GEOPHYSICAL EVALUATION

WEST LINN HIGH SCHOOL

West Linn, Oregon

PREPARED FOR:

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July 1, 2020

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July 1, 2020

Project No. 420012SWG
Report No. 1

MR. NICK PAVEGLIO, P.E.
GEODESIGN, INC.
703 Broadway Street, Suite 650
Vancouver, WA 98660

Subject: Geophysical Evaluation
West Linn High School
West Linn, Oregon

Dear Mr. Paveglio:

In accordance with your authorization, Atlas (formerly Southwest Geophysics) has performed a geophysical evaluation for the project site located at West Linn High School located in West Linn, Oregon. Specifically, our evaluation consisted of performing three seismic P-wave refraction traverses at the project site. The purpose of our study was to develop subsurface velocity profiles of the areas studied, and to assess the depth to bedrock and apparent rippability of the subsurface materials. Our field services were conducted on June 18, 2020. This data report presents our methodology, equipment used, analysis, and results.

If you have any questions, please call us at 503.836.7022.

Respectfully submitted,

Andrew S. Baird
Project Geophysicist

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1. INTRODUCTION

In accordance with your authorization, Atlas (formerly Southwest Geophysics) has performed a geophysical evaluation for the project site located at West Linn High School located in West Linn, Oregon (Figure 1). Specifically, our evaluation consisted of performing three seismic P-wave refraction traverses at the project site. The purpose of our study was to develop subsurface velocity profiles of the areas studied, and to assess the depth to bedrock and apparent rippability of the subsurface materials. Our field services were conducted on June 18, 2020. This data report presents our methodology, equipment used, analysis, and results.

2. SCOPE OF SERVICES

Our scope of services included:

- Performance of three seismic P-wave refraction traverses at the project site.
- Compilation and analysis of the data collected.
- Preparation of this data report presenting our results and conclusions.

3. SITE AND PROJECT DESCRIPTION

The project site is generally located west of Skyline Drive, on the northwest side of West Linn High School in West Linn, Oregon (Figure 1). The study area is located in a cleared patch of dense forest. Wet soil and mud limited access in portions of the site. Figures 2 and 3 present the general site conditions in the areas of the seismic traverses.

4. STUDY METHODOLOGY

A seismic P-wave (compression wave) refraction study was conducted at a portion of the project site to evaluate the rippability characteristics of the subsurface materials and to develop subsurface velocity profiles of the areas studied. The seismic refraction method uses first-arrival times of refracted seismic waves to estimate the thicknesses and seismic velocities of subsurface layers. Seismic P-waves generated at the surface, using a hammer and plate, are refracted at boundaries separating materials of contrasting velocities. These refracted seismic waves are then detected by a series of surface vertical component 30-Hz geophones and recorded with a 24-channel Geometrics Geode seismograph. The travel times of the seismic P-waves are used in conjunction with the shot-to-geophone distances to obtain thickness and velocity information on the subsurface materials.

Three seismic lines (SL-1 through SL-3) were conducted in the study area. The general locations and lengths of the lines were selected by you and your office. The lines were 100, 125 and 150 feet in length. Shot points (signal generation locations) were conducted along the lines at the ends, midpoint, and intermediate points between the ends and the midpoint.

The seismic refraction theory requires that subsurface velocities increase with depth. A layer having a velocity lower than that of the layer above will not generally be detectable by the seismic refraction method and, therefore, could lead to errors in the depth calculations of subsequent layers. In addition, lateral variations in velocity, such as those caused by core stones, intrusions or boulders can also result in the misinterpretation of the subsurface conditions. In general, the effective depth of evaluation for a seismic refraction traverse is approximately one-third to one-fifth the length of the spread.

The seismic P-wave velocity of a material can be correlated to rippability (see Table 1 below), or to some degree "hardness." Table 1 is based on published information from the Caterpillar Performance Handbook (Caterpillar, 2018), as well as our experience with similar materials, and assumes that a Caterpillar D-9 dozer ripping with a single shank is used. We emphasize that the cutoffs in this classification scheme are approximate and that rock characteristics, such as fracture spacing and orientation, play a significant role in determining rock quality or rippability. The rippability of a mass is also dependent on the excavation equipment used and the skill and experience of the equipment operator.

Table 1 – Rippability Classification

Seismic P-wave Velocity	Rippability
0 to 2,000 feet/second	Easy
2,000 to 4,000 feet/second	Moderate
4,000 to 5,500 feet/second	Difficult, Possible Blasting
5,500 to 7,000 feet/second	Very Difficult, Probable Blasting
Greater than 7,000 feet/second	Blasting Generally Required

For trenching operations, the rippability values should be scaled downward. For example, velocities as low as 3,500 feet/second may indicate difficult ripping during trenching operations. In addition, the presence of boulders, which can be troublesome in narrow trenching operations, should be anticipated.

It should be noted that the rippability cutoffs presented in Table 1 are slightly more conservative than those published in the Caterpillar Performance Handbook. Accordingly, the above classification scheme should be used with discretion, and contractors should not be relieved of making their own independent evaluation of the rippability of the on-site materials prior to submitting their bids.

5. RESULTS AND CONCLUSIONS

As previously indicated, three seismic traverses were conducted as part of our study. Figures 4a through 4c present the velocity models generated from our analysis. Based on the results it appears that the project site is underlain by low velocity materials (i.e., topsoil, fill, etc.) in the near surface and higher velocity materials, likely bedrock, at shallow depths. Distinct vertical and lateral velocity variations are evident in the models. Moreover, the degree of weathering and the depth to possible bedrock appears to be variable across the study area.

Based on the refraction results, variability in the excavatability (including depth of rippability) of the subsurface materials should be expected across the project area. Furthermore, blasting may be required depending on the excavation depth, location, equipment used, and desired rate of production. In addition, oversized materials should be expected. A contractor with excavation experience in similar difficult conditions should be consulted for expert advice on excavation methodology, equipment and production rate.

6. LIMITATIONS

The field evaluation and geophysical analyses presented in this report have been conducted in general accordance with current practice and the standard of care exercised by consultants performing similar tasks in the project area. No warranty, express or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be present. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface surveying will be performed upon request.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Atlas should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document. This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

7. SELECTED REFERENCES

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Mooney, H.M., 1976, Handbook of Engineering Geophysics, dated February.

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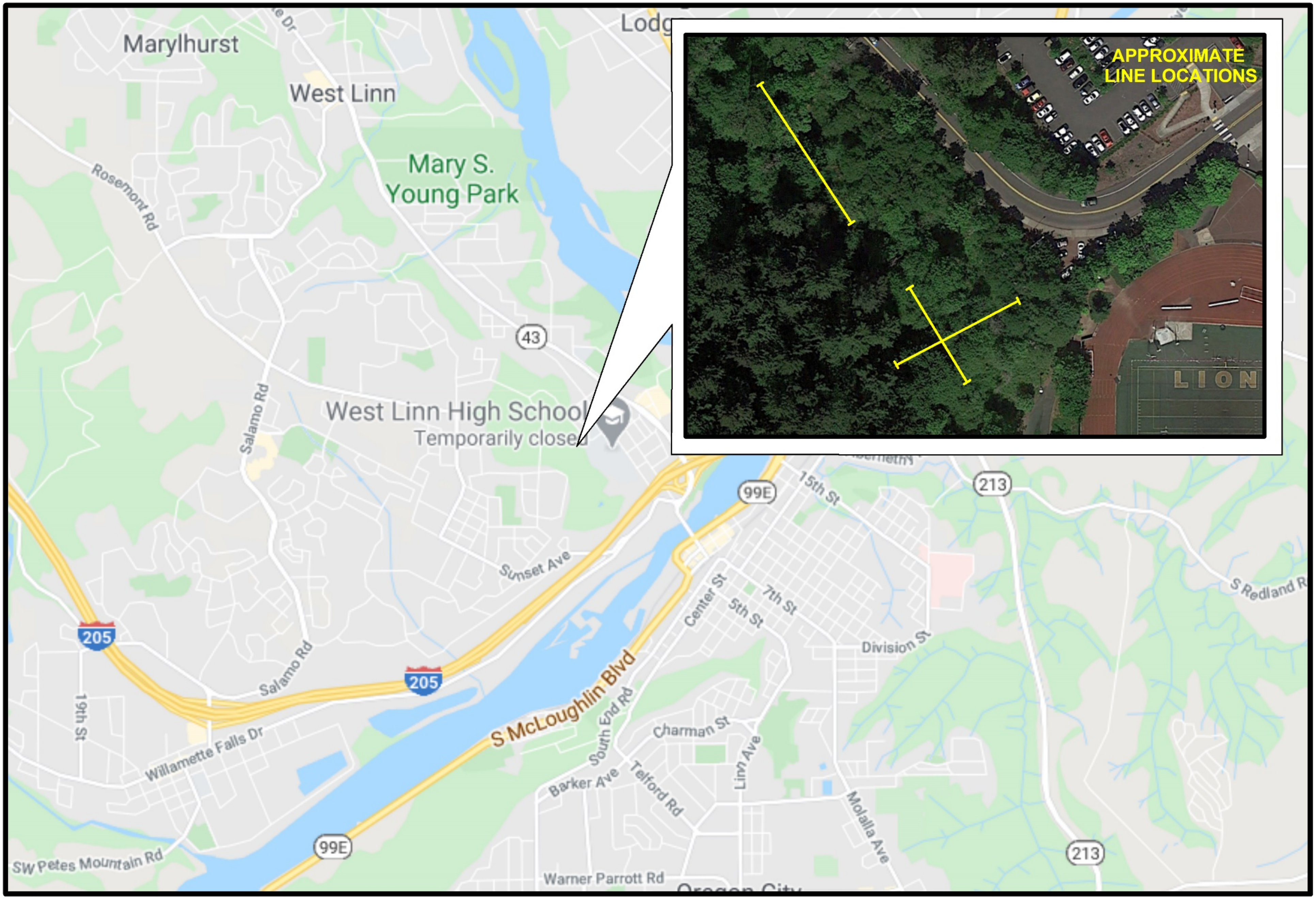


SITE LOCATION MAP

N

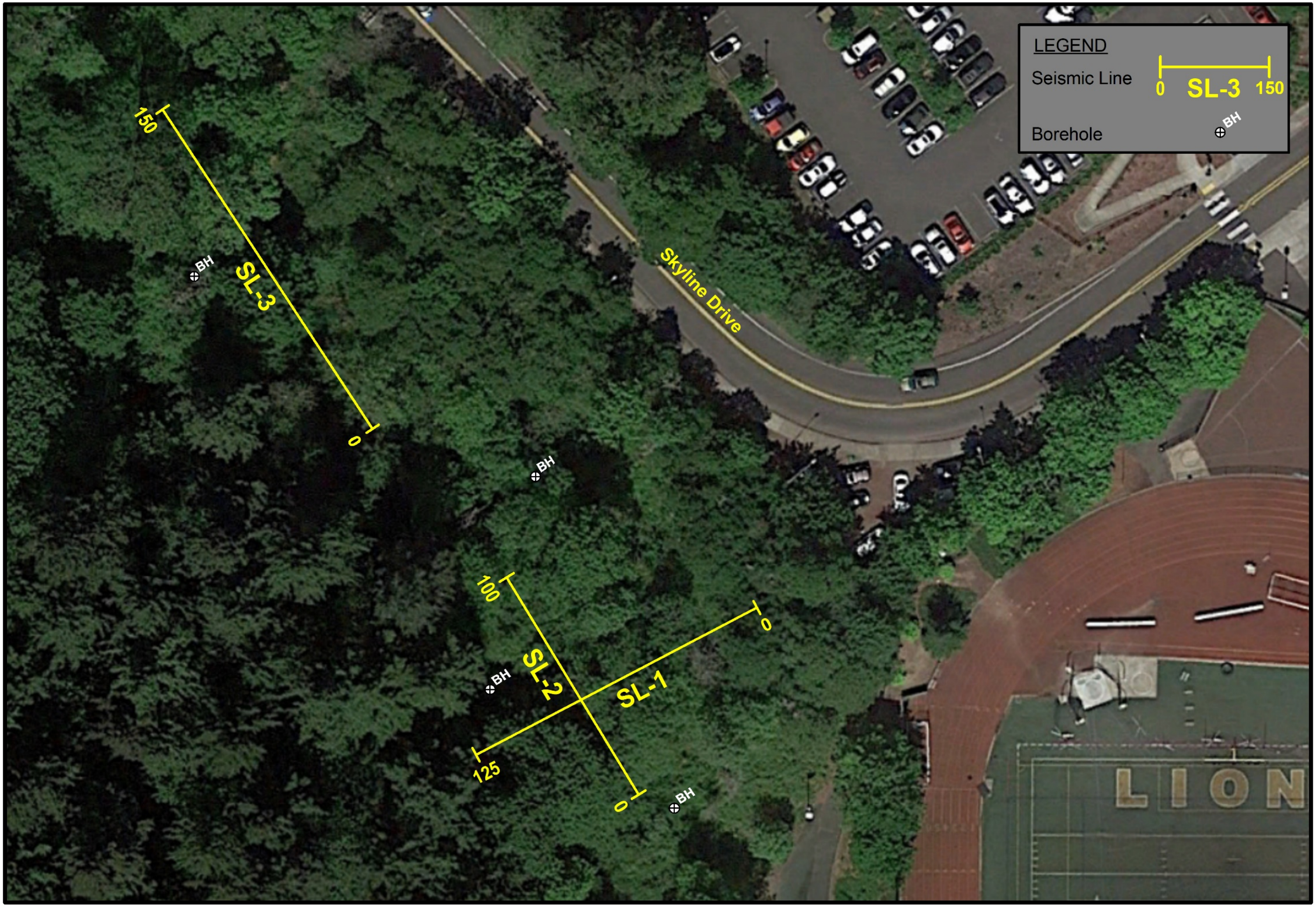
West Linn High School
West Linn, Oregon

Project No.: 420012SWG

Date: 07/20

ATLAS

Figure 1



LINE LOCATION MAP

N

West Linn High School
West Linn, Oregon

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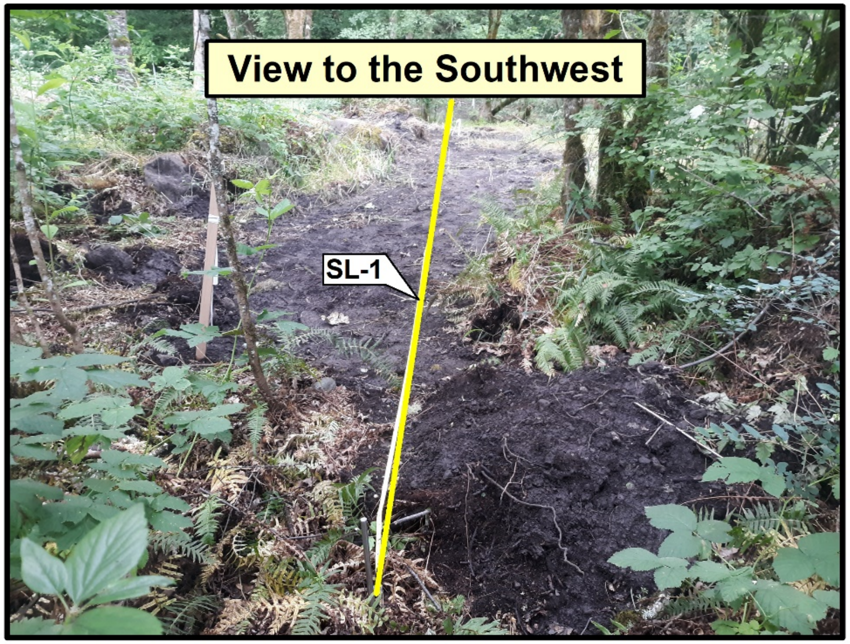
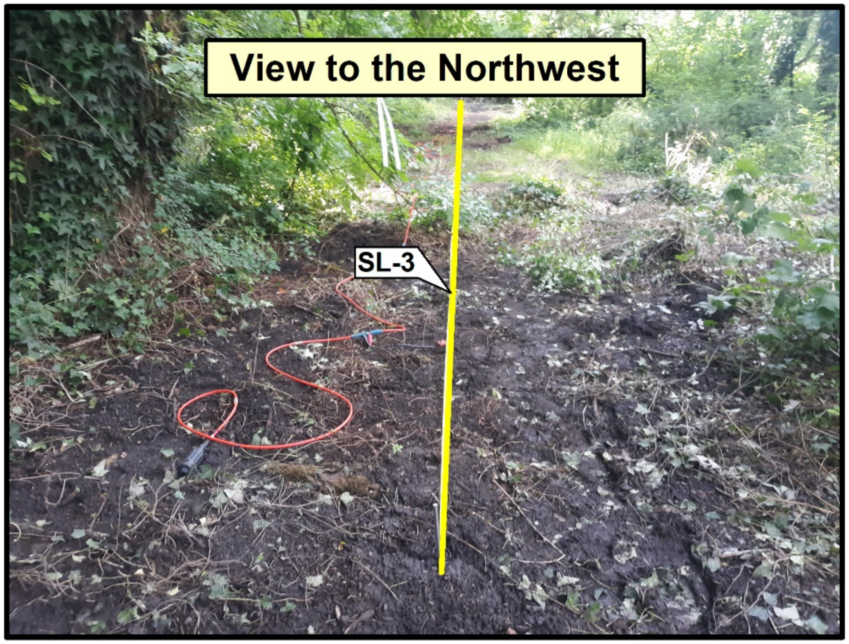
Figure 2

0 50 100

approximate scale in feet





SITE PHOTOGRAPHS

West Linn High School
West Linn, Oregon

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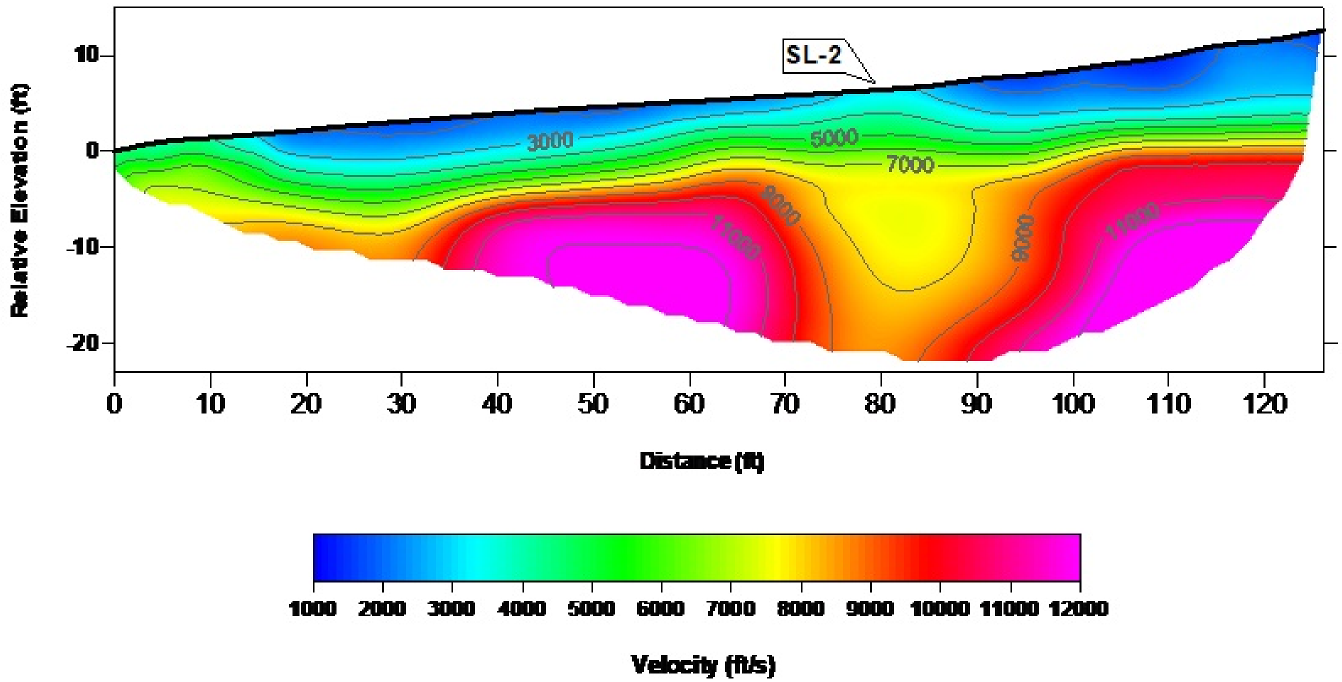
Figure 3

TOMOGRAPHY MODEL

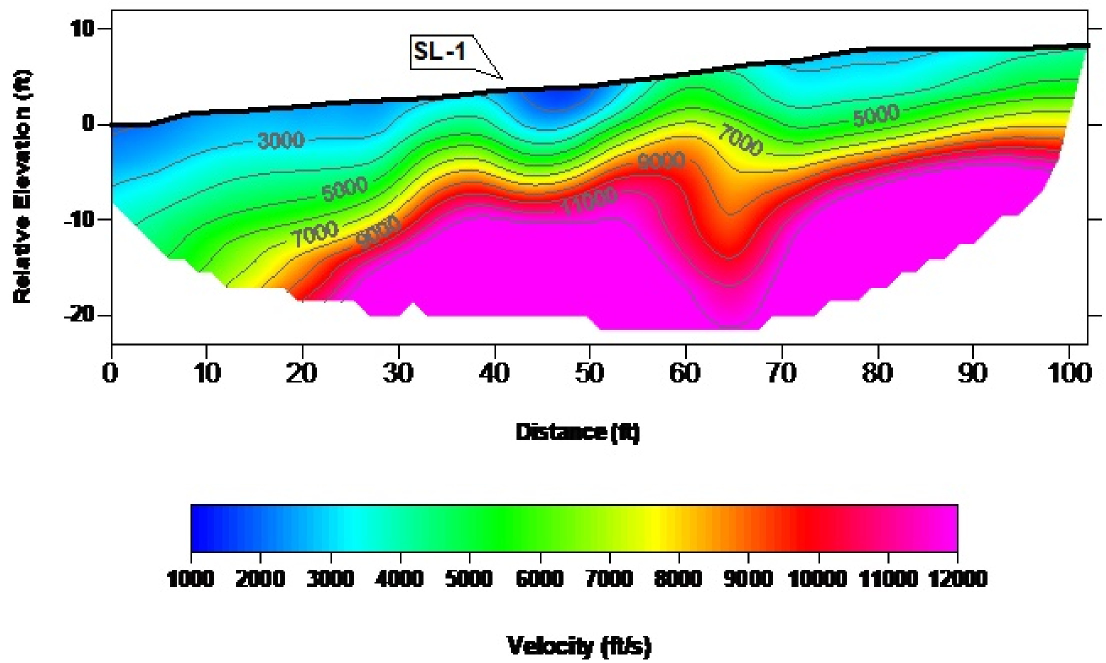
SL-1



SEISMIC PROFILE	West Linn High School West Linn, Oregon	ATLAS Figure 4a	Note: Contour Interval = 1,000 feet per second
	Project No.: 420012SWG / Date: 07/20		

TOMOGRAPHY MODEL

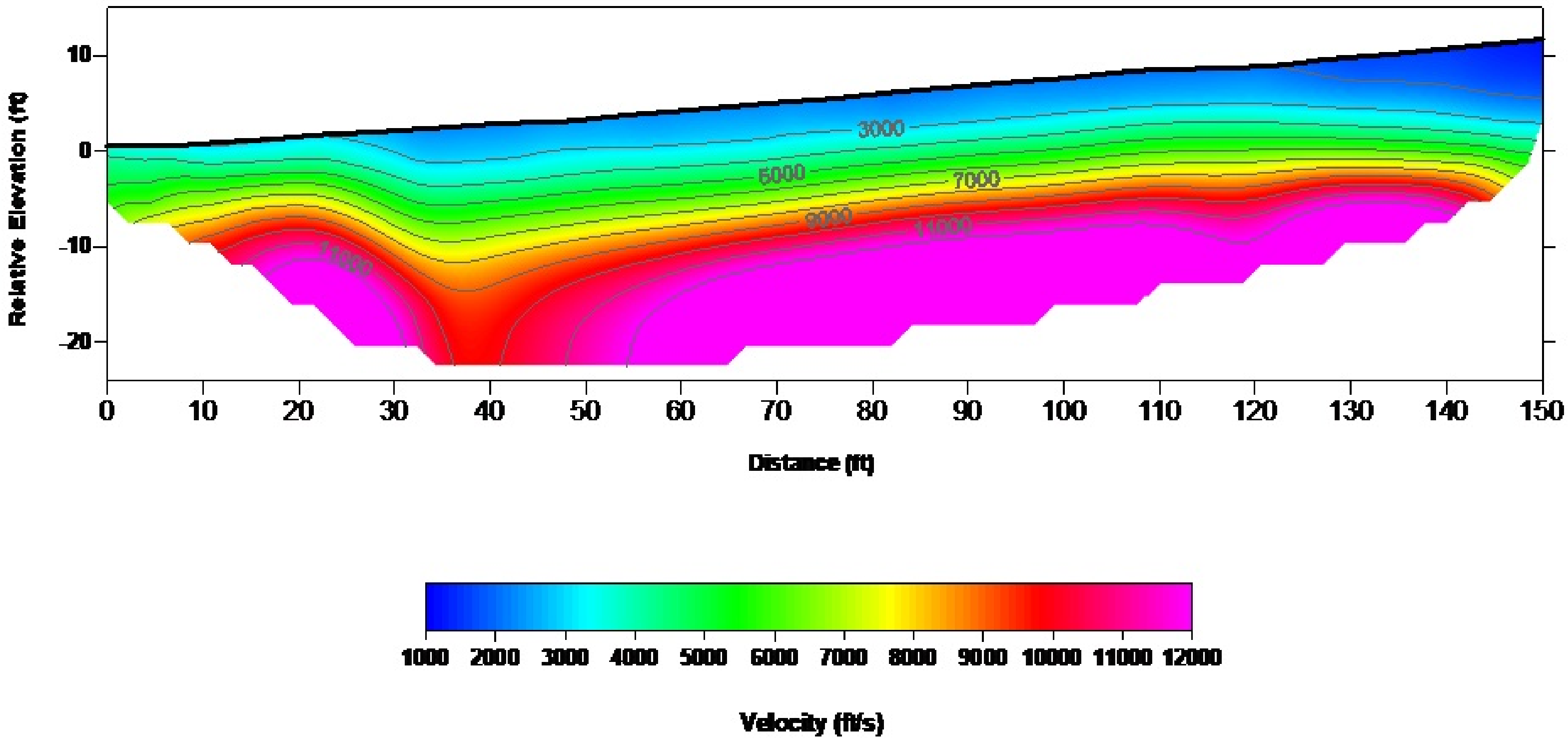
SL-2



SEISMIC PROFILE	West Linn High School West Linn, Oregon Project No.: 420012SWG — Date: 07/20	ATLAS Figure 4b	Note: Contour Interval = 1,000 feet per second

TOMOGRAPHY MODEL

SL-3



SEISMIC PROFILE	West Linn High School West Linn, Oregon		ATLAS Figure 4c	Note: Contour Interval = 1,000 feet per second
	Project No.: 420012SWG	Date: 07/20		