11/6/2023*(revised 12/7/2023)*

RECEIVED
By Mollie Hurt at 12:00 pm, Mar 26, 2024

Merrlawski Investments, LLC
Attn: Chris Merritt

Subject: **Riverside Drive – Channel Migration Zone Evaluation**
TPN: 035067002003; 107 Riverside Dr, Packwood WA 98361
Project Number QG23-175

Dear Mr. Merritt:

At your request, Quality Geo NW, PLLC (QG) has completed a limited evaluation of the potential for channel migration within your property. The general potential for migration of the Cowlitz River is in question. It has been requested that QG evaluate the Channel Migration Zone (CMZ) and provide our interpretation of the possible CMZ hazard.

LEWIS COUNTY CRITICAL AREA ORDINANCE

LCC 17.10.170 "Q" definitions:

> *" Qualified critical area professional" means a person or a team of persons with experience, education, and professional degrees and/or training pertaining to the critical area in question, and with experience in performing delineations, analyzing critical area functions and values, analyzing critical area impacts, and recommending critical area mitigation and restoration. The administrator may require professionals to demonstrate the basis for qualifications and shall make final determination as to qualifications.*
>
> *(c) A qualified professional for geologically hazardous areas must be a professional geologist, a professional engineering geologist or a professional geotechnical engineer… "*

QG employees Geologists, Engineering Geologists, and Professional Engineers who are licensed in Washington State. Our staff have conducted over 500 geotechnical investigations across the state. This report has been prepared and stamped by a WA Licensed Geologist

and Professional Engineer. The license numbers can be referenced with the WA DOL to confirm active licensure.

LCC 17.35A.121 Channel migration zone (CMZ).

> *"Channel migration zone" means the area along a river or stream within which the channel can reasonably be expected to migrate over time as a result of normally occurring processes. It encompasses that area of lateral stream channel movement that can be identified by credible scientific information that is subject to erosion, bank destabilization, rapid stream incision, and/or channel shifting, as well as adjacent areas that are susceptible to channel erosion. For the purpose of this code, linear facilities parallel to the direction of flow, including roads and railroads and flood control levees permanently maintained by a public agency, may be considered to form the boundary of a channel migration zone. [Ord. 1204 Exh. A § 2, 2008]*

LCC 17.38.690 Channel Migration Zones.

> *(1) Classification of Channel Migration Zones. Channel migration zones are areas within which a river channel can be expected to migrate over time due to hydrologically and geomorphologically related processes.*
>
> *(2) Mapped channel migration zones are based on:*
>
> *(a) The location of severe and moderate channel migration areas as identified with the report: Channel Migration and Avulsion Potential Analyses: Upper Nisqually River, Pierce County, Washington, produced by GeoEngineers for Pierce County Public Works and Utilities, Water Programs Division, 2007, 59 pages; or as revised.*
>
> *(b) The location of severe and moderate channel migration areas identified within the report: Geomorphic Evaluation and Channel Migration Zone Analysis Addendum: Cowlitz River, near Packwood and Randle, Lewis County, Washington, produced by GeoEngineers for the Lewis County Public Works Department, 2009, 76 pages; or as revised.*
>
> *(c) The location of historical migration zones (HMZ), avulsion hazard zones (AHZ), and erosion hazard areas (EHA) within the report Reach Analysis and Erosion Hazard Management Plan: Cispus River from River Mile 12.3 (Greenhorn Creek) to River Mile 17.6 (Cispus Road Bridge), prepared by Herrera Environmental*

Consultants, Inc. for the Lewis County Public Works Department, 2004, 105 pages; or as revised.

(d) The location of the channel migration area identified for Rainey Creek within the report: Geomorphic Evaluation and Channel Migration Zone Analysis, Lewis County, Washington, produced by GeoEngineers for the Lewis County Public Works Department, 2003, 52 pages; or as revised.

(e) The location of a channel migration zone may be modified by the administrator based on a study provided by an applicant and prepared by a qualified professional that demonstrates there are specific geologic, landform, hydraulic, sediment transport, or other factors that demonstrate that a specific area is not in the channel migration zone. Such a study shall be developed in accordance with Best Available Science and investigate areas upstream and downstream of the review site that could influence the migration of the channel and the channel migration corridor.

AREA GEOLOGY

QG reviewed available map publications to assess known geologic conditions and hazards present at the site location. The Washington Geologic Information Portal (WGIP), maintained by the Department of Natural Resources Division of Geology and Earth Resources, provides 1:100,000-scale geologic mapping of the region. Geology of the site location and vicinity consists of alpine glacial drift deposits (Qad(e)). The drift on site is described as being, "Quaternary till, outwash, and glaciolacustrine sediments; locally includes loess, talus, and lacustrine deposits."

SITE INVESTIGATION METHODOLOGY

On 9/13/2023, a QG Staff Geologist visited the site to perform visual reconnaissance of the surface and subsurface features of the subject property and its proximal surface water features. While on site, we conducted site surface explorations for a geologic hazard assessment and site feasibility characterization. Approximate relevant property dimensions and water conditions were documented and mapped at representative intervals as access allowed. Soil conditions were evaluated through previous test pit explorations on site. Salient surface features and existing vegetation were documented to assess general site stability as well as observe for signs of local instability of an erosional or subsurface nature currently or in the past.

SITE & SURFACE CONDITIONS

The project area is relatively flat, laying a few feet below the elevation of Cannon Road, inclining generally southeasterly towards the Cowlitz River. The site is undeveloped, with low-lying grass

and shrub cover. A forested area covers the southeastern quarter of the parcel.

SOIL LOG

Site soil conditions were consistent across the property in 4 test pits. Representative lab samples were taken from TP-1.

- **Silt (SM)**
  Beneath the brush and grass was an approximately 5.0-foot layer of brown silt, resembling prehistoric alluvium deposits. Soils further distanced from the river had thin lenses of sandy volcanic ash interbedded in the silts. The silt is described as organic-rich (roots, humus), with light to no mottling, and in a medium stiff condition.

- **Poorly Graded Gravel with Sand (GP)**
  Beneath the cover soils, native sediments resemble a dark gray to brown sandy gravel alluvium, with minimal fines content and high cobble content, in a typically dense condition. Groundwater was encountered within this unit consistently at approximately 7.0 feet below present grade.

SURFACE WATER AND GROUNDWATER CONDITIONS

There are two historical farm ditches on the property that are non-functioning. According to the client, these ditches are reported to have been installed in the 1960's and have been derelict since agricultural operations ceased on the property. One ditch originates from the center of the northeastern property boundary and extends southeast to the Cowlitz River. The other channel runs along the southern property boundary. Neither show signs of active water flow within them.

During our explorations, a pervasive groundwater table was seen as shallow as 7 feet below the surface, in all test pits. This groundwater table is inferred to exist beneath the entire site near the same elevation. Due to the time of year, it may be assumed that this is not a seasonal high, and the water table may raise during the mid-winter months. We interpret the typical seasonal maximum water table to be within 5 feet below grade due to the proximity of the site to the Cowlitz River and its natural seasonal fluctuations.

QG's scope of work did not include determination or monitoring of seasonal groundwater elevation variations, formal documentation of wet season site conditions, or conclusive measurement of groundwater elevations at depths past the extent feasible for explorations at the time of the field explorations.

CHANNEL MIGRATION ZONE HAZARD ANALYSIS

QG performed local CMZ analysis for the site, based on multiple sources of maps & literature. Supporting imagery and map resources can be found in Appendix D.

The Washington Department of Ecology's channel migration potential stream networks data (CHAMP) was reviewed to assess the typical channel migration and local activity of the Cowlitz River near Packwood. It is characterized as an unconfined, braided river with a valley width over 4 times the channel width. The energy associated with the river system results in a stream with a moderate erosion potential.

QG reviewed LiDAR imagery of the local area. The imagery clearly depicts the main channel of the Cowlitz River, and it's associated braids, as well as adjacent small channels where stormwater tributaries flow into the river, or adjacent to the river. The land between the site and the river resembles a historic cut bank, which is a common and often easily discernable feature of a river. Cut banks form along the outside of a river bend where erosion from the river occurs as water is accelerated on the outside of the curve, causing the land to erode and contract.

Additionally, QG reviewed satellite imagery from the present and past. The earliest freely available aerial imagery dates back to 1983. Conditions of the Cowlitz River channel in the subject vicinity do not appear to have greatly changed, with some meandering of the channel braids up to the eastern edge of the site but maintaining a consistent area of influence outside the subject site. Trees and thick vegetation have been able to establish themselves entirely along the eastern edge of the site, without disturbance from channel migration over the last 40 years. In general, it appears that the Cowlitz River is a sinuous, moderate to high energy, braided stream system, within the subject vicinity.

The Lewis County Shoreline Master Program maps depict areas of anticipated CMZ hazards. Based on the mapped hazard potential, half of the site falls within the zone of Severe Risk. The other half of the site falls within the Moderate Risk area, and minorly peeks into the high hazard. However, based on our review of historical photos, maps dating back to 1904, other documented reports, and our observations on the ground, this risk seems less severe or moderate, and more likely low across the entire site, by strict definition. Based on historical maps and photographs the Cowlitz River has not encroached or migrated any closer to the parcel in questions in over 100 years, **and we interpret the site to be of a low risk category for channel migration.**

Barring an unforeseeable catastrophic regional event, or unpredicted future impacts to the river by human activity, QG does not anticipate the CMZ will present a hazard to the subject site for the

foreseeable future. The proposed development is not likely to modify the flooding condition or contribute to additional flooding. **We consider the overall risk to the site to be low overall**. Other than the standard channel and high-water setbacks required by local code from the Cowlitz River, QG does not require any other setbacks or measures be taken regarding the CMZ. We consider any development proposed outside of any critical area or county setbacks to be acceptable at this time.

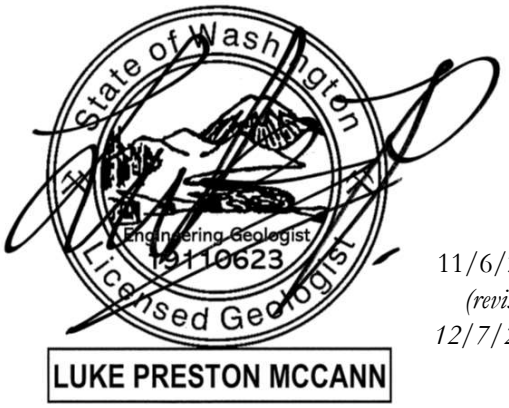
CLOSING REMARKS:

We trust this letter satisfies your project needs currently and greatly thank you for the opportunity to be of service. QG wishes you the best while completing the project.

Respectfully Submitted,
Quality Geo NW, PLLC

Prepared by:

Approved by:



11/6/2023
(revised 12/7/2023)

Ray Gean II
Staff Geologist/Project Manager

Luke Preston McCann, L.E.G.
Principal Licensed Engineering Geologist

LIMITATIONS

Upon acceptance and use of this report, and its interpretations and recommendations, the owner shall agree to indemnify and hold harmless QG, including its owners, employees and subcontractors, from any adverse effects resulting from development and occupation of the subject site. Ultimately, it is the owner's choice to develop and live in such an area of possible geohazards (which exist in perpetuity across the earth in one form or another), and therefore the future consequences, both anticipated and unknown, are solely the responsibility of the owner. By using this report for development of the subject property, the owner must accept and understand that it is not possible to fully anticipate all inherent risks of development. The recommendations provided above are intended to reduce (but may not eliminate) such risks.

This report does not represent a construction specification or engineered plan and shall not be used or referenced as such. The information included in this report should be considered supplemental to the requirements contained in the project plans & specifications and should be read in conjunction with the above referenced information. The selected recommendations presented in this report are intended to inform only the specific corresponding subjects. All other requirements of the above-mentioned items remain valid, unless otherwise specified.

Recommendations contained in this report are based on our understanding of the proposed development and construction activities, field observations and explorations, and laboratory test results. It is possible that soil and groundwater conditions could vary and differ between or beyond the points explored. If soil or groundwater conditions are encountered during construction that differ from those described herein, or If the scope of the proposed construction changes from that described in this report, QG should be notified immediately in order to review and provide supplemental recommendations.

The findings of this study are limited by the level of scope applied. We have prepared this report in substantial accordance with the generally accepted geotechnical engineering practice as it exists in the subject region. No warranty, expressed or implied, is made. The recommendations provided in this report assume that an adequate program of tests and observations will be conducted by a WABO approved special inspection firm during the construction phase in order to evaluate compliance with our recommendations.

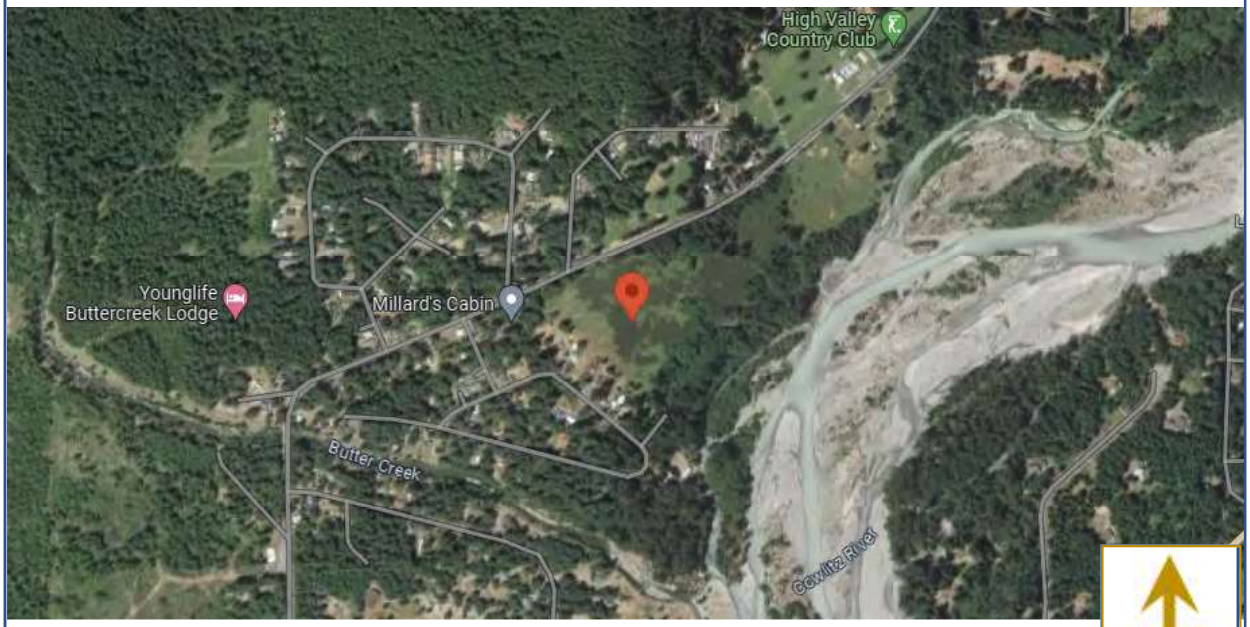
This report may be used only by the Client and their design consultants and only for the purposes stated within a reasonable time from its issuance, but in no event later than 18 months from the date of the report. It is the Client's responsibility to ensure that the Designer, Contractor, Subcontractors, etc. are made aware of this report in its entirety. Note that if another firm assumes Geotechnical Engineer of Record responsibilities they need to review this report and either concur with the findings, conclusions, and recommendations or provide alternate findings, conclusions and recommendation.

Land or facility use, on- and off-site conditions, regulations, or other factors may change over time, and additional work may be required. Based on the intended use of the report, QG may recommend that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by the Client or anyone else will release QG from any liability resulting from the use of this report. The Client, the design consultants, and any unauthorized party, agree to defend, indemnify, and hold harmless QG from any claim or liability associated with such unauthorized use or non-compliance. We recommend that QG be given the opportunity to review the final project plans and specifications to evaluate if our recommendations have been properly interpreted. We assume no responsibility for misinterpretation of our recommendations.

Appendix A. Region & Vicinity Map

REGION

VICINITY



Quality Geo NW, PLLC	**Site Region** Riverside Drive	Source: Google Imagery, 2023 **Scale & Locations are approx.** **Not for Construction**	**Figure 1**

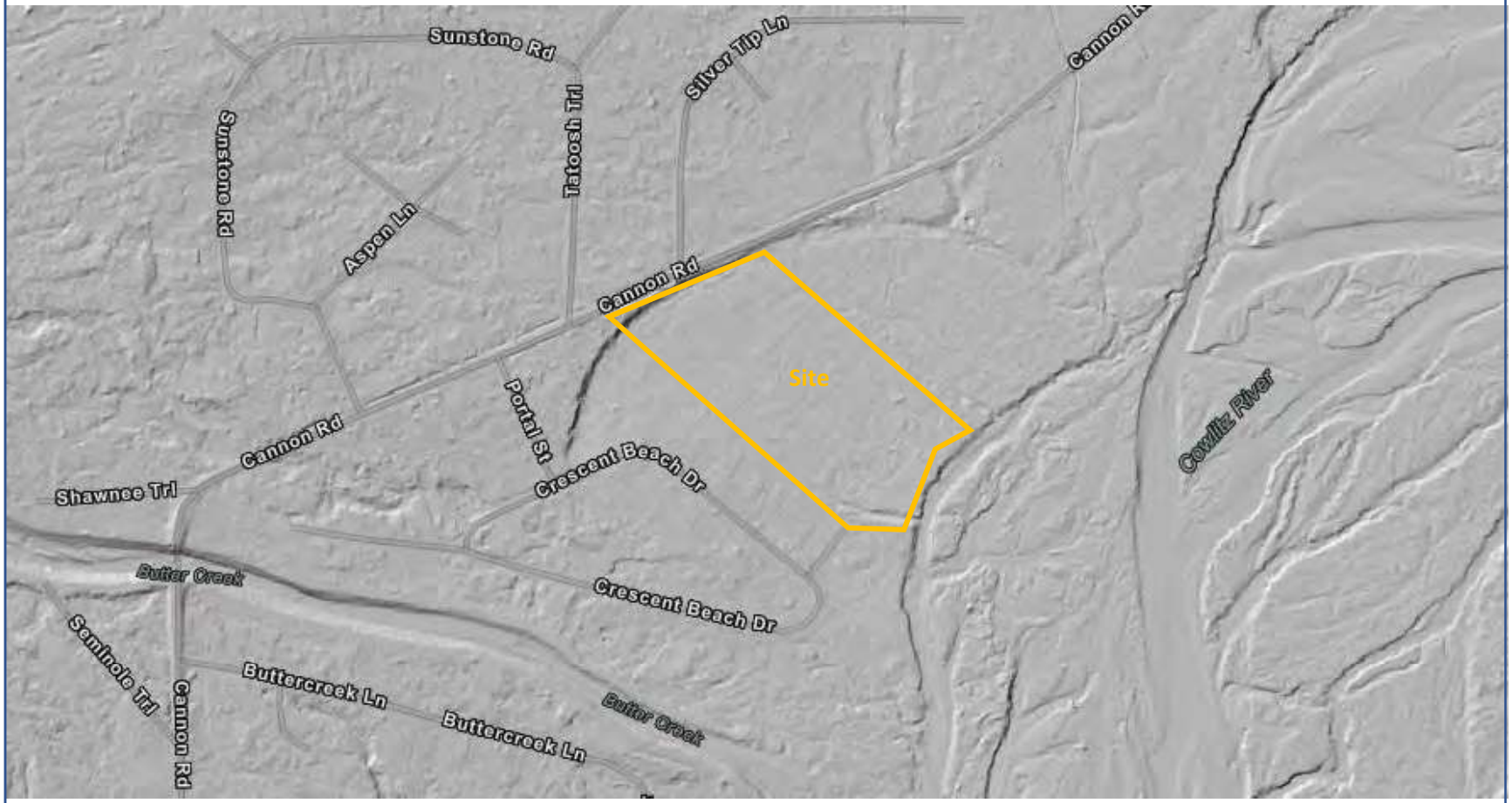
Appendix B. Site Map

Quality Geo NW, PLLC	**Site Map** Riverside Dr	Source: Lewis Co GIS 2023 **Scale & Locations are approx.** **Not for Construction**	**Figure 2**

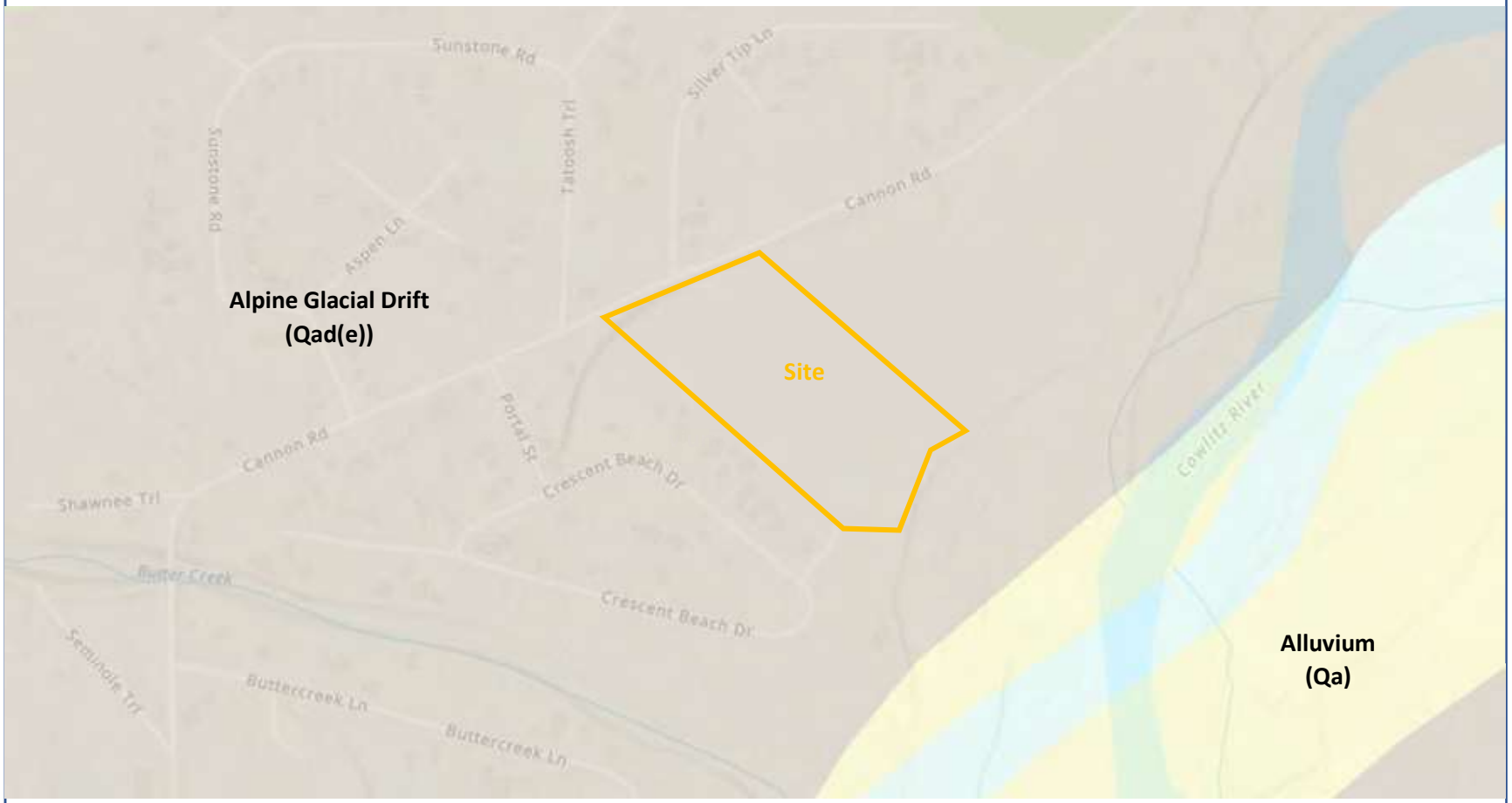
Appendix C. Supporting Imagery & Maps

Quality Geo NW, PLLC	**Site Vicinity Map** Riverside Dr	Source: WA DNR 2023 **Scale & Locations are approx.** **Not for Construction**	**Figure 3**

Quality Geo NW, PLLC	**Parcel Map** Riverside Drive	Source: Lewis Co GIS 2023 **Scale & Locations are approx.** **Not for Construction**	**Figure 4**



Quality Geo NW, PLLC	**LiDAR Imagery** Riverside Dr	Source: WA DNR 2023 **Scale & Locations are approx.** **Not for Construction**	**Figure 5**



Quality Geo NW, PLLC	**Geologic Map** Riverside Dr	Source: WA DNR 2023 **Scale & Locations are approx.** **Not for Construction**	**Figure 6**

Quality Geo NW, PLLC	**Lewis Co Shoreline Master Plan** Channel Migration Zones	Source: Lewis Co GIS 2023 **Scale & Locations are approx.** **Not for Construction**	**Figure 7**

Quality Geo NW, PLLC	**1983 Historic Aerial Imagery** Riverside Dr	Source: Historical Aerials (.com) 2023 **Scale & Locations are approx.** **Not for Construction**	**Figure 8**