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October 2, 1999

ADaPT Job No. WA99-2720-1

VoiceStream Wireless
19807 North Creek Parkway North, Suite 101
Bothell, Washington 98011

Attention: Mr. John McDonagh

Subject: Phase I Environmental Site Assessment
PT Chimacum-6101-A
Jefferson County, Washington

Dear Mr. McDonagh:

ADaPT Engineering, Inc. (ADaPT) is pleased to present the results of our Phase I Environmental Site Assessment for the above-referenced property. This assessment was performed in general accordance with ASTM Practice E 1527-97. Authorization to perform this Phase I was given via VoiceStream PCS purchase order number SEA0000003197.

ADaPT appreciates the opportunity to be of service to you on this project. Should you have any questions concerning this report, or if we can assist you in any way, please feel free to contact us at (206) 654-7045.

Respectfully Submitted,

ADaPT Engineering, Inc.

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JEFFERSON COUNTY
DEPT. OF COMMUNITY DEVELOPMENT

Keith A. Ross, P.G.
Senior Project Manager

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Attachments: Figure 1 Location/Topographic Map
Figure 2 Parcel Map
Figure 3 Site & Vicinity Plan

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1.0 EXECUTIVE SUMMARY

ADaPT is pleased to present the results of the Phase I Environmental Site Assessment (Phase I) for a portion of a site (host parcel) that VoiceStream Wireless proposes to lease (proposed lease area). The host parcel is located on National Forest Development Road 1161 Rd in Jefferson County, Washington. Following is a summary of the Phase I:

Site Description: The rectangularly-shaped host parcel covers a reported 148.58 acres. The site is undeveloped forest with forest dirt roads. ADaPT understands that VoiceStream Wireless proposes to lease a 40' X 40' area at the junction of three dirt roads. The proposed lease area will support a lattice tower and equipment building (see Section 3.0).

Site History: Historical research (see Section 6.0) revealed the host parcel was undeveloped, and has been used for periodic timber harvesting from at least 1940s to the present. The host parcel Historical information specifically dated prior to 1940 was not found by ADaPT. Considering, however, the undeveloped, tree-covered appearance of the host parcel and immediate surrounding area in a 1975 aerial photograph and anecdotal information, it appears likely the host parcel was undeveloped prior to 1940.

Regulatory Agency Information: A review of regulatory agency lists and databases (see Section 8.0) did not reveal any regulated facilities within the appropriate ASTM guidance distances.

Site Reconnaissance: The site reconnaissance (see Section 7.1) did not reveal the presence of the following recognized environmental conditions on the host parcel in the immediate vicinity of the proposed lease area: underground or above ground storage tanks containing hazardous substances; lagoons; landfills; pipelines; hazardous materials and hazardous waste storage/disposal areas including sumps, pits, ponds, drums; dead and chemically stressed vegetation; discarded electrical transformers and capacitors; construction materials suspected to contain hazardous materials, including asbestos; groundwater monitoring wells; obvious locations of past and present chemical disposal.

Conclusions: The Phase I did not reveal the presence of recognized environmental conditions (as defined by ASTM Practice E1527-97) associated with the host parcel, proposed lease area, and immediate surrounding area, that in ADaPT's professional opinion, have resulted in a release of hazardous substances or petroleum products to the host parcel and proposed lease area. As such, it is ADaPT's professional opinion that a Phase II Environmental Site Assessment for the proposed lease area is unwarranted at this time.

The Executive Summary is intended for introductory purposes only and should be used in conjunction with the full text of this report.

2.0 INTRODUCTION

2.1 Purpose

The purpose of the Phase I is to evaluate the proposed lease area and host parcel for indications of recognized environmental conditions due to previous or ongoing, on-site and off-site activities or conditions. Where applicable, the Phase I also strives to satisfy one of the requirements to qualify for the *innocent purchaser/landowner defense* to Comprehensive Environmental Response, Compensation and Liability Act, 42, U.S.C. 9601, et seq. (CERCLA) liability. The Washington Model Toxics Control Act (MTCA), Chapter 70.105D Revised Code of Washington (RCW) has a similar provision for exemption from liability. The Phase I endeavors to provide "*all appropriate inquiry into the previous ownership and uses of the property consistent with good commercial or customary practice in an effort to minimize liability*" as stated in CERCLA and MTCA.

2.2 Special Terms and Conditions

Authorization to perform this Phase I was given via VoiceStream PCS purchase order number SEA0000003197.

2.3 Scope of Work

The scope of work for this study consisted of gathering reasonably ascertainable information in general accordance with the American Society for Testing and Materials (ASTM) Standard Practice for Phase I Environmental Site Assessments (ASTM Practice E 1527-97). Specifically, this Phase I consisted of the following:

- A reconnaissance to assess the host parcel, the proposed lease area, and the parcels immediately surrounding the host parcel for recognized environmental conditions.
- A review of regulatory agency (U.S. Environmental Protection Agency, Washington State Department of Ecology, etc.) database lists, and individual site files, if necessary, to evaluate reported environmental concerns near the host parcel.
- A survey of available local geologic and topographic maps, as well as additional information concerning public and private water sources in the project vicinity.
- A review of historical sources including available business directories, aerial photographs, maps, tax assessment records, and building/planning department records. The historical information was used to evaluate past and present land use at the host parcel and immediate surrounding area to document businesses, activities, or conditions that could possibly compromise the environmental integrity of the host parcel and proposed lease area.
- Preparation of a report documenting the findings of the Phase I and our opinion of the possibility that contamination of the host parcel and proposed lease area may exist due to on-site or nearby off-site land use activities.

2.4 Limitations

This assessment is intended to provide the client with information regarding apparent suspicions of existing and potential recognized environmental conditions associated with the subject property. ADaPT warrants that this Phase I Environmental Site Assessment was performed using generally accepted, good commercial and customary environmental assessment practices. ADaPT believes that the information obtained from the records review and the interviews concerning the site is reliable. However, ADaPT cannot and does not warrant or guarantee that the information provided by these other sources is accurate or complete. No other warranty, either implied or express is given.

Environmental impairment of property because of activities such as illicit or unreported dumping or spilling of hazardous or deleterious materials may not be readily apparent. The opinions and conclusions presented in this report are based on information readily available at the time of the assessment. The collection of quantitative information, such as data generated by the analysis of soil or water samples, was beyond the scope of this assessment. The Phase I does not address the ASTM Phase I non-scope issues of asbestos, radon, lead-based paint, lead in drinking water, and wetlands. Other project specific limitations are presented in the appropriate sections of this report.

This report has been prepared for the exclusive use of VoiceStream Wireless and their agents for specific application to the project site. Use or reliance upon this report by a third party is at their own risk. ADaPT does not make any representation or warranty, express or implied, to such other parties as to the accuracy or completeness of this report or the suitability of its use by such other parties for any purpose whatever, known or unknown, to ADaPT.

3.0 SITE DESCRIPTION

A Location/Topographic Map (Figure 1), Parcel Map (Figure 2), and Site & Vicinity Plan (Figure 3) are attached at the end of the report.

3.1 Location

The host parcel is located east of Center Road 5.6 miles south of Chimacum, Jefferson County, Washington (Section 23, Township 29 North, Range 1 West, W.M.).

3.2 Site and Vicinity Characteristics

The rectangularly-shaped host parcel covers a reported 148.58 acres. The site is undeveloped with mature trees and bushes. Dirt roads traverse the host parcel. ADaPT understands that VoiceStream Wireless proposes to lease a 40'x40' area adjacent to the main dirt road at the top of the ridge. The proposed lease area will support a lattice tower and equipment building.

According to the United States Geological Survey (USGS) 7.5x15-minute series topographic map "Center" (1953, photorevised 1973), the host parcel is at an elevation of approximately 520 feet above mean sea level. Topographically, the proposed lease area is relatively level near the north end of the host parcel. The host parcel is a heavily wooded glacial ridge that trends north south. The surface of the proposed lease area is covered with grass and mature trees.

The host parcel is bordered on the north and east by farm and pasture-lands, on the south by wooded lots and on the west by single family residences.

3.3 Description of Improvements

The proposed lease area has no improvements. The host parcel is unimproved with mature trees and bushes and several dirt roads for access to the trees.

4.0 INTERVIEWS, REPORTS, AND ENVIRONMENTAL LIENS

Persons who may have information concerning environmental conditions at and surrounding the host parcel were interviewed. Pertinent information obtained during the interviews appears below, and in the appropriate sections of this report.

The site is owned by ANE Puget Sound Inc.. Mr. Jim Wick of Woodland Management, said that he is unaware of hazardous substance or petroleum releases on the host parcel or proposed lease area. Mr. Wick additionally said the he had no knowledge of environmental liens held on the site.

Jefferson County Department of Public Works was contacted regarding the location of closed, abandoned or active landfills within ½ mile of the host parcel.

ADaPT performed a concurrent Geotechnical Engineering Evaluation report of the proposed lease area (see Section 5.2).

5.0 PHYSICAL SETTING

5.1 Regional Physiographic Conditions

The host parcel is situated on a rolling upland, glacial terrace/ridge. Specifically, the host parcel is a portion of a glacial ridge which trends north south. In the immediate host parcel vicinity, the western slope drains to Chimacum Creek approximately one-quarter mile west of the host parcel, and the eastern slope drains to an unnamed creek approximately one-quarter mile east of the host parcel.

5.2 Geologic and Soil Conditions

ADaPT completed a Geotechnical Engineering Evaluation of the proposed lease area (ADaPT Report No. WA99-2566, dated September 30, 1999. The evaluation included the drilling of one boring on the proposed lease area to a depth of approximately 28.5 feet below ground surface (bgs).

Surficial soils encountered at the boring location consisted of four inches of grass and topsoil overlying medium dense to very dense, moist, clayey fine to medium sand with trace gravel. From approximately 8.5 feet bgs to the bottom of the 28.5-foot boring, was very dense, moist, silty fine sand with trace gravel that was interpreted to be glacial till. The glacial till and all soil units deposited below the till have been glacial overridden, and compressed by the weight of thousands of feet of glacial ice. Accordingly, those soils are very dense and relatively incompressible.

5.3 Groundwater Conditions

Near-surface or perched groundwater typically occurs when an underlying soil layer of less permeability prevents the downward percolation of water. Water will build up above the less permeable soil, and move laterally in the more permeable overlying soils. Wet or saturated soils may also be encountered at depth due to cleaner sand and gravel zones. Groundwater conditions should be expected to fluctuate due to season, amount of precipitation, and other on-site and off-site factors.

Perched groundwater was not encountered in the 28.5-foot boring that ADaPT drilled for the concurrent geotechnical evaluation. Because of the low permeability of the glacial till, and the trace of mottling observed in the near-surface samples, we interpret site conditions to be conducive to the development of "perched" groundwater.

Although groundwater flow direction is difficult to predict without the installation of at least three monitoring wells that measure water levels over time, an estimate of possible near-surface groundwater flow direction is provided to help evaluate potential on-site and off-site contaminant impacts. Groundwater flow direction is the path along which dissolved contaminants might migrate if present in groundwater supplies. Typically, in this region, the near-surface groundwater flow direction generally follows topography. The subject area slopes down to the west, and so near-surface groundwater flow direction likely follows the topography and moves toward west. Variations in the assumed flow direction may exist that would remain uncharacterized without performing a subsurface exploration program with groundwater monitoring wells, which is beyond the Phase I scope of work.

5.4 Drinking Water Supplies and Water Wells

The host parcel and surrounding area obtain their public drinking water supply from private drinking water wells. While the host parcel has not been developed with drinking water wells, surrounding properties have. Department of Ecology's Southwest Regional Office in Lacey well log records showed ten domestic drinking water wells located within one mile of the host parcel. Based on the separation distances of all of the wells, it is highly unlikely these drinking water supply sources would be influenced by the host parcel.

6.0 HISTORICAL USE INFORMATION

This section is divided into two subsections. The first subsection (Section 6.1) summarizes the various historical sources that were consulted. The second subsection (Section 6.2) is a decade by decade discussion of the historical uses of the host parcel and immediate surrounding area.

6.1 Historical Sources

The land use history of the host parcel and immediate surrounding area was researched utilizing the various reasonably ascertainable sources described below.

Tax Assessment Records

We obtained tax assessment information from the Jefferson County Assessor. The parcel number for the host parcel is 901-231-004.

Aerial Photographs

ADaPT reviewed aerial photographs from the years 1975, 1985, 1989, 1993, and 1997 at Walker & Associates, Inc. of Tukwila, Washington. The photographs range in scale from 1:1,000 to 1:2,000, and are black and white and color. In the review of the aerial photographs, observations are interpretative and limited to the area within approximately one-quarter-mile of the host parcel. The scale of each photograph did not provide a clear image of specific site characteristics. However, we were able to discern the absence and presence of structures on the host parcel, as well as developmental trends in the immediate subject area.

Historical Maps

We reviewed the USGS 7.5-minute series topographic map "Center" dated 1953 and photorevised in 1973.

We reviewed the collection of Sanborn Map Company fire insurance maps at Suzallo Library at the University of Washington. Sanborn maps, as they are commonly referred, typically detail building construction type and use, and may show underground and above ground storage tanks, chemical storage areas, and other recognized environmental conditions. The Sanborn Map Company published maps dating from 1867 to the present for various cities and towns, and therefore the maps are a good source for identifying the past uses of a property. **The reviewed collection did not have Sanborn maps of the subject area.**

6.2 Historical Findings

1940s -1960s

According to Mr. Wick the host parcel and surrounding areas have be used for timber harvest for 40 to 50 years. The current owner purchased the host parcel approximately 12 years ago.

Historical information specifically dated prior to 1940 was not found by ADaPT. Considering, however, the undeveloped, tree-covered appearance of the host parcel and immediate surrounding area in the 1975 aerial photograph and information from Mr. Wick regarding logging history of the host parcel, it appears likely the host parcel was undeveloped prior to 1940.

1970s

The USGS 7.5-minute series topographic map "Center" dated 1953 and photorevised in 1973 depicts the host parcel as undeveloped and covered with vegetation. A 1975 aerial photograph shows the host parcel and immediate surrounding area covered with trees.

1980s

Aerial photographs dated 1985 and 1989 continue to show the host parcel and immediate surrounding area undeveloped and covered with trees. In the greater surrounding area, both residential and agricultural development is evident.

According to Mr. Wick the host parcel was last logged approximately 15 to 20 years ago.

1990s

Aerial photographs dated 1993 and 1997 show the host parcel and immediate surrounding area developed as they are today.

7.0 RESULTS OF RECONNAISSANCE

7.1 On-Site Inspection Observations

An ADaPT representative conducted a reconnaissance of the proposed lease area on September 14, 1999. The purpose of the site reconnaissance was to evaluate current conditions at the proposed lease area and to look for recognized environmental conditions. The reconnaissance consisted of walking on and observing the host parcel and proposed lease area to provide an overlapping field of view. The host parcel building was not accessed.

The site reconnaissance did not reveal signs of the presence of the following on the host parcel or proposed lease area: underground or above ground storage tanks containing hazardous substances; lagoons; landfills; hazardous materials and hazardous waste storage/disposal areas including sumps, pits, ponds, drums; dead and chemically stressed vegetation; discarded electrical transformers and capacitors; construction materials suspected to contain hazardous materials, including asbestos; groundwater monitoring wells; obvious locations of past and present chemical disposal.

During the concurrent geotechnical evaluation (see Section 5.2) of the proposed lease area that included the drilling of one boring, ADaPT personnel did not observe soils that exhibited discoloration or unusual odors indicative of a hazardous substance or petroleum release.

7.2 Adjacent Site and Vicinity Observations

A representative of ADaPT conducted a reconnaissance of the area surrounding the proposed lease area on September 14, 1999. The purpose of this reconnaissance was to observe land use in the proposed lease area vicinity and to evaluate the potential for nearby businesses to generate, use, or store hazardous substances that may affect the host parcel. The off-site reconnaissance was non-intrusive with the adjoining properties observed from the proposed lease area and public right-of-ways. ADaPT did not observe recognized environmental conditions on other parcels immediately adjacent to the proposed lease area.

8.0 STANDARD REGULATORY AGENCY ENVIRONMENTAL RECORD SOURCES

Publicly available and practically reviewable regulatory agency reports generated from databases were reviewed with respect to the host parcel and proposed lease area. The reports, obtained from federal, state, and local government agencies, were reviewed in an effort to document any reported environmental concerns that have occurred at the host parcel or in the surrounding area. Sites or facilities appearing on the reviewed reports, within a certain search distance of the proposed lease area, are discussed below. The search distances ADaPT utilizes for Phase I reports meet those specified in ASTM Practice E 1527-97. The following reports were reviewed (the search distance for each report is listed in parentheses):

- U.S. Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) report (one-half mile) and sites on the National Priority List (one mile).
- Washington State Department of Ecology's (Ecology) Confirmed and Suspected Contaminated Sites report (one mile).
- The EPA's Resource Conservation and Recovery Act (RCRA) total notifiers report (host parcel and adjoining properties), including RCRA Treatment, Storage, and Disposal (TSD) facilities (one-half mile), and TSD facilities subject to Corrective Action (CORRACTS) under RCRA (one mile).
- Ecology's listing of registered Underground Storage Tanks (host parcel and adjoining properties).
- Ecology's listing of Leaking Underground Storage Tanks (one-half mile).
- Emergency Response Notification System (ERNS) Spill Report (host parcel).
- Landfills (one-half mile).

8.1 CERCLIS and NPL

The CERCLIS database is used by EPA to track activity conducted under the Superfund program including sites that represent a long-term threat and are classified on the National Priorities List (NPL). **The review of the database (dated May 11, 1999) did not reveal CERCLIS sites located within approximately one-half mile of the host parcel. The review did not reveal NPL sites located within approximately one mile of the host parcel.**

8.2 Confirmed and Suspected Contaminated Sites Report

Ecology's Confirmed and Suspected Contaminated Sites (CSCS) report is an inventory of suspected or confirmed hazardous substance sites in the state of Washington. **A review of the CSCS report (dated May 21, 1999) did not reveal CSCS facilities located within one mile of the proposed lease area.**

8.3 RCRA Total Notifiers, TSD, and CORRACTS TSD

The RCRA total notifiers report is a list of regulated generators, handlers, transporters, and disposers of hazardous materials. Listing on the RCRA report does not indicate a facility has been adversely affected by a hazardous material, but merely that the facility is required to monitor and document hazardous waste activities to the EPA or Ecology. **The reviewed RCRA total notifiers report (dated May 18, 1999) does not include the host parcel or an adjoining parcel.**

The RCRA total notifiers report does not include any TSD facilities located within one-half mile of the host parcel. The TSD CORRACTS report (dated May 18, 1999) does not include any TSD CORRACTS facilities situated within one mile of the host parcel.

8.4 Underground Storage Tanks

Ecology's report of USTs (dated May 5, 1999) includes USTs that have been registered with state of Washington, in accordance with the Washington UST Regulations (Chapter 173-360 WAC). **A review of Ecology's listing did not reveal the presence of a registered UST facility on or adjoining the host parcel.**

8.5 Leaking Underground Storage Tanks

The leaking UST (LUST) list is an inventory of leaking USTs that have been reported to Ecology. **A review of Ecology's listing of LUST facilities dated May 5, 1999 did not reveal LUST facilities located within approximately one-half mile of the host parcel.**

8.6 Emergency Response Notification System Spill Report

The Emergency Response Notification System (ERNS) Spill Report is a national database used to collect information on reported accidental releases of oil and hazardous substances. The database contains information from spill reports made to federal authorities including the EPA, the United States Coast Guard, the National Response Center, and the United States Department of Transportation. **A review of the yearly ERNS lists, dated from January 1987 through December 1998 did not reveal the host parcel to be listed.**

8.7 Landfills

According to Jefferson County Public Works personnel there are no landfill sites located within one-half mile of the host parcel.

9.0 CONCLUSIONS AND RECOMMENDATIONS

The Phase I did not reveal the presence of recognized environmental conditions (as defined by ASTM Practice E1527-97) associated with the host parcel, proposed lease area, and immediate surrounding area, that in ADaPT's professional opinion, have resulted in a release of hazardous substances or petroleum products to the host parcel and proposed lease area. As such, it is ADaPT's professional opinion that a Phase II Environmental Site Assessment for the proposed lease area is unwarranted at this time.

ADaPT appreciates the opportunity to be of service to you on this project. Should you have any questions concerning this report, or if we can assist you in any way, please contact us at (206) 654-7045.

Respectfully Submitted,

ADaPT Engineering, Inc.

Keith A. Ross
Senior Project Manager

Daryl S. Petrarca, R.E.A.
Vice President of Environmental Services
Senior Reviewer

KAR/kar

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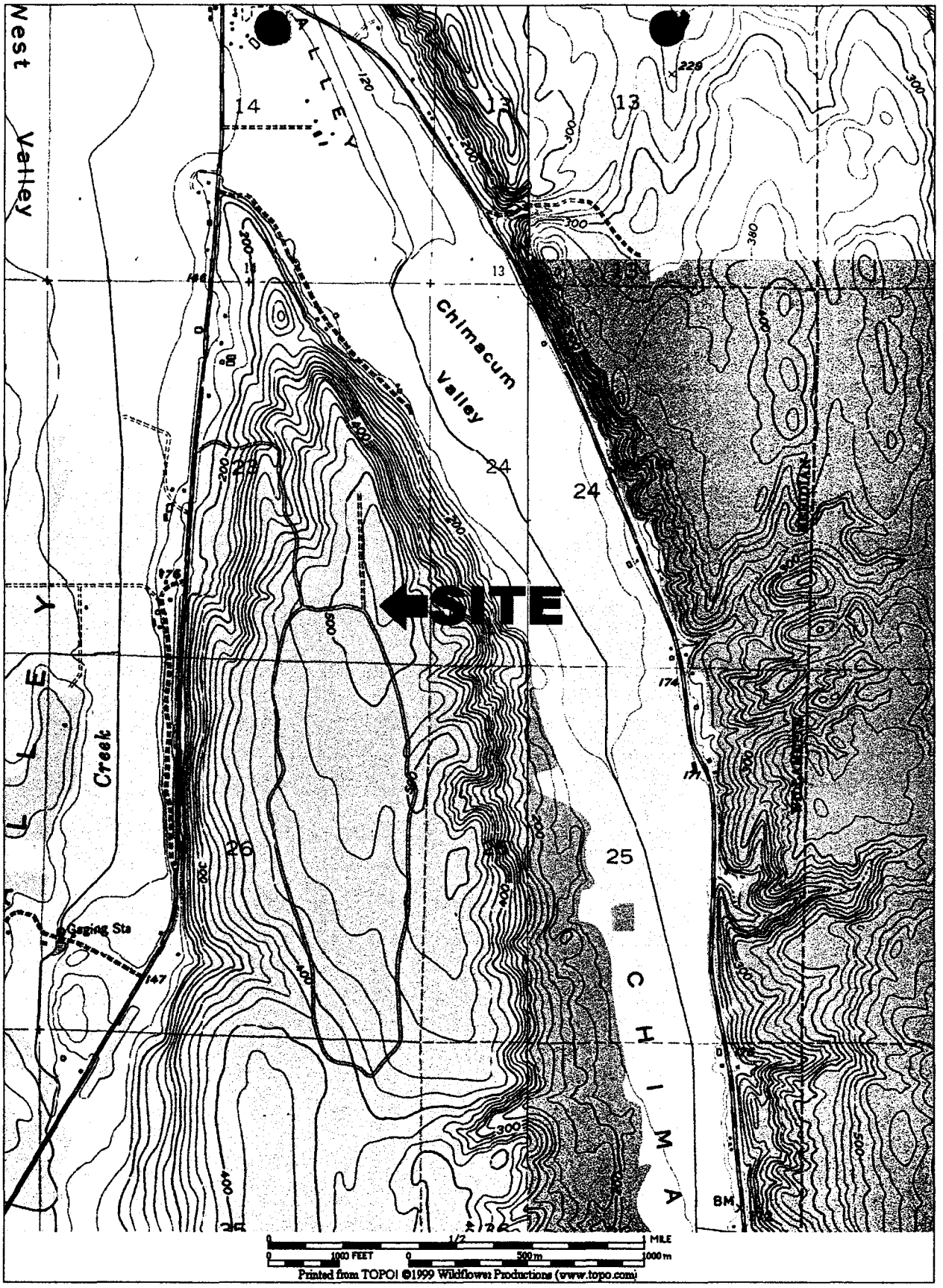

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Ph : 206.654.7045 Fax : 206.654.7048

FIGURE 1 - Location/Topographic Map

Location : PT Chimacum/ANE SE-6101A
SEC 23, T29N, R1W
Pot Townsend, Washington
Client : Voice Stream PCS
Date : 9/20/99 **Job # :** S-WA-99-2720-1

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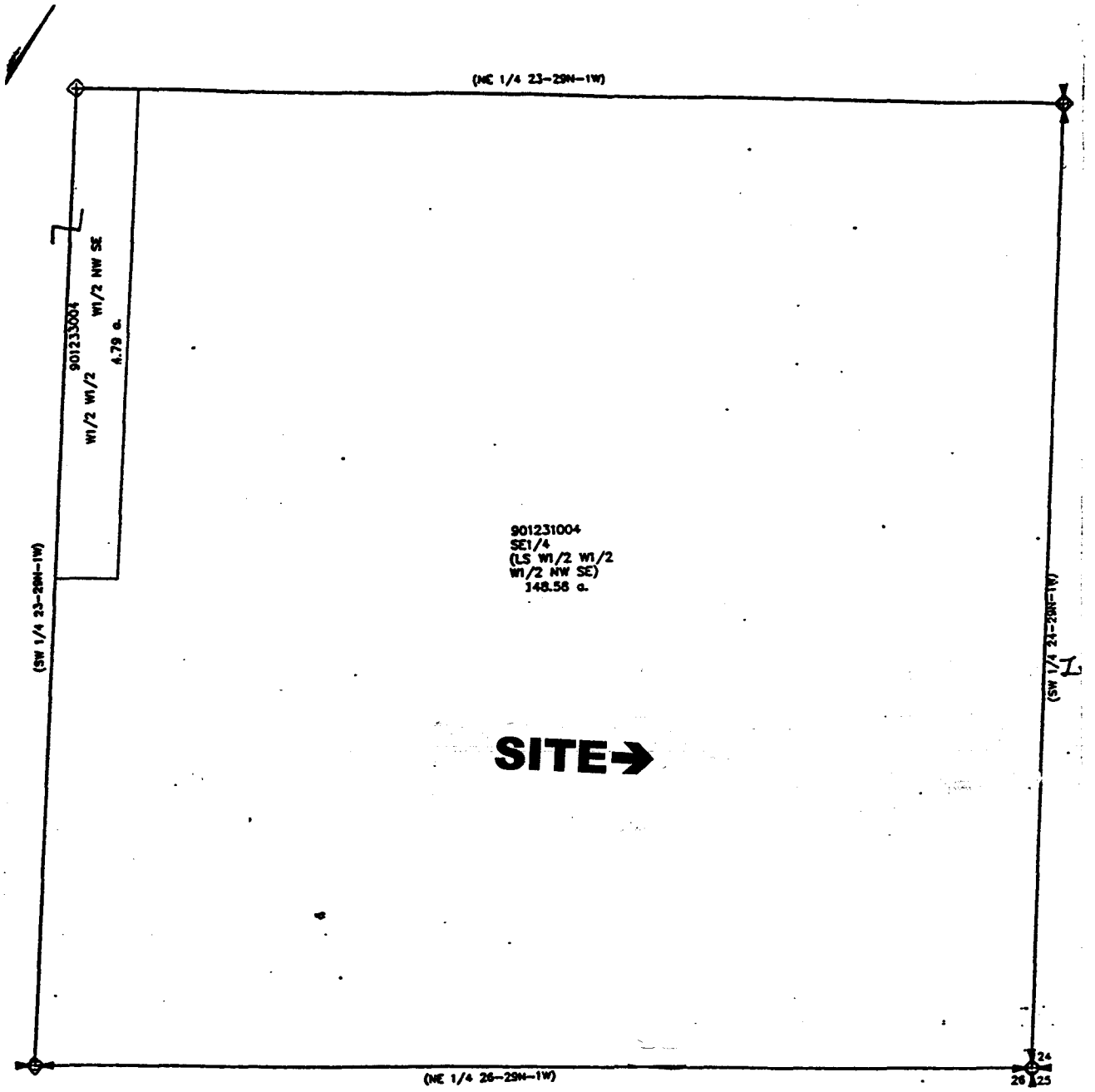

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FIGURE 2 - Parcel Map

Location : PT Chimacum/ANE SE-6101A
SEC 23, T29N, R1W
Pot Townsend, Washington
Client : Voice Stream PCS
Date : 9/20/99 **Job # :** S-WA-99-2720-1

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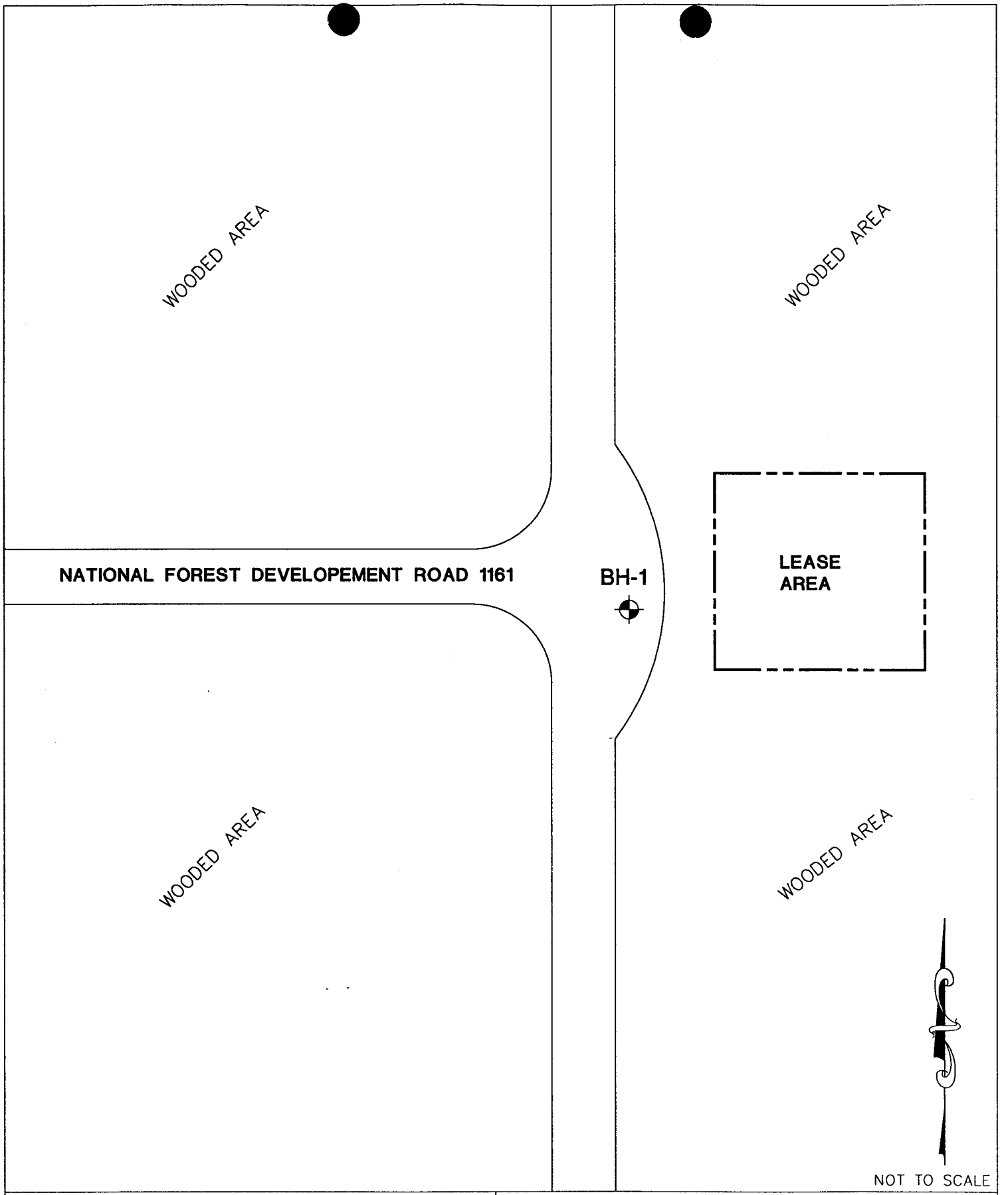

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800 Maynard Avenue S., Suite 403
Seattle, Washington 98134

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FIGURE 3 - Site Plan

Location : PT Chimacum/ANE SE-6101A
SEC 23, T29N, R1W
Pot Townsend, Washington
Client : Voice Stream PCS
Date : 9/20/99 **Job # :** S-WA-99-2720-1

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September 30, 1999

ADaPT Job No. WA99-2720

RECEIVED
DEC 20 1999
JEFFERSON COUNTY
DEPT. OF COMMUNITY DEVELOPMENT

Voice Stream Wireless Corporation
19807 North Creek Parkway, Suite 101
Bothell, Washington 98011

Attention: Mr. John McDonagh

Subject: Geotechnical Engineering Evaluation
PT Chimacum/ANE
SE-6101A
National Forest Development Road 1161 Road
Section 23, T29N, R1W
Chimacum, Washington 98298

Dear Mr. McDonagh:

Pursuant to your request, ADaPT Engineering, Inc. (ADaPT) is pleased to submit this report describing our recent geotechnical engineering evaluation for the above-referenced site. The purpose of this study was to interpret general surface and subsurface site conditions, from which we could evaluate the feasibility of the project and formulate design recommendations concerning site preparation, equipment pad and tower foundations, structural fill, and other considerations. Our scope of services consisted of a surface reconnaissance, a subsurface exploration, geotechnical analyses, and report preparation. Verbal authorization to proceed with our study was given by Voice Stream Wireless Corporation Purchase Order No. SEA0000003197 dated September 24, 1999. This report has been prepared for the exclusive use of Voice Stream Wireless Corporation, and their agents, for specific application to this project in accordance with generally accepted geotechnical engineering practice. We are in the process of completing an environmental site assessment study for this site and the findings will be reported under separate cover.

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We appreciate the opportunity to be of service to you. If you have any questions, or if we can be of further assistance to you, please contact us at (206) 654-7045.

ADaPT Engineering, Inc.

Respectfully submitted,

Ngoc H. Vu

(for) Keith Ross
Senior Geologist

K. V. Lew, P. Eng.
Senior Geotechnical Engineer

Kurt W. Groesch, P.E.
Senior Geotechnical Engineer
Senior Reviewer

KURT W. GROESCH
STATE OF WASHINGTON
19466
REGISTERED PROFESSIONAL ENGINEER
10/1
EXPIRES 6/15/00

KVL/kr

Attachments:	Figure 1	Location/Topographic Map
	Figure 2	Site and Exploration Plan
	Appendix A	Boring Log B-1

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VOICE STREAM WIRELESS CORPORATION
Geotechnical Engineering Evaluation

PT Chimacum/ANE
PCS SE-6101A
Port Townsend, Washington

WA99-2720
September 1999

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13

FILE ZON 99-00057

PROJECT DESCRIPTION

The host parcel is located in Section 23 Township 29N, Range 1W, along National Forest Development Road 1161 Road, south of Chimacum, Washington. The host property is undeveloped forest land. The proposed lease area is located approximately 20 feet east of a "T" intersection at the top of the ridge. The topography of the proposed lease area is fairly level and the ground surface is covered by mature trees, bushes, tall grass and weeds. We understand Voice Stream Wireless proposes to construct a 150-foot lattice communication tower and associated cellular equipment cabinets. The project site and surrounding area are shown on the attached site vicinity map (Location/Topographic Map, Figure 1). The attached Site and Exploration Plan (Figure 2) shows the approximate location of the proposed cellular tower lease area in relation to other site features.

It should be emphasized that the conclusions and recommendations contained in this report are based on our understanding of the currently proposed utilization of the project site, as derived from written information supplied to us by Voice Stream Wireless Corporation. Consequently, if any changes are made to the project, we recommend that we review the changes and modify our recommendations, if appropriate, to reflect those changes.

EXPLORATORY METHODS

We explored surface and subsurface conditions at the project site on September 14, 1999. Our surface exploration consisted of a visual site reconnaissance. Our subsurface exploration consisted of advancing one soil test boring to a depth of approximately 28.5 feet below the existing site grade. The location of the boring, designated as B-1, is shown on the attached Site and Exploration Plan (Figure 2).

The specific location and depth of the exploration performed was selected in relation to the proposed site features, under the constraints of budget and site access. The location of the boring and other features shown on Figure 2 were obtained by hand taping from existing site features. As such, the exploration location shown on Figure 2 should be considered accurate to the degree implied by the measuring methods used.

Boring Methods

The soil boring B-1 was advanced on September 14, 1999 using a truck mounted hollow-stem auger drill rig. The drill rig was operated by an independent company working under subcontract to ADaPT. An engineering geologist from our firm was on-site continuously observed the boring, obtained

representative soil samples, and logged the subsurface conditions. After the boring was completed, the borehole was backfilled with a mixture of soil cuttings and bentonite chips.

During drilling, soil samples were obtained on 5-foot depth intervals using the Standard Penetration Test (SPT) procedure (ASTM: D 1586). This test and sampling method consists of driving a standard 2-inch outside diameter (OD) split-barrel sampler a distance of 18 inches into the soil with a 140-pound hammer, free-falling a distance of 30 inches. The number of blows required to drive the sampler through each of the three, 6-inch intervals is noted. The total number of blows struck during the final 12 inches of penetration is considered the Standard Penetration Resistance, or "blow count". If 50 or more blows are struck within one 6-inch interval, the driving is ceased and the blow count is recorded as 50 blows for the actual number of inches of penetration. The resulting Standard Penetration Resistance values provide a measure of the relative density of granular soils or the relative consistency of cohesive soils.

The boring log appended to this report describes the various types of soils encountered in the boring, based primarily on visual interpretations made in the field. The log also indicates the approximate depth of the contacts between different soil types, although these contacts may be gradational or undulating. Where a change in soil type occurred between sampling intervals, we inferred the depth of contact. In addition, the log indicates the depth of any groundwater observed in the boring; the Standard Penetration Resistance at each sample location, and any laboratory tests performed on the soil samples.

SITE CONDITIONS

The following sections describe our observations, measurements, and interpretations concerning surface, soil, groundwater, and seismic conditions at the project site.

Surface Conditions

The host parcel is located in Section 23 Township 29N, Range 1W, along National Forest Development Road 1161 Road, south of Chimacum, Washington. The host property is undeveloped forest land. The proposed lease area is located approximately 20 feet east of a "T" intersection at the top of the ridge. The topography of the proposed lease area is fairly level and the ground surface is covered by mature trees, bushes, tall grass and weeds. We understand Voice Stream Wireless proposes to construct a 150-foot lattice communication tower and associated cellular equipment cabinets. The project site and surrounding area are shown on the attached site vicinity map (Location Map/Topographic, Figure 1). The attached Site and Exploration Plan (Figure 2) shows the approximate location of the proposed cellular tower lease area in relation to other site features.

Subsurface Conditions

On September 14, 1999, an exploratory test boring was drilled to a depth of approximately 28.5 feet below the existing ground surface. The location of the boring, designated as B-1, is shown on Figure 2. Surficial soils encountered at the boring location consisted of four inches of grass and topsoil overlying dense to very dense, moist, gray/brown, silty clayey sand with gravel which was interpreted to be glacial till. The glacial till deposit extended to the full-explored depth of 28.5 feet. Glacial till is a glacially overconsolidated deposit, which was compressed by the weight of thousands of feet of glacial ice. Accordingly, the till and all soil units deposited stratigraphically below the till are very dense and relatively incompressible.

Groundwater was not encountered at the time of drilling. We noted that soils at shallow depths were brown/gray in color and changed into gray in color below approximately 9-foot depth. We would anticipate that soil conditions at the site are conducive to the development of perched groundwater conditions during periods of heavy rain or sustained precipitation. Perched groundwater develops owing to the relatively impermeable nature of the underlying till, which serves to impede infiltration. It should be recognized that groundwater levels could fluctuate due to factors such as seasonal changes, precipitation or future site utilization.

Seismic Conditions

According to the Seismic Zone Map of the United States contained in Figure 16-2 of the 1997 Uniform Building Code (UBC), the project site lies within Seismic Risk Zone 3. Based on our subsurface exploration, we interpret the site conditions to correspond to a seismic Soil Profile type S_D, for Stiff Soil, as defined by Table 16-J of the 1997 Uniform Building Code, based on the observed range of Standard Penetration Test (SPT) blow counts. The shallow soil conditions were assumed to be representative for site conditions beyond the depths explored.

CONCLUSIONS AND RECOMMENDATIONS

Current development plans call for construction of a 150-foot lattice tower and associated equipment building or cabinets. Based on the subsurface conditions encountered in our boring, we recommend that the proposed tower be supported on a drilled pier foundation. Design criteria for compressive, uplift and lateral support of drilled pier foundations are presented below. Normally, a conventional mat foundation could also be used to support a tower of this type. However, we understand that Voice Stream Wireless prefers to utilize drilled piers for tower foundations as a construction expedient. We should be contacted to provide foundation design recommendations for a mat foundation, if desired, for this site. Our specific

recommendations concerning site preparation, equipment pad foundations, tower foundations, and structural fill are presented in the following sections:

Site Preparation

Site preparation will involve essentially stripping, grading, and preparing subgrades. The following comments and recommendations apply to this site preparation:

Clearing and Grubbing: We do not anticipate that significant grade changes will be required to achieve proposed site grades. At this location, site preparation will largely consist of removal of grass and topsoil, followed by foundation preparation for the lattice cellular tower and equipment cabinets or building. If trees need to be removed from within the compound area, we recommend the trees be removed by tipping, so that the bulk of the tree root mass is removed. The resulting excavation should be backfilled with structural fill. Backfill materials, where required, should be placed and compacted according to the recommendations presented in the Structural Fill section of this report.

Wet Conditions: Because of the silty nature of the near surface soils, the existing site soils at shallow depths are considered moisture-sensitive and prone to disturbance when wet. The contractor should minimize traffic above the prepared subgrade areas to minimize disturbance and softening which would require removal of the unstable soils. During wet conditions, the use of a working surface of quarry spalls or clean sand and gravel may be required to protect the subgrade, especially from vehicular traffic.

Frozen Subgrades: If earthwork takes place during freezing conditions, we recommend that all exposed subgrades be allowed to thaw and be recompacted prior to placing subsequent lifts of structural fill.

Equipment Building or Cabinet Foundation

It is our understanding that the foundation for the proposed equipment building or cabinets will consist of a poured in place concrete slab-on-grade with thickened edges. We anticipate that the pad bearing pressure will be relatively light. However, we recommend that the thickened slab edges be designed as spread footings. The following recommendations and comments are provided for purposes of footing design and construction:

Subgrade Conditions: The proposed equipment pad may be supported by thickened slab edges extended to bear on the existing site soils encountered at depths below 1.5 feet at the location of boring B-1, after they have been compacted in place resulting in a firm and unyielding subgrade condition, or upon structural fill placed above similarly prepared soils. We anticipate the subsoil encountered at the proposed foundation grade will likely consist of dense silty clayey sand with gravel (glacial till).

Depending on the time of year that construction proceeds, it may be possible to compact those soils in place. However, the onsite near surface materials are relatively fine-grained. It will be difficult to achieve a specified compaction should moisture contents above the optimal moisture condition be encountered. Some overexcavation may be necessary if excessively soft or wet subgrade conditions were to be encountered at the foundation design grade levels. In consideration of the light loads imposed by the equipment, we recommend the overexcavation extend no deeper than 2-feet below the thickened slab bearing elevation. A layer of geotextile may be required to separate the structural fill soils from the underlying subgrade materials. Footings should never be cast atop soft, loose, organic, or frozen soils; nor atop subgrades covered by standing water. A representative from ADaPT should be retained to observe the condition of footing subgrades before concrete is poured to verify that they have been adequately prepared.

Footing Dimensions: We recommend that the thickened edge of the slab be designed as a spread footing and be constructed to have a minimum width of 12 inches. For frost protection, the footings should penetrate at least 18 inches below the lowest adjacent exterior grades. Footings may also be supported on structural fill placed on prepared soil subgrade. The horizontal limits of the fill pad below the building or cabinet foundation may be established by extending a line outward from the base of the thickened slab at an angle of 1 Horizontal: 1Vertical (1H: 1V) down to the upper surface of the bearing horizon.

Bearing Pressure: At the location of boring B-1, the near surficial soil should be stripped, excavated to a depth of at least 18-inches below the lowest adjacent grade. The soils at that elevation should be compacted in place if the moisture content allows, resulting in a firm and unyielding subgrade condition. Alternatively, the cabinets could be supported above a maximum thickness of two feet of compacted fill, underlain by a layer of geotextile (filter fabric), if required. A maximum allowable soil bearing pressure of 2,000 pounds per-square-foot can be used for static footing loads. This bearing pressure can be increased by one-third to accommodate transient wind or seismic loads. An allowable base friction coefficient of 0.40 and an allowable passive earth pressure of 350 pounds per cubic foot (pcf), expressed as an equivalent fluid unit weight, may be used for that portion of the foundation embedded more than 1 foot below finished exterior subgrade elevation.

Settlements: We estimate that total post-construction settlements of properly designed footings bearing on properly prepared subgrades could approach 1-inch, with differential settlements approaching one-half of the totals.

Access Driveway

The existing gravel driveway leading to the proposed tower site, in our opinion, can be used as a construction access driveway. Therefore, construction of an access driveway does not appear to be

necessary. If the construction of a segment of new access driveway becomes necessary, site preparation for the access roadway would likely include selective tree removal and grubbing of root balls, stripping of the topsoil and minor grading, followed by subgrade preparation and structural fill placement. We recommend the condition of the roadway subgrade be evaluated once construction begins. Fill placement and subgrade preparation should be completed as discussed in the Structural Fill section of this report.

Tower Drilled Pier Foundations

Based upon the subsurface soil and groundwater conditions disclosed by our test boring, we recommend that the tower be supported on a drilled pier foundation. The following recommendations and comments are provided for purposes of drilled pier design and construction:

Compressive Capacities: We recommend that the drilled pier penetrate at least 15 feet below the ground surface at the location of boring B-1. For vertical compressive soil bearing capacity, we recommend using the unit end bearing capacity presented in Table 1 below. The allowable end bearing capacity, presented in Table 1, includes a safety factor of 1.5 or more.

Table 1
Allowable End Bearing Capacity

Depth (feet)	Allowable Bearing Capacity (tsf)	Limiting Point Resistance (tsf)
15-28.5	6.5 D/B	30 TSF

Notes: D = the embedment depth (in feet) into the bearing layer.
B = pier diameter (feet).

Frictional Capacities: For frictional resistance of the drilled piers, acting both downward and in uplift, we recommend using the allowable skin friction value listed in Table 2. We recommend that frictional resistance be neglected in the uppermost 2 feet below the ground surface. The allowable skin friction value presented includes a safety factor of 1.5.

Table 2
Allowable Skin Friction Capacities

Depth (feet)	Allowable Skin Friction (tsf)
0-2	0.0
2-8	0.35
8-28.5	0.70

Lateral Capacities: For design against lateral forces acting against the drilled pier, two methods are typically used. The parameter used to select the appropriate design method is the length to pier stiffness ratio L/T, where L is the pier length in inches, and T is the relative stiffness factor. The relative stiffness factor (T) should be computed by:

$$T = \left(\frac{EI}{n_h}\right)^{0.2}$$

where E = modulus of elasticity (psi)
I = moment of inertia (in^4)
n_h = constant of horizontal subgrade reaction (pci)

The factors E and I are governed by the internal material strength characteristics of the pier. A representative value of n_h for the soil types encountered at this site is presented below in Table 4. Piers with a L/T ratio of less than 2 may be assumed to be relatively rigid and acting as a pole. The passive pressure approach may be used for this condition. For piers with a L/T ratio greater than 2, the modulus of subgrade reaction method is typically used. Both of these methods are discussed below:

Passive Pressure Method: The passive pressure approach is conservative by neglecting the redistribution of vertical stresses and shear forces that develop near the bottom of the pier and contribute to resisting lateral loads. We recommend using the allowable passive earth pressure (expressed as equivalent fluid unit weights) listed in Table 3. The allowable passive pressure for soils below the maximum depth of the test boring may be assumed to be as that shown for the lowest depth increment below.

Table 3
Allowable Passive Pressures

Depth (feet)	Allowable Passive Pressure (pcf)
0-2	0
2-8	350
8-28.5	400

The allowable passive earth pressure presented in Table 3 may be assumed to be acting over an area measuring 2 pier diameters in width by 8 pier diameters in depth, neglecting the uppermost 2 feet of embedment below the ground surface. According to the NAVFAC Design Manual 7.02 (1986), a lateral deflection equal to about 0.01 times the pier length would be required to mobilize the allowable passive pressure presented above. Higher deflections would mobilize higher passive pressures. When developing the allowable passive pressure listed in Table 3, we have incorporated a safety factor of at least 1.5, which is commonly applied to transient or seismic loading conditions.

Modulus of Subgrade Reaction Method: Using this method, the pier is designed to resist lateral loads based on acceptable lateral deflection limits. For sandy soils, the coefficient of horizontal subgrade reaction (k_h) is considered to be directly proportional to the depth along the pier. The formula to determine k_h is $k_h = n_h x$, where x is the depth below the ground surface in inches. We recommend using the value for the constant of horizontal subgrade reaction (n_h) for the various soil types presented in Table 4 below.

Table 4
Constant of Horizontal Subgrade Reaction (n_h)

Depth (feet)	n_h (pci)
0-2	0
2-8	50
8-28.5	70

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Construction Considerations: At this site, the upper four inches is comprised of grass and topsoil overlying dense to very dense, silty clayey sand with gravel to a depth of 28.5 feet bgs (Glacial Till). In light of hard drilling action encountered during our exploration phase, difficult drilling condition should be anticipated. Cobbles or erratic (boulders) can be expected in native glacial till soils. Although generally favorable soil conditions were encountered, the foundation drilling contractor should be prepared to case the excavation to prevent caving and raveling of the pier shaft sidewalls. No groundwater was encountered in the test hole. Should unanticipated heavy groundwater inflow be encountered during drilling it may be necessary to pump the accumulated groundwater prior to pier concrete placement. Alternatively, the use of bentonite slurry could be utilized to stabilize the drilled pier excavation.

The drilling contractor should be prepared to clean out the bottom of the pier excavation if loose soil is observed or suspected, with or without the presence of slurry or groundwater. As a minimum, we recommend that the drilling contractor have a cleanout bucket on site to remove loose soils and/or mud from the bottom of the pier. If groundwater is present and abundant within the pier hole, we recommend that the foundation concrete be tremied from the bottom of the hole to displace the water and minimize the risk of contaminating the concrete mix. The Drilled Shaft Manual published by the Federal Highway Administration recommends that concrete be placed by tremie methods if more than 3 inches of water has accumulated in the excavation.

Structural Fill

The following comments, recommendations, and conclusions regarding structural fill are provided for design and construction purposes:

Materials: Structural fill includes any fill materials placed under footings, pavements, driveways, and other such structures. Typical materials used for structural fill include: clean, well-graded sand and gravel (pit-run); clean sand; crushed rock; controlled-density fill (CDF); lean-mix concrete; and various soil mixtures of silt, sand, and gravel. Recycled concrete, asphalt, and glass, derived from pulverized parent materials may also be used as structural fill.

Placement and Compaction: Generally, CDF, and lean-mix concrete do not require special placement and compaction procedures. In contrast, pit-run, sand, crushed rock, soil mixtures, and recycled materials should be placed in horizontal lifts not exceeding 8 inches in loose thickness, and each lift should be thoroughly compacted with a mechanical compactor. Using the modified Proctor maximum dry density (ASTM: D-1557) as a standard, we recommend that structural fill used for various on-site applications be compacted to the following minimum densities:

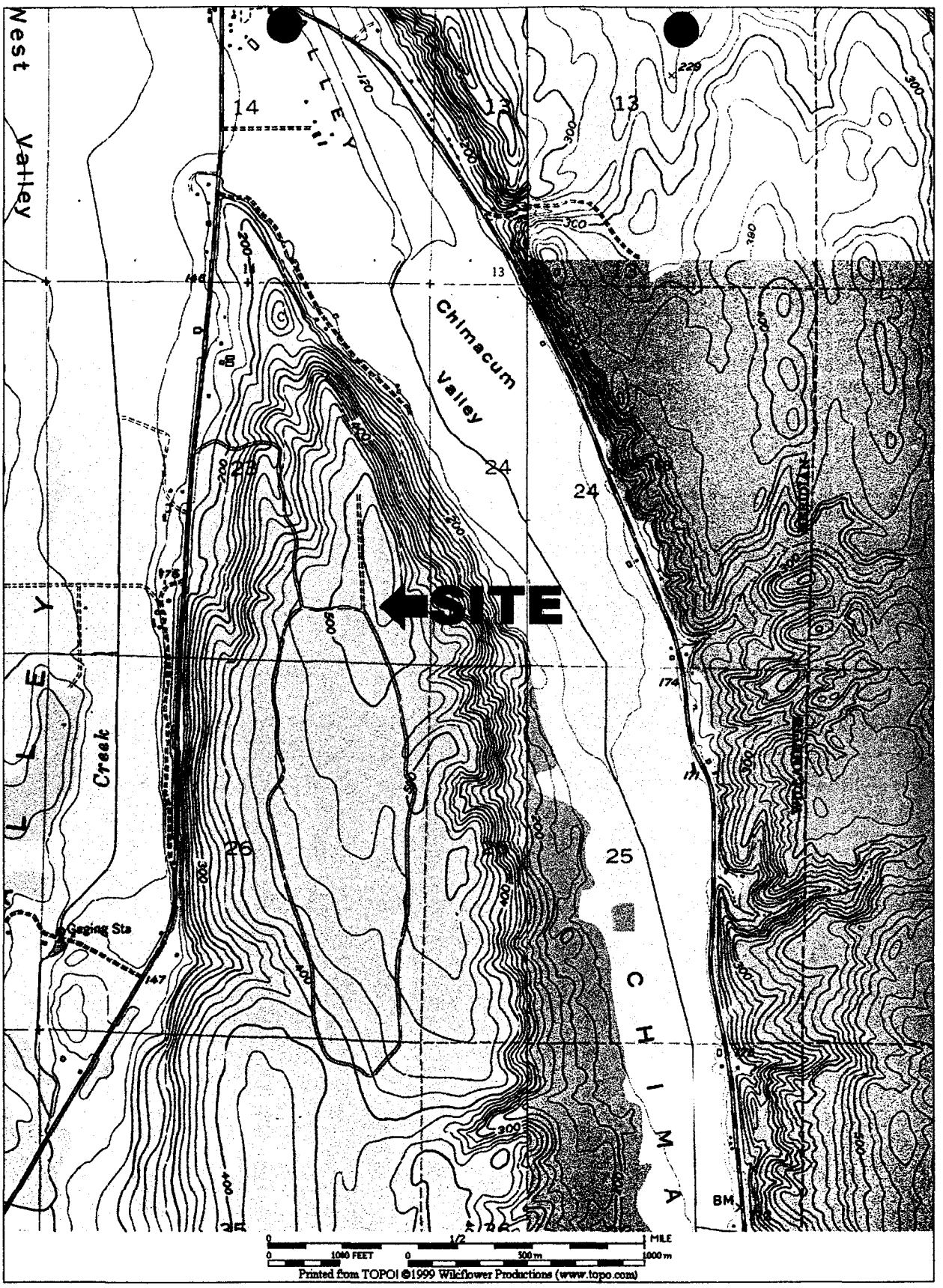
Fill Application	Minimum Compaction
Slab/Footing subgrade	90 percent
Gravel drive subgrade (upper 1 foot)	95 percent
Gravel drive subgrade (below 1 foot)	90 percent

Subgrades and Testing: Regardless of location or material, all structural fill should be placed over firm, unyielding subgrade soils. We recommend that a representative from ADaPT be retained to observe the condition of subgrade soils before fill placement begins, and to perform a series of in-place density tests during soil fill placement. In this way, the adequacy of soil compaction efforts may be evaluated as earthwork progresses.

Fill Content: Soils used for structural fill should not contain individual particles greater than about 6 inches in diameter and should be free of organics, debris, and other deleterious materials. Given these prerequisites, the suitability of soils used for structural fill depends primarily on the grain-size distribution and moisture content of the soils when they are placed. When the "fines" content (that soil fraction passing the U.S. No. 200 Sieve) increases, soils become more sensitive to small changes in moisture content. Soils containing more than about 5 percent fines (by weight) cannot be consistently compacted to a firm, unyielding condition when the moisture content is more than about 2 percentage points above optimum. The existing surficial soils at this site consist of silty clayey sand with gravel, are relatively fine-grained, and should be considered somewhat moisture sensitive. The use of "clean" soil is necessary for fill placement during wet-weather site work, or if the in-situ moisture content of the fine sand soils is too high to allow adequate compaction. Clean soils are defined as granular soils that have a fines content of less than 5 percent (by weight) based on the soil fraction passing the U.S. No.3/4-inch Sieve.

CLOSURE

The conclusions and recommendations presented in this report are based, in part, on the explorations that we performed for this study. If variations in subsurface conditions are discovered during earthwork, we may need to modify this report. The future performance and integrity of the tower foundations will depend largely on proper initial site preparation, drainage, and construction procedures. Monitoring by experienced geotechnical personnel should be considered an integral part of the construction process. We are available to provide geotechnical engineering services during the earthwork and foundation construction phases of the project. If variations in the subgrade conditions are observed at that time, we would be able to provide additional geotechnical recommendations, thus minimizing delays as the project develops. We are also available to review preliminary plans and specifications before construction begins, and to provide geotechnical inspection and testing services during construction.

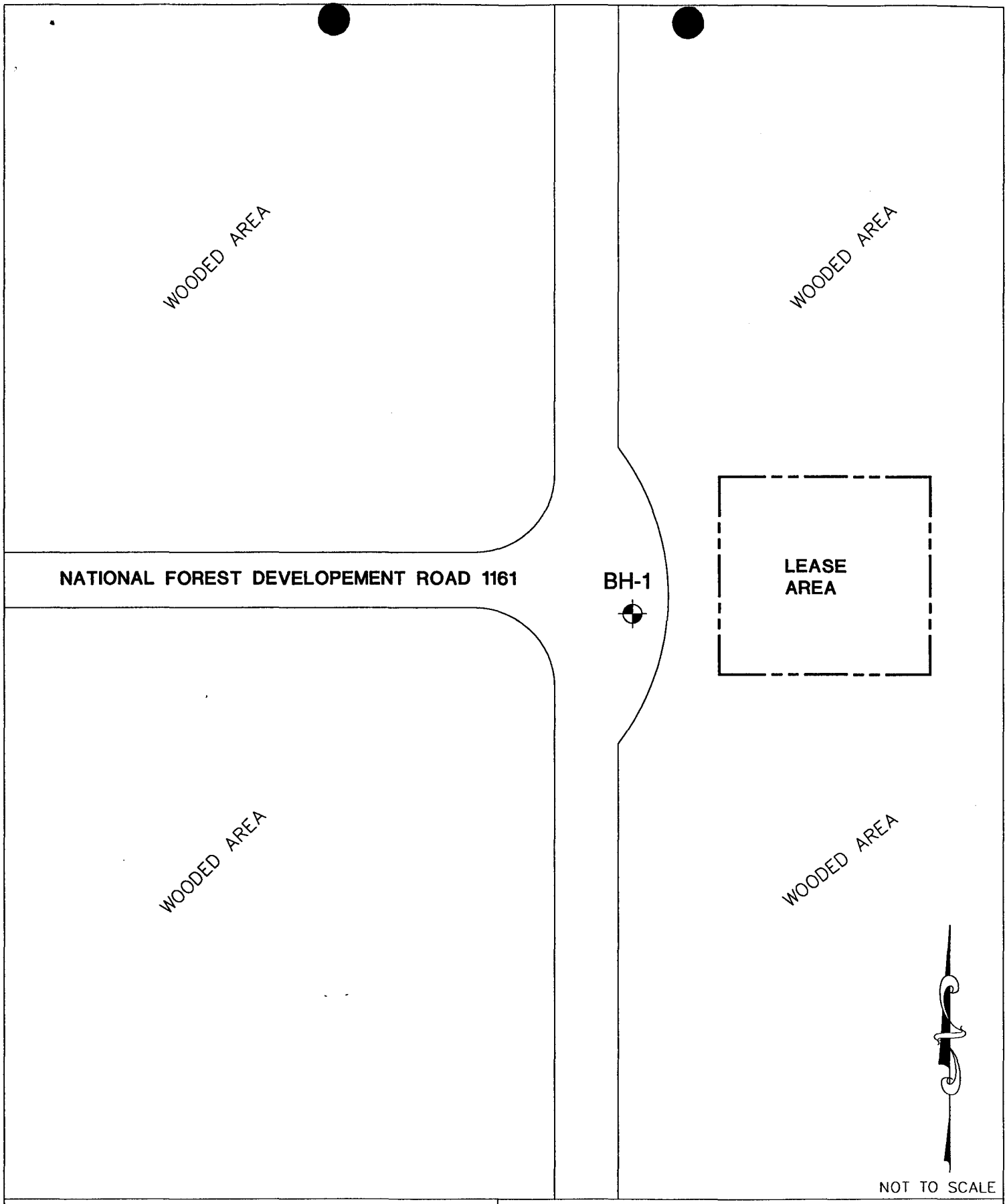


ADaPT Engineering, Inc.
800 Maynard Avenue S., Suite 403
Seattle, Washington 98134

Ph : 206.654.7045 Fax : 206.654.7048

FIGURE 1 - Location/Topographic Map

Location : PT Chimacum/ANE SE-6101A
SEC 23, T29N, R1W
Pot Townsend, Washington
Client : Voice Stream PCS
Date : 9/20/99 **Job # :** S-WA-99-2720



ADaPT **Engineering, Inc.**
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FIGURE 2 - Site Plan

Location : PT Chimacum/ANE SE-6101A
SEC 23, T29N, R1W
Pot Townsend, Washington
Client : Voice Stream PCS
Date : 9/20/99 **Job # :** S-WA-99-2720

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APPENDIX A

BORING LOG

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BORING LOG

AqaPT Engineering, Inc.
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SEATTLE, WASHINGTON 98134
TEL: 206.654.7045 FAX: 206.654.7048

PROJECT : PT Chimacum/ANE
SEC 23, T29N, R1W
Port Townsend, WA

Job Number : WA99-2720
SE-6101A
Voice Stream PCS

Boring No. : B-1

Elevation Reference : N/A
Ground Surface Elevation : N/A

Well Completed : N/A
Casing Elevation : N/A

DEPTH (feet)		SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	OVM READING	GROUND WATER	AS-BUILT DESIGN	TESTING
0	4 inches grass and topsoil							
	Dense to very dense, moist, gray / brown, silty, clayey SAND with gravel (Glacial Till)		BH-1 4.5	12 22 28				
5								
			BH-1 9	13 50/4"				
10								
			BH-1 13.5	50/6"				
15								
	Dense to very dense, moist, gray, silty, clayey SAND with gravel		BH-1 18.5	50/5"				
20								
			BH-1 23.5	50/5"				
25								
			BH-1 28.5	50/5"				
	Boring terminated at 28.5 feet							
30								

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LEGEND

- 2-inch O. D. Split-Spoon Sample
- 1" Geoprobe
- Sample not Recovered
- DATE — Static Water Level at Drilling
- DATE — Static Water Level
- DATE — Perched Groundwater
- Grab Sample
- WTPH-D Ext. 8015 — Type of Analytical Testing Used
- NR — No Recovery
- ATD — At Time of Drilling

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Drilling Start Date : 9/14/99 Drilling Completion Date : 9/14/99 Logged By : KAR