FOSTER PEPPER PLLC

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December 17, 2015

Via E-Mail
Hard Copy to Follow Upon Request

San Juan County
Community Development & Planning
135 Rhone Street
P.O. Box 947
Friday Harbor, WA 98250

RE: *Supplemental Information - Runstad Bank Stabilization*
Shoreline Substantial Development Permit Exemption Determination Request

Ms. McEnery:

This submittal provides the supplemental information in support of the after-the-fact application for a Shoreline Substantial Development Permit Exemption Determination for a bank stabilization construction (the "Project") submitted to San Juan County on June 10, 2015, as you requested. Attached please find the following technical reports:

- Exhibit K – *Topographic Survey*, prepared by San Juan Surveying (December 17, 2015) (Hard copy to be hand delivered today, December 17, 2015)
- Exhibit L – *Geotechnical Engineering Conclusions and Recommendations, Runstad Property, Blakely Island, Washington,* prepared by Hart Crowser, Inc. (December 17, 2015)
- Exhibit M – *Fish and Wildlife Habitat Conservation Area Report, Runstad Property on Blakely Island, San Juan County, Washington,* prepared by Hart Crowser, Inc. (December 17, 2015)
- Exhibit N – *Runstad Property – Supplemental Coastal Geologic Analysis,* prepared by Coast & Harbor Engineering (December 17, 2015)

These documents, in conjunction with the information submitted on June 10, 2015 (including the narrative submittal and Exhibits A through J) demonstrate that the Project complies with applicable San Juan County Code, including the recently modified Critical Areas

Ordinance. The County should determine that the Project is exempt from Shoreline Substantial Development Permit Requirements.

These reports are being provided in provided to you in electronic format. If you require a paper copy of these reports, please let us know. Please contact me at (206) 447-6407, or Stephanie Weir at (206) 447-6236, if you have any questions regarding the attached supplemental information in support of Applicant's Shoreline Substantial Development Permit Exemption Determination Request.

Sincerely,

Joseph A. Brogan
Stephanie G. Weir

Attachments

cc: Randall K. Gaylord, San Juan County Prosecuting Attorney

Exhibit L

GARRY E. HORVITZ
STATE OF WASHINGTON
19478
REGISTERED
PROFESSIONAL ENGINEER
12/17/15

MEMORANDUM

DATE: December 17, 2015

TO: Joe Brogan, Foster Pepper

FROM: Garry E. Horvitz, PE. LEG, Hart Crowser, Inc.

RE: **Geotechnical Engineering Conclusions and Recommendations**
Runstad Property, Blakely Island, Washington
17921-00

CC:

This technical memorandum was prepared by Garry E. Horvitz, PE, LEG, a professional engineer and engineering geologist with more than 40 years of experience in the field of geotechnical engineering. In accordance with SJCC 18.35.055-070, *SJCC 18.35.130(G)(3)(f)(vii)* the qualification of Garry Horvitz meet the San Juan County definition of a "qualified professional." This technical memorandum provides the information, and results of analysis that is required to comply with geotechnical analyses required under the updated, March 31, 2014 San Juan County SJCC 18.35.130 G Ordinance 01-2015.

This memo serves to present our conclusions and recommendations with respect to analyses undertaken to demonstrate the necessity of construction of bank stabilization along beachfront property at the Runstad Property on Blakely Island (the "Project"). Our work was conducted in accordance with the standard of care of our profession, based on commonly accepted engineering principles. No other warranty, express or implied, is made.

This work was completed to satisfy the requirements of the appropriate geotechnical sections of Chapter 18.35.130 of the San Juan County Code. This memo responds to information requests sent by San Juan County on September 18, 2015.

Our site review and analyses demonstrate that the "structures" (defined as the uphill residence, roadway, utilities, and other appurtenances) will likely suffer damage from shoreline erosion without the Project's bank stabilization to prevent further erosion of the bank.

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Background

We had visited the site previously to observe the conditions along the shoreline. Repairs to the beach area had been made shortly after a severe storm event in 2011. The predominant cause of the erosion was likely wave run up at high tide. Repairs at the time consisted of placement of riprap and other rock to stabilize the toe of the failed slope just above the beach.

Based on our observations of soil conditions and review of publicly available geologic mapping sources, the site soils along this edge of Blakely Island consist of a base deposit of glacial till soils. The site slopes steeply from the beach upward toward the interior of the Island. We observed weathered and reworked till soils exposed in areas and it is likely that much of this material is slope debris which has washed own from higher elevations over the years and which has also weathered and loosened in place. Although till is a glacially overridden material and dense in its in situ condition, it weathers quickly and loosens to a very weak and highly erodible material. There are numerous signs of instability along the slope between the gravel road and the water's edge. This is evidenced by oversteepened scarps as well as leaning trees and "pistol-butted" trees which are signs of long term instability.

Portions of the area that were washed away left an oversteepened condition which has warranted stabilization. The stability of these soils is largely a function of the strength of the soils and the angle of the slope. Although the major cause of the oversteepening is the storm event of early 2011, the resultant steep slopes have been reduced in their stability (stability decreases as slope angle increases for any given set of geologic conditions) which warrants the remedial measures which have been undertaken.

Gradational analyses were performed on soil samples retrieved from the site in our laboratory. The results are presented as Figure 2.

Slope Stability Analyses

The San Juan County Code (SJCC 18.35.130(G)(3)(e)(i)) requires conclusive evidence that the structure is in danger and will suffer damage from shoreline erosion caused by tidal action, currents, or waves. In our professional opinion, this is indeed the case.

We have performed slope stability analyses to evaluate the relative factors of safety against instability for the case of the existing slope angles at the site. To do this we have used topographic survey information prepared by San Juan Surveying for Jon Runstad dated November 23, 2015. We prepared cross sections at four locations within the area of the Project. The location of the most reasonable cross section for analysis is shown on the attached Figure 1. The analyses of the critical cross section are presented as Figures 3 and 4.

Slope stability analyses were performed using the software SLOPE/W Version 8.11 (Geo-Slope International 2013) and the Morgenstern-Price method for slope stability analysis for rotational circular slip surfaces. Strength parameters for the site soils were developed based on empirical correlation to grain size based on our experience and professional judgment. Given that these beach deposits are reworked material from the uplands they are likely very loose. We have assigned an angle of internal friction equal to 32 degrees and a unit weight of 120 pounds per cubic foot (pcf).

The resultant analyses indicate a factor of safety equal to 0.99 for the current slope condition and accounting for tidal lag (see Figure 3). This indicates that the overall slope is just barely stable. We also analyzed the stability of the lower portion of the slope. The results of that analyses are shown in Figure 4. The Factor of Safety for that case is 0.54. A Factor of Safety less than 1.0 is indicative of a failure. The implication of this low factor of safety is that the lower slope is essentially in a failed condition and the slope is currently being retained by the buttressing action of the existing bank stabilization of the Project. Without the presence of the stabilizing and buttressing effect of the Project's bank stabilization, the slope will continue to fail in a "calving" mechanism which will cause the slope to regress as "slivers" of the face of the slope continue to fail, if the Project was not present. This would cause an ongoing oversteepening of the slope which would lead to a progressively greater amount of instability and reduce the overall slope Factor of Safety to something significantly below 1.0. As a result larger and larger sections of this slope would tend to fail over shorter and shorter periods of time. Although it is impossible to state unequivocally that the slope failures would reach the edge of the road and utilities within three years it is highly likely that this will be the case due to the increased rate of erosional slope failures.

Alternative Slope Stabilization Measures

The SJCC requires an assessment of alternative methodologies for bank stabilization to provide slope protection.

We concur with the conclusion reached by Coast and Harbor Engineering (identify which report, date, page number) which states, "Wave parameters at the project site for the design storm event are very energetic and only a structural solution can protect against shoreline erosion. From the possible structural solutions, such as sheet-pile wall, revetment, breakwater, or other, a rock bulkhead appears to be the most reasonable method for stabilization of existing uplands at the Runstad property."

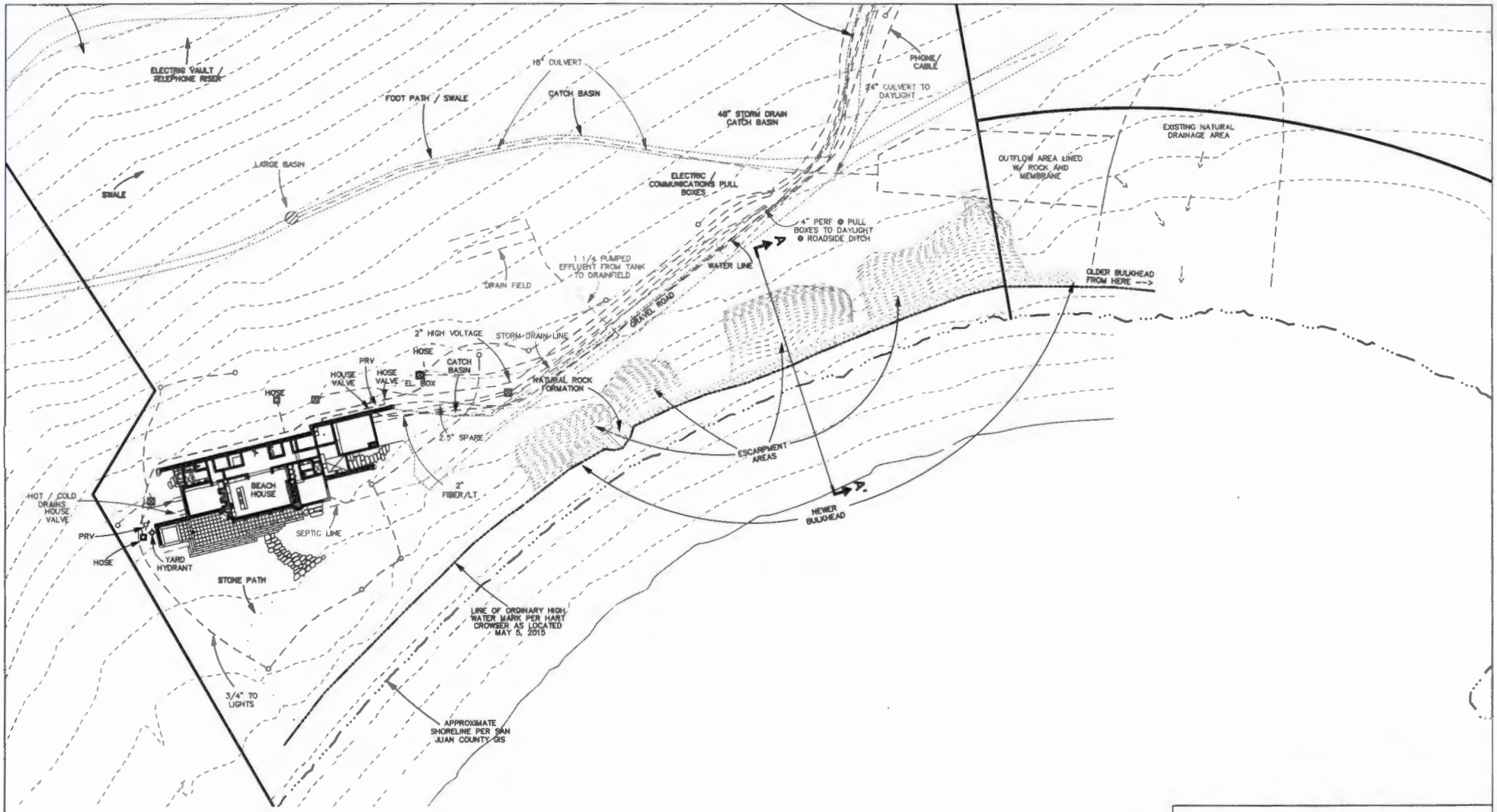
There are potential methodologies that could be employed ***away*** from the existing shoreline that would be protective of the upland structures. For example, the roadway and utilities could be protected from further erosion at the downhill side of the roadway. This could be done by installing a sheetpile wall in what is now the upland, paralleling the road just on the downslope side of the road such that when the unprotected shoreline eroded back to the sheet pile wall the bank regression would be stopped. However, because we do not know what the ongoing erosional forces would be (that might

start eroding a deeper hole in front of the sheet pile wall) it would be necessary to assume that the eventual exposed height of the wall might eventually need to be substantial which would result in the need for a very robust wall with a reinforced concrete cap beam to tie the sheets together. The cost of such a heavy duty structural steel and concrete system would likely be greater than an order of magnitude more expensive than placing what is the existing riprap on the oversteepened slope.

Therefore, it is our professional opinion that the use of riprap to form bank stabilization at the location of the existing oversteepened scarp along the shoreline is both necessary and is the most reasonable and, by far, the most cost effective solution of reduce the rate of slope regression and offer a greater amount of long term protection from the associated roadway and utilities uphill of the shoreline.

Other Potential Impacts

SJCC 18.35.130(G)(3)(f)(vii)(K) requires and "Evaluation of potential effectiveness of corrective measures for on-site drainage issues as an alternative to installing hard or soft structural shoreline stabilization measures." The topography suggests and site observations would indicate that there is potential erosion resulting from the flow of storm water over the slope. Although this may be a contributing factor to erosion of the slope it is minor in comparison to the contribution of wave and current erosion. The onsite drainage issues have been repaired and therefore there is no additional assessment of enhancing on site drainage that is necessary.



Runstad Residence Shoreline Repairs
Blakely Island, Washington

Site Plan

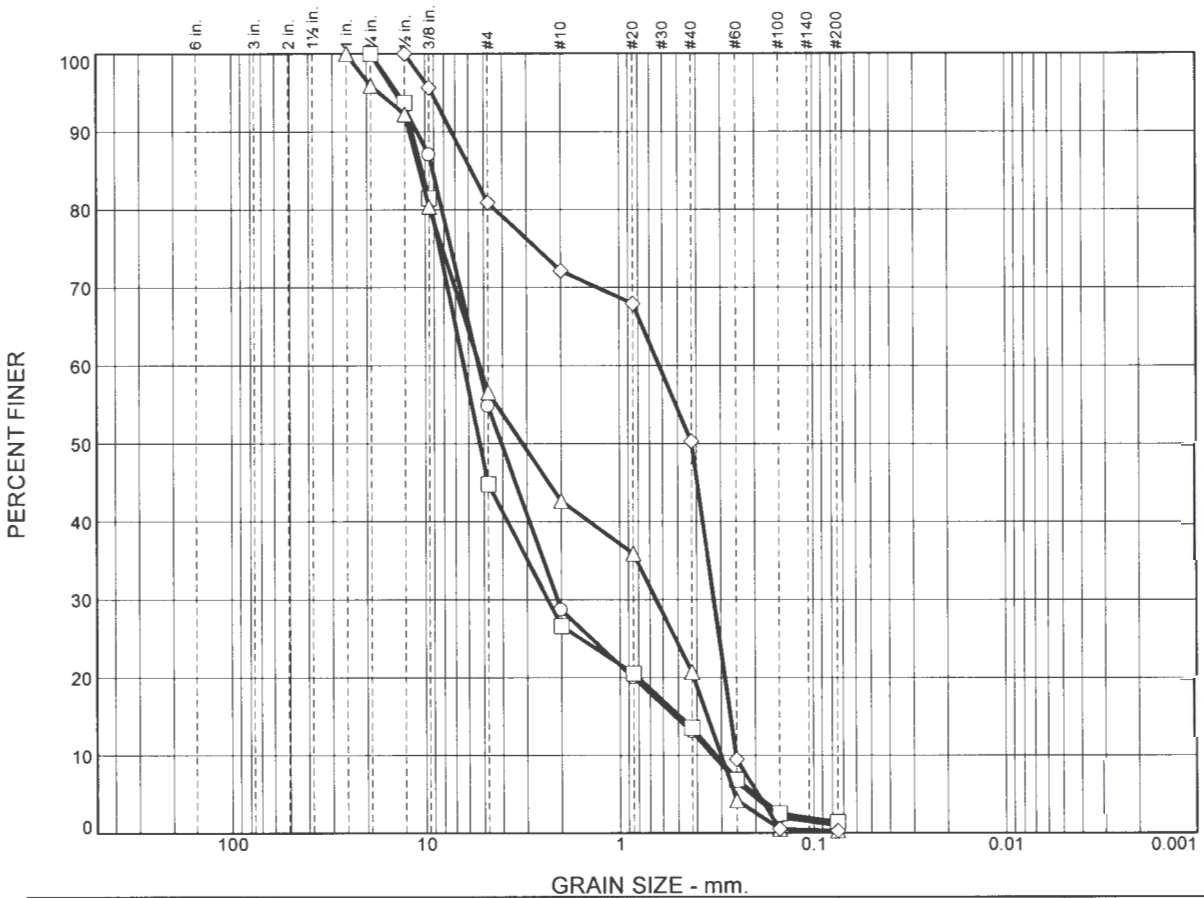
17921-00 12/15

HARTCROWSER

Figure 1

EAL 12/15/15 17921-00-002.dwg

Particle Size Distribution Report



	% +3"	% Gravel	% Sand	% Silt	% Clay
○	0.0	45.2	53.8	1.0	
□	0.0	55.2	43.4	1.4	
△	0.0	43.4	56.3	0.3	
◇	0.0	19.1	80.6	0.3	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	Whaleback	#1		very gravelly SAND, trace silt	SW
□	Whaleback	#2		very sandy GRAVEL, trace silt	GW
△	Whaleback	#3		very gravelly SAND	SP
◇	Whaleback	#4		gravelly SAND	SP

HARTCROWSER

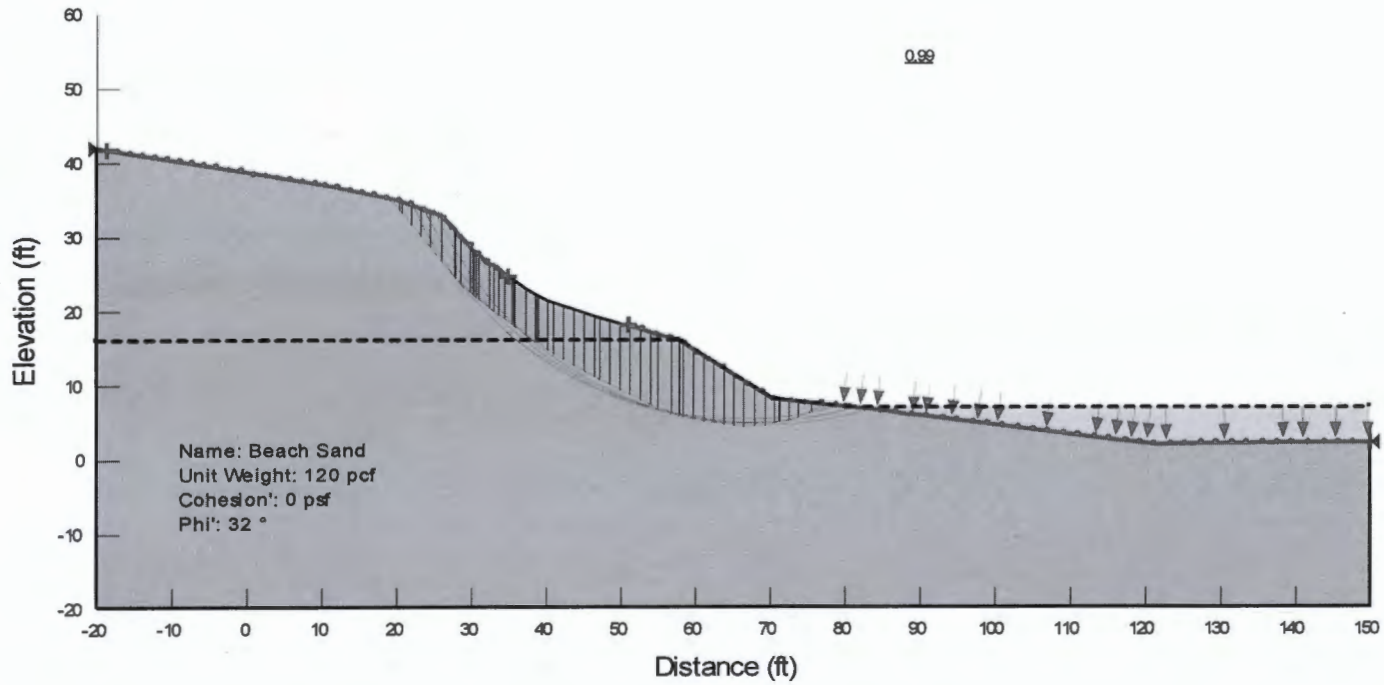
Client:

Project: Runstad Residence Shoreline Repairs

Project No.: 17921-00

Figure 2

Runstad Residence Beach Repair
Slope Stability (Global Stability)
12/15/2015
F of S: 0.99



Runstad Residence Shoreline Repairs
Blakely Island, Washington

Slope Stability
Global Case

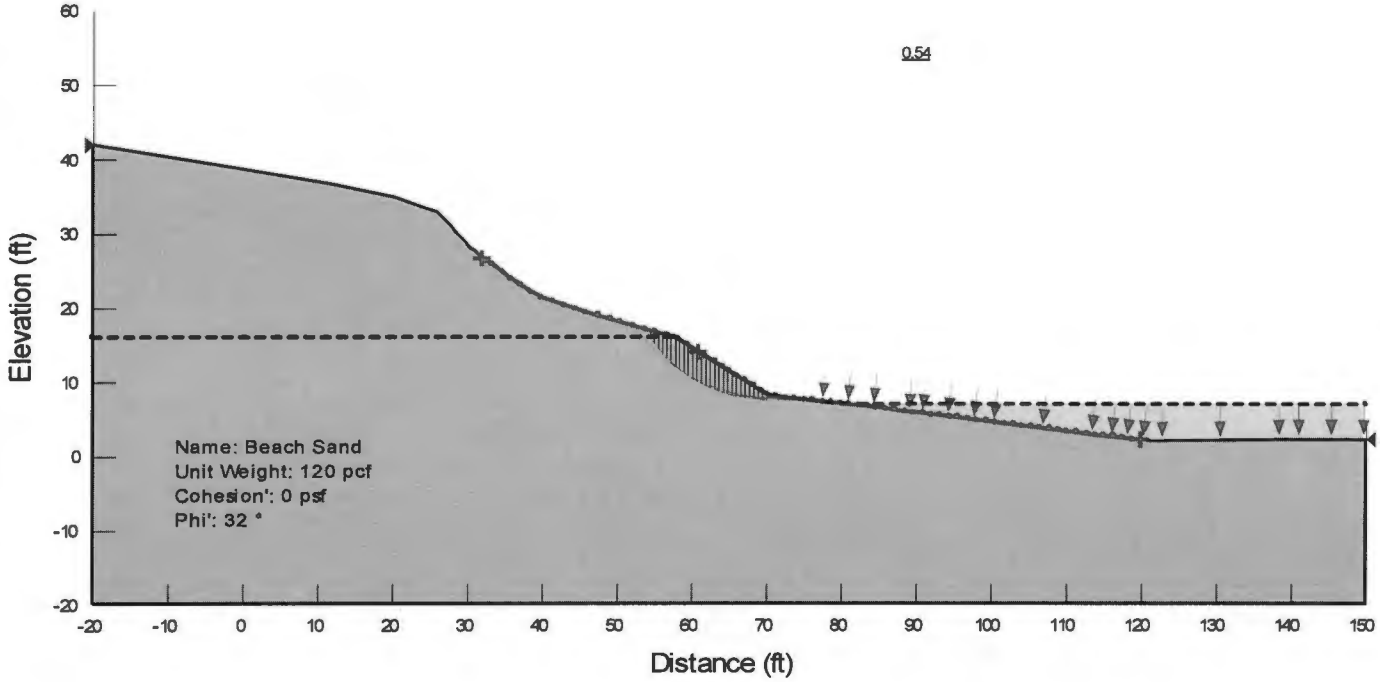
17921-00

12/15

HARTCROWSER

Figure
3

Runstad Residence Beach Repair
Slope Stability (Local Stability)
12/15/2015
F of S: 0.54



Runstad Residence Shoreline Repairs
Blakely Island, Washington

Slope Stability
Local Case

17921-00

12/15

HARTCROWSER

Figure
4

Exhibit K

SURVEYOR'S NOTES

1. THIS TOPOGRAPHIC SURVEY MEETS OR EXCEEDS THE REQUIREMENTS OF WAC 332-130-090.

2. FOR MORE BOUNDARY INFORMATION SEE THE SIMPLE LAND DIVISION RECORDED UNDER AUDITOR'S FILE NUMBER 2010-1014014 AND VOLUME 3 OF LONG PLATS PAGES 13 AND 13A RECORDS OF SAN JUAN COUNTY.

3. THE PURPOSE OF THIS SURVEY WAS TO LOCATE THE ESCARPMENTS ALONG THE BANKS IN THE AREA WHERE THE NEWER BULKHEAD WAS CONSTRUCTED.

4. THE ORDINARY HIGH WATER MARK (OHWM) DEPICTED HEREON, IS DESCRIBED IN HART CROWSER'S NOVEMBER 8, 2013 TECHNICAL MEMORANDUM, ORDINARY HIGH WATER AT RUNSTAD PROPERTY ON BLAKELY ISLAND. THE WASHINGTON DEPARTMENT OF FISH & WILDLIFE AGREED WITH HART CROWSER'S FINDINGS AND DETERMINATION OF THE OHWM IN WDFW CORRESPONDENCE DATED JANUARY 2, 2014.

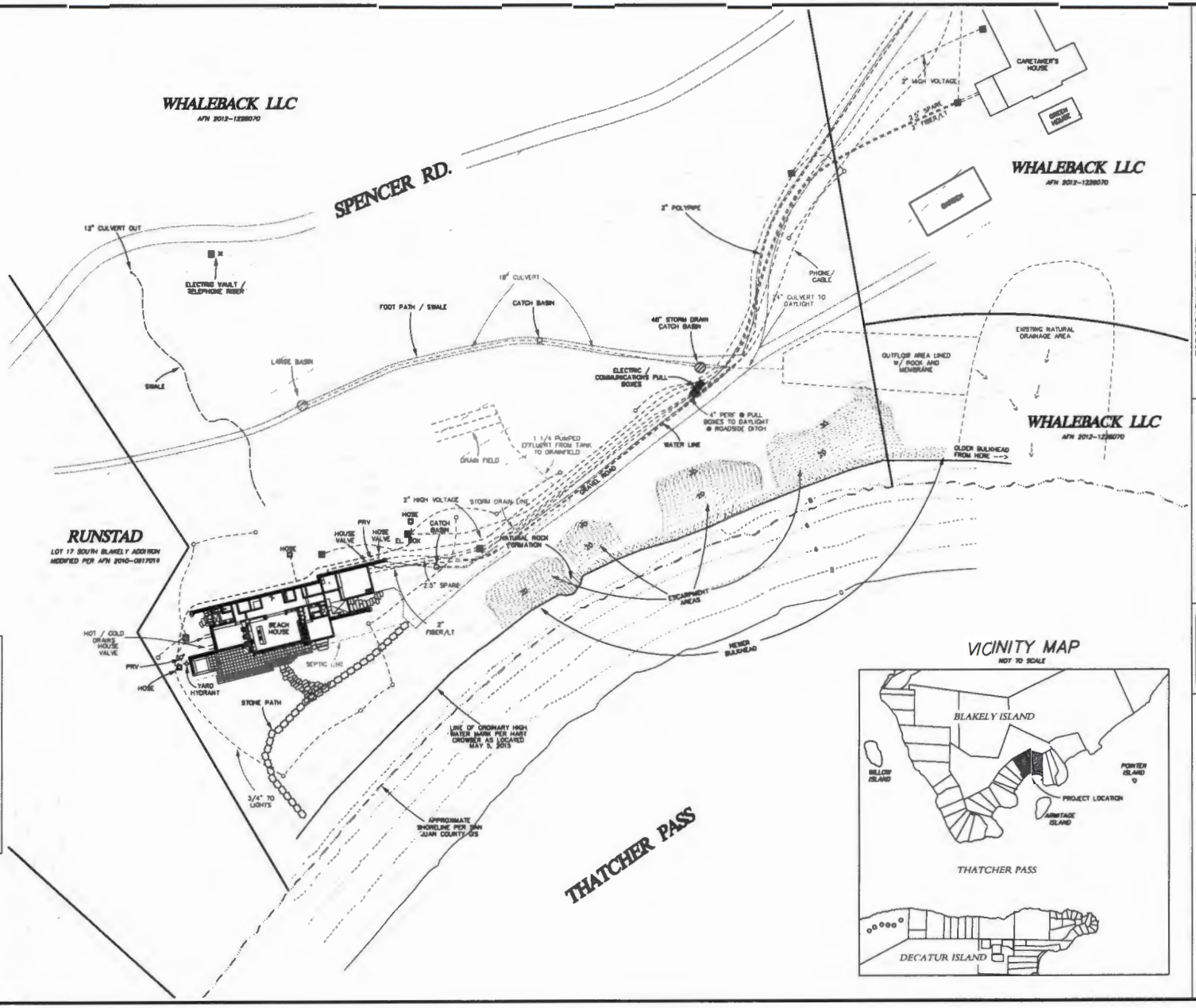
5. UTILITIES SHOWN HEREON IN COLOR ARE APPROXIMATE PER AS-BUILT PDF'S PROVIDED BY THE CLIENT DATED NOVEMBER, 2010. SAID UTILITIES SHOWN IN COLOR WERE NOT LOCATED THIS SURVEY.

6. THE BEACH HOUSE SHOWN HEREON IS PER THAT SITE PLAN PROVIDED AND PREPARED BY CONARD ROMANO ARCHITECTS.

SCALE IN FEET

0 30 60 90

ELEVATION DATUM ~ MLLW = 0.00 (FEET)



LEGEND

- PROPERTY LINE
- LINE OF ORDINARY HIGH WATER MARK
- 5-FT CONTOURS
- 1-FT ESCARPMENT CONTOURS
- ELECTRIC UTILITIES PER AS-BUILTS (SEE NOTE #5)
- SEPTIC LINE PER AS-BUILTS (SEE NOTE #5)
- WATER LINE PER AS-BUILTS (SEE NOTE #5)
- STORM DRAIN PER AS-BUILTS (SEE NOTE #5)
- UTILITY VAULT
- HOSE / SPIGOT
- STORM DRAIN CATCH BASIN - SMALL
- STORM DRAIN CATCH BASIN - LARGE
- TELEPHONE RISER
- SMALL YARD LIGHT
- NEWER BULKHEAD

EQUIPMENT AND PROCEDURES

EQUIPMENT: LEICA 1201+ (ONE SECOND THEODOLITE)

PROCEDURE: FIELD TRAVERSE

VICINITY MAP

NOT TO SCALE

PROPERTY INFORMATION

SITE ADDRESS: BLAKELY ISLAND

TAX PARCEL NUMBER:

DESCRIPTION: ESCARPMENT TOPO

WRS:

JON RUNSTAD
1201 THIRD AVE STE #2700
SEATTLE, WA 98101-3221

TOPOGRAPHIC SURVEY FOR JON RUNSTAD ON BLAKELY ISLAND

DRAWN BY: RWR	COMP REF: 11-089 (TOPO)	JOB NO. 11-089
CHECKED BY: RWR	DATE: 11/23/15	SHEET 1 OF 1

SAN JUAN SURVEYING
P.O. BOX 641
FRIDAY HARBOR, WA 98250
WWW.SAN-JUAN-SURVEYING.COM

SECTION INDEXING DATA

QUARTER / QUARTER	SECTION	TOWNSHIP	RANGE
NW/NE, NE/NE, G.-3	10	35 NORTH	1 WEST

Exhibit M

MEMORANDUM

DATE: December 17, 2015

TO: Joe Brogan, Foster Pepper PLLC

FROM: Jon Houghton, PhD

RE: **Fish and Wildlife Habitat Conservation Area Report**
Runstad Property on Blakely Island, San Juan County, Washington
17921-00

This Fish and Wildlife Habitat Conservation Area (FWHCA) Report describes effects on FHWCA and associated species of a bank stabilization project (the "Project") constructed along the waterfront of a property owned by the Runstad family on Blakely Island, San Juan County, Washington. This Report has been prepared in accordance with the guidance provided in SJCC 18.35.130(G)(3)(f)(vi).

The preparer, Dr. Jon Houghton, is a Senior Marine Biologist and Principal with Hart Crowser, Inc. He is an environmental professional with 45 years of research and consulting experience related to the marine and nearshore ecology of the Salish Sea. In addition, he is a US Fish and Wildlife Service (USFWS)-certified marbled murrelet observer, a marine mammal monitor, and an Audubon Society master birder. He is therefore a "qualified biological professional" per SJCC 18.35.130(G)(3)(f)(vi).

FWHCAS on Site

The shoreline along which the Project was constructed has the following types of FWHCAs (SJCC 18.35.115):

A. **Areas with which endangered, threatened or sensitive species have primary association.** Marine waters adjacent to the site support several species of salmonids and rockfish listed as endangered or threatened under the federal Endangered Species Act (ESA). Additional sensitive species that may occasionally feed in (or over) waters inshore of Armitage Island along the north side of Thatcher Pass and along the project site include peregrine falcon, common loon and marbled murrelet. It is unlikely that southern resident orcas or other whales would enter these confined waters, but Steller's sea lion could occasionally do so.

B. **Shellfish areas.** Various shellfish species (cockles, butter clams, littleneck clams, purple varnish clams, horse clams) are present in low densities at mid- to lower intertidal elevations and

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subtidally along the shoreline downslope from the Project. There is no commercial harvest of these species on the site but limited harvest by local residents may occur from time to time. Dungeness crab and pandalid shrimp may also move into tidal areas below the Project during high tide.

C. **Kelp and eelgrass beds.** Kelp and eelgrass are present on the lower intertidal beach below about 0 feet mean lower low water (MLLW). Kelp (mostly *Saccharina latissima*) is typically attached to a hard substrate such a cobble or rock, while the eelgrass is found in areas with loose sand or mixed silt, sand, and shell habitat.

D. **Forage fish spawning habitat.** Eight forage fish spawning surveys of the most suitable habitat for spawning by surf smelt, Pacific sand lance, and Pacific herring were conducted between November 2013 and January 2014. Surveys were conducted in accordance with Washington Department of Fish and Wildlife (WDFW) protocols by a biologist trained in those protocols, in front of the Project and for about 50 meters on either side of it. No evidence of actual spawning was found but habitats sampled generally appeared to include substrates appropriate for surf smelt spawning.

H. **Habitats of local importance/critical salt water habitats.** This category essentially encompasses all nearshore marine waters of the county since ESA-listed salmonids utilize (have a primary association with) all such waters.

I. **Areas with which select species (see SJCC 18.35.115 (I)) have a primary association.** Of the species listed, Great Blue Heron occasionally forage along the shorelines during lower tides and Pigeon Guillemot may forage in open water areas of Thatcher Pass. No nesting sites for either species are known within the area around Thatcher Pass.

Effects on FWHCA and Conformance with SJCC 18.35.130(G)

Mitigation Sequencing (SJCC 18.35.130(G)(1)(b))

(i) The impacts of construction of the Project on riparian and marine habitats were avoided or minimized to the extent practicable in the following ways:

1. The Project was constructed at or above the OHW line (Hart Crowser 2013), avoiding long-term effects on ecological processes as described in greater detail below.

2. Further upland erosion and introduction of potentially harmful silt to the beach were minimized by land stabilization and revegetation of adjacent uplands completed in early 2012.

3. Intertidal access to the work area was conducted during low tides and over temporary work pads designed to prevent bank and beach erosion and removed following the completion of work.

4. Care was taken to avoid removal of any riparian trees, leaving an intact canopy of mature trees behind the Project.

(ii) Despite the above listed efforts to minimize impacts, construction resulted in the following unmitigated adverse impacts on the beach and nearshore ecological processes.

1. Tracked and wheeled vehicles accessed the work site by driving on the upper beach, accessing the beach via a temporarily placed quarry spalls ramp and apron at the west end of the work zone. Beach gouging by heavy equipment was noted by WDFW inspectors. While much of this work occurred in an area of potential surf smelt spawning, previous surveys by Friends of the San Juans, and subsequent surveys conducted by the Hart Crowser (2014a) suggest that surf smelt have not and do not spawn in the area.

2. Some beach materials, primarily large boulders were removed from the beach and incorporated into the Project, removing substrate for a variety of biota.

(iii) Impacts of construction were rectified or mitigated on site in several ways:

1. Construction was begun by digging back the upland bank (landward of OHW) and excavating a keyway or trench within which to construct the foundation for the Project.

2. Rock used for the Project is of sufficient size to maintain stability in the long term (CHE 2015).

3. The upper beach was regraded to remove equipment tracks.

4. The slopes above the Project were graded and stabilized with straw and by planting of grasses.

5. Quarry spalls placed at the west end of the project area for equipment access to the beach were removed from the beach and from the adjacent riparian zone. This area and the bank to the east were planted with what has become a healthy stand of dune grass (Photograph 1).

(iv) Impacts from the disturbance of on-beach habitats during construction have been reduced or eliminated over time by the natural sorting of beach materials by wave action and by colonization of the backshore at the base of the Project by native salt-tolerant species (Photograph 2). Since at least 2013, there has been no visible evidence of the changes that resulted from work on the

beach. Similarly, there is no evidence of changes in beach substrates related to the presence of the Project. The Applicant has committed to preservation of the shoreline and beach as a low-use area; no motorized vehicles will be allowed on the beach.

(v) The Applicant has committed to implementing a beach nourishment program that will be approved by WDFW.

(vi) The Applicant has committed to implementing a riparian vegetation enhancement plan (Hart Crowser 2014b) that will increase riparian function, and hence function of adjacent intertidal processes along the reach of shoreline in the project area.

(vii) As part of the riparian vegetation enhancement plan, a 4-year monitoring program was included (Hart Crowser 2014b) to ensure survival of installed plants, control of invasive species, and development a healthy riparian understory.

Site Inventories (SJCC 18.35.130(G)(1)(c))

Following emergency construction of the Project, Hart Crowser was contracted to, among other things, assess habitats and ecological functions potentially impacted by Project construction and by its presence along the shoreline. A series of site visits from November 2012 through May 2015, many conducted during low tides, has provided an understanding of the nature of local assemblages, and of seasonal changes in intertidal and riparian habitats. Information on the nature of FWHCAs in the project area is provided in the previous section.

From January 2013 to January 2014, Hart Crowser conducted surveys to detect any forage fish spawn that may be deposited on the beach. Prior surveys had not reported any spawning activity on the beach (San Juan County PHS maps) and our surveys likewise, found none. This surface substrate has persisted relatively unchanged between our first forage fish spawning survey (January 2013; Photograph 3) and our most recent site visit (May 2015; Photograph 4).

During the summer of 2013, Hart Crowser performed a low-tide survey to map the upper extent of a large eelgrass bed that covers much of the shallow subtidal portion of the bay. The upper limit of eelgrass was generally near or below MLLW well removed from direct impacts during construction. Eelgrass present consisted of relatively large plants that appeared to be robust. Local residents reported that the eelgrass bed appeared qualitatively to have changed little over the last decades.

The project area riparian vegetation before Project construction was not documented. However, based on conditions observed by Hart Crowser on the site from 2012 through May 2015, it appears that project construction was completed with considerable care to avoid destruction of existing riparian vegetation. No large trees appear to have been removed and several large (0.5 to over 2 feet diameter

at breast height [dbh]) Douglas fir and red alder remain within 30 feet of the top of the riprap (Photographs 4 and 5). Areas that were directly impacted, either by the slope erosion or by Project construction have been revegetated with grasses (Photograph 4). An area of embankment farther to the west may have been disturbed when used for beach access by equipment during Project construction. This area has been revegetated with native dune grass, *Leymus mollis* (Photograph 1). No non-native invasive shrub or tree species have been identified in the riparian zone.

Effects of Project Construction on FWHCAs (SJCC 18.35.130.G.3.f.vi)

Site visits by WDFW during and following Project construction (e.g., Violation Report dated April 11, 2011) reported disturbance of the upper beach in front of the newly constructed Project. WDFW described evidence of movements of tracked vehicles on the beach, removal of native beach materials for incorporation into the Project, and placement of non-native quarry spalls as a working surface on the beach. This disturbance occurred during a time of year (mid-winter) when it would have significantly impacted forage fish spawning and egg survival if such spawning occurred on this beach. However, surveys conducted by Friends of the San Juans prior to 2011 had failed to detect evidence of spawning on this beach, despite apparently suitable habitat. Following construction, Hart Crowser (2014a) conducted eight surveys of the beach in front of the Project and on adjacent reaches without detecting evidence of spawning, again, despite the presence of habitat and substrates suitable for such activity. We conclude from these results and from general observations of the beach between winter 2012–2013 (e.g., Photograph 2) and spring 2015 (Photograph 4) that the suitability of the beach for forage fish spawning has not been altered either by the construction of, or by the continued presence of, the Project. Thus, the Project appears to have had no net adverse impact on forage fish spawning or spawning habitat.

Another important ecological function of the beach in question is as a migration corridor for juvenile anadromous salmonids as they move through the islands *en route* to the ocean from spawning grounds in rivers on the mainland. While conditions on the beach during construction certainly degraded the quality of that nearshore migration corridor, by the time of the WDFW habitat mapping in early April 2011, conditions appear to have improved substantially. While some areas of non-native quarry spalls remained on the beach and productivity of epibenthic zooplankton prey for the smallest outmigrants would likely have been reduced, these conditions would not have led to immediate mortality or to loss of fitness of outmigrants; most likely, they would simply have moved more quickly through the area to undisturbed beach areas to the east and west. Thus, the impact on this FWHCA characteristic would have been short-term, resulting in minimal, if any, effect on fish survival.

By the spring of 2013, quarry spalls had been removed from the beach, sorting of beach materials by wave action had restored an apparently normal mix of beach substrates (e.g., Photograph 3), and it is reasonable to conclude that production of epibenthic zooplankton would have returned to near pre-construction levels. Through the spring of 2015, the upper beach in front of the Project remained a mix

of sand and gravel as it likely was before construction (e.g., Photograph 4). There is evidence from several photo sequences from 2013 to 2015 that the beach has maintaining a stable elevation or is building in front of the Project (Photographs 6–8 and 9–11). Thus, no continuing adverse impacts on the suitability of the shoreline to support ESA-listed and priority species of salmonids are occurring.

The Runstad shoreline is also a FWHCA for shellfish and macro-vegetation (kelp/eelgrass). These species are found from the lower intertidal area (approximately MLLW) downslope onto the shallow subtidal bench around the north and east side of Runstad shoreline. There is no evidence that construction directly impacted these resources and there is no indication from repeated field inspections that any unusual movement of sediments has been occurring since Project construction that would pose a risk to these resources. Therefore, we conclude that neither Project construction nor its continuing presence has adversely impacted shellfish or eelgrass/kelp assemblages.

Project construction was completed with minimal disturbance of upland riparian vegetation avoiding several large Douglas firs, and red alders that dominate the riparian overstory and provide significant riparian functions of leaf and litter fall, insect production, and shading (Photographs 3 through 5). The Applicant has proposed a planting plan (Hart Crowser 2014b) that would enhance the native vegetative function of the riparian zone by supplementing the existing somewhat sparse understory with plantings of native shrubs. When implemented, this plan and the follow-up monitoring will ensure that the total function of the riparian buffer along this reach of waterfront will increase, likely to a level above that which existed before the upland erosion control measures were implemented in the winter of 2010–2011. This increased riparian function will improve the habitat function of the adjacent marine nearshore by increasing production of leaf and twig litter and insect fall.

Technical analysis based on wave modeling (CHE 2015) has concluded that the Project has had no measureable effect on the nature or movements of coastal sediments along the Runstad shoreline. This finding is consistent with our observations of the nature of local beach materials from early 2013 through May 2015. Based on this analysis and our observations, we find that there has been no observable effect of the Project on the nature of the beach habitat, or on local ecological functions or local FWHCA.

References

CHE 2015. Technical Memorandum, Runstad Property – Supplemental Coastal Geologic Analysis. Prepared by Coast and Harbor Engineering.

Hart Crowser 2013. Ordinary High Water at Runstad Property on Blakely Island. Prepared for J. Brogan, Foster Pepper, PLLC, November 8, 2013.

Hart Crowser 2014a. Forage Fish Spawning Survey, Runstad Residence Beach Repair. Prepared for J. Brogan, Foster Pepper, PLLC, February 13, 2014.

Hart Crowser 2014b. Riparian Enhancement Plan, Runstad Shoreline, Blakely Island, San Juan County, Washington. Prepared for Foster Pepper, PLLC, August 8, 2014.

Attachment:
Photographs

R:\NOTEBOOKS\1792100_Runstad Residence Beach Repair\Deliverables\Memos\FWHCA Memo\20151217\Runstad FHWCA Memo_20151217.docx

Photographs

Photograph 1 – Restored barge landing and rounded boulder embankment, Sept. 10, 2013 (former barge access is in area of dense pale blue-green dune grass on left side of photograph)

Photograph 2 – Project east end, looking west, Sept. 10, 2013

Photograph 3 – Center of Project Area, looking west, Jan. 15, 2013

Photograph 4 – East of center of Project Area, looking west, also showing revegetated area behind Project, May 5, 2015

Photograph 5 – East end of Project section looking west (Project begins below triple-trunk alder; May 5, 2015)

Photograph 6 – Project east end, looking west, Jan. 15, 2013

Photograph 7 – Project east end, looking west, Sept. 10, 2013

Photograph 8 – Project east end, looking west, May 5, 2015

Photograph 9 – West end bed rock, looking west, Jan. 15, 2013

Photograph 10 – West end bed rock, looking west, Sept. 10, 2013

Photograph 11 – West end bed rock, looking west, May 5, 2015

Exhibit N

COAST & HARBOR
ENGINEERING
A Division of Hatch Mott MacDonald

Technical Memorandum
Runstad Property – Supplemental Coastal Geologic Analysis

Prepared by qualified coastal geologic professional (in accordance with SJCC 18.35.055-070). SJCC 18.35.130(G)(3)(f)(vii)

This technical memorandum was prepared by Dr. Vladimir Shepsis, a professional engineer with more than 40 years of experience in the fields of coastal engineering, geomorphology, and hydro and littoral dynamic processes. In accordance with SJCC 18.35.055-070), *SJCC 18.35.130(G)(3)(f)(vii)* the qualification of Dr. Vladimir Shepsis meet the San Juan County definition of a "qualified professional." This technical memorandum provides the information, results of analysis, and coastal modeling that is required to comply with the Supplemental Coastal Geologic Analysis as requested by the updated, March 31, 2014 San Juan County SJCC 18.35.130 G Ordinance 01-2015.

Description of the causes for the erosion, SJCC 18.35.130(G)(3)(f)(vii)(A)

The shoreline along the Runstad property and Blakely Island has been subjected to long-term erosion related to multiple factors, including waves, tidal currents, sea level rise, sediment deficit, and other factors, including upland runoff. The evidence of shoreline erosion can be observed in multiple photographs that were taken during or prior to construction of the recent shoreline erosion protection project. For example, Figure 1 shows the shoreline at the Runstad property prior to construction of the shoreline erosion protection measure.

The figure shows the scarp at the toe of the shoreline bluff which indicates clear evidence of shoreline erosion. Formation of the scarp here is most likely attributed to wave impact during high tide and instability of slope conditions. During high tide, when water depth at the shoreline is 2 to 4 feet or deeper, a significant amount of wave energy that enters the bay is delivered to the bank. This phenomenon was demonstrated by computer simulation of wave refraction / diffraction in the bay. Simulation (numerical modeling) of wave generation and transformation was conducted using the two-dimensional (2-D) numerical model SWAN (a standard tool produced by the Danish Hydraulic Institute). Two numerical modeling grids were constructed and used for simulation: a Large Domain Grid and a Nested Domain Grid. The numerical modeling grids were constructed using available bathymetric survey data from the Puget Sound Digital Elevation Model (Finlayson 2005) and NOAA surveys. Figure 2 shows the numerical modeling domains (nested and large) with depth shown, in color format. For example, deep blue color indicates that water depth of 40 meters and deeper (130 feet and deeper) is located inside the bay at relatively close proximity to the shoreline.

Figure 1. Shoreline along Runstad property prior to construction of shoreline erosion protection measure

Figure 2. Numerical modeling domains (nested high resolution, and large-scale (inset)) in color format, based on DEM and NOAA data

Wave modeling requires depth data throughout the domain. Where depth data are lacking in the nearshore area (not colored in the figure) depth values were generated by interpolation between the NOAA bathymetric data and recent topographic survey data. Wind data that was used to drive the numerical wave model was developed from processing of measured long-term (a total of 60 years) wind data from the Whidbey Island meteorological station at Ault Field. Extreme value analysis of these long-term measured data was performed. The design wind storm parameters were determined as follows: Direction = 140 deg; Return period = 25-year; Speed = 47 m.p.h. (41 knots).

The results of numerical modeling are shown in Figure 3 in color format. The figure shows spatial distribution (plan view) of significat wave height over the nested modeling domain. Reddish color indicates larger waves (higher wave height) and blueish color shows smaller wave heights or no waves. The figure shows that during this design storm a significant amount of wave energy penetrates into the bay and propagates to the shoreline[1]. Wave gauges were deployed in the model along the shoreline to extract energy spectra characteristics of waves directly at the Runstad property. Extracted output at the location of the revetted shoreline at the Runstad property during the design storm event is significant wave height of 2.2 ft with a peak period of 3.7. We emphasize that this modeling is preliminary; with more detailed bathymetry and model refinement, it is likely the wave energy shown to reach the bank could be greater than stated here.

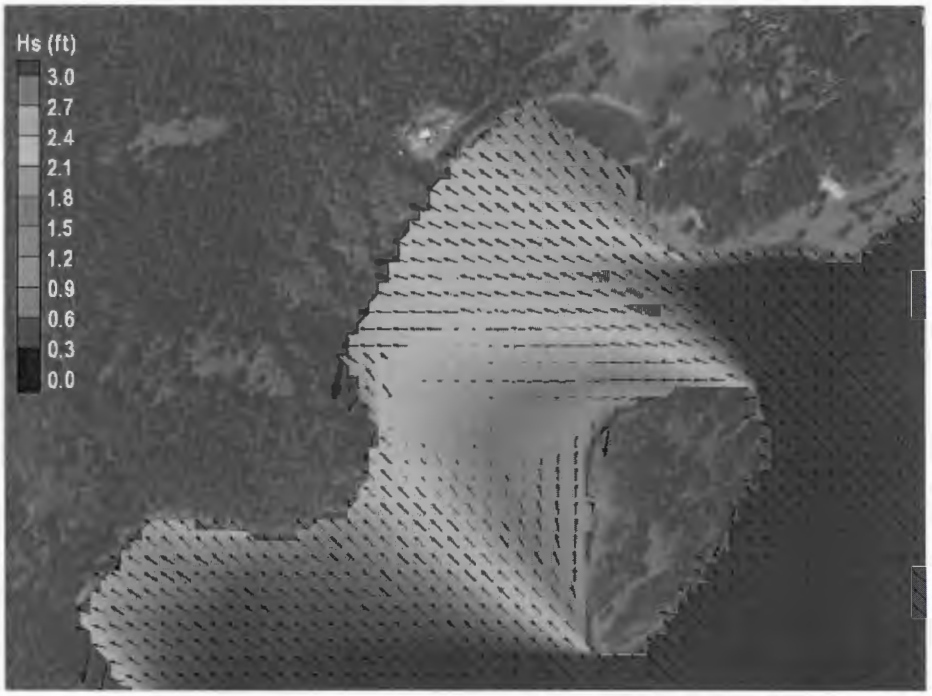


Figure 3. Model results of wave height in vicinity of Runstad property shoreline

The wave energy from these waves dissipates through exerting pressure, stresses, and generating wave runup velocities and other hydrodynamic factors that interact with the bank. Because a large part of the Runstad property shoreline is formed with poorly consolidated material, this material is mobilized by these hydrodynamic factors, resulting in formation of the erosion scarp shown in Figure 4 and other possible scarps at this shoreline.

What was demonstrated by this numerical model case is only one fragment of long-term, multiple, and random wave impacts on the Runstad property shoreline. These impacts have been occurring and will occur in the future. The frequency of these shoreline erosion induced storm events will increase in the future due to climate change. In addition, more wave energy will

[1] The float at the Runstad property was destroyed during a wave storm on December 2009. It is one indicator of strong wave energy impact on the shoreline at this location.

propagate to the shoreline with sea level rise in the future, which would have resulted in more damage to the Runstad shoreline if the bank stabilization project (the "Project") had not been built.

Past erosion rates over a period of at least 30 years, SJCC 18.35.130(G)(3)(f)(vii)(B)
The analysis was conducted to determine historical rates (for the last 30 years) of bluff erosion at the Runstad property, as required by SJCC 18.35.130(G)(3)(f)(vii)(B). It was found that there was no actual measured shoreline position data that potentially could be used for estimating the rates of bluff erosion at the Runstad property. In lieu of actual measurements (topographic survey) data, the typical industry approach would be to process and analyze historical aerial photographic data. For this purpose, CHE compiled and processed the available historical geo-referenced aerial photographs dated from 1942 to the present time. Figure 1 presents some of these aerials from 1941, 2005, 2011, and 2013.

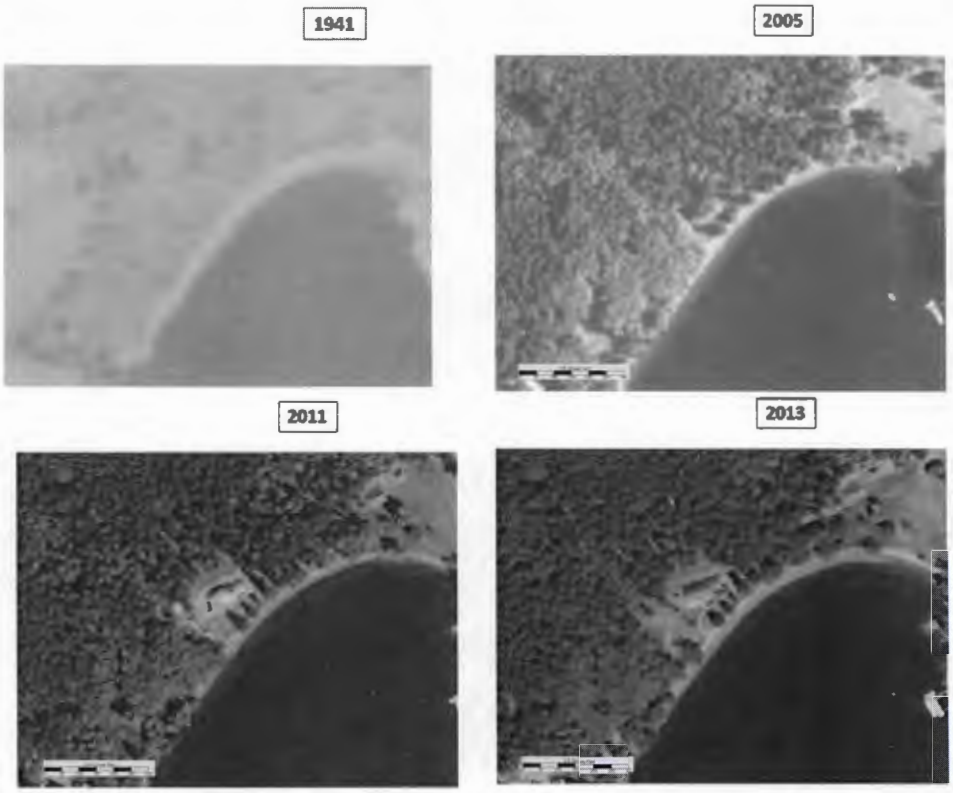


Figure 4. Aerial photographs of Runstad property from 1942 to 2013. Note: tide elevations are different for each photograph.

However, due to insufficient (coarse) resolution of the aerial photographs, any meaningfully estimate of the rate of bluff erosion at the Runstad property shoreline was not feasible. In lieu of sufficient aerial data, for further analysis and engineering effort the rate of shoreline erosion at the Runstad property was estimated based on literature review and data from similar project-prototypes located in the nearby Puget Sound area. Compilation and review of relevant publications and project-prototypes revealed the following:

- Recession rates of the shoreline in Island County appear more commonly to be on the order of a few centimeters (~1") a year, or less. This assessment was made in the U.S. Geological Survey Professional Paper "Coastal Bluffs and Sea Cliffs on Puget Sound, Washington" by Hugh Shipman, dated 2004 (also found on the Washington State Ecology website).
- Jim Johannessen, in his 2011 technical memorandum "Site Enhancement Recommendations: Technical Memorandum for East Lopez Island Beach Nourishment Plan and Monitoring Plan" estimated that the average rate of bluff erosion at East Lopez Island is approximately 1.7" per year. The East Lopez shoreline may be considered as a prototype to the Runstad shoreline, with the understanding that the shoreline at East Lopez Island is open to direct wave impact. The shoreline at the Runstad property, however, is sheltered by Armitage Island which reduces direct wave impact and the rate of erosion, respectively. The estimated rate of erosion (1.7" per year) measured at the East Lopez shoreline most likely would be much smaller for the shoreline at the Runstad property, which is sheltered from direct waves.

Considering the published information above, the historical rate of shoreline erosion at the Runstad property shoreline is estimated at approximately 1" per year. Please note that the estimated rate of erosion herein as well as the estimates of these rates developed by others (see above) present a time-space average estimate of rate of shoreline retreat. In reality, most of the time shoreline erosion is represented with localized retreats (slumps) occurring at various frequencies. For example:

> *The shoreline may be stable for 10-15 years, but retreats by 2-3 feet or a larger distance during one large storm event. During this storm event the retreat (slump) occurs along a localized length of the shoreline. Next, shoreline retreat that may happen in 10-15 years (during an extreme storm event) occurs at a different part of the shoreline. Integrating shoreline retreat for a long period of time (30-40 years) due to slumps occurring with a frequency of 10-15 years at localized locations, one may estimate the rate of erosion for the entire shoreline to be <1" per year.*

Projection of future rates of erosion over the next 30 years, SJCC 18.35.130(G)(3)(f)(vii)(C)
Two scenarios are considered herein for projection of future rates of Runstad property shoreline erosion over the next 30 years: a) shoreline protection with the Project; and b) no shoreline protection.

a) Installation of shoreline erosion protection, the Project, provided a buffer to direct impact of storm waves on soft material of the bluff at the Runstad property. It appears that the Project material is stable to withstand an extreme storm event and is sufficiently durable to maintain the integrity of the structure for at least the next 30 years. It is our opinion that as a result of installation of the Project, the shoreline erosion rate at the Runstad property would be non-detectable and equal to zero during the next 30 years.

b) If no bank stabilization had been installed and would not be installed in the future (for the next 30 years), rates of shoreline erosion would be the same or higher. As discussed above, the rate of erosion is a function of strength and frequency of wind storm events and coincidence of these storms with high water elevations. It is expected that climate change will result in an increased frequency of the high winds and larger wave storm

occurrence during the next 30 years. At the same time, the sea level rise effect will increase probability of coincidence of strong wave storms with high water elevations at the Runstad shoreline. Both of these effects; increase in frequency of strong storm events and increased water level, would result in higher wave energy at the shoreline and an increase in the rate of shoreline erosion, if the shoreline was not protected by the Project. There is no methodology found to predict the change in frequency of strong storm events, coincidence of these events with high water elevations, or the impact of the above on the rate of shoreline erosion at the Runstad property. As a general estimate, it is suggested that during the next 30 years the rate of shoreline erosion at the Runstad shoreline would have been in a range between 1" and 2" per year if no bank stabilization had been installed.

Consideration of the estimated rate of erosion must also be informed by existing slope conditions, which are dynamic. In this case, geotechnical analysis performed by Hart Crowser (December 17, 2015) found that the existing slope is barely stable, HC Memo at 2. Further, Hart Crowser concluded that without the presence of the stabilizing and buttressing effect of the existing riprap erosion protection the slope will continue to fail in a "calving" mechanism which will cause the slope to continue to regress towards the existing roadway and utilities. HC at 3. Thus, rate of erosion is only a time-space average estimate and, in this case, does not represent actual dynamics of the shoreline retreat occurring on-site

Detailed topography from the Project to the lower beach, SJCC 18.35.130(G)(3)(f)(vii)(D)
Two topographic surveys conducted along the bank stabilization at the Runstad property are available; March 2014 and November 2015. Figure 5 shows the results of a 2015 topographic survey at the Runstad property shoreline, overlaid on an aerial photograph in color format.

Figure 5. Results of 2015 topographic survey at Runstad property shoreline, overlaid on aerial photograph

The figure also shows the locations of two transects, A-A' and B-B', that were selected to plot the topography data on a cross-sectional format. The topographic survey data from 2014 and 2015, plotted along these transects are shown in Figure 6.

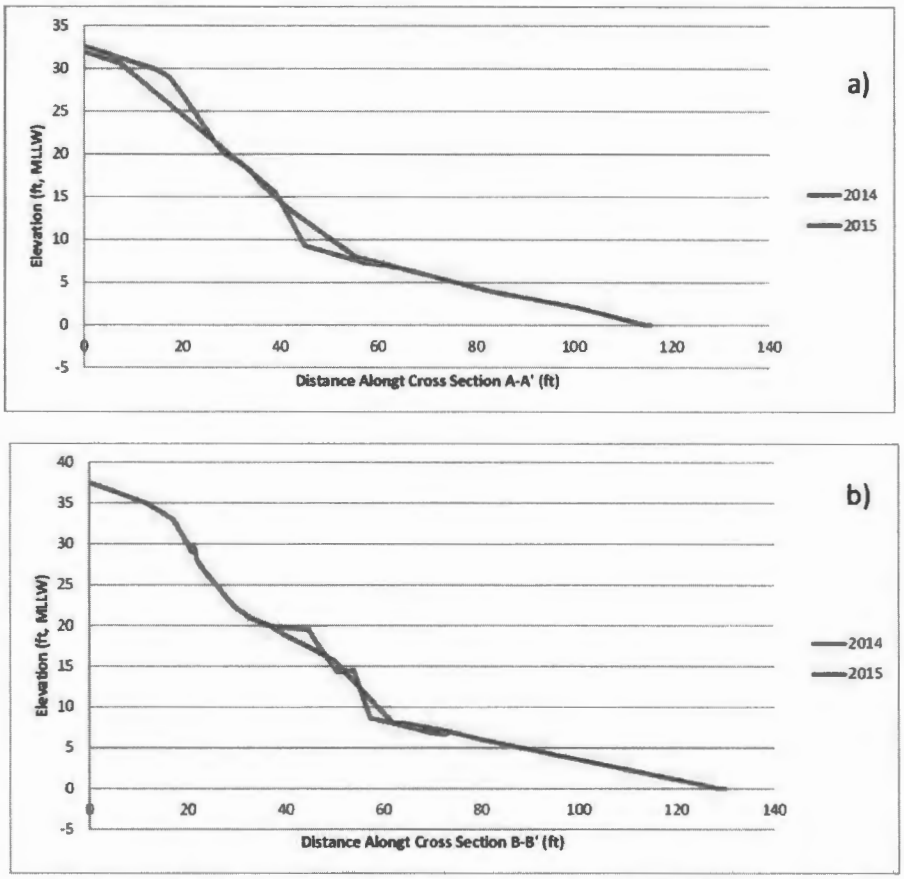


Figure 6. Topographic survey data (2014 and 2015), plotted along transects A-A' (upper plate) and B-B' (lower plate)

The topo survey data do not strictly define the locations of the toe and crest of the Project. Based on review and superposition of the data, it appears the Project was built somewhere between elevations +7 ft and 15 ft of MLLW. The figure above shows that the survey data from 2014 and 2015 closely overlap each other. No erosion at the upper and lower parts of the beach was observed as a result of Project construction. In opposite, some accumulation of sediment at the toe of the Project is shown in the 2015 survey. Further observation may define if this accumulation is an indication of long-term positive effect of the Project on the Runstad shoreline.

Evaluation of anticipated impact of sea level rise on the Project, ecological functions associated with critical salt water habitat (using most recent sea level rise predictions used by the San Juan County public works department in planning road improvements, SJCC 18.35.130(G)(3)(f)(vii)(E)

Different predictions of sea level rise exist for the general Puget Sound area that produce a large range of possible water elevation that may occur in a 100-year time frame period. In addition,

one should be careful about how these general predictions account for uplift phenomena, and, if at all, how these predictions are applicable to the San Juan County area.

Assuming a worst case scenario - maximum predicted level of sea level rise 4 ft for 100 years (U.S. Army Corps of Engineers), still there would be no significant effect on the Project from the increased of water surface level for the next 30 years (project lifetime). The crest elevation of the Project still would be much higher than the water elevation during a wind-wave storm. No overtopping or additional scour above the level of the Project will occur. In addition, the size of rock material in the Project appears to be sufficient. An increase of wave energy (due to increase of water depth and frequency of storms) would not jeopardize the integrity of the Project.

Description of any adverse impacts (including size or quantity of the substrate and/or sediment in the vicinity or downdrift from project), SJCC 18.35.130(G)(3)(f)(vii)(M)

Analysis of possible adverse impacts from construction of the Project on physical environments at the adjacent aquatic area was conducted using available data and results of 2–D wave refraction/diffraction numerical modeling. As directed by SJCC 18.35.130(G)(3)(f)(vii)(M), the impact analysis was focused on the size or quantity of the substrate and sediment in the vicinity or down-drift from the Runstad property shoreline. In other words, the analysis was conducted to determine if construction of the Project resulted in any of the following:

- Change of sediment (type or composition) in front of the property.
- Change of direction and quantity of longshore sediment transport, specifically down-drift from the property.

Sediment characteristics at the Runstad property shoreline were analyzed using ground photographs and based on sampling and grain size analysis of beach sediments in front of the revetment. Figures 7 through 9 are a compilation of photographs showing beach conditions in front of the Project during a four-year period, 2012-2015.

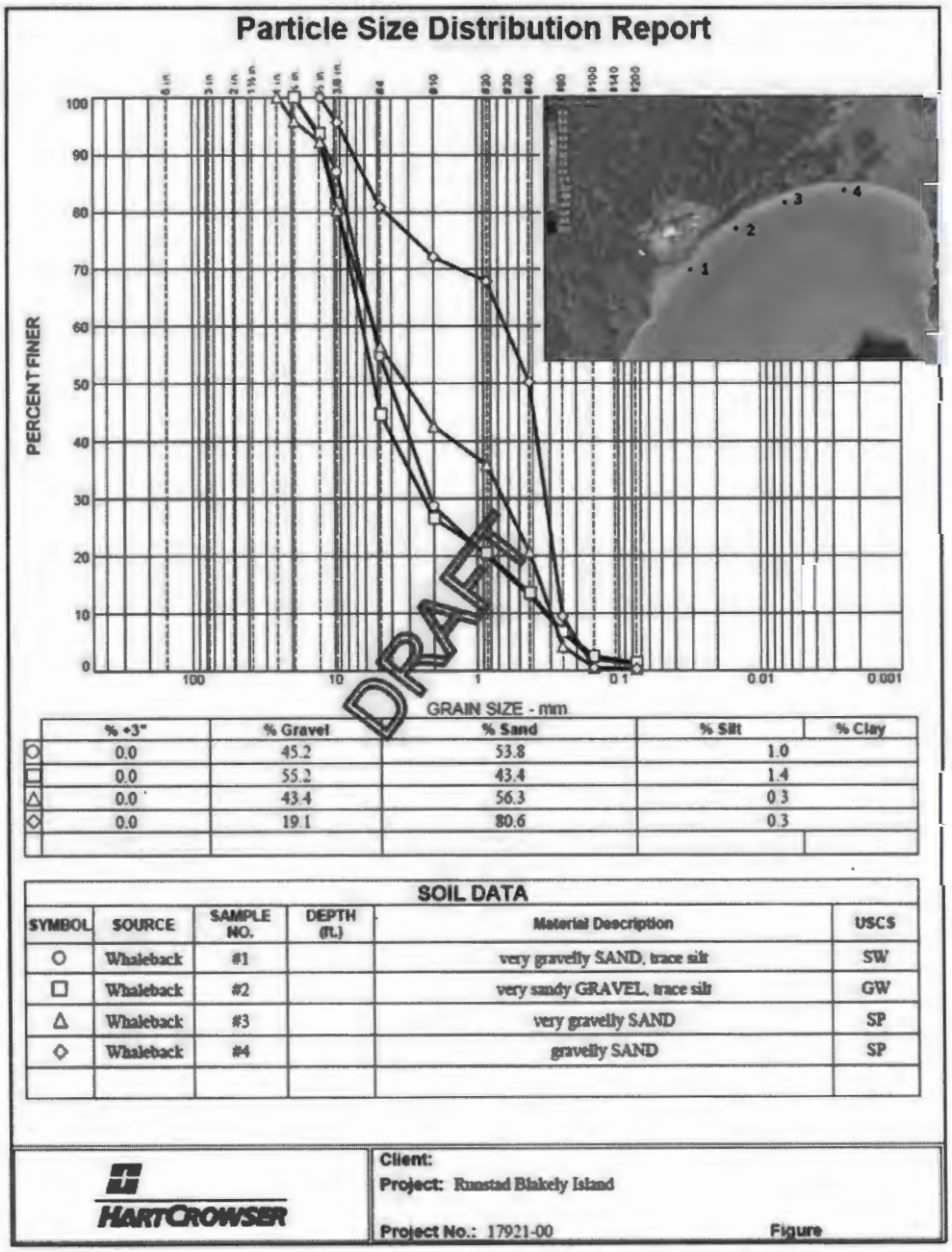
Figure 7. Runstad property shoreline, November 20, 2012

Figure 8. Runstad property shoreline, September 10, 2013

Figure 9. Runstad property shoreline, May 5, 2015

Although the photographs were taken at different times, at various tide elevations, and from different exposition, the similarity of beach sediment in front of the bank stabilization is obvious. For example, Figure 7 was likely taken at high tide conditions and shows a gravelly-sandy beach in front of the bank stabilization. This beach material is estimated at 2" minus and likely fits into a known category of "fish mix." Similar beach material was observed in all the other photographs observed at the project site one year (2013) and three years (2015) later.

In addition to reviewing the photograph data, grain size analysis was conducted on four samples of beach sediment in front of the bank stabilization to develop more specific information on sediment characteristics. Figure 10 shows an approximate location of the samples and preliminary results of grain size analysis of these samples.



	% +3"	% Gravel	% Sand	% Silt	% Clay
○	0.0	45.2	53.8	1.0	
□	0.0	55.2	43.4	1.4	
△	0.0	43.4	56.3	0.3	
◇	0.0	19.1	80.6	0.3	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	Whaleback	#1		very gravelly SAND, trace silt	SW
□	Whaleback	#2		very sandy GRAVEL, trace silt	GW
△	Whaleback	#3		very gravelly SAND	SP
◇	Whaleback	#4		gravelly SAND	SP

Figure 10. Approximate locations of sediment samples at Runstad shoreline and results of grain size analysis

The results of grain size analysis shows that beach sediment along the Runstad shoreline is relatively uniformed and consists of fine gravel and sand. The grain size analysis is consistent with the conclusions of the ground photographs review. Substrate material at the Runstad property most likely has not been altered by construction of the Project. The beach material in front of the bank stabilization has been represented by gravely-sandy material that is relatively stable and similar to that located outside of the Project area. For example, Figure 11 shows a photograph of the shoreline to the west of the Runstad property. The type of sediment at this

shoreline is very similar to the sediment at the Runstad property. The figure shows that the beach is composed of gravel-sandy material (similar to the beach in front of the Project).

In summary, the four years of data demonstrate no negative changes have occurred to the sediment substrate along the Runstad property as a result of constructing the bank stabilization. The material in front of the bank stabilization is composed of relatively stable gravel and sand sediment similar to that observed at the adjacent shoreline that has no bank stabilization.

Figure 11. Type of beach material along shoreline to west from Runstad property

Sediment transport along the project shoreline is generated and controlled mostly by wave hydrodynamics. To evaluate possible impacts from the Project on longshore sediment transport, the results of 2-D wave modeling were employed herein. As discussed above, numerical modeling of wave generation and transformation was conducted using the 2-D numerical model SWAN (a standard tool produced by the Delft Institute of Technology). For the purpose of investigating longshore sediment transport, two wind-wave storms were considered: southeast and south-southeast, with speeds of 41 knots and 39 knots, respectively. These wind storms correspond to a 25-year return period event. Figure 12 shows the results of the modeling, wave heights over the modeling domain in the vicinity of the project site in color format for two storm events; southeast (a) and south-southeast (b). Red color corresponds to higher wave height. Peak wave period for both of these storms was simulated at 4.2 seconds.

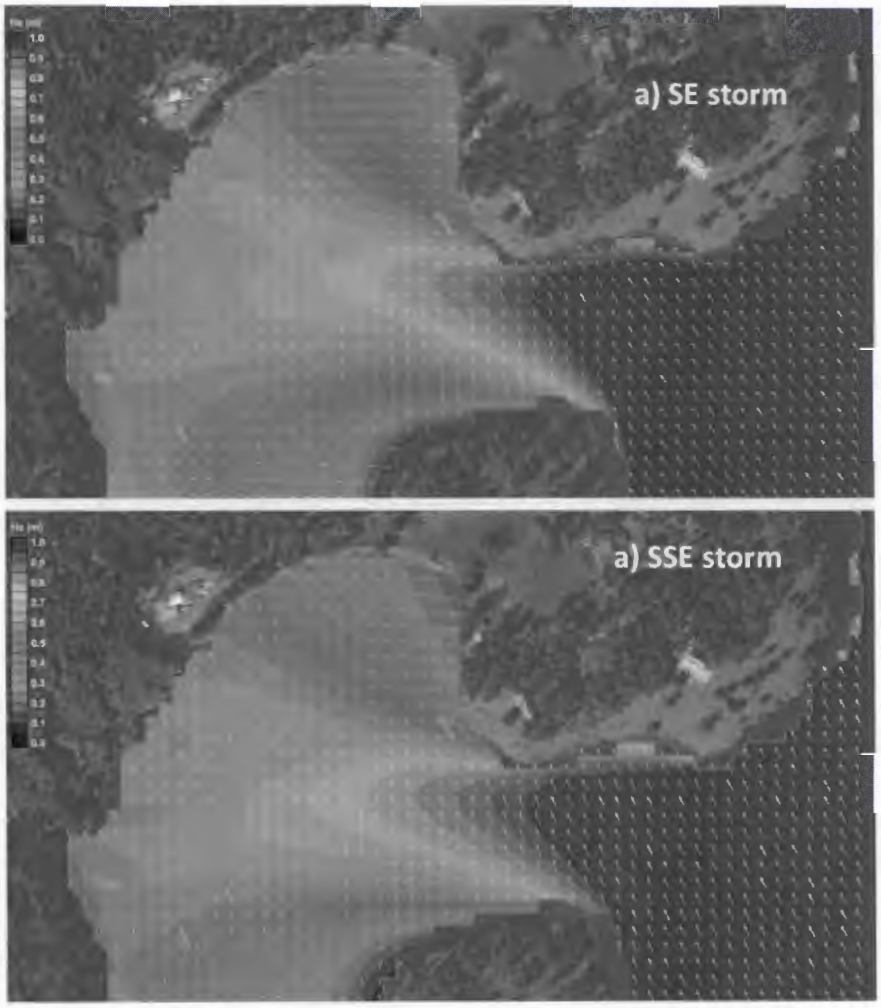


Figure 12. Blakely Island and Runstad property, results of numerical wave modeling, wave heights over modeling domain SE (a) and SSE (b) storm events

The figure shows a significant amount of wave energy penetrates through the opening between Armitage and Blakely Islands inside of the bay during the southeast and south-southeast storm events. Significant wave height at the entrance of the bay is more than 3 ft (maximum wave height is more than 5.5 ft). These types of waves have been observed by local residents during the last several years. The modeling shows that incident waves diffract around the islands and refract on the nearshore shoals. As a result of diffraction and refraction, the waves change their original directions and approach the boundaries of the nearshore shallow area at an angle of approximately 70 to 80 degrees. Figure 13 shows the general orientation of waves approaching the nearshore shallow area with blue arrows.

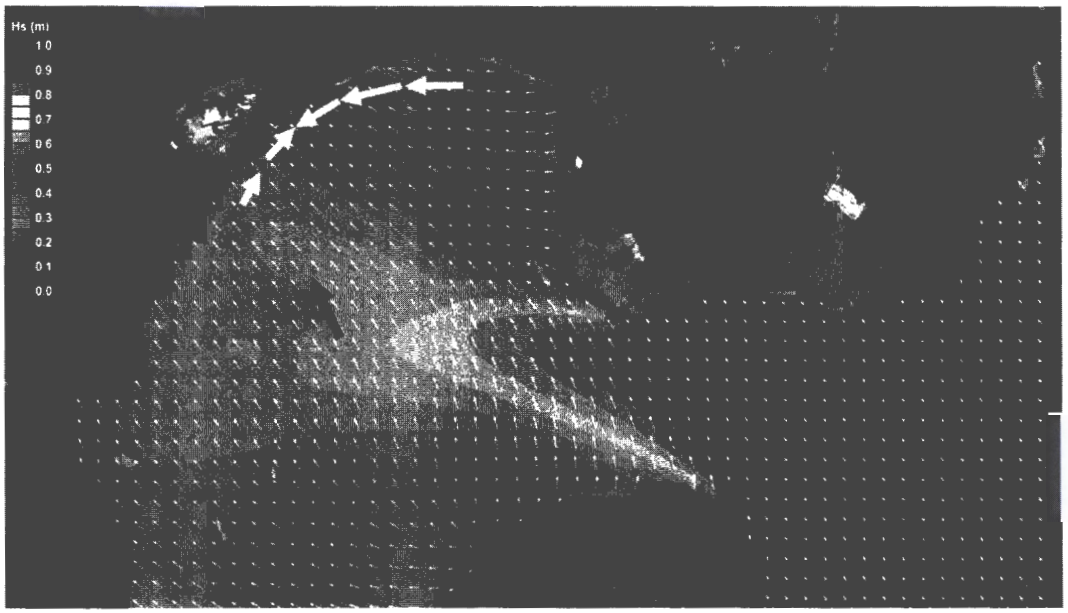


Figure 13. General orientation of waves approaching nearshore shallow area -blue arrows, after diffraction and refraction processes and conceptual localized pattern of sediment transport along the shoreline -yellow arrows

The angled wave approach results in wave energy fluxes along the shoreline, in the same direction. The directions of wave fluxes, in turn, closely correspond to the directions of longshore sediment transport that may occur in the nearshore area. Figure 13 above depicts the conceptual directions of longshore sediment transport (yellow arrows) in the nearshore zone at the Runstad property, which correspond to the directions of wave fluxes due to the angled wave approach. The figure shows that in the vicinity of the Runstad property the localized littoral drift occurs in both directions; from southwest to northeast and from northeast to southwest. The shoreline in the vicinity of the Runstad property is a focus of the localized superimposed littoral drift. In other words, the Runstad property shoreline is down-drift of a regional longshore sediment transport. This means that longshore sediment transport at adjacent shorelines (upstream or downstream) do not depend on conditions along the Runstad shoreline. Or, in other words, the Runstad shoreline is unable to affect (adversely or non-adversely) at any significance the longshore sediment transport at the adjacent shoreline. The logical outcome of this finding is that construction of the Project along the Runstad property shoreline did not, and will not be able to adversely impact the longshore sediment transport at the adjacent shoreline.

SURVEYOR'S NOTES

1. THIS TOPOGRAPHIC SURVEY MEETS OR EXCEEDS THE REQUIREMENTS OF WAC 332-130-090.

2. FOR MORE BOUNDARY INFORMATION SEE THE SIMPLE LAND DIVISION RECORDED UNDER AUDITOR'S FILE NUMBER 2010-1014014 AND VOLUME 5 OF LONG PLATS PAGES 13 AND 13A RECORDS OF SAN JUAN COUNTY.

3. THE PURPOSE OF THIS SURVEY WAS TO LOCATE THE ESCARPMENTS ALONG THE BANK IN THE AREA WHERE THE NEWER BULKHEAD WAS CONSTRUCTED.

4. THE ORDINARY HIGH WATER MARK (OHWM) DEPICTED HEREON, IS DESCRIBED IN HART CROWSER'S NOVEMBER 8, 2013 TECHNICAL MEMORANDUM, ORDINARY HIGH WATER AT RUNSTAD PROPERTY ON BLAKELY ISLAND. THE WASHINGTON DEPARTMENT OF FISH & WILDLIFE AGREED WITH HART CROWSER'S FINDINGS AND DETERMINATION OF THE OHWM IN WDFW CORRESPONDENCE DATED JANUARY 2, 2014.

5. UTILITIES SHOWN HEREON IN COLOR ARE APPROXIMATE PER AS-BUILT PDF'S PROVIDED BY THE CLIENT DATED NOVEMBER, 2010. SAID UTILITIES SHOWN IN COLOR WERE NOT LOCATED THIS SURVEY.

6. THE BEACH HOUSE SHOWN HEREON IS PER THAT SITE PLAN PROVIDED AND PREPARED BY CONARD ROMANO ARCHITECTS.

N
W SAN JUAN SURVEYING E
S

SCALE IN FEET
0 30 60 90
ELEVATION DATUM – MLLW = 0.00 (FEET)

S.J.C. DEPARTMENT OF
DEC 17 2015
COMMUNITY DEVELOPMENT

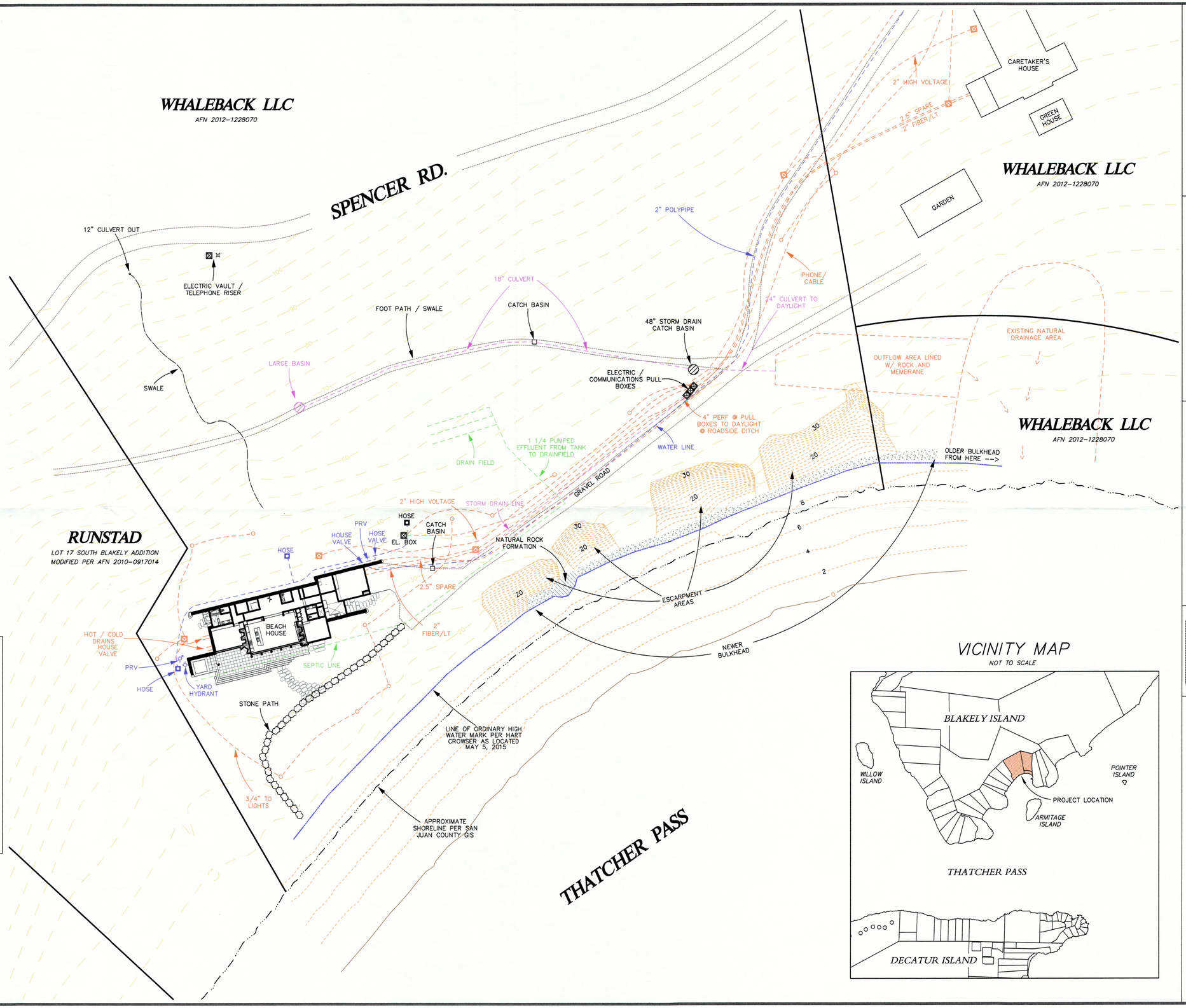
LEGEND

- PROPERTY LINE
- LINE OF ORDINARY HIGH WATER MARK
- 5-FT CONTOURS
- 1-FT ESCARPMENT CONTOURS
- ELECTRIC UTILITIES PER AS-BUILTS (SEE NOTE #5)
- SEPTIC LINE PER AS-BUILTS (SEE NOTE #5)
- WATER LINE PER AS-BUILTS (SEE NOTE #5)
- STORM DRAIN PER AS-BUILTS (SEE NOTE #5)
- UTILITY VAULT
- HOSE / SPIGOT
- STORM DRAIN CATCH BASIN – SMALL
- STORM DRAIN CATCH BASIN – LARGE
- TELEPHONE RISER
- SMALL YARD LIGHT
- NEWER BULKHEAD

EQUIPMENT AND PROCEDURES

EQUIPMENT: LEICA 1201+ (ONE SECOND THEODOLITE)

PROCEDURE: FIELD TRAVERSE



VICINITY MAP

NOT TO SCALE

JON RUNSTAD
1201 THIRD AVE STE #2700
SEATTLE, WA 98101-3221

TOPOGRAPHIC SURVEY FOR **JON RUNSTAD** ON BLAKELY ISLAND

DRAWN BY: NSR	COMP REF: 11-020 (TOPO)	JOB NO: 11-020
CHECKED BY: RJW	DATE: 11/23/15	SHEET 1 OF 1

SAN JUAN SURVEYING
P.O. BOX 611
FRIDAY HARBOR, WA 98250
360.378.2.300
WWW.SANJUANSURVEYING.COM

SECTION INDEXING DATA

SECTION	TOWNSHIP	RANGE
10	35 NORTH	1 WEST

QUARTER / QUARTER: NW/NE, NE/NE, GL-3

ROBERT J. WILSON, STATE OF WASHINGTON, 46118, REGISTERED PROFESSIONAL LAND SURVEYOR — 12-11-15

PROPERTY INFORMATION

SITE ADDRESS: BLAKELY ISLAND
TAX PARCEL NUMBER:
DESCRIPTION: ESCARPMENT TOPO
MISC: