

# Mid-Spencer Island Estuary Restoration

## 60% Design Report

February 2015



Submitted to:



Snohomish County Public Works  
3000 Rockefeller Ave, M/S 607  
Everett, WA 98201-4046

Prepared by:



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# Acknowledgements

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Department of Public Works  
3000 Rockefeller Avenue, M/S 607  
Everett, Washington 98201

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## Section I—Introduction

The Mid-Spencer Island restoration project is designed to enhance access and quality of tidal marsh habitat for juvenile salmonids on 74 acres in the Snohomish River estuary (Figure 1) through the strategic removal of relic dike sections and other habitat modifications, with the following objectives:

- Increase size, quantity, frequency and diversity of breaches;
- Increase biological, hydrologic and geomorphic connectivity between sloughs, intact tidal marsh areas and tidal marsh restoration sites;
- Restore natural processes, including: tidal channel formation, large wood recruitment, sediment delivery, and native revegetation;
- Increase tidal channel density within the project site;
- Enhance quality of habitat for juvenile salmonids; and
- Improve/provide fish access in and out of the tidal marsh.

The design approach includes both immediate habitat improvements as well as the establishment of site conditions that will encourage natural physical processes to improve floodplain connection and restore tidal influence. Combined, these improve access to preferred off-channel habitat for threatened and endangered species of salmonids. It would also improve the overall quality of habitat by returning the site back to the historical tidal wetland conditions. Project elements include strategic breaching of the perimeter dike, lowering sections of the existing dike to an elevation below the mean higher high water (MHHW), creating pilot channels to connect to existing and remnant channel networks and the placement of large wood.

The purpose of this report is to provide an overview of the project's progress and to document the project at the 60-percent design level.



## Section 2—Site and Project Description

Dike construction, filling of historic wetlands and other forms of development over the last century have reduced some Snohomish River estuary wetland habitats by over 80 percent from historical levels (SBSRF 2005 ), preventing juvenile salmon from accessing productive tidal marsh habitat they would encounter on their way to the ocean. The greatest losses of marsh area on the Snohomish River delta have occurred in the forested riverine/tidal zone where timber harvest and diking eliminated tidal channel networks and distributary sloughs.

The proposed 74-acre project site is currently owned and managed by Snohomish County for conservation purposes. The area was historically diked and farmed, but subsequently abandoned in the late-1960s. The dikes along Union and Steamboat Sloughs have since naturally breached in several locations. The breaches and tidal channel connections to the marsh, however, are generally limited in width and are much less frequent on Mid-Spencer Island, than the tidal channel connections found at intact reference sites (e.g. Otter Island located on the East Side of Steamboat Slough). While these breaches allow limited tidal and riverine inundation, their small size prevents full restoration of natural processes and tidal connectivity to the marsh habitat. Increasing the number and size of tidal breaches will contribute to further tidal channel restoration and expansion into the marsh. Currently, the tidal channel density in the marsh is diminished due to historic diking and farming, and the small breach connections to adjacent distributary sloughs limit fish access and increase predation and competition.

Juvenile salmon are dependent on the estuary during this critical life history stage, and the Snohomish River supports seven species of anadromous salmonids, including Chinook, coho, chum and pink salmon; and steelhead, cutthroat and bull trout. The residence time, timing and use of wetland and estuarine habitats varies by life history type. Chinook salmon can be found year-round in estuarine environments as they transition from fluvial-based food webs to estuarine food webs. Estuarine marsh habitat is important during the juvenile life stage for many reasons, but most importantly because it provides abundant sources of insect and amphipod prey, highly favored and energy-dense salmon food, as well as shallow water refugia. The increased growth rates, larger sizes as smolts, and increased life history diversity has been shown to be key and highly correlative to increased numbers of returning adult salmon (Bottom et al. 2008, Beamer 2004). Restoration that reconnects hydrological links has been shown to improve these elements of habitat carrying capacity and opportunity, and has become a focus for restoration efforts in the Pacific Northwest, including the Snohomish River estuary.

Improving hydraulic connections increases the opportunity for fish access to shallow water habitats that provide increased carrying capacity, and increasing the habitat carrying capacity increases the opportunity for juveniles to be supported for each life history. Restoration of marsh food webs, the opportunity to use them, and their connectivity provide the

opportunity for expression of diverse life history strategies. Restoration of wetland habitats also has indirect benefits to a wide variety juvenile salmon through export of organic materials, nutrients, and prey resources from shallow water to main-stem areas.

Our design focuses on the restoration of processes that create and maintain habitat and habitat connections necessary for life history variation. The restoration measures facilitate tidal inundation, improve water quality, and diversify aquatic, wetland and riparian habitat formation. These improvements aim to increase ecological function provided to salmonids, including improved rearing, migration and predator avoidance habitat.

## Section 3—Previous and Recent Studies

### Soil Characterization for On-Site Reuse Report (S&W, 2014)

Shannon and Wilson presented a summary of the geotechnical review and environmental soil sampling and analysis conducted for the Mid-Spencer Island Estuary Restoration project. The purpose of the study was to evaluate whether the materials excavated during construction are suitable for reuse on site and, if not, to evaluate suitable options for off-site disposal. Based on the results of the environmental soil sampling and analysis, over one-third of the samples collected from locations identified for the dike breaches contain arsenic at concentrations exceeding the Model Toxics Control Act (MTCA) Method A cleanup level of 20 mg/kg. None of the samples, however, were found to contain arsenic above the Washington State Marine Sediment Quality Standard (SQS) value of 57 mg/kg. The 95 percent upper tolerance level (UTL) with 95 percent coverage was found to be 20.64 mg/kg. Ecology has published guidance (Ecology, 2007) for owners of large properties affected by areawide smelter contamination that provides for reuse of arsenic- and lead-contaminated soil at the site. Materials hauled off site and used in other projects could exceed the MTCA Method A standard and would be subject to more strict regulations for treatment and disposal of contaminated soils. Therefore, it was recommended that the onsite material should not be used as structural dike fill for other dike projects in the Snohomish Estuary due to the stricter regulations for materials being hauled off site.

The Ecology guidance for reuse of contaminated material (Ecology, 2007) could be applicable for placing this contaminated material along higher ground in and around the dikes. However, contaminated material reuse in areas below the MHHW would be subject to the Ecology Marine SQS. Reuse and grading of excavated materials on the island is considered an acceptable method and will meet the Marine SQS. The grading of materials would need to be built as a series of containment cells in an effort to reduce erosion and turbidity exceedances in Union and Steamboat Slough, resulting from grading of fill material in the intertidal zone.

## Section 4—Project Design

### Temporary Erosion and Sediment Control (TESC) Measures

Temporary Erosion and Sediment Controls will be implemented as a part of the project Stormwater Pollution Prevention Plan (SWPPP) to be covered by a National Permit Discharge Elimination System (NPDES) Section 402, General Construction Stormwater permit. The NPDES 402 permit can be obtained by either Snohomish County or the Contractor. If the County applies for the permit in advance, they would need to transfer the permit to the Contractor after award of the contract, for the Contractor to implement.

Site clearing is limited to only the areas required for excavation of dike breaches and channels, which is approximately six acres out of the approximately 74-acre project boundary. Disturbed areas, above the mean tide and mud line, will be seeded for erosion control and stabilized with staked coir fabric to reduce erosion of the bare soil by tidal flows.

During in-water work, a floating silt curtain or turbidity curtain is proposed to be installed at each breach during excavation to control sediment discharged to Steamboat Slough and Union Slough. The floating silt curtain will be attached to buoys and anchored to remain in place with flood and ebb tides. The floating silt curtain is proposed to allow the contractor the most flexibility in scheduling work while meeting water quality permit requirements.

### Environmental Protection Measures

#### Fish Exclusion and Removal

During excavation of the starter channels, one or more fish block nets will be installed at their connection to Union Slough and Steamboat to exclude fish and remove fish from the excavation work area. During dike grading at elevations close to the mean higher high water (MHHW), the work will be performed out of the water during low tides to the extent possible. The starter channels will need to be excavated to connect with Union Slough and Steamboat Slough at elevations near the mean lower low water. The contractor (or the County) will advance fish exclusion nets from the shoreline into the slough to remove fish and provide the isolated work area. The fish exclusion netting will be set by the contractor on the outside of the silt curtain to isolate fish from the construction area prior to in-water work.

## Section 4— Project Design

Continued

### Temporary Site Access and Staging Area

The construction equipment will be mobilized to the site by barge and tug boat, as there are no available land access routes to the site. Staging of construction equipment and materials may be done from a work deck barge that is anchored and uses vertical steel shafts (spuds) for stability, because the project site will be inundated during high tides and therefore may not allow equipment to be staged on site. As an alternative, equipment may be staged on the island using constructed mounds and protected stockpiles, with erosion and turbidity control, by the Contractor. Work crews will require access to the site by boat each working day.

### Restoration Area

#### Existing Dike Breach

The design elements include lowering the existing dikes along Union Slough (approximately 400 lineal feet) and Steamboat Slough (approximately 900 lineal feet) to elevation 9 ft (NAVD88), to create a wide, low berm slightly higher than the existing ground surface. These lowered dikes will allow tides and streamflow at and above the mean higher high water to discharge overbank onto Mid-Spencer Island.

The dike breaches are designed for three separate locations in order to promote tidal excursion and fish access between surrounding channels (Union and Steamboat Slough) and the interior of Mid-Spencer Island. The existing dike is to be graded to a top elevation of 9 ft (NAVD88) and have the material spread inward to match existing grade (approximately 7 ft elevation) of the interior areas of the site. The locations of three main dike breach areas are shown in Figure 2.

The material from the existing dikes will be spread landward of the dikes, seeded with an erosion control seed mix, and then stabilized with a staked coir fabric. Areas have been identified for spreading the dike material close to the excavation to allow for easier access. The existing dikes may be excavated and the material spread landward by use of a barge-mounted excavator. Amphibious excavators are likely to be used for work further inland.

## Section 4— Project Design

Continued

### Starter Channels

Pilot or “starter” channels will be excavated with invert elevations as low as Mean Lower Low Water (MLLW) to connect the existing tidal channels within the island to the sloughs and allow fish to access interior habitat during lower tidal levels. The pilot channels are located at existing and remnant tidal channel locations, and were developed in coordination with participants at a design charette held at Snohomish County Public Works during July of 2014.

On the western side of the island, adjacent to Union Slough, the existing breach will be expanded to the north and six pilot channels will be created to connect existing channels on the island to Union Slough. On the eastern side of the island, nine pilot channels will be created connecting existing channels on the island to Steamboat Slough.

Due to anticipated tidal flows and wet soil conditions from existing breaches at the site, it is likely that pilot channels and breaches will need to be excavated using either a dredging barge, or an amphibious excavator. Amphibious excavators that use wide tracked pontoons would be best-suited to excavate channel locations inland from the shoreline due to tidal flows that inundate the site periodically and soft estuary soil conditions. Otherwise, mats would need to be placed within the site for access by other types of excavators and the mats would be removed at the end of construction.

The dimensions of the breaches for the pilot channels were designed based on empirical allometric and hydraulic geometry relationships that correlate channel characteristics with tidal prism and restored marsh size (Puget Sound Nearshore Ecosystem Restoration Project, 2011) using the relationship:

$$Y=a x^b$$

Where x is the drainage area and Y is the dependent variable (in this case top width) and a and b are empirically derived coefficients. The empirically derived coefficients of 0.8 for a, and 0.66 for b were used. PSNERP derived these relationships based on investigations by Hood (2002, 2007a), Williams (2002) and PWA (1995) and adjusted for the local Everett tide range. Channel dimensions were calculated using the tidal prism of the flooded site upon breaching. The design team has established a low elevation for the starter channels as MLLW (-2.0 ft).

The typical starter channel cross section dimensions were developed by classifying the presumed tidal prism volume for each channel and creating four categories. A total of about

## Section 4— Project Design

Continued

3000 feet of channel, between 10 and 40 feet wide and about 2 to 10 feet below existing grade, will be excavated.

### Large Wood Structures

At low intertidal elevations, large wood debris (LWD) is typically rare and unstable (easily moved by tides and storms) (Hood 2007b) and hence, wood structures will be anchored to stabilize the structure. At intermediate elevations of about 7.6 ft (NAVD88), LWD is relatively common and this will be a focus for the small clusters of wood to create pools and capture additional wood. At higher elevations of about 8.4 ft (just below MHHW), shrub and tree species will become more common with support from LWD and individual key pieces will be placed in these areas.

Some log structures are located to protect the excavated material placement areas, where it is assumed in this low-energy environment that scour will be minimal and localized to the structure, and deposition will be encouraged land-ward of the wood complex. Wood complexes were also strategically placed to reduce wind and wave action. Wind waves and their effect on sedimentation rates were taken into consideration by placing wood complexes to create shelter effects and reduce the amount of sediment vacating the site on the ebb tide, since sedimentation rates affect habitat evolution.

Guidelines from Fox and Bolton (2007) were consulted when considering log quantities for habitat (the 25th percentile of the number of LWD pieces inventoried in undisturbed channels with bankfull width >20-100 ft); however the recommended target would be higher than is typical for an estuarine environment. Project constraints on site access for construction equipment for log anchoring were a factor in the number and location of large wood structures in the design. The location of the wood structures were selected to capture buoyant wood on the marsh, to develop pools in the starter channel beds at the entrances from the sloughs to prevent the channel mouths from silting in, and to increase complexity of habitat over time.

The wood structures may require anchoring by timber piles, due to site access constraints, the timber piles may need to be driven from a barge-mounted pile driver. The wood structures were located close to the shoreline of the island to allow for pile installation by barge. Pile driving in aquatic areas may need to be vibratory rather than pile hammer methods.

## Section 5—Permits

### Summary of Permits

The Mid-Spencer Island project will apply for the streamlined process as a fish habitat enhancement project as a part of the Joint Aquatic Resources Permit Application (JARPA). Projects that are approved for fish habitat enhancement designation are exempt from State Environmental Protection Act (SEPA) requirements and from local government permits (Snohomish County Shoreline Permit, and Land Disturbing Activity Permit, except the Flood Hazard permit); however, federal and state permits are still required.

The following is a summary of anticipated project permits:

- Hydraulic Project Approval (HPA) (Washington Department of Fish and Wildlife)
- Clean Water Act (CWA), Section 404 Nationwide Permit, Section 10, River and Harbors Act (U.S. Army Corps of Engineers), and National Historic Preservation, Section 106,.
- Endangered Species Act Section 7 Consultation (National Marine Fisheries Service and US Fish and Wildlife Service).
- Clean Water Act (CWA), Section 401 (Washington State Department of Ecology)
- National Pollution Discharge Elimination System Permit (NPDES) (Ecology).
- Flood Hazard Permit (Snohomish County)

### Permit Work Windows

The project is anticipated to have an allowable construction in-water work window from July 16th to February 15th based on the marine fish window from the Washington Department of Fish & Wildlife (WDFW). The in-water work window will be based on provisions in the HPA issued by WDFW. The lowest tides at the project site are likely to occur during July and the in-water construction work is expected to occur during the earliest allowable time period within this work window to take advantage of lower tide windows and lower water levels on-site.

## Section 6—Opinion of Probable Cost

The engineer's opinion of construction cost for the Mid-Spencer Island project at the 60-percent design phase has been provided to Snohomish County under separate cover, and a summary of bid item quantities without costs has been included in the Appendix of this report. The project bid items include mobilization of equipment to the site by barge, temporary sediment control and fish exclusion measures, temporary site access and staging areas, excavation of existing dike breaches and channels, construction of wood structures, stabilization with coir fabric and seeding. Assumptions in the bid items and cost include that the channels can be excavated and the material spread locally without the need for temporary dewatering, and that plantings in the restoration site will be performed by the County.

The temporary staging of equipment and materials is expected to require a barge and has been factored into the cost, including mobilization by tugboat. The excavation bid items and cost are based on the work being performed by amphibious excavators or barge-mounted equipment. Timber piles within wood structures are based on being driven by a barge-mounted pile driver due to site access constraints.

The project cost estimate includes a 20-percent contingency which accounts for project design elements that could change based on further discussion, including:

- Dredging of channels, without the need for temporary dewatering
- Contaminated soil discovery and handling
- Number of Wood structures and type of anchoring.

## Section 7—Project Schedule

The expected project schedule is as follows:

- 60-Percent Design Plans, February 2015
- JARPA Application, March 2015
- 90-Percent Design Plans, April 2015
- Anticipated Permit Award, June 2015
- Final Design Plans, June 2015
- Advertise for Construction, January 2016
- Construction Start, July 2016
- Construction Complete, September 2016

Construction is anticipated to begin in July 2016, coinciding with the marine fish window and the time of the year when lowest tides occur at the project site for performing in-water work. Excavation and spreading of the dike breach areas is expected to require approximately 20 working days, with approximately 45 working days expected for channel excavation and wood structure construction. Including mobilization, and seeding to stabilize the site following excavation and construction, the expected construction time is anticipated to be approximately three months.

## Section 8— Stakeholders and Landowners Coordination

Stakeholders for the Mid-Spencer Island project include the Washington State Department of Natural Resources (DNR), Washington Department of Fish and Wildlife (WDFW), the Tulalip Tribe, the Port of Everett, which is the landowner of the adjacent property to the north, and Buse Timber, who owns the marine piles and barge parking area within Steamboat Slough on the east side of the island. All of the project construction activities occur within Snohomish County property, and the only known safety hazard are contaminated soils on the site which require appropriate handling and treatment.

The Snohomish County hosted a design charrette in July, 2014 with Snohomish County Surface Water Management staff, Snohomish County Environmental Services staff, a member of the Skagit River System Cooperative, and other design team members present. Strategies were discussed for locating channels along Steamboat and Union Slough to connect to existing channels within the island, as well which locations have the highest likelihood for fish access within the Steamboat and Union Slough system to inform and develop a design to provide the highest benefit for fish habitat. Participants at the design charrette identified the preferred areas for the dike breach areas and starter channels, with the two dike breach areas at the northwest and northeast areas of the site providing drainage of the site during ebb tides. The east side of Mid-Spencer Island adjacent to Steamboat Slough was expected to have the higher potential for fish access, and channel locations were identified to connect Steamboat Slough to the interior tidal channel habitat as well as to Union Slough on the west side of the island.

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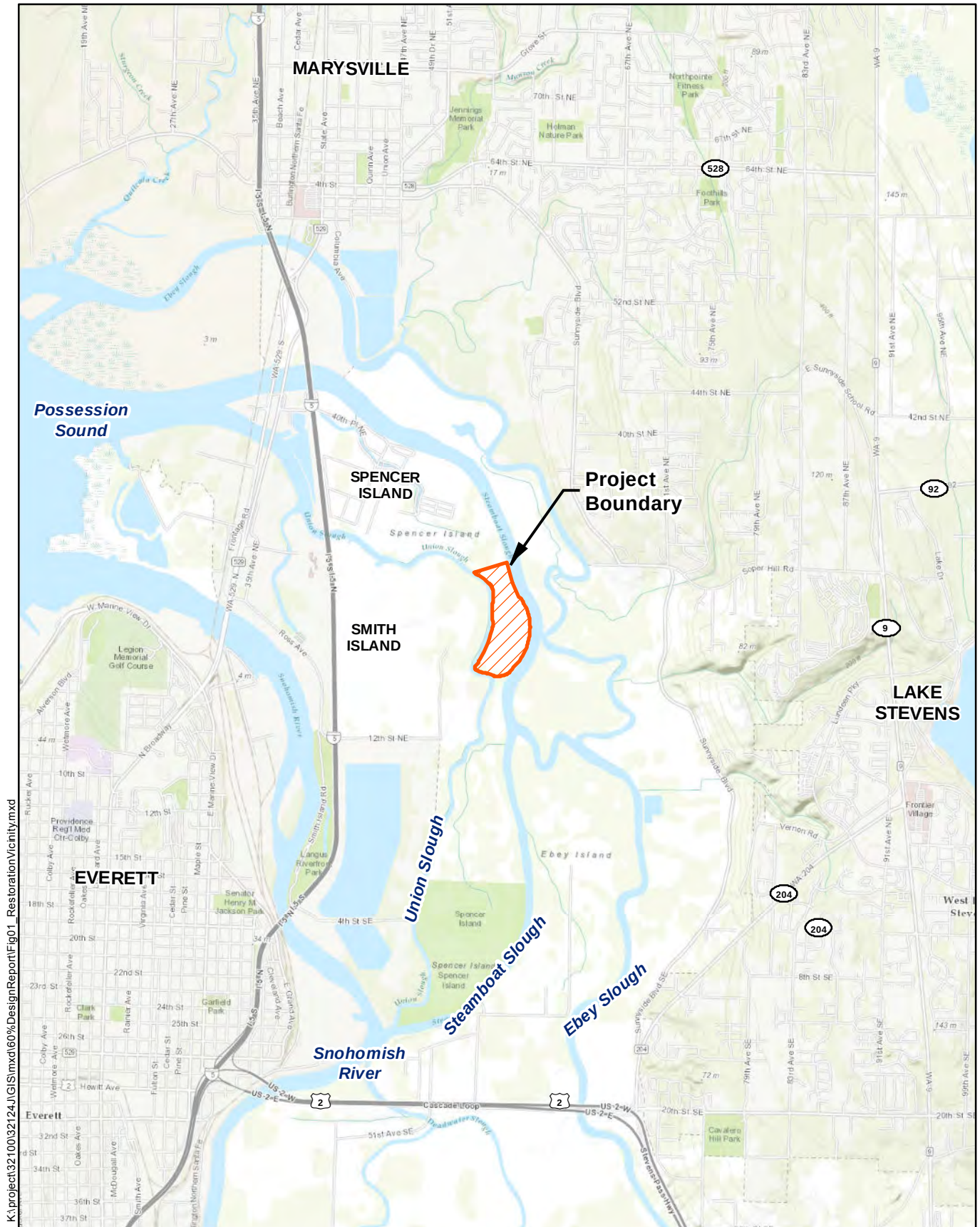
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**Figure 1:  
Location Map**

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NOAA-RAE NA10NMF4630090

**Legend**  
 Project Boundary

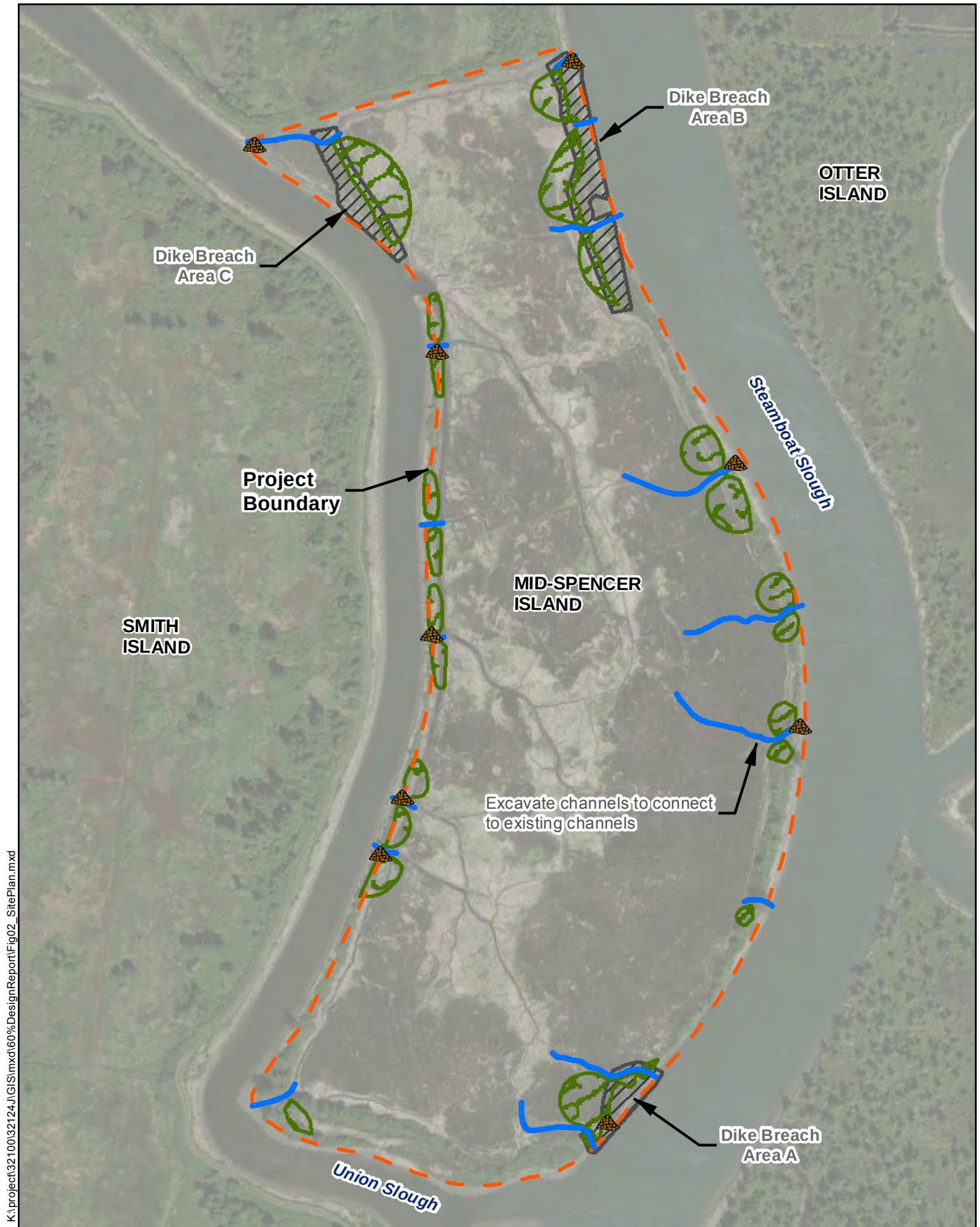
**Snohomish County**  
**otak**  
 Natural Resource Partner

0 2,000 4,000  
 Feet

Note: Topo basemap provided by ArcGIS Online

Date: 2/20/2015  
 341

November 1, 2014 - April 30, 2015



**Figure 2:  
Site Plan**

Mid-Spencer Island Estuary Restoration  
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NOAA-RAE NA10NMF4630090

- Legend**
- Wood Structure
  - Starter Channel
  - Project Boundary
  - Spread Area
  - Dike Breach

November 1, 2014 - April 30, 2015



0 200 400  
Feet

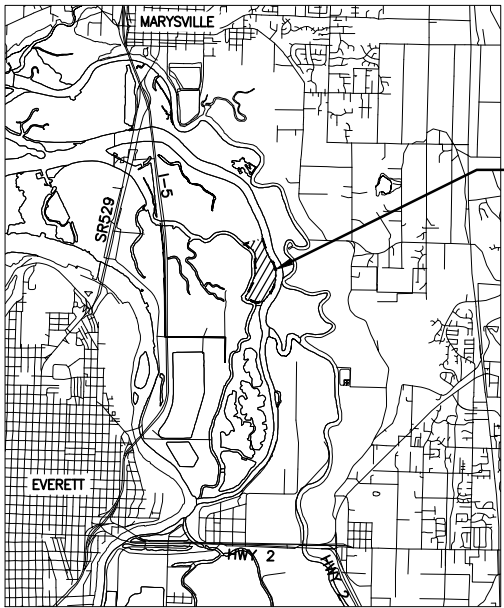
Note: Aerial basemap provided by ArcGIS Online Date: 2/25/2015

**MID-SPENCER ESTUARY RESTORATION  
DRAFT BID SCHEDULE - 60-PERCENT DESIGN**

| REGION<br>10                                 |               |      | STATE<br>WA                            |              |                      |                              |           |
|----------------------------------------------|---------------|------|----------------------------------------|--------------|----------------------|------------------------------|-----------|
| ITEM NO.                                     | PLAN QUANTITY | UNIT | DESCRIPTION                            | STD ITEM NO. | GROUP 1 SNOH. COUNTY | UNIT COST                    | ITEM COST |
| <b>PREPARATION</b>                           |               |      |                                        |              |                      |                              |           |
| 1                                            | 1             | L.S. | MOBILIZATION                           | 0001         | 1                    |                              |           |
| 2                                            | 6             | ACRE | CLEARING AND GRUBBING                  | 0025         | 6                    |                              |           |
| <b>GRADING</b>                               |               |      |                                        |              |                      |                              |           |
| 3                                            | 1,400         | L.F. | DIKE BREACH AND GRADING                | -            | 1,400                |                              |           |
| 4                                            | 20,000        | EST  | SELECT GRADING                         | -            | 20,000               |                              |           |
| <b>DRAINAGE</b>                              |               |      |                                        |              |                      |                              |           |
| 5                                            | 430           | L.F. | CHANNEL EXCAVATION INCL. HAUL, TYPE 1  | -            | 430                  |                              |           |
| 6                                            | 100           | L.F. | CHANNEL EXCAVATION INCL. HAUL, TYPE 2  | -            | 100                  |                              |           |
| 7                                            | 250           | L.F. | CHANNEL EXCAVATION INCL. HAUL, TYPE 3  | -            | 250                  |                              |           |
| 8                                            | 270           | L.F. | CHANNEL EXCAVATION INCL. HAUL, TYPE 4  | -            | 270                  |                              |           |
| 9                                            | 520           | L.F. | CHANNEL EXCAVATION INCL. HAUL, TYPE 5  | -            | 520                  |                              |           |
| 10                                           | 1,470         | L.F. | CHANNEL EXCAVATION INCL. HAUL, TYPE 6  | -            | 1,470                |                              |           |
| <b>EROSION CONTROL AND ROADSIDE PLANTING</b> |               |      |                                        |              |                      |                              |           |
| 11                                           | 90            | DAY  | ESC LEAD                               | 6403         | 90                   |                              |           |
| 12                                           | 29,800        | S.Y. | BIODEGRADABLE EROSION CONTROL BLANKET  | 6455         | 29,800               |                              |           |
| 13                                           | 50,000        | EST  | EROSION/WATER POLLUTION CONTROL        | 6490         | 50,000               |                              |           |
| 14                                           | 6             | ACRE | TEMPORARY SEEDING                      | 6491         | 6                    |                              |           |
| 15                                           | 900           | L.F. | HIGH VISIBILITY FENCE                  | 6635         | 900                  |                              |           |
| 16                                           | 1,600         | L.F. | FLOATING SILT CURTAIN                  | -            | 1,600                |                              |           |
| 17                                           | 1,600         | L.F. | FISH EXCLUSION NET                     | -            | 1,600                |                              |           |
| <b>OTHER ITEMS</b>                           |               |      |                                        |              |                      |                              |           |
| 18                                           | 1             | L.S. | TYPE B PROGRESS SCHEDULE               | 7003         | 1                    |                              |           |
| 19                                           | 1             | L.S. | SPCC PLAN                              | 7736         | 1                    |                              |           |
| 20                                           | 1             | L.S. | TEMPORARY SITE ACCESS AND STAGING AREA | -            | 1                    |                              |           |
| 21                                           | 2             | EACH | 3-LOG WOOD STRUCTURE                   | -            | 2                    |                              |           |
| 22                                           | 7             | EACH | 1-LOG WOOD STRUCTURE                   | -            | 7                    |                              |           |
|                                              |               |      |                                        |              |                      | <b>SUBTOTAL</b>              |           |
|                                              |               |      |                                        |              |                      | <b>20% CONTINGENCY ADDED</b> |           |
|                                              |               |      |                                        |              |                      | <b>SALES TAX (9.5%)</b>      |           |
|                                              |               |      |                                        |              |                      | <b>CONSTRUCTION COST</b>     |           |

# MID-SPENCER ISLAND ESTUARY RESTORATION

## SNOHOMISH COUNTY DEPARTMENT OF PUBLIC WORKS



PROJECT  
LOCATION

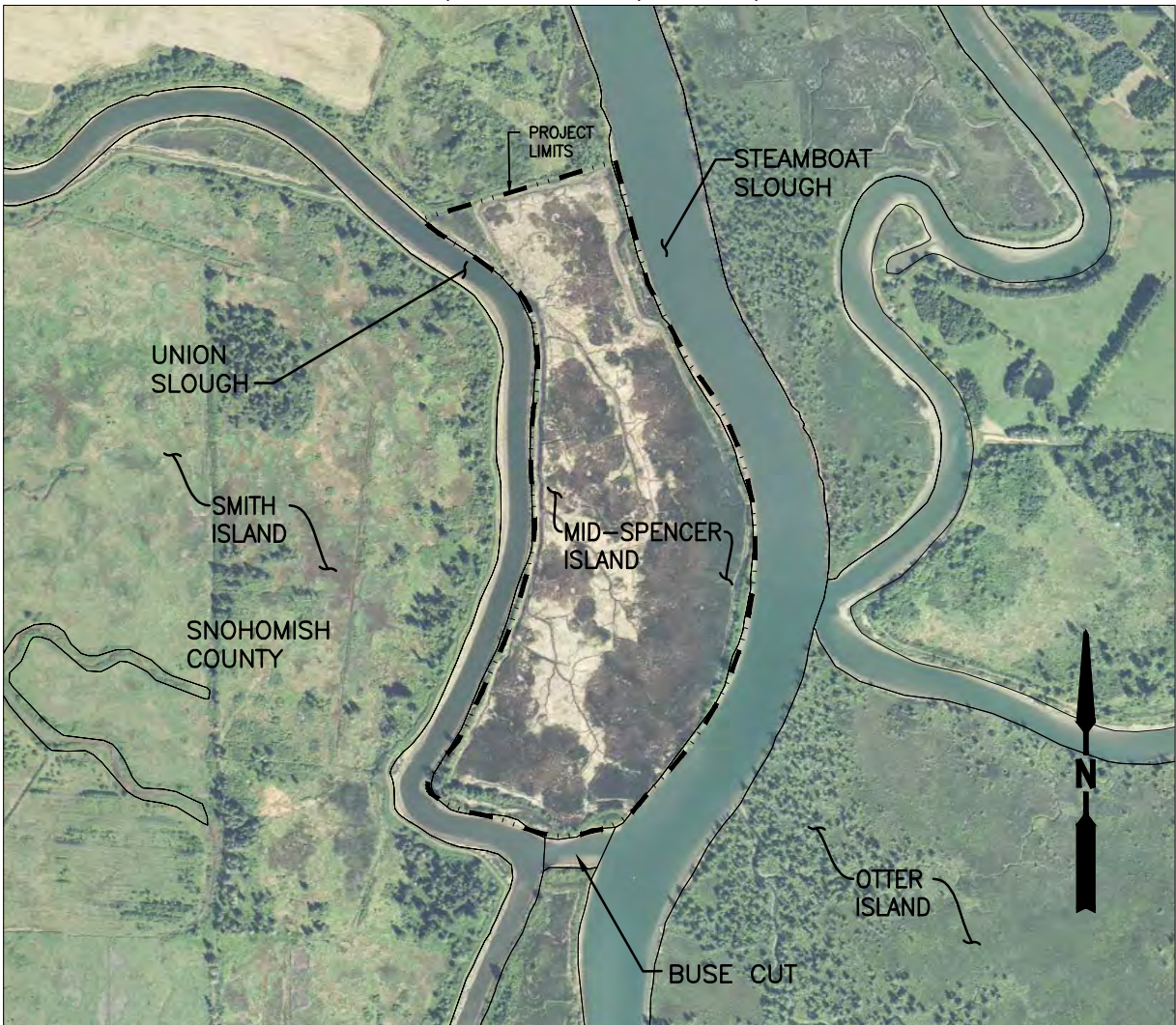
### SHEET INDEX

| SHEET NAME                                  | SHEET # | REF #     |
|---------------------------------------------|---------|-----------|
| COVER, SHEET INDEX AND VICINITY MAP         | 1       | CV01      |
| LEGEND/GENERAL NOTES                        | 2       | LA01      |
| SUMMARY OF QUANTITIES                       | 3       | SQ        |
| PROJECT CONTROL PLAN                        | 4       | CP01      |
| OVERALL SITE PLAN                           | 5       | SP01      |
| TEMPORARY EROSION AND SEDIMENT CONTROL PLAN | 6-8     | EC01-EC03 |
| RESTORATION PLAN                            | 9-10    | RP01-RP02 |
| TYPICAL DIKE BREACH SECTION                 | 11      | GD01      |
| DIKE BREACH PROFILES                        | 12      | GD02      |
| DIKE BREACH SECTIONS                        | 13      | GD03      |
| STARTER CHANNEL PROFILES                    | 14-15   | GD04-GD05 |
| WOOD STRUCTURE DETAIL                       | 16      | WD01      |

FEBRUARY 2015

60% PLAN

SEC. 10; TWN.29N; R.5E,W.M.



### VICINITY MAP

### CONTACT PERSON

**BOB ALDRICH, PROJECT MANAGER**  
SNOHOMISH COUNTY PUBLIC WORKS  
3000 ROCKEFELLER AVENUE  
EVERETT, WA 98201  
425-388-3488



Snohomish County Officials

**DIRECTOR OF PUBLIC WORKS**  
*STEVEN E. THOMSEN, P.E.*

**COUNTY ENGINEER**  
*OWEN B. CARTER, P.E.*

**EXECUTIVE**  
*JOHN LOVICK*

**COUNCIL MEMBERS**  
*KEN KLEIN - DIST. 1*  
*BRIAN SULLIVAN - DIST. 2*  
*STEPHANIE WRIGHT - DIST. 3*  
*TERRY RYAN - DIST. 4*  
*DAVE SOMERS - DIST. 5*

1. ALL WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH THE 2014 EDITION OF THE WASHINGTON STATE DEPARTMENT OF TRANSPORTATION/AMERICAN PUBLIC WORKS ASSOCIATION (WSDOT/APWA) STANDARD SPECIFICATIONS FOR ROAD, BRIDGE AND MUNICIPAL CONSTRUCTION AND CURRENT AMENDMENTS (AS AMENDED BY THE SNOHOMISH COUNTY GENERAL PROVISIONS AND THE PROJECT SPECIAL PROVISIONS) AND THE 2012 SNOHOMISH COUNTY ENGINEERING DESIGN AND DEVELOPMENT STANDARDS (EDDS).
2. ALL DRAINAGE AND GRADING WORK SHALL COMPLY WITH TITLE 30 OF THE SNOHOMISH COUNTY CODE (SCC).
3. ALL AREAS DISTURBED DURING CONSTRUCTION SHALL BE RESTORED TO PRE-CONSTRUCTION CONDITIONS, OR AS SHOWN ON THE PLANS.
4. CONTACT THE UNDERGROUND UTILITIES LOCATION SERVICE (1-800-424-5555) AT LEAST 48 HOURS PRIOR TO CONSTRUCTION.
5. ALL WORK SHALL BE IN ACCORDANCE WITH PERMIT REQUIREMENTS FOR EROSION CONTROL AND DEWATERING. REFER TO SPECIFICATIONS FOR PERMIT REQUIREMENTS.
6. ALL UNSUITABLE OR CLEARED MATERIAL REMOVED FROM THE SITE SHALL BE DISPOSED OF IN AN APPROVED, LEGAL FILL SITE.
7. THE PROJECT AREA RATES HIGH FOR AQUIFER SENSITIVITY TO GROUNDWATER CONTAMINATION.

1. SURVEY AND FLAG LIMITS OF CLEARING AND EXCAVATION PRIOR TO START OF CONSTRUCTION. LOCATE LIMITS BY APPROXIMATE DIMENSIONS AND LOCATIONS SHOWN ON THE SITE PLANS.
2. SURVEY AND STAKE PROPOSED IMPROVEMENTS.
3. INSTALL FISH EXCLUSION SCREENS AND COORDINATE WITH COUNTY STAFF. COUNTY STAFF WILL REMOVE FISH FROM THE ISOLATED WORK AREA.
4. INSTALL TESC MEASURES AT LOCATIONS SHOWN ON THE SITE PLANS.
5. CONSTRUCT IMPROVEMENTS AS SHOWN ON PLANS AND SPECIFICATIONS.
6. REMOVE TESC MEASURES AND FISH SCREENS AFTER DISTURBED AREAS HAVE BEEN STABILIZED.

1. UTILITY PROVIDERS THAT MAY BE AFFECTED BY THE PROPOSED IMPROVEMENTS SHALL BE NOTIFIED IN ADVANCE OF CONSTRUCTION.
2. A LIST OF THE UTILITY PROVIDERS IS PROVIDED BELOW.



November 1, 2011  
HannuGlobal Partner



60% PLAN - NOT FOR CONSTRUCTION

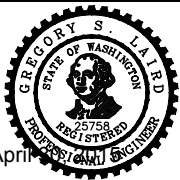
XREF\_LIST  
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Ltscale: 1  
-----  
Resolved  
-----  
SNOCO\_TB  
-----

MID-SPENCER ESTUARY RESTORATION PROJECT  
SUMMARY OF QUANTITIES

| ITEM | PLAN     | UNIT | DESCRIPTION                            | STD ITEM | GROUP 1      |
|------|----------|------|----------------------------------------|----------|--------------|
| NO.  | QUANTITY |      |                                        | NO.      | SNOH. COUNTY |
|      |          |      |                                        |          |              |
|      |          |      | PREPARATION                            |          |              |
| 1    | 1        | L.S. | MOBILIZATION                           | 0001     | 1            |
| 2    | 6        | ACRE | CLEARING AND GRUBBING                  | 0025     | 6            |
|      |          |      |                                        |          |              |
|      |          |      | GRADING                                | —        |              |
| 3    | 1,400    | L.F. | DIKE BREACH AND GRADING                |          | 1,400        |
| 4    | 20,000   | EST  | SELECT GRADING                         |          | 20,000       |
|      |          |      |                                        |          |              |
|      |          |      | DRAINAGE                               | 0408     |              |
| 5    | 430      | L.F. | CHANNEL EXCAVATION INCL. HAUL, TYPE 1  | —        | 430          |
| 6    | 100      | L.F. | CHANNEL EXCAVATION INCL. HAUL, TYPE 2  | —        | 100          |
| 7    | 250      | L.F. | CHANNEL EXCAVATION INCL. HAUL, TYPE 3  | —        | 250          |
| 8    | 270      | L.F. | CHANNEL EXCAVATION INCL. HAUL, TYPE 4  | —        | 270          |
| 9    | 520      | L.F. | CHANNEL EXCAVATION INCL. HAUL, TYPE 5  | —        | 520          |
| 10   | 1,470    | L.F. | CHANNEL EXCAVATION INCL. HAUL, TYPE 6  | —        | 1,470        |
|      |          |      |                                        |          |              |
|      |          |      | EROSION CONTROL AND ROADSIDE PLANTING  |          |              |
| 11   | 90       | DAY  | ESC LEAD                               | 6403     | 90           |
| 12   | 29,800   | S.Y. | BIODEGRADABLE EROSION CONTROL BLANKET  | 6455     | 29,800       |
| 13   | 50,000   | EST  | EROSION/WATER POLLUTION CONTROL        | 6490     | 50,000       |
| 14   | 6        | ACRE | TEMPORARY SEEDING                      | 6491     | 6            |
| 15   | 900      | L.F. | HIGH VISIBILITY FENCE                  | 6635     | 900          |
| 16   | 1,600    | L.F. | FLOATING SILT CURTAIN                  | —        | 1,600        |
| 17   | 1,600    | L.F. | FISH EXCLUSION NET                     | —        | 1,600        |
|      |          |      |                                        |          |              |
|      |          |      | OTHER ITEMS                            |          |              |
| 18   | 1        | L.S. | TYPE B PROGRESS SCHEDULE               | 7003     | 1            |
| 19   | 1        | L.S. | SPCC PLAN                              | 7736     | 1            |
| 20   | 1        | L.S. | TEMPORARY SITE ACCESS AND STAGING AREA | —        | 1            |
| 21   | 2        | EACH | 3-LOG WOOD STRUCTURE                   | —        | 2            |
| 22   | 7        | EACH | 1-LOG WOOD STRUCTURE                   | —        | 7            |

|                         |    |      |      |     |          |    |  |
|-------------------------|----|------|------|-----|----------|----|--|
| PLAN CHECK              | BY | DATE |      |     |          |    |  |
|                         |    |      |      |     |          |    |  |
|                         |    |      |      |     |          |    |  |
|                         |    |      |      |     |          |    |  |
| NOAA-RAE NA10NMF4680090 |    |      |      |     |          |    |  |
|                         |    |      | DATE | NO. | REVISION | BY |  |

|                                              |       |                    |            |
|----------------------------------------------|-------|--------------------|------------|
| Last Saved By: ahmedk Feb 24, 2015 — 11:15am |       |                    |            |
| REGION NO.                                   | STATE | FED. AID PROJ. NO. | SURVEY NO. |
| 10                                           | WASH. |                    |            |
| DESIGNED BY:                                 |       | DRAWN BY:          |            |
| FIELD BOOK(S):                               |       | UPI#               |            |



REVIEWED AND APPROVED  
FOR CONSTRUCTION

OWEN B. CARTER, P.E.  
SNOHOMISH COUNTY ENGINEER

DATE APPROVED: \_\_\_\_\_

SNOHOMISH COUNTY  
DEPARTMENT OF  
PUBLIC WORKS

FUNDING NO. \_\_\_\_\_

MID-SPENCER ISLAND  
ESTUARY RESTORATION

SUMMARY OF QUANTITIES

|                                  |
|----------------------------------|
| REFERENCE<br>SHEET NO.           |
| SQ                               |
| SHEET<br>3<br>OF<br>16<br>SHEETS |

60% PLAN - NOT FOR CONSTRUCTION

A PORTION OF SECTION 10 TOWNSHIP 29 NORTH, RANGE 05 EAST, W.M.

XREF LIST  
Ltscale: 1  
Resolved  
SNOCO\_TB  
32124J-TOPO  
32124J-PRUL

| HORIZONTAL AND VERTICAL CONTROL |           |            |           |                                          |
|---------------------------------|-----------|------------|-----------|------------------------------------------|
|                                 | NORTHING  | EASTING    | ELEVATION | DESCRIPTION                              |
| 4                               | 370393.64 | 1315238.24 | 3.59      | SNOHOMISH COUNTY CP #6<br>STONE 341/1661 |
| 8                               | 375558.66 | 1315149.56 | 8.63      | SNOHOMISH COUNTY CP #10<br>IP 221/1739   |

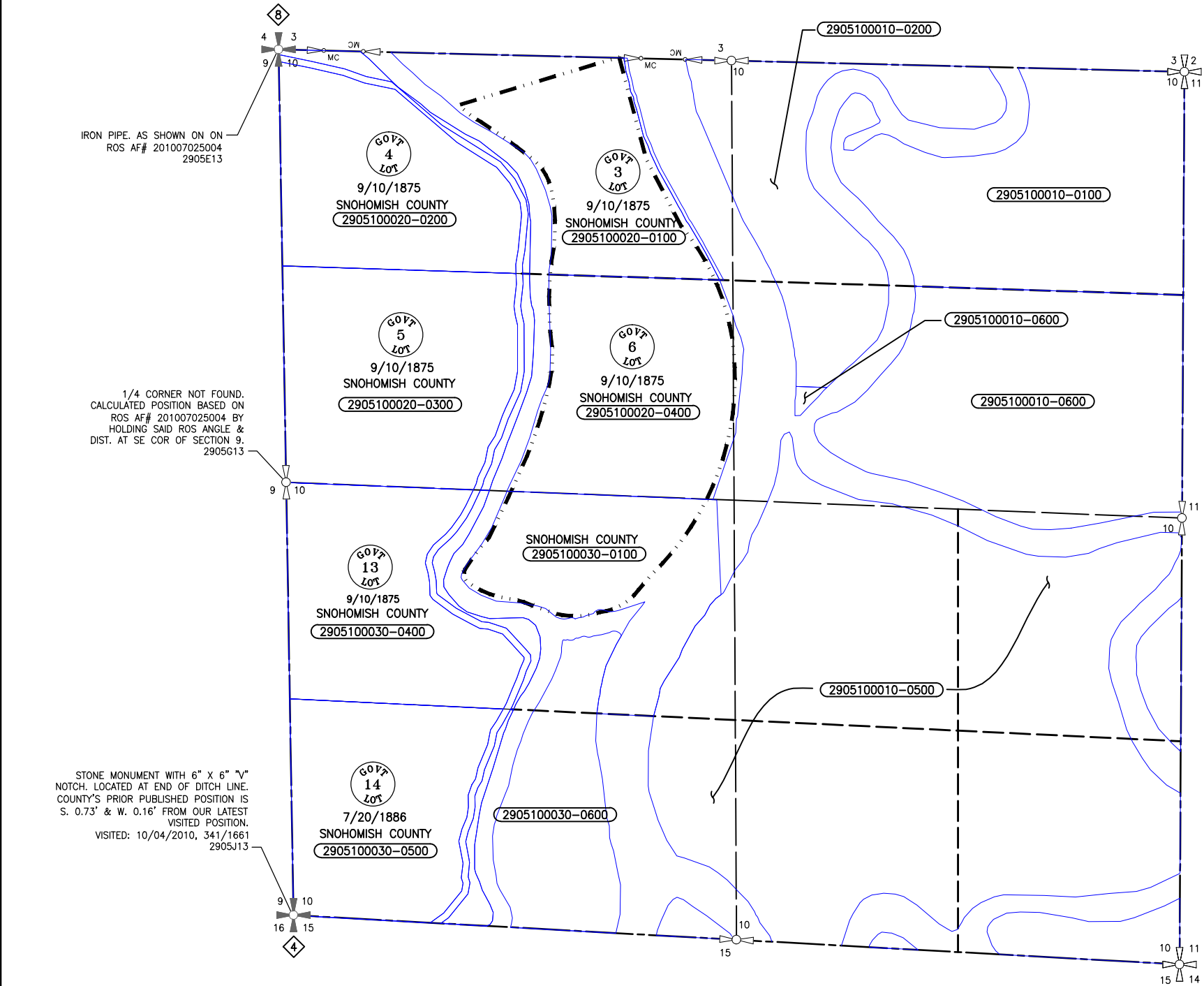
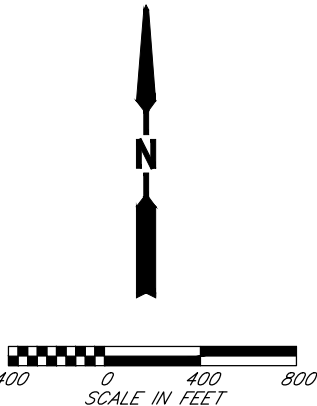
SOURCE OF INFORMATION

- SURVEY POINTS PROVIDED BY COUNTY FOR SMITH ISLAND ESTUARY PROJECT.
- PROPERTY DATA BASED ON COUNTY GIS.
- PLSS DATA PROVIDED BY COUNTY FOR SMITH ISLAND ESTUARY PROJECT.



HORIZONTAL DATUM:  
WASHINGTON STATE COORDINATE  
SYSTEM, NORTH ZONE,  
NAD 83/91 ADJUSTMENT

VERTICAL DATUM: NAVD 88  
DATUM CONVERSION FOR PROJECT:  
NAVD 88 (-) NGVD 29 = 1.109m OR 3.64feet



| PLAN CHECK              | BY | DATE | NO. | REVISION | BY |
|-------------------------|----|------|-----|----------|----|
| NOAA-RAE NA10NMF4680090 |    |      |     |          |    |

|                                             |       |                    |            |
|---------------------------------------------|-------|--------------------|------------|
| Last Saved By: ahmedk Feb 23, 2015 - 5:48pm |       |                    |            |
| REGION NO.                                  | STATE | FED. AID PROJ. NO. | SURVEY NO. |
| 10                                          | WASH. |                    |            |
| DESIGNED BY:                                |       | DRAWN BY:          |            |
| FIELD BOOK(S):                              |       | UPI#               |            |



REVIEWED AND APPROVED  
FOR CONSTRUCTION

OWEN B. CARTER, P.E.  
SNOHOMISH COUNTY ENGINEER

DATE APPROVED:

SNOHOMISH COUNTY  
DEPARTMENT OF  
PUBLIC WORKS

FUNDING NO. \_\_\_\_\_

MID-SPENCER ISLAND  
ESTUARY RESTORATION

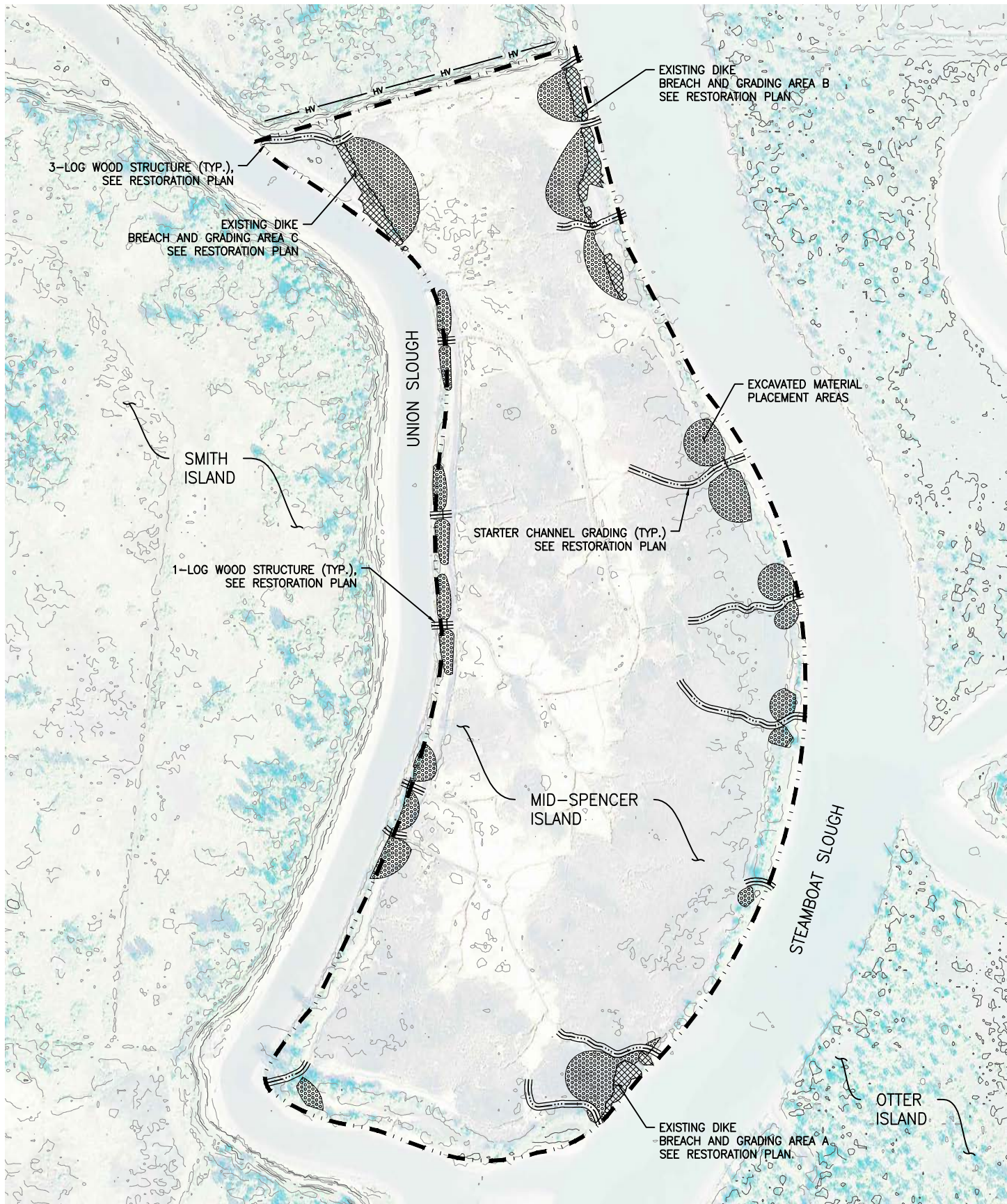
PROJECT CONTROL PLAN

REFERENCE  
SHEET NO.  
CP01

SHEET  
4  
OF  
16  
SHEETS

60% PLAN - NOT FOR CONSTRUCTION

Plotted: Feb 24, 2015 - 11:23 am  
K:\project\32100\32124\Draw\05\_SP01.dwg  
otak  
Layout Name: SP01

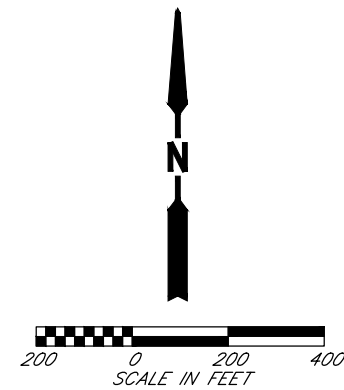


REFERENCE NOTES

1. SEE SHEET CS01 FOR CONSTRUCTION SEQUENCING.
2. SEE SHEET EC01-EC02 FOR TEMPORARY EROSION AND SEDIMENT CONTROL PLAN AND CLEARING LIMITS.
3. SEE SHEETS RP01-RP02 FOR RESTORATION PLAN.
4. SEE SHEETS GD01-GD02 FOR GRADING AND RESTORATION DETAILS.

LEGEND

- PROJECT LIMITS
- DIKE BREACH AREA
- EXCAVATED MATERIAL PLACEMENT AREAS
- STARTER CHANNEL
- CONTOUR (MINOR-EXISTING)



60% PLAN - NOT FOR CONSTRUCTION

|                         |    |      |  |  |  |  |  |                                           |           |                                                                                                                                                |                                                                                       |                                                                                                                             |                                                                            |                                                                        |                                                                        |                    |            |
|-------------------------|----|------|--|--|--|--|--|-------------------------------------------|-----------|------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|------------------------------------------------------------------------|------------------------------------------------------------------------|--------------------|------------|
| PLAN CHECK              | BY | DATE |  |  |  |  |  | Last Saved By: otak Feb 23, 2015 - 7:08pm |           | <br>November 1, 2014 - April 1, 2015<br>Humboldt Bay Area |  | REVIEWED AND APPROVED FOR CONSTRUCTION<br><br>OWEN B. CARTER, P.E.<br>SNOHOMISH COUNTY ENGINEER<br><br>DATE APPROVED: _____ | SNOHOMISH COUNTY<br>DEPARTMENT OF<br>PUBLIC WORKS<br><br>FUNDING NO. _____ | MID-SPENCER ISLAND<br>ESTUARY RESTORATION<br><br>OVERALL SITE PLAN 348 | REFERENCE<br>SHEET NO.<br>SP01<br><br>SHEET<br>5<br>OF<br>16<br>SHEETS |                    |            |
|                         |    |      |  |  |  |  |  | REGION NO.                                | STATE     |                                                                                                                                                |                                                                                       |                                                                                                                             |                                                                            |                                                                        |                                                                        | FED. AID PROJ. NO. | SURVEY NO. |
|                         |    |      |  |  |  |  |  | 10                                        | WASH.     |                                                                                                                                                |                                                                                       |                                                                                                                             |                                                                            |                                                                        |                                                                        |                    |            |
|                         |    |      |  |  |  |  |  | DESIGNED BY:                              | DRAWN BY: |                                                                                                                                                |                                                                                       |                                                                                                                             |                                                                            |                                                                        |                                                                        |                    |            |
|                         |    |      |  |  |  |  |  | FIELD BOOK(S):                            | UPI#      |                                                                                                                                                |                                                                                       |                                                                                                                             |                                                                            |                                                                        |                                                                        |                    |            |
| NOAA-RAE NA10NMF4630090 |    |      |  |  |  |  |  | DATE                                      | NO.       | REVISION                                                                                                                                       | BY                                                                                    |                                                                                                                             |                                                                            |                                                                        |                                                                        |                    |            |



MATCHLINE SEE SHEET EC01

### FISH EXCLUSION GENERAL NOTES

1. INSTALL TEMPORARY EROSION AND SEDIMENT CONTROL AND FISH EXCLUSION IN ACCORDANCE WITH PROJECT PERMITS AND SWPPP.
2. COORDINATE WITH COUNTY FOR FISH REMOVAL PRIOR TO ANY IN-WATER WORK. COUNTY WILL REMOVE FISH FROM THE ISOLATED WORK AREA.

TESC NOTES

1. INSTALL HIGH VISIBILITY SILT FENCE PER WSDOT STD PLAN I-30.17-00.
2. CLEARING LIMITS.
3. INSTALL HIGH VISIBILITY FENCE PER WSDOT STD PLAN I-10.10-01.
4. INSTALL SILT CURTAIN PRIOR TO IN WATER WORK, PER SHEET EC03.
5. INSTALL FISH SCREEN PRIOR TO IN WATER WORK, SEE DETAIL ON SHEET EC03.

### LEGEND

- |                                                                                      |                       |
|--------------------------------------------------------------------------------------|-----------------------|
|   | PROJECT LIMITS        |
|   | STARTER CHANNEL       |
|   | CLEARING LIMITS       |
|   | HIGH VISIBILITY FENCE |
|   | SILT FENCE            |
|   | SILT CURTAIN          |
|   | FISH SCREEN           |
|   | CLEARING              |
|  | DIKE BREACH AREA      |

HORIZONTAL DATUM:  
WASHINGTON STATE COORDINATE SYSTEM,  
NORTH ZONE, NAD 83/91 ADJUSTMENT  
HORIZONTAL DATUM: NAVD88  
TOPOGRAPHIC DATA: CITY OF EVERETT 2009 LIDAR



60% PLAN - NOT FOR CONSTRUCTION

|                         |    |      |      |     |          |  |  |  |    |                                           |       |                    |            |
|-------------------------|----|------|------|-----|----------|--|--|--|----|-------------------------------------------|-------|--------------------|------------|
| PLAN CHECK              | BY | DATE |      |     |          |  |  |  |    | Last Saved By: otak Feb 23, 2015 - 7:13pm |       |                    |            |
|                         |    |      |      |     |          |  |  |  |    | REGION NO.                                | STATE | FED. AID PROJ. NO. | SURVEY NO. |
|                         |    |      |      |     |          |  |  |  |    | 10                                        | WASH. |                    |            |
|                         |    |      |      |     |          |  |  |  |    | DESIGNED BY:                              |       | DRAWN BY:          |            |
| NOAA-RAE NA10NMF4630090 |    |      |      |     |          |  |  |  |    | FIELD BOOK(S):                            |       | UPI#               |            |
|                         |    |      | DATE | NO. | REVISION |  |  |  | BY |                                           |       |                    |            |



REVIEWED AND APPROVED  
FOR CONSTRUCTION

OWEN B. CARTER, P.E.  
SNOHOMISH COUNTY ENGINEER

DATE APPROVED:

SNOHOMISH COUNTY  
DEPARTMENT OF  
PUBLIC WORKS

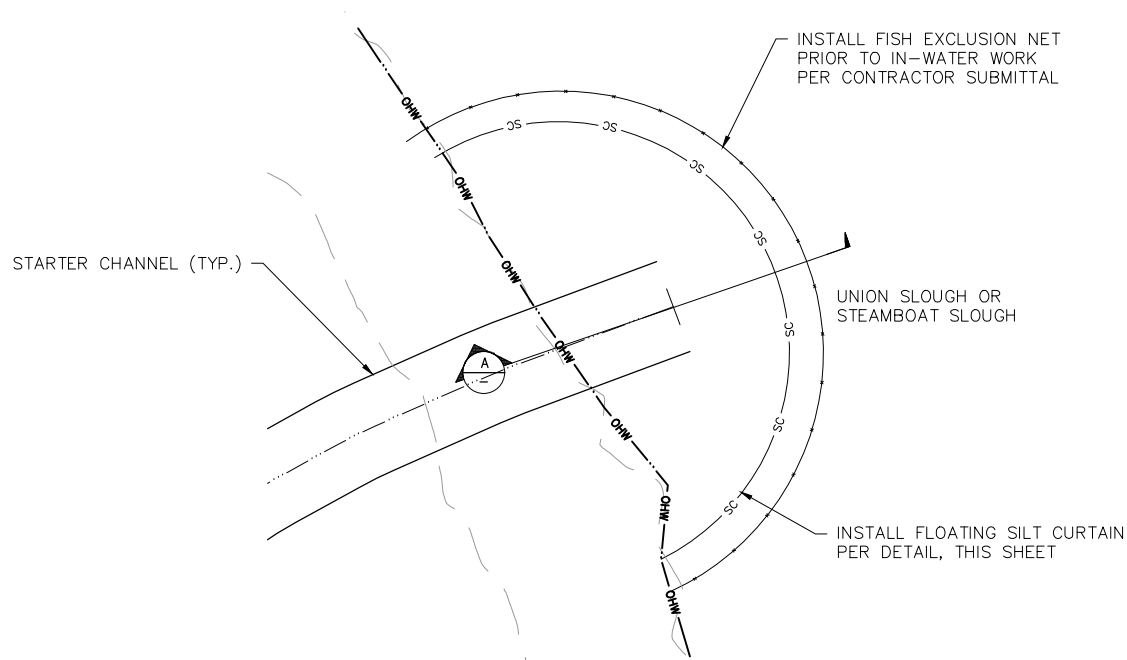
FUNDING NO. \_\_\_\_\_

# MID-SPENCER ISLAND ESTUARY RESTORATION TEMPORARY EROSION AND SEDIMENT CONTROL PLAN<sup>360</sup>

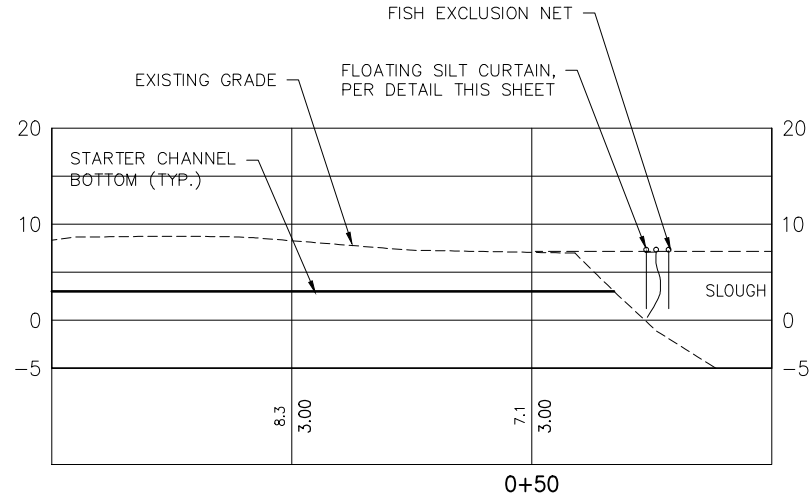
REFERENCE  
SHEET NO.  
**EC02**

SHEET  
**7**  
OF  
**16**  
SHEETS

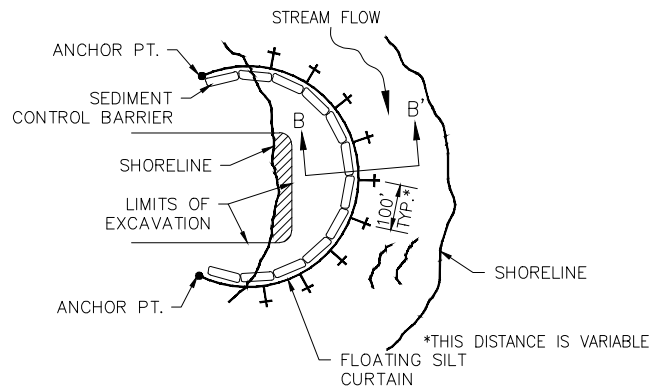
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otak K:\project\32100\32124\Draw\08\_EC03.dwg Layout Name: EC03



**FISH EXCLUSION NET**  
NOT TO SCALE

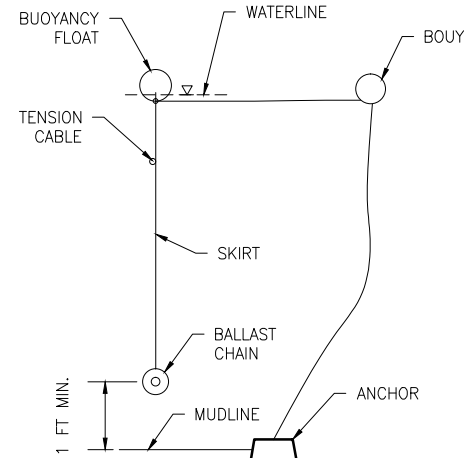
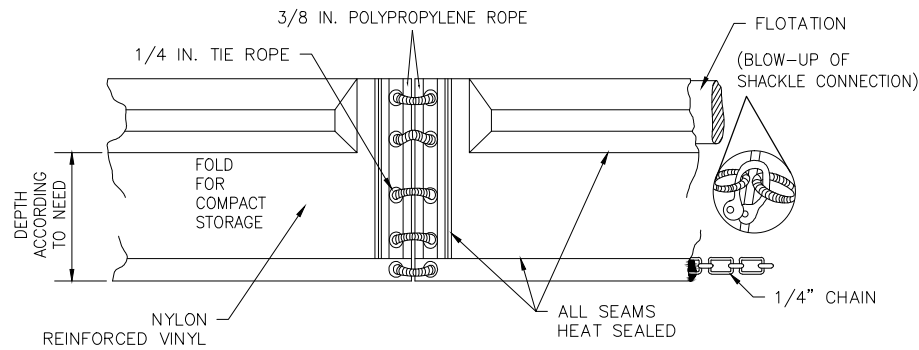


VIEW A-A'



PLAN

**FLOATING SILT CURTAIN**  
NOT TO SCALE



VIEW B-B'

| PLAN CHECK              | BY  | DATE     | NO. | REVISION | BY |
|-------------------------|-----|----------|-----|----------|----|
|                         |     |          |     |          |    |
|                         |     |          |     |          |    |
|                         |     |          |     |          |    |
| NOAA-RAE NA10NMF4680090 |     |          |     |          |    |
| DATE                    | NO. | REVISION | BY  |          |    |

| Last Saved By: ahmedk Feb 24, 2015 - 9:34am |       |                    |            |
|---------------------------------------------|-------|--------------------|------------|
| REGION NO.                                  | STATE | FED. AID PROJ. NO. | SURVEY NO. |
| 10                                          | WASH. |                    |            |
| DESIGNED BY:                                |       | DRAWN BY:          |            |
| FIELD BOOK(S):                              |       | UPI#               |            |



REVIEWED AND APPROVED  
FOR CONSTRUCTION

OWEN B. CARTER, P.E.  
SNOHOMISH COUNTY ENGINEER

DATE APPROVED:

SNOHOMISH COUNTY  
DEPARTMENT OF  
PUBLIC WORKS

FUNDING NO. \_\_\_\_\_

MID-SPENCER ISLAND  
ESTUARY RESTORATION

TEMPORARY EROSION AND  
SEDIMENT CONTROL PLAN

REFERENCE  
SHEET NO.  
EC03

SHEET  
8  
OF  
16  
SHEETS

60% PLAN - NOT FOR CONSTRUCTION



Plotted: Feb 24, 2015 - 11:24am      otak      K:\project\32100\32124\Draw\10\_RP02.dwg      Layout Name: RP02

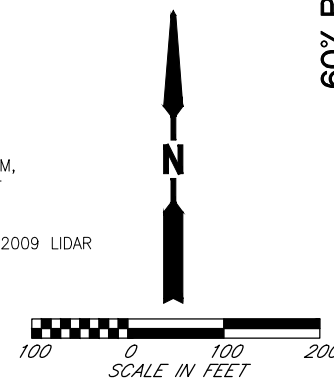


- 1 CONSTRUCT TYPICAL STARTER CHANNEL SECTION TYPE 1 PER  
DETAIL ON SHEET GD04.
- 2 CONSTRUCT TYPICAL STARTER CHANNEL SECTION TYPE 2 PER  
DETAIL ON SHEET GD04.
- 3 CONSTRUCT TYPICAL STARTER CHANNEL SECTION TYPE 3 PER  
DETAIL ON SHEET GD04.
- 4 CONSTRUCT TYPICAL STARTER CHANNEL SECTION TYPE 4 PER  
DETAIL ON SHEET GD04.
- 5 CONSTRUCT TYPICAL STARTER CHANNEL SECTION TYPE 5 PER  
DETAIL ON SHEET GD04.
- 6 CONSTRUCT TYPICAL STARTER CHANNEL SECTION TYPE 6 PER  
DETAIL ON SHEET GD04.
- 7 END STARTER CHANNEL.
- 8 BREACH EXISTING DIKE BY GRADING PER DETAIL ON SHEET GD02.
- 9 CONSTRUCT 1-LOG WOOD COMPLEX PER SHEET WD01.
- 10 CONSTRUCT 3-LOG WOOD COMPLEX PER SHEET WD01.

|                                                                                     |                                    |
|-------------------------------------------------------------------------------------|------------------------------------|
|  | DIKE BREACH AREA                   |
|  | EXCAVATED MATERIAL PLACEMENT AREAS |
|  | STARTER CHANNEL                    |
|  | PROJECT LIMITS                     |
|  | HIGH VISIBILITY FENCE              |
|  | WOOD STRUCTURE                     |

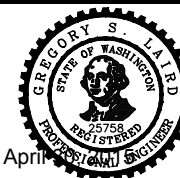
HORIZONTAL DATUM:  
WASHINGTON STATE COORDINATE SYSTEM,  
NORTH ZONE, NAD 83/91 ADJUSTMENT

VERTICAL DATUM: NAVD88  
TOPOGRAPHIC DATA: CITY OF EVERETT 2009 LIDAR



60% PLAN - NOT FOR CONSTRUCTION

|                         |    |      |      |     |          |  |  |  |    |                                             |       |                    |            |
|-------------------------|----|------|------|-----|----------|--|--|--|----|---------------------------------------------|-------|--------------------|------------|
| PLAN CHECK              | BY | DATE |      |     |          |  |  |  |    | Last Saved By: ahmedk Feb 23, 2015 - 5:05pm |       |                    |            |
|                         |    |      |      |     |          |  |  |  |    | REGION NO.                                  | STATE | FED. AID PROJ. NO. | SURVEY NO. |
|                         |    |      |      |     |          |  |  |  |    | 10                                          | WASH. |                    |            |
|                         |    |      |      |     |          |  |  |  |    | DESIGNED BY:                                |       | DRAWN BY:          |            |
| NOAA-RAE NA10NMF4630090 |    |      |      |     |          |  |  |  |    |                                             |       |                    |            |
|                         |    |      | DATE | NO. | REVISION |  |  |  | BY | FIELD BOOK(S):                              |       | UPI#               |            |

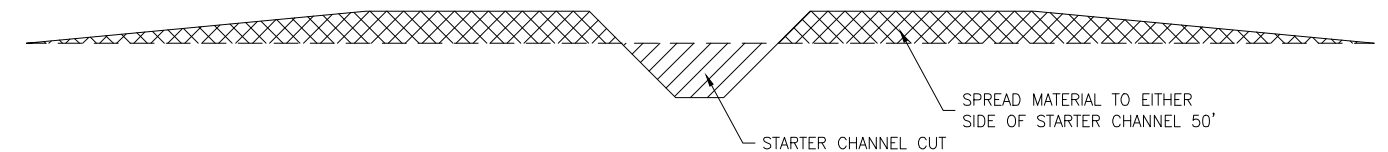
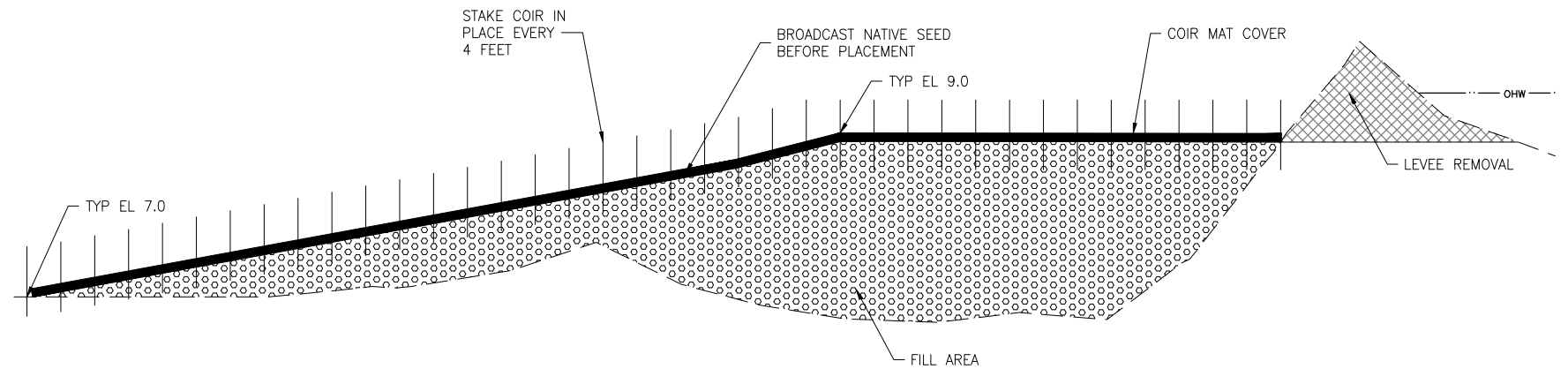
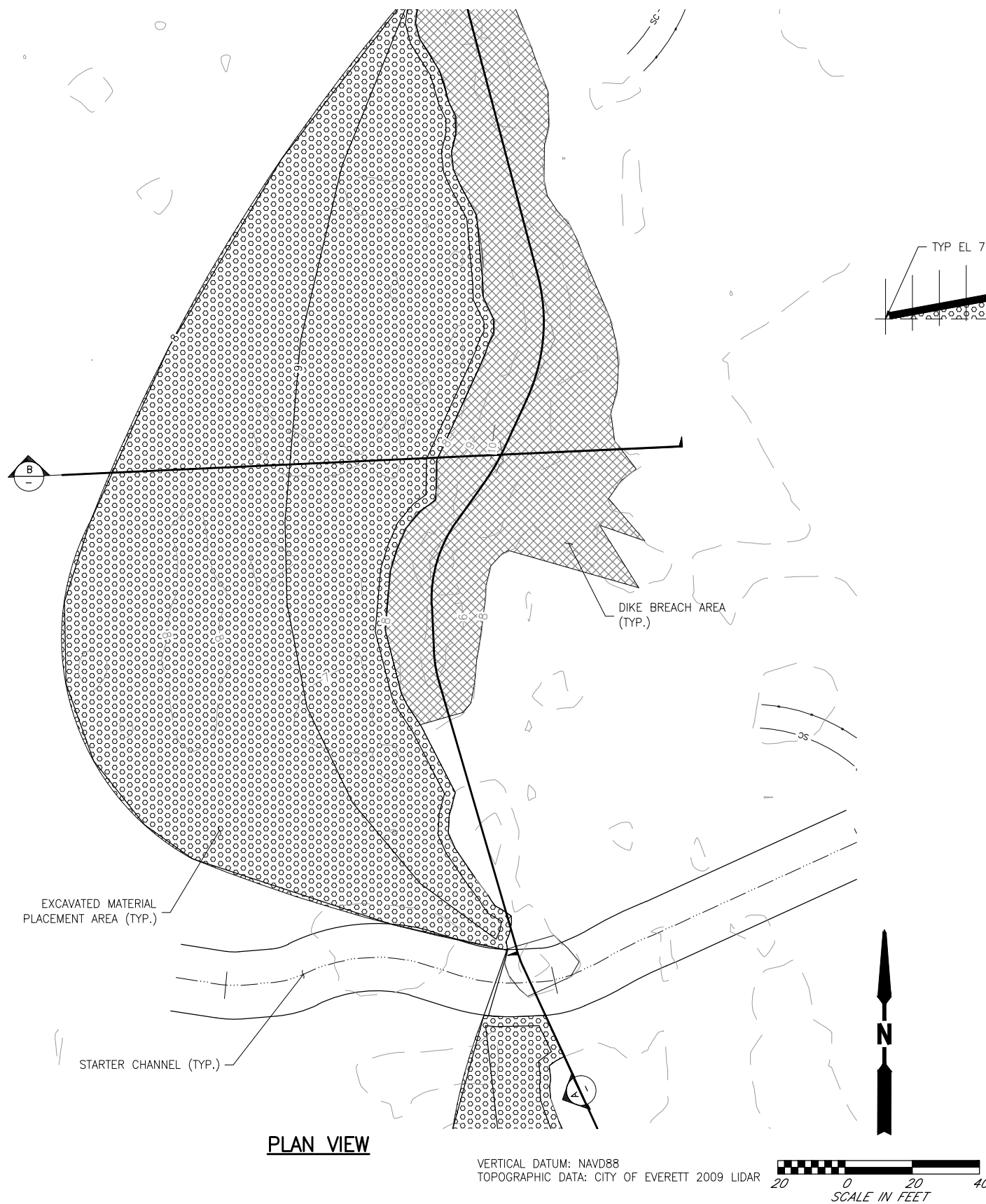


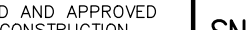
DATE APPROVED:

FUNDING NO. \_\_\_\_\_

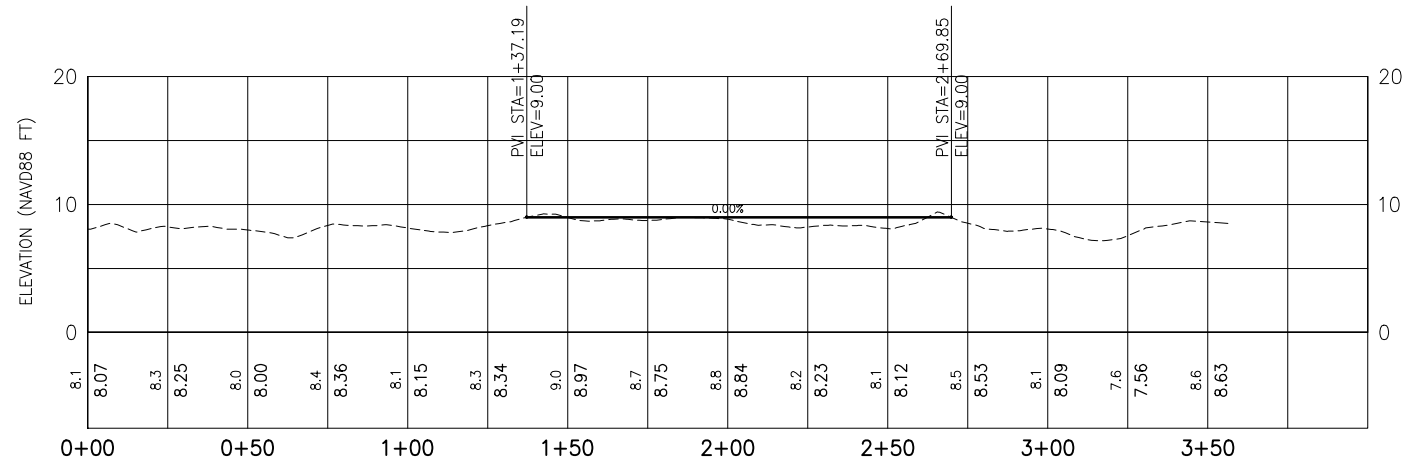
RESTORATION PLAN 353

SHEET  
10  
OF  
16  
SHEETS

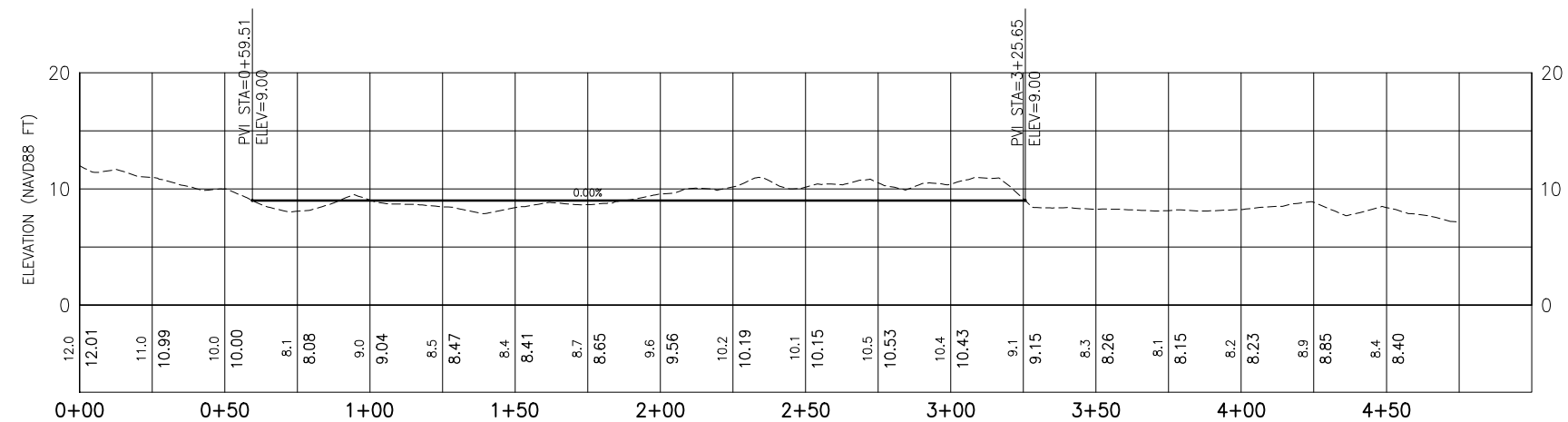


|                         |  |  |      |     |          |  |    |  |  |                                           |       |                    |            |                                                                                       |                                                                                       |                                        |  |                                                   |                                           |                         |                     |  |  |  |  |  |  |  |  |
|-------------------------|--|--|------|-----|----------|--|----|--|--|-------------------------------------------|-------|--------------------|------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|--|---------------------------------------------------|-------------------------------------------|-------------------------|---------------------|--|--|--|--|--|--|--|--|
| PLAN CHECK              |  |  |      | BY  | DATE     |  |    |  |  | Last Saved By: otak Feb 23, 2015 - 6:40pm |       |                    |            |  |  | REVIEWED AND APPROVED FOR CONSTRUCTION |  | SNOHOMISH COUNTY<br>DEPARTMENT OF<br>PUBLIC WORKS | MID—SPENCER ISLAND<br>ESTUARY RESTORATION | TYPICAL DIKE BREACH #54 | REFERENCE SHEET NO. |  |  |  |  |  |  |  |  |
|                         |  |  |      |     |          |  |    |  |  | REGION NO.                                | STATE | FED. AID PROJ. NO. | SURVEY NO. |                                                                                       |                                                                                       | GD01                                   |  |                                                   |                                           |                         |                     |  |  |  |  |  |  |  |  |
|                         |  |  |      |     |          |  |    |  |  | 10                                        | WASH. |                    |            |                                                                                       |                                                                                       |                                        |  |                                                   |                                           |                         |                     |  |  |  |  |  |  |  |  |
|                         |  |  |      |     |          |  |    |  |  | DESIGNED BY:                              |       | DRAWN BY:          |            |                                                                                       |                                                                                       |                                        |  |                                                   |                                           |                         |                     |  |  |  |  |  |  |  |  |
|                         |  |  |      |     |          |  |    |  |  | FIELD BOOK(S):                            |       | UPI#               |            |                                                                                       |                                                                                       |                                        |  |                                                   |                                           |                         |                     |  |  |  |  |  |  |  |  |
| NOAA-RAE NA10NMF4630090 |  |  |      |     |          |  |    |  |  |                                           |       |                    |            |                                                                                       |                                                                                       |                                        |  |                                                   |                                           |                         |                     |  |  |  |  |  |  |  |  |
|                         |  |  | DATE | NO. | REVISION |  | BY |  |  |                                           |       |                    |            |                                                                                       |                                                                                       |                                        |  |                                                   |                                           |                         |                     |  |  |  |  |  |  |  |  |

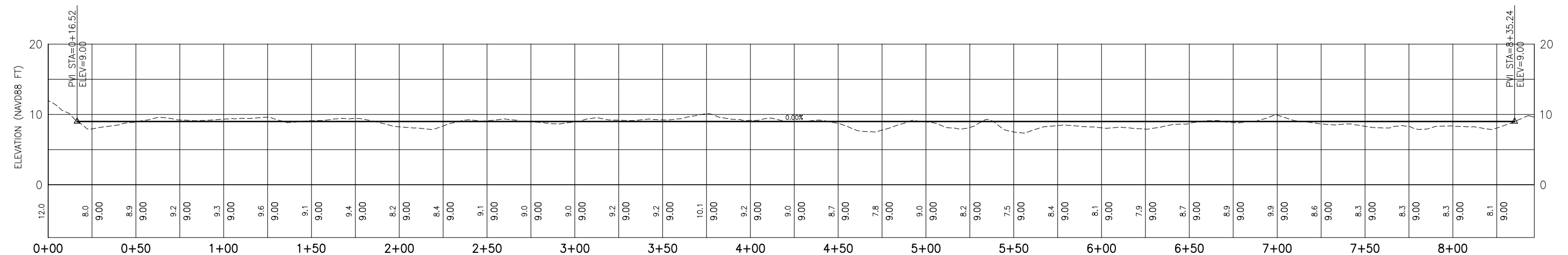
Plotted: Feb 24, 2015 - 11:26am  
otak K:\project\32100\32124\Draw\12\_GD02.dwg Layout Name: GD02



**BREACH AREA A**



**BREACH AREA B**



**BREACH AREA C**



| PLAN CHECK              | BY | DATE |      |     |          |    |  |  |  |
|-------------------------|----|------|------|-----|----------|----|--|--|--|
|                         |    |      |      |     |          |    |  |  |  |
|                         |    |      |      |     |          |    |  |  |  |
|                         |    |      |      |     |          |    |  |  |  |
|                         |    |      |      |     |          |    |  |  |  |
| NOAA-RAE NA10NMF4630090 |    |      |      |     |          |    |  |  |  |
|                         |    |      | DATE | NO. | REVISION | BY |  |  |  |

|                                           |       |                    |            |
|-------------------------------------------|-------|--------------------|------------|
| Last Saved By: otak Feb 23, 2015 - 6:47pm |       |                    |            |
| REGION NO.                                | STATE | FED. AID PROJ. NO. | SURVEY NO. |
| 10                                        | WASH. |                    |            |
| DESIGNED BY:                              |       | DRAWN BY:          |            |
| FIELD BOOK(S):                            |       | UPI#               |            |



REVIEWED AND APPROVED  
FOR CONSTRUCTION

OWEN B. CARTER, P.E.  
SNOHOMISH COUNTY ENGINEER

DATE APPROVED:

SNOHOMISH COUNTY  
DEPARTMENT OF  
PUBLIC WORKS

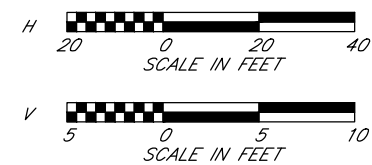
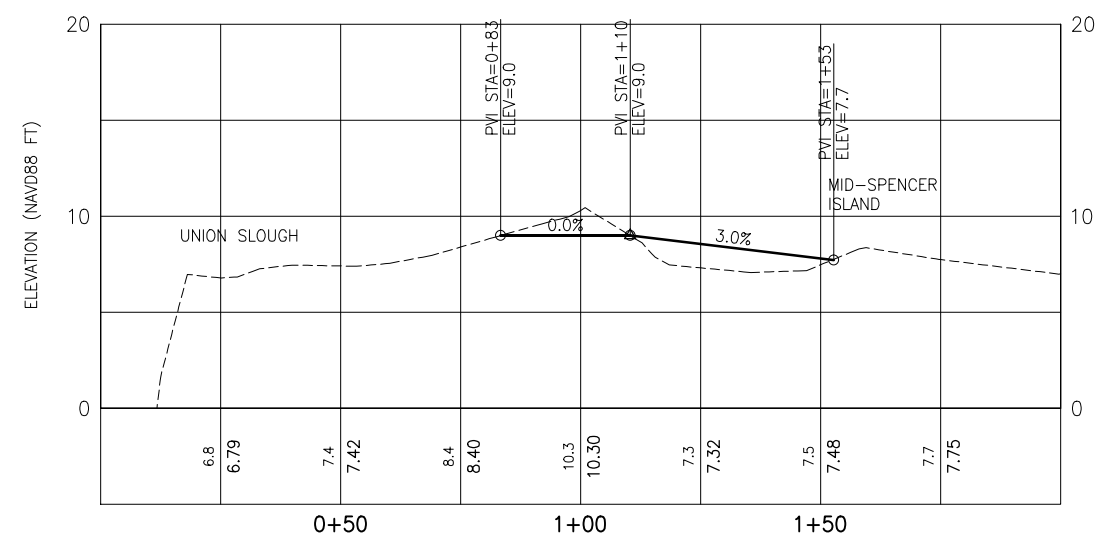
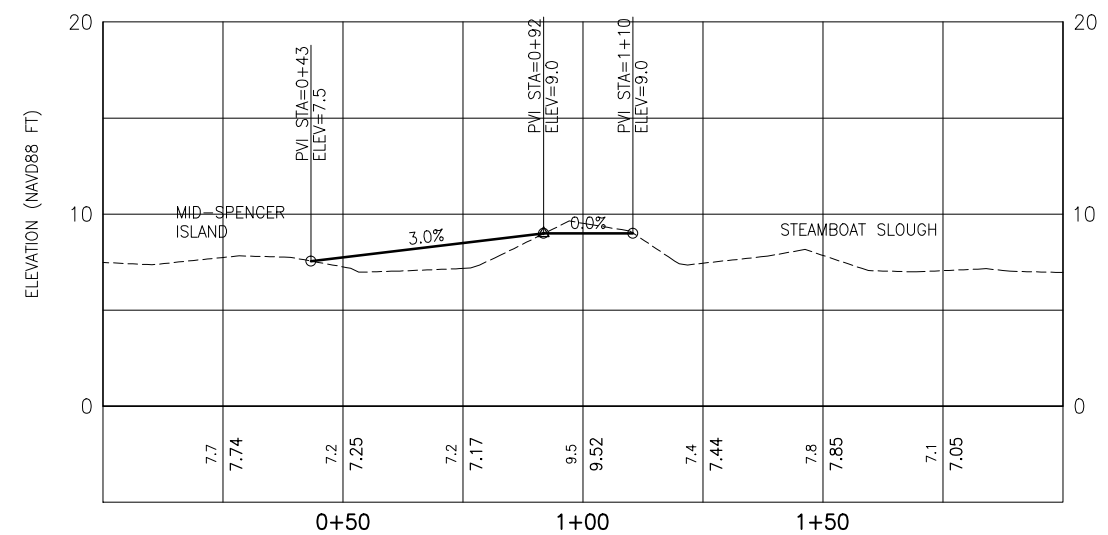
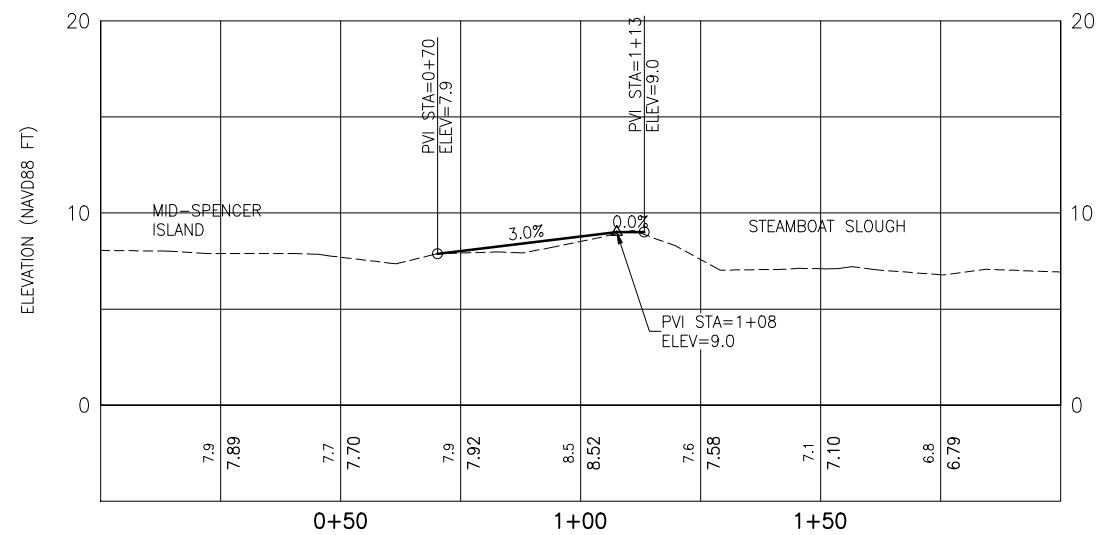
FUNDING NO. \_\_\_\_\_

MID-SPENCER ISLAND  
ESTUARY RESTORATION

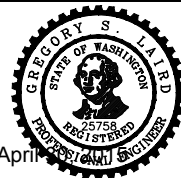
DIKE BREACH PROFILES

REFERENCE  
SHEET NO.  
GD02

SHEET  
12  
OF  
16  
SHEETS



|                         |    |      |      |     |          |  |  |  |    |                                              |       |                    |            |
|-------------------------|----|------|------|-----|----------|--|--|--|----|----------------------------------------------|-------|--------------------|------------|
| PLAN CHECK              | BY | DATE |      |     |          |  |  |  |    | Last Saved By: ahmedk Feb 24, 2015 - 11:16am |       |                    |            |
|                         |    |      |      |     |          |  |  |  |    | REGION NO.                                   | STATE | FED. AID PROJ. NO. | SURVEY NO. |
|                         |    |      |      |     |          |  |  |  |    | 10                                           | WASH. |                    |            |
|                         |    |      |      |     |          |  |  |  |    | DESIGNED BY:                                 |       | DRAWN BY:          |            |
| NOAA-RAE NA10NMF4630090 |    |      |      |     |          |  |  |  |    | FIELD BOOK(S):                               |       |                    | UPI#       |
|                         |    |      | DATE | NO. | REVISION |  |  |  | BY |                                              |       |                    |            |



REVIEWED AND APPROVED  
FOR CONSTRUCTION

OWEN B. CARTER, P.E.  
SNOHOMISH COUNTY ENGINEER

DATE APPROVED:

SNOHOMISH COUNTY  
DEPARTMENT OF  
PUBLIC WORKS

FUNDING NO. \_\_\_\_\_

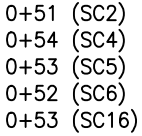
# MID-SPENCER ISLAND ESTUARY RESTORATION

## DIKE BREACH SECTIONS

REFERENCE  
SHEET NO.  
**GD03**

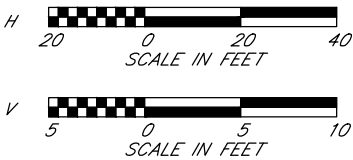
SHEET  
13  
OF  
16  
SHEETS

60% PLAN - NOT FOR CONSTRUCTION



The diagram illustrates a trapezoidal channel cross-section. The top surface is labeled "FINISHED GRADE" and is represented by a dashed line. The existing ground surface is labeled "TYPICAL EXISTING GRADE" and is represented by a solid line with a hatched pattern. The channel bottom is labeled "CHANNEL BOTTOM" and is represented by a solid line with a hatched pattern. The channel width at the bottom is labeled "W". The channel depth is labeled "D". The channel side slopes are labeled "1" on the left and "1" on the right, indicating a 1:1 slope. The channel bottom is labeled "CHANNEL BOTTOM" and is represented by a solid line with a hatched pattern.

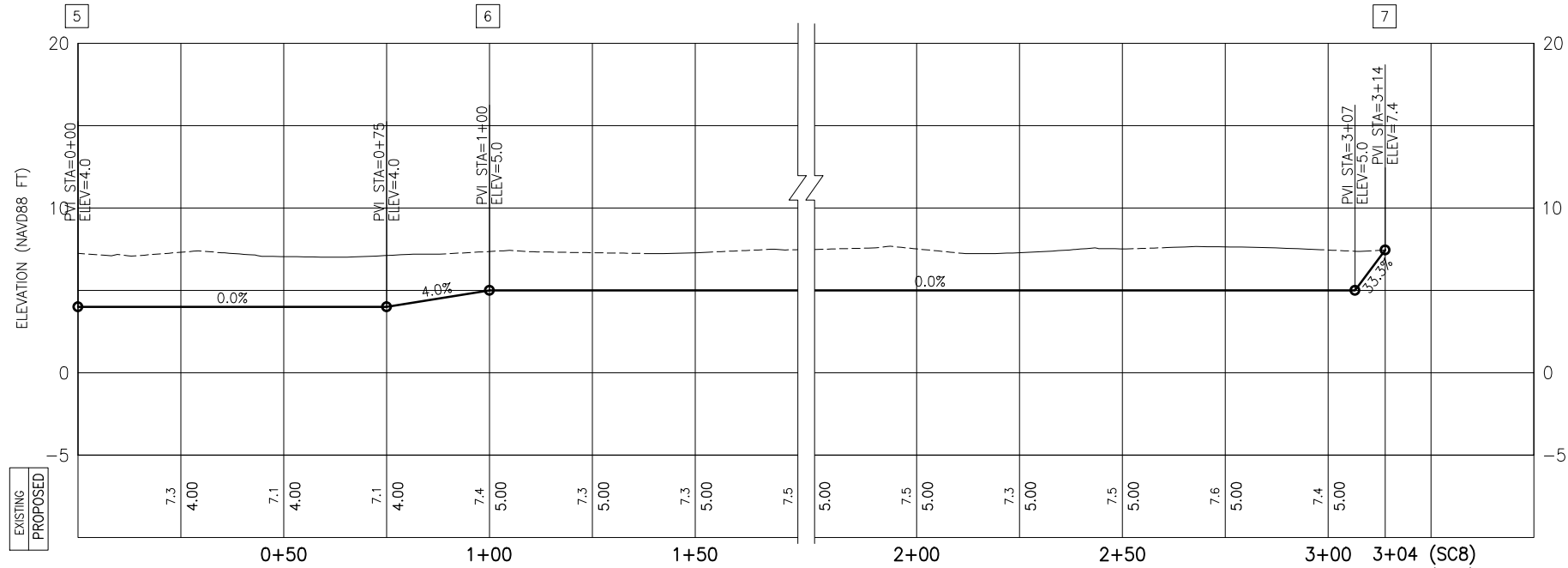
## TYPICAL STARTER CHANNEL SECTION



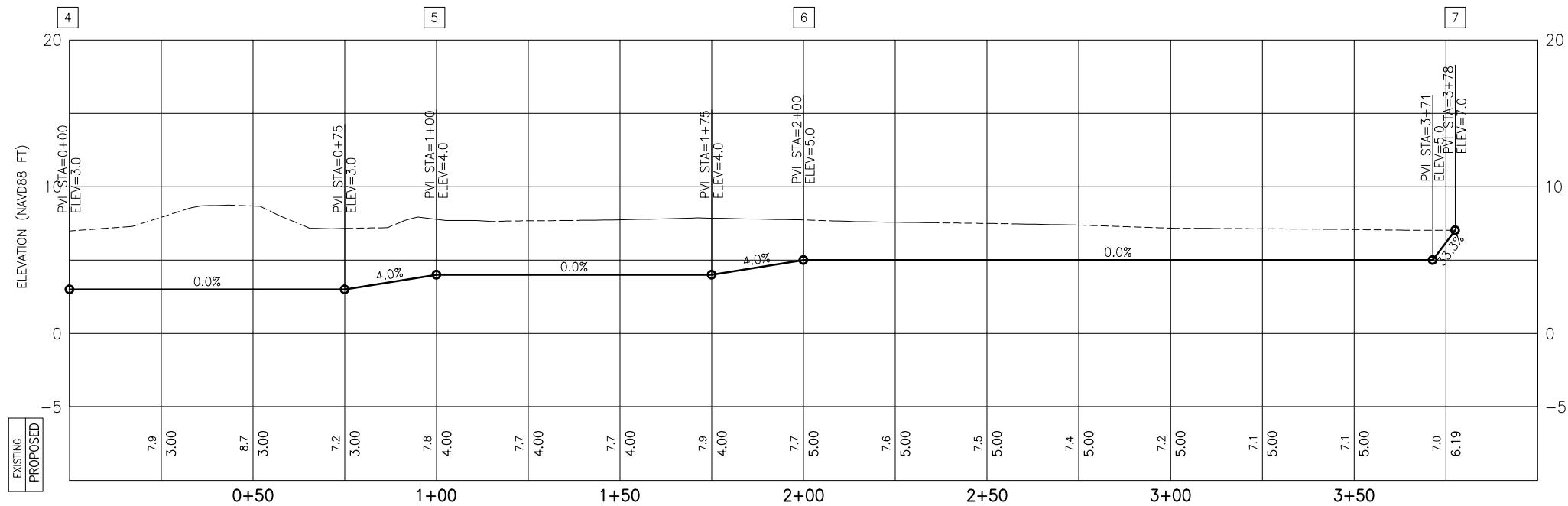
60% PLAN - NOT FOR CONSTRUCTION

|                         |    |      |      |     |          |                |                                           |                    |            |  |                                                                                                                                                                                                                                                                                                                                                              |                                                   |                                           |                             |     |                                    |
|-------------------------|----|------|------|-----|----------|----------------|-------------------------------------------|--------------------|------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|-------------------------------------------|-----------------------------|-----|------------------------------------|
| PLAN CHECK              | BY | DATE |      |     |          |                | Last Saved By: otak Feb 23, 2015 - 6:44pm |                    |            |  |   <div>REVIEWED AND APPROVED<br/>FOR CONSTRUCTION</div> <div>OWEN B. CARTER, P.E.<br/>SNOHOMISH COUNTY ENGINEER</div> <div>DATE APPROVED: _____</div> <div>FUNDING NO. _____</div> | SNOHOMISH COUNTY<br>DEPARTMENT OF<br>PUBLIC WORKS | MID-SPENCER ISLAND<br>ESTUARY RESTORATION | STARTER CHANNEL<br>PROFILES | 357 | REFERENCE<br>SHEET NO.<br><br>GD04 |
|                         |    |      |      |     |          | REGION<br>NO.  | STATE                                     | FED. AID PROJ. NO. | SURVEY NO. |  |                                                                                                                                                                                                                                                                                                                                                              |                                                   |                                           |                             |     |                                    |
|                         |    |      |      |     |          | 10             | WASH.                                     |                    |            |  |                                                                                                                                                                                                                                                                                                                                                              |                                                   |                                           |                             |     |                                    |
|                         |    |      |      |     |          | DESIGNED BY:   |                                           | DRAWN BY:          |            |  |                                                                                                                                                                                                                                                                                                                                                              |                                                   |                                           |                             |     |                                    |
|                         |    |      |      |     |          | FIELD BOOK(S): |                                           | UPI#               |            |  |                                                                                                                                                                                                                                                                                                                                                              |                                                   |                                           |                             |     |                                    |
|                         |    |      |      |     |          |                |                                           |                    |            |  |                                                                                                                                                                                                                                                                                                                                                              |                                                   |                                           |                             |     |                                    |
|                         |    |      |      |     |          |                |                                           |                    |            |  |                                                                                                                                                                                                                                                                                                                                                              |                                                   |                                           |                             |     |                                    |
| NOAA-RAE NA10NMF4630090 |    |      |      |     |          |                |                                           |                    |            |  |                                                                                                                                                                                                                                                                                                                                                              |                                                   |                                           |                             |     |                                    |
|                         |    |      | DATE | NO. | REVISION | BY             |                                           |                    |            |  |                                                                                                                                                                                                                                                                                                                                                              |                                                   |                                           |                             |     |                                    |

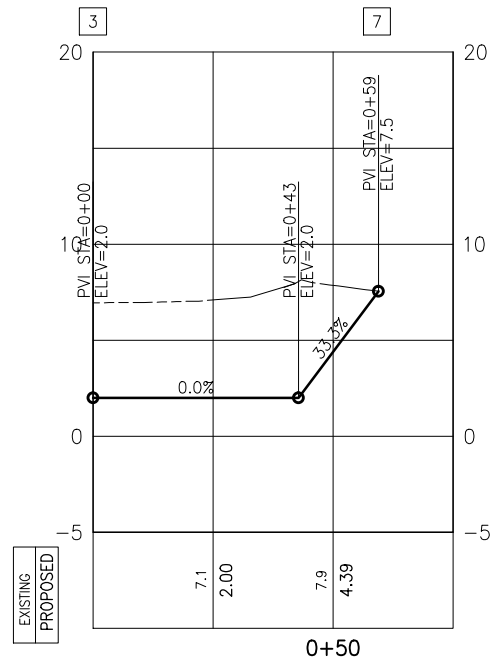
Plotted: Feb 24, 2015 - 11:27am  
otak K:\project\32100\32124\Draw\15\_GD05.dwg Layout Name: GD05



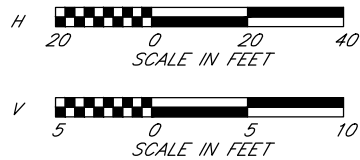
PROFILE ALONG SC8/SC9/SC11/SC12



PROFILE ALONG SC13



PROFILE ALONG SC15



| PLAN CHECK              | BY | DATE |      |     |          |    |  |  |  |
|-------------------------|----|------|------|-----|----------|----|--|--|--|
|                         |    |      |      |     |          |    |  |  |  |
|                         |    |      |      |     |          |    |  |  |  |
|                         |    |      |      |     |          |    |  |  |  |
| NOAA-RAE NA10NMF4630090 |    |      | DATE | NO. | REVISION | BY |  |  |  |

| Last Saved By: otak Feb 23, 2015 - 6:46pm |       |                    |            |
|-------------------------------------------|-------|--------------------|------------|
| REGION NO.                                | STATE | FED. AID PROJ. NO. | SURVEY NO. |
| 10                                        | WASH. |                    |            |
| DESIGNED BY:                              |       | DRAWN BY:          |            |
| FIELD BOOK(S):                            |       | UPI#               |            |

November 1, 2014 - April 2015  
Humboldt County Partner

REVIEWED AND APPROVED FOR CONSTRUCTION

OWEN B. CARTER, P.E.  
SNOHOMISH COUNTY ENGINEER

DATE APPROVED:

SNOHOMISH COUNTY  
DEPARTMENT OF  
PUBLIC WORKS

FUNDING NO. \_\_\_\_\_

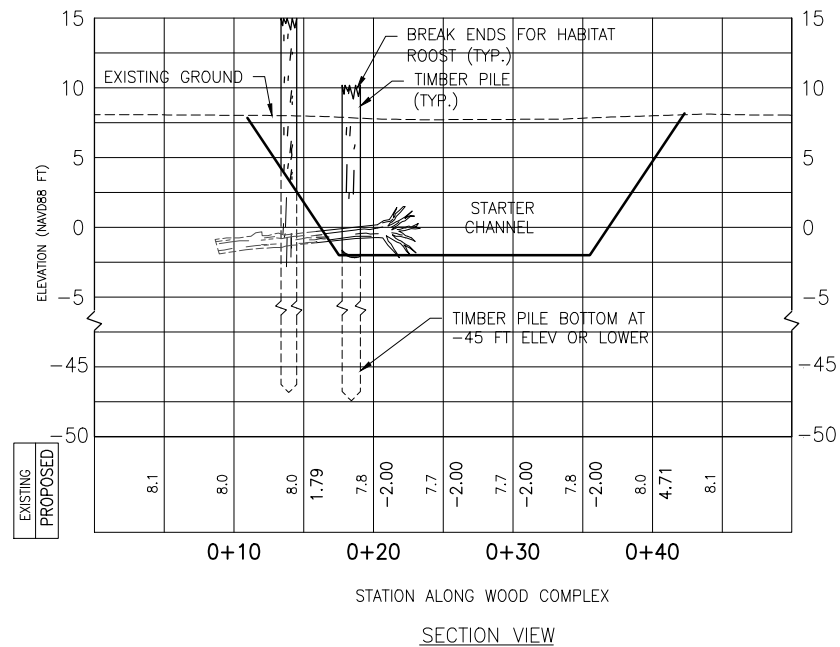
MID-SPENCER ISLAND  
ESTUARY RESTORATION

STARTER CHANNEL  
PROFILE

358

|                       |
|-----------------------|
| REFERENCE SHEET NO.   |
| GD05                  |
| SHEET 15 OF 16 SHEETS |

60% PLAN - NOT FOR CONSTRUCTION



NOTE: SEE SHEETS RP01-RP02  
FOR P1 AND P2 CONTROL POINTS.

|                                       |                                   |
|---------------------------------------|-----------------------------------|
| REFERENCE<br>SHEET NO.<br><b>WD01</b> | SHEET<br>16<br>OF<br>16<br>SHEETS |
|---------------------------------------|-----------------------------------|