

Table G-1. Shovel Probe Table.

Shovel Probe	Pole Number/Access Road	Maximum Depth (cmbs)	Description (cmbs): Description— <i>Comments</i>	Cultural Materials
1	N/A (eastern replacement pole on the Sammamish–Lochleven 115 kV line)	70	0–30: Dark brown fine silt with sand and abundant roots, no gravels observed 30–45: Gray medium-grained sand, > 10 small rounded pebbles, charcoal (fragmentary) 45–70: Light brown mottled with gray fine sand with silt <i>Water obscured bottom</i>	None
2	N/A (replacement pole on the Sammamish–North Bellevue 115 kV line)	50	0–45: Dark brown-black saturated, goopy, fine, silty sand; coarse gravels and grass root mat is dense; water infills the probe 40–50: Dark gray-black, fine silty sand, many fine rootlets; no gravels; root and/or wood debris at 50 cm, well into water table <i>Wood/root barrier and encountering water table < 5 cm below surface</i>	None
3	N/A (south of Sammamish Substation)	100	0–75: Dark brown medium sand with no gravels, to very few gravels and many decomposing organics, oxidation/reduction present; water table at 70 cmbs 75–100: Gray medium to coarse sand with very few subrounded gravels <i>At depth</i>	None
4	N/A (south of Sammamish Substation)	40	0–20: Abundant matted grass and fine grass roots, dark grayish-brown fine-grained sandy silt; water table reached at ~ 2–3 cmbs— <i>O horizon</i> 20–40: Dark grayish-brown fine-grained sandy silt, very few rounded and subrounded gravels/small pebbles, abundant fine grass roots <i>Water table exceeded</i>	None
N/A	N/A (western replacement pole on Sammamish–Lochleven 115 kV line)	N/A	Not dug—this pole was added in the wetland after the archaeological surveys took place	N/A
N/A	N/A (central replacement pole on Sammamish–Lochleven 115 kV line)	N/A	Not dug—this pole was added in the wetland after the archaeological surveys took place	N/A

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N/A	0/2A (replacement pole on the Sammamish–Moorlands No. 1 115 kV line)	N/A	Not dug—this pole was added after the archaeological surveys took place	N/A
N/A	N/A replacement pole on the Sammamish–Moorlands No. 1 115 kV line)	N/A	Not dug—this pole was added after the archaeological surveys took place	N/A
N/A	0/1	N/A	Not dug—in Sammamish Substation	N/A
N/A	0/2	N/A	Not dug—in Sammamish Substation	N/A
N/A	0/3	N/A	Not dug—underground Substation grid	N/A
N/A	0/4	N/A	Not dug—paved	N/A
N/A	0/5	N/A	Not dug—utilities	N/A
5	0/6	100	0–46: Dark brown fine sandy silt, few small–large subround pebbles, many fine roots, abrupt and wavy boundary, disturbed— <i>fill</i> 46–81: Light brown sand with chunks of diatomaceous earth, common dark yellow mottles, increasing compaction with depth, abrupt smooth boundary— <i>alluvial</i> 81–100: Compact, gray coarse sand, compact, homogenous— <i>glacial</i>	20 cmbs: geotechnical fabric, asphalt chunks
6	0/7	97	0–20: Dark brown to black woody top soil— <i>imported fill</i> 20–78: Brown to pale brown gravelly sandy silt with many imported subangular gravels ranging from pea gravels to medium cobbles (railroad ballast); coarse organics common 78–97: Brown loose gravelly sandy silt that becomes increasingly more compact and with increasing silt content; pale gray compact clayey silt clasts within loose pebbly silts at 85 cmbs— <i>disturbed</i> <i>Terminated at depth</i>	20–78 cmbs: common bits of plastic sheeting

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7	0/8	100	0–63: Dark brown fine sandy silt, very few small–medium subround pebbles, many fine roots, disturbed nodules of diatomaceous earth mixed in, smooth and abrupt boundary, disturbed— <i>fill</i> 63–100: Light brown coarse sand, many subround pebbles and cobbles, increasing compaction with depth, very clean homogenous sand layer, unclear if this is pit run or high energy deposit— <i>alluvial</i>	None
8	Access Road	102	0–30: Brown moderately compact gravelly sandy silt with many rounded to subangular gravels; asphalt chunks common— <i>O horizon</i> 30–45: Brown moderately compact pebbly sandy silt; some small wood fragments and asphalt debris 45–90: Brown to grayish-brown mottled compact medium- to fine-grained sandy silt with some to few gravels (decreasing rapidly with depth); fine gray clayey silt inclusions 90–102: Dark gray densely compacted fine sandy silt <i>Terminated at depth</i>	0–30 cmbs: 1 milk glass fragment, 1 pale blue glass fragment with swirl, 1 flat aqua glass fragment 40 cmbs: 1 railroad spike 80 cmbs: asphalt fragments
9	0/9 Radial	30	Surface: grass sod 0–30: Grayish-brown sand with silt, poorly sorted gravels— <i>fill</i> <i>Attempted 3 locations within 1 meter, all extremely compacted with obstructions (bent fence posts in fill soil); not able to penetrate compacted fill</i>	None

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10	0/9 Radial	209 (auger at 87 cmbs)	<p>Surface: grass sod</p> <p>0–37: Grayish-brown sand with silt, poorly sorted gravels, abrupt lower boundary—<i>fill</i></p> <p>37–73: Dark brown silt and sand with organics, abrupt lower boundary—<i>fill</i></p> <p>73–99: Light grayish-brown silt with sparse fine sand, oxidation staining—<i>native</i></p> <p>99–109: Dark gray silt with some organic inclusions, diffuse lower transition—<i>native</i></p> <p>109–143: Light gray silt with fine sand—<i>native</i></p> <p>143–205: Gray silt with fine sand (gets finer with depth), sparse organics, oxidation staining. Water table at 190 cmbs—<i>native</i></p> <p>205–209: Gray silt with oxidation staining, dense rounded gravels—<i>native</i></p>	None
11	0/9 (Radial 7)	240 (auger at 85 cmbs)	<p>Surface: grass sod</p> <p>0–36: Grayish-brown sand with silt, poorly sorted gravels, abrupt lower boundary—<i>fill</i></p> <p>36–77: Dark brown silt and sand with organics, abrupt lower boundary—<i>fill</i></p> <p>77–94: Light grayish-brown silt with sparse fine sand, oxidation staining—<i>native</i></p> <p>94–108: Dark gray silt with some organic inclusions—<i>native</i></p> <p>108–129: Light gray silt with fine sand—<i>native</i></p> <p>129–240: Gray silt with fine sand, sparse organics, oxidation staining—<i>native</i></p>	0–36 cmbs: fragments of glass

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12	0/9 Radial	140 (auger at 80 cmbs)	<p>Surface: grass sod</p> <p>0–40: Brown silty medium-coarse sand with 20% gravel—<i>modern A horizon</i></p> <p>40–80: Dark brown silty medium-coarse sand with less than 10% mostly rounded, some angular, gravels, organically rich, few small roots, very strong blocky pedogenic structure throughout—<i>possible native A horizon—alluvial</i></p> <p>80–90: Grayish-brown silty fine sand, diatomaceous-rich, very few rounded gravels, weak pedogenic structure—<i>alluvial</i></p> <p>90–110: Very dark brown, charcoal-stained silty very fine sand, organically rich, strong blocky structure, very few rounded gravels—<i>possible buried surface, alluvial</i></p> <p>110–140: Light gray, non-organic fine-medium grain sand, abrupt boundary, no structure—<i>alluvial</i></p>	<p>40–60 cmbs: 1 fragment of clear glass, 2 coal clinkers</p> <p>90–110 cmbs: 1 black glass fragment</p>

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13	0/9	170 (auger at 80 cmbs)	<p>Surface: grass sod</p> <p>0–10: Brown silty medium-coarse sand with 20% gravel—<i>modern A horizon</i></p> <p>10–35: Gray medium-coarse sand with poorly sorted gravels—<i>fill</i></p> <p>35–80: Dark brown silty medium-coarse sand with less than 10% mostly rounded, some angular, gravels, organically rich, few small roots, very strong blocky pedogenic structure throughout—<i>possible native A horizon</i></p> <p>80–90: Reddish-brown silty fine sand with few gravels, strong blocky structure, possible diatomaceous content—<i>alluvial</i></p> <p>100–110: Grayish-brown silty fine sand, diatomaceous-rich, very few rounded gravels, weak pedogenic structure—<i>alluvial</i></p> <p>120–130: Dark brown, organically rich, charcoal-stained silty fine sand with very few rounded gravels, medium blocky structure—<i>alluvial</i></p> <p>130–140: Very dark brown, charcoal-stained silty very fine sand, organically rich, strong blocky structure, very few rounded gravels, possible buried surface—<i>alluvial</i></p> <p>140–150: Light gray, non-organic fine-medium grain sand, abrupt boundary, no structure—<i>glacial</i></p> <p>160–170: Very light gray non-organic fine sand, no structure—<i>glacial</i></p>	<p>40–50 cmbs: 1 small cobalt glass fragment, 1 coal clinker</p> <p>130–140 cmbs: 1 chunk of railroad ballast</p>
14	0/9 Radial	120 (auger at 75 cmbs)	<p>Surface: grass sod</p> <p>0–30: Brown silty medium-coarse sand with 20% gravel—<i>modern A horizon</i></p> <p>30–75: Gray medium-coarse sand with poorly sorted gravels—<i>fill</i></p> <p>75–85: Grayish-brown silty fine sand, diatomaceous-rich, very few rounded gravels, weak pedogenic structure—<i>alluvial</i></p> <p>85–100: Dark brown, organically rich, charcoal-stained silty fine sand with very few rounded gravels, medium blocky structure—<i>alluvial</i></p> <p>100–120: Light gray, non-organic fine-medium grain sand, abrupt boundary, no structure—<i>glacial</i></p>	30–75 cmbs: 2 brown glass fragments

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15	0/9 Radial	140 (auger at 80 cmbs)	<p>Surface: grass sod</p> <p>0–40: Brown silty medium-coarse sand with 20% gravel—<i>modern A horizon</i></p> <p>40–80: Dark brown silty medium-coarse sand with less than 10% mostly rounded, some angular, gravels, organically rich, few small roots, very strong blocky pedogenic structure throughout—<i>possible native A horizon—alluvial</i></p> <p>80–100: Grayish-brown silty fine sand, diatomaceous-rich, very few rounded gravels, weak pedogenic structure—<i>alluvial</i></p> <p>100–120: Dark brown, organically rich, charcoal-stained silty fine sand with very few rounded gravels, medium blocky structure—<i>alluvial</i></p> <p>120–140: Light gray, non-organic fine-medium grain sand, abrupt boundary, no structure—<i>glacial</i></p>	<p>40–60 cmbs: 1 metal fragment</p> <p>100–110 cmbs: 1 chunk of railroad ballast</p>
16	0/6 (Radial 4)	180 (auger at 90 cmbs)	<p>Surface: grass sod</p> <p>0–40: Compact, brown sandy silt loam with 25% subround pebbles, gravels, and cobbles—<i>fill</i></p> <p>40–90: Compact, reddish-brown silty fine sand with 25% few gravels—<i>alluvial</i></p> <p>90–110: Grayish-brown silty fine sand, 25% subrounded gravels—<i>alluvial</i></p> <p>110–130: Grayish-brown, organically rich, charcoal-stained silty fine sand with sparse subrounded gravels—<i>possible buried surface—alluvial</i></p> <p>130–140 : Very dark brown, charcoal-stained silty fine sand, organically rich, sparse subrounded gravels—<i>possible buried surface—alluvial</i></p> <p>140–150: Light gray, non-organic fine-medium grain sand—<i>glacial</i></p> <p>150–180: Very light gray non-organic fine sand—<i>glacial</i></p>	<p>20–25 cmbs: 1 colorless glass fragment, 1 concrete chunk</p>

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17	0/6 (Radial 5)	210 (auger at 90 cmbs)	<p>Surface: grass sod</p> <p>0–27: Grayish-brown sand with silt, poorly sorted gravels—<i>fill</i></p> <p>27–78: Dark brown organic silt with sand, abrupt lower boundary—<i>modern A horizon</i></p> <p>78–120: Gray ash or diatomaceous earth—<i>native</i></p> <p>120–205: Gray to grayish-brown, medium grained sand with oxidation staining at base; water table at 160 cmbs—<i>native</i></p> <p>205–210: Gray to grayish-brown silt with oxidation staining—<i>native</i></p>	0–27 cmbs: fragments of brown and colorless glass, slag
18	0/6 (Radial 6)	240 (auger at 85 cmbs)	<p>Surface: grass sod</p> <p>0–51: Grayish-brown sand with silt, poorly sorted gravels—<i>fill</i></p> <p>51–110: Gray ash or diatomaceous earth—<i>native</i></p> <p>110–235: Gray ash or diatomaceous earth—<i>native</i></p> <p>235–240: Gray silt with oxidation staining and dense rounded cobbles—<i>native</i></p>	0–51 cmbs: fragments of brown glass, slag
19	Access Road	100	<p>0–25: Brown fine-grained sandy silt with very few subangular and subrounded gravels (small pebbles); few fine grass roots; few small chunks of asphalt</p> <p>25–32: Light grayish-brown fine-grained silty sand with very few subangular and subrounded gravels (small pebbles); many small to medium-sized chunks of asphalt</p> <p>32–72: Dark brown silty clay loam with very few subrounded and subangular gravels (small pebbles); some small to medium chunks of asphalt</p> <p>72–100: Grayish-brown silty clay loam with very few subrounded and subangular gravels (small pebbles)</p> <p><i>Terminated at depth</i></p>	<p>5 cmbs: 1 strip metal fragment approx. 1/2" long x 5/8" wide</p> <p>35–40 cmbs: 1 small milk glass rim shard</p> <p>75–85 cmbs: 1 plastic label fragment</p>

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20	Access Road	45	0–45: Brown to light brown sandy silt with common poorly sorted subrounded to subangular gravels <i>Terminated due to large board</i>	20 cmbs: 1 concrete boulder 5–45 cmbs: 3 white milk glass fragments; 2 cobalt glass fragments; 3 turquoise glass fragments; 8 coal slag fragments; milled wood throughout
21	0/10	80	0–10: Medium brown silty loam sod layer with small roots, less than 10% gravels, disturbed— <i>fill</i> 10–40: Medium brown silty sand with 30–40% mixed gravels and cobbles, disturbed— <i>fill</i> 40–80: Dark brown silty loam, ~40% mixed gravels and cobbles, disturbed; water table at 60 cmbs— <i>fill</i> <i>Terminated due to water table and fill</i>	0–10 cmbs: plastic, sod mesh, nails 10–40 cmbs: brick in side wall 40–80 cmbs: coal slag, burnt wood fragments
22	Access Road	100	0–20: Dark brown loosely consolidated organic sandy silt with some pea gravels to small rounded cobbles 20–65: Mottled grayish-brown moderately compact gravelly sandy silt with some rounded to subangular gravels ranging from medium to large pebbles 65–100: Gray to dark gray compact silty sand with very few rounded to subrounded gravels ranging from small to medium cobbles <i>Terminated at depth</i>	0–20 cmbs: asphalt chunks 30 cmbs: milled lumber and metal (spike or bracket)
23	Access Road	40	0–40: Dark brown fine- to medium-grained sandy silt with many subrounded to angular gravels ranging from small to large pebbles; few fine grass roots; white utility pipe uncovered in east side of probe at 34 cmbs <i>Terminated at unmarked white utility pipe</i>	None

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24	Access Road	100	0–25: Brown silty sand with common poorly sorted subrounded to angular gravels (small pebbles); many fine roots— <i>railroad fill</i> 25–100: Yellowish-brown sandy silt with oxidation and with few subrounded gravels <i>Terminated at depth</i>	None
25	0/11	100	0–20: Dark brown silty loam, small roots, 15–20% mixed gravels, disturbed— <i>fill</i> 20–40: Medium brown silty sand, ~20% mixed gravels, disturbed— <i>fill</i> 40–55: Dark brown coarse sand, gravels, disturbed— <i>fill</i> 55–100: Medium brown silty sand, ~30% mixed gravels and cobbles, disturbed— <i>fill</i>	20–55 cmbs: coal slag 55–100 cmbs: slag, coal
26	Access Road	80	0–56: Brown sandy silt with common poorly sorted angular to subrounded gravels (small to large pebbles) 56–80: Grayish-brown silty medium-grained sand with many subrounded gravels ranging from pebbles to cobbles <i>Terminated due to gravel infilling</i>	None
27	Access Road	103	0–34: Dark brown fine-grained sandy silt with some subrounded to subangular gravels ranging from small to large pebbles; few fine grass roots 34–63: Dark gray medium- to coarse-grained silty sand with many subrounded to angular gravels ranging from small pebbles to small cobbles; some coal and charcoal fragments throughout 63–103: Light brown to strong brown fine-grained sandy silt with some subrounded to angular gravels ranging from small to large pebbles; few coal and charcoal fragments throughout <i>Terminated at depth</i>	15–20 cmbs: 1 piece of blue plastic tape/sheeting

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28	Access Road	100	0–27: Brown sandy silt with common poorly sorted subrounded to angular gravels ranging from small pebbles to a boulder— <i>disturbed</i> 27–45: Gray coarse-grained sand with asphalt fragments 45–100: Yellowish-brown coarse-grained sand mixed with reddish-brown sandy silt with common subrounded gravels ranging from pebbles to cobbles <i>Terminated at depth</i>	20 cmbs: 1 colorless glass fragment
29	0/12	95	0–25: Dark brown silty loam, small roots, 25–30% mixed gravels, disturbed— <i>fill</i> 25–60: Dark brown to black coarse sand (not midden), 50% mixed gravels, disturbed— <i>fill</i> 60–95: Reddish-brown silty sand, 30–40% mixed gravels, some small roots, disturbed— <i>alluvial</i> <i>Terminated due to root obstruction</i>	25–60 cmbs: coal slag, large metal bolt, glass fragments
30	Access Road	95	0–25: Dark brown loose pebbly sandy silt; many fine roots 25–55: Dark brown to black silty sand with very few gravels; almost entirely coal clinker and furnace clean-out— <i>little soil formation</i> 55–95: Gray-brown gravelly silty sand with common cobbles below 60 cmbs; increasing loose medium sand content with depth; grading downward to pale yellowish-brown sand and common rounded gravels ranging from medium to large cobbles <i>Terminated at cobble and root obstruction</i>	0–55 cmbs: plastic/ modern trash; 1 threaded bolt; sparse clean-out to 65 cmbs
31	Access Road	100	0–10: Brown sandy silt with common poorly sorted subrounded to angular gravels (pebbles) 10–75: Dark grayish-brown silty medium-grained sand with very many subrounded to subangular gravels ranging from pebbles to cobbles; asphalt fragments— <i>disturbed</i> 75–85: Yellowish-brown sand with very few subrounded gravels 85–100: Light yellowish-brown compact fine sandy silt with very few gravels <i>Terminated at depth</i>	None

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32	0/13	100	0–25: Medium brown silty loam, mixed gravels, small roots, disturbed— <i>fill</i> 25–40: Very compact, gray crushed gravel, disturbed— <i>fill</i> 40–85: Dark brown to black coarse sand (not midden), 50% mixed gravels, disturbed— <i>fill</i> 85–100: Reddish-brown silty sand, 15–20% mixed gravels, disturbed— <i>alluvial</i>	40–85 cmbs: coal slag, glass fragments
33	Access Road	54	0–18: Dark brown fine-grained sandy silt with many subrounded to angular gravels ranging from small pebbles to small cobbles; some fine grass roots 18–38: Dark brown slightly silty medium- to coarse-grained sand with very many subrounded to angular gravels ranging from small pebbles to small cobbles 38–54: Olive-gray slightly silty gravelly coarse-grained sand with many subrounded to angular gravels ranging from small to large pebbles <i>Terminated at impenetrable cobble layer</i>	None
34	Access Road	46	0–46: Compact brown to light brown sandy silt with poorly sorted subrounded to angular gravels ranging from pebbles to cobbles (disturbed) <i>Terminated at impenetrable cobble matrix</i>	None
35	Access Road	52	0–9: Dark brown fine-grained sandy silt with many subrounded to angular gravels ranging from small to large pebbles; few grass roots 9–20: Grayish-brown fine-grained sandy silt with many subrounded to subangular gravels ranging from small to large pebbles 20–52: Brownish-gray slightly silty medium- to coarse-grained sand with occasional grayish-brown pockets of sandy silt and with some subrounded to subangular gravels ranging from small pebbles to large cobbles <i>Terminated at large cobble obstruction</i>	25 cmbs: 1 colorless flat glass (window) shard 35–40 cmbs: 1 ripped-apart yellow golf ball husk

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36	Access Road	100	<p>0–18: Dark brown, loose, organic, pebbly topsoil— <i>imported fill</i></p> <p>18–30: Imported pea gravel and angular railroad grade ballast gravels; black plastic at base of pea gravels</p> <p>30–60: Dark brown to black silty sand and many gravels; asphalt and dense pockets of clinker/furnace clean-out</p> <p>60–100: Pale yellowish-brown unconsolidated medium-grained silty sand; few gravels ranging from pea gravels to medium rounded cobbles; active roots</p> <p><i>Terminated at depth</i></p>	<p>0–30 cmbs: fill</p> <p>30–60 cmbs: fill with asphalt and spalls</p>
37	0/14	100	<p>0–45: Medium brown silty loam, 5–10% mixed gravels, disturbed—<i>fill</i></p> <p>45–100: Yellowish-brown fine sand, some oxidation at upper boundary—<i>alluvial</i></p>	0–45 cmbs: plastic, PVC, and metal fragments
38	Access Road	100	<p>0–15: Pale brown pebbly sandy silt—<i>topsoil</i></p> <p>15–30: Brown sandy silt with many blocky subangular ballast spalls; increasing sand content with depth; some clinkers</p> <p>30–55: Yellowish-brown unconsolidated silty sand; gravels decreasing with depth; abundant clinkers</p> <p>55–100: Yellowish-brown loose medium-grained sand with some gravels ranging from pea gravels to rounded cobbles; grading to olive gray slightly silty medium-grained sand</p> <p><i>Terminated at depth</i></p>	<p>15–30 cmbs: railroad fill</p> <p>30–55 cmbs: 1 cobalt glass fragment; 3 colorless glass fragments including 1 milk jug rim and panel bottle body fragment</p>

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39	Access Road	100	<p>0–21: Grayish-brown fine-grained sandy silt with some subrounded and subangular gravels ranging from small pebbles to small cobbles; few fine grass roots; some clinkers throughout</p> <p>21–35: Dark grayish-brown fine-grained sandy silt with few subrounded and subangular gravels ranging from small pebbles to small cobbles; many clinkers throughout</p> <p>35–100: Olive-gray to light brownish-gray medium-grained sand with occasional lenses of oxidized (strong brown) slightly silty sand and with few subrounded and subangular gravels ranging from small pebbles to small cobbles; some clinkers near transition with overlying stratum</p> <p><i>Terminated at depth</i></p>	None
40	Access Road	100	<p>0–30: Brown sandy silt with common angular to subangular gravels—<i>disturbed</i></p> <p>30–47: Dark brown silty sand mottled with black silty sand and with many subrounded to subangular gravels (pebbles)</p> <p>47–100: Yellowish-brown silty sand with oxidation and with few subrounded gravels (pebbles)</p> <p><i>Terminated at depth</i></p>	<p>10 cmbs: metal 12 inch nail</p> <p>17 cmbs: 1 green glass fragment</p>
40	Access Road	100	<p>0–39: Brown sandy silt and black silt beds with common angular to subangular gravels—<i>disturbed</i></p> <p>39–100: Yellowish-brown silty sand with oxidation and with few subrounded gravels (pebbles)</p> <p><i>Terminated at depth</i></p>	<p>20 cmbs: 1 colorless glass fragment</p> <p>15–39 cmbs: 3 wire nails</p>
42	0/15	100	<p>0-45 cmbs: Medium brown silty loam, small roots, 10–15% mixed gravels, disturbed—<i>fill</i></p> <p>45-100 cmbs: Grayish-brown fine silty sand, less than 5% gravels—<i>alluvial</i></p>	0-45 cmbs: glass, coal

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43	Access Road	102	<p>0–57: Dark grayish-brown fine-grained sandy silt with many subrounded to angular gravels ranging from small pebbles to medium cobbles; few fine grass roots</p> <p>57–102: Light grayish-brown fine- to medium-grained slightly silty sand with some subrounded to angular gravels ranging from small to large pebbles</p> <p><i>Terminated at depth</i></p>	<p>10–40 cmbs: 4 pieces of sheet plastic (white/gray); 4 amber glass shards; 2 metal nail fragments; 1 colorless glass shard; 1 glazed white ceramic sherd with floral motif</p>
44	Access Road	100	<p>0–46: Dark grayish-brown fine-grained sandy silt with many subrounded to angular gravels ranging from small pebbles to small cobbles; few fine grass roots</p> <p>46–100: Olive-gray to light brownish-gray slightly silty sand with few subrounded to subangular gravels ranging from small to large cobbles</p> <p><i>Terminated at depth</i></p>	<p>0–46 cmbs: 5 pieces of sheet plastic (white/gray); 6 brick fragments; 5 shell fragments; 9 metal nails/nail fragments; 3 colorless glass shards; 2 amber glass shards; 1 turquoise glass shard; 1 cobalt glass shard; 1 crumpled up tin foil ball</p>

Table G-1. Shovel Probe Table.

Shovel Probe	Pole Number/Access Road	Maximum Depth (cmbs)	Description (cmbs): Description— <i>Comments</i>	Cultural Materials
45	Access Road	100	<p>0–29: Dark brown silty sand with common angular to subrounded gravels (pebbles)—<i>disturbed</i></p> <p>29–47: Yellowish-brown to orange-brown silty sand with common subrounded to angular gravels ranging from pebbles to cobbles</p> <p>47–100: Yellowish-brown sandy silty with few subrounded gravels ranging from pebbles to cobbles; cobbles increase at 97 cmbs</p> <p><i>Terminated at depth</i></p>	<p>5–47 cmbs: 17 colorless glass fragments; 5 aqua flat glass (2 frags at 80 cmbs likely in fall); 1 plastic cap fragment; 5 amber glass fragments; 1 milk glass frag cap “1” “PO...LAIN”; 1 colorless glass bottle base “Duraglass) LI” “23 I” Saturn Illinois glass rim; 1 railroad spike</p> <p>10–20 cmbs: 2 cobalt glass fragments</p> <p>10 cmbs: 1 terracotta pipe fragment</p> <p>25 cmbs: 1 shell fragment (oyster?)</p>
46	Access Road	100	<p>0–35: Brown sandy silt with common poorly sorted subrounded to angular gravels ranging from pebbles to few cobbles</p> <p>35–75: Yellowish-brown silty fine sand with redox and with common subrounded gravels</p> <p>75–100: Light grayish-brown fine sandy silt with redox</p> <p><i>Terminated at depth</i></p>	<p>10 cmbs: 1 metal fragment and 2 colorless glass fragments</p> <p>20 cmbs: 2 amber glass fragments</p> <p>35 cmbs: 2 white ware fragments</p>
47	0/16	80	<p>0-15 cmbs: Dark brown silty loam, small roots, mixed gravels, disturbed—<i>fill</i></p> <p>15-80 cmbs: Gray and yellow-brown silty sand with ~75% mixed gravels and cobbles, disturbed—<i>fill</i></p> <p><i>Terminated due to small plastic pipe at 80 cmbs</i></p>	<p>15-80 cmbs: coal slag, glass fragments, metal</p>

Table G-1. Shovel Probe Table.

Shovel Probe	Pole Number/Access Road	Maximum Depth (cmbs)	Description (cmbs): Description— <i>Comments</i>	Cultural Materials
48	Access Road	80	<p>0–35: Dark brown medium-grained sand with many subangular to angular large gravels—<i>railroad ballast</i></p> <p>35–48: Brown medium-grained silty sand with many rounded to subrounded gravels ranging from pebbles to large cobbles; some roots</p> <p>48–80: Tan medium-grained sand with few subrounded gravels</p> <p><i>Terminated at cobble obstruction</i></p>	<p>0–40 cmbs: 4 amber glass fragments; 9 colorless glass fragments including 1 screw top finish (3/4 inch diameter) and one base; 1 fragment of window glass</p> <p>40 cmbs: 1 metal bolt, 11 inch x 7/8 inch head diameter</p> <p>40–48 cmbs: 1 amber glass fragment; 1 colorless glass screw top bottle finish fragment; 1 metal wire fragment</p>
49	Access Road	100	<p>0–48: Dark brown fine-grained sandy silt with very many subrounded to angular gravels ranging from small pebbles to medium-sized cobbles; few grass roots—<i>fill</i></p> <p>48–100: Light grayish-brown silty fine- to medium-grained sand with few subrounded and subangular gravels ranging from small to medium-sized pebbles</p> <p><i>Terminated at depth</i></p>	<p>0–48 cmbs: 12 amber glass shards (bottle fragments); 12 colorless glass shards (jar and bottle glass); 6 fragments of opaque light plastic sheeting; 3 small pieces of coal; 1 light blue glazed ceramic sherd; 2 pieces of rubber (like shoe sole); 1 glazed ivory plate fragment decorated with a floral motif; 2 white ceramic bowl or plate fragments</p>

Table G-1. Shovel Probe Table.

Shovel Probe	Pole Number/Access Road	Maximum Depth (cmbs)	Description (cmbs): Description— <i>Comments</i>	Cultural Materials
50	0/17	100	0–25: Medium brown silty loam, small roots, mixed gravels, charcoal, disturbed— <i>fill</i> 25–60: Reddish-brown sand with 80–90% angular gravels and cobbles— <i>alluvial</i> 60–100: Reddish-brown sand with 75% rounded gravels— <i>alluvial</i>	25–60 cmbs: glass fragment, coal slag
51	Access Road	86	0–15: Brown loose pebbly organic sandy silt with some ballast spalls— <i>adjusted to west into regrade prism to avoid metal</i> 20–80: Yellowish-brown unconsolidated gravelly silty sand with many rounded and subrounded gravels ranging from pea gravels to medium-sized cobbles; becomes more cobbly and densely compacted with depth; many active roots throughout 80–86: Pale yellowish-brown to grayish-brown slightly silty sand <i>Terminated at gravel and root obstruction</i>	20 cmbs: flat metal covers more than half of the probe; some asphalt and sparse furnace cleanout throughout probe
52	Access Road	100	0–20: Dark brown sandy silt with common poorly sorted subrounded to angular gravels (pebbles) 20–47: Yellowish-brown medium-grained sand with few subrounded gravels (pebbles) 47–60: Light yellowish-brown silty sand with few subrounded gravels 60–68: Black charcoal lens, yellowish-brown sand 68–100: Light grayish-brown silty sand with common subrounded gravels <i>Terminated at depth</i>	20 cmbs: 1 colorless glass fragment
53	Access Road	100	0–19: Dark brown sandy silt with common subrounded to angular gravels (pebbles) 19–40: Mottled yellowish-brown to dark brown silty sand with common subrounded and subangular gravels 40–79: Yellowish-brown medium-grained sand with few subrounded gravels (pebbles) 79–100: Light brown sandy silt with redox and with few subrounded gravels <i>Terminated at depth</i>	None

Table G-1. Shovel Probe Table.

Shovel Probe	Pole Number/Access Road	Maximum Depth (cmbs)	Description (cmbs): Description— <i>Comments</i>	Cultural Materials
54	Access Road	100	<p>0–47: Dark brown silty sand with common angular to subrounded gravels (railroad ballast); some small roots—<i>disturbed</i></p> <p>47–66: Yellowish-brown medium-grained sand with few small- to medium-sized gravels</p> <p>66–100: Light brown silty sand with few small gravels</p> <p><i>Terminated at depth</i></p>	<p>0–27 cmbs: 2 amber glass fragments</p> <p>27 cmbs: 1 colorless glass bottle base “NOT TO BE REFILLED/ 77 3 3B NW 507” 3 inch diameter</p>
55	0/18	100	<p>0–55: Dark brown silty loam, few medium cobbles, small roots, disturbed—<i>fill</i></p> <p>55–100: Grayish-brown medium-fine sand, water table at 90 cmbs—<i>alluvial</i></p>	None
56	Access Road	100	<p>0–20: Dark brown loose gravelly organic-rich sandy silt—<i>topsoil</i></p> <p>20–60: Dark yellowish-brown unconsolidated pebbly silty sand with few gravels ranging from pea gravels to rounded medium-sized cobbles</p> <p>60–100: Grayish-brown loose slightly silty medium-grained sand; very few gravels; medium- to coarse-grained sand inclusions with redox</p> <p><i>Terminated at depth</i></p>	None
57	0/19	100	<p>0–15: Root mat with brown medium to coarse sand and sparse round gravels—<i>fill</i></p> <p>15–45: Brown medium to coarse sand with sparse round gravels, loose, weak blocky structure, some roots disturbed—<i>fill</i></p> <p>45–100: Heavily mottled grayish-brown medium to coarse sand with silt clasts (looks like dredge spoils, possibly from adjacent ditch), roots throughout, disturbed—<i>fill</i></p>	None
58	Access Road	52	<p>0–38: Dark brown fine-grained sandy silt with many subrounded and angular gravels ranging from small pebbles to small cobbles; some fine grass roots</p> <p>38–52: Dark grayish-brown silty medium-grained sand with some subrounded and subangular gravels ranging from small to large pebbles</p> <p><i>Terminated at tree root obstruction</i></p>	None

Table G-1. Shovel Probe Table.

Shovel Probe	Pole Number/Access Road	Maximum Depth (cmbs)	Description (cmbs): Description— <i>Comments</i>	Cultural Materials
59	0/20	93	0–37: Dark brown fine sandy silt with few subround small-large pebbles (railroad ballast), many fine roots, wet, few charcoal flecks, abrupt and wavy boundary disturbed— <i>fill</i> 37–93: Gray medium sand, massive, homogenous, saturated, water table at 75 cmbs— <i>disturbed alluvial or imported golf course sand</i>	0–37 cmbs: railroad ballast
60	1/1	100	0–35: Dark brownish-gray medium grained sand with 10% subround gravels, root zone— <i>alluvial</i> 35–100: Brownish-gray medium to coarse grained sand, few charcoal flecks, many subround gravels, siltier and wetter with depth— <i>alluvial</i>	None
61	1/1	100	Surface: humus in trees between grade and golf course 0–37: Very dark gray silty coarse sand with tree roots and rootlets, subround gravels, sparse charcoal chunks— <i>alluvial</i> 37–100: Dark gray silty coarse sand with sparse subround pebbles and gravels, chunk charcoal, tree roots— <i>alluvial</i>	None
62	1/2	100	0–15: Dark brown silty loam, small roots— <i>fill</i> 15–65: Dark grayish-brown silty sand— <i>alluvial</i> 65–100 cmbs: Gray medium-fine sand, orange silt inclusions, water table at 90 cmbs— <i>glacial</i>	None
63	1/3	110	0–40: Brown medium to coarse sand with sparse gravels, loose, organically rich— <i>fill</i> 40–90: Gray medium to coarse sand with sparse gravels, loose, non-organic— <i>fill</i> 90–110: Mottled grayish-brown to reddish-brown silt (native alluvial) and loose gray sand (fill)— <i>heavily disturbed</i>	None
64	1/4	100	0–50: Dark brown organic-rich silt loam, many rootlets, damp, few charcoal flecks— <i>disturbed wetland</i> 50–100: Gray silt with some dark brown mottling from above stratum, sticky, damp— <i>disturbed wetland</i>	0–50 cmbs: 4 wire nails, coal slag

Table G-1. Shovel Probe Table.

Shovel Probe	Pole Number/Access Road	Maximum Depth (cmbs)	Description (cmbs): Description— <i>Comments</i>	Cultural Materials
65	Access Road	100	0–37: Brown to dark brown silty sand with common angular to subrounded gravels (pebbles) 37–100: Yellowish-brown silty sand with beds of yellowish-brown sand and common subrounded gravels ranging from pebbles to few cobbles <i>Terminated at depth</i>	17 cmbs: 1 wire nail
66	1/5	97	0–15: Dark brown sand— <i>fill</i> 15–60: Grayish-yellow medium-grained sand, few small gravels, few rootlets, some reddish mottling, loose— <i>alluvial</i> 60–80: Grayish-yellow medium-grained sand, few rootlets, some reddish mottling, more compact than upper stratum with many poorly sorted subround gravels— <i>glacial outwash</i> 80–97: Grayish-yellow medium grained sand, looser than stratum above, with fewer gravels— <i>glacial</i>	None
67	Access Road	82	0–10: Loose pebbly silty sand— <i>organic rich topsoil</i> 10–32: Brown moderately compact gravelly silty sand with many gravels, predominantly angular ballast spalls; some plastic bits and sparse clinker 32–68: Dark yellowish-brown unconsolidated pebbly silty sand with some rounded and subrounded gravels ranging from pea gravels to cobbles 68–82: Yellowish-brown to olive-gray slightly silty medium- to coarse-grained sand; some medium cobbles at 95 cmbs, increasing with depth; iron oxide mottling common throughout <i>Terminated at cobble obstruction</i>	None
68	Access Road	82	0–65: Dark grayish-brown fine-grained sandy silt with many subrounded to angular gravels ranging from small pebbles to medium cobbles; few fine grass and blackberry roots; few clinkers throughout 65–82: Brownish-gray fine-grained sandy silt with few subrounded and subangular gravels ranging from small to large pebbles <i>Terminated at large cobble obstruction</i>	20–30 cmbs: 3 small coal chunks 30–35 cmbs: 1 metal wire nail

Table G-1. Shovel Probe Table.

Shovel Probe	Pole Number/Access Road	Maximum Depth (cmbs)	Description (cmbs): Description— <i>Comments</i>	Cultural Materials
69	1/6	90	0–40: Dark brown loamy sand, organically rich, round and subround gravels— <i>fill</i> 40–90: Compact yellowish-brown to grayish-brown coarse sand with gravel and sparse small cobbles, few roots— <i>fill</i>	0–30 cmbs: fragments of clear, brown, and aqua glass 60–80 cmbs: fragments of clear glass and barbed wire
70	1/7	100	0–50: Slightly compact, dark brown sandy loam, with many rootlets— <i>alluvial</i> 50–60: Gray medium grained sand with no gravels, loose— <i>alluvial</i> 60–65: Slightly compact, dark brown sandy loam, with many rootlets— <i>alluvial</i> 65–100: Loose, gray medium grained sand— <i>glacial</i>	None
71	1/8	90	0–30: Compact brown sand and crushed gravel, lightly organic— <i>fill</i> 30–55: Coarse brown sand with rounded gravels and small cobbles— <i>fill</i> 55–80: Reddish-brown silty fine sand, lightly organic, strong blocky structure, clear, wavy lower boundary— <i>alluvial</i> 80–90: Compact, gray sand and gravel— <i>glacial</i>	None
N/A	1/9	N/A	Not dug—inaccessible (dense vegetation)	N/A
72	1/10	95 (auger at 70)	0–70: Mottled dark brown loamy gravel, water table at 50 cmbs— <i>fill</i> 70–85: Brown silty fine sand, organically rich with charcoal flecks, strong, blocky structure with no gravel-buried— <i>alluvial</i> 85–95: Light grayish-brown diatomaceous-rich silty fine sand, sparse organics, weak structure, no gravels— <i>alluvial</i> <i>Terminated due to no recovery with auger</i>	None

Table G-1. Shovel Probe Table.

Shovel Probe	Pole Number/Access Road	Maximum Depth (cmbs)	Description (cmbs): Description— <i>Comments</i>	Cultural Materials
73	1/11	60	Surface: grass, railroad ballast 0–60: Heavily compacted, dark brown silty sand with ~50% small to large subround and subangular gravels and cobbles, very muddy, compaction increasing with depth, water table at 43 cmbs— <i>fill</i> <i>Terminated due to compaction and water table</i>	0–60 cmbs: coal slag, nail fragment, pull tab (modern)
74	1/12	65	0–37: Grayish-brown sandy silt with many subround and subangular gravels— <i>fill</i> 37–65: Heavily compacted, grayish-brown coarse sand with many round and subround gravels— <i>fill</i> <i>Terminated due to compaction</i>	None
75	Access Road	100	0–20: Dark brown silt, some subround gravels— <i>fill</i> 20–50: Moderately compact, dark brown silt mottled with bright orange and red oxidation, 20% subround gravels, disturbed— <i>fill</i> 50–74 cmbs: Grayish-brown silt mottled with oxidation, few gravels, disturbed— <i>alluvial</i> 74–95: Moderately compact, dark brown silt mottled with bright orange and red oxidation, 20% subround gravels, disturbed— <i>alluvial</i> 95–100: Yellowish-gray medium grain sand, few gravels— <i>glacial</i>	None
76	1/13	92	0–35: Brown to gray loose gravelly sandy silt with many rounded to subangular gravels ranging from small to large pebbles— <i>construction fill with occasional angular spall from railroad grade, imported; adjusted for large asphalt chunk at 20 cmbs in south wall</i> 35–85: Yellowish-brown to strong brown compact pebbly silty sand with few rounded and subrounded gravels; intense oxidation staining is uniform throughout matrix; becomes increasingly compact with depth 85–92: Strong brown to reddish-brown compact cobbly silty sand with many rounded small to medium cobbles below 80 cmbs; breaker bar excavation below 65 cmbs with diminishing returns by 85 cm <i>Terminated at gravel/compaction obstruction</i>	30–40 cmbs: 1 piece of colorless glass

Table G-1. Shovel Probe Table.

Shovel Probe	Pole Number/Access Road	Maximum Depth (cmbs)	Description (cmbs): Description— <i>Comments</i>	Cultural Materials
N/A	1/14	N/A	Not dug—utilities	N/A
N/A	2/1	N/A	Not dug—utilities	N/A
N/A	2/2	N/A	Not dug—utilities	N/A
N/A	2/3	N/A	Not dug—utilities	N/A
N/A	2/4	N/A	Not dug—utilities	N/A
N/A	2/5	N/A	Not dug—utilities	N/A
N/A	2/6	N/A	Not dug—utilities	N/A
N/A	2/7	N/A	Not dug—utilities	N/A
N/A	2/8	N/A	Not dug—utilities	N/A
N/A	2/9	N/A	Not dug—utilities	N/A
N/A	2/10	N/A	Not dug—utilities	N/A
N/A	2/12	N/A	Not dug—Totem Lake Substation buried grid	N/A
N/A	2/13	N/A	Not dug—impervious surface and buried utilities	N/A
77	N/A (part of Initial Alignment)	90	Surface: grass, horsetails, railroad ballast 0–27: Compact, dark brown silty sand, moist, with ~40% subangular and subround pebbles and cobbles— <i>fill</i> 27–90: Compact, reddish-brown silty sand, moist, with ~30% subangular and subround pebbles, gravels, and small to extra-large cobbles, compaction increasing with depth— <i>fill</i> <i>Terminated due to compaction</i>	0–27 cmbs: coal slag, plastic sheeting fragments 27–90 cmbs: coal slag
78	N/A (part of Initial Alignment)	73	0–73: Compact, grayish-brown sandy silt with many subround and subangular gravels— <i>fill</i> <i>Terminated due to gravels/ compaction</i>	0–73 cmbs: asphalt chunks, 1 brick fragment, 1 metal screw, 1 wire nail
79	N/A (part of Initial Alignment)	35	0–30: Grayish-brown sandy silt with 20% gravels— <i>fill</i> 30–35: Yellowish-brown sandy silt with 20% gravels and large boulder— <i>fill</i> <i>Terminated due to large boulder obstruction</i>	None

Table G-1. Shovel Probe Table.

Shovel Probe	Pole Number/Access Road	Maximum Depth (cmbs)	Description (cmbs): Description— <i>Comments</i>	Cultural Materials
80	N/A (part of Initial Alignment)	70	0–20: Brown loamy sand and gravel with dense root mat— <i>fill</i> 20–70: Mottled brown and yellowish-brown sandy loam with 20% round and angular gravels and sparse small cobbles, organically rich throughout— <i>lacustrine</i> Terminated due to rock obstruction	None
81	N/A (part of Initial Alignment)	62	0–19: Grayish-brown sandy silt with 10% gravels— <i>fill</i> 19–31: Dark gray sandy silt with 10% gravel— <i>fill</i> 31–62: Very compact, striated gray, brown, and oxidized orange silt with less than 10% gravels— <i>lacustrine</i> <i>Terminated due to compaction</i>	None
82	N/A (part of Initial Alignment)	97	0–45: Brown fine sandy silt, wet, sticky, few gravels, disturbed— <i>fill</i> 45–90: Slightly reddish-brown sand and silt, sand increasing with depth, sticky, few subround gravels— <i>lacustrine</i> 90–97: Yellowish-tan fine silica (ash or diatomaceous)— <i>lacustrine</i>	None
83	N/A (part of Initial Alignment)	40	0–40: Dark gray silt, very wet, some roots, no gravel— <i>fill</i> <i>Terminated due to strong petroleum smell</i>	None
84	N/A (part of Initial Alignment)	97	0–15: Grayish-brown silty loam with ~15% gravel and some rootlets— <i>fill</i> 15–60: Grayish-brown sandy silt with well sorted rounded gravels— <i>fill</i> 60–70: Very compact, light yellow-brown silt with few gravels— <i>fill</i> 70–97: Loose, reddish-brown silty loam, disturbed— <i>fill</i>	70–97 cmbs: coal slag
85	N/A (part of Initial Alignment)	60	0–15: Brown sandy loam with roots— <i>fill</i> 15–60: Compact, mottled brown and yellowish-brown sandy loam with 20% round and angular gravels, compaction increases with depth, weak soil structure— <i>fill</i> <i>Terminated due to rock obstruction</i>	None

Table G-1. Shovel Probe Table.

Shovel Probe	Pole Number/Access Road	Maximum Depth (cmbs)	Description (cmbs): Description— <i>Comments</i>	Cultural Materials
86	DIST (north of 2/13)	65	0–10: Dark brown sandy silt; many roots 10–35: Dark gray sandy silt, moist, with common angular to subrounded gravels— <i>fill</i> 35–40: Tan sandy silt with common gravels— <i>fill</i> 40–65: Dark gray sandy silt, moist, with common angular to subrounded gravels— <i>fill</i> <i>Terminated due to rock obstruction</i>	20–40 cmbs: brick 50 cmbs: PVC fragment 50–65 cmbs: brick fragments
87	2/14	45	0–27: Dark brown sandy silt with some medium-sized rounded to subrounded gravels; roots prevalent; few railroad ballast 27–45: Dark brown silty sand with many coarse pea gravels and few larger gravels; roots prevalent— <i>water table at 33 cmbs</i> <i>Terminated at water table</i>	0–20 cmbs: milled wood fragments
88	2/15	40	0–40: Rail road ballast (coarse angular gravel) with little soil, water table at 35 cmbs— <i>fill</i> <i>Terminated due to ballast and compaction</i>	Railroad ballast
89	2/16	40	0–35: Rail road ballast (coarse angular gravel) with little soil— <i>fill</i> 35–40: Sand fill <i>Terminated due to ballast and compaction</i>	Railroad ballast
90	2/17	33	0–33: Rail road ballast (medium angular gravel) with little soil— <i>fill</i> <i>Terminated due to ballast and compaction</i>	Railroad ballast
91	2/18	85	0–35: Dark grayish-brown coarse sand and gravel— <i>fill</i> 35–85: Gray loamy coarse sand and 20 % gravel, mottled with clay casts— <i>fill</i> <i>Terminated due to compact fill</i>	Railroad ballast
92	2/19	85	0–30: Compact railroad ballast— <i>fill</i> 30–40: Compact, dark grayish-brown loamy sand and gravel— <i>fill</i> 40–85: Compact, yellowish-brown to grayish-brown coarse loamy sand and gravel, few roots— <i>fill</i> <i>Terminated due to compact fill</i>	Railroad ballast

Table G-1. Shovel Probe Table.

Shovel Probe	Pole Number/Access Road	Maximum Depth (cmbs)	Description (cmbs): Description— <i>Comments</i>	Cultural Materials
N/A	2/20	N/A	Not dug—steep slope of fill/ballast from railroad grade to water	N/A
93	2/21	59	0–59: Compact, grayish-brown silty clay, disturbed, with 30% gravels— <i>fill, built up land form in wetlands</i> <i>Terminated due to compaction</i>	None
94	3/1	60	0–60: Gray silty sand with 75% gravels— <i>fill</i> <i>Terminated due to metal pipe</i>	0–60 cmbs: concrete chunks, metal pipe
95	3/2	97	0–97: Gray sand with 30–40% rounded gravels and some bramble roots— <i>fill</i>	0–20 cmbs: fragments of colorless and green glass 50–97 cmbs: concrete chunks
96	3/3	100	0–10: Dark brown silt, organic-rich, some rootlets, few subround gravels— <i>disturbed fill</i> 10–100: Grayish-brown medium grained sand with 50% moderately sorted angular to subround gravels, loose— <i>disturbed fill</i>	None
N/A	3/4	N/A	Not dug—utilities and built up fill 5–10 ft deep	N/A
N/A	3/5	N/A	Not dug—utilities and built up fill 5–10 ft deep	N/A
N/A	3/6	N/A	Not dug—utilities and built up fill 5–10 ft deep	N/A
N/A	3/7	N/A	Not dug—utilities and built up fill 5–10 ft deep	N/A
N/A	3/8	N/A	Not dug—utilities and built up fill 5–10 ft deep	N/A
97	3/9	35	0–35: Compact, gray sandy silt with many rootlets and ~15% gravel, water table at 8 cmbs— <i>fill</i> <i>Terminated due to compaction and water table</i>	None
N/A	3/10	N/A	Not dug—utilities	N/A
98	3/11	57	0–57: Grayish-brown sandy silt with 10–20% gravel and many rootlets, disturbed, water table at 50 cmbs— <i>fill</i>	0–20 cmbs: insulated wire pieces, complete brown Rainier beer bottle (modern), concrete chunks

Table G-1. Shovel Probe Table.

Shovel Probe	Pole Number/Access Road	Maximum Depth (cmbs)	Description (cmbs): Description— <i>Comments</i>	Cultural Materials
99	3/12	95	0–15: Dark brown, silty duff, few gravels, recent— <i>fill</i> 15–65: Coarse, loose gray sandy with 50% well sorted subround gravels— <i>fill</i> 65–95: Compact strong brown silty sand with few rootlets and ~35% poorly sorted subround gravel, disturbed— <i>fill</i>	None
N/A	3/13	N/A	Not dug—utilities	N/A
N/A	3/14	N/A	Not dug—utilities	N/A
N/A	3/15	N/A	Not dug—utilities	N/A
N/A	3/16	N/A	Not dug—utilities	N/A
N/A	3/17	N/A	Not dug—utilities	N/A
N/A	3/18	N/A	Not dug—utilities	N/A
N/A	4/1	N/A	Not dug—utilities	N/A
N/A	4/2	N/A	Not dug—utilities	N/A
N/A	4/3	N/A	Not dug—utilities	N/A
N/A	4/4	N/A	Not dug—utilities	N/A
N/A	4/5	N/A	Not dug—utilities	N/A
N/A	4/6	N/A	Not dug—utilities	N/A
N/A	4/7	N/A	Not dug—utilities	N/A
N/A	DIST north of 4/7	N/A	Not dug—utilities	N/A
N/A	4/8	N/A	Not dug—fill within retaining wall around existing pole, buried utilities	N/A
N/A	4/9	N/A	Not dug—paved and many utilities	N/A
100	4/10	45	0–45: Grayish-brown sandy silt with 50% poorly sorted subround gravels, some rootlets, very wet and muddy, water table at 40 cmbs— <i>alluvial</i> <i>Terminated due to water table</i>	None

Table G-1. Shovel Probe Table.

Shovel Probe	Pole Number/Access Road	Maximum Depth (cmbs)	Description (cmbs): Description— <i>Comments</i>	Cultural Materials
101	4/10	35	0–10: Dense reed grass root mat 10–25: Dark grayish-brown sandy silt with many rounded to subrounded gravels and cobbles, coarse organics present, disturbed; water table at 22 cmbs— <i>fill</i> 25–35: Grayish-brown, saturated, sandy silt with common rounded to subrounded gravels, coarse organics present— <i>fill</i> <i>Terminated due to water table</i>	None
N/A	4/11	N/A	Not dug—paved	N/A
N/A	4/12	N/A	Not dug—paved	N/A
102	4/13	58	0–43: Dark grayish-brown silt with many subround and subangular gravels and cobbles, disturbed— <i>fill</i> 43–58: Compact yellowish-brown sandy silt with some gravels— <i>glacial</i> <i>Terminated due to glacial soils</i>	0–43 cmbs: fragments of plastic, white ceramic, brown bottle glass, 4 wire nails, asphalt chunks, and 1 plastic token/poker chip
103	4/14	92	0–16: Dark grayish-brown silt with root mat and many subround gravels and cobbles, disturbed— <i>fill</i> 16–56: Compact, yellowish-brown sandy silt with many subround gravels and cobbles, disturbed— <i>fill</i> 56–92: Compact, mixed brown to grayish-brown to dark brown with many gravels disturbed— <i>fill</i>	0–16 cmbs: 1 wire nail 80–90 cmbs: 1 chunk concrete
104	4/15	57	0–20: Dark grayish-brown silt with root mat and many subround gravels and cobbles— <i>fill</i> 20–38: Yellowish-brown sandy silt with many subround gravels and cobbles— <i>fill</i> 38–57: Mixed brown and grayish-brown to dark brown disturbed soil with many gravels— <i>fill</i> <i>Terminated due to large cobble/ boulder in probe wall at 28–42 cmbs</i>	None

Table G-1. Shovel Probe Table.

Shovel Probe	Pole Number/Access Road	Maximum Depth (cmbs)	Description (cmbs): Description— <i>Comments</i>	Cultural Materials
105	4/16	65	0–30: Compact, poorly sorted sand and gravel with charcoal staining and few chunks, lightly organic— <i>fill</i> 30–65: Compact, yellowish-brown coarse sand and gravel, non-organic, disturbed— <i>glacial outwash</i> Terminated due to reaching glacial material	None
106	4/17	95	0–25: Dark brown organic-rich silty loam, some rootlets, few gravels, disturbed— <i>fill</i> 25–45: Moderately compact, reddish-yellow sandy silt, sparse roots and few poorly sorted subround to subangular gravels— <i>disturbed alluvial</i> 45–95: Grayish-yellow silty sand, dense subangular poorly sorted gravels— <i>glacial</i>	0–50 cmbs: Modern debris, 1 saw-cut faunal bone (mammal)
N/A	4/11-SWITCH 7688 (Juanita Tap)	N/A	Not dug—paved	N/A
N/A	DIST (Juanita Tap)	N/A	Not dug—paved and utilities	N/A
107	4/12 (Juanita Tap)	100	0–6: Brown silty sand 6–85: Yellowish-brown to olive-grey, loose, medium-grained sand with pea gravels— <i>fill</i> 85–100: Yellowish-brown sand with gravels and compact clay clast inclusions— <i>fill</i>	None
N/A	Replacement Pole on SCL Bothell–Sammamish 115 kV line	N/A	Not dug—paved and utilities	N/A
N/A	Replacement pole on Sammamish–Vitulli 115 kV line	N/A	Not dug—paved and utilities	N/A

Sammamish-Juanita Transmission Line Project

SIMULATION OVERVIEW

- ① PHOTO VIEWPOINT
- SUBSTATION
- TRANSMISSION LINE



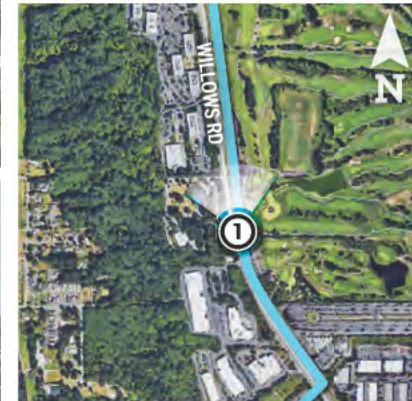
Samamish-Juanita Transmission Line Project

SIMULATION 1 VIEWPOINT

Date: 7/2/2015

Time: 9:16 AM

Viewing Direction: NORTH



- ① PHOTO VIEWPOINT
- SUBSTATION
- TRANSMISSION LINE

 **PUGET SOUND ENERGY**



E ISTIN CO D I NS



PR PO D CON I IONS

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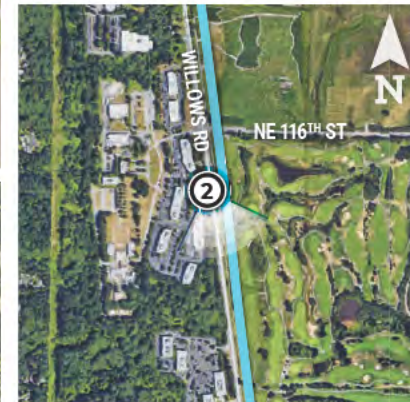
Sammamish-Juanita Transmission Line Project

SIMULATION 2 VIEWPOINT

Date: 7/30/2015

Time: 9:43 AM

Viewing Direction: SOUTH



- ① PHOTO VIEWPOINT
- SUBSTATION
- TRANSMISSION LINE

 **PUGET SOUND ENERGY**



CURRENT CONDITIONS



PROPOSED CONDITIONS

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Photo simulations created by:


Sammamish-Juanita Transmission Line Project

SIMULATION 3 VIEWPOINT

Date: 9/19/2019

Time: 1:28 PM

Viewing Direction: NORTH



- ① PHOTO VIEWPOINT
- SUBSTATION
- TRANSMISSION LINE

PSE PUGET SOUND ENERGY



EXISTING CONDITIONS



PROPOSED CONDITIONS

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Sammamish-Juanita Transmission Line Project

SIMULATION VIEWPOINT 4

Date: 9/19/2019

Time: 1:47 PM

Viewing Direction: NORTH



- ① PHOTO VIEWPOINT
- SUBSTATION
- TRANSMISSION LINE

 **PUGET SOUND ENERGY**



EXISTING CONDITIONS



PROPOSED CONDITIONS

CORTEN

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Sammamish-Juanita Transmission Line Project

SIMULATION VIEWPOINT 4

Date: 9/19/2019

Time: 1:47 PM

Viewing Direction: NORTH



① PHOTO VIEWPOINT

● SUBSTATION

— TRANSMISSION LINE

Photo simulations created by:



R P S C N D I O N S GALVANIZED

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Sammamish-Juanita Transmission Line Project

SIMULATION 5 VIEWPOINT

Date: 9/19/2019

Time: 2:10 PM

Viewing Direction: EAST



- ① PHOTO VIEWPOINT
- SUBSTATION
- TRANSMISSION LINE

Photo simulations created by:



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Sammamish-Juanita Transmission Line Project

SIMULATION VIEWPOINT 5

Date: 9/19/2019

Time: 2:10 PM

Viewing Direction: EAST



- ① PHOTO VIEWPOINT
- SUBSTATION
- TRANSMISSION LINE

Photo simulations created by:



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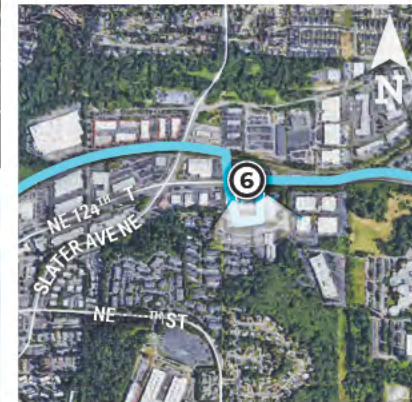
Sammamish-Juanita Transmission Line Project

SIMULATION 6 VIEWPOINT

Date: 9/19/2019

Time: 2:23 PM

Viewing Direction: SOUTH



- ① PHOTO VIEWPOINT
- SUBSTATION
- TRANSMISSION LINE



EXISTING CONDITIONS



PROPOSED CONDITIONS

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Sammamish-Juanita Transmission Line Project

SIMULATION VIEWPOINT 7

Date: 9/19/2019

Time: 3:01 PM

Viewing Direction: SOUTHWEST



- ① PHOTO VIEWPOINT
- SUBSTATION
- TRANSMISSION LINE



EXISTING CONDITIONS



EXISTING CONDITIONS CORTEN

Photo simulations created by:



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Sammamish-Juanita Transmission Line Project

SIMULATION VIEWPOINT 7

Date: 9/19/2019

Time: 3:01 PM

Viewing Direction: SOUTHWEST



- ① PHOTO VIEWPOINT
- SUBSTATION
- TRANSMISSION LINE



EXISTING CONDITIONS



EXISTING CONDITIONS GALVANIZED

Photo simulations created by:


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Sammamish-Juanita Transmission Line Project

SIMULATION 8 VIEWPOINT 8

Date: 9/19/2019

Time: 2:42 PM

Viewing Direction: NORTH



- ① PHOTO VIEWPOINT
- ⊙ SUBSTATION
- TRANSMISSION LINE

Photo simulations created by:



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IN CONDI IONS

SED C DI IO S CORTEN

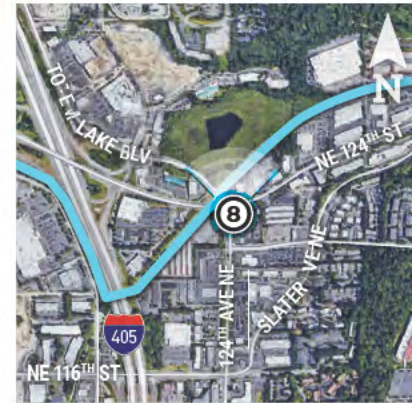
Sammamish-Juanita Transmission Line Project

SIMULATION 8 VIEWPOINT 8

Date: 9/19/2019

Time: 2:42 PM

Viewing Direction: NORTH



- ① PHOTO VIEWPOINT
- ⊙ SUBSTATION
- TRANSMISSION LINE

Photo simulations created by:



Sammamish-Juanita Transmission Line Project

SIMULATION 9 VIEWPOINT

Date: 6/4/2014

Time: 10:33 AM

Viewing Direction: NORTHWEST



- ① PHOTO VIEWPOINT
- ⦿ SUBSTATION
- TRANSMISSION LINE

Photo simulations created by:



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Sammamish-Juanita Transmission Line Project

SIMULATION 9 VIEWPOINT

Date: 6/4/2014

Time: 10:33 AM

Viewing Direction: NORTHWEST



- ① PHOTO VIEWPOINT
- SUBSTATION
- TRANSMISSION LINE

Photo simulations created by:



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PSE PUGET SOUND ENERGY

Sammamish-Juanita Transmission Line Project

SIMULATION VIEWPOINT 10

Date: 9/19/2019

Time: 3:50 PM

Viewing Direction: WEST



- ① PHOTO VIEWPOINT
- SUBSTATION
- TRANSMISSION LINE

PSE PUGET SOUND ENERGY

EXISTING CONDITIONS



PROPOSED CONDITIONS

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Photo simulations created by:
POWER ENGINEERS

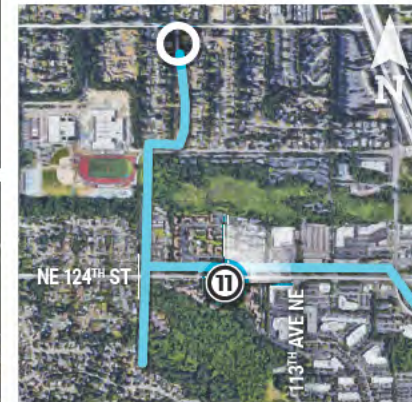
Sammamish–Juanita Transmission Line Project

SIMULATION 11 VIEWPOINT

Date: 9/19/2019

Time: 4:02 PM

Viewing Direction: EAST



① PHOTO VIEWPOINT

● SUBSTATION

— TRANSMISSION LINE



EXISTING CONDITIONS



PROPOSED CONDITIONS CORTEN

Photo simulations created by:



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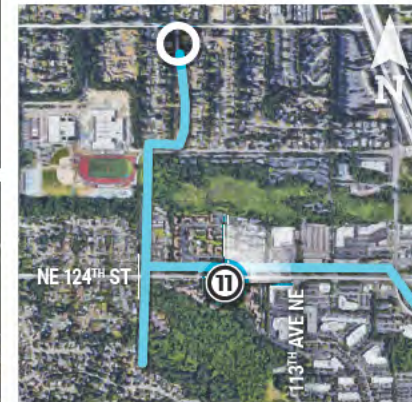
Sammamish-Juanita Transmission Line Project

SIMULATION 11 VIEWPOINT

Date: 9/19/2019

Time: 4:02 PM

Viewing Direction: EAST



① PHOTO VIEWPOINT

① SUBSTATION

— TRANSMISSION LINE



EXISTING CONDITIONS



PROPOSED CONDITIONS GALVANIZED

Photo simulations created by:



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Puget Sound Energy has asked Andrew H. Thatcher, an independent third party expert and former non ionizing radiation expert the State of Washington to address the questions related to health and exposure. His response in its entirety is included below.

1. *Has PSE proposed in its application measures to mitigate exposure to the electromagnetic field to be produced by this proposed power line? If so, would you please send them to me? If not, why not? Has PSE calculated the possible exposure of the children at the Evergreen Academy? If so, would you please send them to me? If not, why not?*
- There are no state or federal standards that address exposure limits to ELF fields. In place of standards or regulations guiding exposure limits, published guidelines from national and international organizations are used and applied. The International Commission on Non Ionizing Radiation Protection (ICNIRP) lists the general public guideline as 2,000 mG. The ICNIRP guidelines were revised in 2010.

Attachment 1 included the results of the calculated exposure to children at the Evergreen Academy.

2. *Code compliance – “the proposed transmission line must comply with City of Kirkland codes. KZC 115.107 requires an assessment of certain criteria” including being “consistent with the public health, safety, and welfare.”*
 - a. *PSE’s general statement of compliance fails to consider the risk to human health of non-ionizing EMF’s from high voltage power lines and associated risk of cancer, especially in children. Many respected agencies and NGOs, including the Federal EPA, The National Institute of Health’s National Cancer Institute, the American Cancer Society and the Washington State Department of Health, have referenced studies that show a 40% to 100% increased risk involves exposure at distances of 50 meters (165 feet) or less and no correlation at distances greater than 200 meters (650 feet). Although these studies do not have statistically significant sample sizes, they do uniformly provide a trend. Because the Evergreen Academy provides service onsite to 150 or more your children several hours a day 5 days a week within 70 – 130 feet of this proposed high-tension power line the current proposed location is not “consistent with the public health, safety, and welfare.” Thus, it is prudent to apply the precautionary principal and locate the transmission line at least 650 feet away from the Evergreen Academy.*
 - b. *In 2a. above the impact of EMF’s from the proposed high voltage transmission line to the health of Evergreen Academy teachers, staff and especially young students needs to be addressed ad does methods that demonstrably minimize and mitigate, and preferably eliminate the risk of those impacts.*

A detailed response is provided in Attachment 2. The predicted winter time magnetic field of 2.6 mG at the playground is significantly less than the 2,000 mG guideline. Likely magnetic field exposures will be significantly less than this estimate. Further, the World Health Organization's most recent summary¹ of the evidence concludes that the current evidence does not confirm the existence of any health consequence from exposures to 60 Hz low level electromagnetic fields. These low magnetic field levels are comparable to sources in our everyday home environment.

¹ <http://www.who.int/peh-emf/about/WhatisEMF/en/index1.html>

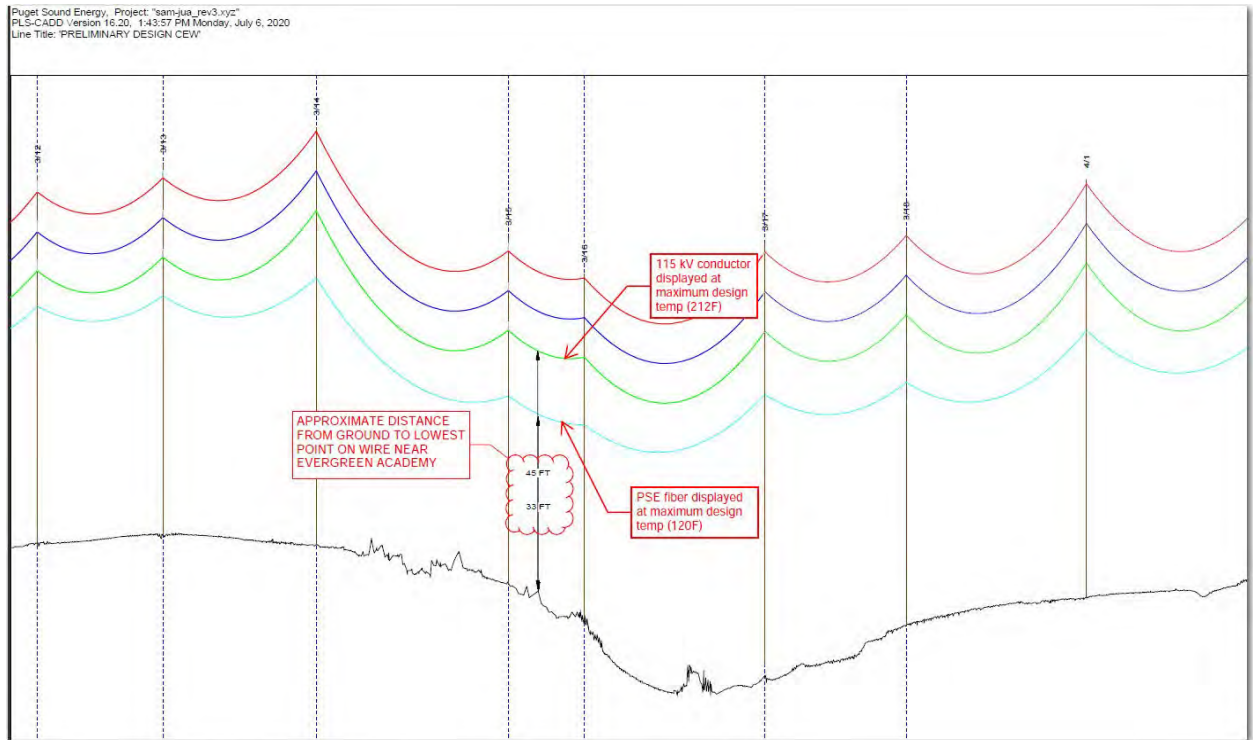
**ATTACHMENT 1: EMF Calculations for Evergreen Academy near Proposed
Sammamish - Juanita 115 kV line**

Puget Sound Energy engineering provided the height of the lines and the electrical current load that one would expect to see during the summer and the cooler (and higher current use) winter. See the first graph which displays the predicted distance from the ground to the lower wire. It is the current load and the height of the 115 kV lines above the ground that are the primary drivers in predicting the magnetic field as a distance away from the power lines. The predicted electrical current load (how many amps are running through the power lines) range from a low of 280 Amps during normal summer operation to a high of 400 Amps during normal winter current loading. To perform the calculations I used the International Telecommunications Union EMFACDC software Version 1.0. As displayed in the following graph a normal summer average electrical loading at the playground located ~100' from the proposed lines results in a predicted magnetic field of 1.8 mG while at the school (~150' away) the predicted magnetic field is 0.9 mG. The last graph displays the results during the winter time with the playground predicted to be 2.6 mG and the classroom at 1.4 mG.

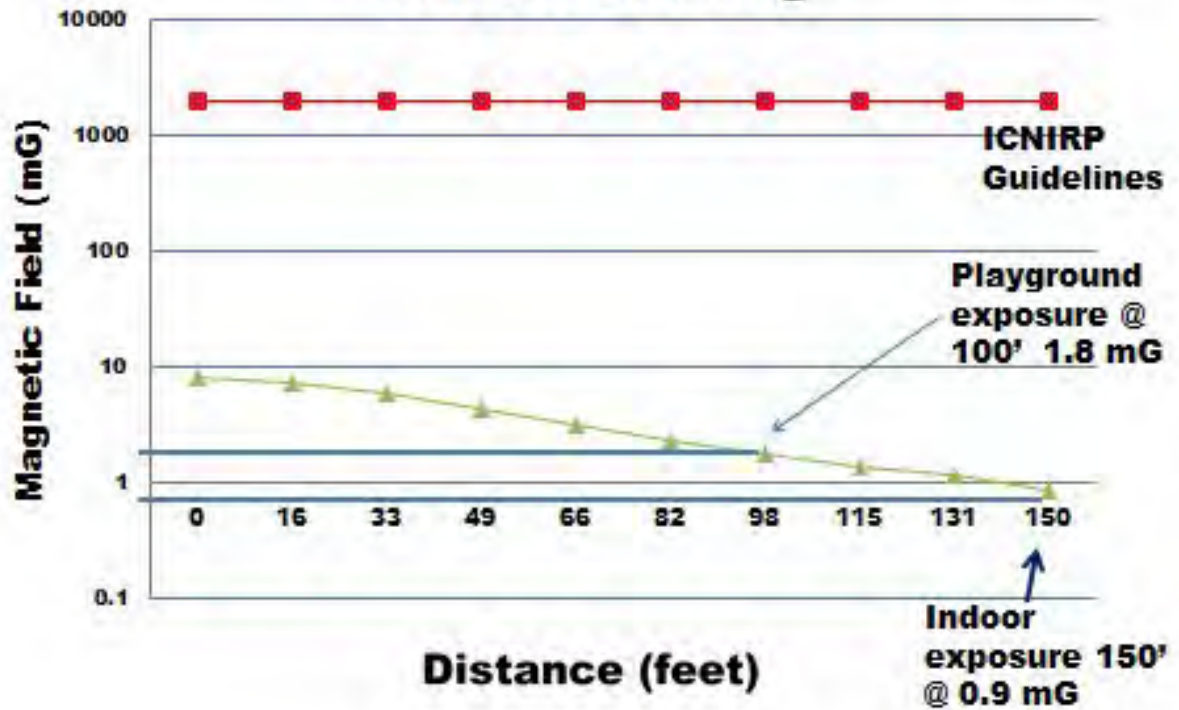
Regards,



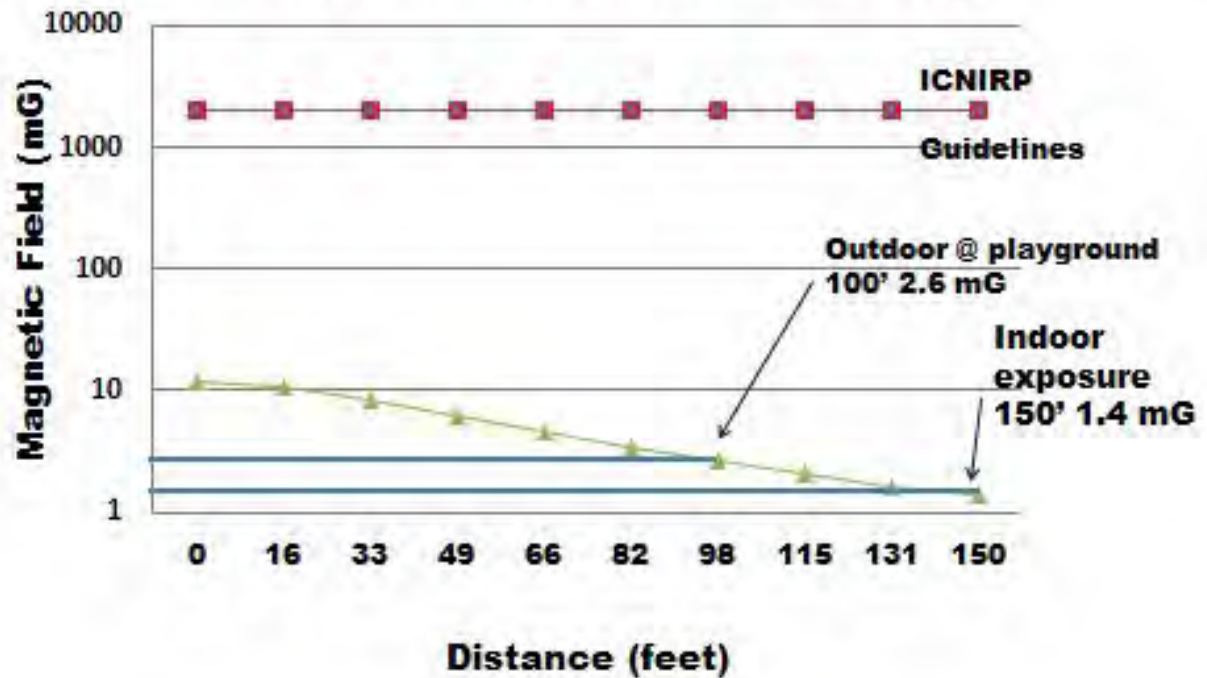
Andrew H. Thatcher, MSHP, CHP



Sammamish Juanita Proposed 115kV Line near Evergreen Academy Normal summer current Loading



Sammamish Juanita Proposed 115kV Line near Evergreen Academy Normal Winter Loading



ATTACHMENT 2:

Power lines and electrical appliances emit low frequency magnetic fields and are pervasive in our home and work environment. While there has been some concern of an association from epidemiological studies between childhood leukemia and Extremely Low Frequency (ELF) magnetic fields, no mechanism by which these fields could result in cancer has been identified. Keep in mind that association is not causation unless the association is strong enough and the underlying mechanism makes sense. In the case of childhood leukemia and ELF magnetic fields, the association is weak (<2) and no mechanism has been identified in spite of over 50 years of research. Further, studies of animals have not shown any indication that ELF magnetic fields are associated with cancer. While it is clear that biological effects from ELF magnetic fields can occur at higher exposures levels found, there is no evidence that these effects are harmful, particularly at low exposure levels found in our environment.

To briefly summarize the existing evidence regarding ELF magnetic fields and adverse health effects I would like to include a brief history of significant authoritative reviews on the subject of Extremely ELF magnetic field exposures and possible adverse health effects, predominately cancer. Following that review I'll briefly address the subject of a plausible biophysical mechanism for harm at low ELF magnetic flux densities. I'll then complete the review with a brief review of the Hill criteria for causal interference.

The two most authoritative reviews of the question of possible health effects of power frequency (60 Hz) fields are a 2002 review by the International Agency for Research on Cancer (IARC, a component of the World Health Organization) and a later (2007) Environmental Health Criteria assessment by the World Health Organization.

IARC Report (2002)

The IARC review² found “limited evidence in humans for the carcinogenicity of extremely low-frequency magnetic fields in relation to childhood leukaemia”, “inadequate evidence” in humans for the carcinogenicity of extremely low-frequency magnetic fields in relation to all other cancers, and “inadequate evidence” in experimental animals for the carcinogenicity of extremely low-frequency magnetic fields³. Based on these considerations, IARC concluded that ELF magnetic fields are “possibly carcinogenic to humans” (Group 2B), while ELF electric fields are “not classifiable as to their carcinogenicity to humans (Group 3).

The classification (2B) is the lowest of several that IARC uses to indicate the weight of evidence that an agent or exposure causes cancer in humans. In the context of IARC’s decision rules, the 2B (“possibly carcinogenic”) designation indicates that the data support some level of suspicion but that the evidence is insufficient to support the conclusion that ELF magnetic fields actually or probably cause cancer in humans under real-world exposure levels.

The World Health Organization’s most recent summary⁴ of the evidence is as follows:

² <https://monographs.iarc.fr/wp-content/uploads/2018/06/mono80.pdf>

³ Quotation marks indicate terminology that has special meaning within the IARC decision process

⁴ <http://www.who.int/peh-emf/about/WhatIsEMF/en/index1.html> accessed 8/23/2020

Based on a recent in-depth review of the scientific literature, the WHO concluded that current evidence does not confirm the existence of any health consequences from exposure to low level electromagnetic fields.

A number of epidemiological studies suggest small increases in risk of childhood leukemia with exposure to low frequency magnetic fields in the home. However, scientists have not generally concluded that these results indicate a cause-effect relation between exposure to the fields and disease (as opposed to artifacts in the study or effects unrelated to field exposure). In part, this conclusion has been reached because animal and laboratory studies fail to demonstrate any reproducible effects that are consistent with the hypothesis that fields cause or promote cancer.

WHO Environmental Health Criteria Document on ELF Fields (2007)

In 2007 the World Health Organization released an Environmental Health Criteria document on ELF fields (hereafter denoted by ELF-EHC)⁵. This massive review of the literature consists of more than 400 pages and cites nearly 1000 references. It was assembled by a Task Group of experts, most of whom were employees of health agencies worldwide, with additional input and review contributed by 150 scientists from around the world. The review was conducted under an extensive protocol using a weight-of-evidence approach and was designed to provide “an evaluation of risks as far as the data will allow.”

The ELF-EHC principally focuses on potential non-cancer risks, but it references and updates the earlier (2002) IARC review of possible carcinogenic effects of ELF fields.

The main conclusions of the ELF-EHC are as follows:

- “[T]here are no substantive health issues related to ELF electric fields at levels generally encountered by members of the public.”
- “In 2002, IARC published a monograph classifying ELF magnetic fields as ‘possibly carcinogenic to humans’. This classification is used to denote an agent for which there is limited evidence of carcinogenicity in humans and less than sufficient evidence for carcinogenicity in experimental animals. The Task Group concluded that additional studies since then do not alter the status of this classification. However, the epidemiological evidence is weakened by methodological problems. Thus, on balance, the evidence related to childhood leukemia is not strong enough to be considered causal.”
- “A number of other adverse health effects have been studied for possible association with ELF magnetic field exposure. The WHO Task Group concluded that scientific evidence supporting an association between ELF magnetic field exposure and all of these health effects is much weaker than for childhood leukemia. In some instances (i.e. for cardiovascular disease or breast cancer) the evidence suggests that these fields do not cause them.”
- “Regarding long-term effects, given the weakness of the evidence for a link between exposure to ELF magnetic fields and childhood leukemia, the benefits of exposure reduction on health are unclear.”

There have been numerous expert reviews by health agencies around the world since then, and the picture has not changed. There is some level of suspicion that long term exposure to magnetic fields above 3-4 mG (milliGauss) might be linked to cancer, but the evidence is not

⁵ https://www.who.int/peh-emf/publications/Compleet_DEC_2007.pdf

strong enough for the health agencies to conclude that the fields actually or probably do cause disease. The evidence is weak and mixed, unlike the evidence linking smoking and lung cancer, for example.

Other notable reviews:

1. The 2008 survey by Scientific Committee on Emerging and Newly Identified Health Risks of the European Union (SCENIHR)⁶ concluded that power frequency magnetic fields may be a carcinogen based on the analysis and occurrence of childhood leukemia (following the IARC 2B assessment). A 2014 update⁷ to this report noted “As stated in the previous opinions, no mechanisms have been identified in experimental studies that could explain these findings. Lack of support from experimental studies and shortcomings of the epidemiological studies prevent a causal interpretation.” In other words, the SCENIHR noted the IARC 2B assessment but concluded that the evidence was not strong enough to infer that the fields actually caused the disease.
2. Swedish Radiation Protection Authority.
 - a. The 2008 report⁸ of the Swedish Radiation Protection Authority concluded that extremely low frequency magnetic fields should continue to be classified as a “possible carcinogen” based upon epidemiological studies of childhood leukemia (again following the IARC 2B classification).
 - b. A 2014 update⁹ to this report notes that while a possible association has been reported in epidemiological research, it has not been confirmed by laboratory or mechanistic research.
 - c. The 2016 update¹⁰ to this report drew the following conclusions:
 - i. “Thirteen years ago a possible link was hypothesized (for breast cancer) but now it is fairly certain that there is no causal relation with exposure to ELF magnetic fields.
 - ii. In an animal model for Amyotrophic Lateral Sclerosis (ALS) no effects of ELF exposure were observed. The animal model for ALS does not support the epidemiological data.
 - iii. New data on the relation between Parkinson's disease and ELF magnetic fields suggest the absence of an effect.
 - iv. New data on the relation between cardiovascular disease and ELF magnetic fields suggest the absence of an effect.
 - v. Some evidence exists for ELF magnetic field exposure on the brain electrical activity, but no effects on memory or cognition have been observed. It is not known if these physiological effects lead to adverse health effects.
 - d. The 2018 update to this report makes the following observations:
 - i. Most of the recent cellular studies are related to the combined exposure of ELF magnetic fields and treatments of chemical or physical agents,

⁶ http://ec.europa.eu/health/ph_risk/committees/04_scenihhr/docs/scenihhr_o_022.pdf

⁷ https://ec.europa.eu/health/scientific_committees/emerging/docs/scenihhr_o_041.pdf

⁸ <https://www.stralsakerhetsmyndigheten.se/en/publications/reports/radiation-protection/2008/200812/>

⁹ <http://emfguide.itu.int/pdfs/SSM-Rapport-2014-16.pdf>

¹⁰ <https://www.stralsakerhetsmyndigheten.se/contentassets/98d67d9e3301450da4b8d2e0f6107313/201615-recent-research-on-emf-and-health-risk-eleventh-report-from-ssms-scientific-council-on-electromagnetic-fields-2016>.

- i.e. promotional effects. The effects were either protective or damaging, depending upon the experimental protocol. Of note is that ELF magnetic fields given before damaging chemical or physical treatment is able to reduce the induced damage.
- ii. Behavioral and cognitive disturbances in animal studies were observed in the 1 mT (10 Gauss) range - or approximately 2,500 times greater than the observed epidemiological association of ELF magnetic fields and childhood cancer.
- iii. A preventative effect of 0.5 mT (5G) exposure to ELF magnetic fields was observed in an Alzheimer disease (AD) mouse model.
- iv. Two large Italian co-carcinogenicity studies reported effects on single tumor types but these endpoints were not related to childhood leukemia and the significance of the studies was limited due to the selective evaluation of tumor endpoints.
- v. Recent studies on ELF magnetic field exposure and childhood leukemia identified changing risk estimates over time (Pedersen et al 2015, and Bunch et al 2016) with decreasing risks in more recent decades. This is not a consistent finding among studies and there exists some question as to the basis of the decrease of observed relative risk.
- vi. The results do not alter the current interpretation of an observed association of residential exposure to ELF magnetic fields and childhood leukemia yet lacking a causal explanation.
- e. The 2019¹¹ update to this report made the following observations:
 - i. As in previous reports, there was no trend with *in vitro* studies for a number of biological endpoints to include DNA damage, antioxidant defences, proliferation, viability and senescence with results showing increases, decreases or no difference when compared to sham controls.
 - ii. For animal studies, no additional insight on issues related to oxidative stress, physiology, fertility. Four recent brain and behavioural studies provided no insight on potential ELF magnetic field mechanisms.
 - iii. Overall the results of occupational studies on adult cancer are inconsistent and no firm conclusions can be made on this subject.
 - iv. One study evaluating residential ELF-MF exposure and leukaemia risk of children observed slightly elevated risks, in line with previous reports. An analysis stratified over the two decades of observation period did not indicate strongly differing risks by time period, thus not confirming the two earlier reports that had observed strongly decreasing risks over time.
- 3. The 2007 World Health Organization report which has stated that "Consistent epidemiological evidence suggests that chronic low -intensity ELF magnetic field exposure is associated with an increased risk of childhood leukemia, precautionary measures are warranted." This refers to the EHC-EMF report cited above. The full quote is: "Consistent epidemiological evidence suggests that chronic low-intensity ELF magnetic field exposure is associated with an increased risk of childhood leukaemia. However, the evidence for a causal relationship is limited, therefore exposure limits based upon epidemiological evidence are not recommended, but some precautionary measures are warranted." The material deleted from the original quote substantially changes the tone of the quote. The kinds of precautionary measurements WHO had in mind are on p. 372 of the EHS report:

¹¹ <https://www.stralsakerhetsmyndigheten.se/en/publications/reports/radiation-protection/2019/201908/>

"Provided that the health, social and economic benefits of electric power are not compromised, implementing very low-cost precautionary procedures to reduce exposures is reasonable and warranted. Policy-makers and community planners should implement very low-cost measures when constructing new facilities and designing new equipment including appliances. Changes to engineering practice to reduce ELF exposure from equipment or devices should be considered, provided that they yield other additional benefits, such as greater safety, or involve little or no cost."

Researchers speculate that if the magnetic field exposure during early childhood years is potentially significant then *in utero* exposures to magnetic fields should also be of concern, since most of the development of a child occurs in the womb and the magnetic field strength is not diminished by the shielding of the mother. The WHO website again provides a summary of effects on pregnancy outcome which I've included below:

Many different sources and exposures to electromagnetic fields in the living and working environment, including computer screens, water beds and electric blankets, radiofrequency welding machines, diathermy equipment and radar, have been evaluated by the WHO and other organizations. The overall weight of evidence shows that exposure to fields at typical environmental levels does not increase the risk of any adverse outcome such as spontaneous abortions, malformations, low birth weight, and congenital diseases. There have been occasional reports of associations between health problems and presumed exposure to electromagnetic fields, such as reports of prematurity and low birth weight in children of workers in the electronics industry, but these have not been regarded by the scientific community as being necessarily caused by the field exposures (as opposed to factors such as exposure to solvents).

Biophysical Mechanisms

A number of papers have examined mechanisms for carcinogenic effects of ELF magnetic fields¹²¹³¹⁴. The WHO has a whole chapter dedicated to the subject¹⁵. The subject of free radical production associated with magnetic field exposures is considered the primary (only) viable mechanism for biological effects. Essentially this would be an indirect mechanism by which genetic damage could occur. If free radical production or interaction were relevant in terms of a possible mechanism for harm, then static magnetic fields would also be relevant as the lifetime of a free radical in the body is on the order of microseconds. Since the wavelength of a 60 Hz field is 17 milliseconds (over 1,000 times longer than the lifetime of a free radical), the body would "see" the 60 Hz magnetic fields as static due to their comparatively long wavelength. The Earth's static magnetic field of ~550 mG in the Pacific Northwest would also be a relevant exposure. Adair's analysis shows just that, one can expect modifications of the radical pair recombination rate under exposures of ~50 μ T (500 mG). By contrast, Hore's analysis shows that at

¹² Adair, RK. Effects of Very Weak Magnetic Fields on Radical Pair Reformation. *Bioelectromagnetics*, 20: 255-263. 1999.

¹³ Hore PJ. Upper bound on the biological effects of 50/60 Hz magnetic fields mediated by radical pairs. *Elife*. Feb 25;8. 2019.

¹⁴ Juutilainen J, Herrala, M et al. Magnetocarcinogenesis: is there a mechanism for carcinogenic effects of weak magnetic fields. *Proc. R. Soc. B* 285: 20180590. 2018.

¹⁵ <https://www.who.int/peh-emf/publications/Chapter%204.pdf>

environmental magnetic field levels of 1 μT (10 mG) the resulting effect would be no greater than traveling a few miles away or toward the north or south pole.

The second possibility was an iron mediated process by which damage could possibly occur. The issue of naturally present iron in our cells as a possible mechanism whereby effects could occur was first proposed in the 1990s¹⁶ and has been reviewed extensively over the years. Fortunately, iron does not exist in our body in sufficient concentration to cause an effect and the exposure would again have to be extremely high. The strength of cellular studies is that they can show cause and effect relationships, unlike epidemiology studies. No cause and effect relationship to date has been demonstrated for power frequency exposures.

The third possibility was related to the potential impact of high voltage AC power lines and the increase in the proportion of charged particles as a result of corona¹⁷. To summarize, some increase in the deposition of airborne pollutants already present in outdoor air would occur due to the presence of corona ions but the overall effect on air concentrations in an outdoor environment would be minimal.

Hill's Criteria for Causal Interference

Using a slightly different approach to the evaluation of ELF magnetic field exposures as a potential carcinogen one can apply the Hill Criteria for Causal Interference. Keeping in mind that association is not causation. This is particularly so when the relative risk is less than 2, like in the research between power lines and childhood leukemia. The epidemiology has revealed a weak but somewhat consistent association with proximity to power lines and childhood leukemia. Using Hill's Criteria for Causal Interference, one can condense the nine criteria down to four main points:

1. Statistically significant and strong relationship between the exposure and the health effect. In effect, the stronger the association, the more confidence one can have that the health effects are caused by the exposure. The pooled analysis of the epidemiology studies by Kheifets¹⁸ et al calculated the odds ratio as 1.44 (95% CI 0.88-2.36) for the highest exposure group for residential exposures. These estimates from epidemiology are not statistically significant as is evident from the confidence interval included 1 (no different than background). Conversely, the laboratory studies have established no such relationship as they are largely negative and has led the WHO to conclude that robust, reliable, and reproducible evidence of effects of magnetic fields at environmental levels on biological systems is lacking (from the laboratory studies).

Much of the focus regarding carcinogenic potential and ELF magnetic field exposure has been on epidemiology. However, cellular and animals studies are particularly relevant. All known human carcinogens that have been studied adequately for carcinogenicity in experimental animals have produced positive results in one or more animal species¹⁹. So the lack of observed effects and supporting evidence while acknowledging that an animal specific ALL model is lacking, remains

¹⁶ <http://web.gps.caltech.edu/~jkirschvink/pdfs/KirschvinkBEMS92.pdf>

¹⁷ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3848581/>

¹⁸ L Kheifets, A Ahlbom, C M Crespi, G Draper, J Hagihara, R M Lowenthal, G Mezei, S Oksuzyan, J Schüz, J Swanson, A Tittarelli, M Vinceti, and V Wunsch Filho. Pooled analysis of recent studies on magnetic fields and childhood leukaemia. *Br J Cancer*. Sep 28, 2010; 103(7): 1128–1135.

¹⁹ Wilbourn J. Haroun L, Heseltine E et al. Response of experimental animals to human carcinogens: an analysis based upon the IARC Monographs programme. *Carcinogenesis*, 7: 1853-1863. 1986.

relevant. In particular, for physical agents such as ionizing radiation or ultraviolet light, the damage to the cell does not depend on the differences between species. As ELF magnetic fields penetrate the body without attenuation, one can expect a similar reaction between cells of different species. Indeed, carcinogens and in particular ionizing radiation and ultraviolet light cause a variety of other acute and chronic effects that would also be observed.

2. Consistency in the results among different types of studies. This would include both epidemiology and animal studies. Among epidemiology studies, one can derive some confidence that a consistent but weak association is observed among pooled analysis by Ahlbom²⁰ and Greenland²¹ as well as Kheifets. However, the results are not entirely consistent as a most recent papers has shown no association (Bunch²², Pedersen²³). The laboratory studies are consistent but only to the extent that they fail to show an effect. Certainly there is no consistency between the laboratory and the epidemiology studies which is needed to have confidence that a health effects exists from magnetic field exposures. A recent pooled analysis²⁴ failed to identify an association between childhood leukemia and distance to the nearest overhead power line of any voltage with the adjusted odds ratio for childhood leukemia at 1.33 (95% CI: 0.92-1.93).

3. Consistent findings of a dose response relationship between the exposure and the health effect. The Kheifets pooled analysis found a modest trend with greater magnetic field. Individual studies did not observe such a trend and in some instances (Draper and Pedersen papers, for example) identified a reverse dose response relationship but those results are generally attributed to chance and not due to the magnetic field exposure itself.

4. Biological plausibility. It is certainly more credible if a health effect from a given exposure is supported scientifically. To date there have been numerous efforts to establish how an adverse biological effect could occur from the relatively weak magnetic fields found near power lines or other electrical sources (see previous section). While a lack of a biological mechanism for adverse effects from low level magnetic fields cannot alone lead one to conclude that no such effects are possible, repeated mechanistic failures does mean that such effects are unlikely. Numerous animal and cellular studies have failed to identify any damage or physiological effect from the very low magnetic fields considered in the childhood cancer studies.

Summary

The predicted winter time magnetic field of 2.6 mG at the playground is significantly less than the 2,000 mG exposure guideline. Likely magnetic field exposures will be significantly less than this estimate. Further, the World Health Organization's most recent summary²⁵ of the

²⁰ Ahlbom A, Day N, Feychting M, Roman E, Skinner J, Dockerty J, Linet M, McBride M, Michaelis J, Tynes T, Verkasalo PK. A pooled analysis of magnetic fields and childhood leukaemia. *Br J Cancer*. 2000;83 (5):692–698.

²¹ Greenland S, Sheppard AR, Kaune WT, Poole C, Kelsh MA. A pooled analysis of magnetic fields, wire codes, and childhood leukemia. Childhood Leukemia-EMF Study Group. *Epidemiology*. 2000;11 (6):624–634.

²² Bunch KJ, Swanson J et al. Epidemiological study of power lines and childhood cancer in the UK: further analyses. *Journal of Radiological Protection*. Vol 36:3. 2016.

²³ Pedersen C, et al. Distance from residence to power line and risk of childhood leukemia: a population based case control study in Denmark. *Cancer Causes Control*. Feb 25(2): 171-7. 2014.

²⁴ Amoon AT, Crespi, CM, et al. Proximity to overhead power lines and childhood leukemia: an international pooled analysis. *British Journal of Cancer*. 119, 364-373. 2018.

²⁵ <http://www.who.int/peh-emf/about/WhatIsEMF/en/index1.html>

evidence concludes that the current evidence does not confirm the existence of any health consequence from exposures to 60 Hz low level electromagnetic fields. These predicted low magnetic field levels are comparable to sources in our everyday home environment.

Respectfully Submitted,



Andrew H Thatcher, MSHHP, CHP



PSE Sammamish – Juanita 115 kV Transmission Line
Code Compliance and
Siting and Design Analysis

February 2020

Proposal

Puget Sound Energy (PSE) is proposing to construct a new approximately 5 mile 115 kV transmission line to serve the Kirkland/Redmond area. The transmission line will be constructed between Sammamish Substation in the City of Redmond and Juanita Substation in the City of Kirkland and will include a loop through Totem Substation in Kirkland. Within the City of Kirkland, the transmission line will predominantly be new construction (2.33 miles), however will also include replacement of existing poles and conductor at locations along NE 124th Street east of Totem Substation and within the existing Sammamish – Moorlands #1 transmission line corridor south of Juanita Substation (0.79 miles). The new segments of transmission line will be constructed within street right-of-way under PSE's franchise agreement within the City of Kirkland and within the unimproved King County Eastside Rail Corridor (ERC) east of 132nd Avenue NE and City of Kirkland Cross Kirkland Corridor (CKC) west of 132nd Avenue NE 100-foot wide multi-use parcels under existing easement rights. The project also includes a crossing of I-405 for which a utility permit will be obtained from the Washington State Department of Transportation (WSDOT).

Project Need

The project is needed to provide additional capacity and reliability within what PSE defines as the Moorlands area (see Map 1). The existing transmission line system in this area consists of 3 lines all built over 50 years ago that serve 12 substations and are reaching their capacity, particularly during peak demand in the winter. The Sammamish – Juanita transmission line project will add a section of a fourth line to this system and remove 2 substations, so the existing 3 line system will serve 10 instead of 12 substations, relieving the existing system from overloads and providing additional capacity to serve future growth. A future transmission line may extend between Juanita Substation in the City of Kirkland and Moorlands Substation in the City of Kenmore. The future line is not included as part of the current proposal.

Community Outreach and Route Selection

In 2011, PSE convened a Stakeholder Advisory Group (SAG) to assist in siting the new Sammamish – Juanita transmission line. The SAG was made up of representatives from area businesses, neighborhoods, property owners, environmental groups, and city staff from the City of Kirkland and the City of Redmond. The goal of the SAG was to develop community-acceptable route alternatives using community input, resulting in a preferred route that meets the needs of PSE customers. The SAG met 8 times in 2011 and 2012 and with the help of a GIS routing tool using weighted opportunity and constraint criteria, developed potential transmission line routes between Sammamish Substation in the City of Redmond and Juanita Substation in the City of Kirkland. The SAG meetings were open to the public. Representatives on the SAG requested that

PSE consider route alternatives that connect with the existing Sammamish – Moorlands #1 transmission line corridor south of Juanita Substation to avoid constructing a transmission line along NE 132nd Ave, so routes that did not connect directly to Juanita Substation were considered.

Community meetings in the City of Redmond and the City of Kirkland were also held at SAG milestones. These milestones included sharing sample route outputs using the SAGs weighting in December 2011, narrowing the routes to 3 alternatives after PSE had conducted in-field constructability review to ensure route feasibility in June 2012, and the SAGs preferred route recommendation in August 2012. Over 400 community comments were collected during the routing process and shared with the SAG to help inform their process. Project briefings also occurred with neighborhood and community groups.

As a result of the year-long SAG and community outreach process, the SAG came up with a recommended preferred route in July 2012, which was shared with the public in August 2012. The SAG's preferred route in the City of Kirkland is generally PSE's proposed route for the new transmission line. Since the SAG process, PSE added a loop to connect into the Totem Substation south of NE 124th Street to provide greater reliability. Additionally, since the transmission line will not connect directly with Juanita Substation, poles and conductor south of the substation need to be replaced to support the additional transmission capacity.

Code Compliance

As well as being the most community-acceptable route option, the proposed transmission line must comply with City of Kirkland codes. KZC 115.107 requires an assessment of certain criteria as part of siting and design of the project.

1. **Review Required:** Applications for new electrical transmission lines shall be reviewed pursuant to Process IIA, as described in Chapter 150 KZC. The Hearing Examiner shall use all criteria listed in the provision of this code describing the requested decision in deciding upon the application. In addition, the Hearing Examiner may approve the application only if:

- a. It is consistent with all applicable development regulations, and to the extent there are no applicable development regulations, the Comprehensive Plan; and

Response: The proposed transmission line is consistent with all applicable development regulations as demonstrated through this Process IIA application submittal; including compliance with KZC 115.107: Public Utility, Electrical Transmission Lines, KZC Chapter 85: Geologically Hazardous Areas, KZC Chapter 90: Critical Areas: Wetlands and Streams, and KZC Chapter 95 Tree Management and Landscaping.

- b. It is consistent with the public health, safety, and welfare.

Response: The proposed transmission line is consistent with the public health, safety, and welfare. The proposed project complies with applicable federal and state regulations for the construction and operation of transmission lines, in addition to compliance with applicable Kirkland Zoning Code provisions.

- 2. Decisional Criteria:** In addition to the criteria established in Chapter 150 KZC, the City may approve an electrical transmission line only if it finds that, based on siting and design analysis, the applicant has demonstrated that the proposal, to the extent technically and operationally feasible, has been sited and designed to minimize and mitigate impacts to:

a. Critical areas, critical area buffers, and significant trees; and

PSE sited the transmission line along the Cross Kirkland Corridor (CKC) and existing rights-of-way where PSE has existing rights to locate a transmission line. As part of the opportunity and constraint criteria used by the SAG to develop routes, critical areas were deemed avoidance areas, whereas corridors along existing rights-of-way were deemed opportunities. PSE has an easement right within the Eastside Rail Corridor (now the Cross Kirkland Corridor and King County Eastrail) as well as franchise rights within City of Kirkland street right-of-way. Pole placement took into consideration avoidance of wetlands and streams to the greatest extent possible, while considering existing utilities and existing and future trail uses. Areas where poles will be located within wetland or stream buffers generally consist of low value habitat due to the existing disturbed nature of the corridor. PSE vegetation management standards limit vegetation height within proximity to the transmission line in compliance with NERC safety requirements. Therefore, existing trees with a mature height of 25 feet or more will be selectively removed from the transmission corridor. PSE will mitigate for tree removal on private property within critical areas and buffers through purchasing credits at an approved mitigation bank. Within the CKC, PSE will reimburse the City of Kirkland for the cost of replacement trees and the City will plant the trees in a compatible environment that does not conflict with the transmission line at such time as they improve the existing trail corridor consistent with their trail master plan in the foreseeable future. In areas where the future trail will result in poles being located within regulated wetlands, PSE will work with the City to explore opportunities to shift the trail alignment to keep the poles from impacting wetlands, where feasible. The permit application materials assume the most conservative impact scenario.

b. Views from public property and rights-of-way that are designated in the Comprehensive Plan; and

The City of Kirkland Comprehensive Plan includes Community Character policy CC-4.5:

Public views of the City, surrounding hillsides, Lake Washington, Seattle, the Cascades and the Olympics are valuable not only for their beauty but also for the sense of orientation and identity that they provide. Almost every area in Kirkland has streets and other public spaces that allow our citizens and visitors to enjoy such views. View corridors along Lake Washington's shoreline are particularly important and should continue to be enhanced as new development occurs. Public views can be easily lost or impaired and it is almost impossible to create new ones. Preservation, therefore, is critical.

The proposed transmission line is compatible with streetscape views, as the poles and wires tend to blend in with the surroundings and are consistent with other above ground utilities and transportation support equipment. PSE has prepared photosimulations from selected public viewpoints depicting the proposed transmission line along public streets as well as the CKC. These have been provided as part of the project permit submittal.

Additionally, the City has identified gateways within the Totem Lake Business District. One such gateway is identified at the intersection of NE 124th Street and 120th Avenue NE/116th Avenue NE. PSE designed the transmission line to avoid locating a pole on the corner of that intersection and instead set the pole on the north side of NE 124th Street west of the intersection. Additionally, PSE has coordinated with the City to design the transmission line near other gateways along the CKC, including near the pedestrian bridge at the intersection of NE 124th Street, 124th Street NE and Totem Lake Boulevard.

c. Schools and residential areas.

Through the transmission line siting process with the SAG, several routes were considered that went along street rights-of-way near residences and schools within the City of Kirkland. These included routes that went west out of Sammamish Substation instead of east and headed north along 132nd Ave NE and 124th Ave NE by way of NE 90th Street and NE 95th Street. The SAG eliminated these routes because of their location in residential neighborhoods and near schools. There were also engineering siting challenges discovered by PSE for routes along these western segments. The SAG requested that PSE also consider routes that avoided NE 132nd Street and entering Juanita Substation from the north to avoid the NE 132nd Avenue residential area. The SAG provided input that resulted in a preferred route ultimately going through predominantly commercial and industrial areas by exiting Sammamish Substation to the east, going through the Totem Lake Business District, and avoiding NE 132nd Ave by interconnecting with the existing Sammamish – Moorlands #1 transmission line verses installing a new transmission line near single-family residential development near Juanita Substation. The existing transmission corridor from just south of NE 124th Street and NE 128th Street will be rebuilt to accommodate the new transmission line capacity within the existing corridor.

3. **Siting and Design Analysis.** As part of the application, the applicant shall submit a siting and design analysis describing how the proposed route and project design was selected. The analysis shall include an assessment of:

- a. How the proposal addresses the City's decisional criteria and justifies the proposed siting and design relative to those criteria;

Response: As noted above, the proposed project complies with the City's decisional criteria in KZC 115.107(4).

- b. Potential technologies and design features that would mitigate the visual and environmental impacts associated with the transmission line;

Response: To the extent feasible, PSE will be installing standard wood transmission poles. At locations where the transmission line turns or soils warrant foundations, different pole options must be used to ensure stability of the infrastructure. This includes the use of guy wires, self-supporting glu-laminate, or self-supporting steel poles. PSE uses the minimum pole height necessary, while balancing span length. The shorter the span length, the greater number of poles required. From a visual standpoint, generally less poles are more desirable. Where tree removal is necessary to adhere to clearance standards along public rights-of-way, PSE will provide tree restoration with transmission compatible trees that are consistent with the City's streetscape standards. PSE will pay a fee in lieu of tree replacement along the CKC so that the City can plant trees consistent with their CKC Master Plan when the trail improvements are implemented in the foreseeable future. PSE will work with private property owners to replant trees within the corridor on private property.

- c. Potential technologies and design features that would mitigate radio frequency interference with existing high-technology uses identified along the proposed route in compliance with applicable NESC standards, IEEE guidelines, and FCC requirements.

Response: The proposed project complies with all applicable federal standards and guidelines for 115 kV transmission lines. PSE considered a route segment near businesses along the ERC corridor north of NE 124th Street that may have resulted in radio frequency interference with a specific business. PSE chose the current route along NE 124th Street east of Totem Substation instead of the route along the ERC corridor as it better ties into the Totem Substation and to avoid any real or perceived technology conflicts.

Examples of mitigating technologies and design features include: design, placement and height of support structures; landscaping and screening; tree retention and restoration; noise

reduction; and specific construction techniques. This analysis shall be limited to those alternatives and design features that meet the system needs of the project.

Map 1: MOORLANDS SYSTEM MAP



Jennifer Anderer

From: David Godfrey <dw.godfrey@outlook.com>
Sent: Monday, April 27, 2020 9:17 AM
To: Nick Cilluffo
Subject: PSE 115kv zon20-00104

Hi Nick:

I hope everything is going okay with you.

My questions about this project concern the segment along on NE 124th Street in Kirkland.

Would the new line be in an existing utility easement?

Which trees will have to be removed?

Is the plan for tree removal in alignment with tree policies approved by the City?

I don't think a Sustainability Plan has been adopted, but hypothetically, would such a plan give any guidance about the advisability of the new line? If so, what might it be?

Has a notice been sent to all the households in the multifamily units west of NE 113th Ave? Or, how is that handled?

How many public comments have you received so far? Can you give me a sense of the tone of the comments?

Also, where is the city of Redmond in its approval process?

My comment is that I'm disappointed to see large trees being removed in the name of increased electrical capacity and reliability given that PSE is not under any obligation to detail those needs and what options they have considered besides building an additional line. I would like to see PSE held to a higher standard than simply their word that the need exists and this plan of action best serves the citizens of Kirkland. The fact that PSE is privately owned and that their interests may not necessarily coincide with the interests of the City is also disconcerting, but, I suppose, outside the purview of the City let alone this permit.

Thanks for answering these questions and taking these comments,

David Godfrey
10306 NE 125th PL
Kirkland, WA
98034



Bedford Properties, LLC
A City of Kirkland Green Business

April 26, 2020

Page 1 of 2

Mr. Nick Cilluffo
Senior Planner
City of Kirkland
Email: NCilluffo@kirklandwa.gov

Dear Mr. Cilluffo

Bedford Properties, LLC owns the property at 12345 NE 120th Avenue NE, Kirkland on which is situated the Evergreen Academy Montessori school. We appreciate the right to comment on Puget Sound Electric's proposed high voltage power line (ZON20-00104) the proposed location of which follows 120th Avenue NE near our property. We have perused PSE's submission to the City of Kirkland as part of the development approval process.

We find PSE's submission incomplete, both in direct regard to our property and concerning broader topics of public interest. The following items need to be addressed:

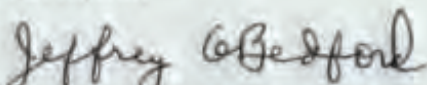
- 1) Community outreach and route selection – "The SAG's preferred route in the City of Kirkland is generally PSE's proposed route for the new transmission line."
 - a. PSE is using a public process that is 8 years in the past. This process is outdated because it does not consider changes in zoning, use, development, public opinion and amendments to the City of Kirkland's Comprehensive Plan. This calls into question PSE's dependence on the results of the SAG process. A new SAG community outreach needs to be convened to determine and reflect the current needs of the public.
 - b. Given that the 2012 SAG needs to be publicly updated to ensure it meets current standards and community needs, alternative routing of the high voltage transmission line needs to be reconsidered. PSE has informed us that "within the City of Kirkland, the transmission line will predominantly be new construction". Consequently, crossing the I-405 in the vicinity of NE 124th Street or NE 128th Street would shorten the length of the transmission line and as a result probably reduce cost. An updated cost analysis of these alternatives is in order.
 - c. The 2012 SAG eliminated some routes "because of their location in residential neighborhoods and near schools." It seems they did not consider that a private Montessori school, The Evergreen Academy, was then and continues to be located at 12345 120th Avenue NE very near the current proposed location of the transmission line which runs along 120th Avenue NE. The location of this school should receive the same recognition regarding transmission line routing as the schools along 132nd Avenue NE.
- 2) Code compliance – "the proposed transmission line must comply with City of Kirkland codes. KZC 115.107 requires an assessment of certain criteria" including being "consistent with the public health, safety, and welfare."

Bedford Properties, LLC
1037 NE 65th Street, Suite 80054, Seattle, WA 98115
Phone: 425 242 5818
Email: admin@bedfordproperties.net

- a. PSE's general statement of compliance fails to consider the risk to human health of non-ionizing EMFs from high-voltage power lines and associated risks of cancer, especially in children. Many respected agencies and NGOs, including the Federal EPA, The National Institute of Health's National Cancer Institute, the American Cancer Society and the Washington State Department of Health, have referenced studies that show a 40% to 100% increased risk of leukemia for children exposed to high-voltage power lines. They show that the highest risk involves exposure at distances of 50 meters (165 feet) or less and no correlation at distances greater than 200 meters (650 feet). Although these studies do not have statistically significant sample sizes, they do uniformly provide a trend. Because the Evergreen Academy provides service onsite to 150 or more young children several hours a day 5 days a week within 70 – 130 feet of this proposed high-tension power line the current proposed location is not "consistent with the public health, safety, and welfare." Thus, it is prudent to apply the precautionary principal and locate the transmission line at least 650 feet away from the Evergreen Academy.
- 3) Decisional Criteria – "The City may approve an electrical transmission line only if it finds that... the applicant has demonstrated that the proposal... has been sited and designed to minimize and mitigate impacts to... Schools and residential areas."
 - a. In 1c. above it has been demonstrated that the Evergreen Academy was not considered in the 2011-12 SAG process of eight years ago. This school needs to be considered.
 - b. In 2a. above the impact of EMFs from the proposed high voltage transmission line to the health of Evergreen Academy teachers, staff and especially young students needs to be addressed as does methods that demonstrably minimize and mitigate, and preferably eliminate, the risk of those impacts.
- 4) Siting and Design Analysis – "the applicant shall submit a siting and design analysis describing how the proposed route and project design was selected. The analysis shall include an assessment of... potential technologies and design features that would mitigate the visual and environmental impacts associated with the transmission line."
 - a. "To the extent feasible, PSE will be installing standard wood transmission poles." We agree but question why the photo simulations only show galvanised or corten poles.

Bedford Properties looks forward to responses from Puget Sound Energy and the City of Kirkland. Please email us should you have any questions.

Best regards,


for David and Jeff Bedford
Property Managers
Bedford Properties, LLC

CC: Ms. Jennifer Anderer, janderer@kirklandwa.gov

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Bedford Properties, LLC
A City of Kirkland Green Business

July 10, 2020

Page 1 of 3

Jennifer Anderer
Planner
Planning and Building Department
City of Kirkland
Email: JAnderer@kirklandwa.gov

Dear Ms. Anderer

Bedford Properties, LLC owns the property at 12345 120th Avenue NE, Kirkland on which is situated the Evergreen Academy Montessori school. Currently, Puget Sound Energy (PSE) proposes to locate a 115kV transmission line within 70 feet of this school. We have studied PSE's submission to the City of Kirkland as part of the development approval process and refer to our two previous submissions to the approval process, dated April 26 and June 18, which have given several reasons why this location has not been shown to be a good idea.

We are concerned that PSE's Code Compliance and Siting and Design Analysis (CCSDA) report, dated February 2020, and related documents do not satisfactorily fulfil at least one of the four Primary Purposes of the Washington State Environmental Policy Act (SEPA): to "stimulate public health and welfare." This oversight was underscored during the Neighborhood Meeting on June 18 when representatives were unable to satisfactorily respond to several of the questions we had submitted to the meeting orally and in our June 17 document.

In our April 26 submission, Bedford Properties explained how PSE's Code Compliance and Siting and Design Analysis (CCSDA) report did not adequately or consistently address four necessary principles: Community Outreach and Route Selection, Code Compliance, Decisional Criteria, and Siting and Design Analysis. This our third submission provides additional information as to why PSE's report inadequately covers Code Compliance because it fails to address the environmental health issue regarding the potential effects on children's health of non-ionizing EMFs, such as from high voltage transmission lines.

This is a serious subject. According to the EPA's report on America's Children and the Environment Third Edition (Updated August 2019), the incidence of cancer in children age 0-19 increased over 16% between 1992 and 2016. Childhood leukemia, the cancer most often linked to exposure to non-ionizing EMFs, increased about 10%. Children aged 0-4 have a

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much higher incidence of cancer than all other age groups except ages 15-19. Many of the Evergreen Academy's students occupy the 0-4 age group. Because of the research we found, we are concerned for the students of the Evergreen Academy, but as lay persons we are not able to certify that these concerns are entirely valid. A critical, expert review of the science developed to date on this subject is in order.

In the June 18 Neighborhood Meeting, as a response to questions in our June 17 submission re: health effects of EMFs we were referred to the Electromagnetic Fields section of PSE's website. This web page does not seem to consider recent research as it refers to sources dated 1998, 1999 and 2002. The one recent reference, Health Canada's Report on EMF (updated to 2019) states: "The International Agency for Research on Cancer (IARC) has classified ELF magnetic fields as 'possibly carcinogenic to humans'. The IARC classification of ELF magnetic fields reflects the fact that some limited evidence exists that ELF magnetic fields might be a risk factor for childhood leukemia." Thus, this PSE web page does little to "stimulate public health and welfare" as required by SEPA.

According to the Guiding Principles of PSE's Projects Process Overview: "If the lead agency determines... that the project may have a significant adverse environmental impact, the lead agency can call upon a neutral third party to prepare an Environmental Impact Statement (EIS), an unbiased appraisal of potential environmental effects, reasonable project alternatives and available measures to lessen, minimize or remove these effects. Opportunities for public comment are available throughout the EIS process." "Environmental health" is listed as an environmental attribute that SEPA requires to be assessed. *Thus, an EIS is required to critically assess the environmental health impacts of EMFs on children.* Since Bedford Properties was not a party to the 2011-12 SAG process, despite the presence of the Evergreen Academy on our affected property, we look forward to participating in the public comment part of the EIS process.

The following summary of references to research, both epidemiology and laboratory studies (none of which are addressed in the project assessment or on PSE's web page), demonstrates that PSE has not adequately addressed the possible effects of non-ionizing EMFs on children's health on its website, and certainly should have prioritized this important environmental health issue in its CCSDA report.

In our April 26 submission we stated that "many respected agencies and NGOs, including the Federal EPA, The National Institute of Health's National Cancer Institute, the American Cancer Society and the Washington State Department of Health, have referenced studies that show a 40% to 100% increased risk of leukemia for children exposed to high-voltage power lines." More recently we discovered a 2019 comprehensive literature review in the international science journal *Progress in Biophysics & Molecular Biology* (volume 141) summarizing over 20 peer reviewed studies on the role of EMFs in induction of DNA damage

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Ms. J. Anderer

July 10, 2020

Page 3 of 3

and oxidative stress, dating from 2006 to 2017. Several of these studies link low frequency, non-ionizing EMFs to cell and DNA damage: oxidative DNA damage, genotoxic potential, DNA double-strand breaks, bacterial transposition, increased mitochondrial ROS.

The National Cancer Institute states that: "Cancer is a genetic disease... caused by changes to genes that control the way our cells function, especially how they grow and divide. Genetic changes that cause cancer ... can also arise during a person's lifetime as a result of errors that occur as cells divide or because of damage to DNA caused by certain environmental exposures." The above-mentioned research certainly shows that low frequency EMFs cause damage to DNA and changes to cells themselves, which can be a precursor to cancer.

Bedford Properties has presented three submissions to the City of Kirkland outlining a number of reasons and asking related questions that demonstrate why PSE's CCSDA report is inadequate on several fronts. In this submission we have also shown why an EIS needs to be prepared to satisfy the environmental requirements of SEPA. We would expect that this EIS would respond to the matters put forward in all three of our submissions. Since an EIS requires PSE to assess alternatives to their current proposal, we suggest assessing relocation alternatives that place the transmission line far away from the children attending our affected school at 12345 120th Avenue NE. Another alternative to assess would be to place the line underground, such as is required by the City of Camas, WA in Chapter 8.52 in the Health and Safety section of their Code of Ordinances.

Please email us should you have any questions.

Best regards,

for Jeffrey A Bedford
David and Jeff Bedford
Property Managers
Bedford Properties, LLC

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Jennifer Anderer

Subject: FW: Notice of Application; PSE 115kV Transmission Lines - ZON20-00104

From: Karen Walter <KWalter@muckleshoot.nsn.us>
Sent: Monday, April 27, 2020 1:47 PM
To: Nick Cilluffo <NCilluffo@kirklandwa.gov>
Subject: RE: Notice of Application; PSE 115kV Transmission Lines - ZON20-00104

Nick,
We received this second email with the attachments as well. We have reviewed this information and offer these comments in the interest of protecting and restoring the Tribe's treaty-protected fisheries resources:

Stream Classifications and Impact Concerns

Stream K-6 was determined to be a Type F (potential fish bearing stream) by the City of Kirkland's consultants as part of the Totem Lake Pedestrian Bridge Project Stream and Wetland Delineation Report (Watershed Company 2019) and the Totem Lake Gateway Project Critical Areas Study and Proposed Mitigation Plan (Perteet Feb 5 2019). See Figure 2 in the Perteet Report.

The PSE Sammamish Juanita Transmission Line Critical Areas Report by AECOM indicates this stream is a Type N stream which is in correct.

This stream and associated wetland K-K will permanent buffer and temporary impacts and 31 trees removed which should be mitigated within the Totem Creek watershed (see Table ES-3)

Stream K-5, a tributary to Wetland K-L and Juanita Creek, is described as being a Type Np (non-fishbearing perennial stream). This may be incorrect given the stream's connectivity to Wetland K-L which has open water elements and appears on the City of Kirkland Sensitive Areas Map to be connected to Juanita Creek. Unless there is a natural barrier on Stream K-5, we suspect that it is accessible and therefore potential fish habitat. More information is needed. Per the CAR, this stream is crossed by the existing transmission line in 3 places. The stream will be crossed using mats; a temporary access route constructed from either the south or west and 6 trees are to be removed from the stream/wetland buffer. There will also be permanent and temporary impacts to this stream/wetland complex due to replacement of pole 4/10. The stream area shown on Map 2 is somewhat confusing as there appears to be more stream channel length (thinner darker blue lines) than just the main stream channel (thicker lighter blue line). The figure should be updated to make the wetland/stream channel relationship clearer. Finally, impacts to Stream K-5 and its buffer should be mitigated either on site or elsewhere in the Juanita Creek basin.

Mitigation

The AECOM (2020) report states:

PSE proposes to mitigate for unavoidable permanent impacts to wetlands and buffers within the City of Kirkland through a fee in lieu payment to the City of Kirkland associated with the master trail plan and by purchasing credits at a local wetland mitigation bank (the Keller Farm Bank).

The Critical Areas Report goes on to note that the *unavoidable removal of 17 trees combined from Wetlands K-D, K-J, and K-K, and 52 trees from the buffers of Wetland K-B/Stream K-7, Wetland K-J/Stream K-3 and Wetland K-K/Stream K-6 will be compensated for through a fee in lieu payment to the City of Kirkland, as these trees are located within the City's CKC trail corridor.*

More information is needed regarding this proposed fee in lieu mitigation approach particularly as the CKC master trail plan/projects have their own permanent and temporary impacts to some of the same wetland and streams in the transmission line corridor. It is essential that mitigation needs for the trail be separated from the power transmission line to avoid double counting or crediting mitigation requirements.

We may have further comments on this mitigation proposal once we have received the details.

Again as noted above, stream buffer impacts should be mitigated on those affected streams and not at the Keller Farms mitigation bank.

We appreciate the opportunity to review this proposal and look forward to the City/applicants' responses to these concerns.

Thank you,
Karen Walter
Watersheds and Land Use Team Leader

*Muckleshoot Indian Tribe Fisheries Division
Habitat Program
39015-A 172nd Ave SE
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PSE Sammamish – Juanita 115 kV Transmission Line

Code Compliance and Siting and Design Analysis

February 2020

Proposal

Puget Sound Energy (PSE) is proposing to construct a new approximately 5 mile 115 kV transmission line to serve the Kirkland/Redmond area. The transmission line will be constructed between Sammamish Substation in the City of Redmond and Juanita Substation in the City of Kirkland and will include a loop through Totem Substation in Kirkland. Within the City of Kirkland, the transmission line will predominantly be new construction (2.33 miles), however will also include replacement of existing poles and conductor at locations along NE 124th Street east of Totem Substation and within the existing Sammamish – Moorlands #1 transmission line corridor south of Juanita Substation (0.79 miles). The new segments of transmission line will be constructed within street right-of-way under PSE's franchise agreement within the City of Kirkland and within the unimproved King County Eastside Rail Corridor (ERC) east of 132nd Avenue NE and City of Kirkland Cross Kirkland Corridor (CKC) west of 132nd Avenue NE 100-foot wide multi-use parcels under existing easement rights. The project also includes a crossing of I-405 for which a utility permit will be obtained from the Washington State Department of Transportation (WSDOT).

Project Need

The project is needed to provide additional capacity and reliability within what PSE defines as the Moorlands area (see Map 1). The existing transmission line system in this area consists of 3 lines all built over 50 years ago that serve 12 substations and are reaching their capacity, particularly during peak demand in the winter. The Sammamish – Juanita transmission line project will add a section of a fourth line to this system and remove 2 substations, so the existing 3 line system will serve 10 instead of 12 substations, relieving the existing system from overloads and providing additional capacity to serve future growth. A future transmission line may extend between Juanita Substation in the City of Kirkland and Moorlands Substation in the City of Kenmore. The future line is not included as part of the current proposal.

Community Outreach and Route Selection

In 2011, PSE convened a Stakeholder Advisory Group (SAG) to assist in siting the new Sammamish – Juanita transmission line. The SAG was made up of representatives from area businesses, neighborhoods, property owners, environmental groups, and city staff from the City of Kirkland and the City of Redmond. The goal of the SAG was to develop community-acceptable route alternatives using community input, resulting in a preferred route that meets the needs of PSE customers. The SAG met 8 times in 2011 and 2012 and with the help of a GIS routing tool using weighted opportunity and constraint criteria, developed potential transmission line routes between Sammamish Substation in the City of Redmond and Juanita Substation in the City of Kirkland. The SAG meetings were open to the public. Representatives on the SAG requested that

PSE consider route alternatives that connect with the existing Sammamish – Moorlands #1 transmission line corridor south of Juanita Substation to avoid constructing a transmission line along NE 132nd Ave, so routes that did not connect directly to Juanita Substation were considered.

Community meetings in the City of Redmond and the City of Kirkland were also held at SAG milestones. These milestones included sharing sample route outputs using the SAGs weighting in December 2011, narrowing the routes to 3 alternatives after PSE had conducted in-field constructability review to ensure route feasibility in June 2012, and the SAGs preferred route recommendation in August 2012. Over 400 community comments were collected during the routing process and shared with the SAG to help inform their process. Project briefings also occurred with neighborhood and community groups.

As a result of the year-long SAG and community outreach process, the SAG came up with a recommended preferred route in July 2012, which was shared with the public in August 2012. The SAG's preferred route in the City of Kirkland is generally PSE's proposed route for the new transmission line. Since the SAG process, PSE added a loop to connect into the Totem Substation south of NE 124th Street to provide greater reliability. Additionally, since the transmission line will not connect directly with Juanita Substation, poles and conductor south of the substation need to be replaced to support the additional transmission capacity.

Code Compliance

As well as being the most community-acceptable route option, the proposed transmission line must comply with City of Kirkland codes. KZC 115.107 requires an assessment of certain criteria as part of siting and design of the project.

- 1. Review Required:** Applications for new electrical transmission lines shall be reviewed pursuant to Process IIA, as described in Chapter 150 KZC. The Hearing Examiner shall use all criteria listed in the provision of this code describing the requested decision in deciding upon the application. In addition, the Hearing Examiner may approve the application only if:

- a. It is consistent with all applicable development regulations, and to the extent there are no applicable development regulations, the Comprehensive Plan; and

Response: The proposed transmission line is consistent with all applicable development regulations as demonstrated through this Process IIA application submittal; including compliance with KZC 115.107: Public Utility, Electrical Transmission Lines, KZC Chapter 85: Geologically Hazardous Areas, KZC Chapter 90: Critical Areas: Wetlands and Streams, and KZC Chapter 95 Tree Management and Landscaping.

- b. It is consistent with the public health, safety, and welfare.

Response: The proposed transmission line is consistent with the public health, safety, and welfare. The proposed project complies with applicable federal and state regulations for the construction and operation of transmission lines, in addition to compliance with applicable Kirkland Zoning Code provisions.

- 2. Decisional Criteria:** In addition to the criteria established in Chapter 150 KZC, the City may approve an electrical transmission line only if it finds that, based on siting and design analysis, the applicant has demonstrated that the proposal, to the extent technically and operationally feasible, has been sited and designed to minimize and mitigate impacts to:

a. Critical areas, critical area buffers, and significant trees; and

PSE sited the transmission line along the Cross Kirkland Corridor (CKC) and existing rights-of-way where PSE has existing rights to locate a transmission line. As part of the opportunity and constraint criteria used by the SAG to develop routes, critical areas were deemed avoidance areas, whereas corridors along existing rights-of-way were deemed opportunities. PSE has an easement right within the Eastside Rail Corridor (now the Cross Kirkland Corridor and King County Eastrail) as well as franchise rights within City of Kirkland street right-of-way. Pole placement took into consideration avoidance of wetlands and streams to the greatest extent possible, while considering existing utilities and existing and future trail uses. Areas where poles will be located within wetland or stream buffers generally consist of low value habitat due to the existing disturbed nature of the corridor. PSE vegetation management standards limit vegetation height within proximity to the transmission line in compliance with NERC safety requirements. Therefore, existing trees with a mature height of 25 feet or more will be selectively removed from the transmission corridor. PSE will mitigate for tree removal on private property within critical areas and buffers through purchasing credits at an approved mitigation bank. Within the CKC, PSE will reimburse the City of Kirkland for the cost of replacement trees and the City will plant the trees in a compatible environment that does not conflict with the transmission line at such time as they improve the existing trail corridor consistent with their trail master plan in the foreseeable future. In areas where the future trail will result in poles being located within regulated wetlands, PSE will work with the City to explore opportunities to shift the trail alignment to keep the poles from impacting wetlands, where feasible. The permit application materials assume the most conservative impact scenario.

b. Views from public property and rights-of-way that are designated in the Comprehensive Plan; and

The City of Kirkland Comprehensive Plan includes Community Character policy CC-4.5:

Public views of the City, surrounding hillsides, Lake Washington, Seattle, the Cascades and the Olympics are valuable not only for their beauty but also for the sense of orientation and identity that they provide. Almost every area in Kirkland has streets and other public spaces that allow our citizens and visitors to enjoy such views. View corridors along Lake Washington's shoreline are particularly important and should continue to be enhanced as new development occurs. Public views can be easily lost or impaired and it is almost impossible to create new ones. Preservation, therefore, is critical.

The proposed transmission line is compatible with streetscape views, as the poles and wires tend to blend in with the surroundings and are consistent with other above ground utilities and transportation support equipment. PSE has prepared photosimulations from selected public viewpoints depicting the proposed transmission line along public streets as well as the CKC. These have been provided as part of the project permit submittal.

Additionally, the City has identified gateways within the Totem Lake Business District. One such gateway is identified at the intersection of NE 124th Street and 120th Avenue NE/116th Avenue NE. PSE designed the transmission line to avoid locating a pole on the corner of that intersection and instead set the pole on the north side of NE 124th Street west of the intersection. Additionally, PSE has coordinated with the City to design the transmission line near other gateways along the CKC, including near the pedestrian bridge at the intersection of NE 124th Street, 124th Street NE and Totem Lake Boulevard.

c. Schools and residential areas.

Through the transmission line siting process with the SAG, several routes were considered that went along street rights-of-way near residences and schools within the City of Kirkland. These included routes that went west out of Sammamish Substation instead of east and headed north along 132nd Ave NE and 124th Ave NE by way of NE 90th Street and NE 95th Street. The SAG eliminated these routes because of their location in residential neighborhoods and near schools. There were also engineering siting challenges discovered by PSE for routes along these western segments. The SAG requested that PSE also consider routes that avoided NE 132nd Street and entering Juanita Substation from the north to avoid the NE 132nd Avenue residential area. The SAG provided input that resulted in a preferred route ultimately going through predominantly commercial and industrial areas by exiting Sammamish Substation to the east, going through the Totem Lake Business District, and avoiding NE 132nd Ave by interconnecting with the existing Sammamish – Moorlands #1 transmission line verses installing a new transmission line near single-family residential development near Juanita Substation. The existing transmission corridor from just south of NE 124th Street and NE 128th Street will be rebuilt to accommodate the new transmission line capacity within the existing corridor.

3. **Siting and Design Analysis.** As part of the application, the applicant shall submit a siting and design analysis describing how the proposed route and project design was selected. The analysis shall include an assessment of:

- a. How the proposal addresses the City's decisional criteria and justifies the proposed siting and design relative to those criteria;

Response: As noted above, the proposed project complies with the City's decisional criteria in KZC 115.107(4).

- b. Potential technologies and design features that would mitigate the visual and environmental impacts associated with the transmission line;

Response: To the extent feasible, PSE will be installing standard wood transmission poles. At locations where the transmission line turns or soils warrant foundations, different pole options must be used to ensure stability of the infrastructure. This includes the use of guy wires, self-supporting glu-laminate, or self-supporting steel poles. PSE uses the minimum pole height necessary, while balancing span length. The shorter the span length, the greater number of poles required. From a visual standpoint, generally less poles are more desirable. Where tree removal is necessary to adhere to clearance standards along public rights-of-way, PSE will provide tree restoration with transmission compatible trees that are consistent with the City's streetscape standards. PSE will pay a fee in lieu of tree replacement along the CKC so that the City can plant trees consistent with their CKC Master Plan when the trail improvements are implemented in the foreseeable future. PSE will work with private property owners to replant trees within the corridor on private property.

- c. Potential technologies and design features that would mitigate radio frequency interference with existing high-technology uses identified along the proposed route in compliance with applicable NESC standards, IEEE guidelines, and FCC requirements.

Response: The proposed project complies with all applicable federal standards and guidelines for 115 kV transmission lines. PSE considered a route segment near businesses along the ERC corridor north of NE 124th Street that may have resulted in radio frequency interference with a specific business. PSE chose the current route along NE 124th Street east of Totem Substation instead of the route along the ERC corridor as it better ties into the Totem Substation and to avoid any real or perceived technology conflicts.

Examples of mitigating technologies and design features include: design, placement and height of support structures; landscaping and screening; tree retention and restoration; noise

reduction; and specific construction techniques. This analysis shall be limited to those alternatives and design features that meet the system needs of the project.

Map 1:

MOORLANDS SYSTEM MAP



Puget Sound Energy Sammamish-Juanita Transmission Line Project Wetland and Stream Delineation Report Preliminary Draft



Puget Sound Energy Sammamish-Juanita Transmission Line Project Wetland and Stream Delineation Report Draft

Prepared By:

A handwritten signature in black ink, appearing to read "Kim Anderson".

Kim Anderson, PWS

A handwritten signature in black ink, appearing to read "Glen Mejia".

Glen Mejia, Fisheries/Wildlife Biologist

A handwritten signature in black ink, appearing to read "Paul Hamidi".

Paul Hamidi, PWS, CPSS

Reviewed By:

A handwritten signature in black ink, appearing to read "Jeff Walker".

Jeff Walker, PWS

Executive Summary

AECOM conducted wetland and stream delineations for Puget Sound Energy along the planned route of the approximately 5-mile Sammamish-Juanita 115-kilovolt transmission line corridor, located in the Cities of Redmond and Kirkland and in unincorporated King County, Washington. The primary goal of the study was to provide information about wetlands and streams, and their buffers, that might be affected by activities associated with the planned transmission line construction project. The objectives of the study were to identify, map, categorize, and rate wetlands and streams within the study area. Initial field surveys were conducted in April, May, and June, 2014; May and June, 2015; April and June, 2016, and October and November, 2017, with an additional site visit to rate wetlands and take representative photographs in August, 2016. Follow-up field surveys to verify and update previously mapped wetland boundaries and to delineate wetlands and streams in previously unsurveyed portions of a revised study area occurred in April, June, and July 2019.

During field surveys, a total of 22 wetlands and 13 streams were delineated in the study area. A total of 83 sample plots were investigated to characterize the upland and wetland conditions within the study area. Table ES-1 provides a summary of the wetlands that were delineated during field surveys, and Table ES-2 summarizes the streams that were encountered. For completeness, Table ES-1 also includes information about three wetlands within the study area that were delineated as part of a different project.

Table ES-1. Summary of Wetlands in the Study Area

Wetland	Area	HGM Class	Cowardin Class	Functional Rating			
				Category	Water Quality Score	Hydrologic Score	Habitat Score
City of Redmond							
R-A	13,068 ft ² (0.30 ac)	Riverine	PEM/PSS/PFO	II	8	7	6
R-B	3,848 ft ² (0.80 ac)	Depressional	PEM/PSS	II	7	7	6
R-C	305 ft ² (0.01 ac)	Depressional	PEM	III	7	6	3
R-D	4,210 ft ² (0.10 ac)	Depressional	PEM	III	7	6	3
R-E ¹	9,975 ft ² (0.23 ac)	Depressional	PEM	II	8	8	4
R-GCA ²	2,831 ft ² 0.07 ac	Riverine	PEM/RAB	III	6	7	4
R-GCB ²	4,617 ft ² (0.11 ac)	Riverine	PEM/RAB	III	6	7	4
R-GCF ²	1,6112 ft ² (0.04 ac)	Slope	PSS/PFO	IV	6	5	4
King County ³							
KC-A ³	8,799 ft ² (0.20 ac)	Depressional	PEM	II	22	20	13
KC-B ³	1,029 ft ² (0.02 ac)	Depressional	PEM	III	22	14	7
City of Kirkland							
K-AA	91.9 ft ² (0.002 ac)	Depressional	PEM	III	6	6	4

Table ES-1 (continued). Summary of Wetlands in the Study Corridor

Wetland	Area	HGM Class	Cowardin Class	Functional Rating			
				Category	Water Quality Score	Hydrologic Score	Habitat Score
K-BB ¹	871 ft ² (0.02 ac)	Depressional	PEM/PSS/PFO	II	7	7	6
K-A	476 ft ² (0.01 ac)	Depressional	PEM	III	7	6	3
K-B	3,047 ft ² (0.07 ac)	Depressional	PEM	IV	6	6	3
K-C	3,634 ft ² (0.08 ac)	Depressional	PEM	III	7	6	3
K-D ¹	28,254 ft ² (0.65 ac)	Depressional	PEM	III	7	7	3
K-DD	225 ft ² (0.01 ac)	Depressional	PEM	III	7	7	3
K-E	1,992 ft ² (0.05 ac)	Depressional	PEM	IV	6	6	3
K-F ¹	19,251 ft ² (0.44 ac)	Depressional	PEM/PFO	III	7	7	3
K-G	10,119 ft ² (0.23 ac)	Depressional	PEM	III	7	7	3
K-H ⁴	1,486 ft ² (0.03 ac)	Depressional	PEM/PFO	III	8	7	3
K-J ¹	49,807 ft ² (1.14 ac)	Depressional	PEM/PSS/ PFO/POW	I	9	9	6
K-K ¹	16,563 ft ² (0.38 ac)	Depressional	PFO	III	6	7	3
K-L ¹	15,130 ft ² (0.35 ac)	Depressional +Riverine	PEM/PSS/ PFO/POW	II	7	7	6
K-HF ¹	25,937 ft ² (0.60 ac)	Depressional	PEM/PSS/ PFO	II	8	8	5
¹ These wetlands extend beyond the study area boundary. Only the acreage within the study area is given. ² Wetlands R-GCA, R-GCB, R-GCF were delineated in 2017 by Parametrix (2018). Information has been included for completeness but has not been verified. ³ Note that based on the requirements in KCC 21A.24.318, the 2004 wetland rating form was used to rate the King County wetlands. ⁴ Wetland K-H is outside the study area boundary, but was mapped and surveyed. HGM = hydrogeomorphic, PEM = palustrine emergent, PSS = palustrine scrub-shrub, PFO = palustrine forested, RAB = riparian aquatic bottom, and POW = palustrine open water.							

Table ES-2. Summary of Streams Within the Study Area

Stream Name/ID	Associated Wetland	Area/Length Within Study Area	Classification
City of Redmond			
Gun Club Creek	Wetlands R-A, R-GCA, R-GCB	74,357 square feet	Class III
Stream R-2	Wetland R-C	137 square feet	Class III
Stream R-3	Wetland R-D	21 square feet	Class III
York Creek	Wetland R-E	579 square feet	Class III
124 th Street Stream	none	602 square feet	Class III
King County			
Stream KC-1	Wetland KC-A	408 square feet	Type N
124 th Street Stream	none	1,588 square feet	Type F
City of Kirkland			
Stream K-1	Wetland K-AA	386 square feet	Type Ns
Stream K-2	Wetland K-BB	219 feet (edge of corridor)	Type F
Stream K-3	Wetland K-J	5,784 square feet	Type F
Stream K-5	Wetland K-L	1,188 square feet	Type Np
Stream K-6	Wetland K-K	1,455 square feet	Type Np
Stream K-7	Wetland K-B	154 square feet	Type Np

Contents

1.0 Site General Information	1-1
2.0 Background and Regulatory Framework	2-1
2.1 Introduction	2-1
2.2 Project Background and Study Objectives	2-1
2.3 Study Area Description	2-1
2.3.1 Study Area – City of Redmond	2-2
2.3.2 Study Area – King County	2-2
2.3.3 Study Area – City of Kirkland	2-2
2.4 Regulatory Information and Definitions – City of Redmond	2-2
2.4.1 Wetlands	2-2
2.4.2 Streams	2-3
2.5 Regulatory Framework and Definitions – King County	2-4
2.5.1 Wetlands	2-4
2.5.2 Streams	2-4
2.6 Regulatory Framework and Definitions – Kirkland	2-5
2.6.1 Wetlands	2-5
2.6.2 Streams	2-5
3.0 Methods	3-1
3.1 Background Review	3-1
3.2 Wetland Delineation	3-1
3.2.1 Field Evaluation – City of Redmond	3-2
3.2.2 Field Evaluation – King County	3-3
3.2.3 Field Evaluation – City of Kirkland	3-4
3.3 Wetland Rating	3-5
3.4 Stream Survey and Rating	3-5
4.0 Results of Background Review	4-1
4.1 City of Redmond	4-1
4.1.1 Wetlands	4-1
4.1.2 Streams	4-1
4.1.3 Soils	4-1
4.1.4 Priority Habitats and Species	4-2
4.2 Unincorporated King County	4-2
4.2.1 Wetlands	4-2
4.2.2 Streams	4-2
4.2.3 Soils	4-3
4.2.4 Priority Habitats and Species	4-3

4.3	City of Kirkland	4-3
4.3.1	Wetlands	4-3
4.3.2	Streams	4-3
4.3.3	Soils	4-4
4.3.4	Priority Habitats and Species	4-5
4.4	Climatic Conditions	4-5
5.0	Results of Field Evaluations – City of Redmond	5-1
5.1	Overview	5-1
5.2	Wetlands	5-1
5.2.1	Wetland R-A	5-1
5.2.2	Wetland R-B	5-2
5.2.3	Wetland R-C	5-3
5.2.4	Wetland R-D	5-3
5.2.5	Wetland R-E	5-3
5.2.6	Offsite Wetlands	5-4
5.3	Streams	5-4
5.3.1	Gun Club Creek	5-4
5.3.2	Stream R-2	5-5
5.3.3	Stream R-3	5-6
5.3.4	York Creek	5-6
5.3.5	124 th Street Stream	5-7
6.0	Results of Field Evaluations – King County	6-1
6.1	Overview	6-1
6.2	Wetlands	6-1
6.2.1	Wetland KC-A	6-1
6.2.2	Wetland KC-B	6-2
6.3	Streams	6-2
6.3.1	Stream KC-1	6-2
6.3.2	124 th Street Stream	6-2
7.0	Results of Field Evaluations – City of Kirkland	7-1
7.1	Overview	7-1
7.1.1	Wetland K-AA and Stream K-1	7-1
7.1.2	Wetland K-BB and Stream K-2	7-2
7.1.3	Wetland K-A	7-3
7.1.4	Wetland K-B and Stream K-7	7-3
7.1.5	Wetland K-C	7-4
7.1.6	Wetland K-D	7-5
7.1.7	Wetland K-DD	7-5
7.1.8	Wetland K-E	7-6
7.1.9	Wetland K-F	7-6

7.1.10	Wetland K-G	7-7
7.1.11	Wetland K-H.....	7-7
7.1.12	Wetland K-J and Stream K-3	7-8
7.1.13	Wetland K-K and Stream K-6.....	7-9
7.1.14	Wetland K-L and Stream K-5	7-10
7.1.15	Wetland K-HF (Heronfield Wetlands).....	7-11
8.0	Wetland and Stream Buffers.....	8-1
8.1	Wetland and Stream Buffers – City of Redmond	8-1
8.1.1	Wetland Buffers	8-1
8.1.2	Stream Buffers	8-2
8.1.3	Buffers of Wetlands and Streams in the Study Area	8-3
8.2	Wetland and Stream Buffers – King County	8-4
8.2.1	Wetland Buffers	8-4
8.2.2	Aquatic Area Buffers.....	8-4
8.2.3	Buffers of Wetlands and Streams in the Study Area	8-5
8.3	Wetland and Stream Buffers – City of Kirkland	8-5
8.3.1	Wetland Buffers	8-5
8.3.2	Stream Buffers	8-6
8.3.3	Buffers of Wetlands and Streams in the Study Area	8-6
9.0	Summary.....	9-1
10.0	References.....	10-1

List of Appendices

Appendix A	Photographic Logs
Appendix B	Field Data Forms
Appendix C	Wetland Rating Forms
Appendix D	Soil Resource Reports
Appendix E	Summary of Wetland Parameters at Sample Plots
Appendix F	Wetland Functional Assessment (Redmond Wetlands)

List of Tables

Table 3.1. Redmond Wetland Survey Dates.....	3-2
Table 3.2. King County Wetland Survey Dates.....	3-3
Table 3.3. Kirkland Wetland Survey Dates	3-4
Table 3.4. Stream Survey Dates	3-6
Table 4.1. Climatic Conditions for Wetland and Stream Delineation Dates.....	4-5
Table 8.1. City of Redmond Wetland Buffer Requirements	8-1
Table 8.2. City of Redmond Stream Buffer Requirements	8-2
Table 8.3. Standard Regulatory Buffers for Study Area Wetlands – City of Redmond.....	8-3
Table 8.4. Standard Regulatory Buffers for Study Area Streams – City of Redmond.....	8-3
Table 8.5. King County Wetland Buffer Requirements Within the Urban Growth Area	8-4
Table 8.6. King County Aquatic Area Buffer Requirements Within the Urban Growth Area.....	8-4
Table 8.7. Standard Regulatory Buffers for Study Area Wetlands and Streams – King County	8-5
Table 8.8. City of Kirkland Standard Wetland Buffers	8-5
Table 8.9. City of Kirkland Standard Stream Buffer Widths.....	8-6
Table 8.10. Standard Regulatory Buffers for Study Area Wetlands – City of Kirkland.....	8-6
Table 8.11. Standard Regulatory Buffers for Study Area Streams – City of Kirkland	8-7
Table 9.1. Summary of Wetlands in the Study Area.....	9-1
Table 9.2 (Continued). Summary of Wetlands in the Study Area	9-2
Table 9.3. Summary of Streams Within the Study Corridor.....	9-2

List of Figures

Figure 1-1	Vicinity Map.....	1-3
Figure 2-1	Redmond Study Area	2-6
Figure 2-2	King County Study Area	2-7
Figure 2-3	Kirkland Study Area	2-8
Figure 4-1	City of Redmond Wetland and Stream Mapping	4-7
Figure 4-2	King County Wetland and Stream Mapping	4-8
Figure 4-3	City of Kirkland Wetland and Stream Mapping.....	4-0
Figure 5-1	City of Redmond Overview of Delineated Wetlands and Streams, Figure 1 of 2	5-8
Figure 5-2	City of Redmond Overview of Delineated Wetlands and Streams, Figure 2 of 2	5-9
Figure 5-3	Wetland R-A and Gun Club Creek.....	5-10
Figure 5-4	Wetland R-B and Gun Club Creek.....	5-11
Figure 5-5	Wetlands R-GCA, R-GCB, R-GCF, and Gun Club Creek	5-12
Figure 5-6	Wetland R-C and Stream R-2	5-13
Figure 5-7	Estimated Off-site Wetland.....	5-14
Figure 5-8	Wetland R-D and Stream R-3	5-15
Figure 5-9	Wetland R-E and York Creek.....	5-16
Figure 5-10	124 th St Stream and Estimated Off-site Wetland (Wetland R-E)	5-17
Figure 6-1	King County Overview of Delineated Wetlands and Streams.....	6-4
Figure 6-2	Wetland KC-A, Stream KC-1, and 124 th Street Stream	6-5
Figure 6-3	Wetland KC-B and 124 th Street Stream.....	6-6
Figure 7-1	City of Kirkland Overview of Delineated Wetlands and Streams, Figure 1 of 3	7-12
Figure 7-2	City of Kirkland Overview of Delineated Wetlands and Streams, Figure 2 of 3	7-13
Figure 7-3	City of Kirkland Overview of Delineated Wetlands and Streams, Figure 3 of 3	7-14
Figure 7-4	Wetland K-AA and Stream K-1	7-15
Figure 7-5	Wetland K-BB and Stream K-2	7-16
Figure 7-6	Wetland K-A.....	7-17
Figure 7-7	Wetlands K-B and K-C and Stream K-7	7-18
Figure 7-8	Wetlands K-D and K-E	7-19
Figure 7-9	Wetlands K-F, K-G, and K-H.....	7-20
Figure 7-10	Wetlands K-J and K-K and Streams K-3 and K-6	7-21
Figure 7-11	Wetland K-L and Stream K-5	7-22
Figure 7-12	Wetland K-HF (Heronfield Wetlands).....	7-23

1.0 Site General Information

Name of Proposal: PSE Sammamish-Juanita Transmission Line

Name of Applicant: Puget Sound Energy (PSE)

Name of Organization and Individuals Preparing this Report: AECOM

Delineators: Kim Anderson, PWS; JD Brooks; Michelle Brownell, WPIT; Paul Hamidi, PWS; Linda Howard; Glen Mejia; and Tina Mirabile, PWS

Report Prepared by: Kim Anderson, PWS; Paul Hamidi, PWS; and Glen Mejia (Fish and Wildlife Biologist)

Report Reviewed by: Jeff Walker, PWS

Date Prepared: October 2019

Location of Proposed Activity: The study area (Figure 1-1) includes an approximately 5-mile linear corridor within which the proposed transmission line will be located, as well as additional areas in the vicinity that were surveyed before the route alignment was finalized. The study area reflects areas that were surveyed for wetlands within the City of Redmond, unincorporated King County, and the City of Kirkland, Washington. The study area begins at the Sammamish Substation (located west of Willows Road, near the end of NE 91st Street; King County Tax Parcel Number 0325059002). It runs from the substation northwest to Willows Road (through Parcel 0325059258) and turns north along a former BNSF railroad route, parallel to Willows Road (Parcels 0325059019, 3426059023, 2726059140, and 2726059145). At NE 124th Street, the corridor turns to the northwest and crosses both Willows Road NE and NE 124th Street and runs roughly west on the north side of 124th Street (Parcel 2726059024). The route turns south and crosses NE 124th toward the Totem Lake Substation, making a loop through Parcels 2726059041, 2726059084, 2726059012, and 2726059087 before heading back north across NE 124th Street and through Parcel 2726059074 to a second former BNSF rail corridor. The study area follows the rail corridor in Kirkland in a generally southwest direction (Parcels 2726059019, 2826059202, and 2826059027). Just before I-405, it turns to the west and crosses the highway, into Parcel 2826059115. The transmission line route then heads northwest on the east side of 120th Avenue NE, crossing over to the west side of the street just before NE 124th Street. It cuts across Parcel 2926059030 and then runs west on the north side of NE 124th Street. The route turns north into Parcel 3754550000 and past the Juanita High School, turns east and runs along the south side of NE 128th Street, and then turns north through Parcel 2926059007 to the Juanita Substation. A small segment of the route heads south across NE 124th Street into Parcel 2926059021.

Portions of the route that were not surveyed for wetlands or streams include sections along NE 124th Street and NE 128th Street in which the project will occur within the street right-of-way either in pavement or in the street landscaping strip. PSE has determined that no sensitive areas will be disturbed along these sections of the proposed transmission line route. Additionally, biologists were not permitted to enter Parcels 2726059041, 276059012, and 2726059067 (the loop south of NE 124th Street) or Parcel 2726059106.

The study area also includes a section of a previously proposed route alignment in Kirkland, which follows the former BNSF railroad route parallel to Willows Road across NE 124th St into Parcel 2726059147. Approximately 750 feet north of NE 125th Street, the corridor turns to the northwest and crosses over to the west side of Willows Road NE (Parcel 276059069), then runs through Parcel 2726059008 until it reaches the second BNSF rail corridor.

The study area is located in Township 25 North, Range 5 East, Section 3; and Township 26 North, Range 5 East, Sections 27-29, and 34.

Site Description: The study area is approximately 52 acres in size, and consists of both developed and undeveloped lands in a predominantly urban setting.

Adjacent Land Uses: Transportation right-of-way, commercial, industrial, residential, agriculture, open space

USGS/NWI topographic map: Kirkland, WA USGS 7.5-minute quadrangle

Landform: Various

Elevation: Ranges from 40 to 180 feet above mean sea level

Water Resource Inventory Area (WRIA): Lake Washington/Cedar/Sammamish (WRIA 8)

Watershed: Sammamish River, Lake Washington/Cedar River

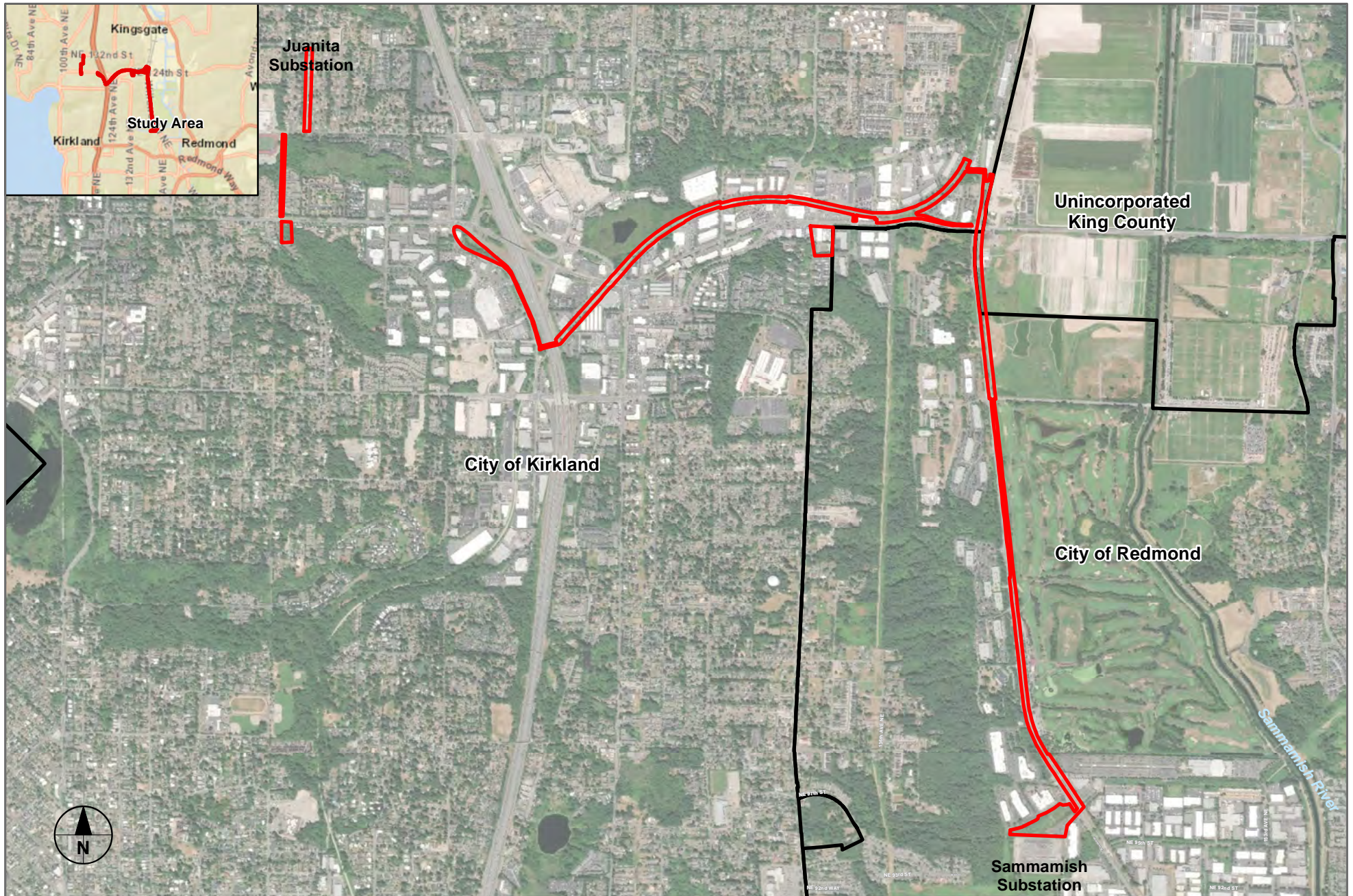
NRCS soil series: Kitsap Silt Loam (34 percent of study area), Indianola Loamy Sand (33 percent), Alderwood Gravelly Sandy Loam (11 percent), Earlmont Silt Loam (9 percent), Everett Very Gravelly Sandy Loam (7 percent), Tukwila Muck (6 percent), Seattle Muck (1 percent)

Cowardin classes: Palustrine emergent (PEM); Palustrine scrub-shrub (PSS), Palustrine forested (PFO), Palustrine Open Water (POW). (Note: POW Cowardin class occurs outside the study area boundary).

Wetland Area Within Study Area: 241,678 square feet (5.5 acres)

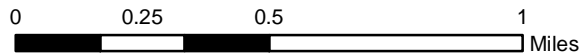
Waters Area Within Study Area: 86,878 square feet (2.0 acres)


Reporting Accuracy: Site wetland boundaries and the ordinary high water mark (OHWM) of streams were delineated and mapped using a Global Positioning System (GPS) unit, with a follow-up survey by David Evans and Associates (DEA) in most cases. Where higher accuracy survey data is available, it is used. Where survey data is unavailable, GPS data is used. Information about wetlands outside of the study area and areas inaccessible to biologists, was determined based on best professional judgment, hand drawn on aerial photos, and digitized into Geographic Information System (GIS). Existing sources of information were also used, as identified within the report.



**Puget Sound Energy
Samamish-Juanita Transmission Line Wetland Delineation**

Project No.: 60608044



 Study Area


 Jurisdictional Boundary

Figure 1-1
Vicinity Map

2.0 Background and Regulatory Framework

2.1 Introduction

This report presents the results of wetland and stream delineations conducted by AECOM for PSE for the proposed Sammamish-Juanita transmission line project, located in Redmond, Kirkland, and unincorporated King County, Washington. Initial field studies to delineate wetland boundaries were conducted during April, May, and June 2014, June 2015, April and June 2016, and October and November 2017. Following a delay of more than a year during which the planned transmission line route changed, follow-up field studies were conducted in April, June, and July 2019 to verify/update delineations more than 5 years old and survey previously undelineated portions of the new transmission line route. This report provides information on wetlands and streams that occur within the study area (as modified in 2019) and that could potentially be affected by the proposed project. Information on wetlands mapped within the initial study area have also been included for informational purposes.

Because the study area spans multiple jurisdictions (Figure 1-1), information presented in this report is separated out by jurisdiction, with separate headings or subheadings for City of Redmond, City of Kirkland, and King County, as appropriate.

2.2 Project Background and Study Objectives

Customer energy usage is straining the capacity of the existing electric system in the areas of Kirkland and Redmond, reducing the ability to provide dependable power to area residents and businesses. PSE is proposing to construct a new 115 kV transmission line between Sammamish Substation in Redmond (9221 Willows Road NE – parcel #0325059002) and Juanita Substation in Kirkland (10910 NE 132nd Street – parcel #2926059007) to increase system capacity and reliability. The transmission line will be approximately 5 miles in length, with approximately 4.25 miles of new transmission line and 0.80 miles of replacement of existing transmission poles and conductor. The project crosses through three jurisdictions, including the City of Redmond, unincorporated King County, and the City of Kirkland. Within the Kirkland, the transmission line will loop through the Totem Lake Substation (13211 NE 123rd Street – parcel #2726059084) south of NE 124th Street. Within the Redmond and unincorporated King County, PSE will install a 1.5-mile construction and maintenance gravel access road. PSE will replace the existing culverts under the existing rail ballast as part of the ballast widening for the access road construction.

The objectives of this study were to identify, map, categorize, and rate wetlands and streams within the study area, and to determine their appropriate regulatory buffers. The information provided in this report will be used to identify and avoid wetlands and streams that could be affected by future project activities. An assessment of project-specific impacts to wetlands/streams and their buffers will be provided in a separate report.

2.3 Study Area Description

The study area is the approximately 5-mile linear corridor that follows the route of the proposed transmission line, as well as some adjacent areas. The study area predominantly consists of developed areas. Nearly the entire corridor has been altered by development, and invasive and other weedy species are prevalent. Surface water flows have also been highly altered, and are directed by a series of culverts and drainage ditches and other stormwater improvements.

2.3.1 Study Area – City of Redmond

Within the City of Redmond, the study area is 19.4 acres (Figure 2-1). From the Sammamish Substation the study area crosses over predominantly developed areas north of the substation and across Willows Road NE, to an old railroad bed on the east side of Willows Road NE. It continues roughly north along a trail on the railroad bed, to the City limits at Parcel 2726059127. In this stretch, the study area includes the railroad bed and narrow bands of undeveloped but heavily altered land that parallel the trail. The dominant vegetation is reed canarygrass (*Phalaris arundinacea*), Himalayan blackberry (*Rubus armeniacus*), and other weedy species, with some trees also present along the trail. Adjacent land uses include commercial/industrial development, Willows Road NE, Overlake Christian Church, the Willows Run Golf Complex, and Sammamish Valley Park. The former railroad itself is currently an unimproved trail that will likely be improved in the future as part of the Eastside Rail Corridor.

2.3.2 Study Area – King County

Within King County, the study area is 2.9 acres (Figure 2-2). The small portion of the study area that runs through unincorporated King County is primarily located on railroad right-of-way land, just inside the Urban Growth Area (UGA) boundary. The King County study area is bounded on the north by NE 124th Street. The adjacent property to the east (Parcel 2726059145) is identified as an Agricultural Production District by King County. The study area includes the railroad bed and narrow bands of predominantly undeveloped but heavily altered land that parallel the trail. The study area includes portions of buildings and other development associated with the agricultural property. The dominant vegetation in the study area is reed canarygrass and other herbaceous weedy species. Adjacent land use to the west is transportation (Willows Road NE). The former railroad itself is currently an unimproved trail that will likely be improved in the future as part of the Eastside Rail Corridor.

2.3.3 Study Area – City of Kirkland

Within the City of Kirkland, the study area is 31.3 acres (Figure 2-3). It includes mostly developed land in an urban setting, with some undeveloped lands included or adjacent. In the developed areas, weedy species and planted trees are prevalent. Important undeveloped lands partially within the study area include the Totem Lake wetlands, the Heronfield wetlands, and a large wetland area east of Juanita High School. Adjacent land uses include agriculture east of the study area and north of NE 124 Street, commercial/industrial development on the north side of NE 124th Street and on both sides of the trail and near I-405, residential development west of I-405, and park/open space associated with Totem Lake and the Heronfield wetlands. The former railroad itself is part of the Cross Kirkland Corridor trail. Sections of the trail have undergone improvements or will be improved in the future.

2.4 Regulatory Information and Definitions – City of Redmond

Regulations pertaining to Critical Areas under the jurisdiction of Redmond can be found in the Redmond Zoning Code (RZC; Title 21 of the Redmond Municipal Code). Critical Areas Regulations are found in Section 21.64 of the RZC. Guidance on critical areas reporting is found in Appendix 1 (Critical Areas Reporting Requirements).

2.4.1 Wetlands

The RZC defines wetlands as follows, which is based on the U.S. Army Corps of Engineers (USACE) definition:

Areas that are inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands do not include those artificial wetlands intentionally created from non-wetland sites, including, but not limited to, irrigation and drainage ditches, grass-lined swales,

canals, detention facilities, wastewater treatment facilities, farm ponds, and landscape amenities, or those wetlands created after July 1, 1990 that were unintentionally created as a result of the construction of a road, street, or highway. Wetlands include those artificial wetlands intentionally created from non-wetland areas created to mitigate conversion of wetlands. (RZC 21.78)

According to RZC 21.64.030, wetlands must be rated and regulated according to the categories defined by the Washington State Department of Ecology (Ecology) *Wetland Rating System for Western Washington* (rating form; Washington Department of Ecology 2014). This system scores wetlands on the basis of their sensitivity to disturbance, the functions they provide, and whether they can be replaced. The four categories of wetlands are briefly described below:

Category I Wetlands that represent a unique or rare wetland type, are more sensitive to disturbance than most wetlands, are relatively undisturbed, and contain ecological attributes that are impossible to replace within a human lifetime, or provide a high level of functions. They include: 1) wetlands identified by scientists at the Washington Natural Heritage Program as high quality, relatively undisturbed wetlands, or wetlands that support state-listed threatened or endangered plants; 2) bogs; 3) mature and old-growth forested wetlands over 1 acre in size; or 4) wetlands that provide a very high level of functions, as evidenced by a score of 23 points or more on the rating form.

Category II Wetlands that provide high levels of some functions which are difficult to replace. They include wetlands scoring 20 to 22 point on the rating form that do not meet the criteria of Category I.

Category III Wetlands that provide a moderate level of functions. They are typically more disturbed and have less diversity or are more isolated from other natural resources in the landscape. They include wetlands scoring 16 to 19 points on the rating form that do not meet the criteria of Category I.

Category IV Wetlands that provide the lowest levels of functions. These wetlands score less than 16 points on the rating form.

2.4.2 Streams

Streams are defined as areas where surface waters produce a channel or bed, which need not contain water year-round. They do not include artificially created irrigation ditches, canals, storm or surface water runoff devices, other entirely artificial watercourses unless they are used by salmonids or created for the purposes of stream mitigation (RZC 21.78).

Riparian stream corridors are a subset of fish and wildlife habitat conservation areas. They include streams and adjacent riparian habitat (stream buffers). Riparian stream corridors contain elements of both aquatic and terrestrial ecosystems that mutually influence each other.

According to RZC 21.64.020, riparian stream corridors are categorized as follows:

Class I – Streams identified as “shorelines of the state” under the City of Redmond Shoreline Master Program.

Class II – Natural streams that are not Class I and are either perennial or intermittent and have salmonid fish use or the potential for salmonid fish use.

Class III – Natural streams that are not Class I or Class II and are either perennial or intermittent and have one of the following characteristics:

- Non-salmonid fish use or the potential for non-salmonid fish use;

- Headwater streams with a surface water connection to salmon-bearing or potentially salmon-bearing streams (Class I or II).

Class IV – Natural streams that are not Class I, Class II, or Class III. They are either perennial or intermittent, do not have fish or the potential for fish, and are non-headwater streams.

Intentionally Created – Manmade streams that do not include streams created as mitigation. Intentionally created streams are created through purposeful human action, such as irrigation and drainage ditches, grass-lined swales, and canals.

2.5 Regulatory Framework and Definitions – King County

In unincorporated King County, regulations pertaining to wetlands and streams are found in King County Code (KCC) Chapter 21A.24, Critical Areas.

2.5.1 Wetlands

The KCC definition of a wetland is based on the USACE definition, and is similar to the definition for the other jurisdictions covered by this report (see Section 2.4.1).

KCC 21A.24.318 classifies wetlands based on the 2004 version of the *Washington State Wetland Rating System for Western Washington* (Washington Department of Ecology 2004). The 2004 rating form has the same four categories of wetlands as those discussed in Section 2.4.1, but the point system is different:

Category I – Greater than 70 points

Category II – 51 to 69 points

Category III – 30 to 50 points

Category IV – less than 30 points.

2.5.2 Streams

King County regulates streams as aquatic areas, which include all non-wetland water features.

The KCC defines a stream as “an aquatic area where surface water produces a channel, not including a wholly artificial channel, unless it is: A) used by salmonids; or B) used to convey a stream that occurred naturally before construction of the artificial channel.”

According to KCC 21A.24.355, aquatic areas are categorized into the following types:

Type S – all aquatic areas inventoried as “shorelines of the state” under King County’s Shoreline Master Program.

Type F – all segments of aquatic areas that are not Type S waters and that contain fish or fish habitat, including waters diverted for use by a federal, state, or tribal fish hatchery from the point of diversion for 1,500 feet of the entire tributary if the tributary is highly significant for protection of downstream water quality.

Type N – all segments of aquatic areas that are not Type S or F waters and that are physically connected to Type S or F waters by an above-ground channel system, pipe or culvert, stream, or wetland.

Type O – all segments of aquatic areas that are not Type S, F, or N waters and that are not physically connected to Type S, F, or N waters by an aboveground channel system, pipe or culvert, stream, or wetland.

An aboveground channel system is considered to be present if the 100-year floodplains of both the contributing and receiving waters are connected. Under certain circumstances (as described in KCC 21A.24.355) an area upstream of a legal human-made barrier may be determined to not be fish habitat.

2.6 Regulatory Framework and Definitions – Kirkland

Within the City of Kirkland, regulations pertaining to wetlands and streams are found in Chapter 90 of the Kirkland Zoning Code (KZC).

2.6.1 Wetlands

The KZC defines wetlands based on the USACE definition (see Section 2.4.1).

The City of Kirkland requires wetlands to be classified and rated in accordance with the 2014 *Washington State Wetland Rating System for Western Washington*. See Section 2.4.1 for a discussion of the four categories of wetlands under this rating system.

2.6.2 Streams

KZC Chapter 5.895 defines streams as “areas where surface waters produce a defined channel or bed that demonstrates clear evidence of the passage of water, including but not limited to bedrock channels, gravel beds, sand and silt beds, and defined-channel swales. The channel or bed need not contain water year-round, provided there is evidence of at least intermittent flow during years of normal rainfall. Streams do not include irrigation ditches, canals, storm or surface water runoff devices, or other entirely artificial watercourses, unless they are used by salmonids or convey a naturally occurring stream that has been diverted into the artificial channel, or are created for the purposes of stream mitigation.”

According to KZC Chapter 5.898, streams are classified according to WAC 222-16-030, as amended:

Type F – Fish bearing. Segments of natural waters, which are within the bankfull widths of defined channels and periodically inundated areas of their associated wetlands, or within lakes, ponds, or impoundments having a surface area of 0.5 acre or greater at seasonal low water and which contain fish habitat pursuant to WAC 22-16-030, as amended.

Type Np – Perennial non-fish bearing. All segments of natural waters within the bankfull width of defined channels that are perennial nonfish habitat streams. Perennial streams are flowing waters that do not go dry any time of a year of normal rainfall and include the intermittent dry portions of the perennial channel below the uppermost point of perennial flow pursuant to WAC 222-16-030, as amended.

Type Ns – Seasonal non-fish bearing. All segments of natural waters within the bankfull width of the defined channels that are not Type F or Np waters. These are seasonal, nonfish habitat streams in which surface flow is not present for at least some portion of a year of normal rainfall and are not located downstream from any stream that is a Type Np water. Ns waters must be physically connected by an above-ground channel system to Type F or Np waters pursuant to WAC 222-16-030, as amended.

J:\DCS\Projects\ENV\Environmental\COMMON\PROJECTS\Puget Sound Energy 05570\Sammamish-Juanita Transmission Line\GIS\Figures\SJ Delineation\2-1 Redmond study area.mxd



**Puget Sound Energy
Sammamish-Juanita
Transmission Line
Wetland Delineation**
Redmond, Washington
Project No.: 60608044



-  Study Area (Redmond)
-  Jurisdictional Boundary

Figure 2-1
Redmond Study Area



**Puget Sound Energy
Sammamish-Juanita
Transmission Line
Wetland Delineation**
King County, Washington
Project No.: 60608044




-  Study Area (King County)
-  Jurisdictional Boundary
-  Urban Growth Area

Figure 2-2
King County Study Area

0 100 200 400
Feet



**Puget Sound Energy
Samamish-Juanita Transmission Line Wetland Delineation**

Kirkland, Washington
Project No.: 60608044

0 0.125 0.25 0.5
Miles



Study Area (Kirkland)
Jurisdictional Boundary

Figure 2-3

Kirkland Study Area

3.0 Methods

3.1 Background Review

AECOM conducted a review of background materials to obtain information about mapped and potential wetland and stream locations in the study area. These materials included the following:

- Digital aerial photos and topographic maps of the study area.
- King County GIS data, showing mapped wetlands, streams, and other critical areas, downloaded from the King County GIS Open Data (<https://gis-kingcounty.opendata.arcgis.com/>).
- The City of Kirkland Sensitive Areas map (http://www.kirklandwa.gov/Assets/IT/GIS/Sensitive+Areas+Map.pdf?_sm_au_=iVVP5FRLs5DqSHHS) and GIS data of Sensitive Areas obtained from the City at <http://inter.kirklandwa.gov/gisdata/AllData/>.
- City of Redmond GIS data and maps, available on-line at <https://www.redmond.gov/416/Maps-GIS>, and GIS data on wetlands obtained directly from the City of Redmond in August 2019.
- National Wetlands Inventory (NWI) GIS data (U.S. Fish and Wildlife Service 1977 to present).
- Custom Soil Resource Report for King County Area, Washington, generated from the U.S. Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) Web Soil Survey (<http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>; Appendix D).
- Washington Department of Fish and Wildlife (WDFW) data on Priority Habitats and Species (PHS) (WDFW 2019a), available on-line at <http://apps.wdfw.wa.gov/phsontheweb/>.
- Data on fish occurrence obtained on-line from WDFW SalmonScape (WDFW 2019b) (<http://apps.wdfw.wa.gov/salmonscape/>).
- Digital data on rare plant species element occurrences from the Washington Natural Heritage Program (Washington Natural Heritage Program 2019).
- Willows Road Culvert Replacement Critical Areas Report (Parametrix 2018).
- Sammamish Valley Park Wetland Delineation Report (The Watershed Company 2009).
- Environmental Determination for Willows Ridge Warehouse – Memorandum (City of Kirkland 2017).

3.2 Wetland Delineation

The *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (USACE 2010) was the primary reference manual for delineations conducted within the study area. This manual is a supplement to the *1987 Corps of Engineers Delineation Manual* (USACE 1987).

For all jurisdictions, the field survey methodology is broken into two sections: one describing the initial wetland delineation and mapping through 2017, and one describing new surveys and wetland

verification/redelineation surveys following changes in the proposed transmission line route and changes in site conditions. Photographs documenting wetland characteristics at the time of field surveys are included in Appendix A of this report. Complete field data forms can be found in Appendix B.

3.2.1 Field Evaluation – City of Redmond

Table 3.1 summarizes field surveys for wetlands within Redmond. The wetlands listed in the table are described in detail in Section 4.1.1. Data sheet numbers are given in parentheses, with additional information for sample plots provided in Appendix B and Appendix E.

Table 3.1. Redmond Wetland Survey Dates

Wetland	Initial Survey Date	Verification/Redelineation Date
R-A	6/4/14 (T1-SP1 to T2-SP3)	n/a – no longer in project area
R-B	5/9/14 (T3-SP1 to T3-SP4)	6/4/19 (SP-1 to SP-4)
R-C	6/29/16 (SP-F1, SP-F2)	n/a
R-D	6/29/16 (SP-D1, SP-D2)	n/a
R-E	6/28/16 (SP-B1 to SP-B4)	n/a
R-GCA ¹	n/a	n/a
R-GCB ¹	n/a	n/a
R-GCF ¹	n/a	n/a
¹ AECOM did not delineate the boundary of this wetland. Information was obtained from Parametrix 2018.		

3.2.1.1 Initial Wetland Delineation

The initial wetland delineation surveys occurred on May 19 and June 4, 2014, and June 28 and 29, 2016. Surveys were conducted to identify, delineate, categorize, and map wetlands in the study area. Additional information to support the information presented in this report was obtained during a May 6, 2015 reconnaissance of wetlands along the Willows Road rail corridor, and during an April 15, 2016 site visit to obtain supporting photographs and other information, and to determine boundaries of Cowardin classes (Cowardin et al. 1979).

Where feasible, biologists followed the instructions for a routine determination, as described in the *Corps Manual* (USACE 1987). In the study area located north of the Sammamish Substation, the site was divided into two sections based on the presence of a paved walkway that cuts through it. In the portion north and west of the walkway, a baseline was established along the road parallel to the stream channel and perpendicular to the hydrologic gradient. Two transects were run to the northwest, across the stream channel, located to capture the range of apparent plant community types in the study area. South and east of the walkway, a single transect was run northeast to southwest through the large stormwater detention feature. The decision was made to run the transect in this direction, rather than perpendicular to the stream channel, because of site conditions and accessibility issues. During previous reconnaissance of the area, biologists determined that the stream channel in this portion of the site is located within a manmade feature and is not hydrologically connected to the adjacent wetland. This transect ended at the path that runs roughly north-south through the site. No soil log holes were located in the upland triangle bounded by the paved walkway, the path, or the parking lot of the adjacent property. This area is a planted upland mitigation site with black sheeting in place to control weeds, and would be altered by digging holes.

Within the portion of the study area along Willows Road NE, wetlands were delineated following an initial reconnaissance to determine probable locations. During the initial reconnaissance, numerous soil probes were located on each side of the railroad bed to obtain information about soils and hydrology, and likely wetland locations were mapped. During the follow-up delineation biologists revisited the likely wetland locations and formally delineated the boundaries, filling out data forms for wetland and upland plots.

Wetland boundaries, as well as sample plots where data was collected, were flagged and numbered, and mapped with a Trimble Geo Explorer handheld GPS unit. Wetland flagging was professionally surveyed by DEA. In instances where survey data is incomplete or unavailable, GPS data obtained by the delineators has been used to as a backup.

Biologists also mapped the demarcation between wetland Cowardin classes in the field. This task was completed by hand drawing the observed boundary lines on high resolution aerial photos in the field and then digitizing these lines in GIS.

For areas where biologists did not have access to adjacent properties and it appeared that a wetland was likely to be present close enough to the project corridor for potential buffer impacts, biologists used aerial photographs, field observations of vegetation and standing water, and soil surveys to come up with “best professional judgment” offsite wetland boundaries, which were then digitized into GIS.

3.2.1.2 Wetland Verification/Redelineation

Wetland verification/redelineations occurred in on June 4, 2019. Field surveys focused on wetlands for which initial delineations occurred more than five years earlier, and in portions of the study area where site conditions have changed since the initial delineation. The wetland identified as R-A during an initial delineation in 2014 was not verified since the proposed project no longer has the potential to impact this wetland or its buffer. The southern and eastern edges of Wetland R-B were verified and documented with sample plots. For the portion of the study area along Willows Road NE, updates were not needed based on the initial wetland delineation date (2016). However, there is evidence that conditions in 2019 were much wetter than those during the initial delineations, likely as a result of a ditch-cleaning project that occurred in 2017 (described in Parametrix 2018). Therefore, biologists reinvestigated the full study area to confirm that no additional wetlands were present and that mapped boundaries were correct. Wetlands associated with Gun Club Creek were not delineated, as these wetlands were mapped as part of a separate project in 2017. Offsite wetlands with buffers extending into the study area were also reevaluated during the June 4, 2019 field survey. The boundary of the offsite wetland east of Wetland R-D was slightly modified based on observations of vegetation and review of high-resolution aerial photography.

3.2.2 Field Evaluation – King County

Table 3.2 summarizes field surveys for wetlands within King County. Data sheet numbers are given in parentheses, with additional information for the referenced sample plots provided in Appendix B and Appendix E.

Table 3.2. King County Wetland Survey Dates

Wetland	Initial Survey Date	Verification/Redelineation Date
KC-A	6/28/16 (SP-A1 to SP-A2)	n/a
KC-B	6/4/19 (SP-1 to SP-2)	n/a

3.2.2.1 Initial Wetland Delineation

Field surveys of the King County portion of the study area were conducted on April 15, 2016. Additional information to support the information presented in this report was obtained during a May 6, 2015 reconnaissance of wetlands along the Willows Road rail corridor. Wetland delineations followed the protocols and technical information provided in the *1987 Corps Manual* and the *2010 Regional Supplement*. Wetland boundaries and sample plots where data was collected were flagged and numbered with a Trimble Geo Explorer handheld GPS. Follow-up professional surveys were done by DEA.

Because of restrictions on accessing properties outside of the study area, delineations along Willows Road NE did not extend beyond the study area boundary. However, biologists investigated surrounding areas from within the corridor and used best professional judgment to determine whether wetlands were likely to be present in these areas. If biologists determined that an off-site wetland was likely to be present close enough to the project corridor for potential buffer impacts, they used aerial photographs, field observations of vegetation and standing water, and soil surveys to come up with approximate wetland boundaries, which were then digitized into GIS.

3.2.2.2 Wetland Verification/Redelineation

Because, the initial wetland delineation in unincorporated King County occurred in 2016, no update to the delineation was needed. However, given the apparent changes in site conditions since 2016, biologists walked the study corridor again on June 4, 2019 to confirm the findings of the previous delineation, focusing on areas with vegetation or hydrology that could indicate the presence of a wetland. One additional wetland was delineated, and other non-wetland areas were documented with sample plots.

3.2.3 Field Evaluation – City of Kirkland

Table 3.3 summarizes field surveys for wetlands within King County. Data sheet numbers are given in parentheses, with additional information for sample plots provided in Appendix B and Appendix E.

Table 3.3. Kirkland Wetland Survey Dates

Wetland	Initial Survey Date	Verification/Redelineation Date
K-AA	4/15/16 (SP500 to SP502)	n/a (no longer in project area)
K-BB	4/15/16 (SP502 to SP504)	n/a (no longer in project area)
K-A	4/16/14 (SP-1, SP-2)	n/a (no longer in project area)
K-B	10/22/17 (SP-KB1, SP-KB2)	7/1/19 (SE boundary confirmed)
K-C	10/22/17 (SP-KC1, SP-KC2)	n/a
K-D	4/16/14 (SP3, SP4)	6/4/19 (SP-KD1, SP-KD2, SP-3, SP-4)
K-DD	6/4/19 (SP-KDD1, SP-KDD2)	n/a
K-E	10/22/17 (SP-KE1, SP-KE2)	n/a
K-F	4/17/14 (SP5); 10/22/17 (SP-KF1)	6/4/19 (SP-KF1 to SP-KF2)
K-G	4/17/14 (SP6, SP7); 11/6/17 (SP-KG1, SP-KG2)	6/4/19 (SP-KG1 to SP-KG2)
K-H	4/17/14 (SP8)	6/4/19 (SP-8)
K-J	4/17/14 (SP9); 10/24/17 (SP-KJ1)	6/4/19 (SP-KJ2)
K-K	4/17/14 (SP10); 10/24/17 (SP-KK1)	6/4/19 (SP-KK1 to SP-KK4, SP-10)
K-L	6/6/14 (T1-SP1, T1-SP2, T2-SP1, T2SP2)	6/20/19 (KL-SP1 to KL-SP4)
K-HF	6/20/19 (SP-1 to SP-2)	n/a

3.2.3.1 Initial Wetland Delineation

Field surveys of the Kirkland portion of the study area were conducted on April 14 through 18, 2014, June 6, 2014, June 18, 2015, August 21, 2015, April 15, 2016, October 20, 22, and 24, 2017, and November 6, 2017. Surveys were conducted to identify, delineate, categorize, and map wetlands and streams in the study area. The study area does not include two sections of the proposed transmission line corridor (along NE 124th Street and NE 128th Street; see Figure 2-3). In these areas the project will occur within the street right-of-way either in pavement or in the street landscaping strip, and PSE determined that a wetland/stream survey was not necessary. Additionally, AECOM did not have permission to survey the section between Willows Road NE and the Kirkland rail corridor (Parcels 2726059008 and 2726059143). Information provided in a SEPA checklist for a proposed project on Parcel 2726059008, indicates that no wetlands or streams occur in this area.

Because of the linear nature of the study area, wetlands were generally delineated along a single transect line. However, in many situations, a second transect line was necessary in order to document wetlands on both sides of a central upland area (such as the railroad corridor). Much of the study area has been altered by development. Many of the wetlands are located in man-made features, such as ditches. In some cases, digging holes to document the soil was problematic because of the rock fill present along the former railroad. Therefore, biologists used site topography to assist with wetland delineations, as appropriate.

Wetland and stream boundaries, as well as sample plots where data was collected, were flagged and numbered, and mapped with a Trimble Geo Explorer handheld GPS unit. Flagged wetland boundaries were then professionally surveyed by DEA. The figures presented in this report utilize the professionally surveyed data provided by DEA. Biologists also mapped the demarcation between wetland Cowardin classes, where applicable and appropriate.

3.2.3.2 Wetland Verification/Redelineation

Biologists revisited the Kirkland study area and verified the boundaries of wetlands mapped in 2014. Because the planned transmission line route has changed since 2017, wetlands that no longer have the potential to be impacted by the proposed project were not verified (Wetlands K-AA, K-BB, and K-A). However, new sections of the route were surveyed for wetlands. These include the west edge of the Heronfield Wetlands and the Totem Lake Substation parcel. Additionally, information about a stream on a privately owned parcel (2726059106) was estimated from an adjacent property.

3.3 Wetland Rating

Wetlands encountered and mapped during field surveys were mapped using the *Washington State Wetland Rating System for Wetland Washington*. For wetlands in Redmond and Kirkland, the 2014 update to the rating system (Washington Department of Ecology 2014) was used, and for wetlands in areas under the jurisdiction of King County, the 2004 version of the rating system (Washington Department of Ecology 2004) was used, in accordance with the KCC. Biologists completed as much of the rating forms as possible in the field, with sections requiring desktop review completed at a later date using GIS and other tools to obtain additional information. The completed rating forms were used to determine a category for each wetland. In the case of large wetlands where biologists were only able to access a small portion in the field, rating forms were completed using all available information and best professional judgment.

Site visits to rate the Redmond wetlands occurred on April 15, June 28, and June 29, 2016. Site visits to rate the King County wetlands occurred on April 15 and June 28, 2016, and June 4, 2019. Site visits to rate the Kirkland wetlands occurred on July 25, 2016 and June 20, 2019. The completed wetland rating forms are provided in Appendix C.

3.4 Stream Survey and Rating

In all jurisdictions, stream boundaries were delineated using physical characteristics to determine the OHWM, based on guidance from Ecology (Anderson et al. 2016) and USACE (2005). Project site stream boundaries and associated OHWMs were determined in the field using observations of matted, bent, or absent vegetation; scour marks; presence of bed and bank; and changes in the plant community.

The OHWMs of streams encountered during field surveys were flagged and numbered, and mapped with the Trimble GPS unit. Following field surveys, the streams were professionally surveyed by DEA.

Streams were initially mapped at the same time as wetland boundaries. During verification/redelineation surveys in 2019, biologists confirmed the mapped locations of streams, adjusting the boundaries as needed. In Redmond, biologists met with Tom Hardy, the City's stream and habitat planner, to obtain additional information about some streams that were initially determined to be non-fish bearing drainage ditches based on the lack of a defined channel and the lack of water during site visits. Following the April 8, 2019 site visit,

AECOM mapped additional streams based on direction from the City. These streams were mapped using GPS but not flagged for follow-up survey. Table 3.4 summarizes field mapping of streams within the study area.

In all jurisdictions, mapped streams were categorized in accordance with the jurisdiction-specific rating instructions presented earlier in this section.

Table 3.4. Stream Survey Dates

Stream	Initial Survey Date	Verification/Redelineation Date
Redmond		
Gun Club Creek	4/15/16	4/8/19 (portion along Willows Creek)
Stream R-2	6/29/16	4/8/19 (extended)
Stream R-3	4/8/19	n/a
York Creek	4/8/19	n/a
124 th Street Stream	4/8/19	n/a
King County		
Stream KC-1	6/28/16	6/4/19
124 th Street Stream	4/8/19	n/a
Kirkland		
Stream K-1	4/15/16	n/a (no longer in project area)
Stream K-2	4/15/16	n/a (no longer in project area)
Stream K-3	10/20/17	6/20/19
Stream K-5	6/6/14	6/20/19
Stream K-6	6/4/19	n/a
Stream K-7	7/1/19	n/a

4.0 Results of Background Review

4.1 City of Redmond

4.1.1 Wetlands

As discussed in Section 3.1, background data reviewed to determine existing mapping of wetlands within the study corridor includes NWI data and maps/GIS data obtained from the City of Redmond website.

According to the City's mapping and GIS data (Figure 4-1), wetlands cross the project corridor at four locations, and the area adjacent to the rail corridor to the east contains a mixture of wetlands and uplands.

Figure 4-1 shows the NWI data for the site. No wetlands are mapped within the study area. However, a large PEM wetland is depicted just east of the study area for most of its length along Willows Road NE.

4.1.2 Streams

Redmond has mapped several locations where streams occur within the study area (Figure 4-1). Gun Club Creek, mapped as a Class III stream, is shown running north of the Sammamish Substation, under Willows Road, and for a short distance parallel to and along the east side of Willows Road. Adjacent to the golf course property, two unnamed Class III streams are mapped running east-west within the study area, with short segments on both sides of the trail, and continuing into the golf course property for a short distance before ending. Just north of NE 116th Street, a Class III stream (York Creek) is mapped running along the east edge of the study area, with a small segment of the stream running east-west under the trail. At the north end of the Redmond portion of the study area, another Class III stream (124th Street Stream) is mapped running north-south on the west side of the trail. WDFW SalmonScape shows Gun Club Creek as a perennial stream within the study area, as well as five intermittent/ephemeral streams that flow east-west across the study area, all of which have a surface water connection to the Sammamish River. Only one of these five streams corresponds with a stream shown on the Redmond GIS mapping.

4.1.3 Soils

The NRCS has mapped six soil map units within the Redmond study area (see Appendix D; USDA NRCS 2019a). Indianola loamy sands (0 to 15 percent slopes) make up the majority (72.4 percent) of the Redmond study area. They are mapped north of the substation, adjacent to the golf course property, and adjacent to a portion of Sammamish Valley Park. These soils occur on sandy glacial outwash moraines, and are somewhat excessively drained with no flooding or ponding. Included within this map unit are 8 percent Alderwood soils, 5 percent Everett soils, and 2 percent Norma soils (in depressions and drainageways).

Alderwood gravelly sandy loams (8 to 15 percent slopes and 15 to 30 percent slopes) are mapped over 16.7 percent of the Redmond study area, at the northwest corner of the Sammamish Substation and at various locations along the rail corridor in the vicinity of NE 116th Street. These soils occur on moraines and till plains, and have formed over basal till with some volcanic ash. They are moderately well drained, and have a low frequency of flooding and ponding. Alderwood gravelly sandy loams are generally considered upland soils, but where they occur in topographic depressions, they may have a component of hydric soils. Included with this map unit are 5 percent Indianola soils, 5 percent Everett soils, 3 percent Shalcar soils and 2 percent Norma soils. The Shalcar and Norma series occur in depressions and are considered hydric soils.

Earlmont silt loams are mapped over 10.2 percent of the Redmond study area. They are mapped near the south end of the study area on the east side of Willows Road NE. These soils occur in floodplains on

diatomaceous earth. They are somewhat poorly drained and occasionally flooded, and are considered hydric soils. Included in this map unit are 10 percent Snohomish variant soils, 1 percent Seattle soils, 1 percent Tukwila soils, and 1 percent Sultan soils. All of these inclusions, with the exception of the Sultan series, are hydric soils that occur in depressions.

A very small percentage (0.7 percent) of the Redmond study area, at its northern end, is mapped as Tukwila muck. These soils occur on floodplains and have formed over herbaceous organic material. They are very poorly drained and ponding is frequent. They are considered hydric soils, and have minor components of three other hydric soil series: Seattle, Bellingham, and Norma.

4.1.4 Priority Habitats and Species

According to WDFW's PHS database (WDFW 2019a), no priority species occur within the portion of the study corridor under Redmond jurisdiction, although a Coho salmon breeding area is mapped in adjacent Willows Creek, which is shown with a hydrologic connection to Gun Club Creek. The only priority habitat mapped in the vicinity of the study corridor is a freshwater emergent wetland just east of the study area.

According to WDFW SalmonScape, modeled fish presence has been mapped in one stream in the Redmond study area (WDFW 2019b). However, this stream, which is shown as an intermittent stream spanning both sides of Willows Road NE, is not shown east of Willows Road NE on the Redmond stream map. Fall Chinook (*Oncorhynchus tshawytscha*), coho (*O. kisutch*), winter steelhead (*O. mykiss*), and sockeye salmon (*O. nerka*) have all been modeled as occurring in this section of stream, based on its location in relation to known species presence and stream gradient. The modeling does not factor in habitat quality, flow, or any other natural or human-caused condition that would otherwise prevent habitat use.

According to Redmond's Fish and Wildlife Habitat Conservation Areas map (City of Redmond 2005), the area along Gun Club Creek west of Willows Road NE has been designated as a Native Growth Protection Easement. Additionally, the study area abuts a Transfer Development Rights Easement (Sammamish Valley Park).

There are no rare plant species or rare/high quality ecological communities mapped within the Redmond study area by the Washington Natural Heritage Program (2019).

4.2 Unincorporated King County

4.2.1 Wetlands

Based on data shown in King County iMap and GIS data layers, no wetlands have been mapped in the study area within unincorporated King County.

4.2.2 Streams

King County GIS data layers show the presence of three connected stream channels within the study area in unincorporated King County (Figure 4-2). One runs north-south on the east side of the railroad bed/trail and appears to receive water from the West side of Willows Road. A second stream flows east from this channel and into the adjacent agricultural property. It is shown as curving up to the north in the direction of NE 124th Street, where it meets up with a third channel that is mapped as a straight east-west channel south of NE 124th Street, and ends just inside the study area. In iMap this stream is shown as running north-south for about 200 feet within the northern portion of the study area before heading east and back up to NE 124th Street. WDFW SalmonScape (WDFW 2017b) has different mapping of streams within the King County portion of the study area. Only one intermittent/perennial stream is shown in the study area vicinity. However, it is shown crossing the study area to the south, in the area under Redmond jurisdiction (see Section 4.1.2), and then flowing north into the agricultural property. It is mapped as coming within 30 feet of the King County study area boundary.

4.2.3 Soils

The NRCS has mapped two soil map units within the unincorporated King County portion of the study area (see Appendix D; USDA NRCS 2019b). Tukwila muck is mapped over 93 percent of the area, with just a small section in the northern end mapped as Earlmont silt loams. Tukwila muck soils occur on floodplains and have formed over herbaceous organic material. They are very poorly drained and ponding is frequent. They are considered hydric soils, and have minor components of three other hydric soil series: Seattle, Bellingham, and Norma. Earlmont silt loam soils occur in floodplains on diatomaceous earth. They are somewhat poorly drained and occasionally flooded, and are considered hydric soils. Included in this map unit are 10 percent Snohomish variant soils, 1 percent Seattle soils, 1 percent Tukwila soils, and 1 percent Sultan soils.

4.2.4 Priority Habitats and Species

According to WDFW's PHS database, no priority habitats occur in or near the portion of the study corridor under King County jurisdiction (WDFW 2019a). The closest salmon-bearing streams are shown within the agricultural property approximately 950 feet to the east of the study area, and north of NE 124th Street, in Kirkland.

WDFW SalmonScape (WDFW 2019b) does not show mapped salmonid fish distribution within the King County portion of the study area. The stream mapped just east of the study area indicates modeled presence of fall Chinook and coho salmon, winter steelhead trout, and sockeye salmon. The nearest section of stream mapped with modeled presence of salmonids is approximately 70 feet from the study area boundary.

There are no rare plant species or rare/high quality ecological communities mapped within the King County study area by the Washington Natural Heritage Program (2019).

4.3 City of Kirkland

4.3.1 Wetlands

As discussed in Section 3.1, background data reviewed to determine existing mapping of wetlands within the study corridor includes the Kirkland sensitive areas map/GIS data and NWI data.

Kirkland GIS mapping shows a large wetland that stretches roughly east-west between Juanita High School and I-405 (Figure 4-3). Another large wetland (the Heronfield wetlands) is mapped south of 124th Street, the northwest tip of which intersects the study area. Another large wetland is mapped at Totem Lake Park, which intersects the study area between 124th Avenue NE and 128th Lane NE. Numerous smaller wetlands are mapped on both sides of the Cross Kirkland Corridor trail at various locations within the study area.

NWI data shows PFO and PSS wetlands that roughly correlate to the Kirkland-mapped Juanita Creek wetland, and a complex of wetland types in the vicinity of Totem Lake and at the Heronfield wetlands, with a coverage similar to the Kirkland GIS mapping. The wetland on the opposite side of the railroad bed from the Totem Lake wetlands is mapped adjacent to the Kirkland-mapped wetland. The smaller wetlands mapped by Kirkland on both sides of the railroad bed do not show up on NWI maps for the area.

4.3.2 Streams

Kirkland sensitive areas GIS data shows three mapped stream channels associated with the study area (Figure 4-3). Two streams are unnamed tributaries that drain into the Totem Lake wetland complex. A third stream is an unnamed tributary that runs east-west through the project corridor in the vicinity of Juanita High School and drains into Juanita Creek about 0.6 mile downstream of the study area. This stream connects to a fourth stream, which runs north-south along the edge/just outside of the study area along portions of 109th

Court NE and 108th Court NE, crossing NE 124th Street. SalmonScape (WDFW 2019b) has a different mapping of streams, showing longer intermittent water courses in the study area. At the east end of the Kirkland study area, an intermittent stream runs along the east side of the Willows Road rail corridor, curving to the east on the north side of NE 124th Street, and eventually flowing into the Sammamish River. Several additional intermittent surface water connections to the Sammamish River are also shown. A second intermittent stream is shown connecting to the first channel and running roughly east-west through the study area. This channel is mapped crossing over to the north side of the Cross Kirkland Corridor trail, and connecting with the Totem Lake wetlands. A third intermittent stream channel crosses the study area in the vicinity of Juanita High School, connecting the large wetland complex in this area with Juanita Creek east of the study area. A fourth intermittent stream channel connects to this channel, running north-south with a slightly different mapping than Kirkland's, and connecting to Heronfield wetlands.

4.3.3 Soils

The NRCS has mapped six soil map units within the Kirkland study area (see Appendix D; USDA NRCS 2019c). Kitsap silt loam, 2 to 8 percent slopes, makes up 66 percent of the study area. This map unit occurs on terraces, and has a parent material of lacustrine deposits. These soils are moderately well drained upland soils, with no flooding or ponding. Minor components include 10 percent Alderwood soils, and 1 percent each of Bellingham, Tukwila, and Seattle soil series. The latter three soils occur in depressions and are considered hydric soils.

Everett very gravelly sandy loams, 8 to 15 percent slopes, occur over 11.0 percent of the study area, at the northwest end near the Juanita Substation and the Juanita High School. They are upland soils that occur on kames, eskers, and moraines, are somewhat excessively drained, and have no ponding or flooding. Minor components include 10 percent each of the Alderwood and Indianola soil series, both of which are upland soils.

Alderwood gravelly sandy loams (8 to 15 percent slopes and 15 to 30 percent slopes) are mapped over 6.7 percent of the Kirkland study area. These soils occur on moraines and till plains, and have formed over basal till with some volcanic ash. They are moderately well drained, and have a low frequency of flooding and ponding. Alderwood gravelly sandy loams are generally considered upland soils, but where they occur in topographic depressions, they may have a component of hydric soils. Included with this map unit are 5 percent Indianola soils, 5 percent Everett soils, 3 percent Shalcar soils and 2 percent Norma soils. The Shalcar and Norma series occur in depressions and are considered hydric soils.

Earlmont silt loam soils occur over 6.1 percent of the study area, at its eastern corner, near the boundary with unincorporated King County. These soils occur on floodplains and have a parent material of diatomaceous earth. They are somewhat poorly drained and occasionally flooded, and are considered hydric soils. Included in this map unit are 10 percent Snohomish variant soils, 1 percent Seattle soils, 1 percent Tukwila soils, and 1 percent Sultan soils. All of these inclusions, with the exception of the Sultan series, are hydric soils that occur in depressions.

Indianola loamy sands (5 to 15 percent slopes) make up 5.8 percent of the Kirkland study area. They occur on sandy glacial outwash moraines, and are somewhat excessively drained with no flooding or ponding. Included within this map unit are 8 percent Alderwood soils, 5 percent Everett soils, and 2 percent Norma soils (in depressions and drainageways).

Seattle muck soils occur over a small portion of the study area (4.5 percent), and are mapped in the vicinity of Totem Lake and the Heronfield wetlands. They are hydric soils that occur in depressions and form over organic parent material. They are very poorly drained, and have frequent ponding.

4.3.4 Priority Habitats and Species

According to WDFW's PHS database, three priority habitats/species occur within the Kirkland portion of the study corridor. These include two large wetland areas between Juanita High School and I-405 (called the Lake Washington Wetlands by PHS), the Heronfield wetlands (also called Lake Washington Wetlands by PHS), and the wetlands associated with Totem Lake, all of which include small portions of the study area. The PHS data does not show any salmon-bearing streams are shown within the study area vicinity.

According to WDFW SalmonScope, there is one mapped salmon-bearing stream within the project area vicinity in Kirkland. This intermittent stream has been mapped at the east end of the Kirkland portion of the study area, running roughly north-south adjacent to the former railroad on its east side. This stream channel curves to the east along the north side of NE 124th Street and meets up with the Sammamish River. SalmonScope indicates documented presence of winter steelhead and sockeye salmon. No other streams within the Kirkland portion of the study area have been mapped as salmon-bearing.

There are no rare plant species or rare/high quality ecological communities mapped within the Kirkland study area by the Washington Natural Heritage Program (2019).

4.4 Climatic Conditions

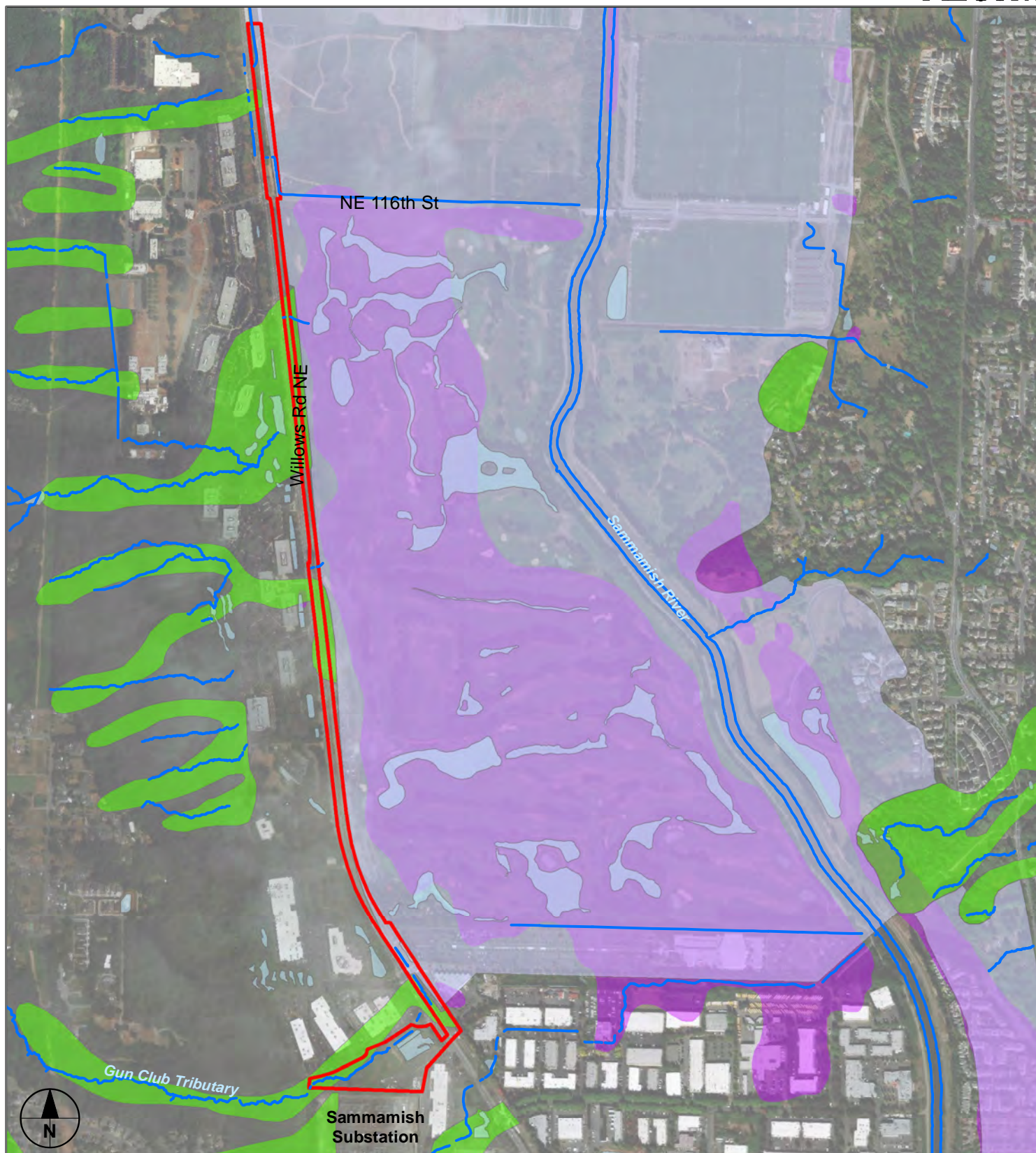
The average air temperature for the region during the dates when wetland and stream delineations were conducted ranged from 41 to 66 °F, with daytime highs ranging from 46 to 78 °F (Table 4.1; Weather Underground 2017a). Wetland delineations were predominantly conducted during the growing season.

Table 4.1. Climatic Conditions for Wetland and Stream Delineation Dates

Date	Average Temp	Daytime High	Precipitation Amount
April 14, 2014	56	70	0.00
April 16, 2014	52	55	0.41
April 17, 2014	52	57	0.70
April 18, 2014	52	60	0.00
May 19, 2014	62	71	0.00
June 4, 2014	60	68	0.00
June 6, 2014	65	78	0.00
April 15, 2016	54	60	0.00
June 28, 2016	66	79	0.00
June 29, 2016	65	73	0.00
October 20, 2017	48	54	0.11
October 22, 2017	55	61	0.06
October 24, 2017	56	66	0.00
November 6, 2017	41	46	0.00
April 8, 2019	54	62	0.00
June 4, 2019	62	73	0.00
June 20, 2019	70	60	0.41
July 1, 2019	81	70	0.00
Source: Weather Underground 2019a			
Note: Table includes only the subset of field survey dates during which delineations were conducted.			

Precipitation was recorded on five delineation dates: 0.41 inches on April 16, 2014, 0.70 inches on April 17, 2014, 0.11 inches on October 20, 2017, 0.06 inches on October 22, 2017, and 0.41 inches on July 1, 2019 (Weather Underground 2019a). Based on historical weather data, regional precipitation recorded during April 2014, June 2016, and October 2017 was 0.2 to 1.61 inches greater than average, depending on the

month. Regional precipitation recorded during June 2019, May 2014, and April 2016 was 0.67 to 1.38 inches lower than average, depending on the month (Weather Underground 2019b). Therefore, wetland delineations were spread out over a range of conditions with respect to precipitation.



0 250 500 1,000
Feet

**Puget Sound Energy
Sammamish-Juanita
Transmission Line
Wetland Delineation**
Redmond, Washington
Project No.: 60608044

- Study Area (Redmond)
- City-mapped Wetlands
- City-mapped Streams
- City-mapped Ponds
- NWI Wetlands
- City-mapped Wetland/Upland Mix

Figure 4-1
**City of Redmond
Wetland and Stream Mapping**



**Puget Sound Energy
Samamish-Juanita
Transmission Line
Wetland Delineation**

King County, Washington
Project No.: 60608044



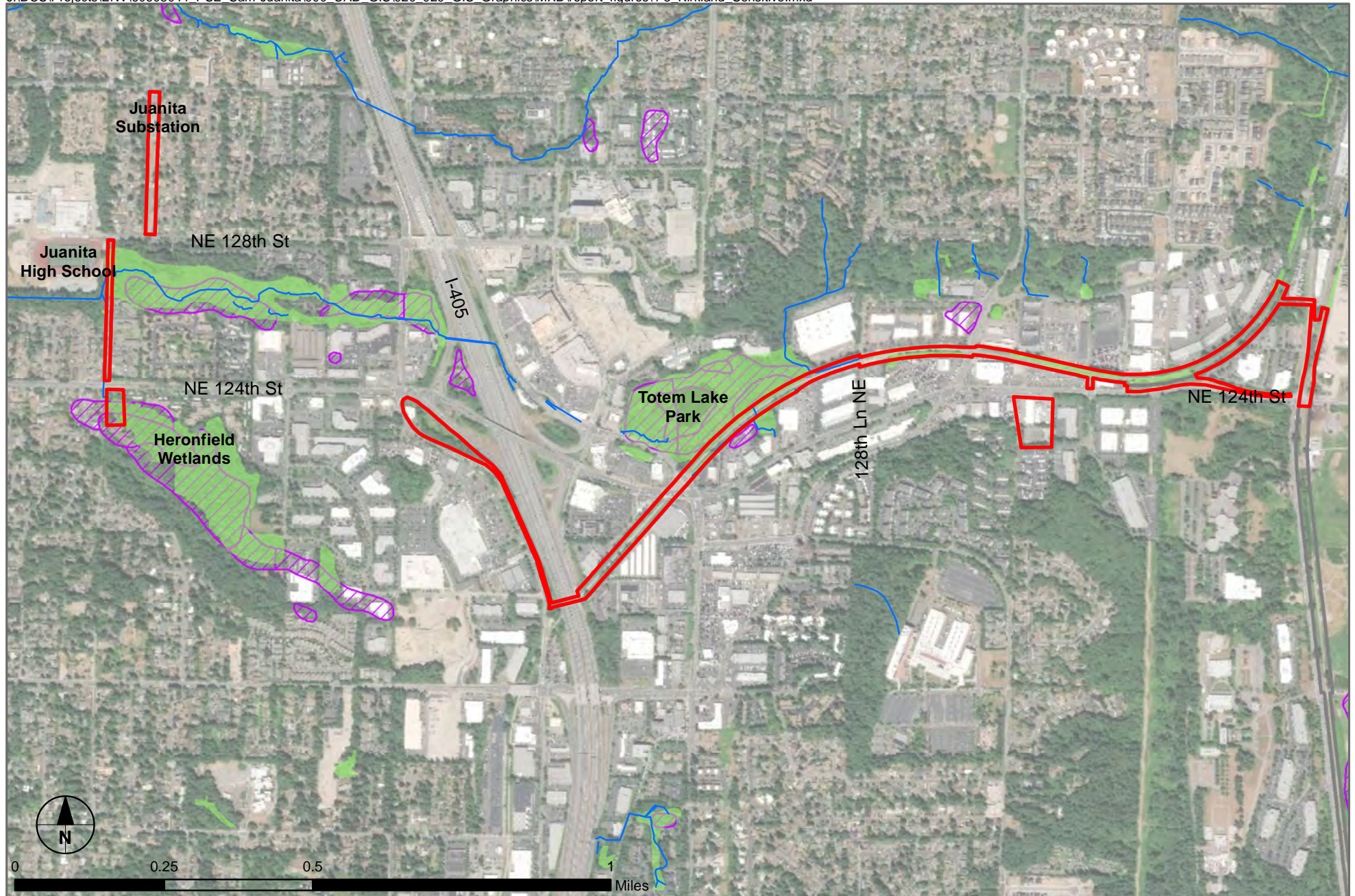
Study Area (King County)



County-mapped Streams

0 100 200 400
Feet

Figure 4-2
**King County
Wetland and Stream Mapping**



**Puget Sound Energy
Samamish-Juanita Transmission Line
Wetland Delineation**

Kirkland, Washington
Project No.: 60608044



Study Area (Kirkland)



City-mapped Streams



NWI Wetlands



City-mapped Wetlands

**Figure 4-3
City of Kirkland
Wetland and Stream Mapping**

5.0 Results of Field Evaluations – City of Redmond

5.1 Overview

Figures 5-1 and 5-2 provide an overview of the wetlands and streams that were delineated within the portions of the project study that are under the Redmond's jurisdiction. Figures 5-3 through 5-10 show detailed information pertaining to site wetlands, including wetland and stream locations, topographic contours, and regulatory buffers. Cowardin classes for these wetlands are shown on maps accompanying the rating forms in Appendix C. A total of 18 sample plots were investigated during the initial field study to characterize the upland and wetland conditions within the study area, with an additional 6 sample plots investigated during the verification/redelineation. Appendix E provides a summary of information for each sample plot, which includes documented findings pertaining to vegetation, soils, and hydrology. The locations of sample plots are shown on Figures 5-3 through 5-10. Additional information can be found on the field data forms in Appendix B and on the wetland rating forms in Appendix C. A functional assessment of the wetlands is provided in Appendix F.

As a result of field evaluations conducted during May and June 2014, June 2016, and June 2019, five wetlands have been mapped within the Redmond portions of the project study area: Wetlands R-A through R-E. Additionally, five streams have been mapped. They are discussed further in the sections that follow.

Three wetlands associated with Gun Club Creek were delineated by Parametrix in November 2017. These wetlands are included in maps and summary tables in this report as Wetlands K-GCA, K-GCB, and K-GCF. Detailed descriptions of these wetlands and associated data can be found in the Willows Road Culvert Replacement Critical Areas Report (Parametrix 2018).

5.2 Wetlands

5.2.1 Wetland R-A

Wetland R-A is a linear PEM/PSS/PFO riverine wetland located along the Gun Club Tributary (Section 5.3.1; Figure 5-3). It is approximately 0.3 acre in size. The wetland appears to receive water from overbank flow from the stream channel, which runs roughly west to east. Based on the rating form, Wetland R-A is a Category II wetland (scoring 21 points). It generally provides high levels of water quality functions and moderate levels of hydrologic and habitat functions. A more detailed discussion of wetland functions can be found in Appendix F.

Vegetation. The vegetation in wetland R-A consists primarily of trees and tall shrubs, with some small PEM areas. Trees overhang the stream channel along much of the wetland's length. The dominant tree species are red alder (*Alnus rubra*) and Pacific willow (*Salix lucida* ssp. *lasiantha*). Trees and shrubs in the understory include Sitka willow (*S. sitchensis*), Pacific ninebark (*Physocarpus capitatus*), salmonberry (*Rubus spectabilis*), and redosier dogwood (*Cornus sericea*), with some Himalayan blackberry. In PSS areas, the same shrub species are prevalent, with rose (*Rosa* sp.) also present in some areas. Along the southern edge of the wetland, shrubs are dense and nearly impenetrable in places. Common herbaceous species in the wetland include slough sedge (*Carex obnupta*), reed canarygrass (except in the most shaded areas), American skunk cabbage (*Lysichiton americanus*), and American speedwell (*Veronica americana*). In wetter areas, common duckweed (*Lemna minor*), water parsley (*Oenanthe sarmentosa*), and watercress (*Nasturtium officinale*) were observed. In open emergent areas, reed canarygrass is the dominant species. Himalayan blackberry is found in scattered areas throughout the wetland.

Soils. At both wetland sample plots for this wetland (T1-SP2 and T2-SP2), soils did not meet any of the normal indicators for hydric soils. However, based on the smooth, greasy feel of the soils, the problematic

hydric soil indicator 2cm Muck (A10) was selected. These sample plots were located waterward of the OHWM.

Hydrology. The predominant hydroperiod in this wetland is saturated, with a few areas that are occasionally flooded. At wetland Sample Plots T1-SP2 and T2-SP2, soil was saturated to the surface and the water table was observed within 16 inches. Therefore, the wetland hydrology indicator Saturation (A3) is present at both locations.

5.2.2 Wetland R-B

Wetland R-B is a PEM/PSS depressional wetland that has developed within a manmade stormwater retention feature (Figure 5-4). A rock wall has been built on the north and east sides of the wetland, and the south and west sides are bermed up with fill. There is no apparent outlet to this wetland, which appears to have been designed to retain water from upslope areas. Based on the rating form, Wetland R-B is a Category II wetland (scoring 20 points). It generally provides moderate levels of water quality, hydrologic, and habitat functions. A more detailed discussion of wetland functions can be found in Appendix F.

Vegetation. The wetland is primarily PEM, with a component of PSS vegetation along its outer edge. Much of the emergent vegetation is in standing water. The dominant species are common spikerush (*Eleocharis palustris*), common rush (*Juncus effusus*), and marshpepper knotweed (*Polygonum hydropiper*), with reed canarygrass present at the drier fringes of the wetland. There are also scattered willows within the emergent portion of the wetland. The most common species within the PSS component of the wetland are Scouler's willow (*Salix scouleriana*), Pacific willow, rose spirea (*Spirea douglasii*), and redosier dogwood. Transmission lines run directly over this wetland, and there is evidence of vegetation maintenance to remove/cut the larger trees.

Soils. At the initial wetland sample plot for this wetland (T3-SP2) soils from 0 to 2 inches were black (10YR 2/1) and high in organic content (roots). From 2 to 7 inches, soils were dark gray (7.5YR 4/1) loamy sands with 5 percent redox concentrations. A strong hydrogen sulfide odor was observed when the soils were disturbed. Biologists could not dig any farther than 7 inches because of the 4 inches of standing water at the sample plot location. The hydric soil determination was made on the basis of the Hydrogen Sulfide (A4) indicator. During the verification/redelineation, at one of the wetland sample plots (SP-2) soils from 0 to 5 inches were very dark gray (10YR 3/1) silt loams. From 5 to 11 inches, dark grayish brown (10YR 4/2) sandy loams with 10 percent gravel were observed, with 5 percent redox concentrations. Below 11 inches, a depleted gray to grayish brown matrix was observed, with 30 percent redox concentrations. The hydric soil determination was made on the basis of the Depleted Matrix (F3) indicator. At wetland sample plot SP-3, similar conditions were observed, with very dark grayish brown sandy loams (10YR 3/2) from 0 to 5 inches, dark grayish brown (2.5Y 4/2) sandy loams with 15 percent redox concentrations and 3 percent depletions from 5-11 inches, and brown (10YR 4/3) sandy loams with 15 percent redox concentrations from 11-16 inches, and dark grayish brown (2.5Y 4/2) loamy fine sands with 15 percent redox concentrations and 3 percent depletions from 16 to 18 inches. These soils also met the criteria for the Depleted Matrix (F3) hydric soil indicator.

Hydrology. Much of the wetland is permanently flooded with standing water, but it is not as frequently flooded along the north and south edges, where occasionally flooded and seasonally flooded areas were observed. At the initial wetland sample plot (T3 SP2), 4 inches of surface water were observed. Therefore, the Surface Water (A1) primary indicator of wetland hydrology was observed. During the verification/redelineation, no standing water, saturated soils were observed at either wetland sample plot. At sample plot SP-2, the Algal Mat or Crust (B4) primary indicator was observed, as well as secondary indicators Water-Stained Leaves (B9), Geomorphic Position (D2), and FAC-Neutral Test (D5). Similar conditions were observed at sample plot SP-3, with the Sparsely Vegetated Concave Surface (B8) primary indicator also observed.

5.2.3 Wetland R-C

Wetland R-C is a very small PEM wetland located in a ditch between Willows Road NE and the former railroad embankment (Figure 5-6). The entire wetland occurs in the survey corridor. Wetland R-C has a depressional hydrogeomorphic (HGM) class. Based on the rating form, Wetland R-C is a Category III wetland (scoring 16 points). It provides moderate levels of water quality and hydrologic functions and low levels of habitat functions. A more detailed discussion of wetland functions can be found in Appendix F. There is evidence that this wetland receives regular vegetation maintenance, given its location adjacent to Willows Road NE.

Vegetation. The dominant vegetation is reed canarygrass, with lesser amounts of giant horsetail (*Equisetum telmateia*), climbing nightshade (*Solanum dulcamara*), and stinging nettle (*Urtica dioica*).

Soils. Soils observed in the wetland (Sample Plot SP-F1) had a layer of sandy sediment approximately 8 inches deep over black (10YR 2/1) organic muck. It met hydric soil indicators Histic Epipedon (A2) and Hydrogen Sulfide (A4).

Hydrology. The primary source of hydrology is channelized flow that enters the wetland through a culvert under Willows Road NE. Water leaves the wetland through a culvert under the former railroad embankment and enters a seasonal stream. The water table was at the surface at the time of the site visit on June 29, 2016. Ponding was observed on May 6, 2015. The dominant hydroperiod is seasonally flooded. Primary wetland hydrology indicators High Water Table (A2) and Saturation (A3) were observed.

5.2.4 Wetland R-D

Wetland R-D is a small linear PEM wetland located in a ditch between Willows Road NE and the former railroad embankment (Figure 5-8). The entire wetland occurs in the study area. Wetland R-D has a depressional HGM class. Based on the rating form, Wetland R-D is a Category III wetland (scoring 16 points). It provides moderate levels of water quality and hydrologic functions and low levels of habitat functions. A more detailed discussion of wetland functions can be found in Appendix F. There is evidence that this area undergoes regular mowing as part of vegetation maintenance for the road right-of-way.

Vegetation. The dominant vegetation is reed canarygrass, with lesser amounts of giant horsetail, Canada thistle (*Cirsium arvense*), Himalayan blackberry, and stinging nettle.

Soils. Soils observed in the wetland (Sample Plot SP-D1) had a dark (10YR 3/1) silt loam surface layer with redoximorphic concentrations. The subsurface was also silt loam (10YR 3/2) with redox concentrations and layers of diatomaceous earth. The soils met the Redox Dark Surface (F6) hydric soil indicator.

Hydrology. The primary source of hydrology is channelized flow that enters the wetland through a culvert under Willows Road NE. Water leaves the wetland through a culvert under the former railroad embankment. A water table was present at 23 inches at the time of the site visit on June 29, 2016. Ponding was observed on May 6, 2015. The dominant hydroperiod is seasonally flooded. Primary wetland hydrology indicators High Water Table (A2) and Saturation (A3) were observed.

5.2.5 Wetland R-E

Wetland R-E is a large PEM wetland located in the diked 100-year floodplain of the Sammamish River. Only a small portion of the wetland (0.23 acre) occurs within the study area (Figure 5-9). Wetland R-E has a depressional HGM class. Site topography is generally flat with minor depressions. Elevations range from approximately 30 feet in the wetland interior and southern boundary to 40 feet. Based on the rating form, which was completed without full access to the wetland, Wetland R-E is a Category II wetland (scoring 20 points). It generally provides high levels of water quality and hydrologic functions and low levels of functions.

A more detailed discussion of wetland functions can be found in Appendix F. This wetland extends to the north into the area under King County's jurisdiction (see Section 6.2.1).

Vegetation. The dominant vegetation is herbaceous, with portions of the wetland being actively used for hay or other seasonal crops. Reed canarygrass is dominant in areas not currently under cultivation. This invasive grass forms thick stands with dense root mats that effectively limit reproduction and growth of native species. Within the study area, other herbaceous species present in smaller amounts include meadow foxtail (*Alopecurus pratensis*), common velvetgrass (*Holcus lanatus*), quackgrass (*Elymus repens*), bluegrass (*Poa* sp.), and giant horsetail.

Soils. Soils observed within the study area are deep, fine-textured, and have a thick dark surface horizon. The predominant textures are silty clay loam and silt loam. Redoximorphic concentrations are present below or within the lower part of the dark (10YR 3/1) A horizon. The southwest portion of the wetland has sandier textures with depth. The dominant soil map unit for the wetland is Tukwila muck. Organic soils in the interior of the wetland were confirmed by a previous delineation (The Watershed Company 2009). Within one of the wetland sample plots within the study area (SP-B3), the Thick Dark Surface (A12) hydric soil indicator was observed. In the other wetland sample plot (SP-B1), problematic hydric soils were observed, with the thick dark surface masking redox concentrations.

Hydrology. The primary sources of hydrology are precipitation and high groundwater across the site. There is also surface and subsurface flow that enters the wetland along its west side. Further to the north in the King County portion of the wetland, Stream KC-1 (see Section 6.3.1) flows into the wetland through a culvert under the railroad tracks. Seepage was also observed entering the wetland near the southwest boundary. Hydrology regimes vary across the wetland from semi-permanently flooded in an oxbow to seasonally saturated areas along the wetland periphery. The dominant hydroperiod is seasonally flooded. Isolated ponding was observed during the June 28, 2016 field visit. Additional ponding was observed during the May 6, 2015 visit.

5.2.6 Offsite Wetlands

Two offsite wetlands just outside the study area boundary (on the Willows Run Golf Course property) were identified based on observations about hydrology and vegetation made from within the study area, aerial photos, and City mapping of wetlands (Figures 5-7 and 5-8). Portions of Wetland R-E outside the study area were also estimated (Figures 5-9 and 5-10). They were not confirmed with sample plots, as biologists did not have access to the adjacent properties.

5.3 Streams

5.3.1 Gun Club Creek

Gun Club Creek is a perennially flowing tributary to the Sammamish River that is associated with the riverine wetlands R-A, R-GCA, and R-GCB (Figures 5-3 through 5-5). The stream extends beyond the study area boundary, with the segment to the west described in the *Puget Sound Energy Sammamish Substation Wetland Delineation and Stream Reconnaissance Report* (AECOM 2016). The portion within the study area totals 74,357 square feet. The OHWM was determined by observations of bed and bank. This stream receives stormwater runoff from adjacent developed areas.

Stream Assessment. The segment of Gun Club Creek on the west side of Willows Road NE is adjacent to commercial developments and has been modified with a series of check dam structures and placement of rock to stabilize the channel and banks. In portions of the tributary, a plastic liner placed below stream material was observed. The stream channel is primarily linear with some meanders. This segment of the stream has a low gradient with low flow. The stream channel width is 3 to 4 feet. The stream bed substrate is a mix of silt/sediment and cobble. Up to 10 inches of sediment has accumulated in the culvert that carries the stream underneath a paved trail. The section of the stream channel adjacent to Wetland R-B is rock-

lined (4- to 6-inch angular) with a depth of 3 to 4 inches. The channel bed is perched approximately 5 feet above the elevation of Wetland R-B, with no direct surface water connection to the wetland.

Gun Club Creek flows through a culvert under Willows Road NE into a linear ditch between the road and the trail. At the time of the initial surveys in 2014 through 2016, this segment of the stream had no flowing water in it, and no defined channel, and was not mapped as a stream. However, following a ditch-cleaning project in 2017 (described in Parametrix 2018), flowing water in a defined channel was observed. During the 2019 surveys, the stream channel ranged from 2 feet to 4 feet wide, with low flow and approximately 4 inches of water in the channel. The channel in this area is split into two sections by a street with a culvert allowing water flow. In both sections, the substrate is silt/mud.

Riparian Corridor Characterization. The riparian corridor on the west side of Willows Road NE is fragmented and truncated by adjacent business and associated parking areas. Riparian vegetation consists of trees and tall shrubs, predominantly red alder, Pacific willow, Sitka willow, Pacific ninebark, salmonberry, redosier dogwood, and Himalayan blackberry. Riparian areas also include landscaping associated with the adjacent commercial developments. The riparian area is approximately 25 feet wide. Wildlife species found in the riparian corridor are primarily birds.

The riparian corridor on the east side of Willows Road NE consists of mowed vegetation, predominantly reed canarygrass, with some cattail and blackberry. A few scattered trees are present near the south end of the mapped stream.

Existing Stream Value for Fisheries Habitat. There is no documentation of salmon in the segments of Gun Club Creek within the study area. Salmonid access to this area is blocked by multiple fish barriers, although, the planned Willows Road Culvert Replacement Project (City of Redmond 2019b) will replace the existing culvert under Willows Road NE with a fish-passable box culvert.

Gun Club Creek has been impaired by the surrounding development and has low habitat quality and diversity. It is relatively small and does not provide the deep pools, stream complexity, and off-channel habitat required by salmonids. While the segment on the west side of Willows Road NE has some riparian cover, the segment east of Willows Road NE lacks this cover, which may affect water temperature and dissolved oxygen content. According to WDFW SalmonScape (WDFW 2019b) and PHS data (WDFW 2019a), the portion of the stream within the study area does not support salmon species. No fish were observed during field investigations; however, this stream likely supports non-salmonid fish. Therefore, our recommended classification for this stream segment is Class III, which matches the rating shown on Redmond's GIS mapping.

5.3.2 Stream R-2

Stream R-2 as shown on Figure 5-6 is an intermittent stream that extends beyond the study area boundary. The portion within the project corridor is 137 square feet. The OHWM was determined by observations of bed and bank. This tributary receives stormwater runoff from Willows Road and the golf course property. WDFW SalmonScape shows this stream flowing into ponds and other stream channels on the golf course property, before eventually draining into the Sammamish River.

Stream Assessment. The segment of Stream R-2 within the project corridor is adjacent to Willows Road and a golf course. This segment of the stream has a low gradient with low flow. East of the trail, the active stream channel is 12 inches wide and has steep vertical banks. The stream bed substrate is primarily silt/sediment. West of the trail, there is no defined channel and the stream has a vegetated bottom (reed canarygrass). The stream appears to lack the aquatic habitat complexity necessary to support fish, including salmon species.

Riparian Corridor Characterization. The riparian corridor is fragmented and truncated by the landscaping on the golf course. Riparian vegetation consists of reed canarygrass and Himalayan blackberry thickets. Wildlife species found in the riparian corridor are primarily common birds.

Existing Stream Value for Fisheries Habitat. There is no documentation of salmon in this segment of the intermittent stream that has been mapped by SalmonScape. However, modeled presence for fall Chinook, coho, and sockeye salmon, and winter steelhead is mapped in this stream just east of the study area boundary. Within the study area, the stream is relatively small and does not provide the deep pools, stream complexity, and off-channel habitat required by salmonids. It also does not provide good habitat for resident fish species, and there is no evidence of resident fish occurring in the stream channel. Our recommended classification for this stream segment is Class III, because it is a headwater stream with likely a surface water connection to a potentially salmon-bearing stream. This matches Redmond's classification.

5.3.3 Stream R-3

Stream R-3 (Figure 5-8) is a very small intermittent stream located between two culverts and associated with Wetland R- D. The portion within the study area totals 21 square feet. This stream was not mapped during the initial survey because it does not have a defined channel. However, based on its connection to fish-bearing surface waters outside the study area, Redmond considers it to be a Class III stream.

Stream Assessment. The segment of Stream R-3 within the study is located between Willows Road NE and the old railroad embankment. This segment of the stream has a low gradient with low flow, with 4 inches of water observed during the April 2019 site visit. The stream is approximately 18 inches wide, with a vegetated bottom (reed canarygrass). The apparent channel was identified by bent down reed canarygrass. The stream appears to lack the aquatic habitat complexity necessary to support fish, including salmon species.

Riparian Corridor Characterization. Within the study area, there is no defined riparian corridor. Vegetation within and adjacent to the stream consists of predominantly reed canarygrass.

Existing Stream Value for Fisheries Habitat. SalmonScape shows a stream in this location, but there is no documentation of salmon in this segment. Within the study area, the stream is relatively small, lacks riparian cover and woody material, and does not provide the deep pools, stream complexity, and off-channel habitat required by salmonids. Fish habitat condition of the stream is low and there is no evidence of resident fish occurring in the stream channel. Based on information from Redmond, this stream is considered a Class III stream because of connections to salmon-bearing stream segments outside the study area.

5.3.4 York Creek

York Creek is a perennial stream that runs within the study area from NE 116th Street and along the east side of the trail, adjacent to Sammamish Valley Park, into Wetland R-E (Figure 5-9). The stream crosses beneath the trail via a culvert, with a small stretch of stream between this culvert and a culvert leading underneath Willows Road NE. SalmonScape and Redmond stream mapping show this stream running east along the north side of NE 116th Street almost to the Sammamish River. The portion within the study area totals 579 square feet. This stream receives stormwater runoff from Willows Road NE. York Creek was not mapped during the initial survey because it does not have a defined channel. However, based on its connection to surface waters outside the study area, Redmond considers it to be a Class III stream.

Stream Assessment. The water observed in the stream segment adjacent to Willows Road NE was stagnant during the site visit in April 2019. Water appeared to be impounded in this area likely due to a culvert under the trail that was filled with sediment. There was no defined channel, and the stream segment was functioning more like a topographic depression that holds water than a channel with flowing water. The area of impounded water was 8 feet wide, with a water depth of 1 foot, and a silt bottom. The segment on

the east side of the trail also had very low flow and no defined channel, with water moving through the vegetation. The channel bottom is vegetated (inundated and bent down reed canarygrass), and during the site visit water was trapped in small depressions rather than being conveyed as streamflow. The stream width north of an access road is 10 inches wide, increasing to approximately 3 feet south of the access road. Both segments of the stream within the study area currently appear to lack the aquatic habitat complexity necessary to support fish, including salmon species.

Riparian Corridor Characterization. In the segment adjacent to Willows Road NE, riparian vegetation consists of predominantly reed canarygrass and Himalayan blackberry, with one alder present. The segment on the east side of the trail, between the culvert and the access road, is surrounded by reed canarygrass that apparently receives regularly maintenance (mowing). South of the access road, alders are present along one side of the riparian corridor. Because the riparian corridor is contiguous with a relatively large area of undeveloped land and includes a mix of wetlands and grassland with scattered shrubs, wildlife use could include small mammals and deer, as well as a variety of birds.

Existing Stream Value for Fisheries Habitat. According to SalmonScape, there is no documentation of salmon in this segment of York Creek. Within the study area, the stream is relatively small and does not provide the deep pools, stream complexity, and off-channel habitat required by salmonids. It also does not provide good habitat for resident fish species, and there is no evidence of resident fish occurring in the stream channel. Based on information from Redmond, this stream is considered a Class III stream because of connections to salmon-bearing stream segments outside the study area.

5.3.5 124th Street Stream

124th Street Stream is likely an intermittent stream that runs adjacent to Willows Road NE, occurring in both Redmond and unincorporated King County. The portion in Redmond totals 602 square feet (Figure 5-10). This stream was not mapped during the initial survey because it does not have a defined channel, no water was present during site visits, and the area was overgrown with blackberry. However, based on its connection to surface waters outside the study area, Redmond considers it to be a Class III stream. During the site visit in April 2019, water was present in the stream and there was evidence that vegetation maintenance had occurred.

Stream Assessment. The segment of 124th Street Stream in Redmond runs along the base of a slope leading down from the road shoulder and flows and is functioning similar to a roadside ditch that collects stormwater runoff from Willows Road NE. This segment of the stream has a low gradient with low flow, with 4 inches of water observed during the April 2019 site visit. The stream is approximately 2 feet wide, with no defined channel and a silt bottom. Fish habitat condition of the stream is low and the stream currently lacks the aquatic habitat complexity necessary to support fish, including salmon species. However, the stream is connected downstream to a larger watercourse where fish are documented.

Riparian Corridor Characterization. Vegetation along the stream consists of predominantly reed canarygrass and Himalayan blackberry, with alders present at the top of the slope. The corridor is narrow and confined by Willows Road NE and the railroad embankment. The corridor is somewhat connected to a relatively large area of undeveloped land and includes a mix of wetlands and grassland with scattered shrubs; wildlife use of this area could include small mammals and deer, as well as a variety of birds.

Existing Stream Value for Fisheries Habitat. SalmonScape shows a stream in this location, but there is no documentation of salmon in this segment. Within the study area, the stream is relatively small and does not provide the deep pools, stream complexity, and off-channel habitat required by salmonids. Based on information from Redmond, this stream is considered a Class III stream because of connections to salmon-bearing stream segments outside the study area.



0 125 250 500
Feet

**Puget Sound Energy
Samamish-Juanita
Transmission Line
Wetland Delineation**

Redmond, Washington
Project No.: 60608044

- Study Area
- Delineated Wetlands
- Delineated Streams
- Wetland Edge
(previous delineation)

Figure 5-1
**City of Redmond
Overview of Delineated
Wetlands and Streams**
Figure 1 of 2



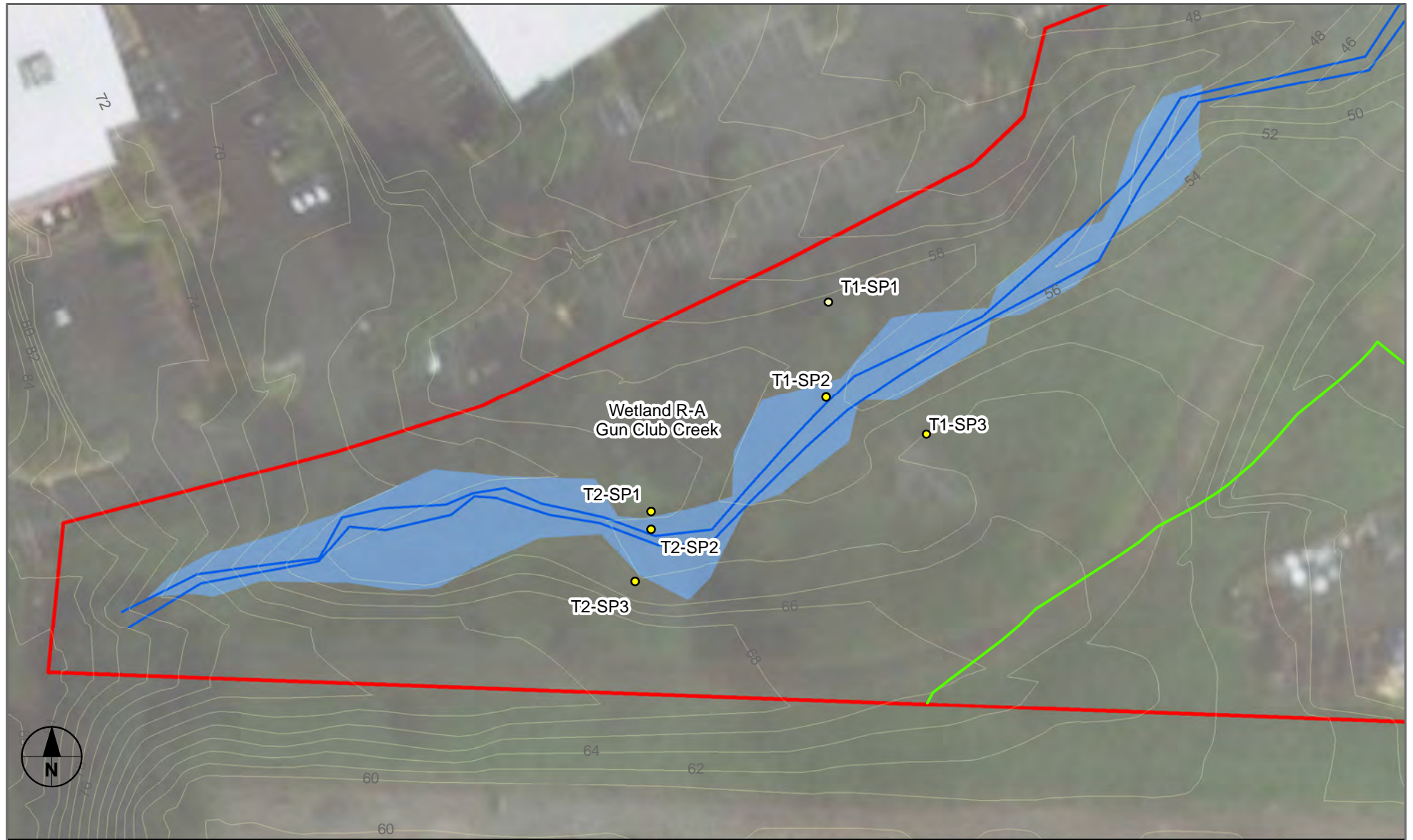
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Feet

**Puget Sound Energy
Samamish-Juanita
Transmission Line
Wetland Delineation**







Redmond, Washington
Project No.: 60608044

- Study Area
- Delineated Wetlands
- Delineated Streams
- Estimated Wetland Edge

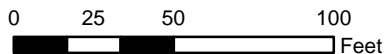
Figure 5-2
**City of Redmond
Overview of Delineated
Wetlands and Streams**
Figure 2 of 2



**Puget Sound Energy
Samamish-Juanita
Transmission Line
Wetland Delineation**

- | | | |
|---|---|---|
|  Study Area |  Delineated Stream |  Delineated Wetland |
|  Sample Plot |  2-foot Contours |  Wetland/Stream Buffer |

Redmond, Washington
Project No.: 60608044





**Figure 5-3
Wetland R-A and
Gun Club Creek**






**Puget Sound Energy
Samamish-Juanita
Transmission Line
Wetland Delineation**

Redmond, Washington
Project No.: 60608044

 Study Area
 Sample Plot

 Delineated Stream
 2-foot Contours

 Delineated Wetland
 Wetland/Stream Buffer
 Wetland Edge
(previous delineation)

0 25 50 100
Feet

**Figure 5-4
Wetland R-B and
Gun Club Creek**