative 6, barrier dune restoration, is the selected final plan (**Figure 3.12**). This plan was selected after careful consideration of the criteria specified in the project authorization; planning objectives and constraints; views of the Shoalwater Bay Indian Tribe; input from the public, including the adjacent non-Indian community; and the views of local, state, and Federal resource and regulatory agencies who have collectively provided valuable input throughout the project planning process.

3.6.1 Rationale for Selection

Alternative 6, barrier dune restoration, is identified as the most appropriate long term solution to the coastal erosion and resulting coastal flooding and storm damage problems affecting the Shoalwater Bay Indian Reservation. This plan is a complete solution to the identified problems, is clearly the most cost effective means of reducing coastal erosion and the resulting flooding and storm damage, is environmentally acceptable and technically feasible, and will enable the Shoalwater Tribe to improve economic and social conditions of the tribal community. **As noted in Paragraph 3.3.2, the project authorization directs that no economic analysis is to be conducted. For this project, therefore, efficiency or cost effectiveness refers to the least cost means of providing flood and storm damage reduction measures.** Alternative 6 provides a complete solution to identified problems and concerns facing the Shoalwater Bay Indian Tribe and their Reservation. All criteria specified in the project authorization are satisfied by this alternative, and this alternative best satisfies the identified planning objectives and evaluation criteria. It is emphasized that selection of this plan

does not preclude ecosystem restoration opportunities which will be addressed in a follow-up study.

3.6.2 Risk and Uncertainty

The comprehensive interagency coastal engineering studies conducted as part of the planning process for this project have confirmed that a modest engineering solution is both a technically feasible and cost effective means to reestablish the storm protection provided by the barrier dune system on Graveyard Spit. After 1985, Graveyard Spit stabilized in position, but the barrier dune continued to lower in profile and to narrow, and consequently became increasingly prone to storm overwash. The littoral drift of sand that previously nourished and maintained the dunes has been interrupted, resulting in significant erosion of the protective dune. To ensure that the Shoalwater Reservation is protected from severe winter storms on a sustained basis over the long term, periodic nourishment of the restored barrier dune will be required. Periodic nourishment is considered construction, and will be budgeted accordingly throughout the life of the project.

The risk of coastal flooding and storm damage to the Shoalwater reservation is closely correlated to historic high water levels overtopping the current barrier dune system. The barrier dune will be raised from current elevations as low as +5 feet to a final elevation of +25 feet above mean lower low water (MLLW) to restore the elevation of the natural dune prior to the onset of erosion and breaching. The dune cross-section is designed for structure reliability while considering the footprint area available to construct the dune on. Constructing the dune higher than +25 feet MLLW would require a larger footprint which is limited by intertidal habitat on the North Cove side and the Willapa Bay North Entrance channel on the seaward side.

The dune restoration will not eliminate upland flooding (i.e., ponding) caused by extreme water elevations, such as extreme storm surges occurring during a MAT. The restored dune is not designed as a flood control structure. North Cove will continue to be hydraulically connected to the Pacific Ocean through two inlets through Graveyard Spit. However, the restored dune will significantly decrease flood elevations in areas most prone to wave run-up, overtopping, and overland wave propagation. Figures 3.6 and 3.7 show the flooding depths for the March 3, 1999 storm condition with the barrier dune restored. The barrier dune restoration is estimated to reduce threat of inventoried structures from 54% (future without-project – see **Table 3.4**) to 7% (future with-project – see **Table 3.12**). The restored dune will mitigate structure damage from debris carried inland by high velocity flows. However, instances of extreme water levels caused by large storm surges occurring at a MAT will still flood low lying upland topography. **Tables 3.13 and 3.14** quantify the structures remaining above a low level of risk for the 50%, 2%, and 1% annual storm surge during tide elevations of MHHW and MAT, respectively. These results indicate some residual flooding risk to structures will exist in the future with-project condition. Residual flooding risk under the future with-project condition will result in minor ponding around five Tribal structures, as shown on **Table 3.12** (Tribal Gaming office, a single family residence, and three duplex residences).

In addition, the restored dune will also mitigate North Cove intertidal and shallow subtidal habitat in-filling with sand and debris deposition due to storm waves overwashing the barrier dune. This will enable consideration of ecosystem restoration opportunities in the Shoalwater Tribe's North Cove embayment.

The proposed barrier dune footprint is designed to withstand a 1% storm event. However, high water level events combined with wave run-up will naturally erode the dune over time, thus a sand reservoir is included in the design to increase the reliability of the dune. The reliability and performance of the restored barrier dune have been analyzed using a life cycle analysis technique coupled with the SBEACH (Storm-induced BEAch CHange) numerical model. The details of the work are included in **Chapter 3 of Appendix 1, Engineering Analysis and Design**. The analysis simulated various historic storm conditions to develop a relationship between the storm return interval and the resultant area per linear foot of dune eroded.

The analysis determined that the restored barrier dune will withstand a 1% annual water level with a high degree of confidence. As designed, the total cross-sectional area per linear foot of dune above mean high water will be 1,785 feet^2. **Table 3.11** includes the computed cross-sectional area lost from the dune for various return intervals. The area eroded from a dune cross-section for a 1% annual storm occurrence ranges from 630 - 800 feet^2, or approximately 35 – 45% of the original cross-section. The barrier dune will likely require periodic nourishment with sand following such an event; however the risk of total failure is low considering over half the original cross-sectional area above mean high water will remain. As the dune naturally erodes, the crest elevation will gradually lower while the cross-sectional area simultaneously narrows. At this time dune nourishment will be required to prevent flooding and storm damage to the Reservation.

The dynamic nature of the Willapa Bay inlet presents a level of uncertainty about how the northern Willapa Bay entrance channel will affect long-term morphology at the bay's mouth. Sea level rise also presents an uncertainty. During the evaluation process, it was determined that the barrier dune restoration presented the greatest flexibility to adapt to long-term uncertainties, while mitigating risk and uncertainly. The importance of frequent monitoring and timely periodic nourishment will be critical toward mitigating this risk.

Table 3.11 Cross-sectional Area Loss of Dune for Various Storm Return Intervals

RETURN INTERVAL (YR)	% ANNUAL OCCURENCE	MEAN (ft^2 – ft beach)	5% C.I. (ft^2 – ft beach)	95% C.I. (ft^2 – ft beach)
2	50	194.5	0.0	291.2
5	20	367.1	335.6	399.2
10	10	426.8	386.0	469.2
50	2	565.0	483.8	662.4
100	1	634.9	518.3	790.7

Table 3.12 Future With-Project Coastal Flood and Storm Damage Residual Risk (March 3, 1999 storm)

Inventory Number	Structure Name / Function	Elevation Above MLLW (feet)	Distance from Shoreline (feet)	Flood and Storm Damage Risk
1	Tribal Business (Fireworks Stand)	15.0	131	Low
2	Tribal Business (Fireworks Stand)	16.5	283	Low
3	Tribal Business (Convenience Store) / Single Family Residence	17.3	334	Low
5	Single Family Residence	19.0	412	Low
7	Tribal Business (Fireworks Stand)	15.6	282	Low
8	Vacant Single Family Residence	16.2	343	Low
9	Vacant Single Family Residence	16.2	343	Low
10	Single Family Residence	16.0	220	Low
11	Single Family Residence	26.0	372	Low
12	Mobile Home Residence	15.2	220	Low
13	Tribal Business (Fireworks Stand)	16.3	169	Low
14	Tribal Business (Fireworks Stand)	16.0	177	Low
15	Tribal Business (Fireworks Stand)	15.8	183	Low
16	Single Family Residence	17.2	225	Low
17	Single Family Residence	17.0	220	Low
18	Single Family Residence	17.0	220	Low
19	Single Family Residence	17.0	220	Low
20	Water Treatment, Pump House, Back-up Generator	14.2	245	Low
21	Single Family Residence	14.2	397	Low
23	Single Family Residence	13.9	361	Low
24	40 foot shipping container	15.0	308	Low
25	40 foot shipping container	14.5	328	Low
26	40 foot shipping container	14.5	338	Low
27	Tribal Business Storage	15.3	287	Low
28	Tribal Business (Convenience Store)	15.3	273	Low
29	Tribal Gaming (Regulators) Office	13.4	422	Medium
30	Tribal Casino Administrative Office	14.8	418	Low
31	Tribal Casino Administrative Office	14.8	435	Low
32	Tribal Casino and emergency back-up generator	14.9	358	Low
33	Bus Shelter	17.4	287	Low
33a	Casino Septic Field	14.6	260	Low
34	Single Family Residence	17.0	190	Low
36	Single Family Residence	16.8	277	Low
37	Single Family Residence	15.1	366	Low
38	Single Family Residence	16.0	364	Low
39	Single Family Residence	16.7	272	Low
40	Single Family Residence	16.7	185	Low

Table 3.12 Future With-Project Coastal Flood and Storm Damage Residual Risk (March 3, 1999 storm) (continued)

Inventory Number	Structure Name / Function	Elevation Above MLLW (feet)	Distance from Shoreline (feet)	Flood and Storm Damage Risk
42	Single Family Residence	14.9	375	Low
43	Single Family Residence	13.0	501	Medium
44	Tribal Business (Fireworks Stand)	14.0	114	Low
45	Mobile Home Residence	15.9	310	Low
47	Single Family Residence	15.9	303	Low
49	Mechanical Repair Building for Tribal Fishing Boats & Gear	15.0	388	Low
50	Mobile Home Residence	13.7	506	Low
51	Single Family Residence	16.0	154	Low
52	Single Family Residence	16.1	151	Low
54	Mobile Home Residence	15.9	306	Low
55	Mobile Home Residence	15.7	306	Low
60	Single Family Residence	18.1	244	Low
61	Single Family Residence	18.0	224	Low
62	Single Family Residence	17.3	289	Low
63	Single Family Residence	18.4	381	Low
64	Single Family Residence	18.4	420	Low
65	Single Family Residence	17.9	420	Low
66	Single Family Residence	18.0	405	Low
67	Single Family Residence	18.1	315	Low
69	Tribal Community Center / Tribal Police	16.4	153	Low
71	Tribal Education Center and Library	17.4	260	Low
72	Tribal Court	15.7	105	Low
73	Tribal Social and Family Services	15.1	163	Low
74	Emergency Back-up Generator (Flood-proofed)	15.1	163	Low
75	Tribal Cultural Repository Building	14.6	276	Low
76	Tribal Counseling / Interview Facility	14.6	276	Low
77	Tribal Warehouse/Maintenance Building	14.6	276	Low
83	Tribal Wellness Center	16.0	463	Low
83a	Emergency Back-up Generator (Flood-proofed)	17.2	460	Low
84	Duplex Family Residence	17.3	710	Low
85	Duplex Family Residence	17.5	720	Low
86	Tribal Gymnasium and Assembly Hall	15.4	707	Low
87	Gymnasium Storage Building	15.4	860	Low
88	Duplex Family Residence	13.5	1032	Medium
89	Duplex Family Residence	13.6	1117	Low
90	Duplex Family Residence	13.3	1213	Medium
91	Duplex Family Residence	12.9	1301	Medium

Table 3.12 Future With-Project Coastal Flood and Storm Damage Residual Risk (March 3, 1999 storm) (continued)

Inventory Number	Structure Name / Function	Elevation Above MLLW (feet)	Distance from Shoreline (feet)	Flood and Storm Damage Risk
92	Tribal Recreational Vehicle Park & Casino Parking	13.6	90	Low
93	Tribal Cemetery	14.3	462	Low
----	State Route 105 traversing the Shoalwater Reservation	15.0 – 16.5	150	Low
----	Old Tokeland Road	15.0 – 15.5	100	Low
----	Shipping Container with Emergency Supplies (on hillside)	N/A	N/A	None
----	Single Family Residence (on hillside)	N/A	N/A	None
----	Tribal Environmental Complex (north, along SR-105)	N/A	N/A	None
----	Single Family Residence (outside Reservation, in Tokeland)	N/A	N/A	Low
----	Single Family Residence (outside Reservation, in Tokeland)	N/A	N/A	Low
----	Single Family Residence (outside Reservation, in Tokeland)	N/A	N/A	Low
----	Single Family Residence (outside Reservation, in Tokeland)	N/A	N/A	Low
----	Single Family Residence (outside Reservation, in Tokeland)	N/A	N/A	Low
----	Single Family Residence (outside Reservation, in Tokeland)	N/A	N/A	Low

Table 3.13 Future With-Project Percentage of Structures at Flooding Risk for Storm Surge Event Frequency Occurring at Mean Higher High Water (MHHW)

Flood and Storm Damage Risk	50% Annual Occurrence	2% Annual Occurrence	1% Annual Occurrence
Low	**100**	**87**	**83**
Medium	**0**	**8**	**6**
High	**0**	**5**	**11**

Table 3.14 Future With-Project Percentage of Structures at Flooding Risk for Storm Surge Event Frequency Occurring at Maximum Astronomical Tide (MAT)

Flood and Storm Damage Risk	50% Annual Occurrence	2% Annual Occurrence	1% Annual Occurrence
Low	83	37	32
Medium	6	19	15
High	11	44	53

3.6.3 Safety Assurance

In accordance with Section 2035 of the Water Resources Development Act (WRDA) of 2007 (Public Law 110-114), the adequacy, appropriateness, and acceptability of the design and proposed construction activities have been evaluated for the purpose of assuring public health, safety, and welfare. In accordance with Appendix D of ER 1105-2-410, the following factors were considered in the design and proposed construction of the project:

(1) Can failure of the project cause a significant loss of life? No. The restored barrier dune will prevent storm waves from overtopping the structure and attacking the Shoalwater Reservation shoreline, except under extreme conditions such as a tsunami wave. The dune is constructed of dredged sand, and is subject to natural erosion due to wave action. The erosion will result in a gradual lowering and narrowing of the dune. If the dune continues to erode unchecked, the potential exists for wind-driven ocean waves to overtop the barrier dune, resulting in wave attack and overtopping of the shoreline and flooding of Shoalwater Reservation uplands and facilities. If required periodic nourishment is delayed, the eroded barrier dune will provide less and less meaningful storm wave attenuation. The condition of the barrier dune will be monitored to determine the need for and timing of periodic nourishment throughout the project life cycle. Periodic nourishment of the barrier dune is an authorized Federal responsibility for this project.

(2) Is the project based on novel methods, present complex challenges for interpretation, contain precedent-setting methods or models, or present conclusions that are likely to change prevailing practices? No. The project employs a very basic and widely demonstrated approach to reducing coastal erosion and providing effective coastal storm damage reduction.

(3) Will the project involve the use of innovative materials or techniques? No. No innovative material or techniques will be employed in the construction of project. The barrier dune restoration will be constructed by dredging sand from a nearby aquatic site and placing it

on Graveyard Spit to replace sand that has eroded from the barrier dune due to interruption of the longshore transport of sediment that once naturally nourished the barrier dune.

(4) Does the project design lack redundancy, resiliency, or robustness? No. The restored barrier dune will erode naturally over time, due to wave action. As the sand is eroded, the profile of the dune will gradually narrow and lower. The result will be a gradual lessening of the level of storm wave protection afforded to the Shoalwater Reservation. Periodic nourishment of the barrier dune will be required to sustain a reasonable level of storm wave protection over the entire life cycle of the project given that there will be multiple storm events over time. Analysis indicates that the dune configuration will be able to withstand a 100 year event (1 percent annual chance of occurrence) with a reasonable degree of confidence. The dune configuration was also designed to be sufficiently robust so as to extend the time interval before periodic nourishment is required.

(5) Does the project have unique construction sequencing or acquisition plans. No. Construction consists simply of dredging sand from a designated nearby aquatic borrow site, pumping the dredged sand to Graveyard Spit, grading the sand to the design configuration, and planting native vegetation in selected areas to reduce wind erosion.

(6) Does the project have a reduced or overlapping design construction schedule? No. The design construction schedule is very straightforward, consisting of sequential dredging, placement, grading, and planting of native vegetation.

3.6.4 Sea Level Rise

Sea level rise presents a threat to the coastline and shore protection infrastructure. Sea level rise in conjunction with storm surge and increased wave energy propagating further inland will inundate shorelines, bays, tidal wetlands, thereby exacerbating coastal erosion.

Review of data on relative sea level changes and the resulting impact on engineering structures has been fully considered in problem evaluation, plan formulation, and the risk and uncertainty analysis for this project. Whereas there is a high probability of sea level rise along the central and southern coast of the state of Washington, precise estimates of future sea level rise are unknown. There is, however, very recent published information for the coast of Washington (Washington Department of Ecology and University of Washington) that has been taken into account. The most likely prediction by 2050 is a five inch sea level rise, with a worst-case scenario of 18 inches. By 2100, the most likely prediction is 11 inches, with a worst-case scenario of 43 inches. Coastal land rebound from previous ice ages and tectonic plate uplift are known factors that are factored in, as well.

In practice, the obtainable height of the restored barrier dune restoration is a function of the available footprint and the angle of repose of dune material. Because sand for dune restoration is sacrificial, erosion rates have been calculated for purposes of establishing the frequency of required periodic nourishment. Sea level rise, coupled with severe winter storms at

high tide is likely to increase the rate the erosion of the barrier dune. The result may be a slight increase, in some time periods, in the frequency that periodic nourishment is required to maintain the barrier dune on Graveyard Spit. See additional discussion of sea level change in **Chapter 6 of Appendix 1, Engineering Analysis and Design**.

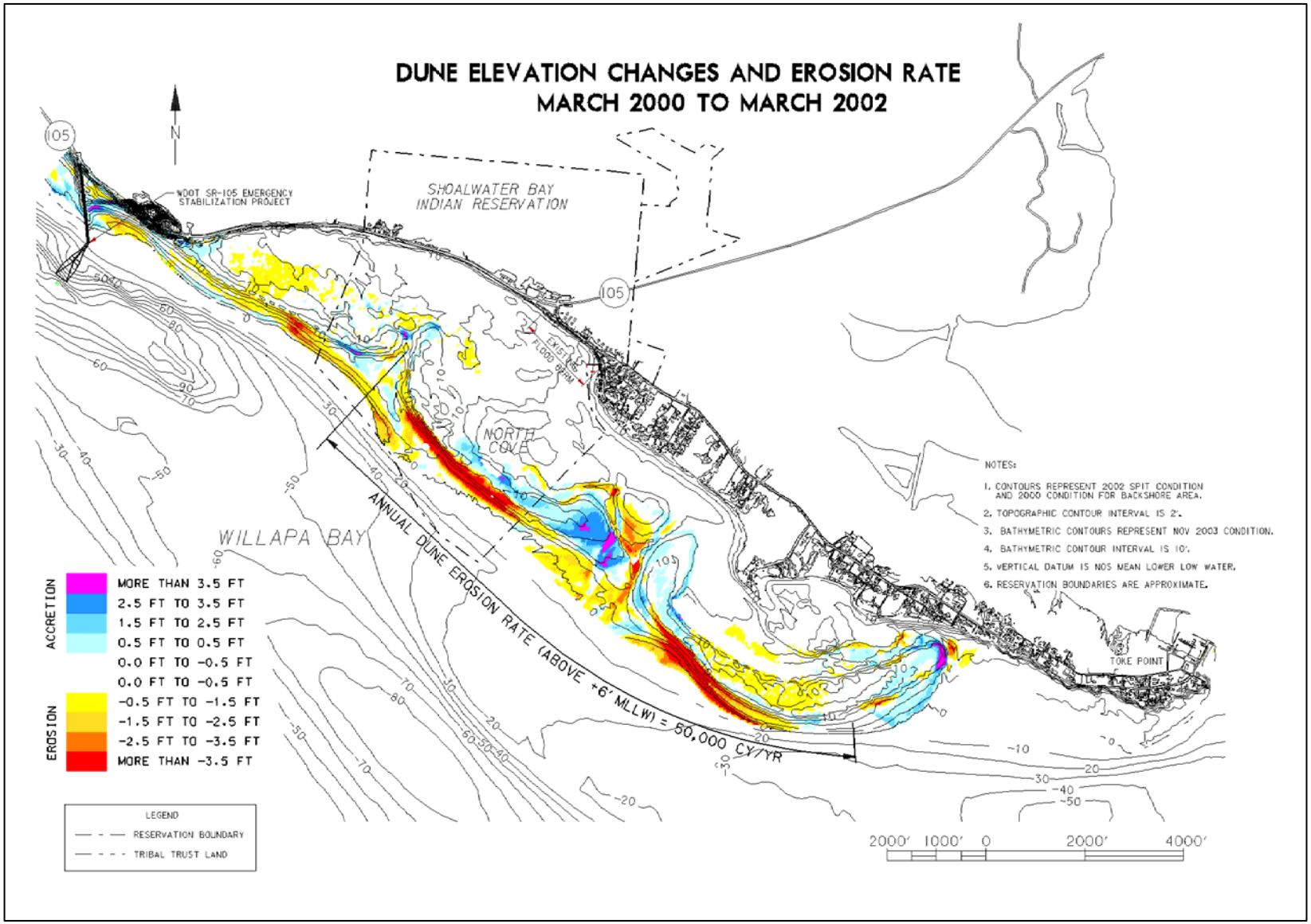

Figure 3.1(a) Barrier Dune Elevation Changes & Erosion Rate Prior to Dune Overwash

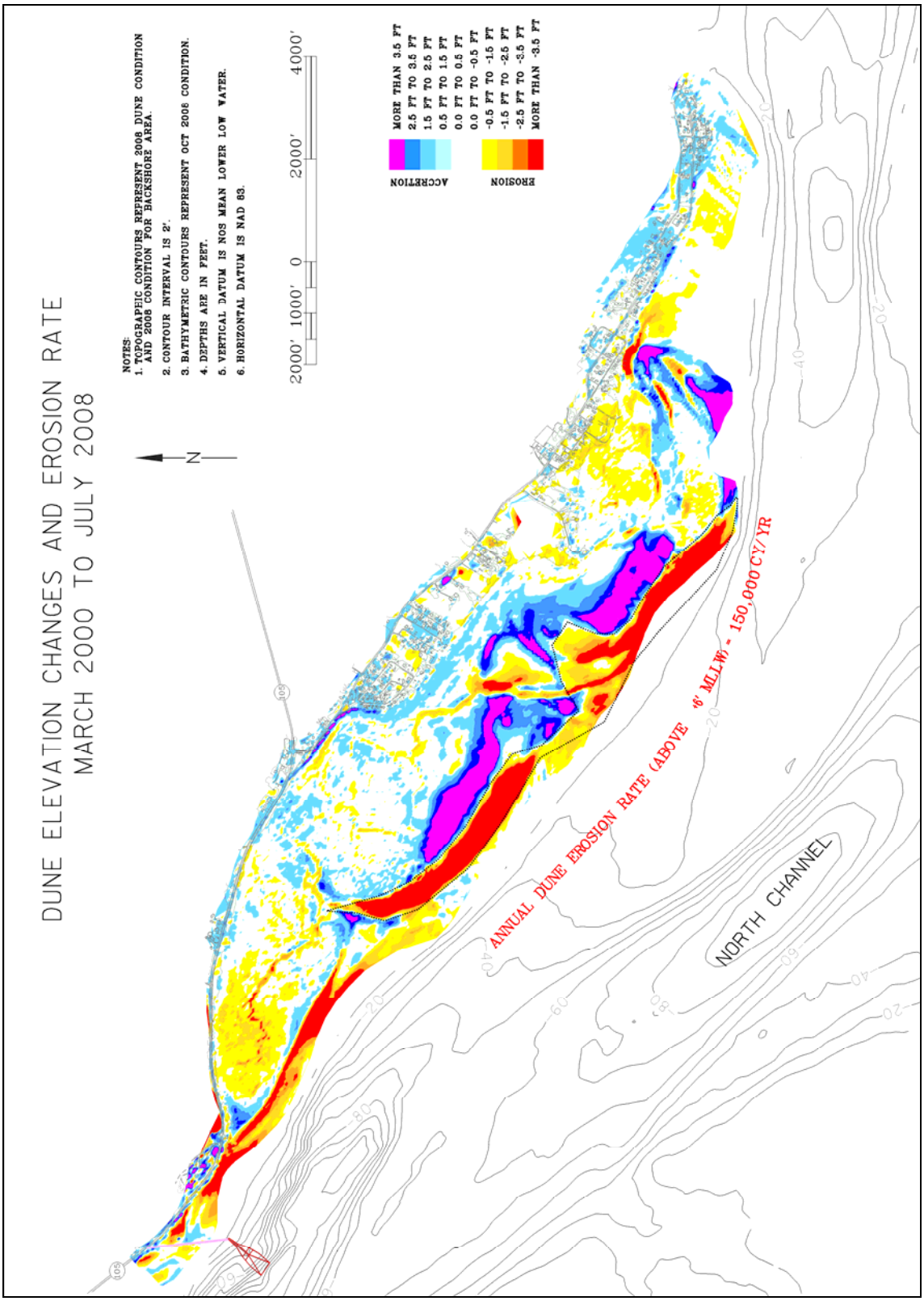

Figure 3.1(b) Barrier Dune Elevation Changes & Erosion Rate Following Dune Overwash

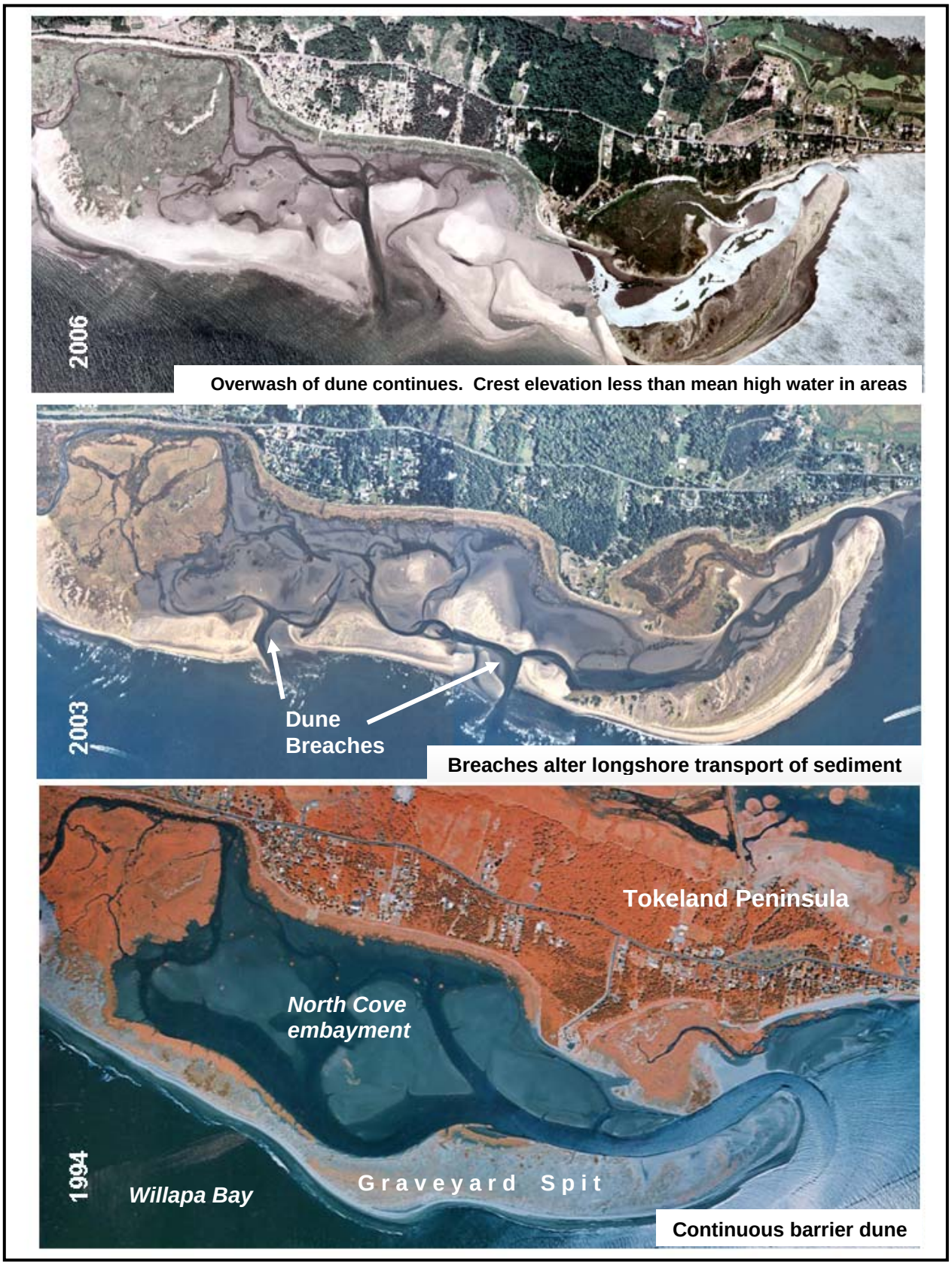

Figure 3.2 Barrier Dune Condition: 1994, 2003, and 2006

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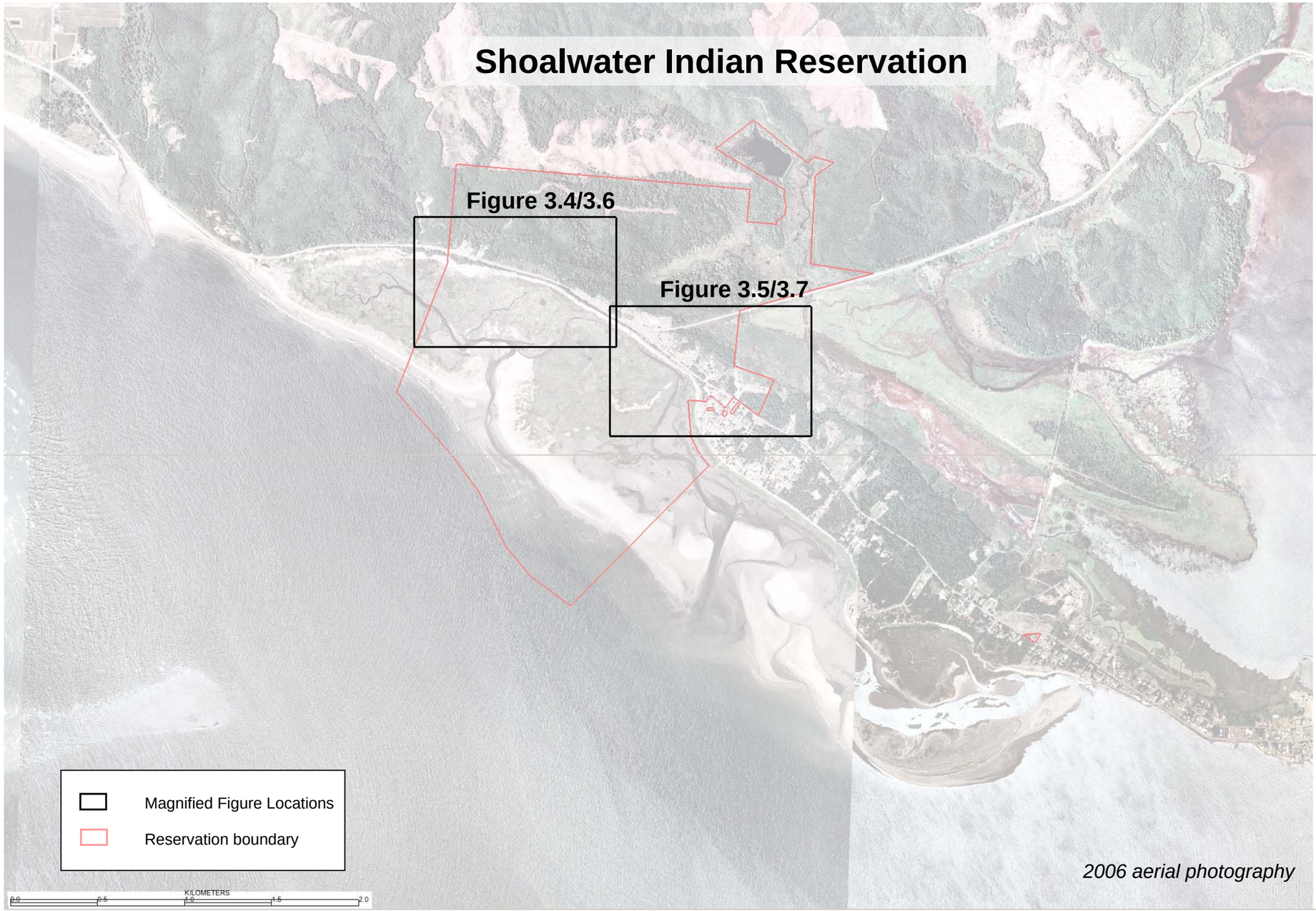


Figure 3.3 Shoalwater Reservation and Locations of Detailed Flood Potential Maps

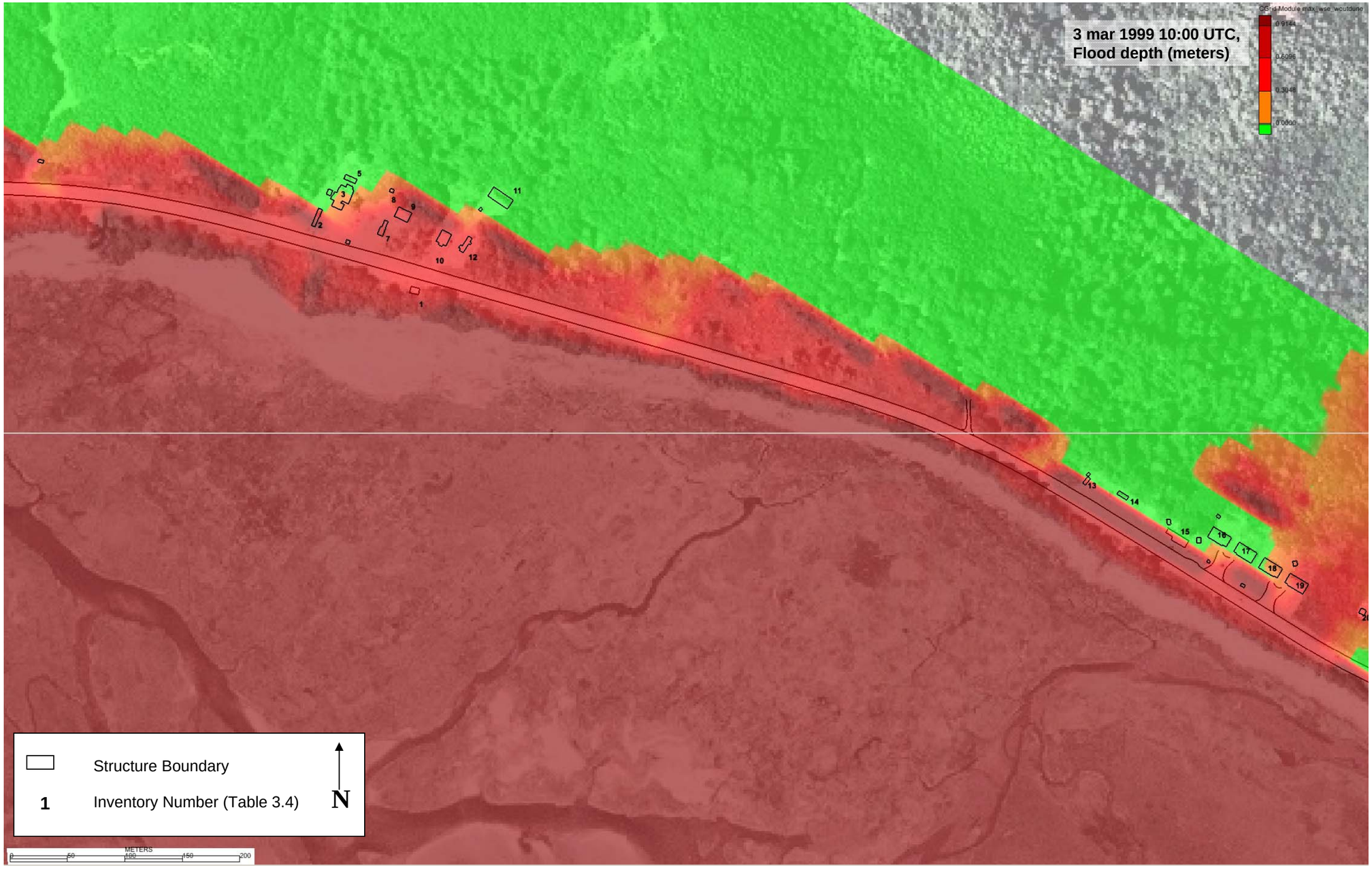


Figure 3.4 Shoalwater Reservation Flooding Potential (Map #1) for 3 March 1999 Storm – Future Without-project Condition

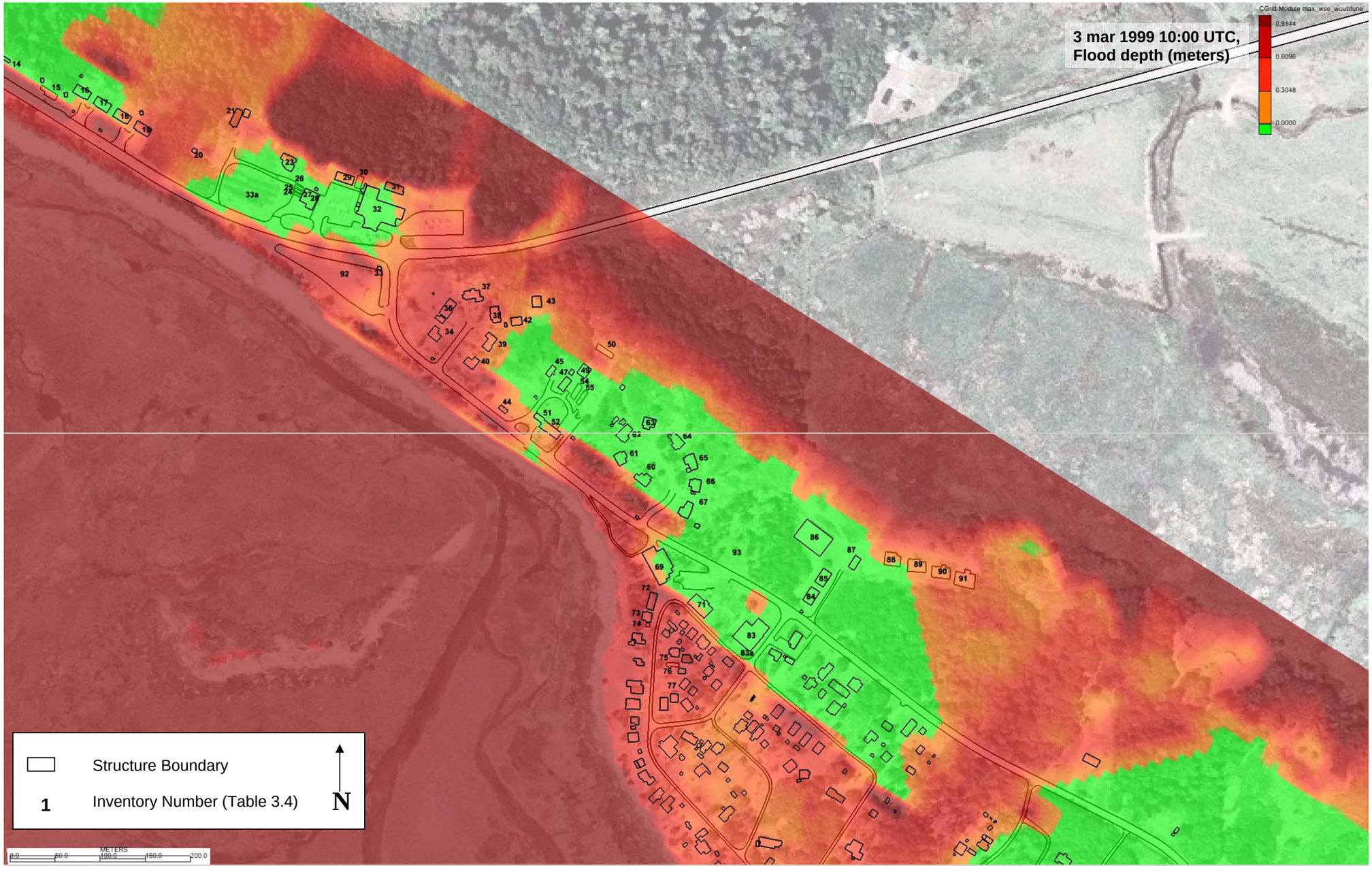


Figure 3.5 Shoalwater Reservation Flooding Potential (Map #2) for 3 March 1999 Storm – Future Without-project Condition

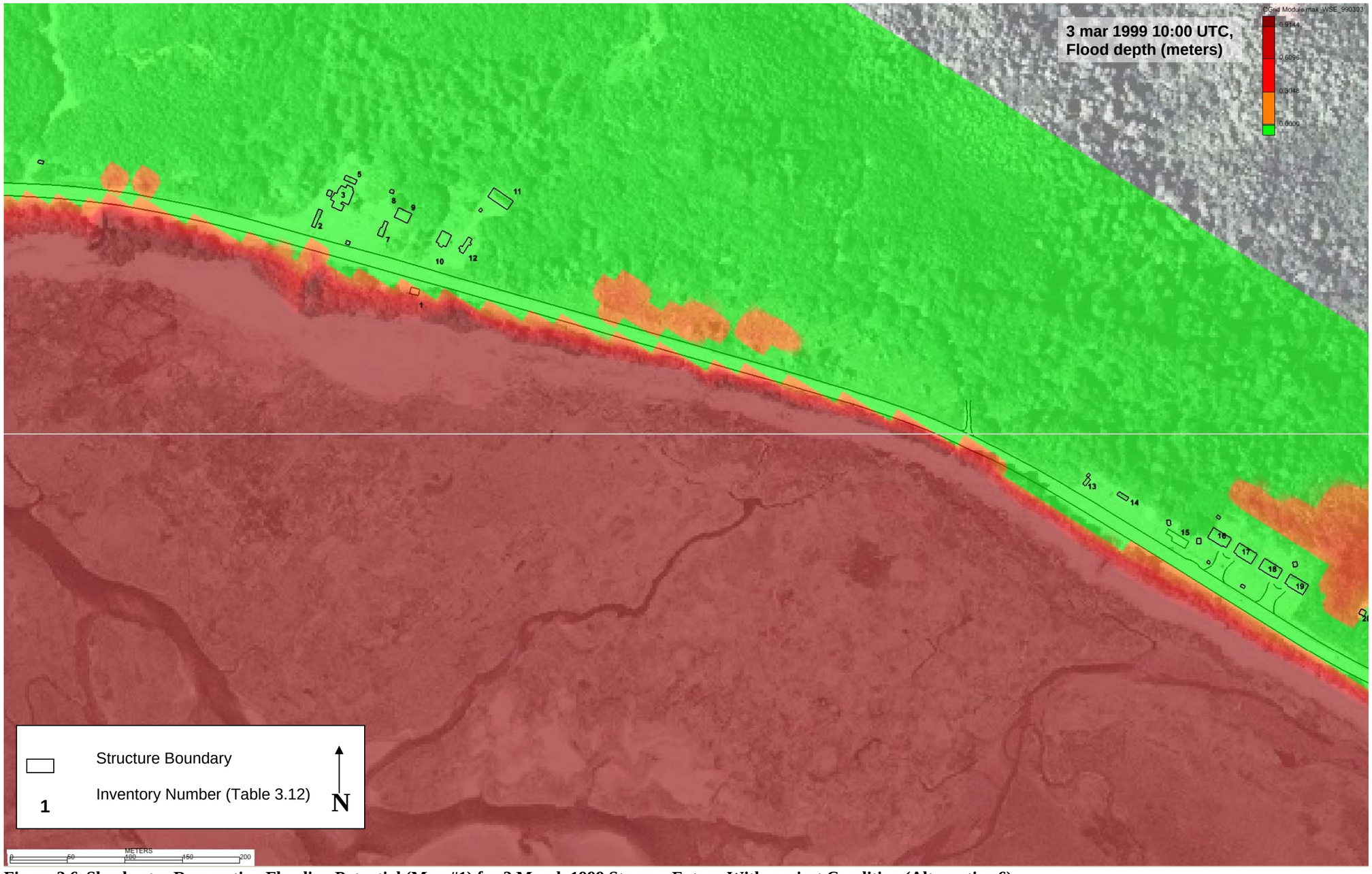


Figure 3.6 Shoalwater Reservation Flooding Potential (Map #1) for 3 March 1999 Storm – Future With-project Condition (Alternative 6)

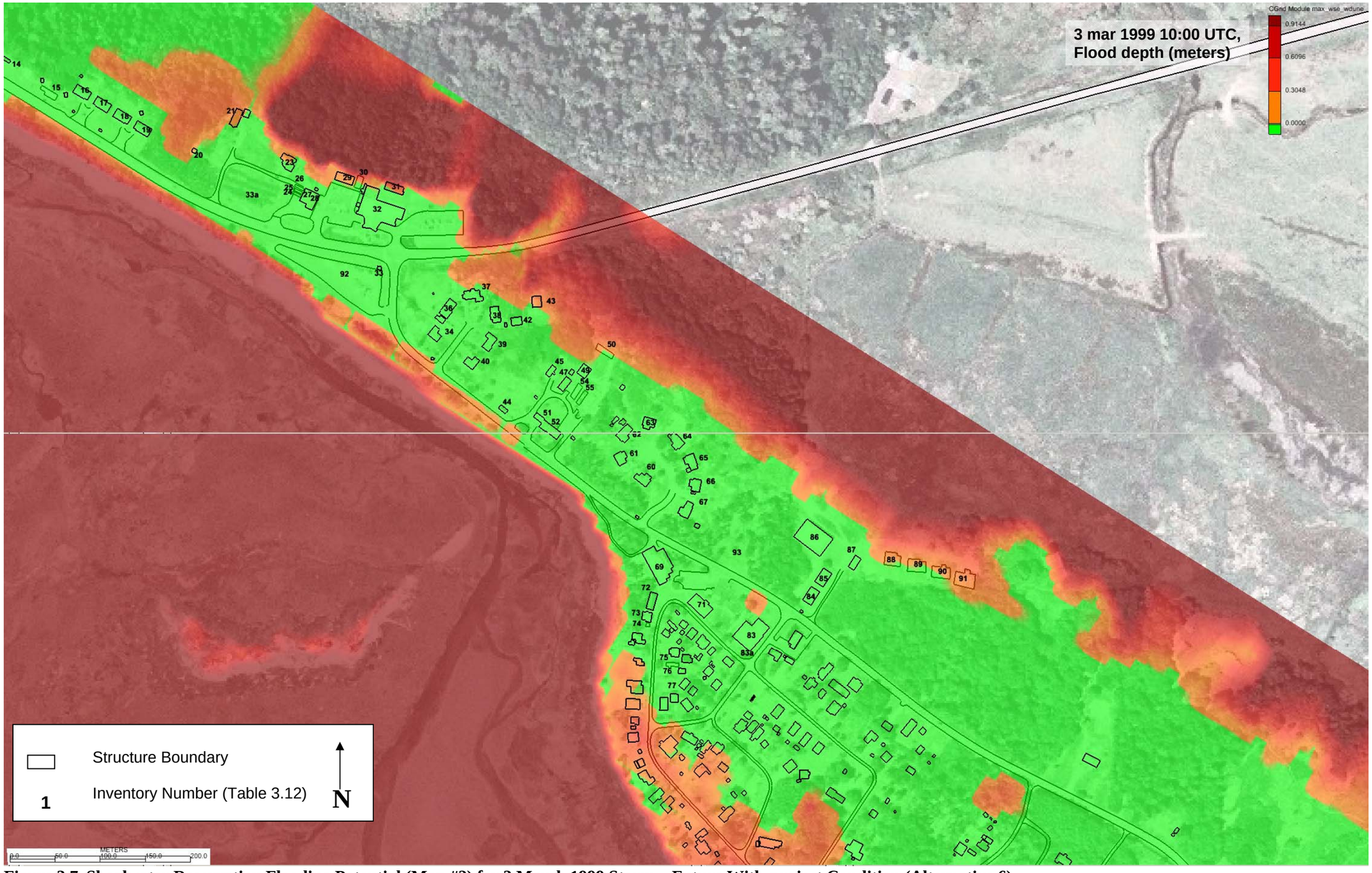


Figure 3.7 Shoalwater Reservation Flooding Potential (Map #2) for 3 March 1999 Storm – Future With-project Condition (Alternative 6)

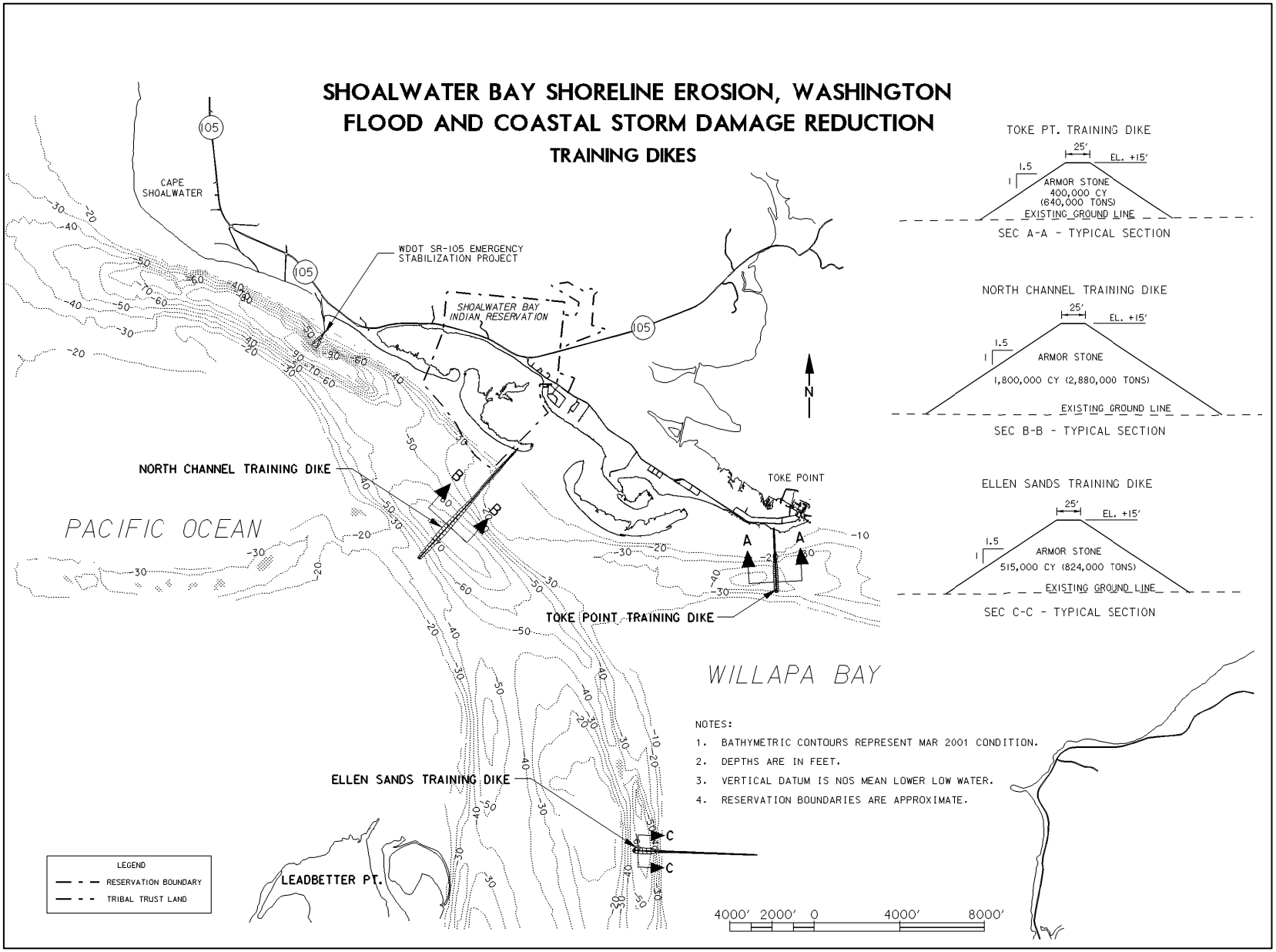
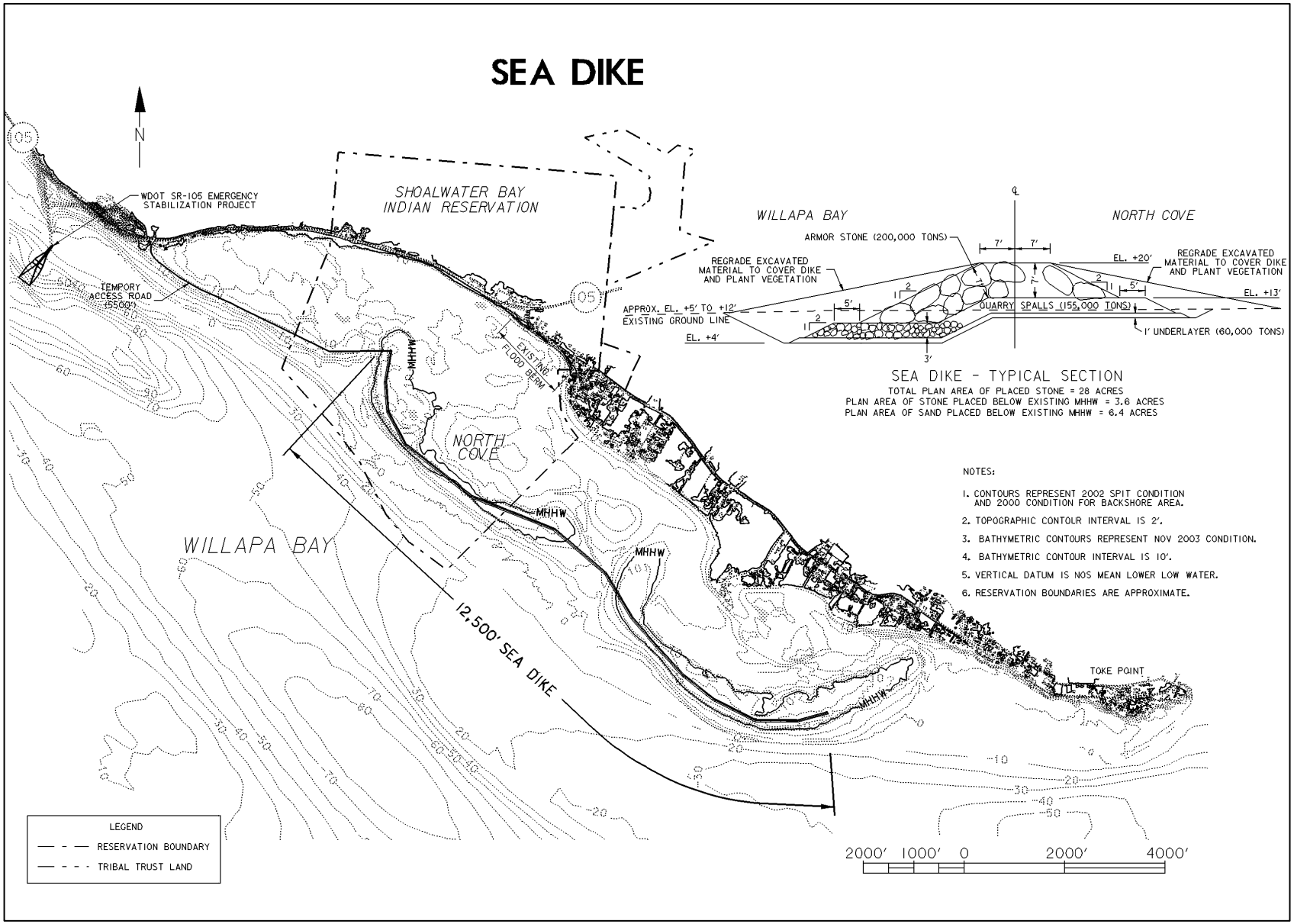


Figure 3.8 Training Dike Locations, Plan and Sections

Figure 3.9 Sea Dike, Plan and Section



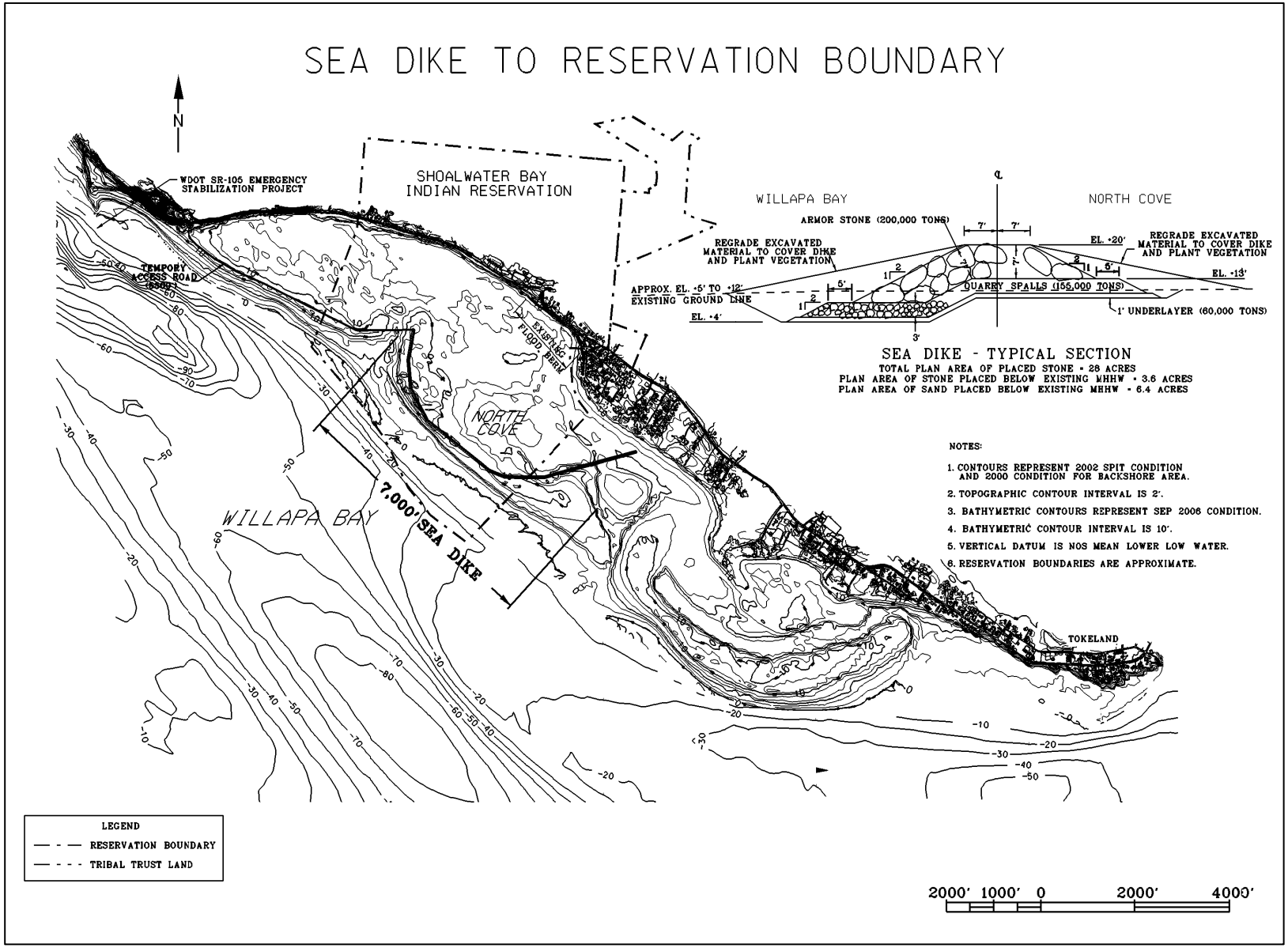


Figure 3.10 Sea Dike to Reservation Boundary, Plan and Section

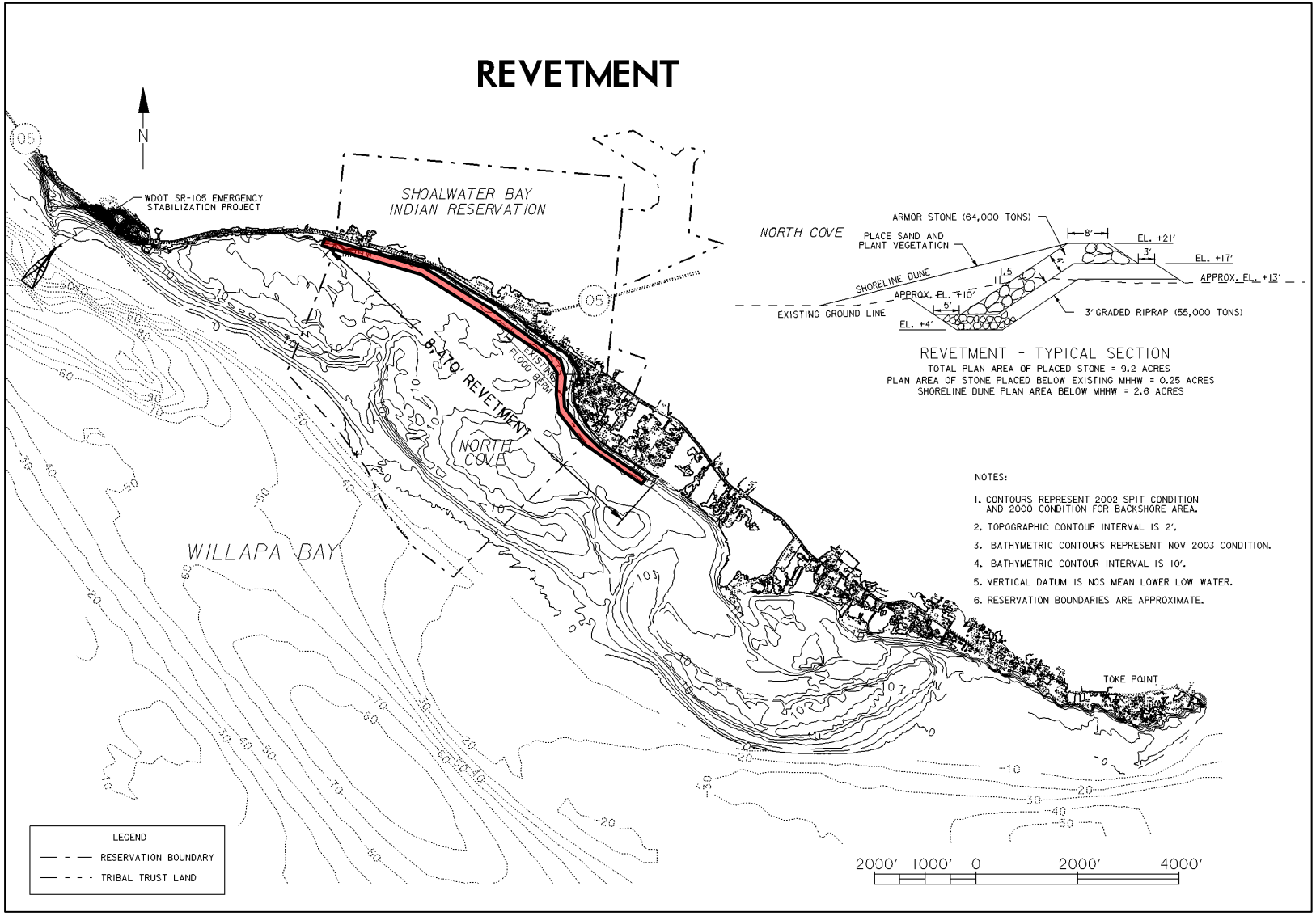


Figure 3.11 Shoreline Revetment, Plan and Section

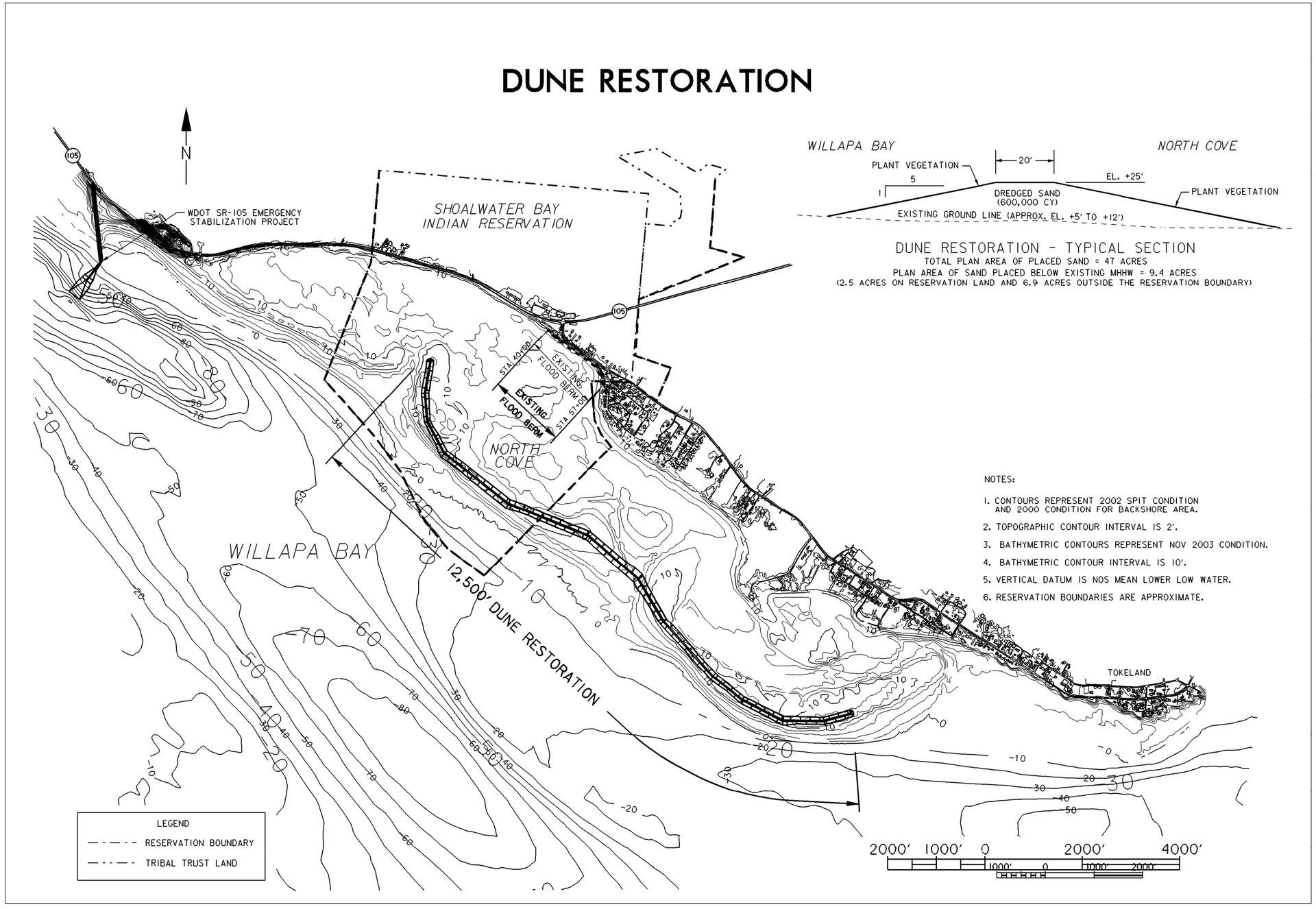


Figure 3.12 Barrier Dune Restoration, Plan and Section

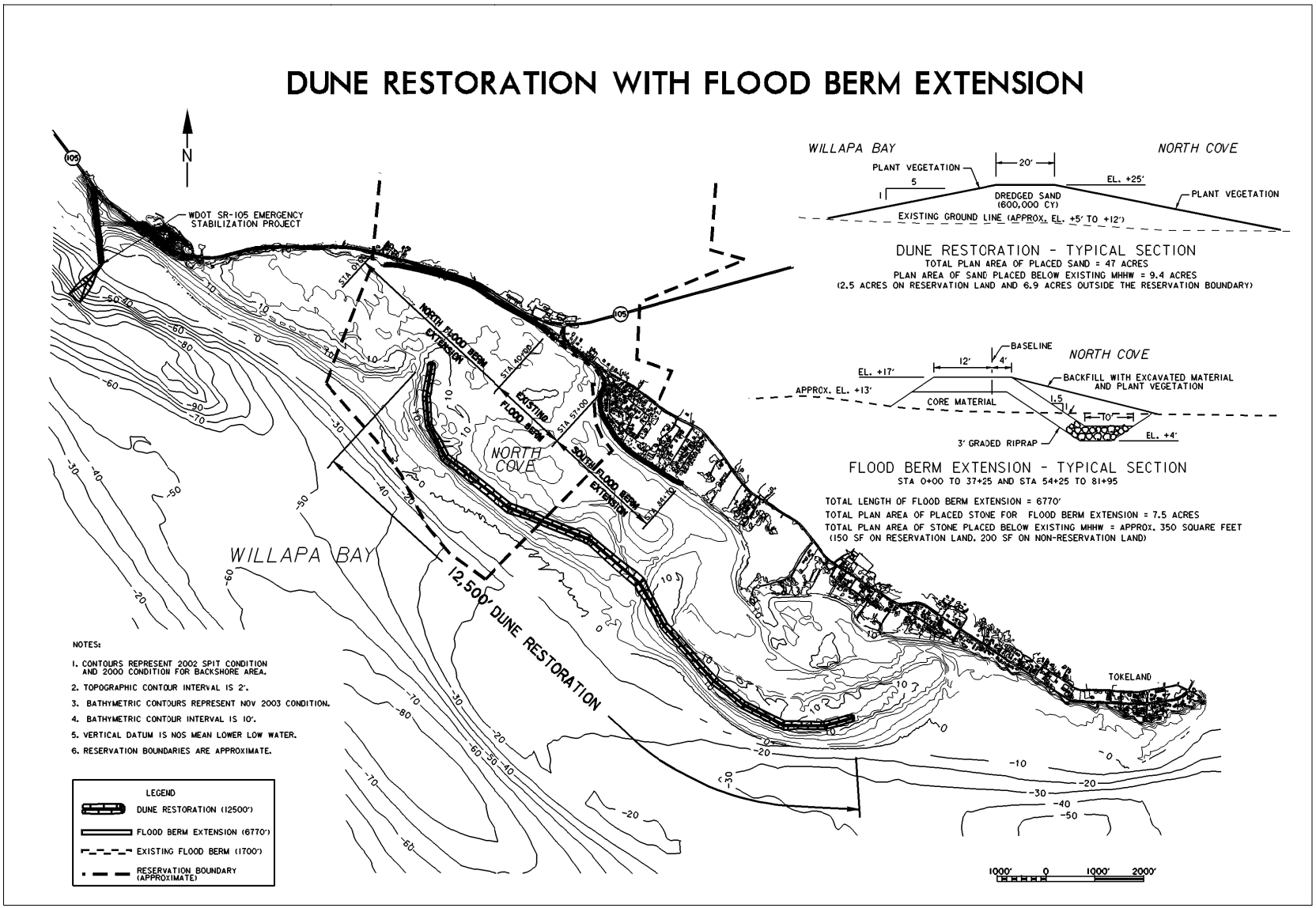


Figure 3.13 Barrier Dune Restoration with Flood Berm Extension, Plan and Sections

SECTION 4: DESCRIPTION OF SELECTED PLAN

4.1 Plan Components

The selected plan is **Alternative 6, barrier dune restoration**. Alternative 6 consists of dredging and grading of dredged sand to restore the deteriorated barrier dune on Graveyard Spit, followed by planting of native dune grass to stabilize and reduce wind-driven erosion of the sand.

4.1.1 Alternative 6, Barrier Dune Restoration

Barrier dune restoration will restore the eroded and breached dune system on Graveyard Spit with sand dredged from the adjacent Willapa Bay entrance and channel. The restored dune is 12,500-feet-long, with a top elevation of +25 feet MLLW, a top width of 20 feet, and a side slope of 1V on 5H (see **Figures 3.12 and 4.2**). The dune restoration will be constructed along the crest of the existing eroded dune. Initial construction will require dredging approximately 600,000 CY of sand from a nearby borrow source at the entrance to Willapa Bay. The dredged sand will be graded and planted with native dune grass, to extend the periodic nourishment interval by stabilizing the sand from wind erosion.

To attain project objectives, dune restoration dimensions maximize the volume of sand that can be placed within the available plan area of the existing eroded dune on Graveyard Spit. The restored dune will again provide the primary storm wave protection to the entire Shoalwater Reservation, including both intertidal habitat in the North Cove embayment and Reservation uplands. If properly maintained through periodic nourishment, storm waves will not overtop and subsequently breach the restored dune. Natural erosion of the dune will occur over time, and thus periodic nourishment will be required to maintain storm wave protection to the Shoalwater Reservation. The cost of periodic nourishment necessitates that the interval between each nourishment cycle be as long as possible. The cost of mobilizing a large dredge to the project site is a major consideration, and the lowest life-cycle cost for this alternative plan is obtained by maximizing the periodic nourishment interval. Given the relatively small plan area on Graveyard Spit, the estimated periodic nourishment interval is maximized at five years.

For both initial construction and periodic nourishment, the sand will be pumped from a nearby aquatic borrow site in Willapa Bay by a large pipeline dredge. A likely sand borrow site has been evaluated in detail (**reference Chapter 5 of Appendix 1**), and is located approximately 5,000 feet from the project site, on the north side of the Willapa Bay North Channel (see **Figure 4.1**). A similar construction process for dredged sand placement in Willapa Bay was successfully carried out by the Washington State Department of Transportation in 1998 for the SR-105 Emergency Stabilization Project to the west of the Shoalwater Reservation. For that project, some 350,000 CY of dredged sand was pumped by hydraulic dredge approximately 8,000 feet for a shoreline beach fill. The proposed primary borrow site identified for the barrier

dune restoration is located on the north side of the North Channel. A secondary sand borrow site is located on the south side of the North Channel.

Utilizing a borrow source adjacent to the Willapa Bay North Channel is proven to be a feasible and cost efficient source of suitable sediment for restoration of the barrier dune. Borrow source sediments are minimized by aligning the dune along the crest of the eroded dune. The dune crest has migrated shoreward following numerous overwash events. Thus the alternative utilizes the overwash sediments as much as possible.

Reclaiming the overwash sediments (i.e., sand) within North Cove shallow embayment to obtain a portion of the clean sand required for barrier dune restoration was investigated, but determined to be very disruptive to the biological community due to the large areal footprint required to obtain the required volume. The sediments overwashed into North Cove have been thinly deposited (less than 2.5 feet) over a relatively broad area. Removal of these sediments will be far less efficient than dredging from a localized area, and will produce only a small portion of the sand required for initial dune restoration. Hydraulic dredging from a borrow source will still be required, with the similar mobilization/demobilization costs as for the proposed borrow source. It is conceivable, however, that an approved ecosystem restoration plan for the North Cove embayment could provide a suitable source for a small portion of clean sand required for the first barrier dune periodic nourishment cycle. This potential borrow source will be investigated during planning for ecosystem restoration to restore degraded ecosystem structure, function, and dynamic processes of the North Cove embayment within the boundaries of the Shoalwater Reservation.

In July 2007, the regional Dredged Material Management Program (DMMP) agencies (U.S. Army Corps of Engineers Seattle District, Environmental Protection Agency Region 10, Washington Department of Ecology, and Washington Department of Natural Resources) signed a suitability determination regarding dredged material associated with construction of this project. Based on the results of the grain-size characterization conducted by the U.S. Geological Survey and the Clean Water Act exclusionary criteria, the DMMP agencies concluded that all material to be dredged from sand borrow sites adjacent to the Willapa Bay North Channel for use in the restoration of the Graveyard Spit barrier dune is suitable for beneficial use or as fill material to restore the eroded barrier dune.

4.1.2 Planting of Native Dune Grass

The restored barrier dune will be planted with native American dune grass (*Elymus mollis*) as an erosion control measure to stabilize the sand and reduce wind-driven erosion. Sparse planting will be done only on the crest of the barrier dune and the back side facing the North Cove embayment. By agreement with the U.S. Fish and Wildlife Service, no dune grass will be planted on the waterward (south) side of the barrier dune facing Willapa Bay. This will be done so as to not discourage nesting by Western snowy plover, an endangered bird species.

4.1.3 Adaptive Management to Minimize Crab Impacts

In 2008, the Corps completed trawling during the July-October dredging period to determine abundance and distribution of Dungeness crabs within the project area. Additional trawls may be conducted just prior to and/or concurrent with the proposed dredging action, including periodic nourishment, to obtain real-time crab data at the time the work is performed. Collected data will provide a basis for adaptive management to minimize impacts to crab populations during dredging activities, including timing dredging to occur during periods of least crab abundance, use of equipment or techniques that minimize potential crab entrainment during dredging, and actions intended to increase crab productivity in the area such as placing oyster shell on intertidal mud flats in Willapa Bay. Unavoidable impacts of dredging on Dungeness crabs will be evaluated in coordination with tribal, state, and Federal agencies.

4.2 Estimated Cost of Selected Plan

Project total first cost and equivalent annual costs of the selected plan are presented below. A detailed cost estimate was developed for the selected plan. The cost estimate was developed using the U.S. Army Corps of Engineers Dredge Estimating Program and presented in the cost engineering M-CACES format. The cost summary of the barrier dune restoration initial construction is shown below in **Table 4.1. Table 4.2** presents the cost summary for each episode of periodic nourishment. See **Table 4.3** for equivalent annual costs. A schedule of initial construction and periodic nourishment/monitoring costs is shown on Table **4.4**. The M-CACES Total Project Cost Summary (TPCS) for the initial construction is shown on **Table 4.5**, and the M-CACES TPCS for periodic nourishment is shown on **Table 4.6.**

Table 4.1 Initial Construction Cost Summary for Alternative 6 (1 October 2009 Effective Price Level)

Construction Item	Cost
Lands and Damages	$ 130,000
Elements	
Hydraulic Pipeline Dredging	$4,643,000
Dune Construction	$3,257,000
Dune Grass Plantings	$ 476,000
Crab Impact Minimization	$ 402,000
Subtotal	$8,778,000
Planning, Engineering & Design (PED)	$ 393,000
Construction Management (E&D, S&A)	$ 526,000
Total First Cost of Initial Construction	$9,827,000

Table 4.2 Periodic Nourishment Cost Summary for Alternative 6 (1 October 2009 Effective Price Level)

Construction Item	Cost
Lands and Damages	$0
Elements	
Hydraulic Pipeline Dredging	$2,093,000
Dune Construction	$1,741,000
Dune Grass Plantings	$ 31,000
Crab Impact Minimization	$ 120,000
Subtotal	$3,985,000
Planning, Engineering & Design (PED)	$ 289,000
Construction Management (E&D, S&A)	$ 238,000
Total First Cost of one Periodic Nourishment	$ 4,512,000

Table 4.3 Equivalent Annual Costs (1 October 2009 Effective Price Level, 50-year Period of Analysis, 4.625 Percent Discount Rate)

Investment Costs	
Present Value of Initial Construction [1]	$ 9,857,000
Present Value of Periodic Nourishment [1]	$16,025,000
Total Present Value Investment Cost	$25,882,000
Average Annual Costs	
Interest and Amortization of Initial Investment	$ 509,000
Periodic Nourishment/Monitoring	$ 827,000
Total Average Annual Costs	$1,336,000
Average Annual Benefits	Not Applicable *
Net Annual Benefits	Not Applicable *
Benefit-Cost Ratio	Not Applicable *

[1] Includes interest during construction.

* Per project authorization, project exempted from any requirement for economic analysis.

A contingency factor of 20 percent applied within the TPCS was arrived at through consideration of a combination of risks and uncertainties. These include: future fuel pricing, future wage rates, dredge availability for the anticipated construction period, dredge production within Willapa Bay, the addition of a booster to pump the length of pipeline, and deposition of dredged material during barrier dune construction. A 20 percent contingency factor applied at the TPCS level is considered to be reasonable and appropriate.

Table 4.4 Construction and Periodic Nourishment/Monitoring Schedule of Costs

#	Year	Initial Construction	Periodic Nourishment (PN) and Monitoring (M)
0	2010	$9,295,000	-
1	2011	$532,000	$20,000 M
2	2012	-	$20,000 M
3	2013	-	$20,000 M
4	2014	-	$132,000 M
5	2015	-	$4,350,000 PN
6	2016	-	-
7	2017	-	-
8	2018	-	$50,000 M
9	2019	-	$112,000 M
10	2020	-	$4,350,000 PN
11	2021	-	-
12	2022	-	-
13	2023	-	$50,000 M
14	2024	-	$112,000 M
15	2025	-	$4,350,000 PN
16	2026	-	-
17	2027	-	-
18	2028	-	$50,000 M
19	2029	-	$112,000 M
20	2030	-	$4,350,000 PN
21	2031	-	-
22	2032	-	-
23	2033	-	$50,000 M
24	2034	-	$112,000 M
25	2035	-	$4,350,000 PN
26	2036	-	-
27	2037	-	-
28	2038	-	$50,000 M
29	2039	-	$112,000 M
30	2040	-	$4,350,000 PN
31	2041	-	-
32	2042	-	-
33	2043	-	$50,000 M
34	2044	-	$112,000 M
35	2045	-	$4,350,000 PN
36	2046	-	-
37	2047	-	-
38	2048	-	$50,000 M
39	2049	-	$112,000 M
40	2050	-	$4,350,000 PN
41	2051	-	-
42	2052	-	-
43	2053	-	$50,000 M
44	2054	-	$112,000 M
45	2055	-	$4,350,000 PN
46	2056	-	-
47	2057	-	-
48	2058	-	$50,000 M
49	2059	-	$112,000 M
50	2060	-	$4,350,000 PN

Table 4.5 Total Project Cost Summary for Initial Construction

****** TOTAL PROJECT COST SUMMARY ******

Printed:7/13/2009
Page 1 of 2

PROJECT: SHOALWATER BAY SHORELINE RESTORATION
LOCATION: WILLAPA BAY, WA

DISTRICT: SEATTLE PREPARED: 25-Jun-09
POC: CHIEF, COST ENGINEERING SECT, John Dudgeon

This Estimate reflects the scope and schedule in report;

Program Year (Budget EC): 2010
Effective Price Level Date: 1 OCT 09

WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	FULLY FUNDED PROJECT ESTIMATE Spent Thru: 27-Mar-09 ($K)	COST ($K)	CNTG ($K)	FULL ($K)
17	BEACH REPLENISHMENT	7,200	1,440	20%	8,640	1.6%	7,315	1,463	8,778	-	7,430	1,486	8,916
	CONSTRUCTION ESTIMATE TOTALS:	7,200	1,440	20%	**8,640**	1.6%	7,315	1,463	8,778		7,430	1,486	8,916
01	LANDS AND DAMAGES	116	12	10%	128	1.6%	118	12	130	50	120	12	182
21	RECONNAISSANCE STUDIES			-	-				-				-
22	FEASIBILITY STUDIES			-						1,746			1,746
30	PLANNING, ENGINEERING & DESIGN	324	64	20%	388	1.3%	329	64	393	-	306	59	365
31	CONSTRUCTION MANAGEMENT	432	86	20%	518	1.5%	439	87	526	-	446	88	534
	PROJECT COST TOTALS:	8,072	1,602	20%	**9,674**	1.6%	8,201	1,626	9,827	1,796	8,302	1,645	**11,743**

CHIEF, COST ENGINEERING SECT, John Dudgeon
PROJECT MANAGER, Steve Babcock
CHIEF, REAL ESTATE, Christopher Borton
CHIEF, PLANNING BR, Mona Thomason
for CHIEF, ENGRNG/CONST DIV, Mark Ohlstrom
CHIEF, OPERATIONS DIV, Stuart Cook
CHIEF, CONSTRUCTION BR, Jim Renick
CHIEF, CONTRACTING DIV, Patricia Blackwood
CHIEF, PM-CP, Beth Coffey
CHIEF, PPMD, Olton Swanson

ESTIMATED FEDERAL COST:	**11,697**
ESTIMATED NON-FEDERAL COST:	**46**
ESTIMATED TOTAL PROJECT COST:	**11,743**

Division Approved: DATE:

_____ CHIEF, COST ENGINEERING
_____ DIRECTOR, REAL ESTATE
_____ CHIEF, PROGRAMS MANAGEMENT
_____ CHIEF, PROGRAMS MANAGEMENT
_____ DIRECTOR OF PPMD

Filename: TPCS_Shoalwater_25Jun09.xls
TPCS

Table 4.6 Total Project Cost Summary for Periodic Nourishment

****** TOTAL PROJECT COST SUMMARY ******

Printed 7/13/2009
Page 1 of 2

PROJECT: SHOALWATER BAY SHORELINE RESTORATION_Periodic Nourishment
LOCATION: WILLAPA BAY, WA

DISTRICT: SEATTLE PREPARED: 25-Jun-09
POC: CHIEF, COST ENGINEERING SECT, John Dudgeon

This Estimate reflects the scope and schedule in report;

Estimate Prepared: 27-Mar-09
Effective Price Level: 1-Oct-09

Program Year (Budget EC): (5-year intervals with 1st interval in 2015)
Effective Price Level Date: 1-Oct-09

Escalated to 25-yr mid-point (year 2035) of 50-yr duration
FULLY FUNDED PROJECT ESTIMATE

WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Spent Thru: 27-Mar-09 ($K)	AVE ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
17	BEACH REPLENISHMENT *Ten Periodic Nourishment Events* *(5-year intervals for 50 yrs)*	33,210	6,642	20%	39,852		33,210	6,642	39,852	-	64.1%	54,498	10,900	65,398
	CONSTRUCTION ESTIMATE TOTALS:	33,210	6,642	20%	**39,852**		33,210	6,642	39,852		64.1%	54,498	10,900	65,398
01	LANDS AND DAMAGES	-	-	-	-	-	-	-	-	-			-	
21	RECONNAISSANCE STUDIES			-	-				-					-
22	FEASIBILITY STUDIES			-						-				-
30	PLANNING, ENGINEERING & DESIGN	2,424	484	20%	2,908		2,424	484	2,908	-	64.1%	3,978	794	4,772
31	CONSTRUCTION MANAGEMENT	1,993	398	20%	2,391		1,993	398	2,391	-	64.1%	3,271	653	3,924
	PROJECT COST TOTALS:	37,627	7,524	20%	**45,151**		37,627	7,524	45,151			61,747	12,347	**74,094**

CHIEF, COST ENGINEERING SECT, John Dudgeon
PROJECT MANAGER, Steve Babcock
CHIEF, REAL ESTATE, Christopher Borton
CHIEF, PLANNING BR, Mona Thorrason
for CHIEF, ENGRNG/CONST DIV, Mark Ohlstrom
CHIEF, OPERATIONS DIV, Stuart Cook
CHIEF, CONSTRUCTION BR, Jim Renick
CHIEF, CONTRACTING DIV, Patricia Blackwood
CHIEF, PM-CP, Beth Coffey
CHIEF, PPMD, Olton Swanson

ESTIMATED FEDERAL COST: **74,094**
ESTIMATED NON-FEDERAL COST: -
ESTIMATED TOTAL PROJECT COST: 74,094

Division Approved: DATE:
_____CHIEF, COST ENGINEERING
_____DIRECTOR, REAL ESTATE
_____CHIEF, PROGRAMS MANAGEMENT
_____CHIEF, PROGRAMS MANAGEMENT
_____DIRECTOR OF PPMD

Filename: TPCS_Shoal_TenPeriodic_25Jun09rev.xls
TPCS

4.3 Design and Construction Considerations

Project technical feasibility and design were heavily influenced by the findings of the comprehensive interagency investigation of coastal processes at Willapa Bay and by the extensive Northwest experience of the U.S. Army Corps of Engineers with similar coastal structures and construction techniques. The comprehensive interagency investigation of coastal processes provided a verifiable basis for the conclusion that modest coastal engineering solutions are an appropriate response to the coastal erosion and associated storm damage problems that are confronting the Shoalwater Tribe and Reservation. The findings of the investigation provided the basis for the conclusion that modest coastal engineering solutions are a technically feasible and cost effective means to provide coastal erosion protection to the Shoalwater Reservation and the flooding and shoreline erosion associated with extreme high tide storm events. The design of project features is based on proven construction techniques used by the Corps and other agencies along the coast of the state of Washington.

Relative sea level rise has been considered in the design of the selected alternative (see **Paragraph 3.6.4 and Chapter 6 of Appendix 1**). Until recently, sea level rise along this stretch of the Washington coast was essentially offset by land rebound. This cancellation of the effects of sea level rise is not expected to prevail in the future, particularly in light of relative sea level rise due to global warming. Physical monitoring of the barrier dune has been incorporated into estimates of frequency and cost of periodic nourishment, with allowance made for budgeting in advance of the point at which breaching and wave overtopping is imminent. Future sea level rise, could, in the future, affect the rate of erosion of barrier dune, necessitating closer physical monitoring.

4.4 Real Estate Requirements

The Corps, in consultation with the Shoalwater Bay Indian Tribe, hereinafter referred to as the "Sponsor," has determined the lands required for the construction, operation and maintenance, hereinafter referred to as "COM," of the Shoalwater Bay Shoreline Erosion, Washington, Flood and Coastal Storm Damage Reduction Project, Shoalwater Bay Indian Reservation (PWI 013725), hereinafter referred to as the "Project." The Corps will provide the Sponsor with legal descriptions, maps, and other written information to enable the Sponsor to fulfill its obligations to provide Project lands. Prior to the issuance of the solicitation for a Government contract for construction or the Government incurring any financial obligations for construction using the Government's own forces, the Sponsor will provide all lands the Corps determines are necessary for COM of the Project. For so long as the Project remains authorized, the Sponsor will ensure these lands are retained by the Sponsor for uses compatible with the authorized purposes of the Project.

4.4.1 Purpose and Relation to Project Document

This real estate section provides information as to lands, easements and rights of way required for the Project, and it supports and is included as a part of the Post-Authorization Decision Document for said Project.

4.4.2 Description of LER Required

The project is located in the Willapa Bay area off of the west coast of the State of Washington in Pacific County. The lands required for the COM of a barrier dune consists of approximately 200 acres (or 188 lineal chains) of tidelands. Approximately 70 acres (or 74 lineal chains) of the tidelands are considered to be within the Shoalwater Reservation. The remaining tidelands, approximately 130 acres (or 114 lineal chains) are adjacent to a residential subdivision southeast of the Shoalwater Reservation. The Sponsor will need to acquire berm/dune easements over approximately 30 tideland parcels outside of the Shoalwater Reservation. No problems are anticipated in obtaining the necessary easements from the landowners. If the Sponsor is unable to acquire an easement from a landowner, then the Corps will exercise its "quick take" authority to acquire on behalf of the Sponsor. It appears that approximately 50% of the Project area outside of the Shoalwater Reservation is owned by the State of Washington and managed by the Department of Natural Resources, hereinafter referred to as "DNR." DNR will not grant a perpetual berm/dune easement, but appears willing to grant a berm/dune easement for as long the Project remains authorized. This non-standard estate is described in paragraph 4.4.4, along with a proposed non-standard estate to be used in the easements over the privately owned parcels.

According to the Pacific County Assessor's Office, the tidelands in this area are valued at $20 per lineal chain. This indicates a nominal value for the tidelands in the Project area, and very nominal values for each parcel within the Project area. Research is ongoing for additional information as to the value of these tidelands and the benefit or increased value to the tidelands or adjacent shoreline parcels due to construction of this Project. No easements for access or staging will be required. Access will be from the water by barge. The barge will be loaded with construction equipment at an off-site location and offloaded, used and stored within the Project area. Sand will be dredged from an aquatic borrow site adjacent to a Federal navigation channel in Willapa Bay (Willapa Bay North Channel), and then piped to the Project area and graded in accordance with the Project design.

4.4.3 LER Owned by Sponsor

The Sponsor does not currently hold title to any of the real estate interests needed for the Project. Shoalwater Reservation lands are Federally owned, held in trust for the Shoalwater Tribe. See Section 4.4.6 for further discussion on these Federally owned lands within the

Project. The rest of the project lands are State or privately owned over which the Sponsor will need to acquire the necessary easements for the Project.

4.4.4 Proposed Non-Standard Estates

The following non-standard easement estate is proposed over the privately owned tidelands for this Project:

PERPETUAL BERM/DUNE EASEMENT

A perpetual and assignable easement and right-of-way in, on, over and across the land described in Schedule A to construct, operate, maintain, patrol, repair, renourish, and replace an off-shore berm or dune and appurtenances thereto, including the right to borrow and/or deposit fill, together with the right to trim, cut, fell and remove therefrom all trees, underbrush, obstructions, and other vegetation, structures, or obstacles within the limits of the easement; reserving however, to the grantor(s), (his) (her) (its) (their) (heirs), successors and assigns all such rights and privileges as may be used without interfering with or abridging the rights and easements hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

The following non-standard easement estate is proposed for the DNR-owned tidelands for this Project:

BERM/DUNE EASEMENT

An assignable easement and right-of-way in, on, over and across the land described in Schedule A for as long as the Shoalwater Bay Shoreline Erosion, Washington, Flood And Coastal Storm Damage Reduction Project, Shoalwater Bay Indian Reservation (PWI 013725) remains authorized, to construct, operate, maintain, patrol, repair, renourish, and replace an off-shore berm or dune and appurtenances thereto, including the right to borrow and/or deposit fill, together with the right to trim, cut, fell and remove therefrom all trees, underbrush, obstructions, and other vegetation, structures, or obstacles within the limits of the easement; reserving however, to the grantor, the State of Washington, all such rights and privileges as may be used without interfering with or abridging the rights and easements hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

If there are any outstanding third party interests such as public roads, and highways, public utilities, railroads, and pipelines, the Sponsor must clear or subordinate any third party interests that could interfere with the project. DNR does not grant perpetual easements, but has tentatively agreed to grant a berm/dune easement for as long as the Project remains authorized.

4.4.5 Overlapping Federal Projects

There are no other federal projects known to be overlapping with this project.

4.4.6 Federally-owned Land Within Project

The Shoalwater Reservation lands are Federally owned, held in trust and managed by the U.S. Department of the Interior, Bureau of Indian Affairs, hereinafter referred to as "BIA." The Shoalwater Reservation consists of approximately 1,140 acres of land including approximately 440 acres of uplands and 700 acres of tidelands. Approximately 70 acres (or 74 lineal chains) of the tidelands are included in the Project footprint. BIA has not been involved in the specific planning process for this Project, however, does fully support it (see **Exhibit 2**, BIA letter dated 18 August 2008). The Sponsor will coordinate with the BIA Office in Portland, Oregon, and will issue to the Department of the Army a Limited Land Use Permit (LLUP) for use of trust lands. This is consistent with the process the Corps has worked out for similar Corps Projects involving Tribal Sponsors and trust lands.

4.4.7 Navigational Servitude

The Corps may exercise navigational servitude for that portion of the barrier dune that will be constructed on lands below the Mean High Water (MHW) line. This Project is primarily for flood control, to protect the tribal village and the state highway from inundation, but has incidental effects on navigation because (1) the depth of Shoalwater Bay will increase as a result of increased tidal flow; and (2) 600,000 cubic yards will be dredged from a federal navigation channel in Willapa Bay and used to construct the berm. Use of the navigational servitude on tidelands below the line of ordinary high tide for Project purposes is consequently within the authority of the United States. Notices will be sent to the underlying landowners of the Government's intent to exercise the right of navigational servitude.

4.4.8 Map

See **Figure 4.3,** real estate map, depicting the location of the barrier dune structure, the Project area, the Shoalwater Reservation including tidelands, DNR-owned tidelands, and privately-owned tidelands.

The Shoalwater Reservation boundary is depicted on **Figure 4.3** as a green line and represents Bureau of Land Management (BLM) electronic survey information provided in 2006 for purposes of this report. There are some uncertainties regarding the waterward boundary of the Reservation below the low water mark, and the western boundary of the Reservation within the tidelands. The Reservation boundary lines do not represent other claims/rights/ownership to other lands/tidelands of the Shoalwater Tribe or the United States Government (BIA) outside of the Reservation boundary.

4.4.9 Flooding

No flooding will be induced by the construction or operation and maintenance of this project. The purpose of this project is to reduce or eliminate coastal erosion, storm damage, and flooding.

4.4.10 Baseline Cost Estimate for Real Estate

The Sponsor will provide lands, easements, rights-of-way and dredged material disposal areas necessary for implementation of the project. If tideland value is nominal at $20 per chain, and the project consists of approximately 188 chains, this would indicate an overall value of slightly less than $3,760 for all of the tidelands in the Project. Additional research will be done as to the value of these tidelands. However, no payments for the easements are anticipated as the special benefits to the inland remainders should offset any compensation. Incidental real estate costs for work already accomplished and work yet to be accomplished is estimated at $70,000 for the Corps. The Sponsor's cost estimate for its real estate efforts is $42,000.

4.4.11 Relocation Assistance --Public Law 91-646

The Sponsor will be advised of Public Law 91-646, as amended. The Sponsor must comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646), as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 C.F.R. Part 24, in acquiring project lands, and will inform all affected persons of applicable benefits, policies, and procedures in connection with said Act. However, there are no families or businesses that will temporarily or permanently require displacement as a result of this project, so there is no resettlement or relocation activity anticipated.

4.4.12 Mineral Activity

At this time the Corps is not aware of any mineral activity that may affect construction, operation or maintenance of the project, or any outstanding mineral interests that need to be acquired or subordinated in the project area.

4.4.13 Sponsor's Capabilities

See **Figure 4.4** for a thorough assessment of the Sponsor's legal and professional capability and experience to acquire and provide the LER for the construction, operation and maintenance of the project. If negotiations with any owners reach an impasse and navigational

servitude cannot be exercised, the Corps will condemn on behalf of the tribe. While the tribe has the legal and professional ability to voluntarily acquire and own real estate, it lacks the authority to condemn and in particular does not have quick take authority.

4.4.14 Zoning

No application or enactment of zoning ordinances is proposed in lieu of or to facilitate acquisition in connection with the project.

4.4.15 Real Estate Schedule

Real Estate anticipated schedule if Decision Document/MOA/Project approved and MOA signed by both parties by July 2009:

USACE provides legal descs/maps, template easement, ownership deeds, informal valuation if required, LLUP, LER Cert docs, & explicit instructions to Tribe for acquiring/certifying LER for the Project	July 2009
Tribe drafts and negotiates easements with each landowner, including DNR	July 2009 - November 2009
Tribe provides signed easements, LLUP and LER Certification and submits all to USACE	November 2009
USACE signs LLUP, reviews/accepts/approves LER Certification and announces that lands are available for advertising and awarding contract for construction to begin in July 2010	December 2009

4.4.16 Facility or Utility Relocations

No facility or utility relocations will be required for this project. The berm/dune will be constructed on offshore tidelands, away from any facilities or infrastructure.

4.4.17 HTRW

The land in the project area is not known or suspected to contain hazardous and/or toxic wastes. In March 2005, an environmental evaluation to identify the existence and extent of any hazardous substances that may exist in, on, or under anticipated project lands was conducted by

the Corps. Nothing was discovered that would indicate any contamination due to hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (hereinafter "CERCLA"), 42 U.S.C. Sections 9601-9675 (reference **Environmental Assessment, Paragraph 3.38**).

4.4.18 Support for or Opposition of Landowners

The Corps is not aware of any landowner opposition to this project.

4.4.19 Sponsor Notification of Risks

Not applicable. The Sponsor will not be doing any advance land acquisition prior to project authorization.

4.4.20 Other Real Estate Issues/Additional Information

None.

4.5 Periodic Nourishment Considerations

Section 545 of the Water Resources Development Act (WRDA) of 2000, as amended by Section 5153 of WRDA 2007, specifies that the project shall be maintained at Federal expense. Periodic nourishment of the barrier dune after initial construction is considered continuing construction.

Erosion rates for the barrier dune restoration were estimated by using topographic and survey data to compute the sand loss that occurred between 2000, 2002, and 2008. Based on these rates, the annual loss of sand from the dune (above +6 feet MLLW) is estimated to be 50,000 CY/year. However, if periodic nourishment is deferred, the erosion rate will increase exponentially. This is demonstrated by computing the erosion rate over the time period where dune integrity has been allowed to weaken over successive storms. Over the time period from 2000 to 2008, the average annual erosion rate increased to 150,000 CY/year, due to repeated storm overwash of the severely eroded dune.

Erosion rates will continue to be monitored through field inspections and periodic topographic and hydrographic surveys. The barrier dune will be monitored annually for the first four years following initial construction to establish a useful baseline of the rate of sand loss for the restored barrier dune. Thereafter, a topographic photogrammetric survey will be performed three years following each periodic nourishment cycle to monitor the erosion rate and thus determine the next required periodic nourishment.

Periodic nourishment requirements for the barrier dune restoration are estimated to be 250,000 CY of sand replacement at 5-year intervals, followed by replanting of native vegetation to stabilize the barrier dune from wind-driven erosion. Sand for periodic nourishment of the dune will be pumped from a nearby borrow site by a large pipeline dredge or similar equipment. A potential borrow site is located approximately 5,000 feet from the project site, on the north side of the Willapa Bay North Channel (see **Figure 4.1**). A secondary borrow site is located on the south side of the Willapa Bay North Channel. Dune erosion rates will continue to be monitored through annual field inspections and periodic topographic and hydrographic surveys. Increased erosion rates related to sea level rise will be captured through this monitoring work and factored into future periodic nourishment designs.

Based on past experience with planting dunes, it is anticipated that the planted dune grass will not require any maintenance to achieve success. Additionally, restoration of the barrier dune will restore natural coastal processes to the area such that the Corps and reviewing state and federal agencies do not feel compensatory mitigation is required.

4.6 Plan Accomplishments

Restoration of the barrier dune on Graveyard Spit will protect the Shoalwater Bay Indian Reservation from the damaging and disastrous effects of coastal storms. Restoration of the barrier dune will significantly reduce the frequency and magnitude of flooding of Reservation uplands due to wave run-up and overland wave propagation during storm events that coincide with extreme water levels. Tribal infrastructure and housing, and essential public facilities which serve the needs of tribal members, will largely be safeguarded from flooding and damage due to coastal storms. Restoration of the barrier dune, together with periodic nourishment, will also prevent storm wave over-wash of the barrier dune and the resultant in-filling and associated degradation and loss of tide flat and intertidal habitat in the North Cove embayment. This will afford the opportunity for future restoration of the 700 acres of degraded Shoalwater Reservation intertidal habitat and tide flats in North Cove upon which the Shoalwater Tribe relied heavily for subsistence shellfish growing and gathering, as well as harvesting of local native plant species for tribal crafts and ceremonial use.

The dune restoration will not eliminate some scattered minor upland flooding caused by extreme water elevations, such as extreme storm surges occurring during a maximum astronomical tide. The restored dune is not designed as a flood control structure, since North Cove will continue to be hydraulically connected to the Pacific Ocean through two inlets. Inundation model results indicate that the restored dune will significantly decrease flood elevations in areas most prone to overland wave propagation and wave run-up. With a restored dune, the threat to the inventoried structures is reduced from 54% (without project) to 7% (with project) during a March 3, 1999 storm condition. The restored dune will also mitigate structure damage from debris carried inland by high velocity sheet flows. However, instances of extreme water levels caused by large storm surges occurring at maximum astronomical tide will flood low lying topography. Thus, some residual flooding risk to structures will exist in the future with-project condition.

Barrier dune restoration will also enable consideration of ecosystem restoration opportunities in the Shoalwater Tribe's North Cove embayment. The restored dune will mitigate the continued loss of intertidal and shallow subtidal habitat. Under the future with-project condition, storm waves will no longer overwash the dune and deposit sand and debris in North Cove.

4.7 Summary of Environmental and Other Social Effects

4.7.1 Environmental Effects

An Environmental Assessment (EA) to evaluate the environmental effects of the proposed project was prepared by the Corps. As the Federal Action Agency for this project, the Corps is required by the National Environmental Policy Act (NEPA) (40 CFR § 1500 et. seq.) to assess the effects to the human environment of proposed agency actions, determine the significance of those effects, and coordinate with other agencies, Tribes, and the interested public in that assessment. The Corps has implemented NEPA through the Corps' ER 200-2-2 regulation. The EA was prepared according to that regulation, and the guidance presented in the Corps' Planning Guidance Notebook, ER 1105-2-100. The EA was prepared specifically to determine if this project warrants the preparation of an Environmental Impact Statement.

Based on the analysis, the EA concludes that the proposed barrier dune restoration project is not a major Federal action significantly affecting the quality of the human environment, and therefore does not require preparation of an Environmental Impact Statement. The barrier dune restoration on and near the Shoalwater Bay Indian Reservation is not a major action and will not result in significant impacts on the human environment. Environmental impacts associated with the proposed project include minor short-term impacts to water quality due to turbidity increase, minor short-term impacts to air quality and noise levels, minor short-term stresses to aquatic organisms due to turbidity increases, burial of small areas of benthos along with attendant plants and animals, and minor short-term impacts to the esthetics of the area during construction.

Eighteen species protected by the Endangered Species Act of 1973, as amended, and one candidate species are potentially found in the vicinity of Shoalwater Bay Erosion Project (see **Table 4.7** below). In accordance with Section 7(a)(2) of the Act, Federally funded, constructed, permitted, or licensed projects must take into consideration impacts to Federally listed and proposed threatened or endangered species. In order to satisfy the requirements of the Act, the Corps consulted with the U.S. Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration (NOAA) Fisheries regarding the effects of the proposed action on listed species. The Corps has prepared a biological evaluation (BE) to determine the effects of the project and propose conservation measures for species affected by the proposed action. The effect determinations described in the Corps' BE can be found in **Table 4.8** below. Both the U.S. Fish and Wildlife Service (by letter dated August 30, 2007) and NOAA Fisheries (by letter dated December 12, 2007) have concurred with the determinations made in the Corps' BE. These letters are attached to the Environmental Assessment for this proposed project.

A Fish and Wildlife Coordination Act Report (CAR) dated August 2006 presents the conclusions of the U.S. Fish and Wildlife Service (USFWS) on the effects of the proposed project. The CAR was provided pursuant to the Fish and Wildlife Coordination Act (48 Stat. 401, as amended 16 U.S.C. 661, *et seq*.) and fulfills section 2(b) of this Act. The USFWS's conclusions, shown on page 15 of the CAR, are as follows:

> *We support the goals of the proposed restoration project in regard to the protection of Tribal lands and resources, and give our support on the presented components of the preferred alternative, pending the satisfactory inclusion of appropriate conservation measures to minimize impacts to fish and wildlife and their habitats during construction."*

The selected plan includes all conservation measures developed during coordination with the USFWS subsequent to the CAR. All USFWS concerns were addressed during the Section 7 Endangered Species Act consultation, with the primary issues concerning the timing of dune restoration and the extent of dune grass plantings to avoid and minimize impacts to Western snowy plovers. This coordination resulted in agreement on the timing of construction and the extent of dune grass planting. As documented in the EA and this report, the Corps has received concurrence from the USFWS that the proposed project is not likely to adversely affect Western snowy plovers or any other threatened or endangered species under USFWS jurisdiction.

Table 4.7 Threatened, Endangered, and Candidate Species and Critical Habitat

Species	Listing Status	Critical Habitat
Brown Pelican *Pelecanus occidentalis*	Endangered	None
Marbled Murrelet *Brachyramphus marmoratus*	Threatened	Designated (none in project area)
Western snowy plover *Charadrius alexandrinus nivosus*	Threatened	Proposed
Northern spotted owl *Strix occidentalis caurina*	Threatened	Designated (none in project area)
Short-tailed albatross *Phoebastria albatrus*	Endangered	None
Streaked horned lark *Eremophilia alpestris strigata*	Candidate	N/A
Coastal-Puget Sound Bull Trout *Salvelinus confluentus*	Threatened	Designated (none in project area)
Leatherback Sea Turtle *Dermochelys coriacea*	Endangered	Designated (none in project area)
Loggerhead Sea Turtle *Caretta caretta*	Threatened	None
Green Sea Turtle *Chelonia mydas*	Threatened	Designated (none in project area)
Olive Ridley Sea Turtle *Lepidochelys olivacea*	Threatened	None
Oregon silverspot butterfly *Speyeria zerene hippolyta*	Endangered	Designated (none in project area)
Steller sea lion *Eumetopias jubatus*	Threatened	Designated (none in project area)
Humpback whale *Megoptera novaeangliae*	Endangered	None
Sperm whale *Physeter catodon*	Endangered	None
Sei whale *Balaenoptera borealis*	Endangered	None
Fin whale *Balaenoptera physalus*	Endangered	None
Blue whale *Balaenoptera musculus*	Endangered	None
Southern resident killer whale *Orcinus orca*	Endangered	Proposed

Table 4.8 Effect Determination Summary

Species	Effect Determination	Critical Habitat Determination
Brown Pelican	Not likely to adversely affect	Not applicable
Marbled Murrelet	Not likely to adversely affect	No effect
Western Snowy Plover	Not likely to adversely affect	No effect on proposed critical habitat
Northern Spotted Owl	No effect	No effect
Short-tailed Albatross	No effect	Not applicable
Streaked Horned Lark	Not likely to adversely affect	Not applicable
Coastal-Puget Sound Bull Trout	Not likely to adversely affect	No effect
Green Sturgeon	Not likely to adversely affect	Not applicable
Leatherback, Loggerhead, Green, and Olive Ridley Sea Turtles	No effect	Not applicable
Oregon Silverspot Butterfly	No effect	No effect
Steller Sea Lion	Not likely to adversely affect	No effect
Humpback Whale	Not likely to adversely affect	Not applicable
Sperm, Sei, Fin, and Blue Whales	No effect	Not applicable
Southern Resident Killer Whale	Not likely to adversely affect	No effect on proposed critical habitat

4.7.2 USACE Environmental Operating Principles

The Corps has established seven Environmental Operating Principles (EOPs) to reaffirm its commitment to the environment. All projects are to be consistent with the EOPs. The following discussion addresses the manner in which the selected plan will be consistent with each of the seven EOPs.

The first five principles are to (1) strive to achieve environmental sustainability; (2) recognize the interdependence of life and the physical environment, and proactively consider environmental consequences of Corps programs; (3) seek balance and synergy among human development activities and natural systems by designing economic and environmental solutions that support and reinforce one another; (4) accept corporate responsibility and accountability for activities and decisions under our control that impact human health and welfare and the continued viability of natural systems; and (5) seek ways and means to assess and mitigate cumulative impacts to the environment. The comprehensive interagency technical studies conducted as part of this study, the formulation and evaluation of alternative plans done in close coordination with resource and regulatory agencies throughout the plan formulation and evaluation process, and the alternatives trade-off analysis are an expression of the care taken by all study participants, including the Shoalwater Tribe leadership, to adhere to these five

principles. The preferred alternative minimizes impacts to Willapa Bay through measures in the project design, while provided effective coastal erosion protection to the Shoalwater Bay Indian Reservation. Restoration of the natural barrier dune on Graveyard Spit with Willapa Bay sand mimics nature, restoring sand that was once supplied by littoral drift and wind and wave action. The preferred alternative has been designed to minimize impacts to fish and wildlife and their habitats, and thus will not require mitigation measures.

The sixth EOP is to build and share an integrated scientific, economic and social knowledge base that supports a greater understanding of the environmental impacts of our work. Data and information collected as part of technical and environmental studies, and during the formulation and evaluation of alternative plans, has contributed to the knowledge base and has been freely shared with the public, stakeholders, and coastal engineering community. This increased knowledge base was critical to the determination that a long-term solution to coastal erosion issues affecting the Shoalwater Reservation was technically feasible, environmentally acceptable, and is a cost effective means of providing coastal erosion protection and storm damage reduction.

The seventh EOP is to respect the views of individuals and groups interested in Corps activities, actively listen to them, and learn from their perspective in the search to find innovative win-win solutions to problems that also protect and enhance the environment. The project development team coordinated extensively and continually with all affected local, state, and Federal agencies, interest groups, and interested citizens residing both on and near the Shoalwater Reservation. Numerous technical meetings, agency coordination meetings, and community workshops and a public meeting were held throughout the course of the study. Most meetings were hosted by the Shoalwater Tribe. It is the consensus of the Corps and the Shoalwater Tribe leadership that a win-win solution has been identified.

4.7.3 Chief of Engineers Actions for Change

On August 24, 2006, the Chief of Engineers of the Corps released "12 Actions for Change for Applying Lessons Learned during Hurricane Katrina and Rita." Several of the 12 Actions are organizational, and thus beyond the scope of this or any individual project. This section summarizes how the preferred alternative will be consistent with the relevant actions.

The 12 Actions include eight actions that direct the Corps to comprehensively design, construct, maintain, and update engineering systems to be more robust, with full stakeholder participation. The formulation of the preferred alternative implements ten of the actions, while actions three (reassess and update policy) and eight (modify organizational behavior) are beyond the scope of this investigation. A long-term solution has been formulated to protect the Shoalwater Reservation from the effects of coastal erosion. The preferred alternative is a comprehensive solution that is environmentally acceptable and technically feasible, cost effective, and will improve the economic and social conditions of the Shoalwater Tribe. Long term adverse environmental effects have been avoided and short-term adverse effects during initial construction and periodic nourishment can and will be effectively minimized. The

Shoalwater Tribe has been deeply involved in every step of the planning process, as have the full suite of local, state, and Federal agencies, interest groups, and interested citizens. In accordance with the project authorization, the Federal government will be responsible for both initial construction and periodic nourishment of the project. Accordingly, the completed works will be monitored and inspected to ensure that the level of protection to the Shoalwater Reservation is maintained. The interagency multi-discipline technical studies that were conducted, together with independent technical review by another Corps coastal district, has helped to refine the project and ensure that a technically feasible and cost effective long-term solution has been achieved.

Two of the 12 Actions require the Corps to effectively communicate with the public about risk. These actions primarily relate to residual risk in flood damage reduction projects. In the particular case of this project, there is little residual risk associated with storm events that coincide with extreme high tides recorded between 1970 and 2007 at this location along the Washington coast. The restored barrier dune is not subject to catastrophic failure, but rather to erosion of sand and gradual lowering of the top elevation of the dune over time. As noted, periodic nourishment will be required to maintain a sufficient dune elevation to prevent overtopping of storm waves that coincide with extreme high tides.

As noted above in **Paragraph 4.6**, the dune restoration will not eliminate flooding caused by extreme water elevations, such as extreme storm surges occurring during a maximum astronomical tide. The restored dune is not designed as a flood control structure, since North Cove will continue to be hydraulically connected to the Pacific Ocean through two inlets. However, the barrier dune will significantly reduce the frequency and magnitude of dynamic water level flooding due to wave run-up and overland wave propagation. Inundation model results indicate the restored dune will significantly decrease flood elevations in areas most prone to overland wave propagation and wave run-up. With a restored dune, the flooding risk to the inventoried structures is reduced from 54% (without project) to 7% (with project) during a March 3, 1999 storm condition. The restored dune will also mitigate structure damage from debris carried inland by high velocity flows. However, instances of extreme water levels caused by large storm surges occurring at maximum astronomical tide will flood low lying topography. Thus some residual flooding risk to structures will exist in the with project condition.

The Corps has discussed the level of protection that will be afforded by the project, as well as the very limited residual risk, with the Shoalwater Tribe. Because they are sited on low spots, a very small number of tribal structures may incur minor ponding of water during an extreme storm event. However, none will be subject to high velocity flows and debris damage as is the case under the future without project condition. Because of the very limited extent of risks, public involvement risk reduction strategies are not appropriate to this project. The Tribe may choose to fill low spots to reduce the residual ponding at these sites. Under the future with project conditions, some fill material may be appropriate for the sites of the Tribal Gaming office, one single family residence, and three duplex residences. A risk associated with the Washington coast, including the Shoalwater Reservation, under the with-project and without-project conditions is that of a subduction earthquake and/or a tsunami. The State of Washington,

in cooperation with the U.S. Geological Survey, has established tsunami evacuation routes all along the coast, including State Route 105 which traverses the Shoalwater Reservation.

4.7.4 Other Social Effects

Alternative 6, barrier dune restoration, will provide a complete solution to identified coastal erosion and related storm damage problems and concerns facing the Shoalwater Bay Indian Tribe and their Reservation. Accordingly, this plan holds the greatest promise of enabling the Shoalwater Tribe to improve their economic and social conditions.

Restoration of the barrier dune on Graveyard Spit will provide the opportunity for ecosystem restoration of the North Cove embayment, thereby enabling the restoration of its previously abundant Tribal subsistence shellfish resources (refer to **Section 1.2.2** for discussion of ecosystem restoration authority and separate study to be conducted). The restored barrier dune will prevent storm waves from over-washing the dune and infilling the tide flats and intertidal habitat with sand. This will thus prevent further degradation and loss of the intertidal habitat and tide flats of the North Cove embayment. Restoration of the ecosystem of the North Cove embayment to return the shellfish habitat will thus encourage its use again as a subsistence resource for the Tribal community. The Shoalwater Tribe relied heavily, both historically and in recent times, on the diversity and productivity of the 700 acres of intertidal habitat and tide flats in the North Cove embayment. The Tribe harvested shellfish in North Cove, on which, along with ocean fisheries, they relied heavily for subsistence food supply. In addition, tribal members harvested local native plant species from the North Cove embayment for tribal crafts and ceremonial use. Protection of the North Cove embayment from further habitat degradation and loss will thus have a positive effect on the Tribe's cultural and religious traditions.

The growing threat of coastal storm flooding and damage to tribal uplands and facilities will be significantly diminished through restoration of the barrier dune. The Shoalwater Tribe has a very small upland land base, and there are no alternative sites upon which to develop needed Tribal facilities and housing. Construction of the proposed project will provide needed assurance to the Shoalwater Tribe that their tribal facilities, housing, and infrastructure are safe from winter coastal erosion and associated storm damage, and that the small tribal population is no longer at risk due to storm-induced flooding. In addition, the Tribe will not be isolated due to flooding and closure of SR-105 which traverses the Shoalwater Reservation.

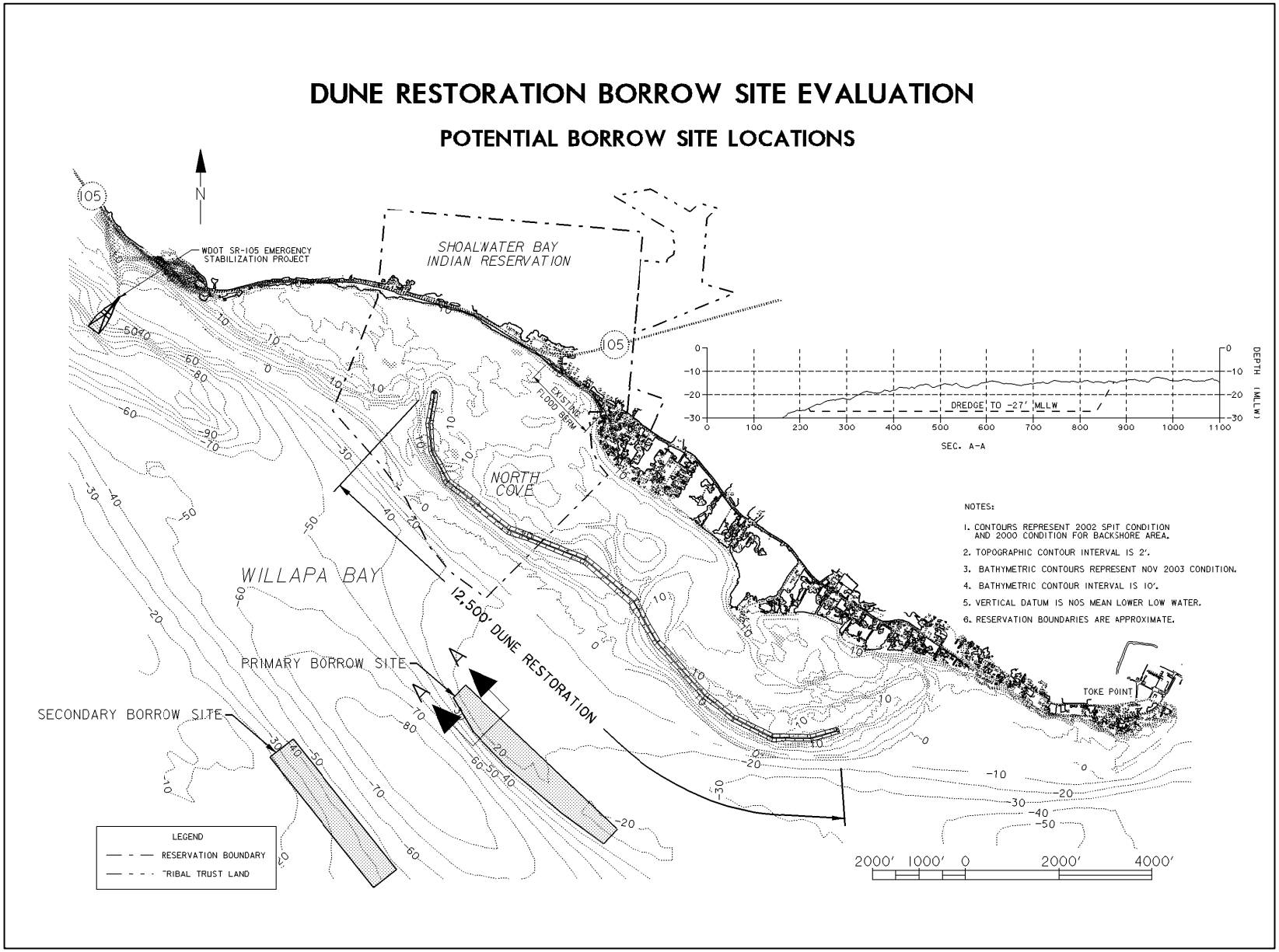


Figure 4.1 Potential Borrow Site Locations for Barrier Dune Restoration

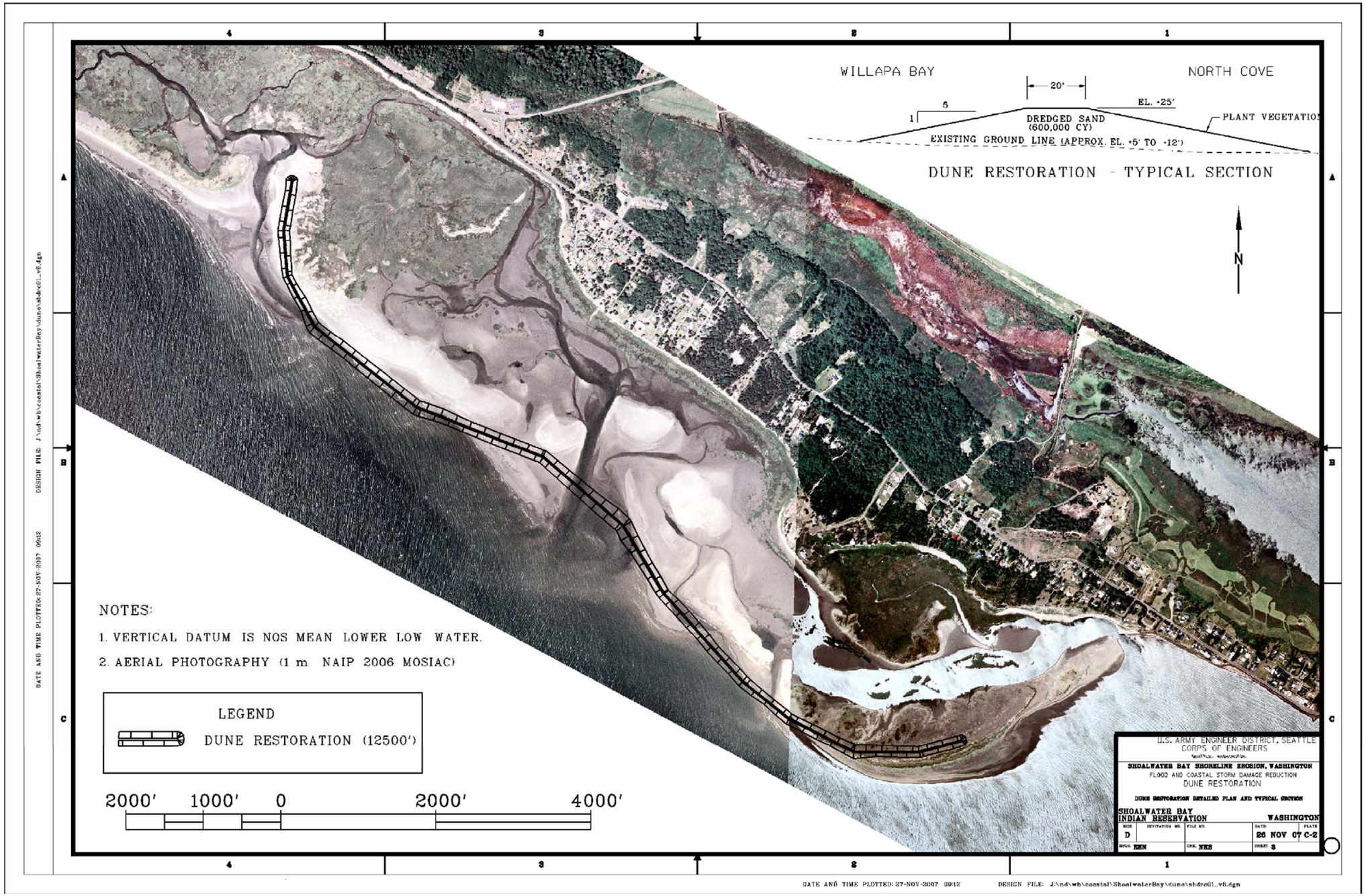


Figure 4.2 Barrier Dune Restoration Photo Overlay and Typical Section

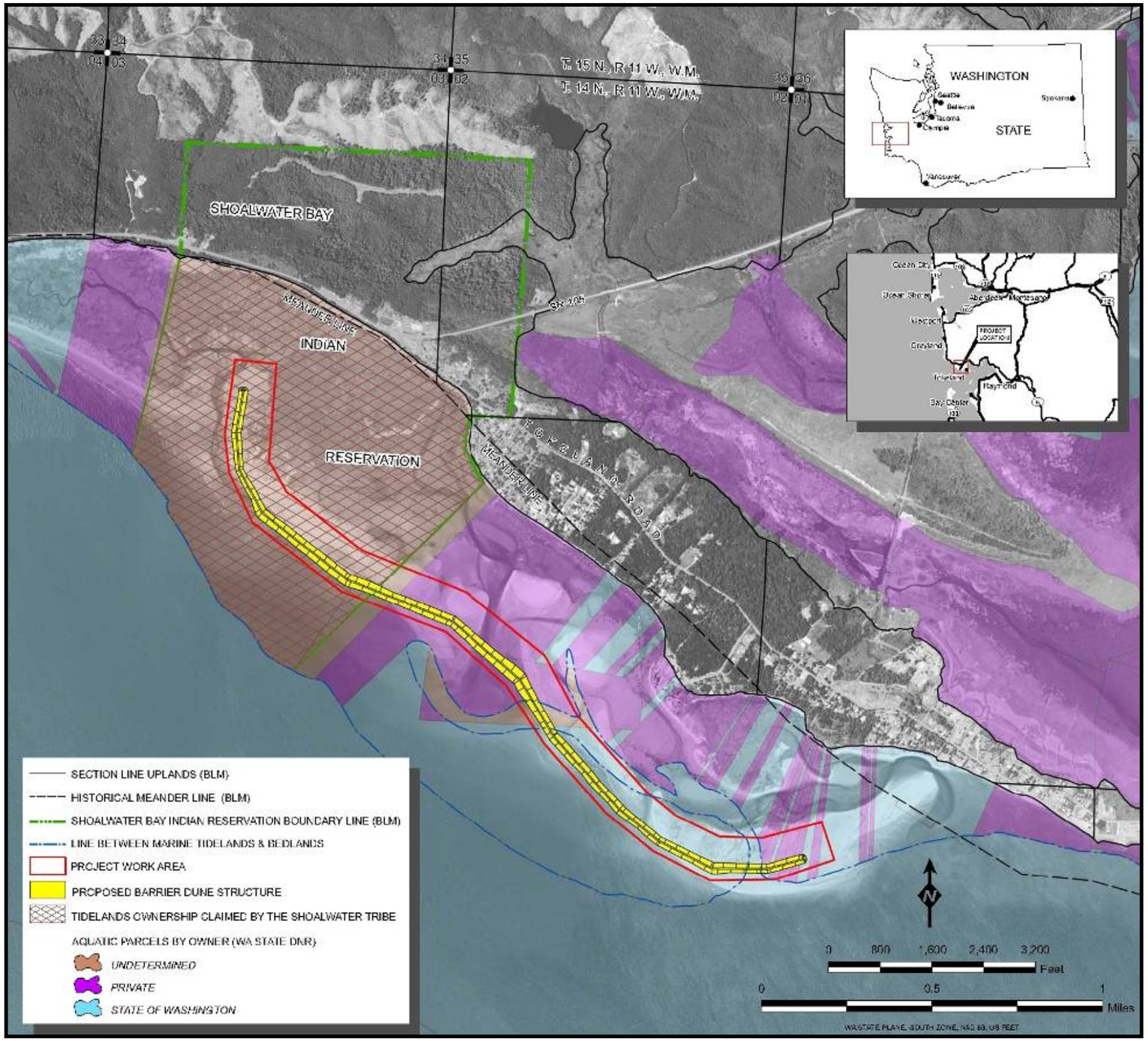


Figure 4.3 Real Estate Map

SHOALWATER BAY SHORELINE EROSION, WASHINGTON
FLOOD AND COASTAL STORM DAMAGE REDUCTION PROJECT
SHOALWATER BAY INDIAN RESERVATION (PWI 013725)

ASSESSMENT OF NON-FEDERAL SPONSOR'S
REAL ESTATE ACQUISITION CAPABILITY

I. **Legal Authority:**

a. Does the sponsor have legal authority to acquire and hold title to real property for project purposes? (yes/no)

b. Does the sponsor have the power of eminent domain for this project? (yes/no)

c. Does the sponsor have "quick-take" authority for this project? (yes/no)
[**Note:** For most governmental agencies within a state such as WA the following applies. Before using these statements determine their application to the situation. "**The Non-Federal Sponsor has the authority to acquire immediate possession. However, title vests after just compensation is determined by agreement or judicial decision.**]

d. Are any of the lands /interests in land required for the project located outside the sponsor's political boundary? (yes/no)

e. Are any of the lands/interests in land required for the project owned by an entity whose property the sponsor cannot condemn? (yes/no)

II. **Human Resource Requirements:**

a. Will the sponsor's in-house staff require training to become familiar with the real estate requirements of Federal projects including P.L. 91-646, as amended? (yes/no)

b. If the answer to II.a. is "yes," has a reasonable plan been developed to provide such training? (yes/no)

c. Does the sponsor's in-house staff have sufficient real estate acquisition experience to meet its responsibilities for the project? (yes/no)

d. Is the sponsor's projected in-house staff level sufficient considering its other work load, if any, and the project schedule? (yes/no)

e. Can the sponsor obtain contractor support, if required, in a timely fashion? (yes/no)

f. Will the sponsor likely request USACE assistance in acquiring real estate? (yes/no) (If "yes," provide description).

Figure 4.4 Sponsor's Capability Assessment

III. **Other Project Variables:**

a. Will the sponsor's staff be located within reasonable proximity to the project site? (yes/no)

b. Has the sponsor approved the project/real estate schedule/milestones? (yes/no)

IV. **Overall Assessment:**

a. Has the sponsor performed satisfactorily on other USACE projects? (yes/no/not applicable)

b. With regard to this project, the sponsor is anticipated to be:

___ highly capable
X fully capable
___ moderately capable
___ marginally capable
___ insufficiently capable. (If sponsor is believed to be "insufficiently capable:, provide explanation).

V. **Coordination:**

a. Has this assessment been coordinated with the sponsor? (yes/no)

b. Does the sponsor concur with this assessment? (yes/no) (If "no," provide explanation).

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Reviewed and approved by:

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Chief, Real Estate Division

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SHOALWATER PROJECT
SPONSOR'S CAPABILITY ASSESSMENT
7/3/2008

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Figure 4.4 Sponsor's Capability Assessment (continued)

SECTION 5: PLAN IMPLEMENTATION

5.1 Plan Responsibilities

Federal and non-Federal responsibilities for implementing the approved plan are summarized below. These responsibilities are derived, in part, from the project authorization, Section 545 of the Water Resources Development Act of 2000, as amended.

5.1.1 Federal Responsibilities

In accordance with the project authorization, the project will be constructed and maintained at 100 percent Federal expense. The Corps will complete the preconstruction engineering and design (PED) phase (detailed construction plans and specifications), and advertise and administer construction contracts following project approval by the Assistant Secretary of the Army (Civil Works). Federal real estate responsibilities for the project are discussed above in **Paragraph 4.4**, Real Estate Requirements.

5.1.2 Non-Federal Responsibilities

As specified in the project authorization, the Shoalwater Tribe will provide all project lands necessary for implementation of the project. Real estate responsibilities of the Shoalwater Tribe are described above in **Paragraph 4.4**, Real Estate Requirements. The Shoalwater Tribe is not required to provide Project Lands until after the Memorandum of Agreement between the Federal government and the Shoalwater Tribe is executed (see **Paragraph 5.2** below).

5.2 Memorandum of Agreement

Based on extensive discussions between Seattle District, Northwestern Division, and Headquarters Office of Counsel regarding the authorizing language for this project, it was determined that a Memorandum of Agreement (MOA) will be entered into between the Department of the Army and the Shoalwater Bay Indian Tribe regarding the provision of lands for the project. An MOA has been prepared, in consultation with Headquarters Office of Counsel, negotiated with the Shoalwater Tribal Council, and informally reviewed by Headquarters Counsel. The MOA will be approved and executed following approval of the project. The MOA contains the following articles: (1) obligations of the Government and the Shoalwater Tribe; (2) dispute resolution; (3) Federal and state laws; (4) relationship of parties; (5) officials not to benefit; (6) hazardous substances; (7) notices; (8) waiver of immunity; (9) termination or suspension; and (10) amendment. The negotiated MOA will be formally submitted for approval after the final report is approved.

5.3 Views of the Shoalwater Bay Indian Tribe

Shoalwater Bay Indian Tribe Resolution 2-06-08-05 was passed at a meeting of the Shoalwater Bay Tribal Council on February 6, 2008 (See **Exhibit 1** at end of this report). The Tribal Council resolved the following:

- Enthusiastic support of the findings and conclusions of the study conducted by the Corps to address coastal erosion and coastal storm damage problems affecting the Shoalwater Bay Indian Reservation;

- Recognition, acceptance, and support for implementation of Alternative 6 (barrier dune restoration) as the most appropriate long-term solution identified by the District Commander; and

- A commitment to provide the lands, easements, and rights-of-way necessary for implementation of the project, as specified in the project authorization, Section 545(b)(2) of the Water Resources Development Act of 2000, as amended.

In response to HQUSACE policy compliance review comments on the draft decision document and draft environmental assessment, the Shoalwater Tribal Council submitted a letter dated July 9, 2008 (See **Exhibit 3** at end of this report). The letter provides the Shoalwater Tribe's unique perspective on the coastal erosion and storm damage threat to the Shoalwater Tribe's lands and heritage. Specifically, the letter describes the Shoalwater Tribe's perspective – briefly summarized below – as to what is at risk due to the increasing coastal erosion and coastal storm damage threat:

- Population, buildings, facilities, and infrastructure elements.
- Old growth spruce trees, tribal burial grounds, and a documented village site
- Cultural uses of intertidal wetlands in the North Cove embayment, which serve both as a source of traditional subsistence foods and "sweet grass" which has cultural and spiritual uses and significance.
- Future economic development and the Tribe's efforts to protect new developments in terms of flood proofing, emergency preparedness, and other mechanisms.
- Extreme loss of fish, shellfish, and wildlife habitat in the North Cove embayment.

5.4 Views of the Bureau of Indian Affairs

By letter dated August 18, 2008, the Northwest Regional Director, Bureau of Indian Affairs, expressed full endorsement and support of the proposed project. In his letter, the Regional Director cited the Federal Government's trust responsibility toward the Shoalwater Bay Indian Tribe, and the urgent need to protect the Shoalwater Tribe's land and heritage from the ravages of coastal storms. (See **Exhibit 2** at end of this report).

SECTION 6: VERTICAL TEAM COORDINATION AND PUBLIC INVOLVEMENT

6.1 Vertical Team Coordination

6.1.1 Policy Compliance Review in 2008

The draft decision document and draft environmental assessment were submitted in December 2007 for policy compliance review. In February 2008, policy compliance review comments were issued by Corps Headquarters. A conference call, to discuss review comments and proposed report revisions, was held on February 26, 2008. Formal responses to review comments were submitted to HQUSACE for consideration subsequent to the February 2008 conference call. HQUSACE reviewed District responses and provided a preliminary analysis of proposed report revisions and supplemental information on May 13, 2008. A second conference call was held on June 5, 2008, at which time agreement was reached between HQUSACE, Northwestern Division, and Seattle District staff on the approach to be taken in revision and submittal of the final report for approval.

6.1.2 Vertical Team In-progress Review in March 2006

An in-progress review (IPR) video teleconference (VTC) was held in March 2006. Participants included representatives from Headquarters (William Schmidt, Lee Ware); Office of the ASA(CW) (Terry Breyman); Northwestern Division (Dennis Wagner, Jim Fredericks, Darlene Guinto, Andrea Walker, Joe Johnson, Surya Bhamidipaty); Shoalwater Bay Tribal Council (Charlene Nelson, Mike Shipman, Holly Blake, Jennifer Taylor, consultant Jay May); and Seattle District (Mona Thomason, Lester Soule, Karen Brooks, Rustin Director, Ann Gerner, Steve Babcock). Guidance stemming from the IPR includes the following:

- The question of whether there needs to be an economic analysis was settled between HQ and Seattle District Offices of Counsel prior to the IPR. No economic justification is required, in accordance with the project authorization, Section 545 of WRDA 2000. Instead, a life cycle cost analysis will be performed on the technically feasible protective structure plan in the final array of alternative plans
- Cost estimates will distinguish between continuing construction (barrier dune restoration periodic nourishment) and operations and maintenance of flood berm.
- The decision document will not make a recommendation, but will describe findings and conclusions relative to the alternative plan that best satisfies the criteria prescribed in the project authorization.
- Clarify the types of physical damages and social impacts that occur on the Shoalwater Reservation under both existing and future without project conditions, as well as the significance (economic, life-safety, cultural).
- Rationale for incidental benefit to adjacent non-tribal land area that will be protected will be stated. Verify that the selected plan is the minimum that can be constructed to protect

the Shoalwater Reservation and satisfy the criteria for plan selection set forth in the project authorization.

- Project cooperation agreement (PCA) would deviate significantly from the model, necessitating coordination with HQ to resolve prior to report submittal. (Note: issue was resolved by HQ/NWD/NWS Counsel determination that a Memorandum of Agreement in lieu of a PCA is appropriate. An MOA has been developed and jointly agreed to by HQ Counsel/NWS Counsel/Shoalwater Tribal Council, and will be submitted concurrently with the final decision document.

6.1.3 Vertical Team In-progress Review in November 2004

An in-progress review (IPR) was held at Seattle District in November 2004. Participants included representatives from Headquarters (William Schmidt, Forester Einarson); Northwestern Division (Dennis Wagner, Gary Bunn, Jim Fredericks, Ken Hall); Shoalwater Bay Tribal Council (Charlene Nelson, Doug Davis, consultant Jay May); and Seattle District (Michael Bevens, Mona Thomason, Linda Smith, Lester Soule, Steve Babcock). Guidance stemming from the IPR includes the following:

- Consideration of ecosystem restoration will require additional authority be granted for this project. The existing project authorization (Section 545 of WRDA 2000) provides only for single purpose coastal erosion protection. [Note: Section 5153 of WRDA 2007 added ecosystem restoration as a project purpose. A separate report addressing this added project purpose will be prepared and submitted].
- Shoreline revetment alternative would protect only the upland portion of the small reservation and therefore will not be carried forward for further evaluation. Though technically feasible, the revetment does not provide a complete solution to identified problems and is, therefore, not carried into the final array of alternative plans.
- Project authorization specifically exempts project from requirement for economic justification. The optimal plan will be identified. Per criteria specified in project authorization, selected plan must be cost-effective. Procedure will be laid out in report.
- Approval authority for the post-authorization decision document will not be delegated. The report will be approved by the ASA(CW), whose office indicates the report will be treated as a priority.
- Upon submittal of the report, the district may proceed with PED-type activities without delay pending report approval.

6.2 Public Involvement

6.2.1 Public Involvement Overview

Public involvement activities were related to developing public information on the study and obtaining public input during the study process. The public involvement/outreach strategy consisted of a series of (1) workshops and a public meeting; (2) workshop and meeting notices, news releases, radio announcements, and public information packets; and (3) speaking engagements

at community organizations by Corps and Shoalwater Tribe personnel. The study also included extensive coordination and review throughout the study process by agencies at the Federal, state, and local governmental level, special interest groups, and the general public. Those entities most directly involved in providing input and review included Shoalwater Bay Indian Tribe, Washington Department of Ecology, Washington Department of Fish and Wildlife, Washington Department of Transportation, Washington Department of Natural Resources, Washington Department of Archaeology and Historic Preservation, U.S. Fish and Wildlife Service, U.S. Geological Survey, Pacific County, and Dexter By The Sea homeowners. The Corps and the Shoalwater Tribe jointly conducted workshops and the public meeting and participated in community outreach engagements.

6.2.2 Public Notice of Preparation issued on October 31, 2007

A Notice of Preparation was issued on October 31, 2007, with factual comments on the impacts of the change in project scope and preferred alternative accepted through November 30, 2007. The Notice of Preparation was issued to notify interested parties of the Corps' plan to prepare, pursuant to the National Environmental Policy Act, the final environmental assessment (EA) for the proposed project. As a result of new information and issues identified in comments on the draft EA, the Corps revised its preferred project alternative (from Alternative 7 – barrier dune restoration with flood berm extension, to Alternative 6 – barrier dune restoration), and proposed to reflect the scope of the new preferred project alternative in the final EA. Unlike the preferred alternative in the draft EA, which was circulated for review and comment from January 24 through February 28, 2007, the new preferred alternative (Alternative 6) would not include flood berm extension along the shoreline of the Shoalwater Reservation or the Tokeland Peninsula. It also would not include relocation of the natural channel draining the southeastern end of North Cove.

6.2.3 Public Meeting on March 29, 2007

A public meeting was held on March 29, 2007 from 7:00 to 9:00 p.m. at the Shoalwater Administration Building. The meeting was held to discuss the proposed shoreline erosion project and to allow the public to ask questions and submit comments for the official record. The comment period for the draft decision document ended on April 6, 2007. Representing the Corps of Engineers at the public meeting were Colonel Michael McCormick, District Commander; Lester Soule, Construction General Program Manager; and Steven Babcock, Project Manager. The Shoalwater Tribal Council was represented by Charlene Nelson, Council Chair; Mike Shipman, Council Vice-Chair; Lynn Clark, Council Secretary; and Jay May, Project Coordinator, Vision Development Group, Inc. The public meeting was attended by 45 citizens, primarily residents of the adjacent community on the Tokeland Peninsula. Prior to the meeting, a news release was posted on the Corps' Seattle District public webpage and also issued to six local newspapers and three local radio stations. The public meeting notice was also posted on the website maintained by and for residents of the adjoining DexterByTheSea residential community.

All public comments were evaluated, and responses to comments and questions on the draft decision document and draft EA were prepared. In addition, a court reporter transcribed the public meeting presentations and comment/question and answer period and prepared a formal transcript of the meeting. All comments received during the public comment period on both the draft decision document and draft EA, together with responses by the Corps' Seattle District, are appended to the final environmental assessment.

6.2.4 Dexter Development Company, Inc. Property Owners Meeting on July 22, 2006

The Dexter Development Company, Inc. property owners association held their annual property owners meeting on Saturday, July 22, 2006 at the Shoalwater Administration Building. The meeting was attended by approximately 45 DexterByTheSea property owners. The Shoalwater Tribe's project manager was invited to make a presentation on project status, and discussed real estate easements that the Shoalwater Tribe will need to acquire from some 26 Dexter property owners for construction of the south flood berm extension.

6.2.5 Dexter Development Company, Inc. Property Owners Meeting on July 16, 2005

The Dexter Development Company, Inc. property owners association held their annual property owners meeting on Saturday, July 16, 2005 at the Shoalwater Administration Building. The meeting was attended by approximately 35 DexterByTheSea property owners. The Corps project manager was invited to make a presentation on the status of project formulation and evaluation. Also attending was the Shoalwater Bay Tribal Council Chair and the Shoalwater Tribe's project manager. The project status handout was electronically distributed to all property owners via the Dexter website. Material covered in the presentation included results of technical studies, formulation and evaluation of alternative plans, and description of the dune restoration/flood berm extension plan that appears to best satisfy criteria set forth in the project authorization. There was a 45 minute question and answer period.

Strong support for the project was expressed by DexterByTheSea property owners, based on recognition that both tribal and non-tribal residents of the area would directly benefit from construction of the project. A portion of the flood berm extension would extend along the shoreline, beyond the Shoalwater Reservation boundary, requiring a perpetual easement be acquired from affected Dexter property owners. The general process of acquiring the easements was described. A summary of the meeting was written up in the Dexter electronic newsletter that is available to all property owners.

6.2.6 Dexter Development Company, Inc. Property Owners Meeting on July 17, 2004

The Dexter Development Company, Inc. property owners association held their annual property owners meeting on Saturday, July 17, 2004 at the Shoalwater Administration Building. The meeting was attended by 31 DexterByTheSea property owners. The Shoalwater Tribe's project manager was invited to make a presentation on project status.

6.2.7 Resource Interagency Meeting on July 16, 2004

A resource interagency meeting was held on July 16, 2004 at the Shoalwater Administration Building. Purpose of the meeting was to discuss environmental aspects and avoidance/ mitigation measures associated with Shoalwater project alternatives. The meeting agenda included a description of the three technically feasible alternatives (sea dike, dune restoration, and dune restoration with flood berm extension), design considerations (construction techniques, project footprint below MHHW, maintenance intervals, borrow sources, beneficial use of dredged material), and environmental considerations associated with the technically feasible alternatives.

The meeting was attended by representatives from the Corps' Seattle District and the following Federal, State and local agencies: U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, Washington Department of Ecology, Washington Department of Natural Resources, Washington Department of Transportation, Pacific County Commissioner, and Shoalwater Bay Tribal Council.

6.2.8 Community Meeting/Workshop on May 12, 2004

A community meeting/workshop was held on May 12, 2004 at the Shoalwater Administration Building. Purpose of the meeting was to provide the public with detailed information, and to have a dialogue with the public, on the technical study findings and alternatives formulation for the proposed project.

Approximately 40 members of the Shoalwater Tribe and the Dexter and Tokeland community attended the meeting. Technical study team members making presentations at the meeting included research scientists from the Corps' Coastal and Hydraulics Laboratory, U.S. Geological Survey's Coastal and Marine Geology Program, Washington Department of Ecology's Coastal Monitoring and Analysis Program, and the Corps' Seattle District. State and Federal regulatory agencies represented at the meeting included U.S. Fish and Wildlife Service, Washington Department of Fish and Wildlife, Washington Department of Natural Resources, Washington Department of Ecology, and U. S. Environmental Protection Agency.

Topics covered included: (1) project authorization; (2) findings and conclusions of technical studies just completed (tides and tidal currents, wave climate and wave generation, prediction of future shoreline and channel location, design and evaluation of hydraulic modification structures, and design and evaluation of protective structures). Following the formal presentations, the technical study team members mingled and engaged the audience in discussion and to answer questions about the technical studies and the alternative plans under consideration.

6.2.9 Agency Coordination Kick-off Meeting on August 20, 2002

A regulatory and resource agency coordination kickoff meeting was conducted by the Corps at the Tribal Center on August 20, 2002. Attendees included representatives from the U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, Port of Willapa Harbor, Washington Department of Ecology, Washington Department of Fish and Wildlife, and Shoalwater Bay Tribal Council. The meeting included a discussion of the scope of the intended study by the Corps' interagency study team, brainstorming of alternative measures to be evaluated to address the storm damage and erosion of tribal lands, and environmental considerations.

6.2.10 Community Meeting/Workshop on June 18, 2002

A community meeting/workshop was held on June 18, 2002 at the Shoalwater Administration Building. Participating in the meeting were 17 members of the interagency study team assembled by the Corps of Engineers to evaluate the coastal erosion problems and formulate alternative plans for detailed engineering, environmental, and economic evaluation. Agency representatives included the Corps' Seattle District office, the Corps' Coastal and Hydraulics Laboratory, the U.S. Geological Survey, and Washington Department of Ecology. The workshop was attended by 51 members of the local community, both Tribal members and non-Tribal residents of the Tokeland Peninsula. The study team made a short presentation on the scope of the technical studies that were being considered to be conducted over the next two years. The majority of meeting was devoted to informal discussions with members of the local community in an effort to better understand the coastal erosion and storm damage issues from the perspective of the people who actually live on and adjacent to the Shoalwater Reservation. The exchange of information and views was very useful in finalizing the scopes of work of the interagency study team.

6.2.11 Community Meeting/Workshop on September 23, 1999

A community meeting/workshop was held by the Corps on September 23, 1999 at the Shoalwater Administration Building, following a meeting between the Tribal Council and the Seattle District Engineer and Northwestern Division Deputy Commander. This meeting was held prior to enactment of legislation authorizing the project. The meeting was held as an opportunity for tribal and non-tribal residents of the area to describe and express concerns about the storm damage and coastal erosion issue. Eleven members of the local community participated in the meeting.

SECTION 7: FINDINGS AND CONCLUSIONS

7.1 Findings

In accordance with Section 545 of the Water Resources Development Act (WRDA) of 2000, as amended by Section 5153 of WRDA 2007, a study to determine the feasibility of providing coastal erosion protection for the Shoalwater Bay Indian Reservation on Willapa Bay, Washington, has been completed. A collaborative interagency investigation conclusively demonstrated that (1) erosion of the natural barrier dune on Graveyard Spit has reached a critical stage and (2) modest engineering solutions are technically feasible to provide coastal erosion protection to the Shoalwater Reservation and reduce flooding and associated damage from coastal storm events that occur under elevated water conditions. Wind-generated waves that have eroded the barrier dune are small by coastal engineering standards. The Shoalwater Reservation is under immediate and growing threat of severe flooding and storm damage to Tribal facilities and infrastructure, and total loss of remaining subsistence intertidal habitat.

A wide array of alternative plans were formulated and evaluated against identified problems and opportunities, and planning objectives and criteria. Seven plans that are neither technically feasible nor environmentally acceptable were screened out. Four alternative plans, plus the No Action alternative, were carried forward for further evaluation: sea dike (Alternative 4), sea dike to Reservation boundary (Alternative 4a), barrier dune restoration (Alternative 6), and barrier dune restoration with flood berm extension (Alternative 7). These four plans would each provide a complete technical solution. The sea dike alternatives were found to have the highest initial construction and annualized cost, and are not environmentally acceptable. The barrier dune restoration with flood berm extension alternative would require extensive mitigation for wetland impacts associated with the flood berm extension, and has significantly higher initial construction and annualized costs than barrier dune restoration (Alternative 6).

7.2 Conclusions

Alternative 6, barrier dune restoration, is the most appropriate long-term solution to the coastal erosion and related storm damage problems affecting the Shoalwater Bay Indian Reservation. With a total first cost for initial construction of $9,827,000, periodic nourishment/monitoring every five years at a cost of $4,512,000, a total present value of $25,883,000, and a total average annual cost of $1,336,000, Alternative 6 best satisfies planning objectives and meets all criteria specified in the project authorization. This plan is a complete solution to identified coastal erosion problems, is a cost-effective means of providing coastal erosion protection, and is environmentally acceptable and technically feasible. By significantly reducing the frequency and magnitude of flooding of tribal lands due to storm wave run-up and overland wave propagation, the plan will also improve the economic and social conditions of the Shoalwater Bay Indian Tribe. Barrier dune restoration will also prevent further degradation of the Tribe's 700-acre North Cove embayment subsistence intertidal habitat. Shoalwater Bay Indian Tribe Resolution 02-06-08-05, expressing strong support for the project, is attached as **Exhibit 1**. Bureau of Indian Affairs letter of support, dated 18 August 2008, is also attached (**Exhibit 2**). This is a vitally important project to a remotely located Native American community in a highly vulnerable location along the Washington coast.

Date: _____

_____
ANTHONY O. WRIGHT
Colonel, Corps of Engineers
Commanding

EXHIBIT 1

SHOALWATER BAY INDIAN TRIBE
P.O Box 130 • Tokeland, Washington 98590
Telephone (360) 267-6766 • FAX (360) 267-6778

SHOALWATER BAY INDIAN TRIBE
RESOLUTION 02-06-08-05

WHEREAS, The Shoalwater Bay Indian Tribe is a Federal recognized Tribe headquartered on the Shoalwater Bay Indian Reservation in the State of Washington; and

WHEREAS, The Shoalwater Bay Tribal Council is the governing body of the Shoalwater Bay Indian Tribe in Accordance with their Constitution and By-laws; and

WHEREAS, The Shoalwater Bay Tribal Council is duty bound to protect the Tribe and its Reservation from physical, social and economic harms; and

WHEREAS, The Shoalwater Bay Tribal Council has pursued its duty by recognizing the serious nature of the physical, social and economic effects of coastal erosion which continues to damage the reservation lands and threaten the stability of the Tribe; and

WHEREAS, In the pursuit of its duty the Tribal Council has address the threat by seeking both Congressional and Administration support for a study to evaluate the problem through US Senate and Congressional representatives of the Tribe, who provided authorization for the project as defined in Section 545 (b)(2) of the Water Resources Development Act of 2000, as amended by Section 5153 of the Water Resources Development Act of 2007 which determined to formulate and evaluate alternative long term solutions, and

WHEREAS, The Tribe has, over several years, enthusiastically participated in the study conducted by the Seattle District US Army Corps of Engineers in cooperation with the Corps Coastal and Hydraulics Laboratory, U.S. Geological Survey, Washington Department of Ecology, U.S. Fish and Wildlife Service and other state and local agencies, and

WHEREAS, The Tribe does fully understand the study evaluations and results.

THEREFORE BE IT RESOLVED, that the Shoalwater Bay Tribal Council hereby enthusiastically supports the findings and conclusions of the study conducted by the U.S. Army Corps of Engineers to address coastal erosion and coastal storm damage problems affecting the Shoalwater Bay Indian Reservation, and

BE IT FURTHER RESOLVED, That the Shoalwater Bay Tribal Council, by its thorough understanding of the alternatives analyzed by the study effort, does recognize, accept and support the implementation of Alternative 6 (barrier dune restoration) for the long term solution identified by the District Commander.

BE IT FINALLLY RESOLVED, That the Shoalwater Bay Tribal Council has committed to provide the lands, easements, and right-of-way necessary for implementation of the project, as specified in the project authorization , Section 545 (b)(2) of the Water Resources Development Act of 2000, as amended by Section 5153 of the Water Resources Development Act of 2007

CERTIFICATION

The above Resolution was passed at a Regular Meeting of the Shoalwater Bay Tribal Council on 02-06-2008 at which a quorum was present by a vote of 5 FOR 0 AGAINST 0 ABSTAIN

Charlene Nelson, Chair
Shoalwater Bay Indian Tribe

Lynn Clark, Secretary
Shoalwater Bay Indian Tribe

Michael Shipman, Vice Chairman
Shoalwater Bay Tribal Council

Holly Blake, Treasurer
Shoalwater Bay Tribal Council

Jennifer Taylor, Member at Large
Shoalwater Bay Tribal Council

Page 2: Resolution 02-06-08-05

EXHIBIT 2

United States Department of the Interior
Bureau of Indian Affairs
Northwest Regional Office
911 NE 11th Avenue
Portland, Oregon 97232-4169

TAKE PRIDE IN AMERICA

AUG 18 2008

COL Anthony O. Wright, Commander
Seattle District, U.S. Army Corps of Engineers
Post Office Box 3755
Seattle, WA 98124-3755

Subject: Letter of Support for Shoalwater Bay Indian Tribe – Shoalwater Reservation Shoalwater Bay Shoreline Erosion, Washington – Flood and Coastal Storm Damage Reduction

Dear COL Wright:

The Bureau of Indian Affairs (BIA) has, as one of its primary mandates, the conservation and protection of lands and properties held in trust for Native American Tribes of this great Country. The Shoalwater Bay Indian Tribe (Tribe) is a federally recognized tribe with a unique coastal location that has been threatened for many years by losses of trust property due to erosion caused by coastal storms. The BIA has followed the efforts of the U.S. Army Corps of Engineers (Corps) fulfilling our Federal responsibilities to protect the reservation lands of the Tribe, and we wholeheartedly endorse and support the study and findings of the Corps' Report referenced above.

The Shoalwater Reservation (Reservation) was established in 1866 by Executive Order of President Andrew Johnson. The Reservation is located on the Tokeland Peninsula on the north shore of the entrance to Willapa Bay, a very large estuarine system on the Pacific Ocean coast of Washington. Willapa Bay is approximately 28 miles north of the mouth of the Columbia River and 12 miles south of the entrance to Grays Harbor. The Reservation is slightly greater than one-square mile in area and consists of 440 acres of uplands and 700 acres of important tide flat and marine salt marsh habitat in North Cove. All Reservation land is tribally owned and is bounded by steep natural hillsides to the east and north, and by Willapa Bay to the south. North Cove's ability to sustain Tribal subsistence shellfish beds and native plant populations has diminished. This has resulted in a significant decrease in opportunity for subsistence shellfish gathering and harvesting of local native plant species for Tribal crafts and ceremonial use.

The BIA recognizes that the Corps, in accordance with its Congressional directives, has completed an investigation of the coastal processes at Willapa Bay affecting the Reservation. Furthermore, the interagency investigation conclusively demonstrated that: (1) erosion of the natural barrier dune on Graveyard Spit has reached a critical stage; and, (2) modest engineering solutions are technically feasible to protect the Reservation from the effects of coastal storms including continued loss of subsistence habitat in the North Cove embayment, erosion of Tribal

uplands, and increasing likelihood of serious damage and destruction of Tribal infrastructure due to uncontrolled flooding and storm wave attack. The report shows that erosion of Graveyard Spit has significantly compromised its historical function as a storm barrier for the Reservation. Without prompt action, the Reservation will incur increasingly frequent and intense storm damage to infrastructure and habitat, and a loss of land due to uncontrolled erosion.

Congressional authorization provides that the Assistant Secretary of the Army (Civil Works) is authorized to construct and maintain a project at Federal expense if the Secretary determines that the project: (a) is a cost effective means of providing coastal erosion protection; (b) is environmentally acceptable and technically feasible; and (c) will improve the economic and social conditions of the Tribe. As trustees for the Tribe, it is the Federal Government's responsibility to ensure that Tribal needs are met to the fullest extent allowed under law. The Corps, as an agency within the Federal government, has consulted with the Tribe on a government-to-government basis throughout the planning process for the proposed project. The Tribe's efforts to preserve their land and heritage have been carefully considered by the Corps, and the proposed project has the full support of the BIA.

Sincerely,

Stanley Speaks
Northwest Regional Director

2

EXHIBIT 3

SHOALWATER BAY INDIAN TRIBE
P.O. Box 130 • Tokeland, Washington 98590
Telephone (360) 267-6766 • FAX (360) 267-6778

July 9th, 2008

COL Michael McCormick, Commander
Seattle District, U.S. Army Corps of Engineers
Post Office Box 3755
Seattle, WA 98124-3755

SUBJECT: Shoalwater Bay Shoreline Erosion, Washington – Flood and Coastal Storm Damage Reduction – Shoalwater Bay Indian Reservation, Post Authorization Decision Document and Environmental Assessment – Policy Compliance Review Comments [dated 2/26/08]

Dear COL McCormick:

During these 10-years of analysis and study of the off shore threats to our reservation lands and water resources we have endured earthquakes, flooding, and storms that have had the potential for much greater damage. We have been fortunate to have escaped serious impacts. Yet, any coastal storm that coincides with an extreme high tide or just a high tide could potentially result in tragedy, and it is the now well-documented and certified possibility of such a threat that has brought us to this final state of the study.

We wish to state as a reminder to the entire study team that the nature of the Tribe's initial request encompassed a vital need by the Tribe that from a historical perspective the safe environment of the Tribal Reservation had altered over time and that we needed assistance from the Federal Government, in this case through our U.S. Congressional Representatives, to overcome the loss of protective barrier dunes which historically sheltered the Reservation from coastal storm damage. Never did we indicate that we had incurred significant damages, except for the loss of the intertidal shellfish and fish habitat. What we saw, and what has been confirmed through now nearly 10-years of study and documentation, is that indeed there has been a major alteration to the safety of our Tribal Reservation, identified as the erosion of the offshore protective barrier dunes. In the final analysis we have lost little, but all agree that we

remain in constant and certain growing danger of losing much, even a very strong potential for the loss of life.

The following reflections from the Tribal Council are ultimately intended to confirm our total commitment to the project as currently designed and documented, and to lend our significant experience and continuity to the study and report process.

We draw from the comments of the Corps HQ that they are seeking a summary of damages to the Tribe's Reservation properties. Those damages can best be described as nuisance flooding, roadway interruption, etc. Except for the losses encountered to the intertidal fishing and shell fishing resources – addressed in subsequent comment responses – the Tribe has had minor damages. The primary issue in the initial request is that we do not wish to have any damages. The loss of the protection we have had for centuries is eroding and through analysis and study we now know that the Congressional request, as specified in WRDA 2000, has proven valid, even more pronounced that originally thought. And, historically the area has endured many many losses of: lighthouses, wildlife refuges, roads and homes, not to mention huge parcels of land – even a mountainside- and the Tribe has lost essential subsistence habitat. And, we have lost the barrier dunes that have provided the vitally important protection these many years. These are the Tribe's losses: protective barrier dunes, some land, and the intertidal habitat that supported subsistence fishing and shell fish.

We note the concerns of the reviewing staff at Corps headquarters that "In general, the revised report does not adequately address concerns raised previously (drawn from previous in-house Progress Reviews), and that the change of alternative has not been carried into the independent technical review...". Thus, we offer that from the perspective of the Shoalwater Bay Tribe, the following are "AT RISK."

- "AT RISK" Population, Buildings, Structures and Infrastructure Elements (See attached excel sheet –"AT RISK"). The "AT RISK" population is the Shoalwater Bay Indian Tribe, a people that are "endangered people" in the national fabric of the American population. What is at risk is a "remnant of a people" from pre-historic time, and not replaceable. And, what little Reservation we have is also not replaceable. The "AT RISK" population represents a unique and priceless link and connection to the past, those who have lived and subsisted here. Yet, to many, what the Shoalwater Bay Tribe represents – our Reservation lands and waters- are being destroyed, lost to erosion due to coastal storm wave attack over many decades. Even our people, subjected to very high rates of infant mortality during the 80's and 90's, though rebounding today, continue at risk without protection from the immense dangers inherently threatening our lands, our resources, our current holdings and our people. Let us be frank here. The Congress, through its arm of the Corps of Engineers has already expended more energy and resources on an 11,000 year old Kennewick Man – who is no longer with us as a live remnant of our Country's Native American heritage- than it seems willing to commit to an entire Tribe of Shoalwater Bay Native Americans

who wish to live safely in the same location as our ancestors did long before a tiny reservation was established by the President in 1866.

- "AT RISK", is defined by the attached table tells a significant story in itself. Any reasonable reviewer, given details of the characterization of the losses described in the comment above, will understand the story of the potential for losses, and the significant historical losses in this immediate location. Prior losses due to erosion, and the imminent threat of losses to Reservation: lands, intertidal habitat, cultural, spiritual, social, economic, and physical resources and assets are obvious and definable.
- "AT RISK" is an entire forest of "Old Growth" spruce trees, Tribal burial grounds that have been identified but not revealed for public knowledge, and a documented Tribal village site less than 200 yards from the current shoreline.
- "AT RISK" are the cultural uses of the intertidal wetlands: In addition to the obvious advantages to the marine fishery habitat for salmon and other native species along the beach, other habitats for a host of fish, birds (eagles, herons, and pelicans), flora and fauna are abundant in the intertidal wetlands. Culturally, this abundant habitat serves, even to this day, as a source of traditional subsistence foods (fish and shellfish) upon which Tribal members depend for their health and dietary welfare. In fact, the intertidal marine habitat provides the last of the culturally traditional foods. This is significant in that these dietary elements are healthy choices in light of Tribal member's propensity for diabetes and other illnesses not traditionally found in the Native diets. Strictly speaking of both cultural and spiritual uses, we cannot overlook the importance of "sweet grass" which is uses extensively in religious ceremonies, for basket weaving, mats, and other woven crafts, for traditional clothing (hats),
- "AT RISK" are all future economic developments and the Tribe's efforts to protect new developments in terms of flood proofing (raising) or other mechanisms: The Tribe has been extremely pro-active in the development of internal building codes and environmental ordinances addressing the issues stemming from the challenges of coastal erosion and flooding. The new Wellness Center was built to new standards and coordinated with Pacific County. Further, an Emergency Management team of more than thirty (30) Tribal and non-Native community members was developed in accordance with CERT standards and trained to react to disaster relief issues. New developments will take on a heightened attention and be developed to standards that consider the location of the Reservation and physical constraints of the uplands.
- "AT RISK" is the EXTREME loss of fish and shell fish habitat. This emphasis is important and should not be diminished. However, of equal or even higher priority is the loss of the barrier dunes which protect the Tribal land base, its commercial, governmental, community, infrastructure, and residential facilities. We should not overlook the vitally important coastal highway (SR 105) which crosses the entire width of the Reservation. And, we should incorporate the Tribe's Wellness and dental clinic which serves both the Tribal and the non-Native population, including a CHSDA (Native, but not Shoalwater Bay Tribal

members) serving all of Pacific County. (See table below addressing "AT RISK" facilities, cultural and spiritual amenities, and infrastructure.)

We firmly believe that the entire burden of risk is the Tribe's, and the Tribe's alone for: loss of life, loss of jobs (Tribe has become a protector of jobs.), loss of resources, loss of infrastructure, loss of environmental and wildlife habitat, loss of culture, loss of spiritual foundation, and loss of community. District must provide Risk and Uncertainty discussion associated with the (new) selected alternative.

We have made these comments at our own suggestion, but with the long standing cooperation of the Corps' Project Team who invited our direct input at this most critical juncture. These reflections are offered from the Shoalwater Bay perspective. Given the nature of the circumstances and the Tribe's intimate familiarity with the properties and resident conditions for hundreds of years, it is appropriate for the Tribe, through its governing Tribal Council, to provide comments based on nearly 10-years of interaction with the technical and administrative Study Team. We are grateful for this opportunity.

From our unique position as a sovereign nation within the boundaries of the United States of America we appreciate the work of the Corps, especially of the Seattle District. We have been encouraged by the faithful and diligent efforts of the Corps staff, as well as the international experts who have participated in the most challenging considerations of the study. We anticipate a long and healthy existence on these lands secure that the efforts reflect positive accomplishments for our Tribal community.

Again, on behalf of the Shoalwater Bay People we offer our sincere thanks,

Charlene Nelson
Tribal Council Chairwoman

Michael Shipman
Tribal Council Vice-Chairman

Lynn Clarke
Tribal Council Secretary

Holly Blake
Tribal Council Treasurer

Jennifer Taylor
Tribal Council Member-at-Large

AT RISK Buildings, Structures and Infrastructure Elements
Shoalwater Bay Indian Reservation, Tokeland, Washington

STRUCTURE NAME	CLASSIFICATION	QUANTITY	LOCATION	COMMENTS
RESERVATION LAND/WATER				
Land	**Uplands**	**440 Acres**	**On-Reservation**	
Marine	**Intertidal**	**700 Acres**	**On-Reservation**	
TRIBAL COMMERCIAL				
Tribal Community Center	Tribal Commercial	1	On- Reservation	Administration for Tribal Government; Service for Elders Lunch Program
Tribal Court	Tribal Commercial	1	On- Reservation	
Tribal Education Center & Library	Tribal Commercial	1	On- Reservation	Including new backup generator
Tribal Clinic and Dental Center	Tribal Commercial	1	On- Reservation	Includes all FF&E and backup generator; serves both Tribal and non-native populations
Tribal Social and Family Services	Tribal Commercial	1	On- Reservation	(See backup generators below)
Tribal Casino (Incl. Admin & TGA)	Tribal Commercial	1	On- Reservation	Includes all FF&E and backup generator; 25,000 visitors annually
Recreational Vehicle Park	Tribal Commercial	1	On- Reservation	
Tribal Businesses (private)	Tribal Commercial	14	On- Reservation	
Environmental Complex	Tribal Commercial	1	On- Reservation	
> Office Buildings		2		
> Labs		2		
> Storage & Maintenance		1		
TRIBAL COMMUNUTY				
Tribal Cultural Building	Tribal Community	1	On-Reservation	
Tribal Cemetary	Tribal Community	1	On- Reservation	Cultural CENTER of Tribe
Gymnasium	Tribal Community	1	On- Reservation	
Emergency & Backup Generators	Tribal Community	2	On- Reservation	
Tribal Community Water (Pumps)	Tribal Community	1	On- Reservation	Including new backup generator
Tribal Storage and Maintenance	Tribal Community	3	On- Reservation	
Community EMERGENCY Evacuation Center	Tribal Community	1	On-Reservation	
Extended Multi-Family Dwellings	Tribal Residential	36	On-Reservation	
Duplex Family Dwellings	Tribal Residential	6	On-Reservation	
Double-wide Trailer Dwellings	Tribal Residential	4	On-Reservation	
PUBLIC INFRASTRUCTURE				
State Highway 105	Public / State		On-Reservation	State Hwy Runs Through Reservation
Old Tokeland Road	Public / County		On-Reservation	County Road Runs Through Reservation

** ALL facilities and structures - commercial or residential - include septic syatems.

End of Post-Authorization Decision Document

Shoalwater Bay Shoreline Erosion, Washington