Results
continued

rise to the high water mark. This would cause an overall circulation of water within the reflecting pool – both horizontally (north to south) and vertically (since water enters the pool near the sediment and leaves it near the water surface). The residence time for water within the pool would be 4 days, which is less than the residence time for water in Capitol Lake under current summer conditions (11 days).

Pre-Dredging of Sediment

For any of the estuary restoration alternatives, it is recommended that the main channel of the restored estuary be dredged before the tide is restored, and that the dredged materials are placed along Deschutes Parkway. This would reduce the need for dredging in Port of Olympia and associated marine facilities and cover the rock slope stabilization along Deschutes Parkway, providing additional intertidal habitat in North and Middle Basins.

If the 5th Ave. dam were removed, a new channel would form in the middle of the lake, initially eroding a large amount of sediment (predicted by the USGS Hydraulic Model). If this area is pre-dredged, the initial pulse of sediment will not end up in Budd Inlet and will not have to be dredged from the Port of Olympia and associated marine facilities. But how would the dredged sediment be disposed of?

Deschutes Parkway, along the west side of the North and Middle Basins, is constructed on roadway fill. Generally, such fill consists of gravelly sand overlaid on native soils (a mixture of loose silts, sands, and some gravel). During earthquake conditions, these native materials liquefy and spread, resulting in shallow and deep-seated slope failures, such as those seen after the 2001 Nisqually Earthquake. In order to stabilize this area in preparation for estuary restoration, significant amounts of rock would be added to weigh down and confine the soft slope.

The pre-dredge sediment could be placed over the rock that is required to stabilize Deschutes Parkway, increasing the area's habitat value. The habitat benefits would include about 5 acres of new high marsh, a rare and valuable habitat in south Puget Sound.

For Alternatives A and B, between 180,000 and 360,000 cubic yards of material would be dredged from the Middle Basin and along the main tidal channel and placed over the buttressed slope along Deschutes Parkway. This pre-dredging would cost between $8.7 and $19.8 million. The variation in cost depends on the quantity of sediment that is dredged from Middle Basin.

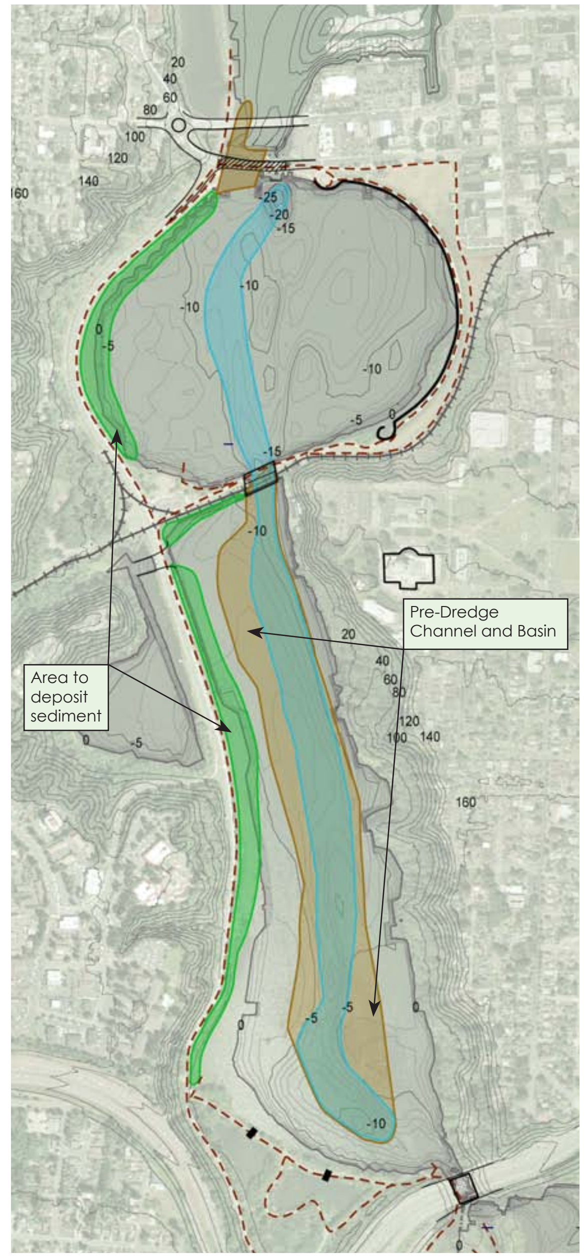

Figure 4. Areas of channel pre-dredging and slope stabilization/habitat creation along the edges of the basins.

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CAPITOL LAKE
Adaptive Management Plan

Engineering Design and Cost Estimates Report

Spring 2007

Study Background

This Fact Sheet is a summary of major findings from the Deschutes Estuary Feasibility Study. It presents information from the 3rd in a series of technical reports. The Deschutes Estuary Feasibility Study, Engineering Design and Cost Estimates report was prepared by Moffatt and Nichol (Seattle, WA), in association with EDAW, Inc. and GeoEngineers.

The full report can be downloaded from the Washington Dept. of General Administration website at: www.ga.wa.gov/CLAMP/EstuaryStudy.htm

The Deschutes Estuary Feasibility Study, Engineering Design and Cost Estimates report describes the results of an analysis of the engineering feasibility and likely cost of the three estuary restoration alternatives that are under consideration. This analysis will help evaluate the feasibility of restoring Capitol Lake to an estuary of the Deschutes River. Capitol Lake is part of the Washington State Capitol Campus and is located in Olympia and Tumwater, Washington.

This report communicates the answers to three major questions. First, how would the physical conditions in a restored estuary affect existing infrastructure, such as roads and bridges? Second, are there feasible engineering designs for each of the restoration alternatives, and does existing infrastructure require enhancements to function in a restored estuary? Third, what is the range of cost estimates for each of the restoration alternatives? To answer these questions,

Estuary Restoration Alternatives

The DEFS considers three estuary restoration alternatives. These alternatives include various modifications to the openings beneath Fifth Avenue and the Burlington Northern Santa Fe (BNSF) railroad crossing, as well as modifications to the North Basin of Capitol Lake.

- **Alternative A** includes a 500-foot opening width at the current Fifth Avenue dam, with necessary modifications to existing infrastructure. This alternative leaves the existing Fourth Avenue Bridge in place and leads to restoration of full tidal hydrology with minimum effects on current land use and infrastructure.
- **Alternative B** includes the changes in Alternative A plus an increased opening width at the BNSF railroad crossing, which is located at the division between the North and Middle Basins of Capitol Lake. The span of the current bridge is 200 feet and increasing this span is thought to improve tidal circulation and reduce hydraulic stress (e.g. scour) at this crossing.
- **Alternative D** includes the changes in Alternative A plus a split basin design. This design divides the North Basin along a north-south line, creating a reflecting pool to the east and a free flowing estuary to the west. This alternative recognizes the value of a reflecting pool for the state capitol while at the same time reconnecting the Deschutes River with Budd Inlet.

Alternative C was considered earlier in the Deschutes Estuary Feasibility Study. This design included Alternative B plus an increased opening width to Percival Cove. Alternative C was rejected because hydrodynamic modeling showed it did not cause

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Results

The preliminary conclusions of the engineering analysis are as follows.

- No fatal flaws have been identified that would rule out any of the restoration alternatives as completely infeasible from an engineering point of view.
- For any of the alternatives, it is recommended that the main channel of the restored estuary be dredged before the tide is restored, and that the dredged materials are placed along Deschutes Parkway. In addition to the habitat benefits, this would decrease the quantity of navigation dredging required at the marinas along Percival Landing and at the Port of Olympia in the years immediately following the restoration of tidal flow in the restored estuary. See back page of this Fact Sheet.
- Construction for all alternatives could be achieved within three to four years, under the assumption that only the Chinook salmon and bull trout windows for in-water work are observed.

Cost Estimates

Table 1 shows the preliminary cost estimates for each estuary restoration alternative. Ranges of costs are provided, including a minimum (most optimistic), average (most likely), and maximum (pessimistic but excluding very remote eventualities). Approximately half of the variability in project costs is associated with initial dredging of the basin and placement of the dredged materials along Deschutes Parkway to provide intertidal habitat. These figures include both the raw construction costs and "soft" costs such as engineering, permitting, and the acquisition of the project right-of-way.

	Low Cost	Avg. Cost	High Cost
Alternative A			
Construction Cost	$46.3	$53.3	$61.0
Total Project Cost	$65.9	$76.1	$87.2
Alternative B			
Construction Cost	$55.9	$63.3	$71.6
Total Project Cost	$79.6	$90.3	$102.3
Alternative D			
Construction Cost	$65.9	$74.5	$84.1
Total Project Cost	$93.8	$106.2	$120.0

Table 1. Preliminary cost estimate ranges for estuary restoration in millions of 2006 dollars.

The project costs are given in 2006 dollars, but the actual year in which the project is implemented affects the total cost of the project. An annual inflation rate of 3.5% is based on the average inflation rate experienced for construction projects between 1990 and 2005, and can be applied to the values in Table 1 to estimate how costs may change if the project is implemented in future years. This average rate can be recalculated as more recent data about average inflation rates for heavy construction becomes available.

Figure 1. Alternative A: New 5th Ave. Bridge (also included in Alternatives B and D).

New Fifth Avenue Bridge

The main element common to all alternatives is a new Fifth Avenue Bridge with a 500-foot span to allow free tidal flow. The aesthetics of the new Fourth Avenue Bridge are continued in this plan, creating an architecturally unified impression. The new bridge provides four lanes of traffic, bicycle and pedestrian lanes on each side, and crossing for all current utilities. This new configuration addresses traffic and pedestrian congestion issues that exist in the current Fifth Avenue configuration. In addition, the plan accommodates City of Olympia plans to construct a pedestrian trail along the abandoned railroad corridor. A separate pedestrian trail will pass over the bridge to downtown Olympia. Figure 1 illustrates a possible bridge and roadway alignment that would allow for a 500-foot opening and minimize effects on surrounding land use and commerce.

Resulsts *continued*

New Railroad Bridge

Alternative B includes a new railroad bridge and pedestrian bridge adjacent to Marathon Park, between the North and Middle Basins. The purpose of the new bridge would be to provide a 500-foot opening that is consistent with the opening at the entrance to Budd Inlet, assuring that the constraint to tidal flow is not simply moved "upstream" in the restored estuary.

The USGS Hydraulics and Sediment Transport Modeling report found that providing a 500-foot opening here would decrease the peak speed of tidal flow under the railroad bridge by 40%. The Engineering Design and Cost Estimates report (this report) determined, however, that the existing railroad bridge could be reinforced to withstand the increased water speed due to tidal flow without being replaced. These retrofit costs are included in Alternative A.

Figure 2. Alternative B: New railroad and pedestrian bridge.

Barrier for Reflecting Pool

The purpose of the reflecting pool barrier in Alternative D would be to provide for the uninterrupted reflection of the State Capitol. The barrier would cut across the North Basin in a generally north-south direction, preventing the water in the eastern part of the basin from emptying during low tide. A concrete pedestrian walkway would run from one shore of the North Basin to the other on top of a sheet pile wall. A sheet pile wall was chosen because creating a rubble-mound dike would take 150,000 tons of rock fill, which would present significant construction challenges and risks.

Although a freshwater pool was originally envisioned, the problems associated with maintaining water quality in a closed system proved complicated and costly; a saltwater pool refreshed by tidal action results in a more self-sustaining system. At the north end of the wall, a set of culverts with tide gates would only allow water to flow into the pool, while a similar set of culverts at the south end of the wall would only let water out. The inlet culverts would be placed low in the water, close to the sediment, while the outlet culverts would be placed about midway between mean tide level and Mean Higher High Water.

Water would flow out with the tide until it reaches a depth that is high enough to maintain the appearance of a reflecting pool. Water in the pool would stay at this depth until the incoming tide causes water to flow in through the inlet culverts and

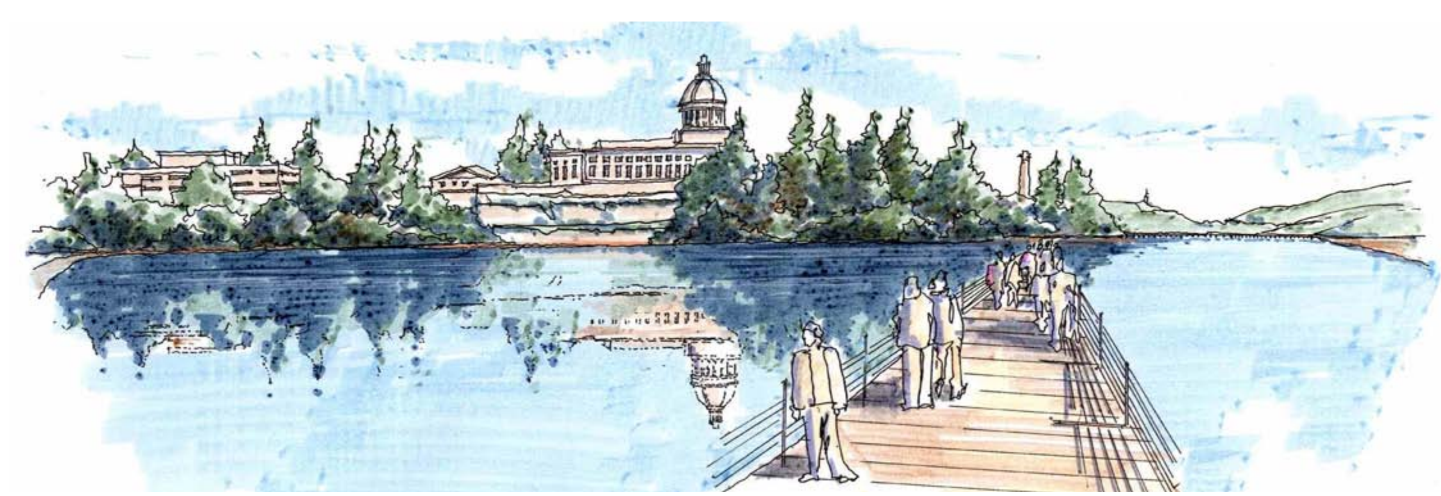

Figure 3. Alternative D: Barrier creating reflecting pool.