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January 10, 2022
Revised from December 29, 2021

Project G19903

PROJECT: Kosta Plat – 60-lot Subdivision – Nettleton and Cochran, Spokane, WA
SUBJECT: Geohazard Evaluation (Revision 1)

This geohazard evaluation is a supplement to our geotechnical exploration and analysis report (GER) titled *60-Lot Subdivision Geotechnical Exploration and Analysis Report*, dated January 13, 2020 (H19903). The soil and hydrology conditions are described in that report. This report has been updated to address the City of Spokane Geohazard Ordinance(s).

INTRODUCTION

The City of Spokane *Geologically Hazardous Area Ordinance* (SMC 17E.040.030, 2018) requires evaluation of geologically hazardous areas, principally erosion and landslide areas. Hazards associated with seismic, volcanic, and mining activity has been determined limited in the City of Spokane. The purpose of the ordinance is to discourage development in geologically hazardous areas unless proponents demonstrate that such areas can be developed consistent to acceptable standards for public health and safety.

Based on this ordinance, geohazard areas in the City of Spokane exhibit at least one of the following characteristics:

A. *Erosion hazard areas are susceptible to severe erosion and may require mitigation measures, engineering solutions or restrictions to development to protect public safety. Erosion hazard areas are defined as "at least those identified by the U.S. department of agriculture natural resource conservation service (NRCS) as having a severe rill and interrill erosion hazard." The NRCS has compiled a table that identifies all soils in the City of Spokane having a severe rill or interrill erosion hazard. This Building Site Development Water Erosion Hazard Table and associated map will be used to classify erosion hazard areas. Erosion hazard areas are also defined as those cutbank areas within a river or stream meander that area highly susceptible to bank carving. A variety of techniques may be used to identify cutbanks along the outside banks or river and stream meanders. Erosion also occurs through the slow process of channel migration. The channel migration zone (CMZ) is the area where the active channel of a stream is prone to movement over time. Channel migration is usually found along a small percentage of the entire stream network length; however effective management of ecological functions in the CMZ is critical to reduce flood hazards, erosion and habitat loss, and to avoid the need for future shoreline stabilization.*
B. *Landslide hazard areas are potentially subject to landslides based on a combination of geologic, topographic and hydrologic factors. These include areas susceptible to landslides because of any combination of bedrock, soil, slope, structure, hydrology or other factors. Classifications of landslide hazard areas include:*
    1. *slopes greater than eighty percent subject to rockfall during seismic shaking;*
    2. *any area with a slope of thirty percent or greater;*
    3. *areas with all three of the following characteristics:*

a. Slopes greater than fifteen percent.
b. Steep hillsides intersecting permeable sediment overlying an impermeable sediment or bedrock; and
c. Evidence of perennial or intermittent springs or ground water seepage.

4. *slopes that are parallel or sub-parallel to planes of weakness (such as bedding-planes, joint systems and fault planes) in subsurface materials;*
5. *areas of previous failures identified by the NRCS as having a severe limitation for building site development;*
6. *areas of previous failures designated on department of natural resources (DNR) maps as landslides;*
7. *areas potentially unstable as a result of bank carving and erosion or areas located in a canyon or on an active alluvial fan subject to inundation by debris flows or catastrophic flooding;*
8. *areas of the Latah formation (sedimentary layers of clay interlain between basalt flows) that are subject to landslides;*
9. *areas of uncompacted fill;*
10. *sloped areas exhibiting recent erosion or mass-wasting landslide activity such as gullies, piping and surfaces devoid of all vegetation;*
11. *sloped areas greater than fifteen percent with previous levels of development that may have changed sloped stability. Slope characteristics may have changed due to removal of vegetation, the removal and disturbance of soil or a change in surface geology, and modification to underlying geology. Slopes may also experience increased water content and corresponding increase in weight and change in soil friction characteristics due to increased irrigation.*
12. *sloped areas exhibiting high rates of creep as evidenced by trees with curved trunks, fence posts angled downslope or retaining walls that are angled downslope or broken.*

A Geohazard Evaluation, Preliminary Report in accordance with SMC 17E.040.090 should be completed if one or more of the hazards listed above are present on a site. The evaluation shall document the extent and nature of geohazard(s) on the property as well as mitigating measures. If the director determines that significant adverse impact of a use or activity located in a geologically hazardous area cannot be mitigated through standards identified in SMC 17E.040.100, the project will require a geohazard mitigation plan.

Project Considerations

A 60-lot subdivision is planned in Spokane, Washington. The development will occupy approximately 12.5 acres and the lot sizes will range from 3,700 to 7,400 square feet. Cochran Street and Nettleton Lane will be extended approximately 700 feet towards the south to provide access to the lots. Based on current plans, construction will be focused on the northern portion of the site.

Location

The site is located at 2500 W. 17th Avenue and occupies Spokane County parcel 25252.0032. It is bordered by the Fish Lake Trail to the east, which runs parallel with Highway 195. The BNSF railway borders to the west. The location is illustrated in the *Vicinity Map* and *Site Plan.*

Scope

The scope of services included:

- Review of available geologic and soil information;
- One site visit to include field reconnaissance of the subject property;
- Evaluate pertinent geologic and hydrologic conditions at the site based on visual observations;
- Develop professional opinions and recommendations relating to potential geologic hazards as defined by the Geologically Hazardous Area Ordinance; and,
- Prepare this report documenting our conclusions.

Laboratory analysis was not included in this scope of services. Additional geotechnical evaluation to support the construction of structures or the safety factors associated with existing fill, cut, or native slopes was not performed. Such an evaluation would require subsurface explorations and geotechnical engineering analysis of information associated with the design of infrastructure and buildings such as architectural drawings, grading plans, and anticipated foundation loading that is not included in this scope of services.

This report addresses only our conclusions related to potential geohazards of slopes, erodible soils, hazardous geology, and uncompacted fill associated with development. The conclusions are based on visual observation of the ground surface conditions and review of available published data. Review of our previous subsurface exploration performed for stormwater design was also completed. Soil parameters associated with foundation design, wall design, structural fill, bearing capacity, or seismic criteria are not addressed in this report.

ENCOUNTERED CONDITIONS

Geologic Setting and USDA Soil Mapping

Geologic mapping of this area shows Miocene basalt (Mwp) belonging to the Priest Rapids Member of the Wanapum Basalt, Columbia River Basalt Group, overlying Miocene Latah Formation (Ml). Mapping also illustrates areas of Quaternary glacial flood deposits (Qfg) in superposed contact with the Mwp and Ml units.

The Glacial Lake Missoula Outburst Floods scoured pre-existing rock and sedimentary formations in many areas while exposing previously buried formations near the margins of developed channels in other areas. The floods resulted in deposition of coarse-grained soil in the consequentially developed channels.

The Mwp unit is described as "*Dark gray to black, fine-grained, dense basalt*." (WSDNR, 2004).

The Ml unit is described as *"Lacustrine and fluvial deposits of finely laminated siltstone, claystone, and minor sandstone; light gray to yellowish gray and light tan; commonly weathers brownish yellow with stains, spots, and seams of limonite; poorly indurated… easily eroded and commonly blanketed by colluvium, talus, and residual soils." (*WSDNR, 2004).

The Qfg unit is described as *"Thick-bedded to massive mixture of boulders, cobbles, pebbles, granules, and sand; contains beds and lenses of sand and silt; gray, yellowish gray, or light brown; poorly to moderately sorted; both matrix and clast supported; locally composed of boulders in a matrix of mostly pebbles and coarse sand; boulders and cobbles consist predominantly of locally derived basalt; found* *mainly outside of the principal flood channels, which approximate the present courses of the Spokane and Little Spokane Rivers.”* (WSDNR, 2004).

The Natural Resource Conservation Service (NRCS, 2021) lists the native soils associated with the site as *Marble Loamy Sand, 15 to 30 percent slopes* (Unit 3122) and *Xerolls silt loam, warm, mass wasted, 8 to 25 percent slopes* (Unit 7103).

Based upon the observed conditions, review of NRCS data, and the results of the modified version of Uniform Soil Loss Equation, K values are listed in the following table:

Soil Unit	Slopes	Kf – rock free	Kw –whole soil	Erosion Hazard Rating
3122	15 to 30 percent	Not Rated	Not Rated	Severe
7103	8 to 25 percent	0.37	0.37	Severe

"Erosion factor Kf (rock free)" indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size. "Erosion factor Kw (whole soil)" indicates the erodibility of the whole soil and susceptibility of a soil to sheet and rill erosion by water. The estimates are modified by the presence of rock fragments (NRCS).

Based upon review of NRCS data, soil limitations that affect Building Site Development are listed in the following table

Soil Unit	Rating	Limiting Features
3122	Very Limited	Slope, Flooding, Depth to Saturated Zone
7103	Very Limited	Slope, Depth to Saturated Zone, Shrink-Swell, Depth to Hard Bedrock

"The ratings for dwellings are based on the soil properties that affect the capacity of the soil to support a load without movement on the properties that affect excavation and construction costs…” (NRCS).

Previous Studies

In 2015, we provided preliminary evaluation of a rockslide that closed Fish Lake Trail immediately downhill from the middle of this project, as shown in the image below. The 2015 study concluded that the failure occurred as a result of seepage and erosion along the contact between the Latah sediments and overlying basalt. Undermining of the basalt resulted in a loss of support and subsequent failure along vertical columnar joints in the basalt cliff above the trail.

Rockslide in 2015 on Fish Lake Trail downhill side of project

Field Reconnaissance

We performed reconnaissance of the site on November 30, 2021, to observe the surface conditions. The 12.5-acre site was undeveloped. A Washington State Department of Transportation (WSDOT) borrow pit was present to the south. A residential subdivision undergoing construction was observed to the north. The BNSF railway bordered the western margin, and the Fish Lake Trail bordered by Highway 195 ran parallel with the eastern property line. Most of the area proposed for development is a basalt plateau defined by cuts to the east and west and sloping margins to the southeast and northeast.

Within the northeast corner, undocumented fill materials were noted at ground surface. These materials consisted of angular basalt cobbles and boulders mixed with silts and sands. The extent of the fill materials was estimated to range from 5 to 20 feet in thickness and covering an area roughly 80 by 250 feet at the southeast end of 17th Avenue.

Along the east property line, the site borders a cut from a historic railway alignment now repurposed as the paved Fish Lake Trail. Vertical cuts were made into basalt bluffs. These outcroppings consist of columnar jointed *Mwp* that formed 20 to 40-foot vertical bluffs. Columnar joints ranged from 4 to 6 feet in spacing. At the base of the bluffs were talus slopes consisting of large angular basalt cobbles and boulders. The total height of the bluffs and talus slopes ranged from 38 feet at the northern extent to 58 feet at the highest point near proposed Lot 22. An exposure of the Latah Formation (Ml) was observed between the columnar bluffs and talus slope as shown in *Photo 4*.

The plateau that forms the central portion of the site consists of proposed lots 6 to 13, 44 to 53, and 22 to 26. This plateau consists of undulating terrain that generally slopes up from east to west. Numerous outcroppings of *Mwp* were observed in the northwest portion. Along the southern edge, the plateau slopes downward from the southern portions of lots 15 to 21. Surface exposures of colluvium and talus were observed in this area. Vegetation consisted of dense understory beneath mature coniferous trees. The slopes ranged from 50 to 70 percent (27 to 35 degrees) along the plateau margin and shallowed near the toe at 20 to 25 percent (11 to 14 degrees). These slopes approach the margin of the WSDOT borrow pit near the southern site boundary.

The western edge of the plateau is bounded by a BNSF railway cut which exposes *Mwp* and *Ml* formations. The property line is setback approximately 15 to 40 feet from the top of the cut. At the southwestern property corner the cut slope is approximately 28 feet in total height and consists of columnar jointed *Mwp*. Slope inclinations were near vertical in the upper portions of the cut and shallowed to 90 percent (42 degrees) along the base where talus had accumulated.

Near the center of the western property line the cut extends to a total height of 54 feet, where the *Mwp* transitions to *Ml* near the top of the cut slope as shown on *Figure 2-2 Geologic Map.* In the northwest portion, slopes in the *Ml* formation were measured at approximately 46 feet in total height. These exposures extended along the western margin of proposed Lots 1 to 6. Multiple localized undermining and erosional features were noted in the upper portions of the *Ml* formation. Field measurements indicate an overall slope of 130 to 135 percent (52 to 53 degrees). At the top of the cut exposures were near vertical and shallowed where sloughed material had accumulated at the toe of the slopes.

Geologic Hazards

Reconnaissance associated with the Geohazard Evaluation, indicates that the following geo-hazard components of SMC 17E.040.030 are present:

- *A. Erosion hazard areas*
- *B. Landslide hazard areas*
    - *1. slopes greater than eighty percent subject to rockfall during seismic shaking;*
    - *2. any area with a slope of thirty percent or greater;*
    - *4. slopes that are parallel or sub-parallel to planes of weakness (such as bedding-planes, joint systems and fault planes) in subsurface materials;*
    - *5. areas of previous failures identified by the NRCS as having a severe limitation for building site development;*
    - *6. areas of previous failures designated on department of natural resources (DNR) maps as landslides;*
    - *8. areas of the Latah formation (sedimentary layers of clay interlain between basalt flows) that are subject to landslides;*
    - *9. areas of uncompacted fill;*
    - *10. sloped areas exhibiting recent erosion or mass-wasting landslide activity such as gullies, piping and surfaces devoid of all vegetation;*
    - *11. sloped areas greater than fifteen percent with previous levels of development that may have changed sloped stability. Slope characteristics may have changed due to removal of vegetation, the removal and disturbance of soil or a change in surface geology, and modification to underlying geology. Slopes may also experience increased water content and corresponding increase in weight and change in soil friction characteristics due to increased irrigation.*

Geologic hazard components are depicted in the attached *Figures.*

Erosion Hazard Areas

As listed by the NRCS onsite soils pose severe erosion potential and are susceptible to sheet and rill erosion. Erosion control plans should include applicable standard Best Management Practices (BMPs) for cuts, fills, roads, and building areas. Vegetation should be retained in areas that do not require grading.

Landslide Hazard Areas

Slopes.

"Footings on or adjacent to slope surfaces shall be founded in a material with embedment and setback from the slope surface sufficient to provide vertical and lateral support for the footing without detrimental settlement." (Section R403.1.7.2, IRC*).* Slopes were visually observed in this evaluation. Slopes can be differentiated into rock cuts, talus, native alluvial sands, and Latah Formation.

Steep rock slopes define the east and west sides of the plateau. These rock slopes are susceptible to periodic rock fall and retrogression of the slope crest over time. Talus accumulation along the base of exposed rock occur below proposed development areas. Talus slopes can reach inclinations of 80 percent. Basalt talus slopes should be left undisturbed or limited to maximum slopes of 1.75 horizontal to 1 vertical (1.75H:1V).

A subsurface investigation was not included in the scope of this geohazard evaluation. Subsurface exploration during a geotechnical engineering evaluation is necessary to provide information related to possible planes of weakness in subsurface materials.

The NRCS lists the rating of site soils as *very limited*, with respect to development of dwellings, due to steep slope conditions. Washington Department of Natural Resources mapping does not show any known landslides on the project site. However, we performed a previous study in 2015 of a rockslide as described above in *Previous Studies.*

No previous levels of development were noted on the project site. However, railroad cuts along the east and west property boundaries have disturbed surface geology and modified the underlying geology. Some of these steep slopes showed signs of soil sloughing/migrating down slope due to a lack of vegetative cover. Increased irrigation in the vicinity of these railroad cuts was not present during the reconnaissance.

Latah Formation (*Ml*).

The *Ml* generally underlies the basalt plateau and exposures are visible around the plateau. Most of the *Ml* is covered with talus or topsoil. *Ml* was encountered below topsoil in test pit 1904 (TP-1904) and TP-1905 in the center of the site as described in the previous report. Exposed clay, silt, and sand of the *Ml* formation should not be disturbed. If encountered in excavations for development or utilities, the geotechnical engineer should be notified to evaluate potential instabilities of the formation and overlying soil and rock.

Alluvium.

The site contains relatively steep native alluvial sand slopes up to 27 degrees (50 percent). This can be attributed to glacial erosion and the angularity of the sand particles. Excavated cut slopes will stand temporarily up to 39 degrees (80 percent) but are unstable, naturally raveling down to 26 degrees. Sand slopes should be graded to a maximum of 27 degrees (50 percent slope or 2H:1V).

Undocumented Fill.

Undocumented fill is limited to a relatively small area at the north end of the project site. It should be evaluated by the geotechnical engineer for potential re-use as compacted structural fill or landscaping materials. No record of compaction testing was provided or readily-available to our knowledge for the undocumented fill materials.

CONCLUSIONS

Various slopes exist on and around the site. Based upon the soil and rock components comprising the slopes, specific recommendations will apply. Vertical rock cuts should be left undisturbed as described below. Signs of rockfall from basalt bluffs and unraveling of soil were observed on steep slopes. A scope of geotechnical exploration and analysis needs to be completed as a basis for geotechnical design of the project. Alterations to slope configurations during development should be expected to accelerate erosion of soil/rock if not properly mitigated with proper grading, drainage, and erosion control methods. The erosion hazard for the site soils is considered moderate for the slope inclinations and lengths observed at the site. Clay and silt soils present off-site tracking issues when exposed in wet weather. Standard BMPs should include placement of rock at points of egress.

Latah Formation is generally limited to the lower margins of the plateau where talus has obscured its exposure. Excavations for roadways, utilities, and residences may encounter the Latah clay, silt, and sand.

RECOMMENDATIONS

Slope Setbacks

Code required building setback from top of slope is at least the smaller of H/3 or 40 feet (*IRC, Figure R403.1.7.1).* A scope of geotechnical exploration and analysis must be completed to provide a basis for design of earthwork including slopes for this project, particularly existing vertical rock cuts due to the underlying Latah Formation.

Slopes

Permanent constructed slopes should be limited to a maximum inclination of 2H:1V unless designed by an engineer registered in the State of Washington. Vertical rock cuts exist which pose risks from falling rock. Ice wedging continuously causes highly fractured basalt to spall from rock faces which accumulate as talus. Talus slopes should be left undisturbed or inclined to maximum slopes of 1.75H:1V.

Soil Erosion

Soil erosion potential is moderate and typical BMP measures should be employed to mitigate transport of soils on and off site. These BMPs should be included in a grading and erosion plan for the site. Standard BMPs should include placement of rock at points of egress. Re-vegetation of disturbed soils should be incorporated into the grading and erosion control plan.

Latah Formation

If Latah is exposed or encountered in development areas, a geotechnical engineering evaluation is recommended.

Alluvium

Alluvial soils were exposed in TP-1901, TP-1902, and TP-1906 during our previous subsurface exploration. Alluvial sands should be graded to a maximum of 27 degrees (50 percent or 2H:1V) for permanent conditions. If exposed, completed surfaces should be protected as soon as possible with mechanical or bio-technical erosion control.

LIMITATIONS

The conclusions presented herein represent our professional opinions based on the limited scope of work performed to date. This report is intended for the sole use of our client for the purposes stated herein and should not be used by other parties for other purposes without contacting us to provide specific evaluation and recommendations. Specific geotechnical evaluation and design for construction is beyond the scope of this report.

We attempted to complete these services in a manner consistent with the level of skill and care ordinarily exercised by members of the profession currently practicing in this area with similar budget and time constraints. No express or implied warranties are offered or made.

Be aware that geohazard evaluation reports do not substitute for a GER to design slopes, walls, roads, utilities, stormwater facilities, structures, and earthwork.

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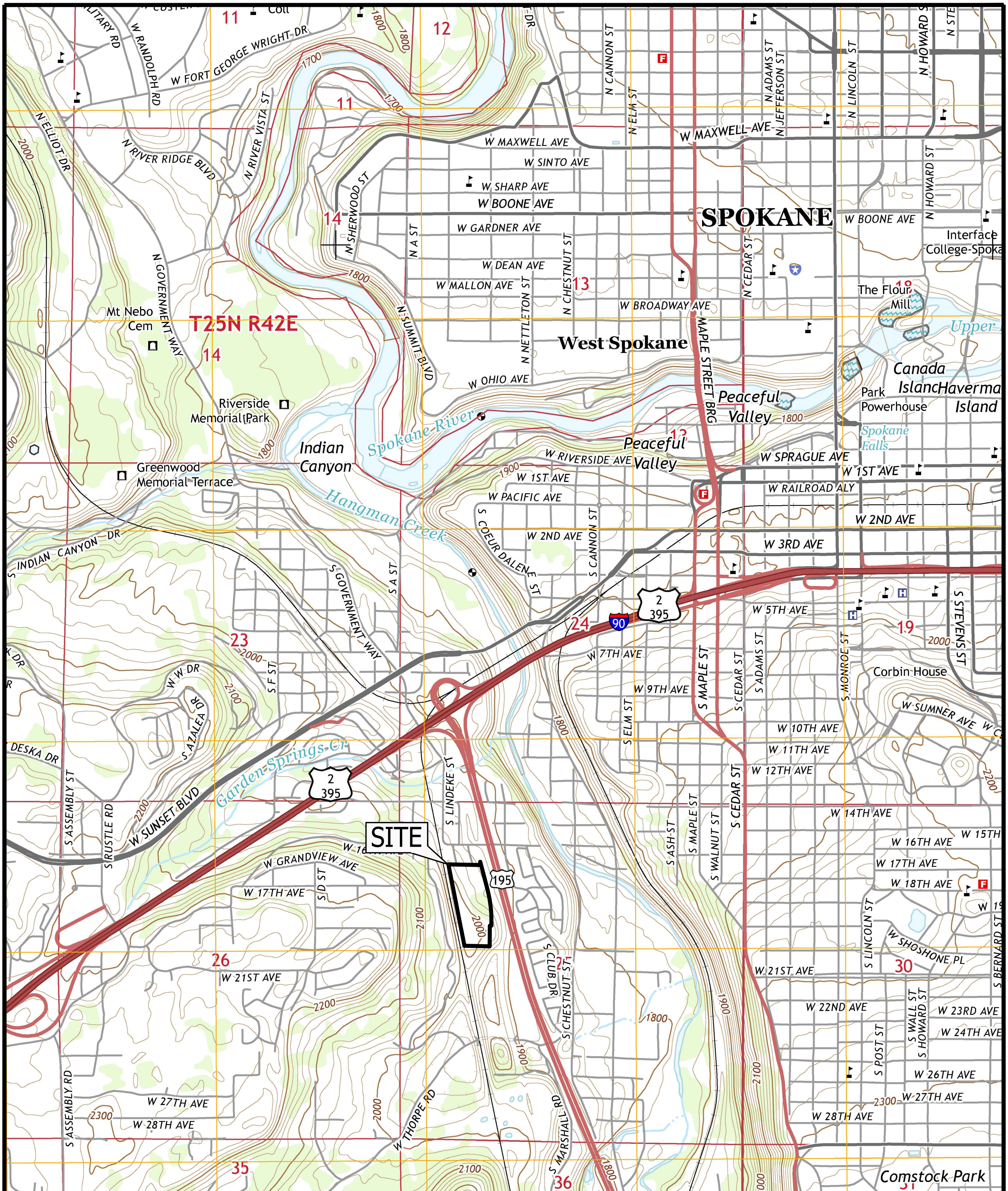
Attachments

Figure 1 – Vicinity Map
Figure 2-1 – Site Plan
Figure 2-2 – Geologic Map
Figure 2-3 – Soil Map
Figure 2-4 – LIDAR Overview Image
Figure 2-5 – Geohazard Map
Figure 3-1 to 3-3 – Photo Log
Important Information about This Geotechnical Engineering Report



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0 1000 2000

SECTION 25
T25N R42E
SPOKANE NW, WA
USGS 2020

Budinger & Associates

VICINITY MAP

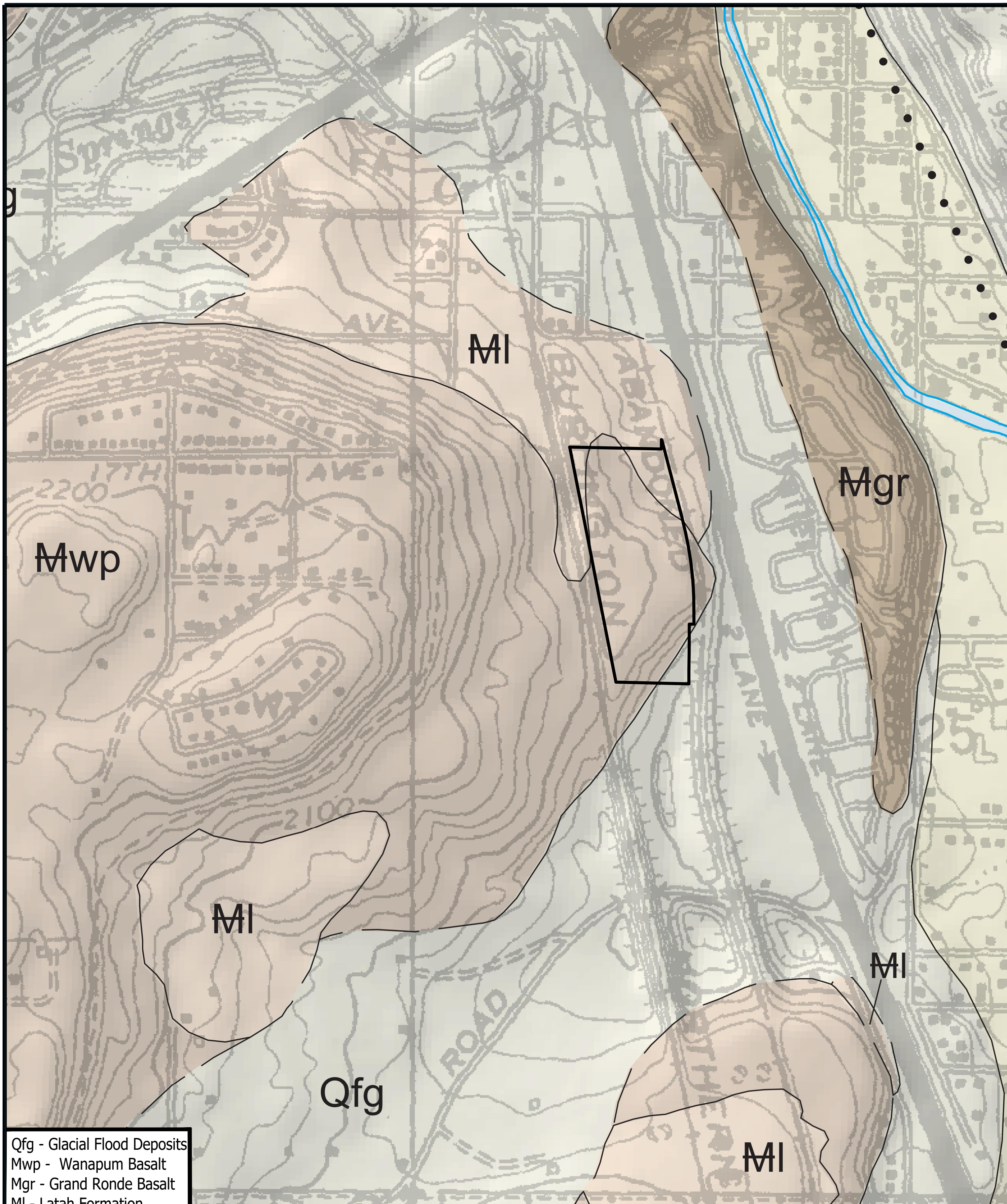
60-LOT SUBDIVISION - NETTLETON & COCHRAN
SPOKANE, WASHINGTON

FIGURE 1

PROJECT NUMBER G19903

DATE: 12/2021

PHOTO LOCATION	SCALE: 1"=160' 0' 80' 160'	Budinger & Associates	SITE PLAN	FIGURE 2-1
			60-LOT SUBDIVISION - NETTLETON & COCHRAN SPOKANE, WASHINGTON	PROJECT NUMBER G19903
				DATE: 12/2021



Qfg - Glacial Flood Deposits
Mwp - Wanapum Basalt
Mgr - Grand Ronde Basalt
Ml - Latah Formation

N

SCALE: 1"=700'

0 350 700

GEOLOGIC MAP OF THE SPOKANE NW 7.5-MINUTE QUADRANGLE, SPOKANE COUNTY, WASHINGTON WADNR 2004

Budinger & Associates

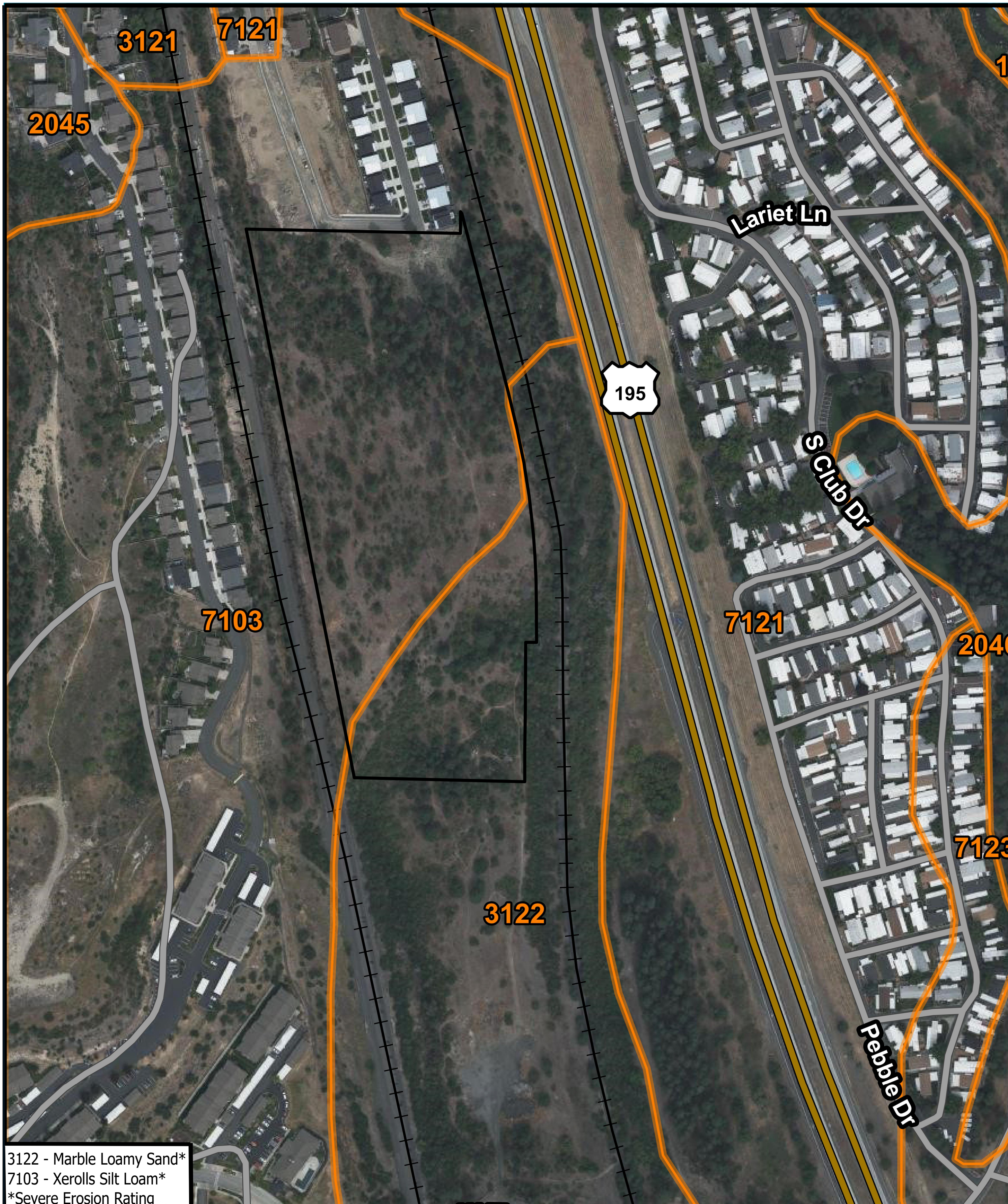
GEOLOGIC MAP

60-LOT SUBDIVISION - NETTLETON & COCHRAN
SPOKANE, WASHINGTON

FIGURE 2-2

PROJECT NUMBER G19903

DATE: 12/2021



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NRCS, 2020

Budinger & Associates

SOIL MAP	FIGURE 2-3
60-LOT SUBDIVISION - NETTLETON & COCHRAN SPOKANE, WASHINGTON	PROJECT NUMBER G19903 DATE: 12/2021

N

SCALE: 1"=160'

0 80 160

SPOKANE LIDAR
WSDNR, 2015

Budinger & Associates

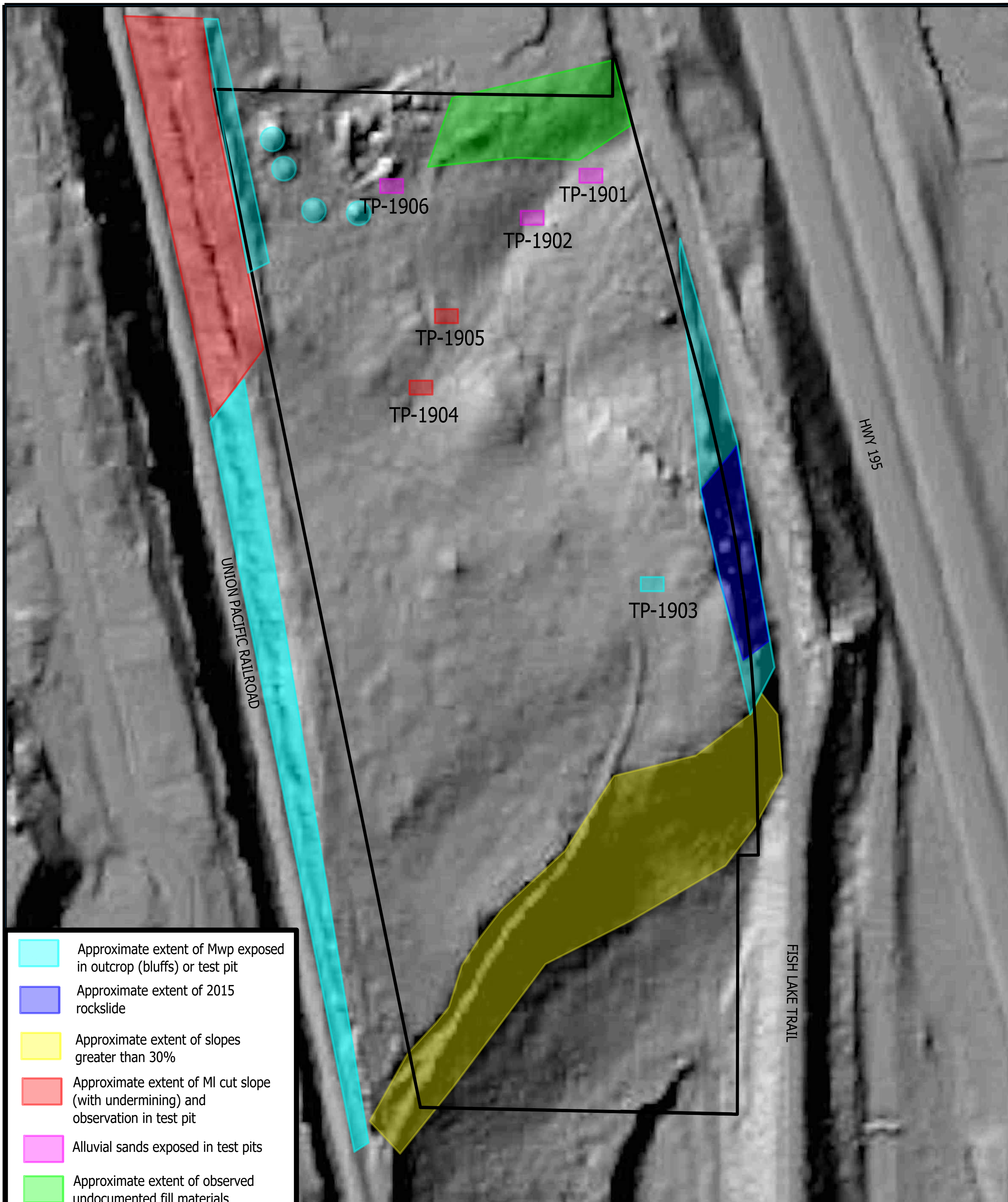
LIDAR OVERVIEW IMAGE

60-LOT SUBDIVISION - NETTLETON & COCHRAN
SPOKANE, WASHINGTON

FIGURE 2-4

PROJECT NUMBER G19903

DATE: 12/2021



N SCALE: 1"=160' 0 80 160	SPOKANE LIDAR WSDNR, 2015	Budinger & Associates	GEOHAZARD MAP 60-LOT SUBDIVISION - NETTLETON & COCHRAN SPOKANE, WASHINGTON	FIGURE 2-5 PROJECT NUMBER G19903 DATE: 12/2021

Photo 1 – Basalt bluff on east property boundary

Photo 2 – Fish Lake Trail along east property boundary

Figure 3-1

Photo 3 – Gently sloping terrain along top of plateau.

Photo 4 – Latah Formation exposed between basalt bluff and talus slope

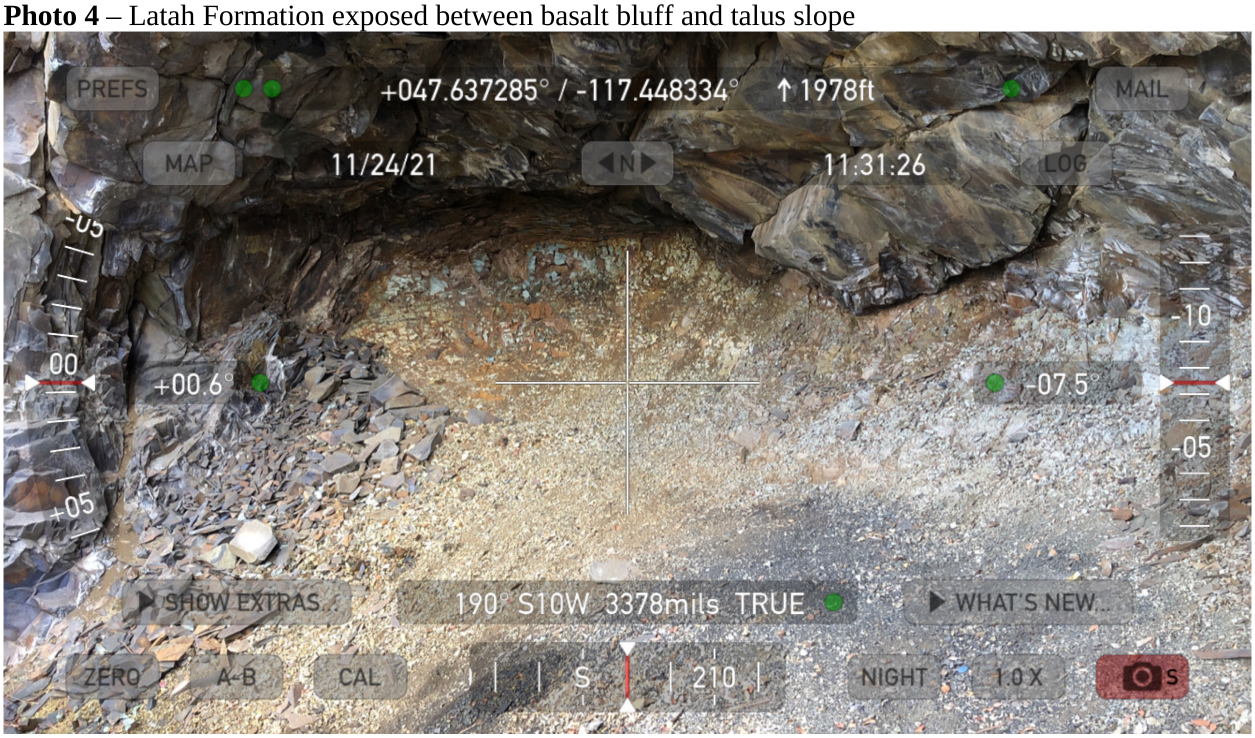


Figure 3-2

Photo 5 – Uncompacted fill in northeast portion of site.

Photo 6 – Latah Formation exposed below basalt along BNSF railway.

Figure 3-3

Appendix A: *GBC - Important Information About Your Geotechnical Report*

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical- engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply this report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

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

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by*: the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

Do Not Redraw the Engineer's Logs

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

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold- prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical- engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.

GBC GEOTECHNICAL BUSINESS COUNCIL
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