GROUNDWATER MONITORING REPORT

Livingston Bay
Camano Island, WA

Prepared for:

Coastal Geologic Services, Inc.

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1.0 Introduction

1.1 Scope

Skillings Connolly, Inc. was hired as a sub consultant to Coastal Geologic Services, Inc. (CGS) to perform groundwater monitoring for the Iverson Preserve and Livingston Bay on Camano Island. The purpose of this groundwater monitoring project t is to characterize the groundwater behavior and response to tides and storm events to determine the extent of tidal forcing, within the Iverson Spit area. Long- term monitoring of shallow groundwater levels and surface water levels within the Iverson Spit area was completed to determine the extent of groundwater fluctuations over the course of year, capturing groundwater levels during winter high tides and during summer drought conditions. Comparison of groundwater levels to daily tidal events was completed to determine the extent of groundwater response within the study area to high tides, which restrict discharge of surface water from an extensive ditch system within the study area. The network of ditches within the Iverson Spit area is contiguous and maintains comparable surface elevations throughout the network. Ditches appear to have been constructed in an effort to drain high groundwater within the study area. The ditch system discharges through a protective dike via a culvert equipped with a tide gate. The tide gate restricts back-flooding of the ditch network during high tide events. The purpose of the monitoring project was to determine how groundwater levels fluctuated throughout the year and to determine what affect, if any, tidal events had on those levels.

Periodic water level measurements were taken at various locations for a 10-month duration. Data recorded over the 10 month study period was compiled to determine how groundwater and surface water levels fluctuated through the Iverson Spit study area during the course of a year.

For this project, six (6) piezometers were located throughout the site to collect groundwater data. Additionally, three (3) standpipes were placed within the ditch system and an additional (1) standpipe was installed in the northern pond to collect surface water data.

A Solinst Level Logger Model 3001 was installed in all piezometers and standpipes; data was recorded for a 10-month period (September 2016 to June 2017), site visits were conducted throughout the duration and data was downloaded during each site visit. A weather gauge station was installed to measure the barometric pressure. This document is to report the data collected.

1.2 Site History and Location

Iverson Preserve is located on the eastern shore of Camano Island, south of Livingston Bay and North of Barnum Point (Section 32, Township 32 N, Range 3 East and Section 5, Township 31 North, Range 3 East, W.M). See Figure 1 for the vicinity map. The site consists of mostly farm land with the northern extent open to the public serving a wildlife preserve with a small trail system. Trails and farm land are protected from tidal influence by a dike and tide gate built in the 1940's. Island County purchased the property in 1999; the shoreline was undeveloped at the time of purchase with the exception of the dike and tide gate. Currently Island County leases 68 acres of the preserve for commercial seed farming (Iverson Preserve Site Management Plan, 2011).

Figure 1. Vicinity Map

1.3 Land Use

Currently the Iverson Preserve is used for commercial agriculture, a wildlife preserve with access to the beach, walking trails and a gravel parking area that accommodates 8 cars. Adjacent to the preserve, the eastern shoreline is characterized by residential development (approximately 47 single family homes) along the east side of Iverson Road.

1.4 Geologic and Hydrologic setting

Iverson Preserve is located at the low point of the contributing basin, within Water Resource Inventory Area 6 (Figure 2. WRIA 6 Basin Map - Appendix A). See Appendix B for location and site topography. The basin is made up of several different land coverings. The Iverson Preserve has a contributing basin of approximately 256 Acres (Ac) See Appendix H, Basin Map. The area is made up of 5 different types of surfaces. Approximately 239 Ac is pervious surface. The pervious surface is made up of 119 Ac of forest, 90 Ac of Agriculture, and 30 Ac of lawn. The other 17 acres are impervious surfaces. The impervious surfaces are comprised of 12 Ac of hard surface (e.g. asphalt roads, concrete driveways, gravel paths and roads, etc.) and 4 Ac of residential roof runoff. On the west border of Iverson Preserve is a steep slope with heavy forest. Most of the upland is forested with some roads and homes with lawns. The preserve itself is mostly commercial agriculture with some walking trails and a paved access road for the homes along the Eastern border. There are no streams, creeks or rivers flowing into the preserve. There is a ditch that runs along the Western border of the preserve near the base of the steep slopes that will intercept sheet flow from the higher elevations. This drainage ditch continues around to the south and then along the eastern boundary of the agricultural area. As the ditch runs along Iverson Rd it cuts in towards the western boundary just before it enters the nature preserve. The ditch system collects water from sheet flow, as well as water from tidal inundation when the tide gate is not

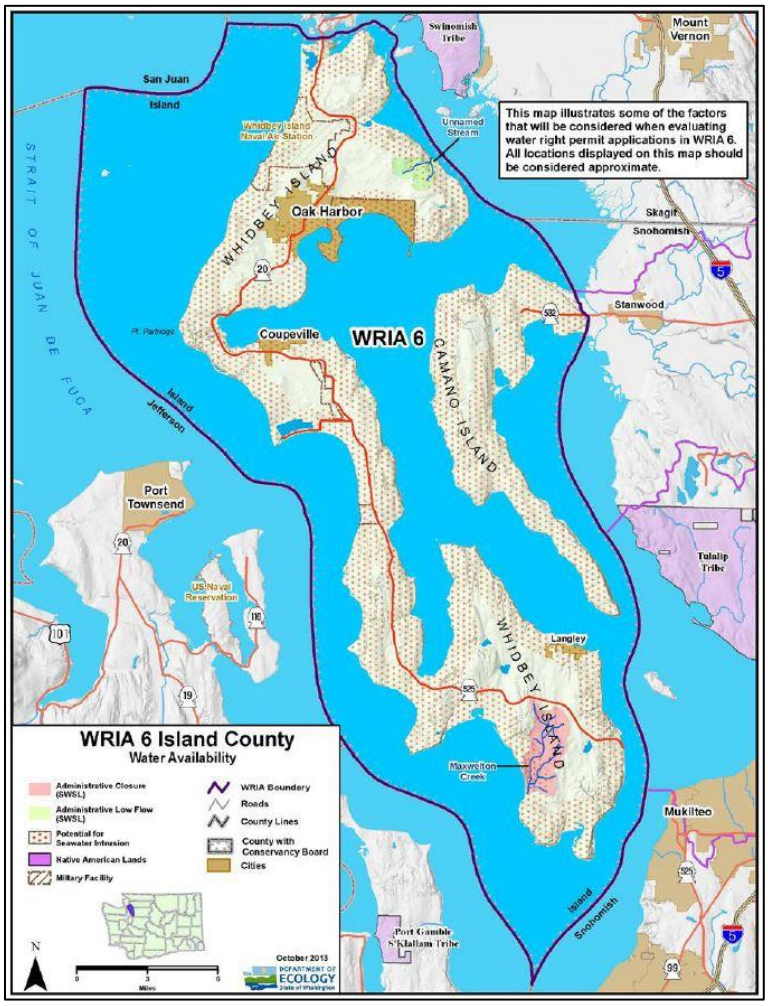


Figure 2. WRIA 6 Basin Map

functioning. Water stored within the ditch system drains through the tide gate during low tide, but is impounded during higher tidal cycles. Groundwater is assumed to be tidally influenced.

Using the Natural Resources Conservation Services (NRCS) Web Soil Survey to generate a soils report for Iverson Preserve, the majority of the preserve inside the dyke was found to be Puget silty clay loam, with 0 – 2 percent slopes (Appendix C). Soil conditions were observed on the initial site visit (September 2016) to install monitoring wells. Upon digging our locations for installation of each monitoring well we noticed that soil conditions varied. Monitoring wells 1, 2 and 3 (MW-#, annotated on the site map) exposed soils consistent with clay loam which have been heavily disturbed from farming practices. Soils were compacted and were heavily saturated; soil conditions were persistent through each horizon. Monitoring well 4 showed a similar clay loam to a depth of roughly 6 – 12 inches, beyond that we encountered sand. Groundwater at the time of placement was observed and soil conditions showed saturation levels almost to the surface. Monitoring well 5 consisted primarily of beach sand and had a high-water table. A more detailed description of all monitoring wells is described in Section 3.0 Monitoring Results of this report.

In order to better understand soil conditions and hydrologic functions, well logs were searched on the Washington State Department of Ecology's well reports webpage. Five well logs were identified in proximity of Livingston Bay (Figure 3. Well Locations). Using the location address indicated on the well logs, it was determined that none of the logs were located within the Iverson Preserve. The well logs represented wells installed on the land above the preserve. Data associated with each well log was referenced and then utilized to better understand hydrologic within the watershed (Appendix D). Information identified in the well logs in section (8) Water Levels and section (10) materials description with logged depths, indicated water bearing sand gravel at approximate depths of 80 to 90 feet from the upper elevations of the slope west of the agricultural field and Preserve. Ground elevations of the Iverson Preserve verses elevation associated with the five identified wells show a 70-foot elevation difference (west of the Preserve). This placed the ground water encountered in the well logs approximately 10 to 20 feet below the ground level of the Iverson Preserve.

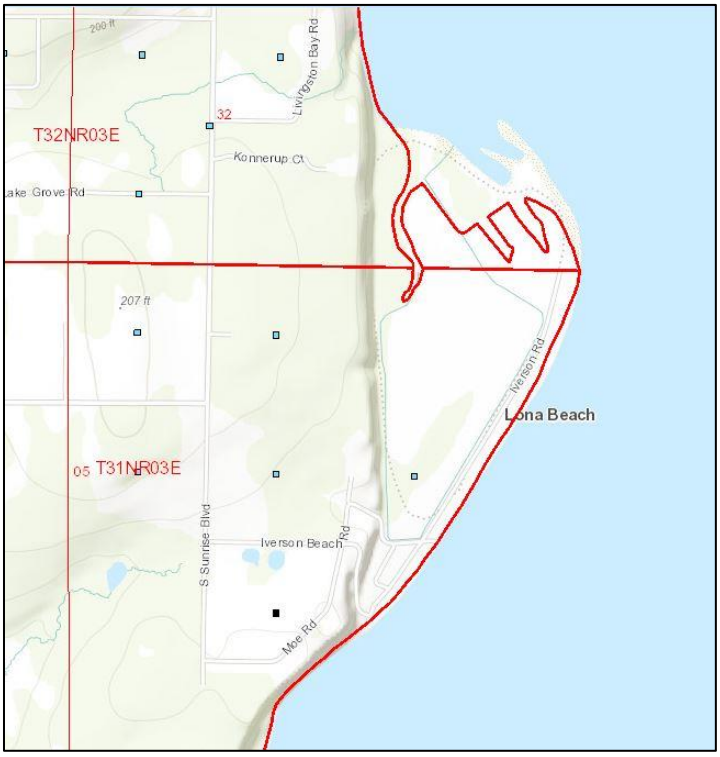


Figure 3. Well locations

2.0 Monitoring Network and Schedule

2.1 Location and Construction of Monitoring Wells

A total of six (6) groundwater monitoring wells and four (4) surface monitoring standpipes were located throughout the Iverson Spit (Figure 3, Appendix E)Five of the groundwater monitoring wells (MW-1 to MW-5) were placed inside the protective dike, one well (MW-6) was placed just outside of the tide gate outside of the dike. Surface water monitoring wells were located in multiple areas; SW-1, SW-2 and SW-4, all located within the ditched system; SW-3 is located within surface pond that had connectivity to the ditch network. All surface water monitoring locations were placed inside the dike in order to collect data on hydrologic influences from tidal surges and groundwater movement (Figure 4. Monitoring Locations).

2.2 Monitoring Schedule

The ground and surface monitoring locations were installed on August 29th, 2016 and removed on June 28th, 2017. Each monitoring well or standpipe had a *Solinst Levelogger Model 3001*. The Levelogger records groundwater and surface water levels and temperature measurements. It

Figure 4. Monitoring Locations

combines a pressure sensor, temperature detector, lithium battery, and datalogger, sealed within stainless-steel housing. The Levelogger measures absolute pressure using a pressure sensor. The Levelogger has high degree of sensitivity (resolution) and an accuracy of 0.05% FS (Full Scale). Once installed, Leveloggers recorded the pressure of the water above the sensor every 15 minutes. The time, date, pressure level, and temperature of the water was stored on the Leveloggers data capture system. The data was then downloaded in the field onto a laptop computer during scheduled site visits. At a later date all data files were translated to spreadsheets and then further translated to charts, graphs and maps. The final interpretation of this data represents a visual time stamp of groundwater activities over time (10 months). A weather monitoring station was set up at MW-3 (Figure 4, Monitoring Locations). The weather monitoring station recorded the barometric pressure every fifteen minutes, with the same time date stamp as the ground and surface water monitoring data loggers.

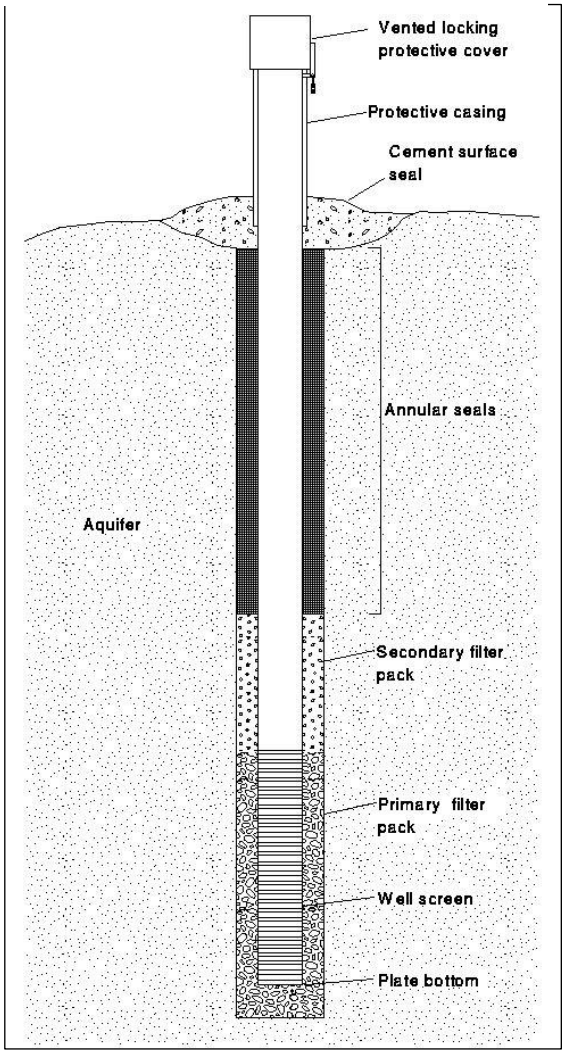
2.3 Sampling Methodologies

A perforated 2" PVC pipe was installed utilizing a hand auger to a depth that would allow groundwater levels to be monitored throughout the Preserve and agricultural area. Depths varied based on locations ranging between 5-10 feet below the surface. The perforated pvc pipe once placed in the excavated hole is surrounded by sand and then capped with bentonite in order to allow proper drainage and protection during the monitoring period (Figure 5. groundwater monitoring well).

The data logger is lowered into the perforated pvc pipe and placed roughly 2" from the bottom. The distance from top of Levellogger to top of pipe is recorded for elevation profiles. The groundwater data is recorded by reading the pressure of the water above the sensor in feet every 15 minutes. The weather station that recorded the barometric pressure in pounds per square inch (PSI) was recorded every 15 minutes. Data was downloaded in the field and brought back to the office for further translation. The data then had to be processed to get the true elevation of the ground water, described in detail below.

Groundwater calculations took into account each monitoring location and elevation. A survey was conducted in order to capture elevations at the top of

Figure 5. Groundwater Monitoring Well



the well casing with the cap on. The depth to the logger was measured and recorded. By subtracting the depth to the logger from the surveyed elevation, the elevation of the logger was obtained. The barometric pressure readings were converted to feet (2.30666 feet/PSI). The time date stamps of the barometric pressure readings and the ground or surface water pressure readings were correlated to process the data. The barometric pressure was subtracted from the monitoring data logger pressure to obtain the height of the water above the data logger. The height of the water above the data logger is added to the calculated elevation of the data logger to obtain the groundwater or surface water elevation.

3.0 Ground Water Monitoring (GWM) Results

3.1 Dates Data Collected

The data was collected from August 29th, 2016 to June 28th, 2017. The data was downloaded from the field on four occasions: October 5th, 2016, November 11th, 2016, January 31st, 2017, and June 28th, 2017. On June 28th, 2017 that data loggers were removed.

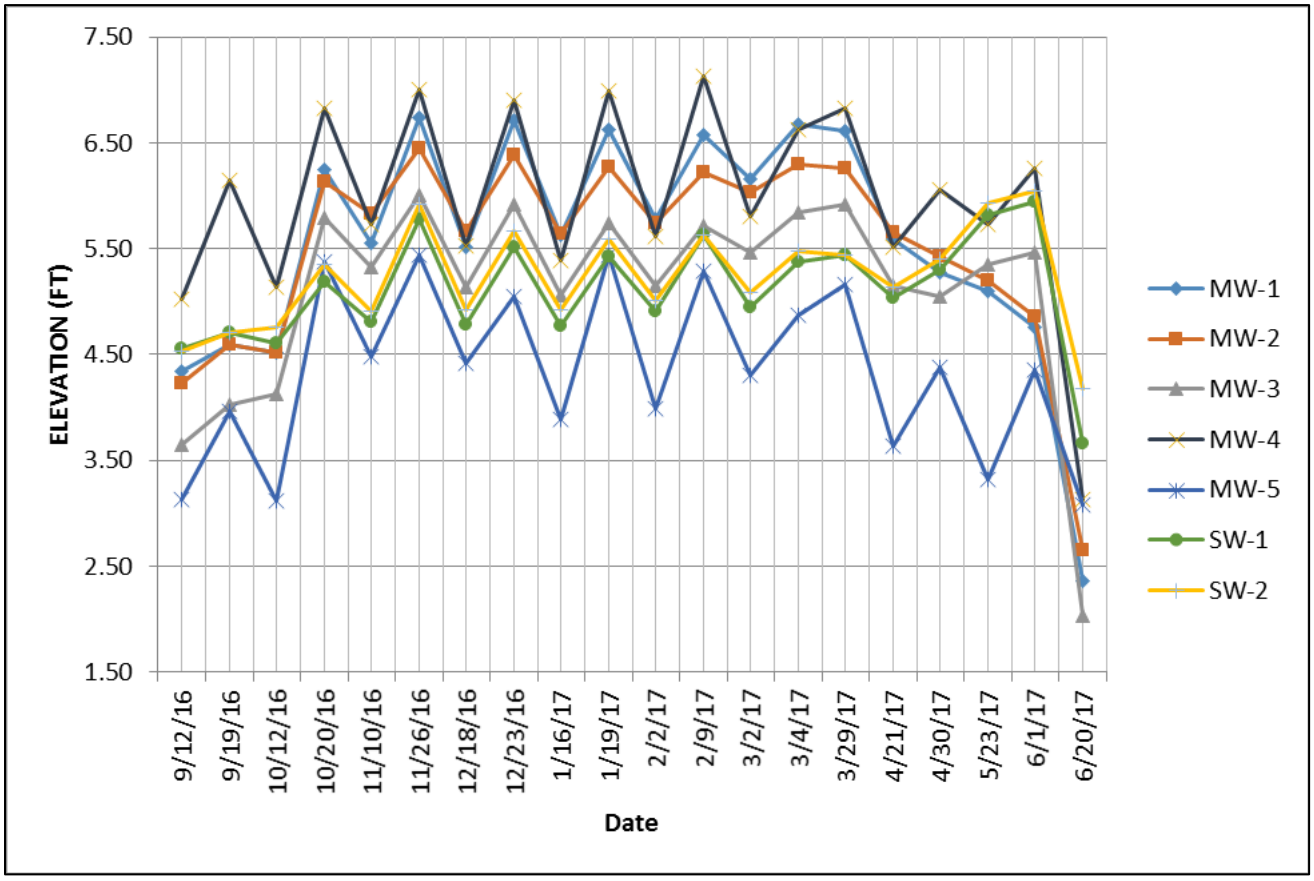


Figure 6. Month over Month Groundwater Elevations

**SW-3 and SW-4 data excluded (refer to Section 3.2 Data Presentation)*

3.2 Data Presentation

There are three interpretive methods identified below and found in the Appendices section of this report. The collected data was analyzed looking for the highest and lowest groundwater elevations for each month. Monitoring wells 1-5 (MW-1, MW-2, MW-3, MW-4, and MW-5) were used for determining the high and low for each month (Figure 6). Month over Month Groundwater Elevations, displays the highest and lowest groundwater and surface water elevations by month at each designated monitoring station.

MW-3, located closest to the western bluff, represents the deepest groundwater levels observed at the Iverson Spit area. MW-4, located closer to the spit, represents the highest groundwater levels observed. Groundwater levels observed at MW-1, MW-2, MW-5, and MW-6 were between those seen at MW-3 and MW-4. Table 1 (Minimum and Maximum Groundwater Levels), indicates the lowest and highest numeric values observed month over month within the study area. Based on these results, it can be determined that groundwater is being influenced by fluctuating water levels associated with proximity to the marine shoreline.

Table 1. Minimum and Maximum Groundwater Levels

	MW-3		MW-4	
Month	Min	Max	Min	Max
September	3.65	4.03	5.02	6.14
October	4.13	5.8	5.13	6.83
November	5.33	6.01	5.72	7.01
December	5.14	5.92	5.53	6.9
January	5.07	5.74	5.39	6.99
February	5.15	5.72	5.62	7.12
March	5.46	5.84	5.81	6.62
April	5.15	5.92	5.52	6.82
May	5.35	5.05	5.73	6.05
June	2.03	5.46	3.13	6.26

Correlating groundwater elevations can be found in Appendix G and is defined by a color matrix that represents high and low groundwater levels. It is noted that MW-4 is consistently higher than the other monitoring wells and MW-3 is constantly lower.

Data from surface monitoring wells SW-3 and SW-4 data indicate that surface water levels were negative (once adjusted to barometric pressure). Due to the fact that all of the surface water monitoring wells (SW-1 through SW-4) were situated within the same ditch system and that water levels within the ditch system fluctuated as a single hydrologic unit, it can be assumed that SW-3 and SW-4 experienced that same fluctuation in surface elevation as recorded at SW-1 and SW-2. As seen in Figure 6, surface water elevations for SW-1 and SW-2 were almost identical. While data recorded at SW-3 and SW-4 was inconclusive and not used for this analysis, the data collected from SW-1 and SW-2 provides enough information to determine the seasonal response to surface water level fluctuations across the Preserve.

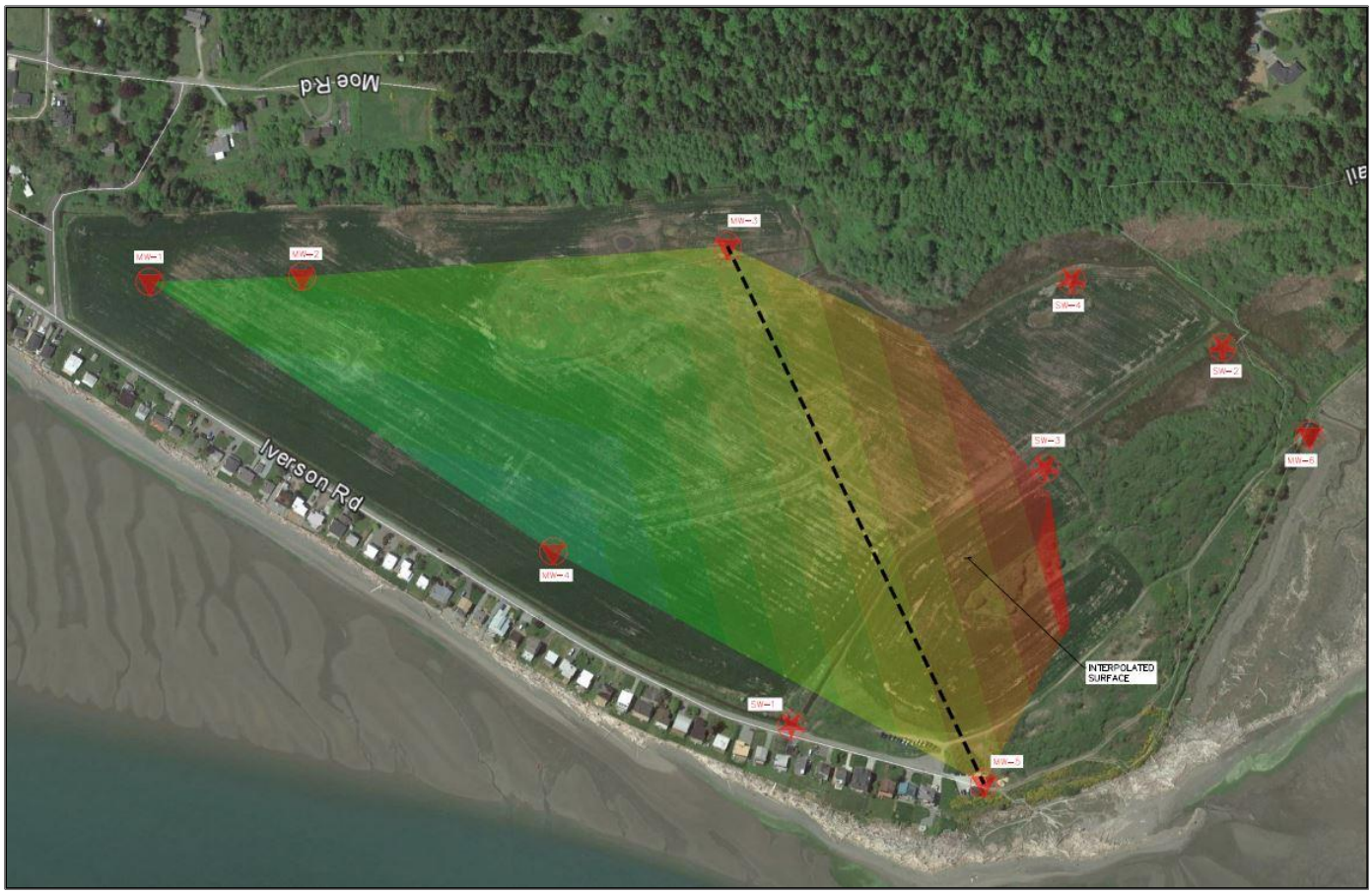


Figure 7. Groundwater Color Matrix (See Appendix G)

The surface monitoring locations show that the ditch's surface water elevation was in the middle of the groundwater elevations until April, when the surface water in the ditch was higher than the groundwater elevations. Appendix G shows groundwater elevations for both highs and lows throughout the duration of the study.

Monitoring well MW-6 located outside of the tide gate was analyzed verses the available tide data. The tide data was recorded from the NOAA tidal predictions webpage and georectified to the survey datum used for site topography and well casing elevations. The NOAA page also allowed for time intervals of every 15 minutes which allowed for a true correlation of the data. Appendix F, Tidal Prediction Charts - reflects tidal predictions for the duration of the study. Appendix G shows groundwater elevation data over the Iverson Bay area.

3.2 Field Observations/Conditions

Site-specific observations were made during each site visit. The first observation (September 2016) during the initial site visit to install monitoring wells includes observations made for soil conditions. Upon digging our locations for installation of each monitoring well we noticed that soil conditions varied. Monitoring wells 1, 2 and 3 exposed soils consistent with clay loam which have been heavily disturbed from farming practices. Soils were compacted and were heavily saturated; soils conditions were persistent through each horizon. Monitoring well 4 showed a similar clay loam to a depth of roughly 6 – 12 inches, beyond that we encountered sand. Groundwater at the time of placement was observed and soil conditions showed saturation levels almost to the surface. Monitoring well 5 consisted primarily of beach sand and had a high-water table. During a later site visit in January 2017, surface water was observed closest to monitoring well 2. The following describes location variables based on visual identification and data analysis translation.

MW-1 is at the southern-most extent of the preserve. Groundwater levels may be tidally influenced and from runoff from storm events. Soils in this area were compacted due to agricultural practices with a high percentage of clay. It was observed that this area has a slight depression allowing standing water during heavy storm events. Vegetation from the slope in this area is not necessarily slowed by take-up.

MW-2 is just north of MW -1 and shows similar groundwater activities. Elevations are similar to MW-1. Soil conditions are persistent with compacted conditions and heavy clays. Lack of vegetation from the slope is allowing additional runoff.

MW-3 Lies at the western boundary and is influenced by seasonal precipitation and sheet flow. It is also groundwater coming off the slope. This area of the slope is covered with a greater density of vegetation allowing for a greater amount of take-up. This is why we might be seeing a decrease in groundwater influences versus MW-1 and MW-2.

MW-4 is located on the eastern extent mid-way up Iverson Rd. It has the highest groundwater levels of all of the monitoring wells. It's believed this location is influenced heavily by tidal fluctuations. Hydrostatic pressure from the bay is preventing the groundwater at well 4 from fully draining. During our site visits the drainage ditch remained full of water, even during the driest of months. MW-4 soil

conditions showed clay at 8 inches below surface and below that was granular sand similar to MW-5 which consisted mainly of beach sand.

MW-5 is located near the preserve parking lot. This Monitoring well had frequent fluctuations that mirrored tidal events. It also had the lowest groundwater levels due to percolation within the soils. Soils consisted mainly of sandy loam.

Surface well data from SW-1 and SW-2 indicate that surface water within the ditch network is fairly consistent across the Iverson Spit area. While four (4) surface water monitoring standpipes were installed, data from two (2) of the dataloggers (SW-3 and SW-4) did not correspond to SW-1 and SW-3, rather indicating a negative water elevation. Since the ditch system appeared to sustain inundation throughout the monitoring period, it was determined that SW-3 and SW-4 data could not be relied on. However, due to the contiguous nature of the ditch network, it can be assumed that surface water elevations were more-or-less consistent throughout the study area.

Surface water was observed as shallow ponding on the southern portion of the study area. This was in close proximity to monitoring well 1 (MW-1) and monitoring well 2 (MW-2). It was determined that shallow ponding was a result of precipitation rather than high groundwater levels. The static water levels within the closest wells were vertically separated from the field ponding (vadose zone present). This is a very common occurrence this time of year into early summer. Agricultural use of the field appears to have included plowing or discing. The surface soils had a high clay content that was likely compressed during agricultural activities. Infiltration is restricted due to the high clay content and is further restricted due to soil compaction associated with agricultural use. This leads to a water budget where precipitation rates exceed the combined rate of infiltration and evapotranspiration; resulting in standing water in the field. The pressure sensors (which recorded on a frequent basis) did not show groundwater levels reaching the surface, so there is a high level of confident that the flooded field was the direct result of reduced infiltration.

4.0 Conclusion

Groundwater levels for Iverson Preserve are shown to fluctuate with seasonal and tidal influence. The inland monitoring wells were found to have a smaller fluctuation in high and low differences compared to the marine shoreline portion, which showed tidally influenced water levels. At no time during the study period did groundwater reach the existing ground levels. Surface flooding, in the form of extensive ponding was observed during the monitoring period. However, groundwater levels did not exceed the surface elevation. It was determined that shallow ponding was a result of precipitation rather than high groundwater levels. Surface ponding was determined to be due reduced infiltration rates associated with agricultural use of Iverson Preserve. The high clay content observed, combined with soil compaction associated with agricultural use has reduced the infiltration rate within the Preserve, creating surface ponding.

With respect to the western boundary, slope conditions did not influence groundwater levels due to heavy/dense vegetation and the conveyance ditch at toe of slope. Soil conditions vary from west to

east within the project boundary. The western extent exhibited a thick layer of clay. Sand predominated through the soil matrix in the eastern extent. Groundwater will move freely through less dense materials thus leading to the assumption that higher levels of pressure influenced by daily tidal fluctuations from Iverson Bay affect groundwater levels at the MW-4 location the most. Evaluation of surface water data indicates that the ditch network throughout the study area likely receives hydrology from high groundwater levels. During the wet season and winter high tides, groundwater remains relatively shallow, being restricted by hydrostatic pressure caused by close proximity to marine waters. During the dry season and lower high tides, groundwater collected within the ditch network is discharged via a single culvert that conveys flows through the protective dike. During high tide, a tide gate on the culvert restricts flows, impounding surface water within the ditch system and maintaining higher groundwater levels. Due to the fact that the average tidal elevation is higher in winter, the tidegate remains closed for longer periods of time, further restricting the existing drainage system. At the very beginning of the study, the tide gate was obstructed, which would have allowed tidal flushing within the ditch system. However, the obstruction was cleared within a few weeks of well installation.

Based on soil type and the slow response time seen in groundwater fluctuations, it can be concluded that while tidal fluctuations have an impact on groundwater levels, it does not appear that the groundwater elevation responds as quickly as observed tidal fluctuations. The use of a tide gate on the discharge culvert likely limits the level of high groundwater within the study area by limiting tidal inundation. The size of the culvert and tide gate also likely limit the volume of surface water discharged from the study area during low tide, based on hydraulic sizing.

Appendix A

WRIA 6 Maps & Information

Island Watershed, WRIA 6

This focus sheet provides information on the availability of water for new uses in the Island Watershed. This information provides a starting point for potential water users in determining the best strategies for securing water for a future project or proposal in this area.

The Island Watershed, also known as Water Resource Inventory Area 6 (WRIA 6), consists of Whidbey and Camano Islands along with several smaller islands. The northern part of Whidbey Island has the largest population density of the area with the city of Oak Harbor and the Naval Air Station. The rest of the islands mainly consist of low density rural development.

There are no major rivers in the watershed, and much of the water available for economic use comes from groundwater, which is recharged exclusively from precipitation. The northern and central part of Whidbey Island is situated in the rain shadow of the Olympic Mountains and therefore the watershed has a high variability of rainfall, from 18 inches at Coupeville to 42 inches at Goss Lake. Most of this precipitation arrives during the winter months when water demands are the lowest, and only a fraction becomes available for human and economic uses. The Island Watershed does not benefit from snow pack so during the summer when there is little rain naturally, low stream flows are dependent on groundwater inflow. This means that groundwater and surface water are least available when water demands are the highest.

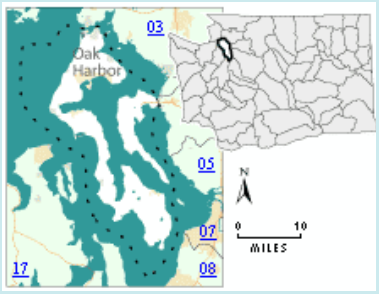
Increasing demands for water from ongoing population growth, declining stream flows and groundwater levels, and the impacts of climate change have put Washington's water supplies at risk. The Island Watershed increasingly lacks water when and where it is needed.

Factors affecting water availability

There are several limiting factors that impact the availability of future use of surface water and groundwater in Island County:

Seawater intrusion

Seawater has intruded into some island aquifers in the coastal areas. This is especially true near Point Partridge, and the northeastern and southern parts of Camano Island. The Department of Ecology



Definitions

Aquifer: A rock formation that is capable of storing and transmitting groundwater.

Mitigation plan: A scientifically-sound plan intended to avoid impairment to existing water rights or capturing water from a closed source.

Permit-exempt well: The state Ground Water Code allows for certain uses of small quantities of groundwater without obtaining a permit from Ecology. (RCW 90.44.050)

Seawater intrusion: The movement of salt water into freshwater aquifers.

(Ecology) will not be able to issue a water right if subsequent pumping of wells will cause contamination of fresh groundwater unless an adequate mitigation plan is submitted and approved by Ecology.

Declining groundwater levels

Declining groundwater levels have been reported in northern Camano Island. Ecology will not be able to issue a water right in this area if it is determined that withdrawing water would further lower these levels, unless an adequate mitigation plan is submitted and approved by Ecology.

Surface waters closed to new uses

Ecology has closed the following surface water source to new appropriations based on recommendations from the state Department of Fish and Wildlife:

- Maxwelton Creek

Furthermore, Department of Fish and Wildlife has recommended that at least ½ of the low flows be maintained in an unnamed creek in Sect 22. T 33N Range 02 East.

Water currently available for new uses

With the exceptions listed above, both surface and groundwater are available for appropriation.

There are currently no limitations on drilling permit-exempt wells for domestic, stock water, irrigation of less than ½ acre, and small industrial supply needs.

Additional options for water supplies

You are encouraged to connect to an existing water system if available. This is the simplest and fastest option.

The groundwater permit exemption allows certain users of small quantities of groundwater (most commonly, single residential well owners) to construct wells and develop their water supplies without obtaining a water right permit from Ecology. For more information about the groundwater permit exemption, refer to https://fortress.wa.gov/ecy/publications/SummaryPages/1511016.html.

The permit exemption may not be available to prospective water users in certain areas that have been closed to further appropriation because there is limited or no water available or saltwater intrusion problems. Check with Ecology staff at the regional office for more information.

If you cannot hook-up to an existing system, or more water is needed than can be obtained from a permit-exempt well, processing your application through the Cost Reimbursement Program may be an option. www.ecy.wa.gov/pubs/0511016.pdf.

In addition, a water rights change application can be processed with the Island County Water Conservancy Board.

For more information on these and other options, refer to "Alternatives for Water Right Application Processing" www.ecy.wa.gov/pubs/1111067.pdf.

Pending water right applications in this watershed

Washington water law is based on the "prior appropriation" system, often called "first in time, first in right." Applications for water from the same source must be processed in the order they are received. (There are certain exceptions, see "Additional options for processing water right applications" above.)

Ecology asks anyone who needs a water right (new, change, or transfer) to submit the pre-application consultation form and meet with us to review your water supply needs and project proposal.

- Apply for a New Water Right
  http://www.ecy.wa.gov/programs/wr/rights/newrights.html
- Apply to Change or Transfer a Water Right or Claim
  http://www.ecy.wa.gov/programs/wr/rights/change_transfer_use.html

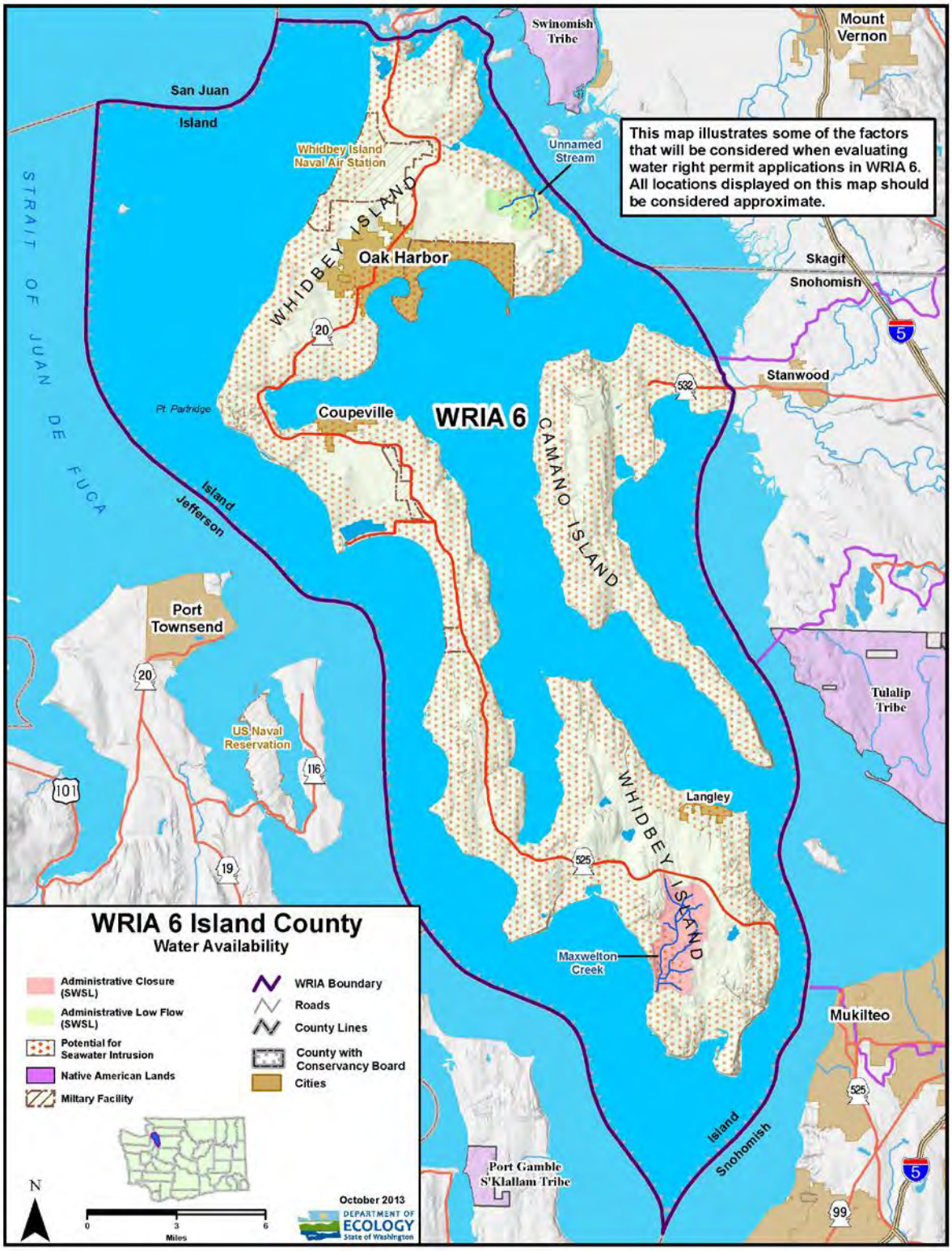
The map in this document shows some of the factors that will be considered when evaluating water right permit applications. Here are some information sources to assist you with your research:

- Locate and research water rights on land parcels anywhere in the state (Water Resource Explorer)
  http://www.ecy.wa.gov/programs/wr/info/webmap.html
- Pending Water Right Applications by County
  http://www.ecy.wa.gov/programs/wr/rights/tracking-apps.html
- Subscribe to a water right application RSS feed for a county or WRIA
  http://www.ecy.wa.gov/programs/wr/rights/wr_app_rss.html
- WRIA map showing the total number of water right claims, certificates, permits and applications
  http://www.ecy.wa.gov/programs/wr/rights/Images/pdf/waterright-wria-maps.pdf
- Search and view well reports using a variety of search tools
  https://fortress.wa.gov/ecy/waterresources/map/WCLSWebMap/default.aspx

For more information

Northwest Regional Office
Water Resources Program
3190 160th Ave. SE
Bellevue WA 98008
425-649-7000

If you need this document in a version for the visually impaired, call the Water Resources Program at 360-407-6872. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.


This map illustrates some of the factors that will be considered when evaluating water right permit applications in WRIA 6. All locations displayed on this map should be considered approximate.
WRIA 6
WRIA 6 Island County
Water Availability
Administrative Closure (SWSL)
Administrative Low Flow (SWSL)
Potential for Seawater Intrusion
Native American Lands
Miltary Facility
WRIA Boundary
Roads
County Lines
County with Conservancy Board
Cities
October 2013
DEPARTMENT OF ECOLOGY
State of Washington
Miles
N
Swinomish Tribe
Mount Vernon
San Juan Island
Whidbey Island Naval Air Station
Unnamed Stream
WHIDBEY ISLAND
Oak Harbor
Skagit
Snohomish
Stanwood
Pt. Partridge
Coupeville
STRAIT OF JUAN DE FUCA
Island
Jefferson
CAMANO ISLAND
Port Townsend
US Naval Reservation
Tulalip Tribe
Langley
Maxwelton Creek
Mukilteo
Port Gamble S'Klallam Tribe
Island
Snohomish

Appendix B

Resource Maps

Data | Active (16) | Legend

County Boundary
County Boundary

Tribal Cultural Resources Contacts
Tribal Cultural Resources Contacts

Contours - 40ft. Interval
Contours - 40ft. Interval

Fire Shutdown Zones
Fire Shutdown Zones

Water Bodies
Water Bodies
- Flats/Gravel Bars
- Ice
- Man Made Features
- Open Water
- Wet Area

Streams
Streams
- Type S
- Type F
- Type N, Np, Ns
- U, unknown
- X, non-typed per WAC 222-16

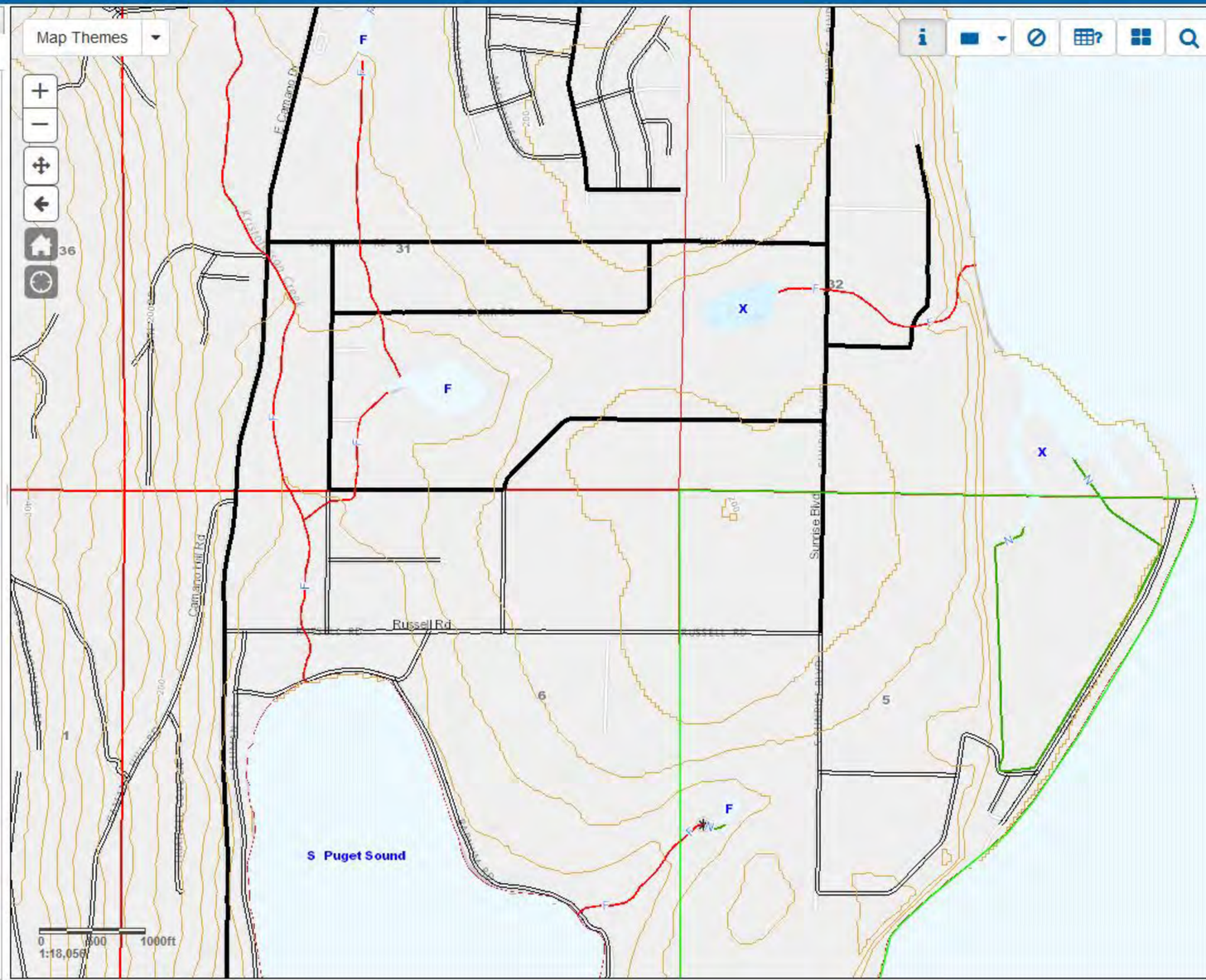
WRIA
WRIA

WAU
WAU

Watershed Analysis
Watershed Analysis

Map Themes

T32N R03E 7



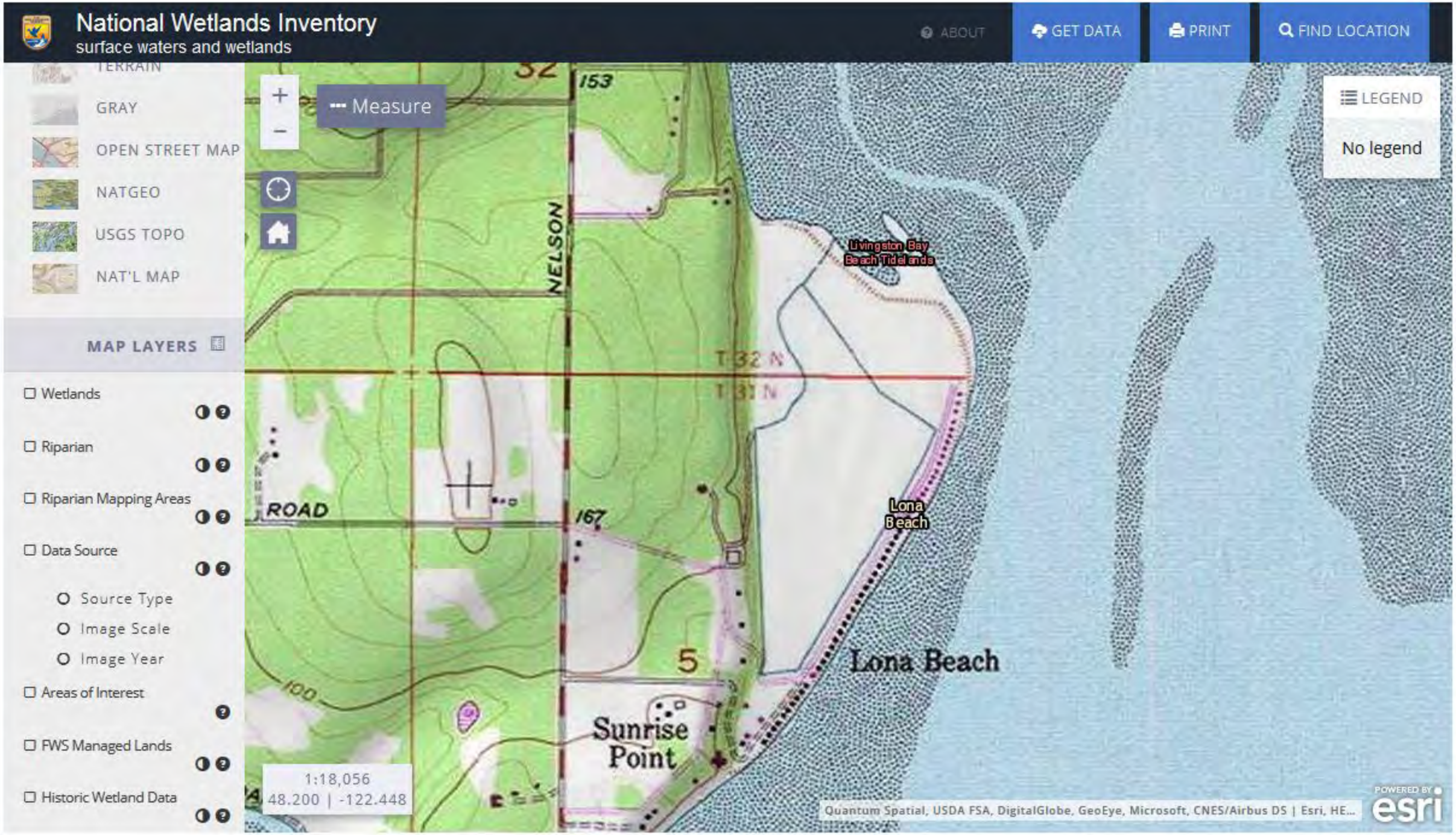
(1 of 15)

Section Survey Lines

TOWNSHIP	T31R03E
PLS_TWP_SUBDIV_TYPE_CD	1
PLS_TWP_SUBDIV_NO	5
LEGAL_DESC_LABEL_NM	S05
LEGAL_DESC_NM	T31-0N R3-0E S05
PLS_TWP_NO	31
PLS_TWP_FRACT_CD	0
PLS_TWP_DIR_CD	N
PLS_RNG_NO	3
PLS_RNG_FRACT_CD	0
PLS_RNG_DIR_CD	E
NON_PLS_TYPE_CD	Null
NON_PLS_SUBDIV_NM	Null

Zoom To


Basemap
Kristoferson Lake
Smith Lake
Carp Lake
Triangle Cove
Sundins Beach
Juniper Beach
Lona Beach
Sunrise Point
Barnum Point
Driftwood Shores
LIVINGSTON BAY
CAMANO ISLAND
ISLAND CO
SNOHOMISH CO
MUD
Piles
Dolphin
Snag
Sand
Rock
Mud
ROAD
NELSON
MABANA
LINDSAY
BARNUM
MOON
DUNNING
SOUTH PASS
LEVEE
Dike
BM 112
BM 252
BM 25


National Wetlands Inventory
surface waters and wetlands
ABOUT
GET DATA
PRINT
FIND LOCATION
TERRAIN
GRAY
OPEN STREET MAP
NATGEO
USGS TOPO
NAT'L MAP
MAP LAYERS
Wetlands
Riparian
Riparian Mapping Areas
Data Source
Source Type
Image Scale
Image Year
Areas of Interest
FWS Managed Lands
Historic Wetland Data
Measure
LEGEND
No legend
NELSON
ROAD
153
167
100
T 32 N
T 31 N
Livingston Bay Beach Tidelands
Lona Beach
Lona Beach
Sunrise Point
5
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48.200 | -122.448
Quantum Spatial, USDA FSA, DigitalGlobe, GeoEye, Microsoft, CNES/Airbus DS | Esri, HE...
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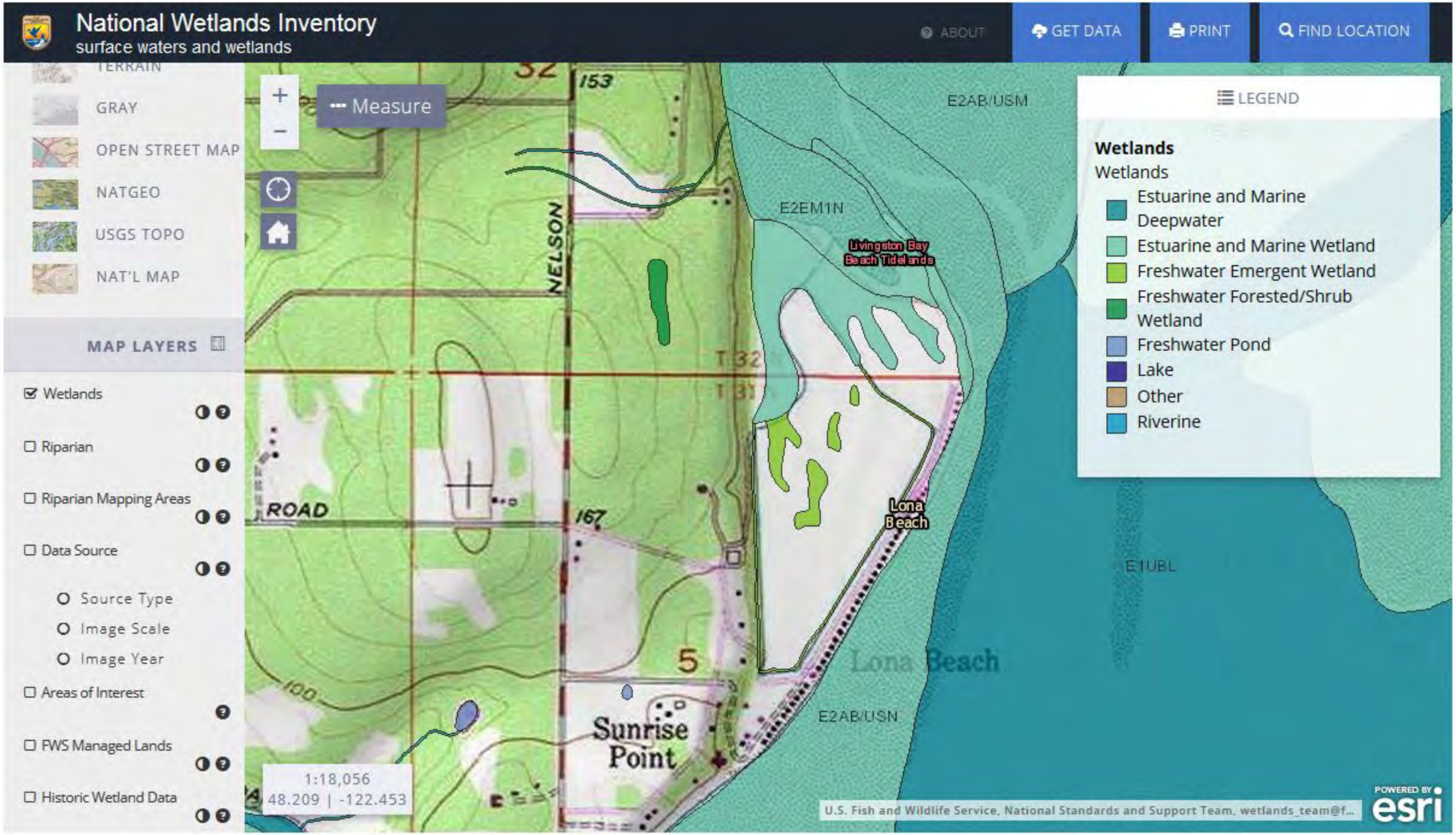
National Wetlands Inventory
surface waters and wetlands
ABOUT
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NAT'L MAP
MAP LAYERS
Wetlands
Riparian
Riparian Mapping Areas
Data Source
Source Type
Image Scale
Image Year
Areas of Interest
FWS Managed Lands
Historic Wetland Data
Measure
LEGEND
Wetlands
Wetlands
Estuarine and Marine Deepwater
Estuarine and Marine Wetland
Freshwater Emergent Wetland
Freshwater Forested/Shrub Wetland
Freshwater Pond
Lake
Other
Riverine
E2AB/USM
E2EM1N
E2AB/USN
E1UBL
Livingston Bay Beach Tidelands
Lona Beach
Sunrise Point
NELSON
ROAD
153
167
100
5
T32
1:18,056
48.209 | -122.453
U.S. Fish and Wildlife Service, National Standards and Support Team, wetlands_team@f...
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Appendix C

NRCS Soils Report

United States Department of Agriculture

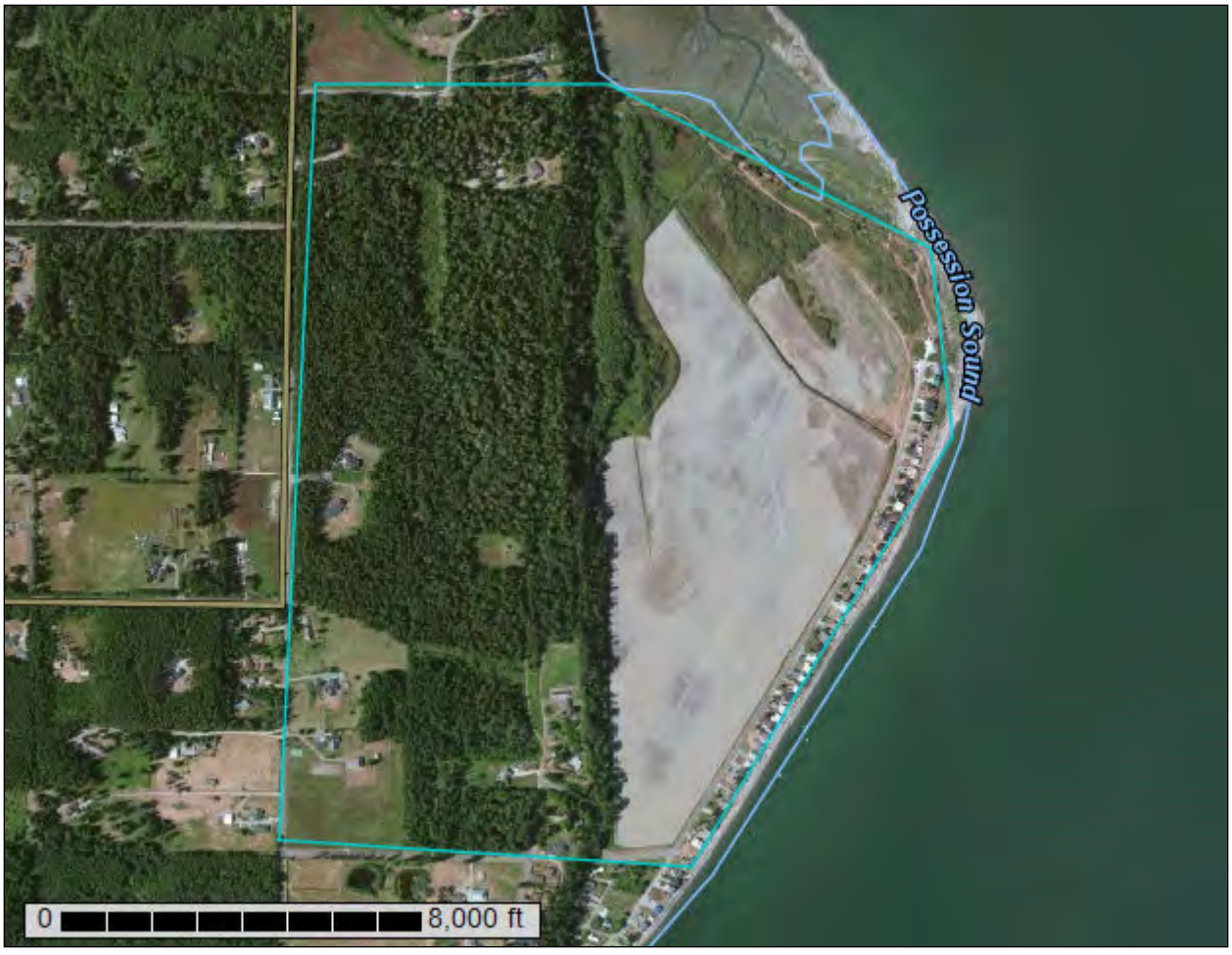
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Island County, Washington

Iverson Preserve



June 30, 2017

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:8,390 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 400 800 1600 2400

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Island County, Washington
Survey Area Data: Version 14, Sep 8, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 9, 2010—Aug 28, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Island County, Washington (WA029)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
1021	Sholander, cool-Spieden complex, 0 to 5 percent slopes	12.7	4.7%
1025	Beaches-Endoaquents, tidal-Xerorthents association, 0 to 5 percent slopes	2.2	0.8%
1054	Puget silty clay loam, 0 to 2 percent slopes	115.8	43.3%
2012	Elwha-Zylstra-Morancreek, cool, complex, 2 to 12 percent slopes	31.0	11.6%
2013	Zylstra-Frostad complex, 0 to 8 percent slopes	0.7	0.3%
2018	Sucia loamy sand, cool, 2 to 10 percent slopes	57.4	21.5%
2023	Sucia-Sholander complex, cool, 2 to 15 percent slopes	28.2	10.6%
3022	Aquic Dystroxerepts-Oxyaquic Xerorthents complex, 15 to 70 percent slopes	19.2	7.2%
Totals for Area of Interest		**267.1**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different

management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Island County, Washington

1021—Sholander, cool-Spieden complex, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2dvrn
Elevation: 0 to 410 feet
Mean annual precipitation: 20 to 40 inches
Mean annual air temperature: 48 to 50 degrees F
Frost-free period: 200 to 240 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Sholander, cool, and similar soils: 45 percent
Spieden and similar soils: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sholander, Cool

Setting

Landform: Valleys
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Glacial outwash over dense glaciomarine deposits

Typical profile

A - 0 to 8 inches: gravelly loam
E - 8 to 16 inches: gravelly sandy loam
Bg1 - 16 to 28 inches: gravelly loamy sand
Bg2 - 28 to 51 inches: gravelly sand
2Cd - 51 to 60 inches: loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: 40 to 60 inches to densic material
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 4 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.3 inches)

Interpretive groups

Land capability classification (irrigated): 4w
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: B/D
Ecological site: western hemlock-western redcedar/red huckleberry-salal/western swordfern (F002XN906WA)
Other vegetative classification: Seasonally Wet Soils (G002XN202WA)
Hydric soil rating: No

Description of Spieden

Setting

Landform: Drainageways
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Glacial outwash

Typical profile

A1 - 0 to 4 inches: mucky silt loam
A2 - 4 to 11 inches: silt loam
E - 11 to 24 inches: gravelly loamy sand
Bg - 24 to 36 inches: gravelly loamy coarse sand
C1 - 36 to 48 inches: coarse sand
C2 - 48 to 60 inches: coarse sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 0 to 8 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water storage in profile: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): 5w
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Ecological site: Sitka spruce - red alder/salmonberry/field horsetail (F002XN904WA)
Other vegetative classification: Wet Soils (G002XN102WA)
Hydric soil rating: Yes

Minor Components

Spieden, drained

Percent of map unit: 10 percent
Landform: Drainageways
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: Sitka spruce - red alder/salmonberry/field horsetail (F002XN904WA)
Other vegetative classification: Seasonally Wet Soils (G002XN202WA)
Hydric soil rating: Yes

Sucia, cool

Percent of map unit: 10 percent
Landform: Valleys
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: western hemlock-western redcedar/red huckleberry-salal/western swordfern (F002XN906WA)
Other vegetative classification: Droughty Soils (G002XN402WA)

Hydric soil rating: No

1025—Beaches-Endoaquents, tidal-Xerorthents association, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2dvs0
Elevation: 0 to 20 feet
Mean annual precipitation: 20 to 40 inches
Mean annual air temperature: 48 to 50 degrees F
Frost-free period: 200 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Beaches: 50 percent
Endoaquents, tidal, and similar soils: 30 percent
Xerorthents and similar soils: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Beaches

Setting

Landform: Beaches
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Beach sand

Typical profile

H1 - 0 to 60 inches: Error

Properties and qualities

Slope: 0 to 5 percent
Depth to water table: About 0 inches
Frequency of flooding: Very frequent

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: Unranked

Description of Endoaquents, Tidal

Setting

Landform: Beaches
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Beach sand

Typical profile

C1 - 0 to 29 inches: gravelly sand

C2 - 29 to 48 inches: very gravelly coarse sand
C3 - 48 to 60 inches: extremely gravelly coarse sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very high (19.98 to 99.90 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: Very frequent
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.3 to 3.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 1.5
Available water storage in profile: Very low (about 1.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A/D
Ecological site: TIDAL MEADOW (R002XN713WA)
Hydric soil rating: Yes

Description of Xerorthents

Setting

Landform: Hillslopes, beaches
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Beach sand and colluvium from glacial outwash

Typical profile

A - 0 to 1 inches: very gravelly sand
C1 - 1 to 20 inches: very gravelly sand
C2 - 20 to 60 inches: very gravelly sand

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Very high (19.98 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 0.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: SALT WATER BLUFF (R002XN723WA)
Hydric soil rating: No

1054—Puget silty clay loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2lthg
Elevation: 0 to 10 feet
Mean annual precipitation: 25 to 40 inches
Mean annual air temperature: 48 to 50 degrees F
Frost-free period: 200 to 240 days
Farmland classification: Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Puget, drained, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Puget, Drained

Setting

Landform: Tidal flats
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 7 inches: silty clay loam
Bg1 - 7 to 17 inches: silty clay loam
Bg2 - 17 to 25 inches: silty clay loam
Bg3 - 25 to 31 inches: silty clay loam
Bg4 - 31 to 40 inches: silty clay loam
Cg1 - 40 to 45 inches: silty clay loam
Cg2 - 45 to 60 inches: silty clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 8 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): 5w
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D

Ecological site: Sitka spruce - red alder/salmonberry/field horsetail (F002XN904WA)
Other vegetative classification: Seasonally Wet Soils (G002XN202WA)
Hydric soil rating: Yes

Minor Components

Xerorthents
Percent of map unit: 5 percent
Landform: Beaches, hillslopes, sea cliffs
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: SALT WATER BLUFF (R002XN723WA)
Hydric soil rating: No

Endoaquents, tidal
Percent of map unit: 5 percent
Landform: Beaches
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: TIDAL MEADOW (R002XN713WA)
Hydric soil rating: Yes

2012—Elwha-Zylstra-Morancreek, cool, complex, 2 to 12 percent slopes

Map Unit Setting
National map unit symbol: 2dvsc
Elevation: 0 to 550 feet
Mean annual precipitation: 25 to 40 inches
Mean annual air temperature: 48 to 50 degrees F
Frost-free period: 200 to 240 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition
Elwha and similar soils: 40 percent
Zylstra and similar soils: 30 percent
Morancreek, cool, and similar soils: 20 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Elwha

Setting
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Glacial drift over dense glaciomarine deposits

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 6 inches: gravelly sandy loam
Bw1 - 6 to 14 inches: gravelly sandy loam
Bw2 - 14 to 26 inches: gravelly sandy loam
Bg - 26 to 35 inches: gravelly sandy loam
2Cd1 - 35 to 44 inches: sandy loam
2Cd2 - 44 to 60 inches: sandy loam

Properties and qualities

Slope: 2 to 12 percent
Depth to restrictive feature: 20 to 40 inches to densic material
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 12 to 20 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: B/D
Ecological site: western hemlock-western redcedar/red huckleberry-salal/western swordfern (F002XN906WA)
Other vegetative classification: Droughty Soils (G002XN402WA)
Hydric soil rating: No

Description of Zylstra

Setting

Landform: Ridges
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Glacial drift over dense glaciomarine deposits

Typical profile

A1 - 0 to 4 inches: loam
A2 - 4 to 12 inches: loam
E - 12 to 18 inches: sandy loam
Bg1 - 18 to 32 inches: gravelly sandy loam
Bg2 - 32 to 37 inches: gravelly loam
Cd - 37 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 2 to 12 percent
Depth to restrictive feature: 20 to 40 inches to densic material
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 4 to 12 inches
Frequency of flooding: None
Frequency of ponding: None

Available water storage in profile: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): 4w
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C/D
Ecological site: western hemlock-western redcedar/red huckleberry-salal/western swordfern (F002XN906WA)
Other vegetative classification: Limited Depth Soils (G002XN302WA)
Hydric soil rating: No

Description of Morancreek, Cool

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Glacial drift

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 3 inches: sandy loam
Bw1 - 3 to 10 inches: sandy loam
Bw2 - 10 to 21 inches: sandy loam
Bg - 21 to 28 inches: sandy loam
C - 28 to 60 inches: sandy loam

Properties and qualities

Slope: 2 to 12 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: About 16 to 28 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: A/D
Ecological site: western hemlock-western redcedar/red huckleberry-salal/western swordfern (F002XN906WA)
Other vegetative classification: Sloping to Steep Soils (G002XN702WA)
Hydric soil rating: No

Minor Components

Everett

Percent of map unit: 10 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear

Across-slope shape: Linear
Ecological site: western hemlock-western redcedar/red huckleberry-salal/western swordfern (F002XN906WA)
Other vegetative classification: Droughty Soils (G002XN402WA)
Hydric soil rating: No

2013—Zylstra-Frostad complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2dvsb
Elevation: 20 to 590 feet
Mean annual precipitation: 25 to 40 inches
Mean annual air temperature: 48 to 50 degrees F
Frost-free period: 200 to 240 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Zylstra and similar soils: 75 percent
Frostad and similar soils: 15 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Zylstra

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Glacial drift over dense glacial drift

Typical profile

A1 - 0 to 4 inches: loam
A2 - 4 to 12 inches: loam
E - 12 to 18 inches: sandy loam
Bg1 - 18 to 32 inches: gravelly sandy loam
Bg2 - 32 to 37 inches: gravelly loam
Cd - 37 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: 20 to 40 inches to densic material
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 4 to 12 inches
Frequency of flooding: None

Frequency of ponding: None
Available water storage in profile: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): 4w
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C/D
Ecological site: western hemlock-western redcedar/red huckleberry-salal/western swordfern (F002XN906WA)
Other vegetative classification: Limited Depth Soils (G002XN302WA)
Hydric soil rating: No

Description of Frostad

Setting

Landform: Drainageways, valleys
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Glacial drift over dense glaciomarine deposits

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 6 inches: loam
Bg - 6 to 16 inches: sandy loam
E - 16 to 21 inches: gravelly sandy loam
2Cd - 21 to 60 inches: sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 20 to 40 inches to densic material
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 0 to 8 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water storage in profile: Very low (about 2.9 inches)

Interpretive groups

Land capability classification (irrigated): 5w
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: D
Ecological site: Sitka spruce - red alder/salmonberry/field horsetail (F002XN904WA)
Other vegetative classification: Wet Soils (G002XN102WA)
Hydric soil rating: Yes

Minor Components

Elwha

Percent of map unit: 10 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear

Ecological site: western hemlock-western redcedar/red huckleberry-salal/western swordfern (F002XN906WA)
Other vegetative classification: Droughty Soils (G002XN402WA)
Hydric soil rating: No

2018—Sucia loamy sand, cool, 2 to 10 percent slopes

Map Unit Setting

National map unit symbol: 2dvs6
Elevation: 0 to 330 feet
Mean annual precipitation: 20 to 40 inches
Mean annual air temperature: 48 to 50 degrees F
Frost-free period: 200 to 240 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Sucia, cool, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sucia, Cool

Setting

Landform: Valleys
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Glacial drift over dense glaciomarine deposits

Typical profile

A - 0 to 8 inches: loamy sand
Bw - 8 to 17 inches: loamy sand
E - 17 to 31 inches: gravelly loamy sand
2Btg - 31 to 38 inches: loam
2Cd - 38 to 60 inches: silt loam

Properties and qualities

Slope: 2 to 10 percent
Depth to restrictive feature: 20 to 40 inches to densic material
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 12 to 20 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A/D

Ecological site: western hemlock-western redcedar/red huckleberry-salal/western swordfern (F002XN906WA)
Other vegetative classification: Droughty Soils (G002XN402WA)
Hydric soil rating: No

Minor Components

Sholander, cool
Percent of map unit: 10 percent
Landform: Valleys
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: western hemlock-western redcedar/red huckleberry-salal/western swordfern (F002XN906WA)
Other vegetative classification: Seasonally Wet Soils (G002XN202WA)
Hydric soil rating: No

2023—Sucia-Sholander complex, cool, 2 to 15 percent slopes

Map Unit Setting
National map unit symbol: 2dvs4
Elevation: 0 to 500 feet
Mean annual precipitation: 20 to 40 inches
Mean annual air temperature: 48 to 50 degrees F
Frost-free period: 200 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Sucia, cool, and similar soils: 50 percent
Sholander, cool, and similar soils: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sucia, Cool

Setting
Landform: Valleys
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Glacial drift over dense glaciomarine deposits

Typical profile
A - 0 to 8 inches: loamy sand
Bw - 8 to 17 inches: loamy sand
E - 17 to 31 inches: gravelly loamy sand
2Btg - 31 to 38 inches: loam
2Cd - 38 to 60 inches: silt loam

Properties and qualities
Slope: 2 to 15 percent
Depth to restrictive feature: 20 to 40 inches to densic material

Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 12 to 20 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.5 inches)

Interpretive groups
Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A/D
Ecological site: western hemlock-western redcedar/red huckleberry-salal/western swordfern (F002XN906WA)
Other vegetative classification: Droughty Soils (G002XN402WA)
Hydric soil rating: No

Description of Sholander, Cool

Setting
Landform: Valleys
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Glacial outwash over dense glaciomarine deposits

Typical profile
A - 0 to 8 inches: gravelly loam
E - 8 to 16 inches: gravelly sandy loam
Bg1 - 16 to 28 inches: gravelly loamy sand
Bg2 - 28 to 51 inches: gravelly sand
2Cd - 51 to 60 inches: loam

Properties and qualities
Slope: 2 to 12 percent
Depth to restrictive feature: 40 to 60 inches to densic material
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 4 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.3 inches)

Interpretive groups
Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: B/D
Ecological site: western hemlock-western redcedar/red huckleberry-salal/western swordfern (F002XN906WA)
Other vegetative classification: Seasonally Wet Soils (G002XN202WA)
Hydric soil rating: No

Minor Components

Spieden
Percent of map unit: 10 percent
Landform: Drainageways

Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: Sitka spruce - red alder/salmonberry/field horsetail (F002XN904WA)
Other vegetative classification: Wet Soils (G002XN102WA)
Hydric soil rating: Yes

3022—Aquic Dystroxerepts-Oxyaquic Xerorthents complex, 15 to 70 percent slopes

Map Unit Setting

National map unit symbol: 2dvsx
Elevation: 0 to 250 feet
Mean annual precipitation: 25 to 40 inches
Mean annual air temperature: 48 to 50 degrees F
Frost-free period: 200 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Oxyaquic xerorthents and similar soils: 45 percent
Aquic dystroxerepts, coastal bluffs, and similar soils: 45 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Oxyaquic Xerorthents

Setting

Landform: Hillslopes, sea cliffs
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Beach sand and colluvium from glacial drift

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
Oe - 2 to 5 inches: slightly decomposed plant material
A - 5 to 9 inches: sand
Bw - 9 to 11 inches: sand
C1 - 11 to 19 inches: sand
C2 - 19 to 36 inches: sand
2Cg - 36 to 58 inches: very fine sandy loam
2Cd - 58 to 83 inches: very fine sandy loam

Properties and qualities

Slope: 15 to 70 percent
Depth to restrictive feature: 40 to 60 inches to densic material
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 16 to 28 inches

Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.7 inches)

Interpretive groups

Land capability classification (irrigated): 7e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A/D
Ecological site: western hemlock-western redcedar/red huckleberry-salal/western swordfern (F002XN906WA)
Hydric soil rating: No

Description of Aquic Dystroxerepts, Coastal Bluffs

Setting

Landform: Sea cliffs, sea cliffs
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Beach sand and colluvium from glacial drift

Typical profile

Oi - 0 to 4 inches: moderately decomposed plant material
Oe - 4 to 7 inches: slightly decomposed plant material
Bw - 7 to 17 inches: loamy sand
Bg1 - 17 to 41 inches: silt loam
Bg2 - 41 to 55 inches: fine sandy loam
Cg - 55 to 63 inches: fine sandy loam

Properties and qualities

Slope: 15 to 70 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.28 to 10.91 in/hr)
Depth to water table: About 16 to 28 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.4 inches)

Interpretive groups

Land capability classification (irrigated): 7e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A/D
Ecological site: western hemlock-western redcedar/red huckleberry-salal/western swordfern (F002XN906WA)
Hydric soil rating: No

Minor Components

Beaches

Percent of map unit: 10 percent
Landform: Beaches
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

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Appendix D

Ecology Well Logs

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

ENTERED

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W064588

UNIQUE WELL I.D. #

Water Right Permit No. 31-3E-5 G

(1) OWNER: Name Ed. Edith Iverson Address 611 E. Iverson Rd. Camano Isl. Wa 98292

(2) LOCATION OF WELL: County Island SW 1/4 NE 1/4 Sec 5 T. 31 N., R 3E W.M.

(2a) STREET ADDRESS OF WELL (or nearest address) SAME

(3) PROPOSED USE: [X] Domestic [ ] Industrial [ ] Municipal [ ] Irrigation [ ] Test Well [ ] Other [ ] DeWater

(4) TYPE OF WORK: Owner's number of well (if more than one)

Abandoned [ ] New well [X] Method: Dug [ ] Bored [ ] Deepened [ ] Cable [X] Driven [ ] Reconditioned [ ] Rotary [ ] Jetted [ ]

(5) DIMENSIONS: Diameter of well 6" inches. Drilled 118' feet. Depth of completed well 115' ft.

(6) CONSTRUCTION DETAILS:

Casing Installed: 6" Diam. from +2 ft. to 108 ft.
Welded [X] Liner installed [ ] Threaded [ ]
" Diam. from ft. to ft.
" Diam. from ft. to ft.

Perforations: Yes [ ] No [X]
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes [X] No [ ]
Manufacturer's Name NAGAROKI
Type S.S Model No.
Diam. 5" Slot size 10 from 115 ft. to 107 ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes [ ] No [X] Size of gravel
Gravel placed from ft. to ft.

Surface seal: Yes [X] No [ ] To what depth? 18 ft.
Material used in seal BENTONITE
Did any strata contain unusable water? Yes [ ] No [X]
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name GOULDS
Type: SUBMERSIBLE H.P. 1

(8) WATER LEVELS: Land-surface elevation above mean sea level
Static level 88' ft. below top of well Date 8-6-96
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes [X] No [ ] If yes, by whom? DRILLER
Yield: 20+ gal./min. with 3 ft. drawdown after 1 hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test gal./min. with ft. drawdown after hrs.
Airtest gal./min. with stem set at ft. for hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes [X] No [ ]

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
TOP SOIL GRAVEL	0	6"
ROCKY HARD PAN	6"	38'
DRY SAND GRAVEL	38'	41'
GRAVEL	41'	52'
DRY SAND GRAVEL	52'	82'
WATER BEARING SAND GRAVEL	82'	116'
GRAY CLAY	116'	120'

RECEIVED
SEP 09 1996
DEPT. OF ECOLOGY

Work Started 7-30 19. Completed 8-6 19 96

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Genes Well Drilling (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address 5115 26th N.W. Stanwood, WA 98292

(Signed) Lawrence Otto Kuyper (WELL DRILLER) License No. 2349

Contractor's Registration No. GENES WD071CC Date 8-6 19 96

(USE ADDITIONAL SHEETS IF NECESSARY)

Ecology is an Equal Opportunity and Affirmative Action employer. For special accommodation needs, contact the Water Resources Program at (206) 407-6600. The TDD number is (206) 407-6006.

ECY 050-1-20 (9/93)

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

ENTERED

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W064587

UNIQUE WELL I.D. #

Water Right Permit No. 31-3E-5G

(1) **OWNER:** Name John W. Orth Address 6096 E. Iverson Rd, Camano Isl. WA. 98292

(2) **LOCATION OF WELL:** County Island SW 1/4 NE 1/4 Sec 5 T. 31 N., R 3E W.M.

(2a) **STREET ADDRESS OF WELL** (or nearest address) SR 14E

(3) **PROPOSED USE:** ☒ Domestic ☐ Industrial ☐ Municipal ☐ ☐ Irrigation ☐ Test Well ☐ Other ☐ ☐ DeWater

(4) **TYPE OF WORK:** Owner's number of well (if more than one)

Abandoned ☐ New well ☒ Method: Dug ☐ Bored ☐ Deepened ☐ Cable ☒ Driven ☐ Reconditioned ☐ Rotary ☐ Jetted ☐

(5) **DIMENSIONS:** Diameter of well 6" inches. Drilled 100' feet. Depth of completed well 100' ft.

(6) **CONSTRUCTION DETAILS:**

Casing Installed: 6" Diam. from +2' ft. to 94'-4½" ft.
Welded ☒ " Diam. from ft. to ft.
Liner installed ☐ Threaded ☐ " Diam. from ft. to ft.

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☒ No ☐
Manufacturer's Name HOUSTON
Type SS. Model No.
Diam. 5" Slot size 10 from 100' ft. to 95'-7½" ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 18' ft.
Material used in seal BENTONITE
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7) **PUMP:** Manufacturer's Name FAIRBANKS MORSE
Type: SUBMERSIBLE H.P. 3/4

(8) **WATER LEVELS:** Land-surface elevation above mean sea level ft.
Static level 75 ft. below top of well Date 7-22-96
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) **WELL TESTS:** Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom?
Yield: 15 gal./min. with 3' ft. drawdown after 1 hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test gal./min. with ft. drawdown after hrs.
Airtest gal./min. with stem set at ft. for hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☒ No ☐

(10) **WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION**

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
TOP SOIL	0	6"
BROWN CLAY	6"	19'
LT BROWN HARDPAN	19'	37'
GRAY SAND GRAVEL	37'	75'
BROWN SAND with CLAY CHIPS	75'	80'
WATER BEARING GRAY SAND GRAVEL	80'	100'

RECEIVED
SEP 09 1996
DEPT. OF ECOLOGY

Work Started 7-16-96 19 Completed 7-22- 1996

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Gene's Well Drilling (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address 5115 268th N.W. Stanwood, WA 98292

(Signed) Lawrence O Harper (WELL DRILLER) License No. 2349

Contractor's Registration No. GENESWD071CC Date 7-23 19 96

(USE ADDITIONAL SHEETS IF NECESSARY)

Ecology is an Equal Opportunity and Affirmative Action employer. For special accommodation needs, contact the Water Resources Program at (206) 407-6600. The TDD number is (206) 407-6006.

ECY 050-1-20 (9/93) * * I

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

ENTERED

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W0645860

UNIQUE WELL I.D. #

Water Right Permit No. 31-3E-5G

(1) OWNER: Name Mark E. Holzknecht Address 8115-180th St. N.E. Sno. WA 98290

(2) LOCATION OF WELL: County Island SW 1/4 NE 1/4 Sec 5 T. 31 N., R. 3E W.M.

(2a) STREET ADDRESS OF WELL (or nearest address) 608 E Iverson Rd, Camano Isl. WA 98292

(3) PROPOSED USE: ☒ Domestic ☐ Industrial ☐ Municipal ☐ ☐ Irrigation ☐ Test Well ☐ Other ☐ ☐ DeWater

(4) TYPE OF WORK: Owner's number of well (if more than one)

Abandoned ☐ New well ☒ Method: Dug ☐ Bored ☐ Deepened ☐ Cable ☒ Driven ☐ Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches. Drilled 110 feet. Depth of completed well 110 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6" Diam. from +3 ft. to 107' ft.
Welded ☒ " Diam. from ft. to ft.
Liner installed ☐ " Diam. from ft. to ft.
Threaded ☐

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Houston
Type S.S. Model No.
Diam. 5" Slot size 12 from 110 ft. to 105 ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 18 ft.
Material used in seal BENTONITE
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name GOULDS
Type: 6" SUBMERSIBLE H.P. 1

(8) WATER LEVELS: Land-surface elevation above mean sea level ft.
Static level 81' ft. below top of well Date 7-28-96
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? DRILLER
Yield: 15+ gal./min. with 3 ft. drawdown after 1 hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test gal./min. with ft. drawdown after hrs.
Airtest gal./min. with stem set at ft. for hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☒ No ☐

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
TOP SOIL DARK BROWN SANDY CLAY	0'	2'
LT BROWN CLAY	2'	38'
BROWN HARD PAN + ROCKS	38'	40'
SAND & GRAVEL	40'	75'
WATER BEARING SAND + GRAVEL	75'	110'

RECEIVED
SEP 09 1996
DEPT. OF ECOLOGY

Work Started 7-23- 19 Completed 7-27 19 96

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Gene's Well Drilling (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address 5115 260th N.W. Stanwood/WA 98292

(Signed) Lawrence Otto Kuker (WELL DRILLER) License No. 2749

Contractor's Registration No. GENESWDO71CL Date 7-31 19 96

(USE ADDITIONAL SHEETS IF NECESSARY)

Ecology is an Equal Opportunity and Affirmative Action employer. For special accommodation needs, contact the Water Resources Program at (206) 407-6600. The TDD number is (206) 407-6006.

ECY 050-1-20 (9/93)

File Original with
Department of Ecology
Second Copy - Owner's Copy
Third Copy - Driller's Copy 98753

WATER WELL REPORT

STATE OF WASHINGTON

Notice of Intent W 118512

UNIQUE WELL I D # AEU 778

Water Right Permit No 31-3E-5 6

(1) OWNER Name June Iverson Address 633 Iverson Bch. Rd Camano Isl, WH

(2) LOCATION OF WELL County ISLAND COUNTY SW 1/4 NE 1/4 Sec 5 T 31 N R 3E WM

(2a) STREET ADDRESS OF WELL (or nearest address) xxx Iverson Bch Rd Camano Isl WH.

TAX PARCEL NO

(3) PROPOSED USE ☒ Domestic ☐ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐ DeWater

(4) TYPE OF WORK Owner's number of well (if more than one)
☒ New Well Method ☐ Dug ☐ Bored ☒ Cable ☐ Driven ☐ Rotary ☐ Jetted
☐ Deepened ☐ Reconditioned ☐ Decommission

(5) DIMENSIONS Diameter of well 6 inches
Drilled 123 feet Depth of completed well 122-9 ft

(6) CONSTRUCTION DETAILS
Casing Installed
☒ Welded 6 " Diam from 1-2 ft to 116-1 ft
☐ Liner installed " Diam from ft to ft
☐ Threaded " Diam from ft to ft

Perforations ☐ Yes ☒ No
Type of perforator used
SIZE of perforations in by in
perforations from ft to ft

Screens ☒ Yes ☐ No ☒ K-Pac Location 117-9 - 115-2
Manufacturer's Name Alloy
Type TELESCOPING Model No
Diam 5" Slot Size .010 from 122-9 ft to 115-2 ft
Diam Slot Size from ft to ft

Gravel/Filter packed ☐ Yes ☐ No ☐ Size of gravel/sand
Material placed from ft to ft

Surface seal ☒ Yes ☐ No To what depth? 19 ft
Material used in seal BENTONITE
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP Manufacturer's Name
Type H P

(8) WATER LEVELS Land surface elevation above mean sea level ft
Static level 82 ft below top of well Date 6-4-01
Artesian pressure lbs per square inch Date
Artesian water is controlled by (Cap, valve, etc)

(9) WELL TESTS Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☒ No If yes, by whom?
Yield gal /min with ft drawdown after hrs
Yield gal /min with ft drawdown after hrs
Yield gal /min with ft drawdown after hrs
Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test 10+ gal /min with 3 ft drawdown after 1 hrs
Airtest gal /min with ft drawdown after hrs
Artesian flow g p m Date
Temperature of water Was a chemical analysis made? ☐ Yes ☒ No

(10) WELL LOG or DECOMMISSIONING PROCEDURE DESCRIPTION
Formation Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated with at least one entry for each change of information Indicate all water encountered

MATERIAL	FROM	TO
TOP SOIL	0	1
LIGHT BROWN CLAY	1	28
LIGHT BROWN SANDY CLAY	28	31
GRAY SAND AND GRAVEL	31	60
GRAY SAND RIVER ROCK	60	62
DARK BROWN CLAY BAILS		
GRAY SAND GRAVEL	62	94
WATER BEARING	94	123
GRAY SAND LIGHT		
BROWN CLAY BAILS		

RECEIVED
JUL 12 2001
DEPT OF ECOLOGY

Work Started 5-24-01 Completed 6-14-01

WELL CONSTRUCTION CERTIFICATION

I constructed and/or accept responsibility for construction of this well and its compliance with all Washington well construction standards Materials used and the information reported above are true to my best knowledge and belief

Type or Print Name License No
(Licensed Driller/Engineer)

Trainee Name License No

Drilling Company Gene's Well Drilling

(Signed) Lawrence O. Hooper License No 2749
(Licensed Driller/Engineer)

Address 5715 268th N.W Stanwood, WA.

Contractor's Registration No GENES WDOTICC Date 6-5-01

(USE ADDITIONAL SHEETS IF NECESSARY)

Ecology is an Equal Opportunity and Affirmative Action employer For special accommodation needs contact the Water Resources Program at (360) 407-6600 The TDD number is (360) 407 6006

ECY 050-1-20 (11/98) 98753

31-3E-5G

File Original with
Department of Ecology
Second Copy - Owner's Copy
Third Copy - Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Notice of Intent W118513

UNIQUE WELL I D # AFS 791

Water Right Permit No

(1) **OWNER:** Name June Iverson Address 633 Iverson Rch. Rd Camano Isl WH.

(2) **LOCATION OF WELL:** County Island SW 1/4 NE 1/4 Sec 5 T 31 NR 3E WM

(2a) **STREET ADDRESS OF WELL:** (or nearest address) ### Iverson Rch. Rd. Camano Isl, WH 98282

TAX PARCEL NO.

(3) **PROPOSED USE:** ☒ Domestic ☐ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐ DeWater

(4) **TYPE OF WORK:** Owner's number of well (if more than one)
☒ New Well Method
☐ Deepened ☐ Dug ☐ Bored
☐ Reconditioned ☒ Cable ☐ Driven
☐ Decommission ☐ Rotary ☐ Jetted

(5) **DIMENSIONS:** Diameter of well 6 inches
Drilled 112 feet Depth of completed well 112 ft

(6) **CONSTRUCTION DETAILS**
Casing Installed:
☒ Welded 6 " Diam from +2 ft to 107 ft
☐ Liner installed " Diam from ft to ft
☐ Threaded " Diam from ft to ft

Perforations: ☐ Yes ☒ No
Type of perforator used
SIZE of perforations in by in
perforations from ft to ft

Screens: ☒ Yes ☐ No ☐ K-Pac Location 106
Manufacturer's Name Alloy
Type S. Steel Model No
Diam 5 Slot Size 10 from 107 ft to 112 ft
Diam Slot Size from ft to ft

Gravel/Filter packed: ☐ Yes ☒ No ☐ Size of gravel/sand
Material placed from ft to ft

Surface seal: ☒ Yes ☐ No To what depth? 18 ft
Material used in seal Bentonite
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? Depth of strata
Method of sealing strata off

(7) **PUMP:** Manufacturer's Name STA-Rite
Type SUB. H P 1

(8) **WATER LEVELS:** Land-surface elevation above mean sea level ft
Static level 86 ft below top of well Date 11-2-01
Artesian pressure lbs per square inch Date
Artesian water is controlled by
(Cap, valve, etc)

(9) **WELL TESTS:** Drawdown is amount water level is lowered below static level
Was a pump test made? ☒ Yes ☐ No If yes, by whom? Genes
Yield 12 gal /min with 3 ft drawdown after 2 hrs
Yield gal /min with ft drawdown after hrs
Yield gal /min with ft drawdown after hrs
Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test gal /min with ft drawdown after hrs
Airtest gal /min with ft drawdown after hrs
Artesian flow g p m Date
Temperature of water Was a chemical analysis made? ☒ Yes ☐ No

(10) **WELL LOG or DECOMMISSIONING PROCEDURE DESCRIPTION**
Formation Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information Indicate all water encountered

MATERIAL	FROM	TO
Top-soil	0	2
cemented sand-gravel	2	7
Brown clay	7	22
Dry sand-gravel	22	93
water sand-gravel	93	112

RECEIVED
NOV 2 1 2001
DEPT OF ECOLOGY

I certify this well meets all State-Co. rules-reqs at time it was drilled
Gene Hitt
11-14-01

Work Started 10-25-01 Completed 11-2-01

WELL CONSTRUCTION CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards Materials used and the information reported above are true to my best knowledge and belief

Type or Print Name License No
(Licensed Driller/Engineer)

Trainee Name License No
Drilling Company Genes Well Drilling
(Signed) William Johns License No 2239
(Licensed Driller/Engineer)
Address 5115 268th N.W. Stanwood, WH
Contractor's Registration No GENESWD07CC Date 11-14-01

(USE ADDITIONAL SHEETS IF NECESSARY)

Ecology is an Equal Opportunity and Affirmative Action employer For special accommodation needs, contact the Water Resources Program at (360) 407-6600 The TDD number is (360) 407-6006

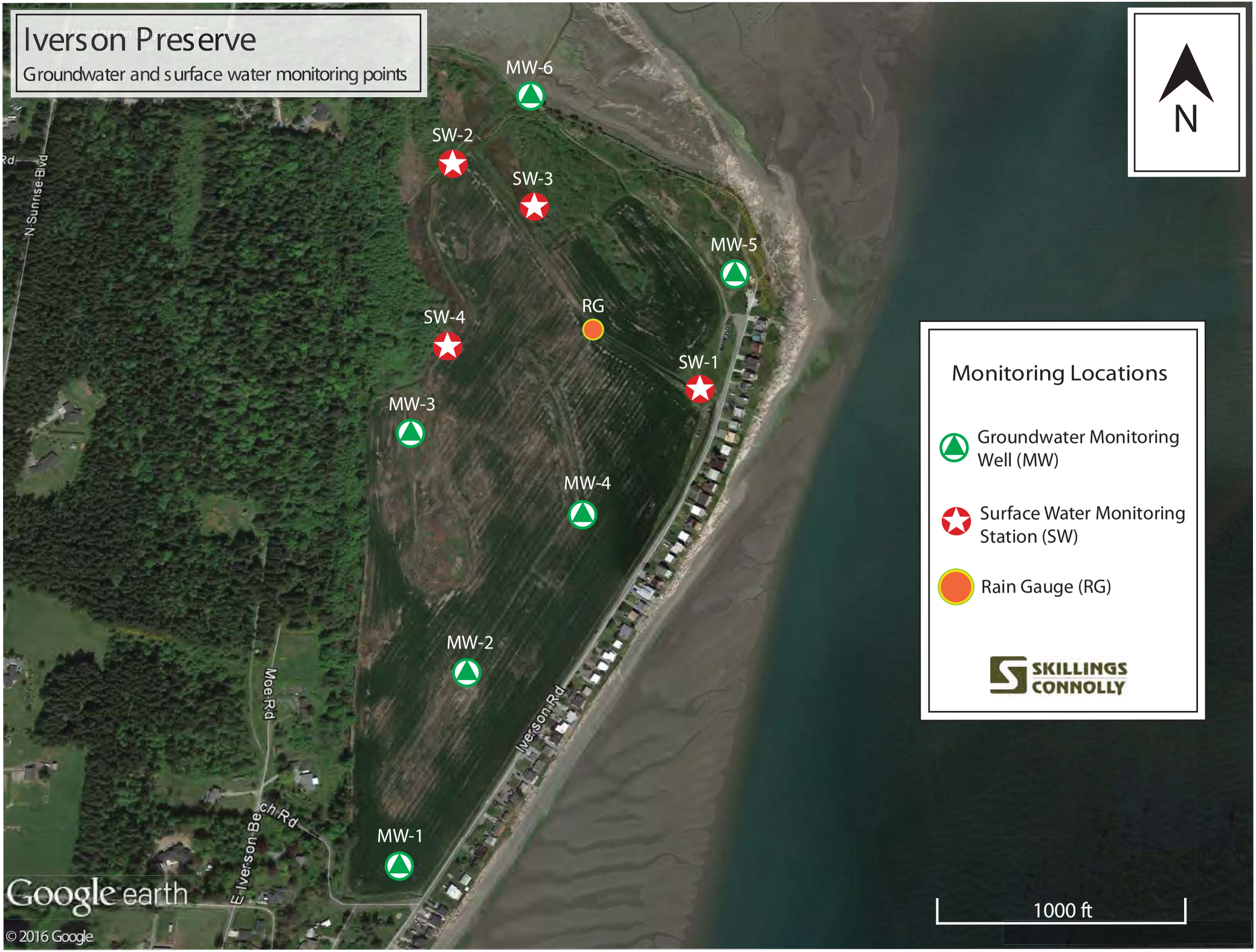
ECY 050-1-20 (11/98)

105528

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

Appendix E

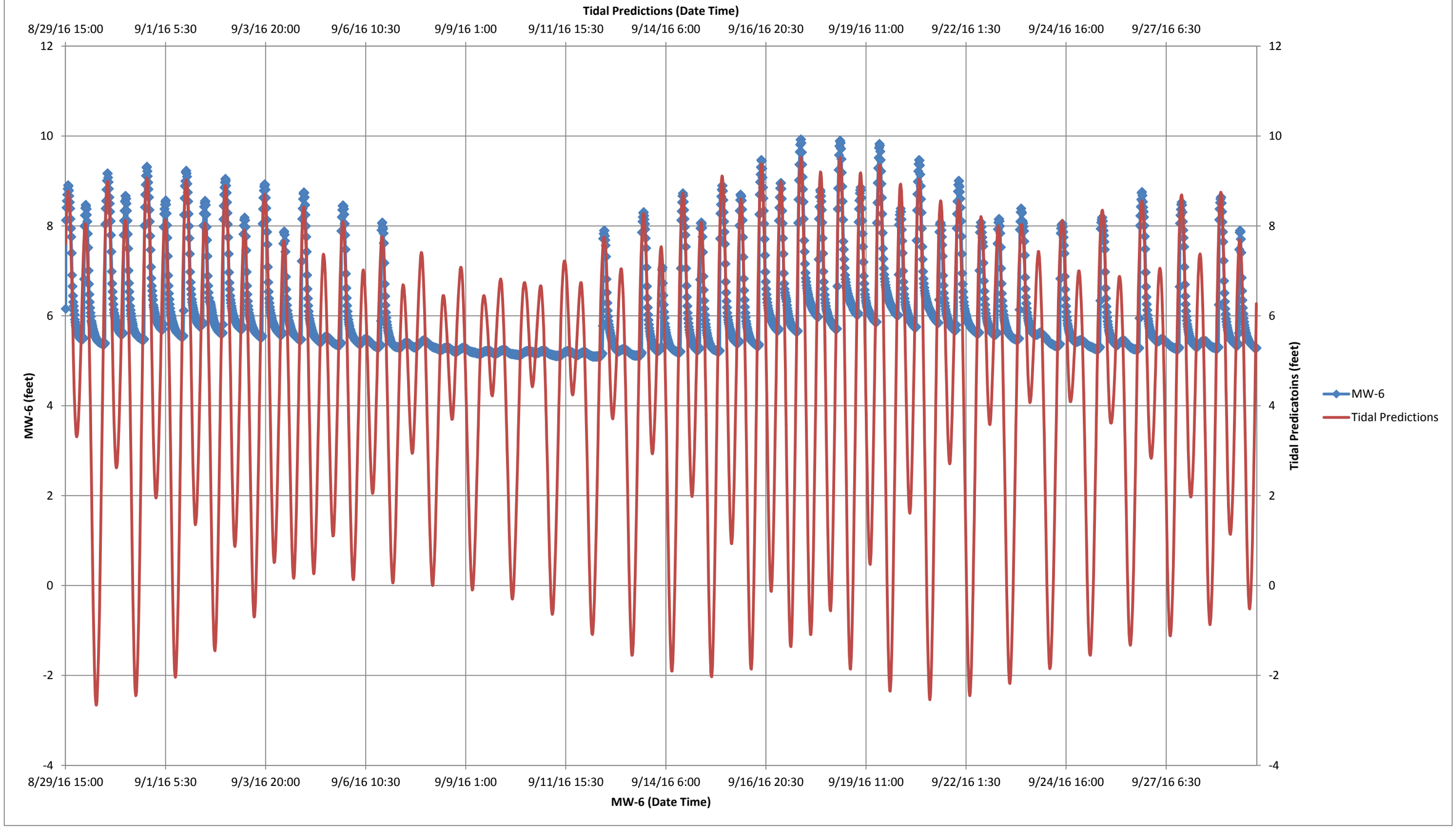
Monitoring Wells Site Map


Iverson Preserve
Groundwater and surface water monitoring points
N
MW-6
SW-2
SW-3
MW-5
RG
SW-4
SW-1
MW-3
MW-4
MW-2
MW-1
N Sunrise Blvd
Moe Rd
Iverson Rd
E Iverson Beach Rd
Monitoring Locations
Groundwater Monitoring Well (MW)
Surface Water Monitoring Station (SW)
Rain Gauge (RG)
SKILLINGS CONNOLLY
1000 ft
Google earth
© 2016 Google

Appendix F

Tide Graph Chart

MW-6 vs Tidal Predictions September 2016



MW-6 vs Tidal Predictions October 2016

Tidal Predictions (Date Time)

9/29/16 15:00 | 10/2/16 5:30 | 10/4/16 20:00 | 10/7/16 10:30 | 10/10/16 1:00 | 10/12/16 15:30 | 10/15/16 6:00 | 10/17/16 20:30 | 10/20/16 11:00 | 10/23/16 1:30 | 10/25/16 16:00 | 10/28/16 6:30

MW-6 (feet)

12 | 10 | 8 | 6 | 4 | 2 | 0 | -2 | -4 | -6

Tidal Predictions (feet)

12 | 10 | 8 | 6 | 4 | 2 | 0 | -2 | -4 | -6

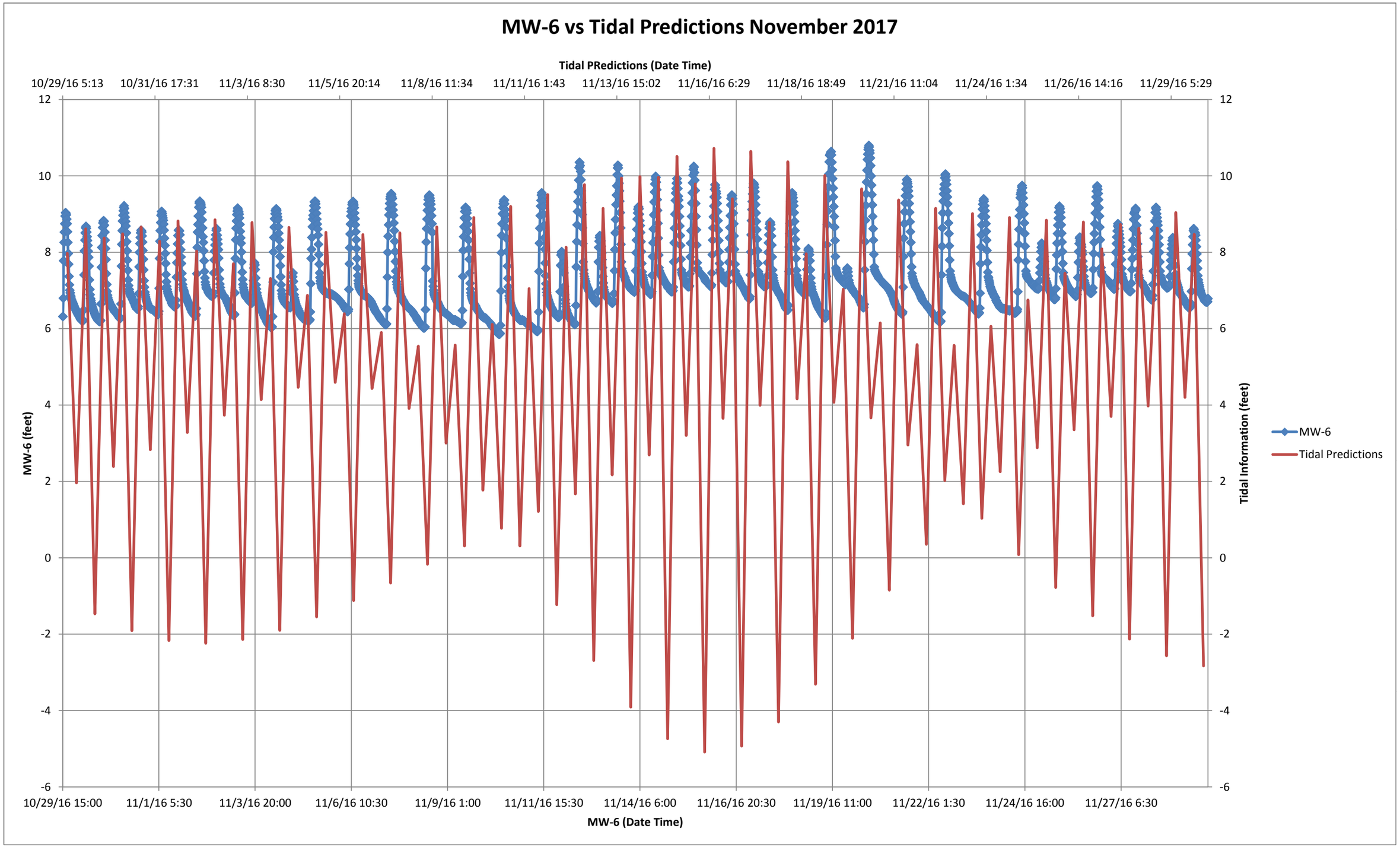
MW-6 (Date Time)

9/29/16 15:00 | 10/2/16 5:30 | 10/4/16 20:00 | 10/7/16 10:30 | 10/10/16 1:00 | 10/12/16 15:30 | 10/15/16 6:00 | 10/17/16 20:30 | 10/20/16 11:00 | 10/23/16 1:30 | 10/25/16 16:00 | 10/28/16 6:30

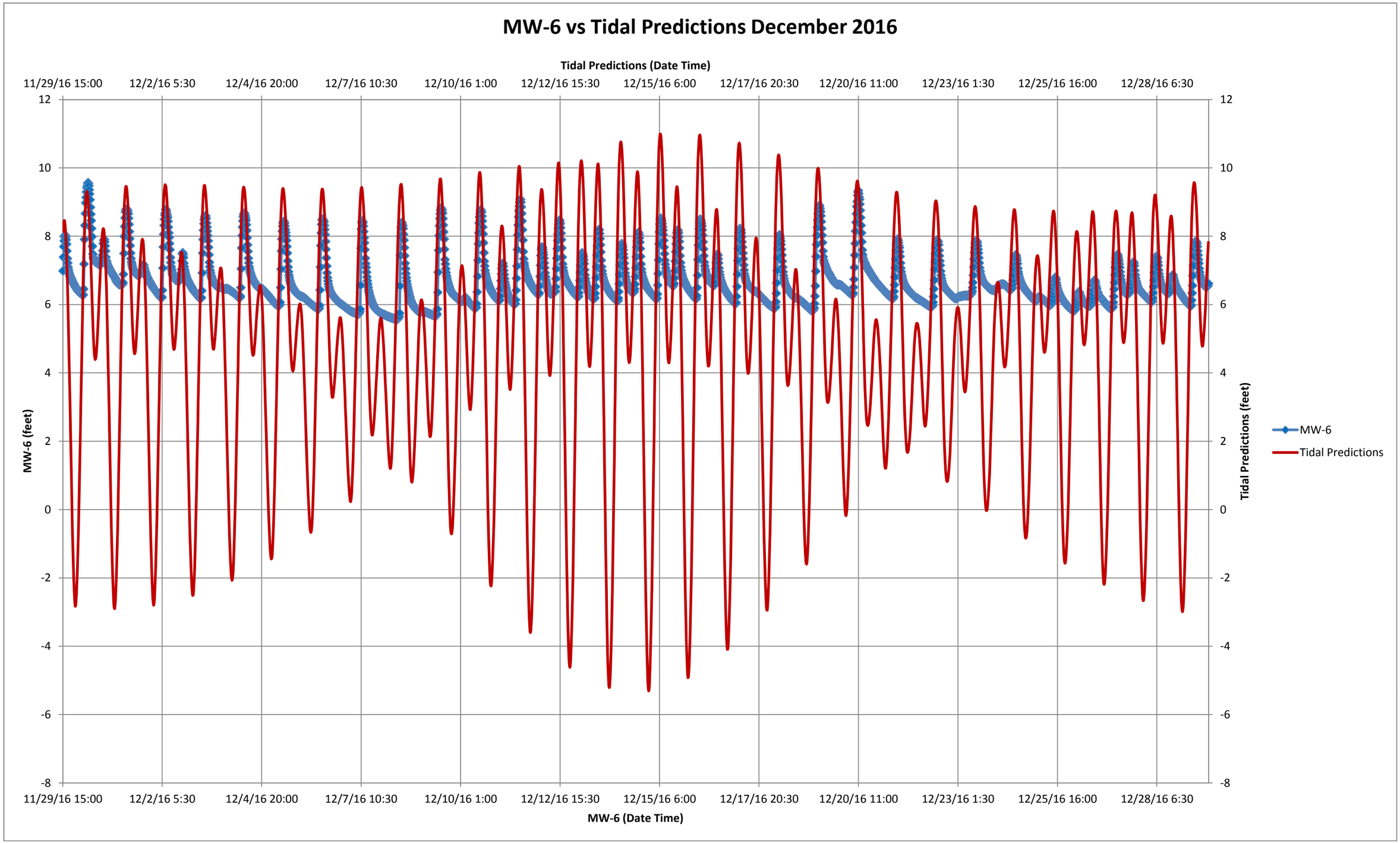
MW-6

Tidal Predictions

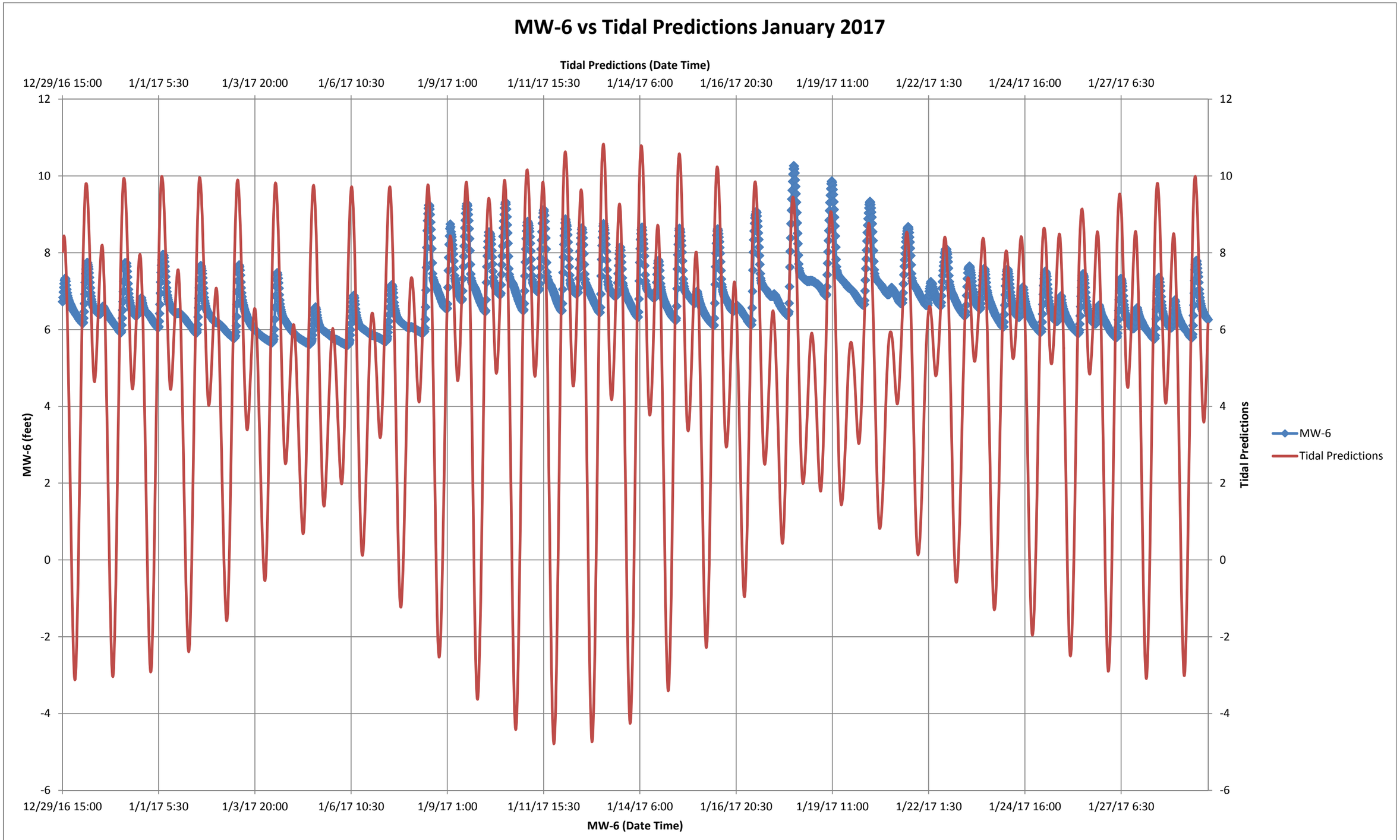
MW-6 vs Tidal Predictions November 2017



MW-6 vs Tidal Predictions December 2016



MW-6 vs Tidal Predictions January 2017



MW-6 vs Tidal Predictions February 2017

Tidal Predictions (Date Time)

1/29/17 15:00 | 2/1/17 5:30 | 2/3/17 20:00 | 2/6/17 10:30 | 2/9/17 1:00 | 2/11/17 15:30 | 2/14/17 6:00 | 2/16/17 20:30 | 2/19/17 11:00 | 2/22/17 1:30 | 2/24/17 16:00 | 2/27/17 6:30

MW-6 (feet)

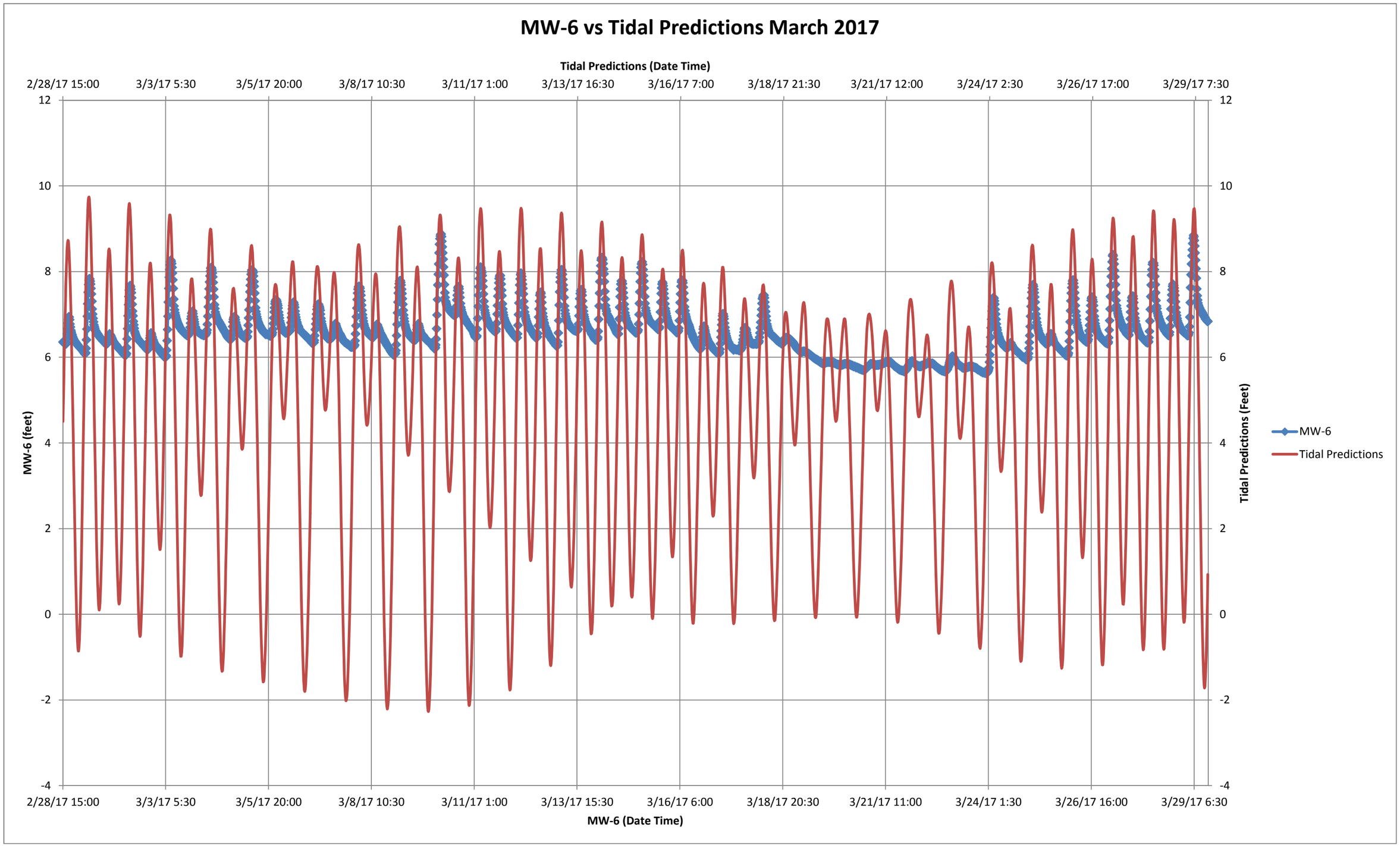
12 | 10 | 8 | 6 | 4 | 2 | 0 | -2 | -4 | -6

MW-6

Tidal Predictions

MW-6 (Date Time)

MW-6 vs Tidal Predictions March 2017



MW-6 vs Tidal Predictions April 2017

Tidal Predictions (Date Time)

3/29/17 15:00 | 4/1/17 5:30 | 4/3/17 20:00 | 4/6/17 10:30 | 4/9/17 1:00 | 4/11/17 15:30 | 4/14/17 6:00 | 4/16/17 20:30 | 4/19/17 11:00 | 4/22/17 1:30 | 4/24/17 16:00 | 4/27/17 6:30

MW-6 (Date Time)

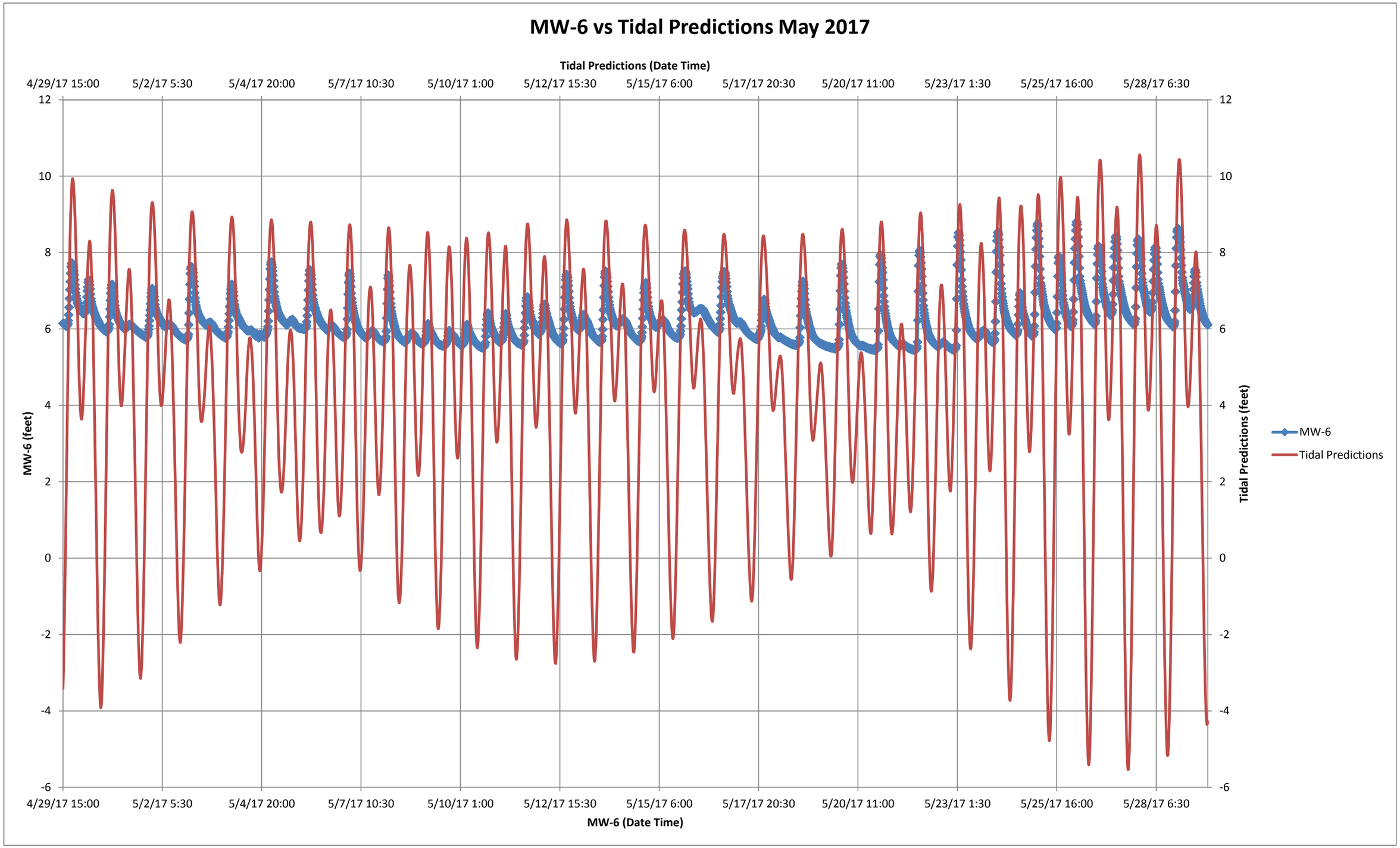
12 | 10 | 8 | 6 | 4 | 2 | 0 | -2 | -4 | -6

Tidal Predictions (feet)

MW-6

Tidal Predictions

MW-6 vs Tidal Predictions May 2017



MW-6 vs Tidal Predictions June 2017

Tidal Predictions (Date Time)

5/29/17 15:00 | 6/1/17 5:30 | 6/3/17 20:00 | 6/6/17 10:30 | 6/9/17 1:00 | 6/11/17 15:30 | 6/14/17 6:00 | 6/16/17 20:30 | 6/19/17 11:00 | 6/22/17 1:30 | 6/24/17 16:00 | 6/27/17 6:30

MW-6 (feet): 12, 10, 8, 6, 4, 2, 0, -2, -4, -6

Tidal PRedictions (feet): 12, 10, 8, 6, 4, 2, 0, -2, -4, -6

MW-6 (Date Time)

MW-6

Tidal Predictions

Appendix G

Ground Water Elevations

(Month over Month, High/Lows)

Plotted By: Sam Rowswell on 12/28/17 2:13 PM
Saved By: srowswell on 12/28/17 1:51 PM
G:\Project\2016\16145 Coastal Geologic Groundwater\CAD\Drawings\Construction\Production\D_16145_S01_GW_LEGEND.dwg

Elevations Table			
NUMBER	MIN ELEV	MAX ELEV	COLOR
1	2.00	2.25	
2	2.25	2.50	
3	2.50	2.75	
4	2.75	3.00	
5	3.00	3.25	
6	3.25	3.50	
7	3.50	3.75	
8	3.75	4.00	
9	4.00	4.25	
10	4.25	4.50	
11	4.50	4.75	
12	4.75	5.00	
13	5.00	5.25	
14	5.25	5.50	
15	5.50	5.75	
16	5.75	6.00	
17	6.00	6.25	
18	6.25	6.50	
19	6.50	6.75	
20	6.75	7.00	
21	7.00	7.25	
22	7.25	7.50	
23	7.50	7.75	
24	7.75	8.00	
25	8.00	8.25	
26	8.25	8.50	
27	8.50	8.75	
28	8.75	9.00	
29	9.00	9.25	

NUMBER COLUMN INDICATES 0.25' INCREMENT OF ELEVATION.

SKILLINGS CONNOLLY
5016 Lacey Boulevard SE, Lacey, WA 98503
Ph.: (360) 491-3399 www.skillings.com

IVERSON PRESERVE AND LIVINGSTON BAY

LEGEND

JOB NUMBER 16145

SHEET 1 OF 21 SHEETS

Elevations Table			
NUMBER	MIN ELEV	MAX ELEV	COLOR
1	3.00	3.25	
2	3.25	3.50	
3	3.50	3.75	
4	3.75	4.00	
5	4.00	4.25	
6	4.25	4.50	
7	4.50	4.75	
8	4.75	5.00	
9	5.00	5.25	

NUMBER COLUMN INDICATES 0.25' INCREMENT OF ELEVATION.

Plotted By: Sam Rowswell on 12/28/17 2:13 PM
Saved By: Srowswell on 12/28/17 1:51 PM
G:\Project\2016\16145 Coastal Geologic Groundwater\CAD\Drawings\Construction\Production\D_16145_S02_GW_160912_LOW.dwg

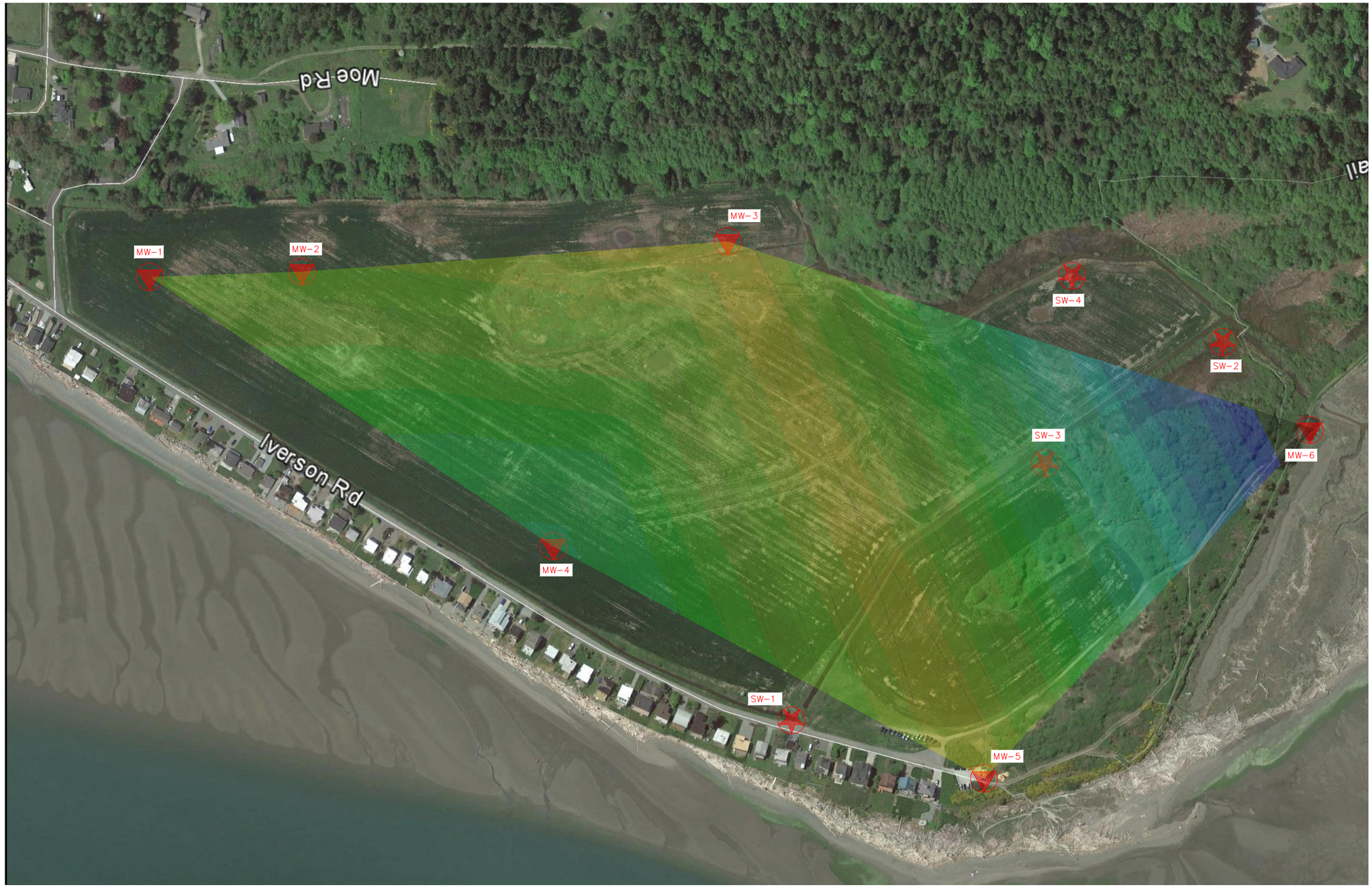
SKILLINGS CONNOLLY
5016 Lacey Boulevard SE, Lacey, WA 98503
Ph.: (360) 491-3399 www.skillings.com

IVERSON PRESERVE AND LIVINGSTON BAY

SEPTEMBER 2016 LOW GROUNDWATER ELEVATION

JOB NUMBER 16145

SHEET 2 OF 21 SHEETS



Elevations Table			
NUMBER	MIN ELEV	MAX ELEV	COLOR
1	3.75	4.00	
2	4.00	4.25	
3	4.25	4.50	
4	4.50	4.75	
5	4.75	5.00	
6	5.00	5.25	
7	5.25	5.50	
8	5.50	5.75	
9	5.75	6.00	
10	6.00	6.25	
11	6.25	6.50	
12	6.50	6.75	
13	6.75	7.00	
14	7.00	7.25	
15	7.25	7.50	
16	7.50	7.75	
17	7.75	8.00	
18	8.00	8.25	
19	8.25	8.50	
20	8.50	8.75	

NUMBER COLUMN INDICATES 0.25' INCREMENT OF ELEVATION.

Plotted By: Sam Rowswell on 12/28/17 2:14 PM
Saved By: Srowswell on 12/28/17 1:51 PM
G:\Project\2016\16145 Coastal Geologic Groundwater\CAD\Drawings\Construction\Production\D_16145_S03_GW_160919_HIGH.dwg

SKILLINGS CONNOLLY
5016 Lacey Boulevard SE, Lacey, WA 98503
Ph.: (360) 491-3399 www.skillings.com

IVERSON PRESERVE AND LIVINGSTON BAY

SEPTEMBER 2016 HIGH GROUNDWATER ELEVATION

JOB NUMBER 16145

SHEET 3 OF 21 SHEETS

N

Elevations Table			
NUMBER	MIN ELEV	MAX ELEV	COLOR
1	2.50	2.75	
2	2.75	3.00	
3	3.00	3.25	
4	3.25	3.50	
5	3.50	3.75	
6	3.75	4.00	
7	4.00	4.25	
8	4.25	4.50	
9	4.50	4.75	
10	4.75	5.00	
11	5.00	5.25	

NUMBER COLUMN INDICATES 0.25' INCREMENT OF ELEVATION.

Plotted By: Sam Rowswell on 12/28/17 2:15 PM
Saved By: Srowswell on 12/28/17 1:52 PM
G:\Project\2016\16145 Coastal Geologic Groundwater\CAD\Drawings\Construction\Production\D_16145_S04_GW_161012_LOW.dwg

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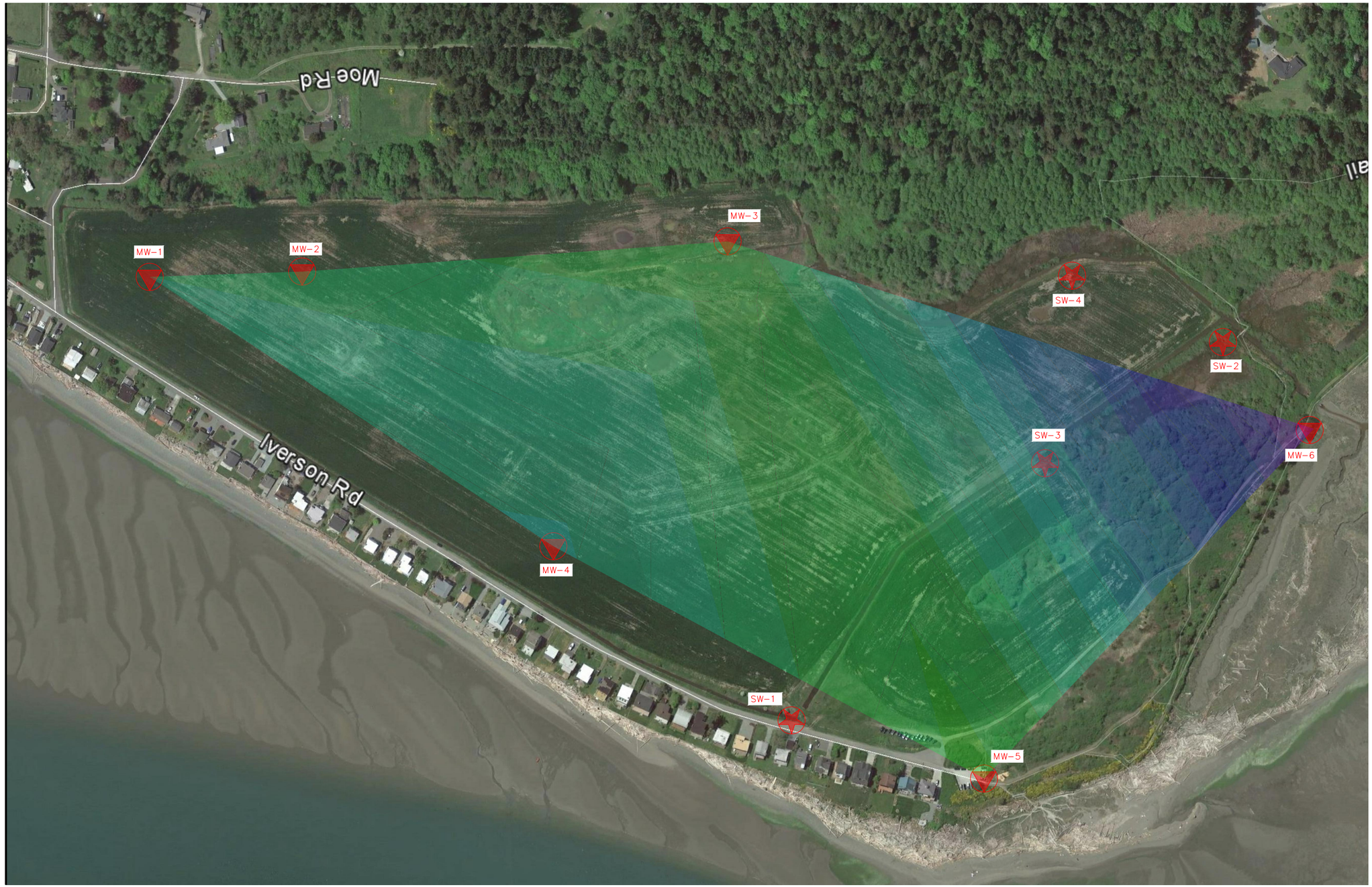
OCTOBER 2016 LOW GROUNDWATER ELEVATION

JOB NUMBER 16145

SHEET 4 OF 21 SHEETS



Elevations Table			
NUMBER	MIN ELEV	MAX ELEV	COLOR
1	5.25	5.50	
2	5.50	5.75	
3	5.75	6.00	
4	6.00	6.25	
5	6.25	6.50	
6	6.50	6.75	
7	6.75	7.00	
8	7.00	7.25	
9	7.25	7.50	
10	7.50	7.75	
11	7.75	8.00	
12	8.00	8.25	
13	8.25	8.50	
14	8.50	8.75	
15	8.75	9.00	
16	9.00	9.25	

NUMBER COLUMN INDICATES 0.25' INCREMENT OF ELEVATION.

Plotted By: Sam Rowswell on 12/28/17 2:15 PM
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OCTOBER 2016 HIGH GROUNDWATER ELEVATION

JOB NUMBER 16145

SHEET 5 OF 21 SHEETS

Elevations Table			
NUMBER	MIN ELEV	MAX ELEV	COLOR
1	4.25	4.50	
2	4.50	4.75	
3	4.75	5.00	
4	5.00	5.25	
5	5.25	5.50	
6	5.50	5.75	
7	5.75	6.00	

NUMBER COLUMN INDICATES 0.25' INCREMENT OF ELEVATION.

Plotted By: Sam Rowswell on 12/28/17 2:16 PM
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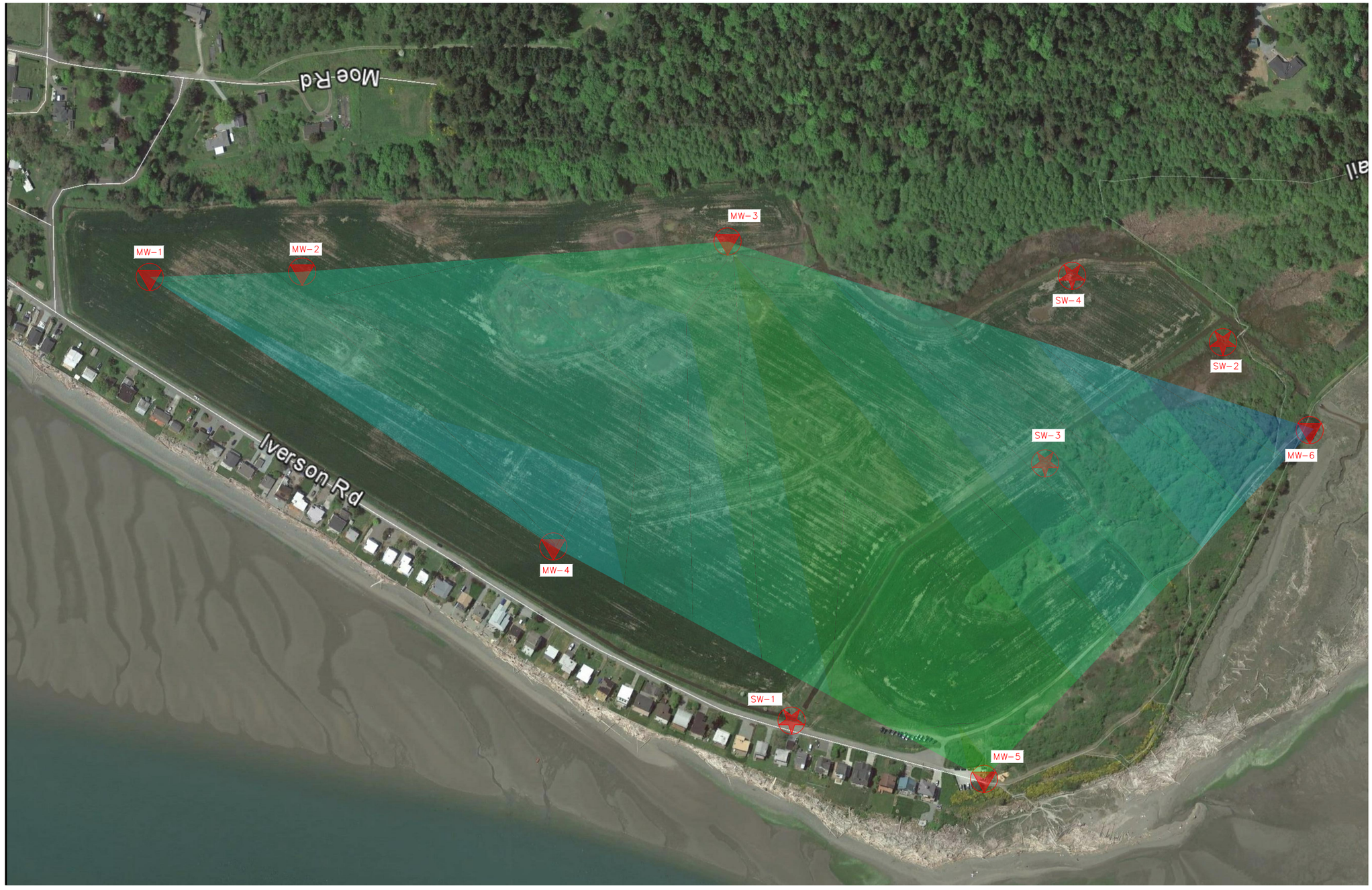
NOVEMBER 2016 LOW GROUNDWATER ELEVATION

JOB NUMBER 16145

SHEET 6 OF 21 SHEETS



Elevations Table			
NUMBER	MIN ELEV	MAX ELEV	COLOR
1	5.25	5.50	
2	5.50	5.75	
3	5.75	6.00	
4	6.00	6.25	
5	6.25	6.50	
6	6.50	6.75	
7	6.75	7.00	
8	7.00	7.25	
9	7.25	7.50	

NUMBER COLUMN INDICATES 0.25' INCREMENT OF ELEVATION.

Plotted By: Sam Rowswell on 12/28/17 2:16 PM
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NOVEMBER 2016 HIGH GROUNDWATER ELEVATION

JOB NUMBER 16145

SHEET 7 OF 21 SHEETS

N

Elevations Table			
NUMBER	MIN ELEV	MAX ELEV	COLOR
1	4.25	4.50	
2	4.50	4.75	
3	4.75	5.00	
4	5.00	5.25	
5	5.25	5.50	
6	5.50	5.75	
7	5.75	6.00	

NUMBER COLUMN INDICATES 0.25' INCREMENT OF ELEVATION.

Plotted By: Sam Rowswell on 12/28/17 2:17 PM
Saved By: Srowswell on 12/28/17 1:52 PM
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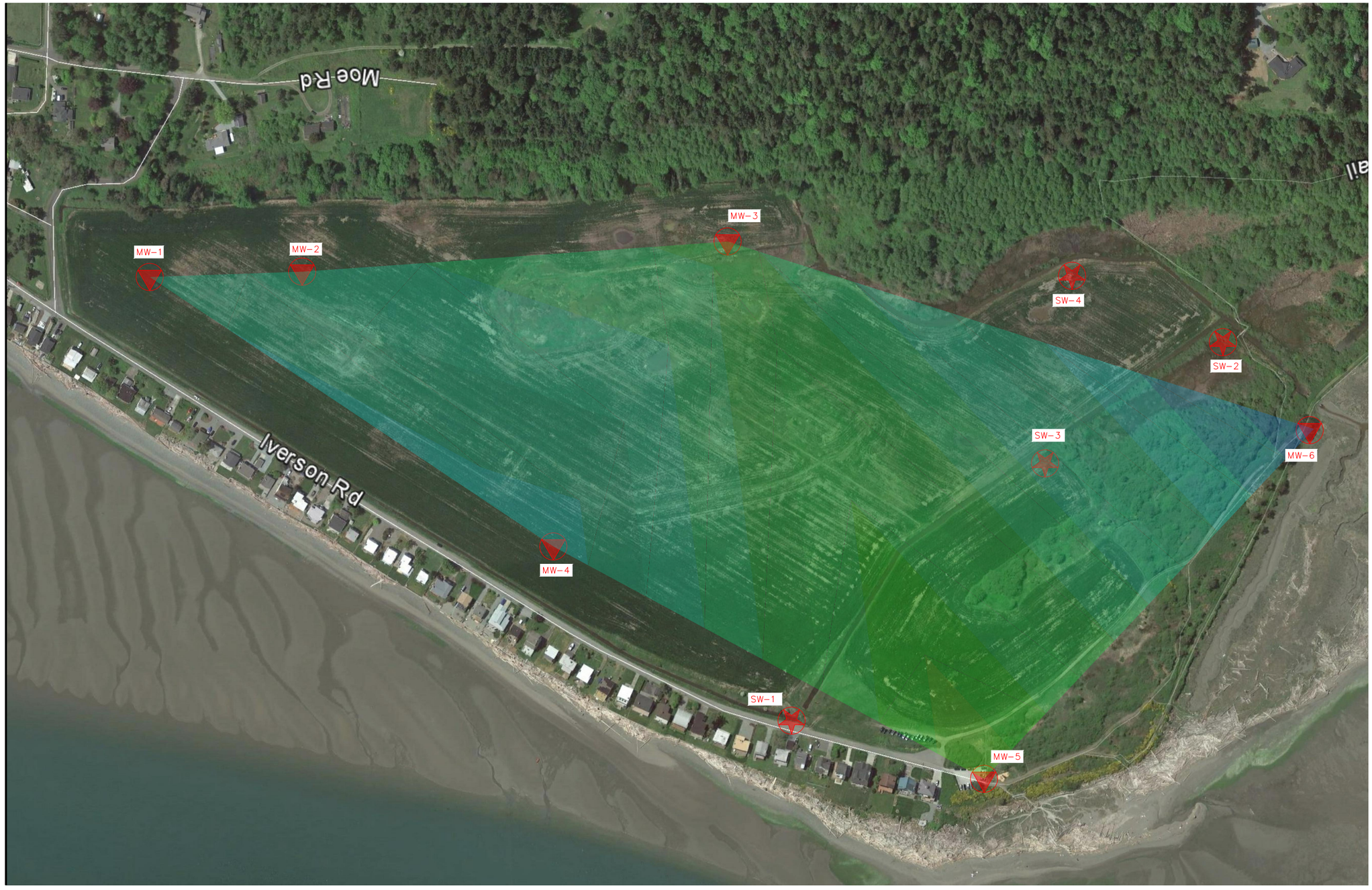
DECEMBER 2016 LOW GROUNDWATER ELEVATION

JOB NUMBER 16145

SHEET 8 OF 21 SHEETS



Elevations Table			
NUMBER	MIN ELEV	MAX ELEV	COLOR
1	5.00	5.25	
2	5.25	5.50	
3	5.50	5.75	
4	5.75	6.00	
5	6.00	6.25	
6	6.25	6.50	
7	6.50	6.75	
8	6.75	7.00	
9	7.00	7.25	
10	7.25	7.50	

NUMBER COLUMN INDICATES 0.25' INCREMENT OF ELEVATION.

Plotted By: Sam Rowswell on 12/28/17 2:17 PM
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DECEMBER 2016 HIGH GROUNDWATER ELEVATION

JOB NUMBER 16145

SHEET 9 OF 21 SHEETS

Elevations Table			
NUMBER	MIN ELEV	MAX ELEV	COLOR
1	3.75	4.00	
2	4.00	4.25	
3	4.25	4.50	
4	4.50	4.75	
5	4.75	5.00	
6	5.00	5.25	
7	5.25	5.50	
8	5.50	5.75	

NUMBER COLUMN INDICATES 0.25' INCREMENT OF ELEVATION.

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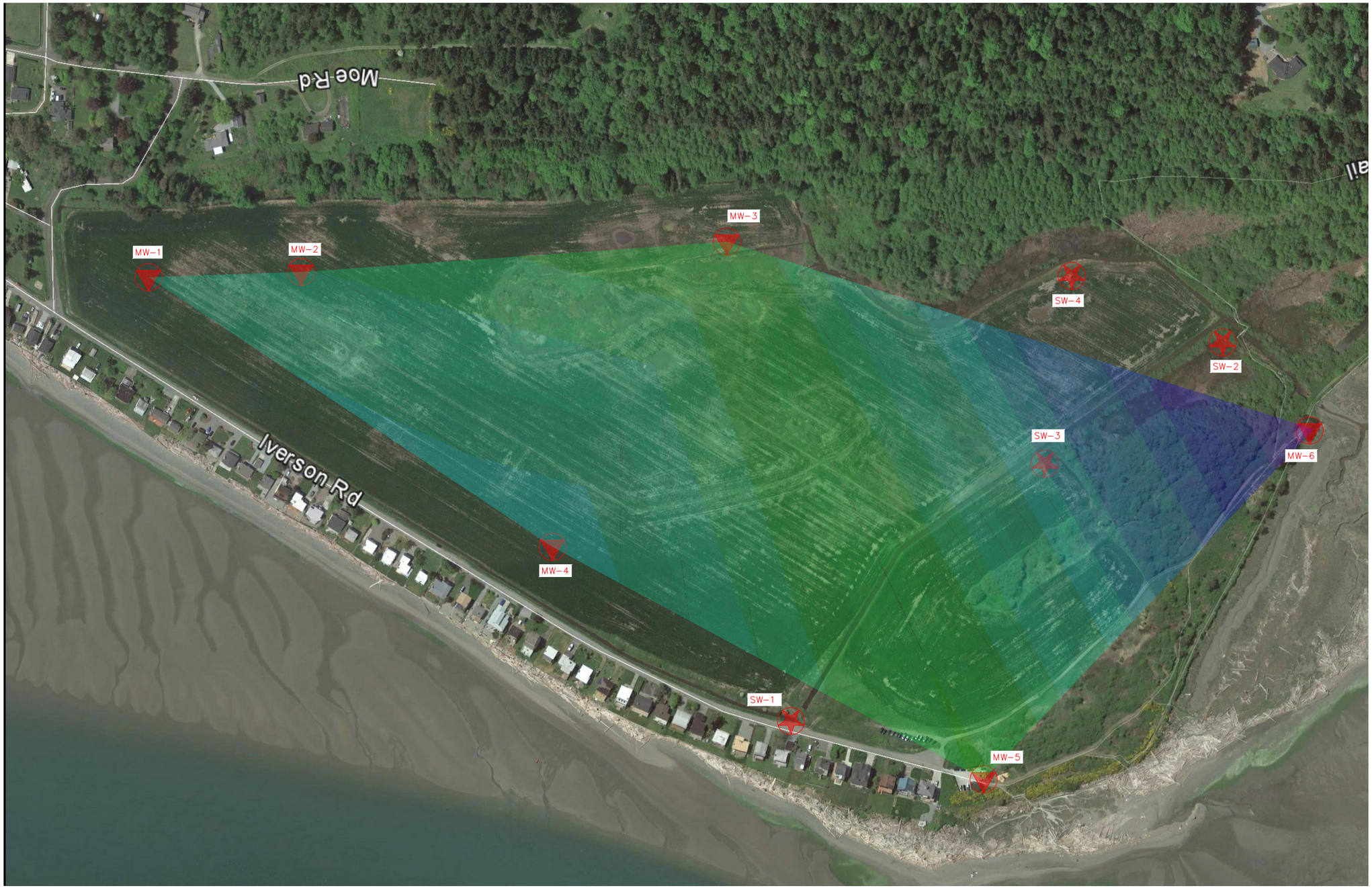
JANUARY 2017 LOW GROUNDWATER ELEVATION

JOB NUMBER 16145

SHEET 10 OF 21 SHEETS



Elevations Table			
NUMBER	MIN ELEV	MAX ELEV	COLOR
1	5.25	5.50	
2	5.50	5.75	
3	5.75	6.00	
4	6.00	6.25	
5	6.25	6.50	
6	6.50	6.75	
7	6.75	7.00	
8	7.00	7.25	
9	7.25	7.50	
10	7.50	7.75	
11	7.75	8.00	
12	8.00	8.25	
13	8.25	8.50	
14	8.50	8.75	
15	8.75	9.00	

NUMBER COLUMN INDICATES 0.25' INCREMENT OF ELEVATION.

Plotted By: Sam Rowswell on 12/28/17 2:18 PM
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JANUARY 2017 HIGH GROUNDWATER ELEVATION

JOB NUMBER 16145

SHEET 11 OF 21 SHEETS

Elevations Table			
NUMBER	MIN ELEV	MAX ELEV	COLOR
1	3.75	4.00	
2	4.00	4.25	
3	4.25	4.50	
4	4.50	4.75	
5	4.75	5.00	
6	5.00	5.25	
7	5.25	5.50	
8	5.50	5.75	
9	5.75	6.00	

NUMBER COLUMN INDICATES 0.25' INCREMENT OF ELEVATION.

Plotted By: Sam Rowswell on 12/28/17 2:19 PM
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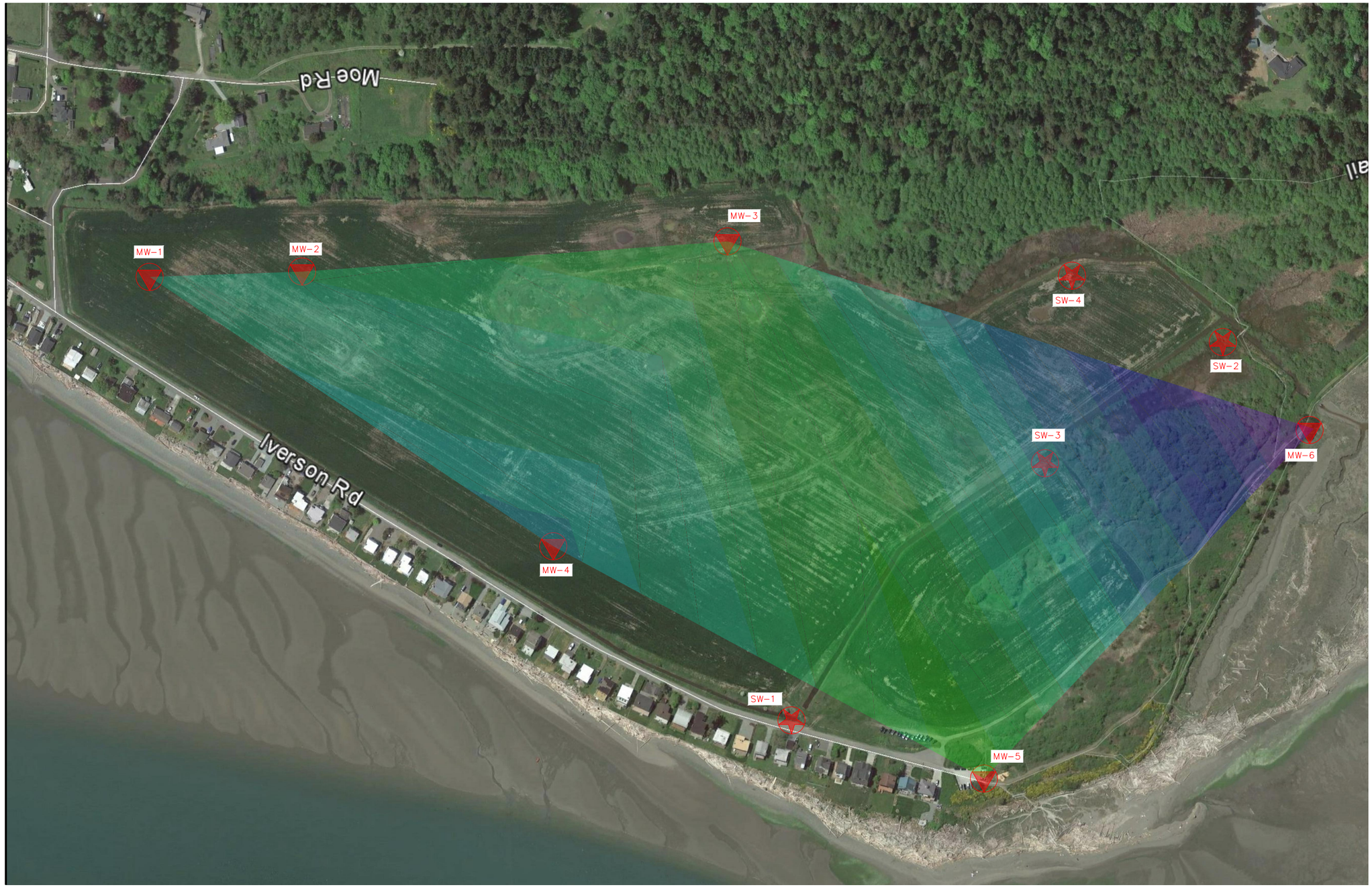
FEBRUARY 2017 LOW GROUNDWATER ELEVATION

JOB NUMBER 16145

SHEET 12 OF 21 SHEETS



Elevations Table			
NUMBER	MIN ELEV	MAX ELEV	COLOR
1	5.25	5.50	
2	5.50	5.75	
3	5.75	6.00	
4	6.00	6.25	
5	6.25	6.50	
6	6.50	6.75	
7	6.75	7.00	
8	7.00	7.25	
9	7.25	7.50	
10	7.50	7.75	
11	7.75	8.00	
12	8.00	8.25	
13	8.25	8.50	
14	8.50	8.75	
15	8.75	9.00	
16	9.00	9.25	

NUMBER COLUMN INDICATES 0.25' INCREMENT OF ELEVATION.

Plotted By: Sam Rowswell on 12/28/17 2:19 PM
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FEBRUARY 2017 HIGH GROUNDWATER ELEVATION

JOB NUMBER 16145

SHEET 13 OF 21 SHEETS

Elevations Table			
NUMBER	MIN ELEV	MAX ELEV	COLOR
1	4.25	4.50	
2	4.50	4.75	
3	4.75	5.00	
4	5.00	5.25	
5	5.25	5.50	
6	5.50	5.75	
7	5.75	6.00	
8	6.00	6.25	

NUMBER COLUMN INDICATES 0.25' INCREMENT OF ELEVATION.

Plotted By: Sam Rowswell on 12/28/17 2:20 PM
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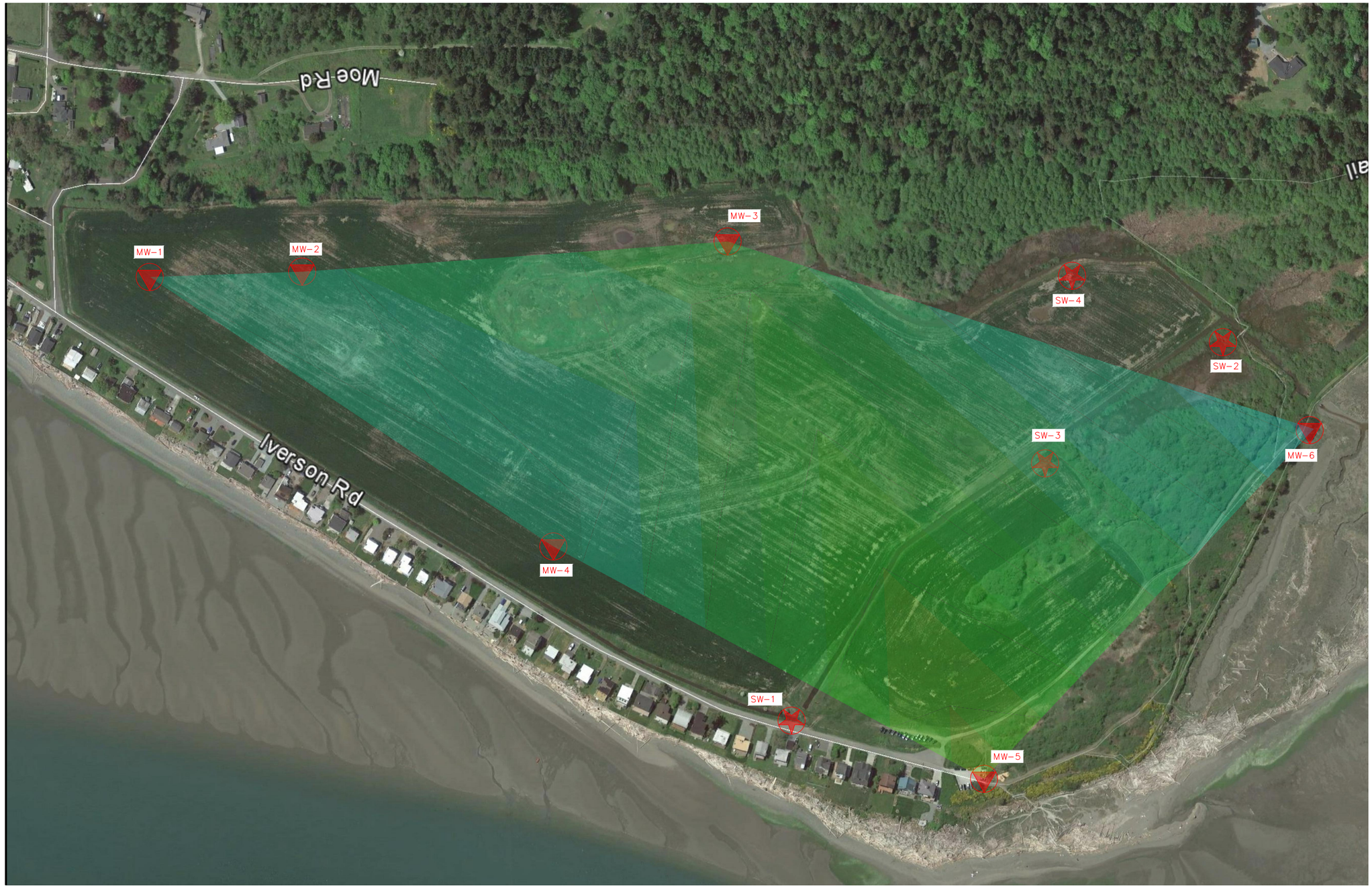
IVERSON PRESERVE AND LIVINGSTON BAY

MARCH 2017 LOW GROUNDWATER ELEVATION

JOB NUMBER 16145

SHEET 14 OF 21 SHEETS



N

Elevations Table			
NUMBER	MIN ELEV	MAX ELEV	COLOR
1	4.75	5.00	
2	5.00	5.25	
3	5.25	5.50	
4	5.50	5.75	
5	5.75	6.00	
6	6.00	6.25	
7	6.25	6.50	
8	6.50	6.75	
9	6.75	7.00	
10	7.00	7.25	

NUMBER COLUMN INDICATES 0.25' INCREMENT OF ELEVATION.

Plotted By: Sam Rowswell on 12/28/17 2:20 PM
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MARCH 2017 HIGH GROUNDWATER ELEVATION

JOB NUMBER 16145

SHEET 15 OF 21 SHEETS

Elevations Table			
NUMBER	MIN ELEV	MAX ELEV	COLOR
1	3.50	3.75	
2	3.75	4.00	
3	4.00	4.25	
4	4.25	4.50	
5	4.50	4.75	
6	4.75	5.00	
7	5.00	5.25	
8	5.25	5.50	
9	5.50	5.75	

NUMBER COLUMN INDICATES 0.25' INCREMENT OF ELEVATION.

Plotted By: Sam Rowswell on 12/28/17 2:21 PM
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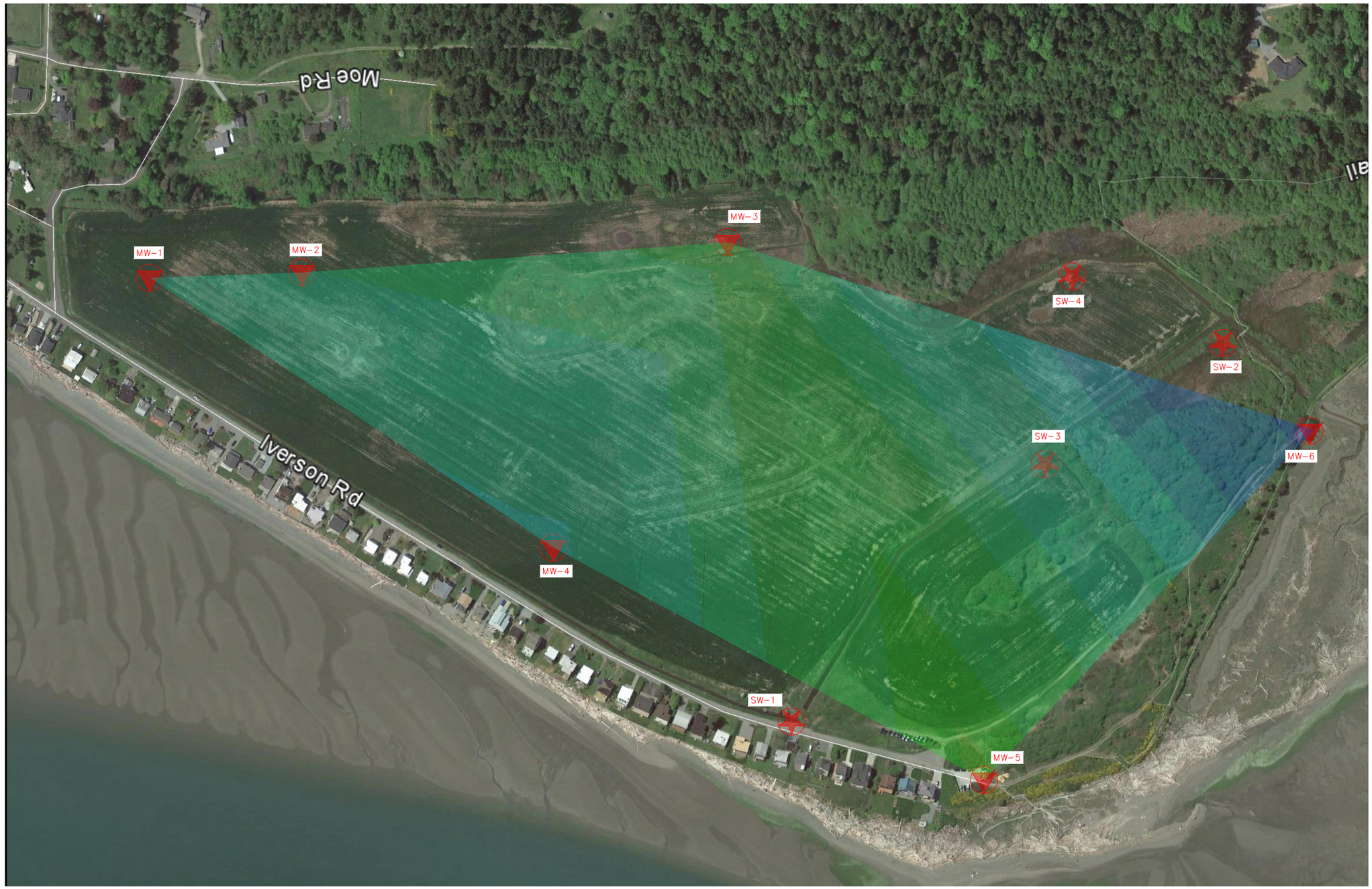
APRIL 2017 LOW GROUNDWATER ELEVATION

JOB NUMBER 16145

SHEET 16 OF 21 SHEETS



Elevations Table			
NUMBER	MIN ELEV	MAX ELEV	COLOR
1	5.00	5.25	
2	5.25	5.50	
3	5.50	5.75	
4	5.75	6.00	
5	6.00	6.25	
6	6.25	6.50	
7	6.50	6.75	
8	6.75	7.00	
9	7.00	7.25	
10	7.25	7.50	
11	7.50	7.75	
12	7.75	8.00	

NUMBER COLUMN INDICATES 0.25' INCREMENT OF ELEVATION.

Plotted By: Sam Rowswell on 12/28/17 2:21 PM
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APRIL 2017 HIGH GROUNDWATER ELEVATION

JOB NUMBER 16145

SHEET 17 OF 21 SHEETS

N

Elevations Table			
NUMBER	MIN ELEV	MAX ELEV	COLOR
1	3.25	3.50	
2	3.50	3.75	
3	3.75	4.00	
4	4.00	4.25	
5	4.25	4.50	
6	4.50	4.75	
7	4.75	5.00	
8	5.00	5.25	
9	5.25	5.50	
10	5.50	5.75	
11	5.75	6.00	

NUMBER COLUMN INDICATES 0.25' INCREMENT OF ELEVATION.

Plotted By: Sam Rowswell on 12/28/17 2:21 PM
Saved By: Srowswell on 12/28/17 1:54 PM
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IVERSON PRESERVE AND LIVINGSTON BAY

MAY 2017 LOW GROUNDWATER ELEVATION

JOB NUMBER 16145

SHEET 18 OF 21 SHEETS

Elevations Table			
NUMBER	MIN ELEV	MAX ELEV	COLOR
1	4.25	4.50	
2	4.50	4.75	
3	4.75	5.00	
4	5.00	5.25	
5	5.25	5.50	
6	5.50	5.75	
7	5.75	6.00	
8	6.00	6.25	
9	6.25	6.50	
10	6.50	6.75	
11	6.75	7.00	

NUMBER COLUMN INDICATES 0.25' INCREMENT OF ELEVATION.

Plotted By: Sam Rowswell on 12/28/17 2:22 PM
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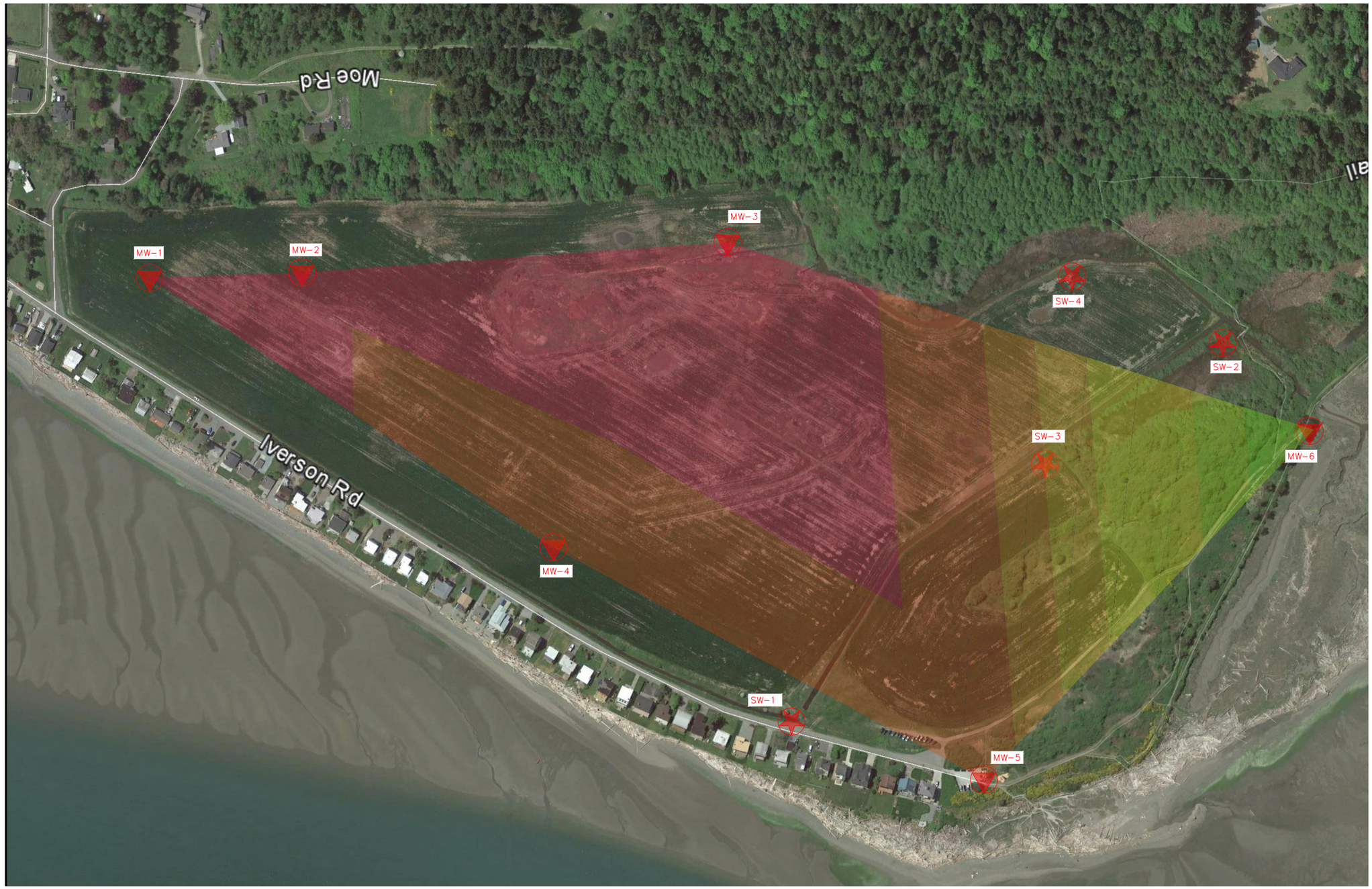
MAY 2017 HIGH GROUNDWATER ELEVATION

JOB NUMBER 16145

SHEET 19 OF 21 SHEETS



N

Elevations Table			
NUMBER	MIN ELEV	MAX ELEV	COLOR
1	2.00	2.25	
2	2.25	2.50	
3	2.50	2.75	
4	2.75	3.00	
5	3.00	3.25	
6	3.25	3.50	
7	3.50	3.75	
8	3.75	4.00	
9	4.00	4.25	
10	4.25	4.50	
11	4.50	4.75	
12	4.75	5.00	

NUMBER COLUMN INDICATES 0.25' INCREMENT OF ELEVATION.

Plotted By: Sam Rowswell on 12/28/17 2:22 PM
Saved By: Srowswell on 12/28/17 1:55 PM
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IVERSON PRESERVE AND LIVINGSTON BAY

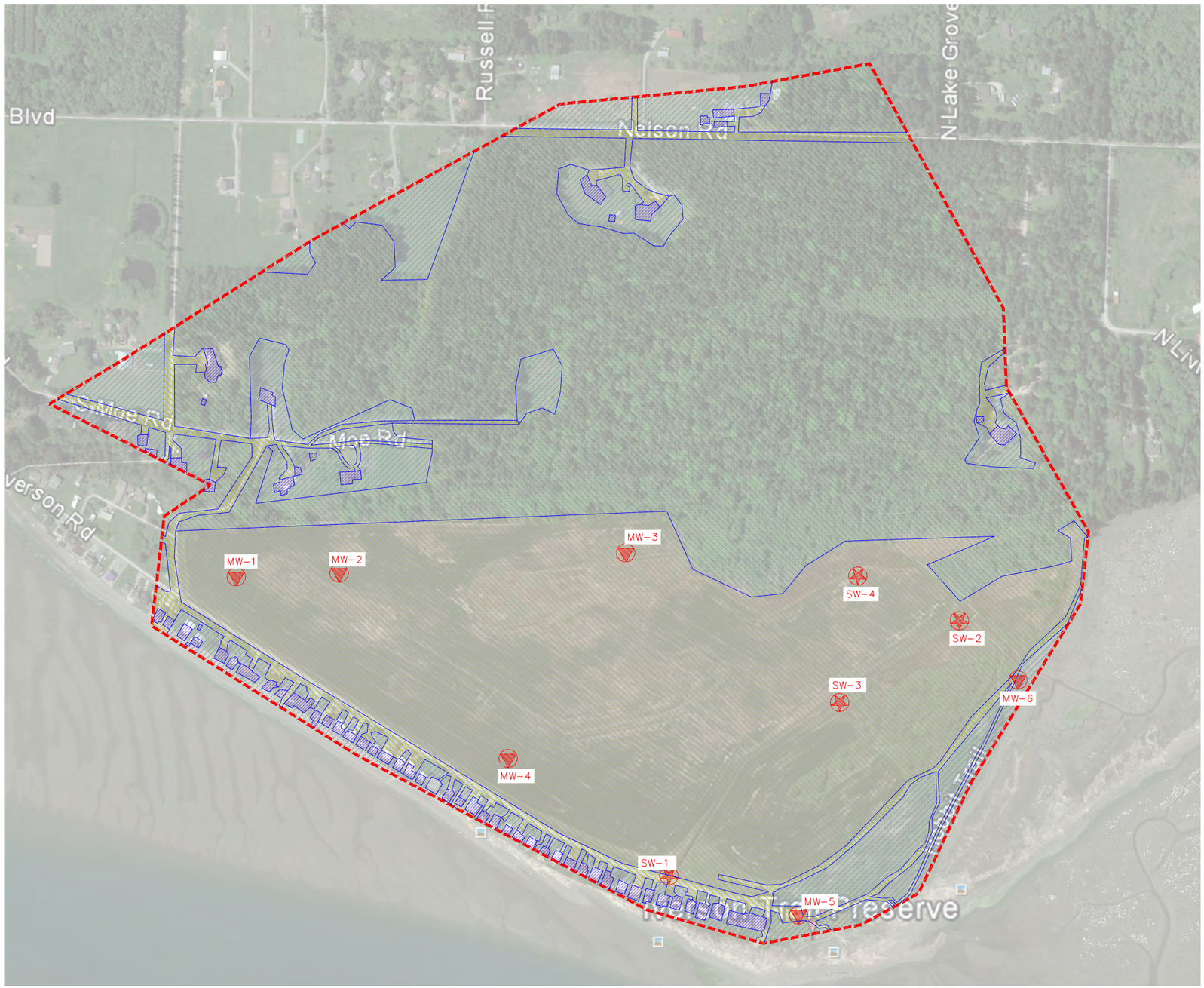
JUNE 2017 LOW GROUNDWATER ELEVATION

JOB NUMBER 16145

SHEET 20 OF 21 SHEETS

Appendix H

Contributing Basin Map



TYPE	AREA (AC)	LEGEND
CONTRIBUTING BASIN	256	
FOREST	119	
LAWN	30	
ROOF	4	
HARD IMPERVIOUS	12	
AGRICULTURE	90	

Plotted By: Sam Rowswell on 12/15/17 11:28 AM
Saved By: Srowswell on 11/29/17 12:07 PM
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IVERSON PRESERVE AND LIVINGSTON BAY

CONTRIBUTING BASIN

JOB NUMBER 16145

SHEET 1 OF 20 SHEETS