

WASHDOT TDR RECEIVING PROPERTIES
Mitigation Plan
for Trails , Roads, and P2 Storm Pipe impacts

Prepared by:

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LIICG-163

APPROVED
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DATE *9/30/11*

N 47° 32' 16.8"

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WSDOT TDR RECEIVING PROPERTIES, MITIGATION SUMMARY

The WSDOT TDR receiving property is property preserved by a conservation easement and acquired by the City of Issaquah. The 43.35 acres area to be acquired is parcel No. 2624069032, and is located south of NE Park Drive, east of PSE Easement, west of BPA Easement, (S 26T24 R6) in WRIA 8 and the East Fork Issaquah Creek drainage (Figure 1: Vicinity Map). The Land is currently owned the City of Issaquah, but may be transferred to King County Department of Natural Resources and Parks as part of a future agreement.

The northern portion of the property that is adjacent to development pads at the Issaquah Highlands and any areas where future trails may be situated (Figure 2), were evaluated for the presence of wetlands and streams in 2010. Four wetlands were identified and delineated in this area, including two large Category II wetlands /riparian corridors previously documented for the Issaquah Highlands EIS as Wetlands EF20 and EF23, and two very small Category 4 wetlands that are located within the western power line cut (Figure 3). For a full description of the parcel and its vegetation and topography, please refer to the delineation report (WSDOT TDR Receiving Properties, Wetland and Stream Delineation, Issaquah MDRT, November 2010). For additional information on current conditions at the site, please refer to the Current Conditions Report (King County Dept. of Natural Resources, October 2010). Part of the P2 storm pipe is outside of the Annexed area and is within King County holdings. Buffers on the Cat 2 wetland EF23 in this area are 125 feet rather than the 50 feet established in the Highlands development agreement.

There are no proposed permanent wetland or stream impacts for this acquisition. There are both permanent and temporary impacts to buffers of both wetlands and streams resulting from trail installation, road construction (College Drive), and a stormwater pipeline installation (P2 Pipeline).

Trails

Trails are an important feature of the Highlands development. An integrated trail and non-vehicular system already exists throughout the Highlands and it was determined early on in the annexation process that the trail system would be expanded into this new area to connect the Highlands with the King County regional trails system. This trail was also part of the SEPA mitigation tied to the development of the adjacent property. At this point in time, the known proposed development within the parcels will include a 12-foot wide paved surfaced trail (hiking and bicycle) that will include two small impacts into the buffer of Wetland/riparian area of EF23.

Trails Impacts: (Figure 4)

- **Buffer Impact Area 1 (BI1) includes a 372 ft² permanent impact** (12 feet wide by ~31 feet long) into the outer edge of the fully vegetated forested 100-foot buffer.
- **Buffer Impact Area 2 (BI2) includes a 4,198 ft² permanent impact** through encroachment through the buffer to cross an area between two wetland lobes, where an historic logging road has already been filled across the area.

The buffer functions along this road are already very limited due to past clearing and grading.

College Drive

College Drive road development involves a buffer encroachment at the northern end of the project near to the Highlands development of Division 17, south of NE Hawthorne Street. The development was installed years ago prior to the current development plan, based on the David Evans Delineations of the early 1990's. It turns out wetland EF 23 extends further north than previously identified. The extension of College Drive therefore cuts significantly through the buffer of Wetland EF23.

College Drive Impacts: (Figure 5)

The total buffer impact, including the temporary extent of clearing for road construction is 4080 ft² with:

- **Buffer Impact Areas 3 and 4 (BI3, BI4) includes 3189 ft² permanent impact** and
- **Buffer Impact Area 4 (BI4) includes 891 ft² temporary impact** (that will be restored with double the normal density of native shrub and herb plantings adjacent to the road shoulder. A chain link fence will be installed along the road edge to further protect the wetland.

The P2 pipeline

The P2 pipeline is a stormwater pipe that conveys stormwater from Parcel 2 to the outfall of EF23/Lost Creek, through a conservation easement and steep slope (Figure 6). The pipe would be trenched through a portion of the EF23 buffer, and laid on top of the soil through another small portion of the buffer in the PE easement (and down the hill to the outfall). The footprint of impact would be restored with shrubs where the pipe is being trenched and mitigated in areas outside of the pipeline for those areas within the PSE easement where the pipe is laid on the surface. The alignment will be placed to avoid major trees. The impact area will be restored in low shrubs and grasses in the PSE easement areas.

The P2 pipeline Impacts: (Figure 6)

- **Buffer Impact/Restoration Area 2 (BI5, R2) includes a 2,314 ft²** (20 feet wide by ~117 feet long) outside of the PSE easement, and
- **Buffer Impact Area 6 (BI6) 3,686 ft²** (20 feet wide by ~184 feet long) within the PSE easement, and
- **Buffer Impact Area 7 (BI7) includes small 925 ft²** at the outfall where the pipe will discharge into a level spreader in the vicinity of Lost Creek at the bottom of the hill. The final location of this will be determined by the engineer with input from the biologist so as to minimize any direct erosive discharge into the creek.

Mitigation sequencing was performed for the project beginning with a critical areas study that preceded the development/trail, road, pipeline design. Of all the possible trail alignments considered, this particular trail route utilized the old logging road

discovered during the critical areas study and by doing so limited critical area encroachment to the bare minimum of buffer disturbance and avoided all wetland impacts (Plan Sheet M1, Figure 4). The road and pipeline have no other locations they can be placed without wetland/stream impacts. The road (College Drive) was platted back in the 1990's and has to be located along the southern edge of the development because of engineering and roads constraints (Plan Sheet M2, Figure 5). The P2 pipeline alignment was determined after extensive work and consultation with King County (Plan Sheet M3, Figure 6). There are other areas where development parcels include wetlands and their buffer but no other encroachments are proposed at this time. The trail will have no native soil disturbance as a result of the encroachment above what was done historically. The new trail surface will be limited to the footprint of the existing logging road bed. The road alignment will disturb soils but they will be replaced within the area to be restored outside of the road shoulder. The pipeline will be trenched within the part of the buffer outside of the PSE pipeline, and rest on top of the soil for the rest of the area that is within the pipeline. The outfall is within an area that has recently been excavated and cleared by the Washington State Department of Transportation. The cleared area is partially within the old intermittent stream alignment. The pipeline outfall is still within the theoretical stream buffer so the impact is accounted for, but no restoration will be done at this location, because it is expected that WDOT will continue to maintain the stream outfall. Mitigation in this area has been moved to upstream, where continued impacts are not expected, and where the riparian buffer could use some enhancement.

Mitigation for all impacts will occur just adjacent to, and nearby the areas where the impact is to occur. There will be a split rail fence in two locations where the trail is within the regulated buffer. The buffer vegetation on the other side of the fence in these areas will be supplemented with native species common to less disturbed areas in the riparian forest. The density of vegetation in those areas just adjacent to the trail will be doubled to assist with limiting human and pet encroachment further into the buffer. The remaining plants will be spread out to supplemental native vegetation within the enhancement buffer in nearby disturbed areas where native vegetation is limited due to past disturbances. No habitat features will be included in the buffer plantings because the riparian forest already supplies a considerable amount of habitat and it is not desired to attract wildlife to the areas near the trails.

There will be a chain link fence along the College Drive road shoulder in the area of the wetland buffer. The P2 stormpipe ditch will be replanted in all areas within the buffer where the pipe is buried and soil and plants are disturbed. BE7 (below the PSE easement) will be reseeded and planted with low woody material because of maintenance restrictions for PSE and Williams gas. The pipeline through the rest of the area will rest above ground and no plantings will be placed for 5-feet on either side of the pipe because of maintenance restrictions. All mitigation areas will be maintained weed-free for a minimum of five years post- all construction.

The acreage for mitigation follows Washington State Department of Ecology Guidelines outlined in Appendix 8F of the Wetlands in Washington State, Volume 2: Guidance for Protecting and managing Wetlands (Granger et al. 2005). The

mitigation ratio recommended for Category 2 wetlands is 4:1 for wetland buffer impacts and 1:1 mitigation for restoration of temporary impacts in-situ.

Mitigation:

Impact Area Name	Name	Acreage (ft2)	Mitigation Type
Trail	BE1	1488	Forest Enhancement Infill
	BE 2	16,792	Forest Enhancement Infill
College Drive	BE3	11,337	Forest Enhancement Infill
	BE4	1,419	Wetland Enhancement Infill
	R1	891	Shrub/grass Restoration
P2 Stormpipe (enhancement in areas added through buffer averaging)	BE5	6,405	Forest Enhancement Infill
	BE6	2,232	Forest Enhancement Infill
	BE7	3,408	Shrub and grass Enhancement Infill
	BE8	3,700	Riparian Enhancement Infill
	R2	2,314	Shrub/grass Restoration

Additionally, 2 overflow culverts will be installed through the trail/logging road at the stream crossing of EF23. Currently water seeps subsurface and pools a small amount to the north of the obstruction. This culvert will allow for freer flow between the north and south wetland lobes during high volume storm events. Fencing, Culvert and Trail specifications will be covered in the trail permit plans.

Specific goals, objectives, and performance standards for the mitigation are:

- 1) Enhancement of Mitigation areas BE1, BE2, BE3, BE5, BE6, BE7, and BE8 and restoration of Mitigation areas R1 and R2 with UPL, FACU and some FAC; BE4 with FAC, FACW, and OBL northwest native species of trees, shrubs and appropriate herbs and ferns to supplement the existing forest vegetation and replace any vegetation lost to historic activities in the area, especially those related to the placement of the logging road, clearing for the utility lines, construction of I90 at the outlet of the drainage for the development to the north. The vegetation added will not include new species, but rather increase the cover and distribution of the existing already diverse species.
- 2) 100% Survival of all planted vegetation by the end of year 1. Survival after year will be replaced by tracking aerial cover to insure the area proceeds to or enhances multi-canopied vegetation communities typical of an undisturbed:
 - Upland forest in the region for areas BE1, BE2, BE3, BE5, BE6
 - Emergent and shrub wetland for BE4

- Shrub and grass community restoration for Areas R1 and R2
 - Riparian enhancement for area BE8
- 3) Maintenance of forested or shrub cover by 2 or more stories of vegetation in all layers (planted and naturally occurring) equivalent to:
- 40 percent by year 2
 - 60 percent by year 3
 - 100 percent by year 5
- 4) Maintenance of native vegetation with not more than 10 percent cover non-native and/or invasive plant cover in any one area in all canopy layers for the full monitoring period.

Monitoring

Monitoring will be carried out by a qualified wetland biologist on years 1, 2, 3, and 5, during the five-year monitoring period and maintenance will be completed twice annually for that period. For Detailed Monitoring Methods, see Appendix B. Maintenance Specifications/directions can be found in Appendix C.

TABLE OF CONTENTS

Project Description	1
Project Location	1
Responsible Parties	1
Existing Conditions on the Annexed Property	2
Topography and soils	2
Hydrology	2
Soils	2
Vegetation	3
Fish and wildlife.....	4
Wetland Ratings.....	5
Functional Assessment of the On-site Wetland	5
Regulatory Requirements.....	6
Mitigation	7
Unavoidable Wetland Buffer Impacts	7
Affected Wetland and Buffer Functions	8
Mitigation Sequencing and Plan Development.....	9
Compensatory Mitigation Overview.....	11
Mitigation Grading Plan	13
Mitigation Area Soils	13
Mitigation Planting Plan	13
Sources of Plant Materials.....	14
Trail	14
Implementation Schedule	14
Construction Management	14
Landscape Maintenance	14
Mitigation Goals, Objectives, and Performance Standards	15
Goals and Objectives	15
Performance Standards	16
Monitoring Plan	17

Contingency Plan	19
Site Protection	20
References	20

The following are found immediately after the reference section:

FIGURES:

- Figure 1: Vicinity Map and Aerial Photograph, WSDOT TDR Receiving Properties Issaquah, Washington.
- Figure 2: WSDOT TDR Receiving Properties, Development pads and Wetlands Inventory.
- Figure 3: WSDOT TDR Receiving Properties, Trails Plan.
- Figure 4: Mountain Bike and Pedestrian Trail, Impact Areas and Enhancement Layout
- Figure 5: College Drive Construction, Impact Areas and Enhancement Layout
- Figure 6: P2 Stormpipe, Impact Areas and Enhancement Layout
- Figure 7: Planting Details, Plant Quantities, Installation instructions

APPENDICES:

- Appendix A Mitigation Type, Area, and Plant Number Calculations
- Appendix B Monitoring Methodology for the Slater Road Site
- Appendix C Maintenance Manual for the WSDOT Receiving Properties Site

WASHDOT TDR RECEIVING PROPERTIES

Buffer Mitigation Plan for Trails, College Drive and P2 Stormpipe impacts

PROJECT DESCRIPTION

The northern portion of the property that is adjacent to development pads at the Issaquah Highlands was evaluated for the presence of wetlands and streams in 2010 (Figures 1 and 2). Four wetlands were identified and delineated in this area, including two large Category II wetlands /riparian corridors previously documented for the Issaquah Highlands EIS as Wetlands EF 20 and EF23, and two very small Category 4 wetlands that are located within the western power line cut (Figure 2). This report covers only EF23 because all proposed impact are limited to this wetland.

There are no proposed wetland impacts for this acquisition. At this point in time, the known proposed development within the parcels will include a 12-foot wide ADA surfaced trail (hiking and bicycle) that will include two small impacts into the buffer of Wetland/riparian area of EF23; buffer encroachment on the northern lobe of EF23 for the construction of College drive, (including the road shoulder); and buffer encroachment on the buffer of EF23 as a result of the construction of the Parcel 2 stormpipe. There are other areas where development parcels include wetlands and their buffer but no other encroachments are proposed at this time (Figure 2). No soil disturbance is expected as a result of this encroachment above what was done historically. The new trail surface will be limited to the existing logging road bed.

PROJECT LOCATION

The WSDOT TDR receiving property is a conservation easement acquired by the King County Department of Natural Resources and Parks (DNRP). The 43.35 acres area to be acquired is parcel No. 2624069032, and is located south of NE Park Drive, east of PSE Easement, west of BPA Easement, (S 26T24 R6) in WRIA 8 and the East Fork Issaquah Creek drainage (Figure 1: Vicinity Map). The Land is currently owned the City of Issaquah.

RESPONSIBLE PARTIES

Applicant and Applicant's Representative:

The project manager is: Keith Niven, AICP
The address is: 1775 – 12th Avenue NW
Issaquah, WA 98027

Wetland Delineation Report Preparer:

On-site delineation
Sarah Spear Cooke for the Issaquah MDRT
4231 NE 110th St
Seattle, WA 98125

206-695-2267

Mitigation Plan Preparer(s):

Off-site mitigation plan
Sarah Cooke (See above)

Party responsible for monitoring, long-term maintenance, and contingency plans:

See Applicant

EXISTING CONDITIONS ON THE ANNEXED PROPERTY

Refer to the Delineation report for additional details

Topography and soils

The site is dominated by a linear ridge running NE by SW with power line cuts on either side. The western power line cut runs northwest by-southeast and the eastern power line cut runs northeast by southwest. The ridge is likely a glacial moraine or glacial terrace that has been partially excavated to the west. The terrace extends east and gently grades down to a flattened plain; the current Grand Ridge Park (Parcel 4, Figure 2). It is unclear if this flattened plain was excavated in earlier development of the Highlands. The central terrace/moraine has been down-cut by a stream channel causing a ravine identified by the stream/wetland that has been delineated in the bottom. The western edge of the terrace/moraine has been graded and cuts steeply to a flattened area underneath and adjacent to the power line cut. The slope is highly erosive and seeps are emerging at the cut face on the power line cut.

Hydrology

This area is in WRIA 8. The local drainage is the East Fork of Issaquah Creek. All surface water flows off this property to the East Fork of Issaquah Creek.

EF 23 is a long linear stream corridor located in a topographical depression eroded through the existing gravels and sands from the glacial deposits existing at the Highlands. It appears to be predominantly groundwater fed, where the creek has eroded into the groundwater-containing layer of the glacial till, with a small amount of local precipitation additions that are added along the way during the rainy season. The southern portion of the wetland system, directly south of the most southerly wetland flags (see Wetland Map, Figure 2), becomes steep and highly incised. It is at this point where it becomes a stream. This stream has been called Lost Creek (Tributary 0814) in the City's stream inventory. Lost Creek continues down hill and merges with the East Fork of Issaquah Creek.

Soils

Soils in the project area (except for the wetlands) are byproducts of the glacial history of the site. The central ridge above Wetland EF23 is a remnant glacial moraine dominated by Everett and Alderwood series gravelly sandy loam soils. The Everett

soils constitute the western half of the site and Alderwood the eastern less steep portion of the site.

The *Alderwood series* (AgC, AGD, AKF on map) are soils that are moderately well drained and found on undulating to hilly soils from 50 to 800 feet in elevation. They are found on glacial moraines and till plains. The parent material is basalt with some volcanic ash in the low grade areas and lacustrine (lake) deposits with a minor amount of volcanic ash in the steeper areas. They have dense, very slowly permeable glacial till at a depth of 20 to 60 inches depending on the slope (shallower on steeper slopes). They are found in areas with a Mean annual precipitation of 25 to 60 inches and a frost-free period of 180 to 220 days. These soils have a weakly consolidated to strongly consolidated substratum at a depth of 24 to 40 inches below ground surface (bgs). In a representative profile of Alderwood gravelly sandy loam, the surface layer and subsoil are very dark brown, dark-brown, and grayish brown (2.5Y 5/2) or (10YR 4/3) gravelly sandy loam to 27 inches bgs. The substratum is grayish-brown (2.5Y 5/2), weakly consolidated to strongly consolidated glacial till that extends to 60 inches bgs or more. The water table is typically at between 18 and 37 inches below ground surface (BGS).

The Alderwood soils to the east of the site are found associated with low grade to level topography. The Alderwood soils found at the bottom of the hill are on a slope of 25 to 70 percent.

The *Everett Series* (EVC, EVD) are soils that are somewhat excessively drained and found on glacial terraces as moraines. Everett soils are gravelly sandy loam to a depth of 18 to 36 inches. They are underlain by very gravelly sand. Slopes are dominantly 0 to 15 percent, but are as steep as 30 percent on terrace fronts. They are found as glacial outwash with volcanic ash in the upper part on glacial moraines and till plains. They are found in areas with a Mean annual precipitation of 30 to 45 inches and a frost-free period of 180 days. These soils have a weakly consolidated to strongly consolidated substratum at a depth of 24 to 40 inches below ground surface (bgs). In a representative profile of Everett gravelly sandy loam, the surface layer (0 to 17 inches BGS) and subsoil are very dark brown, dark-brown, and grayish brown (2.5Y 5/2) or (10YR 4/3) gravelly sandy loam to 32 inches bgs. The substratum is grayish-brown (2.5Y 5/2), very gravelly coarse sand that extends to 60 inches bgs or more. The water table is typically at 80 inches below ground surface (BGS).

The Everett soils to the west of the site found in low grade 5 to 15% topography. Those found down the center of the site are on the ravine/stream channel slope are on 15 to 30 % slopes.

The wetland soils that are actually found in the wetlands are not mapped on the NRCS map but will be described in Section 3 below.

Vegetation

The overall site is situated in the predominantly undeveloped forested portion of the Issaquah Highlands in the south-west corner, south of North Park Drive (Figure 1). The area to the north of Parcel 4 and Tract H, C and B, abuts cleared area for development and dead ends of 14th Place, 15th Avenue, 16th Avenue, and 16th Lane

(Figure 2). The western portion has been partially mown and graded and a power line with metal towers (tracts A and E) runs north to south through the area. The vegetation in this area is mostly grasses intermixed with forbs and woody weedy shrubs, including many weeds (tansy, thistle, Queen Anne's lace, bird's foot trefoil, scotch broom, butterfly bush), with patches of blackberries and reed canary grass and sedges in the area where seeps emerge next to the edge of Parcel 2, there is a linear seep sedge and grass-dominated wetland (Wetland D) and a clump of salmonberry (wetland A). The power line cut borders on a second growth Douglas fir/western hemlock forest to the west (parcel 1). This area is intermixed with western red cedar, with an understory of sword fern, indian plum and some salmonberry and blackberry. This forest continues to a cleared edge well beyond Parcel 1 to the edge of Section 26. Parcel 1 cut this forest in half.

The central forest is dominated by the same community. The forest is older second growth with some remaining older Douglas fir trees that would be over the 60 years old required to call them mature. The forest also contains red alder, big leaf maple, black cottonwood, grand fir, cascara, and some bitter cherry and western white pine in addition to the western red cedar and western hemlock mentioned above. The understory is dominated by dense Himalayan blackberry near the cleared margins and salal, sword fern, trailing blackberry and Oregon grape in the older forested sections margins away from the stream.

The stream corridor (EF 23) is more diverse with an occasional sitka spruce and Scouler willow in tree form along the stream and vine maple, beaked hazelnut, Indian plum, red huckleberry, red elderberry, snowberry, thimbleberry, blackcap raspberry, and evergreen huckleberry on the upper margins and salmonberry, devil's club, black twinberry, nootka rose, hardhack spirea, prickly currant, and red osier dogwood next to, and within the wetland, continuous with the stream. There are many old and very large cedar and Douglas fir logs crossing the stream channel. Skunk cabbage is also very common within the wetland/stream channel in areas where water pools or where the soils are saturated with no spring or summer inundation, and thicker black peat soils have accumulated. There are emergent (PEM: sedge and grass dominated) vegetation classes throughout the wetland corridor, but especially at the southern and northern ends of the wetland portion of the corridor.

The cleared linear feature on the aerial is another utility line that borders the eastern edge of the proposed annexation area. This area was also not investigated for this work. It appears on the aerial to be dominated by grasses and forbs.

Fish and wildlife

No official wildlife censuses were performed for this work. Casual observations during wetland field work included tracks, scat, skulls, and actual sightings or for the birds, noting their song. The following wildlife were noted:

Vertebrates: black bear (scat), Columbia black tail deer (scat), European rabbit (scat), vole (*Microtus*)-dead specimen, eastern gray squirrel, skunk (smelled), raccoon (neighbors told me they see them often).

Reptile and amphibians: Garter snakes, northwestern salamander, long-toed

salamander, *Ensatina*, western redback salamander, and Pacific tree frog (Pacific chorus frog).

Birds: red-tailed hawk, winter wren, Bewirck's wren, robin, common flicker, Steller's jay, northwestern crow, song sparrow.

This would only constitute a sub-list of what is probably present in this area.

The Fish Atlas of Washington lists the southern reach of EF23 (Lost Creek) not far from where it enters the East Fork of Issaquah Creek as possibly having Chinook, coho and sockeye. These would not travel up into the project area. The slope is too steep and the water too intermittent to get up there.

Wetland Ratings

Wetland EF23 (Wetland B) is a highly diverse riverine and slope wetland that is relatively undisturbed but directly adjacent to development so the opportunity to provide water quality and hydrology functions is high. The small size, narrowness of the wetland and dense canopy coverage worked against its ability to score as a Category I wetland. The wetland was only assessed for the portion that was wetland before the terrain became very steep and the water incised a channel so that there was no longer any associated wetland. At this point the wetland becomes Lost Creek Trib 0184 of the East Fork of Issaquah Creek. Any new characteristics that could affect the rating were not evaluated past this point and so this rating could change at a later date when the entire corridor is evaluated. Wetland EF20 is perhaps more diverse from a habitat perspective but lacks the opportunity to provide water quality function and so scored a Category II rating. This wetland was only evaluated for the northern third and again, the wetland rating may not be accurate and could change at a later date when the entire corridor is evaluated. The wetland also disappears and the channel becomes incised as the terrain becomes steep. At this point the wetland becomes Trib 0183A of the East Fork of Issaquah Creek.

Functional Assessment of the On-site Wetland

EF23 (wetland B)'s functional performance is moderate for the potential to remove nutrients and sediment and low/moderate for removal of heavy metals and toxic organics (future potential for these to enter the wetland and the correct soils and vegetation to remove them should there ever be a source to this wetland/riparian system). There is moderate high for reducing peak flows downstream and reducing downstream erosion (because of the ability to store the small amount of precipitation from this small basin size). The potential for groundwater recharge is very low since the wetland is predominantly groundwater fed, (with some precipitation). Habitat suitability overall is moderate/high and suitability for small mammals, birds and invertebrates is moderate. The forested nature of the site and lack of permanent standing water except in an area dominated by a woody shrubs to the south, means there is very little habitat for amphibians except for those not needing water to breed and live. There is a moderate-high habitat for native plants and high potential for export of organics to downstream receiving waters.

Function	Wetland EF23
Potential for Removing Sediment	0.6
Potential for Removing Nutrients	0.6
Potential Removing Heavy Metals & Toxic Organics	0.4
Potential for reducing Peak Flows	0.7
Potential for reducing Downstream Erosion	0.8
Potential for Groundwater Recharge	0.2
General Habitat Suitability	0.7
Habitat Suitability for Invertebrates	0.6
Habitat Suitability for Amphibians	0.1
Habitat Suitability for Birds	0.5
Habitat Suitability for Aquatic Mammals	0.5
Habitat for Native Plant Communities	0.6
Habitat for Production and Export	0.7

The proposed trail system connecting the development areas of the Highlands to the east with the pond feature and commercial area along Highlands Drive is shown in Figure 3. The trail location will occur where there is historic fill. This area has already been filled and therefore having a trail in this location would not cause any additional impact to the wetland. Two 5-foot culverts should be placed under the fill connecting the northern lobe of the wetland with the southern lobe of EF23, so that a hydrologic connection is re-established. It was observed that the northern portion of the wetland is drier than it was historically. This was likely caused when the area to the north was developed decreasing the groundwater supply to this area. It would be advantageous for the wetland if more water were allowed to be directed into the stream channel from the northern end or at any point south of this area. Roof runoff from the development to the north would be a good addition to the stream. This proposal should be evaluated for feasibility and the amount of water available should be modeled. The distribution points and location should also be determined. Lateral spreaders located within a vegetated buffer at least 25 feet from the wetland edge might be a good option. The drier areas south of any topographic highs should also be given priorities for these additional inputs.

REGULATORY REQUIREMENTS

Buffers were established as part of the original development agreement for the Issaquah Highlands only for Category II wetlands (Grand Ridge Annexation and Development Agreement (2-Party), June 1996). The agreement identified a 100-foot

wide buffer on all Category II wetlands. This requirement would apply to Wetland EF23 in City holdings while a 125 foot buffer would apply in King County jurisdiction.

MITIGATION

This section of the report addresses the mitigation approach, mitigation site selection, type of mitigation and mitigation ratios, the proposed mitigation plan, and the mechanisms to protect the mitigation site over the long term.

Unavoidable Wetland Buffer Impacts

There are no proposed wetland or stream impacts for this acquisition except for the “paper fill” at the outfall of the P2 stormpipe in an area already impacted by WSDOT identified below.

Trails: (Figure 4)

Trails are an important feature of the Highlands development. An integrated trail and non-vehicular system already exists throughout the Highlands and it was determined early on in the annexation process that the trail system would be expanded into this new area to connect the Highlands with the King County regional trails system. This trail was also part of the SEPA mitigation tied to the development of the adjacent property. At this point in time, the known proposed development within the parcels will include a 12-foot wide paved surfaced trail (hiking and bicycle) that will include two small impacts into the buffer of Wetland/riparian area of EF23.

Trails Impacts

- **Buffer Impact Area 1 (BI1) includes a 372 ft² permanent impact** (12 feet wide by ~31 feet long) into the outer edge of the fully vegetated forested 100-foot buffer.
- **Buffer Impact Area 2 (BI2) includes a 4,198 ft² permanent impact** through encroachment through the buffer to cross an area between two wetland lobes, where an historic logging road has already been filled across the area.

The buffer functions along this road are already very limited due to past clearing and grading.

College Drive: (Figure 5)

College Drive road development involves a buffer encroachment at the northern end of the project near to the Highlands development of Division 17, south of NE Hawthorne Street. The development was installed years ago prior to the current development plan, based on the David Evans Delineations of the early 1990's. It turns out wetland EF 23 extends further north than previously identified. The extension of College Drive therefore cuts significantly through the buffer of Wetland EF23.

College Drive Impacts

The total buffer impact, including the temporary extent of clearing for road construction is 4080 ft² with:

- **Buffer Impact Areas 3 and 4 (BI3, BI4) includes 3189 ft² permanent impact** and
- **Buffer Impact Area 4 (BI4) includes 891 ft² temporary impact** (that will be restored with double the normal density of native shrub and herb plantings adjacent to the road shoulder. A chain link fence will be installed along the road edge to further protect the wetland.

The P2 pipeline: (Figure 6)

The P2 pipeline is a stormwater pipe that conveys stormwater from Parcel 2 to the outfall of EF23/Lost Creek, through a conservation easement and steep slope (Figure 6). The pipe would be trenched through a portion of the EF23 buffer, and laid on top of the soil through the PSE easement and down the hill to the outfall). The footprint of impact would be restored with shrubs and grasses where the pipe is being trenched and mitigation will be done through buffer averaging, where the buffer has increased in width over the required 125 feet and this new area will be enhanced with additional plantings. The alignment will be placed to avoid major trees. The impact area will be restored in low shrubs and grasses in the PSE easement areas.

The P2 pipeline Impacts

- **Buffer Impact/Restoration Area 2 (BI5, R2) includes a 2,314 ft²** (20 feet wide by ~117 feet long) outside of the PSE easement, and
- **Buffer Impact Area 6 (BI6) 3,686 ft²** (20 feet wide by ~184 feet long) within the PSE easement, and
- **Buffer Impact Area 7 (BI7) includes small 925 ft²** at the outfall where the pipe will discharge into a level spreader in the vicinity of Lost Creek at the bottom of the hill. The final location of this will be determined by the engineer with input from the biologist so as to minimize any direct erosive discharge into the creek.

Affected Wetland and Buffer Functions

There are no anticipated wetland functional losses as a result of these three proposed projects.

Buffer function impacts due to the trail along the logging road, the site of the new proposed trail are already very limited due to clearing and grading in the past. Other than some sapling red alder, there is little to no vegetation along this alignment. There are a few ferns and an occasional vine maple and osoberry, in the area just adjacent that will be impacted during the trail installation. These areas will be replanted once the trail is installed. Fencing the edge of the trail in the area through the EF23 buffer and infill planting through portions of the buffer nearby to the trail will enhance the vegetation communities and wildlife habitat value of the buffer trough these areas, especially in areas where historic clearing has occurred, or on forested margins of nearby parcels and the PSE easement where weeds, especially blackberry, have encroached. Buffer plantings will be used to restore multi-canopied forested conditions in these areas.

Additional buffer impacts due to the installation of College drive will be marginal. This area has already been impacted during the construction of the development to the north. The road shoulder will be restored in native shrubs and the road footprint in the buffer will now be mitigated through infill planting in the remaining buffer adjacent to the road edge and in the wetland directly to the south of the road edge will greatly enhance the condition of these areas over what currently exists because of the historic impacts. This northern lobe of the wetland is currently predominantly composed of red canarygrass. This area will be enhanced through some additions of groundwater and through the removal of the reed canarygrass and planting of native wetland emergent and shrubs (See Figure 7 planting details).

The P2 stormpipe will be installed through EF23 buffer areas where the ongoing maintenance through the power and gas line easements have already cleared much of the native vegetation. These areas are already vegetated in seeded non-native grasses and weeds. Restoration of the pipeline impact footprint through the EF23 buffer area outside of the easement and enhancement planting of area adjacent to the pipeline within the easement of the EF23 buffer, with native and naturalized grasses and low lying shrubs will certainly improve buffer conditions over what is currently present in these areas.

Mitigation Sequencing and Plan Development

The proposed plan is designed to mitigate buffer impacts by following mitigation guidance in *Wetland Mitigation in Washington State, Part I* (Ecology et al. 2006) by first avoiding and minimizing impacts and then compensating for unavoidable impacts. A brief summary of this sequencing is provided below:

- **Avoidance:** The trail alignment avoided any wetland impacts by utilizing the old logging road bed to cross the wetland/riparian system EF23. College Drive avoided wetland impacts by staying north of the wetland, and the P2 pipeline alignment was planned to stay out of EF 23 and Lost Creek except for the outfall where the area has already been and will continue to be graded by the Wa State Department of Transportation.
- **Minimization:** Construction equipment will be kept out of the wetlands and will be limited to the extent possible to the 12-foot wide trail footprint, the road shoulder and the 20-foot pipeline footprint to minimize impacts. Fencing will be hand-installed using fence post diggers and any areas outside the trail/fence will be planted with the plants listed in the mitigation plan (Appendix A, Figure 7).
- **Compensation:** Unavoidable impacts listed above will be compensated for in two areas that will be restored after trail and pipeline installation and eight adjacent Enhancement mitigation areas. No on-the-ground wetland impacts will occur. Impact area BI7 has been already impacted by ongoing maintenance by the Washington State Department of Transportation.

Mitigation for all impacts will occur just adjacent to, and nearby the areas where the impact is to occur. There will be a split rail fence in two locations where the

trail is within the regulated buffer. The buffer vegetation on the other side of the fence in these areas will be supplemented with native species common to less disturbed areas in the riparian forest. The density of vegetation in those areas just adjacent to the trail will be doubled to assist with limiting human and pet encroachment further into the buffer. The remaining plants will be spread out to supplemental native vegetation within the enhancement buffer in nearby disturbed areas where native vegetation is limited due to past disturbances. No habitat features will be included in the buffer plantings because the riparian forest already supplies a considerable amount of habitat and it is not desired to attract wildlife to the areas near the trails.

There will be a chain link fence along the College Drive road shoulder in the area of the wetland buffer. The P2 stormpipe ditch will be replanted in all areas within the buffer where the pipe is buried and soil and plants are disturbed. BE7 (below the PSE easement) will be reseeded and planted with low woody material because of maintenance restrictions for PSE and Williams gas. The pipeline through the rest of the area will rest above ground and no plantings will be done in the vicinity of the pipeline because of maintenance restrictions. All mitigation areas will be maintained weed-free for a minimum of five years post-construction (road, trail, and stormpipe).

The acreage for mitigation follows Washington State Department of Ecology Guidelines outlined in Appendix 8F of the Wetlands in Washington State, Volume 2: Guidance for Protecting and managing Wetlands (Granger et al. 2005). The mitigation ratio recommended for Category 2 wetlands is 4:1 for wetland buffer impacts and 1:1 mitigation for restoration of temporary impacts in-situ.

Mitigation:

Impact area	Name	Acreage (ft2)	Mitigation type
Trail	BE1	1488	Forest Enhancement infill
	BE 2	16,792	Forest Enhancement infill
College Drive	BE3	11,337	Forest Enhancement infill
	BE4	1,419	Wetland Enhancement infill
	R1	891	Shrub/grass Restoration
P2 Stormpipe (enhancement in areas added through buffer averaging)	BE5	6,405	Forest Enhancement infill
	BE6	2,232	Forest Enhancement infill
	BE7	3,408	Shrub and grass Enhancement infill
	BE8	3,700	Riparian enhancement infill
	R2	2,314	Shrub/grass Restoration

Additionally, 2 overflow culverts will be installed through the trail/logging road at the stream crossing of EF23. Currently water seeps subsurface and pools a small amount to the north of the obstruction. This culvert will allow for freer flow during high volume storm events between the north and south wetland lobes. Fencing, Culvert and Trail specifications will be covered in the trail permit plans.

Compensatory Mitigation Overview

Mitigation ratios follow the guidelines developed by the Washington State Department of Ecology in their 2005 "Wetlands in Washington State - Volume 2: Guidance for Protecting and Managing Wetlands". These are based on compensation type, wetland rating, and wetland community type. Ratios provided are 1:4 for buffer enhancement for the CAT II wetland buffer that is being impacted.

Trail

The project will result in a total of 4570 ft² of buffer impact to two areas within the 100-foot buffer as a result of installing an ADA surfaced hiking/biking trail. Vegetation community enhancement and subsequent wildlife and habitat functions is being replaced just adjacent to the trail through infill enhancement planting of PNW native tree, shrub and appropriate herb and fern to 18,280 ft² of the directly adjacent buffer (Enhancement Areas BE1 and BE2; Figure 4). It is the intent of the design to increase the structural stability and to restore habitat typical of Pacific Northwest forested buffer communities in areas adjacent to the trail that have been previously disturbed. This plan proposes to enhance the diverse, native, multi-canopy forested, buffer vegetation in this area.

There will also be a fence in both these locations where the trail is within the regulated 100-foot buffer. The density of vegetation in those areas just adjacent to the trail will be doubled to assist with limiting human and pet encroachment further into the buffer. The remaining plants will be spread out to supplemental native vegetation within the 100-foot buffer in nearby disturbed areas where native vegetation is limited due to past disturbances. No habitat features will be included in the buffer plantings because the riparian forest already supplies a considerable amount of habitat and it is not desired to attract wildlife to the areas near the trails. Plants to be installed will be placed by the restoration ecologist and installed by an installation contractor. **A total of 116 trees, 936 shrubs, and 914 ferns/groundcover plants are specified in 18,280 SF.** These are plants that are already found within the forested area of EF23. There is sufficient diversity that there is no need to further augment species diversity. For a detailed breakdown by area see Appendix A.

Additionally, it is proposed to drill two 12-inch wide culverts through the trail/logging road at the stream crossing of EF23, to provide for a surface reconnection of the stream corridor through this area. Currently water seeps subsurface and pools a small amount to the north of the obstruction. Fencing, culvert and trail specifications will be covered in a supplemental engineering report.

College Drive

The project will result in a total of 4080 ft² of buffer impact (3189 ft² permanent impact, 891 ft² temporary impact) to two areas within the 100-foot buffer as a result of installing the road bed and shoulders (Figure 5). Vegetation community enhancement is being replaced south of the road through restoration of 891 feet (Restoration Area R1) of buffer area directly adjacent to the road shoulder (that will be cleared as part of the construction and infill enhancement planting of PNW native tree, shrub and appropriate herb and fern to 12,756 ft² of the directly adjacent wetland 9Enhancement Area BE4) and buffer (Enhancement Area BE3), (Figure 5). It is the intent of the design to increase the structural stability and to restore habitat typical of Pacific Northwest emergent and scrub shrub wetland and forested buffer communities in areas adjacent to the road that have been historically disturbed. This plan proposes to enhance the diverse, native, multi-canopy forested in the buffer vegetation in this area.

A chain link fence will be installed along the road edge to further protect the wetland. The density of vegetation in the restoration area directly adjacent to the road shoulder will be doubled to assist with limiting human and pet encroachment further into the buffer. The remaining plants will be spread out to supplemental native vegetation within the 100-foot buffer in nearby disturbed areas where native vegetation is limited due to past disturbances. No habitat features will be included in the buffer plantings because the riparian forest already supplies a considerable amount of habitat and it is not desired to attract wildlife to the areas near the trails. Plants to be installed will be placed by the restoration ecologist and installed by an installation contractor. **A total of 73 trees, 722 shrubs, 656 ferns/groundcover, and 213 emergent plugs are specified in 12,756 SF.** These are plants that are already found within the forested area of EF23. There is sufficient diversity that there is no need to further augment species diversity. For a detailed breakdown by area see Appendix A.

P2 Stormpipe

The project will result in a total of 6925 ft² of buffer impact (2314 ft² temporary impact and 4611 ft² of permanent impact) to two areas within the 125-foot buffer as a result of installing the stormpipe that conveys stormwater from parcel 2 to the outfall of Lost Creek near I90 (Figure 6). Vegetation community enhancement is being replaced at the western impact area near the project start through restoration of 2314 ft² feet of buffer area that will be trenched, have pipe installed and then have 12 inches of fill over the top (Restoration Area R2). The actual pipe footprint portion of the 20-foot wide disturbance footprint will only be planted with native ferns, grass seed mix, and shallow woody groundcover. The rest of the 20-foot footprint will be restored by planting shrubs. The pipeline will rest on top of the soil for the rest of the alignment, down to the outfall. The outfall is within an area that has recently been excavated and cleared by the Washington State Department of Transportation. The cleared area is partially within the old intermittent stream alignment. The pipeline outfall is still within the theoretical stream buffer so the impact is accounted for, but no restoration will be done at this location, because it is expected that WDOT will continue to maintain the stream outfall. Mitigation in this area has been moved to upstream,

where continued impacts are not expected, and where the riparian buffer could use some enhancement. The mitigation for the pipeline will be enhancement of buffer area added through buffer averaging with trees and shrubs outside of the PSE easement (Enhancement Areas BE5, BE6), and with shrubs and grasses within the PSE easement (Enhancement Area BE7).

It is the intent of the design to increase the structural stability and to restore habitat typical of Pacific Northwest emergent and scrub shrub wetland and forested buffer communities in areas adjacent to the road that have been historically disturbed. This plan proposes to enhance the diverse, native, multi-canopy forested in the buffer vegetation in this area. Within the larger buffer areas (BE5) plants will be spread out to supplemental native vegetation within the 125-foot buffer in nearby disturbed areas where native vegetation is limited due to past disturbances. No habitat features will be included in the buffer plantings because the riparian forest already supplies a considerable amount of habitat and it is not desired to attract wildlife to the areas near the trails. Plants to be installed will be placed by the restoration ecologist and installed by an installation contractor. **A total of 70 trees, 1046 shrubs, 432 ferns/groundcover are specified for this plan in 15,745 SF.** These are plants that are already found within the forested area of EF23. There is sufficient diversity that there is no need to further augment species diversity. For a detailed breakdown by area see Appendix A.

Mitigation Grading Plan

Grading details are included with the engineering plans for each of the three projects proposed. Natural grades will be maintained to every extent possible, natural grades will be reestablished after trenching for the pipeline. Tree removal will be minimized.

Mitigation Area Soils

Soils on site include typical upland well-drained glacial soils with intact forest duff in most areas. It is anticipated that a slow-release fertilizer and hydrated DRYWATER™ will be added to the soil of each planting pit and that the planting ring will be mulched post-installation.

Mitigation Planting Plan

All Forested buffer enhancement areas will be augmented with native trees, shrubs, and ferns and they will be installed within the mosaic of upland forest, shrub, and groundcover/fern (Appendix A, Figures 4, 5, 6, Details on Figure 7) to enhance the disturbed diverse and forested buffer areas along the proposed trail, road edge, and pipeline route (outside of the PSE easement) associated buffer through the EF23 corridor. The list includes trees, shrubs, ferns, and groundcovers designed to enhance disturbed areas and restore pre-disturbance forested multi-canopy conditions.

Plantings will be located in the field by the mitigation designer and installed by professional plant installation contractors.

Sources of Plant Materials

Plants will be purchased or grown from native stock originating from the Puget Sound region, preferable from King, Snohomish, and Pierce Counties. The as-built plans will document any substitutions by mitigation area that were made as a result of inability to obtain materials. Before any substitutions whatsoever are made, the project biologist must approve the substitutions.

The planting sequence will occur at the same time, during the November to February time period if bare root material is to be used. Conditions of the material include bare root and seedlings. ***Container stock (1-gallon minimum) must be used if the planting is delayed and occurs in the spring (March through mid-May).***

Trail

Details about the trail construction and erosion protection will be included in a separate engineering report.

Implementation Schedule

Implementation of the mitigation plan will commence once the City has allocated necessary funds for the project and the permits have been issued by the County. It is anticipated that the planting will occur after the trail and road and pipeline are constructed (by the beginning of October 2011) and the fencing has been installed. The current schedule is to obtain the permits during the summer of 2011 and to install the trail system and fencing, in the late summer/early fall. The plantings would then be installed during the winter of 2012.

Construction Management

The trail, road and pipeline construction and fence installation will be overseen by the City staff and the construction contractor. **The project ecologist needs to be present on site during the delivery, placement and initial the planting of nursery stock.** In addition, it is important for the project ecologist to approve the final installation.

Landscape Maintenance

The objective of the mitigation design is to restore temporary impacts and enhance all areas adjacent to the trail, road, and pipeline to look and function like natural, high-quality forested buffer typical of other areas of the EF23 corridor that have not been disturbed.

All weedy species will either be graded out during the grading phase, or hand-weeded just prior to planting. Continued weed removal will occur twice yearly as laid out in Appendix C, Buffer Maintenance Plan.

The maintenance that would be required once the buffer enhancement area has been planted is removal of newly germinated and/or sprouted rootstock of weedy

species and thinning of quickly growing naturalized species of red alder. Exotic and invasive species should be hand-weeded from the newly planted areas for the five years after installation. The species currently identified in the mitigation enhancement area are:

- Himalayan blackberry (*Rubus procerus*)
- Butterfly bush (*Buddleia davidii*)
- Bird's-foot trefoil (*Lotus corniculatus*)
- Bracken fern (*Pteridium aquilinum*)
- bull and Canada thistle (*Cirsium vulgare* and *C. arvense*)
- tansy ragwort (*Senecio jacobea*)
- bindweed (*Calystegia sepium*, and *Convolvulus arvensis*)
- holly (*Ilex aquifolia*)
- Any other daisy-like weed including dandelions, thistles, knapweeds, daisies, chicory, hawksbeard, crupina, camphorweed, hawkweeds, catsear, wild lettuce, nipplewort, and pineappleweed

The extent of weed infestation will be monitored in the spring and summer as part of the monitoring plan. Weed removal will occur in May, and early August with a final weeding in September (as needed) for all five years that monitoring is required. Weeding will include the edge of the trail by the fencing to be sure that no weeds from this area spread into the enhancement area. Any trees or shrubs that die over time will be left in place to provide additional wildlife habitat.

MITIGATION GOALS, OBJECTIVES, AND PERFORMANCE STANDARDS

Goals and Objectives

Specific goals, objectives, and performance standards for the mitigation are:

1. Enhancement of Mitigation areas BE1, BE2, BE3, BE5, BE6, BE7, and BE8 and restoration of Mitigation areas R1 and R2 with UPL, FACU and some FAC; BE4 with FAC, FACW, and OBL northwest native species of trees, shrubs and appropriate herbs and ferns to supplement the existing forest vegetation and replace any vegetation lost to historic activities in the area, especially those related to the placement of the logging road, clearing for the utility lines, construction of I90 at the outlet of the drainage for the development to the north. The vegetation added will not include new species, but rather increase the cover and distribution of the existing already diverse species.
2. 100% Survival of all planted vegetation by the end of year 1. Survival after year will be replaced by tracking aerial cover to insure the area proceeds to or enhances multi-canopied vegetation communities typical of an undisturbed:

- Upland forest in the region for areas BE1, BE2, BE3, BE5, BE6
 - Emergent and shrub wetland for BE4
 - Shrub and grass community restoration for Areas R1 and R2
 - Riparian enhancement for area BE8
3. Maintenance of forested or shrub cover by 2 or more stories of vegetation in all layers (planted and naturally occurring) equivalent to:
- 40 percent by year 2
 - 60 percent by year 3
 - 100 percent by year 5
4. Maintenance of native vegetation with not more than 10 percent cover non-native and/or invasive plant cover in any one area in all canopy layers for the full monitoring period.

Performance Standards

GOAL and OBJECTIVE #1: Enhancement of Mitigation areas BE1, BE2, BE3, BE5, BE6, BE7, and BE8 and restoration of Mitigation areas R1 and R2 with UPL, FACU and some FAC; BE4 with FAC, FACW, and OBL northwest native species of trees, shrubs and appropriate herbs and ferns to supplement the existing forest vegetation and replace any vegetation lost to historic activities in the area, especially those related to the placement of the logging road, clearing for the utility lines, construction of I90 at the outlet of the drainage for the development to the north. The vegetation added will not include new species, but rather increase the cover and distribution of the existing already diverse species.

Performance Standard 1: Enhance/Restore through planting by:

BE1	1488 SF	Forest Enhancement infill
BE 2	16,792 SF	Forest Enhancement infill
BE3	11,337 SF	Forest Enhancement infill
BE4	1,419 SF	Wetland Enhancement infill
R1	891 SF	Shrub/grass Restoration
BE5	6,405 SF	Forest Enhancement infill
BE6	2,232 SF	Forest Enhancement infill
BE7	3,408 SF	Shrub and grass Enhancement infill
BE8	3,700 SF	Riparian Enhancement infill
R2	2,314 SF	Shrub/grass Restoration

GOAL and OBJECTIVE #2 100% Survival of all planted vegetation by the end of year 1.

Performance Standard 2: 100% Survival of all planted vegetation by the end of year 1. Perform a survival study and replace all plants that have died so that there are the same number of plants by December as were installed the pervious year.

GOAL and OBJECTIVE #3: Maintenance of forested cover by 2 or more stories of vegetation.

Performance Standard 3: Survival after year 1 will be replaced by tracking aerial cover to insure the area proceeds to or enhances multi-canopied vegetation communities typical of an undisturbed:

- Upland forest in the region for areas BE1, BE2, BE3, BE5, BE6
- Emergent and shrub wetland for BE4
- Shrub and grass community restoration for Areas R1 and R2
- Riparian enhancement for area BE8

Aerial cover in all layers (planted and naturally occurring)

Must be: (excluding invasive plants)

- 40 percent by year 2
- 60 percent by year 3
- 100 percent by year 5.

GOAL and OBJECTIVE #4: Maintenance of native vegetation with not more than 10 percent cover non-native and/or invasive plant cover in any one area in all canopy layers for the full monitoring period.

Performance Standard 4: Weed cover will not exceed 10 percent total all species in in any one area in all canopy layers for the full monitoring period.

MONITORING PLAN

Monitoring during plant installation would be conducted by the project biologist responsible for wetland design. A one-year maintenance period would require the landscape contractor to care for new plantings and replant all dead plants one year after installation would be required (see PS2).

Mitigation monitoring would be conducted after construction of the trail and planting of the enhancement mitigation areas; the exact timing will be negotiated with King County. Monitoring would occur in April for weed census and August when plantings have achieved their maximum growth for that growing season. Monitoring would employ quadrate and transect sampling techniques to determine plant species vigor, percent survivorship of plantings, percent coverage of the mitigation areas in native and weed species. Post-construction mitigation monitoring would be conducted by a qualified wetland ecologist.

Monitoring will consist of field observation and documentation of site conditions in the buffer enhancement areas. Mitigation areas are proposed to be monitored for a period of 5 years on years 1, 2, 3, and 5, or until the mitigation area meets the performance standards for Year 5.

Monitoring Methods shall include the following to track the identified performance standards:

Standard Assessed	Monitoring methodology	Currency	Date Standard met
PS 1:	Oversee the installation of all plantings and sign off on the installation technique, including soil amendments and mulch installation.	Trail: 116 trees, 936 shrubs, & 914 groundcovers planted in 18,280 SF College Dr: 73 trees, 722 shrubs, 213 emergent, 656 ferns/groundcover plugs in 12,756 SF P2 Pipeline: 70 trees, 1046 shrubs, & 432 ground covers in 15,745 SF	August of the first year after installation
PS2:	Perform a survival study and replace all plants that have died so that there are the same number of plants by December as were installed the pervious year.	# of dead plants counted and replaced	December of the first year after installation
PS 3:	Aerial cover by species, plant vigor, and mortality. <u>in all layers</u> (planted and naturally occurring) will be evaluated using 5-meter (~16-ft.) plots for shrubs and 10-meter (~33 ft.) for mature tree dominated plots	Percent cover in all canopy layers (plotted so changes can be tracked by year)	August years 1,2,3 and 5
PS4:	Aerial cover by species, plant vigor, and mortality. <u>in all layers</u> will be evaluated	Percent total aerial cover invasive species	August years 1,2,3 and 5

Weed Assessments: A spring site visit will be conducted in the spring between April 1 and 30 to assess general site and invasive species conditions. If necessary, the project owner will take immediate steps to address invasive species as recommended by the monitoring biologist. A second site visit will be conducted in the late growing season between July 20 and August 15.

Photo Stations: During all monitoring years, photographs will be taken annually at each photo station, and in the same direction(s) at each photo station, to provide clear visual documentation of mitigation conditions and the progress of the mitigation success. Photographs for each year will be provided in each monitoring report. Photo station will provide adequate coverage of each area. The final number of stations will be detailed in the baseline monitoring report. There would be at least two photo stations for each of the ten mitigation areas.

Monitoring reports will be prepared each year in compliance with the County's requirements and will document site conditions and success in meeting performance standards. If performance standards are not met, contingency plans will also be included in the monitoring report. The annual reports will be submitted to the County no later than November 30th each year. All weed memos will be sent to the maintenance contractors not more than 2 weeks after the weed site assessments have been completed (April 30 and August 15-20th).

Contingency Plan

It is important to have a contingency plan in effect should it become apparent through monitoring that the objectives of the buffer enhancement plan are not being met. All contingencies cannot be anticipated; thus, the contingency plan should be flexible so that modifications can be made to the original plan if it is clear that portions of the original design do not produce the desired results. Any problems or potential problems should be evaluated by the project biologist as well as the owner and agencies involved. The contingency plan should be developed based on all recommendations that are scientifically and economically feasible. The City will be responsible for developing contingencies and implementing them.

Contingencies could include such things as including irrigation if plantings are not installed between November and February, or if it is a particularly hot May or June and the plantings are showing drought stress. Installation of mulch to help impede water loss.

If mortality does occur, the project biologist should determine the likely cause for the mortality (nursery stock, poor installation technique, herbivory, drought stress) and decide which plants should be used as replacements.

Based on the monitoring sampling plan outlined above, if survival of plantings falls below the 100 percent standard recommended for the first year, all plants that die will be replaced. Additionally, if the survival of the plants falls below the 80 percent standard (or consists of less than 50 percent cover) in the first three years, the dead plant material will be removed and replanted to the original restored wetland

specifications. The planted areas must be 80 percent vegetated, but by not more than 10 percent exotic invasive species by the end of the fifth year of monitoring, or additional planting must be done and/or invasive species removed by the maintenance activities suggested above. Other contingency measures will be adopted in accordance with Whatcom County's Critical Areas Ordinance (2005).

If there is a significant problem with the mitigation achieving the performance standards specified for any given year, the cause of the problem will be determined and a contingency plan will be developed. The County will be informed of proposed contingency plans, which can include but are not limited to: additional plant installation, substitution of a plant species more suited to site conditions, increased management of invasive and/or competitive species, and herbivory protection. Contingency measures will be implemented during the particular year that they are formulated, but not before agreement with the County has been obtained.

Site Protection

Typically, filter fabric fencing will be installed prior to any grading or construction activities in or adjacent to the wetlands. All existing on-site wetlands/streams will be protected by installation of erosion control measures along the edge where the trail will cross, adjacent to the southern road edge, or the wetland side of the pipeline. This will occur during any construction activities. Details and specifications can be found in the engineering drawings. Fencing should be buried in a shallow trench to prevent silt-laden material from flowing under the fence (Washington State Department of Ecology 1992). The fence should be checked periodically during construction to ensure that the material is in good condition and that the bottom edge stays buried.

All trail installation operations will be scheduled during dry weather to avoid erosion problems.

The proposed length of time for mitigation compliance will be determined in the final mitigation plan. This would allow planted species to become established and increase in size. If performance standards are met, mitigation plants are healthy and vigorous, the mitigation areas meet the appropriate criteria, and the functions have achieved the same or better performance as the original wetlands, the wetland mitigation would be judged successful.

Permanent Native Growth Protection Area (NGPA) signs will be posted every 100 feet along buffer/public area interfaces once the mitigation is installed.

Protection of the mitigation site will occur as a result of the in-place conservation easement and general obligations of the property owner.

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Figures

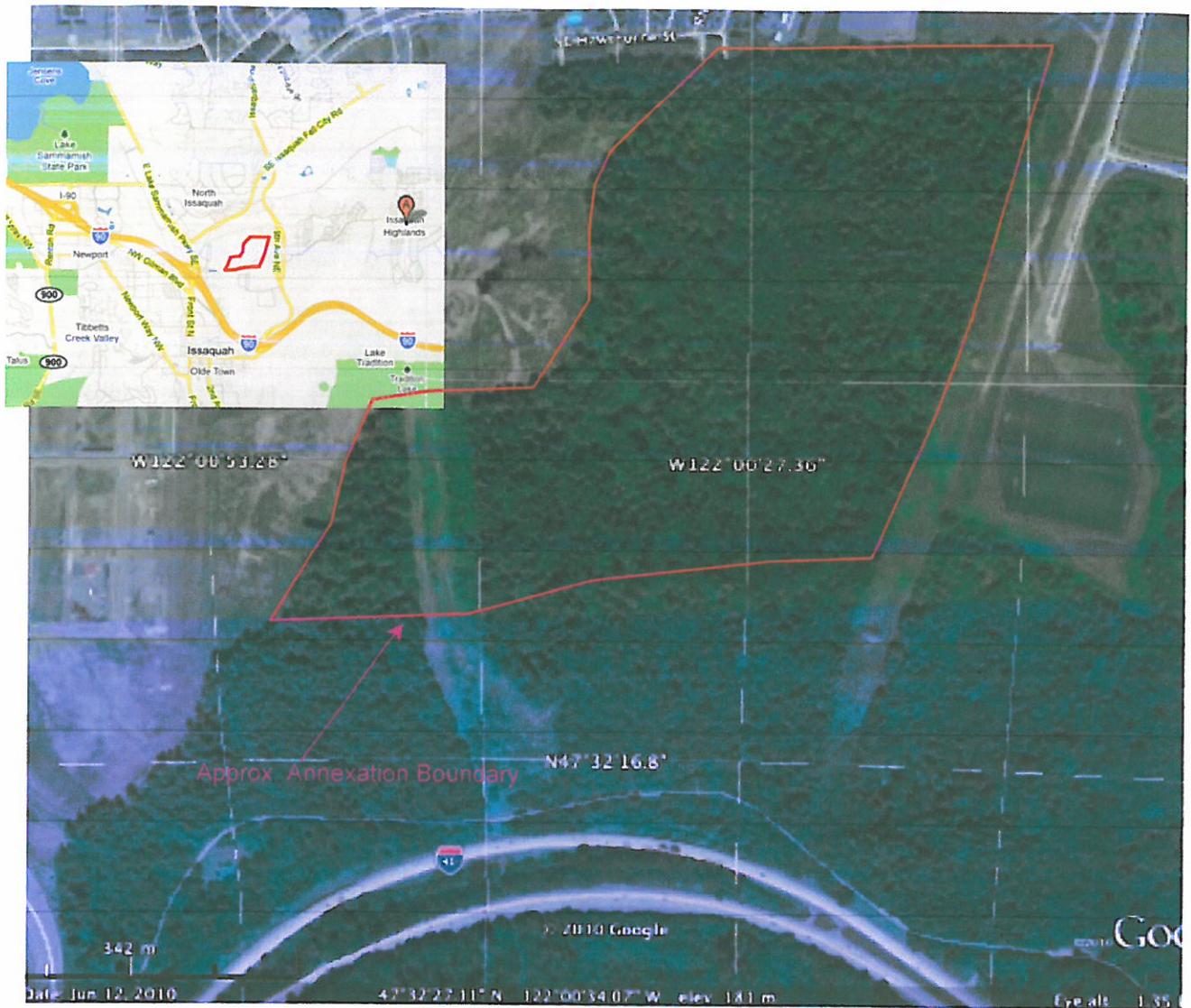


Figure 1: Vicinity Map and Aerial Photograph, WSDOT TDR Receiving Properties Issaquah, Washington. Google Aerials 6/10/2010

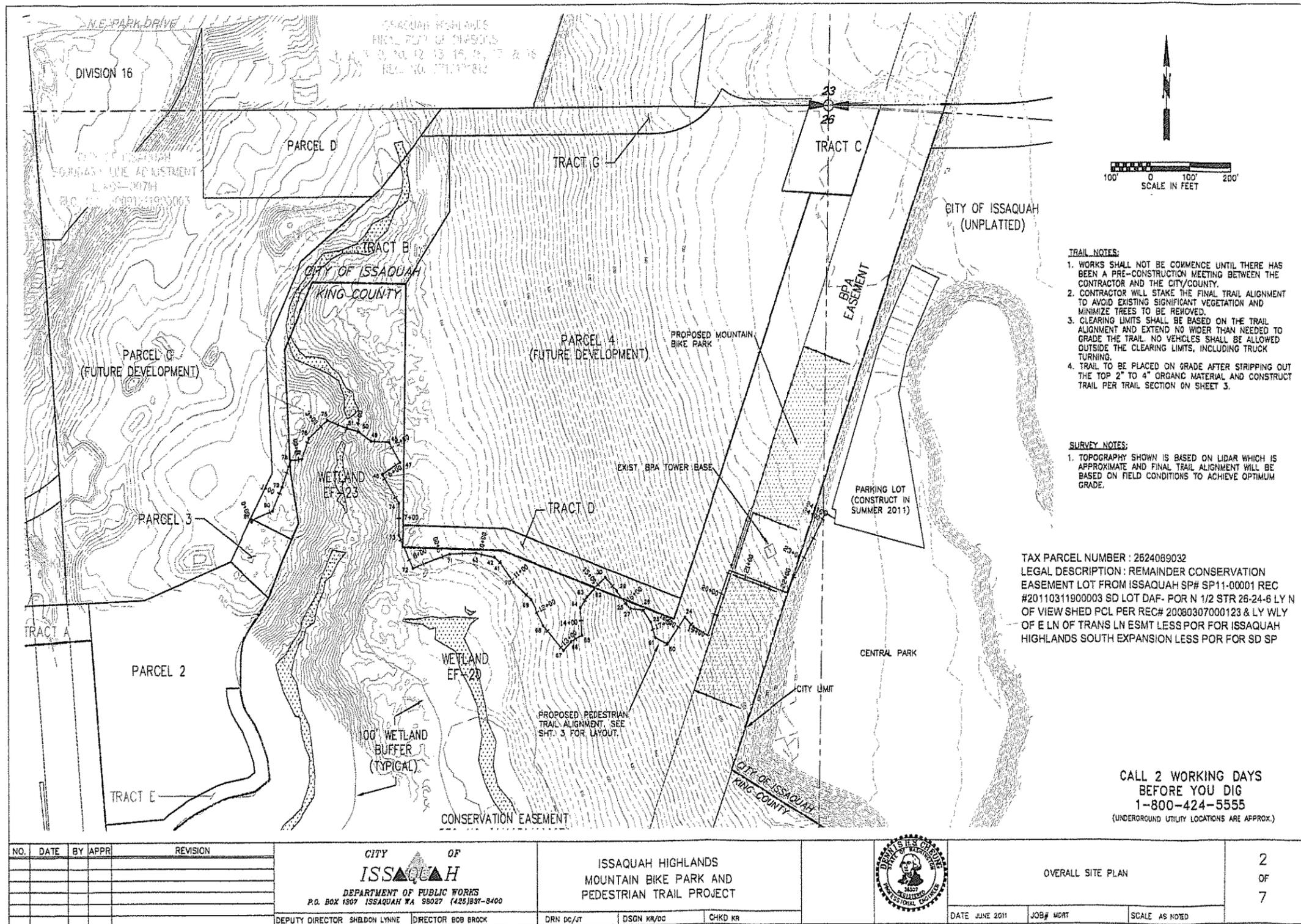


Figure 2: WSDOT TDR Receiving Properties, Development Pads and Inventoried Wetlands. Issaquah MDRT 2010.

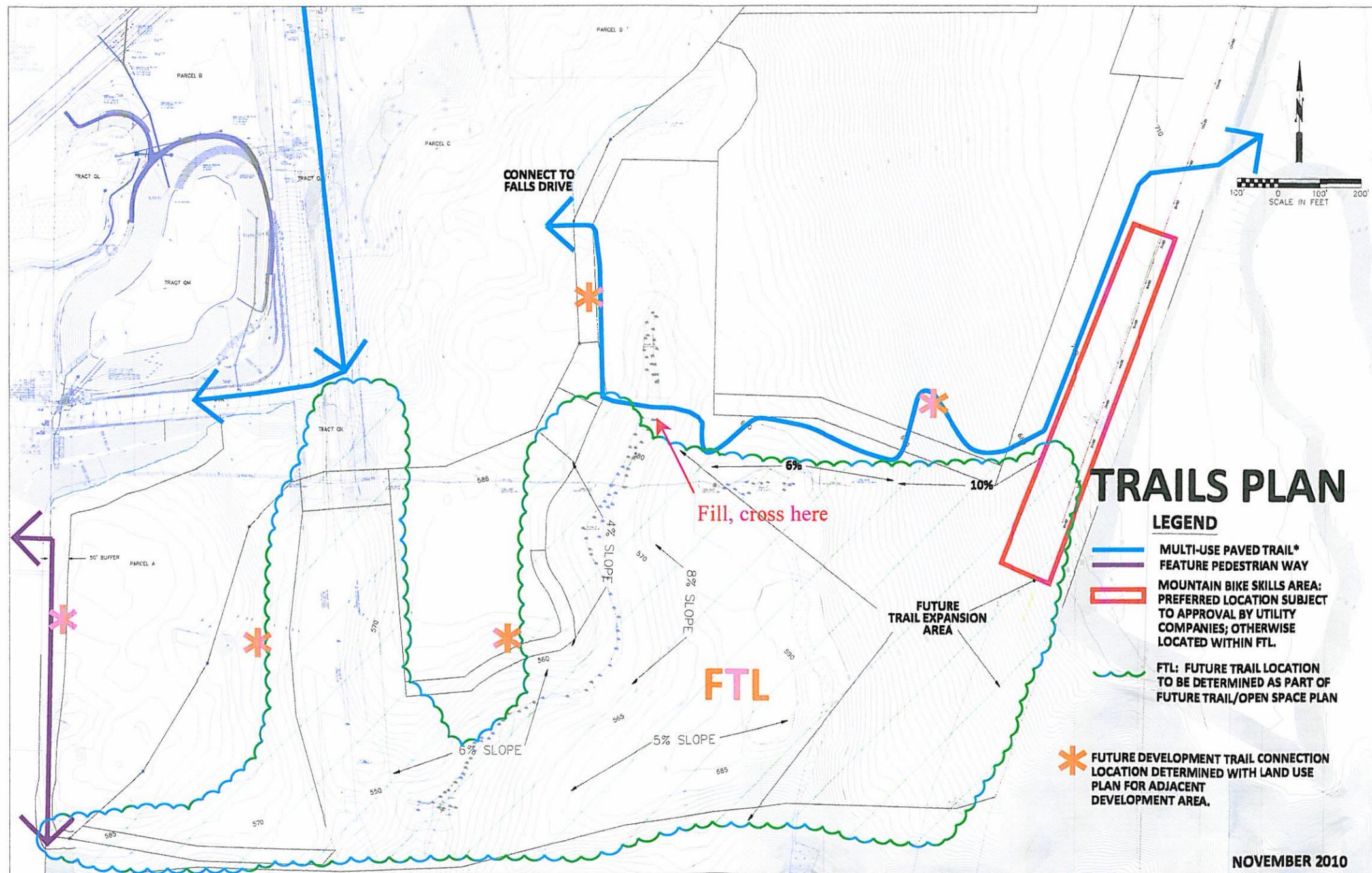
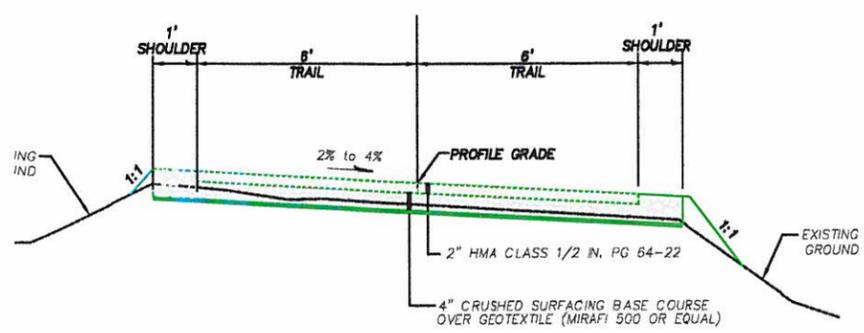
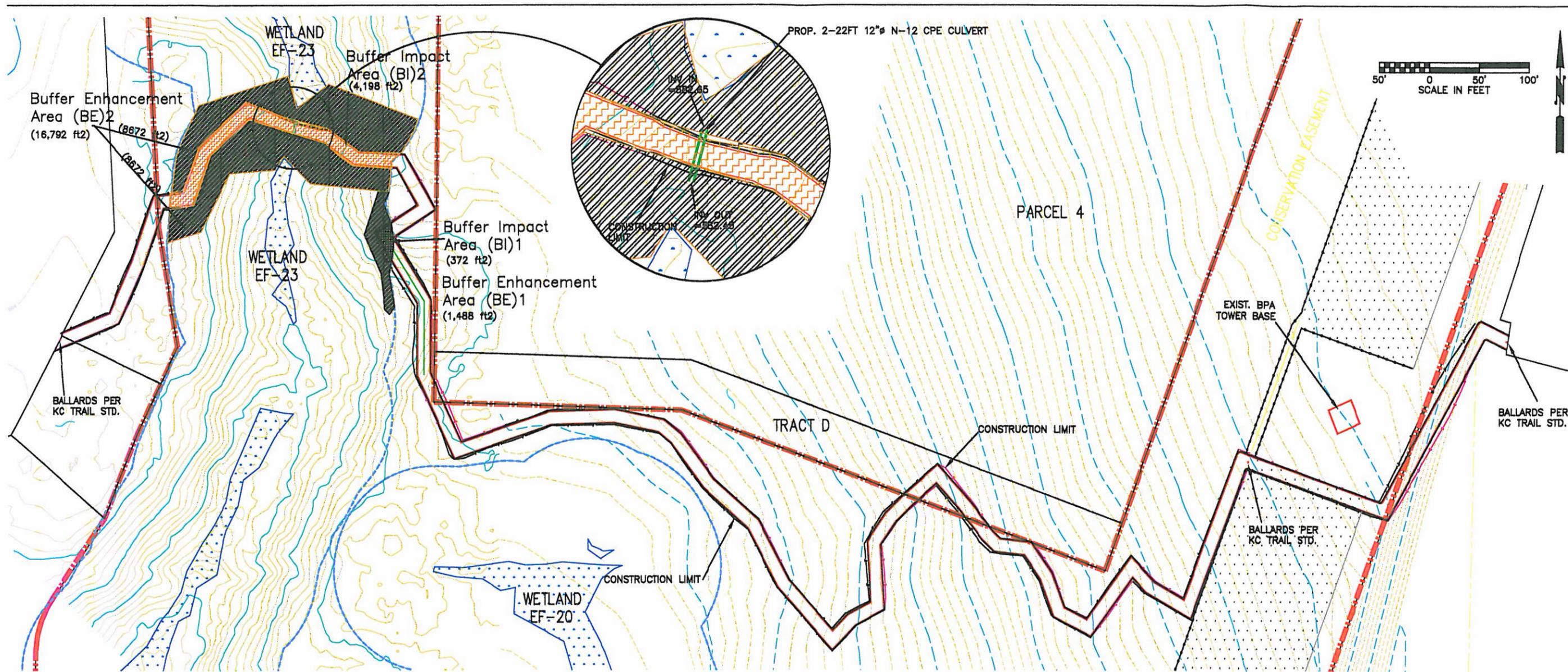
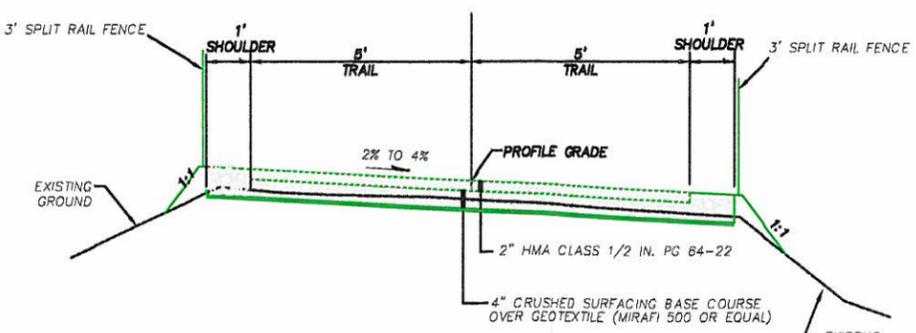


Figure 3: WSDOT TDR Receiving Properties, Proposed Trail Map, MDRT 2010.



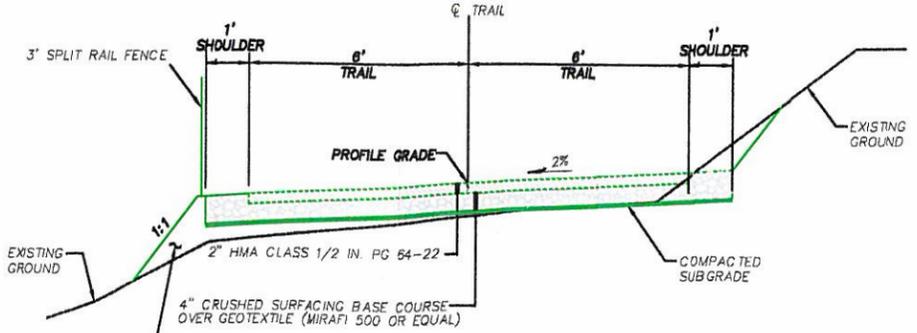
TYPICAL TRAIL SECTION A

NTS
 STA. 0+00 TO STA. 3+50
 STA. 4+00 TO STA. 22+10



TYPICAL TRAIL SECTION B

NTS
 STA. 3+50 TO STA. 4+00



TYPICAL TRAIL SECTION C

NTS
 STA. 22+10 TO STA. 24+16

DATE	BY	APPR	REVISION
6/16/11	SSC		ADD TRAIL IMPACT AND MITIGATION

CITY OF ISSAQUAH
 DEPARTMENT OF PUBLIC WORKS
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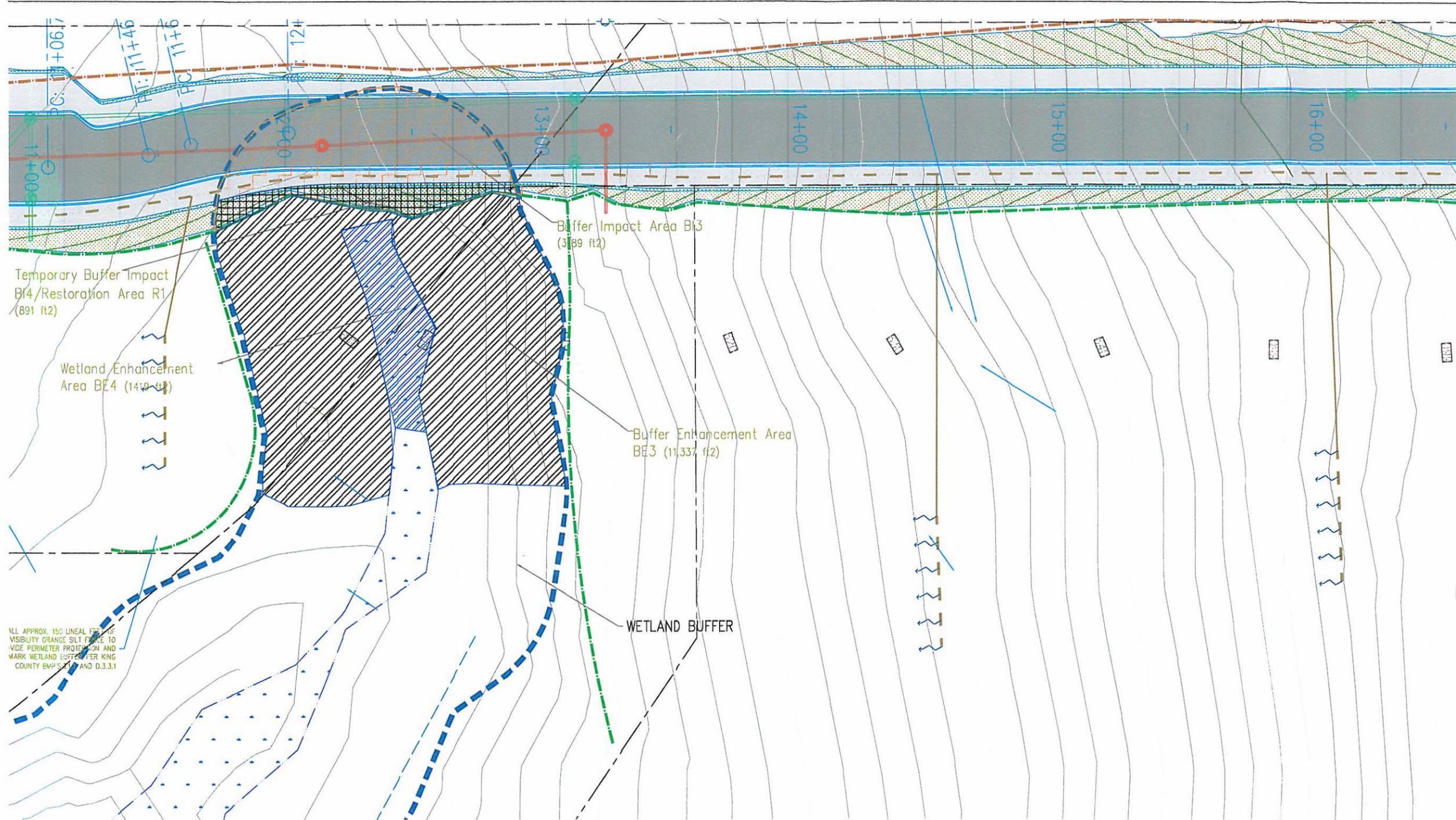
ISSAQUAH HIGHLANDS
 MOUNTAIN BIKE PARK & PEDESTRIAN TRAIL
 IMPACT AND MITIGATION LAYOUT

DRN DC/JT DSGN KR/DC CHKD KR

DENNIS B. SEXTON
 STATE OF WASHINGTON
 2007
 PROFESSIONAL ENGINEER

FIGURE 4. WSDOT TDR RECEIVING PROPERTIES TRAIL ALIGNMENT IMPACT AREAS AND ENHANCEMENT LOCATIONS

DATE JUNE 2011 JOB# 211-04 SCALE AS NOTED



ALL APPROX. 150 LINEAL FEET OF VISIBILITY ORANGE SILT FENCE TO VIDE PERIMETER PROTECTION AND MARK WETLAND BUFFER PER KING COUNTY BMP'S 2.1.1 AND D.3.3.1

TESC PLAN - STA 10+00 TO 22+50
1" = 50'

DATE	BY	APPR	REVISION

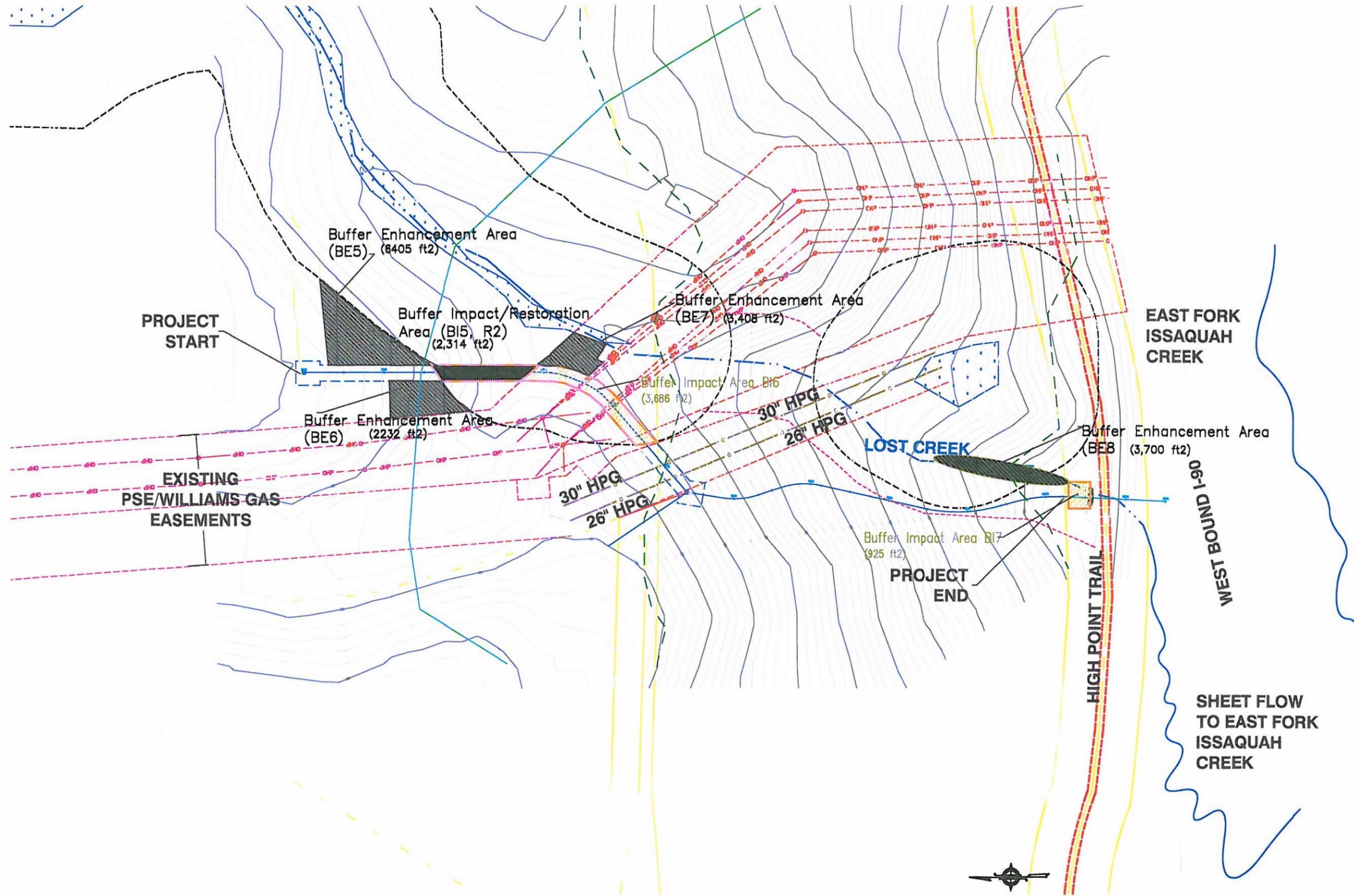

CITY OF ISSAQUAH
 DEPARTMENT OF PUBLIC WORKS
 P.O. BOX 1307 ISSAQUAH WA 98027 (425)837-3400

ISSAQUAH HIGHLANDS
 COLLEGE DRIVE
 IMPACT AND MITIGATION

DRN dc/jt DSGN ssc CHKD KR

FIGURE 5. COLLEGE DRIVE CONSTRUCTION
 IMPACT AREAS AND ENHANCEMENT LOCATIONS

DATE SEPTEMBER 2011 JOB# 211-04 SCALE sc



DATE	BY	APPR	REVISION
9/2011	SSC		

CITY OF ISSAQUAH
 DEPARTMENT OF PUBLIC WORKS
 P.O. BOX 1307 ISSAQUAH WA 98027 (425)837-3400

DEPUTY DIRECTOR SHELDON LYNNE | DIRECTOR BOB BROCK

ISSAQUAH HIGHLANDS
 PARCEL 2 STORMPIPE INSTALLATION
 IMPACT AND MITIGATION LAYOUT

DRN dc/JT | DSGN SSC | CHKD SSC

DATE SEPTEMBER 2011 | JOB# 211-04 | SCALE SC

FIGURE 6 . WSDOT TDR RECEIVING PROPERTIES
 P2 STORMPIPE
 IMPACT AREAS AND ENHANCEMENT LOCATIONS

PARCEL 2 STORMPIPE PLANTING DETAILS

BE7 BUFFER PLANTINGS

SCIENTIFIC NAME	COMMON NAME	QTY	SIZE (MIN.)	NOTES
GAULTHERIA SHALLO	SALAL	48	18" HT.	BARE ROOT
TSUGA HETEROPHYLLA	WESTERN HEMLOCK	5	2'-3' HT.	BARE ROOT
AMERLANCHIER ALNIFOLIA	WESTERN SERVICEBERRY	8	18" HT.	BARE ROOT
CORYLUS CORNUTA	WESTERN HAZELNUT	5	18" HT.	BARE ROOT
RUBUS PARVIFLORUS	THIMBLEBERRY	10	18" HT.	3 CANE MIN.
SAMBUCUS RACEMOSA	RED ELDERBERRY	30	18" HT.	BARE ROOT
SYMPHORICARPOS ALBUS	SNOWBERRY	100	18" HT.	3 CANE MIN.
VACCINIUM OVATUM	EVERGREEN HUCKLEBERRY	42	18" HT.	BARE ROOT
RUBUS URSINUS	TRAINING BLACKBERRY	253	12" HT.	BARE ROOT
DRYOPTERIS EXPANSA	SPREADING WOOD FERN	50	12" HT.	BARE ROOT
POLYSTICHUM MUNITUM	SWORDFERN	80	12" HT.	BARE ROOT

SCIENTIFIC NAME	COMMON NAME	QTY	SIZE (MIN.)	NOTES
PSEUDOTSUGA MENZIESII	DOUGLAS FIR	5	2'-3' HT.	BARE ROOT
THUJA PLICATA	WESTERN RED CEDAR	5	2'-3' HT.	BARE ROOT
AMERLANCHIER ALNIFOLIA	WESTERN SERVICEBERRY	8	18" HT.	BARE ROOT
CORYLUS CORNUTA	WESTERN HAZELNUT	5	18" HT.	BARE ROOT
RUBUS PARVIFLORUS	THIMBLEBERRY	10	18" HT.	3 CANE MIN.
SAMBUCUS RACEMOSA	RED ELDERBERRY	30	18" HT.	BARE ROOT
SYMPHORICARPOS ALBUS	SNOWBERRY	100	18" HT.	3 CANE MIN.
VACCINIUM OVATUM	EVERGREEN HUCKLEBERRY	42	18" HT.	BARE ROOT
RUBUS URSINUS	TRAINING BLACKBERRY	253	12" HT.	BARE ROOT
DRYOPTERIS EXPANSA	SPREADING WOOD FERN	50	12" HT.	BARE ROOT
POLYSTICHUM MUNITUM	SWORDFERN	80	12" HT.	BARE ROOT

COLLEGE DRIVE PLANTING DETAILS

BE3 BUFFER PLANTINGS

SCIENTIFIC NAME	COMMON NAME	QTY	SIZE (MIN.)	NOTES
ACER MACROPHYLLUM	BIG-LEAF MAPLE	16	2'-3' HT.	BARE ROOT
PRUNUS EMARGINATA	BITTERCHERRY	5	2'-3' HT.	BARE ROOT
RHAMNUS PURSHIANA	CASCARA	15	2'-3' HT.	1-GALLON CONTAINER
PSEUDOTSUGA MENZIESII	DOUGLAS FIR	15	2'-3' HT.	BARE ROOT
TSUGA HETEROPHYLLA	WESTERN HEMLOCK	15	2'-3' HT.	BARE ROOT
THUJA PLICATA	WESTERN RED CEDAR	7	2'-3' HT.	1-GALLON CONTAINER
ACER CIRCINATUM*	VINE MAPLE	25	18" HT.	BARE ROOT
AMERLANCHIER ALNIFOLIA	WESTERN SERVICEBERRY	35	18" HT.	BARE ROOT
CORYLUS CORNUTA	WESTERN HAZELNUT	25	18" HT.	BARE ROOT
HOLODISCUS DISCOLOR	OCEAN SPRAY	30	18" HT.	BARE ROOT
MAHONIA NERVOSA	OREGON GRAPE	100	18" HT.	BARE ROOT
OEMLERIA CERASIFORMIS	INDIAN PLUM	100	18" HT.	BARE ROOT
RUBUS PARVIFLORUS	THIMBLEBERRY	35	18" HT.	3 CANE MIN.
SAMBUCUS RACEMOSA	RED ELDERBERRY	50	18" HT.	BARE ROOT
SYMPHORICARPOS ALBUS	SNOWBERRY	100	18" HT.	3 CANE MIN.
VACCINIUM OVATUM	EVERGREEN HUCKLEBERRY	80	18" HT.	BARE ROOT
RUBUS URSINUS	TRAINING BLACKBERRY	167	12" HT.	BARE ROOT
GAULTHERIA SHALLO	SALAL	200	12" HT.	BARE ROOT
POLYSTICHUM MUNITUM	SWORDFERN	200	12" HT.	BARE ROOT

BE4 BUFFER PLANTINGS

SCIENTIFIC NAME	COMMON NAME	QTY	SIZE (MIN.)	NOTES
CORNUS SERICEA	REDSTEM DOGWOOD	20	18" HT.	BARE ROOT
LONICERA INVOLUCRATA	BLACK TWNBERRY	15	18" HT.	BARE ROOT
MAULS FUSCA	WESTERN CRABAPPLE	13	18" HT.	BARE ROOT
RUBUS SPECTABILIS	SALMONBERRY	20	18" HT.	BARE ROOT
SPIREA DOUGLASII	HARDHACK SPIREA	5	18" HT.	BARE ROOT
CAREX OBNUPA	SLOUGH SEDGE	113	PLUG	BARE ROOT
OENANTHE SARMENTOSA	WATER PARSLEY	50	PLUG	BARE ROOT
ATHERIUM FELIX-FEMINA	LADY FERN	50	18" HT.	BARE ROOT
FESTUCA IDAHOENSIS	.3 OZ. SEED FOR HYDROSEED MIX			
LOLIUM PERENNE	.3 OZ. SEED FOR HYDROSEED MIX			
POA COMPRESSA	.3 OZ. SEED FOR HYDROSEED MIX			
SCHIZACHYRIUM SCOPARIUM	.5 OZ SEED FOR HYDROSEED MIX			

R1 BUFFER PLANTINGS

SCIENTIFIC NAME	COMMON NAME	QTY	SIZE (MIN.)	NOTES
AMERLANCHIER ALNIFOLIA	WESTERN SERVICEBERRY	13	18" HT.	BARE ROOT
GAULTHERIA SHALLO	SALAL	20	18" HT.	BARE ROOT
SYMPHORICARPOS ALBUS	SNOWBERRY	21	18" HT.	3 CANE MIN.
VACCINIUM OVATUM	EVERGREEN HUCKLEBERRY	15	18" HT.	BARE ROOT
CAREX OBNUPA	SLOUGH SEDGE	113	PLUG	BARE ROOT
OENANTHE SARMENTOSA	WATER PARSLEY	50	PLUG	BARE ROOT
ATHERIUM FELIX-FEMINA	LADY FERN	50	18" HT.	BARE ROOT
CAREX VESICARIA/UTRICULATA	.4 OZ. SEED FOR HYDROSEED MIX			
ELEOCHARIS OVATA	.3 OZ. SEED FOR HYDROSEED MIX			
GLYCERIA GRANDIS/ELATA	.2 OZ. SEED FOR HYDROSEED MIX			
JUNCUS ACUMINATUS	.2 OZ SEED FOR HYDROSEED MIX			
LEERSIA ORYZOIDES	.3 OZ SEED FOR HYDROSEED MIX			

PARCEL 2 STORMPIPE PLANTING DETAILS

BE6 BUFFER PLANTINGS

SCIENTIFIC NAME	COMMON NAME	QTY	SIZE (MIN.)	NOTES
ACER MACROPHYLLUM	BIG-LEAF MAPLE	2	2'-3' HT.	BARE ROOT
PSEUDOTSUGA MENZIESII	DOUGLAS FIR	2	2'-3' HT.	BARE ROOT
THUJA PLICATA	WESTERN RED CEDAR	2	2'-3' HT.	1-GALLON CONTAINER
ACER CIRCINATUM*	VINE MAPLE	6	18" HT.	BARE ROOT
AMERLANCHIER ALNIFOLIA	WESTERN SERVICEBERRY	8	18" HT.	BARE ROOT
CORYLUS CORNUTA	WESTERN HAZELNUT	5	18" HT.	BARE ROOT
GAULTHERIA SHALLO	SALAL	15	18" HT.	BARE ROOT
OEMLERIA CERASIFORMIS	INDIAN PLUM	7	18" HT.	BARE ROOT
RUBUS PARVIFLORUS	THIMBLEBERRY	10	18" HT.	3 CANE MIN.
RUBUS URSINUS	TRAINING BLACKBERRY	167	12" HT.	BARE ROOT
POLYSTICHUM MUNITUM	SWORDFERN	200	12" HT.	BARE ROOT

TRAIL PLANTING DETAILS

BE1 BUFFER PLANTINGS

SCIENTIFIC NAME	COMMON NAME	QTY	SIZE (MIN.)	NOTES
PRUNUS EMARGINATA	BITTERCHERRY	2	2'-3' HT.	BARE ROOT
RHAMNUS PURSHIANA	CASCARA	3	2'-3' HT.	1-GALLON CONTAINER
THUJA PLICATA	WESTERN RED CEDAR	3	2'-3' HT.	1-GALLON CONTAINER
ACER CIRCINATUM*	VINE MAPLE	5	18" HT.	BARE ROOT
CORYLUS CORNUTA	WESTERN HAZELNUT	7	18" HT.	BARE ROOT
MAHONIA NERVOSA	OREGON GRAPE	12	18" HT.	BARE ROOT
OEMLERIA CERASIFORMIS	INDIAN PLUM	17	18" HT.	BARE ROOT
RUBUS PARVIFLORUS	THIMBLEBERRY	15	18" HT.	3 CANE MIN.
SAMBUCUS RACEMOSA	RED ELDERBERRY	5	18" HT.	BARE ROOT
SYMPHORICARPOS ALBUS	SNOWBERRY	10	18" HT.	3 CANE MIN.
VACCINIUM OVATUM	EVERGREEN HUCKLEBERRY	5	18" HT.	BARE ROOT
RUBUS URSINUS	TRAINING BLACKBERRY	34	12" HT.	BARE ROOT
DRYOPTERIS EXPANSA	SPREADING WOOD FERN	15	12" HT.	BARE ROOT
POLYSTICHUM MUNITUM	SWORDFERN	25	12" HT.	BARE ROOT

BE2 BUFFER PLANTINGS

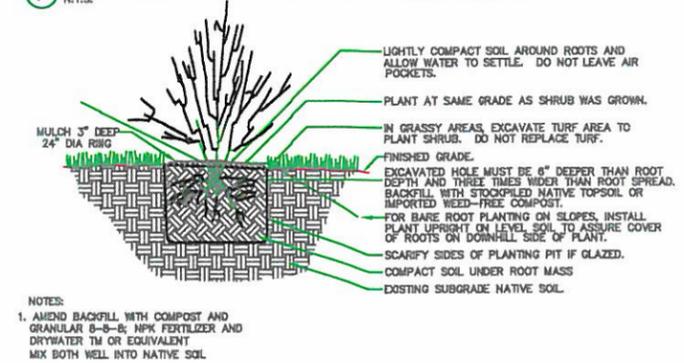
SCIENTIFIC NAME	COMMON NAME	QTY	SIZE (MIN.)	NOTES
ACER MACROPHYLLUM	BIG-LEAF MAPLE	17	2'-3' HT.	BARE ROOT
POPULUS BALSAMIFERA	BLACK COTTONWOOD	9	2'-3' HT.	BARE ROOT
PRUNUS EMARGINATA	BITTERCHERRY	11	2'-3' HT.	BARE ROOT
RHAMNUS PURSHIANA	CASCARA	19	2'-3' HT.	BARE ROOT
PSEUDOTSUGA MENZIESII	DOUGLAS FIR	20	2'-3' HT.	BARE ROOT
THUJA PLICATA	WESTERN RED CEDAR	12	2'-3' HT.	1-GALLON CONTAINER
TSUGA HETEROPHYLLA	WESTERN HEMLOCK	20	2'-3' HT.	BARE ROOT
ACER CIRCINATUM*	VINE MAPLE	30	18" HT.	BARE ROOT
AMERLANCHIER ALNIFOLIA	WESTERN SERVICEBERRY	20	18" HT.	BARE ROOT
CORYLUS CORNUTA	WESTERN HAZELNUT	30	18" HT.	BARE ROOT
GAULTHERIA SHALLO	SALAL	170	18" HT.	BARE ROOT
MAHONIA NERVOSA	OREGON GRAPE	80	18" HT.	BARE ROOT
OEMLERIA CERASIFORMIS	INDIAN PLUM	80	18" HT.	BARE ROOT
RIBES SANGUINEUM	RED CURRANT	40	18" HT.	BARE ROOT
ROSA GYMNOCARPA	PEA-FRUIT ROSE	30	18" HT.	BARE ROOT
RUBUS PARVIFLORUS	THIMBLEBERRY	60	18" HT.	3 CANE MIN.
SAMBUCUS RACEMOSA	RED ELDERBERRY	50	18" HT.	BARE ROOT
SYMPHORICARPOS ALBUS	SNOWBERRY	200	18" HT.	3 CANE MIN.
VACCINIUM OVATUM	EVERGREEN HUCKLEBERRY	70	18" HT.	BARE ROOT
RUBUS URSINUS	TRAINING BLACKBERRY	450	12" HT.	BARE ROOT
DRYOPTERIS EXPANSA	SPREADING WOOD FERN	60	12" HT.	BARE ROOT
POLYSTICHUM MUNITUM	SWORDFERN	330	12" HT.	BARE ROOT

PARCEL 2 STORMPIPE PLANTING DETAILS

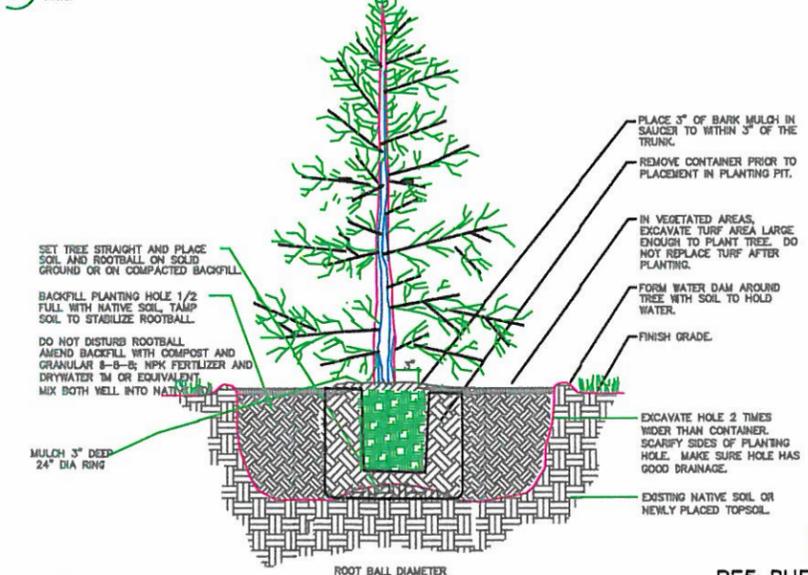
BE5 BUFFER PLANTINGS

SCIENTIFIC NAME	COMMON NAME	QTY	SIZE (MIN.)	NOTES
PRUNUS EMARGINATA	BITTERCHERRY	6	2'-3' HT.	BARE ROOT
RHAMNUS PURSHIANA	CASCARA	8	2'-3' HT.	1-GALLON CONTAINER
PSEUDOTSUGA MENZIESII	DOUGLAS FIR	10	2'-3' HT.	BARE ROOT
TSUGA HETEROPHYLLA	WESTERN HEMLOCK	15	2'-3' HT.	BARE ROOT
THUJA PLICATA	WESTERN RED CEDAR	10	2'-3' HT.	1-GALLON CONTAINER
ACER CIRCINATUM*	VINE MAPLE	40	18" HT.	BARE ROOT
CORYLUS CORNUTA	WESTERN HAZELNUT	40	18" HT.	BARE ROOT
MAHONIA NERVOSA	OREGON GRAPE	50	18" HT.	BARE ROOT
OEMLERIA CERASIFORMIS	INDIAN PLUM	40	18" HT.	BARE ROOT
RUBUS PARVIFLORUS	THIMBLEBERRY	50	18" HT.	3 CANE MIN.
SAMBUCUS RACEMOSA	RED ELDERBERRY	30	18" HT.	BARE ROOT
SYMPHORICARPOS ALBUS	SNOWBERRY	100	18" HT.	3 CANE MIN.
VACCINIUM OVATUM	EVERGREEN HUCKLEBERRY	42	18" HT.	BARE ROOT
RUBUS URSINUS	TRAINING BLACKBERRY	253	12" HT.	BARE ROOT
DRYOPTERIS EXPANSA	SPREADING WOOD FERN	50	12" HT.	BARE ROOT
POLYSTICHUM MUNITUM	SWORDFERN	80	12" HT.	BARE ROOT

1 PLUG PLANTING DETAIL (typ.)



2 CONTAINER TREE DETAIL (typ.)



NOTES:
1. PLANT TREE 1/2" HIGHER THAN DEPTH WATER IMMEDIATELY AND THOROUGHLY, GREATER AT FIRST, 2 or 3 TIMES PER WEEK THROUGH DRY THE SEASON, THEN LESS UNTIL ESTABLISHED.
2. FOR CONTAINER PLANTS, SCORE FOUR SIDES OF ROOTBALL PRIOR TO PLANTING. BUTTERFLY ROOTBALL IF ROOT CURLING IS EVIDENT.

NOTES:
1. ALL PLANTS SHALL BE HAND-PLACED BY THE DESIGNING ECOLOGIST AND INSTALLED BY AN INSTALLATION CONTRACTOR.
2. PLANTS CAN BE AS SPECIFIED IF INSTALLATION OCCURS FROM NOVEMBER THROUGH FEBRUARY. IF INSTALLATION OCCURS AFTER FEBRUARY (THROUGH MAY 15) THEN MATERIAL MUST BE CONTAINERIZED STOCK, NOT BARE ROOT.
3. THE INFILL AREAS IDENTIFIED ON SHEET M1 SHALL BE CLEARED OF WEEDS PRIOR TO AND INSTALLED BY AN INSTALLATION CONTRACTOR.

ARCEL 2 STORMPIPE PLANTING DETAILS

2 BUFFER PLANTINGS

SCIENTIFIC NAME	COMMON NAME	QTY	SIZE (MIN.)	NOTES
GAULTHERIA SHALLO	SALAL	48	18" HT.	BARE ROOT
SYMPHORICARPOS ALBUS	SNOWBERRY	50	18" HT.	3 CANE MIN.
VACCINIUM OVATUM	EVERGREEN HUCKLEBERRY	50	18" HT.	BARE ROOT
TSUGA HETEROPHYLLA	.2 OZ SEED FOR HYDROSEED MIX			
FESTUCA IDAHOENSIS	.4 OZ. SEED FOR HYDROSEED MIX			
LOLIUM PERENNE	.9 OZ. SEED FOR HYDROSEED MIX			
POA COMPRESSA	.3 OZ. SEED FOR HYDROSEED MIX			

DATE	BY	APPR	REVISION

CITY OF ISSAQUAH
DEPARTMENT OF PUBLIC WORKS
P.O. BOX 1307 ISSAQUAH WA 98027 (425)887-8400

ISSAQUAH HIGHLANDS
WSDOT TDR RECEIVING PROPERTIES
MITIGATION PLANTING DETAILS

FIGURE 7. PLANTING DETAILS, PLANTS, QUANTITIES
INSTALLATION INSTRUCTIONS

DEPUTY DIRECTOR SHELDON LYNNE | DIRECTOR BOB BROCK

DRN DC/JT | DSGN SSC | CHKD KR

DATE: JUNE 2011 | JOB#: 211-04 | SCALE: NTS

M4 OF 4

Appendices

Appendix A. Mitigation Type, Area, and Plant Number Calculations

Trail Buffer Enhancement area = 18,280 SF (0.42 AC)

In two separate areas,

BE1= 1488 SF

BE2= 16,792 SF (divided into 2 approx. equal polygons north and south of the trail (see Figure 4)

The required number of trees, shrubs, *and* herbs/ferns for the various areas:

BE1

Forested buffer (total acreage = 1488 SF)

- ◆ 1190 square feet x 0.008 per square foot for trees = 8 trees (12 feet on center at 80% cover)
- ◆ 595 square feet x 0.128 per square foot shrubs = 76 shrubs (3 feet on center at 40% cover)
- ◆ 298 square feet x 0.25 per square foot for emergent = 74 ferns/groundcover (2 feet on center at 20% cover)

BE2

Forested buffer (total acreage = 16,792 SF)

- ◆ 13,434 square feet x 0.008 per square foot for trees = 108 trees (12 feet on center at 80% cover)
- ◆ 6,717 square feet x 0.128 per square foot shrubs = 860 shrubs (3 feet on center at 40% cover)
- ◆ 3,358 square feet x 0.25 per square foot for emergent = 840 ferns/groundcover (2 feet on center at 20% cover)

A total of 116 trees, 936 shrubs, and 914 ferns/groundcover plants are specified

College Drive Buffer Enhancement area = 12,756 SF (0.29 AC)

In two separate areas, plus restoration of temporary impact =891 SF (see Figure 5)

BE 3= 11,337 SF

BE 4= 1419 SF

R1= 891 SF

BE 3

Forested buffer (total acreage = 11,337 SF)

- ◆ 9070 square feet x 0.008 per square foot for trees = **73 trees** (12 feet on center at 80% cover)
- ◆ 4535 square feet x 0.128 per square foot shrubs = **580 shrubs** (3 feet on center at 40% cover)
- ◆ 2267 square feet x 0.25 per square foot for emergent = **567 ferns/groundcover** (2 feet on center at 20% cover)

BE4

Shrub and emergent wetland (total acreage = 1419 SF)

- ◆ 568 square feet x 0.128 per square foot shrubs = **73 shrubs** (3 feet on center at 40% cover)
- ◆ 851 square feet x 0.25 per square foot for emergent = **213 emergent plugs** (2 feet on center at 60% cover)
- ◆ 1419 SF emergent hydroseed

R1

Shrub and emergent Buffer (total acreage = 891 SF)

- ◆ 535 square feet x 0.128 per square foot shrubs = **69 shrubs** (3 feet on center at 60 cover)
- ◆ 356 square feet x 0.25 per square foot for emergent = **89 ferns/groundcover plugs** (2 feet on center at 40% cover)
- ◆ 891 SF hydroseed

A total of 73 trees, 722 shrubs, 656 ferns/groundcover and 213 emergent plugs plants are specified

Parcel 2 Stormpipe Buffer Enhancement area = 15,745 SF (0.36 AC)

In two separate areas, plus restoration of temporary impact =891 SF (see Figure 5)

BE5= 7650 SF

BE6= 987 SF

BE7= 3408 SF

BE8= 3700 SF

R2= 2314 SF

BE5

Forested buffer (total acreage = 7650 SF)

- ◆ 6120 square feet x 0.008 per square foot for trees = **49 trees** (12 feet on center at 80% cover)
- ◆ 3060 square feet x 0.128 per square foot shrubs = **392 shrubs** (3 feet on center at 40% cover)
- ◆ 1530 square feet x 0.25 per square foot for emergent = **383 ferns/groundcover** (2 feet on center at 20% cover)

BE6

Forested buffer (total acreage = 987 SF)

- ◆ 790 square feet x 0.008 per square foot for trees = **6 trees** (12 feet on center at 80% cover)
- ◆ 395 square feet x 0.128 per square foot shrubs = **51 shrubs** (3 feet on center at 40% cover)
- ◆ 197 square feet x 0.25 per square foot for emergent = **49 ferns/groundcover** (2 feet on center at 20% cover)

BE7

Shrub and grass enhancement (total acreage = 3408 SF)

- ◆ 1704 square feet x 0.128 per square foot shrubs = **218 shrubs** (3 feet on center at 50% cover)
- ◆ 1704 square feet hydroseed

BE8

Riparian buffer (total acreage = 3700 SF)

- ◆ 1850 square feet x 0.008 per square foot for trees = **15 trees** (12 feet on center at 50% cover)
- ◆ 1850 square feet x 0.128 per square foot shrubs = **237 shrubs** (3 feet on center at 50% cover)

R2

Shrub and emergent Buffer (total acreage = 2314 SF)

- ◆ 1157 square feet x 0.128 per square foot shrubs = **148 shrubs** (3 feet on center at 50 cover)
- ◆ 1157 square feet hydroseed

A total of 70 trees, 1046 shrubs, 432 ferns/groundcover are specified.

Species List Mitigation Plantings BE1

Species Name	Common Name	Number
<u>Trees</u>		
<i>Prunus emarginata</i>	Bitter cherry	2
<i>Rhamnus purshiana</i>	casacara	3
<i>Thuja plicata</i>	Western red cedar	3
Total trees		8
<u>Shrubs</u>		
<i>Acer circinatum</i>	Vine maple	5
<i>Corylus cornuta</i>	Beaked hazelnut	7
<i>Mahonia nervosa</i>	Oregon grape	12
<i>Oemleria cerasiformis</i>	osoberry	17
<i>Rubus parviflorus</i>	thimbleberry	15
<i>Sambucus racemosa</i>	Red elderberry	5
<i>Symphoricarpos albus</i>	snowberry	10
<i>Vaccinium ovatum</i>	Evergreen huckleberry	5
Total plants		76
<u>Ferns/groundcover</u>		
<i>Rubus ursinus</i>	Trailing blackberry	34
<i>Dryopteris expansa</i>	Spreading wood fern	15
<i>Polystichum munitum</i>	Sword fern	25
Total plants		74

Species List Mitigation Plantings BE2

Species Name	Common Name	Number
<u>Trees</u>		
<i>Acer macrophyllum</i>	Big-leaf maple	17
<i>Populus balsamifera</i>	black cottonwood	9
<i>Prunus emarginata</i>	Bitter cherry	11

<i>Rhamnus purshiana</i>	cascara	19
<i>Pseudotsuga menziessii</i>	Douglas fir	20
<i>Thuja plicata</i>	Western red cedar	12
<i>Tusga heterophylla</i>	Western hemlock	20
Total trees		108
<u>Shrubs</u>		
<i>Acer circinatum</i>	Vine maple	30
<i>Amerlanchier alnifolia</i>	Western serviceberry	20
<i>Corylus cornuta</i>	Beaked hazelnut	30
<i>Gaultheria shallon</i>	salal	170
<i>Mahonia nervosa</i>	Oregon grape	80
<i>Oemleria cerasiformis</i>	osoberry	80
<i>Ribes sanguineum</i>	Red currant	40
<i>Rosa gymnocarpa</i>	Pea-fruit rose	30
<i>Rubus parviflorus</i>	thimbleberry	60
<i>Sambucus racemosa</i>	Red elderberry	50
<i>Symphoricarpos albus</i>	snowberry	200
<i>Vaccinium ovatum</i>	Evergreen huckleberry	70
Total plants		860
<u>Ferns/groundcover</u>		
<i>Rubus ursinus</i>	Trailing blackberry	450
<i>Dryopteris expansa</i>	Spreading wood fern	60
<i>Polystichum munitum</i>	Swordfern	330
Total plants		840

Species List Mitigation Plantings BE3

Species Name	Common Name	Number
<u>Trees</u>		
<i>Acer macrophyllum</i>	Big leaf maple	16
<i>Prunus emarginata</i>	Bitter cherry	5

<i>Rhamnus purshiana</i>	casacara	15
<i>Pseudotsuga menzesii</i>	Douglas fir	15
<i>Tsuga heterophylla</i>	Western hemlock	15
<i>Thuja plicata</i>	Western red cedar	7
Total trees		73
<u>Shrubs</u>		
<i>Acer circinatum</i>	Vine maple	25
<i>Amerlanchier alifolia</i>	Western serviceberry	35
<i>Corylus cornuta</i>	Beaked hazelnut	25
<i>Holodiscus discolor</i>	oceansprtay	30
<i>Mahonia nervosa</i>	Oregon grape	100
<i>Oemleria cerasiformis</i>	osoberry	100
<i>Rubus parviflorus</i>	thimbleberry	35
<i>Sambucus racemosa</i>	Red elderberry	50
<i>Symphoricarpos albus</i>	snowberry	100
<i>Vaccinium ovatum</i>	Evergreen huckleberry	80
Total plants		580
<u>Ferns/groundcover</u>		
<i>Rubus ursinus</i>	Trailing blackberry	167
<i>Gaultheria shallon</i>	salal	200
<i>Polystichum munitum</i>	Sword fern	200
Total plants		567

Species List Mitigation Plantings BE4 (Wetland enhancemen)

Species Name	Common Name	Number
<u>Shrubs</u>		
<i>Cornus sericea</i>	Redstem dogwood	20
<i>Lonicera involucrata</i>	Black twinberry	15
<i>Malus fusca</i>	Western crabapple	13
<i>Rubus spectabilis</i>	salmonberry	20

Spirea douglasii	Hardhack spirea	5	
	Total plants	73	
<i>Emergents</i>			
Carex obnupta	Trailing blackberry	113	
Oenanthe sarmentosa	Water-parsley	50	
Atherium felix-femina	ladyfern	50	
	Total plants	213	
Hydroseed (Handseed)	Seed rate lbs./acre.	% by weight	amount (OZ)
<i>Agrostis tenuis</i>	2	30	.3
<i>Alopecurus geniculatus</i>	4.5	10	.2
<i>Carex obnupta</i>	7	25	1
<i>Eleocharis vata/palustris</i>	7	20	.7
<i>Glyceria grandis/elata</i>	6	15	.4

Species List Mitigation Plantings R1

Species Name	Common Name	Number	
<i>Shrubs</i>			
<i>Amerlanchier alifolia</i>	Western serviceberry	13	
Gaultheria shallon	Salal	20	
Symphoricarpos alba	Snowberry	21	
Vaccinium ovatum	Evergreen huckleberry	15	
		69	
<i>groundcover plugs</i>			
Carex obnupta	Slough sedge	113	
Oenanthe sarmentosa	Water-parsley	50	
Atherium felix-femina	ladyfern	50	
	Total plants	213	
Hydroseed (Handseed)	Seed rate lbs./acre.	% by weight	amount (OZ)

<i>Carex vesicaria/utriculata</i>	7	15	.4
<i>Juncus acuminatus</i>	1	20	.2
<i>Eleocharis ovate</i>	4	15	.3
<i>Glyceria grandis/elata</i>	2	30	.2
<i>Leersia oryzoides</i>	4	20	.3

Species List Mitigation Plantings BE5

Species Name	Common Name	Number
<u>Trees</u>		
<i>Prunus emarginata</i>	Bitter cherry	6
<i>Rhamnus purshiana</i>	cascara	8
<i>Pseudotsuga menzesii</i>	Douglas fir	10
<i>Tsuga heterophylla</i>	Western hemlock	15
<i>Thuja plicata</i>	Western red cedar	10
Total trees		49
<u>Shrubs</u>		
<i>Acer circinatum</i>	Vine maple	40
<i>Corylus cornuta</i>	Beaked hazelnut	40
<i>Mahonia nervosa</i>	Oregon grape	50
<i>Oemleria cerasiformis</i>	osoberry	40
<i>Rubus parviflorus</i>	thimbleberry	50
<i>Sambucus racemosa</i>	Red elderberry	30
<i>Symphoricarpos albus</i>	snowberry	100
<i>Vaccinium ovatum</i>	Evergreen huckleberry	42
Total plants		392
<u>Ferns/groundcover</u>		
<i>Rubus ursinus</i>	Trailing blackberry	253
<i>Dryopteris expansa</i>	Spreading wood fern	50
<i>Polystichum munitum</i>	Sword fern	80
Total plants		383

Species List Mitigation Plantings BE6

Species Name	Common Name	Number
<u>Trees</u>		
Acer macrophyllum	Big-leaf maple	2
Pseudotsuga menziessii	Douglas fir	2
Thuja plicata	Western red cedar	2
Total trees		6
<u>Shrubs</u>		
Acer circinatum	Vine maple	6
Amerlanchier alnifolia	Western serviceberry	8
Corylus cornuta	Beaked hazelnut	5
Gaultheria shallon	salal	15
Oemleria cerasiformis	Osoberry	7
Rubus parviflorus	thimbleberry	10
Total plants		51
<u>Ferns/groundcover</u>		
Rubus ursinus	Trailing blackberry	34
Polystichum munitum	Swordfern	15
Total plants		49

Species List Mitigation Plantings BE7

Species Name	Common Name	Number
<u>Shrubs</u>		
Gaultheria shallon	Salal	38
Rosa nutkana	Nootka rose	40
Symphoricarpos alba	Snowberry	80
Vaccinium ovatum	Evergreen huckleberry	60
Total plants		218

Hydroseed (Handseed)	Seed rate lbs./acre.	% by weight	amount (OZ)
<i>Dactylus glomerata</i>	5	10	.1
<i>Festuca idahoensis</i>	4.5	20	.3
<i>Lolium perenne</i>	5	40	.3
<i>Poa compressa</i>	2	30	.3

Species List Mitigation Plantings BE8

Species Name	Common Name	Number
<u>Trees</u>		
<i>Pseudotsuga menzesii</i>	Douglas fir	5
<i>Tsuga heterophylla</i>	Western hemlock	5
<i>Thuja plicata</i>	Western red cedar	5
Total trees		15
<u>Shrubs</u>		
<i>Acer circinatum</i>	Vine maple	25
<i>Corylus cornuta</i>	Beaked hazelnut	40
<i>Gaultheria shallon</i>	salal	10
<i>Oemleria cerasiformis</i>	Osoberry	80
<i>Salix scouleriana</i>	Scouler willow	52
<i>Sambucus racemosa</i>	Red elderberry	30
Total plants		237

Species List Mitigation Plantings R2

Species Name	Common Name	Number
<u>Shrubs</u>		148
<i>Gaultheria shallon</i>	Salal	48
<i>Symphoricarpos alba</i>	Snowberry	50
<i>Vaccinium ovatum</i>	Evergreen huckleberry	50
Total plants		218

<u>Hydroseed</u> (Handseed)	Seed rate lbs./acre.	% by weight	amount (OZ)
<i>Dactylus glomerata</i>	5	10	.1
<i>Festuca idahoensis</i>	4.5	20	.3
<i>Lolium perenne</i>	5	40	.3
<i>Poa compressa</i>	2	30	.3

Species List Mitigation Plantings BE8

Species Name	Common Name	Number
<u>Trees</u>		
<i>Pseudotsuga menzesii</i>	Douglas fir	5
<i>Tsuga heterophylla</i>	Western hemlock	5
<i>Thuja plicata</i>	Western red cedar	5
Total trees		15
<u>Shrubs</u>		
<i>Acer circinatum</i>	Vine maple	25
<i>Corylus cornuta</i>	Beaked hazelnut	40
<i>Gaultheria shallon</i>	salal	10
<i>Oemleria cerasiformis</i>	Osoberry	80
<i>Salix scouleriana</i>	Scouler willow	52
<i>Sambucus racemosa</i>	Red elderberry	30
Total plants		237

Species List Mitigation Plantings R2

Species Name	Common Name	Number
<u>Shrubs</u>		148
<i>Gaultheria shallon</i>	Salal	38
<i>Symphoricarpos alba</i>	Snowberry	80
<i>Vaccinium ovatum</i>	Evergreen huckleberry	60
Total plants		218

Hydroseed (Handseed)	Seed rate lbs./acre.	% by weight	amount (OZ)
<i>Dactylus glomerata</i>	5	10	.2
<i>Festuca idahoensis</i>	4.5	20	.4
<i>Lolium perenne</i>	5	40	.9
<i>Poa compressa</i>	2	30	.3

Planting notes:

1. Plants will be placed in the field by the project ecologist and planted by an installation contractor.
2. Planting pits shall be excavated at least 6" deeper than root depth and 3-times wider than root spread. Scarify sides of pit if glazed.
3. Every planting pit shall be amended with compost, granular fertilizer (8,8,8/NPK) and Drywater™ or equivalent mixed 1:1 with native soil. Soil shall be compacted after backfilling except for mitigation area BE4 (wetland enhancement College Drive)
4. All plants shall be watered well after installation.

Appendix B: Monitoring Methodology.

- A. INTRODUCTION.
- B. PERFORMANCE STANDARDS.
- C. MONITORING PLAN
- D. MONITORING SCHEDULE.

A. INTRODUCTION.

It is critical to monitor mitigation projects after they have been installed in order to track growth progress and movement towards meeting the performance standards. A well-conceived and executed monitoring plan is essential to determine this progress and to determine whether implementation of contingency measures are needed. It is especially important in the early establishment period, when it is expected that some aspect of the design will need to be modified to prevent mortality of the plantings.

The goals, objectives, and performance standards can be found in those sections of the report. They are the basis for the monitoring plan and constitute the standards against which compliance and success are determined.

B. PERFORMANCE STANDARDS

GOAL and OBJECTIVE #1: Enhancement of Mitigation areas BE1, BE2, BE3, BE5, BE6, BE7, and BE8 and restoration of Mitigation areas R1 and R2 with UPL, FACU and some FAC; BE4 with FAC, FACW, and OBL northwest native species of trees, shrubs and appropriate herbs and ferns to supplement the existing forest vegetation and replace any vegetation lost to historic activities in the area, especially those related to the placement of the logging road, clearing for the utility lines, construction of I90 at the outlet of the drainage for the development to the north. The vegetation added will not include new species, but rather increase the cover and distribution of the existing already diverse species.

Performance Standard 1: Enhance/Restore through plantingby:

BE1	1488 SF	Forest Enhancement infill
BE 2	16,792 SF	Forest Enhancement infill
BE3	11,337 SF	Forest Enhancement infill
BE4	1,419 SF	Wetland Enhancement infill
R1	891 SF	Shrub/grass Restoration
BE5	7,650 SF	Forest Enhancement infill
BE6	987 SF	Forest Enhancement infill
BE7	3,408 SF	Shrub and grass Enhancement infill
BE8	3,700 SF	Riparian Enhancement infill
R2	2,314 SF	Shrub/grass Restoration

GOAL and OBJECTIVE #2 100% Survival of all planted vegetation by the end of year 1.

Performance Standard 2: 100% Survival of all planted vegetation by the end of year 1. Perform a survival study and replace all plants that have died so that there are the same number of plants by December as were installed the pervious year.

GOAL and OBJECTIVE #3: Maintenance of forested cover by 2 or more stories of vegetation.

Performance Standard 3: Survival after year 1 will be replaced by tracking aerial cover to insure the area proceeds to or enhances multi-canopied vegetation communities typical of an undisturbed:

- Upland forest in the region for areas BE1, BE2, BE3, BE5, BE6
- Emergent and shrub wetland for BE4
- Shrub and grass community restoration for Areas R1 and R2
- Riparian enhancement for area BE8

Aerial cover in all layers (planted and naturally occurring)

Must be: (excluding invasive plants)

- 40 percent by year 2
- 60 percent by year 3
- 100 percent by year 5.

GOAL and OBJECTIVE #4: Maintenance of native vegetation with not more than 10 percent cover non-native and/or invasive plant cover in any one area in all canopy layers for the full monitoring period.

Performance Standard 4: Weed cover will not exceed 10 percent total all species in in any one area in all canopy layers for the full monitoring period.

C. MONITORING PLAN

Monitoring during plant installation would be conducted by the project biologist responsible for wetland design. A one-year maintenance period would require the landscape contractor to care for new plantings and replant all dead plants one year after installation would be required (see PS2).

Mitigation monitoring would be conducted after construction of the trail and planting of the enhancement mitigation areas; the exact timing will be negotiated with King County. Monitoring would occur in April for weed census and August when plantings have achieved their maximum growth for that growing season. Monitoring would employ quadrat and transect sampling techniques to determine plant species vigor, percent survivorship of plantings, percent coverage of the mitigation areas in native and weed species. Post-construction mitigation monitoring would be conducted by a qualified wetland ecologist.

Monitoring will consist of field observation and documentation of site conditions in the buffer enhancement areas. Mitigation areas are proposed to be monitored for a period of 5 years on years 1, 2, 3, and 5, or until the mitigation area meets the performance standards for Year 5.

Monitoring Methods shall include the following to track the identified performance standards:

Standard Assessed	Monitoring methodology	Currency	Date Standard met
PS 1:	Oversee the installation of all plantings and sign off on the installation technique, including soil amendments and mulch installation.	Trail: 116 trees, 936 shrubs, & 914 groundcovers planted in 18,280 SF College Dr: 73 trees, 722 shrubs, 213 emergent, 656 ferns/groundcover plugs in 12,756 SF P2 Pipeline: 70 trees, 1046 shrubs, & 432 ground covers in 15,745 SF	August of the first year after installation
PS2:	Perform a survival study and replace all plants that have died so that there are the same number of plants by December as were installed the pervious year.	# of dead plants counted and replaced	December of the first year after installation
PS 3:	Aerial cover by species, plant vigor, and mortality. <u>in all layers</u> (planted and naturally occurring) will be evaluated using 5-meter (~16-ft.) plots for shrubs and 10-meter (~33 ft.) for mature tree dominated plots	Percent cover in all canopy layers (plotted so changes can be tracked by year)	August years 1,2,3 and 5
PS4:	Aerial cover by species, plant vigor, and mortality. <u>in all layers</u> will be evaluated	Percent total aerial cover invasive species	August years 1,2,3 and 5

Weed Assessments: A spring site visit will be conducted in the spring between April 1 and 30 to assess general site and invasive species conditions. If necessary, the project owner will take immediate steps to address invasive species as recommended by the monitoring biologist. A second site visit will be conducted in the late growing season between July 20 and August 15.

Photo Stations: During all monitoring years, photographs will be taken annually at each photo station, and in the same direction(s) at each photo station, to provide clear visual documentation of mitigation conditions and the progress of the mitigation success. Photographs for each year will be provided in each monitoring report. Photo station will provide adequate coverage of each area. The final number of stations will be detailed in the baseline monitoring report. There would be at least two photo stations for each of the ten mitigation areas.

Monitoring reports will be prepared each year in compliance with the County's requirements and will document site conditions and success in meeting performance standards. If performance standards are not met, contingency plans will also be included in the monitoring report. The annual reports will be submitted to the County no later than November 30th each year. All weed memos will be sent to the maintenance contractors not more than 2 weeks after the weed site assessments have been completed (April 30 and August 15-20th).

SAMPLING METHODS FOR EACH VARIABLE.

1. Baseline Transects

Site monitoring will include the establishment of a baseline along the trail, College Drive, and the Pipeline (See Figures 4, 5, and 6). Perpendicular transects will be established every 50 meters along this line. They will extend from the baseline to the mitigation boundary from east to west. Potential sampling stations will be identified along these perpendicular transect lines every 20 meters. Each of these potential sampling stations will be assigned a number sequentially from 1. Sampling stations, where data will be collected, will be selected from among the potential stations for each community/habitat type by selecting 2+ sampling points in each of the ten mitigation sites each from a random numbers table. These number of stations represents the smallest possible sample size for a statistically significant sample to assess cover for native and invasive criteria.

2. Vegetation Assessment

Circular sample plots will be established at these sampling stations, throughout the enhancement area. The center of each plot is marked with a stake topped with flagging and numbered so that it can be easily located in successive years. A 15-meter to 30-meter radius circle at this point, is used to assess survival and health of plantings. The sampling station stakes will be shown in the Baseline Monitoring plan.

Plant survival and Health. Plantings in the 10-meter radius plot are visually evaluated and compared to the mitigation planting plan sheets to determine survival, health, and vigor of plant species. Water or drought stress, mineral deficiencies, and other stressors are identified.

Plant Percent Cover. The plant species present in each 10-meter circular plot

are recorded. A visual estimate of the percent cover of each species is recorded as a cover class estimate. The cover class system used for this study is a nine-increment scale known as the Octave Scale (Gauch 1982), which enables close observation of small changes in vegetation cover.

The Octave Scale (Gauch 1982) for the cover classes is listed below:

0 = single individual	5 = 4-8%
1 = 0.5%	6 = 8-16%
2 = 0.5-1%	7 = 16-32%
3 = 1-2%	8 = 32-64%
4 = 2-4%	9 = >64%

Percent cover of invasive Species. Non-native invasive species will be evaluated as part of the percent cover and species composition assessment. A spring site visit will be conducted in the spring between April 1 and 30 to assess general site and invasive species conditions. If necessary, the project owner will take immediate steps to address invasive species as recommended by the monitoring biologist. A second site visit will be conducted in the late growing season between July 20 and August 15.

3. **Photo Stations:** Photo points are established in locations marked by permanent stakes, across the site. These will be marked on a monitoring Figure of the site. Photographs that cover the entire area of the restoration will be taken from the same locations each monitoring season in August to document appearance, progress, and changes in the vegetation. Photographs for each year will be provided in each monitoring report. Photo station will provide adequate coverage of each area. There will be a minimum of two stations per mitigation site.

4. **Data Analysis:**

- i. The vegetation data will be quantitatively analyzed to assess changes in plant species occurrence, abundance, richness, and overall community diversity. A qualitative assessment of plant health and vigor will also be made.
- ii. Vegetation species occurrences and community changes will be assessed using the data from each sample plot for each year, and comparisons will be made to determine if changes in presence, composition or percent cover have occurred. Data analysis that illustrates the changes will be graphically presented.
- iii. Where percent cover of invasive exotic plants exceeds, or threatens to exceed, the performance standards outlined in the Mitigation Plan will be made.

D. MONITORING SCHEDULE

Post-construction mitigation monitoring would be conducted for four years post-installation on years 1, 2, 3, and 5, by a qualified wetland ecologist. Monitoring will consist of collection of data in the field as well as taking photographic documentation of specific stations across the site.

Weed Assessment Monitoring

Month	Task description
April ; Years 1 through 5	Inspect weed presence in all areas across the site. Identify the locations of weeds. Write a memo to the weeding contractor identifying the species of concern and their presence.

Baseline As-built monitoring tasks (if plantings are installed by the previous fall or spring)

Month	Task description
July/August	Install monitoring transects and stations.
August	Perform baseline surveys: vegetation (especially weeds) and photo stations.
September/ October	Review data and write report for file.

Years 2,3, and 5 Monitoring tasks

Month	Task description
August	Perform comprehensive surveys: vegetation and photo stations
September/ October	Review monitoring data and write report for file.

Additional Monitoring Tasks

Year/Month	Task description
April Year 2	Plant Survival

APPENDIX C. MAINTENANCE PLAN

The site is currently vegetated in predominantly native species. Species exist and most of these are located along the powerline cut and in the meadow area north of the EF23 stream/wetland corridor. There are a few non-native species. These include:

- Himalayan blackberry (*Rubus procerus*)
- Butterfly bush (*Buddleia davidii*)
- Bird's-foot trefoil (*Lotus corniculatus*)
- Bracken fern (*Pteridium aquilinum*)
- bull and Canada thistle (*Cirsium vulgare* and *C. arvense*)
- tansy ragwort (*Senecio jacobea*)
- bindweed (*Calystegia sepium*, and *Convolvulus arvensis*)
- holly (*Ilex aquifolia*)
- Any other daisy-like weed including dandelions, thistles, knapweeds, daisies, chicory, hawksbeard, crupina, camphorweed, hawkweeds, catsear, wild lettuce, nipplewort, and pineappleweed

The extent of weed infestation will be monitored in the spring and summer as part of the monitoring plan. Weed removal will occur in May, and early August with a final weeding in September (as needed) for all five years that monitoring is required. Weeding will include the edge of the trail by the fencing to be sure that no weeds from this area spread into the enhancement area. Any trees or shrubs that die over time will be left in place to provide additional wildlife habitat.

General Maintenance Site Preparation

2011 summer: The trail will be installed and any weed removal within the trail area will be done at that time. The mitigation area will be flagged and boundaries established.

2011 early September: a weed survey will be done to determine the extent of the weeds within EF1 and EF2. A weeding contractor will work on weed removal through October in preparation for November plant installation^[1].

General Maintenance Post-Planting

The extent of weed infestation will be monitored in the spring and summer as part of the monitoring plan. Weed removal should occur in May, and early August, and September (if needed) for the first three years of monitoring and then as needed. The maintenance that would be required once the wetland has been planted is:

Removal of weedy species and thinning of quickly growing species red alder and black cottonwood to 10-feet on-center. These should be hand-pulled if they are small enough or cut down if they are larger. Exotic and invasive species should be hand-weeded or

grubbed from the newly planted areas for ten years after installation (depending on how the site is doing), in the spring and cut and sprayed with Glyphosate after June 15th. Undesirable and weedy exotic plant species shall be maintained at levels below 10% total cover within any given stratum at any time during the monitoring period.

Special care should be taken if purple loosestrife or knotweed (giant, Japanese, or the hybrid Boehemicum) appears on the site. No plants of any of these species is allowed.

Any trees or shrubs that die over time will be left in place to provide additional wildlife habitat.