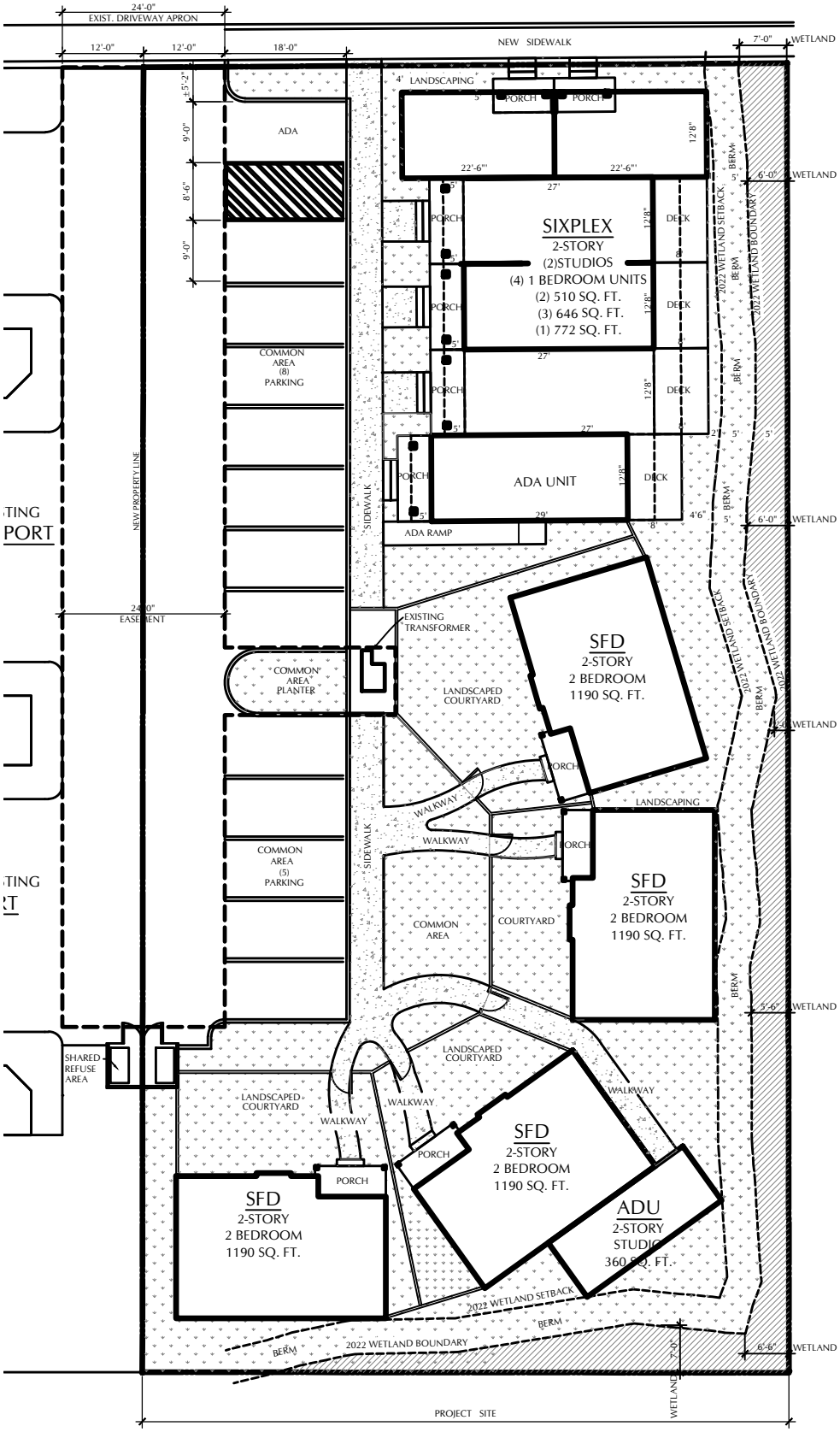
FIRST STREET



SITE PLAN

1 / A1.1

1" = 10'-0"

Earth Engineers, Inc.

2411 Southeast 8th Avenue • Camas • WA 98607
Phone: 360-567-1806
www.earth-engineers.com

March 31, 2022
Revised April 18, 2022

Red Crow, LLC
P.O. Box 825
Cannon Beach, Oregon 97110
Attention: Jamie Lerma, President

Phone: (503) 849-0258
E-mail: jamie@redcrowgc.com

Subject: **Geotechnical Investigation Report**
Proposed Ecola Square Development
Southwest Corner of First Street and Spruce Street
Clatsop County Tax Lot No. 51030AA04402
Cannon Beach, Clatsop County, Oregon
EEI Report No. 22-039-1-*R1*

Dear Mr. Lerma,

Earth Engineers, Inc. (EEI) is pleased to transmit our ***revised*** report for the above referenced project. This report includes the results of our field investigation, an evaluation of geotechnical factors that may influence the proposed construction, and geotechnical recommendations for the proposed structure and general site development. ***This report has been revised to include helical pier recommendations, as requested. Report revision additions are denoted in bold, italics.***

We appreciate the opportunity to perform this geotechnical study and look forward to continued participation during the design and construction phases of this project. If you have any questions pertaining to this report, or if we may be of further service, please contact our office.

Sincerely,
Earth Engineers, Inc.

Troy Hull, P.E., G.E.
Principal Geotechnical Engineer

Jacqui Boyer
Geotechnical Engineering Associate

Attachment: Geotechnical Investigation Report

Distribution (electronic copy only): Addressee

GEOTECHNICAL INVESTIGATION REPORT

for the

Proposed Ecola Square Development
Southwest Corner of First Street and
Spruce Street
Clatsop County Tax Lot No. 51030AA04402
Cannon Beach, Clatsop County, Oregon

Prepared for

Red Crow, LLC
P.O. Box 825
Cannon Beach, Oregon 97110
Attention: Jamie Lerma, President

Prepared by

Earth Engineers, Inc.
2411 Southeast 8th Avenue
Camas, Washington 98607
Telephone (360) 567-1806

EEI Report No. 22-039-1-*R1*

March 31, 2022
Revised April 18, 2022

Jacqui Boyer
Geotechnical Engineering Associate

Troy Hull, P.E., G.E.
Principal Geotechnical Engineer

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1.0 PROJECT INFORMATION

1.1 Project Authorization

Earth Engineers, Inc. (EEI) has completed a geotechnical investigation report for the proposed development on Clatsop County Tax Lot No. 51030AA04402 in Cannon Beach, Clatsop County, Oregon. Our services were authorized by Jamie Lerma with Red Crow, LLC on February 8, 2022 by signing EEI Proposal No. 22-P054 dated February 7, 2022.

1.2 Project Description

Our current understanding of the project is based on the information Mr. Lerma provided to EEI Principal Geotechnical Engineer Troy Hull. We were also provided the following document via e-mail:

- **Plat Map titled "Ecola Square Condominiums" prepared by HLB Otak, dated April 30, 2007.** This map shows the subject property boundaries with respect to the neighboring building and surrounding streets. See Figure 1 below.

Briefly, we understand the project consists of developing one of three options on the property:

1. Six to seven 2-story single family residences, or
2. 16-18 unit, 2-story apartment complex, or
3. 4,200 square foot, 2-story commercial building.

We have not been provided any detailed construction plans for the project. For the purposes of this report, we are assuming maximum foundation loads of 5 kips per linear foot for wall footings, 50 kips for column footings, and 150 psf for floor slabs. With regard to design grades, we are assuming that cuts and fills will be negligible (i.e. less than 2 feet). Finally, we have assumed that the buildings will be constructed in accordance with the 2021 Oregon Residential Specialty Code (ORSC), or the 2019 Oregon Structural Specialty Code (OSSC).

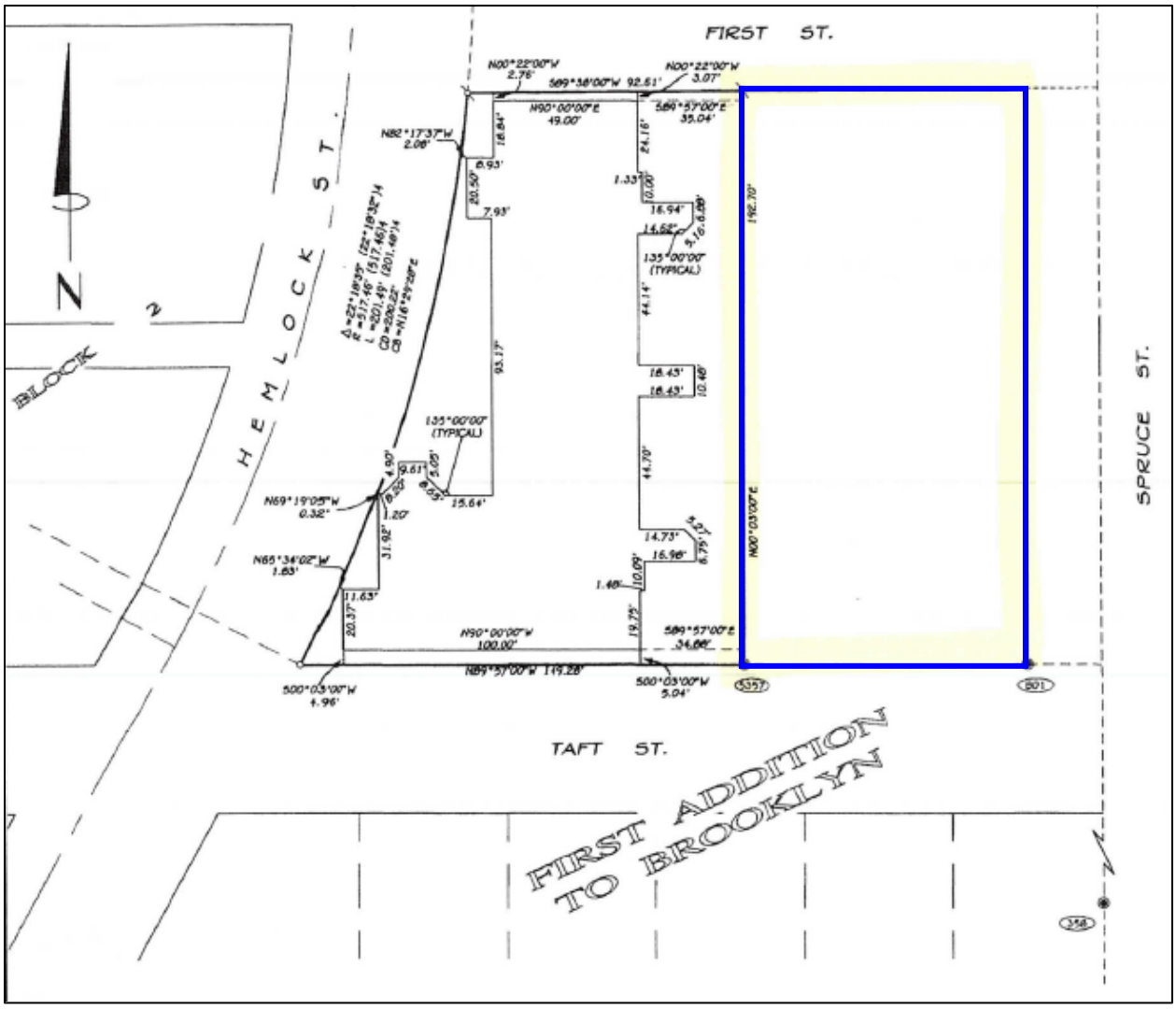


Figure 1: Plat map referenced above showing the project vicinity. The subject property is outlined in blue.

1.3 Purpose and Scope of Services

The purpose of our services was to explore the subsurface conditions at the site to better define the soil, rock, and groundwater properties in order to provide geotechnical related recommendations related to the proposed construction. Our site investigation consisted of advancing two Standard Penetration Test (SPT) borings (B-1 and B-2) located on the subject property using a B-58 truck rig subcontracted from PLi Systems of Hillsboro, Oregon. SPT samples were taken at regular intervals and transported to our laboratory for testing. Laboratory testing was accomplished in general accordance with ASTM procedures.

This report briefly outlines the testing procedures, presents available project information, describes the site, assumed subsurface conditions, and presents recommendations regarding the following:

- A discussion of subsurface conditions encountered including pertinent soil and groundwater conditions.
- Seismic design parameters in accordance with ASCE 7-16.
- Geotechnical related recommendations for deep foundation design.
- Structural fill recommendations, including an evaluation of whether the in-situ soils can be used as structural fill.
- Retaining wall design parameter recommendations, including coefficient of friction and earth pressures.
- Floor slab support recommendations.
- Pavement section thickness recommendations based on an assumed CBR value, as well as assumed traffic loading conditions unless provided to us by the project Civil Engineer.
- Other discussion on geotechnical issues that may impact the project.

It should be noted, our scope of services does not include a Geologic Hazard Assessment to satisfy Clatsop County. If required, we can modify our scope to include this service.

2.0 SITE AND SUBSURFACE CONDITIONS

2.1 Site Location and Description

The site for the proposed development is located at Clatsop County Tax Lot No. 51030AA04402 in Cannon Beach, Oregon. The site is bound to the north by East 1st Avenue, to the east by North Spruce Street, to the south by a vacant property, and to the west by a commercial development. See Figure 2 below for project vicinity.

Figure 2: Project vicinity showing the subject property (outlined in blue).
Source: https://delta.co.clatsop.or.us/apps/ClatsopCounty/.

The subject property is currently vacant. The majority of the property consists of a gravel pad. The western property line runs along the parking lot for the adjacent development. The eastern property line is vegetated with brush, trees and a drainage ditch. In terms of topography, the subject property is level. While on site, we did not observe any signs of soil movement (i.e. cracking in the soil, leaning trees, landscape head scarps etc.). See Photos 1 through 4 below for the current site conditions.

Photo 1: Current site conditions, taken from the northern property line facing south. The drill rig is set up at B-2.

Photo 2: Current site conditions, taken from the southwestern property corner facing northeast. The drill rig is set up at B-2.

Photo 3: Current site conditions, taken from the middle of the property facing south.

Photo 4: Current site conditions along the eastern property line showing the drainage ravine, facing south.

2.2 Mapped Soils and Geology

The underlying geology mapped in the area of the subject property is Miocene aged marine sedimentary rocks of the Astoria Group. This unit is described as "marine sandstone and siltstone, including shelf, slope channel, deltaic and turbidite sandstone, and slope mudstone. Pleistocene aged marine terrace deposits (Qmt) and Pleistocene and Holocene aged stable sand dunes (sd)[1].

The United States Department of Agriculture (USDA) Soil Survey provides geographical information of the soils in Clatsop County as well as summarizing various properties of the soils. The USDA shows the native soils on the property mapped as Unit 12A: Coquille-Clatsop complex on 0 to 1 percent slopes. This very poorly drained soil is formed on flood plains derived from mixed alluvium. A typical profile consists of silt loam overlying silty clay[2].

A review of the Oregon Department of Geology and Mineral Industries (DOGAMIs) Statewide Geohazards Viewer (HazVu) indicated that the subject property is within a severe earthquake hazard zone, a severe Cascadia earthquake shaking hazard zone, and a high liquefaction hazard zone. The database does not map the subject property within a landslide hazard area or in proximity to any mapped historic landslides.

2.3 Subsurface Materials

The site was explored with two SPT borings (B-1 and B-2). Both borings were advanced on the gravel pad. For approximate exploration locations see the Exploration Location Plan in Appendix B. The SPT borings were advanced with a subcontracted B-58 truck rig from PLi Systems of Hillsboro, Oregon. Using mud rotary drilling techniques, both borings were advanced to a depth of 51.5 feet below ground surface (bgs). SPT samples were generally taken at regular intervals within the boring and transported to our laboratory for testing.

Select soil samples were tested in the laboratory to determine material properties for our evaluation. Results of the drilled borings are reported in the Exploration Logs in Appendix C. Laboratory testing was accomplished in general accordance with ASTM procedures. The testing performed included moisture content tests (ASTM D 2216), fines content determinations (ASTM D1140) and Atterberg limit testing (ASTM D4318). The test results have been included on the Exploration Logs in Appendix C and the Report of Atterberg Limits Testing in Appendix E.

In general, we encountered a surficial layer of fill overlying coarse-grained soils overlying fine-grained soils which extended to the terminal depths of our explorations. Each individual stratum encountered is discussed in further detail below.

---

[1] Niem, A.R., and Niem, W., 1985, Geologic map of the Astoria Basin, Clatsop and northernmost Tillamook Counties, northwest Oregon: Portland, Oreg., Oregon Dept. of Geology and Mineral Industries Oil and Gas Investigation Map OGI-14, Plate 1, scale 1:100,000.

[2] Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/ accessed April 1, 2022.

FILL SOILS

In both of our explorations, we encountered fill as the surficial layer. The fill stratum was generally brown gravel with little silt. We also encountered rootlets in this stratum. Laboratory testing on a sample obtained within this stratum yielded a moisture content of 9 percent and fines content of 10 percent passing the #200 sieve. Based on SPT sampling data, this stratum was medium dense. The thickness of this stratum was 2.5 feet in B-1 and 6-inches in B-2.

COARSE-GRAINED SOILS

In both of our exploration, we encountered coarse-grained soils underlying the surficial fill layer described above. This stratum was generally a brown to gray sand with variable amounts of silt. We also encountered heavy organics within this stratum (i.e. wood debris, wood chips, rootlets). Laboratory moisture content testing on samples obtained within this stratum ranged from 22 to 351 percent. It should be noted the very high moisture readings are likely due to the presence of organics and/or ash. Fines content laboratory testing for a sample obtained within this stratum yielded a result of 1 percent passing the #200 sieve. Based on SPT sampling data, this stratum ranged from very loose to medium dense; however, we generally consider this stratum to be loose (N_{60} average of 10). This sand stratum extended to a depth of 10 feet bgs in both of our explorations.

FINE-GRAINED SOILS

In both of our borings, we encountered fine-grained soils underlying the sandy layer described above. The upper portion of this stratum was a gray to brown high plasticity silt with varying amounts of sand. We also encountered heavy organics (i.e. wood debris, wood chips, rootlets), and veins of blue-gray sand within this stratum. Laboratory moisture content testing on samples obtained within this stratum ranged from 34 to 252 percent. It should be noted the very high moisture readings are likely due to the presence of organics and/or ash. Fines content laboratory testing for samples obtained within this stratum ranged from 43 to 99 percent passing the #200 sieve. We also conducted Atterberg testing on samples retrieved within this stratum from B-1 at 10 feet bgs and 15 feet bgs. The testing indicated this stratum is a high plasticity silt (MH). Based on SPT sampling data, this stratum ranged from very soft to very stiff; however, we generally consider this stratum to be very soft (N_{60} average of 2). This very soft silt stratum extended to a depth of 40 feet bgs in both of our explorations.

At a depth of approximately 40 feet bgs, there were no more organics present in the samples obtained and the soil became much stiffer. This stratum was generally gray to blue-gray to brown silt with sand and gravel. Laboratory moisture content testing on samples obtained within this stratum ranged from 9 to 39 percent, indicating a dry to wet condition. Based on SPT sampling data, this stratum ranged from stiff to hard; however, we generally consider this stratum to be hard (N_{60} average of 42). This stratum extended to the terminal depths of our explorations (i.e. 51.5 feet bgs).

The classifications noted above were made in general accordance with the USCS as shown in Appendix D. The above subsurface description is of a generalized nature to highlight the major

subsurface stratification features and material characteristics. The exploration logs included in the Appendix should be reviewed for specific information. These records include soil descriptions, stratifications, and locations of the samples. The stratifications shown on the logs represent the conditions only at the actual exploration location. The fill extent at the exploration locations was estimated based on an examination of the soil samples, the presence of foreign materials, field measurements, and the subsurface data. The exploration performed is not adequate to accurately identify the full extent of existing fill across the site. Consequently, the actual fill extent may be much greater than that shown on the exploration logs and discussed herein. Variations may occur and should be expected across the site. The stratifications represent the approximate boundary between subsurface materials and the actual transition may be gradual. Water level information obtained during field operations is also shown on these logs. The samples that were not altered by laboratory testing will be retained for 90 days from the date of this report and then will be discarded.

2.4 Groundwater Information

During our subsurface investigation, we were not able to identify the depth to groundwater due to the drilling method used (i.e. mud rotary). It should be noted, standing water was observed in the drainage ditch that is located along the eastern property line approximately 4 feet below the elevation of our borings.

In addition, we reviewed publicly available well logs from the Oregon Water Resources Department website (http://apps.wrd.state.or.us/apps/gw/well_log/) for historic information. We found two historical logs for a property located approximately 0.2 miles southwest of the subject property, advanced on December 13, 2002. The logs indicate that groundwater was encountered at a depth of 3 feet below ground surface. See Appendix F for a copy of these well log reports.

It should be noted that groundwater elevations can fluctuate seasonally and annually, especially during periods of extended wet or dry weather, or from changes in land use.

2.5 Seismicity

In accordance with ASCE 7-16, we recommend a Site Class E (soft soil with an average standard penetration resistance less than 15 blows per foot) when considering the average of the upper 100 feet of bearing material beneath the proposed foundations. This recommendation is based on the SPT N-values in our boring B-1 and our local knowledge of the area geology.

Inputting our recommended Site Class as well as the site latitude and longitude into the Structural Engineers Association of California (SEAOC) – OSHPD Seismic Design Maps website (http://seismicmaps.org) which is based on the United States Geological Survey, we obtained the seismic design parameters shown in Table 1 below. Note that the values for F_a and F_v in Table

1 were obtained from ASCE's Supplement 3 dated November 5, 2021 and issued for ASCE 7-16 to correct some seismic design issues in the original publication.

Table 1: Seismic Design Parameter Recommendations (ASCE 7-16, including Supplement 3 dated November 5, 2021)

PARAMETER	RECOMMENDATION
Site Class	E
S_s	1.316g
S_1	0.691g
F_a	1.200
F_v	2.000
S_{MS} (=S_s x F_a)	1.579g
S_{M1} (=S_1 x F_v)	1.382g
S_{DS} (=2/3 x S_s x F_a)	1.053g
S_{D1} (=2/3 x S_1 x F_V)	0.921g
Design PGA (=S_{DS} / 2.5)	0.421g
MCE_G PGA	0.663g
F_{PGA}	1.100
PGA_M (=MCE_G PGA * F_{PGA})	0.730g

Note: Site latitude = 45.8961, longitude = -123.9601

The return interval for the ground motions reported in the table above is 2 percent probability of exceedance in 50 years.

Per Section 11.4.8 of ASCE 7-16 a site-specific ground motion hazard analysis shall be performed in accordance with Section 21.2 for the following conditions:

1. Structures on Site Class D sites with S_1 greater than or equal to 0.2g.

   Exception: ASCE 7-16 does not require a site-specific ground motion hazard analysis when the value of S_{M1} is elected to be increased by 50% for all applications of S_{M1} by the Structural Engineer. If S_{M1} is increased by 50% to avoid having to perform the seismic response analysis, then the resulting value of S_{D1} shall be equal to 2/3 * [1.5*S_{M1}])

2. Structures on Site Class E sites with values of S_s greater than or equal to 1.0, or values of S_1 greater than or equal to 0.2.

   Exception: ASCE 7-16 does not require a site-specific ground motion hazard analysis when:
   1. The Structural Engineer uses the equivalent lateral force design procedure and the value of Cs is determined by Eq. 12.8-2 for all values of T, or
   2. Where (i) the value of S_{ai} is determined by Eq. 15.7-7 for all values of T_i, and (ii) the value of the parameter S_{D1} is replaced with 1.5*S_{D1} in Eq. 15.7-10 and 15.7-11.

We classified this site as Site Class E. Because the S_s value is greater than 1.0 as shown in Table 1 above, a ground motion hazard analysis is required unless the Structural Engineer elects to increase the S_{M1} value by 50 percent (which results in increasing the S_{D1} value by 50 percent). **If the Structural Engineer elects not to utilize the 50 percent increase on S_{M1} and S_{D1}, then EEI should be retained to perform a site-specific ground motion hazard analysis in accordance with Section 21.2 of ASCE 7-16.**

2.6 Soil Liquefaction

Liquefaction occurs when a saturated sand or silt soil starts to behave like a liquid. Liquefaction occurs because of the increased pore pressure and reduced effective stress between solid particles generated by the presence of liquid. It is often caused by severe ground shaking, especially that associated with earthquakes. For the purpose of our hazard evaluation, we consider only the saturated soils within the upper 50 feet of the ground surface to be potentially liquefiable. The liquefaction potential was evaluated based on the SPT N_{60}-values.

Based on this criteria, and assuming a groundwater level as high as 3 feet below existing grade, we consider potentially liquefiable soils to be present between a depth of 3 feet and 50 feet below existing grade.

We performed a detailed liquefaction analysis using Liquefy Pro, version 5.8n software distributed by CivilTech Software. The following input parameters were used:

- A Peak Ground Acceleration (PGA_M) of 0.730g.
- A moment magnitude earthquake of 8.9.
- Groundwater was assumed to be 3 feet bgs at the time of the seismic event.
- C_e (SPT hammer energy correction) value of 1.
- C_b (borehole diameter correction) value of 1.05.
- C_s (sampler correction) value of 1.
- Ishihara/Yoshimine settlement calculation method.
- Modified Stark/Olson fines correction method.
- We assumed an acceptable Factor of Safety (FOS) of 1.3 for liquefaction triggering.

As indicated above, a safety factor of 1.3 was used when evaluating whether a soil would liquefy or not (i.e. soil layers below a safety factor of 1.3 are considered potentially liquefiable). **Based on the above parameters as well as the subsurface information from B-1 and B-2, we calculated that approximately 16-inches of potential total dynamic settlement due to liquefaction could occur during a design level event.** We estimate differential dynamic settlement due to liquefaction could be on the order of 50 to 75 percent of the total dynamic settlement; meaning anywhere from approximately 8- to 12-inches of differential settlement due to liquefaction could occur across the building footprint. A summary presentation of our LiquefyPro analysis is attached in Appendix G.

3.0 EVALUATION AND FOUNDATION RECOMMENDATIONS

3.1 Geotechnical Discussion

Based on our site reconnaissance, it is our professional opinion that the primary factors impacting the proposed development include the following:

1. **Presence of weak, compressible soils** – As discussed above, we encountered compressible soils to a depth of 40 feet bgs. The upper portion of the weak soils was very loose to medium dense sand with an N_{60} average of 10 (i.e. generally loose). Underlying the sandy soils, we encountered very soft to very stiff silt with an N_{60} average of 2 (i.e. generally very soft). It is our professional opinion that these compressible soils are not sufficient for shallow foundation support. As such, we recommend all foundations penetrate through these variable soils to bear on the stiff to hard silt. See Section 3.5 below for detailed deep foundation recommendations (i.e. pin piles ***or helical piers***).

2. **Presence of potentially liquefiable soils** – As stated above, there are potentially liquefiable soils located at the project site. Based on our analysis, approximately 16-inches of total dynamic settlement due to liquefaction could occur with potential differential settlements up to about 8-inches across the proposed building's footprint. This much settlement precludes the use of shallow foundations. As stated above, we are recommending deep foundations for the proposed development that will mitigate risk of settlement in an earthquake level event.

3. **Presence of organics** – As stated above, we encountered heavy organics (i.e. wood debris) in both of our explorations. The presence of organics extended to depths of 40 feet bgs. It is our professional opinion that this material is not sufficient to provide shallow foundation support without risking excess total and differential settlements. As such, we are providing deep foundation recommendations that penetrate through these organic soils to bear on the very stiff to hard soils encountered at a depth of approximately 40 feet bgs. In addition, this material is unsuitable for structural fill.

4. **Presence of potentially expansive soils** – Based on our Atterberg limits lab test results, we encountered potentially moderately expansive silt soils at a depth of approximately 10 feet bgs. Expansive soils are extremely moisture sensitive and cause a higher risk of differential movement. Since we encountered these moderately expansive silt soils 10 feet below the existing ground surface, they are not expected to experience changes in their moisture contents over time. As such, the at-grade elements will not be affected by the potentially expansive soils. However, if site grading includes any major cuts within the building footprint (i.e. cuts greater than 10 feet below the existing ground surface), we should be notified so that we can modify our recommendations to include mitigating the risk of expansive soils that could negatively impact the proposed development.

5. **Shallow groundwater** – As previously mentioned, we anticipate shallow groundwater across the subject property. Although we could not characterize the depth to groundwater due to the drilling method used (i.e. mud rotary), we observed standing water in the drainage ditch along the eastern property line. In addition, nearby well logs indicate that a static water level is as shallow as 3 feet bgs. If any excavations are greater than 3-feet, the contractor should anticipate the need to dewater. The need to dewater can be lessened if the construction occurs in the dry summer and early fall months. Detailed dewatering design is typically left up to the contractor's means and methods, and is not part of our current scope of services.

6. **Lack of detailed design drawings** – Given this project is in its preliminary stages, we have not been provided with a detailed design drawing set for the proposed construction. Once the drawings for the project are complete, we should review those drawings to determine if the design complies with our recommendations or if our recommendations need to be modified.

In summary, this site appears to be developable provided our geotechnical engineering recommendations are followed.

3.2 Site Preparation

Minimal site preparation will be required to install the piles. Any utilities present beneath the proposed construction will need to be located and rerouted as necessary and any abandoned pipes or utility conduits should be removed to inhibit the potential for subsurface erosion. Utility trench excavations should be backfilled with properly compacted structural fill as discussed in Section 3.3 below.

3.3 Structural Fill

Any structural fill placed should be granular, free of organic or other deleterious materials, have a maximum particle size less than 3 inches, be relatively well graded, and have a liquid limit less than 45 and plasticity index less than 25. In our professional opinion, on-site soils are **not** appropriate for use as fill due to the presence of organics. As such, we recommend importing granular, well graded, crushed rock structural fill. Typically, we recommend fill be moisture conditioned to within 3 percentage points below and 2 percentage points above optimum moisture as determined by ASTM D1557 (Modified Proctor). If water must be added, it should be uniformly applied and thoroughly mixed into the soil by disking or scarifying.

Fill should be placed in a relatively uniform horizontal lift on the prepared subgrade. Each loose lift should be about 1 foot. The type of compaction equipment used will ultimately determine the maximum lift thickness. Structural fill should be compacted to at least 95 percent of the Modified Proctor maximum dry density as determined by ASTM D1557.

Each lift of compacted engineered fill should be tested by a representative of the Geotechnical Engineer prior to placement of subsequent lifts. The fill should extend horizontally outward beyond the exterior perimeter of the building and pavements at least 5 feet, prior to sloping.

3.4 Foundation Recommendations

3.4.1 Pin Pile Recommendations

Once the site has been prepared, we recommend the proposed building be supported by 6-inch diameter, schedule 80 steel pipe piles driven to practical refusal using a hydraulic 2,000-pound hammer or equivalent. We also recommend the pin piles all be connected by an integrated, gridded system of rigid grade beams. Refusal for a 6-inch diameter pipe pile using a hammer of this size should be defined as less than 1-inch of penetration in 10 seconds or more. When practical, this refusal criteria should be met for the last 60 seconds of pile driving.

Assuming the piles are driven to refusal using these criteria, the allowable axial capacity for a pile installed vertically would be 30 kips in compression. This allowable axial capacity assumes a factor of safety of 2.0. We recommend a maximum lateral load resistance of 1.0 kip for each vertical pile as long as they are spaced a distance of at least 6D (measured from center to center) where D represents the diameter of the pile. If additional lateral load resistance is needed, we can provide battered pile recommendations.

Based on the known subsurface conditions we anticipate that properly constructed pin pile foundations driven to refusal will experience static settlements on the order of 1-inch and 1/2-inch of total and differential settlement, respectively. We estimate that the average pile driving refusal depth will be encountered at approximately 40 to 50 feet bgs.

3.4.2 Helical Pier Recommendations

As requested, we are providing helical pier recommendations for the subject site to minimize noise disturbance. It should be noted that helical piers can hit shallow refusal due to subsurface obstructions (i.e. rocks and/or debris). We encountered wood debris in our explorations, which slowed down the drilling. As such, the contractor should anticipate the need to put in additional effort to get through the debris.

We recommend galvanized round shaft helical piers with 10- and 12-inch diameter double helices. The helical piers should be installed so that the helix is embedded into the stiff to hard silt encountered at a depth of 40 feet bgs in both of our explorations. In order to achieve the design loads outlined below, the helix needs to be embedded at least 1 foot. For preliminary budgeting purposes, we recommend the helical piers be planned for lengths of 45 to 50 feet.

We have calculated that the recommended stiff to hard silt stratum encountered at about 40 feet in our explorations can achieve a maximum ultimate load of 126 kips. Applying a FOS of 2 results in a maximum allowable compressive capacity of 63 kips. We anticipate that a shaft diameter of 5.5 inches would be necessary to utilize 63 kips.

Given, 2-7/8 inch diameter round shaft helical piers are more common, we are also providing the following recommendations. The 2-7/8-inch diameter helical piers are typically manufactured to have a maximum axial compressive load capacity of 80 kips. Applying a FOS of 2, the piers can be designed for an allowable load capacity of 40 kips. If greater load capacity is needed, a larger shaft diameter should be selected. In order to use a FOS of 2, at least one helical pier should be load tested.

Any helical piles installed vertically (i.e. not battered) may be designed for an allowable lateral load of 1 kip. If additional lateral loads are required the piles should be battered to achieve the necessary loads.

To utilize the fully recommended capacity, the helical piers should be laterally spaced no closer than 3 pier diameters, measured center to center (i.e. 3 feet for a piers with a 12-inch lead helical).

EEI should be scheduled to be on site when each helical pier is installed to inspect the installation and verify our recommendations are met.

3.5 Floor Slab Recommendations

For the purposes of this report, we have assumed that maximum floor slab loads will not exceed 150 psf. Based on the existing soil conditions, the design of the floor slab can be based on a subgrade modulus (k) of 100 pci. This subgrade modulus value represents an anticipated value which would be obtained in a standard in-situ plate test with a 1-foot square plate. Use of this subgrade modulus for design or other on-grade structural elements should include appropriate modification based on dimensions as necessary.

In order to fully mitigate the risk of settlement, the concrete floor slab would need to be tied into the grade beams and supported on the ***deep foundation elements*** recommended above (i.e. designed as a structural floor slab). However, if a conventional, less expensive floor slab-on-grade is preferred, to at least partially mitigate the risk of potential settlement, the floor slab should be supported on at least 12-inches of properly compacted crushed rock gravel structural fill overlying the existing soils. The structural fill recommendations are outlined in Section 4.3 above. The floor slabs should have an adequate number of joints to reduce cracking resulting from any differential movement and shrinkage.

Prior to placing the structural fill, the exposed subgrade surface should be prepared as discussed in Section 3.2. In addition, we recommend a proof-roll utilizing a fully loaded, dual axle dump truck

or water truck in order to identify any unstable areas that should be removed prior to structural fill placement. The proofroll should be observed by a representative of the Geotechnical Engineer. If the subgrade cannot be accessed with a dump truck, then the subgrade will need to be visually evaluated by a representative of the Geotechnical Engineer by soil probing. If fill is required, the structural fill should be placed on the prepared subgrade after it has been approved by the Geotechnical Engineer.

The 12-inch thick crushed rock structural fill should provide a capillary break to limit migration of moisture through the slab. If additional protection against moisture vapor is desired, a moisture vapor retarding membrane may also be incorporated into the design. Factors such as cost, special considerations for construction, and the floor coverings suggest that decisions on the use of vapor retarding membranes be made by the project design team, the contractor and the owner.

3.6 Retaining Wall Recommendations

As stated above, the project is currently in its preliminary stages. As such, we have not been made aware of any proposed retaining walls. Once more detailed plans are known about retaining walls (if any), we should be provided the drawings so that we can update our recommendations as necessary. For the purposes of this report, we have assumed that no walls will be greater than 10 feet tall.

Retaining wall footings should be designed in general accordance with the recommendations contained in Section 4.4 above (i.e. pin piles ***or helical piers***). For insignificant landscape retaining walls not greater than 4 feet tall, where excessive wall movement due to ground movement is acceptable and not a risk to life-safety, they may be supported on conventional shallow foundations designed for an allowable soil bearing capacity of up to 1,500 pounds per square foot.

Lateral earth pressures on walls, which are not restrained at the top, may be calculated on the basis of an “active” equivalent fluid pressure of 35 pcf for level backfill, and 60 pcf for sloping backfill with a maximum 2H:1V slope. Lateral earth pressures on walls that are restrained from yielding at the top (i.e. stem walls) may be calculated on the basis of an “at-rest” equivalent fluid pressure of 55 pcf for level backfill, and 90 pcf for sloping backfill with a maximum 2H:1V slope. The stated equivalent fluid pressures do not include surcharge loads, such as foundation, vehicle, equipment, etc., adjacent to walls, hydrostatic pressure buildup, or earthquake loading. Surcharge loads on walls should be calculated based on the attached calculations/formulas shown in Appendix H.

We recommend that retaining walls be designed for an earth pressure determined using the Mononobe-Okabe method to mitigate future seismic forces. Our calculations were based on one-half of the Design Peak Ground Acceleration (PGA) value of 0.421g, which was obtained from Table 1 above. We have assumed that the retained soil/rock will have a minimum friction angle of 29 degrees and a total unit weight of about 115 pounds per cubic foot. For seismic loading on retaining

walls with level backfill, new research indicates that the seismic load is to be applied at 1/3 H of the wall instead of 2/3 H, where H is the height of the wall[3]. We recommend that a Mononobe-Okabe earthquake thrust per linear foot of 14.3 psf * H^2 be applied at 1/3 H, where H is the height of the wall measured in feet. Note that the recommended earthquake thrust value is appropriate for slopes behind the retaining wall of up to 10 degrees.

Any minor amount of backfill for retaining walls should be select granular material, such as sand or crushed rock with a maximum particle size between ¾ and 1 ½ inches, having less than 5 percent material passing the No. 200 sieve. As stated above, the onsite soils do not meet the requirement for structural fill, and it will be necessary to import material to the project for structure backfill. Silty soils can be used for the last 18 to 24 inches of backfill, thus acting as a seal to the granular backfill.

All backfill behind retaining walls should be moisture conditioned to within ± 2 percent of optimum moisture content, and compacted to a minimum of 92 percent of the material's maximum dry density as determined in accordance with ASTM D1557. Fill materials should be placed in layers that, when compacted, do not exceed about 8 inches. Care in the placement and compaction of fill behind retaining walls must be taken in order to ensure that undue lateral loads are not placed on the walls.

4.7 Pavement Recommendations

After the site has been stripped and prepared as described above, the pavement subgrade should be heavily recompacted with a large roller and proofrolled with a fully loaded dual axle dump truck and then covered with gravel structural fill the same day. Areas found to be soft or yielding under the weight of a dump truck should be overexcavated as recommended by the Geotechnical Engineer's representative and replaced with additional crushed rock gravel fill.

The pavement section thickness recommendations presented in Tables 2 and 3 below are considered typical and minimum for the assumed parameters. In order to achieve the assumed 20-year design life, pavement does need regular maintenance to protect the underlying subgrade from being damaged. The primary concern is subgrade water saturation which can cause it to weaken. Proper site drainage should be maintained to protect pavement areas. In addition, cracks that develop in the pavement should be sealed on a regular basis.

Using the AASHTO method of flexible pavement design, the following design parameters have been assumed:

- An assumed California Bearing Ratio (CBR) value of 10 for the recompacted sandy soil that underlies the proposed driveway pavement areas.
- A pavement life of 30 years.

[3] Lew, M., et al (2010). "Seismic Earth Pressures on Depp Building Basements," SEAOC 2010 Convention Proceedings, Indian Wells, CA.

- A terminal serviceability (Pt) of 2 (i.e. poor condition).
- A regional factor (R) of 3.0.
- Assumed total vehicle trips of:
    - No more than 20 cars per day for car parking (which equates to about (5) 18,000 pound daily equivalent single axle loads, ESALs)
    - No more than 100 cars per day for drive lanes (which equates to about (22) 18,000 pound daily equivalent single axle loads, ESALs)
- An assumed average weight of 4,000 pounds per vehicle was used in our calculations.

The project Civil Engineer should review our assumptions to confirm they are appropriate for the anticipated traffic loading. See Tables 2 and 3 below for recommended pavement section thicknesses based on the above assumptions.

Table 2: Asphaltic Concrete - Recommended Minimum Thicknesses (inches)

Pavement Materials	Car Parking	Drive Lanes
Asphaltic Concrete	2	2
Crushed Aggregate Base Course (less than 5% fines)	6	10

Table 3: Portland Cement Concrete - Recommended Minimum Thicknesses (inches)

Pavement Materials	Car Parking	Drive Lanes
Portland Cement Concrete	6	6
Crushed Aggregate Base Course (less than 5% fines)	4	4

Asphaltic concrete materials should be compacted to at least 91 percent of the material's theoretical maximum density as determined in general accordance with ASTM D 2041 (Rice Specific Gravity). The crushed aggregate base course should consist of well-graded crushed stone with a maximum particle size no greater than 2 inches. Aggregate base course materials should be free of organics or other deleterious materials, be relatively clean (i.e. less than 5 percent soil passing the U.S. #200 sieve), well graded, and have a liquid limit less than 45 and plasticity index less than 25. The base course should be moisture conditioned to within 2 percent of optimum and compacted to a minimum of 95 percent of a modified Proctor as outlined in Section 3.3 of this report. When placed, the lift base course thickness should generally not exceed 12 inches prior to compacting. The type of compaction equipment used will ultimately determine the maximum lift thickness. In addition, we recommend that the structural fill be placed within +/- 2 percent of the optimum moisture for that material.

4.0 CONSTRUCTION CONSIDERATIONS

EEI should be retained to provide observation and testing of construction activities involved in the foundation, earthwork, and related activities of this project. EEI cannot accept any responsibility for any conditions that deviate from those described in this report, nor for the performance of the foundations if not engaged to also provide construction observation for this project.

4.1 Moisture Sensitive Soils/Weather Related Concerns

The upper soils encountered at this site are expected to be sensitive to disturbances caused by construction traffic and to changes in moisture content. During wet weather periods, increases in the moisture content of the soil can cause significant reduction in the soil strength and support capabilities. In addition, soils that become wet may be slow to dry and thus significantly retard the progress of grading and compaction activities. While not required, it will be advantageous to perform earthwork and foundation construction activities during dry weather.

4.2 Drainage and Groundwater Considerations

Water should not be allowed to collect in the foundation excavations or on prepared subgrades for the floor slab during construction. Positive site drainage should be maintained throughout construction activities. Undercut or excavated areas should be sloped toward one corner to facilitate removal of any collected rainwater, groundwater, or surface runoff.

The site grading plan should be developed to provide rapid drainage of surface water away from the building areas and to inhibit infiltration of surface water around the perimeter of the building and beneath the floor slab. The grades should be sloped away from the building area. Stormwater should be piped (tightlined) to either an existing city storm sewer or to the drainage ditch along the eastern property line if allowed.

4.3 Excavations

In Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P". This document and subsequent updates were issued to better insure the safety of workmen entering trenches or excavations. It is mandated by this federal regulation that excavations, whether they be utility trenches, basement excavations or footing excavations, be constructed in accordance with the new OSHA guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's "responsible person", as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

We are providing this information solely as a service to our client. EEI does not assume responsibility for construction site safety or the contractor's compliance with local, state, and federal safety or other regulations.

5.0 REPORT LIMITATIONS

As is standard practice in the geotechnical industry, the conclusions contained in our report are considered preliminary because they are based on assumptions made about the soil, rock, and groundwater conditions exposed at the site during our subsurface investigation. A more complete extent of the actual subsurface conditions can only be identified when they are exposed during construction. Therefore, EEI should be retained as your consultant during construction to observe the actual conditions and to provide our final conclusions. If a different geotechnical consultant is retained to perform geotechnical inspection during construction, then they should be relied upon to provide final design conclusions and recommendations, and should assume the role of geotechnical engineer of record, as is the typical procedure required by the governing jurisdiction.

The geotechnical recommendations presented in this report are based on the available project information, and the subsurface materials described in this report. If any of the noted information is incorrect, please inform EEI in writing so that we may amend the recommendations presented in this report, if appropriate, and if desired by the client. EEI will not be responsible for the implementation of its recommendations when it is not notified of changes in the project.

Once construction plans are finalized and a grading plan has been prepared, EEI should be retained to review those plans, and modify our existing recommendations related to the proposed construction, if determined to be necessary.

The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

This report has been prepared for the exclusive use of Red Crow, LLC for the specific application to the proposed Ecola Square Development located on Clatsop County Tax Lot No. 51030AA04402 in Cannon Beach, Clatsop County, Oregon. EEI does not authorize the use of the advice herein nor the reliance upon the report by third parties without prior written authorization by EEI.

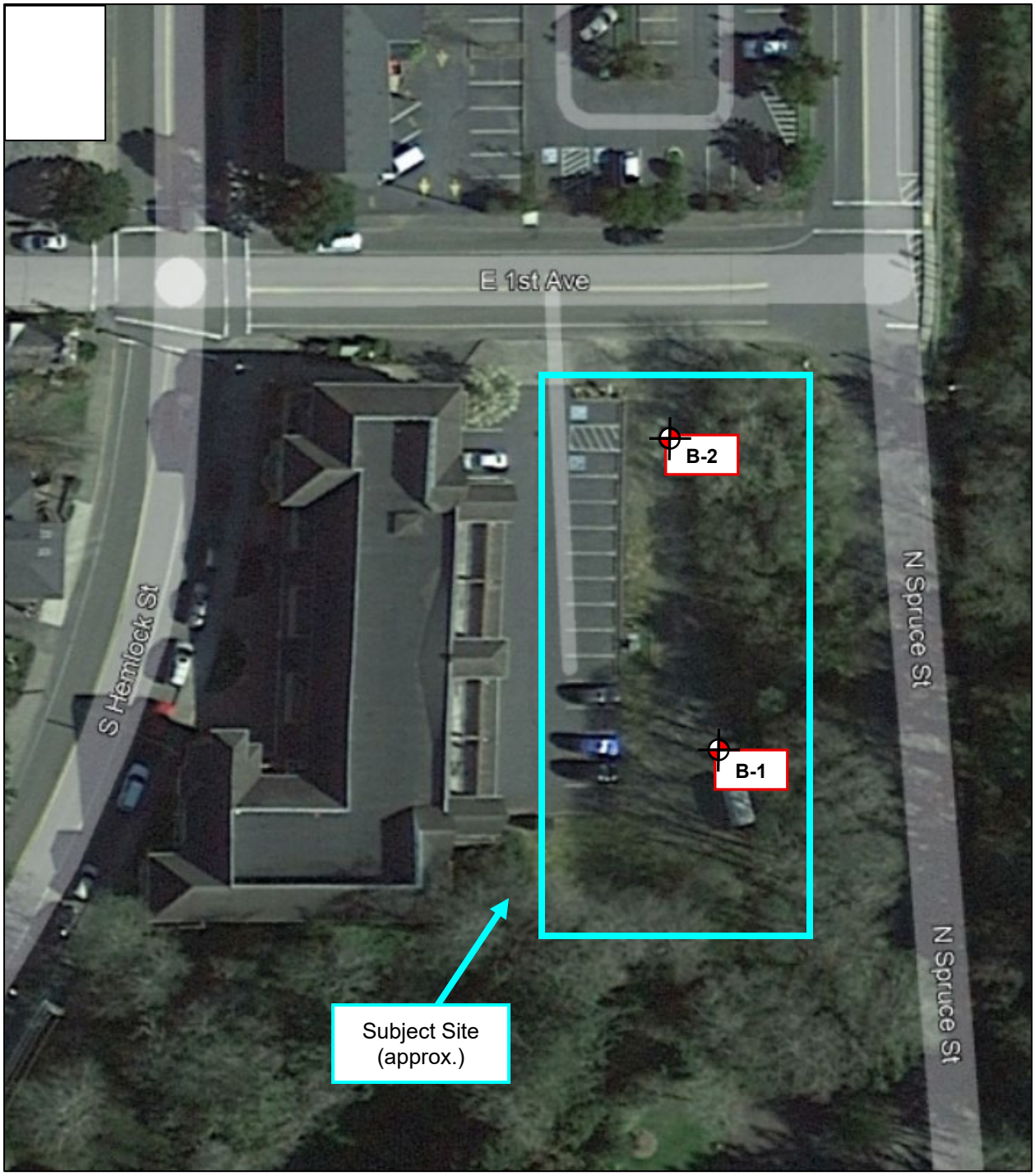
APPENDICES

APPENDIX A – SITE LOCATION PLAN

Base Map Source: https://livingatlas.arcgis.com/topoexplorer/

Earth Engineers, Inc.	**Proposed Ecola Square Development** **Southwest Corner of First Street and Spruce Street** **Tax Lot #51030AA04402** **Cannon Beach, Clatsop County, Oregon**	**Report No. 22-039-1-*R1*** **March 31, 2022** ***(revised April 18, 2022)***

APPENDIX B – EXPLORATION LOCATION PLAN



⊕ = Approximate Boring Location

Base image source: "Google Earth.

Earth Engineers, Inc.	**Proposed Ecola Square Development** **Southwest Corner of First Street and Spruce Street** **Tax Lot #51030AA04402** **Cannon Beach, Clatsop County, Oregon**	**Report No. 22-039-1-*R1*** **March 31, 2022** ***(revised April 18, 2022)***

Appendix C: Boring B-1

Earth Engineers, Inc.

Client: Red Crow, LLC
Project: Proposed Ecola Square Development
Site Address: Southwest Corner of First Street and Spruce Street, Cannon Beach, Clatsop County, OR
Location of Exploration: See Appendix B
Logged By: Jacqui Boyer

Report Number: 22-039-1
Drilling Contractor: PLi Systems
Drilling Method: Mud Rotary w/ SPT Hammer
Drilling Equipment: B-58 Truck Rig
Approximate Ground Surface Elevation (ft msl): 13
Date of Exploration: 2/28/2022

Depth (ft)	Water Level	Lithologic Symbol	Geologic Description of Soil and Rock Strata	Sample Number	Blows per 6 Inches	N-value	Moisture Content (%)	% Passing #200 Sieve	Liquid Limit	Plastic Limit	Pocket Pen (tsf)	Remarks
0			Fill - brown gravel fill with little silt, rootlets, dry to moist, medium dense	SPT-1	5 5 4	12	9	10				
2												
4			Sand (SP) - brown to gray sand with trace silt, heavy organics (wood debris), loose to medium dense	SPT-2	4 5 5	14	22					
6				SPT-3	1 1 2	4	29	1				
8				SPT-4	1 4 1	7	208					
10			Silt (MH) - gray to brown high plasticity silt with little sand, roots, rootlets and woodchips, moist to wet, very loose to loose	SPT-5	0 0 0	0	73	94	66	39		
12				SPT-6	0 0 0	0	111					
14												
16				SPT-7	0 0 0	0	176	99	170	108		
18												
20			vein of gray to blue-gray silty sand with heavy organics encountered	SPT-8	0 0 0	0	96	43				
22												
24												
26				SPT-9	0 2 1	4	252					
28												
30												

Notes : Boring terminated at a depth of approximately 51.5 feet below ground surface (bgs). Grounwater level not able to be determined due to drilling method (i.e. mud rotary). Boring backfilled with bentonite chips on 2/28/22. N60 values reported are based on a SPT hammer energy correction factor of 1.377 (i.e. 82.6/60), reference "Report of SPT Hammer Energies" prepared by NV5 dated 1/17/22. Approximate elevation from Google Earth.

Appendix C: Boring B-1

Earth Engineers, Inc.

Client: Red Crow, LLC
Project: Proposed Ecola Square Development
Site Address: Southwest Corner of First Street and Spruce Street, Cannon Beach, Clatsop County, OR
Location of Exploration: See Appendix B
Logged By: Jacqui Boyer

Report Number: 22-039-1
Drilling Contractor: PLi Systems
Drilling Method: Mud Rotary w/ SPT Hammer
Drilling Equipment: B-58 Truck Rig
Approximate Ground Surface Elevation (ft msl): 13
Date of Exploration: 2/28/2022

Depth (ft)	Water Level	Lithologic Symbol	Geologic Description of Soil and Rock Strata	Sample Number	Blows per 6 Inches	N-value	Moisture Content (%)	% Passing #200 Sieve	Liquid Limit	Plastic Limit	Pocket Pen (tsf)	Remarks
30				SPT-10	0 0 0	0	63	85				
32												
34												
36				SPT-11	0 1 2	4	149	94	57	34		
38												
40			Silt (MH) - gray to blue-gray to brown high plasticity silt with sand and gravel, moist to wet, stiff to hard no more organics encountered	SPT-12	0 3 5	11	39					drilling difficulty increased (drill rattling on gravel)
42												
44												
46				SPT-13	9 14 17	43	9					
48												
50				SPT-14	8 9 15	33	29					
52												
54												
56												
58												
60												

Notes : Boring terminated at a depth of approximately 51.5 feet below ground surface (bgs). Grounwater level not able to be determined due to drilling method (i.e. mud rotary). Boring backfilled with bentonite chips on 2/28/22. N60 values reported are based on a SPT hammer energy correction factor of 1.377 (i.e. 82.6/60), reference "Report of SPT Hammer Energies" prepared by NV5 dated 1/17/22. Approximate elevation from Google Earth.

Appendix C: Boring B-2

Earth Engineers, Inc.

Client: Red Crow, LLC
Project: Proposed Ecola Square Development
Site Address: Southwest Corner of First Street and Spruce Street, Cannon Beach, Clatsop County, OR
Location of Exploration: See Appendix B
Logged By: Jacqui Boyer

Report Number: 22-039-1
Drilling Contractor: PLi Systems
Drilling Method: Mud Rotary w/ SPT Hammer
Drilling Equipment: B-58 Truck Rig
Approximate Ground Surface Elevation (ft msl): 12
Date of Exploration: 2/28/2022

Depth (ft)	Water Level	Lithologic Symbol	Geologic Description of Soil and Rock Strata	Sample Number	Blows per 6 Inches	N-value	Moisture Content (%)	% Passing #200 Sieve	Liquid Limit	Plastic Limit	Pocket Pen (tsf)	Remarks
0			Fill - brown gravel fill with little silt, rootlets, dry to moist, medium dense	SPT-1	18							
			Sand (SM) - brown to gray silty sand wih heavy organics (wood debris), very loose to medium dense		7 4	15	31					
2				SPT-2	11 9 8	23						no sample retained in split spoon
4												
6				SPT-3	5 2 3	7	351					
8				SPT-4	0 1 0	1						no sample retained in split spoon
10			Silt (MH) - gray to brown high plasticity silt with little sand, roots, rootlets and woodchips, moist to wet, very loose to medium dense	SPT-5	0 0 0	0	104					
12												
				SPT-6	0 0 0	0	206					
14												
			vein of wood debris encountered (no soil in split spoon)	SPT-7	37 10 4	19	189					
18												
20			vein of gray to blue-gray coarse-grained sand with heavy organics encountered	SPT-8	0 1 1	3	103					
22												
24												
26				SPT-9	0 0 0	0	111					
28												
30												

Notes : Boring terminated at a depth of approximately 51.5 feet below ground surface (bgs). Grounwater level not able to be determined due to drilling method (i.e. mud rotary). Boring backfilled with bentonite chips on 2/28/22. N60 values reported are based on a SPT hammer energy correction factor of 1.377 (i.e. 82.6/60), reference "Report of SPT Hammer Energies" prepared by NV5 dated 1/17/22. Approximate elevation from Google Earth.

Appendix C: Boring B-2

Earth Engineers, Inc.

Client: Red Crow, LLC
Project: Proposed Ecola Square Development
Site Address: Southwest Corner of First Street and Spruce Street, Cannon Beach, Clatsop County, OR
Location of Exploration: See Appendix B
Logged By: Jacqui Boyer

Report Number: 22-039-1
Drilling Contractor: PLi Systems
Drilling Method: Mud Rotary w/ SPT Hammer
Drilling Equipment: B-58 Truck Rig
Approximate Ground Surface Elevation (ft msl): 12
Date of Exploration: 2/28/2022

Depth (ft)	Water Level	Lithologic Symbol	Geologic Description of Soil and Rock Strata	Sample Number	Blows per 6 Inches	N-value	Moisture Content (%)	% Passing #200 Sieve	Liquid Limit	Plastic Limit	Pocket Pen (tsf)	Remarks
30				SPT-10	1 0 0	0	34					
32												
34												
36												
38												
40			Silt (MH) - gray to blue-gray to brown high plasticity silt with sand and gravel, moist to wet, hard no more organics encountered	SPT-11	15 17 16	45	31					
42												
44												
46												
48												
50				SPT-12	20 33 26	81	16					
52												
54												
56												
58												
60												

Notes : Boring terminated at a depth of approximately 51.5 feet below ground surface (bgs). Grounwater level not able to be determined due to drilling method (i.e. mud rotary). Boring backfilled with bentonite chips on 2/28/22. N60 values reported are based on a SPT hammer energy correction factor of 1.377 (i.e. 82.6/60), reference "Report of SPT Hammer Energies" prepared by NV5 dated 1/17/22. Approximate elevation from Google Earth.

APPENDIX D: SOIL CLASSIFICATION LEGEND

APPARENT CONSISTENCY OF COHESIVE SOILS (PECK, HANSON & THORNBURN 1974, AASHTO 1988)				
Descriptor	**SPT N_{60} (blows/foot)***	**Pocket Penetrometer, Qp (tsf)**	**Torvane (tsf)**	**Field Approximation**
Very Soft	< 2	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	2 – 4	0.25 – 0.50	0.12 – 0.25	Easily penetrated several inches by thumb
Medium Stiff	5 – 8	0.50 – 1.0	0.25 – 0.50	Penetrated several inches by thumb w/moderate effort
Stiff	9 – 15	1.0 – 2.0	0.50 – 1.0	Readily indented by thumbnail
Very Stiff	16 – 30	2.0 – 4.0	1.0 – 2.0	Indented by thumb but penetrated only with great effort
Hard	> 30	> 4.0	> 2.0	Indented by thumbnail with difficulty

* Using SPT N_{60} is considered a crude approximation for cohesive soils.

APPARENT DENSITY OF COHESIONLESS SOILS (AASHTO 1988)	
Descriptor	**SPT N_{60} Value (blows/foot)**
Very Loose	0 – 4
Loose	5 – 10
Medium Dense	11 – 30
Dense	31 – 50
Very Dense	> 50

MOISTURE (ASTM D2488-06)	
Descriptor	**Criteria**
Dry	Absence of moisture, dusty, dry to the touch, well below optimum moisture content (per ASTM D698 or D1557)
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table, well above optimum moisture content (per ASTM D698 or D1557)

PERCENT OR PROPORTION OF SOILS (ASTM D2488-06)	
Descriptor	**Criteria**
Trace	Particles are present but estimated < 5%
Few	5 – 10%
Little	15 – 25%
Some	30 – 45%
Mostly	50 – 100%
Percentages are estimated to nearest 5% in the field. Use "about" unless percentages are based on laboratory testing.	

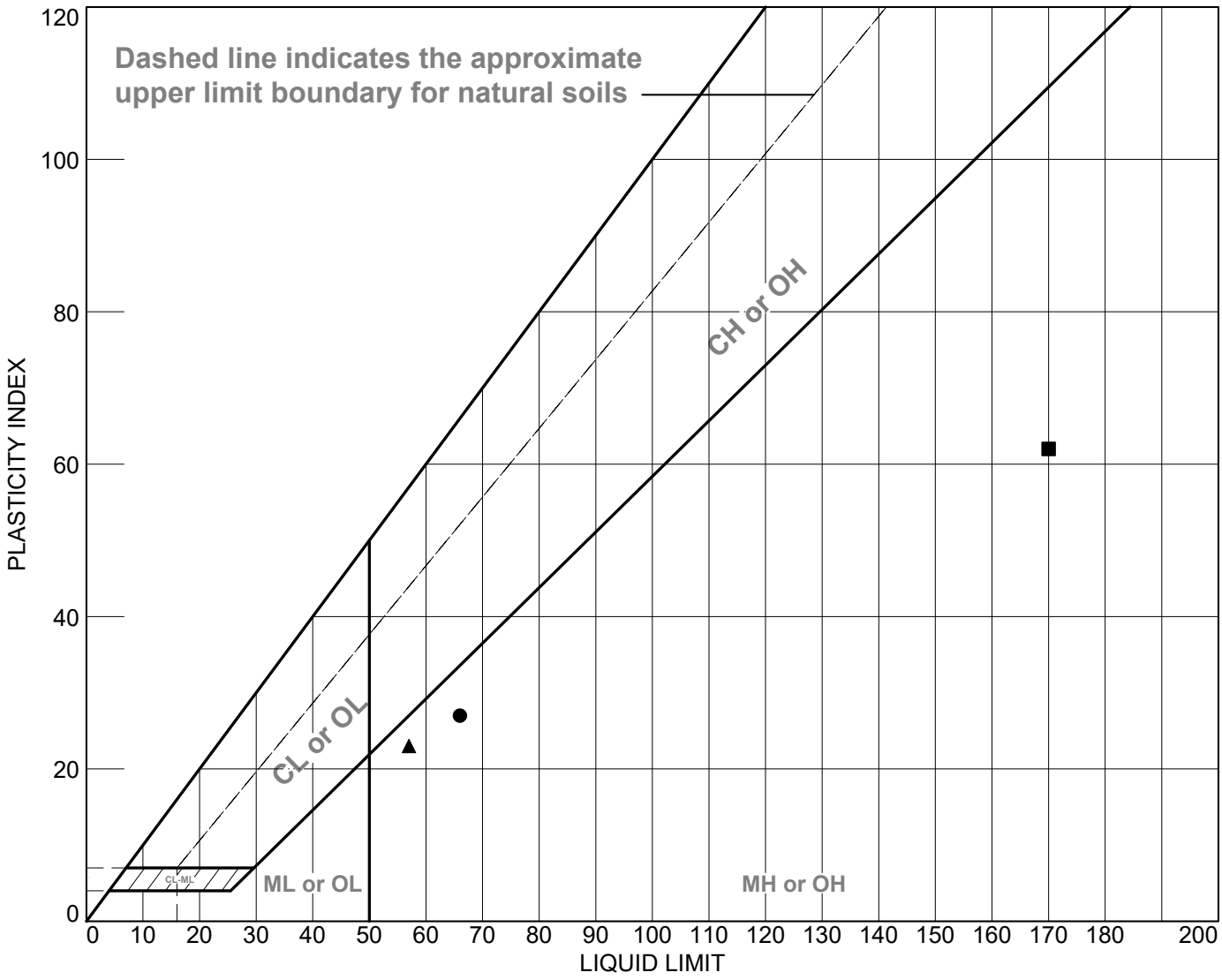
SOIL PARTICLE SIZE (ASTM D2488-06)	
Descriptor	**Size**
Boulder	> 12 inches
Cobble	3 to 12 inches
Gravel - Coarse Fine	¾ inch to 3 inches No. 4 sieve to ¾ inch
Sand - Coarse Medium Fine	No. 10 to No. 4 sieve (4.75mm) No. 40 to No. 10 sieve (2mm) No. 200 to No. 40 sieve (.425mm)
Silt and Clay ("fines")	Passing No. 200 sieve (0.075mm)

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D2488)				
Major Division			**Group Symbol**	**Description**
Coarse Grained Soils (more than 50% retained on #200 sieve)	**Gravel** (50% or more retained on No. 4 sieve)	Clean Gravel	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		Gravel with fines	GM	Silty gravels and gravel-sand-silt mixtures
			GC	Clayey gravels and gravel-sand-clay mixtures
	Sand (> 50% passing No. 4 sieve)	Clean sand	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly-graded sands and gravelly sands, little or no fines
		Sand with fines	SM	Silty sands and sand-silt mixtures
			SC	Clayey sands and sand-clay mixtures
Fine Grained Soils (50% or more passing #200 sieve)	**Silt and Clay** (liquid limit < 50)		ML	Inorganic silts, rock flour and clayey silts
			CL	Inorganic clays of low-medium plasticity, gravelly, sandy & lean clays
			OL	Organic silts and organic silty clays of low plasticity
	Silt and Clay (liquid limit > 50)		MH	Inorganic silts and clayey silts
			CH	Inorganic clays or high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat, muck and other highly organic soils

Earth Engineers, Inc.

GRAPHIC SYMBOL LEGEND		
GRAB		Grab sample
SPT		Standard Penetration Test (2" OD), ASTM D1586
ST		Shelby Tube, ASTM D1587 (pushed)
DM		Dames and Moore ring sampler (3.25" OD and 140-pound hammer)
CORE		Rock coring

APPENDIX E - LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	Boring 1	1	10	72.6	39	66	27	MH
■	Boring 1	2	15	176.0	108	170	62	MH
▲	Boring 1	3	35	149.1	34	57	23	MH

Earth Engineers, Inc.

Client: Red Crow, LLC

Project: Propsed Ecola Square Development

Project No.: 22-039 **Figure**

APPENDIX F

NEARBY HISTORIC WELL LOGS

CLAT 51620

STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-035)

(1) OWNER/PROJECT: Hole Number HA -7
Name Michael Thayer
Address 487 Ocean Ave.
City Cannon Beach State OR Zip 97110

(2) TYPE OF WORK
[X] New [ ] Deepening [ ] Alteration (repair/recondition) [ ] Abandonment

(3) CONSTRUCTION:
[ ] Rotary Air [X] Hand Auger [ ] Hollow Stem Auger
[ ] Rotary Mud [ ] Cable Tool [ ] Push Probe [ ] Other

(4) TYPE OF HOLE:
[X] Uncased Temporary [ ] Cased Permanent
[ ] Uncased Permanent [ ] Slope Stability [ ] Other

(5) USE OF HOLE: Collect soil samples

(6) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [ ] No Depth of Completed Hole 12 ft.

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
3"	0	12				

Backfill placed from ____ ft. to ____ ft. Material ____
Filter Pack placed from ____ ft. to ____ ft. Size of pack ____

(7) CASING/SCREEN: N/A

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
Screen:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]

Slot size ____

(8) WELL TEST:
[ ] Pump [ ] Bailer N/A [ ] Air [ ] Flowing Artesian
Permeability ____ Yield ____ GPM ____
Conductivity ____ PH ____
Temperature of water ____ °F Depth artesian flow found ____ ft.
Was water analysis done? [ ] Yes [ ] No
By whom? ____
Depth of strata analyzed. From ____ ft. to ____ ft.
Remarks: ____

(9) LOCATION OF HOLE by legal description:
County Clatsop Latitude ____ Longitude ____
Township 5 N Range 10 W WM.
Section 30 NE 1/4 NE 1/4
Tax Lot ____ Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address) 487 Ocean Av.
Cannon Beach, OR 97110

Map with location indentified must be attached

(10) STATIC WATER LEVEL:
3 ft. below land surface. Date 12/13/02
Artesian pressure ____ lb. per square inch. Date ____

(11) SUBSURFACE LOG:
Ground Elevation Approximately 15 feet msl

Material Description	From	To	SWL
Elastic Silt.	0	3	
Fat Clay	3	12	

Date Started 12/13/02 Date Completed 12/13/02

(12) ABANDONMENT LOG:

Material Description	From	To	Sacks or Pounds
Bentonite Chips.	0	12	1 Sack

RECEIVED
FEB 27 2003
WATER RESOURCES DEPT
SALEM, OREGON

Date started 12/13/02 Date Completed 12/13/02

Professional Certification
(to be signed by a licensed water supply or monitoring well constructor, or registered geologist or civil engineer).

I accept responsibility for the construction, alteration, or abandonment work performed on during the construction dates reported above. All work performed during this time is in compliance with Oregon geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 61791
Signed J. Foxwell Date ____
Affiliation GeoEngineers

REGISTERED PROFESSIONAL GEOLOGIST
OREGON
JOHN P. FOXWELL
No. G1791

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

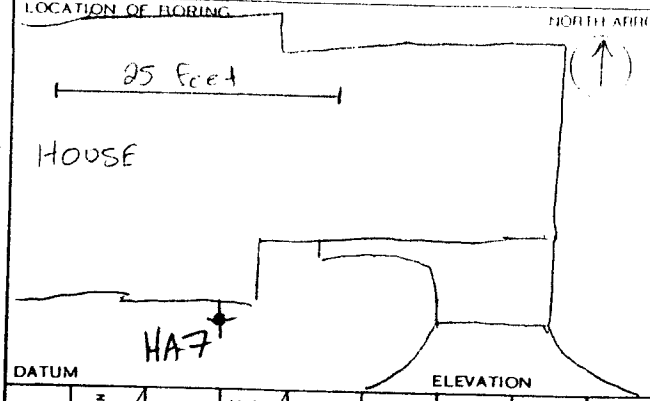
ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER

CLAT 51620

GeoEngineers Inc.

JOB NO	CLIENT	LOCATION
10361-001-00	Michael Thayer	Cannon Beach, OR

LOCATION OF BORING



DATUM ELEVATION

DRILLING METHOD: Hand Auger

SAMPLING METHOD: Hand Auger

BORING NO: HA-7

SHEET: 1 OF 1

	DRILLING START	DRILLING FINISH
WATER LEVEL		
TIME	TIME 13:00	TIME 14:00
DATE	DATE 12/13	DATE 12/13/02
CASING DEPTH		

SURFACE CONDITIONS: Sand

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	DEPTH OF CASING	SAMPLE NO. / SAMPLE DEPTH	BLOWS/FT. SAMPLER	NUMBER OF RINGS	DEPTH IN FEET	SOIL GRAPH	SOIL DESCRIPTION	COMMENTS
						0			
						1	MH	Elastic silt. Brown. Moist. No odor.	
						2			TLV<100 NS
						3			
						4		Medium grey fat clay. Wet. Moderate petroleum odor.	
						5	CH		
						6			TLV 140ppm MS
						7			
						8			
						9			
						10		Becomes yellowish orange at 10ft.	
						11			
						12		Total Depth 12 feet	TLV 220ppm NS
						13			
						14			
						15			
						16			
						17			
						18			
						19			

DRILLING CONTR

CHK'D BY

DATE BY

GEI 25-81

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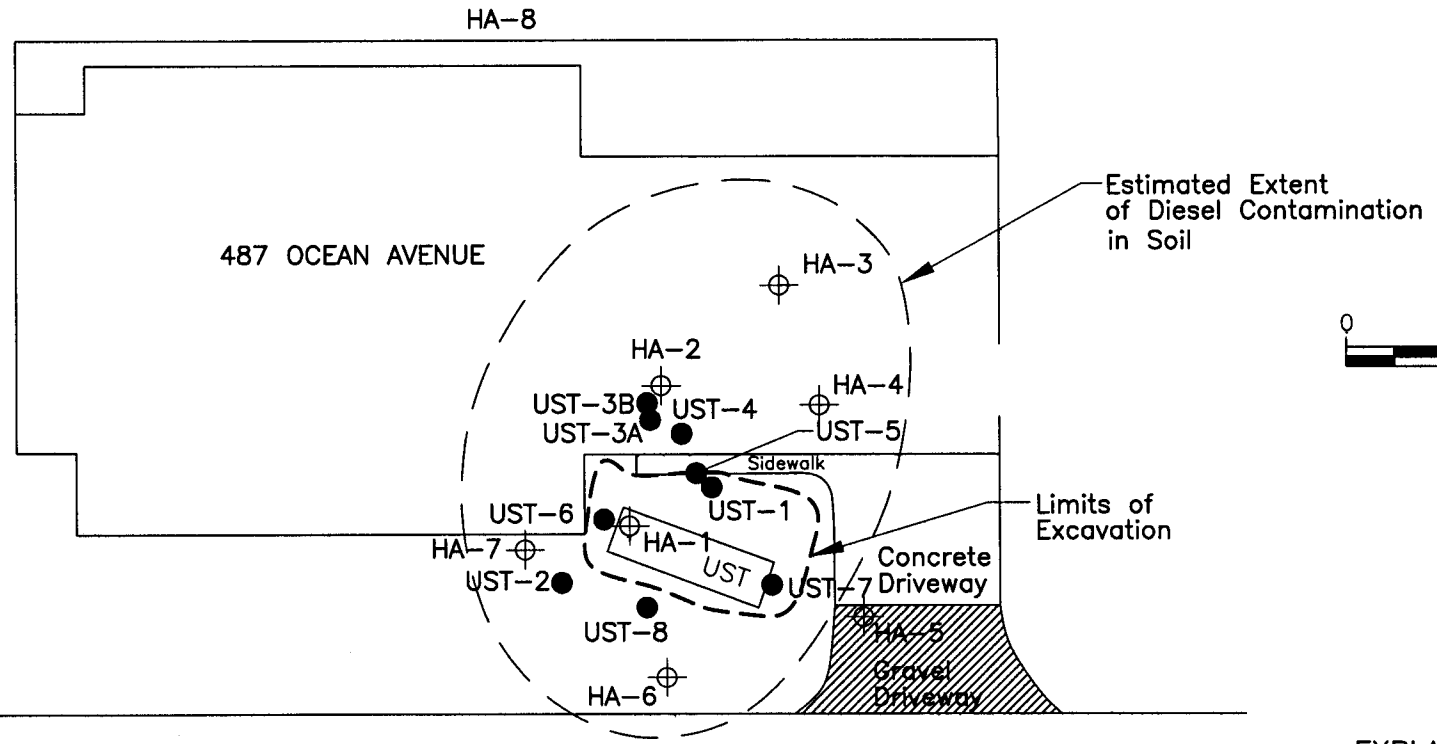
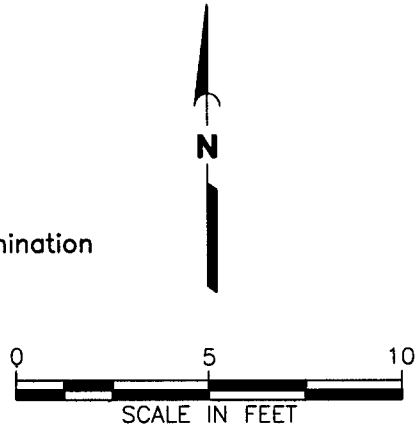
WATER RESOURCES DEPT
SALEM, OREGON

Portland\P:\10\10361001\00\Cad\fig_2.dwg JPF:RLF 03/10/03





RECEIVED
JAN 19 2005
WATER RESOURCES DEPT
SALEM, OREGON

CLAT 51620

EXPLANATION:

⊕ PROPOSED MONITORING WELL LOCATION

Notes: 1. The locations of all features shown are approximate.

2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record.

GeoEngineers

SITE PLAN

FIGURE 2

CLAT 51631

STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-035)

(1) OWNER/PROJECT: Hole Number HA-2
Name Michael Thayer
Address 487 Ocean Ave.
City Cannon Beach State OR Zip 97110

(2) TYPE OF WORK
☒ New ☐ Deepening ☐ Alteration (repair/recondition) ☐ Abandonment

(3) CONSTRUCTION:
☐ Rotary Air ☒ Hand Auger ☐ Hollow Stem Auger
☐ Rotary Mud ☐ Cable Tool ☐ Push Probe ☐ Other

(4) TYPE OF HOLE:
☒ Uncased Temporary ☐ Cased Permanent
☐ Uncased Permanent ☐ Slope Stability ☐ Other

(5) USE OF HOLE: Collect soil samples

(6) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☐ No Depth of Completed Hole 11 ft.

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
3"	0	11				

Backfill placed from ____ ft. to ____ ft. Material ____
Filter Pack placed from ____ ft. to ____ ft. Size of pack ____

(7) CASING/SCREEN: N/A

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Screen:					☐	☐	☐	☐
					☐	☐	☐	☐

Slot size ____

(8) WELL TEST:
☐ Pump ☐ Bailer N/A ☐ Air ☐ Flowing Artesian
Permeability ____ Yield ____ GPM ____
Conductivity ____ PH ____
Temperature of water ____ °F Depth artesian flow found ____ ft.
Was water analysis done? ☐ Yes ☐ No
By whom? ____
Depth of strata analyzed. From ____ ft. to ____ ft.
Remarks: ____

(9) LOCATION OF HOLE by legal description:
County Clatsop Latitude ____ Longitude ____
Township 5 N Range 10 W WM.
Section 30 NE 1/4 NE 1/4
Tax Lot ____ Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address) 487 Ocean Av.
Cannon Beach, OR 97110

Map with location indentified must be attached

(10) STATIC WATER LEVEL:
3 ft. below land surface. Date 12/13/02
Artesian pressure ____ lb. per square inch. Date ____

(11) SUBSURFACE LOG:
Ground Elevation Approximately 15 feet msl

Material Description	From	To	SWL
Plastic Silt w/ Sand.	0	4	
Fat Clay	4	9½	
Silt with Sand	9½	11	

Date Started 12/13/02 Date Completed 12/13/02

(12) ABANDONMENT LOG:

Material Description	From	To	Sacks or Pounds
Bentonite Chips.	0	11	1 Sack

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Date started 12/13/02 Date Completed 12/13/02

Professional Certification
(to be signed by a licensed water supply or monitoring well constructor, or registered geologist or civil engineer).

I accept responsibility for the construction, alteration, or abandonment performed on during the construction dates reported above. All work performed during this time is in compliance with Oregon geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 61791

Signed ____ Date ____

Affiliation Geo Engineers

REGISTERED PROFESSIONAL GEOLOGIST OREGON DAVID A. POWELL No. G1791

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER

APPENDIX G

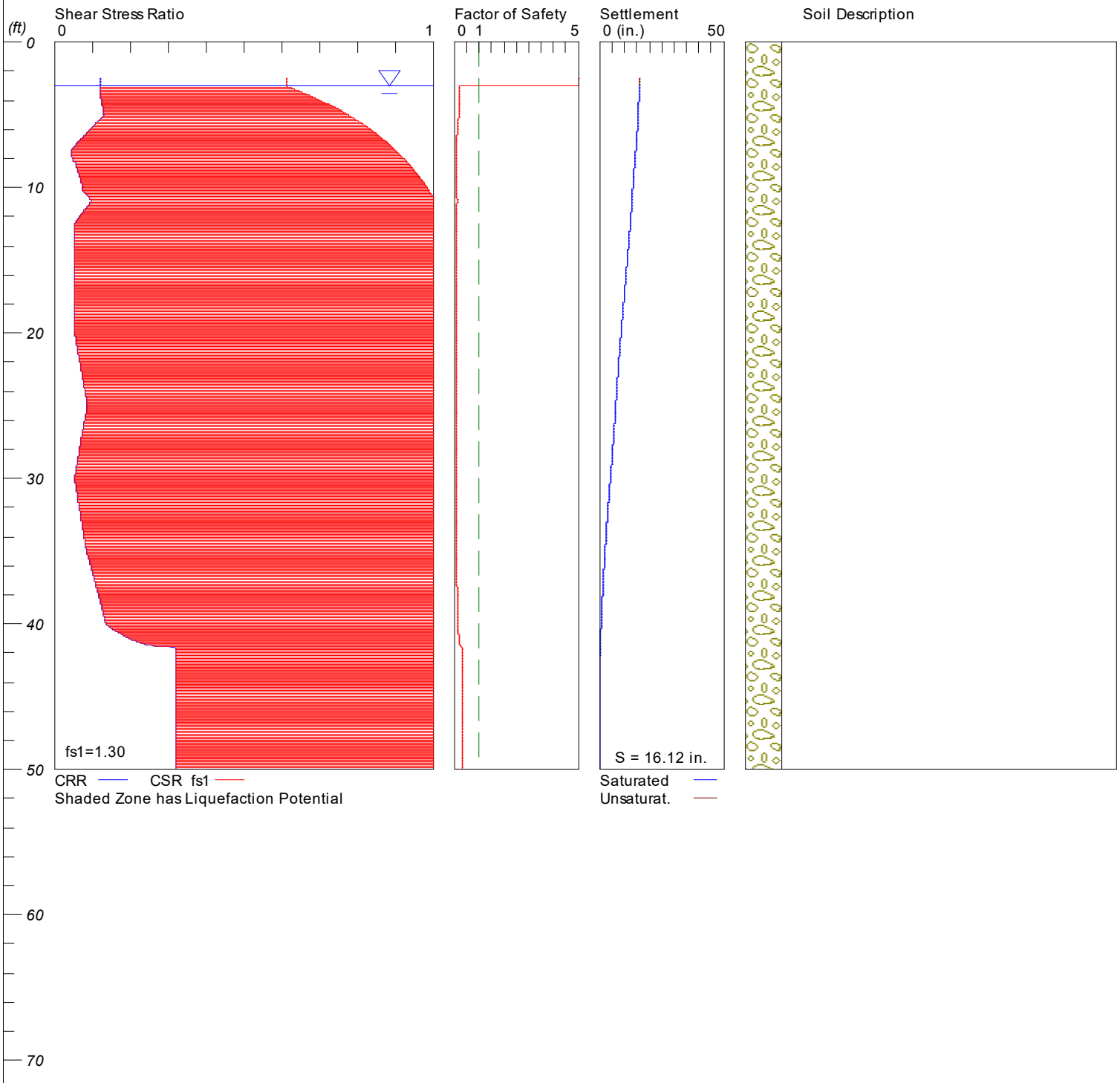
LIQUEFY PRO OUTPUT

LIQUEFACTION ANALYSIS

Proposed Ecola Development

Hole No.=B1 Water Depth=3 ft Surface Elev.=13

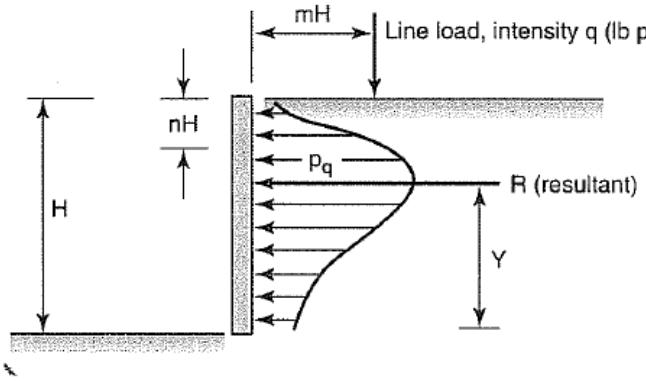
Magnitude=8.9
Acceleration=0.730g



LiquefyPro CivilTech Software USA www.civiltech.com

APPENDIX H: SURCHARGE-INDUCED LATERAL EARTH PRESSURES FOR WALL DESIGN

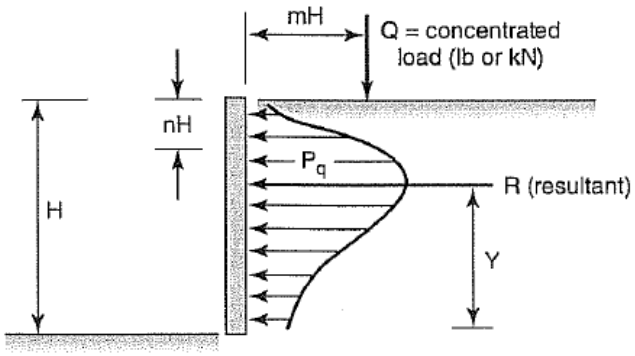
LINE LOAD (applicable for retaining walls not exceeding 20 feet in height):



m	R	Y
0.2	0.55q	0.60 H
0.4	0.55q	0.58 H
0.6	$\frac{0.64q}{m^2+1}$	0.52 H

Figure 16-28 Pressure distribution against vertical wall resulting from line load of intensity *q*.

CONCENTRATED POINT LOAD (applicable for retaining walls not exceeding 20 feet in height):



m	R	Y
0.2	$0.78\frac{Q}{H}$	0.59 H
0.4	$0.78\frac{Q}{H}$	0.59 H
0.6	$0.48\frac{Q}{H}$	0.48 H

Figure 16-27 Pressure distribution against vertical wall resulting from point load, Q.

AREAL LOAD:

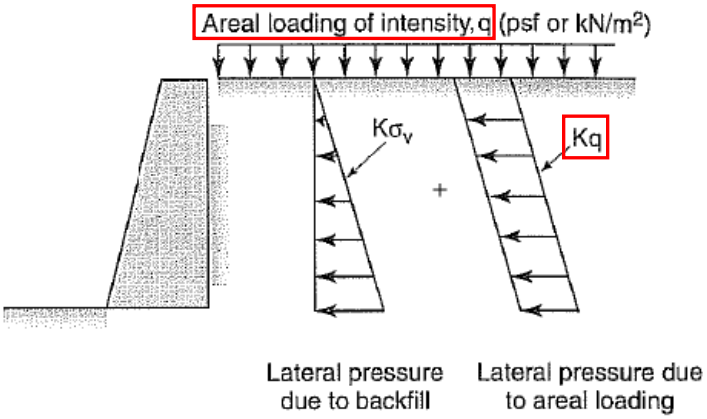
Figure 16-26 Influence of areal loading on wall pressures.

use K=0.4 for active condition (i.e. top of wall allowed to deflect laterally)

use K=0.9 for at-rest condition (i.e. top of wall not allowed to deflect laterally)

Resultant, R = K * q * H

Where H = wall height (feet)



Source of Figures: McCarthy, D.F., 1998, "Essentials of Soil Mechanics and foundations, Basic Geotechnics, Fifth Edition."

Todd Prager & Associates LLC

MEMORANDUM

DATE: September 21, 2022

TO: Jamie Lerma (Red Crow, LLC)

FROM: Todd Prager, RCA #597, ISA Board Certified Master Arborist

RE: Tree Plan for First and Spruce Project

Summary

This report includes tree removal and protection recommendations based on the preliminary site plan for the First and Spruce project in Cannon Beach, Oregon.

Based on the preliminary site plan, 14 trees over 6-inch diameter (DBH) are proposed for removal and 23 trees will be retained. Of the 23 trees recommended for retention, 12 are within the site boundaries and 11 are within the adjacent right-of-way.

The trees to be retained will be protected by adhering to the recommendations in this report.

Background

The property at First and Spruce Street in Cannon Beach is currently zoned commercial. There is a pending conditional use application before the Planning Commission for four to five single family homes and four to seven attached units.

The property is currently vacant, 0.42 acres in size, and contains a narrow strip of wetland along the eastern property line. The wetland and adjacent area are populated with primarily willow species (*Salix sp.*) and red alder (*Alnus rubra*) trees.

Attachment 1 is the existing conditions map with existing tree locations. Attachment 2 is the preliminary site plan with existing tree locations.

At their August 25, 2022 hearing, the Planning Commission requested an arborist report for the project.

Todd Prager & Associates, LLC
601 Atwater Road • Lake Oswego, OR 97034
Phone: 971.295.4835 • Email: todd@toddprager.com • Website: toddprager.com

The assignment requested of our firm for this project was to:

- Assess and tag all trees over 6-inch DBH within and directly adjacent to the development site; and
- Provide a report with recommendations for the trees to be removed based on the proposed site plan along with protection recommendations for the trees to be retained.

Tree Assessment

On September 9, 2022 I completed the inventory of existing trees over 6-inch DBH at the project site.

The complete inventory data for each tree is provided in Attachment 3 and includes the tree number, common name, scientific name, DBH, approximate crown radius, health condition, structural condition, pertinent comments, and treatment recommendations (remove or retain).

The tree numbers in the inventory in Attachment 3 correspond to the tree numbers on the existing conditions map in Attachment 1 and proposed site plan in Attachment 2. The trees were also tagged with their corresponding numbers in the field.

Tree Removal and Retention

A typical minimum recommended root protection zone is to limit construction disturbances to no closer than a radius from a tree of 0.5 feet per inch of DBH if no more than 25 percent of the root protection zone area (estimated at one foot radius per inch of DBH) is impacted. Figure 1 illustrates this concept. This tree protection zone is widely accepted in western Oregon to provide adequate tree protection. This standard may need to be adjusted on a case-by-case basis due to tree health, species, root distribution, whether the tree will be impacted on multiple sides, and other factors.

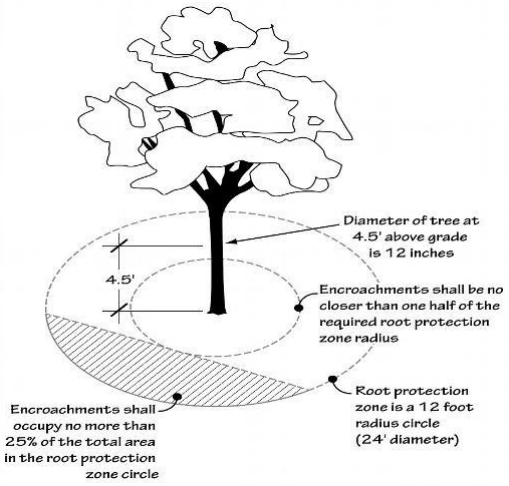


Figure 1: Typical minimum protection zone

Trees 20 and 27 are slightly closer to construction impacts than the typical minimum construction setback illustrated in Figure 1. These trees will be protected with project arborist oversight during construction as further described in the tree protection recommendations section of this report. They will be evaluated in the field during construction with a final recommendation for preservation or removal by the project arborist. If a tree is recommended for removal, coordination and approval from the City of Cannon Beach would be required.

Based on the preliminary site plan and typical minimum root protection illustrated in Attachment 1, 14 trees over 6-inch DBH are proposed for removal and 23 trees will be retained. Of the trees recommended for retention, 12 are within the site boundaries and 11 are within the adjacent right-of-way.

Tree protection recommendations for the trees to be retained are provided in the next section of this report.

Tree Protection Recommendations

As described in the previous section of this report, a typical minimum recommended root protection zone is to limit construction disturbances to no closer than a radius from a tree of 0.5 feet per inch of DBH if no more than 25 percent of the root protection zone area (estimated at one foot radius per inch of DBH) is impacted. Figure 1 illustrates this concept. This standard may need to be adjusted on a case-by-case basis due to tree health, species, root distribution, whether the tree will be impacted on multiple sides, and other factors.

The root protection zone radii of one foot per inch of DBH and typical minimum construction setback radii of 0.5 feet per inch of DBH are shown on the existing conditions map and proposed site plan in Attachments 1 and 2 for the trees to be retained adjacent to proposed construction. The trees to be retained can be protected by placing tree protection fencing at or beyond their typical minimum protection zones wherever possible as shown in Attachments 1 and 2. No grading, excavation, stockpiling, storage, disposal, or any other construction related activity shall occur in the tree protection zones unless specifically reviewed and approved by the project arborist.

The following additional tree protection measures shall apply to the trees to be retained:

- *Tree Protection Fencing*: Tree protection fencing shall be installed in the locations shown in Attachments 1 and 2 prior to construction. If work is required in the tree protection zones, the project arborist shall be consulted to oversee the work.
- *Directional Felling*: Fell the trees to be removed away from the trees to be retained so they do not contact or otherwise damage the trunks or branches of the trees to be retained. No vehicles or heavy equipment shall be permitted within the tree protection zones during tree removal operations.
- *Periodic Risk Assessments***:** A new forest edge will be created at the site with the removal of existing trees for development. This will increase the windthrow risk of exposed trees along the new edges. I recommend that the project arborist conduct a tree risk assessment immediately following site clearing to identify trees that pose significant risks. For trees that pose significant risks, mitigation strategies for retaining them such as pruning or snag creation should be explored as recommended by the project arborist. Any recommended tree removal or snag creation will require the review and approval of the City of Cannon Beach. Risk assessments should be conducted periodically throughout construction to document whether trees are adapting to the new edge conditions and risks are mitigated appropriately with City approval.
- *Stump Removal*: Flush cut and retain stumps or carefully grind stumps of trees to be removed from within the tree protection zones. Do not pull stumps with a machine.

- *Utilities*: The utility alignments are not yet known as of the writing of this report. Utilities shall be routed outside the tree protection zones unless otherwise approved by the project arborist using techniques such as directional boring at appropriate depths or pneumatic excavation.
- *Grading*: The final grading plan is not yet known as of the writing of this report. No grading is permitted within the tree protection zones unless otherwise approved by the project arborist and the amount of grading is four inches or less. If additional grading is required within the tree protection zones, it shall be reviewed and approved with conditions by the project arborist to limit tree impacts. If significant impacts from grading will occur, additional tree removal may be required if permitted by the City of Cannon Beach.
- *Building Foundations Adjacent to Tree Protection Zones*: The project arborist shall be onsite to oversee excavation adjacent to trees 13, 19, 20, 24, 25, and 27. Any roots over 2-inches in diameter will need to be preserved or pruned with sharp pruning tools as directed by the project arborist. Trees 20 and 27 are slightly closer to construction impacts than the typical minimum construction setback illustrated in Figure 1. These trees will be evaluated in the field during construction with a final recommendation for preservation or removal by the project arborist. If a tree is recommended for removal, coordination and approval from the City of Cannon Beach would be required.
- *Compaction Management*: If needed for construction access, a 12-inch layer of wood chips over geotextile fabric shall be placed in the tree protection zones as shown in Attachments 1 and 2 to prevent excessive soil compaction from construction traffic. The project arborist will need to review and approve shifting of the fence locations and final placement of wood chips if required. The fabric and wood chips must be maintained daily to ensure the layer of protection is effective. The fabric and wood chips should be removed after construction is complete.
- *Crown Pruning Trees*: If the crowns of any trees need to be raised and/or reduced, it shall occur prior to construction. The pruning shall be conducted by an ISA certified arborist in accordance with ANSI A300 pruning standards in coordination with the project arborist. The pruning shall be the minimum necessary to achieve the required clearance for construction.
- *Erosion Control*: If erosion control is required within or directly adjacent to the tree protection fencing, straw wattles shall be used to avoid excavation.

Additional tree protection recommendations for the trees to be retained are provided in Attachment 4.

Conclusion

Based on the preliminary site plan, 14 trees over 6-inch diameter (DBH) are proposed for removal and 23 trees will be retained. Of the trees recommended for retention, 12 are within the site boundaries and 11 are within the adjacent right-of-way.

The trees to be retained will be protected by adhering to the recommendations in this report. Any change to the tree protection plan should be approved by the project arborist to ensure that the trees to be retained are adequately protected.

Please contact me if you have questions, concerns, or need any additional information.

Sincerely,

Todd Prager

Todd Prager
ASCA Registered Consulting Arborist #597
ISA Board Certified Master Arborist, WE-6723B
ISA Qualified Tree Risk Assessor
AICP, American Planning Association

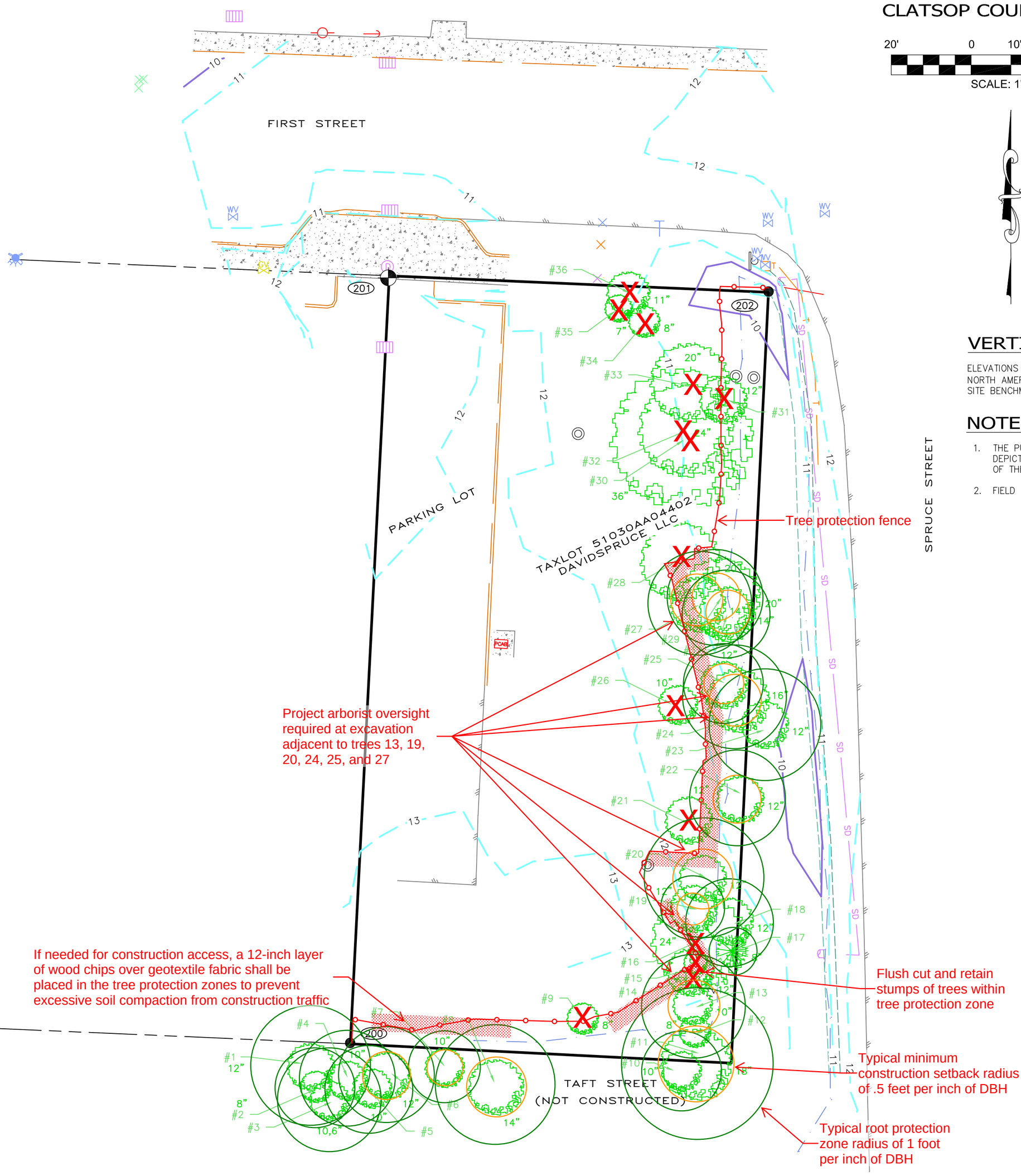
Attachments: Attachment 1 - Existing Conditions Map with Trees
Attachment 2 - Site Plan with Trees
Attachment 3 - Tree Inventory
Attachment 4 - Tree Protection Recommendations
Attachment 5 - Assumptions and Limiting Conditions

Attachment 1

TOPOGRAPHIC SURVEY

FOR RED CROW LLC
TAXLOT 51030AA04402
LOCATED IN THE NE 1/4 OF SECTION 30
TOWNSHIP 5 NORTH, RANGE 10 WEST,
OF THE WILLAMETTE MERIDIAN,
CLATSOP COUNTY, OREGON

20' 0 10' 20' 40'
SCALE: 1" = 20'



VERTICAL DATUM:

ELEVATIONS ARE BASED GPS OBSERVATIONS VIA ORGN
NORTH AMERICAN VERTICAL DATUM 1988 (NAVD88)
SITE BENCHMARKS AT MONUMENTS (201)

NOTES:

1. THE PURPOSE OF THIS SURVEY IS TO GRAPHICALLY DEPICT THE EXISTING CONDITIONS AND IMPROVEMENTS OF THE SUBJECT PROPERTY
2. FIELD WORK WAS COMPLETED IN JUNE, 2022

LEGEND:

- RIGHT OF WAY
- BOUNDARY LINE
- MAJOR CONTOUR
- MINOR CONTOUR
- EDGE OF PAVEMENT
- EDGE OF CONCRETE
- FLOW LINE CURB
- STANDARD CURB
- TELEPHONE
- STORM SEWER
- WETLAND AREA
- CONCRETE HATCH

- MONUMENT NUMBER
- FOUND MONUMENT – SEE MONUMENT NOTES
- TEST PIT / BOREHOLE
- SIGN
- POWER POLE
- GUY ANCHOR
- SANITARY SEWER MANHOLE
- STORM CATCH BASIN
- STORM MANHOLE
- STORM CULVERT
- FIRE HYDRANT

- WATER VALVE
- GAS VALVE
- TELEPHONE RISER
- POWER CABINET
- TELEPHONE CABINET
- TREE – DECIDUOUS
- TREE – CONIFER

MONUMENT NOTES:

(200) FOUND 5/8" IRON ROD WITH YELLOW PLASTIC CAP MARKED "HLB & ASSOC. INC." ±FLUSH WITH GROUND

(201) FOUND TACK IN SIDEWALK ±FLUSH WITH SIDEWALK
HELD AS SITE BENCHMARK WITH AN ELEVATION OF 11.94'

(202) FOUND RUSTY 1/2" IRON PIPE IN DITCH

S&F Land Services
PORTLAND, VANCOUVER, BEND, SEASIDE
1725 N ROOSEVELT DR,
STE B, SEASIDE, OR 97138
(503) 738-3425
WWW.SFLANDS.COM
EMAIL: INFO@SFLANDS.COM

DATE	JOB NO.	FIELD	DRAWN	CHECKED
JUNE 8, 2022	22G51302	JPW	JET	JPW

22G51302_TREE.dwg

SURVEY FOR:
RED CROW LLC

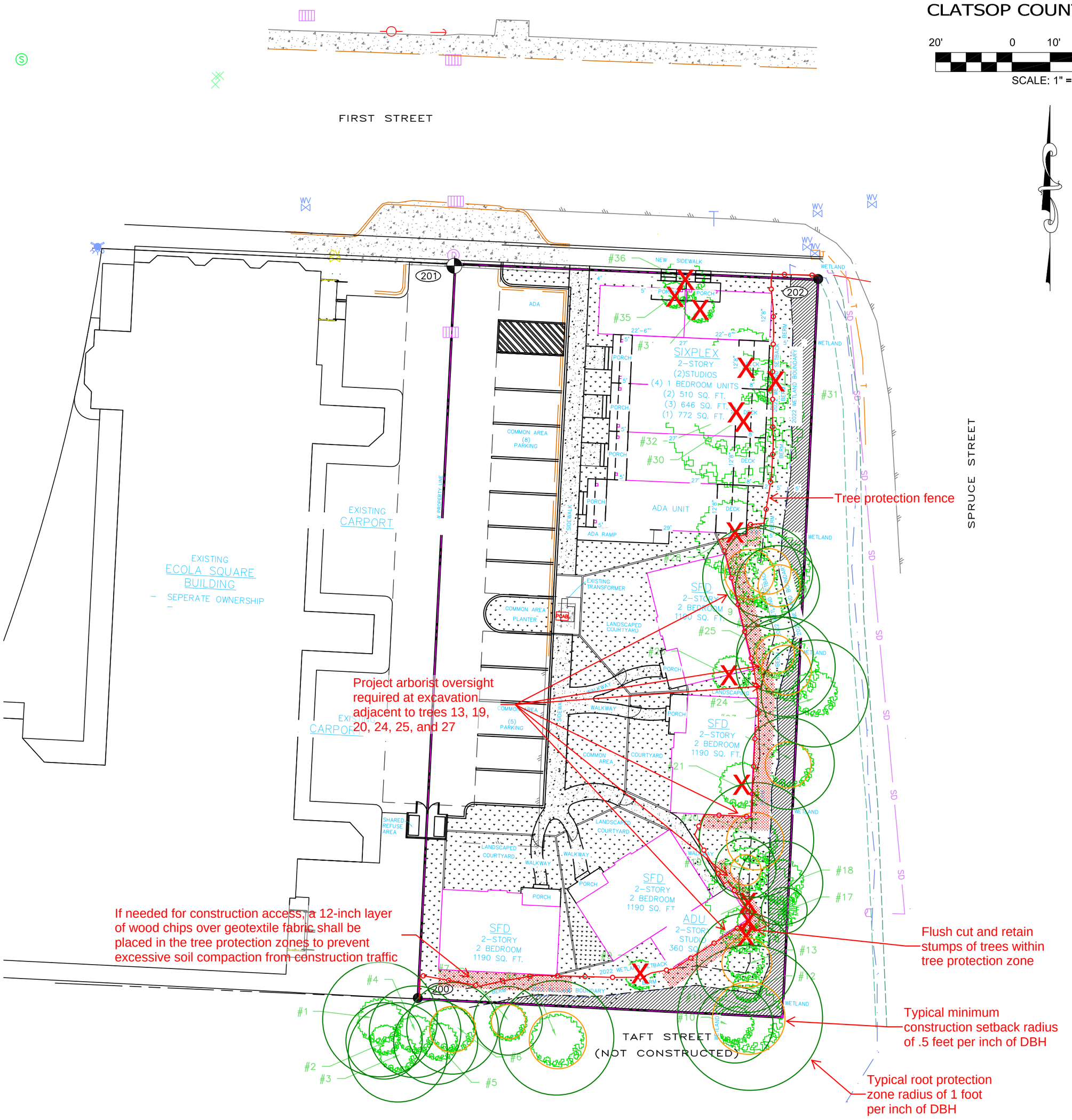
TAXLOT
51030AA04402
NE 1/4 OF SEC 30
T5N, R10W, W.M.
CLATSOP COUNTY

Attachment 2

SITE MAP EXHIBIT

FOR RED CROW LLC
TAXLOT 51030AA04402
LOCATED IN THE NE 1/4 OF SECTION 30
TOWNSHIP 5 NORTH, RANGE 10 WEST,
OF THE WILLAMETTE MERIDIAN,
CLATSOP COUNTY, OREGON

20' 0 10' 20' 40'
SCALE: 1" = 20'



LEGEND:

- RIGHT OF WAY
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- MONUMENT NUMBER
- FOUND MONUMENT – SEE MONUMENT NOTES
- TEST PIT / BOREHOLE
- SIGN
- POWER POLE
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- SANITARY SEWER MANHOLE
- STORM CATCH BASIN
- STORM MANHOLE
- STORM CULVERT
- FIRE HYDRANT

- WATER VALVE
- GAS VALVE
- TELEPHONE RISER
- POWER CABINET
- TELEPHONE CABINET
- TREE – DECIDUOUS
- TREE – CONIFER

MONUMENT NOTES:

(200) FOUND 5/8" IRON ROD WITH YELLOW PLASTIC CAP MARKED "HLB & ASSOC. INC." ±FLUSH WITH GROUND

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EMAIL: INFO@SFLANDS.COM

DATE	JOB NO.	FIELD	DRAWN	CHECKED
JUNE 8, 2022	22G51302	JPW	JET	JPW

22G51302_SITE.dwg

SURVEY FOR:
RED CROW LLC

TAXLOT
51030AA04402
NE 1/4 OF SEC 30
T5N, R10W, W.M.
CLATSOP COUNTY

Todd Prager & Associates LLC

Attachment 3 - Tree Inventory

Attachment 3

Tree No.	Common Name	Scientific Name	DBH[1]	Single DBH[2]	C-Rad[3]	Condition[4]	Structure	Comments	Treatment
1	red alder	*Alnus rubra*	15	15	20	good	fair	one sided	retain
2	red alder	*Alnus rubra*	10	10	10	fair	poor	poor trunk taper, 10% live crown ratio, one sided	retain
3	red alder	*Alnus rubra*	11,7	13	15	fair	fair	codominant at ground level, leans south	retain
4	red alder	*Alnus rubra*	12	12	20	good	fair	one sided	retain
5	red alder	*Alnus rubra*	11	11	10	good	fair	one sided, leans south	retain
6	red alder	*Alnus rubra*	12	12	20	good	fair	one sided	retain
7	red alder	*Alnus rubra*	9	9	12	good	fair	east-west crown extension suppressed by adjacent trees	retain
8	red alder	*Alnus rubra*	15	15	20	good	good		retain
9	Hookers willow	*Salix hookeriana*	7,6	9	19	good	fair	codominant at ground level, extreme lean northwest	remove
10	red alder	*Alnus rubra*	10	10	15	good	fair	one sided	retain
11	red alder	*Alnus rubra*	19	19	20	good	fair	codominant at 10'	retain
12	red alder	*Alnus rubra*	9,7	11	10	good	fair	codominant at 2'	retain
13	red alder	*Alnus rubra*	11,9	13	15	good	fair	codominant at 1' with included bark	retain
14	red alder	*Alnus rubra*	12,12	16	25	good	fair	codominant at 1'	remove
15	red alder	*Alnus rubra*	6	6	0	very poor	very poor	dead	remove
16	Scoulers willow	*Salix scouleriana*	20,17,12	28	30	poor	poor	three stems at 1', 20" stem failed, extensive decay	remove
17	Sitka spruce	*Picea sitchensis*	6	6	10	good	good		retain
18	red alder	*Alnus rubra*	10,5	11	15	fair	fair	one sided, leans toward street, codominant at 1'	retain
19	red alder	*Alnus rubra*	8	8	5	fair	poor	poor trunk taper, 10% live crown ratio	retain
20	red alder	*Alnus rubra*	11,11	15	15	fair	fair	codominant at ground level, south trunk with decay seam and lean toward street	retain
21	red alder	*Alnus rubra*	12,12,12,9	22	25	good	fair	multiple leaders at ground level, ivy along trunk	remove
22	red alder	*Alnus rubra*	10,6,3	12	12	good	fair	multiple leaders at ground level, leans toward street	retain
23	Scoulers willow	*Salix scouleriana*	9,9,5,4	14	20	fair	poor	partially failed into wetland, multiple leaders at lower trunk	retain
24	Hookers willow	*Salix hookeriana*	13	13	20	fair	fair	failed into wetland	retain
25	red alder	*Alnus rubra*	10	10	10	good	fair	significant lean west	remove

Todd Prager & Associates LLC

Attachment 3 - Tree Inventory

Attachment 3

Tree No.	Common Name	Scientific Name	DBH[1]	Single DBH[2]	C-Rad[3]	Condition[4]	Structure	Comments	Treatment
26	Hookers willow	*Salix scouleriana*	6	6	6	fair	poor	fallen over	retain
27	Pacific willow	*Salix lucida*	11,6,5	13	15	fair	poor	fallen over	retain
28	Scoulers willow	*Salix scouleriana*	6	6	7	poor	poor	fallen over, covered with ivy	remove
29	Scoulers willow	*Salix scouleriana*	8,7,5,4	12	12	poor	poor	fallen over	retain
30	Hookers willow	*Salix hookeriana*	9,7,4	12	15	poor	poor	fallen over	remove
31	Hookers willow	*Salix hookeriana*	7,6	9	8	poor	poor	partially failed, top dieback	remove
32	Hookers willow	*Salix hookeriana*	10,10,7	15	12	poor	poor	fallen over, extensive ivy	remove
33	Hookers willow	*Salix hookeriana*	7	7	7	poor	poor	fallen over	remove
34	Hookers willow	*Salix hookeriana*	6,3	6,3	12	fair	fair	extreme lean towards site	remove
35	red alder	*Alnus rubra*	6	6	6	good	good		remove
36	red alder	*Alnus rubra*	10	10	12	good	fair	codominant at 5' with included bark	remove
37	Pacific willow	*Salix lucida*	11	11	10	good	fair	one sided, significant epicormic growth	retain

[1]**DBH** is the trunk diameter in inches measured per International Society of Arboriculture (ISA) standards.

[2]**Single** DBH is the trunk diameter of a multi-stem tree converted to a single number according to the following formula: square root of the sum of the squared diameter of each trunk at 4½ feet above mean ground level.

[3]**C-Rad** is the approximate crown radius in feet.

[4]**Condition and Structure** ratings range from very poor, poor, fair, to good.

Attachment 4
Additional Tree Protection Recommendations

The following recommendations are consistent with City of Cannon Beach Code requirements:

Before Construction Begins

1. Notify all contractors of tree protection procedures. For successful tree protection on a construction site, all contractors must know and understand the goals of tree protection.
    a. Hold a tree protection meeting with all contractors to explain the goals of tree protection.
    b. Have all contractors sign memoranda of understanding regarding the goals of tree protection. The memoranda should include a penalty for violating the tree protection plan. The penalty should equal the resulting fines issued by the local jurisdiction plus the appraised value of the tree(s) within the violated tree protection zone per the current Trunk Formula Method as outlined in the current edition of the ***Guide for Plant Appraisal*** by the Council of Tree & Landscape Appraisers. The penalty should be paid to the owner of the property.
2. Fencing
    a. Trees to remain on site will be protected by installation of tree protection fencing as shown in Attachment 1.
    b. Unless otherwise noted, the fencing should be put in place before the ground is cleared to protect the trees and the soil around the trees from disturbances.
    c. Fencing should be established by the project arborist based on the needs of the trees to be protected and to facilitate construction.
    d. Fencing should consist of 6-foot-high steel fencing on concrete blocks or 6-foot metal fencing secured to the ground with 8-foot metal posts to prevent it from being moved by contractors, sagging, or falling down.
    e. Fencing should remain in the position that is established by the project arborist and not be moved without approval from the project arborist.
3. Signage
    a. All tree protection fencing should have signage as follows so that all contractors understand the purpose of the fencing:

> **TREE PROTECTION ZONE**
>
> **DO NOT REMOVE OR ADJUST THE LOCATION OF THIS TREE PROTECTION FENCING**
> **UNAUTHORIZED ENCROACHMENT MAY RESULT IN FINES**
>
> Please contact the project arborist if alterations to the location of the tree protection fencing are necessary.
>
> Todd Prager, Project Arborist, Todd Prager & Associates, 971-295-4835

    b. Signage should be placed every 75-feet or less.

During Construction

1. Protection Guidelines Within the Tree Protection Zones:
    a. No new buildings; grade change or cut and fill, during or after construction; new impervious surfaces; or utility or drainage field placement should be allowed within the tree protection zones.
    b. No traffic should be allowed within the tree protection zones. This includes but is not limited to vehicle, heavy equipment, or even repeated foot traffic.
    c. No storage of materials including but not limiting to soil, construction material, or waste from the site should be permitted within the tree protection zones. Waste includes but is not limited to concrete wash out, gasoline, diesel, paint, cleaner, thinners, etc.
    d. Construction trailers should not to be parked/placed within the tree protection zones.
    e. No vehicles should be allowed to park within the tree protection zones.
    f. No other activities should be allowed that will cause soil compaction within the tree protection zones.
2. The trees should be protected from any cutting, skinning or breaking of branches, trunks or woody roots.
3. The project arborist should be notified prior to the cutting of woody roots from trees that are to be retained to evaluate and oversee the proper cutting of roots with sharp cutting tools. Cut roots should be immediately covered with soil or mulch to prevent them from drying out.
4. Trees that have woody roots cut should be provided supplemental water during the summer months.
5. Any necessary passage of utilities through the tree protection zones should be by means of tunneling under woody roots by hand digging or boring with oversight by the project arborist.
6. Any deviation from the recommendations in this section should receive prior approval from the project arborist.

After Construction

1. Carefully landscape the areas within the tree protection zones. Do not allow trenching for irrigation or other utilities within the tree protection zones.
2. Carefully plant new plants within the tree protection zones. Avoid cutting the woody roots of trees that are retained.
3. Do not install permanent irrigation within the tree protection zones unless it is drip irrigation to support a specific planting or the irrigation is approved by the project arborist.
4. Provide adequate drainage within the tree protection zones and do not alter soil hydrology significantly from existing conditions for the trees to be retained.
5. Provide for the ongoing inspection and treatment of insect and disease populations that can damage the retained trees and plants.
6. The retained trees may need to be fertilized if recommended by the project arborist.
7. Any deviation from the recommendations in this section should receive prior approval from the project arborist.

Attachment 5
Assumptions and Limiting Conditions

1. Any legal description provided to the consultant is assumed to be correct. The site plans and other information provided by Red Crow, LLC and their consultants was the basis of the information provided in this report.
2. It is assumed that this property is not in violation of any codes, statutes, ordinances, or other governmental regulations.
3. The consultant is not responsible for information gathered from others involved in various activities pertaining to this project. Care has been taken to obtain information from reliable sources.
4. Loss or alteration of any part of this delivered report invalidates the entire report.
5. Drawings and information contained in this report may not be to scale and are intended to be used as display points of reference only.
6. The consultant's role is only to make recommendations. Inaction on the part of those receiving the report is not the responsibility of the consultant.
7. The purpose of this report is to:
   - Provide an assessment and tag all trees over 6-inch DBH within and directly adjacent to the development site; and
   - Provide recommendations for the trees to be removed based on the proposed site plan along with protection recommendations for the trees to be retained.