221-21-000563-STR, PLM-01, MECH-01

BUSCH GEOTECHNICAL CONSULTANTS

October 8, 2021

Gary Robertson
Edoba Design
POB 121
Port Orford, OR 97465

Email: g.robertson@edoba-design.com

Certification Statement for Edoba Design Project, 5th Street, Port Orford, Oregon (APM 33-15-05DA, TL 8901)

Dear Gary:

Thank you for your update of September 10. I am sorry it has taken me so long to get back to you. I understand that the city needs a simple statement about your project.

My understanding of your proposed construction project, and the ground on which it will occur, as documented in detail in my project geotechnical report (BGC, 2021), allows me to conclude that:

Edoba Design can complete the project without the need to mitigate the risks associated with site-specific geologic hazards that potentially could affect fixed improvements on the property or on adjacent properties.

Busch Geotechnical Consultants

R. E. Busch Jr., Ph.D.
Oregon C.E.G. #989

2021 Geotech/WIP/Robertson/Robertson Certification.ltr.doc

Reference to Project Geotechnical Report

BGC [Busch Geotechnical Consultants]. 2021. Geotechnical report for the EDOBA Design Project, 251 5th Street, Port Orford, Oregon (APM 33-15-05DA, TL 8901; Robertson). Unpubl. rept. for client dated July 8. 28 pp. incl. appends (one over-sized).

From: Bob Busch <bob.busch.geotech@gmail.com>
Sent: Tuesday, December 21, 2021 11:21 AM
To: Gary Robertson <g.robertson@edoba-design.com>
Subject: Re: Fw: The Cove, Port Orford | Foundation design with retaining wall

Hi Gary,
At your request I reviewed Allan Goffe's plans for your project. He does great work and I have no criticisms.
Good luck with construction!
Bob

On Tue, Dec 21, 2021 at 10:25 AM Gary Robertson <g.robertson@edoba-design.com> wrote:

Bob:

Here is the design from Ace Engineering for the foundation at the 251 Fifth Street project in Port Orford. He's included a footing/retaining wall design for the areas of the building that will require a stepped foundation. Please let me know your thoughts as soon as you can as I'm trying to submit for the building permit this Thursday! Wish me luck...

Regards,

Gary Robertson
EDOBA Design
T: 206-295-6211
E: g.robertson@edoba-design.com
W: www.edoba-design.com

From: Allan Goffe <atg@ace-engineeringllc.com>
Sent: Tuesday, December 21, 2021 8:20 AM
To: Gary Robertson <g.robertson@edoba-design.com>
Subject: The Cove with retaining wall

Hey Gary,
I was trying to get this to you last night, but it fell into this morning. Let me know if this is what you have in mind. If it looks ok, then probably need to run it by Bob Busch again.

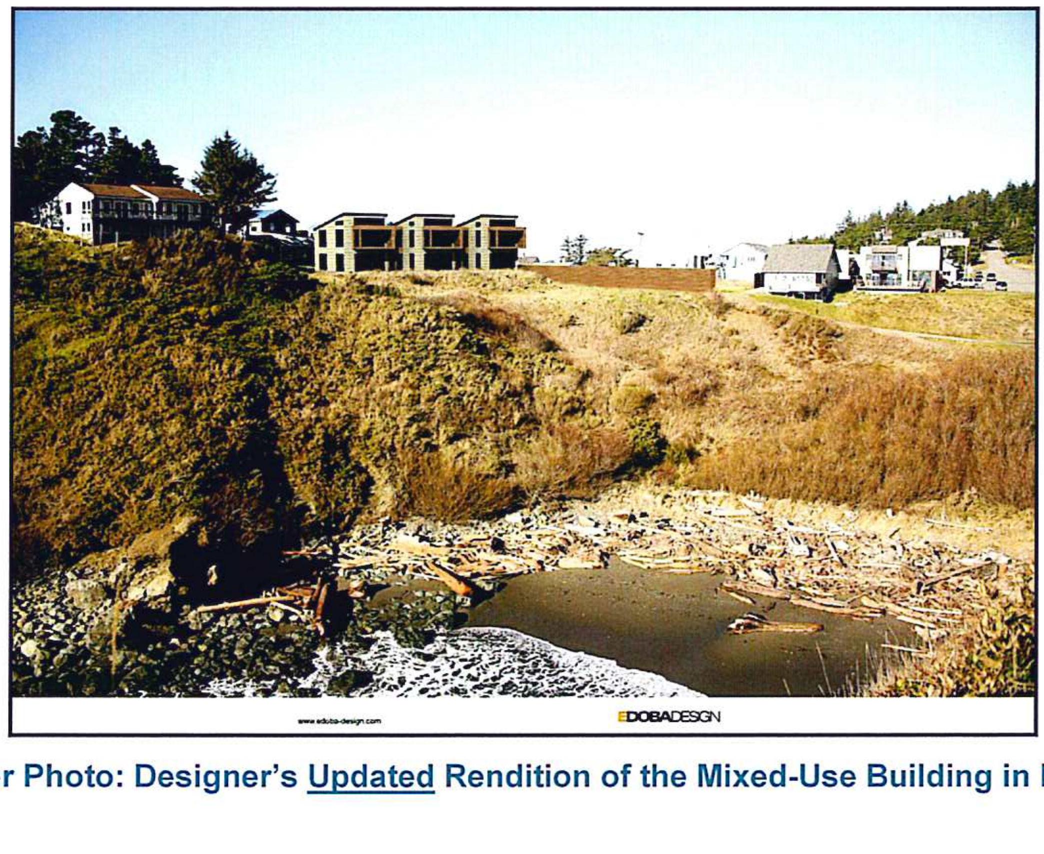
Cheers!

Allan Goffe, PE, SE
ACE ENGINEERING LLC
(541) 552-1417

BUSCH GEOTECHNICAL CONSULTANTS

<u>October 12</u>, 2021

Geotechnical Report for the EDOBA Design Project, 251 5th Street, Port Orford, Oregon (APM 33-15-05DA, TL 8901; Robertson)



Cover Photo: Designer's <u>Updated</u> Rendition of the Mixed-Use Building in Place

97832 S. Bank Chetco River Road, Brookings, OR 97415•541-469-7300•541-469-2903 FAX
Geotechnical and Geologic Studies for Land Development and Resource Management
Please see our website: www.buschgeotech.com

BUSCH GEOTECHNICAL CONSULTANTS

October 12, 2021

Gary Robertson
Edoba Design
POB 121
Port Orford, OR 97465

Email: g.robertson@edoba-design.com

REVISED
Geotechnical Report for the EDOBA Design Project, 251 5th Street, Port Orford, Oregon (APM 33-15-05DA, TL 8901; Robertson)

Contract Information, Site Investigation History, and Scope of Work

I have prepared this revised report for you to submit to the subcontracted Port of Orford City Planner, Crystal Soji of Shoji Planning, LLC. The report addresses all of the requirements of Section 17.16.080 Natural hazard overlay zone (NH) of Chapter 17.16, Supplementary Provisions, of the Port Orford Municipal Code as revised in 2015. I am delivering this document under the terms of Busch Geotechnical Consultants (BGC) contract #21-001 established with you as amended to provide for the additional work.

In 1991 and 2005 BGC geologists and I studied the property for different owners (BGC, 1991, 2005a). In 2005 we began work on a draft report for a commercial project (BGC, 2005a) and in the process generated many figures. As part of our scope-of-work we sub-contracted Winzler & Kelly of Eureka, CA (now GHD) to prepare a foundation design for the structure planned at the time, which was a large multistory building (W&K, 2005). We sent a letter and our draft figures to the Coquille Indian Tribe for review and forwarding to the State Historical Preservation Office (BGC, 2005b). In 1991 we hand-augured 12 shallow holes on the site and in 2003 another firm completed a site evaluation that includes geotechnical drill rig data (Galli, 2003). We based aspects of many of our 2005 figures on the data in that report. Presumably our letter to the Coquille Tribe and the Galli report are on file and accessible to Ms. Soji and others.

I use the following format in this report. I include verbatim text from the ordinance in Times New Roman 12-point font and our responses in 12-point Arial (this font). I struck out my deleted text from the original report and underlined my new text. ~~However, I changed the two-column original version of the ordinance to a one-column format. Ms. Soji forwarded a copy of the ordinance to BGC in 2014 so I could transfer or reference the information in our report for another site (BGC, 2014a) into the language required by the ordinance (BGC, 2014b).~~ You provided me with a copy of the relevant municipal code sections in late August. I follow each ordinance section that requires a response with a statement in a box. The report pagination has changed slightly.

Because BGC did not finalize a report for our 2005 client [Gustafson], and his project was vastly different, I do not quote information from our draft (BGC, 2005a). I do not quote our earlier work, other than borehole data, for the same reason (BGC, 1991). However, I have revised and attached some of our figures to reflect the relationship of the current project to the subsurface conditions 9BGC, 2005a). Finally, I did not do a geotechnical investigation and report for the current Edoba Designs project, so I wrote the responses herein just for this document. I do reference aspects of work by Galli (2003).

In conclusion, this document, including its attachments, fully provides the information requested by the ordinance.

My scope of work for this project included:

- ☐ Meeting owner Gary Robertson onsite to discuss his development plan, inspect the topography in the building area, and consider foundation options;
- ☐ Reviewing plans and other documents provided by Gary, including a project topographic map that shows the location of the proposed structures;
- ☐ Reviewing aspects of past reports by TFGS (2003), Galli (2003), and BGC (BGC, 1991; 2005a, b; 2014a, b);
- ☐ Comparing, as possible, the topographic data from 1991, 2002, and 2020; and
- ☐ Writing and revising this report and providing certification statements (BGC, 2021##b, c).

Excluded from my scope were redoing a subsurface investigation; doing lab testing; completing a mathematical (Factor-of-Safety or FOS) evaluation of the stability of the site; and writing a full geotechnical report. In essence, this document becomes the "project geotechnical report" by default.

A Change of Projects and Foundation-Design Philosophy

The projects that BGC supported in 1991 and 2005, and that TFGS and Galli supported in 2003, all involved large multistory structures that extended from the "flat" on the north edge of the site well down the slope. The property owners wanted as close to "no risk" as possible. As a result, at the time all parties believed these structures warranted a deep foundation, so foundation designs called for deeply embedded cast-in-place piers (e.g., W&K, 2005; Galli, 2003).

The present development plan proposes ##three separate, two-story, small-footprint structures set on the upper flat near the north property line. Only the southwest corner of the southwest structure plots across the break-in-slope at the head-of-slope (there are other breaks-in-slope on the property and on the lots below it, which are owned by the developer and which will not be developed as part of this project or any other).

Based on the current development plan in light of my analysis of the geotechnical data and topography and my change in philosophy, I have recommended, and my client and his structural engineer have agreed to, placing the superstructures on a tied-together grade beam foundation supporting a structural slab. The beam size is yet to be determined. A philosophy underpins my recommendation.

It goes something like this. The risk of a great ($M_w > 8$) is cited as ~37% for an ~8 M_w event and 10% for a ~9 Mw event within the next 50 years (Goldfinger, 2012). The 50-year time period began in 2012 at the issuance of the research paper. A deep foundation for a typical single-family home can cost $100,000 or more (ballpark), depending upon the size of the home, its location with respect to the top-of-bluff, and the site geology. If a Csz earthquake does <u>not</u> occur during the home's economic lifespan (in Oregon often arbitrarily set at a standard mortgage length of 30 years or, in California, at 75 years by the California Coastal Commission), then the owner wasted the money. However, if it <u>does</u> occur, there is absolutely no assurance that the bluff, and hence the foundation, will survive the long-duration (3-5 minutes) and high acceleration (up to ~ 1g) shaking.

In light of this conundrum, for specific cases I have been recommending that the owner utilize a foundation that could tilt or even drift laterally, but would not break up or cause the superstructure to break up (due to a foundation failure). A tied together grade beam foundation is just such a foundation. It is appropriate for some earthflow terranes, for sites experiencing episodic deep creep, and for sites that are not moving statically but conceivably might move during an earthquake. The project engineer designs the beams which can be 12"x18", 18"x24", or other dimensions.

Although decades ago I might not have been comfortable with my current philosophy, I am now. I fully believe that the foundation strategy I have recommended is low-risk strategy than minimizes unnecessary expense while providing a high level of protection from all static situations and most predictable seismic events. None of us can know precisely what a Csz event will do to this site or most others in the coastal PNW.

Responses

Chapter 17.16

SUPPLEMENTARY PROVISIONS

Chapter17.16.080 Natural Hazard Overlay Zone (NH).

A. Purpose of Classification. The purpose of the NH overlay zone is to protect people, lands and development in areas that have been identified as being subject to geologic hazards and to apply review standards to all proposed development activity within the areas subject to geologic hazards.

B. Applicability. For the purposes of these provisions, areas subject to identified geologic hazards are known as "geologic hazard areas" addressed in the Natural Hazard Resources Inventory Section maps of the City of Port Orford Comprehensive Plan, and the City of Port Orford Comprehensive Plan Goals and Policies under Statewide Planning Goal 7: Areas Subject to Natural Disasters and Hazards. Mapping for such geologic hazard areas include the following:

1. Port Orford Geologic Areas Map, 3-A as incorporated into the Port Orford Comprehensive Plan Inventory. Map 3-A was compiled for informational purposes by Oregon Department of Land Conservation and Development GIS 1/14/14.

2. Landslide Inventory Maps of Coastal Curry County Oregon 2014, developed by the Oregon Department of Geology and Mineral Industries (DOGAMI) as incorporated into the Port Orford Comprehensive Plan Inventory including: Blacklock Point to Port Orford 2014, Maps 3-B and Port Orford to Lookout Rock 2014, Map 3-C.

C. Geologic hazard areas may also be identified by site specific characteristics such as, but not limited to, earth flow and slump topography with moderately sloping terrain and irregularities of slope, drainage or soil distribution; areas of recent earth movement exhibited by tension cracks, bowed trees or other indicators, steep slope mass movement areas subject to localized debris slides, debris flows, rock falls or rock slides, and other areas that may be identified by a geologist conducting the technical assessment and any statement and/or report required by this chapter of the City of Port Orford Municipal Code.

1. Geologic hazard areas specifically include those areas, which, because of their relation to or location with respect to Geologic Hazard Areas, are in jeopardy of rapidly moving landslides. Areas identified with more than 15% slope shall be subject to the natural hazards overlay requirements.

2. Those areas identified as geologic hazard areas shall be subject to the following requirements at such time as a development activity application is submitted to the City.

3. Geologist Hazard Assessment. "Geologist" means engineering geologist licensed by the State of Oregon as defined in Section 17.04.030 of this title.

a. The applicant shall present a geologic hazard assessment prepared by a geologist at the applicant's expense that identifies site-specific geologic hazards, associated levels of risk and the suitability of the site for the development activity in view of such hazards. The geologic hazard assessment shall include an analysis of the risk of geologic hazards on the subject property, on contiguous and adjacent property and on upslope and down slope properties that may be at risk from, or pose a risk to, the development activity. The geologic hazard assessment shall also assess erosion and any increase in storm water runoff and any diversion or alteration of natural storm water runoff patterns resulting from the development activity. The geologic hazard assessment shall include one of the following:

i. A certification that the development activity can be accomplished without measures to mitigate or control the risk of geologic hazard to the subject property or to adjacent properties resulting from the proposed development activity.

See A1b response. And see BGC's "Certification Statement" dated October 8 (BGC, 2021.)

ii. A statement that there is an elevated risk posed to the subject property or to adjacent properties by geologic hazards that requires mitigation measures in order for the development activity to be undertaken safely and within the purposes of this section.

Assessment of Geologic Hazards and Risks

The following table is modified from BGC (2020), a report done for a site on the Port Orford headland. The responses are for the Robertson site. BGC (2020) is on file with the county. If desired, please review it for background discussion of the hazards.

Table 1. Summary of Geologic Hazards and Risks

(Considered over the coming 50-year period.)

Geologic Hazard	Associated Level of Risk (Qualitative or Probabilistic)
Weak (<5M) - Moderate (~6.5M) Seismic Shaking	~35% to ~26%, respectively (per USGS)
Very Strong Csz Seismic Shaking (M_w ~9)	<10% (Goldfinger et al., 2012)
Strong Csz Seismic Shaking (M_w 8+)	~37% (Goldfinger et al., 2012)
Landslide Impact	None (slopes above are not at risk of failing)
Liquefaction of sediments	Low (sediments are too old or free draining)
Inundation by a distant-source tsunami	<10% (based on DOGAMI, 2012)
Inundation by a near-source (Csz) tsunami	None (based on DOGAMI, 2012)
Consolidation potential of topsoils	High to Very High (foundation will mitigate)
Slope Failure (static / coseismic)	Static, Low; Coseismic, Uncertain
Fault rupture by the Battle Rock fault zone	Negligible (fault is offshore)

In conclusion, the levels of risk associated with geologic hazards are typical for similar lots located on sand subsoils in the Port Orford area. None of the site-specific lot hazards poses a hazard or risk to an adjoining property (there is none below), nor do hazards at adjacent parcels threaten the subject parcel. The main site-specific hazard, slope instability, will be mitigated via foundation design.

b. If the assessment provides a certification pursuant to subsection (3)(a)(i), the development activity may proceed without further requirements of this section.

c. If the assessment provides a statement pursuant to subsection (3)(b), the applicant must comply with the further requirements of this section prior to any disturbance of the soils or construction.

APPLICANT IS COMPLYING.

d. Applications, subject to subsection (3)(c), where the assessment results in a statement pursuant to subsection (3)(b)(ii) shall provide a geologic hazard mitigation report by a geologist prepared at the applicant's expense containing the following information prior to the Planning Director's determination that the application is complete.

Drawings at scales that allow for clear depiction of the following:

i. An index map showing the location of the development activity within the City of Port Orford.

Figure 1, attached, is an index map in the form of two Google Earth aerial photographs. An arrow (< or ^) points to the property. **Figure 2** is the owner's project topo map. **Figures 3A-3B** are topographic maps prepared by Stuntzner (2003). **Figure 3A** shows the footprint of the large Gustafson structure proposed in 2005. **Figure 3B** shows the current project structures. **Figure 3C** is a figure BGC prepared in 2005.

ii. A topographic site plan that shall include:

(A) All adjacent, contiguous and related property identified in the geologic hazard assessment as being at risk from or posing a risk to the development activity;

There is no adjacent, contiguous, or nearby property that poses a risk to the project. A steep-to-precipitous sand-over-bedrock slope is present below the building area. The risk of a static failure of part of this slope is low, but the Robertson project foundations are designed to mitigate the risk of significant damage to the buildings from a minor slope adjustment of some type (e.g., soil creep). The project base map, **Figure 2**, shows the upper part of this slope. All surrounding ground is neither at risk from, or poses risk to, the property.

(B) The degree of slope on the subject and adjacent properties;

The project topographic map (**Figure 2**) does not show the magnitude of the slope gradient. However, anyone can readily calculate the slope gradient for any place on the map using a ruler and the formula "Rise over Run." Dividing the number of feet of relief (Rise) by the distance traveled (Run) yields the slope gradient in percent. If you need a revised version of the topo map with slope-percent on it, please contact me.

The 2003 Stuntzner topographic map of the site, as seen on **Figure 3B** and **3C,** shows contours all the way down to the beach below.

(C) All features on the subject and adjacent properties that may cause or contribute to mass movement. Such features shall specifically include any landslide, bluff failure or shoreline erosion that could migrate upslope into the subject or adjacent properties;

Parts of the slope below the building area are subject to mass movement, if only coseismic movement. DOGAMI (2020) has mapped two landslides on the southeast-aspect slope near the site, including one directly below it (**Figure 4**). TFGS (2003) shows these same slides on its geologic cross-sections (**Figures 5-7;** see **Figure 3A** for the location of the cross sections), but it did not map the slides in plan view. In order for the landslide below the site to affect the site it would have to progress upslope an estimated 45 feet, which is unlikely in the foreseeable future because it is prehistoric. **Figure 4** shows the location of the large slide relative to the proposed building footprints.

(D) The location of all identified geomorphic features and micro-topographic features related to the identified geologic hazards; and

Figure 4 shows DOGAMI's mapping of the one historic landslide directly below the site. It has not been reactivated, and there are no identifiable microtopographic features such as tension cracks above it.

(E) All features or conditions, which gave rise to the statement pursuant to the assessment, subsection (3)(b)(ii) not otherwise required to be included.

iii. A map that depicts features and conditions associated with any building site or construction site associated with the development activity.

NA. Access and utilities corridors will be from 5th Street.

iv. A technical analysis and narrative describing the following:

(A) The geologic features or conditions of the property as well as those features or conditions which gave rise to the statement pursuant to Section (1)(b);

Because I did not prepare a geotechnical report before I wrote this document, I did not provide a narrative about the regional tectonic and seismic settings, nor did I discuss other hazards and risks in detail. Table 1, preceding (p. 5), identifies possible regional and site-specific geologic hazards and summarizes the levels of risk associated with them. The text below provides brief comments about those hazards with a risk level above Negligible.

1) The seismic potential of the Pacific Northwest is a regional hazard that is directly related to the seismic setting. In brief, Port Orford is on the North America continental plate and the offshore Gorda plate is an oceanic plate. The leading (east) edge of the Gorda plate and a sister plate, the Juan de Fuca, episodically slide down beneath North America on an interface known as the Cascadia subduction zone or Csz. Csz events occur on the order of 300 to thousands of years apart, depending upon the magnitude of the earthquake. Before a Csz event occurs, though, the tectonic plates deform, in the processes triggering smaller magnitude earthquakes. The most recent comprehensive study (Goldfinger et al., 2012) characterized the risk of an ~8 M_w Csz earthquake as ~37% over the next 50 years, and the risk of an ~8.7M_w to 9.1 Mw as 10%. The Robertson project engineer will specific the design seismic parameters. Additional regional information is readily available on the internet from the USGS, DOGAMI, www.homefacts.com, and other sources.

2). TFGS (2003) and I disagree on the risk of liquefaction. Whereas saturated loose deposits are highly susceptible to liquefaction when saturated and shaken by a long-duration earthquake, the loose site deposits are mostly shallow free-draining sands (probably dune sands), fills derived by onsite grading of those sands, and middens (loose deposits of soil and shells). If any of these types of deposits were to liquefy during an intense earthquake, they most likely would liquefy in unconnected zones. It is unlikely that type of liquefaction would lead to ground failure, which actually is the hazard. Finally, there are no records of late Pleistocene deposits liquefying: liquefaction of the Ice Age terrace deposits is unlikely.

3) The elevation of the building area is nominally 75 ft MSL (above mean sea level) (see **Figure 2**). Tsunami run-up modeling by DOGAMI (2012) suggests that only the largest Csz earthquake could generate a tsunami that conceivably could inundate the site. The risk of inundation is essentially the same at all similar open-coast properties at about the project elevation. A near-source (Csz-generated) tsunami could erode lower elevation areas of the slope, which could cause upslope adjustments (i.e., rapid-rate creep, soil slips, perhaps others). However, the proposed foundation design would minimize the risk of damage.

A distant source tsunami could not affect the site.

4) Topsoils, particularly youthful highly organic ones, are prone to consolidate over time as organics decay and pores collapse. Consolidation causes settlement, and that can damage improvements. There is relatively little topsoil within the building area, but it appears that there is a shallow (maximally ~2 ft deep) fill on the downslope side of the middle unit (based on a comparison of the 1991, 2003, and current topographic map with BGC (2005a) cross-section C (**Figure 10**). The planned foundation design (tied together grade beams supporting a structural slab) will mitigate the risk associated with the consolidation hazard.

5) The geologic hazard of greatest concern is the slope instability hazard. There is a mapped historic (>150-yr-old) landslide below the site (**Figure 4**). At its closest it is about 45 ft away. Its head scarp is readily identifiable. The slide has not been reactivated. The last Csz earthquake, which occurred on January 26, 1700, might have caused this slide. The smaller slide shown on **Figure 4** is not below the site so cannot affect it. In conclusion, because the head scarp is ~45 feet away (in plan view) and the toe is not being significantly eroded by marine waves, the risk that the slide will progress into the building area under static conditions is Low to Very Low.

How the ground within and above this slide will respond during the next Csz earthquake is Uncertain. The foundation design (tied together grade beams) will have the ability to span a loss of edge support of five feet or more (the distance is a function of the grade beam size, which is undecided at present). If the loss of support is greater than the design amount, the foundation, and thus the superstructure, is most likely to tilt but not break apart. In conclusion, whereas a Csz event conceivably could cause the landslide to progress into the building area, the risk of loss of life is Negligible and the risk of significant structural damage likely is no higher than Low.

(B) All features related to earth movement or geologic instability on, above and below the site:

(1) The results of all geologic and/or engineering tests performed on soils, material, and rock type subsurface data from drill holes, or other data obtained from the site investigation with data points clearly identified on a map,

I did no new subsurface exploration before preparing this document. However, I reviewed all of the available information. That includes the logs of 7 deep drill holes done by TFGS (2003), 12 augur holes done by BGC geologists (BGC, 1991); three geologic cross-sections done by TFGS (2003) and three done by BGC (2005); and reports by TFGS (2003), Galli (2003), and BGC (1991, 2005a, b).

In 2003 TFGS completed a geologic report that Galli (2003) included as Appendix C in that firm's geotechnical report (Galli, 2003). TFGS supervised a drilling program that advanced 7 boreholes using a mud rotatory drill (see **Figure 3C** for the hole locations). TFGS also supervised the excavation of several backhoe test pits (no records exist). Galli included the borehole logs in his report as Appendix B (see **Figure 11**). The borehole logs are narrative (non-standard) so many kinds of information are missing. TFGS developed cross-sections that schematically show inferred contacts between the identified stratigraphic units. In 2005 when BGC began working on a draft report for the owner at the time (Gustafson), we prepared our own figures (**Figure 9** and **10**) based on our data (BGC, 1991) and data by TFGS (**Figures 6-8**). To simplify, the boreholes encountered fills soils and other "loose soils" that in places lay on top of denser marine terrace sediments that in turn overlie Otter Point Formation sandstone and mudstone bedrock.

Neither TFGS or Galli did any laboratory testing so their work is qualitative and the Galli design was based on assumed parameters.

Because of the lack of certain types of data, I too have had to base my conclusions and recommendations on inferences and assumptions. However, this is not as serious as it sounds because the Robertson project is very different from the project that Galli addressed. In addition, the assumptions required to design a surficial grade beam foundation are much simpler than those required to design a deep cast-in-place (CIP) foundation, e.g., a job I completed recently in Port Orford (BGC, 2014a, b) that required drilling, sampling, testing, and researching same-age (coeval) marine terrace sediments. That report, which is on file with Curry County, provides additional technical information about terrace sands. That information is largely applicable to this site.

I have not redescribed the sediments recorded on the TFGS borehole logs (**Figure 11**). Please see those logs and the geologic cross-sections (**Figures 6-8**) for more information.

In conclusion, I have a high level of confidence that my recommended foundation type is reasonable.

(2) Whether the proposed development activity can be safely sited on the subject property or at the site in view of the geological hazards and risks that have been identified in the geologic hazard assessment,

My summary assessment is that the project structures can be built "safely" despite the geologic hazards and associated risks. As I use it, "safely" means "with a Low risk of significant structural damage during static conditions over the economic lifespan of the structures (arbitrarily set at 50 years) due to site-specific hazards." I cannot assess the risk to which the building area might be exposed during a Csz event, at least with a high degree of confidence. However, the proposed foundation design (connected grade beams supporting a structural slab), if engineered properly and built as designed, will allow the buildings to tilt and/or settle laterally, not break up as a result of a foundation failure. Furthermore, the risk of loss-of-life under any condition is Negligible. These statements do not apply to damage to the superstructure that could be caused by long-duration, high acceleration shaking alone. The risk of that type of damage is not higher at this site than at other similar sites in the PNW. That is, the levels of risk associated with regional and site-specific geologic hazards are typical for other bluff-top lots on the Port Orford coastline.

(3) All features related to earth movement or geologic instability on, adjacent to, upslope or down slope from the subject property,

I did no detailed technical analysis (such as a Factor-of-Safety stability calculation) for this project.

(4) A clear statement of all requirements or conditions that the geologist has determined are necessary to mitigate the geologic hazards,

Geotechnical Recommendations

The following recommendations, as put into effect by the design structural engineer and owner, will mitigate the risk of significant foundation and superstructure damage and the possible loss of life so will render the project "safe."

REC 1. Use a tied together reinforced grade beam foundation to support a structural slab. The foundations should consist of a perimeter grade beam poured neat close to on-grade to minimize the disturbance of middens (see **Figure 3C**). Each should have either linear or a "checkerboard" pattern of interior grade beams. Ideally each would be constructed as a monolithic pour, but this might not be practical for the middle and southwestern building. Use a standard underlayment beneath the slab. Please contact me if you need details.

REC 2. Minimize the number of utilities lines that will run under the slab.

REC 3. Part of the middle building and the southwestern corner of the westernmost building will step down the slope. This will result in a situation in which fill is required inside to temporarily support the bottom of the structural slab. I suggest that you use a "geofoam" rather than a standard compacted aggregate fill (such as ¾-). This will change the surcharge load of the underlayment from ~125 pcf to ~ 3 pcf. [In Crescent City, CA, used geofoam is available. Caltrans used on a Last Chance Grade project south of Crescent City that failed.)

REC 5. Use the seismic design parameters developed by the project structural engineer or architect. Use 42.7425º lat., -124.4940º long., as the GPS coordinates and assume Class D soils. [Galli, 2003, used Class S_D for the Seismic Design Category for the dense marine terrace deposits and Class S_E or S_F for the loose deposits. A Seismic Design Category is not the same thing as a Soil Class.]

REC 6. Tightline roof and other captured residential drainage to Fifth Street.

REC 7. Do not remove native vegetation from below the site unless you replace it with landscaping plants with aggressive root systems (if that is even acceptable to local regulators). Start the replacement plants <u>before</u> you remove the undesired plants. You can search online or consult with local nurseries for a list of suitable plants.

REC 8. Have the project engineering geologist inspect the finished foundation plans and the open, unformed excavations for the grade beams (if they are embedded 2 ft or more) for conformance with the intent of these recommendations. If the development plan changes significantly (if the footprint of any structure becomes over 10% larger or the proposed location of the three structures moves downslope), contact me to review the revised plans. If during plan review I recognize any conditions that are less than optimal I will contact you to discuss modifying the plan. Following any field inspection, I will write a brief report that describes the as-built foundation-soil conditions.

(5) A qualitative assessment of the likelihood that the proposed development activity will cause damage or contribute to damage to adjacent properties resulting from geologic hazards disclosed in the geologic hazard assessment or during the course of the preparation of the geologic hazard mitigation report,

The proposed development activities are highly unlikely to cause or contribute to damage at any neighboring property (the risk is Negligible). There are no planned excavations or surcharge loads that could threaten the upslope properties, and the owner of this property owns the properties below, which cannot be developed due to geologic hazards and risks that cannot be mitigated cost effectively.

(6) A schedule of inspections to be completed by the engineering geologist to assure compliance with recommendations.

The only possible inspection, which cannot be scheduled yet, would be an inspection of the open, unformed excavations for the foundations. Since the foundations will be on the surface rather than deeply embedded, such an inspection likely is unnecessary.

e. In the event the geologic hazard mitigation report fails to include the required information, fails to analyze or take into account documented hazards associated with the subject property or the proposed development activity, fails to consider new information made available to the Director or has other identified significant deficiencies, the Director shall deem the application incomplete, and notify the applicant in writing to identify the deficiencies. Thereafter the applicant shall:

I believe that this document provides all of the requested information and assurances. Therefore, I request that the Director deem the application complete (per item 5 below) and ignore the directive i) as non-applicable.

i. Provide a revised geologic hazard mitigation report or, in the applicant's discretion, request the Director to submit the geologic hazard mitigation report for peer professional review at the applicant's expense.

ii. In the event of peer review, the Director shall provide the applicant with a list of three qualified professionals from which the applicant shall choose one to conduct the peer review.

f. When all of the requirements of the geologic hazard mitigation report have been provided, the geologic hazard report shall be deemed complete for purposes of consideration of the application for development activity.

g. If the geologic hazard mitigation report discloses that the entire subject property is subject to geologic hazards that cannot be mitigated or that the subject property does not contain sufficient area that can be mitigated to allow the development activity as proposed, or that the development activity presents a significant risk of damage to or destabilizing adjacent property that cannot be mitigated in the course of the development activity itself, the development activity shall not be allowed, and the application shall be denied.

h. Prior to approval of the development activity, the applicant shall provide a mitigation plan prepared by a geologist specific to the development activity and based on the approved geologic hazard mitigation report.

i. The mitigation plan must adequately address all issues identified in the geologic hazard mitigation report and protect the subject property and surrounding lands.

The owner will mitigate hazards and risks as discussed in this document by adhering to my **Geotechnical Recommendations.** The recommendations adequately address all issues of geotechnical importance. Because of the minimal site disturbance required (essentially no grading and only skimming the surface to prepare for the construction of the foundations), I do not believe an erosion-control prescription is necessary.

ii. In the event that the development activity is a division of land, the mitigation plan shall specify mitigation measures or improvements that must be implemented on each parcel to assure the protection of the subject property and of other properties from the hazards identified in the geologic hazard mitigation report.

NOT APPLICABLE. The development activity is NOT a division of land.

iii. The mitigation plan shall specify that all measures or improvements must be installed or constructed under the direction of a supervising geologist.

NOT APPLICABLE. There are no measures or improvements that must be installed or constructed under the direction of a supervising engineer. However, an engineer registered in Oregon must design the foundation.

iv. The applicant shall, prior to the issuance of any development permits, record on the title to the subject property a notification that includes a description of the measures or improvements and that also specifies the obligation of subsequent land owners to refrain from interfering with such measures or improvements and to maintain them.

NOT APPLICABLE.

v. A schedule of inspections shall be completed by the geologist to assure compliance with recommendations, and reports shall be provided to the City prior to final plat approvals or issuance of permits for other development activity.

PENDING. When the project engineer completes the drainage plan and foundation plans, I will review them (per **Geotechnical Recommendation REC 8**). When construction starts, I will inspect the prepared foundation alignments if requested (per **REC 8**). I will issue a "certification letter" following the completion of my inspection to document the "as-built" soils conditions. It will be the Client's responsibility to send a copy of my letter to the appropriate regulatory authority.

i. A conditional use permit shall be required for development activity in all geologic hazard areas except where a certification has been provided under subsection (B)(3)(a)((i). The Planning Commission shall consider reports submitted by qualified professionals, including the proposed mitigation plan and any response from affected parties in making their decision. The Director or the Planning Commission may request the input of the City Engineer to be provided at the applicant's expense.

j. Appeals of a conditional use permit which challenge an assessment, report or plan prepared or approved under subsection (B)(3)(a), (d), (e) or (g), shall be accompanied by an analysis of the challenged document. Such analysis must identify and analyze the purported deficiencies with sufficient clarity to allow the Director to assess the concerns. In the event that the Director does not have adequate technical ability to make such an assessment, the Director may submit the matter for recommendation by a geologist in which case the appellant and the applicant shall equally share the cost of such peer review. Peer review shall be based on the entire record of the proposed development activity.

k. If a possible new geological hazard that has not been mapped is brought to the attention of City officials, the City may then require that a geologist be hired by the City to investigate the subject site and report on the nature of the hazard and its possible impact to the proposed use and surrounding properties. The cost of this geological hazard investigation is to be paid by the applicant.

l. The development activity, if approved, must be constructed as approved and must implement the measures and improvements in the approved mitigation plan. The plans submitted for development permits shall bear a statement from the geologist that the mitigation measures contained in the approved mitigation plan have been included in the plans submitted for the permit. If required by the mitigation plan, installation or construction of such measures and improvements shall be undertaken under the supervision of a geologist.

PENDING (per Section 7e). When the project engineer completes the drainage plan and foundation plans, I will review them (per **Geotechnical Recommendation REC 8**). When construction starts, if necessary, I will inspect the foundation alignments (per **REC 8**). I will issue a "certification letter" following the completion of my inspection to document the "as-built" soils conditions. It will be the Client's responsibility to send a copy of my letter to the appropriate regulatory authority.

m. In the case of a building permit, upon the completion of construction and prior to issuance of a certificate of occupancy, the supervising geologist or engineer shall certify that the measures and improvements in the approved mitigation plan have been properly installed. No as-built changes to the requirements of a mitigation plan will be accepted in the absence of certification of the changes by the geologist who prepared the mitigation plan. (Ord. 2015-08 § 1, 2015; Ord. 2009-01 § 1, 2008)

PENDING (per 7e and 11). When the project engineer completes the foundation plans, I will review them (per **Geotechnical Recommendation REC 8**). When construction starts, I will inspect the prepared foundation alignments (per **REC 8**). I will issue a "certification letter" following the completion of my inspection to document the "as-built" soils conditions. I, a CEG registered in Oregon, will sign and stamp all documents. It will be the Client's responsibility to send a copy of my letter to the appropriate regulatory authority.

Additional pages follow.

CLOSURE and AUTHENTICATION

Ms. Soji, I trust that this document will adequately describe and explain the geologic and geotechnical site conditions, geologic hazards and risks, general concerns and mitigation measures, and that it provides the required information. **If some small part does not, please telephone or email me so that I can prepare an addendum or, at your option, a revised document that will meet your needs.**

Thank you, Gary, for hiring Busch Geotechnical Consultants. Please call or email if you have any remaining questions about this document.

Busch Geotechnical Consultants

R. E. Busch Jr., Ph.D.
Oregon C.E.G. #989

Attached: **Captioned Figures 1-11** (pp. 19-31)
Distribution: Emailed to client for forwarding to Crystal Soji; digital copies on file
2021 Geotech/WIP/Robertson/Robertson.SE-SS in Chapter 17.REVISED.doc

REFERENCES CITED

BGC [Busch Geotechnical Consultants]. 1991. Engineering geology of the Hardegger bluff-top homesite, Port Orford, Curry County, OR, with recommendations. Unpubl. rept. for client dated May 17. 23 pp. + 7 appends. + over-sized topographic base map

BGC. 2005a. Proposed foundation design for development at archaeologic site 35CU11, Port Orford, Oregon [Gustafson: Map 33-15-05DA, TL 9100, 9200, 9201, and 8901]. Letter to Donald Ivy, Coquille Indian Tribal Cultural Resources Program, North Bend, dated February 28. 1 p. + 10 pp. of draft figures.

BGC. 2005b. Supplement to existing engineering geology report [TFGS, 2003] with foundation design parameters, Port Orford, Oregon. Incomplete DRAFT rept. for client [Gustafson] dated February. 8 pp. + 10 pp. of draft figures (cited in BGC, 2005a).

BGC. 2014a. Geotechnical report for the Martin bluff-top home, 735 King Street South, Port Orford, Oregon (Map 33 15 05CD, TL 1100). Unpubl rept. for client dated July 11. 51 pp. incl. 20 pp. appends.

BGC. 2014b. Addendum to: Geotechnical report for the Martin bluff-top home, 735 King Street South, Port Orford, Oregon (Map 35 15 05CD, TL 1100). Unpubl. rept. dated August 4. 10 pp. [invertedly numbered pp. 21-30).

BGC. 2021. Certification statement for Edoba Design project, 5th Street, Port Orford, Oregon (APM 33-15-05DA, TL 8901). Ltr. to client dated October 8. 1 p.

Byram, R. S. 2003. Updated site map 35CU11, East Locus. Map prepared for the Coquille Indian Tribe Cultural Resources Program. Dated October 28. 1 pp.

Byram, R. S. and Ivy, D. B. 2004a. Archaeological evaluation of site 35CU11, East Locus, Port Orford, Oregon. Unpubl. rept. for client [Gustafson] dated July. 38 pp. + Appendix, Faunal remains, 35-Cu-11 (9 pp.)

Byram, R. S. 2004b. RE: Port Orford property at 5th Street. Unpubl. letter to owner Gustafson dated July 26. 4 pp.

DOGAMI [Oregon Department of Geology and Mineral Industries]. 2012. Local source (Cascadia subduction zone) tsunami inundation map, Port Orford, Oregon. TIM Curr-04. Plate 1.

DOGAMI. 2020. SLIDO: Statewide landslide information layer for Oregon. V. 4.2. gis.dogami.oregon.gov/maps/slido.

Galli [The Galli Group]. 2003. Geotechnical and geologic site evaluation, proposed building site, Port Orford, Oregon. Unpubl. rept. for client [Gustafson] dated September 25. 12 pp. + Appends. incl. TFGS (2003), q.v.

Goldfinger, C. et al. 2012. Turbidite event history: Methods and implications for Holocene paleoseismology of the Cascadia Subduction Zone. U.S.G.S., Prof. Paper 1661-F, Reston, VA. 184 pp., 64 figs.

Riley, E. W. 1990. Site plan – Motel, 5th St., Port Orford, Oregon. Topographic map, 1 sht. dated March, scale1"=20'.

Stuntzner [Stuntzner Engineering & Forestry]. 2003. Gustafson site topo. 1 sht dated April 2, scale 1"=20' [Revised 2/1/2005 to show Gustafson building footprint].

TFGS [Terra Firma Geologic Services]. 2003. Geologic conditions on the Gustafson property. Unpubl. rept. for client [The Galli Group] dated September 10. 10 pp.

W&K [Winzler & Kelly Consulting Engineers]. 2005. Gustafson preliminary foundation plan (not for construction). Fax dated 2/25. 5 shts.

List of Captioned Figures

Figure 1. Google earth aerial photographs of the site (dated 5/9/2019). North is up. No scale. The red line is the approximate trace of the center of the Battle Rock fault zone. < and ^ point to the site.

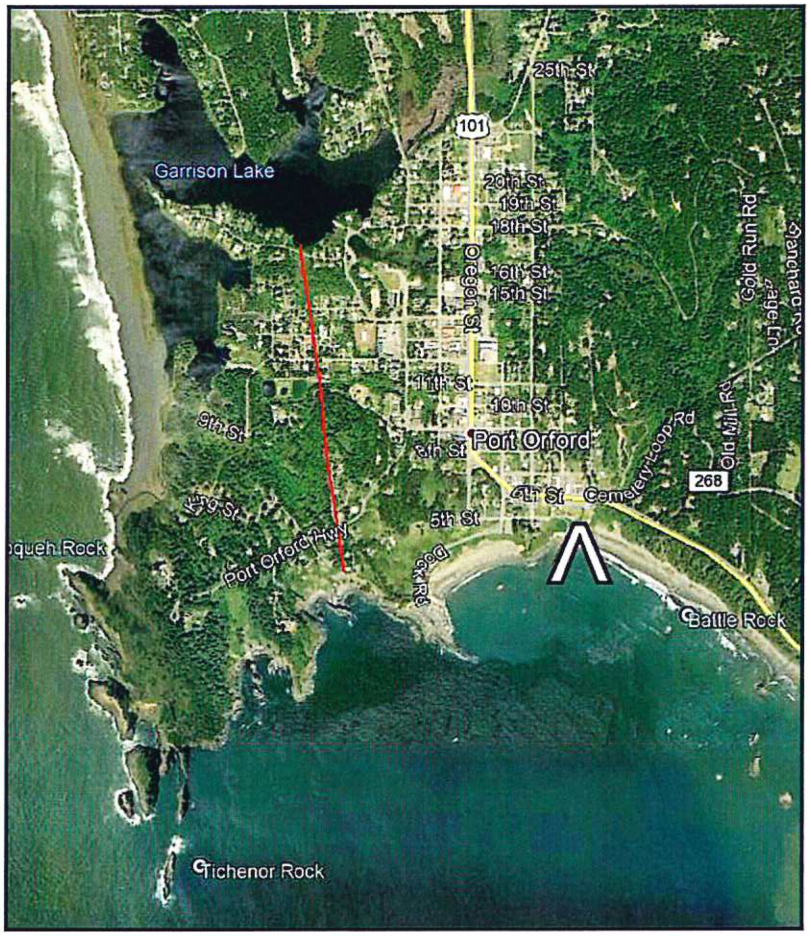


Figure 2. Project Topographic Map (provided by owner). See Figures 3A, B, and C additional topographic information about the site vicinity. The site elevation is just barely above 75 ft. The buildings will be connected by a hallway (not shown).

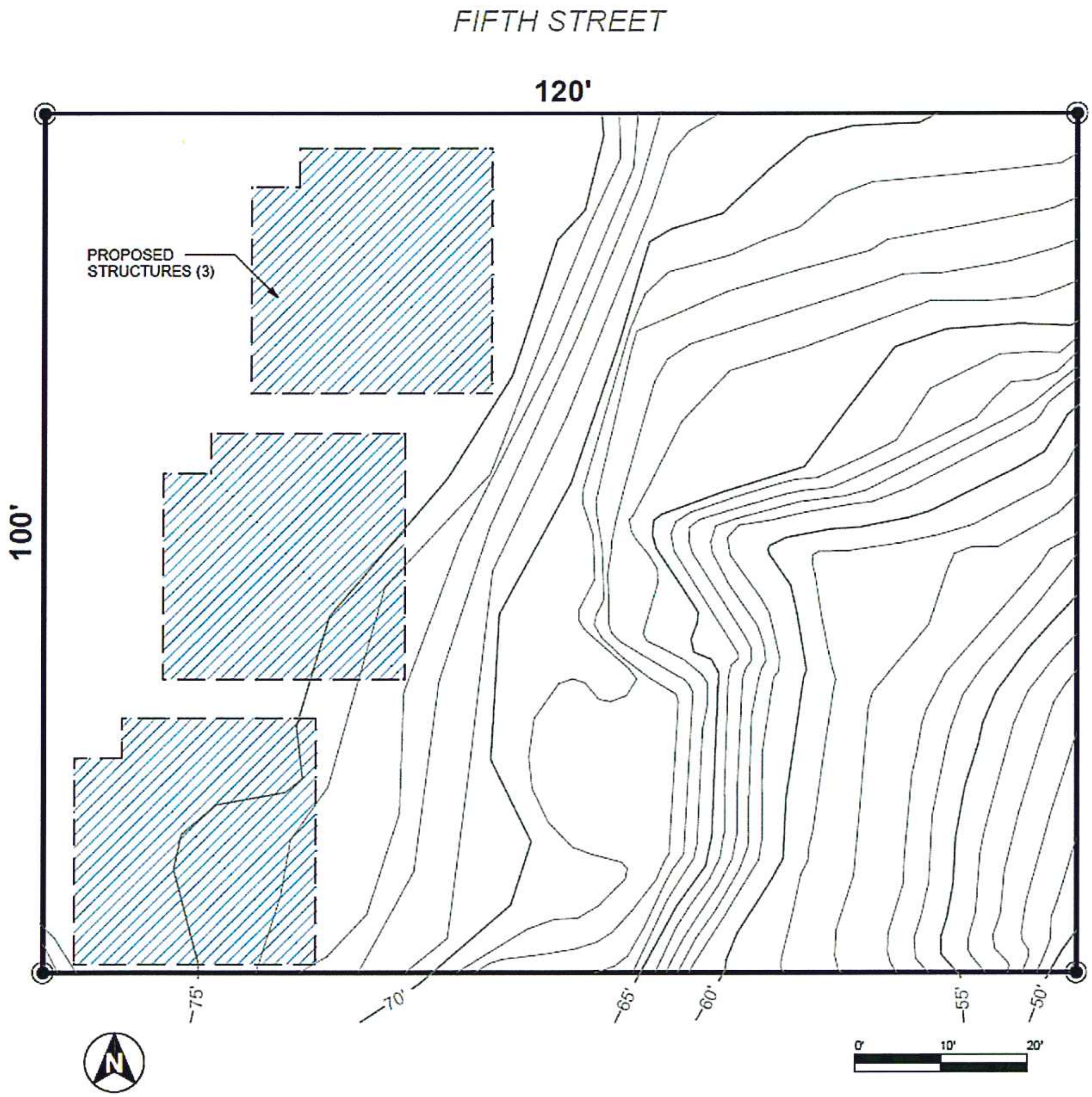


Figure 3B. The Robertson project footprints on the 2003 Stuntzner topographic base map. Current project buildings located and plotted to-scale by client. The buildings will be connected by a hallway (not shown). A comparison of the topography of the building area on this map with that of the project map of **Figure 2** indicates that grading occurred sometime after Stuntzner prepared the firm's map in 2003.

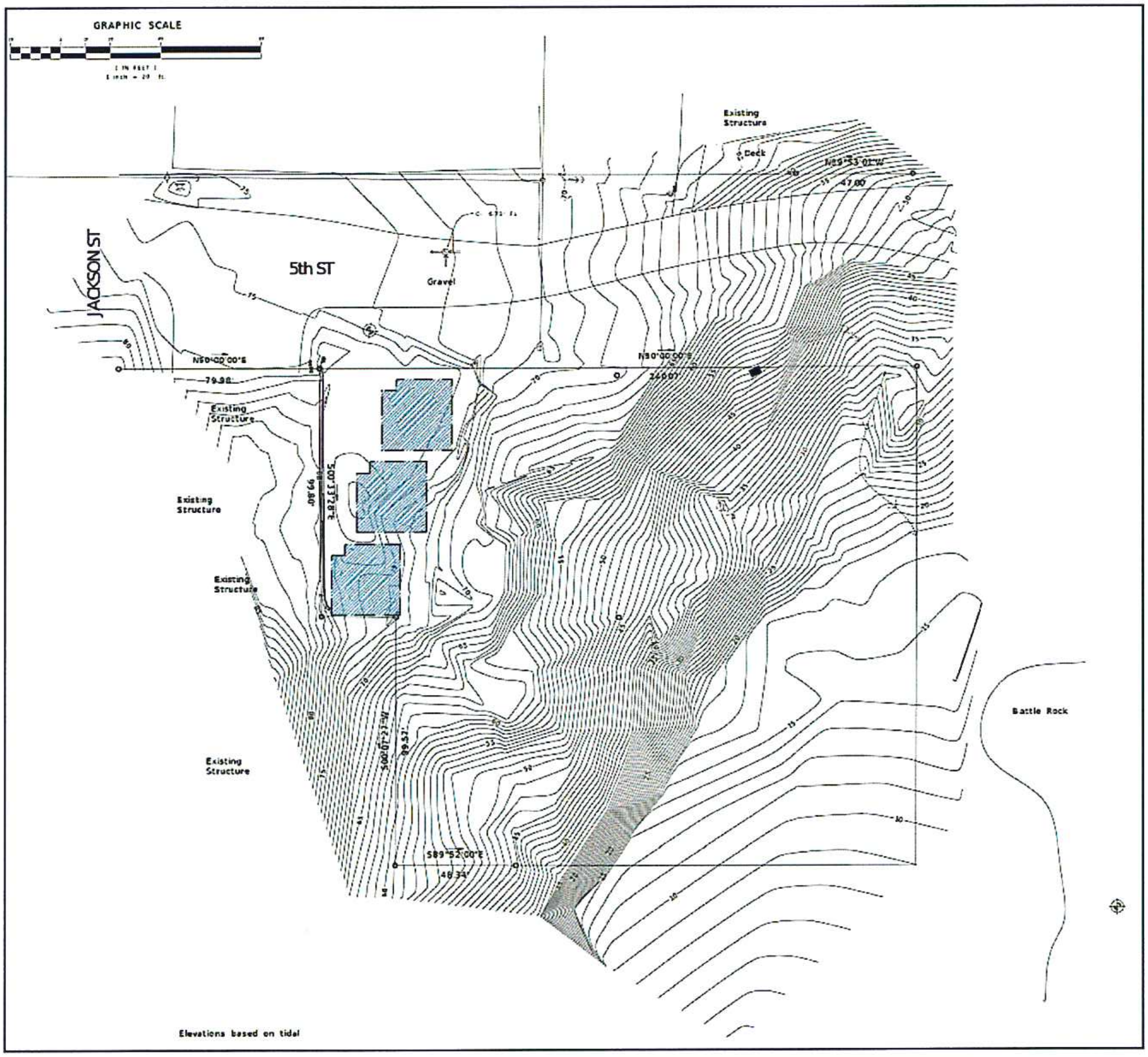


Figure 3C. Stuntzner 2003 topographic map of the 2005 proposed Gustafson building area showing the location of subsurface investigations by BGC (1991) and TFGS (2003), XS and A-B-C series geologic cross sections respectively by TFGS (2003) and BGC (2005a), the proposed building footprint in 2005, and midden deposits (CITCRP, 2004). From BGC (2005a), recaptioned.

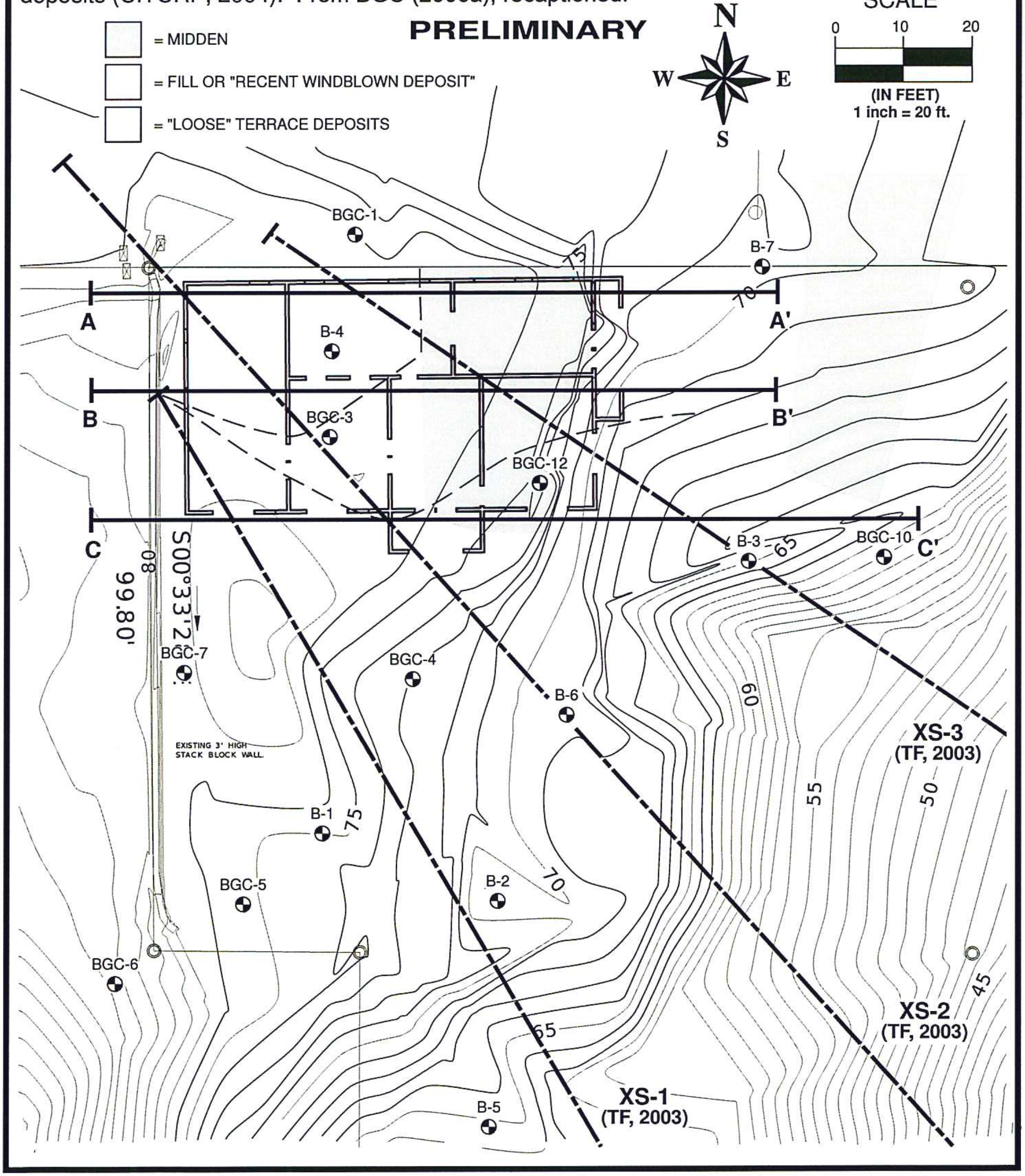


Figure 4. SLIDO v. 4.2 map of landslides in the site vicinity on a bare-earth lidar base (DOGAMI, 2020) showing the project buildings (blue) and other nearby buildings. The dark brown areas are head scarps (steep pitches on the ground); the areas with inclusions are the body of the slides, i.e., debris (often identifiable as hummocky ground). The slides are prehistoric (>150 yrs old) and have not been reactivated, which is why they pose a LOW risk to the project (see text). The top edge of the crown scarp of the large slide is approximately 45 ft away from the nearest project building. Figure developed by the project owner. <u>The buildings will be connected by a hallway (not shown).</u>

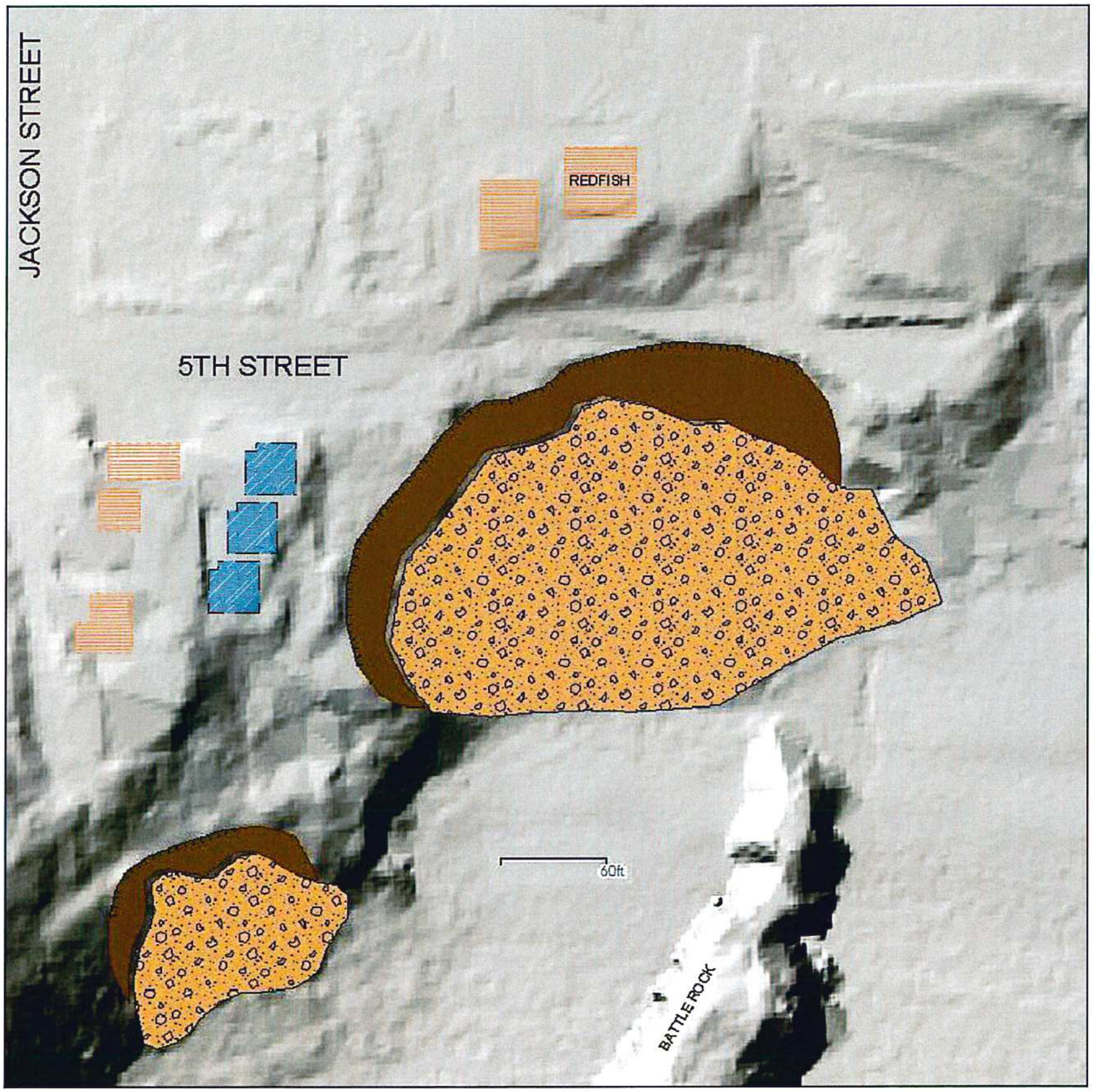


Figure 5. SLIDO map of landslide susceptibility (the risk of landsliding mapped at a regional scale). Gray is Negligible risk; yellow is Low risk; and orange is Moderate risk. The risk assessment is too high under static conditions. The X is the approximate building area.

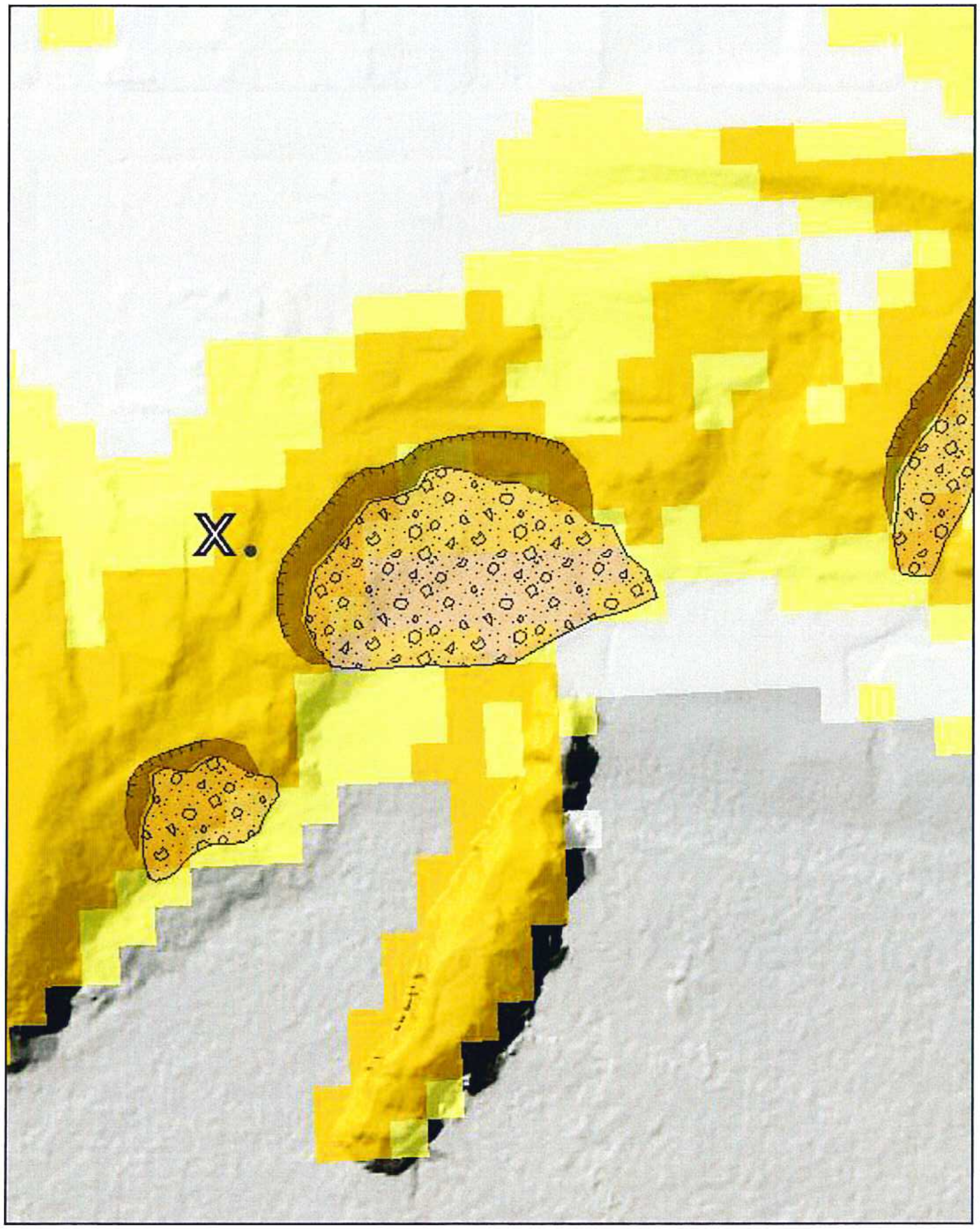


Figure 6. Geologic cross-section XS-1 (TFGS, 2003) as redrawn by BGC (2005a) and "cleaned up" for this report. See Figure 3C for the location of all the following cross-sections.

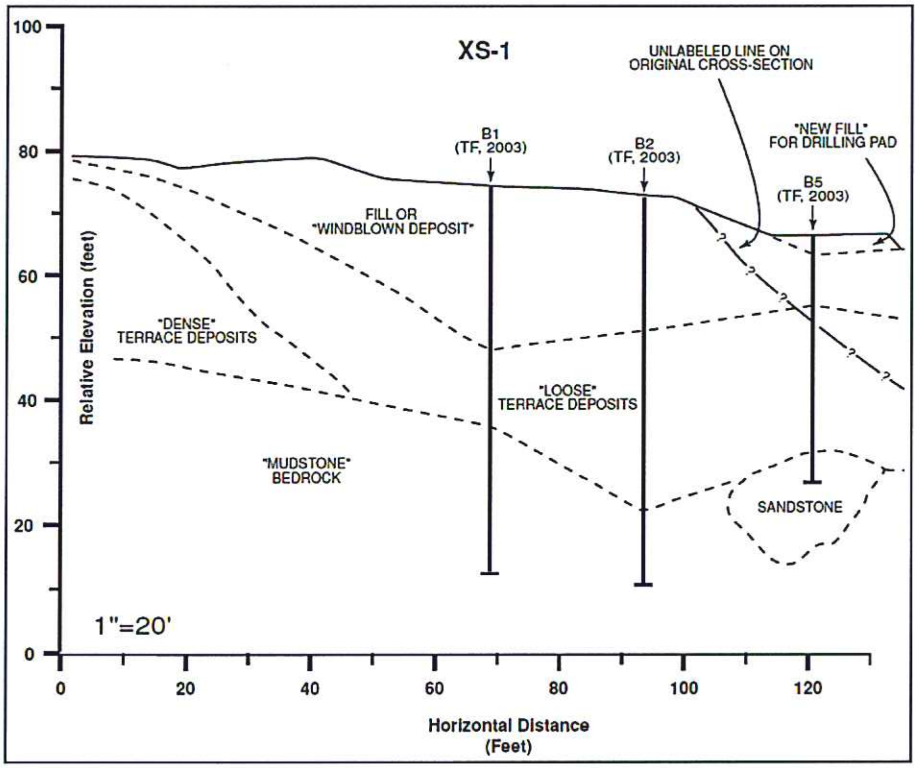


Figure 7. Cross-section XS-2 (TFGS, 2003) as redrawn by BGC (2005a) and "cleaned up."

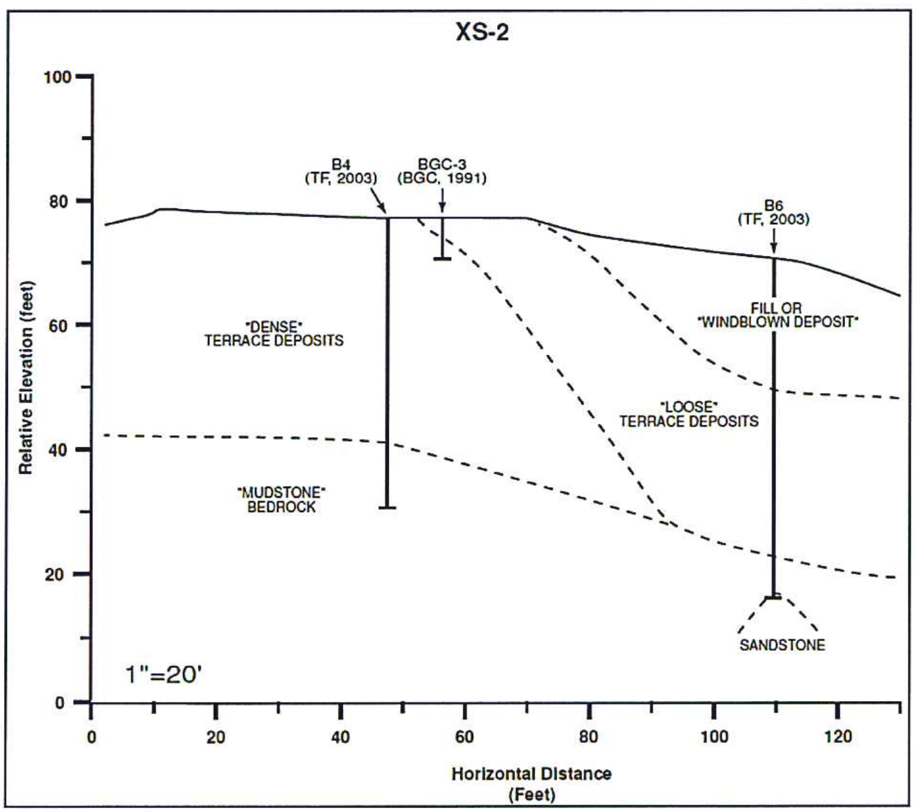


Figure 8. Cross-section XS-3 (TFGS, 2003) as redrawn by BGC (2005a) and "cleaned up."

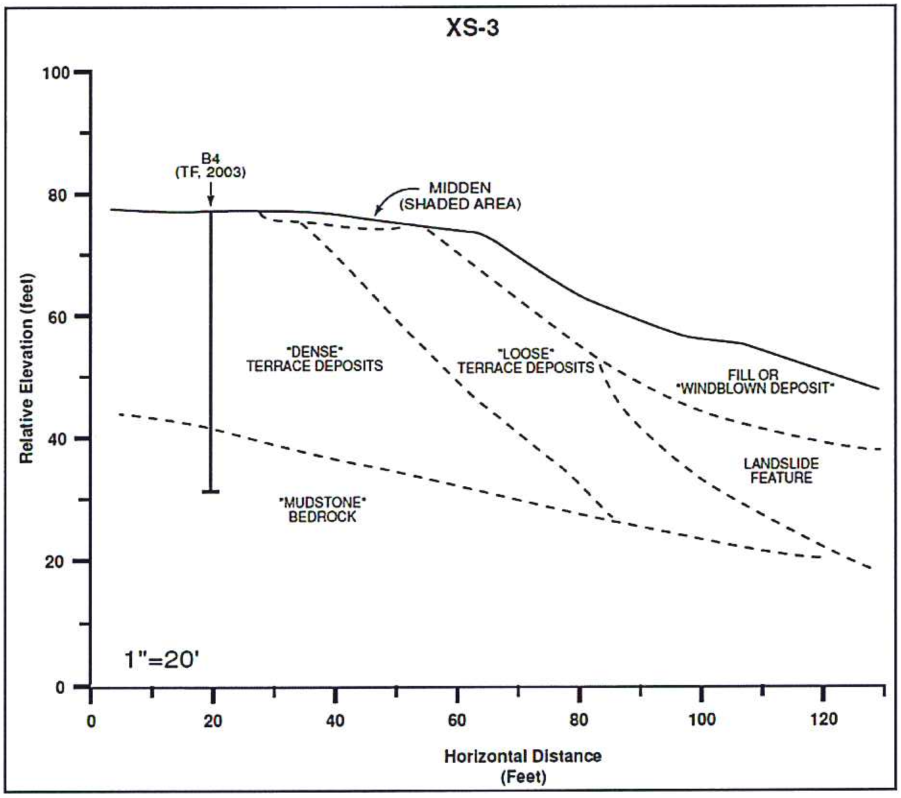


Figure 9. Cross-section B-B' (BGC, 2005a, based on TFGS, 2003). The owner projected the entire building outline onto the section for illustrative purposes. I did not include section A-A' in this report.

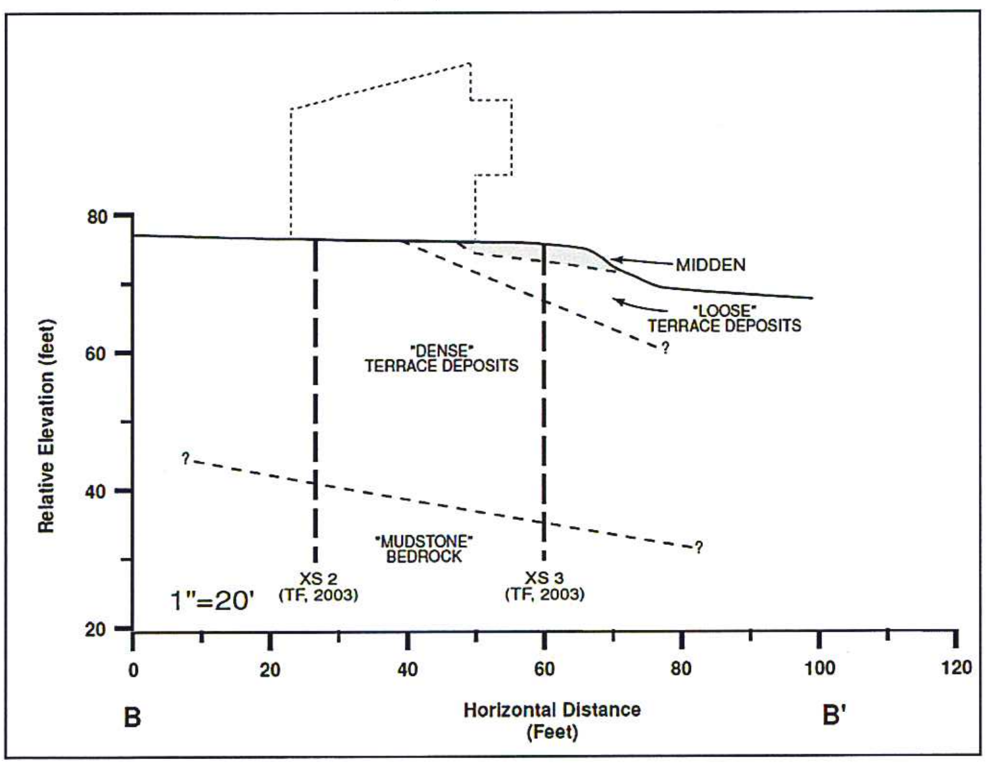


Figure 10. Cross-section C-C' (BGC, 2005a, based on TFGS, 2003). The owner projected the entire building outline onto the section for illustrative purposes.

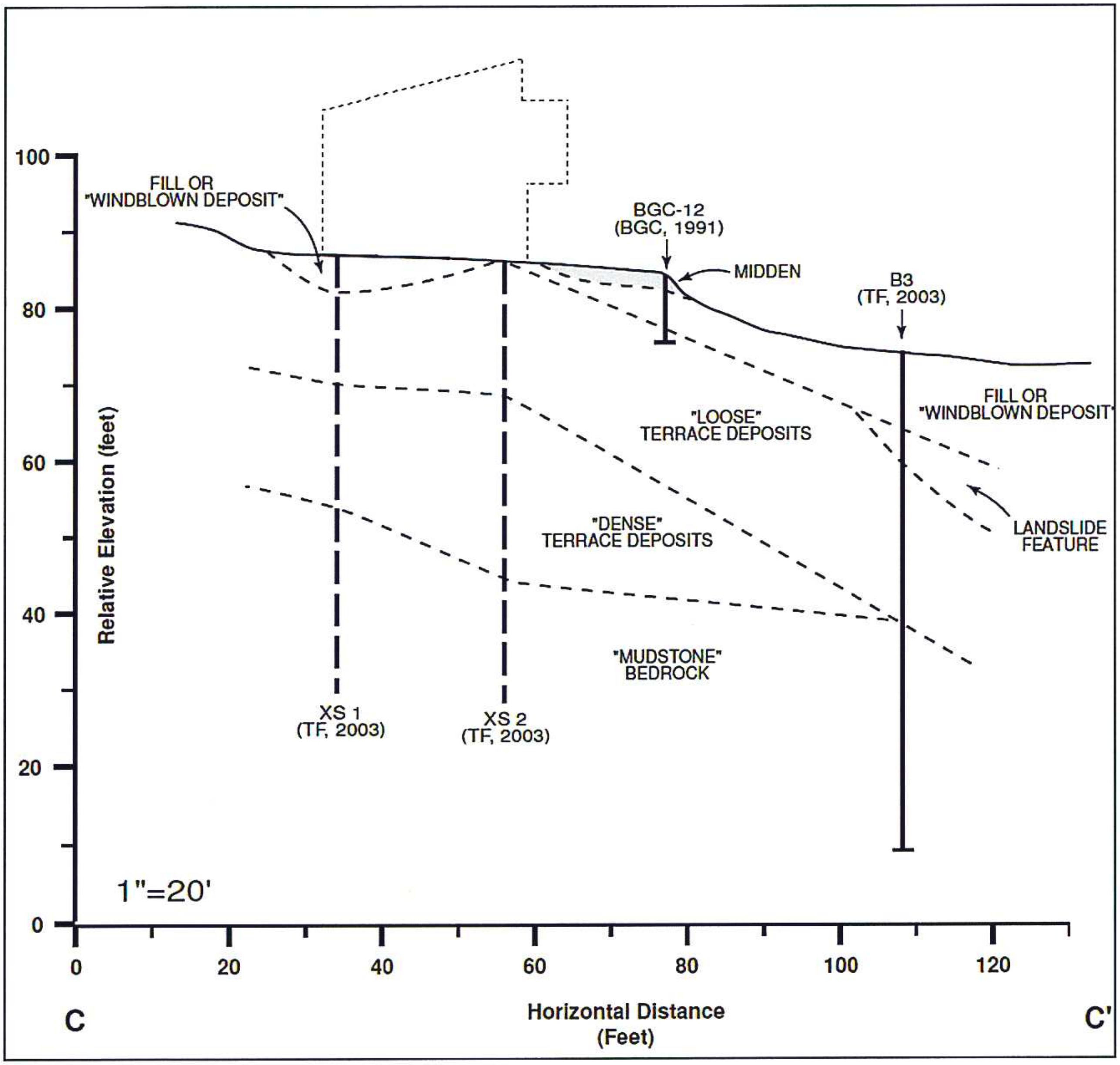


Figure 11. Logs of TFGS (2003) deep drill holes (reproduced via scan). I do not discuss details of the logs in this report. See Figure 3C for the location of the holes.

Gustafson Boring Logs

B1 (Elev top Hole 75')
0-26' Fill and topsoil SP to SM fine grained very loose

26'-38' Terrace sediments N=12@30', 2@36' top water table at 35'

38'-61.5' Mudstone N=9@41', 7@46', 27@51',35@56', 52@61'

B2 (Elev top Hole 71')
0-21' Fill and topsoil SP to SM fine grained very loose

21'-50' Terrace sediments SM to SW, gravel at 40' 45-50' mixed sand and clay from mudstone N=14@26', 9@30', 6@36', 40@41', 10@46', top water table at 35'
50'-61.5' Mudstone N=27@51',12@56', 22@61'

B3 (Elev top Hole 63-65')
0-10.5' Topsoil ± Fill SP to SM fine grained very loose

10.5'-27' Terrace sediments SM to SW N=3@11', 7@16', 12@21' 6@26' can't tell where water table is due to mud rotary

27'-34' Terrace Sediments clay and gravel N=60@30' false reading due to gravel

34'-66.5' Mudstone N=53@35', 30@41', 39@46', 53@51', 50/3"@56', 50/6"@61', 50/5"@65'(easy to hard drilling in mudstone)

B4 (Elev top Hole 76-77')
0-35' Terrace sediments SP-SM to SW N=34@11', 41@16', 47@21' 31@26' 32@31' can't tell where water table is due to mud rotary

35'-45' Mudstone N=20@36', 50/3"@40',(very hard drilling starting at 40')

B5 (Elev top Hole 66')
0-11' Topsoil ± Fill SP to SM fine grained very loose

11'-34' Terrace sediments SP to SM minor gravel at 24' N=7@11', 8@16', 17@21' 4@26', 7@31' samples very wet below 25' but no water on drill rod

34'-39' Sandstone ± Mudstone N=50/5"@35' can't auger past 39' local easy drilling (mudstone?) between 36' and 37' then very hard

B6 (Elev top Hole 69')
0-20' Topsoil ± Fill SP to SM fine grained very loose

20-47' Terrace sediments SM to SP/SW N=6@21', 7@26', 5@31', 10@36', 11@41' top of water table (perched on bedrock) at 35'

47-53' Mudstone N=50/5"@50' (hard drilling)

B7 (Elev top Hole 70' (pad excavated 3' below ground surface at pole)
0-16.5' Terrace sediments SP to SM fine grained N=34@6', 28@11', 31@16'