Bypass Routes 1 and 2; Tree Inventory and Analysis Report

Puget Sound Energy – Energize Eastside Project

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Acronyms and Abbreviations

APS	APS Survey & Mapping, LLC
BCC	Bellevue City Code
DBH	Diameter at 4.5 feet above the surface of the ground.
DEA	David Evans and Associates, Inc.
Ecology	Washington State Department of Ecology
I-90	Interstate-90
ISA	International Society of Arboriculture
LUC	Land Use Code: Title 20 of the Bellevue City Code
NERC	North American Electric Reliability Corporation
PSE	Puget Sound Energy
ROE	Right of entry
ROW	Right-of-way
SR520	State Route 520
WDFW	Washington Department of Fish and Wildlife
WSDOT	Washington State Department of Transportation
TWC	The Watershed Company

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BYPASS ROUTES 1 AND 2 TREE INVENTORY REPORT

PUGET SOUND ENERGY – ENERGIZE EASTSIDE

1 EXECUTIVE SUMMARY

This report summarizes the findings of a tree inventory and impact analysis study for Bypass Route 1 and Bypass Route 2. The Watershed Company conducted a field-based tree inventory from May 31 to July 12, 2016, collecting data on trees in the Bel-Red, Wilburton and Woodridge neighborhoods of Bellevue identified for the Bypass routes. The initial tree inventory covers an area extending 30-feet outward from edge of the rights-of-way in the study area. All vegetation with a potential to reach a height of 15 feet or more were included in the field study as detailed in the methodology section in this report. Tree removal analysis used geospatially referenced wire zone and managed ROW geometry provided by PSE, along with vegetation height restriction information, and our tree inventory data to identify trees to be removed. An estimated total of 1,453 trees would be removed in the Bypass Route 1 under the vegetation removal criteria scenario explained in the methods section in this report; 1,121 of those would be considered significant by the City of Bellevue. An estimated total of 1,242 trees would be removed along Bypass Route 2 under the referenced vegetation removal criteria scenario; 928 of those would be considered significant by the City of Bellevue.

2 INTRODUCTION

The purpose of this report is to present the findings of our tree inventory and tree removal analysis for the Bypass Route 1 and Bypass Route 2 options through the EIS Segment 3 in the City of Bellevue. The Bypass Routes have been identified by PSE as an alternative to a portion of the Willow and Oak Routes. Tree point data and polygon data will be provided in AutoCAD and Microsoft Excel (Excel) format along with this report.

2.1 Background

The Energize Eastside project proposes to build a new electric substation and higher capacity transmission lines to serve homes and businesses on the Eastside. Current route options include Oak and Willow routes that will extend from Redmond to Renton (Figure 1). Recently, PSE identified the Bypass Route 1 and Bypass Route 2 (Figures 2 and 3) as possible alternatives to a portion of the Willow and Oak Routes in the City of Bellevue.

2.2 Defined Study Area

The Bypass 1 alignment is shown in Figure 2. It arcs around the portion of the existing ROW through the Bel-Red, Wilburton and Woodridge neighborhoods, making a connection to the ROW at Northup Way in the north and just south of Lake Hills Connector in the south. Bypass 2 is shown in Figure 3. It follows the Bypass Route 1 alignment but diverges to meet the Lakeside Substation via Richards Road and SE 26th Street. Bypass 1 is approximately 3.9 miles in length. Bypass 2 is approximately 4.5 miles in length. The shared portion of the alignment is approximately 3.4 miles.

The study area consists of right-of-way (ROW) plus an area extending 30-feet outward from both sides of the ROW onto the adjacent property. Any median tree was assessed (except where the median area is wider than 60 feet), as well as trees rooted 30 feet away from the edge of the sidewalk on either side of most roads in the study area. Where the Lake Hills Connector east-bound and west-bound lanes diverge more than 60 feet, the trees located in the ROW but more than 30 feet from the interior edges of the roadway were not inventoried.

3 SITE DESCRIPTION

Bypass Routes 1 and 2 are located within the Bellevue neighborhoods of Bel-Red, Wilburton and Woodridge. The north half of the study area (through Bel-Red and Wilburton) is zoned commercial and office and contains largely office park landscaping with lawns, street trees and perimeter landscape shrubs and trees (Figure 4, Figure 5, Figure 6, Figure 7 and Figure 8). The Woodridge neighborhood is zoned residential and is composed mostly of natural wooded areas (along Lake Hills Connector) (Figure 9 and Figure 10) and some residential landscaping along Richards Road and SE 26th Street (Figure 11 and Figure 12).

Several wetlands and streams were identified around Lake Hills Connector. These features are described in in a separate report.

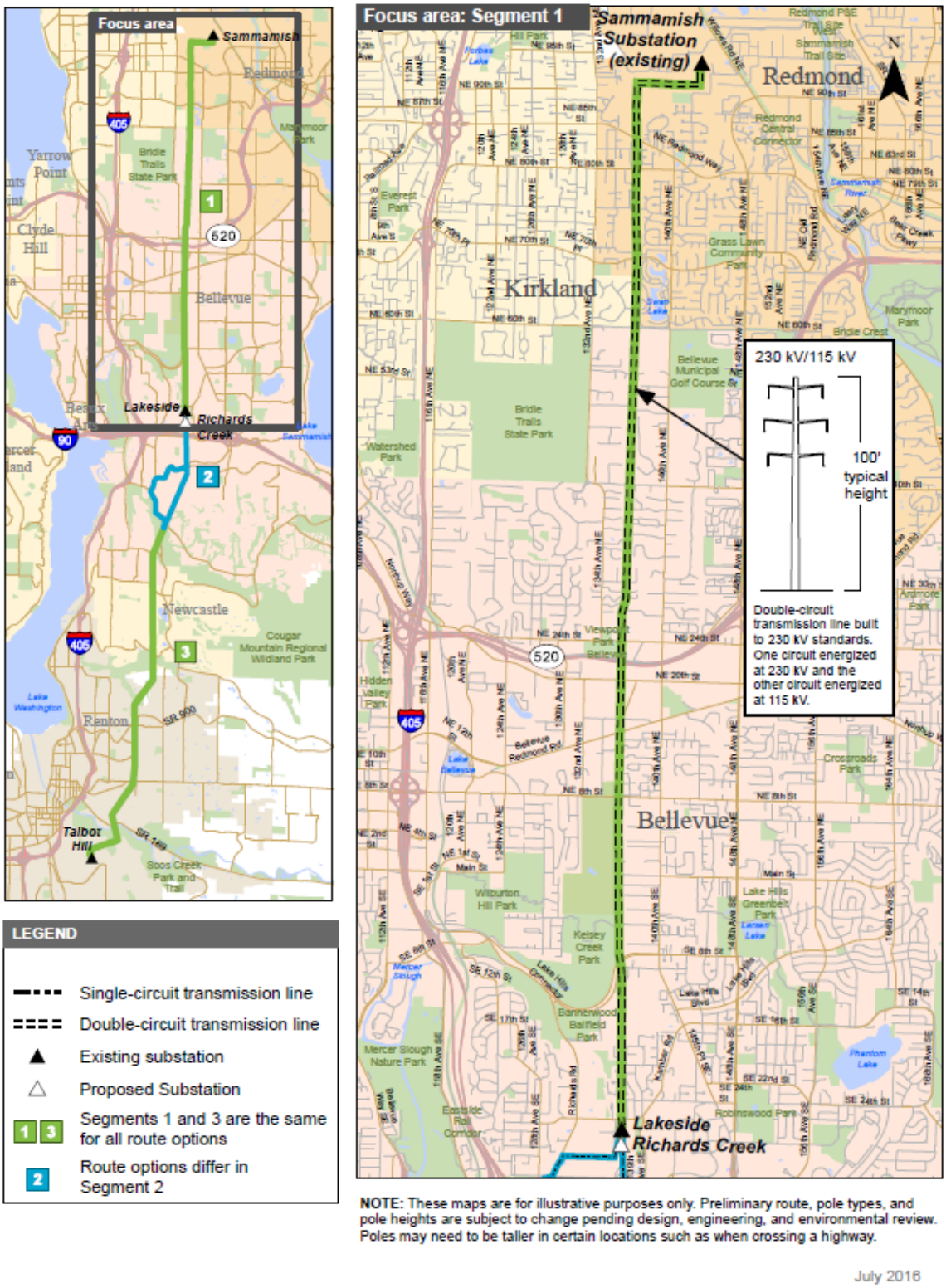

Figure 1 - An overview map showing the proposed Willow 2 Route. The Bypass Routes would provide an alternative to a portion of the route shown. (Energize Eastside, 2016)

East Bellevue Community Council bypass route 1

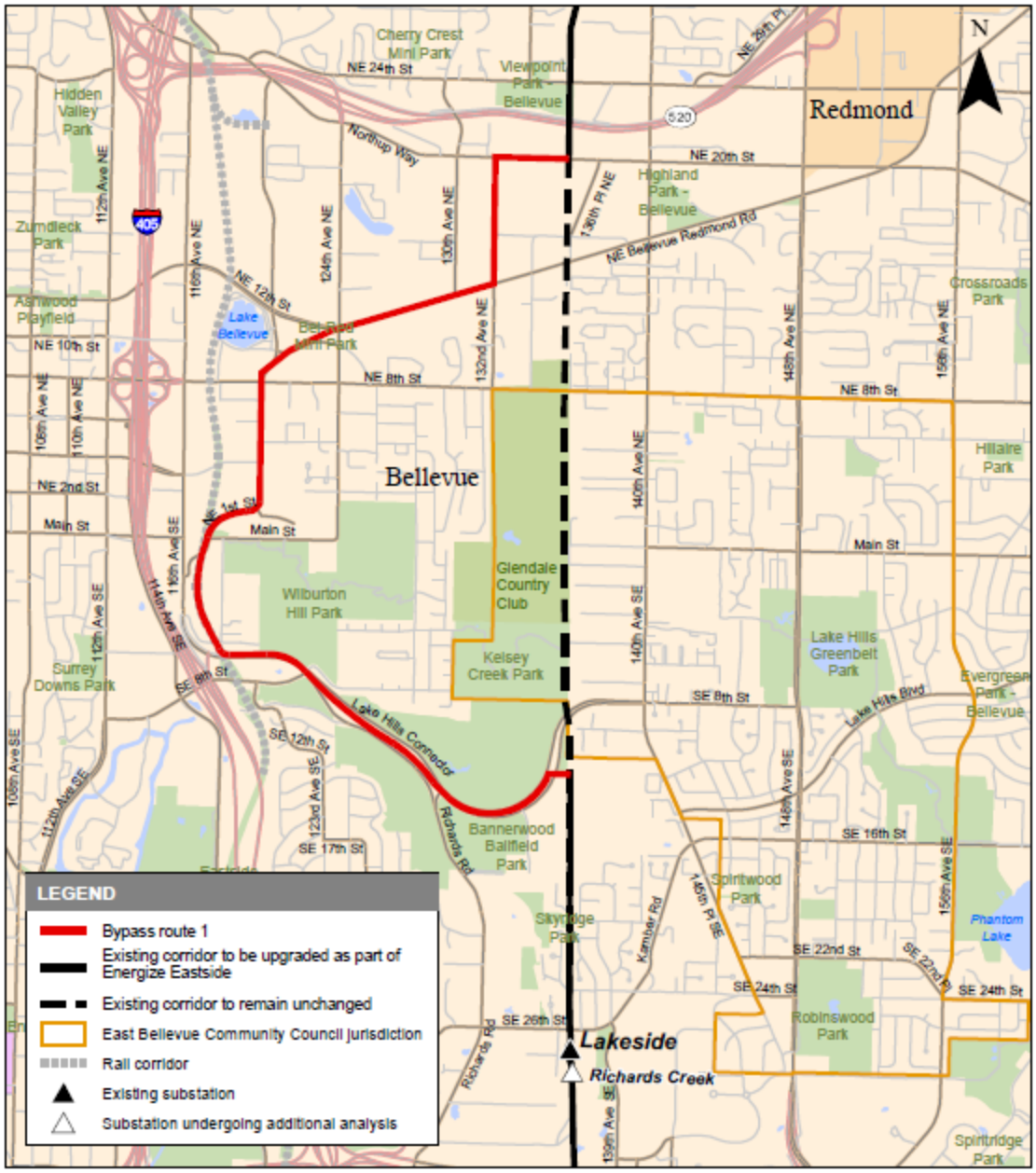

Figure 2 – A map showing Bypass Route 1 (red). (Energize Eastside, 2016)

East Bellevue Community Council bypass route 2

Figure 3 - A map showing Bypass Route 2 (blue). (Energize Eastside, 2016)

4 PHOTOS

Figure 4 – A sugar maple street tree growing along 130th Ave NE (Photo taken June 8, 2016)

Figure 5 - An American sycamore growing as a street tree along 130th Ave NE. (Photo taken on June 8, 2016)

Figure 6 - A Douglas-fir and new landscaping along Bel-Red Road. (Photo taken on June 10, 2016)

Figure 7 - A recently re-aligned section of Bel-Red Road. (Photo taken on June 10, 2016)

Figure 8 - A row of black tupelo street trees along 120th Ave NE (Photo taken on June 13, 2016)

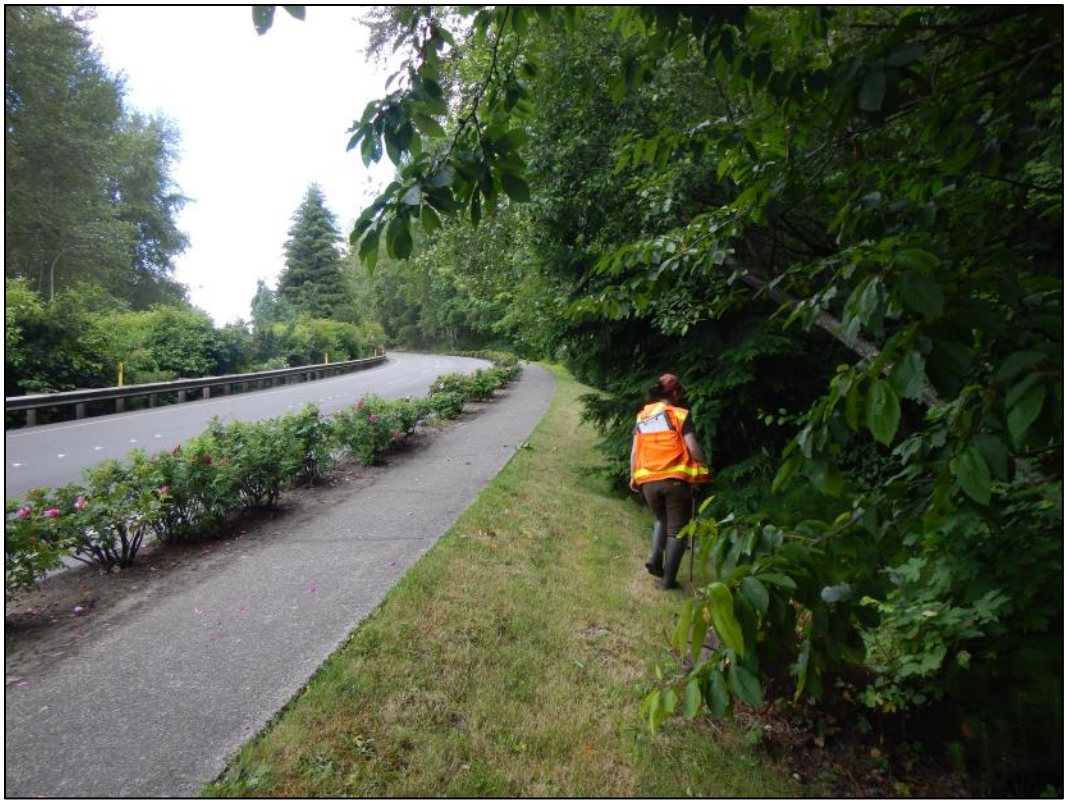

Figure 9 – A natural area north of the west-bound lanes of Lake Hills Connector (Photo taken on June 15, 2016)

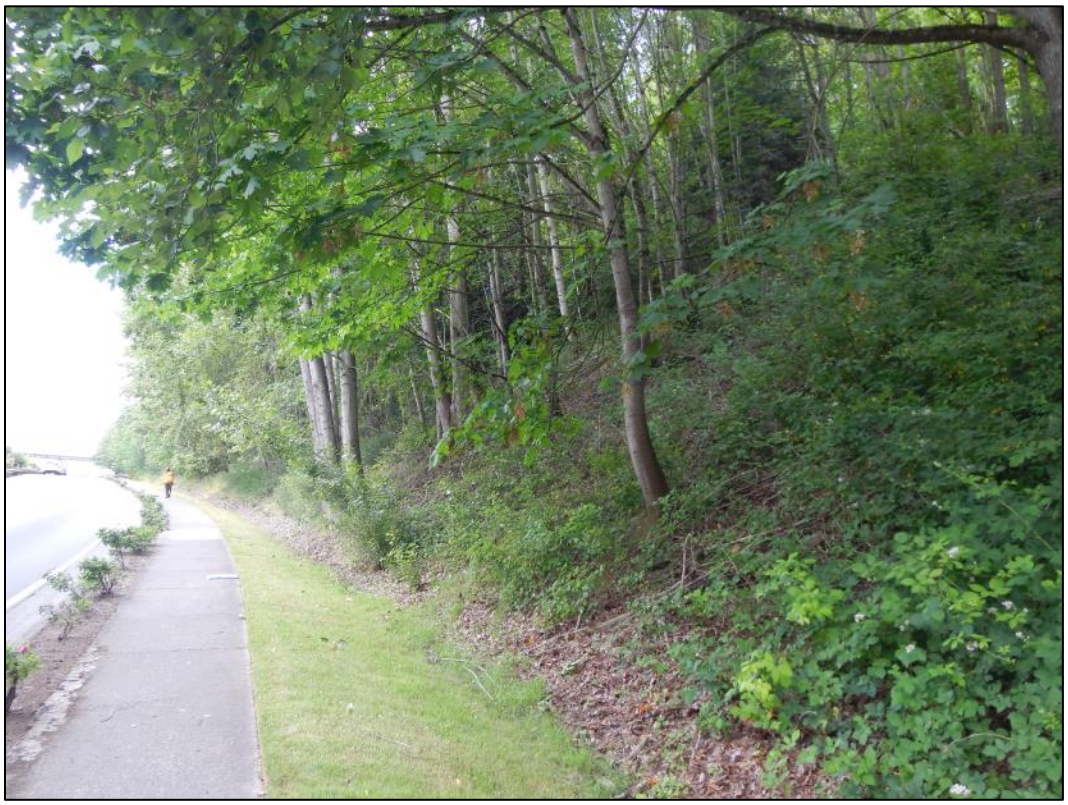

Figure 10 - Looking southeast along the east-bound lanes of Lake Hills Connector showing several big leaf maple trees. (Photo taken on June 15, 2016)

Figure 11 - A retaining wall, fence and vegetation in a residential neighborhood along Richards Road. (Photo taken on July 11, 2016)

Figure 12 - A stand of five- to eight- inch red alder trees growing on the west side of Richards Road.(Photo taken on July 11, 2016)

5 METHODS

The Watershed Company certified arborists conducted a field-based inventory of the Bypass Route 1 and Bypass Route 2 from May 31 to July 12, 2016. Proposed methodology for the inventory was originally developed, written and submitted to PSE in a Technical Memorandum dated March 13, 2015 for review and approved prior to Oak and Willow Route field work. The methodology was developed to comprehensively identify, describe (by collecting attribute data), and locate all vegetation greater than 15 feet tall, or which has the potential to reach a mature height of 15 feet or taller. The following is based on the Energize Eastside methodology, but was adapted, in consultation with PSE, for the specific site conditions and access limitations of the Bypass Routes.

5.1 Vegetation Inventory

5.1.1 Significant Trees

According to LUC 20.50.046, the City of Bellevue defines a significant tree as a healthy evergreen or deciduous tree, eight inches in diameter or greater, measured four feet above existing grade. The Director of the Development Services Department may authorize the exclusion of any tree which for reasons of health, age or site development is not desirable to retain.

Significant trees were assigned an identification number, assessed and mapped, but not tagged in any way. Most of the significant trees assessed were located on private property. As a result, fewer than half of the trees were directly measured for DBH or canopy radius; those attributes were visually estimated from the public ROW where direct measurement could not occur.

5.1.2 Non-Significant Trees and Shrubs

Many small, non-significant trees and shrubs with a maximum potential height of 15 feet or more are rooted throughout the Bypass study area. Our methodology for how to assess and map these plants varies depending on their origin, the surrounding land use type, and how and if they are maintained.

The Landscaped Environment

Any landscaped or maintained tree or shrub (these are generally installed and maintained plants) with a potential maximum height of over 15 feet in a landscaped bed or maintained yard, regardless of trunk diameter or current height was assessed and mapped as a singular point under this study. This data is included in the *tree point* sheet in the updated excel table sent along with this report.

Hedges

Landscaped hedges that are composed of multiple individual plants were mapped and assessed with a polygon instead of tagging the individual plants that make up the hedge. Maintained contiguous groupings of trees and shrubs with a potential maximum height of greater than 15 feet (e.g., cherry laurel, Portuguese laurel, and arborvitae) that are growing in a row and or hedged were assessed as a polygon. Attribute data were collected for each polygon per Section 5.5 below and are included in the *polygon* sheet of the Excel data table update that will be sent along with this report.

Lake Hills Connector and Richards Road Natural Areas

Non-significant trees (with a DBH of less than eight inches) were characterized using a polygon in the natural areas adjacent to Lake Hills Connector and Richards Road. These natural areas are largely characterized by non-planted Sitka and Pacific willow, black cottonwood and red alder trees. The data will be included in the *polygon* sheet of the excel data table.

Landscaped Sub Areas in the Lake Hills Connector and Richards Road Areas

Any planted areas along Lake Hills Connector or Richards Road were treated as "landscaped environment" and assessed according to 5.2.1. These areas include the wetland and buffer mitigation site located northeast of Richards Creek and Lake Hills Connector and small vegetation enhancement pockets along the east-bound lanes of Lake Hills Connector east of 134th Ave SE.

Other Non-Landscaped Areas

Additional non-significant trees in non-landscaped areas (e.g., along the railroad tracks between SE 1st Street and Lake Hills Connector) were mapped using the polygon method as described in 5.2.2.

5.1.3 Authority

Several resources were referenced to determine the maximum height of the various species of tree and shrub encountered in the subject area. For landscape trees and shrubs (plants not native to Washington State), the Oregon State University Department of Horticulture online landscape plant database (Oregon State University, 2016) was referenced. Native trees and shrub maximum heights were verified using the University of Washington WTU herbarium website (University of Washington, 2016) and the USDA plant database (United States Department of Agriculture, 2016). These resources were used for both the scientific names and the common names for the spreadsheet reporting.

5.2 Vegetation Mapping

Trees points along the Bypass Routes were plotted in the field using a hand-held field computer running ArcPAD software. Arborists used high-resolution aerial imagery and field observation to hand-plot the points, using the computer and software to geo-reference tree points as they were collected in the field.

Polygon maps for vegetation described in Sections 5.2.1 and 5.2.2 were hand - drafted on aerial imagery in the field, manually entered into ArcGIS in the office, reviewed and corrected before being converted to AutoCAD.

Table 1 - Attributes recorded for all inventoried vegetation and that are presented in the spreadsheet database.

ATTRIBUTE	DESCRIPTION OF ATTRIBUTE
DATE OF ASSESSMENT	Date that The Watershed Company field crew tagged and assessed the tree or shrub.
ID NUMBER	Unique number assigned to an assessed tree or polygon. This number corresponds to the tag number in the field or the polygon number on the maps.
PARCEL NUMBER	Parcel number(s) in which the subject tree or polygon is located. In some cases, the parcel number corresponds to the closest parcel if the tree is in a City right-of-way.
SCIENTIFIC NAME	Formal scientific name conforming to the International Code of Nomenclature.
COMMON NAME	Name that is based on normal or common language of the Pacific Northwest.
STEMS	Number of trunks or shoots that contribute significantly to the canopy.
DBH	Diameter at Breast Height; or 4.5 feet from the ground surface. See Section 5.5 for variations.
DBH2	DBH of secondary and other minor stems.
HEIGHT	Approximate distance from the ground surface at the trunk to the highest point of the subject tree as visually estimated. Average height for polygons.
CANOPY RADIUS	Measurement from the stem to the average drip line, or end of branches.
CONDITION	Health rating of an assessed tree using a 5-tier system as follows: 1 – Excellent: No apparent problems with the tree. Form is exemplary for the species. 2 – Good: Few minor defects such as crossed branches, minor foliage die-back, minor trunk damage, or unbalanced canopy. 3 – Fair: Several minor problems exist. 4 – Poor: Major defects visible such as significant trunk decay, codominant leaders with included bark, significant canopy die-back, major cracks in a stem or major limbs, and/or other structural problems. Topped trees are generally considered poor. 5 – Dead or dying: Tree is dead or is in a state of significant decline.
NOTES	Additional comments relating to assessment of the tree or polygon unit.

Where possible, the diameter of all subject trees was measured at four feet above the surface of the ground at the trunk (DBH); however, some stems were measured differently due to size or branching structure. Very small trees without a defined stem at four feet above the ground were measured using the caliper-method, in which the stem is measured six inches above the ground. For trees with major branching at or below four feet, the smallest portion of the trunk below major branching was measured. Methodology for measuring diameter of trees with major leans, on steep slopes, and with multiple trunks or stems generally followed those outlined in the *Guide for Plant Appraisal* (Gooding, et al., 2000). Other attributes collected are listed and described in Table 1.

As no rights-of-entry were secured for the Bypass Routes, most attributes (e.g., DBH) for subject trees were estimated from the public ROW.

5.3 Attribute Data Collection

The attributes collected during the field survey are listed and described in Table 1. The Excel spreadsheet database contains information collected during the field visit. General attributes documented for all inventoried vegetation include the date of assessment, unique identification number of tree or polygon, location (parcel number), and name of plant species. Physical attributes include number of stems, stem diameter (DBH), height, canopy radius, condition, and notes. For polygons, approximate number of individual trees or large shrubs within a polygon was recorded instead of stem number, and other physical attributes for vegetation within polygons were recorded as averages.

5.4 Data Management

Data were entered into an Excel spreadsheet in the office and subsequently reviewed, corrected, and organized into a searchable database. The spreadsheet file will be delivered along with this report.

For the purposes of determining what constituted a significant tree, this study excluded all tagged trees or shrubs that rate as *Dead or Dying*. Any tagged tree with a primary DBH equal to or exceeding eight inches with a condition rating of *Excellent*, *Good*, *Fair* or *Poor* is considered significant.

5.5 Methodology for Vegetation Impact Analysis

Vegetation within a utility corridor that has transmission line(s) with an operational voltage of more than 200 kV must be managed in a way that meets federal requirements. The fines/penalties for having a power outage related to vegetation growing into a 230 kV transmission line can be substantial. To ensure compliance with the NERC standard, PSE allows vegetation with a mature height of no greater than 15 feet within the *wire* zone. For evaluation purposes, the same vegetation requirement was applied to the *managed* right-of-way (ROW) zone. The area outside of the managed ROW, but still within the legal ROW is subject to select clearing of trees that pose a risk of damaging the line.

The wire zone is the area measured 10 feet away from the outermost conductor(s) in a static position, whereas the managed ROW zone is the area that extends roughly 16 feet from the outside of the transmission wires in their static position.

The vegetation impact assessment used GIS analysis to evaluate the tree inventory data and the preliminary transmission line design to assess the number of trees that would likely require removal within a specific route. The steps of the analysis are provided below.

5.5.1 Tree Inventory

The tree and vegetation inventory methodology and boundaries of the study area are described above.

5.5.2 Data Compilation

Tree locations used in this analysis were obtained and compiled from survey, GPS, and digitization using high-resolution imagery. Surveyed locations were collected by two survey firms, APS Survey & Mapping (APS) and David Evans and Associates, Inc. (DEA). This information was provided to TWC as tables containing surveyor-assigned point numbers, latitude and longitude coordinates, and surveyors' field notes. Surveyors captured the physical tree tag numbers, which were attached to trees in the field by TWC arborists during the tree inventory. Where possible, the surveyors also collected tree type information and approximate diameter at breast height (DBH).

5.5.3 Tree Point Mapping and Data Set Compilation

Surveyed tree locations were mapped as geospatial points using the coordinate data and then merged with the associated geospatial data associated with each point. Once compiled, the full set of tree points was spatially joined to County parcel geometry. Each point (tree) was assigned a unique identification number generated from a concatenation of tree tag and ten-digit parcel number.

Using the unique identification number, mapped tree points were joined to the arborist's master tree inventory table that contained detailed information for each tree as described in Table 1, above. Maximum potential height values were assigned by species according to best available resources for mature vegetation growth. This was necessary to identify non-compatible species. The resultant dataset provides the location and detailed attribute information for all inventoried trees within the study area.

5.5.4 Vegetation Impact Analysis

The impact analysis was conducted by placing the tree points on a georeferenced base map and overlaying the proposed conductor and pole alignments establishing the wire and managed ROW zones or areas. Impact areas were defined by PSE as: wire zone, managed right-of-way (ROW), legal ROW, pole buffer area, and proposed access roads. Geometry for impact areas were obtained from multiple sources in AutoCAD format, then translated into ArcGIS

polygon data to facilitate overlay with geospatial point data. Survey data for the existing alignments were provided by APS and DEA. Geometry for the prospective corridor alignments was provided by PSE. Proposed access road alignments were provided by PSE in ArcGIS shape file format. Pole buffer areas, defined as the area within a twelve-foot buffer of proposed pole locations, were derived from the proposed pole geometry in the AutoCAD data provided by PSE.

Next, using a series of spatial queries, tree points were classified as occurring within or outside of the designated impact areas for each corridor alignment. Then, within each zone, select-by attribute queries were used to identify records that met the criteria for removal. Removal criteria are listed below.

Removal Criteria

- Remove all dead and dying trees.
- Remove all trees within the legal ROW and outside of the managed ROW with a maximum potential height exceeding 70 feet.
- Remove all trees within the proposed wire zone and managed ROW with a maximum potential height exceeding 15 feet.

5.5.5 Limitations of the Analysis

Several surveyed records were not attributed with a physical tree tag number. To rectify unnumbered point data, surveyed points were analyzed against the mapped parcel data and arborist's master tree inventory table, which recorded parcel numbers. Using the surveyors' notes, high-resolution aerial imagery, and arborists' notes and recollection, unnumbered points were matched with physical tree tag numbers to the extent feasible.

Further, some errors, such as typographical or duplicate values, were present in the notes fields. These errors were rectified based on the best judgement of the analyst through review of the data, documentation, and imagery.

Considering these limitations, it is possible that some tree tags numbers may be incorrectly assigned, which may affect the vegetation impact summary calculations and mapped results.

In addition, the scale of the impact area boundaries drawn in AutoCAD by PSE is unknown. Therefore, mapped impact areas may not align with the planned real-world layout of proposed corridor facilities. Ground-truthing of these results may reveal that some trees appearing in or out of a mapped impact area are incorrect. Furthermore, as impact area geometries were translated from AutoCAD into ArcGIS, some geometric refinements were necessary to address gaps and other issues, which could affect the accuracy of the analysis results.

6 LIMITATIONS

When trees and shrubs occurred within the ROW or on public land, attributes were measured directly. All trees and shrubs on private property were assessed visually only from the sidewalk. On some parcels, line of sight was blocked by solid fences and attributes were estimated from the parts of the tree that were visible. Consequently, most measurements provided in our data table for trees located on private property are approximated only.

Some trees were highly obscured by tall fences or retaining walls. As a result, some trees and shrubs may be misidentified. Some taxa, such as the "cherry" genus, contain many species and botanical varieties that were not identifiable without all characteristics present. Where identification to the species level was not possible, species was indicated with "*sp.*" in the spreadsheet. An unknown cherry tree, for example, was indicated as "*Prunus* sp." If an uncommon tree was simply not identifiable (for lack of leaves or flowers), an "unk.", or "unknown" was entered into the name column of the spreadsheet and any descriptor that would aid in identification was added to the notes field.

Trees and polygons located on the edge of parcel boundaries were assigned a parcel number based on field observations. However, fence lines sometimes do not exactly match parcel lines and the parcel boundary overlay on aerial imagery used in the field was sometimes inaccurate. Determining exact parcel boundary locations in the field was not possible.

Tree size and condition vary with time. Tree inventory data presented and used for the analysis in this report represent a snapshot of conditions at the time of the field work and may not necessarily be accurate in the future.

7 RESULTS

7.1 Vegetation Inventory

A total of 3,035 trees were assessed along the entire Bypass 1 and Bypass 2 Route study areas, with 2,161 of those meeting the City of Bellevue criteria for "significant". The information provided in this Section is baseline information only and does not represent the number of trees that would be removed as a result of the Energize Eastside project. Impact analysis is provide below in Section 7.2.

As the routes share a large portion of their alignment, the following is a separated breakdown of the individual totals. The Bypass Route 1 alignment study area contains 2,638 trees, of which 1,928 are considered significant by the City of Bellevue based on size and health (Table 2). The Bypass Route 2 study area contains 2,420 subject trees, with 1,667 of them are healthy (or relatively so) and exhibit a diameter of eight inches or greater, meeting the City's significant tree definition.

Table 2 - Bypass tree inventory results. These numbers do not represent the number of trees that would be cut or pruned as a result of the Energize Eastside project. See Section 7.2 for impact analysis.

Route	Non-significant trees	Significant trees	GRAND TOTAL
Bypass Route 1	710	1,928	2,638
Bypass Route 2	753	1,667	2,420

A total of 88 polygons containing groupings of non-significant trees and shrubs were mapped and described in this area. The point and polygon data is included in an AutoCAD file that will be delivered with this report.

It should be noted that hundreds of non-significant willows, red alders and black cottonwood trees (between 0 and 7 inches in diameter) in the natural areas along Lake Hills Connector and Richards Road were not individually assessed as a singular point data and do not appear in the tree tally presented here, the collection of points in the AutoCAD file provided with this report, or the tree impact analysis summarized in the next section. They instead were grouped and assessed as polygon data and reported as such in the table of data provided as an excel spreadsheet. Some of these trees exhibit trunk diameters up to seven inches with 30 foot heights.

A 54-inch big leaf maple tree (tree number 10657) is the largest tree assessed, with many other big leaf maples, black cottonwoods, Douglas-firs, and western red cedars exhibiting 30-inch trunks or larger. Most of these larger trees are growing in the Woodridge neighborhood natural areas adjacent to Lake Hills

Connector. Both routes travel through this area, but tree number 10657, mentioned above, is located in the Bypass 2 study area.

Many of the species found in the Bel-Red and Wilburton Neighborhoods are London plane, red maple, Douglas-fir and sweet cherry trees. Many newly-installed trees were located and assessed along the roadways in the Bel-Red and Wilburton neighborhood, including a row of several black tupelos along 120th Ave NE (tree numbers 8743 – 8871).

Many of the subject trees are located in wetlands, associated buffers or structure setbacks. See *Energize Eastside – Bypass Routes 1 and 2 Critical Areas Addendum*, (dated July 15, 2016), for more information on critical areas.

7.2 Impact Analysis Results

7.2.1 Bypass Route 1

An estimated total of 1,453 trees would be removed under the Bypass Route 1 scenario (Table 3) using the removal criteria explained in Section 5.5.4, above. Of those trees to be removed, the City of Bellevue would consider 1,121 of them to be significant trees.

7.2.2 Bypass Route 2

An estimated total of 1,242 trees would be removed in Bypass Route 2 using the removal criteria explained above. Of those trees, the City of Bellevue would consider 928 to be significant.

Table 3 – Summary of the tree impact analysis for the Bypass Routes.

Route	Estimated total number of trees in the Legal ROW, Managed ROW and Wire Zone	Estimated trees to be removed	Removed trees that area also significant in the City of Bellevue
Bypass Route 1	1,672	1,453	1,121
Bypass Route 2	1,472	1,242	928

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