AFN #2014000907 Recorded 06/09/2014 at 11:16 AM DocType: CRITICAL Filed by:
Terry Steeves Page: 1 of 46 Auditor Timothy O. Todd Skamania County, WA

Return To:
Terry Steeves + Ron Richards
1202 Woodard Ck. RD
Skamania WA 98648

**LANDSLIDE HAZARD AREA NOTICE**

Grantor: Terry Steeves + Ron Richards
Grantee: The Public
Tax Parcel #: 2900 Account # 03073614290000
Legal Description: N ½ of Section 43, T03N, R07E, W.M.

**NOTICE:** This site lies within a landslide hazard area. Restrictions on use or alteration of the site may exist. For more information contact the City of Stevenson Planning Department.

LEGAL DESCRIPTION

A portion of Lot 1 of STEVENSON PARK ADDITION, according to the recorded plat thereof, recorded in Book A of Plats, Page 38, in the County of Skamania, State of Washington, described as follows:

Beginning at the Southwesterly corner of said Lot 1; thence following the Westerly line of the said Lot 1 Northwesterly a distance of 170 feet to the initial point of the tract hereby described; thence at a right angle in a Northeasterly direction to the intersection with the center of Kanaka Creek; thence following the center of Kanaka Creek in a Northwesterly direction to a point 150 feet South of the North line of the said Lot 1; thence West to the Westerly line of said Lot 1; thence in a Southeasterly direction following the Westerly line of the said Lot 1 to the initial point.

EXECPT that portion conveyed to Richard Graham, et. Ux., by instrument recorded in Book 36, Page 226.

Skamania County Assessor
Date 8/16/13 Parcel# 3-7-36-1-4-2900-00

Earth Engineers, Inc.

312 SE Stonemill Drive, Suite 115 • Vancouver • WA 98684
Phone: 360-567-1806 • Fax: 360-253-8624
www.earth-engineers.com



August 9, 2013

Ron Richards and Terry Steeves
1202 Woodard Creek Road
Skamania, Washington 98648

Phone: (509) 427-5415
E-mail: terryjsteeves@gmail.com

**Subject:** **Geotechnical Investigation Report**
**Proposed Single Family Residence on Kanaka Creek Road**
**Tax Lot 2900 NE 1/4 of SE 1/4 Section 36, T3N, R7E, Willamette Meridian**
**Stevenson, Washington**
**EEI Report No. 13-079-1**

Dear Mr. Richards and Ms. Steeves:

Per your request, **Earth Engineers, Inc. (EEI)** has completed a geotechnical investigation report for the proposed home to be located at the site referenced above. You authorized our services on July 12, 2013 by signing EEI Proposal No. 13-P1237 issued on July 5, 2013.

## PROJECT UNDERSTANDING AND BACKGROUND

Our current understanding of the project is based on a site visit and discussion between Mr. Ron Richards and Mr. Warren Krager, R.G., C.E.G. as well as Mr. Travis Willis, P.E. with our office on July 11, 2013 and July 26, 2013. In addition, we have been provided with the following geologic hazard and plan review reports prepared by Mr. Krager while he was employed by Chinook Geoservices, Inc. (CGI):

- Engineering Geologic Hazard Reconnaissance and Limited Geologic Assessment Report, Proposed Single Family Residence on Kanaka Creek Road, dated October 21, 2011, prepared by CGI.

- Engineering Geologic Plan Review, Proposed Single Family Residence on Kanaka Creek Road, dated August 16, 2012, prepared by CGI.

The report and plan review by CGI pertain to the City of Stevenson's required evaluation of geologic hazards with respect to siting a single family residence on the subject property. For reference, these reports are included in Appendix E at the back of this report.

The reports by CGI identified an area of possible manmade fill near the proposed building site that could negatively affect foundation support for the proposed home. We understand that you have reoriented the proposed home from the site plan layout considered in the August 16, 2012 CGI plan review and have contacted EEI to provide geotechnical engineering services for design of the home in its new orientation.

At this time we have not seen a revised site plan or grading plan for the proposed development. However, we have discussed your revised home site layout with reference to the south and west property boundaries.

## SCOPE OF SERVICES

The purpose of our services was to perform a geotechnical engineering evaluation of the existing subsurface conditions in the area of the proposed home. Our site investigation consisted of a geologic and geotechnical site reconnaissance of the general area for the proposed home. It also included observation of one test pit near the approximate northeast corner of the proposed home, excavated by a track mounted hydraulic excavator provided by you. We also evaluated the presumed native soil exposed in a cut slope on the west side of the proposed building area.

A soil sample from the test pit was tested in the laboratory to determine the material properties for our geotechnical evaluation. Laboratory testing was accomplished generally in accordance with ASTM procedures. Testing included a moisture content test (ASTM D2216) and a fines content determination (ASTM D1140). The results of the laboratory tests were used to classify the intended foundation bearing soils in accordance with the Unified Soil Classification System (USCS) (ASTM D2487).

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

- A discussion of subsurface conditions encountered including pertinent soil and rock properties and groundwater conditions.
- Geotechnical related recommendations for foundation design including allowable bearing capacity, minimum footing dimensions and estimated settlement.
- Retaining wall design parameters.
- Recommendations for the overall suitability of the on-site soils for use as utility backfill and structural fill.
- Discussions on geotechnical issues that may impact the project including a qualitative evaluation of slope stability.

Our scope did not include an environmental assessment for determining the presence or absence of wetlands or hazardous or toxic materials in the soil, bedrock, surface water, groundwater, or air on or below, or around this site. Any statements in this report or on the

exploration logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes. Our scope also did not include deep soil borings, detailed slope stability modeling, or a stability evaluation of any of the existing driveway grading previously conducted on the property.

## SITE AND PROJECT DESCRIPTION

The subject parcel is an undeveloped residential tax lot within the city limits of Stevenson, Washington. The property is about 400 feet to 500 feet in length north to south and about 100 feet to 150 feet in width. The lot lies on the east side of Kanaka Creek Road, south of its intersection with School Street. Kanaka Creek forms the eastern boundary of the lot. The eastern side of the proposed home site is situated at the crest of the descending western slope of the creek gulch. General slope gradients down slope to the east of the home site range from about 20 to 60 percent as estimated in the field. The general site location is shown in Appendix A at the back of this report.

Appendix B shows the subject tax parcel with the approximate location of the proposed home as well as the approximate test pit location. It is our understanding that the proposed single story home will be constructed in a level, partially excavated area near the south end of the lot. The home will be about 56 feet in length oriented north-south and about 26 to 28 feet in width oriented east-west. The driveway to the proposed home will enter the property at about its mid-point and the driveway will run about 200 feet to the southeast, parallel to Kanaka Creek Road. A pressure septic system will likely be used to pump septic effluent to a mildly sloped portion of the property at higher elevations than the home site. Some prior grading, likely in multiple episodes, has occurred in the area of the proposed home and driveway. The home appears to be mostly in a cut area, with some fill near the proposed northeast and southeast building corners.

The fill near the southeast corner of the home site consists of a steep sided, grass covered mound of recently placed fill at the crest of the descending slope into the creek ravine. We understand that you or your excavation contractor directed placement of this mound of fill, intending to use it for backfill of footings and as a privacy screen. During our July 11, 2013 site meeting with you, EEI expressed concern for the weight of the fill at the crest of the ravine slope potentially initiating a slope failure. At that time we recommended removing the mound of the fill from the crest of the ravine slope.

The manmade fill near the northeast building corner generally is present in what we interpret as the head of a lateral draw in the ravine slope or creek gulch. Silt fencing had been installed across the fill near the northeast building corner. Additionally, the fill appears to be creeping laterally down the slope as evidenced by several tension cracks that run parallel to the top of the slope, which have formed within the fill soils. During our July 11, 2013 site meeting with you, EEI recommended that because this fill appears to encroach into the northeast portion of the proposed building area, a subsurface exploration should be conducted in this area to characterize the fill and native soil. At that time we agreed that you would arrange to hire an excavator to remove the mound of fill from the ravine slope crest and we would coordinate a

future site visit by an EEI Geotechnical Engineer to observe a test pit in the suspected fill area in the northeast corner of the proposed building area.

**Photo 1:** View to north along approximate eastern footing line of proposed home. Mound of fill in the right foreground and brush covered fill near northeast corner are described in the report text above. Stakes circled in red represent the northeast and southeast corners of the proposed home.

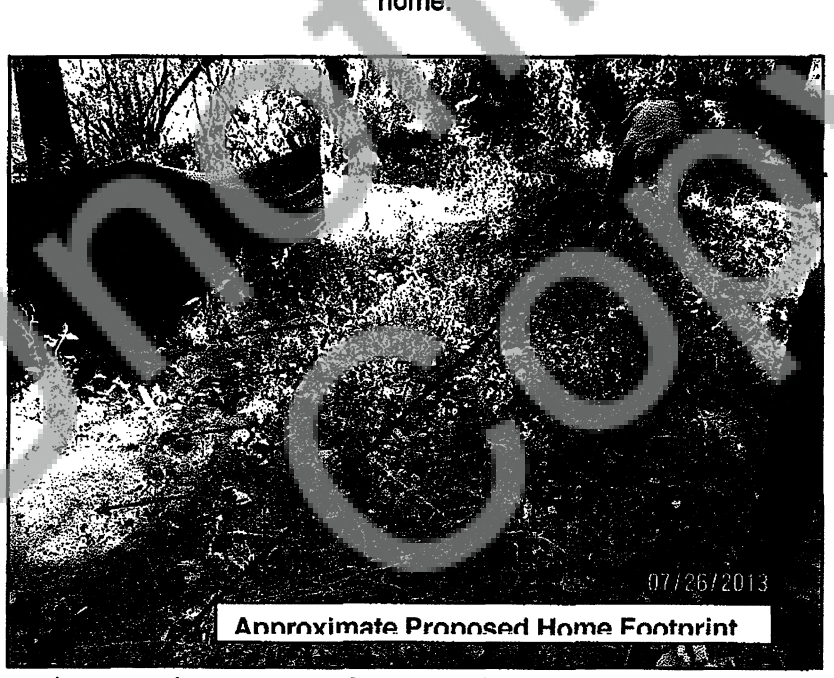



**Photo 2:** Approximate northeast corner of proposed home as observed on July 26, 2013. The hashed red line indicates the fill mass that has slowly settled and crept laterally down the slope.

**Photo 3:** Western side of proposed home will have retaining/foundation wall; this is the existing 4 to 5 foot high cut slope of firm undisturbed native soil.

## MAPPED SOILS AND GEOLOGY

According to the USDA Soil Survey of the Skamania County Area, Washington, soils at the subject property are mapped as Stevenson loam, at 20 percent to 30 percent slopes. The Stevenson loam soil consists of deep, well-drained soil on toe slopes, foot slopes and back slopes of mountains. This soil formed in colluvial landslide and debris flow material derived from basalt, andesite and conglomerate. The USDA describes the Stevenson loam as having a surficial soil layer of slightly sticky clayey soil with moderate to high plasticity. The soil classification of the top 3 feet of soil is CL, or low plasticity clay. With increasing depth, the Stevenson loam becomes less plastic and more granular, with classification grading from ML, low plasticity silt, to GC-GM, clayey gravel to silty gravel.

The local geology of the Stevenson, Washington area is dominated by ancient, active and inactive landslide deposits within a high-relief volcanic and volcaniclastic terrain. The Eagle Creek Formation of lower Miocene age (18 million to 23 million years ago) is mapped in the project area. The Eagle Creek Formation was deposited in a fluvial and alluvial fan environment draining steep active volcanic terrain and consists of a varied sequence of debris flow deposits of conglomerate, breccia, sandstone, siltstone and volcanic tuff. It is our interpretation that the Stevenson loam soils formed on the weathered to decomposed surface of the Eagle Creek Formation.

Kanaka Creek landslide debris flow runout deposits are mapped in the Kanaka Creek ravine on the subject property. These landslide deposits are generally attributable to slope failure of Eagle Creek Formation by undercutting and erosion from the latest Missoula Flood that swept through the Columbia River gorge as recently as 13,500 years ago. The landslide and debris flow deposits include reworked material from the Eagle Creek Formation and Colombia River Basalt.

On this property, it is our interpretation that course cobbles and boulders in the lower elevations of the creek ravine are remnants of the Kanaka Creek landslide debris flows which funneled through the Kanaka Creek drainage.

## SUBSURFACE SOILS

As noted above, subsurface conditions in the area of suspected fill near the northeast building corner were explored using a track mounted excavator subcontracted by Mr. Ron Richards on July 26, 2013. The test pit was excavated near the northeastern corner of the proposed home as shown approximately in Appendix B and in the site photographs below. The test pit was advanced under the direction and observation of EEI representatives Warren Krager and Travis Willis, as well as Mr. Richards.


**Photo 4:** View to north of test pit TP-1 along eastern footing line. Note gray bucket in upper part of photograph is near proposed northeast building corner. Previous and current ground cracks (shown above) suggest that manmade fill is settling or sliding to east.

We observed a layer of loose, dark gray to brown, organic silt with sand fill to a depth of between about 3.5 feet and 5 feet in depth in TP-1. The thicker fill was observed in the eastern end of test pit toward the creek ravine, while the shallower depth was discovered within the east footing line for the home. The fill contained loose, mixed topsoil, clay, clayey silt and gravel soil as well as a large quantity of buried wood debris. Based on the loose condition and the observed organic content, the fill was determined to be unsuitable for foundation support of the proposed home.


**Photo 5:** Test pit TP-1 encountered manmade organic fill and organic topsoil to about a depth of 5 feet near northeast corner of proposed footing line.

At the base of the fill we observed what we interpret as a remnant or disturbed layer of organic topsoil. This layer was somewhat indistinct but had composition similar in character to the overlying organic fill. The combined thickness of the organic fill and remnant organic topsoil is estimated at about 4 feet to 4.5 feet under the home's eastern side. This layer, exposed in profile in the side wall of the test pit, had an eastward descending slope of about 30 degrees which is slightly steeper than a 2H:1V (Horizontal:Vertical). We interpret this slope as the approximate natural slope of the head of the lateral draw above Kanaka Creek. This sloping topsoil surface had organic fill placed or pushed over it. The poor quality of the fill and this incline on which it was placed largely accounts for the previous observed scarp described by CGI and the open tension crack observed more recently by EEI.

Together the sloping topsoil and overlying organic fill appear to underlie an approximately 10 to 15 foot wide swath focused at or near the northeast corner of the home. The organic fill soil does not appear to extend horizontally more than about 10 feet under the eastern side of the proposed home foot point.

Under the fill and topsoil we observed a brown, moist, medium dense, silty sand with gravel. This layer extended to the bottom of the test pit at about 9 feet below existing surface grade. We interpret this layer as native soil generally consistent with the deeper non-plastic to granular layer of Stevenson loam soil described by the USDA. This soil exhibited unconfined compressive strengths (estimated with a pocket penetrometer) of 1.75 to 2.25 tons per square foot (tsf) on fresh excavated moist surfaces in the test pit side wall. An unconfined compressive strength of 4 tsf was measured on a freshly hand trimmed surface exposed in the existing cut slope on the west side of the building area. In the cut slope, soil had become desiccated and

sand and decomposed gravel clasts could be observed in matrix of fine-grained soil. A sample from a depth of 5 to 6 feet in test pit TP-1 indicated 29 percent fines content, indicating a Silty Sand with some Gravel (SM) in accordance with the USCS. Given the material was predominately sand, the pocket penetrometer results have been provided as data only and may not accurately depict the actual soil strength. The only measured natural moisture content of this stratum was 38 percent. The samples that were not altered by laboratory testing will be retained for 60 days from the date of this report and then will be discarded.

It should be noted that due to the debris flow genesis of the Stevenson loam soil, physical properties of the soil may vary widely over short distances. The above subsurface description is of a generalized nature to highlight the major subsurface stratification features and material characteristics. The exploration log included in the Appendix should be reviewed for specific information at specific locations. These records include soil and rock descriptions, stratifications, and locations of the samples. The stratifications shown on the logs represent the conditions only at the actual exploration location. Variations may occur and should be expected. The stratifications represent the approximate boundary between subsurface materials and the actual transition may be gradual. The fill extent at the location of TP-1 was estimated based on an examination of the soil samples, the presence of foreign materials, and the subsurface data. However, we note that test pits alone are not adequate to accurately identify the extent of existing fill. Consequently, the actual fill extent may vary from that shown on the test pit log and discussed herein. 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 60 days from the date of this report and then will be discarded.

**GROUNDWATER**

Groundwater was not encountered in Test Pit, TP-1 or the previous subsurface explorations by CGI. Following our subsurface exploration, EEI representatives descended the sloping lateral draw on foot past the toe of the organic fill to the level of Kanaka Creek. At a few feet above the creek level we observed a natural exposure of Eagle Creek Formation (Stevenson loam), estimated at 20 to 25 feet lower in elevation than the building site. In this exposure the material was firm to very dense, gray in color and exhibited seepage from a fresh hand trimmed surface. We interpret the seepage indicative of a groundwater level on the order to about 20 feet below the building elevation and about 5 feet above the summer level of the creek.

Although groundwater was not encountered in the subsurface investigation, it is possible for a groundwater table and/or perched groundwater to be present within the depths explored at some future time depending upon climatic and rainfall conditions. Design of foundations and retaining walls should consider potential for shallow groundwater.

## GEOTECHNICAL DISCUSSION

The primary geotechnical concern affecting the planned residential construction is the organic manmade fill that appears to underlie the northeastern quadrant of the proposed building area. We also have concern for long term slope stability of the fills place on the crest of the ravine slope, having observed previous signs of slope failure in the form of a vertically offset scarp and tension cracks. These concerns exist for both the eastern margin of the driveway and the home. However, from our on-site discussion of the existing driveway grading, we understand that you accept responsibility for performance of the driveway grading and that you acknowledge that future slope instability may occur in existing graded areas near the crest of the Kanaka Creek ravine slope.

Our focus in this geotechnical report is to provide design and construction recommendations for the home to mitigate potential adverse effects from fill settlement or local slope movement due to the presence of the fill.

It should be noted that EEI cannot completely rule out the risk of the deep seated pre-historic (or portions of) landslide mass reactivating in the future as it has occurred throughout the Stevenson area over numerous past episodes. The risk to the subject property would be similar to other properties located within the pre-historic landslide mass. This potential can increase during periods of extensive rainfall or during a seismic event. However, this risk is unpredictable and cannot be realistically quantified or mitigated within the confines of your property.

All this being said, it is our professional opinion that the proposed home can be supported on a typical shallow foundation system bearing on the native silty sand soils. We also recommend that the foundations be embedded a depth of 2 feet into the native material as measured on the downhill side of the foundation excavation. Given the depth of the native soils, we anticipate that the foundation walls along the eastern wall of the home could be 6 feet or greater in height.

## SITE PREPARATION

The organic fill, existing topsoil, and any other deleterious soils encountered during the excavation will need to be removed completely from proposed foundation areas. The depth of unsuitable fill in test pit TP-1 was approximately 4 to 4.5 feet below the excavated building pad elevation. It is possible that other unknown areas of fill may exist in structural areas. As stated above, once the fills and remnant organic soil has been removed, we recommend that the perimeter foundation subgrade on the eastern side of the proposed building be excavated a minimum of 2 feet into the native silty sand soils as measured on the eastern side of the excavation. EEI should be contacted at the time of site preparation and foundation excavation to document adequate removal of fill and embedment of foundation subgrade into firm soil below the original ground surface.

**STRUCTURAL FILL**

Structural fill materials, if needed, should be free of organic or other deleterious materials, have a maximum particle size generally less than 3 inches, be relatively well graded, and have a liquid limit less than 45 and plasticity index less than 25. In our opinion, the on-site non-organic silty sand with gravel soils may be used as structural fill, provided that it is properly moisture conditioned prior to compaction. Alternatively, clean (i.e. less than 5 percent passing #200 sieve), well-graded imported crushed rock (i.e. ¾- or 1 ½ inch minus gravel) would be suitable for use as structural fill.

We recommend the fill be moisture conditioned to within 3 percentage points below and 2 percentage points above optimum moisture and compacted to within 95 percent of materials maximum dry density as determined by ASTM D698 (Standard Proctor). If water must be added, it should be uniformly applied and thoroughly mixed into the soil by disking or scarifying. It is cautioned that moisture conditioning of the onsite silty sand with gravel for use as structural fill may be very difficult during inclement weather.

Fill should be placed in a relatively uniform horizontal lift on the approved subgrade. Each loose lift should be no greater than about 1-foot. The type of compaction equipment used will ultimately determine the maximum lift thickness. Each lift of compacted engineered fill should be tested by a representative of the Geotechnical Engineer prior to placement of subsequent lifts.

If new structural fill will be constructed on slopes steeper than 5H:1V (such as the crest of the ravine slope), EEI should be contacted in advance to the review the proposed slope fill for global slope stability. If proposed slope fills meet general stability requirements, EEI can provide further slope grading recommendations and construction documentation upon request.

**FOUNDATION RECOMMENDATIONS**

Once the site has been prepared and documented as discussed above, the home can be supported on conventional spread foundations bearing on (1) the medium dense to dense, silty sand with gravel, or (2) on properly compacted structural fill bearing on this material. **If fills are proposed to support the structure, EEI should be contacted in advance to review the fill location, material and final slope stability.** The foundations should not be founded within or atop of any non-structural fill soils. Spread footings for continuous footings for bearing walls or isolated column footings can be designed for allowable soil bearing pressure of up to 1,500 psf. The allowable soil bearing pressure above can be increased by one-third for short term wind or seismic loads. Minimum footing dimensions should be consistent with the provisions of the 2012 International Residential Code (IRC).

Exterior footings and foundations in unheated areas should be located at a depth of at least 18 inches below the final exterior grade or as required locally to provide adequate frost protection. If construction will take place during the winter months, or if the foundation soils will likely be

subjected to freezing temperatures after foundation construction, then the foundation soils should be adequately protected from freezing. Otherwise, interior foundations can be located at nominal depths compatible with architectural and structural design considerations.

Lateral frictional resistance between the base of footings and the subgrade can be expressed as the applied vertical load multiplied by a coefficient of friction of 0.30 for concrete foundations bearing directly on the encountered silty sand with some gravel (pre-historic landslide material). In addition, lateral loads may be resisted by passive earth pressures based on an equivalent fluid pressure of 250 pounds per cubic foot (pcf) for footings poured "neat" against the soils described above, or properly backfilled structural fill. These are ultimate values—we recommend a factor of safety of 1.5 be applied to the equivalent fluid pressure, which is appropriate due to the amount of movement required to develop full passive resistance.

Based on the known subsurface conditions and site geology, laboratory testing and past experience, we anticipate that properly designed and constructed foundations supported on the recommended materials should experience maximum total and differential settlements between adjacent columns on the order of one inch and ½-inch, respectively.

As discussed above, the foundation excavations should be observed by a representative EEI prior to steel or concrete placement to document that the foundation materials are capable of supporting the design loads and are consistent with the materials discussed in this report. Unsuitable soil zones encountered at the bottom of the foundation excavations should be removed to the level of suitable soils as directed by the Geotechnical Engineer. Over excavated areas resulting from removal of unsuitable soil should be backfilled with lean concrete or compacted structural fill in accordance with the recommendations above.

Once approved by EEI, reinforcement steel and concrete should be placed as quickly as possible in foundations excavations to avoid exposure of the foundation subgrade to prolonged wetting and drying. Surface run-off water should be drained away from the excavations and not be allowed to pond in or near foundation areas.

## RETAINING WALL RECOMMENDATIONS

We understand that the west wall of the proposed home will be partially embedded below the height of an existing cut slope and will be designed as a retaining/foundation wall. In addition, it should be considered that the embedded stem wall of a deepened foundation on east side of the home may be required to serve as a retaining wall for soil under the home in the likelihood that the lateral exterior backfill and organic fill will continue to settle and creep down slope. Under these anticipated conditions we recommend that retaining wall foundations be designed in general accordance with the foundation recommendations of this report.

Lateral earth pressures on walls, which are not restrained at the top, may be calculated on the basis of an 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 may be calculated on the basis of an 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.

As stated above, lateral loads may be resisted by frictional resistance between the base of the retaining wall footing and the subgrade, and can be expressed as the applied vertical load multiplied by a coefficient of friction of 0.30 for the native soils. In addition, lateral loads may be resisted by passive earth pressures based on an equivalent fluid density of 250 pcf for footings poured "neat" against in-situ soils, or properly backfilled with structural fill. These are ultimate values. We recommend a factor of safety of 1.5 be applied to the equivalent fluid pressure, which is appropriate due to the amount of movement required to develop full passive resistance.

All backfill for retaining walls should consist of relatively free draining 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. Because of the silt content, the native silty sand with gravel soil does not meet this requirement, and it will be necessary to import material to the project for structure backfill. The native silty sand soils can be used for the top 18 inches of backfill to serve as a seal to reduce surface water infiltration into the specified granular backfill.

All backfill behind retaining walls should be moisture conditioned to within ± 2 percent of optimum moisture content, and compacted to a target density of between 90 percent and 92 percent of the material's maximum dry density as determined in accordance with ASTM D698 (Standard Proctor). Fill materials should be placed in layers that, when compacted, do not exceed about 8 inches. Care must be taken not to over compact fill behind retaining walls to prevent excessive lateral loads from developing against the walls.

## STORMWATER MANAGEMENT

We are not aware of requirements or plans for storm water disposal for this project. On site storm water from roof drains, patio drains, or other drainage features should not discharge near foundations or graded slopes. We recommend that collected storm water be piped via a non-perforated pipe line to a natural drainage area or other approved storm water management system. You should consult with a locally experienced civil engineer if a specific storm water management design is required.

## LIMITATIONS

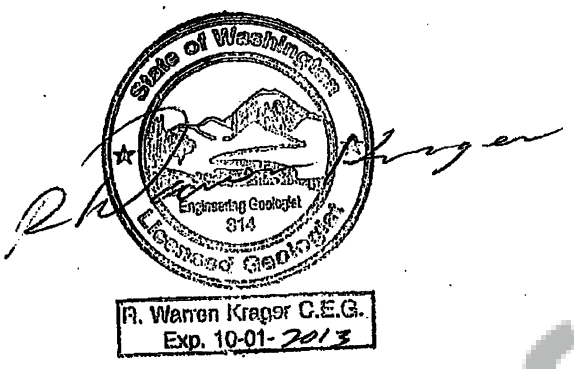
The geotechnical recommendations presented in this report are based on the available project information, building location, and the subsurface materials described in this report. If any of the noted information is incorrect, please inform EEI in writing so that we may amend the recommendations presented 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.

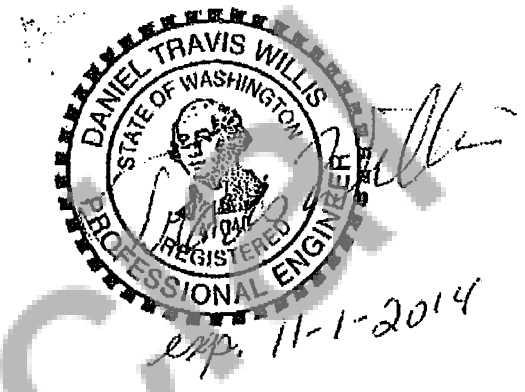
The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

This report has been prepared for the exclusive use of Ron Richards and Terry Steeves for specific application to the property and home described in this report. 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.

We appreciate the opportunity to perform this geotechnical engineering evaluation. If you have any questions pertaining to this report, or if we may be of further service, please contact our office at (360) 567-1806 or Warren Krager's cell phone at 360-903-4861

Sincerely,
**Earth Engineers, Inc.**




R. Warren Krager, R.G., C.E.G.
Senior Engineering Geologist

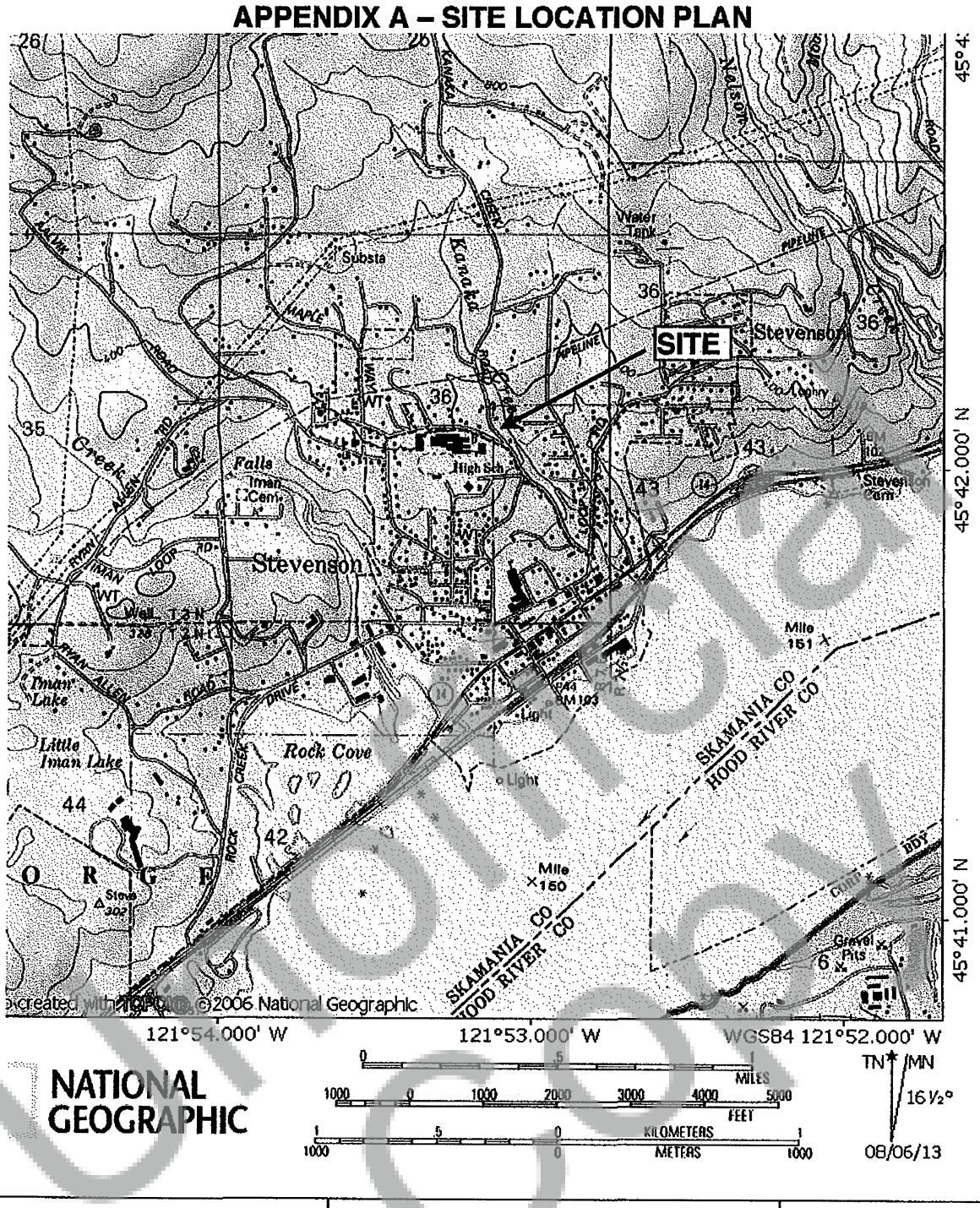
Travis Willis, P.E.
Principal Geotechnical Engineer

WK/TW:wk

Attachments: Appendix A – Exploration Log
Appendix B – Soil and Rock Classification Legends
Appendix C – Local Well Logs
Appendix D – Soil Classification Legend
Appendix E – CGI Reports

Distribution (electronic copy):
Addressee (terryjsteeves@gmail.com)
Eric Watson, P.E., Miller Consulting Engineers (Eric@miller-SE.com)

# APPENDIX A – SITE LOCATION PLAN

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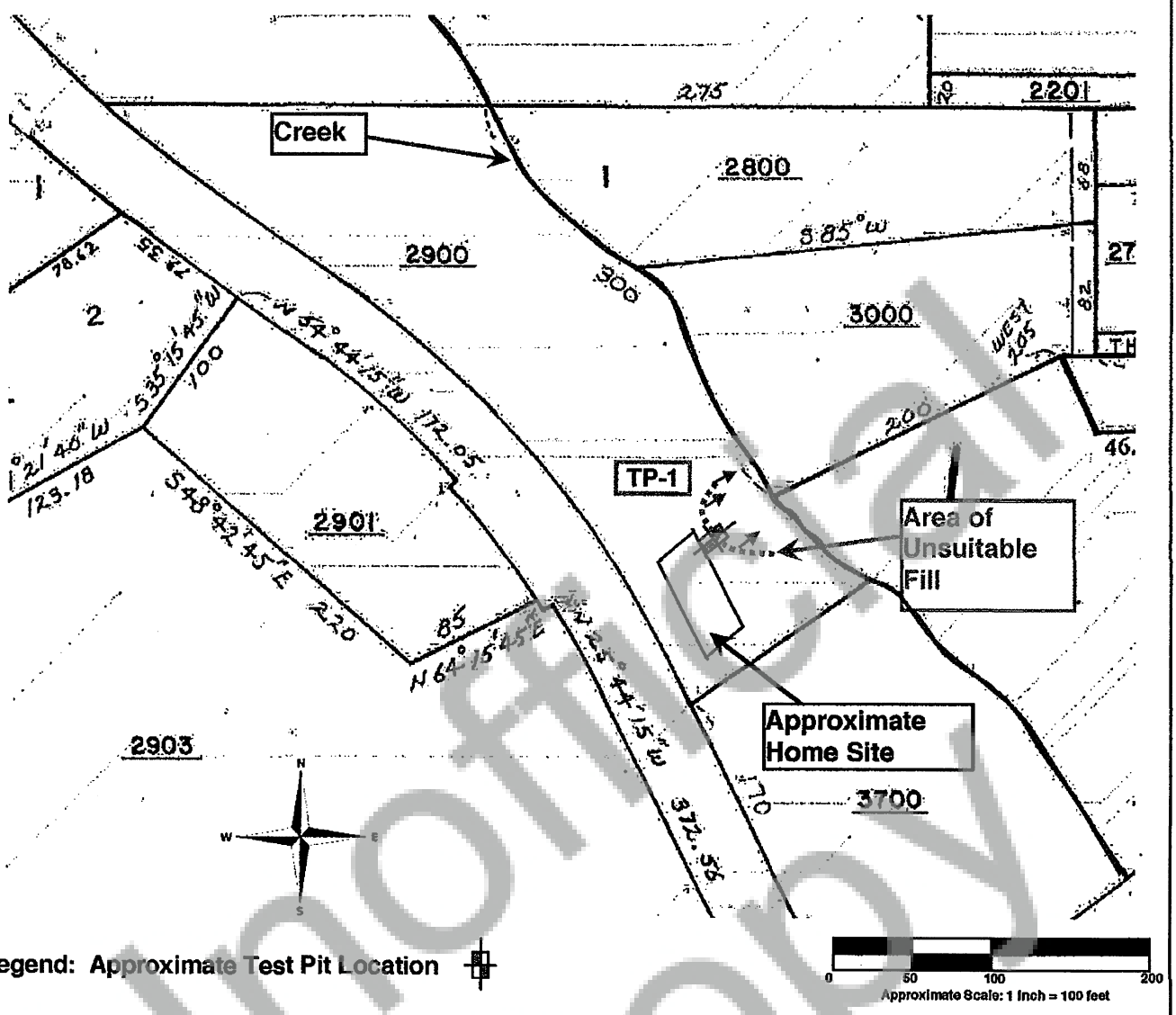
|---|---|---|
| Earth Engineers, Inc. | **Proposed Richards-Steeves Residence<br>Tax Lot 2900 Kanaka Creek Road<br>Stevenson, Washington** | **Report No.<br>13-079-1**<br><br>**August 9, 2013** |

# APPENDIX B – DETAILED SITE PLAN




**Legend:** Approximate Test Pit Location

| | | |
|---|---|---|
| Earth Engineers, Inc. | **Proposed Richards-Steeves Residence**<br>**Tax Lot 2900 Kanaka Creek Road**<br>**Stevenson, Washington** | **Report No. 13-079-1**<br>**August 9, 2013** |

# TEST PIT TP-1

| | |
|---|---|
| CLIENT: Ron Richards - Terry Steeves | EARTH ENGINEERS, INC. PROJECT NO.: 13-079 |
| PROJECT: New Single Family Residence | EQUIPMENT: Hydraulic Excavator w/ 2-foot wide toothed bucket |
| LOCATION: Tax Lot 2900 Kanaka Creek Road, Stevenson, Washington | APPROXIMATE ELEVATION: NA |
| DATE EXCAVATED: July 26, 2013 | LOGGED BY: WK, TW |

| DEPTH (ft) | SAMPLE NO. | SAMPLE | SOIL DESCRIPTION | Digging Effort | % PASSING #200 SIEVE | LIQUID LIMIT | PLASTIC LIMIT | MOISTURE CONTENT (%) | POCKET PEN. (tsf) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Loose, moist, dark gray brown silt with sand and abundant organic material, Manmade fill with buried woody debris. | Easy | | | | | | |
| 5 | | | Layer of organic topsoil | | | | | | | |
| | | | Medium brown, moist, medium dense, **Silty Sand with Gravel (SM)** | Mod. | 29 | | | 38 | | |
| | | | Soil is interpreted as native soil generally consistent with Stevenson loam mapped in local area by USDA | | | | | | | Pocket Penetrometer readings 1.5 to 1.75 tsf |
| | | | Test pit terminated at 9 feet. | | | | | | | No groundwater observed |
| 10 | | | EEI did not witness the backfilling of the excavation. | | | | | | | |



**EARTH ENGINEERS, Inc.**

Test Pit Log, TP-1

# 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<br>Fine | ¾ inch to 3 inches<br>No. 4 sieve to ¾ inch |
| Sand - Coarse<br>Medium<br>Fine | No. 10 to No. 4 sieve (4.75mm)<br>No. 40 to No. 10 sieve (2mm)<br>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 |

Earth
Engineers,
Inc.

1508 Broadway Street • Vancouver • WA 98663
Phone: 360-567-1806 • Fax: 360-253-8624
www.earth-engineers.com



January 14, 2014

Ron Richards and Terry Steeves
1202 Woodard Creek Road
Skamania, Washington 98648

Phone: (509) 427-5415
E-mail: terryjsteeves@gmail.com

**Subject:** **Revised Friction Factor**
**Proposed Single Family Residence on Kanaka Creek Road**
**Tax Lot 2900 NE 1/4 of SE 1/4 Section 36, T3N, R7E, Willamette Meridian**
**Stevenson, Washington**
**EEI Report No. 13-079-3**

Dear Mr. Richards and Ms. Steeves:

Per the request of your structural engineer (Eric Watson with Miller Engineering), **Earth Engineers, Inc. (EEI)** is issuing this letter in order to increase the friction factor used in the footing design for the proposed project. EEI has previously issued a "Geotechnical Investigation Report" for the project dated August 9, 2013; reference EEI Report No. 13-079-1.

In our previous report (13-079-1) we stated that "lateral frictional resistance between the base of footings and the subgrade can be expressed as the applied vertical load multiplied by a coefficient of friction of 0.30 for concrete foundations bearing directly on the encountered silty sand with some gravel (pre-historic landslide material)". Mr. Watson has asked us to increase this factor to a value of 0.35 for the seismic condition. We informed him that it was our professional opinion that the friction factor could be increased to 0.35 under the seismic condition.

Return To:

_____

_____

_____

**HABITAT CONSERVATION AREA NOTICE**

Grantor: _____

Grantee: The Public

Tax Parcel #: _____

Legal Description: _____

_____

_____

_____

**NOTICE:** This site contains a habitat conservation area. Restrictions on use or alteration of the site may exist. For more information contact the City of Stevenson Planning Department.

Habitat Mitigation Plan Recording #: _____

_____

# Fish and Wildlife Conservation Areas Buffer Averaging/Restoration Plan

**Kanaka Creek Road, Stevenson, Washington**

***Prepared for:***
*Ron Richards*
*1202 Woodard Creek Road*
*Stevenson, WA 98648*

***Prepared by:***
*The Resource Company, Inc.*
*915 Broadway, Ste. 250*
*Vancouver, WA 98660*
*(360) 693-4555*

*April 17, 2014*

# TABLE OF CONTENTS



# FIGURES

# FISH AND WILDLIFE HABITAT CONSERVATION AREA RESTORATION PLAN

| | |
|---|---|
| **Project:** | **Kanaka Road** |
| **Applicant:** | **Ron Richards** |
| **Location:** | **Kanaka Road, Stevenson, Washington (Fig. 1)** |
| **Legal Description:** | **N ½ Sect. 43, T03N, R07E, W.M., Skamania County** |
| **Serial Number(s):** | **03073614-2900-000** |
| **Project Type:** | **Single Family Residential** |
| **Jurisdiction:** | **Stevenson, Washington** |
| **Acreage:** | **Approximately 1.3 acres** |
| **Assessment by:** | **Kevin Grosz, P.W.S.** |
| **Site Visit(s):** | **February 2, 2006 & August 17, 2011** |
| **Habitat Assessment Report Date:** | **January 17, 2013** |
| **Habitat Restoration Report Date:** | **March 5, 2014** |
| **Revised Report Date:** | **April 17, 2014** |

## 1.0 INTRODUCTION

This report details a revised habitat for temporary impacts into a fish and wildlife habitat conservation area riparian buffer that is regulated under the City of Stevenson's Critical Areas and Natural Resource Lands Ordinance 1022, Stevenson Municipal Code (SMC) 18.13. Kanaka Creek and its associated buffer were identified and described in a habitat assessment report prepared by The Resource Company, Inc. (TRC) in January 2013. The property is located between Kanaka Creek and Kanaka Creek Road, Stevenson, Washington (Fig. 1). The study area is identified as tax lot 03073614-2900-000 and is approximately 1.3 acres in size. This revised plan uses buffer averaging to compensate for impacts into the riparian buffer for vegetation removal to allow for the house construction and restoration of the trench for rooftop drainage. These activities are regulated under the City of Stevenson's (City) Critical Areas and Natural Resource Lands Ordinance 1022 Stevenson Municipal Code (SMC) 18.13.095 (Fish & Wildlife Habitat Conservation Areas). This predominantly forested property is relatively flat along the western one-half of the property and slopes steeply on the eastern one-half down to Kanaka Creek (Fig. 2).

## 2.0 BACKGROUND

It was determined through the habitat assessment that the 125-foot riparian buffer (Fig. 3) for Kanaka Creek encumbered most of the property which would not allow development of the site. Neither buffer averaging nor buffer enhancement reduced the riparian buffer sufficiently to allow for development of the site. The City's ordinance includes a Nonconforming Uses: Legal Lot of Record (SMC 18.13.085) section to deal with legal established lots that would be prohibited, regulated or restricted under SMC 18.13. The intent of this section is to provide standards by which nonconforming uses are allowed to continue and by which buildable sites on lots of record are to be provided. SMC 18.13.085(B)(1)(b) states that: on legal lots of record where protective buffer areas are required, the buffer areas shall be limited to no more than 50 percent of the lot area located beyond the critical area perimeter as determined by a qualified professional. As per this provision, a 66.0 foot buffer width will allow for use of 50 percent of the lot. The buffer width was determined as shown in Figure 4. This allows for the development to occur on the bench above the creek.

## 3.0 SITE PLAN AND EXISTING CONDITIONS

The applicant is proposing a single family residence and associated infrastructure (driveway, septic system, etc.) as shown in Figure 4. The site is predominantly forested. The vegetation on the site is typical of Westside lowland coniferous forests that were once logged. The site has an overstory comprised of young to medium aged Douglas-fir *(Psuedotsuga menziesii – FACU)* and a few scattered red alder (*Alnus rubra* – FAC) trees. Shrub layer vegetation is dominated by snowberry *(Symphoricarpos albus – FACU),* salmonberry *(Rubus spectabilis - FAC)*, red elderberry *(Sambucus racemosa ssp. pubens – FACU),* and beaked hazelnut *(Corylus cornuta – FACU).* Herbaceous layer vegetation is dominated by swordfern *(Polystichum munitum – FACU),* salal *(Gaultheria shallon –UPL),* and Oregon grape *(Mahonia nervosa – UPL).* In addition, several Oregon white oak (*Quercus garryana*- UPL) occur along the west property line as shown in Figure 4. These oaks which are listed as a priority species by Washington Department of Fish and Wildlife will be preserved. Blackberry dominates in the area where the house and septic system are proposed. Photographs of the project area are located in Photosheet 1.

## 4.0 AVOIDANCE AND MINIMIZATION

The unavoidable impacts into the riparian buffer were necessary to allow for the construction of the house and rooftop drainage. Impacts were limited to the minimal amount necessary to complete the tasks.
The following measures will be taken to avoid further impacts to riparian areas:

1. Riparian buffer boundaries will be temporarily flagged in the field prior to construction.
2. Erosion control measures (e.g. straw bale sediment barriers or sediment fence) will be installed to prevent siltation from entering the sensitive areas during

construction.

3. The erosion control measures will be removed once construction is completed and vegetation has become established.

## 5.0 RIPARIAN BUFFER IMPACTS, COMPENSATION AND RESTORATION

### 5.1 Impacts

To allow for excavation and preparation of the foundation and construction of the house, the applicant has encroached into the 66-foot riparian buffer as shown in Figure 5. This impact area is approximately 600 sq.ft. and is predominantly blackberries (Fig. 5). In addition, the applicant will take the roof-top precipitation run-off to near the creek through a 4 inch drain pipe. The drain pipe will be placed in a four (4) inch deep trench 12 to 24 inches wide and approximately 75 feet long. This will impact approximately 150 sq.ft. of the riparian zone (Fig. 5). This impact area is predominantly blackberries however a few small shrubs may need to be removed for the trench excavation. The impacts to both of these areas are temporary. Buffer averaging as outlined in SMC 18.13.095(F)(3)(b)(i-iii) will be used to compensate for the 600 ft² impact area adjacent to house and the trench area will be restored as outlined below.

### 5.2 Buffer Averaging

To compensate for the 600 ft² riparian buffer impact for the house (Fig. 6), the riparian buffer will be expanded by 600 ft² in the northwest corner of the property adjacent to the existing riparian buffer as shown in Figure 6. This area contains native trees and shrubs and is of higher habitat quality than the impact area. The buffer will not be reduced by more than the 10 percent of the base buffer width (12.5 ft.) and there will not be a net loss of buffer area on the site. Therefore, the averaging plan meets the criteria of SMC 18.13.095(F)(3)(b)(i-iii)

### 5.3 Trench Restoration

The restoration of the 150 foot area for the drain trench is designed to meet the criteria of SMC 18.13.095. The criteria requires that the a minimum plant density of 7 trees and 20 shrubs per 1,000 sq.ft. This plan is designed to meet that requirement.

Additional Trench Requirements:

1. The trench will be excavated at the minimum width necessary for the installation of the pipe.
2. Erosion control BMP's will be employed so that that the stream is not impacted by the trenching, pipe installation and other construction activities.
3. Spoils from the trench will be stored out of the stream.
4. Once installation has been completed the trench will be restored to pre-construction contours. Subsurface soils should be placed first into the trench as backfill, followed by the topsoil.
5. The trench and construction areas will be planted with a native grass seed mixture similar to the mixture (approved by the City) given in Table 1 and shrubs listed in Table 2:

**Table 1. Native Seed Mixture**

Blue wildrye (*Elymus glaucus*) 50%
California brome (*Bromus carinatus*) 30%
Native red fescue (*Festuca rubra*) 10%
Bentgrass (*Agrostis exerata*) 10%
**The seeding rate for this mixture is: 1 lb./1000 sq.ft.**

**Table 2. Trench Restoration Area (150 ft²) Plants & Planting Specifications**

| Species | Stock | Size(Min.) | Spacing(Min.) | Number |
|---|---|---|---|---|
| Common Snowberry (*Symphoricarpos albus*) | Bare Root | 18" | 4' | 2 |
| Salal (*Gaultheria shalon*) | Bare Root | 18" | 4' | 2 |

Additional planting specifications applicable to this plan are listed below.

Source of Plant Materials. All plants will be obtained from nurseries specializing in plant materials native to the Pacific Northwest.

Planting Time. Bare-root shrubs and trees should be planted between December 1 and February 28, when plants are dormant. If planting is conducted outside this time period, containerized plant stock will be used and extra care and watering may be needed to ensure that plants become adequately established.

Planting Guidelines. A hole, one foot in diameter and one foot deep, shall be excavated for bare root stock. The holes should be large enough to accommodate the plant roots without restriction. Plants will be held in place with the top of the root mass at ground level. Topsoil will be backfilled around the roots and lightly tamped to remove any air pockets in the soil. Mulch (3 inches deep) shall be applied around the base of each plant. Future maintenance should use scarification (by hand) to keep the 1-foot diameter area free of herbaceous vegetation until plants are well established. If the soils are not saturated, each plant should be watered at the time of planting. Supplemental watering (every two weeks during the summer season) may also be required to ensure plant survival and mitigation success.

Energy Dissipater. The minimize erosion and scouring at the point of the outfall pipe, rock will be placed around the outfall area as designed by the applicants engineer and shown in Figure 7.

## 6.0 GOALS AND OBJECTIVES

The goal of this restoration plan is to restore the impacted areas with a native plant community. The specific objectives are as follows:
Objective 1: Compensate for the 600 ft² riparian habitat buffer loss through buffer averaging.
Objective 2: Restore the rooftop drain trench area with the native plant community listed in Tables 1 and 2.

## 7.0 MONITORING AND MAINTENANCE

The following actions will be implemented as part of the riparian buffer restoration monitoring and maintenance plan on this site:

1. The initial and all successive year plantings will be supervised by a qualified professional to ensure that correct planting procedures are followed and that plantings are done according to the planting scheme.

2. Monitoring of all planted areas will commence the summer following the initial planting (year 1) and continue in the 2nd, 3rd, 5th, 7th, and 10th years. Monitoring will be conducted by a qualified professional during the late spring or summer time period. For each year that monitoring is required, a report documenting the monitoring results will be submitted to the City of Stevenson. The report will identify deficiencies in the restoration progress and any contingency measures that will be taken to correct those deficiencies. Photographs taken from established photo-stations will be included with these reports.

3. The goal of the restoration plan is to achieve 80% cover by the end of the 10-year monitoring period. To determine if the restoration plan is meeting the expected goal, the performance standards, as listed below, will be tied to each monitoring period.

4. Exotic species should cover less than 20 percent of the riparian restoration area.

5. If the planted stock does not survive, but native naturally colonizing native woody plant species replace them, then the project may be judged to meet the threshold criteria for successful plant community establishment. (Note: All decisions regarding which volunteer species are to be considered acceptable will be made by the City of Stevenson).

6. To ensure planting success, the Applicant will be responsible for performing minor maintenance over the monitoring period. This will include the selective removal of undesirable plant species such as blackberry (*Rubus* spp.) that may be hindering the growth and establishment of the favored plant stands. An area, 1-foot in diameter surrounding each planted woody species, will be kept free of competing vegetation. This can be accomplished either by scarifying the area by hand or through the use of weed-control rings.

7. Maintenance of the restoration area may include irrigation of the planted stock. A watering schedule will be established during the dry months (June through September) so that the plants are watered on a weekly basis during this time period. If necessary, a temporary above ground irrigation system capable of watering the entire restoration area will be installed.

8. Any maintenance that is required within the restoration area will be supervised by a qualified professional familiar with this project.

## 8.0 PERFORMANCE STANDARDS

Performance measures and standards are used to provide a basis for evaluating whether the project's goals and objectives are being met. This plan established the following criteria as the basis for evaluating mitigation compliance and success. In order to meet the goals and objectives, the mitigation must meet the following criteria:

1. Native Woody Species
Performance Measure Year 1 – Planted woody species in the shrub and forested areas of the restoration areas will achieve at least 50 percent survival one year after the site has been planted. Any plants not surviving will be planted back to the original number proposed in this plan.
Performance Measure Years 2-4 – Native woody species (planted or volunteer) will achieve a density of a minimum of 6 shrubs and 3 trees per 1000 sq.ft. in the restoration areas.
Performance Standard #1 (final year monitoring). Aerial cover of native woody species will be at least 80 percent in the restoration areas by the end of the monitoring period (year 10).

2. Invasive species (all years)
No more than 20% (cumulatively) of the cover during any monitoring period shall consist of noxious weeds, including but not limited to blackberries, ivy, thistle, Scotch broom, Queen Anne's lace, or purple loosestrife. There will be zero tolerance for Japanese knotweed.

## 9.0 ADAPTIVE MANAGEMENT PLAN

Adaptive management plans are designed to identify potential courses of action, and any corrective measures to be taken when monitoring indicates project goals are not being met. Table 2 summarizes the maintenance and contingency requirements for this project. In general, the contingency measures for this site are as follows:

1. Replacement Plantings—Replacement plantings will also be made throughout the monitoring period if monitoring reveals that unacceptable plant mortality has occurred. Woody species will be re-planted to the original number of plants proposed in the accepted mitigation plan annually throughout the duration of the monitoring and maintenance period.

2. Planting Plan Modifications—Modifications to the planting plan (i.e., plant species and densities) will be made if monitoring identifies problems with the original planting scheme. For example, if annual monitoring identifies that plant mortality is attributed to an inappropriate hydrologic regime, the replacement plantings should be made using a more suitable plant species. Any recommended changes to the planting scheme will be documented in the annual monitoring report. The addition of any new plant species, not already included in this enhancement plan, must be approved by the City Stevenson.

3. Soil Erosion—Any areas demonstrating soil erosion problems will be restored as soon as possible. If there does not appear to be a problem with the original design, the eroded areas will be restored by replacing any lost topsoil and replanted according to the original planting scheme.

**Table 3. Maintenance and Contingency Requirements**

| Maintenance Component | Defect | Conditions When Maintenance is Needed | Results Expected When Maintenance is Performed |
|---|---|---|---|
| Restoration Areas | Trash and debris | Any trash or debris which exceeds 1 $ft^3/100ft^2$ (equal to the volume of a standard size office garbage can). In general, there should be no evidence of dumping. | Trash and debris cleared from site. |
| Restoration Areas | Erosion | Eroded damage >2 inches deep where cause of damage is still present or where there is potential for continued erosion. | Eroded areas should be stabilized with appropriate erosion control BMPs (e.g., seeding, mulching, rip rap). |
| Restoration Areas | Plant mortality | Plant mortality jeopardizes attaining the required survival rate. | Plants should be replaced according to the planting plan. Modifications to the planting plan should be made if monitoring identifies problems with the original planting scheme. |
| Restoration Areas | Invasion of undesirable plant species. | Undesirable plant species are hindering the growth and establishment of the favored plant stands. | Undesirable species removed by hand, or in accordance with recommendations of the Skamania County Weed Control Board. |

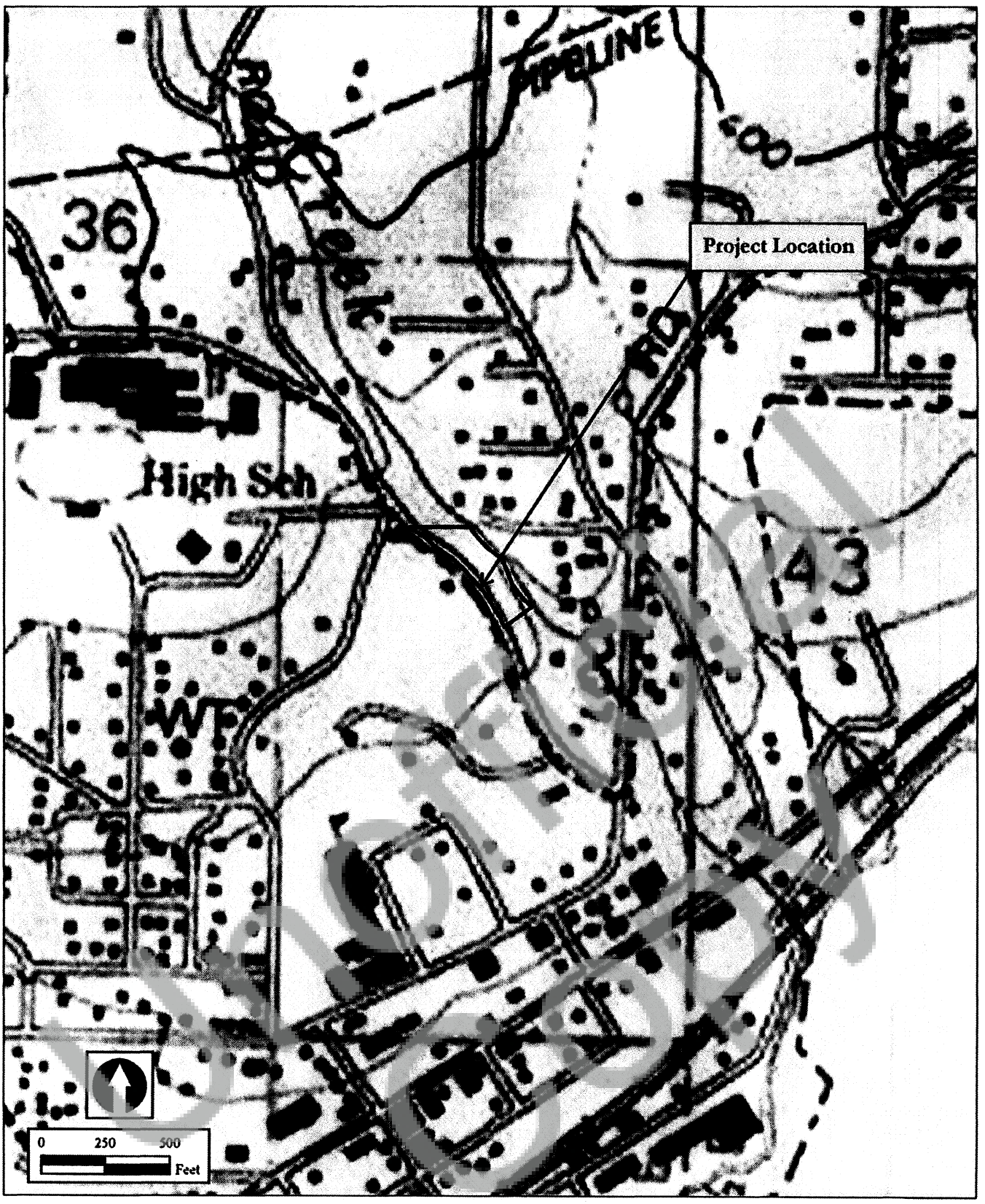
## 10.0 DEMARCATION

In accordance with the SMC 18.13.095(D) (Habitat Buffer Standards), A permanent and perpetual physical demarcation along the outer boundary of the habitat buffer area shall be installed and thereafter maintained. Such demarcation may consist of logs, a tree or hedgerow, wood or wood like fencing, or other prominent physical marking approved by the Planning Department. In addition, signs (minimum size 1 foot x 1 foot and posted 3.5

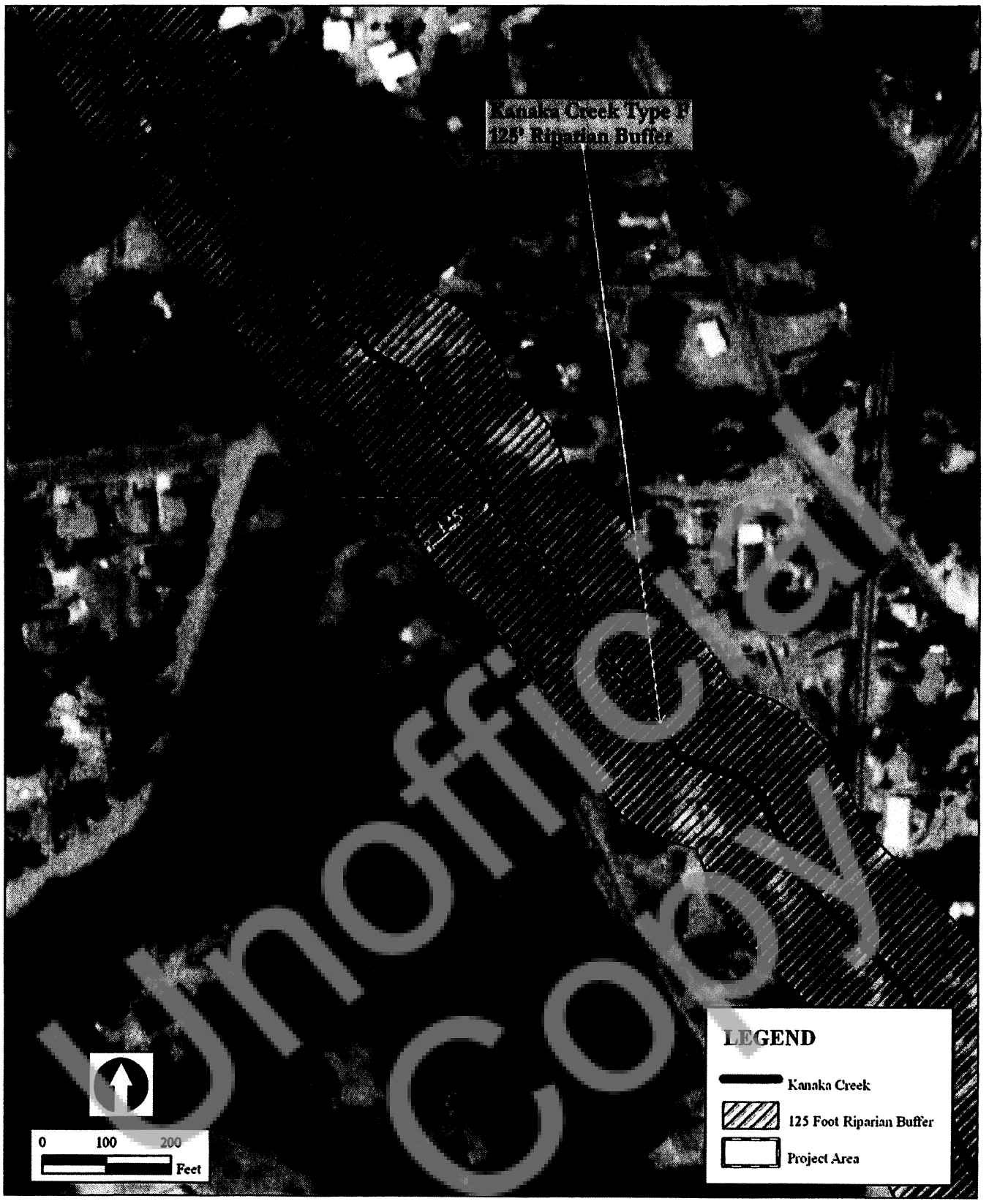
feet above grade) shall be posted at an interval of one per lot or every 150 feet, whichever is less, and perpetually maintained at locations along the outer perimeter of the habitat buffer and worded substantially as follows: WILDLIFE HABITAT BUFFER – PLEASE RETAIN IN A NATURAL STATE. For highly visible areas or areas located along a public right-of-way, interpretive signs may be required in lieu of other signage.

# FIGURES


| | | |
|---|---|---|
| **Ron Richards Project**<br><br>**APPLICANT:**<br>Ron Richards<br>1202 Woodard Creek Rd.<br>Stevenson, WA 98648<br><br>**PURPOSE:** Revised Habitat Mitigation | **Project Location Map**<br>**Kanaka Road Project**<br>**Stevenson, Washington**<br><br>The Resource Company, Inc.<br>ENVIRONMENTAL SERVICES • GIS • HABITAT RESTORATION<br>915 Broadway, Ste. 250, Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242 | **PROPOSED ACTIVITIES IN:**<br>Columbia River/Rock Creek Watershed<br>**LEGAL:** N ½ of Section 43, T03N, R07E, W.M.,<br>**NEAR:** Stevenson, Washington<br>**COUNTY:** Skamania County<br>**DATE:** April 17, 2014<br><br>Figure 1 |

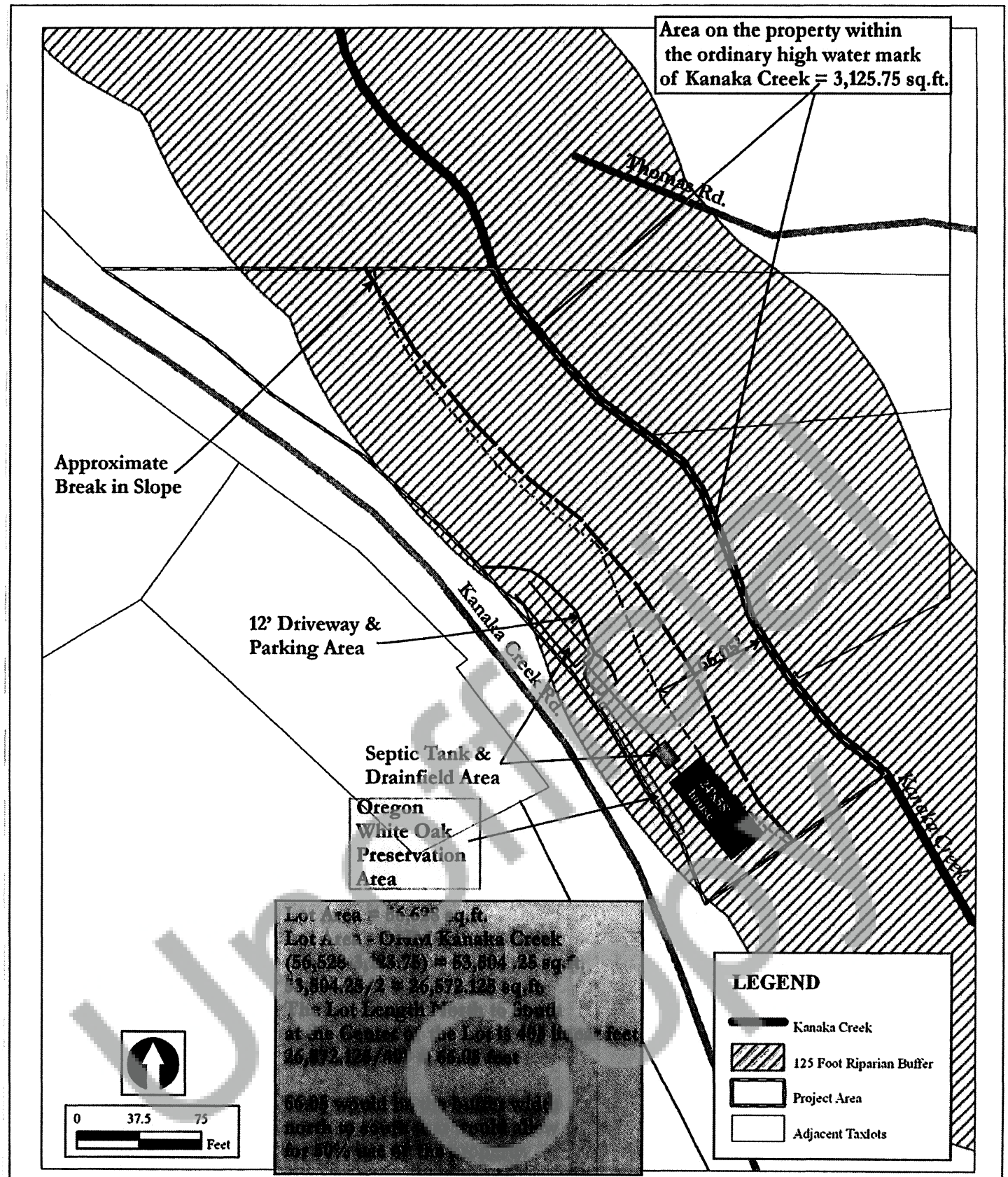



| | | |
|---|---|---|
| **Ron Richards Project**<br><br>**APPLICANT:**<br>Ron Richards<br>1202 Woodard Creek Rd.<br>Stevenson, WA 98648<br><br>**PURPOSE:** Revised Habitat Mitigation | **USGS Topography**<br>**Kanaka Road Project**<br>**Stevenson, Washington**<br><br>The Resource Company, Inc.<br>ENVIRONMENTAL SERVICES • GIS • HABITAT RESTORATION<br>915 Broadway, Ste. 250, Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-5242 | **PROPOSED ACTIVITIES IN:**<br>Columbia River/Rock Creek Watershed<br>**LEGAL:** N ½ of Section 43, T03N, R07E, W.M.,<br>**NEAR:** Stevenson, Washington<br>**COUNTY:** Skamania County<br>**DATE:** April 17, 2014<br><br>Figure 2 |

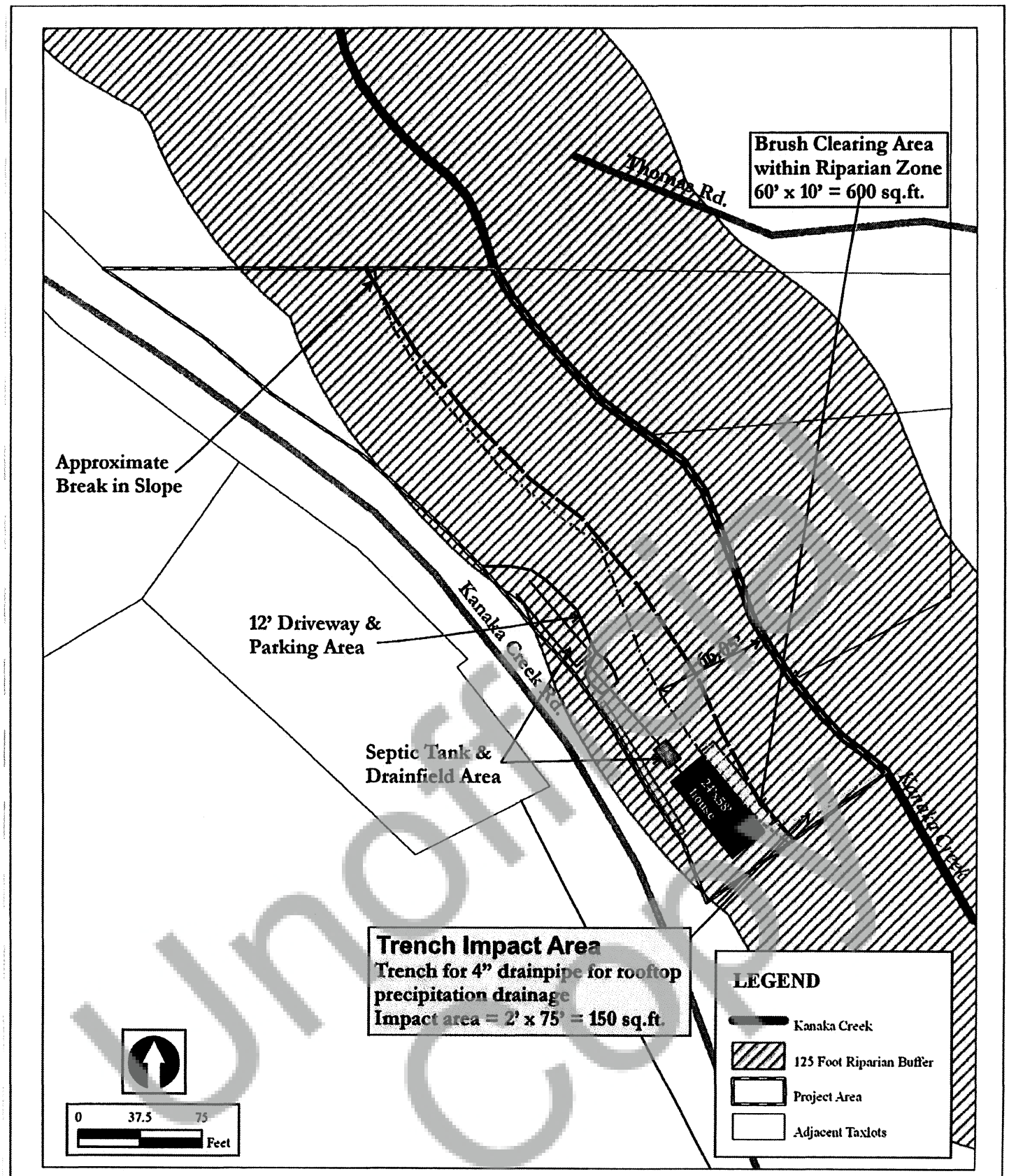




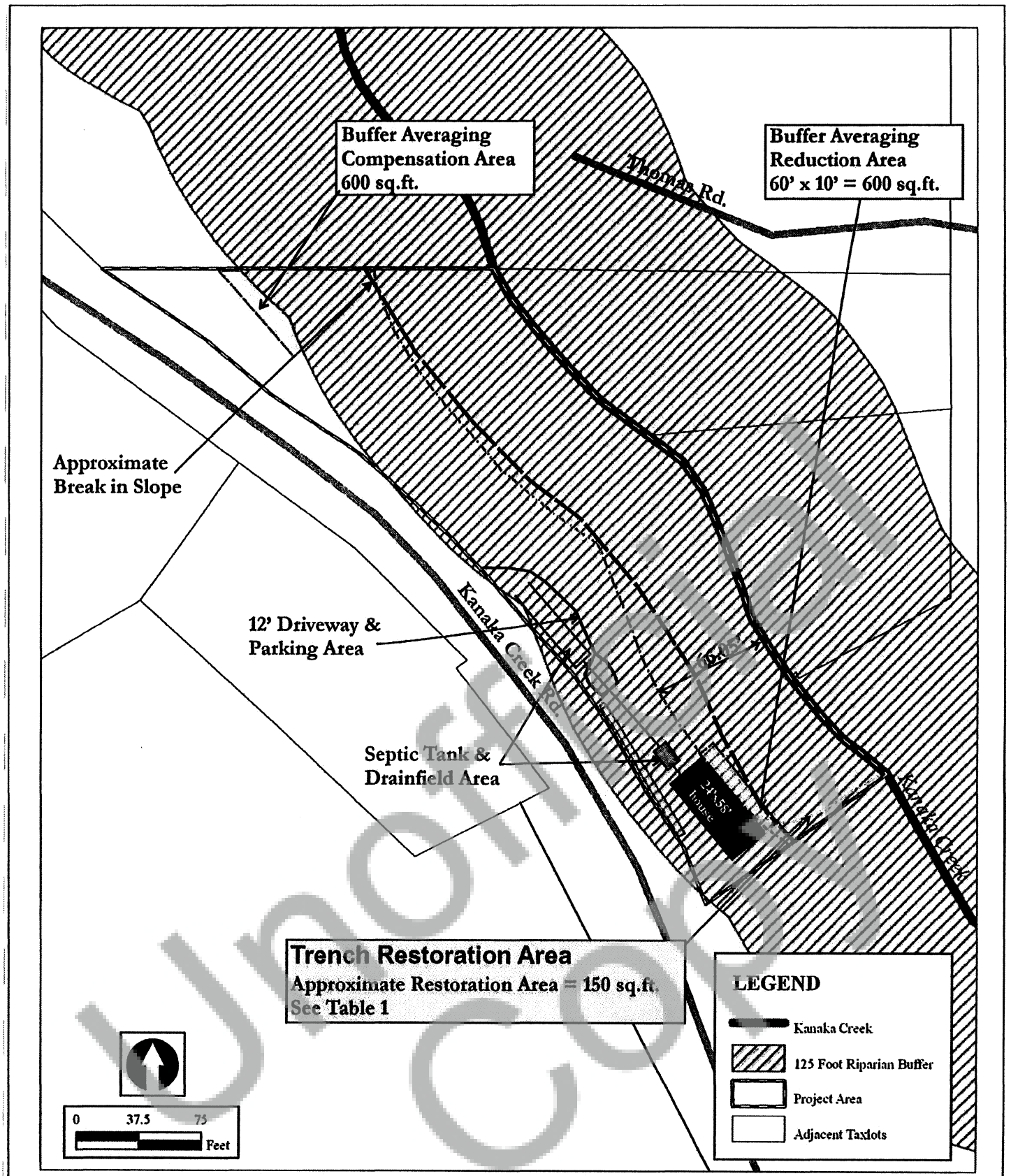

| | | |
|---|---|---|
| **Ron Richards Project**<br><br>**APPLICANT:**<br>Ron Richards<br>1202 Woodard Creek Rd.<br>Stevenson, WA 98648<br><br>**PURPOSE:** Revised Habitat Mitigation | **Kanaka Creek Riparian Buffer**<br>**Kanaka Road Project**<br>**Stevenson, Washington**<br><br>The Resource Company, Inc.<br>ENVIRONMENTAL SERVICES • GIS • HABITAT RESTORATION<br>916 Broadway, Ste. 250, Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-8242 | **PROPOSED ACTIVITIES IN:**<br>Columbia River/Rock Creek Watershed<br>**LEGAL:** N ½ of Section 43, T03N, R07E, W.M.,<br>**NEAR:** Stevenson, Washington<br>**COUNTY:** Skamania County<br>**DATE:** April 17, 2014<br><br>Figure 3 |




| | | |
|---|---|---|
| **Ron Richards Project**<br><br>**APPLICANT:**<br>Ron Richards<br>1202 Woodard Creek Rd.<br>Stevenson, WA 98648<br><br>**PURPOSE:** Revised Habitat Mitigation | **Site Plan/Buildable Area Based on Stevenson CAO**<br>**Kanaka Road Project**<br>**Stevenson, Washington**<br><br>The Resource Company, Inc.<br>ENVIRONMENTAL SERVICES • GIS • HABITAT RESTORATION<br>915 Broadway, Ste. 250, Vancouver, [illegible] ph: 360-693-4555 fax: 360-699-6242 | **PROPOSED ACTIVITIES IN:**<br>Columbia River/Rock Creek Watershed<br>**LEGAL:** N ½ of Section 43, T03N, R07E, W.M.,<br>**NEAR:** Stevenson, Washington<br>**COUNTY:** Skamania County<br>**DATE:** April 17, 2014<br><br>Figure 4 |




| | | |
|---|---|---|
| **Ron Richards Project**<br><br>**APPLICANT:**<br>Ron Richards<br>1202 Woodard Creek Rd.<br>Stevenson, WA 98648<br><br>**PURPOSE:** Revised Habitat Mitigation | **Riparian Buffer Impact Areas**<br>**Kanaka Road Project**<br>**Stevenson, Washington**<br><br>The Resource Company, Inc.<br>ENVIRONMENTAL SERVICES • GIS • HABITAT RESTORATION<br>915 Broadway, Ste. 250, Vancouver, WA 98660 ph: 360-693-4555 fax: 360-690-6242 | **PROPOSED ACTIVITIES IN:**<br>Columbia River/Rock Creek Watershed<br>**LEGAL:** N ½ of Section 43, T03N, R07E, W.M.,<br>**NEAR:** Stevenson, Washington<br>**COUNTY:** Skamania County<br>**DATE:** April 17, 2014<br><br>Figure 5 |




Ron Richards Project

APPLICANT:
Ron Richards
1202 Woodard Creek Rd.
Stevenson, WA 98648

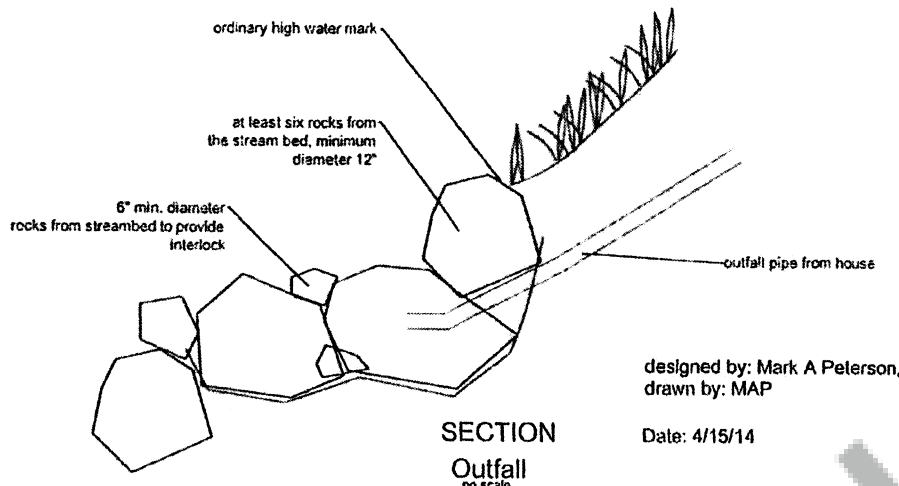
PURPOSE: Revised Habitat Mitigation

**Riparian Buffer Averaging/Restoration Areas**
**Kanaka Road Project**
**Stevenson, Washington**

The Resource Company, Inc.
ENVIRONMENTAL SERVICES • GIS • HABITAT RESTORATION
915 Broadway, Ste. 250, Vancouver, WA 98660 ph: 360-693-4656 fax: 360-699-6242

PROPOSED ACTIVITIES IN:
Columbia River/Rock Creek Watershed
LEGAL: N ½ of Section 43, T03N, R07E, W.M.,
NEAR: Stevenson, Washington
COUNTY: Skamania County
DATE: April 17, 2014

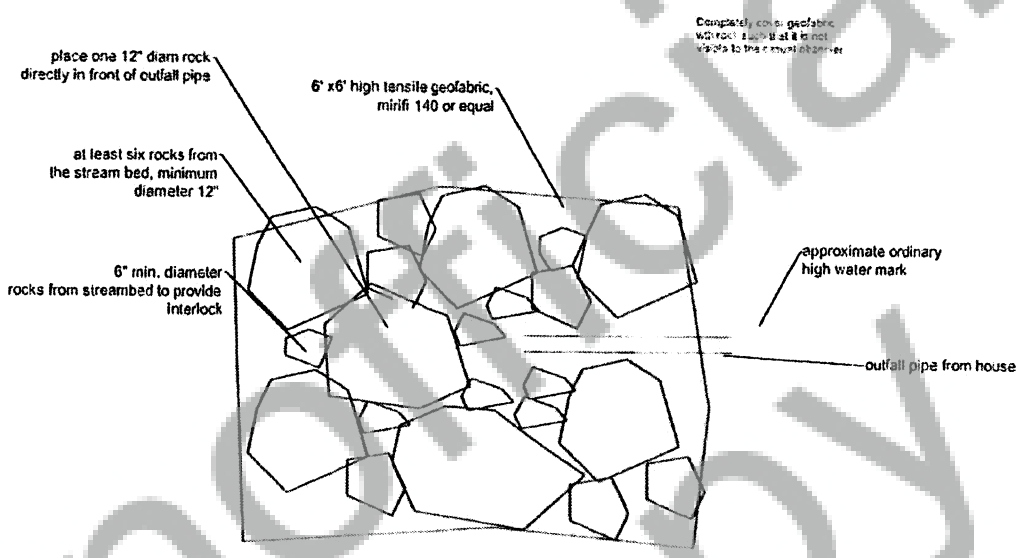
Figure 6




designed by: Mark A Peterson, P.E.
drawn by: MAP

Date: 4/15/14

SECTION
Outfall
no scale



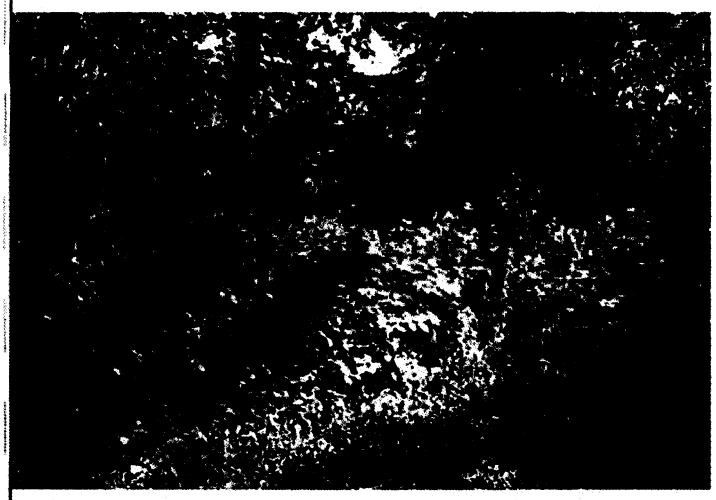

designed by: Mark A Peterson, P.E.
drawn by: MAP

Date: 4/15/14

PLAN VIEW
Outfall
no scale



| | | |
|---|---|---|
| **Ron Richards Project**<br><br>**APPLICANT:**<br>Ron Richards<br>1202 Woodard Creek Rd.<br>Stevenson, WA 98648<br><br>**PURPOSE:** Revised Habitat Mitigation | **Outfall Energy Dissipater Details**<br>**Kanaka Road Project**<br>**Stevenson, Washington**<br><br>The Resource Company, Inc.<br>ENVIRONMENTAL SERVICES • GIS • HABITAT RESTORATION<br>915 Broadway, Ste. 250, Vancouver, WA 98660 ph: 360-693-4555 fax: 360-690-6242 | **PROPOSED ACTIVITIES IN:**<br>Columbia River/Rock Creek Watershed<br>**LEGAL:** N ½ of Section 43, T03N, R07E, W.M.,<br>**NEAR:** Stevenson, Washington<br>**COUNTY:** Skamania County<br>**DATE:** April 17, 2014<br><br>**Figure 7** |



Vegetation in the area of the proposed development

Vegetation in the area of the proposed development

Vegetation in the area of the proposed development

Compensation Area Vegetation

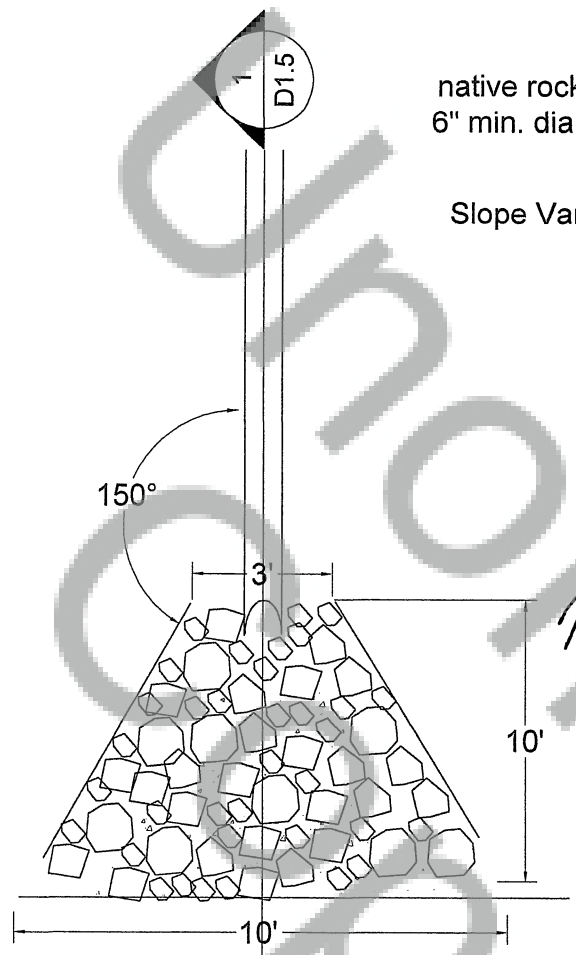
Compensation Area Vegetation

Middle section of stream facing south.



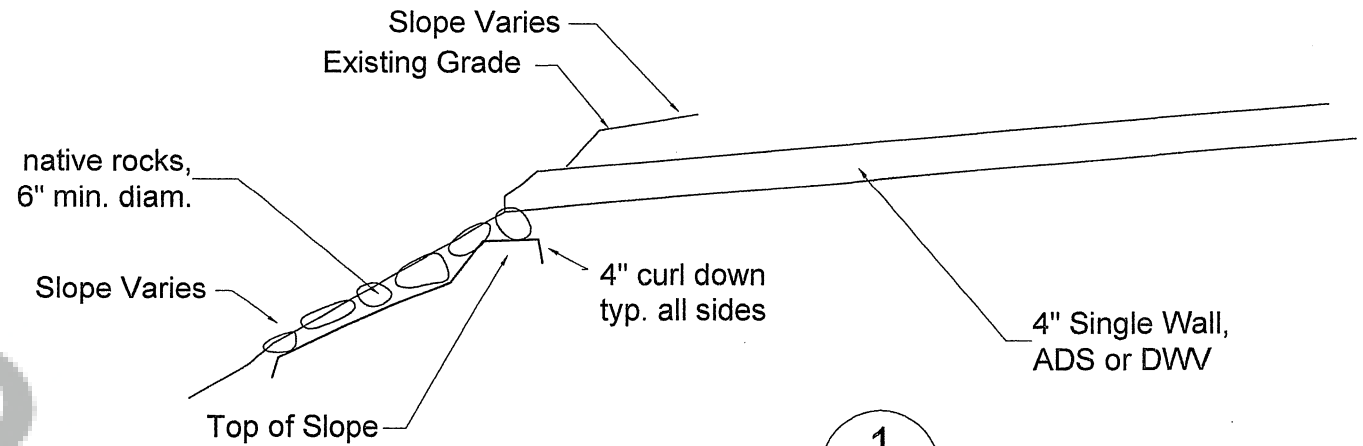
| | | |
|---|---|---|
| **Ron Richards Project**<br><br>**APPLICANT:**<br>Ron Richards<br>1202 Woodard Creek Rd.<br>Stevenson, WA 98648<br><br>**PURPOSE:** Revised Habitat Mitigation | **Site Photographs**<br>**Kanaka Road Project**<br>**Stevenson, Washington**<br><br>The Resource Company, Inc.<br>ENVIRONMENTAL SERVICES • GIS • HABITAT RESTORATION<br>915 Broadway, Ste. 250, Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-5242 | **PROPOSED ACTIVITIES IN:**<br>Columbia River/Rock Creek Watershed<br>**LEGAL:** N ½ of Section 43, T03N, R07E, W.M.,<br>**NEAR:** Stevenson, Washington<br>**COUNTY:** Skamania County<br>**DATE:** April 17, 2014<br><br>**Photo Sheet 1** |

# Richards/Steeves
# Stormwater Outfall



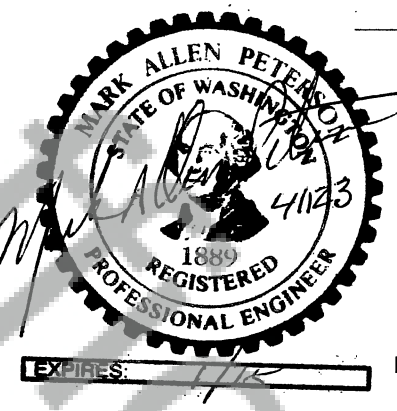

OUTFALL DETAIL

NO SCALE

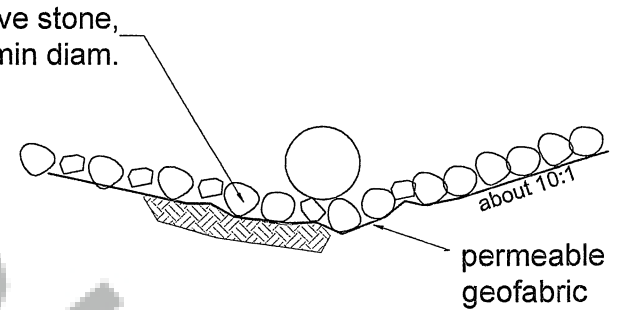



SECTION 1/D1.5

NO SCALE




2/D1.5




SECTION 2/D1.5

NO SCALE

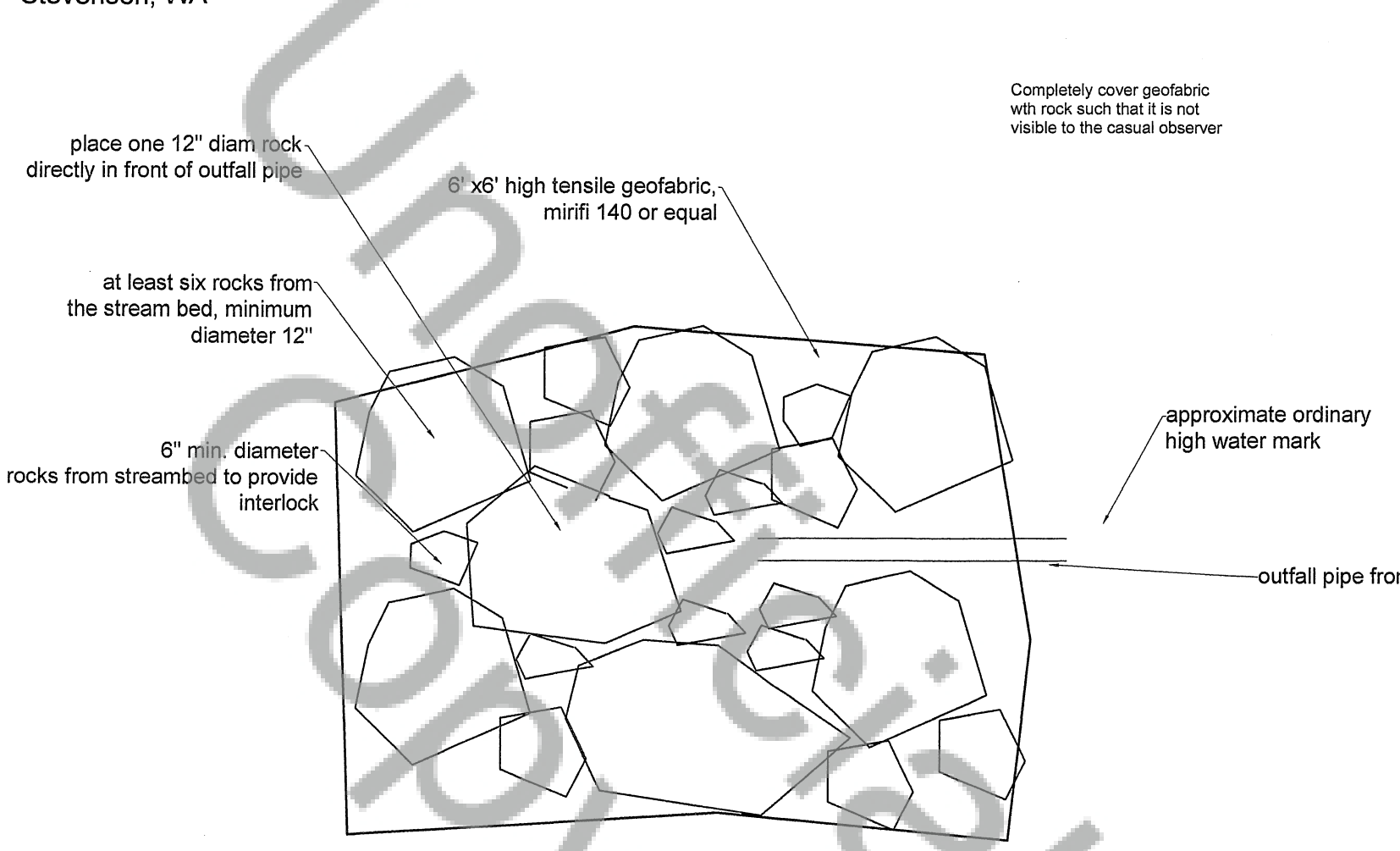


MARK PETERSON, P.E.
640 NE Major St.
Stevenson, WA
541-905-1219

D1.5

REVISION OF PRIOR SUBMITTAL

Richards/Steeves residence
Kanaka Creek Road
Stevenson, WA

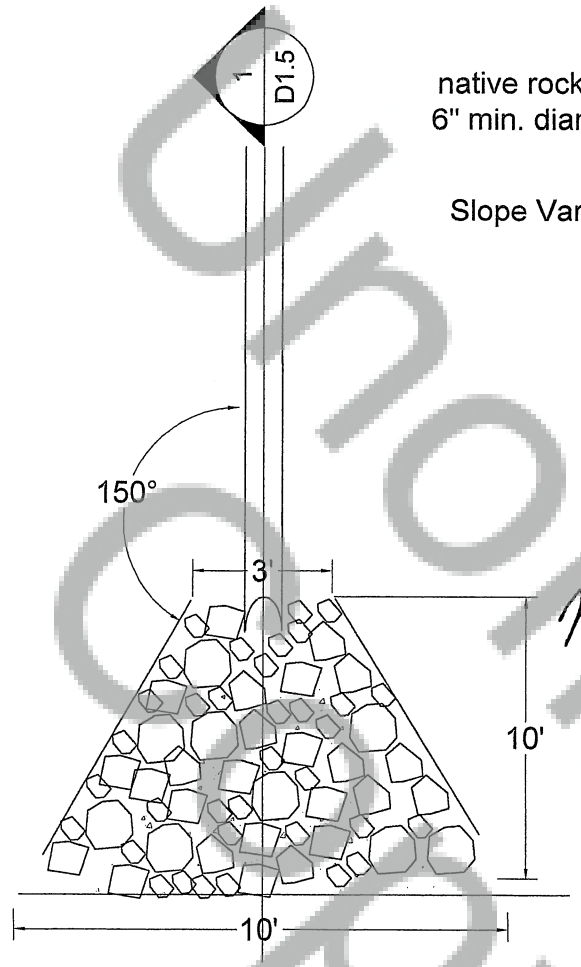



PLAN VIEW
Outfall
no scale

designed by: Mark A Peterson, P.E.
drawn by: MAP

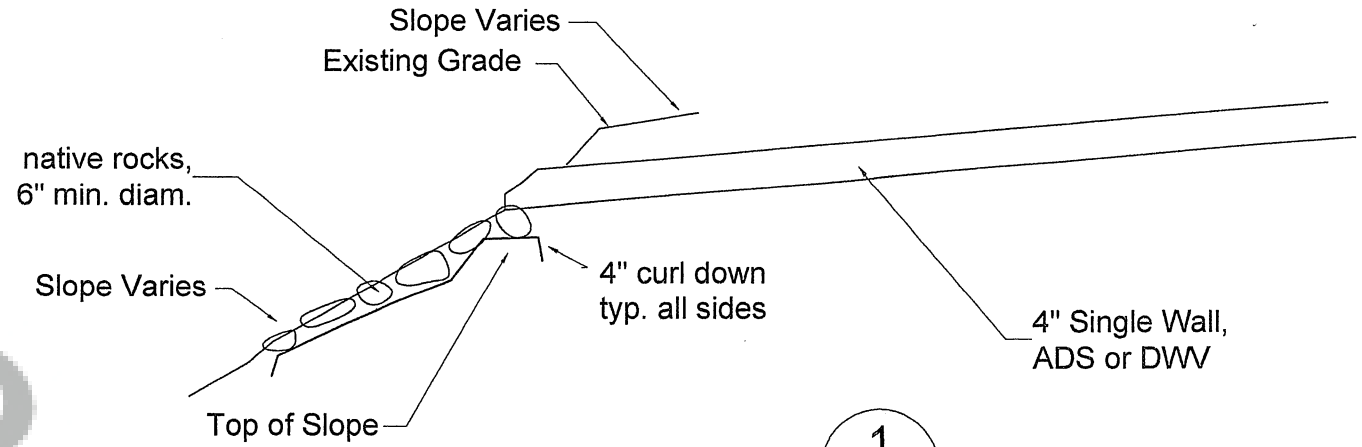
Date: 4/15/14

# Richards/Steeves
# Stormwater Outfall




OUTFALL DETAIL

NO SCALE




SECTION 1/D1.5

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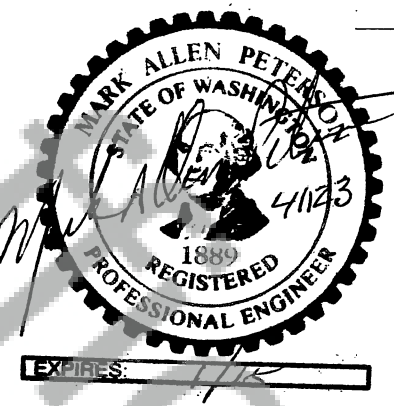


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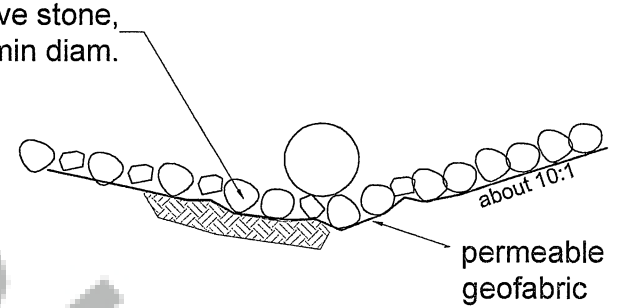


SECTION 2/D1.5

NO SCALE

D1.5

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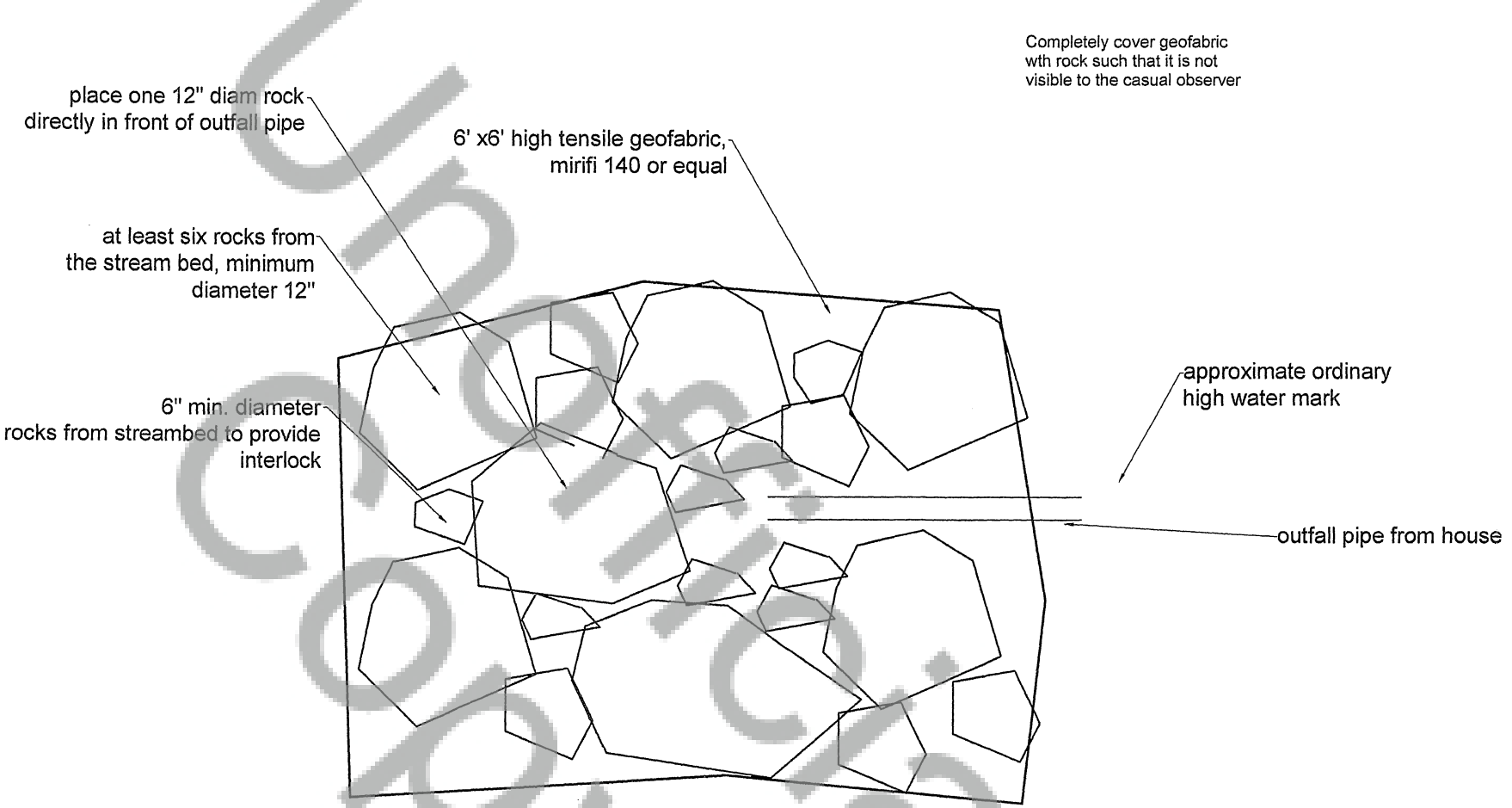
REVISION OF PRIOR SUBMITTAL

Richards/Steeves residence
Kanaka Creek Road
Stevenson, WA




PLAN VIEW
Outfall
no scale

designed by: Mark A Peterson, P.E.
drawn by: MAP

Date: 4/15/14