Port of EVERETT

Beach Enhancement For Mount Baker Terminal

(Rail Barge Transfer Facility)

AAPA Environmental Award Submittal — Mitigation Category

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INTRODUCTION AND HIGHLIGHTS

The majority of the east side of Puget Sound was hardened with riprap and bulkheads during the 20th Century, and much of this armored shoreline along the east shore of the Sound is occupied by the BNSF Railways (BNSF). Restoration of more natural shoreline habitats, and the processes that sustain those habitats have been identified by several regional restoration planning efforts that are underway in the Sound as one of the elements critical to recovery of Puget Sound salmon, several species of which have been recently listed as threatened with extinction under the Endangered Species Act. The Port of Everett (Port), in part, to offset potential impacts of new pier construction in Everett, Washington, and to further the state of scientific understanding of one particular shoreline restoration approach, restored approximately 1,100 feet of shoreline habitat in an area where existing infrastructure precludes re-establishment of natural processes. This project has created, through addition of sediment, a more natural beach profile with a beach face, storm berm, and backshore, waterward of the rock bulkhead supporting the BNSF railroad. Physical monitoring has shown that the 335-m pebble/sand beach constructed near Mukilteo, using 10,700 m^3 of material has responded to the ambient wave environment much as predicted through two winters. Biological monitoring has shown a high level of biological activity by juvenile salmonids and forage fish. However, it is not yet certain if forage fish (sand lance) that previously spawned in sand at the base of the railroad bulkhead will spawn significantly on the new beach.

GOALS AND OBJECTIVES

The Port's overall project objective was to develop a rail barge transfer facility (RBTF) to transfer oversized aerospace containers from barges directly to rail cars at a location that minimizes interference with on-going rail operations.

The goals of the beach restoration were the following:

- To restore shoreline functions along a segment shoreline where existing infrastructure (the BNSF railroad) has resulted in lowered beach elevations, greatly reduced sediment supplies to the beach, and isolated the beach from terrestrial plant matter and insects that contribute to important nearshore food webs. To establish the feasibility and longevity of this type of beach restoration at this site.

- To assess the economic and physical feasibility, and biological benefits of beach restoration along armored shorelines.

DISCUSSION

BACKGROUND

The need for the RBTF (which has been recently renamed Mt. Baker Terminal) project developed from changes in the aerospace industry's approach to building a new generation of aircraft by bringing components, often constructed elsewhere, to a single location (in this case, Paine Field in southwest Everett) for final assembly. The Port of Everett had a long history of transferring large containers of aircraft components from ships or barges to rail cars at the Port's Pacific Terminal, located approximately 4 miles from the rail spur leading to Paine Field. Plans to increase the size of such containers would have required extensive modifications to clearances along the BNSF mainline between the Port and the spur. Also, the increase in the number and length of shutdowns of the mainline required for such transshipments would have greatly impacted BNSF operations.

The Port worked with a variety of stakeholders to develop a plan by which oversized containers would be transferred from ocean-going vessels to

a barge in the deepwater port area, and the barge would deliver the containers to a site within ¼ mile of the spur. A new pier (the RBTF) would be built to transfer the oversized containers to rail cars for a short movement onto the spur leading up to Paine Field.

The actual effects of the pier construction on littoral ecology of the area were expected to be difficult to predict or measure (e.g., behavioral changes in the migration patterns of juvenile salmonids upon encountering the overwater structure, while moving along the shoreline). In the course of initial contacts with agency and tribal biologists, a strong interest was expressed in an experimental restoration of the existing armored shoreline over which the pier would pass as a conservation measure. The expectation was that the project would at least enhance the state of knowledge of how to restore the many such shorelines in Puget Sound, and potentially, would improve that same nearshore migration corridor that the pier would cross, as well as other ecological functions provided by gradually sloping sediment beaches vs. armored beaches.

Known and potential ecological effects of shoreline armoring are widely recognized by biologists and resource managers in Puget Sound have been well summarized by Williams and Thom (2001). Effects can include some or all of the following: beach degradation, coarsening of beach sediments, loss of sources of sediment, loss of riparian vegetation, changes in marine vegetation; any or all of these invariably result in changes in use of shorelines by fish and invertebrates. Scientists developing plans to restore depleted anadromous fish runs in Puget Sound have called for restoration of nearshore ecological function along many kilometers of Puget Sound shoreline (Shared Strategy 2007). Ecological functions can best be restored through restoration of the physical and hydrologic processes that support those functions. One major challenge to restoring these physical processes is that most of the armoring in question has been placed to protect public or private land uses.

In these areas where restoring physical processes (e.g., feeder bluffs) that form and maintain natural beaches is not possible, beach function may nonetheless be restored by other means. This paper describes a recent project constructed in Everett, Washington (Figures 1 and 2) where the objective was to rebuild the beach in front of an armored beach segment (Figure 3) to provide the full extent of foreshore, storm berm, and backshore that would be expected to occur naturally in the extant wave exposure, and given the presumed types of natural sources of sediment.

Figure 1: Aerial vicinity map; site 1 is the rail barge transfer facility location.

Figure 2: Pre-construction aerial photo detailing hardened shoreline, abandoned tank farm (right), and BNSF main line (in shadows).

Figure 3: Pre-construction photo on eastern side of proposed enhancement looking west toward abandoned tank farm.

OBJECTIVES AND METHODOLOGY

Objectives

Specific objectives of the RBTF Beach Restoration project were as follows:

- To provide physical data on the feasibility and longevity of one approach to the restoration of shoreline functions along armored reaches of Puget Sound;
- To provide biological data on the ecological functions of artificially restored beaches;
- To offset through increases in shoreline functions, potential reductions in function that might result from pier construction.

Approach

The project design included a coarse beach core with at mixed sediment beach face and a sandy backshore (Figure 4). It was expected that waves would sort the mixed sediment placed on the beach face to provide bands of predominantly sand sediment and shell that are preferred spawning habitat for forage fish. Construction of the beach restoration began in September 2005 with placement of approximately 7,100 metric tons of the beach core material, 7.6-cm minus rounded river gravel. The beach face material, approximately 6,600 metric tons of habitat mix of 3.8-cm minus sand, granules, and pebbles, was placed and graded to a 7h:1v slope; east of the pier, this work was completed in December 2005 (Figure 5); west of the pier, the beach was completed in January 2006. Approximately 2,675 metric tons of backshore sand was placed in May and June 2006. Approximately 15 cm of topsoil was added and mixed in with the sand in October 2006 to aid in establishment of backshore vegetation. All materials were brought to the site by truck and graded to the specified contours by tracked equipment.

Figure 4: Beach design concept

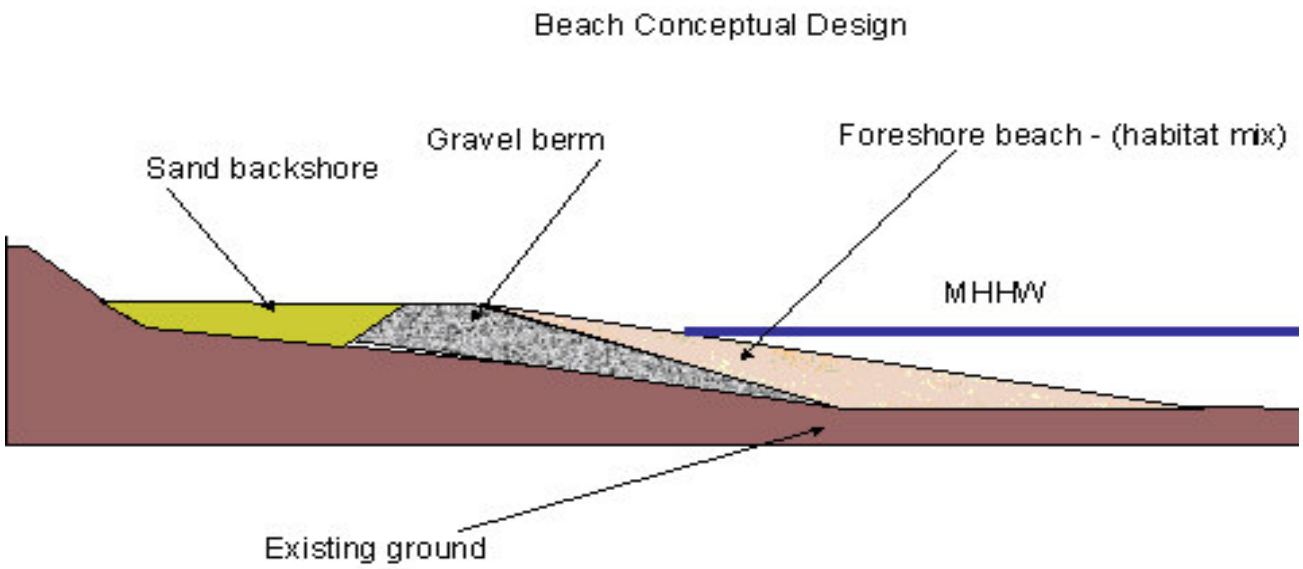

Figure 5: Completed beach east of pier, December 2005, view to west.

Monitoring

The CMMP established a 20-year program for monitoring the physical changes that the restored beach undergoes as a result of wave and current forces. The beach profile is measured on six transects and surface and sub-surface grain size is measured at specified elevations on each transect. Fixed photo points were established that will be photographed periodically through-out the monitoring. Biological performance of three marine indicators (fish use, epibenthic prey populations, and forage fish spawning) is also being monitored on the restored beach and on adjacent reference beaches. Eel-grass in the project area is also being monitored, primarily to determine the effect of the pier, but also to monitor changes in adjacent eelgrass beds that may result from the beach restoration. Biological monitoring is required in Years 1 - 3 (2006 - 2008), and then in years 5, 7, and 10.

Performance Criteria

Because this mitigation project is viewed as an experimental demonstration, performance criteria are tailored to evaluating the feasibility of this approach. Each year's monitoring data will be reviewed by an interagency adaptive management team (AMT), and future actions and requirements will be based on the recommendations of that team, which includes representatives of the scientific and regulatory community (USACOE, USFWS, NOAA Fisheries, WDFW, City of Everett, local tribes, WDNR, Ecology). The criteria for success of the beach restoration are:

- Beach profiles will not change by more than +/-1.5 foot by Year 5;
- Substrate composition along the upper beach will be suitable for forage fish spawning over a minimum of 50 percent of the beach length enhanced;

- Juvenile salmonids use on restored beach catch per unit effort (CPUE) comparable to or greater than that on the unrestored reference beach;
- Epibenthic zooplankton densities on restored beach (CPUE) comparable to or greater than that on the unrestored reference beach; and
- No net adverse impacts to eelgrass in the project area.

Benefits to Environmental Quality, Beautification, and Community Involvement

The RBTF beach restoration will yield important data that can be used to plan, design and implement additional shoreline restoration along additional areas of armored Puget Sound shorelines; this approach to restoration is expected to contribute significantly to the on-going and newly initiated efforts to restore the health of the Sound and its threatened salmonid populations. While the long-term monitoring to assess achievement of all performance criteria has not yet been conducted, quantitative and qualitative observations made in the first 18 months since project completion provide encouraging confirmation of its success.

Physical monitoring of beach stability and sediment movement (May and November 2006) showed that the larger central portion (approximately 300 m) of the restored area showed only minor redistribution of sediments and a few cm of accretion. A substantial storm berm had formed and a large number of large woody debris pieces had accumulated (Figure 5). The western end (approximately 25 m) of the reconstructed beach had lost some finer material from the surficial habitat mix. This material may have been deposited in the backshore immediately to the east and/or transported to the accreting beach face farther to the east. The east end of the restored beach, which was unconfined by terrain features, was expected to lose material to the east.

As of November 2006, the beach profile located 10 m from the end of the construction had lost approximately 1.0 m from the beach face. This material had been moved eastward by waves forming a gradual and natural-appearing transition with the unrestored beach in front of the railroad bulkhead to the east (Figure 6).

Figure 6: Transition zone between restored and unrestored beach in front of railroad bulkhead (looking east).

No significant difference has been seen between the density of epibenthic zooplankton on the project and reference beaches. Epibenthos at both beaches in April 2006 was dominated by gammarid amphipods.
Similarly, no significant difference has been seen in the mean catch of juvenile salmonids at the four locations fished with a 37-m beach seine in April and May 2006.

Numbers and length frequency of juvenile chum, coho, and Chinook salmon were quite similar between the project and reference beaches. Sand lance schools were captured in various sets at both project and reference beaches. We conclude that biological performance of the beach is largely as expected: There is high use of this shoreline near the mouth of the Snohomish River by juvenile salmonids; in the long term, habitat created may be more suitable for spawning by surf smelt than by sand lance but a single sand lance egg was found in samples from the restored beach in January 2007.

The newly restored beach provides a much more attractive shoreline than previously existed east and west of the new pier and the new public access and landscaped park facilities (to open in 2008) will provide a superior opportunity for shoreline access, enjoyment, and recreation that did not previously exist at the site.

Level of Port Involvement

Port staff were active participants in the planning, permitting, conceptual design, and construction oversight of the RBTF Beach Enhancement. In particular, the Port Executive Director, the Chief of Engineering and Planning, the Port Legal Counsel, the Port Senior Planner, and the Port's environmental consultant were integral in negotiations with Native American Tribes, and the regulatory community that paved the way for project implementation.

Creativity of the Solution

As described above, the RBTF Project contained several creative and pioneering elements:

- A beach restoration design that includes a larger grain size core to ensure the longevity of the overall project;

- Inclusion of a substantial area of backshore that is expected to provide significant riparian function;
- Active use of a multi-agency adaptive management process to assess project success and contingent actions that may include renourishment needs;
- Active dissemination of project data in the scientific community so that knowledge and experienced gained can benefit regional shoreline restoration planning;
- Integration of the habitat restoration design with public access and education – the new beach will provide substantial recreational opportunities during periods of high tide that did not previously exist at the site.

Immediate Project Benefits

As noted above, the project has shown immediate habitat benefits for a variety of invertebrates, birds, and fish, including threatened Chinook salmon. Use by juvenile salmonids observed in spring of 2006 and 2007 was at a level equal to that observed at the adjacent reference beach. It is fully expected, that the benefits provided by the project will undergo steady and long-term increases over the coming years.

Cost-Effectiveness

It is somewhat difficult to evaluate the cost-effectiveness of the beach restoration separate from the overall cost of the Rail Barge Transfer Facility. The restoration (including associated public access improvements) amounted to approximately $1.7 million of the total facility cost of $30.6 million, or approximately 4.7 percent of the total cost of the project. Inclusion of the restoration as a part of the project the Port gained the advocacy and support of the Tulalip and Suquamish Tribes, who became cooperating

agencies with the lead federal permitting agency, the Corps of Engineers. The beach restoration demonstration project also gained the strong support of other permitting agencies, including NOAA Fisheries who must evaluate for the Corps, the potential effects of the project on anadromous salmonids listed as Threatened under the Endangered Species Act (ESA).

Transferability of the Technology

This project included a number of technical elements that are highly applicable to other public port projects in Puget Sound and elsewhere in the Pacific Northwest:

- The project demonstrates a feasible approach to beach restoration waterward of armored shorelines where navigation depths are not an issue; the approach can be used as mitigation, or as a contribution to salmon and forage fish habitat restoration. This approach is transferable to other local agencies such as BNSF and Washington State Ferries, who have projects along the Puget Sound shoreline.

- Use of a regional restoration plan (the Snohomish River Basin Salmon Conservation Plan) as an endorsement to gain agency acceptance of a mitigation approach.

CONCLUSIONS

The RBTF Beach Restoration Project provided the Port of Everett with a unique opportunity to achieve several desirable outcomes:

- Completion of needed new Port facility in support of the regionally and nationally important aerospace industry;

- Establishing and maintaining a partnership with, and advocacy by treaty Indian tribes with substantial regulatory influence;

- Demonstration of an innovative approach to restoration of ecological functions, including those important to ESA-listed species, along armored shorelines where infrastructure must be preserved;
- Gaining an increased public, regulatory, and scientific awareness of the ecological stewardship of the Port; and
- Establishment of precedents for Puget Sound ports and ports in other areas to use in mitigation planning and agency negotiations to achieve solutions that are both cost-effective for ports and beneficial to important local natural resources.

PROJECT STATUS

Pier construction was completed in July 2006. Qualitative inspections have shown the physical condition of the project (slopes, elevations, substrata) to be as designed. Physical monitoring has shown less than expected rates of loss of material from the extremities and accretion of material in the central portion of the project. A high level of biological use has been documented and is expected to increase over the coming decades. A high degree of satisfaction with Port's beach restoration was expressed by local, state, and federal agency representatives at the first meeting of the AMT and during numerous site visits. Monitoring will be continued through 2026.

Figure 7: Aerial of finished park and beach.