



# CITY OF PORTLAND ENVIRONMENTAL SERVICES



1120 SW Fifth Avenue, Room 1000, Portland, Oregon 97204 ■ Charlie Hales, Mayor ■ Dean Marriott, Director

**DATE:** February 26, 2013  
**TO:** Planning and Sustainability Commission  
**FROM:** Mike Rosen, BES  
**CC:** Eric Engstrom, BPS  
**SUBJECT:** West Hayden Island – Floodplain Mitigation

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## Context

The Portland Planning and Sustainability Commission requested staff to return at a future work session to present options for mitigation impacts to the floodplain on West Hayden Island.

The roughly 200-acre floodplain within the proposed development footprint on West Hayden Island is dynamic and covers all other habitat types on the island. Floodplains provide important riverine functions such as flood hazard mitigation, water filtration, sediment transport, nutrient cycling, habitat formation, and food web among other functions identified in the expert memos.

The floodplain includes:

- Areas that are frequently flooded and provide off-channel habitat for salmonids during seasonal high water events; and
- Areas of forested floodplain that are inundated during larger events and provide flood storage as well as multiple floodplain processes that support habitat formation and maintenance.

Hydrological modeling would determine at what intervals the floodplain on the island is inundated with the river. However, during the 1996 flood (described by the US Army Corps of Engineers in their recent modeling for the Columbia River Treaty as a 30-year event), nearly all of the floodplain in the Port's terminal footprint was inundated. For this exercise, staff assumes that full mitigation of impacts to the floodplain would mean replacing 200 acres of floodplain elsewhere in the West Hayden Island mitigation geography, and that all functions would be evaluated. Note that the 200-acre area excludes the 100-acre Dredge Material Management Area, which has been raised out of the floodplain but not mapped as such.

## Examples

BES staff researched examples of floodplain enhancement projects in the region. Below is a summary of the type of actions, the functional benefits and construction costs. Each floodplain project is unique in terms of site conditions and projects goals. Because there is so much variation, staff recommends using a range of costs instead of a single or averaged per acre cost.

1. Culvert Replacement *\$45,000 - \$100,000 per structure*
  - Benefits include increased flood storage and reduced flood hazard impacts.
  - Benefits vary depending on current function of culvert.
  - Costs vary depending on accessibility, size and replacement need (if any) of culvert.
  - Simple solution to enhance local hydrology and fish passage into floodplain habitat.
  
2. Floodgate retrofit with self-regulating structure *\$50,000 - \$178,000 per structure*
  - Benefits include increased flood storage and flood retention period, plus reduced flood hazard impacts.
  - Requires maintenance in perpetuity.
  
3. Floodplain Reconnection: Levee Breach and Setback *\$24,000 - \$313,000 per acre*
  - Benefits include unencumbered flood regime and maximum floodplain function.
  - Excellent opportunity to restore numerous floodplain habitat types: off-channel, wetland, forest, shallow water.
  - Costs vary significantly depending on location, land ownership, existing levee condition, presence of roads or utilities, and imperative of protection of adjacent land and infrastructure.
  - May require ACOE certification, as well as maintenance in perpetuity.

### **West Hayden Island Floodplain Mitigation**

Table 1 shows how these types of projects could fit into the West Hayden Island mitigation package. There are three general approaches; the numbers correspond to the example projects above:

**Alternative 1.** Keep the existing mitigation package with forest mitigation actions occurring on Government Island/West Hayden Island and wetlands and shallow water mitigation actions occurring on West Hayden Island; then add in a culvert replacement project on the north side of West Hayden Island. This would enhance existing floodplain function on the island, but not replace lost floodplain area.

**Alternative 2.** Keep the existing mitigation package as in Alternative 1, exclude the culvert work and instead add an off-site floodplain mitigation action such as a floodgate retrofit. The objective would be to replace flood storage functions, but not necessarily target habitats. This approach would spread out the mitigation across a large geography and could result in duplicative actions (e.g., frequently flood areas could provide shallow water habitat).

**Alternative 3.** This alternative would forgo the proposed mitigation package and instead complete a holistic floodplain reconnection project by breaching and removing a section of levee. Consolidate mitigation actions so that the floodplain, forest, wetland and shallow water mitigation occurs at one off-site location (a portion of the forest mitigation would still occur on WHI). Because of the dynamic nature of floodplains, target habitats would be created naturally (or engineered as part of the project). This would take advantage of natural processes and interactions between habitats and better replace the habitat mosaic being impacted on WHI.

Distance off-site from the island would require recalculation of the amount of forest, wetland and shallow water mitigation needed (please refer to the Forest Mitigation Framework for an explanation of distance modifiers). For the purposes of this exercise, it is assumed adequate shallow water and wetland mitigation can be achieved off-site in Alternative 3.

The construction costs for floodplain mitigation are estimates. Some cost estimates include design, construction, and monitoring while others are construction only. **Land costs are not included.** Costs presented for other habitat categories (shallow water, wetlands etc.) are inclusive – design, engineering, construction, and maintenance. If the mitigation actions were consolidated or co-located it could reduce the overall mitigation costs. And there are significant economies of scale with these types of projects that can also affect costs.

Mike Rosen, Manager  
Watershed Division  
City of Portland  
Bureau of Environmental Services

**Table 1. WHI Floodplain Mitigation: Alternative Mitigation Packages**

Mitigation Category	Alternative #1	Alternative #2	Alternative #3
<b>Floodplain</b>	WHI culvert replacement	off-site Floodgate Retrofit 200 acre	off-site Levee Breach ≥ 200 acre
Floodplain Functions Replaced	None replaced; some existing function enhanced	<i>hydrology only</i> replaced at 1:1 ratio off-site	Reclaim floodplain reconnection <i>hydrology &amp; habitat</i> replace floodplain at 1:1 ratio off-site replaced habitat at ≥ 1:1 ratio off-site
Floodplain Project Construction Cost	\$45,000 - \$100,000 per structure	\$50,000 - \$178,000 per structure	\$24,000 - \$313,000 per acre = \$4.8M - \$62.6M
<b>shallow water</b>	WHI on-site (\$5M)	WHI on-site (\$5M)	achieved with off-site floodplain reconnection
<b>wetlands</b>	WHI on-site (\$3.5M)	WHI on-site (\$3.5M)	achieved with off-site floodplain reconnection
<b>forests</b>	WHI & Gov Is. (\$15-25M <sup>1</sup> )	WHI & Gov Is. (\$15-25M <sup>1</sup> )	WHI on-site (\$2.7M-\$12.7M <sup>1</sup> ) & off-site floodplain reconnection (\$8.9M-18.9M <sup>1,2</sup> )
<b>grasslands</b>	off-site grant (\$1.5M)	off-site grant (\$1.5M)	off-site grant (\$1.5M)
<b>total relative cost</b>	\$25.1 - \$35.1M	\$25.1M - \$35.2M	\$17.9M - \$72M

Assumptions:

- Flow frequency and volume on WHI have not been evaluated; mitigation is based on minimum 1:1 replacement of floodplain area
- Floodplain impact is approximately 200 acres of WHI that are within active floodplain (revised acreage excludes Dredge Deposit Management Area)
- The off-site floodplain projects are within the agreed mitigation geography; no specific sites are identified
- Floodplain project costs are estimates. Some include design, construction, and monitoring. Others are construction only. Land costs are not included.
- An analysis of forest mitigation acreage has not been completed for Alternative 3

<sup>1</sup> subject to revision based on ECONorthwest economic analysis <sup>2</sup> represents approximately 350 acres floodplain forest restoration