DAVID EVANS AND ASSOCIATES INC.

MEMORANDUM

DATE: February 28, 2017

TO: Niki Iverson
Willamette Water Supply Program (WWSP)

FROM: Ethan Rosenthal
David Evans and Associates, Inc. (DEA)

SUBJECT: Willamette Water Supply Program–Conceptual Post-Construction Site Restoration Plan

CC: Sarah Betz, DEA and Jill Chomycia, MWH

Introduction

This memorandum provides a conceptual post-construction site restoration plan for proposed pipeline resources crossings (i.e., wetlands, creeks, and riparian areas) associated with the Willamette Water Supply Program (Program). This plan is considered conceptual and intended to provide overall site restoration guidance, specifically site revegetation guidance, along proposed pipeline construction corridors. Site specific resource crossing restoration design work will be required as part of final design for each Program work package and will need to take into consideration local site conditions, engineering constraints, local regulatory requirements (e.g., Clean Water Services (CWS) and local land use code requirements), and conditions associated with any issued Program wide permits (e.g., US Army Corps of Engineers 404 permit, Department of State Lands removal-fill permit).

Site Restoration Concept

Typical Planting Plan

The site restoration concept provides planting plans for disturbed riparian and wetlands areas at proposed resource crossings (Attachment 1). The Program has established planting restrictions in proximity to the pipe to avoid potential risks of disturbance and damage to the pipe due to plant roots. This results in the following planting zones:

- **Restricted Zone:** This is typically a 12-foot-wide corridor over the pipe in which only shallow rooting vegetation may be planted. An exception is along stream banks where the pipe will be buried deeper and medium rooting vegetation will be allowed.
- **Safety Zone:** This consists of the permanent easement area beyond the Restricted Zone. Medium rooting vegetation is allowed in this zone.
- **Temporary Easement:** Temporary easement areas may be planted with deep rooting vegetation.

Planting Plan Exceptions

Conceptual planting plans are provided in Attachment 1 and represent the typical planting plan for the majority of resource crossings. However, there are a few exceptions where the typical planting plan may be adjusted to accommodate current land use and land owner needs. Exceptions occur in areas of existing managed pasture or other agricultural wetlands.

Planting Plan by Resource Crossing

Attachment 2 provides a table listing of each crossing and whether or not the typical plan is likely to be applied. The presence of existing utilities at some locations could also result in modifications to the typical planting plan; however, although mentioned in some instances, this is beyond the level of detail provided in this conceptual plan and will be addressed during the final design stage for each work package.

Planting Densities

Planting densities shall be based on CWS design guidelines regardless of jurisdiction, unless local jurisdiction requirements specify otherwise or site specific habitat conditions warrant adjustments to CWS guidelines. The intent of CWS plant density guidelines is to assure the establishment of a dense cover by native plantings, with the understanding that some plantings will die off naturally.

Irrigation

Irrigation is not required by this plan unless required by the respective local jurisdiction or desired by the Partners to promote plant establishment. Success criteria described below allow for a 20-percent mortality rate.

Invasive Species Control

Most project crossings currently contain extensive coverage by invasive species, both at and adjacent to the crossing locations. The most prominent invasive species include Himalayan blackberry (*Rubus armeniacus*), reed canarygrass (*Phalaris arundinacea*), and English ivy (*Hedera helix*). Non-native pasture grasses are also ubiquitous throughout the project area. It is not reasonable to completely remove and eradicate these species from the project area. However, the Program shall be responsible for controlling such species within reason, so as to allow successful establishment of native plantings during the monitoring period described below.

Success Criteria

The following success criteria are proposed:

Areas with Native Plantings

1. For areas in which the typical or similar native plantings are proposed, tree and shrub survival will at a minimum be 80 percent of the initial installed total at each crossing (e.g. not on a parcel by parcel breakdown but for the entire crossing) by the end of the monitoring period. Native volunteer recruits may be included in plant counts.
2. For areas in which the typical or similar native plantings are proposed, invasive species shall be controlled to prevent them from smothering or otherwise preventing the successful establishment of planted native species during the monitoring period.

Managed Pasture Areas or Similar

3. Areas of managed pasture that will be replanted to pasture shall at a minimum have 90-percent coverage after the first growing season.

Areas of cropland shall be restored in accordance with landowner agreements. Success criteria, which are intended to serve regulatory requirements, are not included for croplands.

Monitoring and Reporting

Monitoring and reporting of all areas receiving native plantings shall occur for a minimum of three years post installation, which is the typical minimum requirement of the USACE and DSL. Individual jurisdictions may require longer monitoring periods. If plantings are unsuccessful, then permitting agencies may require new plantings and the monitoring period to be extended. Areas receiving pasture seeding shall only be monitored for one year (as-built plus end-of-year monitoring), assuming successful plant establishment. Monitoring and reporting for cropland areas are not included as part of this plan, which is intended for regulatory purposes.

The following monitoring schedule is proposed for areas receiving native plantings:

Monitoring	Protocol	Timing
As-built monitoring	Total plant count	Within 2 weeks of planting
Year 1	Total plant count	Summer to early Fall following initial planting season
Year 2	Total plant count	Summer to early Fall
Year 3	Total plant count	Summer to early Fall

A monitoring report or memo shall be prepared for each monitoring event. Monitoring shall compare findings relative to the success criteria outlined in this memorandum or as required by authorized permits. Site photos shall be taken and included in monitoring reports.

Attachments

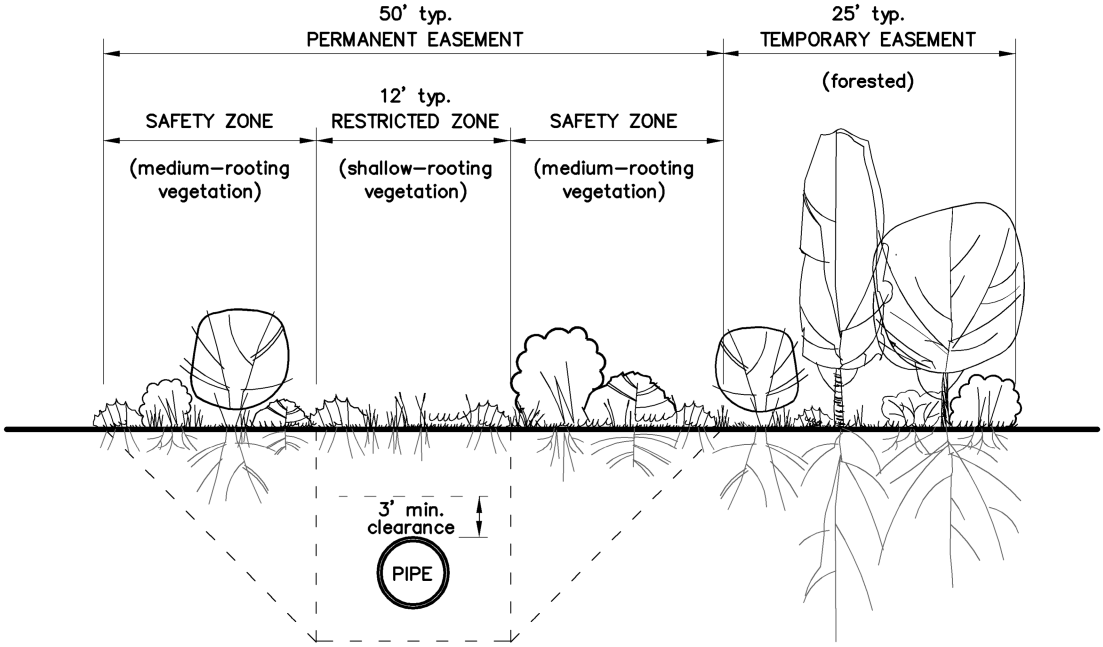
Attachment 1: Typical Site Restoration Plans for Wetland and Riparian Areas
Attachment 2: Table 1: Site Restoration by Resource Crossing

P:\T\TVWD00000008\0600INFO\0670Reports\Site Revegetation Memo\Final\2017-02-28 SiteRestorationMemo.docx

Attachment 1: Typical Site Restoration Plans for Wetland and Riparian Areas

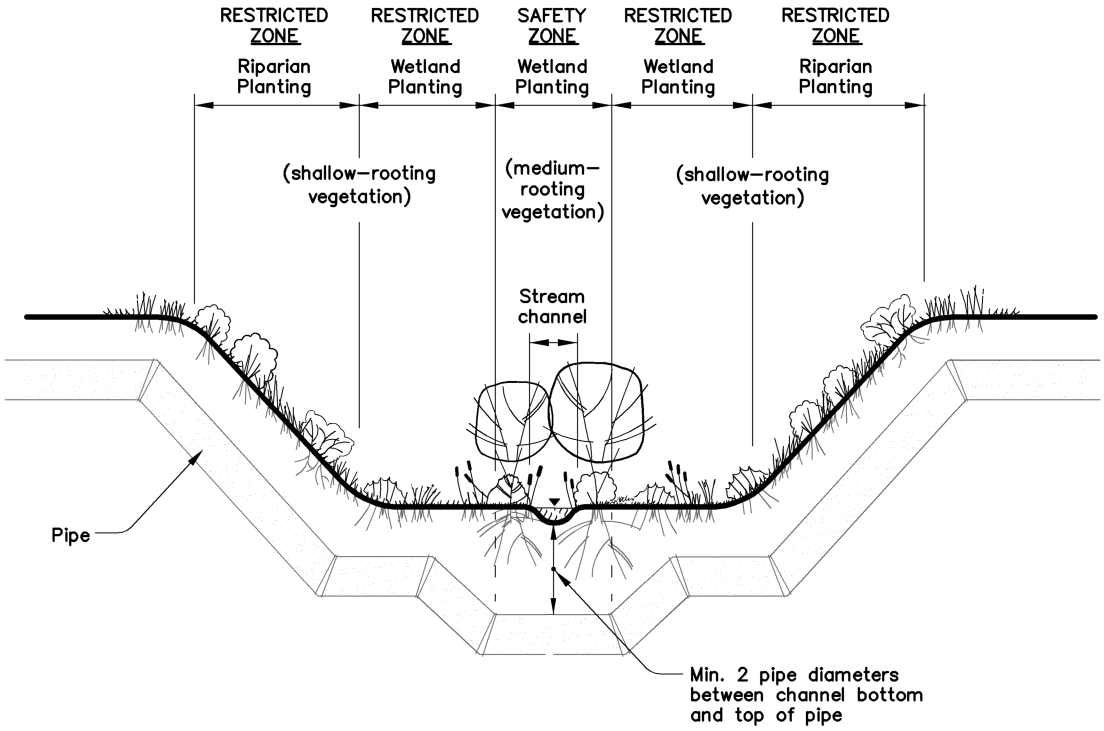
TYPICAL SITE RESTORATION IN WETLAND AND RIPARIAN RESOURCE CROSSINGS

- See plant communities for Wetland Areas and Riparian Areas on sheets 2 and 3.
- Refer to Crossings spreadsheet for areas where exceptions to typical site restoration apply (e.g. agricultural wetlands).



TYPICAL PROFILE ALONG RESTRICTED ZONE

- See plant communities for Restricted Zones and Safety Zones on sheets 2 and 3.
- Refer to Crossings spreadsheet for areas where exceptions to typical site restoration apply.



DSGN	DAVID EVANS AND ASSOCIATES INC.	Willamette Water Supply Our Reliable Water	RESOURCE CROSSING SITE RESTORATION PLAN	SHEET 1
DR			WILLAMETTE WATER SUPPLY PROGRAM	DATE
CHK				
APVD				PROJ

FILENAME: WILLAMETTE_MITIGATION TYPICALS.DWG PLOT DATE AND TIME:

TYPICAL SITE RESTORATION IN WETLANDS

WETLAND PLANT COMMUNITIES, TYPICAL *

"Restricted Zone" (shallow-rooting vegetation) WETLAND			
	Common Name	Botanical Name	Plant Category
	Slough Sedge	Carex obnupta	Herb
	Spreading Rush	Juncus patens	Herb
	Small Fruited Bulrush	Scirpus microcarpus	Herb
	Creeping Spike Rush	Elocharis palustris	Herb
	Tufted Hairgrass	Deschampsia cespitosa	Grass
	Meadow Barley	Hordeum brachyantherum	Grass
	Rice Cutgrass	Leersia oryzoides	Grass
	Spike Bentgrass	Agrostis exarata	Grass
"Safety Zone" (medium-rooting vegetation) WETLAND			
	Common Name	Botanical Name	Plant Category
	Swamp Rose	Rosa pisocarpa	Shrub
	Douglas Spirea	Spirea douglasii	Herb
	Redtwig Dogwood	Cornus sericea	Herb
	Pacific Ninebark	Physocarpus capitatus	Herb
	Small Fruited Bulrush	Scirpus microcarpus	Herb
	Slough Sedge	Carex obnupta	Herb
	Tufted Hairgrass	Deschampsia cespitosa	Grass
	Meadow Barley	Hordeum brachyantherum	Grass
	Rice Cutgrass	Leersia oryzoides	Grass
	Spike Bentgrass	Agrostis exarata	Grass
"Temporary Easement" (forested) WETLAND			
	Common Name	Botanical Name	Plant Category
	Red Alder	Alnus rubra	Tree
	Douglas Hawthorn	Crataegus douglasii	Tree
	Oregon Ash	Fraxinus latifolia	Tree
	Pacific Willow	Salix lasiandra	Shrub
	Pacific Ninebark	Physocarpus capitatus	Shrub
	Red-osier Dogwood	Cornus sericea	Shrub
	Snowberry	Symphoricarpos albus	Shrub
	Slough Sedge	Carex obnupta	Herb
	Dewey's Sedge	Carex deweyana	Herb
	Small Fruited Bulrush	Scirpus microcarpus	Herb
	Tall Managrass	Glyceria elata	Grass

* Typical plant communities. Species substitutions may occur during final design so long as substitute species are listed as native by Clean Water Services, Metro, or City of Portland plant lists and are consistent with the proposed habitat type.

TYPICAL SITE RESTORATION IN RIPARIAN AREAS

RIPARIAN PLANT COMMUNITIES, TYPICAL *

"Restricted Zone" (shallow–rooting vegetation) RIPARIAN			
	Common Name	Botanical Name	Plant Category
	Snowberry	Symphoricarpos albus	Shrub
	Kelsey's Dwarf Red-osier Dogwood	Cornus sericea 'Kelseyi'	Dwarf shrub
	Western Swordfern	Polystichum munitum	Groundcover
	Dewey's Sedge	Carex deweyana	Herb
	Bigleaf lupine	Lupinus polyphillus	Herb
	Yarrow	Achillea mellefolium	Herb
	Canada Goldenrod	Solidago elongata	Herb
	Spike Bentgrass	Agrostis exarata	Grass
	Blue Wildrye	Elymus glaucus	Grass
	Native California Brome	Bromus carinatus	Grass
"Safety Zone" (medium–rooting vegetation) RIPARIAN			
	Common Name	Botanical Name	Plant Category
	Vine maple	Acer circinatum	Shrub
	Red elderbery	Sambucus racemosa	Shrub
	Snowberry	Symphoricarpos albus	Shrub
	Salmonberry	Rubus spectabilis	Shrub
	Swamp Rose	Rosa pisocarpa	Shrub
	Dewey's Sedge	Carex deweyana	Herb
	Bigleaf lupine	Lupinus polyphillus	Herb
	Spike Bentgrass	Agrostis exarata	Grass
	Blue Wildrye	Elymus glaucus	Grass
	Native California Brome	Bromus carinatus	Grass
"Temporary Easement" (forested) RIPARIAN			
	Common Name	Botanical Name	Plant Category
	Red Alder	Alnus rubra	Tree
	Douglas Hawthorn	Crataegus douglasii	Tree
	Western Red Cedar	Thuja plicata	Tree
	Red Elderberry	Sambucus racemosa	Shrub
	Red-osier Dogwood	Cornus stolonifera	Shrub
	Indian Plum	Oemleris cerasiformis	Shrub
	Snowberry	Symphoricarpos albus	Shrub
	Salmonberry	Rubus spectabilis	Shrub
	Spike Bentgrass	Agrostis exarata	Grass
	Native California Brome	Bromus carinatus	Grass

* Typical plant communities. Species substitutions may occur during final design so long as substitute species are listed as native by Clean Water Services, Metro, or City of Portland plant lists and are consistent with the proposed habitat type.

Attachment 2: Table 1: Site Restoration by Resource Crossing

Work Package	Resource Crossing	Delineation Feature ID's	Resource Description	Apply Typical Revegetation Plan	Notes
RWF 1.0	Willamette River	Willamette River	Steep upland forested bluff leads down to a narrow moderate to gradual sloping flood bench adjacent to open water/channel of Willamette River. OHW extends beyond the channel and onto the floodbench as evidenced by flood deposits, drift lines, and a break between persistent vegetation cover in the herbaceous layer. The intake is located in the river proper, with no above ground structures.	Yes, riparian plantings along slope. See notes.	Plant with forested riparian community. Pipe buried deep enough, no need for planting limitations (i.e. rooting depth).
RWF 1.0	Arrowhead Creek at Arrowhead Creek Lane	Arrowhead Creek	Perennial stream that drains to Coffee Lake Creek. Forested riparian corridor in most areas, but dominated by blackberry at proposed crossing location.	Yes, riparian plantings along slope.	No wetland impacts at this location. Limits of riparian plantings to be determined per City of Wilsonville land use code or top of slope at a minimum.
PLM_1.0	Coffee Lake Creek at Industrial Way/Ore-Pac Avenue	S-M1-1 and W-M1-1	Creek is small and sparsely vegetated in this location. Contains fringe of riverine palustrine emergent wetland dominated by reed canarygrass.	Yes, wetland and riparian plantings.	Limits of riparian plantings to be determined per City of Wilsonville land use code.
PLM_1.0	Tapman Creek at SW Ridder Road	S1-2	Highly degraded, ditched section of creek that is a tributary to Coffee Lake Creek. Creek is mostly piped north of Ridder road accept at small pond outlet point, surrounded by parking lot, adjacent to north side of road.	No plantings. All work in existing roadway.	Impacts Avoided
PLM_4.0	WQ facility in line with tributary to Hedges Creek at SW 124th Ave/Tualatin-Sherwood Rd intersection	124th-B	Water detention pond in-line with natural intermittent drainage feature. Outflows are piped from this feature to unknown location but are assumed to make their way to Hedges Creek.	No, see notes.	Replace with existing WQ facility plantings (e.g. cattails) and adjacent landscaping.
PLM_4.0	Rock Creek at Tualatin-Sherwood Road	S2-1	Crossing to occur over existing box culverts in roadway. Fairly degraded stream corridor on north side of proposed crossing. Stream is ditched in a ravine formed in part by adjacent development fills. Riparian corridor consists of extensive Himalayan blackberry thickets with some tree canopy. Stream has perennial flow. Flows to the Tualatin National Wildlife Refuge. South side of crossing consists of extensive floodplain with relatively degraded habitat and permitted mitigation site.	No plantings. All work in existing roadway.	Impacts Avoided
PLM_4.0	Chicken Creek at Roy Rogers Road	S2-2 and W-M4-1	Chicken Creek is a perennial stream. Flows to the Tualatin National Wildlife Refuge. Slope wetland with palustrine emergent wetland dominated by invasive reed canarygrass occupies most of the floodplain on north side of creek. Narrower flood bench with forested wetland occurs on south side of creek, with forested riparian community and blackberry thickets continuing along the adjacent steep slope.	Yes, wetland and riparian plantings.	Limits of riparian plantings on south side to be determined per City of Sherwood and CWS code or top of slope at a minimum. North side is per Washington County code.
PLM_4.0	Tualatin River at Roy Rogers Road	S2-3 and W2-3	River crossing adjacent to Tualatin River National Wildlife Refuge. The refuge consists of managed wet pasture/ag fields in this area. The river has a relatively narrow band of forested riparian vegetation along both banks.	No, see notes.	Impacts Avoided. Staging areas are in upland areas and shall be seeded with erosion control seed mix or planted as agreed to with property owners.
PLM_4.0	Wetland North of Elsner Road	W2-4	Depressional agricultural wetland that floods in winter providing potential winter time waterfowl habitat. Likely connects to Tualatin River off-site to the west of Roy Rogers Road during periods of river flooding, but otherwise likely no direct surface water connection.	Yes, riparian plantings	Wetland area is an agricultural wetland that is plowed annually. Restore per agreement with landowner. Limits of riparian area plantings to be determined per Washington County code.
PLM_5.0	Drainage North of Beef Bend Road #1	S2-4 and W-M5-10	Small intermittent drainage that runs through forested slope wetland in ravine bottom. Ravine slopes are forested.	Yes, wetland and riparian plantings.	Limits of riparian plantings per Washington County code or top of slope at a minimum.
PLM_5.0	Drainage North of Beef Bend Road #2	S-M5-7	Unnamed creek in steep v-shaped ravine with no floodplain in bottom at crossing location. Channel is deeply incised. Creek is perennial but with very minimal flow in summer. Ravine slopes are forested.	No, see notes.	Impacts Avoided. Restoration of upland staging areas to be coordinated with landowner.
PLM_5.0	Agricultural drainage crossing at Roy Rogers Road	S-M5-6	Agricultural drainage ditch mostly on east side of Roy Rogers Road, but small section is exposed on west side before being piped further west through private property.	No, see notes.	Apply erosion control see mix. Impacts are to a very short section of agricultural ditch situated between roadway and development fill.
PLM_5.0	Bridge North of Bull Mountain Road	S-M5-5	Unnamed perennial creek in steep v-shaped ravine with no floodplain in bottom at crossing location. Ravine slopes are forested.	No, see notes.	Impacts Avoided. Restoration of upland staging areas to be coordinated with landowner.
PLM_5.0	Wetland at Scholls Ferry Road	M5-PW1, M5-PW2	Potential agricultural wetlands (hay field) situated in depressions along north side of Scholls Ferry Road.	No, see notes.	Agricultural wetland. Restore per landowner agreement.
PLM_5.0	Creek Crossings at Scholls Ferry Road near Vandermost Road	S2-5 and S2-6	Confluence of two drainages. Eastern drainage is a perennial creek with forested areas on both sides of road, although only a very narrow band of trees on the north side. West drainage near Vandermost Road flows from in-line irrigation pond, then along north side of Scholls Ferry road in ditch, and then flows under road via culvert, continues along south side of road until joins the eastern creek. Stream corridors are fairly degraded although habitat quality appears better on south side of road.	Yes, riparian plantings.	Limits of riparian plantings to be determined per City of Beaverton and CWS code.
PLM_5.0	Wetland at Tile Flat Road/Kobbe Drive	W-M5-9	Small isolated depressional wetland dominated by emergent species bordered by trees. Bordered by roads and pasture.	Yes, wetland and riparian plantings.	Limits of riparian plantings per Washington County code.
PLM_5.0	Wetlands near Intersection of Tile Flat and Grabhorn Roads	W2-7	Emergent wetlands dominated by reed canarygrass bordered by upland pasture. Drains west via an eroding channel through culverts under Grabhorn Road.	Yes, wetland and riparian plantings.	Limits of riparian plantings per Washington County code.

Work Package	Resource Crossing	Delineation Feature ID's	Resource Description	Apply Typical Revegetation Plan	Notes
PLM_5.0	McKernan Creek at Grabhorn Road	S2-7 and W-M5-8	Perennial creek parallels east side of road before crossing the road via a culvert. Forested/scrub-shrub wetlands border the creek on east side of road. Lower quality riparian corridor found on west side of road.	Yes, wetland and riparian plantings.	Limits of riparian plantings per Washington County code.
PLM_5.0	Unnamed Seasonal Drainage North of McKernan Creek	D2-43	Seasonal drainage at bend in Grabhorn Road on west side that connects to drainage ditch along east side of road. Drainage ditch may be historic/shifted seasonal channel. Drains to McKernan Creek.	No, see notes.	No earthwork proposed in roadside ditch. Restore adjacent areas with erosion control seed mix or per landowner agreement.
PLM_5.0	Unnamed Seasonal Drainage at Tanabe Property	S-M5-1	Poorly defined seasonal drainage. Bordered by a mix of native forest and invasive Himalayan blackberry thickets.	Yes, riparian plantings.	Limits of riparian plantings per Washington County code.
PLM_5.0	Wetland and small tributary at Clark Hill Road	W-M5-3	Pasture wetland and swale/drainage connected to high quality forested wetland with large trees. Notable beaver activity. Wetland is wet year round. Very poor fish habitat further downstream across Clark Hill Road due to ditching and	No, see notes.	Restore pasture wetland back to pasture per landowner agreement.
PLM_5.0	Agricultural wetland along Clark Hill Road	W-M5-2	Agricultural wetland. Drains to forested wetland on west side of Clark Hill Road.	No, see notes.	Agricultural wetland. Restore per landowner agreement.
PLM_5.0	Agricultural wetland along Farmington Road	W-M5-1	Agricultural wetland planted with willows, potentially as nursery stock.	No, see notes.	Agricultural wetland. Restore per landowner agreement.
PLW_1.0	Agricultural wetland along Rosedale Road	W-W1-1	Agricultural wetland planted to grass, extends into residential front yard.	No, see notes.	Agricultural wetland. Restore per landowner agreement.
PLW_1.0	Unnamed Seasonal Drainage North of Rosedale Road	W-W1-5, S-W1-2	Wetland swale through grazed pasture. Contains a small channel approx. 3 ft wide by 6 inch deep. OHW extends beyond top of bank and is approx. 5 ft wide.	Yes, wetland and riparian plantings.	Limits of riparian plantings per City of Hillsboro and CWS codes.
PLW_1.0	Unnamed Tributary to Butternut Creek	PHS-C1	Forested wetland swale that drains to Butternut Creek beyond the project area.	Yes, wetland and riparian plantings.	Limits of riparian plantings per City of Hillsboro and CWS codes.
PLW_1.0	Butternut Creek	PHS-A	Creek crossing along future Cornelius Pass Road in South Hillsboro development. High quality habitat, meandering creek through wetland floodplain with intact forested riparian corridor.	No, see notes.	Trenchless crossing, impacts avoided. If staging areas cannot avoid riparian zone, then riparian plantings will be needed per City of Hillsboro and CWS code.
PLW_1.0	Reedville Creek at Cornelius Pass Road	W-W1-4	Small creek with forested wetland immediately adjacent on west side of road. Wetland is part of a mitigation site.	Yes, riparian plantings	Trenchless crossing. Restore northern staging area with riparian plantings per City of Hillsboro and CWS code. Southern staging area is in roadway.
PLW_2.0	Beaverton Creek at Cornelius Pass Road	W-W2-1 and S-W2-1	Reed canarygrass dominated floodplain wetlands with perennial creek. Steep slopes to floodplain are forested on south side, but with some clearing from previous utility work. Slopes on north side of creek mostly consist of non-native shrubs and herbs, with limited number of native trees.	Yes, wetland and riparian plantings.	Adjustments may be needed due to existing utilities (i.e. sewer line) adjacent to proposed crossing. Limits of riparian plantings per City of Hillsboro and CWS code.
PLW_2.0	Rock Creek at Cornelius Pass Road	W-W2-2 and-S-W2-2	Perennial creek with narrow fringe of native riparian shrub vegetation. Forested wetland occurs at edge of study area approximately 35 feet from OHW of the creek. Active restoration (i.e. native plantings) has recently taken place and trail is proposed through this area.	Yes, wetland and riparian plantings.	Coordinate potential planting adjustments with City of Hillsboro and Metro at this public park. Limits of riparian plantings per City of Hillsboro and CWS code. Additional plantings may be needed in park per landowner agreement.
PLW_2.0	Wetlands near Cornelius Pass northern terminus (east side of Corn Pass)	Corn Pass-C and Corn Pass-E	Small depressional emergent wetlands adjacent to former rail grade. Generally of low quality due to invasives and surrounding disturbance.	Yes, wetland and riparian plantings.	Check for planting height restrictions due to nearby powerlines. Limits of riparian plantings per City of Hillsboro and CWS code.
PLW_2.0	Wetlands near pipe connection near existing Cornelius Pass pump station	W-W2-3	Wetland pasture mostly dominated by non-native grasses and forbs. Contains non-listed checkermallow species. Bordered by development, but abuts Dawson Creek off-site to the west.	Potentially, riparian plantings. See notes.	Wetlands avoided. Riparian plantings could be required per City of Hillsboro and/or CWS codes.
PLE_1.0	Wetland at NE Corner of 165th/Farmington intersection	E-01	Wetland pasture mostly dominated by non-native grasses.	Yes, wetland and riparian plantings.	Limits of riparian plantings per City of Beaverton and CWS codes.
PLE_1.0	Beaverton Creek at Millikan Way	W4-1 and S4-1	Emergent reed canarygrass dominated wetland floodplain of perennial creek. Near Tualatin Hills Nature Park	Potentially, riparian plantings. See notes.	Trenchless crossing, wetland impacts avoided. If staging in riparian areas, then restore with riparian plantings per City of Beaverton and CWS codes. Staging areas in upland areas and shall be seeded with erosion control seed mix or planted as agreed to with property owners.
PLE_1.0	Beaverton Creek at Millikan Way and BNSF RR	S4-2	Deep and wide channelized creek section.	No, see notes.	Impacts avoided. Feature locate adjacent to, but outside of project limits.

Work Package	Resource Crossing	Delineation Feature ID's	Resource Description	Apply Typical Revegetation Plan	Notes
WWSS WTP	Wetland A	A	Small isolated depressional palustrine scrub-shrub wetland, roughly half of which is surrounded by rocky slopes and rock overhangs. Dominated by native vegetation including Douglas spirea, Oregon ash, Pacific crabapple, slough sedge, swamp rose, and Pacific willow. Bordered by Oregon oak/madrone and Douglas fir habitats.	No, see notes.	Permanent impact to entire wetland.