ENCLOSURE C

CORPS WETLAND AND AQUATIC RESOURCE IMPACT ANALYSIS

Refer to Figures 1 and 2 and Enclosure B for aquatic resources and location of these resources in the specified areas discussed below. In addition, Table 1 includes a summary of on-site impacts and wetland classifications in the project area, and Table 3 includes details of on and off-site impacts by project area, creek basin, acreage, and Cowardin/HGM classification for each project area as specified below.

MILLER CREEK BASIN

A. Runway Safety Area/North Airfield

Aquatic resource impacts in this area include 2.75 acres of wetland impacts, and filling 980 linear feet of Miller Creek. Impacts also include filling 5.24 acre-feet of the Miller Creek floodplain. The wetland impacts include 1.22 acres of PFO impact; 0.27 acre of PSS impact; and 1.26 acres of PEM impact. The majority of impacts are occurring to slope wetlands, which are the predominant HGM class in the area. This area contains approximately 27.84 acres of wetlands. The proposed projects will impact approximately 10% of the wetlands in this complex.

Water Quality Functions

The nutrient/sediment trapping function of the wetlands impacted would be eliminated. In some areas (FW5 and 6) the potential for the wetland to generate sediments and nutrient runoff from recently plowed earth and the introduction of contaminants to the receiving waters (i.e. farming chemicals) would be reduced by eliminating farming in this area.

Hydrologic Functions

Filling 2.75 acres of wetlands in this area would eliminate areas where seasonal or perennial saturation supports wetlands. The fill in this area is not likely to alter the general discharge of groundwater from upslope areas of Miller Creek because the fill will be permeable and would allow continued groundwater movement to the remaining wetlands. New areas of groundwater discharge should develop near the base of the fill, which would ultimately reach Miller Creek. The timing of this discharge is likely to change with the placement of fill. Filling of 2.75 acres of wetlands in this area has the potential to negatively impact baseflow support to Miller Creek. However, field observations by the Corps of groundwater expression from existing permeable fill in the area of Wetlands 3, 4, and 5 was evident during the summer of 2001 (a drought year), when low flow conditions become critical for aquatic resources dependent on Miller Creek and its associated wetlands.

The placement of fill in Wetlands A1, FW5 and FW6 would result in a loss of floodplain to Miller Creek. This loss could result in increased flood stages downstream, increased peak velocities, and channel scour. These changes could degrade habitat to fish and other biota. Elimination of floodplain areas could also reduce the export of organic matter to the creek, affecting the type and amount of aquatic invertebrates that are

available to fish and other aquatic organisms. If food availability was reduced, fish populations or growth rates could decline.

Habitat Suitability Functions

Fish Habitat - Filling portions of Wetland A1 would result in direct and indirect impacts to fish habitat. The impacts would include physical alteration of the stream channel, loss of shade, and changes in food resources. Fill of all or portions of the remaining wetlands would indirectly impact fish habitat by altering other wetland functions (organic matter export, groundwater discharge/recharge, water quality, food chain support). Temporal impacts are likely to occur for a fairly long period of time between the filling and relocation of a portion of Miller Creek and the time it takes for the system to function as intended (such as providing shade and organic export materials as well as the time it would take for the new creek channel and its gravel components to stabilize).

Waterfowl and Passerine Bird Habitat - Passerine bird habitat would be eliminated from the area of wetland impact. This would result in a reduction in the localized population of some species.

The waterfowl habitat functions of Wetlands A1, FW5, and FW6 would be lost. This would result in some reduction in forage habitat for waterfowl during the over-wintering period, and loss of a small amount of nesting habitat for mallard ducks.

Amphibian Habitat - Filling these wetlands would eliminate some potential breeding habitat (within Wetland A1) and habitat for non-breeding adults. These reductions could reduce prey availability for some birds and small mammals. Some amphibian species may be able to disperse to adjacent areas but it is likely that a large number of individuals will perish from the proposed activities in this area.

Invertebrate Habitat - Invertebrate habitat would be eliminated from the area of impact. This reduction is likely to result in localized food chain disruptions and the availability of prey species.

Small Mammal Habitat - Small mammal habitat would be eliminated from the area of impact, resulting in a reduction in the localized population of some species. Coyote would experience some loss of habitat, but would be expected to remain in the area, as they likely use upland habitats for most needs. Other small mammals may be able to disperse to unoccupied or under-occupied territories adjacent to the impact area, but it is likely that some individuals of some species will perish during construction activities.

Carbon Export - A reduction in carbon export from riverine wetlands to Miller Creek would occur due to the loss of portions of Wetland A1. This reduction could alter or reduce the type and availability of aquatic invertebrates available for fish in the creek. If food availability was reduced, fish populations or growth rates could decline.

B. Vacca Farm Mitigation Area/Relocation of Miller Creek

There are no permanent wetland fill impacts in this area. This area will be used as a compensatory mitigation site. Approximately 8.07 acres of jurisdictional wetlands are located in this area (inclusive of the open water area of Lora Lake which totals 3.06 acres).

Mitigation at the Vacca Farm Mitigation Site will result in modification of existing shrub or emergent wetland (Wetlands A1, A2, A3, A4), farmed wetlands (FW1, FW2 FW3, FW9, FW10 and FW11), and prior converted cropland. Relocation of the Miller Creek channel will result in channel excavation, grading, and construction in 2.21 acres of wetland. Placement of fill to create channel banks will require fill placement in 1.79 acres of wetland. Based on the design elevation, these banks are anticipated to remain wetlands. Finally, excavation of new floodplain in currently farmed areas will modify 1.56 acres of wetland.

Water Quality Functions

Temporary impacts to water quality in Miller Creek could result from increased sedimentation and turbidity during mitigation construction, enhancement activities, and relocation of a portion of the creek channel. Nutrient and sediment trapping functions of the site will be temporarily reduced. Once the new Miller Creek channel is constructed and water is diverted from the old channel to the new channel, it is likely a short-term and temporary sedimentation plume will be generated and adversely affect water quality to downstream areas of Miller Creek. Water quality functions for the site as a whole are likely to improve after mitigation activities are complete and the site has been stabilized.

Hydrologic Functions

Low and high flow impacts could potentially occur from reconstructing a portion of Miller Creek. There is potential for the new streambed material to shift and move during high flows, causing scour and head cutting to adjacent areas of Miller Creek, potentially changing the hydroperiod of riverine wetlands. Likewise, the new channel could cause impacts to low flows if surface water went subsurface during summer and fall low flow periods. This, in turn, could marginalize the hydroperiod of riverine wetlands in the area. The flood storage function of the site is likely to improve because the proposed mitigation will create slightly more flood storage capacity.

Habitat Suitability Functions

Wildlife habitat functions will be substantively reduced on a temporary basis while the mitigation is being constructed. Most of the wildlife utilizing the site (mostly birds and small mammals) are likely to be able to disperse to adjacent areas. If these areas are already occupied, then some wildlife species may perish from construction of the mitigation site.

Fish Habitat - The site may provide refuge areas for fish during high storm events when Miller Creek Detention Facility/Lora Lake/Vacca Farm all flood. This

habitat function should not be impaired by constructing the mitigation during summer low-flow periods. Indirect adverse affects to fish utilizing Miller Creek could occur from water quality impacts experienced during construction and enhancement activities on the site. This indirect impact to fish habitat is likely to be minor and short-termed, unless flows in the newly constructed channel are not maintained at present level or better during low flow periods.

Waterfowl and Passerine Bird Habitat - The conversion of this site from open farmland to a palustrine scrub/shrub community will eliminate this area as waterfowl habitat. Waterfowl will likely disperse to unoccupied areas of farmland or grassy expanse in the vicinity.

Passerine bird habitat would be temporarily eliminated from the site during construction activities, although use of the site by passerine birds is somewhat limited because of the ongoing farming of the site. Passerine birds utilizing the site are likely to be displaced to forested adjacent areas. If these areas are already overcrowded or occupied, some individuals of some species may perish.

Amphibian Habitat - The site offers both breeding and non-breeding habitat for amphibian species. Amphibians utilizing the site are likely to perish during construction activities. Some individuals may be able to disperse to adjacent areas.

Invertebrate Habitat - Construction and enhancement activities occurring on this site will eliminate invertebrate habitat on a temporary basis.

Small Mammal Habitat - Small mammals utilizing the site may disperse to adjacent areas. Many small mammals are likely to perish from the activities proposed on this site. This impact is expected to be short-term because small mammal populations are likely to quickly reestablish once the mitigation has been completed and stabilized.

Carbon Export - There is little opportunity for this function to occur because there is very little woody material currently vegetating the farmed site. It is likely the site does generate some detrital input during flood events when peat soils are flooded and detritus is suspended in the floodwaters. This detrital contribution is likely to be insignificant. There may be a short-term loss in this function from removal of the reed canary grass dominated areas of Miller Creek and adjacent wetlands. However, construction and enhancement activities in this area are expected to have negligible long-term impacts to current carbon export functions.

C. Riverine Wetlands

Existing riverine wetlands along Miller Creek within the project area total approximately 6.97 acres. Impacts will occur to 1.05 acres of riverine wetlands - 0.90 acres of PFO and 0.15 acres of PEM. The proposed projects will eliminate approximately 15% of riverine wetlands located in the project area. In addition, the riverine wetland buffer

enhancement activities proposed by the applicant will involve disturbances such as planting trees and shrubs which will redistribute wetland soils. In some of the wetlands, prior to planting native trees and shrubs, clearing and grubbing activities to remove existing non-native vegetation will redistribute topsoil. In these areas, installation of a temporary irrigation system will also disturb wetland soils. The effects of this mitigation on the functions provided by the riverine wetlands follows.

Water Quality Functions

Removal of residential land uses would reduce the amounts of sediments, nutrients, and chemicals entering wetlands and Miller Creek. However, during removal of structures, roadways and driveways in this area and the implementation of the riverine wetland and buffer enhancement activities there could be a temporary increase in sediment delivery to the stream. Impacting a small percent of the riverine wetlands in the project area is likely to have minor impacts on water quality functions by reducing the areal extent of riverine wetlands providing nutrient and sediment trapping functions and removing heavy metals and organic toxins.

Hydrologic Functions

The Corps does not anticipate changes to occur, over existing conditions, to groundwater exchange, flood storage and desynchronization functions of the riverine wetlands by eliminating a small percent of this area within the project boundaries.

Habitat Suitability Functions

Fish Habitat - Filling of just over one acre of riverine wetlands and soil disturbance activities adjacent to Miller Creek (including the removal of structures and riprap and enhancement activities) could have a short-term, indirect and temporal impact on fish habitat in Miller Creek by causing turbidity and sediment plumes. The reduction of riparian habitat by one acre along Miller Creek could also reduce the food supply available for fish utilizing the creek.

Waterfowl and Passerine Bird Habitat - The riverine wetlands do not provide waterfowl habitat so no change in this function would occur. Potential management of habitat (per the WHMP) may reduce habitat value for certain species of passerine birds.

Amphibian Habitat - The riverine wetlands being impacted by the proposal do not provide much amphibian breeding habitat, therefore this function will not be impacted. Areas for non-breeding amphibians will be reduced by filling one acre of riverine wetlands. Soil disturbance activities in the existing riverine wetlands may displace amphibians utilizing the area. In some areas, non-breeding amphibians may perish from the riverine and buffer enhancement activities.

Invertebrate Habitat - Decreasing riverine wetlands by one acre will decrease the amount and potentially types of invertebrates which support the food chain of Miller Creek. This could indirectly affect fish populations and health in the creek.

Small Mammal Habitat - Because of dispersal patterns of small mammals, the Corps believes the impacts from filling one acre of riverine wetland will be minor. Most small mammals utilizing the area are likely able to avoid the construction activities. Enhancement activities may displace some small mammals temporarily, but this is likely to be minor.

Carbon Export - There will be a temporal impact to this function from filling 1 acre of riverine wetlands. Organic material delivery to Miller Creek will be somewhat reduced in the PFO impact areas for many years. Replacement of this function, by enhancement of existing forested areas, could take many years to regain current performance levels. Soil and vegetation disturbances for enhancement purposes will likely limit this function in the wetlands being enhanced on a temporal basis.

D. Third Runway Area (West Airfield/West Acquisition Area)

The largest impact area will occur from construction of the new third runway on the west side of the existing airfield.

Impacts will occur to 11.05 acres of wetlands and other waters of the U.S. in this area including 5.14 acres of PFO, 1.80 acres of PSS, 3.80 acres of PEM, 0.18 acres of POW, and 0.13 acres of channels. These impacts are predominantly to slope wetlands (10.54 acres). The wetlands in this area are associated with a variety of hydrologic features, including hillside seeps, roadside ditches, seasonally saturated depressions, and riverine areas of Miller Creek. Wetlands in this area of the project total approximately 15.74 acres. MPU projects will impact 70% of the wetlands located in this area of the Miller Creek watershed.

Water Quality Functions

The nutrient and sediment trapping functions of the wetlands would be eliminated. Coincident with wetland filling, potential sources of sediment and uncontrolled urban runoff from 12th Avenue and adjacent residential areas would be removed. Water quality functions of the wetlands are expected to be replaced by BMP's and stormwater detention ponds. These BMP's cannot effectively replace the water quality functions of the existing 11.05 acres of wetlands being permanently filled in this area. One water quality function not offset by BMP's is the ability to effectively control nutrients. BMP's also cannot effectively control pH and dissolved oxygen levels. Recent studies suggest appropriately designed and properly sited BMP's can provide some mitigation of stormwater impacts on stream communities. However, the resulting communities can differ greatly from those in undeveloped watersheds and reflect a fundamental alteration in stream biotic diversity, structure, and function. For example, no BMP's were able to restore the full complement of macroinvertebrate families found in the reference watersheds. This, in turn can have an effect on water quality by eliminating, reducing, or restructuring detrital food chain support functions down to the nitrogen-fixing bacteria. Studies have also shown that BMP's for stormwater did little to attenuate the impacts of urbanization once the watershed reached 20% impervious cover (Azous, 2001).

Hydrologic Functions

Placement of fill and wall construction will alter ditch and drainage channels (Waters A, B and W) connected to Wetland 37 via a culvert under 12th Avenue South. Channel A is a ditch constructed adjacent to 12th Avenue South. Water in drainage Channel A flows south from Wetland 19 and north from Wetland 21. Water in drainage Channel W flows from Wetland 20 to Channel A. The two water channels converge and are then culverted under 12th Avenue South and discharged into Wetland 37. Channelized flow continues through Wetland 37 to Miller Creek.

The filling of wetlands would eliminate areas where seasonal or perennial saturation supports wetlands. The fill may not alter the general discharge of groundwater from upslope areas to Miller Creek because the permeability of the fill would allow continued infiltration of stormwater and groundwater movement. New areas of groundwater discharge will likely develop near the base of the fill, which is designed to ultimately reach Miller Creek. The timing of the discharge will be permanently altered.

The proposed development actions could increase peak flows and reduce base flows in Miller Creek, and thus potentially affect the habitat and water quality functions of these creeks.

The activities associated with implementing the proposed projects will include adding new impervious surfaces (new runways, taxiways, parking, and roadways). This action could change the hydrologic flow regime of Miller Creek, including increased peak-flow magnitude and frequency, and increased peak-flow duration. The potential effects of high-flow impacts in the stream include increased erosion and sedimentation, habitat damage from scouring flows, and impaired habitat use during high-flow period.

The new impervious surfaces could increase stormwater runoff rates and volumes. Changes in runoff could increase flooding and erosion and could degrade instream aquatic habitat and water quality in Miller Creek downstream of stormwater inputs from the new impervious areas.

Wetland hydrology to Wetland 39 may be impaired because the Port's stormwater Pond D is located where it could intercept ground and surface water flows to this wetland. Pond D is designed to be excavated 20 feet deep in the location of existing Wetland 41 A, just upslope of Wetland 39. Based on the models performed by the Port for the temporary stormwater pond in Wetland 37, indirect impacts to Wetland 39 are likely because of a potential disruption of the groundwater flow maintaining hydrology to this wetland. This, in turn, could marginalize the wetlands hydrologic functions by limiting the opportunity of this wetland to attenuate and detain stormwater flows and to reduce peak flows. Wetland 39 is characterized as seasonally to permanently saturated. Diverting groundwater and surface flows away from this wetland and into a constructed stormwater pond, would likely change the vegetation structure of the wetland, resulting in a decrease in functional effectiveness of this wetland as a whole. The Port has included 0.02 of an acre of indirect impacts as a result of this potential disruption.

Habitat Suitability Functions

Fish Habitat - No direct impacts to fish habitat functions would occur as a result of fill placement in the wetlands. Indirect impacts to habitat conditions resulting from wetland fill (e.g., water quality (refer to page 7) and export of organic carbon (refer to page 10)) are addressed elsewhere in this paragraph.

Potential impacts to critical habitat in the estuary of Miller Creek (approximately 2 miles downstream of the impact area) include increased sedimentation in these estuaries caused by high-flow erosion in the upper watershed (where project construction would occur) and potential changes in the estuarine hydrology by siltation accumulation. Accumulation of sediments in the estuaries at the mouths of the creeks could produce a corresponding vegetation and hydrologic change over time.

Waterfowl and Passerine Bird Habitat - Passerine bird habitat would be eliminated from the areas of wetland fill, and non-paved portions of the new embankment would provide different habitat for a less diverse array of bird species. Because a large portion of the wetlands in this area will be permanently impacted, many individual passerine birds are likely to perish as adjacent remaining habitat is probably already occupied. Birds using these habitats are distributed over the landscape and are expected to occur in many urban habitats. Passerine birds which are dependent on wetlands for part of their life requirements would be impacted the most in this area. Substantive impacts on the regional populations of birds in this area could occur due to increased habitat loss.

A small portion of this area contains some existing open pasture with wetland depressions likely utilized by waterfowl. Eliminating this open pasture area west of 12th Avenue will reduce waterfowl habitat in the immediate area.

Amphibian Habitat - The filling of these wetlands would eliminate habitat for non-breeding amphibians. Amphibians utilizing the wetlands to be impacted by the proposal are likely to perish, reducing the biodiversity in the area. These reductions could reduce prey availability for some birds and small mammals. Some of the more mobile amphibian species may be able to disperse to under or unoccupied territories during construction activities. No loss in breeding habitat is expected to occur. However, indirect impacts to both breeding and non-breeding amphibians due to hydroperiod changes could occur as a result of project construction in this area.

Invertebrate Habitat - The filling of these wetlands would eliminate invertebrate habitat. Many invertebrates cannot disperse rapidly enough to avoid death. Species richness and numbers are likely to be reduced substantively on a temporary basis. Species richness of invertebrates could be reduced permanently in this area due to the loss of slope wetlands. These reductions are likely to reduce prey availability for some birds, small mammals and fish.

Small Mammal Habitat - Small mammal habitat would be eliminated from the areas of wetland fill. This would result in a reduction in the localized population of some species. The reduction of the wetlands by 70% in this area is likely to have substantive impacts on local small mammal habitat. The remaining migration corridor in this area is also being substantively impacted. Reduction of the migration corridor will likely result in many small mammals to perish from project impacts in this area. More mobile mammals such as coyote would experience loss of habitat, but would be expected to remain in the area, as they are likely to use upland habitats for most needs.

Carbon Export - A major reduction in carbon export to Miller Creek would occur due to the loss of these wetlands and the drainage channels which convey dissolved and particulate organic carbon to Miller Creek. This reduction could alter or reduce the type and availability of aquatic invertebrates available for fish in the creek. If food availability was reduced, fish populations or growth rates could decline. The forested riverine areas of Wetlands 18 and 37 are expected to provide plant and insect detritus to Miller Creek, and rank high for this function. These riverine wetlands will not continue to function high for carbon export because the areal extent of forest and shrub wetland habitat (and associated insect and detrital input) will be reduced substantively. A large portion of the source of organic carbon delivered to the creek will be eliminated by the project. Opportunity for this function to occur at a self-sustaining level will be substantively reduced.

WALKER CREEK BASIN (subset of Third Runway Area)

Walker Creek emerges from a hillslope seep flowing west to Wetland 44, crossing underneath SR 509 through a culvert and continuing west through Wetland 43. Walker Creek is the most undisturbed of the three subject waterways in terms of existing impervious surface and residential, industrial and commercial uses in the watershed, and due to the large expanse of Wetland 43. Both the headwater seep areas of Walker Creek and portions of adjacent Wetland 44 will be filled and impacted by construction activities.

Impacts will occur to 1.53 acres of wetlands in the Walker Creek basin. Of this 0.42 acres is PFO, 0.18 acres is PSS, and 0.93 acres is PEM. Wetlands within the project area within the Walker Creek basin total approximately 37.50 (the majority of this is Wetland 43 - 33.43 acres in size). The proposed projects will impact approximately 4% of the wetlands in this basin. However, if you do not include the large expanse of Wetland 43, the proposed projects would affect 38% of the wetlands in the headwaters of Walker Creek.

<u>Water Quality Functions</u>

The nutrient and sediment trapping functions of the wetlands would be eliminated. Construction activities could increase sediment and turbidity in Walker Creek, and if it were severe enough, could adversely affect water quality in the lower reaches of Miller Creek, resulting in direct and indirect impacts to the aquatic fauna and flora of the creeks.

Hydrologic Functions

The filling of wetlands would eliminate areas where seasonal or perennial saturation supports wetlands and would likely alter the general discharge of groundwater from upslope areas to Wetland 44, Wetland 43 or the source of Walker Creek. This could, in turn, reduce baseflow to Walker Creek, producing direct and indirect impacts on the aquatic and semi-aquatic resources dependent on the creek.

The activities associated with implementing the proposed projects will include adding new impervious surfaces (new runways, taxiways, parking, and roadways). This action could change the hydrologic flow regime of Walker Creek, including increased peak-flow magnitude and frequency, and increased peak-flow duration. The potential effects of high-flow impacts in the stream are increased erosion and sedimentation, habitat damage from scouring flows, and impaired habitat use during high-flow periods.

Hydrologic modeling has demonstrated a potential low stream flow impact due to the proposed projects. If low stream flow impacts are large enough, the wetted stream area of the creek could be reduced, which would adversely affect fish and aquatic habitat.

Habitat Suitability Functions

Fish Habitat - No direct impacts to fish habitat functions would occur as a result of fill placement in the wetlands in this area. Indirect impacts to habitat conditions resulting from fill in Wetland 44 (e.g., water quality and export of organic carbon) are addressed separately.

Waterfowl and Passerine Bird Habitat - Passerine bird habitat would be eliminated from the areas of wetland fill, and non-paved portions of the new embankment would provide different habitat for a less diverse array of bird species. Passerine birds which cannot find suitable territory nearby would perish.

Mowed wetlands on the airfield used by foraging and loafing waterfowl would be eliminated, thus reducing the available habitat in the area. However, because of active wildlife management on the airfield, wildlife use of these areas is not substantial.

Amphibian Habitat - The filling of a portion of Wetland 44 would eliminate habitat for non-breeding amphibians. No loss in breeding habitat would occur, because ponded areas in Wetland 44 do not persist long enough for breeding requirements. The reduction could reduce prey availability for some birds and small mammals. Because of the large areas of Wetland 44 and Wetland 43 remaining following project construction, amphibian species occurring in the area would be expected to remain in the area, except for those individuals who are likely to perish from direct construction impacts.

Invertebrate Habitat - Reduction in habitat would occur from filling the wetlands on the airfield and a portion of Wetland 44. The reduction could reduce prey availability for some birds and small mammals. Food web impacts could also occur.

Small Mammal Habitat - Small mammal habitat would be eliminated from the areas of wetland fill. This would result in a localized reduction in the populations of some species. Individuals of some species are likely to perish due to construction activities, while others may be able to disperse to adjacent areas.

Carbon Export - Placement of fill in the upper portion of Wetland 44 would result in reductions of detritus exported during the winter and spring months to downslope areas. Because of its distance from Walker Creek and the large capacity of Wetland 43 to contribute organic carbon to the creek, this change would be expected to be fairly minor. No direct impacts on fish populations in Walker Creek would be expected, but indirect impacts could occur from a potential change to the food web structure.

DES MOINES CREEK BASIN

In the Des Moines Creek watershed, Master Plan Update improvements will result in an increase of 123 acres of impervious surface. This increases the total amount of impervious area in the watershed by about 4% above the existing baseline condition (approximately 35% impervious surface).

E. SASA (East Branch Des Moines Creek)

Impacts will occur to 2.95 acres (this includes 2.78 acres of indirect and direct permanent impacts and 0.17 acres of temporary impacts from placement of silt fencing) of wetlands in the SASA area. Of this acreage, 1.37 are PFO, 0.47 are PSS, and 1.11 are PEM wetlands. The majority of wetlands being impacted in this area would be classified as slope wetlands.

There are approximately 7.22 acres of wetlands in the SASA area (along and adjacent to East Branch of Des Moines Creek). The SASA project will impact about 41% of these wetlands.

Water Quality Functions

The nutrient and sediment trapping functions of the wetlands would be eliminated. Consequences of loosing this function to Des Moines Creek or adjacent wetlands would be expected to be minor because coincident with wetland filling, potential sources of nutrients and other chemicals applied to the wetlands during golf course operations would be eliminated. However, eventually, other pollution-generating surfaces will replace that of the golf course. Tyee Valley Golf Course Management has requested that the Port allow a portion of the public golf course to remain open on a reduced scale after the proposed mitigation is constructed. The golf course has submitted a plan to the Port and the Corps which incorporates “environmentally friendly” turf management. If the golf course remains, the turf management plan will be implemented and the amount of fertilizers, herbicides and pesticides will be reduced dramatically, with a corresponding benefit to Des Moines Creek water quality.

Hydrologic Functions

The filling of wetlands as proposed, would eliminate areas where seasonal or perennial saturation supports wetlands. The fill may alter the general discharge of groundwater from upslope areas to Des Moines Creek.

The increase in new impervious surfaces in the Des Moines Creek watershed could increase stormwater runoff rates and volumes. Changes in runoff are expected to increase flooding and erosion and degrade instream aquatic habitat and water quality in Des Moines Creek downstream of stormwater inputs from the new impervious areas. Hydrologic modeling has demonstrated a potential low stream flow impact due to the proposed projects. If low stream flow impacts are large enough, the wetted stream area of the creek could be reduced, which would adversely affect fish and aquatic habitat.

Habitat Suitability Functions

Fish Habitat - Removal of vegetation to construct the bridge (0.54 of an acre of Wetland 52 - PEM/PSS/PFO) in this area will directly impact fish habitat functions by removing food web support and detrital input. Indirect impacts to habitat conditions resulting from wetland fill (i.e., water quality and export of organic carbon) and shading effects from the bridge are discussed elsewhere in this paragraph.

Potential impacts to critical habitat in the estuary of Des Moines Creek (approximately 2 miles downstream of the project area) include increased sedimentation in the estuary caused by high-flow erosion in the upper watershed where project impacts will occur and potential changes in the estuarine hydrology.

Waterfowl and Passerine Bird Habitat - Passerine bird habitat would be eliminated from the areas of wetland fill. This would result in a reduction in the localized population of some species. Because 41% of the immediate area's wetlands will be replaced by the SASA complex (coupled with upland deforestation) passerine bird habitat will be greatly reduced. The intact riverine corridor of the East Branch of Des Moines Creek is extremely narrow and likely already occupied by urban tolerant bird species. Individuals of many species are likely to perish from SASA construction.

The waterfowl habitat functions of Wetlands G1, G2, G3, G4, and G5 would be lost. This would result in some reduction in forage habitat for waterfowl.

Amphibian Habitat - Impacts to Wetlands 52 and 53 would eliminate habitat for non-breeding amphibians. No loss in breeding habitat would occur because these wetlands do not offer prolonged ponding necessary for amphibian breeding. These reductions could reduce prey availability for some birds and small mammals. Because the Des Moines Creek riverine area will remain following project construction, amphibian species potentially occurring in the area would be expected to remain if they could disperse effectively during construction activities and if there is unoccupied territory available.

Invertebrate Habitat - Species richness and numbers are likely to decrease in the area due to SASA construction and operation, lowering the function of the remaining habitat. This could have an indirect effect on fisheries resources in Des Moines Creek.

Small Mammal Habitat - Small mammal habitat would be eliminated from the areas of wetland fill. This would result in a reduction in the localized population of some species. The remaining portion of the Des Moines Creek riverine area would contain adequate habitat of similar quality to the wetlands being filled, and support populations of species that are currently in the area. If these territories are already overpopulated, then some individuals of the species may perish.

Carbon Export - A reduction in carbon export to Des Moines Creek could occur as a result of increased shading and decreased plant growth beneath the bridge constructed over Des Moines Creek and Wetland 52, and the filling of 2.95 acres of wetlands in this area. The shade from the bridge would reduce algal production in the creek, which could alter the type and availability of aquatic invertebrates available for fish within a short segment of the creek. If food availability was reduced, fish populations or growth rates could decline.

F. Tyee Mitigation Area/IWS Lagoon Area (West Branch Des Moines Creek)

Approximately 0.07 of an acre of permanent impact will occur in the West Branch of Des Moines Creek (outside and east of the mitigation site) for the extension of a culvert for a permanent haul road for delivery of material excavated from the on-site borrow areas. No impacts are anticipated from construction of the Tyee Mitigation Area, since no grading will occur (only hand planting of vegetation will occur in this wetland). The wetlands currently in this area consist of approximately 38.51 acres (including most of the headwaters wetlands to the West Branch of Des Moines Creek, the riverine wetlands associated with the West Branch, the NW Ponds, and turf areas of the golf course). Enhancement activities will include approximately 10.46 acres of this total.

Water Quality Functions

Temporary impacts to water quality in Des Moines Creek could result from increased sedimentation and turbidity during mitigation construction and enhancement activities. This impact is likely to be minor because no grading of the site is required to accomplish the mitigation activities. Most of the site will be hand planted. Water quality functions for the site as a whole are likely to improve after mitigation activities are complete and the site has been stabilized.

Hydrologic Functions

The flood storage capacity function of the site is likely to improve somewhat by slightly increasing stormwater detention in the area for the 10-year storm event and above. The proposed mitigation project has been coordinated with the Des Moines Creek Basin Plan Committee, who have plans to implement restoration activities in the Des Moines Creek basin (in the NW Ponds area) in the very near future.

Habitat Suitability Functions

Wildlife habitat functions will be reduced on a temporary basis while the mitigation is being constructed. Most of the wildlife utilizing the site (mostly waterfowl) are likely to be able to disperse to adjacent areas. If these areas are already occupied, then some wildlife species may perish from construction of the mitigation site.

Fish Habitat - The site may provide refuge areas for fish during high storm events when a large portion of the golf course mitigation area is persistently flooded. This habitat function should not be impaired by implementing the enhancement and fill activities during summer low-flow periods. Indirect adverse affects to fish utilizing Des Moines Creek could occur from water quality impacts experienced during enhancement activities on the site. This indirect impact to fish habitat is likely to be very minor and short-termed because the amount of earth movement required to implement mitigation plans at this site is minimal.

Waterfowl and Passerine Bird Habitat - The conversion of this site from golf course turf to a palustrine scrub/shrub community will eliminate this area as waterfowl habitat. Waterfowl will likely disperse to unoccupied areas in the vicinity.

The golf course turf area provides little to none passerine bird habitat. Passerine birds residing in this area are likely utilizing the NW Ponds wetland complex and may be temporarily disturbed by noise generated from the mitigation activities. This impact is likely to be temporary and minor.

Amphibian Habitat - The site and adjacent areas offer both breeding and non-breeding habitat for amphibian species. Amphibians utilizing the turf area of the site are likely to perish during construction activities. Some individuals may be able to disperse to adjacent areas.

Invertebrate Habitat - The turf area of the mitigation site provides minimal habitat requirements for invertebrate communities. Mitigation activities are likely to have only a minor, short-term impacts on the invertebrate communities present in the area. Invertebrates are likely to quickly recolonize the area once mitigation is complete and stabilized.

Small Mammal Habitat - Small mammal habitat is somewhat limited on the golf course mitigation site. Small mammals utilizing the site are likely to disperse to adjacent areas. This impact is expected to be short-term because small mammal populations are most likely used to dispersal in this area because of golf course activities occurring year-round on the site.

Carbon Export - There is little opportunity for this function to occur because there is very little woody material currently vegetating the turf area of the golf course. It is likely that the site does generate some detrital input during flood events. However, this detrital contribution is likely to be insignificant. Construction and enhancement

activities on the site are expected to have negligible impacts to current carbon export functions.

G. Borrow Sites (main stem Des Moines Creek)

Impacts will occur to 1.03 acres of wetlands and 0.01 of an acre of channel (Water S) in Borrow Area 1 from excavation and landclearing activities.

Water Quality Functions

The nutrient and sediment trapping functions of the wetlands being impacted would be eliminated. The large landclearing and excavation activities in the Borrow Areas could affect water quality adversely in Des Moines Creek.

Hydrologic Functions

The proposed clearing and excavation of the borrow areas will substantively alter land cover, potentially affecting infiltration, eliminating evapotranspiration and generally reducing the contribution of precipitation to groundwater. The effect of this could be long-term by reducing seepage flows and diminishing base flows in Des Moines Creek or by increasing infiltration and runoff rates thereby causing channel scour and bank erosion to downstream areas of Des Moines Creek.

Several wetlands downslope of Borrow Area 1 (Wetlands 48, 32, B15, B12, and B4) could be adversely affected by the proposed large scale alteration of the landscape in this Borrow Area.

Potential hydrologic impacts include reduction in baseflow to Des Moines Creek, and/or uncontrolled stormwater runoff which could change the hydroperiod of, and cause scouring within the existing wetlands. This could result in water quality impacts to Des Moines Creek.

Borrow Area 4 is located about 400 ft. south of Wetland 28, the headwaters of the western tributary to Des Moines Creek. Wetland 28 is maintained by several water sources, including groundwater emanating from beneath the existing airfield, runoff from wetlands located east of Des Moines Memorial Drive, and runoff from surrounding developments. Some water infiltrating into Borrow Area 4 may also reach the south and southeastern portion of Wetland 28. Excavation in Borrow Area 4 could impact the wetland hydrology of Wetland 28, which could indirectly affect Des Moines Creek.

According to the literature, the effective season for supporting aquatic dependent species requires water to be present through the second week in June. The activities within the Borrow Sites may adversely alter existing wetland functions, such as the hydroperiod necessary for breeding amphibians, in addition to reducing base flows in Des Moines Creek. Adverse affects to the hydroperiod of the wetlands in the borrow areas may limit the input and output of nutrients, resulting in a potential indirect effect to the food chain and water quality functions, while limiting the borrow area wetlands availability for habitat.

Habitat Suitability Functions

Fish Habitat - No direct impacts to fish habitat functions would occur as a result of excavating the Borrow Areas. Indirect impacts could occur from altering the water quality and the hydrology (reduction in summer low flows or increasing peak flows) reaching the creek.

Waterfowl and Passerine Bird Habitat - Passerine bird habitat would generally be eliminated from the areas of excavation, although some species would likely use the areas as they became vegetated with herbaceous cover. Many individuals of certain species could potentially perish as a result of eliminating habitat in the Borrow Areas.

No impacts to waterfowl habitat or populations would occur because the Borrow Areas do not contain any open water areas or grassy expanses.

Amphibian Habitat - The loss of some non-breeding habitat for amphibians would occur. No loss in breeding habitat would occur. These reductions could reduce prey availability for some birds and small mammals. Amphibians unable to disperse during excavation activities are likely to perish.

Invertebrate Habitat - Removing both wetland and upland forest and shrub communities from the Borrow Areas is likely to have an adverse affect on invertebrate species richness and numbers. This could have a negative effect on the food chain support functions found in the area and indirectly affect fish and wildlife populations in the area.

Small Mammal Habitat - Small mammal habitat would be eliminated from the areas of excavation. It is unlikely the diversity or numbers of species occurring in the area would be reduced. The Des Moines Creek riverine area would contain adequate habitat of similar quality to the wetlands being filled, and support populations of species that are currently in the area, unless areas used for small mammal dispersion are already overpopulated. If this is the case, then individuals of certain species are likely to perish and a reduction in overall population numbers in the area will result.

Carbon Export - Removal of a large portion of the woody vegetation from the forested and shrub system adjacent to Des Moines Creek could have a substantive impact on dissolved and particulate organic matter reaching the creek, which in turn could have a negative effect on the food web. Deforestation of the borrow areas will eliminate the source of organic carbon from this area even though the surface water features in the borrow areas are proposed to remain intact. The export and delivery of organic carbon could still occur, however, the opportunity will be greatly reduced for years by eliminating the source. Replanting the borrow areas following project completion will reduce the impacts somewhat.

GREEN RIVER

H. Auburn off-site compensatory mitigation area

All of the wetlands located within the mitigation area will experience some impacts from construction of the mitigation area at Auburn. All the impacts occurring from construction of the mitigation would be considered temporary, with the exception of the permanent road fill (0.12 acres). Impacts are discussed below.

The wetlands at this site are palustrine emergent wetlands dominated by pasture grasses. The wetlands have saturated soils during the winter and early spring months, and pond water to several inches in depth during periods of heavy rainfall.

The proposed activities would subject 1.55 acres of palustrine emergent wetland to temporary alteration from construction of a temporary access road. Portions of wetlands would be temporarily filled with 24 inches of road ballast. Following construction, the temporary fill will be removed and the areas will be restored through reestablishment of the original topography, and through hydroseeding with a wetland grass mixture.

Construction of the wetland mitigation would permanently alter 12.71 acres of palustrine emergent wetland, itemized as follows: A permanent access road would fill 0.12 acres of wetland through the placement of 18 inches of construction ballast consisting of 3 inches of crushed surface over 15 inches of shoulder ballast. Construction staging requirements would temporarily impact 5.11 acres of wetland by fill with construction and shoulder ballast (following construction, the staging area will be removed and the wetlands enhanced by planting native trees and shrubs). An existing drainage channel will be excavated to a depth of at least 18 inches converting up to 2.20 acres of seasonally saturated emergent wetland to a seasonally flooded emergent wetland. The constructed wetland will require substantive grading and excavation and therefore permanent alterations will occur to 5.28 acres of wetland (the area where the two basins will be excavated). Approximately 440,000 cubic yards of material will be excavated from wetland and non-wetland areas in order to create basins appropriately shaped for the wetland hydrology to establish a diversity of wetland habitats. Approximately two-thirds of the material will be removed from the area and disposed of in an appropriate manner. The remaining material will be stored and later used as replacement soil on site.

Water Quality Functions

Temporary impacts to water quality in the Green River could result from increased sedimentation and turbidity during mitigation construction and enhancement activities prior to revegetation of the site. About 9.13 acres of wetlands on the Auburn site will be enhanced by planting native tree and shrub vegetation. The enhancement activities in this area will create soil disturbances from preparing the site for planting, planting the site, and installing a temporary irrigation system, potentially adversely affecting water quality of the Green River on a temporary basis. Nutrient and sediment trapping functions of the site will be temporarily reduced. Water quality functions for the site as

a whole are likely to improve after mitigation activities are complete and the site has been stabilized.

Hydrologic Functions

No adverse impacts are anticipated to occur to the existing hydrology of the site due to mitigation construction. The flood storage function of the site is likely to improve once the surface water connection from the site to the Green River has been established.

Habitat Suitability Functions

Wildlife habitat functions will be substantively reduced on a temporary basis while the mitigation is being constructed. Most of the wildlife utilizing the site (mostly birds and small mammals) are likely to be able to disperse to adjacent areas. If these areas are already occupied, then some wildlife species may perish from the temporary loss of habitat at the mitigation site.

Fish Habitat - The site does not contain direct fish habitat. Indirect adverse affects to fish utilizing the Green River could occur from water quality impacts experienced during construction and enhancement activities on the site. This indirect impact to fish habitat is likely to be minor and short-termed.

Waterfowl and Passerine Bird Habitat - The unmowed condition of the site makes it unsuitable for waterfowl use, except during times of heavy rainfall when stormwater ponds on the site. Areas adjacent to the site are still in active farmland, which gives waterfowl ample opportunity to disperse to these areas if they are present during construction of the mitigation site. Impacts to waterfowl utilizing the site will be minor.

Passerine bird habitat would be temporarily eliminated from the site during construction activities, although use of the site by passerine birds is somewhat limited because of the mostly herbaceous cover. Passerine birds utilizing the site are likely to be displaced to forested adjacent areas (east of the Green River). If these areas are already overcrowded or occupied, some individuals of some species may perish.

Amphibian Habitat - The site does not offer breeding habitat for amphibian species. Non-breeding amphibians utilizing the site are likely to perish during construction activities.

Invertebrate Habitat - Construction and enhancement activities occurring on this site will eliminate invertebrate habitat on a temporary basis.

Small Mammal Habitat - Small mammals utilizing the site may disperse to adjacent areas. Many small mammals are likely to perish from the activities proposed on this site. This impact is expected to be short-term.

Carbon Export - There is little opportunity for this function to occur because of the lack of a surface water connection from the mitigation site to the Green River. In

addition, there is very little woody material currently vegetating the site. It is likely the site does generate some detritus which is exported to the river by wind and storm events but this is likely to be insignificant. Construction and enhancement activities on the site are expected to have negligible impacts to current carbon export functions.