ENVIRONMENTAL SERVICES
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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.

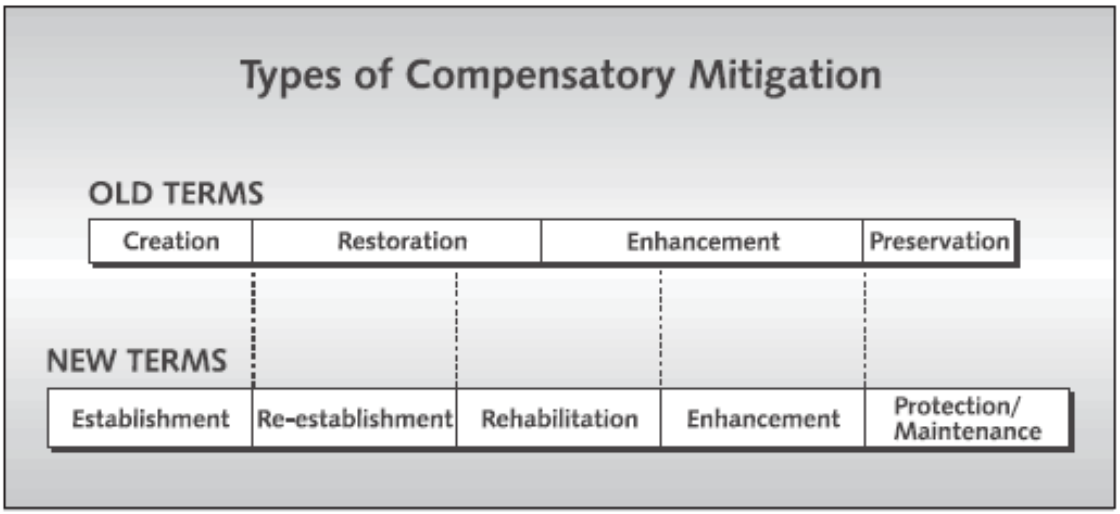

Figure 1. Old and new terms for types of compensatory mitigation.

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

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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.

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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.					

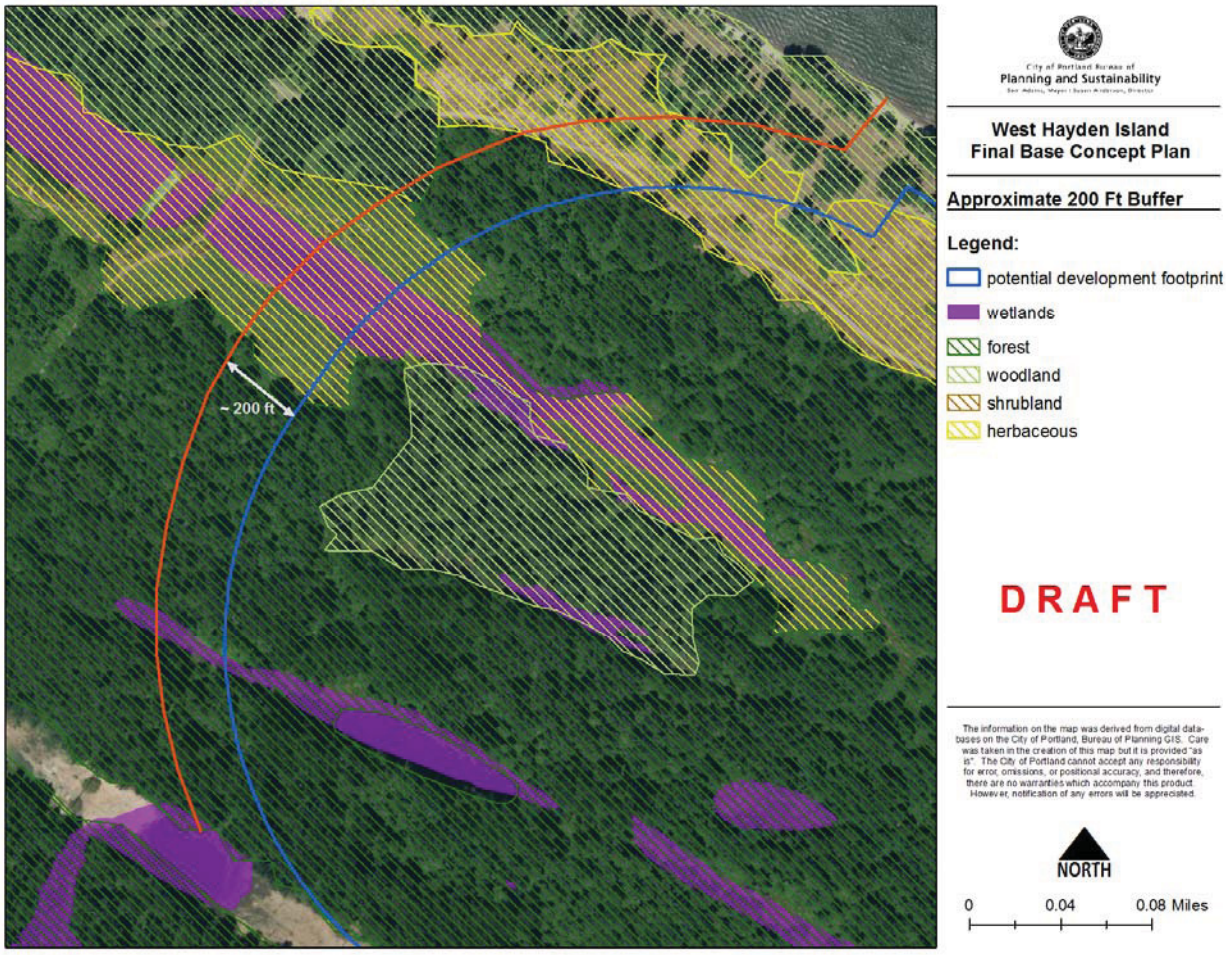
21 These ratios are based on the assumption that the rehabilitation or enhancement actions implemented represent the average degree of improvement possible for the site. Proposals to implement more effective rehabilitation or enhancement actions may result in a lower ratio, while less effective actions 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.


~ 200 ft
City of Portland Bureau of
Planning and Sustainability
West Hayden Island
Final Base Concept Plan
Approximate 200 Ft Buffer
Legend:
potential development footprint
wetlands
forest
woodland
shrubland
herbaceous
DRAFT
The information on the map was derived from digital data-bases on the City of Portland, Bureau of Planning GIS. Care was taken in the creation of this map but it is provided "as is". The City of Portland cannot accept any responsibility for error, omissions, or positional accuracy, and therefore, there are no warranties which accompany this product. However, notification of any errors will be appreciated.
NORTH
0
0.04
0.08 Miles

ADDENDUM
CITY OF PORTLAND WHI FOREST MITIGATION FRAMEWORK
August 16, 2012

This document provides background documentation for the City of Portland's West Hayden Island (WHI) Forest Mitigation Framework (hereafter referred to as the "framework"). The framework was provided to the WHI mitigation sub-committee on March 22, 2012. This Addendum is in response to inquires from the Port of Portland requesting documentation on the development and rationale behind the framework. Please refer to the framework for full details.

The framework was developed as a flexible tool to quantify a variety of mitigation proposals aimed at replacing the permanent loss of high functioning, high quality floodplain forest currently present on WHI. Note that the framework only addresses the floodplain forest habitat type; other riverine habitats are also impacted by this proposed development and addressed using different methods.

The City's framework was developed specifically for WHI forests and tailored to specific functions provided by the site and what would be required to replace those features and functions. Evaluating projects on a case by case basis in light of conditions on the ground is an approach shared by nearly all regulatory agencies.

Contents

1.0 Goal of Mitigation

It's important to state that the City's goal for floodplain forest mitigation is to replace the entire suite of functions that the existing forest conditions on WHI currently provide. In other words, mitigation will have been fulfilled when the unique suite of ecological functions provided by WHI forest is replaced. The City's framework quantifies what it will take to bring the floodplain forest ecosystem back up to its existing baseline function (or no-net-loss). It is possible to quantify this because the science we have drawn from to develop the framework is based on this concept.

The Portland City Council resolution cited the Community Work Group's goal of a "net gain in ecosystem function" as guidance for the annexation project. City staff have operationalized this goal into two steps. The first step is in-kind replacement of natural resource features and functions. In-kind replacement brings the ecosystem functions back to baseline conditions. The second step is to pursue additional ecosystem enhancements that will provide a gain in function. The second step can be everything from additional tree plantings, to more acres of wetland creation, to retrofitting a building with a habitat roof. By setting a benchmark in the framework for returning floodplain forests back to baseline (step one), it's logical that "net gain" for floodplain forests can be defined as additional effort above and beyond this threshold.

2.0 Existing Conditions

The framework starts by defining the existing conditions in the WHI forest. This becomes the benchmark for determining how much mitigation is necessary to return to the baseline condition.

The existing floodplain forests on WHI are a high quality example of a rare type of habitat in the Lower Columbia River. The WHI forest represents 4% of the total floodplain forest between the Bonneville Dam and the Pacific Ocean. The dominant trees are black cottonwood and Oregon ash; some of the trees within the impact zone are at least 150 years old. Extensive characterization of WHI habitats are found in the *Hayden Island Natural Resources Inventory* (HINRI, 2012) as well as two supplemental memos on forest conditions (BES, 2012 and BES, 2011). City staff and contractors collectively spent hundreds of hours on the ground on WHI studying this resource. The HINRI identifies the floodplain forest as a Special Habitat Area that provides high relative rank riparian corridor functions. A narrative description of ecological functions provided by the floodplain forest is provided in section 1 of the framework.

In summary, five of the primary attributes of WHI floodplain forests are:

a) **Scale** – The large size of the WHI forest is very important. Many species prefer or are dependent on large habitats with interior areas that are not heavily impacted by edge effects and surrounding noise, light, vibration, etc. These large habitats are increasing rare in our fragmented landscapes.

b) **Location** – WHI is uniquely located at the confluence of the two largest rivers in our region. Confluence sites like this provide tremendous value for terrestrial as well as

aquatic species. Its proximity to urbanization also creates a riverine habitat oasis for fish and wildlife species in the Metro area.

c) **Age** – The forested area proposed for impact is at least 100 years old. It includes some Oregon ash trees that are at least 150 years old. Few sites in the Lower Columbia have ash trees this old; this provides unique conditions for plants and wildlife that are difficult, if not impossible, to replicate (BES, 2012). The older age fosters unique features like soil conditions and dead wood that wildlife need.

d) **Rarity** – The bottomland cottonwood/ash floodplain forest covering most of WHI is a high quality example of a rare habitat type in the Northwest. This forest type only occurs in large riverine floodplains and is disappearing from our ecosystems. This finding is consistent with multiple assessments by other agencies.

e) **Health & Complexity** – Within the Lower Columbia River estuary, WHI is a relatively healthy floodplain habitat. The canopy is essentially completely native trees. Portions of the site – including those with minimal invasive cover - are considered "reference condition" by experienced ecologists for this habitat. This is due to the presence of all the primary native vegetation layers, varied age classes, vegetation regeneration, deep leaf litter, and standing/downed wood. The health of the forest is reflected by the presence of 13 at-risk terrestrial wildlife species.

Findings by other natural resources agencies support the City's conclusion that WHI forests are unique and high value. Below is a list of designations specifically for WHI as well as designations for the type of forest habitat found on WHI.

2.1 Designations for WHI Highlighting Ecological Importance

a) The Oregon Department of Fish and Wildlife (ODFW) has identified and mapped WHI as a **Conservation Opportunity Area** (COA) within the state (ODFW, 2009). COAs are defined in Oregon as "those areas where the likelihood of successful conservation is strongest, and the conservation needs of wildlife and their habitats would be best met" (ODFW, 2005). COAs are selected through a three step process of computerized site selection, validation of the results using expert opinion, and peer review. WHI meets COA criteria because it supports priority habitats and species and is extremely valuable on a local and regional landscape context as a riverine island that connects both terrestrial and aquatic ecological systems (S. Barnes, pers. comm.).

b) **ODFW Category 1 or 2 habitat:** ODFW has a comprehensive habitat mitigation policy that is applicable to state owned lands on WHI and includes habitat categories and associated mitigation goals and strategies (Oregon Administrative Rule 635-415-0000 – 635-415-0025). Category 1 is defined as irreplaceable, essential and limited and the mitigation goal is no loss of habitat quantity or quality. The mitigation strategy for Category 1 is avoidance. Category 2 is defined as essential and limited with the mitigation goal of no net loss of habitat quantity or quality and to provide a net benefit of habitat quantity or quality. The mitigation strategy for Category 2 is in-kind and in-proximity. As a member of the WHI Public Advisory Committee, ODFW has made preliminary category determinations for habitats on WHI (ODFW, 2011).

ODFW's preliminary determination is Category 1 or 2 for WHI's mature riparian bottomland forest; Category 2 for wetlands and shallow water; and Category 2 to 4 for the dredge deposit management area. Its is very significant that ODFW is considering a Category 1 determination for forests while other habitats such as wetlands and shallow water fall into Category 2. This is primarily due to the forest's age, size, health and location. In the ODFW policy Category 1 is irreplaceable habitat with a mitigation policy of avoidance.

c) NOAA Fisheries has identified the shorelines of WHI as **Critical Habitat** for 11 ESA-listed Columbia River salmon and steelhead, as well as the Columbia Eulachon. Floodplain forests on WHI provide both direct and indirect benefits to these listed taxa.

d) WHI is identified as a **Habitat of Concern** (HOC) in Metro's 2005 Inventory of Regionally Significant Habitat. The HOC designation is a tool used in Metro's inventory to identify unique, rare or declining habitats not captured by their riparian GIS model. The following HOC criteria are relevant to WHI: island, connectivity corridor, and rare habitat type: bottomland hardwood forests (floodplain forests).

e) WHI is also ranked as **Riparian/Wildlife Class 1** combined relative resource ranking in Metro's Inventory of Regionally Significant Habitat. Class 1 is the highest rank and signifies that a habitat is providing the full suite of ecological functions associated with riparian habitat. This includes microclimate and shade, sediment, pollution and nutrient cycling flow moderation, large wood dynamics, wildlife habitat, and other important functions (Metro, 2005).

The above designations refer to WHI specifically. In addition to site level evaluations, the type of forest habitat found on WHI has been identified in multiple regional conservation plans. Depending on the context, this habitat is referred to as floodplain forest, cottonwood gallery, bottomland hardwood forest, or bottomland riparian. The habitat type can also be described more specifically as plant communities or associations at various scales.

f) **Priority Habitat** by Partners in Flight, a coalition biologists and ornithologists from research organizations, academia, the Bureau of Land Management, US Forest Service, and the US fish and Wildlife Service. Oregon/Washington PIF have identified riparian deciduous woodlands such as those on WHI as a Priority Habitat in their plan for the lowlands of Oregon and Washington. Features and conditions considered important within this habitat: large canopy trees, sub-canopy/tall shrub foliage, dense understory, snags, and large, structurally diverse patches. All are present within WHI forests. PIF has set several biological targets for this habitat including maintaining existing stands, maintain existing contiguous tracts > 50 acres, and retaining all cottonwoods > 22 inch diameter breast height (PIF, 2000).

g) **High Priority Plant Association/Ecological Element** in the Oregon Natural Areas Plan, produced by the Oregon Biodiversity Information Center at PSU's Institute for Natural Resources. In the Willamette Valley Ecoregion, the plan has identified riparian areas comprised of Oregon ash, black cottonwood, and snowberry as a high priority (the highest rank) ecosystem element or plant association. The dominant

native shrubs in WHI forests are red-osier dogwood and snowberry. The primary factor driving the ranking in the state plan is the risk that the plant community will disappear from the landscape. Risk is assessed base on rarity, threats, ecological fragility, and the "adequacy and viability of protected occurrences" (ONHAC, 2010).

h) ODFW identified riparian habitats a **Strategy Habitat** in the Oregon Conservation Strategy (OCS) (ODFW, 2005). Strategy habitats are habitats in decline and are a major focus of the state's conservation planning and priorities. Floodplain forests are a special type of riparian habitat are specifically called out in the OCS for their immense value to wildlife. ODFW describes cottonwood forests such as those on WHI as a **keystone habitat**, meaning they "have a large impact on the ecosystem relative to their abundance on the landscape." (ODFW, 2005)

3.0 Development of Base Forest Mitigation Ratios & Modifiers

The purpose of the City's framework is to provide a sound mechanism for evaluating a range of forest mitigation proposals. The framework provides flexibility and options by mixing and matching types of mitigation, different geographies, and different timeframes.

There is no established methodology in place to quantify compensatory mitigation of impacts to estuarine island floodplain forest habitat. Therefore, in order to develop a mitigation framework, staff turned to existing best practices in the region for natural resource mitigation. The first step was to select programs with parallel conditions and extrapolate best practices to produce a sound, defensible approach. Staff reviewed a number of agency programs and built the approach on science-based principles. Extensive documentation of the approach is detailed in the framework document.

One of the programs with an approach applicable to WHI is the Washington State Department of Ecology (DOE) wetland mitigation program (Washington Department of Ecology, 2006). Certain core elements of the program are relevant and transferable to WHI floodplain forests, such as consideration for the rarity of the habitat and the level of effort needed for different mitigation activities (preservation vs. enhancement vs. new plantings). DOE is required to use best available science and their program was jointly developed with the US EPA and US Army Corps. Extensive documentation and rationale for principles that are applied to WHI can be found in the DOE background documents. The DOE approach has undergone comprehensive peer review, has been formally adopted, and it is now an established best practice in mitigation.

An essential element of the DOE program is the relationship among types of mitigation. Mitigation actions including re-establishment, enhancement and preservation do not provide equal ecological benefit per unit of area. The DOE approach provides a consistent, science-based, and extensively reviewed method to address these differences. Using re-establishment as a starting point, the DOE formula states that rehabilitation requires twice the area for of that re-establishment, and enhancement requires four times more area than re-establishment. Preservation necessitates an independent set of ratios.

Natural resource mitigation seeks to replace natural features that are lost to development. Re-establishment is a form of mitigation where an area that was formerly habitat is converted back into habitat thereby adding new habitat area to ecosystem. Other forms of

mitigation such as enhancement or rehabilitation improve upon existing habitats to increase or enhance ecological functions. With an enhancement/rehabilitation approach, the end result from development is less total habitat area, but the remaining habitat is improved. See *Definitions* below for additional explanation and refer to Sections 4 and 8 of the framework.

The DOE formula is essential because a mix of methods has been and continues to be part of the various mitigation proposals for WHI forests. Ultimately, this allows for flexibility with different options to achieve compensatory mitigation.

In the process of determining appropriate and adequate mitigation, the DOE guidance clearly emphasizes that each project should be evaluated on a case by case basis. Consideration should be given to the specific impact and how any proposed mitigation will compensate. The following factors are some of those considered when evaluating mitigation and are relevant to WHI:

- The quality of the impacted resource
- Any unique, rare or important functions that will be lost
- Location (many factors, including wildlife corridors)
- Time it will take to replace lost functions
- Experience of the implementing entity

DOE provides a set of mitigation ratios in table 1a (included in the framework and here again as Attachment A). The ratio table addresses quality of habitat impacted and type of mitigation action undertaken. DOE guidance is clear that these are not prescriptive for all projects, but used as a starting point with consideration of factors (including the above list) that will change ratios:

> "In addition to the risk of failure and the temporal loss, a higher or lower mitigation ratio may be required based on the nature and effectiveness of the mitigation itself and tradeoffs associated with out-of-kind and off-site mitigation." – Washington Department of Ecology, 2006

When the City developed the framework, there was no specific mitigation proposed. The City started with appropriate base ratios and then added multipliers for distance and the unique functions provided by an island and habitat mosaic at the Willamette/Columbia River confluence. The City also included an additive factor for time. This allowed the City to define geographic limits of mitigation and evaluate any potential proposal.

It is important to understand that in the framework that the City uses, the starting point is the base ratio for re-establishment; all other ratios are generated from that number. In order to select a set of base ratios, the City evaluated table 1a and selected the ratios for Category II wetlands (3:1 re-establishment, 6:1 rehabilitation, 12:1 enhancement). These are the starting points that the modifiers apply to. Starting with base ratios and adjusting them for project specific factors is entirely consistent with the DOE approach.

The DOE uses a category system to rate wetlands. Category I is the highest value, Category II is high quality, Category III is considered average or typical, and Category IV is low quality and degraded. Because WHI floodplain forest is a high quality, rare and unique natural resource, the City determined the second category was a reasonable parallel condition.

The rationale for ratios that are higher than 1:1 is provided in the DOE guidance document as well as DOE's Appendix 8-F to Wetlands in Washington State Volume 2 (Granger, 2005). Essentially, at a minimum mitigation ratios need to account for temporal loss and risk of failure. Research has shown that high rates of failure and gaps in time have resulted in less than 1:1 replacement of wetland resources. Adding a factor of 1 for each is considered minimally adequate as a starting point on any mitigation project. This brings the base ratio for re-establishment up to 3:1, which is the number used for Category II in the DOE framework. Because of the long time horizon for desired forest conditions to develop, and the need to credit advanced mitigation, the frameworks includes a temporal modifier (described later).

The DOE ratios assume the level of function provided by the mitigation site is equal to that provided by the impact site. This is an essential element because it ensures equal replacement of lost ecological functions.

3.1 Risk of Failure Removed From Base Ratios

During the process of evaluating the Port's initial Government Island proposal, Port staff communicated to City staff that due to the Port's successful track record with mitigation, risk of failure should not be applied to their proposal. City staff agreed and removed risk of failure from the base ratios. The revised, lower base ratios are: 2:1 re-establishment, 4:1 rehabilitation, 8:1 enhancement. This effectively dropped the base ratio to Category III in the DOE framework, reflecting wetland resources that are considered average or typical.

Table 3 contains all the revised ratios and modifiers used in the City's framework and is included as Attachment C.

3.2 Definitions

The City of Portland developed the framework specifically to address the loss of high functioning floodplain forest on WHI. In a mitigation arena where multiple methods of mitigation are proposed, it's essential to define types of mitigation. The City saw benefit in the definitions used by the DOE, the Corps and EPA in the DOE guidance document. The definitions separate activities in a clear way that is transferable to floodplain forests. Because different mitigations actions do not provide equal ecological benefit per unit area, the DOE guidance links ratios to each category of mitigation.

In order to make the definitions most useful in a floodplain forest context, the City adapted the language to the site and habitat type. However, the principle of the definition remained completely intact as it was carried over to the framework. The different methods each have a ratio, which allows for flexibility in proposals and a clear, consistent way to quantify mitigation when methods are combined.

Definitions are included in Section 4 on page 3 of the framework. For further clarity, the framework also includes example projects under each mitigation definition (Section 8 page 9).

To add additional clarity on this topic, the principle differences between the primary four methods are summarized:

- **Re-establishment** is the act of creating new habitat in a place that was former habitat. Most importantly, this results in a gain in habitat area (acreage).

- **Rehabilitation** is the reintroduction of environmental processes into an existing degraded habitat. This provides significant functional lift, but does not produce a gain in habitat area (acreage). In the WHI context, this would be introducing or increasing the extent and/or frequency of flooding into an existing forest stand that has been disconnected from the river. Rehabilitation has not been proposed thus far in the WHI process.

- **Enhancement** is the act of improving structural conditions (usually vegetation) in an existing degraded habitat. This provides some functional lift, but less than rehabilitation. It does not produce a gain in habitat area (acreage).

- **Preservation** reduces the risk of additional habitat removal in the future. However, it does not produce a gain in habitat area (acreage). Preserving the remaining WHI forest is an appropriate mitigation method; however, this action does not contribute towards replacing lost functions.

4.0 Unique Attributes of WHI Location

West Hayden Island is a unique location at the confluence of the Willamette and Columbia Rivers; this is supported by the following ecological and biological examples. These attributes reflect the rationale behind prioritization of on-site and in-proximity mitigation, and the increase in effort required for off-site mitigation. For fish and wildlife species, staff focus here on at-risk species and ESA-listed fish. For the purposes of the City framework, these can be considered surrogates for the hundreds of resident and migratory species that depend on the Confluence area. This is not a complete list, but illustrative of the types of functions the framework seeks to replace.

> "Acceptable compensation (whether on-site or off-site) should be a part of a network or *corridor* connecting significant habitat areas or other open space areas whenever possible. When evaluating proposals, agencies keep in mind the natural patterns and corridors in the watershed. As described earlier, rivers and streams function as freeways for the movement of wildlife, water, sediments, and nutrients. Where applicable, compensatory mitigation should contribute to and preserve these corridors to support and maintain the functions of the watershed." – Washington Department of Ecology, 2006

a) Upper Willamette River (UWR) basin juvenile Chinook use the shorelines of WHI. The near shore floodplain forests on WHI provide a direct benefit to these fish. Interior floodplain forests on the island have an indirect - but significant - relationship with the high quality salmonid habitat along the shore. Recent genetic analysis of juvenile salmon and steelhead use of near shore habitat on WHI indicates a strong presence of UWR Chinook. In contrast, these fish found have not been found to venture further up the Columbia River in any significant numbers. Sampling around the perimeter of Hayden Island yielded an UWR Chinook catch rate of 24% of 273 individuals (NWFSC 2009). Sampling at the mouth of the

Sandy River yielded a much smaller presence of UWR Chinook, with 6% of 426 individuals (Sather, 2009). However, it's not possible to determine if these UWR Chinook arrived at the Sandy from the Willamette or if they are from genetic stock used in past hatchery practices (Gregory, 2012). A statement from Port consultant ENVIRON on fish use at Government Island is consistent with this fact (Port of Portland, 2012). Because the Chinook found around Hayden have a higher likelihood of natal ties to habitat in the Upper Willamette, it is expected that mitigating damages to Hayden Island habitat much further upstream of the Willamette-Columbia confluence will not produce a direct benefit to these ESA-listed fish.

b) Situated at the confluence of the Willamette and Columbia, WHI serves an ecological nexus for the two largest river basins in the Northwest. At-risk Northern red-legged frogs provide a good example of how this serves a specific species. WHI supports a reproducing population of these frogs. Their center of activity on WHI is the cluster of small interior wetlands in the middle of the island surrounded by the oldest stand of cottonwood and ash forest. The wetlands provide egg laying sites, the forest canopy and deep leaf litter provides cool moist active season habitat. Generally, these frogs can be expected to live out their entire lives on WHI. However, from time to time, some will leave WHI to seek out new habitats and others will arrive at WHI to occupy the site.

Under current existing conditions, the WHI population has easy access to both the Willamette and Columbia Rivers. Columbia and Willamette frogs can recruit to the island and WHI frogs can disperse to either basin. This facilitates genetic exchange between to the two major basins, bolstering genetic diversity and promoting species viability.

The preferred development footprint on WHI eliminates the majority of the Northern red-legged frog habitat on the Island. When this Northern red-legged frog population is severely impacted, the best chance to replicate this unique function is to provide on-site or in-proximity habitat replacement. A mitigation project any distance upstream on the Willamette or in either direction on the Columbia will not provide the same critical linkage between basins.

c) Bald eagles provide a similar example to Northern red-legged frogs of how WHI serves as an "ecological crossroads." Or, one might say a "hub" on a wildlife corridor network. This species relies on large trees and forests along major river corridors for nesting, roosting, hunting, and perching. Multiple pairs nest along the Willamette River in Portland and distribution continues south into the valley concentrated along the main stem Willamette River. The Lower Columbia also provides a major habitat corridor and is home to one of the densest populations of eagles in the Northwest. WHI, situated at the junction of these two major eagle corridors, provides excellent eagle habitat. When forested habitat is lost on WHI, in-proximity mitigation provides the best chance to replicate this "service" to two major eagle populations/corridors.

At the local site scale, forested habitat on WHI provides nesting and roosting opportunities with access to high quality foraging areas at Smith and Bybee wetlands, Vancouver Bottoms, on Sauvie Island, and along both Columbia and Willamette river channels.

Eagles provide a good example of how WHI lies at in the intersection of two major fish and wildlife corridors. Hundreds of species in addition to eagles utilize these corridors, many traveling hundreds of miles along them. Mitigating with high quality habitat in close proximity to the confluence will preserve unique ecological functions provided at this

corridor intersection. This is consistent with the goal of addressing natural patterns on the landscape and preserving fish and wildlife corridor functions.

d) At a Metro regional scale WHI is an integral part of a fish and wildlife habitat complex found at the confluence of the Willamette and Columbia Rivers. It provides a north-south link between the Smith and Bybee Wetlands and the Willamette River to the south and Shillapoo Wildlife Area, Vancouver Lake and Ridgefield NWR to the north. WHI also provides an east-west link between Government Island and Portland Airport to the east and Sauvie Island to the west. WHI lies at the center of this "Confluence Complex."

What does this mean exactly? Neotropical migratory songbirds can serve as an illustrative example. In the spring, these migrants are moving north from the tropics, some will stop in the metro area on sites like WHI to breed and others will push farther north. This group includes orioles, warblers, vireos, flycatchers, martins and other species. On a typical day in early May these neotropical migrants are moving north along the Willamette river corridor and Willamette bluff. They use both urban habitats and natural areas. As they move along, they key into larger habitat patches and tend to concentrate and linger at them. After Willamette bluff, they will move through Smith and Bybee wetlands and then on to extensive forest habitat on WHI. After WHI, they will continue north through Vancouver bottoms, on to Sauvie Island and Ridgefield NWR.

Once the habitat is lost on WHI, the best chance to replicate or "re-build" this integral part of the "Confluence Complex" is to provide in-proximity habitat mitigation. A natural area like Government Island will also support similar neotropical migrants in migration, but it does not provide the same integral link within a cluster of habitat at the Willamette/Columbia River confluence.

In terms of selecting location for mitigation, the DOE guidance states:

> "compensation should occur in a location where the targeted functions can be reasonably performed and sustained…" - Washington Department of Ecology, 2006

Because WHI performs unique functions related to the Willamette/Columbia River confluence, it's logical that mitigation should occur on-site (ideal) or in close proximity to the confluence. Increased effort is required for off-proximity mitigation actions in order to replace the features and functions lost.

4.1 In-Proximity vs. Off-Proximity

In the process of evaluating potential locations for WHI forest mitigation, it's important to define geographies and understand how they relate to mitigation goals. To be most effective, mitigation is evaluated on a project specific basis. This is consistent among agency approaches. Oregon Department of Fish and Wildlife (ODFW) has developed a comprehensive habitat mitigation policy that is applicable to WHI and includes definitions that assist in delineating geographic boundaries (Oregon Administrative Rule 635-415-0000 – 635-415-0025). The following definitions and guidance were provided by ODFW biologist Susan Barnes and are directly applicable to WHI wildlife and their habitats (ODFW, 2001):

In-Proximity

"In-Proximity Habitat Mitigation" refers to mitigation measures that are completed within, or in proximity to the area affected by a development action. The policy defines "in proximity" to mean within the same home range or watershed (depending on the species or population being considered) of the species or population being impacted by the development. The choice between a watershed or home range should be based on which scale has the highest likelihood to benefit the species or population that is directly affected by the activity. The intent is that mitigation sites be chosen such that the greatest possible benefit to fish and wildlife can be achieved, but also so that the eventual benefits are provided to the impacted population. Choosing the appropriate scale for siting mitigation should include consideration for the mobility of the species of concern. For mobile species, it is acceptable to site mitigation projects farther away from the project site if it is reasonably expected that the population using the project site will eventually utilize the mitigation site. If the primary species affected by the development has low mobility, it will be necessary to locate mitigation activities on, or in very close proximity to the project site.

Off-Proximity

"Off -Proximity Habitat Mitigation" refers to mitigation measures that are completed outside the area required for in-proximity mitigation, but within the physiographic province of the development action. This standard provides flexibility to allow for the maximum potential benefits of mitigation to fish and wildlife species to be realized through site selection. Where off-proximity mitigation is acceptable, project proponents would be allowed to identify potential mitigation sites that are most suitable to habitat replacement. These sites must still be within the province of the project, though.

Among the hundreds of wildlife species using WHI, the HINRI has documented 13 terrestrial at-risk species or "species of concern" that use the floodplain forest habitat. These include nine birds, four bats, and one amphibian.

As outlined by the above in-proximity definition, a choice should be made between a watershed scale and a home range scale with consideration for less mobile species. Following the guidance in the definition, less mobile at-risk species home ranges should define in-proximity area in order to ensure "the eventual benefits are provided to the impacted population."

The intent of using home range criteria to delineate in-proximity geography is to ensure the impacted local population will be able to move to and colonize the replacement habitat. The distance they can be expected to move is defined by their home range. In other words, when a development impact removes habitat and the new, replacement habitat is located within the target species home range, then they would hypothetically be able to move to the new habitat. In practice, this often means locating mitigation on the project site, or in very close proximity.

With regards to watershed scale, WHI is positioned at the "bottom" of the Columbia River watershed in the broad, historic floodplain at the confluence with the Willamette River and its floodplain. The Columbia watershed is a vast area including multiple western states and British Columbia; obviously this watershed scale is not appropriate for WHI mitigation.

The City framework requires that any mitigation be within the Columbia River historic floodplain and limited to the two USGS defined reaches: Middle Tidal Flood Plain Basin and

Upper Tidal Flood Plain Basin (Simenstad, 2011). This geography is consistent with the Columbia River corridor portion of the fifth field HUC (10 digit: 1709001202). This extends downstream to the mouth of the Lewis River and upstream to Reed Island, which is just upstream from the mouth of the Sandy River. This area includes the Willamette River from its mouth to Multnomah Channel.

Viable on-site mitigation is the preferred approach by the City of Portland as well as other regulatory agencies. However, on WHI the remaining acreage outside the development footprint is comprised of high quality forests and other habitats with limited area and capacity to accommodate forest mitigation. There are some opportunities for forest enhancement on-site and the City supports pursuing these.

From a practical standpoint, onsite work is limited and cannot provide adequate mitigation for forest impacts. Therefore, the City framework assumes the most likely and beneficial location for mitigation is off WHI, but within proximity to the Willamette River confluence. Preserving this proximity allows the chance to replicate unique ecological functions provided by WHI's location, including support for at-risk species.

The City defines in-proximity as off WHI, but within five miles. Five miles was originally chosen to maintain a close proximity to the mouth of the Willamette River and based on best professional judgment of the habitat requirements of the overall assemblage of species found on the island. Following ODFW definitions and guidance, the City assessed home ranges for at-risk species with variable mobility and determined that a five mile range for in-proximity was appropriate.

Some of the 13 at-risk species in WHI forests are highly mobile while others are not. Northern red-legged frogs and white-breasted nuthatches ("slender-billed") have limited mobility and serve to help define in-proximity. Both are year round residents on WHI and have been documented to breed there. White-breasted nuthatch home ranges are 25-37 acres and a pair will spend all year within that territory (Grubb, 2008). Northern red-legged frogs are also year round residents on the island, breeding in wetlands and moving into adjacent forest where soil moisture is suitable (Rombough, 2011). Aside from occasional immigration or exodus, individual frogs will spend their entire lives on WHI.

In contrast breeding band-tailed pigeons are highly mobile and may move as much as 30 miles in a day during the breeding season (Sanders, 2006). However, ODFW guidance stipulates that the lowest mobility species should delineate in-proximity mitigation. Depending on the distance, it feasible that low mobility at-risk species (white-breasted nuthatch and Northern red-legged frog) may be able to colonize a very close proximity mitigation site from WHI.

It's more certain that more mobile at-risk species would be able to utilize an in-proximity site within five miles. Bald eagle breeding home ranges in the Lower Columbia Estuary average 8.38 *square miles* (Issacs and Anthony, 2006). This equates to 1.63 mile radius from a nest or center point of a circle. Therefore an in-proximity site within five miles would likely accommodate a WHI eagle's breeding home range, but an off-proximity site beyond five miles clearly would not. Although the eagle home range could justify a tighter distance than 5 miles, other ecological functions associated with confluence operate at a larger scale (corridor connection, assemblages of species and habitats). To best capture the suite of functions, the geographic limit for in-proximity is set at five miles.

Consistent with the ODFW definitions, off-proximity is then defined as greater than five miles from WHI.

4.2 Distance Modifier

WHI provides a singularly unique location at the confluence of two major Northwest rivers. Location of mitigation is a key consideration. The objective of the distance modifier is to provide a flexible geography in which to complete mitigation while adequately addressing how ecological function changes with location. It is an established best practice in natural resource mitigation that on-site ratios are lower and off-site ratios are higher.

Recognizing the limits of on-site forest mitigation, the framework adopts a three tiered geographic approach: on-site, in-proximity (within 5 miles of WHI), and off-proximity (> 5 miles, but within the two USGS defined Columbia River reaches). The intent of the in-proximity area is to maintain the influence of the river confluence area and the unique ecological functions associated with it. In-proximity mitigation also seeks to accommodate at-risk wildlife species with limited mobility per the ODFW guidance.

Table 1. The framework ratios relative to distance.

Mitigation Method	base ratio	on-site (base ratio ÷ 1.5)	in-proximity 0-5 mile from WHI (no multiplier)	off-proximity > 5 miles from WHI (base ratio x 1.5)
Re-establishment	2:1	1.3:1	2:1	3:1
Rehabilitation	4:1	2.6:1	4:1	6:1
Enhancement	8:1	5.3:1	8:1	12:1
Preservation	15:1	10:1	15:1	22.5:1

Anticipating that in-proximity is the best and most likely location for replacement of unique ecological functions, the base ratios for the framework are applied to in-proximity mitigation. The base ratios are then divided by 1.5 for onsite work. The objective for the on-site credit is to *prioritize and incentivize* mitigation on WHI with low ratios (i.e. 1.3:1 for re-establishment). To achieve a comparable effect for off-proximity, the base ratios are multiplied by 1.5. The intent of the off-proximity multiplier is to address limited mobility for certain at-risk wildlife species and recognize that unique functions associated with the confluence cannot be replaced.

The 1.5 multiplier is derived in part from Clean Water Services' (CWS) vegetated corridor mitigation requirements (CWS, 2007). The CWS program has refined and improved its approach for over a decade and is now an established best practice for regional mitigation. CSW's ratio table is included as Attachment B (and on page 6 of the City's framework). They

identify 4 distinct geographies related to drainage basins and ratios increase as one moves away from the impact site. CWS uses an additive factor to increase ratios as distance increases. The additive factors are larger for higher quality habitat (this is consistent with the DOE approach in that higher quality habitats warrant increased mitigation) The CWS ratio table and modifiers only address a single type of mitigation (re-establishment).

In evaluating the CWS approach, the City opted to use a modest multiplier for distance, rather than an additive factor. As mentioned earlier, an essential element of the City framework is the proportional relationship between mitigation methods and their associated ratios. An additive factor would unequally or disproportionally affect the ratios for different mitigation methods. A low multiplier of 1.5 maintains a simple, logical progression of ratios as the mitigation moves from on-site to in-proximity to off-proximity. For re-establishment the sequence is 1.3:1 for onsite, 2:1 for in-proximity, and 3:1 for off-proximity. The 1.5 multiplier also allows the framework to utilize a set of ratios for preservation that are within the acceptable range of 10:1 to 20:1 identified by the DOE. For preservation, the sequence is 10:1 for on-site, 15:1 for in-proximity, and 22.5:1 for off-proximity. Most importantly, the distance multiplier preserves the proportional relationship between mitigation methods.

5.0 Unique Ecological Functions Provided by Old Age of Impacted Stand

A review of aerial photography dating back to 1935 establishes the age of the impacted floodplain stand. The 1935 image (Attachment D) shows the forest stand with the same linear depressions that are wetlands within the forest today. The 1935 image also shows some small gaps in the canopy at the east end of the impact zone (east of the current dredge area). These gaps can be seen progressively filling in to their current full condition in later aerial photographs (i.e. 1948, 1977).

If one conservatively assumes the trees in the 1935 image are only 20 years old, then the vast majority of the stand is at least 100 years old. Using historic this historic imagery and on the ground surveys, staff therefore conservatively assume that the impact stand is 100 years old for the purposes of mitigation. Many of the unique ecological functions provided by the forest are derived from its advanced age and the conditions that it supports. Therefore 100 years is the time horizon for a newly planted stand to develop the target functions that are provided today.

The floodplain forest that will be lost on WHI contains some Oregon ash trees that are at least 150 years old. Oregon ash trees this old have previously been documented from only a few sites along the Lower Columbia River (BES, 2012). In addition to rare “old growth” Oregon ash specimens, the age and overall complexity of WHI impact forests provide unique conditions/functions that are the target for mitigation. Per the definition of temporal loss (below), mitigation is not complete until these target functions are provided. Unique conditions result from the presence of all the primary native vegetation layers, varied age classes, vegetation regeneration, deep leaf litter, and standing/downed wood. The health of the forest is reflected by the presence of 13 at-risk terrestrial wildlife species. A few examples of at-risk species follow; these can be considered surrogates (or “umbrella species”) for the hundreds of plants and animals that occur on WHI.

On WHI terrestrial dispersal of Northern red-legged frogs is concentrated in the older stand of trees that will be lost to development. This central stand on the island is older than forests to the west and south. As a result, the forest floor has a deeper, more developed layer of leaf litter that retains soil moisture better than younger stands where faster draining sandier soils are found. This older forest also surrounds the wetlands the frogs are using for egg laying. Because Northern red-legged frogs lack the ability to burrow or climb, they are restricted to moist soil surfaces (Rombough, 2011 & Rombough pers. comm.). This species can be expected to use the younger dryer stands on WHI during periods of active precipitation. However, the fact that they shun the younger stands on WHI (approx 60-70 years old) highlights the fact on a local riverine island with similar soils suitable conditions will not develop in a forest mitigation site for at least 100 years.

Bald eagles provide another example of how the advanced age of a forest provides critical functions. While many ecological functions are provided by a cottonwood tree as it matures, bald eagles in Oregon build nests in trees that are 42 – 67.2 inches diameter at breast height (dbh), or 3.5 - 5.6 feet in diameter (Issacs and Anthony, 2006). The City's memo on tree age documents several Oregon ash and black cottonwoods within the impact zone that are greater than four feet in diameter. Under typical conditions, a nine year old black cottonwood is about 7 inches dbh and a 60 year old is about 24-30 inches dbh (SWCA, 2007). As a forest mitigation site develops, Bald eagles will not able to utilize newly planted trees as nest sites until they are in the range of 80 to 100 years old.

Once cottonwood and ash trees have developed to full maturity, they will slowly senesce and convert into snags, then fall down and provide downed wood on the forest floor. Along with larger, older live trees, at-risk pileated woodpeckers rely on these snags and downed wood for nest and forage sites. Downed wood on the forest floor also provides microclimates utilized by many other organisms. Similarly, in older growth phases cottonwood and ash tree bark develops deep groves and interstitial spaces that are used by bats as roost sites (and many other organisms). At-risk bats also rely on cavities in old trees and hollowed out snags as roost habitat.

In summary, very large live trees and senescent elements (leaf litter, snags, downed wood) of a mature forest provide critical functions for at-risk wildlife species and these are some of the target functions for WHI forest mitigation. In other words, the mitigation site will not be ready for species of concern to "move in" for about 100 years.

5.1 Time Modifier

Best practices in natural resource mitigation mandate that mitigation must be tailored to specific project impacts. The permanent loss of area and specific functions inform the goals of project level mitigation. In addition to location, a consideration of timing is also essential.

> **Definition of temporal loss**
> "Temporal loss is the loss of functions between the time an impact occurs and the time the functions are re-established. In the context of wetland mitigation, it is the loss of functions that occurs between the time functions are lost at an impact site and the time those functions are fully replaced at a mitigation site." - Washington Department of Ecology, 2006

For WHI floodplain forest, many of the unique functions provided are a result of the advanced age of the impact stand. The long gap in time it will take for these conditions to develop at a mitigation site justify an additional consideration for temporal loss in the mitigation ratio. A mechanism to credit advanced mitigation is also needed.

- "Increases in mitigation ratios are appropriate under the following circumstances:
    - A long time will elapse between the loss of wetland functions at the impact site and establishment of wetland functions at the mitigation site.

- Reductions in mitigation ratios are appropriate under the following circumstances:
    - The proposed actions for compensation are conducted in advance of the impact and are shown to be successful."

- Washington Department of Ecology, 2006

DOE guidance emphasizes the mitigation ratios provided are starting point on which to evaluate mitigation needs. Factors such as the time horizon to attain desired replacement functions should be considered. As described earlier, the greater than 1:1 base ratios include a minimum consideration for temporal loss (Granger, 2005). However mitigation for a mature floodplain forest will take longer to develop than a typical wetland mitigation project, therefore an additional temporal factor is warranted. This approach is supported by the increase ratio in DOE table 1a for Category I forest wetlands which is 6:1 for re-establishment. This is a 50% increase over other Category I resources and twice that for Category II. The 6:1 forested wetland ratio in table 1a is 3 times what the City is using as re-establishment ratio for the framework (2:1). The 6:1 ratio is justifiable in the DOE guidance because forested wetlands are rare and they take longer to develop than other vegetation communities. Both of these concepts also hold true for WHI floodplain forests.

Another consideration with the temporal modifier is that floodplain forest *enhancement* actions will achieve desired functions much faster than re-establishment actions. Forest treatments that control invasive understory, re-establish a native shrub component, and inter plant native tree saplings are widely and successfully implemented in our region. If these enhancement actions are implemented well in advance of the impact, there is an opportunity to provide concurrent function where the mitigation site is fully functional prior to impact providing a temporal gain. This is the case with proposed forest enhancements and they are credited as temporal gains in the City's evaluation.

If floodplain forest re-establishment is implemented in advance there is a chance to reduce the temporal loss, but realistically its not possible completely eliminate the temporal loss. The framework is designed to credit advanced mitigation in this manner and credits have been applied to the proposed Government Island plantings based on the schedule provided by the Port.

The temporal modifier is additive and not a multiplier; it is either added or subtracted from the ratio. In the formula sequence, the temporal factor is added after the location modifier, so it is not multiplied or amplified beyond a factor of 1.0. The modifier is + 1.0 for loss and is based on the 100 year time horizon for floodplain forest development to desired function. This allows for increments of 0.1 per decade. The temporal gain modifier is – 1.0 for each decade of concurrent function provided (applicable to enhancement actions). It can also be applied as – 0.5 in case the desired function can be achieved within 5 years.

Table 2 – The Framework's Temporal Modifier. "Desired Future Condition" (or DFC) refers to the condition where a project has been fully established and is providing all the target functions.

temporal loss	temporal gain
+ 0.1 to for each decade until desired future condition attained	- 1.0 for each decade of concurrent desired future condition functions provided by advanced mitigation can also be expressed as: - 0.5 for every 5 years of concurrent desired future condition functions provided by advanced mitigation

Temporal credits and debits were applied following this method when the City evaluated the Port's proposed mitigation on Government Island as detailed in the City response (City of Portland, 2012). Although enhancement actions on WHI or Government Island were not proposed at that time, the temporal credit was applied to suggested enhancement options on WHI or Government Island that would help close the mitigation gap.

To summarize how these are applied: assume that today is year zero and the project impact is at year 30. An advanced forest re-establishment action is implemented today in year zero. It takes 100 years to achieve the desired functions. Because the impact is in year 30, the mitigation gets a 30 year jump start resulting in a 70 year gap from impact until the mitigation site achieves the target functions. The result is a temporal addition to the ratio of + 0.7. If the mitigation project were implemented at the same time as impact, the temporal addition would be the full +1.0.

In the same time scenario, a forest enhancement action is implemented today in year zero. Assuming the enhancement action takes 10 years to reach full functions, this will result in a 20 year overlap of concurrent function provided by both the mitigation site and impact site. For the two full decades of concurrent function a credit of – 2.0 is subtracted from the ratio.

As mentioned earlier, these time factors are added/subtract after the distance modifier so the effect is not amplified and it is limited to a maximum addition of + 1.0 to any ratio.

6.0 Island Mosaic Habitat Modifier

WHI is an estuarine island situated in the center of the Columbia river's main stem channel. Islands provide unique ecological features such as high ratios of shoreline to interior area and increased isolation from terrestrial disturbance and predation. Part of the objective of this modifier is to prioritize locating mitigation on an estuarine island in the Columbia River in order to replace ecological functions associated with the island landform.

The other objective of this modifier is to locate floodplain forest mitigation within a mosaic of estuarine floodplain habitats. 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 synergistic habitat

effect results in an ecological whole that is greater than the sum of its parts. The intent of this modifier is to recognize that a cottonwood/ash planting on a 50 acre plot bounded on one side by the river and three sides by warehouses would not have the same value as a 50 acre plot planted on a site like Government Island or Sauvie Island.

The City chose a 1.5 multiplier rather than an additive factor to preserve the proportional relationship among mitigation methods. The city combined these landscape considerations into a single multiplier and they are presented as an "or" choice in the framework. This means it only applies if neither criterion is met. In other words, a project does not need to meet both the island and habitat mosaic criteria (but this is ideal to best replace ecological function). A mitigation site could be on the mainland and within a mosaic and the modifier would not apply. And the site could be on island but not within a mosaic and the modifier would not apply. To date, this modifier has not been applied to any proposals.

7.0 Using Wetland Mitigation as a Model for the Floodplain Forest Framework

How can the City base most of its framework on wetlands when floodplain forests are a different habitat type? This is a reasonable question. Staff's process was to select programs with parallel conditions and extrapolate best practices to produce a sound, defensible approach. There are a number of good reasons and rationales for drawing from the wetland mitigation field. The guidance provided by DOE, the Corps and EPA is applicable for the following reasons:

1) The basic principles of mitigation are sound and based on best available science. There is a large body of scientific research that backs up these mitigation ratios.

2) The program quantifies the effort needed for different mitigation actions (preservation vs. enhancement vs. new planting). This provides flexibility and options to achieve mitigation by mixing and matching approaches.

3) The program addresses gaps in time and risk of failure. In applying the Mitigation Framework to WHI, City staff removed the risk of failure part of the ratio due to the Port's track record of success in mitigation projects.

4) The program follows established and widely accepted natural resource mitigation practices – not new experimental approaches.

5) The program addresses the rarity and quality of the habitat; the floodplain forests on WHI are an excellent example of a high quality habitat that is disappearing from the state and the Northwest.

6) Although the underlying principles are more important than the type of resource, wetlands are in fact an appropriate habitat to use as a basis for WHI forest mitigation because:

    i) Hydrology is a component of both floodplain forests and wetlands. The forest is essentially part of the river and this habitat type is only found in large river

floodplains. In a floodplain, ground water and surface water hydrology combine with soils to foster conditions needed to support this habitat's key plant species.

ii) This is an undeveloped floodplain forest. On sites such as this, wetlands are often naturally integrated into a floodplain forest greatly enhancing the forest's ecological value. On WHI there are 8 wetlands within the impacted forest, and 3 or 4 directly adjacent.

7) The DOE approach has an explicit method of quantifying natural resource mitigation, providing the City and Port with the ability to equitably replace target functions and improve upon them, thereby achieving a net gain in ecosystem function.

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Attachment 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.

Attachment B.

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

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

Attachment C.

Table 3. City of Portland WHI Floodplain Forest Mitigation Framework. Summary of base ratios and modifiers. Modified from 3/22/12 framework; risk of failure removed resulting in lower base ratios.

Mitigation Method	on-site base ratio ÷ 1.5	0-5 miles from WHI = no change to base ratio	for > 5 miles from WHI base ratio x 1.5	island mosaic site is on island and floodplain habitat mosaic = no change to base ratio	island mosaic site is not on island or a floodplain habitat mosaic base ratio x 1.5	temporal loss & gain modifiers = varies by project timeline
Re-establishment	1.3:1	2:1	3:1	2:1	3:1	varies
Rehabilitation	2.6:1	4:1	6:1	4:1	6:1	varies
Enhancement	5.3:1	8:1	12:1	8:1	12:1	varies
Preservation	10:1	15:1	22.5:1	15:1	22.5:1	n/a

Attachment D.