GEOTECHNICAL REPORT
Proposed Bullfrog Apartments
4240 Bullfrog Road
Cle Elum, Washington

PROJECT NO. 24-228
July 2024

Site Plan – Option 2 Rendering by Runberg Architecture Group

Prepared for:
Kamiak

PanGEO INCORPORATED
Geotechnical & Earthquake Engineering Consultants

PanGEO
INCORPORATED
Geotechnical & Earthquake
Engineering Consultants

July 30, 2024 *(revised November 21, 2024)*
PanGEO Project No. 24-228

Mr. Scott Lien
Kamiak
1700 Westlake Ave N, Suite 200
Seattle, WA 98109

Subject: **Geotechnical Report**
Proposed Bullfrog Apartments
4240 Bullfrog Road, Cle Elum, Washington

Dear Mr. Lien:

As requested, PanGEO, Inc. is pleased to present the following geotechnical report for the proposed Bullfrog Apartments project at 4240 Bullfrog Road in Cle Elum, Washington. In preparing this report, we observed and logged five test pits at the site and performed our engineering analyses. The results of our study and our recommendations are summarized in the attached report.

In summary, the site is underlain by a thin layer of loose to medium dense existing fill and loess deposits that are underlain by loose to dense granular alluvial deposits. The granular alluvial soils are considered competent for foundation support. Therefore, it is our opinion that the proposed buildings may be supported by spread footings bearing on the alluvial deposits, provided the footing subgrade is prepared as described in this report.

We appreciate the opportunity to be of service. Should you have any questions, please do not hesitate to call.

Sincerely,

Steven T. Swenson, L.G.
Senior Geologist

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GEOTECHNICAL REPORT
PROPOSED BULLFROG APARTMENTS
4240 BULLFROG ROAD
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1.0 INTRODUCTION

As requested, PanGEO, Inc. is pleased to present the following geotechnical report to assist the project team with the design and construction of the proposed Bullfrog Apartments project at 4240 Bullfrog Road in Cle Elum, Washington. This study was performed in general accordance with our mutually agreed scope of services outlined in our proposal dated March 26, 2024. Our scope of services included reviewing readily available geologic data, conducting a site reconnaissance, observing excavation of five test pits at the site, conducting engineering analyses, and preparing this geotechnical report.

2.0 SITE AND PROJECT DESCRIPTION

The project site is an approximately 1.72-acre lot located at 4240 Bullfrog Road in Cle Elum, Washington (see Figure 1, Vicinity Map). The site is bound by an asphalt paved access drive to the north, by Bullfrog Road to the west, and by Cle Elum-Roslyn school district properties to south and east. Based on our field observations, the existing site grade is generally level. The site is currently occupied by multiple one-story model homes and an asphalt paved roadway that passes through the site. Existing site conditions at the time of our fieldwork are shown in Plate 1, below.

Plate 1 *– Facing south from the site entrance in the northwest portion of site.*

Based on a review of a preliminary site plan, we understand it is proposed to remove the existing structures and to construct two workforce housing buildings at the site. As currently envisioned, the proposed buildings will be 2-story at grade structures of lightly loaded wood frame construction. The approximate layout of the proposed development is shown in Figure 2, Site and Exploration Plan. Based on the current design information, we anticipate that temporary excavations for the foundation construction will be on the order of about 2 to 3 feet deep.

We understand that infiltration facilities may be installed as part of the proposed development, if feasible. PanGEO has conducted an infiltration evaluation at the site and the results are provided in a separate report.

The subject site is mapped within a coal mine hazard area. Our review of the coal mine hazards at the site is discussed in *Section 6.0* of this report.

The conclusions and recommendations in this report are based on our understanding of the proposed development, which is in turn based on the project information provided to us. If the above project description is incorrect, or the project information changes, we should be consulted to review the recommendations contained in this study and make modifications, if needed. PanGEO should be retained to provide a review of the final design to confirm that our geotechnical recommendations have been correctly interpreted and adequately implemented in the construction documents.

3.0 SUBSURFACE EXPLORATIONS

Five test pits (TP-1 through TP-5) were excavated at the subject site on June 25, 2024, to evaluate subsurface conditions. The approximate test pit locations are indicated in Figure 2. The test pits were excavated up to 9 feet below the existing ground surface using a Kubota U27 rubber tracked mini-excavator owned and operated by Tamarack Trail Builders of Roslyn, Washington.

A geologist from PanGEO was present during the field explorations to observe the test pit excavations, to obtain representative soil samples, and to describe and document the soils encountered in the explorations. The soil samples were described using the system outlined in Figure A-1. The test pit logs are presented in Appendix A as Figures A-2 through A-6 and provide descriptions of the materials encountered, depths to soil contacts, and depths of seepage or caving observed in the test pit sidewalls.

The relative in-situ density of cohesionless soils, or the relative consistency of fine-grained soils, was estimated from the excavating action of the excavator, the stability of the test pit sidewalls, and probing with a ½-inch diameter steel rod (T-probe). Where soil contacts were gradual or undulating, the average depth of the contact was recorded in the log. After each test pit was logged, the excavation was backfilled with the excavated soils and the surface was tamped and re-graded smooth.

4.0 LABORATORY TESTING

Grain size distribution tests were conducted on select representative soil samples obtained from the test pits. The grain size distribution tests were performed according to ASTM D1140. The test results are noted on the test pit logs in Appendix A, where appropriate. The grain size distribution test results are also plotted and included in Appendix B.

5.0 SUBSURFACE CONDITIONS

5.1 Site Geology and USDA Soil Mapping

Subsurface conditions in the vicinity of the site were evaluated by reviewing the *Geologic Map of the Wenatchee 1:100,000 Quadrangle, Washington* (Tabor, et al., 1982). Based on our review, the primary geologic unit at the site is mainstream alluvium of the Yakima River (Geologic Map Unit *Qlbm*). According to the geologic map, this soil unit consists of mixed-lithology cobble gravel forming a distinct terrace about 165 feet above the Yakima River in the project vicinity. This soil unit is capped by a discontinuous mantle of loess.

Review of the soils map for the area of the site available on the USDA NRCS Web Soil Survey indicates the site is underlain by Roslyn ashy sandy loam, 0 to 5 percent slopes (Map Unit 201). Roslyn ashy sandy loam soils are described as well drained.

5.2 Soil Conditions

For a detailed description of the subsurface conditions encountered at each test pit location, please refer to the test pit logs provided in Appendix A. Based on the subsurface conditions encountered at our test pit locations, the materials at the site generally appear to be consistent with the geologic mapping. The following is a generalized description of the materials encountered in the test pits:

> **Fill:** At test pit TP-2, a layer of loose to medium dense silty sand with gravel interpreted as existing fill was encountered to about 3 feet below grade. In

addition, a 6- to 9-inch-thick surficial layer of crushed gravel fill material was encountered at the ground surface at test pits TP-3 and TP-4.

Loess: Underlying the fill at test pits TP-3 and TP-4, and near the ground surface at TP-5, loose to medium dense silty fine sand to sandy silt that we interpret to be loess was encountered. The loess was encountered to about 2 feet below grade at test pits TP-3 and TP-4 and to about 4 feet below grade at TP-5. This soil unit was not encountered at the remaining test pit locations.

Mainstream Alluvium: Underlying the existing fill at TP-2, the loess at TP-3 to TP-5, and near the ground surface at TP-1, loose to dense poorly to well graded gravel with a varying silt and sand content was encountered to the maximum depths explored. The upper roughly 1½ to 4½ feet of this soil unit was typically weathered and had a slightly higher fines content. This soil unit is interpreted as mainstream alluvium which is consistent with the geologic mapping of the area. This soil unit contained numerous to abundant cobbles and occasional small boulders. This soil unit was encountered to the maximum exploration depth of up to 9 feet below grade at our test pit locations.

Soil conditions between our exploration locations may vary from those encountered. The nature and extent of variations between our exploratory locations may not become evident until construction. If variations do appear, PanGEO should be requested to reevaluate the recommendations in this report.

5.3 Groundwater Conditions

Groundwater was not encountered within the maximum exploration depth of 9 feet below grade at the time of excavation. Groundwater levels and seepage rates will fluctuate depending on the season and precipitation. In general, groundwater levels are higher during the wet season (October through May).

6.0 COAL MINE HAZARD REVIEW

The subject site is underlain by abandoned underground mine workings of the Northwest Improvement Company's (NWIC) No. 5 mine. Section 18.01.030(F)(4) of the Cle Elum Municipal Code defines mine hazard areas as areas underlain by, adjacent to, or affected by mine workings such as adits, gangways, tunnels, drifts, or air shafts. with the potential for creating large underground voids susceptible to collapse.

The subject site is mapped in the southwest portion of the southwest quarter of the southeast quarter of Section 21, Township 20 North, Range 15 East (swSW Sec 21 T20N R15E). As part of our study, we reviewed *The Washington State Coal Mine Map Collection: A Catalog Index, and User's Guide* (Schasse et al., 1994) and coal mine maps available on the Washington Department of Natural Resources (DNR) Washington Geologic Information Portal website. Specifically, we reviewed maps KT23A (1947), KT23D (1963), and KT26F (1947) which show the extent of mine workings of the NWIC No. 5 mine beneath the site.

Based on the results of our research, the subject site is underlain by the No. 5 Mine's 12th West Level. Rooms beneath the subject site were mined between 1939 and 1941. Elevation data on the NWIC No. 5 maps indicate the 12th West Level gangway elevation beneath the subject site is about 712.9 feet (NGVD29 presumed), which is about 1,407 feet below the site grade. There were no surface entries mapped in the project area.

For the purposes of risk assessment, sites underlain by underground workings that are more than 300 feet below the surface are commonly considered 'Declassified'. 'Declassified' coal mine hazard areas are areas where the risk of catastrophic collapse is not significant and that the hazard assessment report has determined that the site does not require any special engineering or hazard mitigation.

Based on the results of our coal mine hazard assessment, the subject site would be considered 'declassified' and it is our opinion that engineering measures to mitigate collapse or subsidence due to mining activities are not necessary for this project.

7.0 GEOTECHNICAL RECOMMENDATIONS

7.1 Seismic Design Considerations

The seismic design of the buildings may be accomplished using the 2018 or the 2021 editions of the International Building Code (IBC), which specifies a design earthquake having a 2% probability of occurrence in 50 years (return interval of 2,475 years). Based on the soil conditions encountered in our test pits, it is our opinion that Site Class D (Stiff Soil) should be assumed for the project design.

Liquefaction is a process that can occur when soils lose shear strength for short periods of time during a seismic event. Ground shaking of sufficient strength and duration results in the loss of grain-to-grain contact and an increase in pore water pressure, causing the soil to behave as a fluid. Soils with a potential for liquefaction are typically cohesionless, predominately silt and sand sized, loose to medium dense, and must be saturated. In our opinion, liquefaction is not a design consideration for this site because of the dense, coarse-grained granular nature of the alluvial deposits underlying the site.

7.2 Building Foundations

Based on the subsurface conditions encountered at our test pits, it is our opinion that conventional footings are appropriate for the proposed project. We anticipate that competent bearing soils consisting of medium dense to dense mainstream alluvial deposits will be present at the footing subgrade elevation at the majority of the site. However, loose to medium dense existing fill and loess deposits that are not considered suitable for foundation support may be encountered in some areas of the footing excavations. If existing fill or loess deposits are present at the foundation subgrade level, we recommend they are overexcavated to expose competent mainstream alluvial soils, and the resulting overexcavation be backfilled with structural fill.

7.2.1 Allowable Bearing Pressure

To limit post-construction settlement to about 1-inch or less, we recommend a maximum allowable soil bearing pressure of 2,500 pounds per square foot (psf) be used to size the footings.

For allowable stress design, the recommended bearing pressure may be increased by one-third for transient loading, such as wind or seismic forces. Continuous and individual spread footings should have minimum widths of 18 and 24 inches, respectively. Foundation elements should be placed at a minimum depth of 24 inches below final exterior grade for frost protection considerations.

Footings designed and constructed in accordance with the above recommendations should experience total settlement of about one inch or less, and differential settlement of about ½ inch. Most of the anticipated settlement should occur during construction as dead loads are applied.

7.2.2 Lateral Resistance

Lateral loads on the structures may be resisted by passive earth pressure developed against the embedded portion of the foundation system and by frictional resistance between the bottom of the foundation and the supporting subgrade soils. Footings bearing on granular structural fill or on adequately compacted alluvium may be designed using a frictional coefficient of 0.35 to evaluate sliding resistance developed between the concrete and the subgrade soil. Passive soil resistance may be calculated using an equivalent fluid weight of 300 pounds per cubic foot (pcf), assuming foundations are backfilled with structural fill. The above values include a geotechnical factor of safety of 1.5. Unless covered by pavements or slabs, the passive resistance in the upper 12 inches of soil should be neglected.

7.2.3 Perimeter Footing Drains

Footing drains should be installed around the perimeter of the buildings, at or just below the bottom of the footings. Under no circumstances should roof downspout drain lines be connected to the footing drain systems. Roof downspouts must be separately tightlined to appropriate discharge locations. Cleanouts should be installed at strategic locations to allow for periodic maintenance of the footing drain and downspout tightline systems.

Based on the coarse granular nature of the alluvial soils and the absence of groundwater, groundwater seepage, or evidence of seasonal groundwater in our subsurface explorations at the site, it is our opinion that discharge from the footing drains will be negligible. Therefore, it is our opinion that routing the footing drains to a dry well may be feasible.

7.2.4 Footing Overexcavation

If existing fill or loess deposits are encountered at the design footing subgrade elevation, we recommend overexcavating to competent mainstream alluvial soils. Based on the subsurface conditions encountered at our test pits, we anticipate that the overexcavation depths should generally be no more than about 3 feet.

The footings may extend down to competent alluvial deposits or the overexcavation may be backfilled with granular structural fill, such as the onsite mainstream alluvial soils screened to remove particles larger than 6-inches in diameter, crushed surfacing base course (CSBC) per WSDOT Standard Specifications (WSDOT, 2024) or WSDOT Gravel Borrow before construction of the footings. The overexcavation width should extend at least one-half the overexcavation depth beyond the edges of the footings.

7.2.5 Footing Subgrade Preparation

We encountered large cobbles and boulders in the mainstream alluvial deposits. Cobbles larger than 6-inches in diameter and boulders encountered at the foundation subgrade elevation will act as "hard points" which will cause differential settlement and result in development of cracks in the foundation and stem walls. Where cobbles larger than 6 inches in diameter or boulders are encountered at the foundation subgrade elevation, they should be overexcavated and replaced with granular structural fill.

Footing subgrades should be compacted to a firm and unyielding condition prior to setting forms and placing reinforcing steel. Loose or softened soil at the footing subgrade should be removed from the footing excavations or re-compacted in place. The adequacy of the footing subgrade soils should be verified by a representative of PanGEO, prior to placing forms or rebar.

7.3 Below-Grade Wall Design Parameters

Below grade walls should be properly designed to resist the pressure exerted by the soils behind the walls and surcharge loads. Proper drainage provisions should also be provided behind the walls to intercept and remove groundwater from behind the wall. Our geotechnical recommendations for the design and construction of below grade walls are presented below.

7.3.1 Lateral Earth Pressures

The below grade portions of the walls with level backslopes that are designed to yield should be designed for a static lateral earth pressure based upon an equivalent fluid weight of 35 pounds per cubic foot (pcf). If the top of retaining walls with level backslopes are restrained from lateral movement, the walls should be designed for a static earth pressure based upon an equivalent fluid weight of 55 pcf. A uniform pressure of 7H psf should be added to reflect the increase loading for seismic conditions, where H corresponds to the buried depth of the wall. The recommended lateral pressures assume that the backfill behind the wall consists of a free draining and properly compacted fill with adequate drainage provisions.

7.3.2 Wall Surcharge

Any surcharge loads located within a 1H:1V (Horizontal:Vertical) projection from the base of the walls should be included in the design calculation. The horizontal pressure on the below-grade wall from a surcharge load may be estimated as 35% of the vertical surcharge load.

7.3.3 Lateral Resistance

Lateral forces from wind or seismic loading and unbalanced lateral earth pressures may be resisted by passive earth pressures acting against the embedded portions of the foundation and the friction at the bottom of foundation elements. For design purposes, an allowable passive pressure of 300 pounds per cubic foot (pcf) and an allowable friction coefficient 0.35 may be used. These values include a geotechnical factor of safety of at least 1.5, assuming that the structural fill adjacent to the sides of the foundation has been properly compacted. A one-third increase of these values is appropriate for transient loads.

7.3.4 Wall Drainage and Waterproofing

Provisions for wall drainage should consist of a rigid 4-inch diameter perforated drainpipe at the base of the wall footings. The drainpipe should be embedded in 12 to 18 inches of washed rock. A minimum 12-inch-wide layer of open-graded, free draining granular material (i.e. pea gravel or washed rock) is recommended adjacent to the wall for the full height of the wall. Alternatively, a composite drainage material, such as Miradrain 6000 may be used in lieu of open-graded, free draining granular material. The composite drainage material should be installed per the manufacturer's recommendations. The drainpipe at the base of the wall should be graded to direct water to a suitable outlet.

Waterproofing considerations are beyond our scope of work. We recommend that a building envelope specialist be consulted to determine appropriate damp-proofing or water-proofing measures.

7.3.5 Wall Backfill

Given the relatively high fines content of the existing fill and loess deposits, we do not recommend using these soils for wall backfill. The relatively clean mainstream alluvial deposits, in general, may be used for wall backfill. If imported wall backfill is needed, we recommend using Gravel Borrow per Section 9-03.14(1) of the 2024 WSDOT *Standard Specifications*. Small hand operated compaction equipment should be used within 5 feet of walls to prevent overstressing the walls. In areas where space is limited between the wall and the face of excavation, pea gravel or clean crushed rock may be used as backfill without compaction. Beyond 5 feet from the walls, the on-site soils may be used as backfill in non-structural areas (i.e., areas not supporting structural load-bearing elements).

Wall backfill should be moisture conditioned to near its optimum moisture content, placed in loose, horizontal lifts less than 8 to 12 inches in thickness, and systematically compacted to a dense and relatively unyielding condition. The adequacy of the compaction should be verified by PanGEO personnel. If density testing will be performed, the test results should indicate at least 95 percent of the maximum dry density, as determined using test method ASTM D-1557. Within 5 feet of the wall, the backfill should be compacted with hand-operated equipment to at least 90 percent of the maximum dry density.

7.4 Floors Slabs

It is our opinion that conventional concrete slab-on-grade floor construction is appropriate for this project. The floor slab should be supported on loess or mainstream alluvial deposits compacted in-place to a firm and unyielding condition or on properly compacted structural fill. If loose or soft soils are present below a portion of the floor slab, we recommend that the loose/soft soils be removed and replaced with properly compacted structural fill.

Interior concrete slab-on-grade floors should be underlain by at least 4 inches of capillary break. The capillary break material should meet the gradational requirements provided in Table 1, below.

Table 1 – Capillary Break Gradation

Sieve Size	Percent Passing
¾-inch	100
No. 4	0 – 10
No. 100	0 – 5
No. 200	0 – 3

The capillary break should be placed on the subgrade that has been compacted to a dense and unyielding condition.

A minimum 10-mil polyethylene vapor barrier should also be placed directly below the slabs. Construction joints should be incorporated into the floor slab to control cracking.

7.5 Pavement

New asphalt pavement will be constructed as part of the proposed development. Assuming the pavement will generally be used by light passenger cars and trucks, with only occasional heavy truck use (i.e., garbage trucks, delivery trucks, etc.), as a minimum, we recommend that the new pavement section consist of 3 inches of hot mix asphalt (HMA, WSDOT 9-03.8) overlying a 6-inch thick layer of crushed surfacing base course (CSBC, WSDOT 9-03.9(3)), overlying properly compacted on-site soils. In the parking areas where heavy truck traffic will be limited, a lighter pavement section consisting of 2½ inches HMA over 4 inches CSBC may be used.

Both the soils and the crushed rock base should be compacted to a minimum of 95% of the materials maximum dry density as determined by ASTM D 1557 (Modified Proctor). The subgrade should be proofrolled with a fully loaded dump truck to assist in identifying soft or unstable areas. Any loose, yielding areas identified during the compaction or proofroll processes should be overexcavated and replaced with structural fill compacted to a minimum of 95 percent of its maximum dry density.

It should be noted that actual pavement performance will depend on a number of factors, including the actual traffic loading conditions. The recommended pavement section will need to be revised if the traffic level will be more or less than our assumed value.

8.0 EARTHWORK CONSIDERATIONS

8.1 Site Preparation

Site preparation includes striping and clearing of surface vegetation and deleterious materials in the footprints of proposed structures and pavement areas and excavating to the design subgrade. All stripped materials should be properly disposed off-site or be "wasted" on site in non-structural landscaping areas. Based on the conditions encountered at our test pit locations, we anticipate the stripping depth would be 6 inches or less.

Following the site striping, excavation, and overexcavation (if warranted), the exposed subgrade should be compacted to a dense and unyielding condition as confirmed by PanGEO. Soil in loose or soft areas should be overexcavated and replaced with compacted structural fill.

8.2 Temporary Excavation Slopes

Temporary excavations should be constructed in accordance with Part N of WAC (Washington Administrative Code) 296-155. The contractor is responsible for maintaining safe excavation slopes and/or shoring. It is our opinion that temporary excavations in the loess or existing fill may be cut at a maximum 1H:1V (Horizontal:Vertical) inclination and temporary excavations in the underlying mainstream alluvial deposits may be sloped as steep as 1½H:1V.

Temporary excavations should be evaluated in the field during construction based on actual observed soil conditions. If seepage is encountered, excavation slope inclinations may need to be reduced. During wet weather, the cut slopes may need to be flattened to reduce potential erosion or should be covered with plastic sheeting.

8.3 Material Reuse

The contractor should be aware that the near surface existing fill and loess deposits encountered at our test pits have a relatively high fines content and may be difficult to compact to the requirements of structural fill. As a result, these materials will not likely be suitable for use as structural backfill, particularly during periods of wet weather or during extended periods of hot and dry weather. The underlying mainstream alluvial soils may be reused as structural fill, however cobbles larger than 6-inches in diameter and boulders should be removed. If it is planned to reuse the onsite soils, the excavated soil should be stockpiled and protected with plastic sheeting to prevent it from becoming saturated by precipitation or runoff.

8.4 Structural Fill and Compaction

In the context of this report, structural fill is defined as compacted fill placed under buildings, roadways, slabs, pavements, or other load-bearing areas. For retaining wall and foundation backfill, cobbles larger than 6 inches in size should be screened and excluded. Imported structural fill, if needed, should consist of well-graded granular soils such as Gravel Borrow (WSDOT 9-03.14(1)), or an approved equivalent.

Structural fill should be moisture conditioned to within about 3 percent of optimum moisture content, placed in loose, horizontal lifts less than 8 inches in thickness, and systematically compacted to a dense and relatively unyielding condition and to at least 95 percent of the maximum dry density, as determined using test method ASTM D1557 (Modified Proctor).

The procedure to achieve proper density of a compacted fill depends on the size and type of compacting equipment, the number of passes, thickness of the layer being compacted, and certain soil properties. When size of the excavation restricts the use of heavy equipment, smaller equipment can be used, but the soil must be placed in thin enough layers to achieve the required compaction.

Generally, loosely compacted soils result from poor workmanship or soils placed at improper moisture content. Soils with a high percentage of silt or clay are particularly susceptible to becoming too wet, and coarse-grained materials easily become too dry for proper compaction. Silty or clayey soils with a moisture content too high for adequate compaction should be dried as necessary, or moisture conditioned by mixing with drier materials. Sprinkling is sometimes required to wet a coarse-grained soil to near optimum moisture content before compaction.

8.5 Wet Weather Construction

General recommendations relative to earthwork performed in wet weather or in wet conditions are presented below. The following procedures are best management practices recommended for use in wet weather construction:

- Earthwork should be performed in small areas to minimize subgrade exposure to wet weather. Excavation or the removal of unsuitable soil should be followed promptly by the placement and compaction of clean structural fill. The size and type of construction equipment used may have to be limited to prevent soil disturbance.
- During wet weather, the allowable fines content of the structural fill should be reduced to no more than 5 percent by weight based on the portion passing the 0.75-inch sieve. The fines should be non-plastic.
- The ground surface within the construction area should be graded to promote run-off of surface water and to prevent the ponding of water.
- Geotextile silt fences should be installed at strategic locations around the site to control erosion and the movement of soil.
- Excavation slopes and soils stockpiled on site should be covered with plastic sheeting.

8.6 Surface Drainage and Erosion Considerations

Adequate drainage provisions are imperative and we recommend both short- and long-term drainage measures be incorporated into the project design and construction. Surface runoff can be controlled during construction by careful grading practices. Typically, this includes the construction of shallow, upgrade perimeter ditches or low earthen berms to collect runoff and prevent water from entering the excavation. All collected water should be directed under control to a positive and permanent discharge system.

Permanent control of surface water should be incorporated in the final grading design. Adequate surface gradients and drainage systems should be incorporated into the design such that surface runoff is directed away from structures. Potential problems associated with erosion may also be reduced by establishing vegetation within disturbed areas immediately following grading operations.

Under no circumstances should water be allowed to pond immediately adjacent to paved areas or foundations. All pavement drainage should be directed into conduits which carry runoff away from the pavement into storm drain systems or other appropriate outlets.

9.0 ADDITIONAL SERVICES

To confirm that our recommendations are properly incorporated into the design and construction of the proposed development, PanGEO should be retained to conduct a review of the final project plans and specifications, and to monitor the construction of geotechnical elements. PanGEO can provide you with a cost estimate for construction monitoring services upon request.

10.0 CLOSURE

We have prepared this report for Kamiak and the project design team. Recommendations contained in this report are based on a site reconnaissance, a subsurface exploration program, review of pertinent subsurface information, and our understanding of the project. The study was performed using a mutually agreed-upon scope of services.

Variations in soil conditions may exist between the locations of the explorations and the actual conditions underlying the site. The nature and extent of soil variations may not be evident until construction occurs. If any soil conditions are encountered at the site that are different from those described in this report, we should be notified immediately to review the applicability of our recommendations. Additionally, we should also be notified to review the applicability of our recommendations if there are any changes in the project scope.

The scope of our work does not include services related to construction safety precautions. Our recommendations are not intended to direct the contractors' methods, techniques, sequences or procedures, except as specifically described in our report for consideration in design. Additionally, the scope of our services specifically excludes the assessment of environmental characteristics, particularly those involving hazardous substances. We are not mold consultants nor are our recommendations to be interpreted as being preventative of mold development. A mold specialist should be consulted for all mold-related issues.

This report has been prepared for planning and design purposes for specific application to the proposed project in accordance with the generally accepted standards of local practice at the time this report was written. No warranty, express or implied, is made.

This report may be used only by the client and for the purposes stated, within a reasonable time from its issuance. Land use, site conditions (both off and on-site), or other factors including advances in our understanding of applied science, may change over time and could materially affect our findings. Therefore, this report should not be relied upon after 24 months from its issuance. PanGEO should be notified if the project is delayed by more than 24 months from the date of this report so that we may review the applicability of our conclusions considering the time lapse.

It is the client's responsibility to see that all parties to this project, including the designer, contractor, subcontractors, etc., are made aware of this report in its entirety. The use of information contained in this report for bidding purposes should be done at the contractor's option and risk. Any party other than the client who wishes to use this report shall notify PanGEO of such intended use and for permission to copy this report. Based on the intended use of the report, PanGEO may require that additional work be performed and that an updated report be reissued. Noncompliance with any of these requirements will release PanGEO from any liability resulting from the use of this report.

Sincerely,

PanGEO, Inc.

11/21/2024

Steven T. Swenson, L.G.
Senior Geologist

H. Michael Xue, P.E.
Principal Geotechnical Engineer

11.0 REFERENCES

International Code Council, 2018 and 2021, *International Building Code (IBC).*

Schasse, H.W., Koler, M.L., Eberle, N.A, and Christie, R.A., 1994, *The Washington State Coal Mine Map Collection: A Catalog, Index, and User's Guide*, Open-File Report 94-7, Washington State Department of Natural Resources Division of Geology and Earth Resources.

Tabor, R.W., Waitt, R.B., Frizzell Jr., V.A., Swanson, D.A, Byerly, G.R., Bentley, R.D., 1982, *Geologic Map of the Wenatchee 1:100,000 Quadrangle, Central Washington:* U. S. Geological Survey Geologic Miscellaneous Investigations Series Map I-1311, 1 sheet, scale 1:100,000, with 26 p. text.

Washington State Coal Mine Map Collection, Maps KT23A, KT23D, and KT26F, Washington State Department of Natural Resources Division of Geology and Earth Resources, downloaded from the Washington State Geologic Information Portal.

Washington State Department of Transportation, 2024, *Standard Specifications for Road, Bridge and Municipal Construction, M 41-10.*

Base map modified from ESRI topographic imagery.

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Not to Scale

PanGEO INCORPORATED	**Bullfrog Apartments** **4240 Bullfrog Road** **Cle Elum, WA**	**VICINITY MAP**	
		Project No. **24-228**	Figure No. **1**

Notes: Base map obtained from Google Earth. Proposed building layout 'Option B'.

Legend:
Approximate Test Pit Location

PanGEO INCORPORATED

Bullfrog Apartments
4240 Bullfrog Road
Cle Elum, WA

SITE AND EXPLORATION PLAN

Project No.	Figure No.
24-228	2

APPENDIX A

SUMMARY TEST PIT LOGS

RELATIVE DENSITY / CONSISTENCY

SAND / GRAVEL			SILT / CLAY		
Density	SPT N-values	Approx. Relative Density (%)	Consistency	SPT N-values	Approx. Undrained Shear Strength (psf)
Very Loose	<4	<15	Very Soft	<2	<250
Loose	4 to 10	15 - 35	Soft	2 to 4	250 - 500
Med. Dense	10 to 30	35 - 65	Med. Stiff	4 to 8	500 - 1000
Dense	30 to 50	65 - 85	Stiff	8 to 15	1000 - 2000
Very Dense	>50	85 - 100	Very Stiff	15 to 30	2000 - 4000
			Hard	>30	>4000

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		GROUP DESCRIPTIONS	
Gravel 50% or more of the coarse fraction retained on the #4 sieve. Use dual symbols (eg. GP-GM) for 5% to 12% fines.	GRAVEL (<5% fines)	GW	Well-graded GRAVEL
		GP	Poorly-graded GRAVEL
	GRAVEL (>12% fines)	GM	Silty GRAVEL
		GC	Clayey GRAVEL
Sand 50% or more of the coarse fraction passing the #4 sieve. Use dual symbols (eg. SP-SM) for 5% to 12% fines.	SAND (<5% fines)	SW	Well-graded SAND
		SP	Poorly-graded SAND
	SAND (>12% fines)	SM	Silty SAND
		SC	Clayey SAND
Silt and Clay 50%or more passing #200 sieve	Liquid Limit < 50	ML	SILT
		CL	Lean CLAY
		OL	Organic SILT or CLAY
	Liquid Limit > 50	MH	Elastic SILT
		CH	Fat CLAY
		OH	Organic SILT or CLAY
Highly Organic Soils		PT	PEAT

Notes: 1. Soil exploration logs contain material descriptions based on visual observation and field tests using a system modified from the Uniform Soil Classification System (USCS). Where necessary laboratory tests have been conducted (as noted in the "Other Tests" column), unit descriptions may include a classification. Please refer to the discussions in the report text for a more complete description of the subsurface conditions.

2. The graphic symbols given above are not inclusive of all symbols that may appear on the borehole logs. Other symbols may be used where field observations indicated mixed soil constituents or dual constituent materials.

DESCRIPTIONS OF SOIL STRUCTURES

Layered: Units of material distinguished by color and/or composition from material units above and below
Laminated: Layers of soil typically 0.05 to 1mm thick, max. 1 cm
Lens: Layer of soil that pinches out laterally
Interlayered: Alternating layers of differing soil material
Pocket: Erratic, discontinuous deposit of limited extent
Homogeneous: Soil with uniform color and composition throughout
Fissured: Breaks along defined planes
Slickensided: Fracture planes that are polished or glossy
Blocky: Angular soil lumps that resist breakdown
Disrupted: Soil that is broken and mixed
Scattered: Less than one per foot
Numerous: More than one per foot
BCN: Angle between bedding plane and a plane normal to core axis

COMPONENT DEFINITIONS

COMPONENT	SIZE / SIEVE RANGE	COMPONENT	SIZE / SIEVE RANGE
Boulder:	> 12 inches	Sand	
Cobbles:	3 to 12 inches	Coarse Sand:	#4 to #10 sieve (4.5 to 2.0 mm)
Gravel		Medium Sand:	#10 to #40 sieve (2.0 to 0.42 mm)
Coarse Gravel:	3 to 3/4 inches	Fine Sand:	#40 to #200 sieve (0.42 to 0.074 mm)
Fine Gravel:	3/4 inches to #4 sieve	Silt	0.074 to 0.002 mm
		Clay	<0.002 mm

TEST SYMBOLS

for In Situ and Laboratory Tests listed in "Other Tests" column.

ATT	Atterberg Limit Test
Comp	Compaction Tests
Con	Consolidation
DD	Dry Density
DS	Direct Shear
%F	Fines Content
GS	Grain Size
Perm	Permeability
PP	Pocket Penetrometer
R	R-value
SG	Specific Gravity
TV	Torvane
TXC	Triaxial Compression
UCC	Unconfined Compression

SYMBOLS

Sample/In Situ test types and intervals

- 2-inch OD Split Spoon, SPT (140-lb. hammer, 30" drop)
- 3.25-inch OD Spilt Spoon (300-lb hammer, 30" drop)
- Non-standard penetration test (see boring log for details)
- Thin wall (Shelby) tube
- Grab
- Rock core
- Vane Shear

MONITORING WELL

- Groundwater Level at time of drilling (ATD)
- Static Groundwater Level
- Cement / Concrete Seal
- Bentonite grout / seal
- Silica sand backfill
- Slotted tip
- Slough
- Bottom of Boring

MOISTURE CONTENT

Dry	Dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water

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Terms and Symbols for Boring and Test Pit Logs

Figure A-1

Test Pit Logs

Project No: 24-228
Project Name: Bullfrog Apartments, Cle Elum, WA
Date Excavated: 06/25/2024

Test Pit No. TP-1 (PIT-1)

Location: See Figure 2

Approximate ground surface elevation: 2,127 feet

Depth (ft)	Material Description
0 – 4.5	Loose to medium dense, brown, silty SAND with gravel to silty GRAVEL with sand, dry to moist. Weathered. **[Mainstream Alluvium]** • Abundant roots to about 3 feet, slight caving
4.5 – 9	Medium dense to dense, brown, poorly graded GRAVEL with silt and sand, moist. • Small-scale Pilot Infiltration Test conducted about 5 feet below grade • **Sample at 5:** 5.0% fines (GP-GM) • Numerous cobbles, occasional small boulders • Minor caving


Left Photo: Tape measure at about 5 feet below grade. **Right Photo:** Infiltration test in progress.

TP-1 was terminated approximately 9 feet below grade at the conclusion of infiltration testing. Groundwater was not encountered at the time of excavation.

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Figure A-2

Test Pit Logs

Project No: 24-228
Project Name: Bullfrog Apartments, Cle Elum, WA
Date Excavated: 06/25/2024

Test Pit No. TP-2

Location: See Figure 2

Approximate ground surface elevation: 2,127 feet

Depth (ft)	Material Description
0 – 3	Loose to medium dense, brown, silty SAND with gravel, dry to moist. **[Fill]** • Thin layer of gray crushed rock around 1.5 feet
3 – 5	Medium dense, brown, silty SAND with gravel, moist. Weathered. **[Mainstream Alluvium]** • Occasional cobbles
5 – 7	Medium dense to dense, brown, poorly graded GRAVEL with silt and sand, moist. • Numerous cobbles, occasional small boulders

Photo: Test pit around 5 feet deep.

TP-2 was terminated approximately 7 feet below grade. Groundwater was not encountered at the time of excavation.

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Test Pit Logs

Project No: 24-228
Project Name: Bullfrog Apartments, Cle Elum, WA
Date Excavated: 06/25/2024

Test Pit No. TP-3

Location: See Figure 2

Approximate ground surface elevation: 2,124 feet

Depth (ft)	Material Description
0 – 0.5	Loose, gray, poorly graded GRAVEL with silt and sand, dry. Crushed gravel. **[Fill]**
0.5 – 2	Loose to medium dense, brown, silty fine SAND to sandy SILT, moist, **[Loess]** • Numerous roots
2 – 3.5	Medium dense to dense, brown, poorly graded GRAVEL with silt and sand, moist. **[Mainstream Alluvium]** • Numerous cobbles, occasional small boulders
3.5 – 9	Dense, brown, well to poorly graded GRAVEL with sand, moist. • Numerous cobbles, occasional small boulders • **Sample at 5':** 4.4% fines (GW) • **Sample at 8.5':** 4.1% fines (GP)

Photo: Test pit around 7 feet deep.

TP-3 was terminated approximately 9 feet below grade due to practical excavation refusal on a boulder. Groundwater was not encountered at the time of excavation.

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Figure A-4

Test Pit Logs

Project No: 24-228
Project Name: Bullfrog Apartments, Cle Elum, WA
Date Excavated: 06/25/2024

Test Pit No. TP-4

Location: See Figure 2

Approximate ground surface elevation: 2,126 feet

Depth (ft)	Material Description
0 – 0.75	Loose, gray, poorly graded GRAVEL with silt and sand, dry. Crushed gravel. **[Fill]**
0.75 – 2	Loose to medium dense, silty fine SAND to sandy SILT, dry to moist, **[Loess]** • Numerous roots • **Sample at 1.5':** 47.0% fines (SM)
2 – 4	Medium dense to dense, brown, silty GRAVEL with sand, dry to moist. **[Mainstream Alluvium]** • Numerous cobbles, occasional small boulders
4 – 8	Medium dense to dense, brown, well to poorly graded GRAVEL with sand, moist. • Numerous cobbles, occasional small boulders

Photo: Completed test pit.

TP-4 was terminated approximately 8 feet below grade. Groundwater was not encountered at the time of excavation.

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Figure A-5

Test Pit Logs

Project No: 24-228
Project Name: Bullfrog Apartments, Cle Elum, WA
Date Excavated: 06/25/2024

Test Pit No. TP-5

Location: See Figure 2

Approximate ground surface elevation: 2,126 feet

Depth (ft)	Material Description
0 – 4	Loose to medium dense, silty fine SAND to sandy SILT, dry to moist, **[Loess]** • Numerous roots
4 – 6.5	Medium dense to dense, brown, poorly graded GRAVEL with silt and sand, moist. **[Alluvium]** • Numerous cobbles, occasional small boulders • **Sample at 6':** 5.5% fines

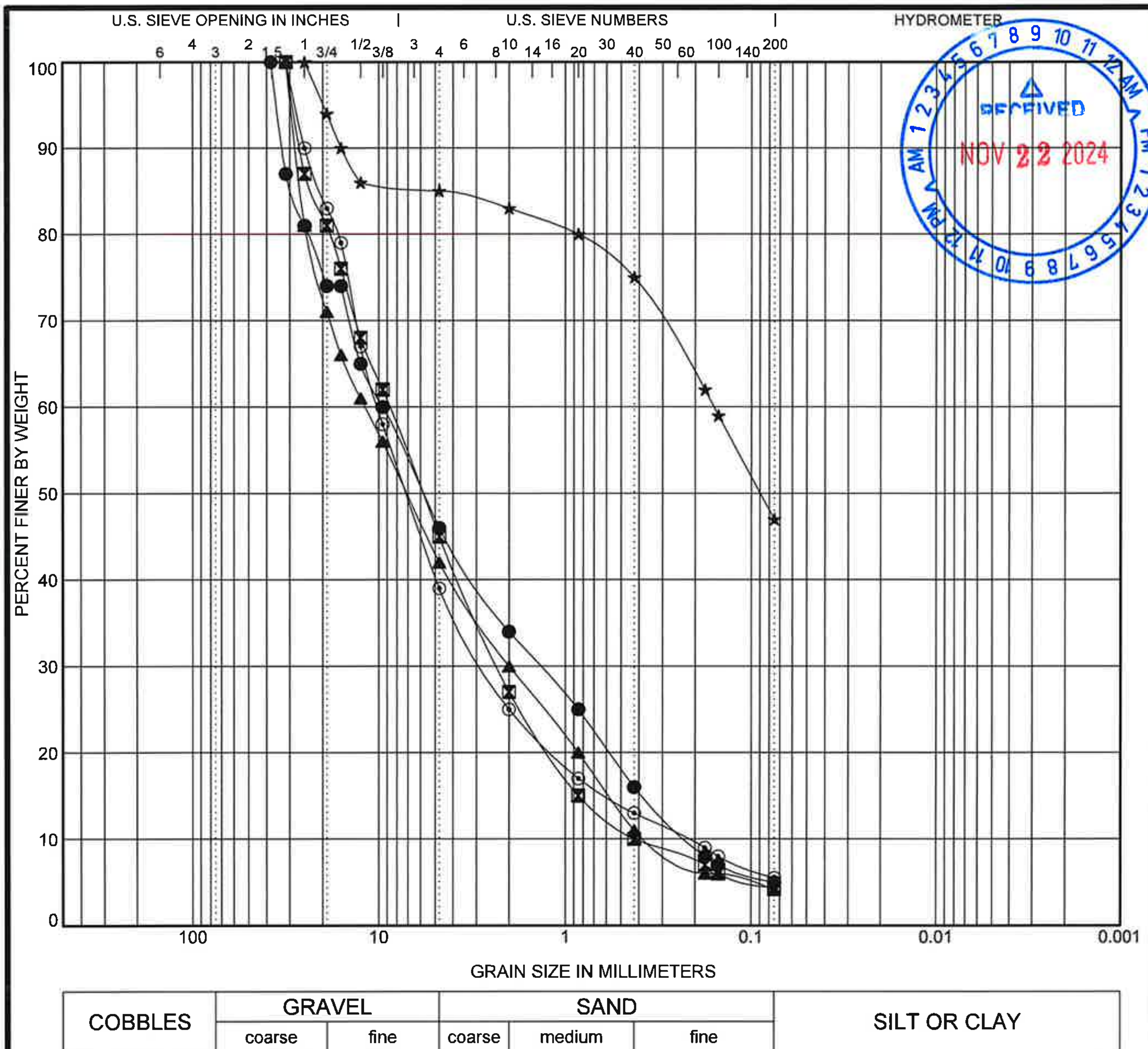
Photo: Test pit at 5 feet.

TP-5 was terminated approximately 6.5 feet below grade. Groundwater was not encountered at the time of excavation.

Logged by: S Swenson

APPENDIX B

GEOTECHNICAL LABORATORY TEST RESULTS



Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● TP-1	@ 5.0 ft.	POORLY GRADED GRAVEL with SILT and SAND(GP-GM)	NP	NP	NP	0.89	43.23
⊠ TP-3	@ 5.0 ft.	WELL-GRADED GRAVEL with SAND(GW)	NP	NP	NP	1.43	20.65
▲ TP-3	@ 8.5 ft.	POORLY GRADED GRAVEL with SAND(GP)	NP	NP	NP	0.95	33.19
★ TP-4	@ 1.5 ft.	SILTY SAND with GRAVEL(SM)	NP	NP	NP		
⊙ TP-5	@ 6.0 ft.	POORLY GRADED GRAVEL with SILT and SAND(GP-GM)	NP	NP	NP	3.33	45.92

Specimen Identification		D100	D90	D60	D10	%Gravel	%Sand	%Silt	%Clay
● TP-1	5.0	38	32.894	9.525	0.22	54.0	41.0	5.0	
⊠ TP-3	5.0	31.5	26.37	8.776	0.425	55.0	40.6	4.4	
▲ TP-3	8.5	31.5	27.892	11.839	0.357	58.0	37.9	4.1	
★ TP-4	1.5	25	16	0.159		15.0	38.0	47.0	
⊙ TP-5	6.0	31.5	25	10.118	0.22	61.0	33.5	5.5	

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GRAIN SIZE DISTRIBUTION

Project: Bullfrog Apartments
Job Number: 24-228
Location: 4240 Bullfrog Road, Cle Elum, WA

Figure B-1