WHI Mitigation Subcommittee
Meeting #6
April 25th, 2012

Agenda

1. Approve meeting minutes and notes

2. Review emailed materials

3. Review Port's proposal

4. Discussion

City of Portland WHI Forest Mitigation Framework

Bureau of Environmental Services and the Office of Healthy Working Rivers
Final March 22, 2012

This memorandum provides a mitigation framework for the permanent loss of floodplain forest on West Hayden Island (WHI). Some additional considerations for natural resource mitigation are included. This science-based forest mitigation approach is derived from established practices for natural resource impacts. The framework is a functional approach with the objective of "no net loss" of forest resources from development impacts. Financial costs for forest mitigation are not addressed; cost estimates can be generated based on this framework. This framework tool quantifies proposed mitigation actions on WHI and identifies the balance of remaining mitigation required to meet no net loss.

In other words, this framework and tool serve to answer the question: What mitigation is required for no net loss of floodplain forest functions from proposed WHI development?

Contents:

1. Summary of Forest & Woodland Habitat Functions from Hayden Island Natural Resources Inventory

West Hayden Island functions as one of the largest intact island habitats (830-950 acres depending on river stage) in the Lower Columbia and Willamette Rivers, third to Sauvie and Government Islands. Located on the Pacific Flyway, the island provides vital stopover and nesting habitat for birds traveling thousands of miles between North, Central, and South America. At the local scale the natural area provides a substantial north-south habitat connection between Vancouver Lake and the Smith and Bybee Wetlands Natural Area, and a habitat anchor on the Columbia River corridor. The industrial and urban landscape adjacent to the island serve to further elevate its significance within the landscape. The relatively large, unfragmented, and complex mosaic of habitats on WHI provides a range of functions and values. WHI includes emergent and herbaceous wetlands, forested wetlands, backwater channels, grasslands, interior forests, and bottomland hardwood forests and riparian habitats contiguous to beaches and shallow, open water river habitat.

WHI and the south banks of the Oregon Slough contain one of the largest remnant stands of historically abundant cottonwood-ash floodplain forests in the Lower Columbia River Basin, 548 acres in total, 480 of which is located on WHI. These riparian forests are characterized by black cottonwood, Oregon ash and Pacific willow as principal tree species. The understory is dominated by several native shrub species such as snowberry, gooseberry, dogwood and cottonwood and ash seedlings. The herbaceous layer is diverse and includes stinging nettle, sword fern, miner's lettuce, trailing blackberry, cleavers, and buttercup (*Ranunculus spp*.) among others. Invasive plant communities are established in areas exposed to more recent, frequent or ongoing disturbance; mainly along roads, trails, utility corridors and grazed areas. However, within the island's forests, the prevalence of Armenian blackberry and other invasive plant species quickly diminishes past the edge of habitat units; there are very few invasive plant species found

within the interior of the forest habitat. The forest's large size and contiguous condition provides extensive interior habitat that supports area-sensitive wildlife populations.

The island's forests provide important habitat for birds, amphibians, mammals and bats, and supply near shore aquatic communities with food and cover. Breeding and migratory bird densities in the area's riparian cottonwood forests are high. Nine at-risk* species of birds and at-risk Northern red-legged frogs use the forests on WHI. Large trees provide quality nesting habitat for birds such as bald eagles; snags and downed wood support pileated woodpeckers, white-breasted nuthatches and other wildlife. Bat surveys conducted for the *Hayden Island Natural Resources Inventory* (HINRI) revealed the presence of four at-risk bat species in the cottonwood/ash forests of WHI: California myotis, long-legged myotis, silver-haired bat and Yuma myotis.

The cottonwood/ash forest on WHI is identified as a Special Habitat Area (SHA) in the HINRI. The forest meets the following criteria: it supports myriad at-risk species, such as peregrine falcons and breeding willow flycatchers; it is a unique and rare habitat type; and it serves as a stopover and breeding ground for dozens of migratory avian species, such as Pacific-slope flycatchers, Bullock's orioles, Swainson's thrushes and yellow warblers.

Across nearly the entire forest the primary vegetation layers are present: herbaceous, shrub, sub-canopy and canopy. Standing and downed large wood provide critical structural elements for multiple plant and animal species production. A variety of wetland types are naturally integrated into the forest habitat. Land use practices that include filling the floodplain on the island have altered natural flow patterns across the landscape; however large areas of forest are still inundated several times per year. This flooding maintains key, natural habitat-forming processes within the floodplain forest of the Lower Columbia River.

The forests located along the shoreline, within, and around shoreline wetlands support 14 ESA protected populations of salmon and trout, and Pacific Eulachon, by creating and maintaining critical habitat that provides multiple functions for fish: food, rearing, resting, predator avoidance, and sediment transport/capture.

Additional functions provided by the forest on WHI: microclimate and shade, flow moderation, water storage, bank forming processes, pollution and nutrient control (carbon, nitrogen), large wood capture and recruitment to the channel, organic inputs, food web and nutrient cycling. These functions also support ESA listed fish as well as special status wildlife species.

WHI is identified as a "Conservation Opportunity Area" by the Oregon Department of Fish and Wildlife in the Oregon Conservation Strategy (OCS) due to its large size, unique position on the landscape, and multiple "strategy" (priority) habitats including riparian forests. Black Cottonwood forests like those found on WHI are specifically highlighted in the OCS due to their immense value to wildlife. The City of Portland has also identified black cottonwood floodplain forests as a Special Status Habitat.

* "at-risk" species have been identified as in decline and of conservation concern by USFWS, NOAA, ODFW, and/or the OR Biodiversity Information Center: includes threatened, endangered, candidate, concern, sensitive, imperiled, and rare species.

2. Assumptions

- Existing conditions are based on the Hayden Island Natural Resources Inventory (HINRI).
- Impacts are based on Worley Parsons Final Base Concept Plan.
- "Baseline" represents the current conditions on WHI: 480 acres of existing, mostly contiguous floodplain forest comprised primarily of ash and cottonwood within the active or historic Columbia River floodplain. Portions of the 480 acres flood several times per year. No net loss is measured against baseline.
- WHI floodplain forest is part of a unique island habitat mosaic in the river's estuary. The forest is healthy and receives a high relative rank in the NRI.

- The island's location at the confluence of the Pacific Northwest's two largest rivers adds to the unique significance of the resource.

- The goal of this mitigation is "no net loss" of bottomland floodplain forest functions, measured against baseline conditions. The mitigation methodologies outlined below provide valid frameworks to derive a "no net loss" of functions framework for floodplain forests on WHI.

- Any off site forest mitigation location will be within the active and/or historic floodplain of the Columbia River. It will be adjacent to the river channel and to wetlands and/or contain wetlands within the existing or future forest. It will receive regular (at least annual) inundation from the river; river inundation can be across the entire site or across a portion of the site.

- Any off site forest mitigation will be on a single site, not split up among multiple smaller sites.

- Any mitigation site(s) will be protected from development in perpetuity.

- This memorandum does not address recreation impacts

3. Developing the Mitigation Framework

The City's ratio approach is based on established practices in use by other agencies regulating natural resources. The City has followed this approach because there are no established mitigation methods or standards for floodplain forest in the Pacific Northwest. The ratios from existing practices have not been transposed to generate forest ratios; rather the emphasis is on how ratios change proportionally for different mitigation activities (i.e. preservation vs. enhancement), and how ratios adjust for distance from impact site, adjacency to other habitats, the quality/rarity of the resource, chance of success, and temporal loss.

4. Mitigation Terminology

The terms used in this document are based on definitions used for wetland mitigation in Publication #06-06-011a from WA Dept of Ecology, Corps, and EPA (see Documents Referenced Section 10).

Re-establishment is a form of *restoration* where habitat is fully re-established on a site where it is absent, but formerly occurred. Re-establishment includes re-introduction of hydrologic processes and vegetation that result in highly functioning habitat. This approach results in a gain in habitat acreage and an increase in functions and key ecological process provided by the habitat.

Rehabilitation is a form of *restoration* similar to e*nhancement*, but also involves improving/restoring larger scale environmental processes like flooding. This approach is used to improve existing *degraded* habitat and reaps larger benefits than enhancement. It does not increase habitat acreage, but can significantly improve function.

Enhancement is a process to improve/enhance/heighten functions of *existing functioning habitat* through invasive plant species removal and native planting. This approach does not increase habitat acreage, but modifies condition of existing vegetation structure. It does not address environmental processes like flooding.

Preservation ("Protection/Maintenance") is removing an imminent threat or cause of decline of a forest habitat. Typically completed through acquisition of land or easements. Results in net loss of habitat acreage, but can preserve multiple functions long term and prevent additional loss. Preservation includes stewardship commitment.

Creation ("Establishment") is the process of creating a habitat where is did not previously (historically) exist. This approach results in a gain in habitat acreage. *Note: This approach is not suitable for WHI forest mitigation because it implies the site would be outside the floodplain. The City assumes the mitigation location will be located within the floodplain; therefore it is not included as an option in this framework.*

Figure 1: The following diagram from Publication #06-06-11a compares this terminology with traditional mitigation terms.

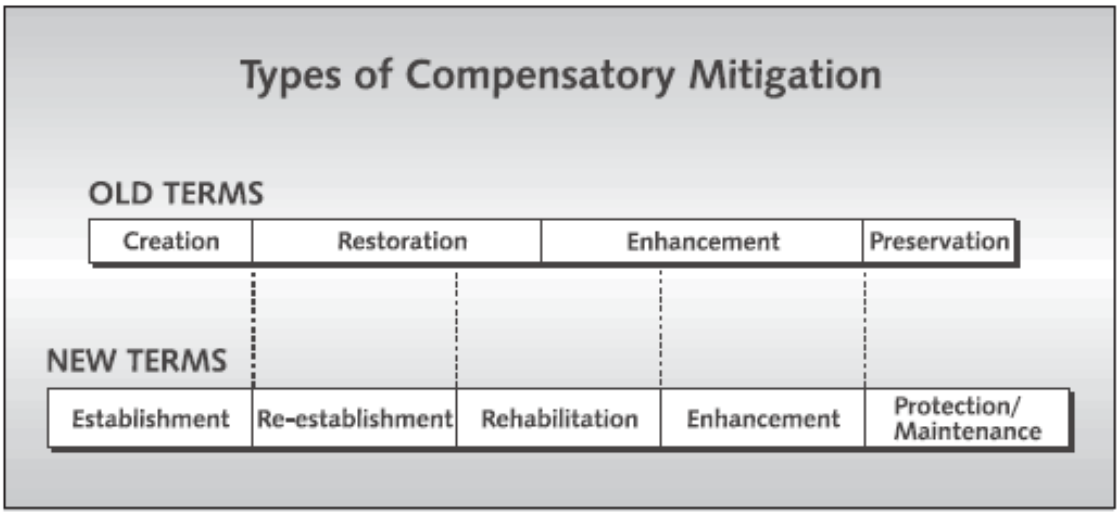


Figure 1. Old and new terms for types of compensatory mitigation.

5. Example Mitigation Programs

This section summarizes four different approaches to natural resource mitigation that are used to derive the mitigation framework.

5a. Wetland Mitigation Approach use by Washington Department of Ecology, US Army Corps of Engineers, and the US Environmental Protection Agency in Washington State

The three above agencies have adopted an approach to wetland mitigation in Washington state as detailed in Publication #06-06-011a *Wetland Mitigation in Washington State Part 1: Agency Polices and Guidance.* The various mitigation requirements (sequencing, ratios, etc.) are based on a "no net loss" of function goal. The agencies scale mitigation ratios based on type of mitigation activity, resource quality and rarity. Following the terms defined earlier, the relative ratios are summarized in this table for four mitigation methods ("Creation" is excluded because it is assumed the WHI forest mitigation site will be within the Columbia River floodplain context that currently or has historically supported this habitat type):

Table 2. Relative ratios for mitigation methods summarized from Publication #06-06-11a

lower ratios ----------→ higher ratios			
re-establishment	rehabilitation	enhancement	preservation

Example ratios from Publication #06-06-11a to show relative requirement for types of mitigation for Category II wetlands:

- Re-establishment: 3:1
- Rehabilitation 6:1
- Enhancement 12:1
- Preservation 10:1 – 20:1 (case by case)

Table 1a from Publication #06-06-011a (Appendix A) shows the framework of mitigation ratios; how these are applied varies project by project. Lower quality wetlands (Category IV, III) require lower ratios while higher quality (Category I, II) require higher ratios. Rare habitats like forested wetlands also push ratios higher (for example 6:1 to 24:1 depending on mitigation activity for forested wetlands).

The HINRI report has identified WHI floodplain forest as unique and "high" relative quality/quantity due to the river confluence location, relatively large size, contiguous interior area, and adjacency/integration of other habitats (wetlands, shallow water, grasslands, river channel) creating a diverse habitat mosaic.

5b. Wetland Mitigation Approach use by Oregon Department of State Lands

The Oregon Department of State Lands (DSL) regulates wetlands and other waters of the state. In Oregon, compensatory wetland mitigation must meet minimum replacement ratios and replace lost functions and values as determined through an approved functional assessment method. DSL's mitigation program contains several principal objectives: replacement of lost functions and values; local replacement for locally important functions and values; mitigation area should be self-sustaining with minimal long term maintenance; mitigation sites must meet suitability criteria; and projects must minimize temporal loss. The goal of DSL's principal objectives is to direct compensatory mitigation to the appropriate location and ecosystem processes that will result in successful and meaningful mitigation.

DSL requires minimum ratios for compensatory mitigation to maintain the total area of the state's resource base and to replace functions that may be size dependent. DSL uses standard mitigation terminology, including enhancement, creation, and restoration.

DSL's minimum compensatory mitigation ratio requirements for wetlands:
Restoration: 1:1
Creation: 1.5:1
Enhancement: 3:1

Although DSL guidance refers to these older terms, in practice mitigation requirements have evolved and guidance for implementing them has changed significantly. When using enhancement as a compensatory mitigation tool, the applicant must address causes of hydrologic degradation. They do not approve enhancement projects based solely on vegetation. Additionally, for enhancement projects, a "zone of influence" is identified. Enhancement credits would apply only to the areas clearly affected by a reversal of the cause of degradation.

DSL requires use of the appropriate functions and values assessment methodology for the region, hydrogeomorphic (HGM) type, and area of impact. In the Portland area, these include the HGM-based Assessment of Oregon Wetland and Riparian Sites – Willamette Valley Ecoregion - riverine impounding, slope, or flats subclasses (reference-based method) and the Oregon Rapid Wetland Assessment Protocol (ORWAP). Both of these methods are designed very specifically for wetlands and therefore of limited value in assessing the floodplain forest ecosystem, but are useful in understanding the relationship of functional assessments to the mitigation process.

The compensatory mitigation approach used by DSL employs a combination of approaches and weighting factors including ratios, function and value assessments, wetland class (in-kind requirement), site location considerations, and temporal loss.

5c. Vegetated Corridor Mitigation Requirements under Clean Water Services Environmental Review Design and Construction Standards (Chapter 3)

Clean Water Services (CWS) uses the following table to determine mitigation ratios for impacts to vegetated corridors. The ratios are for replacement (or "re-establishment", meaning a new planting where no vegetated corridor currently exists). Ratios increase with distance from impact area. Based on CWS definitions, the condition of the impact habitat on WHI is "good". The NRI has ranked the impact habitat as "high."

CWS also allows "enhancement" of existing vegetated corridors at a minimum ratio of 2:1 if all the following criteria are met: 1) proposed enhancement site is unlikely to be enhanced in the future, 2) the habitat to be enhanced is "marginal" or "degraded", and 3) the enhanced habitat is permanently protected by easement.

Table 1 – from Clean Water Services Environmental Review Design and Construction Standards

Replacement Mitigation Ratios Required for Approved Encroachments into a Vegetated Corridor

Location of Replacement Mitigation	Condition of Vegetated Corridor to be Replaced		
	Good	Marginal	Degraded
On development site:	1:1	1:1	1:1
Off-Site:			
Less than 0.25 miles from site and within same drainage basin.	1.5:1	1:1	1:1
0.25 miles or more from site and within same drainage basin.	1.75:1	1.25:1	1.25:1
Different drainage sub-basin (Drainage sub-basin must be located within the Tualatin River Basin and no further than 1 mile outside the District's Boundary).	2:1	1.5:1	1.5:1

5d. Proposed Habitat Mitigation Approaches from the WHI Mitigation and Enhancement Subcommittee

Mitigation and enhancement subcommittee member the Port of Portland has proposed a forest mitigation ratio of 1:1 with efforts focused on preservation and enhancement on-site. Metro has not proposed any specific ratios for consideration.

Portland Audubon had provided the following recommended "effective ratios" and rationale for natural resource mitigation for WHI impacts vis-à-vis the WHI Mitigation and Enhancement Subcommittee:

> "Spatial ratios and timing and time horizon would be the priority criteria. We recommend using an "effective ratio" type approach to mitigation: it essentially has multipliers both on the debit (resource impact) and the credit (resource compensation) components of the equation.
>
> Debits are weighted by the importance of the resources that will be lost (e.g., H (3:1), M (2:1), L (1:1) and the credits are weighted by the type of mitigation (e.g., restoration (1:1), creation (1.5:1) and preservation and/or enhancement (3:1). The debit side of the ratio is multiplied by the credit side of the ratio to derive a larger overall effective ratio. For example: H -Debit x Preservation Credit = 3 x 3 for an effective ratio of 9:1.
>
> Additional consideration should be given to the timing of the actions---increased credit for advance mitigation; increased mitigation for time lags. An additional package of actions should be added above and beyond these mitigation activities in order to achieve the "net increase" in ecological function. Consideration needs to be given to the fact that the function of the remaining habitat on the island will be impacted as well by the loss of complexity, loss of overall size of the natural area and disturbance factors."

The impacted forest habitat on WHI is ranked by the HINRI as "high" relative quality/quantity habitat. Re-establishment receives a higher ratio in this approach due to its increased chance of failure. Using the 3x "high" multiplier and effective ratio approach results in the following ratios:

- Rehabilitation (Restoration): 3:1
- Re-establishment (Creation): 4.5:1
- Enhancement & Preservation 9:1

6. Impacts to Floodplain Forest on WHI

Overlaying the Final Base Concept with the Hayden Island NRI results in two separate impacts to floodplain forest habitat on WHI:

1) Permanent loss of 140 acres of bottomland floodplain forest on WHI ranked as a high relative quality/quantity resource by the NRI. All of the natural resource functions provided by this 140 acres will be lost (functions were summarized earlier in Section 1).

2) Fragmentation, smaller patch size, decreased interior to edge ratio, simplification, and disturbance on the remaining 340 forest acres on WHI. This is an indirect impact of the marine industrial development, which is considered a high impact land use adjacent to a natural resource area.

    a) The existing edge of the forest stand is a "porous" edge, transitioning to the open herbaceous cover of the dredge management area, wetlands, clumps of trees and shrubs, and the beach and river channel. The new edge will be a "hard" edge with ongoing light, noise and vibration disturbance, and severely limited "porosity" for terrestrial wildlife.

    b) The resulting forest stand will be smaller with a higher ratio of edge to interior area. This will reduce interior area functions like microclimate and suitability to interior specialist wildlife species (i.e. at-risk pileated woodpeckers)

    c) The resulting stand will have reduced presence of interior wetland habitat, simplifying the forest habitat and making it unsuitable to some wildlife species like pond-breeding amphibians (i.e. at-risk northern red-legged frogs).

    d) The resulting stand will be impacted by the amount of fill required to raise the industrial development area up and out of the floodplain. This will further alter hydraulic processes on the island such as groundwater recharge, stormwater runoff, and surface water (rainfall and flood events) dispersion. Additionally, the fill footprint will further alter the flood prism in this tidal environment.

Development buffers are widely used to address adverse edge effects on sensitive habitats. A 200-foot buffer from the terminal development footprint results in an indirect impact area of 18 acres for the forest habitat. The adverse effect of the industrial land use is most severe at the initial edge and gradually decreases as the distance from development increases. As you move into the forest interior functions like microclimate emerge and edge effects like nest predation decrease. Because the edge effect is gradual across the length of the buffer, 50 percent of the acreage (nine acres) is added to the impact bringing the total forest impact to **149 acres** (see Appendix B for map of impact zone).

Because the new edge degrades intact habitat, the 18 acre indirect impact zone cannot count toward mitigation measures. In other words, actions to improve habitat within the indirect impact zone are not credited.

Inclusion of the nine indirect impact acres quantifies the adverse *edge* effects of impact #2. However, other negative effects are not addressed: reduced total interior area, smaller patch size, and stand simplification (less wetlands). These are harder to quantify and this framework does not account for these negative impacts at this time.

In ecological terms, bigger is often better. WHI forest is part of a dynamic habitat mosaic uniquely located at the confluence of the Willamette and Columbia Rivers. In a synergistic effect, WHI's large size (~900 acres) further enhances functions provided by location and natural integration of multiple habitats. Even if the impacted functions were fully replaced (to the extent possible) with an off-site ~400 acre project, there will still be a loss of synergy from the island's size, natural resources and location. In other words, two separate 450 acres islands do not provide all of the exact same functions as a single 900 acre WHI. The loss of synergistic effect is difficult to quantify and is not fully addressed in this framework.

7. City of Portland Mitigation Framework for Floodplain Forest Impacts on West Hayden Island

Table 3. The City's mitigation requirements to meet "no net loss" of forest functions are derived from the following base ratios plus or minus any relevant modifiers.

Mitigation Method	Base Ratio
Re-establishment	3:1
Rehabilitation	6:1
Enhancement	12:1
Preservation	15:1

Temporal Loss vs. Gain Modifiers: These factors address either losses or gains in available functioning habitat in the time between the impact and the full establishment of a mitigation site. In contrast to habitats like grasslands or wetlands, forest habitat has an inherently long delay in reaching full function. It is estimate that a newly planted stand of floodplain forest will take 80-100 years to reach the level of function currently provided at the WHI impact site. Full function not only relates to the height of the trees, but also to soil conditions, presence of snags and downed wood, and native shrub and sub-canopy layers of vegetation.

The current time frame for the development is 10-20 years. It is likely there will be a time lag between the impact and the creation and full function of an off-site forest mitigation project. However, it is also possible that some advanced mitigation may result in a temporal gain in habitat function. For example, a short term action that re-introduces frequent river flows into a cottonwood stand that has been disconnected from the river would create a near term improvement in function.

The base ratios incorporate temporal loss based on a mitigation project that is constructed concurrent with resource impacts. The temporal modifiers account for additional temporal loss expected with forest mitigation as well as potential temporal gains.

Table 4. These temporal ratio modifiers apply to Re-establishment, Rehabilitation, and Enhancement. *They do not apply to Preservation*. "Desired Future Condition" (or DFC) refers to the condition where a project has been fully established and is providing all the intended functions.

temporal loss	temporal gain
+ 0.1 to base ratio for each decade until desired future condition attained	- 0.5 from base ratio for every 5 years of concurrent desired future condition functions provided by advanced mitigation

On-site vs. Off-site Ratio Modifiers: On-site mitigation is often preferred by regulating agencies. However, because WHI floodplain forest is relatively healthy and high value, it has limited capacity to benefit from on-site mitigation. In order to meet no net loss, off-site mitigation will likely be required. As stated earlier, it is assumed off-site mitigation will occur within the current/historic Columbia River floodplain. The hydrogeomorphic reaches referenced in the table are delineated in the USGS Columbia River Estuary Ecosystem Classification report; reach F/6 is the Middle Tidal Flood Plain Basin and reach G/7 is the Upper Tidal Flood Plain Basin (see Documents Referenced).

Table 5. On-site and Off-site modifiers

mitigation location	base ratio modifier
on-site	divide base ratio by 1.5
0-5 miles from WHI	no change in base ratio
> 5 miles but within Columbia River Estuary hydrogeomorphic Reaches F or G	multiply base ratio by 1.5

Island Mosaic Habitat Modifier: The adjacency and natural integration of WHI's floodplain forest with shallow water, multiple wetland types, wide open herbaceous areas, and two Columbia River channels makes it significantly more valuable. This function of this island mosaic can be hard to quantify. As stated earlier, in order to maintain "no net loss" of functions provided by WHI floodplain forest, it is assumed any off-site mitigation will be located within the active and/or historic floodplain of the Columbia River. Mitigation will be on an island adjacent to the river channel and to multiple wetlands and/or contain wetlands within the forest. The site will receive regular (at least annual) inundation from the river; river inundation can be across the entire site, or across a portion of the site. *This modifier only applies to off-site.*

Table 6. Island Mosaic Modifiers

Island Mosaic	base ratio modifier
forest mitigation is on an island and naturally integrated into a diverse floodplain habitat mosaic	no change to base ratio
forest mitigation site <u>not</u> on an island, rather a stand alone habitat patch; or <u>not</u> integrated with other floodplain habitats	multiple base ratio by 1.5

Table 7 on page 12 provides a summary of base ratios and how the modifiers affect base ratios. Table 8 on page 13 provides forest mitigation requirements in acres for WHI based on a set of project-level assumptions.

8. WHI Floodplain Forest Mitigation Method Examples (for either On-site or Off-site projects)

The mitigation terms were defined earlier in Section 4; here we provide examples of how each of the mitigation methods would be applied on-the-ground for impacted floodplain forest habitat:

Re-establishment: existing condition is a site within the floodplain that has been cleared and filled: vacant land, agriculture, dilapidated residential, ball fields etc. The site was historically floodplain forest and/or wetlands. Hydrologic processes are re-introduced into the site, grading removes fill and re-establishes channels or basins, and extensive dense planting efforts establish cottonwood/ash/willow vegetation community and large downed wood is added. Functions are significantly improved and there is a gain in habitat acreage.

Rehabilitation: existing condition is a relatively healthy cottonwood/ash forest but historic hydrologic processes that have been reduced or eliminated by humans. A regular flood regime is reinstated and the forest now receives full or partial inundation during periods of high water. Vegetation enhancement activities would also be included. Functions are significantly improved, but there is no gain in habitat acreage.

Enhancement: existing condition is cottonwood/ash forest with some tree regeneration, a shrub layer that is a mix of native and non-native species. Ground covers are a mix of natives and non-natives. All the primary vegetation layers are present, but non-native cover is adversely affecting the forest. By controlling non-native plants and planting new natives at a relative low density, total native cover is increased and non-native cover is reduced. Tree regeneration is boosted. The result is forest functions are slightly improved with no gain in acreage.

Preservation: existing condition is a floodplain ash/cottonwood forest interspersed with wetlands and the river floods on a regular basis. Site is under an imminent threat and is purchased and brought into permanent conservation status. Or the land maintains same ownership, but a change in zoning and/or legal instruments bring the resource under permanent protection. A land steward is identified and funded. Functions are not improved and there is no gain in habitat acreage.

9. Other Mitigation Considerations

- This mitigation framework does not address **wetlands**, however, on WHI wetlands are naturally integrated into the floodplain forest. Mapped wetlands overlap with mapped forest and areas of forest that flood are both wetlands and non-wetlands. Restoration concepts are being considered for on-site wetlands to meet City mitigation requirements. Expansion of wetland areas by increased frequency and magnitude of flooding on WHI will likely also result in enhanced functions for floodplain forest. Should actions like these occur, they should be credited on site as "rehabilitation" mitigation activities.

- As stated earlier, the off-site forest mitigation will include a **wetland** component within or directly adjacent. Therefore, it logical to infer some wetland mitigation credit could be gained off-site.

- At-risk **northern red-legged frogs** use the floodplain forest for active season (non-breeding movement) life stages and utilize three specific interior wetlands for breeding, including the Port mitigation wetland. All of these wetlands are within the proposed development footprint and would be eliminated (see Amphibian Inventory for supporting details). Given this at-risk species severe vulnerability to this development, significant mitigation measures must be considered. Current on-site wetland mitigation concepts focus on enhancing shoreline wetlands, however these are not suitable for red-legged frog breeding requirements due to their variable hydroperiods. Mitigation for this species could take the form of newly created wetlands within the remaining forest or actions off-site. The City is consulting with regional experts to ascertain mitigation actions with the best chance of success for supporting this at-risk species.

- In the process of developing this mitigation framework, the City looked at a *draft* version of the Willamette Partnership's **functional assessment tool for Western Floodplain Habitat**. This tool was created as a join effort between Paul Adamus, Defenders of Wildlife, and the Willamette Partnership. The tool is currently in draft form and has not been formally released by the Willamette Partnership; therefore it is not available to formally incorporate in this mitigation framework.

  The rapid assessment tool examines a total of 30 indicators of various floodplain functions. The assessment assigns a score to six different categories for the user, which are then weighted for the final overall score. The six categories are; landscape context, non-invasive species, vegetation structure and distribution, flooding regime, rare species, and risk/stressors.

  Three of the six categories had a weighting factor of three, one had a weight factor of two, and two categories had no weight factor. The three most heavily weighted categories are landscape

context, flooding regime, and risk/stressors. These categories give the best indication of properly functioning processes as they relate to floodplains.

While the Western Floodplain Habitat assessment method will be a valuable tool to assist in assessing impacts and potential mitigation, it gives a relative score, so the assessment is useful as a means to inform policy decisions or to compare relative values of impact and/or mitigation sites.

- City Council Resolution #36805 called for continued planning for at least 500 acres as open space and no more than 300 acres of land for marine terminal development. The resolution referenced the Community Working Group's (CWG) project principles as guidance. One of the principles is that the project should result in a "**net increase in ecosystem functions**". This mitigation framework's objective is "no net loss". In order to meet the CWG's goal, additional actions that improve natural resources are required.

- **Preservation** of remaining habitat on site is a valid mitigation method if certain conditions are met. The action causing the preservation is the change in zoning (current is MUF-19) to open space zoning. Additional measures for permanent protection are needed such as environmental overlays, plan district code, deed restriction, agreements and/or easements.

Table 7. Summary of base ratios and modifier affects on base ratios.

Mitigation Method	**Base Ratio**	**location modifier** for on-site ÷ 1.5	**location modifier** for 0-5 miles from WHI = no change to base ratio	**location modifier** for > 5 miles from WHI x 1.5	**temporal loss & gain modifiers** = varies by project	**island mosaic modifier** site is on island and floodplain habitat mosaic = no change to base ratio	**island mosaic modifier** site is not on island or a floodplain habitat mosaic x 1.5
Re-establishment	3:1	2:1	3:1	4.5	varies	3:1	4.5
Rehabilitation	6:1	4:1	6:1	9:1	varies	6:1	9:1
Enhancement	12:1	8:1	12:1	18:1	varies	12:1	18:1
Preservation	15:1	10:1	15:1	22.5:1	varies	15:1	22.5:1

Table 8. Floodplain Forest Mitigation Package

Below is a mitigation package for forest impacts on WHI. With some project-level assumptions, the conclusion is preserving and enhancing the remaining forest on site mitigates for **51.6** impact acres, leaving a balance of **97.4** impacts acres to mitigate off-site. Therefore, actions on-site account for roughly a third of the mitigation needed. Another 390 acres of land, where re-establishment is employed, is needed to achieve no net loss.

Because a specific off-site location has not been identified, and no specific projects have been proposed on site, some assumptions have been made about how mitigation efforts will be directed. The package below is based on the Port of Portland's stated preference for mitigating on-site. It is assumed, based on conversation to date, that a mix of mitigation methods will be employed. Once on-site opportunities are exhausted, off-site mitigation could take the form of any mitigation method or a combination of methods. Re-establishment is included below for off-site and it is the preferred off-site method, as it should result in an eventual net increase in habitat acreage. Enhancement and Rehabilitation will increase functions, but not acreage. Preservation results in a net loss of acreage compared to baseline.

The impact to forests is **149 acres** (direct loss + 50% of indirect impact). The available remaining forest habitat for mitigation on WHI is 322 acres (remaining 340 – 18 indirect impact zone).

Mitigation Method	base ratio	location modifier	temporal modifier	island habitat modifier	impact acres applied to ratio	total acres mitigation required	**on-site mitigation available**	**off-site mitigation required**	impact acres mitigated out of 149 total required (% of 149)
Preservation	15:1	on-site ÷ 1.5 = 10:1	n/a	n/a for on-site	149	1,490	322		32.2 acres (22%)
Enhancement	12:1	on-site ÷ 1.5 = 8:1	gain – 1.0[a] = 7:1	n/a for on-site	116.8[b]	817.6	103[c]		19.4 acres (13%)
Remaining Mitigation:									
Re-establishment	3:1	off-site < 5 mile = no change	loss + 1.0[d] = 4:1	site is on an island = no change	97.4	390		390	97.4 acres (65%)
Other Methods to achieve off-site mitigation for the remaining 97.4 impact acres. Only **one** of these is needed, these are not additive. Re-establishment (above) is the preferred off-site method; acreages below illustrate what requirements are for other methods. Includes same assumptions about locations and timing.									
Rehabilitation	6:1	off-site < 5 mile = no change	gain – 1.0[a] = 5:1	site is on an island = no change	97.4	487		487	97.4 acres (65%)
Enhancement	12:1	off-site < 5 mile = no change	gain – 1.0[a] = 11:1	site is on an island = no change	97.4	1,071.4		1,071.4	97.4 acres (65%)
Preservation	15:1	off-site < 5 mile = no change	n/a	site is on an island = no change	97.4	1,461		1,461	97.4 acres (65%)

[a] assumes ten years to DFC for enhancement (reveg shrub layer, supplement tree regeneration, etc) and then 10 years to development impact = 10 year temporal gain.
[b] each action mitigates for part of impact and that acreage is subtracted from the next method; on-site preservation mitigated for 22% (322 of 1,490) of the requirements because only 322 acres are available. The next enhancement calculation is based on the remaining balance of 116.8 acres
[c] the HINRI vegetation inventory determined that approximately 103 acres of the remaining forest habitat would need treatment of the shrub layer for invasive Armenian Blackberry and also non-native herbaceous cover. The remaining 219 acres have either trace or no non-native cover and enhancement will not provide measurable lift in plant community composition.
[d] assumes 100 years to DFC with full function comparable to impact site

This is an example scenario that makes a set of project-level assumptions. Depending on location/project/method, acreages can be generated using base ratios and modifiers for any type of approach.

10. Documents Referenced

Oregon Department of State Lands (DSL), 2011. *A Guide to the Removal Fill Process.* Produced by the Oregon Department of State Lands, Salem, Oregon. November 2011.

Columbia River Estuary Ecosystem Classification—Concept and Application: U.S. Geological Survey Open-File Report 2011-1228, 54 p. Simenstad, C.A., Burke, J.L., O'Connor, J.E., Cannon, C., Heatwole, D.W., Ramirez, M.F., Waite, I.R., Counihan, T.D., and Jones, K.L., 2011,

Wetland Mitigation in Washington State - Part 1: Agency Policies and Guidance. Department of Ecology, U.S. Army Corps of Engineers (Seattle District), U.S. Environmental Protection Agency (Region 10). Publication # 06-06-011a. March 2006.

Hayden Island Natural Resource Inventory (HINRI) Report. Public Review Draft June 2011. City of Portland Bureau of Planning and Sustainability.

Design and Construction Standards Environmental Review Chapter 3 Sensitive Areas and Vegetated Corridors. Clean Water Services, Washington County, OR. June 2007.

Amphibians and Reptiles of West Hayden Island, Multnomah County, Oregon. Rombough Biological. Prepared for the City of Portland Bureau of Environmental Services. August 2011.

Appendix A.

Table 1a from Publication #06-06-11a (WA Ecology, Corps, EPA). Details the framework of mitigation ratios; how these are applied varies project by project. Lower quality wetlands (Category IV, III) require lower ratios while higher quality (Category I, II) require higher ratios. Rare habitats like forested wetlands also push ratios higher (for example 6:1 to 24:1 depending on mitigation activity).

Table 1a. Mitigation ratios for western Washington.

Category and Type of Wetland Impacts	Re-establishment or Creation	Rehabilitation Only[21]	Re-establishment or Creation (R/C) and Rehabilitation (RH)[21]	Re-establishment or Creation (R/C) and Enhancement (E)[21]	Enhancement Only[21]
All Category IV	1.5:1	3:1	1:1 R/C and 1:1RH	1:1 R/C and 2:1 E	6:1
All Category III	2:1	4:1	1:1 R/C and 2:1 RH	1:1 R/C and 4:1 E	8:1
Category II Estuarine	Case-by-case	4:1 Rehabilitation of an estuarine wetland	Case-by-case	Case-by-case	Case-by-case
Category II Interdunal	2:1 Compensation must be interdunal wetland	4:1 Compensation must be interdunal wetland	1:1 R/C and 2:1 RH Compensation must be interdunal wetland	Not considered an option[22]	Not considered an option[22]
All other Category II	3:1	6:1	1:1 R/C and 4:1 RH	1:1 R/C and 8:1 E	12:1
Category I Forested	6:1	12:1	1:1 R/C and 10:1 RH	1:1 R/C and 20:1 E	24:1
Category I - based on score for functions	4:1	8:1	1:1 R/C and 6:1 RH	1:1 R/C and 12:1 E	16:1
Category I Natural Heritage site	Not considered possible[23]	6:1 Rehabilitation of a Natural Heritage site	R/C Not considered possible[23]	R/C Not considered possible[23]	Case-by-case
Category I Coastal Lagoon	Not considered possible[23]	6:1 Rehabilitation of a coastal lagoon	R/C not considered possible[23]	R/C not considered possible[23]	Case-by-case
Category I Bog	Not considered possible[23]	6:1 Rehabilitation of a bog	R/C Not considered possible[23]	R/C Not considered possible[23]	Case-by-case
Category I Estuarine	Case-by-case	6:1 Rehabilitation of an estuarine wetland	Case-by-case	Case-by-case	Case-by-case
NOTE: Typical ratios for preservation are discussed in Section 6.5.5.					

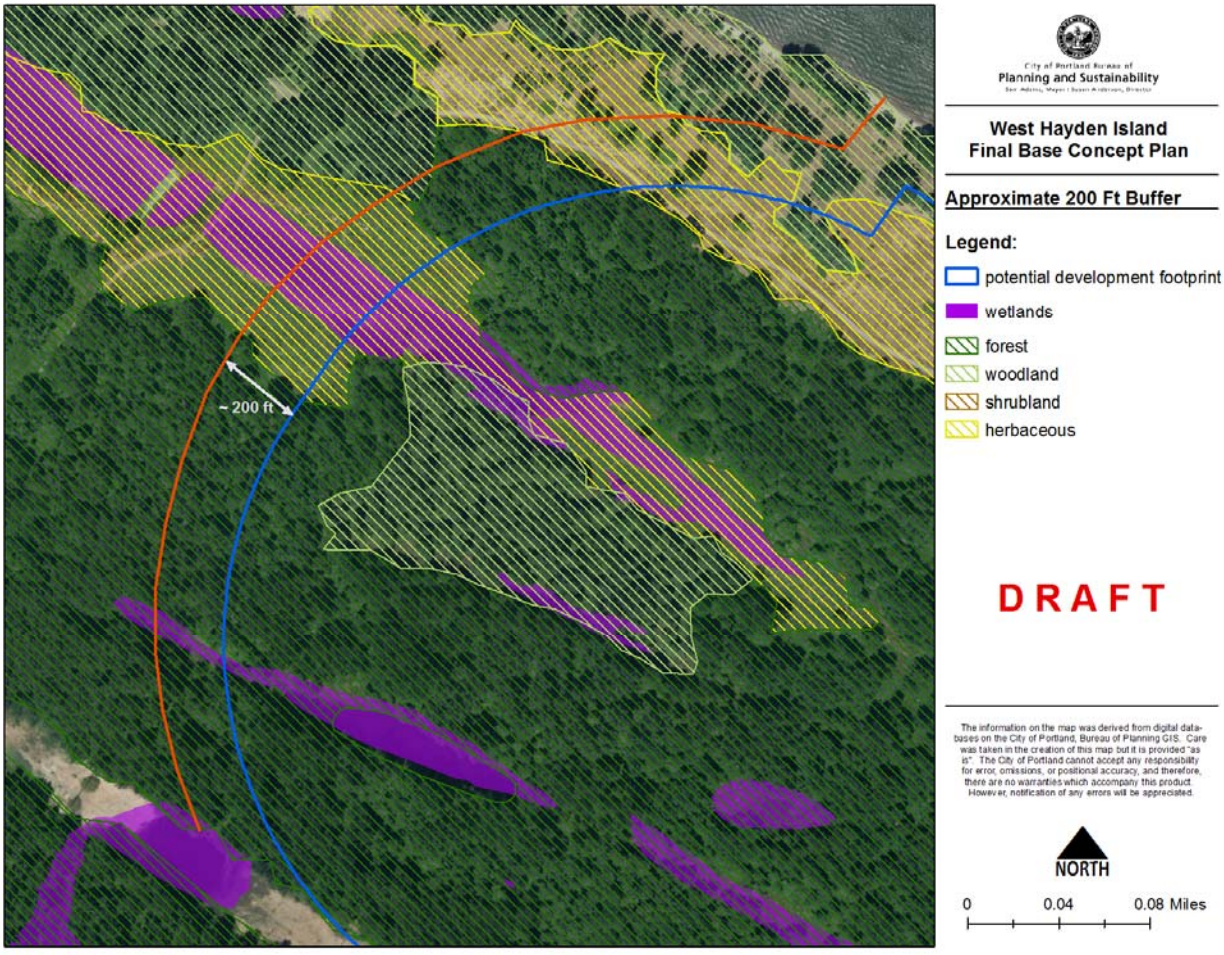
21 These ratios are based on the assumption that the rehabilitation or enhancement actions implemented represent the average degree of improvement possible for the site. Proposals to implement more effective rehabilitation or enhancement actions may result in a lower ratio, while less effective actions may result in a higher ratio. The distinction between rehabilitation and enhancement is not clear-cut. Instead, rehabilitation and enhancement actions span a continuum. Proposals that fall within the gray area between rehabilitation and enhancement will result in a ratio that lies between the ratios for rehabilitation and the ratios for enhancement (see Appendix H for further discussion).

22 Due to the dynamic nature of interdunal systems, enhancement is not considered an ecologically appropriate action.

23 Natural Heritage sites, coastal lagoons, and bogs are considered irreplaceable wetlands because they perform some functions that cannot be replaced through compensatory mitigation. Impacts to such wetlands would therefore result in a net loss of some functions no matter what kind of compensation is proposed.

Appendix B.

Map of 18 acre indirect impact zone on forest habitat.



WHI Mitigation and Enhancement Subcommittee
3/21/2012

Update Table 1: Approximate Habitat Impacts, Restoration and Costs

	City Shallow Water Habitat[1,2, 6]	Port SWH[15,22]	City Wetlands[1, 2, 3, 6]	Port Wetlands[16,22]	BPS Forest/ Woodland[1, 2, 3]	Port Forest[17]	BES Forest Functional Assessment	City Shrub[1, 2, 3]	Port Shrub[18]	City Grassy/ Sparsely Vegetated[1, 2, 3]	Port Grassy Sparsely Vegetated[19]
Habitat Impacts and Mitigation (approximate acreages)											
Existing Habitat	170		45		480	480	480	25		230	
Impacted Habitat[4]	Total = 1 Terminal = 1 Recreation = TBD	*0.34* *TBD*	Total = 10 Terminal = 10 Recreation = <1	*10.5* *TBD*	Total = 140 Terminal = 138 Recreation = 2	125.3 TBD	Total = 149 Direct = 140 Buffer Impacts = 18 (50%) [24]	Total = 5 Terminal = 5 Recreation = <1	*21* *TBD*	Total = 125 Terminal = 123 Recreation = 2	*93.8 barren weedy fill* *TBD*
Mitigation Ratios[5]	2:1 – 5:1	*1:1 - 3:1*	2:1 – 3:1 [7]	*1:1 - 6:1* [16]	2:1 – 3:1	1:1	3:1 - 15:1	1:1	*0:1*	1.2:1	*1:1 for grassland*
Mitigation Needed	2 - 5	*est 0.34 - 1*	20 - 30	*est 27.8* [16]	280 – 420	500 acres protection, plus enhancement	See Below	5	*0*	150	*TBD*
On-Island Habitat Mitigation Opportunity[4]	195		35		340		322 [25]	18		100	
On-Island and Off-Island Mitigation (approximate acreages)											
On-Island Habitat Mitigation[9]	2 - 5		20 - 30		340		322 of protection 103 of enhancement	0 [8]		0 [10]	
Off-Island Mitigation[9]	0		0		80 pruchase and enhancement		390 of re-establishment	0		150 [10]	
On-Island Surplus Habitat	190		15 - 5		0		0	18		0	
Mitigation Cost Estimates[19,20]											
Mitigation Costs/sq ft	$22.50 - $66.00 [11, 12]	*$41.32*	$3.20 - $45.00 [11, 12]	*$1.15 -$6.90*	$1.35 - $10.00 [13]	$0.32 - $1.20	$1.35 - $10.00	NA	*$0*	$0.17 - $1.00	*$0.23*
On-Island Mitigation Costs	$5 M [14]	*$600k - $1.8M*	$3.5 M [14]	*$1.4 - $8.3*	$1.7 M over 30 yrs	$9M Protection	$1.7 M over 30 yrs	NA	*0*	$0	*TBD*
Off-Island Mitigation Costs	$0		$0		$23.3 M	Enhancement Projects	$23 M (high cost 169 M; median $73 M)	NA	*0*	$1M - $6.5M	*0*
Total Mitigation Costs	$5M	*$600k - $1.8M*	$3.5 M	*$1.4 - $8.3*	$25 M	TBD	$25 M	NA[9]	*0*	$1M - $6M	*TBD*
OS Valuation					$4 M	$9M					
OS Credit					$22M off-site - $4M OS Value = $19.3 M off-site						

1. Shallow water habitat includes the area below ordinary high water (20ft NAVD88) that was mapped as wetland, forest, woodland, shrubland or grassland in the Hayden Island Natural Resources Inventory based on August 2010 aerial photography. This does not include area within the main river channel as mapped based on August 2010 aerial photography.
2. The floodplain overlaps all habitat types; the floodplain is not reported separately.
3. In the case where wetlands overlap forest, woodland, shrubland or grassy/sparsely vegetated lands, wetlands supersede for the purpose of calculating mitigation needs.
4. Acreages based on the Worley Parsons Final Base Concept Plan, previously called A2 (February 2012).
5. Subject to further discussion. There is disagreement about what the ratios should be. These are intended to provide a ballpark of how much mitigation may be needed.

6. Final mitigation for the shallow water and wetland impacts would be determined by a state and federal process with City participation, which would involve a more specific assessment of functional impacts and the amount of functional lift provided by the specific mitigation proposed.
7. The Port Mitigation Wetland will likely be impacted by development. Mitigating for a mitigation wetland usually carries a higher ratio. In addition, the mitigation wetland is breeding ground for red-legged frog, which could impact the ratio as well.
8. The City is not proposing to require shrubland mitigation. Shrubby vegetation would be included within the forest area enhancements and therefore the costs is captured in the forest mitigation costs.
9. The City used the higher ratio to determine mitigation needs on and off-island.
10. The City suggests that all mitigation for impacts to sparsely vegetated/grassland areas be performed on Government Island because A) much of the grassland mitigation opportunity areas are also where recreation is likely to occur; and B) coupling WHI mitigation with Airport Futures mitigation would take advantage of economies of scale.

11. The upper range of the costs includes actions like removing groins or encountering unexpected material underground (e.g. boat hulls or burial grounds). The lower range includes costs for excavating sandy material.
12. Markups include engineering, permitting, etc. and can vary a great deal depending on the complexity of the project.
13. Forest enhancements like removing invasive and planting native plants would be included in the low range. The upper range would include actions like amending the soil.
14. Using the highest ratio and the lowest cost estimates
15. Estimates do not include dock shading impacts. The Portland Harbor Feasibility Study places estimates for in-water mitigation at $1 to $2 million per acre. A local bank is selling in water credits for approximately $1.8 million per acre.
16. Wetland mitigation ratios are: Restoration 1:1, Creation 1.5:1, Enhancement 3:1, and mitigation for the mitigation site is 2 * ratio. This results in a mitigation commitment ranging from 12.5 acres to 42.5 acres. Costs range from $50k/acre to $300k/acre for construction costs or local mitigation banks ($150-180k/credit). There are no local banks available at this time within the service area (assume local credits would be in the range of $200 to $250k/credit). A conceptual mitigation project includes 22.7 acres of restoration (1:1) plus 5.1 aces of enhancement (3.1). A specific project would match impacts and regulations and methods at the time of development.
17. Cost estimates are based on a recent project on Government Island tree planting project estimate for $14k/acre.

18. The Port has not identified any costs associated with Shrub habitat due to the fact that the impacted habitat is predominantly blackberries and other invasives. In addition, this type of habitat has not been a requirement of City mitigation in the past to our knowledge.
19. Grassland cost estimates are derived from the first phase of the Airport Futures Government Island grassland project. This project is costing $500k/50 acres over 8 years. It is difficult for the Port to discuss the "Grassy Sparsely Vegetated" type since this is not an NRI category. No grassland was present in the City's NRI data. The Port's NRI also does not show any grassland in the development footprint. The Port is interested in restoring existing grasslands on the island.
20. Port costs do not include land costs, on-going maintenance, compliance costs, or other on-going costs such as security, property management, and the like.
21. Port costs are in today's dollars
22. A conceptual mitigation project for state and federal compensatory mitigation for wetlands and shallow water habitat impacts. The construction cost estimate was approximately $7M. Estimated operating, maintenance, and compliance monitoring costs for the resulting site are estimated to be $110/year.
23. Advanced mitigation needs to be creditted
24. There are 18 acres of forest/woodland vegetation location within 200 ft of the hard edge of development. The development will impacts resources within the buffer (e.g. light, noise, vibration). To account for this 50% of the 18 acres are inclued in the total impact acres.
25. The 18 acres within the 200 ft buffer cannot be counted towards on-site mitigation because the functions provided by those 18 acres will be diminished by impacts from the development (e.g. lighting, noise, vibration). The buffer must be maintain to prevent impacts from encroaching further into the remaining resource area.

Bureau of Planning and Sustainability
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WHI Mitigation and Enhancement
City Draft Term Sheet
3-23-12

Note: The costs come from a memo summarizing Tetra Tech's restoration information, a letter to Planning and Sustainability Commission (River Plan), costs provided by the Port at the WHI Subcommittee meetings, costs provided by the Lower Columbia Estuary Project, and a peer review of restoration projects summarized by WorelyParsons. The costs below represent a conglomeration of the source data and include design, permitting, site preparation, construction, a contingency and long term (~30 years) operating and maintenance.

1. Shallow Water Habitat (designated critical habitat for 14 ESA-protected fish populations)
    a. Restore and enhance 5 acres in and around Benson pond to mitigate for the approximately 1 acre of terminal impacts to SWH (using a ratio of 5:1)
        i. Recreational impacts and mitigation would be determined through a future master planning process
    b. The cost will be about $5M
        i. 5 acres x $1M/acre
    c. This is the city's minimum expectation to compensate for impacts and should be used to begin a discussion with state and federal agencies (see 6.a below)

2. Wetlands
    a. Restore and enhance 25 acres of wetland (using an ratio of 2.5:1)
        i. Increase the extent of and frequency of flooding at the Benson Pond wetland complex;
        ii. Modify connection between Benson Pond and North Improve and enhance the vegetative composition of North Wetland; and
        iii. Choose 1-2 smaller interior wetlands (no surface connection to Columbia River) to re-create red-legged frog habitat.
    b. The cost will be about $3.5M
        i. 25 acres x $139K/acre
    c. This is the city's minimum expectation to compensate for impacts and should be used to begin a discussion with state and federal agencies (see 6.a below)

3. Grasslands (western meadowlark habitat)
    a. Enhance 200 acres of grassland, all at one site on an estuarine island (using a ratio of 2 : 1) OR
    b. Re-establish 150 acres of new grassland habitat, all at one site located on an estuarine island (using a ratio of 1.2 : 1)
    c. Specify the location and actions within the IGA or provide the money to a 3rd party to find the site and do the work
    d. Total cost $1.5M
        i. 150 acres x $100K/acre

4. Forest and Woodland
    a. Invest $1.7M over 30 years to enhance and maintain the 340 acres of forest functions through invasive removal and native plantings where appropriate
        i. Year 1-5: $1,730/acre
        ii. Year 5-30: $250/acre
    b. Provide lump sum of $23 M to a 3rd party to re-establish floodplain forest at one estuarine islands site within the acceptable geography (see 5.d)

5. OS Valuation
    a. The value of the 380 acres of Port-owned land, with an OS zone, would be $33M based on market rate of approximately $2/sq ft for urban open space land.
    b. City assumes that the value of the land as highly-encumbered MUF with SEC overlay is slightly more than $33M,

i. This recognizes that the land currently has an environmental zone applied to it, it is within the 100 year floodplain and there are no urban services (sewer, water, etc.)

c. To estimate the decreased value of going from the current highly-encumbered MUF w/ SEC to OS we assume that the value as MUF/SEC is 10% greater than the value as OS or $3.3M
d. To account for this decrease in value, instead of contributing $23.3M for off-site forest/woodland enhancement and restoration, the Port would contribute $19 M

6. Other Terms
    a. Port begins talks with state/feds/city by 2017 to pursue an agreement for early mitigation for shallow water and wetland impacts.
        i. The mitigation outlined in 1 and 2 should be used as a starting point for those discussions.
        ii. The city would actively participate in the discussion but would not issue land use permits for impacts to shallow water habitat or wetlands within the 300 acres. The only permits required within the 300 acres would be through the state and federal processes.
    b. All mitigation and enhancement actions will be at least 5 years in advance of terminal development
    c. If the mitigation off-site is able to protect, restore or enhance all habitat types in one location (the mosaic approach), for example in places like Deer Island, then the total off-site mitigation acreage/costs could be reduced.
    d. Permanent protection will evolve over time from OS zoning to an easement (or similar tool), with specific milestones (dates or actions) that trigger changes in protection

Conclusions

1. $13.5 M to be spent on-site for habitat restoration and enhancement
    a. $1.7 M forest/woodland
    b. $8.5 M on shallow water habitat and wetlands (final to be determined through state/federal permitting process)

2. $20.5 M to be spent on off-site habitat restoration and enhancement
    a. $1.5 M on grasslands
    b. $19 M on forest/woodland