APPENDIX H

TECHNICAL REPORT ON

WETLAND FUNCTIONS AND VALUES ASSESSMENT

BP CHERRY POINT COGENERATION PROJECT

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April 9, 2003

013-1421.541
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EXECUTIVE SUMMARY

Wetlands were delineated at and adjacent to the proposed site for the BP Cherry Point Cogeneration Project. It is estimated that the project will impact approximately 69 acres of land (including the plant site and construction laydown areas). The wetland delineation was carried out to determine the best location for the project site and a configuration that would minimize impacts to wetlands. Details regarding the delineation can be found in a report entitled *BP Cherry Point Cogeneration Project Wetland Delineation Report* (Golder, 2002).

Ten wetlands were identified. The majority of these wetlands (Wetlands A, B, C, D, E, F, G, H, and J) are likely to be considered "depressional outflow" wetlands. These wetlands occur in topographic depressions that exhibit closed contour intervals on three sides, with a surface water outflow to channels, streams, or rivers via a defined channel. Wetland I is likely to be 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.

The purpose of the wetland function and value analysis is to determine the function of the wetlands in the ecosystem of the surrounding area and what value they contribute in carrying out their overall function. In summary, the analysis indicates that most of the wetlands on the project site function moderately well in the production of biomass (carbon) and export to adjacent aquatic environments. The wetlands function at low to moderate levels for sediment removal, flood control, and reduction of downstream erosion. Habitat suitability, including habitat for invertebrates, amphibians, birds, and mammals, was generally rated low. The remaining functions were assessed at relatively low levels of performance based on the lack of diversity of marginally hydrophytic, non-native species and a lack of interspersion with other wetland habitat types.

The wetlands at the project site are within one of several drainage basins[1] in the Terrell Creek Watershed (Figure 1). Other than wetlands, there are no other waterbodies in the project area, although drainage most likely occurs on the site through several manmade ditches that were created to drain the area for agricultural use. In the drainage basin, water from precipitation flows northwesterly as sheetflow, through soils, or conveyed by a system of ditches. Overland flow is intercepted by ditches running both perpendicular and parallel to Grandview Road. The water is channeled under Grandview Road and enters a natural drainage pattern that flows into two manmade duck ponds. Water flowing out of the duck ponds continues to flow northwesterly via a ditch and eventually enters Terrell Creek west of Jackson Road.

[1] The size of the drainage basin was adjusted (April 2003) to reflect new information provided by URS. See communication from URS to Golder Associates dated 04/09/03.

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LIST OF ACRONYMS AND ABBREVIATIONS

AU	Assessment unit
DO	Dissolved oxygen
Ecology	Washington State Department of Ecology
LWD	Large woody debris
m	meter
NRNH	Department of Natural Resources Natural Heritage
TSS	Total suspended solids
USFWS	U.S. Fish and Wildlife Service
WDFW	Washington Department of Fish and Wildlife

1. INTRODUCTION

A wetland functions and values assessment was conducted for potentially impacted wetlands on approximately 35.37 acres within the study area (Wetlands A, B, C, D, F, G, I, and J – see Figure 2) using the *Methods for Assessing Wetland Functions - Volume I: Riverine and Depressional Wetlands in the Lowlands of Western Washington* (Washington State Department of Ecology, 1999). Ecology's methodology is currently recognized as one of the most scientifically acceptable methods of assessing functions of individual wetlands. Other methodologies, including Reppert (1979), the *Wetland Functions Characterization Tool for Linear Projects* (WSDOT, 2000) and WET (Wetland Evaluation Technique) are outdated or not appropriate to assess the wetlands at this project site. Based on current available methodologies and recommendations from Ecology (Personal Communication, 2001), representatives from Golder Associates, including a participant in one of Ecology's training workshops for this methodology, used the *Methods for Assessing Wetland Functions* for the BP project. Wetland E, discussed within the *BP Cherry Point Cogeneration Project* Wetland *Delineation Report* (Golder, 2002), was not assessed because it will not be disturbed by construction activities. Ratings were assessed for 15 categories of wetland functions based on a number of variables that were evaluated for each category as discussed in Section 2.

Wetlands within the study area are of two types: depressional outflow and riverine. Depressional wetlands are those wetlands that occur in topographic depressions that exhibit closed contour intervals on three sides and elevations that are lower than the surrounding wetlands. Depressional outflow wetlands are those that have a surface water outflow to a stream or river. Depressional closed wetlands are those that have no surface water outflow to channels, streams, or rivers. Riverine wetlands occur in floodplains and riparian corridors in association with stream or river channels. The distinguishing characteristic of riverine wetlands in Washington is that they are frequently flooded by overbank flow from the stream or river.

According to Ecology's methodology, the assessment results "will include two basic types of information: 1) a numerical index of the potential level of performance (water quality and quantity functions) or habitat suitability (habitat functions); and 2) a subjective rating of the opportunity for a function to be performed. The numeric index represents the potential level of performance of a function on a scale of 0 to 10. The indices are a numerical representation of a qualititative assessment" (Ecology, 1999).

2. FUNCTION CATEGORIES AND METHODS

This section summarizes the functional categories and the methods that were used to make the analysis. The sentence in bold at the beginning of each function description is taken directly from the Ecology methodology (Ecology, 1999). The Ecology methodology for depressional outflow and riverine wetlands is intended to do the following:

- Assess the level at which a wetland area performs a function (level of performance), not its value;
- Be scientifically acceptable (based on the best available scientific information);
- Be practical, relatively rapid, and cost-effective;
- Be numerically based;
- Be useful for assessing individual wetlands in making wetland management decisions;
- Be sensitive to differences between regions and wetland types;
- Be easy to revise in light of new knowledge;
- Allow for assessments at different levels of data collection and detail;
- Be "transparent" in that users can backtrack through the equations to determine how results are determined;
- Be user-friendly for trained people;
- Generate reproducible results; and
- Be insensitive to small changes in input, so slight variations in input will not cause significant changes in output.

The methodology focuses on physical characteristics of the wetlands to systematically score the area to determine how a wetland performs certain functions.

2.1 Potential for Removing Sediments

Removing sediment is defined as the wetland processes that retain sediment in a wetland, keeping it from moving to downgradient surface waters in the watershed.

This is the wetland function that removes sediments from the water column, preventing their movement downstream. The presence of dense vegetation within a wetland indicates a wetland has potential to perform this function. Relatively undisturbed wetlands and surrounding upgradient areas within a watershed will carry less sediment than wetlands surrounded by development and activities that disturb sediment.

Each wetland at the project site was evaluated for the presence of moving water on the surface of the wetland, the presence and cover of vegetation, and the amount of wetland and upgradient disturbance.

2.2 Potential for Removing Nutrients and Potential for Removing Heavy Metals and Toxic Organics

Removing nutrients is defined as the wetland processes that remove nutrients (particularly phosphorus and nitrogen) present in surface waters.

Removing metals and toxic organic compounds is defined as the wetland processes that retain toxic metals and toxic organic compounds into the wetland, and keep them from going to downgradient waters in the watershed.

The removal of nutrients and toxicants is defined as the wetland process that removes nutrients (fertilizers) and toxicants (pesticides and heavy metals) from incoming water, and prevents them from going to downstream waters. There are three major processes by which wetlands remove nutrients and toxicants from water:

- Trapping sediments rich in nutrients and toxicants,
- Adsorption to soils high in clay content or organic matter, and
- Nitrification and denitrification in alternating aerobic and anaerobic conditions.

Wetlands naturally purify water by removing organic and mineral particulate matter through a variety of chemical, physical and biological processes. Nutrients and toxicants may be removed from incoming water. For example, particles settle out of slowed wetland flow and adhere to dense wetland vegetation. Dense vegetation also enhances the algal and bacterial activity necessary for organic degradation and biochemical uptake of particulates. Wetland conditions may also promote ion exchange that alters chemical pollutants, as well as precipitation of chemicals out of the water flow (Reppert et al., 1979).

A wetland's size, vegetative cover, and proximity to pollution sources affect these processes. The configuration of a wetland also influences its water quality improvement capability (Adamus et al., 1987). Wetlands with no permanent outlet have a high capacity for sediment trapping because of slowed flow and filtering of water that percolates into the ground.

The ability of a wetland to perform removal of nutrients and toxicants is closely related to other features such as sediment removal; water quality parameters; wetland hydrology; and vegetation community composition, density, richness, structure, and productivity. A wetland's functions vary with the nature of the wetland, the degree of disturbance of the wetland, and unusual events and seasonal cycles. Water quality parameters such as dissolved oxygen (DO), pH, and total suspended solids (TSS) influence the chemical form and fate of nutrients, metals, and organic compounds in wetland systems. Nutrients and other pollutants that often bind with suspended sediments are incorporated into the soils through sedimentation. Nutrients, metals and organic materials stored in the soils are either taken up by vegetation as biomass, buried in the sediments as peat is deposited, or exported out of the wetland.

2.3 Potential for Removing Peak Flows

Reducing peak flows is defined as the wetland processes or characteristics by which the peak flow in the downgradient part of the watershed is reduced during major rainfall events that cause flooding.

Wetlands provide flood/stormwater control through detention of peak flows within a wetland system and slow the discharge of the water to downstream receiving waters. The efficiency of a particular wetland system in performing runoff control is based upon the storage capacity and outlet discharge capacity of the wetland relative to the magnitude of the inflow. The value of wetlands in reducing downstream flooding increases with an increase in wetland area, the magnitude of the flood, the proximity of the wetland to the flooded area, and the lack of other storage areas.

Wetlands at the project site were evaluated for their ability to detain stormwater flows and provide storage capacity. This evaluation included digging soil pits to observe soil conditions, and determining the topography of the area and the potential for stormwater runoff to the wetlands.

2.4 Potential for Decreasing Downstream Erosion

Decreasing downstream erosion is defined as the wetland processes that decrease erosion of stream channels further downstream in the watershed by reducing the duration of erosive flows.

Decreased water velocity, vegetative structure, soil root-binding properties, and substrate type will lessen the effect of water-related erosion. This function is especially important in shallow floodplain wetlands where velocities are slow and vegetation is dense. Such vegetation is composed of species that provide for effective trapping of sediments, and impede or slow water flow, so that sediments settle out and downstream erosion does not occur. Erosion and shoreline protection is especially important in riparian corridors where the vegetation can have strong root systems to hold sediments together and prevent loss of stream banks. This function is not present in isolated wetlands that do not have water flowing through them.

The wetlands at the project site were evaluated to determine if there were significant flows of water moving through the wetland complex and if the wetlands could be a possible source of water that could create downgradient erosion.

2.5 Potential for Recharging Groundwater

Recharging groundwater is defined as the wetland processes by which surface water coming into a wetland is transported into subsurface water that moves either into unconfined aquifers or into interflow. Interflow supports flows in streams during the dry season.

Wetlands can recharge an aquifer, discharge to a downstream wetland, and/or attenuate surface water flows. Wetlands can provide groundwater recharge or discharge, or provide both at different times of the year. The majority of wetlands serve predominantly for groundwater discharge and only a few are recharge systems. Groundwater recharge replenishes aquifers and filters water. Groundwater discharges often occur elsewhere (often in other wetlands), and provide a perennial water source for wetlands and dry season stream flow, benefiting aquatic dependent species.

Soils and underlying geologic conditions were evaluated at the site to determine the potential for groundwater recharge at the project site.

2.6 General Habitat Suitability

General habitat suitability is defined as the characteristics or processes present in a wetland that indicate general habitat suitability for a broad range of wetland-associated species.

Many species of wildlife are adapted to or require wetland habitats for at least a portion of their life cycle. The variety of vegetation, substrate types, hydrologic regimes, and the sizes and characteristics of the edge between habitat types are critical factors for wildlife. The association between adjacent habitats is especially important in riparian areas that are crucial to many species of wildlife.

The wetlands at the project site were evaluated for habitat value by noting vegetation types, wildlife, and signs of wildlife at the site. In addition, data and information from the U.S. Fish and Wildlife Service (USFWS) and Washington Department of Fish and Wildlife (WDFW) were reviewed for the presence of sensitive species and priority habitats.

2.7 Habitat Suitability for Invertebrates

Habitat suitability for invertebrates is defined as the wetland characteristics that help maintain a high number of invertebrate species in the wetland.

Wetlands near aquatic habitats can be considered to have aquatic invertebrates (insects), even if none are directly observed. Examples of invertebrate habitat are muddy, shallow water areas where water velocities are slow, there is no fine sediment build-up, and thin-stemmed emergent plants such as sedges, rushes, and some aquatic herbs are present. Evaluation of the wetlands at the project site included visual observations for invertebrate habitat.

2.8 Habitat Suitability for Amphibians

Habitat suitability for amphibians is defined as the wetland characteristics that contribute to the feeding, breeding, or refuge needs of amphibian species.

Wetlands that contain elements that contribute to the feeding, breeding, and refuge needs of amphibians serve as suitable habitat for amphibians. Water depth is important, because individual species often require specific depths for survival and reproduction. In general, shallow water zones with between 1 and 2.5 feet of water are ideal. Urbanized wetlands where bullfrogs are present are less likely to have a rich amphibian fauna due the likelihood that they will out-compete native species.

The wetlands were evaluated for the presence of shallow water areas and other habitat characteristics suitable for amphibians.

2.9 Habitat Suitability for Anadromous Fish

Habitat suitability for anadromous fish is defined as the environmental characteristics that contribute to the refuge and egg-laying needs of anadromous fish species.

These needs include permanent water within channels or streams, cover, depth, surface area, and appropriate substrate, including gravel. Although this function is applicable to some depressional outflow and riverine flow-through wetlands, there is no permanent standing water within the onsite channels and therefore, habitat is not available for anadromous fish.

2.10 Habitat Suitability for Resident Fish

Habitat suitability for resident fish is defined as the environmental characteristics that contribute to the refuge needs of resident native fish species and the habitat provided by streams within the Assessment Unit (AU).

The model for depressional outflow wetlands does not require the presence of permanent open water. Seasonal flooding during winter and spring may provide enough water to support some resident fish populations.

The subject wetlands were evaluated for the presence of interspersion between vegetation and open water (not applicable), water depths (not applicable), cover, and substrate type, as well as other characteristics used to evaulate an area for resident fish habitat.

2.11 Habitat Suitability for Wetland-Associated Birds

Habitat suitability for wetland-associated birds is defined as the environmental characteristics in a wetland that provide habitats or life resources for species of wetland-associated birds.

High habitat potential is available in seasonally flooded agricultural fields, large structurally diverse wetlands, or lacustrine (lake or large pond) systems with associated wetland and buffer habitats.

During wetland delineations, observations of birds and bird habitat were noted.

2.12 Habitat Suitability for Wetland-Associated Mammals

Habitat suitability for wetland-associated mammals is defined as wetland features and characteristics that support life requirements of four aquatic or semi-aquatic mammals.

This function assesses a wetland's potential to support four wetland-associated mammal species including beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), river otter (*Lutra canadensis*), and mink (*Mustela vison*). High habitat potential occurs where a large, very structurally diverse habitat is present within the wetland or adjacent buffer boundary that is at least 100 feet wide. The presence of houses and domesticated pets decreases the likelihood of the presence of native small mammals.

During the wetland delineation, neither wetland-associated mammals, nor signs of wetland-associated mammals were observed because habitat is not suitable for the species.

2.13 Native Plant Richness

Native plant richness is defined as the degree to which a wetland provides habitat for a relatively high number of native plant species.

Plant species occur in distinct communities that are identifiable and often repeated across the landscape. Most species of both plants and wildlife have preferred habitats in specific zones associated with physical gradients such as light, moisture, hydrologic regime, and elevation. High plant species richness is often associated with areas that have multiple habitats in close proximity. Mature wetland systems are characterized by the presence of many niches accounting for high plant and animal diversity. Rare, large, or unusual habitats are valuable and are often set aside as sanctuaries.

The rarity of a wetland community "type" may be due to the lack of a particular set of environmental factors, or species distributions in a particular watershed or region. The rarity of a wetland-associated species may be due to the fact that the species is adapted to a specific set of environmental conditions, which may not be present in very many places. The opportunity for the species to have appropriate conditions for living may therefore be rare. Wetlands may also be differentially lost and rare in a region because particular wetland types have experienced more development pressure or are especially sensitive to human impacts.

The wetland delineation included an evaluation and analysis of the types of vegetation occurring on the site. In addition, the Department of Natural Resources Natural Heritage Program (DNRNHP) Database was queried to determine the potential presence of important plant species.

2.14 Potential for Primary Production and Organic Export

The function of primary production and organic export is defined as wetland processes that result in the production of plant material and its subsequent export to surface waters.

Wetlands generally are characterized by high primary productivity (food production that fuels the food chain). Primary production within wetlands can be important to wildlife and fish that spend part or all of their life cycles within wetlands. There are two major energy flow patterns in wetlands:

- The grazing food chain, which involves the consumption of living green plants; and
- The detrital food chain composed of organisms that depend on detritus and/or organic debris for their food source.

Areas with surface flow have the potential to export decomposed photosynthetic products beyond the boundary of the wetland.

Nutrient cycling in wetlands occurs in both plants and in the sediments. Nutrients can be stored in sediments by being bound to organic compounds and clays. Nutrients that are incorporated into plant tissues are unavailable to the ecosystem as long as the plant material is alive. Annual growth in deciduous plants usually dies back at the end of the growing season, and the biomass falls to the ground. The biomass either decomposes and releases the nutrients as dissolved compounds, or stays bound to organic matter in saturated conditions until conditions become conducive for decomposition. Once the nutrients are released, they become available for uptake by other plants or can be stored in the sediments.

Performance of this function is reliant upon the ability of the wetland to move organic material out of the wetland and into other contiguous aquatic systems.

3. RESULTS

3.1 Wetland A – Depressional Outflow Wetland

3.1.1 Potential for Removing Sediments

Index score: Wetland A = 4

This depressional outflow wetland contains herbaceous vegetation, which aids in the retention of water and sediments, although retention is not complete due to the outflow of water from the wetland via channels. Wetland A scored a 4, indicating that this system functions at a low to moderate level in the removal of sediments. The upgradient sub-basin (southeast of the wetland) land uses are primarily undisturbed, historic farmland and forested/emergent wetlands. Surrounding buffers are vegetated and undisturbed, with the exception of the northern buffer that is approximately 100 meters (m) from Grandview Road. The wetland area was historically used as a pasture and is currently being farmed for hybrid poplars. The source of hydrology for the system is primarily precipitation and subsequent water moving downgradient along a clay till cemented layer of soil. The topography of the site and surrounding area is flat, or nearly flat, and has low erosion potential. Thus, there is little potential for sediment influx into this wetland system. Therefore, the potential for removing sediments from this source is low to moderate.

3.1.2 Potential for Removing Nutrients

Index score: Wetland A = 2

Phosphorus and nitrogen are removed from incoming waters at a low level in this system, as the wetland scored a 2 for this function. The clay component of the soils within the wetland (loamy silts and loamy clay silts) allows for maximum adsorption of phosphorus. Vegetation within the wetland, including a hybrid poplar canopy and an herbaceous understory, indicates that the area has a moderate to high level of primary production and therefore has the potential to remove nitrogen at a moderate level. However, the area to the southeast of the site is undeveloped and not being farmed. Thus, there is probably little to no nitrogen or phosphorus in the incoming water to be removed.

3.1.3 Potential for Removing Metals and Toxic Organics

Index score: Wetland A = 4

Wetland A scored a 4 for the function of removing metals and toxic organics. The indexed rating is low to moderate resulting from the lack of open water to contribute to chemical processes that act in the removal of sediments. Plant uptake and adsorption contribute to the removal of metals and toxic organics, and the emergent vegetation and clay component of the existing soils contributes to uptake. However, due to the undisturbed nature of the property and the hydrological source, it is not likely that high levels of metals are released into the wetland.

3.1.4 Potential for Reducing Peak Flows

Index score: Wetland A = 2

The opportunity to reduce peak flows in Wetland A is low. The upgradient lands are largely undisturbed and are not currently being used for agricultural purposes. The wetland receives a large amount of precipitation and acts minimally to reduce sheet flows to adjacent lands downslope from the site by absorbing water. There is little opportunity for this wetland to store large amounts of water because it is unconstricted and lacks the capacity to hold a significant volume of water.

3.1.5 Potential for Decreasing Downstream Erosion

Index score: Wetland A = 2

Wetland A scored a 2 for the function of decreasing downstream erosion. The wetland system does not act adequately to retain stormwater by reducing erosive flows, including high-velocity and high-volume flows. This is due to the lack of storage capacity (volume) of the wetland. The most weighted factor in the analysis is the area that is seasonally ponded or inundated within the contributing basin. This factor determines the retention time and capacity of water within the wetland. The small size of Wetland A in relation to the watershed contributes to a lack of function for decreasing downstream erosion.

3.1.6 Potential for Recharging Groundwater

Index score: Wetland A = 3

Wetland A scored at 3, a low functional index, for the potential for recharging groundwater. The clay component of the site soils prevents water from infiltrating into the groundwater table rapidly. As mentioned in the wetland delineation report (Golder, 2002), the soils within the area, Birch Bay, Labounty, Tromp, and Kickerville, are silt loams with slow permeability, and silt clay loams. These soils have moderate to very slow infiltration rates and their composition prevents infiltration.

3.1.7 General Habitat Suitability

Index score: Wetland A = 2

Wetland A scored a 2 for general habitat suitability. Although this wetland would not likely be considered forested due to the fact that the hybrid poplars have been planted for harvesting, this area currently contains both planted hybrid poplars and emergent wetland vegetation and therefore, is more diverse than Wetlands B, C, D, and G. However, the wetland is not complex in physical structure and does not have high species richness. Standing water would only be a few inches deep in the winter and spring, and would not present any open water features. The habitat types within the wetland are a uniform system comprised of a hybrid poplar canopy and an understory dominated by creeping buttercup. The poplars do provide organic material to the surface of the wetland and they act to stabilize soil within the area. The action of the immature poplars is that of a farmed system, and no dead snags or large woody debris (LWD) are available for use within the system.

The low index rating indicates that although adjacent upland, undisturbed buffer habitat is available on two sides of the system, the wetland is relatively small in size and provides little habitat for wetland-dependent species.

3.1.8 Habitat Suitability for Invertebrates

Index score: Wetland A = 1

Wetland A scored a 1 for macroinvertebrate habitat. Surface inundation is a required component for the life cycle of many invertebrates and occurs during the wet season in this system. The area has relatively undisturbed buffers on three sides, but Grandview Road is within 50m of the northern edge of the system. Interspersion is low in this system, attributing to a low score for the wetland. Plant richness is low, the hybrid poplars located on the site are not yet mature. These factors contribute to the low rating for this system with respect to invertebrate habitat suitability.

3.1.9 Habitat Suitability for Amphibians

Index score: Wetland A = 2

Wetland A scored a 2 for amphibian habitat suitability. Because the wetland is not inundated to depths needed for most egg laying at any time of the year, it is unlikely that aquatic amphibians utilize this habitat for breeding purposes. The nearest stream or open waterbody is approximately one mile northwest of the site. In addition to the lack of open water, aquatic bed vegetation, including thin-stemmed vegetation used for egg deposition, is not available. LWD is important in the life cycle of some species and the lack of LWD indicates low potential for this function. Upland habitat is available within buffers and corridors and the area may serve as habitat for some upland species of amphibian that do not require open water for their life cycles.

3.1.10 Habitat Suitability for Anadromous Fish

Index score: Wetland A = 0

Wetland A scored a 0 for anadromous fish habitat because it does not perform this function. There is no open water or streams within the proposed project site.

3.1.11 Habitat Suitability for Resident Fish

Index score: Wetland A = 1

Wetland A scored a 1 for resident fish habitat. Although a manmade ditch traverses Wetland A, there are no open waters or streams within the proposed project site. The potential to perform this function is low. The index score of 1 is due to the presence of the ditches and the availability of prey items, including aquatic invertebrates.

3.1.12 Habitat Suitability for Wetland-Associated Birds

Index score: Wetland A = 4

Although the index score for Wetland A for habitat for wetland-associated birds is 4, wetland bird species were not observed to utilize this habitat. A low to moderate rating of 4 is due to the contribution of several variables within the wetland, including a relatively undeveloped buffer on three sides, the presence of hybrid poplars and indices greater than zero for amphibian and invertebrate habitat. The closed canopy and lack of open water within the system limit use by waterfowl and the low of habitat suitability for invertebrates and amphibians indicates that few prey species occur within the area. Additionally, the lack of plant species richness and the limited size of the wetland indicate that the area is not likely used by wetland-dependent species. Non-wetland birds, including American robin, raven, songbirds, and foraging red-tailed hawk, use this site.

3.1.13 Habitat Suitability for Wetland-Associated Mammals

Index score: Wetland A = 2

Wetland A scored a 2 for wetland-associated mammal habitat. The model is based on four wetland-associated mammal species, beaver, muskrat, river otter, and mink. These species are not present on the project site, as there is no open water or riverine system within the wetland or in the immediate vicinity of the project site. A rating of 2 results from the contributions of several variables present within the wetland, including an undeveloped buffer and the presence of woody and emergent vegetation.

3.1.14 Native Plant Richness

Index score: Wetland A = 1

Due to a general lack of native species, Wetland A scored a 1 for native plant richness (Table 1). Although not recently cleared, the area has historically been used as a pasture and is within a planted hybrid poplar crop. Five of the dominant species are non-native and four are native. The most dominant herbaceous species within the understory, creeping buttercup, was introduced from Europe. Blackberry dominates the fringe of the southwestern corner of the wetland and it is a non-native, invasive species that is undesirable. There are no mature trees. Historically, the area was cleared and recently a portion of the wetland was planted with hybrid poplar trees. The existing vegetative condition of the wetland suggests that this area could be improved structurally by increasing species diversity by planting with more native species.

3.1.15 Potential for Primary Production and Organic Export

Index score: Wetland A = 6

Wetland A scored a 6 for primary production and organic export. An extensive layer of herbaceous vegetation exists within the wetland and contributes to the production of organic matter. This material is then transported to contiguous aquatic systems via the manmade drainage ditch.

3.2 Wetlands B and C– Depressional Outflow Wetlands

Wetlands B (consisting of patchwork wetlands B1-B4) and C are in close proximity to each other (see Figure 2) and have similar characteristics including vegetation, soils, and hydrology. These wetlands were assessed separately (see Appendix B for functional data sheets), but their similar functional scores, wetland characteristics, and proximity allow for a combined presentation of results.

3.2.1 Potential for Removing Sediment

Index scores: Wetland B = 4, C = 4

As previously discussed, the upgradient sub-basin is comprised of approximately two square miles of undisturbed forested and emergent wetlands, abandoned agricultural fields, and a few rural residences. There is little potential for large amounts of sediment to be carried through these wetlands, especially considering that the densely vegetated buffers surrounding the wetlands act to remove sediment before it enters the wetlands at the project site. Additionally, as compared to stream flow, the sheet flow mechanism of water transport into the wetlands reduces the potential for sediments to enter the area.

3.2.2 Potential for Removing Nutrients

Index scores: Wetland B = 2, C = 2

Wetlands B and C contain high amounts of clay material that function to remove phosphorus from incoming waters. Primary productivity within the wetlands is relatively high based on the vegetative structure of the wetlands. Therefore, nitrogen is most likely being removed. Upgradient land uses include pasture and livestock grazing. The majority of the surrounding land is undeveloped. Current farming operations are most likely distant enough from the wetland systems to be of no consequence. Therefore, although the wetland would function reasonably well at removing nutrients, the amount of excess nutrients entering the wetland is likely low.

3.2.3 Potential for Removing Metals and Toxic Organic Compounds

Index scores: Wetland B = 4, C = 4

The primary method by which metals and toxic organics are removed is through the process of sedimentation. Soils within Wetlands B and C also contain high amounts of

clay material, which can adsorb heavy metals. Although the clay composition and the presence of emergent vegetation may contribute to higher performance of this function, the upgradient areas produce little sediment and do not likely contribute to high levels of metals and toxic compounds.

A low pH will induce precipitation of metals within the waters of a wetland. The pH of these wetlands was not assessed because the summer wetland conditions were much drier than the saturated conditions observed in late spring and did not allow for pH measurements. During winter and spring, these wetlands are inundated with several inches of water in portions of each system that were more topographically depressed. In the absence of inundation, wetlands cannot remove metals from surface waters. The potential to perform this function is moderate and most likely occurs seasonally with inundation.

3.2.4 Potential for Reducing Peak Flows

Index scores: Wetland B = 2, C = 2

Storage of floodwater is an important function of many wetlands, but these outflow wetlands do not have high capacity for flood storage due to their unconstricted nature. The upgradient-contributing watershed is primarily undeveloped pasture and wetted forest, which contributes to a low rating for this function.

3.2.5 Potential for Decreasing Downstream Erosion

Index scores: Wetland B = 2, C = 3

Wetlands B and C do not retain large quantities of stormwater so that water velocities are greatly reduced. This function is performed at a low to moderate degree within these wetland systems, as stormwater is released (at lower velocities with decreased volume) to manmade drainage channels. Also, because the upgradient watershed is primarily undeveloped pasture and wetted forest, these areas will tend retain stormwater within their own systems, creating less of an opportunity for Wetlands B and C to store water and prevent erosion.

3.2.6 Potential for Recharging Groundwater

Index scores: Wetland B = 3, C = 3

This function is at a low level for Wetlands B and C due to the nature of the existing subsurface characteristics on-site. The wetland soils contain a high amount of clay and have slow permeability to water. In addition, there is a consolidated glacial till approximately 12 to 24 inches below the A-horizon that inhibits downward movement of water. These conditions do not allow for easy percolation of surface water into the existing groundwater. Interflow (recharge of shallow surface water) may occur within the wetland systems, as subsurface sheetflow is carried downgradient into the watershed. Additional variables in determining groundwater recharge are the occurrence of seasonal

inundation that contributes to the infiltration of water below the surface and the occurrence of permanent open water. Permanent open water does not occur in these systems. Moderate levels of inundation (0 to 20 cm) occur within these systems seasonally.

3.2.7 General Habitat Suitability

Index scores: Wetland B = 2, C = 2

Wetlands B and C were rated at low levels for general habitat suitability. Native plant richness is low and diversity of existing vegetation does not create habitat for a variety of fauna. The wetlands and associated buffers lack structural diversity, resulting in wetland systems unsuitable to a variety of animal species. In addition, interspersion of wetland types is low and there is no standing water within the system to provide habitat for animals that require open water for a portion of their life cycle. Mature trees, snags, and LWD (important habitats for invertebrates, reptiles, and small mammals) do not occur within the area.

The low index rating indicates that these areas are not likely to be used by a wide variety of wetland-dependent species, although the areas do serve as corridors between the wetland systems and undisturbed upland and forested sites.

3.2.8 Habitat Suitability for Invertebrates

Index scores: Wetland B = 1, C = 0

Wetlands B and C scored extremely low index ratings for invertebrate habitat suitability. This rating is based on the lack of open water within the systems, a lack of interspersion between wetland types, a lack of LWD and a lack of diversity within the vegetation strata. The absence of open water, including aquatic vegetative structure, influences the availability of habitat for invertebrates since many species' life cycles are dependent upon different water regimes.

3.2.9 Habitat Suitability for Amphibians

Index scores: Wetland B = 2, C = 1

Wetland C scored 1 for amphibian habitat suitability, while Wetland B scored slightly higher with a 2. These low scores are based on the general lack of habitat for breeding, foraging, and refuge for amphibian species. Although buffers within 100 m of the wetland systems are relatively undisturbed, the wetlands do not contain quality habitat for most amphibian species. These wetland systems contain no LWD, no leaf litter, and no permanent open water. Although they are inundated (0 to 20 cm) during the wet season, this inundation does not consistently coincide with breeding seasons for many amphibian species.

3.2.10 Habitat Suitability for Anadromous Fish

Index scores: Wetland B = 0, C = 0

Although this function may be performed within some depressional outflow wetlands, the lack of permanent open water and other physical features that support anadromous fish habitat make these wetlands unsuitable for this function.

3.2.11 Habitat Suitability for Resident Fish

Index scores: Wetland B = 1, C = 0

As noted above, these wetlands contain no permanent open water. Although permanent open water is not necessary to provide habitat for some resident fish populations, seasonal inundation within the drainage channels does not support resident fish. These channels are nearly 100 percent vegetated. The closest contiguous aquatic system that supports resident species is approximately one mile from the project area (Terrell Creek).

3.2.12 Habitat Suitability for Wetland-Associated Birds

Index scores: Wetland B = 3, C = 3

No wetland-associated bird species, including waterfowl, shorebirds, or heron were observed within Wetlands B and C. The low scores for invertebrate and amphibian habitats, species that serve as prey for birds, indicate that the areas are not likely to support wetland-associated species. Additionally, a lack of snags and open water within the systems indicates that breeding and foraging are unlikely. Although the areas are open with no canopy to discourage usage, there is no open water to attract waterfowl and shorebirds. The area may be used by wetland species during flyovers, but resident populations are unlikely.

The score of 3 resulted from the aforementioned scores for amphibian and invertebrate habitat and the presence of an undeveloped buffer, including trees and shrubs that may provide screening and cover habitat for birds using the wetland system.

3.2.13 Habitat Suitability for Wetland-Associated Mammals

Index scores: Wetland B = 2, C = 2

Although the subject wetlands did not score zero for this function, the function is not generally applicable to this project site. This function was developed based on use of an area by wetland-associated mammals, including beaver, mink, river otter, and muskrat. These species were not observed and are not likely to occur within the subject areas. There is no open water component within the wetlands or within the immediate vicinity of the wetlands, and therefore, there is no habitat for these species. However, instead of rating the wetlands at 0 for this function, modeling resulted in a score of 2 for both wetlands because of the close proximity to woody browse habitat and the presence of emergent vegetation. These ratings overstate the value of the wetlands for this function because they do not take into account the fact that no wetland-associated mammals could exist on this property due to a lack of open water.

3.2.14 Native Plant Richness

Index scores: Wetland B = 0, C = 0

Due to the presence of greater than 50 percent non-native plants within these areas, the lack of associated plant assemblages, the lack of trees and bogs, and the existence of only one vegetative stratum, the wetlands rated 0 for native plant richness (Table 2).

3.2.15 Potential for Primary Production and Organic Export

Index scores: Wetland B = 6, C = 6

The moderate value of creating primary production and exporting it is rated significantly higher than other functions for Wetlands B and C. These wetlands produce a substantial amount of total biomass and then export the organic material to adjacent aquatic ecosystems. The ratings for this function are based on the percent of vegetation cover, including that of non-evergreen plants, the amount of seasonally flooded area, the presence of organic soils, and an herbaceous understory.

Herbaceous and deciduous plants decompose at faster rates than does evergreen material. These faster decomposition rates contribute to more readily available biomass export. Wetlands B and C contain primarily herbaceous material that decomposes relatively quickly and is exported more easily through outflow of surface water.

The amount of seasonally flooded area within a wetland determines the amount of exported material, because material cannot be moved without the presence of water. These wetlands are seasonally inundated and therefore, the exportation of material occurs on a seasonal basis. Additionally, a lack of organic material in the soils, as seen in the subject wetlands, has been shown to increase exportation levels.

3.3 Wetland D– Depressional Outflow Wetland

Although Wetland D has similar characteristics to B and C, its large size and position within the plant site footprint warrant a separate discussion of its functional analysis.

3.3.1 Potential for Removing Sediment

Index score: Wetland D = 5

As previously discussed, the upgradient sub-basin is comprised of approximately two square miles of undisturbed forested and emergent wetlands, abandoned agricultural fields, and a few rural residences. There is little potential for large amounts of sediment to be carried through these wetlands, especially considering that the densely vegetated buffers surrounding the wetlands act to remove sediment before it enters the wetlands at the project site. Additionally, as compared to stream flow, the sheet flow mechanism of water transport into the wetlands reduces the potential for sediments to enter the area.

3.3.2 Potential for Removing Nutrients

Index score: Wetland D = 3

Wetland D contains high amounts of clay material that functions to remove phosphorus from incoming waters. Primary productivity within the wetlands is relatively high based on the vegetative structure of the wetland. Therefore nitrogen is most likely being removed. Although upgradient land uses include pasture and livestock grazing. The majority of the surrounding land is undeveloped. Current farming operations are most likely distant enough from the wetland systems to be of no consequence. Therefore, the nutrient removal function is most likely being performed at a low level in the wetland.

3.3.3 Potential for Removing Metals and Toxic Organic Compounds

Index score: Wetland D = 5

The primary method by which metals and toxic organics are removed is through the process of sedimentation. Soils within Wetlands D also contain high amounts of clay material, which can adsorb heavy metals. Although the clay composition and the presence of emergent vegetation may contribute to higher performance of this function, the upgradient areas produce little sediment and do not likely contribute to high levels of metals and toxic compounds.

A low pH will induce precipitation of metals within the water of a wetland. The pH of these wetlands was not assessed because the summer wetland conditions were much drier than the saturated conditions observed in late spring and did not allow for pH measurements. During winter and spring, these wetlands are inundated with several inches of water in portions of each system. In the absence of inundation, wetlands cannot remove metals from surface waters. The potential to perform this function is moderate.

3.3.4 Potential for Reducing Peak Flows

Index scores: Wetland D = 4

Storage of floodwater is an important function of many wetlands, although these outflow wetlands do not have high amounts of flood storage based on its flat topography and its unconstricted nature. The upgradient-contributing sub-basin is primarily undeveloped pasture and wetted forest, which tend to contribute to a low rating for this function. However, Wetland D is more effective for flood control than Wetlands A, B and C because of its size and its upgradient location.

3.3.5 Potential for Decreasing Downstream Erosion

Index score: Wetland D = 5

Wetland D retains a moderate amount of stormwater so that water velocities are moderately reduced, especially during the winter and fall. This function is performed to a moderate degree within this wetland system as stormwater is released (at lower velocities with decreased volume) to the main east-west manmade drainage channel, and then water is moved north via the main north-south channel located adjacent to the Refinery fenceline. The upgradient sub-basin is primarily undeveloped pasture and wetted forest and those undeveloped areas will tend to retain stormwater within their

own systems, creating less of an opportunity for Wetland D to store runoff water and prevent erosion.

3.3.6 Potential for Recharging Groundwater

Index score: Wetland D = 5

This function is performed at a moderate level in Wetland D due to the nature of the existing subsurface characteristics onsite. As discussed in the analysis of Wetlands B and C, the wetland soils contain a high level of clay and have slow permeability to water. These conditions do not allow for easy percolation of surface water into the existing groundwater. Permanent open water does not occur in Wetland D, although extensive inundation does occur during the late fall, winter and early spring.

3.3.7 General Habitat Suitability

Index score: Wetland D = 2

Wetland D was indexed at a low level for general habitat suitability. Native plant richness is low and diversity of existing vegetation does not create habitat for a variety of fauna. With the exception of the eastern forested area, associated buffers lack structural diversity, resulting in wetland systems unsuitable to a variety of animal species. In addition, interspersion of wetland types is low and there is no permanent standing water within the system to provide habitat for animals that require open water for a portion of their life cycle. Mature trees, snags, and LWD (important habitats for invertebrates, reptiles and small mammals) do not occur within Wetland D.

The low index rating indicates that these areas are not likely to be used by a wide variety of wetland-dependent species, although the areas do serve as corridors between the wetland systems and undisturbed upland and forested sites.

3.3.8 Habitat Suitability for Invertebrates

Index score: Wetland D = 0

Wetland D did not rate on the index for invertebrate habitat suitability. This rating is based on the lack of permanent open water within the system, a lack of interspersion between wetland types, a lack of LWD, and a lack of diversity within the vegetation strata.

3.3.9 Habitat Suitability for Amphibians

Index score: Wetland D = 1

Wetland D scored a 1 for amphibian habitat suitability. This extremely low rating is attributed to the general lack of habitat for breeding, foraging, and refuge for amphibian species. The Refinery buffers this wetland system to the west and is separated from the wetland by a north-south running ditch that has seasonally flowing (low velocity) water. This ditch could be used by some amphibian species that are dependent on water for part of their life cycle, but it does not provide permanent water and water most likely

stagnates. Although the wetland is inundated (0 to 20 cm) during the wet season, this wetland contains few habitat characteristics typical of valuable amphibian habitat including LWD.

3.3.10 Habitat Suitability for Anadromous Fish

Index score: Wetland D = 0

Although this function may be performed within some depressional outflow wetlands, the lack of permanent open water and other physical features that support anadromous fish habitat make this wetland unsuitable for this function.

3.3.11 Habitat Suitability for Resident Fish

Index score: Wetland D = 0

As noted above, this wetland contains no permanent open water. Although permanent open water is not necessary to provide habitat for some resident fish populations, seasonal inundation within the drainage channels does not support resident fish. These channels are close to 100 percent vegetated. The closest contiguous aquatic system that supports resident species is approximately one mile from the project area (Terrell Creek).

3.3.12 Habitat Suitability for Wetland-Associated Birds

Index score: Wetland D = 3

Although some variables that contribute to this rating are present, including mostly undeveloped buffers (with the exception of the Refinery to the west) and the presence of trees and shrubs within these buffers, Wetland D scored relatively low for this function. No wetland-associated bird species, including waterfowl, shorebirds, or heron, were observed within the wetland during numerous field visits. A lack of snags and permanent open water within the wetland suggests that breeding and foraging are unlikely. Although the areas are open with no canopy to discourage usage, there is no open water to attract waterfowl and shorebirds. The area may be used by wetland species during flyovers, but resident populations are unlikely.

3.3.13 Habitat Suitability for Wetland-Associated Mammals

Index score: Wetland D = 2

Although Wetland D scored above zero for this function, the function is not generally applicable to this project site as discussed in the analysis of Wetlands B and C. The model for this function includes variables such as approximate proximity to woody browse habitat and emergent vegetation, which are present in Wetland D. This rating

overstates the value of this wetland for this function because no wetland-associated mammals could exist on this property due to a lack of open water.

3.3.14 Native Plant Richness

Index score: Wetland D = 0

Due to the presence of greater than 50 percent non-native plants within the area, the lack of associated plant assemblages, the lack of trees and bogs, and the existence of only one vegetative stratum, Wetland D rated 0 for native plant richness (Table 3).

3.3.15 Potential for Primary Production and Organic Export

Index score: Wetland D = 7

Wetland D rated moderately for the creation of primary production and its export. This wetland produces a large amount of total biomass and then exports the organic material to adjacent aquatic ecosystems via the main east-west and north-south ditches. The rating for this function is based on the percent vegetation cover, including that of non-evergreen plants, the amount of seasonally flooded area, the presence of organic soils, and an herbaceous understory.

Wetland D is seasonally inundated and therefore the exportation of material is likely highest during the wet season, when lateral flow to the ditches is at its highest.

3.4 Wetland F – AU-1 - Depressional Outflow Wetland

Wetland F (Assessment Unit 1 [AU-1]) occurs within laydown area 2 and is approximately 12.81 acres in size. It is bordered to the north by an upland fringe of relatively sparse planted immature Douglas fir and then a gravel road. It is bordered to the west by a forested area, to the east by a paved road, and to the south by a gravel-walking trail. Wetland F contains a 0.6 acre shrub-scrub area that was assessed separately as Wetland F, AU-2.

3.4.1 Potential for Removing Sediments

Index score: Wetland F = 5

Wetland F is downgradient from Grandview road. This wetland is relatively large in comparison with other wetlands delineated for this project. There is a potential for Wetland F to remove sediments from impervious surfaces in the vicinity of the wetland.

3.4.2 Potential for Removing Nutrients

Index score: Wetland F = 3

Phosphorus and nitrogen are removed from incoming waters at a moderate level in this system; the wetland was indexed at 3 for this function. The clay component of the soils within the wetland (loamy silts and loamy clay silts) allows for maximum adsorption of phosphorus.

3.4.3 Potential for Removing Metals and Toxic Organics

Index score: Wetland F = 5

Wetland F was indexed at 5 for the function of removing metals and toxic organics. The indexed rating is moderate as a result of no open water to contribute to chemical processes that act in the removal of sediments. Plant uptake and adsorption contribute to the removal of metals and toxic organics and the emergent vegetation and clay component of the existing soils contributes to uptake.

3.4.4 Potential for Reducing Peak Flows

Index score: Wetland F = 4

Wetland F has a much smaller drainage basin than the rest of the wetlands. Wetland I consists of a ditch, which intercepts all the water from the south. Blaine Road prevents water from the east from reaching Wetland F. However, there is potential for some water to enter the wetland during major storm events. Essentially, the drainage basin is the size of the unit (5.18 ha). However, there is potential for some water to enter the unit. Because of this potential best professional judgment was used to double the size of the basin for the purpose of the model. This wetland was indexed at 4 for reducing peak flows. This wetland has a moderate level of flood storage according to the model.

3.4.5 Potential for Decreasing Downstream Erosion

Index score: Wetland F = 5

Wetland F has a moderate value for decreasing downstream erosion. The wetland stores water, and decreases runoff, which decreases flows from the wetland. The decreased flow reduces down slope erosion potential.

3.4.6 Potential for Recharging Groundwater

Index score: Wetland F = 5

Wetland F, AU-1, scored a 5, a moderate functional rating, for the potential for recharging groundwater. As noted above, the clay component of the site soils prevents

water from infiltrating into the groundwater table. Therefore, it is unlikely that Wetland F contributes significantly to groundwater recharge.

3.4.7 General Habitat Suitability

Index score: Wetland F = 2

Wetland F, AU-1, scored a 2 for general habitat suitability. This area contains shrub-scrub wetlands, although the willow component is limited to a few individuals per wetland pocket and does not provide habitat for a large number of wildlife. Habitat types are not highly interspersed within the system and surrounding upland habitat.

3.4.8 Habitat Suitability for Invertebrates

Index score: Wetland F = 2

Wetland F, AU-1, scored a 2 on the index for macroinvertebrate habitat. Surface inundation, a required component of the life cycle of many invertebrates, is seasonal onsite and does not often coincide with most invertebrate species' mating season, and associated egg deposition. The area has relatively undisturbed buffers on one side, but Grandview Road is within 25 m of the northern edge of the system and paved parking lots occur in the southeast corner of the system. Interspersion is low with respect to other wetland systems, indicating a low score for the wetland. Plant richness is low, and no mature trees are located within the shrub-scrub areas. These factors contribute to the low rating for this system with respect to invertebrate habitat suitability.

3.4.9 Habitat Suitability for Amphibians

Index score: Wetland F = 2

Wetland F, AU-1, scored a 2 on the index for amphibian habitat suitability. Although the wetland is inundated (0 to 20 cm) during the wet season, it is unlikely that aquatic amphibians utilize this habitat for breeding purposes because there is no connection with a streams or open water. The nearest water-holding ditch is the man-made channel associated with Wetland I, which acts as the southern boundary to Wetland F. In addition to the lack of open water, aquatic bed vegetation is not available. LWD is important in the life cycle of some species and the lack of LWD indicates low potential for this function. Upland habitat is available within buffers and corridors and the area may serve as habitat for some upland species of amphibian that do not require open water for their life cycle.

3.4.10 Habitat Suitability for Anadromous Fish

Index score: Wetland F = 1

There is no open water or streams within the proposed project site. This function is not applicable to Wetland F.

3.4.11 Habitat Suitability for Resident Fish

Index score: Wetland F = 1

There is no open water or streams within the proposed project site. A score of 1 reflects the presence of a ditch within the wetland, but it overstates the wetland's value for this function.

3.4.12 Habitat Suitability for Wetland-Associated Birds

Index score: Wetland F = 3

Although Wetland F's score for wetland-associated bird habitat suitability is 3, it is unlikely that wetland bird species utilize this habitat. A rating of 3 results from the presence of several variables within the wetland, including an undeveloped buffer on two sides, the presence of shrubs greater than 1 m in height, and indices greater than zero for amphibian and invertebrate habitat. The lack of open water within the system limits use by waterfowl and the lack of habitat suitability for invertebrates and amphibians indicate that few prey species occur within the area. Additionally, the lack of plant species richness and strata indicates that the area is not likely to be used by wetland-dependent species. Non-wetland birds, including songbirds, utilize the site.

3.4.13 Habitat Suitability for Wetland-Associated Mammals

Index score: Wetland F = 1

Wetland F scored a 1 on the index for wetland-associated mammal habitat. The model was based on four wetland-associated mammal species, beaver, muskrat, river otter, and mink. These species are not present on the project site because there is no open water or riverine system within the wetland or in the immediate vicinity of the project site.

3.4.14 Native Plant Richness

Index score: Wetland F = 1

Due to a general lack of native species, Wetland F scored a 1 on the index for native plant richness (Table 4). Although not recently cleared, the area has historically been used as a pasture and is widely interspersed with immature planted hybrid poplars and Douglas fir. Mature trees within the area are limited to a few poplars that were probably not planted. The area has been maintained through mowing for fire prevention. The existing vegetative condition of the wetland suggests that this area could be greatly improved structurally by increasing species diversity.

3.4.15 Potential for Primary Production and Organic Export

Index score: Wetland F = 8

The creation of primary production and its export is the highest rated function by a significant level for Wetland F, AU-1. This wetland produces a large amount of total biomass and then exports the organic material to adjacent aquatic ecosystems. The

ratings for this function are based on the percent vegetation cover, including that of non-evergreen plants, the amount of seasonally flooded area, the presence of organic soils, and an herbaceous understory.

3.5 Wetland F – AU- 2 - Depressional Outflow Wetland

Wetland F, AU-2, occurs within laydown Area 2 and is approximately 0.6 acres in size within Wetland F. It is bordered to the east by a paved parking lot and on all other sides by Wetland F (AU-1).

3.5.1 Potential for Removing Sediments

Index score: Wetland F (AU-2) = 5

There are impervious surfaces (roads, parking lots, etc.) in the vicinity of Wetland F, AU -, and it may function to remove sediments from stormwater that originates from these areas.

3.5.2 Potential for Removing Nutrients

Index score: Wetland F (AU-2) = 2

Phosphorus and nitrogen are removed from incoming waters at a low level in this system; the wetland was indexed at 2 for this function. The clay component of the soils within the wetland (loamy silts and loamy clay silts) allows for maximum adsorption of phosphorus.

3.5.3 Potential for Removing Metals and Toxic Organics

Index score: Wetland F (AU-2) = 4

Wetland F, AU-2, scored a 4 for the function of removing metals and toxic organics. The rating is moderate resulting from no open water to contribute to chemical processes that act in the removal of sediments. Plant uptake and adsorption contribute to the removal of metals and toxic organics and the emergent vegetation and clay component of the existing soils contributes to uptake.

3.5.4 Potential for Reducing Peak Flows

Index score: Wetland F (AU-2) = 2

The opportunity to reduce peak flows in Wetland F, AU-2, scored a 2 in the functional analysis as a result of the flat topography and the unconstricted nature of the wetland.

3.5.5 Potential for Decreasing Downstream Erosion

Index score: Wetland F (AU-2) = 4

Wetland F, AU-2, scored a 4 for the function of decreasing downstream erosion due to the unconstricted nature of the wetland.

3.5.6 Potential for Recharging Groundwater

Index score: Wetland F (AU-2) = 2

Wetland F, AU-2, scored a 2, a low functional index, for the potential for recharging groundwater. As noted above, the clay component of the site soils significantly reduces the potential for surface water to infiltrate into the groundwater table. Therefore, it is unlikely that Wetland F, AU-2 contributes significantly to groundwater recharge.

3.5.7 General Habitat Suitability

Index score: Wetland F (AU-2) = 2

Wetland F, AU-2, scored a 2 for general habitat suitability. This area contains shrub-scrub wetlands (immature hybrid poplars) that are rated slightly higher than emergent wetlands for habitat suitability. However, habitat types are not highly interspersed within the system and surrounding wetland habitat.

3.5.8 Habitat Suitability for Invertebrates

Index score: Wetland F (AU-2) = 1

Wetland F, AU-2, scored a 1 on the index for macroinvertebrate habitat. Surface inundation, a required component of the life cycle of many invertebrates, is seasonal and does not often coincide with most invertebrate species' mating season, and associated egg deposition. The area has relatively undisturbed buffers on one side, but Grandview Road is within 50 m of the northern edge of the system and paved parking lots occur in the southeast corner of the system. Interspersion is low with respect to other wetland systems, indicating a low score for the wetland. Plant richness is low, and few mature trees are located within the shrub-scrub areas. These factors contribute to the low rating for this system with respect to invertebrate habitat suitability.

3.5.9 Habitat Suitability for Amphibians

Index score: Wetland F (AU-2) = 2

Wetland F, AU-2, scored a 1 on the index for amphibian habitat suitability. Although the wetland is inundated (0 to 20 cm) during the wet season, it is unlikely that aquatic amphibians utilize this habitat for breeding purposes because there is no connection with a stream or open water. The nearest stream is the ditched channel associated with Wetland I, which acts as the southern boundary to Wetland F. In addition to the lack of open water, aquatic bed vegetation, including thin-stemmed vegetation used for egg deposition, is not available. LWD is important in the life cycle of some species and the lack of LWD indicates low potential for this function. Upland habitat is available within buffers and corridors and the area may serve as habitat for some upland species of amphibian that do not require open water for their life cycle.

3.5.10 Habitat Suitability for Anadromous Fish

Index score: Wetland F (AU-2) = 0

There is no open water or streams within this wetland area, therefore it is does not perform this function.

3.5.11 Habitat Suitability for Resident Fish

Index score: Wetland F (AU-2) = 1

There is no open water or streams within the proposed project site, therefore this wetland it does not perform this function.

3.5.12 Habitat Suitability for Wetland-Associated Birds

Index score: Wetland F (AU-2) = 2

Wetland F, AU-2's score of 2 for wetland-associated bird habitat suitability overstates the wetland's value for this function because it is unlikely that wetland bird species utilize this habitat. The score is a result of the presence of several variables within the wetland, including an undeveloped buffer on two sides, the presence of shrubs greater than 1 m in height, and indices greater than zero for amphibian and invertebrate habitat. The lack of open water within the system limits use by waterfowl and the lack of habitat suitability for invertebrates and amphibians indicate that few prey species occur within the area. Additionally, the lack of plant species richness and the limited size of the AU indicate that the area is not likely to be used by wetland-dependent species. Non-wetland birds including songbirds use the site.

3.5.13 Habitat Suitability for Wetland-Associated Mammals

Index score: Wetland F (AU-2) = 1

Wetland F, AU-2, scored a 1 on the index for wetland-associated mammal habitat. As previously stated, the model was based on four wetland-associated mammal species, beaver, muskrat, river otter, and mink. These species are not present on the project site, because there is no open water or riverine system within the wetland or in the immediate vicinity of the project site.

3.5.14 Native Plant Richness

Index score: Wetland F (AU-2) = 0

Due to a general lack of native species, Wetland F, AU-2, scored a 0 on the index for native plant richness (Table 5). Although not recently cleared, the area has historically been used as pasture and features immature planted hybrid poplars and Douglas fir widely interspersed throughout the area. Mature trees within the area are limited to a few poplars that were probably not planted. The area has been maintained through mowing for fire prevention. The existing vegetative condition of the wetland suggests that this area could be improved structurally by increasing species diversity.

3.5.15 Potential for Primary Production and Organic Export

Index score: Wetland F (AU-2) = 8

The creation of primary production and its export is the highest rated function by a significant level for all subject wetlands. As previously discussed, these wetlands produce a large amount of total biomass and then export the organic material to adjacent aquatic ecosystems. The ratings for this function are based on the percent vegetation cover, including that of non-evergreen plants, the amount of seasonally flooded area, the presence of organic soils, and an herbaceous understory.

3.6 Wetlands G, H and J– Depressional Outflow Wetlands

Although Wetlands G, H, and J are separated by roads (see Figure 2), they have similar characteristics including vegetation, soils, and hydrology and were likely one wetland system before the roads were constructed. All wetlands are bounded by ditches that connect them hydrologically to each other and to Wetland F. These wetlands were assessed separately (see Appendix B for functional data sheets) but their similar functional scores and wetland characteristics allow for a combined presentation of the results. It should be noted that not all of Wetland H was delineated, only the proposed impact area was surveyed due to the presence of approximately 10 inches of snow at the time of the site visit (January 30, 2002).

3.6.1 Potential for Removing Sediment

Index scores: Wetland G = 4, H = 4, J = 5

Wetlands G, H, and J are located downgradient of the Refinery and other associated facilities. During large storm events stormwater may exceed the capacity of drainage ditches and are likely to capture moderate amounts of sediments.

3.6.2 Potential for Removing Nutrients

Index scores: Wetland G = 2, H = 3, J = 3

Wetlands G, H and J contain relatively high amounts of clay material that function to remove phosphorus from incoming waters. Primary productivity within the wetlands is high based on the vegetative structure of the wetlands. Upgradient land uses include industrial activities and these wetland systems function at low to moderate levels for this function.

3.6.3 Potential for Removing Metals and Toxic Organic Compounds

Index scores: Wetland G = 5, H = 5, J = 5.

Soils within Wetlands G, H, and J contain relatively high amounts of clay material, which can adsorb heavy metals. The clay composition and the presence of emergent vegetation may also contribute to this area's ability to perform this function.

During winter and spring, these wetlands are inundated with several inches of water in portions of each system and act to remove materials from surface waters. The potential to perform this function is moderate.

3.6.4 Potential for Reducing Peak Flows

Index scores: Wetland G = 2, H = 3, J = 3.

Wetlands G, H, and J have low to moderate levels for this function because of their potential to store water.

3.6.5 Potential for Decreasing Downstream Erosion

Index scores: Wetland G = 3, H = 3, J = 3

Wetlands G, H, and J have low to moderate potential to store water, which reduces downstream erosion potential.

The extent of woody vegetation cover present within a wetland system will serve to hinder the movement of water because the stiff vegetation provides a structural barrier to flow. There is no woody vegetation present in the wetlands. The wetlands are relatively unconstricted as well, and unconstricted wetlands score low for decreasing erosion due to their broad, flat nature. Additionally, the relatively small size of the wetlands hampers their capability to handle large amounts of stormwater from the

upgradient Refinery. Finally, the refinery's runoff is diverted to drainage ditches, and does not enter the wetlands to any significant amount.

3.6.6 Potential for Recharging Groundwater

Index scores: Wetland G =4, H = 5, J = 5.

As described in the analysis of Wetlands B and C, this function is performed at a low to moderate level for all wetlands in the project area due to the nature of the existing subsurface characteristics onsite. The wetland soils contain a high level of clay and have slow permeability for water. Additional variables used to determine groundwater recharge are the occurrence of seasonal inundation that contributes to the infiltration of water below the surface and the occurrence of permanent open water. Permanent open water does not occur in these systems. Moderate inundation (0 to 20 cm) occurs during the wet season.

3.6.7 General Habitat Suitability

Index scores: G = 1, H = 1, J = 2.

Wetlands G, H and J scored low for general habitat suitability. Native plant richness is low and diversity of existing vegetation does not create habitat for a variety of fauna. The wetlands are isolated in a sense that they are surrounded on all sides by ditches and then paved surfaces associated with the Refinery, resulting in wetland systems unsuitable to a variety of animal species.

Interspersion of wetland types does not occur and there is no permanent standing water within the systems to provide habitat for animals that require open water for a portion of their life cycle. Mature trees, snags, and LWD (important habitats for invertebrates, reptiles and small mammals) do not occur within the wetland systems.

3.6.8 Habitat Suitability for Invertebrates

Index scores: Wetland G = 1, H = 1, J = 1.

Wetlands G, H and J scored extremely low index ratings for invertebrate habitat suitability. This rating is based on the lack of open water within the systems, a lack of interspersion between wetland types, a lack of LWD, and a lack of diversity within the vegetation strata. The absence of permanent open water, including aquatic vegetative structure, influences the availability of habitat for invertebrates since many species' life cycles are dependent upon different water regimes. Perimeter ditches along the east and west boundaries of Wetlands G and H may serve as habitat for invertebrates, but the hydrology is seasonal and not consistent with most invertebrate reproduction.

3.6.9 Habitat Suitability for Amphibians

Index scores: Wetland G = 1, H = 1, J = 1.

Wetlands G, H and J scored 1 for amphibian habitat suitability. These very low ratings are based on the general lack of habitat for breeding, foraging, and refuge for amphibian species, including relatively disturbed buffers. These wetland systems contain no LWD, no leaf litter, and no permanent open water, although they are inundated (0 to 20 cm) during the wet season. Perimeter ditches along the east and west boundaries of Wetlands G and H may serve as habitat for amphibians, but the hydrology is seasonal and not consistent with most amphibian reproduction.

3.6.10 Habitat Suitability for Anadromous Fish

Index scores: Wetland G = 0, H = 0, J = 0.

Although this function may be performed within some depressional outflow wetlands, the lack of permanent open water and other physical features that support anadromous fish habitat make these wetlands unsuitable for this function.

3.6.11 Habitat Suitability for Resident Fish

Index scores: Wetland G = 1, H = 1, J = 0.

As noted above, these wetlands contain no permanent open water. Although permanent open water is not necessary to provide habitat for some resident fish populations, seasonal inundation within the drainage channels does not support resident fish. These channels are nearly 100 percent vegetated. The closest contiguous aquatic system that supports resident species is approximately one mile from the project area (Terrell Creek).

3.6.12 Habitat Suitability for Wetland-Associated Birds

Index scores: Wetland G = 2, H = 2, J = 3.

Wetlands G, H, and J scored relatively low for this function. No wetland-associated bird species, including waterfowl, shorebirds, or heron, were observed within the wetland systems. Additionally, a lack of snags and open water within the systems indicates that breeding and foraging are unlikely. Although the areas are open with no canopy to discourage usage, there is no open water to attract waterfowl and shorebirds. The area may be used by wetland species during flyovers, but resident populations are unlikely.

The scores of 2, 2, and 3 most likely resulted from presence (albeit low) of amphibian and invertebrate habitat, including trees and shrubs that may provide screening and cover habitat for birds using the wetland system.

3.6.13 Habitat Suitability for Wetland-Associated Mammals

Index scores: Wetland G = 1, H = 1, J = 2.

Although the subject wetlands scored low for this function, the function is not generally applicable to this project site as previously discussed.

3.6.14 Native Plant Richness

Index scores: Wetland G = 0, H = 0, J = 0.

Due to the presence of greater than 50 percent non-native plants within the wetland, the lack of associated plant assemblages, the lack of trees and bogs, and the existence of only one vegetative stratum, the wetland systems rated 0 for native plant richness (Table 6). Because Wetland H was surveyed when approximately 10 inches of snow were on the ground, vegetation types within Wetland H were assumed based on previous field visits and the relative homogeneity of facultative wetland plants within the general area.

3.6.15 Potential for Primary Production and Organic Export

Index scores: Wetland G = 7, H = 7, J = 7.

The creation of primary production and its export is the highest rated function by a significant level for all subject wetlands. As previously discussed, these wetlands produce a large amount of total biomass and then export the organic material to adjacent aquatic ecosystems. The ratings for this function are based on the percent vegetation cover, including that of non-evergreen plants, the amount of seasonally flooded area, the presence of organic soils, and an herbaceous understory.

3.7 Wetland I – Riverine Flow-Through Wetland

Wetland I is a riverine flow-through wetland. Although Wetland I does not fall into the same category as all other wetlands on the proposed project site, the same functions were assessed. While this wetland was delineated, it will not be disturbed by project activities.

3.7.1 Potential for Removing Sediments

Index score: Wetland I = 5

Potential to perform this function is evaluated based on a riverine flow-through wetland's ability to reduce water velocities utilizing vegetation as blockage. Wetland I scored a 5 on the functional index, indicating that this system functions moderately in the removal of sediments. The channel does not meander and therefore water retention is not at its optimum. Emergent vegetation occurs within the channel in portions and contributes to the reduction of precipitation and runoff velocity. Forest vegetation occurs along the banks of the channel and does not aid in velocity reduction in the same capacity as the emergent vegetation. The wetland is narrow on either side of the channel and does not provide much storage for floodwaters during overflow periods. Additionally, the primary land use in the immediate vicinity of the channel is developed industrial lands, and incoming sediment loads are greater in this wetland system than most others that were delineated for the proposed project.

3.7.2 Potential for Removing Nutrients

Index score: Wetland I = 5

Phosphorus and nitrogen are removed from incoming waters at a moderate level in this system; the wetland scored a 5 for this function. The clay component of the soils within the wetland (loamy silts and loamy clay silts) allows for maximum adsorption of phosphorus. The area upgradient of the wetland is Wetland J and the developed portion of the Refinery. These developed areas will produce sediments with a higher nutrient load than the undeveloped areas upgradient of wetlands within the proposed plant site location.

3.7.3 Potential for Removing Metals and Toxic Organics

Index score: Wetland I = 5

Wetland I scored a 5 for the function of removing metals and toxic organics. The indexed rating is moderate as a result of the moderate rating for sediment removal. Also contributing to the moderate rating is the total amount of emergent vegetation within the wetland system. The system is dominated by forested vegetation with an herbaceous understory with less than 100 percent coverage.

3.7.4 Potential for Reducing Peak Flows

Index score: Wetland I = 5

Wetland I is essentially a drainage ditch, which was constructed to carry water away from the existing refinery. The model gave this wetland a moderate value. This value is artificially high. If the ditch had not been constructed the reduction of peak flows would have been significantly higher. There is an apparent flaw in the model. The model assumes the wetland has the opportunity to reduce peak flows in Wetland I moderately and was rated at 5 in the functional analysis. Because the upgradient land is the contractor parking lot, roads and surrounding wetlands F, G, and J, the wetland receives a moderate amount of storm water runoff from these areas. The model assumes it stores this water during times of flooding; water flow from the channel moves from east to west as shown in Figure 2. In actuality, the wetland expedites the removal of water from this area during peak flows.

3.7.5 Potential for Decreasing Downstream Erosion

Index score: Wetland I = 8

Wetland I scored an 8 for the function of decreasing downstream erosion. The model assumes the system acts to retain stormwater by reducing erosive flow including high-velocity and high-volume flows. Qualitatively, the wetland functions at a high level based on the close proximity to contractor parking lot and road impervious surfaces that contribute to runoff. However, since this wetland was designed to carry water faster to the natural drainage, which it connects to, in reality it has a low value for reducing downstream erosion.

3.7.6 Potential for Recharging Groundwater

Index score: Wetland I = 1

Wetland I scored a 1, a low to moderate functional index rating, for the potential for recharging groundwater. The clay component of the site soils prevents water from infiltrating into the groundwater table. These soils have moderate to very slow infiltration rates and their composition prevents infiltration. Additionally, the channel is relatively narrow, and narrow units usually have less recharge than wider units.

3.7.7 General Habitat Suitability

Index score: Wetland I = 3

Wetland I scored a 3 for general habitat suitability. This area contains both forested and emergent wetland vegetation but the system is relatively narrow and provides fragmented habitat for wetland species. Although more diverse than neighboring wetlands within the parcel, the area is not complex in physical structure and does not have high plant richness. Standing water would likely be greater than 20 cm in the channel during periods of high precipitation. Habitat types are not highly interspersed within the system, as it is a uniform system comprised of a hybrid poplar canopy and an herbaceous understory. The poplars do provide organic material to the surface of the wetland and they act to stabilize soil within the area. The immature poplars are a farmed system, so no dead snags or LWD are available for use within the system.

The low score indicates that although adjacent upland undisturbed buffer habitat is available immediately north of the wetland system, the wetland is relatively small in size and narrow and provides little habitat for wetland-dependent species.

3.7.8 Habitat Suitability for Invertebrates

Index score: Wetland I = 1

Wetland I scored a 1 on the index for macroinvertebrate habitat. Surface inundation occurs within the channel, allowing for appropriate habitat for invertebrates, but

interspersion is low with respect to other wetland systems. Plant richness is low and no mature trees are located on the site. These factors contribute to the low rating for this system with respect to invertebrate habitat suitability.

3.7.9 Habitat Suitability for Amphibians

Index score: Wetland I = 1

Wetland I scored a 1 on the index for amphibian habitat suitability. Although the channel is inundated during the wet season, emergent vegetation within the channel is limited. Large woody debris is important in the life cycle of some species and the lack of LWD indicates low potential for this function. Upland habitat is available within buffers and corridors and the area may serve as habitat for some upland species of amphibian that do not require open water for their life cycle.

3.7.10 Habitat Suitability for Anadromous Fish

Index score: Wetland I = 2

Although there is inundation during the wet season, there is no permanent open water within the wetland system. The score of 2 for this function indicates that other variables, including adjacent canopy cover, are present. Flows are likely intermittent as evidenced by a lack of standing water within the channel at the time of the delineation in August 2001. Additionally, the channel bed was entirely muddy clay material, devoid of gravels and cobbles. Thus, the potential to perform this function is low.

3.7.11 Habitat Suitability for Resident Fish

Index score: Wetland I = 2

The potential to perform this function is not applicable to riverine flow-through wetlands.

3.7.12 Habitat Suitability for Wetland-Associated Birds

Index score: Wetland I = 2

Although Wetland I's score for wetland-associated bird habitat suitability is 2, it is unlikely that wetland bird species utilize this habitat. The rating most likely results from the presence of several features within the wetland, including the presence of hybrid poplars and indices greater than zero for amphibian and invertebrate habitat. The closed canopy and lack of permanent open water within the system limit use by waterfowl and the low habitat suitability for invertebrates and amphibians indicates that few prey species occur within the area. Non-wetland birds utilize the site including sparrows, American robin, and songbirds.

3.7.13 Habitat Suitability for Wetland-Associated Mammals

Index score: Wetland I = 2

Wetland I scored a 2 on the index for wetland-associated mammal habitat. As noted above, the model was based on four wetland-associated mammal species, beaver, muskrat, river otter, and mink. These species are not present on the project site as there is no permanent riverine system within the wetland or in the immediate vicinity of the project site. A rating of 2 most likely results from the presence of several variables within the wetland that contribute to the index rating, including the presence of woody and emergent vegetation.

3.7.14 Native Plant Richness

Index score: Wetland I = 3

Wetland I scored a 3 on the index for native plant richness (Table 7). The area has been severely disturbed as evidenced by the manmade channel and habitat fragmentation by development and the installation of a walking trail. Approximately six of the dominant species are native. Although the existing vegetative condition of the wetland is relatively successful, the small size and narrow configuration of the wetland in addition to the proximity to developed areas suggests that this area could perform more optimally with respect to native plants.

3.7.15 Potential for Primary Production and Organic Export

Index score: Wetland I = 9

Unlike all of the other wetlands that were delineated for this proposed project, Wetland I is not a depressional outflow wetland, but is a riverine flow-through wetland. Wetland I scored a 9 on the index for this function. This high rating is likely due to a high percentage of vegetative cover, including emergent vegetation and deciduous trees that more readily decompose and contribute to exportation of biomass.

4. REFERENCES

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TABLES

TABLE 1

Native and Non-Native Vegetation within Wetland A

Vegetation Stratum	Common Name	Scientific Name	Native (Y/N)	Origin
Tree	Hybrid Black Poplar	*Populus* spp.	Potentially	Unknown
Shrub	Himalayan blackberry	*Rubus discolor*	N	Europe
Herb	Red top	*Agrostis alba*	Y	Native
	Canada thistle	*Cirsium arvense*	Y	Native
	Velvetgrass	*Holcus lanatus*	N	Europe
	Birds-foot trefoil	*Lotus corniculatus*	N	Europe
	Creeping buttercup	*Ranunculus repens*	N	Europe
	Kentucky bluegrass	*Poa pratensis*	Y	Native
	Reed canary grass	*Phalaris arundinacea*	Debatable	Europe/Native
	Soft rush	*Juncus effusus*	Y	Native

TABLE 2

Native and Non-native Plant Species within Wetlands B and C[1]

Vegetation Stratum	Common Name	Scientific Name	Native (Y/N)	Origin
Tree	None			
Shrub	None			
Herb	Tall fescue	*Festuca pratensis*	N	Europe
	Rough bluegrass	*Poa trivialis*	N	Europe
	Bull thistle	*Cirsium vulgare*	N	Europe
	Lady's thumb	*Polygonum persicaria*	N	Likely Europe
	Velvetgrass	*Holcus lanatus*	N	Europe
	Baltic rush	*Juncus balticus*	Y	Native
	Meadow foxtail	*Alopecurus pratensis*	N	Europe
	Kentucky bluegrass	*Poa pratensis*	Y	Native
	Vetch	*Vicia* spp.	N	Europe
	Curly dock	*Rumex crispus*		
	Creeping buttercup	*Ranunculus repens*	N	Europe

[1] This table represents a summary of species within the wetlands. Not all species are found within all wetlands.

TABLE 3

Native and Non-native Plant Species within Wetland D

Vegetation Stratum	Common Name	Scientific Name	Native (Y/N)	Origin
Tree	None			
Shrub	Himalayan blackberry	*Rubus discolor*	N	Europe
	Evergreen blackberry	*Rubus laciniatus*	N	Europe
Herb	Red top	*Agrostis alba*	Y	Native
	Canada thistle	*Cirsium arvense*	Y	Native
	Soft rush	*Juncus effusus*	Y	Native
	Tall fescue	*Festuca pratensis*	N	Europe
	Spikerush	*Eleocharis acicularis*	Y	Native
	Bull thistle	*Cirsium vulgare*	N	Europe
	Colonial bentgrass	*Agrostis tenuis*	N	Europe
	Rough bluegrass	*Poa trivialis*	N	Europe
	Hardstem bulrush	*Scirpus acutus*	Y	Native
	Velvetgrass	*Holcus lanatus*	N	Europe
	Kentucky bluegrass	*Poa pratensis*	Y	Native
	Quackgrass	*Agropyron repens*		
	Meadow foxtail	*Alopecurus pratensis*	N	Europe
	Vetch	*Vicia* spp.	N	Europe
	Vernal sweetgrass	*Anthoxanthum odorata*	N	Europe
	Birds-foot trefoil	*Lotus corniculatus*	N	Europe
	Slough sedge	*Carex obnupta*	Y	Native
	Creeping buttercup	*Ranunculus repens*	N	Europe
	Reed canary grass	*Phalaris arundinacea*	Debatable	Europe/ Native
	Soft rush	*Juncus effusus*	Y	Native

TABLE 4

Native and Non-Native Vegetation within Wetland F (AU1)

Vegetation Strata	Common Name	Scientific Name	Native (Y/N)	Origin
Tree	Black cottonwood	*Populus trichocarpa*	Y	Native
	Douglas fir	*Pseudotsuga menziesii*	Y	Native
Shrub	Himalayan blackberry	*Rubus discolor*	N	Old-World
	Scouler's willow	*Salix scouleriana*	Y	Native
	Sitka willow	*Salix sitchensis*	N	Native
	Hardhack	*Spiraea douglasii*	Y	Native
Herb	Reed canary grass	*Phalaris arundinacea*	Debatable	Europe/Native
	Meadow foxtail	*Alopecurus pratensis*	N	Europe
	Red clover	*Trifolium pratense*	N	Europe
	Chickweed	*Stellaria media*	N	Europe
	False soloman's seal	*Smilacina racemosa*	Y	Native
	Bull thistle	*Cirsium vulgare*	N	Europe
	Birds-foot trefoil	*Lotus corniculatus*	N	Europe
	Curly dock	*Rumex crispus*	N	Europe
	Soft rush	*Juncus effuses*	Y	Native
	Slough sedge	*Carex obnupta*	N	Native
	English plantain	*Plantago lanceolata*	N	Europe
	Kentucky bluegrass	*Poa pratensis*	Y	Native
	Catsear	*Hypochaeris glabra*	N	Europe
	Colonial bentgrass	*Agrostis tenuis*	N	Europe
	Velvetgrass	*Holcus lanatus*	N	Europe

TABLE 5

Native and Non-Native Vegetation within Wetland F (AU-2)

Vegetation Strata	Common Name	Scientific Name	Native (Y/N)	Origin
Tree	Black cottonwood	*Populus trichocarpa*	Y	Native
Shrub	None.			
Herb	Reed canary grass	*Phalaris arundinacea*	Debatable	Europe/Native
	Meadow foxtail	*Alopecurus pratensis*	N	Europe
	Kentucky bluegrass	*Poa pratensis*	Y	Native
	Colonial bentgrass	*Agrostis tenuis*	N	Europe
	Velvetgrass	*Holcus lanatus*	N	Europe

TABLE 6

Native and Non-native Plant Species within Wetlands G, H and J[1]

Vegetation Stratum	Common Name	Scientific Name	Native (Y/N)	Origin
Tree	None			
Shrub	None			
Herb	Red top	*Agrostis alba*	Y	Native
	Colonial bentgrass	*Agrostis tenuis*	N	Europe
	Canada thistle	*Cirsium arvense*	Y	Native
	Bull thistle	*Cirsium vulgare*	N	Europe
	Velvetgrass	*Holcus lanatus*	N	Europe
	Meadow foxtail	*Alopecurus pratensis*	N	Europe
	English plantain	*Plantago lanceolata*	N	Europe
	Red clover	*Trifolium pratense*	N	Europe
	Vetch	*Vicia* spp.	N	Europe
	Reed canary grass	*Phalaris arundinacea*	Debatable	Europe/ Native

[1] This table represents a summary of species within the wetlands. Not all species are found within both wetlands.

TABLE 7

Native and Non-Native Vegetation within Wetland I

Vegetation Strata	**Common Name**	**Scientific Name**	**Native (Y/N)**	**Origin**
Tree	Hybrid black poplar	*Populus* spp.	Potentially	Unknown
	Red alder	*Alnus rubra*	Y	Native
Shrub	Scouler's willow	*Salix scouleriana*	Y	Native
Herb	Slough sedge	*Carex obnopta*	Y	Native
	Baltic rush	*Juncus balticus*	Y	Native
	Reed canary grass	*Phalaris arundinacea*	Debatable	Europe/ Native
	Soft rush	*Juncus effusus*	Y	Native

Summary Index Score Results for All Wetlands Within Proposed Project Location

Wetland Name	Potential for Removing Sediments	Potential for Removing Nutrients	Potential for Removing Heavy Metal and Toxic Organics	Potential for Removing Peak Flows	Potential for Decreasing Downstream Erosion	Potential for Recharging Groundwater	General Habitat Suitability	Habitat Suitability for Invertebrates	Habitat Suitability for Amphibians	Habitat Suitability for Anadromous Fish	Habitat Suitability for Resident Fish	Habitat Suitability for Wetland-Associated Birds	Habitat Suitability for Wetland-Associated Mammals	Native Plant Richness	Potential for Primary Production and Organic Export
A	4	2	4	2	2	3	2	1	2	0	1	4	2	1	6
B (B1-B4)	4	2	4	2	2	3	2	1	2	0	1	3	2	0	6
C	4	2	4	2	3	3	2	0	1	0	0	3	2	0	6
D	5	3	5	4	5	5	2	0	1	0	0	3	2	0	7
F –AU1	5	3	5	4	5	5	2	2	2	1	1	3	1	1	8
F – AU2	5	2	4	2	4	2	2	1	2	0	1	2	1	0	8
G	4	2	5	2	3	4	1	1	1	0	1	2	1	0	7
H	4	3	5	3	3	5	1	1	1	0	1	2	1	0	7
I	5	5	5	5	8	1	3	1	1	2	2	2	2	3	9
J	5	3	5	3	3	5	2	1	1	0	0	3	2	0	7

FIGURES

APPENDIX A

APPENDIX B