REVISED COGENERATION PROJECT COMPENSATORY MITIGATION AREAS WETLAND DELINEATION REPORT

BP Cherry Point

Prepared for

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1.0 INTRODUCTION

URS conducted an investigation to determine the presence, geographic extent, and character of wetlands on two separate portions of the BP Cherry Point Refinery property located in Whatcom County, Washington. The study area is situated immediately north of the existing refinery, which is located at 4519 Grandview Road. The refinery is situated on the south side of Grandview Road, whereas the study area is situated north of Grandview Road (Figure 1). The study area encompasses the two Compensatory Mitigation Areas (CMAs, divided into CMA1 and CMA2) that are separated by Blaine Road.

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. The study area encompassing this site extends across most of the road right-of-ways (ROWs) and the setback areas between the ROWs and CMA1. Thus, the study area for CMA1 is 53.3 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 study area encompassing this site extends across most of the ROWs and the setback areas between the ROWs and CMA2. Thus, the study area for CMA2 is 63.5 acres in size. The study areas included much of the ROWs and the setback areas because these areas will be managed as buffers for the mitigation sites.

The investigation served to assist in the planning and permitting of compensatory mitigation to offset proposed impacts associated with the construction of a 720-megawatt cogeneration power plant and lay-down areas that will be used in refinery operations.

This report documents the investigation work performed, describes the site's wetlands and uplands, and characterizes the vegetation communities, soils, and hydrologic regimes observed to occur on the property. The baseline understanding provided by this investigation will greatly improve the design of wetland enhancement.

2.0 METHODS

2.1 WETLAND DELINEATION

Documents reviewed to aid determination of wetlands, streams, and priority habitats and species in the mitigation areas and its vicinity are as follows:

- National Wetlands Inventory Map, Blaine, Washington Quadrangle (USFWS 1987)
- USGS Topographic Maps, Blaine, Washington and Birch Point, Washington Quadrangles (USGS 1991)
- *Soil Survey of Whatcom County Area Washington* (Goldin 1992)
- Priority Habitat and Species (PHS) database (Golder Associates 2002)

- Natural Heritage Program (NHP) database (Golder Associates 2002)
- *Wetland Mitigation Potential Survey Report – BP Cherry Point Property* (URS 2001)

Wetland determination and delineation was made on site by URS wetland biologists using the 1987 U.S. Army Corps of Engineers (Corps) *Wetlands Delineation Manual* and the 1997 Washington State Department of Ecology (Ecology) *Wetland Identification and Delineation Manual*. The 1997 Ecology methodology was developed to be consistent with the 1987 Corps Manual. Delineated and surveyed wetland boundaries are subject to verification and approval.

For regulatory purposes, wetlands are defined as:

> Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

According to the two manuals, the following three characteristics usually must be present for an area to be identified as a wetland: (1) hydrophytic vegetation, (2) hydric soil, and (3) wetland hydrology. Hydrophytic vegetation consists of those plant species growing in water, soil, or on a substrate that at least periodically lacks oxygen. Hydric soils are saturated, flooded, or ponded long enough during the growing season to become deoxygenated in the upper soil horizon. Wetland hydrology includes seasonal, periodic, or permanent inundation or soil saturation that creates anaerobic conditions in the soil for a sufficient portion of the growing season for wetland soil and vegetation to be maintained.

The growing season is defined by the Corps manual as the period when ambient temperatures are typically at or above freezing (0 degrees Celsius or 32 degrees Fahrenheit). Data from the WETS tables for the area indicate that this period typically (70% probability) occurs from March 12 to October 31 and is 223 days long.

A total of 22 plots were used to investigate CMA1 and 29 plots to investigate CMA2. CMA1 was investigated in the autumn 2001 and autumn 2002, whereas CMA2 was investigated in the winter, spring, and autumn of 2002. The plots were placed in locations deemed representative of their surrounding areas. Both wetlands and uplands were sampled by these plots. Some of these plots were located just outside the CMAs to characterize the areas that will serve as buffers. The presence or absence of hydrophytic vegetation, hydric soil, and wetland hydrology indicators were documented for each sample plot as a means of justifying the delineated wetland boundaries.

2.1.1 Hydrophytic Vegetation

The dominant plant species in each vegetation community were identified. Vegetation communities are defined here as a contiguous assortment of plants in a given area sharing similar environmental conditions. Dominant plants are those plant species that comprise at least 20% aerial cover of a given plot. The sample plots are circular and have a 30-foot radius for trees and shrubs and a 5-foot radius for

herbaceous plants. Plots were situated so that they best represent the vegetation present within each community.

The hydrophytic indicator status for each dominant species as designated by the US Fish and Wildlife Service (USFWS 1996) for Region 9 was used to determine whether the vegetation in each community is hydrophytic. To meet the hydrophytic vegetation criteria, more than 50% of the dominant species must have an indicator status of obligate, facultative wetland, and/or facultative. Indicator status categories are defined in Table 1. The Region 9 wetland indicator status for each plant species mentioned in the report is shown next to its scientific name.

TABLE 1
PLANT SPECIES WETLAND INDICATOR CATEGORIES

Indicator Category	Occurrence	Probability in Wetlands (estimated)
Obligate (OBL)	Occurs almost always in wetlands under natural conditions.	>99%
Facultative Wetland (FACW)	Usually occurs in wetlands, but occasionally found in non-wetlands.	67-99%
Facultative (FAC)	Equally likely to occur in non-wetlands, but occasionally found in wetlands.	34-66%
Facultative Upland (FACU)	Usually occurs in non-wetlands, but often found in wetlands.	1-33%
Upland (UPL)	Occurs in wetlands in another region, occurs almost always under natural conditions in non-wetlands in this region.	<1%

2.1.2 Hydric Soil

Soil observations were made in wetlands and adjacent upland areas by digging 1.5-foot deep soil profiles in each sample plot. Soil color and other characteristics used to indicate hydric soils were documented. Soil taxonomy and drainage class were determined by reviewing the results of the *Soil Survey of the Whatcom County Area, Washington* (Goldin 1992).

Soil in which any of the following indicators is present meets the criteria for hydric soil:

- **Gleyed soil (gray colors).** Gleyed soils develop when mineral soil is saturated or inundated for sufficient periods of time to result in anaerobic (no oxygen) conditions. Anaerobic conditions cause elements common in soil, such as iron and manganese, to exist in reduced forms that are usually bluish, greenish, or grayish in color. Soil colors are determined using a Munsell color chart (Kollmorgen Corporation 1995), which has separate pages for gley-colored soils.

- **Low chroma matrix.** A low chroma matrix develops when mineral soil is saturated or inundated for substantial periods of time during the growing season (but not long enough to produce gleyed soil) to result in anaerobic (no oxygen) or hypoxic (low oxygen) conditions. A

soil matrix is the portion of a given soil layer (usually more than 50% by volume) that has the predominant color. The Munsell color chart uses abbreviations to describe colors, e.g., 10YR 3/2. In the abbreviation, the last number indicates chroma; a chroma of 1 or 2 is considered low. Soils with a matrix chroma of 2 are usually considered hydric when mottles are present. Mottles are rust-colored spots or blotches in the soil formed by the oxidation of iron compounds via fluctuating water levels. Mottles found in soil with a matrix chroma of 2 or less often indicate that a soil is hydric.

- **High organic content.** Soil retains high levels of organic matter when saturation prevents decomposition over long periods, thus allowing organic debris to accumulate. Organic content is considered high if the soil is composed of more than 20 to 30% (threshold differs depending upon other soil characteristics) organic material by weight in a layer at least 8 inches thick located in the upper 32 inches of the soil profile.

- **Soils appearing on the hydric soils list.** A list of hydric soils has been compiled by the U.S. Department of Agriculture's National Technical Committee for Hydric Soils. Listed soils have reducing conditions for a significant portion of the growing season in a major portion of the root zone and are frequently saturated within 12 inches of the soil surface.

- **Other hydric indicators.** Other positive indicators of hydric soil include sulfide or "rotten egg" odor, aquic or peraquic moisture regimes, and the presence of iron or manganese concretions.

2.1.3 Wetland Hydrology

To determine whether a vegetation community has wetland hydrology, an area is examined for inundation, soil saturation, shallow groundwater tables, or other hydrologic indicators. An area in which soils are saturated to the surface for at least 5 to 12% of the growing season meets the criterion for wetland hydrology. Since the growing season in low elevation areas of Whatcom County typically occurs from April 19 to October 21 (a total of 26.5 weeks), saturation is only required to occur here for at least 1.3 to 3.2 weeks to meet the wetland hydrology criterion. Seasonal changes in water levels and the effect of recent precipitation events must be considered when evaluating an area's hydrology. Wetland hydrology can also be inferred from the presence of any of the following indicators: watermarks on vegetation, drift lines, sediment deposits, water-stained leaves, surface-scoured areas, wetland drainage patterns, and/or oxidized root channels.

2.2 WETLAND MAPPING

The borders between wetland and upland areas and sample plots were marked in the field by wire stakes and plastic flagging. The horizontal location of each point was then recorded with differential global positioning system (DGPS) units that are capable of recording real-time sub-meter data. The Trimble Pathfinder Pro XL GPS unit was used in CMA1, and the Trimble Ag132 GPS unit was primarily used in CMA2.

The Trimble Ag132 GPS Unit was configured to the following specifications:

- Position Mode: >3 Satellites
- Elevation mask: >15 degrees
- SNR mask: >6.0
- PDOP Mask: <6.0

The Trimble Pathfinder Pro XL GPS Unit was configured to the following specifications:

- Position Mode: Manual 3D
- Elevation mask: 10 degrees
- SNR mask: 4.0
- PDOP Mask: 6.0

The data was mapped in Lat/Long NAD83 coordinate system.

The points recorded with the Pro XL were differentially corrected with data from the Thurston County Community (CORS) Base Station. The Pro XL GPS receiver is capable of collecting sub-meter positional data. The TSC-1 data logger configuration helps ensure that sub-meter data was collected. There is a maximum distance of 300 kilometers (km) (186 miles) between the wetland site and the Thurston County CORS base station. This distance is still adequate to collect sub-meter data at the RMS (root mean square, equal to 68% confidence) level.

For the Ag132 GPS unit, the data was collected with real-time DGPS signals; therefore, no post-processing to a base station was necessary. The U.S. Coast Guard Whidbey Island DGPS broadcast site is the closest station to the wetland survey site. It is less than 100 km (62 miles) from the survey site. With this distance, the Ag132 GPS unit is capable of recording positions on the wetland survey site with an accuracy of less than 2 meters (6.6 feet). One National Geodetic Survey (NGS) control point (PID = AI2004) was used as control during each survey day, which has a horizontal order of A. This is a very accurate control point to check the accuracy of the GPS unit. The standard deviations of each control point yielded sub-meter results at the RMS level. The largest standard deviation error value was the Northing value of 0.55 meters (1.8 feet). This substantiates that sub-meter results were actually observed by the Ag132 GPS unit to delineate the wetland boundaries.

2.3 WETLAND CLASSIFICATION

Wetlands are classified according to *the Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979). Under the Cowardin classification scheme, wetlands and deepwater habitats are grouped into systems based on shared hydrologic factors. These systems are as follows: palustrine, marine, estuarine, riverine, and lacustrine.

The palustrine system includes all nontidal wetlands dominated by trees, shrubs, emergent herbaceous plants, mosses, and/or lichens, and all such wetlands that occur in tidal areas where the salinity due to ocean-derived salts is below 5 parts per thousand. Wetlands included in the palustrine system are those commonly referred to as marshes, swamps, bogs, fens, prairies, seeps, and intermittent ponds.

Palustrine wetlands are divided into classes by the dominant vegetation. Forested wetlands or forested wetland communities are dominated by trees or arborescent shrubs greater than 20 feet tall with at least 30% cover. Scrub-shrub wetlands or scrub-shrub wetland communities are dominated by woody shrubs less than 20 feet tall with at least 30% cover. Emergent herbaceous wetlands or emergent herbaceous wetland communities are dominated by nonwoody, vascular plants with at least 30% cover.

2.4 WETLAND RATINGS

Wetland were rated using Ecology's Four-Tier Wetlands Rating System (Ecology 1993). Ecology recognizes four categories of wetlands: Category I, Category II, Category III, and Category IV.

Category I wetland contains the following criteria:

- Documented habitat for endangered or threatened fish or animal species or for potentially extirpated plant species recognized by state or federal agencies
- High quality native wetland communities, including documented Category I or II quality Natural Heritage wetland sites and sites which qualify as a Category I or II quality Natural Heritage wetland
- High quality regionally rare wetland communities with irreplaceable ecological functions
- Wetlands of exceptional local significance

Category II wetlands are those that meet the following criteria:

- Regulated wetlands that do not contain features outlined in Category I
- Documented habitats for sensitive plant, fish, or animal species recognized by federal or state agencies
- Rare wetland communities that are not of high quality
- Wetland types with significant functions that may not be adequately replicated through creation or restoration
- Regulated wetland contiguous with salmonid fish-bearing waters, including streams where flow is intermittent
- Regulated wetlands with significant use by fish and wildlife

Category II wetlands occur more commonly than Category I wetlands but still need a high level of protection.

Category III wetlands meet the following criteria:

- Regulated wetlands that do not contain features outlined in categories I, II, or IV

Category III wetlands are smaller, less diverse, and/or more isolated in the landscape than Category II wetlands. They occur more frequently, are difficult to replace, and need a moderate level of protection.

Category IV wetlands meet the following criteria:

- Regulated wetlands that do not meet the criteria or a category I or II wetland
- Isolated wetlands that are less than or equal to one acre in size; and have only one wetland class; and have only one dominant plant species
- Isolated wetlands that are less than or equal to two acres in size, and have only one wetland class and a predominance of exotic species

Category IV wetlands are the smallest, most isolated, and have the least diverse vegetation. These are wetlands that should be replaceable and, in some cases, can be improved from a habitat standpoint. These wetlands do provide important functions and values and should be protected to some degree. Regional differences may call for a more narrow definition of this category.

2.5 FUNCTIONAL ASSESSMENT

Wetland functions comprise the hydrological, biogeochemical, and ecological processes and manifestations of these processes that occur within wetlands. The functions wetlands perform are many and often difficult to distinguish. Wetland functions include surface water and stormwater flow moderation, groundwater recharge, water quality maintenance and improvement, primary production and organic export, and terrestrial and aquatic habitat provision. The functions that wetlands perform generally benefit the physical and ecological processes of the surrounding landscape and reflect the ecological health of the surrounding watersheds. Functional performance varies between different wetlands and between different functions performed by the same wetland. Functions are easily confused with values, which are more closely associated with the goods and services that wetlands provide to society.

URS assessed the performance of wetland functions for the proposed restoration site using the Washington State Methods for Assessing Wetland Functions (Ecology 1999). This method is based on the Hydrogeomorphic Approach for Assessing Wetland Functions (HGM Approach). The Corps and other federal and state agencies are currently implementing the HGM approach to wetland functional assessment through the development of regional guidebooks.

Since the on-site wetlands are so large and extend beyond the CMA boundaries, it was necessary to constrain the assessment units to the wetland areas within each CMA. Constraining the assessment units to each CMA greatly facilitated functional assessment.

3.0 RESULTS

The survey area consists of relatively flat, overgrown pasture that contains very few buildings or roads and has relatively little human activity. This area 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.

3.1 COMMUNITY TYPES

The predominant habitat type in the CMAs is seasonally moist or saturated meadow dominated by non-native pasture grasses. Some small patches of mature and semi-mature forest and shrub-dominated areas occur adjacent to and within the site. Tree and shrub cover on site also occurs along the unmaintained drainage ditches that traverse either at an east-west or north-south orientation. However, a few individual trees and shrubs, mostly seedlings, are found scattered in some portions of the CMAs.

The meadow areas contain a mosaic of moderately distinct patches of herbaceous plant communities. A patch is a relatively small area with a fairly distinct assemblage of species. The patches dominated by herbaceous vegetation range in size from 100 square feet (ft^2) to at least 10,000 ft^2 and most have a somewhat complex shape.

The existing distribution of patches may be partially explained by variation in hydrologic regime, which is mostly dependent on micro-topographic variation. Thus, patches dominated by FACW plants (67 to 99% of individuals of the species within a region are found within wetlands) were typically found in moister areas than patches dominated by FAC plants (>33 to <67% of individuals of the species within a region are found within wetlands).

FAC plants were found to dominate both wetland and upland patches. Distinction between wetland and upland meadow areas is indicated more by soil and hydrologic conditions than by dominant vegetation.

Most of the meadow areas are classified as palustrine emergent (PEM) wetland class (community type) as according to the Cowardin et al. (1979) classification system. Wetland communities present in the site vicinity are indicated by the National Wetlands Inventory (NWI) map shown in Figure 2. Since NWI maps are widely considered to show only a rough estimate of the geographic extent of wetland communities in a given area, Figure 2 should not be considered an accurate depiction of the wetland communities found in the site vicinity.

PEM wetlands are dominated by herbaceous vegetation with fewer than 30% cover by woody plants. The majority of this wetland area is considered to be palustrine emergent, temporarily flooded (PEMA)

wetlands. 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 substantially in the latter half of the growing season.

Substantial portions of the wetlands are considered to be palustrine emergent, seasonally flooded (PEMC) wetlands. These wetland communities typically have seasonal inundation and retain saturation for longer periods than PEMA wetland communities.

CMA1 and CMA2 both contain patches of forest less than 1 acre in size. CMA1 contains a small (0.3-acre), circular patch of palustrine forested wetland (PFO) near the center of the mitigation area. Another forested area within CMA1 is a portion of the riparian forest associated with Terrell Creek. This portion of upland riparian forest is over 0.5 acre in size and surrounds the northern portion of the main ditch channel. This channel extends north from near the southern edge of CMA1 through the riparian forest until it joins Terrell Creek.

CMA2 contains two forested areas and is adjacent to three others. The first patch within CMA2 is primarily upland, approximately 0.75-acre in size, and is fully encompassed by CMA2. This patch is located near CMA2's northeast corner. The second forested patch is a 0.3-acre portion of a relatively large (approximately 5.7 acres) patch of mature forest that lies mainly outside CMA2. The 0.3-acre portion is within the northeastern portion of this forested area and is considered upland.

The three forested areas adjacent to CMA2 are each greater than 1 acre in size. The 5.7-acre patch of mature forest lies along the western boundary of CMA2's main section and south of the 'panhandle'. The panhandle is the unofficial title for the northwestern portion of CMA2 located west of the finger of forest that extends north from the forest patch mentioned above. The portion of this forest delineated as wetland is 0.78 acre in size and is located along the forest's eastern and southern edge just outside CMA2. Another patch of mature forest exists adjacent to the southwestern corner of the CMA2 panhandle. This forested patch appears to be wetland mosaic (containing a majority of wetland patches versus upland patches). The third forest area is the riparian forest associated with Terrell Creek that lies immediately north of the eastern three-quarters of CMA2.

CMA2 contains a few small plant communities dominated by shrubs. A palustrine scrub-shrub (PSS) wetland community is located just east of the eastern forest patch and is 0.27 acre in size. A portion of this scrub-shrub wetland community is located in a temporary flooded area (PSSA) and a portion is located in a seasonally flooded area (PSSC). An upland shrub community is also present along the part of the southern edge of the CMA2 panhandle. This community occurs along the site boundary and is adjacent to the forested patch along the southwestern edge of the CMA2 panhandle.

The distribution and character of uplands and wetlands found on site will be discussed further in Sections 3.3 and 3.4 of this report.

3.2 SOIL TYPES AND HYDROLOGIC REGIMES

The five soil types found in the mitigation areas include Bellingham silty clay loam, Birchbay silt loam, Kickerville silt loam, Labounty silt loam, and Whitehorn silt loam (Goldin 1992). These and other soil types found in the site vicinity are indicated in the Soil Survey Map in Figure 3. This map shows the geographic extent of each soil type as indicated by its numeric indicator where Bellingham silty clay loam = 11, Birchbay silt loam = 12 and 13, Kickerville silt loam = 80, Labounty silt loam = 94, and Whitehorn silt loam = 184.

All soils in the survey area formed on a wave-reworked glaciomarine drift plain that was deposited during the Fraser (late Wisconsin) glaciation 10,000 to 30,000 years ago. The drift plain is a stratigraphic layer called Bellingham Drift. This layer consists of clay till that extends from soil substratum to more than 70 feet below ground surface (bgs). This layer is considered to be an aquitard, allowing relatively little water to percolate to Terrell Creek or to the aquifer located below the Bellingham Drift.

The soils here formed under a climate with 35 to 45 inches of average annual rainfall, 50 degrees Fahrenheit average annual air temperature, and typically 175 to 198 days per year that are frost-free (Goldin, 1992). Actual climatic conditions at the CMAs were extrapolated from over 30 years of data gathered at the WETS weather stations in Blaine and the Bellingham International Airport (NRCS 1999). According to this extrapolation, average annual precipitation is 36 inches, and average annual temperature is 49.5 degrees Fahrenheit.

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 extends 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 poor soil drainage in this portion of Whatcom County fosters widespread near-surface saturation and/or shallow inundation during the wet season. High rates of runoff during the wet season combined with moderate rates of evapotranspiration during the dry season removes most of the moisture stored in the soil, causing relatively dry conditions in the latter half of the dry season.

The Labounty soil predominates in CMA1, whereas the Whitehorn and Birchbay soils predominate in CMA2. Kickerville silt loam comprises a minor portion of the CMA1 whereas Bellingham silt loam

comprises a small portion of CMA2. All soil types are moderately fertile, but have poor vertical drainage due to the underlying clay till.

Labounty, Whitehorn, and Bellingham soils are poorly drained soils listed as hydric, but contain inclusions of non-hydric soils. Surface and subsurface horizons of these soils have low hydraulic conductivity restricting downward percolation of water and sustaining saturation near the soil surface throughout most of the wet season.

The surface horizon for the Labounty silt loam is a silt loam that is 10 to 12 inches thick. The upper portion of the subsoil layer is mottled silt loam that is typically 12 inches thick. The lower portion of the subsoil layer is a silt loam or clay loam that extends from 22 to 35 inches bgs. The substratum typically begins 35 inches bgs and is typically has a high percentage of clay. In some areas, the substratum contains sandy lenses, and/or pebbles. Permeability for the Labounty soil is slow and drainage is considered poor.

The morphology of the Whitehorn soil type is similar to the Labounty silt loam, but the Whitehorn has a coarser texture in the subsoil. Whitehorn silt loam typically has a silt loam surface layer that is 10 to 14 inches deep. The upper 8 inches of the subsoil is loam and very fine sandy loam, whereas the lower 8 inches of the subsoil is very gravelly sandy loam. The substratum typically begins 26 inches bgs and a loam that typically has a high percentage of clay. In some areas, the substratum contains sandy lenses, and/or pebbles.

Although drainage for the Whitehorn soil is considered by Goldin (1992) to be poor, a detailed investigation conducted by ENSR Consulting and Engineering (1992) discovered drainage rates through the sandy subsurface horizons to be relatively rapid. The study concluded that the drainage for this soil should be considered moderately poor, but that the soil should continue to be considered as hydric. The study also concluded that despite spatial intermingling of the three soils, the designations of Labounty and Whitehorn soils as hydric and Birchbay soils as non-hydric are correct.

Bellingham silty clay loam is located in the westernmost wetland area within the CMA2 panhandle. Bellingham silty clay loam is a poorly drained, hydric soil that occurs in depression terraces. It formed in an admixture of loess, alluvium, and glaciolacustrine deposits. The surface layer is typically a brown silty clay loam that is 10 inches deep. The subsoil is a mottled silty clay loam that is 14 inches thick. The substratum is typically comprised by silty clay loam. In some areas, the subsoil and/or substratum has more than 60% clay. Permeability is slow and drainage is poor.

In contrast to the other soil types, Birchbay silt loam and Kickerville silt loam are non-hydric, moderately well drained soils.

Birchbay silt loam typically has loam or silt loam surface layer that is 8 to 12 inches thick. The subsoil is a gravelly silt loam that is 6 to 20 inches thick. The upper 18 inches of the substratum is a very gravelly sand, whereas the lower part of the substratum to a depth of 60 inches has a high percentage of clay. The depth from the soil surface to the sand substratum in the survey area is typically 14 to 18 inches.

Permeability in the Birchbay soil is moderate in the surface layer, very rapid in the sandy upper part of the substratum, and slow in the lower part of the substratum.

Kickerville silt loam occurs in the upland area near the southeastern corner of CMA1. Kickerville silt loam is a well drained soil that occurs on outwash terraces. It formed in a mixture of loess and volcanic ash over glacial outwash. The surface layer is typically a dark brown silt loam that is 9 inches deep. The upper portion of the subsoil is a dark yellowish brown silt loam that is 13 inches thick and the lower portion of the subsoil is a dark yellowish brown very gravelly loam that is 10 inches thick. The substratum is typically gravelly sand that extends to at least 60 inches bgs.

The Labounty, Whitehorn, and Bellingham soils typically support a hydrologic regime that is saturated throughout most of the wet season and may remain somewhat moist for much of the dry season. The Birchbay soil may typically support very moist to saturated soils throughout much of the wet season but dries earlier in the dry season than the hydric soils found on site. Lastly, the Kickerville silt loam typically remains unsaturated throughout the wet season.

Distribution of soil types and their associated hydrologic regimes were partially confirmed in the field. Soil and hydrologic conditions vary across the CMA, especially between uplands and wetlands. Wetland areas in CMA1 typically have soil and hydrologic conditions similar to those that are described for Labounty silt loam. Wetland areas in CMA2 typically have soil similar to those that are described for Whitehorn silt loam. Upland areas typically contain soil and hydrologic conditions similar to those that are described for Birchbay silt loam, but some upland soils had some differences. See Appendix A (Wetland Delineation Data Sheets) for details.

Historic cultivation for crops and hay disturbed soil structure and smoothed what was likely rough topography dominated by hummocks. The hummocks may have been formed by a combination of wave-reworking (swale and swell topography) and tree fall (pit and mound topography).

It is likely that relative to pre-settlement times, the water table rises higher in winter and drops lower in summer. Drainage ditches were established to facilitate drainage and expedite drying of soil. These ditches continue to function, although they are not maintained and are overgrown with vegetation. Ditch drainage combined with historical cultivation has likely caused the hydrologic regime to fluctuate more than had occurred prior to cultivation. As a result, soil in most areas on site including both wetlands and uplands are saturated near the surface during the wet season and retain low to moderate moisture levels by the end of the growing season. The gentle topography and soil structure redevelopment during the past few years may have allowed soils to regain some of their inherent permeability and storage capacity, thus allowing them to moderate hydrologic fluctuation.

No subsurface drainage structures such as drainage tiles are known to occur or were observed during the site investigation. However, drainage tiles were installed in the region during the early part of the 20th century. Although most have not been maintained for decades, there may be some tiles constructed of cedar box drains on site that may still be actively draining groundwater (Timblin pers. comm. 2001).

Total precipitation from in the project vicinity was below average, but within the normal range for 2001 and 2002 as determined by the WETS tables.

3.3 CMA1

The CMA1 site is 50.3 acres in size and is situated north of Grandview Road and east of Blaine Road. This site is composed of one large wetland with a few scattered upland patches. The wetland and its various community types are described in Subsection 3.3.1 and upland patches are described in Subsection 3.3.2. The geographic extent of uplands and wetlands in CMA1 is shown in Figure 4A.

In general, CMA1 slopes to the north and northwest. 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. Historic cultivation has substantially disturbed the site, making delineation of wetlands from uplands difficult. In addition, a ditch system continues to facilitate site drainage.

A broad, shallow ditch carries surface water north across the site. The ditch is 5 to 20 feet wide and 0.5 to 1.5 feet below the elevation of land immediately surrounding it. The ditch slopes northward at approximately 0.5% grade. The ditch rapidly becomes a well-defined channel after it exits CMA1 to the north; this channel leads to Terrell Creek. The ditch contains slowly flowing water during the wet season and no surface water from June through October. The hydraulic input for the ditch is precipitation captured by the land immediately within CMA1 and the west-facing and northwest-facing portions of the hill near the southeastern corner of CMA1.

Runoff from undeveloped areas south of Grandview Road in the vicinity of the proposed power plant construction site enters the deep roadside ditches that bypass the CMAs. This runoff collects in the ditch just east of Blaine Road and just west of CMA1 that leads directly to Terrell Creek.

3.3.1 Wetlands

CMA1 contains 38.4 acres of a large wetland that extends off site (Figure 4a). The large wetland in CMA1 is rated as a Category II wetland using the Washington State Wetlands Rating System (Ecology 1993). See Appendix B (Washington Department of Ecology Wetlands Rating Field Data Forms) for details. Despite its degraded condition, this wetland satisfies the criteria for Category II status since it is fairly large and hydrologically connected via intermittent streams to Terrell Creek, a salmon-bearing stream with an intact riparian forest.

The large CMA1 wetland is composed of three different wetland community types: temporarily flooded palustrine emergent (PEMA) wetland communities, seasonally flooded palustrine emergent (PEMC) wetland communities, and seasonally flooded palustrine forested (PFOC) wetland communities.

PEMA Wetland Communities

PEMA wetland communities comprise 25.9 acres (51.4%) of the total area of CMA1. Although this wetland type is identified as having temporary flooding, floods here are probably very rare. Instead, PEMA communities retain saturation at or near the surface of the soil for long periods, especially overlapping the beginning of the growing season, but typically dry out substantially in the latter half of the growing season.

Most PEMA wetland communities are dominated by colonial bentgrass (*Agrostis capillaris*/FAC), creeping bentgrass (*Agrostis stolonifera*/FACW), and/or reed canarygrass (*Phalaris arundinacea*/FACW). A few other species found to co-dominate with the bentgrasses include quackgrass (*Elytrigia repens*/FAC-) and common velvetgrass (*Holcus lanatus*/FAC). Several PEMA communities are composed of aggregations of many small, species-poor patches that are typically 500 to 5,000 ft^2 in size. Reed canarygrass is often found in nearly monotypic patches, which are especially large in the northwestern portion of CMA1, and in small patches (100-1,000 ft^2) in the other portions of the site. A few small patches are dominated by slough sedge (*Carex obnupta*/OBL), a native sedge. Field horsetail (*Equisetum arvense*/FAC), common velvetgrass, slough sedge, and meadow foxtail (*Alopecurus pratensis*/FACW) are common in subdominant (<20% cover) levels. A few scattered individuals of red alder (*Alnus rubra*/FAC) saplings and paper birch (*Betula papyrifera*/FAC) trees are also present.

The soil in the PEMA wetland areas of CMA1 typically has two distinct soil horizons (layers). The surface horizon is typically 12 to 14 inches deep and ranges from a very dark gray (10YR 3/1) to a very dark grayish brown (10YR 3/2) silt loam. The surface horizon is typically divided into 2 sub-horizons. The upper, or A1 horizon, has similar colors as described above and typically extends to 8 inches in depth. The lower, or A2 horizon, ranges widely in coloration. This layer may have a very dark gray (10YR 3/1) silt loam or sandy loam or a dusky red (2.5YR 4/2) sandy loam with common, distinct dark brown (7.5Y 3/4, 7.5Y 4/4) mottles. The A2 layer typically extends from 8 to 12 inches bgs. The subsoil horizon extends from 12 to greater than 18 inches and may have a dark gray (10YR 4/1) silt loam, a light yellowish brown (10YR 6/4) sandy loam, or a dark brown (7.5Y 4/2) silt loam matrix with many, prominent dark brown (7.5Y 4/4) mottles.

PEMC Wetland Communities

PEMC wetland communities comprise 12.2 acres (24.2%) of CMA1. On the CMA1 site, the PEMC wetland communities are dispersed across the relatively flat part of the site but also encompass the entire portion of the main ditch south of where it enters the riparian forest (see Section3.1). Since all of CMA1 was historically cultivated, topographic variation has been minimized which causes the borders of these communities to be difficult to define.

These wetland communities are typically dominated by soft rush (*Juncus effusus*/FACW*)*, reed canarygrass, colonial bentgrass, and creeping bentgrass. As in the PEMA communities, reed canarygrass is often found in nearly monotypic patches, which are especially large in the northwestern portion of

CMA1, but relatively small (100 to 1,000 ft^2) in the other portions of the site. Velvetgrass, creeping buttercup (*Ranunculus repens*/FACW), and slender rush (*Juncus tenuis*/FACW-) are also present. Scattered individuals of hardhack (*Spiraea douglasii*/FACW) and clustered wild rose (*Rosa pisocarpa*/FAC) occur along portions of the main ditch that runs south to north through the CMA1 site.

As determined from field investigations for the *Wetland Mitigation Potential Survey Report* (URS 2001), reed canarygrass vigor as measured by the height of stems appeared to vary across the undeveloped portions of the BP Cherry Point property. Typically, stands within PEMC communities produce stems that are 6 to 8 feet tall, thus indicating moisture sufficient for high vigor. In contrast, stands within PEMA communities produce stems that are only 4 to 6 feet tall, indicating that the drier conditions in these areas may have reduced reed canarygrass vigor.

The soil in the PEMC wetland areas typically has two distinct soil horizons (layers). The surface horizon is typically 14 inches deep and is divided into 2 sub-horizons. The upper, or A1 horizon, typically extends to 6 inches in depth and is a very dark gray (10YR 3/1) silt loam. The lower, or A2 horizon, has the same matrix color and texture as the upper horizon, but also has common, distinct dark brown (7.5Y 3/4, 7.5Y 4/4) mottles. This sub-horizon may also have black manganese concretions.

Inundation in these communities is typically shallow (<3 inches) during winter and early spring and dispersed across broad areas with very fine variation in inundation depth and persistence. These communities sustain inundation for long periods, extending into the early part of the growing season, but typically have no inundation and tend to dry out during the latter half of the growing season.

PFOC Wetland Community

As mentioned previously, a small (0.3-acre), circular patch of forested wetland exists near the center of CMA1. This PFOC community is dominated by a dense stand of quaking aspen (*Populus tremuloides*/FAC+). The trees in this patch range from seedlings to 40-foot-tall semi-mature individuals. Although no investigation of the soil in this community occurred, it is likely that the soil here does not differ greatly from the soil in the PEMC communities. This area appears to have shallow (<3 inches) inundation throughout much of the wet season and is thus considered seasonally flooded according to the Cowardin classification system.

Ditch/Hedge Community

A shallow ditch oriented east-west in the northwest portion of the site has a few trees and shrubs along its edges. A portion of this ditch appears to have been filled and is now only a hedgerow. Vegetation along this ditch/hedgerow includes Douglas fir (*Pseudotsuga menziesii*/FACU) saplings, Himalayan blackberry (*Rubus discolor*/FACU), snowberry (*Symphoricarpos albus*/FACU), and hardhack.

As discussed previously, most of the main ditch is encompassed by a PEMC community. The ditch enters a degraded riparian forest that extends 350 feet north to the northern border of CMA2. This riparian forest will be described in the next subsection.

3.3.2 Uplands

Eight upland patches are present in CMA1 (Figure 4a) covering 12.0 acres (23.8%) of the total area in CMA1. These upland patches are designated as 1-A, 1-B, etc. The largest upland patches in CMA1 (Upland 1-A and 1-B) are located in the southeast corner of the mitigation site. The five remaining upland patches (Uplands 1-C through 1-G) are located in the northern half of the CMA1 site. The sizes of these upland patches are listed in Table 2.

TABLE 2
CMA1 UPLAND PATCH SIZE

Upland Name	Size (acres)
Upland 1-A	5.14
Upland 1-B	1.89
Upland 1-C	0.12
Upland 1-D	0.50
Upland 1-E	3.63
Upland 1-F	0.38
Upland 1-G	0.31
Total upland area	**11.97**

Colonial bentgrass occurs in most upland meadows of CMA1 in dominant amounts. One or more species including tall fescue (*Festuca arundinacea*/FAC-), quackgrass, Canada thistle (*Cirsium arvense*/FAC-), common velvetgrass, and/or meadow fescue (*Festuca pratensis*/FACU+) typically co-dominate with colonial bentgrass in these upland meadows. One upland meadow patch near the southeast corner of the site is entirely dominated by reed canarygrass, which is normally found in wetlands. Many upland meadow areas contain subdominant amounts of several other species including sweet vernal grass (*Anthoxanthum odoratum*/FACU), orchard grass (*Dactylis glomerata*/FACU), tiny vetch (*Vicia hirsuta*/NI), cat's ear (*Hypochaeris* sp.), and hawkbit (*Leontodon* sp.).

The upland riparian forest located in the northern portion of CMA1 and contained with Upland 1-E is dominated by semi-mature red alder and a thick layer of Himalayan blackberry. Other species present in subdominant amounts are semi-mature paper birch, clustered wild rose, and common snowberry. Most of this community is situated on the relatively steep side-slopes that rise more than 6 feet in elevation above the channel bottom. Himalayan blackberry is present along the edge of the riparian forest associated with Terrell Creek and therefore is included in other portions of Upland 1-C and 1-G. In other the other upland areas where it is found (Uplands 1-A, 1-B, 1-C, and 1-F), Himalayan blackberry occurs as isolated shrubs or immature sprigs.

The soil in the upland patches typically has three distinct soil horizons. The A1 horizon is a dark brown (10YR 3/3) silt loam, which extends typically 8 inches in depth. Below this horizon is the A2 horizon, which consists of a dark brown silt loam with dark brown (7.5Y 4/3) mottles. The mottle abundance and contrast in the A2 horizon ranges from few and faint to common and distinct. The A2 horizon extends to 12 to 16 inches in depth. The B horizon extends below the A2 horizon and typically consists of a dark

brown (7.5Y 4/2) or dark yellowish brown (10YR 3/4) silt loam matrix with common, distinct dark brown (7.5Y 3/4) mottles.

Upland patches mainly occurred in well-drained areas that are either slightly elevated or sloped at approximately 3% or greater. Several of these areas are likely supported by Birchbay silt loam soil, which has a sandy substratum that is typically within 2 feet from the soil surface. The substratum layer facilitates drainage of the upper layers. Other upland areas may not have this sandy subsurface layer, but have lateral drainage sufficient to impede soils from becoming saturated for long periods outside of the wet season. Thus, upland patches tend to drain earlier in the year and are drier during the growing season.

3.4 CMA2

CMA2 is a total of 59.8 acres in size and is situated north of Grandview Road and just west of Blaine Road. CMA2 contains a large wetland that extends off site, but also contains upland patches of various sizes. The portion of the wetland in the main section of CMA2 is connected off-site to the portions of the wetland in the panhandle. The wetland and its various community types are described in Subsection 3.4.1; upland patches are described in Subsection 3.4.2. The geographic extent of the uplands and wetland communities in CMA2 are shown in Figure 4B.

The easternmost 350 feet of CMA2 is fairly flat, but the remaining portions slope west at approximately 2.25% grade. 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, creating ditches that continue to facilitate site drainage. Most of the site is sloped so that surface runoff and subsurface moisture seep toward the ditch system leading west across the site.

Two ditches of moderate depth carry surface water north and west across the site. One ditch leads north along the western boundary of CMA2. This ditch is 2 to 3 feet wide 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 4 feet wide and 1 to 2 feet deep. This ditch extends across the main section of CMA2. It then crosses the northern portion of the upland forest where most of the trees are semi-mature or sapling red alders and much of the mid-story is dominated by Himalayan blackberry. The confluence of the two ditches is located just west of the forest. The ditch continues west across the southern boundary of the panhandle of CMA2. The ditch enters the off-site forested wetland mosaic and continues west. A small portion of ditch flow is diverted north through the forest and then flows north through the 4.6-acre mitigation site established in 2000. The ditches contain flowing or standing water during the wet season and no surface water during the dry season. The hydraulic input for the ditch is precipitation captured by the land immediately within CMA2.

3.4.1 Wetlands

CMA2 contains one large wetland that extends across 41.3 acres (69.1%) of this CMA (Figure 4b). As mentioned earlier, the wetland area in the main section of the site is connected off-site to the wetland area in the panhandle.

The wetland in CMA2 is rated as a Category II wetland using the Washington State Wetlands Rating System (Ecology 1993). Despite its degraded condition, this wetland satisfies the criteria for Category II status since it is fairly large and hydrologically connected via intermittent streams to Terrell Creek, a salmon-bearing stream with an intact riparian forest.

Wetland covers a lower proportion of area in CMA2 compared with CMA1. Approximately 76.2% of CMA1 is wetlands, whereas wetlands comprise approximately 69.1% of CMA2. As mentioned previously, the predominant wetland type in both CMAs is PEMA.

PEMA Wetland Communities

PEMA wetland communities comprise 29.7 acres (49.7%) of the total area of CMA2. Most PEMA patches in CMA2 are dominated by colonial bentgrass and/or creeping bentgrass. Other species such as reed canarygrass and tall fescue co-dominate these communities with the bentgrasses. Many PEMA communities are comprised by aggregations of several species-poor patches that are somewhat smaller than the patches found in CMA1 (approximately 100 to 1,000 ft^2 in size). A few of these patches are dominated by slough sedge. The patches dominated by bentgrasses typically contain the greatest number of subdominant species such as reed canarygrass, soft rush, tall fescue, common velvetgrass, bird's foot trefoil (*Lotus corniculatus*/FAC), and rib plantain (*Plantago lanceolata*/FACU+). A few sparsely distributed red alder seedlings and hardhack sprouts occur in this patch type.

PEMC Wetland Communities

Several patches of PEMC wetland communities occur in this survey section. PEMC wetland areas comprise a total of 11.6 acres, which is 19.4% of CMA2. These communities sustain inundation for long periods, especially during the early part of the growing season, but typically have no inundation during the latter half of the growing season. Inundation in these communities is typically shallow (<3 inches) during winter and early spring and dispersed across broad areas with very fine variation in inundation depth and persistence.

PEMC patches are typically dominated by reed canarygrass, creeping bentgrass, and soft rush. As with PEMA communities, many patches dominated by reed canarygrass typically contain less than 5% cover by any other species. PEMC communities typically contain a few subdominant (<20% cover) species including field horsetail, slough sedge, creeping buttercup, and bird vetch (*Vicia cracca*/NI). A few sparsely distributed individuals of hardhack sprouts occur in the PEMC areas.

The ditches are typically vegetated with shrubs or tree seedlings and saplings. The species most commonly found along the ditches within uplands include red alder, Himalayan blackberry, and Indian plum (*Oemleria cerasiformis*/FACU). Most of these ditches are steep-sided and are fairly deep (2 feet or more), as measured from the top of the bank to the bottom of the ditch.

PSS Wetland Community

A small PSS community lies within the northeast portion of the main section of CMA2. This community is 0.27 acres in size and is situated immediately east of an upland forest area. The western portion of the PSS community does not appear to be seasonally flooded and is therefore classified as PSSA. The PSSA portion of the community is approximately 0.09 acre in size. The eastern portion of the PSS community is seasonally flooded and is therefore classified as PSSC. The PSSC portion of the community is approximately 0.18 acre in size.

Both portions of the community are strongly dominated by hardhack, a native species well adapted to the environmental conditions present at the CMAs. Other shrubs including Himalayan blackberry and Sitka willow (*Salix sitchensis*/FACW) are present as well. The shrubs have several stems per individual, but the density between shrubs is moderate. The hardhack shrubs present average 10 feet in height. A moderately dense layer of grasses (mainly reed canarygrass and bentgrass) exists throughout this community.

PFO Wetland Communities

As discussed in Section 3.1 of this report, three forested areas larger than 1 acre in size occur adjacent to CMA2. Each of these forested areas is separated from each other by upland and wetland meadow. Two of these patches include palustrine forested, (PFOA) wetland communities.

The PFOA located just west of the main section of CMA2 is along the east edge of a large upland forest patch. The PFOA community is 0.78 acre in size and is dominated by mature red alder, black cottonwood (*Populus balsamifera* ssp. *trichocarpa*/FAC), and paper birch in the canopy and a wide variety of shrub species in the mid-story layer. Most trees and shrubs are perched upon hummocks that are 1 to 2.5 feet above the surrounding elevation, where most of the other vegetation is located. Shrub and small tree species found mainly on the hummocks include Indian plum, Himalayan blackberry, oceanspray (*Holodiscus discolor*/NI), and snowberry. Several red alder saplings less than 20 feet in height comprise a small portion of the mid-story. Red elderberry (*Sambucus racemosa*/FACU), black gooseberry (*Ribes lacustre*/FAC+), and salmonberry (*Rubus spectabilis*/FAC+) are situated low on the mounds and in relatively high areas between mounds. Shrubs species found in low areas between hummocks include clustered wild rose, black twinberry (*Lonicera involucrata*/FAC+), and Sitka willow. The understory layer is moderately developed on the hummocks with trailing blackberry (*Rubus ursinus*/FACU), stinging nettle (*Urtica dioica*/FAC+), youth-on-age (*Tolmiea menziesii*/FAC), and sword fern (*Polystichum munitum*/FACU) present. Between hummocks, there are some small stands of reed canarygrass and creeping bentgrass between hummocks. The soil in low portions of the hummocks and between

hummocks was saturated during the late winter field visit, and appears to remain saturated for a few weeks during the early part of the growing season.

The PFOA wetland mosaic community located adjacent to the southwestern portion of the panhandle is similar to the PFOA community described above. Paper birch, red alder, and black cottonwood dominate the overstory whereas salmonberry and snowberry dominate the mid-story. A variety of other native tree and shrub species are also present. Herbaceous plants including sword fern, youth-on-age, and creeping buttercup comprise the understory. The ditch that flows west across the southern boundary of the panhandle of CMA2 enters this forested wetland and then flows north through the 4.6-acre mitigation site established in 2000.

Ditch/Hedgerow Communities

The ditches are typically vegetated with shrubs or tree seedlings and saplings. The species most commonly found along the ditches within uplands include red alder, Himalayan blackberry, and Indian plum. Most of these ditches are steep-sided and fairly deep (2 feet or more), as measured from the top of the bank to the bottom of the ditch. Some ditches appear to have been filled and are now only hedgerows. The hedgerows are found in both wetlands and uplands. The wetland hedgerow in the northwest section contains a few large black cottonwoods and several semi-mature red alders.

3.4.2 Uplands

Eleven upland patches are present covering 18.42 acres (30.1%) of CMA2. These upland patches are designated as 2-A, 2-B, etc. Nine of these upland patches (Uplands 2-A through 2-H and most of Upland 2-J) are located in the main section of the CMA2 site. Part of Upland 2-J and the remaining two upland areas (Uplands 2-I and 2-K) are located in the CMA2 panhandle. The sizes of these upland patches are listed in Table 3.

TABLE 3
CMA2 UPLAND PATCH SIZE

Upland Name	Size (acres)
Upland 2-A	5.86
Upland 2-B	0.07
Upland 2-C	0.14
Upland 2-D	0.17
Upland 2-E	0.21
Upland 2-F	0.52
Upland 2-G	0.03
Upland 2-H	0.20
Upland 2-I	1.78
Upland 2-J	5.03
Upland 2-K	4.41
Total upland area	**18.42**

Most of these upland patches are meadows dominated by colonial bentgrass, with a number of subdominant species including sweet vernal grass, quackgrass, tall fescue, Canada thistle, common velvetgrass, and rib plantain. Other subdominant species that are found in smaller quantities include orchard grass, tiny vetch, and cat's ear. A few individuals of mature trees and seedlings are scattered in various locations throughout the upland meadows. Many of the saplings are situated along ditches or hedgerows, which are found in both wetlands and uplands.

As mentioned in Section 3.1, one forested patch lies entirely within CMA2, another forested patch is partially within CMA2, and two other forested areas are immediately adjacent to CMA2.

The forested patch encompassed by CMA2 is within a portion of Upland 2-A located in the northeast corner of the main section of CMA2. This upland forest is approximately 0.75 acre in size and contains two adjacent community types. The southern community consists of a few mature Douglas fir trees with an understory dominated by Himalayan blackberry. The trees typically range from 50 to 70 feet tall with 1 to 1.25-foot dbh. The northern community consists of several semi-mature red alders with a few semi-mature black cottonwoods. A few shrubs including hardhack, beaked hazelnut, and Himalayan blackberry are scattered about the mid-story layer.

The forested patch partially partly within CMA2 is a relatively large (approximately 5.7 acres), mature forest that straddles the west boundary of the main section of CMA2. The 0.78-acre PFO portion of this forested area was discussed in the previous section. The portion of the upland forest located within CMA2 is Upland 2-. This upland will likely be converted to wetland from the additional surface water to be directed to this area from the proposed plant site detention pond (see Draft Wetland Mitigation Plan BP Cherry Point).

Except for the eastern portion of the large forest patch that encompasses Upland 2-N and the wetland portion of the forest (PFO community), the forest is situated upon a 2 to 4% slope facing west. The PFO occurs along the eastern and southern edges of this area, where the slope is relatively flat. Most mature trees in the forest are deciduous, broad-leaf trees that appear to be >50 years old, are 70 to 80 feet tall, and have a diameter at breast height (dbh) of 1 to 1.5 feet. A well-developed mid-story layer exists below the canopy and a few ferns and herbaceous plants are scattered throughout the forest floor (understory). The shrub layer is dominated by snowberry, Indian plum saplings, and/or salmonberry in most areas, but also contains red elderberry, black gooseberry, beaked hazelnut (*Corylus cornuta*/NI), Himalayan blackberry, oceanspray, and red alder seedlings. The understory is relatively sparse, but is often dominated by trailing blackberry and contains some sword fern as well.

In general, three distinct soil horizons are present in upland soils. The A1 horizon is a dark reddish brown (5YR 2.5/2) loam that extends from the surface to 3 inches depth. The A2 horizon is a dark brown (10YR 3/3) loam or silt loam, which typically extends to 9 inches in depth. Below this horizon is the E horizon, which consists of a brown (10YR 4/3) sandy loam that extends from 9 to over 18 inches in depth.

Upland patches mainly occur in well-drained areas that are either slightly elevated or sloped at a grade that is approximately 2% or greater. Most uplands are supported by soil that is best described as Birchbay silt loam soil, which has a sandy substratum that is typically within 2 feet of the soil surface. The substratum layer facilitates drainage of the upper layers, allowing this soil to drain earlier in the year and remain drier during the growing season.

3.5 WILDLIFE

A list of threatened or endangered species of plants and animals and priority habitats requests was requested from the USFWS, the Natural Heritage Program (NHP) and the Washington Department of Fish and Wildlife (WDFW) by Golder Associates (2002).

In a response dated July 2, 2001, the NHP responded that there are no known rare, threatened or endangered species of plant or high quality ecosystems within the mitigation areas. The USFWS responded on June 27, 2001. Their response indicated that several listed species may occur within the project vicinity. These species include wintering bald eagles, bull trout, and foraging marbled murrelets. Although these species may occur near Lake Terrell, approximately 1.5 miles southeast of the proposed project site, it is unlikely that these species utilize the area due to forest fragmentation and the industrial character of the refinery. Bull trout do not utilize the area and would not be affected by the project.

The WDFW has responded to a request for Priority Species and Priority Habitat. The WDFW indicates that portions of the area are considered priority habitats because they are "Wetlands on the flat coastal area from Cherry Point/Lake Terrell, draining north; this area is 'pocked' with hundreds of wetlands, many too small to record." Bald eagle breeding locations were identified within 2 miles of the CMAs. Additionally, Terrell Creek, which drains Lake Terrell, runs north of the CMAs. The Terrell Creek watershed contains several priority species including sea-run cutthroat trout, winter steelhead, and coho salmon. Two Wildlife Heritage Points are identified within Lake Terrell, approximately 1 mile southeast of the proposed construction site.

The CMAs do provide habitat for a limited number of species. The expansive fields dominated by overgrown pasture grasses provides habitat for scores of mice and voles, which attract red-tail hawks, great blue herons, and coyotes. Some native grassland birds, such as savannah sparrow and common snipe, and one game bird species (ring-necked pheasant), a non-native species that is regularly stocked here by WDFW, also inhabit the fields.

The forested areas in the vicinity provide cover for several species that primarily utilize the fields for foraging. These species include coyote, mule deer, red-tail hawk, American robin, and others. Most migratory and resident bird species present, such as red-shafted flicker, downy woodpecker, common yellowthroat, song sparrow, and spotted towhee, utilize the forested areas for cover and foraging. Several Pacific chorus frogs have been found in and around the ditches near the forested areas. One red-legged frog was observed in the forested wetland mosaic situated just south of the CMA2 panhandle.

3.6 FUNCTIONAL PERFORMANCE

The *Methods for Assessing Wetland Functions* (Ecology 1999) was applied to the two CMAs as they exist currently. See Appendix C for the data used for each assessment.

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 part of an 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. This assessment unit ranges from over 100 feet elevation at its east edge to 45-50 feet elevation at its west edge. 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. This area ranges from 45 to 50 feet elevation at its east edge to 25 feet elevation at its west edge. Surface water in this portion of the wetland flows at velocities much slower than the velocities typically attained within the assessment unit. The contributing basin for the assessment unit associated with CMA2 is comprised by the area within the assessment unit itself.

As a result of the gentle slope, channels outside the assessment undisturbed by ditching tend to have floodplain wetland communities surrounding them that are 30 to over 100 feet wide. These communities are likely flooded during high flows whereas wetland areas adjacent to and elevated above the floodplain wetland communities remain free from flooding. In addition, ditch flow overtopping banks and sheet flow appear to occur much more frequently outside of the assessment unit than within the assessment unit.

The wetlands within the two assessment units both classify as Depressional Outflow wetlands according to the classification system used by this functional assessment method. 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 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).

Thirteen of the fifteen wetland functions listed by the method were evaluated for each CMA assessment unit. The two functions related to fish habitat could not be evaluated since the wetlands currently do not provide fish habitat. Thus, the scores for both functions for each CMA are shown as not 'N/A' (not applicable). The possible range of values for each function is 1 to 10, where 10 represents the highest level of performance. The results of this evaluation are summarized in Table 4.

TABLE 4
WETLAND FUNCTIONAL PERFORMANCE FOR THE WETLANDS IN CMA1 AND CMA2

Wetland Function	CMA1-Levels	CMA2-Levels	Relevant Measures or Indicators
Potential for Removing Sediments	4	4	Live & dead storage, outlet constriction, % area seasonally inundated, % area vegetated, % area with emergent vegetation class.
Potential for Removing Nutrients	2	2	Index for removing sediments, % area with clay or organic soils, % area seasonally inundated minus % area permanently inundated, outlet constriction.
Potential for Removing Heavy Metals and Toxic Organics	4	4	Index for removing sediments, % area with clay or organic soils, soil pH, % area with emergent vegetation class, % area seasonally inundated.
Potential for Reducing Peak Flows	4	4	Elevational difference between outlet bottom & flood marks, outlet constriction, ratio of inundated area to contributing basin.
Potential for Decreasing Downstream Erosion	5	5	Elevational difference between outlet bottom & flood marks, outlet constriction, % forest and shrub area, ratio of inundated area to contributing basin.
Potential for Recharging Groundwater	3	2	Infiltration rate category of soils, % area seasonally inundated minus % area permanently inundated.
General Habitat Suitability	3	3	Buffer condition, % area with canopy closure, maximum number of strata, snags, vegetation class interspersion, LWD, number of water regimes, number of water depth categories, water and vegetation interspersion, number of native plant species, presence of mature trees, edge habitat, land uses within 1 km of wetland.
Habitat Suitability for Invertebrates	2	3	Channels or streams with permanently flowing water, substrates surface types, vegetation class interspersion, LWD, water and vegetation interspersion, maximum number of strata present, number of plant assemblages, number of water regimes, categories of different aquatic bed structures, presence of tannins (-).
Habitat Suitability for Amphibians	2	2	Buffer condition, surface substrate types, water and vegetation interspersion, LWD, % area with permanent inundation, size & structure of submerged vegetation, water pH, land uses within 1 km of wetland.
Habitat Suitability for Anadromous 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.

TABLE 4 (Continued)
WETLAND FUNCTIONAL PERFORMANCE FOR THE WETLANDS IN CMA1 AND CMA2

Wetland Function	CMA1-Levels	CMA2-Levels	Relevant Measures or Indicators
Habitat Suitability for Birds	4	4	Buffer condition, snags, vegetation class interspersion, edge habitat, special habitat features (i.e. wetland within 8 km of a brackish or salt water estuary), % permanent open water, index for invertebrate habitat suitability, index for amphibian habitat suitability, index for fish habitat suitability, % canopy closure (-).
Habitat Suitability for Mammals	3	3	Buffer condition, number of water depth categories, corridor condition, beaver foraging opportunity, emergent vegetation class presence, water and vegetation interspersion, % area of open water and aquatic bed, banks with fine-textured soils, channel with permanent flowing water, index of either anadromous or resident fish habitat suitability, land uses within 1 km of wetland (-)
Native Plant Richness	1	1	Maximum number of strata, number of plant assemblages, presence of mature trees, number of native plant species, % area covered by sphagnum bog, % area dominated by non-native plant species. (-).
Potential for Primary Production and Organic Export	6	6	% area vegetated, % area with non-evergreen vegetation, % area with herbaceous understory, extent of organic soils, % area seasonally inundated, % area covered by a sphagnum bog.

The functional performance for the assessment units associated with CMA1 and CMA2 were found to be fairly similar.

For both the CMA1 and CMA2 assessment units, the ability to remove sediment from surface water inputs is rated moderate, whereas the ability to remove nutrients is rated moderately low. Although flow inputs are minor, both wetlands have large areas that are periodically inundated during the wet season. Most portions of each site has outflow that is only somewhat constricted. Both also have a high proportion of their areas dominated by emergent herbaceous vegetation, which purportedly aids in capturing and retaining sediments from the water column. Nutrient removal is relatively low since both areas retain only very small areas of permanent inundation and do not have very high clay content in the surface layer of their soils. Since flow inputs are minor, neither wetland has much opportunity to perform these two functions.

The potential for removing heavy metals and toxins is moderate for both CMA1 and CMA2 according to the model. Since few toxins enter these wetlands, toxin removal is a function that they have little opportunity to perform.

The ability to reduce peak flows and decrease downstream erosion is moderate for both CMA1 and CMA2. The small (<0.3 meter) elevational difference between outlet bottom and the ordinary high water mark and the moderately constricted outflow in both CMA1 and CMA2 aid performance of this function. In addition, the ratio of inundated area to the contributing basin is relatively high. However, the area of forest and scrub-shrub dominated communities is very small for both sites, lowering the performance potential for both functions. These sites only have a moderate opportunity to perform these functions because although they are not subject to flooding from upgradient areas, they do release a considerable volume of water during the wet season (probably greater than 10 million cubic feet per year for each site).

TABLE 4 (Continued)
WETLAND FUNCTIONAL PERFORMANCE FOR THE WETLANDS IN CMA1 AND CMA2

The potential to recharge groundwater is low for both CMA1 and CMA2. Although both sites have a relatively high proportion of area that is seasonally inundated, much of this water likely does not infiltrate into subsoil because soil permeability and infiltration rates at both sites are very low.

Performance of habitat functions for both sites are rated moderately low. As mentioned previously, both sites have been disturbed by many years of tilling, plowing, and grazing. The environmental heterogeneity has been greatly reduced and native vegetation has been replaced by non-native, invasive species such as reed canarygrass. Current conditions provide habitat for only a limited number of organisms and suppress opportunities for diverse ecological communities to develop. However, the assessment units contain small patches of forest and are adjacent to the riparian forest associated with Terrell Creek, improving their performance of habitat functions. Although paved roads comprise nearly 50% of their borders, these roads support only light traffic. Despite their proximity to the refinery, the mitigation areas are situated in a rural area located near fragments of intact forest, several freshwater waterbodies, and a diverse array of near-shore habitats (bays, estuaries, etc.).

The potential for primary production and organic export is moderate since most of each site is vegetated with non-evergreen vegetation, most of which is herbaceous, and a high proportion of each site is periodically inundated during the wet season. A fair amount of dissolved and particulate organic matter is likely exported via seasonal outflow through ditches and other surface water channels.

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APPENDIX A

WETLAND DELINEATION DATA SHEETS

APPENDIX B

WASHINGTON DEPARTMENT OF ECOLOGY WETLANDS RATING FIELD DATA FORMS

APPENDIX C

WETLAND FUNCTIONAL PERFORMANCE DATA SHEETS