

**EXH. DRK-17
DOCKETS UE-22 ___/UG-22 ___
2022 PSE GENERAL RATE CASE
WITNESS: DAN'L R. KOCH**

**BEFORE THE
WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION**

**WASHINGTON UTILITIES AND
TRANSPORTATION COMMISSION,**

Complainant,

v.

PUGET SOUND ENERGY,

Respondent.

**Docket UE-22 ___
Docket UG-22 ___**

**SIXTEENTH EXHIBIT (NONCONFIDENTIAL) TO THE
PREFILED DIRECT TESTIMONY OF**

DAN'L R. KOCH

ON BEHALF OF PUGET SOUND ENERGY

JANUARY 31, 2022

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Project Alternatives

CHAPTER 2. PROJECT ALTERNATIVES

This chapter describes the alternatives considered in the EIS. The Phase 1 Draft EIS considered a No Action Alternative and three primary action alternatives, with several sub-options within those. The Phase 2 Draft EIS carried forward Alternative 1 from the Phase 1 Draft EIS for project-level EIS review, as well as the No Action Alternative. The Phase 2 Draft EIS action alternatives include a new substation and several alternatives for overhead 230 kV lines to supply the new substation.

The Final EIS adds to and refines the alternatives under consideration. PSE's Proposed Alignment, which was developed by PSE based on the project alternatives evaluated in the Phase 2 Draft EIS, includes adjustments to pole locations and types. PSE's Proposed Alignment also includes two design options within the Newcastle Segment. PSE selected its preferred alignment because it would attain the objectives defined in Chapter 1 (see Section 1.3) and would reduce some of the potential impacts associated with an overhead transmission line. PSE's Proposed Alignment described and evaluated in this Final EIS is not a new alignment, but rather a refinement of the designs evaluated in the Phase 2 Draft EIS.

The full range of alternatives under consideration therefore includes the following:

- No Action Alternative
- Alternative 1 (Components, Segments, and Options)
 - Richards Creek Substation and Improvements to Other Substations*
 - Redmond Segment*
 - Bellevue North Segment*
 - Bellevue Central Segment, Existing Corridor Option*
 - Bellevue Central Segment, Bypass Option 1
 - Bellevue Central Segment, Bypass Option 2
 - Bellevue South Segment, Oak 1 Option
 - Bellevue South Segment, Oak 2 Option
 - Bellevue South Segment, Willow 1 Option*
 - Bellevue South Segment, Willow 2 Option
 - Newcastle Segment, Option 1- No Code Variance
 - Newcastle Segment, Option 2- Code Variance*
 - Renton Segment*

*Included in PSE's Proposed Alignment for analysis in the Final EIS.

While the Final EIS focuses on PSE's Proposed Alignment and does not repeat information about other alignment options evaluated in the Phase 2 Draft EIS, the alternatives evaluated in the Phase 2 Draft EIS may still be considered by the Partner Cities in the permit review process. The Partner Cities have not identified a preferred alternative.

This chapter also identifies alternatives considered but not evaluated in the EIS. The Phase 1 Draft EIS described several programmatic-level alternatives that were considered and not carried forward and the reasons they were not. The Phase 2 Draft EIS describes alternatives that were not carried forward, either from the Phase 1 Draft EIS or from the scoping process, because they did not meet PSE's project objectives (see Section 2.2 of the Phase 2 Draft EIS). In this Final EIS, Section 2.2 summarizes the reasons that alternatives were not carried forward in the Draft EISs, and also describes alternatives considered after publication of the Phase 2 Draft EIS but were not carried forward.

As required by SEPA (Washington Administrative Code [WAC] 197-11-440), benefits and disadvantages of delaying PSE's project are also described at the end of this chapter (presented in Section 2.3).

The Phase 1 Draft EIS was published on January 28, 2016. It evaluated, at a programmatic level, the environmental impacts of alternative methods to address the electrical transmission capacity deficiency identified by PSE. The Phase 1 Draft EIS was programmatic in nature and addressed a broad range of potential alternatives. While not required under SEPA, the Partner Cities opted to provide the Phase 1 evaluation to ensure that the alternatives considered in the Phase 2 Draft EIS reflect the full range of feasible alternatives to meet PSE's project objectives. The Phase 1 Draft EIS broadly evaluates the general impacts and implications associated with a broad range of available technologies. Based on their analysis of their system and the findings of the Phase 1 Draft EIS, PSE determined that a wire-based solution was the only feasible and reasonable project alternative to meet their project objectives. The evaluation conducted during Phase 1 was also used by the Partner Cities to narrow the range of alternatives for consideration in the Phase 2 Draft EIS.

Project Terminology

The Final EIS uses the following terms:

PSE's Proposed Alignment – PSE's Proposed Alignment is composed of six transmission line segments: Redmond, North Bellevue, Central Bellevue, South Bellevue, Newcastle, and Renton. PSE's Proposed Alignment also includes the Richards Creek substation.

Segment – Segments are components of PSE's Proposed Alignment and include identified portions of the transmission line route, generally divided by city boundaries, except there are three segments for Bellevue. The Final EIS evaluates six distinct segments.

Option – Options are alternative pole configurations identified by PSE for specific segments, designed to address public comments or jurisdictional considerations. In addition to the options described in the Phase 2 Draft EIS, for the Final EIS analysis, two options have been identified for the Newcastle Segment: one that would not require a code variance (Option 1), and another that would require a code variance (Option 2).

Corridor, Route, Alignment – These are all general terms for the path travelled by the transmission line, and are essentially synonyms. Corridor generally refers to the entire length of the line, whereas route and alignment refer to a given portion of a segment or option.

PSE's Right-of-Way – Refers to the land over which PSE has a right to build and operate its transmission lines. PSE's right-of-way includes parcels owned outright by PSE, and parcels owned by others over which PSE owns an easement allowing the transmission lines. Portions of the transmission lines within public right-of-way are typically allowed through franchise agreements with the public entity that owns the right-of-way.

Easement – Refers to a formal legal agreement giving PSE the right to use the real property of another for a specific purpose, such as overhead transmission lines. An easement specifies the width and other dimensions over a given parcel. The easement is a real property interest, but legal title to the underlying land is retained by the original owner for all other purposes. PSE's Proposed Alignment would be located entirely within its existing easement. The typical easement width for existing corridor is 100 feet.

Informed by the Phase 1 analysis, the Phase 2 Draft EIS was project-specific and focused on PSE's then-preferred alignment of the new 230 kV transmission lines (with the available design details at the time of that analysis) and alternative alignment routes also called options. This Final EIS focuses on PSE's Proposed Alignment and includes updated design and route details, which differ in some aspects from the preferred alignment as presented in the Phase 2 Draft EIS. PSE also provided more specific information about pole types, heights, and locations for its Proposed Alignment, as well as additional information about construction timing that was not available for the Phase 2 Draft EIS.

The Phase 1 Draft EIS includes important information on project background and the regulatory context, which is not repeated in the project-specific Phase 2 Draft or Final EIS documents; the reader is referred to the Phase 1 Draft EIS for additional information on those topics, and cross-references are included in the Final EIS for convenience of readers.

The Final EIS is focused on the information needed to evaluate PSE's proposed project, at a level of detail sufficient for decision makers to comply with SEPA during permitting but is still based on design details that may be further refined during the permitting stages. Information on context is included as needed to provide a complete analysis for the project-level Final EIS, with more detailed supporting information incorporated by reference to the Phase 1 and Phase 2 Draft EIS documents and appendices. If information on existing resources in the study area (i.e., the affected environment) or regulatory context has not changed since publication of the Phase 2 Draft EIS, the information is not repeated in the Final EIS; rather, a cross-reference is provided, and this information is incorporated by reference. For all resources, however, the Final EIS includes a full analysis of the potential impacts of PSE's Proposed Alignment, generally by segment and option, even if the impact analysis has not changed since the Phase 2 Draft EIS.

To keep the information in Chapter 2 concise, some project details that relate to a specific element of the environment are presented in Chapter 4, *Long-term (Operation) Impacts and Potential Mitigation*, or Chapter 5, *Short-term (Construction) Impacts and Mitigation*. For example, while Chapter 2 includes general information on vegetation clearing zones associated with the project, further details about vegetation clearing (such as the number, location, and type of trees removed) are described and analyzed as appropriate in Sections 4.4 and 5.4, *Plants and Animals*. Similarly, information on pipeline safety, both during construction and operation, is presented in Sections 4.9 and 5.9, *Environmental Health – Pipeline Safety*. Chapter 2 focuses on the key components of PSE's Proposed Alignment at an appropriate level of detail to support the analysis presented in Chapters 4 and 5.

Project Area and Study Area

This Final EIS uses two related terms: "study area" and "project area." In general, "project area" refers to the lands crossed by the proposed transmission line corridor (both existing and new) and the substations, any properties with easements for the project, as well as the adjacent properties. In contrast, the term "study area" is used to describe the area associated with a specific resource element that could be affected by the project. The study area differs from element to element, depending on the spatial nature of the potential impacts. The study area for each resource element is defined in the introduction or methodology discussion in each Chapter 4 subsection, and often shown on a map for clarity. In addition, the study area as referred to in the Final EIS focuses on PSE's Proposed Alignment, which is entirely in the existing corridor (and differs from the Phase 2 study area in some cases).

2.1 FINAL EIS PROJECT ALTERNATIVES

This Final EIS evaluates PSE's proposed Energize Eastside project (PSE's Proposed Alignment), and a No Action Alternative (as required by SEPA, WAC 197-11-440). The No Action Alternative provides a benchmark against which the impacts of the project and other alternatives can be compared.

PSE's Proposed Alignment includes two main components:

1. **A new substation, called the Richards Creek substation**, adjacent to the existing Lakeside substation in Bellevue; and
2. **New 230 kV overhead transmission lines**, connecting the Richards Creek substation to both the Sammamish substation in Redmond and the Talbot Hill substation in Renton, through the cities of Redmond, Bellevue, Newcastle, and Renton.

The new Richards Creek substation and transmission lines would increase electrical capacity and improve electrical transmission grid reliability for Eastside communities. PSE has proposed a route alignment for the transmission lines, as described in Section 2.1.2. The Partner Cities, in cooperation with PSE, have determined that these route and pole options are reasonable alternatives that could attain or approximate PSE's objectives for the proposed project, and should be considered along with the other alternatives evaluated in the Phase 2 Draft EIS.

2.1.1 No Action Alternative

SEPA requires the analysis of the No Action Alternative in an EIS, against which an action alternative (e.g., PSE's Proposed Alignment or any other alternative) can be evaluated and compared. For the Final EIS, the No Action Alternative is defined as those actions PSE would undertake to maintain and operate the existing transmission system if the proposed project is not approved. The No Action Alternative represents the most likely outcome if the project is not implemented, and it is considered the baseline condition.

Under the No Action Alternative, PSE would continue to manage its system in largely the same manner as at present, with some exceptions. Specifically, PSE indicates it would be necessary to operate with additional Corrective Action Plans (CAPs) including load shedding plans as described in Section 1.3. These additional plans are not necessary at present but will become necessary as the electrical load continues to grow. Operation of the existing system includes maintenance programs to reduce the likelihood of equipment failure (including pole replacement), and stockpiling additional equipment so that in the event of a failure, repairs could be made as quickly as possible.

Implementation of the No Action Alternative would not meet PSE's objectives for the proposed project, which are to maintain a reliable electrical supply system and to address a deficiency in transmission capacity on the Eastside. Implementation of the No Action Alternative would increase the risk to the Eastside of power outages or system damage during peak power events.

2.1.2 PSE's Proposed Alignment: New Substation and 230 kV Transmission Lines

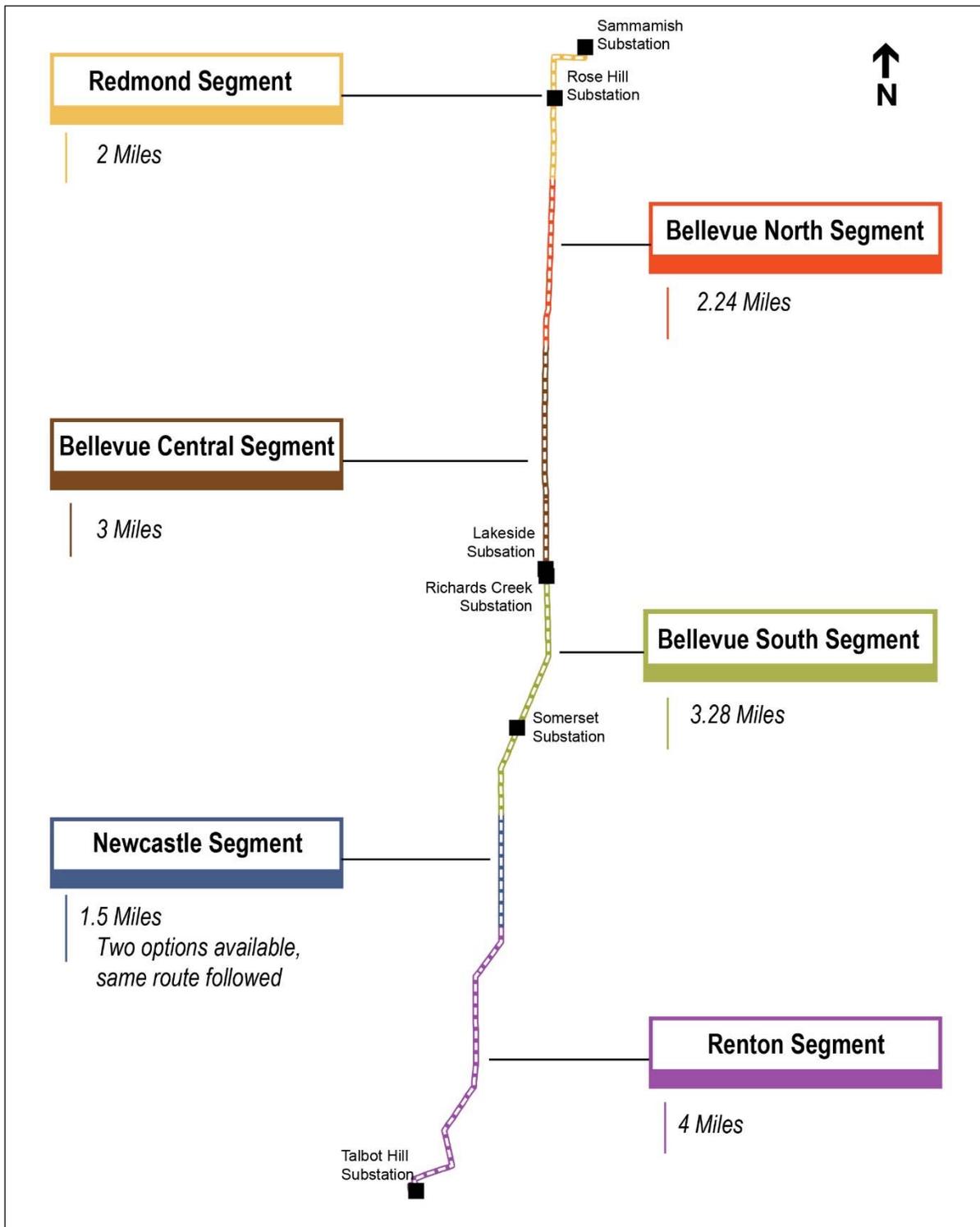
PSE's Proposed Alignment includes a new substation (Richards Creek) and approximately 16 miles of new 230 kV electrical transmission lines to connect two existing bulk energy systems (the Sammamish substation in Redmond, and the Talbot Hill substation in Renton). This alternative is a variant of Alternative 1 in the Phase 2 Draft EIS, and Option A under Alternative 1 in the Phase 1 Draft EIS. For the Final EIS, the proposed 230 kV transmission line corridor is divided into six main segments (with one of the segments containing two pole configuration options) to aid in the analysis and organize material for the decision-makers. To assist Bellevue and the other Partner Cities in evaluating the project during the decision-making process, the segments are organized primarily by city jurisdiction, from north to south: Redmond, Bellevue, Newcastle, and Renton. Because of the distance and previous route options that were studied in Phase 2, the route within Bellevue is separated into three segments (Bellevue North, Bellevue Central, and Bellevue South).

In the Bellevue Central and Bellevue South Segments, the Phase 2 Draft EIS analyzed options for routing the transmission lines along various corridors other than PSE's existing 115 kV corridor. These options are not PSE's preferred alignment, but they may still be considered by the jurisdictions in their permitting decisions.

In fall 2017, PSE submitted two permit applications, one to the City of Bellevue (extending from the Lakeside substation area to the southern city limit) and one to the City of Newcastle (PSE, 2017b and 2017c, respectively). Information in the two permit applications is generally at a finer scale than the design information available for analysis in the Phase 2 Draft EIS, including additional data on *critical areas* and project components, such as pole types and locations. Analysis in the Final EIS for PSE's Proposed Alignment reflects the refined design details presented in these permit applications where applicable. PSE continues to refine the project design to reduce potential impacts and address the technical requirements of the project as it prepares other permit applications. The Final EIS includes a new appendix (Appendix I) that compares the information used in the Phase 2 Draft EIS to what was used in the Final EIS.

Figure 2-1 lists the segments and options that comprise PSE's Proposed Alignment as presented in the Final EIS. To be viable, PSE's Proposed Alignment requires continuous transmission lines across all six segments. The segments are color-coded for reference throughout this Final EIS.

The Richards Creek substation is described first below, followed by information on the proposed 230 kV transmission lines. For the transmission lines, general information is first presented on shared components of the alternative, followed by information for each of the individual segments and options. Details on the construction of the lines are presented separately, in Section 2.1.3, *Construction*. This section describes the major components (substation equipment, pole design, vegetation management, etc.) of the alternatives. Potential significant environmental impacts and mitigation are identified in Chapter 4 (*Long-term [Operation] Impacts and Potential Mitigation*) and Chapter 5 (*Short-term [Construction] Impacts and Potential Mitigation*).

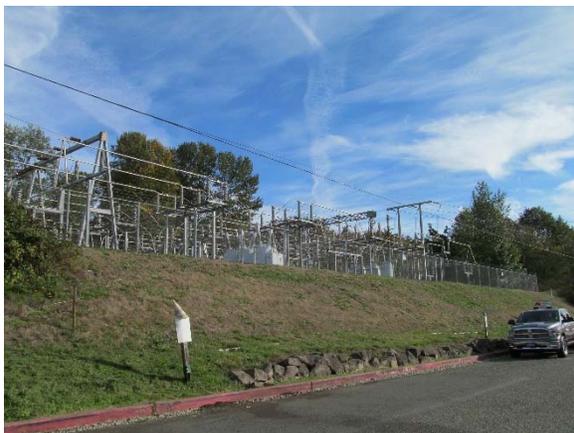


Source: King County, 2015; Ecology, 2014; Open Street Map 2016.

Figure 2-1. PSE's Proposed Alignment: 230 kV Transmission Line Corridor Summary, by Segment (Conceptual)

2.1.2.1 New Richards Creek Substation and Improvements to Other Substations

PSE proposes to construct a new substation as part of the Energize Eastside project. The new Richards Creek substation would be immediately south of the existing Lakeside substation (see Figure 2-2) on parcels 102405-9083 and 102405-9130 in the City of Bellevue (see Figure 2-3). The total lot area for the substation site is 7.82 acres in size, and the fenced substation yard would cover approximately 2 acres within a fenced lot. The substation would include a new 230 kV transformer (see Figure 2-2) and associated electrical equipment such as circuit breakers, switches, electrical bus, and connections to the new transmission lines. The main function of the substation would be to house the transformer and related equipment needed to step down the 230 kV voltage (bulk power) from the new transmission lines to 115 kV needed for use by the local distribution system.



Lakeside Substation (looking east)



230 kV Transformer

The substation would include the necessary foundations, access ways, stormwater drainage, a control house, and security fencing. The *dead-end towers* with ground wire mast, located within the fenced lot, would be approximately 70 feet tall. The new substation would be in approximately the same location as PSE's current pole storage yard (see Figure 2-3).

The existing driveway and access road from SE 30th Street to the substation entrance gate would be paved with asphalt, and the route would be reconfigured relative to the current alignment to allow the delivery of large equipment, such as the transformer (see Figure 2-2). The reconfigured driveway would be 24 feet wide at the corners and 20 feet wide at the straight sections. The driveway would include 2-foot shoulders on each side of the pavement. Appropriate drainage for the driveway would be included in the site design, and include replacing the existing culverts under the driveway adjacent to SE 30th Street. The existing unimproved, degraded road between the proposed Richards Creek substation site and existing Lakeside substation would not be removed as part of construction; however, it could be removed to facilitate critical areas mitigation.

In addition to the construction of the new Richards Creek substation, some construction would be needed for the planned upgrades to the Sammamish, Rose Hill, Lakeside, and Talbot Hill substations. In general, all upgrades to the existing substations are expected to occur within the existing footprint of these facilities. Work would include connecting the substation equipment to the new 230 kV transmission lines, including potential pole replacement and related grading and excavation. Specific upgrades to other substations that are not described here could require additional review under SEPA, as determined by the respective jurisdictions.

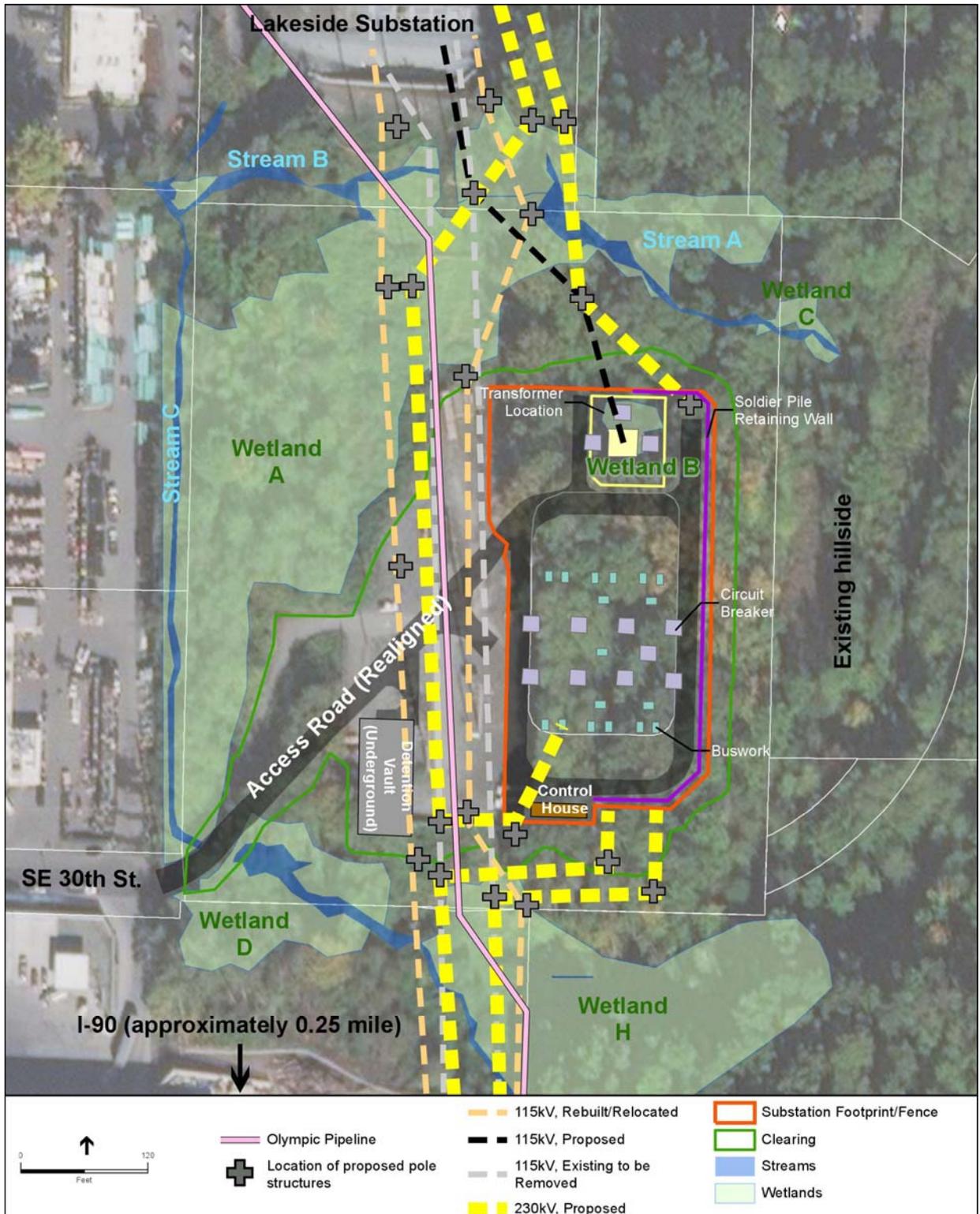


Figure 2-2. Conceptual Site Plan for the New Richards Creek Substation



Gravel Surface



Looking north to the Lakeside substation



View to SE 30th Street access



Vegetated hillslope of the east boundary

Figure 2-3. Existing Conditions at the New Richards Creek Substation

The yard surfacing inside the substation fence and for a perimeter 5 feet outside the fence would consist of well-drained insulating yard rock (3/4-inch crushed quarry rock), with interior driveways in the substation consisting of gravel surfacing (crushed surfacing top course). The retaining wall on the east side of the substation would be an approximately 25-foot-tall soldier-pile wall. The fence would be a 7-foot chain link fence with three strands of barbed wire on top.

Under the Bellevue Land Use Code (LUC), Electrical Utility Facilities require 15 feet of Type 1 Landscaping on all sides (LUC 20.20.520(F)(2)(a)). In addition to retaining natural vegetation where feasible, additional landscaping would be installed along all substation boundaries.

The western boundary is made up of critical areas that would also be enhanced as part of the culvert replacement mitigation. PSE is planning to replace and upgrade the culverts carrying a small, perennial stream beneath the access road to the Richards Creek substation site. Two aging and undersized culverts (two side-by-side, 18-inch corrugated metal pipe culverts) are inadequate to carry the combined flow and sediment loading along the stream. The proposed project includes a new

culvert crossing, and restoring and enhancing affected adjoining habitat areas. These include affected wetlands and the realigned and enhanced stream sections extending upstream and downstream of the crossing. Construction associated with the culvert replacement and stream realignment would temporarily disturb the stream, wetlands, and their associated buffers, but would result in net habitat benefits following project implementation. The culvert replacement and stream realignment would increase streamflow conveyance capacity, improve sediment transport, facilitate sediment removal from the system, replace undersized culverts, reduce flooding that now occurs on the adjoining property to the west, improve fish passage, and improve in-stream and riparian habitat conditions.

Natural resources on the site, including streams, wetlands, vegetation, and slopes, are described in Section 4.3, *Water Resources*, and Section 4.4, *Plants and Animals*.

Improvements to Existing Substations

In addition to the new Richards Creek substation, the proposed project requires upgrades to several existing substations in the study area, including the Sammamish, Rose Hill, Lakeside, and Talbot Hill substations. Substation locations are shown on Figures 1-1 and 2-1. In general, all upgrades to the existing substations are expected to occur within the existing footprint of these facilities, and no yard expansion is proposed at any of these substations. No significant impacts are anticipated for these substation upgrades; therefore, no further analysis of impacts to resource topics at these substations is included in the EIS. Under PSE's Proposed Alignment, no upgrades would be needed at the Somerset substation.

- At the Sammamish substation, PSE would add new 230 kV line bays. Additional equipment improvements (e.g., replacement switchgear, breakers, etc.) would also occur.
- At the Rose Hill substation, in order to operate both lines of the Energize Eastside project at 230 kV, PSE would rebuild the existing substation from a 115 kV to 12.5 kV substation to a 230 kV to 12.5 kV substation. This would entail installing a new transformer and other ancillary equipment. This work would take place within the existing fenced PSE property.
- At the Lakeside substation, PSE would install new lines to interconnect with the existing 115 kV system that serves the Eastside.
- At the Talbot Hill substation, PSE would add new circuit breakers, control equipment, and wires.
- At all substations, additional work may include installing conduits, cable trenches, grounding, security upgrades and/or drainage improvements. (As at all active substations, periodic equipment replacement and related work are also expected during operations.)

2.1.2.2 Overview of the New 230 kV Transmission Lines

The proposed project (PSE's Proposed Alignment) is to construct and operate two 230 kV transmission line circuits, from the Sammamish substation in Redmond to the proposed Richards Creek substation in Bellevue, and from Richards Creek substation to the Talbot Hill substation in Renton, a distance of approximately 16 miles. PSE's Proposed Alignment follows an existing 115 kV transmission line corridor from the Sammamish substation to Talbot Hill substation, which is referred to in this Final EIS as the "existing corridor." PSE's Proposed Alignment is entirely in the existing corridor, with no new corridor needed and no segments routed along existing roadways (as was the case for some of the options described in the Phase 2 Draft EIS). Although the Newcastle Segment in the Final EIS includes two options, these are not route options – rather, they differ in terms of pole type and width placement within the *right-of-way* of the existing corridor and in relation to easements for the Olympic Pipeline system.

The project would replace two existing 115 kV transmission lines in the existing corridor with two 230 kV transmission lines on new poles. The current plan for the Energize Eastside project is to operate both circuits at 230 kV. PSE proposes to power both transmission lines in the corridor at 230 kV instead of having one at 230 kV and one at high-capacity 115 kV (as was described in the Phase 2 Draft EIS). This would serve as mitigation to reduce *electric and magnetic fields (EMF)* caused by the transmission lines, and would result in lower risk of pipeline corrosion and *alternating current (AC) interference* (as described in more detail in Sections 4.8 and 4.9, respectively). Note that this design differs from the earlier plan as described and analyzed in the Phase 2 Draft EIS, which involved initially constructing a 230 kV line and a high-capacity 115 kV line (designed to be operable at 230 kV in the future).

The majority (approximately 95 percent) of the existing 115 kV transmission lines are strung on wooden H-frame structures; in a few locations (e.g., near substations or highway crossings), the existing lines are on other pole or structure types, such as single wood poles or steel monopoles.

The existing transmission line corridor was originally established in the late 1920s and early 1930s. The original power lines were upgraded to 115 kV in the 1960s. Maintenance has occurred over time, and in 2007, PSE replaced or reframed approximately 200 H-frame structures on the existing corridor. As part of the proposed Energize Eastside project, the existing, older H-frame structures would be replaced primarily with a combination of single-circuit and double-circuit steel monopoles,

Transmission Line Terminology

Transmission Line – A system of structures, wires, *insulators*, and associated hardware that carries electric energy from one point to another in an electric power system.

Wire – The cable component of the transmission line through which electricity flows. Also referred to as the conductor.

Circuit – In general terms, the pathway for an electrical current. For use in this EIS, circuit is used in the context of the number of circuits carried on a single pole or structure. A single-circuit line carries wires for only one circuit, and each pole would support three wires. A double-circuit line carries wires for two circuits, and each pole would support six wires.

Dead-end Tower – Structure used where the line ends, or turns with a high angle, or at major crossings (such as highways or rivers). Dead-end towers must be stronger than other poles because they are under tension from just one side. Often they have additional guy wires, are larger in diameter, and/or have larger footings than other poles.

although some wood poles would remain, particularly near substations. The new poles would be taller in most cases than the existing H-frame structures. Along the corridor, the typical height of the existing single-circuit H-frame structures is 60 feet (ranging from 39 to 115 feet); the typical height of the proposed poles ranges from 50 to 99 feet, depending on type (ranging up to 135 feet). In most locations, the existing 115 kV transmission lines are strung on two adjacent H-frame structures (i.e., typically four poles total) at a single location; the project would consolidate these lines onto one or two pole structures. In most cases, the new poles would be installed in approximately the same locations along the existing corridor (i.e., within 25 feet up or down the line) as the existing poles; in several locations, the new poles could be moved farther up or down along the line to avoid sensitive resources, such as wetlands, streams, or unstable slopes. In general, PSE's Proposed Alignment would result in fewer poles along the existing corridor, but the poles would typically be 35 feet taller than the existing structures; with taller poles, the wire attaching points would also be generally higher than at present. More details on pole designs, including illustrations and photographs, are presented below.

The existing 115 kV transmission line corridor contains two of several transmission lines in the developed and growing Eastside region. In most portions of the Energize Eastside project area, the existing two 115 kV H-frame structures are the only lines within the corridor. In some portions, such as in south Redmond and near substations, however, the line is co-located with other transmission and distribution line poles and structures. The lines also cross and/or run parallel to other transmission line corridors in several locations, including a 230 kV line owned and operated by Seattle City Light (SCL), supported on steel lattice towers, that crosses PSE's Proposed Alignment in Renton.



PSE's 115 kV lines and SCL's 230 kV line at 10120 126th Avenue SE, Renton

Pole Design

The majority of the existing 115 kV transmission lines are strung on wooden H-frame structures, typically about 60 feet tall. PSE's project would generally replace these structures and use a variety of replacement pole types (Tables 2-1 and 2-2), including the following:

- One double-circuit steel monopole
- Two single-circuit steel monopoles

Different pole types, pole heights, and span lengths would be used to respond to topographic conditions and other landscape features, as well as to mitigate potential visual impacts within specific areas. Along most of PSE's Proposed Alignment, the new poles would be double-circuit steel monopoles with a typical height of 95 to 99 feet, although they could be taller in some locations (e.g., crossing major highways, ravines, or other transmission lines). The tallest poles would be near the Richards Creek substation and would be approximately 135 feet tall in order to cross over other transmission lines. Paired single-circuit monopoles (typically ranging in height from 50 to 96 feet) would be used in select locations in all of the segments, but particularly in the Redmond, Bellevue South, Newcastle, and Renton Segments. Pole type and placement are also influenced by right-of-way width, code requirements, and other site-specific factors, such as where PSE shares its right-of-way with the Olympic Pipeline system (operated by BP Pipelines-North America [BP]).

PSE's Proposed Alignment would have slightly different conductor supports than shown in the Phase 2 Draft EIS. The proposed supports are shown in Table 2-1, and have a slightly narrower profile than those shown in the Phase 2 Draft EIS. These narrower supports mean that the managed right-of-way can be slightly narrower, which would reduce the extent of tree removal and trimming necessary to maintain safe clearance from the lines (as described in more detail in Section 4.4, *Plants and Animals*). This design also reduces the amount of pole hardware required.

To meet *National Electric Safety Code* (NESC), FERC, and North American Electric Reliability Corporation (NERC) requirements to prevent contact with the lines, adequate clearances must be maintained between each wire, the ground, adjacent buildings, and trees. Pole height therefore would vary depending on the number of circuits, the arrangement of the circuits on the poles, pole location, topography, and adjacent uses.

What Determines Pole Height?

Factors affecting pole height include the necessary ground clearance for the specific voltage of the lines, the total number of wires on the pole, and the separation required between wires. Ground clearance and separation between wires for 230 kV lines must be greater than for 115 kV. Poles that carry just one circuit have only three wires and can generally be lower than poles carrying two circuits, which typically requires six wires.

What Determines Pole Type?

Pole types are chosen to be cost effective, but other factors are also considered, including the number of circuits needed, concerns about height, and the width of available right-of-way. H-frame structures have lower profiles than many monopoles because wires are separated horizontally rather than vertically as they are on a monopole. However, if two circuits are needed in one corridor, there may not be enough horizontal clearance to allow two H-frames. If height of the poles is not a major concern, or if there is insufficient room for H-frames, monopoles can be used. Monopoles carrying a double-circuit can be constructed with the smallest overall footprint and are preferred for cost purposes over using pairs of monopoles in parallel. In some circumstances, however, pairs of monopoles may be used to limit the overall height and thus reduce visual impacts.

Specific pole locations would be determined based on site engineering but would generally be within 25 feet of the existing H-frame structures in most locations along the existing corridor. Therefore, pole span (i.e., the spacing between poles) would be approximately the same as the existing lines, typically 575 to 700 feet. Spacing can range from 125 to 1,550 feet, depending on site-specific constraints. Pole locations would generally be based on tensioning needs for the wire (including where turns are needed along the route), underground obstacles at pole foundation locations, and allowable structural heights, all while attempting to use as few poles as possible. PSE would also avoid placing poles in environmentally critical areas like wetlands, streams, and on unstable slopes to the greatest extent feasible.

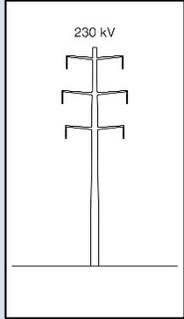
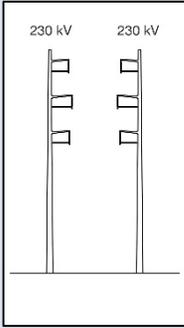
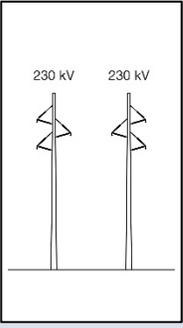
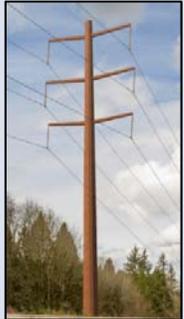
The diameter of the poles depends on height, as well as loading, and would be greatest at the base. Typical (*tangent*) poles would be 2.5 to 6 feet at the base (not including the foundation). Tangent poles are poles that are in a straight line with other poles. *Dead-end poles* and angle poles (poles where the transmission line changes direction) need to be larger than tangent poles to handle the asymmetrical weight and tension from the lines they are holding.

An additional shield wire would be installed on top of the new poles to reduce the impact and/or magnitude of ground faults (such as from lightning or system faults). The shield wire would include a fiber-optic cable inside (optical ground wire, or OPGW), which is used solely by PSE and the BPA for transmission system communications purposes. Shield wires are shown in the visual simulations in the Phase 2 Draft EIS as well as in this Final EIS and can be seen at top of each pole.

In addition to the height and diameter of the poles, the diameter of the conductor (i.e., wire) would also increase. The wire on the existing 115 kV transmission lines is currently 1.063 inches in diameter; the wire diameter of the proposed new wires would be 1.545 inches to accommodate the increased load on the higher voltage 230 kV lines.

The main characteristics of the various pole types are summarized and illustrated in Table 2-1 and Table 2-2 (showing typical and atypical pole types, respectively). A pole that is used throughout a segment is considered a “typical” pole. Poles that are used infrequently for special situations are referred to as “atypical.” Atypical poles include terminus poles at substations, corner poles, and poles used to cross major roads, for example. PSE’s Proposed Alignment would include poles that could have various finishes, including galvanized (light gray), self-weathering (reddish brown), or painted (powder coat). Finishes could be specified by location to better blend with the background or sky, and are listed and described as a potential mitigation measure for long-term scenic view and aesthetic impacts in Section 4.2.6, *Mitigation Measures*.”

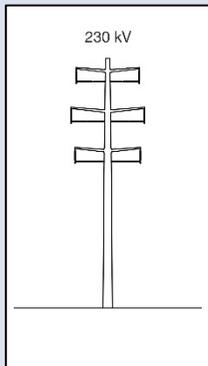
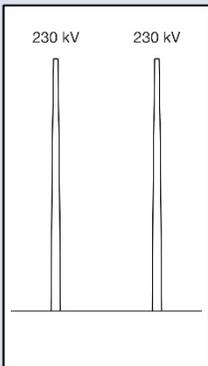
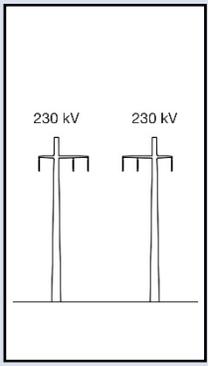
Table 2-1. Summary of Proposed Typical Pole Types

	One Double-Circuit Monopole	Two Single-Circuit Monopoles	Two Single-Circuit Monopoles
Line Configuration ¹	Six wires total, three on each side of the pole	Three wires stacked vertically on each pole	Three wires stacked in a delta configuration (shown below)
Typical Height ²	95 feet	93 feet	83 feet
Pole Replacement	Replaces four existing poles (two H-frame structures) with one pole in most areas	Replaces four existing poles (two H-frame structures) with two poles in some areas	Replaces four existing poles (two H-frame structures) with two poles in some areas
Segments (and options) using this pole type	Redmond, Bellevue North, Bellevue Central, Bellevue South, and Renton Segments. Generally placed in the center of the corridor.	Newcastle (Option 1). Placed on the outer edge of the right-of-way on each side of the Olympic Pipeline system.	Redmond, Bellevue South, Newcastle (Option 2), and Renton Segments. Placed on the outer edge of the right-of-way on each side of the Olympic Pipeline system.
Diameter (at base)	Typically 4.5–6 feet	Typically 3.5–5.5 feet	Typically 2.5–5.5 feet
Diagram	 <p>[C-1 pole]</p>	 <p>[C-2 poles]</p>	 <p>[C-16 poles]</p>
Simulation			

¹ An additional shield wire would be installed on top of the new poles for fault and lightning protection. For more information, see Section 2.1.2.2.

² Typical heights presented here are for all segments across the 16-mile line. Typical pole heights vary depending on the segment and can be taller than the typical heights presented for the whole project. Site-specific pole heights are used for some areas of the analysis where individual pole configurations are described.

Table 2-2. Summary of Proposed Atypical Pole Types

	One Double-Circuit Monopole	Two Single-Circuit Monopoles	Two Single-Circuit Monopoles
Line Configuration ¹	Six wires total, three on each side of the pole	Three wires stacked vertically on each pole	Three wires arrayed horizontally on each pole
Typical Height ²	99 feet	98 feet	50 feet
Pole Replacement	Replaces four existing poles (two H-frame structures) with one pole in most areas	Replaces four existing poles (two H-frame structures) with two poles in some areas	Replaces four existing poles (two H-frame structures) with two poles in some areas
Segments using this pole type	Proposed for use in the Redmond, Bellevue North, Bellevue Central, Bellevue South, and Renton Segments.	Proposed for use in the Redmond, Bellevue North, Bellevue Central, Bellevue South, Newcastle, and Renton Segments.	Proposed for use in the Renton Segment.
Typical location	In areas where a C-1 pole would not work best because of topography, curvature of the transmission line, or a roadway crossing. Generally placed in the center of the corridor.	At substations, freeway crossings, and changes in direction. Generally used on either side of the Olympic Pipeline system when the pipeline is the center of the corridor.	At the SCL transmission line crossing.
Diameter for typical poles (at base)	Typically 4.5–6 feet	Typically 3.5–6.5 feet	Typically 3–5 feet
Diagram	 <p>[C-1B pole]</p>	 <p>[C-18 poles]</p>	 <p>[C-17 poles]</p>

¹ An additional shield wire would be installed on top of the new poles for fault and lightning protection (see Section 2.1.2.2.)

² Typical heights presented here are for all segments across the 16-mile line. Typical pole heights vary depending on the segment and can be taller than the typical heights presented for the whole project. Site-specific pole heights are used for some areas of the analysis where individual pole configurations are described.

Note: Simulations of C-1B and C-18 pole configurations are provided in Appendix C.

Olympic Pipeline System

The Olympic Pipeline system is an underground petroleum pipeline system that is co-located with the existing PSE 115 kV transmission line corridor throughout the entire Energize Eastside project area, except in the central portion of the Renton Segment. The Olympic Pipeline system is a 400-mile interstate pipeline system that runs from Blaine, Washington to Portland, Oregon. The system transports gasoline, diesel, and jet fuel through two pipelines – one 16 inches and one 20 inches in diameter. In the Energize Eastside project area, the pipelines are generally co-located with PSE's transmission line within all of the segments, although in the Renton Segment it only co-located in the north portion of the segment (although it crosses the corridor in the southern portion of the segment). The transmission line corridor predates the pipeline by approximately three decades. In most of the segments, the pipeline system is along either the east or west side of the PSE right-of-way, crisscrossing the right-of-way from east or west in numerous locations. In parts of the corridor (especially the Newcastle Segment), however, the pipeline system is buried in the center of the right-of-way. BP is the operator of the Olympic Pipeline system, and partial owner of the Olympic Pipe Line Company, with Enbridge, Inc. (Olympic Pipe Line Company, 2017). Typically, the proposed poles would be located at least 13 feet from the Olympic Pipeline system where it is co-located with the transmission lines to reduce the need for additional arc shielding protection.

Due to the level of public concern expressed during scoping for both Phase 1 and Phase 2 regarding the potential risk of a leak, fire, or explosion that could occur as a result of constructing or operating the transmission lines in the same corridor as the Olympic Pipeline system, the pipeline safety issue is addressed specifically as one of two environmental health issues. Information on pipeline safety, both during construction and operation, is presented in Sections 4.9 and 5.9, *Environmental Health – Pipeline Safety*.



Sign marking location of the Olympic Pipeline system in existing corridor (foreground); telecom equipment mounted on existing poles (background)



Utility pole carrying transmission wires (top section), distribution wires (middle section), and telecom wires (lower section)

Telecommunications Equipment and Other Underbuild Components

Along portions of the transmission lines, telecommunications (telecom) equipment, distribution lines, and cellular equipment is attached to PSE's existing poles, collectively referred to as "underbuild."

PSE hosts *telecommunications* (telecom) equipment, which is owned and operated by other providers. The telecom companies' attachments to transmission facilities are regulated by state law (specifically, House Bill [HB] 2886 and Revised Code of Washington [RCW] Chapter 80.54); PSE and the Partner Cities have limited authority over the telecom underbuild equipment. In general, telecom equipment that is on an existing pole could be relocated to a new pole in the same general location, but existing attachments to poles cannot remain with just telecom equipment on it once the electric distribution lines have been removed.

In the Energize Eastside project area, cellular equipment is co-located along the existing corridor in eight locations:

- Overlake (13460 NE 40th Street, Bellevue)
- Kelsey Creek (13601 SE 10th Street, Bellevue)
- Tyee Middle School (3858 136th Avenue SE, Bellevue)
- Somerset substation (5200 Coal Creek Parkway SE, Bellevue)
- Somerset Recreation Center (4445 136th Place SE, Bellevue)
- Newport Hills (12843 SE 60th Street, Bellevue)
- Newcastle Way (12833 Newcastle Way, Newcastle)
- 4th Street (old Cemetery Road) (3205 NE 4th Street, Renton)

PSE would allow cellular equipment on poles proposed to be replaced by the Energize Eastside project to be relocated to new structures if requested by individual carriers. As of the writing of the Final EIS, telecom equipment at all locations except at Newport Hills is expected to be relocated to the new poles; the Newport Hills equipment would be decommissioned. If cellular equipment is relocated to the new 230 kV poles, PSE will work with the telecom companies to reinstall the equipment onto the new poles, per local jurisdiction regulations and Chapter 80.54 RCW.

If distribution lines are present with communication underbuild, the opportunity of placing communications equipment underground would be discussed with the various providers. Parallel distribution underbuild would not be used on the 230 kV poles.

Additional information on the co-located telecom equipment and distribution lines is included in Sections 4.2, *Scenic Views and the Aesthetic Environment*.

Vegetation Management and Maintenance

PSE's Proposed Alignment includes both initial vegetation clearing to accommodate the more restrictive standards associated with the 230 kV transmission lines, as well as ongoing vegetation maintenance along the corridor to keep tall vegetation (trees and shrubs) and noxious weeds from growing within the transmission line right-of-way (as now occurs on the existing corridor). For vegetation clearing, it is assumed that all species within the managed right-of-way with a mature height

of more than 15 feet will be removed and could be replaced with 230 kV-compatible vegetation. (In some circumstances, PSE can modify this requirement, in consultation with property owners and site-specific features.) Additional details on vegetation management are presented in Sections 4.4 and 5.4, *Plants and Animals*, including information on the number, species, and location of trees that could be removed for PSE's project. In the context of this EIS analysis, "vegetation management" refers to initial clearing or removal of trees and shrubs to construct the new transmission lines or substation, whereas "vegetation maintenance" refers to the long-term trimming or pruning of vegetation to maintain adequate line clearance and safety.

Managed Right-of-Way

To ensure safe and reliable operation of overhead transmission lines, the NESC specifies minimum horizontal and vertical clearances between the transmission lines and vegetation, buildings, and the ground. Trees and overhanging branches must be managed or removed to maintain appropriate clearances. For more details, see Section 4.4, *Plants and Animals*.

Access Roads

In some locations, additional access roads (either temporary or permanent) would be required to reach the transmission line corridor. Preliminary access plans have been developed for each structure location. For additional information on access roads, see Section 2.1.3, *Construction*, and Appendix A-2. In general, PSE will maintain existing access routes; however, new access routes that are developed for the Energize Eastside project are expected to be removed following construction and the area restored to its previous condition.

2.1.2.3 Transmission Line Segments

The following sections describe each of the segments and options of PSE's Proposed Alignment, from north (Redmond) to south (Renton), including sample visual simulations of the proposed transmission poles. (Additional simulations for the segments are found in Section 4.2, *Scenic Views and Aesthetic Environment*.) Throughout the EIS analysis, the Richards Creek substation site (as described in Section 2.1.2.1) is addressed separately from the transmission line segments. These sections provide a conceptual explanation of the typical pole designs used along portions of the segment. In many cases, different pole types are proposed in site-specific locations, some of which are not shown at this scale. Generally, the segment sheets that follow show where double-circuit vs. single-circuit (paired) poles are located. For most elements of the environment, site-specific pole configuration information did not need to be considered, beyond pole location and number of poles, because that level of detail would not change the findings of the analysis. However, for the visual and recreation analysis, atypical pole configurations are called out as necessary to inform the visual and recreation analyses, which describe pole configurations in greater detail. More detail is also available on the website as a Google Earth KMZ file, or in Appendix A-2, which both show the pole types used in specific locations. In particular, the Google Earth KMZ file enables the user to zoom in to specific pole locations at a finer scale possible than a printed document or PDF file to view the data used for this analysis.

For the Newcastle Segment, two options are analyzed in this Final EIS. The No Code Variance Option (Option 1) is similar to what was evaluated in the Phase 2 Draft EIS. The Code Variance Option (Option 2) is PSE's preferred option in this segment, because the poles can be shorter and can be set farther away from homes. (More details on the Code Variance Option for the Newcastle Segment are provided in the Land Use analysis; see Section 4.1.5.8.)



Redmond Segment

DESCRIPTION

Start: Sammamish Substation

End: Redmond-Bellevue Boundary

PSE's Proposed Alignment

PROPOSED POLES & LOCATION

1 Single-Circuit Steel Pairs

- Approximately 13 wooden H-frames replaced with 6 single-circuit pairs.
- Height:
 - 91' (typical); (existing: 61')
 - 118' (maximum); (existing: 79')

2 Double-Circuit Steel Monopole

- Approximately 30 wooden H-frames replaced with approximately 15 double-circuit, 230 kV steel monopoles.
- Height:
 - 102' (typical); (existing: 61')
 - 109' (maximum); (existing: 79')

QUICK FACTS

Jurisdiction: Redmond

Segment Length: 2 miles

Easement / Property Acquisition

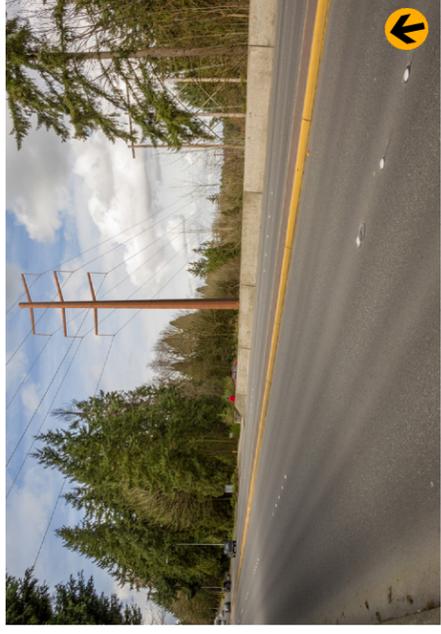
- Entirely in PSE's existing 100-foot corridor; no new easements or property acquisition needed.

Olympic Pipeline Info

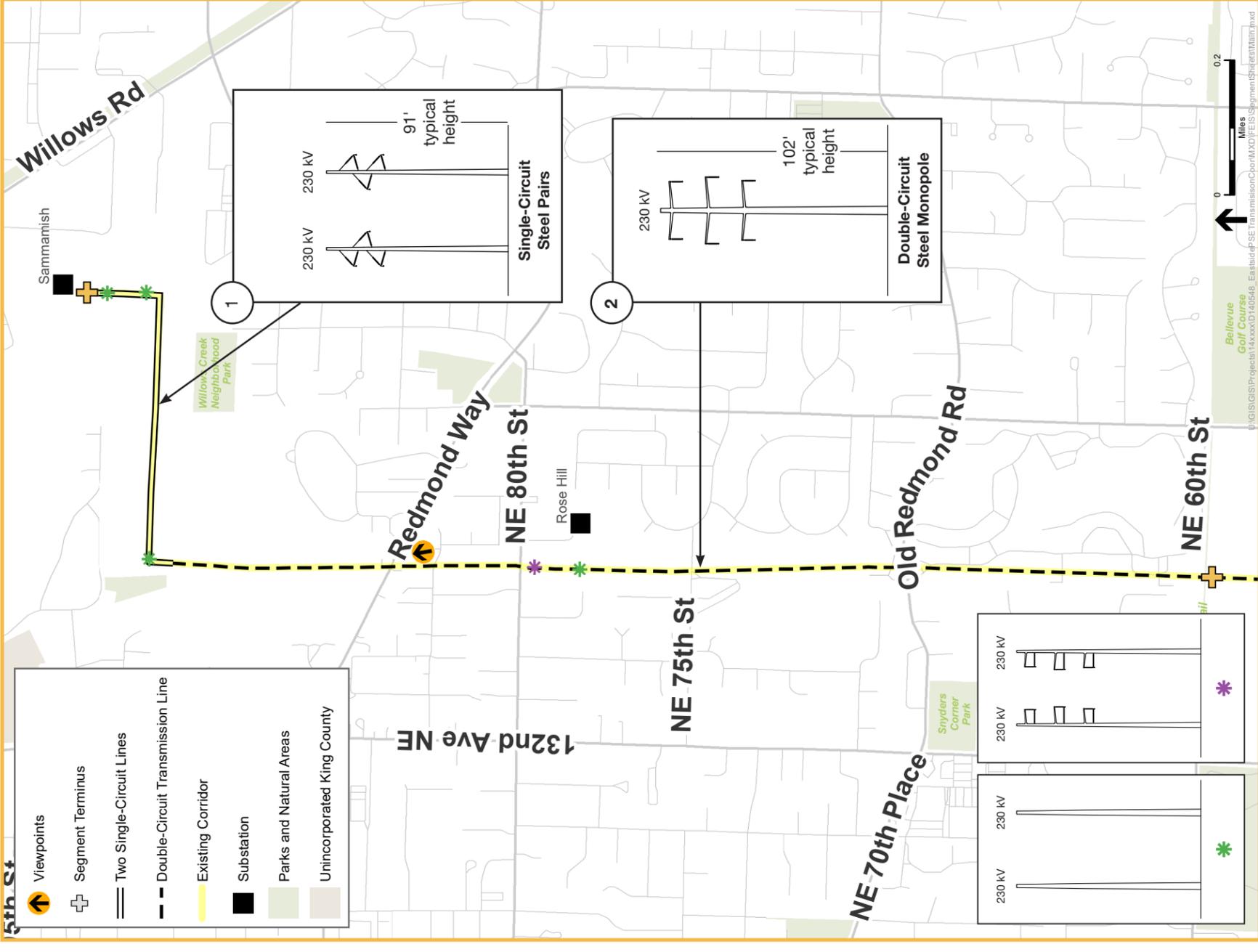
- Co-located in existing corridor; pipelines buried on either side (east or west) of corridor.
- Poles would be placed in the center of the corridor.



From Redmond Way looking north (existing conditions)



Simulation of proposed project (Power Engineers, 2017)





Bellevue North Segment

DESCRIPTION

Start: Redmond-Bellevue Boundary
End: Northrup Way/NE 20th St

PSE's Proposed Alignment

PROPOSED POLES & LOCATION

- Approximately 38 wooden H-frames replaced with approximately 17 double-circuit, 230 kV steel monopoles.
- Height:
 - 93' (typical); (existing: 54')
 - 100' (maximum); (existing: 70')

QUICK FACTS

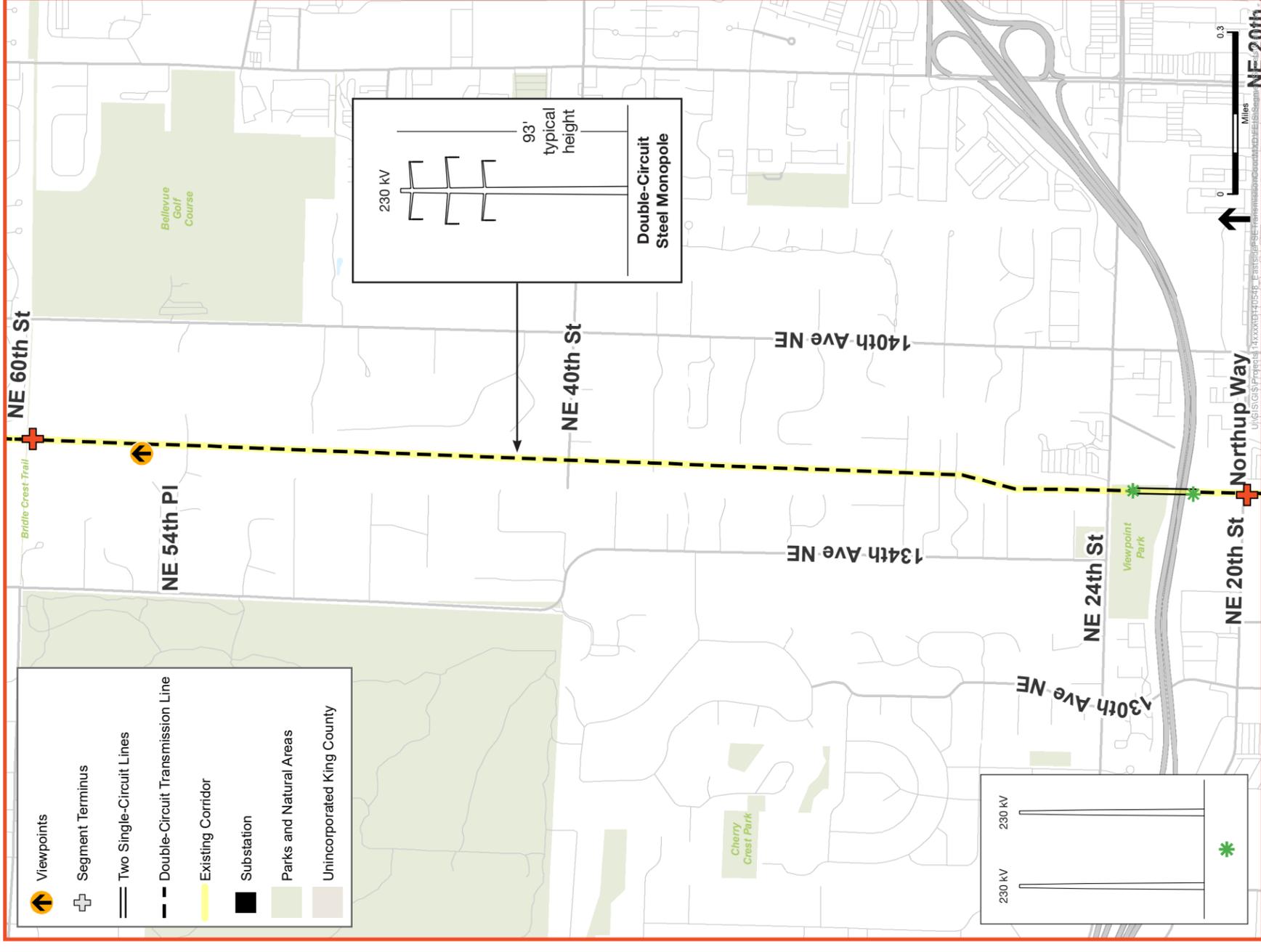
- Jurisdiction:** Bellevue
- Segment Length:** 2.2 miles
- Easement / Property Acquisition**
 - Entirely in PSE's existing 100-foot corridor; no new easements or property acquisition needed.
- Olympic Pipeline Info**
 - Co-located in existing corridor; pipelines buried on either side (east or west) of corridor.
 - Poles would be placed in the center of the corridor.



From NE 54th PI looking north (existing conditions)



Simulation of proposed project (Power Engineers, 2017)





Bellevue Central Segment

DESCRIPTION

Start: Northrup Way/NE 20th St

End: Richards Creek Substation (New)

PSE's Proposed Alignment

PROPOSED POLES & LOCATION

- Approximately 49 wooden H-frames replaced with approximately 24 double-circuit, 230 kV steel monopoles.
- Height:
 - 96' (typical); (existing: 56')
 - 113' (maximum); (existing: 79')
 - Substation poles may be taller

QUICK FACTS

Jurisdiction: Bellevue; East Bellevue Community Council also has jurisdiction between NE 8th St and SE 12th St for some permitting decisions.

Segment Length: 3 miles

Easement / Property Acquisition

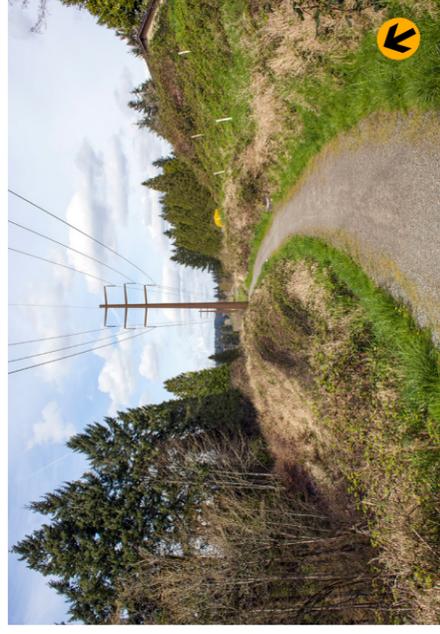
- Entirely in PSE's existing 100-foot corridor; no new easements or property acquisition needed.

Olympic Pipeline Info

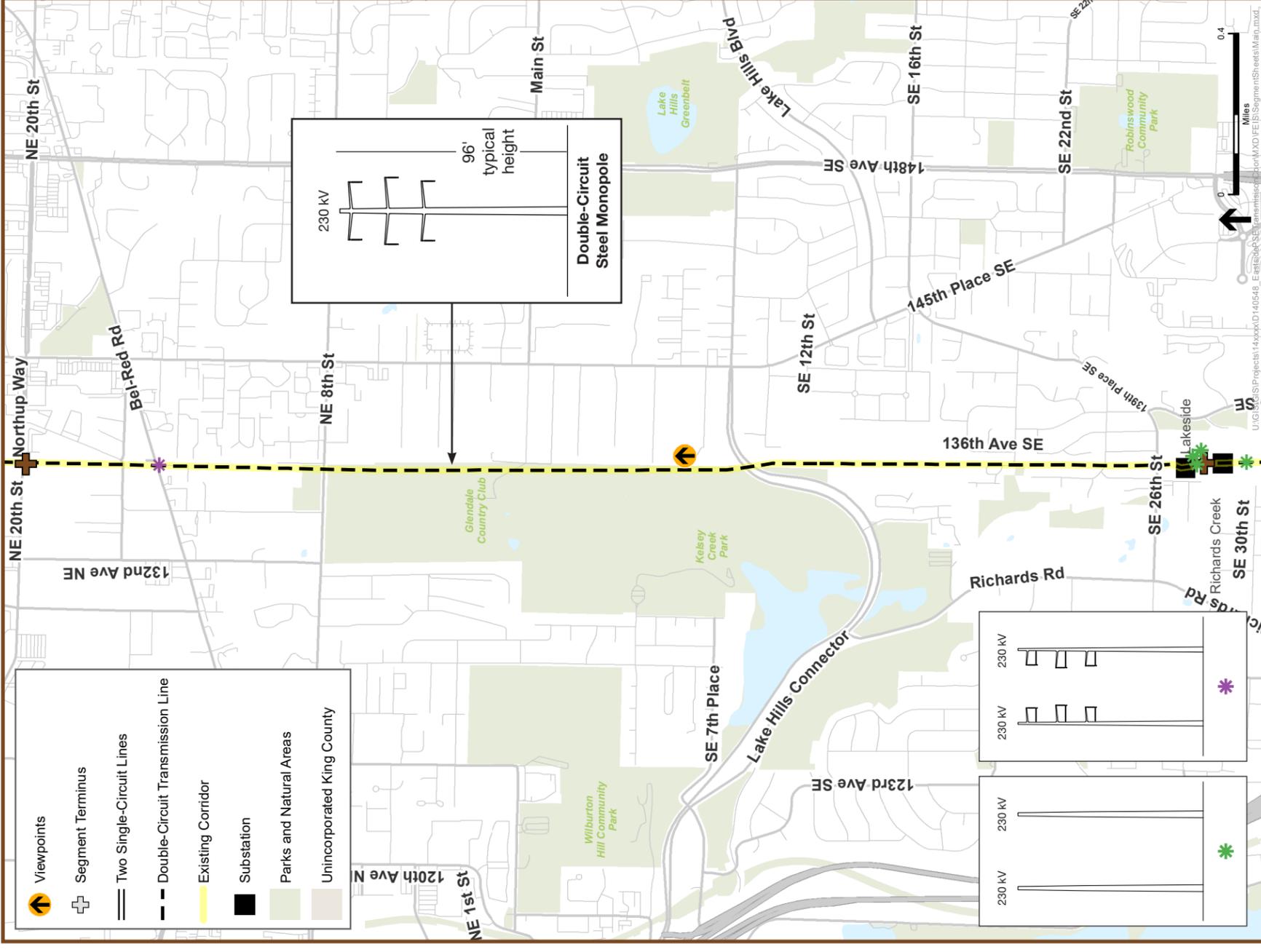
- Co-located in existing corridor; pipelines buried on either side (east or west) of corridor.
- Poles would be placed in the center of the corridor.



From SE 5th Street looking north (existing conditions)



Simulation of proposed project (Power Engineers, 2017)





Bellevue South Segment

DESCRIPTION

Start: Richards Creek Substation (New)
End: Bellevue-Newcastle Boundary

PSE's Proposed Alignment

PROPOSED POLES & LOCATION

- 1 **Double-Circuit Steel Monopole**
 - Location: Existing corridor north of SE Newport Way and between Somerset Substation and SE 60th St.
 - Approximately 22 wooden H-frames replaced with approximately 16 double-circuit 230 kV steel monopoles.
 - Typical height = 92'; (existing: 60')
 - Maximum height = 109'; (existing: 90')
- 2 **Single-Circuit Steel Pairs**
 - Location: Existing corridor south of SE 60th St. and between SE Newport Way and Somerset substation.
 - Approximately 26 wooden H-frames replaced with approximately 26 pairs of single-circuit 230 kV steel monopoles.
 - Typical height = 80'; (existing: 60')
 - Maximum height = 91'; (existing: 90')

QUICK FACTS

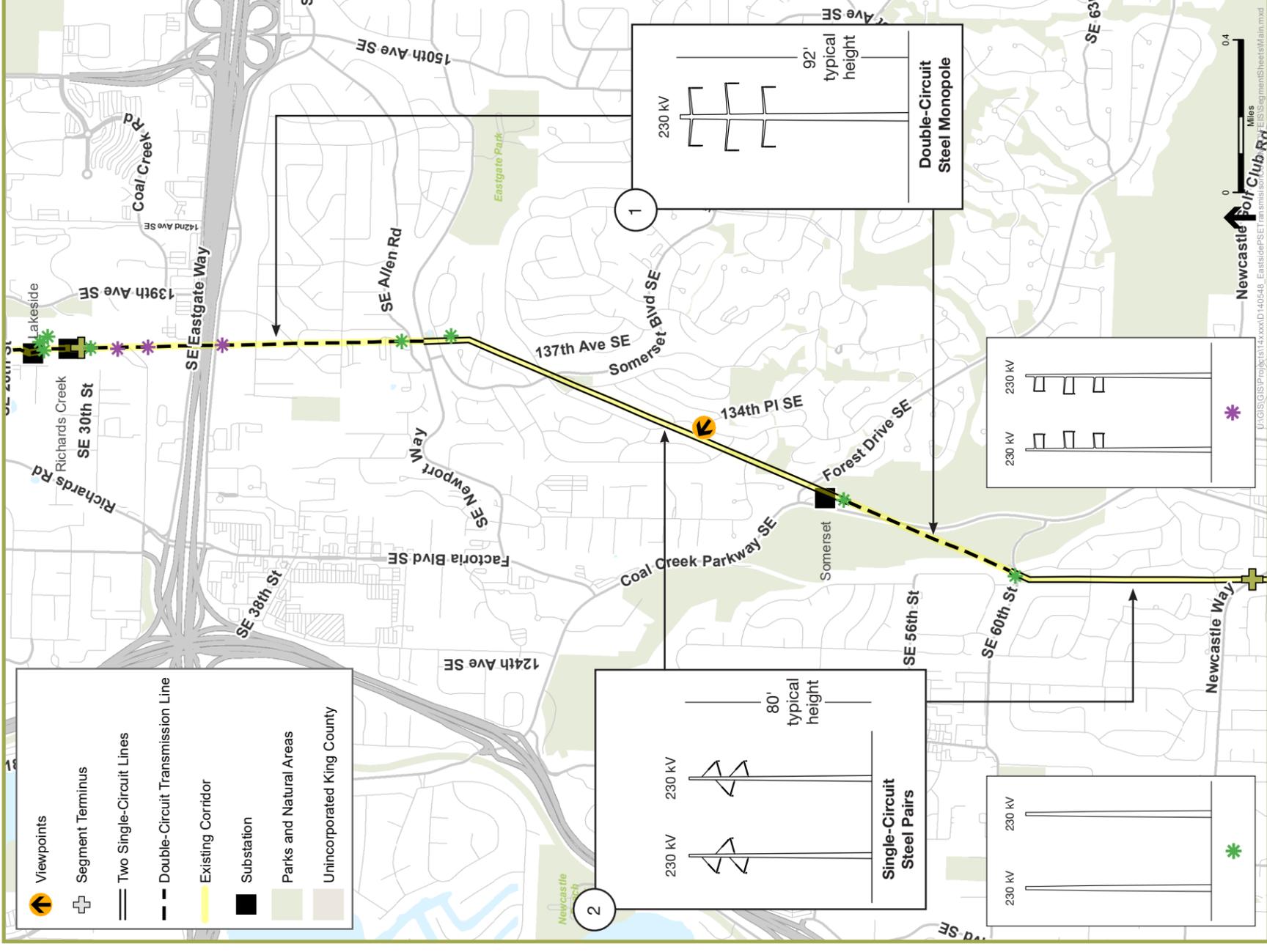
- Jurisdiction:** Bellevue
- Segment Length:** 3.3 miles
- Easement / Property Acquisition**
- Entirely in PSE's existing 100-foot corridor; no new easements or property acquisition needed.
- Olympic Pipeline Info**
- 16" pipeline uses existing corridor (often in the center); poles would be placed on either side.
 - 20" pipeline uses existing corridor south of Somerset.



From 134th Pl SE looking west (existing conditions)



Simulation of proposed project (Power Engineers, 2017)





Newcastle Segment

NO CODE VARIANCE

PSE's Proposed Alignment

DESCRIPTION

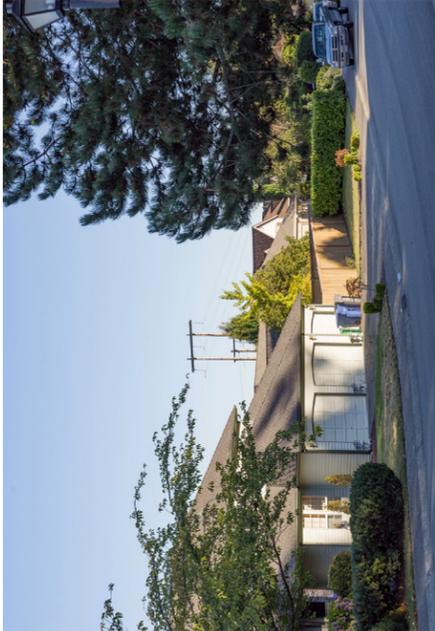
Start: Bellevue-Newcastle Boundary
End: Newcastle-Renton Boundary

PROPOSED POLES & LOCATION

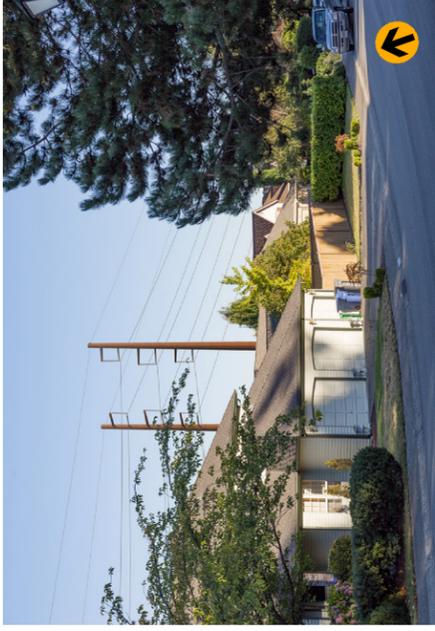
- Approximately 24 wooden H-frames (50 poles) replaced with approximately 12 pairs of single-circuit, 230 kV steel monopoles that are located near the outer edges of the right-of-way.
- Height:
 - 95' (typical); (existing: 55')
 - 109' (maximum); (existing: 75')

QUICK FACTS

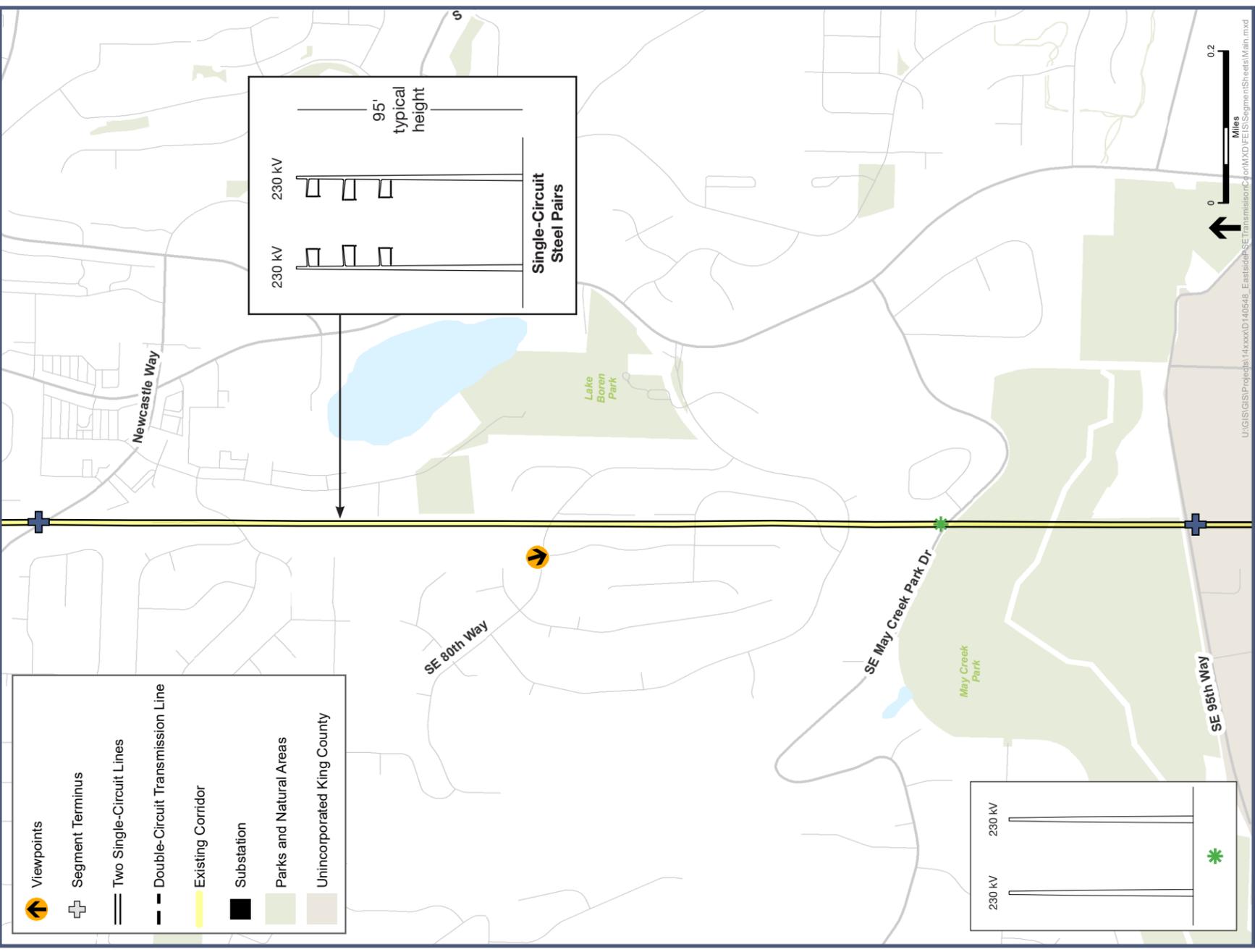
- Jurisdiction:** Newcastle
- Segment Length:** 1.5 miles
- Easement / Property Acquisition**
 - Entirely in PSE's existing 100-foot corridor; no new easements or property acquisition needed.
- Olympic Pipeline Info**
 - Co-located in existing corridor; pipelines buried in the center of corridor.
 - Poles would be placed with one on either side of the pipelines.



From SE 80th Way looking southeast (existing conditions)



Simulation of proposed project (Power Engineers, 2017)





Newcastle Segment

PSE's Proposed Alignment

CODE VARIANCE (PSE'S PREFERRED OPTION)

DESCRIPTION

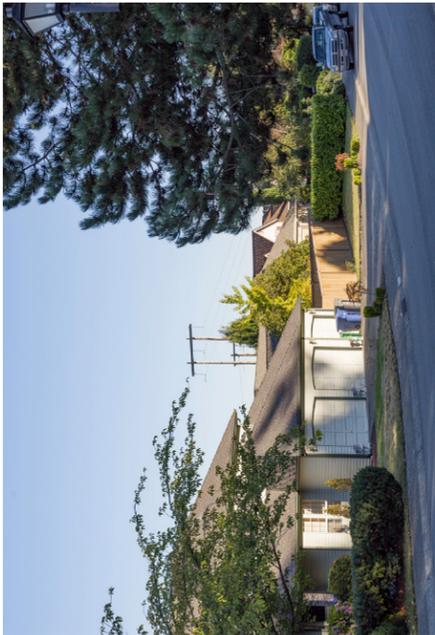
Start: Bellevue-Newcastle Boundary
End: Newcastle-Renton Boundary

PROPOSED POLES & LOCATION

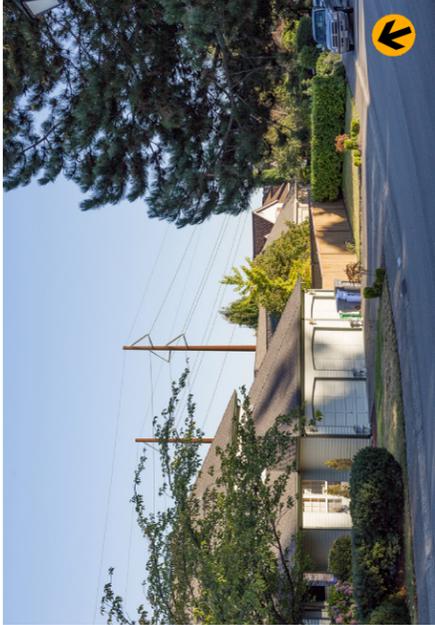
- Approximately 24 wooden H-frames (50 poles) replaced with approximately 12 pairs of single-circuit, 230 kV steel monopoles that are located near the center of the right-of-way.
- Height:
 - 81' (typical); (existing: 55')
 - 92' (maximum); (existing: 75')

QUICK FACTS

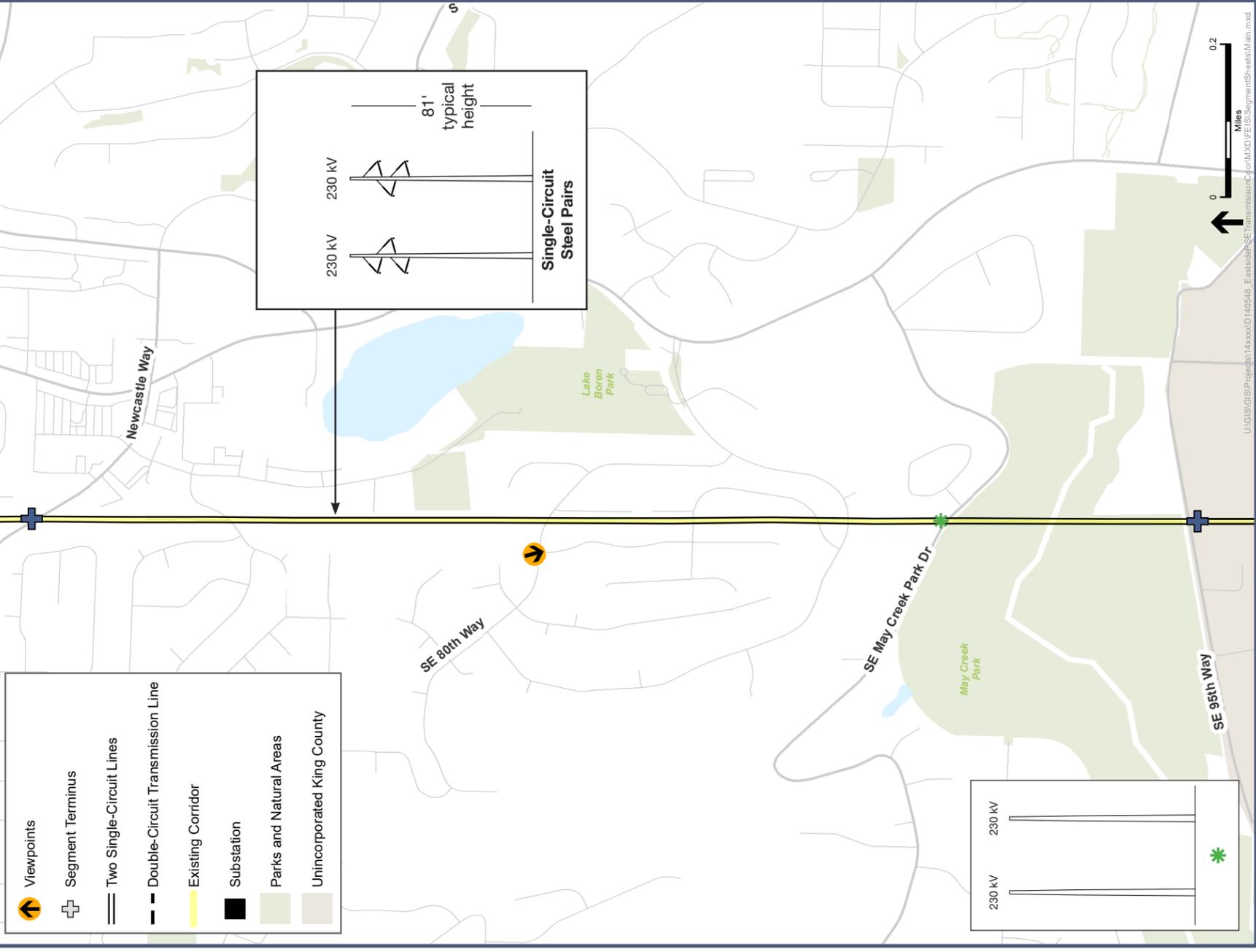
- Jurisdiction:** Newcastle
- Segment Length:** 1.5 miles
- Easement / Property Acquisition**
 - Entirely in PSE's existing 100-foot corridor; no new easements or property acquisition needed.
- Olympic Pipeline Info**
 - Co-located in existing corridor; pipelines buried in the center of corridor.
 - Poles would be placed with one on either side of the pipelines.



From SE 80th Way looking southeast (existing conditions)



Simulation of proposed project (Power Engineers, 2017)





Renton Segment

DESCRIPTION

Start: Newcastle-Renton Boundary
End: Talbot Hill Substation

PROPOSED POLES & LOCATION

- 1 Single-Circuit Steel Pairs**
 - Location: Existing corridor north of Honey Creek Open Space.
 - Approximately 22 wooden H-frames replaced with approximately 11 pairs of single-circuit 230 kV steel monopoles.
 - Typical height = 50-84'; (existing: 55')
 - Maximum height = 50-94'; (existing: 93')
- 2 Double-Circuit Steel Monopole**
 - Location: Existing corridor south of Honey Creek Open Space.
 - Approximately 48 wooden H-frames replaced with approximately 27 double-circuit 230 kV steel monopoles.
 - Typical height = 94'; (existing: 55')
 - Maximum height = 118'; (existing: 93')
 - Two poles required at Talbot Hill substation for dead-end structures.

QUICK FACTS

- Jurisdiction:** Renton
- Segment Length:** 4 miles
- Easement / Property Acquisition**
- Entirely in PSE's existing 100-foot corridor; no new easements or property acquisition needed.
- Olympic Pipeline Info**
- Co-located in northern portion of existing corridor; pipelines buried in the center of corridor.
 - Poles would be placed with one on either side of the pipelines.



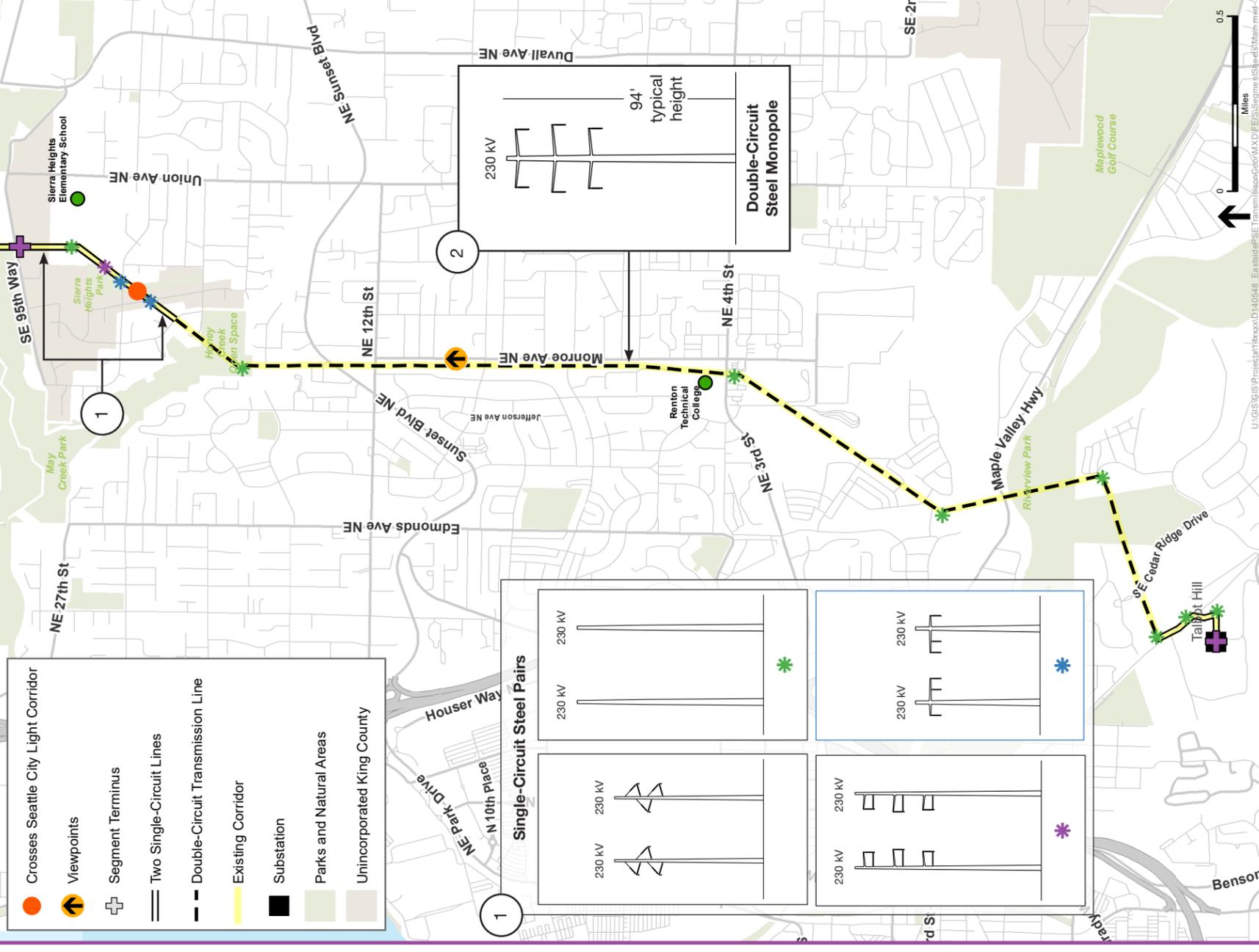
From Monroe Ave NE looking north (existing conditions)



Simulation of proposed project (Power Engineers, 2017)



PSE's Proposed Alignment



2.1.3 Construction

Construction activities associated with the Energize Eastside project are summarized below, both for the No Action Alternative and for PSE's Proposed Alignment. The description of project construction is organized by its two main components (the Richards Creek substation and the 230 kV transmission lines), because these differ in associated activities. Construction of the 230 kV transmission lines would involve similar activities regardless of segment or option; therefore, that discussion is not presented or organized by segment. In addition, the project as analyzed in this Final EIS is still in design development. Although more information is presented in the Final EIS relative to the design details analyzed in the Phase 2 Draft EIS, PSE continues to refine the project design; therefore, the Final EIS continues to consider a range of options and to evaluate the worst-case consequences of that range of options. PSE and its contractors will continue to refine site-specific construction plans throughout the permit process. Site-specific construction impacts associated with the project (e.g., impacts to a particular element of the environment) are described as appropriate in Chapter 5.

As described earlier, because of public concern during the scoping process regarding pipeline safety, a detailed analysis of issues associated with the presence of the Olympic Pipeline system, especially in the context of construction, is included in the Final EIS. Construction-related information associated with the pipeline system is noted in general here, but the full analysis is presented in Chapter 5, Section 5.9 (*Environmental Health – Pipeline Safety*).

More details on the construction methods, equipment used, and sequencing for the Energize Eastside project is included in Appendix A-1.

2.1.3.1 No Action Alternative

Under the No Action Alternative, no construction activities would occur. Occasional pole, wire, and related equipment replacement or repair are considered to be maintenance activities, and therefore are evaluated for long-term (operation) impacts.

2.1.3.2 PSE's Proposed Alignment

Substation and transmission line construction would occur simultaneously. The substation would not be operational until at least one of the new 230 kV transmission lines was completed, connecting the substation to the regional transmission grid.

New Richards Creek Substation and Improvements to Other Substations

Construction of a new substation would require clearing and grading to create a level area for the new transformer and supporting equipment. This would require installation of an approximately 25-foot high soldier-pile retaining wall on the east. The preliminary grading quantities provided by PSE are an estimated 27,480 cubic yards of excavation and 8,000 cubic yards of fill. Approximately 3,550 truck trips would be associated with excavation. Most excavated material would be removed, but some could be used to backfill and restore grades.

The drainage control system would require *trenching*, placement of pipes, and connection to the City storm drainage system. The culvert replacement on the access road would be constructed in accordance with aquatic permit requirements, including limits on the timing for construction, protection of water quality, and other measures to protect stream and wetland habitat.

Access to the substation site is via SE 30th Street. The existing driveway and access road would be reconfigured. The access road would be paved and be approximately 20 feet wide, and approximately 24 feet wide at corners. The access road would include 2-foot shoulders on each side of the pavement. Asphalt paving equipment would be used to construct the access road to the substation. The substation yard would be paved with crushed rock. Concrete foundations would be poured to support the transformer and supporting equipment (circuit breakers, electrical buswork, control house, and connections to the new transmission lines), designed in accordance with regulatory requirements and industry standards. All disturbed areas that are not paved would be planted to control erosion and meet landscaping requirements.

Construction equipment would include, among other things:

- Specialized oversize trucks and trailers
- *Backhoes or excavators*
- Pile driver
- Concrete trucks
- Cranes or other specialty equipment to place transformers

Delivery of the transformer and poles to the site would require oversize trucks. Use of oversize trucks could be restricted to certain hours to avoid or minimize traffic impacts. Additional information on construction equipment and sequencing is included in Appendix A-1. Construction of the substation could take up to 18 months to complete all aspects, including landscaping and final site restoration. However, the substation could be energized before all site improvements were completed.

Construction of the new substation would not likely require the use of a temporary staging area. If equipment storage is required prior to installation, it would likely be stored at a PSE-owned facility or a temporary storage area.

Night construction work would not be needed for the new substation, with the possible exception of delivery of oversize equipment, such as a transformer. For example, the transformer might be delivered to the site at night because of highway restrictions for oversize loads. Extended construction hours may be necessary to meet system operational windows or permit conditions. Road closures are not expected to be necessary for substation construction.

The size and type of crews used to develop the substation would vary over time as the station is built. Each crew could have between two and five vehicles to support their various activities. Vehicles associated with electrical assembly work would primarily be smaller vehicles, such as personal vehicles and work trucks. The actual number of vehicles used depends on the contractor's approach to construction and what is necessary to meet contractual schedule obligations. The control house is a pre-fabricated structure that would be delivered to the site on a trailer and then set on the foundation with a crane. Trucks would also deliver equipment and materials to the substation site. Heavy equipment would be employed primarily during civil construction work, including shoring, grading, and drainage installation. Equipment such as cranes would be used to set electrical equipment on foundations.

PSE will prepare the area for foundations to support the new control house, transformer, and associated electrical equipment in accordance with regulatory requirements and industry standards.

Construction noise would be generated by the installation of appurtenant utilities, such as, natural gas, water, and sewer pipelines, as well as transmission lines (if necessary).

As described in Section 2.1.2.1, in addition to the construction of the new Richards Creek substation, some construction would be needed for the planned upgrades to the Sammamish, Rose Hill, Lakeside, and Talbot Hill substations.

Construction of the 230 kV Transmission Lines

The new transmission lines would be constructed within PSE's existing 115 kV transmission line corridor. Most of the corridor can be accessed via the highly developed road system in the project area, although temporary access roads will need to be constructed in some locations.

Construction methods along road rights-of-way and along the existing corridor would be similar in nature. Common elements of anticipated construction activities are summarized below.

Coordination with Olympic Pipe Line Company. For portions of the corridor, construction of the new 230 kV transmission lines poses potential risks of interaction with or disruption to the Olympic Pipeline system, necessitating particular attention to these risks. Extensive coordination with the Olympic Pipe Line Company (Olympic) would be required during project design and construction to avoid disruption to the pipelines. For details about construction considerations associated with the presence of the pipelines, see Chapter 5, Section 5.9 (*Environmental Health – Pipeline Safety*).

Coordination with Seattle City Light. For portions of the corridor where the proposed transmission lines cross or run parallel to the existing 230 kV line owned and operated by SCL, PSE would coordinate with SCL during project design and construction to avoid disruption to the line.

Construction Phasing and Schedule. Construction of the transmission lines would typically take approximately 12 to 18 months (over two construction phases) and would be constructed concurrently with construction of the Richards Creek substation. Under certain conditions, construction can be accelerated or slowed down depending on the number of crews working at the same time. The project is expected to be built in phases, with the south end (from the Talbot Hill substation to the proposed Richards Creek substation) being the first phase, followed by the north phase as soon as design, permitting, and energization of the south phase would allow. The project needs to be built in two construction phases to keep the Lakeside substation energized, thereby keeping the transmission system on-line to serve customers. During the construction of the south phase, the Lakeside substation will be served from the north and likewise, once the south phase is complete, it will be used to serve the Eastside while the north half is constructed.

The schedule for construction of PSE's project depends on the completion and outcome of the environmental review process, including the duration of regulatory agency reviews and timing of permit approvals. If the project is approved and implemented, construction would likely begin by mid-2018. Construction work would be done in phases, with construction occurring on more than one structure at a time in different parts of the transmission line right-of-way. PSE estimates that the south phase of the transmission line would take approximately 9 months, as would construction of the substation, not including final site restoration. PSE estimates that the north phase would take an additional 9 months, as would final site restoration at the substation. However, additional construction crews may be used to reduce the construction window. Based on this, project completion would be late 2019 at the earliest.

The installation schedule for poles depends on whether a given pole is placed on a foundation or is a directly embedded pole. Poles on foundations take longer. At a given location, typically, the foundation for a steel transmission line pole involves work at a site for 1 to 3 days; setting the pole occurs in 1 day; and stringing the wires across the pole occurs over 1 or 2 days. These three stages of work can be separated by up to 1 month or more. Therefore, in any given location, construction activity would take place over 3 to 14 days within a period of approximately 2 months. For direct embed steel poles, no foundation is set. Typically, the hole is prepared and the pole is set in a single day, with the wires installed up to a month later. The sequence of construction activities is illustrated in Figure 2-4.

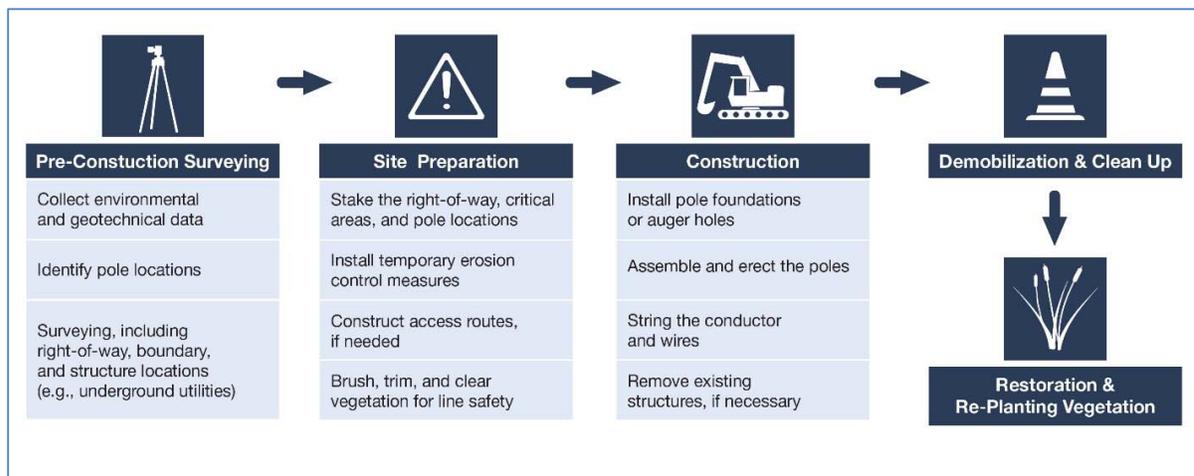


Figure 2-4. Construction Sequencing

The overall construction would be a combination of linear progression and grouping of similar size structures. Construction of foundations requiring similar size equipment (e.g., *augers* and cranes) would be one construction sequence, while poles not requiring foundations would be another sequence. As the foundations cure and become ready for pole installation, the pole and wire crews come through and install the poles. Once all of the poles are installed in a stringing section, the line crews can install the new conductor.

Construction Activities and Equipment. A typical construction crew for a transmission line installation project consists of 10 to 40 people, including transmission line and road construction workers, inspectors and administrative personnel, surveyors, and other support personnel. Construction equipment required for construction of the overhead transmission lines would include the following:

- Bulldozers
- Backhoes
- *Trackhoes*
- Trucks to transport bulldozers, backhoes, trackhoes, cranes
- Bucket trucks
- *Auxiliary rubber tire vehicles*
- Auger or vacuum trucks
- Dump trucks
- Concrete trucks or *concrete pump trucks*
- Cranes
- *Line trucks*
- Wire reel trailer for hauling conductor reels
- *Tensioner* for applying tension to the wire coming off reels during pull
- *Puller* for pulling rope/hard line with attached wire

Clearing and Grading. Trees and vegetation would be removed within the right-of-way following PSE's vegetation management requirements to facilitate project construction and to ensure the safe operation of the line. Grasses, shrubs, and saplings would be trimmed or cleared in areas subject to ground-disturbing activities. All areas disturbed by tree clearing within the managed right-of-way would be revegetated following construction (incorporating property owner input where feasible), and trees within the tensioning sites outside of the PSE right-of-way would be allowed to regrow. For more information on tree clearing, see Sections 4.4 and 5.4, *Plants and Animals*.

Disturbance of site soils would be necessary for clearing and grading to prepare foundation pads, as well as potential temporary staging areas and equipment access depending on the location of the proposed transmission line. Construction would require temporary construction access roads in some locations. Typical structure removal and installation activities would disturb an area about 50 feet by 50 feet (0.06 acre). In some areas, the disturbance area may need to be larger (e.g., where the terrain is more difficult). Conversely, it may be possible to reduce the disturbance area in other locations to minimize impacts to sensitive resources, such as wetlands. The appropriate *best management practices (BMPs)* will be used to minimize impacts on sensitive resource.

Access Roads. Along the existing corridor, PSE has existing access roads and will use these pathways to the greatest extent possible. At some sites, access roads may need to be improved to accommodate construction equipment. Improvements may include vegetation clearing, widening, or laying gravel. As there are many road crossings, the use of an access road for the project would likely be limited to the installation of nearby poles and wire installation (i.e., pulling and tensioning). Typically, an access road would be used to access two to five pole sites. Construction BMPs will be used to control stormwater run-off. Access roads will be restored to their previous condition or to NESC vegetation specifications when within the managed right-of-way. Maps showing preliminary access road locations are provided in Appendix A-2. These maps reflect probable access routes identified by PSE prior to individual property owner consultation that was ongoing during the preparation of this Final EIS.

Pole Installation. Pole installation methods along road right-of-way and along the existing transmission line corridor are similar. Along roadways, it is often necessary to temporarily close a lane of traffic when moving in equipment, delivering materials, setting foundations, and placing poles. PSE would obtain street use permits when this work is performed, which include traffic control plans and construction windows. Traffic controls with caution signs, flaggers, and cones are used to direct and control traffic around the work area to allow for the safe handling and placement of both equipment and materials. If necessary, sidewalk access would be blocked off and pedestrian traffic would be detoured. Similarly, if parking spaces are in the work area, they may be temporarily coned off to preserve the space needed to complete the work. Work in the road right-of-way can be limited to specific working hours as established by the permit. For this reason, pole installation along roadways may require additional working days if the daily working times are limited.

The methods used to install new steel poles will depend on the type of pole used and both its physical and functional location. Poles can be directly embedded in the ground (similar to a wood pole). Such poles do not require a foundation and are installed using a vacuum truck or, when safe, an auger to excavate the hole, which typically results in less surface area disturbance than other equipment (such as a backhoe or drill). PSE has completed site-specific engineering and has determined that approximately 60 percent of the poles would be directly embedded.



Vacuum truck in the existing corridor in Newcastle excavating a hole for installation of a replacement transmission pole.

For some poles, drilled pier foundations would be necessary, which involves setting the anchor bolts in a poured column of concrete. Drilled pier foundations for new 230 kV poles are typically augered (drilled) 4 to 8 feet in diameter with steel reinforcements that could extend 25 to 50 feet deep depending on the structure type and soil conditions. The hole is filled with concrete and allowed to cure (harden) for several days. Once the foundation concrete has cured properly, poles are set and anchored to the foundations. For the remaining 40 percent of pole locations, concrete pole foundations would need to be installed. The actual number of each pole type will be determined during final design. PSE is refining the transmission line design to reduce ground disturbance, including the number of poles that require engineered foundations. Engineered foundations are typically required at angle and dead-end poles, so they cannot be eliminated.

Steel poles would typically be delivered to the site in 30- to 50-foot sections, and assembled in the field. The delivery would require one or two vehicle trips per pole. The base is installed first, as described above; once the base is installed, the subsequent sections are added. Typically, no welding is required, as the ends of the segmented poles are tapered, designed to overlap using slip joints or connected with flange joints.

PSE does not generally anticipate the need for homeowners to vacate their homes during pole installation. However, in locations where site access by vehicles is difficult, PSE has suggested that cranes or helicopters could be used to lift poles sections over a building, in order to reduce impacts from creating temporary access. In such cases, residents would likely be asked to vacate the premises for a couple of hours to ensure their safety. This type of construction is not proposed in any specific location by PSE at this time, but is listed and described as a potential mitigation measure for construction phase land use impacts in Section 5.1.3, *Mitigation Measures*.

Temporary Stringing/Pulling Sites. To replace the transmission conductor, stringing and tensioning equipment will be staged near new steel poles at an estimated eight to ten locations along the corridor. The disturbance area associated with the stringing sites will avoid sensitive resources (such as wetlands, streams, and unstable slopes) to the extent feasible. Each stringing site will be approximately 7,500 square feet in area (e.g., 87 feet by 87 feet). Pulling sites would typically be 2 to

3 miles apart along the right-of-way, with specific sites determined close to the time the stringing activity takes place. Similar to work areas for pole construction, the shape of the stringing site will depend on the presence of adjacent critical areas, existing land conditions, and area needed for equipment staging based on the angle needed to string the conductor. Stringing sites are expected to largely overlap other work areas (e.g., for pole replacement, access, and vegetation management) and are not expected to require additional tree removal. Any additional impacts resulting from stringing sites will be temporary in nature; temporary impact areas will be re-vegetated and left to return their natural state or enhanced following construction. It may be more efficient and less disruptive to adjacent property owners in some locations to use a helicopter for stringing. This is identified as a mitigation measure in Section 5.1.3, *Mitigation Measures*, as well as in Appendix M.

Transmission Line (Wire) Installation. Once the poles are set in place and stringing sites established, the transmission line conductor (wire) is installed (Figure 2-5). The wire-stringing operation requires equipment at each end of the section being strung, with the establishment of the temporary pulling or tensioning sites. Wires are pulled between these pulling sites through pulleys affixed to each pole structure. Once the wire is strung, the pulleys would be removed and the wire clipped into its final hardware attachment. Following the installation of wires, surfaces around the new poles and in work areas would be restored.

For safety, the NESC has established minimum wire clearances (i.e., the wire height above the ground). PSE has designed 230 kV transmission lines for the Energize Eastside wires to be 28 feet or more from the ground under maximum sag conditions, which meets or exceeds NESC's minimum conductor wire height. Additional clearance would be provided over roadway and highway crossings.

Removal of Existing Poles: After installation of the new poles and transmission lines, including wire installation and energization, the existing poles and wires would be removed. After energization and successful testing of the new fiber optic communications lines, the old poles and lines would be removed within a few days to a few months. For poles with cellular equipment, transfer from the old pole to the new one would occur within approximately 90 days, and would have to occur before the affected poles could be removed. Because the existing wood poles are treated with a preservative, they are regulated as hazardous waste; the removed poles would be disposed of at an approved landfill in compliance with state and federal regulations.

Interstate 90 (I-90) and State Route 520 (SR 520) Crossings. The Bellevue North Segment crosses SR 520 and the Bellevue South Segment crosses I-90. Poles installed at these crossing locations would need to be 10 to 15 feet taller than the other nearby poles, although the existing topography at both of these crossing sites limits the need for taller structures. When stringing the transmission lines at the highway crossings, PSE would work with the Washington State Department of Transportation to determine appropriate times to conduct the work and related safety factors. Construction and stringing may require rolling slowdowns along the highway (with the use of flaggers), as well as some night work. Also, dead-end structures would be installed in the vicinity of the I-90 and SR 520 crossings for line stability.



Worker rebuilding a transmission line



Workers connecting a transmission line to insulators



Stringing a transmission line



Installing a steel monopole with pulleys attached

Figure 2-5. Transmission Line Pole and Wire Installation

Staging Areas. Staging areas and a construction field office would be required along the project corridor during construction. Specific staging sites would be determined by PSE and its contractor after final design has been approved. In most instances, staging sites are located on properties that have already been developed, such as parking lots or graded lots. For a project of this scope, PSE would identify sites near the corridor with good access. Some staging sites are for short-term use (less than 3 months), while others may be used for the entire duration of the project (greater than a year). Short-term sites are used to accept delivery of materials (e.g., pole sections, insulators, conductors, and associated hardware). Longer term sites can be used for temporary construction offices (e.g., trailers) in addition to material storage. The longer term sites are often larger and used to accommodate parking for construction vehicles in addition to material storage. To the extent possible, PSE locates and uses staging area sites on properties that it already owns or leases, that are already paved, and that are close to the transmission line corridor. It is possible that recreation sites or facilities may be used for temporary construction staging (as described in Section 5.6.2). PSE would work with the appropriate cities to identify suitable locations for staging that would have minimal adverse impacts to recreation. Following construction, PSE would restore staging areas if any ground disturbance had occurred.

Other Activities. Installation of the new overhead transmission lines would require other construction activities that may include additional boring holes for geotechnical investigations, or relocating existing distribution and telecommunications facilities.

Demobilization and Restoration. Areas temporarily disturbed by construction activities will be restored to pre-project conditions. Site restoration includes removal of temporary erosion control measures and temporary access roads, ground level regrading, revegetation, wetland mitigation (if needed), and other activities. Restoration will be coordinated with the property owner and relevant permitting agencies.

2.2 ALTERNATIVES CONSIDERED BUT NOT INCLUDED

2.2.1 From the Phase 1 Draft EIS

The Phase 1 Draft EIS considered a range of programmatic alternatives, some of which were not included in the analysis. The following alternatives were considered but not included in the Phase 1 Draft EIS:

- Use Existing BPA High Power Transmission Line.
- Upgrade/Adjust the Existing Electrical System.
- Larger Generation Facilities.
- Submerged 230 kV Transmission Line in Lake Sammamish.
- Other Approaches such as phasing, combining partial solutions, changing a transmission line from AC to direct current (DC), limiting the flow of power from sources outside of the Eastside, and limiting the scope of potential to Bellevue only.

The reasons each of these suggestions were not included in the EIS analysis are described in Section 2.4 of the Phase 1 Draft EIS.

2.2.2 From the Phase 2 Draft EIS

The Phase 2 Draft EIS considered a range of project-level alternatives, some of which were not included in the analysis. The following alternatives were considered but not included in the Phase 2 Draft EIS:

- Seattle City Light Transmission Line
- Underground Transmission Line
- Underwater Transmission Line in Lake Washington
- New 115 kV Transmission Line
- Seattle Public Utilities Water Line Corridor
- Other Routes and Options
- Alternative 2 and “Alternative 2B”

The reasons each of these suggested alternatives were not included in the EIS analysis are described in Section 2.2 of the Phase 2 Draft EIS.

2.2.3 For the Final EIS

During the comment periods on the Phase 1 Draft EIS and Phase 2 Draft EIS, comments were submitted that debate the reasons given for the elimination of some of the alternatives listed above. The responses to comments in Chapter 6, Appendix J, and Appendix K of this Final EIS address these comments. These are not further discussed in this chapter. For the Final EIS, one additional alternative for the Newcastle Segment was considered and not included: undergrounding a portion of the transmission line in Newcastle, as described below.

2.2.3.1 *Underground a Portion of the Transmission Line in Newcastle*

Undergrounding a portion of the transmission line was listed as a potential mitigation measure in the Phase 2 Draft EIS. After publication of the Phase 2 Draft EIS, the Partner Cities considered whether there should be an alternative in any of the segments that would travel underground. In Newcastle specifically, there were potential significant impacts on the *aesthetic environment*, but no feasible alternate routes had been identified, so the possibility of an underground alternative was discussed. The Phase 1 Draft EIS describes the problems with placing the transmission line underground generally within the existing corridor, due to the presence of the Olympic Pipeline system. In Newcastle, the Olympic Pipeline system occupies the center of the corridor, making it impossible to place an underground transmission line where it would not interfere with the pipelines. For these reasons, an underground option would need to use City road right-of-way. Selecting a feasible route for an underground segment involves a number of technical steps, such as determining where connections can be made to the overhead portion, and examining potential utility conflicts. PSE indicated that, under its tariff, any such design request must be paid for by the requesting party. PSE also indicated that the time it would take to design and install an underground segment could delay the project several years. Lacking a design, it is not possible to prepare a project-level analysis. The delay involved in developing a design could also have an adverse effect on the reliability of the electrical transmission system on the Eastside. After careful consideration, this alternative was not carried forward for analysis in the Final EIS.

2.3 BENEFITS AND DISADVANTAGES OF DELAYING THE PROJECT

PSE has identified the need to provide additional capacity by the winter of 2017–2018 to comply with its anticipated capacity requirements. PSE’s objectives for the project, and criteria for evaluating options to meet its objectives, are described in detail in Section 2.2 of the Phase 1 Draft EIS. The impacts and potential benefits of a conservation-focused non-transmission alternative are evaluated as part of Alternative 2 in the Phase 1 Draft EIS, including a number of potential combinations of approaches.

Delaying the project for 1 to 2 years would have the benefit of avoiding the impacts in the near future for the action alternative described in the Phase 2 Draft EIS and the Final EIS. It is possible that by delaying the project, some of the expanded conservation measures described in the Phase 1 Draft EIS would be incorporated into development, reducing energy demand further than PSE has projected. However, as noted by the EIS Consultant Team in their independent review of PSE load projections and needs assessments (Stantec, 2015), PSE has assumed high levels of conservation in its estimates of load projection. Under the No Action Alternative, the Final EIS assumes that PSE would continue to achieve 100 percent of the company’s conservation goals as outlined in its 2017 Integrated Resource Plan (PSE, 2017d), systemwide and for the Eastside, which means that a very aggressive campaign would be needed to exceed these goals. Conservation goals are achieved through a variety of energy efficiency improvements implemented by PSE and its customers, largely through voluntary participation. Additional conservation could have the benefit of reducing greenhouse gas generation from electrical consumption on the Eastside. Under WAC 480-100-238, however, PSE “has the responsibility to meet its system demand with a least cost mix of energy supply resources and conservation.” Accordingly, PSE’s ability to fund conservation and new technologies is limited to those that are cost-effective. Delaying the project could allow technological advancements to occur in areas such as battery storage or generation, providing additional feasible alternatives to increased transmission capacity in the near term; however, identifying a time frame when these advancements could occur is speculative. At this time, there are no currently known, widely accepted technologies that PSE would employ that could feasibly and reliably address the transmission capacity deficiency on the Eastside. Under the No Action Alternative, however, PSE would not be precluded from seeking out new technologies. For example, if the project were delayed, PSE could explore the possibility of using battery technology to address the near-term problem. Impacts associated with battery technology are described in the Phase 1 Draft EIS. Aside from the concerns about reliability of this relatively new technology, impacts were not considered significant.

The disadvantages of delaying the project are that the risks of power outages (described in Chapter 1 of the Phase 1 Draft EIS) associated with the No Action Alternative could develop over time. PSE’s customers could respond with increased energy conservation during peak periods to avoid outages, but PSE could not rely on voluntary conservation during such periods unless they have control over customers’ rates of consumption. This type of demand reduction is technically feasible, but PSE cannot compel customers to adopt it, and few have shown willingness to employ that option under its current conservation program. Therefore, PSE would still be faced with creating temporary outages to protect the regional grid. Given the lack of certainty regarding potential effectiveness of conservation measures, project delay would likely fail to achieve the project objectives. It is also possible that the awareness of the risk of outages could discourage development within the Eastside, which would place the Partner Cities at an economic disadvantage to other jurisdictions in the region. A declining reliability of the electrical power supply on the Eastside would be inconsistent with local planning policies.