FINAL COGENERATION PROJECT COMPENSATORY MITIGATION PLAN

BP Cherry Point

Prepared for
BP West Coast Products, LLC
BP Cherry Point Refinery
4519 Grandview Road
Blaine, WA 98230

June 2, 2004

URS

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Final Cogeneration Project Compensatory Mitigation Plan, BP Cherry Point

ERRATA [Please make the following changes to your copy.]

Insert to Section 9.0 to follow paragraph 5:

The timing of maintenance/contingency measures will be based on the stage of plant growth when the measures will be most effective. The timing will be affected by weather patterns that affect the growing season and plant growth. If conditions and circumstances require maintenance/contingency activities to occur more than 5 days in 30 days between February 15 and July 31 (the WDFW-recommended period to protect against disturbing heron nesting and rearing activities), then Whatcom County Planning and Development Services will be notified and appropriate monitoring and protective measures will be agreed upon before the maintenance activity proceeds.

Insert to Section 10.0 in the first paragraph before the last sentence:

Earthwork is expected to be conducted during the dry months of late summer and early fall and therefore within the WDFW-recommended construction window for protection of heron nesting colonies (July 31 to February 15). Initial planting is also expected to be completed within this window. However, if conditions or circumstances require planting outside that window, then Whatcom County Planning and Development Services will be notified and appropriate monitoring and protective measures will be agreed upon before the planting proceeds.

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EXECUTIVE SUMMARY

This Wetland Mitigation Plan was prepared to ensure appropriate mitigation for the wetland impacts associated with the proposed construction of the Cherry Point Cogeneration Project (Cogeneration Project), a 720-megawatt, gas-fired, combined cycle cogeneration facility (power plant), and the associated construction lay-down areas at the BP Cherry Point property. The BP Cherry Point property is located near Blaine, Washington, in unincorporated Whatcom County. Although the placement and design of the Cogeneration Project has avoided and minimized wetland impacts to the extent feasible, 4.86 acres of wetland will be temporarily disturbed and 30.51 acres of wetland will be permanently filled. The intent of the plan is to mitigate for these impacts by producing a net increase in wetland functional performance within the sub-basins that contain the proposed construction site.

The proposed construction will disturb low quality, historically degraded wetlands. Most of the area in the vicinity of the construction site is composed of broad fields drained by ditches and dominated by overgrown pasture grasses. Large portions of the wetlands are strongly dominated by non-native, invasive vegetation, primarily reed canarygrass (*Phalaris arundinacea*).

Wetland impacts associated with the proposed project will be mitigated via standard mitigation sequencing. Potential wetland impacts have been avoided and minimized by designing the location of construction areas away from delineated wetlands as much as possible given engineering constraints and the prevalence of wetlands in the area. A total of 9.27 acres containing both wetlands and wetland buffers (uplands) will be temporarily filled and subsequently restored. Another 1.81 acres of upland will be temporarily eliminated and subsequently forested after construction is complete to enhance a visual buffer between the plant site and Grandview Road. Any temporary or inadvertent impacts to wetlands that may occur during construction will be repaired and rehabilitated as appropriate.

Unavoidable impacts to wetlands will be compensated. The plan includes rehabilitating approximately 110 acres of degraded wetlands and surrounding uplands located within the BP Cherry Point property. These Compensatory Mitigation Areas (CMAs) will be rehabilitated by restoring historic drainage patterns via re-routing treated stormwater runoff and plugging existing ditches, removing and suppressing non-native, invasive plants such as reed canarygrass, and establishing native plant communities. Re-routing stormwater runoff will include installing pipes, culverts, and an inlet channel with diffuse-flow outlets to direct runoff from one of the two proposed detention ponds to one of the CMAs rather than let all of it go through a roadside ditch directly to Terrell Creek. All runoff from the other detention pond will be directed through an existing culvert to a series of ponds connected by natural channels and swales. The re-routed stormwater runoff will be directed to large natural areas that will provide additional hydrologic storage and water quality treatment. The forest and shrub habitats that will develop in the CMAs will further improve hydrologic storage through increased evapotranspiration and interception of precipitation. Thus, hydrologic impacts as well as other types of wetland impacts will be compensated.

The areas to be used for mitigation were selected as among the best available in the Terrell Creek basin. BP owns a large part of the basin, and BP's lands north of Grandview Road (about 1,000 acres) were assessed for mitigation potential. In all this area, the two proposed CMAs were judged to have the greatest potential for compensating wetland impacts associated with this project. The CMAs are located as near as possible to the proposed construction site, are positioned to receive re-routed stormwater runoff, and have great potential for improving ecological connectivity between the Terrell Creek corridor and natural areas to the south including the Lake Terrell State Wildlife Area. No other areas had more potential benefits. A survey of the properties for sale in the Terrell Creek basin revealed that only 5 parcels at least 20 acres in size are available. None of these parcels or combination of these parcels are able to provide the mitigation opportunities of the proposed mitigation areas.

1.0 PROJECT DESCRIPTION

1.1 PROJECT LOCATION

The BP Cherry Point property is located near Blaine, Washington in unincorporated Whatcom County. Whatcom County is bordered by Skagit County to the south, Georgia Strait to the west, and British Columbia, Canada to the north. The Cogeneration Project will be located east of the existing refinery within the BP Cherry Point property, south of Grandview Road and north of Brown Road.

The proposed construction area is approximately two miles east of Cherry Point and Georgia Strait in Sections 7 and 8 of Township 39, Range 1E. Minimization and restoration of wetland impacts will occur in this area. Compensatory mitigation will occur in the proposed Compensatory Mitigation Areas (CMAs), which will be located north of Grandview Road on the BP Cherry Point property in Sections 5 and 6 of Township 39, Range 1E. A site map showing the areas that will be impacted and the areas that will be restored and rehabilitated as compensatory mitigation is Figure 1.

A map showing the project site superimposed over a National Wetlands Inventory Map for the area is Figure 3 of the *Wetland Delineation Report BP Cherry Point Cogeneration Project [Revised]* (Golder Associates 2003a). A map showing the project site superimposed over a Soil Conservation Service (SCS) Soil Survey map is Figure 4 of the *Wetland Delineation Report BP Cherry Point Cogeneration Project [Revised]* (Golder Associates 2003a). These figures are also presented in Appendix A.

1.2 RESPONSIBLE PARTIES

BP West Coast Products, LLC (BP) is the project proponent and permit applicant. The contact person at BP for this project is Mike Torpey, who is the lead on Cogeneration Project permitting for BP. His phone number and address are as follows: 360/371-1757, BP Cherry Point Refinery, 4519 Grandview Road, Blaine, Washington 98230. The consulting firms responsible for the wetland delineation report entitled *Wetland Delineation Report BP Cherry Point Cogeneration Project [Revised]* (Golder Associates 2003a) are Golder Associates, Inc. and Schott and Associates. URS Corporation is responsible for the Wetland Mitigation Plan and the delineation report of preexisting conditions on the compensatory mitigation areas.

1.3 DESCRIPTION OF OVERALL PROJECT

The proposed Cogeneration Project is the construction of a 720-megawatt, gas-fired cogeneration electric power plant and associated facilities including construction lay-down areas and access roads. Because the cogeneration facility will be an integral part of the refinery, it must be located in close proximity to the refinery facilities. The power plant will be configured with combined-cycle combustion turbines, each driving an electric generator. Electricity and steam produced by the cogeneration facility will power Refinery operations, greatly reducing the need for steam from existing refinery boilers. Excess electricity produced by the cogeneration facility will be provided to the Bonneville Power Administration (BPA) electrical grid. A Corps of Engineers (COE) permit for impacts on wetlands related to construction of a power line that will service the proposed power plant has been in place since 2000. The access roads and the area for the transmission tower pads have been constructed, but the towers and conductors have not been erected.

The cogeneration facility, including site access roads and a visual buffer area, will encompass 33.17 acres, of which approximately 25 acres will be converted to impervious surface area for the plant construction. Construction of the power plant and associated facilities (i.e. access roads) will permanently fill and/or cut off the hydrologic source for 11.91 acres of wetland (Table 1).

Approximately 33.1 acres of undeveloped land will be converted to construction lay-down areas. Lay-down areas are lots with graveled or impervious surface area that provide staging areas during construction and equipment storage area after construction. An existing gravel lot (Contractor's parking lot) that is 3.18 acres in size will be used for lay-down as well. The construction of the lay-down areas will fill a total of 23.46 acres of wetlands, of which 4.86 acres will be temporarily filled.

Two portions of the lay-down areas totaling 11.08 acres will be temporary and removed after construction is complete. 9.27 acres of these temporarily impacted areas are considered Restoration Areas since the 4.86 acres of wetlands and 4.41 acres of wetland buffers (uplands) that comprise these areas will be restored to native plant communities. The remaining 1.81 acres is within an upland area more than 300 feet from the nearest wetland to be restored. Upland forest will be established in this area to enhance visual buffer between the plant site and Grandview Road and provide ecological connectivity between the East Restoration Area and the forested areas east of the plant site. A map of existing wetlands, the proposed impact areas, the Restoration Areas, and the visual buffer areas is provided by Figure 2.

Thus, a total of 35.37 acres of wetlands will be filled. The total wetland area to be temporarily filled is 4.86 acres and the total wetland area to be permanently filled is 30.51 acres. Over 10,000 cubic yards of material will be removed from the construction site for this project.

Table 1
Expected Wetland Impacts

Project Area	Total Area (acres)	Area of Permanent Wetland Fill (acres)	Area of Temporary Wetland Fill (acres)
Cogeneration Facility[1]	33.17	11.91	0
Lay-Down Area 1	6.29	4.39	0
Lay-Down Area 2[2]	16.61	8.75[3]	4.66
Lay-Down Area 3	5.46	5.46	0
Lay-Down Area 4	4.74	0	0.20
Existing developed area (contractor's parking lot)	3.18	0	0
Total	**69.45**	**30.51**	**4.86**

[1] This area includes the power plant, Detention Pond 1, the two access roads, the northernmost 300 feet of the maintenance road, and the visual (forest) buffer area west of Lay-Down Area and north of the plant site.
[2] The area for Lay-Down Area 2 includes Detention Pond 2.
[3] The permanent wetland impact area includes the walking path that will traverse the West Restoration Area (see Section 4).

Within the construction zones, vegetation will be cleared, topsoil will be excavated, and the soil surface will be graded, compacted, and filled. The Cogeneration Project includes construction of power plant facilities, graveled or paved work areas and parking lots, paved access roads, and detention ponds.

The impervious surfaces to be created by the proposed project will reduce hydrologic storage and induce higher rates of runoff. This area is a relatively small portion (0.4%) of the total watershed area that comprises the Terrell Creek watershed, which is approximately 20.8 square miles in size. If left unmanaged, runoff from the site may degrade water quality and alter hydrologic regimes of downstream waterbodies (wetlands and Terrell Creek) and consequently degrade their habitat quality.

Two detention ponds will be constructed to control surface runoff from the proposed construction areas (Golder Associates 2002). Detention Pond 1 will collect runoff from the cogeneration facility and the portion of Lay-Down Area 4 to be restored after construction is complete. This area is labeled the East Restoration Area. Detention Pond 2 will collect runoff from the Lay-Down Areas 1, 2, and 3 including the portion of Lay-Down Area 2 to become the West Restoration Area (Figure 2). Oil/water separators will be installed at the inlet to each pond. The ponds have been designed to meet technical requirements of both Whatcom County and the Washington State Department of Ecology (Ecology) to provide adequate water quality treatment and flow control for runoff from impermeable surfaces to be created by the proposed construction.

Detention Pond 1 will be located in the northwest corner of the cogeneration site. Runoff from Detention Pond 1 will be piped northwest across Grandview Road and Blaine Road and dispersed across a large area within one of the CMAs. Detention Pond 2 will be located just west of Lay-Down Area 2. Runoff from Detention Pond 2 will discharge to an existing drainageway that extends across Grandview Road to an extensive pond and wetland system. Both areas to receive site runoff drain to Terrell Creek near its crossing under Jackson Road.

Thus, runoff from the project site will be directed to its historic drainage areas where it will support and enhance existing wetlands before draining to Terrell Creek. In addition, directing runoff to these wetland areas will improve runoff water quality and prevent increasing flow fluctuation in Terrell Creek above existing levels. A more detailed description of the post-mitigation hydrologic scenario is in Section 5.6.2.

Outside of the proposed construction area, existing ditches will be re-routed to avoid the plant site and support areas. Surface water in these ditches will continue to flow north under Grandview Road through the same ditches that currently support runoff from the undeveloped project site.

Impacts associated with the proposed project will be mitigated by applying the standard mitigation sequence. The placement and design of the Cogeneration Project has avoided and minimized wetland impacts to the extent practicable. The temporary portions of the lay-down areas will be restored to support native wetland and upland plant communities. Permanent impacts to the remaining 30.51 acres of wetlands to be filled will be compensated by rehabilitating approximately 110 acres of nearby lands mainly consisting of degraded wetland.

The proposed construction will disturb low quality, historically degraded wetlands. Although the wetlands within the proposed project site impart a variety of wetland functions, performance of these functions occurs at fairly low levels. The proposed restoration and compensatory mitigation will establish wetland and wetland buffer (upland) communities that perform these functions at moderate to high levels. In addition, proposed topographic and hydrologic modifications to the CMAs will restore historic drainage patterns.

1.4 WETLAND DELINEATION OF IMPACT SITE

See the *Wetland Delineation Report BP Cherry Point Cogeneration Project [Revised]* (Golder Associates 2003a) for the wetland delineation and maps.

2.0 ECOLOGICAL ASSESSMENT OF IMPACT SITE

This section summarizes ecological conditions of the proposed project site as determined in part by the findings of Golder Associates. Detailed descriptions of the environmental conditions of the proposed construction zones including the existing vegetation, soil, water regime, and wildlife of the on-site wetlands and uplands are found in the *Wetland Delineation Report BP Cherry Point Cogeneration Project [Revised]* (Golder Associates 2003a) and the *Technical Report on Wetland Functions and Values Assessment BP Cherry Point Cogeneration Project [Revised]* (Golder Associates 2003b). These reports describe the geographic extent, functions, and ratings of the wetlands delineated in the vicinity of the proposed construction areas.

2.1 EXISTING VEGETATION

Most of the area within the proposed construction site and vicinity is composed of wide fields that are dominated by overgrown pasture grasses. These fields are fallow agricultural land that has not been cultivated in over 10 years. Interspersed with the fields are hedgerows and patches of semi-mature forest plantations that were planted for pulpwood harvest. Tree species comprising these plantation areas include Douglas fir (*Pseudotsuga menziesii*) and hybrid poplar (*Populus trichocarpa* x *deltoides*). Mature forest containing deciduous and coniferous trees that colonized the site naturally is located southeast of the proposed plant site. There are no existing structures within the proposed construction area.

A map showing delineated vegetation communities superimposed on an oblique aerial photograph of the construction areas, refinery, and areas to the west is Figure 5 of the *Wetland Delineation Report BP Cherry Point Cogeneration Project [Revised]* (Golder Associates 2003a). A map showing delineated vegetation communities superimposed on an overhead aerial photograph of the plant site and areas to the south and east is Figure 6 of the *Wetland Delineation Report BP Cherry Point Cogeneration Project [Revised]* (Golder Associates 2003a). These figures are presented below in Appendix A.

A large proportion of these fields are composed of palustrine emergent (PEM) wetlands as defined by the classification system of Cowardin et al. (1979). The PEM wetlands primarily consist of non-native pasture grasses such as red top (*Agrostis stolonifera*), colonial bent grass (*Agrostis capillaris*), velvet grass (*Holcus lanatus*), and reed canarygrass (*Phalaris arundinacea*). Large amounts of soft rush (*Juncus effusus*), a graminoid, also occur in these wetlands. The vegetation within the PEM wetlands has not been mowed or grazed in over 10 years.

One 0.6-acre palustrine scrub-shrub (PSS) wetland area containing immature hybrid poplar trees and one 1.69 palustrine forest (PFO) wetland that supports semi-mature (at least 12 years old and over 20 feet tall) hybrid poplar also occur within the construction zones.

Upland areas within the project site are primarily dominated by Himalayan blackberry (*Rubus discolor*), but contain some evergreen blackberry (*Rubus laciniatus*) as well. Some Douglas fir saplings planted in these areas are also present in some upland patches. Uplands also include some portions of the abandoned meadow area as well; these areas are dominated by colonial bentgrass and contain some stinging nettle (*Urtica dioica*), birdsfoot trefoil (*Lotus corniculatus*), and Canada thistle (*Cirsium arvense*). Some upland areas contain species found in the adjacent wetland areas including colonial bentgrass, reed canarygrass, and red alder (*Alnus rubra*) saplings.

The area encompassing the BP Cherry Point property originally supported forest with coniferous evergreen and broad-leaf deciduous trees, but was logged at least 100 years ago. The land was then cultivated for the first half of the 20th century and used as pasture and cropland. The predominant agricultural use of these areas was cattle grazing, which fostered the spread of non-native pasture grasses.

2.2 EXISTING WATER REGIME

The primary sources of surface water and soil moisture to the construction site are precipitation and lateral drainage from adjacent areas. Vertical drainage through the soil is limited by the underlying clay till, especially where it is within two feet of the soil surface. Lateral drainage is limited by low relief. As a result, soil saturation above 18 inches is widespread through the wet season in both wetland and upland areas. However, most areas of the project site typically dry out substantially in the latter half of the growing season.

The drainage ditches that are present throughout the site were originally installed to facilitate drainage and expedite drying of the soil for farming. These ditches continue to function although they are not maintained and are overgrown with vegetation.

2.3 EXISTING SOILS

Most of the soil in the area was derived from glaciomarine drift plains and is underlain by clay till starting at 10 to 30 inches below ground surface (bgs). Soil in the project site ranges from loam to silty clay loam, though some sandy soils and gravel not reflective of native conditions are present in some of the upland areas. The finer textured soils are mainly restricted to the wetlands. A map showing soil sampling locations is Figure 7B of the *Wetland Delineation Report BP Cherry Point Cogeneration Project [Revised]* (Golder Associates 2003a). This figure is presented below in Appendix A.

The two soil series mapped as occurring within the construction site including the Restoration Areas are Whitehorn silt loam, a hydric soil, and Birchbay silt loam, a nonhydric soil. As expected, the soils characteristic of Whitehorn silt loam are typically found in wetland areas whereas the soils characteristic of Birchbay silt loam are found in the upland areas.

Whitehorn silt loam is a very deep soil considered by Goldin (1992) to be poorly drained. However, a wetland delineation conducted by ENSR Consulting and Engineering (1992) that included intensive investigation of soils and hydrologic regime within the proposed site for the Cogeneration Project found high permeability and rapid lateral drainage within subsoil layers of soils characteristic of Whitehorn silt loam. As a result, the study concluded that the Whitehorn silt loam within this area should be considered somewhat poorly drained rather than poorly drained (Golder Associates 2003a). This soil is moderately fertile, has a moderate amount of organic matter, and is slightly acidic in the surface layer. The soil series contains inclusions of non-hydric soils. The water table in this soil fluctuates between 1 foot above ground and 1 foot below ground from November to May.

In contrast, Birchbay silt loam is a very deep, moderately well drained soil. The surface layer of the Birchbay silt loam is moderately fertile, has a moderate amount of organic matter, and is slightly acidic. This soil series has better natural drainage than the other soil types in the study area and is not listed as a hydric soil. The water table in this soil typically varies between 2 and 4 feet depth from December through April.

Topographic relief is minimal, but the area generally slopes to the north and northwest. Topography in the area is rolling to flat as determined by recent geologic history. Historic cultivation for crops and hay disturbed soil structure and smoothed what was likely rough micro-topography dominated by small hummocks

2.4 EXISTING FAUNA

The broad fields provide habitat for the abundant field mice, voles, and various small rodents. The forested patches located nearby provide habitat for wildlife species commonly found in woodland edge habitat in western Washington. These species include coyote, black-tailed deer, and numerous resident and migratory birds such as red-tailed hawk, American robin, song sparrow, and common yellowthroat. No amphibians, reptiles, or fish are known to inhabit the construction site.

A great blue heron (*Ardea herodias*) breeding colony is located approximately one mile west of CMA 2 and over one mile west of CMA 1 (Figure 1). This colony of between 200 and 400 breeding pairs (fluctuates over time) represents one of 4 large colonies located in northwestern Washington and southwestern British Columbia. Individuals from this colony are known to use nearby open field habitats similar to those present on CMA 1 and CMA 2. These nearby fields are used for staging during the nesting season and for foraging for amphibians and small mammals throughout the year.

Colony nesting bird species, including great blue herons, are considered a priority species in the state of Washington (WDFW 2000). Whatcom County lists herons as a species of local importance in its Critical Areas Code, Appendix C (Whatcom County). In connection with a different project, BP completed a *Heron Habitat Management Plan* in spring 2004 addressing the impacts of current and future construction on their lands north of Grandview Road (URS 2004). As part of this plan, a 1-year monitoring program began in March 2004 by a local biologist familiar with the local heron population. This monitoring seeks to specify high heron use areas on BP's property and what heron activities are occurring in those locations. This program will help BP adjust the implementation strategy for this mitigation plan on CMA 1 and 2. A more detailed discussion of issues concerning the heron colony is provided in Appendix F: *BP Cherry Point Cogeneration Facility Wetland Mitigation and the Birch Bay Great Blue Heron Colony*.

2.5 FUNCTIONS AND VALUES

The wetlands within the proposed project site serve a variety of hydrologic functions such as improving water quality, reducing peak flow, and decreasing downstream erosion. They also provide habitat suitability functions for wildlife, mainly mammals and birds. A more detailed discussion of the current functional performance of the wetlands within the construction site is in the *Technical Report on Wetland Functions and Values Assessment BP Cherry Point Cogeneration Project [Revised]* (Golder Associates 2003b).

2.6 WATER QUALITY

Although no water quality monitoring has occurred on the site, the quality of surface water there is likely high. As stated earlier, the main source of moisture to the construction site is precipitation and drainage from adjacent areas. Since precipitation water quality is good and the adjacent areas that provide drainage are undeveloped and well vegetated, no water quality problems are expected to be present.

2.7 BUFFERS

Undeveloped upland areas that serve as wetland buffer areas are scattered across the project site. These upland areas support various plant communities including abandoned meadow, regularly maintained grassland, Douglas fir/Himalayan blackberry patches, Himalayan blackberry patches without Douglas fir, semi-mature hybrid poplar forest patches, and native mixed coniferous/deciduous forest. Upland portions of the abandoned meadow are found throughout the project site. The plantation and forested areas are mainly situated north and east of the proposed power plant and west of the northern portion of Lay-Down Area 2. Grandview Road limits the buffer area north of the project site to the right-of-way (ROW) immediately south of the road. Figure 6 of the *Wetland Delineation Report BP Cherry Point Cogeneration Project [Revised]* (Golder Associates 2003a), which is provided in Appendix A of this plan, shows the distribution of these plant communities within and immediately adjacent to the cogeneration facility site.

The area east of the plant site consists of hybrid poplar forest plantation and a small amount of mature forest dominated by both deciduous broad-leaved and coniferous needle-leaved trees. This area is over 2,000 feet wide (east-west). The area immediately south and southeast of the cogeneration facility site is comprised of the portion of Wetland D that will not be impacted by the proposed construction. Wetland D is a seasonally saturated/inundated palustrine emergent (PEM) wetland dominated by non-native pasture grasses and other herbaceous species. This wetland appears to extend east off site into the meadow area south of the forest plantation. The area southeast of Wetland D is a forested area that is mainly comprised of mature upland forest dominated by paper birch (*Betula papyrifera*), big-leaf maple (*Acer macrophyllum*), Douglas fir, and black cottonwood (*Populus balsamifera* ssp. *trichocarpa*). This area also contains Wetland E, a PFO wetland, and a mosaic of small, forested wetland patches. Blackberry (*Rubus* sp.) lines the edge of this forested area and dominates the narrow upland area south and southwest of Wetland D and north of Brown Road.

The area between Lay-Down Areas 1, 2, and 3 and the cogeneration facility where Wetland H is located is a regularly maintained field dominated by pasture grasses that serves as a utility corridor for the BP Cherry Point property (see Figure 2). The area west of the northern portion of Lay-Down Area 2 is a 500-foot wide patch of mature mixed coniferous/deciduous forest. This area is bordered to the west by the main entrance road for the BP Cherry Point Refinery.

2.8 WETLAND RATING

As determined by Golder Associates (2003a), each wetland within the construction zone is rated as a Category III wetland. See the *Wetland Delineation Report BP Cherry Point Cogeneration Project [Revised]* (Golder Associates 2003a) for copies of the original data sheets.

The ratings used for this project conform to the rating system described by the Washington State Wetlands Rating System – Western Washington (Ecology 1993). Wetlands with the Category III rating are the most frequently encountered and typically require a moderate level of protection. The Ecology rating system is designed to differentiate between wetland quality based on rarity, irreplaceability, sensitivity to disturbance, and functional performance. The wetlands found in the project area are not Category I or II wetlands since they do not provide habitat for sensitive or important wildlife or plants, are not regionally rare, and do not provide very high functional performance. No on-site wetlands are considered Category IV wetlands since all wetlands present are hydrologically connected to Terrell Creek.

2.9 POSITIONS AND FUNCTIONS OF THE WETLANDS IN THE LANDSCAPE

With the exception of Wetland I, the Hydrogeomorphic Classification of the wetlands within the project area is depressional outflow. These wetlands vary in size, but all are situated in topographical depressions that have closed contours on three sides and support surface water outflow to downstream waterbodies. Wetland I is considered a riverine flow-through wetland. Riverine flow-through wetlands are those that do not retain surface water significantly longer than the duration of a flood event.

These wetlands perform most hydrologic and habitat functions albeit at low performance levels as discussed in Section 4.4.4. The wetlands here have limited opportunities to perform some hydrologic functions since the areas within their upgradient catchment areas are undeveloped, well vegetated, and do not produce exceptionally large outflows of water. As mentioned earlier, the main sources of moisture to these wetlands is precipitation and shallow subsurface drainage from adjacent uplands. Although the site is located in the central part of the watershed, the on-site wetlands are situated in relatively small subcatchments and therefore have limited amounts of subsurface drainage provided to them.

The project site and adjacent areas to the east are part of a corridor of undeveloped land between the Lake Terrell Wildlife Area, a 1,500-acre reserve managed by the Washington Department of Fish and Wildlife (WDFW), and the Terrell Creek riparian forest. Although this corridor is fragmented by roads and both abandoned and active pasture, it may provide ecological connections between these areas for a wide variety of wildlife including large mammals such as blacktail deer and coyote. The proposed construction is not expected to severely degrade these connections since the on-site areas to the east will remain vegetated.

3.0 MITIGATION APPROACH

3.1 MITIGATION SEQUENCING

Although BP evaluated a number of project alternatives, it decided that the Cogeneration Project will best serve to provide reliable steam and electrical power to the BP Cherry Point Refinery and provide efficient and cost-effective electrical power to the region. The Cogeneration Project will also minimize the Refinery's reliance on outside sources for electricity and minimize impacts to the environment. For more information see *Siting and Wetland 404(b)1 Alternatives Analysis, BP Cherry Point Cogeneration Project [Revised]* (Golder Associates 2003c).

BP also evaluated alternative sites for the Cogeneration Project based on the following criteria: sufficient acreage available, wetland impacts, proximity to the Refinery and related infrastructure, security and accessibility.

The proposed site avoids and minimizes wetland impacts as much as possible. Of the five possible alternative sites considered, only one that is large enough for the proposed project would impact less wetland area. However, that site was too far away from the refinery to be practicable for cogeneration and raised significant security concerns. Thus, the proposed site avoids and minimizes wetland impacts and meets the siting criteria best of all the sites considered.

The proposed plan is designed to mitigate wetland impacts by following the standard mitigation sequence as outlined in the Memorandum of Agreement between the Environmental Protection Agency (EPA) and the US Army Corps of Engineers (Corps). This sequence and a brief summary of how each mitigation component will be accomplished is provided below:

1. **Avoidance:** As discussed above, the site chosen for construction avoids wetland impacts. For a detailed account of how wetland impacts have been avoided by the proposed project, see *Siting and Wetland 404(b)1 Alternatives Analysis, BP Cherry Point Cogeneration Project [Revised}* (Golder Associates 2003c).

2. **Minimization:** Within the construction site, impacts to wetlands will be minimized by locating the construction areas away from delineated wetlands as much as possible given engineering constraints. The proposed construction will disturb low quality, historically degraded wetlands and avoid the high quality, forested wetlands located on the property. In addition, project-specific Stormwater Pollution Prevention Plans (SWPPPs) will be composed to provide guidelines for preventing the discharge of fill material in wetlands and streams during both construction and operation.

3. **Restoration:** Restoration of temporarily disturbed wetlands and wetland buffers will occur to re-establish wetland conditions and improve performance of most wetland functions. Any temporary

or inadvertent impacts to wetlands that may occur during construction will be repaired and rehabilitated as appropriate. Inadvertent impacts may include clearing and trampling of vegetation, soil compaction, discharge of fill, and alterations to hydrologic regime as a result of these activities. For a detailed account of how restoration of intentionally temporary impacts will be achieved, see Section 4 of this report.

4. **Compensation:** Unavoidable impacts to wetlands will be compensated by rehabilitating degraded wetland and upland areas within a portion of the BP Cherry Point property that will not be directly impacted by the proposed construction. For a detailed account of how compensatory mitigation will be achieved, see Section 5 of this report.

The plan for restoration and compensation incorporates recommendations from several resources including *Guidelines for Developing Freshwater Wetlands Mitigation Plans and Proposals* (*Guidelines*) (Hruby and Brower 1994), *Restoring Wetlands in Washington* (Stevens and Vanbianchi 1993), and *Washington State Wetland Mitigation Study – Phase 1: Compliance* (Ecology 2001). In addition, wetland and upland forest patches existing within the BP Cherry Point property were used in part as reference sites for the planting plans of restoration and compensatory mitigation.

3.2 GOALS

The goals of this mitigation plan are as follows:

1. Restore a total of 9.27 acres of wetlands and wetland buffers (uplands) to emergent, scrub-shrub, and forested habitats dominated by native vegetation within two Restoration Areas located in the northern portion of the construction site.

2. Rehabilitate approximately 110 acres of degraded wetlands and wetland buffers (uplands) within the two CMAs located on the BP Cherry Point property. Rehabilitation will occur by restoring historic drainage patterns via re-routing treated stormwater runoff and plugging existing ditches, removing and suppressing non-native, invasive plants such as reed canarygrass, and establishing emergent, scrub-shrub, and forested habitats dominated by native vegetation. Re-routing stormwater runoff will include installing pipes, culverts, and an inlet channel with diffuse-flow outlets to direct runoff from one of the two proposed detention ponds to a portion of the mitigation area rather than let it continue to go through a roadside ditch directly to Terrell Creek.

3.3 OBJECTIVES AND PERFORMANCE STANDARDS

This section describes the specific objectives and performance standards for the mitigation proposed for this project. A summary of these performance standards is provided in Appendix H.

3.3.1 Wetland Hydrology

Objective A: Re-establish wetland hydrology over 4.86 acres of the temporary lay-down areas (Restoration Areas) in the approximate locations of existing wetlands.

Performance Standard: Soils throughout the restored wetland areas within the Restoration Areas will be saturated to the surface for at least 10% of the growing season. The growing season extends from March 12 to October 31 and is 223 days long (Goldin 1992). Thus, the wetland hydrology criterion for the restored wetlands within the Restoration Areas is saturation at the soil surface for at least 22 consecutive days during the growing season. The presence of a free water surface within 12 inches of the soil surface over a continuous 22-day period during the growing season will be used to indicate wetland hydrology within the Restoration Areas. This performance standard meets the guidelines of wetland hydrology set by the Corps of Engineers Wetlands Delineation Manual (Corps 1987).

Objective B: Maintain wetland hydrology over the 79.7 acres of existing wetlands within the CMAs.

Performance Standard: As with the Restoration Areas, the wetland hydrology performance standard for the CMA's is saturation at the soil surface or inundation to a depth not exceeding 6 inches for at least 22 consecutive days period during the growing season. Measurement will be the presence of a free water surface within 12 inches of the soil surface over a continuous 22-day period during the growing season and will be part of the hydrologic monitoring program (Appendix G). This performance standard meets the guidelines of wetland hydrology set by the Corps of Engineers Wetlands Delineation Manual (Corps 1987).

3.3.2 Vegetation

Objective A: Maintain survival of planted trees and shrubs during the first five years before adequate vegetation cover can be measured.

Performance Standard: A survival/replacement standard will apply to trees and shrubs for the first five years after implementation, before cover is large enough to provide a reasonable method of measurement. One hundred percent survival is required for the first year and 80 percent for years 2 through 5 or until woody species cover reaches 30 percent in areas planted to tree and shrub communities.

Measurement: Measurement will be by a sampling method consisting of plots located along transects that span the width of each Restoration Area and each CMA. As recommended by Krebs (1999), at least 1% of the total area to be monitored will be sampled directly.

Objective B: Establish a variety of forested, scrub-shrub, and emergent plant communities dominated by native vegetation in both wetlands and buffer areas (uplands) within the Restoration Areas and the CMAs.

Performance Standard: The performance standards for cover of installed and volunteer woody (tree and shrub) and herbaceous vegetation outlined in Table 2 will be applied to all portions of the Restoration Areas and CMAs where tree and shrub communities will be planted. As explained in Section 4.6.5, some areas will remain free of installed trees and shrubs. Volunteer plants are those plants that establish on their own without direct planting or seeding. Herbaceous cover standards are much higher than the tree and shrub cover standards since herbaceous plants are expected to more rapidly colonize greater proportions of both the Restoration Areas and the CMAs.

Measurement: Measurement will be conducted by using a sampling method consisting of plots located along transects that span the width of each Restoration Area and each CMA. As recommended by Krebs (1999), at least 1% of the total area to be monitored will be sampled directly.

Table 2
Installed and Volunteer Plant Cover Standards

Criterion	Year 1	Year 2	Year 3	Year 5	Year 7	Year 10
Tree and shrub cover (%)	*	*	*	30	55	80
Herbaceous cover (%)	40	60	80	90	90	80

* = Tree and shrub survival, rather than cover, is measured during the first five years or until woody species cover reaches 30 percent in areas planted to tree and shrub communities.

Objective C: Reduce and suppress cover by non-native, invasive plant species.

Performance Standard: The performance standards for non-native, invasive vegetation outlined in Table 3 will be applied to all portions of the Restoration Areas and CMAs, including uplands and buffer areas. Those portions of the CMAs that currently have greater than 20% cover by reed canarygrass will have a performance standard of <20% through year 5. Portions of the CMAs that currently have less than 20% cover by reed canarygrass will have a performance standard of <10%. Since the Restoration Areas will have less than 20% cover by reed canarygrass immediately prior to initiating restoration activity, only the performance standard of <10% will be applied to these areas. By year 7, all areas are to have less than 10% cover of invasive species.

Measurement: Measurement will be conducted by using a sampling method consisting of plots located along transects that span the width of each Restoration Area and each CMA. As recommended by Krebs (1999), at least 1% of the total area to be monitored will be sampled directly.

The non-native, invasive plant species currently found in the CMAs include reed canarygrass, Himalayan blackberry, and evergreen blackberry. Of all these species, only reed canarygrass is listed by the Washington State Noxious Weed Control Board as a noxious species in Whatcom County. Reed canarygrass is a Class C weed, which indicates that is widespread and is targeted for control to serve educational or biological efforts only.

Table 3
Cover of Non-Native, Invasive Species

Species	Year 1	Year 2	Year 3	Year 5	Year 7	Year 10
Himalayan blackberry and evergreen blackberry (%)	<10	<10	<10	<10	<10	<10
Reed canarygrass cover in areas with >20% pre-existing cover (%)*	<20	<20	<20	<20	<10	<10
Reed canarygrass cover in areas with <20% pre-existing cover (%)*	<10	<10	<10	<10	<10	<10

* See Section 5.4.5, which discusses existing reed canarygrass cover distribution in the CMAs, and Figures 7A and 7B, which show existing reed canarygrass cover in the CMAs.

4.0 PROPOSED RESTORATION

4.1 SITE DESCRIPTION

Construction impacts associated with the Cogeneration Project that are intended to be temporary will occur in the northernmost 6.33 acres of Lay-Down Area 2 and all of Lay-Down Area 4. The western 2.94 acres of Lay-Down Area 4, which is 4.75 acres in total size, will be restored after construction is complete. This area will become the East Restoration Area. The remaining 1.81-acre portion of Lay-Down Area 4 contains no wetlands and will be planted as upland forest. The northernmost 273 feet (approximately) of Lay-Down Area 2, which is 6.33 acres in total size, will become the West Restoration Area. (Figures 1 and 2).

The total area of existing wetland within the East Restoration Area is 0.2 acres whereas the total area of existing wetland within the West Restoration Area is 4.66 acres. The wetland within Lay-Down Area 4 is a 0.2-acre portion of Wetland B-4, which is a PEMA wetland dominated by non-native pasture grasses. The wetland in Lay-Down Area 2 is called Wetland F and is also a PEMA wetland dominated by non-native pasture grasses. Detailed descriptions and maps of existing wetlands and plant communities at these sites are found in the *Wetland Delineation Report BP Cherry Point Cogeneration Project [Revised]* (Golder Associates 2003a).

4.2 OWNERSHIP

The Restoration Areas are within the BP Cherry Point property, which is owned by BP.

4.3 RATIONALE FOR CHOICE

The Restoration Areas were selected for the following attributes:

- The Restoration Areas are located within the portions of the proposed construction site that are only needed during construction of the Cogeneration Project. Because they will be located within temporary lay-down areas, the sites can be readily manipulated by heavy machinery to re-create wetlands and uplands in approximately their existing locations.

- The Restoration Areas are situated so that runoff can be directed to them from areas outside of the proposed construction site that will remain undeveloped. This runoff will be diverted to ensure that wetland hydrology will be established in the restored wetlands. The diversion will also be part of restoring flows to historic drainages.

- After removing compacted gravel installed for lay-down operations, native topsoil will be re-applied to the Restoration Areas. This topsoil currently supports trees, shrubs, and herbaceous vegetation and will be stored during project construction. Although the construction period will last 1.5 to 2 years, soil will be stored in a manner that minimizes reduction in soil fertility. Soil that currently supports reed canarygrass will not be applied to the Restoration Areas.

- The trees and shrubs that will establish in the Restoration Areas will provide a visual buffer between Grandview Road and the proposed facility site. The existing forest patches west of each Restoration Area and the Upland communities to be established in the Restoration Areas will provide buffer for the wetlands within the Restoration Areas as well as visual buffers for the plant site.

4.4 ECOLOGICAL ASSESSMENT OF THE RESTORATION AREAS

The Restoration Areas comprise portions of the area surveyed for the *Wetland Delineation Report BP Cherry Point Cogeneration Project [Revised]* (Golder Associates 2003a). Thus, much of the information contained in Section 2, which summarizes the ecological conditions of the proposed project site as determined by the Golder Associates (2003a) report, applies to the Restoration Areas as well.

The remainder of this Section deals with the topics listed in part 2.5.4 of the *Guidelines*:

4.4.1 Hydrology

Most of the West Restoration Area is wetland whereas most of the East Restoration Area is upland. The wetlands in the Restoration Areas are mainly palustrine emergent wetlands that are temporarily flooded (PEMA). Although this wetland type is identified as having temporary flooding, floods here are probably very rare. Instead, these 'wet meadow' communities retain saturation at or near the surface of the soil for long periods, extending into the beginning of the growing season, but typically dry out in the latter half of the growing season.

According to 30 years of data gathered at the WETS weather stations in Blaine and at the Bellingham International Airport, average annual temperature is 49.3 degrees Fahrenheit and average annual precipitation is approximately 36 inches (NRCS 1999). The wet season is herein defined as October 1 through May 31, the 8-month period in which over 82 % of yearly rainfall occurs according to the WETS table climate data from the Bellingham International Airport (NRCS 1999). The dry season (April 1 to September 30) should not be confused with the growing season, which is the period when soil temperatures 19.7 inches below the ground surface are greater than 41 degrees Fahrenheit (5 degrees Celsius) according to the 1987 Corps Wetlands Delineation Manual. The growing season length for the area is approximately

223 days as determined by averaging growing season length given by Goldin (1992) for Bellingham and Blaine. This period occurs from March 12 to October 31.

Soil moisture levels vary greatly between wet season and the dry season because the difference in precipitation between these periods is exacerbated by the poorly drained soils and their high rates of runoff. The low relief in the area and the clay till underlying most of the soils in this portion of Whatcom County greatly decreases vertical and lateral drainage, fostering widespread near-surface saturation and/or shallow inundation during the wet season. Soils in this portion of Whatcom County were formed in glaciomarine drift (Bellingham Drift) and are underlain by clay till starting at 10 to 30 inches bgs (Goldin 1992). Evapotranspiration and a minor amount of infiltration removes most of the moisture stored, causing relatively dry conditions in the latter half of the dry season.

Neither of the Restoration Areas is drained by ditches. However, subsurface drainage and overland flow from these areas reach the ditches that originate in undeveloped areas south of the proposed construction site. These ditches primarily carry surface water during the wet season and are dry during the dry season. A map of existing topography and drainage including ditches in these areas is in Figure 4.1-2 in the *BP Cherry Point Cogeneration Project – Application for Site Certification* (Golder Associates 2003d). This figure is presented below in Appendix A.

The portion of the ditch system outside the project area will be reconfigured during construction so that it will continue to convey surface water to areas where it currently flows. A map showing the ditch system plan during construction is in Figure 1A of the *BP Cherry Point Cogeneration Project Surface Water Management Design Basis* (Golder Associates 2002). An upgraded version of this figure that reflects minor changes in the construction plan is presented below in Appendix A.

After construction is complete and the temporary lay-down areas removed, ditch surface water will be diverted to supply seasonally inundated areas within the wetlands that will be restored. This diverted surface water will also ensure that the seasonally saturated portions of the restored wetlands possess wetland hydrology. Diverting minor amounts of flow to these areas will compensate for the loss of surface and ground water that is supplied by the areas to be eliminated by construction of the Cogeneration Project. A map showing the ditch system plan during operation is in Figure 1B in the *Design Basis BP Cherry Point Cogeneration Surface Water Management Design Basis* (Golder Associates 2002). An updated version of this figure that reflects minor changes in the construction plan is presented below in Appendix A.

4.4.2 Experience

URS has had experience with the design and construction of wetlands in projects located in Oregon, Washington, and Alaska. For example, URS managed the design and monitoring of two created mitigation wetlands using stormwater as the water source for the Boeing Company in western Washington. One project in included restoring a stream for trout habitat and creating a segment of new stream to link with the wetland. URS also designed a 4.58-acre compensatory mitigation site located within the BP Cherry Point property north of Grandview Road that involved removing non-native plants, creating a 0.5-acre seasonally inundated area, and establishing a mosaic of native plant communities (Corps Reference #98-4-02349).

4.4.3 Exotics (Non-native, Invasive Species)

For the purposes of this project, non-native species are considered to be species that were introduced to western Washington during white settlement. Of the non-native species in the area, only three non-native plants are considered to be invasive and therefore problematic to mitigation success. The three species are reed canarygrass, Himalayan blackberry, and evergreen blackberry. Since these species are likely to recolonize the mitigation areas (both the Restoration Areas and the CMAs) if not controlled, they will be the focus of the non-native, invasive species control program.

Of these species, reed canarygrass will likely be the most difficult to control. Reed canarygrass is extremely aggressive and often forms persistent monocultures in wetlands and riparian areas. This coarse-stemmed grass grows so vigorously that it is able to eliminate competing native wetland vegetation and prevent its reestablishment for indefinite lengths of time (Apfelbaum and Sams 1987; Lyons 2002). Reed canarygrass can form dense, persistent, monotypic stands in wetlands, moist meadows, and riparian areas. These stands exclude and displace native plants and animals and may be of little use to wildlife (Hoffman & Kearns 1997). In addition, reed canarygrass readily re-establishes itself upon clearing and can rapidly spread from intact stands. Reed canarygrass can be controlled using an aggressive, persistent approach.

The blackberry species present on site are known to aggressively invade upland areas and suppress establishment of native vegetation.

Control of non-native, invasive plant species in the mitigation areas will consist of a three-pronged approach: 1) initial removal, 2) subsequent maintenance for short-term control, and 3) establishment of native plant communities for long-term control.

Initial removal will occur through the removal of both the invasive vegetation and topsoil from the Restoration Areas prior to construction of the lay-down areas. Only topsoil currently supporting vegetation that does not include the above-mentioned non-native, invasive plants will be stored on site throughout the construction period.

Since the topsoil piles will be covered and stored for approximately 2 years, many of the seeds and rhizomes within the topsoil will die over the course of topsoil storage. Once the temporary lay-down areas are removed, the stored topsoil will be re-applied to the Restoration Areas. Non-native, invasive species that resprout will be sprayed with herbicide containing glyphosate plus surfactants. This or anic herbicide that contains active ingredients other than or in addition to glyphosate will only be applied to areas free from inundation and unlikely to support inundation within 2 weeks of the application. All herbicide will be applied by state-licensed applicators under a permit from the Washington State Department of Agriculture.

After native plants are installed and the seed mix applied, weed control will occur through a combination of mechanical removal and herbicide application. Mechanical control will include mowing and hand-pulling near installed plants to remove rhizomes as well as shoots. Weed control will occur with great care to prevent damage to native vegetation and will continue throughout the monitoring and maintenance period, as necessary.

As will be discussed in Section 8, URS will monitor success of non-native, invasive species control each year of a 10-year period subsequent to the initial planting and seeding. Monitoring results will guide recommendations given by URS to maintain cover by non-native, invasive plants below thresholds set by the performance standards. Areas with unacceptable levels of non-native, invasive plants will be marked in the field so that the maintenance crew can more accurately target their treatment practices. Although removal of non-native, invasive plants is expected to occur throughout the 10-year period, the intensity of the maintenance effort should decrease over time. Eventually, native vegetation will serve to suppress non-native plants over large portions of the site by shading and soil resource competition.

4.4.4 Wetland Functions

The proposed restoration has been designed to improve the performance of wetland functions. Wetland functions are defined as the biogeochemical, hydrological, and ecological processes and manifestations of these processes that occur within wetlands. Wetland functions tend to exert a relatively strong influence over the functional performance of the surrounding landscape. Functions are easily confused with values, which are more closely associated with the goods and services that wetlands provide to society.

The functional assessment method applied to wetlands on site is detailed in the *Methods for Assessing Wetland Functions* (Ecology 1999), which is based on the Hydrogeomorphic Approach for Assessing Wetland Functions (HGM Approach). The Corps of Engineers and other federal and state agencies are currently implementing the HGM approach to wetland functional assessment through the development of regional guidebooks. The possible range of index values for each function is 1 to 10, where 10 represents the highest level of performance. A total of 13 wetland functions were evaluated for each wetland area assessed. Since the on-site wetlands receive subsurface flow from adjacent uplands and are open basins with seasonal outflow, they are classified as depressional outflow wetlands.

The product of wetland functional performance index and wetland acreage was calculated for each function to determine acre-points. Although the wetland functional performance is influenced by wetland size, acre-points is a metric that essentially gives equal importance to wetland functional performance and wetland size. Acre-points (also called functional units) can be used to compare gain and loss of functional performance for each function, but should not be summed to account for each wetland's gain and loss of overall functional performance.

As mentioned earlier, the West Restoration Area is 6.33 acres in size and contains 4.72 acres of the 13.41 acres that comprise Wetland F. Since 0.06 acres of wetland within the West Restoration Area will be filled by a 5-foot wide walking path, only 4.66 acres of wetlands will be restored here.

Golder Associates (2003b) conducted the functional assessment method for Wetland F, under current conditions. Only part of the AU-1 portion of Wetland F will be temporarily affected by the lay-down construction. URS conducted another functional assessment for the portion of Wetland F that will be restored (West Restoration Area) as it will exist 25 years after compensatory mitigation is initiated (see Table 4). The completed data sheet for this assessment is presented in Appendix B. Although the northern 0.2 acres of Wetland B4 located within the East Restoration Area will also be restored, this area is considered too small to justify a full functional assessment.

Table 4
Comparison Between Wetland Functional Performance for Wetland F Under Current Conditions And 25 Years After Restoration Is Initiated in The West Restoration Area

Wetland Function	Functional Indices/ Acre-points Before Restoration	Functional Indices/ Acre-points 25 Years After Restoration	Explanation
	Temporarily filled portion of Wetland F (4.66 ac)	Restored Portion of Wetland F (4.66 ac)	
Potential for Removing Sediments	5/ 23.3	6/ 27.96	Slight increase (+4.66 acre-points) predicted due to increased constriction at the outlet.
Potential for Removing Nutrients	3/ 13.98	5/ 23.3	Slight increase (+9.32 acre-points) predicted due to increased areas that undergo fluctuation between aerobic and anaerobic conditions.
Potential for Removing Heavy Metals and Toxic Organics	5/ 23.3	4/ 18.64	Despite increased outlet constriction, slight decrease (-4.66 acre-points) predicted due to decreased cover by herbaceous vegetation.
Potential for Reducing Peak Flows	4/ 18.64	5/ 23.3	Slight increase (+4.66 acre-points) predicted due to increased outlet constriction.
Potential for Decreasing Downstream Erosion	5/ 23.3	8/ 37.28	Increase (+13.98 acre-points) predicted due to increased outlet constriction and increased cover by forest and scrub-shrub vegetation.
Potential for Recharging Groundwater	5/ 23.3	5/ 23.3	No change predicted since infiltration rate will not change.
General Habitat Suitability	2/ 9.32	4/ 18.64	Increase (+9.32 acre-points) predicted since there will be an increase in canopy closure, number of vegetation strata, number of snags, vegetation class interspersion, large woody debris, number of native plant species, and number of vegetation assemblages.
Habitat Suitability for Invertebrates	2/ 9.32	4/ 18.64	Increase (+9.32 acre-points) predicted due to increase in vegetation class interspersion, large woody debris, and maximum number of vegetation strata.
Habitat Suitability for Amphibians	2/ 9.32	2/ 9.32	No predicted despite installment of habitat features because the buffer condition and amount of seasonally inundated area will not change.
Habitat Suitability for Anadramous Fish	N/A	N/A	No anadromous fish can or will be able to access the site.
Habitat Suitability for Resident Fish	N/A	N/A	No resident fish can or will be able to access the site.
Habitat Suitability for Birds	3/ 13.98	4/ 18.64	Increase (+4.66 acre-points) predicted due to increase in number of snags, vegetation class interspersion, and invertebrate habitat suitability.

Table 4 (Continued)
Comparison Between Wetland Functional Performance for Wetland F Under Current Conditions and 25 Years After Restoration is Initiated in the West Restoration Area

Wetland Function	Functional Indices/ Acre-points Before Restoration Temporarily filled portion of Wetland F (4.66 ac)	Functional Indices/ Acre-points 25 Years After Restoration Restored Portion of Wetland F (4.66 ac)	Explanation
Habitat Suitability for Mammals	1/ 4.66	1/ 4.66	No change predicted due to proximity of plant site and associated facilities.
Native Plant Richness	1/ 4.66	4/ 18.64	Increase (+13.98 acre-points) predicted due to increase in maximum number of strata and number of native plant species, and decrease in area dominated by non-native plant species.
Potential for Primary Production and Organic Export	8/ 37.28	9/ 41.94	Increase (+4.66 acre-points) predicted due to increased rate of organic matter production.

According to the results of the functional assessment, the portion of Wetland F to be restored will slightly improve its currently low to moderate ability to remove sediment and nutrients from surface water inputs 25 years after restoration activity is initiated. The expected increases in the performance of the sediment and nutrient removal functions reflect the proposed hydrologic modifications, which will divert ditch flow from adjacent areas to seasonally inundated habitats and release these flows slowly through a constricted outlet (see Section 4.6). Conforming to the definition given by Ecology (1999), these seasonally inundated areas will possess inundation for greater than one month per year. As typical for most seasonally inundated wetlands in this region, on-site inundation will occur in the early part of the growing season. The opportunity for this wetland to perform these functions will remain low since these wetlands will only receive runoff from areas that will remain free from development or agriculture.

The potential for removing heavy metals and toxins will slightly decrease according to the model. The model interprets the decrease in herbaceous vegetation as a cause for a decrease in the wetland's ability to remove heavy metals and toxins. Since few of these contaminants enter the wetland currently and few are expected in the future, toxin and heavy metal removal is a function the wetland has and will have little opportunity to perform.

The wetland's current abilities to reduce peak flows and decrease downstream erosion will both improve as a result of the proposed restoration, which will direct a controlled amount of runoff to the restored wetland within the West Restoration Area. The shallowly inundated areas to be created will retain this runoff and thereby reduce peak flows and decrease the potential for downstream erosion. In addition, the increased cover by forest and scrub-shrub communities will further increase performance of these functions by fostering more evapotranspiration and improving the soil's ability to retain moisture and resist erosion. Given that surface water will be delivered to this wetland in greater quantity than had occurred previously, the opportunity for the wetland to perform peak flow reduction and downstream erosion reduction functions will be increased to a moderate level.

The potential for the wetland to recharge groundwater will remain low. The installment of compacted gravel padding atop the soil for the construction of the lay-down areas may temporarily diminish soil permeability. However, soil permeability will increase over time through the improvement of soil structure wrought by increases in tree and shrub root penetration and distribution. In spite of these improvements, infiltration rates to underlying aquifers will remain fairly slow at this site due to the relatively impermeable clay till found below the topsoil. The opportunity for this function to be performed may be slightly increased by the greater influx of surface water in the West Restoration Area after restoration is complete.

General habitat suitability will improve substantially due to the establishment of a variety of wetland habitats and native plants. Installation of the various vegetation classes and habitat features will provide greater opportunities for wildlife to forage, take cover, and breed. The mosaic of plant communities will also create more 'edges' (transition areas between plant communities), which will augment both wildlife and plant diversity.

Wildlife that will likely benefit from the proposed restoration are primarily invertebrates, birds, and amphibians. No threatened or endangered species are expected to benefit directly from the proposed restoration. The existing chain-link fence around the refinery including the proposed West Restoration Area and construction of chain-link fence around the proposed East Restoration Area will deter large mammals such as deer and coyote from accessing these sites. Given the deterring factors of the site and its surrounding area, the opportunity for the restored wetland to perform the habitat suitability functions will be low to moderate.

Since the wetlands currently do not provide fish habitat and will not provide fish habitat after mitigation activity is complete, the functional performance for Habitat Suitability for Anadromous Fish and Habitat Suitability for Resident Fish can not be evaluated. Although Golder Associates (2003b) did evaluate these functions for the wetlands in the construction site, they gave them very low scores (0 or 1).

The moderate to high amount of biomass produced by this wetland is currently exported at moderate rates to adjacent aquatic ecosystems via the ditch outlet. The proposed mitigation may cause more biomass to be produced on site through the establishment and growth of primarily deciduous, broad-leaved trees and shrubs. Organic material will continue to be released from the site at moderate rates through the meandering channel to be excavated on site.

In summary, the model predicts that the proposed restoration will incur improvements for nine functions, no change in three functions, and a slight decrease in one function.

In addition to the functional assessment, the Washington State Wetlands Rating System (Ecology 1993) was applied by URS to the portion of Wetland F that will be restored (West Restoration Area) as it will exist 25 years after restoration is initiated. Despite being less than 5 acres in size and nearly surrounded by roads and lay-down areas, this wetland area is predicted to support conditions suitable for rating as a Category II wetland. In particular, the wetland is predicted to retain three wetland community types that are moderately well interspersed, support relatively high plant diversity, have some beneficial habitat features, and maintain its hydrologic connection to Terrell Creek. The completed wetland ratings data form for the 4.66-acre wetland within the West Restoration Area under conditions predicted for 25 years following initial mitigation activity is presented in Appendix C. Although the northern 0.2 acres of Wetland B4 located within the East Restoration Area will also be restored, no future rating is given for this wetland since it is so small.

4.4.5 Buffers

The undeveloped areas outside of the proposed construction site that serve as buffers for the wetlands within the Restoration Areas will be maintained as wetland buffers.

Upland communities will be established in the portions of the Restoration Areas that were delineated as upland by Golder Associates (2003a). These uplands will also serve as buffers for the wetlands to be restored within the Restoration Areas. Excluding the gravel path, upland areas comprise 4.28 acres within the Restoration Areas. Uplands comprise 2.74 acres of the 2.94 acres in the East Restoration Area and 1.6 acres of the 6.33 acres in the West Restoration Area. The upland areas are mainly concentrated along the northern edge of these sites. The gravel path will cover 0.12 acres of the West Restoration Area. Upland communities will be established in the approximate locations of the areas that are currently upland. These areas will serve as buffers for the restored wetlands.

The eastern portion of Lay-Down Area 4 not included in the East Restoration Area will be reforested to serve as visual buffer for the plant site and provide a ecological connectivity between the East Restoration Area and the forested areas east of the project site.

4.4.6 Land Use

The uses of the Restoration Areas and the Cogeneration Project area will remain as planned for an indefinite length of time. The areas within BP Cherry Point property south of Grandview Road are zoned as 'heavy impact industrial'. However, current and expected future land uses in the area near the Restoration Areas are not likely to inhibit restoration of the Restoration Areas or degrade their functional performance over time. Air quality modeling indicates that emissions from the cogeneration facility will not significantly affect current ambient air quality in the area (Golder Associates 2003d). Water sources for the Restoration Areas will primarily be ditches re-routed so that they convey runoff from undeveloped areas on the BP Cherry Point property. The undeveloped land at BP Cherry Point includes hybrid poplar forest plantations, natural forest stands, abandoned pastures, and grasslands regularly maintained by mowing. Runoff from the Cogeneration Facility and associated lay-down areas will be directed away from the Restoration Areas.

Although land use in the vicinity of the project may change over time, no development that may occur here will likely degrade the Restoration Areas. Portions of forested plantations may be logged in the future to serve their intended purpose, but will likely be replanted. The portions of the plantations and natural forest stands that are not within the proposed construction areas and are within 200 feet south of Grandview Road will remain standing. These forested areas will serve as buffers between Grandview Road and the proposed facilities. Expansion of refinery or cogeneration operations may include erecting structures or lay-down areas in the fields located south of the proposed plant site. In addition, new utility lines may be added or existing utility lines maintained in the area between the plant site and Lay-Down Areas 1, 2, and 3 where Wetland H is located (Figure 2). However, no permanent structures that are not associated with the proposed project are likely to be erected within 100 feet of the wetlands within either Restoration Area. In addition, air quality modeling indicates that emissions from the cogeneration facility will not significantly affect current ambient air quality in the area (Golder Associates 2003d).

Current and future land uses outside the BP Cherry Point property are not likely to inhibit the proposed restoration or degrade functional performance of the restored wetlands over time. The nearest property to the Restoration Areas that is not owned by BP is located approximately 0.25 miles east of the East Restoration Area. Although it currently conveys light to moderate traffic, the portion of Grandview Road east of the intersection with Blaine Road (also known as State Route 548) is not likely to be expanded at any time (Lee pers. comm. 2003).

4.5 CONSTRAINTS

There are no known constraints outside the owner's control that might affect the Restoration Areas.

4.6 SITE PLAN

The temporarily impacted lay-down areas will be manipulated to create conditions that promote the establishment of native trees and shrubs. A variety of native wetland plant communities will be established in the approximate locations of existing wetland areas, and upland forest communities will be established in the approximate locations of areas that are currently upland.

4.6.1 Topography

Surface elevations that will foster upland conditions will be re-established in the approximate locations where uplands are currently found. Upland areas will be slightly elevated above wetlands and thus may be seasonally saturated below 12 inches beneath the soil surface. Wetlands will occur in the approximate locations where they are currently found, but their surface elevations will vary to include seasonally inundated areas as well as seasonally saturated areas. Site contours will be graded to allow a variety of hydrologic regimes within wetland areas that span from seasonally saturated 1 foot beneath the soil surface to seasonally inundated up to 1.5 feet above the soil surface. The proposed post-restoration contours for the Restoration Areas are shown in Figure 3.

Small mounds or 'hummocks' will be created throughout large portions of the Restoration Areas. Hummocks will be created by contouring imported topsoil that will be removed for power plant and lay-down area construction. Hummocks will have a slightly deeper effective rooting zone and will thus provide more moisture, nutrients, and rooting medium to vegetation per area of ground. Creating these hummocks will augment overall topographic variability on the site and facilitate the establishment of native trees and shrubs, which typically require deeper root penetration than herbaceous plants. The mounds will create a wider array of micro-environmental conditions that may provide greater opportunities for an increased diversity of plants and other organisms to utilize the site. Hummocks will not serve as berms for the seasonally inundated areas since berms typically require compaction, which is not conducive to plant growth.

Hummocks will be curving and oblong in shape have an average diameter of about 24 feet. The typical height above the surrounding elevation will be 1 foot, and no hummock will rise more than 1.5 feet in elevation. The hummocks will be spaced at approximately 60 feet on center (approximately 12 hummocks per acre). Hummocks will cover approximately 12.5% of the areas in which they are created.

Recontouring will occur by trackhoe and bulldozer during the dry season when soil moisture is at a seasonal low. Native vegetation will be installed during the following wet season.

4.6.2 Hydrologic Modifications

The Restoration Areas will be recontoured to create small seasonally inundated areas that will be vegetated with emergent herbaceous plants. As discussed in Section 4.6.2, surface water will be supplied to these seasonally inundated areas by diverting stormwater runoff from ditches that will be located adjacent to the Restoration Areas. See Appendix A for the upgraded version of Figure 1B of the *BP Cherry Point Cogeneration Project Surface Water Management Design Basis* (Golder Associates 2002) in Appendix A for the location of these ditches.

To ensure that appropriate flow levels will be diverted to the Restoration Areas, water levels will be controlled by adjustable weirs or similar devices. With these adjustable features, minor changes in channel flow may be made during the first 1 to 2 years after installation. If necessary, further adjustments with these features may be made as site conditions change.

The surface water diversion to the West Restoration Area will be directed through a 2-foot wide, meandering open channel excavated in the wetland portion of the West Restoration Area. The channel will direct water westward through the site and feed the two seasonally inundated areas to be created. The total size of the seasonally inundated area within the West Restoration Area will be at least 1.3 acre as measured by the ordinary high water mark. Maximum flow velocity through the channel will be less than 0.25 foot per second.

A 2-foot wide, open channel will also serve to convey surface water to and from the seasonally inundated area to be created in the East Restoration Area. Surface water will enter through a created channel to the seasonally inundated area when the water level is below the elevation of the weir to be installed at the diversion. When the water level exceeds the elevation of the weir, the seasonally inundated area will no longer accept water from the ditch, which will continue to support flow. This 'off-line' design minimizes intra-seasonal water level fluctuation within the seasonally inundated area and prevents flooding. The total size of this seasonally inundated area will be at least 0.06 acre as measured by the ordinary high water mark. Maximum flow velocity through the channel will be less than 0.25 foot per second.

4.6.3 Soil

As discussed earlier, native topsoil will be re-applied to the Restoration Areas after removing compacted gravel from the temporary lay-down areas. As discussed in Section 2.3, these soils are primarily loam and silt and extend 20 to 30 inches bgs before meeting the relatively impervious clay till layer. All soil placed in the Restoration Areas will be native, non-sandy soils taken from above the clay till layer.

The soil may be covered with mulch, erosion-control matting, and/or sterile annual grass seed to prevent soil erosion and sedimentation. These areas will then be replanted with native vegetation as soon as practicable. Tree and shrub planting will occur after site preparation work is complete. The planting, seeding, and mulch ring installment to occur on site are described further in Section 4.6.5.

A 5-foot wide walking path will be constructed across the West Restoration Area. The path will be comprised of gravel or wood chips and will traverse 0.06 acre of upland and 0.06 acre of wetland. The gravel path will be designed and constructed so that it will not be a barrier to surface or subsurface water flow.

4.6.4 Habitat Features

A number of habitat features will be distributed across the Restoration Areas. The habitat features planned for the site will provide structure to encourage habitat utilization by native wildlife species.

After recontouring is complete, at least 28 downed logs (3 per acre) will be placed across the Restoration Areas. Most of these logs will be derived from the hybrid poplars and Douglas firs that will be removed from the proposed construction areas. Most of these trees are 25 to 35 feet tall and have a diameter at breast height (dbh) that is 7 to 10 inches. Hybrid poplar logs will be left to dry for a few months before being placed in the mitigation areas to ensure that they do not sprout. A few other logs will be taken from the mixed deciduous/coniferous forest area on the BP Cherry Point property south of Grandview Road where an access road was recently constructed. These logs range in length from 35 to 90 feet and in diameter from 10 to 24 inches. The larger logs may have to cut into two or three pieces before transporting them to the mitigation areas.

Some logs will be stacked atop each other in a pyramidal shape (2 logs on bottom, 1 on top) to simulate woody debris of larger size. Other logs will be placed so that they extend into the seasonally inundated areas. The logs will act as habitat features, providing foraging opportunities and cover for insects, amphibians, small mammals, and birds (Stevens and Vanbianchi 1993).

A number of artificial snags, or dead-standing trees, will be erected on site. The logs to be used as artificial snags will be derived from the same source of woody material for the downed logs. Each snag will be at least 20 feet tall and at least one snag per Restoration Area will have a dbh greater than 12 inches. The base of each snag will be installed at least 4 feet bgs and stabilized with cement. A 10-foot long cross-beam may be attached to each snag to provide perches for red-tail hawks and other birds. The hawks and other predatory birds will prey on mice and voles, which might otherwise jeopardize the installed plants by gnawing and girdling.

At least two wildlife brush shelters will be constructed in each Restoration Area. These shelters will be placed away from areas that will be seasonally inundated. The base of each shelter will be composed of large, preferably rot-resistant boughs or logs that are 10 to 15 feet long and 4 to 6 inches in diameter. These pieces will be stacked criss-cross with parallel logs spaced approximately 2 feet from each other until the structure is 1 to 2 feet high. Branches of a gradually smaller diameter will be placed between and above the base logs in tee-pee style to form a more compact weave. Coniferous evergreen branches with needles still attached should be added to each pile to enhance shelter cover. The end product will be a sturdy, dome-like structure 4 to 6 feet high that has adequate space for small mammals to move about. Wildlife brush shelters provide heavy cover close to the ground, which can attract a variety of wildlife including rabbits, mice, voles, small birds, and amphibians (Monroe 2001; Connecticut Wildlife Division 1999).

In addition, plants like rushes and sedges will be placed in the shallow areas of each area expected to be seasonally inundated to provide ovideposition sites for native amphibians. These could be supplemented with branches or twigs with less than 8 mm (0.3 inch) diameter (Richter 1999) installed deep in pond substrate to prevent them from being dislodged by the rise and fall of water levels. The ovideposition sites provided by the branches will supplement those sites provided by the emergent vegetation that will become established in shallowly inundated areas.

4.6.5 Vegetation Establishment

The distribution of plant communities to be established in the Restoration Areas is shown in Figure 3. Plant schedules for these areas are shown in Tables 5 through 8. These schedules apply to the upland and wetland areas that will be restored. The schedules show the spacing, quantity, and condition of species to be installed in each community type. Included in these tables is the wetland indicator status (explained in the *Revised Cogeneration Project Compensatory Mitigation Areas Wetland Delineation Report* <URS 2003a>) for each plant species according to US Fish and Wildlife Service (1996).

The species chosen for each planting zone are deemed appropriate for the environmental conditions expected in the areas where they occur. The species composition, density (spacing), and other specifications of plant materials indicated in the plant schedules are based on findings from field investigations, best professional judgment, and recommendations from various resources.

Table 5 is the plant schedule for the Upland Forest communities, Table 6 is the plant schedule for the seasonally saturated (SS) wetland communities, and Table 7 is the plant schedule for the seasonally saturated (SI) wetland communities. Table 8 presents the specifications for the native seed mix that will be applied to all communities within the Restoration Areas.

Table 5
Planting Plan for Upland Communities

Scientific Name	Common Name/Wetland indicator status	Spacing	Condition & Size
Alnus rubra	Red alder/FAC	Intersperse the various tree species so that overall spacing on center = 12 ft	bare-root, 1.5’-3’
Betula papyrifera	Paper birch/FAC		bare-root, 1.5’-3’
Prunus emarginata	Bitter cherry/FACU		bare-root, 12-18”
Pseudotsuga menziesii	Douglas fir/FACU		bare-root, 1.5’-3’
Salix scouleriana	Scouler willow/FAC		rooted cutting, 1.5’-3’
Thuja plicata	Western red cedar/FAC		bare-root, 1.5’-3’
Tsuga heterophylla	Western hemlock/FACU-		bare-root, 1.5’-3’
Crataegus douglasii	Douglas hawthorn/FAC	Intersperse the various shrub species so that overall spacing on center = 8 ft	bare-root, 1.5’-3’
Holodiscus discolor	Oceanspray/NI		bare-root, 1.5’-3’
Oemleria cerasiformis	Indian plum/FACU		bare-root, 1.5’-3’
Rosa nutkana	Nootka rose/FAC-		bare-root, 1.5’-3’
Sambucus racemosa	Red elderberry/FACU		bare-root, 1.5’-3’
Symphoricarpos albus	Common snowberry/FACU		bare-root, 1.5’-3’

Table 6
Planting Plan for Seasonally Saturated (SS) Wetland Communities

Scientific Name	Common Name/Wetland indicator status	Spacing	Condition & Size
Alnus rubra	Red alder/FAC	Intersperse the various tree species so that overall spacing on center = 9 ft	bare-root, 1.5'-3'
Betula papyrifera	Paper birch/FAC		bare-root, 1.5'-3'
Picea sitchensis	Sitka spruce/FAC		bare-root, 1.5'-3'
Populus balsamifera ssp. *trichocarpa*	Black cottonwood/FAC		bare-root, 1.5'-3'
Salix lucida var. *lasiandra*	Pacific willow/FACW+		rooted cutting, 1.5'-3'
Salix scouleriana	Scouler willow/FAC		rooted cutting, 1.5'-3'
Thuja plicata	Western red cedar/FAC		bare-root, 1.5'-3'
Cornus sericea	Red-osier dogwood/FACW	Intersperse the various shrub species so that overall spacing on center = 6.5 ft	bare-root, 1.5'-3'
Crataegus douglasii	Douglas hawthorn/FAC		bare-root, 1.5'-3'
Malus fusca	Western crabapple/FACW		bare-root, 1.5'-3'
Physocarpus capitatus	Pacific ninebark/FACW-		bare-root, 1.5'-3'
Rosa nutkana	Nootka rose/FAC-		bare-root, 1.5'-3'
Rosa pisocarpa	Clustered wild rose/FAC		bare-root, 1.5'-3'
Rubus spectabilis	Salmonberry/FAC+		bare-root, 1.5'-3'
Salix piperi	Piper's willow/FACW		rooted cutting, 1.5'-3'
Salix sitchensis	Sitka willow/FACW		rooted cutting, 1.5'-3'
Camassia quamash	Common camas/FACW	Install patches of herbaceous species where overall spacing on center = 1.5 ft over 1% of SS	plugs
Carex obnupta	Slough sedge/OBL		plugs
Deschampsia caespitosa	Tufted hairgrass/FACW		plugs
Eleocharis palustris	Creeping spike-rush/OBL		plugs
Juncus ensifolius	Daggerleaf rush/FACW		plugs

Table 7
Planting Plan for Seasonally Inundated (SI) Wetland Communities

Scientific Name	Common Name/Wetland indicator status	Spacing	Condition & Size
Fraxinus latifolia	Oregon ash/FACW	Intersperse the various tree species so that overall spacing on center = 14.5 ft	bare-root, 1.5'-3'
Salix lucida var. *lasiandra*	Pacific willow/FACW+		rooted cutting, 1.5'-3'
Populus balsamifera ssp. *trichocarpa*	Black cottonwood/FAC		bare-root, 1.5'-3'
Populus tremuloides	Quaking aspen/FAC+	Create small groves with 4.5 ft. on center over 2% of SI	bare-root, 1.5'-3'
Cornus sericea	Red-osier dogwood/FACW	Intersperse the various shrub species so that overall spacing on center = 6.5 ft	bare-root, 1.5'-3'
Lonicera involucrata	Black twinberry/FAC+		bare-root, 1.5'-3'
Physocarpus capitatus	Pacific ninebark/FACW-		bare-root, 1.5'-3'
Rosa pisocarpa	Clustered wild rose/FAC		bare-root, 1.5'-3'
Salix piperi	Piper's willow/FACW		bare-root, 1.5'-3'
Salix sitchensis	Sitka willow/FACW		bare-root, 1.5'-3'
Carex stipata	Sawbeak sedge/OBL	Install patches of herbaceous species where overall spacing on center = 1.5 ft over 1% of SS	plugs
Carex utriculata	Beaked sedge/OBL		plugs
Carex obnupta	Slough sedge/OBL		plugs
Eleocharis palustris	Creeping spike-rush/OBL		plugs
Juncus bolanderi	Bolander's rush/OBL		plugs
Scirpus americanus	American bulrush/OBL		plugs
Scirpus microcarpus	Small-fruited bulrush/OBL		plugs
Typha latifolia	Common cattail/OBL		plugs

Table 8
Native Seed Mix

Scientific Name	Common Name/Wetland Indicator Status	Estimated Quantity (% by weight)
Agrostis stolonifera	Creeping bentgrass/FACW	35%
Alopecurus aequalis	Short-awn foxtail/OBL	2.5%
Alopecurus geniculatus	Water foxtail/OBL	17.5%
Danthonia intermedia	Timber oatgrass/FACU+	2.5%
Festuca rubra	Red fescue/FAC	40%
Hordeum brachyantherum	Meadow barley/FACW-	2.5%

For Tables 5, 6, and 7, the average spacing is given for trees, shrubs, and herbaceous plants to be installed in each community. To improve habitat heterogeneity, planting densities will not be uniform throughout each zone. Instead, the zones will contain patches with a relatively high density, patches with moderate density, and patches with a relatively low density. The variety in density will allow planting in areas most suitable for their establishment and growth. The locations of the patches will be determined in the field.

Overall spacing for the Upland community is at a lower density than the SS or SI community types since there is far less reed canarygrass found in upland areas. Planting densities are set higher in the SS and SI communities to help suppress cover by reed canarygrass by increased competition and shading. Although their overall densities will be equal, the SI communities will have a higher ratio of shrubs to trees than the SS communities since native shrubs are better able to greater levels of hydrologic fluctuation.

No trees or shrubs will be planted in a few patches within the Upland and SI communities. In the Upland communities, these patches will be constricted to areas that have less than 20% reed canarygrass prior to initial mitigation activity. In the SI communities, these communities will be restricted to areas that are expected to have long periods of shallow (<1.5-foot) inundation.

Upland communities will be established in the portions of the Restoration Areas that were delineated as upland by Golder Associates (2003a). These communities may be saturated near or at the soil surface for a few months during the wet season. The overall tree and shrub spacing for the Upland communities will be approximately 985 plants per acre, which requires an overall spacing of 6.65 feet on-center.

SS communities will be established in wetland areas that will be seasonally saturated, but typically retain no saturation near the soil surface during the dry season. Some of these areas may retain shallow inundation for 1 to 3 months during the wet season. The overall tree and shrub density for the SS communities will be approximately 1,565 plants per acre, which requires an overall spacing of 5.3 feet on-center.

SI communities will be established in wetland areas that are seasonally inundated, but retain low levels of soil moisture during the latter half of the dry season. These areas will typically retain shallow inundation for greater than 3 months during the wet season and will likely remain saturated for a longer periods than the SS communities during the early part of the growing season. The overall tree and shrub density for the SI communities will be approximately 1,430 plants per acre, which requires an overall spacing of 5.5 feet on-center.

Herbaceous plants will be installed in various patches covering approximately 1% of the SS communities and 1% of the SI communities. The planting density for these patches will be approximately 1.5 feet on-center, which is roughly equal to 9,670 plants per acre.

Planting will be accomplished using a multi-phase approach. The initial phase will occur during the fall and/or spring before the Year 1 monitoring event. At this time, 50% of the woody (tree and shrub) and herbaceous plants will be installed. The remaining plants will be installed over the subsequent 3 to 4 years. If necessary, additional applications of the native seed mix may occur over the subsequent 3 to 4 years as well. This multi-phase approach allows more accurate assessment of on-site growing conditions, which is especially important in areas that will be seasonally inundated and/or where herbaceous vegetation will be planted.

The species in the seed mix are native grasses tolerant of a broad range of hydrologic regimes. The seed mix will be applied to the Restoration Areas in two phases. The first phase will occur in late summer or early fall a few weeks prior to installing any trees or shrubs. The second phase will occur the following spring after the first phase of tree and shrub planting is complete. At this time, the mix will only be applied to the interstitial space between mulch rings. Since interstitial spaces should comprise approximately 85% of the total area, the actual area upon which this seed mix will be applied is 7.9 acres. The total cumulative seeding rate will be 40 pounds per acre, which is a relatively high seeding rate for mitigation areas.

Nurseries specializing in wetland restoration will provide the plant stock. Trees and shrubs will be derived from local sources so that they are best adapted to the on-site conditions. All cuttings will be obtained from 1- to 2-year old wood, will be >3/8-inch in diameter, and will be >3 feet long. The quality and quantity of plants will also be verified by a URS biologist.

An installment contractor with experience in wetland rehabilitation will be responsible for plantings and seedings. Locations of each plant community zone will be staked in the field, and placement of plants will be verified by a URS biologist. All plants will be installed, and all seeds will be spread in spring or fall to enhance their chances of establishment and survival.

Each installed planting will receive a ring of imported mulch that will be at least 4 feet in diameter and 3 to 4 inches thick. However, mulch should be kept at least 1 inch away from the base of each plant to prevent pathogen and pest infestation. The mulch will be wood and bark-based with very few weed seeds. Mulch rings will help to suppress invasion by non-native plants, retain soil moisture, and contribute organic matter to the soil over time.

A minimum of water-soluble, slow-release, cold-weather tolerant fertilizer pellets will be applied to the soil pit where each tree and shrub is installed. Fertilizer pellets will be placed 3 to 4 inches below the ground surface adjacent to installed plant roots. In addition, a powder form of fertilizer will be applied to the ground surface at the base of each planting. This fertilizer will be a moderate- to rapid-release fertilizer to promote establishment and growth. Care will be taken to place the powder form of fertilizer only on the exposed soil at the base of the plant and not on the mulch where the high carbon:nitrogen ratio could cause much of the fertilizer to be rapidly depleted by micro-organisms.

Except for some cuttings, all installed plants will be protected from foraging mammals by plastic seedling protection tubes. In addition, plastic mesh exclusions may be constructed over patches of herbaceous plants to protect them from predation by geese, ducks, or mammals. These protections may be very important in preventing widespread mortality of newly installed plants.

4.6.6 Irrigation

An irrigation system will be constructed within the Restoration Areas after recontouring is complete. Water for irrigation will be derived from tapped water sources at the BP Cherry Point property. Irrigation will supply water during the latter half of the growing season to counter seasonal drought. Irrigation will likely enhance survivability of installed trees and shrubs, but may also encourage the growth of non-native, invasive plants such as reed canarygrass.

Irrigation water will be distributed by large ‘guns’ that have a spray diameter of 110 feet. The irrigation guns will be placed upon carts that travel automatically at slow, consistent speeds to ensure even distribution. Temporary paths less than 10-feet wide and spaced 200 feet apart will be made for the carts to travel across the Restoration Areas. Irrigation will continue through the second and possibly third growing seasons after planting is initiated. Irrigation equipment will be continually monitored and maintained by trained personnel. URS will be informed of irrigation equipment performance and will advise adjustments to the irrigation system as necessary.

The system will supplement rainfall to ensure that installed plants are provided with 0.5 inch of water per week from June or July through October, the driest portion of the year. Rainfall rates will be monitored on a weekly basis by checking data gathered by the weather station on the BP Cherry Point property.

5.0 PROPOSED COMPENSATORY MITIGATION

The proposed plan is designed to appropriately compensate for losses in wetland functional performance expected from the proposed construction. To compensate for the unavoidable and permanent removal of 30.51 acres of wetland, BP proposes to rehabilitate approximately 110.1 acres of wetland and wetland buffer degraded by historic agricultural practices.

5.1 SITE DESCRIPTION

The Compensatory Mitigation Areas (CMAs) are located on the BP Cherry Point property north of Grandview Road, just north of the site of the proposed Cogeneration Project (Figure 1). CMA1 is located east of Blaine Road, north of the proposed power plant site. It is situated in the southwest quarter of Section 5 of Township 39N, Range 1E. CMA1 is 50.3 acres in size. CMA2 is located west of Blaine Road in the southeast quarter of Section 6 of Township 39N, Range 1E. CMA2 is 59.8 acres in size. The geographic extent, location, and general character of the wetlands within CMA1 and CMA2 are described in the *Revised Compensatory Mitigation Areas Wetland Delineation Report* (URS 2003a). This report shows results of investigations that have occurred from 2001 to 2002.

The borders of each CMA are 25 feet from the outer edge of the ROW for Blaine Road and 50 feet from the northern edge of the ROW for Grandview Road. The ROW for Blaine Road extends 30 feet to the east and

30 feet to the west of the road's centerline. The ROW for Grandview Road extends 65 feet north and 20 to 25 feet south of the road's centerline. The ROWs contain telephone lines, power lines, and ditches. The areas between the ROWs and the CMAs are considered setback areas and will be reserved for possible utility installment.

5.2 OWNERSHIP

The CMAs are within the BP Cherry Point property, which is owned by BP.

5.3 RATIONALE FOR CHOICE

5.3.1 Mitigation Ratio

This plan proposes to enhance the CMAs to compensate for total wetland impacts at a ratio greater than 3:1 (see Table 9). Permanent impact to the PFO hybrid cottonwood plantation wetland will be compensated at a 4.5:1 ratio. Since this impact will consist of 1.69 acres of wetland, 7.61 acres will be enhanced as compensation. As requested by the Corps, the 4.86 acres of temporal impact from construction of the lay-down areas to be restored will be compensated at a 1:1 ratio. Enhancing 28.43 acres of wetland buffer (upland) will compensate for 3.55 acres of permanent wetland impact. The remaining 69.21 acres of degraded wetlands to be enhanced in the CMAs will compensate the remaining 24.99 acres of proposed wetland impact.

Although at least 1.2 acres of upland are expected to become wetland as a result of the proposed compensatory mitigation, wetland conversion will likely occur in small patches, the exact locations of which are difficult to predict. These factors would make monitoring to prove wetland conversion problematic. Therefore, BP has not claimed any credit for the wetland creation expected in CMA2.

Table 9
Summary of Compensatory Mitigation Acres, Ratios, and Credits

Type of Compensatory Mitigation	Size of Proposed Compensatory Mitigation Areas (acres)	Proposed Mitigation Ratio	Mitigation Credit (acres) [1]
Enhancement of existing degraded wetlands to compensate for temporary impacts to PEM wetlands	4.86	1:1	4.86
Enhancement of existing degraded wetlands to compensate for impacts to PFO wetland	7.61	4.5:1	1.69
Enhancement of wetland buffer areas (uplands)	28.43	8:1	3.55
Enhancement of existing degraded wetlands to compensate for permanent impacts to PEM wetlands	69.21	2.8:1	24.99
Total area	**110.11**	**3.1:1**	**35.37**

[1] Mitigation credit determined by dividing the acreage of each mitigation type by the proposed mitigation ratio.

The Corps normally recommends compensating for permanent wetland impacts at a minimum of 3:1 ratio for wetland enhancement. For temporary wetland impacts, the Corps recommends using a 1:1 ratio for wetland enhancement. Ecology guidance emphasizes that "the goal is always to replace the lost functions at a 1:1 ratio" (Ecology 1998). Ecology has established general mitigation ratios because it is usually necessary to increase the replacement acreage in order to accomplish the goal of replacing lost function. According to Ecology's ratios, impacts to Category II and Category III PEM wetlands can be compensated at a 4:1 ratio for enhancement whereas impacts to Category II and Category III PFO wetlands can be compensated at a 6:1 ratio for enhancement.

The proposed downward adjustment of Ecology's general mitigation ratios is appropriate in this situation for several reasons:

- The wetland areas to be eliminated have already been greatly disturbed by historical agricultural practices. The wetlands within the construction zones are rated as Category III wetlands under the Washington State Wetlands Rating System (Ecology 1993) and are providing only minimal performance of wetland functions. The loss of such wetlands will constitute only minimal environmental impact. Accordingly, their functional performance can be more than fully replaced with lower ratios than those outlined in Ecology's guidance.

- The wetland areas to be enhanced have also been greatly disturbed by historical agricultural practices though they are classified as Category II wetlands. These areas have high potential for improvement via rehabilitation. The proposed compensatory mitigation will significantly improve overall wetland functional performance on site and convert low quality Category II wetlands into a high quality Category II wetlands within 25 years. The completed wetland ratings data forms for the CMAs under conditions predicted for 25 years following initial mitigation activity are presented in Appendix C.

- URS has the extensive experience and technical knowledge of the BP Cherry Point property necessary to achieve successful wetland enhancement as proposed by this plan. URS designed and is currently monitoring enhancement of a 4.58-acre wetland area on the BP Cherry Point property that was initiated in fall 2000. This area was abandoned agricultural land strongly dominated by reed canarygrass. By reducing reed canarygrass cover, creating a shallow, seasonally inundated area, and establishing native plant communities, the goal of improving ecological integrity and overall functional performance is well on the way to being accomplished. This project is considered as a pilot project for the proposed compensatory mitigation. A copy of the *Year 2 Monitoring Report for Wetland Compensatory Mitigation, 4.58 acres BP Cherry Point Refinery* (URS 2002) is in Appendix D. An addendum displaying the additional photographs depicting site progress has been added to the monitoring report.

As recommended by the Federal Committee on Characterization of Wetlands for wetland enhancement and restoration projects, the proposed enhancement and restoration will improve wetland functional performance and benefit the functional performance of the surrounding landscape (Lewis, Jr. et al. 1995). Non-native, invasive plants (reed canarygrass, Himalayan blackberry, and evergreen blackberry) will be removed as much as possible. Stormwater runoff from the cogeneration facility's detention pond will be directed to a portion of one of the CMAs to improve water quality and restore historic drainage patterns. Stormwater from the detention pond to serve Lay-Down Areas 1, 2, and 3 will be directed to existing ponds and wetlands located west of the CMAs, also contributing to the restoration of historic drainage patterns. A mosaic of wetland habitats with diverse species composition and structure will be established in the CMAs. Habitat features such as downed logs and wildlife brush shelters will be placed in various locations to provide additional cover and forage for wildlife.

5.3.2 Site Selection

Off-Site Areas

A survey of the Terrell Creek basin was conducted to search for off-site properties that may be suitable for use in compensatory mitigation. Five vacant land properties equal to or greater than 20 acres in size and situated within the Terrell Creek watershed were for sale in 2002 (Figure 4). None of these properties were deemed to have high potential to compensate for the proposed wetland impacts. A combination of two or more of these properties used for compensatory mitigation would not satisfactorily compensate the proposed impacts either. Even in combination, the total area in these off-site parcels that could be used for compensatory mitigation is much lower than the total area to be used in the CMAs. Moreover, the logistics required for rehabilitating and maintaining one or more off-site mitigation areas would be problematic. A brief description of these five properties and their potential to provide area for compensatory mitigation is provided below:

1. The property closest to the project site is located on Brown Road, less than 0.5 mile east of the refinery. This parcel is 39.1 acres in size and is being sold by Re/Max Inc., Whatcom County. This property supports mature, second-growth forest over the western half and regularly maintained meadow (abandoned pasture) over the eastern half. The National Wetland Inventory (NWI) shows wetlands extending across the entire property. Approximately one-half the property contains a PFOA wetland community and the remaining half contains PEMA and PEMC wetland communities. A wetland delineation conducted in 1992 (Pegasus Earth Sensing Corporation 1992) found that most of the site consists of upland. However, the study found 11 wetlands totaling 9.3 acres in cumulative size. Wetlands were found in both the forest and the meadow. Since the property is far from a reliable source of water, creating wetlands on site would likely be difficult without a large amount of grading. The property is reportedly situated on a drainage divide and so only part of the property lies within the Terrell Creek basin. Thus, the potential for this property to be used as compensatory mitigation is low to moderate.

2. Another vacant-land property located within the Terrell Creek basin is located just south of Aldergrove Road, a few hundred feet west of North Star Road. This parcel is 21.5 acres in size and is currently for sale. Wetlands appear to be present on site. The NWI map shows this property to contain approximately 7.5 acres of PEMA wetlands. Review of aerial photographs and roadside observations indicated that a large portion of the site is meadow that is likely mowed for hay. The maintained meadow is over 15 acres in size and may extend across much of the PEMA wetland as indicated by the NWI map. Mature deciduous, broad-leaved forest extends east from the source of Terrell Creek across much of the property. A substantial portion of the on-site forest appears to be wetland. This portion of wetland is likely performing wetland functions at a relatively high level and could not be greatly improved. The property appears to have moderate potential for wetland enhancement and/or creation in the meadow areas.

3. This vacant-land property is located north of Grandview Road and east of Kickerville Road. The property is 20 acres in size and lies just north of Terrell Creek. The property is situated at the end of a gravel road and is relatively secluded. According to the NWI map, no wetlands occur in or near this property. Deciduous, broad-leaved forest covers much of the site. A utility corridor that is over 100 feet wide runs across the middle of the property. Trees and shrubs within the corridor appear to have been cleared and meadow vegetation that replaced the trees and shrubs appear to be well maintained. The northern portion of the site appears to be open forest with abundant brush and some gravel roads. A tributary of Terrell Creek runs through mature forest located along the southern edge of the property. The tributary joins Terrell Creek approximately 200 feet west of the property boundary. This parcel is almost entirely surrounded by forest and maintained meadows. The potential to enhance or create wetlands in this property appears low.

4. The fourth vacant-land property for sale that is located within the Terrell Creek basin is located on the corner of Blaine Road and Arnie Road. The NWI map shows that wetlands cover well over one-half the property. PEMA/PSSA wetland communities are shown to be located in the northern and southeastern portions of the site. A PFOA community is situated in the northeastern part of the parcel. This property is partially cleared, but contains mature deciduous, broad-leaved forest across much of the southern portion of the site and in the PFOA wetland community in the northeastern portion of the site. Overgrown meadow exists in the northwestern and central portions of the site. A few trees and shrubs are scattered across the meadow areas. The site has fairly level topography with no water features. This 40-acre property lies just east of a residential development. Properties to the north east, and south remain undeveloped or are under agricultural production. The potential to enhance or create wetlands in this property appears moderate.

5. This 21-acre property is located off of Holiday Road, just south of Birch Bay – Lynden Road. The NWI map shows that a PEMC wetland community covers approximately one half the property. This wetland area extends across much of the northern and eastern portions of the parcel where very few trees and shrubs are present. Large areas in the western and southern parts of the property support shrub-dominated habitats and semi-mature to mature deciduous, broad-leaved forest. The site has fairly level topography with no water features. The parcel is situated very just east and south of moderate density commercial and residential development. Properties to the south and east remain undeveloped or are under agricultural production. The potential to enhance or create wetlands in this property appears moderate.

<u>On-Site Areas</u>

In 2001, URS assessed over 1,000 acres (>400 hectares) of mostly agricultural land north of Grandview Road on the BP Cherry Point property for its potential to be used as compensatory mitigation (URS 2001; see Appendix E). An on-site investigation and remote resource information analysis were conducted to determine the presence, extent, and character of wetlands and uplands in the survey area. Vegetation communities were mapped and characterized according to dominant and subdominant plant species. Wetland plant communities were classified according to the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979). Surface soil layers and hydrologic regimes of each community type were described. Performance of wetland functions was assessed using the *Method for Assessing Wetland Functions* (Ecology 1999) as a guide.

The two main factors assessed to evaluate mitigation potential were environmental conditions and wetland functional performance. Other factors considered in assessing mitigation potential include site access and potential for re-establishing ecological connectivity.

Most portions of the mitigation potential survey area were considered to have at least moderate mitigation potential. The potential for restoring wetlands appeared low since virtually no areas that were historically drained for agriculture currently lack wetland hydrologic regime. The potential for creating wetlands also appeared low since few upland areas that lack valuable habitat such as mature forest occur on site. In contrast, the potential for enhancing wetlands on site was considered fairly high since degraded wetlands with moderately good conditions for growing native plants are widespread. A few sites considered to have especially high potential for enhancement were identified.

The CMAs were among the sites considered to have very high potential for enhancement for a number of reasons. In brief these reasons include good growing conditions, high potential to enhance ecological connectivity to intact natural communities located nearby, good accessibility, and high likelihood that environmental quality in the area will not degrade substantially over time. These reasons are discussed in more detail in the next section.

5.3.3 Compensatory Mitigation Potential of the CMAs

The large meadow areas encompassing the CMAs are readily accessible to laborers and heavy machinery from adjacent roads. Laborers and heavy machinery will need to access the site during site preparation, planting, and maintenance operations. The ditches separating the roads from the sites can be temporarily bridged to permit all-terrain vehicles (ATVs) carrying mulch and plants to cross them.

The open meadows within CMA2 will facilitate construction of a culvert and inlet channel necessary to direct stormwater runoff to this area from the detention pond proposed for the plant site. Directing stormwater runoff to this area will restore historic drainage patterns and provide additional hydrologic storage and water quality treatment. The broad slope within the site will allow flow to be dispersed across a wide area, improving hydrologic storage and performance of hydrologic functions. Most portions of the ditches within the CMAs could be filled to reduce the sites' overall drainage rates, thereby increasing hydrologic storage. The forest and shrub habitats that will develop in the CMAs will further improve hydrologic storage through increased evapotranspiration and interception of precipitation.

Both CMAs and the meadow areas adjacent are considered to have high potential for establishing a wetland complex including forest and shrub-dominated habitats (URS 2000a). Soils and hydrologic conditions present on site appear capable of supporting moderate to rapid growth of trees and shrubs, thus facilitating the re-establishment of forest and scrub-shrub habitat. Additionally, establishing forested and scrub-shrub habitat may encourage natural colonization by native trees and shrubs in meadow areas adjacent to the CMAs.

Growing conditions at the CMAs are adequate for establishing a variety of native plant communities despite some inherent problems. Although most of the soils are saturated or inundated long enough to become deoxygenated in the upper soil horizon during the early part of the growing season, virtually all areas become fairly dry and the soils well oxygenated as the season progresses. The runoff introduced to CMA2 will considerably increase inundation duration, but even the wettest areas here will continue to become fairly dry during the latter part of the growing season.

Although these areas have been degraded by past agricultural practices, the CMAs have not been cultivated and the ditches on site have not been maintained for at least 10 years. Soil structure, the arrangement of soil particles, has likely redeveloped to some degree over these past few years, improving soil drainage and aeration. Although most of the areas in the CMAs are covered with non-native grasses, native plants can be readily established using appropriate techniques.

Restoring or enhancing habitat types that have been eliminated or degraded by past agricultural practices may greatly bolster local ecological vigor. Re-establishing wetland habitats with mature, native vegetation will contribute to the re-establishment of a key component of the landscape's ecological integrity.

There is high potential for increasing connectivity between the CMAs and ecologically important areas located nearby. Enhancement of CMA1 will create a forested corridor between the Terrell Creek riparian forest and the mature upland forest located atop the hill just north of Grandview Road. Such a connection will improve ecological connectivity between the Terrell Creek riparian forest and the large forested areas south of Grandview Road. These forested areas south of Grandview Road extend south to the Lake Terrell Wildlife Area, a 1,500-acre reserve managed by the Washington Department of Fish and Wildlife (WDFW). These intact forests currently support many native plant species and provide habitat for a variety of wildlife including large mammals such as blacktail deer and coyotes. Connecting these forested areas is also considered desirable for heron, which have been observed preferentially flying along tree lines to reach foraging areas.

Enhancement of CMA2 will broaden the connection established by enhancement of CMA1 to include the area south of Terrell Creek and west of Blaine Road. CMA2 will extend west to the east edge of the existing mitigation site initiated in 2000, connecting this area with the habitat network to be enhanced by the proposed compensatory mitigation. Enhancement of both CMA1 and CMA2 will facilitate wildlife migration and dispersal in the Terrell Creek watershed. Migration and dispersal habitat is especially important to areas like this portion of Whatcom County that retain forested areas heavily fragmented by development. Creation of this corridor will also provide greater opportunities for native plants to exchange pollen and spread seed to and from intact forest and wetland habitats.

If no enhancement occurs in the CMAs, pioneering species such as red alder, hardhack (*Spiraea douglasii*), Himalayan blackberry, and evergreen blackberry will eventually colonize large portions of the seasonally saturated wetlands and upland meadows. The seasonally inundated portions of the wetlands may continue to be dominated by reed canarygrass and the few other herbaceous species present for a long time. Native forest and shrub-land communities may eventually dominate these areas, but not until many decades perhaps centuries have passed. Instead, successional processes can be artificially accelerated to produce forests and shrub-lands with a variety of native vegetation in much less time if appropriate techniques are applied.

5.4 ECOLOGICAL ASSESSMENT OF MITIGATION SITE

The *Revised Cogeneration Project Compensatory Mitigation Areas Wetland Delineation Report* (URS 2003a) details existing conditions within the CMAs including plant communities, soils, hydrologic regime, wetland functions, buffers, and land use. Much of the information from this report is summarized in this section.

5.4.1 Plant Communities

The CMAs and surrounding lands are predominantly composed of grassy areas that were once cultivated for hay. These areas have all been degraded by historic agricultural practices including plowing, planting with non-native grasses, and ditching. However, wetland conditions persist across most of the area. Of the 50.3 acres comprised by CMA1, 38.4 acres (76.2%) were determined to be jurisdictional wetland (see Figure 5A). Of the 59.8 acres comprised by CMA2, 41.3 acres (69.2%) were determined to be jurisdictional wetland (see Figure 5B).

Most of the lands within the CMAs are PEM wetlands dominated by non-native pasture grasses. Approximately 69.8% of the wetlands found in the CMAs are PEM communities that are seasonally saturated, but not inundated (PEMA). Most PEMA wetland areas are dominated by colonial bentgrass, but contain some areas with dominant amounts of soft rush and/or reed canarygrass. The distribution of each species is very patchy, and some patches in most areas are fairly small (100 to 1,000 ft^2). PEMA communities contain a few subdominant species including field horsetail, slough sedge (*Carex obnupta*), tall fescue (*Festuca arundinacea*), and other herbaceous species well adapted to moist, open conditions.

Nearly all of the remaining 30.2% of on-site wetlands are comprised by PEM communities that are seasonally flooded (PEMC). Most PEMC wetlands are dominated by reed canarygrass, soft rush, and/or creeping bentgrass. Species distribution in these communities is also patchy. PEMC communities also contain creeping buttercup (*Ranunculus repens*), field horsetail, meadow foxtail, and slough sedge.

A patchy mix of immature trees, shrubs, and herbaceous species are found lining the several ditches that traverse the CMAs. The vast majority of ditches were excavated in wetland areas and thus are considered portions of those wetlands. Plant species most commonly found along these ditches include black cottonwood, hardhack, Himalayan blackberry, evergreen blackberry, clustered wild rose (*Rosa pisocarpa*), and red alder. Typically, these trees and shrubs are rooted adjacent to the ditch whereas reed canarygrass and/or a few other hydrophytic herbaceous species are rooted within the ditch. Although these ditches are not maintained and are overgrown with vegetation, most ditches continue to facilitate drainage from the CMAs.

Upland areas are interspersed within the wetlands present on site. Upland areas comprise 12.0 acres (23.8%) of CMA1 and 18.4 acres (30.8%) of CMA2. Most of this upland area is meadow that is difficult to distinguish from adjacent wetland meadow areas. Virtually all uplands present in the CMAs are slightly elevated above the wetlands that surround them or are situated on well-drained slopes. However, most uplands in the CMAs typically retain saturation near the soil surface for long periods during the wet season. Upland meadow areas are dominated by non-native pasture grasses, typically colonial bentgrass and common velvetgrass. Some upland meadow areas have substantial amounts of other pasture grasses including quackgrass (*Elytrigia repens*), tall fescue, reed canarygrass, and sweet vernal grass. In addition, small patches of Himalayan blackberry and evergreen blackberry, two non-native, invasive shrubs, are found in both meadow and forested portions of the upland areas.

5.4.2 Soils

Two of the three soil series that predominate in the CMAs are considered hydric since they typically sustain saturation at or near the soil surface throughout extended periods of the growing season. All three soil types are moderately fertile and slightly acidic in the surface layer (Goldin 1992). A more detailed description of the soil types is in the wetland delineation report for the CMAs (URS 2003a).

As mentioned in Section 2.3, most of the soil in this portion of Whatcom County was formed in Bellingham Drift and is underlain by clay till (Goldin 1992). Bellingham Drift is the surface stratigraphic layer underlying a large area encompassing the proposed construction site and CMAs. This layer is 70 to 80 feet thick and is considered to be an aquitard, allowing relatively little water to percolate to Terrell Creek or to the aquifer located below the Bellingham Drift. A profile drawing showing the stratigraphic layers in the area is in Figure 3.3-5 of *BP Cherry Point Cogeneration Project – Application for Site Certification* (Golder Associates 2003d). This drawing is presented in Appendix A.

5.4.3 Hydrology

A very high proportion of precipitation falling across this area is stored in the soil and surface depressions or becomes runoff that enters Terrell Creek as surface water during the wet season and the early part of the dry season. As a result, the main source of water for Terrell Creek is surface water runoff from the 20.8 square mile drainage area, including runoff from Lake Terrell. Although mean annual flow in the lower portion of Terrell Creek (west of the Jackson Road crossing) is estimated to be 20 to 30 cfs (Wenger pers. comm. 2002), the creek has been known to dry up completely most summers (State of Washington Department of Water Resources 1960).

The clay till and low relief found throughout the area greatly decreases vertical and lateral drainage, fostering widespread near-surface saturation and/or shallow inundation during the wet season. The surface soil layers in most areas on site are saturated at or near the surface during most of the wet season. As shown in Figures 5A and 5B, large portions of the CMAs support shallow (typically 1 to 3 inches deep) inundation that persists through most of the wet season. Water depths and soil moisture in the CMAs steadily decline during the latter part of the wet season and the early part of the dry season via evaporation, transpiration, and infiltration. The vast majority of the sites retain low to moderate moisture levels by the end of the growing season. No areas within the CMAs consistently support surface water throughout the year.

Figures 6A and 6B show existing hydrologic pathways and surface flow rates within and downgradient of each CMA. The surface water pathways within the CMAs occur in ditches and natural channels as well as in broad swales where surface water may be dispersed across swales as semi-concentrated flow or across very broad swales as sheet flow. Subsurface pathways were estimated as occurring within the topsoil near the soil surface; this type of flow path is termed interflow. To determine locations of hydrologic pathways, ditches and swales were walked and water was pumped into one important ditch to observe its flow. Observations of topography and observations of water flow during storm events contributed to identifying hydrologic pathways. Various flow observations were also compared to rainfall data collected by the BP meteorological station.

Estimates of flow rates at various locations were made during a 6-month, 24-hour storm event that occurred December 13, 2001. These estimates were confirmed by calculations made using the Soil Conservation Service (SCS) method to predict runoff that would occur on site during the 6-month, 24-hour storm event. The SCS method, or the SCS Curve-Number Method, was created by the US Soil Conservation Service and is a commonly used approach for predicting runoff from watersheds (SCS 1973).

CMA1 drains northward to Terrell Creek (see Figure 6A). The hydrologic input for the ditch is precipitation that falls on the land immediately within CMA1 and the west-facing portion of the hill immediately east of CMA1. The hillslope in the southeastern portion of the site faces northwest at approximately 3.5% grade. The rest of the site is nearly flat, but slopes gently (<1% grade) to the north. A broad, shallow ditch carries surface water north across the site. The ditch is 5 to 20 feet wide and 1 to 1.5 feet below the elevation of land immediately surrounding it.

The ditch contains slowly flowing water during the wet season and shallow standing water and/or no standing water from June through October. The ditch rapidly becomes a well-defined channel after it exits CMA1 to the north. This channel leads through the steeply sloped riparian forest to join Terrell Creek.

A smaller and much shallower ditch is also present in CMA1. This ditch extends from the west edge of the site to the main ditch in the northwestern part of the site. This ditch is situated on a relatively flat grade and does not appear to support any flowing water except perhaps during very large winter storm events. The ditch is approximately 2.5 feet wide and 1 feet deep below the elevation of the land surrounding it. A portion of this ditch appears to have been filled and is now only a hedgerow.

CMA2 drains westward to the extensive wetland system off-site, which drains to Terrell Creek near the crossing at Jackson Road (see Figure 6B). The easternmost 350 feet of CMA2 is fairly flat, but the remaining portions including the 'panhandle' slope west at approximately 2.25% grade. The panhandle is the unofficial title for the northwestern portion of CMA2 located west of the finger of forest that extends north from the large forest situated along the western boundary of CMA2's main section. The panhandle generally slopes west at approximately 2.5% grade, but it does contain some areas as steep as 6%. As with CMA1, historic cultivation has substantially disturbed the site, including the creation of ditches that continue to facilitate site drainage. Most of the site is sloped so that subsurface moisture seeps toward the ditch system that leads west across the site.

Two ditches of moderate depth carry surface water north and west across CMA2. The ditch leading north along the western boundary of CMA2 is 2 to 3 feet wide (bottom width) and 2 to 4 feet below the elevation of land immediately surrounding it. The northern portion of this ditch is just within the large upland forest community. The ditch leading west across the site is 2 to 3 feet wide (bottom width) and 1 to 2 feet deep. This ditch crosses the northern portion of the forest patch located just outside of CMA2. The confluence of the two ditches is located at the western edge of the forest, at the southeastern corner of the panhandle. Below the confluence, the ditch continues west along the southern edge of the CMA2 panhandle and extends off site.

Once off site, the ditch runs through the large forested area west of CMA2. From this point flows splits, with some leading north as sheet flow through a large PEM wetland, then west to Terrell Creek just east of

Jackson Road and the remaining flow following the ditch to two large ponds that drain to Terrell Creek under Jackson Road.

It should be noted that a small, but substantial amount of water from the west-flowing ditch currently leads north to become dispersed across a wide portion of the CMA2 panhandle. Some surface water travels north from this ditch through the seasonally inundated wetland area located northwest of the existing forest patch. A portion of this water seeps westward through the adjacent upland, which is sloped to the west and transmits groundwater at moderate rates through a subsurface soil layer. Near the southern portion of this seasonally inundated area is another location where some flow splits from the ditch to the north. Most of this semi-concentrated flow travels west to a swale that directs flow northward. Surface water in the swale then seeps westward through the adjacent upland, as with the sloped upland discussed above. As a result of this seepage, the seasonally inundated area at the western edge of CMA2 and the forested wetland to the south remain shallowly inundated and/or saturated throughout most of the wet season. Most of the water here seeps west to the ditch that runs north along the east edge of an existing compensatory mitigation site that was established in 2000 (Corps Reference #98-4-02349).

Runoff from the plant site and a much larger area to the south is currently directed to the ditch along the east side of Blaine Road. Water flow in the ditch occurs mainly during the wet season and has been observed to be typically greater than 1 cfs during the wet season. The ditch is lined with rip-rap for most of its length, but does contain enough soil in some spots to support hydrophytic plants. The ditch leads to a concrete culvert that is 3 feet in outside diameter and located south of Terrell Creek. The culvert leads north by northeast down through a narrow thicket of Himalayan blackberry and into the mature deciduous, broad-leaved riparian forest. The culvert descends a 20-40% slope and leads to a 50-foot long gravel channel than connects with Terrell Creek just upstream of the large culvert under Blaine Road. Both the culvert and the channel appear stable and likely do not contribute much sediment to Terrell Creek.

Stormwater runoff from a large portion of the refinery is detained in a detention pond and subsequently pumped to the Strait of Georgia near Cherry Point. Runoff from over 50 acres of undeveloped forest and shrub-land in the northwest portion of the refinery property is directed off-site via ditches and culverts to a Terrell Creek tributary located west of Jackson Road. Stormwater runoff on the northeastern portion of the refinery is routed through a culvert under Grandview Road that leads to a series of ponds and wetlands in the undeveloped area west of CMA2.

The area west of CMA2 contains four ponds connected by wetlands and seasonally flowing channels. The ponds are all permanently inundated and of varying size and shape. The first two ponds in the pond series were constructed by WDFW in the 1990's. The first pond is relatively small (0.25 acre), and the second pond is fairly large (4.5 acres). Outflow from both ponds is controlled by weirs located at each pond's outlet. Although the ponds are intended to provide habitat for waterfowl, these ponds induce water quality treatment by providing approximately 200,000 to 250,000 ft^3 of hydrologic dead storage each winter. Surface water released from the large pond flows through a wide, densely vegetated channel that leads west. A few small wetlands may receive some flow from this channel, but most of the flow enters the third pond after joining runoff from the ditch that leads west of CMA2. Surface water from the third pond, which is approximately 3.5 acres in size, drains through a culvert to the fourth pond, which is approximately 2.5 acres in size. The fourth pond drains to Terrell Creek through a culvert under Jackson Road.

As mentioned earlier, soil moisture levels vary greatly between wet season and the dry season because the difference in precipitation between these periods is exacerbated by the poorly drained soils and their high rates of runoff. Moreover, historical cultivation of clayey soils combined with ditch drainage likely caused the hydrologic regime to fluctuate more than had occurred prior to cultivation. However, the gentle topography combined with the soil structure redevelopment that likely occurred during the past few years without cultivation may have allowed soils in the CMAs to regain some of their inherent permeability and storage capacity, thereby allowing them to moderate hydrologic fluctuation to some degree.

A comprehensive monitoring of the site's hydrologic regime is being initiated. On CMA 1, approximately 6 shallow wells will be systematically located to capture current versus post-mitigation surface and subsurface hydrologic change associated with the ditches. Between 15 and 20 shallow wells will be installed in strategic locations throughout CMA 2 to measure current versus post-mitigation hydrologic patterns. An explanation of the methods, data collection, and results garnered are described in the Cogeneration Project Hydrologic Monitoring Work Plan (Appendix G). The information will be used to improve design and implementation of the mitigation and to provide a means for assessing hydrologic conditions before and after surface water diversions are made. They will be monitored frequently through the end of the mitigation monitoring period. In addition to determining the site's hydroperiod (water level fluctuation) and its spatial variation, monitoring will determine locations and rates of existing and post-mitigation flowpaths, both above the surface and as shallow groundwater.

The areas sampled by each gauge will be delineated and mapped prior to diverting surface water to the site. Surface elevation and hydrologic regime of the area immediately surrounding the gauge will be similar to the area that the gauge is determined to be sampling. It is presumed that changes in hydrologic regime will occur in some areas and not occur in other areas.

The map will be checked for adequacy through observations of on-site conditions after the hydrologic modifications are implemented. The geographic extent of the areas sampled by each gauge as presented in the map may be altered to reflect actual changes in hydrologic regime. Any alterations to the map will be documented and explained in monitoring reports.

5.4.4 Experience

URS designed a 4.6-acre compensatory mitigation site located within the BP Cherry Point property north of Grandview Road (Corps Reference #98-4-02349). This project involved rehabilitating a portion of a PEM wetland including removal of non-native, invasive plants, creating a 0.5-acre seasonally inundated area, and establishing a mosaic of native plant communities. Two years of site monitoring have shown that the wetland rehabilitation is on a trajectory toward success. Approximately 90% of the trees and shrubs installed on site have survived and over 90% of these plants show no signs of stress. Whereas herbaceous cover in most portions of the site is greater than 100%, cover by reed canarygrass, a non-native, invasive weed, has been reduced from over 90% to approximately 12% of the site. A copy of the *Year 2 Monitoring Report for Wetland Compensatory Mitigation, 4.58 acres BP Cherry Point Refinery* (URS 2002) is in Appendix D.

5.4.5 Exotic (Non-Native, Invasive) Species

The proposed mitigation will control the non-native, invasive plants growing in the CMAs. Non-native plants dominate most portions of the CMAs. As with the Restoration Areas, only reed canarygrass, Himalayan blackberry, and evergreen blackberry are considered invasive, which signifies that they can be highly competitive and difficult to control. Thus, these species will be the focus of the non-native, invasive species control program.

As discussed earlier, most wetland areas of the CMAs are dominated by intergrading patches of reed canarygrass, bentgrass, and soft rush. Most of the upland areas are dominated by non-native pasture grasses such as colonial bentgrass, velvetgrass, and tall fescue. A few uplands contain patches of Himalayan and evergreen blackberry growing apart from and/or entangled with native trees and shrubs.

The existing distribution of reed canarygrass across the CMAs was mapped by use of a Global Positioning System (GPS) with sub-meter accuracy (Figure 7A and 7B). Three categories of reed canarygrass cover were defined to guide the mapping effort: 1) <20% cover, 2) 20% to 95% cover, and 3) >95% cover. The cover categories used to gauge reed canarygrass distribution reflects actual conditions on site. The limited number of categories facilitated the mapping effort. The area covered in reed canarygrass for each category is presented in Table 10.

Table 10
Existing Reed Canarygrass Cover

Cover Category	CMA1 (acres)	CMA2 (acres)	Total (acres)
<20%	25.43	38.44	63.87
20-95%	15.36	12.42	27.78
>95%	9.57	8.93	18.50

The total area that supports greater than 20% cover by reed canarygrass is 46.28 acres, which is about 42% of the total area encompassed by the CMAs. Although 9.5 acres smaller than CMA2, CMA1 contains a larger amount of area with greater than 20% reed canarygrass cover. This pattern correlates to the higher proportion of wetland area in CMA1. The vast majority of reed canarygrass found in the CMAs occurs in wetlands. However, a few on-site upland areas support reed canarygrass, including a few patches with greater than 20% cover.

As with the Restoration Areas, control of non-native, invasive plant species will consist of a three-pronged approach: 1) initial removal, 2) subsequent maintenance for short-term control, and 3) establishment of native plant communities for long-term control. This approach will be applied to all areas within the CMAs. The first two prongs of the three-pronged approach will be applied to the areas between the CMAs and the ditches within the ROWs.

Removal will occur through a combination of mowing, tilling, and herbicide application. Subsequent maintenance will mainly employ hand-pulling and herbicide application, but may involve some mowing as well. Native trees and shrubs will eventually provide enough shade and organic litter to suppress growth of non-native, shade-intolerant plants from large portions of the site.

Those areas that have greater than 20% cover by reed canarygrass will be regularly mowed for two growing seasons prior to the initial phase of planting. Frequent mowing during this time will diminish the reed canarygrass population in these areas by removing above-ground plant matter, depleting carbohydrate reserves, and suppressing seed production. Any small patches of reed canarygrass found within areas mapped as having <20% cover by reed canarygrass will be mowed or sprayed with herbicide.

Clumps of Himalayan and evergreen blackberry that are not intertwined with native trees and shrubs will be mowed with a brush-cutter. Blackberry that is intertwined with trees will be removed by hand to prevent damage to native vegetation. Cut stems may be mechanically chopped to pieces less than 0.5 foot in length with a crop chopper and may be left on site to serve as mulch.

Those areas that contain greater than 20% cover by reed canarygrass will be tilled. Tilling will occur after mowing during the growing season prior to the initial phase of planting. A large rototiller pulled by tractor will till soils to a 6-inch depth. These portions of the site will then be disked to further break up the clods and kill rhizomes that survived the mowing. Areas with less than 20% cover by reed canarygrass will not be tilled since tilling is not necessary or practical to suppress reed canarygrass in these areas and tilling is not critical to establishing native trees and shrubs. However, any stands of reed canarygrass found in these areas will be mowed and subsequently sprayed with herbicide.

Tilling and disking will fatally damage many of the reed canarygrass rhizomes, but will likely encourage buried seeds and undamaged rhizomes to resprout. Reed canarygrass that does resprout will be sprayed with herbicide. The herbicide applied on site will consist of glyphosate plus surfactants and will only be applied to areas free from inundation and unlikely to support inundation within 2 weeks of application. Herbicide will be applied by state-licensed applicators. This sequence of mowing, tilling, disking, and spraying herbicide will work to exhaust energy supplies of the reed canarygrass population. The herbaceous seed mix selected for the tilled areas has been recommended by the Corps of Engineers because it has proven to be effective at competing with reestablishing reed canarygrass.

The second and third components of the three-pronged approach to non-native, invasive plant control will be implemented equally between tilled and untilled areas. As with the Restoration Areas, weed control will occur through a combination of mechanical removal and herbicide application after native plants are installed and the seed mix applied. Although such maintenance is expected to occur throughout most of the 10-year monitoring and maintenance period, the intensity of the maintenance effort should decrease over time. Eventually, native vegetation will serve to suppress non-native plants over large portions of the site by shading and soil resource competition.

The road ROWs and the setback areas between the CMAs and the road ROWs will be regularly mowed throughout the 10-year monitoring period. This will suppress reed canarygrass or any other exotic plants from producing and disseminating propagules to the CMAs from these areas.

As previously mentioned, URS will monitor the success of non-native, invasive species control each year of the 10-year period. Contingencies will be made if control methods fail to attain performance standards, as necessary. For reed canarygrass, the contingency measures consist of targeted efforts to control outbreaks such as manual removal of invasive species, additional spot applications of herbicide, more frequent mowing, and additional plantings and/or seedings in problem areas.

5.4.6 Wetland Functions

The proposed rehabilitation is predicted to significantly improve the performance of several wetland functions. URS assessed performance of wetland functions for each portion of the CMAs using the *Methods for Assessing Wetland Functions* (Ecology 1999). Functional performance of the wetlands under current conditions is documented in the delineation report for the CMAs (URS 2003a).

The wetlands within the vicinity of the compensatory mitigation were broken into multiple assessment units to more accurately evaluate their functional performance. The assessment units are divided by differences in contributing basin and hydrologic regime.

The assessment unit associated with CMA1 is the wetland area within CMA1. Although this wetland extends beyond CMA1 to the east, drainage within CMA1 either leads to the main ditch or to two intermittently flowing channels that are just east of the main ditch. Surface water in the wetland area east of CMA1 drains away from CMA1 and enters a seasonally flowing channel that leads to Terrell Creek several hundred feet upstream of where surface water from CMA1 enters the creek. The contributing basin for the CMA1 assessment unit is comprised by CMA1 and a small upland area southeast of CMA1.

The assessment unit associated with CMA2 includes the wetland within CMA2 and the area to the north and south of the CMA2 panhandle. This area is estimated to be approximately 68 acres in size and does not include the two ponds created by WDFW, the channels leading to them from the culvert under Grandview Road, or the existing mitigation area (see Figure 6B). The assessment unit contains the portion of the large contiguous wetland extending west to the floodplain for Terrell Creek near Jackson Road that generally slopes west at an average 2.5% grade. As a result, most surface water flows west at relatively rapid velocities. The vast majority of the part of this wetland that lies outside the assessment unit slopes west at approximately 1% grade and has relatively slow flow velocities. As a result of the gentle slope, ditch flooding and sheet flow is much more common in the area outside the assessment unit (see *Revised Cogeneration Project Compensatory Mitigation Areas Wetland Delineation Report* <URS 2003a> for more details). The contributing basin for the CMA2 assessment unit under current conditions is comprised by the area within the assessment unit itself. For post-mitigation conditions, the contributing basin also includes the cogeneration facility (33 acres).

The wetlands within the two assessment units both classify as Depressional Outflow wetlands. Because most portions of the wetland within CMA1 have very gentle slope and precipitation appears to be nearly 90% of this wetland’s water source, the wetland within CMA1 nearly classifies as a Flat wetland according to the classification system used by the functional assessment method. The CMA2 assessment unit nearly classifies as a Slope wetland since it slopes west at an average of 2.5% grade. However, both wetland areas classify as Depressional Outflow wetlands because they are open basins with subsurface inflow from adjacent uplands, do not receive river or stream flooding, and emit outflow that ultimately leads to a downstream waterbody (Terrell Creek).

The assessment method was also applied to the assessment units under current conditions and under conditions that are expected to develop 25 years after compensatory mitigation is initiated. The completed data sheets for these assessments are presented in Appendix B.

The results of this evaluation are summarized in Tables 11 and 12. The possible range of index values for each function is 1 to 10, where 10 represents the highest level of performance. The acreage of each mitigation area was used to calculate acre-points. As explained previously, acre-point calculation provides a more quantitative means of comparing gains in functional performance induced by mitigation with losses in functional performance induced by the proposed construction. As recommended by Ecology (1999), URS compared the results of the functional assessments for the mitigation areas with those for the construction site to better determine the adequacy of the compensatory mitigation plan to offset the proposed impacts.

Table 11
Comparison Between Functional Performance of the Assessment Unit Associated With CMA1 (38.4 Acres) Under Current Conditions and 25 Years After Compensatory Mitigation Is Initiated

Wetland Function	Functional Indices – Existing Condition	Functional Indices – 25 Years Post Mitigation	Explanation
Potential for Removing Sediments	4/ 153.6	3/ 115.2	Decrease (-38.4 acre points) predicted since area of herbaceous vegetation cover will decrease.
Potential for Removing Nutrients	2/ 76.8	2/ 76.8	No change predicted since the size of seasonally inundated area will not change substantially.
Potential for Removing Heavy Metals and Toxic Organics	4/ 153.6	3/ 115.2	Decrease (-38.4 acre-points) predicted due to decrease in cover by herbaceous vegetation.
Potential for Reducing Peak Flows	4/ 153.6	4/ 153.6	No change predicted since ditch plugging will occur only in the upper portion of the ditch.
Potential for Decreasing Downstream Erosion	5/ 192.0	7/ 268.8	Increase (+76.8 acre-points) predicted due to increase in percent covered by forest and shrub vegetation.
Potential for Recharging Groundwater	3/ 115.2	3/ 115.2	No change predicted since vertical drainage in this area will remain slow.
General Habitat Suitability	3/ 115.2	5/ 230.4	Increase (+76.8 acre-points) predicted due to increase in area with canopy closure, maximum number of strata, number of snags, vegetation class interspersion, large woody debris, water and vegetation interspersion, and number of native plant species.
Habitat Suitability for Invertebrates	2/ 76.8	4/ 153.6	Increase (+76.8 acre-points) predicted due to increase in exposed substrate, vegetation class interspersion, large woody debris, maximum number of vegetation strata present.
Habitat Suitability for Amphibians	2/ 76.8	3/ 115.2	Increase (+38.4 acre-points) predicted due to increase in surface substrate types, water and vegetation interspersion, and large woody debris.
Habitat Suitability for Anadramous Fish	N/A	N/A	No anadromous fish can or will be able to access the site.
Habitat Suitability for Resident Fish	N/A	N/A	No resident fish can or will be able to access the site.
Habitat Suitability for Birds	4/ 153.6	5/ 192.0	Increase (+38.4 acre points) predicted with increase in number of snags, vegetation class interspersion, special habitat features, index for invertebrate habitat suitability, and index for amphibian habitat suitability
Habitat Suitability for Mammals	3/ 115.2	4/ 153.6	Increase (+38.4 acre-points) predicted due to increase in water and vegetation interspersion and forest cover.
Native Plant Richness	1/ 38.4	3/ 115.2	Increase (+76.8 acre-points) predicted due to increase in maximum number of strata, number of native plant species, and decrease in area dominated by non-native plant species.
Potential for Primary Production and Organic Export	6/ 230.4	7/ 268.8	Increase (+38.4 acre-points) predicted due to increase in area covered by woody vegetation.

Table 12
Comparison Between Functional Performance of the Assessment Unit Associated With CMA2 (64 Acres) Under Current Conditions and 25 Years After Compensatory Mitigation is Initiated

Wetland Function	Functional Indices – Existing Conditions	Functional Indices – 25 Years Post Mitigation	Explanation
Potential for Removing Sediments	4/ 256	4/ 256	No change predicted despite increase in seasonally inundated area due to decrease in cover by herbaceous vegetation.
Potential for Removing Nutrients	2/ 128	2/ 128	No change predicted despite increase in seasonally inundated area due to decrease in cover by herbaceous vegetation and no change in soil type.
Potential for Removing Heavy Metals and Toxic Organics	4/ 256	3/ 192	Decrease (-64 acre-points) predicted due to the decrease in cover by herbaceous vegetation despite the increase in seasonally inundated area.
Potential for Reducing Peak Flows	4/ 256	4/ 256	No change predicted since increase in size of seasonally inundated area will not be accompanied by a great increase in outlet constriction.
Potential for Decreasing Downstream Erosion	5/ 320	7/ 448	Increase (+128 acre-points) predicted due to increase in percent area covered by forest and shrub vegetation.
Potential for Recharging Groundwater	2/ 128	3/ 192	Increase (+64 acre-points) predicted due to increase in seasonally inundated area.
General Habitat Suitability	3/ 192	6/ 384	Substantial increase (+192 acre-points) predicted due to increase in area with canopy closure, maximum number of strata, number of snags, vegetation class interspersion, large woody debris, number of water regimes, number of water depth categories, water and vegetation interspersion, and number of native plant species.
Habitat Suitability for Invertebrates	3/ 192	6/ 384	Increase (+192 acre-points) predicted due to increase in exposed substrate, vegetation class interspersion, large woody debris, water and vegetation interspersion, maximum number of vegetation strata present, and inundation depth and persistence.
Habitat Suitability for Amphibians	2/ 128	4/ 256	Increase (+128 acre-points) predicted due to increase in water and vegetation interspersion and large woody debris.
Habitat Suitability for Anadramous Fish	N/A	N/A	No anadromous fish can or will be able to access the site.
Habitat Suitability for Resident Fish	N/A	N/A	No resident fish can or will be able to access the site.
Habitat Suitability for Birds	4/ 256	6/ 384	Increase (+128 acre-points) predicted due to increase in number of snags, vegetation class interspersion, special habitat features, index for invertebrate habitat suitability, and index for amphibian habitat suitability.
Habitat Suitability for Mammals	3/ 192	4/ 256	Increase (+64 acre-points) predicted due to increase in forested cover and connection to high quality forested habitat.
Native Plant Richness	1/ 64	5/ 320	Increase (+256 acre-points) predicted due to increase in maximum number of strata and number of native plant species, and decrease in area dominated by non-native plant species.
Potential for Primary Production and Organic Export	6/ 384	7/ 448	Increase (+64 acre-points) predicted due to increase in seasonally inundated area and area covered by woody vegetation.

The abilities for the CMA1 and CMA2 assessment units to remove sediment from surface water inputs are rated moderate, whereas their abilities to remove nutrients is rated moderately low. According to the results of the functional assessment, sediment and nutrient sequestration is limited by the lack of permanent water, low permeability of the soils, and low level of outlet constriction in each CMA. Sediment and nutrient capture is aided by the high cover of herbaceous vegetation and presence of seasonally inundated areas.

According to the results of the assessment, the performance of these functions will not change 25 years after compensatory mitigation is initiated. Performance is not predicted to change in CMA1 since the proposed topographic and hydrologic manipulations there will not greatly constrict outflow. Despite that inundation frequency, duration, and magnitude will increase considerably in CMA2, the model does not predict any increase performance of sediment and nutrient removal functions due to the expected decrease in herbaceous cover from shading by forest and scrub-shrub vegetation. Since all the runoff from CMA1 is from well-vegetated areas that will remain relatively undisturbed, the opportunity for CMA1 to enact its potential to remove sediments and/or nutrients will be low. Since most sediments in the runoff from the plant site will be removed by the proposed detention pond and oil/water separator, the opportunity for CMA2 to enact its potential to remove sediments and/or nutrients will be low to moderate.

The potential for removing heavy metals is rated moderate for both wetland areas according to the assessment results. Since precipitation provides the vast majority of the water for these wetlands, few toxins enter these wetlands. Thus, toxin removal is a function the wetlands currently have little opportunity to perform. The performance of this function is predicted to slightly decrease below its current level 25 years after compensatory mitigation is initiated. The decreases are predicted for both CMAs due to the expected decrease in cover by herbaceous vegetation. CMA1 and the portion of the assessment unit associated with CMA2 to be unaffected by runoff piped from the plant site will continue to have little opportunity to perform this function in the future. In contrast, the opportunity for the portion of CMA2 that will receive stormwater runoff to perform this function will increase to some degree.

The abilities of the wetlands to reduce peak flows and decrease downstream erosion are rated moderate according to the results of the assessment. The performance of these functions within the CMAs are limited by the moderate amount of seasonally inundated areas, low amount of woody vegetation, and low level of outlet constriction. However, the high ratio of wetland area to contributing basin area enhances the performance of these functions. The opportunity for these functions to be performed is moderate since there is a moderate amount of runoff from the wetlands. It should be noted that the opportunities for the CMAs to reduce peak flows and decrease downstream erosion are currently low to moderate these sites.

Despite the proposed hydrologic modifications, the model does not predict that the potential to reduce peak flows in the CMAs will change. Although the proposed topographic and hydrologic modifications will increase hydrologic storage and reduce peak runoff rates to some degree, the flooding depth, outlet constriction, and ratio of inundated area to sub-catchment area will not increase substantially for either CMA. Although the inundated area within the assessment unit associated with CMA2 will nearly double in size, the inundated area to sub-catchment area ratio does not increase dramatically because the plant site (33 acres) will become part of CMA2's catchment area. As a result, the model does not predict any increase in the ability of either CMA to reduce peak flow. However, directing stormwater to CMA2 will substantially decrease peak runoff rates delivered from the plant site to Terrell Creek. Instead of being directed through a large ditch along the east edge of Blaine Road that leads directly to the creek, runoff piped to CMA2 will be stored on site and in the large area downgradient before reaching Terrell Creek near its crossing with Jackson Road. The opportunity for CMA1 to reduce peak flows will continue to be low to moderate, but will be moderate to high in CMA2 due to the inflow of detention pond runoff.

The ability to decrease downstream erosion is predicted to improve to some degree in both CMAs. Although the peak runoff reduction and downstream erosion control functions are closely related, only the erosion-control function is predicted by the model to improve due to the substantial increase in forest and scrub-shrub vegetation. The woody vegetation will produce improve hydrologic storage and increase hydraulic roughness, thereby reducing runoff and associated erosion from the CMAs. Despite the establishment of woody vegetation, surface water inputs to the CMAs (especially in CMA2, post mitigation) will continue to overwhelm soil storage capacity, thereby perpetuating the relatively high surface water runoff from the sites. The opportunity for CMA1 to decrease downstream erosion will continue to be low to moderate, but will increase to a moderate to high level in CMA2 where runoff will be delivered from the plant site. Hydrologic storage in CMA2 will reduce the erosive power of the plant site runoff, which would be much higher if all of it was funneled to the large ditch east of Blaine Road.

The potential for the assessment units to recharge groundwater is rated to be moderately low due to the poor vertical drainage of their soils. Because of the more widespread inundation in CMA1, this area is rated to have slightly higher potential to recharge groundwater than CMA2 assessment unit. Infiltration rates are very slow within the BP Cherry Point property and surrounding areas because of the soils here are underlain by a thick stratigraphic layer high in clay and silt (Bellingham glaciomarine drift). Terrell Creek receives virtually no base flow from groundwater sources (State of Washington Department of Water Resources 1960).

Results of the assessment predict that the potential for the CMA1 to recharge groundwater will remain at the current level, yet the potential for CMA2 to recharge groundwater will increase slightly. CMA1's potential is not expected to change since the increase in inundation due to the proposed topographic and hydrologic modifications will not be very large. In contrast, the extent of seasonally inundated area in the assessment unit associated with CMA2 is expected to nearly double. This increased inundation will cause greater amounts of ground water to be stored in the soil within and downgradient of CMA. Given the very low permeability and infiltration capacity of the soils in the area, the opportunity to recharge groundwater stored in stratigraphic layers below the soil will remain low for both CMAs.

The proposed rehabilitation will substantially improve habitat suitability functions on site. Suppression of non-native, invasive plants and establishment of native vegetation will enhance wildlife habitat as well as increase primary production and organic export. Establishing native plant communities will create more habitat structure and diversity, which will likely augment both wildlife and plant diversity. Given the proximity of relatively intact habitats such as mature forests, streams, lakes, and coastal habitats, the opportunity for these wetlands to perform the habitat suitability functions will be moderate to high.

The increased extent of inundation to occur in CMA2 and the native emergent vegetation and woody debris to be established in inundated portions of both CMAs will provide increased opportunities for aquatic insects and amphibians to find cover, food, and breeding sites. The absence of surface water in late summer will continue to prevent colonization by organisms such as bullfrogs, a non-native amphibian species that preys upon amphibian larvae (Richter 1999). Pacific chorus frogs and red-legged frogs are present in nearby areas and will likely colonize the enhanced wetlands in only a few years following their installation.

Other wildlife likely to benefit from the proposed compensatory mitigation includes mammals and birds. Mammals that rely upon woodland and woodland/meadow edge habitat such as blacktail deer, coyotes, Douglas squirrels, raccoons, and porcupines will benefit from the establishment of forest and scrub-shrub communities. A wide variety of birds will likely find nesting and/or foraging habitat in the CMAs 25 years following initial mitigation activity including warblers, sparrows, swallows, woodpeckers, hawks, and shrikes.

Upon reaching maturity, the trees and shrubs to be installed will provide habitat for a variety of wildlife including mammals, birds, and amphibians. The forested and scrub-shrub areas will provide shelter and thermal insulation for many species, which is especially important during winter. These habitats will permit nesting and breeding for a variety of species incapable of utilizing the open meadows for such activities. The wooded areas will also serve as a migration and dispersal corridor connecting the forested areas south of Grandview Road with the riparian forest surrounding Terrell Creek to the north. Migration and dispersal habitat is especially important to areas like this portion of Whatcom County where forested areas are severely fragmented by development.

The forested and scrub-shrub areas will encourage the establishment and growth of native mid-story and understory vegetation and suppress invasion by non-native, invasive plants. The forested and scrub-shrub communities to be established on site may eventually expand into adjacent unimproved areas, thereby further enhancing habitat value for the area. However, the model predicts that the increase in native, woody vegetation will suppress improvement of bird habitat suitability, causing no score increase in CMA1 and only an increase of 2 performance points in CMA2.

Aquatic insects, amphibians, and other animals attracted to the enhanced wetlands and uplands will provide increased foraging opportunities for a variety of birds including passerines (perching birds), waterfowl, raptors, and great blue herons. Herons forage for amphibians and small mammals in the shallow ponds and fallow fields north of Grandview Road (Eissinger pers. comm. 2001). Significant areas of open field habitat will be maintained for heron foraging. The quality of these foraging areas will be much improved over their current condition. Herons will profit from the increase in inundated areas with surface water less than 50 cm (20 inches) deep that support amphibians (Short and Cooper 1985). Converting the extensive reed canarygrass on CMA 1 and 2 to another herbaceous cover will benefit herons also while searching for small mammals. Herons have been observed avoiding the tall dense cover that reed canarygrass presents (Eissinger pers. comm. 2003).

No threatened or endangered species are expected to benefit directly from the proposed compensatory mitigation.

Since the wetlands currently do not provide fish habitat and will not provide fish habitat after mitigation activity is complete, the functional performance for Habitat Suitability for Anadromous Fish and Habitat Suitability for Resident Fish can not be evaluated. Thus, the scores for the mitigation wetlands are shown as not ‘N/A’ (not applicable).

The wetland communities to be established on site will continue to generate relatively high rates of primary productivity and release organic matter to downstream areas at moderate rates via the seasonally flowing channels. A substantial increase in primary production and organic export is predicted to result from the proposed rehabilitation. As a result, the proposed mitigation is predicted to cause more biomass to be retained on site (locked up in trees and shrubs) and also produce an increased rate of organic matter release.

In summary, the model predicts that the proposed mitigation will cause generally slight increases in the performance of hydrologic functions and substantial increases in the performance of wetland habitat functions. For CMA1, the index for one hydrologic function (Decreasing Downstream Erosion) will increase, the index for another hydrologic function (Removing Heavy Metals and Toxic Organics) will decrease slightly, and the indices for the remaining four hydrologic functions will not change. For CMA2, the indices for two hydrologic functions (Decreasing Downstream Erosion, and Recharging Groundwater) will increase slightly whereas the remaining four hydrologic functions will not change. Performance of all habitat functions will increase in both CMAs, but increases will be slightly larger in CMA2 assessment unit. The greater performance increase predicted for the assessment unit associated with CMA2 is attributed to the dramatic increase in inundation and the relatively moderate decrease in herbaceous vegetation.

Gains and losses in functional performance from the proposed mitigation have been calculated in acre-points, which is the product of wetland functional performance index and wetland acreage. The Washington State Methods for Assessing Wetland Functions (Ecology 1999) suggests measuring functional performance in terms of acre-points. Although the wetland functional performance is influenced by wetland size, this measurement essentially gives equal importance to wetland functional performance and wetland size. Acre-points or functional units can be used to compare gain and loss in overall wetland functional performance.

The cumulative loss of wetland functional performance that will occur as a result of the proposed construction has been calculated. The results of this calculation are shown in Table 13. A total of ten wetland areas will be eliminated. The temporal loss in functional performance of the 4.66-acre portion of Wetland F that will be restored subsequent to construction was discussed in Section 4.4.4.

Table 13
Wetland Functional Performance Indices and Acre-Points for Existing Wetland Areas That Will be Permanently Eliminated by the Proposed Construction. [1]

Function	Wetland A (1.69 ac)[2]	Wetland B (2.81 ac)[2]	Wetland C (0.88 ac)[2]	Wetland D (5.92 ac)[2]	Wetland F (8.75 ac)[2]		Wetland G (5.46 ac)[2]	Wetland H (0.23 ac)[2]	Wetland I (0.15 ac)[2]	Wetland J (4.39 ac)[2]	Sum (30.58 ac)
					AU-1 (8.15 ac)	AU-2 (0.6 ac)					
Potential for Removing Sediment	4/ 6.76	4/ 11.24	4/ 3.52	5/ 5.45	5/ 40.75	5/ 3.0	4/ 21.84	4/ 0.92	5/ 0.75	5/ 21.95	116.18
Potential for Removing Nutrients	2/ 3.38	2/ 5.62	2/ 1.76	3/ 17.76	3/ 24.45	2/ 1.2	2/ 10.92	3/ 0.69	5/ 0.75	3/ 13.17	79.7
Potential for Removing Heavy Metals and Toxic Organics	4/ 6.76	4/ 11.24	4/ 3.52	5/ 5.45	5/ 40.75	4/ 2.4	5/ 27.3	5/ 1.15	5/ 0.75	5/ 21.95	121.27
Potential for Reducing Peak Flows	2/ 3.38	2/ 5.62	2/ 1.76	4/ 23.68	4/ 32.6	2/ 1.2	2/ 10.92	3/ 0.69	5/ 0.75	3/ 13.17	93.77
Potential for Decreasing Downstream Erosion	2/ 3.38	2/ 5.62	3/ 2.64	5/ 29.6	5/ 40.75	4/ 2.4	3/ 16.38	3/ 0.69	8/ 1.2	3/ 13.17	115.83
Potential for Recharging Groundwater	3/ 5.07	3/ 8.43	3/ 2.64	5/ 29.6	5/ 40.75	2/ 1.2	4/ 21.84	5/ 1.15	1/ 0.15	5/ 21.95	132.78
General Habitat Suitability	2/ 3.38	2/ 5.62	2/ 1.76	2/ 11.84	2/ 16.3	2/ 1.2	1/ 5.46	1/ 0.23	3/ 0.45	2/ 8.78	55.02
Habitat Suitability for Invertebrates	1/ 1.69	1/ 2.81	0/ 0	0/ 0	2/ 16.3	1/ 0.6	1/ 5.46	1/ 0.23	1/ 0.15	1/ 4.39	31.63
Habitat Suitability for Amphibians	2/ 3.38	2/ 5.62	1/ 0.88	1/ 5.92	2/ 16.3	2/ 1.2	1/ 5.46	1/ 0.23	1/ 0.15	1/ 4.39	43.53
Habitat Suitability for Anadromous Fish	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Habitat Suitability for Resident Fish	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Habitat Suitability for Wetland- Associated Birds	4/ 6.76	3/ 8.43	3/ 2.64	3/ 17.76	3/ 23.85	2/ 1.2	2/ 10.92	2/ 0.46	2/ 0.3	3/ 13.17	85.49
Habitat Suitability for Wetland- Associated Mammals	2/ 3.38	2/ 5.62	2/ 1.76	2/ 11.84	1/ 8.15	1/ 0.6	1/ 5.46	1/ 0.23	2/ 0.3	2/ 8.78	46.12
Native Plant Richness	1/ 1.69	0/ 0	0/ 0	0/ 0	1/ 8.15	0/ 0	0/ 0	0/ 0	3/ 0.45	0/ 0	10.29
Primary Production and Export	6/ 10.14	6/ 16.86	6/ 5.28	7/ 41.44	6/ 48.9	8/ 4.8	7/ 38.22	7/ 1.61	9/ 1.35	7/ 30.73	199.33

1 Wetland E and Wetland K will not be affected by the proposed project.
2 These acreages indicate the impact area for each wetland. The temporary loss of wetland functional performance by the 4.66-acre portion of Wetland F that will become the West Restoration Area is tabulated in Table 4 and is discussed in Subsection 4.4.4.
3 The scores for functional performance are averaged for all wetlands to be affected by the proposed project; the score for Wetland F is the sum of its AU's scores weighted by acreage.

Predicted gains in wetland functional performance from the proposed mitigation were compared with predicted losses in wetland functional performance from the proposed construction (see Table 14). With the exception of Decreasing Downstream Erosion, the method predicts that there will be a net loss in the performance of hydrologic functions as a result of the proposed construction and mitigation. With the exception of Primary Production and Export, the method predicts that the proposed construction and mitigation will lead to a net increase in performance of habitat functions.

Table 14
Expected Gross and Net Gains And Losses of Acre-Points

Hydrologic Functions				Habitat Functions			
Function	**Gains from Mitigation**	**Losses from Construction**	**Expected Net Gain or Loss (+ or -)**	**Function**	**Gains from Mitigation**	**Losses from Construction**	**Expected Net Gain or Loss (+ or -)**
Potential for Removing Sediment	33.74	116.18	-82.44	General Habitat Suitability	278.12	55.02	+223.1
Potential for Removing Nutrients	9.32	79.7	-70.38	Habitat Suitability for Invertebrates	278.12	31.63	+246.49
Potential for Removing Heavy Metals and Toxic Organics	-107.06	121.57	-228.33	Habitat Suitability for Amphibians	166.4	43.53	+122.87
Potential for Reducing Peak Flows	4.66	93.77	-89.11	Habitat Suitability for Anadromous Fish	N/A	N/A	N/A
Potential for Decreasing Downstream Erosion	218.78	115.83	+102.95	Habitat Suitability for Resident Fish	N/A	N/A	N/A
Potential for Recharging Groundwater	64.0	132.78	-68.78	Habitat Suitability for Wetland-Associated Birds	171.06	85.49	+86.57
				Habitat Suitability for Wetland-Associated Mammals	102.4	46.12	+56.28
				Native Plant Richness	346.78	10.29	+336.49
				Primary Production and Export	107.06	199.33	-92.27

It should be noted that despite widespread acceptance of the functional assessment method used for this assessment, the accuracy of its results is limited. As indicated in the method's guidelines, the indices do not denote actual functional performance, but only an estimate of performance based on readily observable aspects of a given site and the relationship between these aspects and the various functions. Many of the relationships between site aspects and wetland functions are simply hypothesized relationships because specific information regarding the relationships may be lacking (Ecology 1999). The validity of these relationships may be especially weak for the hydrologic functions.

Analysis of the CMAs' hydrostratigraphy and soils combined with various observations of the site's hydrologic regime have provided further insight into the factors affecting hydrologic functions. The conclusions regarding performance of hydrologic functions that were drawn from these analyses and observations differ to some degree from the results of the functional assessment using Ecology's methods. In particular, it was shown that sloping topography, poor vertical drainage, and long-term saturation and inundation recurrent across the construction site and the CMAs combine to severely limit the potential to reduce peak flows or recharge groundwater in these areas. Other wetland functions, such as the potential to remove sediments, nutrients, and toxins, are also limited to some degree by the combination of topographic, soil, and hydrologic factors found at these sites. Thus, results of the functional assessment may overestimate current performance levels of most hydrologic functions in the construction site and the CMAs.

Although the rehabilitation proposed for the CMAs is expected to improve performance of these and other hydrologic functions, the functional assessment model does not predict large increases in performance. These predictions underestimate the actual improvement expected because the model lacks the sensitivity adequate to account for the changes in site conditions that will be caused by the proposed mitigation. For instance, adding the contributing basin area comprised by the plant site (33 acres) to the assessment unit associated with CMA2 has no effect on the scores for the hydrologic functions.

In addition, the model fails to incorporate the mitigating effect of the proposed detention ponds on the changes in project site's hydrologic regime. Because the ponds are being designed using updated techniques and will include dead storage, they will mitigate performance losses of all hydrologic functions except Potential to for Recharging Groundwater, a function which is not significant on the BP Cherry Point property due to the underlying aquitard.

Thus, the actual performance losses of hydrologic function due to the proposed construction will be less than indicated by the functional assessment results whereas the expected gains will be as great or greater than indicated by the functional assessment results. As a result, the proposed mitigation will adequately offset the losses of hydrologic function performance to be caused by the proposed construction (including detention pond construction).

The proposed mitigation will greatly improve ecological integrity and functionality of the wetlands within the CMAs. Applying Ecology's wetland rating system to the CMA wetlands under conditions predicted to occur 25 years following initial mitigation activity results in Category II wetlands with very high scores, indicating a highly valuable Category II wetland. The existing wetlands within the CMAs are rated as a Category II wetlands using the Washington State Wetlands Rating System (Ecology 1993). Despite their degraded condition, these wetlands satisfy the criteria for Category II status since they are fairly large and hydrologically connected via intermittent streams to Terrell Creek, a salmon-bearing stream with an intact riparian forest. However, they barely exceed the threshold between Category III and Category II wetlands. The completed wetland ratings data forms for the CMAs under current and predicted conditions are presented in Appendix C.

5.4.7 Buffers

The upland areas scattered across various portions of the CMAs share borders with the wetland areas within the CMAs and are thus considered wetland buffers. Most of these upland meadow areas are only slightly higher in elevation than the wetlands and retain saturation for long periods during the wet season. The Upland Forest communities to be established within these areas will improve their service as wetland buffers, thereby enhancing performance of both hydrologic and habitat wetland functions.

The riparian forest associated with Terrell Creek will provide a buffer to most of the northern border of the CMAs. Only the westernmost portion of CMA2 does not border this mature mixed deciduous/coniferous forest. Two patches of mature forest distinct from the riparian forest associated with Terrell Creek also border CMA2. These forests are mainly composed of deciduous broad-leaved trees, but have several native coniferous trees approaching canopy level.

In areas along Blaine Road and Grandview Road, wetlands extend to the edge of the ROW or beyond. In these areas there is no opportunity for designating upland buffers. In other areas of the CMAs, the wetland continues beyond the boundary of the CMA, and these areas likewise have no opportunity for wetland buffers. The latter areas border on other BP property with no active land use, and the functions often provided by buffers are less important or are provided by the wetland.

5.4.8 Land Use

Although the BP Cherry Point property north of Grandview Road is zoned for 'light impact industrial' development, BP intends to maintain this area in a natural state. As stated earlier, the CMAs primarily contain abandoned pasture that has not been cultivated in over 10 years. These areas are currently utilized by the Washington Fish and Wildlife Service (WDFW) to produce grain for ring-necked pheasants, which are released here each autumn for the relatively few hunters that pursue them. These areas endure only occasional human traffic. WDFW in conjunction with Ducks Unlimited has also constructed two ponds, both of which provide habitat for waterfowl. The grain-production areas and ponds are located over several hundred feet from the proposed CMAs and no major conflicts with hunters are expected (Reed pers. comm. 2002).

A large area overlapping most of CMA1 is open to cattle grazing under a 5-year contract with a dairy farmer that began in 2001. Typically, the approximately 60 cows and 25 calves congregate on the hill where they have been fed hay through the winter. However, the cattle are free to enter the wetland through a gate that is open for most of the growing season. During this time, the cattle graze virtually all the herbaceous species present within the grazing area, including slough sedge. Observations of the grazed area in October 2002 found that herbaceous plant species diversity has increased substantially since before the grazing began. In addition, the surface layer of the soil appears slightly disturbed by the trampling effect of the cattle. Since the grazing contract is revocable, the cattle will be readily removed before compensatory mitigation is initiated.

The meadow areas west of CMA2 and east of CMA1 are also within the BP Cherry Point property and therefore will be retained as undeveloped areas. The riparian forest to the north serves as the buffer area for Terrell Creek and thus is off-limits to development.

Current and expected future land uses in the area near the CMAs are not likely to deter enhancement of the CMAs or degrade their functional performance over time. Air quality modeling indicates that emissions from the cogeneration facility will not significantly affect current ambient air quality in the area (Golder Associates 2003d). Although residential development may increase to some degree over the next few decades, the areas adjacent to the CMAs will likely retain their rural character. The nearest properties to the CMAs outside BP ownership are north of Terrell Creek and are approximately 0.25 miles away. Although it currently conveys light to moderate traffic, Blaine Road and the portion of Grandview Road east of the intersection with Blaine Road (also known as State Route 548) is not likely to be expanded at any time (Lee pers. comm. 2003). Since the portion of Grandview Road west of its intersection with Blaine Road conveys only light traffic, this area will not likely be expanded either.

5.5 CONSTRAINTS

Vandalism by trespassers may be the only constraint to mitigation success that is outside the owner's control. However, no vandalism has occurred to the existing mitigation site located just west of CMA2 and none is expected to occur in the CMAs. The mitigation sites are within BP Cherry Point property near the refinery and currently undergo regular security checks by the existing security contractor.

5.6 SITE PLAN

5.6.1 Hydrologic Modifications

The hydrologic modifications proposed for the CMAs include plugging (filling) portions of some ditches in both CMAs, directing stormwater runoff to CMA2 from the detention pond to be constructed at the plant site, and excavation of swales to ensure that runoff is dispersed across a wide area of CMA2. These modifications will restore historic drainage patterns, further improve water quality of the runoff from the detention pond, and reduce drainage efficiency, thereby increasing hydrologic storage.

The portions of ditches within the CMAs that will not be filled lack the potential to contribute to hydrologic restoration. Because these ditches convey relatively high flows during winter storm events, filling them would likely cause erosion (possibly gullying) and ultimately not improve hydrologic storage or performance of hydrologic functions on the site.

Figure 8A contains the plan drawing showing modifications proposed for CMA1 and Figure 8B contains cross section drawings detailing ditch plugging proposed for CMA1. Figure 9A contains the plan drawing showing modifications proposed for CMA2 and Figure 9B contains the cross section drawings detailing ditch plugging proposed for CMA2.

The locations of the main ditches within CMA1 and CMA2 as they currently exist are shown in Figure 5A and Figure 5B. Native soil will be used to plug the upper (southern) portion of the main ditch in CMA1, the shallow ditch that extends east-west in the northwestern part of CMA1, the upper (eastern) portion of the east-west ditch in CMA2, and the upper (southern) portion of the ditch along the west boundary of CMA2.

To the extent practicable, soil from spoils cast adjacent to the ditches will be used to fill the ditches. Soil excavated upon creating the inlet channel and some broad swales will also be used to fill ditches. The areas immediately surrounding the ditches to be filled may be recontoured to further simulate historical topography. The areas recontoured as part of the ditch filling and swale creation will be planted and seeded with native plants.

Directing stormwater runoff to CMA2 will require piping runoff from the proposed detention pond for the plant site to a channel that will be constructed in the eastern portion of CMA2. Treated runoff from the detention pond will be directed west along the south edge of Grandview Road and then north through a culvert to be installed under Grandview Road. Runoff will then lead north through an approximately 1,050-foot long inlet channel to be excavated near the east edge of the site.

The inlet channel will be constructed to match the existing very gradual slope (0.3%) with a two-foot base and half-foot depth below the existing ground surface. Additional depth within the channel will be created by constructing berms to surround the channel. Except for the sections of the berm that will serve as outlets, the berm will be constructed of compacted fill excavated from other portions of CMA2. The channel bottom and berms have been designed to tolerate colonization by unmaintained vegetation.

Six ‘disperser outlets’ consisting of 75-foot wide sections of permeable material (coarse sand and gravel) will be installed in the western berm. The disperser outlets will be constructed at strategic locations along the western berm of the channel so that runoff will be spread across a wide portion of CMA2. The disperser outlets will also dissipate flow energy, releasing water at relatively low rates to prevent erosion. The stormwater will seep through the gravel and continue westward down the slope as sheet flow and semi-concentrated flow. Construction drawings detailing the inlet channel and its disperser outlets are shown in Figure 9C.

The inlet channel is designed to provide dispersed stormwater flows to CMA2 while limiting grading activities within existing areas. The channel is placed near the top of a broad west-facing slope within CMA2. The shallowly excavated channel will allow flow to exit the channel through the disperser outlets during most wet season storm events. To ensure even distribution of flow amongst all the disperser outlets, water levels in the channel will be controlled by adjustable weirs or similar devices. The culvert outlet (inlet to the inlet channel) will also be designed to allow minor adjustments in constriction. With these adjustable features, minor changes in channel flow may be made during the first 1 to 2 years after installation to maximize flow dispersal. If necessary, further adjustments with these features may be made as site conditions change.

Flow from the northern portion of the inlet channel will lead west and northwest through three broad swales to be excavated within the upland area that exists just west of where the inlet channel will be constructed. Although it is not clearly shown in Figure 5B, the existing elevation of the eastern portion of this upland area is slightly above the location of the proposed outlets in the northern portion of the inlet channel. Thus, creating these swales is necessary to encourage overland flow to continue westward to prevent it from flowing southward as a result of the existing topographic obstructions. As a result, it ensures that runoff will be dispersed over a wide area. Excavation of the swales will lower surface elevations no more than 1 foot across portions of the upland that are approximately 50 feet wide. The slope and aspect of these swales will remain very similar to existing conditions, but the lowered elevations will allow surface water to flow through them. Cross-section drawings detailing swale excavations are shown in Figure 9D.

The inlet channel will not be extended across the entire length of CMA2 (approximately 1,600 feet north-south) because the topography north of the existing east-west ditch does not permit overland flow to travel westward. Several seasonally inundated wetland areas currently convey flow in ephemeral minor channels southward to the ditch. Any runoff introduced to these wetlands would be captured by these minor channels and carried to the newly filled ditch. The channel stops short of this ditch to prevent directing flows there that would erode newly placed material. Thus, extending the inlet channel to its proposed terminus maximizes flow dispersal across CMA2 without creating a potential source of erosion and siltation.

5.6.2 Post-mitigation hydrologic pathways and rates

Figures 10A and 10B show the expected post-mitigation hydrologic pathways and surface flow rates within and downgradient of each CMA as a result of the proposed hydrologic modifications. As with existing conditions, post-mitigation flow will occur in ditches, in natural channels, over wide areas as sheet flow, and through subsurface pathways.

Stormwater runoff from the two proposed detention ponds will be directed to areas north of Grandview Road and west of Blaine Road. The majority of discharges from the detention pond for the plant site will drain to CMA2 via the culvert that will be constructed under Grandview Road just west of its intersection with Blaine Road. The pond will be designed so that only when outflow rates exceeding the rate expected to occur during the 6-month, 24-hour storm will pond runoff be directed to the existing culvert under Grandview Road that leads to the large ditch along the east side of Blaine Road. According to preliminary calculations derived from the original detention pond design work (Golder Associates 2002), outflow from this detention pond during the 6-month, 24-hour storm event will be approximately 1.33 cfs. All discharges from the detention pond for Lay-Down Areas 1, 2, and 3 and the contractor's parking lot will drain to a ditch that currently leads to a culvert under Grandview Road to a series of ponds and wetlands connected by well-vegetated channels and swales.

Estimates of flow rates were made for the 6-month, 24-hour storm event by summing expected discharge rates for these storms from the detention ponds (as determined by the pond design calculations) and flow rates for existing conditions estimated using the SCS method. The increase in flow rate in ditches and channels downgradient from the input points is predicted to be slightly less than the increase in flow rate at the input points due to flow attenuation by soil and depressional storage. Although flow will be progressively reduced as it travels downgradient, these reductions will not be equally progressive due to variations in topography and vegetative roughness.

Filling the upper portion of the main ditch and the entirety of the minor ditch in CMA1 will reduce drainage rates from this site. However, the extent of seasonally inundated area is only expected to increase near the upper portion of the main ditch since the minor ditch supports relatively low flow rates.

The proposed hydrologic modifications will slightly increase constrictions to surface water flow both CMAs. Filling large portions of existing ditches will reduce the rate of surface water drainage, thereby increasing the extent of seasonal inundation. The frequency, duration, and magnitude of inundation will increase substantially in low-lying areas immediately upgradient from the portions of the ditches that will be filled. In CMA1, this area is constricted to the area near the main ditch south of the existing aspen stand (Figure 10A). In CMA2, the increase in seasonally inundated area will be greatest immediately downgradient of the inlet channel, east of the forested patch, and south of the forested patch (Figure 10B).

Runoff released from the proposed inlet channel will flow westward across a wide portion of CMA2 and downgradient areas. From the disperser outlets, surface water will flow west and northwest as sheet flow and semi-concentrated flow. Flow from the southern portion of the inlet channel will lead westward across CMA2 and off-site to the south of the large forested patch located just west of the main body of CMA2.

Surface and ground water flow that would have been directed north by the existing ditch along the west edge of CMA2 will instead go further west due to the proposed ditch plugging. This water will then lead north and then west across a broad meadow area until it enters the relatively flat wetland area just east of the large WDFW pond.

Flow from the northern disperser outlets will lead to the seasonally inundated area located just east of the large forested patch. The additional surface water introduced to the seasonally inundated area will cause it to have increased duration, magnitude, and frequency of inundation. This area will drain to the portion of the west-flowing ditch that runs through the northern part of the large forest patch. Flow in the west-flowing ditch follows a somewhat complex path, but most flow eventually joins Terrell Creek near Jackson Road.

As mentioned earlier, a substantial amount of water from the west-flowing ditch currently leads north to become dispersed across a wide portion of the CMA2 panhandle. It is expected that a substantial amount of water introduced by the inlet channel will follow these existing pathways and increase moisture levels across a wide portion of the CMA2 panhandle. As a result, the extent of seasonally inundated area in the panhandle will increase in areas where shallow inundation currently occurs.

The drainage pathways west of CMA2 are complex and extend for over 0.5 mile through ponds, connecting channels, and wetlands before crossing by culvert under Jackson Road to Terrell Creek. Thus, runoff delivered to these areas will more closely follow historic drainage patterns rather than being ditched or tightlined directly to the creek. In addition, the potential to improve water quality of this runoff will be maximized. The runoff will also provide additional surface water to the ponds, most of which have their levels controlled by artificial structures such as culverts and weirs.

It must be noted that at least 1.2 acres of existing upland scattered across the main body of CMA2 are expected to become wetland. These areas are mainly on slightly elevated ground near areas that will likely be subjected to increased soil saturation and inundation. At least 0.25 acres of this wetland conversion area consists of the three swales that will be excavated from the existing upland in the eastern portion of the site. Although the likelihood of conversion is high, it is not high enough to allow BP to gain extra mitigation credit for creating wetlands.

5.6.3 Soil

The native soils within the CMAs will serve as an adequate growing medium for the plants to be installed. Most of this soil typically consists of a silt loam or loam surface layer that is 10 to 14 inches deep. Subsoil layers are typically silt loam or sandy loam that are 8 to 16 inches thick. See the *Revised Cogeneration Project Compensatory Mitigation Areas Wetland Delineation Report* (URS 2003a) for more information about on-site soils.

Soil disturbed by tilling or filling may be covered with mulch or erosion-control matting to prevent soil erosion. These areas will then be replanted with native vegetation as soon as practicable. The created swales and filled ditches in both CMAs will be designed to encourage colonization by vegetation and will be seeded with the native seed mix.

5.6.4 Habitat Features

A number of habitat features will be distributed across the CMAs. The habitat features planned for the site will provide structure to encourage habitat utilization by native wildlife species.

At least 330 downed logs (3 per acre) will be placed across the CMAs. Some of these logs will be derived from the trees that will be removed for construction of the Cogeneration Project. A few others will be taken from the downed logs recently created by construction of an access road on the BP Cherry Point property south of Grandview Road. In addition, approximately 55 non-native cedar (*Cupressaceae* family) trees will be cut from a windbreak that protects an abandoned orchard plot located just north of CMA2. The windbreak trees are approximately 30 feet tall with 8-inch dbh. The proposed tree cutting will reduce the tree density to 9-feet on-center, which will allow the remaining trees to accelerate their lateral and vertical growth. The logs will act as habitat features by providing foraging opportunities, cover, and perching or haul-out sites for small mammals, birds, and amphibians (Stevens and Vanbianchi 1993).

A number of artificial snags (dead-standing trees) and wildlife brush shelters will be erected on site. In addition, woody branches will placed in seasonally inundated areas. The materials, specifications, and benefits for these habitat features will be as described in Section 4.6.4.

Several small (<0.5 acres) seasonally inundated shallow ponds will be established on CMA 1 and 2 to promote native amphibian production. Seasonally inundated ponds dry up during the dry season making it impossible for non-native bullfrogs to successfully breed because of their two year tadpole cycle.

Habitat features are designed to benefit the local breeding great blue heron population. Woody debris, eradication of invasive vegetation, and establishment of small seasonal ponds all provide increased opportunity for heron foraging. Details of these benefits are available in the appendix F – *BP Cherry Point Cogeneration Facility Wetland Mitigation and the Birch Bay Great Blue Heron Colony*.

5.6.5 Vegetation Establishment

The distribution of plant communities to be established in CMA1 is shown in Figure 11A and the distribution of plant communities to be established in CMA2 is shown in Figure 11B. The plant communities planned for the CMAs are the same as those planned for the Restoration Areas. Plant species composition, spacing, condition, and size for these communities are shown in Tables 5 to 8 and discussed in Section 4.6.5. The requirements for the Restoration Areas regarding plant stock, installation, seedling protection, and maintenance will also apply to the CMAs.

As with the Restoration Areas, planting will be accomplished in a multi-phase approach. Planting will be especially limited across portions of CMA2 to be affected by the proposed hydrologic modifications in the first 1 to 2 years following the implementation of the hydrologic modifications. This will prevent subjecting large numbers of installed plants to a hydrologic regime inappropriate for their establishment and allow greater flexibility in treating reed canarygrass. Close observations of the new hydrologic regime over the first few years will help guide placement, species composition, and condition of the plants that will be installed during this time.

The seed mix depicted in Table 8 will be applied to the interstitial areas between installed plants wherever tilling occurs in the CMAs. As discussed earlier, tilling will occur prior to the initial planting phase in all of the 44.26 acres mapped as having $\geq$20% reed canarygrass cover. However, the mix will only be applied to the interstitial space between mulch rings, which should comprise approximately 85% of the tilled areas. Thus, the actual area upon which this seed mix will be applied is 37.3 acres. As with the Restoration Areas, the total seeding rate will be 40 pounds per acre, which is a relatively high seeding rate for mitigation areas.

5.6.6 Irrigation

The methods of irrigation proposed for the Restoration Areas will also be applied to the CMAs. All portions of the CMAs where trees and shrubs are installed will receive irrigation.

Given typical summer precipitation amounts, providing 0.5 inch of water per week to the CMAs (110.1 acres), the Restoration Areas (9.3 acres), and the visual buffer to be forested (1.8 acres) will require approximately 124,000 gallons of water per day. This volume is roughly equivalent to 0.38 acre-foot per day or 0.19 cubic foot per second (cfs). If summer precipitation is 30% below normal, then meeting the irrigation goal will require approximately 323,400 gallons of water per day. This volume is roughly equivalent to 0.99 acre-foot per day or 0.5 cfs.

Normal rainfall is considered a monthly or yearly amount that is above the lower 30% and below the upper 30% (z-values between –0.524 and 0.524 according to the standard normal distribution) of the amounts shown in NRCS's WETS table (NRCS 1999) for the Bellingham International Airport. Although this weather station is no longer operating, precipitation data from this station located within 12 miles of the CMAs spans over 20 years and is therefore a reliable source for comparison with current and future precipitation data.

6.0 CONSTRUCTION SPECIFICATIONS & AS-BUILT REPORT

Installment of topographic and hydrologic modifications, habitat features, plants, seeds, mulch, soil amendments, erosion control matting, and other features within the mitigation areas will be achieved by local contractors with proven experience. Work requiring heavy machinery, such as the proposed topographic and hydrologic modifications, will likely be awarded to Donaghy Construction, a local firm that was provided construction services to BP Cherry Point for many years. Other work that is more labor-intensive, such as installing native plants, will be rewarded to a local bidder that demonstrates competence and relevant experience.

Upon completion of the mitigation areas construction, an as-built report will be generated documenting the final grading, hydrologic pathways, and planting schemes. The report will include the elements recommended in *Guidelines for Developing Freshwater Wetlands Mitigation Plans and Proposals* (Hruby and Brower 1994). The as-built report will provide a time zero baseline comparing the actual changes in site hydrology, identifying the success of invasive vegetation eradication, and the final woody and herbaceous plantings layout. The report will also include photographs of the wetlands taken from permanent reference points. The baseline information will be used for calculating the success of the performance standards in subsequent monitoring reports and assist in identifying required planting replacements, if needed.

The primary source for plant materials and fertilizer will be Fourth Corner Nurseries, which is located in Bellingham. The plants that they provide are primarily derived from stock taken from lowland areas in Whatcom County.

As with the existing compensatory mitigation site, the primary contractor that will supply maintenance for the mitigation areas will likely be Berry Acres. Berry Acres is a professional landscaping company that has been providing landscape maintenance services to BP Cherry Point for several years. URS will regularly communicate with the contractors who will carry out maintenance tasks. The maintenance crew will be responsible for operating the irrigation system, controlling exotic plant populations, providing plant protection (replacing seedling protection tubes), and regularly reporting to URS ecologists who will make recommendations for adjusting the maintenance regime as necessary.

7.0 SITE PROTECTION

A restrictive covenant on the deed will be applied to the Restoration Areas and CMAs to ensure that they remain in their respective natural states in perpetuity. No development of the CMA portions of the BP Cherry Point property will be allowed for any purpose by any entity whatsoever. The restrictive covenant on deeds pertaining to the restoration areas shall restrict all activities except those associated with maintenance of utilities and their corridors. Any clearing, grading, or filling will be prohibited except to achieve changes required to meet mitigation requirements or further improve performance of wetland functions. No deposition of materials or fills as a result of any clearing, grading, or development of any property will be allowed. The restrictive covenant will run with the land and inure to the benefit of and be binding upon BP, their successors, and assigns.

To temporarily protect the restored areas from human trespass, brightly colored rope fences will be strung on wooden stakes around the perimeter of each Restoration Area and each CMA. The fences will be intended to discourage people from disturbing the installed plants through physical harm and incidental introduction of non-native, invasive grass seed. The fences will remain in place for 5 years or until it is judged that the installed plants within the mitigation areas no longer require such protection. Small signs explaining the intent of the fences and the mitigation project will be erected at strategic locations along the borders of each mitigation area.

The people who will access the Restoration Areas will be restricted to BP employees and official visitors to the BP Cherry Point facilities. The chain-link/barbed-wire fences to be erected around the Cogeneration Project area will encompass each Restoration Area, thereby preventing trespassers from accessing these areas. Except for maintenance crew people and URS scientists, access to the Restoration Areas will be restricted to the walking path to be constructed in the West Restoration Area. Colored rope fence will be installed along both sides of the path to encourage people to stay on the walking path and not disturb the Restoration Areas.

Public access to the portions of the BP Cherry Point property north of Grandview Road, which encompasses the CMAs, will continue to be open to the public. The majority of the people that access these areas are the hunters that pursue ring-neck pheasants released here during early autumn. BP will continue to allow pheasant hunting and other activities in these areas as long as they cause no harm to the CMAs.

Cattle, or any other domestic animals, will no longer be allowed to graze in any of the mitigation areas. The grazing contract for the area overlapping with CMA1 would be revoked or modified to prevent cattle from grazing within 100 feet of this area.

Regular security checks by the existing security contractor will discourage vandalism in the CMAs, although it is not expected to be a problem.

8.0 MONITORING PLAN

The purpose of monitoring and maintenance is to ensure that mitigation plan goals are met. Construction of the power plant and the lay-down areas will be monitored to ensure that wetland impacts are avoided and minimized according to plan. The Restoration Areas and CMAs will be monitored over a 10-year period to ensure that these areas function as designed.

Monitoring of the proposed restoration and compensatory mitigation will be guided by the conditions contained in this plan including pre-established performance standards. A 10-year monitoring plan will be implemented to assess the degree to which objectives and performance standards (Section 3.3) are being met. Monitoring will be conducted by a URS biologist immediately following the initial planting, and 1, 2, 3, 5, 7, and 10 years afterward.

Maintenance will be guided by maintenance actions required by this plan (Section 9) and any recommended contingencies made following implementation of the plan. The majority of maintenance activity will be directed towards removing non-native plants that resprout after initial suppression. However, other maintenance actions tending to the proposed hydrologic modifications and the installed plants may also be necessary. Contingency measures will be recommended and subsequently implemented if site conditions fail to attain expectations. Expectations of site performance are elucidated by the performance standards, which are discussed in Section 3.3 of this report.

8.1 CONSTRUCTION MONITORING

A URS scientist will monitor construction operations regularly during the time of construction. The scientist will monitor operations to ensure that impacts only occur in areas where they have been designated to occur. Vegetation clearing and fill placement will be monitored regularly.

Contingencies will be made if the extent of impacts is greater than expected. All unexpected impacts will be compensated by enhancements of equal or greater value to the compensatory mitigation. Monitoring results will be compiled in a construction monitoring report. The report will be sent to the Corps, Ecology, and EFSEC. Any discrepancies between expected and actual impacts will be mentioned in the report. In addition, contingencies used to compensate for these unexpected impacts will also be mentioned.

8.2 RESTORATION AND COMPENSATORY MITIGATION MONITORING

Monitoring procedures for the Restoration Areas and the CMAs will be similar. Monitoring will determine whether site conditions are meeting performance standards and are likely to continue meeting performance standards throughout the monitoring period. Since removal of the temporary lay-down areas and the subsequent restoration will begin approximately 2 years after project construction is initiated, the monitoring period for the Restoration Areas will begin approximately 2 years after the monitoring period for the CMAs begins.

8.2.1 Wetland Hydrology

Monitoring will assess the hydrologic regime of the Restoration Areas and the CMAs. This monitoring effort will determine whether a wetland hydrologic regime is occurring in the wetlands restored in the Restoration Areas and will generally characterize the hydrologic regime of both uplands and wetlands in both the Restoration Areas and the CMAs.

At least four shallow monitoring wells will be installed in Restoration Areas and six in CMA 1. Between 15 and 20 shallow monitoring wells will be distributed across CMA 2. The majority of the wells will be placed in locations representing typical hydrologic regimes in both the SS and SI wetland areas down gradient of the level spreader. The remaining wells will be installed in locations representing typical hydrologic regimes in the upland areas. Wells will consist of a screened (perforated) pipe installed to the depth of the fine-grained substrate that forms an aquitard and sealed at the soil surface with bentonite and/or grout.

Both surface water gauges and shallow monitoring wells will be monitored within the compensatory mitigation site. Monitoring activities will follow the program outlined in the Cogeneration Project Hydrologic Monitoring Work Plan (Appendix G). For each well and gauge, statistical comparisons will be made between the data collected before and after hydrologic modifications associated with the mitigation are implemented. Special attention will be paid to the level of the free water surface both above and below ground and its fluctuation over time. Inter-annual comparisons will be adjusted by differences in precipitation that occur between the years being compared. As mentioned in Section 3.3.1, those gauges that demonstrate increases in saturation or inundation persistence independent of increases in precipitation levels will be determined to be within areas that have become 'hydrologically restored'.

Depth to soil saturation and free water surface within the wells will be measured during the early part of the growing season, which is the time when soil saturation will most likely be present within wetlands in western Whatcom County.

Observations of standing surface water and groundwater levels will be made in both the Restoration Areas and the CMAs. In addition to well monitoring, groundwater observations will be made by excavating temporary unlined boreholes with a soil corer to depths not more than 18 inches. The holes created by a soil corer are typically less than 3 inches in diameter and thus have very little impact to the site. Boreholes will be excavated across various portions of the mitigation areas that lack standing water during the time of investigation. Depth to soil saturation and free water surface will be measured within each borehole. These observations will be made during the early and middle portions of the growing season.

8.2.2 Hydrologic Modifications

Hydrologic modifications including the diversion of ditch flow through the West Restoration Area, the diversion of detention pond runoff from the plant site to CMA2, and the various ditch plugs to be installed across both CMAs will be monitored for proper operation. These modifications will be inspected at least once every winter or spring while surface water is flowing through the inlet channel and once during the vegetation monitoring event of each monitoring year. Inspectors will determine the structural integrity and stability of channels, pipes, energy dissipaters, and other structures used for the proposed modifications.

Surface water flow and evidence of surface water flow will be observed to determine whether the actual altered hydrologic regime approximates the design. Any unexpected and harmful erosion or flooding will be recorded and appropriate contingencies to reduce and repair damage will be recommended. Monitoring of the modified hydrologic regime will be especially careful and frequent during the first two years after installation. Results of this monitoring, combined with rainfall data analysis, will help guide the location and species composition of any new plants to be placed in areas where the hydrologic regime has been altered.

8.2.3 Vegetation

URS will locate plots along transects that span the width of each Restoration Area and each CMA. Transect locations will be dispersed across the sites using a stratified random approach to prevent biased plot placement. Both transect and plot locations will be recorded by a GPS unit with sub-meter accuracy. The GPS unit will also be used to determine the planned plant community (Upland, SS wetland, or SI wetland) and the pre-mitigation cover by reed canarygrass (<20%, 20-95%, or >95%) for each plot.

Each transect will be oriented longitudinally (north-south) and randomly situated within 100-meter wide (328-foot wide) bands. Each band will be spaced 10 meters apart to prevent transects from being too closely spaced. Transects will be broken into 100-meter long (328-foot-long) segments, which will also be spaced 10 meters apart from each other. Sample plot centers will be randomly selected along each segment during each sampling event (Figure 12).

Plots will consist of an inner circle with a 2-m (6.56-foot) radius encompassed by an outer circle with an 8-m (26.24-foot) radius. Cover of herbaceous vegetation will be gauged within the inner circle whereas cover of installed woody vegetation will be assessed within the outer circle.

Vegetative survival and cover will be visually estimated by experienced URS ecologists. Woody vegetation success will be gauged by percent survival during the first five years and by percent cover during the remaining five years of mitigation monitoring. Herbaceous vegetation will be measured by percent cover throughout the entire monitoring period. Cover of volunteer plants (vegetation not planted or seeded during any planting events) will be measured for both herbaceous and woody species found within the plots. Cover of trees and shrubs, herbaceous plants, and each plant species will be recorded for each plot. Plant cover will be assessed using a geometric cover classification system with the following categories: 0-2%, 2-4%, 4-8%, 8-16%, 16-32%, 32-64%, >64%. This system facilitates precise assessment of plant cover in the lower ranges, which is especially important for monitoring the spread of recently established vegetation.

As recommended by Krebs (1999), at least 1% of the total area to be monitored will be sampled directly. Since each plot will cover approximately 2,162 ft^2 (0.05 acre), at least 10 plots will be used to sample the Restoration Areas and at least 60 plots will be used to sample the CMAs.

Since invasion by non-native, invasive plants will likely be aggressive, monitoring the cover of non-native, invasive species will be persistent and intensive. In addition to monitoring by plot method as described above, URS ecologists will observe and record the distribution and abundance of non-native, invasive plants each spring and summer in every year of the 10-year monitoring period. Eradication of non-native species will be maintained in all mitigation areas, including uplands and buffer areas.

Those portions of the CMAs that currently have greater than 20% cover by reed canarygrass will have a performance standard of <20%. Portions of the CMAs that currently have less than 20% cover by reed canarygrass will have a performance standard of <10%. Since the Restoration Areas will have less than 20% cover by reed canarygrass immediately prior to initiating restoration activity, only the performance standard of <10% will be applied to these areas. As recommended by Krebs (1999), at least 1% of the total area to be monitored will be sampled directly.

Areas with levels of non-native, invasive plants that appear to be approaching or exceeding performance thresholds will be marked in the field so that the maintenance crew can more accurately target their treatment practices. These unacceptable patches will also be mapped by URS ecologists with a GPS unit with sub-meter accuracy. Results of this monitoring will guide recommendations given by URS to maintain cover by non-native, invasive plants below thresholds set by the performance standards.

Although predation of installed plants has not been a problem at the existing mitigation site, URS ecologists will document any evidence of predation that may occur within the mitigation areas. URS will observe the condition of seedling protection tubes and any other protections provided to installed plants. The effectiveness of these protections will also be monitored. URS will ensure that seedling protection tubes or any other protections provided to installed plants will be in working condition.

8.2.4 Photographs

Several photographs taken from permanent photo-points will be used to aid the monitoring effort. Panoramic photographs showing a maximum amount of each Restoration Area and each CMA will be included. Each permanent photo-point will have its respective Universal Trans-Meridian (UTM) point as recorded by GPS and a detailed narrative description referencing its location relative to existing landmarks. Photos from the permanent photo-points will be taken during each vegetation monitoring event in Years 0, 1, 2, 3, 5, 7, and 10 of the monitoring period. For Year 0, photographs will be taken prior to and during initial mitigation activity. Other photographs may be taken during spring to better document each site's flow regime during the wet season. The photos and their respective narrative descriptions will be provided in each monitoring report.

9.0 MAINTENANCE AND CONTINGENCY PLAN

As mentioned earlier, the primary sub-contractor that will supply maintenance crews will likely be Berry Acres, a crew of landscape professionals with experience in native plant installment and exotic plant control. Sub-contractors will report regularly to URS ecologists who will make recommendations for adjusting the maintenance regime as necessary.

Restoration of the Restoration Areas and rehabilitation of the CMAs will be accomplished under an adaptive management strategy. This strategy will entail responding to monitoring results to appropriately and efficiently maintain or improve site conditions.

If monitoring results demonstrate that site conditions fail to meet performance standards, contingencies will be implemented. For instance, if one of the non-native, invasive species attains cover values that exceed their acceptable thresholds, then a more aggressive approach to weed control will be taken. Such an approach may include more frequent applications of herbicide, more frequent hand-removal, and/or more frequent mowing. These actions may be complemented with additional plantings and/or seedings in problem areas.

If a performance standard is not met for any given year, URS will analyze of the cause of failure, propose corrective actions, and present a time frame for implementing these actions. A letter report will be sent to the Corps and Ecology for their approval before implementing the corrective actions.

Even if all performance standards are met, corrective actions may still be implemented if monitoring reveals problems that could lead to poor performance or future problems. For instance, if a breach in the inlet channel is causing erosive flows to be directed through a part of CMA2, then the breach will be repaired to restore sheet flow and the eroded area mended with seed mix, mulch, and/or new plantings, as necessary. Descriptions of such problems and corrective actions taken to solve them will be included in the monitoring reports.

Examples of problems expected during the maintenance period and the corrective actions that will likely be taken to solve them are as follows:

1. **Wetland hydrology.** If wetland hydrology (free water to within 12 inches of soil surface over 22-contiguous days) is not established in at least 4.86 acres of the Restoration Areas and maintained in the existing wetlands within the CMAs, then further topographic or hydrologic modifications will be made to ensure that these objectives are met. Topographic modifications may include re-grading portions of the site to effectively raise the groundwater in these areas. Hydrologic modifications may include adjusting the adjustable weirs to be installed so that more surface flow could enter an area that is not meeting the minimum requirements of wetland hydrology.

2. **Flow dispersal.** If flow is not evenly distributed between all disperser outlets within the inlet channel to CMA2, then the adjustable weirs within the channel will be adjusted to maximize flow distribution. If flow is evenly distributed between disperser outlets, but is not adequately dispersed across the main portion of CMA2, then URS will recommend grading appropriate to maximize flow dispersal. Any grading that occurs after the initial planting will be accomplished during the dry season and with a small grader or shovels to avoid damaging native plants. To prevent erosion, grading would occur during the dry season and the native seed mix would be applied to areas that have been disturbed.

3. **Invasion by non-native, invasive plants.** Weed control maintenance will occur frequently and aggressively to combat invasions before cover by non-native, invasive plants approach or exceed performance thresholds. As discussed earlier, distribution and abundance of weeds will be

monitored every year of the 10-year monitoring period by URS. Those portions of the CMAs that currently have greater than 20% cover by reed canarygrass will have a performance standard of <20%. Portions of the CMAs that currently have less than 20% cover by reed canarygrass will have a performance standard of <10%. Since the Restoration Areas will have less than 20% cover by reed canarygrass immediately prior to initiating restoration activity, only the performance standard of <10% will be applied to these areas. Monitoring results will guide recommendations given by URS to maintain cover by non-native, invasive plants below the above thresholds. Although removal of non-native, invasive plants is expected to occur throughout the 10-year period, the intensity of the maintenance effort should decrease over time. Following any monitoring year when standards are not being met, additional control and replacement measures will be added to maintenance activities. More information about the weed control program is in Section 4.4.3.

4. **Mortality of installed vegetation.** The multi-phase approach to planting described in Section 4.6.5 also follows an adaptive management strategy. URS ecologists will closely observe the various limitations to plant growth that may be present or may develop during the first few years after the initial planting. These observations will effectively guide placement, species composition, and condition of the plants that will be installed during this time. Special attention will be paid to site conditions in those portions of the mitigation areas affected by the proposed topographic and hydrologic modifications. If, during the monitoring period, the woody species survival or areal cover percentage or the herbaceous community percent cover falls below the established performance standard, additional plantings will be used to bring survival and / or percent cover up to stated goals.

   If predation on installed plants by wildlife becomes a substantial source of plant mortality, then corrective action will be taken. If predation is generally restricted to those seedlings that have lost their protection tubes, URS will recommend that these plants be replaced with protection tubes fitted so that they are less likely to fall off. Tubes that have not fallen off their respective plants but appear unstable will be stabilized. BP will budget funds as required to pay for planning, implementing, and monitoring any contingency procedures that may be required to achieve the mitigation goals. The budget will equal approximately 20% of the total cost of the proposed mitigation, which is estimated to be $1.66 million. Thus, the total value of the maintenance and contingency budget will be $332,000. The parent company guarantee, as described in section 11, will be in the total amount that it is estimated that the restoration and compensatory mitigation will cost and thus will be sufficient to ensure that funds necessary for maintenance and to repair problems will be available.

5. **Reporting.** Results of the monitoring will be compiled in monitoring reports that will be delivered to the Corps, EFSEC, and Ecology by October of Years 1, 2, 3, 5, 7, and 10 for each monitoring period. Reports will state monitoring methods, show monitoring results including photographs, compare these results with performance standards, and discuss the site conditions observed. The current year’s results will be compared with the performance standards and results from previous years. If monitoring results are below performance standards, maintenance and contingency recommendations necessary to improve success will be made.

Regular maintenance activity and any contingency actions made during the year will also be reported. The effectiveness of these actions will be gauged during site monitoring. An evaluation of the effectiveness of these actions will be included in the reports.

Record drawings showing topography, hydrologic modifications, and plant communities of the Restoration Areas and the CMAs will be drafted after the initial mitigation activity including the initial planting is complete. These drawings will be submitted to the Corps, EFSEC, and Ecology within 60 days of completing the initial planting of each mitigation area.

10.0 IMPLEMENTATION SCHEDULE

10.1 CONSTRUCTION SCHEDULE

The starting time for constructing the Cogeneration Project and installing its associated mitigation is dependent upon when the necessary permits are issued. Although the chronological order and seasonal timing of mitigation actions will occur as discussed below, exact dates for these actions can not yet be determined given the uncertainty regarding the timing of permit issuance. For illustrative purposes, the dates provided below assume that project construction will begin in early 2005.

In the CMAs, activities of the weed control program that do not entail mechanized clearing of wetlands and therefore do not require the above-mentioned permits may begin a few months prior to the construction start date. Such activities, including mowing and herbicide application, will begin in spring 2005. Tilling would be anticipated to occur in spring and early autumn 2005. Non-native, invasive plant removal would continue through the growing season of 2005. Removal would continue as maintenance for short-term control throughout the monitoring period.

The proposed topographic and hydrologic modifications will be implemented and habitat features would be installed in summer 2005. The initial phase of planting in the CMAs would be implemented in autumn 2005. Species known to be less tolerant of winter conditions as seedlings (i.e. western red cedar) and some of the herbaceous plants would be installed in spring 2006. The native seed will be applied immediately after these plants are installed. The remaining plants would be installed over the next 2 to 3 years. Although the inlet channel would have been fully installed for a year, runoff would not be diverted to CMA2 until fall 2006, which would allow the initial phase plants to have established to some degree.

The proposed restoration would begin after the end of the construction period, which is expected to last 1.5 to 2 years. If the construction period began in spring 2005, the initial restoration activity would occur after the temporary lay-down areas were removed in 2007. Initial activity including topsoil import, hydrologic and topographic modifications, and habitat feature installment would occur during summer 2008. Weed removal would also occur at this time as necessary.

The initial seeding of the Restoration Areas would occur in late summer 2005, a few weeks prior to implementing the initial planting phase. Species known to be less tolerant of winter conditions as seedlings and some of the herbaceous plants would be installed in spring 2008. The second phase of seeding would occur immediately after these plants are installed. The remaining plants would be installed over the next 2 to 3 years.

10.2 MONITORING SCHEDULE

As discussed earlier, some form of monitoring will occur during every year of the 10-year monitoring period. Formal monitoring of wetland hydrology and vegetation will occur in Years 1, 2, 3, 5, 7, and 10.

Observations of wetland hydrology will be made throughout the monitoring period. Formal monitoring will include measurements of free water surface elevations in the monitoring wells to be installed in the mitigation areas. These measurements will be taken on a weekly basis for at least four weeks from the second or third week of March on or after March 12 to the second or third week of April during Years 1, 2, 3, 5, 7, and 10. Extrapolations between weekly measurements will determine whether soil saturation in the wetland areas meets the wetland hydrology criterion.

Observations of vegetation, native, non-native, invasive, and volunteer, will be made throughout the monitoring period. Formal monitoring will include estimates of cover using circular plots. These estimates will be made during the early part of summer to ensure that flowering plants will be readily identifiable and data collected will not be skewed by seasonal variation. More specifically, vegetation monitoring will occur between June 21 and July 15 of Years 1, 2, 3, 5, 7, and 10.

10.3 REPORTING SCHEDULE

As stated in Section 10, monitoring results will be reported to the Corps, EFSEC, and Ecology by October of Years 1, 2, 3, 5, 7, and 10 for each monitoring period.

11.0 PARENT COMPANY GUARANTEE

BP Corporation North America Inc will provide a guarantee to the Army Corps of Engineer’s to ensure that funds are available to construct or complete the construction of, and for monitoring and maintenance of the compensatory wetland mitigation associated with the BP Cherry Point Cogeneration Project. The Parent Company Guarantee will be used instead of a performance bond to ensure BP’s accountability for the proposed mitigation. BP will provide the Parent Company Guarantee to the Corps prior to project construction. The amount of the guarantee will equal the estimated dollar amount that the restoration and compensatory mitigation will cost. The preliminary cost estimate of the proposed mitigation, and therefore the proposed amount of the guarantee, is $1.66 million.

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FIGURES

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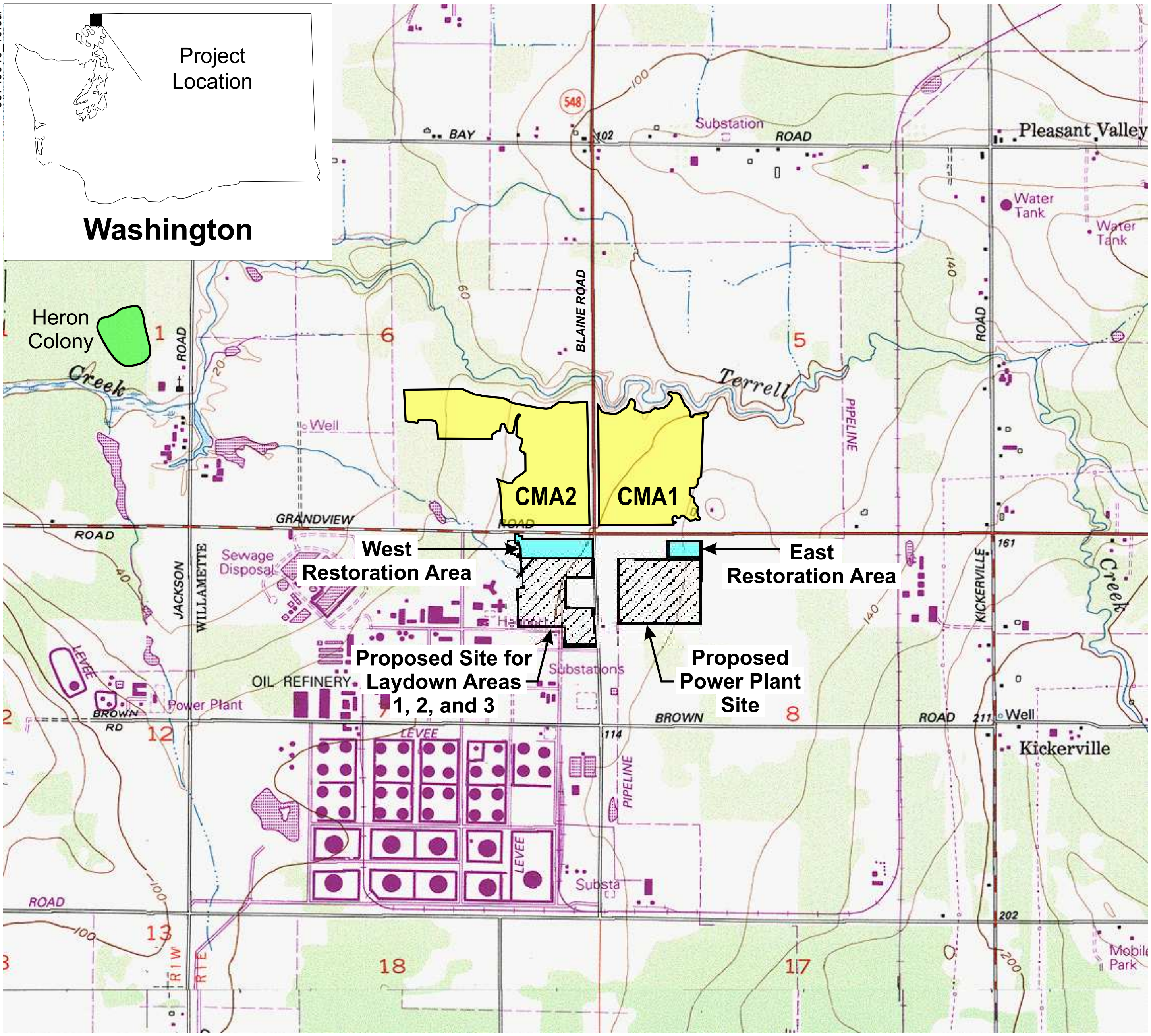

Map created with TOPO!™ © 1997 Wildflower Productions, www.topo.com, based on USGS topographic map

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Scale in Miles

Job No. 33749546

Figure 1

Site Vicinity Map

URS

Wetland Mitigation Plan
BP Cherry Point