Department of Energy

Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

CORPORATE

In reply refer to: DK-7

Mr. Ron T. Blewett
Law Offices of Clark and Feeney
The Train Station, Suite 106
1229 Main Street
P.O. Drawer 285
Lewiston, ID 83501

RE: FOIA Request #06-029

Dear Mr. Blewett:

This letter responds to your request for information that you made to the Bonneville Power Administration (BPA) under the Freedom of Information Act (FOIA), 5 U.S.C. 552. Your letter was received in this office on August 28, 2006, and was assigned a controlled number of 06-029. In your letter you requested the following:

1. All geotechnical information in BPA's possession and control related to BPA investigation of subsurface conditions at the Mt. Solo Quarry, Mt. Solo Road, City of Longview, State of Washington, including by not limited to:

    a) Core log boring information;
    b) Evaluation of the soil and subsurface conditions;
    c) Any lab reports and/or other documentation regarding items a) and b) above;
    d) Any and all other documents and records related in anyway to items a) and b) above.

BPA has enclosed, in their entirety, all documents responsive to your above FOIA request in the form of emails, reports, charts, maps, drawings, photographs and other documents which have been provided in hard copy along with a CD version of the "FINAL GEOTECHNICAL REPORT MOUNT SOLO – LONGVIEW BPA TOWER STUDY 8-30-06" submitted by SHANNON & WILSON, INC.

If you are dissatisfied with this determination, you may make an appeal within thirty (30) days of receipt of this letter to the Director of Office of Hearings and Appeals, Department of Energy, 1000 Independence Avenue SW, Washington, DC 20585. Both the envelope and the letter must be clearly marked "Freedom of Information Act Appeal."

You will be billed, under separate cover by our Accounting Department, in the amount of $291.78 for search, review and duplication costs associated with processing your request. If you have any questions regarding this response, please contact me at (503) 230-7303 or Laura M. Atterbury, FOIA Specialist, at 503-230-7305.

Sincerely,

/s/ Christina J. Brannon

Christina J. Brannon
Freedom of Information Act Officer

Enclosure: Responsive FOIA documents

Dostert,Dawneen M - TRFS-3

From: Dostert,Dawneen M - TRFS-3
Sent: Friday, June 16, 2006 7:21 AM
To: 'rblewett@clarkandfeeney.com'
Cc: Margeson,Jacilyn R - LC-7
Subject: Mt Solo Studies, BPA Case No. 20060246

Ron,

Please let Mr. Don Blewett know that we will be conducting additional Geotechnical studies evaluating slope stability on the southwest flank of Mt Solo. The study will include the area of the four towers near and including the one being relocated.

While we appreciate the financial difficulties for the 3B's company, we must reiterate that there is grave concern that any blasting performed most likely will be detrimental to our facilities. 3B's is taking on a huge liability by going forward with this plan and not waiting for the relocation of the tower and studies of slope stability to be completed.

Jaci Margeson and myself will be in training most of next week. If you have any concerns, questions, or correspondence for us during this period, please make it to Neal Meisner's attention, nemeisner@bpa.gov, 503-230-5529.

Dawneen Dostert
Realty Specialist
Bonneville Power Administration
Office: 503-230-5589
Cell: 503- 956-8808
Fax: 503-230-5513

The City of Longview Washington

RECEIVED
AUG 28 2006
REAL ESTATE FIELD SERVICES

Date: August 25, 2006

To: Barbara Ritchie, Washington State Department of Ecology SEPA Unit
Danette Guy, Department of Fish & Wildlife
David F. Dietzman, Department of Natural Resources SEPA Center,
Robert Whitlam, Office of Archaeology & Historic Preservation
Rusty Post, D.O.E., Vancouver Field Office, Stormwater Section
Jeff Barsness, Development Services Engineer, WS Department of Transportation
Cowlitz County Health Department
Cowlitz Indian Tribe
Dave Joyner, Southwest Clean Air Agency
Judi Stayer, Consolidated Diking Improvement District No. 1
Steve Harvey, Cowlitz Wahkiakum Council of Governments
Steve Manlow, Lower Columbia Fish Recovery Board
Dawneen Dostert, Bonneville Power Authority
Cowlitz County PUD – Right of Way
Gordon Franklin, Natural Resources Conservation Services
Ruth Deery, Audobon Society
Amy Fischer, The Daily News
Mike Wojtowicz, Cowlitz County Department of Building & Planning
Jeff Cameron, Longview Public Works Director
Craig Bozarth, Longview City Engineer
Tom Gorman, Construction Manager
Dixie Wells, Longview Police Department
Jim Kambeitz, Longview Fire Marshal
Robert Casey, Mt. Solo Homeowners Association

From: John Brickey, Director of Community Development

Subject: SEPA Environmental Checklist Review – **Application #E2006-17**

Project: 3 B's Land and Gravel, LLC has filed an application for a critical areas permit to mine a portion of the Mt. Solo Quarry. The applicant is combining two existing quarries into one quarry called the Mt. Solo-Goble Quarry. Additional critical area permits may be required as further phases of the quarry are mined. The address for the quarry site is 4710 Mt. Solo Road, Longview, WA 98632.

The applicant has submitted an Environmental Checklist for review under WAC 197-11, the SEPA Rules.

The subject property consists of a rock quarry, vacant land and easements for BPA regional electrical transmission lines and towers. The property is zoned ***M-2 Manufacturing District***. The Comprehensive Plan classification is ***Heavy Industrial***. The adjacent properties consist

primarily of single-family homes on large lots, industrial uses and motorcycle/ATV raceway near the quarry.

Please review the attached SEPA documents and provide your written comments to me by no later than **5:00 p.m., September 8, 2006.**

If you have any questions or need additional information, please contact Steve Langdon, Principal Planner or myself at (360) 442-5086.

Thank you.

Attachment

cc: Applicant
File Copy
Counter Copy
City Attorney

The City of Longview Washington

SEPA RULES

WAC 197-11-970

MITIGATED DETERMINATION OF NON-SIGNIFICANCE

Description of Proposal: **E 2006-17:** 3 B's Land and Gravel, LLC is proposing to quarry rock in two previously established adjacent rock quarries, known commonly as the Mt. Solo Quarry and the Goble Quarry. The combined quarry will be referred to as the Mt. Solo-Goble Quarry and is approximately 109 acres in size. The rock quarrying will primarily be within the lower areas of the quarry. In the process of quarrying, the site will be developed and reclaimed in an attractive manner for re-sale.

Proponent: Colby Blewett, Project Superintendent
3 B's Land and Gravel, LLC
P.O. Box 72
4710 Mt. Solo Road
Longview, WA 98632
Phone: (208) 830-9978

Location of Proposal: The address for the site is 4710 Mt. Solo Road. The proposed project will be located generally north and west of the intersection of SR 432 (Mt. Solo Drive) and Memorial Park Drive. The site is primarily located in the NE¼ of Section 26 and the NW¼ of Section 25, T8N, R3W, Willamette Meridian, in Cowlitz County.

Lead Agency: **CITY OF LONGVIEW, WASHINGTON**

The lead agency for this proposal has determined that it does not have a probable significant adverse impact on the environment. An Environmental Impact Statement (EIS) is not required under RCW 43.21C.030(2)(c). This decision was made after a review of a completed environmental checklist and other information on file with the lead agency. This information is available to the public on request. This determination is subject to the mitigated measures as identified below and shall be deemed conditions of approval of the critical areas permit pursuant to LMC Title 17 and building permit pursuant to LMC Title 16 Buildings and Construction. Such conditions are considered binding and may not be altered by subsequent decisions unless the threshold determination is re-issued.

1. City of Longview critical areas mapping indicators show that the Mt. Solo-Goble Quarry includes geologic hazard areas as defined in LMC 17.10.050. The applicant has submitted a Geotechnical Engineering Evaluation dated July 26, 2006 for the southwest portion of the Mt. Solo Quarry (identified as "Mt. Solo Area #1" under question A.6 of the SEPA checklist.) The July 26, 2006 report will be the basis for issuing a Critical Areas Permit for Mt. Solo Area #1 only. Before moving operations to any other portion of the Mt. Solo-Goble Quarry, the quarry owner and/or operator shall obtain from the City a critical area permit for that area or, per LMC 17.10.080 B, obtain a written report from the City confirming that no critical areas are present in the area proposed for mining.
2. Future phases of the development of the Mt. Solo-Goble Quarry are subject to the Critical Areas Ordinance in place at the time the critical areas permit or critical areas determination is requested.
3. The Washington State Department of Natural Resources (DNR) has exclusive authority to regulate mine reclamation and approve reclamation plans. Before any critical areas permits are issued, beyond that for Mt. Solo Area # 1, the quarry owner and/or operator shall submit written confirmation from the Washington State Department of Natural Resources that the Mt. Solo-Goble Quarry has a valid reclamation plan and the quarry is in compliance with the reclamation plan.
4. Before any critical areas permits are issued, beyond that for Mt. Solo Area # 1, the quarry owner and/or operator shall submit written confirmation from the Washington State Department of Ecology Water Quality Program that the Mt. Solo-Goble Quarry has a valid Sand and Gravel General Permit and that the Mt. Solo-Goble Quarry is in compliance with the permit.
5. Before any critical areas permits are issued, beyond that for Mt. Solo Area # 1, the quarry owner and/or operator shall submit written confirmation from the Southwest Clean Air Agency that the Mt. Solo-Goble Quarry has a valid Air Discharge Permit and that the Mt. Solo-Goble Quarry is in compliance with the permit.
6. Per the SEPA checklist (page 13), blasting is only allowed between 8 a.m. to 5 p.m., Monday through Friday.

☒ This MDNS is issued under 197-11-340(2); the lead agency will not act on this proposal for 14 days from the date below. Comments must be submitted by **September 8, 2006.**

Responsible Official: John Brickey

Position/Title: Director/Building Official

Department: Community Development

Address: PO Box 128, Longview, WA 98632

Phone: (360) 442-5086

Contact Person: Steve Langdon, Principal Planner

Date: 08/25/06 Signature John Brickey

3. Address and phone number of applicant and contact person:

Please communicate with Colby Blewett, project superintendent, and send a copy of communications to Ron Blewett and Scott Galina as attorneys for 3 B's Land and Gravel.

Colby Blewett	Ron Blewett
Project Superintendent	Scott Galina
3 B's Land and Gravel, LLc	Attorneys for 3 B's Land and Gravel
P.O. Box 72	P. O. Drawer 285
4710 Mt. Solo Road	Lewiston, Idaho 83501
Longview, Washington 98632	
Phone: (208) 830-9978	

4. Date checklist prepared: SL 8/25/06

This checklist is prepared August 16, 2006. in an effort to avoid litigation and cooperate with the City, but without waiver and with full reservation of all rights, this checklist is prepared for submission on or about 8/15/06.

5. Agency requesting checklist:

The City of Longview's request for this checklist was communicated to Applicant on July 24, 2006.

6. Proposed timing or schedule (including phasing, if applicable):

The Mt. Solo – Goble quarry is located generally at 4710 Mt. Solo Road, Longview, Washington.

The timing and phasing of development of the Mt. Solo-Goble quarry can only be projected with approximation, as the same will vary depending on subsurface conditions and market factors over which Applicant has no control. Approximate schedule projections are offered below. A shorthand reference is offered for each area of the quarry described below; more detailed descriptions of the specific areas of the quarry referred to here are contained within Exhibit A. Except as otherwise indicated, the areas described below are identified in order of approximate projected mining sequence.

A) Mt Solo Area #1:

This area of the quarry generally borders the Mt. Solo Road and is generally west and east of the primary large man-made pond along the Mr. Solo Road. This area is described within the July 26, 2006 geotechnical report attached as exhibit "B". This area of development was segregated in an attempt to divine an obviously inconsequential area for Applicant to proceed while geotechnical analysis progressed elsewhere. The schedule for Area 1 follows:

1. Mine and crush aggregate upon permitting and for approximately 2-12 months thereafter;
2. Use the area concurrently during mining and thereafter to stockpile and process aggregate and aggregate by-products and support retail sales from this area and other areas of the quarry;
3. Reclaim per standards of the Washington Department of Natural Resources.

B) Mt. Solo Area #2.

This area of the quarry is generally north of the primary man-made retention pond mentioned above, and contemplates development of the existing rock face evident from previous mining. This area was segregated

WAC 197-11-960 Environmental checklist.

ENVIRONMENTAL CHECKLIST

Purpose of checklist:

The State Environmental Policy Act (SEPA), chapter 43.21C RCW, requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. An environmental impact statement (EIS) must be prepared for all proposals with probable significant adverse impacts on the quality of the environment. The purpose of this checklist is to provide information to help you and the agency identify impacts from your proposal (and to reduce or avoid impacts from the proposal, if it can be done) and to help the agency decide whether an EIS is required.

Instructions for applicants:

This environmental checklist asks you to describe some basic information about your proposal. Governmental agencies use this checklist to determine whether the environmental impacts of your proposal are significant, requiring preparation of an EIS. Answer the questions briefly, with the most precise information known, or give the best description you can.

You must answer each question accurately and carefully, to the best of your knowledge. In most cases, you should be able to answer the questions from your own observations or project plans without the need to hire experts. If you really do not know the answer, or if a question does not apply to your proposal, write "do not know" or "does not apply." Complete answers to the questions now may avoid unnecessary delays later.

Some questions ask about governmental regulations, such as zoning, shoreline, and landmark designations. Answer these questions if you can. If you have problems, the governmental agencies can assist you.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

Use of checklist for nonproject proposals:

Complete this checklist for nonproject proposals, even though questions may be answered "does not apply." IN ADDITION, complete the SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS (part D).

For nonproject actions, the references in the checklist to the words "project," "applicant," and "property or site" should be read as "proposal," "proposer," and "affected geographic area," respectively.

A. BACKGROUND

1. Name of proposed project, if applicable:

This Project contemplates continuation of historical mining and reclamation of two previously established and permitted adjacent rock quarries, known commonly as the Mt. Solo quarry and the Goble quarry.

To better describe our plans, the Mt. Solo Quarry is divided into five separate areas. These areas, as well as a description of the Goble quarry, are described within Exhibit "A," attached to this checklist.

The Combined quarry will be commonly referred to as the Mt. Solo-Goble Quarry.

Where answers to these checklist questions may differ for different areas of the quarry

2. Name of applicant: 3 B's Land and Gravel, LLC, a Washington limited liability company.

because in development of area 1 it became obvious that additional competent rock could be readily mined in this adjacent location. The schedule for area 2 follows:

1. Mine and crush aggregate upon permitting either concurrently with or upon completion of area #1, and for 2-12 months thereafter.
2. Use the area concurrently during mining and thereafter to stockpile and process aggregate and aggregate by-products and support retail sales from this area and other areas of the quarry.
3. Reclaim per standards of the Washington Department of Natural Resrouces.

C) Goble Quarry.

This area of the quarry is generally along the Mt. Solo Road and across that road from the old Reynolds Aluminum facility. This area is segregated from the development areas above for schedule purposes, because it is expected that initiation of mining in this area will be subsequent to that in the forgoing arreas. The schedule for the Goble quarry follows:

1. Mine and crush aggregate upon permitting or upon substantial completion of areas 1 and 2, and continue for approximately 5 to 10 years thereafter.
2. Use the area concurrently during mining to stockpile and support retail sales of aggregate and aggregate by-product from this area and other areas of the quarry.
3. Reclaim per standards of Washington Department of Natural Resources.

D)Mt. Solo Area #3:

This area of the quarry is generally north and west of area #2 above. This area is segregated from the development areas above for schedule purposes, because it is expected that development of this area will be gradual and may not be substantially commenced for many years. The Schedule for area 3 is:

1. Commence gradual removal of overburden in approximately 2 to 7 years, as market conditions dictate, and continue periodically thereafter until mining of the Goble quarry is substantially completed.
2. Commence mining and crushing aggregate as market conditions dictate or when the Goble quarry mining is completed, continuing for approximately 5 -10 years depending on market conditions.
3. Use the area concurrently to stockpile and support retail sales of aggregate and aggregate by-products from this area and other areas of the quarry.
4. Reclaim per Washington Department of Natural Resources.

E) Mt . Solo Area #4.

This area of the quarry is generally the lower area along the Mt. Solo Road and adjacent to other mining areas. This area is segregated from the development areas above for schedule purposes, because it is expected that, while this area will be used to support mining, no significant mining is anticipated in these areas. The schedule for this area is:

1. Upon commencement of mining in area #1, utilize area 4 primarily to support mining elsewhere during all quarry operations in all areas, including for example the hauling, stockpiling and retail sale of aggregate and aggregate by-products, maintenance and strategic location of production and support equipment and structures.
2. Reclaim per Washington Department of Natural Resources.

F) Mt. Solo Area # 5.

This area of the quarry is generally the upper area of the quarry and consists of most of the acreage of the entire Mt. Solo quarry. This area is segregated from other development areas because little continuing active mining of the area is currently planned in that location, other than as may facilitate development the property for resale. The only anticipated exception may be that mining may be required in Area 5 (a) pending the City's consideration of

critical areas permitting abd/or (b) if critical areas permitting allowing mining elsewhere is delayed, unduly restricted, or prohibited. The schedule for development of this portion of the quarry is:

1. Re-shape and re-claim the area in an attractive manner and in accord with reclamation standards of the Washington Department of Natural Resources. Excavation will be required, but it is not anticipated that any blasting will be required, other than potentially small areas as necessary to comply with standards for re-shaping of historical mining activity, and develop the property for resale.

Note: As set forth above, although it is not our desire, it may become necessary at any time for Applicant to commence and continue mining in Area 5, if critical areas permitting from the City, allowing mining in other areas, is delayed, unduly restricted, or prohibited.

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

There are no plans for future expansion of this proposal if a Determination of Nonsignificance is issued and if a Critical Areas Permit is issued.

PLEASE NOTE: that the only reason the City requested this application is to allow work in critical areas; the City has expressly advised applicant that no critical areas permit is required for mining operations in the upper portions of the quarry, where slopes are not designated as "critical." PLEASE NOTE that if for any reason the applicant does not receive a Determination of Nonsignificance and a Critical Areas Permit, then applicant reserves the right to withdraw this application entirely and immediately commence full-scale mining operations in the upper portion of the quarry and in any other areas not currently designated as critical areas all such mining to be performed according to existing permitting and according to law.

PLEASE NOTE that if this application is accepted, a determination of Non-significance is entered, and a Critical Areas Permit is issued, then Applicant's long-range plans for the property include a future attempt, under separate proposals and in accord with City of Longview standards, to develop an attractive rural residential subdivision in the upper portions of the quarry, and to re-sell reclaimed areas in the lower portions of the quarry for commercial re-sale. These long-range plans are beyond the scope of this proposal.

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.

The following environmental information has been and is being prepared:

1. The Mt. Solo Quarry is a historic quarry originating in 1970 and continuing periodically since. The quarry is currently permitted for mining operations and environmentally beneficial reclamation by the Washington Department of Natural Resources.
2. The Goble Quarry is a historic quarry also originating long ago, and continuing periodically since. The quarry is currently permitted for mining operations and environmentally beneficial reclamation by the Washington Department of Natural Resources.
3. A previous SEPA procedure and mitigated determination of nonsignifiance were required prior to original permitting of the quarry.
4. Applicant is in the process of joining reclamation plans for the Mt. Solo and Goble quarries for a joint reclamation plan before the Washington Department of Natural Resources.
5. On or about March 2, 2006, Applicant applied for a Critical Areas Permit at the instruction of the City of Longview; the permit has not yet been issued.
6. On or about March 9, 2006, the Southwest Clean Air Agency assume Lead Agency status pursuant to WAC 197-11-050.
7. On April 19, 2006, the Southwest Clean Air Agency as "Lead Agency" issued a Determination of Nonsignificance under the State Environmental Policy Act (SEPA) covering crushing and blasting at the Mt. Solo quarry, 4710 Mt. Solo Road, Longview, Washington, and elsewhere.
8. On April 19, 2006, the Southwest Clean Air Agency issued an Air Discharge Permit #06-2671 covering crushing and blasting at the Mt. Solo quarry, 4710, Mt. Solo Road, Longview, Washington, and elsewhere.
9. On or about July 24, 2006, the City of Longview directed that Applicant pursue a second SEPA procedure and submit this checklist as a condition of, and applicable to, its Critical Areas Permit. Applicant was advised that no Critical Areas permit was required for work in the quarry other than in areas mapped as Critical Areas.
10. On or about July 26, 2006, a geotechnical evaluation was prepared for Mt. Solo quarry area #1. The evaluation is attached as exhibit B.
11. Geotechnical evaluations are ongoing for the remaining areas of the Mt. Solo-Goble quarry that are within what the City of Longview has determined to be Critical Areas. No work is planned inconsistent with or prior to geotechnical evaluation in ay areas the City has mapped as critical

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain.

Not other than as described in answer #8 above.

10. List any government approvals or permits that will be needed for your proposal, if known.

None other than those identified in answer #8 above.

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agencies may modify this form to include additional specific information on project description.)

Applicant proposes to quarry rock, primary in the lower areas of the quarry, and in the process develop and reclaim the historic quarry areas in an attractive manner for re-sale. For more details please see answer to question # 6 and #8 above, which describe the proposal in detail.

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.
Mt. Solo Quarry is located generally at 4710 Mt. Solo Road in Longview, Wa. The Goble quarry is adjacent to the Mt. Solo quarry. The property is located in section 26, T34 N, R 3 W, WM. For a more completed description please see the answer to question #6 above, and Exhibit "A" attached.

Primarily located:
NE¼, Section 26
NW¼, Section 25
T8N, R3W W.M.

TO BE COMPLETED BY APPLICANT

EVALUATION FOR AGENCY USE ONLY

B. ENVIRONMENTAL ELEMENTS

SLL 8/25/06

1. **Earth**

a. General description of the site (circle one): Flat, rolling, hilly, steep slopes, mountainous, other . . . .

The proper answer to this question is "other;" the land varies and includes flat benches, flat areas previously mined, rolling area, and steep slopes previously mined.

b. What is the steepest slope on the site (approximate percent slope)?

Vertical.

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any prime farmland.

To the extent soils are found, those soils include silty loam and clay.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

There are no mapped history of landslides within the project. A landslide was mapped east of the proposed development area, as described in more detail within the July 26, 2006 geotechnical report, page 2.

There is no observable soil movement of site which is of significance, but this is a historical quarry in mid-development. Prior to recent repair of one BPA electrical tower, there were indications of adjacent soil movement; the tower was improperly constructed and has since been repaired and the area is stable. There are some locations in the historical quarry where historical overburden deposits show historical slippage, but have since reached an angle of repose. Similarly, one site access road has been observed to indicate prior movement.

Further development and reclamation of the quarry will be consistent with geotechnical recommendations, which will not deteriorate but will improve all site conditions.

e. Describe the purpose, type, and approximate quantities of any filling or grading proposed. Indicate source of fill.

The focus of this project is extraction, and not fill. Some fill will be required to reclaim mining operations in accord with Washington State DNR standards. To the extent fill is required for these purposes, fill will be obtained from waste material and overburden on site.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

Minor erosion can be expected in any mining operation. Certainly the historically mined site is and has been subject to minor erosion for years. Activity under this proposal will limit any historical erosion. Reclamation under approved DNR procedure will mitigate erosion, with such procedure as grass seeding and the like; customary good construction practice during mining and sloping operations will include silt fence, rock berms, and other devices, all of which would likely to reduce erosion below historical levels.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

None are contemplated under this proposal. To the extent some portions of the property may be sold or developed in the future, a different permitting procedure would be followed in accord with City of Longview Ordinances.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

Please see answer to question (f.) above.

a. **Air**

a. What types of emissions to the air would result from the proposal (i.e., dust, automobile, odors, industrial wood smoke) during construction and when the project is completed? If any, generally describe and give approximate quantities if known.

Air emissions may include engine exhaust, blasting dust, crushing dust, and miscellaneous operational dust and emissions, all of which are already permitted under SWCAA air discharge permit # 06-2671. See SWCAA technical support document for more detail.

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

None that affect our proposal. There are off-site sources of omissions in the general areas, by reason of its heavy industrial use.

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

Please see the requirements of SWCAA air discharge permit # 06-2671.. Dust emissions will be abated by spray bars at crusher transfer locations, water on roads, limiting visible emissions from engines, and similar such good construction practices.

3. **Water**

a. Surface:

1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

There is no water body of which we are aware in the general vicinity other than:
1) There is a primary man made pond on the project site and located along the Mt. Solo Road, that is used for mining activity and storm water retention.
2) There are several small shallow man-made run-off ponds on site that retain storm water.
3) There is general storm water run-off on site in periods of precipitation; this surface water collects in natural depressions as run-off areas. To our best knowledge there is no water body that fits the proper definition of a seasonal stream. City representatives indicate that they could hear water running in a depression earlier this year on the north and west side of tax lot 106890100, and that it may be considered as a seasonal stream. Applicant is unable to locate any such live water at this time.
4) The Columbia River is far to the south and not on the site. There is a consolidated diking district ditch across Mt. Solo Road from the subject property, and off the project site.

2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.

The work that is described will be no different than that already permitted and historically performed, and some of that work will be within 200' of man-made retention ponds and other surface water run-off areas. There are no drawings for this work, nor has there ever been to our knowledge. For a description of the work please see responses to questions # A(6) and B(1)(h) above. All work will be completed under established DNR permits, or DNR permits as modified from time to time.

3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

No fill or dredge material is currently planned to be removed from or filled over any surface water or wetland, save and except only to the extent some man-made retention areas may be filled but only if specifically authorized by Washington Department of Natural Resources Reclamation plans.

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

None, other than water may be withdrawn from the man-made retention pond for dust abatement and similar uses in aggregate processing.

5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

No.

6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

No.

b. Ground:

1) Will ground water be withdrawn, or will water be discharged to ground water? Give general description, purpose, and approximate quantities if known.

No.

2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals. . . ; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

None unless, under a separate permitting process, a small residential sized septic area is installed to accommodate an office or maintenance structure. No such structure is currently planned.

c. Water runoff (including stormwater):

1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

Storm Water run-off has historically been controlled with the primary retention pond along the Mt. Solo Road, and with various other small water collection areas that appear to have served the site well. There does not appear to be any evidence of storm water reaching the highway in the lower portions of the quarry.

2) Could waste materials enter ground or surface waters? If so, generally describe.

No

d. Proposed measures to reduce or control surface, ground, and runoff water impacts, if any:

Compliance with DOE permit for mining operations; for more information please see answer to question B(3)(c)(1) and B(1)(h) above

4. **Plants**

a. Check or circle types of vegetation found on the site:

——— deciduous tree: alder, maple, aspen, other
X evergreen tree: fir, cedar, pine, other
X shrubs
X grass
——— pasture
——— crop or grain
X wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
——— water plants: water lily, eelgrass, milfoil, other
——— other types of vegetation

Alder + Maple trees have been observed on site.
SLC 8/25/06

b. What kind and amount of vegetation will be removed or altered?

Grass and Shrubs and Trees will be removed in the areas of mining operations.

c. List threatened or endangered species known to be on or near the site.

None known.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

Reclamation will be per Washington State Department of Natural Resources permit. During reclamation procedure, salvaged topsoil will be replaced over cut slopes excluding rock slopes, and re-seeded to appropriate native grasses.

5. **Animals**

a. Circle any birds and animals which have been observed on or near the site or are known to be on or near the site:

(birds) hawk, heron, eagle, songbirds, other:

A variety of birds have been observed on site including hawks + songbirds
SLC 8/25/

mammals: deer, bear, elk, beaver, other:
fish: bass, salmon, trout, herring, shellfish, other:

Deer have been observed on site
SLC
8/25/06

Answer: there aren't any of these that we have noticed, except perhaps some birds.

b. List any threatened or endangered species known to be on or near the site. None Known.

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AGENCY USE ONLY

c. Is the site part of a migration route? If so, explain.

None known.

d. Proposed measures to preserve or enhance wildlife, if any:

None.

6. Energy and natural resources

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

Electric motors and Diesel motors.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

No.

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

Best management procedure shall be used for consumption of Diesel and Electric energy.

7. Environmental health

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.

There are no such risks known other than a potential for spilling fuel. There may be blasting but emissions are non-toxic and are already permitted under an Air Discharge Permit.

1) Describe special emergency services that might be required.

None.

2) Proposed measures to reduce or control environmental health hazards, if any:

Any bulk fuel will be stored in an approved containment structure.

No blasting supplies will be stored on site, and will only exist on site temporarily as incidental to a periodic blast, and then only in accord with approved and regulated procedures by individuals permitted to possess blasting materials. Applicant has been in contact with the City Fire Marshal. Any and all blasting will be performed by a licensed and insured blasting contractor. Blasting procedures are regulated by various government entities. Blasting will be in accord with all laws and regulations.

b. **Noise**

1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?

None.

2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

Noise from mining has historically included occasional blasting and regular equipment and truck operation consistent with the current zoning for the property. This type of noise is expected to continue. The frequency of blasting will depend on market demand for materials and the size of the blast. We expect to keep blasts small to reduce noise and vibration levels, and so perhaps a maximum blast frequency of once per month might be a reasonable projection, depending on market demand and variables beyond Applicant's control.

Noise from traffic and crusher operation will be between 7 am and 10 pm. Blasting will be between 8 am and 5 pm, weekdays.

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3) Proposed measures to reduce or control noise impacts, if any:

See answer to previous question for limited hours of operation. All equipment will be muffled.

8. **Land and shoreline use**

a. What is the current use of the site and adjacent properties?

The current use of the site is as follows:

1) Rock Quarry.
2) Bonneville Power Administration maintains electric transmission lines and towers on site. The following factors apply to the BPA transmission lines and towers:
   a. BPA does not own any property on site; the site is owned by applicant.
   b. BPA does own limited easements for placement of its transmission lines and towers.
   c. The BPA easements do not prohibit Applicant from mining. . For example only, the BPA easement recorded as Cowitz County instrument # 715806 expressly provide as follows:
      "[Applicant] shall have the right to remove rock from said right of way and adjacent land by use of blasting powder where necessary, provided that the

[Applicant] shall notify Bonneville Power Administration at least 15 days before the blasting is to be done."

d. BPA has acknowledged Applicants right to mine, so long as BPA's towers and lines are not damaged.

e. BPA has a duty to construct and maintain its towers so as not to infringe on Applicants right to mine rock.

The current use of adjacent properties are as follows:

1) There are various residential properties located generally above the historical quarry, and three residential properties containing a total of two active homes located approximately across the Mt.Solo Road from the old Reynolds Aluminum Plant. Unless Applicants aspirations for critical slope permitting are not achieved for work in the lower portions of the quarry, most of the residential areas will be well removed from most active mining operations; failing that, mining will bre required in the upper portions of the quarry.
2) There are industrial areas adjacent to the historical quarry and all along the Mt. Solo Road.
3) There is a raceway in the area.

---

b. Has the site been used for agriculture? If so, describe.

No

c. Describe any structures on the site.

There is a shop building in the southwest corner of the site.

d. Will any structures be demolished? If so, what?

No.

e. What is the current zoning classification of the site?

Mining use is historical and therefore Applicant has questioned the applicability of City land use regulation ordinances. However, Applicant is advised that current City zoning is M-2 Manufacturing District, and that this zoning designation does not restrict mining operations.

f. What is the current comprehensive plan designation of the site?

See answer to question (e) above. Applicant is advised that current City comprehensive plan designation is **"Heavy Industrial."**

g. If applicable, what is the current shoreline master program designation of the site?

None

h. Has any part of the site been classified as an "environmentally sensitive" area? If so, specify.

The only environmental sensitivity is that, largely because the site is a historical quarry, the resulting steep slopes have caused the City to designate some portions of the quarry as "critical area." The City's position is that a critical area permit is required for work in those portions of the quarry. With reservation of all rights, Applicant is attempting to comply as a courtesy. City code sections 17.10.080 and 17.20.260 address critical areas permitting. Please see WAC 197-11-908.

i. Approximately how many people would reside or work in the completed project?

Applicant's plan will soon require at least 12 new employees. Future plans should expand that number to as many as 20 or more new employees for the City of Longview. Some of these employees may be seasonal.

Further, development of this quarry will help facilitate economical development of the "Mint Farm," for new businesses desiring to relocate there, as it will provide an economical and nearby source for fill dirt and construction aggregates used in development.

j. Approximately how many people would the completed project displace?

None.

k. Proposed measures to avoid or reduce displacement impacts, if any:

None.

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l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

The proposed use is consistent with historical use of the quarry, and is indeed *required* to comply with existing permits. The proposed use is also consistent with current City zoning and the comprehensive plan, to the extent either are applicable.

9. **Housing**

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

None.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

None.

c. Proposed measures to reduce or control housing impacts, if any:

None.

10. **Aesthetics**

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

It is possible that a 14' temporary building may be constructed under a separate permitting process.

b. What views in the immediate vicinity would be altered or obstructed?

Equipment and some new rock faces will be visible during mining operations, but there are no views that will be obstructed. Views will be improved by reclamation process required by law.

c. Proposed measures to reduce or control aesthetic impacts, if any:

Comply with Washington Department of Natural Resources reclamation plans.

11. **Light and glare**

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

None, except to the extent security lighting may be required.

b. Could light or glare from the finished project be a safety hazard or interfere with views?

No

c. What existing off-site sources of light or glare may affect your proposal?

None.

d. Proposed measures to reduce or control light and glare impacts, if any:

None.

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EVALUATION FOR AGENCY USE ONLY

12. **Recreation**

a. What designated and informal recreational opportunities are in the immediate vicinity?

The Columbia Rive is 2000 feet away and there is a motocross park across the road.

b. Would the proposed project displace any existing recreational uses? If so, describe.

No

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

None

13. **Historic and cultural preservation**

a. Are there any places or objects listed on, or proposed for, national, state, or local preservation registers known to be on or next to the site? If so, generally describe.

None known

b. Generally describe any landmarks or evidence of historic, archaeological, scientific, or cultural importance known to be on or next to the site.

None known

c. Proposed measures to reduce or control impacts, if any:

None

14. Transportation

a. Identify public streets and highways serving the site, and describe proposed access to the existing street system. Show on site plans, if any.

The highway servicing what the City has denominated a "heavy industrial' area, is route 432, commonly known as the Mt. Solo road.

b. Is site currently served by public transit? If not, what is the approximate distance to the nearest transit stop?

No; downtown Longview is two miles distant. The ~~neatest~~ Nearest transit stop is two miles away at 38th Avenue and Ocean Beach Highway.

SW 8/25/06

c. How many parking spaces would the completed project have? How many would the project eliminate?

None. Ample on-site parking exists on an aggregate surface for quarry operations.

d. Will the proposal require any new roads or streets, or improvements to existing roads or streets, not including driveways? If so, generally describe (indicate whether public or private).

No.

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e. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

No

f. How many vehicular trips per day would be generated by the completed project? If known, indicate when peak volumes would occur.

Projected hauling operations may generally 20-80 TPD onto and from Mt. Solo road, with peak volumes between 7-11 am and 2-5pm. During full-scale operations, employees will add as many as 30 trips per day at morning and night. People calling for various reasons may add more trips.

g. Proposed measures to reduce or control transportation impacts, if any:

Encourage sales during mid morning and mid afternoon times.

15. **Public services**

a. Would the project result in an increased need for public services (for example: fire protection, police protection, health care, schools, other)? If so, generally describe.

No

b. Proposed measures to reduce or control direct impacts on public services, if any.

None

16. **Utilities**

City water, garbage + recyling services are also available in that area.
SLL
8/24/06

a. Circle utilities currently available at the site: electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other.

Electricity is currently available.

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.

A small septic sewer system may or may not be developed for office and maintenance use, in accord with separate procedures and permits.

C. SIGNATURE

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: Colby Blewett Project Superintendent 3B's Land + Gravel, LLC.

Date Submitted: 8-16-06

EXHIBIT "A" TO SEPA CHECKLIST

Legal Description for Mt. Solo – Goble Quarry.

The proper legal description for the Mt. Solo-Goble quarry is attached as exhibit "A-1,"

Since development areas are identified here by County parcel numbers, the following table correlates the legal descriptions within Exhibit A-1 to those parcel numbers:

Reference within Exhibit A-1	Parcel Number
A	10960100
B	106950100, 106940100, & 106930100
C	106900100 & 106890100
D	106840100
E	106910100
F	WL3513028
G	106850100

Description of Discussion Areas Within Mt. Solo-Goble Quarry

Please see exhibit A-2, which is a map illustrating the approximate location of the following quarry areas.

Mt. Solo Area 1:

Area #1 is generally described as the area east and west of the large man-made pond along Mt. Solo Road. This area is approximately illustrated in pink shading within exhibit A-2.

More specifically, Area #1 is the area described within the July 26, 2006 geotechnical report attached as exhibit B, and is divided into Area 1A and Area 1B. Area 1 A includes an area in the west and north portions of tax lot 106960100. Area 1B includes generally the southeast portion of tax lot 106950100.

Mt. Solo Area 2:

Area #2 is that area adjacent to and generally north of Area #1. This area is approximately illustrated in yellow shading within exhibit A-2.

More specifically, Area #2 includes the following:

That area south of the common border between tax lots 106960100 and 106920100, extending south to an imaginary line drawn roughly between the southeast corner of Area #1A and the north side of the primary man-made retention pond.

Together with and including as small approximately triangular portion of tax lot 106950100 which is north of the primary manmade pond and west of an imaginary line that runs 100' west of the BPA transmission l lines in tax lot 106950100.

Goble Quarry:

The area known as "Goble Quarry" is generally along the Mt. Solo Road and across from the old Reynolds Aluminum facility. This area is approximately illustrated in green shading within Exhibit A-2.

More specifically, the "Goble Quarry" includes the following:

Tax lot 106850100, save and except that portion within 100' of any BPA transmission tower; and,

Those small southern portions of tax lots 106840100 and WL2513028 abutting Mt. Solo Road, which lie south of the BPA power-line easement road and north of the Mt. Solo Road (The BPA power line easement road used as a boundary marker for this description is that road which lies immediately above and somewhat above and parallel to the Mt. Solo Road in this location); and,

That portion of tax lot 106840100 lying south of an imaginary line drawn west from a point the northern-most portion of tax lot 106850100 to the northern most portion of the first adjoining neighboring property to the west.

Mt. Solo Area 3.

Area #3 is that area generally north and west of Area #2 above. This area is approximately illustrated in blue shading within exhibit A-2.

More specifically, the area includes:

Tax lots 106920100 and 106900100; and,

That portion of tax lots 106890100 and 106910100 lying west of an imaginary line that runs 100' west of the western-most BPA power lines.

Mt Solo Area 4.

Area #4 is the lower area of the quarry along Mt. Solo Road, and not already identified above. The approximate locations of this area is illustrated in red dotting within exhibit A-2.

More specifically, area # 4 includes the remaining portions of the following tax lots not otherwise described above:

106960100
106950100
106930100
106940100
106910100

Mt. Solo Area 5.

Area # 5 includes generally the upper areas of the quarry and consists of most of the acreage of the quarry. The approximate location of this area is illustrated in green dotting within exhibit A-2.

More specifically, Area 5 includes those portions of the following tax lots not otherwise described above:

106840100
106890100
WL 2513028

ORDER NO.: 60032JR

Exhibit A-1

PARCEL A:

A TRACT OF LAND IN SECTION 26, TOWNSHIP 8 NORTH, RANGE 3 WEST OF THE W.M.:

BEGINNING AT A POINT WHICH IS NORTH 1,811.05 FEET AND EAST 716.37 FEET FROM LONG-BELL MONUMENT NO. 303, SET TO MARK THE NORTHWEST CORNER OF THE CRUMLINE LADUE D.L.C. IN COWLITZ COUNTY, WASHINGTON, AND RUNNING
THENCE SOUTH 66° 18' WEST 602 FEET TO AN INTERSECTION WITH THE NORTHERLY RIGHT OF WAY LINE OF PERMANENT HIGHWAY NO. 11;
THENCE EASTERLY ALONG THE NORTHERLY RIGHT OF WAY LINE OF PERMANENT HIGHWAY NO. 11, 773.73 FEET;
THENCE NORTH 66° 18' EAST 598.66 FEET TO THE WESTERLY BOUNDARY LINE OF A TRACT OF LAND CONVEYED TO ROBERT RADAKOVICH BY DEED RECORDED UNDER AUDITOR'S FILE NO. 870911043;
THENCE NORTH 50° 10' 30" WEST, AND ALONG SAID RADAKOVICH TRACT 413.8 FEET;
THENCE NORTH 29° 48' 30" WEST, ALONG SAID RADAKOVICH TRACT 362.3 FEET TO THE PLACE OF BEGINNING;

EXCEPT THAT PORTION CONVEYED TO COWLITZ COUNTY BY DEED RECORDED UNDER AUDITOR'S FILE NO. 820503030.

PARCEL B:

TRACT 1:

A PARCEL OF LAND SITUATED PARTLY IN SECTION 25 AND PARTLY IN SECTION 26, TOWNSHIP 8 NORTH, RANGE 3 WEST OF THE W.M., COWLITZ COUNTY, WASHINGTON, AND MORE FULLY DESCRIBED AS FOLLOWS:

BEGINNING ON THE NORTHERLY RIGHT OF WAY LINE OF PERMANENT HIGHWAY NO. 11 AT A POINT WHICH IS NORTH 443.53 FEET AND EAST 1083.10 FEET FROM A CONCRETE MONUMENT BEARING A METAL PLAT INSCRIBED LB 303 WHICH IS SET TO MARK THE NORTHWEST CORNER OF THE CRUMLINE LADUE D.L.C., THE ABOVE POINT OF BEGINNING BEING ALSO SOUTH 76° 15' WEST 98.00 FEET FROM A CONCRETE MONUMENT BEARING A METAL PLATE INSCRIBED LB 169 WHICH IS SET TO MARK THE QUARTER CORNER BETWEEN SECTIONS 25 AND 29, TOWNSHIP 8 NORTH, RANGE 3 WEST OF THE W.M.;
THENCE NORTH 21° 43' 30" EAST 250.00 FEET TO THE WESTERLY LINE OF PROPERTY CONVEYED TO ROBERT RADAKOVICH BY DEED RECORDED UNDER AUDITOR'S FILE NO. 870911043;
THENCE SOUTH 82° 34' 30" EAST, ALONG SAID RADAKOVICH TRACT 170.00 FEET;
THENCE NORTH 85° 25' 30" EAST, ALONG SAID RADAKOVICH TRACT, 45.50 FEET;
THENCE SOUTH 30° 24' 30" EAST, ALONG SAID RADAKOVICH TRACT 138.3 FEET TO THE NORTHERLY RIGHT OF WAY LINE OF THE SAID PERMANENT HIGHWAY NO. 11;
THENCE ON A CURVE TO THE LEFT HAVING A RADIUS OF 603.0 FEET AN ARC DISTANCE OF 103.2 FEET;
THENCE CONTINUING ALONG SAID RIGHT OF WAY LINE SOUTH 59° 35' 30" WEST 65.20 FEET;
THENCE ON A CURVE TO THE RIGHT HAVING A RADIUS OF 256.5 FEET THROUGH A CENTRAL ANGLE OF 52° 07' AN ARC DISTANCE OF 233.27 FEET TO THE TRUE POINT OF BEGINNING.

TRACT 2:

A PARCEL OF LAND SITUATED IN SECTION 26, TOWNSHIP 8 NORTH, RANGE 3 WEST IN COWLITZ COUNTY, WASHINGTON, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING ON THE NORTHERLY BOUNDARY LINE OF PERMANENT HIGHWAY NO. 11 AT A POINT WHICH IS NORTH 443.53 FEET AND EAST 1083.10 FEET FROM A CONCRETE MONUMENT BEARING A METAL PLAT INSCRIBED LB 303 WHICH IS SET TO MARK THE NORTHWEST CORNER OF THE CRUMLINE LADUE D.L.C.; THE ABOVE POINT OF BEGINNING ALSO BEING SOUTH 76° 15' WEST 92.0 FEET FROM A CONCRETE MONUMENT BEARING A METAL PLATE INSCRIBED LB 169 WHICH IS SET TO MARK THE QUARTER CORNER COMMON TO SECTIONS 25 AND 26, TOWNSHIP 8 NORTH, RANGE 3 WEST OF THE W.M.;
THENCE NORTH 21° 42' 30" EAST 250.00 FEET;
THENCE SOUTH 63° 34' WEST 290.33 FEET TO THE NORTHERLY BOUNDARY LINE OF THE AFORESAID HIGHWAY NO. 11;
THENCE ALONG THIS SAID BOUNDARY LINE ON A CURVE TO THE LEFT HAVING A RADIUS OF 136.8 FEET AND A BACK SEMI-TANGENT WHICH BEARS SOUTH 26° 26' EAST THROUGH A CENTRAL ANGLE OF 41° 51' 30" AN ARC DISTANCE OF 94.38 FEET;
THENCE SOUTH 68° 17' 30" EAST 106.0 FEET TO THE POINT OF BEGINNING.

TRACT 3:

A PARCEL OF LAND SITUATED IN SECTION 26, TOWNSHIP 8 NORTH, RANGE 3 WEST OF THE W.M. IN COWLITZ COUNTY, WASHINGTON, AND IS MORE FULLY DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT NORTH 1,811.05 FEET AND EAST 716.37 FEET FROM A CONCRETE MONUMENT BEARING A METAL PLATE INSCRIBED LB 303, SET TO MARK THE NORTHWEST CORNER OF THE CRUMLINE LADUE D.L.C.;
THENCE SOUTH 66° 18' WEST 602 FEET, MORE OR LESS, TO THE NORTHERLY BOUNDARY OF HIGHWAY PH #11;
THENCE SOUTHEASTERLY ALONG SAID BOUNDARY 773.73 FEET;
THENCE NORTH 66° 18' EAST 598.66 FEET TO THE TRUE POINT OF BEGINNING OF THIS DESCRIPTION; SAID POINT ALSO BEING ON THE WESTERLY BOUNDARY LINE OF A TRACT OF LAND CONVEYED TO ROBERT RADAKOVICH BY DEED RECORDED UNDER AUDITOR'S FILE NO. 870911043;
THENCE SOUTH 66° 18' WEST 598.66 FEET, MORE OR LESS, TO THE NORTHEASTERLY BOUNDARY OF HIGHWAY PH #11;
THENCE SOUTHEASTERLY ALONG SAID HIGHWAY BOUNDARY 512.2 FEET TO THE NORTHWESTERLY BOUNDARY OF THE PARCEL CONVEYED TO CHARLES ERION, BY DEED DATED JUNE 24, 1955 AND RECORDED AUGUST 30, 1955, UNDER AUDITOR'S FILE NO. 441184;
THENCE NORTH 63° 34' EAST 290.33 FEET, TO THE ABOVE MENTIONED WESTERLY LINE OF SAID RADAKOVICH TRACT;
THENCE NORTHERLY IN A STRAIGHT LINE, ALONG SAID RADAKOVICH TRACT, TO THE TRUE POINT OF BEGINNING;

EXCEPT THOSE PORTIONS OF SAID TRACTS 1, 2, AND 3 OF PARCEL B; THOSE LANDS CONVEYED TO COWLITZ COUNTY, WASHINGTON, BY DEED RECORDED UNDER AUDITOR'S FILE NO. 820524024.

PARCEL C:

A TRACT OF LAND IN SECTION 26, TOWNSHIP 8 NORTH, RANGE 3 WEST OF THE W.M., AND IN SECTION 25, TOWNSHIP 8 NORTH, RANGE 3 WEST OF THE W.M., DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT NORTH A DISTANCE OF 1,811.05 FEET AND EAST A DISTANCE OF 716.57 FEET FROM L.B. MONUMENT NO. 303 SET TO MARK THE NORTHWEST CORNER OF THE CRUMLINE LADUE D.L.C., SAID POINT ALSO BEING THE SOUTHEASTERLY CORNER OF A TRACT OF LAND CONVEYED TO VERNON D. DAVIS, ET UX, AND RECORDED IN VOLUME 708 AT PAGE 1498 UNDER AUDITOR'S FILE NO. 585552;
THENCE SOUTH 67° 36' 03" EAST ALONG THE NORTH LINE OF A TRACT OF LAND CONVEYED TO ROBERT P. RADAKOVICH, ET UX, AND RECORDED UNDER AUDITOR'S FILE NO. 870911043, A DISTANCE OF 1,661.19 FEET TO THE TRUE POINT OF BEGINNING;
THENCE NORTH 64° 00' EAST A DISTANCE OF 277.00 FEET;
THENCE NORTH 26° 00' 00" WEST A DISTANCE OF 740.00 FEET TO A POINT THAT IS SOUTH 26° 00' 00" EAST A DISTANCE OF 30.00 FEET FROM THE CENTERLINE OF A 60.00 FOOT ROAD EASEMENT;
THENCE SOUTH 73° 38' 04" WEST A DISTANCE OF 131.00 FEET;
THENCE ON A CURVE TO THE RIGHT WITH A CENTRAL ANGLE OF 11° 47' 03" AND A RADIUS OF 375.00 FEET, AN ARC DISTANCE OF 77.13 FEET;
THENCE SOUTH 85° 25' 07" WEST A DISTANCE OF 159.28 FEET;
THENCE ON A CURVE TO THE RIGHT WITH A CENTRAL ANGLE OF 06° 28' 38" AND A RADIUS OF 310.00 FEET AN ARC DISTANCE OF 35.05 FEET;
THENCE NORTH 88° 06' 16" WEST A DISTANCE OF 127.87 FEET;
THENCE ON A CURVE TO THE RIGHT WITH A CENTRAL ANGLE OF 03° 46' 43" AND A RADIUS OF 920.00 FEET AN ARC DISTANCE OF 60.68 FEET;
THENCE SOUTH 88° 07' 01" WEST A DISTANCE OF 160.50 FEET;
THENCE ON A CURVE TO THE RIGHT WITH A CENTRAL ANGLE OF 28° 52' 26" AND A RADIUS OF 325.00 FEET AN ARC DISTANCE OF 163.78 FEET;
THENCE NORTH 63° 00' 33" WEST A DISTANCE OF 267.67 FEET;
THENCE ON A CURVE TO THE LEFT WITH A CENTRAL ANGLE OF 103° 23' 38" AND A RADIUS OF 150.00 FEET AN ARC DISTANCE OF 270.68 FEET;
THENCE SOUTH 13° 35' 48" WEST A DISTANCE OF 113.65 FEET;
THENCE FOLLOWING A CURVE TO THE RIGHT IN A SOUTHERLY DIRECTION TO A POINT ON THE NORTHERLY BOUNDARY OF THE AFOREMENTIONED RADAKOVICH TRACT;
THENCE SOUTH 67° 36' 03" EAST ALONG SAID NORTH LINE TO THE TRUE POINT OF BEGINNING.

PARCEL D:

THAT PORTION OF THE NORTHWEST QUARTER AND THE SOUTHWEST QUARTER OF SECTION 25, TOWNSHIP 8 NORTH, RANGE 3 WEST OF THE W.M., DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT NORTH A DISTANCE OF 1,811.05 FEET AND EAST A DISTANCE OF 716.57 FEET FROM L.B. MONUMENT NO. 303 SET TO MARK THE NORTHWEST CORNER OF THE CRUMLINE LADUE D.L.C., SAID POINT ALSO BEING THE SOUTHEASTERLY CORNER OF A TRACT OF LAND CONVEYED TO VERNON D. DAVIS, ET UX, AND RECORDED IN VOLUME 708 AT PAGE 1498 UNDER AUDITOR'S FILE NO. 585552;
THENCE SOUTH 67° 36' 03" EAST ALONG THE NORTH LINE OF A TRACT OF LAND CONVEYED TO ROBERT P. RADAKOVICH, ET UX, AND RECORDED UNDER AUDITOR'S FILE NO. 870911043, A DISTANCE OF 1,661.19 FEET;
THENCE NORTH 64° 00' EAST A DISTANCE OF 277.00 FEET;
THENCE NORTH 26° 00' 00" WEST A DISTANCE OF 740.00 FEET TO A POINT THAT IS SOUTH 26° 00' 00" EAST A DISTANCE OF 30.00 FEET FROM THE CENTERLINE OF A 60.00

FOOT ROAD EASEMENT AND THE TRUE POINT OF BEGINNING OF THE PROPERTY HEREIN DESCRIBED;
THENCE ON A CURVE TO THE RIGHT WITH A CENTRAL ANGLE OF 21° 03' 15" AND A RADIUS OF 265.00 FEET, AN ARC DISTANCE OF 97.38 FEET;
THENCE SOUTH 85° 18' 41" EAST A DISTANCE OF 220.42 FEET;
THENCE ON A CURVE TO THE LEFT WITH A CENTRAL ANGLE OF 47° 25' 29" AND A RADIUS OF 305.00 FEET, AN ARC DISTANCE OF 252.45 FEET;
THENCE NORTH 47° 15' 50" EAST A DISTANCE OF 225.99 FEET;
THENCE ON A CURVE TO THE RIGHT WITH A CENTRAL ANGLE OF 66° 00' 07" AND A RADIUS OF 200.00 FEET, AN ARC DISTANCE OF 230.39 FEET;
THENCE SOUTH 66° 44' 03" EAST A DISTANCE OF 63.22 FEET;
THENCE ON A CURVE TO THE RIGHT WITH A CENTRAL ANGLE OF 21° 41' 51" AND A RADIUS OF 735.00 FEET, AN ARC DISTANCE OF 278.34 FEET;
THENCE LEAVING THE SOUTHERLY RIGHT OF WAY LINE OF THE AFOREMENTIONED EASEMENT ON A BEARING OF SOUTH 08° 30' 45" EAST, AND ALONG ASSESSOR'S PLAT NO. 20, A DISTANCE OF 1,928.62 FEET TO A POINT IN THE RIGHT OF WAY OF MEMORIAL PARK DRIVE;
THENCE NORTH 49° 09' 03" WEST ALONG THE NORTHERLY BOUNDARY LINE OF A TRACT OF LAND CONVEYED TO GOBLE QUARRY, INC., BY DEED RECORDED UNDER AUDITOR'S FILE NO. 910605009, A DISTANCE OF 373.43 FEET;
THENCE SOUTH 83° 57' 21" WEST ALONG SAID GOBLE TRACT, A DISTANCE OF 71.85 FEET;
THENCE SOUTH 63° 13' 21" WEST ALONG SAID GOBLE TRACT, A DISTANCE OF 108.80 FEET;
THENCE NORTH 70° 01' 39" WEST ALONG SAID GOBLE TRACT, A DISTANCE OF 289.50 FEET;
THENCE NORTH 48° 08' 39" WEST ALONG SAID GOBLE TRACT, A DISTANCE OF 106.80 FEET;
THENCE SOUTH 77° 33' 21" WEST ALONG SAID GOBLE TRACT, A DISTANCE OF 461.01 FEET; SAID POINT ALSO ON THE SOUTHEASTERLY BOUNDARY LINE OF A TRACT OF LAND CONVEYED TO LOUIS ADLER BY DEED RECORDED UNDER AUDITOR'S FILE NO. 970304080;
THENCE NORTH 21° 25' 21" EAST, ALONG SAID ADLER TRACT, A DISTANCE OF 325.68 FEET, TO AN ANGLE CORNER;
THENCE NORTH 18° 02' 31" WEST, ALONG SAID ADLER TRACT, AND A TRACT OF LAND CONVEYED TO THE U.S.A. BY DEED RECORDED UNDER AUDITOR'S FILE NO. 637321, A DISTANCE OF 441.87 FEET;
THENCE NORTH 86° 56' 41" WEST, ALONG A TRACT OF LAND CONVEYED TO THE U.S.A. BY DEED RECORDED UNDER AUDITOR'S FILE NO. 636984, A DISTANCE OF 145.73 FEET, TO THE EASTERLY BOUNDARY LINE OF TRACT OF LAND CONVEYED TO ROBERT RADAKOVICH BY DEED RECORDED UNDER AUDITOR'S FILE NO. 870911043;
THENCE NORTH 24° 55' 44" EAST, ALONG SAID RADAKOVICH TRACT, 47.61 FEET;
THENCE NORTH 64° 00' EAST A DISTANCE OF 277.00 FEET;
THENCE NORTH 26° 00' WEST A DISTANCE OF 740.00 FEET TO THE TRUE POINT OF BEGINNING.

PARCEL E:

A PARCEL OF LAND SITUATED IN SECTION 26, TOWNSHIP 8 NORTH, RANGE 3 WEST OF THE W.M., AND IN SECTION 25, TOWNSHIP 8 NORTH, RANGE 3 WEST OF THE W.M., MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE SOUTHEASTERLY CORNER OF THAT TRACT OF LAND CONVEYED TO VERNON D. DAVIS, ET UX, AUDITOR'S FILE NO. 585552, SAID POINT BEING THE TRUE POINT OF BEGINNING;
THENCE SOUTH 29° 50' 12" EAST 362.30 FEET;
THENCE SOUTH 50° 12' 12" EAST 413.80 FEET TO THE NORTHEAST CORNER OF PARCEL A, A TRACT OF LAND CONVEYED TO ROBERT RADAKOVICH BY DEED RECORDED UNDER AUDITOR'S FILE NO. 881129050;
THENCE SOUTH 02° 51' 46" WEST, ALONG SAID RADAKOVICH TRACT PARCEL A, 559.51 FEET;
THENCE SOUTH 82° 35' 15" EAST, ALONG THE NORTHERLY LINE OF PARCEL B OF RADAKOVICH TRACT RECORDED UNDER AUDITOR'S FILE NO. 881129050, 170.00 FEET;
THENCE NORTH 84° 24' 44" EAST, ALONG SAID RADAKOVICH PARCEL B TRACT, 45.50 FEET;
THENCE SOUTH 29° 30' 30" EAST, ALONG SAID RADAKOVICH PARCEL B TRACT, 137.24 FEET TO THE NORTH RIGHT OF WAY OF MT. SOLO ROAD;
THENCE ALONG THE NORTH RIGHT OF WAY OF MT. SOLO ROAD ON A CURVE TO THE RIGHT WITH A CENTRAL ANGLE OF 24° 37' 00" AND A RADIUS OF 602.88 FEET FOR AN ARC DISTANCE OF 259.02 FEET;
THENCE SOUTH 85° 59' 46" EAST 154.60 FEET;
THENCE ON A CURVE TO THE RIGHT, WITH A CENTRAL ANGLE OF 18° 58' 24" AND A RADIUS OF 249.93 FEET FOR AN ARC DISTANCE OF 82.76 FEET, TO THE WESTERLY BOUNDARY LINE OF A TRACT OF LAND CONVEYED TO RANDALL BRADFORD BY DEED RECORDED UNDER AUDITOR'S FILE NO. 920713013;
THENCE NORTH 24° 55' 44" EAST, ALONG SAID BRADFORD TRACT, 700.86 FEET;
THENCE NORTH 67° 36' 03" WEST 1,661.19 FEET TO THE POINT OF BEGINNING.

PARCEL F:

LOT 13, BLOCK 2, ASSESSOR'S PLAT NO. 21, ACCORDING TO THE PLAT THEREOF RECORDED IN VOLUME 13 OF PLATS, PAGE 133, RECORDS OF SAID COUNTY.

PARCEL G:

A PARCEL OF LAND SITUATED IN SECTION 25, TOWNSHIP 8 NORTH, RANGE 3 WEST OF THE WILLAMETTE MERIDIAN, AND BEING PARTLY IN THE CRUMLINE LA DUE DONATION LAND CLAIM IN COWLITZ COUNTY, WASHINGTON AND IS MORE FULLY DESCRIBED AS FOLLOWS:

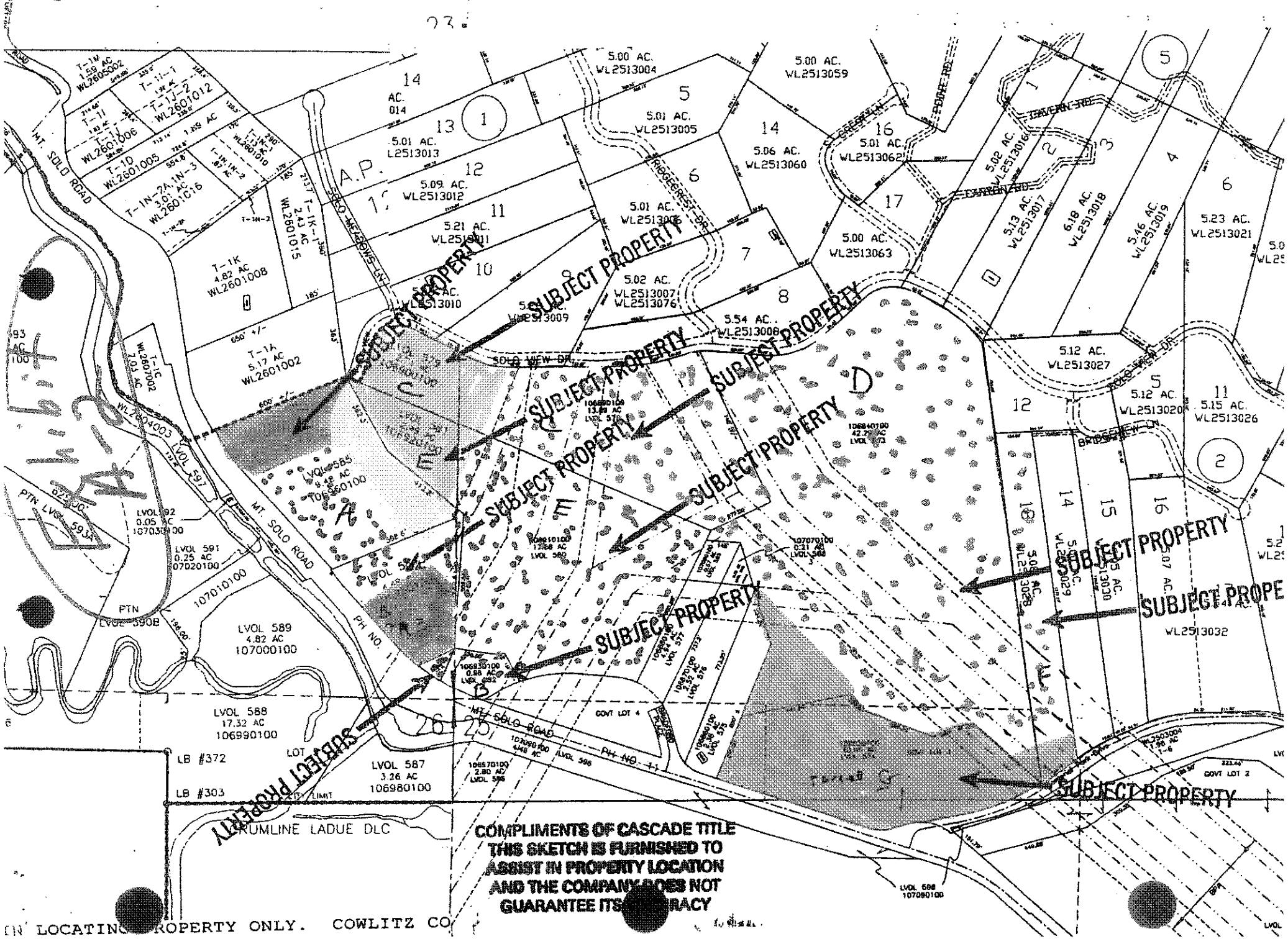
BEGINNING AT A POINT AT STATION 97+16.5 ON THE CENTERLINE OF PH NO. 11 AND IS 3205.06 FEET EAST AND 22.88 FEET SOUTH OF A CONCRETE MONUMENT BEARING A METAL PLATE INSCRIBED LB 303, SET TO MARK THE NORTHWEST CORNER OF THE CRUMLINE LA DUE DONATION LAND CLAIM;
THENCE ALONG THE CENTERLINE OF PH NO. 11, SOUTH 72° 13' WEST 222.50 FEET;
THENCE NORTH 72° 38' WEST 61.20 FEET;
THENCE NORTH 17° 22' EAST 30.00 FEET TO THE NORTHEASTERLY BOUNDARY OF PH NO. 11;
THENCE NORTH 72° 38' WEST 671.35 FEET TO AN IRON PIPE FOUND WHICH MARKS THE SOUTHEASTERLY CORNER OF THE PARCEL OF LAND DESCRIBED IN VOLUME 490, PAGE 69, UNDER COWLITZ COUNTY AUDITOR'S FILE NO. 353490;
THENCE ALONG THE SOUTHEASTERLY BOUNDARY OF THIS SAID PARCEL, NORTH 21° 27' EAST 275.00 FEET;

THENCE NORTH 77° 35' EAST 461.96 FEET, MORE OR LESS, TO A POINT ON THE CENTERLINE OF THE B.P.A. CHEHALIS-LONGVIEW TRANSMISSION LINE ACCESS ROAD AS THE SAME IS NOW CONSTRUCTED;
THENCE ALONG THIS SAID CENTERLINE SOUTH 48° 07' EAST 106.80 FEET;
THENCE SOUTH 70° 00' EAST 289.50 FEET;
THENCE NORTH 63° 15' EAST 108.80 FEET;
THENCE NORTH 83° 59' EAST 65.00 FEET, MORE OR LESS, TO THE SOUTHWESTERLY BOUNDARY OF THE B.P.A. CHEHALIS-LONGVIEW TRANSMISSION LINE RIGHT OF WAY, THIS SAID BOUNDARY BEING SITUATED ON A LINE PARALLEL TO AND 4.70 FEET SOUTHWESTERLY FROM THE 2.3 SV AIRWAY LIGHTING CIRCUIT WHICH IS A SINGLE WOODPOLE LINE;
THENCE ALONG THIS SAID BOUNDARY AS ABOVE DEFINED, SOUTHEASTERLY TO A POINT IN MEMORIAL PARK DRIVE;
THENCE SOUTHWESTERLY ALONG THIS SAID ROAD 506.00 FEET, MORE OR LESS, TO THE POINT OF BEGINNING.

EXCEPT THE RIGHT OF WAY OF THE B.P.A. ACCESS ROAD AND OF LONGVIEW MEMORIAL PARK DRIVE AND OF PERMANENT HIGHWAY NO. 11.

SITUATE IN COWLITZ COUNTY, STATE OF WASHINGTON

A-1 Pg 6/1



IN LOCATING PROPERTY ONLY. COWLITZ CO

SLL
8/25/06

GEOTECHNICAL ENGINEERING EVALUATION

Proposed Quarry Development – Southwest Area
Mt. Solo Rock Quarry
Longview, Washington

July 26, 2006

ALLWEST
Materials Testing • Geotechnical Engineering

ALLWEST
Materials Testing • Geotechnical Engineering

July 26, 2006

Mr. Warren Watts, P.E
WW Engineering
3435 Clemans Road
Clarkston, WA 99403

RE: Geotechnical Evaluation
Proposed Quarry Development – Southwest Area
Mt. Solo Quarry
Longview, Washington

Dear Mr. Watts,

On July 11, 2006 I met with you and representatives from the City of Longview, Washington Department of Natural Resources and 3B's Land and Gravel at the project site. At the meeting, we delivered our Preliminary Geotechnical Engineering Evaluation report dated July 10, 2006. Based on our discussions at the project site, we understand additional information will be required prior to the contractor continuing work in the southwestern portion of the property. This letter is intended to provide the additional geotechnical information for this area.

PROPOSED DEVELOPMENT

We understand the contractor intends to develop the southwestern portion of the property. The area of proposed development is shown on the attached Site Plan. The proposed development area is subdivided into two zones. The first zone, Zone A, is approximately 150 feet by 200 feet in plan dimensions. The bedrock in this area will be drilled, blasted, excavated and crushed to produce aggregate products. The area will be excavated down to an elevation approximately 25 feet above the elevation of Mt. Solo Road. The excavated face will vary in height from approximately 10 feet at the southern end to 30 feet at the northern end. The top of the excavation will be set back from Solo View Road a minimum of 75 feet.

The second zone, Zone B, is located on the east side of the existing pond. A ridge of material remaining from previous pit development is located in this area. The contractor intends to excavate this material by ripping and mass excavation. The material will be used for embankment fill or crushed depending on material quality.

690 W. Capstone Court • Hayden, ID 83835 • (208) 762-4721 • Fax (208) 762-0942

MAPPED GEOLOGIC HAZARDS

A portion of the proposed development area has been mapped as a critical area by the City of Longview due to steep slopes. The steep slopes were created by previous rock quarry development. A copy of the map depicting the critical area as provided by the City of Longview is included with this report for reference.

An active, deep-seated landslide was mapped to the east of the proposed development area on the Digital Landslide Inventory of the Cowlitz County Urban Corridor (Report of Investigations 35, Version 1.0, May 2006) by Karl W. Wegmann with the Washington Division of Geology and Earth Resources. The mapped landslide does not include the proposed development area.

SITE CONDITIONS

The subject property is located on the north side of Mt. Solo Road (SR-432) and east of Solo View Drive in Longview, Washington. Specifically, the property is located in Section 25, Township 8 North, Range 3 West in Cowlitz County, Washington. The property is bordered on the south by Mt. Solo Road and on the west and north by Solo View Road. The proposed development area has plan dimensions of 1300 feet by 300 feet comprising roughly 10 acres. The proposed development area is a portion of a larger aggregation of properties comprising approximately 100 acres. Industrial properties are located to the south of the subject property. The properties to the north, east and west are residential or undeveloped. A topographic map of the property is included for reference.

SITE HISTORY

Aerial photographs indicate the property has been used as a rock quarry since the 1970's. Near-vertical slopes are present on the north side of the proposed development area in the previously developed areas of the quarry. The slopes in basalt bedrock have been stable with respect to large-scale slope stability. The overlying soil mantle exhibits signs of sloughing and erosion. A landslide occurred in the area to the north of the proposed development area and undermined the tower foundation for a BPA high voltage line. We understand a new foundation has been constructed to support the tower.

SUBSURFACE CONDITIONS

Competent basalt bedrock is exposed in the floor of the existing excavation and the face of the excavated slopes to the north. Holes have been drilled in the proposed excavation area in preparation for blasting. The drilling encountered competent basalt to the proposed bottom of the excavation (approximately 25 feet). At our direction, the contractor advanced 5 air rotary drill holes in Zone A between the

proposed excavated slope and the existing roadway. The locations of the drill holes are depicted on the Boring Location Map. The holes were drilled to a depth of 30 feet below the existing ground surface. The drilling encountered hard to very basalt throughout the majority of the holes. The one exception was a soft zone approximately 1 foot thick at a depth of 12 feet in drill hole B-3.

The contractor also drilled eleven air rotary holes in Zone B. The drill holes were advanced to depths ranging from 14 to 58 feet below the existing ground surface. The drill holes in Zone B encountered 4 to 36 feet of soil and rock overburden overlying competent basalt bedrock. Basalt bedrock was present at the bottom of each of the drill holes at the elevation of the proposed excavation bottom. The generalized subsurface profiles are shown on the exploratory logs attached with this report.

SEISMIC HAZARD

The seismic design parameters were calculated using Seismic Design Parameters software, version 3.10 provided by the 2003 International Building Code. The following latitude and longitude were used to specify the location of the subject property:

Latitude: 46.16130 N
Longitude: 123.02395 W

The maximum earthquake spectral response accelerations based on site classification B are:

Short Period Response (S_S) = 1.008g
One Second Response (S_1) = 0.404g

CONCLUSIONS AND RECOMMENDATIONS

Slope Stability

Zone A will be developed in competent basalt bedrock. Drill holes in the area of the proposed slope confirmed the presence of competent basalt bedrock. Based on the characteristics of the exposed basalt bedrock, the history of performance of excavated slopes in this specific area of the quarry and the conditions encountered in the drill holes, it is our opinion the excavated slope in Zone A will be stable with respect to large-scale slope movement. Raveling of the loose rock should be expected. Excavation of the soil and rock materials in Zone B will not disturb or affect the existing excavated slopes to the north. No new slopes will be created by the development in Zone B.

Slope Construction
Excavated slopes in the overburden soil should be constructed no steeper than 2:1 (horizontal to vertical). The basalt bedrock is hard to very hard, slightly to moderately weathered and highly fractured. Based on the observed condition of the bedrock and the past history of excavated slopes on the site, excavations in basalt bedrock will be stable at near-vertical faces. To improve slope performance, we recommend the excavations in basalt bedrock be planned and constructed with vertical faces not exceeding 30 feet in height. Development of the first phase of the rock quarry will not create excavated slopes in bedrock greater than 30 feet in exposed height.

Foundations
Foundation construction is not proposed within the scope of project development.

Soil Compaction Criteria
If fill is placed to support permanent roadways or buildings it is classified as structural fill. Structural fill should be compacted to a minimum of 95% of the maximum dry density as determined by ASTM D-1557 (modified Proctor).

Surface and Subsurface Drainage
Subsurface drainage will not be required for this phase of the proposed development of the rock quarry. Surface water drainage should be directed to a storm water collection system.

Lateral Earth Pressures
Lateral earth pressures are not applicable to the proposed development of the rock quarry.

Erosion Vulnerability
The risk of water erosion of the on-site soils varies from slight to severe. The bedrock is not susceptible to erosion. Erosion control measures such as silt fences, straw bale dikes and sediment basins will be necessary if construction occurs during heavy periods of precipitation. The exposed native soils will be susceptible to gullying and erosion. Minor areas of sloughing may be anticipated on constructed slopes until vegetation is established. We recommend constructed slopes be maintained through removal of sloughed materials and additional re-vegetation.

Suitability for Fill
The excavated soil and rock materials are suitable for use as structural and non-structural fill. Structural fill placement is not included within the scope of construction for development of this phase of the rock quarry.

Laboratory Data and Soil Index Properties
No laboratory testing was performed within the scope of this evaluation.

Building Limitations
Buildings will not be constructed within the scope of this phase of the development of the rock quarry.

Access Roadway Construction
An access roadway will be constructed along the southern border of the property. The roadway will cross the existing pond. It will be necessary to place fill to establish the grades of the proposed roadway. The roadway is intended to be temporary. All fill materials placed for access roadway construction will be removed at the conclusion of rock quarry development.

If you have any questions, or need additional information, please give us a call.

Sincerely,

ALLWEST Testing & Engineering, LLC

Chris C. Beck, P.E.

ATTACHED: Site Plan
Critical Area Map
Topographic Map
Boring Location Map
Boring Logs

CHRIS C. BECK
STATE OF WASHINGTON
0027669
REGISTERED
PROFESSIONAL ENGINEER
EXPIRES 11/23/2007

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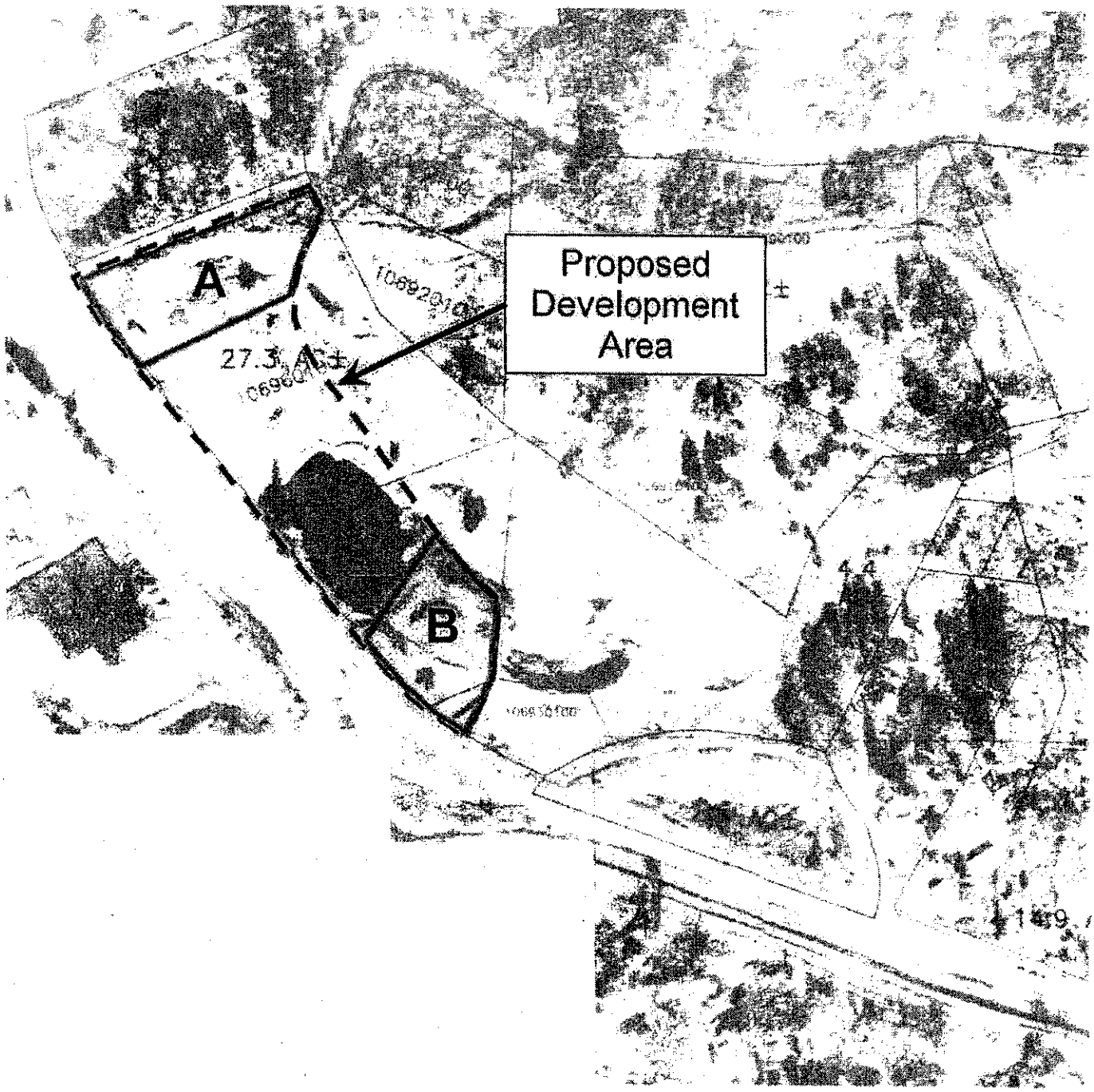
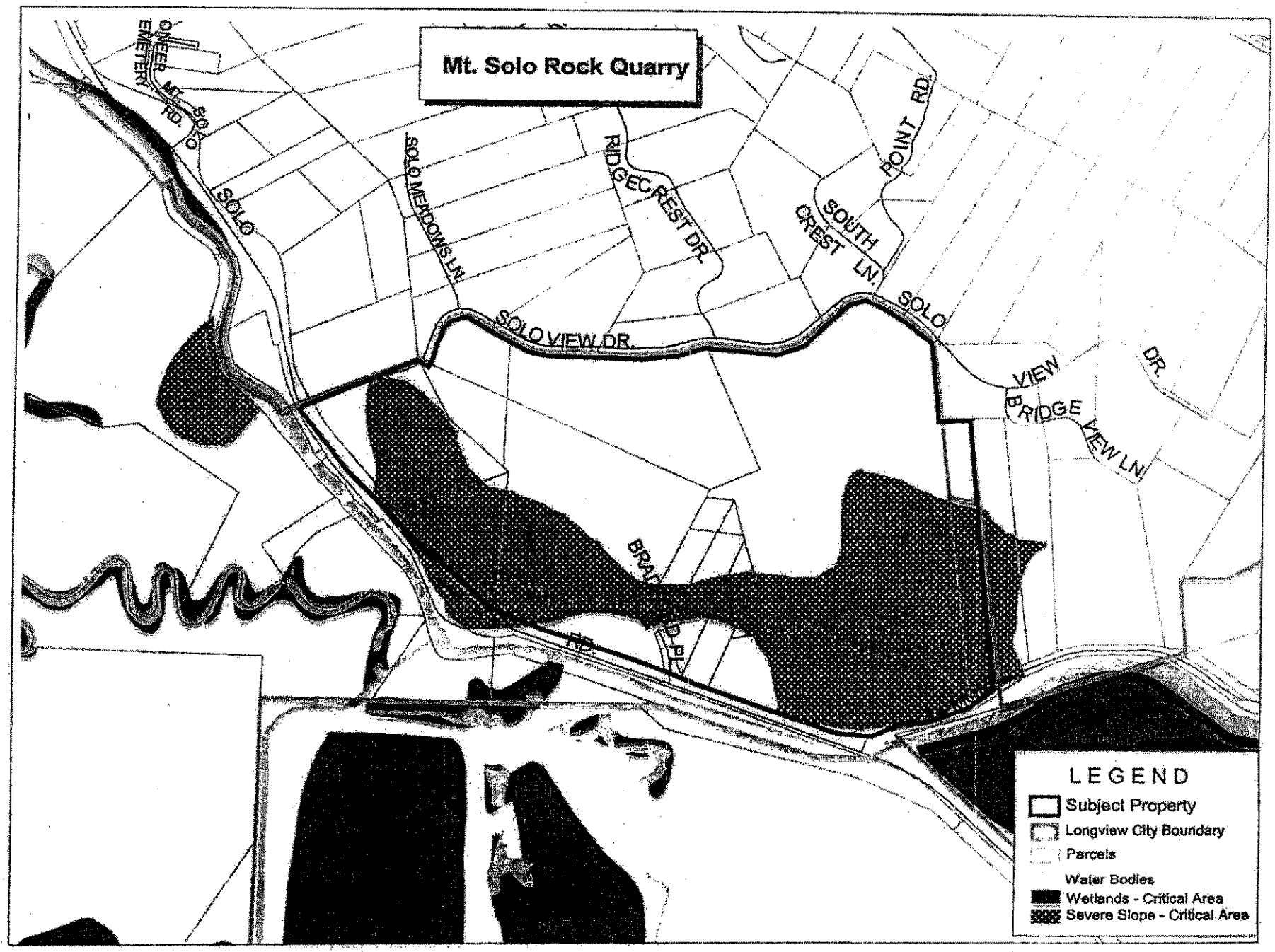
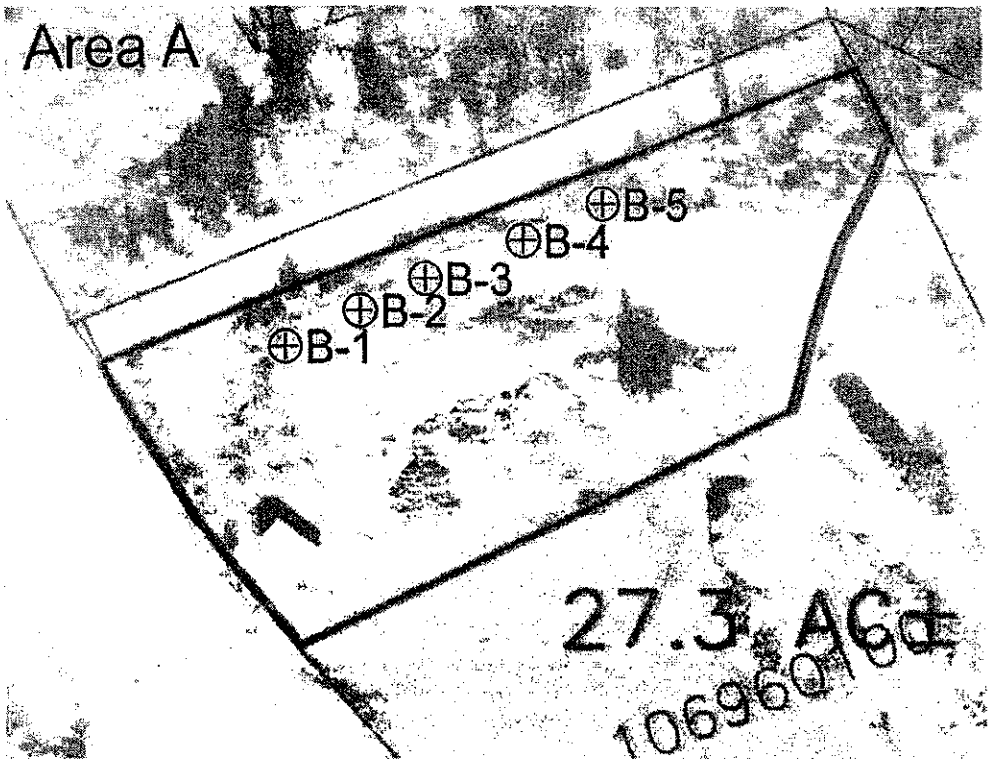
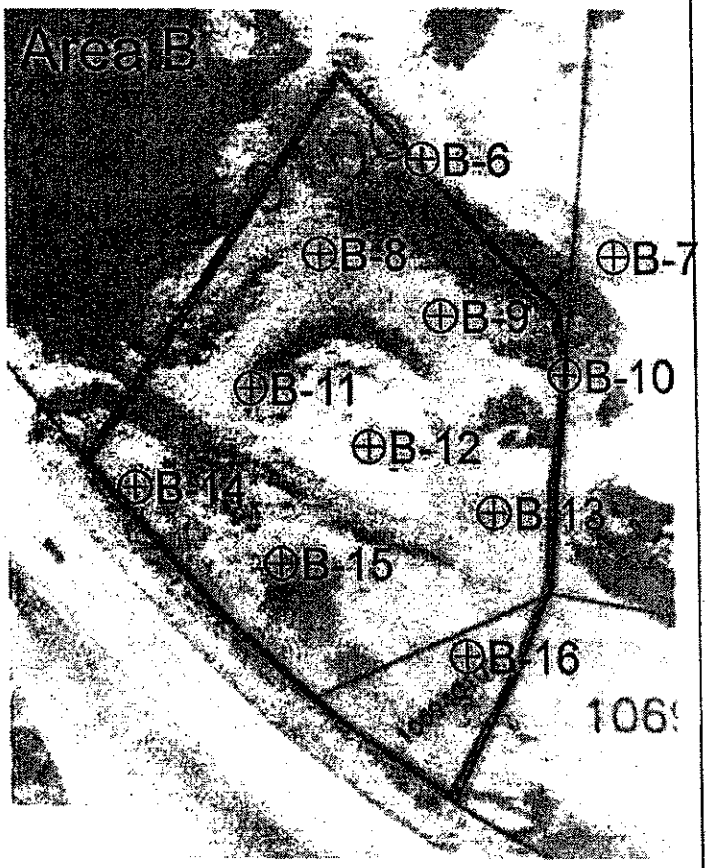


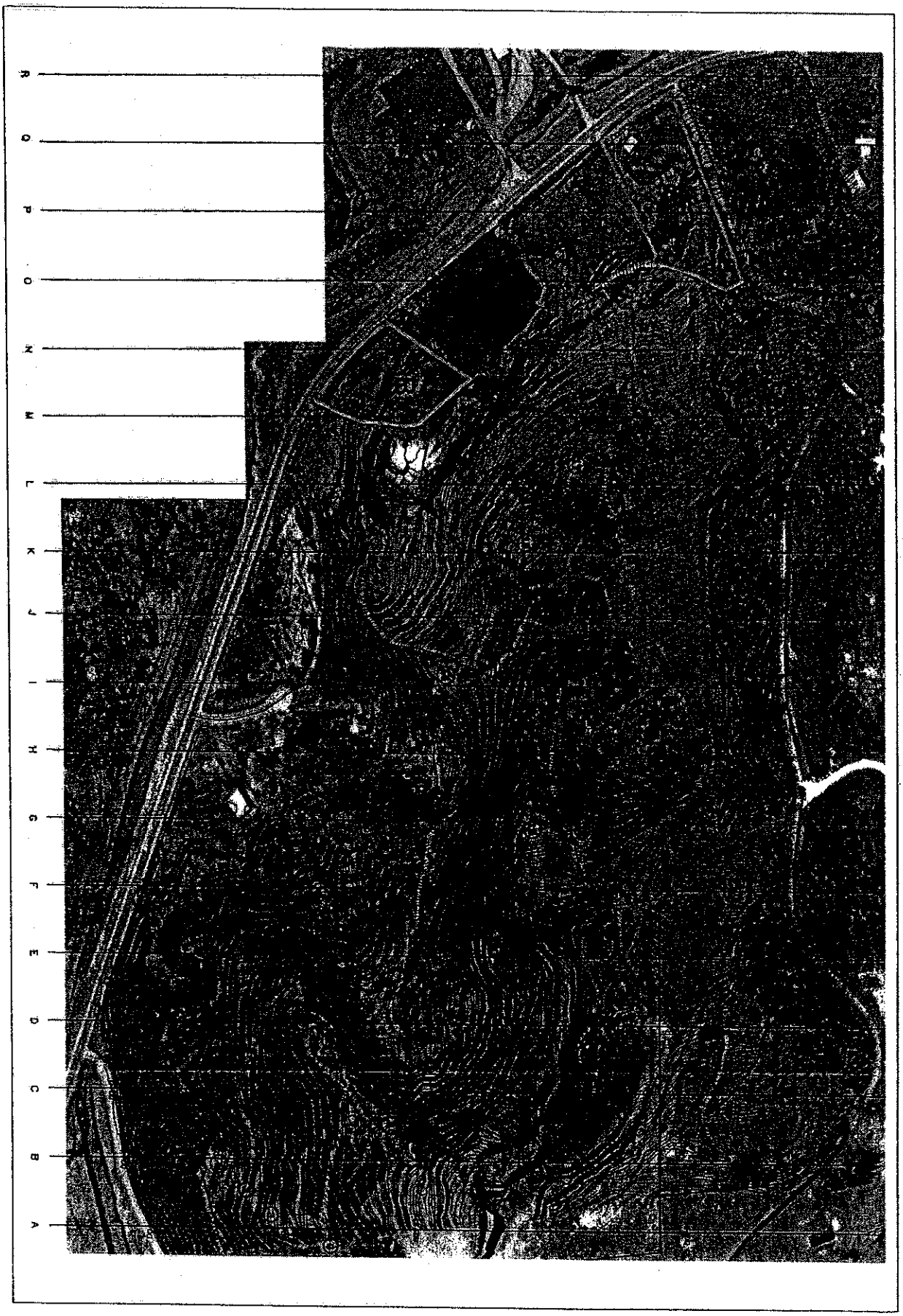
TITLE: Site Plan			ALLWEST MATERIALS TESTING • GEOTECHNICAL ENGINEERING 690 W. CAPSTONE COURT HAYDEN, ID 83835 (208) 762-4721	
SCALE: NONE	DATE: 7/06	FILE: 106-131G		SHEET 1 OF 1


Mt. Solo Rock Quarry
PIONEER CEMETERY
MT. SOLO RD.
SOLO
SOLO MEADOWS LN.
RIDGECREST DR.
SOUTH CREST LN.
POINT RD.
SOLO VIEW DR.
SOLO
VIEW
DR.
BRIDGE VIEW LN.
RD.
LEGEND
Subject Property
Longview City Boundary
Parcels
Water Bodies
Wetlands - Critical Area
Severe Slope - Critical Area





TITLE: Boring Location Map			ALLWEST MATERIALS TESTING • GEOTECHNICAL ENGINEERING 690 W. CAPSTONE COURT HAYDEN, ID 83835 (208) 762-4721	
SCALE: NONE	DATE: 7/06	FILE: 106-131G		SHEET 1 OF 1



TITLE: Topographic Map			ALLWEST MATERIALS TESTING • GEOTECHNICAL ENGINEERING 690 W. CAPSTONE COURT H[illegible]N, ID 83835 [illegible]62-4721	
SCALE: NONE	DATE: 7/	FILE: 106-131G		SHEET 1 OF 1

LOG OF BORING

PROJECT: 106-131G Mt. Solo Rock Quarry WW Engineering	BORING: B-1 LOCATION:
	DATE: SCALE: 1" = 10'

Depth 0.0	ASTM D2487 Symbol	Description of Materials	N	WL	Tests or Notes
30.0	ROCK	BASALT. Hard to very hard, moderately fractured, slightly weathered.			
		Boring terminated.			

LOG OF BORING

ALLWEST
Materials Testing • Geotechnical Engineering

PROJECT:	106-131G Mt. Solo Rock Quarry WW Engineering	BORING:	B-2
		LOCATION:	
		DATE:	SCALE: 1" = 10'

Depth	ASTM D2487 Symbol	Description of Materials	N	WL	Tests or Notes
0.0	ROCK	BASALT. Hard to very hard, moderately fractured, slightly weathered.			
30.0		Boring terminated.			

LOG OF BORING

PROJECT: 106-131G Mt. Solo Rock Quarry WW Engineering	BORING: B-3 LOCATION: DATE:	SCALE: 1" = 10'

Depth	ASTM D2487 Symbol	Description of Materials	N	WL	Tests or Notes
0.0	ROCK	BASALT. Hard to very hard, moderately fractured, slightly weathered.			
12.0					
13.0	ROCK	WEATHERED BASALT. Soft, highly fractured, highly weathered, with CLAY.			
	ROCK	BASALT. Hard to very hard, moderately fractured, slightly weathered.			
30.0					
		Boring terminated.			

LOG OF BORING

PROJECT: 106-131G Mt. Solo Rock Quarry WW Engineering	BORING: B-4 LOCATION:
	DATE: SCALE: 1" = 10'

Depth 0.0	ASTM D2487 Symbol	Description of Materials	N	WL	Tests or Notes
30.0	ROCK	BASALT. Hard to very hard, moderately fractured, slightly weathered.			
		Boring terminated.			

LOG OF BORING

PROJECT: 106-131G Mt. Solo Rock Quarry WW Engineering	BORING: B-5 LOCATION:
	DATE: / SCALE: 1" = 10'

Depth 0.0	ASTM D2487 Symbol	Description of Materials	N	WL	Tests or Notes
30.0	ROCK	BASALT. Hard to very hard, moderately fractured, slightly weathered.			
		Boring terminated.			

LOG OF BORING

PROJECT: 106-131G Mt. Solo Rock Quarry WW Engineering	BORING: B-6 LOCATION:
	DATE: SCALE: 1" = 10'

Depth 0.0	ASTM D2487 Symbol	Description of Materials	N	WL	Tests or Notes
15.0	ROCK	BASALT. Hard to very hard, moderately fractured, slightly weathered.			
24.0	ROCK	BASALT. Moderately hard to hard, moderately fractured, moderately weathered.			
		Boring terminated.			

LOG OF BORING

PROJECT: 106-131G Mt. Solo Rock Quarry WW Engineering	BORING: B-7 LOCATION:
	DATE: SCALE: 1" = 10'

Depth 0.0	ASTM D2487 Symbol	Description of Materials	N	WL	Tests or Notes
24.0	ROCK	BASALT. Hard to very hard, moderately fractured, slightly weathered.			
		Boring terminated.			

LOG OF BORING

PROJECT: 106-131G Mt. Solo Rock Quarry WW Engineering	BORING: B-8 LOCATION:
	DATE: / SCALE: 1" = 10'

Depth 0.0	ASTM D2487 Symbol	Description of Materials	N	WL	Tests or Notes
4.0	ROCK	BASALT. Hard to very hard, moderately fractured, slightly weathered.			
16.0	CL	Silty CLAY with BASALT cobbles and boulders.			
52.0	ROCK	BASALT. Hard to very hard, moderately fractured, slightly weathered.			
		Boring terminated.			

LOG OF BORING

PROJECT: 106-131G Mt. Solo Rock Quarry WW Engineering	BORING: B-9 LOCATION:	
	DATE:	SCALE: 1" = 10'

Depth 0.0	ASTM D2487 Symbol	Description of Materials	N	WL	Tests or Notes
18.0	CL	Silty CLAY with BASALT cobbles and boulders.			
26.0	ROCK	BASALT. Hard to very hard, moderately fractured, slightly weathered.			
32.0	CL	Silty CLAY with BASALT cobbles and boulders.			
35.0	ROCK	WEATHERED BASALT. Soft, highly fractured, highly weathered, with CLAY.			
57.0	CL	Silty CLAY with BASALT cobbles and boulders. BASALT. Hard to very hard, moderately fractured, slightly weathered.			
		Boring terminated.			

LOG OF BORING

PROJECT: 106-131G Mt. Solo Rock Quarry WW Engineering	BORING: B-10 LOCATION:
	DATE: SCALE: 1" = 10'

Depth 0.0	ASTM D2487 Symbol	Description of Materials	N	WL	Tests or Notes
22.0	CL	Silty CLAY with BASALT cobbles and boulders.			
58.0	ROCK	BASALT. Hard to very hard, moderately fractured, slightly weathered.			
		Boring terminated.			

LOG OF BORING

PROJECT: 106-131G Mt. Solo Rock Quarry WW Engineering	BORING: B-11 LOCATION:
	DATE: SCALE: 1" = 10'

Depth	ASTM D2487 Symbol	Description of Materials	N	WL	Tests or Notes
0.0	CL	Silty CLAY with BASALT cobbles and boulders.			
18.0	ROCK	BASALT. Hard to very hard, moderately fractured, slightly weathered.			
38.0		Boring terminated.			

LOG OF BORING

ALLWEST

PROJECT: 106-131G Mt. Solo Rock Quarry WW Engineering	BORING: B-12 LOCATION:
	DATE: SCALE: 1" = 10'

Depth	ASTM D2487 Symbol	Description of Materials	N	WL	Tests or Notes
0.0	CL	Silty CLAY with BASALT cobbles and boulders.			
20.0	ROCK	BASALT. Hard to very hard, moderately fractured, slightly weathered.			
37.0		Boring terminated.			

LOG OF BORING

PROJECT: 106-131G Mt. Solo Rock Quarry WW Engineering	BORING: B-13 LOCATION:
	DATE: / SCALE: 1" = 10'

Depth	ASTM D2487 Symbol	Description of Materials	N	WL	Tests or Notes
0.0	ROCK	BASALT. Hard to very hard, moderately fractured, slightly weathered.			
6.0	CL	Silty CLAY with BASALT cobbles and boulders.			
38.0	ROCK	BASALT. Hard to very hard, moderately fractured, slightly weathered.			
48.0		Boring terminated.			

LOG OF BORING

ALLWEST

PROJECT:	106-131G Mt. Solo Rock Quarry WW Engineering	BORING:	B-14
		LOCATION:	
		DATE:	SCALE: 1" = 10'

Depth 0.0	ASTM D2487 Symbol	Description of Materials	N	WL	Tests or Notes
4.0	CL	Silty CLAY with BASALT cobbles and boulders.			
14.0	ROCK	BASALT. Hard to very hard, moderately fractured, slightly weathered.			
		Boring terminated.			

LOG OF BORING

PROJECT: 106-131G Mt. Solo Rock Quarry WW Engineering	BORING: B-15 LOCATION:
	DATE: SCALE: 1" = 10'

Depth	ASTM D2487 Symbol	Description of Materials	N	WL	Tests or Notes
0.0	CL	Silty CLAY with BASALT cobbles and boulders.			
24.0		Boring terminated.			

LOG OF BORING

ALLWEST

PROJECT: 106-131G Mt. Solo Rock Quarry WW Engineering	BORING: B-16 LOCATION:
	DATE: SCALE: 1" = 10'

Depth 0.0	ASTM D2487 Symbol	Description of Materials	N	WL	Tests or Notes
12.0	CL	Silty CLAY with BASALT cobbles and boulders.			
24.0	ROCK	BASALT. Hard to very hard, moderately fractured, slightly weathered.			
		Boring terminated.			

Dostert,Dawneen M - TRFS-3

From: Robinson,W Chris - TNSE-MODA
Sent: Wednesday, July 26, 2006 3:29 PM
To: Dostert,Dawneen M - TRFS-3
Subject: FW: 106-131 Mt Solo Quarry - Southwest GEE.pdf

Attachments: 106-131 Mt Solo Quarry - Southwest GEE.pdf

106-131 Mt Solo Quarry - South...

Dawneen-

Here is a copy of the All-West Geotechnical Evaluation given to the City of LV on July 11 from Steve Langdon, city engineer. I have noted a few significant shortcomings in their write-up. These are questions that you might want to put to Highland Enterprises at your next convenient time...

1-Is Chris Beck a Geotechnical Engineer(his stamp just indicates Engineer)? Washington state and 2006 IBC code(sect. 1613.5.5) requires a geotechnical or engineering geologist make the subsurface material shear velocity estimates in lieu actual seismic testing;

2-All-West Engineering has used the wrong bulding Code(IBC 2003), see IBC 2006.
Note: soils around our tower structures have significantly different shear velocity estimates than what they used for Site Class B. e.g. Ours would be site class C or D on the hill(judging from seismic tests);

3-Given the knowledge of slope instability directly adjacent to the development area(north, p.2) No slope investigations, drilling, or lab soils testing have been performed on the slopes soils to know what the affect of further development would be on these areas.

4-Where is the Reclamation Plan required by WA DNR? Are finished 2:1 slopes(p.4) the expected standard?

5-The first phases here have mentioned no proposed slope excavations >30ft in height. Excavations outside of this area(150ft west of P-A str.#46/1) have already been performed which, if blasted, excavated, and completed would be min. 50ft high.

6-The "Surface/subsurface drainage(p.4)" section mentions channeling runoff to storm drainage(and fish streams?), nothing mentioned of sediment settling ponds or water treatment(adjacent to major waterways).

7-Lateral earth Pressures sect(p.4) data not presented or calculated for cut-slopes on soils, nor has soil labs testing been carried out;

8-Where is Slope Stability analysis, test data, investigations?

9-What are the finished road grades? No mention of BPA Access roads, since the former legal powerline access road(east side of pond, Zone B) has been obliterated, and the Zone A plan takes out the one remaining road(center of site)?

10-What about the plans for the remaining 130 acres? The finished slopes in the reclamation plan around the BPA tower structures?

These are just a few casual questions I would have regarding this development all required by law in the state of Washington.

Also Colby Blewett telephoned me on 7/25/2006 to ask for a copy of the new Shannon & Wilson Geotech Report, when it is available. I told him to call you when it comes out.

Chris Robinson
BPA Engineering Geologist

-----Original Message-----
From: Steve Langdon [mailto:steve.langdon@ci.longview.wa.us]
Sent: Wednesday, July 26, 2006 11:02 AM
To: Dostert,Dawneen M - TRFS-3; Robinson,W Chris - TNSE-MODA
Subject: FW: 106-131 Mt Solo Quarry - Southwest GEE.pdf

FYI - Attached is the latest Geotechnical Report we have received from the applicant. ...Steve Langdon, Principal Planner

-----Original Message-----
From: John Brickey
Sent: Wednesday, July 26, 2006 10:55 AM
To: Steve Langdon
Subject: 106-131 Mt Solo Quarry - Southwest GEE.pdf

<<106-131 Mt Solo Quarry - Southwest GEE.pdf>>

Wolcott,Marian - TR-3

From: Worth,Franklin S - TNFF-TPP-3
Sent: Friday, September 01, 2006 10:27 AM
To: Dostert,Dawneen M - TRFS-3; Margeson,Jacilyn R - LC-7; Wolcott,Marian - TR-3; Meisner,Neal E - TRFS-3; Jones,Terrie L - TFO-OLYMPIA; Furrer,Robin R - TF-DITT2; Courts,Alan L - TN-DITT-2; Kempner,Leon Jr - TNFC-TPP-3
Subject: FW: BPA Mt Solo Longview Geotechnical Study - Final Report

Attachments: Final Geotechnical Report Mount Solo-Longview BPA Tower Study, 8-30-06.pdf

Final
chnical Report M

Here's the final Shannon and Wilson geotech report for the additional studies on Mt. Solo. After reading through it, it has language to discuss the following:

1. The additional analyses Chris and I asked to be done lowered the factor of safety to 1.1 for 46/1. This is still marginally stable, and above failure modes. This reinforces my prior message that slope stability is now less of a concern than previously thought.

2. Predicted ground movement from a 50-year earthquake with a 10% chance of occurrence is less than half an inch.

3. S & W states that blasting should not affect the towers, provided the operator is in accordance with the Washington State Administrative Code (WAC) 296-52-76705, which limits maximum velocities allowed near structures.

You can forward this report as you deem necessary. Hard copies should arrive early next week after the holiday.

I think we should start expanding our focus to the R/W on the east side of Mt. Solo facing Longview. If the quarry operator plans to excavate or blast in that area, we need to look at the bore logs they did to see what the subsurface conditions are. This could possibly lead to more slope stability analyses if we feel uncomfortable about opening up those slopes (which are much steeper than on the west side of the quarry property.

Frank
-----Original Message-----
From: Laureen McKenna [mailto:LMM@shanwil.com]
Sent: Thursday, August 31, 2006 9:51 AM
To: Worth,Franklin S - TNFF-TPP-3; Robinson,W Chris - TNSE-MODA
Cc: Chris Robertson
Subject: BPA Mt Solo Longview Geotechnical Study - Final Report

Frank,

Hard copy is in the mail.
I'll be out tomorrow and all of next week, so if you have any questions after today, please contact Chris Robertson directly.

Thanks for giving us the opportunity to work with you again. Please keep me updated on the project.

-Laureen

Laureen M. McKenna, P.E.
Senior Engineer
Shannon & Wilson, Inc.
400 N 34th Street, Suite 100

Seattle, WA 98103

Direct: (206) 695-6728
Cell: (206) 491-2352
Fax: (206) 695-6777

Department of Energy

Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

GENERAL COUNSEL

August 23, 2006

In reply refer to: LC-7

Initially sent by fax (208) 746-9160

Ron T. Blewett
Attorney
Clark and Feeney
P.O. Drawer 285
Lewiston, ID 83501

RE: Mt. Solo Quarry - 3 B's Land & Gravel

Dear Mr. Blewett:

You asked me if BPA will provide you with geotechnical information in BPA's possession and control related to its contractor's, Shannon & Wilson, Inc., investigation of the Mt. Solo Quarry. Specifically you asked for the core log boring information at the Mt. Solo Quarry. As you know, BPA asked Shannon & Wilson to evaluate the soil conditions around three towers that are adjacent to the tower BPA recently replaced because of landslide conditions at the Mt. Solo site. As I mentioned in our conversation yesterday, on August 22, 2006, BPA has not received a final report from Shannon & Wilson because the lab tests results on the soil have been delayed due to a backlog at the lab. The soil characteristics determined by the lab testing are necessary for the slope stability analyses being conducted by Shannon & Wilson. Consequently, BPA does not have the requested information in its possession and control to provide to you and to your client.

If you chose to file a Freedom of Information Act request, please be aware that our external web page, www.bpa.gov, contains useful information on how to file the request.

Sincerely,

Jacilyn R. Margoson

Jacilyn R. Margoson
Assistant General Counsel

COPY

This fax was received by GFI FAXmaker fax server. For more information, visit: http://www.gfi.com

U.S. DEPARTMENT OF ENERGY - BONNEVILLE POWER ADMINISTRATION

BPA F 5450.05 (10-94)

ENGINEERING AND TECHNICAL SERVICES REPORT

TITLE	DATE	REPORT NO.
GEOTECHNICAL INVESTIGATION FOR RELOCATION OF PAUL-ALSTON #1, STR. #46/1	June 2, 2004	TNSE 04-42
	AUTHOR W. Chris Robinson – TNSE/MODA Reviewed by Franklin Worth - TNFF	
	Assisted By Al Tolentino - TFZ	
REQ ORG. TNFF / PAGES / ABM/W.O.	REVIEWED BY S. K. An – TNSE/MODA	

SUMMARY:

A Geotechnical Investigation to determine the most suitable location for relocation of Paul-Alston No. 1 str. #46/1 was performed in two phases, on September 19, 2002, and Oct 25, 2002, for test pit excavation and geologic investigation, and later on June 2, 2004, for an exploratory seismic refraction subsurface investigation. The site is located in NW ¼ section 25/T.8N/R.3W. in Cowlitz County, near Longview, WA. Phase I consisted of the following tests:

(1) Three test pit trenches approx. 14-16 feet in depth were excavated by backhoe, where (modified ASTM 4.08 D 1587) Shelby tube samples were taken for undisturbed soil density values, Field Torvane test to determine approximate soil shear values, and a Soiltest C700 pocket pressure-penetrometer test to determine approximate soil bearing capacity in-situ. Seven soil samples were taken from various locations in the test pits for lab testing.
(2) Geological investigation (ASTM 4.09 D 5434) to verify local substrata, depths to water table and bedrock, with supporting diagrams;
(3) Site geomorphology from websites, publications, and research to identify and evaluate possible hazards such as landslide/slump potential, flood hazards, and seismic/earthquake risks;
(4) Lab Tests(ASTM 4.08 D) were performed on seven soil samples to determine various characteristics:
   a. USCS Soil Classification and gradation(D 2487, D 2488), hydrometer(D 422), Specific Gravity(D 854), Atterberg limits(D 4318), and natural moisture content(D 2216);

Phase II addendum consisted of an exploratory seismic refraction investigation for purposes of determining the depths and location of bedrock with more accuracy and precision:

Three 12-geophone arrays were set up (with 10-ft spacing) running perpendicular to the centerline of ROW, with line #1 (crossing at station #6) 150 ft ahead(SW) of the str. #46/1, line #2(crossing at sta. #6) in the center of the existing str. #46/1, and line #3(crossing at sta. #6) located 300 ft behind str. #46/1(North).

This geotechnical report with exploratory seismic test results(Phase II) addendum contains the findings of the above testing and investigations. Follow-up technical support is available for design and construction.

DESCRIPTORS:

Geotechnical,Paul-Alston Structure Relocation, Columbia River Crossing

DISTRIBUTION:

Worth, Franklin S. –TNFF
Kempner, Leon -TNFC

Official File – TNSE

DOE F 1325.8*
(08-89)

United States Government **Department of Energy**

memorandum

Bonneville Power Administration

DATE: Nov 2002

REPLY TO ATTN OF: W. Christopher Robinson, TNSE

SUBJECT: **Geotechnical Evaluation of Paul Alston Line #1 str. #46/1**

TO: Frank Worth, Civil Engineer – TNS
Jim Rustvold, Civil Engineer - TNS

On September 19 and October 25, 2002, on-site visits were conducted to determine the subsurface strata to a depth of approximately 16 feet around the base of Paul-Alston Line #1, structure #46/1, on a toe bench of Mount Solo, approximately 3 miles west of Longview, Washington, in NW ¼ Section 25/T.8N/R.3W. A publications search indicated the most likely geologic members and soil associations at this location, followed by lab testing of soils recovered from the 3 test pits, and on-site reconnaissance.

GEOLOGY:

The 1987 USGS 1:250,000 scale map indicated 40 million-yr-old ash tuff volcaniclastic silts of the Olequa member (Cowlitz formation) interbedded with Grays River/Goble Basalt intrusive and flow volcanics. At some point, this area was subjected to overbank brackish estuarial inundation, as indicated by the blue-gray silt layer at approx. 12 ft depth. The ash tuff volcaniclastic silts have weathered into elastic silts and clays of low to moderate plasticity in this area. The site is located on a southwest-facing 18% slope vegetated with scrub brush and alders.

FINDINGS:

Three test pit trenches were made, one across the largest of several escarpments that were located, and two approximately 70ft back on line from the structure. These were the generalized findings(See test pit logs, att):

- 0-0.2ft Weathered scoria ash with little organics.
- 0.2-5ft –Elastic Silt(ash) with Sand soft, moist, permeable; orange and yellow-brown.
- 5-6ft – Lean Clay(ash) with Sand; soft to very stiff, massive, damp, yellow-brown.
- 6-7.5ft- Elastic Silt(ash); very stiff; massive, low permeability, damp, lt. gray/orange mottle.
- 7.5-12ft – Lean Clay(ash), very stiff, massive, impermeable, damp, gray/orange mottle.
- 12-14ft –Silt (ash), very stiff, massive, low permeability, moist, blue-gray(not found in TP-3)
- 14ft + Silt (weathered dacite ash tuff siltstone); very stiff, massive, moist, lt. brown.
- NO bedrock was encountered in these test pits and no bedrock outcrops were within 250 ft.

These strata indicate several volcanic ash fall events, with at least one estuarial inundation event for a significant period of time, with long periods of surficial weathering/erosion between events. The uppermost volcanic ashfall event here is approximately 25million years old, subjected to a very long period of surficial erosion. At the base lies highly weathered and degrading 40 million year-old oceanic "hackly" basalts most likely deposited or intrusive into water bearing strata.

SUBSURFACE CONDITIONS:

The surface to approximately 6 feet depth is composed of soft elastic silts with some sand, with low permeability lean clay at the base, both moist and cohesive (moderately plastic). This layer was clearly a separate volcanic ashfall event.

Shear strength ϕ-angle $\cong$ 14°-26° due to the low degree of consolidation and near saturation.
Unconfined Compressive strength $\cong$ 1000 psf(lb/ft^2), subject to water saturation.
Dry density $\cong$ 93 lb/ft^3, with a saturated density of approximately 110 lb/ft^3.

From 6 feet to approximately 12 feet depth were elastic silts and clays(highly plastic) another separate previous volcanic(andesitic) ashfall event. Because of erosional removal of some surface materials over time on this layer, it is apparent that these ash materials have become highly consolidated and very stiff, much more so than the surface layer. As occurred above, the base of this layer is less permeable lean clays resulting from degradation and induration of the finer material there. Because of the higher plasticity of this material, saturation can introduce substantial instability in this layer, especially as it is located on a slope or if subjected to additional loading, causing it to become a possible "slip plane."

Shear strength ϕ-angle $\cong$ 16°-28° depending greatly on water saturation
Unconfined Compressive strength $\cong$ 2200 psf, subject to water saturation
Dry density $\cong$ 66 lb/ft^3, with a saturated density of approximately 105 lb/ft^3.

At approximately 12-14ft depth were found an anoxic blue-gray silt(lower plasticity) layer, likely caused by a protracted period of estuarial inundation or slough-like condition here. As in the above layer, this very stiff material has been subjected to overburden erosion over several millions of years, and is very consolidated. As such, it is likely more stable in-place than the materials above it.

Shear strength ϕ-angle $\cong$ 26°-32° depending greatly on water saturation
Unconfined Compressive strength $\cong$ 2500 psf, subject to water saturation
Dry density $\cong$ 66 lb/ft^3, with a saturated density of approximately 105 lb/ft^3.

The above materials rest on a highly weathered ash tuff siltstone(low plasticity), which itself has been subjected to erosional and weathering affects over several millions of years prior to the above events. It is very stiff, massive, and consolidated, although with some jointing, which weakens the rock to lower shear values in places. As such, it is otherwise the most stable (despite the 3h:1v slope downgrade) of all the layers, and much less permeable. The top surface would be the deepest significant "slip plane" here.

Shear strength ϕ-angle $\cong$ 28°-32° depending greatly on water saturation
Unconfined Compressive strength $\cong$ 6000 psf, subject to water saturation
Dry density $\cong$ 102 lb/ft^3, with a saturated density of approximately 127 lb/ft^3

In Test Pit #1, the visible ground crack resulting from the latest movement on the escarpment under structure #46/1 measured a shear displacement of 0.6-ft. Based upon a stratigraphic match of soil materials on both sides of the scarp(see photo, Scarp in Test Pit #1), the *total* accumulated displacement measures out to be approx. 2.7-ft, indicating a long-term process of slow movement and shear on this scarp. Most likely, as in the past, further displacements could be triggered by specific events during periods of high moisture saturation stress.

GROUNDWATER AND SURFACE RUNOFF:

NO groundwater was encountered during this investigation in any of the test pits, and the different layers of silt ash and ash tuff siltstone have degraded to clays and elastic silts with characteristically low permeability. As such, and because of the 5h:1v slope it is likely 90% of the precipitation here will end up in runoff, not groundwater. However, these slopes are very sensitive to long-term exposure to precipitation(over months or years) and to changes in the precipitation rate.

SLOPE CONDITIONS

Slopes range from 5:1(h:v) near the structure itself to 3:1(h:v) beyond 120ft ahead-on-line, to 280 ft ahead on line where 1:1(h:v)slope in a rock quarry exists. Given these slopes and the variable-to-high plasticity, these silt and clay materials probably are in a differentially "slow creep" condition, depending on moisture saturation and differential settlement of the various layers. This slow creep will continue to cause some differentially distortional stresses on the structure at variable depths. Also notable, already low natural soil shear strength and consolidation might be lost if the surface materials were disturbed or if subjected to long periods of continued/high precipitation. The computed factor of safety(FS) of this slope falls between 3-5(DLISA Analysis), and the likelihood of a catastrophic failure appears to be only very slight. Even given the devegetation caused by a recent wildfire in the area, slope stability here appears to be dependent on the combined instances of perched groundwater saturation and the possible shaking due to a seismic event of M5 or greater magnitude within a 60 mile radius (see SEISMIC CONSIDERATIONS).

SEISMIC CONSIDERATIONS:

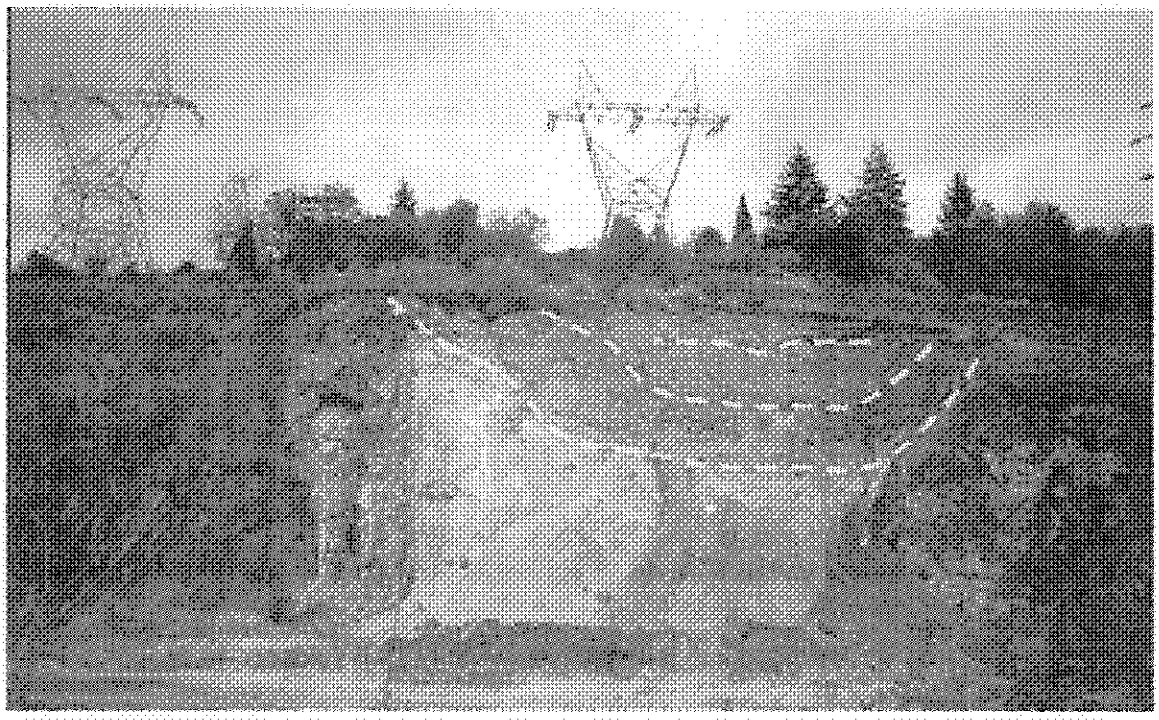
This area has been categorized as zone 3 for IBC-2000 purposes. A review of the available earthquake and seismic literature was conducted via US Geological Survey and Washington State Dept of Natural Resources publications(See att.). There have been earthquakes of magnitude M6.8 as recently as February, 2001, although the epicenter was located 60 miles to the north and approx. 32 miles deep, and there have been several others within that radius since 1949 ranging from M5.1 to M7.1, some lasting as long as 40 seconds. According to the Alston Substation(5 miles west of Mt. Solo) seismometer data , the Nisqually Quake of February 2001 had peak ground accelerations of 0.02g(vertical), 0.06g(east-west), and 0.08g(north-south).

Generally, with regards to earthquakes of M5 or greater, the past 50 years have been the most peaceful in this area's history. Based on the minor moss and vegetation growth on the walls of this scarp, as well as the *total* scarp #1 displacement(approx. 2.7-ft), it is very likely this most recent quake might have accelerated the movement of the slow creep and shear already in progress at this site, resulting in the visible 0.6-ft crack displacement at the site. Given optimal high moisture condition and the vegetation stripping on the hillside caused by a recent wildfire, it is possible that shaking by an earthquake such as the February 2001 Nisqually Quake destabilized segments of this slope and caused the latest slip/dip shear such as was found at this site under structure #46/1. This type of occurrence could create additional compressive or distortional stresses on the structure's grillage footings in the future.

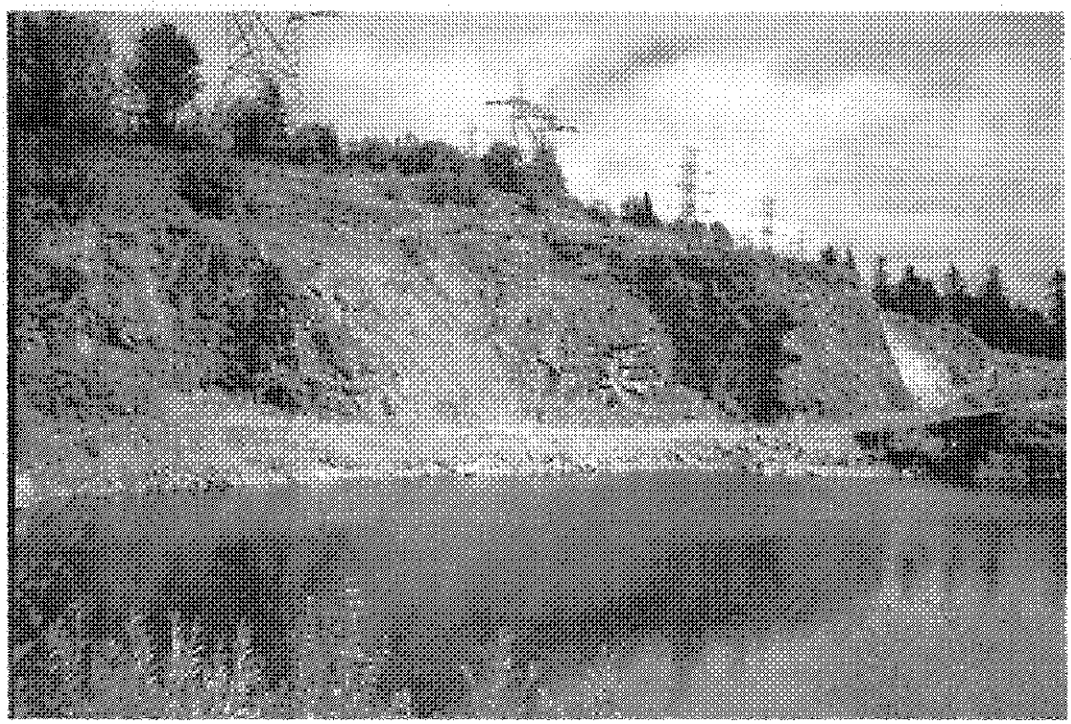
Christopher Robinson
Geologist, BPA/ TNSE

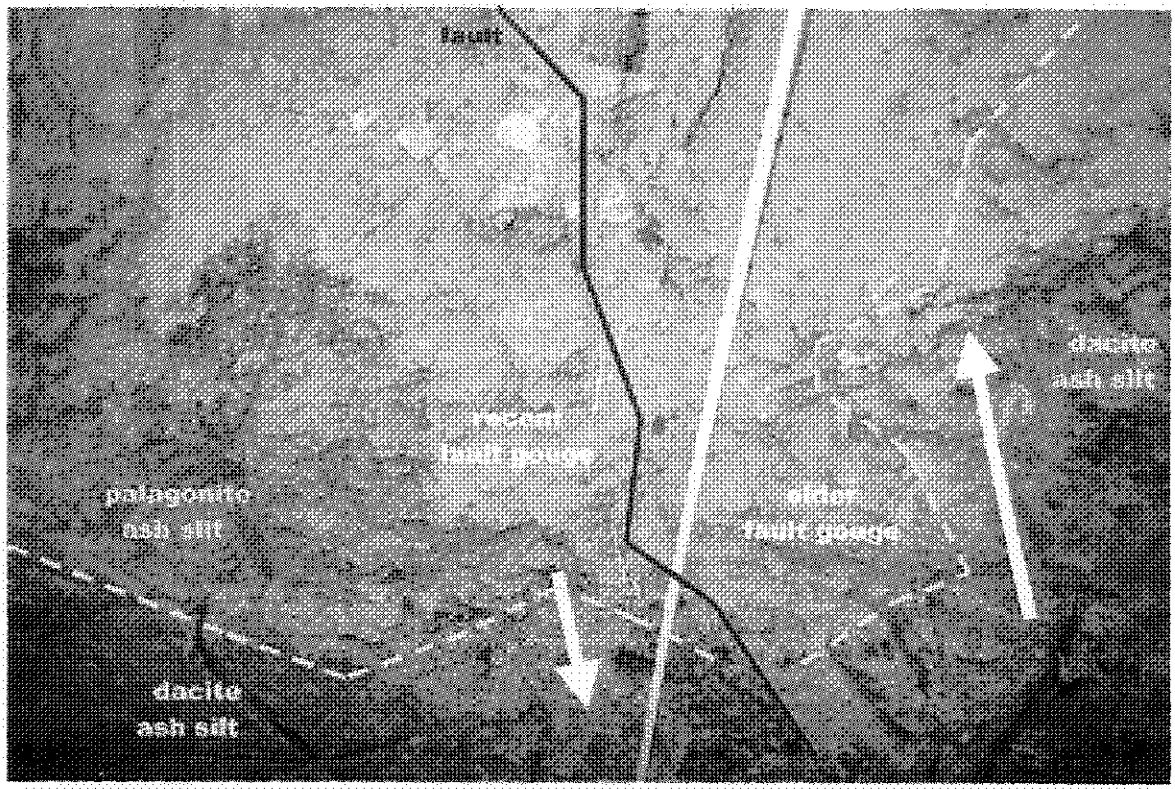
cc:
F.Worth, TN
J. Rustvold -TN
Official File - TNSE

PHOTOGRAPHS



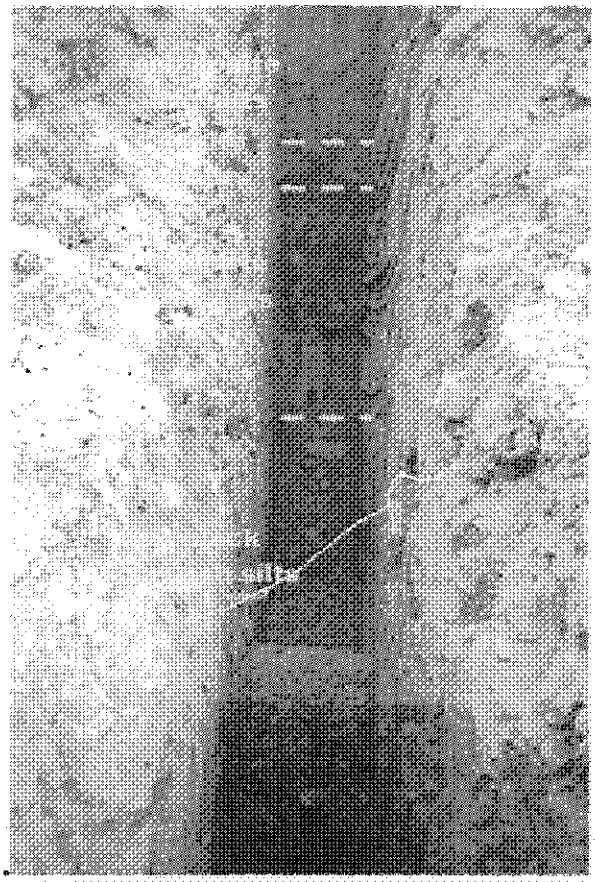
Northeast view from quarry looking up-slope at structure #46/1(second structure from left). Note exposures of bedding plane slip surfaces, recent talus sloughing in the quarry, and adjacent weathered hackly basalt slopes(below).



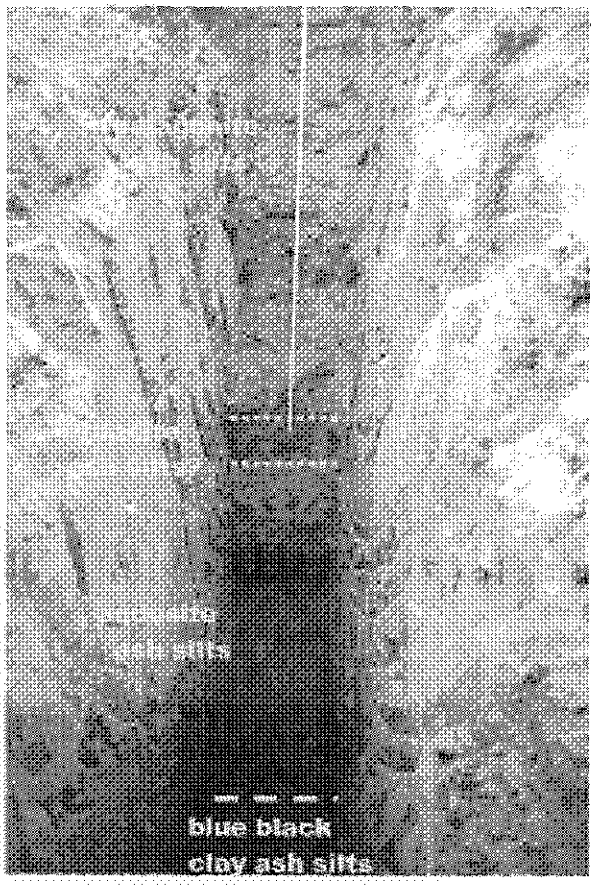


Test Pit #1: Cross-cut of fault scarp under structure #46/1 at the west wall of TP-1. Note approx. 3 ft total vertical displacement in ash silt layer and fault gouge in scarp.

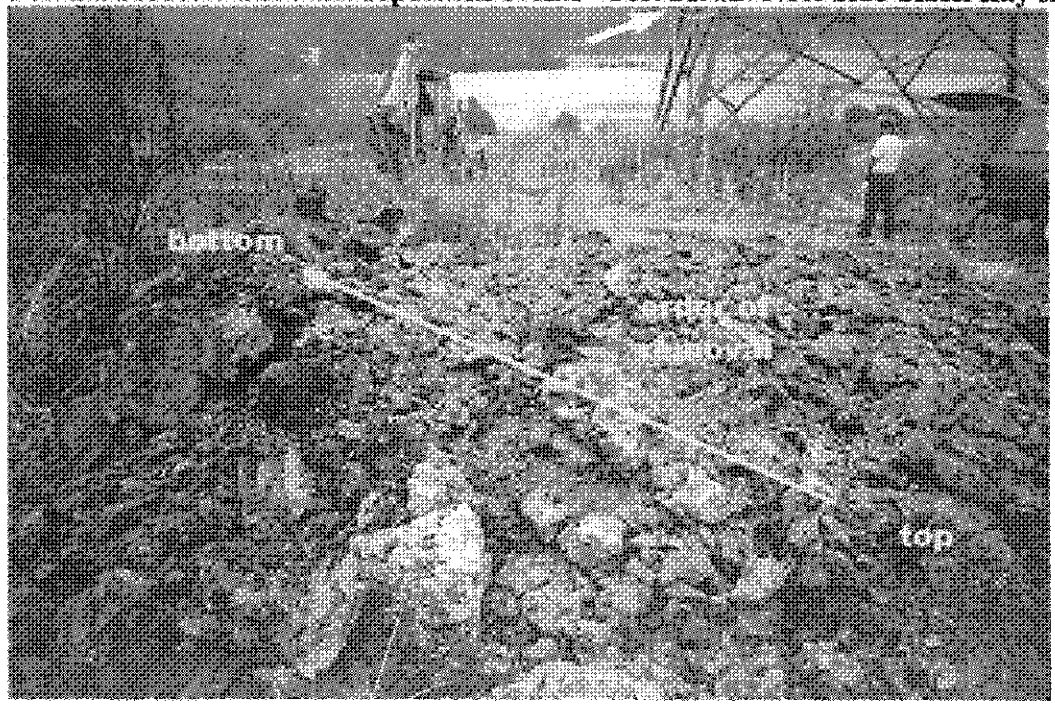
Test Pit #1: West view of excavation material –palagonite ash silts surface material, and blue-black estuarial deposit clay silts at the right.



Test Pit #1: Note three ash deposition events

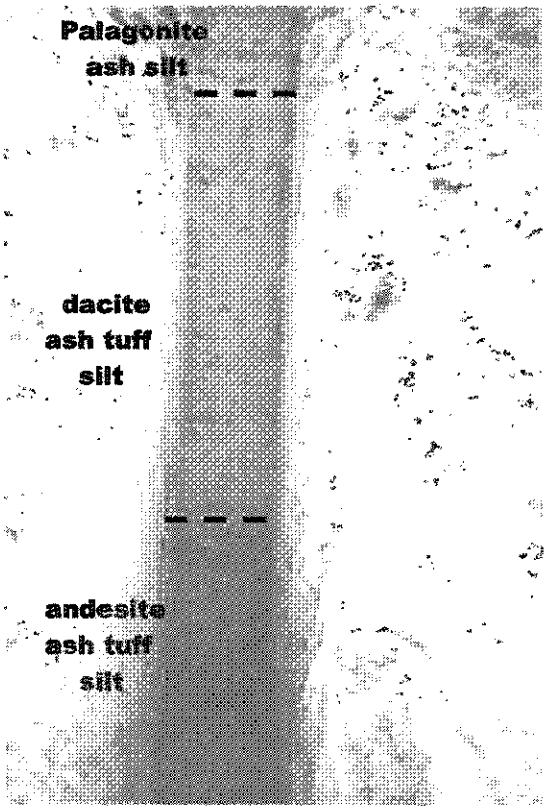


Test Pit #2: Note blue-black clay silts at base



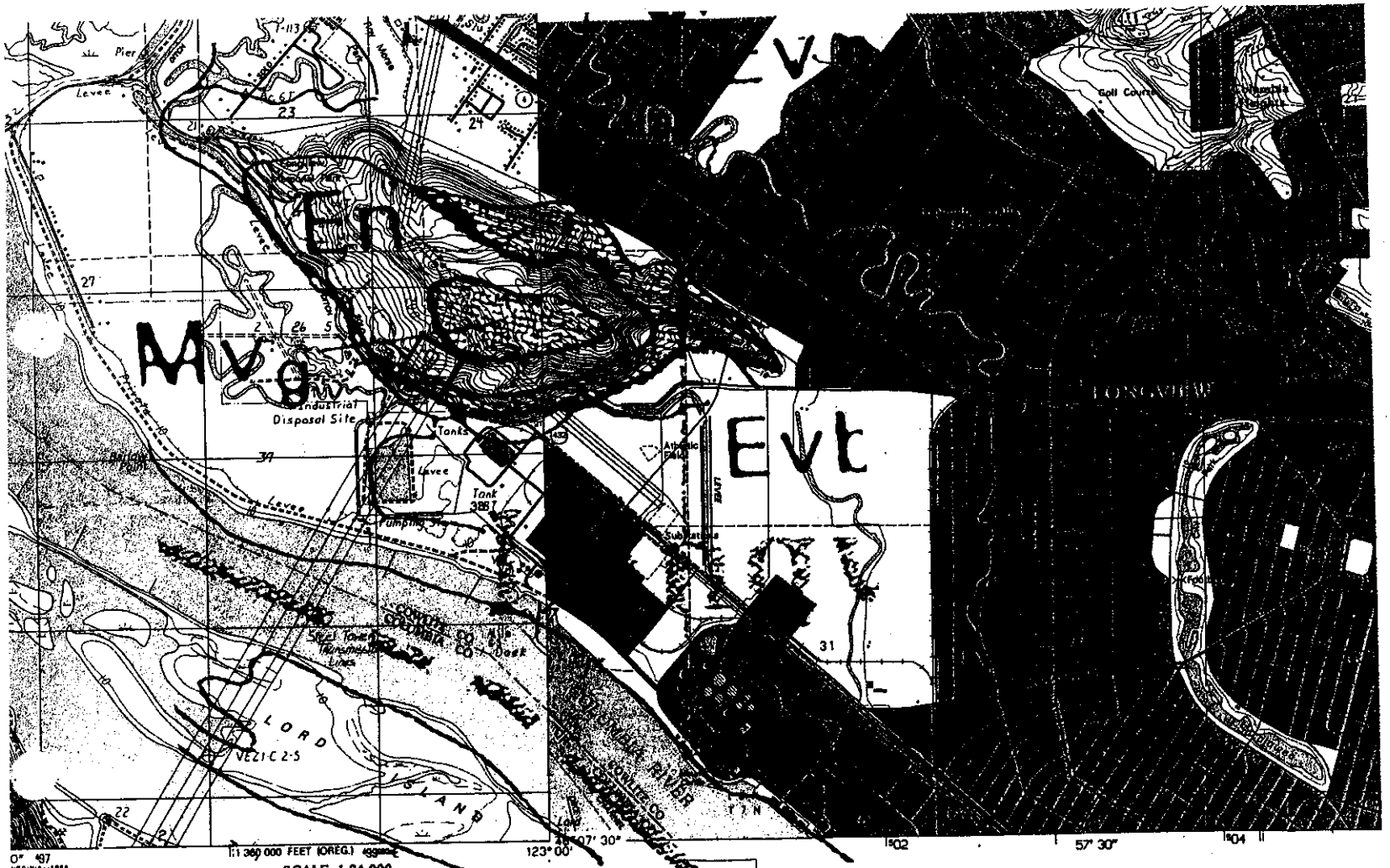
Test Pit #2: View south over pit. Note separate ash silt materials in tailings (foreground to back)in order of removal and bent cross member in the tower structure #46/1 (top right).

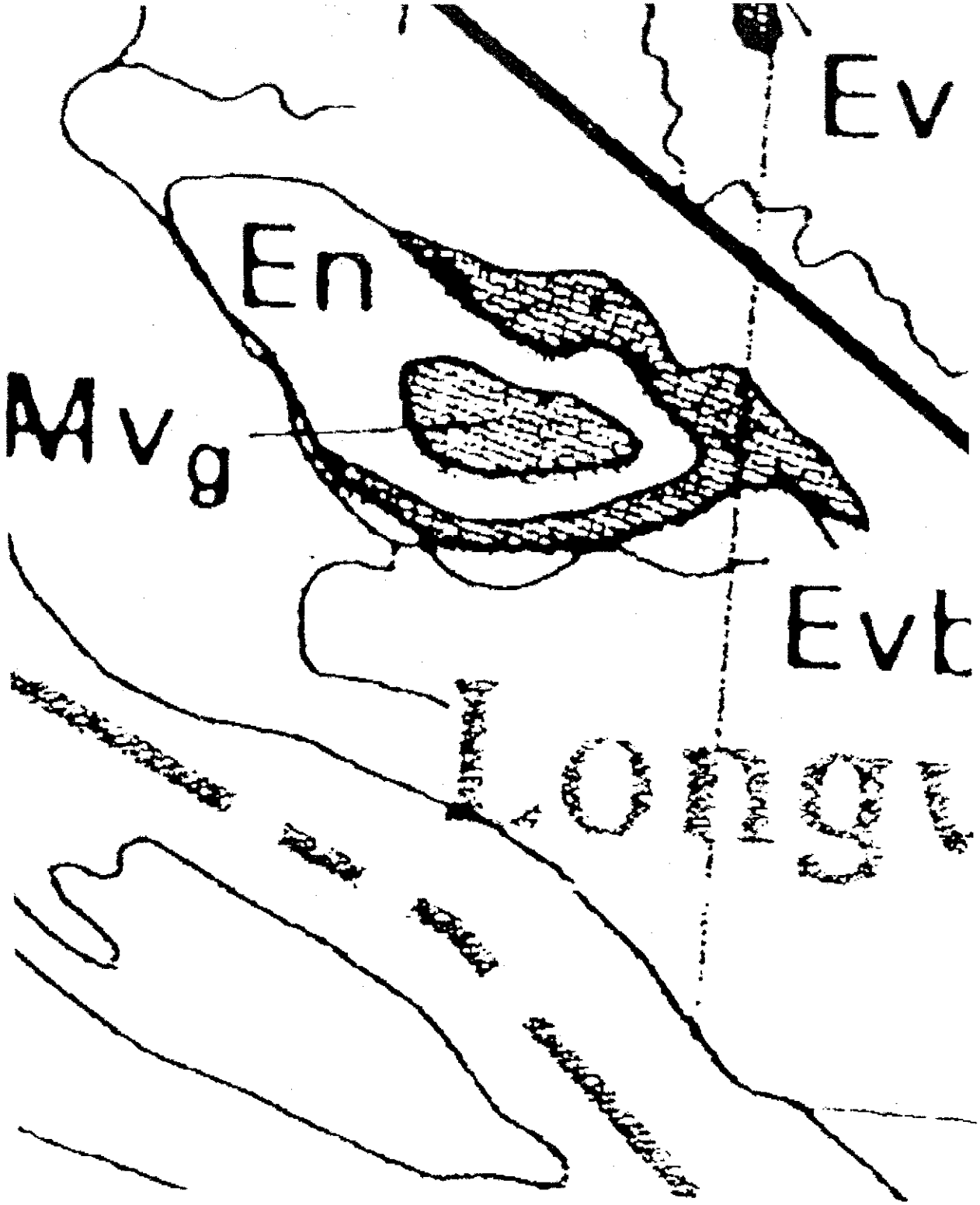
Test Pit #3: Red palagonite ash silt tailings(front) and lighter dacite ash (back of pile).



Test Pit #3: Note separate ash layers, no blue-black estuarial deposit

SITE LOCATION
PAUL-ALSTON LINE 1
Structure #46/1

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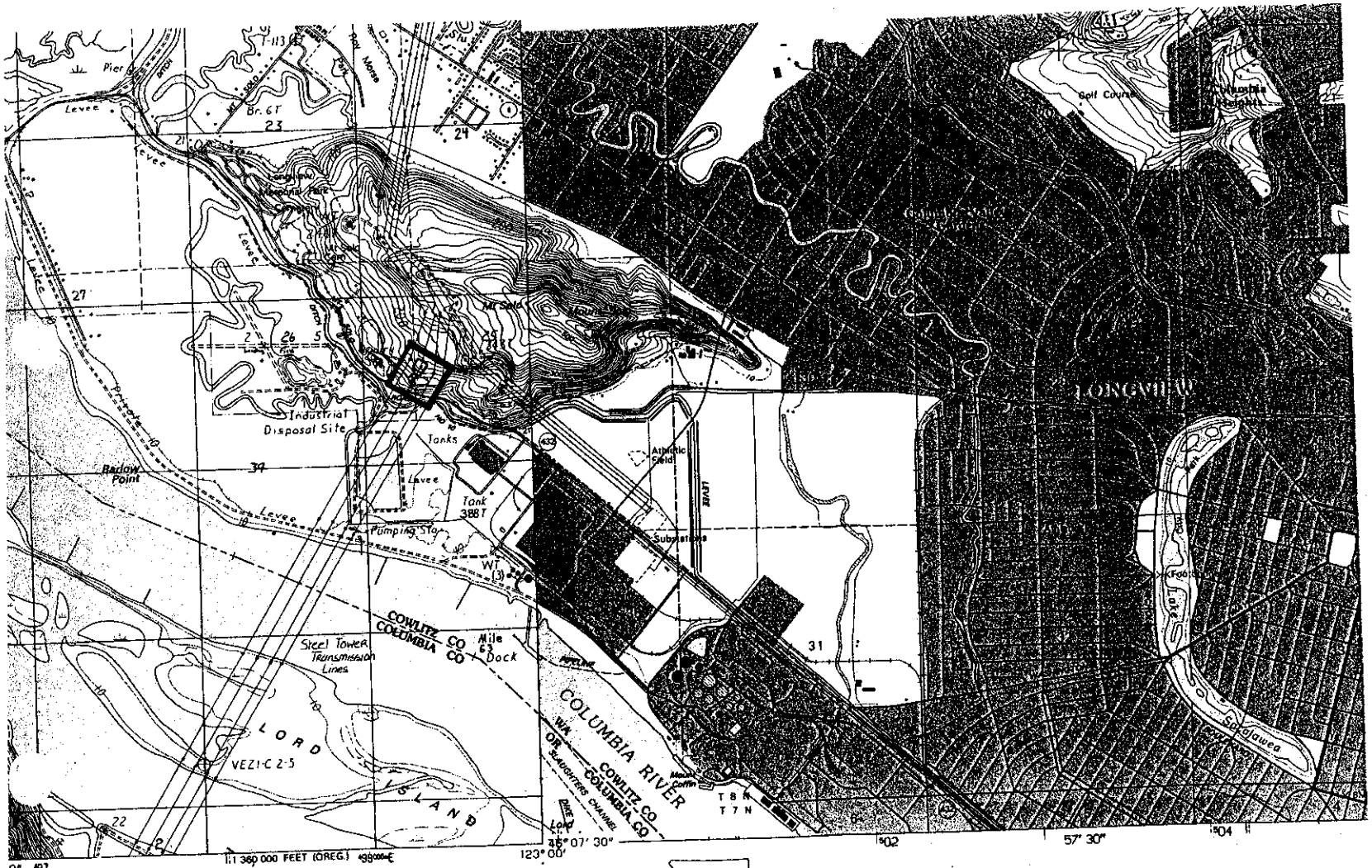

SCALE 1:24 000

KILOMETERS
METERS
MILES
FEET

WASHINGTON

QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

1 Elochoman Lake
2 Abernathy Mtn.
3 Castle Rock
4 Oak Point
5 Kalso
6 Clatskanie
7 Delena
8 Rainier

ADJOINING 7.5' QUADRANGLE NAMES

ROAD LEGEND

Improved Road
Unimproved Road
Trail
Interstate Route
U.S. Route
State Route

CONTOUR INTERVAL 20 FEET
SUPPLEMENTARY CONTOUR INTERVAL 10 FEET
CONTROL ELEVATIONS SHOWN TO THE NEAREST 0.1 FOOT
OTHER ELEVATIONS SHOWN TO THE NEAREST FOOT
To convert meters to feet multiply by 3.2808
To convert feet to meters multiply by 0.3048
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 4 FEET

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092

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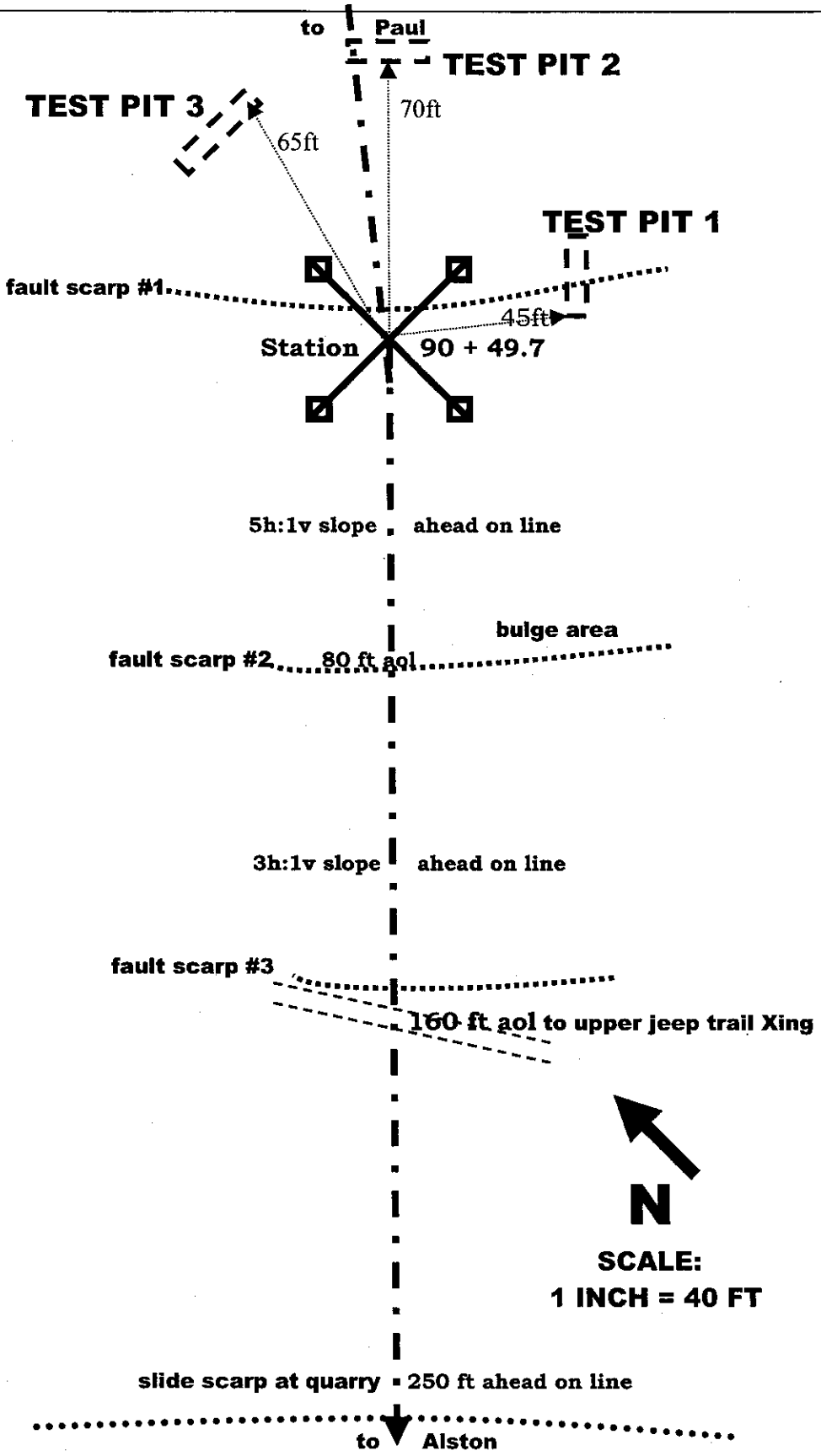
2

COAL CREEK, WASH. – OREG.
PROVISIONAL EDITION 1985
46123-B1-TF-024

SITE LOCATION
PAUL-ALSTON LINE 1
Structure #46/1

TEST PIT LOCATIONS

PAUL-ALSTON STRUCTURE #46/1



Test Pit and Bore Hole Log Legend

Name and USCS Symbol- Based on Unified Soil Classification System, ASTM D 2487-90, 2488-90.

Color- Visual observation.

Moisture- Dry: Absence of moisture, dusty, dry to touch
Damp: Enough moisture to darken color of soil
Moist: Clearly moist throughout, fully softened fines
Wet: Fully saturated, free water in soil

Consistency of Fines-

Consistency	thumb penetration	N value (SPT)	c cohesion (psf)
very soft	> 1 inch	0-2	0-250
soft	1/2 to 1 inch	2-5	250-500
med. stiff/Firm	1/4 to 1/2 inch	5-10	500-1000
stiff	up to 1/4 inch	10-20	1000-2000
very stiff	thumbnail only	20-30	2000-4000
hard	thumbnail unable	>30	>4000

Relative Density of Clean Sands and Gravels-

Relative Density	N value (SPT)
very loose	0-4
loose	4-10
med. dense	10-30
dense	30-50
very dense	>50

Granular Grain Sizes-

		US sieve size	Metric
Sand	fine	No. 200 - No 40	0.074 - 0.42 mm
	medium	No. 40 - No. 10	0.42 - 2 mm
	coarse	No. 10 - No. 4	2 - 4.75 mm
Gravel	fine	No. 4 - 3/4 inch	4.75 - 19 mm
	coarse	3/4 - 3 inch	19 - 75 mm
Cobbles		3 - 12 inch	75 - 305 mm
Boulders		>12 inch	> 305 mm

SPT- Standard Penetration Test, ASTM D 1586-84

Dry Density from disturbed samples obtained during SPT testing is not very accurate, best used for relative comparison between layers.

Stratification Lines shown on the logs represent approximate boundaries between soil types and the actual in situ transition may be gradual vertically or discontinuous laterally.

Conversions-

1 lb/ft^3 = 16.018 kg/m^3
1 kN/m^3 = 6.367 lb/ft^3
1 ft = 0.3048 m
1 in = 0.0254 m
1 kN/m^2 = 20.89 lb/ft^2
1 kN/m^2 = 1 kPa

Log of Test Pit (TP) or Bore Hole (BH) No. -TP-1

Project:	- PAUL-ALSTON #1 Structure 46/1
Location:	- 25ft East of Structure
Ground Elevation:	- 170 ft AMSL
Excavation Method:	- Case 580 Super C Backhoe
Depth to Water:	- No groundwater encountered
Date:	- 09/19/02
Logged By:	- WCR

Depth feet	Graphic Log	USCS Symbol	Soil Classification	Sample No.	Torvane & Penetrom. tsf	Dry Density pcf	Plastic Index	Liquid Limit %	Water Content %
0.2		ML	Weathered Scoria Ash deposit, 10% Organics						
		MH	ELASTIC SILT w/SAND; palagonite ash	1-1	τ_s =	93.2	11.5	62	18.2
			<2%gravel; 6% sand;93%fines	3-1	<0.1 - >2.0(aggreg)				
2			Soft, moist,mottled, permeable		q_u = <0.1 - >4.5(aggreg)				
3			orange + brownish yellow components						
		CL	LEAN CLAY w/SAND; palagonite ash;	1-2	τ_s = 0.49	64.1	20	43	36.5
4			28% sand;72% fines; soft, massive structure,		q_u = 1.6				
6			yellow-brown						
7									
		ML	SILT; weathered dacite ash tuffs;	1-3	τ_s =	92.0	7.6	32	24
8			4% sand; 96% fines; med. stiff; massive;		0.69 - 1.15				
8.7			damp, lt.brown						
		MH	ELASTIC SILT; lt. gray w/orange mottling, med.stiff, massiv			59.0	57.5	101.6	67
9.5			9.7% fine sand; 87.5% silt; 2.8% clay fines;	2-	τs = 0.74, q_u = 1.6				
10		CL	LEAN CLAY andesite ash deposit	2-2	τ_s = 0.83	66.0	11	33	58.8
			3.8% fine sand; 96.2% fines;		q_u = >4.5				
			Very stiff; massive, damp,						
12			gray w/some orange mottling						
		ML	SILT; anoxic gray-blue estuarine deposit;	2-3	τ_s = 1.06	66.4	7.6	32	52
			4.4% fine sand; 95.6% fines		q_u = 3.075				
14			very stiff, massive, moist, bluish gray						
15			Bottom of Test Pit - No bedrock encountered		τ_s =				
		ML	SILT; very weathered, fr. dacite ash tuff	2-4	0.3 - 2.0	102.4	7.6	32	24.5
16			>90% fines; very stiff,massive, moist, lt. brown		q_u =>4.5				
			GEOLOGIC INTERPRETATION:						
			Volcanic ash deposits(four separate events)						
18			on highly weathered basalt intrusives						

Remarks:

*Unified Soil Classification System(ASTM # D-2487, D-2488), Spec.Grav.(D-854), Hydrometer (D-422)
Atterberg limits(ASTM D-421), Moist Density-Mod. Proctor(D-1557)
Dry Density obtained from hammer-driven modified Shelby tube samples (ASTM D-1587)

Legend: Clay, Silt, Sand, Gravel

Log of Test Pit (TP) or Bore Hole (BH) No. -TP-2

Project:	- PAUL-ALSTON #1 Structure 46/1
Location:	- 70ft Back on Line from str. #46/1
Ground Elevation:	- 174 ft AMSL
Excavation Method:	- Case 580 Super C Backhoe
Depth to Water:	- No groundwater encountered
Date:	- 09/19/02
Logged By:	- WCR

Depth meters	Graphic Log	USCS Symbol	Soil Classification	Sample No.	Torvane & Penetrom. tsf	Dry Density pcf	Plastic Index	Liquid Limit %	Water Content %
0.2		ML	Weathered Scoria Ash deposit, 10% organics						
		MH	ELASTIC SILT w/SAND; palagonite ash;	1-1	τ_s =	93.2	11.5	62	18.2
			<2% gravel; 6% sand; 93%fines	3-1	<0.1 - >2.0(aggreg)				
2			Soft, moist, mottled, permeable		q_u = < 0.1 - >4.5(aggreg)				
			orange + brownish yellow components						
4									
5					τ_s = 0.49				
		CL	LEAN CLAY w/SAND; palagonite ash;	1-2	q_u = 1.6	64.1	20	43	36.5
6			28% fine sand; 72%fines, soft, massive, damp, yellow-brown						
		MH	ELASTIC SILT; lt.gray w/ orange mottling;	2-1	τ_s = 0.74	59.0	57.5	101.5	66.8
			9.7% fine sand; 87.5% silt; 2.8% clay fines;		q_u = 1.6				
7.5			Very stiff; massive, damp, impermeable						
8		CL	LEAN CLAY; andesite ash deposit	2-2	τ_s = 0.83	66.0	11	33	58.8
			3.8% fine sand; 96.2% fines;		q_u = >4.5				
			Very stiff; massive, damp;						
10			gray w/ some orange mottling						
11.5									
12		ML	SILT; anoxic blue-gray estuarine deposit;	2-3	τ_s = 1.06	66.4	7.6	32	52
			4.4% fine sand; 95.6% fines		q_u = 3.075				
			very stiff, massive, moist, bluish-gray						
14			bottom of Test Pit - No bedrock encountered						
		ML	SILT;very weathered, fr. dacite ash tuffs	2-4	τ_s =	102.4	7.6	32	24.5
			>90% fines; very stiff, massive, moist, lt. brown		0.3 - 2.0				
16					q_u = >4.5				
			GEOLOGIC INTERPRETATION:						
			Volcanic ash deposits(four separate events)						
18			on highly weathered basalt intrusives						

Remarks:

*Unified Soil Classification System(ASTM # D-2487, D-2488), Spec.Grav.(D-854), Hydrometer (D-422)
Atterberg limits(ASTM D-421), Moist Density-Mod. Proctor(D-1557)
Dry Density obtained from hammer-driven modified Shelby tube samples (ASTM D-1587)

Legend: Clay, Silt, Sand, Gravel

Log of Test Pit (TP) or Bore Hole (BH) No. -TP-3

Project:	- PAUL-ALSTON #1 Structure 46/1
Location:	- 65ft NNW from str. #46/1
Ground Elevation:	- 172 ft AMSL
Excavation Method:	- Case 580 Super C Backhoe
Depth to Water:	- No groundwater encountered
Date:	- 09/19/02
Logged By:	- WCR

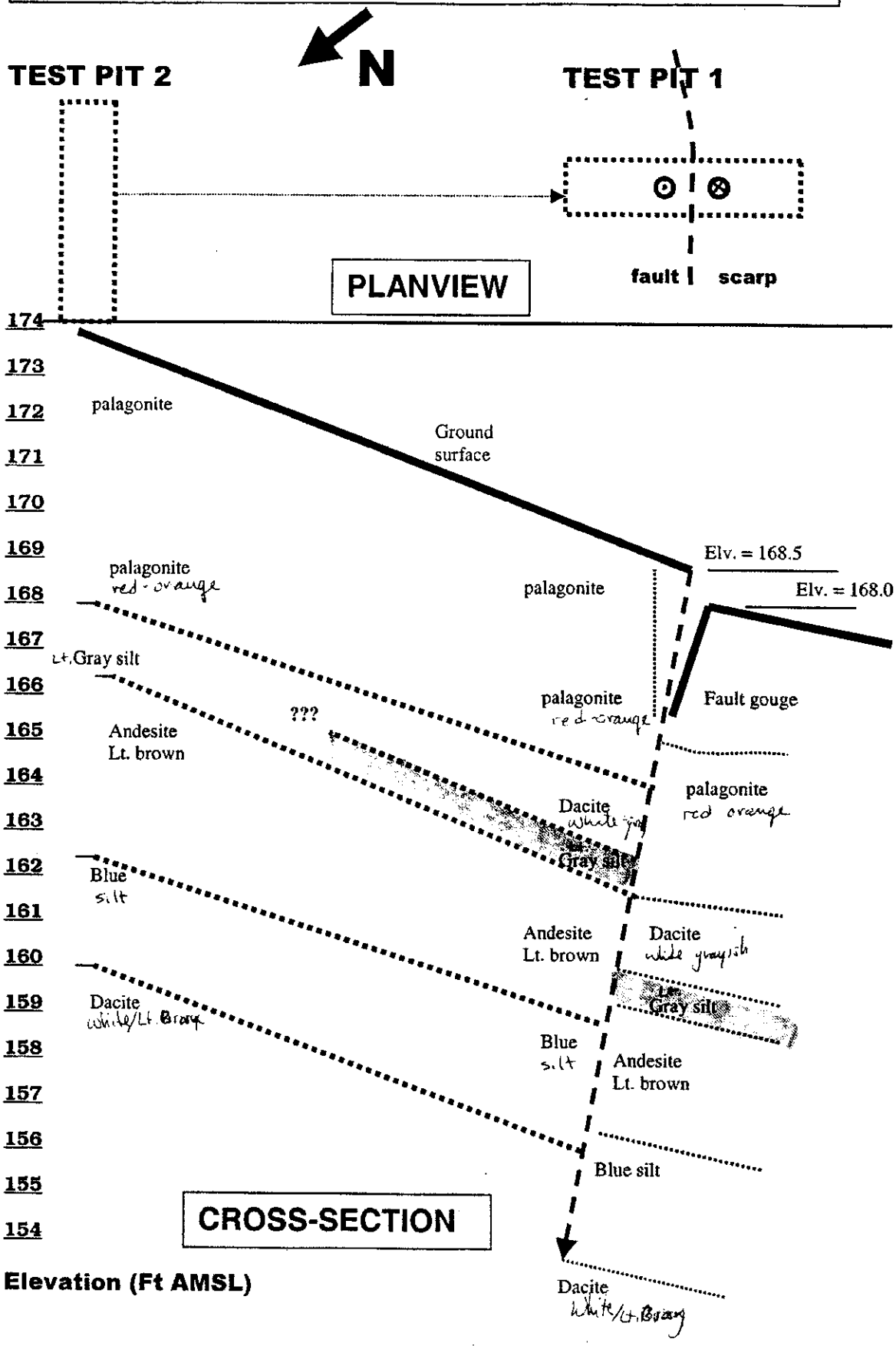
Depth meters	Graphic Log	USCS Symbol	Soil Classification	Sample No.	Torvane & Penetrom. tsf	Dry Density pcf	Plastic Index	Liquid Limit %	Water Content %
0.2		ML	Weathered Scoria Ash deposit, 10% organics						
		MH	ELASTIC SILT w/SAND; palagonite ash	1-1	τ_s =	93.2	11.5	62	18.2
			<2% gravel; 6% fine sand; 93%fines;	3-1	<0.1 - >2.0(aggreg)				
2			Soft, moist, mottled, permeable		q_u = < 0.1 - >4.5(aggreg)				
3			orange + brownish yellow components						
		ML	SILT; weathered dacite ash tuffs;	1-3	τ_s =	92.0	7.6	32	24
4			4% sand, 96% fines; very stiff, massive, damp;		0.69 -1.15				
			lt.brown w/some orange mottling						
6									
8				2-1					
		MH	ELASTIC SILT;lt.gray w/orange mottling;very stif		τ_s = 0.74	59.0	57.5	101.5	66.8
8.5			9.7% fine sand; 87.5% silt; 2.8% clay fines; damp		q_u = 1.6				
		CL	LEAN CLAY; andesite ash deposit;	2-2	τ_s = 0.83	66.0	11	33	58.8
10			3.8% fine sand; 96.2% fines;		q_u = >4.5				
			Very stiff; massive, damp;						
			gray w/ some orange mottling						
12									
			GEOLOGIC INTERPRETATION:						
			Volcanic ash deposits(four separate events)						
14			on highly weathered basalt intrusives						
15.5			bottom of Test Pit - No bedrock encountered						
16		ML	SILT;very weathered, fr. dacite ash tuff	2-4	τ_s =				
			>90% fines; very stiff, massive, moist, lt. brown		0.3 - 2.0	102.4	7.6	32	24.4
					q_u = >4.5				
18									

Remarks:

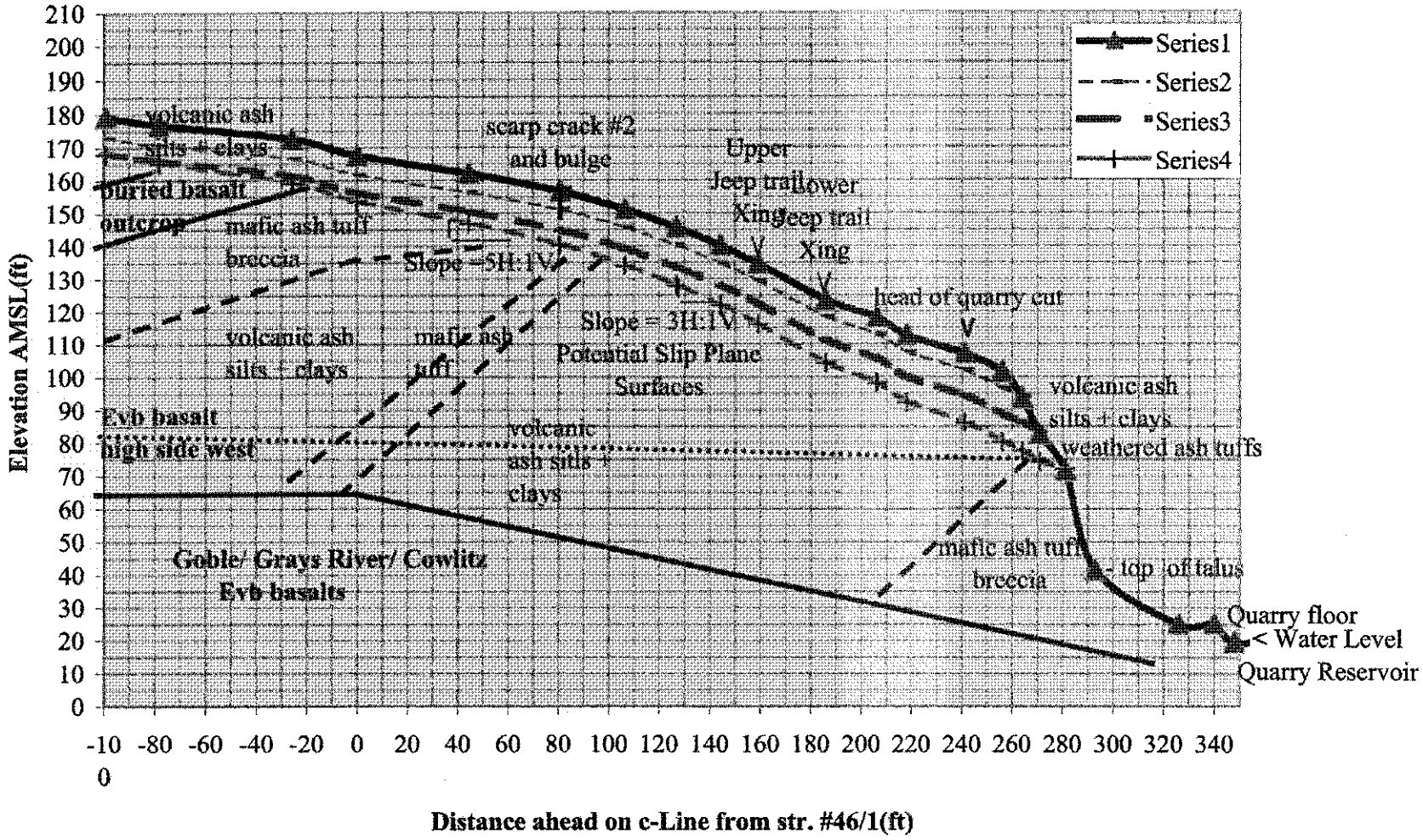
*Unified Soil Classification System(ASTM # D-2487, D-2488), Spec.Grav.(D-854), Hydrometer (D-422)
Atterberg limits(ASTM D-421), Moist Density-Mod. Proctor(D-1557)
Dry Density obtained from hammer-driven modified Shelby tube samples (ASTM D-1587)

Legend: Clay, Silt, Sand, Gravel

SCARP #1 CROSS-SECTION
PAUL-ALSTON STRUCTURE #46/1



PAUL-ALSTON Line #1 Str. #46/1 c-Line Cross-Section



DETERMINISTIC LEVEL I STABILITY ANALYSIS

Infinite Slope Equation

	Soil depth (ft)	15.00
	Surface slope (%)	33.00
	Tree surcharge (psf)	20.00
	Root cohesion (psf)	20.00
	Groundwater ratio	0.90 FULL SAT.
	Friction angle (deg)	22.00
	Soil cohesion (psf)	1500.00
	Dry unit weight (pcf)	92.00
	Moisture content (%)	67.00
	Specific gravity	2.71
SOLVE FOR	Factor of safety	

Factor of safety	Dry unit wt. (pcf)	Moist unit wt. (pcf)	Saturated unit wt. (pcf)	Saturated moist. cont. (pcf)	Moisture content (%)
3.46	92.00	120.45	120.45	30.93	30.93

DETERMINISTIC LEVEL I STABILITY ANALYSIS

Infinite Slope Equation

	Soil depth (ft)	15.00
	Surface slope (%)	33.00
	Tree surcharge (psf)	20.00
	Root cohesion (psf)	20.00
	Groundwater ratio	0.01 Dry
	Friction angle (deg)	30.00
	Soil cohesion (psf)	1500.00
	Dry unit weight (pcf)	92.00
	Moisture content (%)	67.00
	Specific gravity	2.71
SOLVE FOR	Factor of safety	

Factor of safety	Dry unit wt. (pcf)	Moist unit wt. (pcf)	Saturated unit wt. (pcf)	Saturated moist. cont. (pcf)	Moisture content (%)
4.54	92.00	120.45	120.45	30.93	30.93

DETERMINISTIC LEVEL I STABILITY ANALYSIS

Infinite Slope Equation

	Soil depth (ft)	12.00
	Surface slope (%)	33.00
	Tree surcharge (psf)	20.00
	Root cohesion (psf)	20.00
	Groundwater ratio	0.90 FULL SAT.
	Friction angle (deg)	22.00
	Soil cohesion (psf)	2000.00
	Dry unit weight (pcf)	66.00
	Moisture content (%)	67.00
	Specific gravity	2.71
SOLVE FOR	Factor of safety	

Factor of safety	Dry unit wt. (pcf)	Moist unit wt. (pcf)	Saturated unit wt. (pcf)	Saturated moist. cont. (pcf)	Moisture content (%)
5.92	66.00	104.05	104.05	57.65	57.65

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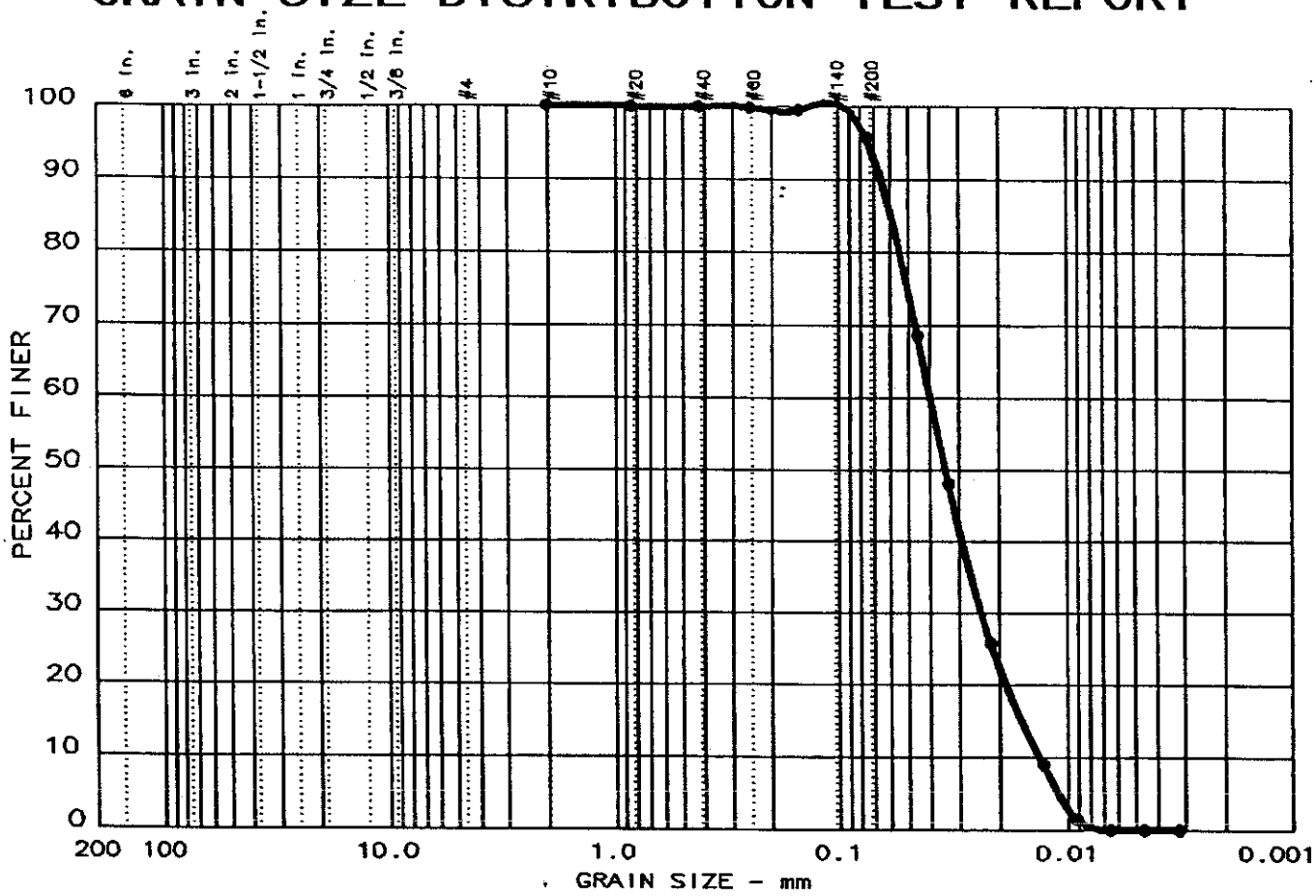
DETERMINISTIC LEVEL I STABILITY ANALYSIS

Infinite Slope Equation

	Soil depth (ft)	12.00
	Surface slope (%)	33.00
	Tree surcharge (psf)	20.00
	Root cohesion (psf)	20.00
	Groundwater ratio	0.01
	Friction angle (deg)	22.00
	Soil cohesion (psf)	2000.00
	Dry unit weight (pcf)	66.00
	Moisture content (%)	67.00
	Specific gravity	2.71
SOLVE FOR	Factor of safety	

Factor of safety	Dry unit wt. (pcf)	Moist unit wt. (pcf)	Saturated unit wt. (pcf)	Saturated moist. cont. (pcf)	Moisture content (%)
6.57	66.00	104.05	104.05	57.65	57.65

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	3	0.0	0.0	4.4	95.6	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	32.1	7.6			0.03	0.024	0.0160	0.0133	1.08	3.0

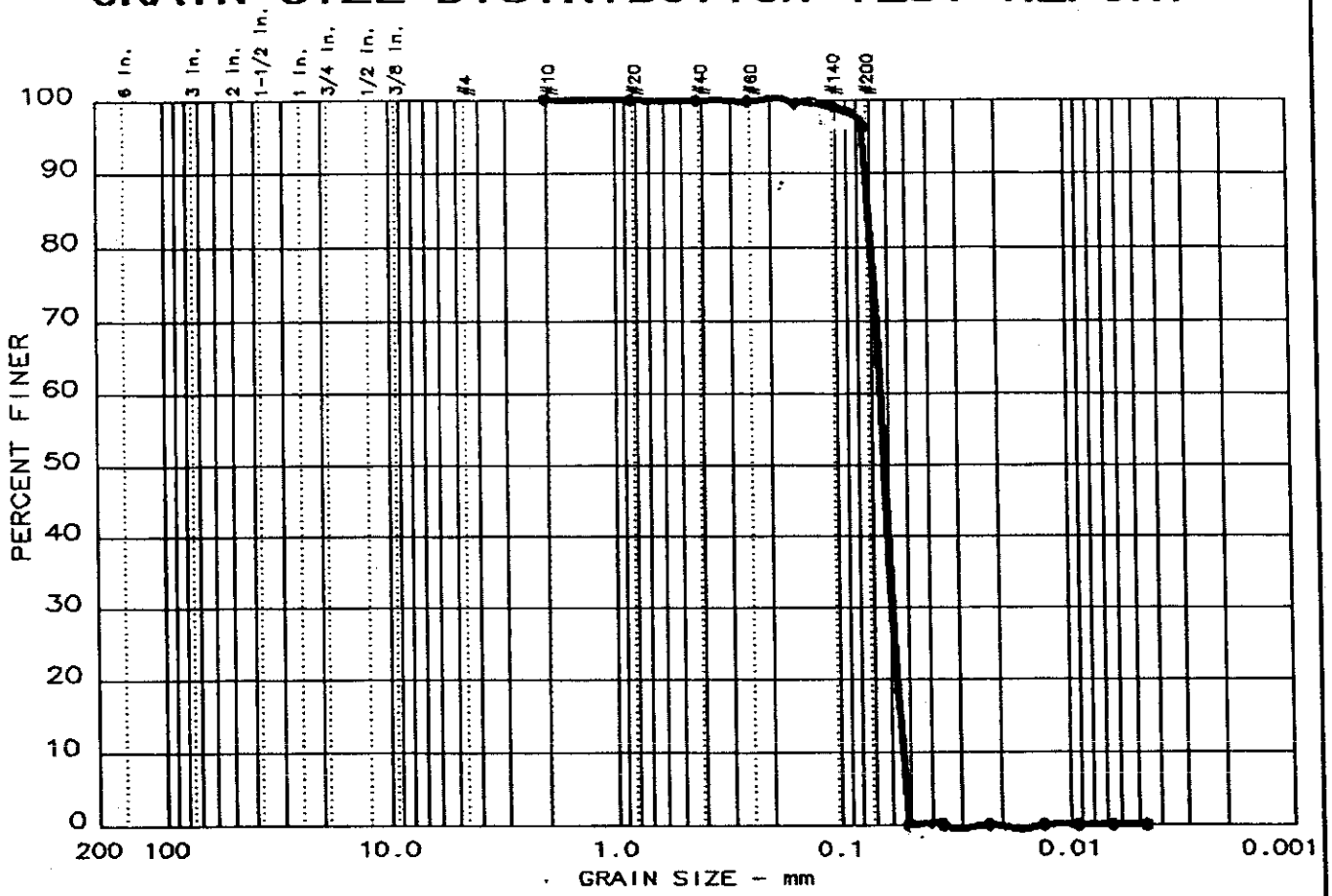
MATERIAL DESCRIPTION	USCS	AASHTO
● SILT: Dark Gray-Blue anoxic	ML	A-4(7.9)

Project No.: S0-02001
Project: PAUL-ALSTON LINE No.1 str. #46/1
● Location: TP-2, 12-14ft depth
(Pit #1) Sample #2-3
Date: 10-18-2002

Remarks:
Nat. Moist = 52.2%
Assumed Spec Grav = 2.75
Drk GRAY-BLUE 10YR 4/1
DRY DENSITY = 66.4 pcf
- HCL rxn
Figure No. 1A

GRAIN SIZE DISTRIBUTION TEST REPORT
BONNEVILLE POWER ADMINISTRATION

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	4	0.0	0.0	3.8	96.2	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	33.1	11			0.06	0.058	0.0554	0.0542	0.98	1.2

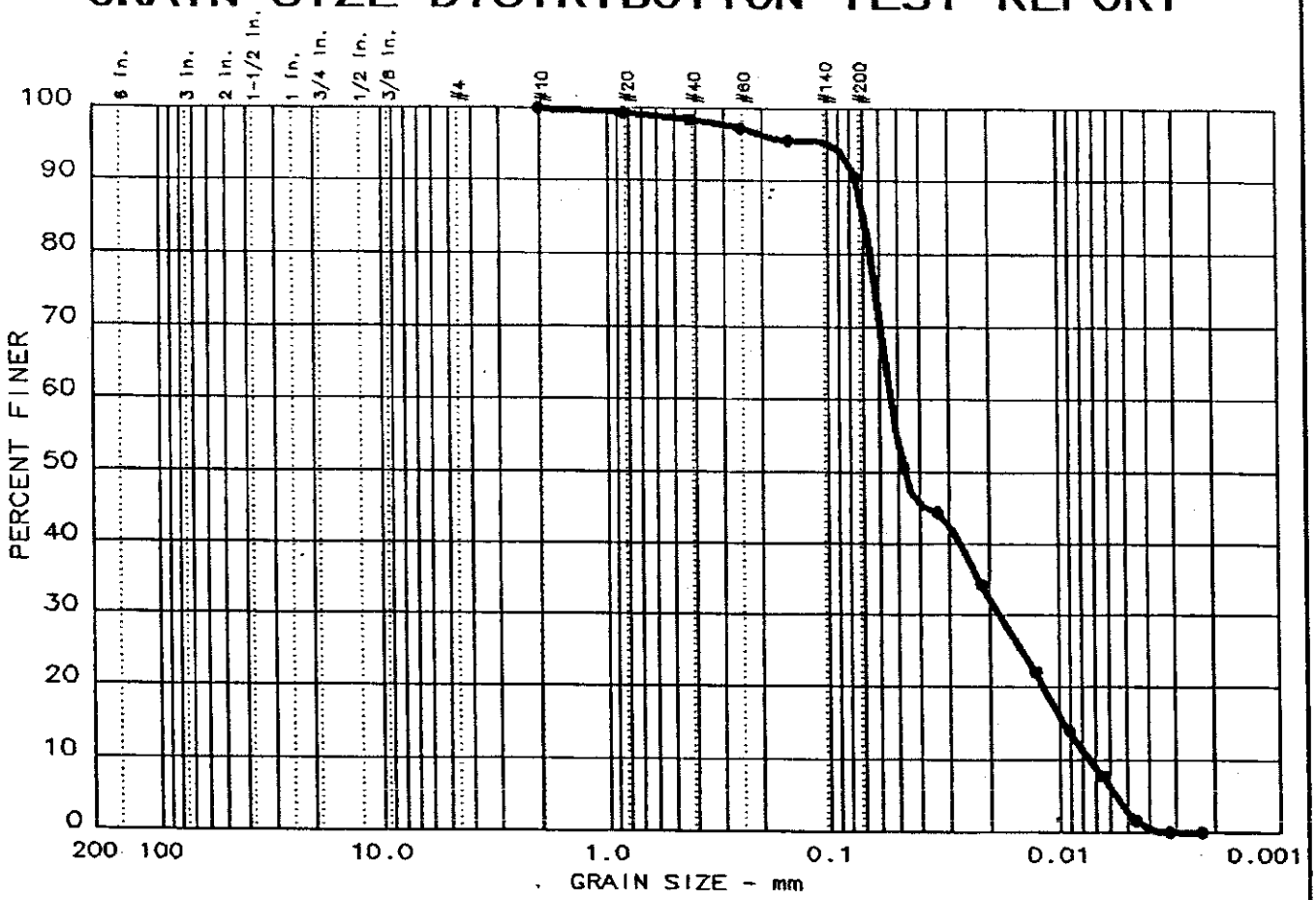
MATERIAL DESCRIPTION	USCS	AASHTO
● LEAN CLAY	CL	A-6(10.5)

Project No.: SO-02002
Project: PAUL-ALSTON Line 1, str. #46/1
● Location: TP-1,TP-2 7.5-11.5ft depth
(Colls #2, 2A) Sample #2-2, 2-4
Date: 10-18-2002

GRAIN SIZE DISTRIBUTION TEST REPORT
BONNEVILLE POWER ADMINISTRATION

Remarks:
Nat. Moist = 58.8%
Assumed Spec grav = 2.71
~~Lt Brown~~ Gray 10YR 6/2
DRY DENSIY = 66.0 pcf
-HCL rxn
Figure No. 2A

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	6	0.0	0.0	9.7	87.5	2.8

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	101.6	57.5			0.05	0.018	0.0095	0.0073	0.85	7.3

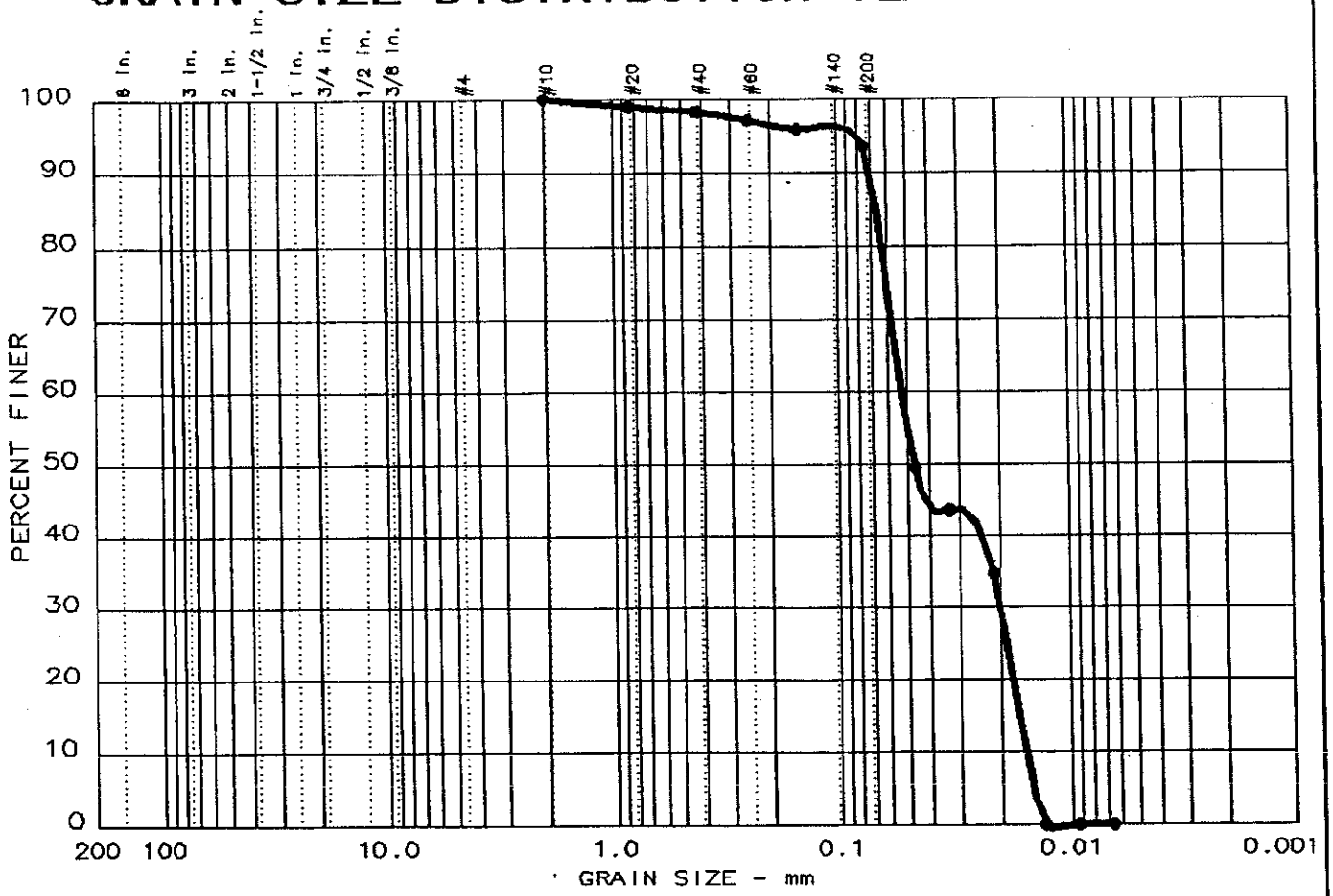
MATERIAL DESCRIPTION	USCS	AASHTO
● ELASTIC SILT	MH	A-7-5(57.1)

Project No.: SO-02003
Project: PAUL-ALSTON Line 1, str. #46/1
● Location: TP-2; 2-6ft depth
(Cells # 1A, 7A) Sample #2-1
Date: 10-18-2002

GRAIN SIZE DISTRIBUTION TEST REPORT
BONNEVILLE POWER ADMINISTRATION

Remarks:
Nat. Moist=66.8%
Assumed Spec Grav = 2.75
Lt.Gray 10YR 7/2
DRY DENSITY =59.0 pcf
-HCL rxn
Figure No. 3A

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	7	0.0	0.0	6.6	93.4	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	62.0	11.5			0.05	0.020	0.0168	0.0158	0.48	3.3

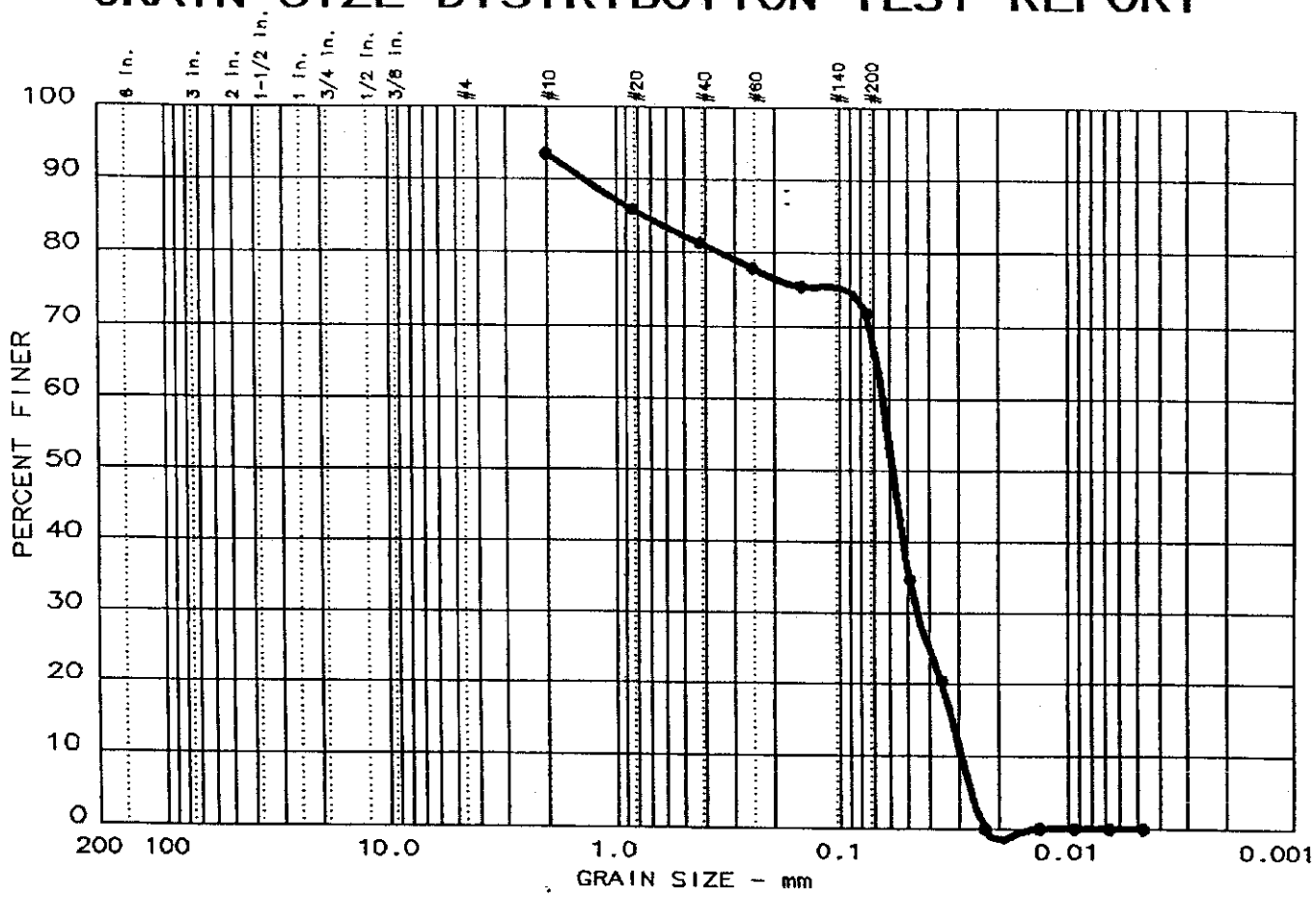
MATERIAL DESCRIPTION	USCS	AASHTO
● ELASTIC SILT (palagonite ash)	MH	A-7-5(19.5)

Project No.: SO-02004
Project: PAUL-ALSTON Line 1,str. #46/1
● Location: TP-1 @ 0.5-8ft depth; TP-3 @ 2-3ft depth
(Cells #3A,6A) Sample #1-1, 3-1
Date: 10-18-2002

GRAIN SIZE DISTRIBUTION TEST REPORT
BONNEVILLE POWER ADMINISTRATION

Remarks:
Nat. Moist = 18.2%
Spec Grav = 2.71
Brown-Yellow 10YR 6/8
DRY DENSITY = 93.2 pcf
-HCL rxn
Figure No. _____

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	8	0.0	0.0	28.3	71.7	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	42.9	20.1	0.75		0.06	0.045	0.0318	0.0290	1.10	2.2

MATERIAL DESCRIPTION	USCS	AASHTO
● LEAN CLAY w/SAND (palogonite ash)	CL	A-7-6(12.1)

Project No.: SO-02005
Project: PAUL-ALSTON Line 1, str. #46/1
● Location: TP-1; 3-8ft depth
(Cell #4) Sample #1-2
Date: 10-18-2002

GRAIN SIZE DISTRIBUTION TEST REPORT
BONNEVILLE POWER ADMINISTRATION

Remarks:
Nat. Moist = 36.5%
Assumed Spec Grav = 2.66
YELLOW-BROWN 10YR 5/8
DRY DENSITY = 64.1pcf
-HCL rxn
Figure No. 5A

PAUL-ALSTON STR. #46/1
ADDENDUM FOR EXPLORATORY SEISMIC INVESTIGATION

JUNE 2, 2004

PROCEDURE

On June 2, 2004 an Exploratory Seismic Refraction Investigation was conducted in the vicinity of the tower structure 46/1, with three seismic cross-sections set perpendicular to the centerline of the ROW. Seismic line #1 was approx. 40 ft southwest along centerline. Seismic line #2 was underneath the centerline of the existing tower structure, and Seismic Line #3 was 80 ft North along centerLine of ROW. 12 geophones per line were set at 10-foot intervals along the cross-sections, with station #6 situated at the centerlines of ROW. A combination of 12-guage blanks and hammer/plate signals were used at stations 1, 3, 6, 9, and 12. The findings are shown in the attached velocity plot cross-sections, and a geological interpretation of the subsurface materials generating refractions were made, based on identification of the materials taken in the original three test pits, some subsequent inspections of the quarry below the structure, and the general geologic source information available.

INVESTIGATION

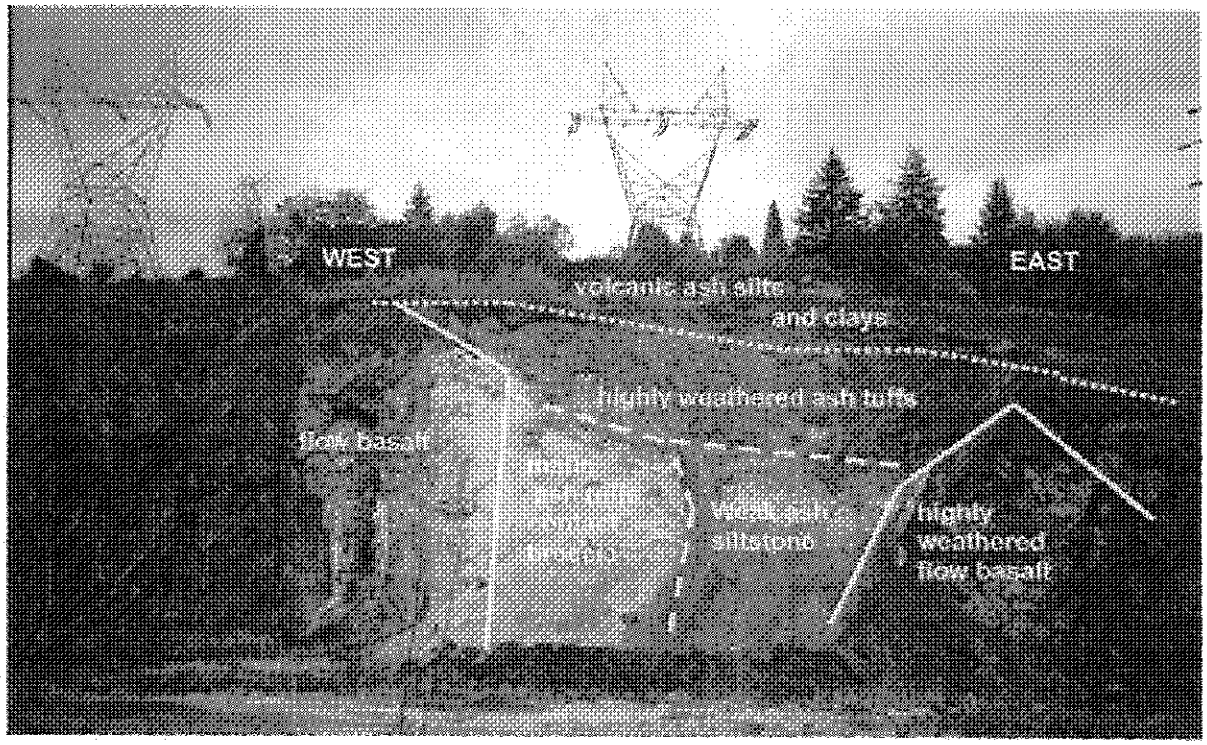
Comparison of the Exploratory Seismic Line Velocity data with the test pits and the open cross-section 250 ft below the tower structure at the quarry, together indicated consistency with the analysis of this 45-38 million-yr-old geological formation known as the Goble volcanics/Grays River/Cowlitz formation. This formation is comprised of clinopyroxene-phyric flow basalts interbedded with subaqueous deposited mafic ash tuffs, volcaniclastic silt breccias, and marine mica siltstone with carbonaceous(coal) seam deposits of nearly the same age.

Most of the subsurface materials located in the seismic study were mafic ash tuffs and volcaniclastic silts(and clays), deposited in conditions of extreme weathering under aqueous conditions some 40 million years ago, and are poorly consolidated/ compacted (Olympic Silt Loam/clay – USDA Soil Conservation Service class). They exhibit typically low shear strength, high compressibility, high shrink-swell potential, high corrosivity, and are highly subject to frost action. They also exhibit moderate-to-severe erosion hazard thus requiring surface stabilization.

At the top subsurface sections(see photo, below), the volcanic ash silts and clays have essentially little, if any shear strength(seismic headwave velocities of <1,100 ft/sec) and can absorb substantial amounts of runoff water over a long periods of exposure, thus adding to the overburden density(seismic headwave velocities of 3,800-5,800 ft/sec are consistant with this). The weathered ash tuff and siltstone materials below can be broken with hand strength and therefore exhibit low(1,100-1,500 ft/sec) seismic velocities. They are of relatively low effective shear strength/density and cannot be relied upon to withstand this extra weight, as well as performing anchor or footing functions. The surface slopes from the existing tower site to the quarry 250 ft downslope are approximately 1V:5H to 1V:3H here and thus exacerbate this already weak soils condition, for purposes of slope stability. Also, the toe of this slope has

already been removed through quarry activities and as such, there is added momentum downslope, opposed primarily by existing material consolidation strength.

Note that the basalt flow beds are nearly vertical in orientation(to 1V:2H slope) dipping northwest to southeast, with mafic ash tuffs and volcaniclastic silts pushed ahead of them into the marine mica siltstone materials under subaqueous conditions, providing a poor foundation rock for these already unstable materials. These conditions lead to extreme weathering in these contact zones and thus poor soil shear strength along the general slope where they occur. However, the pyroxene-clast basalt beds are a moderately strong rock material, and thus could be expected to have substantially higher densitites and shear strengths of all the materials found here. It is this material which is identified in the cross-sections for possible anchor/ foundation capability.



Sites 300+ further upslope from the existing tower structure site could be expected to have significantly more bedrock for anchoring purposes, and likely closer to the surface, based on the information found in the exploratory seismic line cross-sections. There was also an existing bench already existing in this area further upslope from the tower structure. Further seismic investigation would be in order to confirm this hypothesis.

SUMMARY OF FINDINGS

Coordinating the velocity information found in the exploratory seismic testing with expected material velocities and the materials found in the excavations, as well as the known geology of the area, several conclusions could be made:

1. Significant bedrock basalts(20+ ft thick) are located from 20-60ft west of the tower structure #46/1 in Seismic line #2, at approx. 70-75ft depth. In seismic line #3, the same basalt bed plane surface appears from 10-70ft west of the centerline of ROW at 80-100ft deep. Also in seismic line #3 there appear to be some 10-20ft thick weathered basalt outcrops at a shallower depths; 30-50ft east of centerline of ROW at approx. 30ft depth, and 10-40ft west of centerline of ROW at 10-40ft depth.

2. Most of the subsurface materials located in the seismic study were mafic ash tuffs and volcaniclastic silts(and clays), deposited in conditions of extreme weathering under aqueous conditions some 40 million years ago, and are poorly consolidated/ compacted (Olympic Silt Loam/clay – USDA Soil Conservation Service class). They exhibit typically low shear strength, high compressibility, high shrink-swell potential, high steel corrosivity, moderate-to-severe erosion hazard, and are highly subject to frost action.

3. There are >1V:2H dip to the bedplanes (generally northwest to southeast) and a 1V:5H erosion surface slopes(NE to SW) grading to 1V:3H 150 further downslope SW to the quarry, which is 250 ft ahead on line.

4. In addition to the February 2001 M6.8 Nisqually earthquake described in the original report, it was reported by local residents that substantial blasting was conducted at the quarry 250 ft downslope in June of 2000, which may also have affected the tower structures foundations under the indicated conditions in the November 2002 Paul-Alston Geotechnical Evaluation Report in the SLOPE CONDITIONS and SEISMIC CONSIDERATIONS Sections.

COMMENTS

1. Except for the indicated bedrock locations(Re: Summary Item #1), there does not appear to be solid basalt rock bedding down to 70-ft depth at either of the other two seismic lines #1 or #2 locations, within a 60-ft radius of the tower structure and downslope to the quarry, 250 ft ahead on line to the SW. These areas appear to be susceptible to the subsurface structural instabilities described in the November 2002 Paul-Alston Geotechnical Evaluation Report in the SLOPE CONDITIONS and SEISMIC CONSIDERATIONS Sections, and in the following items #3 and #4.

2. It is believed that this site is located directly on an unconformity between two distinct geological formations, the major one being the Goble/Grays River/Cowlitz basalt flows which is comprised of clinopyroxene-phyric basalts interbedded with subaqueous deposited mafic ash tuffs, volcaniclastic silt breccias, and marine mica siltstone, so bedding orientations are neither entirely planar or horizontal in orientations. As such,

there is considerable vertical and horizontal variation in material densities, which complicates a velocity-based, horizontal-bedding interpretation procedure, although a clear indication of soil shear strengths can be correlated for foundations purposes.

3. Due to the >1V:2H slope to the bedplanes (generally northwest to southeast) and the 1V:5H erosion surface slopes(NE to SW) grading to 1V:3H 150 further downslope SW to the quarry (250 ft ahead on line), these interbedded mafic ash tuffs and volcaniclastic silt materials can be somewhat unstable under conditions of saturation and shaking, such as might be expected during area earthquakes, or just local blasting operations, as was performed at the quarry below in June of 2000.

4. Regarding the general slope conditions at the existing tower structure site, and because of the subsurface conditions existing at this site in the SUMMARY and November 2002 Paul-Alston Geotechnical Evaluation Report in the SLOPE CONDITIONS and SEISMIC CONSIDERATIONS Sections, this site would be considered to be a generally poor site to locate a large dead-end tower structure with this structure's line support requirements. Because of the indications of basalt bedrock at various depths on seismic line #3, it is possible that more stable conditions exist yet further upslope(300-400-ft on centerline of ROW) for siting such a structure, if possible. However, further exploratory seismic or drilling would be required in these other areas to ascertain this.

W. Christopher Robinson
BPA Geologist

Att: Site Location and Geology/Topographic Map
Site Planview of Seismic Line Locations
Site Centerline Cross-Section
Seismic Cross-Sections(3)
Washington State Geology Map References

REFERENCES:

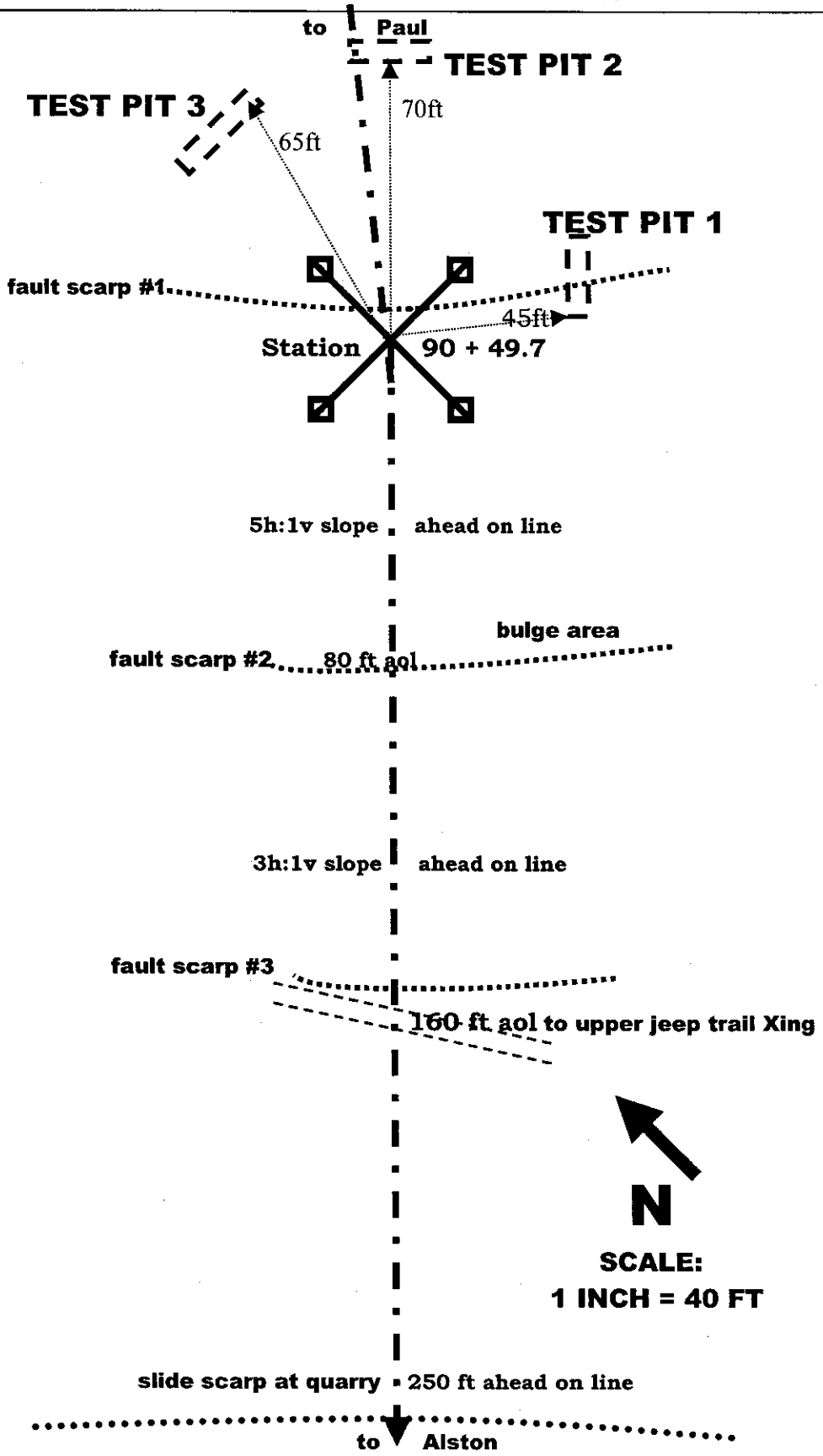
Geologic Map of Washington, Southwest Quadrant(1:250K scale); T. Walsh, M. Korosec, W. Phillips, R. Logan, H. Schasse(Washington Dept of Natural Resources, Div. of Geology and Earth Resources,1987)

Information on the Nisqually Earthquake, February 28, 2001; Washington Dept. of Natural Resources, Div. of Geology and Earth Resources Website: www.wa.gov/dnr/htdocs/ger/quakes.htm

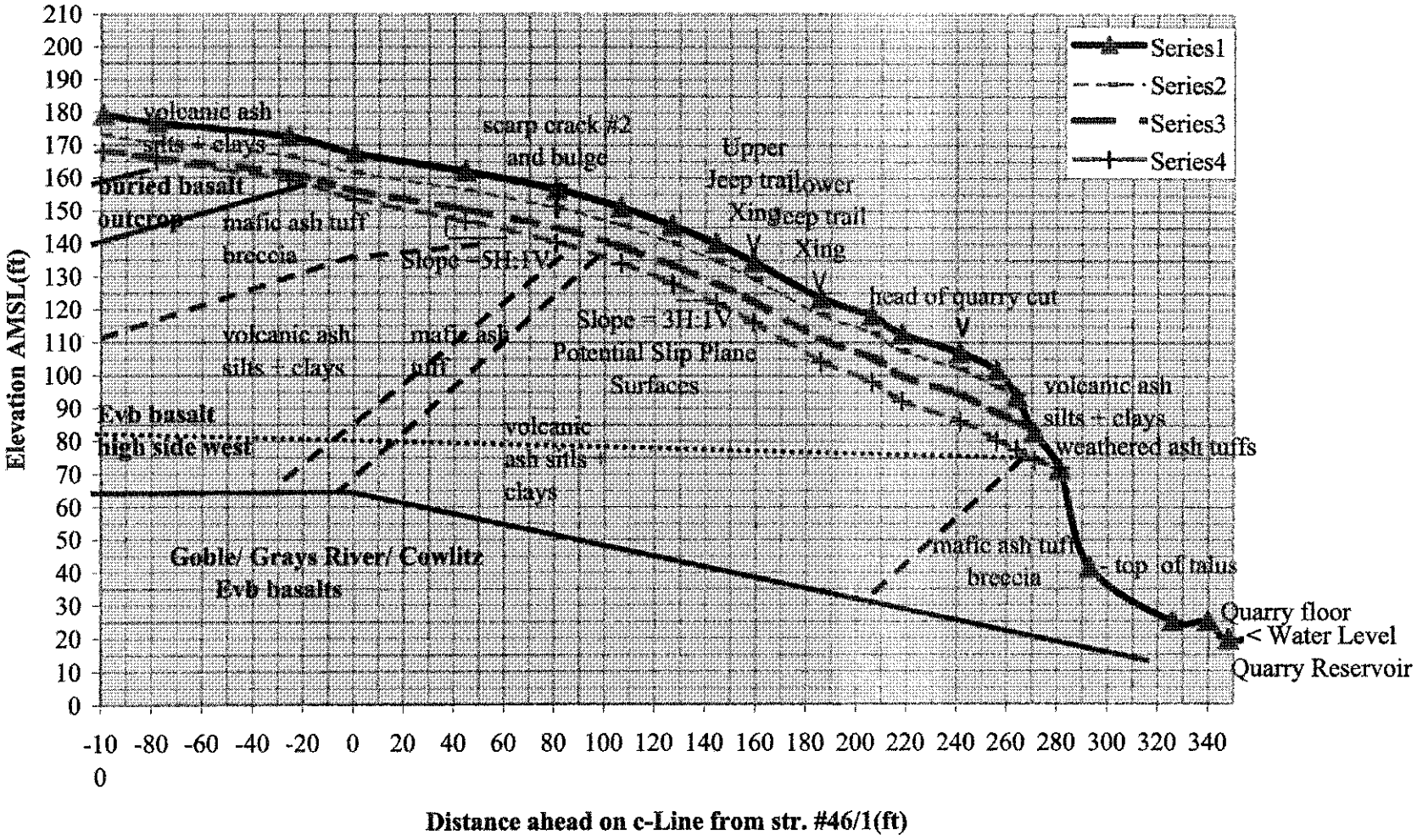
Soil Survey of Cowlitz County Area, Washington; USDA Soil Conservation Service and Washington State Agricultural Experiment Station(February,1974)

TEST PIT LOCATIONS

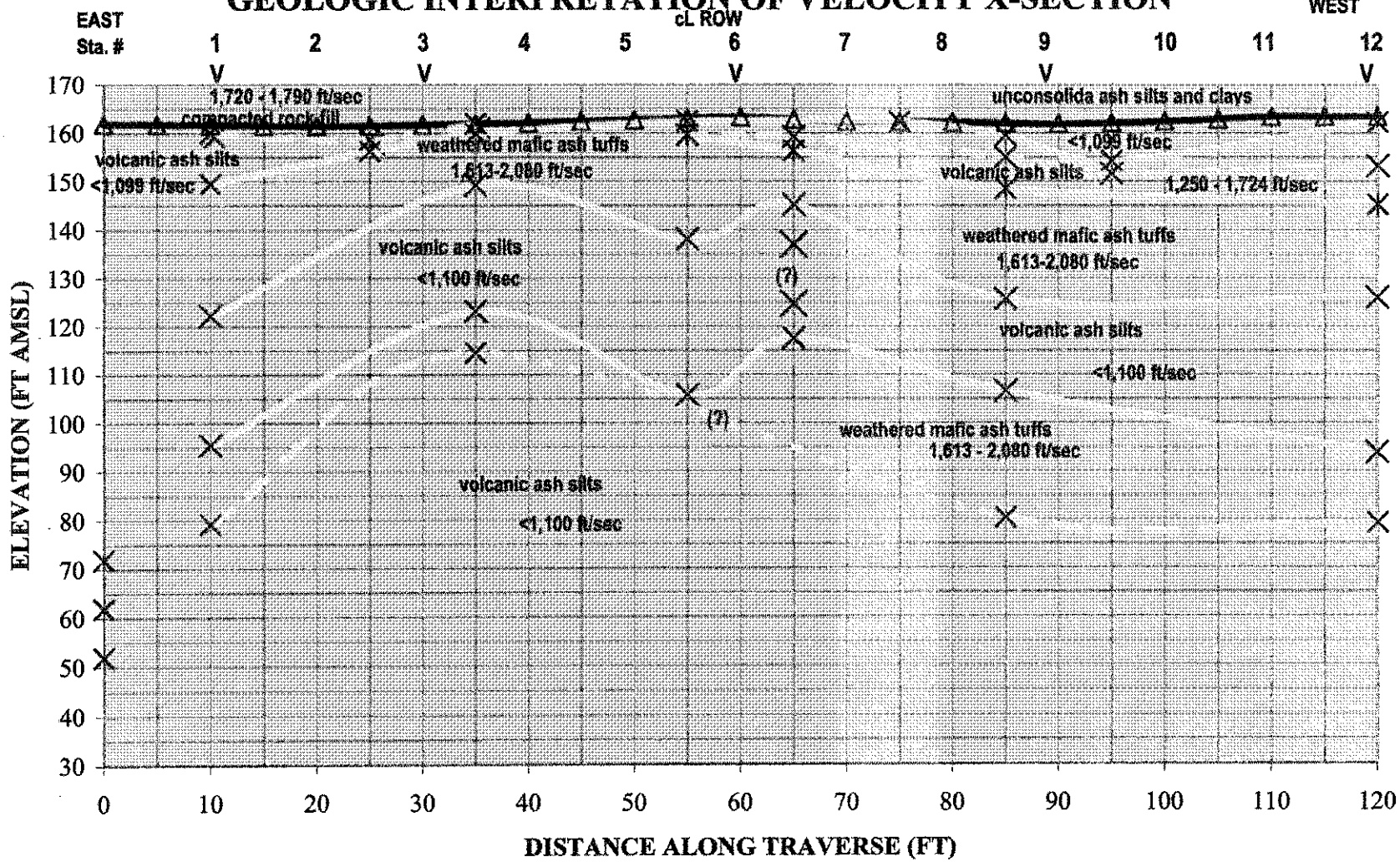
PAUL-ALSTON STRUCTURE #46/1



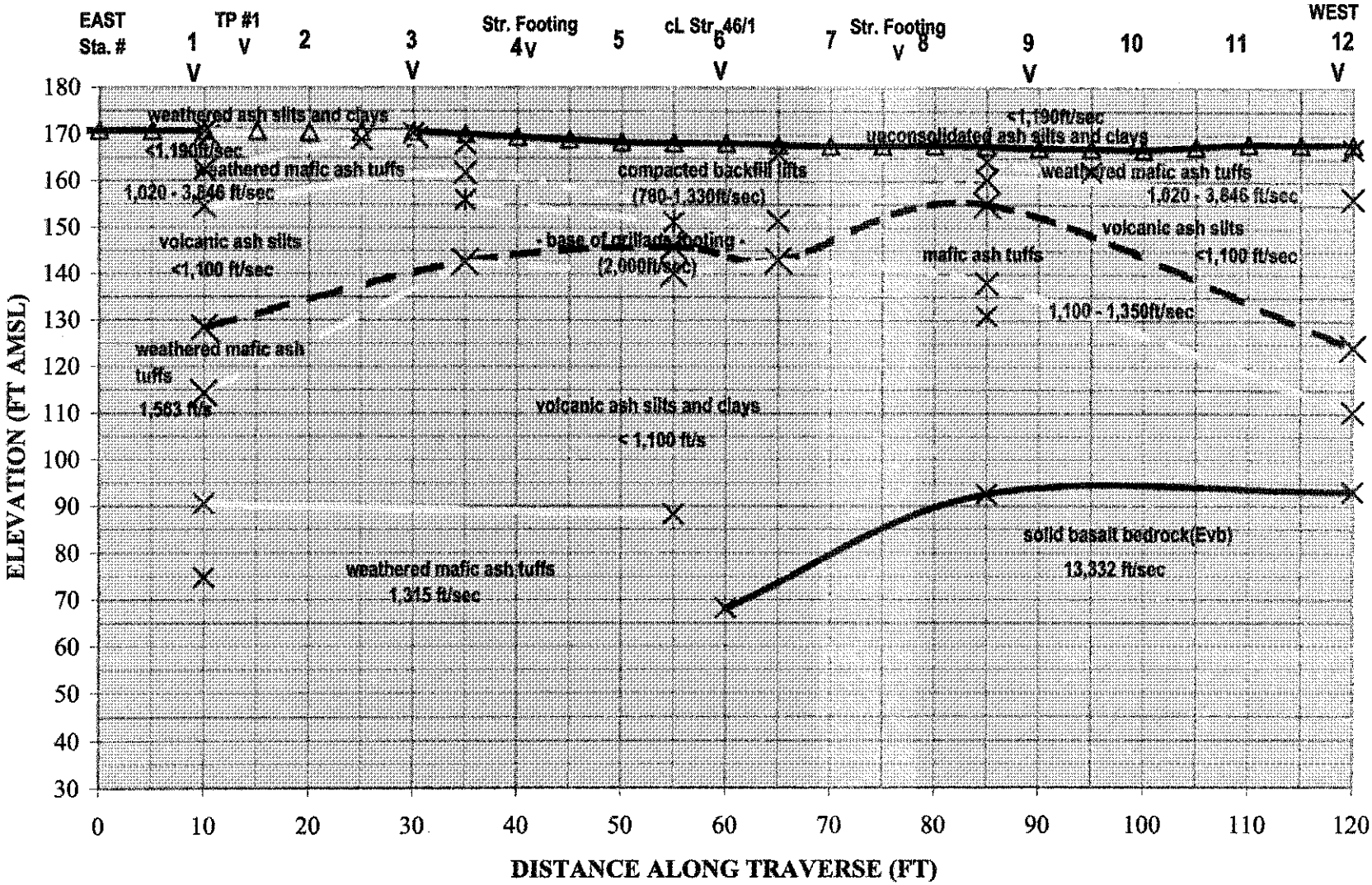
PAUL-ALSTON Line #1 Str. #46/1 c-Line Cross-Section



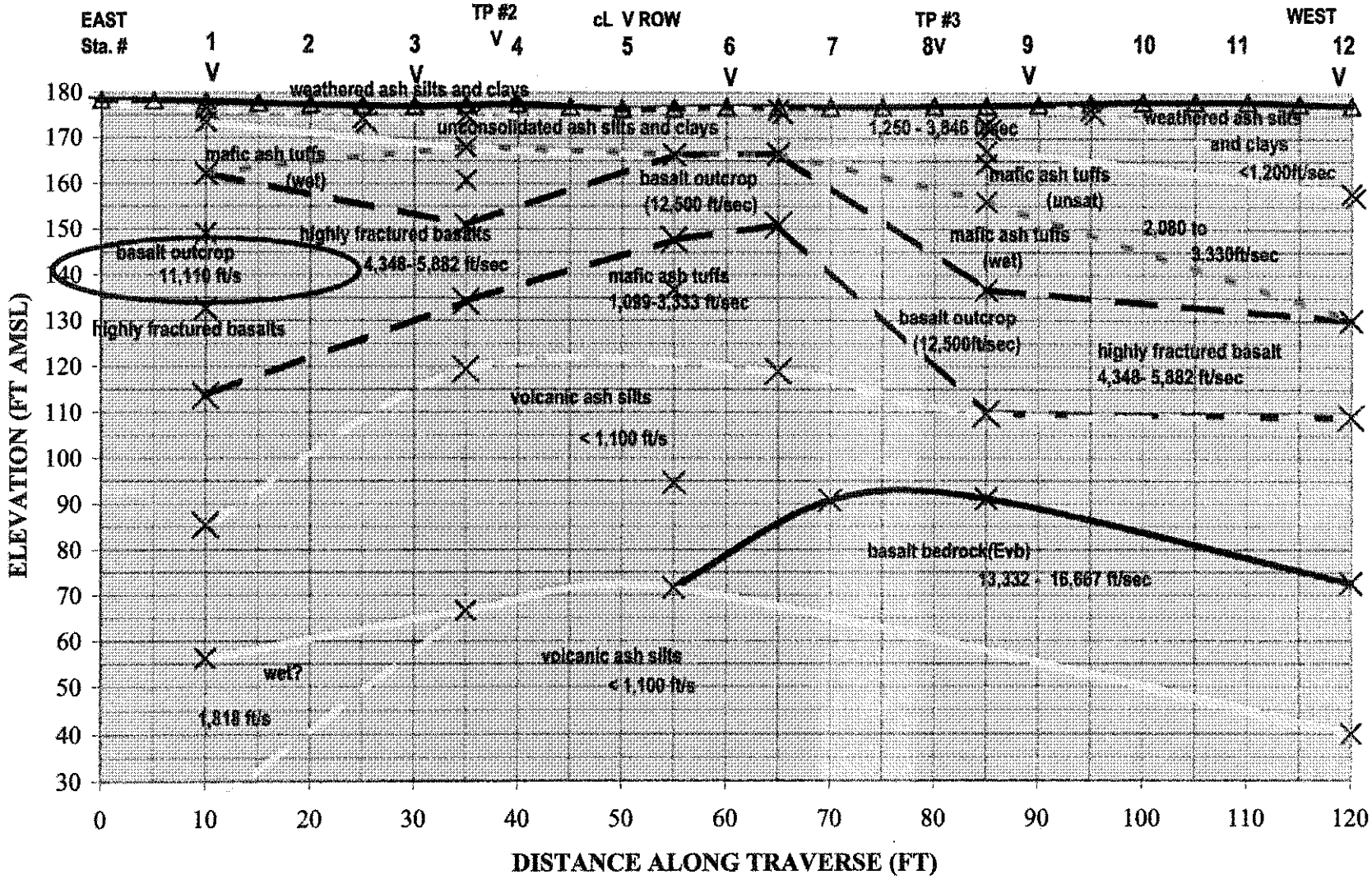
PAUL-ALSTON STR. 46/1, LINE #1
GEOLOGIC INTERPRETATION OF VELOCITY X-SECTION



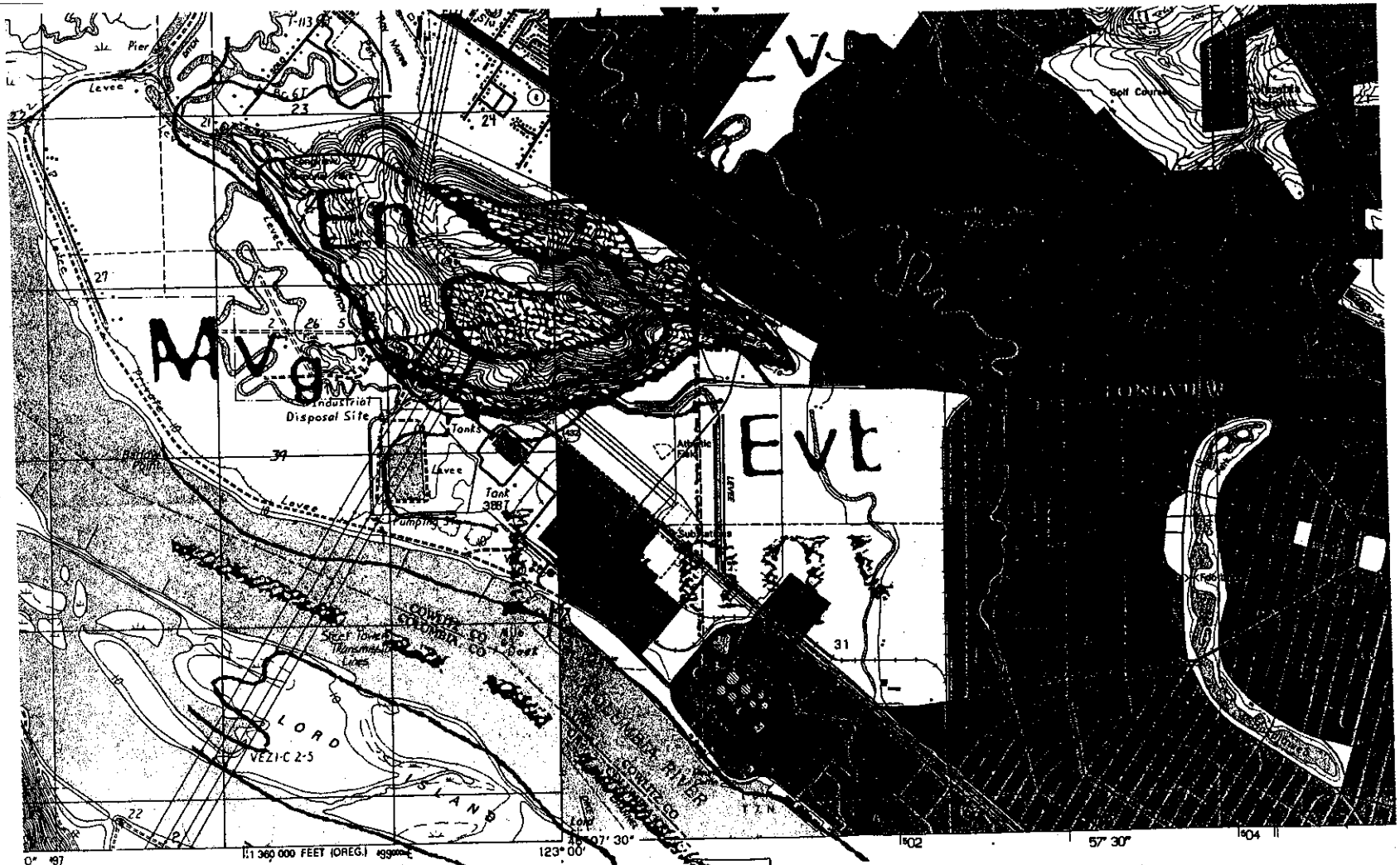
PAUL-ALSTON STR. 46/1, LINE #2
GEOLOGIC INTERPRETATION OF VELOCITY X-SECTION



PAUL-ALSTON STR. 46/1, LINE #3
GEOLOGIC INTERPRETATION OF VELOCITY X-SECTION



SITE LOCATION AND GEOLOGY
PAUL-ALSTON LINE 1
tructure #46/1



SCALE 1:24 000

KILOMETERS
METERS
MILES
FEET

WASHINGTON

QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

1 Elochoman Lake
2 Abernathy Min.
3 Castle Rock
4 Oak Point
5 Kelso
6 Clatskanie
7 Delena
8 Rainier

ADJOINING 7.5' QUADRANGLE NAMES

ROAD LEGEND

Improved Road
Unimproved Road
Trail
Interstate Route
U.S. Route
State Route

NAL MAP
m original
wings. Infor-
s of date of
2

CONTOUR INTERVAL 20 FEET
SUPPLEMENTARY CONTOUR INTERVAL 10 FEET
CONTROL ELEVATIONS SHOWN TO THE NEAREST 0.1 FOOT
OTHER ELEVATIONS SHOWN TO THE NEAREST FOOT
To convert meters to feet multiply by 3.2808
To convert feet to meters multiply by 0.3048
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 6 FEET
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092

COAL CREEK, WASH.–OREG.
PROVISIONAL EDITION 1985
46123-B1-TF-024

tonalite (Swanson, 1

* See pamphlet for intrusive rock classification.

EOCENE VOLCANIC ROCKS

Undivided

Volcanic rocks, undivided—Basalt, basaltic andesite, and rhyolite flows and volcaniclastic rocks, with interbeds of feldspathic sandstone, siltstone, and rare coal. Includes part of the Naches Formation

Lava Flows

Rhyolite flows—Rhyolite flows, and tuffs and associated flow breccia; flows are banded and have platy jointing; tuffs are welded crystal-lithic ash flows containing some pumice lapilli and are interbedded with minor thin feldspathic sandstones and shales; contains associated plugs and dikes on Teanaway Ridge. Includes parts of the Naches Formation

Andesite flows—Porphyritic and minor aphyric andesite flows and flow breccia; in the Centralia-Chehalis area, massive to platy clinopyroxene basaltic andesite with lesser basalt and andesite, interbedded with pyroclastic rocks and feldspathic sandstones, especially at the base; becomes olivine-bearing and more flow dominated eastward toward Morton; south of Cliffdell along the Naches River, altered green to brownish-green plagioclase-clinopyroxene andesite, rarely with hornblende, and lesser volcanic breccia and tuff; in the Taneum Ridge area, altered pyroxene andesite, dacite and rhyolite flows interbedded with commonly welded rhyolitic tuffs, volcaniclastic breccia, and minor coal-bearing sedimentary rock. Includes the Taneum Formation and part of the Northcraft Formation

Volcaniclastic Rocks

Volcaniclastic rocks—Andesitic volcaniclastic breccia, conglomerate, lithic tuff, volcanic sandstone, and siltstone; commonly interbedded with feldspathic sandstones and andesite flows; north of the Puyallup River, breccias and conglomerates of probable mudflow origin dominate; between the Puyallup and Nisqually Rivers and north of the Skookumchuck River, dominantly volcanic sandstones and siltstones, with lesser interbedded breccia and conglomerate. Includes part of the Northcraft Formation (Gard, 1968; Buckovic, 1974; Hagen, 1987)

Tuff—Mafic and silicic tuff; in the Willapa Hills area, subaqueous, massive to well-bedded, palagonitic basaltic lapilli tuff and tuff breccia, basaltic sandstone, siltstone, and conglomerate; in the Cascade Range, the tuffs are silicic crystal lithic and pumiceous. Includes Pe Ell Volcanics Member of the Cowlitz Formation (Henriksen, 1956) and welded tuff at Spencer Creek (Swanson, 1964)

Basalt flows—Aphyric to sparsely phyric basalt flows and flow breccia; in the Willapa Hills, subaerial clinopyroxene-phyric basalt with minor pillow basalt, interbedded with subaqueous mafic tuff, volcaniclastic breccia, basaltic sandstone and conglomerate, and marine micaceous feldspathic sandstone and siltstone; in the Summit Creek area southeast of Mount Rainier, dense, sparsely phyric clinopyroxene basalt interbedded with silicic tuff, argillite, and feldspathic and volcaniclastic fluvial sedimentary rocks; on Teanaway Ridge, dense to glassy pyroxene and rare olivine basalt and basaltic andesite with mafic tuff and minor intermediate volcanic rocks, rhyolite tuffs, and feldspathic sandstone and siltstone; north of Manastash Ridge, microporphyritic olivine basalt with interbedded mafic tuff; north of the Little Naches River, altered aphyric to porphyritic pyroxene basalt, olivine-clinopyroxene basalt and pyroxene basaltic andesite, feldspathic sandstone and siltstone. Includes basalt of Summit Creek (Vance and others, in press), Teanaway Formation, basalt of Frost Mountain (Tabor and others, 1982), part of the Naches Formation, and volcanic rocks of Grays River [The Grays River unit includes rocks previously mapped as the Goble Volcanics Member of the Cowlitz Formation by Henriksen (1956), Goble Volcanics by Livingston (1966), volcanic rocks within the Cowlitz Formation by Livingston (1966), and volcanic rocks of Unit B by Wolfe and McKee (1972); see Phillips, 1987a, and Walsh, 1987a]

Crescent Formation Lava Flows and Volcaniclastic Rocks

Lower to middle Eocene Crescent Formation—Fine-grained, dominantly submarine tholeiitic basalt flows and flow breccia, typically with zeolitic or chloritic alteration; pillows and altered palagonite common; locally contains thin interbeds of basaltic tuff and siltstone with foraminiferal faunas referrable to the Ulatisian Stage; probably originated as mid-ocean ridge basalt and as seamounts; accreted to continent by middle Eocene time (about 48 m.y. ago); forms basement in the Coast Range

PRE-TERTIARY VOLCANIC ROCKS

Marine

Oligocene to upper Eocene marine sedimentary rocks—Indistinctly bedded to massive, commonly concretionary, light-gray tuffaceous siltstone and fine-grained tuffaceous sandstone; lower strata contain discontinuous beds of basaltic and glauconitic sandstone; dominantly offshore marine but grades into nonmarine volcaniclastic rocks east of Chehalis. Contains foraminiferal faunas referable to the Refugian and Zemmorian Stages. Consists of the Lincoln Creek Formation and part of Unit B of Wolfe and McKee (1972)

Nearshore

Oligocene to upper Eocene nearshore sedimentary rocks—Basaltic conglomerate, sandstone, tuffaceous siltstone, pumice-lithic lapilli tuff, claystone, and lignite; locally interbedded with basaltic andesite flows; depositional environments range from nearshore marine to nonmarine; contains foraminiferal fauna referable to the Refugian Stage. Consists of the Toutle Formation

EOCENE SEDIMENTARY ROCKS

Marine

Em_2

Middle to upper Eocene marine sedimentary rocks—Laminated to massive, tuffaceous siltstone, claystone, shale, and massive to crossbedded micaceous feldspathic sandstone in lower part, interbeds of basaltic sandstone; locally interbedded with basalt flows, tuffs, tuff breccias, and conglomerates. Contains foraminiferal faunas referable to the Narizian Stage. Includes part of the McIntosh Formation, Stillwater Creek Member of the Cowlitz Formation (Henriksen, 1956), Humptulips Formation (Rau, 1984, 1986), siltstone of Skamokawa Creek (Wells, 1981), siltstone of Cliff Point (Wells, 1979), siltstone and sandstone at Omeara Point (Wells, in press), siltstone at Shoalwater Bay (Wells, in press), and part of Unit B of Wolfe and McKee (1972)

Lower? to middle Eocene marine sedimentary rocks—Siltstone and massive to planar-laminated micaceous feldspathic sandstone, locally with graded bedding. Contains foraminiferal faunas referable to the Ulatisian Stage. Includes Unit A of Wolfe and McKee (1972), part of the McIntosh Formation (Wagner, 1967a), sandstone of Megler (Wells, 1979), part of the Crescent Formation (Rau, 1966), and the Hoh Assemblage (Rau, 1986)

Nearshore

En

Middle to upper Eocene nearshore sedimentary rocks—Nearshore marine to nonmarine micaceous feldspathic sandstone, siltstone, shale, carbonaceous siltstone, claystone, and thick coal seams; locally interbedded with basalt flows and volcaniclastic rocks. Contains foraminiferal faunas referable to the Narizian Stage. Includes Skookumchuck Formation, Olequa Creek Member of the Cowlitz Formation (Henriksen, 1956), Cowlitz Formation (Wells, 1981), and rocks mapped as upper McIntosh by Pease and Hoover (1957) [See Logan, 1987a]

Continental

Ec_2

Middle to upper Eocene continental sedimentary rocks—Micaceous feldspathic sandstone and lithofeldspathic sandstone interbedded with siltstone, shale, claystone, and coal; locally, interbedded with lava flows, tuffs, volcaniclastic breccias, and pebble conglomerates, and brackish-water deposits. Includes Puget Group undivided, Carbonado, Spiketon, and Roslyn Formations, parts of the Naches Formation, the Summit Creek sandstone (Ellingson, 1959), the Lookout Creek sandstone (Schreiber, 1981) and the beds of Chambers Creek (Winters, 1984)

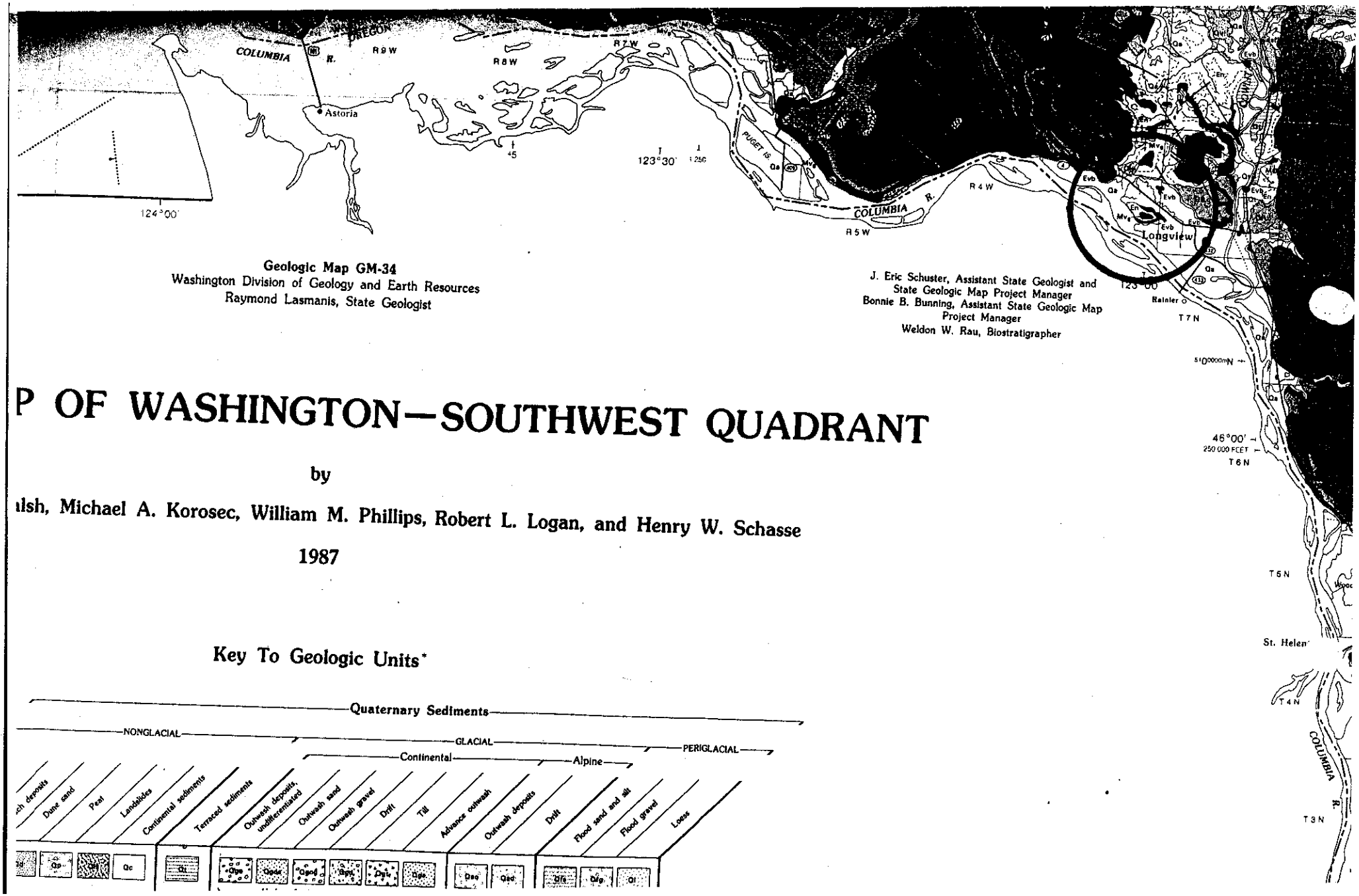
Lower to middle Eocene continental sedimentary rocks—Micaceous feldspathic sandstone and lithofeldspathic sandstone with lesser amounts of carbonaceous siltstone and shale, pebbly sandstone, conglomerate, and coal; locally interbedded with tuffs and volcaniclastic breccias. Consists of Swauk and Manastash Formations

CRETACEOUS AND JURASSIC SEDIMENTARY ROCKS

Marine

Marine sedimentary rocks—Lithofeldspathic sandstone and mudstone, with lesser conglomerate and greenstone, minor chert, and very rare green tuff. Radiolarian faunas indicate an age of Triassic(?), Jurassic, and Early Cretaceous; limestone clasts in a conglomerate have yielded fusulinids of probable Permian age. Consists of part of the Russell Ranch Formation

Chert-rich marine sedimentary rocks—Lithofeldspathic sandstone, mudstone, radiolarian chert, greenstone, green tuff, and red shale; characterized by thin stringers of altered green tuff and red shale within chert-rich horizons; contains radiolarian faunas referable to the Tithonian and Valanginian or Hauterivian Stages. Consists of part of the Russell Ranch Formation



Geologic Map GM-34
Washington Division of Geology and Earth Resources
Raymond Lasmanis, State Geologist

J. Eric Schuster, Assistant State Geologist and
State Geologic Map Project Manager
Bonnie B. Bunning, Assistant State Geologic Map
Project Manager
Weldon W. Rau, Biostratigrapher

P OF WASHINGTON—SOUTHWEST QUADRANT

by

ılsh, Michael A. Korosec, William M. Phillips, Robert L. Logan, and Henry W. Schasse

1987

Key To Geologic Units*

COWLITZ AREA, WASHINGTON — SHEET NUMBER 31

1 ¾ ½ ¼ 0 1 Mile

5 000 3 000 2 000 1 000 0 5 000 Feet

Scale 1:20 000

N

Wolcott,Marian - TR-3

From: Worth,Franklin S - TNFF-TPP-3
Sent: Tuesday, August 29, 2006 7:56 AM
To: Dostert,Dawneen M - TRFS-3; Jones,Terrie L - TFO-OLYMPIA; Robinson,W Chris - TNSE-MODA; Wolcott,Marian - TR-3; Margeson,Jacilyn R - LC-7
Cc: Meisner,Neal E - TRFS-3; Kempner,Leon Jr - TNFC-TPP-3; Smith,Patrick L - TNFE-TPP-3; Underwood,F Darrel - TFO-OLYMPIA; Courts,Alan L - TN-DITT-2; Furrer,Robin R - TF-DITT2; Frost,David L - TFOQ-LONGVIEW
Subject: RE: Mt Solo Update

Yesterday, I sent all the comments that Chris Robinson and I had on the draft report to Shannon and Wilson. We also asked for an additional case for the slope stability analysis for Paul - Allston #2, 46/1. Laureen McKenna, the project engineer for S & W, called after she had received the comments to tell me that she will try to get a final report in the mail by September 8. This will be within the schedule for the FOIA request. I asked for 5 copies. She will also send an electronic copy to me, which I can forward to anyone who is interested.

The bottom line: S & W has made the determination that the slopes below the other three crossing structures will be stabile under "normal" conditions. Under certain combinations of conditions of things like saturated soils, seismic shock (not blasting), etc. the factor of safety approaches 1.2, which is still a marginally stabile condition. It will be interesting to see what the additional analyses we requested will show. However, the question of slope stability seems to be less of a concern now.

If blasting is going to occur in the SW corner of the quarry, I am not as concerned as doing the blasting immediately downslope from 46/1. We should still get our blasting monitor on-site to see what effects show up at 46/1, so we need to know any schedules in advance.

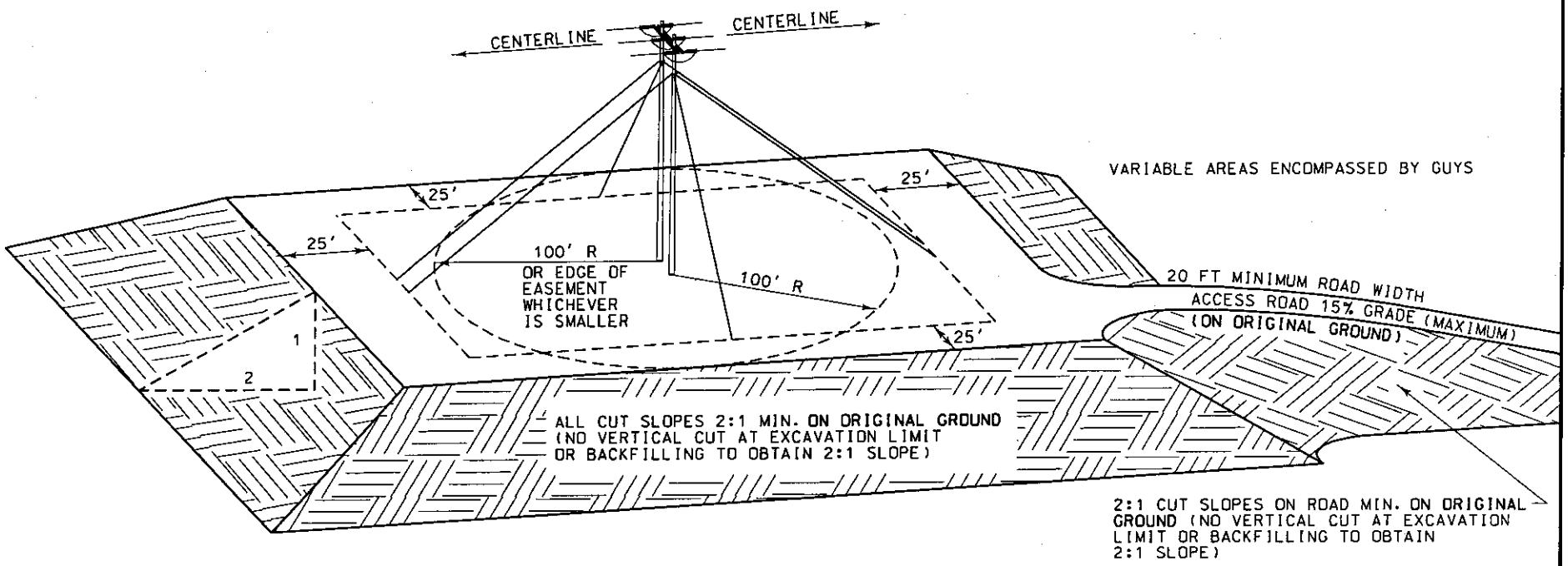
Frank

-----Original Message-----
From: Dostert,Dawneen M - TRFS-3
Sent: Tuesday, August 29, 2006 7:14 AM
To: Dostert,Dawneen M - TRFS-3; Jones,Terrie L - TFO-OLYMPIA; Robinson,W Chris - TNSE-MODA; Worth,Franklin S - TNFF-TPP-3; Wolcott,Marian - TR-3; Margeson,Jacilyn R - LC-7
Cc: Meisner,Neal E - TRFS-3; Kempner,Leon Jr - TNFC-TPP-3; Smith,Patrick L - TNFE-TPP-3; Underwood,F Darrel - TFO-OLYMPIA; Courts,Alan L - TN-DITT-2; Furrer,Robin R - TF-DITT2; Frost,David L - TFOQ-LONGVIEW
Subject: RE: Mt Solo Update

We had received a request from the 3B's attorney for the Geo Tech report, which we still don't have. Frank was able to get a draft report from Shannon and Wilson and had this to say:

The report is a draft and not complete because the lab testing results are not totally in. A number of slope stability analyses depend on the soil tests. There was a huge backup for the test lab (vacations, illness, techs quitting, etc.) and we had to wait until our turn in the queue came up.

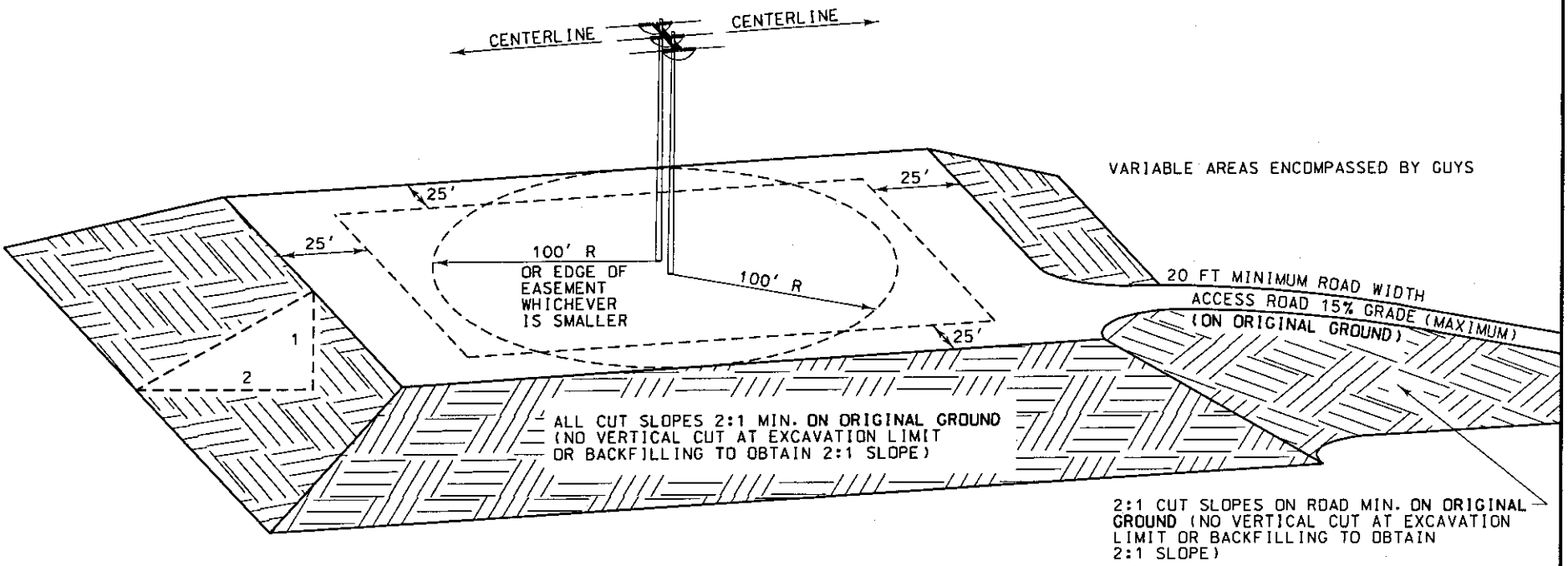
FIGURE 2 SHOWS THE TYPICAL LIMITS OF LARGE SCALE EXCAVATION AROUND BPA POLE STRUCTURES.



BPA RESERVES THE RIGHT TO EXPAND LISTED LIMITS BASED ON SAFETY AND RELIABILITY ISSUES.

FIGURE 2 LARGE SCALE EXCAVATION REQUIREMENTS FOR POLE STRUCTURES

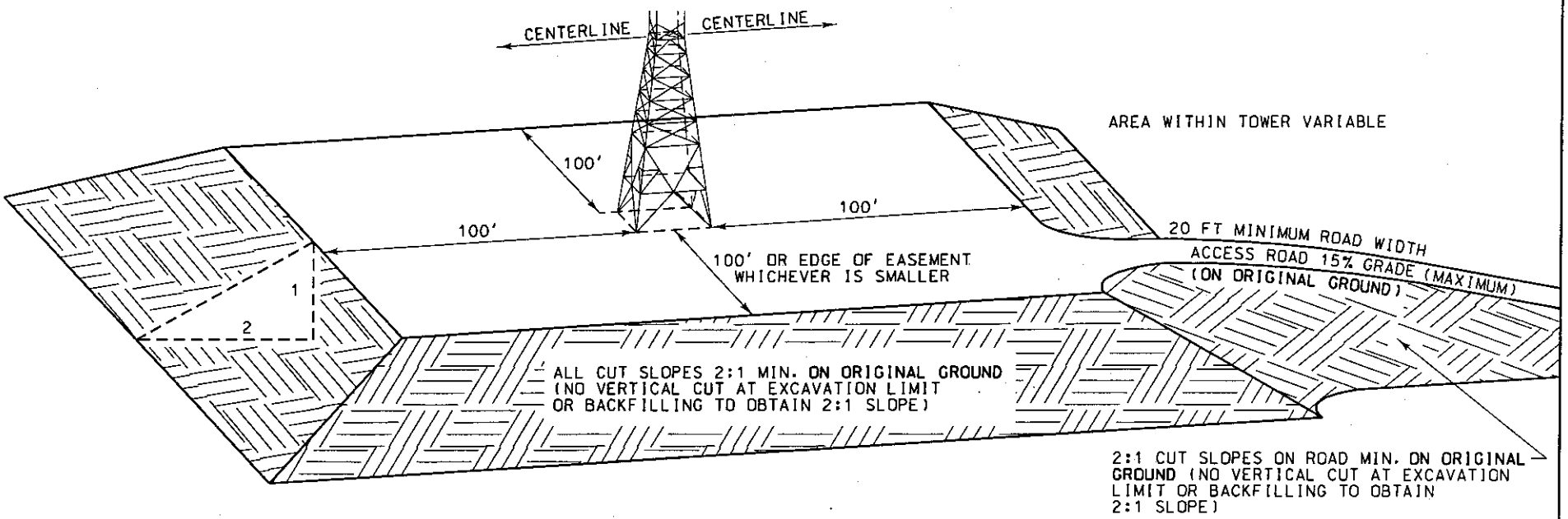
FIGURE 2 SHOWS THE TYPICAL LIMITS OF LARGE SCALE EXCAVATION AROUND BPA POLE STRUCTURES.



BPA RESERVES THE RIGHT TO EXPAND LISTED LIMITS BASED ON SAFETY AND RELIABILITY ISSUES.

FIGURE 2 LARGE SCALE EXCAVATION REQUIREMENTS FOR POLE STRUCTURES

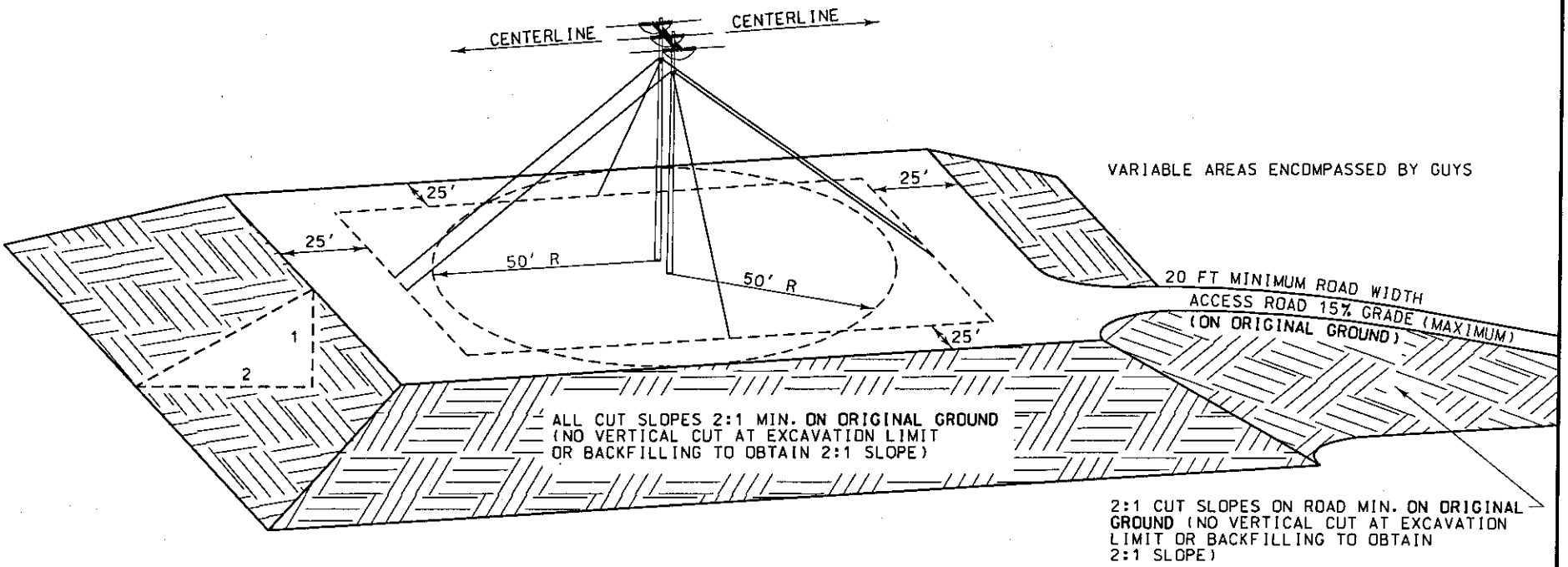
FIGURE 1 SHOWS THE TYPICAL LIMITS OF LARGE SCALE EXCAVATION AROUND BPA STEEL LATTICE TOWERS.



BPA RESERVES THE RIGHT TO EXPAND LISTED LIMITS BASED ON SAFETY AND RELIABILITY ISSUES.

FIGURE 1 TYPICAL LARGE SCALE EXCAVATION LIMITS FOR STEEL LATTICE TOWERS

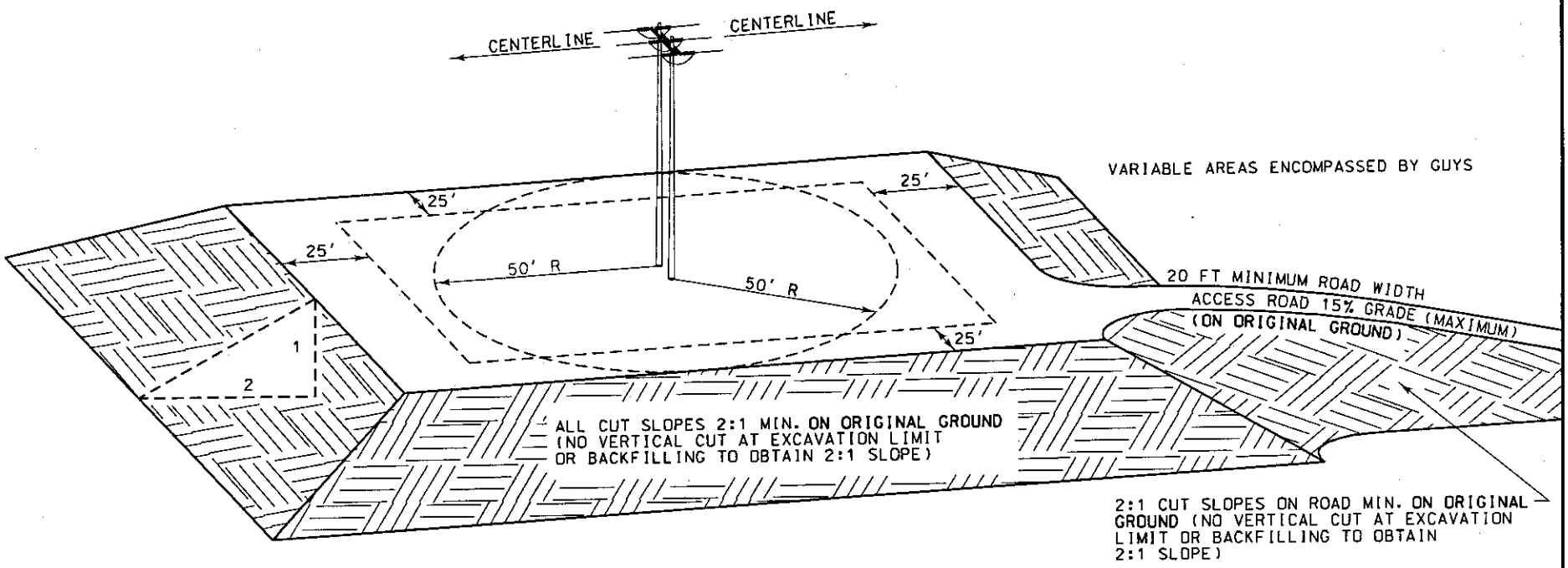
FIGURE 2 SHOWS THE TYPICAL LIMITS OF EXCAVATION AROUND BPA POLE STRUCTURES.



BPA RESERVES THE RIGHT TO EXPAND LISTED LIMITS BASED ON SAFETY AND RELIABILITY ISSUES.

FIGURE 2 TYPICAL EXCAVATION LIMITS FOR POLE STRUCTURES (NOT APPLICABLE TO LARGE SCALE OPERATIONS)

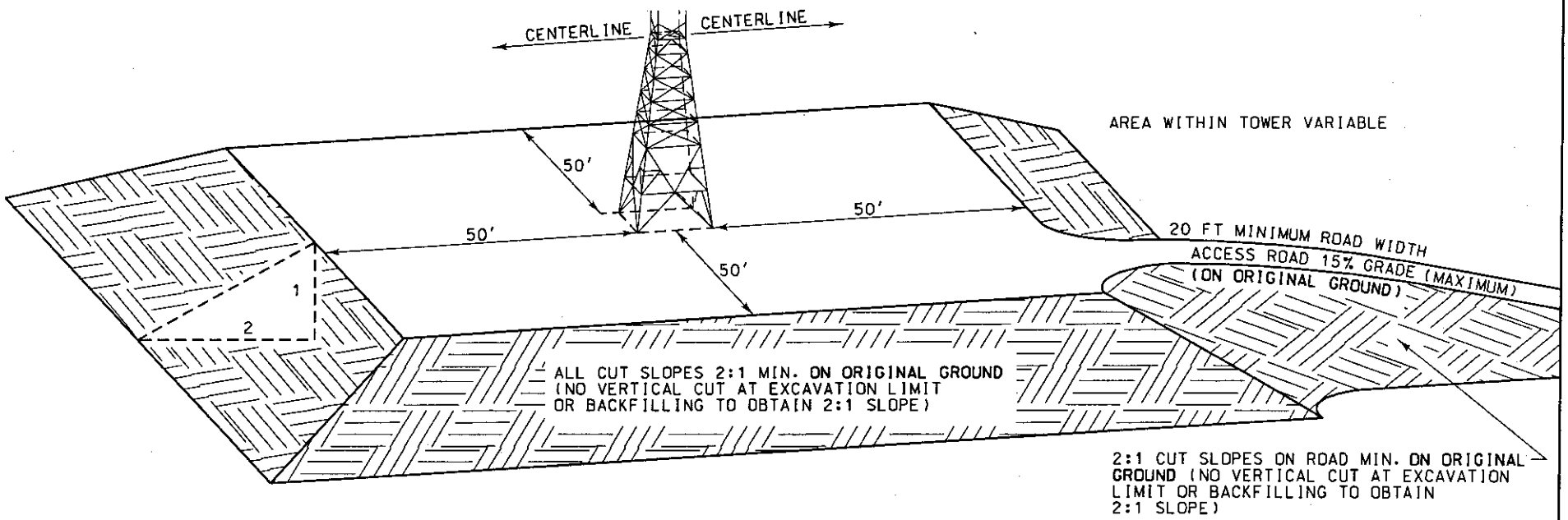
FIGURE 2 SHOWS THE TYPICAL LIMITS OF EXCAVATION AROUND BPA POLE STRUCTURES.



BPA RESERVES THE RIGHT TO EXPAND LISTED LIMITS BASED ON SAFETY AND RELIABILITY ISSUES.

FIGURE 2 TYPICAL EXCAVATION
LIMITS FOR POLE STRUCTURES
(NOT APPLICABLE TO LARGE SCALE OPERATIONS)

FIGURE 1 SHOWS THE TYPICAL LIMITS OF EXCAVATION AROUND BPA STEEL LATTICE TOWERS.



BPA RESERVES THE RIGHT TO EXPAND LISTED LIMITS BASED ON SAFETY AND RELIABILITY ISSUES.

FIGURE 1 TYPICAL EXCAVATION
LIMITS FOR STEEL LATTICE TOWERS
(NOT APPLICABLE FOR LARGE SCALE OPERATIONS)

Oden,Kim L - TRFT-3

From: Sherrill,Karen C - TR-3 on behalf of Wolcott,Marian - TR-3
Sent: Monday, September 18, 2006 10:06 AM
To: Oden,Kim L - TRFT-3
Subject: FW: Excavation Drawings

Karen C. Sherrill
Personal Assistant
BPA Real Property Services

-----Original Message-----
From: Worth,Franklin S - TNFF-TPP-3
Sent: Monday, September 18, 2006 9:23 AM
To: Wolcott,Marian - TR-3; Dostert,Dawneen M - TRFS-3; Margeson,Jacilyn R - LC-7; Bottemiller,Steven C - TRV-3
Cc: Courts,Alan L - TN-DITT-2; Jones,Terrie L - TFO-OLYMPIA; Underwood,F Darrel - TFO-OLYMPIA
Subject: FW: Excavation Drawings

I found that I did have electronic versions of the updated, large scale excavation limits drawings.

Frank

-----Original Message-----
From: Vermeers,Danna J - TNLD-TPP-3
Sent: Wednesday, September 06, 2006 9:01 AM
To: ADL_TNL_ALL; ADL_TNF_ALL; Van Bergen,Glenn - TNP-TPP-3; Korsness,Mark A - TNP-TPP-3; Beck,Gary O - TNP-TPP-3; Robinson,Kirk M - TNP-TPP-3
Subject: Excavation Drawings

We have recently created new excavation drawings. The requirements for typical excavation are essentially the same but the new drawings have some added clarification. We have also created another class of excavation drawings, these are to address instances where we have large scale excavation (i.e. gravel pits, mining, etc.). Please use these new drawings in place of the existing versions.

Please let me know if you have any questions or comments.

Thank you

Shortcut to: \\rs2f01\public\TNLD\Vermeers\Excavation_Drawings

Oden,Kim L - TRFT-3

From: Sherrill,Karen C - TR-3 on behalf of Wolcott,Marian - TR-3
Sent: Monday, September 18, 2006 10:06 AM
To: Oden,Kim L - TRFT-3
Subject: FW: Mt. Solo

Karen C. Sherrill
Personal Assistant
BPA Real Property Services

From: Worth,Franklin S - TNFF-TPP-3
Sent: Monday, September 18, 2006 8:12 AM
To: Wolcott,Marian - TR-3
Cc: Dostert,Dawneen M - TRFS-3; Jones,Terrie L - TFO-OLYMPIA; Margeson,Jacilyn R - LC-7
Subject: Mt. Solo

Marian,

As a follow-up to our Friday meeting, here is a reiteration of my opinion of the information presented in Shannon and Wilson's August 30, 2006, geotechnical report on the river crossing towers on the south side of Mt. Solo:

Slope stability analyses indicate that the towers in question are stabile in their current conditions, and are not going to be susceptible to movement from typical saturation, earthquakes, or blasting vibrations. The analyses done for three scenarios cutting to the north from the existing rock face toward Paul -Allston #2, 46/1, in 50-, 75-, and 100-foot increments also show stability even though the factor of safety is reduced to 1.1. Thus, for these situations, I believe slope stability is not a serious issue at the studied locations for the factors used in the calculations.

However, no slope stability analysis was done for the slope to the west of 46/1 (toward a proposed quarry extraction area). It remains an unknown, but based on the other analyses, I am not as concerned as I was previously.

My concern is now moved to the transmission corridor on the eastern side of Mt. Solo. The slopes are steeper here, and we have a number of issues with tower stability in this area (in particular, Lexington - Longview #1, 9/1, and Longview - Chehalis #1 and #3, 1/6). There is also evidence of recent slides in an area noted by the City of Longview as a slide area.

If we cannot obtain the boring logs done by 3B's for their geotechnical report to be submitted to the City, then we must plan to perform our own studies.

Frank

Franklin S. Worth
Senior Geotechnical Engineer
TNFF - TPP3
360-619-6565
503-604-8940 (Pager)
360-619-6984 (fax)

Oden,Kim L - TRFT-3

From: Sherrill,Karen C - TR-3 on behalf of Wolcott,Marian - TR-3
Sent: Monday, September 18, 2006 10:10 AM
To: Oden,Kim L - TRFT-3
Subject: FW: Seismic Refraction Studies for 46/1 at Mt Solo

Karen C. Sherrill
Personal Assistant
BPA Real Property Services

From: Worth,Franklin S - TNFF-TPP-3
Sent: Wednesday, September 06, 2006 1:23 PM
To: Wolcott,Marian - TR-3
Subject: Seismic Refraction Studies for 46/1 at Mt Solo

Marian,

I just talked to Chris. He did reduce the seismic data that he compiled for 46/1, but didn't do any analyses or a report. He will forward the cross-sections as a .pdf file to me in the morning. He is presently out in the field.

Frank

Franklin S. Worth
Senior Geotechnical Engineer
TNFF - TPP3
360-619-6565
503-604-8940 (Pager)
360-619-6984 (fax)

Wolcott,Marian - TR-3

From: Worth,Franklin S - TNFF-TPP-3
Sent: Friday, September 08, 2006 10:11 AM
To: Wolcott,Marian - TR-3
Subject: FW: Report Comments

Attachments: ShanWil Report Comments - Mt. Solo.doc

Here's the e-mail sending our comments.

Frank

-----Original Message-----
From: Worth,Franklin S - TNFF-TPP-3
Sent: Monday, August 28, 2006 8:53 AM
To: 'lmm@shanwil.com'
Subject: Report Comments

Laureen,

All I can say is: when Chris and I got done going through the report and discussing it on Friday, I thought there were a lot more comments than this. I guess Chris and I resolved more questions than I remember (I was getting woozy from the contract work, etc.) Anyway, here are our few comments. Call if you have questions. Chris will be over in The Dalles most of this week.

ShanWil
ırt Comments - I

Thanks,

Frank

Franklin S. Worth
Senior Geotechnical Engineer
TNFF - TPP3
360-619-6565
503-604-8940 (Pager)
360-619-6984 (fax)

COMMENTS FROM CHRIS ROBINSON AND FRANK WORTH:
REPORT FOR ADDITIONAL TOWER STUDIES AT MT. SOLO

Page 1, Section 2.0, Site and Project Description:

The dates listed for the construction of the four towers is reversed. The correct relations are 46/1 in 1973, 36/1 in 1969, 2/3 (L – A Nos. 1 and 2) in 1966, and 2/3 (L – A Nos. 3 and 4) in 1943.

Page 8, Section 8.2.3, Seismic Load

Can you predict a displacement to go with your seismic assumptions? Is there a way to correlate blasting effects (velocities, displacement) to seismic loads and predict responses of the slope and tower?

Page 9, Section 8.3, Slope Stability Results, 2nd Paragraph

We would like to see an additional analysis of slope stability with excavation 100 feet back from the existing face. This would correspond to the area that has already been cleared of some overburden in preparation (?) for blasting and removal.

Oden,Kim L - TRFT-3

From: Sherrill,Karen C - TR-3 on behalf of Wolcott,Marian - TR-3
Sent: Monday, September 18, 2006 10:07 AM
To: Oden,Kim L - TRFT-3
Subject: FW: Figure 2 replaced

Attachments: Figures.pdf

Figures.pdf (5 MB)

Karen C. Sherrill
Personal Assistant
BPA Real Property Services

-----Original Message-----
From: Worth,Franklin S - TNFF-TPP-3
Sent: Friday, September 08, 2006 11:20 AM
To: Wolcott,Marian - TR-3
Subject: FW: Figure 2 replaced

-----Original Message-----
From: Laureen McKenna [mailto:LMM@shanwil.com]
Sent: Sunday, August 20, 2006 3:50 PM
To: Worth,Franklin S - TNFF-TPP-3
Subject: Figure 2 replaced

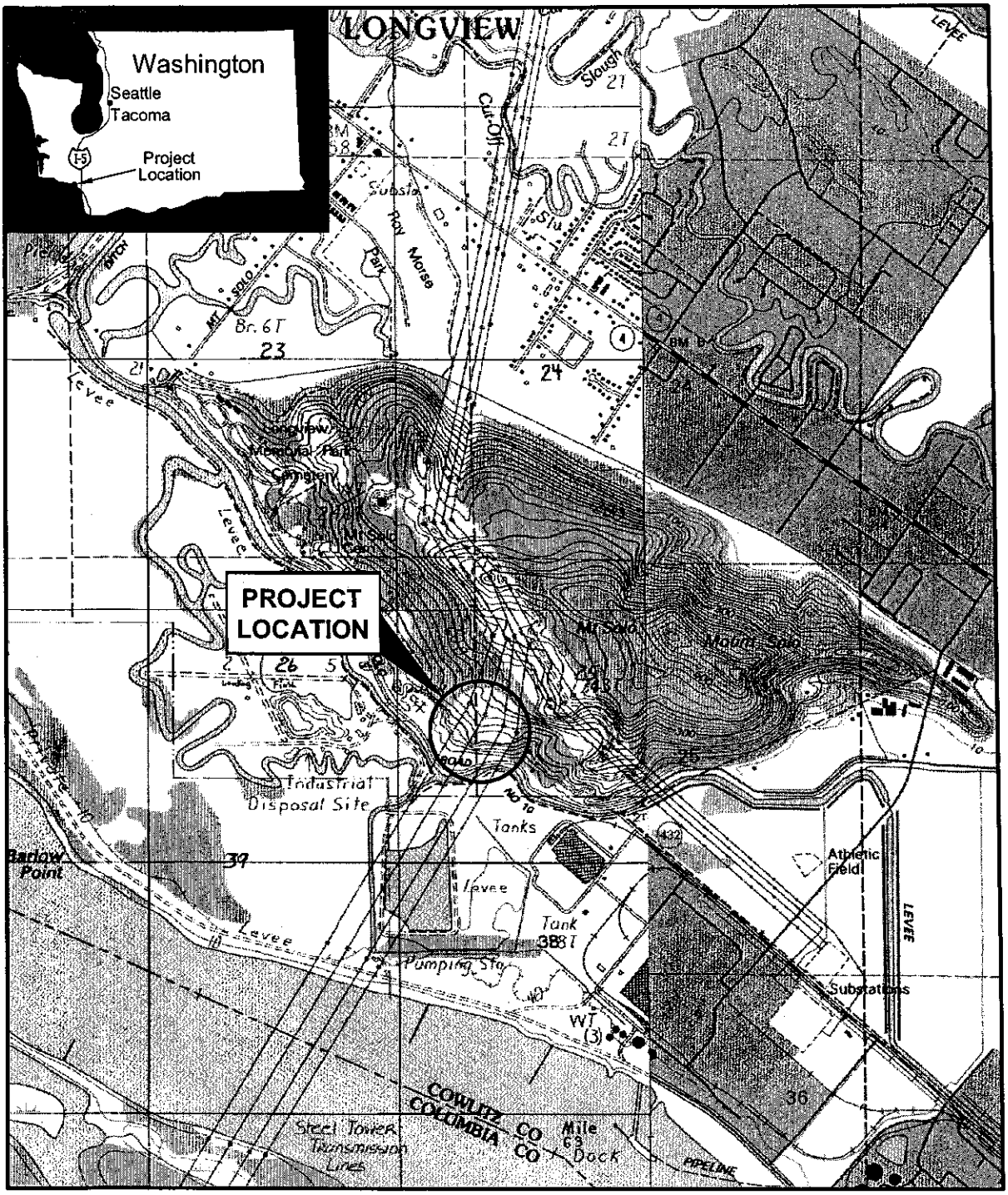
Frank,

Please disregard the other file labeled figures.pdf. I inserted an older copy of figure 2. The attached file has the most recent version that you should refer to while reviewing our draft report.

Thanks,
Laureen

Laureen M. McKenna, P.E.
Senior Engineer
Shannon & Wilson, Inc.
400 N 34th Street, Suite 100
Seattle, WA 98103

Direct: (206) 695-6728
Cell: (206) 491-2352
Fax: (206) 695-6777



0 1/2 1

Scale in Miles

NOTE

Map adapted from 1:24,000 USGS topographic maps of Coal Creek, WA-OR quadrangle, dated 1985, and Kelso, WA quadrangle, dated 1990.

Bonneville Power Administration
Mt. Solo / Longview Tower Study
Longview, Washington

VICINITY MAP

August 2006 21-1-20543-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 1

File: J: 211 20543-001 21-1-20543-001 Fig 1.dwg Date: 08-04-2006 Author: SAC

0 300 600

Approximate Scale in Feet
Contour Interval = 5 Feet

LEGEND

B-101 Boring Designation and Approximate Location

B-1 Previous Napavine-Allston No .1 Tower 36/1 Study Boring Designation and Approximate Location

36/1 Tower Location and Designation

Proposed Development Area Described in Allwest Letter Dated 7-26-06 Regarding Geotechnical Evaluation, Proposed Quarry Development - Southwest Area, Mt. Solo Quarry, Longview, Washington

A Generalized Subsurface Profile (See Figures 3 through 5)

NOTE

Figure adapted from PDF file of orthorectified imagery aerial photograph provided by the Bonneville Power Administration, dated 6-30-06.

Bonneville Power Administration
Mt. Solo / Longview Tower Study
Longview, Washington

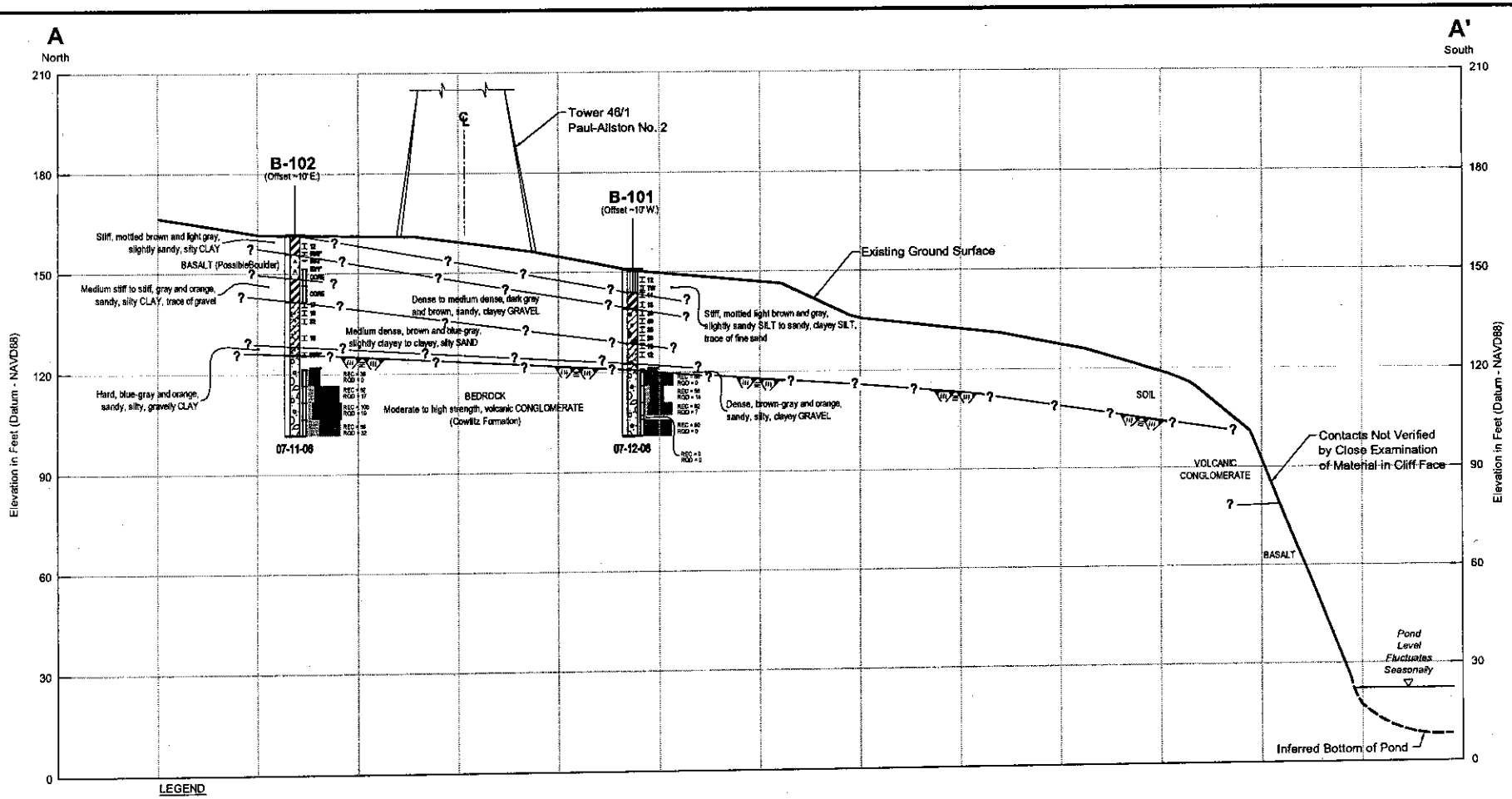
SITE AND EXPLORATION PLAN

August 2006 21-1-20543-001

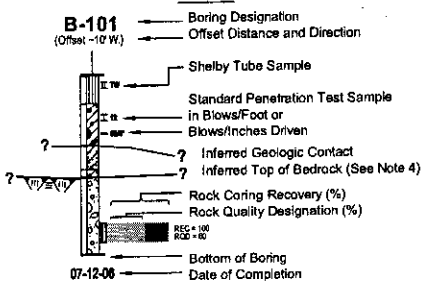
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 2

File: J: 211 20543-001 21-1-20543-001 Fig 2.dwg Date: 08-18-2006 Author: SAC



LEGEND



0 30 60

Scale in Feet
Vertical = Horizontal

NOTES

1. Ground surface developed from orthorectified imagery aerial photography taken 6-30-06, provided by Bonneville Power Administration.
2. Ground surface elevations of borings have been adjusted to match the approximated ground surface elevation profile.
3. This subsurface profile is generalized from materials observed in soil borings. Variations between the profile and actual conditions may exist.
4. Inferred top of bedrock based on information from seismic line and field reconnaissance.

Bonneville Power Administration
Mt. Solo / Longview Tower Study
Longview, Washington

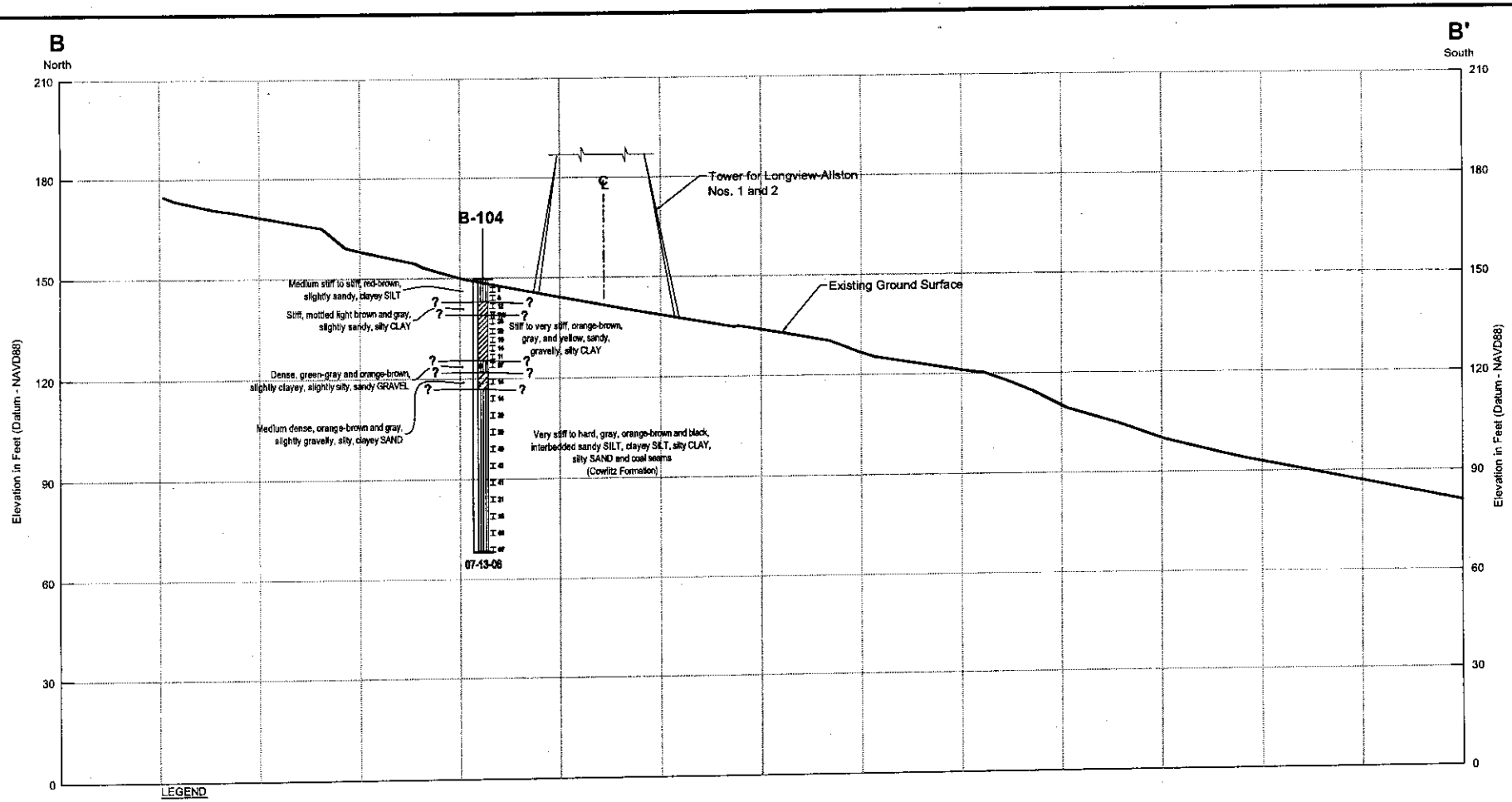
GENERALIZED SUBSURFACE PROFILE A-A'

August 2006 | 21-1-20543-001

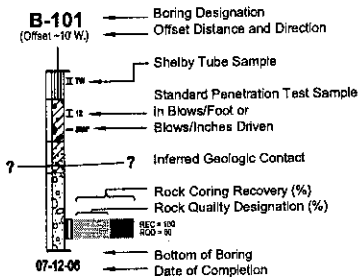
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

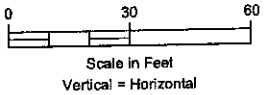
FIG. 3

File: J:\211 20543-001 21-1-20543-001 Profiles.dwg Date: 08-18-2006 Author: SAC



LEGEND





NOTES

1. Ground surface developed from orthorectified imagery aerial photography taken 6-30-06, provided by Bonneville Power Administration.
2. This subsurface profile is generalized from materials observed in soil borings. Variations between the profile and actual conditions may exist.

Bonneville Power Administration
Mt. Solo / Longview Tower Study
Longview, Washington

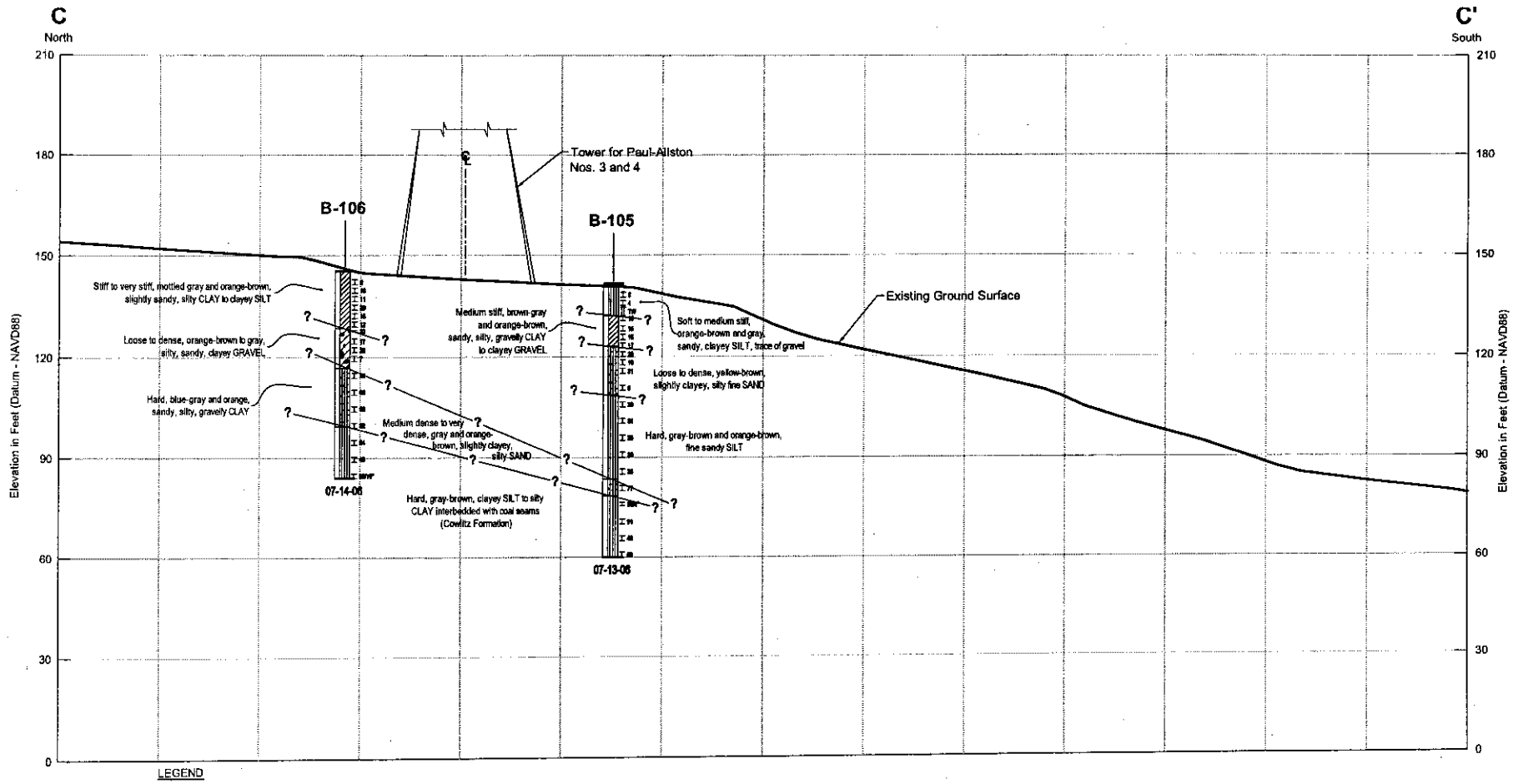
GENERALIZED SUBSURFACE PROFILE B-B'

August 2006 | 21-1-20543-001

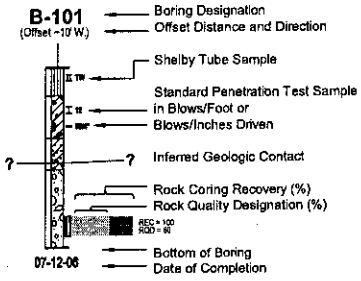
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

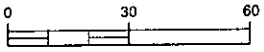
FIG. 4

File: J: 211 20543-001 21-1-20543-001 Profiles.dwg Date: 08-18-2006 Author: SAC



LEGEND





NOTES

1. Ground surface developed from orthorectified imagery aerial photography taken 6-30-06, provided by Bonneville Power Administration.
2. Ground surface elevations of borings have been adjusted to match the approximated ground surface elevation profile.
3. This subsurface profile is generalized from materials observed in soil borings. Variations between the profile and actual conditions may exist.

Bonneville Power Administration
Mt. Solo / Longview Tower Study
Longview, Washington

GENERALIZED SUBSURFACE PROFILE C-C'

August 2006 | 21-1-20543-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 5

File: J: 211 20543-001 21-1-20543-001 Profiles.dwg Date: 08-18-2006 Author: SAC

X 6984 Faxed to Frank

GEODESIGN INC
Geotechnical · Environmental · Geological

Fax Transmittal

To:	Dawneen Dostert	From:	Erick Staley
Company:	BPA	Date:	8/3/06
Fax:	503-230-5513	Phone:	503-956-8808
cc:			
GDI Project:	3BGravel-1-01		
RE:	Drilling in Longview, WA		

☐ Urgent ☐ For Review ☐ Please Comment ☐ Please Reply

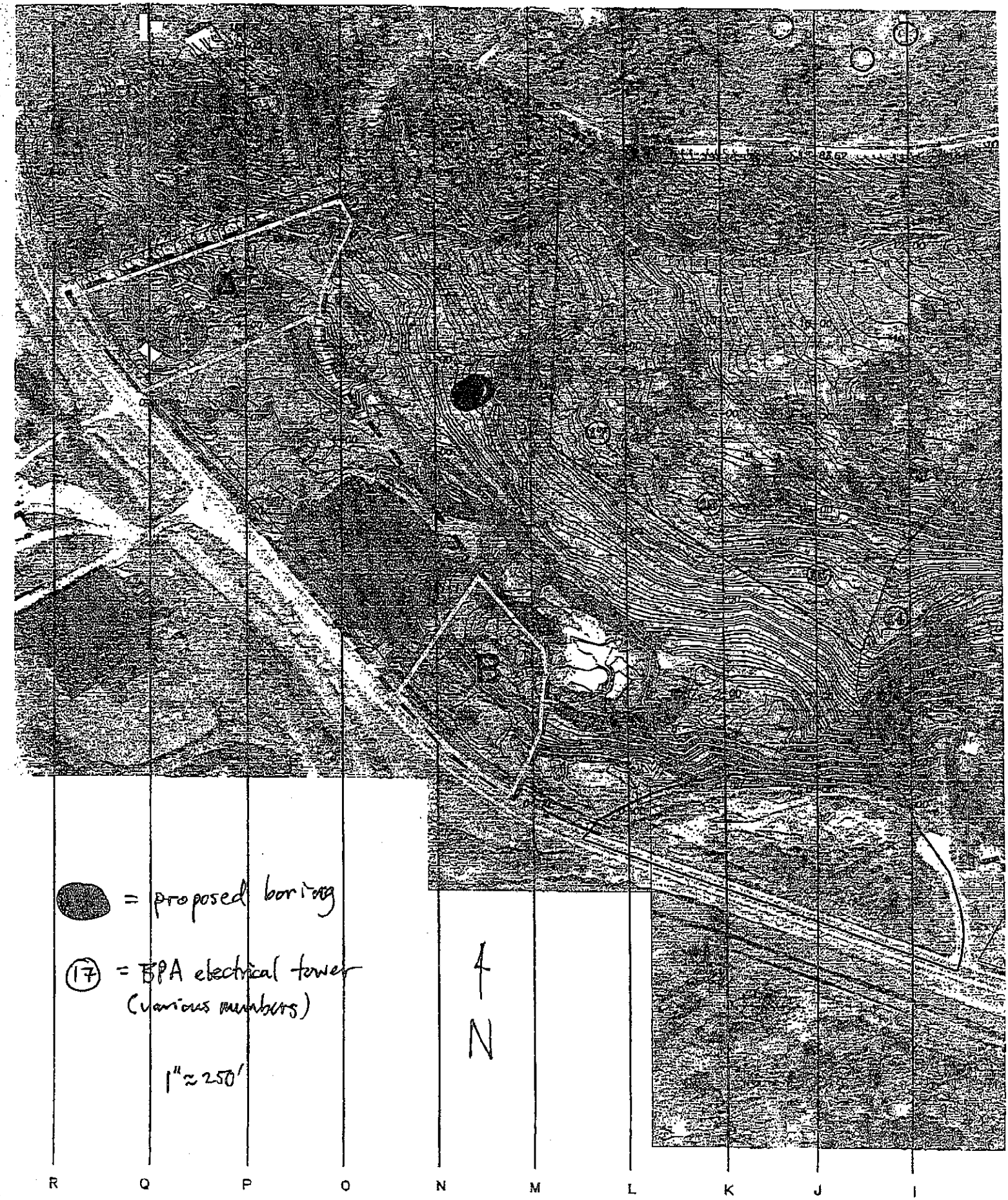
No. Pages	Description:
1	Fax Transmittal
2	Site map with proposed borings (2 pages, 1/2 of map each)
3	Total Pages

Dawneen,

I was contacted by our client, 3B's Land and Gravel, to forward you a map showing where we plan to put borings at the Mt. Solo Rock Quarry in Longview, WA. Our objective is to drill 5 borings using wire-line rock coring to characterize the rock at the site. We understand that BPA wishes to meet on site to discuss safety concerns drilling in proximity to the towers. We will be on site at 8am tomorrow (8/4/06). Please contact me on my cell phone should you have any questions: 503-539-1543

CONFIDENTIAL NOTICE: The information contained in this facsimile is confidential and may also be subject to the attorney-client privilege. The information is intended only for the use of the individual or entity to whom it is addressed. If the reader of this message is not the intended recipient, this serviceas as notification that any reading, disclosure, copying, distribution, or the taking of any action in reliance on the contents of this communication is strictly prohibited. If this transmission was received in error, please immediately notify us at (503) 968-8787 and return the original message to me at the address above via the U.S. Postal Service.

15575 SW Sequoia Parkway · Suite 100 · Portland, Oregon 97224 · Phone (503) 968-8787 · Fax (503) 968-3068


A
B
17
= proposed boring
17 = BPA electrical tower
(various numbers)
1" ≈ 250'
N
R
Q
P
O
N
M
L
K
J
I

J
I
H
G
F
E
D
C
B
A

Oden,Kim L - TRFT-3

From: Sherrill,Karen C - TR-3 on behalf of Wolcott,Marian - TR-3
Sent: Monday, September 18, 2006 10:10 AM
To: Oden,Kim L - TRFT-3
Subject: FW: Mt.Solo /Paul-Alston str.#46/1 Expl. Seismic Investigations

Attachments: P-A#2-46-1-1.doc; P-A#2-46-1-2.doc; P-A#2-46-1-3.doc; P-A#2-46-1-4.doc

Karen C. Sherrill
Personal Assistant
BPA Real Property Services

From: Worth,Franklin S - TNFF-TPP-3
Sent: Thursday, September 07, 2006 6:48 AM
To: Wolcott,Marian - TR-3
Subject: FW: Mt.Solo /Paul-Alston str.#46/1 Expl. Seismic Investigations

Marian,

Here is the info from Chris's seismic refraction studies on Mt. Solo. I think you now have all of the reports and data from all the investigations we did, or had done. If more information is needed, I guess we could send all of our e-mail strings, but they don't do any analysis or studies of the subsurface conditions.

Frank

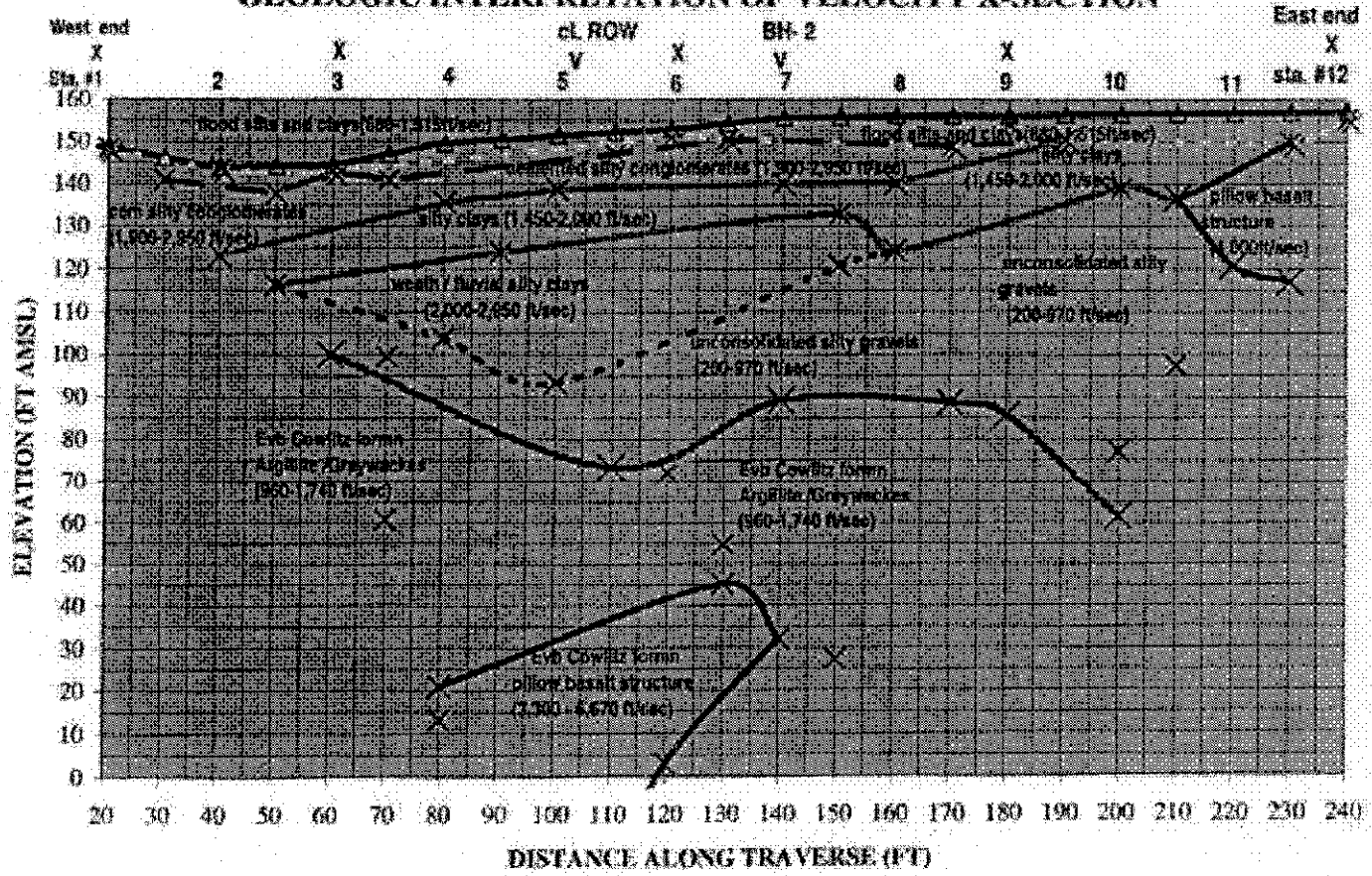
-----Original Message-----
From: Robinson,W Chris - TNSE-MODA
Sent: Wednesday, September 06, 2006 5:01 PM
To: Worth,Franklin S - TNFF-TPP-3
Subject: Mt.Solo /Paul-Alston str.#46/1 Expl. Siesmic Investigations

Frank -
As requested, see attached Exploratory Seismic Investigations performed in July 2006 for the Paul-Alston line #2 str.# 46/1...

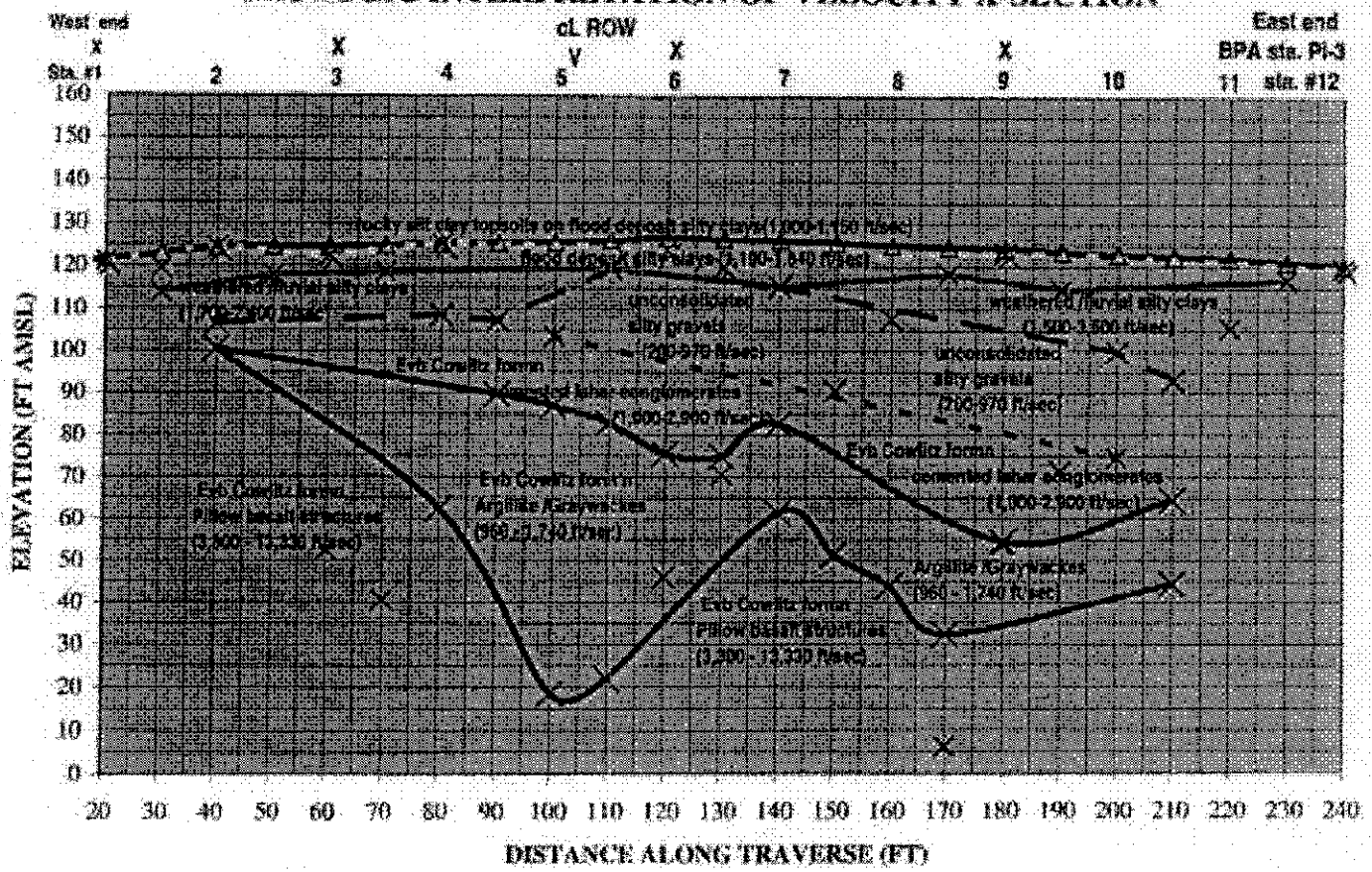
P-A#2-46-1-1.doc (93 KB) P-A#2-46-1-2.doc (94 KB) P-A#2-46-1-3.doc (68 KB) P-A#2-46-1-4.doc (86 KB)

Chris Robinson
BPA Engineering Geologist

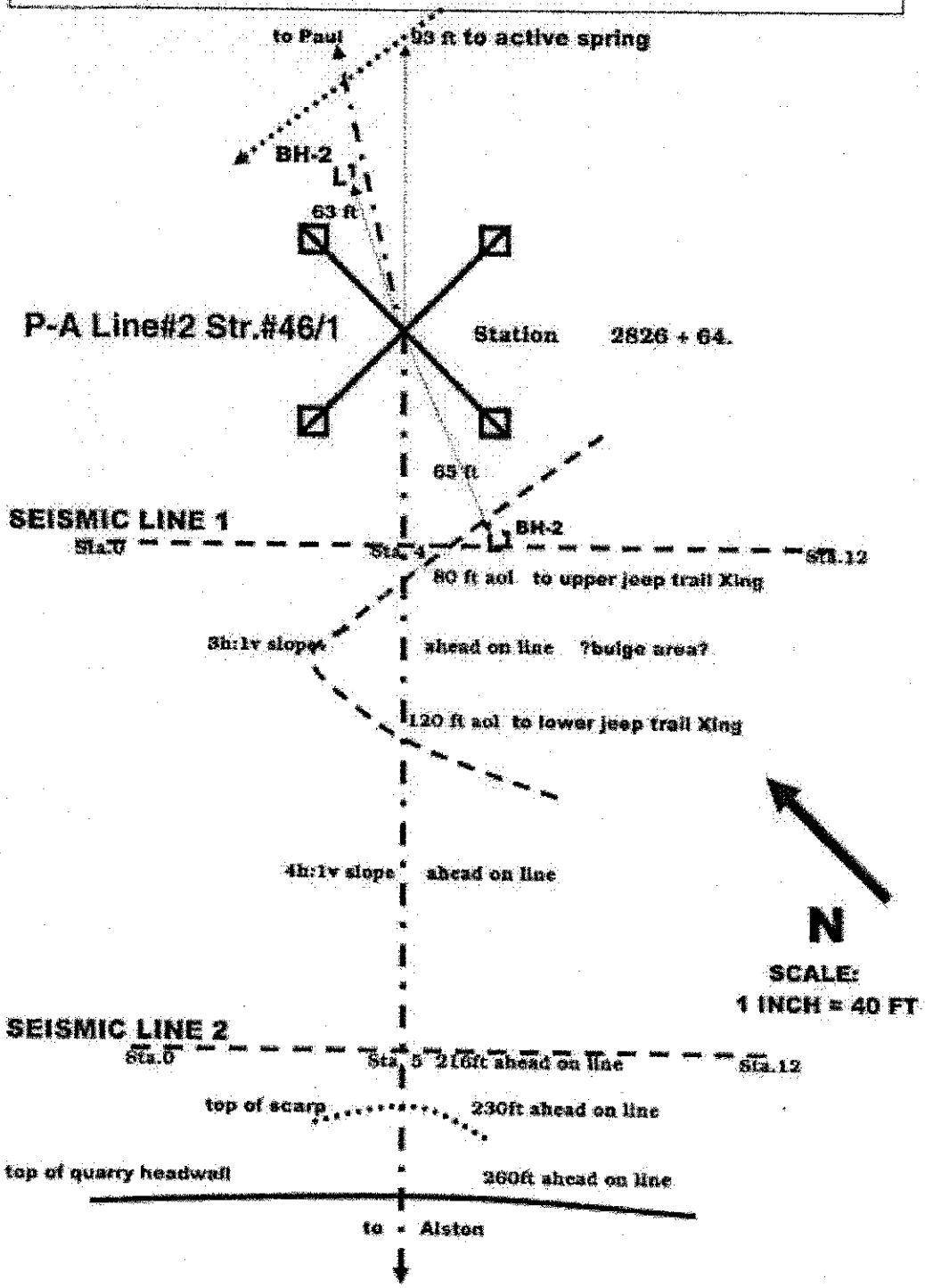
PAUL-ALSTON #2 str. #46/1 - 65ft AOL
GEOLOGIC INTERPRETATION OF VELOCITY X-SECTION

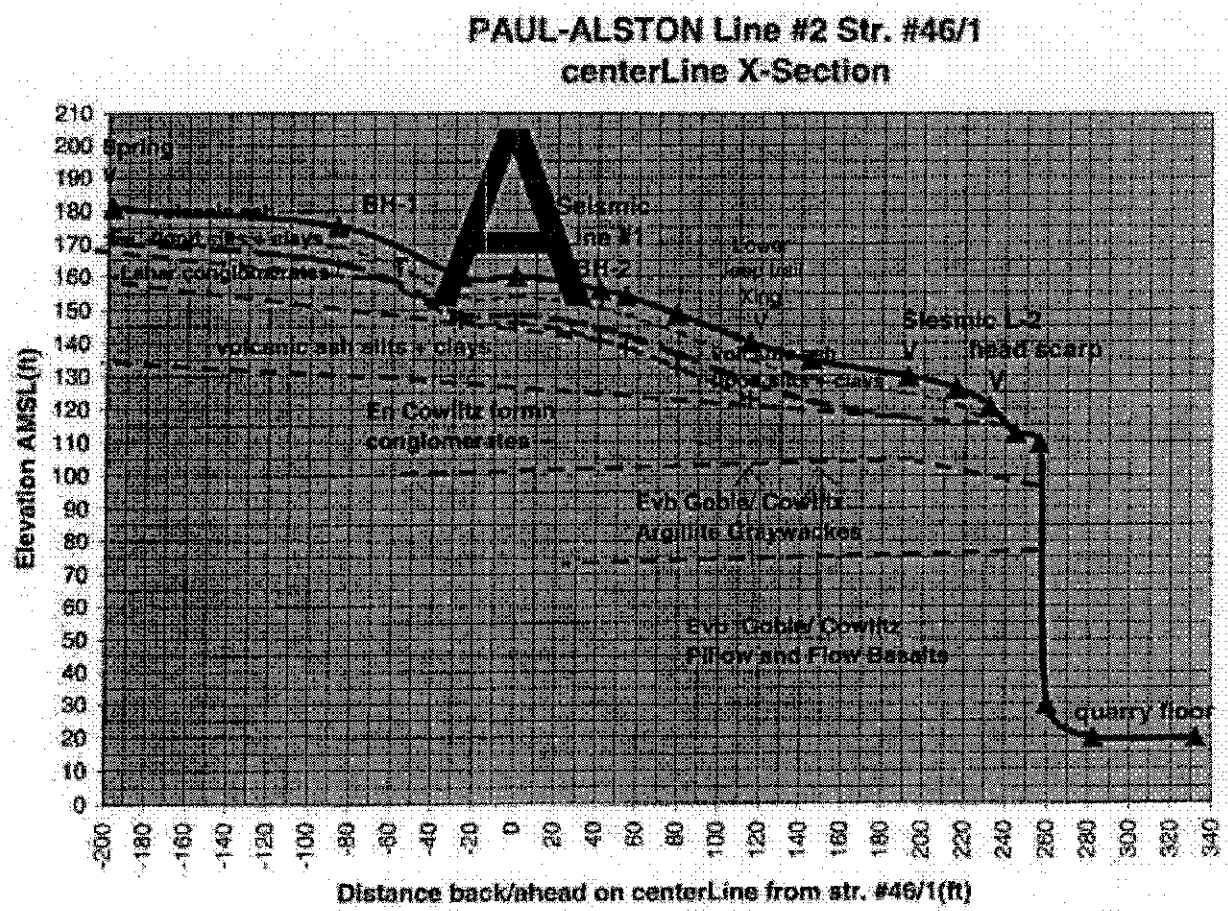


PAUL-ALSTON #2 str. #46/1 - 210ft AOL
GEOLOGIC INTERPRETATION OF VELOCITY X-SECTION



BOREHOLE AND SEISMIC TESTS
PAUL-ALSTON Line 2 STRUCTURE #46/1




PAUL-ALSTON Line #2 Str. #46/1
centerLine X-Section
Elevation AMSL(ft)
Distance back/ahead on centerLine from str. #46/1(ft)
Spring
BH-1
Seismic
line #1
BH-2
Seismic L-2
head scarp
volcanic ash silts & clays
Eo Cowlitz formin
conglomerates
Evb Goble/ Cowlitz
Argillite Graywackes
Evb Goble/ Cowlitz
Pillow and Flow Basalts
quarry floor

Oden,Kim L - TRFT-3

From: Sherrill,Karen C - TR-3 on behalf of Wolcott,Marian - TR-3
Sent: Monday, September 18, 2006 10:06 AM
To: Oden,Kim L - TRFT-3
Subject: FW: Draft report

Attachments: GrainSizes.pdf; AtterbergLimits.pdf

GrainSizes.pdf (36 KB) AtterbergLimits.pdf (16 KB)

Karen C. Sherrill
Personal Assistant
BPA Real Property Services

-----Original Message-----
From: Worth,Franklin S - TNFF-TPP-3
Sent: Friday, September 08, 2006 11:21 AM
To: Wolcott,Marian - TR-3
Subject: FW: Draft report

-----Original Message-----
From: Laureen McKenna [mailto:LMM@shanwil.com]
Sent: Tuesday, August 22, 2006 4:14 PM
To: Worth,Franklin S - TNFF-TPP-3
Cc: Robinson,W Chris - TNSE-MODA; Chris Robertson
Subject: RE: Draft report

Frank,

Here are pdfs of our laboratory test results. I will need to make some minor edits to the boring logs, profiles, and subsurface conditions description, but in general, the lab results do not impact our recommendations. I will hold off on making the edits until I hear from you regarding your review of the report.

Thanks,
Laureen

Laureen M. McKenna, P.E.
Senior Engineer
Shannon & Wilson, Inc.

400 N 34th Street, Suite 100
Seattle, WA 98103

Direct: (206) 695-6728
Cell: (206) 491-2352
Fax: (206) 695-6777

>>> "Worth,Franklin S - TNFF-TPP-3" <fsworth@bpa.gov> 8/22/2006 11:09 AM >>>
Hi, Laureen.

I got back into the office from my Monday-Tuesday field trip a little while ago, so I have not had a chance to read over the material you sent. I will try to get to it this afternoon. I also forwarded your e-mails to Chris so he will have a chance to look it over. I told him to get comments back to me so I can be a single source for getting back to you.

By the way, our realty contact for the Mt. Solo stuff got a letter from the attorney for the quarry operator (3B's) claiming BPA was withholding information from them by not providing the latest geotech report. I responded to realty and our legal staff that we still had not received the final report and wouldn't release it until we reviewed the draft and had a final report in our hands. There is an remote chance that someone representing 3B's may call Shannon and Wilson to verify our situation.

Hopefully, I will get in touch with you tomorrow.

Frank

-----Original Message-----
From: Laureen McKenna [mailto:LMM@shanwil.com]
Sent: Friday, August 18, 2006 5:25 PM
To: Worth,Franklin S - TNFF-TPP-3
Cc: Chris Robertson
Subject: Draft report

Hi Frank,

Well better late than never I guess. I apologize for not getting you a draft earlier, but here is the text, a table, and the associated figures for our draft report. Unfortunately, I do not have the lab testing yet, so we may have some edits to the text and figures once I get the final copies of the lab test results. Please keep this mind as you review the report.

I will forward you what I have of our appendices in another email to follow.

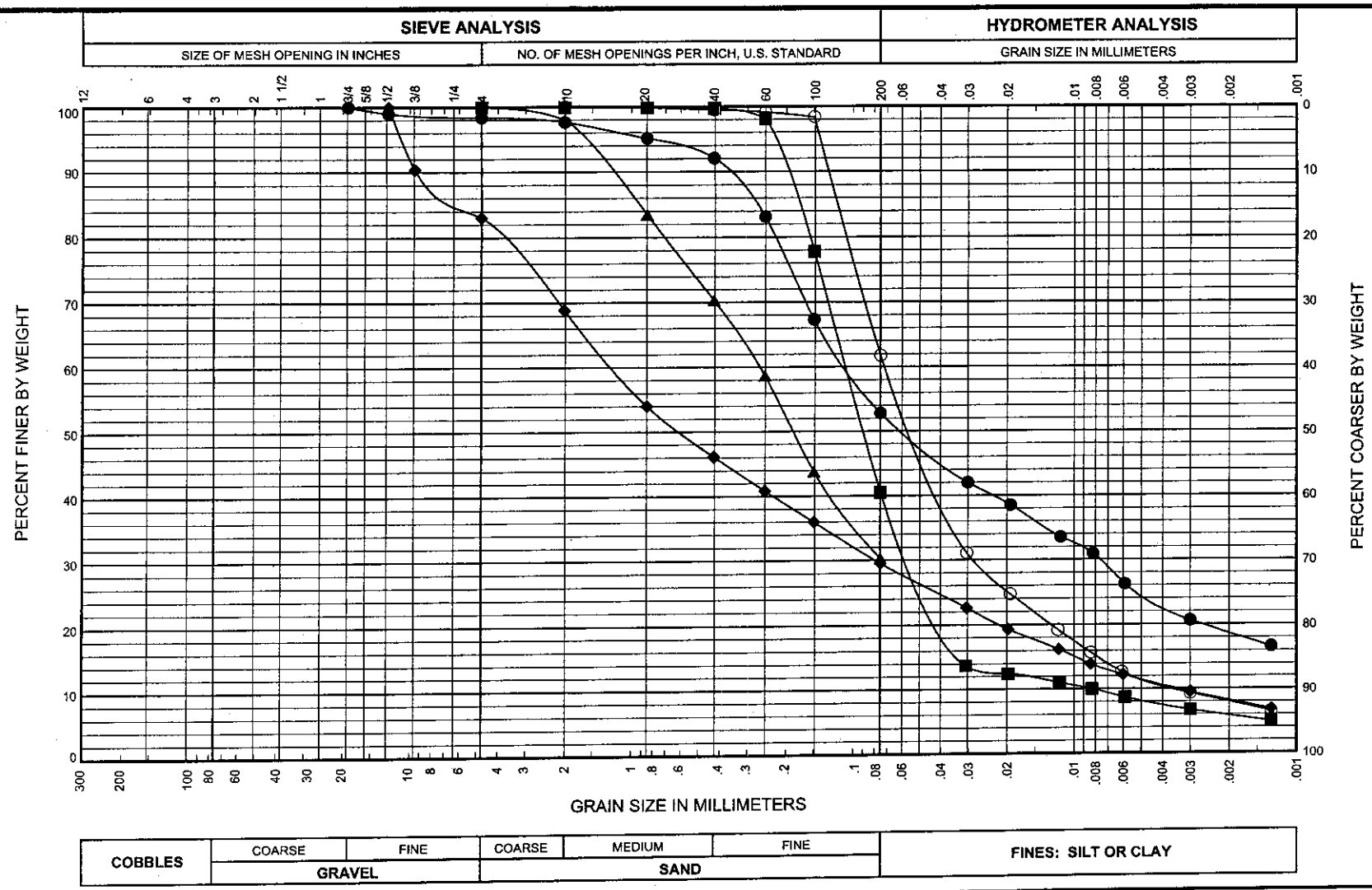
Please let us know if you have any comments along the way. I hope that we can have the lab testing and any subsequent tweaks to the report done

by the end of Tuesday. (I'd like to say Monday, but I'm not sure if the lab can support me on that!)

Have a good weekend,
Laureen

Laureen M. McKenna, P.E.
Senior Engineer
Shannon & Wilson, Inc.
400 N 34th Street, Suite 100
Seattle, WA 98103

Direct: (206) 695-6728
Cell: (206) 491-2352
Fax: (206) 695-6777



BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SAMPLE DESCRIPTION	FINES %	NAT. W.C. %	LL %	PL %	PI %
● B-101, S-10	25.0	ML	Gray-brown, clayey, sandy SILT, trace of gravel	52.8	45.2			
■ B-102, S-7	25.0	SM	Gray, slightly clayey, silty, fine SAND	40.5	30.3			
▲ B-104, S-10	25.0	SM	Orange-brown, silty, fine to medium SAND; trace of rust oxidation	30.3	39.8			
◆ B-105, S-6	15.0	SM	Brown, slightly clayey, gravelly, silty SAND	29.5	55.1			
○ B-106, S-13	40.0	ML	Light brown, slightly clayey, fine sandy SILT	61.8	25.7			

Bonneville Power Administration
Mt Solo/Longview Tower Study
Longview, Washington

GRAIN SIZE DISTRIBUTION

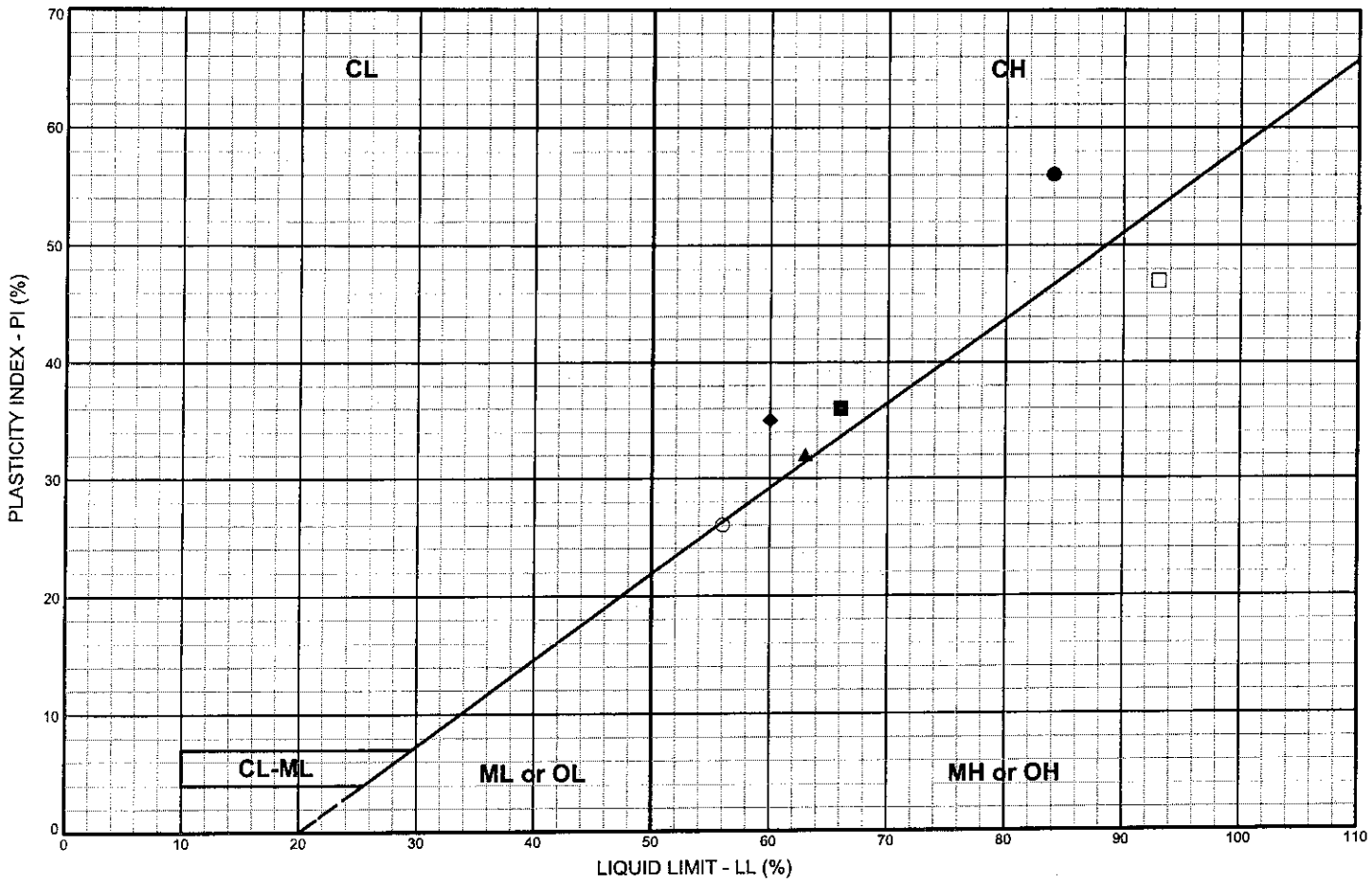
August 2006 | 21-1-20543-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-1

FIG. B-1

GSA MAIN 21-20543333.GPJ SHAN WIL.GDT 8/22/06



LEGEND

CL: Low plasticity inorganic clays; sandy and silty clays

CH: High plasticity inorganic clays

ML or OL: Inorganic and organic silts and clayey silts of low plasticity

MH or OH: Inorganic and organic silts and clayey silts of high plasticity

CL-ML: Silty clays and clayey silts

BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SOIL CLASSIFICATION	LL %	PL %	PI %	NAT. W.C. %	PASS. #200, %
● B-102, S-1	2.5	CH	Orange-brown, silty CLAY, trace medium to fine sand; scattered rust oxidation	84	28	56	32.6	
■ B-102, R-2	15.0	CH	Orange-brown, slightly fine sandy CLAY, trace of gravel	66	30	36	36.7	
▲ B-102, S-9	35.0	CH	Gray-brown, slightly gravelly, slightly fine sandy, silty CLAY; occasional rust oxidation	63	31	32	36.8	
◆ B-104, S-3	7.5	CH	Orange-brown, slightly fine to medium sandy, silty CLAY; scattered iron oxidation	60	25	35	30.9	
○ B-105, S-16	55.0	CH/MH	Gray-brown, slightly fine to medium sandy, silty CLAY; trace of rust oxidation	56	30	26	36.0	
□ B-106, S-16	55.1	MH	Gray, slightly fine sandy, clayey SILT, trace of coarse sand	93	46	47	48.3	

Bonneville Power Administration
Mt Solo/Longview Tower Study
Longview, Washington

PLASTICITY CHART

August 2006 21-1-20543-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-2

FIG. B-2

ATT. MAIN 21-20543333.GPJ SHAN WIL.GDT 8/22/06

Final Geotechnical Report
Mount Solo-Longview BPA Tower Study
Longview, Washington

August 30, 2006

SHANNON & WILSON, INC.

At Shannon & Wilson, our mission is to be a progressive, well-managed professional consulting firm in the fields of engineering and applied earth sciences. Our goal is to perform our services with the highest degree of professionalism with due consideration to the best interests of the public, our clients, and our employees.

Submitted To:
Mr. Franklin S. Worth
TNFF – TPP3 Bonneville Power Administration
P.O. Box 61409
Vancouver, Washington 98666-1409

By:
Shannon & Wilson, Inc.
400 N 34th Street, Suite 100
Seattle, Washington 98103

21-1-20543-001

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

ALASKA
COLORADO
FLORIDA
MISSOURI
OREGON
WASHINGTON

August 30, 2006

TNFF – TPP3 Bonneville Power Administration
P.O. Box 61409
Vancouver, WA 98666-1409

Attn: Mr. Franklin Worth

RE: FINAL GEOTECHNICAL REPORT, MOUNT SOLO-LONGVIEW BPA TOWER STUDY, LONGIVEW, WASHINGTON

Pleased find enclosed five copies of our geotechnical report for the above-referenced project. This report, which was previously submitted as draft on August 18, 2006, presents the results of our geotechnical studies for the proposed Mount Solo-Longview Bonneville Power Administration (BPA) Tower Study in Longview, Washington. Review comments provided to us by BPA on August 28, 2006 have been incorporated into this report.

If you have any questions or require further information, please contact me at (206) 632-8020.

Sincerely,

SHANNON & WILSON, INC.

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LMM:CAR/lmm

Enclosure: Final Geotechnical Report, Mount Solo – Longview BPA Tower Study, Longview, Washington (5 copies)

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21-1-20543-001

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FINAL GEOTECHNICAL REPORT
MOUNT SOLO-LONGVIEW BPA TOWER STUDY
LONGVIEW, WASHINGTON

1.0 INTRODUCTION

This report presents the results of our subsurface explorations, laboratory tests, and geotechnical engineering studies performed to evaluate the subsurface conditions near three Bonneville Power Administration (BPA) river crossing anchor structures (or towers) on Mount Solo in Longview, Washington. (See Figure 1, Vicinity map.) In July 2006, Napavine-Allston No. 1 Tower 36/1, which is adjacent to the three towers being studied, was replaced because of landslide movement that affected the foundations and caused distortion of the structure. BPA decided to evaluate the stability of the three adjacent towers because of the landslide that affected Tower 36/1 and recent renewed mining activities nearby on Mt. Solo. BPA retained Shannon & Wilson to explore the subsurface conditions and evaluate the slope stability at the tower sites. Our scope of services included conducting a site reconnaissance, drilling six exploratory borings at the site, performing laboratory tests, interpreting subsurface conditions, performing slope stability analyses, and preparing this report. A draft report was submitted to BPA on August 18, 2006, for review. On August 28, 2006, BPA provided the following comments resulting from that review of our draft report: correct the tower construction dates; evaluate the effects of blasting vibrations on slope stability; and analyze the slope at Tower 46/1 with a cut within 100 feet of the tower.

Our scope of our services was outlined in a proposal dated June 14, 2006. Our services were authorized by BPA in a contractual agreement with Shannon & Wilson, Inc. on June 16, 2006.

2.0 SITE AND PROJECT DESCRIPTION

The southwest flank of Mount Solo in Longview, Washington, supports four dead-end towers that form the north anchorage for transmission lines crossing the Columbia River. From west to east, these towers and transmission lines are:

- Paul-Allston No. 2 Tower 46/1 (X118D dead-end tower – built in 1973)
- Napavine-Allston No. 1 Tower 36/1 (X118D dead-end tower – built in 1969)
- Longview-Allston Nos. 1 and 2 Tower 2/3 (S33D dead-end tower – built in 1966)
- Longview-Allston Nos. 3 and 4 Tower 2/3 (1L dead-end tower – built in 1943)

The first two towers are about 150 to 200 feet above a quarry floor and a pond in the quarry. The quarry slopes are nearly vertical for about 75 feet. Above the quarry, the slopes are about 3 Horizontal to 1 Vertical (3H to 1V), which typically flatten to about 5H to 1V near the towers. During our site visits, we observed that the pond water level in the quarry dries up, except during wet summers, and floods parts of the quarry floor above the pond during the wet winter months.

Historical aerial photos show that quarry activities have occurred near the towers at various times at least since the 1950s. Recently, mining activity was reestablished, including surface stripping of soil as close as 150 feet away from the westernmost tower (Paul-Allston No. 2 Tower 46/1).

The Napavine-Allston No. 1 Tower 36/1 was deformed because of ground movement, which led BPA to replace the tower with a new structure 75 feet upslope. In December 2005, we provided BPA with an interpretation of subsurface conditions near this tower and geotechnical recommendations for design of the replacement tower foundations.

3.0 SITE RECONNAISSANCE AND FIELD EXPLORATIONS

On June 28, 2006, Bill Laprade, L.E.G., and Laureen McKenna of Shannon & Wilson visited the site to conduct a geological site reconnaissance. During the site visit, they observed surficial soils and exposed rock formations, looked for evidence of slope movement or disturbance, marked boring locations, and identified access issues for drilling purposes. Information gathered from the site reconnaissance was integrated into our interpretation of the subsurface conditions in the project vicinity, which is presented in this report.

Subsurface explorations conducted for the project consisted of drilling five borings, designated B-101, B-102, and B-104 through B-106. A sixth boring was proposed. However, it was not drilled because the truck-mounted rig used to drill the borings could not access the proposed drill hole location downslope of the tower. The approximate locations of the borings are shown in the Site and Exploration Plan, Figure 2. The locations of the borings are also presented in Table A-1, Summary of Planned Boring Locations, of Appendix A, Subsurface Explorations. A general description of the subsurface exploration program and logs of the borings are also presented in Appendix A.

4.0 LABORATORY TESTING

Geotechnical laboratory testing performed on soil samples collected during subsurface explorations included visual classification, moisture content determinations, grain size analyses, and Atterberg limits determinations. The laboratory tests were conducted to determine the index properties of the soil. All tests were performed at the Shannon & Wilson, Inc. laboratory in Seattle in general accordance with American Society for Testing and Materials (ASTM) standards. The results of the laboratory testing were incorporated into the soil descriptions shown in the borings logs included in Appendix A. More detailed descriptions and results of the laboratory tests are presented in Appendix B.

5.0 GEOLOGY

Published geologic maps of the area indicate that the site is underlain by Middle to Upper Eocene sedimentary rock locally interbedded with basalt flows and volcaniclastic rock of the Cowlitz Formation (Livingston, 1966a and 1966b; Walsh, 1987). Sedimentary rock near the site consists of sandstone, siltstone, shale, conglomerate, and coal beds. Basalt flows are described as being interbedded with tuff, volcaniclastic breccia, basaltic sandstone, and conglomerate.

During our explorations, we encountered soil layers in the upper portions of borings that resemble weathered alluvial deposits. These deposits may have been left by floods that passed down the ancestral Columbia River.

Much of the soil encountered in the borings below the weathered alluvium consisted of soil interbedded with coal seams. These soil layers probably represent residual soil, soil that formed in place by weathering of rock, or poorly indurated rock of the Cowlitz Formation. The subsurface conditions observed during our explorations indicated that the volcaniclastic rock in this area is highly weathered in places.

6.0 SUBSURFACE CONDITIONS

6.1 Subsurface Soils and Rock

Interpreted subsurface conditions at the three tower sites (starting with the westernmost tower) are summarized in the Generalized Subsurface Profiles A-A', B-B', and C-C', shown in Figures 3, 4, and 5, respectively. The locations of these profiles are shown on the Site and Exploration Plan presented in Figure 2. At the Paul-Allston No. 2 Tower 46/1 and Longview-Allston Nos. 1

and 2 Tower 2/3 sites, the ground slopes from north to south. At the Longview-Allston Nos. 3 and 4 Tower 2/3 site, the ground slopes down to the south and to the east. Profile C-C' presents our interpretation of the subsurface conditions below the ground from north to south. Because of the lack of contour information, a profile presenting the sloping ground to the east of Tower 2/3 could not be developed.

Generalized Subsurface Profile A-A' (Figure 3) shows our interpretation of the subsurface conditions near Paul-Allston No. 2 Tower 46/1. In general, 30 to 36 feet of soil overlies bedrock. The overall sequence of soil and rock layers encountered in the borings corresponds reasonably well with a seismic refraction study performed by Chris Robinson of BPA (provided to us in an email dated July 26, 2006). The soil encountered in borings B-101 and B-102 consisted of 12 to 20 feet of stiff clay and silt overlying about 13 to 16 feet of medium dense, clayey gravel; clayey, sandy silt; and silty sand, and 2 to 3 feet of hard, gravelly clay. Basalt was encountered in boring B-102 within the stiff clay layer from about 6 to 13 feet, which could be a boulder or a thin valley fill basalt flow. The underlying Cowlitz Formation was moderate to high strength conglomerate with gray, andesitic, gravel- to cobble-sized clasts in a fine-grained matrix. The conglomerate varies in degree of weathering from fresh to highly weathered.

Subsurface conditions encountered near the Longview-Allston Nos. 1 and 2 Tower 2/3 in boring B-104 are shown on the Generalized Subsurface Profile, B-B' (Figure 4). In general, an approximately 33-foot-thick sequence of medium to high plasticity clay, silt, sand, and gravel layers overlies deeply weathered or poorly lithified sedimentary rock of the Cowlitz Formation. The Cowlitz Formation encountered in boring B-104 was drilled and sampled using soil drilling techniques. It consisted of hard, sandy silt and clayey silt with sand, clay, and coal interbeds. Coal seams up to 10 inches thick were recovered in 1.5-foot-long samples. It is possible that coal interbeds may exist in thicknesses of up to several feet at this site.

Generalized Subsurface Profile C-C' (Figure 5) shows our interpretation of the subsurface conditions near Longview-Allston Nos. 3 and 4 Tower 2/3, based on borings B-105 and B-106. In general, an approximately 43- to 63-foot-thick sequence of low to high plasticity clay, silt, sand, and gravel layers overlies deeply weathered or poorly lithified sedimentary rock of the Cowlitz Formation. The soil encountered in borings B-105 and B-106 consisted of 16 to 18 feet of soft to very stiff, silty clay and clayey silt, overlying 29 to 44 feet of loose to dense, slightly clayey, gravelly, silty sand to silty, sandy gravel, fine sandy silt, or slightly fine sandy, silty clay. The underlying Cowlitz Formation is similar to the description above for Longview Allston Nos. 1 and 2, Tower 2/3 and boring B-104.

6.2 Groundwater

Groundwater was not observed during drilling of the borings. A gravel layer between 12 and 22.5 feet in B-101 and the upper silt layer in B-105 were wet or moist to wet. Iron-oxide staining was observed in many of the soil layers. These observations indicate that the subsurface soils are likely seasonally saturated.

7.0 EVIDENCE OF LANDSLIDING

We looked for evidence of landsliding at the three tower study sites while conducting our site reconnaissance and explorations, reviewing soil samples in the laboratory, and reviewing aerial photos and published geologic, critical area, and landslide inventory maps. As mentioned previously, a landslide affected the Napavine-Allston No. 1 Tower 36/1, which led to the relocation of the tower. The Tower 36/1 site is generally underlain by 33 to 36 feet of medium stiff to stiff, silty clay and clayey silt overlying the Cowlitz Formation Conglomerate (Shannon & Wilson, 2005). The tower was affected when its foundations in this soil layer moved either during high groundwater conditions and/or during past seismic events.

We did not observe evidence of landsliding near the three towers in this study during our reconnaissance or in our review of aerial photographs. The three tower study sites are underlain by 10 to 20 feet of the medium stiff to stiff clay and clayey silt, which is similar to the soil in the upper 36 feet at the Tower 36/1 site. Below this clay/silt layer are predominantly granular soil and gravelly clay layers. These soil layers were typically dense or hard, with the exception of localized zones of looser or softer soil. Design drawings provided to us by BPA show that foundations for the towers at these sites were typically near the bottom of the upper cohesive layer, at a depth of 11 to 14 feet bgs. Consequently, it is likely that the tower foundations at these sites bear on the underlying dense and hard soil layers, which would be less vulnerable to movement.

Soil samples collected to the depth of the borings were examined for indications of past landslide movement. Cohesive soil affected by previous landslide movement is typically characterized by blocky texture, slickensides, and/or sheared silt and clay. We did not observe such features in samples collected during our subsurface explorations.

Steep slopes are present south and east of the towers (Figure 2). The City of Longview considers these "severe" slopes to be critical areas (City of Longview, 2003). According to Jones & Stokes (2005), severe slopes are considered slopes of 30 percent or greater. As shown in our profiles,

the ground slopes about 18 to 36 percent down to the south at all three tower sites. At Tower 46/1, a nearly vertical slope exists approximately 200 feet south of the tower (i.e., the face of the quarry).

Landslide deposits have been identified about ½ to 1 mile east of the Longview-Allston Nos. 3 and 4 Tower 2/3, in the eastern portion of Mount Solo (Livingston, 1966b). Immediately east of the tower sites, Cowlitz County mapped an active landslide area (Cowlitz County, 2003). We observed this area east of Longview-Allston Nos. 3 and 4 Tower 2/3 during our site reconnaissance (Figure 2). The vegetation in the mapped landslide zone is less mature than the surrounding area, suggesting that the area has experienced significant movement in recent years.

8.0 ENGINEERING STUDIES AND RECOMMENDATIONS

8.1 General

The geotechnical report prepared for the quarry developer (Allwest, July 2006) indicates that quarry development may occur as close as 300 to 400 feet south of Paul-Allston No. 2 Tower 46/1. Quarry development in this location would consist of ripping and mass excavation. Farther away, approximately 600 feet to the west, additional quarry development may occur, which would consist of drilling, blasting, excavating, and crushing operations. As described in the Allwest report, the proposed quarry operations would not encroach on the existing steep, previously quarried slopes below the towers, but would occur farther south.

In our opinion, the slopes at the three tower sites are generally stable in their current condition. Our opinion is based on the shallow depth of medium stiff to stiff silt and clay underlying the ground surface and the generally dense and hard soil layers underlying this shallow, cohesive layer.

We performed slope stability analyses on the slope that appears more critical where the quarry face is 200 feet south of Paul-Allston No. 2 Tower 46/1. The following presents our assumptions, analytical procedures, and slope stability analysis results.

8.2 Slope Stability Analysis Assumptions

8.2.1 Soil Properties

Soil properties were estimated based on our results and interpretation of the field explorations and the laboratory testing. Properties included unit weight, angle of internal friction, and cohesion. Soil unit weights were estimated using moisture content, relative density, grain size distribution, and our experience with similar soil types. We estimated the angle of internal friction based on the soil type, geologic unit, relative density, and our experience with similar soil types. Because the upper clay layer at Tower 46/1 was generally similar to the upper clay layer at the Tower 36/1 site in appearance, structure, and density, we assumed the same soil properties as those assigned for the upper clay layer in the Tower 36/1 study.

Figure 2 shows the interpreted subsurface conditions that we used in our slope stability analyses. Our interpretation assumed that the bedrock surface is relatively planar to the quarry face downslope. We assumed that the soil layers above the conglomerate follow a similar trend.

8.2.2 Surcharge Load

It is our understanding that Tower 46/1 is the same type of tower as Tower 36/1 (a X118D dead-end tower). As a result, we assumed that each tower leg foundation supports a maximum load of 363 kips. We assumed that this load would be applied over a 12-foot by 12-foot grillage footing area.

8.2.3 Seismic Load

We performed pseudo-static seismic slope stability analyses, which use a constant horizontal static force calculated using a seismic coefficient. U.S. Geological Survey (USGS) maps indicate that for recurrence intervals of 475 years (i.e., a 10 percent chance of occurrence in 50 years), the peak ground acceleration (PGA) on soft rock at the project site is 0.19g. Because the PGA is experienced only a few times within the transient record of earthquake shaking, and the actual earthquake ground motion is cyclic in nature, as opposed to a static force, values of the seismic coefficient are typically one-third to one-half the value of the PGA. Therefore, we considered a horizontal seismic coefficient equal to half of the PGA for our seismic slope stability analyses.

8.2.4 Blasting Vibrations

Ground shaking from an earthquake can be characterized with a PGA, while ground motions resulting from blasting activity are typically characterized with peak particle velocities (PGV). Earthquake and blasting ground motions could be approximately compared by considering the typical peak particle velocity of the two types of motions. Representative peak particle velocities associated with seismic ground motions can be roughly estimated using representative average values of the ratio of maximum velocity to peak acceleration (PGV/PGA) for various geologic conditions. These ratios are developed from historical ground motion studies (Seed and Idriss, 1982). Using the average ratios from the Seed and Idriss (1982) studies, we estimate the approximate PGV from an earthquake to be on the order of 2 to 4 inches per second (ips).

Maximum limits for blast-induced ground vibrations at certain types of constructed facilities are specified in Washington Administration Code (WAC) 296-52-67065. According to WAC, maximum allowable ground vibration limits can be determined by one of three different methods provided in the regulation, including measuring the peak particle velocity of blast-induced vibrations. If this method is used, maximum allowable peak particle velocities are limited to the following: 1.25 inches per second (ips) for structures within 0 to 300 feet of the blast site, 1.0 ips for structures within 300 to 5,000 feet of the blast site, and 0.75 ips for structures more than 5,001 feet from the blast site. If blasting activity meets this regulation, it is our opinion that blast-induced vibrations will not affect slope stability of the tower sites and, therefore, they were not analyzed.

Although the tower structures may be safe from blast-induced vibrations, they could still be at risk if flyrock is not controlled during blasting operations. Regulations concerning flyrock from blasting operations are also included in WAC 296-52-67065. It should be noted that flyrock cannot be propelled from the blast area onto property where the blasting operation has not contracted and received a written waiver from the owner. We recommend that BPA review WAC 296-52-67065 to get a further understanding of the state regulations regarding blasting activity.

8.3 Slope Stability Results

Slope stability analyses were performed assuming static and seismic conditions for both fully saturated (i.e., groundwater at ground surface) and unsaturated ground conditions. We also evaluated a scenario whereby further excavation of the quarry face cut back 50, 75, and 100 feet

from the current face. We evaluated two possible failure planes – the first being in the upper clay layer bgs, and the second through the thin loose sand and gravel layer overlying the conglomerate. Selected results of our analyses are shown in Figures 6 and 7. These figures show the assumed surficial geometry, soil layer depths and properties, groundwater levels, and search limits applied to the stability analyses. All results are summarized in the table titled, "Summary of Slope Stability Results."

Our analyses suggest that the slope should be stable under static conditions, if an earthquake of 10 percent probability of occurrence in 50 years occurs (approximately 500-year recurrence interval) , or if high groundwater conditions occur. Further quarry excavations into the face would reduce the Factor of Safety (FS) against sliding. We calculated an FS as low as 1.1 if the quarry excavation cut back 100 feet into the face, a 500-year earthquake event occurred, with high groundwater conditions present. With an FS of 1.1, it is our opinion that ground movement at the Tower 46/1 would be less than ½ inch during the analyzed conditions described above.

9.0 LIMITATIONS

This report was prepared for the exclusive use of the BPA for studying the existing towers on Mount Solo in Longview, Washington. The report should not be considered a warranty of subsurface conditions, such as those interpreted from the exploration logs and discussions of subsurface conditions included in this report.

The analyses, conclusions, and recommendations contained in this report are based on site conditions as they presently exist. We assume that the explorations made for this study are representative of the subsurface conditions at the tower sites; i.e., the subsurface conditions everywhere are not significantly different from those disclosed by the explorations. If conditions different from those described in this report are observed or appear to be present during construction, we should be advised at once so that we can review these conditions and reconsider our recommendations, where necessary. If conditions have changed because of natural forces or construction operations at or near the site, it is recommended that this report be reviewed to determine the applicability of the conclusions and recommendations considering the changed conditions and time lapse.

Within the limitations of the scope, schedule and budget, the analyses, conclusions, and recommendations presented in this report were prepared in accordance with generally accepted professional geotechnical engineering principles and practice in this area at the time this report was prepared. We make no other warranty, either express or implied.

The scope of our services did not include any environmental assessment or evaluation of hazardous or toxic materials in the soil, surface water, groundwater, or air at the subject site. Shannon & Wilson, Inc., has qualified personnel to assist you with these services should they be necessary.

Shannon & Wilson, Inc. has prepared and included as Appendix C, "Important Information About Your Geotechnical Report," to assist you and others in understanding the use and limitations of our reports.

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10.0 REFERENCES

Allwest Materials Testing Geotechnical Engineering, 2006, Letter regarding geotechnical evaluation, proposed quarry development – southwest area, Mt. Solo Quarry, Longview, Washington: Allwest Materials Testing Geotechnical Engineering, July 26.

City of Longview, 2003, Critical areas generalized: http://www.ci.longview.wa.us/gis/documents/critareas.pdf.

Cowlitz County, 2003, Digital landslide study map: http://www.co.cowlitz.wa.us/gis/landslide.htm.

Jones & Stokes, 2005, City of Longview comprehensive plan update, final existing conditions: Report prepared by Jones & Stokes for Cowlitz Wahkiakum Council of Governments, June 30.

Livingston, V. E., 1966a, Preliminary geologic map and cross section of the Cathlamet-Coal Creek area, Cowlitz and Wahkiakum counties, Washington: Washington Division of Geology and Earth Resources, Bulletin 54, scale 1:62,500.

Livingston, V. E., 1966b, Geologic map and cross-section of the Kelso 7.5-minute quadrangle: Washington Division of Geology and Earth Resources, Bulletin 54, scale 1:24,000.

Seed, H.B., and Idriss, I.M., 1982, Ground motions and soil liquefaction during earthquakes: Oakland, Calif., Earthquake Engineering Research Institute.

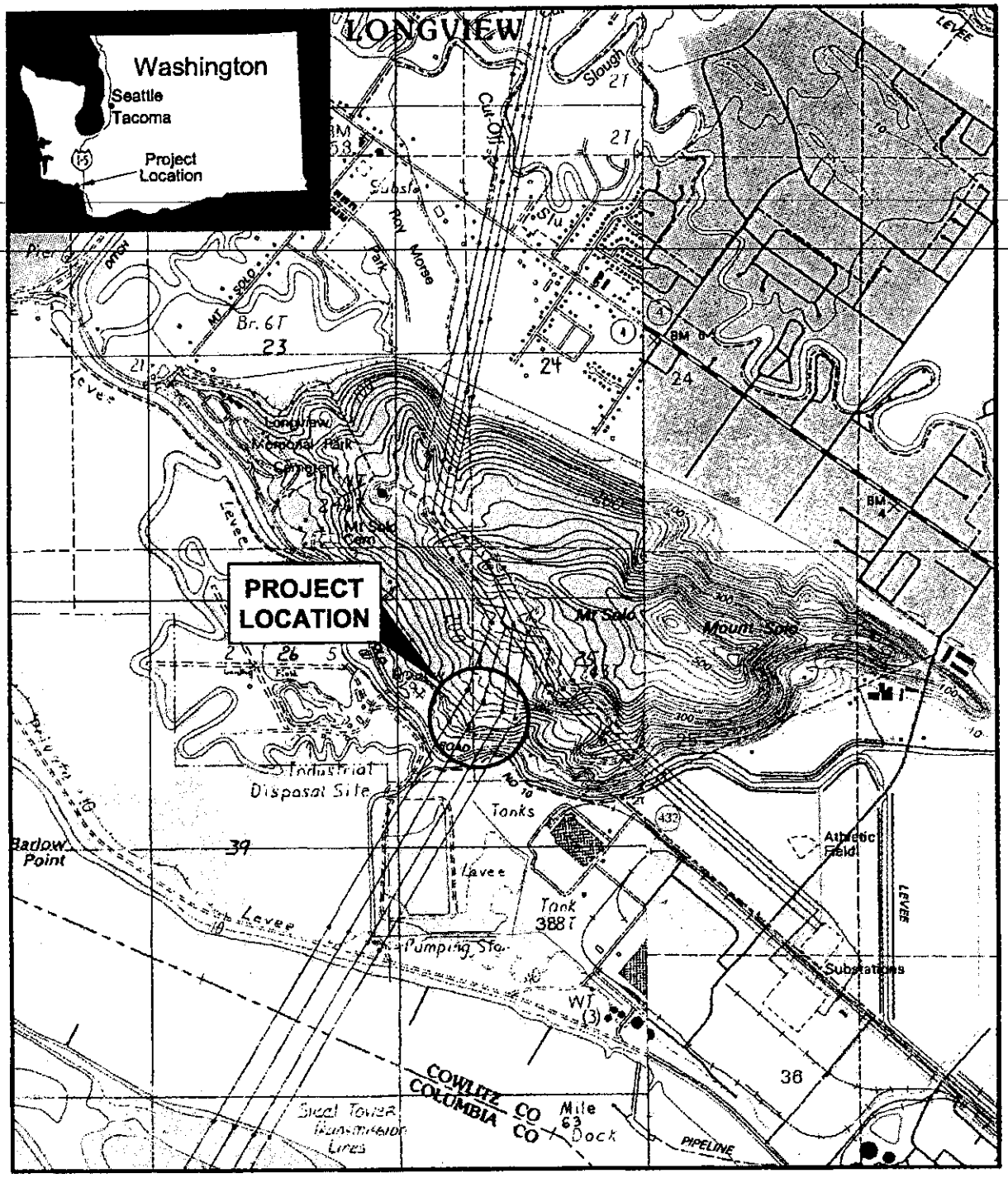
Shannon & Wilson, 2005, Geotechnical report, BPA Napavine-Allston No. 1, Tower 36/1 replacement, Longview, Washington: Report prepared by Shannon & Wilson, Inc., Seattle, Wash., for Bonneville Power Administration, Vancouver, Wash.,, December.

SUMMARY OF SLOPE STABILITY RESULTS
PAUL-ALLSTON NO. 2 TOWER 46/1

Loading Condition	Factor of Safety (FS)	
	~~Failure in Upper Clay~~ Layer	~~Failure in Gravel/Sand~~ Layer Above Conglomerate
Static Cases		
Static, unsaturated	4.2	3.5
Static, fully saturated	2.8	1.8
Face of slope cut back 50 feet toward tower; static and fully saturated	2.4	1.7
Face of slope cut back 75 feet toward tower; static and fully saturated	2.4	1.6
Face of slope cut back 100 feet toward tower; static and fully saturated	2.4	1.4
Seismic Cases		
Seismic, unsaturated	2.7	2.5
Seismic, fully saturated	1.7	1.2
Face of slope cut back 50 feet toward tower; seismic and fully saturated	1.6	1.2
Face of slope cut back 75 feet toward tower; seismic and fully saturated	1.6	1.2
Face of slope cut back 100 feet toward tower; seismic and fully saturated	1.5	1.1

Notes:

1. The analyses were performed using the computer program Slope/W Version 6.16, developed by Geo-slope.
2. See Figures 6 and 7 for slope stability model input and results of selected cases.



0 1/2 1

Scale in Miles

NOTE

Map adapted from 1:24,000 USGS topographic maps of Coal Creek, WA-OR quadrangle, dated 1985, and Kelso, WA quadrangle, dated 1990.

Bonneville Power Administration
Mt. Solo / Longview Tower Study
Longview, Washington

VICINITY MAP

August 2006 21-1-20543-001

SHANNON & WILSON, INC.
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FIG. 1

File: J:\211\20543-001\21-1-20543-001 Fig 1.dwg Date: 08-03-2006 Author: SAC

0 300 600

Approximate Scale In Feet
Contour Interval = 5 Feet

LEGEND

B-101 Boring Designation and Approximate Location

B-1 Previous Napavine-Allston No .1 Tower 36/1 Study Boring Designation and Approximate Location

36/1 Tower Location and Designation

Proposed Development Area Described in Allwest Letter Dated 7-26-06 Regarding Geotechnical Evaluation, Proposed Quarry Development - Southwest Area, Mt. Solo Quarry, Longview, Washington

A Generalized Subsurface Profile (See Figures 3 through 5)

NOTE

Figure adapted from PDF file of orthorectified imagery aerial photograph provided by the Bonneville Power Administration, dated 6-30-06.

Bonneville Power Administration
Mt. Solo / Longview Tower Study
Longview, Washington

SITE AND EXPLORATION PLAN

August 2006 21-1-20543-001

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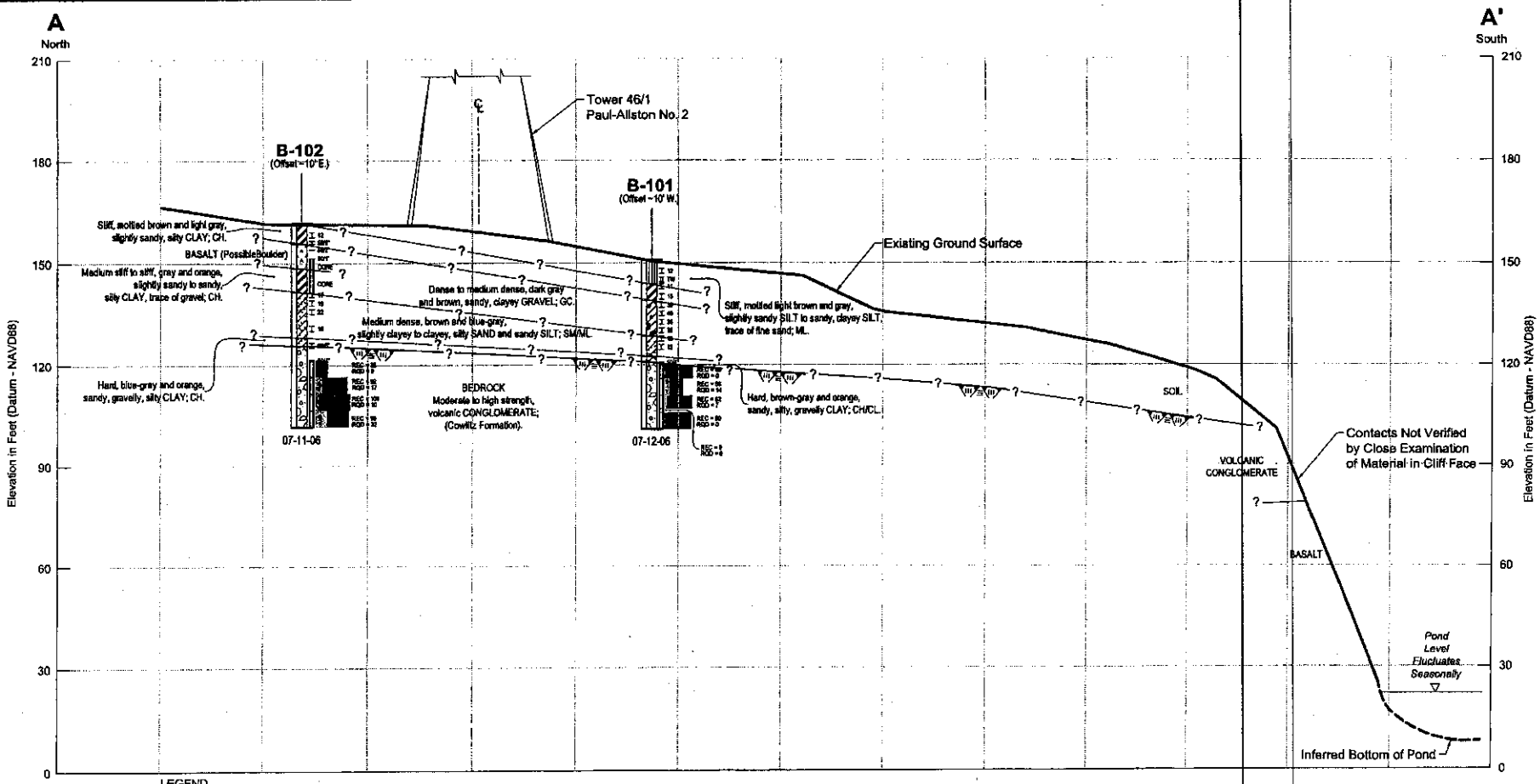
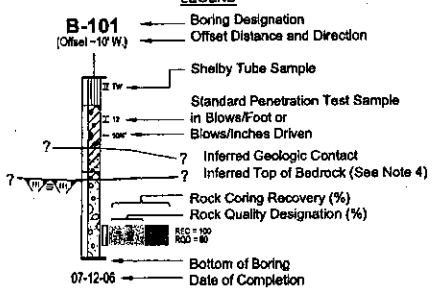
Geotechnical and Environmental Consultants

FIG. 2

File: J:\211\20543-001\21-1-20543-001 Fig 2.dwg Date: 08-18-2006 Author: SAC



LEGEND



0 30 60

Scale in Feet
Vertical = Horizontal

NOTES

1. Ground surface developed from orthorectified imagery aerial photography taken 6-30-06, provided by Bonneville Power Administration.
2. Ground surface elevations of borings have been adjusted to match the approximated ground surface elevation profile.
3. This subsurface profile is generalized from materials observed in soil borings. Variations between the profile and actual conditions may exist.
4. Inferred top of bedrock based on information from seismic line and field reconnaissance.

Bonneville Power Administration
Mt. Solo / Longview Tower Study
Longview, Washington

GENERALIZED SUBSURFACE PROFILE A-A'

August 2006 | 21-1-20543-001

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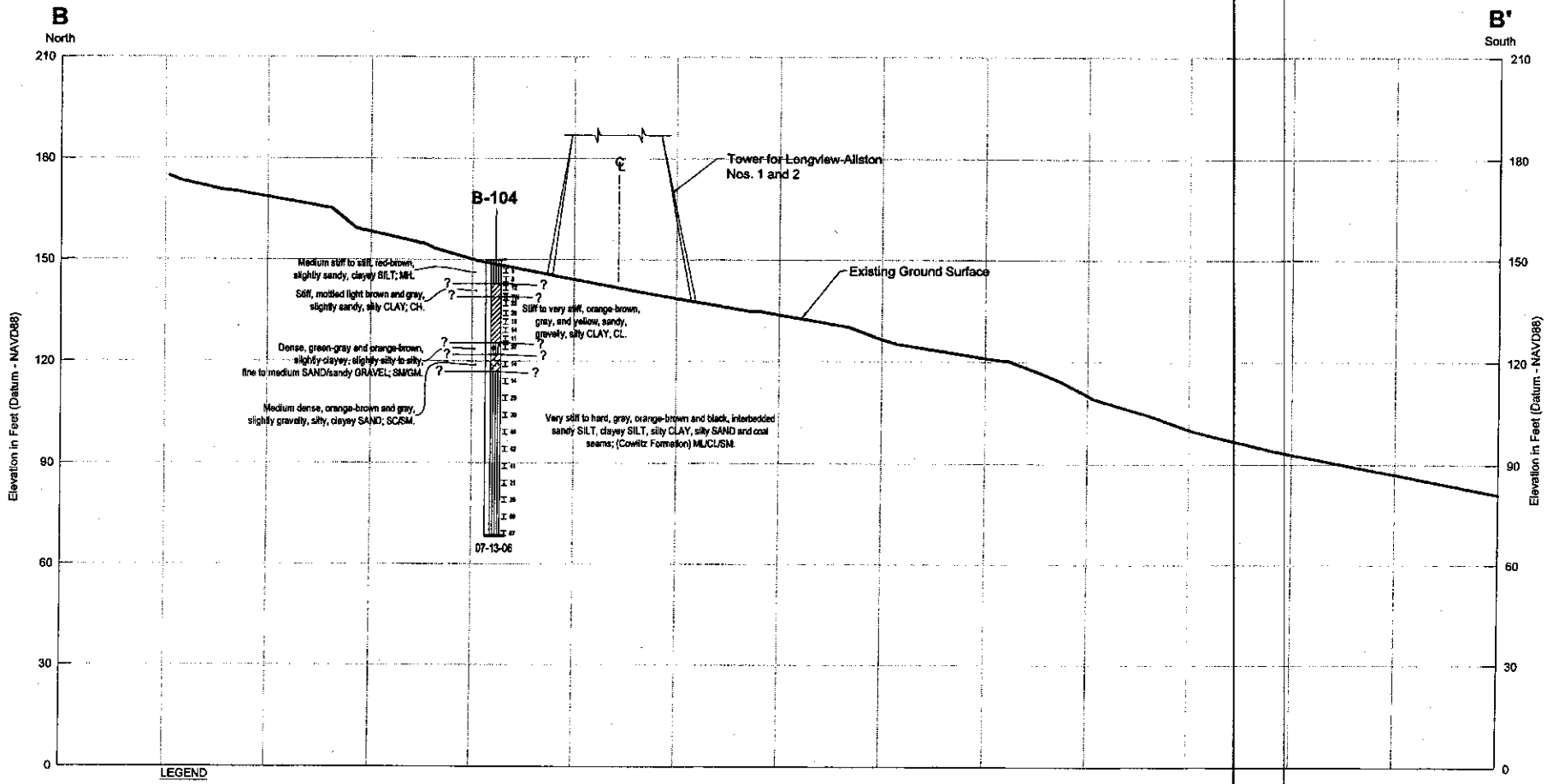
Geotechnical and Environmental Consultants

FIG. 3

File: J:\21\20543-001\21-1-20543-001 Profiles.dwg Date: 08-29-2006 Author: SAC



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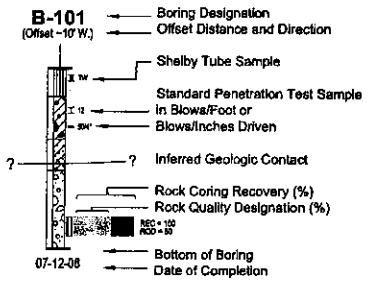

NOTES

1. Ground surface developed from orthorectified imagery aerial photography taken 6-30-06, provided by Bonneville Power Administration.
2. This subsurface profile is generalized from materials observed in soil borings. Variations between the profile and actual conditions may exist.

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Longview, Washington

GENERALIZED SUBSURFACE PROFILE B-B'

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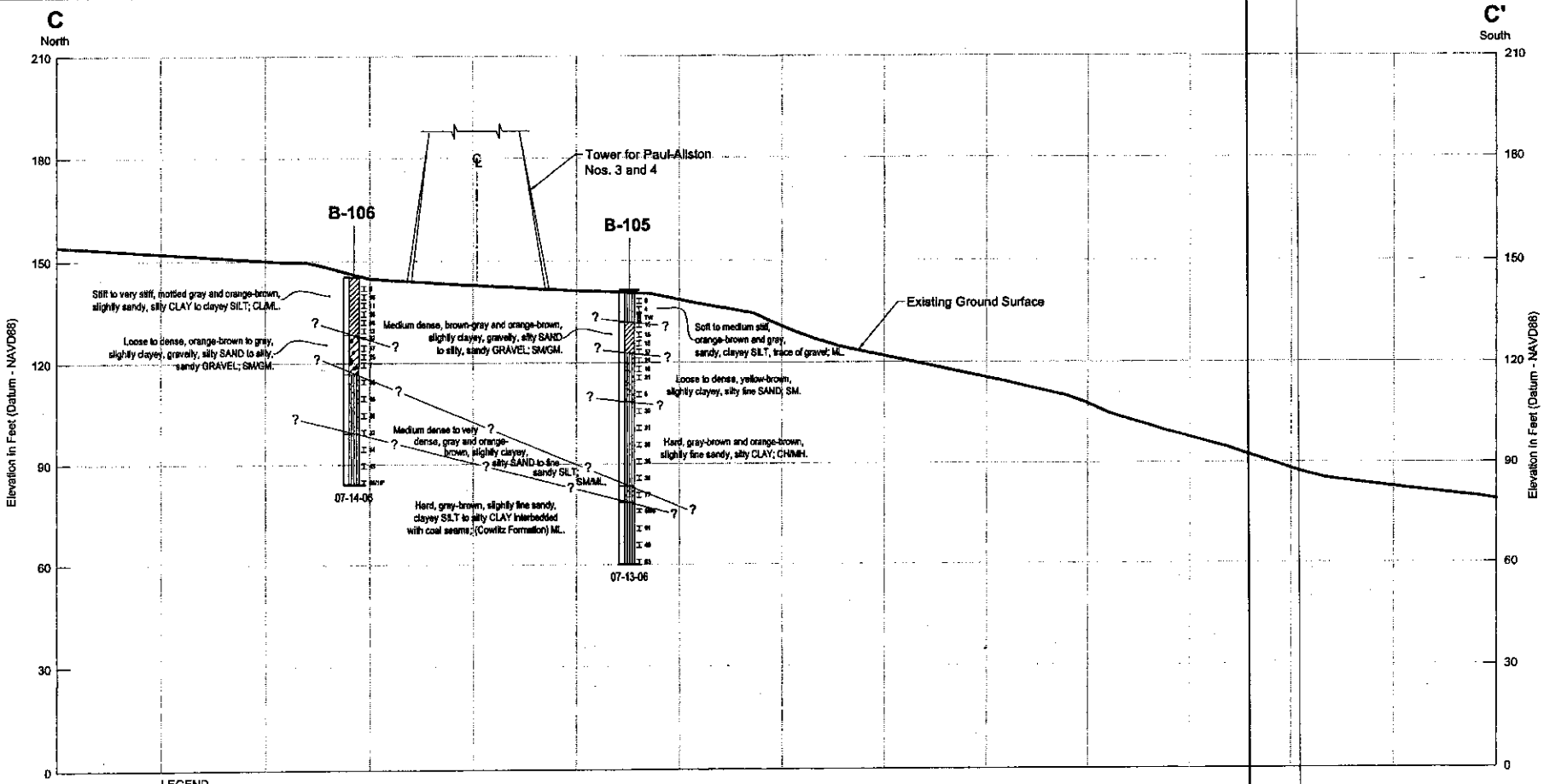
FIG. 4

File: J:\21\20543-001\21-1-20543-001 Profiles.dwg Date: 08-30-2006 Author: SAC



LEGEND

B-101 (Offset ~10' W.) — Boring Designation; Offset Distance and Direction

Shelby Tube Sample

Standard Penetration Test Sample in Blows/Foot or Blows/Inches Driven

Inferred Geologic Contact

Rock Coring Recovery (%)

Rock Quality Designation (%)

Bottom of Boring

Date of Completion

07-12-06

0 30 60

Scale in Feet

Vertical = Horizontal

NOTES

1. Ground surface developed from orthorectified imagery aerial photography taken 6-30-06, provided by Bonneville Power Administration.
2. Ground surface elevations of borings have been adjusted to match the approximated ground surface elevation profile.
3. This subsurface profile is generalized from materials observed in soil borings. Variations between the profile and actual conditions may exist.

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Mt. Solo / Longview Tower Study
Longview, Washington

GENERALIZED SUBSURFACE PROFILE C-C'

August 2006 | 21-1-20543-001

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FIG. 5

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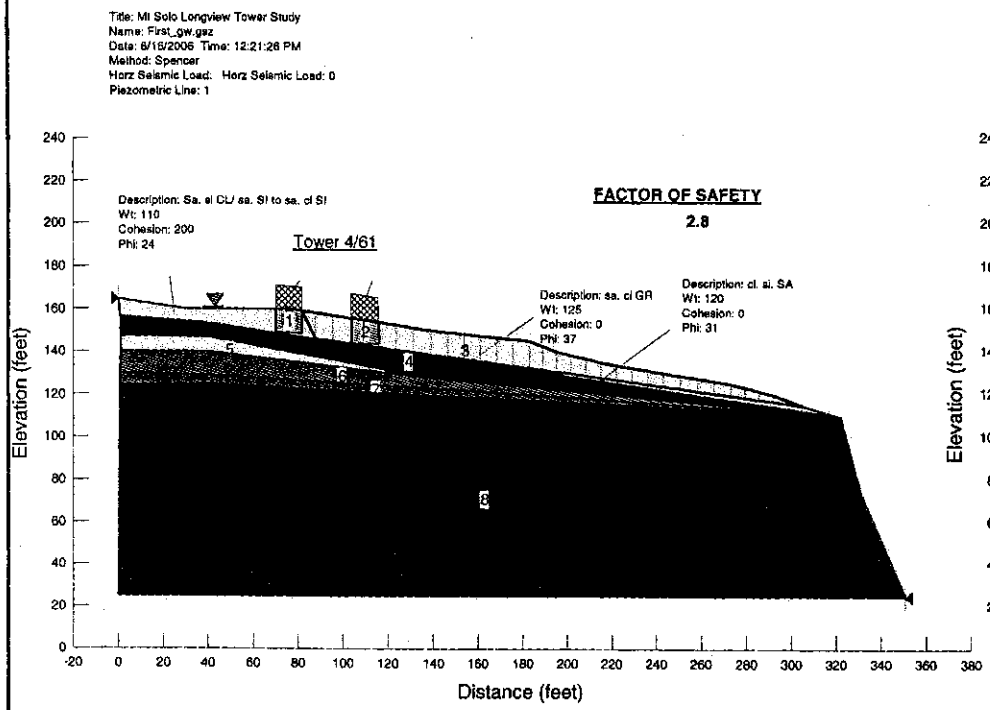
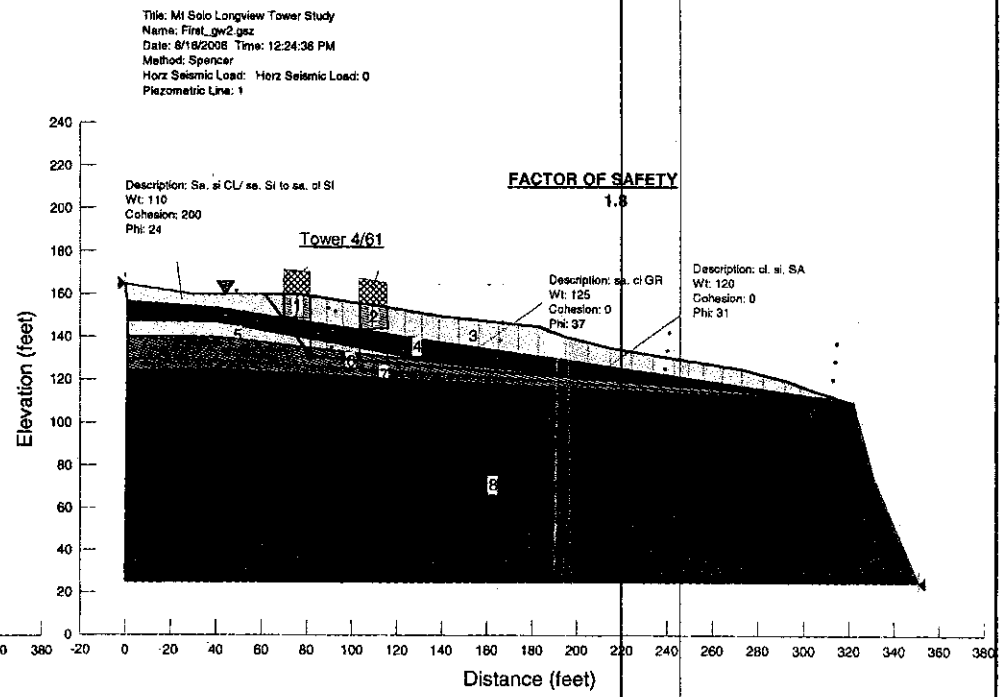


FAILURE IN UPPER CLAY LAYER



FAILURE IN GRAVEL SAND LAYER ABOVE CONGLOMERATE

NOTES:

1. The analyses were performed using the computer program Slope/W Version 6.16 (Geo-Slope 2005).
2. The Spencer's method of analyses used in the analyses satisfies both moment and force equilbrium for the failure surfaces shown.
3. The thick black line on the plots above indicates the location of the potential failure surface.
4. The units for the soil parameters shown are: Unit Weight - pounds per cubic foot (pcf); Cohesion - pounds per square foot (psf), and Friction (Phi) - degrees.
5. The surcharge load of Tower 46/1 was considered. The compression load of 363 kips per tower leg was assumed, which was the same value assumed for Napavine-Allston No. 1 Tower 36/1.
6. Groundwater was not encountered in the borings; however, a fully saturated case was analyzed, which assumes groundwater may rise to the ground surface during a period of heavy percipitation.
7. The factors of safety under static, unsaturated conditions for failure in the upper clay layer and the gravel/sand layer are 4.2 and 3.5, repsectively.
8. The factor of safetys under seismic, saturated conditions for failure in the upper clay layer and the gravel/sand layer are 1.7 and 1.2, respectively.

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Longview, Washington

SLOPE STABILITY RESULTS
STATIC LOADING, SATURATED GROUND CONDITION

August 2006 | 21-1-20543-001

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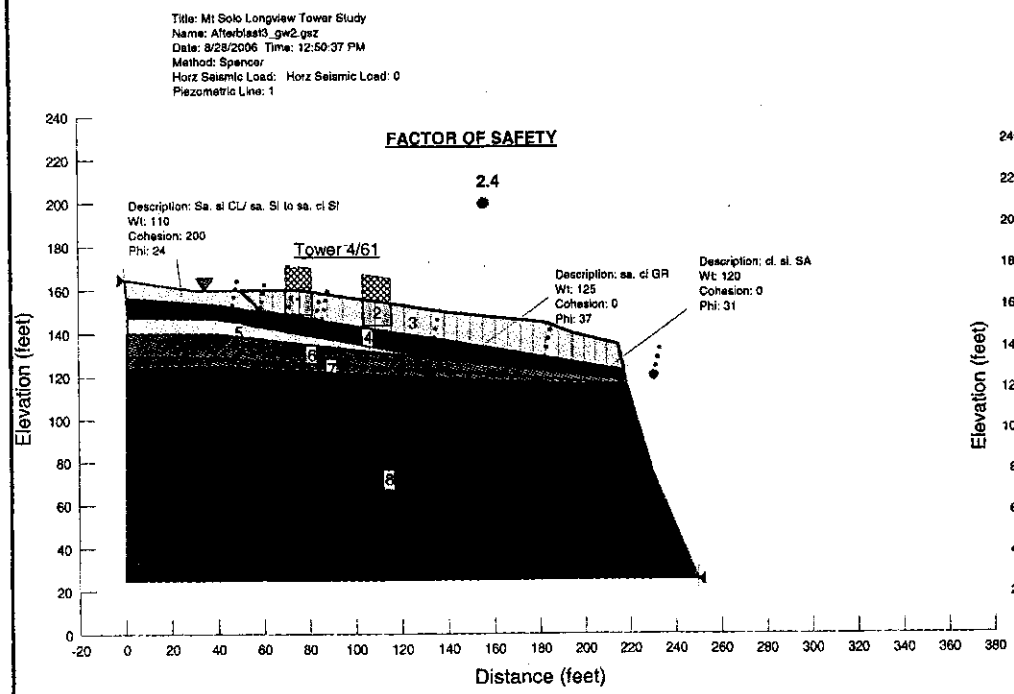
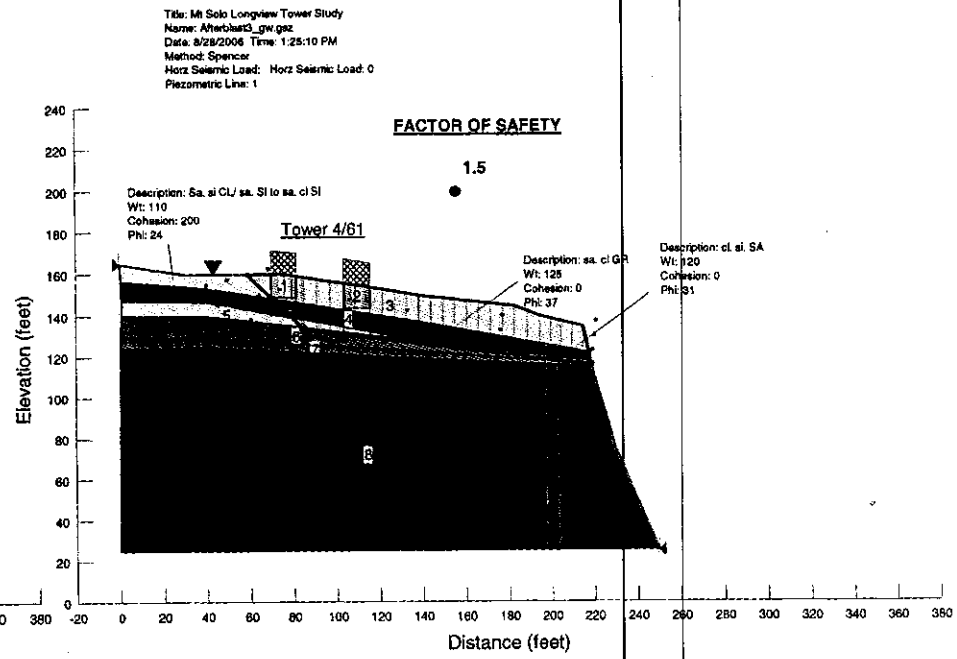
FIG. 6



FAILURE IN UPPER CLAY LAYER



FAILURE IN GRAVEL SAND LAYER ABOVE CONGLOMERATE

NOTES:

1. The analyses were performed using the computer program Slope/W Version 6.16 (Geo-Slope 2005).
2. The Spencer's method of analyses used in the analyses satisfies both moment and force equilbrium for the potential failure surfaces shown.
3. The thick black line on the plots above indicates the location of the failure surface.
4. The units for the soil parameters shown are: Unit Weight - pounds per cubic foot (pcf); Cohesion - pounds per square foot (psf), and Friction (Phi) - degrees.
5. The surcharge load of Tower 46/1 was considered. The compression load of 363 kips per tower leg was assumed, which was the same value assumed for Napavine-Allston No. 1 Tower 36/1.
6. Groundwater was not encountered in the borings; however, a fully saturated case was analyzed, which assumes groundwater may rise to the ground surface during a period of heavy percipitation.

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SLOPE STABILITY RESULTS
STATIC LOADING, SATURATED GROUND CONDITION, CUT WITHIN 100 FEET OF TOWER

August 2006 | 21-1-20543-001

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FIG. 7

APPENDIX A

SUBSURFACE EXPLORATIONS

APPENDIX A

SUBSURFACE EXPLORATIONS

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APPENDIX A

SUBSURFACE EXPLORATIONS

A.1 INTRODUCTION

Five soil borings, designated B-101, B-102, and B-104 through B-106, were completed for the proposed Bonneville Power Administration (BPA) Mount Solo-Longview tower study between July 10 and 14, 2006. The locations of the borings are shown on the exploration plan presented in Figure 2 of the main text of this report and in Table A-1 of this appendix. These locations were determined approximately by measuring with a tape from the center of the existing tower. A hand-held global positioning system (GPS) unit was used to determine the northing and easting coordinates of each boring location. The ground surface elevations at each boring location were surveyed by BPA.

A.2 BORINGS

The borings were drilled to evaluate subsurface conditions and develop parameters for engineering studies. Classification of soil observed during drilling was based on the Unified Soil Classification System (USCS), as described in Figure A-1. Engineering classification of rock core was based on the International Society for Rock Mechanics (ISRM) Rock Classification Methods. The terminology used to describe the rock core is described in Figure A-2. The logs of the borings are presented as Figures A-3 through A-7.

The borings were drilled by Boart Longyear under subcontract to Shannon & Wilson, Inc., with a truck-mounted rig using mud-rotary drilling techniques until bedrock was encountered, and then wire line rock coring techniques. In general, the mud-rotary drilling procedure consisted of drilling the formation materials and removing the cuttings by circulating drilling mud. The cuttings were deposited in a settling tank at the ground surface. The drilling mud used was a mixture of water and bentonite. After each boring was completed, the hole was filled with bentonite chips to seal the hole. Boring depths ranged from 50 to 81.5 feet below the existing ground surface.

A.2.1 Penetration Test Soil Sampling

Standard Penetration Tests (SPTs) were generally performed in the borings at 2.5-foot intervals in the upper 25 feet and at 5-foot intervals thereafter until bedrock was encountered. The tests were performed in general accordance with the American Society for Testing and Materials (ASTM) Designation: D 1586, Standard Method for Penetration Test and Split-Barrel Sampling of Soils. The SPT consists of driving a 2-inch outside-diameter (O.D.) split-spoon sampler a total distance of 18 inches into the bottom of the boring with a 140-pound hammer falling 30 inches. The number of blows required to cause the last 12 inches of penetration is termed the Standard Penetration Resistance (N-value). When penetration resistances exceeded 50 blows for 6 inches or less of penetration, the test was terminated and the number of blows and the corresponding penetration were recorded. The N-values were recorded by a geologist from our firm and plotted on a log of the boring. The N-values provide a means for evaluating the relative consistency (stiffness) of cohesive soils and the relative compactness, or density, of cohesionless (granular) soils. A more detailed description of the N-values and how they relate to soil characteristics is presented in Figure A-1.

The split-spoon sampler used during the penetration testing recovers a disturbed sample of the soil. The samples were classified in the field and recorded on the logs by our field representative, sealed in jars, and returned to our laboratory for testing. Laboratory testing was performed on selected samples; the results of the testing are presented in Appendix B.

A.2.2 Relatively Undisturbed Soil Sampling

At selected locations, relatively undisturbed samples were obtained using hydraulically pushed, thin-walled tube samplers, also known as Shelby tube samplers. The Shelby tube samples were obtained in general accordance with ASTM D 1587-94, Standard Practice for Thin-Walled Tube Geotechnical Sampling of Soils. This sampling method employs a thin-walled, steel tube connected to a sampling head that is attached to the drill rods. The tube is pushed by the hydraulic rams of the drill rig into the soil below the bottom of a drill hole and then retracted to obtain a sample. This type of tube is generally used in soft to stiff, fine-grained soils, although occasionally it is used in stiffer soils.

The locations and types of the relatively undisturbed samples obtained in the borings are shown on the logs presented in Appendix A.

A.2.3 Rock Core Sampling

In borings B-101 and B-102, after the boreholes were advanced through the surficial soil deposits, hazard quotient (HQ) core drilling techniques were utilized. In boring B-101, the core barrel was also used to advance the hole between 10 and 20 feet. Continuous core runs were obtained, typically in 5-foot intervals. During coring operations, the rate of penetration, the estimated quantity of return drill mud, and the action of the drill rig (whether rough, jerky, or smooth) was observed and recorded in the field log. Attention was paid to the drilling characteristics so that probable reasons for core loss could be interpreted. Rock core recovered from the borings was logged and placed into plastic core boxes furnished by the driller. The core boxes were labeled and the core was arranged in descending sequence beginning at the upper left end of the core box partition and continuing in the other partitions from left to right. Each core run was separated from the preceding run by blocks labeled with the depth of the core interval. Zones of core loss were indicated with blocks and labeled with the interval where the loss occurred. If the zone of core loss was uncertain, the core loss was assigned to the bottom of the run. Empty spaces within the core boxes were then filled with blocks to reduce core movement. The core boxes were then stored in the Shannon & Wilson warehouse in Seattle, Washington, for further visual observation and testing.

TABLE A-1
SUMMARY OF PLANNED BORING LOCATIONS

	Location	Distance from Tower Center
B-101	Paul-Allston No. 2 Tower 46/1	50 feet south (downslope) 9 feet east
B-102	Paul-Allston No. 2 Tower 46/1	51 feet north (upslope) 10 feet west
B-103*	Longview-Allston Nos. 1 and 2 Tower 2/3	44 feet south (downslope) 2 feet west
B-104	Longview-Allston Nos. 1 and 2 Tower 2/3	36 feet north (upslope) 2 feet west
B-105	Longview-Allston Nos. 3 and 4 Tower 2/3	38 feet south (downslope) 6 feet east
B-106	Longview-Allston Nos. 3 and 4 Tower 2/3	34 feet north (upslope) 6 feet west

*Note:
Boring B-103 was not drilled because of access issues.

Shannon & Wilson, Inc. (S&W), uses a soil classification system modified from the Unified Soil Classification System (USCS). Elements of the USCS and other definitions are provided on this and the following page. Soil descriptions are based on visual-manual procedures (ASTM D 2488-93) unless otherwise noted.

S&W CLASSIFICATION OF SOIL CONSTITUENTS

- MAJOR constituents compose more than 50 percent, by weight, of the soil. Major consituents are capitalized (i.e., SAND).
- Minor constituents compose 12 to 50 percent of the soil and precede the major constituents (i.e., silty SAND). Minor constituents preceded by "slightly" compose 5 to 12 percent of the soil (i.e., slightly silty SAND).
- Trace constituents compose 0 to 5 percent of the soil (i.e., slightly silty SAND, trace of gravel).

MOISTURE CONTENT DEFINITIONS

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, from below water table

ABBREVIATIONS

ATD	At Time of Drilling
Elev.	Elevation
ft	feet
FeO	Iron Oxide
MgO	Magnesium Oxide
HSA	Hollow Stem Auger
ID	Inside Diameter
in	inches
lbs	pounds
Mon.	Monument cover
N	Blows for last two 6-inch increments
NA	Not applicable or not available
NP	Non plastic
OD	Outside diameter
OVA	Organic vapor analyzer
PID	Photo-ionization detector
ppm	parts per million
PVC	Polyvinyl Chloride
SS	Split spoon sampler
SPT	Standard penetration test
USC	Unified soil classification
WLI	Water level indicator

GRAIN SIZE DEFINITION

DESCRIPTION	SIEVE NUMBER AND/OR SIZE
FINES	< #200 (0.08 mm)
SAND*	
- Fine	#200 to #40 (0.08 to 0.4 mm)
- Medium	#40 to #10 (0.4 to 2 mm)
- Coarse	#10 to #4 (2 to 5 mm)
GRAVEL*	
- Fine	#4 to 3/4 inch (5 to 19 mm)
- Coarse	3/4 to 3 inches (19 to 76 mm)
COBBLES	3 to 12 inches (76 to 305 mm)
BOULDERS	> 12 inches (305 mm)

* Unless otherwise noted, sand and gravel, when present, range from fine to coarse in grain size.

RELATIVE DENSITY / CONSISTENCY

COARSE-GRAINED SOILS		FINE-GRAINED SOILS	
N, SPT, BLOWS/FT.	RELATIVE DENSITY	N, SPT, BLOWS/FT.	RELATIVE CONSISTENCY
0 - 4	Very loose	Under 2	Very soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium dense	4 - 8	Medium stiff
30 - 50	Dense	8 - 15	Stiff
Over 50	Very dense	15 - 30	Very stiff
		Over 30	Hard

WELL AND OTHER SYMBOLS

Bent. Cement Grout	Surface Cement Seal
Bentonite Grout	Asphalt or Cap
Bentonite Chips	Slough
Silica Sand	Bedrock
PVC Screen	
Vibrating Wire	

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SOIL CLASSIFICATION AND LOG KEY

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FIG. A-1
Sheet 1 of 2

BASED ON INTERNATIONAL SOCIETY FOR ROCK MECHANICS (ISRM) ROCK CLASSIFICATION METHODS

STRATIGRAPHIC STRUCTURE TERMS

MASSIVE - Rock without significant structure

BEDDED - Regular layering from sedimentation

FISSILE - Tendency to break along laminations

FOLIATED - Parallel arrangement or distribution of minerals

for metamorphic rocks:
SCHISTOSE - Parallel arrangement of tabular minerals giving a planar fissility

GNEISSOSE - Segregation of minerals into bands

CLEAVAGE - Tendency to split along secondary, planar textures or structures

ROCK STRENGTH

DESCRIPTION	FIELD IDENTIFICATION	APPROXIMATE UNCONFINED COMPRESSIVE STRENGTH (MPa)	APPROXIMATE UNCONFINED COMPRESSIVE STRENGTH (psi)
Very Low Strength	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife	<5.0	<700
Low Strength	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer	5.0 to 25	700 to 4,000
Moderate Strength	Cannot be scraped or peeled by a pocket knife, specimen can be fractured with a single blow of geological hammer	25 to 50	4,000 to 7,000
Medium High Strength	Specimen requires more than one blow of geological hammer to fracture it	50 to 100	7,000 to 15,000
High Strength	Specimen requires many blows of geological hammer to fracture it	100 to 250	15,000 to 36,000
Very High Strength	Specimen can only be chipped with geological hammer	>250	>36,000

VESCULARITY

Slightly Vesicular	1 to 10%
Moderately Vesicular	10 to 30%
Highly Vesicular	30 to 50%
Scoriaceous	>50%

JOINT ROUGHNESS

SMALL SCALE	INTERMEDIATE SCALE
Rough	Stepped
Smooth	Undulating
Slickensided	Planar

WEATHERING

TERM	DESCRIPTION
Fresh	No visible signs of rock material weathering: perhaps slight discoloration on major discontinuity surfaces.
Slightly Weathered	Slight penetration of discoloration away from fracture. Fractures may contain thin filling.
Moderately Weathered	Partial to complete discoloration away from fracture. Rock not friable except for poorly cemented rock. Fractures may contain thick filling.
Highly Weathered	All rock is discolored. Rock is friable except for poorly cemented rock. Corestones may be present.
Completely Weathered	All rock is decomposed and/or disintegrated to soil. The original mass is still largely intact.

DISCONTINUITY TERMS

FRACTURE - Collective term for any natural break excluding shears, shear zones, and faults

JOINT (JT) - Planar break with little or no displacement

FOLIATION JOINT (FJ) or BEDDING JOINT (BJ) - Joint along foliation or bedding

INCIPIENT JOINT (IJ) or INCIPIENT FRACTURE (IF) - Joint or fracture not evident until wetted and dried; breaks along existing surface

RANDOM FRACTURE (RF) - Natural, very irregular fracture that does not belong to a set

BEDDING PLANE SEPARATION or PARTING - A separation along bedding after extraction from stress relief or slaking

FRACTURE ZONE (FZ) - Planar zone of broken rock without gouge

MECHANICAL BREAK (MB) - Breaks due to drilling or handling; drilling break (DB), hammer break (HB)

SHEAR (SH) - Surface of differential movement evident by presence of slickensides, striations, or polishing

SHEAR ZONE (SZ) - Zone of gouge and rock fragments bounded by planar shear surfaces

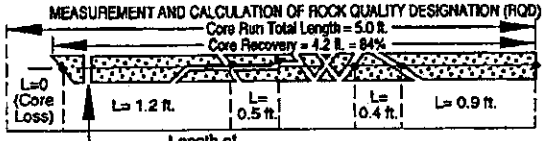
FAULT (FT) - Shear zone of significant extent; differentiation from shear zone may be site-specific

STRUCTURE SPACING TERMS

STRATIGRAPHIC	SPACING	DISCONTINUITY *
Very Thick	>6 ft. (2 m)	Very Wide
Thick	2 to 6 Ft. (0.6 to 2 m)	Wide
Medium	8 to 24 in. (0.2 to 0.6 m)	Medium
Thin	2-1/2 to 8 in. (60 to 200 mm)	Close
Very Thin	3/4 to 2-1/2 in. (20 to 60 mm)	Very Close
Laminated: Thickly	1/4 to 3/4 in. (6 to 20 mm)	Extremely Close
Laminated: Thinly	<1/4 in. (<6 mm)	Extremely Close

* Refers to apparent spacing along core axis unless measured orthogonal to discontinuity; should then report for each set

MEASUREMENT AND CALCULATION OF ROCK QUALITY DESIGNATION (RQD)



$$RQD = \frac{\sum \text{Length of Core Pieces} > 4\text{ in.}}{\text{Total Core Run Length}} \times 100\% \quad RQD = \frac{1.2 + 0.5 + 0.4 + 0.9}{5.0} \times 100\% \quad RQD = 60\%$$

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ROCK CLASSIFICATION AND LOG KEY

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FIG. A-2

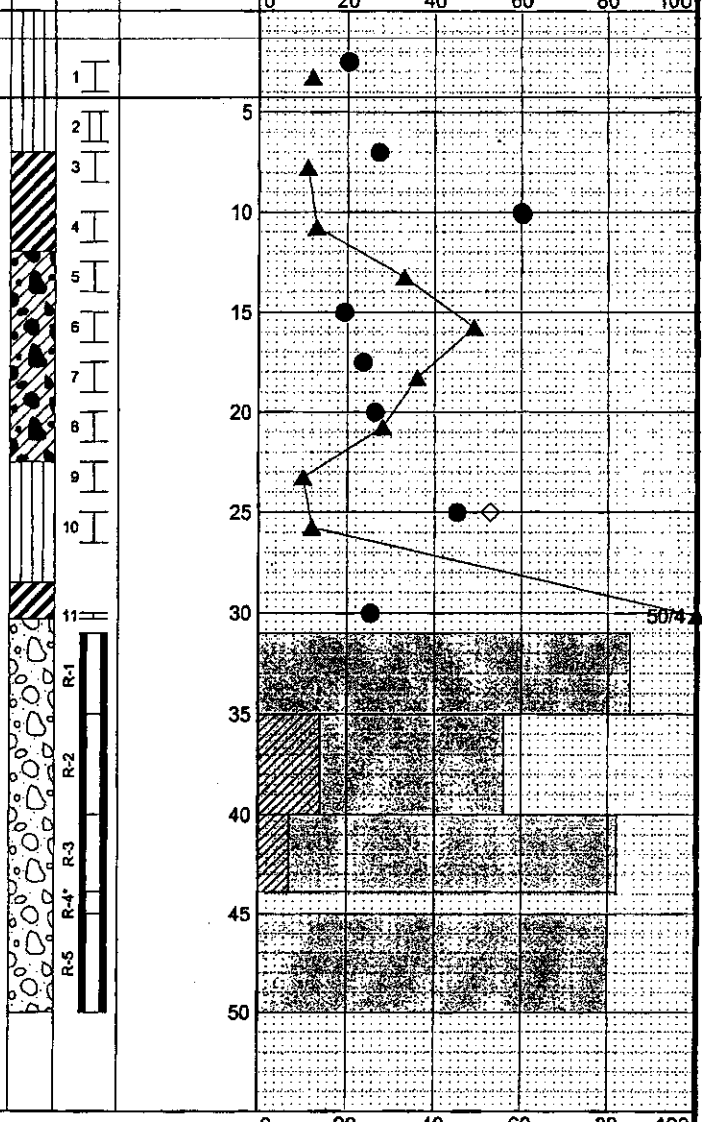
File: J:□211□20543-001□21-1-20543-001 Fig A-2.dwg Date: 08-17-2006 Author: SAC

Total Depth:	50 ft.	Northing:	5,110,627 ft.	Drilling Method:	Mud Rotary & Rock Core	Hole Diam.:	
Top Elevation:	155.6 ft.	Easting:	499,267 ft.	Drilling Company:	Boart Longyear	Rod Type:	
Vert. Datum:		Station:		Drill Rig Equipment:	Mobile B-59	Hammer Type:	Cathead
Horiz. Datum:		Offset:	-	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft
Stiff, mottled light brown and gray, slightly sandy SILT to sandy, clayey SILT, trace of fine sand; moist; micaceous, scattered to abundant manganese and iron-oxide nodules; ML.	7.0
Stiff, mottled orange-brown and gray, silty CLAY, trace of fine sand; moist; high plasticity, micaceous, scattered to abundant manganese and iron-oxide nodules; CH/CL.	12.0
Dense to medium dense, dark gray and brown, sandy, clayey GRAVEL; wet; basalt clasts; GC.	22.5
Medium dense, brown and blue-gray, clayey, sandy SILT and clayey, silty SAND, trace of gravel; moist; micaceous, scattered charcoal fragments; iron-oxide stained locally; weathered; ML/SM.	28.5
Hard, blue-gray and orange, sandy, silty, gravelly CLAY, trace of fine gravel; moist; micaceous; scattered charcoal fragments; CH/CL.	30.3
VOLCANIC CONGLOMERATE: Moderate to high strength, blue-gray to black, welded, gravel to cobble-sized andesite clasts in a fine-grained matrix; slightly to highly weathered; rough, moderate to high angle, open joints with heavy iron-oxide staining above 43.9 feet. (Cowlitz Formation) - fractured to sand-size particles between 40 to 40.7 feet	50.0
BOTTOM OF BORING COMPLETED 7/12/2006	



LEGEND

- * Sample Not Recovered
- Standard Penetration Test
- Thin Wall Sample
- Rock Core
- Ground Water Level in Well

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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LOG OF BORING B-101

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FIG. A-3

MASTER LOG E 21-20543333.GPJ SHAN WIL.GDT 8/30/06 Log: DH Rev: LMM Typ: EET

Total Depth:	60 ft.	Northing:	5,110,645 ft.	Drilling Method:	Mud Rotary & Rock Core	Hole Diam.:	
Top Elevation:	163.9 ft.	Easting:	499,278 ft.	Drilling Company:	Boart Longyear	Rod Type:	
Vert. Datum:		Station:		Drill Rig Equipment:	Mobile B-59	Hammer Type:	Cathead
Horiz. Datum:		Offset:	-	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Stiff, mottled brown and light gray, trace to slightly sandy, silty CLAY; moist; high plasticity, micaceous, scattered manganese and iron-oxide nodules; moderately to completed weathered gravel basalt clasts below 5 feet; CH.

5.9

BASALT BOULDER: Medium high to high strength, gray, smooth to rough joints, non-vesicular, iron-oxide staining in joints; low- to high-angle fractures; slightly weathered.

13.0

Medium stiff to stiff, gray and orange, slightly fine sandy to sandy, silty CLAY, trace of gravel; moist; high plasticity; CH.

20.0

Medium dense, brown and blue-gray, slightly clayey to clayey, silty SAND; moist; medium to high plasticity, micaceous, weathered; wet below 35 feet; SM.

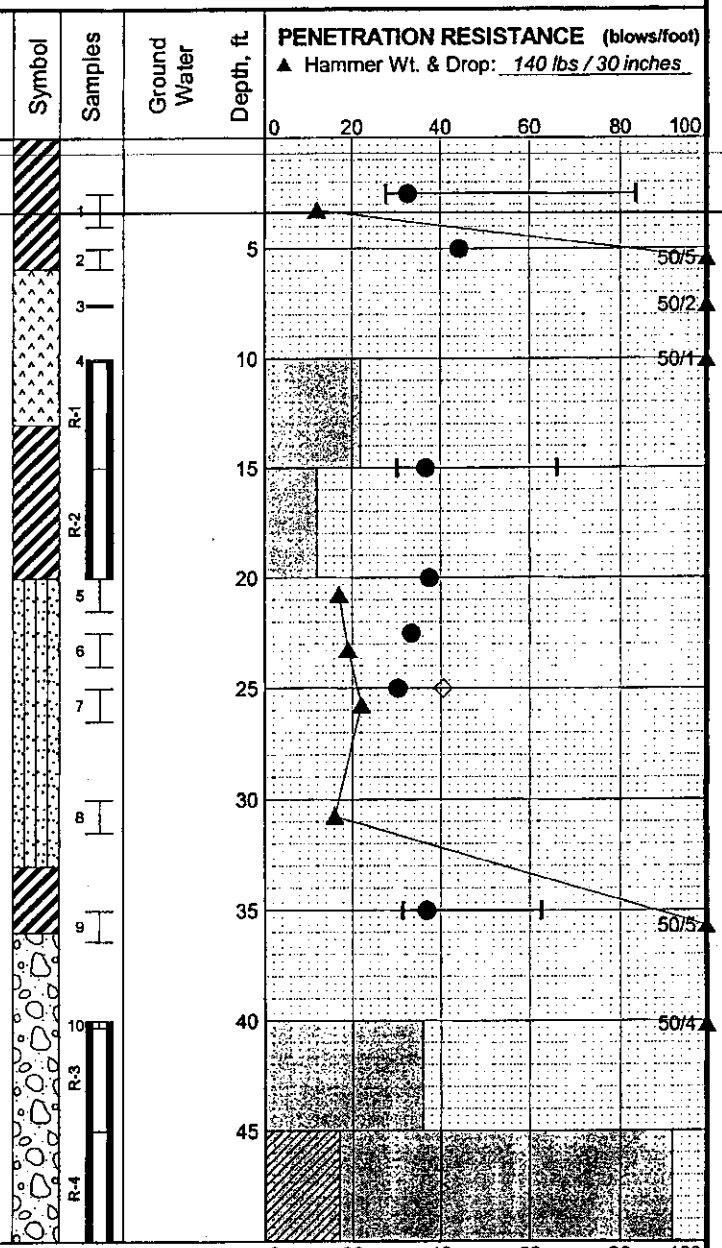
33.0

Hard, blue-gray and orange, slightly sandy to sandy, slightly gravelly to gravelly, silty CLAY; moist; scattered charcoal fragments; CH.

36.0

VOLCANIC CONGLOMERATE: Moderate to high strength, blue-gray, welded, andesitic clasts in sandy matrix; fresh to moderately weathered, fine gravel to cobble size; moderate to high angle, open, rough joints, iron-oxide stained above 50 feet. (Cowlitz Formation).

CONTINUED NEXT SHEET



LEGEND

- * Sample Not Recovered
- Standard Penetration Test
- Rock Core
- ◇ % Fines (<0.075mm)
- ● % Water Content
- Plastic Limit ⊢●⊣ Liquid Limit
- ▼ Ground Water Level in Well

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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LOG OF BORING B-102

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FIG. A-4
Sheet 1 of 2

MASTER LOG E 21-205433333.GPJ SHAN WIL.GDT 8/30/06 Log: DH Rev: LMM Typ: EET

Total Depth:	60 ft.	Northing:	5,110,645 ft.	Drilling Method:	Mud Rotary & Rock Core	Hole Diam.:	
Top Elevation:	163.9 ft.	Easting:	499,278 ft.	Drilling Company:	Boart Longyear	Rod Type:	
Vert. Datum:		Station:		Drill Rig Equipment:	Mobile B-59	Hammer Type:	Cathead
Horiz. Datum:		Offset:	-	Other Comments:			

SOIL DESCRIPTION *Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.*	Depth, ft	Symbol	Samples	Ground Water	Depth, ft	PENETRATION RESISTANCE (blows/foot) ▲ Hammer Wt. & Drop: 140 lbs / 30 inches 0 20 40 60 80 100
- heavily fractured between 51.4 and 55 feet			R-5			
			R-6		55	
BOTTOM OF BORING COMPLETED 7/11/2006	60.0				60	
					65	
					70	
					75	
					80	
					85	
					90	
					95	

0 20 40 60 80 100

▨ RQD (%) ▩ Recovery (%)

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ├──●──┤ Liquid Limit

LEGEND

- • Sample Not Recovered
- I Standard Penetration Test
- ▯ Rock Core

▼ Ground Water Level in Well

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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LOG OF BORING B-102

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FIG. A-4
Sheet 2 of 2

MASTER LOG E 21-20543333.GPJ SHAN WIL.GDT 8/30/06 Log: DH Rev: LMM Typ: EET

Total Depth:	81.5 ft.	Northing:	5,110,562 ft.	Drilling Method:	Mud Rotary & Rock Core	Hole Diam.:	
Top Elevation:	149.7 ft.	Easting:	499,422 ft.	Drilling Company:	Boart Longyear	Rod Type:	
Vert. Datum:		Station:		Drill Rig Equipment:	Mobile B-59	Hammer Type:	Cathead
Horiz. Datum:		Offset:	-	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Medium stiff to stiff, red-brown, slightly sandy, clayey SILT; moist; medium plasticity, scattered iron-oxide and manganese nodules, ML.

7.0

Stiff, mottled light brown and gray, slightly sandy, silty CLAY; moist; medium to high plasticity, scattered iron-oxide and manganese nodules; CH.

11.0

Stiff to very stiff, orange-brown, gray, and yellow, sandy, gravelly, silty CLAY; moist; medium to high plasticity, heavily weathered, tuffaceous gravel clasts; CL.

24.5

Dense, green-gray and orange-brown, slightly clayey, slightly silty to silty, fine to medium SAND/sandy GRAVEL; moist; angular iron-oxide stained basalt clasts; SM/GM.

28.0

Medium dense, orange-brown and gray, slightly gravelly, silty, clayey SAND; moist; SC/SM.

33.0

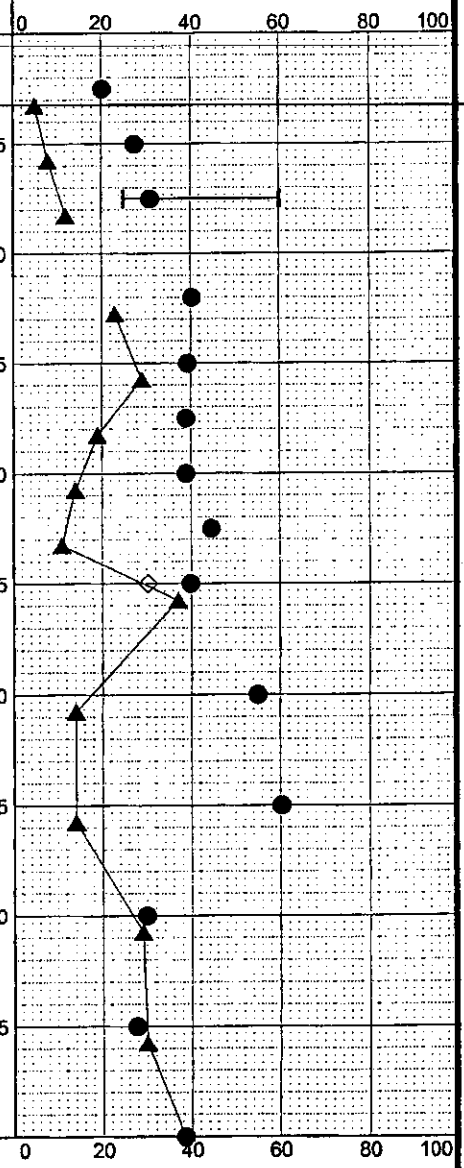
Very stiff to hard, gray, orange-brown and black, sandy SILT and clayey SILT, interbedded with silty CLAY, silty SAND, and coal seams; moist; partially indurated; (Cowlitz Formation) ML/CL/SM.

CONTINUED NEXT SHEET

Depth, ft | Symbol | Samples | Ground Water | Depth, ft

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches



◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

LEGEND

* Sample Not Recovered

I Standard Penetration Test

II Thin Wall Sample

▼ Ground Water Level in Well

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

Bonneville Power Administration
Mt Solo/Longview Tower Study
Longview, Washington

LOG OF BORING B-104

August 2006 | 21-1-20543-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-5
Sheet 1 of 2

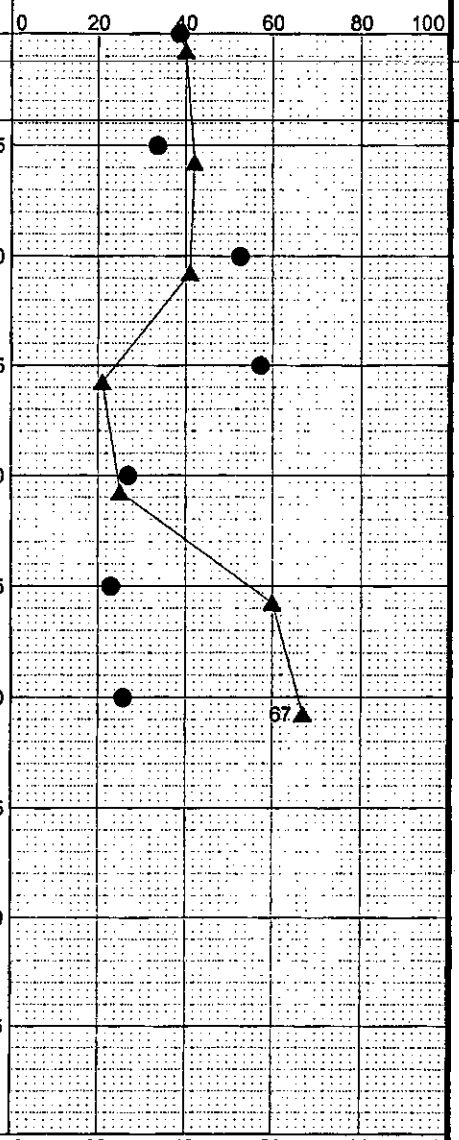
MASTER_LOG_E 21-20543333.GPJ SHAN_WIL.GDT 8/30/06 Log: DH Rev: LMM Typ: EET

Total Depth:	81.5 ft.	Northing:	5,110,562 ft.	Drilling Method:	Mud Rotary & Rock Core	Hole Diam.:	
Top Elevation:	149.7 ft.	Easting:	499,422 ft.	Drilling Company:	Boart Longyear	Rod Type:	
Vert. Datum:		Station:		Drill Rig Equipment:	Mobile B-59	Hammer Type:	Cathead
Horiz. Datum:		Offset:	-	Other Comments:			

SOIL DESCRIPTION	Depth, ft	Symbol	Samples	Ground Water	Depth, ft
Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.					
			15		
			16		55
			17		60
			18		65
			19		70
			20		75
			21		80
BOTTOM OF BORING COMPLETED 7/13/2006	81.5				85
					90
					95

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*



◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

LEGEND

* Sample Not Recovered

I Standard Penetration Test

II Thin Wall Sample

▼ Ground Water Level in Well

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

Bonneville Power Administration
Mt Solo/Longview Tower Study
Longview, Washington

LOG OF BORING B-104

August 2006 | 21-1-20543-001

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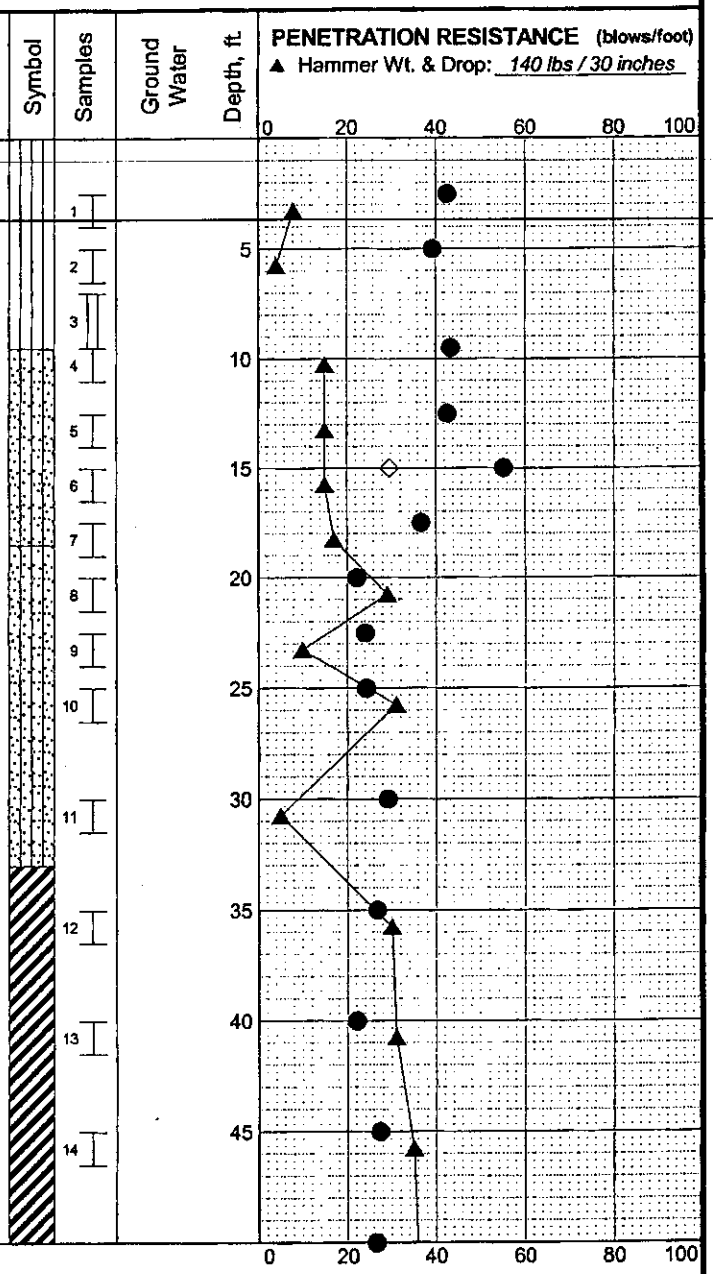
FIG. A-5
Sheet 2 of 2

MASTER LOG E 21-20543333.GPJ SHAN WIL.GDT 8/30/06 Log: DH Rev: LMM Typ: EET

Total Depth:	81.5 ft.	Northing:	5,110,516 ft.	Drilling Method:	Mud Rotary & Rock Core	Hole Diam.:	
Top Elevation:	142.2 ft.	Easting:	499,455 ft.	Drilling Company:	Boart Longyear	Rod Type:	
Vert. Datum:		Station:		Drill Rig Equipment:	Mobile B-59	Hammer Type:	Cathead
Horiz. Datum:		Offset:	-	Other Comments:			

SOIL DESCRIPTION *Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.*	Depth, ft
Soft to medium stiff, orange-brown and gray, sandy, clayey SILT, trace of gravel; moist to wet; medium to high plasticity, micaceous; trace of iron-oxide nodules; scattered wood and charcoal; ML.	
Medium dense, brown-gray and orange-brown, slightly clayey, gravelly, silty SAND to silty, sandy GRAVEL; moist; medium plasticity, weathered; angular iron-oxide stained basalt clasts; SM/GM.	9.5
Loose to dense, yellow-brown, slightly clayey, silty, fine SAND; moist; low plasticity, micaceous; dark brown, silty, fine sand below 30 feet; SM.	18.5
Hard, gray-brown and orange-brown, slightly fine sandy to sandy, silty CLAY; moist; low to medium plasticity grading to slightly fine sandy, clayey SILT; micaceous; CH/MH.	33.0

CONTINUED NEXT SHEET



LEGEND

- * Sample Not Recovered
- Standard Penetration Test
- Thin Wall Sample
- Ground Water Level in Well

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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LOG OF BORING B-105

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FIG. A-6
Sheet 1 of 2

MASTER LOG E 21-20543333.GPJ SHAN WIL.GDT 8/30/06 Log: DH Rev: LMM Typ: EET

Total Depth:	81.5 ft.	Northing:	5,110,516 ft.	Drilling Method:	Mud Rotary & Rock Core
Top Elevation:	142.2 ft.	Easting:	499,455 ft.	Drilling Company:	Boart Longyear
Vert. Datum:		Station:		Drill Rig Equipment:	Mobile B-59
Horiz. Datum:		Offset:	-	Other Comments:	

Hole Diam.: ____ Rod Type: ____ Hammer Type: Cathead

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, ft.	Symbol	Samples	Ground Water	Depth, ft.
		15		
		16		55
58.0		17		60
63.0		18		65
		19		70
		20		75
		21		80
81.5				85
				90
				95

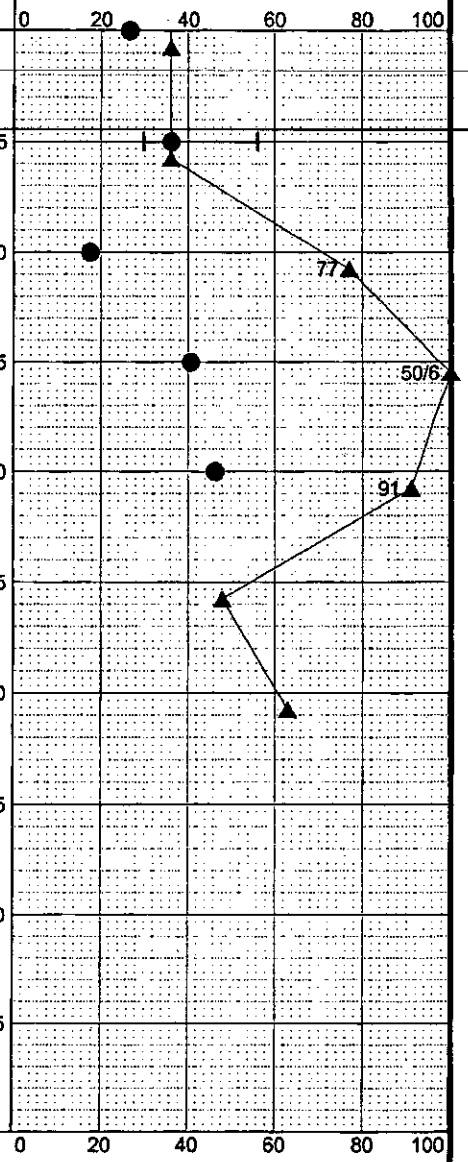
Very dense, gray, slightly clayey, silty SAND; moist; micaceous; irregular silt and sand bands; SM.

Hard, gray, slightly clayey, slightly fine sandy SILT; moist; medium plasticity, micaceous, interbedded with coal seams; (Cowlitz Formation) ML.

BOTTOM OF BORING COMPLETED 7/13/2006

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*



LEGEND

- * Sample Not Recovered
- Standard Penetration Test
- Thin Wall Sample
- Ground Water Level in Well

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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Longview, Washington

LOG OF BORING B-105

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FIG. A-6
Sheet 2 of 2

MASTER LOG E 21-20543333.GPJ SHAN WIL.GDT 8/30/06 Log: DH Rev: LMM Typ: EET

Total Depth:	61.4 ft.	Northing:	5,110,535 ft.	Drilling Method:	Mud Rotary & Rock Core	Hole Diam.:	
Top Elevation:	142.0 ft.	Easting:	499,463 ft.	Drilling Company:	Boart Longyear	Rod Type:	
Vert. Datum:		Station:		Drill Rig Equipment:	Mobile B-59	Hammer Type:	Cathead
Horiz. Datum:		Offset:	-	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Stiff to very stiff, mottled gray and orange-brown, slightly sandy, silty CLAY to clayey SILT; moist; medium to high plasticity, micaceous; becomes gravelly below 10 feet, scattered iron-oxide and manganese nodles; CL/ML.

17.0

Loose to dense, orange-brown to gray, slightly clayey, gravelly, silty SAND to silty, sandy GRAVEL; moist; weathered; angular iron-oxide stained basalt clasts; SM/GM.

28.5

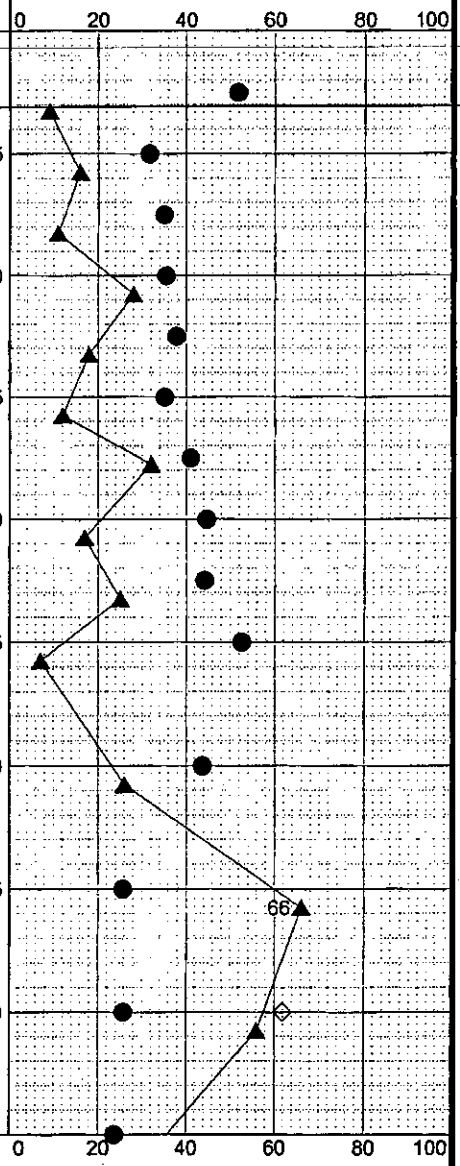
Medium dense to very dense, gray and orange-brown, slightly clayey, silty SAND to fine sandy SILT; moist; micaceous; irregular high-angle laminations; SM/ML.

CONTINUED NEXT SHEET

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches



LEGEND

- Sample Not Recovered
- Standard Penetration Test
- Ground Water Level in Well

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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LOG OF BORING B-106

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FIG. A-7
Sheet 1 of 2

MASTER LOG E 21-20543333.GPJ SHAN WIL.GDT 8/30/06 Log: DH Rev: LMM Typ: EET

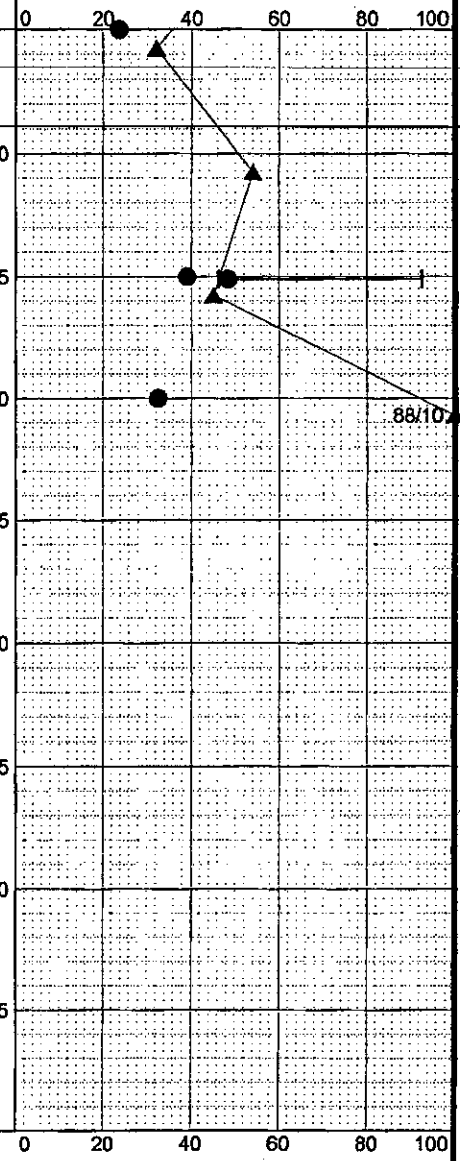
Total Depth:	61.4 ft.	Northing:	5,110,535 ft.	Drilling Method:	Mud Rotary & Rock Core
Top Elevation:	142.0 ft.	Easting:	499,463 ft.	Drilling Company:	Boart Longyear
Vert. Datum:		Station:		Drill Rig Equipment:	Mobile B-59
Horiz. Datum:		Offset:	-	Other Comments:	

Hole Diam.: ____ Rod Type: ____ Hammer Type: Cathead

SOIL DESCRIPTION	Depth, ft	Samples
Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.		
Hard, brown-gray, slightly fine sandy, silty CLAY to clayey SILT; moist; high plasticity, interbedded with coal seams; (Cowlitz Formation) CH/MH.	46.0	14, 15, 16, 17
BOTTOM OF BORING COMPLETED 7/14/2006	61.4	

Ground Water Depth, ft

PENETRATION RESISTANCE (blows/foot)
▲ Hammer Wt. & Drop: 140 lbs / 30 inches



LEGEND
* Sample Not Recovered
I Standard Penetration Test

▼ Ground Water Level in Well

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES
1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

Bonneville Power Administration
Mt Solo/Longview Tower Study
Longview, Washington

LOG OF BORING B-106

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FIG. A-7
Sheet 2 of 2

MASTER LOG E 21-20543333.GPJ SHAN WIL.GDT 8/30/06 Log: DH Rev: LMM Typ: EET

APPENDIX B

GEOTECHNICAL LABORATORY TESTING PROCEDURES AND RESULTS

APPENDIX B

GEOTECHNICAL LABORATORY TESTING PROCEDURES AND RESULTS

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B.5	ATTERBERG LIMITS DETERMINATION	B-2

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B-1 Grain Size Distribution
B-2 Plasticity Chart

APPENDIX B

GEOTECHNICAL LABORATORY TESTING PROCEDURES AND RESULTS

B.1 INTRODUCTION

This appendix presents laboratory test procedures and results for tests performed on soil and rock samples obtained from our field explorations for the Bonneville Power Administration (BPA) Mount Solo-Longview tower study. Selected samples recovered from the borings were tested to determine index properties and engineering characteristics of the subsurface soils.

Laboratory testing was performed in general accordance with the American Society for Testing and Materials (ASTM) and with International Society of Rock Mechanics (ISRM) standard test procedures in October and November 2005. Laboratory tests, including water content determinations, grain size analyses, and Atterberg limits determinations, were conducted at the Shannon & Wilson, Inc. laboratory in Seattle, Washington.

B.2 VISUAL CLASSIFICATION

Each soil sample recovered from the borings was visually reclassified in our laboratory using a system based on the ASTM Designation: D 2487, Standard Test Method for Classification of Soil for Engineering Purposes, and ASTM Designation: D 2488, Standard Recommended Practice for Description of Soils (Visual-Manual Procedure). These ASTM standards use the Unified Soil Classification System (USCS). The USCS is described in Figure A-1 in Appendix A. Engineering classification of the rock core used data collected in the field, and was based on the ISRM Rock Classification Methods. The terminology used to describe the rock core is described in Appendix A, Figure A-2. The visual classification made using these systems allows for convenient and relatively consistent comparison of soil and rock logged by different people, from widespread geographic areas.

Soil and rock classifications have been incorporated into the descriptions on the boring logs presented in Appendix A, Figures A-3 through A-7.

B.3 WATER CONTENT DETERMINATION

The water content of soil samples recovered from the field explorations was determined in general accordance with ASTM Designation: D 2216, Standard Method of Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures. Comparison of water content of a soil/rock with its index properties can be useful in characterizing soil unit weight, consistency, compressibility, and strength. Water content is presented on each boring log in Appendix A.

B.4 GRAIN SIZE ANALYSIS

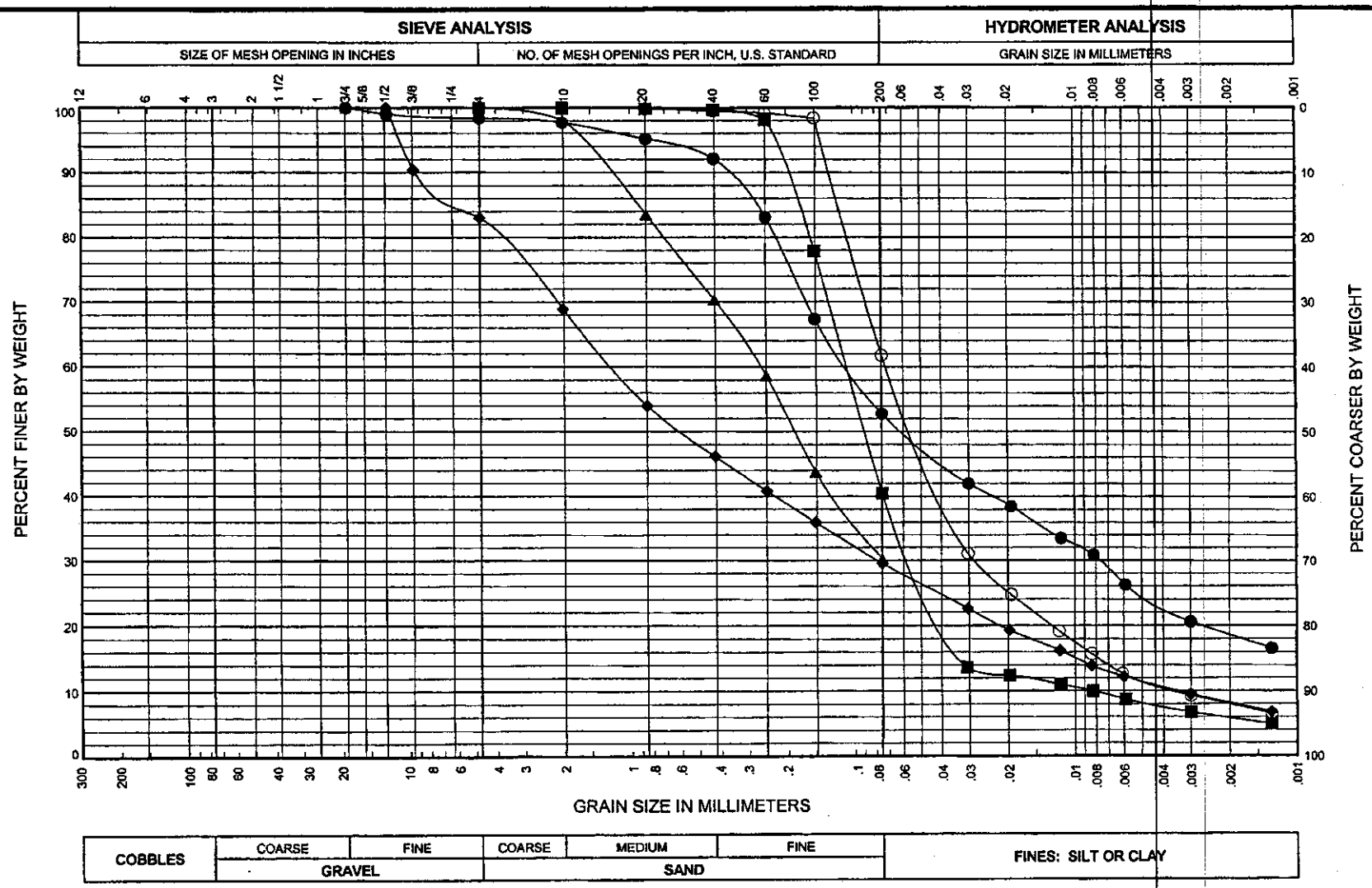
Grain size analyses were performed on selected samples in general accordance with ASTM Designation: D 422, Standard Method for Particle-Size Analysis of Soils. Results of these analyses are presented in Figure B-1. Along with each grain size distribution is a tabulated summary containing the sample description, USCS symbol for the soil group, percentage of fines passing the No. 200 sieve, and the natural water content.

Grain size distribution is used to assist in classifying soils and to provide correlation with soil properties, including permeability, capillarity, susceptibility to liquefaction, sensitivity to moisture, and strength.

B.5 ATTERBERG LIMITS DETERMINATION

Atterberg limits can be used to assist in classification of soils, to evaluate soil consistency (when compared with water content), and to provide correlation with soil properties including compressibility and strength.

Atterberg limits tests were performed on selected fine-grained samples to determine soil plasticity. The tests were performed in general accordance with ASTM Designation: D 4318, Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils. The Atterberg Limits include Liquid Limit (LL), Plastic Limit (PL), and Plasticity Index (PI=LL-PL). The results of the Atterberg Limit determinations are presented graphically in Figure B-2 and on the boring logs in Appendix A.



BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SAMPLE DESCRIPTION	FINES %	NAT. W.C. %	LL %	PL %	PI %
● B-101, S-10	25.0	ML	Gray-brown, clayey, sandy SILT, trace of gravel	52.8	45.2			
■ B-102, S-7	25.0	SM	Gray, slightly clayey, silty, fine SAND	40.5	30.3			
▲ B-104, S-10	25.0	SM	Orange-brown, silty, fine to medium SAND; trace of rust oxidation	30.3	39.8			
◆ B-105, S-6	15.0	SM	Brown, slightly clayey, gravelly, silty SAND	29.5	55.1			
○ B-106, S-13	40.0	ML	Light brown, slightly clayey, fine sandy SILT	61.8	25.7			

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Longview, Washington

GRAIN SIZE DISTRIBUTION

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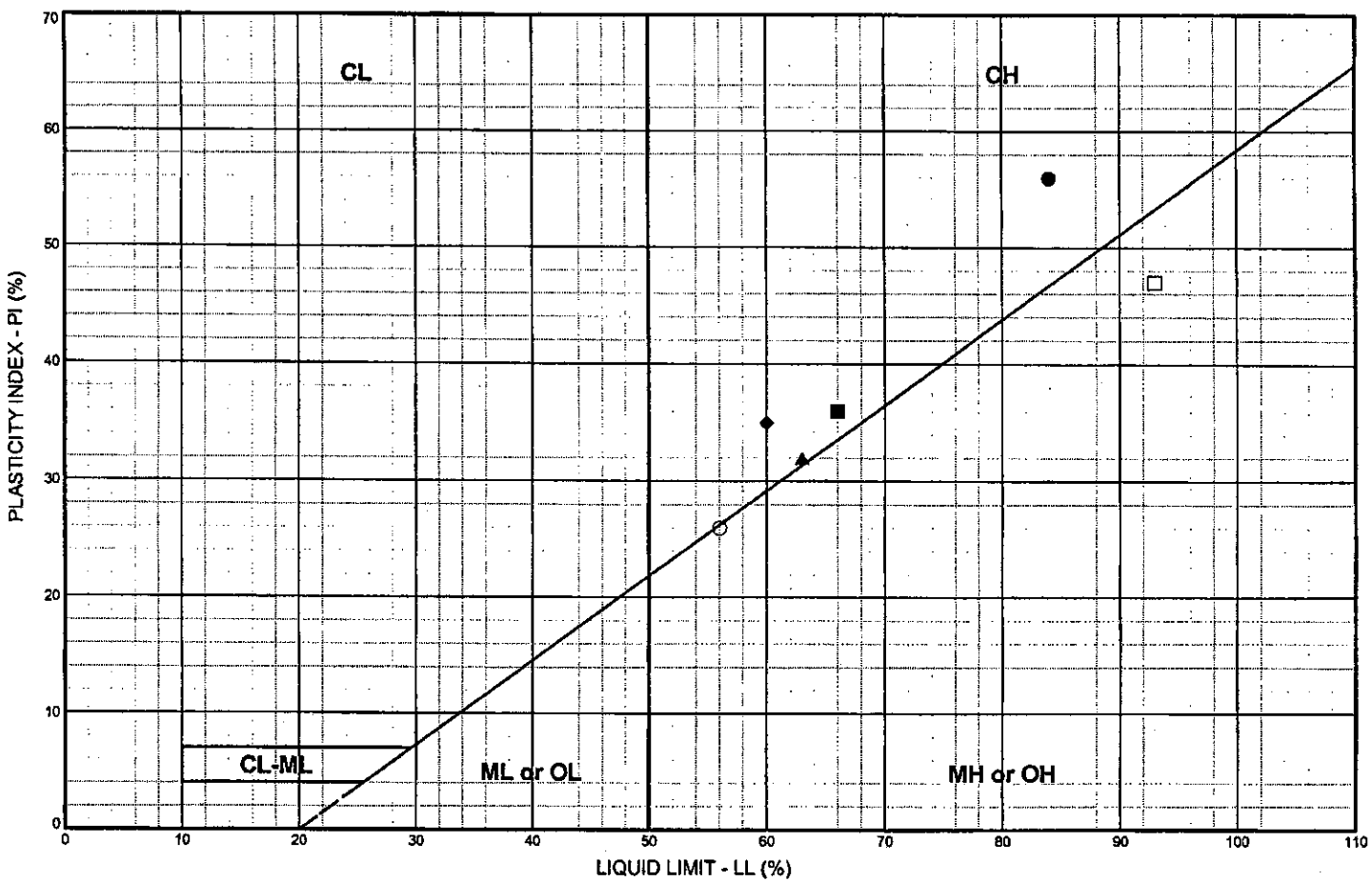
FIG. B-1

FIG. B-1



LEGEND

CL: Low plasticity inorganic clays; sandy and silty clays

CH: High plasticity inorganic clays

ML or OL: Inorganic and organic silts and clayey silts of low plasticity

MH or OH: Inorganic and organic silts and clayey silts of high plasticity

CL-ML: Silty clays and clayey silts

BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SOIL CLASSIFICATION	LL %	PL %	PI %	NAT. W.C. %	PASS. #200, %
● B-102, S-1	2.5	CH	Orange-brown, silty CLAY, trace medium to fine sand; scattered rust oxidation	84	28	56	32.6	
■ B-102, R-2	15.0	CH	Orange-brown, slightly fine sandy CLAY, trace of gravel	66	30	36	36.7	
▲ B-102, S-9	35.0	CH	Gray-brown, slightly gravelly, slightly fine sandy, silty CLAY; occasional rust oxidation	63	31	32	36.8	
◆ B-104, S-3	7.5	CH	Orange-brown, slightly fine to medium sandy, silty CLAY; scattered iron oxidation	60	25	35	30.9	
○ B-105, S-16	55.0	CH/MH	Gray-brown, slightly fine to medium sandy, silty CLAY; trace of rust oxidation	56	30	26	36.0	
□ B-106, S-16	55.1	MH	Gray, slightly fine sandy, clayey SILT, trace of coarse sand	93	46	47	48.3	

Bonneville Power Administration
Mt Solo/Longview Tower Study
Longview, Washington

PLASTICITY CHART

August 2006 21-1-20543-001

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FIG. B-2

FIG. B-2

ATT_MAIN 21-20543333.GPJ SHAN WIL.GDT 8/28/06

APPENDIX C

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL REPORT

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Attachment to and part of Report 21-1-20543-001

Date: August 30, 2006
To: Mr. Franklin S. Worth
TNFF – TPP3 Bonneville Power Administration

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include: the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used: (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors which were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the
ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland

Oden,Kim L - TRFT-3

From: Sherrill,Karen C - TR-3 on behalf of Wolcott,Marian - TR-3
Sent: Monday, September 18, 2006 10:05 AM
To: Oden,Kim L - TRFT-3
Subject: FW: Additional Mt. Solo Thoughts

Karen C. Sherrill
Personal Assistant
BPA Real Property Services

From: Worth,Franklin S - TNFF-TPP-3
Sent: Monday, September 18, 2006 9:32 AM
To: Wolcott,Marian - TR-3
Subject: Additional Mt. Solo Thoughts

Marian,

My previous e-mail did not include some other items I wish to include. I had a senior moment while I was writing it.

Basically, I want to say that BPA still needs to keep watch on the three river crossing towers. We have a surveyed base line, so regular checks for any movement can be made. We should also request that TLM keep the bases of all the towers as cleared as possible so visual inspection of the ground will be unobstructed. We still have a contract in place for monitoring of the blasting, so we may want to check out a couple of events just for info.

Frank

Franklin S. Worth
Senior Geotechnical Engineer
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