**CITY OF KIRKLAND**
**Planning and Community Development Department**
**123 Fifth Avenue, Kirkland, WA 98033 425.587-3225**
**www.ci.kirkland.wa.us**

# MEMORANDUM

**To:** Tony Leavitt, Associate Planner

**From:** Deborah Powers, Urban Forester

**Date:** November 5, 2008

**Subject:** PSE Juanita Substation (ZON08-00010) Tree Plan II Review

Below are my comments in response to the revisions submitted for this project:

**Type 1 Trees:**
146, 216, 460, 1300 and the Norway maple located near the NE 132 Ave right-of-way.

**Type 2 Trees:**
1298, 1299, and 195

**Type 2 Trees:**
1296, 1297, 227, and 196.

**Notes:**

- Applicant shall incorporate Type 1 trees into landscape plan.
- Applicant to place steel plates on remaining Limits of Disturbance per arborist report to protect Type 1 tree roots from heavy equipment traffic.
- Tree Fencing per Arborist Recommendation for all onsite and offsite trees
- Fencing for all onsite and offsite trees with overhanging driplines to remain in place for the duration of the project.

Let me know if you have any questions regarding this review.

# SOUND ANALYSIS
# JUANITA SUBSTATION
# KIRKLAND, WASHINGTON

**Submitted to:**

**Puget Sound Energy**
**355 – 110th Avenue NE, EST-05E**
**Bellevue, Washington 98004**

**Prepared by:**

**Ioana Park, P.E.**
**BRC Acoustics & Technology Consulting**
**1741 1st Avenue S.**
**Seattle, Washington 98134**

**April 25, 2008**

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## 1. INTRODUCTION

This report is a sound analysis for the proposed replacement of the Puget Sound Energy Juanita Substation located at 10910 NE 132nd Street in Kirkland, Washington. The report evaluates future sound levels from two new electrical transformers proposed for the site.

## 2. PROJECT SITE AND NEARBY LAND USES

Figure 1-1 shows the location of the existing Juanita Substation, a plan of the future proposed substation, surrounding properties, and sound measurement and analysis locations. The existing substation is located near the south end of the Puget Sound Energy property. The proposed, future substation would be located near the north end of the property. The project site's east and west boundaries adjoin single-family residential properties in the Juanita Hills subdivision.

The PSE property and neighboring residential properties are zoned RSX 7.2 (Single-Family Residential) by the City of Kirkland.

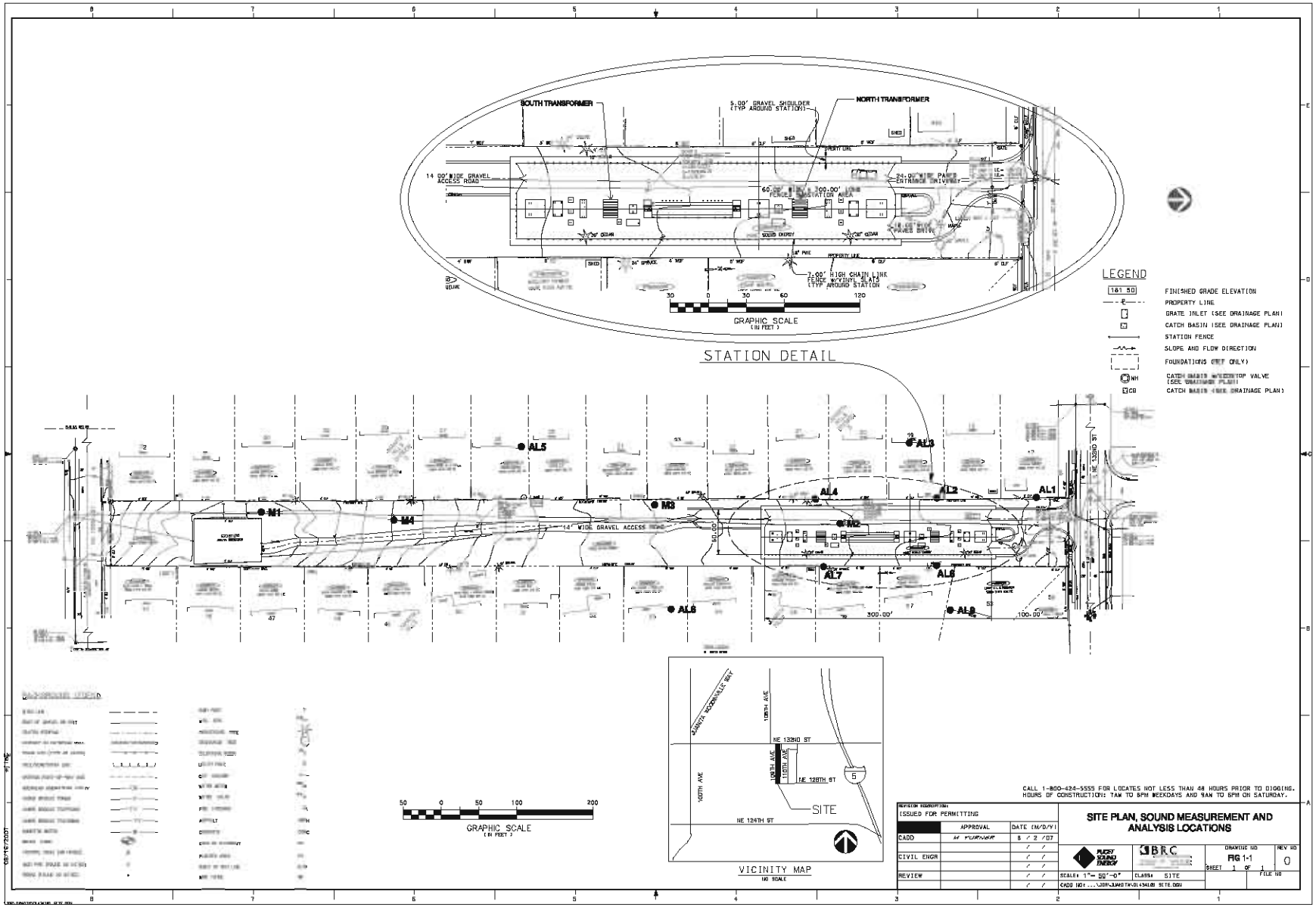
## 3. SOUND LEVEL DESCRIPTORS

Sound is measured as sound level in units of decibels, dB. Environmental sound is often measured as A-weighted sound level in dBA. The A-weighting is a specific weighting filter in a sound level meter that corresponds to human hearing sensitivity at the various sound frequencies. People normally experience sound levels between about 30 and 90 dBA, depending on their activity. For example, a loud nearby vehicle, radio or power tool may produce 80 to 90 dBA, normal conversation is about 50 to 60 dBA, and a bedroom or quiet office is about 30 to 40 dBA.

Each 10-dB increase in sound level corresponds to a tenfold increase of sound energy, but is judged by a listener as only a doubling of loudness. The smallest changes in sound level considered clearly noticeable are about 3 to 5 dBA.

Sound levels from two or more sources are combined using logarithms, not by adding the levels. When two levels are combined, the louder level predominates, and the combined level is the louder level plus 0 to 3 dBA. Some examples: 50 dBA combined with 50 dBA is 53 dBA, and 50 dBA combined with 40 dBA results in 50.4 dBA.

Because sound levels fluctuate over time, several A-weighted sound level descriptors are used to characterize the sound. In this report, the following descriptors are used:


SOUTH TRANSFORMER
NORTH TRANSFORMER
5.00' GRAVEL SHOULDER (TYP AROUND STATION)
14.00' WIDE GRAVEL ACCESS ROAD
24.00' WIDE PAVED ENTRANCE DRIVEWAY
60.00' BY 300.00' LONG FENCED STATION AREA
7.00' HIGH CHAIN LINK FENCE W/VINYL SLATS (TYP AROUND STATION)
GRAPHIC SCALE (IN FEET)
STATION DETAIL
LEGEND
161.50 FINISHED GRADE ELEVATION
PROPERTY LINE
GRATE INLET (SEE DRAINAGE PLAN)
CATCH BASIN (SEE DRAINAGE PLAN)
STATION FENCE
SLOPE AND FLOW DIRECTION
FOUNDATIONS (PET ONLY)
CATCH BASIN W/SHUTOFF VALVE (SEE DRAINAGE PLAN)
CATCH BASIN (SEE DRAINAGE PLAN)
AL1
AL2
AL3
AL4
AL5
AL6
AL7
AL8
AL9
M1
M2
M3
M4
14' WIDE GRAVEL ACCESS ROAD
300.00'
100.00'
GRAPHIC SCALE (IN FEET)
VICINITY MAP
NO SCALE
SITE
NE 124TH ST
NE 128TH ST
NE 132ND ST
100TH AVE
CALL 1-800-424-5555 FOR LOCATES NOT LESS THAN 48 HOURS PRIOR TO DIGGING.
HOURS OF CONSTRUCTION: 7AM TO 8PM WEEKDAYS AND 9AM TO 6PM ON SATURDAY.
ISSUED FOR PERMITTING
APPROVAL
DATE (M/D/Y)
CADD
CIVIL ENGR
REVIEW
SITE PLAN, SOUND MEASUREMENT AND ANALYSIS LOCATIONS
PUGET SOUND ENERGY
BRC
DRAWING NO
FIG 1-1
REV NO
0
SHEET 1 OF 1
FILE NO
SCALE: 1"= 50'-0"
CLASS: SITE

| | |
|---|---|
| **Leq** | **Equivalent sound level, Leq**, is the most commonly used descriptor for measuring fluctuating sound. The Leq is the level of a constant sound that, over a given time period, contains the same amount of sound energy as the measured fluctuating sound. |
| **Ldn** | **Day-night average sound level, Ldn**, is the Leq over 24 hours with a 10 dBA penalty added during the nighttime hours of 10 p.m. to 7 a.m. The Ldn is often used to measure the overall 24-hour sound to determine land use compatibility and overall impacts. The Ldn is usually close to the same level as the daytime Leq. |
| **Lmax** | **Maximum sound level, Lmax**, is the highest instantaneous sound level for a given sound source, event or time period. Because the Lmax in a neighborhood will, unlike Leq, typically have large fluctuations from hour to hour and day to day, Lmax is seldom used to measure noise impact, except in cases where brief high-level sound is causing an impact such as sleep disturbance. |
| **Lmin** | **Minimum Sound Level** is the lowest instantaneous sound level and is typically the level of background noise that may be expected if all the fluctuating noise sources were removed. |

When considering sounds with a frequency spectrum such as the hum of a transformer, which is characterized by a large portion of the sound energy being concentrated in the 60-Hz and 120-Hz bands, the sound pressure levels at the different frequencies are also measured. These sound pressure levels are usually measured for frequency bands of one octave centered at frequencies of 31, 63, 125, 250, 500, 1000 (1k), 2000 (2k), 4000 (4k), and 8000 (8k) Hz. The most important of these octave bands in terms of potential annoyance is the 125 Hz octave band, because transformer hum occurs primarily at 120 Hz.

## 4. EXISTING SOUND LEVELS

Sound levels were measured from 2 p.m. on Tuesday, July 10 to 4 p.m. on Thursday, July 12, 2007 at four locations near the substation site, shown in Figure 1-1 as Locations M1 to M4. The continuous monitoring was conducting using two Bruel & Kjaer 2238 and two Larson Davis 870 Integrating Sound Level Meters. All instruments conform to ANSI S1.4 requirements for Type I measurement systems. All measurements were conducted at the first-story elevation of five feet above ground. The locations of the measurements were selected to represent existing sound levels at nearby residential properties and are listed in Table 4-1.

**TABLE 4-1**
**SOUND MONITORING LOCATIONS**

| Location | Description |
|---|---|
| M1 | Near the east property line of Parcel 30 |
| M2 | Near the east property line of Parcel 20 |
| M3 | Near the east property line of Parcel 23 |
| M4 | Near the east property line of Parcel 28 |

Results of the long-term measurements are shown in Figures A-1 to A-12 in Appendix A. The A-weighted sound levels are shown as hourly Leq, Lmax, Lmin, and 24-hour Ldn on days when 24 hours of data were recorded.

Existing sound levels at the monitoring locations are caused predominantly by traffic on NE 128$^{th}$ and NE 132$^{nd}$ Streets, occasional aircraft overflights, and local residential noise sources. The measured hourly Leq sound levels are fairly steady in the upper 40s to mid 50s dBA during the monitoring period.

The existing hourly Leq measured during the quietest nighttime hours are shown in Table 4-2.

**TABLE 4-2**
**EXISTING QUIETEST-HOUR EQUIVALENT SOUND LEVELS**

| | MONITORING LOCATION | | | |
|---|---|---|---|---|
| | **1** | **2** | **3** | **4** |
| A-weighted sound level, dBA | 45 | 42 | 43 | 42 |

## 5. PERMITTED SOUND LEVELS

The project is subject to noise regulations contained in Chapter 115.95, *Noise Regulations,* of the City of Kirkland Zoning Code. In Section 1 of this regulation, the City adopts by reference the Maximum Environmental Noise Levels contained in Chapter 173-60 of the Washington Administrative Code (WAC).

Guidelines for evaluating noise increases over existing sound levels are provided by the Environmental Protection Agency (EPA).

Permissible sound levels in 173-60 WAC are based on the Environmental Designation for Noise Abatement (EDNA) of source and receiving properties. The EDNA is determined based on land-use criteria, with residential use being Class A EDNA, commercial use Class B EDNA, and industrial use being Class C EDNA. In areas covered by a local zoning ordinance, the EDNA conforms to the zoning ordinance.

The site of the Juanita Substation and residential properties within Juanita Hills, to the east and west of the substation, are considered Class A EDNA.

The State of Washington noise limits for EDNA A source and receiver properties are shown in Table 5-1.

**TABLE 5-1**
**STATE OF WASHINGTON PERMITTED SOUND LEVELS FOR EDNA CLASS B SOURCES AND CLASS A RECEIVERS**

| Daytime* | Nighttime |
|---|---|
| 55 dBA | 45 dBA |

*Daytime is defined as 7 a.m. to 10 p.m.;
Nighttime is defined as 10 p.m. to 7 a.m.

The Washington Administrative Code exempts electrical substations from the nighttime reduction in noise limits. Therefore, the limit for sound levels produced at the Juanita Substation and received at nearby residences is 55 dBA during all hours.

Adverse environmental impacts associated with noise increases can be evaluated using the U.S. Environmental Protection Agency *Noise Guidelines for Environmental Impact Statements* (EPA, 1975). Noise increases of 0-5 dBA at residences are considered a slight impact, 5-10 dBA a significant impact, and over 10 dBA a serious impact. These criteria are presented as guidelines only, and have no statutory authority. However, they are appropriate for assessing the impact of environmental noise.

## 6. PREDICTED SOUND LEVELS FROM THE PROPOSED TRANSFORMERS

The transformer type proposed for the two units at the Juanita Substation is a 25-MVA model. In order to quantify the expected noise emissions of the proposed transformers, measurements of reference sound levels were conducted at another PSE transformer reported to be similar to the proposed units. The reference transformer is located at the PSE Pickering Substation in Issaquah.

Sound levels produced by the transformer were measured in one-octave bands at reference distances of 10 to 20 feet in four directions surrounding the transformer. The measurement results were normalized to sound levels at a reference distance of 50 feet, summarized in Table 6-1. The four directions are defined with respect to the principal features of the transformer and also to the proposed orientation of the north transformer at the Juanita site. For the south transformer at the Juanita Substation, the four directions are rotated by 180 degrees compared to Table 6-1.

**TABLE 6-1**
**TRANSFORMER REFERENCE SOUND LEVELS**
**DERIVED FROM MEASUREMENTS AT PICKERING SUBSTATION**

| **Direction for North Transformer** | | **Sound Level at 50 Feet, dBA** |
|---|---|---|
| **1** | (East) | **52** |
| **2** | High-voltage bushings (North) | **53** |
| **3** | (West) | **46** |
| **4** | Low-voltage bushings (South) | **47** |

The sound levels received at surrounding properties from the two 25-MVA transformers located as shown in Figure 1-1 at the Juanita Substation were computed using the Environmental Noise Model program. The sound predictions were executed for nine Analysis Locations, listed in Table 6-2 and shown in Figure 1-1.

| TABLE 6-2<br>SOUND ANALYSIS LOCATIONS | |
|---|---|
| **AL #** | **Description** |
| 1 | East property line of Parcel 17 |
| 2 | East property line of Parcel 19, directly west of the north transformer |
| 3 | Second story of residence on Parcel 19 |
| 4 | East property line of Parcel 21, directly west of the south transformer |
| 5 | Second story of residence on Parcel 26 |
| 6 | Second story of residence on Parcel 53 |
| 7 | West property line of Parcel 56, directly east of the south transformer |
| 8 | West property line of Parcel 57, directly east of the north transformer |
| 9 | Second story of residence on Parcel 58 |

The computed A-weighted sound levels at the Analysis Locations without additional noise mitigation are shown in Table 6-3. The table also shows State of Washington noise limits and existing measured quietest-hour Leq at the nearest monitoring location.

| TABLE 6-3<br>CALCULATED TRANSFORMER SOUND LEVELS WITHOUT MITIGATION<br>A-WEIGHTED DECIBELS (dBA) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Analysis Location** | | | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
| Proposed 25-MVA transformers | 42 | 51 | 44 | 50 | 29 | 33 | 47 | 48 | 41 |
| State of Washington Permitted Sound Level | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 |
| Existing quietest-hour Leq | -- | 42 | 42 | 42 | 42 | 43 | 42 | 42 | 42 |

The calculations indicate that, without mitigation, A-weighted sound levels produced by the proposed transformers would meet the State of Washington daytime and nighttime noise limit of 55 dBA at all Analysis Locations.

At the Analysis Locations that represent actual residences (AL3, AL5, AL6, and AL9), the predicted sound levels are substantially lower than the noise limits and are in the range of or lower than existing measured sound levels at the nearest Monitoring Locations. At the same Analysis Locations, the predicted sound levels shown in Table 6-3 are also below the nighttime noise limit of 45 dBA that applies to EDNA Class A source and receiver properties. As stated previously, electrical substations are exempt from the nighttime reduction in the noise limit.

## 7. SOUND MITIGATION MEASURES

The predicted sound levels presented in Table 6-3 indicate that the new transformers proposed for the Juanita Substation without noise mitigation would comply with applicable noise limits and would be in the range of or lower than existing sound levels at most Analysis Locations and at all actual residences.

At the property-line locations closest to the two transformers (Analysis Locations 2, 4, 7, and 8) the predicted sound levels are higher than existing nighttime sound levels by 5 to 9 dBA. These sound-level increases would be considered a significant noise impact according to EPA guidelines and would be noticeable.

Puget Sound Energy proposes to construct an 18-foot high, 300-foot long wall along the fence line on the east side of the transformers. In order to minimize sound reflections, the barrier surface facing the transformers would be sound-absorptive. The minimum construction of the barrier panels shall be a 1-3/4 inch concrete core faced on the transformer side with Model RDNBP panels by Durisol Inc. or equivalent. The face panels on the transformer side shall have minimum NRC 0.85 and minimum absorption coefficient 0.30 in the 125-hertz one-third octave band.

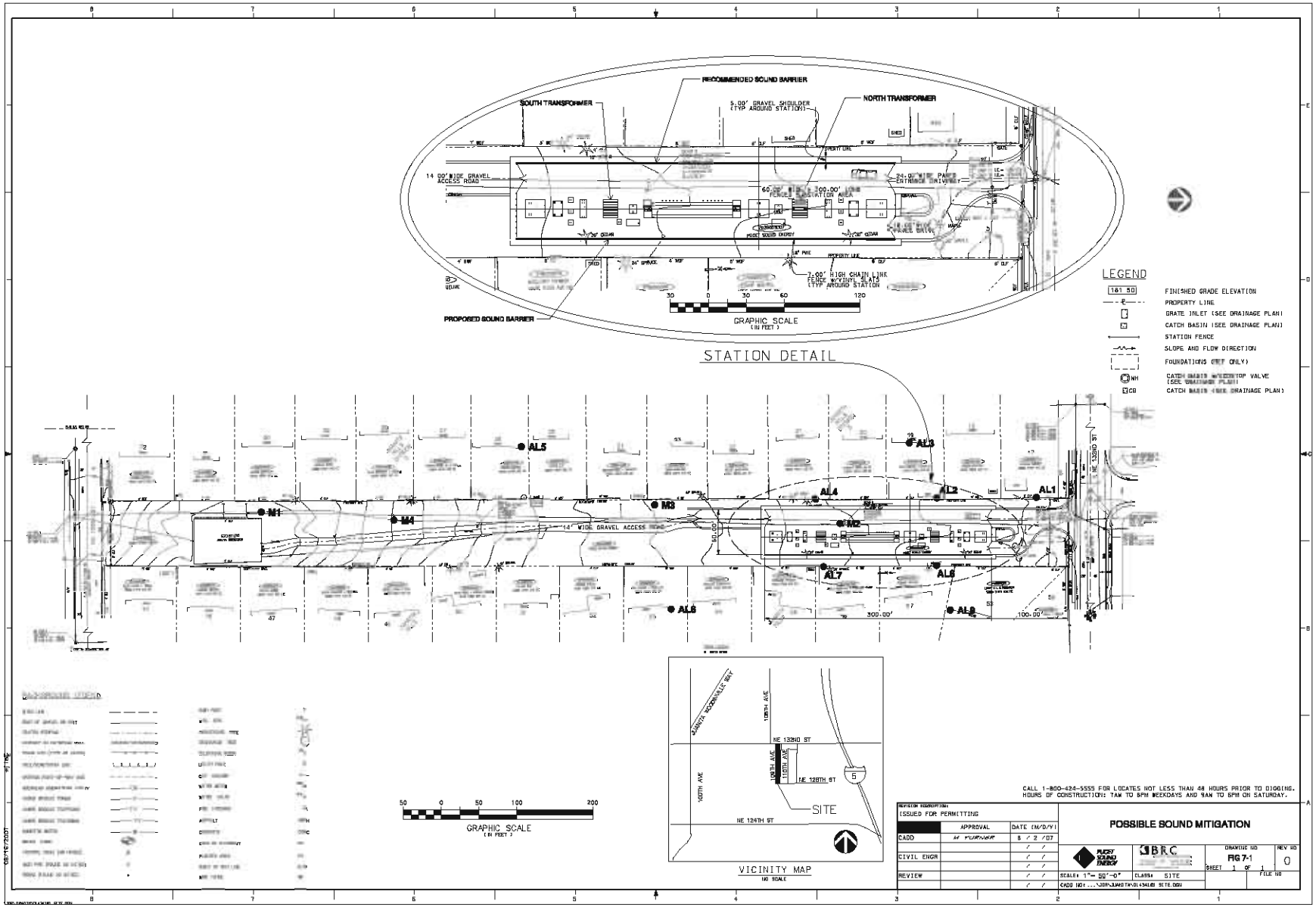
It is recommended that a similar sound barrier be constructed along the west fence line. The height of the barrier west of the transformers shall be equal to the height of the transformers (excluding the top bushings). Both barriers shall be constructed without gaps, including along the ground. The locations of the sound barriers are shown in Figure 7-1. Table 7-1 shows predicted sound levels from the transformers with the recommended sound barriers in place.

**TABLE 7-1**
**CALCULATED TRANSFORMER SOUND LEVELS WITH SOUND BARRIERS**
**A-WEIGHTED DECIBELS (dBA)**

| | **Analysis Location** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
| Proposed 25-MVA transformers | 40 | 34 | 36 | 38 | 32 | 25 | 30 | 31 | 31 |
| State of Washington Permitted Sound Level | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 |
| Existing quietest-hour Leq | -- | 42 | 42 | 42 | 42 | 43 | 42 | 42 | 42 |

The results in Table 7-1 indicate that, with the recommended sound barriers in place, A-weighted sound levels produced by the proposed transformers at all Analysis Locations would meet the State of Washington daytime and nighttime noise limit of 55 dBA by a wide margin, would be in the range of or lower than existing nighttime sound levels at the nearest Monitoring Locations, and would be below the nighttime noise limit of 45 dBA that applies to EDNA Class A source and receiver properties. As stated previously, electrical substations are exempt from the nighttime reduction in the noise limit.

*---End of Report---*


RECOMMENDED SOUND BARRIER
SOUTH TRANSFORMER
NORTH TRANSFORMER
5.00' GRAVEL SHOULDER (TYP AROUND STATION)
14.00' WIDE GRAVEL ACCESS ROAD
24.00' WIDE PAVED ENTRANCE DRIVEWAY
PUGET SOUND ENERGY
7.00' HIGH CHAIN LINK FENCE W/VINYL SLATS (TYP AROUND STATION)
PROPOSED SOUND BARRIER
GRAPHIC SCALE (IN FEET)
STATION DETAIL
LEGEND
161.50 FINISHED GRADE ELEVATION
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AL2
AL3
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AL5
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AL7
AL8
AL9
M1
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14' WIDE GRAVEL ACCESS ROAD
300.00'
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NO SCALE
SITE
NE 132ND ST
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NE 124TH ST
CALL 1-800-424-5555 FOR LOCATES NOT LESS THAN 48 HOURS PRIOR TO DIGGING.
HOURS OF CONSTRUCTION: 7AM TO 6PM WEEKDAYS AND 9AM TO 6PM ON SATURDAY.
ISSUED FOR PERMITTING
APPROVAL
DATE (M/D/Y)
CADD
CIVIL ENGR
REVIEW
POSSIBLE SOUND MITIGATION
PUGET SOUND ENERGY
BRC
DRAWING NO
FIG 7-1
REV NO
0
SHEET 1 OF 1
FILE NO
SCALE: 1"= 50'-0"
CLASS: SITE

# APPENDIX A

## Results of Long-Term Sound Monitoring

## FIGURE A-1
## EXISTING SOUND LEVELS

LOCATION M1
DATE: 7/10/07

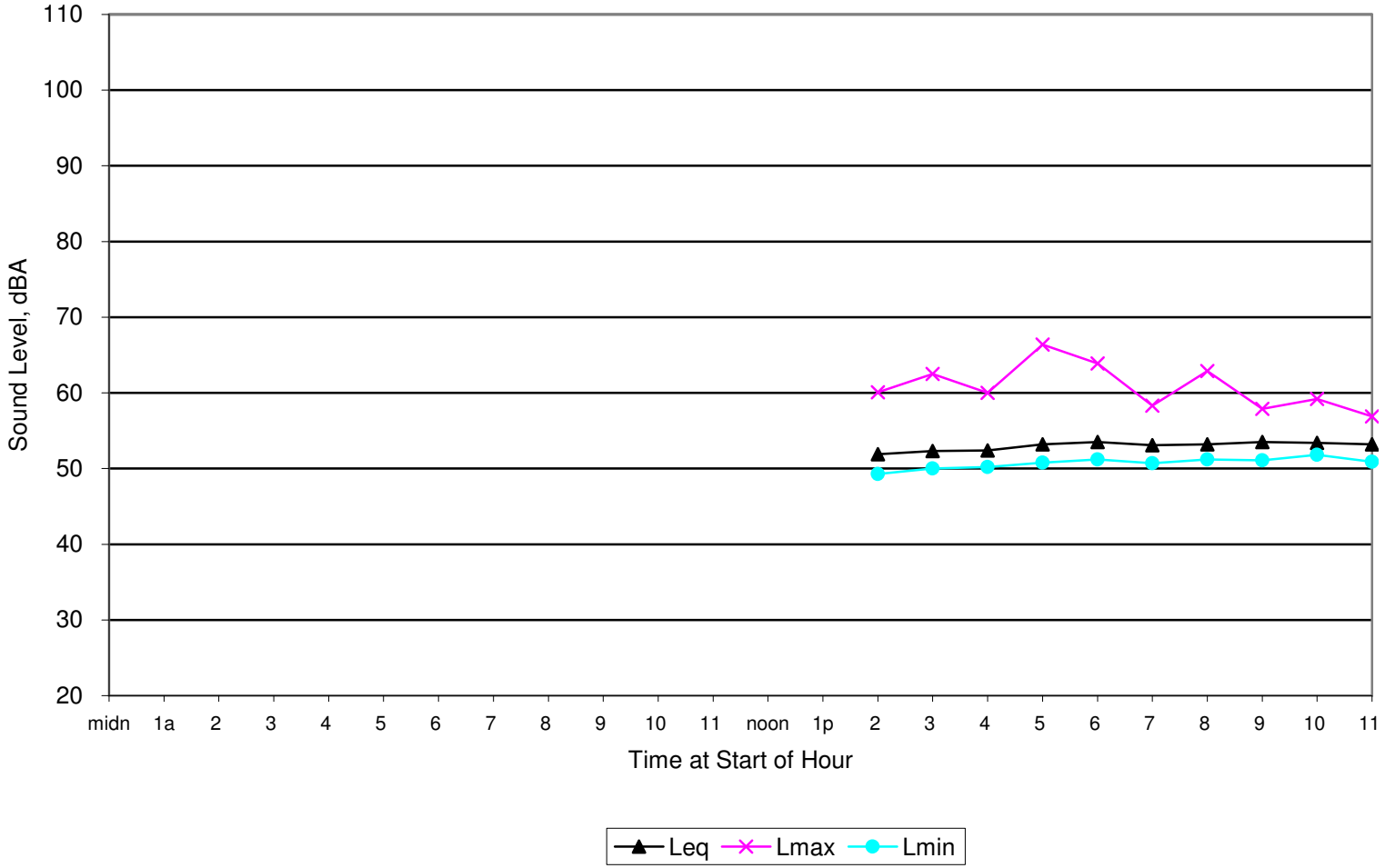


**FIGURE A-2**
**EXISTING SOUND LEVELS**

LOCATION M1
DATE: 7/11/07

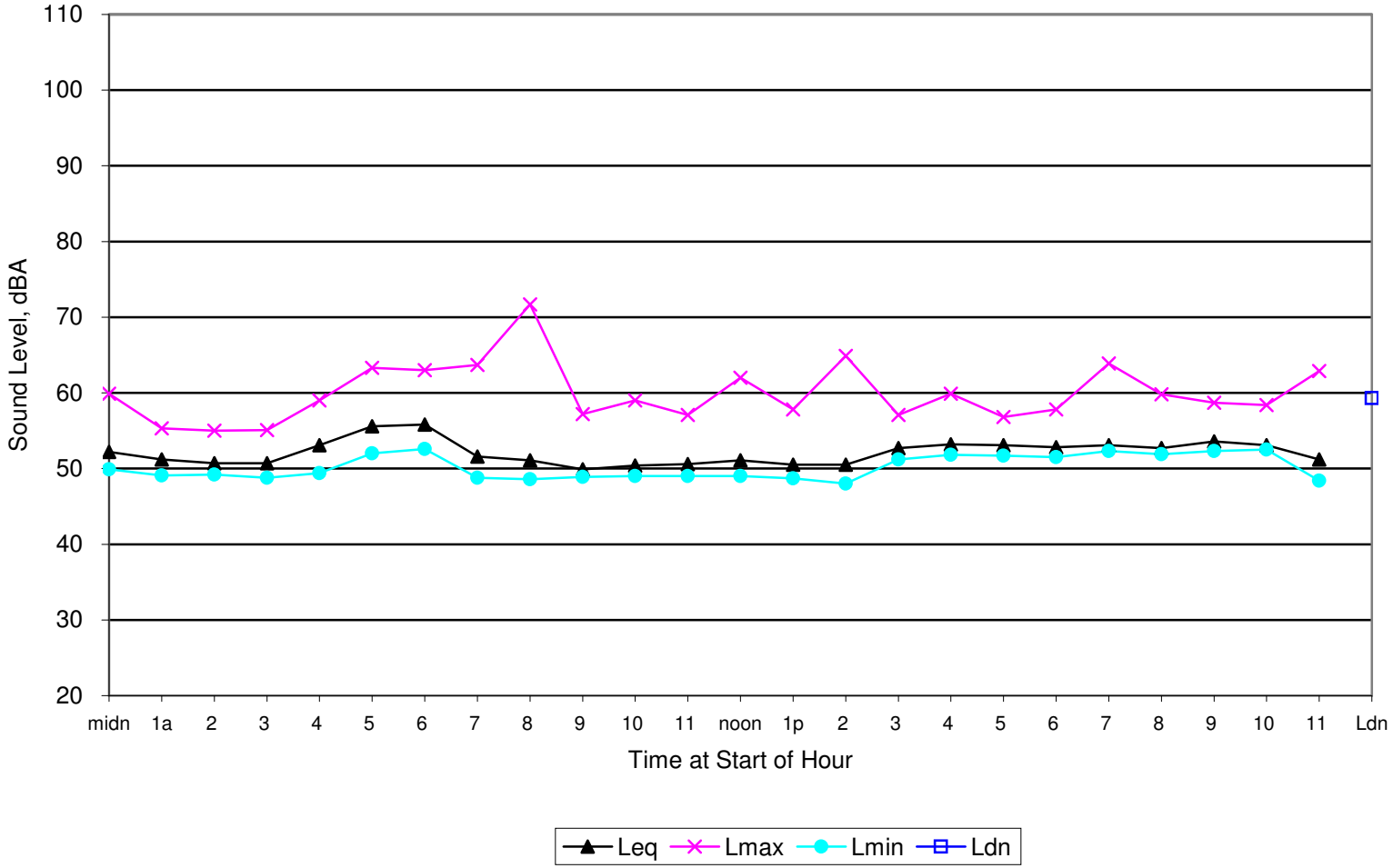


**FIGURE A-3**
**EXISTING SOUND LEVELS**

LOCATION M1
DATE: 7/12/07

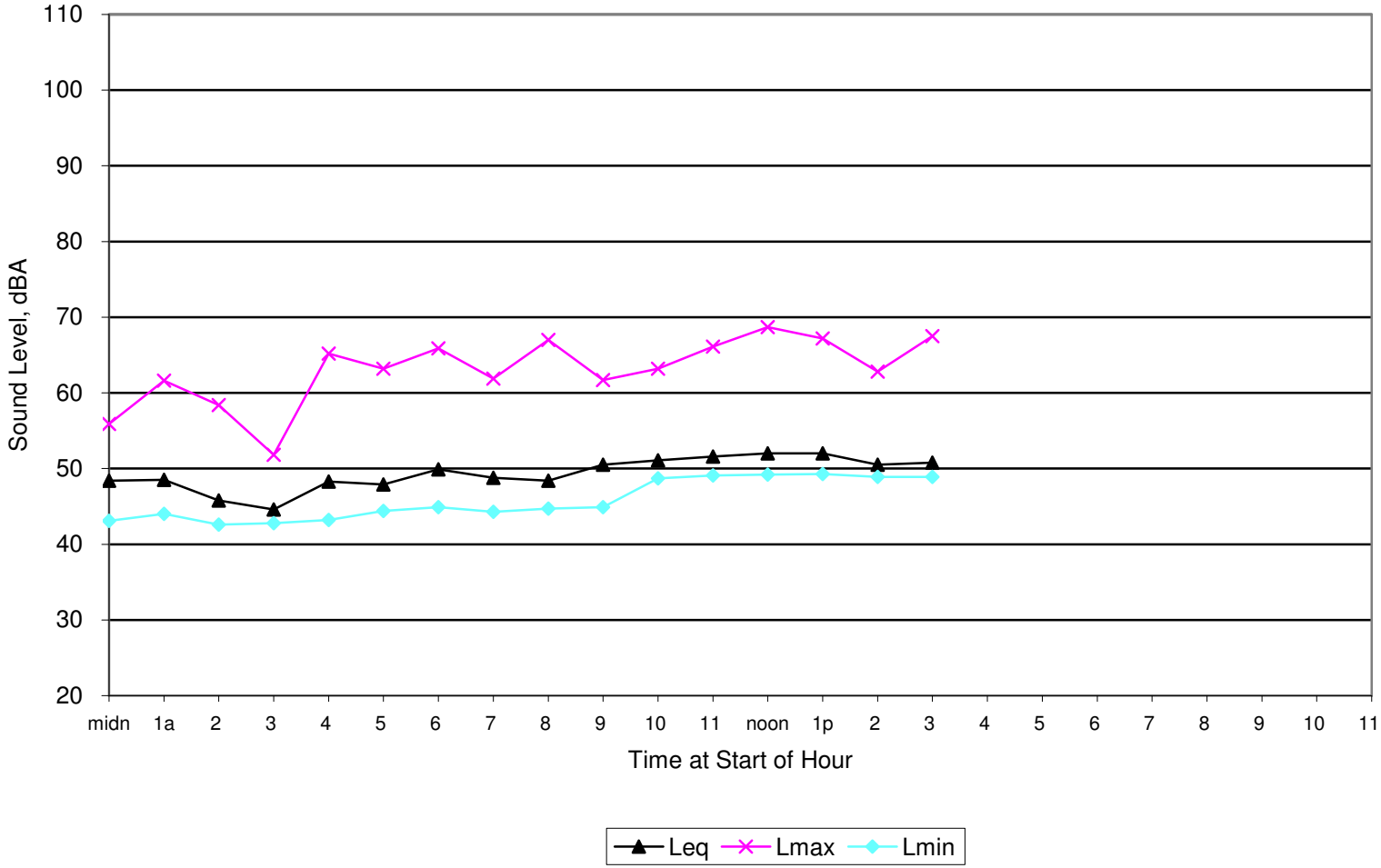


**FIGURE A-4**
**EXISTING SOUND LEVELS**

LOCATION M2
DATE: 7/10/07

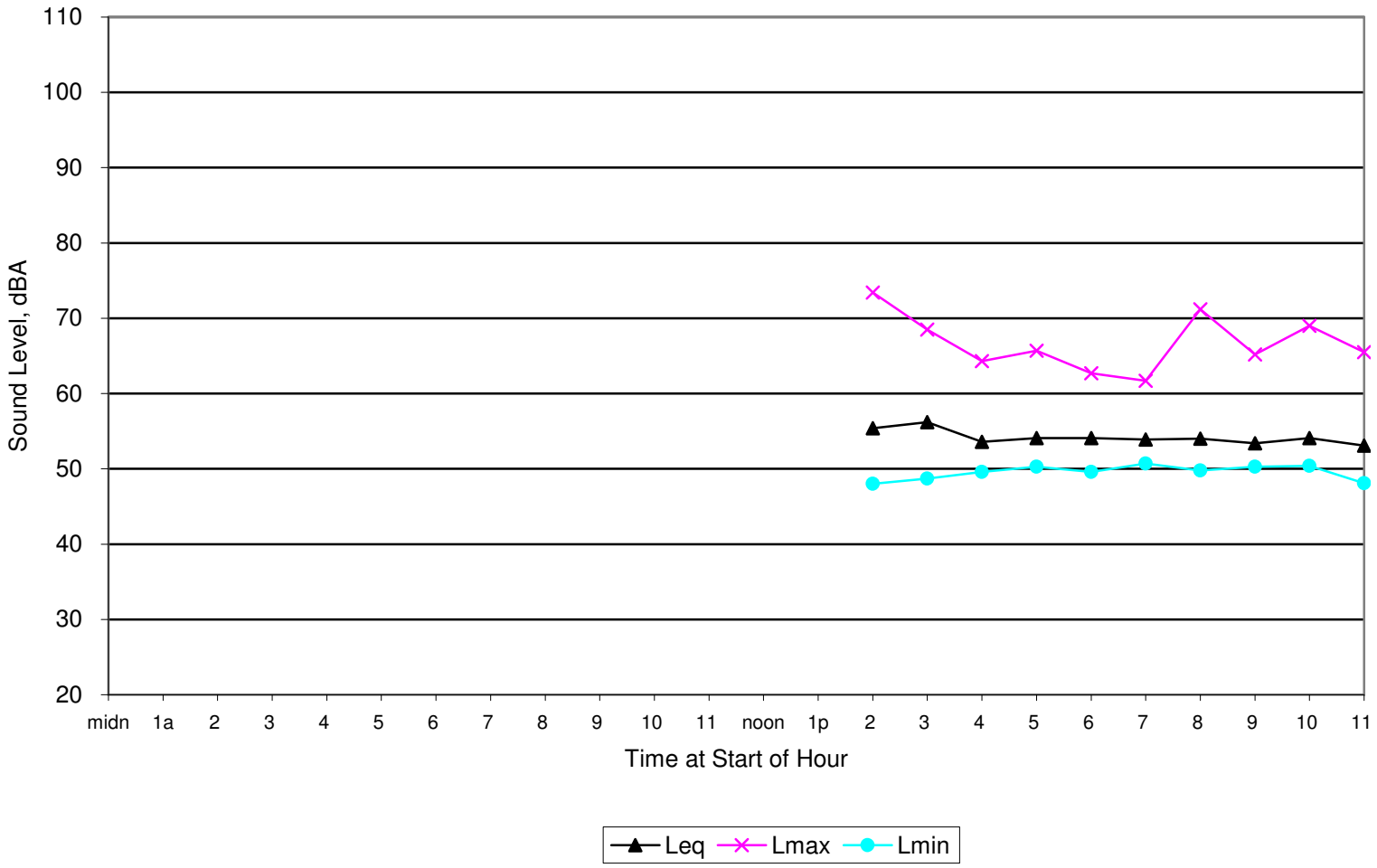


**FIGURE A-5**
**EXISTING SOUND LEVELS**

LOCATION M2
DATE: 7/11/07

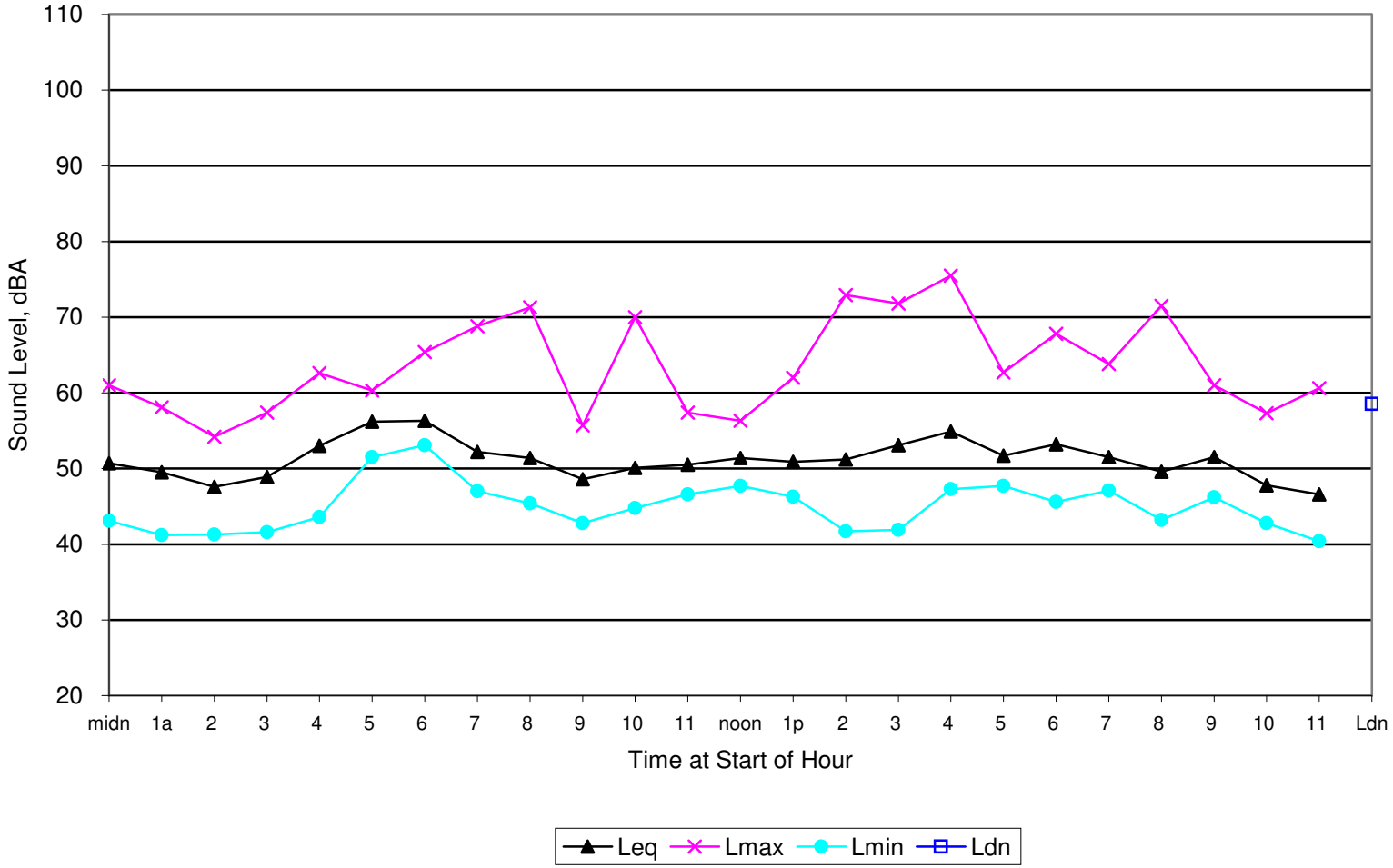


**FIGURE A-6**
**EXISTING SOUND LEVELS**

LOCATION M2
DATE: 7/12/07

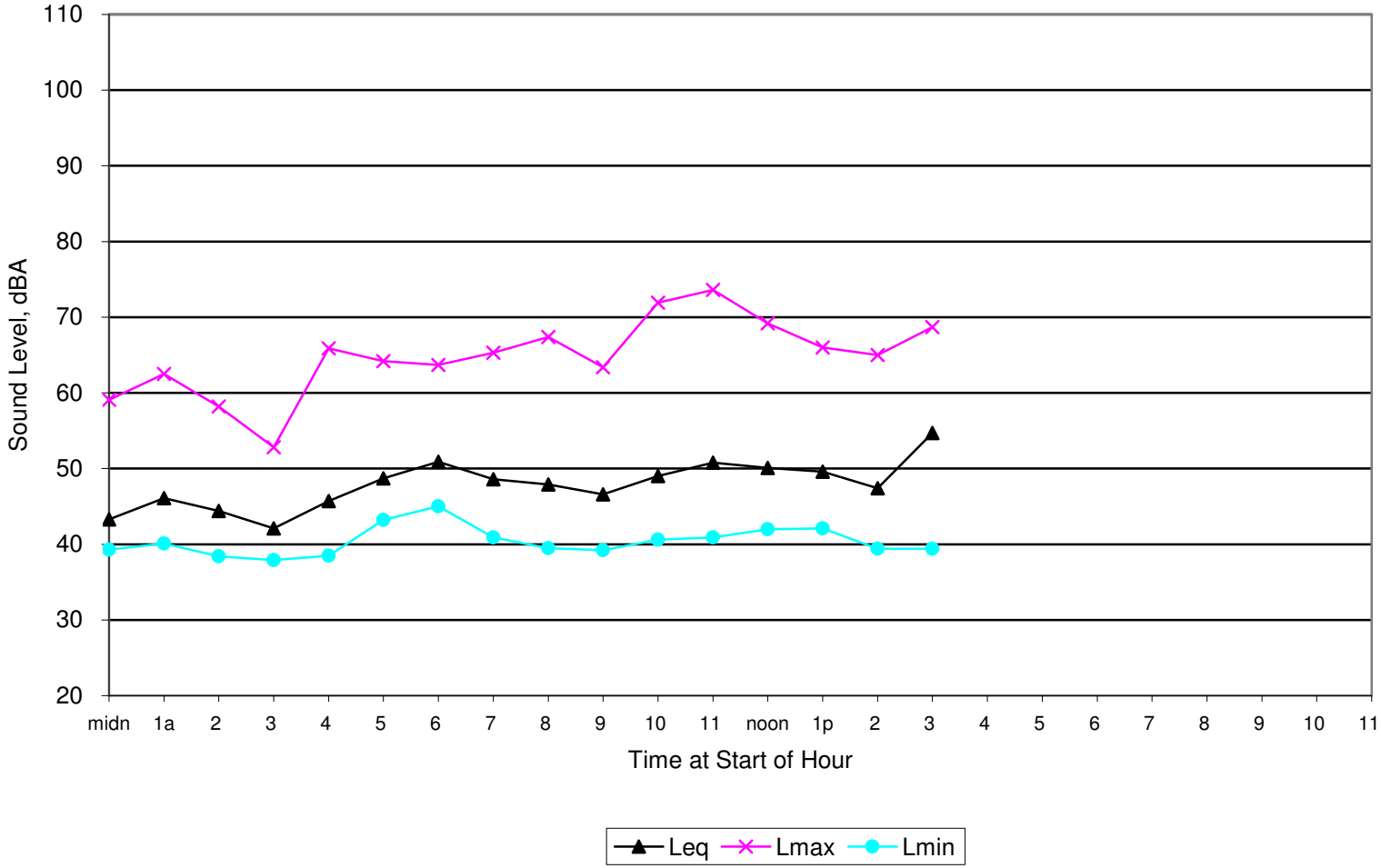


**FIGURE A-7**
**EXISTING SOUND LEVELS**

LOCATION M3
DATE: 7/10/07

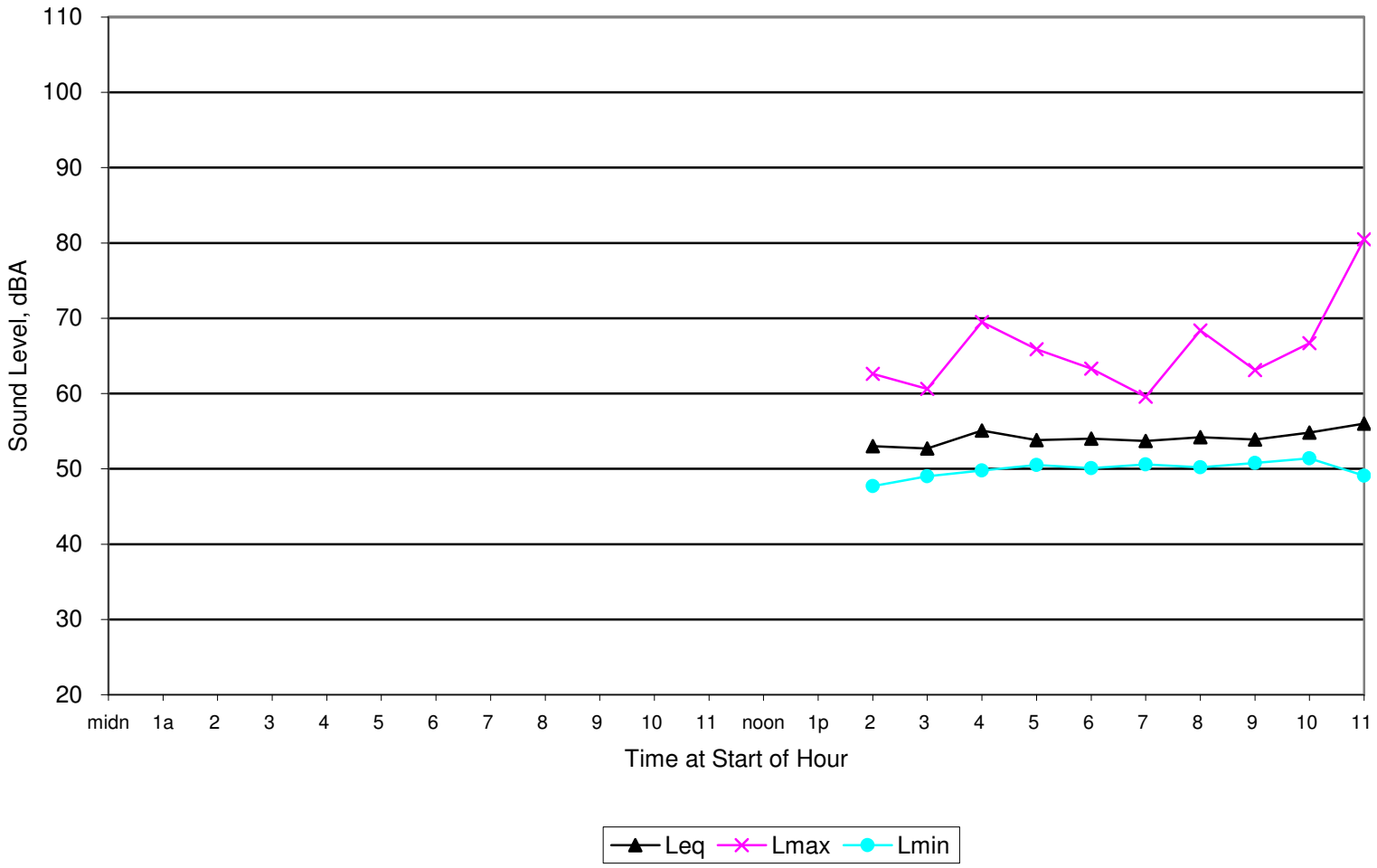


**FIGURE A-8**
**EXISTING SOUND LEVELS**

LOCATION M3
DATE: 7/11/07

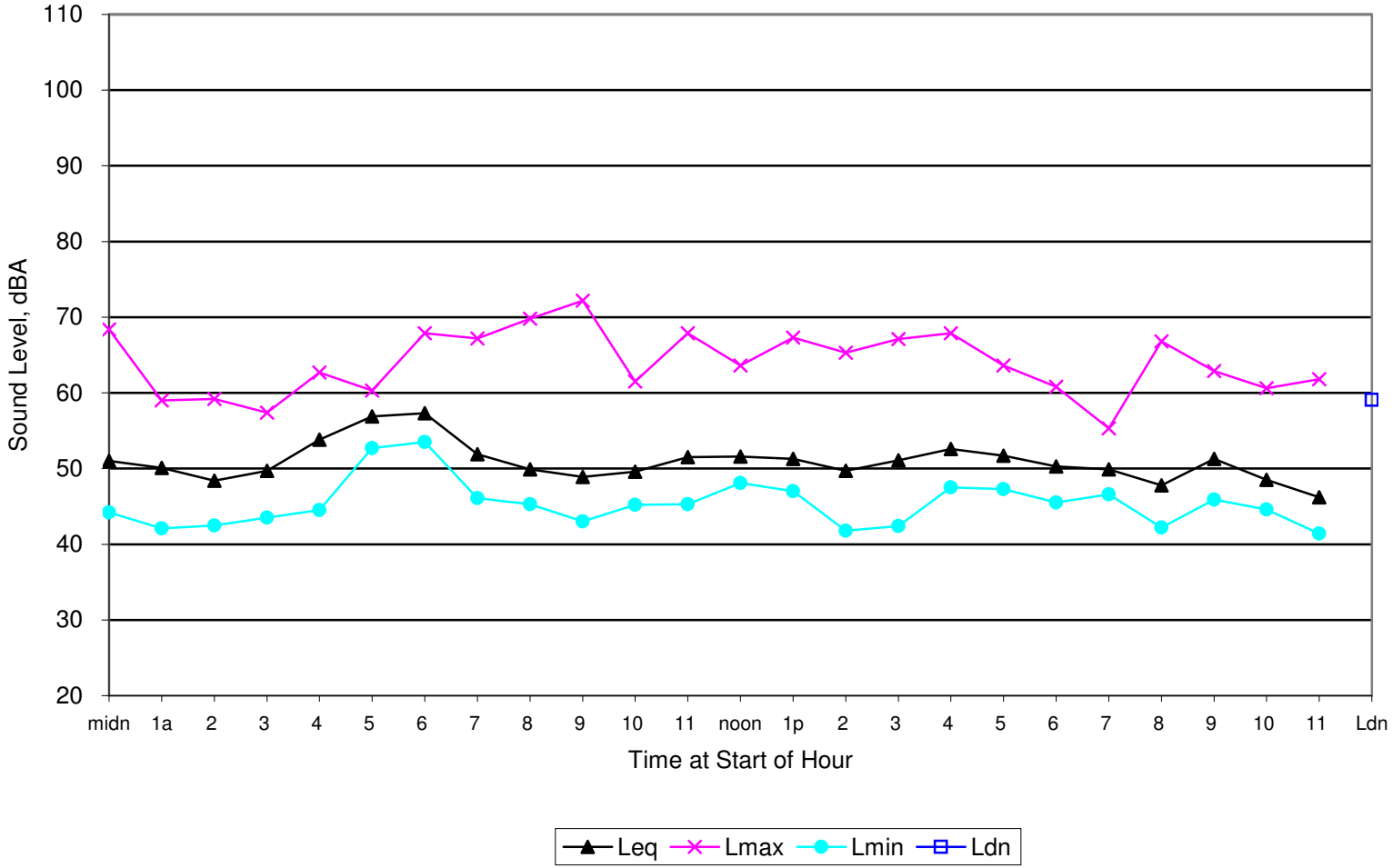
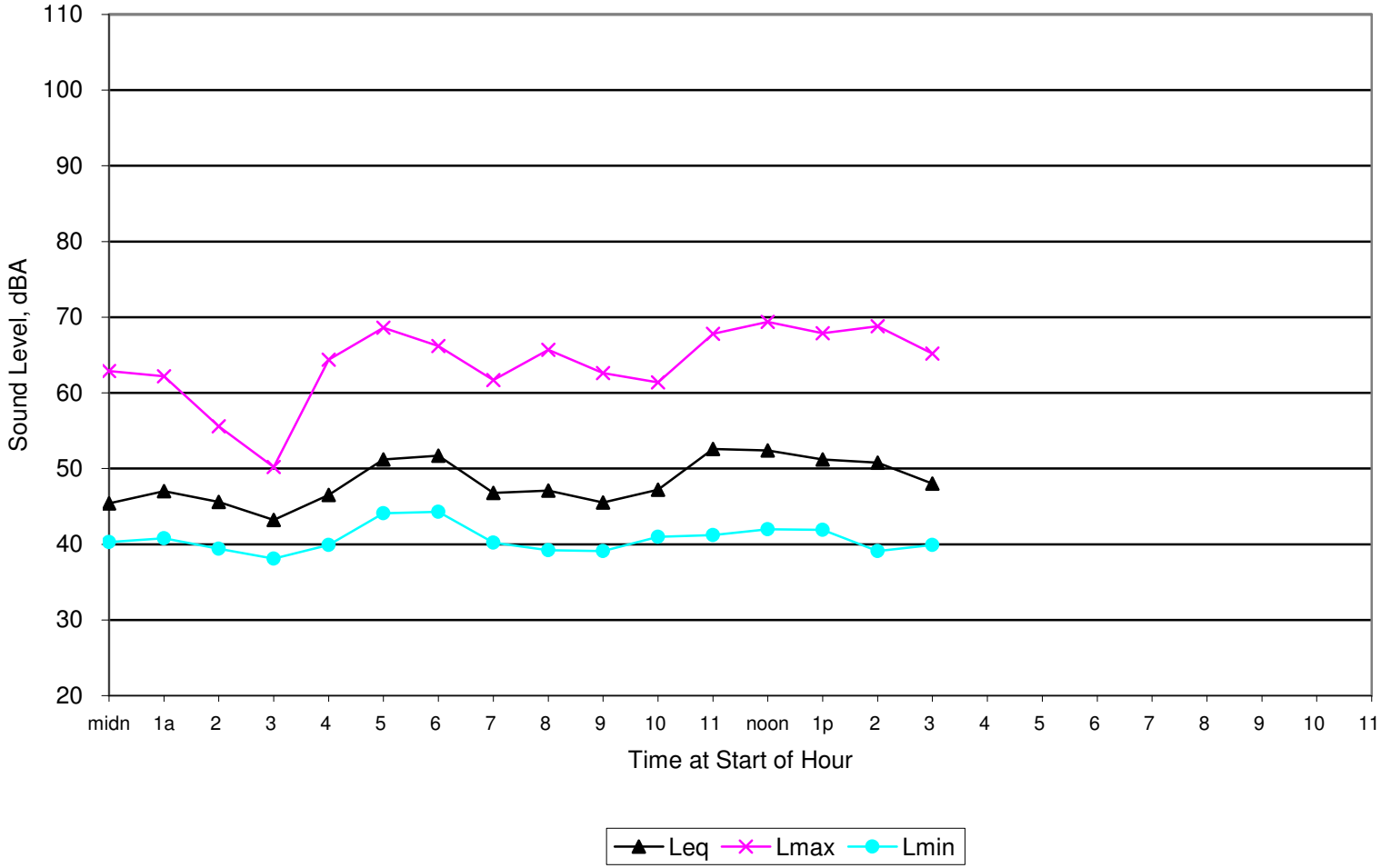


**FIGURE A-9**
**EXISTING SOUND LEVELS**

LOCATION M3
DATE: 7/12/07



## FIGURE A-10
## EXISTING SOUND LEVELS

LOCATION M4
DATE: 7/10/07

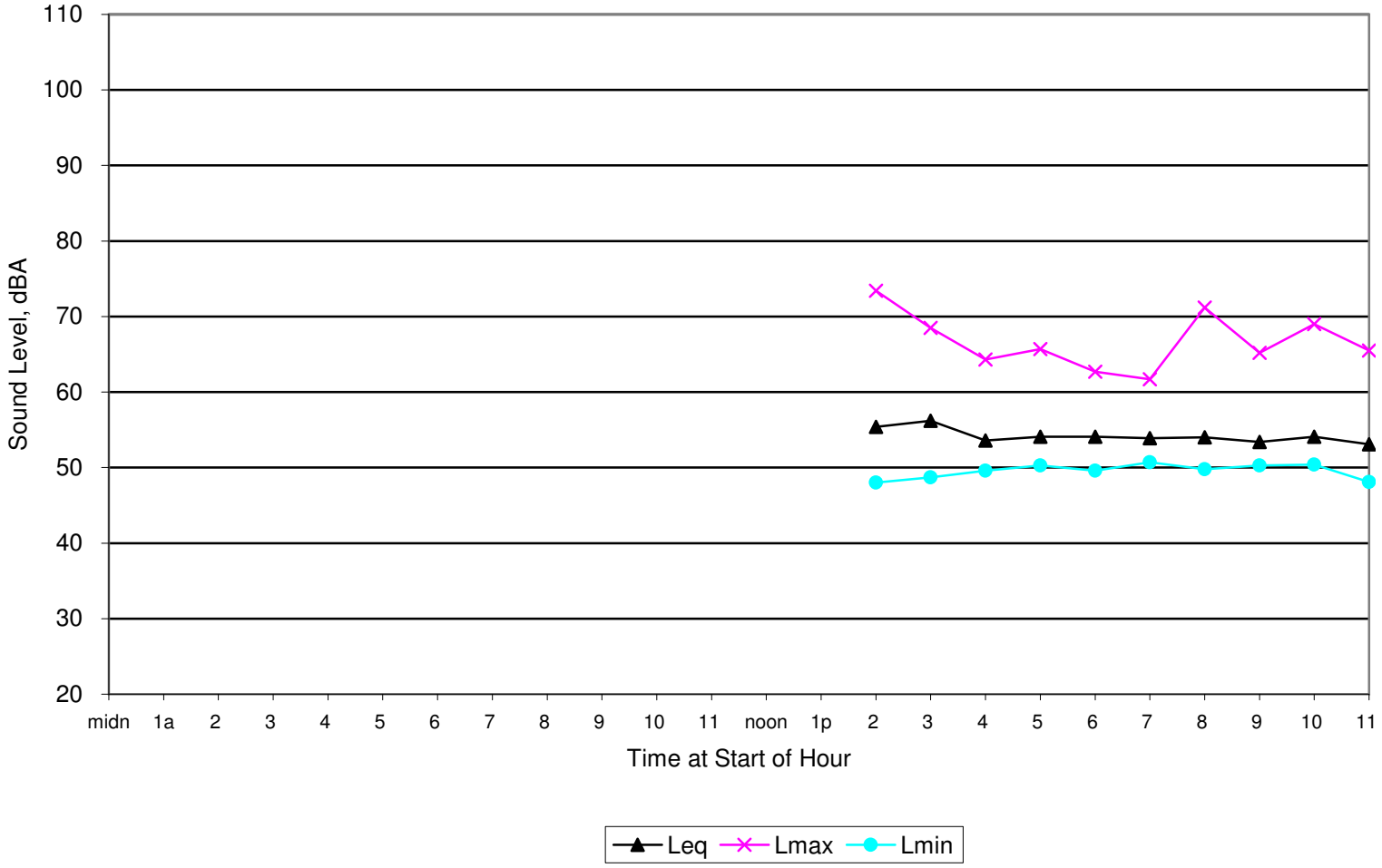


**FIGURE A-11**
**EXISTING SOUND LEVELS**

LOCATION M4
DATE: 7/11/07

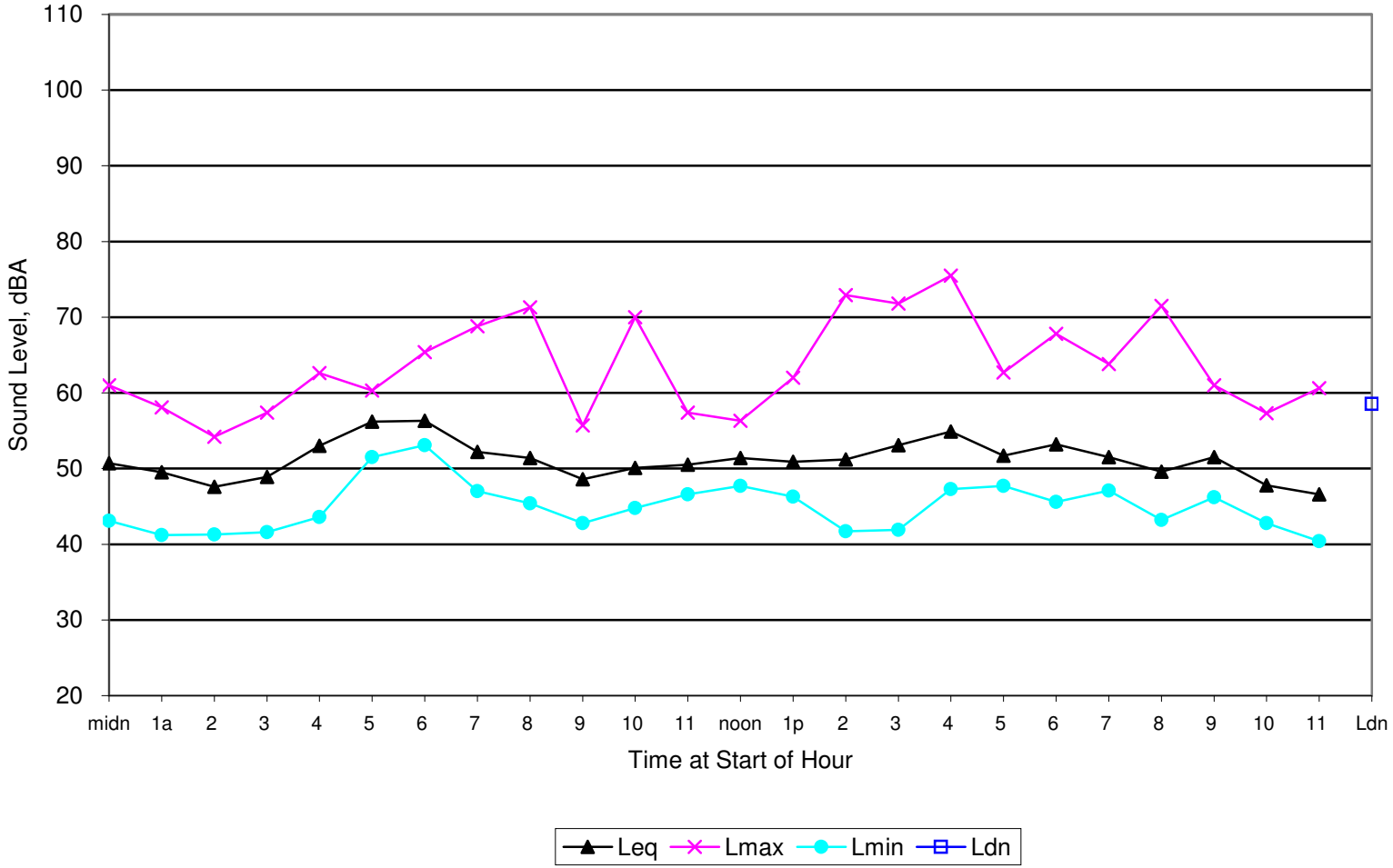
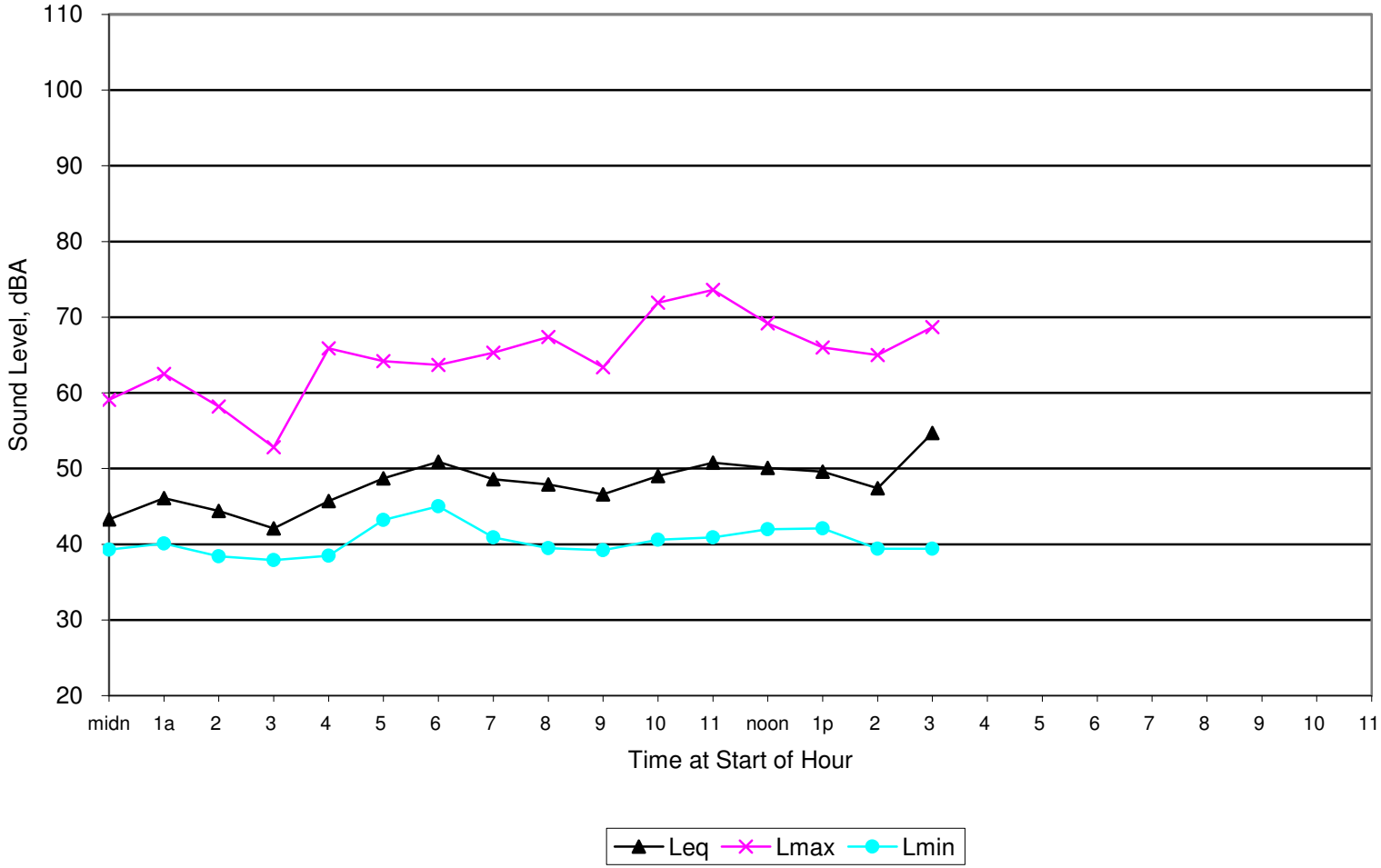


**FIGURE A-12**
**EXISTING SOUND LEVELS**

LOCATION M4
DATE: 7/12/07



# GEOTECHNICAL ENGINEERING SERVICES
# JUANITA SUBSTATION IMPROVEMENTS
# KIRKLAND, WASHINGTON

FEBRUARY 29, 2007

FOR
PUGET SOUND ENERGY

GEOENGINEERS

# Geotechnical Engineering Services
# Juanita Substation Improvements
# Kirkland, Washington
## File No. 0186-760-00

**February 29, 2007**

**Prepared for:**

**Puget Sound Energy**
**PO Box 90868, EST-04W**
**Bellevue, Washington 98009-0868**

**Attention: John Rorabacher, PE**

**Prepared by:**


**GeoEngineers, Inc.**
**Plaza 600 Building**
**600 Stewart Street, Suite 1700**
**Seattle, Washington 98101**
**(206) 728-2674**

For **Timothy D. Bailey, PE**
**Geotechnical Engineer**

**Bo McFadden, PE, LEG**
**Principal**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STATE OF WASHINGTON
26693
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2/29/08
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# GEOTECHNICAL ENGINEERING SERVICES
# JUANITA SUBSTATION IMPROVEMENTS
# KIRKLAND, WASHINGTON
# FOR
# PUGET SOUND ENERGY

## INTRODUCTION

This report summarizes the results of our geotechnical engineering services for the proposed improvements to the existing Puget Sound Energy (PSE) Juanita substation. The site is located at 10910 Northeast 132nd Street in Kirkland, Washington. The site is shown in relation to the surrounding improvements on the Vicinity Map, Figure 1, and the Site Plan, Figures 2A and 2B. We previously provided a draft version of this report dated February 27, 2008; this version of the report incorporates comments we received.

Our geotechnical engineering services were completed in general accordance with our proposal dated February 6, 2008. Our scope of work includes:

- Completing eight test pits and three infiltration tests at the site;
- Completing laboratory testing on selected soil samples from the test pits;
- Providing geotechnical conclusions and recommendations for the proposed improvements; and
- Preparing this report.

## PROJECT DESCRIPTION

Our understanding of the project is based on our discussion with John Rorabacher of PSE. We visited the site on February 8, 2008 to evaluate access considerations and develop an appropriate exploration plan.

We understand that the existing substation at the south end of the site will be removed and that a new, larger substation will be constructed at the north end of the site. The proposed 115 kV substation equipment will include dead end towers, buses, transformers, metal-clad switchgear and gas breakers. A stormwater infiltration facility is also planned just south of the new substation to manage stormwater from the substation. The layout of these features is shown on the Site Plan, Figures 2A and 2B.

## FIELD EXPLORATION AND LABORATORY TESTING

### FIELD EXPLORATIONS

The subsurface conditions at the site were evaluated by completing eight test pits (TP-1 through TP-8) to depths of 5 to 10 feet below existing site grades. The approximate locations of the test pits are shown on the Site Plan, Figures 2A and 2B. A detailed description of the field exploration program is presented in Appendix A.

### INFILTRATION TESTING

We also completed three infiltration tests at the location of the proposed stormwater facility. The tests were completed in accordance with the procedure outlined in Reference 6-A in the King County, Washington, Surface Water Design Manual. The infiltration test holes were completed in test pits TP-4, TP-5 and TP-6, as shown in Figure 2B. Details of the infiltration testing procedure are presented in Appendix A. The results of the infiltration rate tests are presented in Table 1, together with the approximate elevations of each test.

**Table 1. Infiltration Test Results**

| Location | Approximate Elevation of Test (feet) | Measured Infiltration Rate (inches/hour) | $D_{10}$ Size from Sieve Analysis (mm) |
|---|---|---|---|
| TP-4 | 175.5 | 72 | NA |
| TP-5 | 175.5 | 66 | 1 |
| TP-6 | 175.5 | 69 | 1 |

### LABORATORY TESTING

Soil samples were obtained during the exploration program and taken to GeoEngineers' laboratory for further evaluation. Selected samples were tested for the determination of moisture content, fines content (material passing the U.S. No. 200 sieve) and grain size distribution (sieve analysis). A description of the laboratory testing and the test results are presented in Appendix B or on the exploration logs in Appendix A, as appropriate.

## SITE CONDITIONS

### SURFACE CONDITIONS

The site is a long, rectangular parcel approximately 85 feet wide from east to west and 1,250 feet long from north to south. The site is accessed via a gravel driveway off NE 132nd Street on the north. The existing substation is located near the south end of the site. Overhead power lines come in from the north and south. The substation is connected to Northeast 132nd Street through the gravel driveway that runs centrally along the site in the north-south direction. The site slopes gently down from north to south, with a total change in elevation of approximately 40 feet across the length of the site. Vegetation on the site includes bushes and trees (primarily on the east and west boundaries of the site) outside the existing substation fence.

### GEOLOGY

Geologic information for the project area (Minard, 1983) indicates that native surficial soils at the site are composed of recessional outwash sand and gravel overlying very dense glacial till. Outwash sand generally consists of sand with gravel and occasional cobbles and boulders, and glacial till generally consists of a very compact, poorly sorted, nonstratified mixture of clay, silt, sand, gravel and cobbles.

### SUBSURFACE CONDITIONS

Based on the explorations performed at the site, the subsurface conditions generally consist of topsoil overlying loose to medium dense recessional outwash overlying dense to very dense glacial till.

We encountered approximately 6 to 12 inches of topsoil in the test pits. The topsoil is generally underlain by recessional outwash consisting of loose to dense gravel and sand with varying silt content. The recessional outwash extended to the depth explored (10 feet) in test pits TP-1 through TP-6. The recessional outwash extended to 4½ feet and 2 feet in test pits TP-7 and TP-8, respectively. In test pits TP-7 and TP-8, the recessional outwash was underlain by glacial till consisting of very dense silty sand with gravel.

Groundwater was not encountered in any of our explorations.

## CONCLUSIONS AND RECOMMENDATIONS

### SUMMARY

A summary of the primary geotechnical considerations is provided below. The summary is presented for introductory purposes only and should be used in conjunction with the complete recommendations presented in this report.

- The site is designated as seismic Site Class C per the 2006 International Building Code (IBC).
- On-site soils are suitable for reuse as structural fill during periods of dry weather and may be suitable during wet weather as well, provided they can be moisture-conditioned to meet compaction requirements. If on-site soils cannot be adequately compacted during wet weather, imported gravel borrow should be used.
- Substation equipment can be supported on shallow foundations with an allowable bearing pressure of 3,500 pounds per square foot (psf), a passive resistance of 250 psf and a base friction value of 0.4. We estimate total settlement on the order of ½ to 1 inch.
- Dead-end structures can be supported on mat foundations or drilled shaft foundations; allowable bearing pressures for mat foundations and parameters for drilled shaft design are included in later sections of this report.
- Some on-site soils are suitable for reuse as structural fill during periods of dry weather and may be suitable during wet weather as well, provided they can be moisture-conditioned to meet compaction requirements. If on-site soils cannot be adequately compacted during wet weather, imported gravel borrow should be used.
- Stormwater can be infiltrated into recessional outwash using a long-term design infiltration rate of 9 inches per hour.

Our specific geotechnical recommendations are presented in the following sections of this report.

### EARTHQUAKE ENGINEERING

We recommend the 2006 IBC parameters for Site Class, short period spectral response acceleration ($S_S$), 1-second period spectral response acceleration ($S_1$) and Seismic Coefficients $F_A$ and $F_V$ presented in Table 2.

**Table 2. 2006 IBC Seismic Parameters**

| 2006 IBC Parameter | Recommended Value |
|---|---|
| Site Class | C |
| Short Period Spectral Response Acceleration, $S_S$ (percent g) | 119.5 |
| 1-Second Period Spectral Response Acceleration, $S_1$ (percent g) | 40.9 |
| Seismic Coefficient, $F_A$ | 1.00 |
| Seismic Coefficient, $F_V$ | 1.39 |

We evaluated the site for seismic hazards including liquefaction, lateral spreading and fault rupture. Our evaluation indicates that the site does not have liquefiable soils present and therefore also has no risk of liquefaction-induced lateral spreading. In addition, the site has a low risk of fault rupture, based on the distance from mapped faults.

## SHALLOW FOUNDATIONS AND MAT FOUNDATIONS

### *Allowable Bearing Pressure*

We recommend that the substation equipment be supported on conventional shallow spread footings or mat foundations bearing either on the native soils or on properly compacted structural fill placed over the native soils. The mat foundations and spread footings, where required, may be designed using an allowable soil bearing pressure of 3,500 psf. An allowable edge pressure of 4,000 psf may be used in the design of dead-end tower foundations. The allowable soil bearing values apply to the total of dead and long-term live loads and may be increased by up to one-third for transient loads such as wind or seismic forces. A subgrade modulus of 200 pounds per cubic inch (pci) may be used for the design of mat foundations.

### *Embedment*

In general, we recommend that the bottom of foundations be embedded at least 18 inches below the lowest adjacent grade for frost protection. The foundation embedment depth may be reduced to 12 inches for small, lightly loaded footings where frost action will not affect equipment performance, or an additional 6-inch-thick layer of gravel that is not susceptible to frost may be placed below the foundations to achieve an embedment of 18 inches. The gravel should meet the requirements of "yard course" surfacing material presented in the "Structural Fill" section of this report.

### *Settlement*

Provided all loose soil is removed and the subgrade is prepared as recommended below in the "Construction Considerations" section, we estimate that the total settlement of shallow foundations will be on the order of ½ to 1 inch. Differential settlements are expected to be less than ½ inch.

### *Lateral Resistance*

Lateral foundation loads can be resisted by passive resistance on the sides of foundations and by friction on the base of the foundations. For foundations supported on native soils or on structural fill placed and compacted in accordance with our recommendations, the allowable frictional resistance can be computed using a coefficient of friction of 0.4 applied to vertical dead-load forces.

The allowable passive resistance can be computed using an equivalent fluid density of 250 pounds per cubic foot (pcf) (triangular distribution) if these elements are poured directly against compacted native soils or surrounded by structural fill. The structural fill should extend out from the face of the foundation element for a distance at least equal to three times the height of the element and be compacted to at least 95 percent of the maximum dry density (MDD) estimated in general accordance with American Society for Testing and Materials (ASTM) D 1557.

The above coefficient of friction and passive equivalent fluid density values incorporate a factor of safety of about 1.5.

### *Construction Considerations*

If soft soil areas are present at the foundation subgrade elevation, the soft areas should be removed and replaced with structural fill. In such instances, the zone of structural fill should extend laterally beyond the footing edges for a horizontal distance that is at least equal to the thickness of the fill.

We recommend that a representative from our firm observe the condition of all footing excavations to evaluate whether the work is completed in accordance with our recommendations and whether the subsurface conditions are as anticipated.

## DRILLED SHAFTS

### *General*

The dead-end towers may be supported on shallow mat foundations as discussed above or drilled shafts, which may be preferable to shallow mat foundations because of space limitations. We recommend that the drilled shafts extend to a depth of at least 15 feet below the existing ground surface.

### *Axial Capacity*

The applied axial loads on the drilled shafts are generally very small in comparison to the applied overturning moments, resulting from the tension in the wires along with possible ice and wind loading. The axial capacity of the drilled shafts in compression will be developed primarily from friction in the medium dense to dense recessional outwash and end bearing in the very dense recessional outwash or glacial till. Provided the drilled shafts are embedded at least 15 feet below the existing ground surface, we anticipate that the allowable axial capacity for shafts at least 3 feet in diameter will be greater than 100 kips.

### *Lateral Capacity*

The design of the drilled shafts will be governed by the lateral loads on the structures. The lateral capacity of the drilled shafts will develop from the stiffness of the drilled shaft and the lateral resistance of the soil surrounding the drilled shaft.

We understand that the shafts will be designed using the LPILE™ program. For evaluation of the lateral load behavior of the drilled shafts, the parameters in Table 3 can be used as input soil parameters for the LPILE™ program. Based on our evaluation, the soil profile can be divided into two soil layers as shown in Table 3.

**Table 3. Lateral Pile Analysis Input Parameters**

| Soil Parameter | Layer 1 | Layer 2 |
|---|---|---|
| Depth (in) | 0-150 | 150-600 |
| Soil Type (p-y curve model) | Sand (Reese) | Sand (Reese) |
| Effective Unit Weight (lb/in$^3$) | 0.0723 | 0.0752 |
| Friction Angle (degrees) | 34 | 38 |
| p-y Modulus, k (lb/in$^3$) | 90 | 150 |

### *Drilled Shaft Settlement*

We estimate that postconstruction settlement of drilled shaft foundations, designed and installed as recommended, will be on the order of ½ inch or less. Maximum differential settlement should be less than about one-half the postconstruction settlement. Most of this settlement will occur rapidly as loads are applied.

### *Construction Considerations*

Temporary casing will not likely be required to keep the drilled holes open. However, the contractor should have temporary casing available for use if sloughing and caving of the site walls is encountered because of perched groundwater seepage. We recommend that the drilled shaft foundation excavations be observed by GeoEngineers.

## EARTHWORK

### *Excavation Considerations*

Recessional outwash and glacial till were observed in the explorations. We anticipate that these soils can be excavated with conventional excavation equipment, such as trackhoes or dozers. Cobbles and boulders were encountered in the soils at the site, and the contractor should be prepared to remove them where necessary.

### *Clearing and Grubbing*

Removal and demolition of existing substation structures should include removal of foundation elements. Existing voids or new depressions created during site preparation should be cleaned of loose soil or debris and backfilled with structural fill.

Trees, brush and other vegetation, including topsoil with roots, should be stripped and removed from areas where structural fill will be placed. The stripped material should be placed in landscaping areas or transported off-site for disposal.

### *Subgrade Preparation*

In areas where structural fill is to be placed, the upper 8 to 12 inches of existing subgrade soils should be compacted and evaluated prior to fill placement. This can be done either by probing or by proof-rolling with heavy, rubber-tired construction equipment. Likewise, the exposed subgrade in the proposed foundation areas for structures should be evaluated after site grading is complete. Probing should be used to evaluate the subgrades where proof-rolling is not possible or if site grading takes place during wet weather. Soft zones noted during proof-rolling or probing should be excavated and replaced with compacted structural fill.

### *Erosion and Sedimentation Control*

Potential sources or causes of erosion and sedimentation depend upon construction methods, slope length and gradient, amount of soil exposed and/or disturbed, soil type, construction sequencing and weather. The project impact on erosion-prone areas can be reduced by implementing an erosion and sedimentation control plan. The plan should be designed in accordance with applicable city and/or county standards. The plan should incorporate basic planning principles, including:

- Scheduling grading and construction to reduce soil exposure;
- Retaining existing vegetation whenever feasible;
- Revegetating or mulching denuded areas;
- Directing runoff away from denuded areas;
- Minimizing the length and steepness of slopes with exposed soils;
- Decreasing runoff velocities;
- Confining sediment to the project site; and
- Inspecting and maintaining control measures frequently.

We recommend that graded and disturbed slopes be tracked in place with the equipment running perpendicular to the slope contours so that the track marks provide a texture to help resist erosion and channeling. Some sloughing and raveling of slopes with exposed or disturbed soil should be expected.

Temporary erosion protection should be used and maintained in areas with exposed or disturbed soils to help reduce the potential for erosion and reduce transport of sediment to adjacent areas. Temporary erosion protection should include the construction of a silt fence around the perimeter of the work area prior to the commencement of grading activities. Permanent erosion protection should be provided by reestablishing vegetation using hydroseeding and/or landscape planting.

Until the permanent erosion protection is established and the site is stabilized, site monitoring should be performed by qualified personnel to evaluate the effectiveness of the erosion control measures and repair and/or modify them as appropriate. Provisions for modifications to the erosion control system based on monitoring observations should be included in the erosion and sedimentation control plan.

### *Structural Fill*

**Materials.** Materials used to raise site grades, placed to support structures or pavements, or used for utility trench backfill are classified as structural fill for the purpose of this report. Structural fill material quality varies depending upon its use as described below:

1. On-site soils may be used as structural fill during dry weather. On-site soils may also be used during wet weather provided that they can be moisture-conditioned to meet compaction specifications. If on-site soils cannot be moisture-conditioned, imported gravel borrow should conform to Puget Sound Energy Base Course Aggregate Specification 1275.1310 as described in the following table:

| US Standard Sieve Size | Percent Passing (by weight) |
|---|---|
| 3 inch | 100 |
| ¾ inch | > 90 |
| ¼ inch | 50-65 |
| U.S. No. 200 | < 5 |

2. Structural fill placed as "yard course crushed aggregate" surfacing material should be angular crushed rock conforming to Puget Sound Energy Specification 1275.1330 as described in the following table:

| US Standard Sieve Size | Percent Passing (by weight) |
|---|---|
| 1½ inches | 100 |
| 1 inch | 60 to 100 |
| ¾ or ⅝ inch | 0 to 35 |
| ⅜ inch | 0 to 5 |

**Fill Placement and Compaction Criteria.** Structural fill should be mechanically compacted to a firm, non-yielding condition. In general, structural fill should be placed in loose lifts not exceeding 8 to 10 inches in thickness. Each lift should be conditioned to the proper moisture content and compacted to the specified density before placing subsequent lifts. Structural fill should be compacted to the following criteria:

1. Structural fill placed below foundations or to establish yard grades should be compacted to at least 95 percent of the MDD estimated in general accordance with ASTM D 1557. Structural fill placed to form finished slopes should also be compacted to at least 95 percent of the MDD.

2. Structural fill (including utility trench backfill) placed outside of areas where foundations, roadways, parking and yard areas are to be located should be compacted to at least 90 percent of the MDD estimated in general accordance with ASTM D 1557.

We recommend that a representative from our firm be present during proof-rolling and/or probing of the exposed subgrade soils in structure areas prior to the placement of structural fill and also during the placement of structural fill. Our representative will evaluate the adequacy of the subgrade soils and identify areas needing further work, perform in-place moisture-density tests in the fill to evaluate whether the work is being done in accordance with the compaction specifications, and advise on any modifications to procedures that may be appropriate for the prevailing conditions.

### *Weather Considerations*

The native soils contain a sufficient percentage of fines (silt) and are moisture-sensitive. When the moisture content of these soils is appreciably above the optimum moisture content, these soils become muddy and unstable, operation of equipment on these soils will be difficult, and it will be difficult to meet the required compaction criteria. Additionally, disturbance of these near-surface soils should be expected if earthwork is completed during periods of wet weather.

The wet weather season in the Puget Sound region generally begins in October and continues through May; however, periods of wet weather may occur during any month of the year. The optimum earthwork period for these types of soils is typically June through September. If wet weather earthwork is unavoidable, we recommend that:

- Stockpiles of on-site soils that will be used as structural fill during wet weather should be covered with plastic sheeting to protect them from rain.
- If on-site soils cannot be moisture-conditioned to meet compaction requirements during wet weather, imported gravel borrow should be used as discussed previously in the "Structural Fill" section of this report.
- The ground surface in and around the work area should be sloped so that surface water is directed away from the work area. The ground surface should be graded such that areas of ponded water do not develop. The contractor should take measures to prevent surface water from collecting in excavations and trenches. Measures should be implemented to remove surface water from the work area.

### *Temporary Slopes*

The soils encountered at the site are classified as Type C soil in accordance with the provisions of Title 296-155 of the Washington Administrative Code (WAC), Part N, "Excavation, Trenching, and Shoring." We recommend that temporary slopes in excess of 4 feet in height be inclined no steeper than 1½H:1V (horizontal to vertical). Flatter slopes may be necessary if localized sloughing occurs. For open cuts at the site, we recommend that:

- No traffic, construction equipment, stockpiles or building supplies be allowed at the top of cut slopes within a distance of at least 5 feet from the top of the cut.
- Exposed soil along the slope be protected from surface erosion using waterproof tarps or plastic sheeting.
- Construction activities be scheduled so that the length of time that the temporary cut is left open is kept as short as possible.
- Erosion control measures be implemented as appropriate such that runoff from the site is reduced to the extent practicable.
- Surface water be diverted away from the excavation.
- The general condition of the slopes be observed periodically by a geotechnical engineer to confirm adequate stability.

Because the contractor has control of the construction operations, the contractor should be made responsible for the stability of cut slopes, as well as the safety of the excavations. All shoring and temporary slopes must conform to applicable local, state and federal safety regulations.

### *Permanent Slopes*

We recommend that permanent cut and fill slopes be constructed no steeper than 2H:1V. To achieve uniform compaction, we recommend that fill slopes be overbuilt slightly and subsequently cut back to expose properly compacted fill.

To reduce erosion, newly constructed slopes should be planted or hydroseeded shortly after completion of grading. Until the vegetation is established, some sloughing and raveling of the slopes should be expected. This may require localized repairs and reseeding. Temporary covering, such as clear heavy plastic sheeting, jute fabric, loose straw or excelsior matting should be used to protect the slopes during periods of rainfall.

### SITE DRAINAGE AND INFILTRATION

We recommend that the ground surface be sloped to drain away from the proposed substation. Pavement surfaces should be sloped such that surface water runoff is collected and routed to suitable discharge points. We understand that stormwater at the site will be infiltrated using a stormwater pond that will be located south of the substation.

Using the simplified method from the King County Surface Water Design Manual, the maximum design infiltration rate based on the infiltration testing is 22 inches per hour. Based on the sieve analysis results and long-term studies (Ecology, 2001), we recommend a long-term design infiltration rate of 9 inches per hour.

## LIMITATIONS

We have prepared this report for the exclusive use of Puget Sound Energy and their authorized agents for the proposed Juanita Substation Improvements in Kirkland, Washington.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of geotechnical engineering in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

Any electronic form, facsimile or hard copy of the original document (email, text, table, and/or figure), if provided, and any attachments are only a copy of the original document. The original document is stored by GeoEngineers, Inc. and will serve as the official document of record.

Please refer to Appendix C, Report Limitations and Guidelines for Use, for additional information pertaining to use of this report.

## REFERENCES

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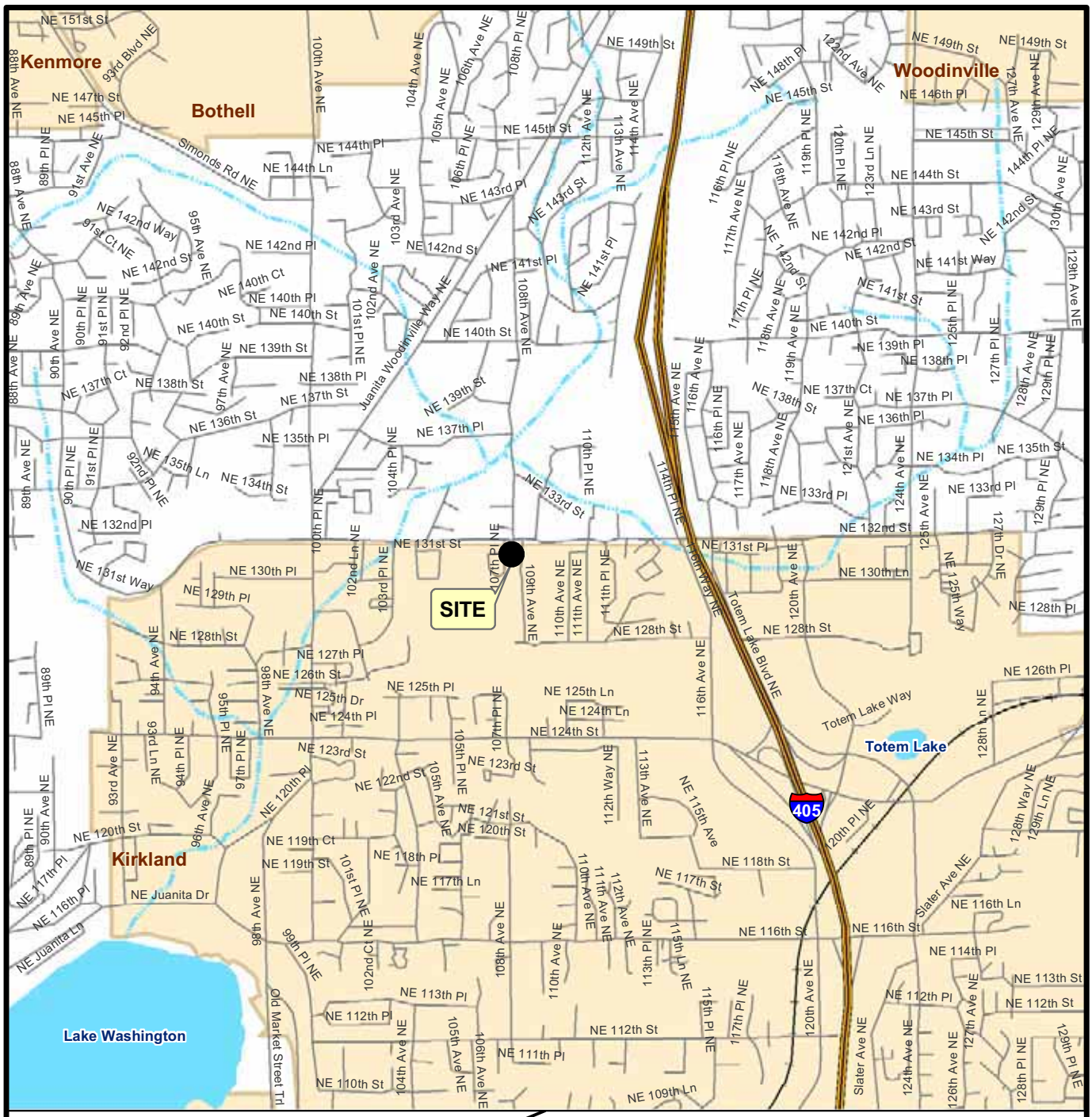


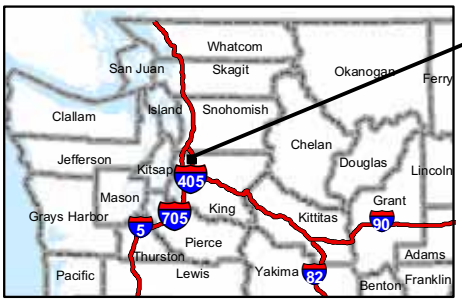


Lambert Conformal Conic
Washington State Plane North
North American Datum 1983

Data Sources: Interstates, state routes, and roads from TIGER 2000.
County boundaries, cities, and waterbodies from Department of Ecology.

Note: This drawing is for informational purposes.
It is intended to assist in showing features discussed in an attached document.

All locations are approximate.

0 1,000 2,000 Feet

N

# VICINITY MAP

**Juanita Substation Improvements**
**Kirkland, Washington**

GEOENGINEERS

**FIGURE 1**

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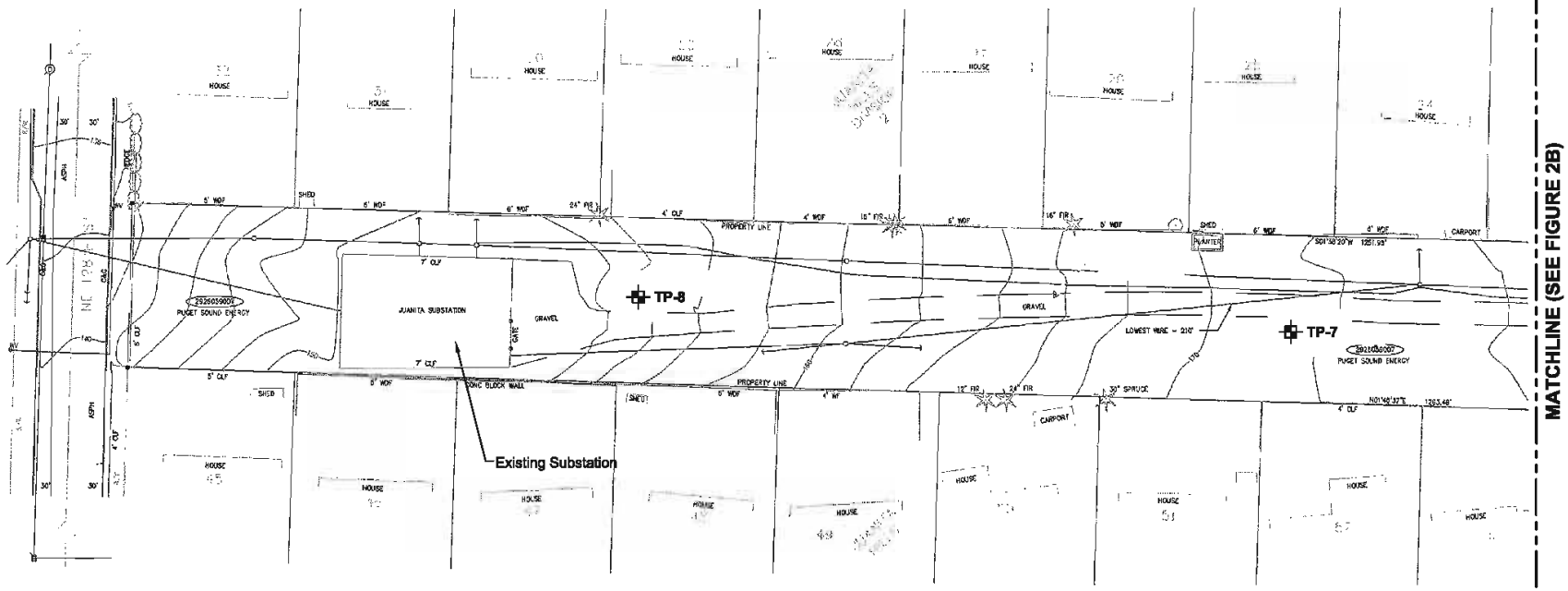
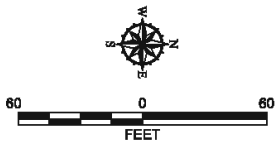
Map Revised: February 27, 2008 ETB




## Notes

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Reference: PDF of drawing file "SVTPXPSEN000000114.dwg", provided by David Evans and Associates, dated May 8, 2007.

## Legend

TP-1 Test Pit Location

**Site Plan**

Juanita Substation Improvements
Kirkland, Washington

GEOENGINEERS

**Figure 2A**

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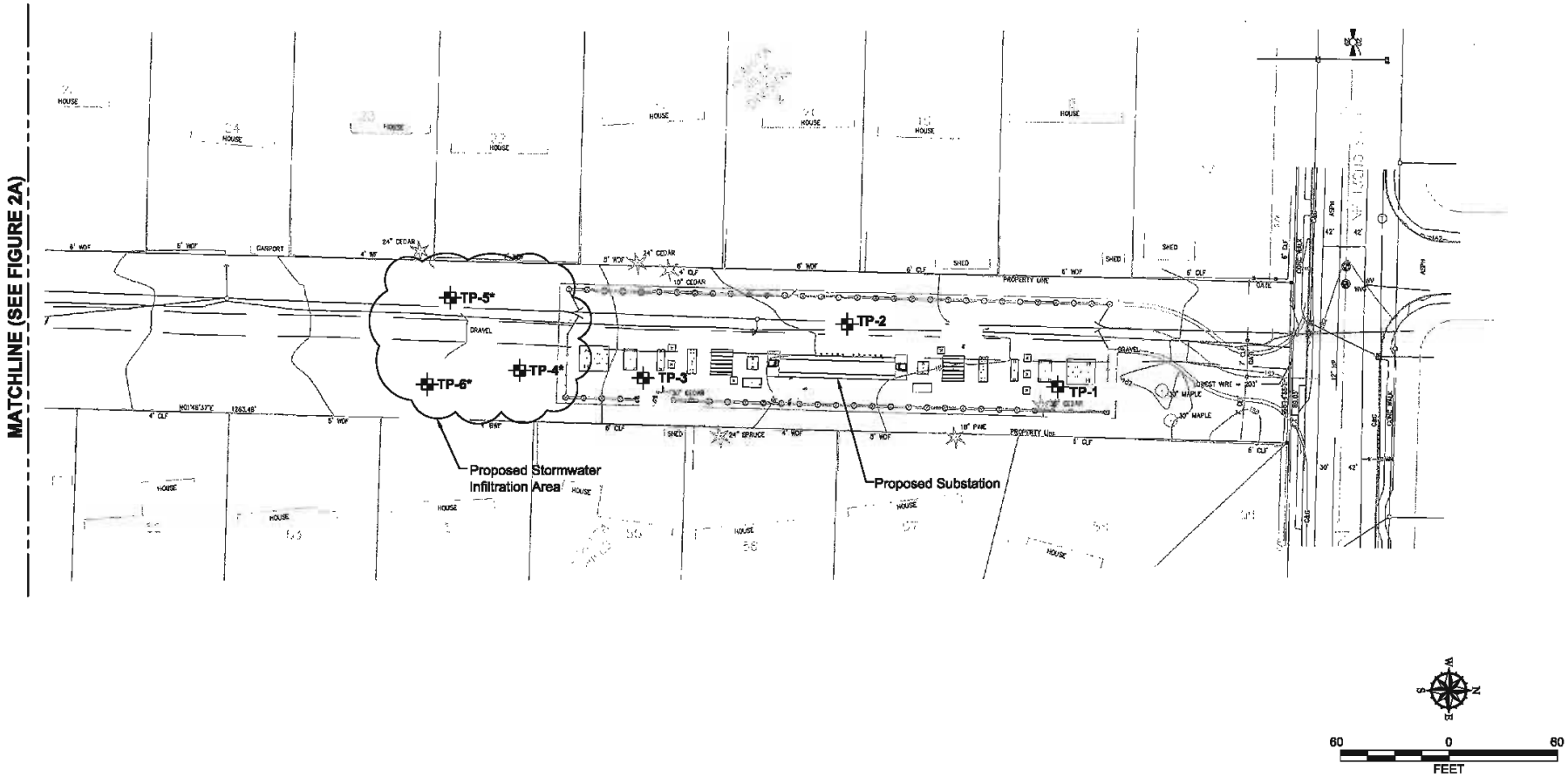


## Notes

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Reference: PDF of drawing file "SVTPXPSEN00000114.dwg", provided by David Evans and Associates, dated May 8, 2007.

## Legend

TP-1 Test Pit Location (*Indicates Infiltration Test)

**Site Plan**

Juanita Substation Improvements
Kirkland, Washington

GEOENGINEERS

**Figure 2B**

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GeoEngineers

# *Appendix A*
## *Field Explorations*

# APPENDIX A
# FIELD EXPLORATIONS

## GENERAL

Subsurface conditions were explored at the site by completing eight test pits (TP-1 through TP-8). The test pits were completed by Kelly's Excavating, Inc. of Pacific, Washington, on February 11, 2008. We also completed three infiltration tests (at test pit locations TP-4 through TP-6) at the location of the proposed stormwater facility. The locations of the explorations were estimated in the field by measuring distances from site features through taping and pacing. The approximate exploration locations are shown on the Site Plan, Figures 2A and 2B. Exploration elevations were estimated based on a topographic map provided by Puget Sound Energy dated May 8, 2007.

## TEST PITS

The test pits were excavated using a rubber-tired backhoe. The test pits were continuously observed by a geotechnical engineer from our firm who examined and classified the soils encountered, obtained representative soil samples, observed groundwater conditions and prepared a detailed log of each test pit.

Soils encountered in the test pits were visually classified in general accordance with the classification system described in Figure A-1. A key to the exploration log symbols is also presented in Figure A-1. The logs of the test pits are presented in Figures A-2 through A-9. The logs reflect our interpretation of the field conditions and the results of laboratory testing and evaluation of samples. They also indicate the depths at which the soil types or their characteristics change, although the change might actually be gradual.

The test pits were backfilled with the excavated soils and compacted to the extent practicable with the bucket of the excavator. The fill will not behave as structural fill and will likely need to be recompacted during construction of the substation.

## INFILTRATION TESTS

Three infiltration tests were performed on February 11, 2008, and completed in accordance with the procedure outline in Reference 6-A in the King County, Washington, Surface Water Design Manual. The tests were conducted in tests pits TP-4 through TP-6 after excavating to a depth of approximately 4 to 4½ feet below the existing ground surface. The infiltration tests were conducted at a depth of approximately 4½ to 5 feet below the existing ground surface. Our geotechnical engineer extended the hole to the desired depth using 6-inch-diameter hand auger.

To prevent caving of the poorly-graded sand, the hand-augered boring was cased with 6-inch-diameter polyvinyl chloride (PVC) pipe. Approximately 2 inches of ½- to ¾-inch rock was placed on the bottom of the hole. The hole was then filled with water to a depth of at least 12 inches and allowed to saturate for at least 30 minutes. After the saturation period, the hole was filled with 6 inches of water. Water level drop was measured for a known period. The last water level drop was used to calculate the percolation rate.

## GROUNDWATER CONDITIONS

No groundwater was observed during our explorations. Groundwater conditions observed during the explorations represent a short-term condition and may or may not be representative of the long-term groundwater conditions at the site.

## SOIL CLASSIFICATION CHART

| MAJOR DIVISIONS | | | SYMBOLS GRAPH | SYMBOLS LETTER | TYPICAL DESCRIPTIONS |
|---|---|---|---|---|---|
| COARSE GRAINED SOILS<br>MORE THAN 50% RETAINED ON NO. 200 SIEVE | GRAVEL AND GRAVELLY SOILS<br>MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE | CLEAN GRAVELS<br>(LITTLE OR NO FINES) | | GW | WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES |
| | | | | GP | POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES |
| | | GRAVELS WITH FINES<br>(APPRECIABLE AMOUNT OF FINES) | | GM | SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES |
| | | | | GC | CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES |
| | SAND AND SANDY SOILS<br>MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE | CLEAN SANDS<br>(LITTLE OR NO FINES) | | SW | WELL-GRADED SANDS, GRAVELLY SANDS |
| | | | | SP | POORLY-GRADED SANDS, GRAVELLY SAND |
| | | SANDS WITH FINES<br>(APPRECIABLE AMOUNT OF FINES) | | SM | SILTY SANDS, SAND - SILT MIXTURES |
| | | | | SC | CLAYEY SANDS, SAND - CLAY MIXTURES |
| FINE GRAINED SOILS<br>MORE THAN 50% PASSING NO. 200 SIEVE | SILTS AND CLAYS | LIQUID LIMIT LESS THAN 50 | | ML | INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY |
| | | | | CL | INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS |
| | | | | OL | ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY |
| | SILTS AND CLAYS | LIQUID LIMIT GREATER THAN 50 | | MH | INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS |
| | | | | CH | INORGANIC CLAYS OF HIGH PLASTICITY |
| | | | | OH | ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY |
| HIGHLY ORGANIC SOILS | | | | PT | PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS |

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

## ADDITIONAL MATERIAL SYMBOLS

| SYMBOLS GRAPH | SYMBOLS LETTER | TYPICAL DESCRIPTIONS |
|---|---|---|
| | CC | Cement Concrete |
| | AC | Asphalt Concrete |
| | CR | Crushed Rock/ Quarry Spalls |
| | TS | Topsoil/ Forest Duff/Sod |

**Measured groundwater level in exploration, well, or piezometer**

**Groundwater observed at time of exploration**

**Perched water observed at time of exploration**

**Measured free product in well or piezometer**

### Stratigraphic Contact

**Distinct contact between soil strata or geologic units**

**Gradual change between soil strata or geologic units**

**Approximate location of soil strata change within a geologic soil unit**

### Sampler Symbol Descriptions

**2.4-inch I.D. split barrel**

**Standard Penetration Test (SPT)**

**Shelby tube**

**Piston**

**Direct-Push**

**Bulk or grab**

**Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.**

**A "P" indicates sampler pushed using the weight of the drill rig.**

### Laboratory / Field Tests

| | |
|---|---|
| %F | Percent fines |
| AL | Atterberg limits |
| CA | Chemical analysis |
| CP | Laboratory compaction test |
| CS | Consolidation test |
| DS | Direct shear |
| HA | Hydrometer analysis |
| MC | Moisture content |
| MD | Moisture content and dry density |
| OC | Organic content |
| PM | Permeability or hydraulic conductivity |
| PP | Pocket penetrometer |
| SA | Sieve analysis |
| TX | Triaxial compression |
| UC | Unconfined compression |
| VS | Vane shear |

### Sheen Classification

| | |
|---|---|
| NS | No Visible Sheen |
| SS | Slight Sheen |
| MS | Moderate Sheen |
| HS | Heavy Sheen |
| NT | Not Tested |

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

**KEY TO EXPLORATION LOGS**

GEOENGINEERS

**FIGURE A-1**

Date Excavated: 02/11/08

Logged by: ASR

Equipment: Komastu PC 75

Surface Elevation (ft): Approximately 182

| Elevation feet | Depth feet | Sample | Sample Number | Graphic Log | Group Symbol | MATERIAL DESCRIPTION | Moisture Content % | OTHER TESTS AND NOTES |
|---|---|---|---|---|---|---|---|---|
| | 0 | | | | TS | Brown silty fine to medium sand with gravel and tree roots (topsoil) | | |
| | | | | | GP-GM | Brown fine to coarse gravel with silt, sand and cobbles (medium dense to dense, moist) | | |
| | | X | 1 | | | | | |
| | 5 | | | | | | | |
| | | | | | | Becomes dense | | |
| | | X | 2 | | | | 8 | SA; %F = 11 |
| | 10 | | | | | Test pit completed at 10 feet<br>No groundwater seepage observed<br>Minor caving observed at 7 to 9 feet | | |
| | 15 | | | | | | | |

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 foot.

V6_GTTPIT P:\0\0186760\00\FINALS\018676000.GPJ GEIV6_1.GDT 2/27/08

## LOG OF TEST PIT TP-1

GEOENGINEERS

Project: Juanita Substation Improvements
Project Location: Kirkland, Washington
Project Number: 0186-760-00

Figure A-2
Sheet 1 of 1

Date Excavated: 02/11/08

Logged by: ASR

Equipment: Komastu PC 75

Surface Elevation (ft): Approximately 182

| Elevation feet | Depth feet | Sample | Sample Number | Graphic Log | Group Symbol | MATERIAL DESCRIPTION | Moisture Content % | OTHER TESTS AND NOTES |
|---|---|---|---|---|---|---|---|---|
| | 0 | | | | TS | Brown silty fine to medium sand with tree roots (topsoil) | | |
| | | | | | SP-SM | Dark brown silty fine to medium sand with gravel with trace roots (loose, moist) | | |
| | | | | | GP-GM | Brown fine to coarse gravel with sand, cobbles and silt (medium dense to dense, moist) | | |
| | 5 | X | 1 | | | | | |
| | 10 | | | | | Test pit completed at 10 feet<br>No groundwater seepage observed<br>No caving observed | | |
| | 15 | | | | | | | |

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 foot.

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## LOG OF TEST PIT TP-2

GEOENGINEERS

Project: Juanita Substation Improvements
Project Location: Kirkland, Washington
Project Number: 0186-760-00

Figure A-3
Sheet 1 of 1

Date Excavated: 02/11/08

Logged by: ASR

Equipment: Komastu PC 75

Surface Elevation (ft): Approximately 180

| Elevation feet | Depth feet | Sample | Sample Number | Graphic Log | Group Symbol | MATERIAL DESCRIPTION | Moisture Content % | OTHER TESTS AND NOTES |
|---|---|---|---|---|---|---|---|---|
| | 0 | | | | TS | Brown silty fine to medium sand (topsoil) | | |
| | | | | | GP-GM | Brown fine to coarse gravel with sand, cobbles and silt (medium dense to medium dense, moist) | | |
| | 5 | | | | | | | |
| | | X | 1 | | SP | Gray medium to coarse sand with gravel (dense, moist) | 6 | SA; %F = 2 |
| | 10 | | | | | Test pit completed at 10 feet<br>No groundwater seepage observed<br>Minor caving observed at 6 feet | | |
| | 15 | | | | | | | |

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 foot.

## LOG OF TEST PIT TP-3

GEOENGINEERS

Project: Juanita Substation Improvements
Project Location: Kirkland, Washington
Project Number: 0186-760-00

Figure A-4
Sheet 1 of 1



V6_GTTPIT P:\0\0186760\00\FINALS\018676000.GPJ GEIV6_1.GDT 2/27/08

Date Excavated: 02/11/08

Logged by: ASR

Equipment: Komastu PC 75

Surface Elevation (ft): Approximately 180

| Elevation feet | Depth feet | Sample | Sample Number | Graphic Log | Group Symbol | MATERIAL DESCRIPTION | Moisture Content % | OTHER TESTS AND NOTES |
|---|---|---|---|---|---|---|---|---|
| | 0 | | | | TS | Brown silty fine to medium sand with tree roots (topsoil) | | |
| | | | | | SP-SM | Brown silty fine to medium sand with gravel (medium dense, moist) | | |
| | | | | | ML | Brown silt with sand and gravel (medium stiff, moist) | | |
| | | X | 1 | | | | 19 | SA; %F = 54 |
| | | | | | GP-GM | Brown fine to coarse gravel with silt, sand and cobbles (medium dense to dense, moist) | | Infiltration test |
| | 5 | | | | | | | |
| | 10 | | | | | Test pit completed at 10 feet<br>No groundwater seepage observed<br>Minor caving observed at 6 feet | | |
| | 15 | | | | | | | |

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 foot.

# LOG OF TEST PIT TP-4

GEOENGINEERS

Project: Juanita Substation Improvements
Project Location: Kirkland, Washington
Project Number: 0186-760-00

Figure A-5
Sheet 1 of 1



V6 GTTPIT P:\0\0186760\00\FINALS\018676000.GPJ GEIV6_1.GDT 2/27/08

Date Excavated: 02/11/08

Logged by: ASR

Equipment: Komastu PC 75

Surface Elevation (ft): Approximately 180

| Elevation feet | Depth feet | Sample | Sample Number | Graphic Log | Group Symbol | MATERIAL DESCRIPTION | Moisture Content % | OTHER TESTS AND NOTES |
|---|---|---|---|---|---|---|---|---|
| | 0 | | | | TS | Brown silty fine to medium sand with tree roots (topsoil) | | |
| | | | | | GM | Brown silty fine to coarse gravel with sand (medium dense to dense, moist) | | |
| | | X | 1 | | | | 8 | SA; %F = 15<br>Infiltration test |
| | 5 | | | | | | | |
| | 10 | | | | | Test pit completed at 10 feet<br>No groundwater seepage observed<br>Moderate caving observed at 6 feet | | |
| | 15 | | | | | | | |

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 foot.

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## LOG OF TEST PIT TP-5

GEOENGINEERS

Project: Juanita Substation Improvements
Project Location: Kirkland, Washington
Project Number: 0186-760-00

Figure A-6
Sheet 1 of 1

Date Excavated: 02/11/08

Logged by: ASR

Equipment: Komastu PC 75

Surface Elevation (ft): Approximately 180

| Elevation feet | Depth feet | Sample | Sample Number | Graphic Log | Group Symbol | MATERIAL DESCRIPTION | Moisture Content % | OTHER TESTS AND NOTES |
|---|---|---|---|---|---|---|---|---|
| | 0 | | | | TS | Topsoil | | |
| | | | | | GP-GM | Brown fine to coarse gravel with silt and sand (medium dense to dense, moist) | | |
| | | X | 1 | | | | 6 | SA; %F = 7<br>Infiltration test |
| | 5 | | | | | | | |
| | 10 | | | | | Test pit completed at 10 feet<br>No groundwater seepage observed<br>No caving observed | | |
| | 15 | | | | | | | |

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 foot.

## LOG OF TEST PIT TP-6

GEOENGINEERS

Project: Juanita Substation Improvements
Project Location: Kirkland, Washington
Project Number: 0186-760-00

Figure A-7
Sheet 1 of 1



V6_GTTPIT P:\0\0186760\00\FINALS\018676000.GPJ GEIV6_1.GDT 2/27/08

Date Excavated: 02/11/08

Logged by: ASR

Equipment: Komastu PC 75

Surface Elevation (ft): Approximately 172

| Elevation feet | Depth feet | Sample | Sample Number | Graphic Log | Group Symbol | MATERIAL DESCRIPTION | Moisture Content % | OTHER TESTS AND NOTES |
|---|---|---|---|---|---|---|---|---|
| | 0 | | | | TS | Brown silty fine to medium sand with gravel and tree roots (topsoil) | | |
| | | | | | SP-SM | Dark brown sand with silt and gravel and tree roots (loose to medium dense, moist) | | |
| | | | | | GP-GM | Brown gravel with silt and sand (medium dense, moist) | | |
| | 5 | X | 1 | | SM | Gray silty fine to medium sand with gravel (very dense, moist) | | |
| | 10 | | | | | Test pit completed at 10 feet<br>No groundwater seepage observed<br>No caving observed | | |
| | 15 | | | | | | | |

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 foot.

## LOG OF TEST PIT TP-7

GEOENGINEERS

Project: Juanita Substation Improvements
Project Location: Kirkland, Washington
Project Number: 0186-760-00

Figure A-8
Sheet 1 of 1



V6_GTTPIT P:\0\0186760\00\FINALS\018676000.GPJ GEIV6_1.GDT 2/27/08

Date Excavated: 02/11/08

Logged by: ASR

Equipment: Komastu PC 75

Surface Elevation (ft): Approximately 156

| Elevation feet | Depth feet | Sample | Sample Number | Graphic Log | Group Symbol | MATERIAL DESCRIPTION | Moisture Content % | OTHER TESTS AND NOTES |
|---|---|---|---|---|---|---|---|---|
| | 0 | | | | TS | Brown silty fine to medium sand with gravel and tree roots (topsoil) | | |
| | | | | | GP-GM | Brown gravel with silt and sand (loose to medium dense, moist) | | |
| | | | | | SM | Gray silty fine to medium sand with gravel (very dense, moist) | | |
| | | X | 1 | | | | 13 | %F = 33 |
| | 5 | | | | | Test pit completed at 5 feet<br>No groundwater seepage observed<br>No caving observed | | |
| | 10 | | | | | | | |
| | 15 | | | | | | | |

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 foot.

## LOG OF TEST PIT TP-8

GEOENGINEERS

Project: Juanita Substation Improvements
Project Location: Kirkland, Washington
Project Number: 0186-760-00

Figure A-9
Sheet 1 of 1



V6 GTTPIT P:\0\0186760\00\FINALS\018676000.GPJ GEIV6_1.GDT 2/27/08

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# *Appendix B*
## *Laboratory Testing*

# APPENDIX B
# LABORATORY TESTING

## GENERAL

Soil samples obtained from the field explorations were transported to our laboratory and examined to confirm or modify field classifications, as well as to evaluate index properties of the soil samples. Representative samples were selected for laboratory testing consisting of the determination of the moisture content, percent fines (material passing the U.S. No. 200 sieve) and grain size distribution (sieve analysis). The tests were performed in general accordance with test methods of the American Society for Testing and Materials (ASTM) or other applicable procedures.

The sieve analysis results are presented in Figures B-1 and B-2. The results of the moisture content and percent passing the U.S. No. 200 sieve determinations are presented at the respective sample depths on the exploration logs in Appendix A.

## MOISTURE CONTENT TESTING

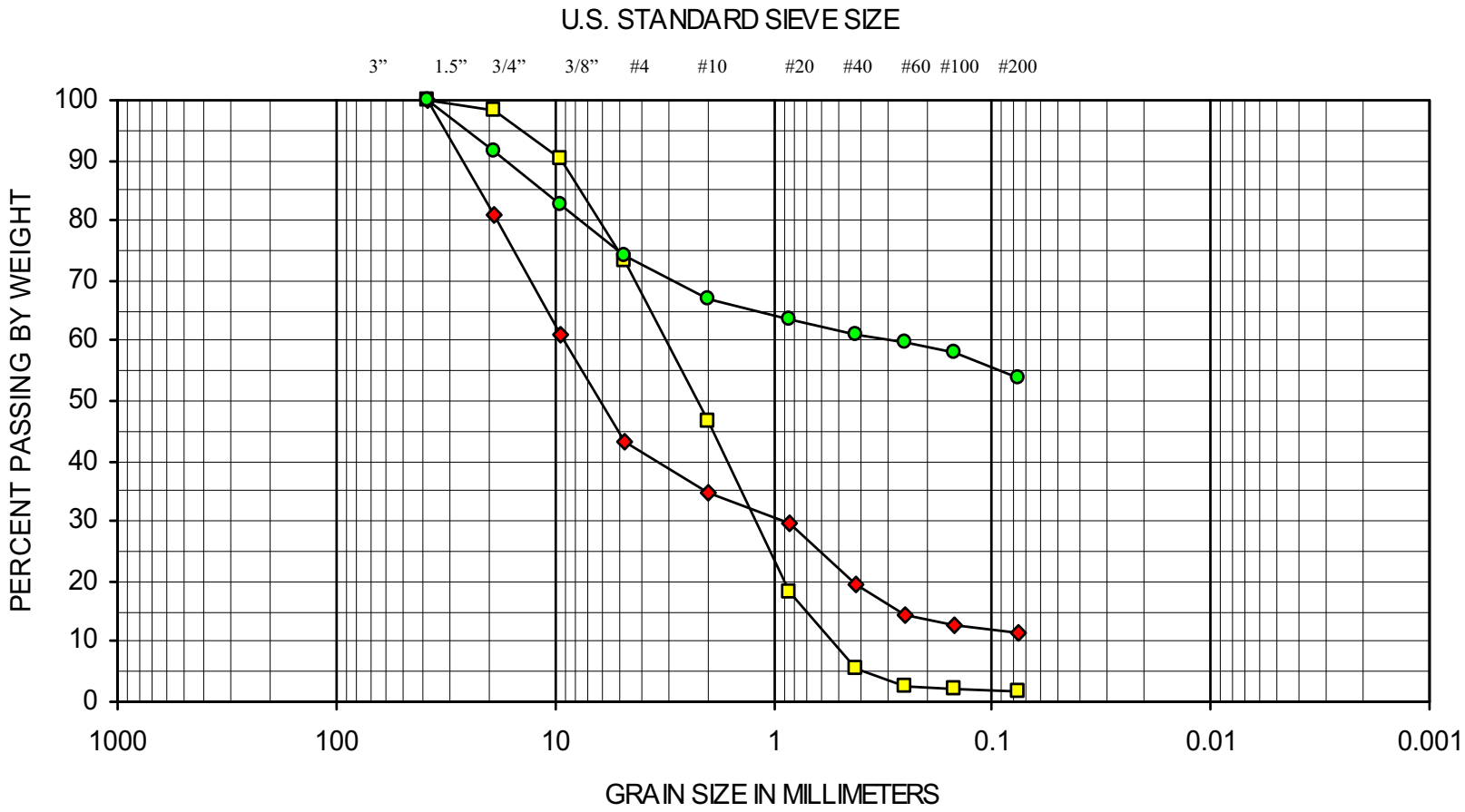
Moisture content tests were completed in general accordance with ASTM D 2216 for representative samples obtained from the explorations. The results of these tests are presented on the exploration logs in Appendix A at the depths at which the samples were obtained.

## PERCENT PASSING U.S. NO. 200 SIEVE

Selected samples were "washed" through the U.S. No. 200 mesh sieve to determine the relative percentages of coarse- and fine-grained particles in the soil. The percent passing value represents the percentage by weight of the sample finer than the U.S. No. 200 sieve. These tests were conducted to verify field descriptions and to determine the fines content for analysis purposes. The tests were conducted in general accordance with ASTM D 1140, and the results are shown on the exploration logs in Appendix A at the respective sample depths.

## SIEVE ANALYSES

Sieve analyses were performed on selected samples in general accordance with ASTM D 422 to determine the sample grain size distribution. The wet sieve analysis method was used to determine the percentage of soil greater than the U.S. No. 200 mesh sieve. The results of the sieve analyses were plotted, were classified in general accordance with the Unified Soil Classification System (USCS), and are presented in Figures B-1 and B-2.




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | COARSE | FINE | COARSE | MEDIUM | FINE | |

| SYMBOL | EXPLORATION NUMBER | DEPTH (ft) | SOIL CLASSIFICATION |
|---|---|---|---|
| ◆ | TP-1 | 8 | Gray medium sand with gravel (SP) |
| □ | TP-3 | 4 | Brown silty medium to coarse gravel with sand (GM) |
| ● | TP-4 | 4 | Brown silt with sand and gravel (ML) |

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**SIEVE ANALYSIS RESULTS**

**FIGURE B-1**

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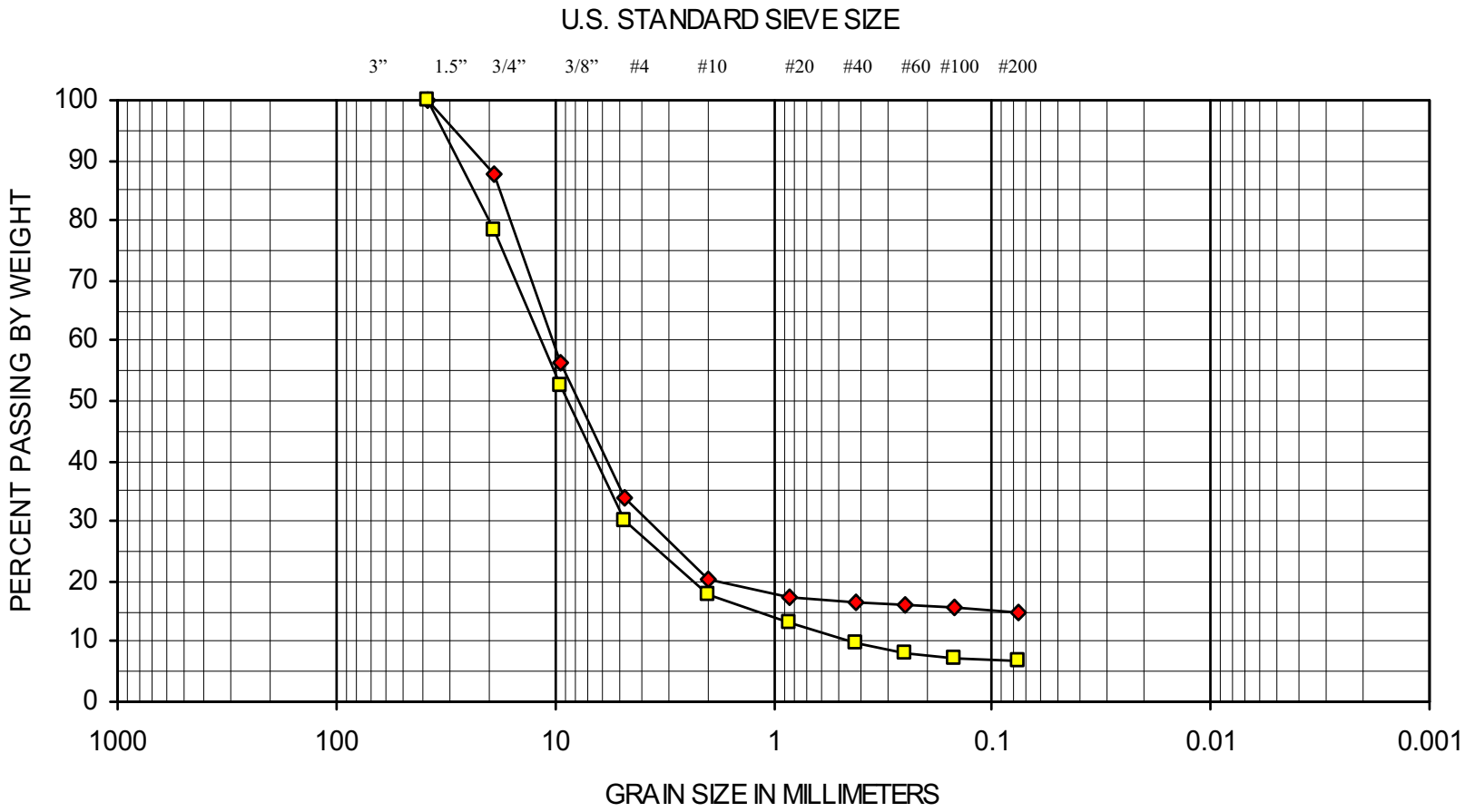


| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | COARSE | FINE | COARSE | MEDIUM | FINE | |

| SYMBOL | EXPLORATION NUMBER | DEPTH (ft) | SOIL CLASSIFICATION |
|---|---|---|---|
| ◆ | TP-5 | 8 | Brown silty fine to coarse gravel with sand (GM) |
| ■ | TP-6 | 4 | Brown fine to coarse gravel with silt and sand (GP-GM) |

**SIEVE ANALYSIS RESULTS**

**FIGURE B-2**

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# *APPENDIX C*

## *REPORT LIMITATIONS AND GUIDELINES FOR USE*

## APPENDIX C
## REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This appendix provides information to help you manage your risks with respect to the use of this report.

### GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES, PERSONS AND PROJECTS

This report has been prepared for the exclusive use of Puget Sound Energy (PSE) and their authorized agents. This report may be made available to other members of the design and construction team for review. This report is not intended for use by others, and the information contained herein is not applicable to other sites.

GeoEngineers structures our services to meet the specific needs of our clients. For example, a geotechnical or geologic study conducted for a civil engineer or architect may not fulfill the needs of a construction contractor or even another civil engineer or architect that are involved in the same project. Because each geotechnical or geologic study is unique, each geotechnical engineering or geologic report is unique, prepared solely for the specific client and project site. Our report is prepared for the exclusive use of Puget Sound Energy and their authorized agents. No other party may rely on the product of our services unless we agree in advance to such reliance in writing. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with our Agreement with Puget Sound Energy and generally accepted geotechnical practices in this area at the time this report was prepared. This report should not be applied for any purpose or project except the one originally contemplated.

### A GEOTECHNICAL ENGINEERING OR GEOLOGIC REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

This report has been prepared for the Juanita Substation Improvements in Kirkland, Washington. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, do not rely on this report if it was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

For example, changes that can affect the applicability of this report include those that affect:

- the function of the proposed structures;
- elevation, configuration, location, orientation or weight of the proposed structures;
- composition of the design team; or
- project ownership.

If important changes are made after the date of this report, GeoEngineers should be given the opportunity to review our interpretations and recommendations and provide written modifications or confirmation, as appropriate.

[1] Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org .

## SUBSURFACE CONDITIONS CAN CHANGE

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by manmade events such as construction on or adjacent to the site, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. Always contact GeoEngineers before applying a report to determine if it remains applicable.

## MOST GEOTECHNICAL AND GEOLOGIC FINDINGS ARE PROFESSIONAL OPINIONS

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied our professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ, sometimes significantly, from those indicated in this report. Our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

## GEOTECHNICAL ENGINEERING REPORT RECOMMENDATIONS ARE NOT FINAL

Do not over-rely on the preliminary construction recommendations included in this report. These recommendations are not final, because they were developed principally from GeoEngineers' professional judgment and opinion. GeoEngineers' recommendations can be finalized only by observing actual subsurface conditions revealed during construction. GeoEngineers cannot assume responsibility or liability for this report's recommendations if we do not perform construction observation.

Sufficient monitoring, testing and consultation by GeoEngineers should be provided during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether or not earthwork activities are completed in accordance with our recommendations. Retaining GeoEngineers for construction observation for this project is the most effective method of managing the risks associated with unanticipated conditions.

## A GEOTECHNICAL ENGINEERING OR GEOLOGIC REPORT COULD BE SUBJECT TO MISINTERPRETATION

Misinterpretation of this report by other design team members can result in costly problems. You could lower that risk by having GeoEngineers confer with appropriate members of the design team after submitting the report. Also retain GeoEngineers to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering or geologic report. Reduce that risk by having GeoEngineers participate in pre-bid and preconstruction conferences, and by providing construction observation.

## DO NOT REDRAW THE EXPLORATION LOGS

Geotechnical engineers and geologists prepare final boring and test pit logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, but recognize that separating logs from the report can elevate risk.

## GIVE CONTRACTORS A COMPLETE REPORT AND GUIDANCE

Some owners and design professionals believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering or geologic report, but preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with GeoEngineers and/or to conduct additional study to obtain the specific types of information they need or prefer. A pre-bid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might an owner be in a position to give contractors the best information available, while requiring them to at least share the financial responsibilities stemming from unanticipated conditions. Further, a contingency for unanticipated conditions should be included in your project budget and schedule.

## CONTRACTORS ARE RESPONSIBLE FOR SITE SAFETY ON THEIR OWN CONSTRUCTION PROJECTS

Our geotechnical recommendations are not intended to direct the contractor's procedures, methods, schedule or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and to adjacent properties.

## READ THESE PROVISIONS CLOSELY

Some clients, design professionals and contractors may not recognize that the geoscience practices (geotechnical engineering or geology) are far less exact than other engineering and natural science disciplines. This lack of understanding can create unrealistic expectations that could lead to disappointments, claims and disputes. GeoEngineers includes these explanatory "limitations" provisions in our reports to help reduce such risks. Please confer with GeoEngineers if you are unclear how these "Report Limitations and Guidelines for Use" apply to your project or site.

## GEOTECHNICAL, GEOLOGIC AND ENVIRONMENTAL REPORTS SHOULD NOT BE INTERCHANGED

The equipment, techniques and personnel used to perform an environmental study differ significantly from those used to perform a geotechnical or geologic study and vice versa. For that reason, a geotechnical engineering or geologic report does not usually relate any environmental findings, conclusions or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Similarly, environmental reports are not used to address geotechnical or geologic concerns regarding a specific project.

## BIOLOGICAL POLLUTANTS

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention or assessment of the presence of Biological Pollutants. Accordingly, this report does not include any interpretations, recommendations, findings, or conclusions regarding the detecting, assessing, preventing or abating of Biological Pollutants and no conclusions or inferences should be drawn regarding Biological Pollutants, as they may relate to this project. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and/or any of their byproducts.

If Client desires these specialized services, they should be obtained from a consultant who offers services in this specialized field.

The charts in KZC 17.10 contain the basic zoning regulations that apply in each RSX 35, RSX 12.5, RSX 8.5, RSX 7.2 and RX 5.0 zones of the City. Use these charts by reading down the left hand column entitled Use. Once you locate the use in which you are interested, read across to find the regulations that apply to that use.

| | |
|---|---|
| Zone RSX | Section 17.08 – GENERAL REGULATIONS<br>The following regulations apply to all uses in this zone unless otherwise noted: |
| | 1. Refer to Chapter 1 KZC to determine what other provisions of this code may apply to the subject property. |
| | 2. If any portion of a structure is adjoining a low density zone, then either:<br>a. The height of that portion of the structure shall not exceed 15 feet above average building elevation, or<br>b. The horizontal length of any facade of that portion of the structure which is parallel to the boundary of the low density zone shall not exceed 50 feet.<br>See KZC 115.30, Distance Between Structures/Adjacency to Institutional Use, for further details.<br>(Does not apply to Detached Dwelling Unit and Mini-School or Mini-Day-Care Center uses). |

link to Section 17.10 table



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E-mail Code Publishing

| Section 17.10 | USE ⇩ / REGULATIONS ⇨ | DIRECTIONS: FIRST, read down to find use...THEN, across for REGULATIONS | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Required Review Process | MINIMUMS | | | | MAXIMUMS | | Landscape Category (See Ch. 95) | Sign Category (See Ch. 100) | Required Parking Spaces (See Ch. 105) | Special Regulations (See also General Regulations) |
| | | | Lot Size | REQUIRED YARDS (See Ch. 115) | | | Lot Coverage | Height of Structure | | | | |
| | | | | Front | Side | Rear | | | | | | |
| .040 | Mini-School or Mini-Day-Care Center (continued) | | | | | | | | | | | REGULATIONS CONTINUED FROM PREVIOUS PAGE<br>5. Structured play areas must be setback from all property lines by five feet.<br>6. An on-site passenger loading area may be required depending on the number of attendees and the extent of the abutting right-of-way improvements.<br>7. The location of parking and passenger loading areas shall be designed to reduce impacts on nearby residential uses.<br>8. Electrical signs shall not be permitted. Size of signs may be limited to be compatible with nearby residential uses.<br>9. May include accessory living facilities for staff persons.<br>10. These uses are subject to the requirements established by the Department of Social and Health Services (WAC Title 388). |
| .050 | (Reserved) | | | | | | | | | | | |
| .060 | Golf Course | Process IIA, Chapter 150 KZC. | 1 acre | 50′ | 50′ on each side | 50′ | 50% | 30′ above average building elevation. | E | B | See KZC 105.25. | 1. Site design must minimize adverse impacts on surrounding residential neighborhoods.<br>2. May not include miniature golf.<br>3. The following accessory uses are specifically permitted as part of this use.<br>a. Equipment storage facilities.<br>b. Retail sales and rental of golf equipment and accessories.<br>c. A restaurant. |
| .070 | Public Utility | See Spec. Reg. 2. | None | 20′ | 20′ on each side | 20′ | 70% | 30′ above average building elevation. | A | | | 1. Site design must minimize adverse impacts on surrounding residential neighborhoods.<br>2. The required review process is as follows:<br>a. If the subject property, including all contiguous property owned by the applicant and held by others for future use by the applicant, is less than five acres, the required review process is Process IIA, Chapter 150 KZC.<br>b. If the subject property, including all contiguous property owned by the applicant and held by others for future use by the applicant, is five or more acres, a Master Plan, approved through Process IIB, Chapter 152 KZC, is required. The Master Plan must show building placement, building dimensions, roadways, utility locations, land uses within the Master Plan area, parking location, buffering, and landscaping.<br>3. Landscape Category A or B may be required depending on the type of use on the subject property and the impacts associated with the use on the nearby uses. |
| .080 | Government Facility Community Facility | | | | 10′ on each side | 10′ | | | C See Spec. Reg. 3. | | | |

# MAINTENANCE AND RETENTION AGREEMENT FOR TREES AND REQUIRED LANDSCAPING

*Project Name:*

*Address:*

*Parcel No:*

This agreement is entered into between each undersigned owner of the real property and the City of Kirkland, in consideration of approval by the City of a permit under City of Kirkland File/Permit No. for the hereinafter described real property in Kirkland, King County, Washington.

Each undersigned owner jointly and severally hereby agrees to maintain and retain the trees and other vegetation required by the City to be planted or retained on the real property described below, in accordance with the final approved landscaping plan/site plan (on file in the Kirkland Department of Planning and Community Development) throughout the life of the project, pursuant to Chapter 95 of the KZC unless written approval for removal is granted by the Kirkland Department of Planning and Community Development.

Each of the undersigned agree to defend, pay, and save harmless the City of Kirkland, its officers, agents, and employees from any and all claims of every nature whatsoever, real or imaginary, which may be made against the City, its officers, agents, or employees for any damage to property or injury to any person arising out of the maintenance of said trees and other said vegetation on said owner's property or out of the actions of the undersigned in carrying out the responsibilities under this agreement, excepting therefrom only such claims as may arise solely out of the negligence of the City of Kirkland, its officers, agents, or employees.

This Agreement shall be binding upon the heirs, successors and assigns of each of the undersigned and shall run with the land. This Agreement shall, at the expense of the undersigned, be recorded by the City of Kirkland with the King County Department of Elections and Records.

Failure to maintain and retain said trees and other said vegetation in accordance with this agreement may subject the undersigned to civil penalties as authorized by Chapter 95 of the KZC.

The real property owned by the undersigned and the subject property of this Agreement is situated in Kirkland, King County, Washington and described as follows:

DATED at Kirkland, Washington, this _____ day of _____, _____

**CITY OF KIRKLAND**
**PLANNING & COMMUNITY DEVELOPMENT**
**123 5th Avenue, Kirkland, WA 98033 425.587.3225**
**www.ci.kirkland.wa.us**

# Tree Plan II – Multi-Family, Commercial, Land Surface Modification, and Other Non-Residential Uses

Trees and other vegetation are important elements of the physical environment which protect public health, safety and general welfare in a variety of ways. These regulations establish a process and standards to provide for the protection, preservation, replacement, proper maintenance and use of significant trees, associated vegetation and woodlands located in the City of Kirkland. **For Multi-Family, Commercial and other non-residential uses, the regulations require retention of viable trees within the required setbacks and landscape buffers. These requirements are discussed in Section 95.35.2.B.2 of the Kirkland Zoning Code (KZC) and are summarized below.**

## Helpful terms to complete the tree plans described below:

1. **Significant Tree**: A tree that is at least 6 inches in diameter at breast height (DBH) (The diameter or thickness of a tree trunk measured at 4.5 feet from the ground).
2. **Dripline**: The distance from the tree trunk that is equal to the furthest extent of the tree's crown.
3. **Impact:** A condition or activity that affects a part of a tree, including the trunk, branches, and critical root zone.
4. **Qualified Professional**: An individual that possesses and demonstrates the ability to perform tree risk assessments and prescribe appropriate measures necessary for the preservation of trees during development; must at a minimum be certified by the International Society of Arboriculture (ISA).
5. A **Type 1 Tree** is a viable tree that meets at least one of the following criteria:
    i. Landmark tree (pre-designated);
    ii. Specimen tree (very good to excellent condition and free of major defects);
    iii. Tree groves and associated vegetation to be set aside as preserved groves;
    iv. Trees on slopes of at least 10%; or
    v. Trees that are a part of a grove that extends into adjacent property.

## Permit Submittal Requirements - Multi-Family, Commercial and Non-Residential

***The following information is required for all permits in order for the application to be deemed complete. Incomplete applications will not be accepted.***

**Tree Plan II** is required for a development permit or land surface modification resulting in site disturbance and impact to a significant tree in required yards and areas for required landscaping for:

- Three or more detached, attached, or stacked dwelling units
- Any use other than residential

A. The following general information must be incorporated on the site plan:
    1. Accurate location of all public trees (i.e. street trees) and private significant trees and their driplines measured relative to visible site features. Please number all trees (tag in field and label on plan) for reference purposes. *If the trees are not accurately located on a site plan, the Planning Official may require that their locations be surveyed.*
    2. Size (DBH) and species (or at least type) of the significant trees;
    3. General health of these trees; and
    4. Approximate trunk location and dripline of significant trees that are on adjacent property with driplines extending over the subject property line.

B. If there are significant trees in the right-of-way, required yards (setbacks) or areas for required landscaping or potential areas for required landscaping (i.e. parking lots), the tree plan must include a report from a qualified professional containing the following information:
   1. Size and species of these trees (located in these areas);
   2. A complete description of each tree's health and viability. If a tree is not viable for retention, the reason(s) must be soundly based on health, high risk of failure due to structure, defects, unavoidable isolation (windfirmness), or suitability of species and for which no reasonable alternative action is possible (pruning, cabling, etc.). The impact of necessary tree removal to remaining trees, including those in a grove or on adjacent properties, must also be discussed.
   3. The location of limits of disturbance around all trees potentially impacted by site disturbances and any special instructions for work within that protection area (hand-digging, tunneling, root pruning, maximum grade change).
   4. A discussion of timing and installation of tree protection measures that must include fencing and be in accordance with the Tree Protection Standards as outlined in KZC 95.35.6.

C. Site Design and Retention Requirements
   1. The applicant shall pursue applicable variations to development, as outlined in KZC 95.35.4.A.2 and 95.35.4.A.3, for the retention of Type 1 trees where feasible in required yards and landscaping areas.
   2. If removal of a Type 1 tree in required landscaping areas is proposed, the applicant shall provide reasons for the proposed removal that may require assistance from a qualified professional.
   3. Sites shall comply with required landscaping pursuant to KZC 95.40. Preserved trees in required landscaping areas shall apply toward required landscaping requirements.

D. Final Plan Requirements
   1. Demolition and grading plans shall depict tree protection measures, as recommended by a qualified professional, if existing trees are to be retained and their driplines are within the area of disturbance.
   2. Landscape Plans shall show all retained trees.
   3. The applicant shall enter into all required tree preservation and maintenance agreements pursuant to KZC 95.50.

**Note: This is an overview of tree requirements, for more details and information visit our website at http://www.ci.kirkland.wa.us/depart/planning/trees.htm or request a copy of Ordinance 4010.**

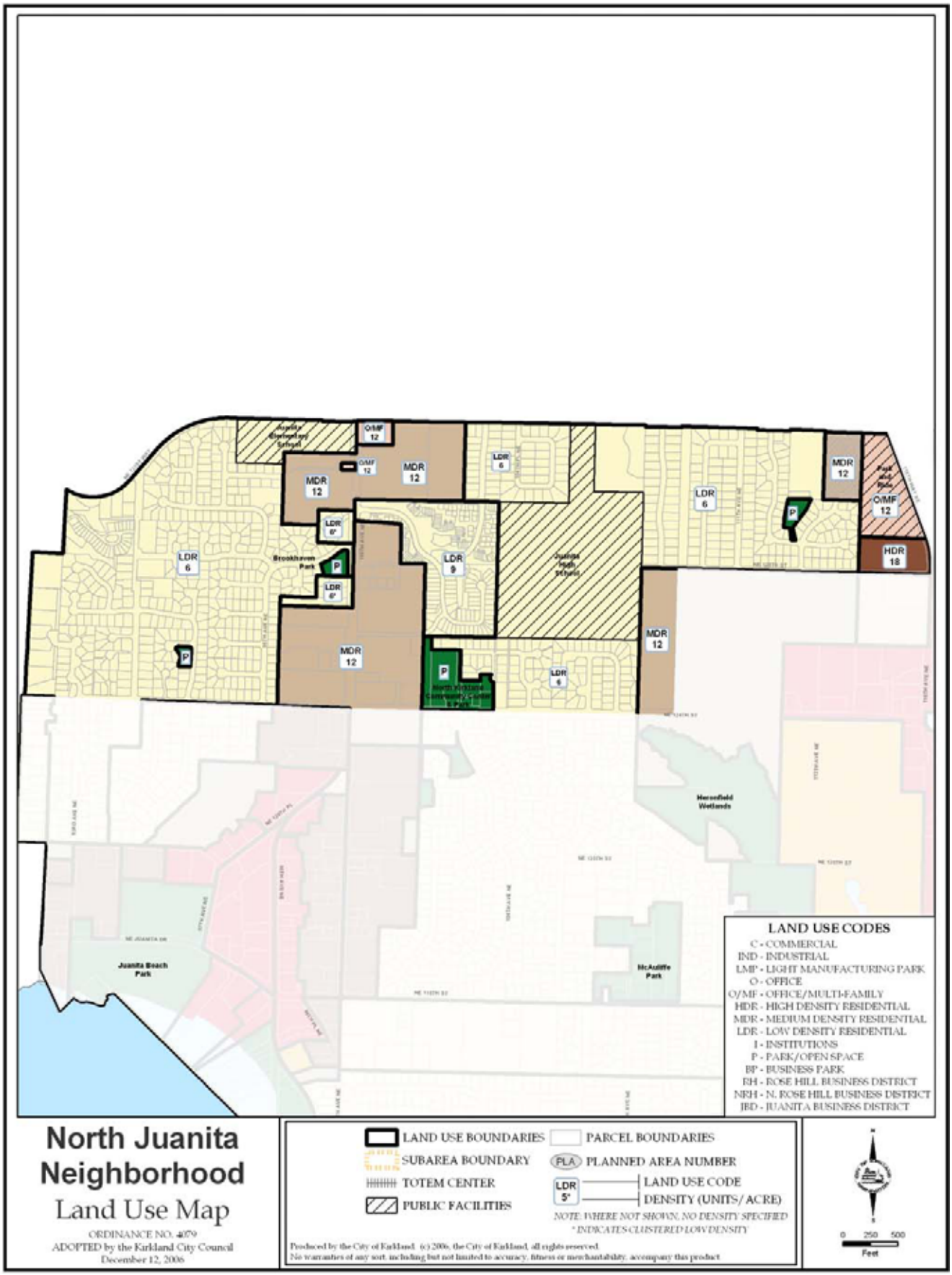



**Figure J-2a: North Juanita Land Use**

# XI. Utilities

CHARTING A FUTURE COURSE

## ◆ RELATIONSHIP TO THE FRAMEWORK GOALS ◆

The **Utilities Element** highlights the following Framework Goals:

FG-1 Maintain and enhance Kirkland's unique character.

FG-2 Support a strong sense of community.

FG-3 Maintain vibrant and stable residential neighborhoods and mixed-use development, with housing for diverse incomes, ages, and lifestyles.

✓ **FG-4 Promote a strong and diverse economy.**

FG-5 Protect and preserve environmentally sensitive areas, and a healthy environment.

FG-6 Identify, protect and preserve the City's historic resources, and enhance the identity of those areas and neighborhoods in which they exist.

✓ **FG-7 Encourage low impact development and sustainable building practices.**

FG-8 Maintain and enhance Kirkland's strong physical, visual, and perceptual linkages to Lake Washington.

FG-9 Provide accessibility to pedestrians, bicyclists, and alternative mode users within and between neighborhoods, public spaces, and business districts and to regional facilities.

FG-10 Create a transportation system that allows the mobility of people and goods by providing a variety of transportation options.

FG-11 Maintain existing park facilities, while seeking opportunities to expand and enhance the current range and quality of facilities.

✓ **FG-12 Ensure public safety.**

✓ **FG-13 Maintain existing adopted levels of service for important public facilities.**

FG-14 Plan for a fair share of regional growth, consistent with State and regional goals to minimize low-density sprawl and direct growth to urban areas.

✓ **FG-15 Solve regional problems that affect Kirkland through regional coordination and partnerships.**

FG-16 Promote active citizen involvement and outreach education in development decisions and planning for Kirkland's future.

FG-17 Establish development regulations that are fair and predictable.

# XI. Utilities

## A. Introduction

The Utilities Element addresses water, sewer, surface water, electric power, natural gas and telecommunications.

Kirkland's existing utility infrastructure is generally adequate to meet the growth needs of the City for many years. The primary focus of the City in the coming years will be to continue to update existing systems to increase efficiency and to avoid maintenance problems associated with older facilities. Each utility function presents a unique problem. For water, Kirkland faces regional supply issues that require regional solutions. For sewer, the City must consider how to service areas on septic systems as those areas become more urbanized. For surface water, the City is challenged to manage a growing system to handle increased urbanization while maintaining and enhancing water quality. For telecommunications, the City must find economical ways to install its fiber-optic network to meet the City's needs and respond to changes in technology and, where possible, utilize its telecommunications investments and partnerships to benefit citizens, businesses and public institutions.

For non-City-managed utilities, the City faces the challenge of facilitating system improvements and new technologies while minimizing the impacts associated with above-ground utility installations.

### *Existing Conditions*

The City of Kirkland currently provides the following utility services:

- **Water** – All areas of the City except those north of NE 116th Street who are served by the Northshore Utility District. Figure U-1 shows the City's water system.

- **Sewer** – All areas of the City south of NE 116th Street. The Northshore Utility District provides sewer service to most areas north of NE 116th Street. Figure U-2 shows the City's sewer system.

- **Surface Water** – All areas of the City. Figure U-3 shows the City's surface water system.

The following non-City-managed utilities provide additional services:

- **Northshore Utility District** – provides water and sewer services to the northern portions of the City and Kirkland's growth areas. Figures U-4 and U-5 show the water and sewer systems.

- **Puget Sound Energy** – transmits and distributes electric power and natural gas in a nine-county area, including Kirkland and much of King County. Figures showing the location of electrical and gas facilities are not available from PSE.

- **Telecommunications** – Kirkland has both wired and wireless telephone services, cable TV service and high speed cable internet services all provided by a variety of non-managed providers.

### *City Managed Facilities*

**Water**

The City of Kirkland provides water service to all of its residents, except those north of NE 116th Street who are served by the Northshore Utility District (see Figure U-1). One multifamily complex in the NE corner of the City, south of NE 132nd Street between 124th Avenue NE and 128th Avenue NE, is served by the Woodinville Water District.

The City's water system is primarily a gravity system consisting of 181 miles of water lines and 19.5 million gallons of storage capacity. Projected costs associated with the water system are primarily maintenance and replacement costs. The system generally has sufficient capacity to serve growth anticipated through the land use plan and no capacity costs are anticipated through 2022.

Seattle Public Utilities supplies the City's drinking water and is contracted to do so into the near future. The City, as a member of the Cascade Water Alliance, is also planning to secure and develop water supplies

from other areas in the long-term. Cascade collects regional capital facilities charges to fund planning and development of future water sources. The City is part of a regional solution to address water needs.

**Sewer**

The City of Kirkland provides sanitary sewer service to all of its residents south of NE 116th Street (see Figure U-2). The Northshore Utility District provides sewer service to most residents north of NE 116th Street.

The collection system consists of 35 wastewater collection basins, 88 miles of sewer pipe, nine lift stations and force mains, and approximately 2200 manholes. Approximately five to 10 percent of Kirkland residents use septic systems. Sewer extensions have typically been funded by developers and local homeowners through the City-managed Emergency Sewer Program. The system's most serious deficiency is the age of some of the pipelines. The 45-year-old concrete pipes allow inflow/infiltration and root intrusions which reduce capacity of the system and increase operation and maintenance costs. The primary costs anticipated to maintain existing levels of service are related to replacement and rehabilitation of older pipelines, improvement of pumping capacity, and system expansions in the Lake Plaza Basin, Central Way Basin, and Juanita Basin. These improvements will provide adequate capacity to serve growth anticipated through the land use plan through 2022.

The King County Department of Metropolitan Services (METRO) provides the City's service area with sanitary sewer treatment services at a capacity of 100 gallons per day per capita under the terms of an intergovernmental agreement. Northshore Utility District and City sewage are treated at Metro's West Point and Renton treatment plants.

**Surface Water**

The City maintains conveyance, detention and water quality treatment systems in public rights-of-way. These systems accept stormwater runoff and surface water from private property within the City and from neighboring jurisdictions. As of 2004, the City system contains 364 public and private detention systems which include vaults and ponds, 9,867 public and private catch basins and 170.4 miles of public and private pipes. Figure U-3 shows the City surface management water system.

A watershed approach has been used for managing the surface water utility by dividing the City into nine drainage basins. The largest and most important streams are Juanita and Forbes Creek. The size of their drainage basins makes them especially important for receipt of stormwaters and discharge into Lake Washington. Yarrow Creek also has a large basin area within the City and is significant because it provides salmonid fish habitat and productive associated wetlands. Smaller critical drainages include Carillon Creek, Cochran Springs Creek and Everest Creek. More information on the watershed and drainage basins can be found in the Natural Environment Element.

**City Telecommunications**

Over time, the City is installing a fiber-optic network to service its governmental facilities and traffic control system. In addition, the City is partnering with other cities and schools to lay the foundation for a regional telecommunication system. Figure U-6 shows the fiber-optic network in Kirkland, which includes partnerships with the City, Lake Washington School District, the University of Washington and the City of Bellevue to install publicly owned fiber-optic in major rights-of-way.

## *NON-CITY-MANAGED UTILITIES*

### Northshore Utility District: Water and Sewer

The Northshore Utility District provides water and sewer services to northern portions of the City and Kirkland's growth areas. Figure U-4 illustrates the existing Northshore water system and proposed improvements. Figure U-5 illustrates the existing Northshore sewer system. Northshore wastewaters are treated at King County's Department of Natural Resources West Point and Renton treatment plants. The water system has five reservoir sites with a 29-million-gallon capacity. The District is in the process of developing a sewer system capital improvement plan for replacement and repair of the older, damaged sections of the system. Repair and maintenance of the system occur when needed and extensions necessitated by future development will be provided by the developer.

Northshore can provide service to accommodate Kirkland's future growth.

### Puget Sound Energy: Electricity and Natural Gas

Puget Sound Energy (PSE) is a public service company regulated by the Washington Utilities and Transportation Commission (WUTC), which provides the Kirkland area with electricity and natural gas. PSE distributes power transmitted by Bonneville Power Administration (BPA), and generates, transmits, and distributes power as part of the interconnected Northwest power grid. Although there has historically been a net surplus in electricity supply in the Northwest, in recent years there has been a balance between supply and demand. Future forecasts indicate some scenarios where deficits may emerge, requiring additional power purchases, new generation, and further conservation.

Kirkland is a part of the Eastside and Northshore Electrical Subareas. Power is delivered on 230 kV transmission lines to substations in Redmond and Renton, where the voltage is transformed to 115 kV. Several distribution stations in Kirkland further transform the voltage to 12.5 kV which is then distributed to customers. A double-circuit 230 kV Seattle City Light transmission line runs through Kirkland near 124th Avenue NE, but does not directly serve the Eastside subarea.

PSE's long-range plans through the year 2022 indicate the need for three new distribution substations in Kirkland and a new 115 kV line along the eastern and northern City boundaries to connect to the Sammamish substation in Redmond.

PSE provides natural gas to five Washington counties, including King County. PSE has not historically planned for gas main and service extensions, but reacts to customer demand. The gas industry is regulated by the Washington Utilities and Transportation Commission, which requires gas companies to demonstrate that existing ratepayers will not subsidize new customers.

The Northwest distribution pipeline and gas station are located east of the Kirkland City limits. Existing four-inch to eight-inch gas lines in Kirkland, as well as extensions currently anticipated, will service Kirkland's growth.

### Telecommunication Service Providers

Wired telephone service and certain related special services are available in the City. System facilities within Kirkland include switching stations, trunk lines, and distributions lines. There are four switching stations in Kirkland at 101 Market Street, 10020 133rd Place NE, NE 95th Street/128th Avenue NE, and NE 43rd Street/Lake Washington Boulevard. Trunk lines connecting the switching stations are concrete-encased four-inch conduit, and distribution lines are either pole-mounted or underground. Service and facility expansions are driven by customer demand.

Several companies provide wireless telephone service. Cellular telecommunication permits wireless transmission of messages on a network of strategically placed receivers (i.e., mobile telephone communications). Receivers may be placed on tall poles, lattice-type towers, or buildings. The cellular tele-

phone industry does not plan facilities far into the future, but uses market demand to determine expansion into new service areas.

Cable TV and internet services are also available in Kirkland. The Kirkland system is fed from a microwave receiving site in Bellevue. The majority of trunk and distribution lines are overhead lines rather than underground. The local provider has the technical capacity to serve any new development in the City by simply adding new trunk or distribution lines. High speed DSL services are available in the community.

Many telecommunication vendors own optic fiber in Kirkland rights-of-way for commercial use. The City of Kirkland has access to some of these strands through franchise agreements.

### *RELATIONSHIP TO OTHER ELEMENTS*

The Utilities Element supports other elements of the Comprehensive Plan by establishing policies for provision of efficient urban services to serve anticipated growth and development. This Element supports an infrastructure for servicing existing development and areas targeted for growth by the Land Use Element. The telecommunications policies will help implement the policies of the Land Use, Economic Development, Transportation, and Public Services Elements by facilitating the movement of information as an alternative to the historic commuter/work relationship. Finally, utility policies provide direction to the goals and policies of the Capital Facilities Element.

Policies for public services such as emergency services, schools, and libraries are contained in the Public Services Element.

### *RELATIONSHIP TO OTHER PLANS*

In preparing this Element, the City has reviewed and considered the following documents:

- City of Kirkland Comprehensive Water Plan;
- City of Kirkland Comprehensive Sewer Plan;
- City of Kirkland Surface Water Master Plan;
- Northshore Utility District Comprehensive Water Plan;
- Northshore Utility District Sewer and Water Plan Maps;
- Puget Sound Energy GMA Electrical Facilities Plan.

## B. UTILITIES CONCEPT

The Utilities Element supports the continued provision of adequate utility services to support existing and future development. Levels of service are established for City-managed utilities and levels of service are established for non-City purveyors of water and sewer. In addition, concurrency requirements are established for new development.

The Utilities Element provides policies for regional coordination of utility needs. A basis for coordination with regional and local providers is established to ensure fair and consistent review of system expansions and enhancements while providing appropriate public input. The environmental and aesthetic concerns of the community are balanced with the need to provide affordable and reliable utility service.

The importance of efficiency and conservation is stressed as a cost-effective means of accommodating the growing demand for services.

## C. UTILITIES GOALS AND POLICIES

**Goal U-1: Maintain the quality of life in Kirkland through the planned provision of public and private utilities.**

**Goal U-2: Provide an efficient system to deliver high quality water.**

**Goal U-3: Protect public health and environmental quality through appropriate and efficient design, installation, and maintenance of sanitary sewer facilities.**

**Goal U-4: Provide surface water management facilities programs and services that provide adequate drainage and minimize flooding while protecting and enhancing the water quality and habitat value of streams, lakes, and wetlands.**

**Goal U-5: Ensure adequate and competitively priced telecommunication infrastructure, facilities and services.**

**Goal U-6: Facilitate the development and maintenance of non-City-managed utilities at the appropriate levels of service.**

### *GENERAL*

**Community Values**

As an urban area, Kirkland is accustomed to a high level of utility service. These services accommodate the lifestyles of Kirkland residents and the success of Kirkland businesses. To maintain these community values, Kirkland must balance the quality of the service provided with the costs and community impacts.

***Goal U-1: Maintain the quality of life in Kirkland through the planned provision of public and private utilities.***

***Policy U-1.1: Maintain an inventory of existing capital facilities and utilities, including locations and capacities of such systems and facilities.***

An accurate inventory of existing utility locations and capacities will ensure that the City can plan for new growth in a manner that reflects the ability to service that growth with adequate services.

***Policy U-1.2: Provide for needed capital facilities and utilities based on adopted levels of service and forecasted growth in accordance with the Land Use Element of this Plan.***

This policy is intended to ensure that the Capital Facilities, Land Use, and Utilities Elements are functioning in concert. This systematic planning allows the City to make accurate land use projections based on utility plans and allows utility providers to plan for utilities in a manner that reflects expected land use patterns and densities.

***Policy U-1.3: Use the following level of service standards for determining the need for public sewer, water, and surface water facilities:***

**Table U-1**
**Water, Sewer and Surface Water Level of Service**

| Facility | Standard |
|---|---|
| Water distribution: | 112 gallons/day/capita |
| Water storage: | 362 gallons/capita plus 3.2 million gallons for fire storage |
| Sanitary sewer collection: | 100 gallons/day/capita |
| Surface water management: | Convey, detain and treat stormwater runoff in a manner that provides adequate drainage for the appropriate storm to ensure safety, welfare, and convenience in developed areas while protecting the hydrologic regime and quality of water and fish/ wildlife habitat in streams, lakes and wetland. |

***Policy U-1.4: Ensure that utility services are provided in a manner that is environmentally sensitive, safe and aesthetically compatible with surrounding land uses.***

A variety of factors are at stake in the consideration of any proposed utility expansion. Mitigating environmental and aesthetic impacts can have implications on cost and efficiency of the system. Therefore, it is appropriate to weigh costs against a full consideration of benefits that will be derived. Individual implementation issues arising under this policy should be resolved on a case-by-case basis in light of all these considerations.

***Policy U-1.5: Facilitate and encourage the conservation of utility resources.***

The demand for utilities, such as water and electricity, may be met by either increasing the supply or reducing the demand. As the region continues to face challenges to the supply of these resources, conservation measures can be employed to delay need for new supplies.

***Policy U-1.6: Minimize impacts of personal wireless services, telecommunication facilities, and towers on adjacent land uses through careful siting and design. Facilitate the approval of facilities that meet certain standards relating to location and configuration.***

In order to minimize potential impacts, personal wireless services facilities should be located to the extent possible in nonresidential areas. They should be encouraged to be located in areas where the impact of the facilities will be minimal on residential areas such as in industrial or some commercial areas. In general, there should be a preference for more, smaller facilities located on existing structures, such as buildings or electrical transmission towers, or for co-locating on existing towers. When new facilities are required, carriers should be required to use techniques to disguise or camouflage the facilities and associated equipment shelters, so that they fit in with the surroundings.

In recognition of the important role telecommunications plays in facilitating business and personal communication, the City should enable carriers to quickly and efficiently site and configure facilities in ways that meet our standards. One of the best ways is to provide faster permit review for the locations and types of facilities the City wants to encourage.

Also recognizing changing technology and flux in the industry, the City should ensure that abandoned facilities are removed promptly. The burden of removing the facilities should fall to the property owner or operator of the facility and not the City.

***Policy U-1.7: Install new and, where feasible, existing utility distribution lines underground.***

Undergrounding of utility lines will visually enhance the area in which it occurs. In addition, undergrounding can reduce the potential for power outages associated with wind damage and eliminate unsightly pruning of vegetation. The complexities of undergrounding could increase as new utility lines are added to existing poles (i.e., new franchises).

Undergrounding utilities can be especially effective along major routes with good regional views. The City should explore prioritizing the undergrounding of utility lines in these areas.

Kirkland should acknowledge the disproportionate costs of undergrounding existing lines for smaller developments by allowing owners to defer until undergrounding occurs as part of a larger project where economies of scale can be realized. The City will need to consider the rates and tariffs of the WUTC in deciding where to underground existing distribution lines.

***Policy U-1.8: Encourage the joint use of utility corridors and facilities consistent with prudent utility practice.***

Additional efficiencies may be achieved by coordinating utility corridors. Examples include sharing right-of-way acquisition costs and joint use of rights-of-way for utility and pedestrian trails.

***Policy U-1.9: Coordinate with other jurisdictions when utility additions and improvements cross jurisdictional boundaries to ensure that decisions are consistent with regional demand and resources and consistency in timing of permit review.***

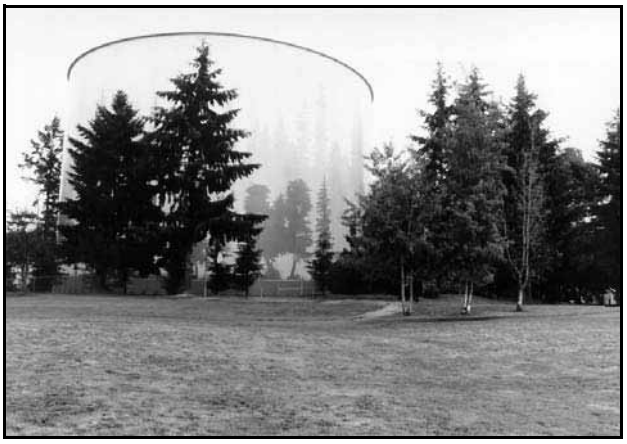
Where utility improvements are planned to serve regional demand, it is imperative that affected jurisdictions and utilities work together from the early planning stage. This will help reduce delays and a lower quality of regional service.

### *CITY-MANAGED UTILITIES*

**Water**

***Goal U-2: Provide an efficient system to deliver high quality water.***

***Policy U-2.1: Work in coordination with other jurisdictions and purveyors in the region to ensure a reliable, economic source of water and to address the long-term regional water demand needs of all agencies and purveyors.***



*Water tank in North Rose Hill Neighborhood*

To accomplish this, Kirkland needs to participate in and facilitate the development of a regional water supply system that effectively balances regional water resources and regional water supply needs and provides equitable participation in ownership and management.

***Policy U-2.2: Implement system rehabilitation and improvements in order to manage water resources.***

Increasing system efficiencies by taking such measures as replacement of older pipes can delay the need for new and more costly supply solutions.

***Policy U-2.3: Protect public health and safety, through the appropriate design, installation, and maintenance of water facilities.***

The primary concerns with water supply are quantity and quality. The quantity of water has health and safety implications, particularly related to fire suppression. Water quality has obvious public health implications regulated by different levels of government.

**Sewer**

***Goal U-3: Protect public health and environmental quality through appropriate and efficient design, installation, and maintenance of sanitary sewer facilities.***

***Policy U-3.1: Work with King County, adjoining jurisdictions, and local purveyors to manage, regulate, and maintain the regional sewer system.***

The existing regional sewage system has the capacity to handle Kirkland's future growth. The system will require maintenance and improvements to increase efficiencies.

***Policy U-3.2: Ensure that all new development proposals are served by adequate sanitary sewer systems.***

In general, new development should not be permitted on property that is served only by septic tanks. However, in limited situations, septic systems should be considered for low-density residential development where no reasonable alternatives exist upon demonstration that soil conditions will permit proper functioning of a septic system.

***Policy U-3.3: Connect areas that are on septic systems to sanitary sewer.***

Some older, less urbanized areas of the City are served only by septic systems. As these systems age and fail, they present health and environmental risks. The City should facilitate sewer extensions to these areas by prioritizing City-funded extensions and facilitating innovative privately funded solutions such as Local Improvement Districts and latecomer agreements.

***Policy U-3.4: Correct deficiencies and increase system efficiency. Emphasis should be placed on correcting deficiencies that present sewage overflow risks.***

The greatest system deficiencies in Kirkland's sanitary sewer system are related to the age and reliability of parts of the system. Infiltration and inflow of stormwater into the older pipes decreases system capacity and exfiltration of effluent from older pipes presents environmental and health risks. The focus should continue to be on updating older portions of the systems, with an emphasis on areas where overflows could occur near water bodies.

**Surface Water**

***Goal U-4: Provide surface water management facilities programs and services that provide adequate drainage and minimize flooding while protecting and enhancing the water quality and habitat value of streams, lakes, and wetlands.***

***Policy U-4.1: Adopt surface water design standards for new development and redevelopment that incorporate best available research and technology in protecting water resources in an economical and feasible manner.***

The goal of surface water design for new development and redevelopment projects is to provide adequate drainage and to provide post-construction controls that mimic predevelopment hydrologic patterns and protect water quality to the degree that is economically feasible. Such facilities may include low impact development techniques and/or structural controls such as detention vaults or ponds, infiltration facilities, biofiltration swales, or wetvaults.

***Policy U-4.2: Adopt and implement standards for control of runoff and erosion from construction sites.***

In order to reduce erosion from construction, use of erosion control techniques should be required at all sites where significant clearing and grading will take place.

***Policy U-4.3: Minimize the surface water impacts of development through the use of environmentally "low impact development" techniques.***

Low impact development techniques include the following:

- Minimize creation of impervious surfaces;
- Use site soils and vegetation to soak up and filter stormwater runoff;
- Use green roofs to minimize runoff from impervious surfaces; and
- Collect and store water for landscaping or other nonpotable water uses.

The City should respond to new low impact technologies and evaluate techniques that may be feasible in Kirkland, and to evaluate possible incentives for use of such techniques.

***Policy U-4.4: Minimize environmental damage from spilling and/or dumping of pollutants into the storm drainage system.***

The City should respond to instances of spilling and dumping of materials into the storm drainage system through activities such as the following:

- Identify and where appropriate take enforcement action against those responsible for nonstormwa-

ter discharges, including requiring cleanup or conducting abatement;

- Maintain and periodically update inter-City and intraagency spill coordination and response procedures; and
- Conduct surveys to identify and eliminate illicit connections to the storm drainage system.

***Policy U-4.5: Require businesses and residents to take steps to prevent stormwater pollution.***

It is much easier to prevent pollution than to clean up polluted waters. Businesses and residents should be required to use both nonstructural and structural "best management practices" (BMPs) to prevent discharge of pollutants from everyday activities. BMPs range from covering materials stored outdoors, sweeping rather than using water to clean parking lots, and installation of oil/water separators to connecting car washing areas to sanitary sewers.

***Policy U-4.6: Assess the quality of water and habitat in local streams and lakes to evaluate the effectiveness of utility standards and programs and to focus future efforts.***

Identification of specific water quality and habitat concerns and the tracking of changes over time should help to improve the efficiency and cost-effectiveness of programs and projects. Such assessment is a recommended element of several State and federal programs.

***Policy U-4.7: Ensure that privately owned stormwater facilities are operated and maintained in a manner that maximizes their quantity and quality control benefits.***

When well-maintained detention and water quality facilities on private property serve to protect downstream resources, City programs should be continued to ensure that privately owned stormwater facilities are operated and maintained so that downstream systems are not affected.

***Policy U-4.8: Educate the public on protecting and enhancing the quality of our water resources.***

The City should strive to raise awareness of the impact that everyday business and residential activities can have on water quality and fish habitat and populations, and to provide information on practices, such as natural yard care, proper storage of materials, and washing practices, that can prevent the discharge of pollutants. Citizen volunteers should be involved in activities that increase stewardship of our water resources. The City should also explore new techniques for engaging the public and effecting positive changes in behavior.

***Policy U-4.9: Coordinate basin planning, pollution prevention, and restoration activities with neighboring jurisdictions.***

Watersheds do not stop at jurisdictional boundaries, and must be analyzed and restored as whole entities. The City should coordinate activities with King County, Bellevue and Redmond and other jurisdictions as appropriate to maximize the positive impact of projects and programs.

***Policy U-4.10: Participate in regional surface water resources and fish resource conservation planning efforts.***

The City should continue in the participation of the WRIA 8 salmon conservation planning effort and the Puget Sound Shared Strategy. The purpose of this project is to develop a plan for recovery of salmon habitat functions of the greater Lake Washington Watershed. Habitat is the only one of the four "H's," Habitat, Hydropower, Hatcheries, and Harvest, which is under local government control. Recovery of salmon stocks listed as threatened under the Federal Endangered Species Act would reduce the regulatory and liability burden for local jurisdictions, help to protect a vital part of our regional economy, and protect a species that has great cultural significance in the Pacific Northwest.

***Policy U-4.11: Ensure compliance with State and federal regulations related to surface water quality and fisheries resources.***

The City should coordinate surface water management requirements and programs with a variety of State and federal programs and regulations, including but not limited to the following:

- National Pollutant Discharge Elimination System, Phase II;
- Puget Sound Water Quality Management Plan; and
- Federal Endangered Species Act listing of Chinook salmon as a threatened species.

This policy is intended to acknowledge and accommodate future regulatory changes.

**Telecommunications**

***Goal U-5: Ensure adequate and competitively priced telecommunication infrastructure, facilities and services.***

***Policy U-5.1: Manage the City's existing and planned telecommunication improvements to optimize service delivery opportunities in Kirkland.***

The City should plan and install sufficient capacity into its telecommunication system to meet future City needs.

***Policy U-5.2: Use partnerships to achieve cooperation and cost-sharing in building telecommunication systems and providing service.***

The City should establish partnerships with other public agencies and private sector organizations to achieve cooperation and cost-sharing in building telecommunication systems and providing services. Partnerships may include the use of shared telecommunication space, such as towers, buildings and fiber-optic lines.

***Policy U-5.3: Review and update City policies, procedures and regulations to facilitate the installation and maintenance of telecommunication systems.***

The City should review and update its policies, procedures and practices to ensure that they facilitate the installation of new telecommunication systems and support existing systems. In addition, the City's development regulations need to be flexible or revised on a regular basis to respond to changes in technology and consumer needs.

***Policy U-5.4: Seek opportunities to enhance the number of service providers in the community to increase choice and encourage competitive pricing and high quality customer service.***

Choice, availability and price are important factors to telecommunication consumers. The City should look for opportunities to increase the number of high quality service providers to have competitively priced and high quality telecommunication systems in Kirkland.

***Policy U-5.5: Involve community stakeholders and service providers in telecommunication decisions.***

The City should involve consumers, service providers and other public entities with telecommunication systems in Kirkland when reviewing its policies, practices and development regulations to ensure that consumer needs are being met and that providers and other public entities can install the facilities.

## *NON-CITY-MANAGED UTILITIES*

The Washington Utilities and Transportation Commission (WUTC) has traditionally been the primary regulatory agency for private utilities. The WUTC has the authority to define the costs that a utility can recover, and consequently has the oversight to ensure that the utility acts prudently and responsibly. Under the Growth Management Act, local jurisdictions now have the obligation and requirement to plan for utilities including the identification of utility corridors.

Kirkland will need to consider the obligations of the utilities to WUTC regulation when considering policies and regulation affecting their operations.

**Coordination**

***Goal U-6: Facilitate the development and maintenance of non-City-managed utilities at the appropriate levels of service.***

***Policy U-6.1: Work with non-City-managed utilities and review facility plans to ensure that they reflect and support Kirkland's land use plan. Likewise, the City should work with providers to ensure that utilities are available to support land uses and to maintain appropriate levels of service.***

This policy is intended to ensure that non-City providers are in compliance with the City's Comprehensive Plan as mandated by the Growth Management Act. This systematic planning allows the City to make accurate land use projections based on utility plans and allows utility providers to plan for utilities in a manner that reflects expected land use patterns and densities.

***Policy U-6.2: Coordinate with non-City providers of water and sewer on a joint program for maintaining adopted levels of service, concurrency requirements, funding, and construction of shared public facilities.***

Under the provisions of this Comprehensive Plan, the City is establishing specific utility requirements for itself and utilities serving the Kirkland area consistent with the requirements of the Growth Management Act.

***Policy U-6.3: Coordinate with the appropriate utility provider when considering land use decisions in the vicinity of proposed facility locations to ensure land use compatibility.***

Working with utilities in advance of key land use decisions has the potential to eliminate potential conflicts and ensure that utility considerations are factored into the development review process.

***Policy U-6.4: Provide timely and effective notice to utilities of the construction, maintenance, or repair of streets, roads, or other facilities and coordinate such work with the serving utilities.***

Providing utilities the opportunity to coordinate construction projects with City projects has two distinct advantages: it could save the utility money by reducing construction expenditures and it can help the City to avoid multiple roadcuts for various utility installations.