GEOTECHNICAL EVALUATION
PROPOSED APRTMENTS
PARCEL NO. 55156.9189
LIBERTY LAKE, WASHINGTON

Inland Pacific Engineering Company Project No. 15-189

October 29, 2015

IPEC

Inland Pacific Engineering Company
Geotechnical Engineering and Consulting

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Geotechnical Engineering and Consulting

October 29, 2015
Project No. 15-189

Mr. Steve White
Copper Basin Construction
P.O. Box 949
Hayden, ID 83835

Re: **Geotechnical Evaluation**
Proposed Apartments
Parcel No. 55156.9189
Liberty Lake, WA

Dear Mr. White:

We have completed the geotechnical evaluation for the proposed apartments located at the above-referenced site in Liberty Lake, Washington. The purpose of evaluation was to assess subsurface soil and groundwater conditions to assist in design and construction of foundations and slabs, and pavements, and in preparation of plans and specifications.

We appreciate the opportunity to provide our services to you on this project. If you have any questions or need additional information, please do not hesitate to call me at (509) 209-6262 at your convenience.

Sincerely,
Inland Pacific Engineering Company

Paul T. Nelson, P.E.
Principal Engineer

Attachment: Geotechnical Evaluation Report

P.O. Box 1566, Veradale, WA 99037
Phone 509-209-6262

GEOTECHNICAL EVALUATION
PROPOSED APRTMENTS
PARCEL NO. 55156.9189
LIBERTY LAKE, WASHINGTON

Inland Pacific Engineering Company Project No. 15-189

October 29, 2015

Prepared for:

Copper Basin Construction
Hayden, Idaho

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Parcel 55156.9189
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1.0 INTRODUCTION

1.1 Project Description

We understand that the proposed project will consist of constructing 14 multi-family residential structures and associated parking, drive, and stormwater management facilities at the site. The construction will likely include one to three-story, slab-on-grade structures of wood frame construction. At this time, specific design criteria are not available. For our purposes, we have assumed that wall loads will be on the order of 1 to 2 kips per lineal foot and column loads will be 50 kips or less. We have further assumed that traffic loads will consist primarily of light automobiles having axle loads of 4 tons or less and truck traffic for inventory delivery.

1.2 Purpose

The purpose of the evaluation is to assess subsurface soil, bedrock, and groundwater conditions to assist in design and construction of foundations, slabs, pavements, and stormwater management facilities and in preparation of plans and specifications for construction.

1.3 Scope

Our services were requested by Mr. Steve White of Copper Basin Construction. Mr. White authorized us to proceed on October 5, 2015. The scope of work agreed upon consisted of the following:

- review of existing geotechnical data and reports for the development, if available
- observe the excavation of 8 test pits at the site to depths ranging from 10 to 15 feet,
- performing laboratory tests on samples obtained from the test pits,
- classifying the soils and preparing test pit logs, and
- submitting a geotechnical report containing logs of the test pits, results of our field investigation, our analyses and our recommendations for design and construction.

1.4 Available Information

We were provided a preliminary site plan for the project. The plan showed the proposed locations of the buildings, parking, roadways, existing roadways, existing structures, ground surface elevation contours, and property lines. This plan did not indicate who prepared it and was not dated.

1.5 Locations and Elevations

The test pits were excavated at or near locations selected by us and/or Mr. White in the field. The test pit locations are shown on the Test Pit Location Map in Appendix A. The test pits were excavated by a subcontracted excavator working under subcontract to Copper Basin Construction.

2.0 RESULTS

2.1 Logs

Log of Test Pit sheets indicating the vertical sequence of soils and materials encountered and groundwater observations are included in Appendix B. The strata changes were measured during excavation of the test pits. Please note that the depths shown as changes between the strata are only approximate. The changes are likely transitions and the depths of changes vary between the test pits. Geologic origins for each stratum are based on the soil type, available geologic maps, previous geotechnical reports for this and adjacent sites, and available common knowledge of the depositional history of the site.

2.2 Site Conditions

The site is relatively level in the east half and slopes up in the west half and to the south towards the Legacy Ridge development. The site generally slopes down to north, with approximately 50 feet of relief. The site is with mature pine trees on the hillside and is open and grass-covered in the flatter areas in the east half. Numerous bedrock outcrops are present in the higher elevations of the site.

2.3 Soils

Geologic maps indicate the soils in this area consist primarily of glacially deposited soils over shallow bedrock. According to the Natural Resources Conservation Service (NRCS) Soil Survey of Spokane County, the site soils are classified as Lenz-Rock outcrop complex (5072 and 5073) and Urban land-Opportunity, disturbed complex (7111). The Lenz-Rock soils are described as well drained soil that formed in loess mixed with minor amounts of volcanic ash over residuum and/or colluvium derived from granitic and metamorphic rocks. The Urban land-Opportunity soils are described as well drained soil that formed in sandy and gravelly glaciofluvial deposits with minor amounts of volcanic ash and loess in the upper part. The native soils encountered in the test pits were consistent with the NRCS data.

Test Pits TP-2, TP-4, and TP-5 encountered existing fill which extended to depths ranging from 6 to 8 feet. The fill consisted primarily of silty sand or silty gravel. At Test Pit TP-4, silt fill was encountered below the 3½-foot depth. The remaining test pits encountered approximately 1/2 foot of topsoil at the surface. Below the topsoil or existing fill, the test pits in the lower area in the east half (Test Pits TP-2, TP-3 through TP-5, and TP-8) encountered silty to well or poorly graded gravels and sands to their termination depths. Test Pits TP-1, TP-6, and TP-7 encountered silty gravels (glacial outwash and/or weathered basalt) or silty sands (colluvium) to their refusal depths.

Test Pits TP-1, TP-6, and TP-7 met refusal at depths ranging from 3.5 to 5 feet. Refusal is defined as the depth at which the excavation could not be advanced further. Refusal can be caused by boulders, bedrock, very dense soils, or obstructions. Because weathered bedrock was encountered in several test pits during excavation, and because bedrock is exposed at the surface in some areas, it is our opinion that refusal was caused by intact bedrock.

2.4 Groundwater

Groundwater was not encountered in the test pits during or immediately after excavation. Groundwater is believed to currently exist at some depth below the termination or refusal depths of the test pits. Well log data in the vicinity of the site indicate that groundwater is typically on the order of 100 to 130 feet below the ground surface.

2.5 Laboratory Testing

Laboratory tests were performed on select samples from the test pits. The tests consisted of grain size analysis and were performed in accordance with ASTM D 6913 procedures. A data sheet summarizing the tests performed is attached in Appendix C.

3.0 DESIGN DATA

We understand that the proposed project will consist of constructing 14 multi-family residential structures and associated parking, drive, and stormwater management facilities at the site. The construction will likely include one to three-story, slab-on-grade structures of wood frame construction. At this time, specific design criteria are not available. For our purposes, we have assumed that wall loads will be on the order of 1 to 2 kips per lineal foot and column loads will be 50 kips or less. We have further assumed that traffic loads will consist primarily of light automobiles having axle loads of 4 tons or less and truck traffic for inventory delivery.

If design loads or elevations change, we should be contacted. Additional analyses may be necessary.

4.0 ANALYSIS AND RECOMMENDATIONS

4.1 Discussion

Based on the data obtained from the test pits, it is our opinion that the proposed buildings can be supported on conventional spread footings bearing on the native soils, bedrock, or on compacted structural fill placed over the native soils or bedrock. The floor slabs can be placed over the native soils or bedrock below the topsoil or existing fill, or on compacted structural fill placed over the native soils or bedrock.

However, existing fill was encountered in Test Pits TP-2, TP-4, and TP-5. We recommend that the existing fill be removed and replaced with a compacted structural fill if present below structures. Based on our observations of the fill, it is our opinion that much of the existing fill can be re-used as structural fill.

Stormwater management using subsurface infiltration is feasible in the glacial gravels encountered in the lower area of the site. It is our opinion that drywells could be used for subsurface infiltration.

In the parking and drive areas, the native soils or bedrock should provide adequate support for the anticipated traffic loads.

4.2 Site Preparation

We recommend that any existing topsoil, root zone, and any existing fill, if encountered, be excavated and removed from the building, parking, and drive areas. After these soils have been removed, we recommend surface compacting the exposed soils prior to placing structural fill or forms for footings. Structural fill should be placed in 6- to 8-inch-thick loose lifts at or near optimum moisture content and compacted to a minimum of 95 percent of the maximum dry density determined in accordance with ASTM D 1557 (modified Proctor). Non-structural fill should be placed in twelve-inch-thick, loose lifts and compacted to at least 85 percent of the modified Proctor maximum dry density.

4.3 Foundations

We recommend that continuous foundations be placed at least 24 inches below the exposed ground surface for frost protection or as required by local building codes. Interior footings can be placed immediately below the slab. For unheated footings, we recommend that they be placed a minimum of 36 inches below the exposed ground surface.

We recommend that subgrades be evaluated by a geotechnical engineer for support of the proposed construction. Soils judged to be unsuitable should be subexcavated and replaced with compacted structural fill.

In some areas, foundation subgrades may transition from soil to bedrock. In order to reduce the potential for abrupt differential settlement, we recommend subexcavating the bedrock a minimum of 12 inches below bottom-of-footing elevation and replacing with a compacted structural fill. Alternatively, the subgrade could transition from soil to bedrock at a 10:1 (H:V) taper in the upper 12 inches.

We recommend that any subexcavations be oversized (widened) 1 foot horizontally from the edges of the footings for each foot of excavation below bottom-of-footing grade (1:1 oversizing). All foundation bearing surfaces should be free of loose soil and debris. If the foundation bearing soils are disturbed by excavation, the exposed soil should be re-compacted to a minimum of 95 percent of the modified Proctor maximum dry density.

It is our opinion that the native soils encountered at the site would be suitable for support of isolated or continuous footings designed for a net allowable bearing pressure of 3,000 pounds per square foot (psf). Fill or backfill placed and compacted as previously recommended would be suitable for support of isolated or continuous footings designed for a net allowable bearing pressure of 3,000 psf. This recommended bearing capacity includes a safety factor of at least 3.0

against shear failure. The maximum net allowable bearing pressure values may be increased up to 30 percent to account for transient loads such as wind and seismic.

If the previous recommendations are implemented, it is our opinion that total settlement will be less than 1 inch. It is also our opinion that differential settlement will be less than ½ inch across a distance of 40 feet.

We recommend that all backfill placed on the exterior sides of the foundation walls be compacted to a minimum of 90 percent of the modified Proctor maximum dry density. Beneath slabs, steps, and pavements, it should be compacted to a minimum of 95 percent of the modified Proctor maximum dry density. Backfill should be brought up uniformly on both sides of the foundation walls to minimize displacement of the foundation walls.

4.4 Floor Slabs

After the construction of the building pads have been completed, slab subgrades will consist of silty sands or structural fill. Interior footing and mechanical trenches should be compacted to a minimum of 95 percent of the modified Proctor maximum dry density.

We recommend using a subgrade modulus of 200 pounds per cubic inch per inch of deflection (pci) to design the slabs. If a minimum of 6 inches of crushed gravel road base is placed above the subgrade, a modulus of 250 pci could be used for design.

We recommend placing a minimum of 6 inches of crushed aggregate having less than 5 percent by weight passing a 200 sieve immediately below the slabs. This aggregate cushion will reduce moisture transmission to the floor slabs from the subgrade soils by creating a capillary break. The aggregate cushion should be compacted to a minimum of 95 percent of the modified Proctor maximum dry density.

If moisture-sensitive floor coverings or coatings will be used, a vapor retarder beneath the slabs should be considered. The designer of the buildings is best suited to make the decision regarding use of a vapor retarder, placement, and location relative to the slab base. We would be available to discuss the methods available.

4.5 Exterior Slabs

The silty sands and silty gravels at the site are considered to be low to moderately frost-susceptible. If these soils become saturated and freeze, up to ½ inch of heave may occur. This heave may become a nuisance for slabs or steps in front of doors or at other critical grade areas adjacent to the building. One way to reduce this heave is to remove the frost-susceptible soils down to bottom-of-footing grade and replace them with non-frost-susceptible sand or sandy gravel. Sand or sandy gravel having less than 5 percent of the particles by weight passing a 200 sieve is considered to be non-frost-susceptible.

4.6 Friction Coefficients

For mass concrete placed over the native sands or gravels, we recommend using a coefficient of friction against sliding of 0.40. For mass concrete placed over granular structural fill, we recommend using a coefficient of friction against sliding of 0.45. For mass concrete placed over bedrock, we recommend using a coefficient of friction against sliding of 0.65. For mass concrete placed on a vapor retarder over the native soils, we recommend using a coefficient of friction against sliding of 0.35.

4.7 Lateral Earth Pressures

Any below-grade or retaining walls will retain low to significant amounts of soil. To reduce the potential for hydrostatic pressures to develop against the walls, we recommend using a free-draining granular material with less than 5 percent passing a 200 sieve as backfill. The backfill material should consist of a sand or sandy gravel having 100 percent by weight passing a 1½ inch sieve and less than 5 percent passing a 200 sieve.

The equivalent fluid pressure used to design the walls will depend on the soil type used as backfill and whether the walls are designed to be flexible (allowed to move) or rigid (not allowed to move).

Assuming a sand or sandy gravel backfill with an internal friction angle of 34 degrees and a unit weight of 125 pound per cubic foot (pcf), we recommend using the following values for design:

A. Flexible Walls

Active Earth Pressure Coefficient, K_a:	0.28
Equivalent Fluid Pressure, pcf:	35

B. Rigid Walls

At-rest Earth Pressure Coefficient, K_0:	0.44
Equivalent Fluid Pressure, pcf:	55

For passive pressures, we recommend using a passive earth pressure coefficient K_P of 3.54 and an equivalent fluid pressure of 440 pcf for design.

4.8 Seismic Conditions

An S_S coefficient of 0.343g should be used for the project site per Figure 1613.3.1(1) in the 2012 edition of the International Building Code. An S_1 coefficient of 0.115g should be used for the project site per Figure 1613.3.1(2). The seismic coefficients should be modified for a soil site class C per Table 1613.3.5(1) of the International Building Code.

4.9 Utilities

Support soils for utilities will consist primarily of silty sands, gravels, or bedrock. It is our opinion that the native soils or bedrock will provide adequate support for utilities. Unsuitable soils (e.g., loose, soft, organic, etc.), if encountered, should be removed and replaced with structural fill. We recommend that bedrock be subexcavated a minimum 12 inches below pipe invert elevation to reduce the potential for point loads on the pipe. For trench sidewall support, the site soils are considered Type C soils according to Occupational Safety and Health Administration (OSHA) guidelines.

Backfill placed over the utilities should consist of a debris-free mineral soil. Soils from the trench excavation can be used as backfill above the pipe. Backfill should be placed and compacted to a minimum of 95 percent of the modified Proctor maximum dry density. Compaction to 85 percent would be suitable in landscape areas.

4.10 Site Grading and Drainage

We recommend that the site be graded to provide positive runoff away from the proposed structures. We recommend that landscape areas be sloped a minimum of 6 inches within 10 feet of structures and that slabs be sloped a minimum of 2 percent.

4.11 Stormwater Recommendations

Based on the data obtained from the test pits and laboratory tests performed, it is our opinion that swales and drywells would be suitable for infiltration of stormwater.

We estimated a design outflow rate for drywells using the results of the laboratory tests and the procedures described in the SRSM manual, Appendix 4A (Spokane 200 Method). The following table summarizes the results of the analysis.

Test Pit	Depth (feet)	USCS Classification	Percent Fines	Normalized Outflow Rate (cfs/ft)	Recommended Design Drywell Outflow Rate (cfs)	
					Type A	Type B
TP-2	14	GW	3.7	0.145	0.30	1.0
TP-3	12	GP-GM	9.6	0.028	0.07	0.12
TP-5	12	GW	4.0	0.124	0.30	1.0
TP-8	14	SP	4.2	0.111	0.30	0.85

These recommended design outflow rates include a safety factors of 1.3 and 2.3 as required by the SRSM.

5.0 PAVEMENTS

5.1 Subgrade Preparation

After stripping any topsoil or existing fill, we recommend that the upper 8 inches of the resulting subgrade be scarified, moistened or dried to within 3 percent of optimum moisture, and compacted to a minimum of 95 percent of the modified Proctor maximum dry density determined in accordance with ASTM D 1557. Where fill is required, we recommend that it be similarly moisture conditioned and compacted. If there are areas that cannot be compacted, we recommend that the unstable soils be removed and replaced with soils similar to the surrounding subgrade soils.

We recommend that the subgrade surface be shaped to provide for positive drainage to minimize the potential for water to pond in the subgrade. Because the site soils are low to moderately frost-susceptible, it will be important to avoid creating "bathtubs" in the subgrade where water can pond and freeze, which could heave the pavement.

After preparing the subgrade, we anticipate that the subgrade will consist primarily of silty sands or structural fill consisting of these soils. The silty sand soils are moderately sensitive to disturbance, especially when wet. If these soils are wet, we recommend that construction traffic be minimized where these soils are exposed. If these soils become unstable, other measures, such as excavation and replacement or geotextile fabric may be necessary.

5.2 Test Rolling

Prior to placing the aggregate base, we recommend that all subgrade areas be proof-rolled with a loaded dump truck. This precautionary measure would assist in detecting any localized soft areas. Any soft areas discovered during the proof-rolling operation should be excavated and replaced with a suitable structural fill material. The structural fill should be similar to the existing subgrade soil type to provide a uniform subgrade. We recommend that the proof-rolling process be observed by an experienced geotechnical engineer to make the final evaluation of the subgrade.

5.3 Pavement Section Design

Based on our project understanding and knowledge of subsurface site conditions, we recommend a pavement section consisting of a minimum of 2 inches of asphalt over 6 inches of crushed gravel base for car parking areas. If anticipated traffic data becomes available, we should be notified so we can review our pavement recommendations and provide revisions if necessary.

5.4 Materials and Compaction

We recommend specifying crushed gravel base meeting the requirements of the Washington Department of Transportation (WSDOT) Standard Specification 9-03.9(3) for crushed gravel surfacing (base course and/or top course). We recommend that the asphalt concrete pavement meet the requirements of WSDOT Standard Specification for Class ½ inch HMA asphalt concrete pavements. We recommend that the crushed gravel surfacing be compacted to a minimum of 95 percent of the modified Proctor maximum dry density. We recommend that the asphaltic concrete surface be compacted to minimum of 92 percent of the Rice density.

6.0 CONSTRUCTION

6.1 Excavation

Based on our observations of the test pit excavations, it is our opinion the on-site soils can be excavated with standard soil excavation equipment. The bedrock may require mechanical splitting or blasting. We recommend excavations greater than four feet deep be sloped no steeper than 1.5:1 (horizontal to vertical), or that deeper excavations be shored or braced in accordance with OSHA specifications and local codes. The soils present at the site are considered to be Type C soils by OSHA. The bedrock can be sloped at ½:1 slopes.

6.2 Observations

We recommend that a geotechnical engineer observe all subgrades prior to placing fill or forms for footings to evaluate if the soils are suitable for support of the proposed structure and to evaluate whether the subsurface conditions are consistent with the test pits.

6.3 Backfills and Fills

The site soils which will be reused as backfill or fill are likely to be dry of optimum moisture content. These soils may require wetting to achieve adequate compaction. Backfills and fills should be placed in thin lifts not exceeding 6 to 8 inches. Most of the on-site native soils and much of the existing fill can be used as structural fill provided particles larger than six inches and all debris are removed.

6.4 Testing

We recommend in-place density tests be performed on all fill placed. We recommend at least one test for every 2,500 square feet in the building area for each foot of fill placed. We recommend at least one test for every 100 cubic yards of fill placed in the parking and drive areas with at least one test for every 2 feet of fill placed. At least one density test should be taken for every 100 feet of trench at vertical intervals not exceeding 2 feet.

6.5 Cold Weather

If site grading and construction are anticipated during cold weather, we recommend that good winter construction practices be observed. All snow and ice should be removed from excavated and fill areas prior to additional earthwork or construction. No fill, footings, or slabs should be placed on soils which have frozen or contain frozen material. Frozen soils should not be used as backfill or fill.

Concrete delivered to the site should meet the temperature requirements of ASTM C 94. Concrete should not be placed upon frozen soils or soils which contain frozen material. Concrete should be protected from freezing until the necessary strength is achieved. Frost should not be permitted to penetrate below footings bearing on frost-susceptible soils since such freezing could heave and crack the footings and/or foundation walls.

6.6 Wet Weather

The sands and silts encountered at the site are moderately sensitive to disturbance when wet. If these soils become wet and unstable, we recommend that construction traffic be minimized where these soils are exposed. Low ground pressure (tracked) equipment should be used to minimize disturbance. For high traffic areas, such as access or haul roads, we recommend placing a woven, water-permeable geotextile fabric (e.g., Mirafi 500X or 600X) and 12 to18 inches of crushed gravel to reduce disturbance. Specific options should be evaluated during construction in order to select the most cost-effective option.

7.0 PROCEDURES

7.1 Excavation and Sampling

The test pits were excavated on October 1, 2015 using a tracked backhoe operated by an independent firm working under subcontract to Copper Basin Construction. A geotechnical engineer from our firm continuously observed the test pit excavations and logged the surface and subsurface conditions. After we logged the test pits, the test pits were backfilled.

7.2 Soil Classification

The soils encountered in the test pits were visually and manually classified in the field by our field personnel in accordance with ASTM D 2488, "Description and Identification of Soils (Visual-Manual Procedures)".

8.0 GENERAL RECOMMENDATIONS

8.1 Basis of Recommendations

The analyses and recommendations submitted in this report are based on the data obtained from the test pits excavated at the locations indicated on the Test Pit Location Map in Appendix A. It should be recognized that the explorations performed for this evaluation reveal subsurface conditions only at discreet locations across the project site and that actual conditions in other areas could vary. Furthermore, the nature and extent of any such variations would not become evident until additional explorations are performed or until construction activities have begun. If significant variations are observed at that time, we may need to modify our conclusions and recommendations contained in this report to reflect the actual site conditions.

8.2 Groundwater Fluctuations

We made water level observations in the test pits at the times and conditions stated on the test pit logs. These data were interpreted in the text of this report. The period of observation was relatively short and fluctuation in the groundwater level may occur due to rainfall, flooding, irrigation, spring thaw and other seasonal and annual factors not evident at the time the observations were made. Design drawings and specifications and construction planning should recognize the possibility of fluctuations.

8.3 Use of Report

This report is for the exclusive use of the addressee and the copied parties to use in design of the proposed project and to prepare construction documents. In the absence of our written approval, we make no representations and assume no responsibility to other parties regarding this report. The data, analyses, and recommendations may not be appropriate for other structures or purposes. We recommend that parties contemplating other structures or purposes contact us.

8.4 Level of Care

Services performed by the geotechnical engineers for this project have been conducted in a manner consistent with that level of care ordinarily exercised by members of the profession currently practicing in this area under similar budget and time restraints. No warranty, expressed or implied, is intended or made.

8.5 Professional Certification

This report was prepared by me or under my direct supervision and I am a duly registered engineer under the laws of the State of Washington.

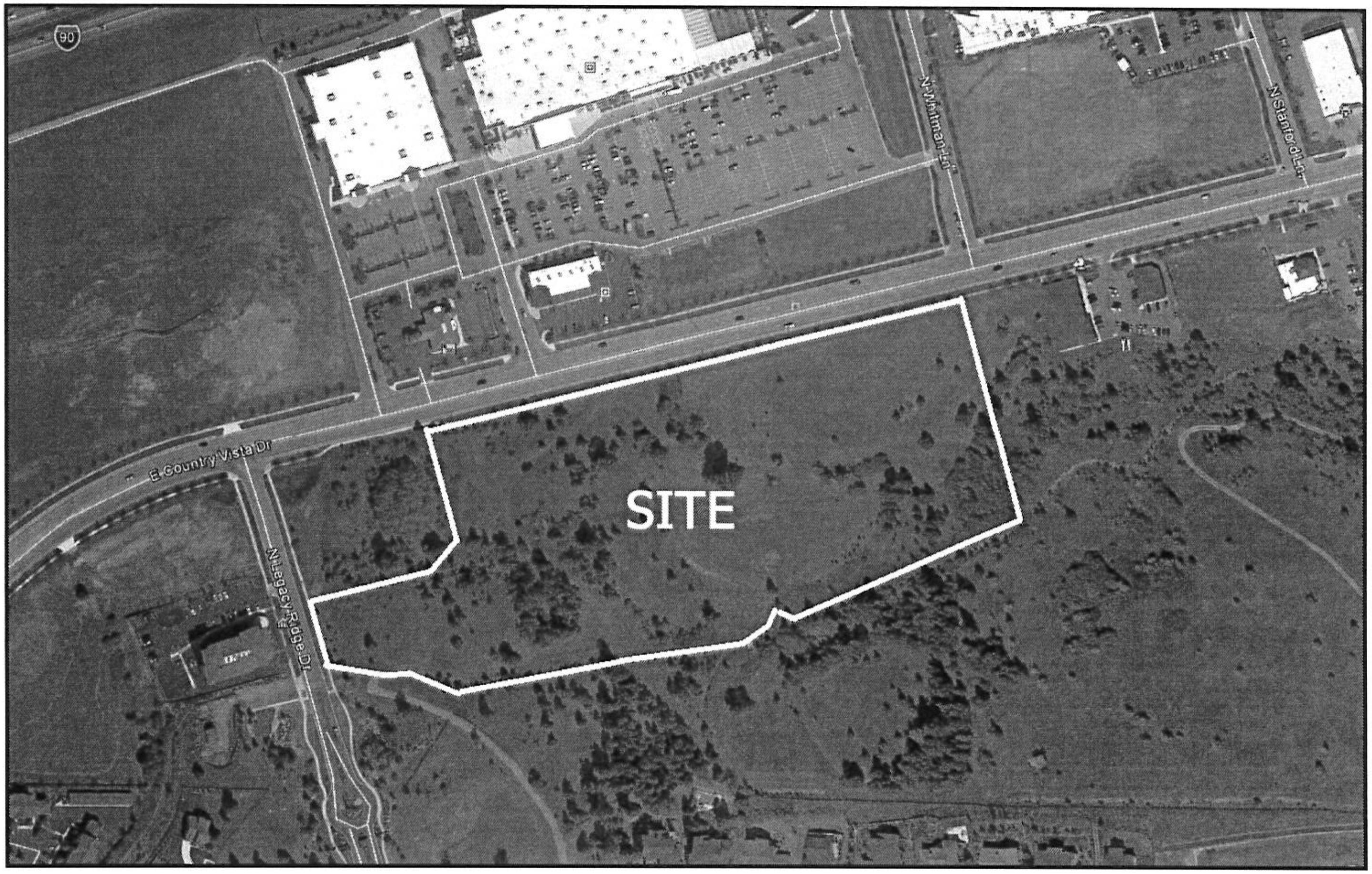
Paul T. Nelson, P.E.
Principal Engineer

PAUL T NELSON
STATE OF WASHINGTON
37228
REGISTERED
PROFESSIONAL ENGINEER
10-29-15

APPENDIX A

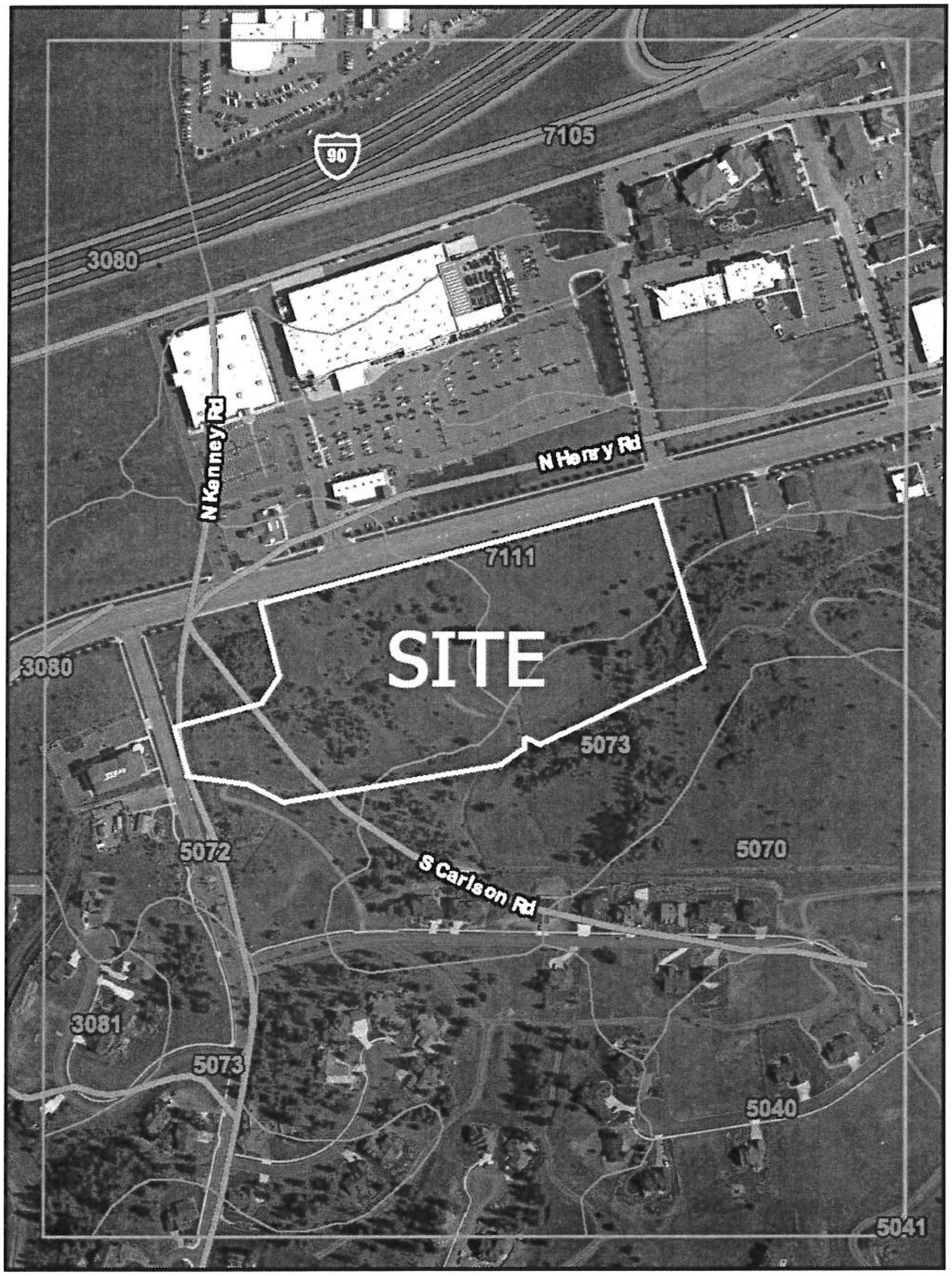
SITE LOCATION MAP, NRCS MAP, TEST PIT LOCATION MAP

FIGURE 1



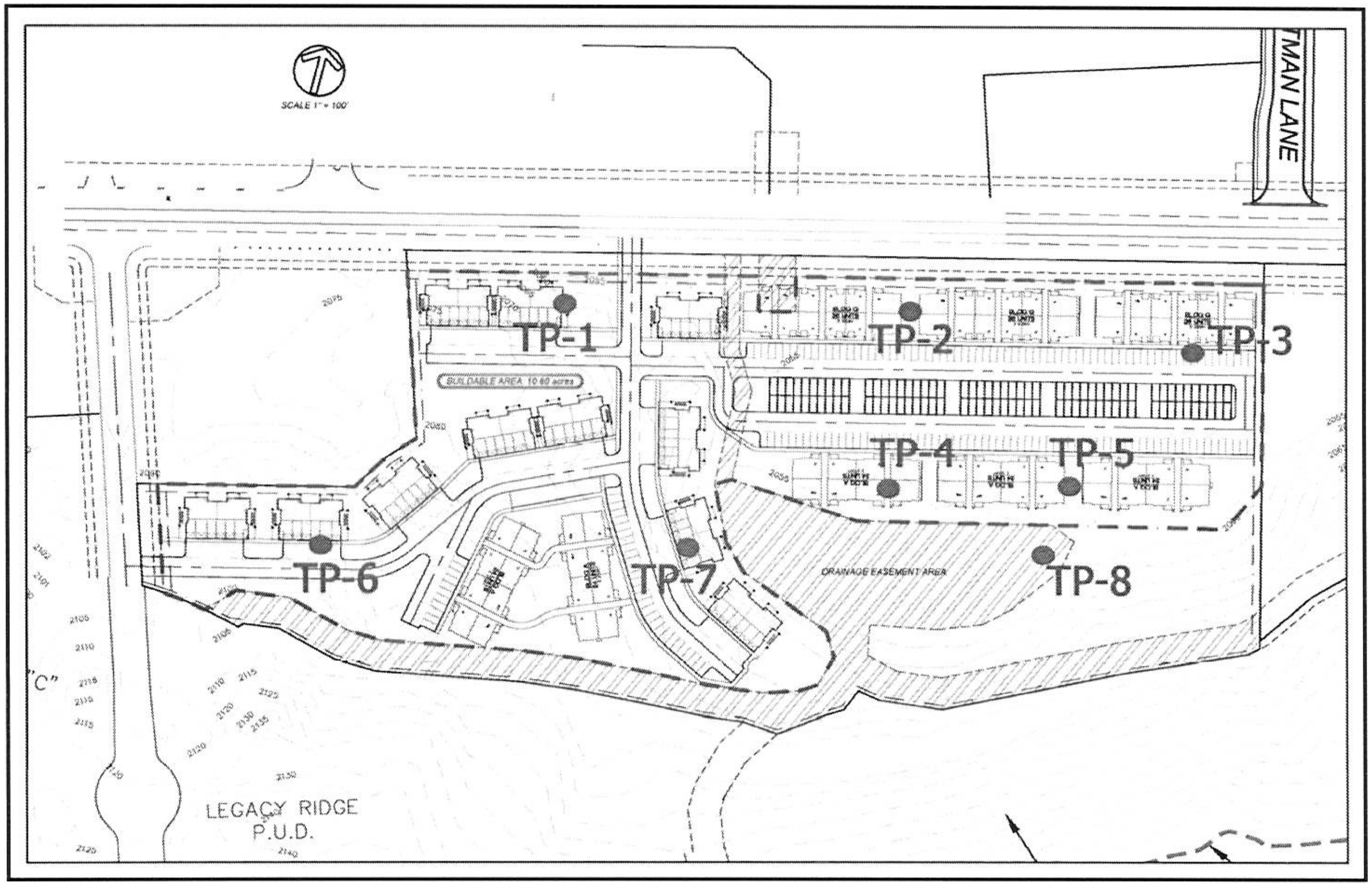
Site Location Map		
IPEC Inland Pacific Engineering Company Geotechnical Engineering and Consulting	Project No. 15-189	October 28, 2015
	Proposed Apartments Parcel No. 55156.9189 Liberty Lake, WA	

FIGURE 2



NRCS Map		
IPEC Inland Pacific Engineering Company Geotechnical Engineering and Consulting	Project No. 15-189	October 28, 2015
	Proposed Apartments Parcel No. 55156.9189 Liberty Lake, WA	

FIGURE 3



Test Pit Location Map		
IPEC Inland Pacific Engineering Company Geotechnical Engineering and Consulting	Project No. 15-189 Proposed Apartments Parcel No. 55156.9189 Liberty Lake, WA	October 28, 2015

APPENDIX B

LOGS OF TEST PITS, DECRIPTIVE TERMINOLOGY

IPEC
Inland Pacific Engineering Company
3012 North Sullivan Road, Suite C
Spokane Valley, WA 99216
Telephone: 509-209-6262
Fax: 509-290-5734

TEST PIT NUMBER TP-1

CLIENT Copper Basin Construction
PROJECT NAME Liberty Lake Apartments
PROJECT NUMBER 15-189
PROJECT LOCATION Liberty Lake, WA
DATE STARTED 10/1/15 **COMPLETED** 10/1/15
GROUND ELEVATION ____ **TEST PIT SIZE** 36 inches
EXCAVATION CONTRACTOR Client Supplied
GROUND WATER LEVELS:
EXCAVATION METHOD Trackhoe
AT TIME OF EXCAVATION --- Not encountered
LOGGED BY PTN **CHECKED BY** PTN
AT END OF EXCAVATION --- Not encountered
NOTES ____
AFTER EXCAVATION --- Not encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG		MATERIAL DESCRIPTION
0		SM		0.5	(SM) SILTY SAND, fine to medium grained, with roots, dark brown, moist. (Topsoil)
		GM		3.5	(GM) SILTY GRAVEL with SAND, fine to coarse grained, with Cobbles, brown, moist. (Weathered Bedrock)

Refusal.

Groundwater not encountered.

Test Pit immediately backfilled.

IPEC

Inland Pacific Engineering Company
3012 North Sullivan Road, Suite C
Spokane Valley, WA 99216
Telephone: 509-209-6262
Fax: 509-290-5734

TEST PIT NUMBER TP-2

CLIENT Copper Basin Construction
PROJECT NAME Liberty Lake Apartments
PROJECT NUMBER 15-189
PROJECT LOCATION Liberty Lake, WA
DATE STARTED 10/1/15 **COMPLETED** 10/1/15
GROUND ELEVATION ____ **TEST PIT SIZE** 36 inches
EXCAVATION CONTRACTOR Client Supplied
GROUND WATER LEVELS:
EXCAVATION METHOD Trackhoe
AT TIME OF EXCAVATION --- Not encountered
LOGGED BY PTN **CHECKED BY** PTN
AT END OF EXCAVATION --- Not encountered
NOTES ____
AFTER EXCAVATION --- Not encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0–0.5			SM		(SM) FILL: Silty Sand, fine to medium grained, with roots, dark brown, moist.
0.5–6.0			GM		(GM) FILL: Silty Gravel with Sand, fine to coarse grained, with Cobbles, brown, moist.
6.0–8.0			GP-GM		(GP-GM) POORLY GRADED GRAVEL with SILT and SAND, fine to coarse grained, a trace of Cobbles, brown, moist. (Glacial Outwash)
8.0–15.0		Fines = 4%	GW		(GW) WELL GRADED GRAVEL with SAND, fine to coarse grained, a trace of Cobbles, brown, moist. (Glacial Outwash)

End of test pit.

Groundwater not encountered.

Test pit immediately backfilled.

IPEC

Inland Pacific Engineering Company
3012 North Sullivan Road, Suite C
Spokane Valley, WA 99216
Telephone: 509-209-6262
Fax: 509-290-5734

TEST PIT NUMBER TP-3

CLIENT Copper Basin Construction
PROJECT NAME Liberty Lake Apartments
PROJECT NUMBER 15-189
PROJECT LOCATION Liberty Lake, WA
DATE STARTED 10/1/15 **COMPLETED** 10/1/15
GROUND ELEVATION ____ **TEST PIT SIZE** 36 inches
EXCAVATION CONTRACTOR Client Supplied
GROUND WATER LEVELS:
EXCAVATION METHOD Trackhoe
AT TIME OF EXCAVATION --- Not encountered
LOGGED BY PTN **CHECKED BY** PTN
AT END OF EXCAVATION --- Not encountered
NOTES
AFTER EXCAVATION --- Not encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0 – 0.5			SM	0.5	(SM) SILTY SAND, fine to medium grained, with roots, dark brown, moist. (Topsoil)
0.5 – 4.0			GM	4.0	(GM) SILTY GRAVEL with SAND, fine to coarse grained, with Cobbles, brown, moist. (Glacial Outwash)
4.0 – 15.0		Fines = 10%	GP-GM	15.0	(GP-GM) POORLY GRADED GRAVEL with SILT and SAND, fine to coarse grained, with Cobbles, brown, moist. (Glacial Outwash)

Depth scale: 0, 5, 10, 15

End of test pit.

Groundwater not encountered.

Test pit immediately backfilled.

IPEC

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TEST PIT NUMBER TP-4

CLIENT Copper Basin Construction
PROJECT NAME Liberty Lake Apartments
PROJECT NUMBER 15-189
PROJECT LOCATION Liberty Lake, WA
DATE STARTED 10/1/15 **COMPLETED** 10/1/15
GROUND ELEVATION ____ **TEST PIT SIZE** 36 inches
EXCAVATION CONTRACTOR Client Supplied
GROUND WATER LEVELS:
EXCAVATION METHOD Trackhoe
AT TIME OF EXCAVATION --- Not encountered
LOGGED BY PTN **CHECKED BY** PTN
AT END OF EXCAVATION --- Not encountered
NOTES ____
AFTER EXCAVATION --- Not encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0		SM		(SM) FILL: Silty Sand, fine to medium grained, a trace of Gravel, brown to dark brown, moist.
			3.5	
5		ML		(ML) FILL: Silt, light tan, moist.
			6.5	
		GW		(GW) WELL GRADED GRAVEL with SAND, fine to coarse grained, a trace of Cobbles, brown, moist. (Glacial Outwash)
10			10.0	

End of test pit.

Groundwater not encountered.

Test pit immediately backfilled.

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TEST PIT NUMBER TP-5

CLIENT Copper Basin Construction
PROJECT NAME Liberty Lake Apartments
PROJECT NUMBER 15-189
PROJECT LOCATION Liberty Lake, WA
DATE STARTED 10/1/15 **COMPLETED** 10/1/15
GROUND ELEVATION **TEST PIT SIZE** 36 inches
EXCAVATION CONTRACTOR Client Supplied
GROUND WATER LEVELS:
EXCAVATION METHOD Trackhoe
AT TIME OF EXCAVATION --- Not encountered
LOGGED BY PTN **CHECKED BY** PTN
AT END OF EXCAVATION --- Not encountered
NOTES
AFTER EXCAVATION --- Not encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0–0.5			SM	0.5	(SM) FILL: Silty Sand, fine to coarse grained, with roots, dark brown, moist.
0.5–8.0			GM	8.0	(GM) FILL: Silty Gravel with Sand, fine to coarse grained, with Cobbles, brown, moist.
8.0–15.0		Fines = 4%	GW	15.0	(GW) WELL GRADED GRAVEL with SAND, fine to coarse grained, a trace of Cobbles, brown, moist. (Glacial Outwash)

Depth scale: 0, 5, 10, 15

End of test pit.

Groundwater not encountered.

Test pit immediately backfilled.

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TEST PIT NUMBER TP-6

CLIENT Copper Basin Construction		**PROJECT NAME** Liberty Lake Apartments	
PROJECT NUMBER 15-189		**PROJECT LOCATION** Liberty Lake, WA	
DATE STARTED 10/1/15	**COMPLETED** 10/1/15	**GROUND ELEVATION**	**TEST PIT SIZE** 36 inches
EXCAVATION CONTRACTOR Client Supplied		**GROUND WATER LEVELS:**	
EXCAVATION METHOD Trackhoe		**AT TIME OF EXCAVATION** --- Not encountered	
LOGGED BY PTN	**CHECKED BY** PTN	**AT END OF EXCAVATION** --- Not encountered	
NOTES		**AFTER EXCAVATION** --- Not encountered	

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG		MATERIAL DESCRIPTION
0		SM		0.5	(SM) SILTY SAND, fine to medium grained, with roots, dark brown, moist. (Topsoil)
		SM		4.0	(SM) SILTY SAND, fine to medium grained, brown, moist. (Colluvium)

Refusal.

Groundwater not encountered.

Test Pit immediately backfilled.

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TEST PIT NUMBER TP-7

CLIENT	Copper Basin Construction	PROJECT NAME	Liberty Lake Apartments
PROJECT NUMBER	15-189	PROJECT LOCATION	Liberty Lake, WA
DATE STARTED	10/1/15 COMPLETED 10/1/15	GROUND ELEVATION	TEST PIT SIZE 36 inches
EXCAVATION CONTRACTOR	Client Supplied	GROUND WATER LEVELS:	
EXCAVATION METHOD	Trackhoe	AT TIME OF EXCAVATION	--- Not encountered
LOGGED BY	PTN CHECKED BY PTN	AT END OF EXCAVATION	--- Not encountered
NOTES		AFTER EXCAVATION	--- Not encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0		SM	0.5	(SM) SILTY SAND, fine to medium grained, with roots, dark brown, moist. (Topsoil)
		GM	3.0	(GM) SILTY GRAVEL with SAND, fine to coarse grained, a trace of Cobbles, brown, moist. (Glacial Outwash)
5		GM	5.0	(GM) SILTY GRAVEL with SAND, fine to coarse grained, light brown, moist. (Weathered Bedrock)

Refusal.

Groundwater not encountered.

Test Pit immediately backfilled.

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TEST PIT NUMBER TP-8

CLIENT Copper Basin Construction
PROJECT NAME Liberty Lake Apartments
PROJECT NUMBER 15-189
PROJECT LOCATION Liberty Lake, WA
DATE STARTED 10/1/15 **COMPLETED** 10/1/15
GROUND ELEVATION ____ **TEST PIT SIZE** 36 inches
EXCAVATION CONTRACTOR Client Supplied
GROUND WATER LEVELS:
EXCAVATION METHOD Trackhoe
AT TIME OF EXCAVATION --- Not encountered
LOGGED BY PTN **CHECKED BY** PTN
AT END OF EXCAVATION --- Not encountered
NOTES
AFTER EXCAVATION --- Not encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	MATERIAL DESCRIPTION
0 – 0.5			SM	(SM) SILTY SAND, fine to medium grained, with roots, dark brown, moist. (Topsoil)
0.5 – 1.5			SM	(SM) SILTY SAND, fine to medium grained, a trace of Gravel, brown, moist. (Glacial Outwash)
1.5 – 6.0			SP	(SP) POORLY GRADED SAND with GRAVEL, medium to coarse grained, brown, moist. (Glacial Outwash)
6.0 – 8.0			GP	(GP) POORLY GRADED GRAVEL with SAND, fine to coarse grained, a trace of Cobbles, brown, moist. (Glacial Outwash)
8.0 – 15.0		Fines = 4%	SP	(SP) POORLY GRADED SAND, fine to medium grained, brown, moist. (Glacial Outwash)

End of test pit.

Groundwater not encountered.

Test pit immediately backfilled.

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RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N-VALVE			
COARSE-GRAINED SOILS		FINE-GRAINED SOILS	
DENSITY	N(BLOWS/FT)	CONSISTENCY	N(BLOWS/FT)
Very Loose	0 - 4	Very Soft	0 - 1
Loose	4 - 10	Soft	2 - 3
Medium-Dense	11 - 30	Rather Soft	4 - 5
		Medium	6 - 8
Dense	31 - 50	Rather Stiff	9 - 12
		Stiff	13 - 16
Very Dense	> 50	Very Stiff	17 - 30
		Hard	> 30

USCS SOIL CLASSIFICATION				
MAJOR DIVISIONS			GROUP DESCRIPTIONS	
Coarse-Grained Soils <50% passes #200 sieve	Gravel and Gravelly Soils <50% coarse fraction passes #4 sieve	Gravel (with little or no fines)	GW	Well Graded Gravel
			GP	Poorly Graded Gravel
		Gravel (with >12% fines)	GM	Silty Gravel
			GC	Clayey Gravel
	Sandy and Sandy Soils >50% coarse fraction passes #4 sieve	Sand (with little or no fines)	SW	Well Graded Sand
			SP	Poorly Graded Sand
		Sand (with >12% fines)	SM	Silty Sand
			SC	Clayey Sand
Fine-Grained Soils >50% passes #200 sieve	Silt and Clay Liquid Limit < 50		ML	Silt
			CL	Lean Clay
			OL	Organic Silt and Clay (low plasticity)
	Salt and Clay Liquid Limit > 50		MH	Inorganic Silt
			CH	Fat Clay
			OH	Organic Clay and Silt (med to high plasticity)
Highly Organic Soils			PT	Peat / Muck

MODIFIERS	
DESCRIPTION	RANGE
Occasional	<5%
Trace	5% - 12%
With	>12%

MOISTURE CONTENT	
DESCRIPTION	FIELD OBSERVATION
Dry	Absence of moisture, dusty, dry to the touch
Moist	Dry of optimum moisture content
Wet	Wet of optimum moisture content

MAJOR DIVISIONS WITH GRAIN SIZE							
SIEVE SIZE							
12"	3"	3/4"	4	10	40	200	
GRAIN SIZE (INCHES)							
12	3	0.75	0.19	0.079	0.0171	0.0029	
Boulders	Cobbles	Gravel		Sand			Silt and Clay
		Coarse	Fine	Coarse	Medium	Fine	

APPENDIX C

LABORATORY TEST RESULTS

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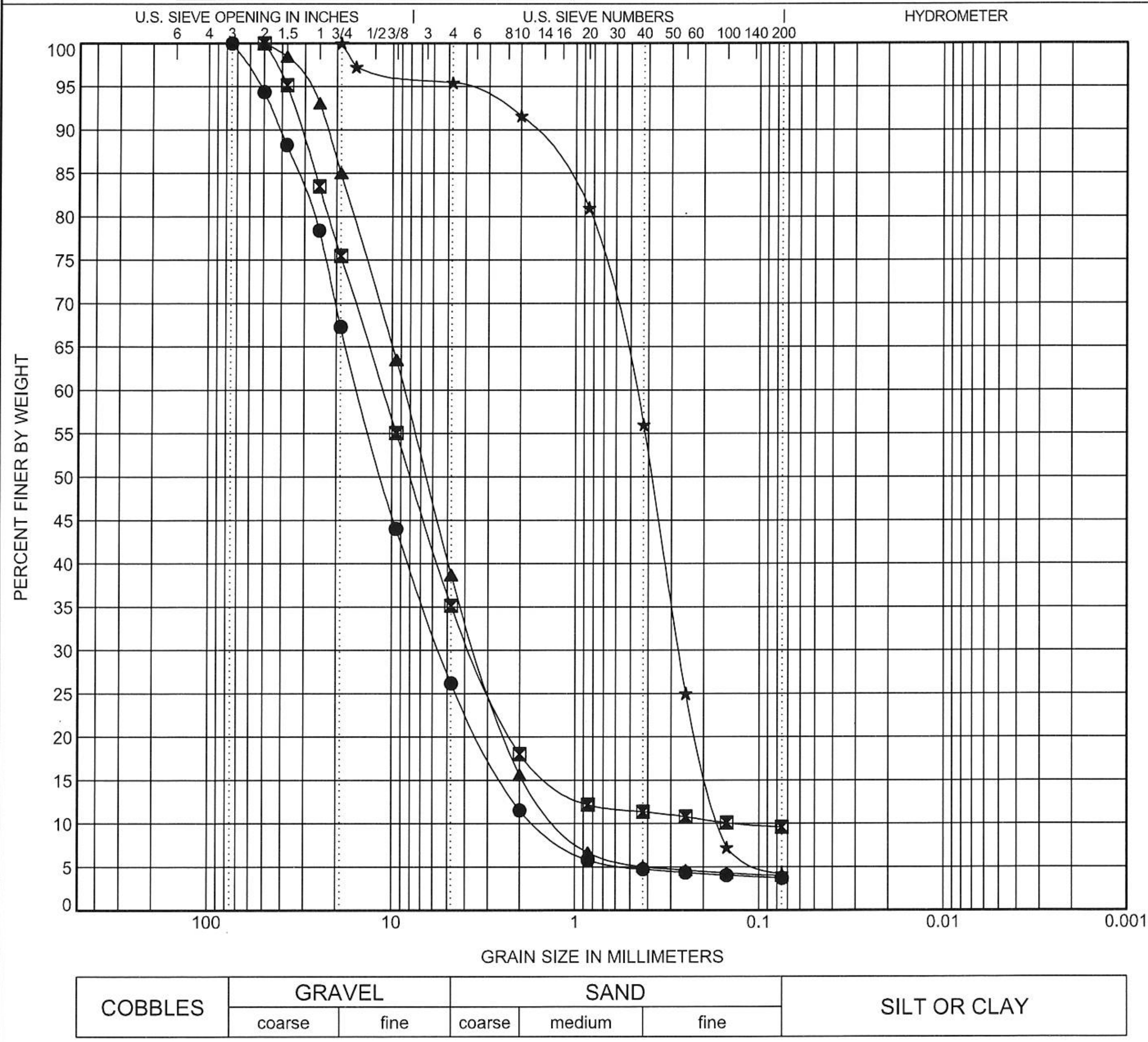
GRAIN SIZE DISTRIBUTION

CLIENT Copper Basin Construction
PROJECT NAME Liberty Lake Apartments
PROJECT NUMBER 15-189
PROJECT LOCATION Liberty Lake, WA



	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	**TP-2**	**14.0**	**GW Well Graded Gravel with Sand**				**1.25**	**9.61**
☒	**TP-3**	**12.0**	**GP-GM Poorly Graded Gravel with Silt and Sand**				**8.95**	**84.10**
▲	**TP-5**	**12.0**	**GW Well Graded Gravel with Sand**				**1.17**	**7.37**
★	**TP-8**	**14.0**	**SP Poorly Graded Sand**				**0.96**	**2.92**

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP-2**	**14.0**	**75**	**15.285**	**5.509**	**1.59**	**73.8**	**22.5**	**3.7**	
☒	**TP-3**	**12.0**	**50**	**11.228**	**3.663**	**0.134**	**64.9**	**25.5**	**9.6**	
▲	**TP-5**	**12.0**	**50**	**8.614**	**3.428**	**1.169**	**61.3**	**34.7**	**4.0**	
★	**TP-8**	**14.0**	**19**	**0.475**	**0.272**	**0.162**	**4.6**	**91.2**	**4.2**	