RECLAMATION

Managing Water in the West

Catherine Creek Rivermile 44 Habitat Enhancement Project Phases III and IV Basis of Design Report

U. S. Department of the Interior
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U.S. DEPARTMENT OF THE INTERIOR

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1. Introduction

The Bureau of Reclamation (Reclamation) and Bonneville Power Administration (BPA) contribute to the implementation of salmonid habitat improvement projects in the Columbia River Basin to help meet commitments contained in the 2014 Supplemental Federal Columbia River Power System (FCRPS) Biological Opinion (NOAA Fisheries 2014). This Biological Opinion includes a Reasonable and Prudent Alternative (RPA), or a suite of actions, to protect salmon and steelhead listed under the Endangered Species Act (ESA) across their life cycles. Habitat improvement projects in various Columbia River tributaries are one aspect of this RPA. Reclamation provides technical assistance to states, tribes, federal agencies, and other local partners for identification, design, and construction of stream habitat improvement projects that primarily address streamflow, access, entrainment, and channel complexity limiting factors. Reclamation's contributions to habitat improvement are all meant to be within the framework of the FCRPS RPA or related commitments.

This report summarizes the basis of design for a project focusing on aquatic and riparian habitat improvement within one of the highest priority locations on Catherine Creek for Spring Chinook Salmon and Spring/Summer steelhead along a 1.9-mile reach of Catherine Creek.

2. Background

The Catherine Creek Rivermile 44 (CC-44) Project is located on Catherine Creek near rivermile (RM) 44 within the Catherine Creek Assessment and Biological Opinion Area. This report describes the design goals, objectives, constraints, and criteria used for CC-44 Phase III and IV which span from approximately RM 44.0 to 44.6 and 43.4 to 44.0, respectively as shown in Figure 1. This project spans four different land parcels and will often be discussed in reference to parcel numbers 1 through 4. These numbers begin at the downstream parcel and work their way upstream. Based on Figure 1, Parcel 1 is located between RM 42.8 and 42.9; Parcel 2 is located between RM 42.9 and 43.3; Parcel 3 is located between RM 43.3 and 44.05; and Parcel 4 is located between RM 44.05 and 44.8. For the purposes of this report and proposed designs, Parcels 1 and 2 were considered one phase of the project (Phase IV) and Parcels 3 and 4 were considered one phase of the project (Phase III). Phase III was eventually broken up into two separate design efforts due to scale, complexity, and timing of potential construction.

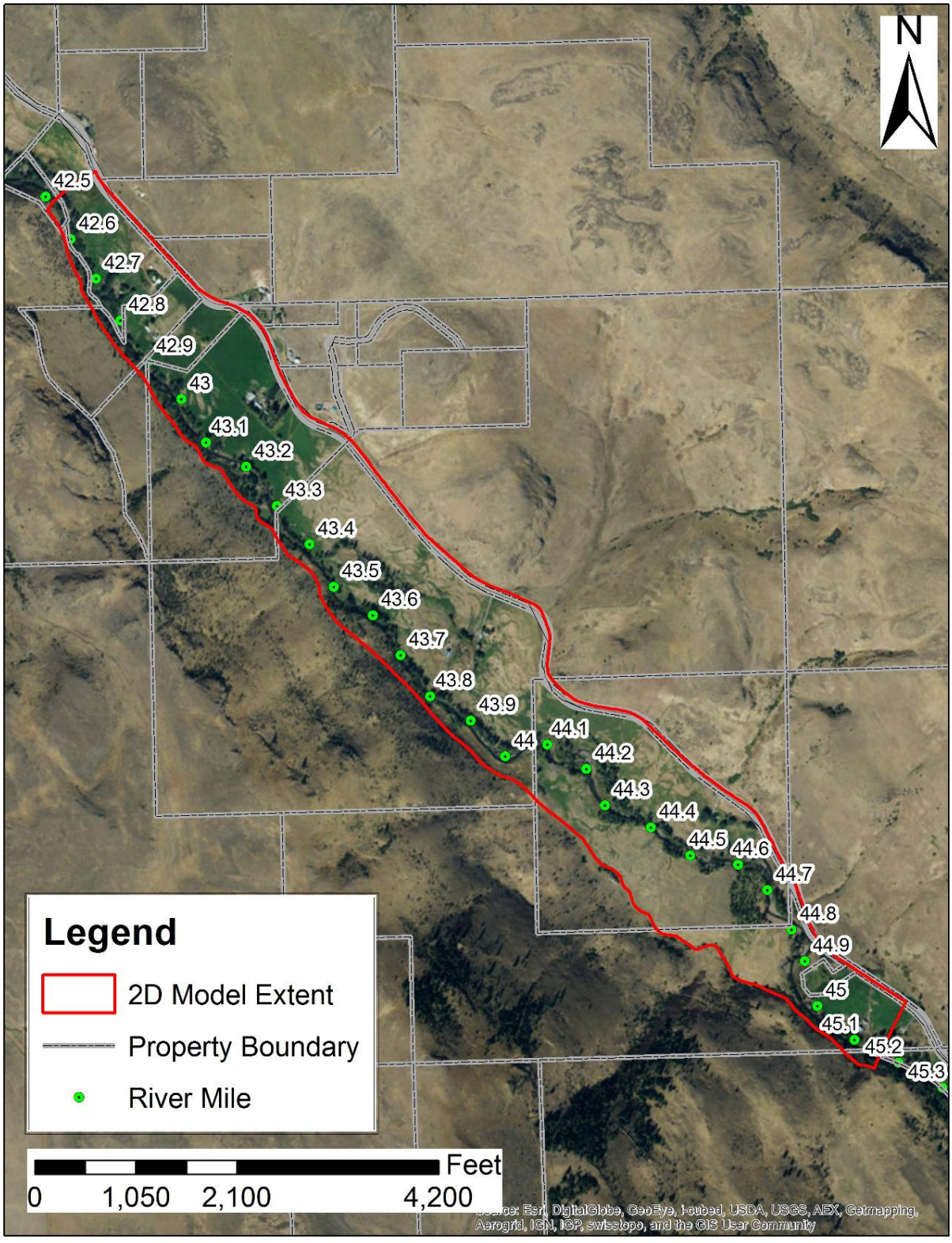


Figure 1. Vicinity Map of the CC-44 Phase III and IV Project Area.

The project is within Reach CCC3B as defined for Spring/Summer Chinook and has the limiting factors as shown in Figure 2. With respect to Snake River steelhead, the project is within Reach UGS10B and has the limiting factors shown in Figure 3. This reach is currently the focus of efforts by the action agencies (BPA and Reclamation). "The local expert panel's deliberations indicate that to create more summer rearing habitat, habitat improvement actions should improve the limiting factors of peripheral and transitional habitats, floodplains, channel structure and form, temperature, water quantity, sediment, riparian areas, and barriers," (taken directly from the Grande Ronde Subbasin Work Plan, Reclamation 2014). This project design is to respond to these limiting factors to the extent possible within the constraints described below.

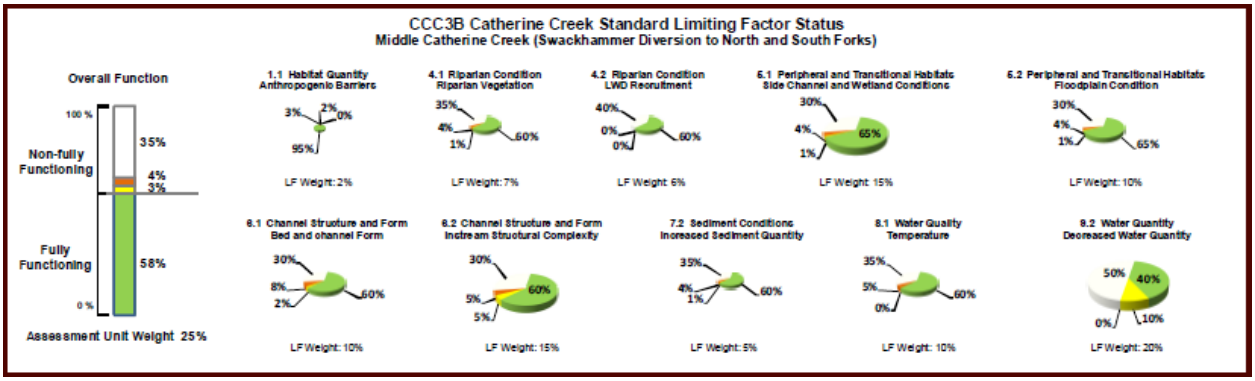


Figure 2. Upper Grande Ronde Chinook Limiting Factors [1].

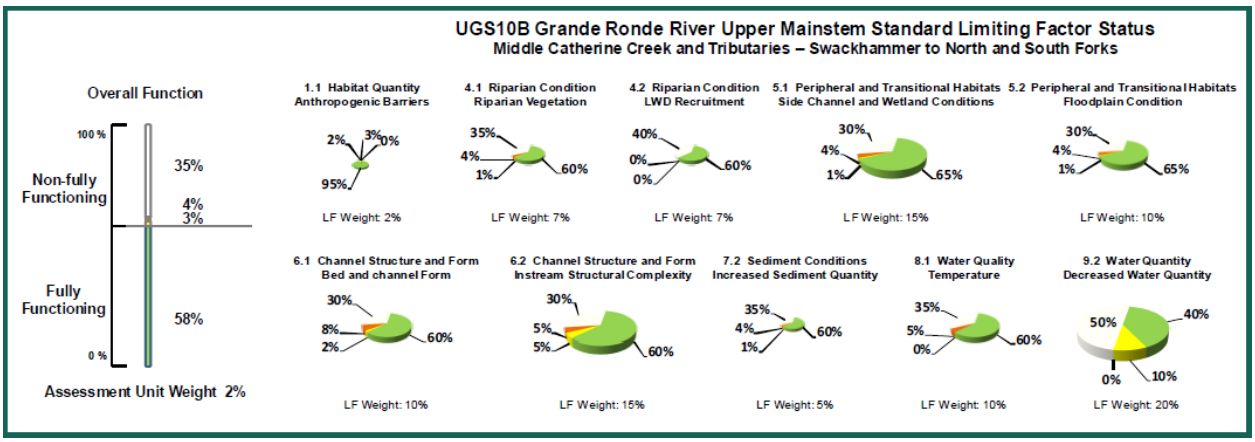


Figure 3. Upper Grande Ronde Spring/Summer Steelhead Limiting Factors [1].

1 http://www.usbr.gov/pn/fcrps/habitat/panels/2012panels/piemaps/2012/UpperGrandeRonde_Chinook_XLS_20130530_20130701.pdf

Although draft, the Catherine Creek Atlas designates this reach (BSR CCC4) as a tier I priority biological significant reach and ranks near the top in terms of opportunity to expand juvenile summer rearing capacity for spring Chinook Salmon. Current Oregon Department of Fish and Wildlife (ODFW) and Reclamation research confirms this project reach is a high priority area for critical juvenile Chinook Salmon summer and winter habitat and is also key adult spring Chinook spawning habitat. Summer 2014 fish liberation suggests that summer steelhead spawning occurs nearby, if not within, the project area due to the presence of zero-year juveniles.

3. Project Goals and Objectives

3.1 Goals

The goal of the project, as outlined in the original CC-44 Project Management Plan (Reclamation 2015), is to improve conditions for juvenile Chinook Salmon and Spring/Summer steelhead by responding to the limiting factors identified in the expert panel process and shown in Figures 2 and 3, above. This has been further refined during the early design process to "Restore and improve juvenile Chinook Salmon and Spring/Summer steelhead and related ecosystem processes and services within the existing character and function of Catherine Creek while protecting and maintaining the utility and economic viability of the existing working ranches," (Reclamation 2015).

3.2 Objectives

The limiting factors identified above outline the most basic design objectives. More detailed design objectives were compiled from various meetings, conversations, and emails between Reclamation design staff and key stakeholders including the Union Soil and Water Conservation District (USWCD), the Confederated Tribes of the Umatilla Indian Reservation (CTUIR), ODFW, and the Grande Ronde Model Watershed. The fundamental intent is to design the riparian corridor to a more natural form and with natural materials to return the reach to a more natural self-sustaining reach with greater potential to support the target juvenile and adult fishes.

The following limiting factors form the objectives to help reach the project goal. Immediately below each objective is a basic description of how the objective will be met. In some cases, an action benefits multiple limiting factors and so may be repeated.

- Increase habitat quantity
    - Increase channel sinuosity to a more natural level thereby increasing channel length and subsequent wetted habitat area.

  - Develop pool-riffle sequences with runs and glides to increase the heterogeneity of the channel both horizontally and vertically to create more diverse habitat types.
  - Improve the quantity of deep, slow pools that occur at low flows with protective cover (e.g., large woody material [LWM] and overhanging vegetation).
- Riparian Condition (riparian vegetation)
  - Provide locations to encourage and allow seed deposition, sprouting, and growth to develop complex, healthy, and diverse riparian communities.
    - Adjust channel to a more natural geometry to encourage flooding where appropriate.
    - Develop inset floodplains and re-contour floodplains where appropriate.
  - Protect riparian vegetation through conservation easements to allow natural regeneration to begin and develop a diverse age class of vegetation for long-term stability.
- Riparian Condition (LWM recruitment)
  - Supplement natural LWM with engineered LWM jams and floodplain roughness.
  - Protect riparian vegetation through conservation easements to allow natural regeneration to begin and develop a diverse age class of vegetation for long-term stability and future large wood recruitment.
- Channel Structure (streambed and channel form)
  - Increase channel sinuosity to an expected natural level.
  - Develop pool-riffle sequences with glides and runs to increase the heterogeneity of the channel both horizontally and vertically to create more diverse channel structure.
- Channel Structure (instream structural complexity)
  - Increase channel sinuosity to an expected natural level.
  - Develop pool-riffle sequences with glides and runs to increase the heterogeneity of the channel both horizontally and vertically to create more diverse channel structure.
  - Add supplemental boulders.
  - Add supplemental LWM.
- Peripheral and Transitional Habitats (side channel and wetland conditions)
  - Develop side channels, alcoves, floodplain swale complexes, and wetlands.
- Peripheral and Transitional Habitats (floodplain condition)
  - Develop side channels, alcoves, floodplain swale complexes, and wetlands.
  - Provide locations to encourage and allow seed deposition, sprouting, and growth to develop complex, healthy, and diverse riparian communities.

    - Adjust the channel to an expected natural geometry to encourage flooding where appropriate at a frequency more natural for meadow systems.
    - Develop inset floodplains and re-contour floodplains where appropriate.
- Sediment Conditions (increased sediment quantity)
    - Encourage long-term riparian community development and sustainability to strengthen streambanks to a more natural level through conservation easements.
        - Improve floodplain connectivity.
        - Native replanting.
    - Install LWM structures.
- Water Quality (temperature)
    - Narrow and deepen the channel to a more natural expected geometry at riffles for both high and lows flows to reduce the surface area to water volume ratio.
        - Improve floodplain connectivity.
        - Native replanting.
    - Encourage long-term riparian community development and sustainability through conservation easements.

3.3 Constraints

The proposed habitat enhancement design for the CC-44 project takes into account the constraints associated with the project from key stakeholders and regulatory agencies. The project spans over multiple parcels and landowners who each utilize their land differently and have different management goals for their property while regulatory agencies are often concerned with potential project impacts (flooding, LWM risk, habitat, etc.). The major design constraints are defined below and all have been considered throughout and impacted the final design of the habitat enhancement project.

3.3.1 Landowner

- Parcel 4
    - Minimal increase in flooding from existing conditions.
    - No impact to wheel line to irrigate land for pasture.
    - Continue to provide a low-flow crossing of Catherine Creek.
    - Omit a side channel originally proposed in the 30 percent draft design to allow grazing of pasture within the riparian corridor.
    - Limit floodplain inundation onto productive farm land.

- Parcel 3
  - Retain landowner access across side channel (historic 1937 channel).
  - No negative effect to structures (barn and house) associated with flooding.
  - Minimal floodplain grading where possible.
  - Retain northern pastures for continued agricultural use.
- Parcel 2
  - Continue to provide a low-flow crossing of Catherine Creek.
  - No increase in flooding from existing conditions.
  - No impact to new irrigation infrastructure.
  - Protect seasonal recreational area (RV camping site).
  - Reduce risk of LWM within recreational area.
  - Maintain access for cattle use on a portion of the limited flat ground along the south side of Catherine Creek.
  - Maintain riprap upstream of seasonal recreational area along right bank.
- Parcel 1
  - Continue to provide a low-flow crossing of Catherine Creek.
  - No increase in flooding from existing conditions.
  - No impact to new irrigation infrastructure.
  - No downstream adverse effects to downstream landowners.
  - Minimal construction access through main driveway.

3.3.2 Regulatory

- Minimize the number of active channels during critical low flow periods to no more than two parallel channels, with one providing the majority of the conveyance (15 of the 18 cfs typically unless short length).
- Do not create or worsen any partial or full passage barriers.
- Project is located within a Zone A Federal Emergency Management Agency (FEMA) regulatory floodplain. A Zone A Floodplain is an approximate area of 100-year inundation with no base flood elevations established. Design needs to adhere to County Code with development within floodplain.
- Do not adversely impact the city of Union, Oregon or downstream landowners.

4. Historic Conditions

The historical conditions of Catherine Creek through the project area are defined as the unaltered or natural conditions prior to large-scale human influences. More detail about the historic conditions beyond this report can be found in the Catherine Creek Reach Assessment Grande Ronde River Basin (Reclamation 2012). Catherine Creek was predominately a single thread channel with a relatively straight, unconfined channel with a sinuosity of less than 1.5, with a moderate to low gradient, with coarse alluvium and colluvium comprising the bed and banks (Reclamation 2012). The historic bed form likely ranged from pool riffle to plane bed (Reclamation 2012). From 1934 to 1942, U.S. Bureau of Fisheries summary stream habitat survey from sections that included the project area recorded an average of 20 resting pools per mile (Reclamation 2012). Secondary and floodplain side channels would have been prevalent in areas where beaver were active or where LWM structures had developed (Reclamation 2012). Habitat diversity was associated with instream rock and/or accumulations of woody material, beaver dams, and riparian cover along the channel margins (Reclamation 2012). It is assumed that the riparian corridor would have been wide and robust with an over story dominate of black cottonwoods with an understory consisting of river birch, willow, dogwood, alder, ninebark, and other native shrubs and brush. A summary of historical/potential target conditions can be found in Table 2 in the Proposed Conditions section.

5. Hydrology

5.1 Catherine Creek

Catherine Creek flows in a primarily western direction up to the Project with the exception of the North Fork Catherine Creek which flows predominately south. The watershed basin area for this location consists of approximately 109 square miles with a mean basin elevation of 5,170 and a mean annual precipitation of 38 inches. There is a U.S. Geological Survey (USGS) stream gage (Gage #13320000) located approximately 3.7 miles upstream of our project site on Catherine Creek. The basin area of this gage is approximately 104 square miles. The small increase in basin area likely does not affect peak or low flow stream discharge and gage records were used to develop site hydrology for the Project.

A hydrologic analysis was completed for the Catherine Creek watershed at Gage #13320000 to establish and identify various discharge estimates for design consideration. These flows included peak flood frequency discharges (2-, 5-, 25-, 100-year, etc. recurrence intervals), fish passage design flows (5 percent and 95 percent daily annual exceedance flows) and other key fish use timing flows (average flows during juvenile winter rearing, etc.). Gage #13320000 has instantaneous peak flow data and daily flow data from 1911 through the current day (2011 water year for this analysis) (Appendix A). The gage is currently being maintained by the Oregon Department of Water Resources (ODWR).

5.1.1 Annual Peak Discharges

To estimate annual instantaneous peak flows for the project area, the instantaneous peak flow data from this gage was statistically analyzed using a Log-Pearson Type III (LP3) Distribution to estimate flood recurrence intervals and discharges at the gage location. The Log Pearson Type III statistical distribution used within this study is described in Bulletin 17B from the USGS (USGS 1982). Table 1 shows selected flood frequency intervals and their estimated discharge based upon our analysis at the USGS gage site which represents the peak discharge events observed at the Project. Figure 4 shows the historically observed instantaneous peak flow events compared to estimated recurrence intervals.

Table 1. Flood Frequency Return Discharges.

Return Frequency (Years)	Exceedance Probability	Discharge (cfs)
1.005	0.995	276
1.010	0.99	307
1.05	0.95	410
1.11	0.9	475
1.25	0.8	565
1.5	0.6667	659
2	0.5	770
2.33	0.4292	821
5	0.2	1028
10	0.1	1185
25	0.04	1370
50	0.02	1500
100	0.01	1622
200	0.005	1740
500	0.002	1890

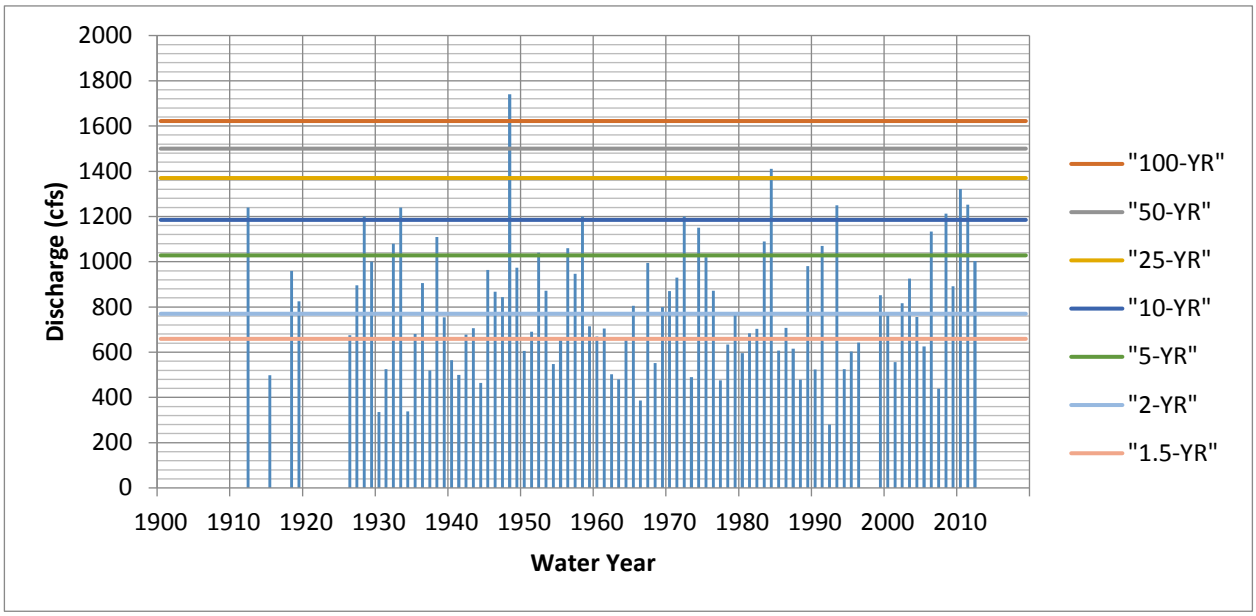


Figure 4. Observed Instantaneous Peak Flows Compared to Estimated Recurrence Intervals.

These instantaneous peak discharges typically fall throughout the months of April and May (85 percent of historical peaks). This is due the late retention of snow within the basin creating a snowmelt dominated watershed at the Project location. Late snow pack and peak runoff in June accounts for another 13 percent of historical peak occurrences with peak flows only occurring prior to April approximately 2 percent of the time. These rare events are likely low elevation rain on snow events that typically happen in late December or early January. The one event that occurred during this time frame was a rain on snow event in early January 1972 where instantaneous peak flows only reached 490 cfs.

5.1.2 Daily Annual Exceedance

In addition to historic recorded peak flows, daily average flows were analyzed for the period of record to estimate daily annual exceedance flows. These average daily flows represent a discharge that is met or exceeded for a certain percentage of the year. For example, fish passage is typically determined for a high flow, 5 percent daily annual exceedance and a low flow, 95 percent annual exceedance. The 5 percent daily annual exceedance flow is observed or exceeded only 5 percent of the year or approximately 18 days while the 95 percent daily annual exceedance flow is observed or exceeded 95 percent of the year or approximately 347 days. Figure 5 shows the daily annual flow exceedance curve for the Project.

The daily average discharge used to evaluate low flow hydraulic conditions for the proposed design is based on the 95 percent daily annual exceedance discharge of approximately 18 cfs. The discharge used to represent high annual flows is the 5 percent daily annual exceedance of approximately 450 cfs. Figure 5 is also used to estimate the average number of days of activation for proposed side channels and other features designed to activate at specific discharges.

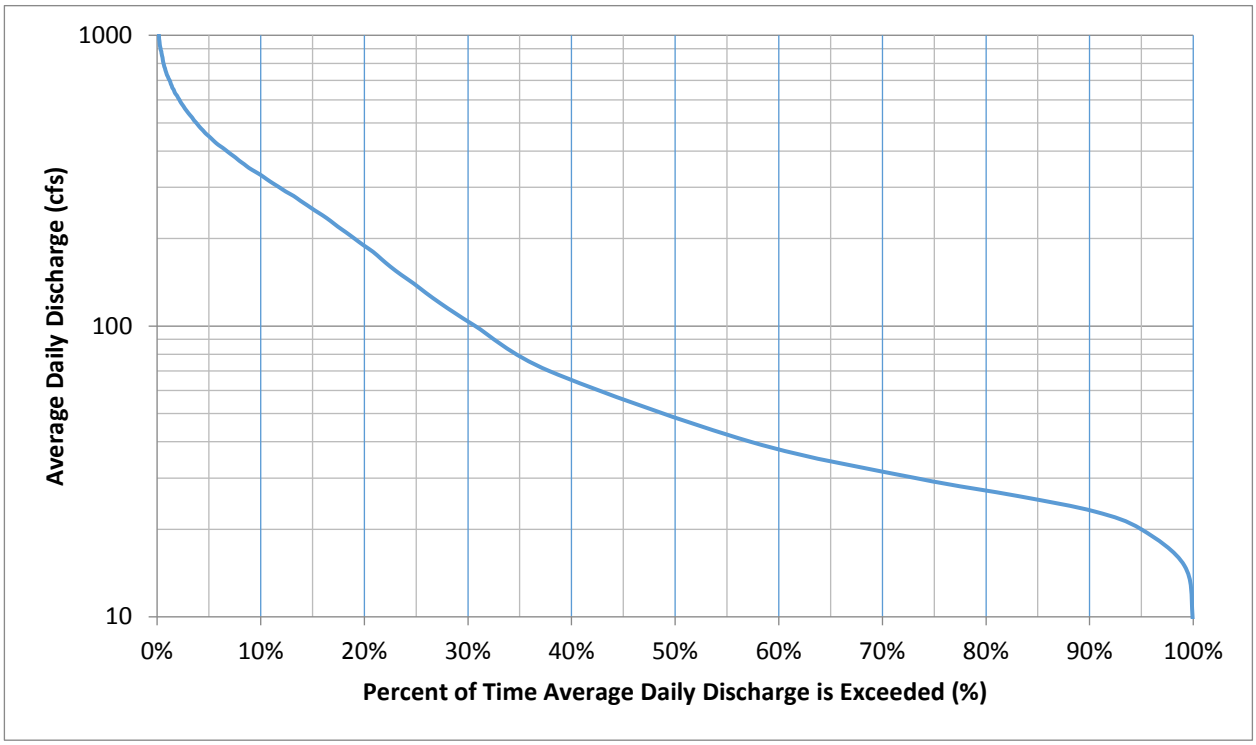


Figure 5. Daily Annual Flow Exceedance Curve for Gage #13320000.

5.1.3 Hydrology and Fish Use

To determine design discharges for side channel activations and alcoves, the fish use periodicity was overlaid with the average annual hydrograph to determine average discharges rates during specific fish use. Figure 6 displays this overlay of fish use and average daily flow at the Project.

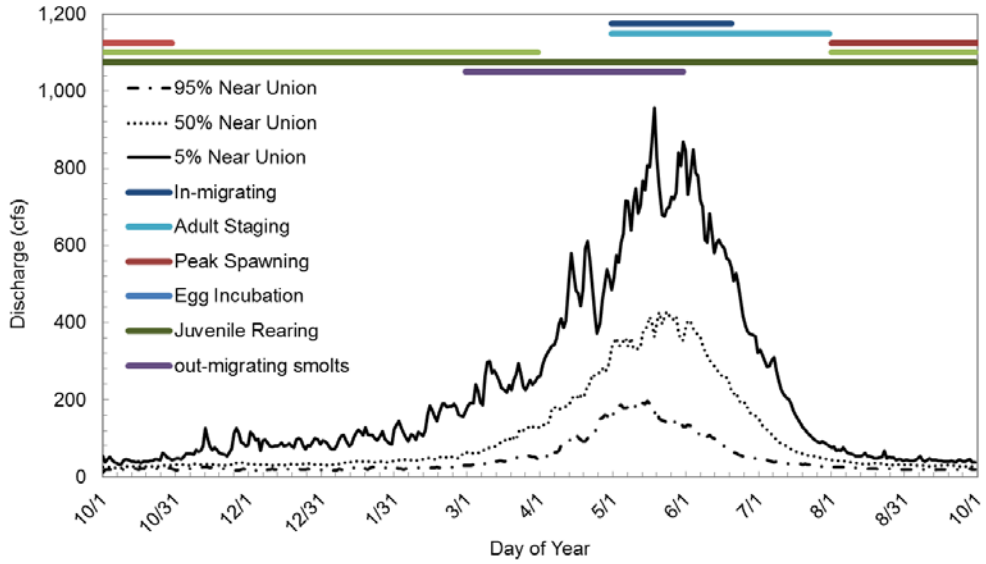


Figure 6. Fish Periodicity and Average Daily Discharge Overlay.

Based on discussions with local fish biologists (CTUIR and ODFW) four critical time frames were evaluated for over-wintering juveniles. This time frame was January through April and the determined critical flows for these months for juvenile salmonids were 40-, 60-, 120- and 280-cfs for January, February, March, and April, respectively.

5.1.4 Groundwater Hydrology

There is no good source for historical groundwater data throughout the Project. The CTUIR installed and monitored 12 shallow groundwater wells throughout Parcel 3 beginning in the winter of 2014 and continuing through the summer of 2015. This data is preliminary, but overall shows a correlation to Catherine Creek stage height implying that the shallow groundwater is fairly well connected to Catherine Creek. Typical low groundwater levels were approximately 30 to 38 inches below the ground surface as shown in Figure 7.

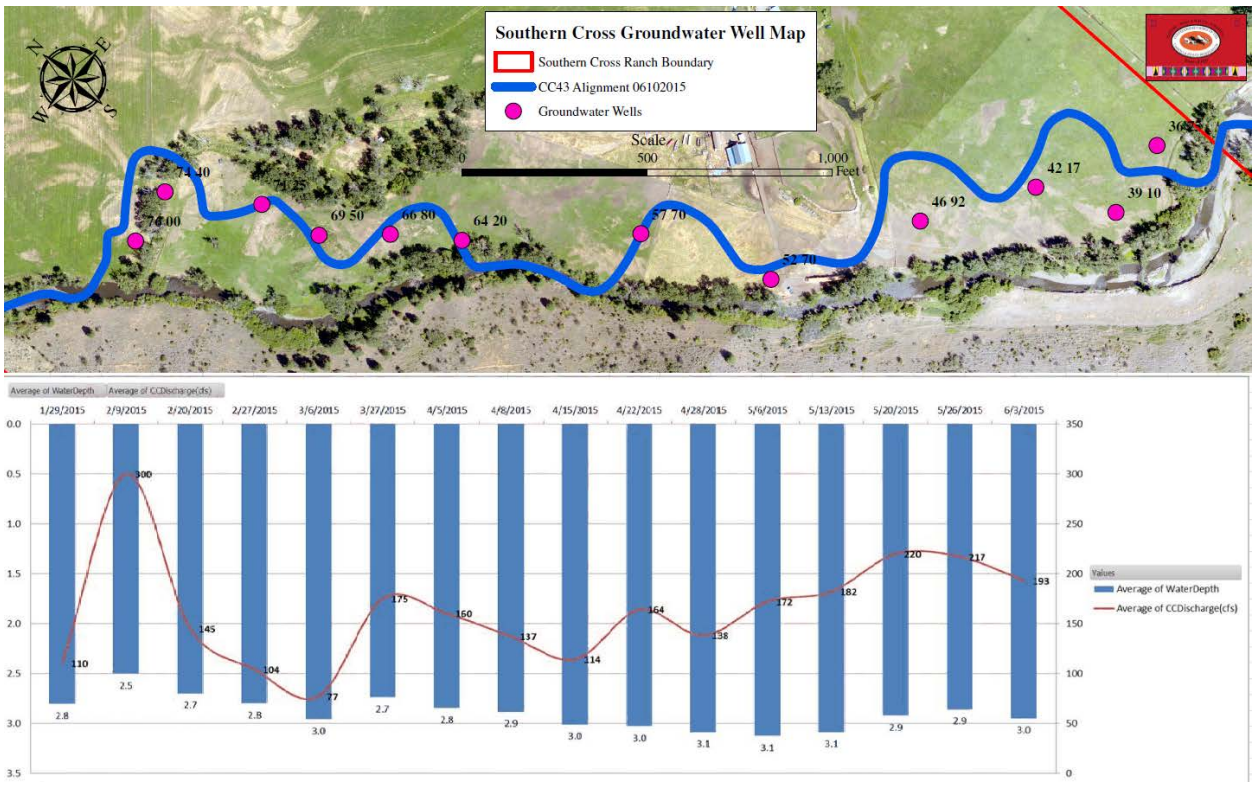


Figure 7. Aerial Location of Groundwater Wells and Average Depth to Groundwater Compared to Average Daily Discharge in Catherine Creek (data provided by CTUIR 2016).

6. Existing Conditions

The existing conditions of Catherine Creek through the Project are defined as predominately a single thread channel with a relatively straight, unconfined channel with a sinuosity of approximately 1.08, with a moderate to low gradient, and with coarse alluvium and colluvium comprising the bed and banks (Reclamation 2012). The channel is typically shallow and over-widened due to degradation in riparian vegetation promoting faster than normal lateral expansion. The existing bed form is dominated by a plane bed geometry with the exception of a handful of forced pools developed from interaction with channel wood and channel bank riparian vegetation (cottonwood trees). These forced pools are short in length, and provide limited deep primary pool habitat. It is estimated that there are 3.9 large pools per mile (Reclamation 2012). There is one small side channel located on Parcel 4 that has developed from lateral migration of the main channel within the last 10 years. This channel was enhanced in 2013 during construction of the first phase of this project. Large woody material jams are limited throughout this reach as active land management has historically cleared debris jams out of the main channel. It is estimated that on average three log jams are present per mile through this reach (Reclamation 2012). A summary of existing conditions can be found in Table 2.

Existing conditions were analyzed electronically based on an electronic Computer Aided Drafting (CAD) surface developed from a conglomeration of sources. Reclamation obtained Light Detection and Ranging (LiDAR) in 2009 and 2011 of the project area and this data was used for representation of floodplain surfaces. Multiple topographic surveys were completed to obtain an accurate representation of existing channel bathymetry including verification of floodplain topography within proposed side channels. These topographic surveys were predominately contracted through Reclamation and were completed between 2009 and 2014. Small additional sections of topographic survey were completed by the CTUIR and were completed between 2013 and 2015. All LiDAR and topographic information were combined into one large existing conditions topographic surface within AutoCAD. This representative surface was used in the development of hydraulic models, the proposed conditions surfaces, and construction quantities. The electronic surface is based on the US State Plane Coordinate System, Oregon North Zone, North American Datum 1983, International Feet. The vertical datum is North American Vertical Datum 1988, feet.

7. Proposed Conditions

Over time, natural alluvial stream systems attain a degree of balance between seemingly opposing forces. For example, in a natural stream system the rate at which a stream's left bank erodes will eventually become equal to the rate at which a gravel bar develops along its right bank due to deposition and vegetation growth. Similarly, erosion and sedimentation along a stream valley becomes balanced such that changes in the stream gradient are gentle over long distances; transitioning from relatively steeper grades upstream to more gentle grades downstream. Such balanced systems are said to be in "dynamic equilibrium" (Hack 1960). Without human intervention such as continued levee construction, riprap placement, removal of riparian vegetation, etc. a disturbed system will naturally attempt to achieve dynamic equilibrium. Depending upon the stream system, this can take from decades to centuries. Our design approach is targeted at fast-forwarding these natural geomorphic processes and promotes a self-sustaining and naturally functioning system. Once established at this geomorphic level, the stream corridor within the project boundary will be the foundation upon which healthy aquatic and riparian habitat will thrive. These habitats will, in turn, help enable the stream to maintain and sustain itself.

The following sections describe the proposed enhancements and basis of design for selected features. Each parcel is described separately as key design staff varied from parcel to parcel, and therefore, basis of design shifted slightly on certain elements. Restoration efforts within the Project are initially based on recommended target conditions obtained from within the Reclamation Reach Assessment for this segment of Catherine Creek along with preferred habitat target conditions for steelhead and Spring Chinook Salmon (Reclamation 2012). Table 2 shows a summary of the historic, existing, and target restoration characteristics while Table 3 shows preferred target conditions for steelhead and Spring Chinook Salmon.

Table 2. Summary of Historic, Existing, and Enhancement Target Conditions (Reclamation 2012).

Form	Historical Condition	Existing Condition	Target Condition
Large Pools (per mile)	5-8	3.9	5-8
Sinuosity	1.09-1.1	1.08	1.09-1.1
Large Woody Material Jams	Unknown	3	5-10
Channel Geometry	Locally entrenched, low width to depth ratio	Locally entrenched, high width to depth ratio	Locally entrenched, low width to depth ratio
Riverbed	Locally armored with coarse alluvium	Locally armored with coarse alluvium and anthropogenic bank hardening (riprap)	Locally armored with coarse alluvium with an increase in abundance and diversity in bedforms
Side Channels	Few	Fewer	Few, more than existing
Floodplain Connection	Locally limited to narrow active floodplain	Locally limited narrow active floodplain further reduced by channelization	Locally limited to narrow active floodplain
Riparian Condition	Multi-age and species of vegetation including mature trees with varied successional stage	Patchy mature trees with a riparian area generally less than 25 feet wide	Multi-age and species of vegetation including mature trees with varied successional stage

Table 3. Preferred Habitat Conditions for Steelhead and Spring Chinook Salmon (Reclamation 2012).

Type	Target
Pool Frequency (pools/mile)	23-47[1]
Large Woody Debris (pieces/mile)	> 20[2]
Width/Max. Depth ratio in scour pools	< 10

1. Pool frequency of 23-47 per mile is based on main channel width of 25-75 feet.
2. Large wood is considered greater than 12 inches in diameter, more than 35 feet long.

Reclamation's historic conditions summary of pools, large pools being between 5 and 8 pools per mile, is contradicted by studies completed in 1934 through 1942 by the U.S. Bureau of Fisheries. From their estimates through this reach there were approximately 20 resting pools per mile on average, which is much closer to the preferred condition for steelhead and Spring Chinook Salmon (McIntosh et al. 1990). It is assumed that a restoration goal closer to the historically documented pool frequency of 20 resting pools per mile is more appropriate for the Project.

Electronic surfaces were developed to represent proposed conditions on each parcel. These surfaces were combined with the original existing conditions surface to create an overall proposed conditions surface that was used to analyze proposed hydraulic conditions, and construction quantities. These electronic surfaces were ultimately used in the final construction drawings for each parcel and are available upon request.

7.1 Parcel 4

The proposed restoration efforts associated with Parcel 4 are designed to largely work within the existing channel alignment and existing conservation easement. Enhancement efforts work on reducing the overall channel width to depth ratio, enhancing and creating additional pools, development of periphery habitat including the creation of multiple side channels and alcoves, slight increase in floodprone area during high frequency flood recurrence intervals (1.5-, 2-year, etc.) and the creation of instream habitat complexity through the placement of LWM structures. The slight increase in floodprone area during high frequency events shall provide more suitable habitat for riparian development and growth to promote long-term riparian and floodplain processes and interaction. The proposed design for Parcel 4 as shown in Appendix D, meets the goals and objectives of this project while taking into account the design constraints associated with this parcel. Table 4 below summarizes proposed habitat features associated with Parcel 4.

Table 4. Summary of Proposed Conditions.

Characteristic	Proposed Conditions
	Parcel 4
Main Channel Length (ft)	3,700
Sinuousity (ft/ft)	1.28
Number of Perennial Side Channels	1
Number of Emphemeral Side Channels	4
Side Channel Length (ft)	2,400
Pools	8
Pools (pools per mile)	11
Bankfull Width (ft) - 1.5 year	50
Bankfull Depth (ft) - 1.5 year	2
Inundation Area (Acres) - 2 year	16.1
Large Woody Material (pieces per mile) - Key Members Only	365
Large Woody Material (pieces per mile) - based on TA criteria	11

7.1.1 Main Channel

Proposed modifications to the main channel are centered around reducing bankfull width to depth ratios and increasing pool frequency, and quality. The existing channel planform is relatively straight with a measured sinuosity through Parcel 4 of 1.16. The over widened channel allows for the development of small increases in meander length as the proposed channel moves from one bank to the other within the existing channel footprint. The proposed alignment creates a proposed sinuosity of 1.28 through Parcel 4. These small meanders allow for the development of multiple split flow channels or high flow channels, and alcoves throughout the proposed project. This attempts to reduce bankfull widths and low flow widths while maintaining the existing floodplain elevations and connectivity. In one particular location where the existing conservation easement was slightly wider than normal we proposed the development of a new riffle and meander bend near main channel Station 16+00. This design methodology develops a minimum of two split channel segments and one new meander with a downstream alcove that could be overtopped during the 1.5-year discharge.

Other portions of the Parcel 4 channel will not be modified, leaving some riffle and pool locations intact or shifted slightly upstream or downstream. The width of the channel is often reduced by filling in from one or both bank edges to a more appropriate width. These fill locations were limited to adjacent bank heights often due to intact young riparian vegetation. The location and extent of the riffles and pools were through the remeandered sections and defined based on the planform of the proposed alignment. Where existing pools and riffles were located, they were often enhanced through the development of smaller radii of curvature or the placement of suitable channel bed material.

There are two split flow channel segments within the proposed design for Parcel 4. The first split flow is located from main channel Station 7+50 to 10+25 and utilizes a small existing split channel. The main channel is designed to accommodate approximately 90 percent of the bankfull discharge while the split channel will convey the remaining 10 percent. This channel will be formed mainly through the enhancement and enlargement of an existing gravel bar located between the two channels. The second split flow channel segment is located from main channel Station 11+75 to 15+10 and utilizes a small existing channel along the right bank. The main channel (left channel) is designed to accommodate approximately 80 percent of the bankfull discharge while the split channel (right channel) will convey the remaining 20 percent. This channel will be formed mainly through the enhancement and enlargement of an existing island between the two channels preserving a large vegetated portion of that island.

Riffles

There are five riffle crest within the proposed channel grading activities. Four of these riffles are designed at existing channel invert elevations and will not be modified. One riffle (Sta. 16+42) is a constructed riffle. The slope of the riffle was based on identified planform

locations of habitat types (riffle, pool, glide, etc.) along with the downstream riffle crest elevation. The average riffle to riffle slope through this area is 0.005 ft/ft. The designed riffle is approximately 50 feet long prior to transitioning to a run with a slope of 0.028 ft/ft. Riffles were designed to convey the 1.5-year discharge prior to overtopping. This discharge was considered the bankfull discharge for the Parcel 4 design.

The riffle crest cross section has a designed bankfull width of approximately 50 feet with an average depth at the riffle of approximately 2.7 feet. This geometry was developed from looking at analog conditions with Catherine Creek upstream of the project through the Hall Ranch reach in addition to various imperical formulae that predict bankfull width and depth based on channel characteristics including bankfull discharge, basin area, average sediment size, etc. The cross section is trapezoidal in shape with a small slope within the flat portion of the trapezoidal down to the thalweg elevation. This taper from the toe of slope down to the thalweg elevation provides some collection of flow during low flow conditions to maximize low flow depth. Low flow width is designed to be approximately 40 feet with an average depth of 0.7 feet. Bank side slopes are designed to be 1.5:1 (horizontal:vertical).

The constructed riffle at Sta. 16+42 will require existing material to be overexcavated and replaced with a specified gradation that is anticipated to be stable at the 1.5-year flow event as shown in Table 5. Additional washing in of fines into the voids is also specified to prevent flow from going subsurface. If existing riffles are not composed of acceptable materials, they shall be overexcavated and replaced with specified riffle materials.

Table 5. Specified Riffle Matrix Gradation.

Percent Finer	Size Range
D100	> 10"
D84	8" - 10"
D50	4" - 6"
D15	< 4"

D100, 84, 50 and 15 represent the size class of material that is smaller than the specified size. (e.g. D84 is the size that 84 percent of the material by weight is smaller than).

Pools

There are five enhanced or constructed pools throughout Parcel 4. Within these pools there are two geometric variations. The first type of pool is designed to allow 5 feet of large wood to occupy the pool channel section. The remaining pool section is 8 feet to 10 feet from the face of the wood structure to the toe of the point bar. The point bars are designed so that the grade breaks are a foot higher than the interpolated riffle crest elevation at a given station creating a narrow low flow channel width through this pool section with shallow overtopping flows above low flow condition across the point bar. The slope from the toe up to the grade

break is approximately 2:1 (horizontal:vertical) and was based on a slightly flatter slope than the angle of repose of the channel bed material. The upper end of the point bar has a flatter slope, which varies from site to site due to varying bank heights, and daylights from the grade break to the top of bank. The material on the point bars is existing well-graded 6”-minus material that is designed to be mobile at the 1.5-year discharge. The second type of pool is shaped by excavating the streambed and using that excavated material to create the gravel bar. Since the channel varies in width and height to the top of bank, only the low flow section is designed so it is similar to the first pool. The gravel bar material is the in-situ material from the excavated side of the channel.

Glides

Glides were designed as a smooth transition point from the end of a pool to the downstream riffle crest. The glides were designed to have a negative slope out of the pool up to the riffle crest of 1 to 2 percent. This slope is based off of reviewing pool and glide exit slopes immediately upstream of the project and through the Hall Ranch reach. Glides are typical zones of spawning activity where fish prefer clean gravel with limited fines. Glides shall be evaluated on site to determine if they are composed of suitable material. They can be left intact if suitable material is present, otherwise glides shall be overexcavated 1 foot and replaced with acceptable material that meets the specific gradation in Table 6 below.

Table 6. Specified Glide Matrix Gradation.

Percent Finer	Size Range
D100	> 4"
D10	< 1"

D100, 10 represent the size class of material that is smaller than the specified size. (e.g. D10 is the size that 10 percent of the material by weight is smaller than).

7.1.2 Side Channels

There are four proposed side channels located throughout Parcel 4. All of these side channels are designed to activate at a range of discharges based on potential fish use and juvenile refuge during high flows and low winter flows. All side channels shall be activated at the 1.5-year return interval discharge. All side channels have shaped alcoves near the downstream end of the channel to provide backwater connection during low flow.

Side Channel 1 is a back-bar channel that follows an existing depression along the margin between the floodplain terrace and the point bar consisting of gravel and cobble material and is approximately 400 feet long and has an average channel slope of 1.4 percent. The channel

is designed to be trapezoidal in shape with a 6 foot bottom width and 1.5:1 (horizontal:vertical) side slopes. This channel is a high flow side channel and is designed to activate near the 1.5-year discharge. The channel construction will largely be field-directed and approved by the Contracting Agency. The shaping of the side channel is intended to keep the existing vegetation intact. The downstream end of the side channel has a steeper slope to tie into the channel invert of the main channel. This steeper slope is set at 5 percent and shall be overexcavated 6 inches below design grade and replaced with 6-inch minus rounded gravels to protect the side channel from headcutting. This alcove provides approximately 50 feet of backwater habitat during low flow conditions.

Side Channel 2 follows an old channel scar along river left. The shaping of this side channel will consist primarily of removing the high points along the approximate alignment as directed and approved by the Contracting Agency. The proposed side channel is approximately 420 feet long with an average slope of 0.9 percent. The channel is designed to be trapezoidal in shape with a 3 foot bottom width and 1.5:1 side slopes. This channel is a high flow side channel and is designed to activate near the 1.5-year discharge. The contractor will be expected to use small equipment during the excavation, as well as minimize disturbance of existing vegetation. The downstream end of the side channel has a steeper slope to tie into the channel invert of the main channel. This steeper slope is set at 5.6 percent and shall be overexcavated 6 inches below design grade and replaced with 6-inch minus rounded gravels to protect the side channel from headcutting. This alcove provides approximately 60 feet of backwater habitat during low flow conditions.

Side Channel 3 follows a historic diversion channel with mature shrubs and trees, overhanging fallen logs, and well-vegetated channel bottom. This channel is approximately 855 feet long with an average channel slope of 0.9 percent. This channel is designed to be trapezoidal in shape with a 6-foot bottom width and 1.5:1 side slopes. This channel is designed to activate near a discharge of 150 cfs which should provide activation on average of 88 days per year. The downstream end of the side channel has a steeper slope to tie into the channel invert of the main channel. This steeper slope is set at 20 percent and shall be overexcavated 6 inches below design grade and replaced with 6-inch minus rounded gravels to protect the side channel from headcutting. This steep slope is designed to be fully submerged even during low flows. This alcove provides approximately 100 feet of backwater habitat during low flow conditions. There are at least two noted locations where field-directed excavation of high points will be necessary to maintain a downsloping longitudinal profile.

Side Channel 4 begins in a historic diversion channel and then sharply turns to follow a heavily vegetated ditch that historically acted as the fish bypass return channel back to the main channel. This side channel is approximately 490 feet long with an average channel slope of 0.9 percent. This channel is designed to be trapezoidal in shape with a 6-foot bottom width and 1.5:1 side slopes. This channel is designed to activate near a discharge of 40 cfs which should provide activation on average of 208 days per year. The downstream end of the

side channel has a steeper slope to tie into the channel invert of the main channel. This steeper slope is set at 5 percent and shall be overexcavated 6 inches below design grade and replaced with 6-inch minus rounded gravels to protect the side channel from headcutting. This alcove provides approximately 130 feet of backwater habitat during low flow conditions. This channel has been designed where excavation is only required at the upstream and downstream ends. High points between these excavation zones will be excavated as directed and approved by the Contracting Agency. The contractor will be required to cause minimal disturbance of the existing vegetation.

7.1.3 Alcoves

There are two alcoves proposed on Parcel 4. Alcove 1 is located off of the right bank of the main channel near Station 10+25. Alcove 1 collects water from over bank flow off of an outside meander bend and channels it back to the main channel. This alcove is an enhancement effort to an existing low lying swale. Alcove 1 is approximately 270 feet long with an average slope of 0.8 percent. In addition to the overbank flow, Alcove 1 also receives excess flow from an existing irrigation diversion bubbler screen. This input of water is seasonal and not a continuous source of water. It is anticipated that these frequent flows will assist in removal of sediment and organic debris that tends to accumulate in backwater areas like alcoves, thereby extending its design life. During low flow conditions this alcove will provide approximately 100 feet of backwater habitat.

Alcove 2 is located off of the right bank of the main channel near Station 18+50. Alcove 2 is approximately 65 feet long with a flat bottom slope that ties into the main channel's thalweg elevation. Alcove 2 has a typical trapezoidal cross section starting with a narrow bottom width of 4 feet and expanding to a bottom width of 15 feet. This alcove will see overtopping flows from the main channel during a 1.5-year discharge. It is anticipated that these frequent flows will assist in removal of sediment and organic debris that tends to accumulate in backwater areas like alcoves, thereby extending its design life. During low flow conditions this alcove will provide approximately 55 feet of backwater habitat.

7.1.4 Large Woody Material Structures

There are multiple locations and types of LWM structures proposed throughout Parcel 4 to increase hydraulic diversity, increase aquatic habitat, and to aid in flow deflection and bank retention. Table 7 displays the various types of proposed structures and the number of structures located within Parcel 4. The descriptions below discuss each specific type of LWM structure.

Table 7. Parcel 4 Typical Large Woody Material Structures.

LWM Structure Type	Quantity
Side Channel Inlet	1
Streambank Habitat	4
Tight Radius Bend	4
Mild Radius Bend	4
Sweeper Log	2
High Energy	4
Small Apex Jam	7
Large Apex Jam	2
Brush Mattress	578 lineal feet
Edge Roughness	365 lineal feet
Single Log with Rootwad	34
Treetop with Branches	25
Floodplain Log	4

Side Channel Inlet LWM Structure – This LWM structure is proposed for only one location and was designed specifically for the channel and floodplain geometry of that location. This LWM structure is located at the upstream end of Side Channel 1 and includes logs that occupy a significant portion of the floodplain and are oriented in a manner that will deflect flow towards Side Channel 1. The intent of the floodplain logs are to increase the amount of flow that enters Side Channel 1 when flow overtops the left bank of the creek. This structure also includes three logs with rootwads that project into the low flow portion of the channel (Table 8). These in-channel logs and rootwads are intended to enhance an existing scour hole at this location and to provide edge roughness and create habitat diversity along the creek channel's left bank.

Table 8. Side Channel Inlet Structure Material Schedule.

Log Type	Material Size	Quantity
A	10' Long, 12" DBH log	1
D	15' Long, 12" DBH log with Rootwad	1
E	20' Long, 12" DBH log with rootwad	4
Racking Material	4'-10' Long, 3"-9" Dia. Log	12

Streambank Habitat LWM Structure – This LWM structure is intended to provide aquatic habitat without influencing the overall flow characteristics of the creek. The structure includes several logs with rootwads anchored in the bank along with one large log pinned in the exposed portions of the anchored logs, and some racking material and slash to create

diversity to the structure (Table 9). This structure will be placed at locations where the existing channel lacks edge habitat but where the overall flow characteristics are acceptable. This structure will extend far enough into the channel and provide variable sized material to create locations along the channel edge with zero or near-zero flow velocity for salmonids to utilize. However, the structure will not redirect the flow enough to cause a noticeable change in the location or direction of the overall channel. Localized scour holes are expected to be created and persist off the tips of these structures.

Table 9. Streambank Habitat Structure Material Schedule.

Log Type	Material Size	Quantity
C	15' Long, 12" DBH Log	1
D	15' Long, 12" DBH log with rootwad	1
H	20' Long, 18" DBH log with rootwad	2
K	25' Long, 18" DBH log with rootwad	1
N	30' Long, 18" DBH log with rootwad	2
Racking Material	4'-10' Long, 3"-9" Dia. Log	15
Slash Material	Tree tops, limbs with branches and needles	0.5 CY

Total number of Streambank Habitat LWM Structures = 4

Tight Radius Bend LWM Structure – This LWM structure is intended to provide a combination of aquatic habitat and channel bank stability at locations of existing or designed tight radius bends in the channel (Table 10). The structure includes multiple logs with and without rootwads extending from the bank into the channel. This structure has multiple layers of logs, including logs angled at varying elevations, to provide habitat through a large range of flow conditions. The structure is relatively dense because of the high flow energy that will be directed into the structure and high flow momentum that will need to be redirected by the structure. The structure is intended to preserve the tight radius bend in the channel without allowing noticeable bank erosion for several decades into the future. A deep scour pool is expected to develop and persist at the front side of the structure, but the structure is expected to allow insignificant amounts of erosion to the upper bank.

Table 10. Tight Radius Bend Structure Material Schedule.

Log Type	Material Size	Quantity
A	10’ Long, 12” DBH Log	2
F	20’ Long, 15” DBH log	2
G	20’ Long, 15” DBH log with rootwad	2
H	20’ Long, 18” DBH log with rootwad	1
J	25’ Long, 15” DBH log with rootwad	3
N	30’ Long, 18’ DBH log with rootwad	8
Racking Material	4’-10’ Long, 3”-9” Dia. Log	30
Slash Material	Tree tops, limbs with branches and needles	2 CY

Mild Radius Bend LWM Structure – This LWM structure is intended to provide the same functions as the Tight Radius Bend LWM Structure except at locations along the outside of bends with larger radii where the momentum of flow being redirected is less and the layout of the structure could be less dense (Table 11).

Table 11. Mild Radius Bend Structure Material Schedule.

Log Type	Material Size	Quantity
A	30’ Long, 16”-18” DBH log with rootwad	2
G	25’ Long, 15” DBH Log with rootwad	1
L	30’ Long, 15” DBH log with rootwad	12
M	30’ Long, 18” DBH log with rootwad	1
N	40’ Long, 18” DBH log with rootwad	1
Racking Material	4’-10’ Long, 3”-9” Dia. Log	30
Slash Material	Tree tops, limbs with branches and needles	2 CY

Sweeper Log LWM Structure – This LWM structure is intended to provide localized aquatic habitat along the bank and in the low flow channel of the creek. The structure consists of several logs, some of which are included only to provide long term stability (Table 12). The primary component of the structure is the log that is oriented parallel to the direction of flow and covers the entire bank height with the end projecting into the low flow channel. The purpose of this structure is to mimic the habitat created when a tree at the edge of the bank is undermined and topples over into the creek. Leaving a rootwad up on the floodplain and a tree top projecting down into the low flow channel.

Table 12. Sweeper Log Structure Material Schedule.

Log Type	Material Size	Quantity
N	30' Long, 16" – 18" DBH Log with rootwad	4
Tree Top	25' Long, with branches	1
Racking Material	4'-10' Long, 3"-9" Dia. Log	10
Slash Material	Tree tops, limbs with branches and needles	1 CY

High Energy LWM Bank Structure – This LWM structure is intended to provide a combination of aquatic habitat and channel bank stability at the locations of highest flow energy striking the bank. This structure will be placed at locations where flow is oriented almost directly at the bank and will make a sudden turn, creating a large scour pool at the face of the structure. The structure includes multiple logs with and without rootwads extending from the bank into the channel (Table 13). This structure has multiple layers of logs, including logs angled at varying elevations, to provide habitat through a large range of flow conditions. The face of the structure is very dense because of the high flow energy that will be directed into the structure and need to be redirected by the structure.

Table 13. High Energy Bank Structure Material Schedule.

Log Type	Material Size	Quantity
F	20' Long, 15" DBH log	2
G	20' Long, 15" DBH Log with rootwad	4
H	20' Long, 18" DBH log with rootwad	6
J	25' Long, 15" DBH log with rootwad	2
O	40' Long, 18" DBH log	1
Racking Material	4'-10' Long, 3"-9" Dia. Log	25
Slash Material	Tree tops, limbs with branches and needles	1.5 CY

Small Apex Jam LWM Structure – This LWM structure is intended to be placed within the main channel on gravel bars. The primary function of this structure is to maintain the location and shape of the gravel bars by assisting in recruitment of streambed sediments behind the structures. The secondary function is to slightly redirect flow, either into secondary channels or back into the main channel. These structures will typically be overtopped by flow during very large peak flow events such as the 100-year peak flow (Table 14).

Table 14. Small Apex Jam Structure Material Schedule.

Log Type	Material Size	Quantity
H	20' Long, 16" – 18" DBH Log with rootwad	2
P	10' Long, 18" DBH Log	1
Racking Material	4'-10' Long, 3"-9" Dia. Log	8

Large Apex Jam LWM Structure – This LWM structure is intended to be placed within the main channel on gravel bars. The primary function is to significantly influence flow distribution. These LWM structures have a frontal face that is about 20 feet wide and are sufficiently high so that flow will not overtop them during a 100-year peak flow event. The large blunt face of these structures coupled with no flow overtopping will result in significant flow redirection during channel forming flow events. Along with redirecting flow, there will be an area of zero to very low velocity behind each structure that will encourage sediment deposition during channel forming flow events (Table 15).

Table 15. Large Apex Jam Structure Material Schedule.

Log Type	Material Size	Quantity
A	10' Long, 12" DBH log	2
H	20' Long, 16" – 18" DBH Log with rootwad	9
I	25' Long, 12" DBH log	3
Racking Material	4'-10' Long, 3"-9" Dia. Log	40

Brush Mattress – This feature is intended to be placed along the edges of the main creek channel to provide roughness and habitat complexity. Brush Mattress is a linear feature typically placed along riffles and glides where flow is tangent and there are minimal erosional stresses directed at the banks. The structure includes layers of dead brush and live pole cuttings set into the bank near the low flow channel edge. Both the dead brush and live cuttings will provide roughness near the channel margin immediately, with the goal of establishing mature willows from the live cuttings to provide benefits for the long term.

Edge Roughness LWM Structure – This LWM structure is intended to be placed along the edges of the main creek channel to provide roughness and habitat complexity. These structures are a linear feature typically placed along riffles where flow is tangent and there are minimal erosional stresses directed at the banks. The structure includes layers of dead brush and live pole cuttings. These LWM structures are similar to a live brush mattress edge treatment, but includes logs with rootwads and racking material to create a more dense and robust configuration of woody material.

Single Log with Rootwad – This feature is just individual logs with rootwads placed at locations to improve habitat value. These logs are expected to be smaller diameter (e.g., 6 to 10 inches) than the key members that make up complex LWM structures; however, larger diameter logs are allowable. These logs are typically placed in or crossing side channels or other areas where flow occurs at shallow depths and low energy. These logs do not have a specific design on how they will be anchored, but instead will rely on "field fitting" to secure them. These logs will be secured by either wedging them against live trees or embedded into the bank or floodplain surface.

Tree Top with Branches – This feature is similar to the Single Log with Rootwad except that they consist of the top of a conifer species tree including intact branches. These tree tops are typically placed in or crossing side channels or other areas where flow occurs at shallow depths and low energy. These tree tops do not have a specific design on how they will be anchored, but instead will rely on "field fitting" to secure them. These tree tops will be secured by either wedging them against live trees or embedded into the bank or floodplain surface.

Floodplain Log – This feature consists of single logs 20 feet long 18 inch DBH with rootwads that are partially embedded into the floodplain surface to increase roughness of the floodplain, create a diversity of hydraulic characteristics across the floodplain, and assist in establishment of live woody vegetation on the floodplain. Because these logs are placed on floodplain surfaces that have a few feet of inundation during flood events, and will experience flows with moderate velocities, about half of each log is buried into the floodplain surface.

7.1.5 Riparian Planting

Revegetation efforts are focused on developing a robust and diverse riparian environment enveloping the entire restoration reach. The establishment of healthy, self-sustaining native vegetative community throughout the project site is vital to the success of the Project. Revegetation immediately after grading provides key initial site stabilization and energy dissipation even as the plants begin to provide food web support. Such communities promote short-term and long-term bank stabilization; shade for cooler water; protective cover for fish; habitat for terrestrial wildlife (birds, mammals, amphibians, and macroinvertebrates); and woody debris recruitment in the future. A robust riparian plant community also provides greater protective cover, food sources, habitat complexity and diversity, and migration continuity for the larger ecosystem.

The species of plants proposed in this plan vary in relation to the stream's bankfull elevation, with the more hydrophytic plants closer to the stream and the more drought-tolerant species at higher elevations. The proposed vegetation consists of plant species native to the area that are typically found at similar sites within the region. Where possible and appropriate based on plant condition, clumps of existing shrubs (particularly willow) may be salvaged during construction. Willows that cannot be salvaged as whole plants can provide whips to be used as live stakes.

Revegetation activities will occur immediately following earth moving activities. Once the final grade has been attained, all disturbed areas will be replanted as appropriate. The proposed planting plan developed by the Reclamation and the updated planting plan developed by the USWCD is attached as Appendix E.

Four "Planting Zones" have been identified based on elevations relative to the proposed bankfull elevation of the creek. These zones include the Bank Zone, Riparian, Live Stake, and Live Brush Trench. Specific plant communities have been chosen for each zone that reflects the anticipated hydrology available for each zone. Grading has been designed to avoid areas with unburned vegetation. Descriptions of each zone and respective plant communities are contained in the following sections. Typical planting spacing and seed application rates can be found within the planting plans found in Appendix E.

Bank Zone

Streambank vegetation will be dominated by a dense shrub community. Limits of the bank zone were delineated based on the limits of the 5 percent and 2-year limits of inundation from the 2-dimensional hydraulic model for the proposed condition. The proposed vegetation will consist of live cuttings, plugs, and container plants. The densities of cuttings/plugs will vary based on their respective locations along the stream channel. However, in most cases, the willow cuttings should be spaced at approximately 3-foot on-center intervals when located at the outside of channel meanders and further apart (5-foot on-center intervals) in areas where streambank protection is less of a concern (for example, the inside of channel meanders and along straight sections). Sedge plugs should be spaced approximately 2-foot on-center and should be scattered randomly throughout the zone. Species that will be used in the Bank Zone are listed below.

- McKenzie Willow (*Salix prolixa*)
- Black Cottonwood (*Populus trichocarpa*)
- Coyote Willow (*Salix exigua*)
- Nebraska Sedge (*Carex Nebrascensis*)
- Red Osier Dogwood (*Cornus sericea*)
- Black Cottonwood (*Populus trichocarpa*)
- Speckled Alder (*Alnus incana*)
- Black Hawthorne (*Crataegus douglasii*)
- Water Birch (*Betula occidentalis*)

Riparian Zone

The proposed vegetation structure for the Riparian Zone will consist of an open forest with shrub understory and herbaceous groundcover. This zone is a transition between the bank and upland zones. Limits of the Riparian zone were delineated based on the limits of the 2-year and CREP boundary which is near the 10-year inundation limit. Inundation limits were generated from the 2-dimensional hydraulic model for the proposed condition. The proposed vegetation listed below will be applied as a combination of live cuttings, container plants and plugs. The species proposed for the Riparian Zone are listed below.

- Pacific Willow (*Salix lucida*)
- Black Cottonwood (*Populus trichocarpa*)
- Red Osier Dogwood (*Cornus sericea*)
- Black Hawthorne (*Crataegus douglasii*)
- Water Birch (*Betula occidentalis*)
- Speckled Alder (*Alnus incana*)
- Snowberry (*Symphoricarpos albus*)
- Woods' Rose (*Rosa woodsia*)
- Chokecherry (*Prunus virginiana*)
- Blue Elderberry (*Sambucus nigra*)
- Golden Currant (*Ribes aureum*)

Live Stake Zone

The live stake zone is the wettest zone within the enhancement area. This zone is located between the 120 cfs and 5 percent inundation limits based on the 2-dimensional hydraulic model for the proposed condition. The only species proposed for the Live Stake Zone is Mackenzie Willow (*Salix Prolixa*) with a recommended spacing of 5-foot on-center.

Live Brush Trench

The live brush trench zones will be strategically located in areas primarily within the bank zone that would benefit from the additional structure provided by the brush trench. The following species will be used for the live brush trench.

- McKenzie Willow (*Salix prolixa*)
- Black Cottonwood (*Populus trichocarpa*)
- Coyote Willow (*Salix exigua*)

Seed mix for Bank and Riparian Zones

The proposed seed mix for these two zones will include a combination of grasses and other forbs including:

- Tufted hairgrass (*Deschampsia Cespitosa*)
- Nebraska sedge (*Carex Nebrascensis*)
- Small fruited bull rush (*Scirpus Microcarpus*)
- Idaho fescue (*Festuca idahoensis*)
- Bluebunch wheatgrass (*Agropyron spicatum*)
- Blue wildrye (*Elymus glaucus*)
- Sherman big bluegrass (*Poa secunda*)
- Grande ronde basin/trailhead wildrye (*Leymus cinereus*)

Seed mix for Access/Staging Zones

The proposed seed mix for this zone will include a combination of grasses including:

- Tufted hairgrass (*Deschampsia cespitosa*)
- Idaho fescue (*Festuca idahoensis*)
- Bluebunch wheatgrass (*Agropyron spicatum*)
- Blue wildrye (*Elymus glaucus*)
- Sherman big bluegrass (*Poa secunda*)
- Grande ronde basin/trailhead wildrye (*Leymus cinereus*)

7.2 Parcel 3

Parcel 3 is currently owned and operated by the CTUIR and the proposed design through this has evolved from earlier stages due to an increased desire to re-establish fully functional natural processes through this section of the Project. Proposed enhancements associated with Parcel 3 include the creation of a new main channel alignment that meander throughout the floodplain promoting more floodplain interaction including two side channels, six floodplain swale complexes, three alcoves, and numerous instream habitat boulders and instream and floodplain LWM for habitat complexity, and channel and floodplain roughness. The proposed enhancements associated with Parcel 3 are described in more detail below. The design drawings for Parcel 3 can be found in Appendix F. Table 16 summarizes proposed habitat features associated with Parcel 3.

Table 16. Summary of Proposed Conditions.

Characteristic	Proposed Conditions
	Parcel 3
Main Channel Length (ft)	4,413
Sinuousity (ft/ft)	1.42
Number of Perennial Side Channels	4
Number of Emphemeral Side Channels	23
Side Channel Length (ft)	14,913
Pools	17
Pools (pools per mile)	20
Bankfull Width (ft) - 1.25 year	42 – 54
Ave. Bankfull Depth (ft) - 1.25 year	2.0 – 2.2
Inundation Area (Acres) - 2 year	39.2

Characteristic	Proposed Conditions
	Parcel 3
Large Woody Material (pieces per mile) - Key Members Only	1,675
Large Woody Material (pieces per mile) - based on TA criteria	90

7.2.1 Main Channel

The proposed main channel is predominately located outside of its current alignment. Its current alignment is locked in against the left valley toe and has been locked in that location for over 75 years based on historical aerial imagery and historical accounts of anthropogenic affects from a previous landowner. The proposed main channel alignment is designed to develop a more sinuous channel with a more appropriate meander pattern, belt width, and wider more robust riparian corridor. The existing channel planform is relatively straight with a measured sinuosity through Parcel 3 of 1.10. The proposed alignment creates an approximately 5,000-foot-long main channel through Parcel 3 with a new sinuosity of approximately 1.40. Proposed modifications to the main channel are centered around reducing bankfull width to depth ratios, reducing low flow top width (increasing low flow depth) and increasing pool frequency, and quality.

In addition to the proposed changes in main channel planform, the goal of increasing in-channel diversity led the design goal of transitioning the main channel from a plane bed channel to a riffle – pool sequence channel. A variable vertical profile was created that transitions from riffle crests to pools, to glides, and back to riffles. This natural planform was based on observed channel profiles in analog reaches within Catherine Creek on the Hall Ranch reach and at other isolated locations within Catherine Creek on Parcel 4. These observations provided the templates for variations in profile, planform, and section and are discussed in more detail below in the riffle and pool sections.

The proposed channel being newly constructed allows for the channel to be constructed to design geometries to provide floodplain activation at desired discharges. In eastern Oregon, the channel forming flow is often related to the 1.2- to 2-year discharge (Castro and Jackson 2001). With one of the design objectives to increase floodprone areas, the baseline main channel design discharge used was on the more frequent return interval of 1.25 years. In addition to this measurement, the effective discharge was estimated for the existing channel based off the existing one-dimensional hydraulic model prepared by Reclamation, and sediment transport pebble count data provided by Reclamation. Based on the long historic gage record upstream of the project site, at site channel hydraulics at five typical cross sections located throughout the project area, the effective discharge for the effective channel

through Parcel 3 is estimated to be 434 cfs. This is 131 cfs lower than the 1.25-year discharge of 565 cfs. With the design of side channels, swale complexes, etc., it was a design goal to maintain a minimum discharge equal to the estimated effective discharge of 434 cfs within the main channel to provide an effective discharge within the proposed channel equal to the effective discharge of the existing conditions. This provides at the most 131 cfs to be dispersed throughout the floodplain during a 1.25-year event.

Riffles

Riffles act as the vertical control of a channel regulating the amount of discharge through the main channel prior to overtopping it banks and activating its floodplain. It is the riffle cross section that controls the conveyance capacity of the channel through a riffle pool sequence. Each riffle designed within Parcel 3 was designed based off a desired discharge through that reach depending on upstream floodplain activation, side channels, etc. Appropriate riffle cross sections were evaluated from analog conditions on Catherine Creek within the Hall Ranch reach as well as numerous empirical formulae. The cross section shape regardless of the design discharge was consistent and was designed to convey the design discharge as well as trying to reduce low flow top width (increase low flow depth). This resulted in a two stage channel as depicted in Figure 8. This two stage channel has the inset channel shaped as a 'V' so that low flow tends to concentrate toward the center of the thalweg. The inset channel was designed based on maintaining a minimum channel depth at riffle crests of 1 foot (maximum depth) at the 95 percent annual exceedance discharge of 18 cfs. This inset channel reduces top width at low flows reducing solar thermal inputs while trying to maximize depth for fish passage. The second stage channel was more trapezoidal in shape with a sloping bottom. The sloping bottom of the channel reduces the immediate bank height at the edges of the channel creating a short height of potential bank erosion.

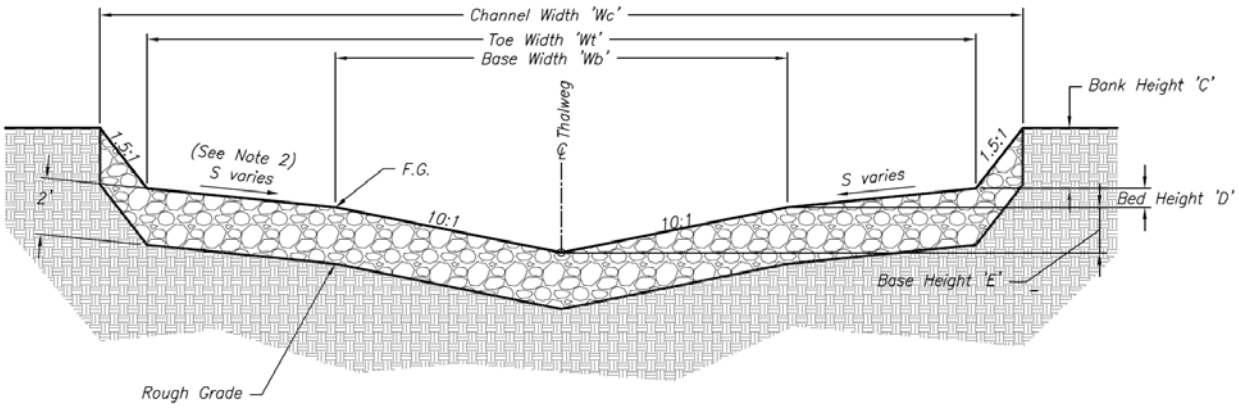


Figure 8. Typical Riffle Crest Cross Section.

The estimated and associated design discharge for the main channel is approximated as the 1.25-year discharge with a desired minimum flow in the main channel exceeding the effective discharge of 435 cfs at bankfull design events. This design criteria associated with floodplain features and side channels developed the design discharges for all of the designed riffles. These design discharges can be seen in Table 17. Through this reach, the existing average width to depth ratio of the channel is approximately 37 at the design bankfull discharge. The average riffle width to depth ratio of the proposed conditions is approximately 22. This reduction in bankfull width comes from narrowing the channel width to a more suitable natural width (average of 60 feet down to 46 feet) and deepening the depth of the channel (average of 1.8 feet up to 2.1 feet at riffles) to increase floodplain connectivity.

Table 17. Design Bankfull Discharges for Main Channel Riffles.

Station	Design Discharge (cfs)	Top Width (ft)	Max Depth (ft)	Top Width/Ave. Depth
5+85	565	Match Existing		
8+00	565	49	3.3	23
10+23	550	50	3.3	23
12+90	542	44	3.1	21
15+90	535	44	3.1	21
19+15	470	43	3.1	21
22+28	455	44	3.1	21
24+90	455	43	3.0	21
28+00	462	43	3.1	21
31+63	470	Match Existing		
34+20	462	49	3.2	23
36+70	477	48	3.2	23
39+40	470	42	3.0	21
41+45	470	42	3.0	21
43+67	470	42	3.0	21
46+35	542	54	3.3	26
48+35	535	54	3.3	26

The constructed and designed channel riffles will be constructed. This will require the existing material to be overexcavated and replaced with a specified gradation that is anticipated to be as stable as the existing material is during a bankfull discharge event. This riffle gradation is shown in Table 18. Additional washing of fines into the voids is also specified to prevent flow from going subsurface.

Table 18. Specified Riffle Matrix Gradation.

Percent Finer	Size Range
D100	10" – 12”
D84	7" - 10"
D50	3" - 5"
D16	0.5" – 2”

D100, 84, 50 and 15 represent the size class of material that is smaller than the specified size. (e.g. D84 is the size that 84 percent of the material by weight is smaller than).

In addition to the specified riffle gradation, each constructed riffle will have habitat boulders incorporated into it. Habitat boulders are specified in two size classifications: small boulders (12” to 24”) and large boulders (24” to 48”). The number of boulders range per riffle structure based on riffle length and width. Boulders typically range from 14 to 23 small boulders and 10 to 16 large boulders per riffle. These boulders are intended to provide channel roughness, create complex hydraulic flow patterns through riffles and provide pockets of ineffective flow to act as resting areas for passing fish. Habitat boulders are to be embedded into the constructed riffle a minimum of 50 percent, with a diverse range of bury to create a natural appearing and functioning riffle.

Pools

Pools throughout the main channel were developed initially based on reference pool data upstream of the project area and throughout the Hall Ranch area farther upstream on Catherine Creek. Reference pool data ranged from 0.8 up to 1.8 times the bankfull riffle width depending on pool formation and radius of curvature of channel bends. Typical bend pools starting from the outside bend had a 0.5:1 to 2:1 slope (horizontal:vertical) down to the thalweg elevation, and typical bottom widths of 8 feet, slopes up the toe of the point bar from 3:1 to 5:1 up to a break point where the point bar had a slope of 7:1 to 40:1. Proposed pools had an initial typical geometry moving from the outside bend toward the inside of the point bar of a 1:1 down to the thalweg elevation, a bottom width of 7 feet, up the point bar at a 3:1 slope to a break point along the point bar then a variable slope of 10:1 to 20:1 up to the bank on the inside of the point bar. The bottom width was ultimately increased to 14 feet to accommodate channel blockage associated with LWM structures typically located throughout a constructed channel bend. This allowed for the development of more bank habitat along the outside of channel bends. A typical pool section can be seen in Figure 9.

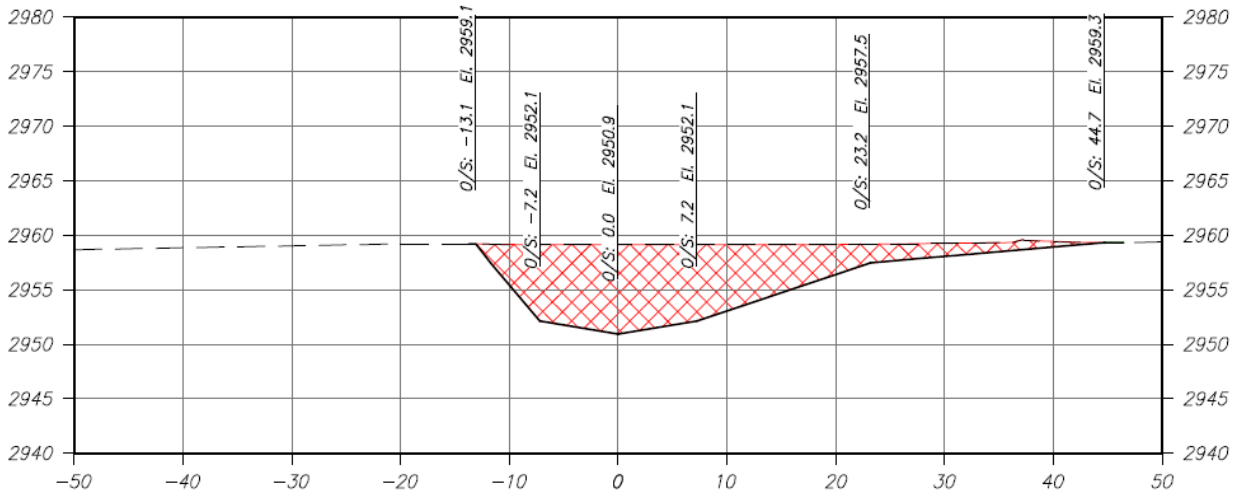


Figure 9. Typical Pool Section.

Point bar material along the inside of bends will activate at high flows and deposit throughout glides and riffles during the rising limb of bankfull discharge events. To enable the glides to be sustainable and provide suitable spawning material into the future, point bar material was specified. Point bar material can be left intact if suitable material is present (Table 19), otherwise, point bars shall be overexcavated 1.5 feet and replaced with acceptable material that meets the specific gradation in Table 20. Where existing material is deemed acceptable, material shall be unconsolidated.

Table 19. Acceptable In-Situ Point Bar Material.

Percent Finer	Size Range
D100	12"
D84	2" – 6”
D50	0.5” – 3”
D16	.08” – 1”

D100, 84, etc. represent the size class of material that is smaller than the specified size. (e.g. D84 is the size that 84 percent of the material by weight is smaller than).

Table 20. Placed Glide Material.

Percent Finer	Size Range
D100	12"
D84	3" – 6”
D50	1” – 3”
D16	0.25” – 1”
D10	< 0.5”

D100, 84, etc. represent the size class of material that is smaller than the specified size. (e.g. D84 is the size that 84 percent of the material by weight is smaller than).

Glides

Glides were designed as a smooth transition point from the end of a pool to the downstream riffle crest. The glides were designed to have a negative slope out of the pool up to the riffle crest of 1 to 2 percent. This slope is based off reviewing pool and glide exit slopes immediately upstream of the project and through the Hall Ranch reach. Glides are typical zones of spawning activity where fish prefer clean gravel with limited fines. Glides shall be evaluated on site to determine if they are composed of suitable material. They can be left intact if suitable material is present (Table 21), otherwise glides shall be overexcavated 1.5 feet and replaced with acceptable material that meets the specific gradation in Table 22. Where existing material is deemed acceptable, material shall be uncompacted and left loose for a depth of 1 foot below the finished grade to provide easy mobilization of fines out of the glide matrix.

Table 21. Acceptable In-Situ Glide Material.

Percent Finer	Size Range
D100	12"
D84	3" – 6”
D50	1” – 4”
D16	.08” – 1”

D100, 84, etc. represent the size class of material that is smaller than the specified size. (e.g. D84 is the size that 84 percent of the material by weight is smaller than).

Table 22. Placed Glide Material.

Percent Finer	Size Range
D100	12"
D84	3" – 6”
D50	1” – 3”
D16	0.25” – 1”
D10	< 0.5”

D100, 84, etc. represent the size class of material that is smaller than the specified size. (e.g. D84 is the size that 84 percent of the material by weight is smaller than).

7.2.2 Side Channels

There are two designed side channels within the Parcel 3 segment of the proposed restoration. One of these channels is designed to be perennial while the other channel is ephemeral. Side channel 1 is perennial and is located on river right (looking downstream) and departs from the main channel near Sta. 17+00 and reconnects with the main channel near Sta. 44+50. Side channel 2 is ephemeral and is located on river left and departs from the main channel near Sta. 24+50 and reconnects with the main channel near Sta. 29+00.

Side Channel 1 is located in an existing historic channel (pre 1937) swale that is located north of the proposed main channel. The inlet of the side channel will act as a control section to limit the amount of discharge entering the side channel to approximately 60 cfs during the 1.25-year discharge. This control is important to maintain conveyance underneath the proposed side channel crossing that maintains access to the parcel’s outbuildings and does not negatively affect flooding of nearby infrastructure. This maximum design discharge in side channel 1 during the 1.25-year discharge event is 80 cfs. The inlet is designed to 60 cfs due to the discharge entering Side Channel 1 from proposed Swale Complex 2 that contributes approximately 20 cfs. There is a middle section of the side channel that will be graded to remove fine grain sediment that has settled in the historic channel upstream and downstream of the proposed crossing location. The downstream connection back into the main channel will also require some excavation to effectively tie into the new main channel. The remaining portions of the side channel will be left intact as they exist and allowed to change as they become accustomed to the new flow regime. The shaping of the side channel is intended to keep the majority of existing vegetation intact. The total channel length in Side Channel 1 is approximately 2,317 feet long. The control section at the upstream end of Side Channel 1 has a design bottom width of 2 feet with 2:1 (horizontal:vertical) side slopes. To maintain vertical control of Side Channel 1 to control discharge intake, the existing channel material will be overexcavated 2 feet and replaced with compact riffle material as previously defined. The remaining portions of Side Channel 1 have typical trapezoidal section with a bottom width of 12 feet and 1:1 (horizontal:vertical) side slopes.

Side Channel 2 is located on the river left floodplain and cuts off one channel meander on the main channel from main channel Station 24+53 down to Station 28+93. The total channel length in Side Channel 2 is approximately 430 feet long. Side Channel 2 is designed to begin activation at 60 cfs. To maintain vertical control of Side Channel 2 the initial 70 feet of existing channel material will be overexcavated 2 feet and replaced with compact riffle material as previously defined. The typical section within Side Channel 2 has a 5-foot bottom width and 1:1 (horizontal:vertical) side slopes.

7.2.3 Alcoves

There are three alcoves proposed within the proposed design. These alcoves are designed to be connected at the downstream end to the main channel year round. Some of the alcoves are designed to receive floodplain flows to aid in flushing the alcoves of fine grained sediment and organic debris.

Alcove 1 is located on river left near main channel Station 29+73. Alcove 1 is located within the existing channel alignment and is approximately 250 long with the alcove invert predominately following the existing channel bottom. There are three proposed pools along the length of this alcove with residual depths of pool set at approximately 2.5 feet. Upstream of the alcove is proposed general fill located within the existing channel. It is anticipated that this will create a preferential flow path down the existing channel and groundwater will emerge at the upstream end of the alcove. This "blind channel" is anticipated to provide a small undefined quantity of flow through this alcove year round providing cool water refuge in the summer months and warm water refuge through winter.

Alcove 2 is located on river right near main channel Station 35+37. Alcove 2 is located at the downstream end of Swale Complex 4. Alcove 2 is approximately 125 feet long and ties into the main channel near the upstream extents of a pool. Alcove 2 is designed with a narrow inlet at the downstream end and then expanding in width and depth upstream of the inlet. This increase in depth provides residual depths within Alcove 2 of approximately 3.0 feet deep, based on the downstream riffle control. Alcove 2 is located within Swale B of Swale Complex 4 and is designed to receive flushing flows through this swale at flows greater than the 1.25-year discharge. These flows should assist in flushing the alcove of fine grained sediment and organic debris, ultimately extending the beneficial life of Alcove 2. Given the observed groundwater depths in this area and the designed channel and alcove, it is anticipated that this channel may be receiving groundwater at the most upstream end of the alcove, providing cool water refuge in the summer months and warm water refuge through winter.

Alcove 3 is located on river right near main channel Station 45+29. Alcove 3 is located to provide a floodplain connection between Side Channel 1 and the main channel. Alcove 3 was designed as a wide shallow swale with an inset alcove channel in it. Alcove 3 is approximately 100-foot long within a 300-foot-long floodplain swale channel. Alcove 3 is

designed with a narrow inlet at the downstream end and then expanding in width and depth upstream of the inlet. This increase in depth provides residual depths within Alcove 3 of approximately 1 foot deep based on the downstream riffle control. Alcove 3 is located within a shallow swale and is designed to receive flushing flows through this swale at flows greater than the 1.25-year discharge from Side Channel 1. These flows should assist in flushing the alcove of fine grained sediments and organic debris, ultimately extending the beneficial life of Alcove 3.

7.2.4 Floodplain Complexes

One of the main objectives of the project through Parcel 3 was to increase the riparian corridor width, uplift the riparian condition, and develop more transitional and periphery habitat. The proposed design increases accessible riparian and periphery habitat by designing an increase in floodprone area through the creation of swale complexes. The uplift for the Parcel 3 portion of the project was modeled by the Denver Technical Service Center. The analysis compared the habitat suitability between existing and proposed conditions based on the hydraulic results of a 2D numerical model, a report of the findings can be found in Appendix J. There are six designed swale complexes throughout Parcel 3 that are designed to increase floodplain inundation, store more groundwater, connect and develop a larger riparian corridor that through time will develop into a wide self-maintaining functional riparian corridor. By decreasing topographic elevation, the swale complexes increase floodplain activation and frequency of activation. In addition to increased connectivity to surface water, decreasing topographic elevation of the swale complexes will reduce the depth to groundwater creating an environment where riparian vegetation will have increased survival rates and potentially higher annual growth rates to establish a more robust riparian community. Each swale complex was designed to resemble a historic meander scar or series of meander scars with small sinuous “E” type channels meandering throughout and amongst them. Analog conditions were obtained from multiple desktop studies utilizing Google Earth. An example of analog swale complexes can be seen in Figure 10 and Figure 11.



Figure 10. Analog Swale Complex Located Adjacent to the Heart River, Wyoming (flow is from top right to bottom left).



Figure 11. Analog Swale Complex Located Adjacent to Slough Creek, Wyoming (flow is from top right to bottom left).

Some design elements are consistent throughout the swale complexes. All swale complexes were designed to activate on an annual basis, typically starting to activate close to a main channel discharge of approximately 160 cfs providing on average 84 days of activation per year per swale. Floodplain swales are typically trapezoidal in shape with bottom widths of 20 to 50 feet. The side slopes of swale channels up to existing grade are typically set at 5:1 (horizontal to vertical). Vertical profiles of the swales complexes start at 0.75 below the 1.25-year water surface elevation within the main channel. They then extend to 0.5 feet below the 1.25-year water surface elevation within the main channel at the downstream connection.

Small inset swale complex channels have a 2-foot bottom width and typical side slopes of 1:1 (horizontal to vertical). The vertical profile of inset swale channels start at the same elevation as the larger swales and slowly cut into the swale down to the connection point at the downstream end. Downstream end vertical control is typically 0 to 0.5 feet lower than the downstream riffle control to provide at a minimum some backwater alcove habitat at low flow conditions. Vertical complexity is not shown within the design plans, but is called to be field directed and should include the excavation of pools at bend locations within the swale complex channels that vary from 1 to 3 feet below the average gradient. In addition to vertical complexity, the side slopes shall vary slightly typically laying them flatter along the inside bank of meander bends.

Abandoned oxbow pools are designed to provide potential carry over capacity for salmonids who might end up entrapped within the complexes. These pools are designed to be excavated a minimum of 3 feet below existing groundwater depth during construction. It is anticipated that the proposed design will increase local groundwater elevations and should result in abandoned oxbow pools being greater than 3 feet in depth. Designed with ample cover over these pools, it is theorized that a salmonid could survive in them until they become active with the main channel again at which point they could migrate back to the main channel.

Blind channels are similar in design to small inset swale complex channels except that they do not have an upstream connection. These channels are all located within the existing channel alignment and fill material will be placed upstream of them blocking off any regular surface water flow. In theory, these abandoned channel fill areas will likely have a higher hydraulic conductivity providing an underground preferential flow path that surfaces at the upstream end of the blind channels. Blind channels are designed with a 2-foot bottom width and 1:1 (horizonatal to vertical) sides slopes. Variability both vertically and spatially are shown in the design plans that create a complex groundwater input channel, maintains near bank vegetation throughout the existing channel, and creates a dynamic habitat area suitable for various stages of aquatic life.

Swale Complex 1 (SWC-1) is located along river left and consists of two inlet swales, and one blind channel that all connect and form one reconnection with the main channel. SWC-1 Swale A comes off the main channel near main channel Station 9+84 and reconnects with the main channel near main channel Station 23+81 and is approximately 1,200 feet long. SWC-1

Swale B come off of the main channel near main channel Station 8+74 and connects to SWC-1 Swale A at approximately SWC-1 Swale A Station 2+75 and is approximately 357 feet long.

Within SWC-1, Swales A and B are two small sinuous swale complex channels, three abandoned oxbow pools, and a blind channel all that connect and create an alcove at its confluence with the main channel. The two abandoned oxbow pools are connected to the main channel by the smaller swale complex channels. These pools are designed to act as off channel and wetland habitat. The blind channel is located within the existing channel where it is designed to be abandoned. The confluence of the swale channel with the main channel will act as an alcove during periods of low flow. The alcove is designed to be approximately 140 feet long based on low flow conditions at the downstream riffle control in the main channel. A total summary of metrics associated with SWC-1 can be found below in Table 23.

Table 23. Swale Complex 1 Metrics.

Swale Complex 1	Length (ft)	Bottom Width (ft)	Oxbow Pools (Number)
Swale A	1214	50	2
Swale B	357	50	0
Swale Channel A	1640	2	1
Swale Channel B	506	2	0
Swale Channel C	174	2	1
Swale Channel D (Blind Channel)	532	2	1

Swale Complex 2 (SWC-2) is located along river right and consists of two inlet swales, and one swale that reconnects with Side Channel 1. SWC-2 Swale A comes off the main channel near main channel Station 11+91 and is approximately 624 feet long. SWC-2 Swale B comes off the main channel near main channel Station 12+92 and is approximately 300 feet long where it ties into SWC-2 Swale A at Swale A Station 3+49. SWC-2 Swale C is approximately 200 feet long and connects between SWC-2 Swale A (Sta. 1+50) and SWC-2 Swale B (Sta. 2+50). SWC-2 Swale D creates an abandoned meander off of SWC-2 Swale A (Sta. 1+18 and Sta. 3+66) and is approximately 317 feet long. SWC-2 Swale E creates an abandoned meander off of SWC-2 Swale D (Sta. 1+57) and connects to SWC-2 Swale A (Sta. 4+72). This swale complex outlets to Side Channel 1 through SWC-2 Swale A at Side Channel 1 Station 2+29.

Within SWC-2 Swales A – D, there are four small sinuous swale complex channels containing two abandoned oxbow pools, that all connect to Side Channel 1. The two abandoned oxbow pools are connected to the main channel and Side Channel 1 by the smaller swale complex channels. These pools are designed to act as off channel and wetland habitat. A total summary of metrics associated with SWC-2 can be found below in Table 24.

Table 24. Swale Complex 2 Metrics.

Swale Complex 2	Length (ft)	Bottom Width (ft)	Oxbow Pools (Number)
Swale A	514	50	0
Swale B	296	50	0
Swale C	202	30	1
Swale D	317	25	1
Swale E	208	20	0
Swale Channel A	806	2	0
Swale Channel B	237	2	0
Swale Channel C	267	2	1
Swale Channel D	306	2	1

Swale Complex 3 (SWC-3) is located along river right and consists of two inlet swales, and one swale that reconnects with the main channel. SWC-3 Swale A comes off the main channel near main channel Station 19+66 and reconnects to the main channel (Sta. 26+36) and is approximately 632 feet long. SWC-3 Swale B comes off the floodplain downstream of the inlet to Side Channel 1 and is approximately 234 feet long where it crosses SWC-3 Swale A and turns into SWC-3 Swale C at Swale A Station 1+96. SWC-3 Swale B captures floodplain discharges overtopping Side Channel 1 to control the amount of water flowing through Side Channel 1 near infrastructure (house, barn, and new bridge). SWC-3 Swale C is approximately 230 feet long and connects the end of Swale B to SWC-3 Swale A (Sta. 4+34).

Within SWC-3 Swales A - C there are two small sinuous swale complex channels containing one abandoned oxbow pool, and an alcove at its confluence with the main channel. The abandoned oxbow pool is connected to the main channel by the smaller swale complex channels. This pool is designed to act as off channel and wetland habitat. The confluence of the swale channel with the main channel will act as an alcove during periods of low flow. The alcove is designed to be approximately 150 feet long based on low flow conditions at the downstream riffle control in the main channel. A total summary of metrics associated with SWC-3 can be found below in Table 25.

Table 25. Swale Complex 3 Metrics.

Swale Complex 3	Length (ft)	Bottom Width (ft)	Oxbow Pools (Number)
Swale A	632	50	1
Swale B	234	50	0
Swale C	230	50	0
Swale Channel A	858	2	1
Swale Channel B	342	2	0

Swale Complex 4 (SWC-4) is located along river right and consists of three inlet swales, two pull from the main channel and one pulls from Side Channel 1. There are four outlet swales, two of which connect to the main channel and two that connect with Side Channel 1. SWC-4 Swale A comes off the main channel near main channel Station 27+64 and reconnects to the main channel (Sta. 34+57) and is approximately 690 feet long. SWC-4 Swale B comes off the main channel near main channel Station 30+51 and is approximately 514 feet long where it ties back into the main channel (Sta. 35+27). SWC-6 Swale C is approximately 678 feet long and connects between Side Channel 1 Sta. 7+16 and SWC-6 Swale B (Sta. 2+05). SWC-4 Swale D creates an approximately 336 foot long abandoned meander off of SWC-4 Swale A (Sta. 3+30) and connects to Side Channel 1 (Sta. 12+43). SWC-2 Swale E creates an approximately 249 foot long abandoned meander off of SWC-4 Swale A (Sta. 4+12) and connects to Side Channel 1 (Sta. 14+03).

Within SWC-4 Swales A - E there are three small sinuous swale complex channels containing one abandoned oxbow pool, and one alcove that all connect back to the main channel. The abandoned oxbow pool is connected to the main channel by the smaller swale complex channels. This pool is designed to act as off channel and wetland habitat. A total summary of metrics associated with SWC-4 can be found in Table 26. The alcove associated with the swale complex is described in more detail as Alcove 2 above.

Table 26. Swale Complex 4 Metrics.

Swale Complex 4	Length (ft)	Bottom Width (ft)	Oxbow Pools (Number)
Swale A	690	50	0
Swale B	514	50	0
Swale C	678	40	1
Swale D	331	40	0
Swale E	249	40	0

Swale Complex 4	Length (ft)	Bottom Width (ft)	Oxbow Pools (Number)
Swale Channel A	1014	2	0
Swale Channel B	215	2	0
Swale Channel C	307	2	1
Alcove 2	150	3	0

Swale Complex 5 (SWC-5) is located along river left and consists of two inlet swales, and one blind channel that all connect and form one reconnection with the main channel. There are no larger swales designed within SWC-5 due to existing low ground and existing levels of floodplain activation. This swale complex is composed of three swale channels only with no excavated swales or abandoned oxbow channels. SWC-5 Channel A comes off the main channel near main channel Station 33+92 and reconnects with the main channel near main channel Station 49+78 and is approximately 1,408 feet long. SWC-5 Channel B comes off of the main channel near main channel Station 37+89 and connects to SWC-5 Channel A at approximately SWC-5 Channel A Station 3+71 and is approximately 69 feet long. The blind channel SWC-5 Channel C is located within the existing channel where it is designed to be abandoned. SWC-5 Channel C is approximately 142 feet long and ties into SWC-5 Channel A at Sta. 12+66. A total summary of metrics associated with SWC-5 can be found in Table 27.

Table 27. Swale Complex 5 Metrics.

Swale Complex 5	Length (ft)	Bottom Width (ft)	Oxbow Pools (Number)
Swale Channel A	1408	2	0
Swale Channel B	69	2	0
Swale Channel C	142	2	0

Swale Complex 6 (SWC-6) is located along river right and consists of two inlet swales, and one swale that reconnects with the main channel. SWC-6 Swale A comes off the main channel near main channel Station 45+92 and reconnects to the main channel (Sta. 55+39) and is approximately 800 feet long. SWC-6 Swale B comes off the main channel near main channel Station 47+17 and connects to SWC-6 Swale A at SWC-6 Swale A Station 6+19 and is approximately 530 feet long.

Within SWC-3 Swales A - B there are four small sinuous swale complex channels containing three abandoned oxbow pools. The abandoned oxbow pools are connected to the main channel by the smaller swale complex channels. One abandoned oxbow pool (SWC-6 Swale A Sta. 1+00) is connected to the main channel through a porous blind channel connection. This connection consists of approximately 100 feet of placed clean gravels that extend from the right channel bank to the upstream end of the oxbow pool. This feature is designed to promote groundwater exchange and movement through the proposed oxbow pool and potentially down through the swale complex channel. These oxbow pools are designed to act as off channel and wetland habitat. A total summary of metrics associated with SWC-3 can be found in Table 28.

Table 28. Swale Complex 6 Metrics.

Swale Complex 6	Length (ft)	Bottom Width (ft)	Oxbow Pools (Number)
Swale A	758	50	2
Swale B	530	50	1
Swale Channel A	809	2	1
Swale Channel B	1047	2	0
Swale Channel C	232	2	1
Swale Channel D	134	2	1

7.2.5 Large Woody Material Structures

There are multiple locations and types of LWM structures proposed throughout Parcel 3 to increase hydraulic diversity, increase aquatic habitat, and to aid in flow deflection, bank retention, and to create roughness and cover throughout the floodplain. Table 29 displays the various types of proposed structures and the number of structures located within Parcel 3. The descriptions below discuss each specific type of LWM structure.

Table 29. Parcel 4 Typical Large Woody Material Structures.

LWM Structure Type	Quantity
Upstream Bend Component	16
Middle Bend Component	19
Downstream Bend Component	12
Streambank Habitat	6

LWM Structure Type	Quantity
Sweeper Log	5
High Energy Bank	4
Small Apex Jam	6
Large Apex Jam	1
Side Channel 1 Inlet	1
Large Gravel Bar Tree	17
Three-Log Bank Roughness	43
Tree Top Bank Roughness	9
Bank Log with Boulders	2
Onsite Walnut Tree	4
Brush Mattress	1,450 lineal feet
Edge Roughness	570 lineal feet
Tree Top Floodplain Roughness	106
Two-Log Floodplain Roughness	200
Single Log with Rootwad	42
Treetop with Branches	200

Bend Components – At each of the 16 bends in the designed main channel there is a deep pool with a riffle leading into the pool and a glide exiting the pool. A major design goal for the project was to have LWM structures throughout the length of the pool with key member logs and other wood pieces projecting from the outside bank to at least the channel thalweg to provide quality aquatic habitat in the pools. Each of the pools have slightly different geometry (e.g., radius of curvature, length, depth) but for the most part are very similar.

Instead of designing a unique LWM structure at each pool, three different LWM structures were designed to be used as components. Each component fits a typical part of the channel geometry. The Upstream Bend Component is designed to fit in the transition from riffle to pool, the Middle Bend Component is designed to be in the deepest part of the pool, and the Downstream Bend Component is designed to fit in the transition from pool to glide. The three components are applied to each bend per the unique configuration of that bend, and when completed the combination of structure components creates a contiguous LWM structure through the pool.

Not all bends have the same configuration of components. For instance, a longer pool requires two Middle Bend Components to fill the bank along the deepest part of the pool, but shorter pools only require one Middle Bend Component. Bends that had short transitions from the deep part of the pool to relatively shallow glide did not have sufficient bank height

for a Downstream Bend Component so a more compact LWM structure was used. The number of each type of component to use at a specific bend was determined based on the configuration of that bend.

An additional benefit from using combinations of three component structures instead of unique designs at each bend is that the contractor becomes familiar with construction of each component after the first couple of each type are constructed. Later in the project, the familiarity should reduce time required to construct the structures, and should reduce the chance for errors. Additionally, while constructing each component the Contractor will add 50 to 70 percent of the racking material for that structure, then after each group of component structures is completed, the remaining racking material is applied to the group, which ties the components together forming a single structure through the bend that is unique looking due to variability in key member logs and their rootwads, and different configuration of racking material.

Upstream Bend Component – This bend component structure is designed to be located at the upstream end of the pool, in the shallower part of the pool with the upstream end typically near the transition from the riffle to the pool. The intent of this component structure is to provide aquatic habitat in the pool and provide stability to the channel bank on the outside of the bend where erosion is likely, especially prior to establishment of riparian vegetation. Because this component is placed at the upstream end of the pool and closest to the riffle leading into the pool it will encounter the greatest force from flow of any LWM structure in the bend. Because of the high energy location, the Upstream Bend Component does not have logs extending as far out from the bank into the channel as the other two components. The Upstream Bend Component will dissipate flow energy, allowing other bend components to have logs projecting farther into the channel, and will help initiate turning of flow in the main channel to follow the bend (Table 30).

Table 30. Upstream Bend Component Material Schedule.

Log Type	Material Size	Quantity
E	20’ to 25’ Long, 12” Dia. Log	4
F	20’ Long, 12” DBH Log with Rootwad	4
I	30’ Long, 18” DBH Log with Rootwad	1
Sm. Racking Mat.	6’ to 15’ Long, 3” to 8” Dia. Log	8
Lg. Racking Mat.	6’ to 15’ Long, 8” to 12” Dia. Log	8
Slash	Tree Tops, Limbs with Branches and Needles	As Directed by C.O.

Middle Bend Component – This bend component structure is designed to be located at the deepest part of each pool. The intent of this component structure is to provide aquatic habitat in the pool and provide stability to the channel bank on the outside of the bend where erosion is likely, especially prior to establishment of riparian vegetation. This component structure is the tallest of the three components due to where it is located and the intent to provide LWM from the bottom of the pool up to near the bankfull elevation. The Middle Bend Component is designed to have key member logs that extend 20 feet from the top of bank and about 13 feet from toe of channel bank. These key member logs and associated racking material are designed to extend from the bank across the channel to just past the thalweg (Table 31).

Table 31. Middle Bend Component Material Schedule.

Log Type	Material Size	Quantity
D	15’ to 20’ Long, 12” Dia. Log	4
E	20’ to 25’ Long, 12” Dia. Log	1
I	30’ Long, 18” DBH Log with Rootwad	3
K	40’ Long, 18” DBH Log with Rootwad	1
Tree Top	25’ Long Tree Top with Branches	3
Sm. Racking Mat.	6’ to 15’ Long, 3” to 8” Dia. Log	8
Lg. Racking Mat.	6’ to 15’ Long, 8” to 12” Dia. Log	8
Slash	Tree Tops, Limbs with Branches and Needles	As Directed by C.O.

Downstream Bend Component – This bend component structure is designed to be located at the downstream end of the pool where the channel is transitioning from the pool to a glide. The intent of this component structure is to provide aquatic habitat in the pool and provide stability to the channel bank on the outside of the bend where erosion is likely, especially prior to establishment of riparian vegetation. At some bends the transition from pool to glide occurs over a fairly short distance and the resulting low bank height where the downstream end of this component would have been located was not sufficient to provide the necessary burial and associated anchorage for the key members. Therefore, at some bends there is no Downstream Bend Component and a more compact LWM structure is used in its place. The Downstream Bend Component is designed to have key member logs that extend 20 feet from the top of bank and about 16 feet from toe of channel bank. These key member logs and associated racking material are designed to extend from the bank across the channel to just past the thalweg. A full tree with branches is included on the top layer of the component structure providing a sweeper type feature immediately downstream (Table 32).

Table 32. Downstream Bend Component Material Schedule.

Log Type	Material Size	Quantity
E	20’ to 25’ Long, 12” Dia. Log	5
F	20’ Long, 12” DBH Log with Rootwad	3
I	30’ Long, 18” DBH Log with Rootwad	4
K	40’ Long, 18” DBH Log with Rootwad	1
Tree Top	25’ Long Tree Top with Branches	2
Full Tree	40’ Long Full Tree with Rootwad and Branches	1
Sm. Racking Mat.	6’ to 15’ Long, 3” to 8” Dia. Log	10
Lg. Racking Mat.	6’ to 15’ Long, 8” to 12” Dia. Log	10
Slash	Tree Tops, Limbs with Branches and Needles	As Directed by C.O.

Streambank Habitat Structure – This LWM structure is intended to provide aquatic habitat along the creek banks without influencing the overall flow characteristics of the creek. The structure includes several key member logs with rootwads extending into the channel and cut ends buried in the bank, along with a tree top set to act as a sweeper on the downstream side. The tree top is pinched between key member logs for its anchorage. Racking material and slash, placed within the frame formed by the key members, helps to create diversity within the structure (Table 33). This structure will be placed at locations where the existing channel lacks edge habitat but where the overall flow characteristics are acceptable. This structure will extend far enough into the channel and provide variable sized material to create locations along the channel edge with zero or near-zero flow velocity for salmonids to utilize. However, the structure will not redirect the flow enough to cause a noticeable change in the location or direction of the overall channel. Localized scour holes are expected to be created and persist off the tips of these structures.

Table 33. Streambank Habitat Structure Material Schedule.

Log Type	Material Size	Quantity
F	20’ Long, 12” DBH Log with Rootwad	1
G	20’ Long, 18” DBH Log with Rootwad	3
H	30’ Long, 18” Dia. Log	1
I	30’ Long, 18” DBH Log with Rootwad	1
Tree Top	25’ Long Tree Top with Branches	1
Sm. Racking Mat.	6’ to 15’ Long, 3” to 8” Dia. Log	8
Lg. Racking Mat.	6’ to 15’ Long, 8” to 12” Dia. Log	8
Slash	Tree Tops, Limbs with Branches and Needles	As Directed by C.O.

Sweeper Log Structure – This LWM structure is intended to provide localized aquatic habitat along the bank and in the low flow channel of the creek. The structure consists of several key member logs, some of which are included mainly to hold in place the "sweeper log" that is not buried in the bank and thus gains its stability from the buried key member logs. The primary component of the structure is the "sweeper log" that is oriented nearly parallel to the direction of flow and covers the entire bank height with one end projecting into the low flow channel. A tree top is also included with the same orientation as the "sweeper log" (Table 34). The purpose of this structure is to mimic the habitat created when a tree at the edge of the bank is undermined and topples over into the creek, leaving a rootwad up on the floodplain and a tree top projecting down into the low flow channel. Most Sweeper Log structures are located at the transition from pool to glide, with the "sweeper log" extending into the glide, these are often locations where the bank height was too low to allow installation of a Downstream Bend Component.

Table 34. Sweeper Log Structure Material Schedule.

Log Type	Material Size	Quantity
I	30' Long, 18" DBH Log with Rootwad	4
Tree Top	25' Long Tree Top with Branches	1
Sm. Racking Mat.	6' to 15' Long, 3" to 8" Dia. Log	8
Lg. Racking Mat.	6' to 15' Long, 8" to 12" Dia. Log	8
Slash	Tree Tops, Limbs with Branches and Needles	As Directed by C.O.

High Energy Bank Structure – This LWM structure is intended to provide a combination of aquatic habitat and channel bank stability at the locations of highest flow energy striking the bank. This structure will be placed at locations where flow is oriented almost directly at the bank and will make an abrupt turn, creating a large scour pool at the face of the structure. The structure includes multiple logs with and without rootwads extending as much as 20 feet from the top of bank into the channel, extending just beyond the thalweg (Table 35). This structure has multiple layers of logs, including logs angled at varying elevations, to provide habitat through a large range of flow conditions and to protect the full height of the bank. The face of the structure is very dense because of the high flow energy that will be directed into the structure and needs to be redirected by the structure. Racking material and slash is added to the framework created by the key members to provide diverse aquatic habitat.

Table 35. High Energy Bank Structure Material Schedule.

Log Type	Material Size	Quantity
D	15’ to 20’ Long, 12” Dia. Log	2
E	20’ to 25’ Long, 12” Dia. Log	4
F	20’ Long, 12” DBH Log with Rootwad	2
G	20’ Long, 18” DBH Log with Rootwad	5
I	30’ Long, 18” DBH Log with Rootwad	2
J	40’ Long, 18” Dia. Log	1
K	40’ Long, 18” DBH Log with Rootwad	2
Sm. Racking Mat.	6’ to 15’ Long, 3” to 8” Dia. Log	15
Lg. Racking Mat.	6’ to 15’ Long, 8” to 12” Dia. Log	15
Slash	Tree Tops, Limbs with Branches and Needles	As Directed by C.O.

Small Apex Jam – This LWM structure is intended to be placed within the ordinary high water line of the main channel, often on point bars. The primary function of this structure is to maintain the location and shape of the gravel bars by assisting in recruitment of streambed sediments behind the structures. The secondary function is to slightly redirect flow, either into secondary channels or back into the main channel. These structures will typically be overtopped by flow during peak flow events such as the 10-year peak flow (Table 36).

Table 36. Small Apex Jam Material Schedule.

Log Type	Material Size	Quantity
C	10’ Long, 18” Dia. Log	1
G	20’ Long, 18” DBH Log with Rootwad	2
Sm. Racking Mat.	6’ to 15’ Long, 3” to 8” Dia. Log	5
Lg. Racking Mat.	6’ to 15’ Long, 8” to 12” Dia. Log	5

Large Apex Jam – This LWM structure is intended to be placed within the main channel. The primary function is to significantly influence flow paths by splitting flow around the structure. These LWM structures have a frontal face that is about 20 feet wide and are sufficiently high so that flow will not overtop them during a 100-year peak flow event. The large blunt face of these structures coupled with no flow overtopping will result in significant flow redirection during channel forming flow events. Along with redirecting flow, there will be an area of zero to very low velocity behind each structure that will provide velocity refuge while encouraging sediment deposition during channel forming flow events (Table 37).

Table 37. Large Apex Jam Material Schedule.

Log Type	Material Size	Quantity
A	10’ Long, 12” Dia. Log	2
E	20’ to 25’ Long, 12” Dia. Log	3
G	20’ Long, 18” DBH Log with Rootwad	9
Sm. Racking Mat.	6’ to 15’ Long, 3” to 8” Dia. Log	20
Lg. Racking Mat.	6’ to 15’ Long, 8” to 12” Dia. Log	20

Side Channel 1 Inlet Structure – This LWM structure is designed specifically for one location on the project, on the main channel at the entrance to Side Channel 1. This structure has two separate functions, maintaining the side channel inlet geometry and providing aquatic habitat. Side Channel 1 is located on the outside of a bend where the creek banks are susceptible to erosion. Side Channel 1 is a highly important part of the overall project, conveying a significant amount of flow to a large amount of off-channel habitat. It is critical that the amount of flow leaving the main channel and entering Side Channel 1 matches the design flow rates and does not increase or decrease over time due to changes at the inlet. The Side Channel 1 Inlet Structure will provide stability to both the main channel bank and the side channel bank and bed at the inlet. Key member logs with rootwads buried in the bank and racking material woven in between the key member logs will prevent bank erosion, thus maintaining the inlet size at the designed configuration. A log buried just beneath the bed of the side channel and spanning the width of the side channel will prevent the side channel bed at the inlet from eroding to a lower elevation, thus protecting the hydraulic characteristics of the inlet (Table 38). The irregular face of the LWM structure in the main channel will induce minor turbulence at the side channel inlet which is expected to prevent sediment deposition at the inlet. The LWM in the main channel will also provide aquatic habitat along the margin of the creek.

Table 38. Side Channel 1 Inlet Structure Material Schedule.

Log Type	Material Size	Quantity
E	20’ to 25’ Long, 12” Dia. Log	4
F	20’ Long, 12” DBH Log with Rootwad	12
H	30’ Long, 18” DBH Log with Rootwad	2
Sm. Racking Mat.	6’ to 15’ Long, 3” to 8” Dia. Log	15
Lg. Racking Mat.	6’ to 15’ Long, 8” to 12” Dia. Log	15
Slash	Tree Tops, Limbs with Branches and Needles	As Directed by C.O.

Large Gravel Bar Tree – This LWM feature is meant to simulate a mature conifer tree that has fallen over and is partially in the creek channel. This LWM feature consists of a single complete fir or spruce tree that is a minimum of 60 feet long, includes a rootwad, and has a majority of branches intact. At most locations the tree is placed on the inside bank of a bend with the rootwad on the top of bank immediately upstream of the constructed point bar. The tree extends down the bank slope and downstream, crossing the edge of the point bar with the top of the tree in the pool at the apex of the bend. The tree is anchored in two locations using wood piling (Table 39). This feature provides margin and pool habitat through a wide range of flows and simulates a naturally occurring habitat feature.

Table 39. Large Gravel Bar Tree Material Schedule.

Log Type	Material Size	Quantity
Log Piling	10’ Long, 6” Dia. Log	4
Full Tree	60’ Long Tree with Rootwad and Branches	1

Three-Log Bank Roughness Element – This LWM element is intended to be placed along the banks of the main channel in glides and riffles, and a few locations in side channels, to provide edge roughness for hydraulic diversity and aquatic habitat. The primary function of this is to provide habitat along the shallower and faster flowing segments of the creek channel, which also have low bank heights. The secondary function is to provide stability to the channel banks. This structure was designed to be simple to construct, providing a large area of quality habitat with high reliability at a low cost (Table 40).

Table 40. Three-Log Bank Roughness Element Material Schedule.

Log Type	Material Size	Quantity
F	20’ Long, 12” DBH Log with Rootwad	3
Sm. Racking Mat.	6’ to 15’ Long, 3” to 8” Dia. Log	5
Lg. Racking Mat.	6’ to 15’ Long, 8” to 12” Dia. Log	5

Tree Top Bank Roughness Element – This LWM element is intended to be placed along the banks of the main channel in glides and riffles to provide edge roughness for hydraulic diversity and aquatic habitat. This LWM element consists of a 25-foot-long tree top from a conifer with branches intact. The tree top is placed along the toe of bank slope parallel to flow direction. The tree top is held in place by four wood piling (Table 41). This structure was designed to be simple to construct, providing habitat along the channel margin at minimal cost.

Table 41. Tree Top Bank Roughness Element Material Schedule.

Log Type	Material Size	Quantity
Log Piling	6' Long, 4" Dia. Log	4
Tree Top	25' Long Tree Top with Branches	1

Bank Log with Boulders – This LWM element is intended to be placed along the edges of the main creek channel at locations where no channel grading is proposed and the existing creek channel will continue to be the channel in the future. This LWM element is designed to provide a simple method to install large wood pieces that extend from the floodplain to the low flow channel at locations where access is limited. This element consists of a 40 foot long log with rootwad that is placed with the rootwad near the top of channel bank and the top end in the main channel angled downstream from the rootwad. Two large, partially buried, boulders are placed on the downstream side of the log to hold the log in place (Table 42). The element is minimalistic but provides some flow diversity and habitat along the channel fringe at difficult to access locations.

Table 42. Bank Log with Boulders Material Schedule.

Log Type	Material Size	Quantity
K	40' Long, 18" DBH Log with Rootwad	1
Boulder	40" min. Dia.	2

Onsite Walnut Tree Placement – This LWM element is essentially the same as "Bank Log with Boulders", except that the trees will be harvested from the project site instead of imported. The local sponsor has identified surplus trees onsite, some of which need to be removed for construction of the project. The trees are large walnut trees that will provide good habitat in the creek given the amount of branches. The Contracting Officer will identify the trees for the Contractor, then the Contractor will harvest the flagged trees and place in the channel with the rootwad on the top of bank and the tree top extending into the main channel with two large boulders to hold the walnut tree in place (Table 43).

Table 43. Onsite Walnut Tree Placement Material Schedule.

Log Type	Material Size	Quantity
Walnut Tree	From Onsite, Identified by the C.O.	1
Boulder	40" min. Dia.	2

Brush Mattress – This feature is intended to be placed along the edges of the main creek channel to provide roughness and habitat complexity. Brush Mattress is a linear feature typically placed along riffles and glides where flow is tangent and there are minimal erosional stresses directed at the banks. The structure includes layers of dead brush and live pole cuttings set into the bank near the low flow channel edge. Both the dead brush and live cuttings will provide roughness near the channel margin immediately, with the goal of establishing mature willows from the live cuttings to provide benefits for the long term.

Edge Roughness – This LWM feature is intended to be placed along the edges of the main creek channel to provide roughness and habitat complexity. Edge Roughness is a linear feature typically placed along riffles and glides where flow is tangent and there are minimal erosional stresses directed at the banks. The structure includes layers of dead brush and live pole cuttings set into the bank near the low flow channel edge. Both the dead brush and live cuttings will provide roughness near the channel margin immediately, with the goal of establishing mature willows from the live cuttings to provide benefits for the long term. These LWM features are similar to live brush mattress edge treatment, but includes logs with rootwads and racking material to create a more dense and robust configuration of woody material.

Tree Top Floodplain Roughness Element – This LWM element is intended to be placed on the floodplain to provide floodplain roughness and diversity. This LWM element consists of a 25 foot long tree top from a conifer with branches intact. The tree top is placed on the floodplain, including in swales, floodplain complexes, and side channels constructed as part of this project. The tree top is held in place by four wood pilings (Table 44). This structure was designed to be simple to construct, providing floodplain roughness, prior to when plants are established, at minimal cost, and to encourage deposition of sediment which is expected to contain seeds that will grow into riparian zone plants.

Table 44. Tree Top Floodplain Roughness Element Material Schedule.

Log Type	Material Size	Quantity
Log Piling	6’ Long, 4” Dia. Log	4
Tree Top	25’ Long Tree Top with Branches	1

Two-Log Floodplain Roughness Element – This LWM element is intended to be placed on the floodplain to provide floodplain roughness and diversity. This LWM element consists of a 25 foot long tree top from a conifer with branches intact. The tree top is placed on the floodplain, including in swales, floodplain complexes, and side channels constructed as part of this project. A 20 foot long log with rootwad intact is placed over the tree top and about 2/3 of the log with rootwad is buried. The buried portion of the log with rootwad anchors both large wood pieces (Table 45). This structure was designed to be simple to construct,

providing floodplain roughness prior to when plants are established at minimal cost, and to encourage deposition of sediment which is expected to contain seeds that will grow into riparian zone plants.

Table 45. Two-Log Floodplain Roughness Element Material Schedule.

Log Type	Material Size	Quantity
F	20' Long, 12" DBH Log with Rootwad	1
Tree Top	25' Long Tree Top with Branches	1

Single Log with Rootwad on Floodplain – This feature is just individual logs with rootwads placed at locations throughout the floodplain to improve habitat value. These logs are expected to be smaller diameter (e.g., 6 to 10 inches) than the key members that make up complex LWM structures; however, larger diameter logs are allowable. These logs are typically placed in or crossing side channels, alcoves, and flood swale complexes. These logs do not have a specific design on how they will be anchored, but instead will rely on "field fitting" to secure them. These logs will be secured by either wedging them against live trees or embedded into the floodplain surface.

Tree Top with Branches on Floodplain – This feature is similar to the Single Log with Rootwad except that they consist of the top of a conifer species tree including intact branches. These tree tops are typically placed in or crossing side channels, alcoves, and flood swale complexes. These tree tops do not have a specific design on how they will be anchored, but instead will rely on "field fitting" to secure them. These tree tops will be secured by either wedging them against live trees or embedded into the floodplain surface.

7.2.6 Riparian Planting

The CTUIR, the project sponsor for Parcel 3, is designing and implementing the revegetation plan associated with this project. Revegetation efforts are focused on developing a robust and diverse riparian environment enveloping the entire restoration reach. This revegetation plan will be implemented over multiple years. The establishment of healthy, self-sustaining native vegetative community throughout the project site is vital to the success of the Project. Revegetation immediately after grading provides key initial site stabilization and energy dissipation even as the plants begin to provide food web support. Such communities promote short-term and long-term bank stabilization; shade for cooler water; protective cover for fish; habitat for terrestrial wildlife (birds, mammals, amphibians, and macroinvertebrates); and woody debris recruitment in the future. A robust riparian plant community also provides greater protective cover, food sources, habitat complexity and diversity, and migration continuity for the larger ecosystem.

The species of plants proposed in this plan vary in relation to the stream's bankfull elevation, with the more hydrophytic plants closer to the stream and the more drought-tolerant species at higher elevations. The proposed vegetation consists of plant species native to the area that are typically found at similar sites within the region. Where possible and appropriate based on plant condition, clumps of existing shrubs (particularly willow) may be salvaged during construction. Willows that cannot be salvaged as whole plants can provide whips to be used as live stakes.

Revegetation activities will occur immediately following earth moving activities. Once the final grade has been attained, all disturbed areas will be replanted as appropriate. It is anticipated that supplemental irrigation may be required to assist with vegetation establishment. This need for supplemental irrigation will be determined during the planting phase. The most current planting plan developed by the CTUIR is attached as Appendix G.

7.3 Parcels 1 and 2

Proposed enhancements associated with Parcels 1 and 2 are focused on the installation of LWM structures to increase in-channel habitat complexity, redirect flow, create localized scour pools, and develop zones of aggradation within the channel to reduce existing bankfull widths. Also associated with these main channel wood structures is the creation of a 730 foot side channel along river left floodplain and one alcove along river right floodplain. The proposed enhancements associated with Parcels 1 and 2 are described in more detail below. The design drawings for Parcels 1 and 2 can be found in Appendix H. Table 46 summarizes proposed habitat features associated with Parcels 1 and 2.

Table 46. Summary of Proposed Conditions.

Characteristic	Proposed Conditions
	Parcel 1 & 2
Main Channel Length (ft)	2,254
Sinuousity (ft/ft)	1.05
Number of Perennial Side Channels	1
Number of Emphemeral Side Channels	1
Side Channel Length (ft)	700
Pools	6
Pools (pools per mile)	14

Characteristic	Proposed Conditions
	Parcel 1 & 2
Bankfull Width (ft) - 1.25 year	65.0
Bankfull Depth (ft) - 1.25 year	1.3
Inundation Area (Acres) - 2 year	2.5
Large Woody Material (pieces per mile) - Key Members Only	529
Large Woody Material (pieces per mile) - based on TA criteria	35

7.3.1 Side Channel

Proposed enhancements on Parcel 2 include the construction of a new side channel through a large gravel bar on river left. This side channel's inlet is located in a small pool adjacent to some small existing vegetation on river left bank. The inlet of the side channel is also located at the upstream extent of a left bank gravel bar. With the consistent location of the pool in the main channel it is anticipated that the inlet to the side channel shall remain stable. The channel is designed to meander through this floodplain for an approximate length of 730 feet and outlets back to the main channel on a left bank lateral bar just upstream of a small forced pool located under an intact cottonwood tree located on left bank. The outlet of the side channel is located in a more depositional zone and its performance could vary depending on how the main channel reacts to the proposed LWM structures placed within the channel, specifically those immediately upstream and adjacent to the outlet of the side channel. The channel planform was based on avoidance of major riparian vegetation throughout the floodplain and staying within the negotiated conservation easement to maintain habitat protection throughout the length of the side channel. The side channel is designed to activate at a flow rate of approximately 40 cfs which results in an annual activation of approximately 208 days and should be active during the critical over wintering time frame.

The proposed side channel has a typical trapezoidal cross section with a six foot bottom width and 2:1 (horizontal: vertical) side slopes up to existing grade. Within the side channel profile, there are multiple pools excavated into the channel at bend and proposed LWM structures where localized scour is likely to maintain or form these pools naturally. The most downstream 100 feet of the side channel has a flat slope in profile and will act as a shallow backwater alcove during periods of flow when the side channel is not activated. The upstream end of the side channel shall be over excavated 1.5 feet and replaced with 12-inch minus cobbles and gravels to assist in maintaining vertical grade at the side channel inlet.

7.3.2 Alcove

There is one proposed alcove within Parcels 1 and 2 accessed via the right bank near main channel Station 24+80. This area will contain a narrow inlet to the alcove and will expand through an open area surrounded by large cottonwood trees. Minor excavation will be required in this area with little to no excavation within the active drip zones of the surrounding vegetation. The alcove is relatively flat in profile, but with a small narrow entrance deposition of fine grained sediment shall be minimal.

7.3.3 Large Woody Material Structures

There are multiple locations and types of LWM structures proposed throughout Parcels 1 and 2 to increase hydraulic diversity, increase aquatic habitat, and to aid in flow deflection, bank retention, and to create roughness and cover throughout the floodplain. Table 47 displays the various types of proposed structures and the number of structures located within Parcels 1 and 2. The descriptions below discuss each specific type of LWM structure.

Table 47. Parcel 4 Typical Large Woody Material Structures.

LWM Structure Type	Quantity
Type A	4
Type B	1
Type C	1
Type D	3
Type E	1
Type F	3
Side Channel Spanning Log	7
Single Log with Rootwad	25
25' Tree Top	21
40' Full Tree	3
60' Margin Tree	1
Edge Roughness	115 lineal feet

7.3.4 Riparian Planting

The USWCD, the project sponsor for Parcels 1 and 2, is implementing the revegetation plan associated with this project. Revegetation efforts are focusing on live stakes located in and adjacent to proposed LWM structures, live stake trenching through gravel bars and directly behind an existing riprap bank along with seeding and mulching of access roads and other impacted areas.

Revegetation activities will occur immediately following or during earth moving and LWM structure construction activities. Once the final grade has been attained, all disturbed areas will be replanted as designated within the design plans. The most current planting plan is incorporated in the design plans for Parcels 1 and 2 and is attached as Appendix I.

7.4 Summary of Proposed Conditions

Table 48 summarizes proposed enhancement metrics compared to historic and existing conditions for all parcels and the entire designed project as a whole. These metrics are based on the proposed plans for each parcel.

Table 48. Summary of Historic, Existing, and Proposed Conditions.

Characteristic	Historic / Target Condition	Existing Condition	Proposed Conditions			
			Parcel 4	Parcel 3	Parcel 1 & 2	Combined
Main Channel Length (ft)	Unknown	9151	3700	4413	2254	10367
Sinuousity (ft/ft)	1.09 - 1.1	1.02	1.28	1.42	1.05	1.29
Number of Perennial Side Channels	Unknown	0	1	4	1	6
Number of Emphemeral Side Channels	Unknown	0	4	23	1	28
Side Channel Length (ft)	Unknown	0	2400	14913	700	18013
Pools	Unknown	5	8	17	6	31
Pools (pools per mile)	5 - 8 large pools/ 20	3	11	20	14	16
Bankfull Width (ft) - 1.25 year	Unknown	65	50	42-54	65.0	
Bankfull Depth (ft) - 1.25 year	Unknown	1.2	2	2.7	1.3	
Inundation Area (Acres) - 2 year	Unknown	19	16.1	39.2	2.5	57.8
Large Woody Material (pieces per mile) - Key Members Only		2.9 - 3.4	365	1675	529	959
Large Woody Material (pieces per mile) - based on TA criteria	>20	2.9-3.4	11	90	35	48

One item that will not be described via each parcel is the risk assessment associated with the design of proposed large woody material structures. Large woody material structures can be dangerous to river users, can alter locations of bank erosion and deposition, can increase risk to infrastructure on the project site and downstream and can raise water surface elevations and change local hydraulics. The Pacific Northwest Region Resource and Technical Services

Large Woody Material - Risk Based Design Guidelines were used to assess the risks associated with any proposed large woody material structure for this project (USBOR, 2014). These guidelines assess public safety risk against LWM structure characteristics to rank risk as low or high public safety risk. These guidelines also assess potential property damage risk against stream response potential to rank property risk as low, medium or high. These potential risk factors are utilized to provide minimum design criteria, and design methodology. The higher the combined risks the more stable proposed structures are required to be designed. A more complete description of this risk assessment and minimum design guidelines is provided in Appendix C Large Wood Risk Assessment.

8. Hydraulic Model

Hydraulic models were utilized throughout the design process. Existing conditions were assessed and used as baseline data for comparisons to proposed conditions. Proposed conditions were used to assess specific design entities to validate assumptions, design criteria, and recommendations. Hydraulic analyses were completed using both one and two dimensional models.

8.1 Existing Conditions

An original existing conditions model was developed throughout this project reach for Reclamation's Reach Assessment for Reaches 3 and 4. This model was a one dimensional HEC-RAS model. This model was used initially to analyze existing conditions, including channel shears, velocities, widths, depths, inundation extents, and incipient motion of sediments. These characteristics were used for comparison of proposed conditions. After the completion of the one-dimensional model, a two-dimensional model was developed and analyzed for the existing conditions. A summary of this report can be found in Appendix B.

8.2 Proposed Conditions

Proposed conditions were modeled using a variety of hydraulic modeling techniques. Riffle control sections were initially modeled using at a station hydraulic characteristics to determine critical and normal depth. This analysis provided the initial cross sectional dimensions for the proposed channel design. HEC-RAS was then used to analyze riffle cross sections, as well as all vertical grade breaks. From the one-dimensional hydraulic model the design was modified slightly to adjust for the gradually varied flow from the initial assumption of normal depth. After this adjustment, a two-dimensional model was used to analyze proposed hydraulic conditions. Again, the proposed design was modified and the two-dimensional model was rerun. The final two-dimensional model was summarized to show the hydraulic characteristics and their variation from the existing conditions. A summary of the proposed hydraulic conditions can be found in Appendix B.

9. Literature Cited

Parenthetical Reference	Bibliographic Citation
Castro and Jackson 2001	Castro, J. M. and P. L. Jackson, Phillip. "Bankfull Discharge Recurrence Intervals and Regional Hydraulic Geometry Relationships: Patterns in the Pacific Northwest, USA," in the Journal of the American Water Resources Association, Vol. 37, No. 5, October 2001, pp. 1249-1262.
CTUIR 2016	Confederated Tribes of the Umatillla Indian Reservation. 2016. Personal communication with Allen Childs on March 18, 2016.
Hack 1960	Hack, J. T. 1960. Interpretation of erosional topography in humid-temperate regions, American Journal of Science, v. 258A, pp80-97, 1960.
McIntosh et al. 1990	McIntosh et al. 1990. Bruce, Sharon Clarke, James Sedell. "Bureau of Fisheries Stream Habitat Surveys", Project No. 1989-10400, 167 electronic pages, (BPA Report DOE/BP-02246-1).
NOAA Fisheries 2014	National Oceanic and Atmospheric Administration, National Marine Fisheries Service. *2014 Supplemental FCRPS Biological Opinion. NWR-2013-9562*. January 17, 2014.
Reclamation 2012	U.S. Bureau of Reclamation. 2012. *The Catherine Creek Reach Assessment – Grande Ronde River Basin – Tributary Habitat Program, Oregon*. July 2012.
Reclamation 2014	U.S. Bureau of Reclamation. 2014. *Reclamation FCRPS BiOp Tributary Habitat Program, CSRO Grande Ronde Subbasin Work Plan – For Internal Use Only*. January 12, 2014.
Reclamation 2015	U.S. Bureau of Reclamation. 2015. *Project Management Plan Version 1.3 Catherine Creek River Mile 44 Phase III/IV Habitat Enhancement Project – LaGrande, Oregon*. February 2015.
USGS 1982	U.S. Geological Survey. 1982. Guidelines for Determining Flood Flow Frequency Bulletin #17B of the Hydrology Subcommittee (United States Geological Survey).

APPENDICES

APPENDIX A

HYDROLOGY

StreamStats Version 3.0

Basin Characteristics Ungaged Site Report

Date: Fri Mar 18, 2016 8:27:23 AM GMT-6
Study Area: Oregon
NAD 1983 Latitude: 45.187 (45 11 13)
NAD 1983 Longitude: -117.8259 (-117 49 33)

Label	Value	Units	Definition
DRNAREA	109	square miles	Area that drains to a point on a stream
DRNDENSITY	0.69	miles per square mile	Basin drainage density defined as total stream length divided by drainage area.
ELEV	5170	feet	Mean Basin Elevation
ELEVMAX	undefined	feet	Maximum basin elevation
MINBELEV	undefined	feet	Minimum basin elevation
RELIEF	undefined	feet	Maximum - minimum elevation
BSLOPD	15.6	degrees	Mean basin slope measured in degrees
MAXBSLOPD	undefined	degrees	Maximum basin slope, in degrees, using ArcInfo Grid with NHDPlus 30-m resolution elevation data.
MINBSLOPD	undefined	degrees	Minimum basin slope, in degrees, using ArcInfo Grid with NHDPlus 30-m resolution elevation data.
STRMTOT	122	miles	Total length of mapped streams in basin
STATE_HWY	11.3	miles	Length of state highways in basin
MAJ_ROADS	14.2	miles	Length of non-state major roads in basin
MIN_ROADS	296	miles	Length of non-state minor roads in basin
PRECIP	38	inches	Mean Annual Precipitation
I24H2Y	1.64	inches	Maximum 24-hour precipitation that occurs on average once in 2 years - Equivalent to precitation intensity index
WATCAPORC	0.15	in per in	Available water capacity from STATSGO data using methods from SIR 2005-5116
WATCAPORR	undefined	in per in	Available water capacity from STATSGO data using methods from SIR 2008-5126
SOILPERM	1.13	inches per hour	Average Soil Permeability
OR_HIPERMA	undefined	percent	Percent basin surface area containing high permeability aquifer units as defined in SIR 2008-5126
OR_HIPERMG	undefined	percent	Percent basin surface area containing high permeability geologic units as defined in SIR 2008-5126
MAXTEMP	51.9	degrees F	Mean annual maximum air temperature over basin area from PRISM 1971-2000 800-m grid
MINTEMP	30.3	degrees F	Mean annual minimum air temperature over basin area from PRISM 1971-2000 800-m grid
JANMAXTMP	31.5	degrees F	Mean Maximum January Temperature
JANMINTMP	16.5	degrees F	Mean Minimum January Temperature
JANMAXT2K	undefined	degrees F	Mean Maximum January Temperature from 2K resolution PRISM 1961-1990 data
JANMINT2K	undefined	degrees F	Mean Minimum January Temperature from 2K resolution PRISM 1961-1990 data
LC11WATER	0	percent	Percent of open water, class 11, from NLCD 2011
LC11BARE	0	percent	Percentage of barren from NLCD 2011 class 31

LC11FORSHB	97	percent	Percentage of forests and shrub lands, classes 41 to 52, from NLCD 2011
LC11HERB	2	percent	Percentage of herbaceous from NLCD 2011 classes 71-74
LC11CRPHAY	0	percent	Percentage of cultivated crops and hay, classes 81 and 82, from NLCD 2011
LC11WETLND	0	percent	Percentage of wetlands, classes 90 and 95, from NLCD 2011
LC11DVOPN	0	percent	Percentage of developed open area from NLCD 2011 class 21
LC11DVLO	0	percent	Percentage of developed area, low intensity, from NLCD 2011 class 22
LC11DVMD	0	percent	Percentage of area developed, medium intensity, NLCD 2011 class 23
LC11DEVHI	0	percent	Percentage of area developed, high intensity, NLCD 2011 class 24
LC11IMP	0.19	percent	Percentage of impervious area determined from NLCD 2011 impervious dataset
IMPERV	0	percent	Percentage of impervious area
FOREST	undefined	percent	Percentage of area covered by forest
ORREG2	363	dimensionless	Indicator flag for Oregon region 2

USGS Stream Gage Analysis

Project: CC-44 Habitat Enhancement **Analyst:** J. Fealko
Watercourse: Catherine Creek **Latest Revision:** 1/11/2013

Workbook Description

- This workbook is:
- contains spreadsheets that facilitate the analysis and/or design of this project,
- lists the general project and workbook information that is consistent throughout the workbook,
- lists the titles of the spreadsheets contained in this workbook, and
- is intended for use with ENGLISH UNITS.

Filename: *C:\RIO ASE\Projects\Grande Ronde\CC-44\Working\BOD\[Catherine Creek Gauge.xlsx]Peak Flows*

Sheet Titles:

USGS Stream Gage Analysis
Gage and Site Information
Daily Historic Record
Daily Flow Statistics
Monthly Flow Statistics
Instantaneous Annual Peak Flow
Log-Pearson Type III Distribution
Water Rights Analysis

Gage and Site Information

Project: CC-44 Habitat Enhancement **Analyst:** J. Fealko
Watercourse: Catherine Creek **Latest Revision:** 1/11/2013

Spreadsheet Description

- This spreadsheet contains basic information about the USGS stream gage and the downstream limits of the project site.

Gage Information

Gage Number:	13320000
Latitude:	45°09'20" N
Longitude:	117°46'26" W NAD27
Location:	Catherine Creek Near Union, Oregon
Hydrologic Unit:	17060104
Drainage Area:	105
Period of Record:	08/01/1911-Current (OWRD Currently Manages)

Daily Historic Record

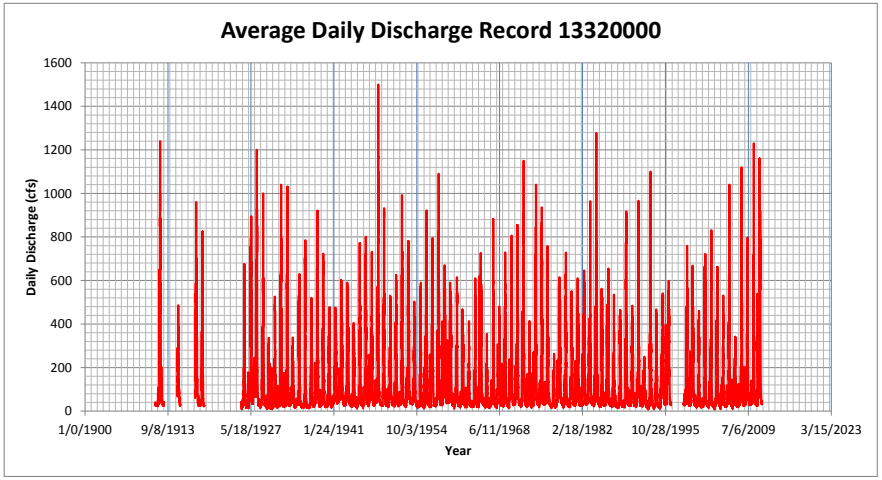
Project: CC-44 Habitat Enhancement **Site:** J. Fealko
Watercourse: Catherine Creek **Latest Revision:** 1/11/2013

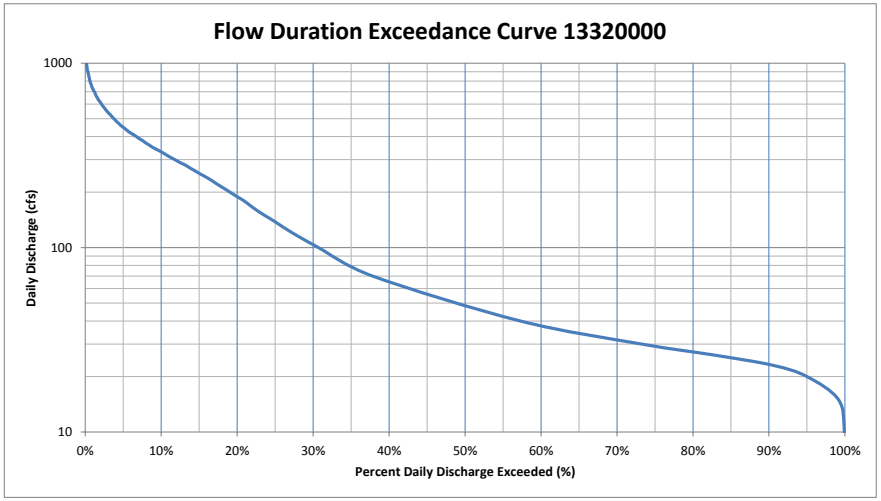
Spreadsheet Description

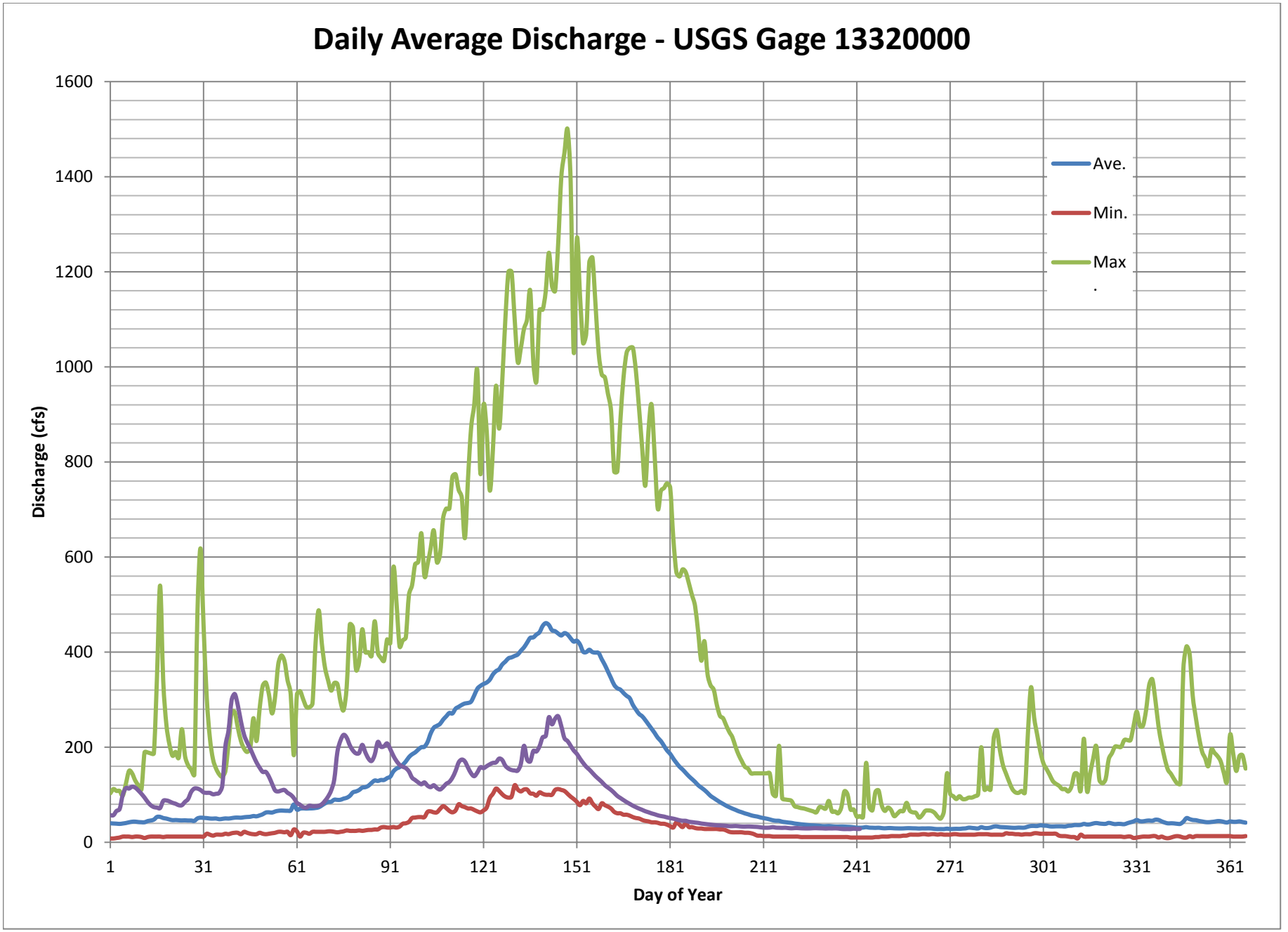
- This spreadsheet contains the average daily discharge for the historic period of record.
- This spreadsheet ranks the discharges and estimates the percent exceeded for each flow to develop a flow duration exceedance curve.
- This spreadsheet contains a graph of the average daily discharge record and a

Date	Gage 13320000 Discharge (cfs)	Interval	Gage 13320000 Histogram	% Interval	Total %
8/1/1911	34	5	0	0%	100%
8/2/1911	34	10	22	0%	100%
8/3/1911	40	15	251	1%	99%
8/4/1911	40	20	1327	4%	95%
8/5/1911	34	23	1421	4%	91%
8/6/1911	34	26	2359	7%	83%
8/7/1911	34	30	3170	10%	73%
8/8/1911	34	40	5091	16%	57%
8/9/1911	34	70	6197	19%	38%
8/10/1911	29	100	2285	7%	31%
8/11/1911	29	110	582	2%	29%
8/12/1911	29	120	505	2%	27%
8/13/1911	29	130	433	1%	26%
8/14/1911	29	140	375	1%	25%
8/15/1911	29	150	386	1%	24%
8/16/1911	29	160	333	1%	23%
8/17/1911	29	170	280	1%	22%
8/18/1911	29	180	256	1%	21%
8/19/1911	29	190	305	1%	20%
8/20/1911	29	200	269	1%	19%
8/21/1911	29	210	259	1%	18%
8/22/1911	29	220	258	1%	17%
8/23/1911	29	230	222	1%	17%
8/24/1911	29	240	234	1%	16%
8/25/1911	24	250	252	1%	15%
8/26/1911	24	260	224	1%	15%
8/27/1911	24	270	222	1%	14%
8/28/1911	24	280	199	1%	13%
8/29/1911	24	290	244	1%	12%
8/30/1911	24	300	200	1%	12%
8/31/1911	24	310	205	1%	11%
9/1/1911	24	320	185	1%	11%
9/2/1911	24	330	169	1%	10%
9/3/1911	24	340	194	1%	9%
9/4/1911	24	350	186	1%	9%
9/5/1911	29	360	141	0%	8%
9/6/1911	34	370	150	0%	8%
9/7/1911	34	380	123	0%	8%
9/8/1911	29	390	139	0%	7%
9/9/1911	29	400	127	0%	7%
9/10/1911	24	410	124	0%	6%
9/11/1911	24	420	137	0%	6%
9/12/1911	24	430	109	0%	6%
9/13/1911	24	440	93	0%	5%
9/14/1911	24	450	93	0%	5%
9/15/1911	24	460	99	0%	5%
9/16/1911	24	470	73	0%	4%
9/17/1911	24	480	81	0%	4%
9/18/1911	24	490	68	0%	4%
9/19/1911	24	500	63	0%	4%

5% Exceedance Flow:	450
50% Exceedance Flow:	48
95% Exceedance Flow:	20






Daily Average Discharge - USGS Gage 13320000
Discharge (cfs)
1600
1400
1200
1000
800
600
400
200
0
1
31
61
91
121
151
181
211
241
271
301
331
361
Day of Year
Ave.
Min.
Max.

Daily Flow Statistics

Project: CC-44 Habitat Enhancement **Site:** J. Fealko
Watercourse: Catherine Creek **Latest Revision:** 1/11/2013

Spreadsheet Description

- This spreadsheet contains the average daily discharge for the historic period of record.
- This spreadsheet contains a graph of the average daily discharge record along with the maximum and minimum daily average discharges.

USGS Gage - 13320000										
Day of Year	Month	Day	5%	Average	95%	Min	Max	Observed	Sum	St. Dev.
1	1	1		40		8	103	86	3442	20.5
2	1	2		40		8	112	86	3396	20.4
3	1	3		39		9	108	86	3367	20.1
4	1	4		39		10	108	86	3328	18.9
5	1	5		40		12	98	86	3393	18.8
6	1	6		41		12	123	86	3484	21.5
7	1	7		42		12	150	86	3611	25.8
8	1	8		43		11	145	86	3713	26.7
9	1	9		43		12	130	86	3735	25.5
10	1	10		43		12	120	86	3663	23.6
11	1	11		42		11	111	86	3630	23.0
12	1	12		42		9	189	86	3621	25.7
13	1	13		45		11	189	86	3835	27.8
14	1	14		46		12	187	86	3939	28.7
15	1	15		48		12	187	86	4106	32.6
16	1	16		53		12	347	86	4580	51.7
17	1	17		54		12	540	86	4597	62.0
18	1	18		51		11	341	86	4385	43.9
19	1	19		50		12	249	86	4294	38.8
20	1	20		48		12	206	86	4131	33.7
21	1	21		47		12	182	86	4002	29.7
22	1	22		47		12	190	86	4027	28.8
23	1	23		46		12	178	86	3985	28.1
24	1	24		46		12	238	86	3959	32.1
25	1	25		46		12	182	86	3970	30.3
26	1	26		46		12	162	86	3943	29.5
27	1	27		46		12	153	86	3936	27.9
28	1	28		45		12	142	86	3873	26.4
29	1	29		50		12	480	86	4322	54.7
30	1	30		52		12	618	86	4459	67.6
31	1	31		51		12	452	86	4416	52.5
32	2	1		51		18	304	86	4380	41.9
33	2	2		50		16	220	86	4300	36.8
34	2	3		50		14	175	86	4285	32.1
35	2	4		50		16	155	86	4313	30.5
36	2	5		49		16	143	86	4181	26.7
37	2	6		49		16	138	86	4236	25.5
38	2	7		50		18	150	86	4313	27.0
39	2	8		50		17	208	86	4295	29.1
40	2	9		51		19	275	86	4370	33.0
41	2	10		52		20	274	86	4458	34.6
42	2	11		52		20	241	86	4471	33.6
43	2	12		52		17	213	86	4442	31.6
44	2	13		53		22	197	86	4533	31.5
45	2	14		53		20	190	86	4586	32.4

Daily Flow Statistics

Project: CC-44 Habitat Enhancement **Site:** J. Fealko
Watercourse: Catherine Creek **Latest Revision:** 1/11/2013

Spreadsheet Description

- This spreadsheet contains the average daily discharge for the historic period of record.
- This spreadsheet contains a graph of the average daily discharge record along with the maximum and minimum daily average discharges.

USGS Gage - 13320000										
Day of Year	Month	Day	5%	Average	95%	Min	Max	Observed	Sum	St. Dev.
46	2	15		54		18	198	86	4618	34.3
47	2	16		55		17	261	86	4744	39.4
48	2	17		55		17	213	86	4697	34.9
49	2	18		57		20	281	86	4868	39.4
50	2	19		59		18	329	86	5066	45.9
51	2	20		63		17	336	86	5380	51.8
52	2	21		63		18	311	86	5428	53.8
53	2	22		63		19	271	86	5371	50.2
54	2	23		65		20	307	86	5569	55.7
55	2	24		66		22	375	86	5690	59.3
56	2	25		67		22	393	86	5733	62.5
57	2	26		66		21	381	86	5711	57.5
58	2	27		66		22	340	86	5705	51.1
59	2	28		67		15	311	86	5763	46.5
60	2	29		80		27	183	22	1751	51.4
61	3	1		69		23	311	87	5976	45.8
62	3	2		71		12	318	87	6149	47.7
63	3	3		71		20	301	87	6202	46.9
64	3	4		71		20	285	87	6165	46.9
65	3	5		71		18	284	87	6191	46.7
66	3	6		71		22	292	87	6215	48.0
67	3	7		72		22	421	87	6282	54.0
68	3	8		74		22	488	87	6400	57.4
69	3	9		78		22	418	87	6743	54.7
70	3	10		82		22	368	87	7108	59.0
71	3	11		85		23	341	87	7382	64.2
72	3	12		85		23	319	87	7425	63.1
73	3	13		90		22	335	87	7791	65.3
74	3	14		89		21	333	87	7764	63.4
75	3	15		89		22	296	87	7782	60.4
76	3	16		92		23	278	87	7992	58.6
77	3	17		94		25	327	87	8145	56.1
78	3	18		98		24	458	87	8504	64.3
79	3	19		105		24	452	87	9124	75.4
80	3	20		107		24	363	87	9322	68.1
81	3	21		110		25	380	87	9611	70.6
82	3	22		115		24	448	87	9976	78.3
83	3	23		116		25	400	87	10126	77.9
84	3	24		119		26	400	87	10387	79.5
85	3	25		125		26	392	87	10892	83.1
86	3	26		130		27	465	87	11276	87.6
87	3	27		129		27	399	87	11181	76.7
88	3	28		131		31	388	87	11406	73.0
89	3	29		131		32	382	87	11404	69.7
90	3	30		135		31	427	87	11712	73.3

Daily Flow Statistics

Project: CC-44 Habitat Enhancement **Site:** J. Fealko
Watercourse: Catherine Creek **Latest Revision:** 1/11/2013

Spreadsheet Description

- This spreadsheet contains the average daily discharge for the historic period of record.
- This spreadsheet contains a graph of the average daily discharge record along with the maximum and minimum daily average discharges.

USGS Gage - 13320000										
Day of Year	Month	Day	5%	Average	95%	Min	Max	Observed	Sum	St. Dev.
91	3	31		138		31	419	87	11995	72.8
92	4	1		149		32	578	87	12928	85.4
93	4	2		155		31	504	87	13446	84.6
94	4	3		158		33	412	87	13723	83.1
95	4	4		163		39	425	87	14159	86.9
96	4	5		170		40	431	87	14788	90.7
97	4	6		179		43	520	87	15561	96.1
98	4	7		185		51	540	87	16088	95.9
99	4	8		189		52	585	87	16450	100.0
100	4	9		195		53	590	87	16961	105.0
101	4	10		200		53	650	87	17408	117.0
102	4	11		201		53	560	87	17517	111.0
103	4	12		211		64	585	87	18330	115.0
104	4	13		229		65	619	87	19890	123.0
105	4	14		241		63	656	87	20993	136.0
106	4	15		245		63	589	87	21327	132.0
107	4	16		249		70	605	87	21697	132.0
108	4	17		258		76	682	87	22461	135.0
109	4	18		265		72	702	87	23031	143.0
110	4	19		272		66	702	87	23690	154.0
111	4	20		271		63	769	87	23585	149.0
112	4	21		281		67	774	87	24455	157.0
113	4	22		285		80	741	87	24819	158.0
114	4	23		289		76	725	87	25153	144.0
115	4	24		292		74	640	87	25370	134.0
116	4	25		293		71	765	87	25518	133.0
117	4	26		296		71	872	87	25735	141.0
118	4	27		309		68	920	87	26840	153.0
119	4	28		323		65	992	87	28078	164.0
120	4	29		329		63	775	87	28591	156.0
121	4	30		333		67	920	87	28966	159.0
122	5	1		336		73	865	87	29221	155.0
123	5	2		342		93	740	87	29780	148.0
124	5	3		353		102	825	87	30750	153.0
125	5	4		360		113	960	87	31353	160.0
126	5	5		364		108	870	87	31690	153.0
127	5	6		374		101	970	87	32512	162.0
128	5	7		380		96	1100	87	33082	175.0
129	5	8		387		94	1200	87	33660	185.0
130	5	9		389		96	1200	87	33854	187.0
131	5	10		392		120	1100	87	34073	189.0
132	5	11		395		111	1010	87	34362	192.0
133	5	12		403		107	1040	87	35028	199.0
134	5	13		410		111	1080	87	35692	203.0
135	5	14		420		111	1100	87	36518	205.0

Daily Flow Statistics

Project: CC-44 Habitat Enhancement **Site:** J. Fealko
Watercourse: Catherine Creek **Latest Revision:** 1/11/2013

Spreadsheet Description

- This spreadsheet contains the average daily discharge for the historic period of record.
- This spreadsheet contains a graph of the average daily discharge record along with the maximum and minimum daily average discharges.

USGS Gage - 13320000										
Day of Year	Month	Day	5%	Average	95%	Min	Max	Observed	Sum	St. Dev.
136	5	15		430		103	1160	87	37374	213.0
137	5	16		431		102	1010	87	37500	200.0
138	5	17		437		98	969	87	38001	197.0
139	5	18		442		105	1120	87	38474	206.0
140	5	19		455		102	1120	87	39547	230.0
141	5	20		461		100	1160	87	40131	237.0
142	5	21		457		100	1240	87	39716	227.0
143	5	22		446		100	1170	87	38840	212.0
144	5	23		444		110	1160	87	38591	206.0
145	5	24		439		112	1260	87	38180	207.0
146	5	25		435		110	1400	87	37867	210.0
147	5	26		440		108	1450	87	38248	219.0
148	5	27		437		102	1500	87	37988	224.0
149	5	28		429		96	1390	87	37308	216.0
150	5	29		422		91	1030	87	36682	204.0
151	5	30		424		85	1270	87	36888	219.0
152	5	31		416		78	1150	87	36188	214.0
153	6	1		401		87	1050	87	34907	199.0
154	6	2		400		82	1070	87	34811	206.0
155	6	3		405		92	1220	87	35253	221.0
156	6	4		400		82	1230	87	34815	219.0
157	6	5		399		75	1130	87	34678	219.0
158	6	6		398		70	1030	87	34592	214.0
159	6	7		385		82	984	87	33516	208.0
160	6	8		373		78	978	87	32488	200.0
161	6	9		359		75	943	87	31250	192.0
162	6	10		345		71	907	87	29996	182.0
163	6	11		331		64	780	87	28820	174.0
164	6	12		324		61	780	87	28224	170.0
165	6	13		321		61	889	87	27934	179.0
166	6	14		314		58	978	87	27321	184.0
167	6	15		308		58	1030	87	26760	183.0
168	6	16		303		56	1040	87	26360	181.0
169	6	17		289		53	1040	87	25113	167.0
170	6	18		279		51	990	87	24290	161.0
171	6	19		270		50	912	87	23526	154.0
172	6	20		265		47	829	87	23058	152.0
173	6	21		257		45	750	87	22335	150.0
174	6	22		248		44	863	87	21575	149.0
175	6	23		239		42	921	87	20816	149.0
176	6	24		230		42	814	87	20034	141.0
177	6	25		220		41	702	87	19152	135.0
178	6	26		213		39	739	87	18539	132.0
179	6	27		203		39	745	87	17624	124.0
180	6	28		193		37	755	87	16748	122.0

Daily Flow Statistics

Project: CC-44 Habitat Enhancement **Site:** J. Fealko
Watercourse: Catherine Creek **Latest Revision:** 1/11/2013

Spreadsheet Description

- This spreadsheet contains the average daily discharge for the historic period of record.
- This spreadsheet contains a graph of the average daily discharge record along with the maximum and minimum daily average discharges.

USGS Gage - 13320000										
Day of Year	Month	Day	5%	Average	95%	Min	Max	Observed	Sum	St. Dev.
181	6	29		186		34	746	87	16203	121.0
182	6	30		176		31	640	87	15343	111.0
183	7	1		167		42	568	87	14528	102.0
184	7	2		159		37	559	87	13824	96.4
185	7	3		153		32	574	87	13334	95.7
186	7	4		146		40	568	87	12672	92.8
187	7	5		139		32	545	87	12056	89.0
188	7	6		133		32	520	87	11537	85.7
189	7	7		127		30	497	87	11067	82.6
190	7	8		120		29	442	87	10443	77.4
191	7	9		115		29	382	87	10017	72.1
192	7	10		110		28	423	87	9540	69.3
193	7	11		104		28	354	87	9021	62.5
194	7	12		98		28	330	87	8480	58.1
195	7	13		93		28	321	87	8104	54.9
196	7	14		89		28	289	87	7720	49.7
197	7	15		85		27	266	87	7355	45.9
198	7	16		81		27	261	87	7032	42.9
199	7	17		77		25	246	87	6699	39.6
200	7	18		74		22	232	87	6422	37.8
201	7	19		71		21	221	87	6163	35.8
202	7	20		68		21	201	87	5937	33.3
203	7	21		65		21	184	87	5682	30.8
204	7	22		63		21	171	87	5502	28.7
205	7	23		61		20	159	87	5294	27.1
206	7	24		59		20	155	87	5135	26.3
207	7	25		57		19	145	87	4944	24.4
208	7	26		55		17	145	87	4805	23.4
209	7	27		54		14	145	87	4710	22.5
210	7	28		52		14	145	87	4551	22.1
211	7	29		51		13	145	87	4426	21.5
212	7	30		50		13	145	87	4322	21.1
213	7	31		48		13	145	87	4187	19.7
214	8	1		46		12	102	88	4072	17.2
215	8	2		45		12	98	88	3982	17.0
216	8	3		45		12	203	88	3981	22.6
217	8	4		43		12	93	88	3814	15.9
218	8	5		42		12	90	88	3729	15.2
219	8	6		42		12	89	88	3654	14.5
220	8	7		41		12	87	88	3589	15.0
221	8	8		40		12	76	88	3473	13.4
222	8	9		39		12	74	88	3402	12.5
223	8	10		38		11	72	88	3337	12.2
224	8	11		37		11	71	88	3277	11.7
225	8	12		36		11	69	88	3203	11.3

Daily Flow Statistics

Project: CC-44 Habitat Enhancement **Site:** J. Fealko
Watercourse: Catherine Creek **Latest Revision:** 1/11/2013

Spreadsheet Description

- This spreadsheet contains the average daily discharge for the historic period of record.
- This spreadsheet contains a graph of the average daily discharge record along with the maximum and minimum daily average discharges.

USGS Gage - 13320000										
Day of Year	Month	Day	5%	Average	95%	Min	Max	Observed	Sum	St. Dev.
226	8	13		36		11	67	88	3151	10.9
227	8	14		36		11	65	88	3120	10.9
228	8	15		35		11	63	88	3090	11.1
229	8	16		35		11	74	88	3049	11.5
230	8	17		34		11	73	88	2984	10.9
231	8	18		34		11	71	88	2986	10.5
232	8	19		34		11	87	88	3011	11.6
233	8	20		34		11	65	88	2965	10.5
234	8	21		33		11	65	88	2917	10.4
235	8	22		33		11	61	88	2903	10.2
236	8	23		33		11	73	88	2924	11.2
237	8	24		33		11	107	88	2906	12.9
238	8	25		33		11	101	88	2868	12.2
239	8	26		32		10	69	88	2840	10.8
240	8	27		32		10	69	88	2776	10.3
241	8	28		31		10	54	88	2710	8.7
242	8	29		31		10	55	88	2694	8.7
243	8	30		31		10	53	88	2722	9.0
244	8	31		32		10	167	88	2802	16.7
245	9	1		31		10	75	88	2711	10.3
246	9	2		31		10	67	88	2692	9.5
247	9	3		30		11	106	88	2664	11.2
248	9	4		31		11	109	88	2691	12.4
249	9	5		30		12	78	88	2635	9.3
250	9	6		29		12	66	88	2591	8.5
251	9	7		30		12	73	88	2627	10.0
252	9	8		30		13	68	88	2634	9.8
253	9	9		29		13	55	88	2584	8.5
254	9	10		29		13	60	88	2568	8.8
255	9	11		29		13	66	88	2560	8.9
256	9	12		29		14	66	88	2571	9.6
257	9	13		30		14	83	88	2603	10.3
258	9	14		30		16	67	88	2617	9.3
259	9	15		29		16	63	88	2589	9.3
260	9	16		29		16	62	88	2579	8.6
261	9	17		29		16	52	88	2540	7.2
262	9	18		29		17	57	88	2572	8.2
263	9	19		29		17	66	88	2563	8.3
264	9	20		29		16	67	88	2575	8.2
265	9	21		29		17	66	88	2554	8.3
266	9	22		28		17	62	88	2480	7.5
267	9	23		28		16	54	88	2451	7.3
268	9	24		28		17	50	88	2452	7.1
269	9	25		28		16	65	88	2448	7.9
270	9	26		29		16	145	88	2527	14.4

Daily Flow Statistics

Project: CC-44 Habitat Enhancement **Site:** J. Fealko
Watercourse: Catherine Creek **Latest Revision:** 1/11/2013

Spreadsheet Description

- This spreadsheet contains the average daily discharge for the historic period of record.
- This spreadsheet contains a graph of the average daily discharge record along with the maximum and minimum daily average discharges.

USGS Gage - 13320000										
Day of Year	Month	Day	5%	Average	95%	Min	Max	Observed	Sum	St. Dev.
271	9	27		28		16	102	88	2452	10.0
272	9	28		28		17	97	88	2476	10.3
273	9	29		28		17	91	88	2495	11.4
274	9	30		28		16	97	88	2484	11.4
275	10	1		29		16	91	86	2483	11.7
276	10	2		29		16	91	86	2522	10.8
277	10	3		31		16	94	86	2639	12.5
278	10	4		30		16	94	86	2601	12.6
279	10	5		30		16	97	86	2547	11.8
280	10	6		29		17	101	86	2500	11.9
281	10	7		32		17	200	86	2726	22.2
282	10	8		30		17	111	86	2596	13.0
283	10	9		30		17	115	86	2570	14.8
284	10	10		31		16	111	86	2656	14.7
285	10	11		33		16	218	86	2835	23.7
286	10	12		33		16	236	86	2868	25.9
287	10	13		32		16	194	86	2764	21.4
288	10	14		32		16	162	86	2730	18.8
289	10	15		31		19	144	86	2699	17.0
290	10	16		31		18	127	86	2663	15.5
291	10	17		31		18	112	86	2623	14.1
292	10	18		30		17	105	86	2617	13.7
293	10	19		31		17	104	86	2654	13.6
294	10	20		31		16	108	86	2640	13.5
295	10	21		31		17	104	86	2657	13.2
296	10	22		33		17	228	86	2830	24.5
297	10	23		34		17	326	86	2953	33.7
298	10	24		34		19	263	86	2960	27.6
299	10	25		34		19	226	86	2938	24.1
300	10	26		36		18	191	86	3072	22.8
301	10	27		35		18	166	86	3014	20.3
302	10	28		35		18	154	86	2995	19.7
303	10	29		34		18	142	86	2880	16.2
304	10	30		33		18	129	86	2851	15.0
305	10	31		34		18	123	86	2880	14.4
306	11	1		34		14	119	87	2924	14.7
307	11	2		34		13	112	87	2914	14.6
308	11	3		33		13	112	87	2889	13.9
309	11	4		35		12	107	87	3017	15.1
310	11	5		35		11	117	87	3046	16.2
311	11	6		36		11	144	87	3156	21.0
312	11	7		36		8	143	87	3152	21.0
313	11	8		37		16	109	87	3180	18.5
314	11	9		39		12	218	87	3361	26.4
315	11	10		37		12	108	87	3255	19.1

Daily Flow Statistics

Project: CC-44 Habitat Enhancement **Site:** J. Fealko
Watercourse: Catherine Creek **Latest Revision:** 1/11/2013

Spreadsheet Description

- This spreadsheet contains the average daily discharge for the historic period of record.
- This spreadsheet contains a graph of the average daily discharge record along with the maximum and minimum daily average discharges.

USGS Gage - 13320000										
Day of Year	Month	Day	5%	Average	95%	Min	Max	Observed	Sum	St. Dev.
316	11	11		38		12	144	87	3285	20.3
317	11	12		40		12	176	87	3437	23.7
318	11	13		41		12	202	87	3520	27.1
319	11	14		40		12	131	87	3436	20.3
320	11	15		39		12	124	87	3388	20.1
321	11	16		39		12	133	87	3372	20.1
322	11	17		41		12	175	87	3548	25.8
323	11	18		40		12	187	87	3434	23.5
324	11	19		38		12	201	87	3324	23.7
325	11	20		39		12	201	87	3375	24.3
326	11	21		39		12	201	87	3353	24.8
327	11	22		38		11	215	87	3303	24.8
328	11	23		40		12	215	87	3497	27.0
329	11	24		42		12	215	87	3660	29.9
330	11	25		44		9	245	87	3827	34.2
331	11	26		47		10	275	87	4074	42.4
332	11	27		44		11	245	87	3867	33.1
333	11	28		44		12	245	87	3839	34.8
334	11	29		45		12	278	87	3933	38.7
335	11	30		46		12	331	87	3980	42.7
336	12	1		45		13	343	87	3930	39.7
337	12	2		48		13	299	87	4131	40.5
338	12	3		47		10	244	87	4090	41.5
339	12	4		44		12	207	87	3826	33.8
340	12	5		42		9.5	176	87	3621	28.9
341	12	6		40		8.5	153	87	3463	25.0
342	12	7		40		10	144	87	3481	24.9
343	12	8		40		12	133	87	3452	24.9
344	12	9		39		13	124	87	3381	22.7
345	12	10		39		12	123	87	3380	21.9
346	12	11		44		10	366	87	3784	42.1
347	12	12		51		10	412	87	4425	64.7
348	12	13		49		13	396	87	4242	55.2
349	12	14		47		11	308	87	4085	48.1
350	12	15		47		13	262	87	4048	41.8
351	12	16		45		13	222	87	3907	36.1
352	12	17		44		13	191	87	3813	31.9
353	12	18		43		13	177	87	3703	29.7
354	12	19		42		13	160	87	3671	28.4
355	12	20		43		13	195	87	3726	29.2
356	12	21		44		13	188	87	3786	29.0
357	12	22		45		13	181	87	3876	30.4
358	12	23		44		13	170	87	3851	28.9
359	12	24		43		13	146	87	3730	25.8
360	12	25		42		13	127	87	3616	22.8

Daily Flow Statistics

Project: CC-44 Habitat Enhancement **Site:** J. Fealko
Watercourse: Catherine Creek **Latest Revision:** 1/11/2013

Spreadsheet Description

- This spreadsheet contains the average daily discharge for the historic period of record.
- This spreadsheet contains a graph of the average daily discharge record along with the maximum and minimum daily average discharges.

USGS Gage - 13320000										
Day of Year	Month	Day	5%	Average	95%	Min	Max	Observed	Sum	St. Dev.
361	12	26		44		13	226	87	3815	29.8
362	12	27		43		12	187	87	3751	26.7
363	12	28		43		12	150	87	3746	24.5
364	12	29		44		12	181	87	3832	28.0
365	12	30		43		12	183	87	3707	26.4
366	12	31		41		13	155	87	3595	23.6

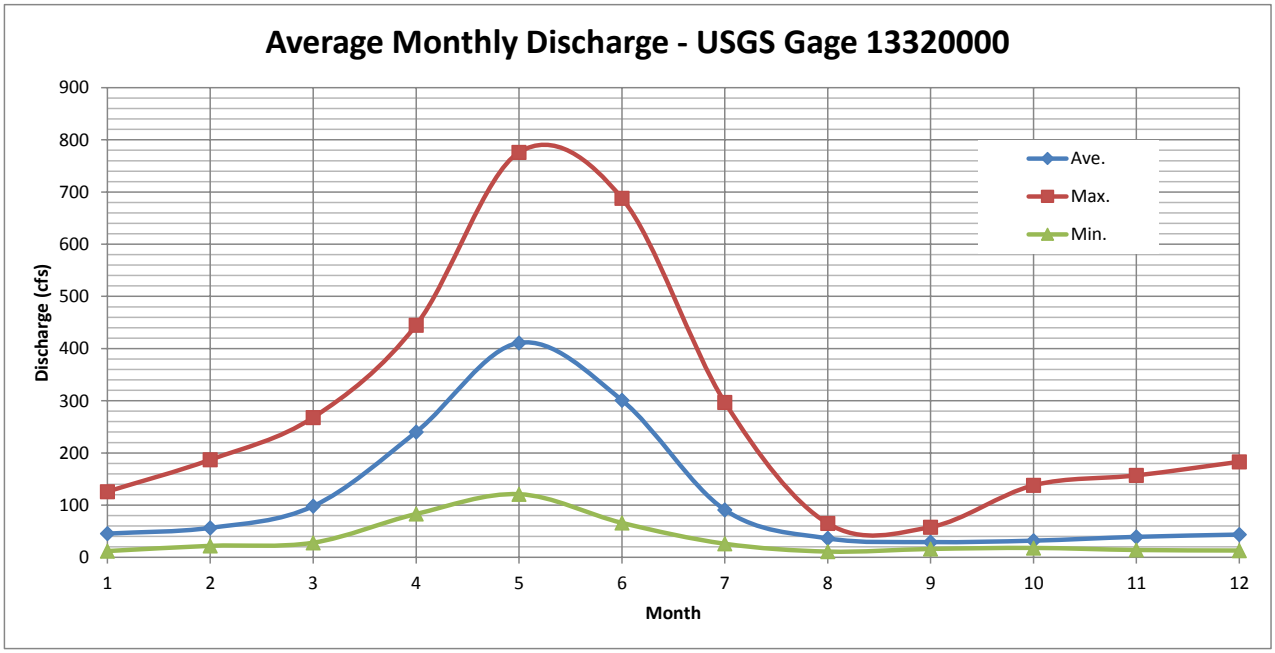
Monthly Flow Statistics

Project: CC-44 Habitat Enhancement
Watercourse: Catherine Creek
Site: J. Fealko
Latest Revision: 1/11/2013

Spreadsheet Description

- This spreadsheet contains the average monthly discharge for the historic period of record.
- This spreadsheet contains a graph of the average monthly discharge record along with the maximum and minimum monthly average discharges.

USGS Gage - 13320000							
Month	Minimum	Average	Maximum	95%	80%	20%	5%
January	12	45.4	126	20	26	57	103
February	22	56.5	187	22	29	72	135
March	28	98.1	268	31	47	139	240
April	83	240	445	76	121	341	528
May	121	411	776	155	249	554	797
June	66	301	688	74	147	424	675
July	26	91	297	30	44	126	220
August	11	36.3	65	19	25	45	60
September	16	29.2	58	18	22	34	45
October	18	31.9	138	19	23	36	53
November	14	39.2	157	19	25	46	85
December	13	43.6	183	18	24	54	104



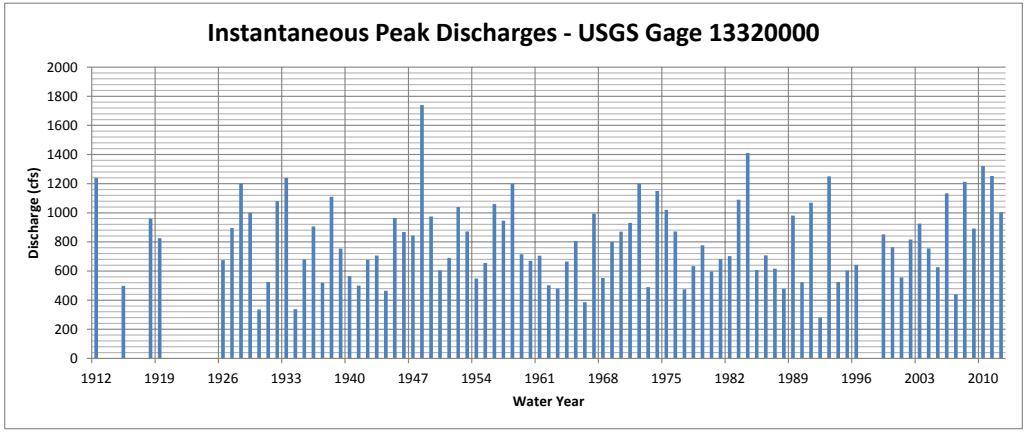
Instantaneous Annual Peak Flow

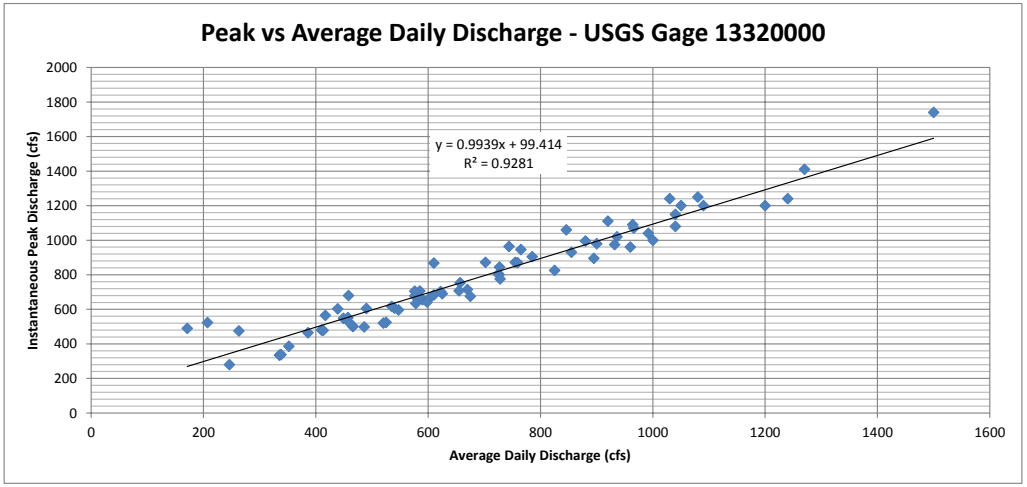
Project: CC-44 Habitat Enhancement **Site:** J. Fealko
Watercourse: Catherine Creek **Latest Revision:** 1/11/2013

Spreadsheet Description

- This spreadsheet contains the annual instantaneous peak discharges for the historic period of record.
- This spreadsheet contains a graph of the peak annual discharges along with a graph showing instantaneous peak compared to the daily average discharge.

	13320000		
Water Year	Date	Peak Discharge (cfs)	Average Day Discharge (cfs)
1912	05/21/12	1240	1240
1913			
1914			
1915	05/18/15	498	486
1916			
1917			
1918	05/04/18	960	960
1919	05/26/19	825	825
1920			
1921			
1922			
1923			
1924			
1925			
1926	04/19/26	675	675
1927	06/09/27	895	895
1928	05/08/28	1200	1200
1929	05/24/29	1000	1000
1930	05/03/30	335	335
1931	05/03/31	525	525
1932	05/13/32	1080	1040
1933	06/03/33	1240	1030
1934	04/23/34	338	338
1935	04/15/35	680	458
1936	05/13/36	905	785
1937	05/14/37	520	520
1938	04/30/38	1110	920
1939	05/02/39	754	657
1940	05/10/40	565	417
1941	05/13/41	500	466
1942	04/17/42	678	576
1943	04/15/43	706	585
1944	05/06/44	464	386
1945	05/04/45	964	744
1946	04/25/46	868	610
1947	05/07/47	844	727
1948	05/27/48	1740	1500
1949	05/15/49	974	932
1950	05/22/50	605	490
1951	05/11/51	690	625
1952	04/28/52	1040	992





Instantaneous Annual Peak Flow

Project: CC-44 Habitat Enhancement **Site:** J. Fealko
Watercourse: Catherine Creek **Latest Revision:** 1/11/2013

Spreadsheet Description

- This spreadsheet contains the annual instantaneous peak discharges for the historic period of record.
- This spreadsheet contains a graph of the peak annual discharges along with a graph showing instantaneous peak compared to the daily average discharge.

	13320000		
Water Year	Date	Peak Discharge (cfs)	Average Day Discharge (cfs)
1953	06/13/53	872	755
1954	05/09/54	548	449
1955	06/10/55	655	590
1956	05/23/56	1060	846
1957	05/18/57	946	765
1958	05/21/58	1200	1090
1959	05/15/59	715	670
1960	04/08/60	670	585
1961	05/25/61	705	576
1962	04/19/62	502	466
1963	05/22/63	480	410
1964	06/06/64	665	602
1965	04/30/65	805	725
1966	05/06/66	386	352
1967	05/22/67	995	880
1968	05/20/68	552	457
1969	05/11/69	800	726
1970	06/04/70	870	759
1971	05/28/71	930	855
1972	06/01/72	1200	1050
1973	01/16/73	490	171
1974	06/16/74	1150	1040
1975	06/02/75	1020	936
1976	05/10/76	872	702
1977	06/08/77	475	263
1978	04/01/78	634	578
1979	05/24/79	776	728
1980	04/29/80	596	547
1981	05/01/81	683	610
1982	05/25/82	703	622
1983	05/28/83	1090	964
1984	05/30/84	1410	1270
1985	04/15/85	607	540
1986	05/31/86	707	655
1987	04/30/87	616	535
1988	04/16/88	478	413
1989	05/07/89	980	900
1990	05/20/90	523	207
1991	05/19/91	1070	966
1992	05/07/92	280	246
1993	05/13/93	1250	1080
1994	04/20/94	525	459

Instantaneous Annual Peak Flow

Project: CC-44 Habitat Enhancement **Site:** J. Fealko
Watercourse: Catherine Creek **Latest Revision:** 1/11/2013

Spreadsheet Description

- This spreadsheet contains the annual instantaneous peak discharges for the historic period of record.
- This spreadsheet contains a graph of the peak annual discharges along with a graph showing instantaneous peak compared to the daily average discharge.

	13320000		
Water Year	Date	Peak Discharge (cfs)	Average Day Discharge (cfs)
1995	05/16/95	603	439
1996	05/17/96	642	598
1997			
1998			
1999		852	757
2000		763	668
2001		556	459
2002		817	722
2003		925	831
2004		755	660
2005		626	530
2006		1133	1040
2007		439	342
2008		1213	1120
2009		892	797
2010		1322	1230
2011		1252	1160
2012		1004	910

Log-Pearson Type III Distribution

Project: CC-44 Habitat Enhancement **Site:** J. Fealko
Watercourse: Catherine Creek **Latest Revision:** 1/11/2013

Spreadsheet Description

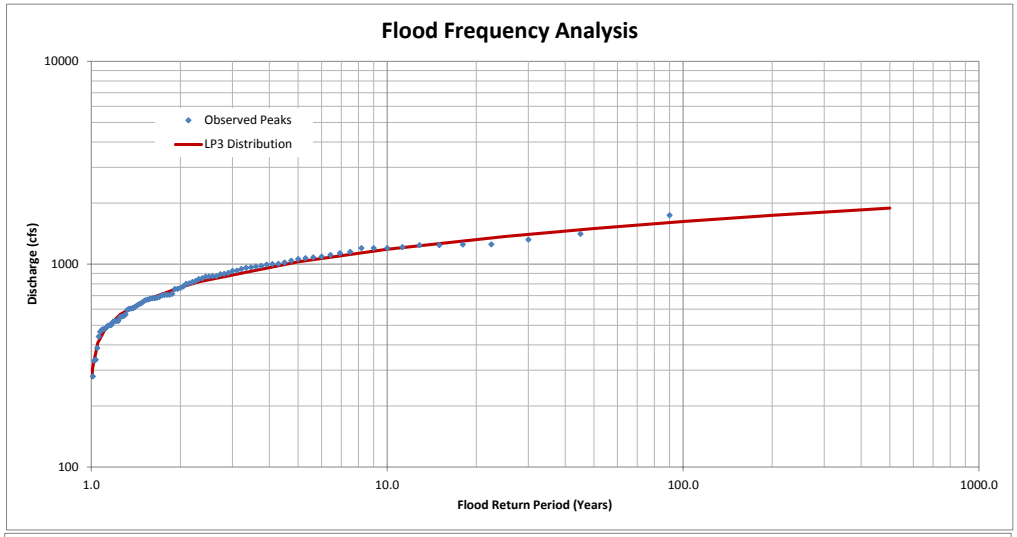
- This spreadsheet contains the results from a LP3 analysis conducted on the gage using the USGS WinPKFQ Program, which follows the USGS Bulleting 17B guidelines.
- This spreadsheet contains a graph of the flood frequency analysis as well as a graph showing the instantaneous peak discharges and how they relate to selected recurrence intervals.

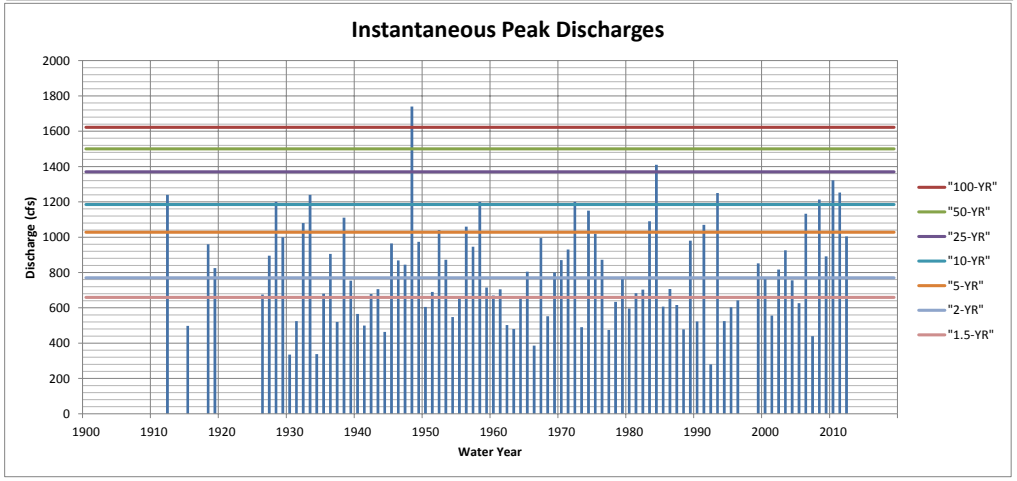
Return Frequency (Years)	Exceedance Probability	Discharge (cfs)
1.005	0.995	276
1.010	0.99	307
1.05	0.95	410
1.11	0.9	475
1.25	0.8	565
1.5	0.66666667	659
2	0.5	770
2.33	0.4292	821
5	0.2	1028
10	0.1	1185
25	0.04	1370
50	0.02	1500
100	0.01	1622
200	0.005	1740
500	0.002	1890

100	1900	1622
	2019	1622
50	1900	1500
	2019	1500
25	1900	1370
	2019	1370
10	1900	1185
	2019	1185
5	1900	1028
	2019	1028
2	1900	770
	2019	770
1.5	1900	659
	2019	659

For Plotting Only

Rank	Discharge (cfs)	Weibul Position	Return Period (years)
1	1740	0.011	90.0
2	1410	0.022	45.0
3	1322	0.033	30.0
4	1252	0.044	22.5
5	1250	0.056	18.0
6	1240	0.067	15.0
7	1240	0.078	12.9
8	1213	0.089	11.3
9	1200	0.100	10.0
10	1200	0.111	9.0
11	1200	0.122	8.2
12	1150	0.133	7.5
13	1133	0.144	6.9
14	1110	0.156	6.4
15	1090	0.167	6.0
16	1080	0.178	5.6
17	1070	0.189	5.3
18	1060	0.200	5.0
19	1040	0.211	4.7
20	1020	0.222	4.5
21	1004	0.233	4.3
22	1000	0.244	4.1
23	995	0.256	3.9
24	980	0.267	3.8
25	974	0.278	3.6
26	964	0.289	3.5
27	960	0.300	3.3
28	946	0.311	3.2
29	930	0.322	3.1
30	925	0.333	3.0
31	905	0.344	2.9
32	895	0.356	2.8
33	892	0.367	2.7
34	872	0.378	2.6
35	872	0.389	2.6
36	870	0.400	2.5
37	868	0.411	2.4
38	852	0.422	2.4
39	844	0.433	2.3
40	825	0.444	2.3
41	817	0.456	2.2
42	805	0.467	2.1
43	800	0.478	2.1
44	776	0.489	2.0
45	763	0.500	2.0
46	755	0.511	2.0
47	754	0.522	1.9
48	715	0.533	1.9
49	707	0.544	1.8
50	706	0.556	1.8
51	705	0.567	1.8





Log-Pearson Type III Distribution

Project: CC-44 Habitat Enhancement **Site:** J. Fealko
Watercourse: Catherine Creek **Latest Revision:** 1/11/2013

Spreadsheet Description

- This spreadsheet contains the results from a LP3 analysis conducted on the gage using the USGS WinPKFQ Program, which follows the USGS Bulleting 17B guidelines.
- This spreadsheet contains a graph of the flood frequency analysis as well as a graph showing the instantaneous peak discharges and how they relate to selected recurrence intervals.

Return Frequency (Years)	Exceedance Probability	Discharge (cfs)

Rank	Discharge (cfs)	Weibul Position	Return Period (years)
52	703	0.578	1.7
53	690	0.589	1.7
54	683	0.600	1.7
55	680	0.611	1.6
56	678	0.622	1.6
57	675	0.633	1.6
58	670	0.644	1.6
59	665	0.656	1.5
60	655	0.667	1.5
61	642	0.678	1.5
62	634	0.689	1.5
63	626	0.700	1.4
64	616	0.711	1.4
65	607	0.722	1.4
66	605	0.733	1.4
67	603	0.744	1.3
68	596	0.756	1.3
69	565	0.767	1.3
70	556	0.778	1.3
71	552	0.789	1.3
72	548	0.800	1.3
73	525	0.811	1.2
74	525	0.822	1.2
75	523	0.833	1.2
76	520	0.844	1.2
77	502	0.856	1.2
78	500	0.867	1.2
79	498	0.878	1.1
80	490	0.889	1.1
81	480	0.900	1.1
82	478	0.911	1.1
83	475	0.922	1.1
84	464	0.933	1.1
85	439	0.944	1.1
86	386	0.956	1.0
87	338	0.967	1.0
88	335	0.978	1.0
89	280	0.989	1.0

APPENDIX B

PARCEL 4 FINAL DESIGN PLANS

UNION SOIL AND WATER CONSERVATION DISTRICT

CC-44 PHASE III HABITAT ENHANCEMENT PLANS - PARCEL 4

FINAL DESIGN DRAWINGS

PREPARED FOR:
UNION SOIL AND WATER CONSERVATION DISTRICT
KATE FRENYEA
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LA GRANDE, OR 97850
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PREPARED BY:
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION, PACIFIC NORTHWEST REGION
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10507 N. MCALISTER RD.
LA GRANDE, OR 97850
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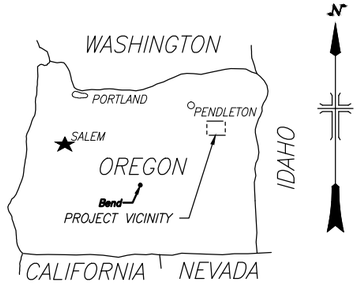
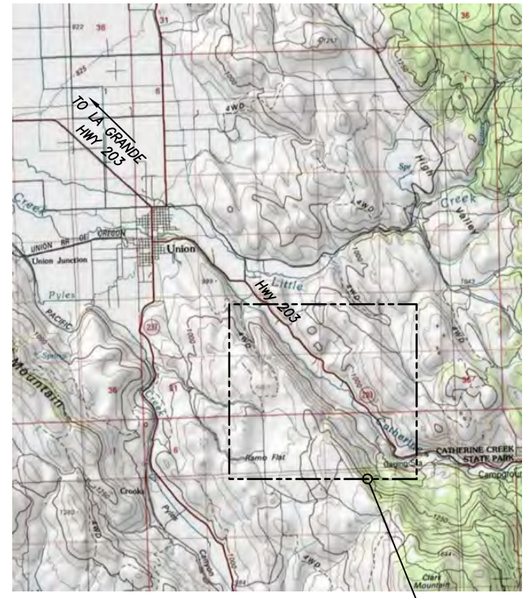
SITE SUMMARY
T4S, R40E, SEC.34
UNION COUNTY, WA.
45°10'10.22"N 117°47'58.49"W



PARTNERS:
OREGON DEPARTMENT OF FISH AND WILDLIFE
CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION
BONNEVILLE POWER ADMINISTRATION





VICINTIY MAP

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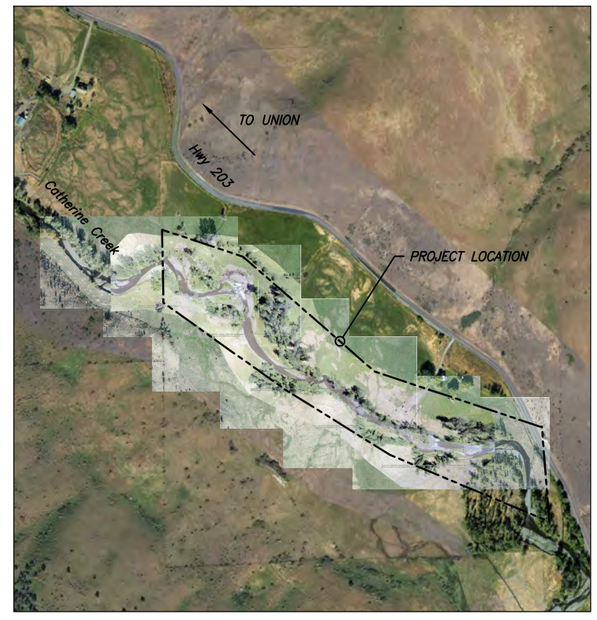
SCALE OF FEET



LOCATION MAP

500 0 500 1000 1500
SCALE OF FEET

SHEET INDEX

1	1678-100-1950	COVER SHEET
2	1678-100-1951	GENERAL NOTES AND ABBREVIATIONS
3	1678-100-1952	SURVEY CONTROL
4	1678-100-1953	EXISTING CONDITIONS - PARCEL 4
5	1678-100-1954	ACCESS & STAGING PLAN - PARCEL 4
6	1678-100-1955	DEWATERING PLAN - PARCEL 4 - STEP 1
7	1678-100-1956	DEWATERING PLAN - PARCEL 4 - STEP 2
8	1678-100-1957	DEWATERING PLAN - PARCEL 4 - STEP 3
9	1678-100-1958	DEWATERING PLAN - PARCEL 4 - STEP 4
10	1678-100-1959	DEWATERING PLAN - PARCEL 4 - DETAILS
11	1678-100-1960	PARCEL 4 - ROUGH GRADE - EARTHWORK CUT AND FILL AREAS AND FLOODPLAIN ZONES
12	1678-100-1961	GRADING PLAN OVERVIEW
13	1678-100-1962	GRADING PLAN - STA. 0+00 TO STA. 17+00
14	1678-100-1963	GRADING PLAN - STA. 17+00 TO STA. 28+00
15	1678-100-1964	GRADING PLAN - STA. 28+00 TO STA. 38+64
16	1678-100-1965	MAIN CHANNEL PLAN AND PROFILE - STA. 0+00 TO STA. 8+00
17	1678-100-1966	MAIN CHANNEL PLAN AND PROFILE - STA. 8+00 TO STA. 12+90
18	1678-100-1967	MAIN CHANNEL PLAN AND PROFILE - STA. 12+90 TO STA. 17+80
19	1678-100-1968	MAIN CHANNEL PLAN AND PROFILE - STA. 17+80 TO STA. 22+70
20	1678-100-1969	MAIN CHANNEL PLAN AND PROFILE - STA. 22+70 TO STA. 27+60
21	1678-100-1970	MAIN CHANNEL PLAN AND PROFILE - STA. 27+60 TO STA. 32+50
22	1678-100-1971	MAIN CHANNEL SPLIT FLOW PLAN AND PROFILE - STA. 11+47 TO STA. 14+44
23	1678-100-1972	SIDE CHANNEL 1 - PLAN, PROFILE, & SECTIONS
24	1678-100-1973	SIDE CHANNEL 2 - PLAN, PROFILE, & SECTIONS
25	1678-100-1974	SIDE CHANNEL 3 - PLAN, PROFILE, & SECTIONS
26	1678-100-1975	SIDE CHANNEL 4 - PLAN, PROFILE, & SECTIONS
27	1678-100-1976	ALCOVE 1 - PLAN, PROFILE, AND SECTIONS
28	1678-100-1977	ALCOVE 2 - PLAN, PROFILE, AND SECTIONS
29	1678-100-1978	MAIN CHANNEL CROSS SECTIONS - STA. 9+13 TO STA. 11+47
30	1678-100-1979	MAIN CHANNEL CROSS SECTIONS - STA. 12+24 TO STA. 15+12
31	1678-100-1980	MAIN CHANNEL CROSS SECTIONS - STA. 15+78 TO STA. 18+17
32	1678-100-1981	MAIN CHANNEL CROSS SECTIONS - STA. 18+63 TO STA. 27+61
33	1678-100-1982	MAIN CHANNEL CROSS SECTIONS - STA. 28+45 TO STA. 29+20
34	1678-100-1983	MAIN CHANNEL SPLIT FLOW CROSS SECTIONS - STA. 3+15 TO STA. 4+65
35	1678-100-1984	STABILIZED LIVESTOCK ACCESS PAD AND FLOODPLAIN BENCH - PLAN & SECTION
36	1678-100-1985	RIFFLE DETAILS
37	1678-100-1986	POOL AND BAR DETAILS
38	1678-100-1987	LWM PLAN - STA 0+00 TO 13+50
39	1678-100-1988	LWM PLAN - STA 13+50 TO 22+00
40	1678-100-1989	LWM PLAN - STA 22+00 TO 30+00
41	1678-100-1990	LWM PLAN - STA 30+00 TO 34+00
42	1678-100-1991	LWM DETAILS - SIDE CHANNEL INLET STRUCTURE
43	1678-100-1992	LWM DETAILS - STREAMBANK HABITAT STRUCTURE
44	1678-100-1993	LWM DETAILS - TIGHT RADIUS BEND STRUCTURE
45	1678-100-1994	LWM DETAILS - TIGHT RADIUS BEND STRUCTURE
46	1678-100-1995	LWM DETAILS - MILD RADIUS BEND STRUCTURE
47	1678-100-1996	LWM DETAILS - MILD RADIUS BEND STRUCTURE
48	1678-100-1997	LWM DETAILS - HIGH ENERGY BANK STRUCTURE
49	1678-100-1998	LWM DETAILS - HIGH ENERGY BANK STRUCTURE
50	1678-100-1999	LWM DETAILS - LARGE APEX JAM
51	1678-100-2000	LWM DETAILS - LARGE APEX JAM
52	1678-100-2001	LWM DETAILS - SMALL APEX JAM
53	1678-100-2002	LWM DETAILS - SWEEPER LOG STRUCTURE
54	1678-100-2003	LWM DETAILS - EDGE ROUGHNESS / BRUSH MATTRESS
55	1678-100-2004	LWM DETAILS - FLOODPLAIN LOGS / SINGLE LOGS
56	1678-100-2005	PLANTING PLAN OVERVIEW - PARCEL 4
57	1678-100-2006	PLANTING PLAN
58	1678-100-2007	PLANTING PLAN
59	1678-100-2008	PLANTING DETAILS
60	1678-100-2009	PLANTING DETAILS
61	1678-100-2010	LIVE BRUSH TRENCH PLAN AND SECTIONS

RECLAMATION
Managing Water in the West

Union Soil and Water Conservation District

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BUREAU OF RECLAMATION

COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 - COVER SHEET

Jay B. Hoyde
DESIGNED
KK
DRAWN
Mike Knutson P.E.
CHECKED
Jay B. Hoyde P.E.
TECH. APPR. NAME, PROF. ABBR.
Charles Spindler
ADMIN. APPROVAL
NAME Charles Spindler
TITLE Program Manager-Acting
CSRO (BOISE, IDAHO) 2015-04-30

COVER SHEET

1678-100-1950

SHEET 1 OF 2

DATE AND TIME PLOTTED
APRIL 28, 2015 11:28
PLOTTED BY
JHOYDE

CAD SYSTEM
AutoCAD Rel. 19.1s
CAD FILENAME
1678-100-1950.DWG

GENERAL NOTES:

1. Work shown on these plans will be performed for the Union Soil and Water Conservation District (USWCD), herein referred to as "Contracting Agency." Contact information for Contracting Agency's representative is included on Sheet 1678–100–T1. Contracting Agency's representative (or other persons assigned by Contracting Agency to act as Contracting Agency's representative) are herein referred to as the "Contracting Officer."
2. The drawings contained within should not be applied to any project except the one specified; specifically the habitat enhancements on Catherine Creek within the project boundary for CC–44 PHASE III – Parcel 4 as seen on the cover sheet.
3. The contractor shall construct the stream enhancement in accordance with the plans stamped "Approved for Construction." These plans will be provided to the contractor by Contracting Agency prior to construction. Work shall not be done without the current set of approved construction plans.
4. The enhancement designs depicted herein are approximate and are intended to express the overall design intent of the project. These designs may need to be adjusted in the field during construction in order to meet the specific site conditions and intended function.
5. Elevations and distances shown are in feet and decimals.
6. Horizontal datum is US State Plane Coordinate System, Oregon North Zone, NAD 83, International Feet. The vertical datum is NAVD 88, feet.
7. Topographic mapping within stream banks of the project area is based on surveys performed with ground survey equipment. Topographic mapping outside of the stream banks is based on LiDAR imaging. Due to continued erosion of the stream bank, the geometry of the stream banks at the time of construction could be different than shown on these plans.
8. Existing underground utility locations have not been completely identified and may not be shown on these plans. The contractor is responsible to locate utilities prior to construction and protect utilities during construction. The telephone number for the one call center for utility locates is 1–800–424–5555.
9. The contractor shall pursue work in a continuous and diligent manner to ensure a timely completion of the project.
10. The contractor shall be responsible for the general safety during construction, and all work shall conform to pertinent safety regulations and codes. The contractor shall be solely and completely responsible for compliance with all applicable provisions of OSHA and OAR Chapter 437, in the construction practices for all employees directly engaged in the construction of this project.
11. All material and workmanship furnished on or for the project must meet the minimum requirements of project permits, approving agencies, specifications as set forth herein, or whichever is more restrictive.
12. Contractor shall be responsible for obtaining, at contractor's expense, all construction permits as required by local, state and federal agencies. Contractor shall provide all material, labor, and equipment required to comply with all applicable permit conditions and requirements.
13. Contractor shall confirm the access point, route(s), and locations of temporary staging and storage areas with the Contracting Officer prior to transporting materials and equipment to the project site.
14. Prior to commencement of work, contractor shall provide the Contracting Agency with a detailed construction schedule and work plan for approval. The contractor shall not begin any construction work until the project schedule and work plan is approved by the Contracting Officer.
15. All construction shall be closely coordinated with the Contracting Officer so that the quality of work can be checked for approval.
16. All work within the actively flowing channel or side channels of Catherine Creek shall occur within the allowable fish window (July 1 – August 15).
17. Anytime work occurs within the actively flowing channel, the contractor shall monitor turbidity in the creek once per hour at a location 100 feet downstream of the construction activity using turbidity monitoring equipment provided by the contracting officer. Turbidity in the creek shall be limited to the levels listed in the permits and specifications, and the contractor shall modify work procedures if necessary as listed in the specifications. The contracting officer will assist the contractor during initial measurements to ensure the contractor is using the testing equipment correctly, however, the contractor will be responsible to perform all measurements and maintain a log that documents the dates, times, and turbidity levels of all measurements taken.
18. The contractor shall notify the Contracting Officer a minimum of 5 working days in advance of cofferdam construction and placement of fill in the creek channel to coordinate fish removal. The Contracting Agency will be responsible for all fish removal and handling.
19. Fish exclusion shall be conducted in this project area prior to any dewatering activities, or construction within or directly adjacent to the channel.
20. The contractor shall install and maintain appropriate sediment control devices throughout the whole project site, including the construction staging area and stockpile area throughout the projects' construction. Temporary construction and permanent erosion control measures shall be designed, constructed and maintained in accordance with all applicable local, state and federal regulations.
21. Dewatering within cofferdams shall be performed to the extent necessary to construct the project as shown on these plans, as determined by the Contractor. Discharge from dewatering within the work area shall be routed to floodplain areas so as to allow the removal of fine sediments or other contaminant prior to reentering Catherine Creek. All pumps used by the Contractor for dewatering shall have screened intakes that meet Oregon Department of Fish and Wildlife specifications and National Oceanic and Atmospheric Administration (NOAA) juvenile fish screening criteria.
22. Discharges entering active streams on site shall satisfy all state and federal standards and project permit requirements for contaminants and turbidity.
23. Diverted and controlled streamflow can be used to test and adjust newly constructed stream structures prior to permanently activating new stream segments.
24. Construction shall minimize disturbance to and maximize reuse of existing riparian vegetation.
25. All material not used on–site shall be disposed of on–site as directed by the Contracting Officer or shall be hauled offsite and properly disposed of.
26. Engineer responsible for the preparation of these drawings and specifications will not be responsible for, or liable for, unauthorized changes to, or use of, these drawings. All changes to the drawings and specifications must be in writing and approved by the Engineer responsible for the preparations of the drawings and specifications.
27. Record Drawings (as–built drawings) shall be accurately recorded by the Contractor for future use, reference and monitoring. The Contractor shall be responsible to accurately record any alterations from the Construction Documents with red pen on a set of hand marked record drawings. Submittal of Record Drawings is a condition of final acceptance.

ABBREVIATIONS

T	Township
R	Range
Sec.	Section
ID	Idaho
OR	Oregon
U.S.	United States
NAD	North American Datum
NAVD	North American Vertical Datum
FCRPS	Federal Columbia River Power System
CSRO	Columbia–Snake Salmon Recovery Office
OSHA	Occupational Safety and Health Administration
OAR	Oregon Administrative Rules
CP	Control Point
STA	Station
O.G.	Original Grade
F.G.	Finished Grade
OHW	Ordinary High Water
WSE	Water Surface Elevation

SUMMARY OF QUANTITIES

BID ITEM	QUANTITY	UNIT	DESCRIPTION
1	1	Lump Sum	Mobilization and Demobilization
2	1	Lump Sum	Environmental Controls (SWPPP, ESC, Etc.)
3	1	Lump Sum	Temporary Flow Bypass Channel @ Upstream
4	1	Lump Sum	36" HDPE Temporary Bypass Pipe
5	1	Lump Sum	Cofferdams and Temporary Diversion Dams
6	1	Lump Sum	Dewatering
7	1	Lump Sum	Temporary Haul Roads
8	700	SY	Temporary Access Road Stabilization
9	1000	CY	Stripping
10	490	CY	Floodplain Excavation
11	2863	CY	Main Channel Excavation
12	1871	CY	Side Channel and Alcove Excavation
13	3574	CY	Excavated Material Placed and Compacted as Fill
14	1	EA	Stabilized Livestock Crossing
15	2.5000	Acre	Fine Grading Channel and Floodplain
16	115	CY	Riffle Construction
17	46	CY	Glide Construction
18	574	CY	Bar Construction
19	1	EA	Side Channel Inlet LWM Structure
20	4	EA	Streambank Habitat LWM Structure
21	4	EA	Tight Radius Bend LWM Structure
22	4	EA	Mild Radius Bend LWM Structure
23	2	EA	Sweeper Log LWM Structure
24	4	EA	High Energy LWM Bank Structure
25	7	EA	Small Apex Jam LWM Structure
26	2	EA	Large Apex Jam LWM Structure
27	365	Linear Foot	Edge Roughness LWM Structure
28	34	EA	Single Log with Rootwad
29	25	EA	Tree Top With Branches
30	4	EA	Floodplain Log
31	1	Lump Sum	Plant and Sod Salvage and Transplanting
32	2.20	Acre	Bank Zone Planting
33	5.67	Acre	Riparian Zone Planting
34	1.95	Acre	Live Stakes (Installation Only)
35	12.52	Acre	Seeding (Bank, Riparian, Wetland, Access, and Dense Veg Zones)
36	30	Ton	Straw Mulch
37	1	Lump Sum	Site Cleanup and Repair
38	578	Linear Foot	Brush Mattress in Riffle Zones
39	1945	Linear Foot	Willow Trenching
40	1	EA	Temporary Creek Crossing

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRAND RONDE SUBBASIN
CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 – GENEREAL NOTES AND ABBREVEATIONS

Jay B. Hovde
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TECH. APPR. NAME, PROF. ABBR.
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NAME Charles Spindler
TITLE Program Manager–Acting
CSRO (BOISE, IDAHO) 2015–04–30

GENERAL NOTES AND ABBREVIATIONS

1678–100–1951

SHEET 2 OF 2

DATE AND TIME PLOTTED
APRIL 28, 2015 13:36
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JHOVDE

CAD SYSTEM
AutoCAD Rel. 19.1s
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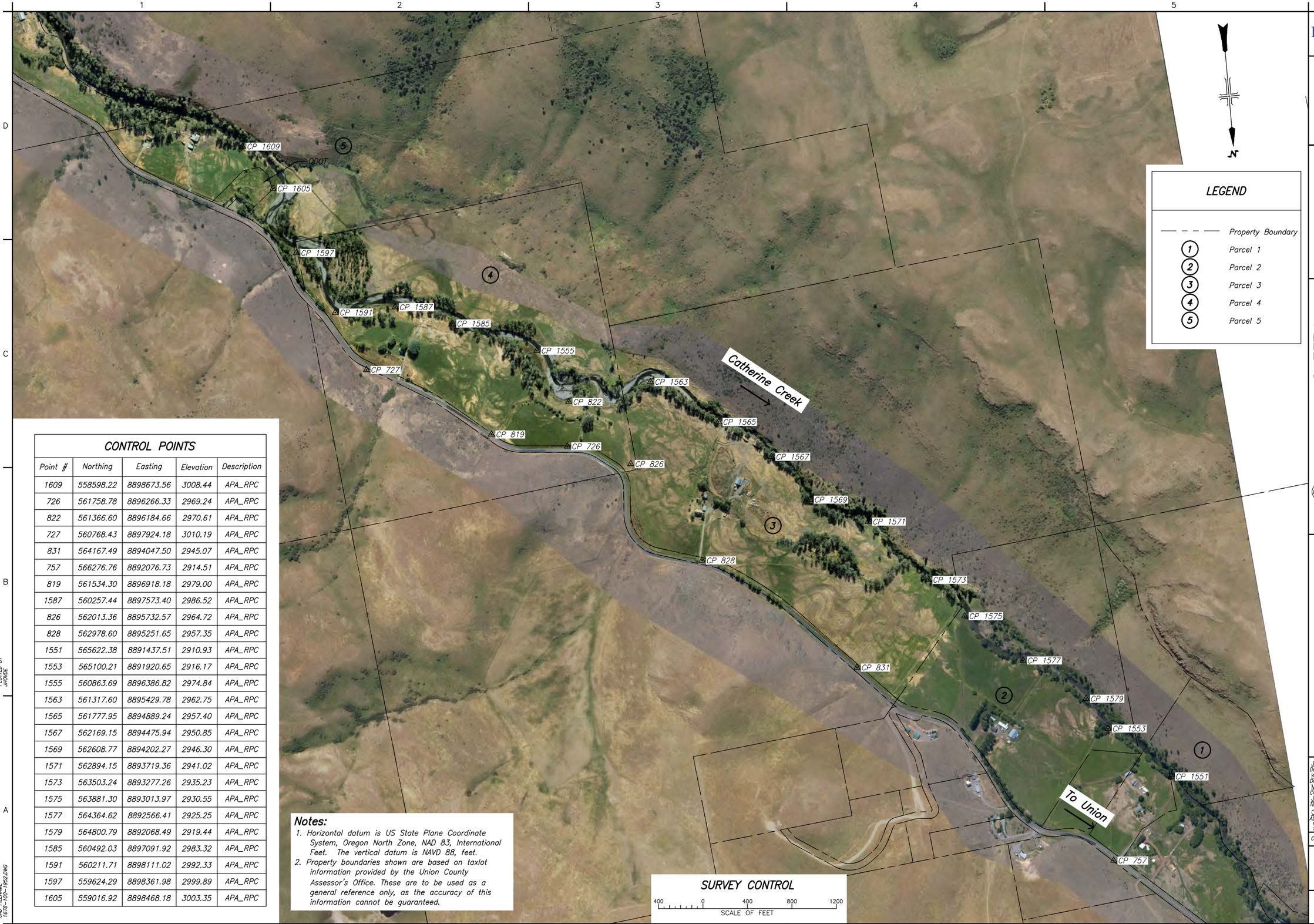
1678–100–1951.DWG



LEGEND

- Property Boundary
- (1) Parcel 1
- (2) Parcel 2
- (3) Parcel 3
- (4) Parcel 4
- (5) Parcel 5

CONTROL POINTS

Point #	Northing	Easting	Elevation	Description
1609	558598.22	8898673.56	3008.44	APA_RPC
726	561758.78	8896266.33	2969.24	APA_RPC
822	561366.60	8896184.66	2970.61	APA_RPC
727	560768.43	8897924.18	3010.19	APA_RPC
831	564167.49	8894047.50	2945.07	APA_RPC
757	566276.76	8892076.73	2914.51	APA_RPC
819	561534.30	8896918.18	2979.00	APA_RPC
1587	560257.44	8897573.40	2986.52	APA_RPC
826	562013.36	8895732.57	2964.72	APA_RPC
828	562978.60	8895251.65	2957.35	APA_RPC
1551	565622.38	8891437.51	2910.93	APA_RPC
1553	565100.21	8891920.65	2916.17	APA_RPC
1555	560863.69	8896386.82	2974.84	APA_RPC
1563	561317.60	8895429.78	2962.75	APA_RPC
1565	561777.95	8894889.24	2957.40	APA_RPC
1567	562169.15	8894475.94	2950.85	APA_RPC
1569	562608.77	8894202.27	2946.30	APA_RPC
1571	562894.15	8893719.36	2941.02	APA_RPC
1573	563503.24	8893277.26	2935.23	APA_RPC
1575	563881.30	8893013.97	2930.55	APA_RPC
1577	564364.62	8892566.41	2925.25	APA_RPC
1579	564800.79	8892068.49	2919.44	APA_RPC
1585	560492.03	8897091.92	2983.32	APA_RPC
1591	560211.71	8898111.02	2992.33	APA_RPC
1597	559624.29	8898361.98	2999.89	APA_RPC
1605	559016.92	8898468.18	3003.35	APA_RPC

Notes:

1. Horizontal datum is US State Plane Coordinate System, Oregon North Zone, NAD 83, International Feet. The vertical datum is NAVD 88, feet.
2. Property boundaries shown are based on taxlot information provided by the Union County Assessor's Office. These are to be used as a general reference only, as the accuracy of this information cannot be guaranteed.

SURVEY CONTROL

400 0 400 800 1200

SCALE OF FEET

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Managing Water in the West

Union Soil and Water Conservation District

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BUREAU OF RECLAMATION

COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 - SURVEY CONTROL

Jay B. Hovde
DESIGNED
KK
DRAWN
Mike Knutson P.E.
CHECKED
Jay B. Hovde P.E.
TECH. APPR. NAME, PROF. ABBR.
Charles Spindler
ADMIN. APPROVAL
NAME:Charles Spindler
TITLE:Program Manager--Acting
CSRO (BOISE, IDAHO) 2015-04-30

SURVEY CONTROL

1678-100-1952

SHEET 1 OF 1

DATE AND TIME PLOTTED
APRIL 28, 2015 13:53
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1678-100-1952.DWG

Phase II pipeline alignment

Phase I large wood structure

Downstream limits of Phase III

Existing hardened crossing

Catherine Creek Flow

Historic POD and fish screen(to be removed by others)

Phase I/II large wood structures

Phase II pipeline alignment

Phase II roughened channel

Upstream limits of Phase III

Historic POD

Culvert

Phase I large wood structures

Car frame in stream channel. Location shown is approximate

NRCS pipeline

Spoils pile

Existing corrals

Phase II turbulent bubbler screen overflow pipe

Phase II POD

NRCS pipeline

Phase II pipeline alignment

Approx. location of Phase II ODFW fish screen

HWY 203

Phase II ODFW fish screen bypass pipe

Phase II turbulent bubbler screen

LEGEND

- Existing Wetland
- Existing OHW
- Existing CREP Fence

EXISTING CONDITIONS PARCEL 4

150 0 150 300 450

SCALE OF FEET

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 – EXISTING CONDITIONS

Jay B. Hovde
DESIGNED
KK
DRAWN
Mike Knutson P.E.
CHECKED
Jay B. Hovde P.E.
TECH. APPR. NAME, PROF. ABBR.
Charles Spindler
ADMIN. APPROVAL
NAME Charles Spindler
TITLE Program Manager-Acting
CSRO (BOISE, IDAHO) 2015-04-30

PARCEL 4 – EXISTING CONDITIONS

1678-100-1953

SHEET 1 OF 1

DATE AND TIME PLOTTED
APRIL 28, 2015 13:57
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JHOVDE

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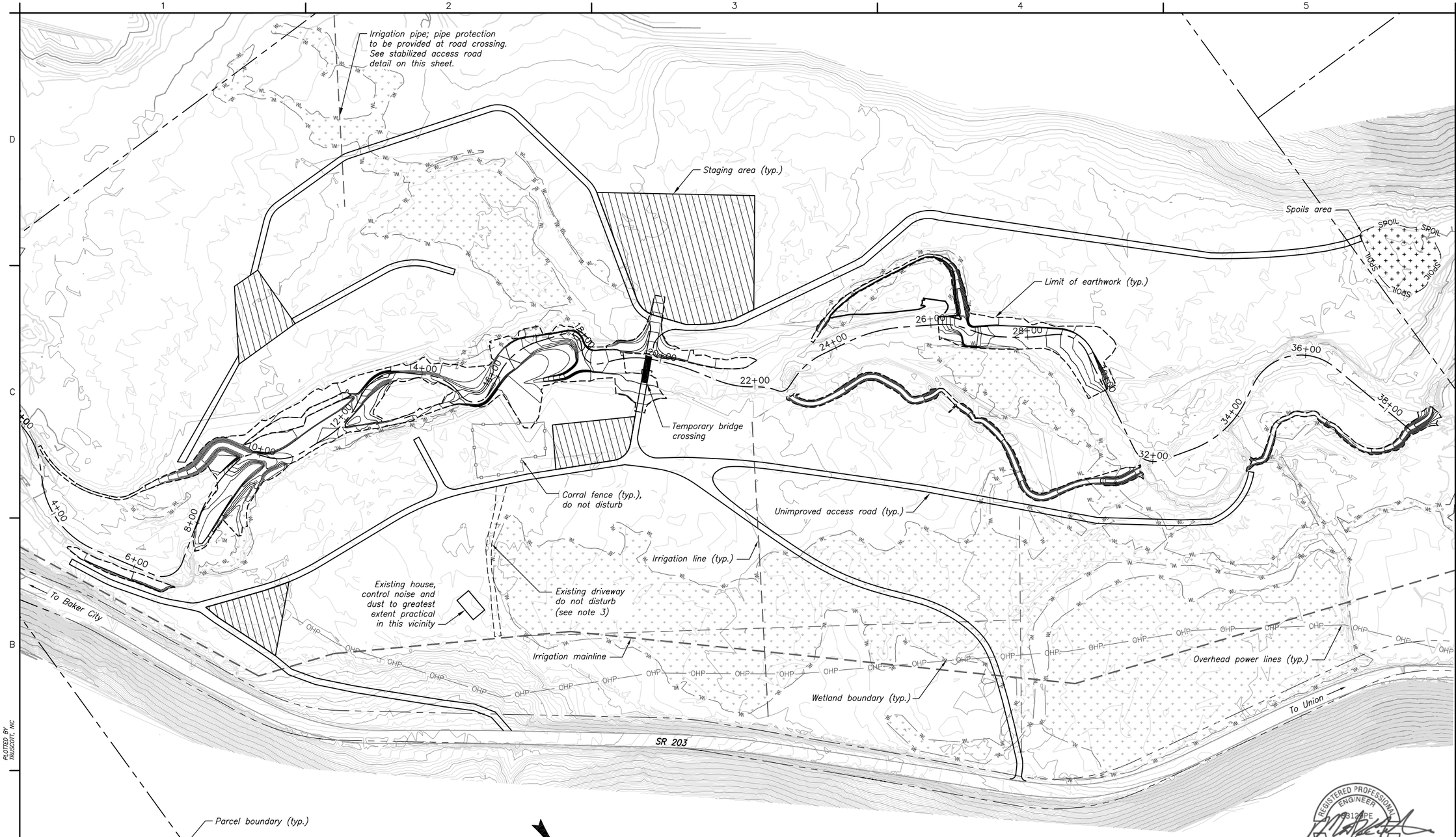
1678-100-1953.DWG

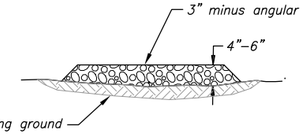


Notes:

1. *If the earthwork on parcel #4 results in excess soil or soil unsuitable for reuse in channel construction, this material shall be hauled to and disposed at the spoils area identified on this sheet and located on parcel #3.*
2. *Temporary access routes shown on this sheet are approximate. The Contracting Officer will stake or similarly identify the exact locations for temporary access routes prior to the beginning of construction.*
3. *Do not use the existing driveway that is access to the house for any construction access purposes.*
4. *Do not disturb corral fencing.*
5. *Dust control shall be implemented during the entire length of the project. Spray access roads with water as needed to prevent dust generation. Dewatering water from isolated work areas that has passed through fish screens may be used for dust control as approved by the Contracting Officer.*

ACCESS & STAGING PLAN – PARCEL 4

100 0 100 200 300
SCALE OF FEET



STABILIZED ACCESS ROAD DETAIL

NTS

Note:

1. *Place rock as needed for stabilization in erosional depressions or wet areas within access roads. Rock to be placed in road over irrigation pipe crossing to provide additional separation between road and pipe.*

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
ACCESS & STAGING PLAN

REGISTERED PROFESSIONAL ENGINEER
83134PE
OREGON
JULY 14, 2008
MARTIN K. FISHER
4/27/2015

RENEWAL DATE: 12/31/2015

A. NELSON
DRAWN

X Jay Hovde
ACCEPTED

BOISE, ID 2015-04-27

ACCESS & STAGING

PARCEL 3

1678-100-1954

SHEET 1 OF 1

DATE AND TIME PLOTTED
TRUSCOTT, NIC
PLOTTED BY
TRUSCOTT, NIC

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Smith_Phase_3-4_Access_Staging.dwg

Temporary diversion dam across creek to divert all flow temporarily into side channel 3

36" HDPE pipe for high flow bypass

Move pump intake as necessary to accommodate all project elements within diverted channel area

LWM structure to be constructed as part of step 2 of dewatering

Excavate side channel 3 per sheet 1678–100–1974 prior to diverting flow from creek into channel

Wetland boundary (typ.)

Temporary diversion dam at downstream end

Cofferdam

22+00 23+00 24+00 25+00 26+00 27+00 28+00 29+00 30+00 31+00 32+00 33+00 35+00 36+00 37+00 38+00 38+64

SD

P

WL

N

DEWATERING PLAN – PARCEL 4 – STEP 1

50 0 50 100 150

SCALE OF FEET

PUMP INTAKE PUMP DISCHARGE

P

DEWATERING PUMP DETAIL

NTS

Notes:

1. Channel construction on parcel 4 shall be completed in several steps. Step 1 is illustrated on this sheet.
2. Pumps shall be screened for fish protection per ODFW requirements. The Contractor shall submit a dewatering plan to the Contracting Officer a minimum of 10 working days prior to operating dewatering pumps.
3. Water pumped from inside cofferdams and diversion areas shall not be discharged directly into flowing surface waters or wetlands. Discharge at locations shown on this sheet or at other locations approved by the Contracting Officer.

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
4/29/2015
RENEWAL DATE: 12/31/2015

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CC–44 PHASE III HABITAT ENHANCEMENT
DEWATERING PLAN – PARCEL 4 – STEP 1

M. FISHER
DRAWN

X Jay Hovde
ACCEPTED

BOISE, ID 2015–04–28

DEWATERING PLAN

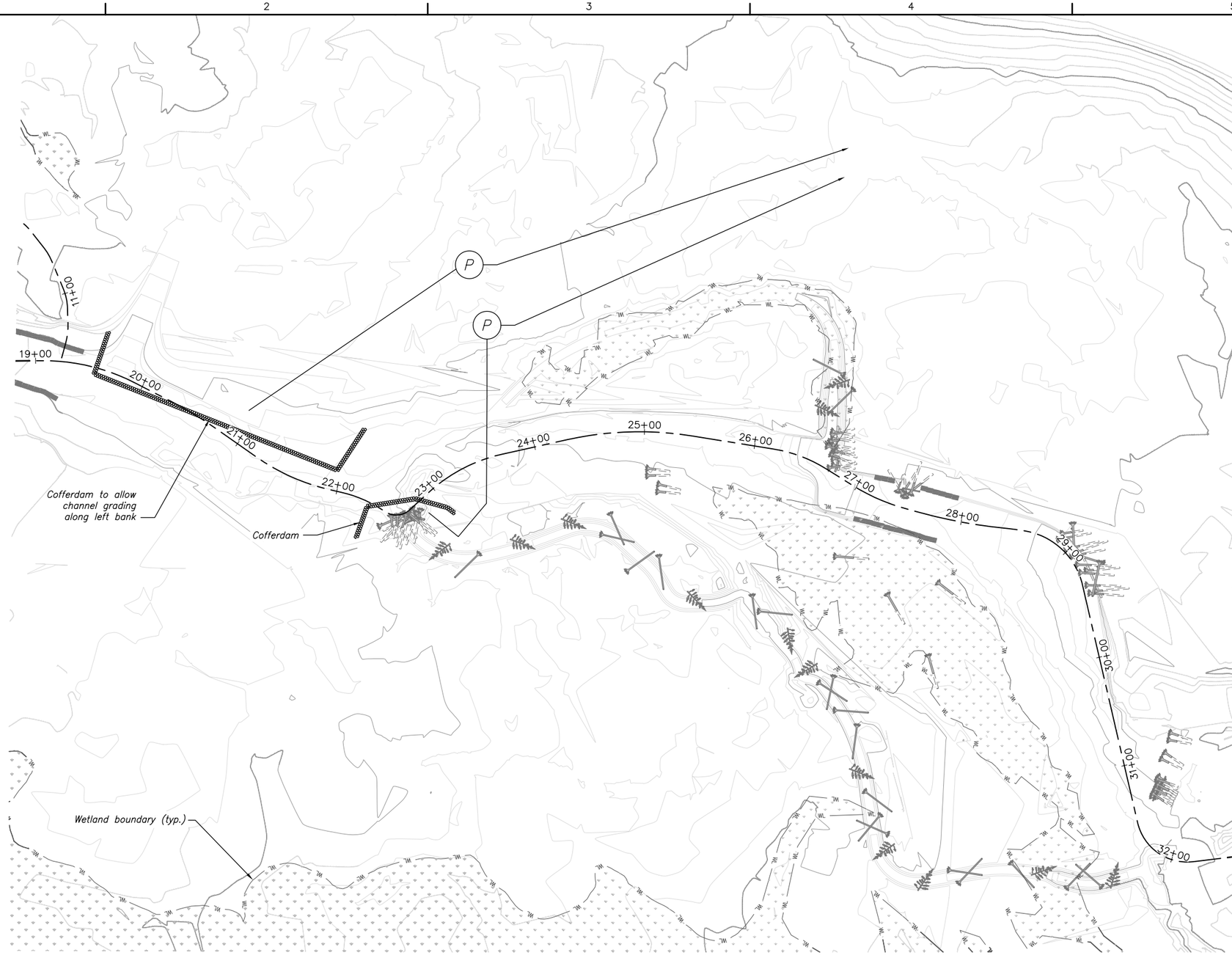
PARCEL 4 – STEP 1

1678–100–1955

SHEET 1 OF 5

DATE AND TIME PLOTTED
April 28, 2015 15:56
PLOTTED BY
FISHER, MARTIN

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Smith_Phase_3-4_Dewatering.dwg



REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
RENEWAL DATE: 12/31/2015

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GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
DEWATERING PLAN – PARCEL 4 – STEP 2

Notes:

1. Channel construction on parcel 4 shall be completed in several steps. step 2 is illustrated on this sheet.
2. Pumps shall be screened for fish protection per ODFW requirements. The Contractor shall submit a dewatering plan to the Contracting Officer a minimum of 10 working days prior to operating dewatering pumps.
3. Water pumped from inside cofferdams and diversion areas shall not be discharged directly into flowing surface waters or wetlands. Discharge at locations shown on this sheet or at other locations approved by the Contracting Officer.

DEWATERING PLAN – PARCEL 4 – STEP 2

50 0 50 100 150
SCALE OF FEET

PUMP INTAKE PUMP DISCHARGE

P

DEWATERING PUMP DETAIL

NTS

M. FISHER
DRAWN

Jay Hovde
ACCEPTED

BOISE, ID 2015-04-27

DEWATERING PLAN

PARCEL 4 – STEP 2

1678-100-1956

SHEET 2 OF 5

DATE AND TIME PLOTTED
April 28, 2015 11:43
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FISHER, MARTIN

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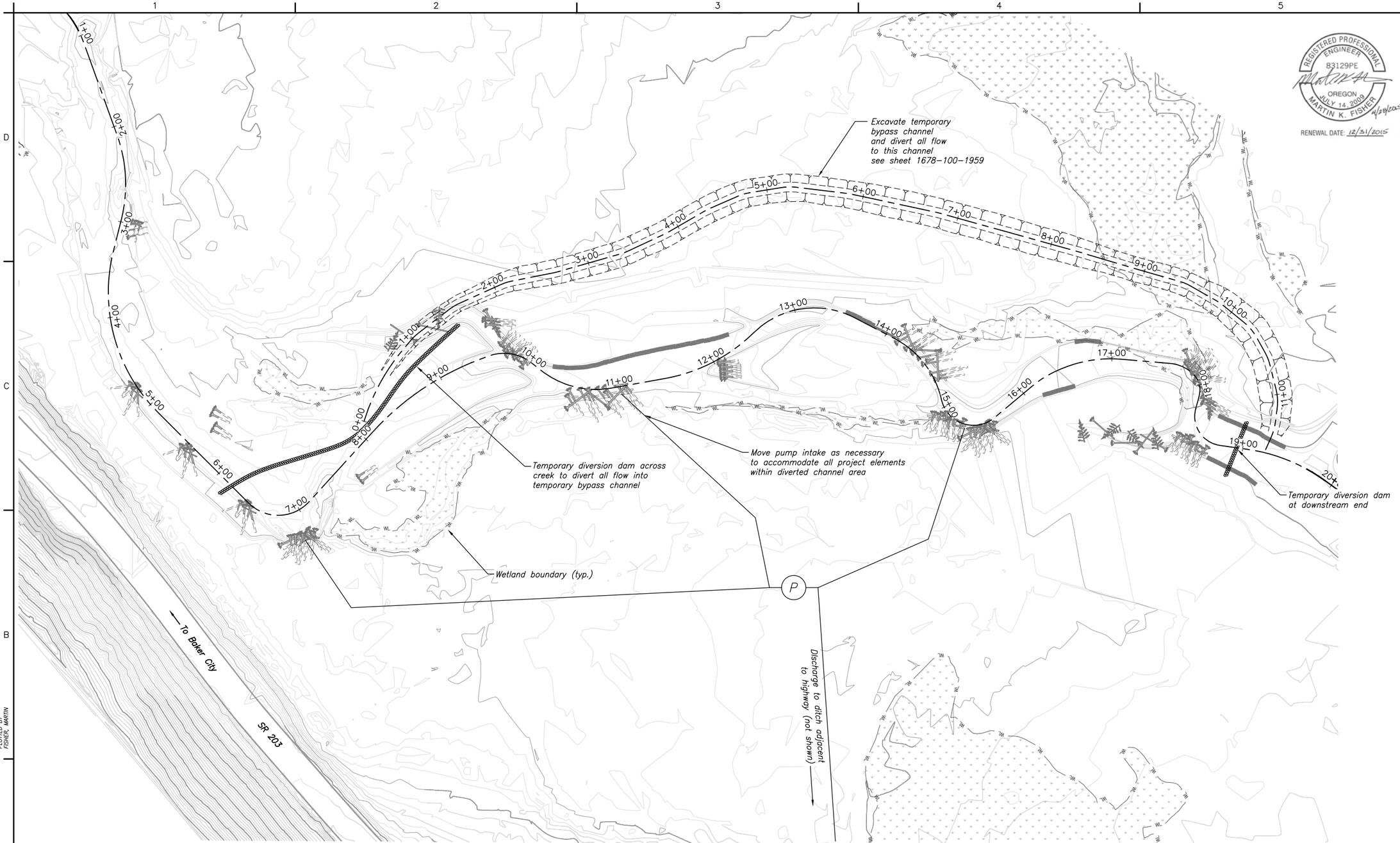

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
4/28/2015
RENEWAL DATE: 12/31/2015

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GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
DEWATERING PLAN – PARCEL 4 – STEP 3

NOTES:

1. Channel construction on parcel 4 shall be completed in several steps. Step 3 is illustrated on this sheet.
2. Pumps shall be screened for fish protection per ODFW requirements. The Contractor shall submit a dewatering plan to the Contracting Officer a minimum of 10 working days prior to operating dewatering pumps.
3. Water pumped from inside cofferdams and diversion areas shall not be discharged directly into flowing surface waters or wetlands. Discharge at locations shown on this sheet or at other locations approved by the Contracting Officer.

DEWATERING PLAN – PARCEL 4 – STEP 3

50 0 50 100 150
SCALE OF FEET

PUMP INTAKE — PUMP (P) — DISCHARGE

DEWATERING PUMP DETAIL

NTS

M. FISHER
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015-04-27

DEWATERING PLAN

PARCEL 4 – STEP 3

1678-100-1957

SHEET 3 OF 5

DATE AND TIME PLOTTED
April 28, 2015 11:44
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FISHER, MARTIN

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Smith_Phase_3-4_Dewatering.dwg

Cofferdam around LWM structure construction area (typ.)

1+00
2+00
3+00
4+00
5+00
6+00
7+00
8+00
9+00
10+00
11+00
12+00
13+00
14+00
15+00
16+00
17+00
18+00
19+00
20+

P

Wetland boundary (typ.)

To Baker City

SR 203

Discharge to ditch adjacent to highway (not shown)

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
4/29/2015
RENEWAL DATE: 12/31/2015

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GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
DEWATERING PLAN – PARCEL 4 – STEP 4

Notes:

1. Channel construction on parcel 4 shall be completed in several steps. Step 4 is illustrated on this sheet.
2. Pumps shall be screened for fish protection per ODFW requirements. The Contractor shall submit a dewatering plan to the Contracting Officer a minimum of 10 working days prior to operating dewatering pumps.
3. Water pumped from inside cofferdams and diversion areas shall not be discharged directly into flowing surface waters or wetlands. Discharge at locations shown on this sheet or at other locations approved by the Contracting Officer.

N

DEWATERING PLAN – PARCEL 4 – STEP 4
50 0 50 100 150
SCALE OF FEET

PUMP INTAKE — PUMP (P) — DISCHARGE

DEWATERING PUMP DETAIL
NTS

M. FISHER
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015-04-27

DEWATERING PLAN

PARCEL 4 – STEP 4

1678-100-1958

SHEET 4 OF 5

DATE AND TIME PLOTTED
April 28, 2015 11:45
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FISHER, MARTIN

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
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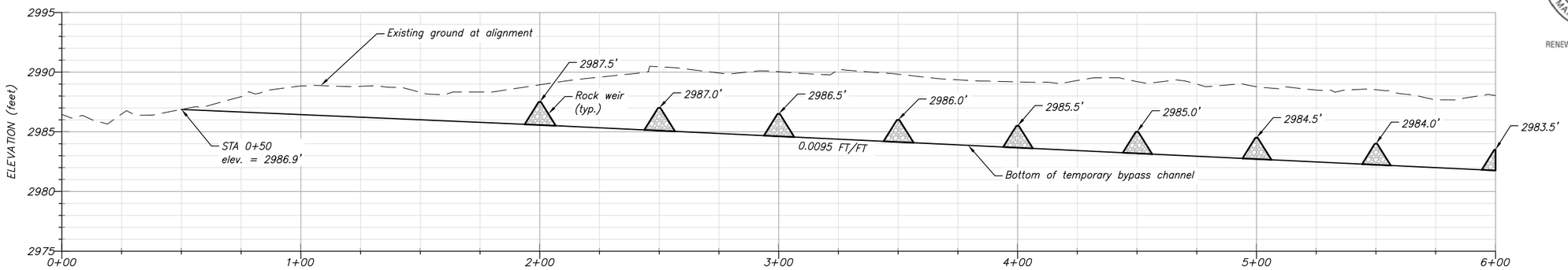
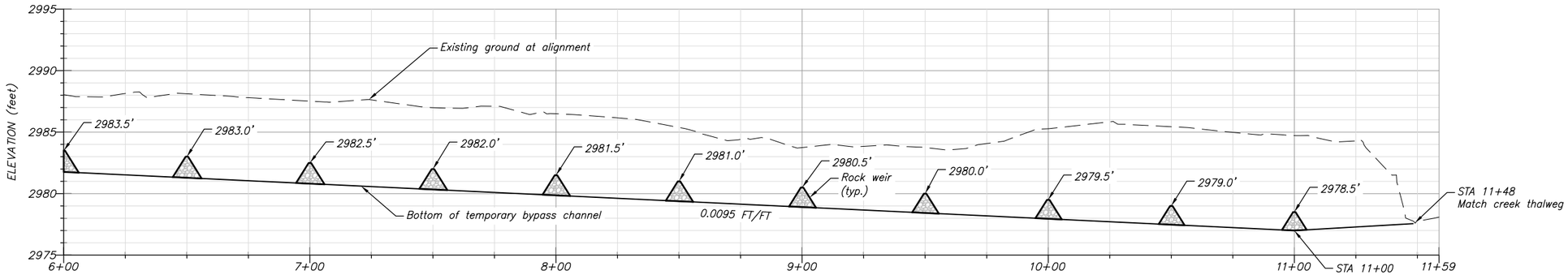
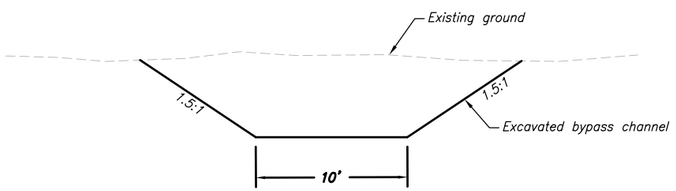


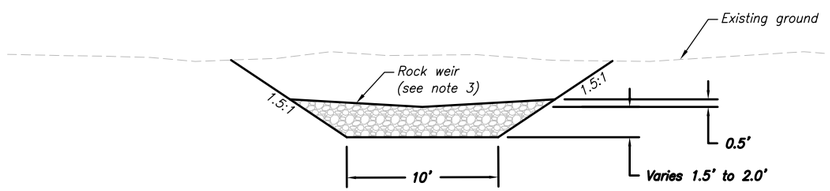
PROFILE ALONG TEMPORARY BYPASS CENTERLINE



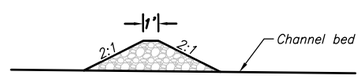
PROFILE ALONG TEMPORARY BYPASS CENTERLINE



TEMPORARY BYPASS CHANNEL – TYPICAL SECTION



TEMPORARY BYPASS CHANNEL – TYPICAL SECTION AT ROCK WEIR



ROCK WEIR – TYPICAL SECTION

Notes:

1. Tops of rock weirs shall be to the elevation shown on this sheet.
2. Change in water surface elevation between upstream and downstream side of each rock weir shall not exceed 0.5 feet.
3. Rock weirs shall be constructed of angular quarry rock with a gradation consisting of D100 = 8 inches, D50 = 3 to 5 inches, and D10 = ½ to 2 inches. Material obtained on site as part of channel excavation may be substituted for imported quarry rock if on site material is of sufficient size to be stable during a flow rate of 70 cfs in the bypass channel.

DEWATERING PLAN – PARCEL 4 – DETAILS

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
4/29/2015
RENEWAL DATE: 12/31/2015

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GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
DEWATERING PLAN – PARCEL 4 – DETAILS

M. FISHER
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015-04-27

DEWATERING PLAN

PARCEL 4 – DETAILS

1678-100-1959

SHEET 5 OF 5

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FISHER, MARTIN

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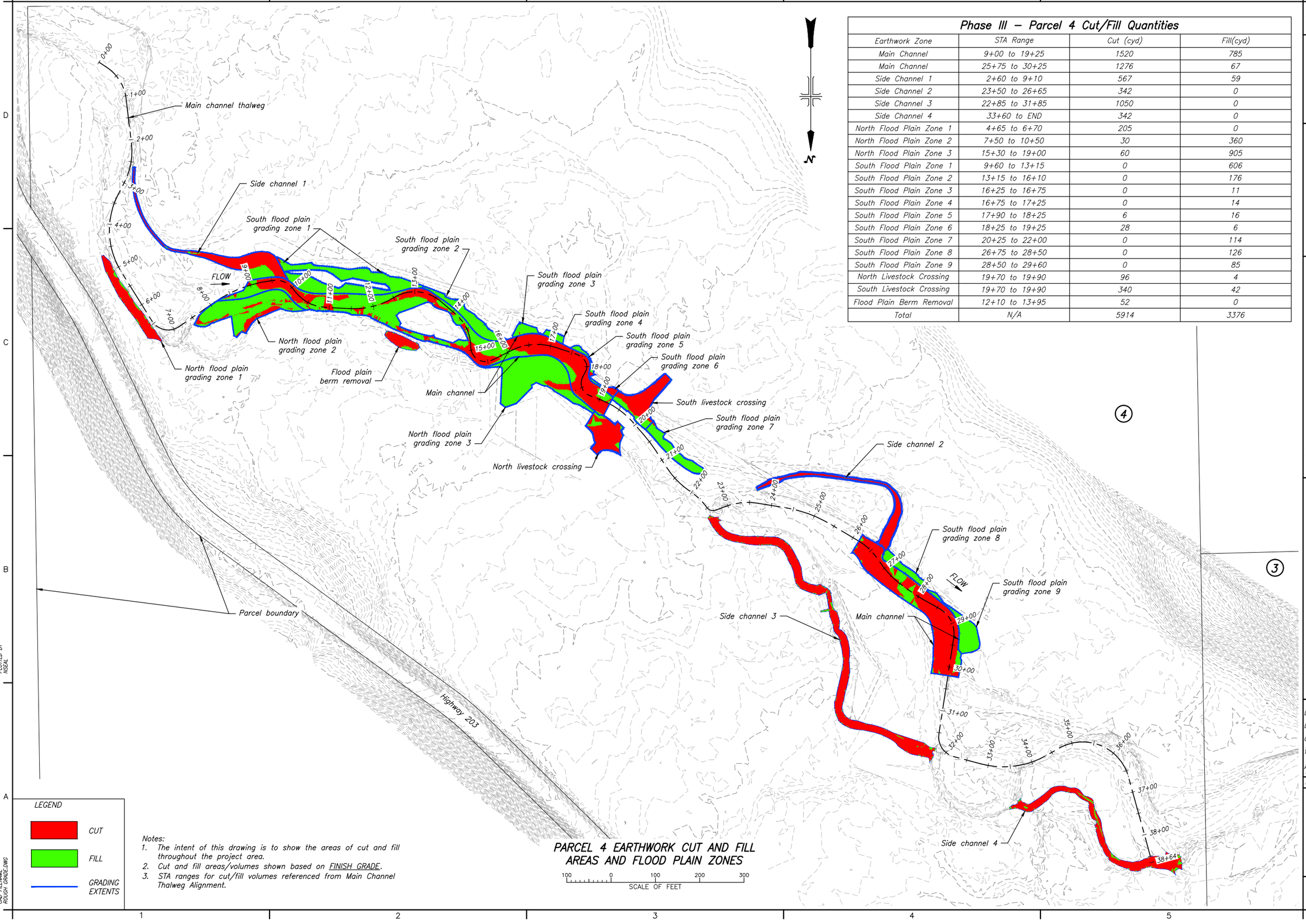

Phase III – Parcel 4 Cut/Fill Quantities			
Earthwork Zone	STA Range	Cut (cyd)	Fill(cyd)
Main Channel	9+00 to 19+25	1520	785
Main Channel	25+75 to 30+25	1276	67
Side Channel 1	2+60 to 9+10	567	59
Side Channel 2	23+50 to 26+65	342	0
Side Channel 3	22+85 to 31+85	1050	0
Side Channel 4	33+60 to END	342	0
North Flood Plain Zone 1	4+65 to 6+70	205	0
North Flood Plain Zone 2	7+50 to 10+50	30	360
North Flood Plain Zone 3	15+30 to 19+00	60	905
South Flood Plain Zone 1	9+60 to 13+15	0	606
South Flood Plain Zone 2	13+15 to 16+10	0	176
South Flood Plain Zone 3	16+25 to 16+75	0	11
South Flood Plain Zone 4	16+75 to 17+25	0	14
South Flood Plain Zone 5	17+90 to 18+25	6	16
South Flood Plain Zone 6	18+25 to 19+25	28	6
South Flood Plain Zone 7	20+25 to 22+00	0	114
South Flood Plain Zone 8	26+75 to 28+50	0	126
South Flood Plain Zone 9	28+50 to 29+60	0	85
North Livestock Crossing	19+70 to 19+90	96	4
South Livestock Crossing	19+70 to 19+90	340	42
Flood Plain Berm Removal	12+10 to 13+95	52	0
Total	N/A	5914	3376

LEGEND

CUT

FILL

GRADING EXTENTS

Notes:
1. The intent of this drawing is to show the areas of cut and fill throughout the project area.
2. Cut and fill areas/volumes shown based on FINISH GRADE.
3. STA ranges for cut/fill volumes referenced from Main Channel Thalweg Alignment.

PARCEL 4 EARTHWORK CUT AND FILL AREAS AND FLOOD PLAIN ZONES

100 0 100 200 300
SCALE OF FEET

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 – ROUGH GRADE

Nate Seal
DESIGNED
NS/JET/JEB
DRAWN
Mike Knutson, P.E.
CHECKED
Janice E. Baconguis, P.E.
TECH. APPR.
Charles Spindler
APPROVED Charles Spindler
ADMIN APPROVAL – Program Manager–Acting
BOISE, ID 2015–04–30

PARCEL 4 – ROUGH GRADE

EARTHWORK CUT AND FILL AREAS AND FLOOD PLAIN ZONES

1678–100–1960

SHEET 1 OF 1

DATE AND TIME PLOTTED
JANUARY 29, 2015 12:59
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NSEAL

CAD SYSTEM
AutoCAD Rel. 19.1s
CAD FILENAME
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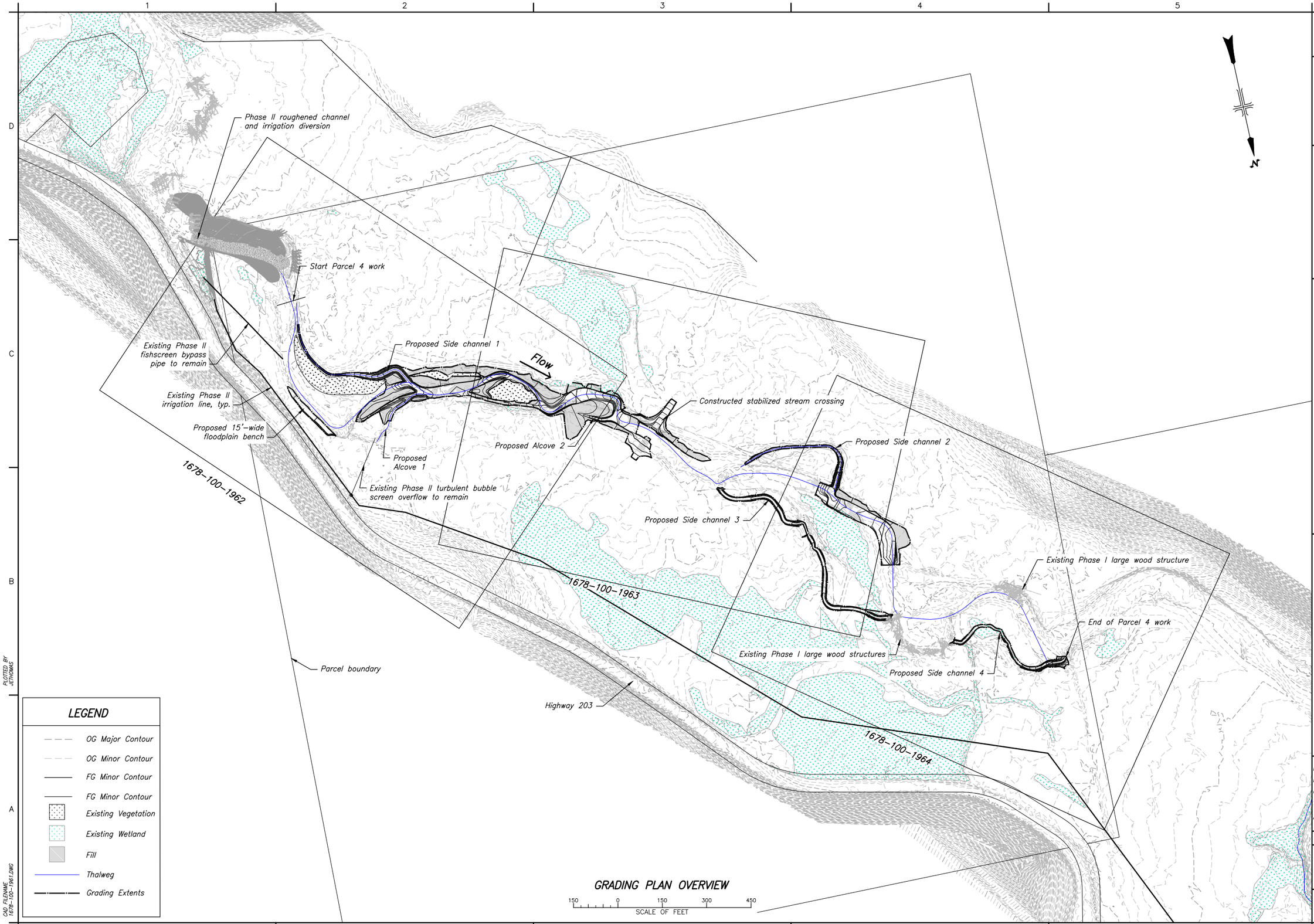

LEGEND

- OG Major Contour
- OG Minor Contour
- FG Minor Contour
- FG Minor Contour
- Existing Vegetation
- Existing Wetland
- Fill
- Thalweg
- Grading Extents

GRADING PLAN OVERVIEW

150 0 150 300 450
SCALE OF FEET

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COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
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GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 - GRADING PLAN OVERVIEW

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GRADING PLAN OVERVIEW

1678-100-1961

SHEET 1 OF 4

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1678-100-1961.DWG

Parcel boundary

Existing Phase II project features

Start Parcel 4 work

Existing Phase II fishscreen bypass pipe to remain

Existing channel (typ.)

Begin excavation of preferential flow path and scour pool ~Sta. 8+90 see Drawings 1678-100-1965 to -1971

Side channel 1 see Drawing 1678-100-1972

Minimize disturbance of existing vegetation

Remove concrete slab near left bank this area

Proposed 15'-wide bench (3 LWM placements not shown) ~Sta. 4+66 to Sta. 6+77

Existing Phase II turbulent bubbler screen overflow to remain

See riffle construction details Drawing 1678-100-1985 ~Sta. 16+42

Shape gravel bar from excavated streambed material see Drawing 1678-100-1986, typ. ~Sta. 14+35 to ~Sta. 16+10

Existing split flow, excavate preferential flow path on channel left for main channel and channel right for smaller split flow channel from ~Sta. 11+89 to ~Sta. 14+95

Maintain flow drainage to channel ~Sta. 12+55

Do not disturb, stake out extents of existing vegetation prior to filling gravel bar, as approved by the CO (typ.)

Do not disturb

Main Channel Split Flow see Drawing 1678-100-1971

Grade existing spoils pile this area to match floodplain

Place streambed material from excavation of preferential flow path in the main channel to hatched area on this island bar

Alcove 1 and split flow shaping see Drawing 1678-100-1976

Begin Alcove 1 grading

Maintain drain path for overflow pipe

Begin gravel bar shaping

Existing Phase II irrigation pipeline (typ.)

Flow

LEGEND

- OG Major Contour
- OG Minor Contour
- FG Minor Contour
- FG Minor Contour
- Existing Vegetation
- Existing Wetland
- Fill
- Thalweg
- Grading Extents

GRADING PLAN

PARCEL 4 – STA. 0+00 TO STA. 17+00

50 0 50 100 150

SCALE OF FEET

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GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT

PARCEL 4 - GRADING PLAN

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GRADING PLAN
STA. 0+00 TO
STA. 17+00

1678-100-1962

SHEET 2 OF 4

Constructed stabilized stream crossing
see Drawing 1678-100-1984

Side channel 2
see Drawing 1678-100-1973

Floodplain bench
~Sta. 18+96 to ~Sta. 21+87

Resume main channel grading
~Sta. 26+12

Extend left bank 20'
into existing channel
to elev. 2975'

Stop channel shaping and
tie-in to existing channel

Flow

Grade existing spoils pile to match
floodplain (potential source for
riffle/glide material)

Remove car frame,
cloud location shown
is approximate

Alcove 2
see Drawing 1678-100-1977

Remove existing spoils pile

Remove existing culvert and headworks,
re-shape per plan and CO

Existing Phase II
irrigation line

Side channel 3
see Drawing 1678-100-1974

Existing Phase II
irrigation line

LEGEND

- OG Major Contour
- OG Minor Contour
- FG Minor Contour
- FG Minor Contour
- Existing Vegetation
- Existing Wetland
- Fill
- Thalweg
- Grading Extents

GRADING PLAN

PARCEL 4 – STA. 17+00 TO STA. 28+00

50 0 50 100 150

SCALE OF FEET

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CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 – GRADING PLAN

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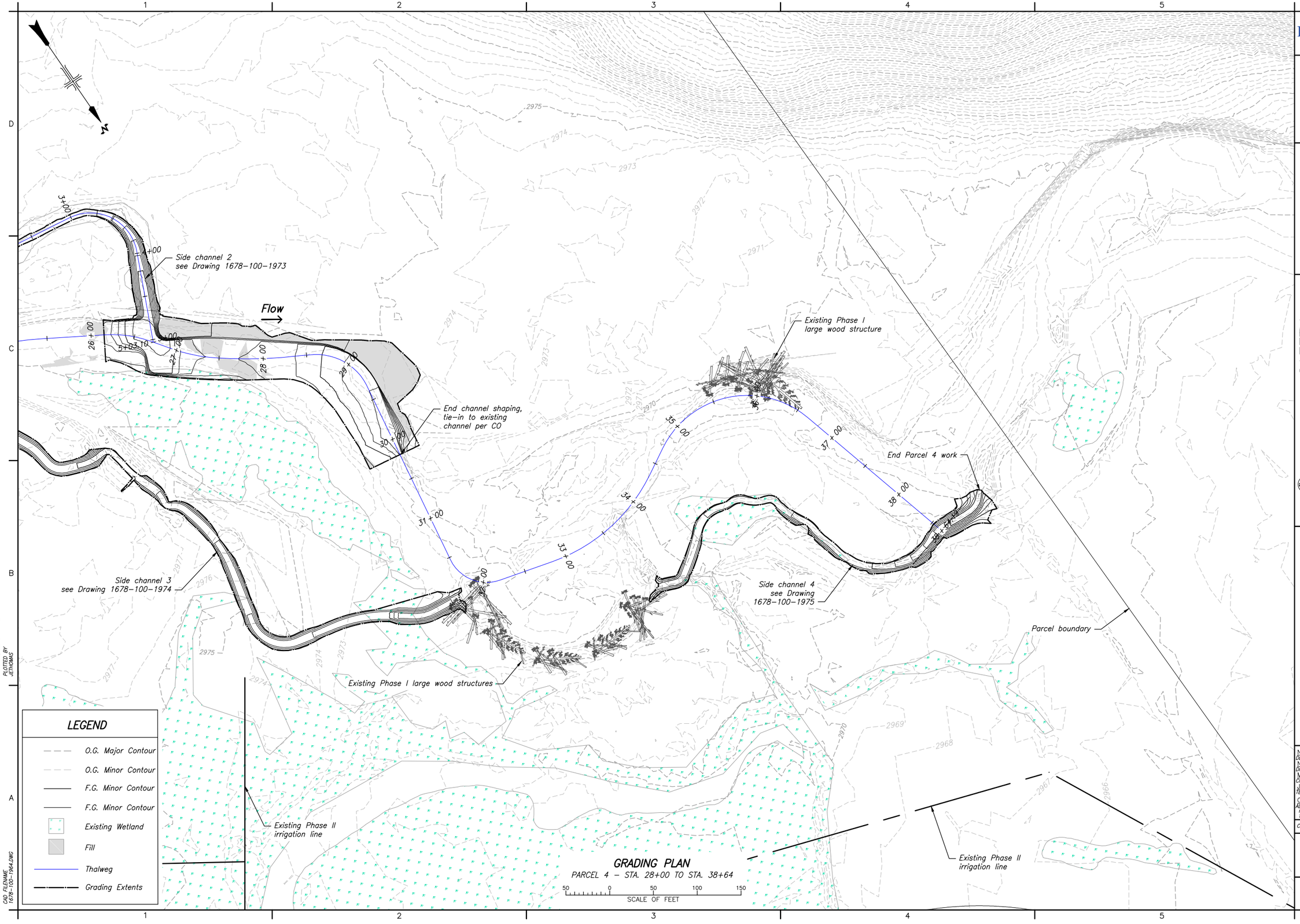
GRADING PLAN
STA. 17+00 TO
STA. 28+00

1678-100-1963

SHEET 3 OF 4



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CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 – GRADING PLAN

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GRADING PLAN
STA. 28+00 TO
STA. 38+64

1678-100-1964

SHEET 4 OF 4

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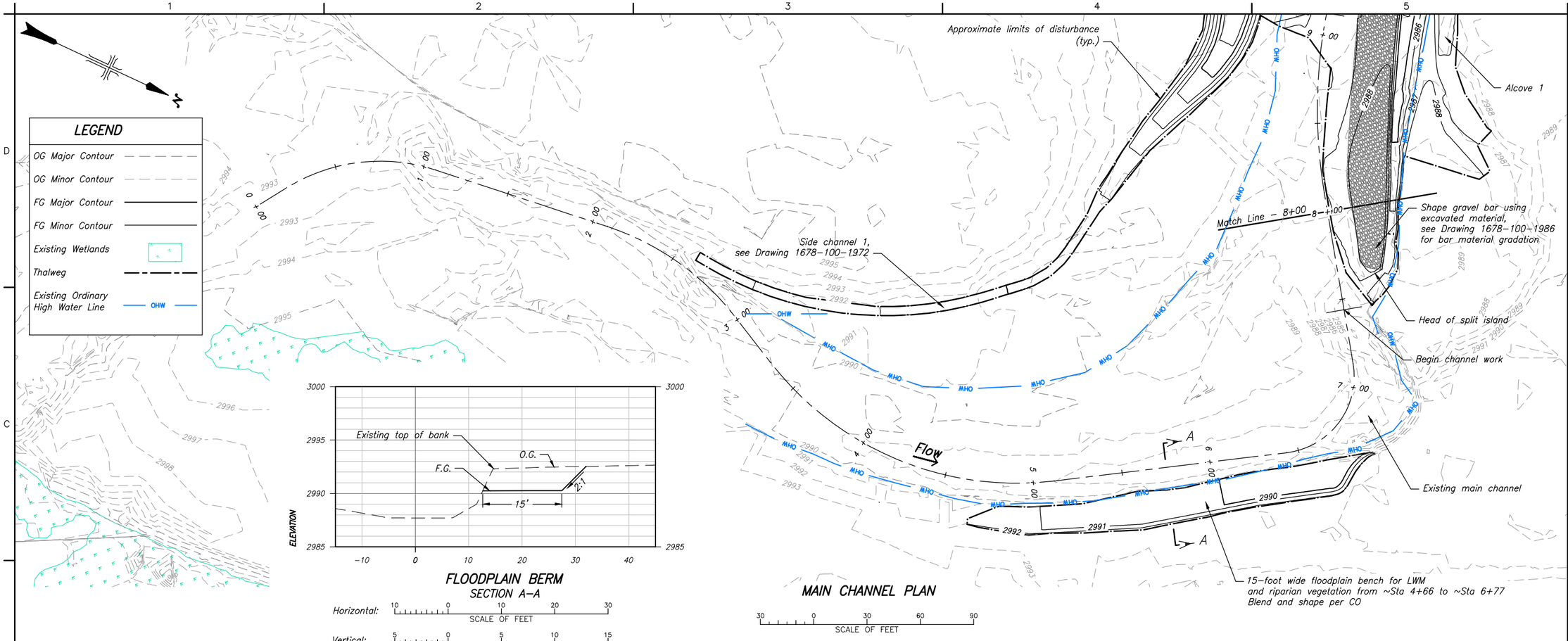

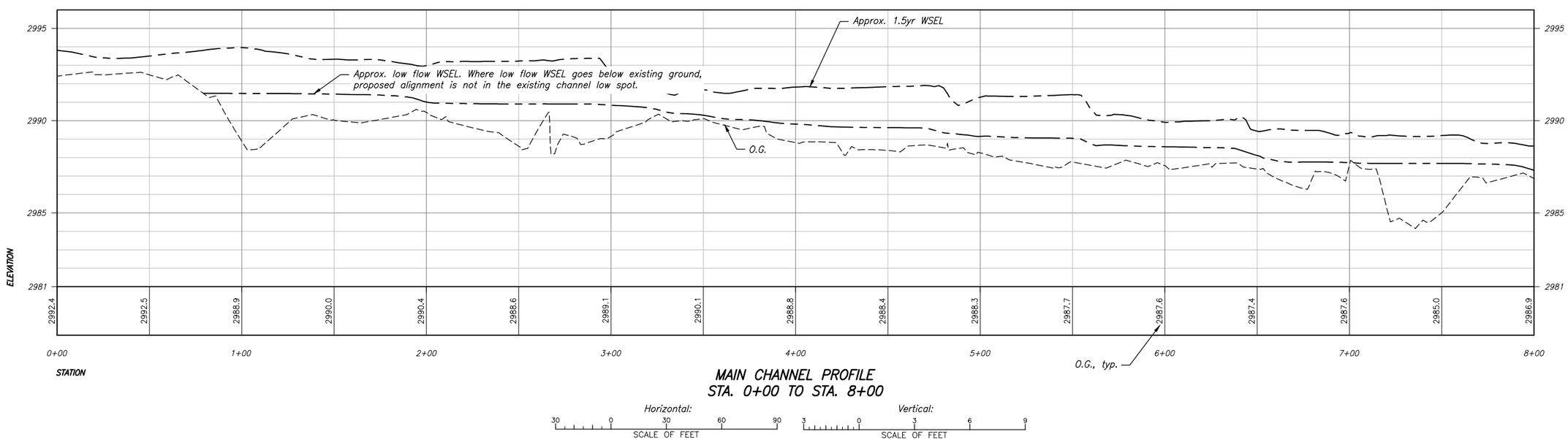

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GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 - MAIN CHANNEL
PLAN AND PROFILE

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MAIN CHANNEL
STA. 0+00 TO STA. 8+00

PLAN AND PROFILE

1678-100-1965

SHEET 1 OF 7

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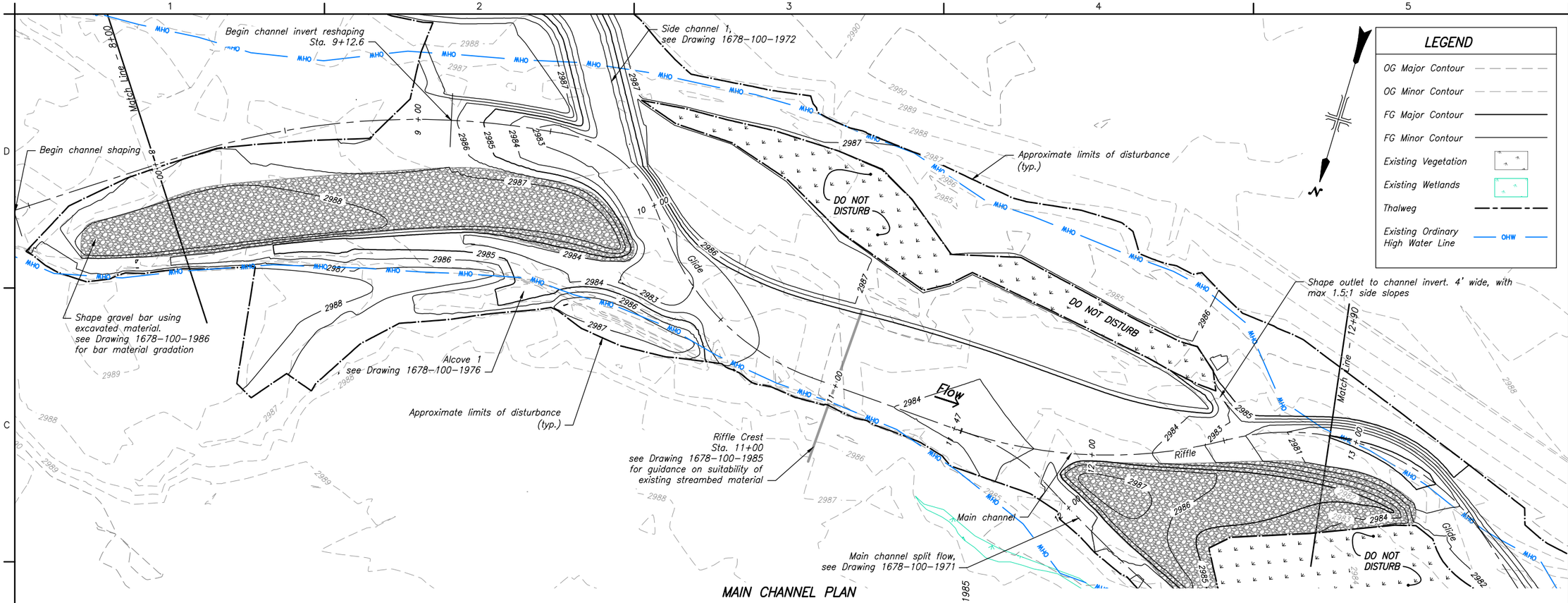
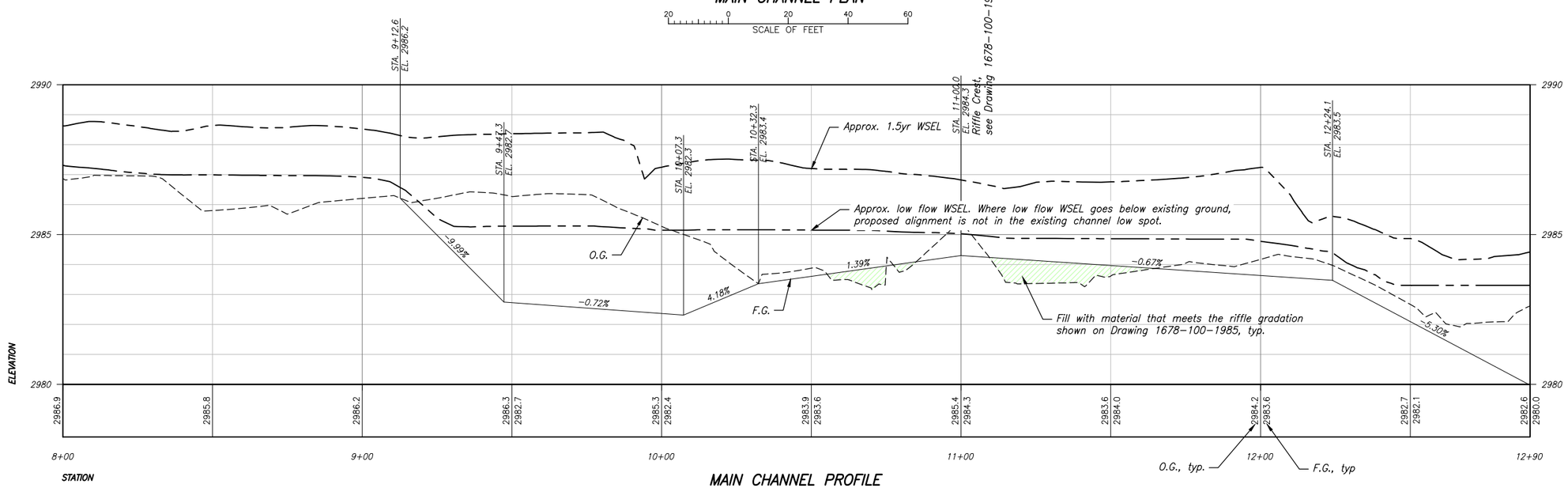


MAIN CHANNEL PLAN

SCALE OF FEET: 20 0 20 40 60



MAIN CHANNEL PROFILE STA. 8+00 TO STA. 12+90

Horizontal: SCALE OF FEET: 20 0 20 40 60

Vertical: SCALE OF FEET: 2 0 2 4 6

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CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 - MAIN CHANNEL
PLAN AND PROFILE

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MAIN CHANNEL STA. 8+00 TO STA. 12+90

PLAN AND PROFILE

1678-100-1966

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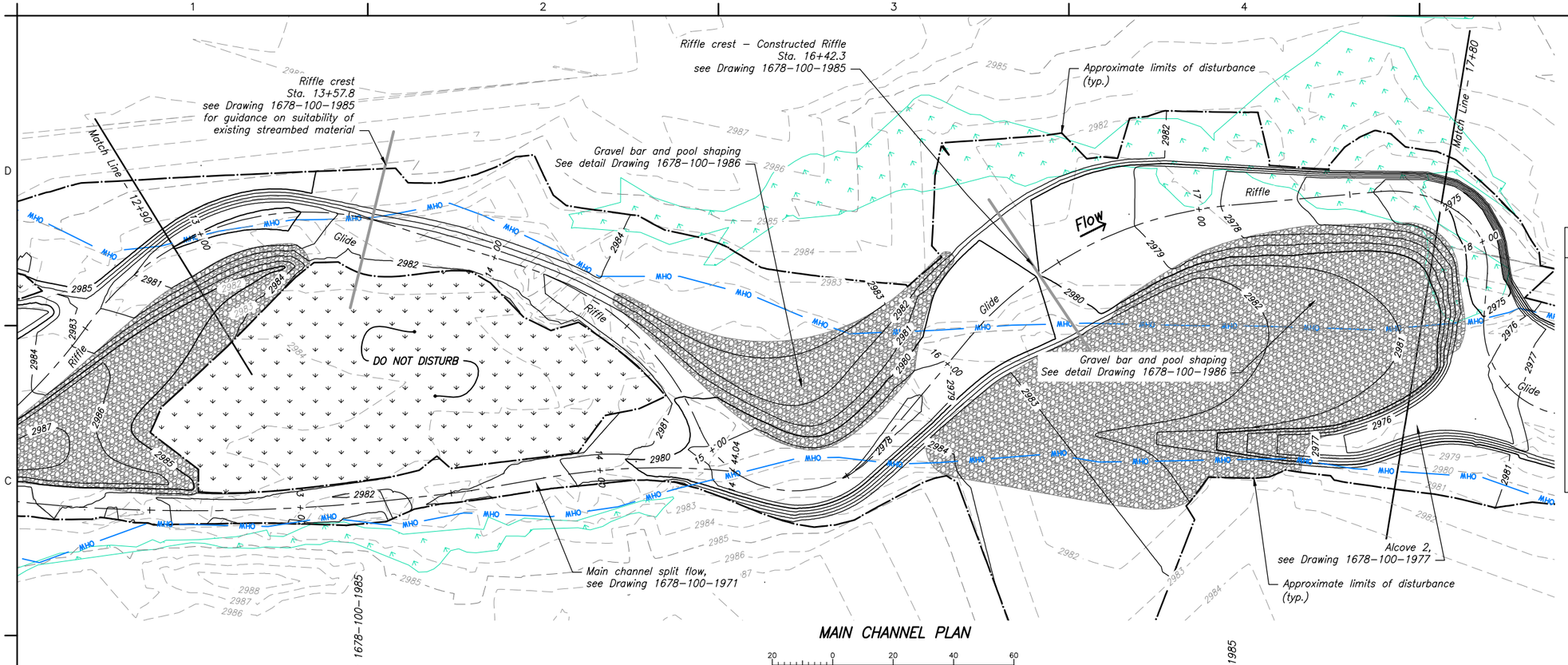
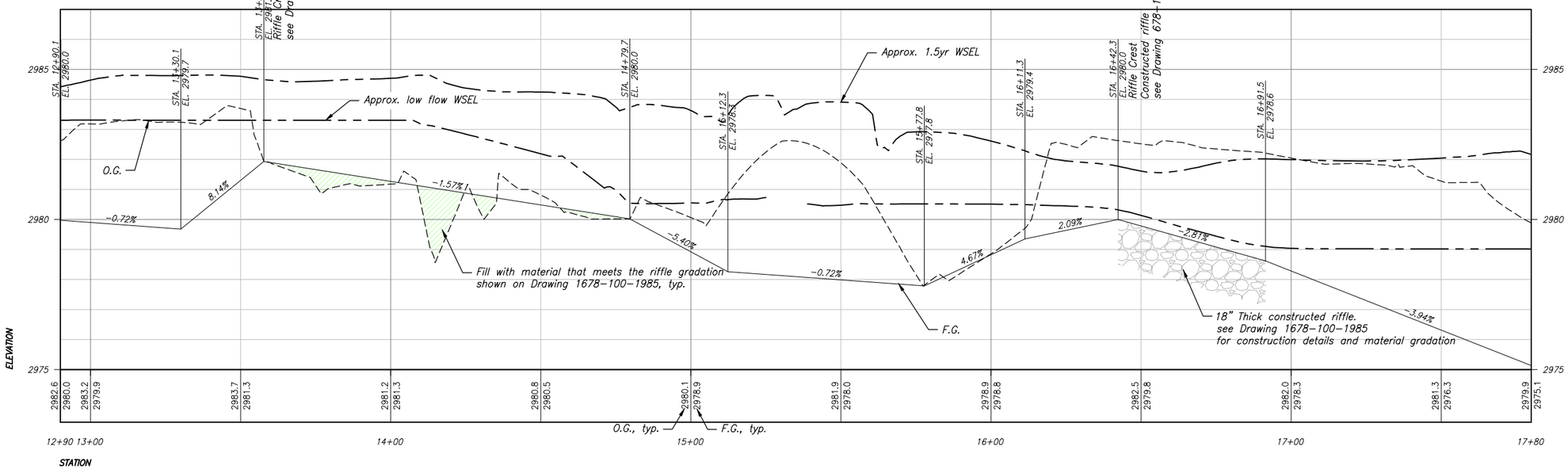


MAIN CHANNEL PLAN

SCALE OF FEET



MAIN CHANNEL PROFILE
STA. 12+90 TO STA. 17+80

Horizontal: SCALE OF FEET

Vertical: SCALE OF FEET

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CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 – MAIN CHANNEL
PLAN AND PROFILE

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MAIN CHANNEL
STA. 12+90 TO STA. 17+80

PLAN AND PROFILE

1678-100-1967

SHEET 3 OF 7

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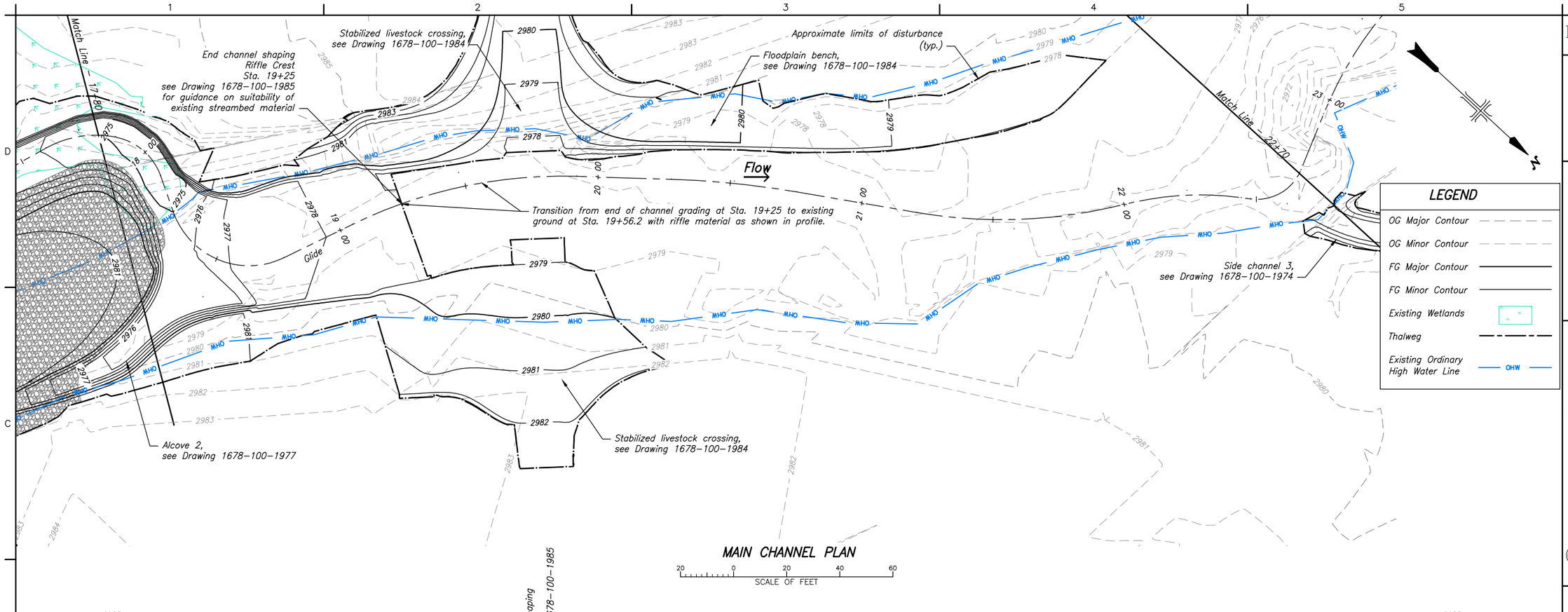

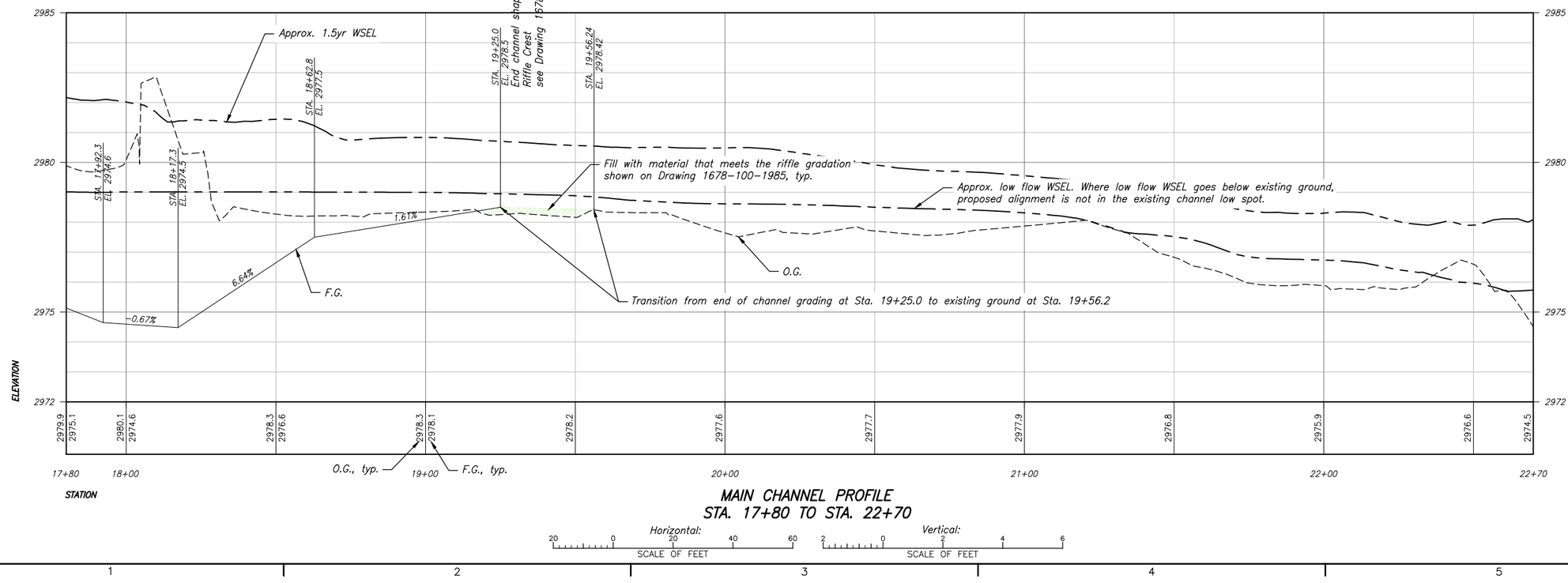

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CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 – MAIN CHANNEL
PLAN AND PROFILE

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MAIN CHANNEL
STA. 17+80 TO STA. 22+70

PLAN AND PROFILE

1678–100–1968

SHEET 4 OF 7

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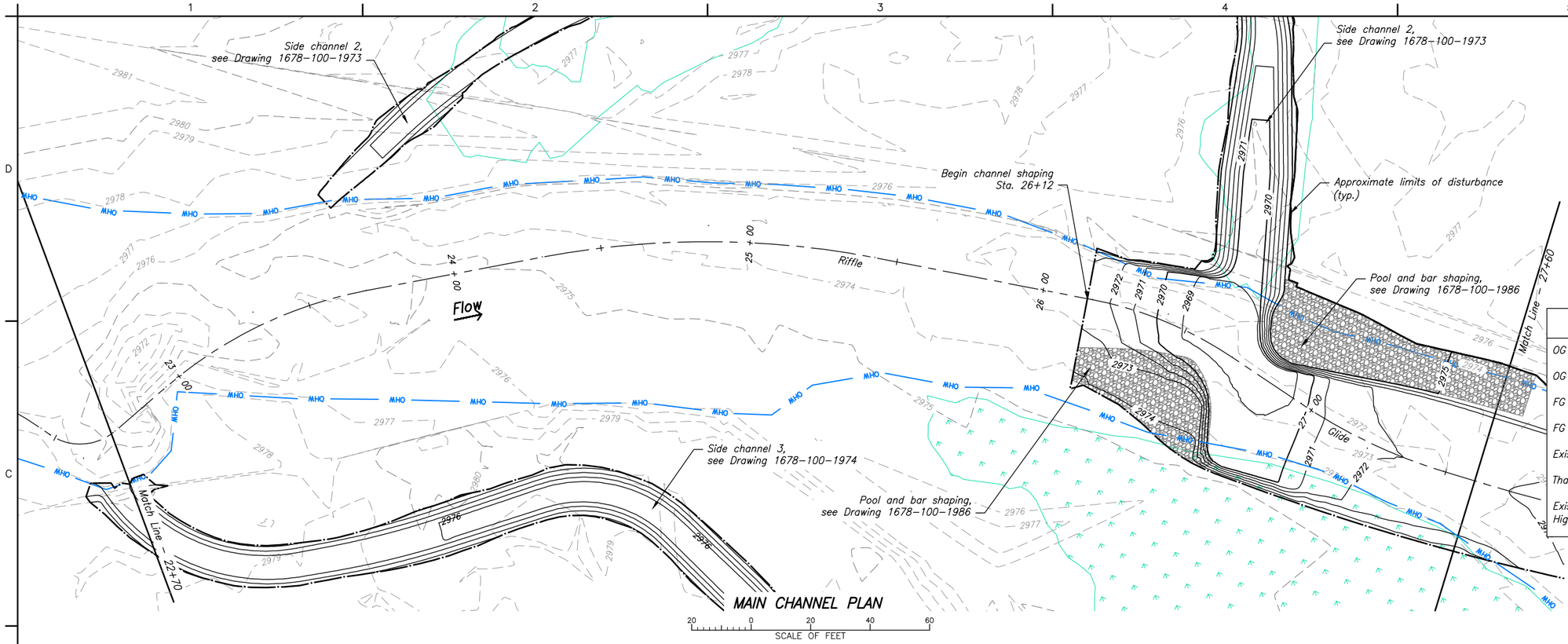
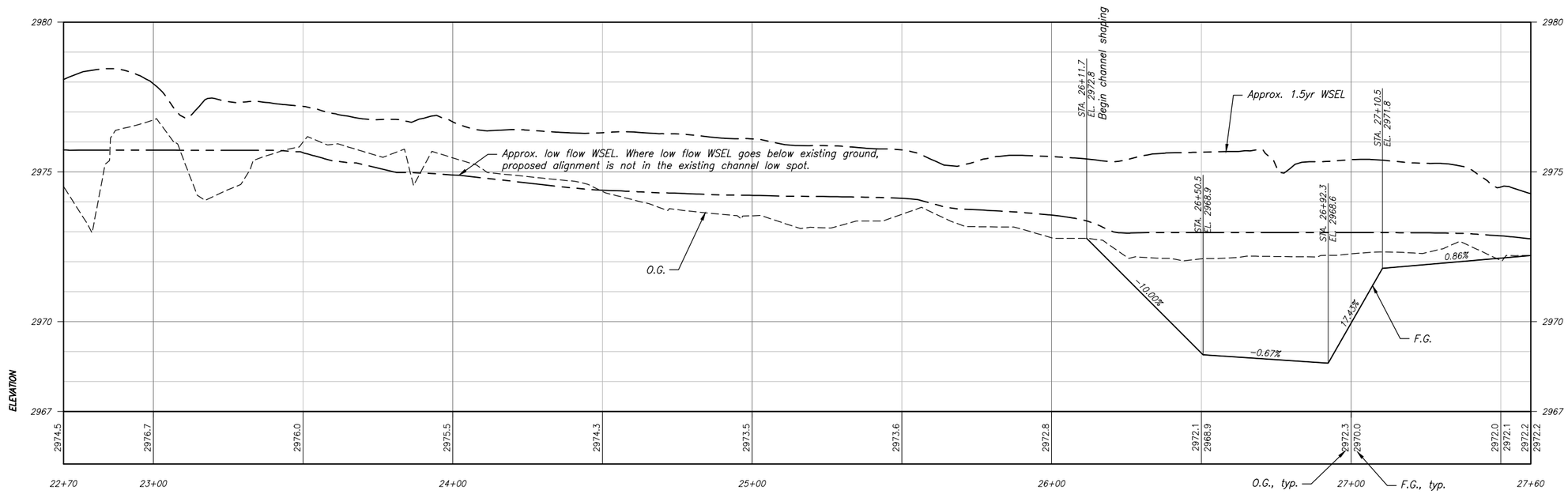


MAIN CHANNEL PLAN

SCALE OF FEET



MAIN CHANNEL PROFILE
STA. 22+70 TO STA. 27+60

Horizontal: SCALE OF FEET

Vertical: SCALE OF FEET

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CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 - MAIN CHANNEL
PLAN AND PROFILE

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MAIN CHANNEL
STA. 22+70 TO STA. 27+60

PLAN AND PROFILE

1678-100-1969

SHEET 5 OF 7

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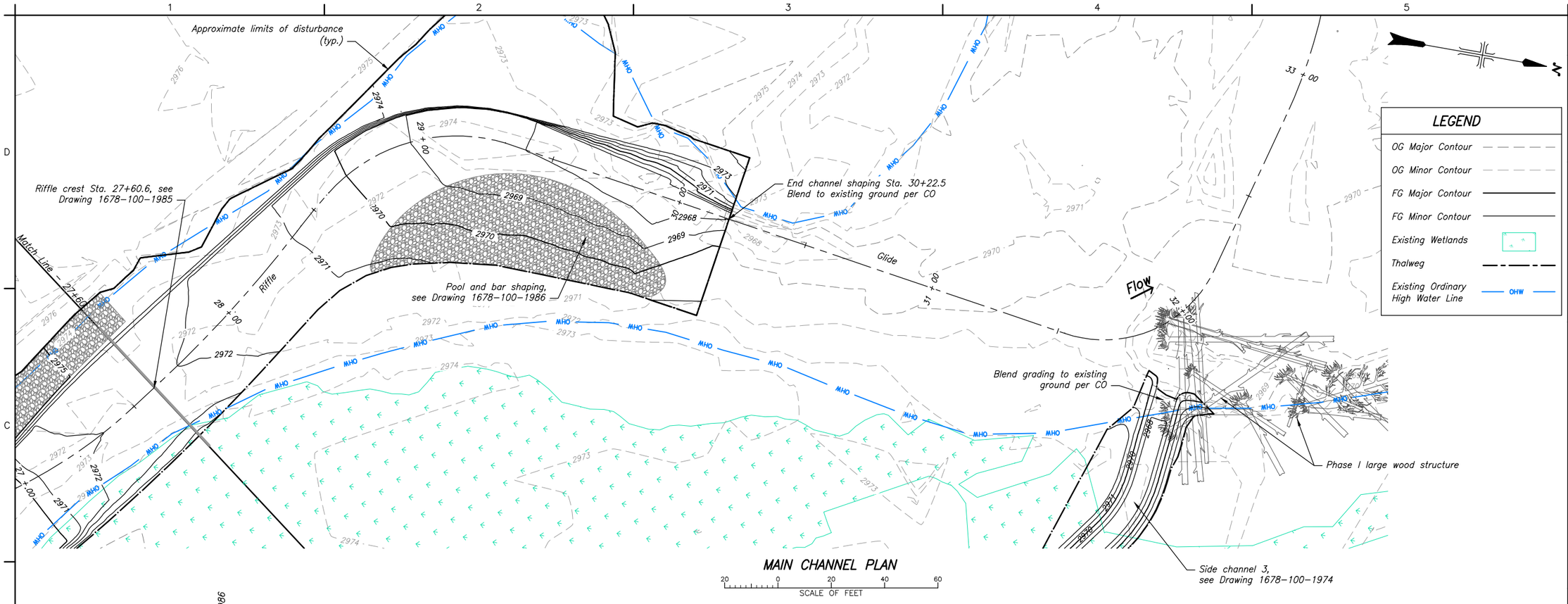

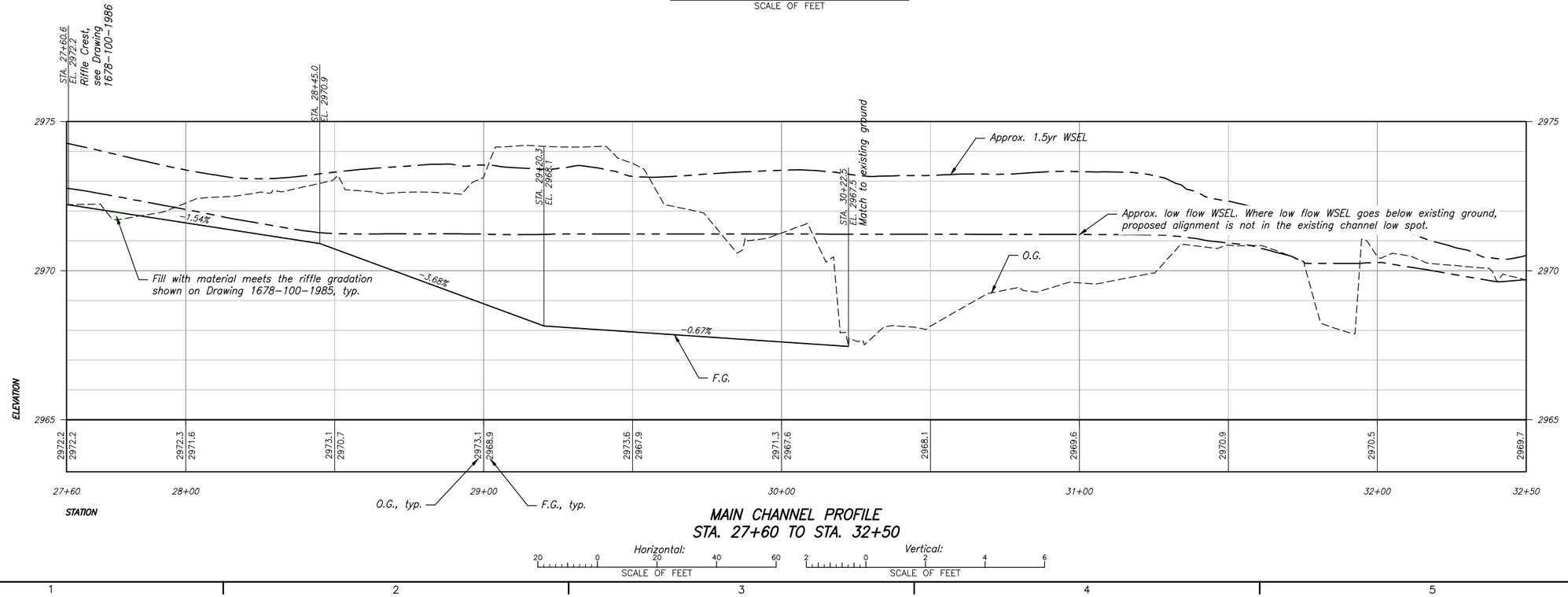

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GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 - MAIN CHANNEL
PLAN AND PROFILE

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APPROVED	Charles Spindler
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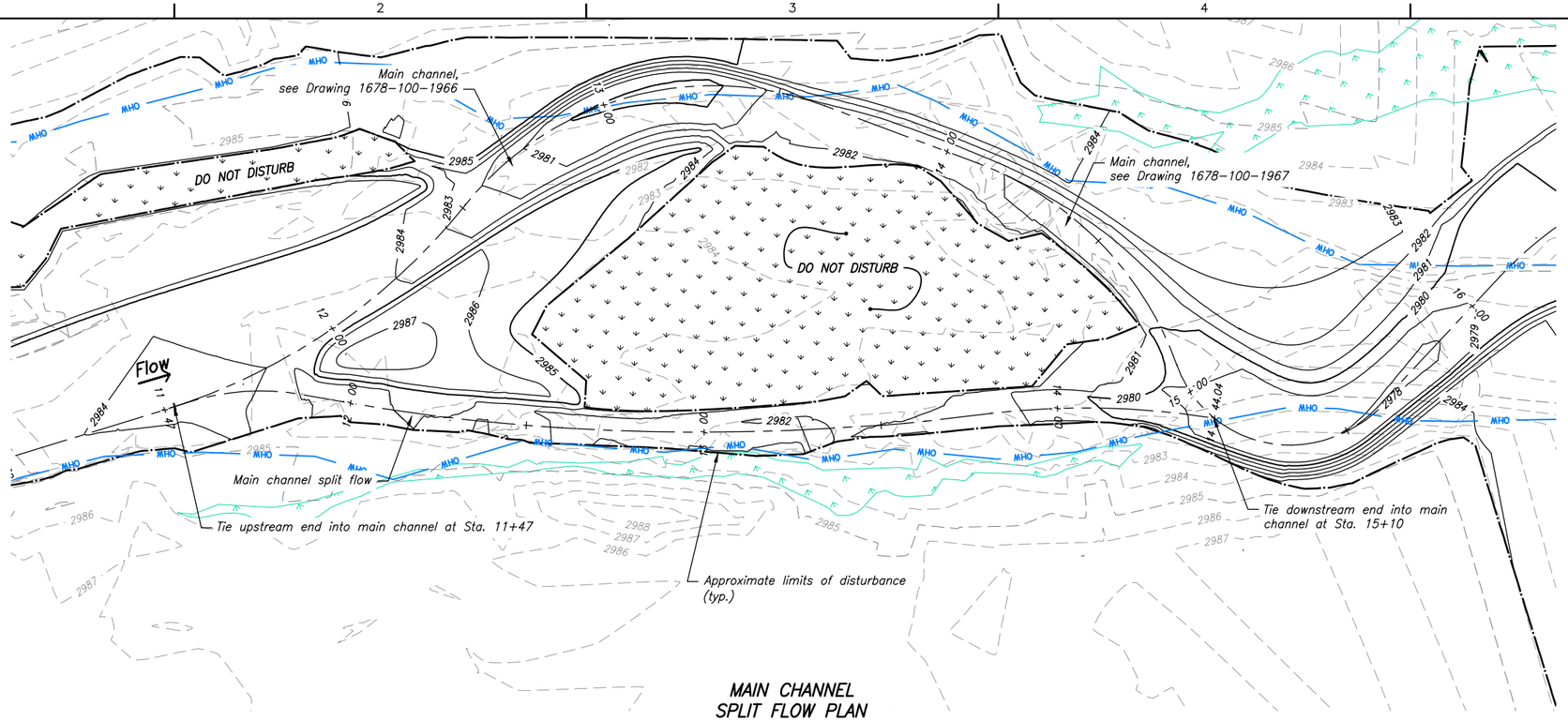
CSRO (BOISE, IDAHO)	2015-04-30

MAIN CHANNEL
STA. 27+60 TO
STA. 32+50

PLAN AND PROFILE

1678-100-1970

SHEET 6 OF 7



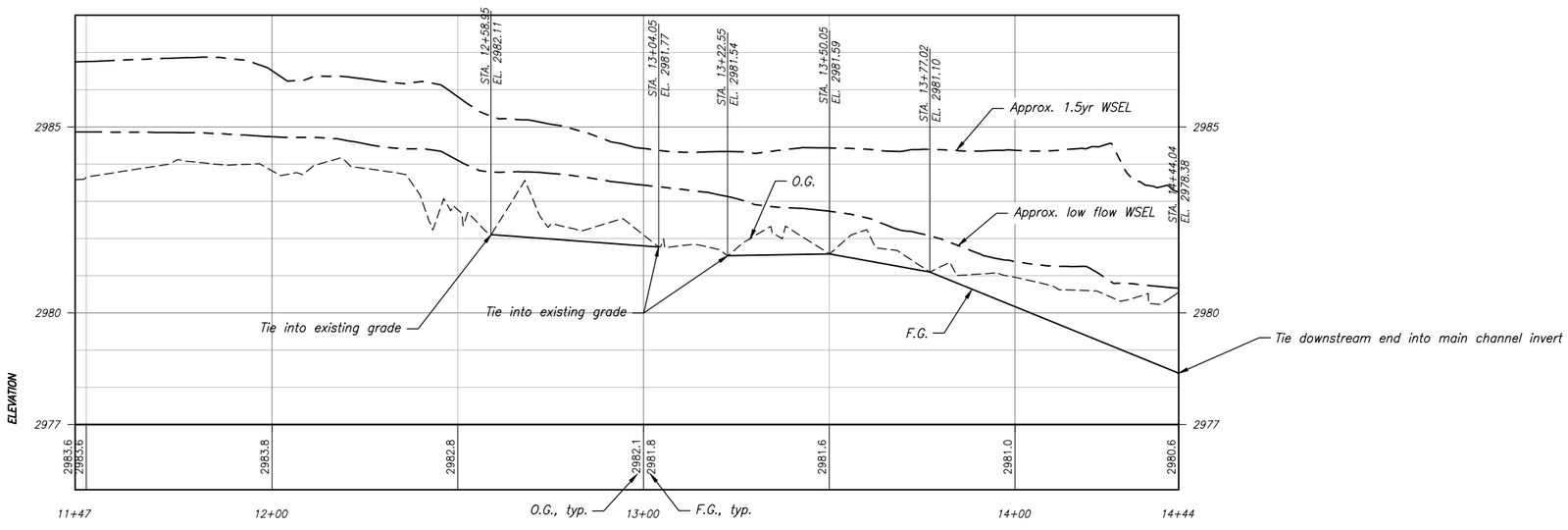
MAIN CHANNEL SPLIT FLOW PLAN

SCALE OF FEET: 20 0 20 40 60

N

LEGEND

- OG Major Contour
- OG Minor Contour
- FG Major Contour
- FG Minor Contour
- Existing Vegetation
- Existing Wetlands
- Thalweg
- Existing Ordinary High Water Line — OHW



MAIN CHANNEL SPLIT FLOW PROFILE STA. 11+47 TO STA. 14+44

Horizontal: 20 0 20 40 60 SCALE OF FEET

Vertical: 2 0 2 4 6 SCALE OF FEET

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CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 - MAIN CHANNEL SPLIT FLOW
PLAN AND PROFILE

DESIGNED	Nate Seal
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CSRO (BOISE, IDAHO)	2015-04-30

MAIN CHANNEL SPLIT FLOW STA. 11+47 TO STA. 14+44

PLAN AND PROFILE

1678-100-1971

SHEET 7 OF 7

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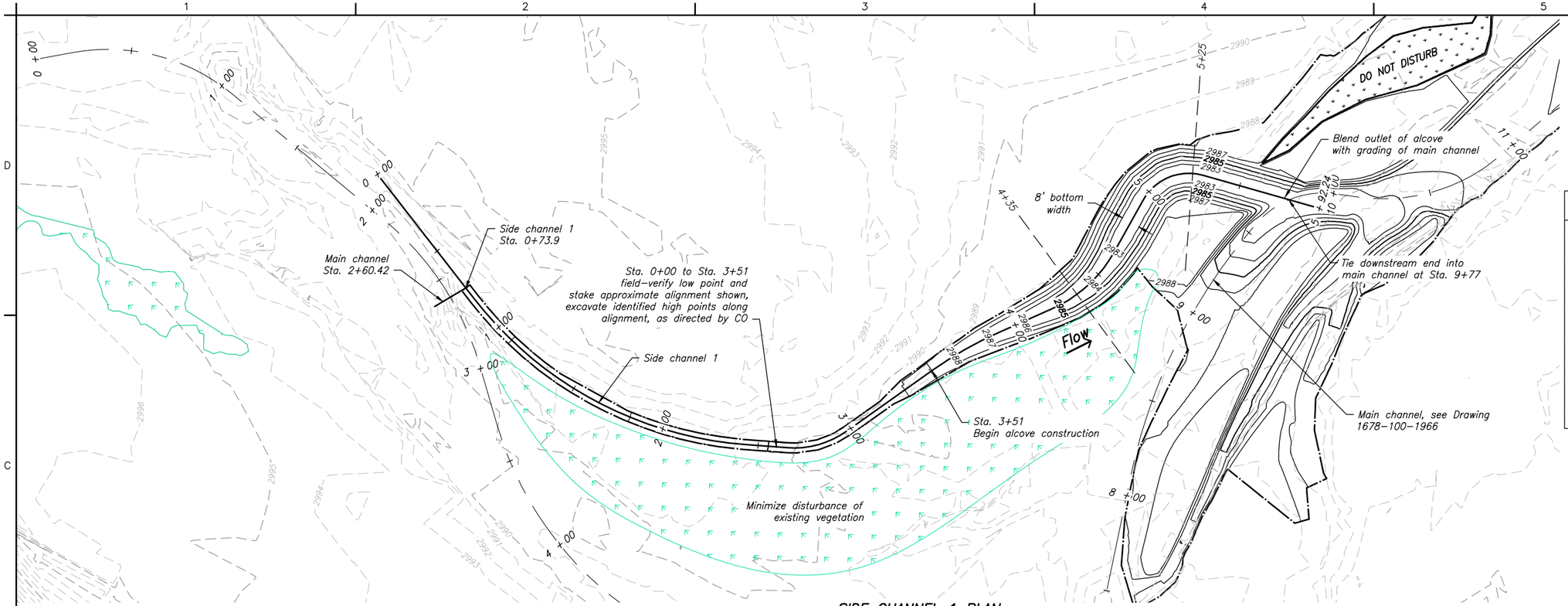
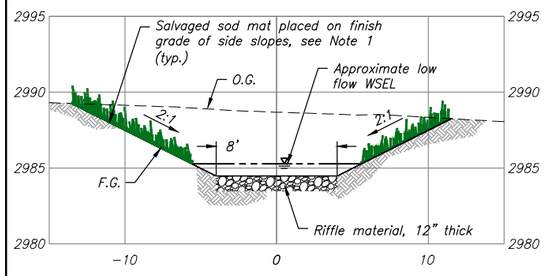


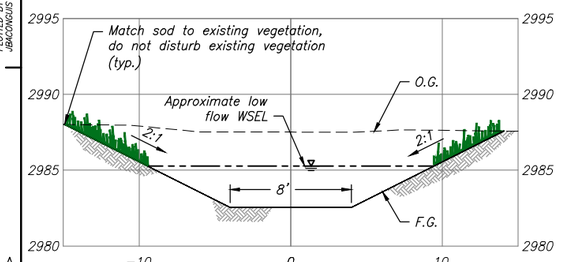
LEGEND

- O.G. Major Contour
- O.G. Minor Contour
- F.G. Major Contour
- F.G. Minor Contour
- Existing Vegetation
- Existing Wetlands
- Thalweg
- Disturbance

SIDE CHANNEL 1 PLAN

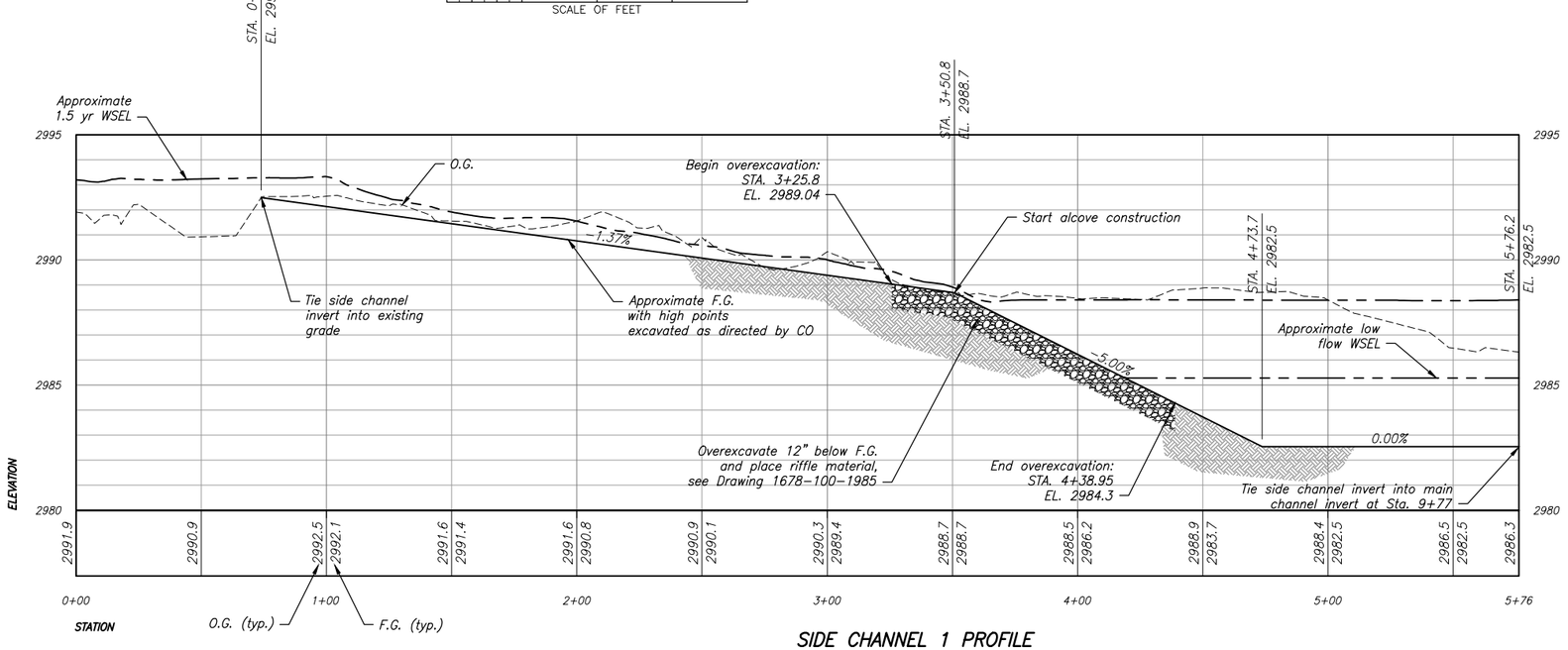
SCALE OF FEET: 30 0 30 60 90





SIDE CHANNEL 1 SECTIONS

SCALE OF FEET: 5 0 5 10 15



SIDE CHANNEL 1 PROFILE

HORIZONTAL SCALE: 30 0 30 60 90 SCALE OF FEET

VERTICAL SCALE: 3 0 3 6 9 SCALE OF FEET

NOTES:

1. Salvage sod and keep moist during construction, if applicable, and place on side slopes above finish grade and above low flow WSEL of alcove per specification section 32 92 10.

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 – SIDE CHANNEL 1

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Janice F. Baconguis, P.E.
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ADMIN. APPROVAL
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TITLE Program Manager–Acting
CSRO (BOISE, IDAHO) 2015–04–30

SIDE CHANNEL 1

1678–100–1972

SHEET 1 OF 4

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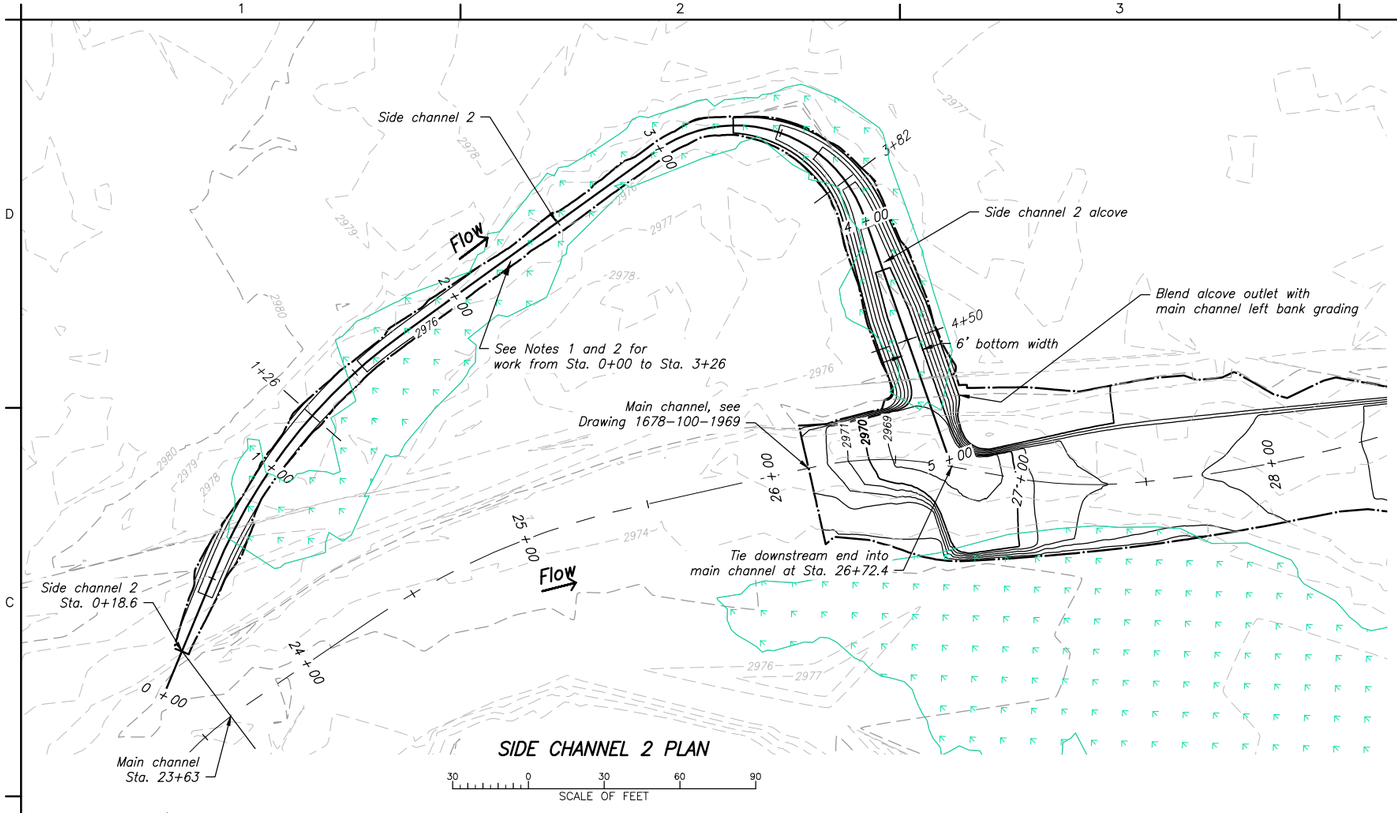
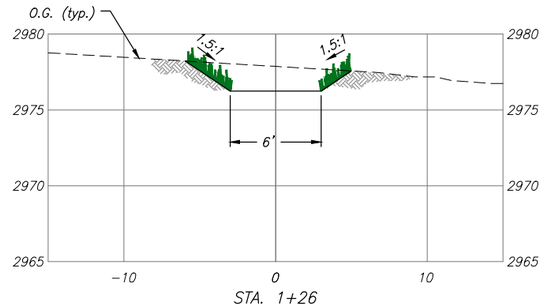
CAD FILENAME
SIDECHANNEL1.DWG



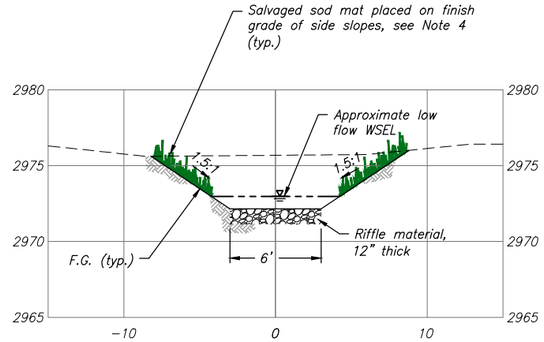
SIDE CHANNEL 2 PLAN

SCALE OF FEET: 30 0 30 60 90

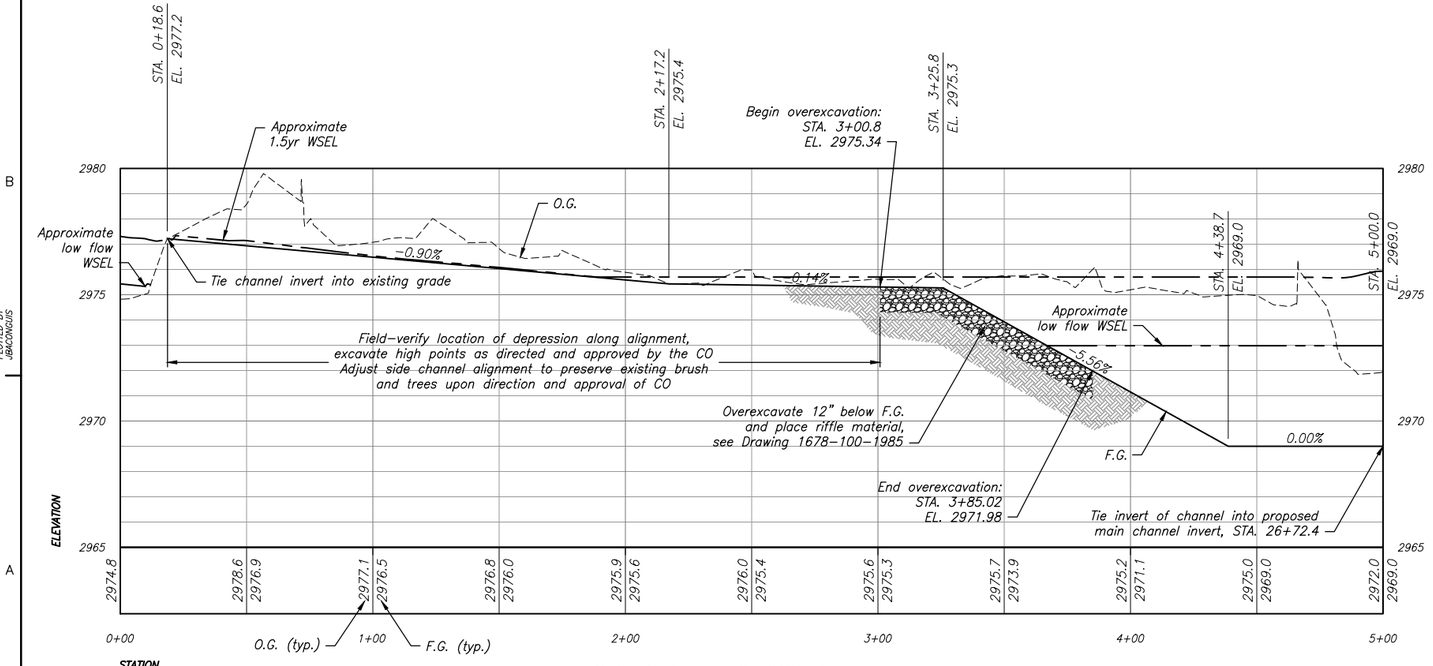
LEGEND
O.G. Major Contour
O.G. Minor Contour
F.G. Major Contour
F.G. Minor Contour
Existing Wetlands
Thalweg
Disturbance



STA. 1+26



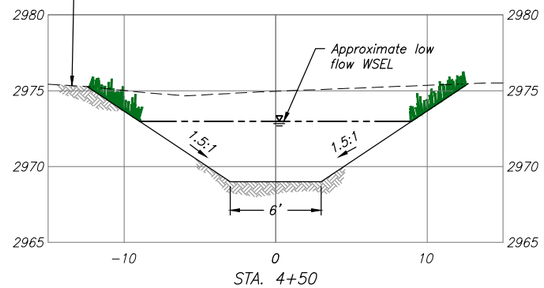
STA. 3+82



SIDE CHANNEL 2 PROFILE

HORIZONTAL SCALE: 30 0 30 60 90 SCALE OF FEET

VERTICAL SCALE: 3 0 3 6 9 SCALE OF FEET



STA. 4+50

SIDE CHANNEL 2 SECTIONS

SCALE OF FEET: 5 0 5 10 15

NOTES:

1. Field-verify and stake low point along approximate alignment shown.
2. Excavate identified high points along alignment from Sta. 0+00 to Sta. 3+26 to facilitate flow through side channel at high flow, as directed by CO. Payment for excavation of high points shall be based on time and materials.
3. Alcove construction begins at approximate Sta. 3+26 as shown in this drawing.
4. Salvage sod and keep moist during construction, if applicable, and place on side slopes above finish grade and above low flow WSEL of alcove per specification section 32 92 10.
5. If fines are found along slip face of alcove, excavate 12" below finish grade elevation and replace with riffle material from Sta. 3+26 to Sta. 4+39.

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COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 - SIDE CHANNEL 2

DESIGNED	Jason Thomas
DRAWN	JET/NS/JEB
CHECKED	Mike Knutson, P.E.
TECH. APPR.	Janice F. Baconguis, P.E. NAME, PROF. ABBR.
ADMIN. APPROVAL	Charles Spindler NAME Charles Spindler TITLE Program Manager-Acting
	CSRO (BOISE, IDAHO) 2015-04-30

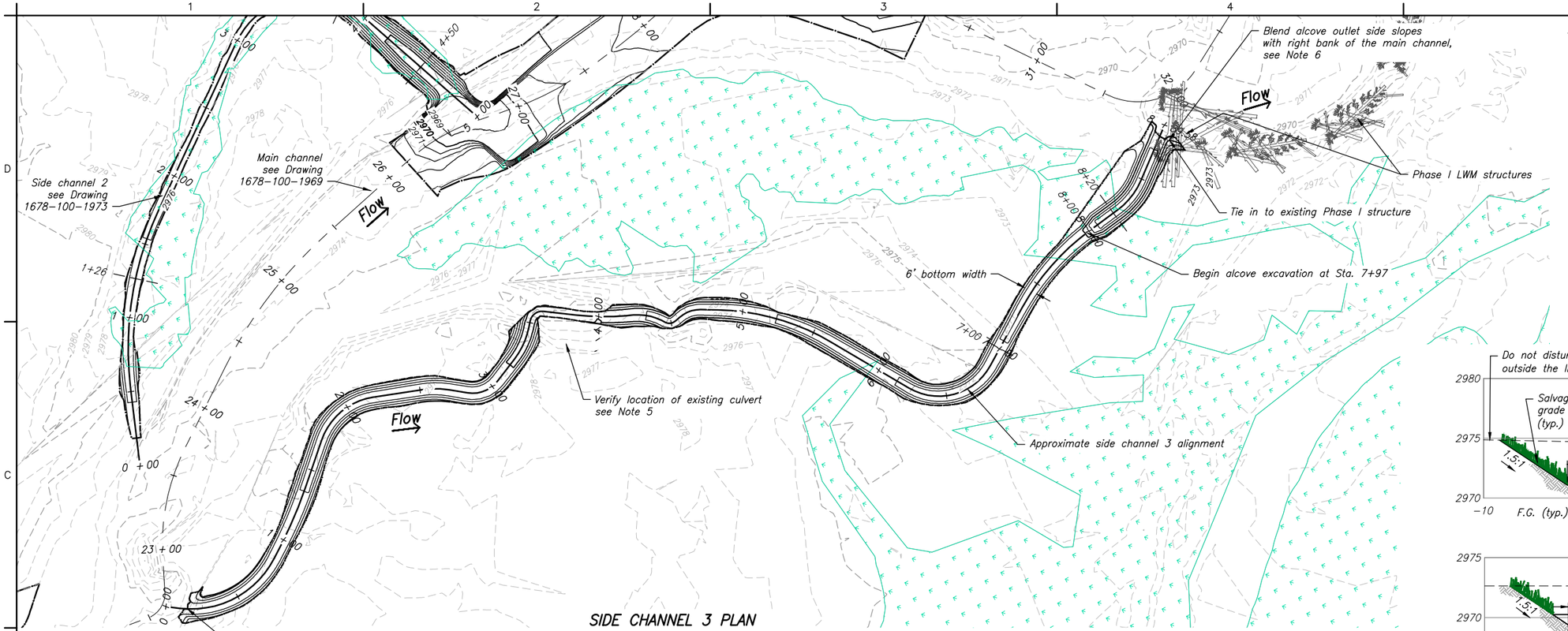
SIDE CHANNEL 2

1678-100-1973

SHEET 2 OF 4

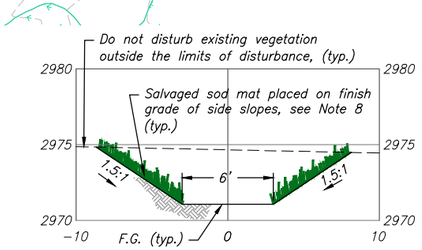
DATE AND TIME PLOTTED
APRIL 28, 2015 13:37
PLOTTED BY
JBACONGUIS

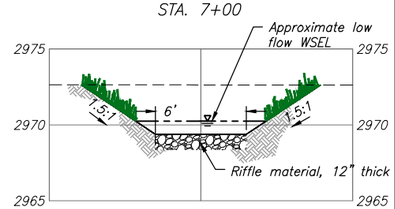
CAD SYSTEM
AutoCAD Rel. 19.1s
CAD FILENAME
SIDECHANNEL2.DWG

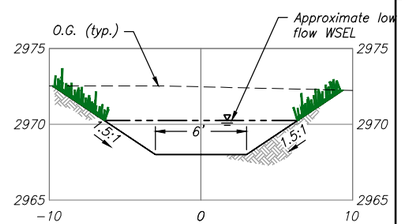


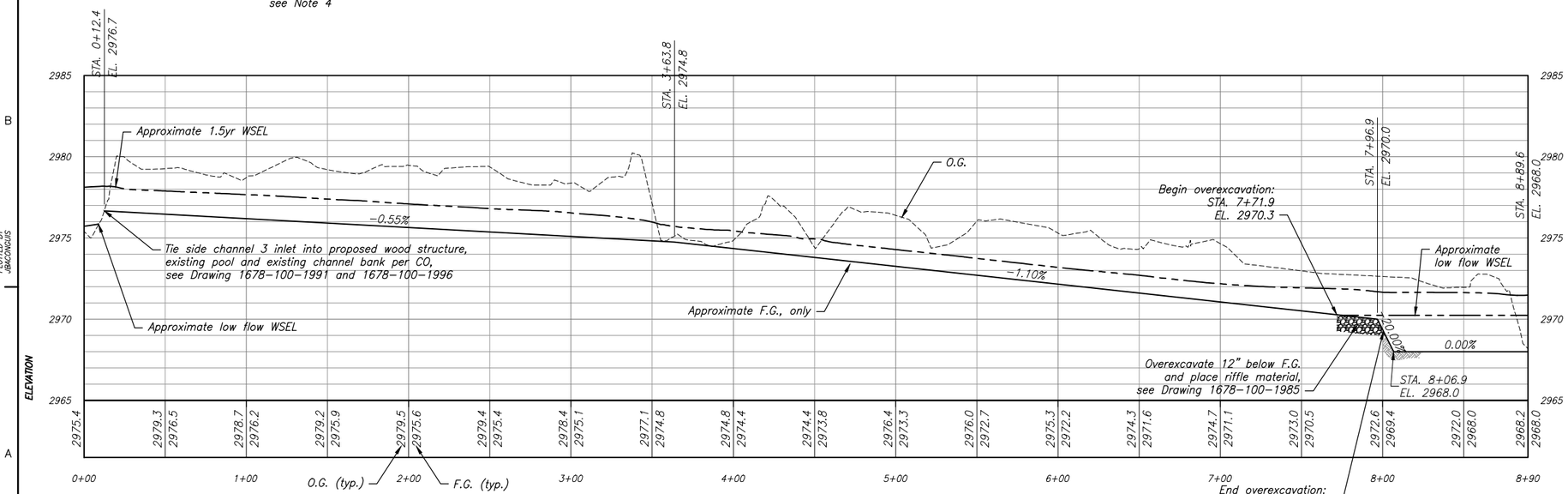
SIDE CHANNEL 3 PLAN

SCALE OF FEET: 40 0 40 80 120









SIDE CHANNEL 3 PROFILE

HORIZONTAL SCALE: 30 0 30 60 90 SCALE OF FEET

VERTICAL SCALE: 3 0 3 6 9 SCALE OF FEET

SIDE CHANNEL 3 SECTIONS

SCALE OF FEET: 5 0 5 10 15

NOTES:

1. Field–verify and stake location of side channel alignment, as approved by the CO.
2. Remove existing high points along alignment.
3. Blend excavated sections with adjacent channel geometry, as approved by the CO.
4. Blend side channel entrance with bleeder jam structure per CO–see Drawings 1678–100–1991 and 1978–100–1996.
5. Remove existing culvert and high ground, grade in side channel as shown.
6. Blend alcove for side channel 3 into pool on upstream side of existing LWM structure upon direction and approval of CO.
7. Minimize disturbance to existing vegetation as directed by CO.
8. Salvage sod and keep moist during construction, if applicable, and place on side slopes above finish grade and above low flow WSEL of alcove per specification section 32 92 10.

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COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 – SIDE CHANNEL 3

Jason Thomas
DESIGNED JET/NS/JEB
DRAWN Mike Knutson, P.E.
CHECKED Janice E. Baconguis, P.E.
TECH. APPR. NAME, PROF. ABBR.
Charles Spindler
ADMIN. APPROVAL NAME Charles Spindler TITLE Program Manager–Acting
CSRO (BOISE, IDAHO) 2015–04–30

SIDE CHANNEL 3

1678–100–1974
SHEET 3 OF 4

DATE AND TIME PLOTTED
APRIL 28, 2015 13:36
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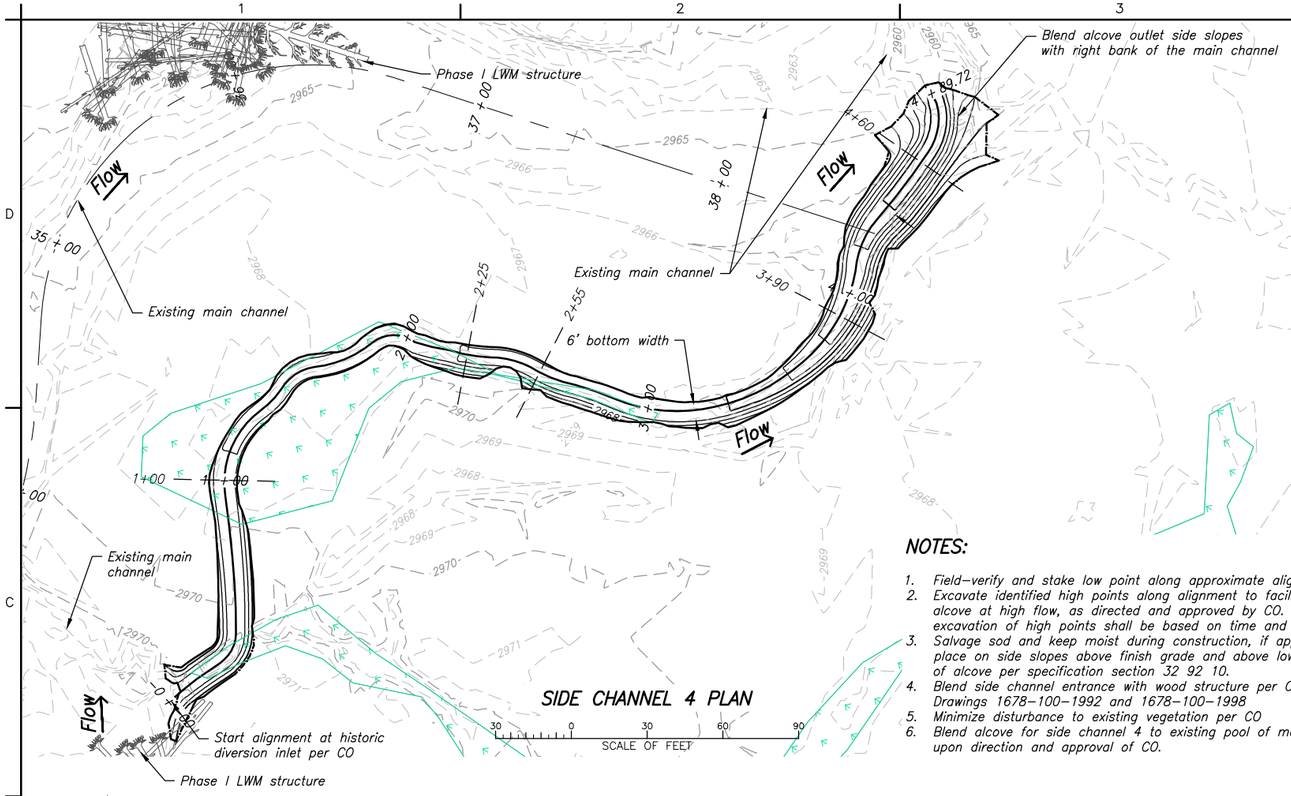
JBACONGUIS

CAD SYSTEM
AutoCAD Rel. 19.1s
CAD FILENAME
SIDECHANNEL3.DWG



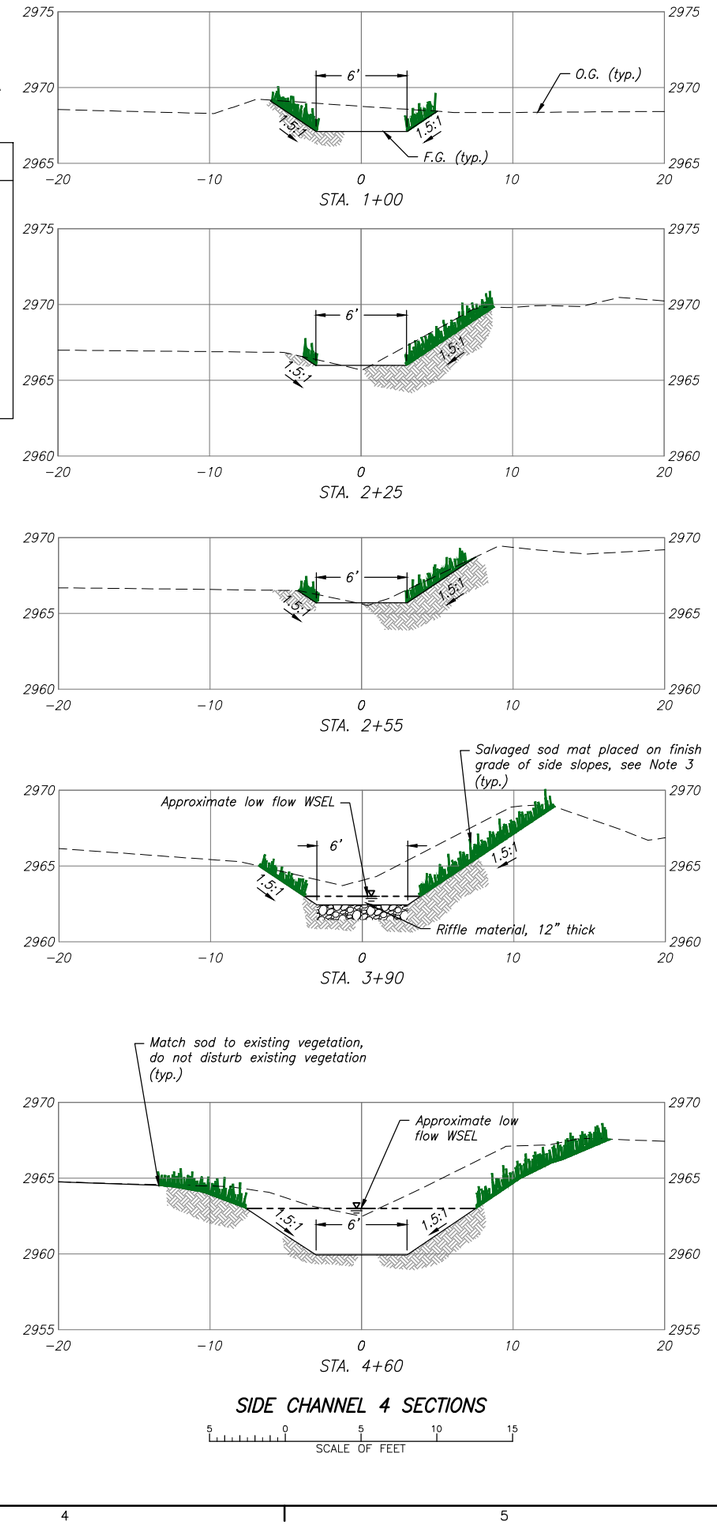
SIDE CHANNEL 4 PLAN

NOTES:

1. Field–verify and stake low point along approximate alignment shown.
2. Excavate identified high points along alignment to facilitate flow to alcove at high flow, as directed and approved by CO. Payment for excavation of high points shall be based on time and materials.
3. Salvage sod and keep moist during construction, if applicable, and place on side slopes above finish grade and above low flow WSEL of alcove per specification section 32 92 10.
4. Blend side channel entrance with wood structure per CO, see Drawings 1678–100–1992 and 1678–100–1998
5. Minimize disturbance to existing vegetation per CO
6. Blend alcove for side channel 4 to existing pool of main channel upon direction and approval of CO.

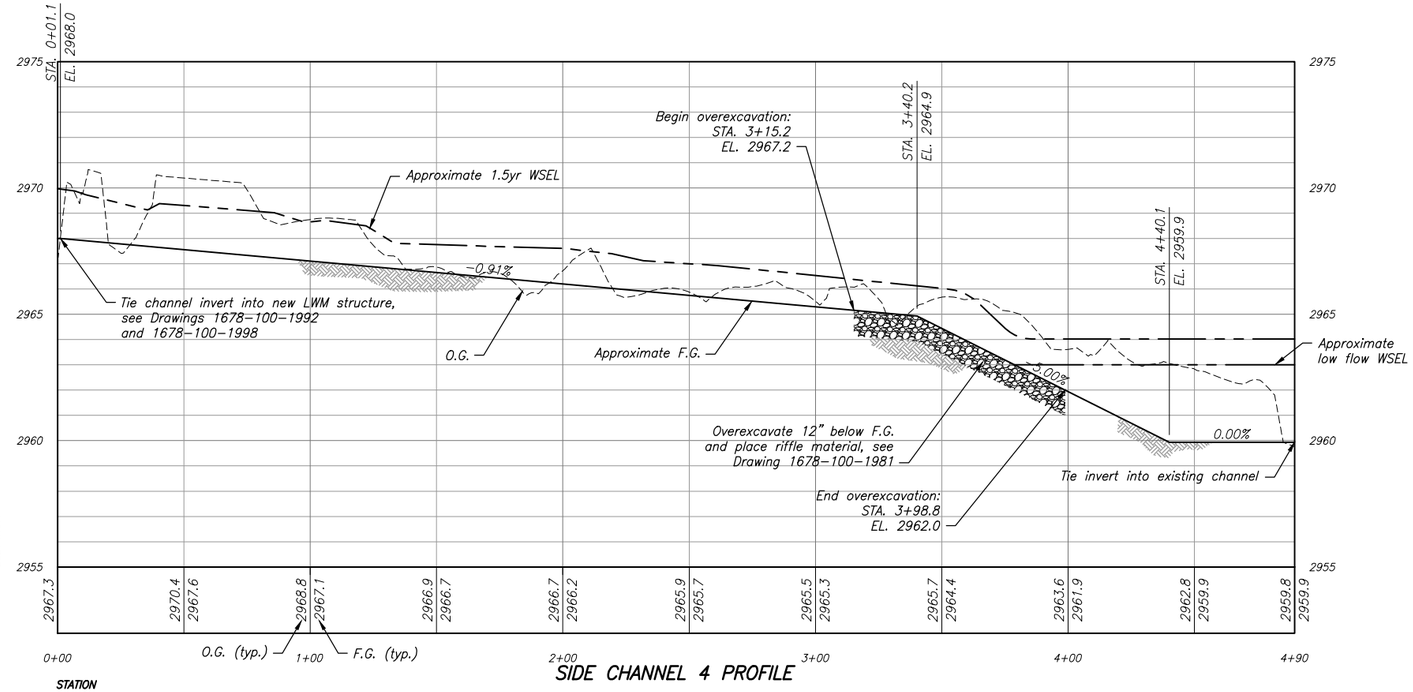
LEGEND

- O.G. Major Contour
- O.G. Minor Contour
- F.G. Major Contour
- F.G. Minor Contour
- Existing Wetlands
- Thalweg
- Disturbance



SIDE CHANNEL 4 SECTIONS

SCALE OF FEET



SIDE CHANNEL 4 PROFILE

HORIZONTAL SCALE: SCALE OF FEET

VERTICAL SCALE: SCALE OF FEET

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 – SIDE CHANNEL 4

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ADMIN. APPROVAL	Charles Spindler (NAME Charles Spindler, TITLE Program Manager–Acting)
CSRO (BOISE, IDAHO)	2015–04–30

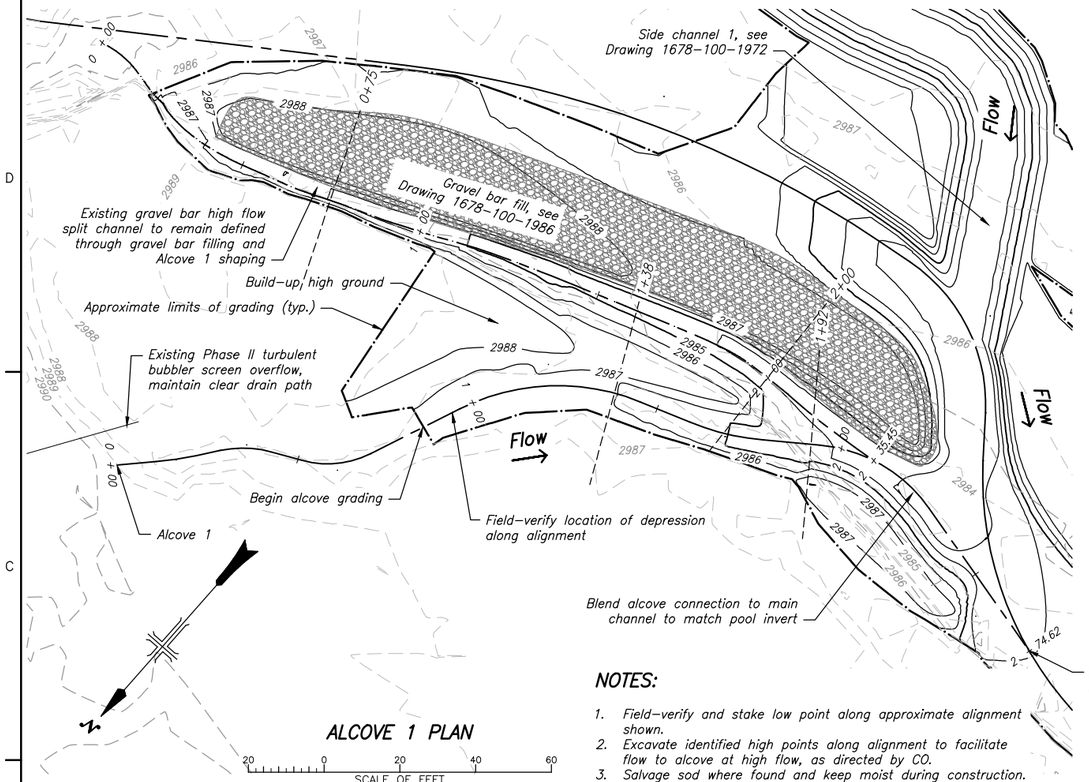
SIDE CHANNEL 4

1678–100–1975

SHEET 4 OF 4

DATE AND TIME PLOTTED
APRIL 28, 2015 13:35
PLOTTED BY
JBACONGUIS

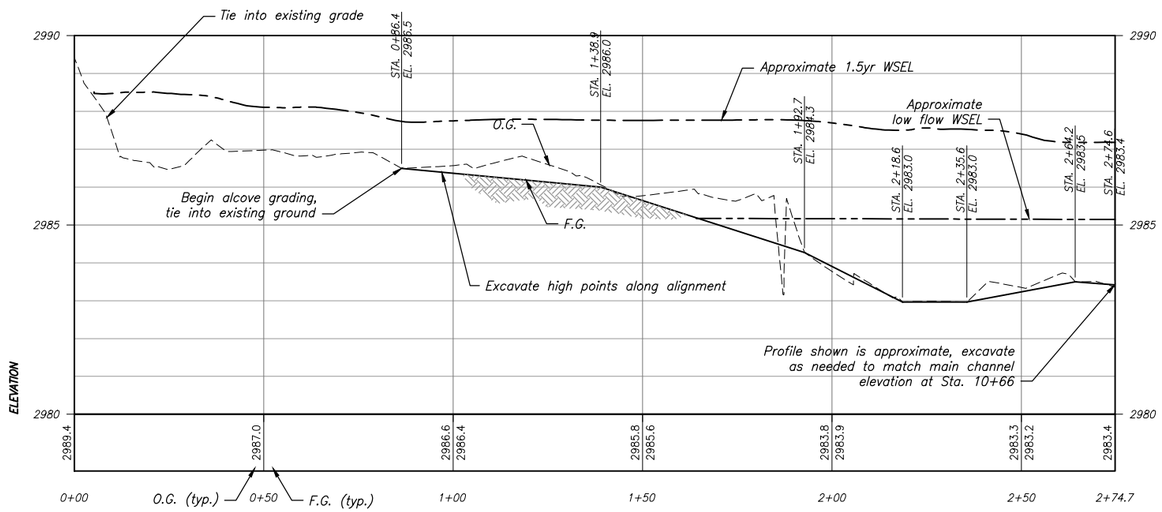
CAD SYSTEM
AutoCAD Rel. 19.1s
CAD FILENAME
SIDECHANNEL.DWG



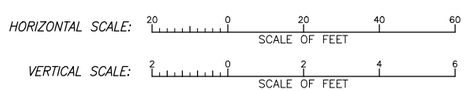
ALCOVE 1 PLAN

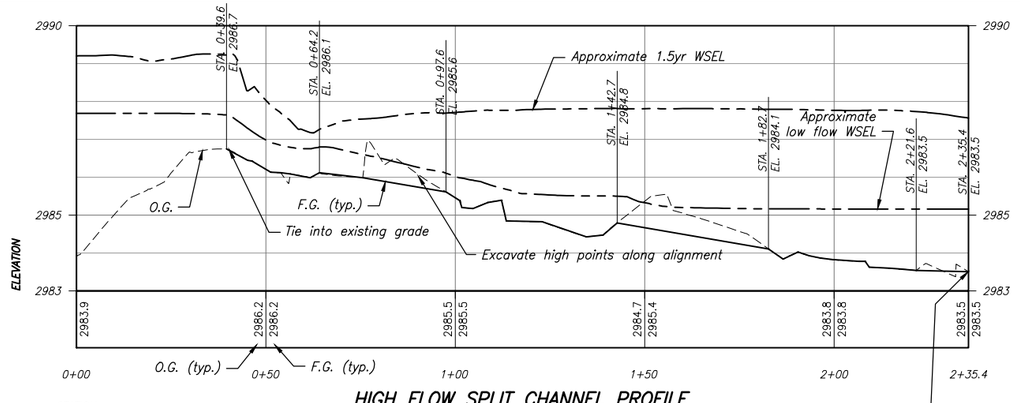
NOTES:

1. Field-verify and stake low point along approximate alignment shown.
2. Excavate identified high points along alignment to facilitate flow to alcove at high flow, as directed by CO.
3. Salvage sod where found and keep moist during construction. Place on alcove side slopes above finish grade.

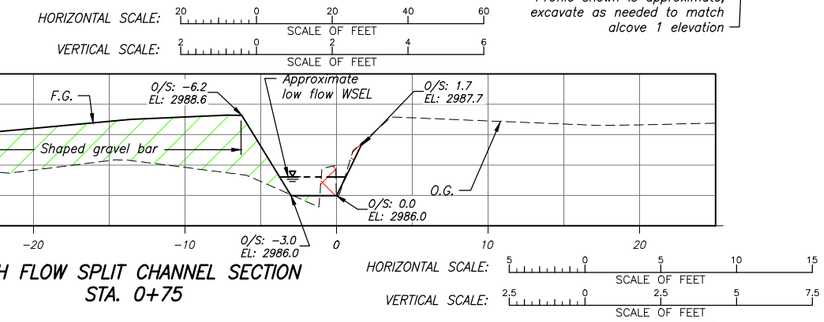


ALCOVE 1 PROFILE

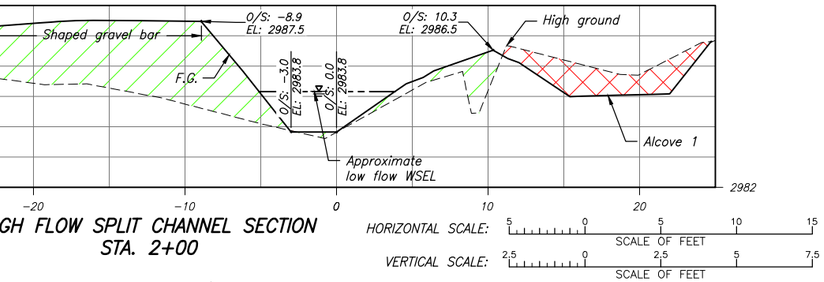




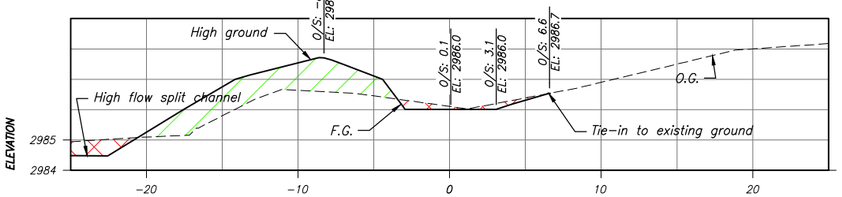
HIGH FLOW SPLIT CHANNEL PROFILE



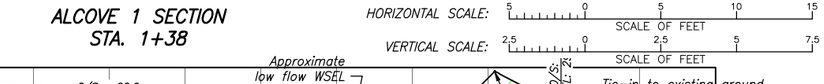
HIGH FLOW SPLIT CHANNEL SECTION STA. 0+75

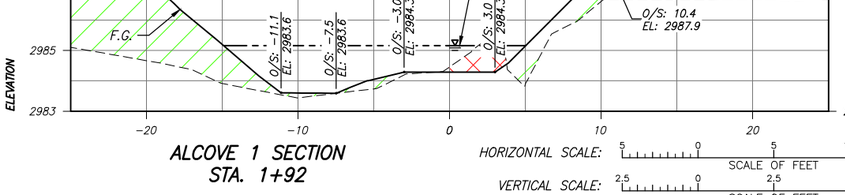


HIGH FLOW SPLIT CHANNEL SECTION STA. 2+00



ALCOVE 1 SECTION STA. 1+38





ALCOVE 1 SECTION STA. 1+92

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 - ALCOVE 1 PLAN, PROFILE, AND SECTIONS

Nate Seal
DESIGNED
NS
DRAWN
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CSRO (BOISE, IDAHO) 2015-04-30

ALCOVE 1
PLAN, PROFILE, AND SECTIONS

1678-100-1976
SHEET 1 OF 2

DATE AND TIME PLOTTED
JANUARY 27, 2015 00:12
PLOTTED BY
JBACONGUIS

CAD SYSTEM
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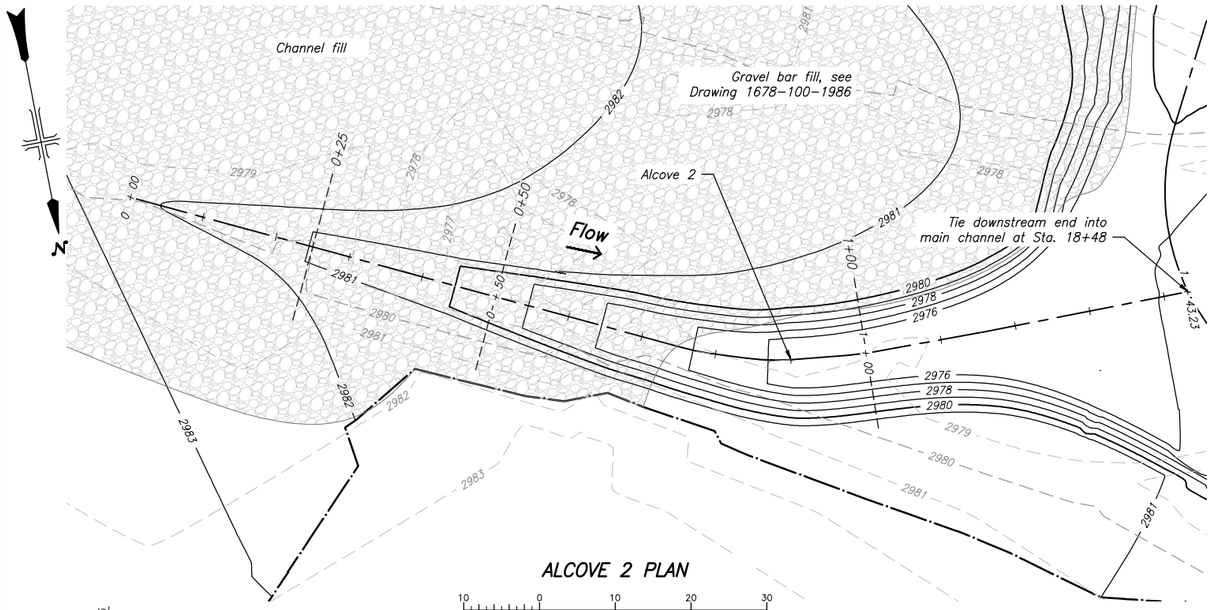
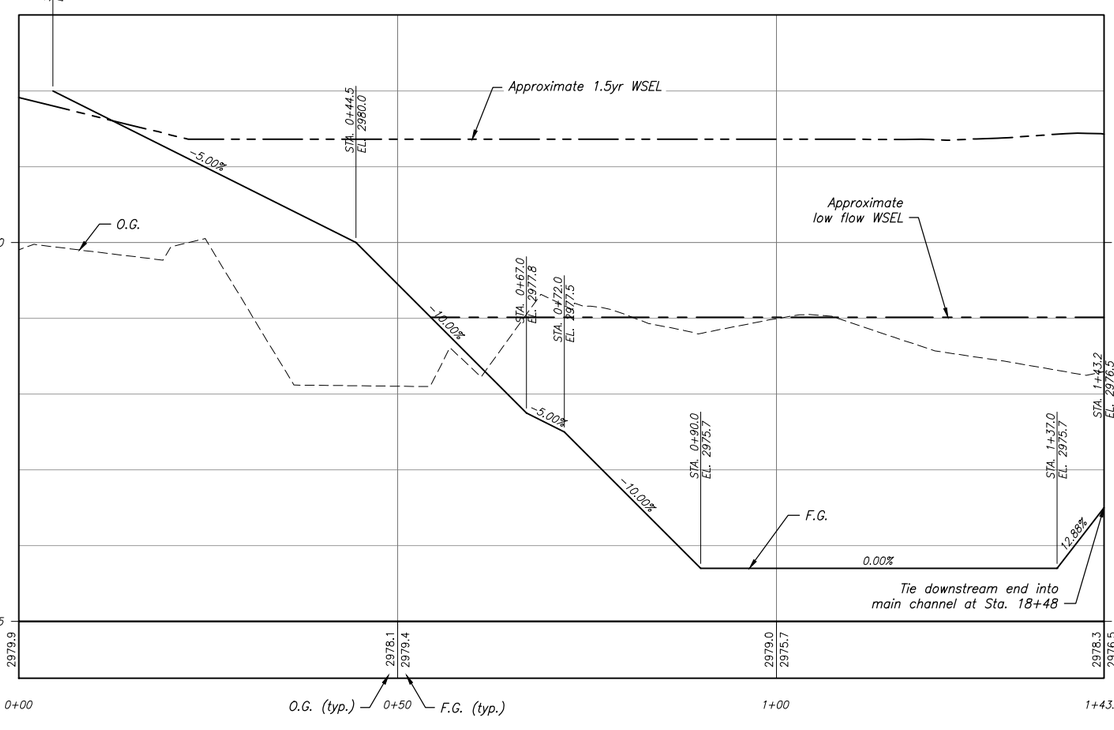


ALCOVE 2 PLAN

SCALE OF FEET



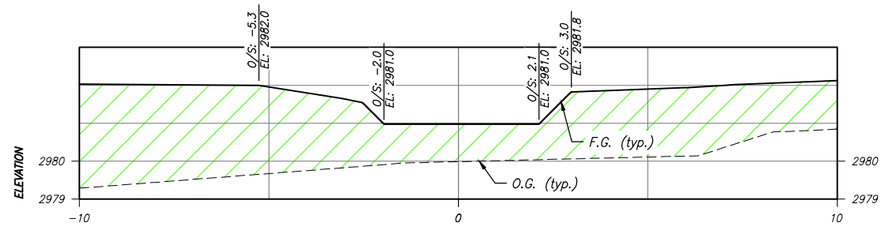
ALCOVE 2 PROFILE

HORIZONTAL SCALE: SCALE OF FEET

VERTICAL SCALE: SCALE OF FEET

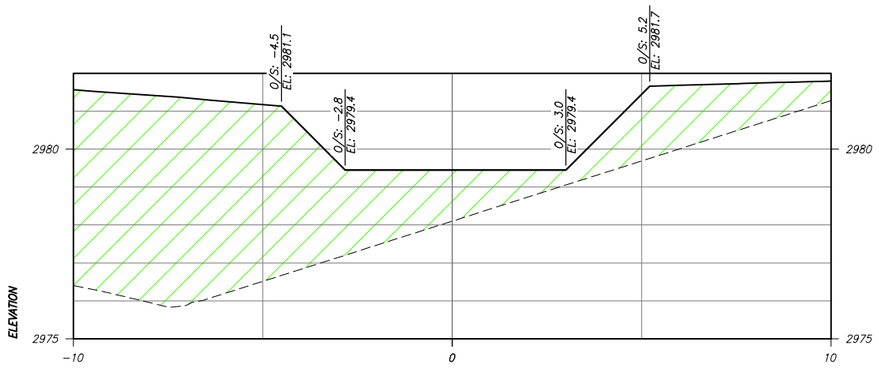
Cut

Fill



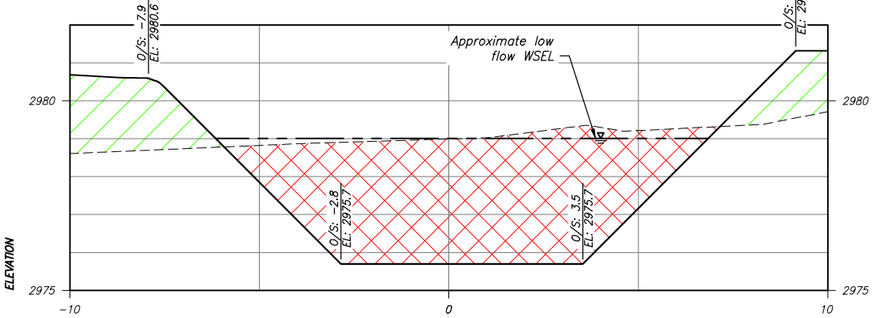
ALCOVE 2 SECTION
STA. 0+25

SCALE OF FEET



ALCOVE 2 SECTION
STA. 0+50

SCALE OF FEET



ALCOVE 2 SECTION
STA. 1+00

SCALE OF FEET

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CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 - ALCOVE 2 DETAILS

DESIGNED: Janice E. Baconguis, P.E.
DRAWN: JEB
CHECKED: Mike Knutson, P.E.
TECH. APPR.: Janice E. Baconguis, P.E.
APPROVED: Charles Spindler
ADMIN APPROVAL: Charles Spindler - Program Manager-Acting
CSRO (BOISE, IDAHO) 2015-04-30

ALCOVE 2

PLAN, PROFILE, AND SECTIONS

1678-100-1977

SHEET 2 OF 2

DATE AND TIME PLOTTED: JANUARY 28, 2015 16:08
PLOTTED BY: JBACONGUIS

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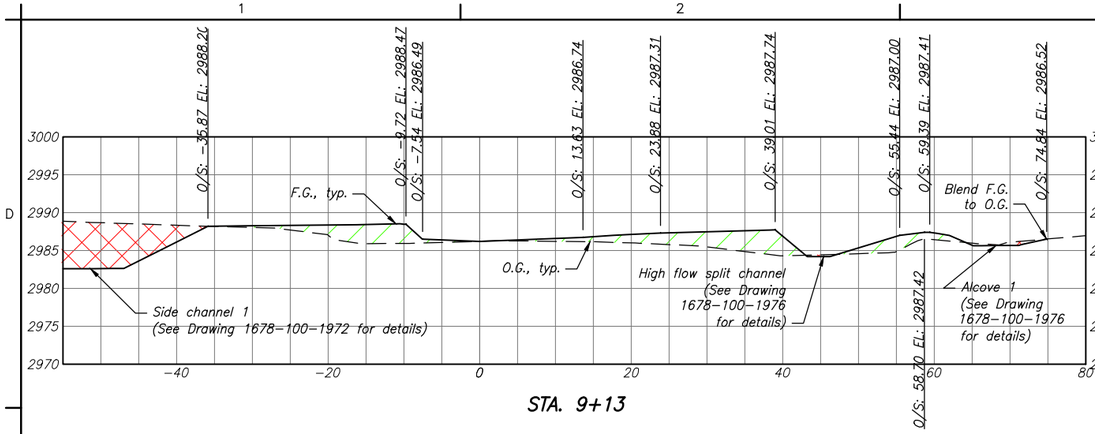

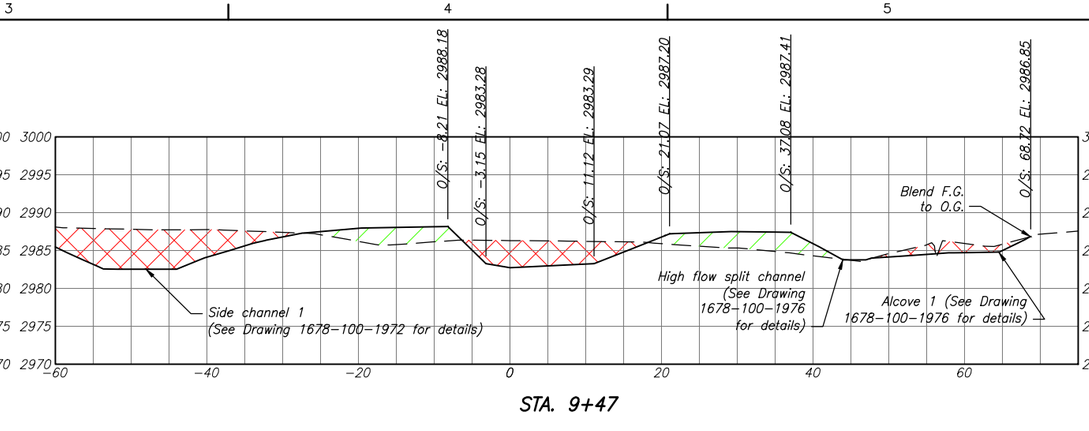

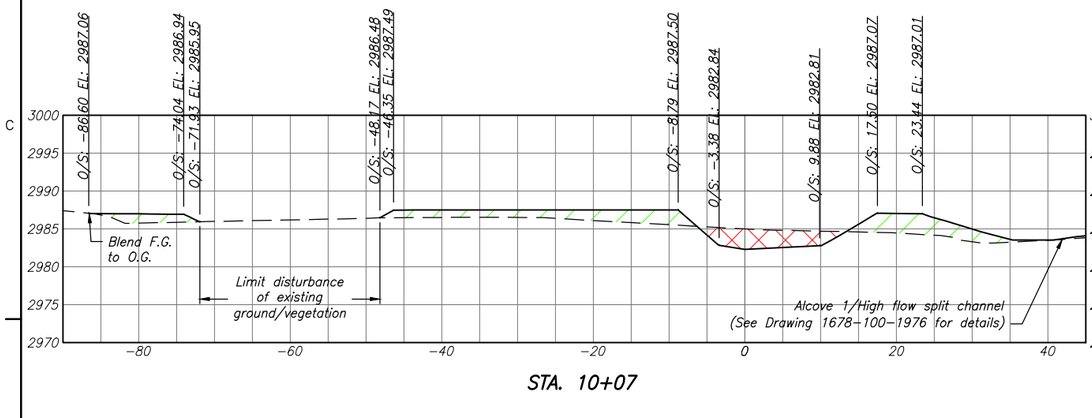

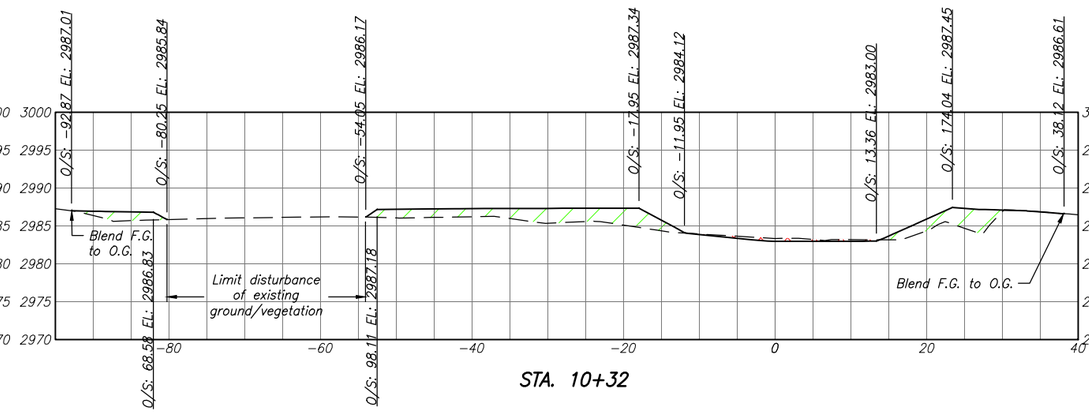

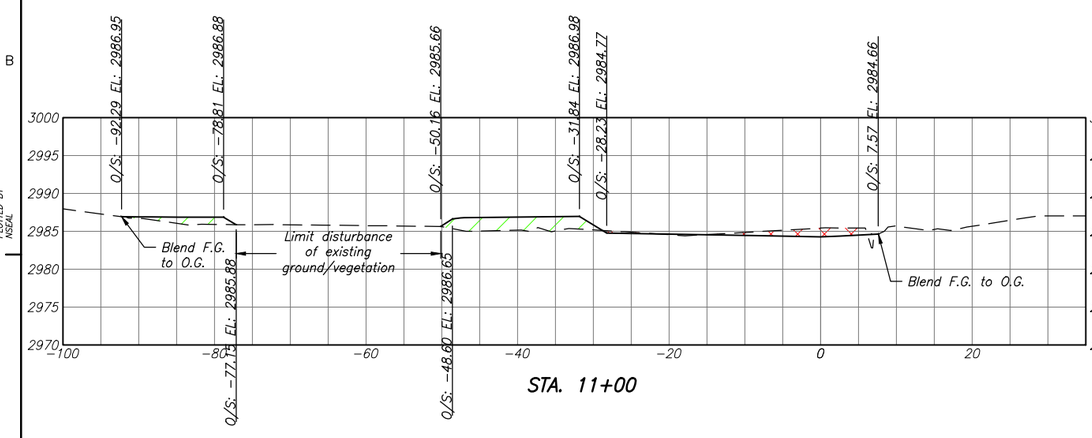

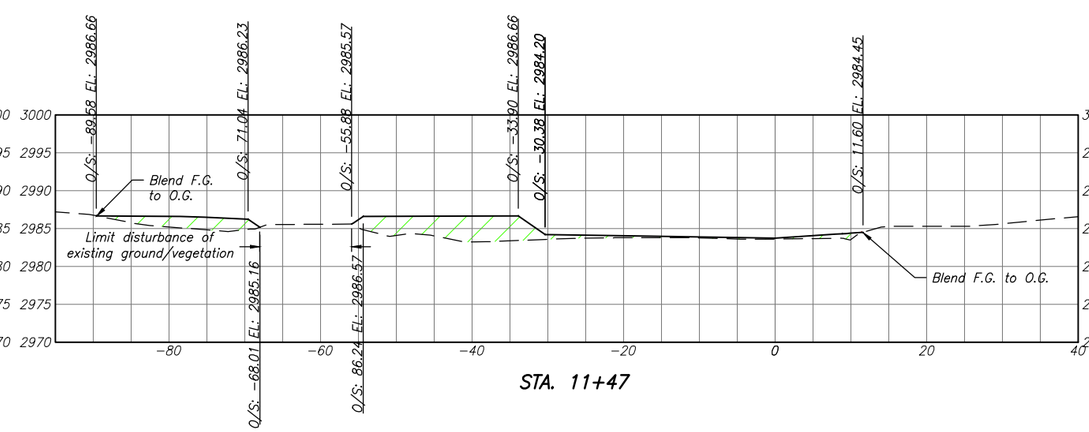

Cut

Fill

MAIN CHANNEL CROSS SECTIONS STA. 9+13 TO STA. 11+47

SCALE OF FEET

Notes

1. Cross sections face downstream.
2. Y-axis is elevation, X-axis is distance in feet along a chord perpendicular to the thalweg. The zero station shown on these cross sections represents the thalweg alignment.
3. Constructed channel shall transition smoothly between the pool and riffle geometries shown in the typical cross sections. Cross section geometry shown represents one point in a smooth transition.
4. Cross-sections are to be used to stake out the channel offsets at the vertical grade breaks of the channel profile.
5. Thalweg elevations can be found in plan and profile drawings (1678-100-1965 thru 1971).

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 - MAIN CHANNEL CROSS SECTIONS

DESIGNED	Nate Seal
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APPROVED	Charles Spindler
ADMIN APPROVAL	Charles Spindler - Program Manager-Acting
CSRO (BOISE, IDAHO)	2015-04-30

MAIN CHANNEL STA. 9+13 TO STA. 11+47

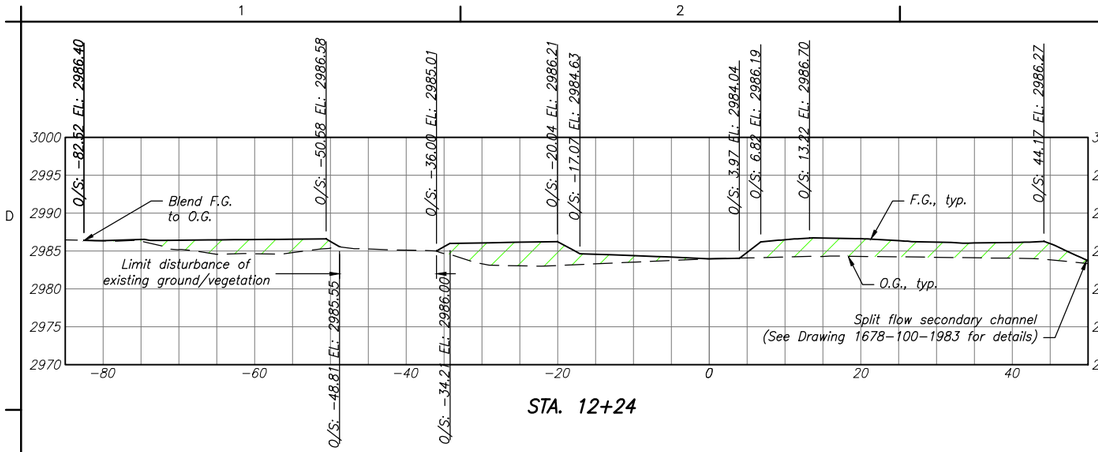
CROSS SECTIONS

1678-100-1978

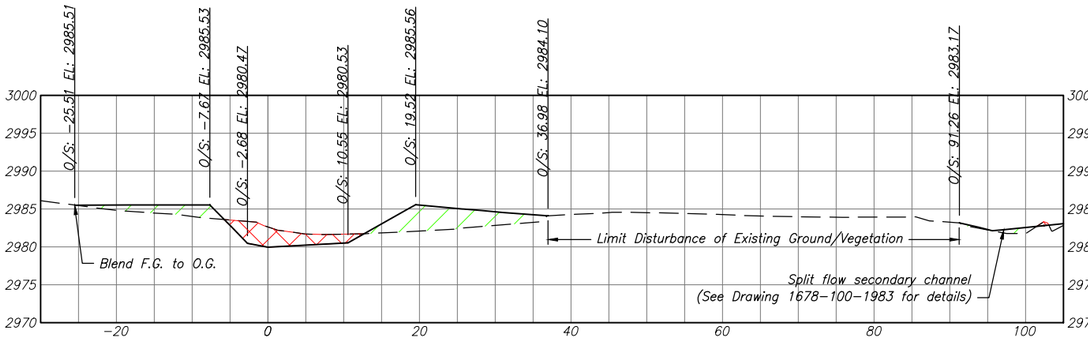
SHEET 1 OF 5

DATE AND TIME PLOTTED
JANUARY 28, 2015 13:49
PLOTTED BY
NSEAL

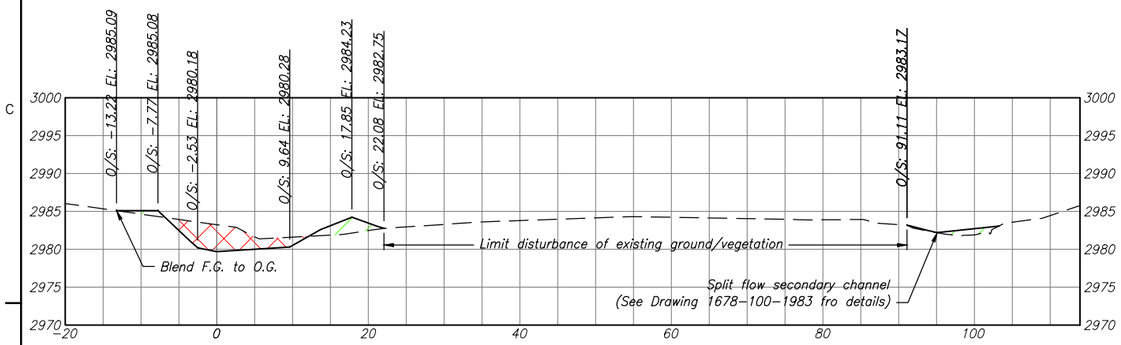
CAD SY CHANNEL
AutoCAD Rel. 19.1s
CAD FILENAME
CROSS SECTIONS.DWG



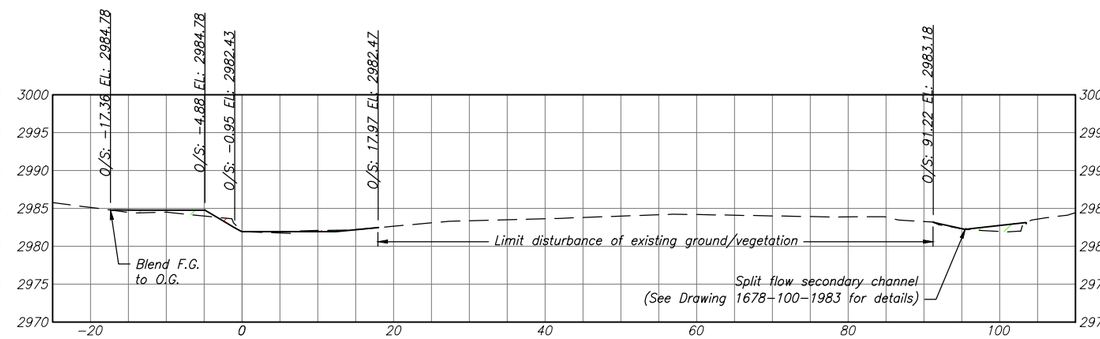
STA. 12+24



STA. 12+90



STA. 13+30



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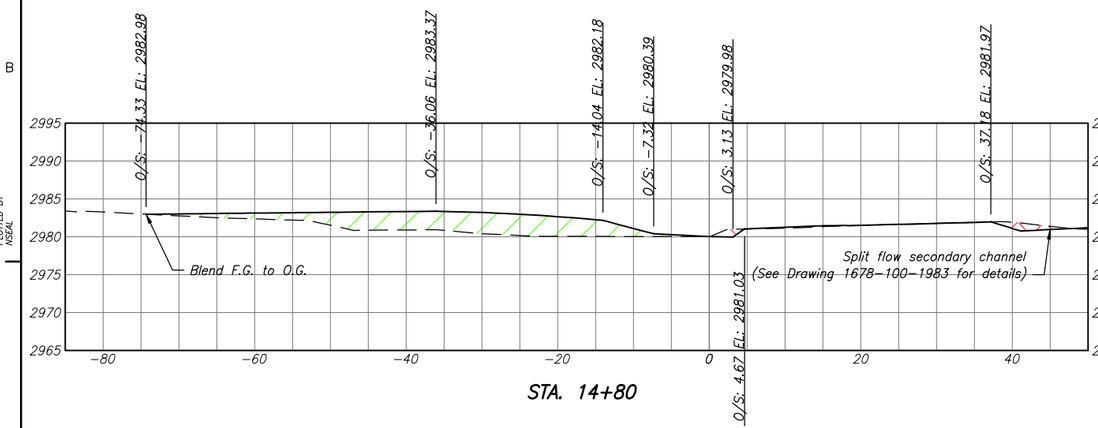
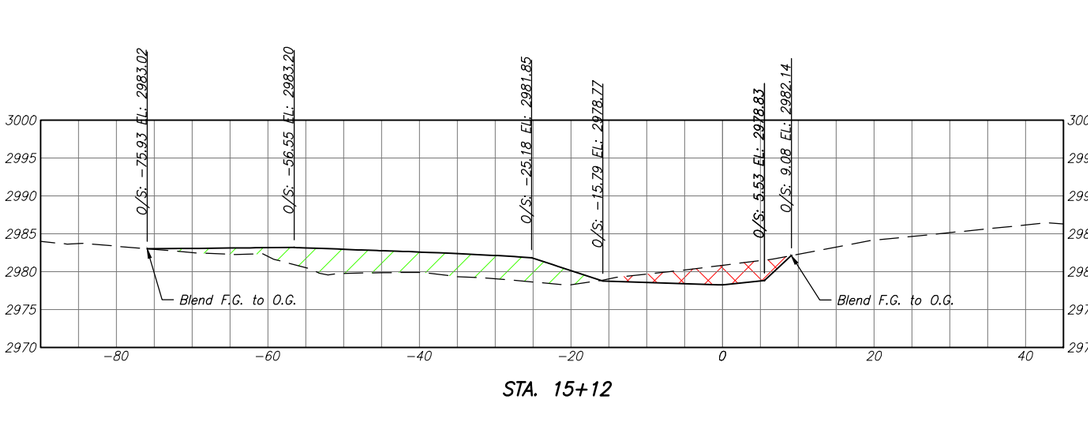


STA. 14+80



STA. 15+12

Cut

Fill

MAIN CHANNEL CROSS SECTIONS
STA. 12+24 TO STA. 15+12

SCALE OF FEET

Notes

1. Cross sections face downstream.
2. Y-axis is elevation, X-axis is distance in feet along a chord perpendicular to the thalweg. The zero station shown on these cross sections represents the thalweg alignment.
3. Constructed channel shall transition smoothly between the pool and riffle geometries shown in the typical cross sections. Cross section geometry shown represents one point in a smooth transition.
4. Cross-sections are to be used to stake out the channel offsets at the vertical grade breaks of the channel profile.
5. Thalweg elevations can be found in plan and profile drawings (1678-100-1965 thru 1971)

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 - MAIN CHANNEL CROSS SECTIONS

Nate Seal	DESIGNED
NS	DRAWN
Mike Knutson, P.E.	CHECKED
Janice E. Baconguis, P.E.	TECH. APPR.
Charles Spindler	APPROVED
Charles Spindler - Program Manager-Acting	ADMIN APPROVAL
CSRO (BOISE, IDAHO)	2015-04-30

MAIN CHANNEL STA. 12+24 TO STA. 15+12

CROSS SECTIONS

1678-100-1979

SHEET 2 OF 5

DATE AND TIME PLOTTED
MARCH 17, 2015 15:23
PLOTTED BY
NSEAL

CAD SY CHANNEL
AutoCAD Rel. 19.1s
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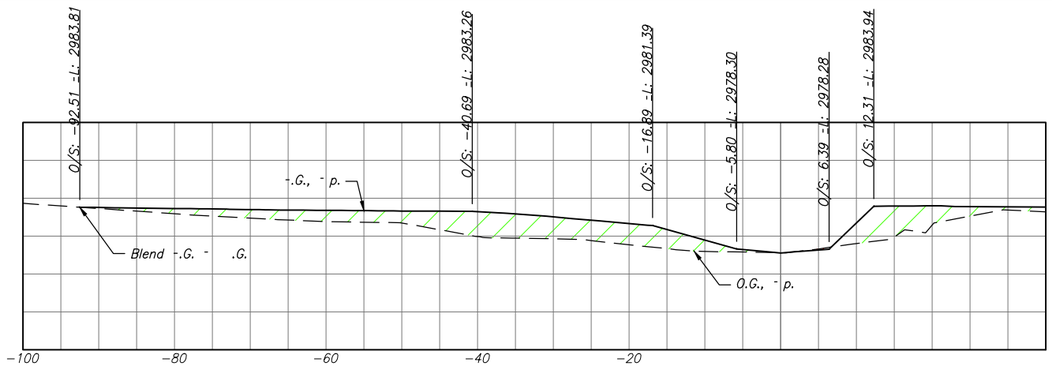
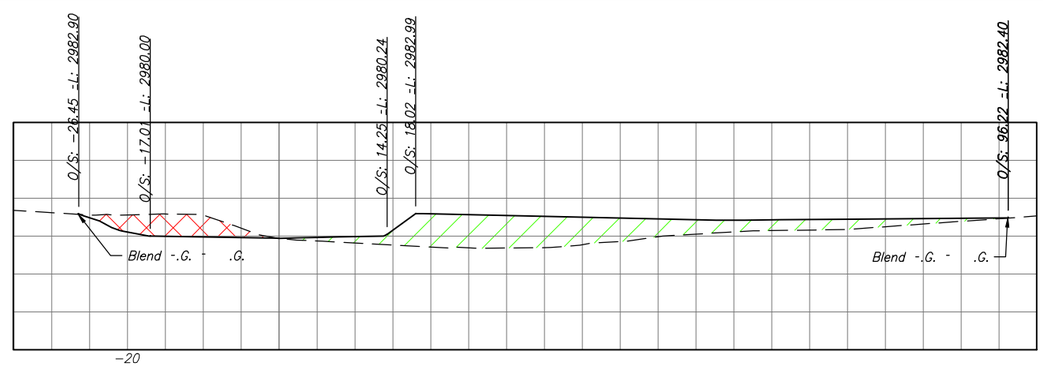
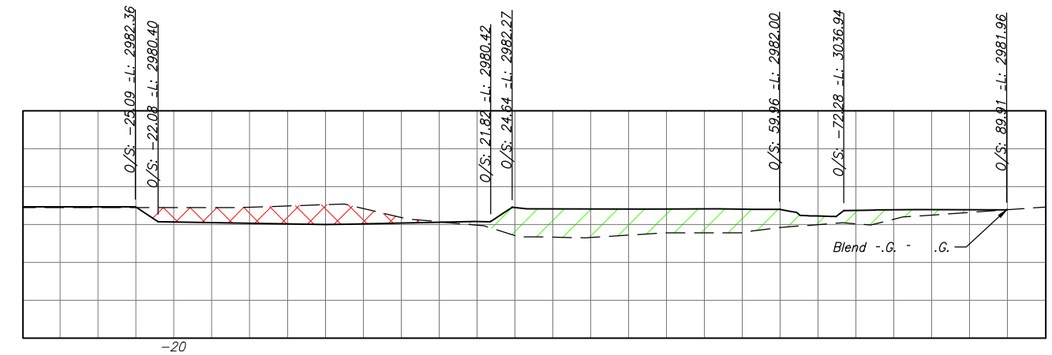
CROSS SECTIONS.DWG



T-. 15+78



ST-. 16+11



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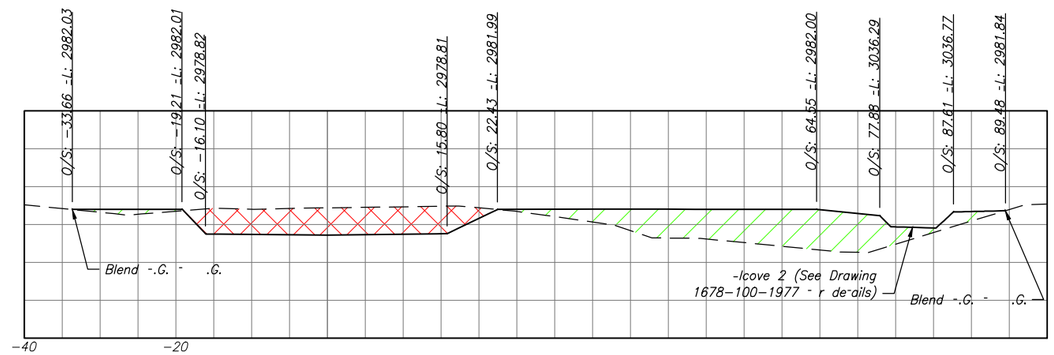
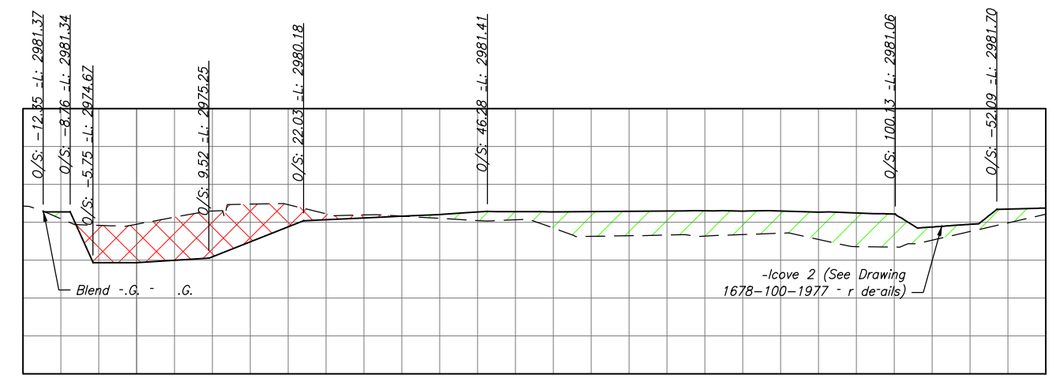
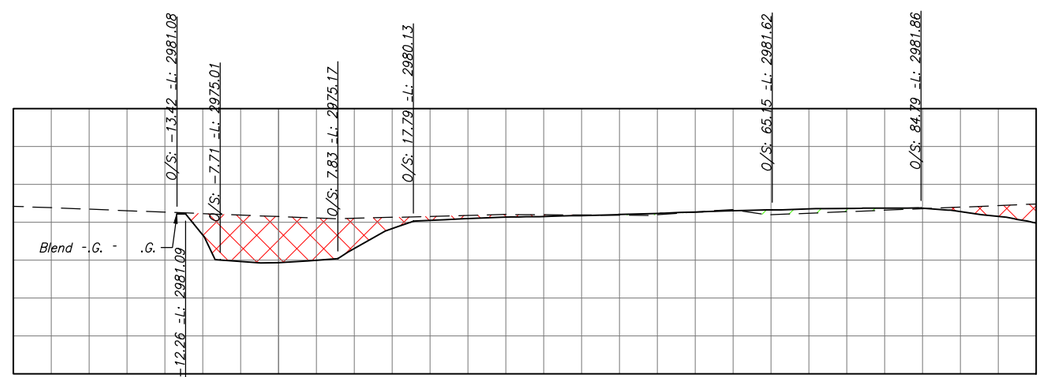


ST-. 16+91



ST-. 17+92



ST-. 18+17

Cut

-ill

M-IN CH =L CROSS S=CTIONS
ST-. 15+78 TO ST-. 18+17

10 0 10 20 30
SCAL= O =T

No-
. Cross sec-ions -ace downs-ream.
2. Y-axis is eleva-ion, X-axis is dis-ance in - along a chord perpendicular -he -halweg. The zero s-a-ion shown on -hese cross sec-ions represen -he -halweg alignmen-.
3. Cons-ruc- d channel shall -ransi-ion smoo-hly be- n -he pool and ri -le geome-ries shown in -he - pical cross sec-ions. Cross sec-ion geome-ry shown represen- ne poin- in a smoo-h -ransi-ion.
4. Cross-sec-ions are - be used -ake ou -he channel o - a -he ver-ical grade breaks o -he channel pro-ile.
5. Thalweg eleva-ions can be - ind in plan and pro-ile drawings (1678-100-1965 -hru 1971

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BUR=. - =CL -TION
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- \PS HABITAT IMPROV=M=NT PROGRAM

GR = ROND= SUBB- IN
CC-44 PH = III H- IT-T =NH =M=NT
P-\C=L 4 - M-IN CH =L CROSS S=CTIONS

g- al
D=SIGN=D
NS
DR-
Mike Knu- n, P.=.
H=CK=D
Janice =. Baconguis, P.=.
I=CH. - \.
Charles Spindler
- GV=D Charles Spindler
- I N - GN - Program Manager- -ing
CSRO (BOIS=, ID-HO) 2015-04-30

M-IN CH =L ST-. 15+78 TO ST-. 18+17

CROSS S=CTIONS

1678-100-1980

H=-T 3 0- 5

D-T= - TIM= PLOT=D
M-\CH 26, 2015 - 15:24
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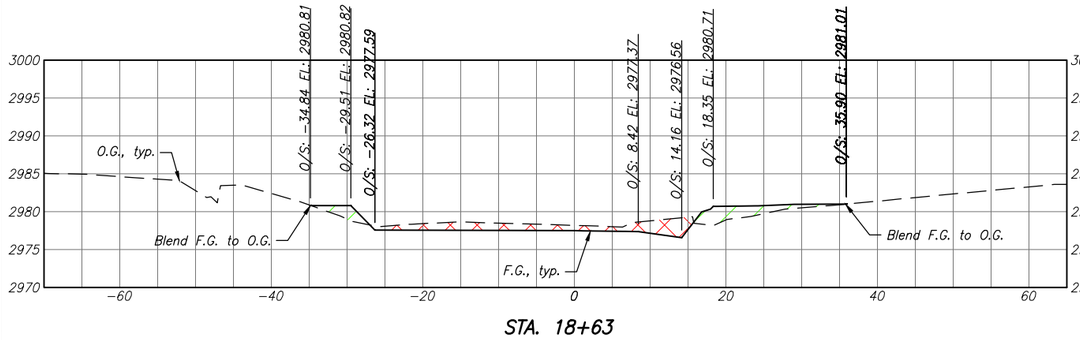
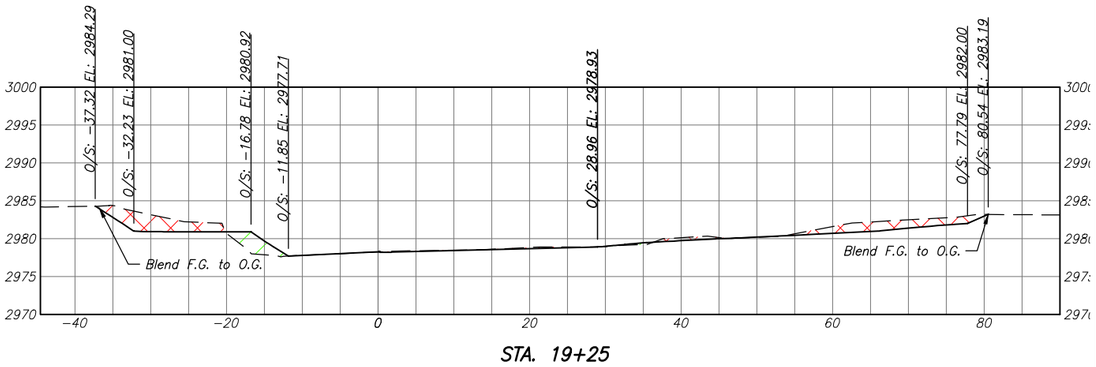
CROSS S=CTIONS.DWG



STA. 18+63



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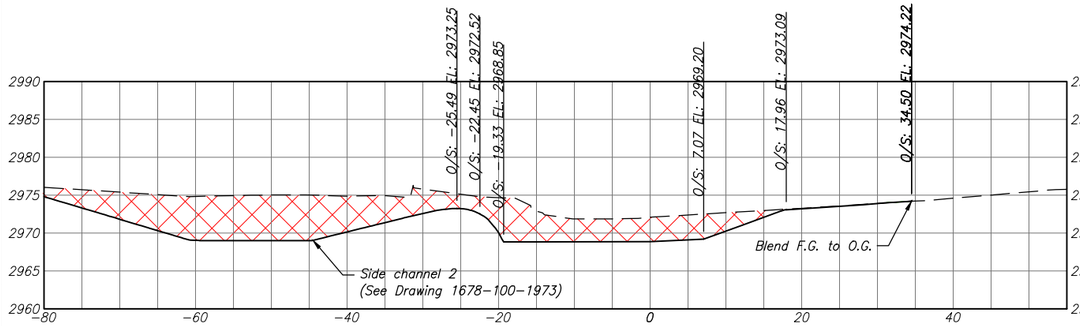

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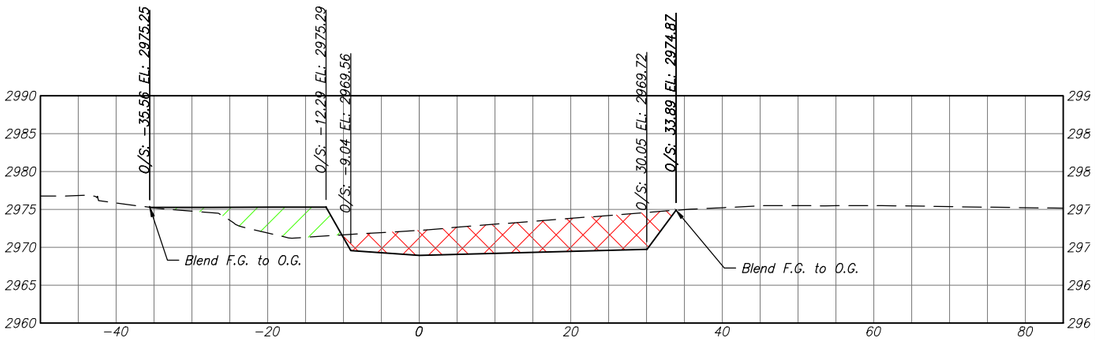

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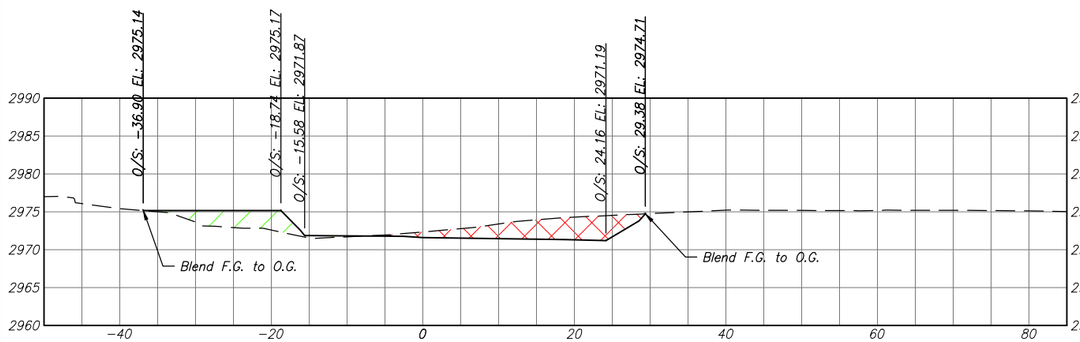
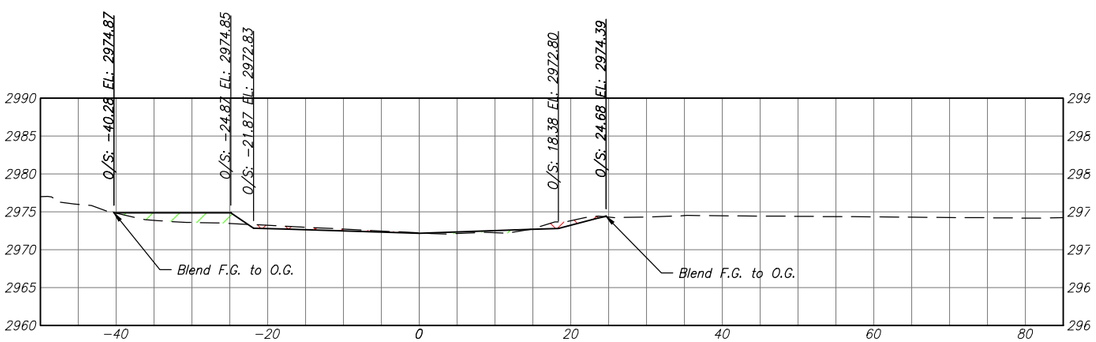


STA. 27+11



STA. 27+61

Cut

Fill

MAIN CHANNEL CROSS SECTIONS
STA. 18+63 TO STA. 27+61

10 0 10 20 30
SCALE OF FEET

Notes

1. Cross sections face downstream.
2. Y-axis is elevation, X-axis is distance in feet along a chord perpendicular to the thalweg. The zero station shown on these cross sections represents the thalweg alignment.
3. Constructed channel shall transition smoothly between the pool and riffle geometries shown in the typical cross sections. Cross section geometry shown represents one point in a smooth transition.
4. Cross-sections are to be used to stake out the channel offsets at the vertical grade breaks of the channel profile.
5. Thalweg elevations can be found in plan and profile drawings (1678-100-1965 thru 1971).

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 - MAIN CHANNEL CROSS SECTIONS

DESIGNED Nate Seal
DRAWN NS
CHECKED Mike Knutson, P.E.
TECH. APPR. Janice E. Baconguis, P.E.
APPROVED Charles Spindler
ADMIN APPROVAL Charles Spindler - Program Manager-Acting
CSRO (BOISE, IDAHO) 2015-04-30

MAIN CHANNEL STA. 18+63 TO STA. 27+61

CROSS SECTIONS

1678-100-1981

SHEET 4 OF 5

DATE AND TIME PLOTTED
MARCH 18, 2015 11:29
PLOTTED BY
NSEAL

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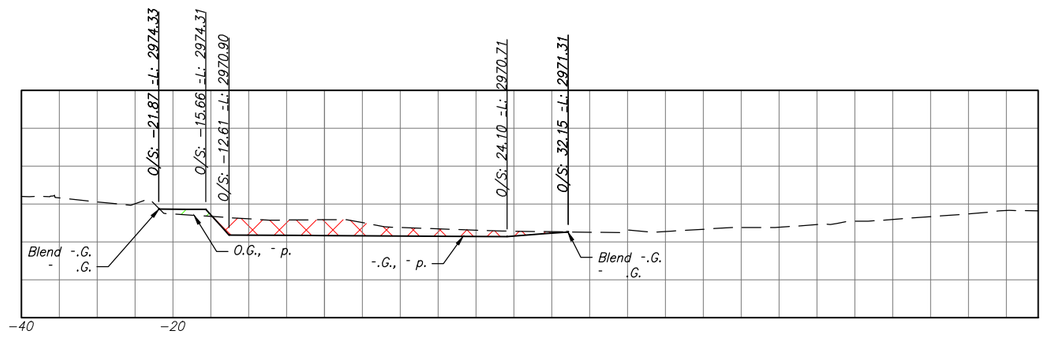
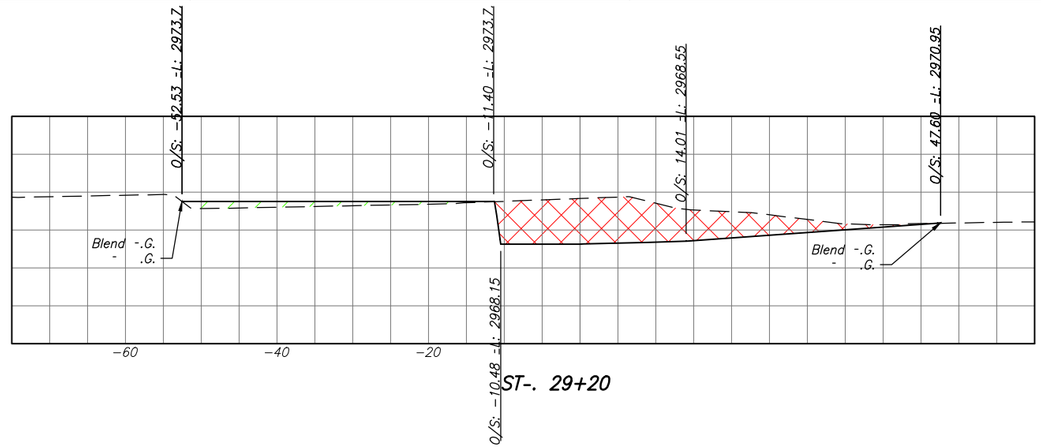


ST-. 28+45



ST-. 29+20

Cu-

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-IN CH =L CROSS
S=CTIONS
ST-. 28+45 TO ST-. 29+20

10 0 10 20 30
SCAL= O =T

No-
. Cross sec-ions -ace downs-ream.
2. Y-axis is eleva-ion, X-axis is dis-ance in - along a chord perpendicular -he -halweg. The zero s-a-ion shown on -hese cross sec-ions represen -he -halweg alignmen-.
3. Cons-ruc- d channel shall -ransi-ion smoo-hly be- n -he pool and ri -le geome-ries shown in -he - pical cross sec-ions. Cross sec-ion geome-ry shown represen- ne poin- in a smoo-h -ransi-ion.
4. Cross-sec-ions are - be used -ake ou -he channel o - a -he ver-ical grade breaks o -he channel pro-ile.
5. Thalweg eleva-ions can be - ınd in plan and pro-ile drawings (1678-100-1965 -hru 1971).

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- \PS HABITAT IMPROV=M=NT PROGRAM

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P- \C=L 4 - M-IN CH =L CROSS S=CTIONS

a- al
D=SIGN=D
NS
DR-
Mike Knu- n, P.=.
H=CK=D
Janice =. Baconguis, P.=.
T=CH. - \.
Charles Spindler
- \OV=D Charles Spindler
- IN - \OV - Program Manager- -ing

CSRO (BOIS=, ID-HO) 2015-04-30

M-IN CH =L ST-.
28+45 TO ST-. 29+20

CROSS S=CTIONS

1678-100-1982

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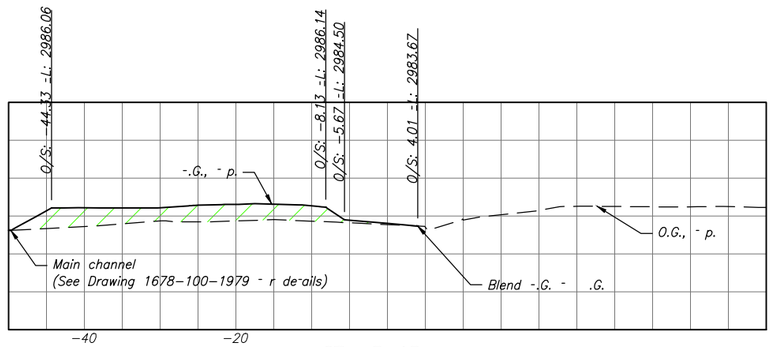

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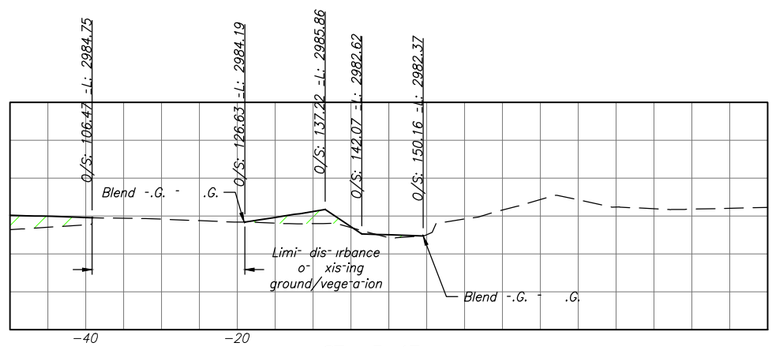

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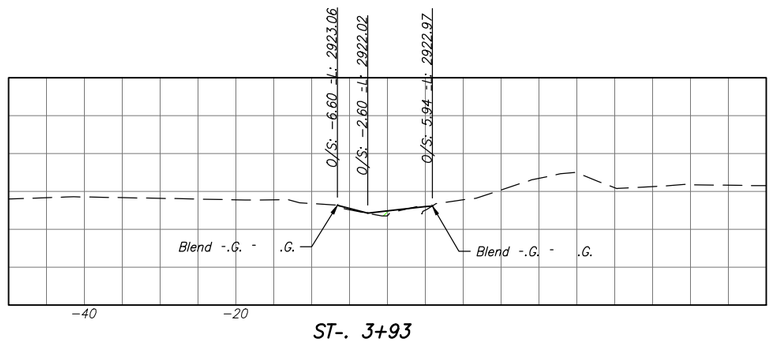

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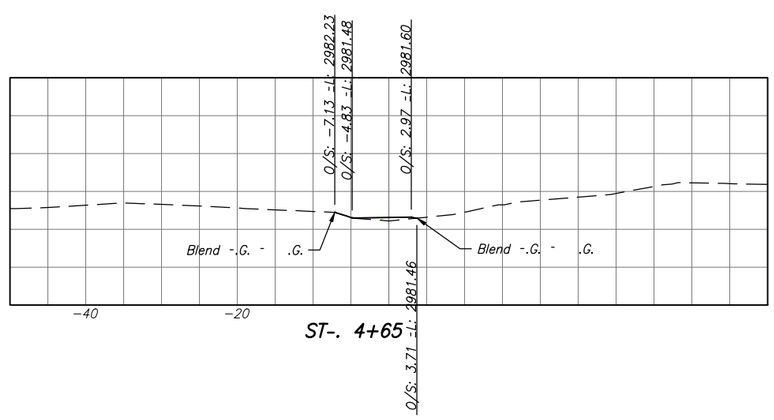

ST-. 4+65

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-IN CH =L SPLIT -
\OSS S=CTIONS
ST-. 3+15 TO ST-. 4+65

10 0 10 20 30
SCAL= O ==T

No-
. Cross sec-ions -ace downs-ream.
2. Y-axis is eleva-ion, X-axis is dis-ance in - along a chord perpendicular -he -halweg. The zero s-a-ion shown on -hese cross sec-ions represen -he -halweg alignmen-.
3. Cons-ruc- d channel shall -ransi-ion smoo-hly be- n -he pool and ri -le geome-ries shown in -he - pical cross sec-ions. Cross sec-ion geome-ry shown represen- ne poin- in a smoo-h -ransi-ion.
4. Cross-sec-ions are - be used -ake ou -he channel o - a -he ver-ical grade breaks o -he channel pro-ile.
5. Thalweg eleva-ions can be - ınd in plan and pro-ile drawings (1678-100-1965 -hru 1971

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GR = ROND= SUBB- IN
CC-44 PH = III H- IT-T =NH =M=NT
P-\C=L 4 - M-IN CH =L SPLIT - \OSS
S=CTIONS

a- al
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DR-
Mike Knu- n, P.=.
H=CK=D
Janice =. Baconguis, P.=.
T=CH. - \.
Charles Spindler
- \OV=D Charles Spindler
- IN - \OV - Program Manager- -ing
CSRO (BOIS=, ID-HO) 2015-04-30

P-\C=L 4 - M-IN
CH =L SPLIT -
\OSS S=CTIONS

CROSS S=CTIONS

1678-100-1983

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NS=

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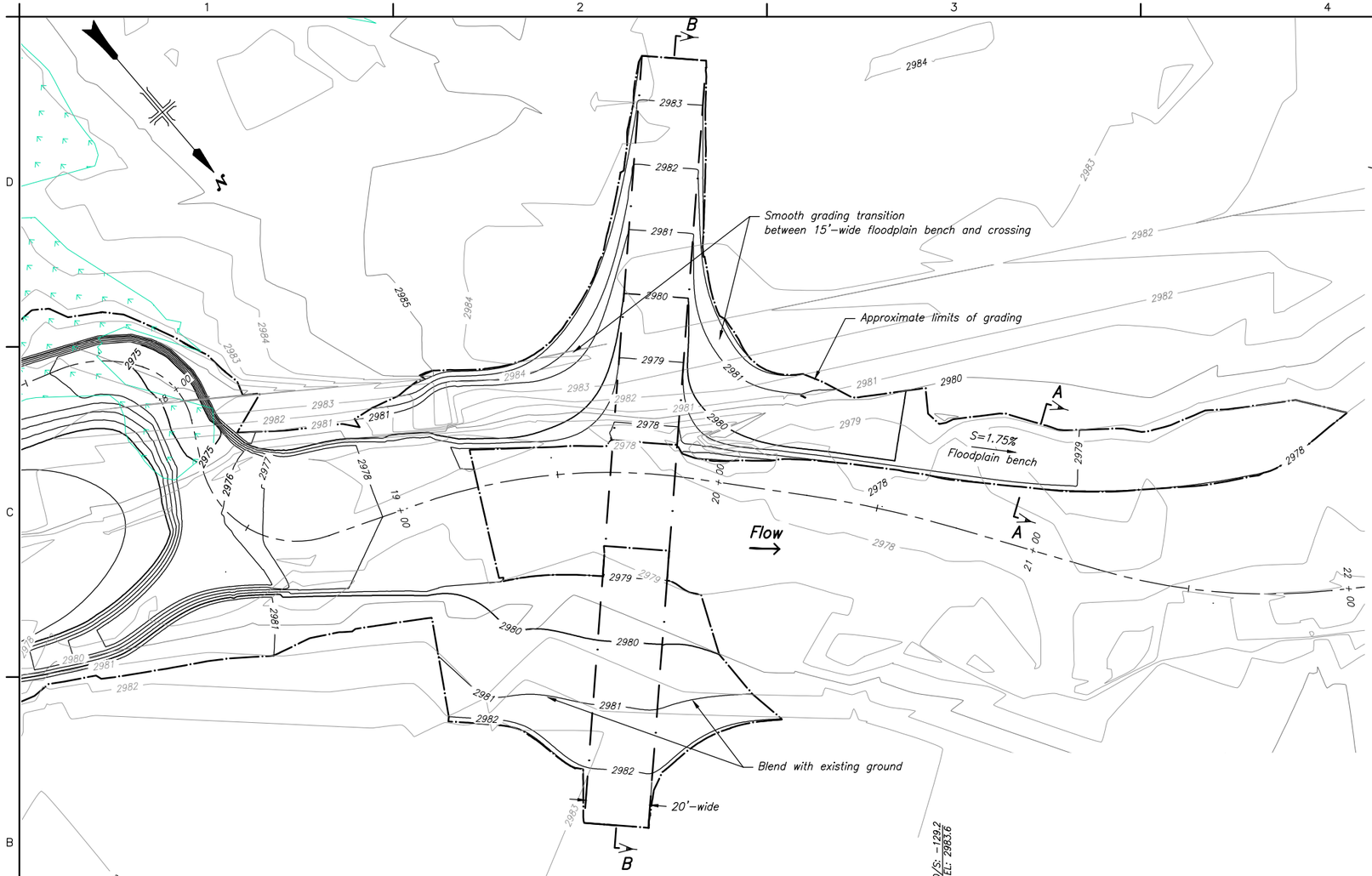
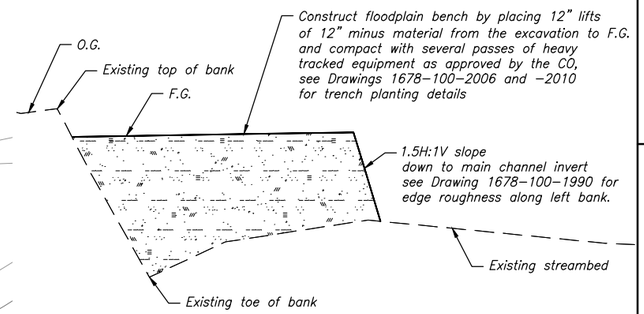


MAIN CHANNEL STA. 19+75 LIVESTOCK ACCESS PAD PLAN

20 0 20 40 60
SCALE OF FEET

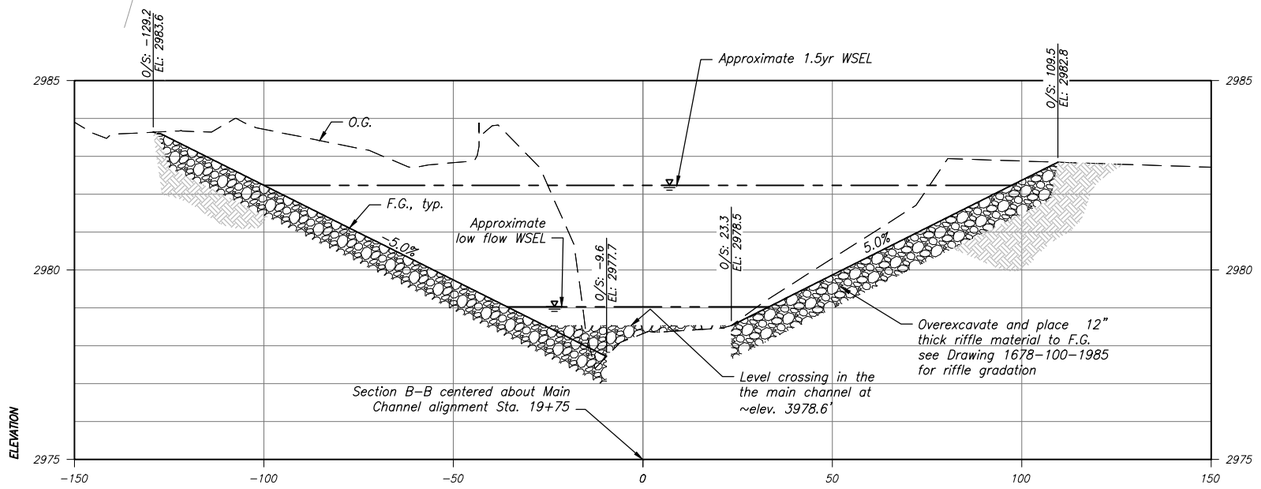


SECTION A–A

5 0 5 10 15
SCALE OF FEET

NOTES:

1. Construct two 12"–thick stabilized livestock access pads on each bank across the riffle at Sta. 19+75 of the main channel. Fill main channel in between the access pads to create a level surface.
2. Notify Contracting Office prior to installation of livestock access pads in this location.
3. Crossing shall be constructed using riffle material.
4. Compact using several passes of tracked equipment as approved by the CO.



SECTION B–B

HORIZONTAL SCALE: 20 0 20 40 60
SCALE OF FEET

VERTICAL SCALE: 2 0 2 4 6
SCALE OF FEET

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GRANDE RONDE SUBBASIN

CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 – STABILIZED LIVESTOCK ACCESS PAD

Jason Thomas	DESIGNED
JET/JEB	DRAWN
Mike Knutson, P.E.	CHECKED
Janice F. Baconguis, P.E.	TECH. APPR.
Charles Spindler	APPROVED
ADMIN APPROVAL – Charles Spindler – Program Manager–Acting	
CSRO (BOISE, IDAHO)	2015–04–30

STABILIZED LIVESTOCK ACCESS PAD AND FLOODPLAIN BENCH

PLAN AND SECTIONS

1678–100–1984

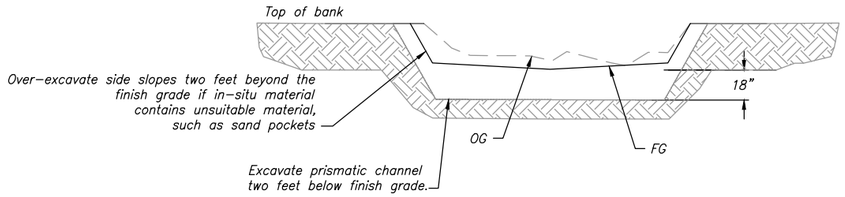
SHEET 1 OF 1

DATE AND TIME PLOTTED
APRIL 28, 2015 10:30
PLOTTED BY
JETHOMAS

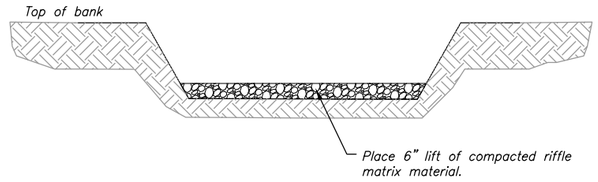
CAD SYSTEM
AutoCAD Rel. 19.1s
CAD FILENAME
CROSSING DETAIL.DWG

RIFFLE CONSTRUCTION STEPS

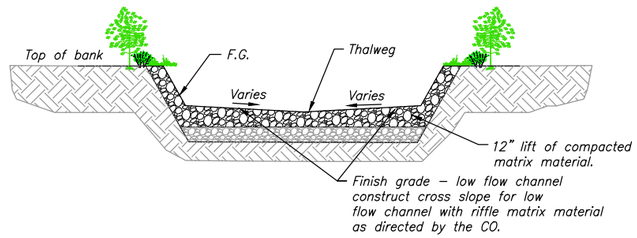
STEP 1 – Rough Grade



STEP 2 – First Lift



STEP 4 – Finish Grade



N.T.S.

CONSTRUCTION NOTES FOR RIFFLE AT STA 16+42

1. Stockpile engineered fill material per design specifications. Materials are to be stockpiled in the immediate project area or transported from the sorting area as needed.
2. Treat existing channel bed by removing organics and creating a prismatic working surface.
3. Overexcavate 18" below the finish grade elevation and 2 feet
4. Import engineered riffle matrix material. Compact matrix material in 6–inch a lift using D6 or larger bulldozer, or similar equipment. Track on matrix material sufficiently to compact material. Add a layer of fines on the surface. Wash fines into matrix material using a trash pump and 2–inch fire hose with a nozzle until water ponds on the surface and approved by the contracting officer.
5. Wash fines into matrix and compact with excavator bucket.
6. Repeat matrix construction placement in another 12–inch lift to design channel thalweg elevation. Grade top lift with a cross–slope as directed by the CO to form the low flow channel.
7. Use rounded material for the riffle gradation on this sheet.

CONSTRUCTION NOTES FOR ALL OTHER RIFFLES

1. Evaluate suitabiity of existing material at proposed riffles by comparing with riffle gradation on this sheet, as approved by the CO.
2. Where applicable, excavate unsuitable material from the riffle crest station to five feet downstream and 18 inches below the finish grade. Fill with material that meets the riffle gradation on this sheet.

Riffle Gradation

Percent Finer	Size Range
D100	10 inch +
D84	8 inch to 10 inch
D50	4 inch to 6 inch
D15	1 inch to 4 inch
D10	Fines

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GRANDE RONDE SUBBASIN

CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 – RIFFLE DETAILS

Janice E. Baconguis, P.E.
DESIGNED
JEB
DRAWN
Mike Knutson, P.E.
CHECKED
Janice E. Baconguis, P.E.
TECH. APPR.
Charles Spindler
APPROVED Charles Spindler
ADMIN APPROVAL – Program Manager–Acting
CSRO (BOISE, IDAHO) 2015–04–30

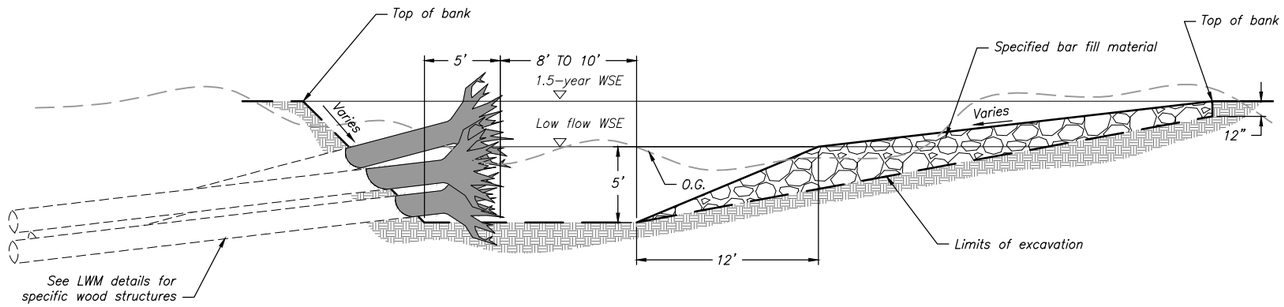
RIFFLE CONSTRUCTION DETAILS

1678–100–1985

SHEET 1 OF 1

DATE AND TIME PLOTTED
JANUARY 29, 2015 18:53
PLOTTED BY
JBACONGUIS

CAD SYSTEM
AutoCAD Rel. 19.1s
CAD FILENAME
RIFFLE TYPICAL SECTION.DWG

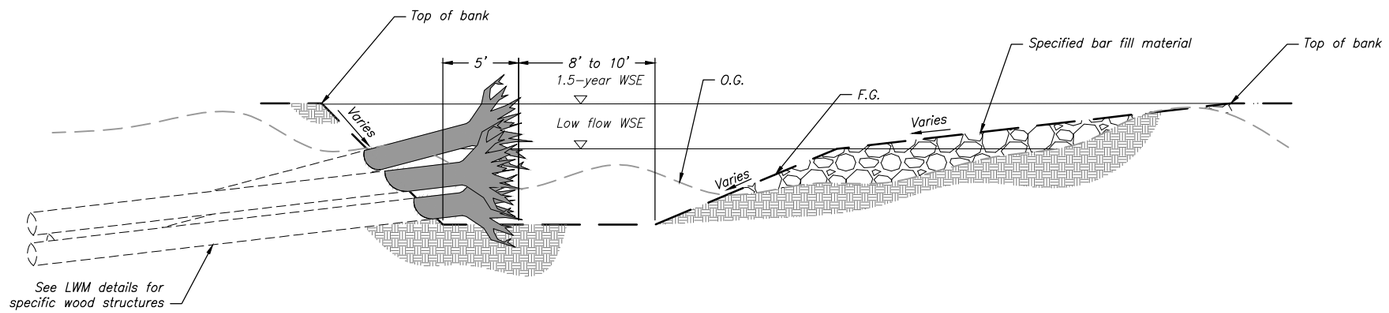


BAR AND POOL WITH SPECIFIED FILL SECTION

NOTES FOR BARS AT STA 14+50 TO STA 15+25 AND STA 16+50 TO STA 18+50:

1. *Excavate pool extents to the lateral and vertical extents shown on the drawings.*
2. *Excavate bar to the limits shown on this drawing.*
3. *Use native material from the excavated pool and bar areas that meets specifications as fill material for the bars. Otherwise, screen material to meet specified gradation on this sheet.*
4. *Adjust the toe of the shaped bar to provide 8 to 10 feet of pool width between the face of the log structure and the toe of the gravel bar as approved by the CO.*
5. *Compact using excavator or similar equipment as approved by the CO.*

Bar Gradation	
Bucket Scoops	Size Range
D100	4 inch to 8 inch
D50	2 inch to 4 inch
D15	1 inch–minus



BAR AND POOL SECTION
APPLIES TO ALL OTHER BARS/POOLS

NOTES FOR ALL OTHER BARS:

1. *Excavate pool extents to the lateral and vertical extents shown on the drawings as approved by the CO.*
2. *Use native material from the excavated pool as fill for the bars. Shape bars to the extents shown on the drawing.*
3. *Adjust the toe of the shaped bar to provide 8 to 10 feet of pool width between the face of the log structure and the toe of the gravel bar as approved by the CO.*
4. *Compact using excavator or similar equipment as approved by the CO.*

5 0 5 10 15
SCALE OF FEET

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Union Soil and Water Conservation District

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U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLUMBIA/SNAKE SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 – POOL AND BAR DETAILS

DATE AND TIME PLOTTED
Not Plotted
PLOTTED BY
Not Plotted

CAD SYSTEM
AUTOCAD
CAD FILENAME
UNKNOWN

DESIGNED	Janice E. Baconguis, P.E.
DRAWN	JEB
CHECKED	Mike Knutson, P.E.
TECH. APPR.	Janice E. Baconguis, P.E.
APPROVED	Charles Spindler
ADMIN APPROVAL	Charles Spindler – Program Manager–Acting
CSRO (BOISE, IDAHO)	2015–04–30

POOL AND BAR DETAILS

SECTIONS

1678–100–1986

SHEET 1 OF 1

Side channel inlet structure
(1 total this sheet)

Single log with rootwad
(2 total this sheet)

Tree top with branches
(2 total this sheet)

Sweeper log structure
(1 total this sheet)

High energy bank structure
(1 total this sheet)

Brush mattress 185 ft

Brush mattress 20 ft

Streambank habitat structure
(3 total this sheet)

Small apex jam
(3 total this sheet)

Large apex jam
(1 total this sheet)

Mild radius bend structure
(1 total this sheet)

Tight radius bend structure
(1 total this sheet)

3+00
4+00
5+00
6+00
7+00
8+00
9+00
10+00
11+00
12+00
13+00

To Baker City

Hwy 203

see sheet 1678-100-1988
Match line see sheet

Notes:

1. *Exact locations of LWM structures will be staked in the field by the Contracting Officer.*
2. *Due to the time that has passed since the topographic survey was performed, there will be some locations where the ground topography on the day of construction will not match the topography shown on this sheet. The Contracting Officer will coordinate with the Contractor to make slight adjustments to the LWM structure location and/or layout to accommodate changes to the topography.*
3. *See sheets 1678-100-1991 through 1678-100-2004 for LWM structure details.*
4. *Single logs with rootwads and tree tops with branches shall be placed in side channels and alcoves as directed by the Contracting Officer; no excavation will be required for placement.*

N

LWM PLAN STA 0+00 TO 13+50

30 0 30 60 90
SCALE OF FEET

REGISTERED PROFESSIONAL ENGINEER
93124PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
4/27/2015

RENEWAL DATE: 12/31/2015

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Managing Water in the West

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BUREAU OF RECLAMATION
COLUMBIA/SNAKE RIVER SALMON RECOVERY GROUP
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
LWM PLAN STA 0+00 TO 13+50

M. FISHER/ N. TRUSCOTT
DRAWN

X Jay Hovde
ACCEPTED

BOISE, ID 2015-04-27

LWM PLAN

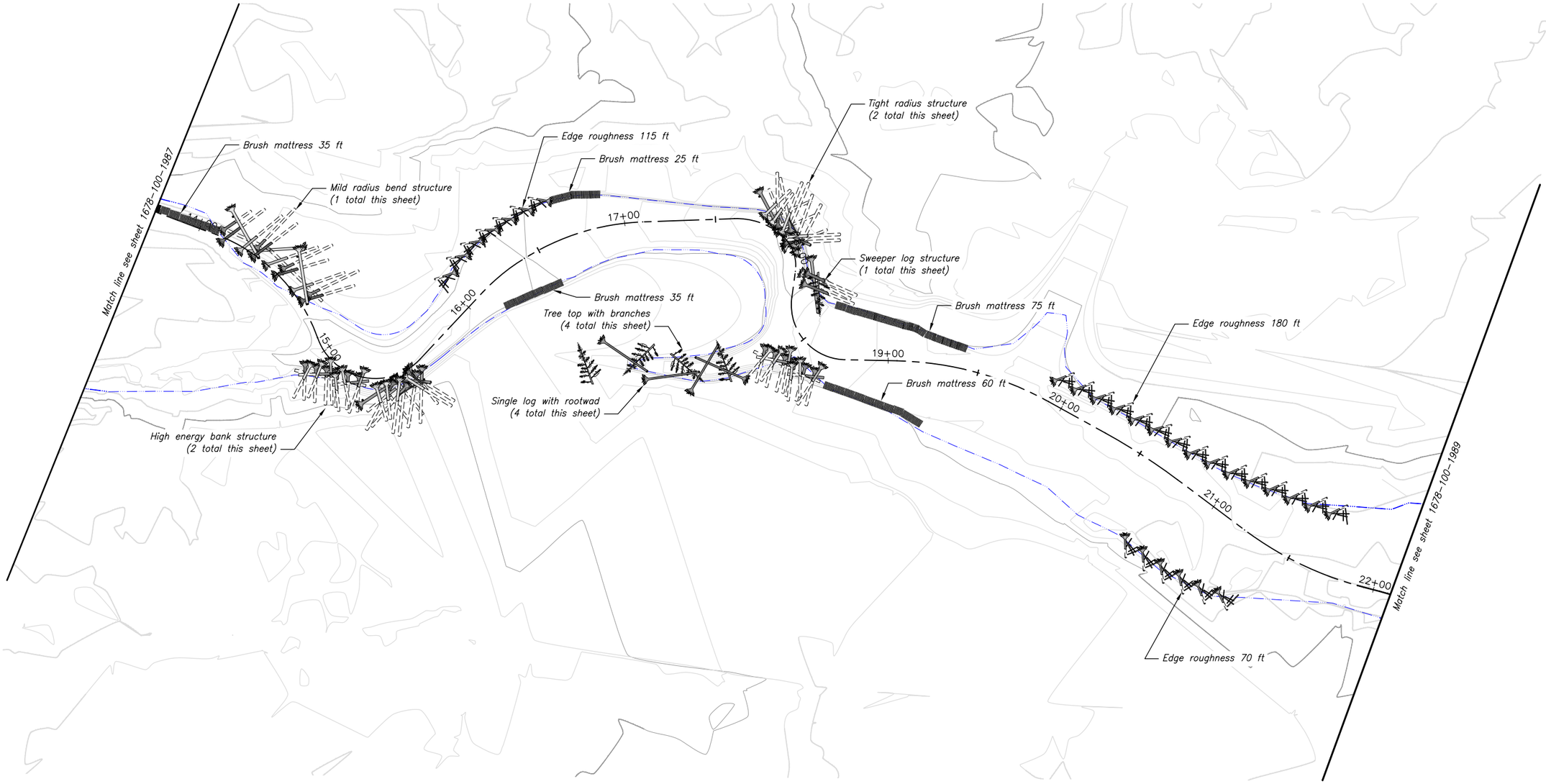
STA 0+00 TO 13+50

1678-100-1987

SHEET 1 OF 4

DATE AND TIME PLOTTED
April 27, 2015 21:13
PLOTTED BY
TRUSCOTT, NIC

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Smith_Phase_3-4_LWM.dwg



Notes:

1. *Exact locations of LWM structures will be staked in the field by the Contracting Officer.*
2. *Due to the time that has passed since the topographic survey was performed, there will be some locations where the ground topography on the day of construction will not match the topography shown on this sheet. The Contracting Officer will coordinate with the Contractor to make slight adjustments to the LWM structure location and/or layout to accommodate changes to the topography.*
3. *See sheets 1678-100-1991 through 1678-100-2004 for LWM structure details.*
4. *Single logs with rootwads and tree tops with branches shall be placed in side channels and alcoves as directed by the Contracting Officer; no excavation will be required for placement.*

N

LWM PLAN STA 13+50 TO 22+00

30 0 30 60 90

SCALE OF FEET

REGISTERED PROFESSIONAL ENGINEER
13126PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
4/27/2015

RENEWAL DATE: 12/31/2015

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
LWM PLAN STA 13+50 TO 22+00

M. FISHER/ N. TRUSCOTT
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015-04-27

LWM PLAN

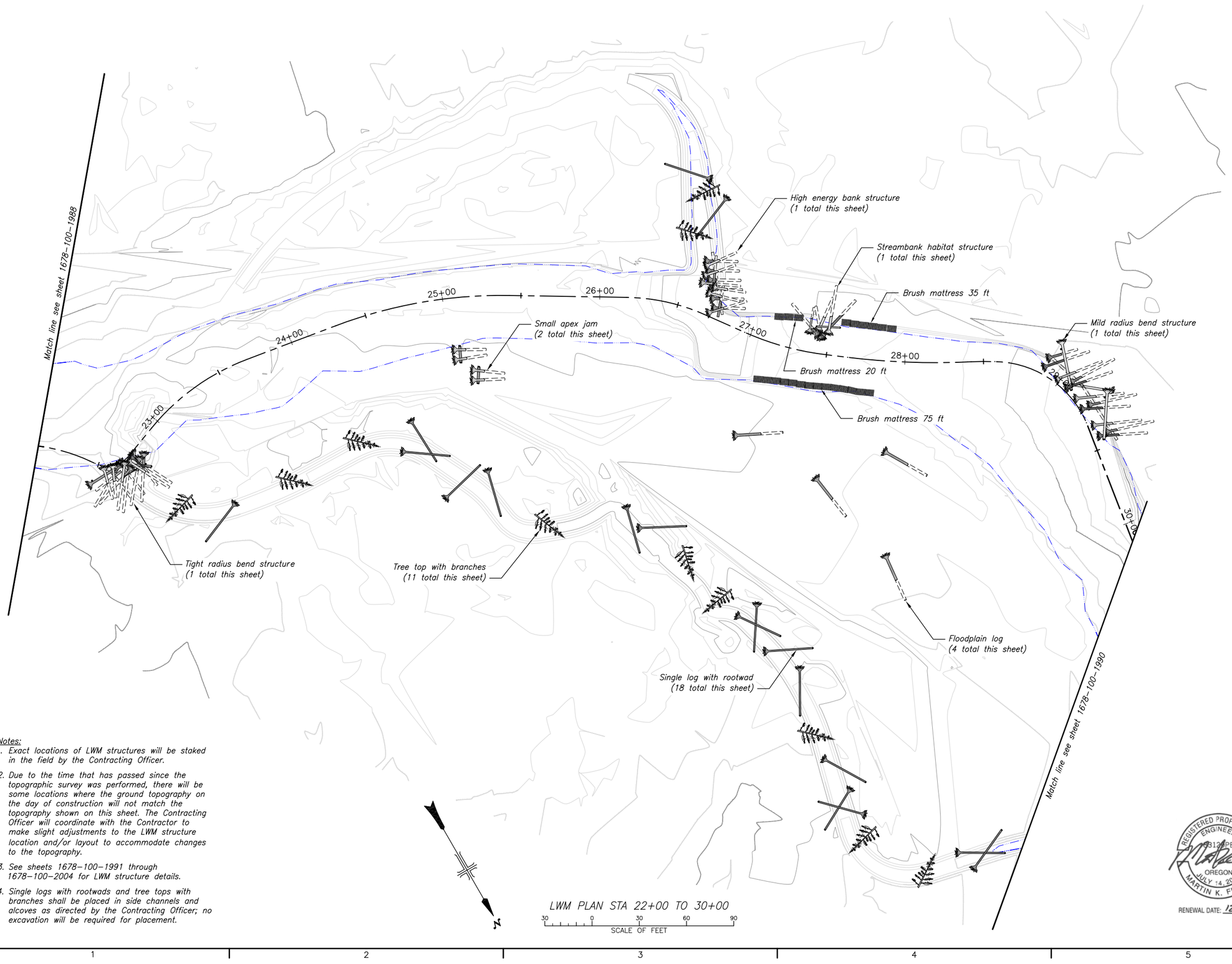
STA 13+50 TO 22+00

1678-100-1988

SHEET 2 OF 4

DATE AND TIME PLOTTED
April 27, 2015 21:14
PLOTTED BY
TRUSCOTT, NIC

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Smith_Phase_3-4_LWM.dwg



LWM PLAN STA 22+00 TO 30+00

30 0 30 60 90
SCALE OF FEET

Notes:

1. *Exact locations of LWM structures will be staked in the field by the Contracting Officer.*
2. *Due to the time that has passed since the topographic survey was performed, there will be some locations where the ground topography on the day of construction will not match the topography shown on this sheet. The Contracting Officer will coordinate with the Contractor to make slight adjustments to the LWM structure location and/or layout to accommodate changes to the topography.*
3. *See sheets 1678-100-1991 through 1678-100-2004 for LWM structure details.*
4. *Single logs with rootwads and tree tops with branches shall be placed in side channels and alcoves as directed by the Contracting Officer; no excavation will be required for placement.*

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
LWM PLAN STA 22+00 TO 30+00

M. FISHER/ N. TRUSCOTT
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015-04-27

REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 14, 2006
MARTIN K. FISHER
9312PE
4/27/2015

RENEWAL DATE: 12/31/2015

LWM PLAN

STA 22+00 TO 30+00

1678-100-1989

SHEET 3 OF 4

DATE AND TIME PLOTTED
April 27, 2015 21:14
PLOTTED BY
TRUSCOTT, NIC

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Smith_Phase_3-4_LWM.dwg

Match line see sheet 1678-100-1989

31+00

32+00

33+00

34+00

35+00

36+00

37+00

38+00

Small apex jam
(2 total this sheet)

Large apex jam
(1 total this sheet)

Previously constructed
structure (typ.)

Single log with rootwad
(10 total this sheet)

Mild radius bend structure
(1 total this sheet)

Tree top with branches
(8 total this sheet)

N

LWM PLAN STA 30+00 TO 34+00

30 0 30 60 90

SCALE OF FEET

Notes:

1. Exact locations of LWM structures will be staked in the field by the Contracting Officer.
2. Due to the time that has passed since the topographic survey was performed, there will be some locations where the ground topography on the day of construction will not match the topography shown on this sheet. The Contracting Officer will coordinate with the Contractor to make slight adjustments to the LWM structure location and/or layout to accommodate changes to the topography.
3. See sheets 1678-100-1991 through 1678-100-2004 for LWM structure details.
4. Single logs with rootwads and tree tops with branches shall be placed in side channels and alcoves as directed by the Contracting Officer; no excavation will be required for placement.

REGISTERED PROFESSIONAL ENGINEER
13121PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
4/27/2015

RENEWAL DATE: 12/31/2015

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
LWM PLAN STA 30+00 TO 34+00

M. FISHER/ N. TRUSCOTT
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015-04-27

LWM PLAN

STA 30+00 TO 34+00

1678-100-1990

SHEET 4 OF 4

DATE AND TIME PLOTTED
April 27, 2015 21:14
PLOTTED BY
TRUSCOTT, NIC

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
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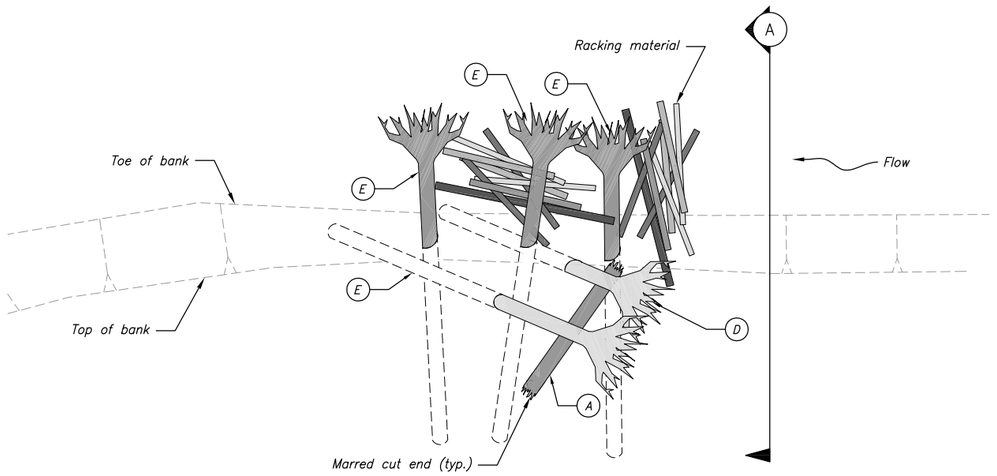
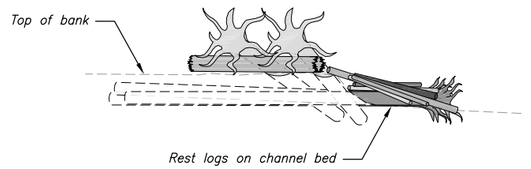


PLAN VIEW – SIDE CHANNEL INLET STRUCTURE

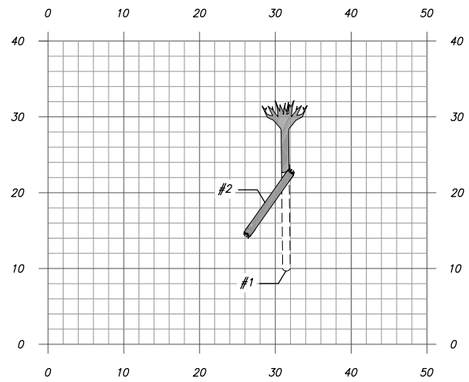
5 0 5 10 15
SCALE OF FEET



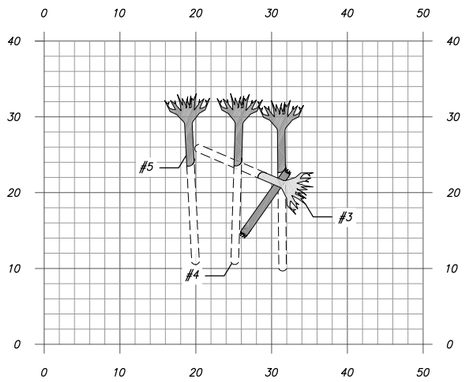
ELEVATION A – SIDE CHANNEL INLET STRUCTURE SIDE VIEW

5 0 5 10 15
SCALE OF FEET

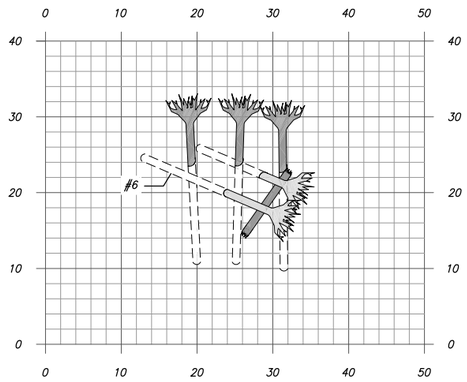
Step 1: Place log #1 at channel bed then backfill and place log #2 on top of backfilled bank.



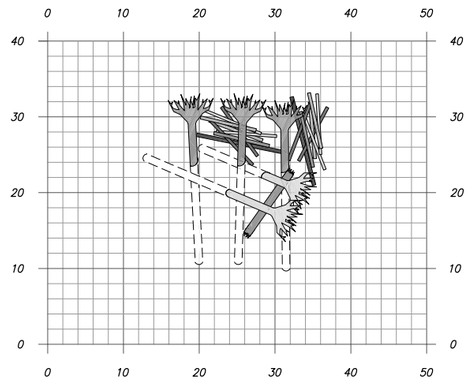
Step 2: Excavate as necessary to place log #3 then backfill to existing bankline and excavate as necessary to place logs #4 and #5.



Step 3: Excavate as required to place log #6 then backfill to the existing bankline, compacting moderately in 1' lifts.



Step 4: Incorporate racking material.



Notes:

1. Construction of this structure requires careful placement of logs to achieve the desired outcome. The Contractor shall place logs as illustrated on this sheet unless otherwise directed by the Contracting Officer.
2. All logs shall come from Douglas fir, lodgepole pine, or ponderosa pine.
3. The exact location of each side channel inlet structure shall be determined by the Contracting Officer.
4. Cut ends of logs that will be exposed at structure completion shall be marred prior to installation. The Contractor shall use an excavator, bulldozer, or other heavy equipment to tear apart wood fibers at the cut end of the log to create the appearance of a log that has naturally broken apart.

SIDE CHANNEL INLET STRUCTURE SCHEDULE

ITEM	DESCRIPTION	QUANTITY
Log type (A)	10' long, 12" dia. log	1
Log type (D)	15' long, 12" DBH log with rootwad	1
Log type (E)	20' long, 12" DBH log with rootwad	4
Racking material	4'–10' long, 3"–9" dia. log	16

SIDE CHANNEL INLET STRUCTURE CONSTRUCTION DETAILS
STRUCTURE STATION
3+10

REGISTERED PROFESSIONAL ENGINEER
13124PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
4/27/2015
RENEWAL DATE: 12/31/2015

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COLUMBIA/SNAKE RIVER SALMON RECOVERY GROUP
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
LWM DETAILS – SIDE CHANNEL INLET STRUCTURE

N. TRUSCOTT
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015-04-27

LWM DETAILS

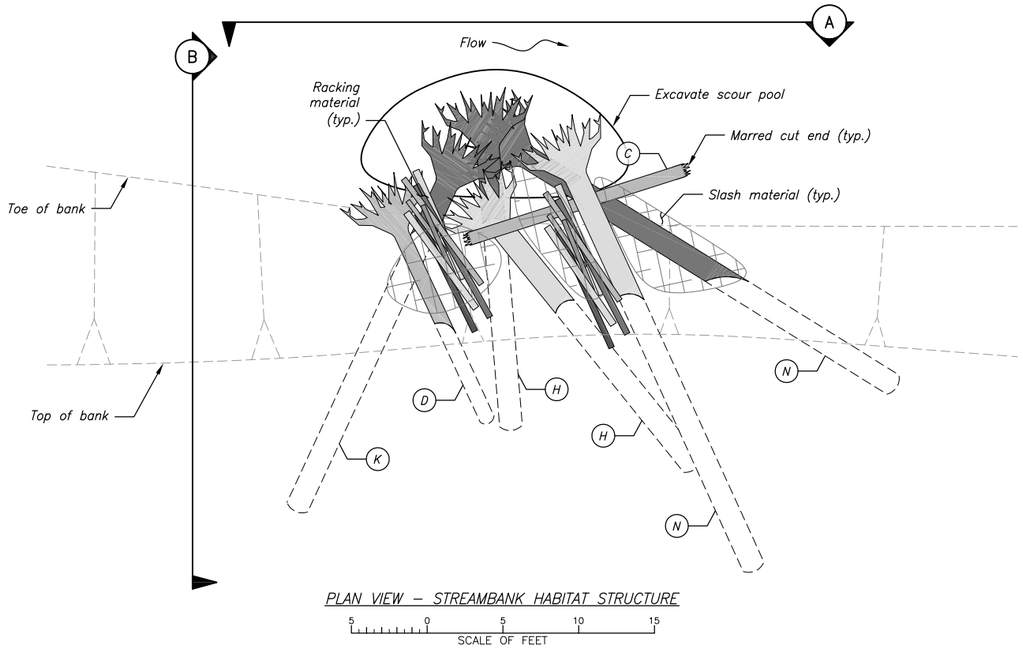
SIDE CHANNEL INLET STRUCTURE

1678-100-1991

SHEET 1 OF 14

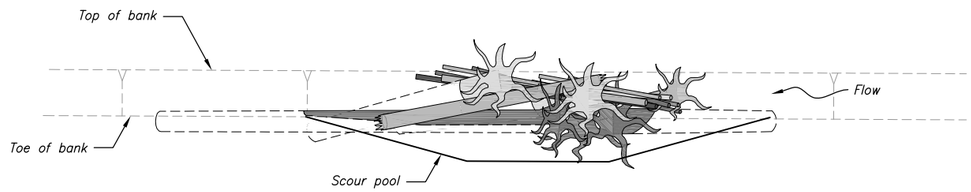
DATE AND TIME PLOTTED
April 27, 2015 21:16
PLOTTED BY
TRUSCOTT, NIC

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Phase_3-4_SideChannelInletDetails@Structure_Details.dwg



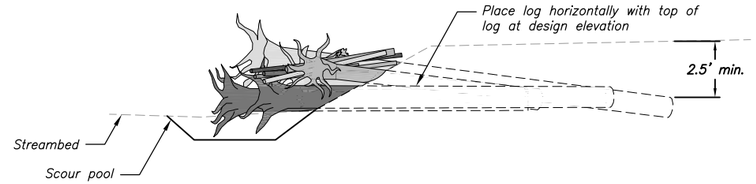
PLAN VIEW – STREAMBANK HABITAT STRUCTURE

5 0 5 10 15
SCALE OF FEET



ELEVATION A – STREAMBANK HABITAT STRUCTURE FRONT VIEW

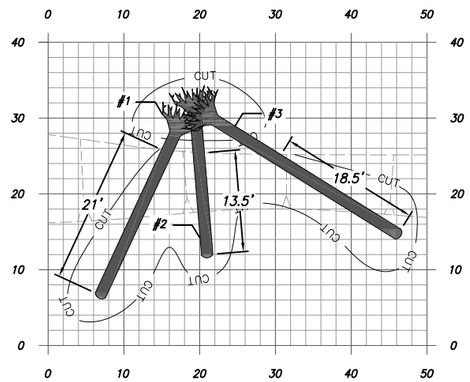
5 0 5 10 15
SCALE OF FEET



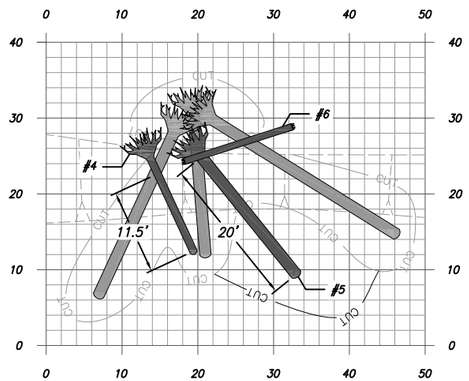
ELEVATION B – STREAMBANK HABITAT STRUCTURE SIDE VIEW

5 0 5 10 15
SCALE OF FEET

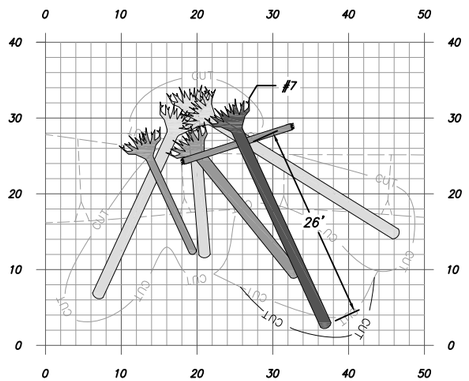
Step 1: Excavate scour pool as directed by Contracting Officer, then excavate trenches for bottom layer of logs; place logs horizontally at the elevation shown on this sheet.



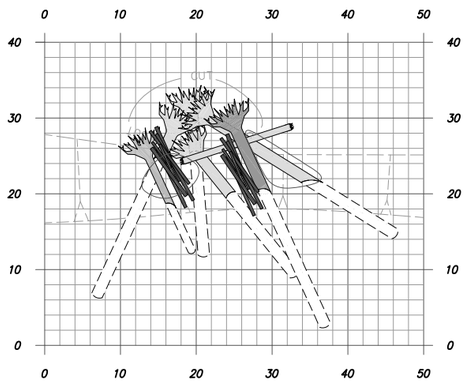
Step 2: Expand trench if necessary, then place logs #4 and #5 in the orientation shown; angled into the bank on a minimum slope of 10H:1V. Rest log #6 on top of log #5, angling it into the streambed on the downstream end.



Step 3: Expand trench if necessary to place log #7; rest log #7 on top of log #6 and angle into the bank on a minimum slope of 10H:1V.



Step 4: Incorporate racking and slash material into structure by weaving it between logs and pressing pieces into the bank. Backfill the excavated trench compacting moderately in 1' lifts to the original bank line.



Notes:

1. *Construction of this structure requires careful placement of logs to achieve the desired outcome. The Contractor shall place logs as illustrated on this sheet unless otherwise directed by the Contracting Officer.*
2. *All logs shall come from Douglas fir, lodgepole pine, or ponderosa pine.*
3. *The exact location of each streambank habitat structure shall be determined by the Contracting Officer.*
4. *Cut ends of logs that will be exposed at structure completion shall be marred prior to installation. The Contractor shall use an excavator, bulldozer, or other heavy equipment to tear apart wood fibers at the cut end of the log to create the appearance of a log that has naturally broken apart.*
5. *Racking and slash material shall be incorporated into each streambank habitat structure by weaving it in between placed logs, placing it in voids, pressing it into the bank, or otherwise including it in the structure as directed by the Contracting Officer.*

STREAMBANK HABITAT STRUCTURE MATERIAL SCHEDULE

ITEM	DESCRIPTION	QUANTITY
Log type (C)	15' long, 12" dia. log	1
Log type (D)	15' long, 12" DBH log with rootwad	1
Log type (H)	20' long, 18" DBH log with rootwad	2
Log type (K)	25' long, 18" DBH log with rootwad	1
Log type (N)	30' long, 18" DBH log with rootwad	2
Racking material	4'–10' long, 3"–9" dia. log	15
Slash material	Tree tops, limbs with branches and needles	0.5 CY

STREAMBANK HABITAT STRUCTURE CONSTRUCTION DETAILS

STRUCTURE STATION	DESIGN ELEVATION
4+80	2990.3'
5+65	2989.3'
6+45	2989.1'
27+45	2973.5'

REGISTERED PROFESSIONAL ENGINEER 13126PE OREGON JULY 14, 2006 MARTIN K. FISHER 4/27/2015

RENEWAL DATE: 12/31/2015

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BUREAU OF RECLAMATION
COLUMBIA/SNAKE RIVER SALMON RECOVERY GROUP
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC–44 PHASE III & IV HABITAT ENHANCEMENT
LWM DETAILS – STREAMBANK HABITAT STRUCTURE DETAILS

N. TRUSCOTT
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015–04–27

LWM DETAILS

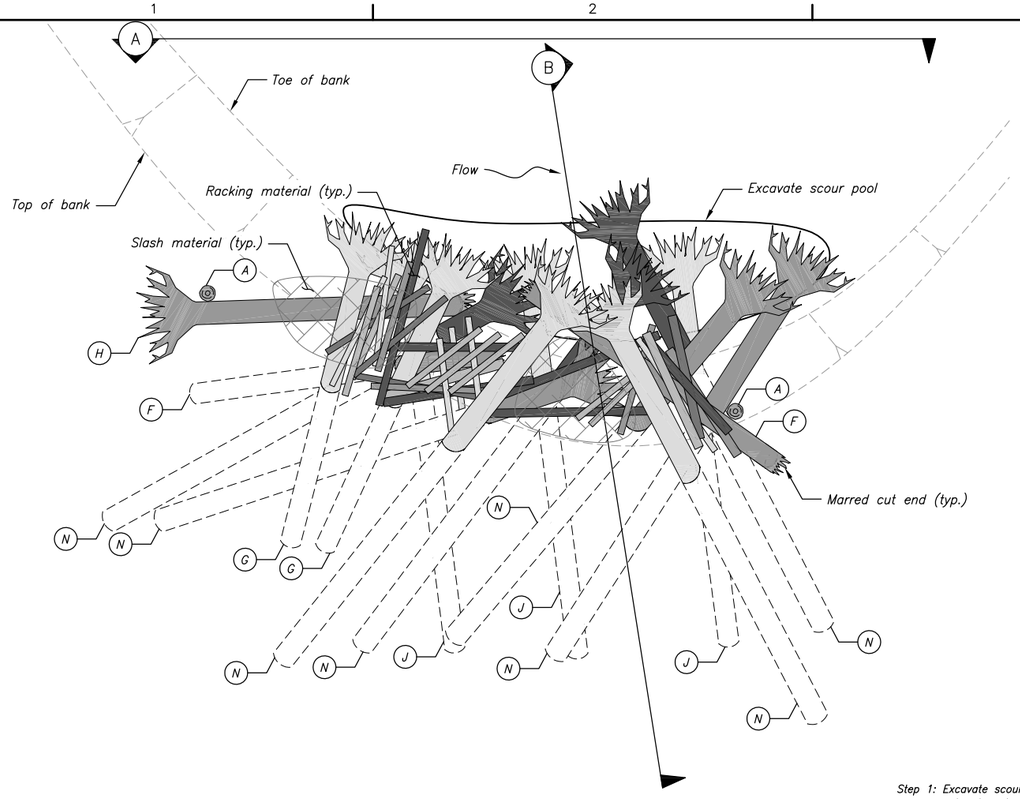
STREAMBANK HABITAT STRUCTURE

1678–100–1992

SHEET 2 OF 14

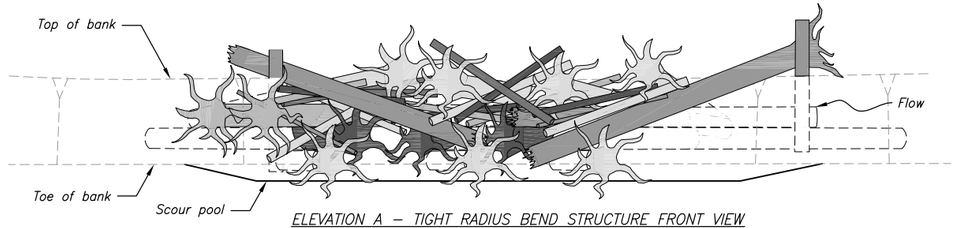
DATE AND TIME PLOTTED
April 27, 2015 21:17
PLOTTED BY
TRUSCOTT, NIC

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Parcel_3_LWM_Strmbnk_Hab_Details.dwg



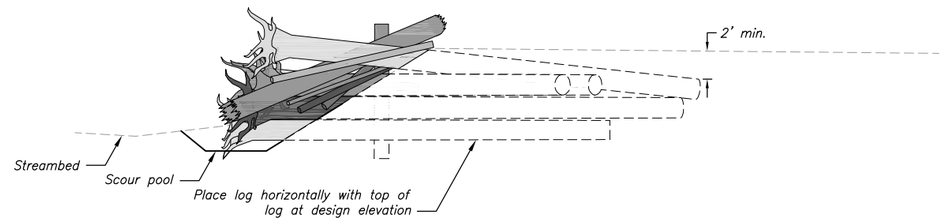
PLAN VIEW – TIGHT RADIUS BEND STRUCTURE

SCALE OF FEET



ELEVATION A – TIGHT RADIUS BEND STRUCTURE FRONT VIEW

SCALE OF FEET



ELEVATION B – TIGHT RADIUS BEND STRUCTURE SIDE VIEW

SCALE OF FEET

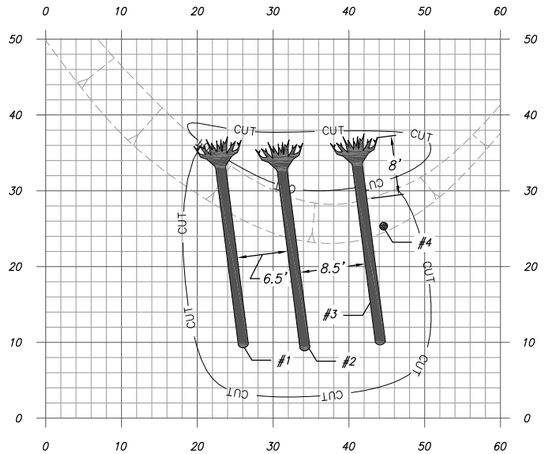
Notes:

1. Construction of this structure requires careful placement of logs to achieve the desired outcome. The Contractor shall place logs as illustrated on this sheet unless otherwise directed by the Contracting Officer.
2. All logs shall come from Douglas fir, lodgepole pine, or ponderosa pine.
3. The exact location of each tight radius bend structure shall be determined by the Contracting Officer.
4. Cut ends of logs that will be exposed at structure completion shall be marred prior to installation. The Contractor shall use an excavator, bulldozer, or other heavy equipment to tear apart wood fibers at the cut end of the log to create the appearance of a log that has naturally broken apart.
5. Racking and slash material shall be incorporated into each tight radius bend structure by weaving it in between placed logs, placing it in voids, pressing it into the bank, or otherwise including it in the structure as directed by the Contracting Officer.

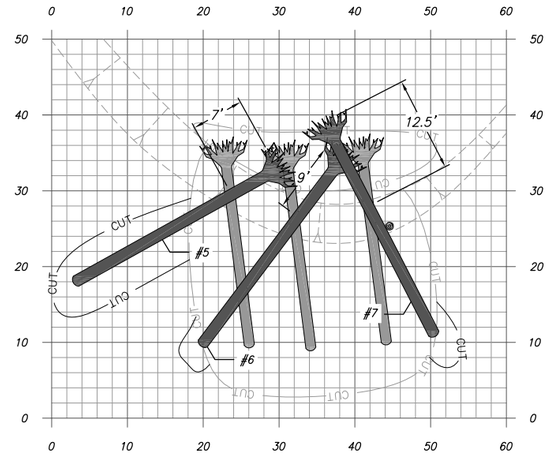
TIGHT RADIUS BEND STRUCTURE MATERIAL SCHEDULE

ITEM	DESCRIPTION	QUANTITY
Log type (A)	10' long, 12" dia. log	2
Log type (F)	20' long, 15" dia. log	2
Log type (G)	20' long, 15" DBH log with rootwad	2
Log type (H)	20' long, 18" DBH log with rootwad	1
Log type (J)	25' long, 15" DBH log with rootwad	3
Log type (N)	30' long, 18" DBH log with rootwad	8
Racking material	4'–10' long, 3"–9" dia. log	30
Slash material	Tree tops, limbs with branches and needles	2 CY

Step 1: Excavate scour pool as directed by Contracting Officer, then excavate as necessary to place logs #1–#3 horizontally at the design elevation specified on this sheet. Excavate or drive log #4 (vertical pile) and partially backfill for temporary stability.



Step 2: Expand excavation as necessary to place logs #5–#7 by resting them on top of previously placed logs in the orientation shown.



Construction sequencing continued on sheet 1678–100–1994

TIGHT RADIUS BEND STRUCTURE CONSTRUCTION DETAILS

STRUCTURE STATION	DESIGN ELEVATION
6+90	2987.2'
15+50	2980.2'
17+90	2975.7'
22+60	2975.1'

REGISTERED PROFESSIONAL ENGINEER 93129PE OREGON JULY 14, 2009 MARTIN K. FISHER 4/27/2015

RENEWAL DATE: 12/31/2015

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ICF INTERNATIONAL

Union Soil and Water Conservation District

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U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLUMBIA/SNAKE RIVER SALMON RECOVERY GROUP
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC–44 PHASE III HABITAT ENHANCEMENT
LWM DETAILS – TIGHT RADIUS BEND STRUCTURE

N. TRUSCOTT
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015–04–27

LWM DETAILS

TIGHT RADIUS BEND STRUCTURE

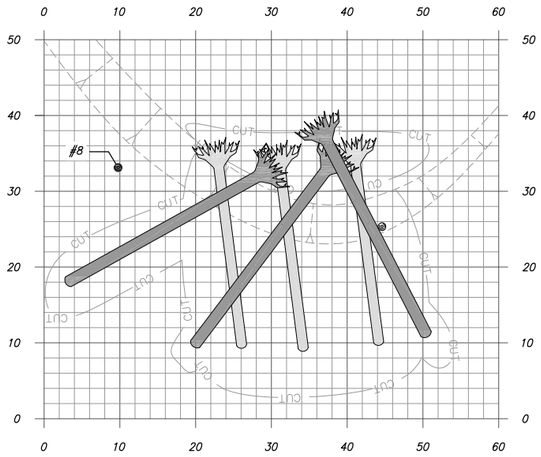
1678–100–1993

SHEET 3 OF 14

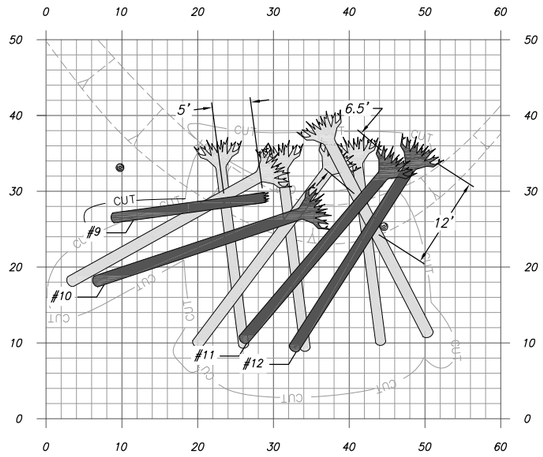
DATE AND TIME PLOTTED April 27, 2015 21:17
PLOTTED BY TRUSCOTT, NIC

CAD SYSTEM AutoCAD Civil 3D 2014
CAD FILENAME CC44_Phase_3-4_LWM_Tight_Rad_Bend_Jam_Details.dwg

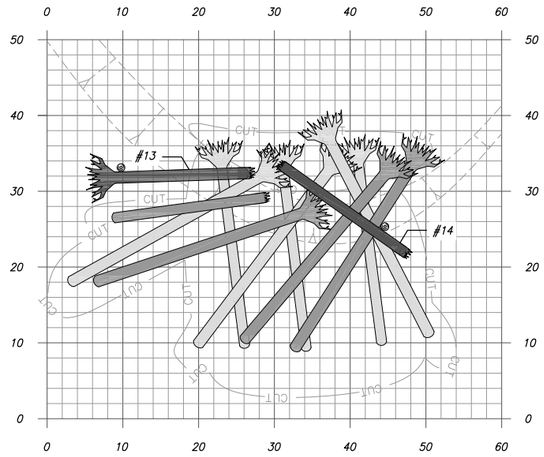
Step 3: Install log #8 (vertical pile) by driving or excavating. Partially backfill to provide temporary stability.



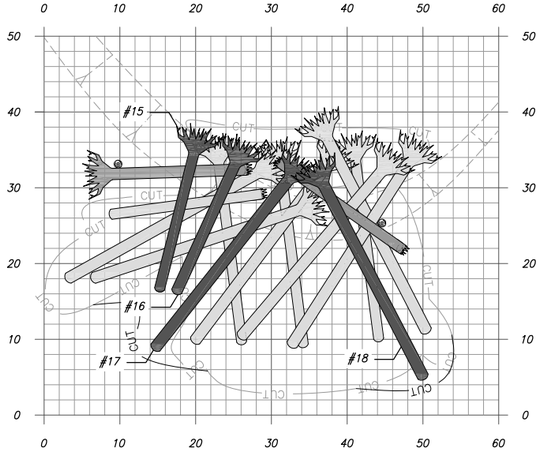
Step 4: Excavate as necessary to place logs #9–#12 as shown, resting them horizontally on previously placed logs.



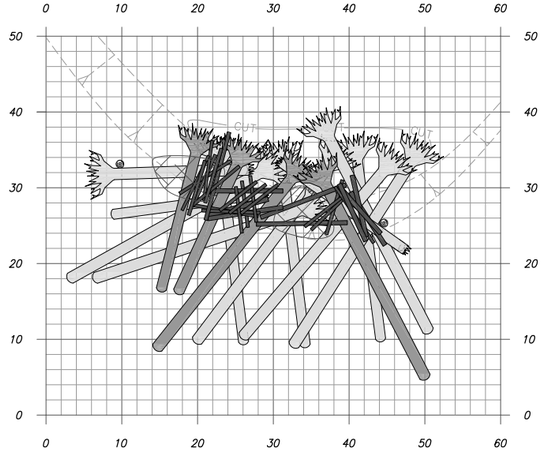
Step 5: Backfill around logs #7 and #8 (vertical piles) to existing ground, then place logs #13 and #14 as shown, resting one end on the bank and the other on previously placed logs.



Step 6: Place logs #15–#18 as shown, resting the rootwad ends on previously placed logs and angling the cut end into the bank so cut end has a minimum of 2' of cover when backfilled.



Step 7: Incorporate racking and slash material into structure by weaving it between logs and pressing pieces into the bank. Backfill the structure to existing ground, compacting moderately in 1' lifts.



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BUREAU OF RECLAMATION
COLUMBIA/SNAKE RIVER SALMON RECOVERY GROUP
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
LWM DETAILS – TIGHT RADIUS BEND STRUCTURE

N. TRUSCOTT
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015-04-27

LWM DETAILS

TIGHT RADIUS BEND STRUCTURE

1678-100-1994

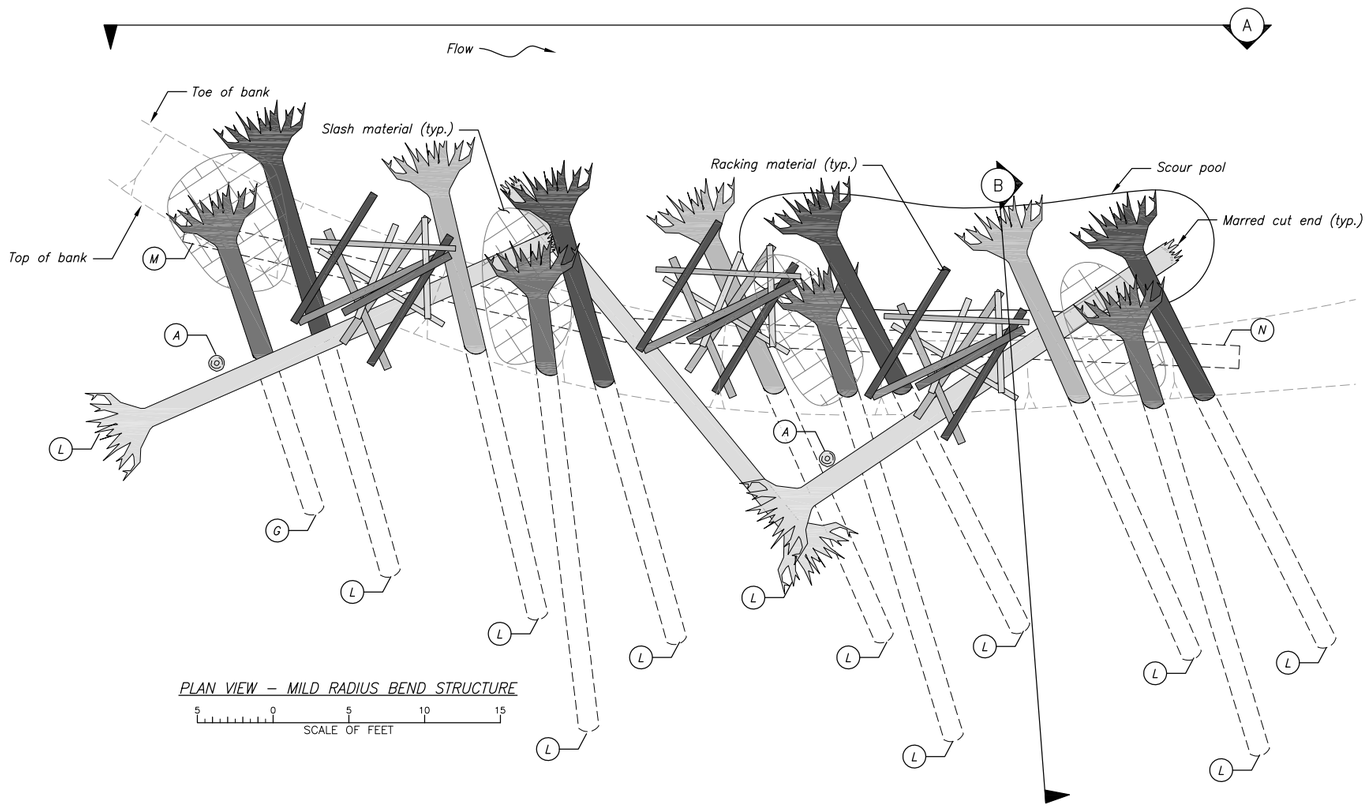
SHEET 4 OF 14

REGISTERED PROFESSIONAL ENGINEER
13121PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
4/27/2015

RENEWAL DATE: 12/31/2015

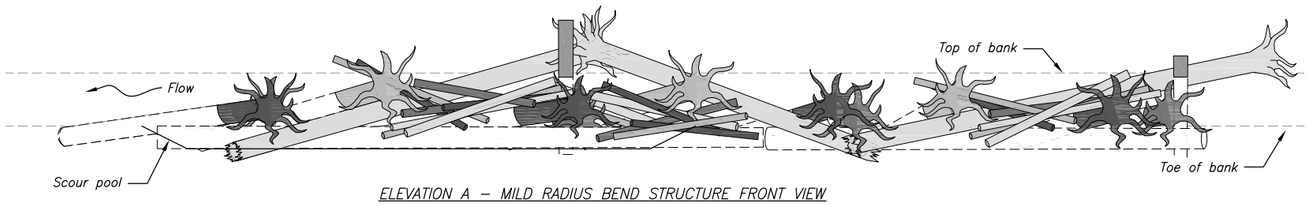
DATE AND TIME PLOTTED
April 27, 2015 21:17
PLOTTED BY
TRUSCOTT, NIC

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Phase_3-4_LWM_Tight_Rad_Bend_Dam_Details.dwg



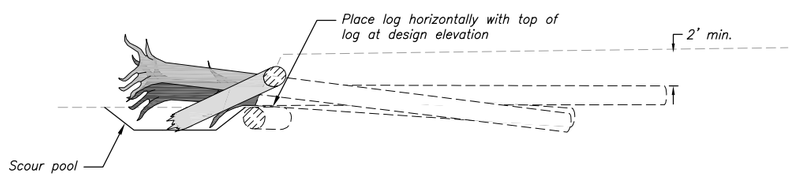
PLAN VIEW – MILD RADIUS BEND STRUCTURE

5 0 5 10 15
SCALE OF FEET



ELEVATION A – MILD RADIUS BEND STRUCTURE FRONT VIEW

5 0 5 10 15
SCALE OF FEET



ELEVATION B – MILD RADIUS BEND STRUCTURE SIDE VIEW

5 0 5 10 15
SCALE OF FEET

Notes:

1. Construction of this structure requires careful placement of logs to achieve the desired outcome. The Contractor shall place logs as illustrated on this sheet unless otherwise directed by the Contracting Officer.
2. All logs shall come from Douglas fir, lodgepole pine, or ponderosa pine.
3. The exact location of each mild radius bend structure shall be determined by the Contracting Officer.
4. Cut ends of logs that will be exposed at structure completion shall be marred prior to installation. The Contractor shall use an excavator, bulldozer, or other heavy equipment to tear apart wood fibers at the cut end of the log to create the appearance of a log that has naturally broken apart.
5. Racking and slash material shall be incorporated into each mild radius bend structure by weaving it in between placed logs, placing it in voids, pressing it into the bank, or otherwise including it in the structure as directed by the Contracting Officer.
6. See sheet 1678–100–1996 for construction sequencing.

MILD RADIUS BEND STRUCTURE MATERIAL SCHEDULE

ITEM	DESCRIPTION	QUANTITY
Log type (A)	Vertical pile, 12" dia. log	2
Log type (G)	25' long, 15" DBH log with rootwad	1
Log type (L)	30' long, 15" DBH log with rootwad	12
Log type (M)	30' long, 18" dia. log	1
Log type (N)	40' long, 18" dia. log	1
Racking material	4'–10' long, 3"–9" dia. log	30
Slash material	Tree tops, limbs with branches and needles	2 CY

MILD RADIUS BEND STRUCTURE CONSTRUCTION DETAILS

STRUCTURE STATION	DESIGN ELEVATION
10+75	2983.9'
14+50	2980.4'
29+25	2968.3'
33+50	2966.0'

REGISTERED PROFESSIONAL ENGINEER
19312PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
4/27/2015
RENEWAL DATE: 12/31/2015

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
LWM DETAILS – MILD RADIUS BEND DETAILS

N. TRUSCOTT
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015-04-27

LWM DETAILS

MILD RADIUS BEND STRUCTURE

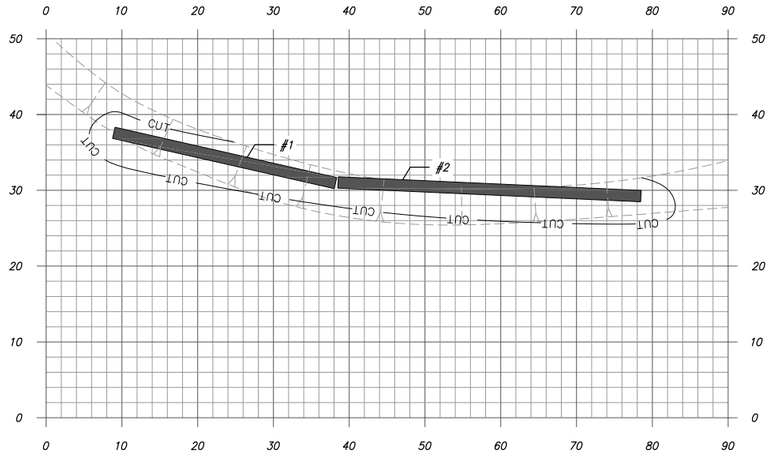
1678–100–1995

SHEET 5 OF 14

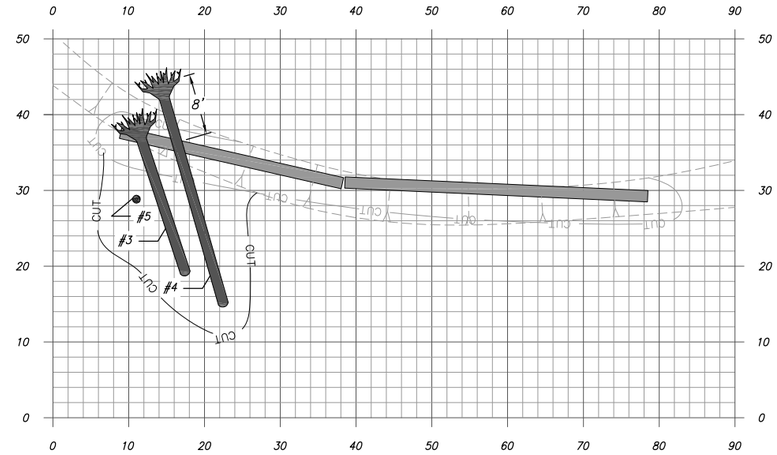
DATE AND TIME PLOTTED
April 27, 2015 21:22
PLOTTED BY
TRUSCOTT, NIC

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Phase_3-4_LWM_Mild_Rad_Bend_3Dm_Details.dwg

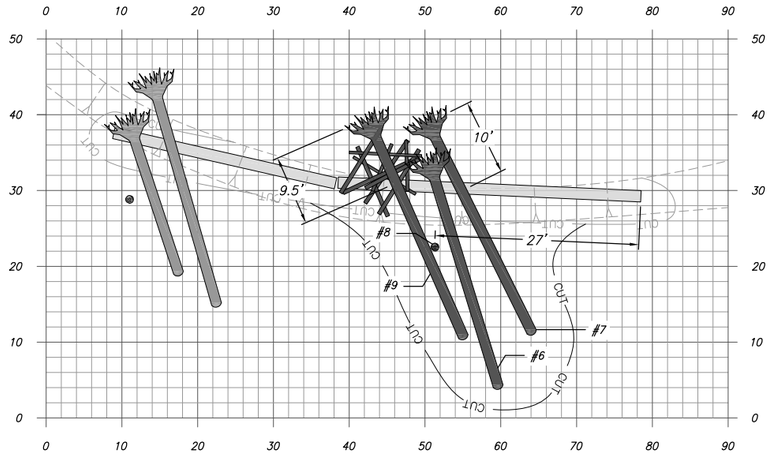
Step 1: Excavate as necessary to place logs #1 and #2 at the design elevation shown on sheet 1678-100-1995.



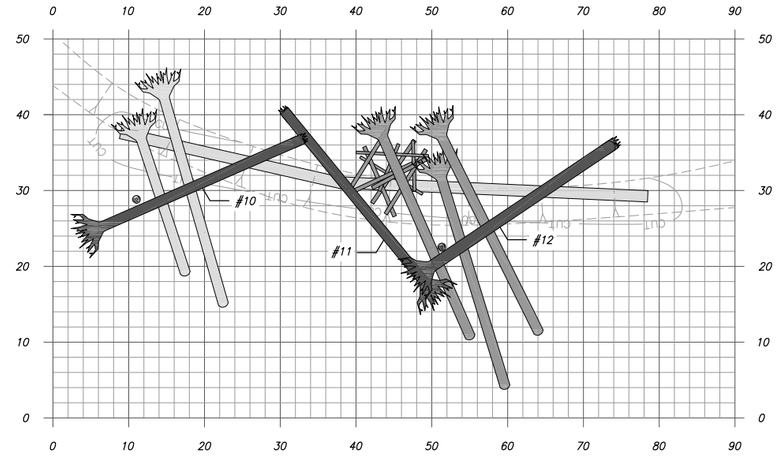
Step 2: Excavate as necessary to place logs #3 and #4, resting them on top of log #1. Log #3 shall be placed horizontally, log #4 on a minimum slope of 15H:1V into the bank. Install log #5 (vertical pile) by driving or excavating, then backfill over logs #3 and #4.



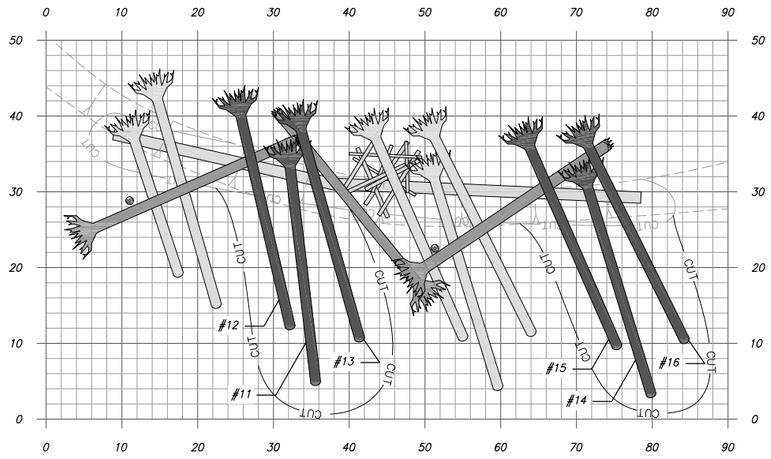
Step 3: Excavate as necessary to place logs #6 and #7, resting them on top of log #2. Log #6 shall be placed horizontally, log #7 on a minimum slope of 15H:1V into the bank. Install log #8 (vertical pile) by driving or excavating. Place racking material as shown and rest log #9 on top of racking material, angling it into the bank on a minimum slope of 15H:1V then backfill over logs.



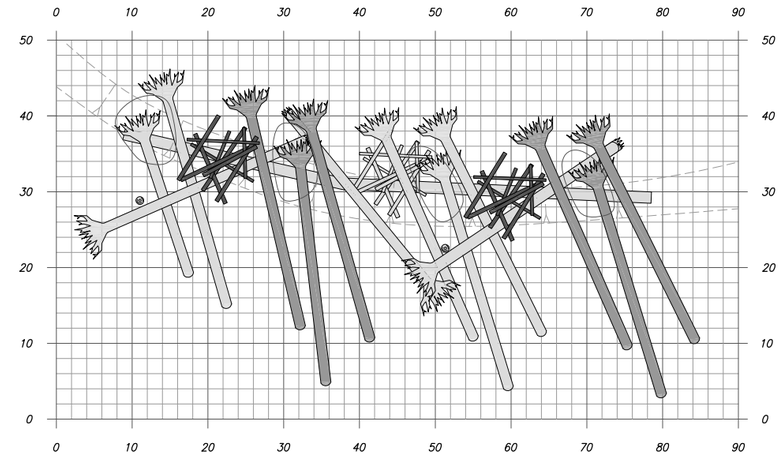
Step 4: Place logs #10-#12 as shown, resting the rootwad end of each log on top of the bank and angling the marred end in the streambed as directed by the contracting officer.



Step 5: Excavate as necessary to place logs #11-#16, resting them on previously placed logs. logs #11 and #14 shall be horizontal, while logs #12, #13, #15 and #16 shall be angled on a minimum slope of 15H:1V into the bank.



Step 5: Incorporate racking and slash material into structure by weaving it between logs and pressing pieces into the bank. Backfill the structure to existing bankline, compacting moderately in 1' lifts.



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COLUMBIA/SNAKE RIVER SALMON RECOVERY GROUP
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
LWM DETAILS - MILD RADIUS BEND DETAILS

N. TRUSCOTT
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015-04-27

LWM DETAILS

MILD RADIUS BEND STRUCTURE

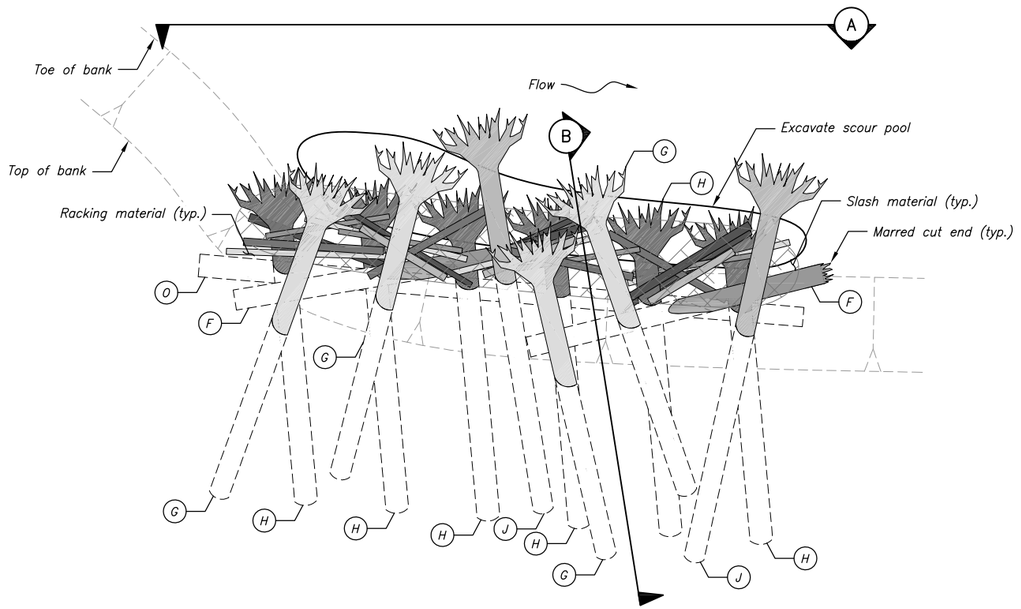
1678-100-1996

SHEET 6 OF 14

REGISTERED PROFESSIONAL ENGINEER
83124PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
4/27/2015
RENEWAL DATE: 12/31/2015

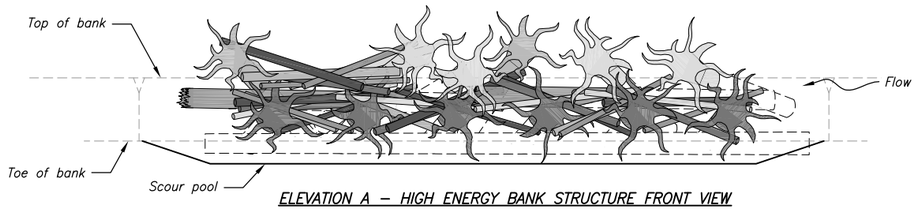
DATE AND TIME PLOTTED
April 27, 2015 21:22
PLOTTED BY
TRUSCOTT, NIC

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Phase_3-4_LWM_Mild_Rad_Bend_Dtl_Details.dwg



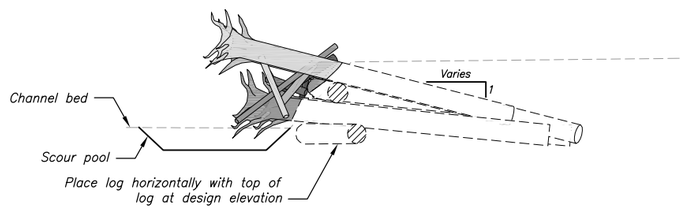
PLAN VIEW – HIGH ENERGY BANK STRUCTURE

5 0 5 10 15
SCALE OF FEET



ELEVATION A – HIGH ENERGY BANK STRUCTURE FRONT VIEW

5 0 5 10 15
SCALE OF FEET



ELEVATION B – HIGH ENERGY BANK STRUCTURE SIDE VIEW

5 0 5 10 15
SCALE OF FEET

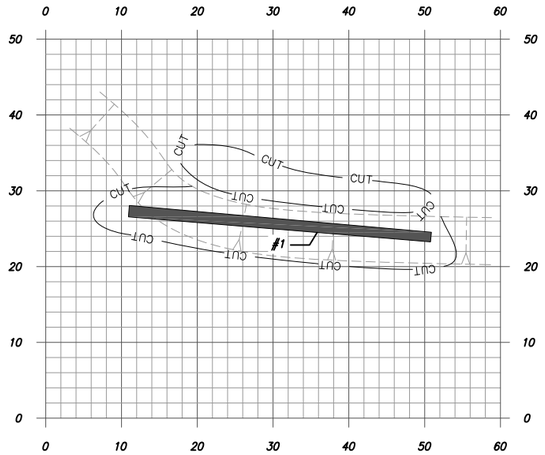
Notes:

1. *Construction of this structure requires careful placement of logs to achieve the desired outcome. The Contractor shall place logs as illustrated on this sheet unless otherwise directed by the Contracting Officer.*
2. *All logs shall come from Douglas fir, lodgepole pine, or ponderosa pine.*
3. *The exact location of each high energy bank structure shall be determined by the Contracting Officer.*
4. *Cut ends of logs that will be exposed at structure completion shall be marred prior to installation. The Contractor shall use an excavator, bulldozer, or other heavy equipment to tear apart wood fibers at the cut end of the log to create the appearance of a log that has naturally broken apart.*
5. *Racking and slash material shall be incorporated into each structure by weaving it in between placed logs, placing it in voids, pressing it into the bank, or otherwise including it in the structure as directed by the Contracting Officer.*

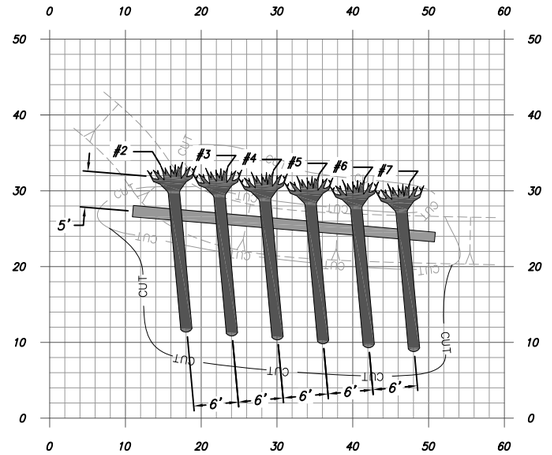
HIGH ENERGY BANK STRUCTURE MATERIAL SCHEDULE

ITEM	DESCRIPTION	QUANTITY
Log type (F)	20' long, 15" dia. log	2
Log type (G)	20' long, 15" DBH log with rootwad	4
Log type (H)	20' long, 18" DBH log with rootwad	6
Log type (J)	25' long, 15" DBH log with rootwad	2
Log type (O)	40' long, 18" dia. log	1
Racking material	4'–10' long, 3"–9" dia. log	25
Slash material	Tree tops, limbs with branches and needles	1.5 CY

Step 1: Excavate scour pool as directed by Contracting Officer, then excavate as necessary to place log #1 (footer log) at design elevation.



Step 2: Excavate as necessary to place logs #2–#7. Logs shall be placed horizontally.



Construction sequencing continued on sheet 1678–100–1998

HIGH ENERGY BANK STRUCTURE CONSTRUCTION DETAILS

STRUCTURE STATION	DESIGN ELEVATION
9+90	2985.9'
15+15	2979.0'
18+50	2974.5'
26+85	2973.9'

REGISTERED PROFESSIONAL ENGINEER
23124PE
OREGON
JULY 14, 2008
MARTIN K. FISHER
4/27/2015
RENEWAL DATE: 12/31/2015

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COLUMBIA/SNAKE RIVER SALMON RECOVERY GROUP
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
LWM DETAILS – HIGH ENERGY BANK STRUCTURE

N. TRUSCOTT
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015-04-27

LWM DETAILS

HIGH ENERGY BANK STRUCTURE

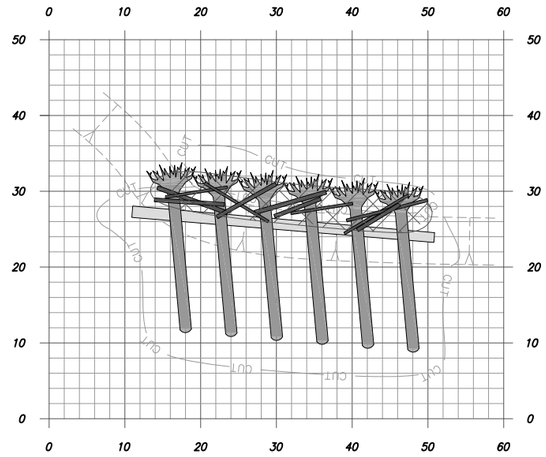
1678-100-1997

SHEET 7 OF 14

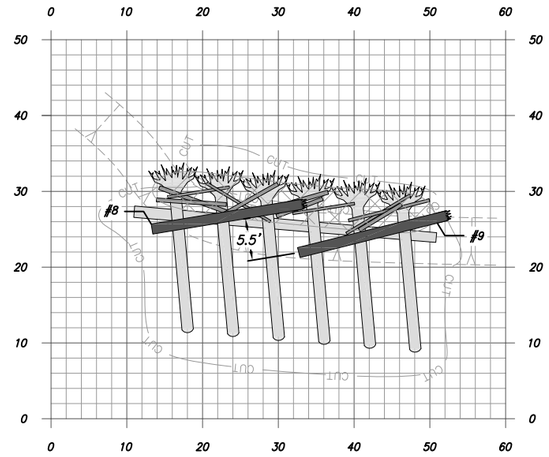
DATE AND TIME PLOTTED
April 27, 2015 21:22
PLOTTED BY
TRUSCOTT, NIC

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Phase_3-4_LWM_High_Energy_BankStructure_Details.dwg

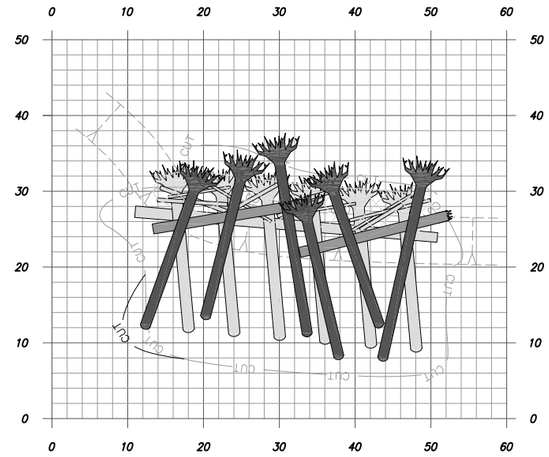
Step 3: Incorporate approximately one half of the total amount of racking and slash material into the structure by placing them as directed by the contracting officer.



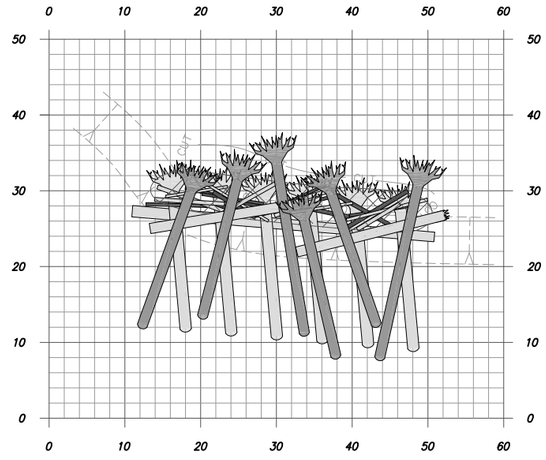
Step 4: Place logs #8 and #9, resting them on previously placed logs.



Step 5: Expand excavation if necessary and place logs #10–#15 as shown, varying the angle into the bank between 4.5H:1V to 9H:1V.



Step 6: Incorporate remainder of racking and slash material into structure by weaving it between logs and pressing pieces into the bank. Backfill the structure to existing bank line, compacting moderately in 1' lifts.



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BUREAU OF RECLAMATION
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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
LWM DETAILS – HIGH ENERGY BANK STRUCTURE

N. TRUSCOTT
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015-04-27

LWM DETAILS

HIGH ENERGY BANK STRUCTURE

1678-100-1998

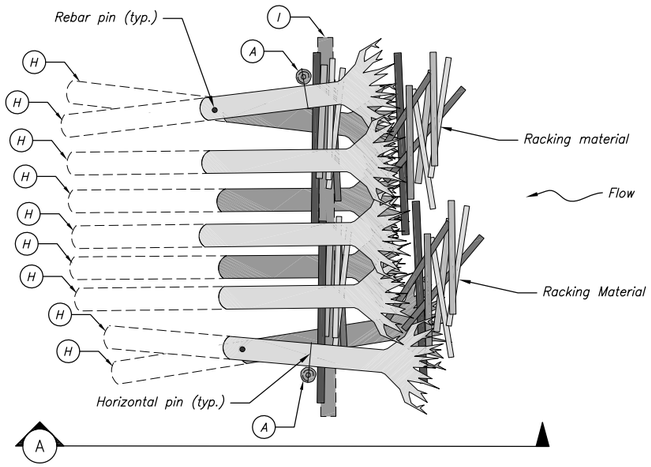
SHEET 8 OF 14

REGISTERED PROFESSIONAL ENGINEER
53127PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
4/27/2015

RENEWAL DATE: 12/31/2015

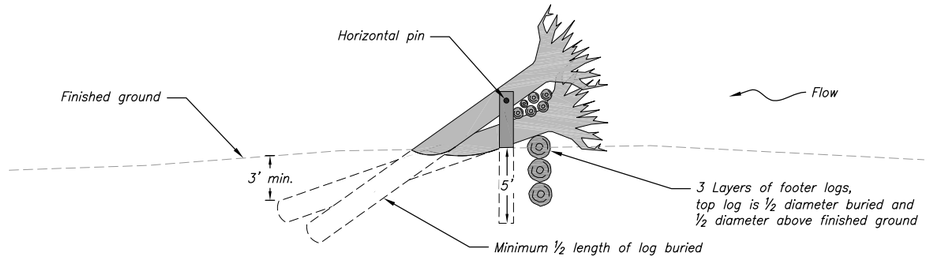
DATE AND TIME PLOTTED
April 27, 2015 21:22
PLOTTED BY
TRUSCOTT, NIC

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Phase_3-4_LWM_High_Energy_Bank_Structure_Details.dwg



PLAN VIEW – LARGE APEX JAM

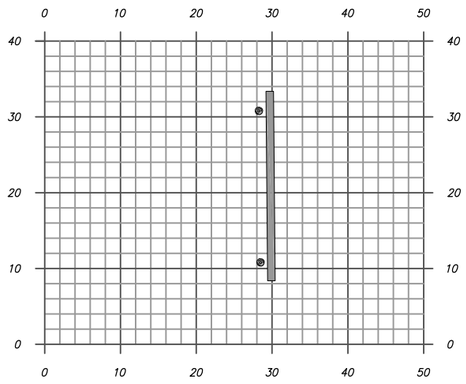
5 0 5 10 15
SCALE OF FEET



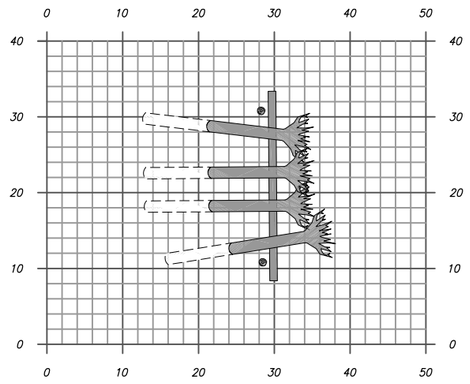
ELEVATION A – LARGE APEX JAM SIDE VIEW

5 0 5 10 15
SCALE OF FEET

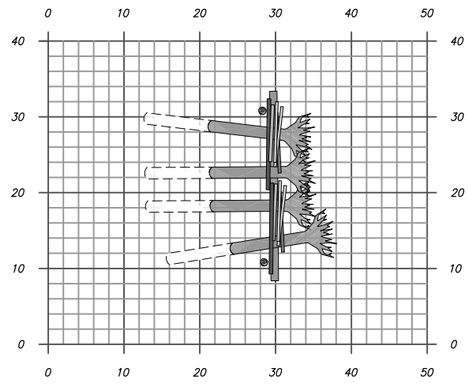
Step 1: Place footer logs and vertical piling logs.



Step 2: Place lower row of apex jam logs with rootwads.



Step 3: Place racking material over lower row of apex jam logs and in front of vertical piling logs.



Construction sequencing continued on sheet 1678–100–2000

NOTES:

1. Construction of this structure requires careful placement of logs to achieve the desired outcome. The Contractor shall place logs as illustrated on this sheet unless otherwise directed by the Contracting Officer.
2. All logs shall come from Douglas fir, lodgepole pine, or ponderosa pine.
3. The exact location of each large apex jam shall be determined by the Contracting Officer.
4. Rebar pins shall be #4 rebar. To install pins drill a ½" pilot hole then install rebar pin by hammering with a jackhammer or sledge hammer.
5. Horizontal pins shall be 1" diameter all–thread. Drill 1 ¼" hole through vertical log and top layer log with rootwad. Insert 1" diameter all–thread through hole. Place washer at each end and secure with nut at each end. Cut excess length of all–thread so end is flush with nut.

LARGE APEX JAM SCHEDULE

ITEM	DESCRIPTION	QUANTITY
Log type (A)	10' long, 12" dia. log	2
Log type (H)	20' long, 16"–18" DBH log with rootwad	9
Log type (I)	25 long, 12" dia. log	3
Racking material	4'–10' long, 3"–9" dia. log	40

LARGE APEX JAM CONSTRUCTION DETAILS
STRUCTURE STATION

12+25
31+25

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2006
MARTIN K. FISHER
4/29/2015
RENEWAL DATE: 12/31/2015

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Managing Water in the West

ICF INTERNATIONAL

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BUREAU OF RECLAMATION
COLUMBIA/SNAKE RIVER SALMON RECOVERY GROUP
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC–44 PHASE III HABITAT ENHANCEMENT
LWM DETAILS – LARGE APEX JAM

M. FISHER
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015–04–27

LWM DETAILS

LARGE APEX JAM

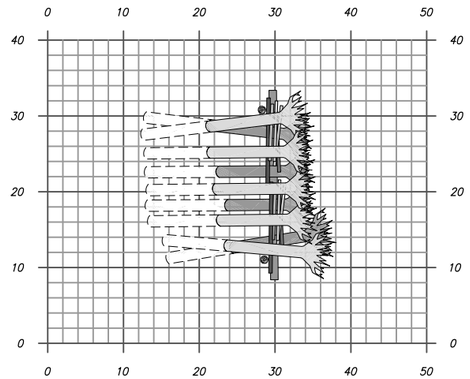
1678–100–1999

SHEET 9 OF 14

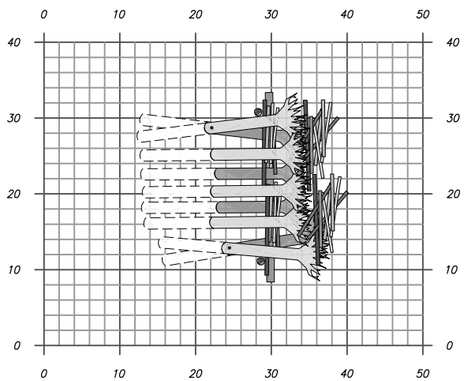
DATE AND TIME PLOTTED
April 28, 2015 11:53
PLOTTED BY
FISHER, MARTIN

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Parcel_3_LWM_BIGApex_Details.dwg

Step 4: Place second layer of apex jam logs with rootwads.



Step 5: Place racking material in front of apex jam. Install 2 rebar pins, 1 at each location where upper layer log with rootwad crosses lower layer log with rootwad. Install 2 horizontal pins, 1 connecting each pile to adjacent log with rootwad.



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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
LWM DETAILS – LARGE APEX JAM

M. FISHER
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015-04-27

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
4/29/2015

RENEWAL DATE: 12/31/2015

LWM DETAILS

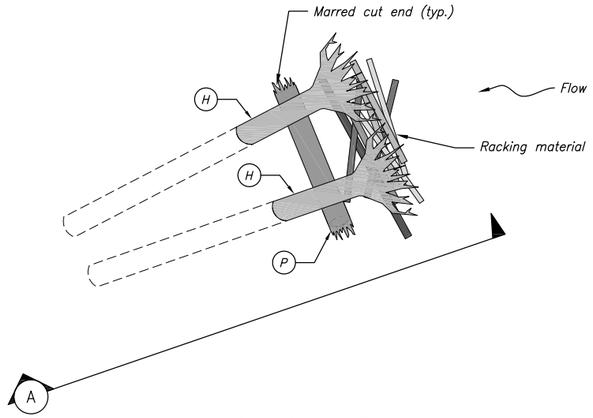
LARGE APEX JAM

1678-100-2000

SHEET 10 OF 14

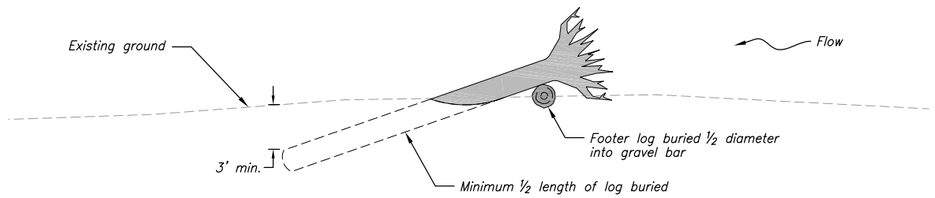
DATE AND TIME PLOTTED
April 28, 2015 11:54
PLOTTED BY
FISHER, MARTIN

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Parcel_3_LWM_BIOApex_Details.dwg



PLAN VIEW – SMALL APEX JAM

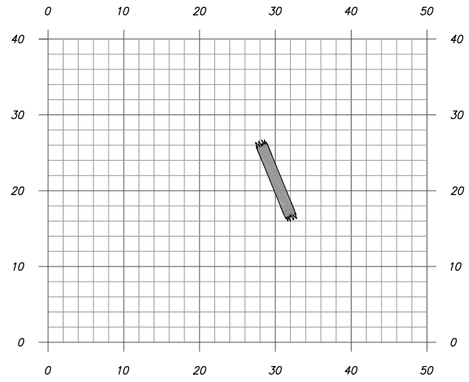
5 0 5 10 15
SCALE OF FEET



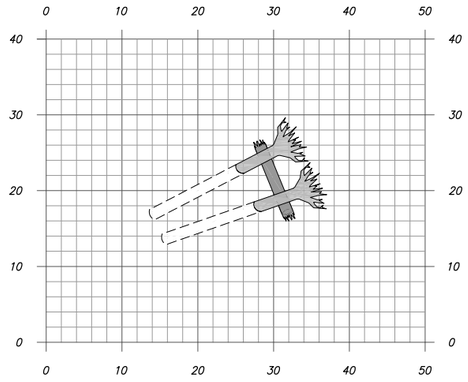
ELEVATION A – SMALL APEX JAM SIDE VIEW

5 0 5 10 15
SCALE OF FEET

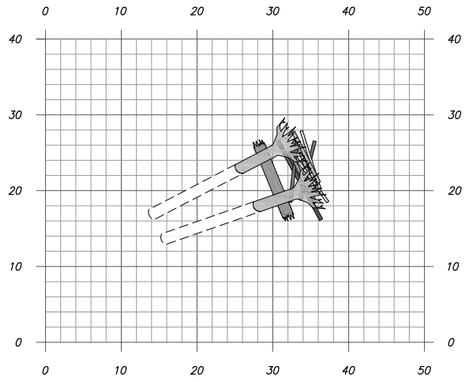
Step 1: Place footer log, buried ½ diameter into gravel bar.



Step 2: Place 2 logs with rootwads over footer log and bury cut ends into gravel bar.



Step 3: Incorporate racking material.



Notes:

1. Construction of this structure requires careful placement of logs to achieve the desired outcome. The Contractor shall place logs as illustrated on this sheet unless otherwise directed by the Contracting Officer.
2. All logs shall come from Douglas fir, lodgepole pine, or ponderosa pine.
3. The exact location of each small apex jam shall be determined by the Contracting Officer.
4. Cut ends of logs that will be exposed at structure completion shall be marred prior to installation. The Contractor shall use an excavator, bulldozer, or other heavy equipment to tear apart wood fibers at the cut end of the log to create the appearance of a log that has naturally broken apart.

SMALL APEX JAM SCHEDULE

ITEM	DESCRIPTION	QUANTITY
Log type (H)	20' long, 16"–18" DBH log with rootwad	2
Log type (P)	10' long, 18" dia. log	1
Racking material	4'–10' long, 3"–9" dia. log	8

SMALL APEX JAM CONSTRUCTION DETAILS
STRUCTURE STATION

5+60
5+70
7+70
25+05
25+15
30+85
30+95

REGISTERED PROFESSIONAL ENGINEER
13124PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
4/27/2015
RENEWAL DATE: 12/31/2015

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COLUMBIA/SNAKE RIVER SALMON RECOVERY GROUP
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
LWM DETAILS – SMALL APEX JAM

M. FISHER
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015-04-27

LWM DETAILS

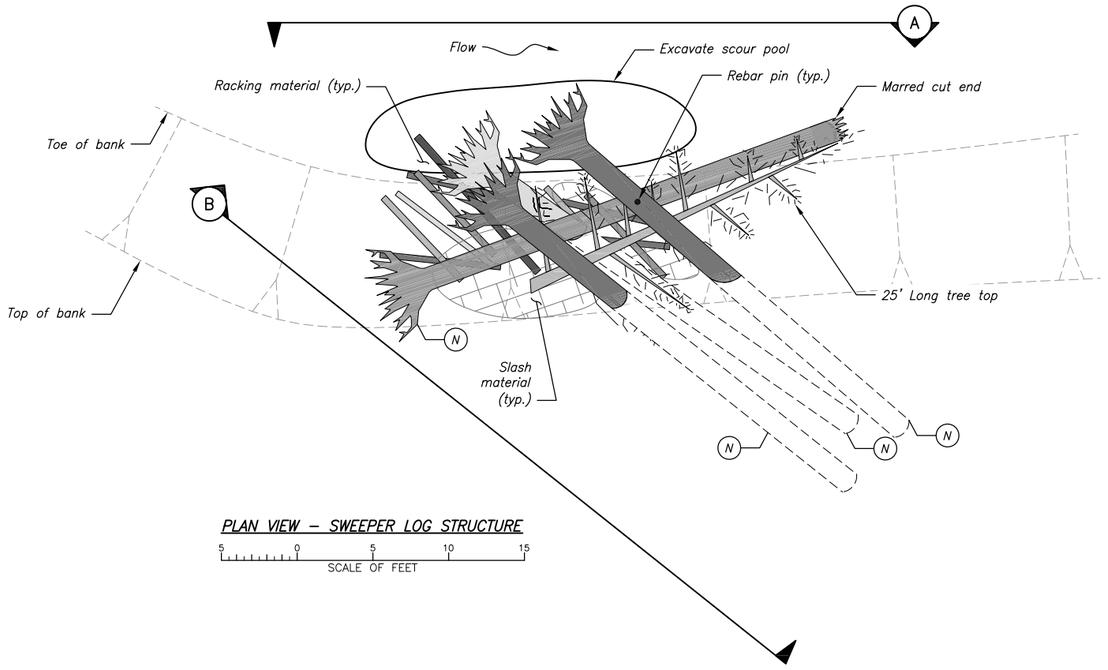
SMALL APEX JAM

1678-100-2001

SHEET 11 OF 14

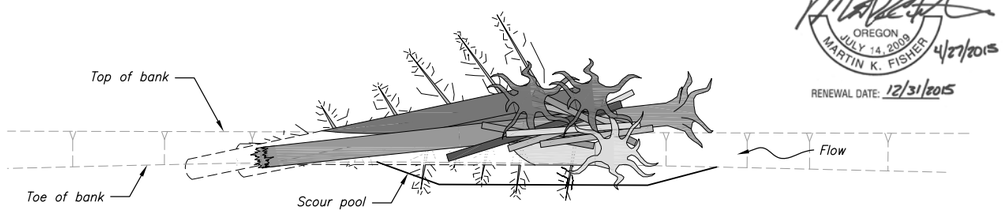
DATE AND TIME PLOTTED
April 27, 2015 21:26
PLOTTED BY
TRUSCOTT, NIC

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Parcel_3_LWM_SmallApex_Details.dwg



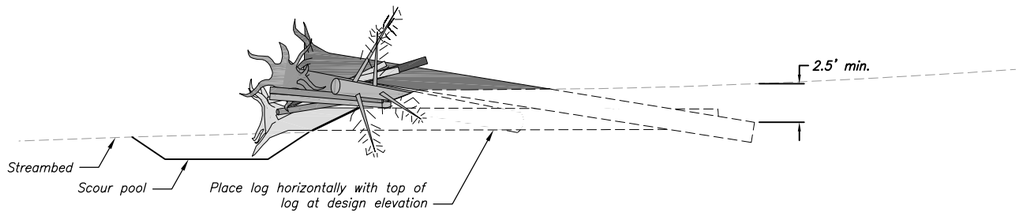
PLAN VIEW – SWEEPER LOG STRUCTURE

5 0 5 10 15
SCALE OF FEET



ELEVATION A – SWEEPER LOG STRUCTURE FRONT VIEW

5 0 5 10 15
SCALE OF FEET



ELEVATION B – SWEEPER LOG STRUCTURE SIDE VIEW

5 0 5 10 15
SCALE OF FEET

REGISTERED PROFESSIONAL ENGINEER
13128PE
OREGON
JULY 14, 2006
MARTIN K. FISHER
4/27/2015
RENEWAL DATE: 12/31/2015

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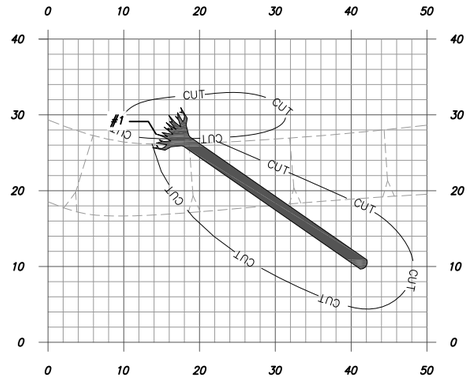
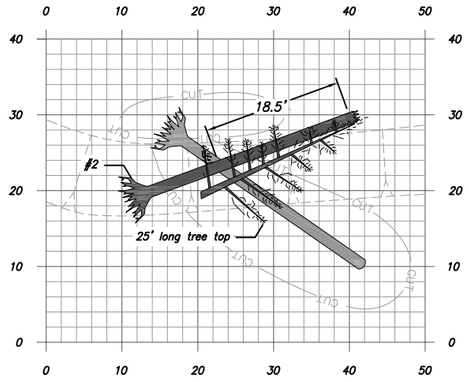
GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
LWM DETAILS – SWEEPER LOG STRUCTURE

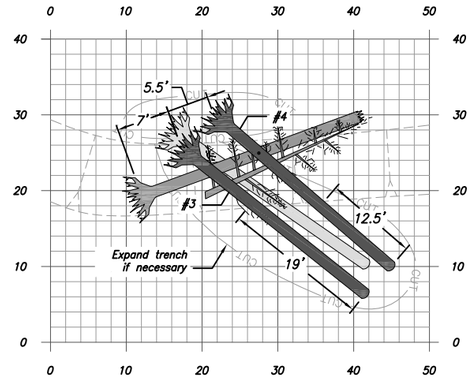
Step 1: Excavate scour pool as directed by Contracting Officer and trench for log #1; place log horizontally at elevation identified on this sheet. rootwad shall sit just past the toe of bank.



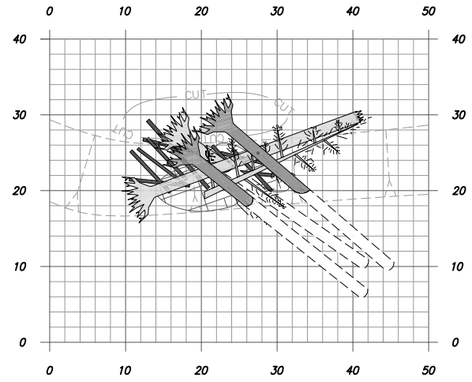
Step 2: Place log #2 with rootwad on or near the top of bank and cut end angled towards the streambed in the downstream direction. Position 25' long tree top with full branches on the bank side of log #2.



Step 3: Expand trench if necessary to make room for logs #3 and #4; logs shall rest on top of log #2 and hold the tree top in place. Logs shall be angled into bank with a minimum of 2.5' of cover at their cut ends. Pin log #4 to log #2 with rebar pin.



Step 4: Incorporate racking and slash material into structures by weaving it between logs and pressing pieces into the bank. Backfill the excavated trench compacting moderately in 1' lifts to the original bank line.



Notes:

1. *Construction of this structure requires careful placement of logs to achieve the desired outcome. The Contractor shall place logs as illustrated on this sheet unless otherwise directed by the Contracting Officer.*
2. *All logs shall come from Douglas fir, lodgepole pine, or ponderosa pine. The 25' long tree top with full branches may come from any of the three species listed above, or grand fir.*
3. *The exact location of each sweeper log structure shall be determined by the Contracting Officer.*
4. *Rebar pins shall be #4 rebar. To install pins drill a ½" pilot hole then install rebar pin by hammering with a jackhammer or sledge hammer.*
5. *Cut ends of logs that will be exposed at structure completion shall be marred prior to installation. The Contractor shall use an excavator, bulldozer, or other heavy equipment to tear apart wood fibers at the cut end of the log to create the appearance of a log that has naturally broken apart.*
6. *Racking and slash material shall be incorporated into each sweeper log structure by weaving it in between placed logs, placing it in voids, pressing it into the bank, or otherwise including it in the structure as directed by the Contracting Officer.*

SWEEPER LOG STRUCTURE SCHEDULE

ITEM	DESCRIPTION	QUANTITY
Log type (N)	30' long, 16"–18" DBH log with rootwad	4
Racking material	4'–10' long, 3"–9" dia. log	10
Slash material	Tree tops, limbs with branches and needles	1 CY
Tree top	25' long tree top with full branches	

SWEEPER LOG STRUCTURE CONSTRUCTION DETAILS

STRUCTURE STATION	DESIGN ELEVATION
SC1 5+40	2985.0'
18+10	2978.5'

N. TRUSCOTT
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015-04-27

LWM DETAILS

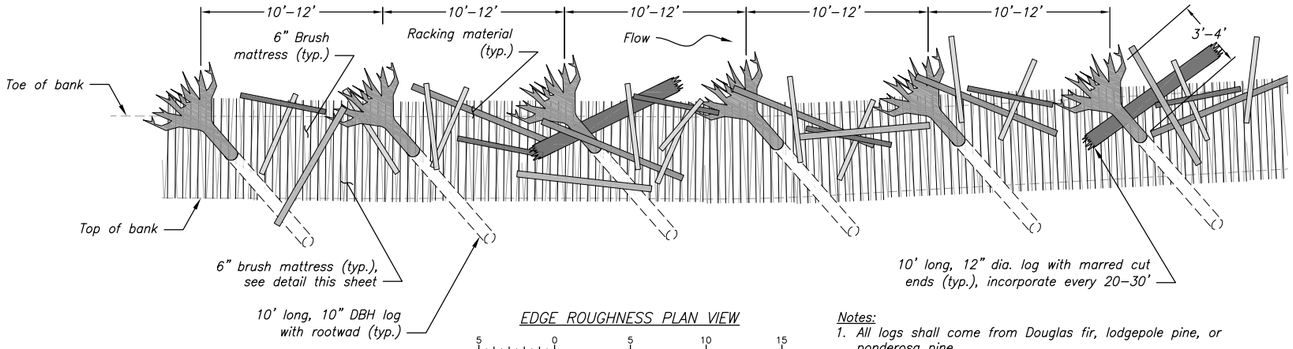
SWEEPER LOG STRUCTURE

1678-100-2002

SHEET 12 OF 14

DATE AND TIME PLOTTED
April 27, 2015 21:26
PLOTTED BY
TRUSCOTT, NIC

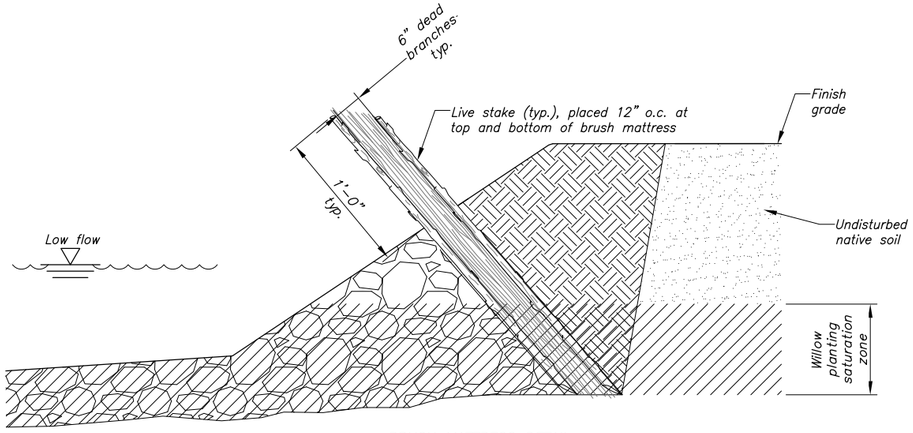
CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Parcel_3_LWM_Sweeper_Details.dwg



EDGE ROUGHNESS PLAN VIEW

5 0 5 10 15
SCALE OF FEET

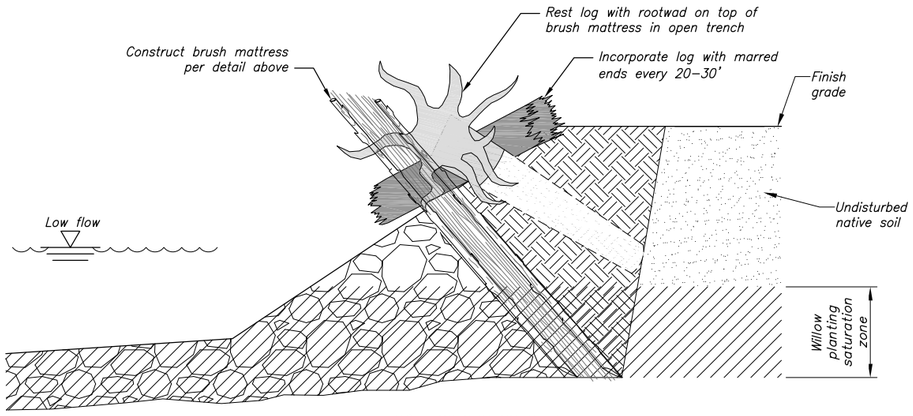
Notes:
1. All logs shall come from Douglas fir, lodgepole pine, or ponderosa pine.
2. Embedded logs with rootwads shall be placed approximately every 10'–12' on center and placed with their rootwads oriented slightly upstream.
3. Logs shall be placed such that approximately ⅓ of the total length (including rootwad) is exposed. logs shall be placed on a minimum slope of 7.5h:1v into the bank.
4. Logs shall be placed while the trench excavated to place brush mattress is open.
5. Prior to backfilling, racking material shall be incorporated into the log–brush mattress complex as directed by the contracting officer.



BRUSH MATTRESS DETAIL

N.T.S.

Notes:
1. Brush mattress shall be composed of a 6 inch layer of dead branches of native species, between two layers of live cuttings. Material will be supplied by the Contracting Officer.
2. A trench shall be excavated at location identified in these plans so the bottom of the brush mattress is within the saturation zone.
3. Live cuttings shall be placed every 12 inches for the entire length of trench. Live cuttings shall be installed with buds oriented upward.
4. Dead branches shall be placed uniformly along the trench on top of the live cuttings to a compressed depth of 6 inches.
5. A top layer of live cuttings shall be placed every 12 inches along the length of the brush mattress. Live cuttings shall be installed with buds oriented upward.
6. Soil shall be backfilled in 6 inch lifts. The first lift shall be washed into the brush mat with water to eliminate voids. Supplemental lifts shall be compacted.
7. To construct edge roughness, incorporate logs with rootwads and marred ends into open trench prior to backfilling trench, then backfill and finally incorporate racking material.



EDGE ROUGHNESS DETAIL

N.T.S.

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COLUMBIA/SNAKE RIVER SALMON RECOVERY GROUP
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC–44 PHASE III HABITAT ENHANCEMENT
LWM DETAILS – EDGE ROUGHNESS/ BRUSH MATTRESS

N. TRUSCOTT
DRAWN

xJay Hovde
ACCEPTED

BOISE, ID 2015–04–27

LWM DETAILS

EDGE ROUGHNESS/BRUSH MATTRESS

1678–100–2003

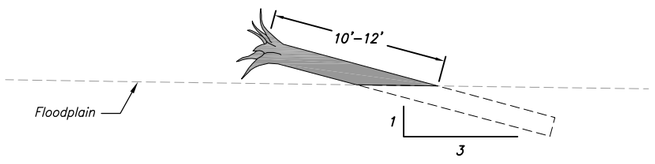
SHEET 13 OF 14

REGISTERED PROFESSIONAL ENGINEER
93127PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
4/27/2015

RENEWAL DATE: 12/31/2015

DATE AND TIME PLOTTED
April 27, 2015 21:26
PLOTTED BY
TRUSCOTT, NIC

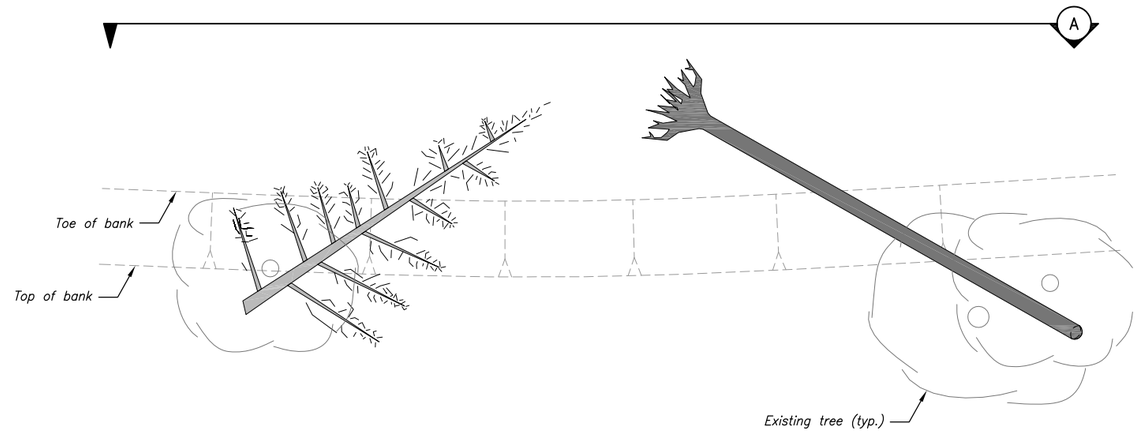
CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Parcel_3_LWM_Edge_Rough_Details.dwg



FLOODPLAIN LOG INSTALLATION DETAILS

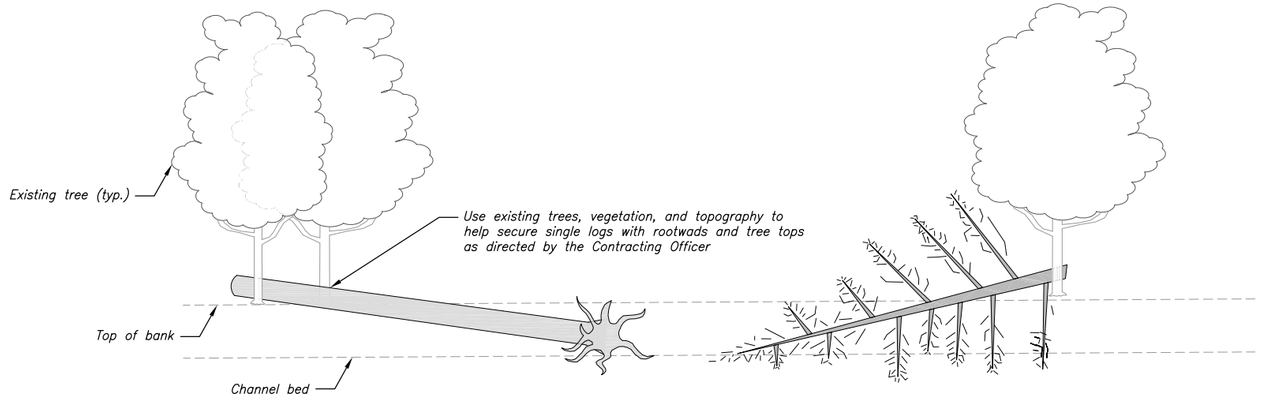
5 0 5 10 15
SCALE OF FEET

Notes:
1. All logs shall come from Douglas fir, lodgepole pine, or ponderosa pine.
2. The exact location of each floodplain log shall be determined by the Contracting Officer.
3. Bury logs on a minimum 3H:1V slope with 10–12' of exposed log.



SINGLE LOG WITH ROOTWAD AND TREE TOP WITH BRANCHES PLACEMENT PLAN VIEW

5 0 5 10 15
SCALE OF FEET



ELEVATION A – SINGLE LOG WITH ROOTWAD AND TREE TOP WITH BRANCHES PLACEMENT FRONT VIEW

5 0 5 10 15
SCALE OF FEET

Notes:
1. All logs with rootwads shall come from Douglas fir, lodgepole pine, or ponderosa pine. Tree tops with branches may come from grand fir trees.
2. The exact location of each single log with rootwad or tree top with branches shall be determined by the Contracting Officer.
3. Single logs with rootwads and tree tops with branches shall be placed without excavation by resting them on top of finished ground. Where possible, use existing trees, vegetation, or topography to help secure logs and tree tops as directed by the Contracting Officer.

REGISTERED PROFESSIONAL ENGINEER
13129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
4/27/2015
RENEWAL DATE: 12/31/2015

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COLUMBIA/SNAKE RIVER SALMON RECOVERY GROUP
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC–44 PHASE III HABITAT ENHANCEMENT
LWM DETAILS – FLOODPLAIN LOGS/
SINGLE LOGS

N. TRUSCOTT
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015–04–27

LWM DETAILS

FLOODPLAIN LOGS/SINGLE LOGS

1678–100–2004

SHEET 14 OF 14

DATE AND TIME PLOTTED
April 27, 2015 21:26
PLOTTED BY
TRUSCOTT, NIC

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Parcel_3_LWM_Fldpln_Single_Logs.dwg

Construction access route

Access & staging Area (TYP.)

Existing Vegetation (Do Not Disturb)

Side channel 1

Side channel 2

Side channel 3

Side channel 4

Alcove 1

Alcove 2

Flow

Main channel thalweg

Live brush trench (TYP.)

Approx. CREP boundary

Protect and plant around existing surviving vegetation

Protect and plant around existing surviving vegetation

Existing wetland (TYP.)

HWY 203

0 +00
1 +00
2 +00
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11 +00
12 +00
13 +00
14 +00
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16 +00
17 +00
18 +00
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28 +00
29 +00
30 +00
31 +00
32 +00
33 +00
34 +00
35 +00
36 +00
37 +00
38 +00
38 +164.19

LEGEND

- Planting Zone 1
- Planting Zone 2
- Planting Zone 3
- Planting Zone 4
- Existing Wetland
- Channel
- Live Brush Trench

100 0 100 200 300
SCALE OF FEET

N

NOTE:
Care should be taken by contractor to work around existing vegetation to the greatest extent possible. Shrubs and small trees distrubed shall be transplanted to an appropriate zone/location in a timely manner to increase odds of survivability.

PLANTING ZONES AND AREAS

ZONE	QTY
Zone 1 – Bank Zone	1.72 AC
Zone 2 – Riparian Zone	6.93 AC
Zone 3 – Live Staking	1.64 AC
Zone 4 – Access & Staging Seeding Zone	4.51 AC
Live Brush Trench	2026 LF

DATE AND TIME PLOTTED
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JHOVDE

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C-BASE-PLNT-ZONE-90PC.DWG

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 – PLANTING PLAN

Jay B. Hovde
DESIGNED
Jay B. Hovde
DRAWN
Mike Knutson P.E.
CHECKED
Jay B. Hovde P.E.
TECH. APPR.
Charles Spindler
APPROVED Charles Spindler
ADMIN APPROVAL – Program Manager–Acting

BOISE, ID 2015–04–30

PLANTING PLAN

OVERVIEW

1678–100–2005

SHEET 1 OF 6

Construction access route

Existing vegetation (do not disturb)

Live brush trench (TYP.)

Side channel 1

Flow

Access & staging area (TYP.)

Alcove 2

Approx. CREP boundary

Alcove 1

Main channel thalweg

HWY 20.3

Existing wetland (TYP.)

0 +00
1 +00
2 +00
3 +00
4 +00
5 +00
6 +00
7 +00
8 +00
9 +00
10 +00
11 +00
12 +00
13 +00
14 +00
15 +00
16 +00
17 +00
18 +00
19 +00
20 +00
21 +00
22 +00
23 +00

LEGEND

- Planting Zone 1
- Planting Zone 2
- Planting Zone 3
- Planting Zone 4
- Existing Wetland
- Channel
- Willow Trench

N

60 0 60 120 180
SCALE OF FEET

NOTE:
Care should be taken by contractor to work around existing vegetation to the greatest extent possible. Shrubs and small trees distrubed shall be transplanted to an appropriate zone/location in a timely manner to increase odds of survivability.

DATE AND TIME PLOTTED
MARCH 25, 2015 - 14:36
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GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 - PLANTING PLAN

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Jay B. Hovde	DRAWN
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BOISE, ID	2015-04-30

PLANTING PLAN

1678-100-2006

SHEET 2 OF 6

Access & staging area (TYP.)

Side channel 2

Construction access route

Protect and plant around existing surviving vegetation

20 +00
21 +00
22 +00
23 +00
24 +00
25 +00
26 +00
27 +00
28 +00
29 +00
30 +00
31 +00
32 +00
33 +00
34 +00
35 +00
36 +00
37 +00
38 +00
38 +64.19

Live brush trench (TYP.)

Flow

Approx. CREP boundary

Side channel 3

Side channel 4

Main channel thalweg

Protect and plant around existing surviving vegetation

Existing wetland (TYP.)

HWY 203

LEGEND

- Planting Zone 1
- Planting Zone 2
- Planting Zone 3
- Planting Zone 4
- Existing Wetland
- Channel
- Live Brush Trench

60 0 60 120 180
SCALE OF FEET

NOTE:
Care should be taken by contractor to work around existing vegetation to the greatest extent possible. Shrubs and small trees distrubed shall be transplanted to an appropriate zone/location in a timely manner to increase odds of survivability.

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MARCH 25, 2015 14:36
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JHOVDE

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AutoCAD Rel. 19.1s
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C-BASE-PLNT-ZONE-90PC.DWG

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 - PLANTING PLAN

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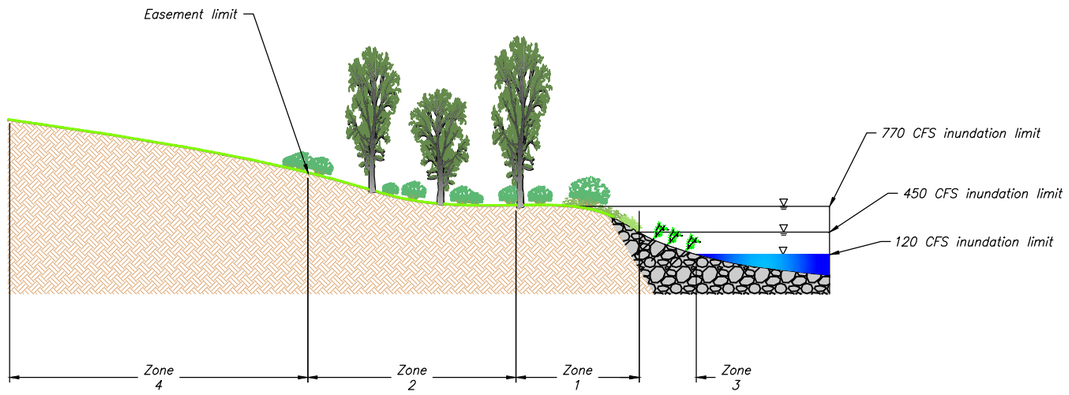
BOISE, ID 2015-04-30

PLANTING PLAN

1678-100-2007

SHEET 3 OF 6



TYPICAL PLANTING ZONES SECTION
N.T.S.

LEGEND

Zone 1 – Bank Zone

Zone 2 – Riparian Zone

Zone 3 – Live Stakes

Zone 4 – Access/Staging zone (reseeding only)

NOTES:

1. Remove/control noxious/invasive species prior to grading and planting. submit control plan to project manager for approval.
2. Adjust plant location and spacing to accommodate local microsite conditions.
3. Add topsoil mix or organic mulch at base of plants if necessary.
4. Plant live cuttings in areas that support permanent or seasonal saturated conditions.
5. Install browse protection as needed for tree and shrub plantings.
6. If plant species/form or size is not available submit proposed substitute to project manager for approval.
7. Planting applications are based on usda–nrcs technical notes and literature.

PLANTING ZONE TABLES

Zone 1 – Bank

Common Name	Scientific Name	Size	Approx. Spacing (ft.)	Approx. Percent of Zone	Units
McKenzie Willow	Salix Prolixa	Live Stake	3	15%	1249
Black Cottonwood	Populus Trichocarpa	Live Stake	5	10%	300
Coyote Willow	Salix Exigua	Live Stake	3	15%	1249
Nebraska Sedge	Carex Nebrascensis	Plug	2	5%	937
Red Osier Dogwood	Cornus Sericea	1 Gallon	10	15%	113
Black Cottonwood	Populus Trichocarpa	1 Gallon	10	20%	150
Speckled Alder	Rosa Woodsii	1 Gallon	20	5%	10
Black Hawthorn	Crataegus douglasii	1 Gallon	20	10%	19
Water Birch	Betula Occidentalis	1 Gallon	25	5	6

Zone 2 – Riparian

Common Name	Scientific Name	Size	Approx. Spacing (ft.)	Approx. Percent of Zone	Units
Pacific Willow	Salix Lasiandra	Live Stake	3	10%	1208
Black Cottonwood	Populus Trichocarpa	1 Gallon	20	25%	189
Red Osier Dogwood	Cornus Sericea	1 Gallon	20	10%	76
Black Hawthorn	Crataegus douglasii	1 Gallon	20	10%	76
Water Birch	Betula occidentalis	1 Gallon	40	5%	10
Speckled Alder	Alnus incana	1 Gallon	10	5%	151
Snowberry	Symphoricarpos albus	Plug	15	15%	202
Wood's Rose	Rosa woodsii	Plug	15	10	135
Chokecherry	Prunus virginiana	Plug	15	5	68
Blue Elderberry	Sambucus nigra	1 Gallon	15	5	68
Golden Currant	Ribes aureum	Plug	30	10	34

Zone 3 – Live Stakes

Common Name	Scientific Name	Size	Approx. Spacing (ft.)	Approx. Percent of Zone	Units
McKenzie Willow	Salix Prolixa	Live Stake	5	100%	2858

Seeding – Zones 1 and 2

Common Name	Scientific Name	Rate (lbs/Acre)	Quantity (lbs)
Tuffted Hairgrass	Deschampsia Caespitosa	1	17.30
Nebraska sedge	Carex Nebrascensis	1	8.65
Small fruited bull rush	Scirpus Microcarpus	1	8.65
Idaho fescue	Festuca idahoensis	2	43.25
Bluebunch wheatgrass	Agropyron spicatum	1	17.30
Blue wildrye	Elymus glaucus	2	34.60
Sherman big bluegrass	Poa secunda	1	17.30
Grande ronde basin/trailhead wildrye	Leymus cinereus	2	34.60

Seeding– Zone 4

Common Name	Scientific Name	Rate (lbs/Acre)	Quantity (lbs)
Tufted hairgrass	Deschampsia cespitosa	2	9
Idaho fescue	Festuca idahoensis	2	22.55
Bluebunch wheatgrass	Agropyron spicatum	1	9.02
Blue wildrye	Elymus glaucus	2	22.55
Sherman big bluegrass	Poa secunda	1	9.02
Grande ronde basin/trailhead wildrye	Leymus cinereus	2	18.04

Live Brush Trench

Common Name	Scientific Name	Approx Spacing (FT)	Length (LF)	Units (EA)
McKenzie Willow	Salix Prolixa	See Detail	2026	405
Black Cottonwood	Populus Trichocarpa	See Detail	2026	405
Coyote Willow	Salix Exigua	See Detail	2026	405

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 – PLANTING DETAILS

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TITLE Program Manager–Acting
CSRO (BOISE, IDAHO) 2015-4-30

PLANTING DETAILS

1678–100–2008

SHEET 4 OF 6

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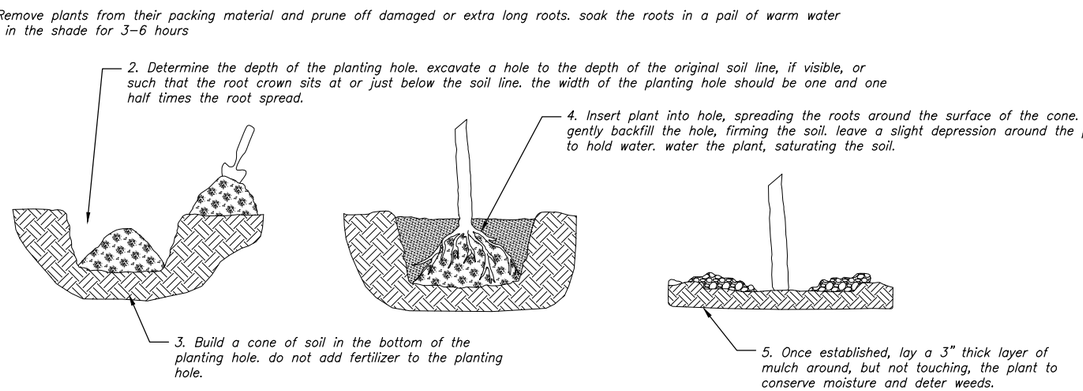
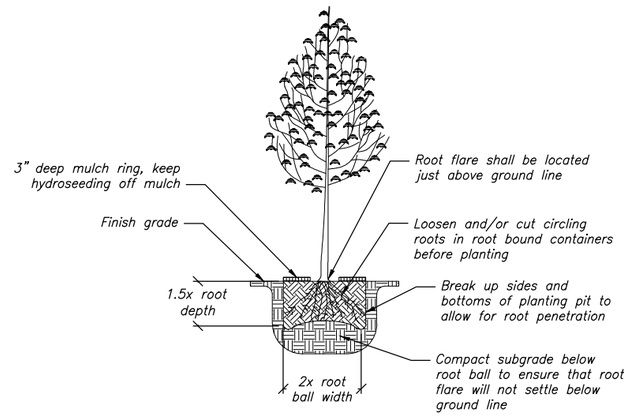


BARE–ROOT PLANTING DETAIL
N.T.S.



TREE PLANTING DETAIL
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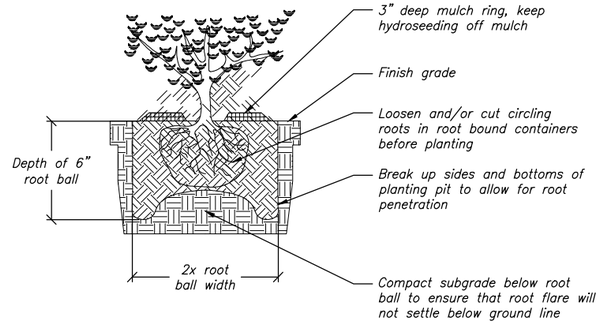

SHRUB PLANTING DETAIL
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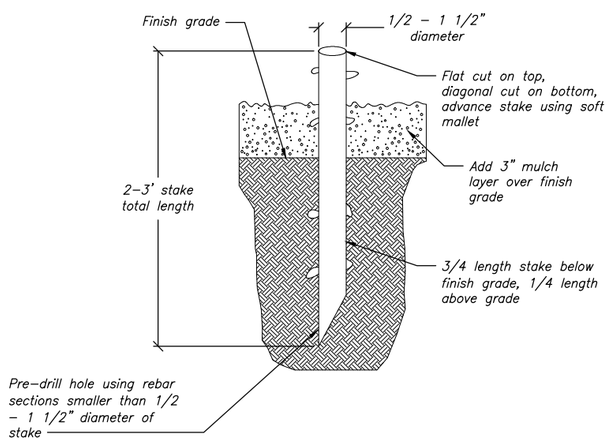
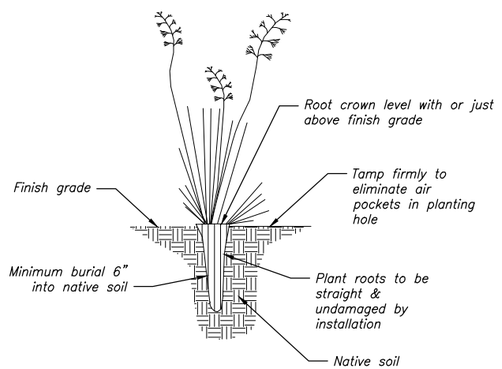


LIVE STAKING DETAIL
N.T.S.



PLUG PLANTING DETAIL
N.T.S.

NOTES:
1. Leaves and root crown to remain undamaged during planting.
2. Create planting hole by driving steel spike into soil and working spike to widen hole.
3. Plant after fall rains have dampened soil unless directed otherwise

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GRANDE RONDE SUBBASIN
CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 – PLANTING DETAILS

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CSRO (BOISE, IDAHO)	2015–04–30

PLANTING DETAILS

1678–100–2009

SHEET 5 OF 6

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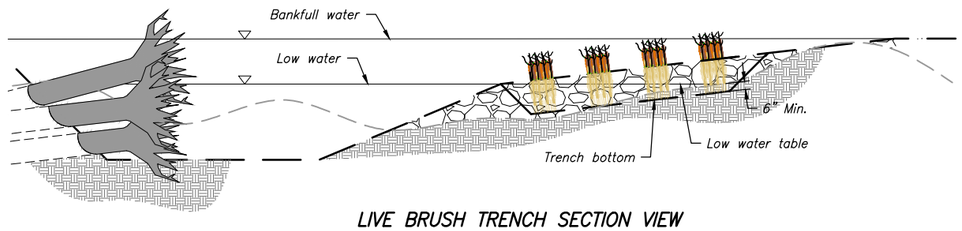
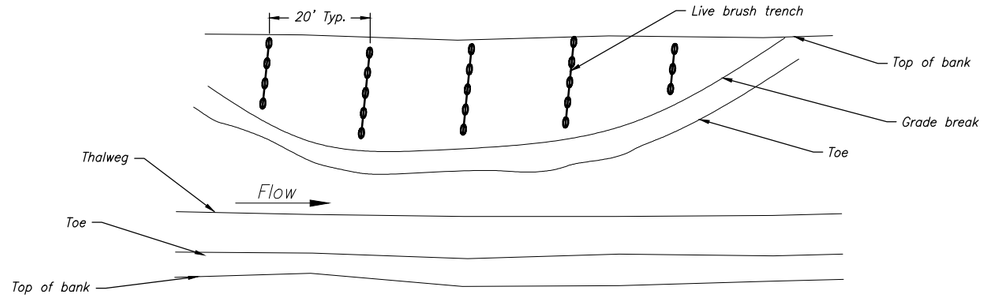
BRUSH TRENCH

Intent of live brush trench is to establish woody vegetation in exposed alluvial surfaces (gravel bars) that have near term roughness provided by dead material consisting of various woody branches from shrubs and trees and long term roughness from live willow growth.

Material is placed facing downstream and angled to resist ice flows for stability. Brush layer is dense enough to capture floating debris and to slow velocities, but no too dense to completely obstruct flow.



LIVE BRUSH TRENCH SECTION VIEW
N.T.S.



LIVE BRUSH TRENCH PLAN VIEW
N.T.S.

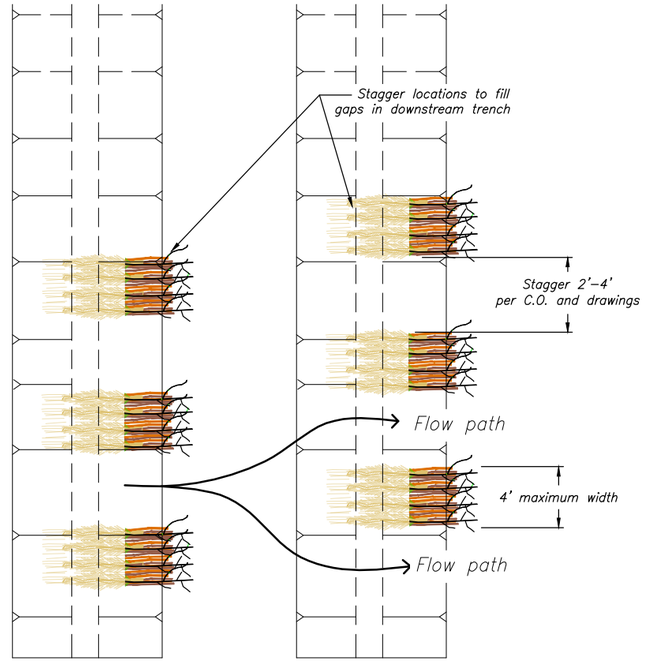


EXAMPLE: LIVE BRUSH TRENCH CONSTRUCTION

NOTE:

Excavator used to pull back material while live willow stakes are placed (Layer 1). Once placed excavator can cover with 6" layer of material then pull back again for placement of dead material layer and finally pull bucket and compact fill.

(Photo courtesy of D. Polster)

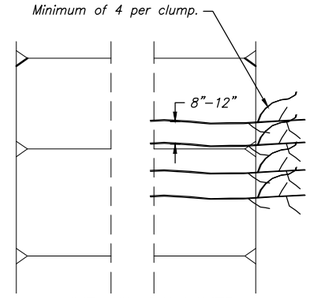


TYPICAL LIVE BRUSH TRENCH PLAN

SCALE OF FEET 0 1 2 3 4 5 6

NOTES:

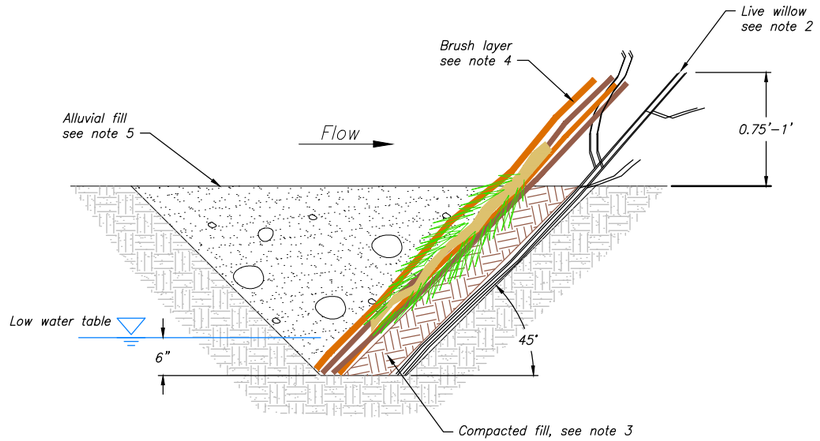
1. *Either excavate hole to 6" below low water table with 45° side slopes, or use excavator to pull back material and place each layer as described in photo caption.*
2. *Place Layer 1 – Live willow stakes 6" below low water table in manner as specified by "live stakes". Place along outside of hole on downstream face at 8"–12"spacing with a minimum of 4 to 10 per excavated hole and as directed by C.O.*
3. *Place 6" layer of material excavated from hole on layer 1 and compact against layer 1 with bucket.*
4. *Place 6" layer of brush consisting of live and dead stems and branches of mixed diameter between 1/2" to 4" and sufficient length to protrude 2'–4' above surface as shown and per C.O.*
5. *Replace excavated material in hole and compact with bucket.*
6. *Blend over any remaining material into floodplain to create rough micro–pockets per C.O.*



LIVE WILLOW LAYER 1
N.T.S.

LIVE STAKES

Live stakes consist of locally harvested willow or cottonwood stakes. Stakes are between approximately 3/4" to 4" in diameter depending upon species and source. Stakes harvested with care and cut to lengths of 3' to 4'. Stakes shall be bundled and submerged in standing water for 5 to 7 days prior to planting. Care should be taken to mark upward or downward ends of stakes (i.e. dipped in latex paint or other) when harvesting such that they are re–planted in the appropriate direction. Harvested live–stakes shall not be allowed to dry–out and must be planted after removal from soaking location. Stakes should be buried by a minimum of 75% of their length and must have some small portion of their top exposed to air.



SECTION A–A

SCALE OF FEET 1 0 1 2 3

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FCRPS HABITAT IMPROVEMENT PROGRAM – IDAHO

GRANDE RONDE SUBBASIN
CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 4 –LIVE BRUSH TRENCH

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CSRO (BOISE, IDAHO)	2015–04–30

LIVE BRUSH TRENCH
PLAN AND SECTIONS

1678–100–2010

SHEET 6 OF 6

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LIVE BRUSH TRENCH.DWG

APPENDIX C

PARCEL 4 PLANTING PLANS

CC44 Phase III Planting Map 1

- 2015 Redd Locations
- Zone 1 - Riparian Potted Plants, 97565 sf.
- Zone 2 - Bank Zone, 51571 sf.
- Zone 3 - Live Cuttings, 8523 sf.
- Zone 4 - Seeding, 332272 sf.
- Willow Trenching, 15826 sf.

Scale

100 0 100 Feet

N

Flow Direction

CC44 Phase III Planting Map 2

- 2015 Redd Locations
- Zone 1 - Riparian Potted Plants, 97565 sf.
- Zone 2 - Bank Zone, 51571 sf.
- Zone 3 - Live Cuttings, 8523 sf.
- Zone 4 - Seeding, 332272 sf.
- Willow Trenching, 15826 sf.

Scale

120 0 120 Feet

Flow Direction

N

APPENDIX D

PARCEL 3 FINAL DESIGN PLANS

GRANDE RONDE SUBBASIN FISH HABITAT RESTORATION

CATHERINE CREEK CC-44 PHASE III HABITAT ENHANCEMENT PLANS - PARCEL 3

CONSTRUCTION DRAWINGS

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PARTNERS:
OREGON DEPARTMENT OF FISH AND WILDLIFE
UNION SOIL AND WATER CONSERVATION DISTRICT
BONNEVILLE POWER ADMINISTRATION

SITE SUMMARY
T4S, R40E, SEC.34
UNION COUNTY, WA.
45°10'10.22"N 117°47'58.49"W





VICINITY MAP
5000 0 5000 10000 15000
SCALE OF FEET



LOCATION MAP
500 0 500 1000 1500
SCALE OF FEET

SHEET	SHEET NUMBER	SHEET TITLE
1	1678-100-2011	COVER SHEET
2	1678-100-2012	GENERAL NOTES & ABBREVIATIONS
3	1678-100-2013	SURVEY CONTROL
4	1678-100-2014	EXISTING CONDITIONS - PARCEL 3
5	1678-100-2015	PROPOSED CONDITIONS - PARCEL 3
6	1678-100-2016	ACCESS & STAGING - YEAR 1 5+00 TO 33+00
7	1678-100-2017	ACCESS & STAGING - YEAR 1 33+00 TO 55+00
8	1678-100-2018	ACCESS & STAGING - YEAR 2 5+00 TO 33+00
9	1678-100-2019	ACCESS & STAGING - YEAR 2 33+00 TO 55+00
10	1678-100-2020	ACCESS & STAGING - STOCKPILE & TEMPORARY BRIDGE DETAILS
11	1678-100-2021	DEWATERING PLAN - YEAR 1 0+00 TO 32+00
12	1678-100-2022	DEWATERING PLAN - YEAR 1 32+00 TO 48+50
13	1678-100-2023	DEWATERING PLAN - UPSTREAM CONNECTION
14	1678-100-2024	DEWATERING PLAN - MIDDLE CONNECTION
15	1678-100-2025	DEWATERING PLAN - DOWNSTREAM CONNECTION
16	1678-100-2026	DEWATERING PLAN - DEWATERING DETAILS
17	1678-100-2027	DEWATERING PLAN - CHANNEL DIVERSION PROCEDURE
18	1678-100-2028	EARTHWORK CUT & FILL AREAS
19	1678-100-2029	GRADING PLAN OVERVIEW - PARCEL 3
20	1678-100-2030	GRADING PLAN - STA 6+00 TO 21+00
21	1678-100-2031	GRADING PLAN - STA 21+00 TO 34+00
22	1678-100-2032	GRADING PLAN - STA 34+00 TO 50+00
23	1678-100-2033	GRADING PLAN - STA 50+00 TO 60+00
24	1678-100-2034	GRADING PLAN - IRRIGATION DITCH FILL
25	1678-100-2035	GRADING PLAN - IRRIGATION DITCH FILL
26	1678-100-2036	GRADING PLAN - IRRIGATION DITCH FILL
27	1678-100-2037	MAIN CHANNEL PLAN & PROFILE-STA 5+00-10+00
28	1678-100-2038	MAIN CHANNEL PLAN & PROFILE-STA 10+00-15+00
29	1678-100-2039	MAIN CHANNEL PLAN & PROFILE-STA 15+00-19+50
30	1678-100-2040	MAIN CHANNEL PLAN & PROFILE-STA 19+50-25+00
31	1678-100-2041	MAIN CHANNEL PLAN & PROFILE-STA 25+00-30+00
32	1678-100-2042	MAIN CHANNEL PLAN & PROFILE-STA 30+00-35+00
33	1678-100-2043	MAIN CHANNEL PLAN & PROFILE-STA 35+00-40+00
34	1678-100-2044	MAIN CHANNEL PLAN & PROFILE-STA 40+00-45+00
35	1678-100-2045	MAIN CHANNEL PLAN & PROFILE-STA 45+00-49+85
36	1678-100-2046	MAIN CHANNEL PLAN & PROFILE-STA 49+85-51+50
37	1678-100-2047	MAIN CHANNEL CROSS SECTIONS-STA 6+50-9+25
38	1678-100-2048	MAIN CHANNEL CROSS SECTIONS-STA 9+55-12+00
39	1678-100-2049	MAIN CHANNEL CROSS SECTIONS-STA 12+45-15+30
40	1678-100-2050	MAIN CHANNEL CROSS SECTIONS-STA 15+90-20+80
41	1678-100-2051	MAIN CHANNEL CROSS SECTIONS-STA 21+13-24+90
42	1678-100-2052	MAIN CHANNEL CROSS SECTIONS-STA 26+05-29+25
43	1678-100-2053	MAIN CHANNEL CROSS SECTIONS-STA 30+02-33+20
44	1678-100-2054	MAIN CHANNEL CROSS SECTIONS-STA 33+50-35+94
45	1678-100-2055	MAIN CHANNEL CROSS SECTIONS-STA 36+30-38+92
46	1678-100-2056	MAIN CHANNEL CROSS SECTIONS-STA 39+40-41+45
47	1678-100-2057	MAIN CHANNEL CROSS SECTIONS-STA 42+25-45+70
48	1678-100-2058	MAIN CHANNEL CROSS SECTIONS-STA 46+05-49+45
49	1678-100-2059	MAIN CHANNEL - CROSS SECTIONS - STA 49+97

SHEET	SHEET NUMBER	SHEET TITLE
50	1678-100-2060	SOD SALVAGE AREAS - PLAN
51	1678-100-2061	TOPSOIL PLACEMENT AREAS - PLAN
52	1678-100-2062	TYPICAL POINT BAR POOL DETAIL - SECTION
53	1678-100-2063	RIFFLE AND GLIDE CONSTRUCTION - DETAILS
54	1678-100-2064	EXISTING CHANNEL FILL - PLAN & SECTIONS
55	1678-100-2065	EXISTING CHANNEL FILL - PLAN & SECTIONS
56	1678-100-2066	EXISTING CHANNEL FILL - PLAN & SECTIONS
57	1678-100-2067	EXCESS FILL AREA - DETAILS
58	1678-100-2068	SIDE CHANNEL 1 - PLAN, PROFILE, & SECTIONS
59	1678-100-2069	SIDE CHANNEL 1 - PLAN, & PROFILE
60	1678-100-2070	SIDE CHANNEL 1 - PLAN, & PROFILE
61	1678-100-2071	SIDE CHANNEL 1 - CROSS SECTIONS
62	1678-100-2072	SIDE CHANNEL 2 - PLAN & PROFILE
63	1678-100-2073	SIDE CHANNEL 2 - SECTIONS
64	1678-100-2074	FLOOD SWALE COMPLEX 1 - PLAN
65	1678-100-2075	FLOOD SWALE COMPLEX 1 - SWALE A & CHANNEL A PLAN & PROFILE
66	1678-100-2076	FLOOD SWALE COMPLEX 1 - SWALE A & CHANNEL A PLAN & PROFILE
67	1678-100-2077	FLOOD SWALE COMPLEX 1 - SWALE B & CHANNEL B PLAN & PROFILE
68	1678-100-2078	FLOOD SWALE COMPLEX 1 - CHANNEL C & CHANNEL D PLAN & PROFILE
69	1678-100-2079	FLOOD SWALE COMPLEX 1 - SECTION VIEW
70	1678-100-2080	FLOOD SWALE COMPLEX 1 - SECTION VIEW
71	1678-100-2081	FLOOD SWALE COMPLEX 1 - SECTION VIEW
72	1678-100-2082	FLOOD SWALE COMPLEX 2 - PLAN
73	1678-100-2083	FLOOD SWALE COMPLEX 2 - SWALE A & CHANNEL A PLAN & PROFILE
74	1678-100-2084	FLOOD SWALE COMPLEX 2 - SWALE B & CHANNEL B PLAN & PROFILE
75	1678-100-2085	FLOOD SWALE COMPLEX 2 - SWALE C & CHANNEL C PLAN & PROFILE
76	1678-100-2086	FLOOD SWALE COMPLEX 2 - SWALE D, SWALE E, & CHANNEL D PLAN & PROFILE
77	1678-100-2087	FLOOD SWALE COMPLEX 2-SWALE A-SECTION VIEW
78	1678-100-2088	FLOOD SWALE COMPLEX 2-SWALE B & C-SECTION VIEW
79	1678-100-2089	FLOOD SWALE COMPLEX 2-SWALE D & E - SECTION VIEW
80	1678-100-2090	FLOOD SWALE COMPLEX 3 - PLAN
81	1678-100-2091	FLOOD SWALE COMPLEX 3 - SWALE A & CHANNEL A PLAN & PROFILE
82	1678-100-2092	FLOOD SWALE COMPLEX 3 - SWALES B & C, CHANNEL B - PLAN & PROFILE
83	1678-100-2093	FLOOD SWALE COMPLEX 3 - SWALES A, B, & C - SECTION VIEW
84	1678-100-2094	FLOOD SWALE 4 - PLAN
85	1678-100-2095	FLOOD SWALE 4 - SWALE A & CHANNEL A PLAN & PROFILE
86	1678-100-2096	FLOOD SWALE 4 - SWALE B, CHANNEL B, & ALCOVE 2 PLAN & PROFILE
87	1678-100-2097	FLOOD SWALE 4 - SWALE C & CHANNEL C PLAN & PROFILE
88	1678-100-2098	FLOOD SWALE 4 - SWALE D & E PLAN & PROFILE
89	1678-100-2099	FLOOD SWALE 4 SWALE A SECTIONS
90	1678-100-2100	FLOOD SWALE 4 SWALE B SECTIONS
91	1678-100-2101	FLOOD SWALE 4 SWALE C SECTIONS
92	1678-100-2102	FLOOD SWALE 4 SWALE D & E SECTIONS

SHEET	SHEET NUMBER	SHEET TITLE
93	1678-100-2103	FLOOD SWALE 5 - PLAN
94	1678-100-2104	FLOOD SWALE 5 - CHANNEL A PLAN & PROFILE
95	1678-100-2105	FLOOD SWALE 5 - CHANNEL A PLAN & PROFILE
96	1678-100-2106	FLOOD SWALE 5 - CHANNEL B & C PLAN & PROFILE
97	1678-100-2107	FLOOD SWALE 5 - CHANNEL A SECTIONS
98	1678-100-2108	FLOOD SWALE 5 - CHANNEL B & C SECTIONS
99	1678-100-2109	FLOOD SWALE COMPLEX 6 - PLAN
100	1678-100-2110	FLOOD SWALE COMPLEX 6 - SWALE A & CHANNEL A PLAN & PROFILE
101	1678-100-2111	FLOOD SWALE COMPLEX 6 - SWALE B & CHANNEL B - PLAN & PROFILE
102	1678-100-2112	FLOOD SWALE COMPLEX 6 - SWALE A & SWALE B SECTIONS
103	1678-100-2113	ALCOVE 1 DETAILS - PLAN, PROFILE, & SECTIONS
104	1678-100-2114	ALCOVE 3 DETAILS - PLAN, PROFILE, & SECTIONS
105	1678-100-2115	EXISTING CHANNEL FILL PLUGS & BLIND CHANNEL DETAILS
106	1678-100-2116	LWM PLAN - YEAR 1 2+50 TO 13+00
107	1678-100-2117	LWM PLAN - YEAR 1 13+00 TO 23+00
108	1678-100-2118	LWM PLAN - YEAR 1 23+00 TO 33+00
109	1678-100-2119	LWM PLAN - YEAR 1 33+00 TO 44+50
110	1678-100-2120	LWM PLAN - YEAR 1 44+50 TO 51+00
111	1678-100-2121	LWM PLAN - YEAR 1 SIDE CHANNEL 1
112	1678-100-2122	LWM PLAN - YEAR 1 SIDE CHANNEL 1
113	1678-100-2123	LWM PLAN - YEAR 2 3+00 TO 14+25
114	1678-100-2124	LWM PLAN - YEAR 2 14+25 TO 25+00
115	1678-100-2125	LWM PLAN - YEAR 2 25+00 TO 35+50
116	1678-100-2126	LWM PLAN - YEAR 2 35+50 TO 44+00
117	1678-100-2127	LWM PLAN - YEAR 2 46+25 TO 57+00
118	1678-100-2128	LWM DETAILS - UPSTREAM BEND COMPONENT
119	1678-100-2129	LWM DETAILS - UPSTREAM BEND COMPONENT
120	1678-100-2130	LWM DETAILS - MIDDLE BEND COMPONENT
121	1678-100-2131	LWM DETAILS - MIDDLE BEND COMPONENT
122	1678-100-2132	LWM DETAILS - MIDDLE BEND COMPONENT
123	1678-100-2133	LWM DETAILS - DOWNSTREAM BEND COMPONENT
124	1678-100-2134	LWM DETAILS - DOWNSTREAM BEND COMPONENT
125	1678-100-2135	LWM DETAILS - DOWNSTREAM BEND COMPONENT
126	1678-100-2136	LWM DETAILS - SMALL APEX JAM
127	1678-100-2137	LWM DETAILS - SIDE CHANNEL 1 INLET STRUCTURE
128	1678-100-2138	LWM DETAILS - SIDE CHANNEL 1 INLET STRUCTURE
129	1678-100-2139	LWM DETAILS - STREAMBANK HABITAT STRUCTURE
130	1678-100-2140	LWM DETAILS - STREAMBANK HABITAT STRUCTURE
131	1678-100-2141	LWM DETAILS - SWEEPER LOG STRUCTURE
132	1678-100-2142	LWM DETAILS - SWEEPER LOG STRUCTURE
133	1678-100-2143	LWM DETAILS - HIGH ENERGY BANK STRUCTURE
134	1678-100-2144	LWM DETAILS - HIGH ENERGY BANK STRUCTURE
135	1678-100-2145	LWM DETAILS - HIGH ENERGY BANK STRUCTURE
136	1678-100-2146	LWM DETAILS - LARGE APEX JAM
137	1678-100-2147	LWM DETAILS - ON SITE WALNUT TREE & BANK LOG WITH BOULDERS
138	1678-100-2148	LWM DETAILS -LARGE GRAVEL BAR TREE
139	1678-100-2149	LWM DETAILS - BANK ROUGHNESS ELEMENTS
140	1678-100-2150	LWM DETAILS - FLOODPLAIN ROUGHNESS ELEMENTS
141	1678-100-2151	LWM DETAILS - BRUSH MATTRESS & EDGE ROUGHNESS

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

Joy B. Hovde
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JH/TKK
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Mike Knutson P.E.
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Joy B. Hovde P.E.
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BOISE, IDAHO 2015-09-14

COVER SHEET

1678-100-2011
SHEET 1 OF 2

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KKOHRMAS

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GENERAL NOTES:

1. Work shown on these plans will be performed for the Confederated Tribes of the Umatilla Indian Reservation (CTUIR), herein referred to as "Contracting Agency." Contact information for Contracting Agency's representative is included on Sheet 1678-100-2011. Contracting Agency's representative (or other persons assigned by Contracting Agency to act as Contracting Agency's representative) are herein referred to as the "Contracting Officer."
2. The drawings contained within should not be applied to any project except the one specified; specifically the habitat enhancements on Catherine Creek within the project boundary for CC-44 PHASE III – Parcel 3 as seen on the cover sheet.
3. The Contractor shall construct the stream enhancement in accordance with the plans stamped "Approved for Construction." These plans will be provided to the Contractor by the Contracting Agency prior to construction. Work shall not be done without the current set of approved construction plans.
4. The enhancement designs depicted herein are approximate and are intended to express the overall design intent of the project. These designs may need to be adjusted in the field during construction in order to meet the specific site conditions and intended function. Adjustments are to be authorized by the Contracting Officer after consensus with the "Engineer".
5. Elevations and distances shown are in feet and decimals.
6. Horizontal datum is US State Plane Coordinate System, Oregon North Zone, NAD 83, International Feet. The vertical datum is NAVD 88, feet.
7. Topographic mapping within stream banks of the project area is based on surveys performed with ground survey equipment. Topographic mapping outside of the stream banks is based on LiDAR imaging. Due to continued evolution of the channel, the geometry of the stream at the time of construction could be different than shown on these plans.
8. Existing underground utility locations have not been completely identified and may not be shown on these plans. The Contractor is responsible to locate utilities prior to construction and protect utilities during construction. The telephone number for the one call center for utility locates is 1-800-424-5555.
9. The Contractor shall pursue work in a continuous and diligent manner to ensure a timely completion of the project.
10. The Contractor shall be responsible for the general safety during construction, and all work shall conform to pertinent safety regulations and codes. The Contractor shall be solely and completely responsible for compliance with all applicable provisions of OSHA and OAR Chapter 437, in the construction practices for all employees directly engaged in the construction of this project.
11. All material and workmanship furnished on or for the project must meet the minimum requirements of project permits, approving agencies, specifications as set forth herein, or whichever is more restrictive.
12. Contractor shall be responsible for obtaining, at Contractor's expense, all construction permits as required by local, state and federal agencies. Contractor shall provide all material, labor, and equipment required to comply with all applicable permit conditions and requirements.
13. Contractor shall confirm the access point, route(s), and locations of temporary staging and storage areas with the Contracting Officer prior to transporting materials and equipment to the project site.
14. Prior to commencement of work, Contractor shall provide the Contracting Agency with a detailed construction schedule and work plan for approval. The Contractor shall not begin any construction work until the project schedule and work plan is approved by the Contracting Officer.
15. All construction shall be closely coordinated with the Contracting Officer so that the quality of work can be checked for approval.
16. All work within the actively flowing channel or side channels of Catherine Creek shall occur only within the allowable fish window (July 1 – August 15).
17. Anytime work occurs within the actively flowing channel, the Contractor shall monitor turbidity in the creek once per hour at a location 100 feet downstream of the construction activity using turbidity monitoring equipment provided by the Contracting Officer. Turbidity in the creek shall be limited to the levels listed in the permits and specifications, and the Contractor shall modify work procedures if necessary as listed in the specifications. The Contracting Officer will assist the Contractor during initial measurements to ensure the Contractor is using the testing equipment correctly, however, the Contractor will be responsible to perform all measurements and maintain a log that documents the dates, times, and turbidity levels of all measurements taken.
18. The Contractor shall notify the Contracting Officer a minimum of 5 working days in advance of in-channel work and work area isolation to coordinate fish removal. The Contracting Agency will be responsible for all fish removal and handling.
19. Fish exclusion shall be conducted in this project area prior to any dewatering activities or construction within or directly connected to the existing channel of Catherine Creek. Fish exclusion shall be conducted by the Contracting Agency.
20. The Contractor shall install and maintain appropriate sediment control devices throughout the project site, including the construction staging area and stockpile area throughout the projects' construction. Temporary construction and permanent erosion control measures shall be designed, constructed and maintained in accordance with all applicable local, state and federal regulations.
21. Dewatering of work areas shall be performed to the extent that at LWM structures standing water is no deeper than the diameter of the log(s) on the lowest layer of the structure, and at constructed channel areas the depth of water in the work zone is shallow enough so that the Contracting Officer can easily verify the finished channel bed elevation. Discharge from dewatering within the work area shall be routed to floodplain areas to allow the removal of fine sediments or other contaminant prior to reentering Catherine Creek. All pumps used in the active channel by the Contractor for dewatering of areas in or directly connected to the actively flowing creek channel shall have screened intakes that meet Oregon Department of Fish and Wildlife specifications and National Oceanic and Atmospheric Administration (NOAA) juvenile fish screening criteria. All dewatering during Year 1 will not require screened intakes.
22. Discharges entering active streams on site shall satisfy all state and federal standards and project permit requirements for contaminants and turbidity.
23. Construction shall minimize disturbance to and maximize reuse of existing riparian vegetation per the sod salvage areas shown on the plans.
24. All excavated soil not used as part of channel or floodplain construction shall be disposed of on-site at locations shown on these drawings or as directed by the Contracting Officer.
25. The Engineers responsible for the preparation of these drawings and specifications will not be responsible for, or liable for, unauthorized changes to, or use of, these drawings. All changes to constructed features that varies from the drawings and specifications must be in writing and approved by the Engineer responsible for the preparations of the drawings and specifications.
26. Record Drawings (as-built drawings) shall be accurately recorded by the Contractor for future use, reference and monitoring. The Contractor shall be responsible to accurately record any alterations from the Construction Documents with red pen on a set of hand marked record drawings. Submittal of Record Drawings is a condition of final acceptance.

ABBREVIATIONS

T	Township	STA, Sta.	Station
R	Range	O.G.	Original Grade
Sec.	Section	F.G.	Finished Grade
ID	Idaho	OHW	Ordinary High Water
OR	Oregon	WSE	Water Surface Elevation
U.S.	United States	CY	Cubic Yard
NAD	North American Datum	SY	Square Yard
NAVD	North American Vertical Datum	LF	Linear Feet
FCRPS	Federal Columbia River Power System		
CSRO	Columbia-Snake Salmon Recovery Office		
OSHA	Occupational Safety and Health Administration		
OAR	Oregon Administrative Rules		
CP	Control Point		

SUMMARY OF QUANTITIES (Year 1 and Year 2)

BID ITEM	YEAR 1 QTY	YEAR 2 QTY	TOTAL QTY	UNIT	DESCRIPTION
1	1	1	2	Lump Sum	Mobilization and Demobilization
2	1	1	2	Lump Sum	Environmental Controls (SWPPP, ESC, Etc.)
3	1	1	2	Lump Sum	Temporary Haul Roads
4	1000	1000	2000	SY	Temporary Access Road Stabilization
5	–	2	2	Each	Temporary Bridge Crossing
6	–	1	1	Lump Sum	Cofferdams and Temporary Diversion Dams
7	1	1	2	Lump Sum	Dewatering
8	3	10	13	Acre	Site Clearing
9	22473	8671	31144	CY	Floodplain Excavation (includes SC1, SC2, ALC1, ALC3, SWC1 to SWC6)
10	21027	2667	23694	CY	Main Channel Excavation
11	5102	–	5102	CY	Riffle Overexcavation
12	5102	–	5102	CY	Riffle Material Screening
13	5102	–	5102	CY	Riffle Construction
14	615	49314	49929	CY	Excavated Material Placed and Compacted as Fill
15	400	–	400	Each	In-Channel Habitat Boulders
16	38	5	43	Each	Three log Bank Roughness Element
17	9	–	9	Each	Tree Top Bank Roughness Element
18	12	4	16	Each	Upstream Bend Component
19	17	2	19	Each	Middle Bend Component
20	10	2	12	Each	Downstream Bend Component
21	5	1	6	Each	Small Apex Jam
22	10	7	17	Each	Large Gravel Bar Tree
23	1	–	1	Each	Side Channel 1 Inlet Structure
24	2	4	6	Each	Streambank Habitat Structure
25	3	2	5	Each	Sweeper Log Structure
26	3	1	4	Each	High Energy Bank Structure
27	–	4	4	Each	Onsite Walnut Tree Placement
28	–	1	1	Each	Large Apex Jam
29	–	2	2	Each	Bank Log with Boulders
30	465	105	570	LF	Edge Roughness
31	755	695	1450	LF	Brush Mattress
32	100	100	200	Each	Two log Floodplain Roughness Element
33	18	24	42	Each	Single Log With Rootwad on Floodplain
34	100	100	200	Each	Tree Top With Branches on Floodplain
35	28	78	106	Each	Tree Top Floodplain Roughness Element
36	150	50	200	Each	Large Racking Member (12"-8")
37	150	50	200	Each	Small Racking Member (8"-4")
38	2000	1000	3000	CY	Slash Material
39	20	20	40	Acre	Straw Mulch
40	1	1	2	Lump Sum	Site Cleanup
41	8611	2264	10875	CY	Sod Salvage, Maintain, and Transplant
42	20	20	40	Hours	Track Hoe (300 Series)
43	80	80	160	Hours	Track Hoe (200 Series)
44	60	60	120	Hours	Dozer (D5 or D6)
45	40	40	80	Hours	Dump Truck (Off-road)
46	20	20	40	Hours	End Dump (30-Foot)

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

Jay B. Hovde
DESIGNED
JH/KK
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Mike Knutson P.E.
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BOISE, IDAHO 2015-09-14

GENERAL NOTES AND ABBREVIATIONS

1678-100-2012

SHEET 2 OF 2

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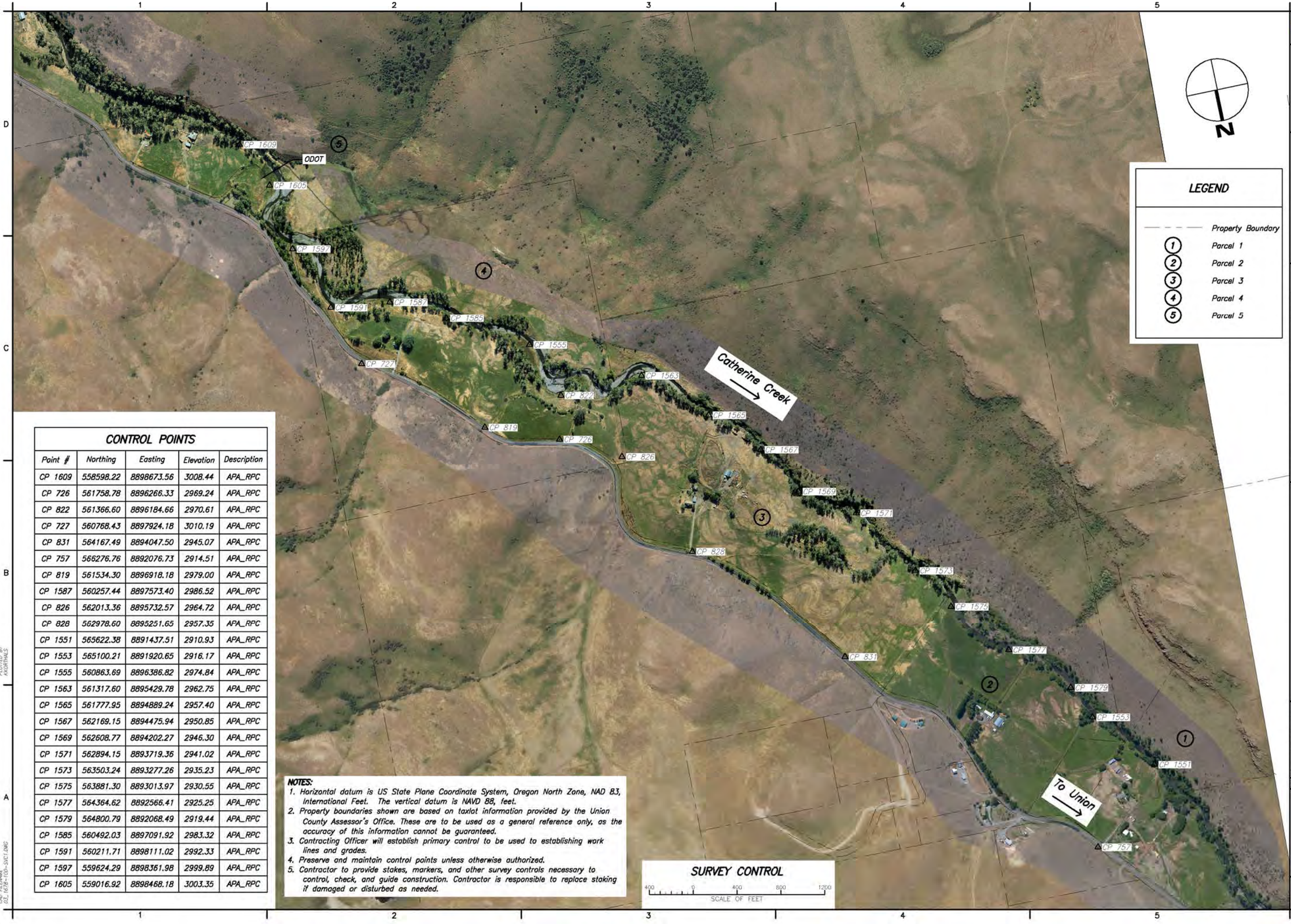

CONTROL POINTS

Point #	Northing	Easting	Elevation	Description
CP 1609	558598.22	8898673.56	3008.44	APA_RPC
CP 726	561758.78	8896266.33	2969.24	APA_RPC
CP 822	561366.60	8896184.66	2970.61	APA_RPC
CP 727	560768.43	8897924.18	3010.19	APA_RPC
CP 831	564167.49	8894047.50	2945.07	APA_RPC
CP 757	566276.76	8892076.73	2914.51	APA_RPC
CP 819	561534.30	8896918.18	2979.00	APA_RPC
CP 1587	560257.44	8897573.40	2986.52	APA_RPC
CP 826	562013.36	8895732.57	2964.72	APA_RPC
CP 828	562978.60	8895251.65	2957.35	APA_RPC
CP 1551	565622.38	8891437.51	2910.93	APA_RPC
CP 1553	565100.21	8891920.65	2916.17	APA_RPC
CP 1555	560863.69	8896386.82	2974.84	APA_RPC
CP 1563	561317.60	8895429.78	2962.75	APA_RPC
CP 1565	561777.95	8894889.24	2957.40	APA_RPC
CP 1567	562169.15	8894475.94	2950.85	APA_RPC
CP 1569	562608.77	8894202.27	2946.30	APA_RPC
CP 1571	562894.15	8893719.36	2941.02	APA_RPC
CP 1573	563503.24	8893277.26	2935.23	APA_RPC
CP 1575	563881.30	8893013.97	2930.55	APA_RPC
CP 1577	564364.62	8892566.41	2925.25	APA_RPC
CP 1579	564800.79	8892068.49	2919.44	APA_RPC
CP 1585	560492.03	8897091.92	2983.32	APA_RPC
CP 1591	560211.71	8898111.02	2992.33	APA_RPC
CP 1597	559624.29	8898361.98	2999.89	APA_RPC
CP 1605	559016.92	8898468.18	3003.35	APA_RPC

NOTES:

1. Horizontal datum is US State Plane Coordinate System, Oregon North Zone, NAD 83, International Feet. The vertical datum is NAVD 88, feet.
2. Property boundaries shown are based on taxlot information provided by the Union County Assessor's Office. These are to be used as a general reference only, as the accuracy of this information cannot be guaranteed.
3. Contracting Officer will establish primary control to be used to establishing work lines and grades.
4. Preserve and maintain control points unless otherwise authorized.
5. Contractor to provide stakes, markers, and other survey controls necessary to control, check, and guide construction. Contractor is responsible to replace staking if damaged or disturbed as needed.

SURVEY CONTROL

400 0 400 800 1200
SCALE OF FEET

LEGEND

- Property Boundary
- (1) Parcel 1
- (2) Parcel 2
- (3) Parcel 3
- (4) Parcel 4
- (5) Parcel 5

N

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

Jay B. Hovde
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Mike Knutson P.E.
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Jay B. Hovde P.E.
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BOISE, IDAHO 2015-09-14

SURVEY CONTROL

1678-100-2013

SHEET 1 OF 1

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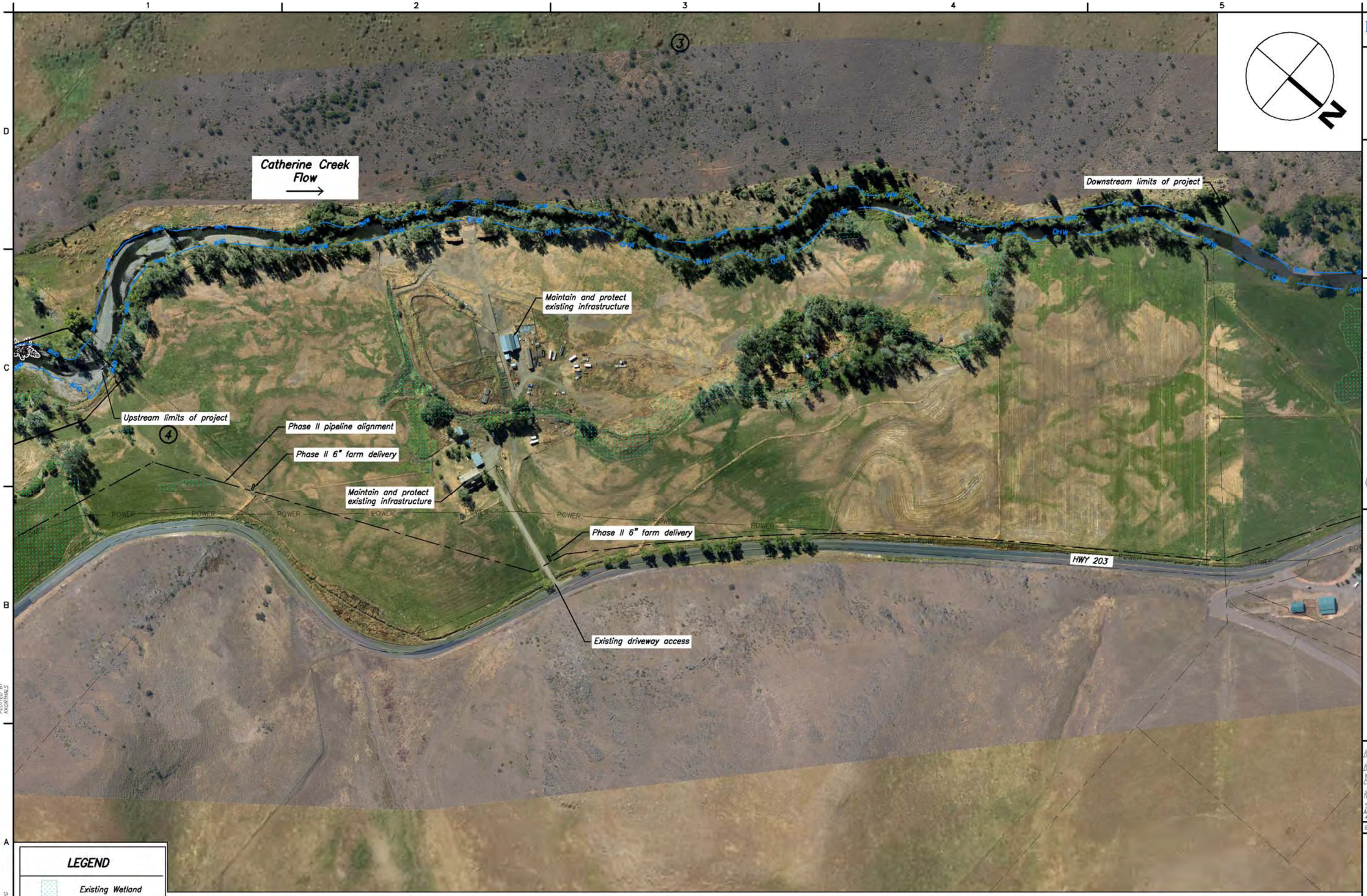

EXISTING CONDITIONS
PARCEL 3

150 0 150 300 450
SCALE OF FEET

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BOISE, IDAHO 2015-09-14

EXISTING CONDITIONS

PLAN

1678-100-2014
SHEET 1 OF 1

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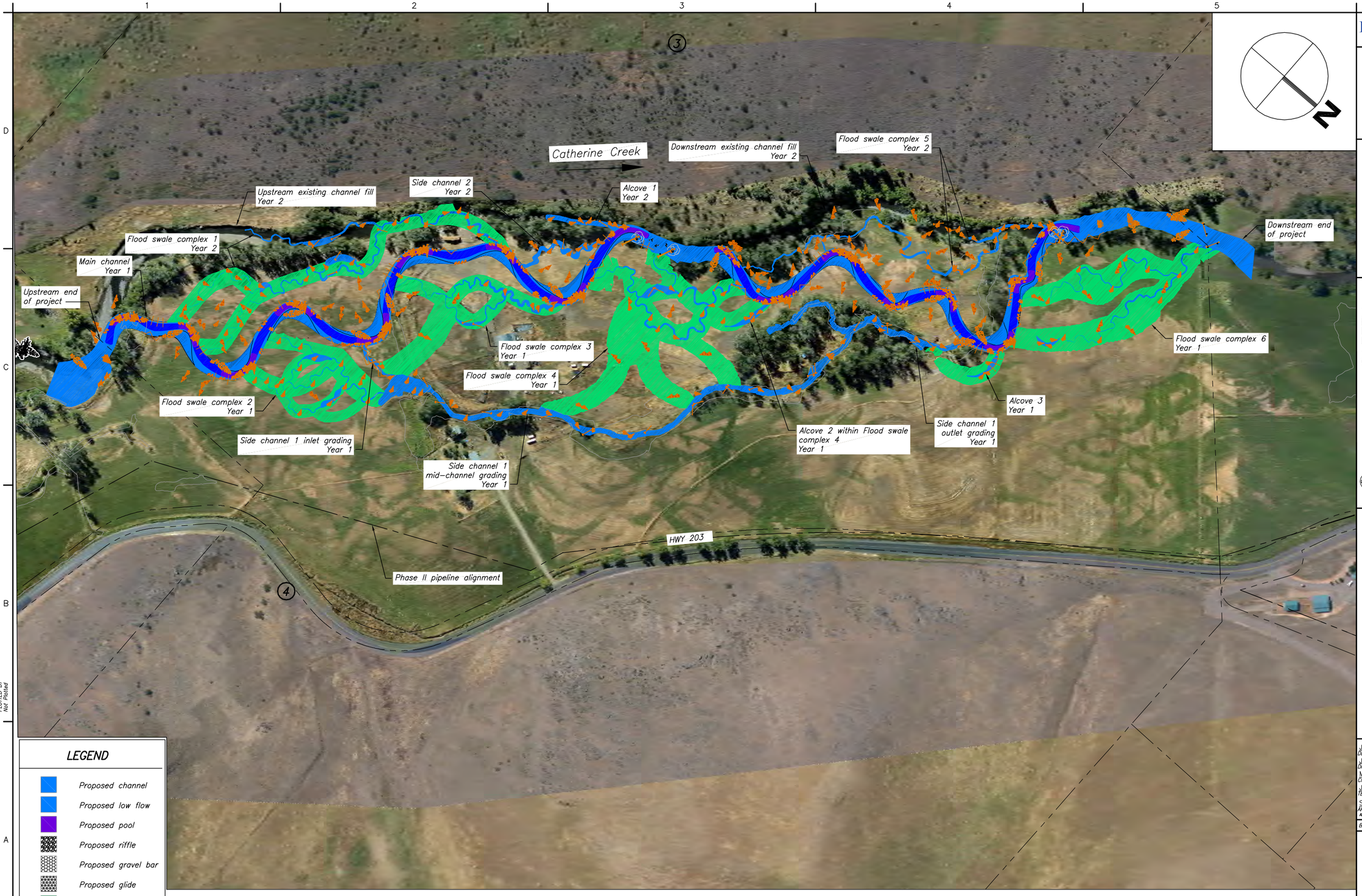

LEGEND

- Proposed channel
- Proposed low flow
- Proposed pool
- Proposed riffle
- Proposed gravel bar
- Proposed glide
- Proposed swale
- Large Woody Material
- Parcel Boundary

PROPOSED CONDITIONS
PARCEL 3

150 0 150 300 450
SCALE OF FEET

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Managing Water in the West

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BUREAU OF RECLAMATION
COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

Jeffrey J Fealko P.E.
DESIGNED
JJF
DRAWN
Mike Knutson P.E.
CHECKED
Jay B Hovde P.E.
TECH. APPR.
Steve Montague-Acting
APPROVED
ADMIN. APPROVAL - PROGRAM MANAGER

BOISE, IDAHO 2015-09-14

PROPOSED CONDITIONS

PLAN

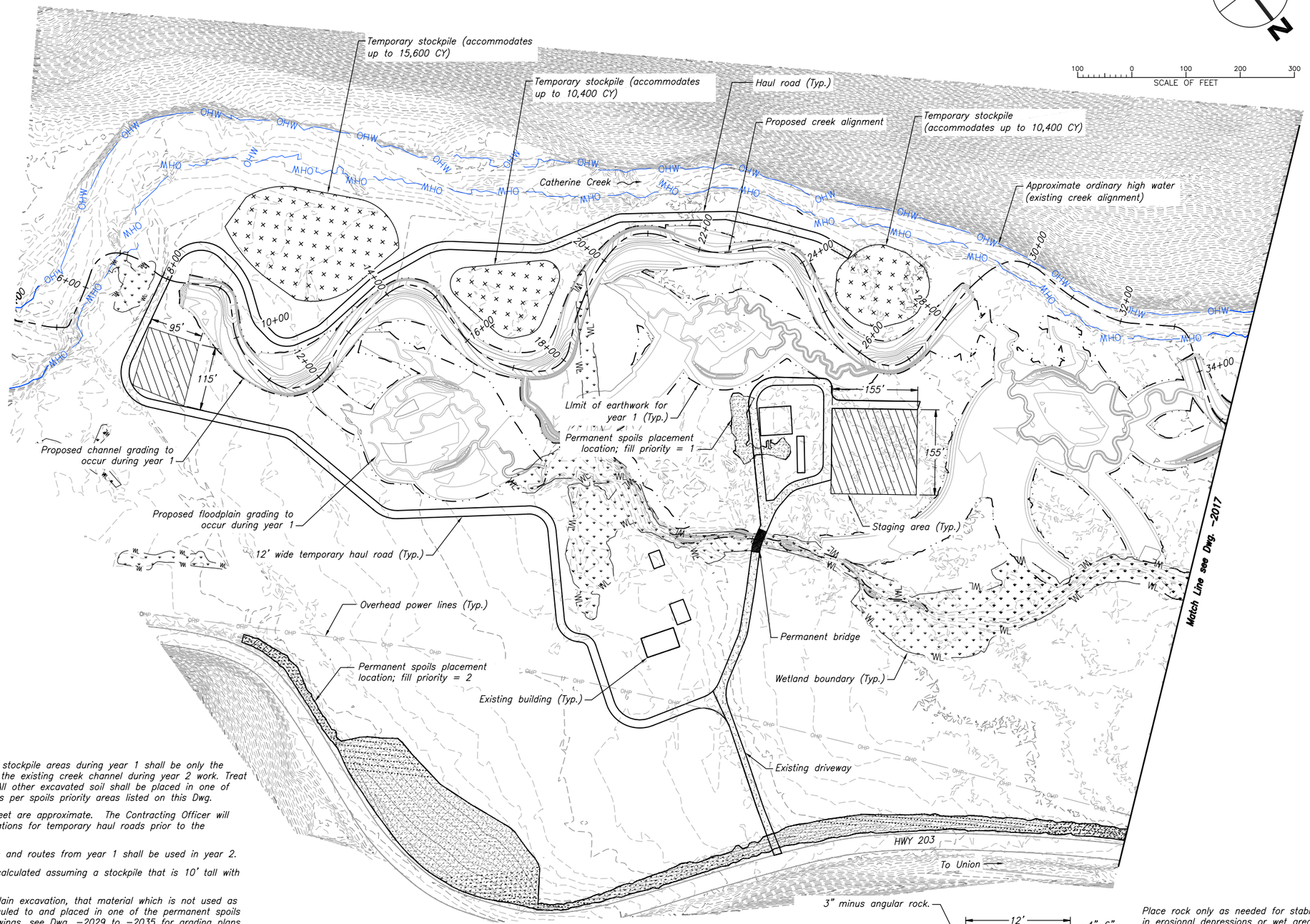
1678-100-2015
SHEET 1 OF 1

DATE AND TIME PLOTTED
Not Plotted
PLOTTED BY
Not Plotted

CAD SYSTEM
AUTOCAD
CAD FILENAME
UNKNOWN

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2006
MARTIN K. FISHER
9/1/15

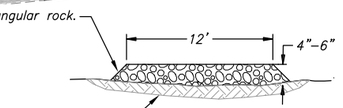
RENEWAL DATE: 12/31/2015



NOTES:

1. Material placed in designated temporary stockpile areas during year 1 shall be only the material necessary for fill placement in the existing creek channel during year 2 work. Treat stockpiles as shown on Dwg. -2020. All other excavated soil shall be placed in one of the permanent spoils placement locations per spoils priority areas listed on this Dwg.
2. Temporary haul roads shown on this sheet are approximate. The Contracting Officer will stake or similarly identify the exact locations for temporary haul roads prior to the beginning of construction.
3. Whenever possible, temporary haul roads and routes from year 1 shall be used in year 2.
4. Volumes for temporary stockpiles were calculated assuming a stockpile that is 10' tall with 2:1 side slopes.
5. All excess soil from channel and floodplain excavation, that material which is not used as fill to construct the project, shall be hauled to and placed in one of the permanent spoils placement location shown on these Drawings, see Dwg. -2029 to -2035 for grading plans. Permanent spoils placement locations are listed on these Drawings with labels that identify the order of preference for use. Priority 1 area shall be completely filled before any fill is placed in priority 2 area, etc.
6. Dust control shall be implemented during the entire length of the project. Spray haul roads with water as needed to prevent dust generation. Dewatering water from isolated work areas that has passed through fish screens may be used for dust control as approved by the Contracting Officer.

YEAR 1 STA. 5+00 TO 35+00



STABILIZED HAUL ROAD DETAIL
NTS

Place rock only as needed for stabilization in erosional depressions or wet areas along haul roads.

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

A. NELSON
DRAWN

X Jay Hovde
ACCEPTED
NAME
TITLE

BOISE, ID 2015-09-11

ACCESS & STAGING

YEAR 1
5+00 TO 35+00

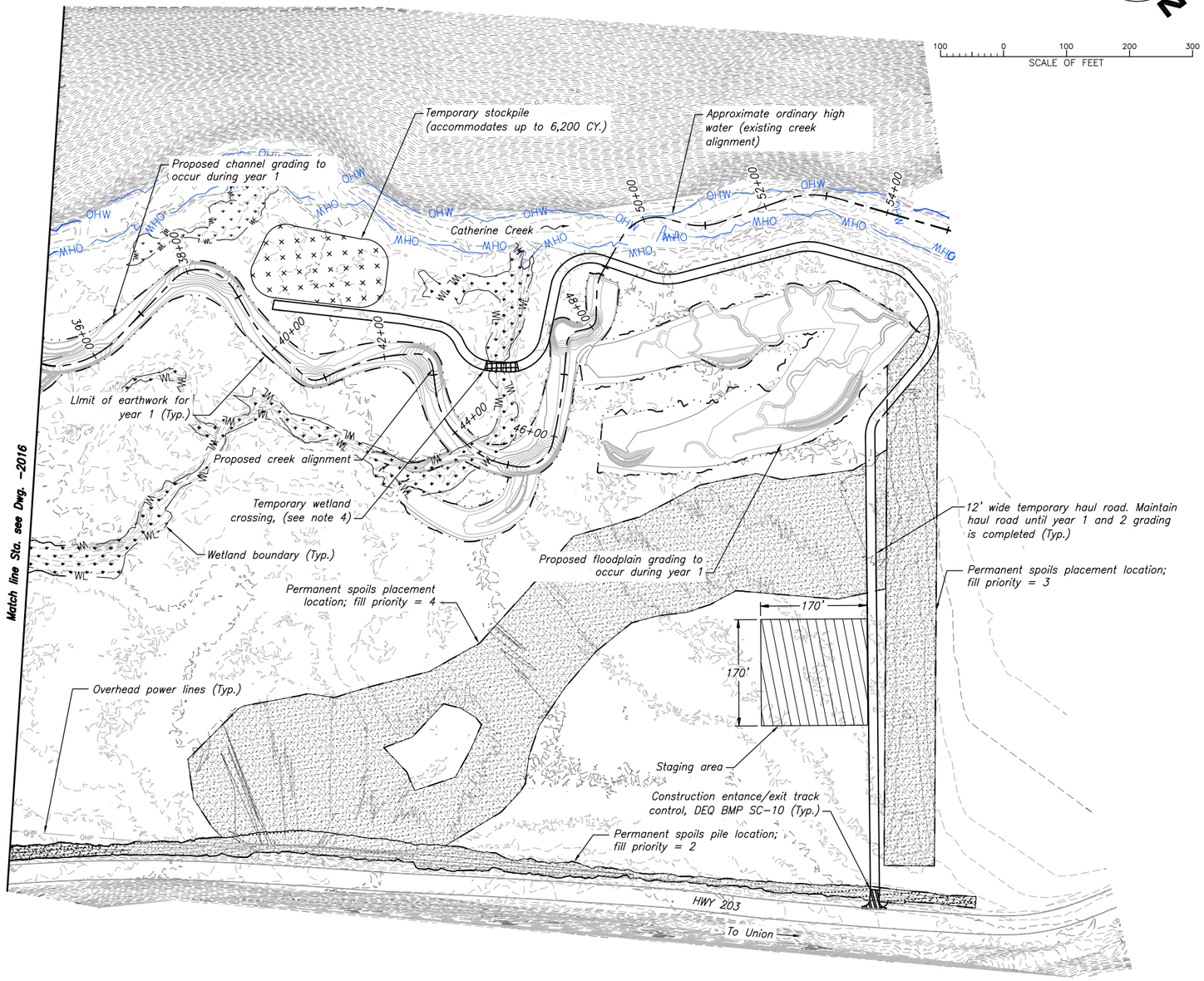
1678-100-2016

SHEET 1 OF 5

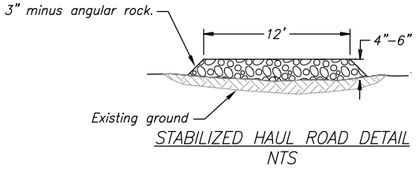
DATE AND TIME PLOTTED
August 24, 2015 08:38
PLOTTED BY
FISHER, MARTIN

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Phase_3-4_Parcel3_Access_Staging.dwg

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2006
MARTIN K. FISHER
9/1/15
RENEWAL DATE: 12/31/2015



YEAR 1 STA. 35+00 TO 55+00



STABILIZED HAUL ROAD DETAIL
NTS

Place rock only as needed for stabilization in erosional depressions or wet areas along haul roads.

NOTES:

1. Material placed in designated temporary stockpile areas during year 1 shall be only the material necessary for fill placement in the existing creek channel during year 2 work. Treat stockpiles as shown on Dwg. -2020. All other excavated soil shall be placed in one of the permanent spoils placement locations per spoils priority areas listed on this Dwg.
2. Temporary haul roads shown on this sheet are approximate. The Contracting Officer will stake or similarly identify the exact locations for temporary haul roads prior to the beginning of construction.
3. Whenever possible, temporary haul roads and routes from year 1 shall be used in year 2.
4. Volumes for temporary stockpiles were calculated assuming a stockpile that is 10' tall with 2:1 side slopes.
5. All excess soil from channel and floodplain excavation, that material which is not used as fill to construct the project, shall be hauled to and placed in one of the permanent spoils placement location shown on these Drawings, see Dwg. -2029 to -2035 for grading plans. Permanent spoils placement locations are listed on these Drawings with labels that identify the order of preference for use. Priority 1 area shall be completely filled before any fill is placed in priority 2 area, etc.
6. Dust control shall be implemented during the entire length of the project. Spray haul roads with water as needed to prevent dust generation. Dewatering water from isolated work areas that has passed through fish screens may be used for dust control as approved by the Contracting Officer.

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COLUMBIA/SNAKE RIVER SALMON RECOVERY GROUP
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

A. NELSON
DRAWN

X Jay Hovde
ACCEPTED
NAME
TITLE

BOISE, ID 2015-09-11

ACCESS & STAGING

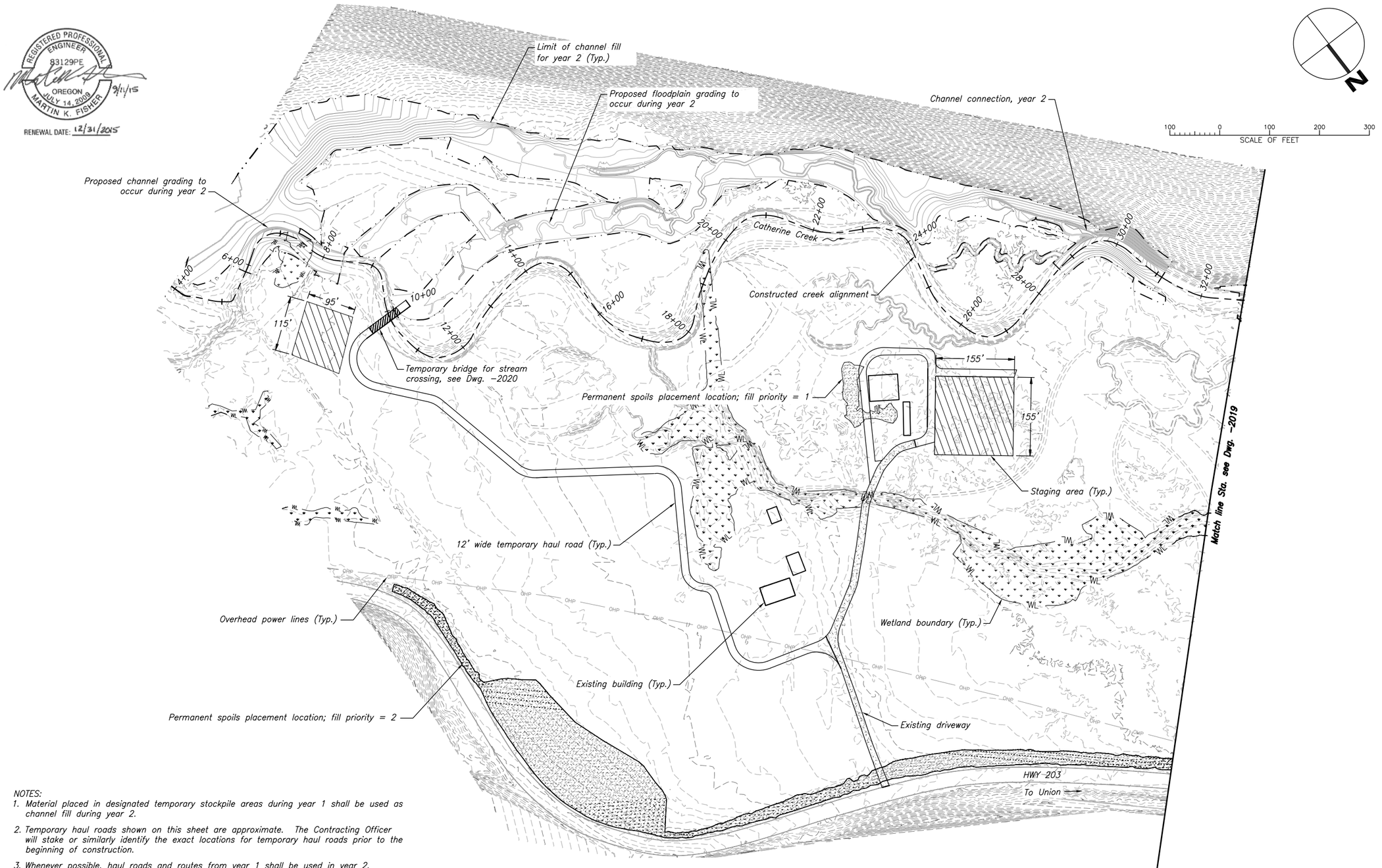
Year 1
35+00 to 55+00

1678-100-2017

SHEET 2 OF 5

DATE AND TIME PLOTTED
August 24, 2015 08:38
PLOTTED BY
FISHER, MARTIN

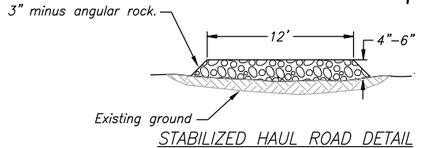
CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Phase_3-4_Parcel3_Access_Staging2.dwg



NOTES:

1. Material placed in designated temporary stockpile areas during year 1 shall be used as channel fill during year 2.
2. Temporary haul roads shown on this sheet are approximate. The Contracting Officer will stake or similarly identify the exact locations for temporary haul roads prior to the beginning of construction.
3. Whenever possible, haul roads and routes from year 1 shall be used in year 2.
4. All excess soil from channel and floodplain excavation, that material which is not used as fill to construct the project, shall be hauled to and placed in one of the permanent spoils placement location shown on these Drawings, see Dwg. –2029 to –2035 for grading plans. Permanent spoils placement locations are listed on these Drawings with labels that identify the order of preference for use. Fill priority 1 area shall be completely filled before any fill is placed in fill priority 2 area, etc.
5. Dust control shall be implemented during the entire length of the project. Spray haul roads with water as needed to prevent dust generation. Dewatering water from isolated work areas that has passed through fish screens may be used for dust control as approved by the Contracting Officer.

YEAR 2 STA. 5+00 TO 33+00



STABILIZED HAUL ROAD DETAIL
NTS

Place rock only as needed for stabilization in erosional depressions or wet areas along haul roads.

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2006
MARTIN K. FISHER
9/1/15
RENEWAL DATE: 12/31/2015

RECLAMATION
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GRANDE RONDE SUBBASIN

CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

A. NELSON
DRAWN

x Jay Hovde
ACCEPTED
NAME
TITLE

BOISE, ID 2015–09–11

ACCESS & STAGING

Year 2
5+00 to 33+00

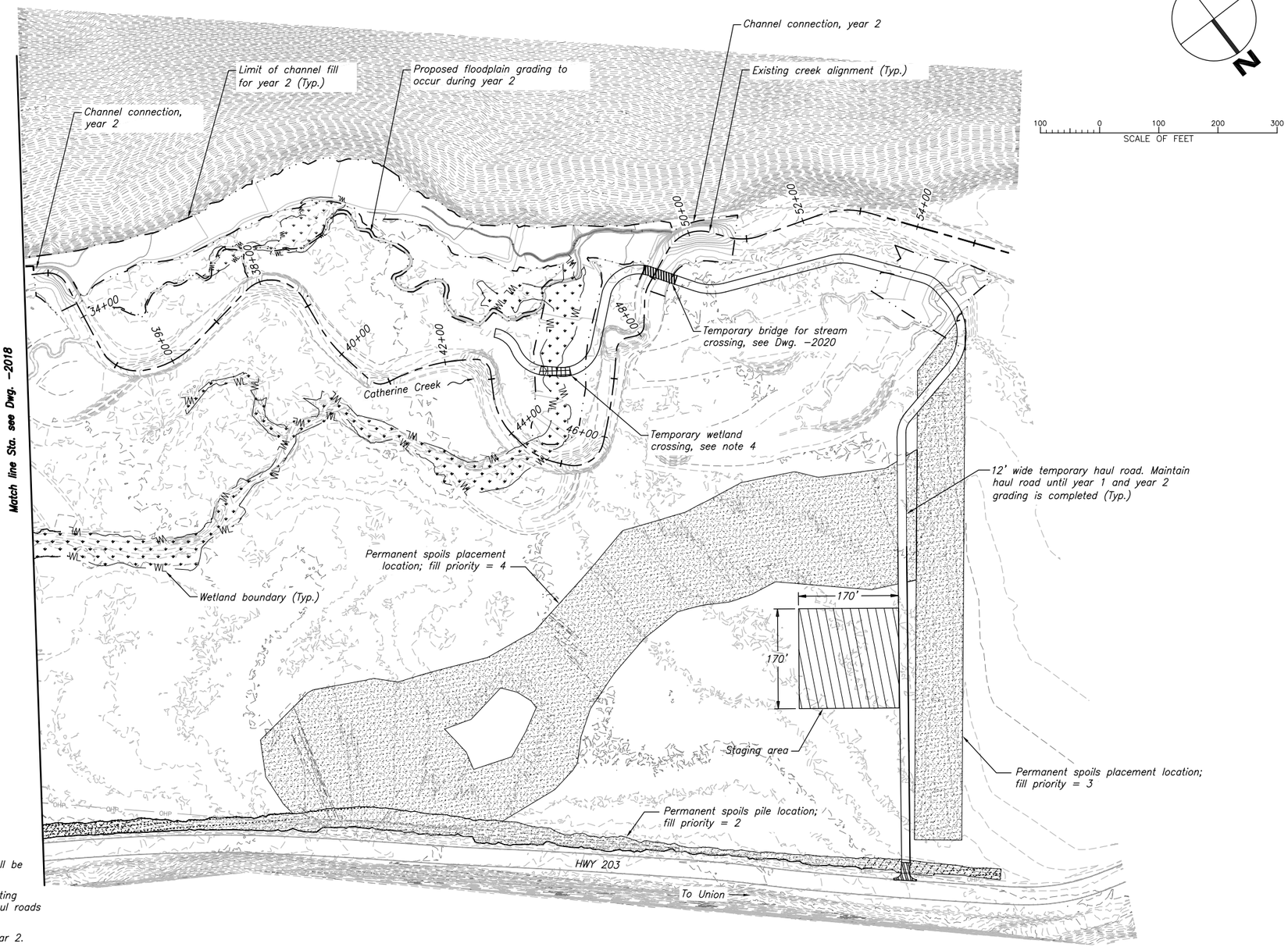
1678–100–2018

SHEET 3 OF 5

DATE AND TIME PLOTTED
TRUSCOTT, NIC
PLOTTED BY
FISHER, MARTIN

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Phase_3-4_Parcel3_Access_Staging.dwg

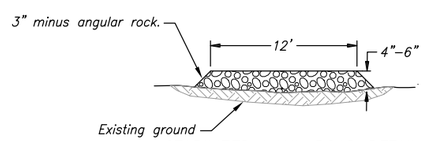
REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2006
MARTIN K. FISHER
9/1/15
RENEWAL DATE: 12/31/2015



NOTES:

1. Material placed in designated temporary stockpile areas during year 1 shall be used as channel fill during year 2.
2. Temporary haul roads shown on this sheet are approximate. The Contracting Officer will stake or similarly identify the exact locations for temporary haul roads prior to the beginning of construction.
3. Whenever possible, temporary haul roads from year 1 shall be used in year 2.
4. The wetland crossing shown on this Dwg. may require installation of a short temporary bridge or culvert depending on hydrologic and site conditions.
5. All excess soil from channel and floodplain excavation, that material which is not used as fill to construct the project, shall be hauled to and placed in one of the permanent spoils placement location shown on these Drawings, see Dwg. -2029 to -2035 for grading plans. Permanent spoils placement locations are listed on these Drawings with labels that identify the order of spoils fill preference for use. Fill priority 1 area shall be completely filled before any fill is placed in fill priority 2 area, etc.
6. Dust control shall be implemented during the entire length of the project. Spray haul roads with water as needed to prevent dust generation. Dewatering water from isolated work areas that has passed through fish screens may be used for dust control as approved by the Contracting Officer.

YEAR 2 STA. 33+00 TO 55+00



STABILIZED HAUL ROAD DETAIL
NTS

Place rock only as needed for stabilization in erosional depressions or wet areas along haul roads.

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

A. NELSON
DRAWN

X Jay Hovde
ACCEPTED
NAME
TITLE

BOISE, ID 2015-09-11

ACCESS & STAGING

Year 2
33+00 to 55+00

1678-100-2019

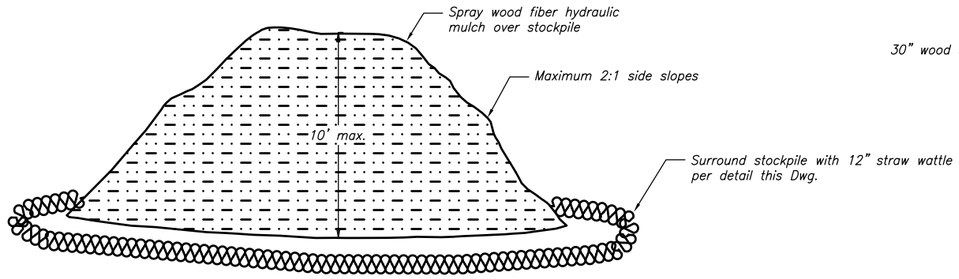
SHEET 4 OF 5

DATE AND TIME PLOTTED
September 11, 2015 15:49
PLOTTED BY
FISHER, MARTIN

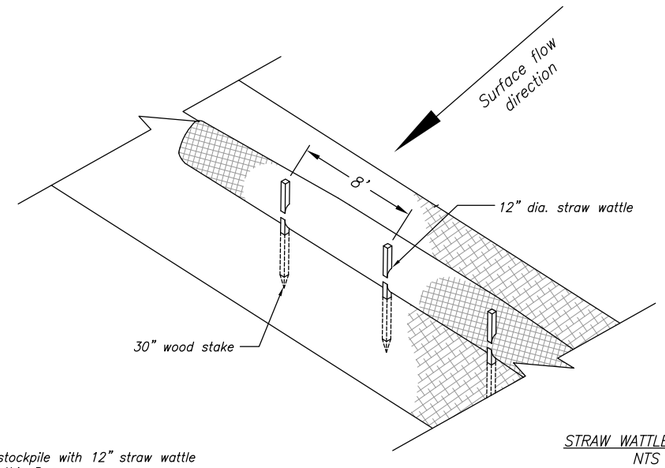
CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Phase_3-4_Parcel3_Access_Staging.dwg

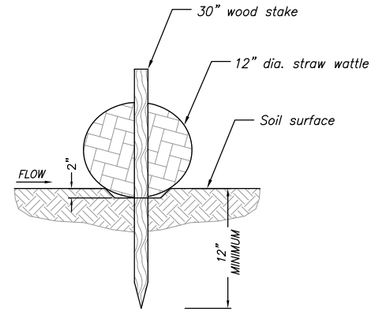
NOTES:

1. Stockpiles shall be temporarily stabilized with a wood fiber hydraulic mulch while the site is inactive between construction seasons. Stockpiles shall be treated prior to completing year 1 work or earlier as directed by the Contracting Officer.
2. Wood fiber hydraulic mulch shall consist of a mix of wood mulch (from wood, wood waste or other sources) and a tackifier.
3. The Contractor shall submit a hydraulic mulch mix for review and approval by the Contracting Officer prior to application.
4. Apply mulch at a rate of 3,000 lbs per acre unless otherwise directed by Contracting Officer.
5. Wood fiber hydraulic mulch shall be applied as a slurry with equipment that is capable of mixing and spraying components of mulch. Equipment shall be capable of producing a homogeneous mix and uniform application rate. Apply mulch in successive passes until specified application rate is achieved.
6. Stock piles shall be inspected by the Contractor a minimum of twice per month or within 48 hours following a major storm event when the site is inactive between construction seasons. Wattles shall be repaired or replaced as needed by the contractor to provide filtration of stormwater runoff from stockpile. The Contractor shall reapply wood fiber hydraulic mulch as needed when it is observed that mulch is not providing cover over stockpile.

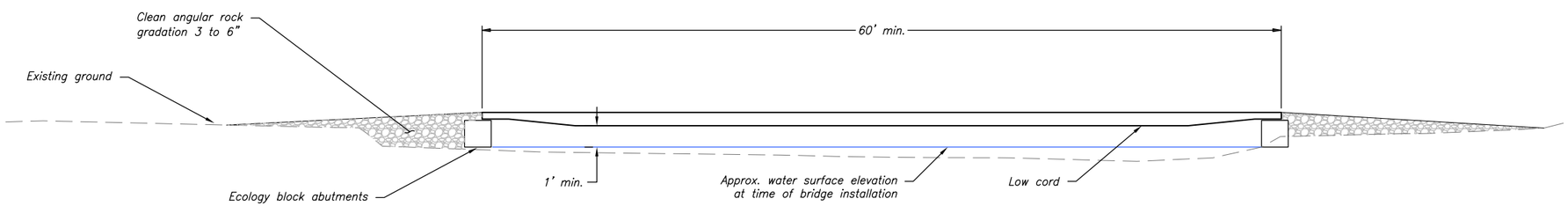


STOCKPILE DETAIL
NTS





STRAW WATTLE DETAIL
NTS



NOTES:

1. Contractor shall notify Contracting Officer 10 days prior to installation of temporary bridge crossing. Contracting Officer will instruct Contractor on acceptable location for temporary bridge. Contracting Officer will review area for presence of active spawning sites and adults of listed fish prior to bridge removal.
2. The Contractor shall furnish and maintain all equipment and materials required to install temporary bridge as shown on this sheet.
3. Fill for approach ramps to the temporary bridge shall be clean angular rock with a gradation of 3" to 6".
4. The Contractor is solely responsible for ensuring the structural integrity of the temporary bridge and maintaining the bridge throughout the duration of the project.
5. The low chord of the bridge shall be a minimum of 1' above the water surface elevation at the time of bridge installation. In the event of an unanticipated rise in water surface elevation due to unanticipated hydrologic conditions the Contractor shall remove the temporary bridge.
6. The exact location, elevation of bridge deck, and configuration of approach ramps will be determined in the field with the aid of the Contracting Officer. The work shown on this sheet is an example of an acceptable method of placing abutments, constructing approach ramps and placing the bridge deck. The Contractor shall submit a temporary bridge plan for review and approval at least 10 working days prior to installing the bridge.

TEMPORARY BRIDGE DETAIL
NTS

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2006
MARTIN K. FISHER
9/11/15
RENEWAL DATE: 12/31/2015

RECLAMATION
Managing Water in the West

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COLUMBIA/SNAKE RIVER SALMON RECOVERY GROUP
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

A. NELSON
DRAWN

X Jay Hovde
ACCEPTED
NAME
TITLE

BOISE, ID 2015-09-11

ACCESS & STAGING

STOCKPILE & TEMPORARY BRIDGE DETAILS

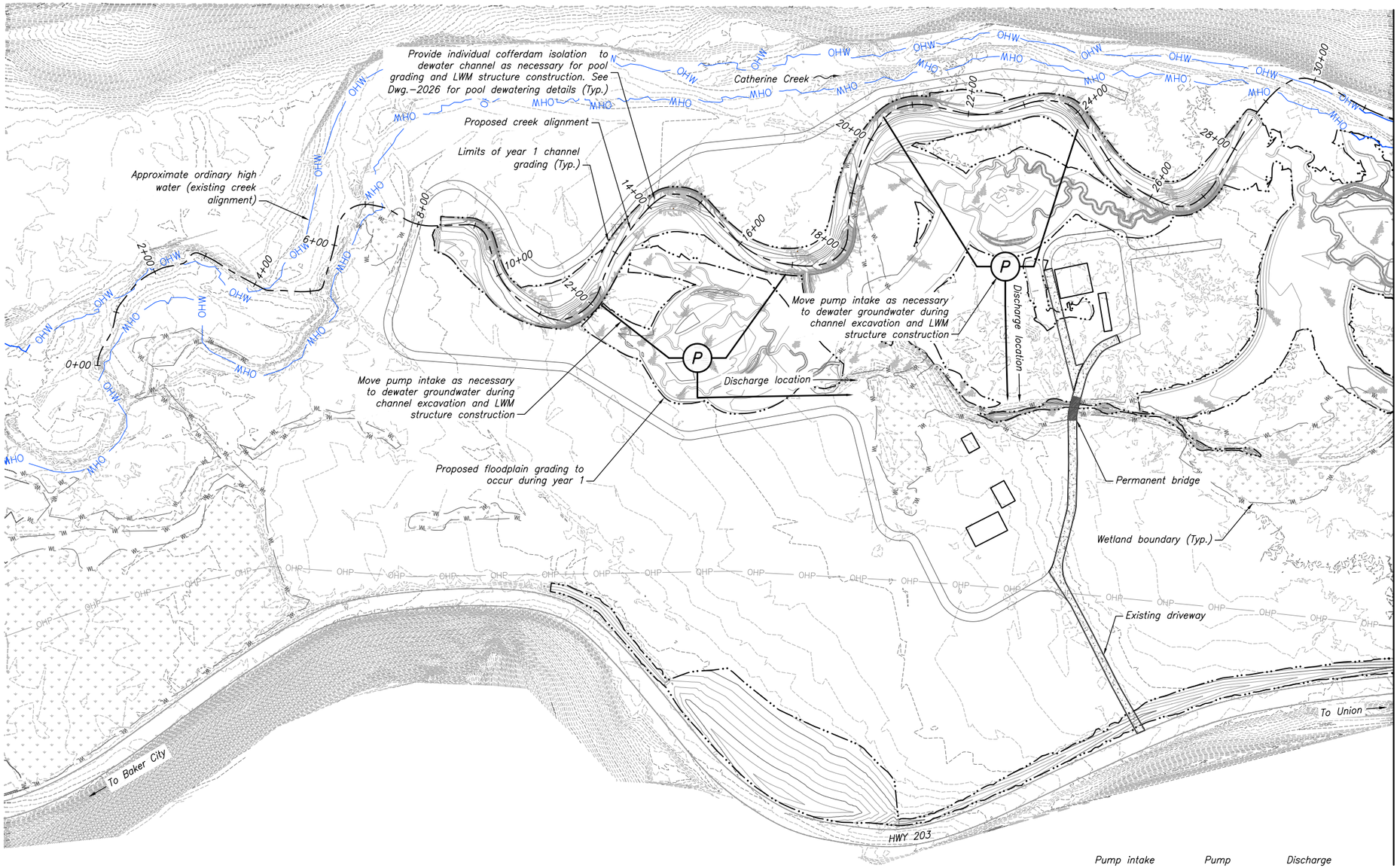
1678-100-2020

SHEET 5 OF 5

DATE AND TIME PLOTTED
September 11, 2015 15:49
PLOTTED BY
FISHER, MARTIN

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Phase_3-4_Parcel3_TESC.dwg

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2006
MARTIN K. FISHER
9/11/15
RENEWAL DATE: 12/31/2015



YEAR 1 0+00 TO 32+00

Pump intake — Pump — Discharge

P

Dewatering pump detail
NTS

NOTES:
1. Move pumps as necessary to dewater groundwater during channel excavation and construction of LWM structures. Surface flows from Catherine Creek will not be connected to Year 1 excavation but a significant amount of groundwater is expected to be present in areas of excavation.
3. At the location of each LWM structure the area shall be dewatered to the extent that standing water is present in the excavation no greater than the diameter of the lowest log in the LWM structure.

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COLUMBIA/SNAKE RIVER SALMON RECOVERY GROUP
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

M. FISHER
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015–09–11

DEWATERING PLAN

YEAR 1
0+00 TO 32+00

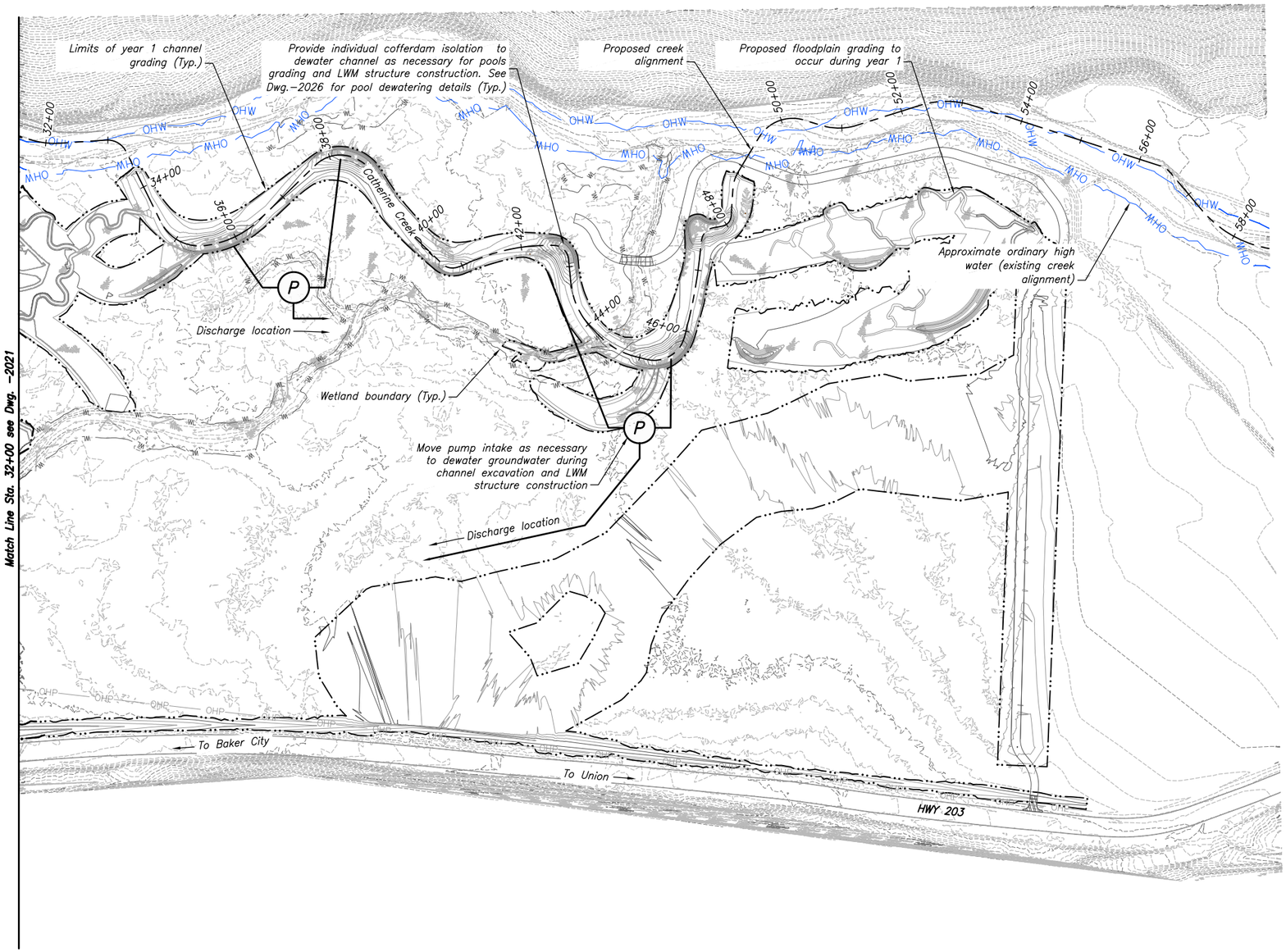
1678–100–2021

SHEET 1 OF 7

DATE AND TIME PLOTTED
September 11, 2015 15:59
PLOTTED BY
M. FISHER

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Phase_3-4_Parcel3_Dewatering.dwg

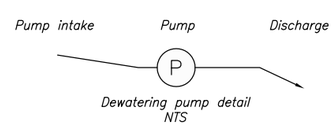
REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
9/11/15
RENEWAL DATE: 12/31/2015



N

NOTES:
1. Move pumps as necessary to dewater groundwater during channel excavation and construction of LWM structures. Surface flows from Catherine Creek will not be connected to Year 1 excavation but a significant amount of groundwater is expected to be present in areas of excavation.
2. At the location of each LWM structure the area shall be dewatered to the extent that standing water is present in the excavation no greater than the diameter of the lowest log in the LWM structure.

YEAR 1 32+00 TO 58+50



Dewatering pump detail
NTS

RECLAMATION
Managing Water in the West

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U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

M. FISHER
DRAWN

X Jay Hovde
ACCEPTED

BOISE, ID 2015-09-11

DEWATERING PLAN

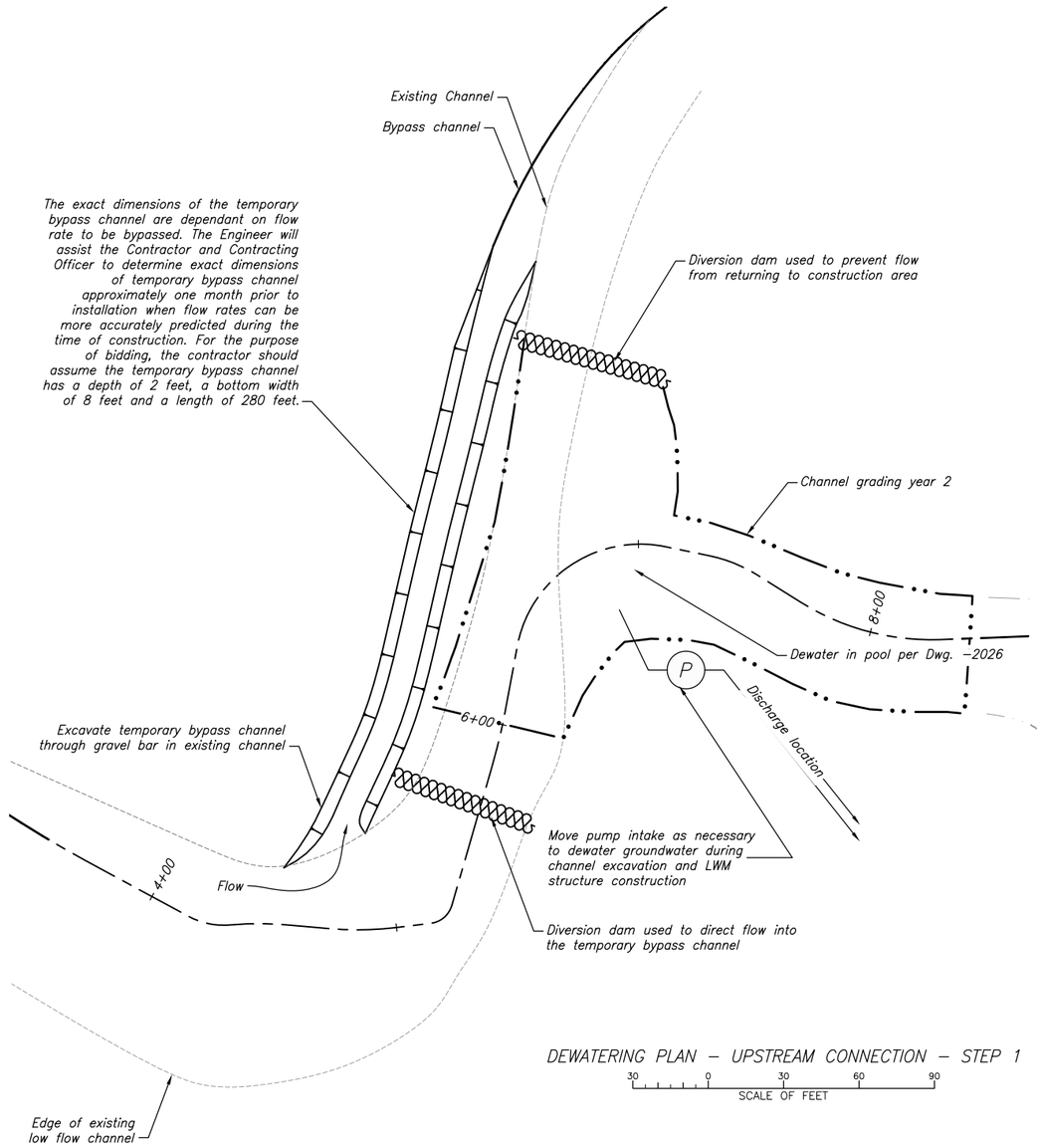
YEAR 1
32+00 TO 58+50

1678-100-2022

SHEET 2 OF 7

DATE AND TIME PLOTTED
September 11, 2015 16:00
PLOTTED BY
M. FISHER

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Phase_3-4_Parcel3_Dewatering.dwg



DEWATERING PLAN – UPSTREAM CONNECTION – STEP 1

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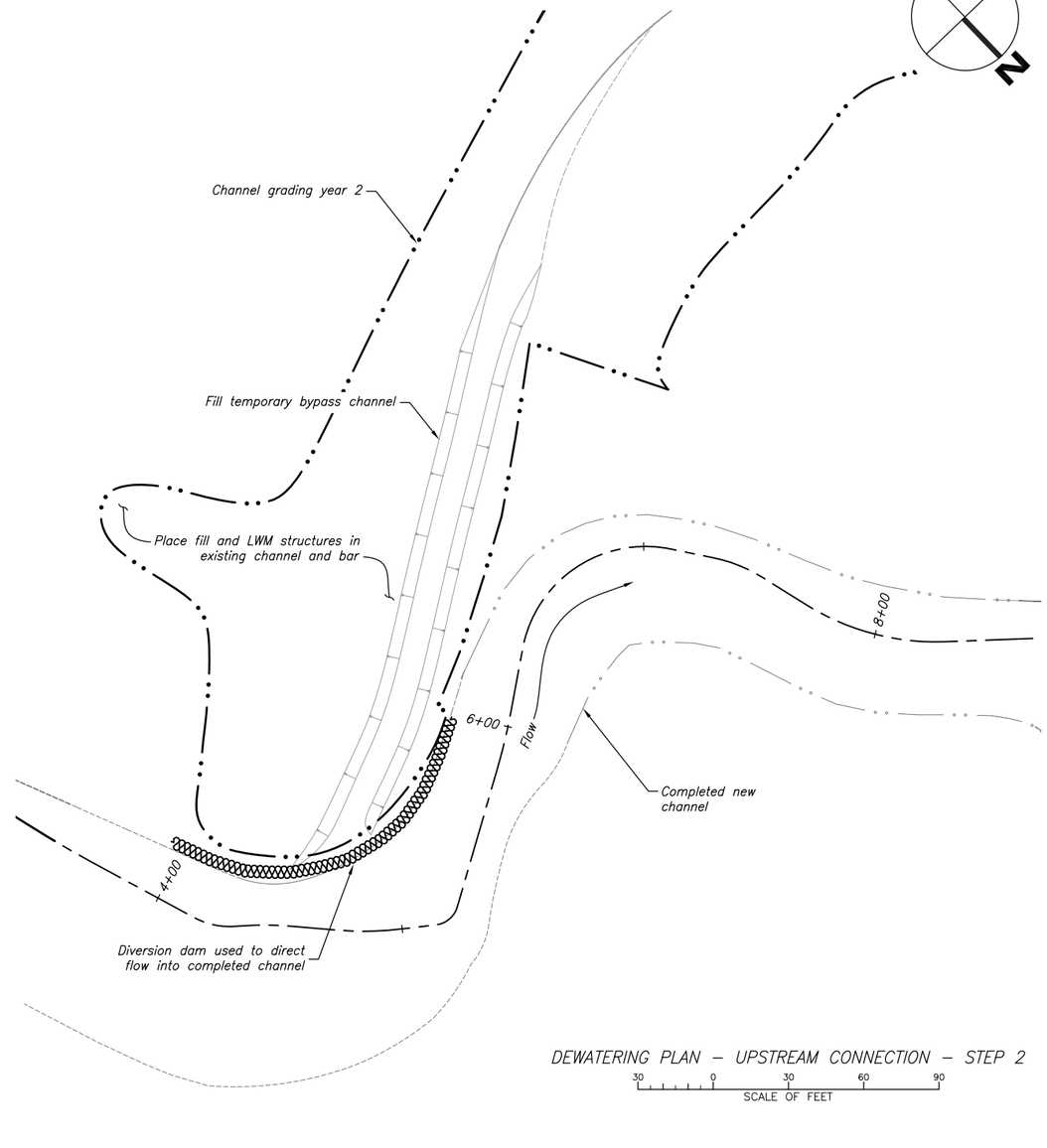
SCALE OF FEET



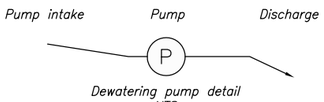
DEWATERING PLAN – UPSTREAM CONNECTION – STEP 2

30 0 30 60 90
SCALE OF FEET

NOTES:

1. Mainstem channel grading will occur in two steps between Sta. 4+00 and Sta. 8+40. The first step will include excavating a temporary bypass channel through a gravel bar on the left bank of the existing channel, and installing a diversion dam to force all flow into the temporary bypass channel, allowing channel grading to occur in the area of the existing creek channel, installation of LWM structures, and filling of the approximately 75 feet of the channel to be abandoned. The second step includes removing the main channel diversion dam and placing a diversion dam at the inlet of the temporary bypass channel to divert all flow into the newly constructed creek channel and allow placement of fill in the existing channel and the temporary bypass channel that will be abandoned.
3. At the location of each LWM structure the area shall be dewatered to the extent that standing water is present in the excavation no greater than the diameter of the lowest log in the LWM structure.
4. All dewatering pumps shall be screened for fish protection per ODFW requirements.
5. Water pumped from inside cofferdams shall not be discharged directly to flowing surface waters or wetlands.

DEWATERING PLAN – YEAR 2 UPSTREAM CONNECTION



Dewatering pump detail
NTS

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2006
MARTIN K. FISHER
9/14/15

RENEWAL DATE: 12/31/2015

RECLAMATION
Managing Water in the West

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BUREAU OF RECLAMATION
COLUMBIA/SNAKE RIVER SALMON RECOVERY GROUP
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

M. FISHER
DRAWN

X Jay Hovde
ACCEPTED

BOISE, ID 2015-09-11

DEWATERING PLAN

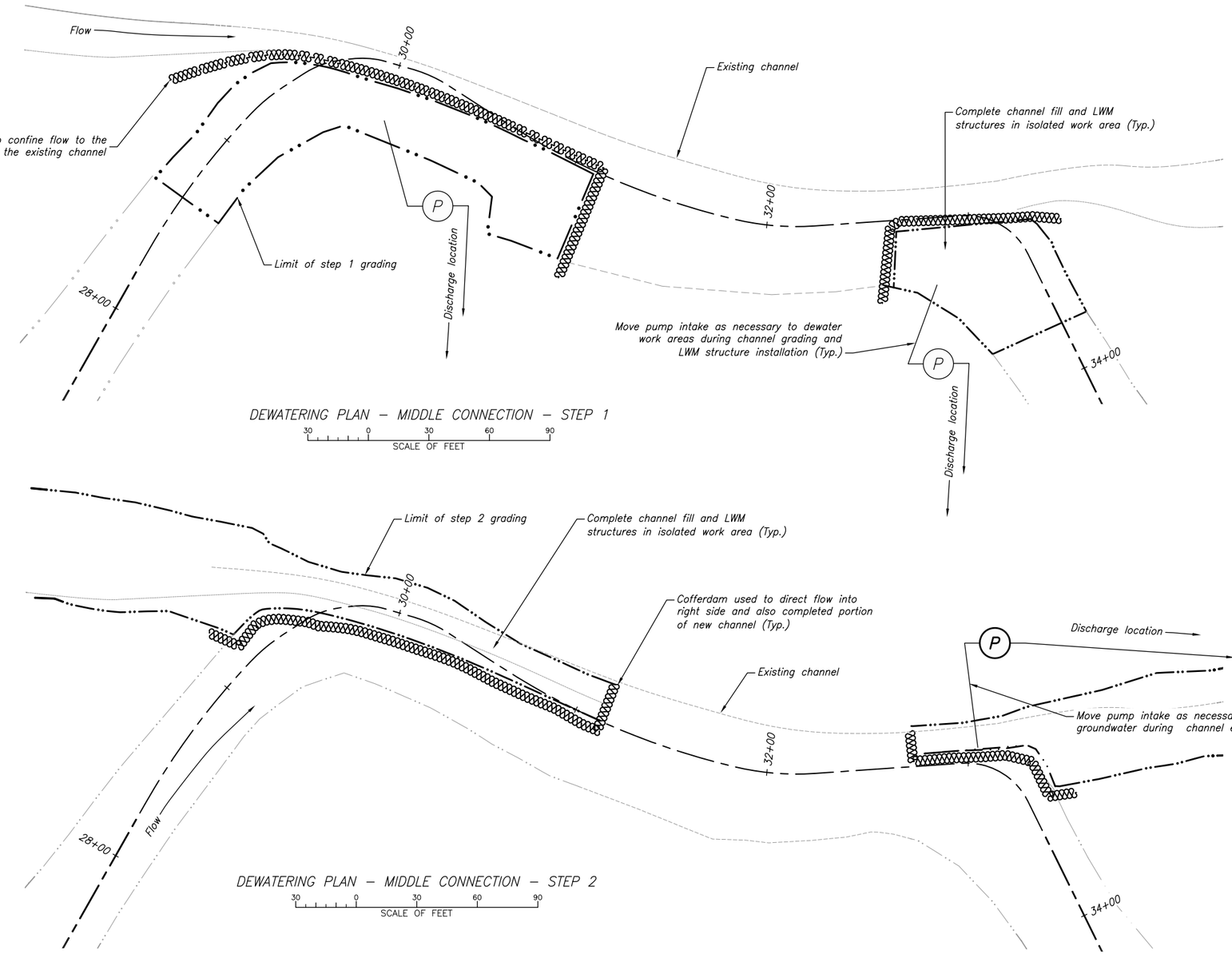
YEAR 2
UPSTREAM CONNECTION

1678-100-2023

SHEET 3 OF 7

DATE AND TIME PLOTTED
September 11, 2015 16:00
PLOTTED BY
M. FISHER

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Phase_3-4_Parcel3_Dewatering.dwg



DEWATERING PLAN – MIDDLE CONNECTION – STEP 1

30 0 30 60 90
SCALE OF FEET

DEWATERING PLAN – MIDDLE CONNECTION – STEP 2

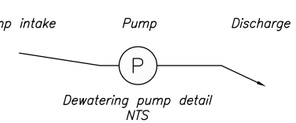
30 0 30 60 90
SCALE OF FEET

DEWATERING PLAN – YEAR 2 MIDDLE CONNECTION

N

NOTES:

1. Mainstem channel grading will occur in two steps.
2. The first step will include installing a cofferdam that will isolate the right side of the stream channel from surface water flow so that channel grading and LWM structure construction can occur. Channel isolation will occur between Sta. 28+50 and Sta. 31+15 and between 32+70 and 33+75. Flows diverted around the cofferdam will remain in left (southwest) side of the existing channel. After channel grading and LWM structure work is completed in the isolated portion of the channel, flow can be diverted from the existing channel into the new channel.
3. The second step of dewatering will be to isolate the left side of the channel so that channel grading and LWM structure construction can occur in the left portion. All flow in the creek will be in the newly constructed channel.
3. At the location of each LWM structure the area shall be dewatered to the extent that standing water is present in the excavation no greater than the diameter of the lowest log in the LWM structure.
4. Dewatering pumps shall be screened for fish protection per ODFW requirements.
5. Water pumped from inside cofferdams shall not be discharged directly to flowing surface waters or wetlands.



Dewatering pump detail
NTS

REGISTERED PROFESSIONAL ENGINEER
93129PE
OREGON
JULY 14, 2006
MARTIN K. FISHER
9/14/15

RENEWAL DATE: 12/31/2015

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

M. FISHER
DRAWN

x Jay Hovde
ACCEPTED

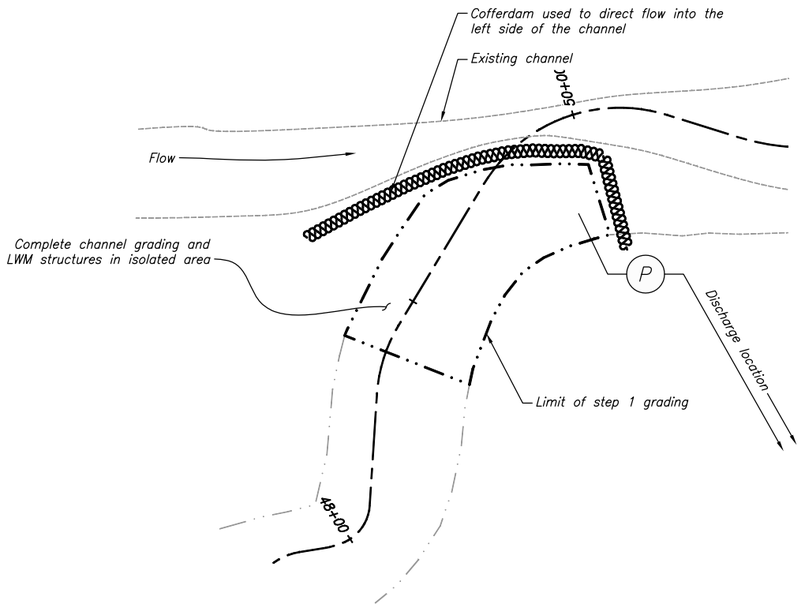
BOISE, ID 2015-09-11

DEWATERING PLAN

YEAR 2 MIDDLE CONNECTION

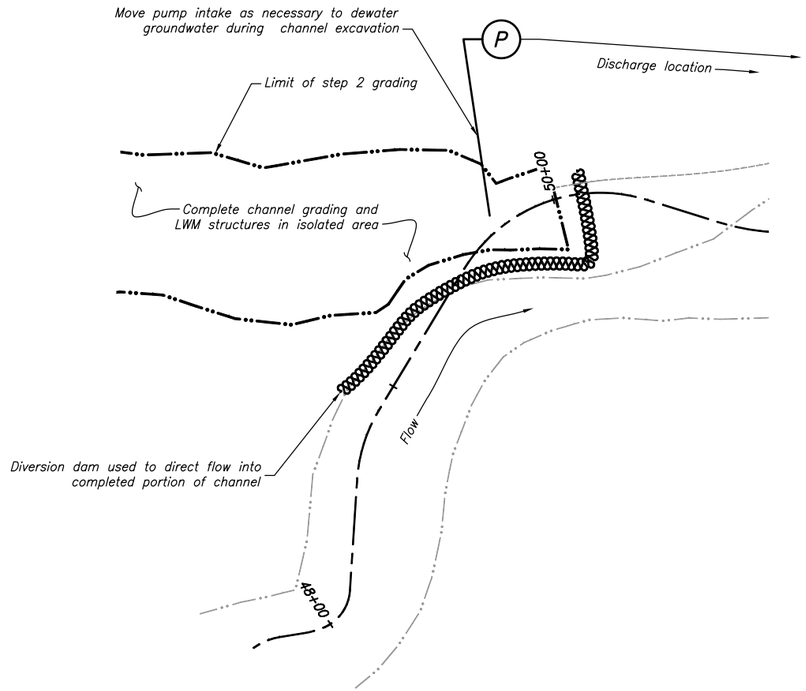
1678-100-2024

SHEET 4 OF 7



DEWATERING PLAN – DOWNSTREAM CONNECTION – STEP 1

30 0 30 60 90
SCALE OF FEET



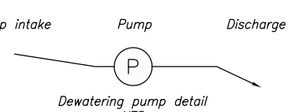
DEWATERING PLAN – DOWNSTREAM CONNECTION – STEP 2

30 0 30 60 90
SCALE OF FEET

NOTES:

1. Mainstem channel grading will occur in two steps between Sta. 48+50 and Sta. 50+00. The first step will include installing a cofferdam that will isolate the right side of the stream channel from surface water flow. Flows diverted around the cofferdam will remain in left (southwest) side of the existing channel so that channel grading and LWM structure placement can occur. After channel grading and LWM structure work is completed in the isolated portion of the channel, flow can be diverted from the existing channel into the new channel.
2. The second step of dewatering will be to isolate the left side of the channel so that channel grading and LWM structure construction can occur in the left portion. All flow in the creek will be in the newly constructed channel.
3. At the location of each LWM structure the area shall be dewatered to the extent that standing water is present in the excavation no greater than the diameter of the lowest log in the LWM structure.
4. Dewatering pumps shall be screened for fish protection per ODFW requirements.
5. Water pumped from inside cofferdams shall not be discharged directly to flowing surface waters or wetlands.

DEWATERING PLAN – YEAR 2 DOWNSTREAM CONNECTION



REGISTERED PROFESSIONAL ENGINEER
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RENEWAL DATE: 12/31/2015

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GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

M. FISHER
DRAWN

X Jay Hovde
ACCEPTED

BOISE, ID 2015-09-11

DEWATERING PLAN

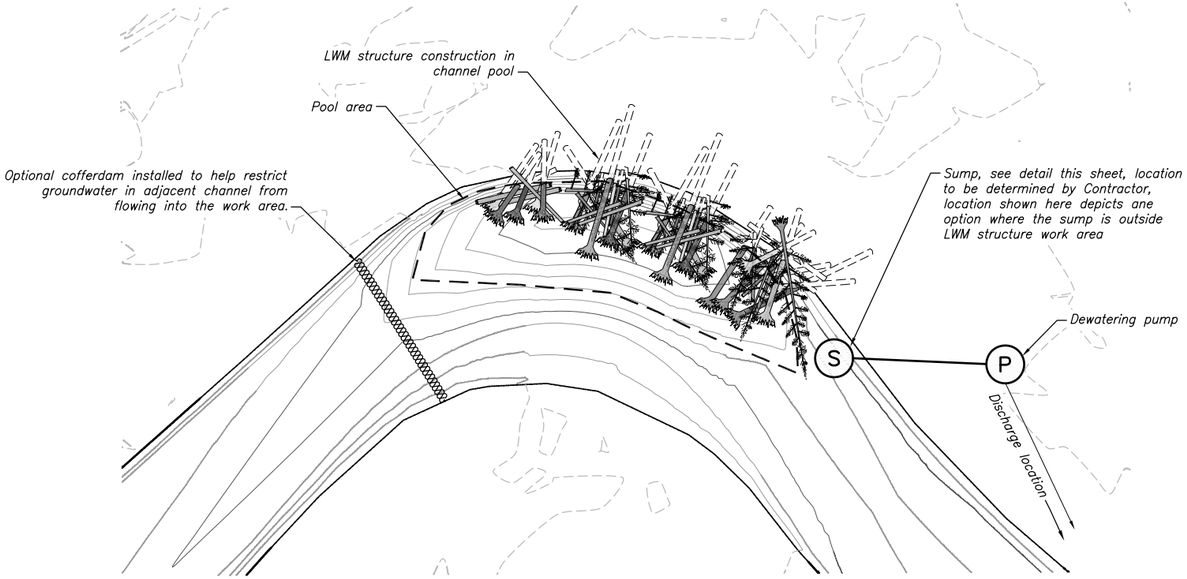
YEAR 2 DOWNSTREAM CONNECTION

1678-100-2025

SHEET 5 OF 7

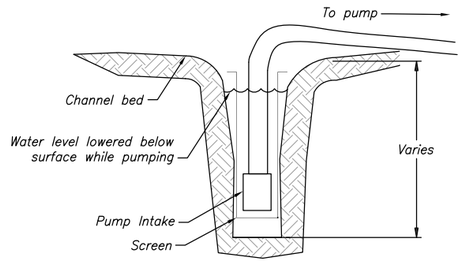
DATE AND TIME PLOTTED
September 11, 2015 16:00
PLOTTED BY
M. FISHER

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Phase_3-4_Parcel3_Dewatering.dwg

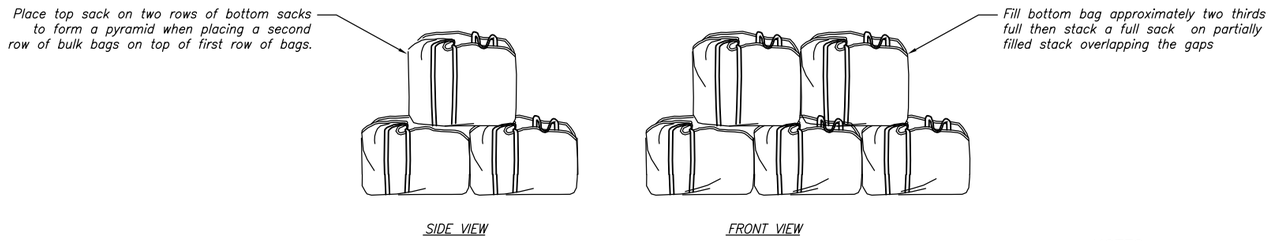


NOTES:

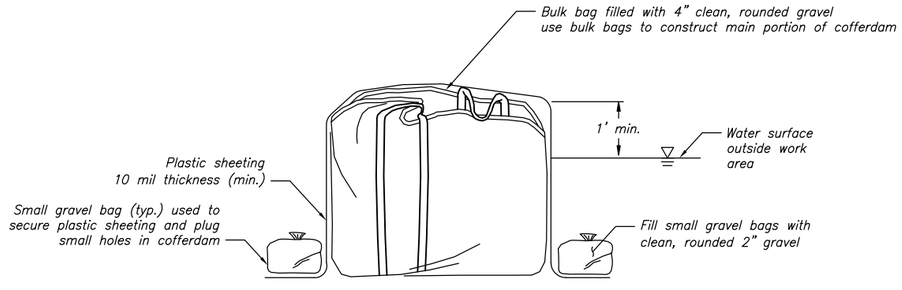
1. The Contractor is responsible for providing pump capacity and associated equipment sufficient to dewater the work site. At no time shall final channel grading or construction of LWM structures occur if the work area is not dewatered to the extent of the minimum requirements listed in Note 2.
2. During construction of LWM structures and during final channel grading, the work area shall be dewatered to a depth no greater than the diameter of the lowest log in the LWM structure.
3. All water pumped from work areas shall be discharged to upland areas at locations shown on these drawings or as directed by the Contracting Officer.
4. Turbid groundwater pumped during dewatering activities shall not be directly discharged to Catherine Creek.
5. Cofferdams shown in this detail are optional at the Contractor's selection. These cofferdams limit the amount of groundwater that would flow into the work area from adjacent constructed stream channel. If the Contractor has sufficient pump capacity to meet the minimum water depth requirements in the work area then the cofferdams may not be needed.
6. The sump and pump intake configuration shown on this drawing is one option for dewatering the work area. The Contractor shall be responsible for selecting a sump and intake configuration that allows dewatering to meet the minimum requirements listed in Note 2.



Sump Pump Detail



SIDE VIEW FRONT VIEW



NOTES:

1. Cofferdams shall be used to isolate work areas from the actively flowing channel and for dewatering groundwater in work areas.
2. The Contractor shall submit a Dewatering Plan for review and approval by the Contracting Officer a minimum of 10 working days prior to beginning work.
3. All pump intakes at locations connected to surface flow in Catherine Creek shall be screened for fish protection as required by ODFW.
4. Cofferdams may be constructed as shown on these drawings. Alternative methods of cofferdam construction are allowable if they provide similar or better performance than the method shown here, and if approved by the Contracting Officer.

DEWATERING DETAILS

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GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

M. FISHER/ N. TRUSCOTT
DRAWN

X Jay Hovde
ACCEPTED

BOISE, ID 2015-09-11

DEWATERING PLAN

DEWATERING DETAILS

1678-100-2026

SHEET 6 OF 7

REGISTERED PROFESSIONAL ENGINEER
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MARTIN K. FISHER
9/14/15

RENEWAL DATE: 12/31/2015

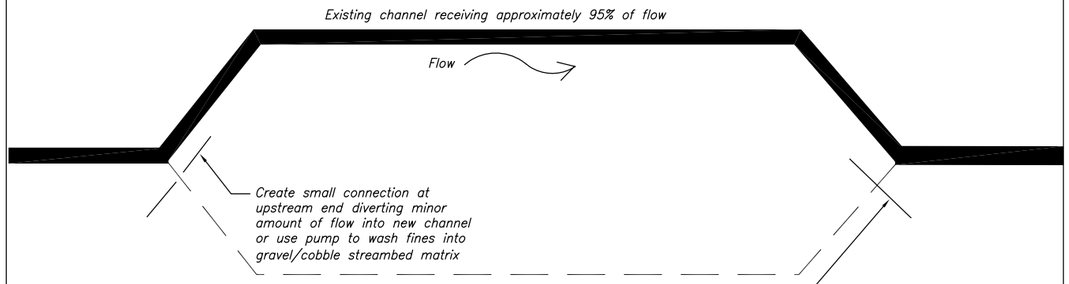
DATE AND TIME PLOTTED
September 11, 2015 16:01
PLOTTED BY
M. FISHER

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Phase_3-4_Parcel3_Sump_Pump_Detail.dwg

NOTES:
1. Use pumped water applied to new channel to wash the fines into the gravel/cobble bed material. Alternatively, a small opening can be made in the upstream diversion to allow a minor amount of flow from the creek to enter the new channel. During either process, place a pump at the downstream end of the new channel that will pump turbid water onto an upland area. The capacity of the downstream pump shall exceed the amount of flow applied upstream.

2. When water pumped from the downstream end is no longer significantly turbid the pump can be removed and the downstream end of the new channel can be opened up to the existing channel. Amount of allowable turbidity of the flow in the new channel varies depending on the flow rate in the new channel vs. flow rate in the existing channel. After mixing at the downstream connection, flow in the creek channel shall meet water quality standards for maximum turbidity as required by multiple state and federal permits.

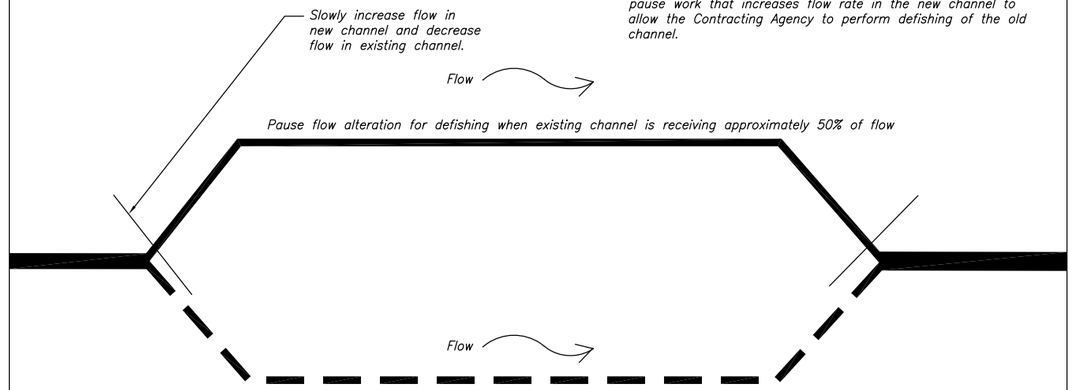
3. Following open connection, monitor turbidity of water in the creek 300 feet downstream of where new channel and existing channel meet. Incrementally increase upstream connection to fifty percent of total flow as turbidity of water at monitoring station decreases to allowable levels.



STAGE 1

NOTES:
1. Slowly increase the amount of flow entering the new channel. The Contracting Officer will determine the rate to increase flow into the new channel. It is critical that the flow increase is done slowly to minimize turbidity generated in the new channel, and to prevent stranding of fish in the existing channel where flow rate is decreasing.

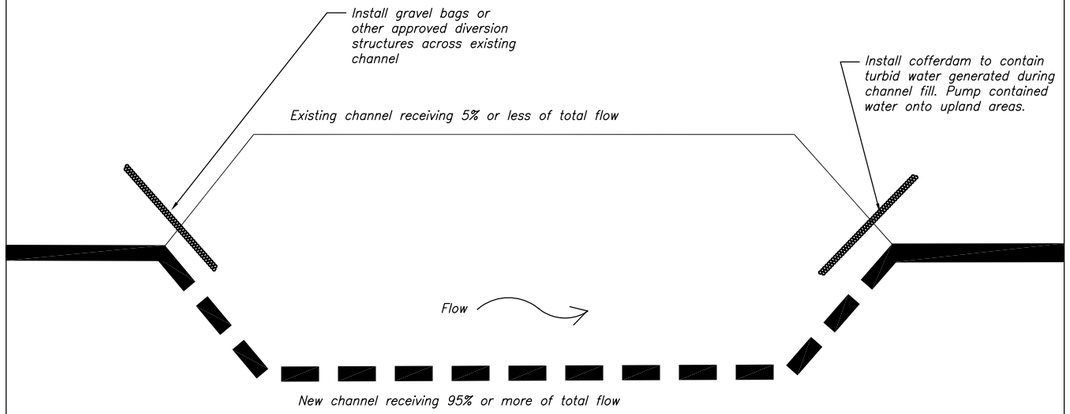
2. When approximately half of the flow is in the new channel, pause work that increases flow rate in the new channel to allow the Contracting Agency to perform defishing of the old channel.



STAGE 2

NOTES:
1. After defishing of existing channel is complete as determined by the Contracting Officer, resume work to slowly increase amount of total flow entering the new channel.

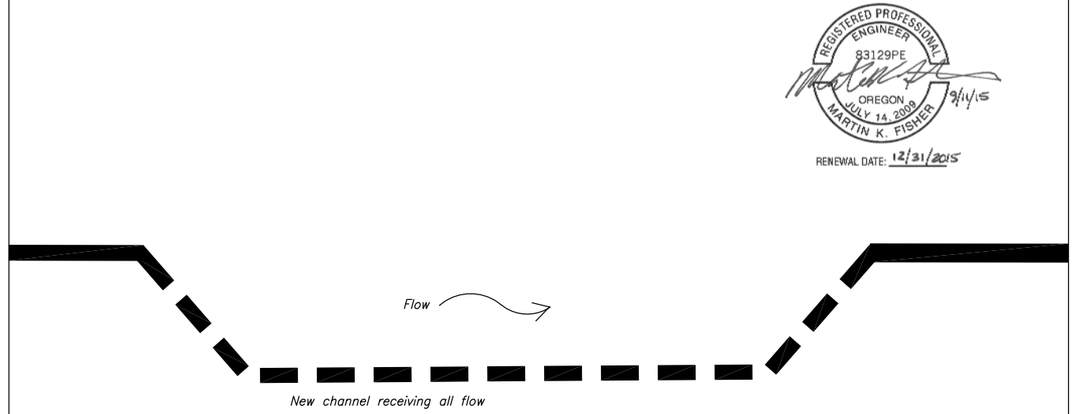
2. Install temporary diversion dam across upstream end of Existing channel to complete diversion. Install temporary cofferdam at downstream end of existing channel to contain turbid water generated during fill placement in existing channel.



STAGE 3

NOTES:
1. Fill existing channel as shown in Grading Plan sheets in these Drawings.

2. Remove temporary diversion dam and cofferdam from abandoned channel.



STAGE 4

REGISTERED PROFESSIONAL ENGINEER
83129PE
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JULY 14, 2009
MARTIN K. FISHER
9/4/15
RENEWAL DATE: 12/31/2015

CHANNEL DIVERSION PROCEDURE

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

M. FISHER
DRAWN

X Jay Hovde
ACCEPTED

BOISE, ID 2015-09-11

DEWATERING PLAN

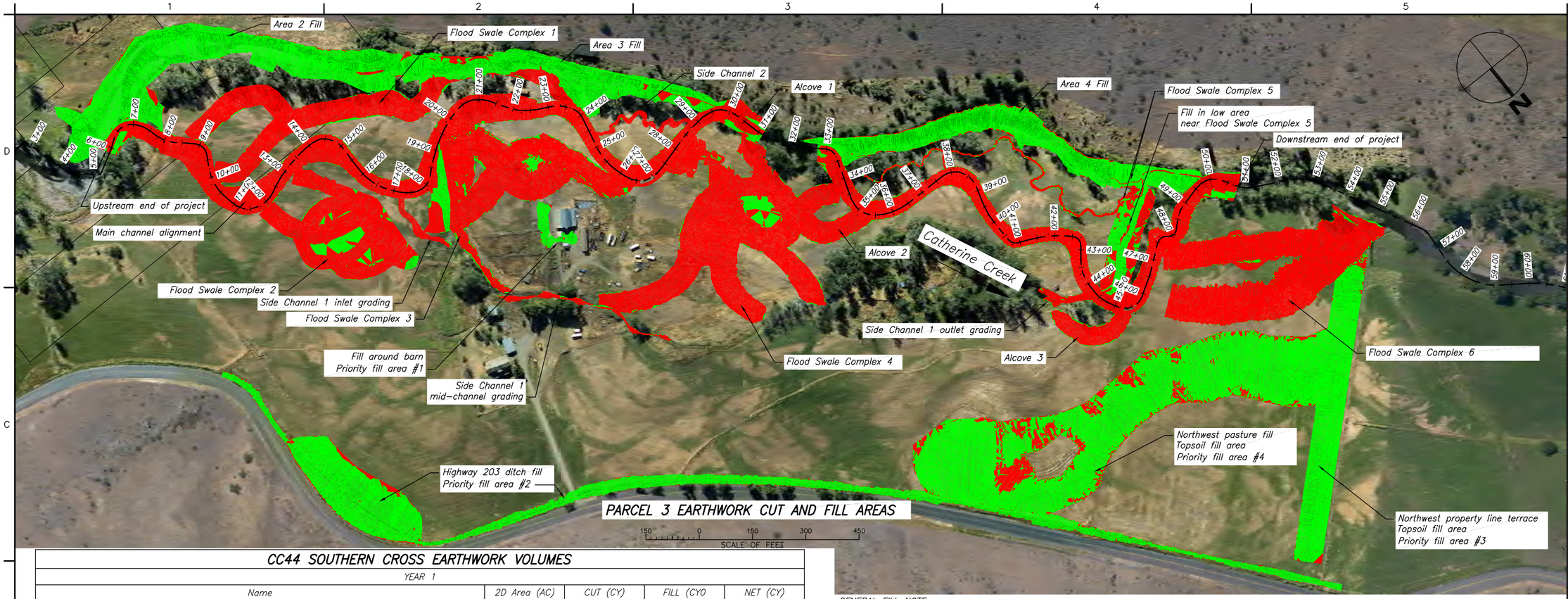
CHANNEL DIVERSION PROCEDURE

1678-100-2027

SHEET 7 OF 7

DATE AND TIME PLOTTED
September 11, 2015 16:02
PLOTTED BY
M. FISHER

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Phase_3-4_Schematic_Diversion.dwg



PARCEL 3 EARTHWORK CUT AND FILL AREAS

150 0 150 300 450
SCALE OF FEET

CC44 SOUTHERN CROSS EARTHWORK VOLUMES

YEAR 1

Name	2D Area (AC)	CUT (CY)	FILL (CYO	NET (CY)
MAIN CHANNEL	3.9	21027	9	21018<Cut>
FLOOD SWALE COMPLEX 2	1.7	2336	47	2289<Cut>
FLOOD SWALE COMPLEX 3	1.7	3577	47	3530<Cut>
FLOOD SWALE COMPLEX 4 (PARTIAL)	2.9	9113	0	9113<Cut>
FLOOD SWALE COMPLEX 6 (PARTIAL)	2.2	4857	97	4760<Cut>
SIDE CHANNEL 1	0.9	1763	415	1348<Cut>
ALCOVE 3	0.3	827	0	827<Cut>
YEAR 1 SUBTOTAL*	13.5	43500	615	42885<Cut>

YEAR 2

Name	2D Area (SY)	Cut (CY)	FILL (CYO	NET (CY)
MAIN CHANNEL CONNECTION	0.8	2667	243	2424<Cut>
FLOOD SWALE COMPLEX 1 (EXCAVATED FROM O.G.)	2.1	3893	1377	2516<Cut>
FLOOD SWALE COMPLEX 1 (AMOUNT REDUCED FROM AREA 3 FILL TO SHAPE CHANNEL D)	0.5	888	27	861<Cut from Area 3 fill>
FLOOD SWALE COMPLEX 4 (CONNECT SWALES UPSTREAM TO MAIN CHANNEL)	0.4	264	0	264<Cut>
FLOOD SWALE COMPLEX 6 (CONNECT SWALES DOWNSTREAM TO MAIN CHANNEL)	0.3	700	6	693<Cut>
FLOOD SWALE COMPLEX 5 (EXCAVATED FROM O.G.)	0.2	246	92	154<Cut>
FLOOD SWALE COMPLEX 5 (AMOUNT REDUCED FROM AREA 4 FILL TO SHAPE CHANNEL)	0.1	162	1	161<Cut from Area 4 fill>
SIDE CHANNEL 2	0.1	329	0	329<Cut>
ALCOVE 3	0.3	827	0	827<Cut>
FILL LOW AREA NEAR FLOOD SWALE COMPLEX 5	0.6	113	435	325<Fill>
AREA 2 FILL	1.7	19	15338	15319<Fill>
AREA 3 FILL	2.3	31	11693	11661<Fill>
AREA 4 FILL	1.6	4	7382	7378<Fill>
FILL AROUND BARN	0.1	0	90	90<Fill>
HIGHWAY 203 DITCH FILL	2.9	15	7919	7904<Fill>
NORTHWEST PROPERTY LINE TERRACE FILL	1.6	6	3410	3404<Fill>
NORTHWEST PASTURE FILL	5.4	137	5525	5388<Fill>
YEAR 2 SUBTOTAL*	20.8	10301	53538	43237<Fill>
OVERALL COMPOSITE SURFACE*	32.6	52171	49929	2243<Cut>

GENERAL FILL NOTE:
Unless otherwise noted on other drawings, at locations where the grading requires fill to create the shape and topography shown on the Drawings, the Contractor shall place fill in one (1) foot maximum lifts and compact using mechanical compaction equipment such as a vibratory compactor head or roller compactor. No testing of compacted density will be performed, but the intent is to achieve an 85% relative density; acceptance will be by the Contracting Officer observing fill placement and compaction effort.

GENERAL EXCAVATION NOTES:
1. Provide excavation as required for construction of the Work shown on the Drawings.
2. Excavation shall be done to the lines and grades shown on the Drawings and as indicated by construction staking provided by the Contractor.
3. The quantity of material to be excavated has been measured by surface subtraction in AutoCAD and is therefore in-place and not factored for expansion.
4. Shape, trim, and finish cut slopes to conform with lines, grades, and cross-sections shown on the Drawings.
5. Stockpile excavated material that is suitable for use as fill until material is needed.
6. Dry excavated material may be stockpiled near each work site. Wet excavated material shall be hauled to a stockpile area where turbid water draining from the material cannot enter the waterway.
7. As boulders larger than 18 inches in diameter are discovered during excavation, remove and stock pile at locations to be used in the riffle construction.

FINISH GRADING NOTES:
1. Finish grading shall be within ±0.50 feet Horizontal and ±0.10 feet Vertical of the locations and elevations shown on the Drawings and construction stakes.
2. Where 6 to 12 inches of topsoil is applied, the topsoil shall be compacted by a single pass with an excavator tracks or similar equipment to provide a uniform firm compaction, prior to measurement of finish grade.
3. Shall be flush with adjacent surfaces unless otherwise indicated.
4. Shall be inspected and approved by the Contracting Officer prior to seeding or other activity that would hinder adjustments to the finish grading.
5. Compaction of finished surface is not required where the finished surface is achieved through only excavation, except in main channel excavation areas through riffles, glides, and point bars.

TABLE NOTE:
* The cut and fill volumes of each feature were calculated using a comparison of the proposed surface of each feature surface to the original ground surface. The proposed surface of one feature may overlap the surface of one or more proposed features, particularly in the Year 2 work areas. Therefore, the sum of the cut and fill volumes of the features for each year will not correspond with the earthwork cut and fill volumes of the overall composite surface of the entire project shown at the bottom of the table.

LEGEND

Fill

Cut

*Cut areas are shown in red and fill areas are shown in green.

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

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DESIGNED
DB
DRAWN
Mike Knutson P.E.
CHECKED
Jeffrey J Fealko P.E.
TECH. APPR.
Steve Montague-Acting
APPROVED
ADMIN. APPROVAL - TITLE
BOISE, ID 2015-09-14

EARTHWORK CUT AND FILL AREAS

PLAN

1678-100-2028
SHEET 1 OF 1

DATE AND TIME PLOTTED
AUGUST 26, 2015 14:38
PLOTTED BY
JBACONGUS

CAD SYSTEM
AutoCAD Rel. 20.0s
CAD FILENAME
1678-100-EN_RECOVER.DWG

1678–100–2030

1678–100–2031

1678–100–2032

1678–100–2033

1678–100–2034

1678–100–2035

1678–100–2036

Upstream existing channel fill

Flood swale complex 1

Side channel 2

Large Woody Material (typ.)

Downstream existing channel fill

Alcove 1

Downstream Plug

Catherine Creek

Plug 3

Flood swale complex 5

Downstream end of project

N 561462.9427
E 8895111.9688

FLOW

Upstream Plug

Flood swale complex 3

Flood swale complex 4

Main channel

Upstream end of project

Flood swale complex 2

Side channel 1 inlet grading

Flood swale complex 6

Alcove 3

Alcove 2 within Flood swale complex 4

Fill around barn
Priority fill area #1

Limits of excavation, typ.

Side channel 1
mid-channel grading

Proposed bridge

Existing house

Existing driveway

HWY 203

Northwest pasture fill
Topsoil fill area
Priority fill area #4

Northwest property line terrace
Topsoil fill ara
Priority fill area #3

Highway 203 ditch fill
Priority fill area #2

Lot line, typ.

LEGEND

Year 1 Construction

Year 2 Construction

Existing wetland areas

GRADING PLAN OVERVIEW

150 0 150 300 450
SCALE OF FEET

NOTES:
1. Priority fill area #3 is located on the project site on the North side of Highway 203 and will be located by the C.O.

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GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

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DR
DRAWN
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Jeffrey J. Fegitko P.E.
TECH. APPR.
Steve Montague–Acting
APPROVED
HDMS APPROVAL – PROGRAM MANAGER

BOISE, IDAHO 2015–09–14

GRADING PLAN OVERVIEW

PLAN

1678–100–2029

SHEET 1 OF 8

DATE AND TIME PLOTTED
AUGUST 12, 2015 - 14:37
PLOTTED BY
JBACONGUIS

CAD SYSTEM
AutoCAD Rel. 20.0s
CAD FILENAME
I:\2_1678-1100-DP.DWG

Existing channel fill
see Dwg. –2064

N: 561462.9427
E: 8895111.9688

Spring channel (Channel D)
shaped in the fill
of the existing main channel
(see Dwg. –2078)

FLOW

Plug 1 to concentrate subsurface
flow to Channel D of Flood
Swale Complex 1
see section detail Dwg. –2115

Channel C
see Dwg. –2078

Match Line
see Sheet –2032

Flood swale complex 1
Swale B and Channel B
see Dwg. –2077

Upstream Plug
see section detail
Dwg. –2115

Flood swale complex 1
see Dwgs. –2074 to 2081

Flood swale complex 3
Begin flood swale grading
at Main Channel Sta. 19+66

Fill existing ditch
to match adjacent floodplain
as directed by C.O.

Flood swale complex 1
Begin flood swale grading
at Main Channel Sta. 8+74

Swale A/Channel A
see Dwgs. –2075 to –2076

Start Side channel 1 inlet excavation
Main Channel Sta. 17+25

Flood swale complex 3
see Dwgs. –2090 to –2093
for details

Begin channel fill to shape
left bank of proposed main channel
See Dwg. –2064

Main channel

Limit of excavation, typ.

Begin main channel
shaping Main Channel Sta. 5+84
N 561383.7
E 8895673.4
Surface at beginning of
alignment may not be accurate. Grade
transition
from the existing channel to the
proposed channel as directed by the C.O.

Flood swale complex 2
Begin flood swale grading
at Main Channel Sta. 12+92

Flood swale complex 3
Begin Flood swale grading at
N 562145.1
E 8895060.5

Upstream end of project
~Main Channel Sta. 4+70

Flood swale complex 1
Begin flood swale grading
at Main Channel Sta. 9+84

Side channel 1 inlet shaping
see. Dwgs. –2068 to –2071

Flood swale complex 2
Begin flood swale grading
at Main Channel Sta. 11+91

Flood swale complex 2
Dwgs. –2082 to –2089

Connect Flood swale complex 2
to Side channel 1 at Side Channel 1 Sta. 2+24

Grading limits

Existing wetland

LEGEND

Year 1 Construction

Year 2 Construction

Existing wetland areas

GRADING PLAN
Main Channel Sta. 6+00 TO Main Channel Sta. 21+00

40 0 40 80 120
SCALE OF FEET

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BUREAU OF RECLAMATION
COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

Jeffrey J. Fealko P.E.	DESIGNED
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Mike Knutson P.E.	CHECKED
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Steve Montague–Acting	APPROVED
	ADMIN APPROVAL – PROGRAM MANAGER
BOISE, IDAHO	2015–08–14

GRADING PLAN
Main Channel Sta. 6+00
TO
Main Channel Sta.
21+00

PLAN

1678–100–2030

SHEET 2 OF 8

DATE AND TIME PLOTTED
AUGUST 12, 2015 14:37
PLOTTED BY
JBUCKINGHAM

CAD SYSTEM
AutoCAD Rel. 20.0s
CAD FILENAME
I:_1678-100-02\DWG

Flood swale complex 1
see Dwg. −2074 to −2081

Existing channel fill
(Dwg. −2065)

Plug 2 to concentrate
sursurface flow to Alcove 1
see Dwg. −2115)

Begin Alcove 1 shaping in
existing channel fill
N 562156.2
E 8894421.5

Alcove 1 (−Dwg. 2113)
shaped into existing
channel fill −Dwg. −2065)

End Alcove 1 shaping
at Main Channel Sta. 29+73

Begin flood swale complex 4
Flood swale grading at
Main Channel Sta. 30+51

Match Line
see Sheet −2030

Match Line
see Sheet −2032

Downstream plug
see section detail
Dwg. −2115

End Flood swale complex 1
Flood swale grading at
Main Channel Sta. 23+86

Side channel 2
see Dwg. −2072 to −2073

End Side channel 2
grading at Main Channel Sta. 28+93

Begin Flood swale complex 5
grading at Main Channel Sta. 33+92

Main channel

Begin Side channel 2
grading at
Main Channel Sta. 24+53

FLOW

End Flood swale complex 4
grading at Main Channel Sta. 34+57

Begin flood swale complex 4
Flood swale grading at
Main Channel Sta. 27+64

Flood swale complex 3
see Dwgs. −2090 to 2093

Flood swale complex 4
see Dwgs. −2094 to −2102

FLOW

End Flood swale complex 3
grading at Main Channel Sta. 26+35

Grading limits

Existing structures, typ.

Alcove 2

Fill around barn
Priority fill area #1
Place material as
directed by C.O.

Grading limits

Flood swale complex 3
Begin flood swale grading
N 562145.1
E 8895060.5

Begin flood swale complex 4
Flood swale grading at
Side channel 1 Main Channel Sta. 7+16
N 562590.8
E 8894884.5

End flood swale complex 4
Flood swale grading at
Side channel 1 Main Channel Sta. 14+03
N 562978.1
E 8894404.3

Proposed bridge

Side channel 1
mid−channel grading
see Dwgs. −2068 to 2071

End Side channel 1
mid−channel grading
Main Channel Sta. 9+48
N 562791.2
E 8894787.6

End flood swale complex 4
Flood swale grading at
Side channel 1 Main Channel Sta. 12+44
N 5625912.6
E 8894544.8

Begin Side channel 1
mid−channel grading
Main Channel Sta. 4+30
N 562391.1
E 8895084.5

Match Line
see Sheet −2035

Existing Side channel 1
No grading from Main Channel Sta. 9+48 to Main Channel Sta. 21+28

LEGEND

Year 1 Construction

Year 2 Construction

Existing wetland areas

GRADING PLAN
STA 21+00 TO STA 34+00

40 0 40 80 120
SCALE OF FEET

RECLAMATION
Managing Water in the West

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BOISE, IDAHO 2015−09−14

GRADING PLAN
Main Channel Sta.
21+00 TO
Main Channel Sta.
34+00

PLAN

1678−100−2031
SHEET 3 OF 8

DATE AND TIME PLOTTED
AUGUST 12, 2015 14:37
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JBACONGUIS

CAD SYSTEM
AutoCAD Rel. 20.0s
CAD FILENAME
I:2_1678−100−GP.DWG

Match Line see Sheet –2031

Match Line see Sheet –2033

Existing channel fill see Dwg. –2066

Downstream Plug see section detail Dwg. –2115

Begin channel grading of Flood swale complex 5 channel in existing channel fill at N 563029.7 E 8893594.3

End Flood swale complex 5 channel at Main Channel Sta. 49+78

Flood swale complex 5 see Dwgs. –2103 to –2107

Plug 3 in existing channel fill see Dwg. –2115

FLOW

Begin flood swale complex 5 channel grading at Main Channel Sta. 33+92

End Flood swale complex 4 grading at Main Channel Sta. 34+57

Main channel

(–2067) B

Fill existing ditch

Flood swale complex 4 see Dwgs. –2094 to 2102

End Flood swale complex 4 grading at Main Channel Sta. 35+27

Begin flood swale channel 6 Flood swale grading at Main Channel Sta. 47+17

Alcove 2

Begin Side channel 1 downstream grading at Main Channel Sta. 21+28 N 563327.7 E 8893886.9

Begin flood swale channel 6 Flood swale grading at Main Channel Sta. 45+92

Flood swale complex 6 see Dwgs. –2108 to –2112

Blind channel see section detail Dwg. –2115

Side channel 1 see Dwgs. –2068 to –2071

Begin Alcove 3 grading at Side channel 1 Main Channel Sta. 21+52 N 563349.0 E 8893876.6

End Side channel 1 downstream grading Main Channel Sta. 44+59

End Alcove 3 grading Main Channel Sta. 45+29

Existing Side channel 1 No grading until Main Channel Sta. 21+28

Fill low point area as directed by the C.O.

Northwest pasture fill Topsoil fill area Priority #4

Alcove 3 see Dwg. –2114

Begin flood swale complex 4 Flood swale grading at Side channel 1 Main Channel Sta. 14+03 N 562978.1 E 8894404.3

Match Line see Sheet –2036

LEGEND

Year 1 Construction

Year 2 Construction

Existing wetland areas

GENERAL FILL NOTE:
Unless otherwise noted on other drawings, at locations where the grading requires fill to create the shape and topography shown on the Drawings, the Contractor shall place fill in one (1) foot maximum lifts and compact using mechanical compaction equipment such as a vibratory compactor head or roller compactor. No testing of compacted density will be performed, but the intent is to achieve an 85% relative density; acceptance will be by the Contracting Officer observing fill placement and compaction effort.

GRADING PLAN

Main Channel Sta. 34+00 TO Main Channel Sta. 50+00

40 0 40 80 120
SCALE OF FEET

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CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

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BOISE, IDAHO 2015–09–14

GRADING PLAN
Main Channel Sta. 34+00 TO Main Channel Sta. 50+00
PLAN

1678–100–2032
SHEET 4 OF 8

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I:_1678-100-DRAWG

Utilize boulders for LWM structures and channel roughness

End Flood swale complex 5 channel grading at Main Channel Sta. 49+78

Remove existing diversion dam as directed by C.O. Location is approximate. Contractor to field verify location.

Main channel

End Flood swale complex 6 grading at Main Channel Sta. 55+39

Downstream end of project Main Channel Sta. 55+60

FLOW

Flood swale complex 6 see Dwgs. -2108 to -2112

Blind channel See Dwgs. -2109, -2110, and -2115

Deep pool

Northwest pasture fill Topsoil fill area Priority fill area #4

Match Line see Sheet -2032

Match Line see Sheet -2036

Lot line, typ.

Northwest property line terrace Topsoil fill area Priority fill area #3

LEGEND

Year 1 Construction

Year 2 Construction

Existing wetland areas

N

GRADING PLAN

Main Channel Sta. 50+00 TO Main Channel Sta. 60+00

40 0 40 80 120

SCALE OF FEET

GENERAL FILL NOTE:
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No testing of compacted density will be performed, but the intent is to achieve an 85% relative density; acceptance will be by the Contracting Officer observing fill placement and compaction effort.

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CC-44 PHASE III HABITAT ENHANCEMENT
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BOISE, IDAHO 2015-09-14

GRADING PLAN
Main Channel Sta. 50+00 TO Main Channel Sta. 60+00

PLAN

1678-100-2033

SHEET 5 OF 8

DATE AND TIME PLOTTED
AUGUST 12, 2015 14:37
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JBACONGUS

CAD SYSTEM
AutoCAD Rel. 20.0s
CAD FILENAME
I:_1678-100-08\DWG

Lot line, typ.

Begin Highway 203 ditch fill
N 562075.7
E 8895829.3

B' (-2067)

Highway 203 ditch fill
Priority fill area #2

Existing house

Existing driveway

2960

2965

2970

2972

2976

HWY 203

Match Line
see Sheet -2035

N

LEGEND
Year 1 Construction
Year 2 Construction
Existing wetland areas

B'

GENERAL FILL NOTE:
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GRADING PLAN
IRRIGATION DITCH FILL

40 0 40 80 120
SCALE OF FEET

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GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

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BOISE, IDAHO	2015-09-14

GRADING PLAN
IRRIGATION DITCH FILL

PLAN

1678-100-2034

SHEET 6 OF 8

DATE AND TIME PLOTTED: AUGUST 12, 2015 14:37
PLOTTED BY: JBALDONADO

CAD SYSTEM: AutoCAD Rel. 20.0s
CAD FILENAME: I:_1678-100-GP.DWG

Match Line
see Sheet -2032

Northwest pasture fill
Topsoil fill area
Priority fill area #4

Highway 203 ditch fill
Priority fill area #2

Match Line
see Sheet -2035

HWY 203

See typical ditch fill section -2067

Match Line
see Sheet -2036

2945
2950
2955
2960

N

LEGEND

Year 1 Construction

Year 2 Construction

Existing wetland areas

GENERAL FILL NOTE:

Unless otherwise noted on other drawings, at locations where the grading requires fill to create the shape and topography shown on the Drawings, the Contractor shall place fill in one (1) foot maximum lifts and compact using mechanical compaction equipment such as a vibratory compactor head or roller compactor. No testing of compacted density will be performed, but the intent is to achieve an 85%%% relative density; acceptance will be by the Contracting Officer observing fill placement and compaction effort.

GRADING PLAN
IRRIGATION DITCH FILL
40 0 40 80 120
SCALE OF FEET

DATE AND TIME PLOTTED:
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PLOTTED BY:
JBALDWIN

CAD SYSTEM
AutoCAD Rel. 20.0s
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GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

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BOISE, IDAHO 2015-09-14

GRADING PLAN
IRRIGATION DITCH FILL

PLAN

1678-100-2035
SHEET 7 OF 8

Match Line see Sheet –2032

Match Line see Sheet –2033

Match Line see Sheet –2035

D (–2067)

C (–2067)

Northwest pasture fill topsoil fill area Priority #4

Northwest property line terrace topsoil fill area Priority #3

Lot line, typ.

Do not place excess material this area, as directed by the C.O.

Highway 203 ditch fill Priority area #2

End Highway 203 ditch fill N 564515.1 E 8893749.5

HWY 203

2940

2945

2935

LEGEND

Year 1 Construction

Year 2 Construction

Existing wetland areas

GENERAL FILL NOTE:

Unless otherwise noted on other drawings, at locations where the grading requires fill to create the shape and topography shown on the Drawings, the Contractor shall place fill in one (1) foot maximum lifts and compact using mechanical compaction equipment such as a vibratory compactor head or roller compactor. No testing of compacted density will be performed, but the intent is to achieve an 85%%% relative density; acceptance will be by the Contracting Officer observing fill placement and compaction effort.

GRADING PLAN

IRRIGATION DITCH FILL

40 0 40 80 120

SCALE OF FEET

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GRANDE RONDE SUBBASIN

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BOISE, IDAHO 2015–09–14

GRADING PLAN
IRRIGATION DITCH FILL

PLAN

1678–100–2036

SHEET 8 OF 8

DATE AND TIME PLOTTED
AUGUST 12, 2015 14:37
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JBALCONGUIS

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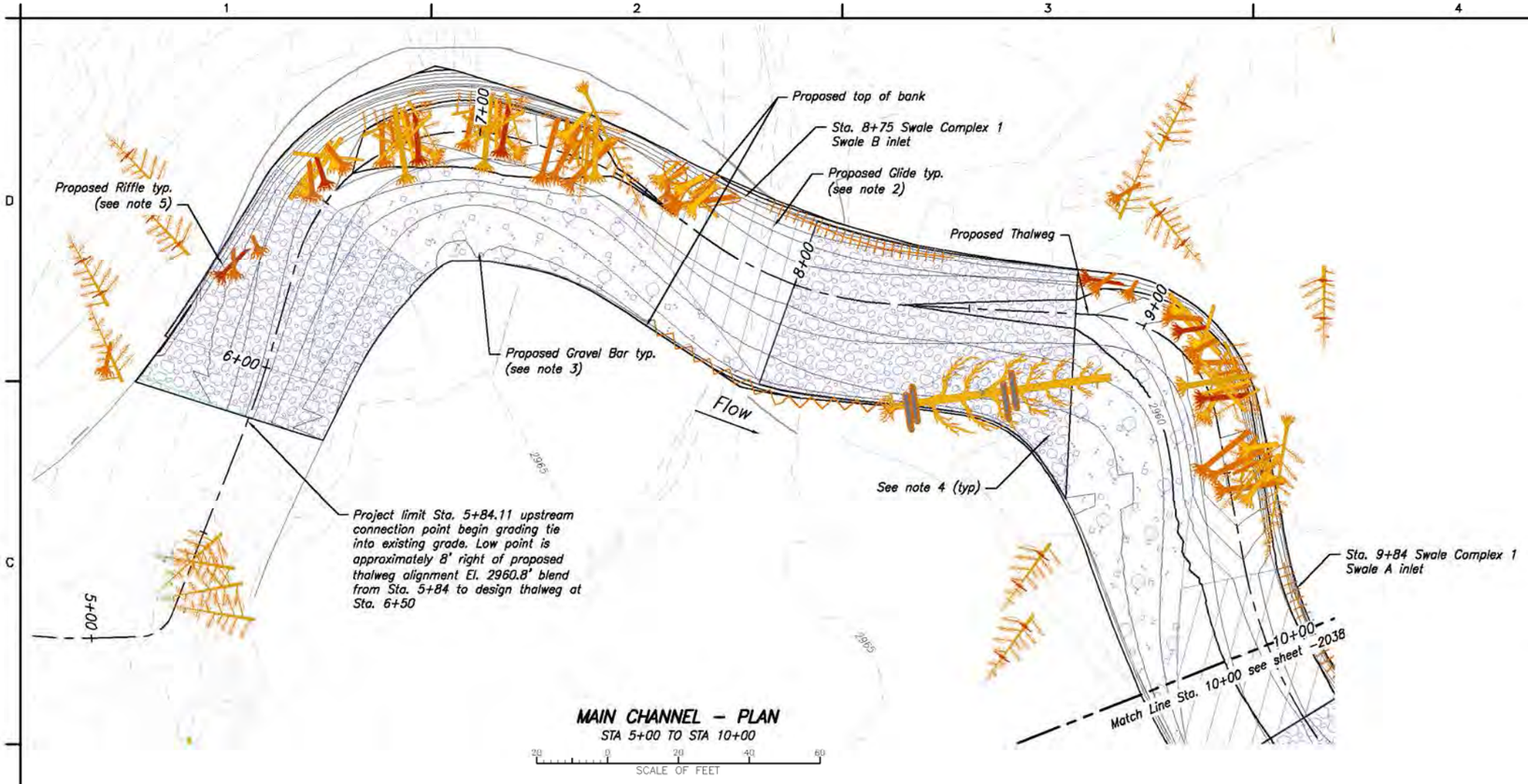


MAIN CHANNEL – PLAN
STA 5+00 TO STA 10+00

20 0 20 40 60
SCALE OF FEET

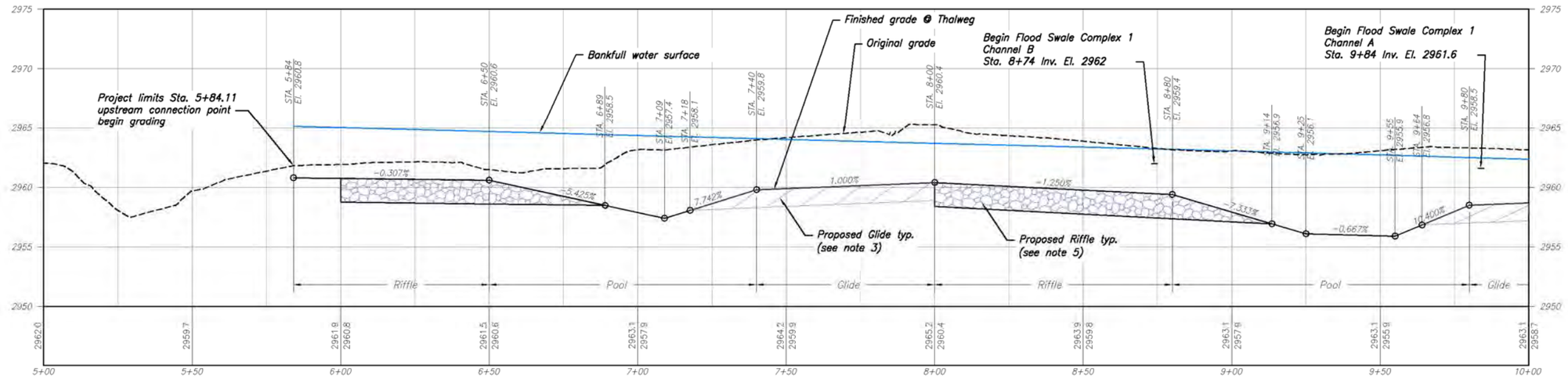
LEGEND

- Proposed Thalweg
- Existing Wetlands
- ELEV — OG Major Contour
- OG Minor Contour
- ELEV — FG Major Contour
- FG Minor Contour
- Property Boundaries

N

NOTES:

1. Cross sections are shown at all major vertical grade breaks shown in profile view. Sections can be found on sheets –2047 and –2059.
2. Glides shall be mechanically lifted and uncompacted for a minimum depth of 18 inches. Contracting Officer shall accept or reject uncompacted glide material based on the gradation shown on sheet –2062. If rejected, material shall be over excavated and rebuilt with acceptable material as shown on sheet –2062. Contractor shall take care to not overly compact glide material.
3. Gravel bar shall be graded to design elevations as shown on plans. Contracting Officer shall accept or reject gravel bar material based on the gradation shown on sheet –2062. If rejected, material shall be over excavated and rebuilt with acceptable material as shown on sheet –2062.
4. No boulders grater than 12 inches in diameter shall be placed in areas where riffle and gravel bars overlap. Riffle material shall be placed in these overlap areas.
5. Riffles shall be graded to design elevations as shown on plans. Contracting Officer shall accept or reject riffle bed material based on the gradation shown on sheet –2063. If rejected, material shall be over excavated and rebuilt with acceptable material as shown on sheet –2063.
6. For large woody material structures see sheets –2116 to –2127.



MAIN CHANNEL – THALWEG PROFILE
STA 5+00 TO STA 10+00

HORIZONTAL SCALE
20 0 20 40 60
SCALE OF FEET

VERTICAL SCALE
5 0 5 10 15
SCALE OF FEET

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GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

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BOISE, IDAHO	2015–09–14

MAIN CHANNEL
STA. 5+00 TO
STA. 10+00

PLAN AND PROFILE

1678–100–2037
SHEET 1 OF 10

DATE AND TIME PLOTTED
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MBENGSTROM

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CAD FILENAME
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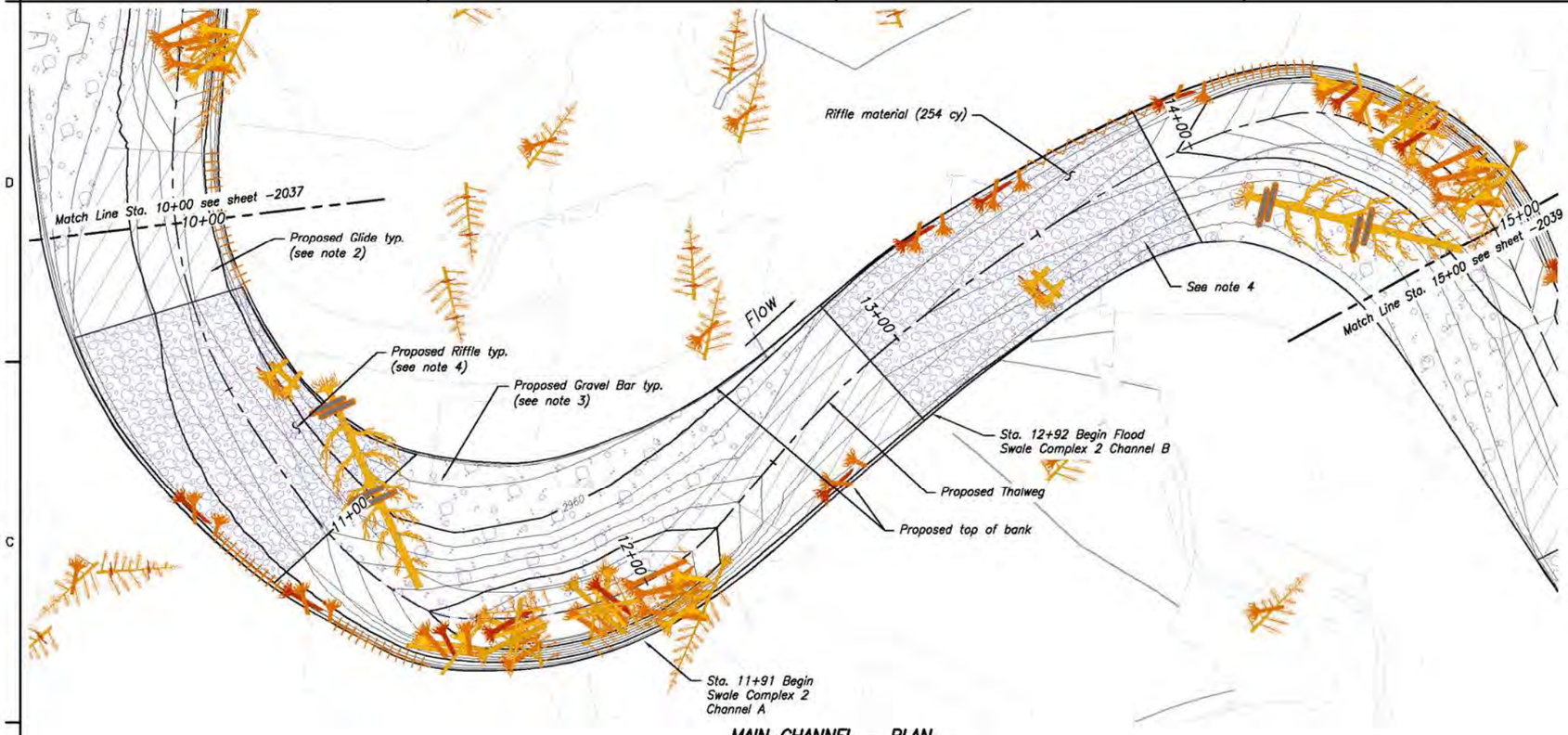
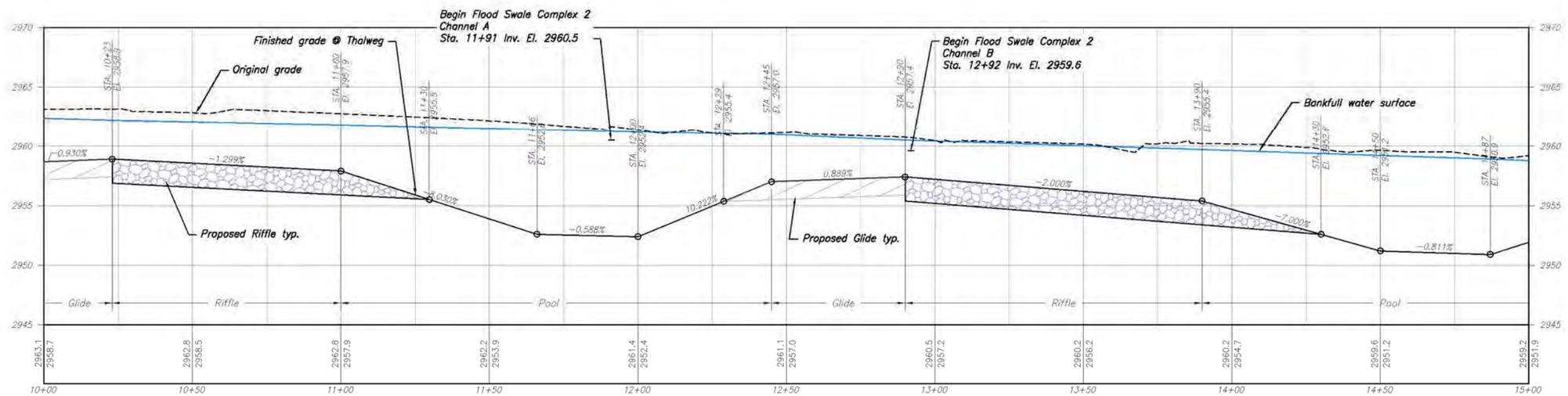


MAIN CHANNEL – PLAN
STA 10+00 TO STA 15+00

SCALE OF FEET



MAIN CHANNEL – THALWEG PROFILE
STA 10+00 TO STA 15+00

HORIZONTAL SCALE
SCALE OF FEET

VERTICAL SCALE
SCALE OF FEET

LEGEND

- Proposed Thalweg
- Existing Wetlands
- ELEV — OG Major Contour
- OG Minor Contour
- ELEV — FG Major Contour
- FG Minor Contour
- Property Boundaries

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6. For large woody material structures see sheets –2116 to –2127.

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BOISE, IDAHO	2015–09–14

MAIN CHANNEL
STA. 10+00 TO
STA. 15+00

PLAN AND PROFILE

1678–100–2038

SHEET 2 OF 10

DATE AND TIME PLOTTED
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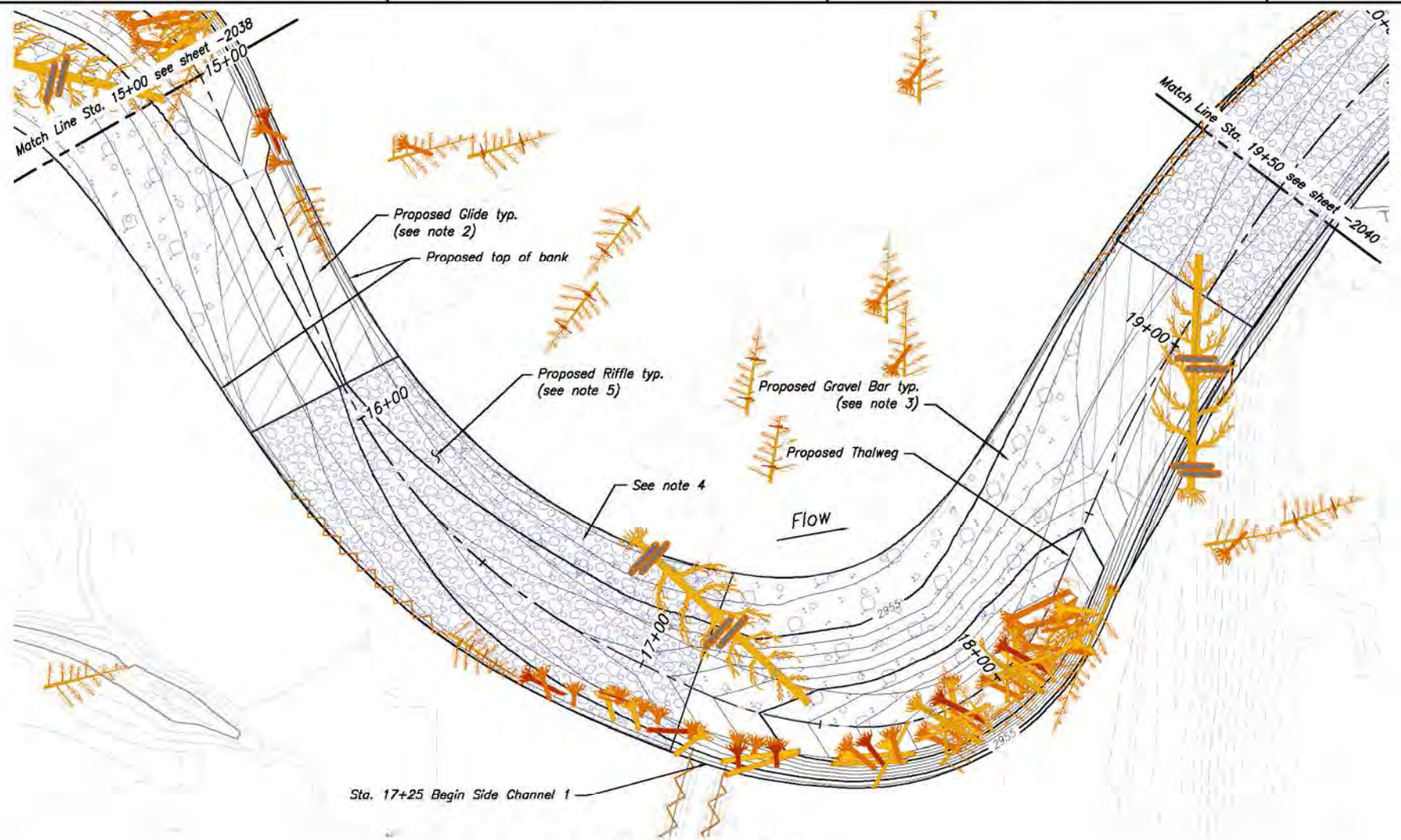
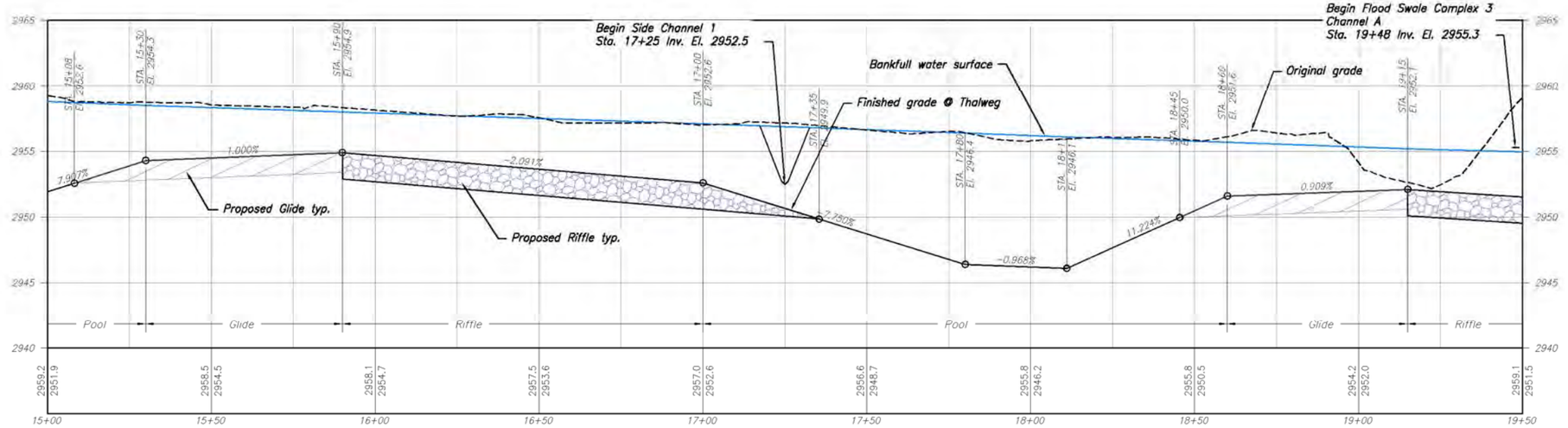


MAIN CHANNEL – PLAN
STA 15+00 TO STA 19+50

SCALE OF FEET: 20 0 20 40 80



MAIN CHANNEL – THALWEG PROFILE
STA 15+00 TO STA 19+50

HORIZONTAL SCALE: 20 0 20 40 60 SCALE OF FEET

VERTICAL SCALE: 5 0 5 10 15 SCALE OF FEET

LEGEND

- Proposed Thalweg
- Existing Wetlands
- ELEV — OG Major Contour
- OG Minor Contour
- ELEV — FG Major Contour
- FG Minor Contour
- Property Boundaries

N

NOTES:

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6. For large woody material structures see sheets –2116 to –2127.

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FCRPS HABITAT IMPROVEMENT PROGRAM

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CC-44 PHASE III HABITAT ENHANCEMENT
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BOISE, IDAHO	2015–09–14

MAIN CHANNEL
STA. 15+00 TO
STA. 19+50

PLAN AND PROFILE

1678–100–2039
SHEET 3 OF 10

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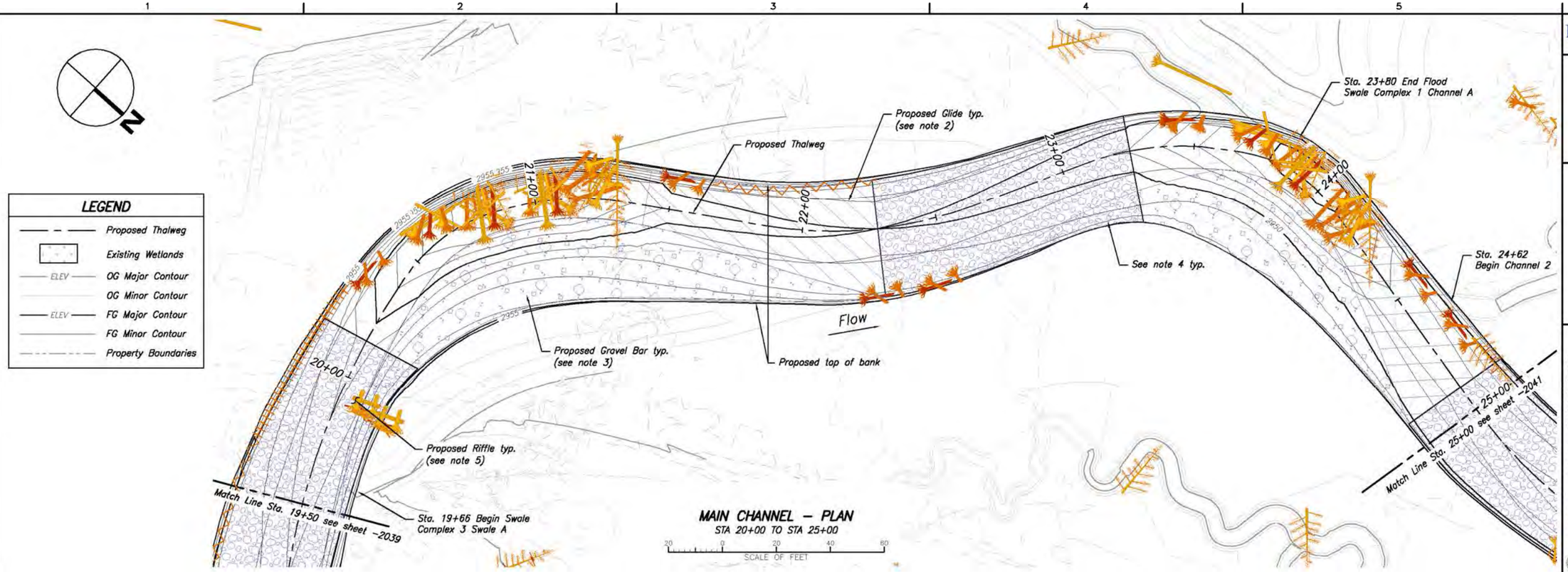
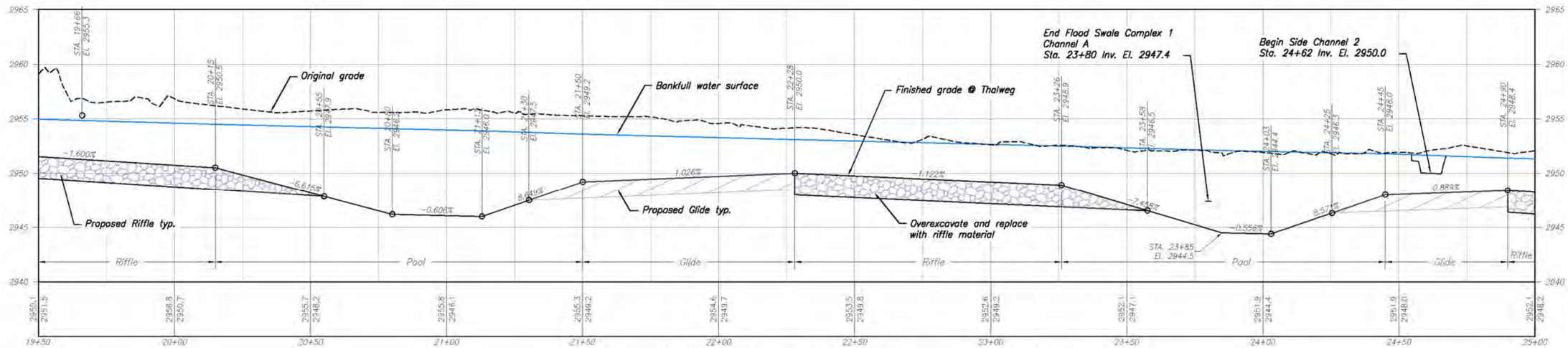
CAD SYSTEM: AutoCAD Rel. 19.1s
CAD FILENAME: PLAN AND PROFILE SHEETS – MAIN CHANNEL.DWG





NOTES:

1. Cross sections are shown at all major vertical grade breaks shown in profile view. Sections can be found on sheets –2047 and –2059.
2. Glides shall be mechanically lifted and uncompacted for a minimum depth of 18 inches. Contracting Officer shall accept or reject uncompacted glide material based on the gradation shown on sheet –2062. If rejected, material shall be over excavated and rebuilt with acceptable material as shown on sheet –2062. Contractor shall take care to not overly compact glide material.
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6. For large woody material structures see sheets –2116 to –2127.

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COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

Jeffrey J. Fegitko P.E.
DESIGNED
JF
DRAWN
Mike Knutson P.E.
CHECKED
Jeffrey J. Fegitko P.E.
TECH. APPR.
Steve Montague–Acting
APPROVED
ADMIN APPROVAL – PROGRAM MANAGER
BOISE, IDAHO 2015–09–14

MAIN CHANNEL
STA. 19+50 TO
STA. 25+00

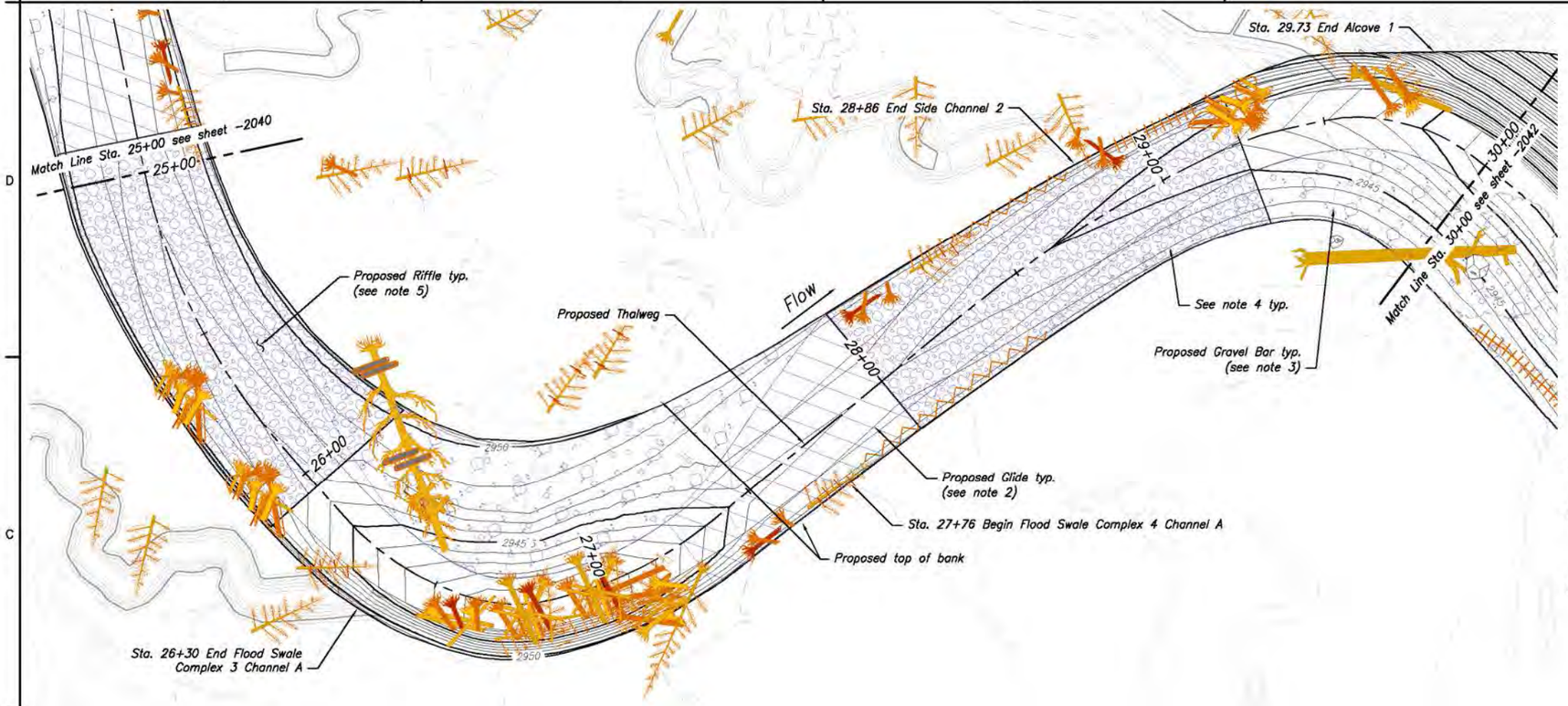
PLAN AND PROFILE

1678–100–2040

SHEET 4 OF 10

DATE AND TIME PLOTTED)
MAY 26, 2015 17:07
PLOTTED BY
MBERGSTROM

CAD SYSTEM
AutoCAD Rel. 18.1s
CAD FILENAME
PLAN AND PROFILE SHEETS – MAIN CHANNEL.DWG



MAIN CHANNEL – PLAN
STA 25+00 TO STA 30+00

20 0 20 40 60
SCALE OF FEET

LEGEND

- Proposed Thalweg
- Existing Wetlands
- ELEV — OG Major Contour
- OG Minor Contour
- ELEV — FG Major Contour
- FG Minor Contour
- Property Boundaries

N

NOTES:

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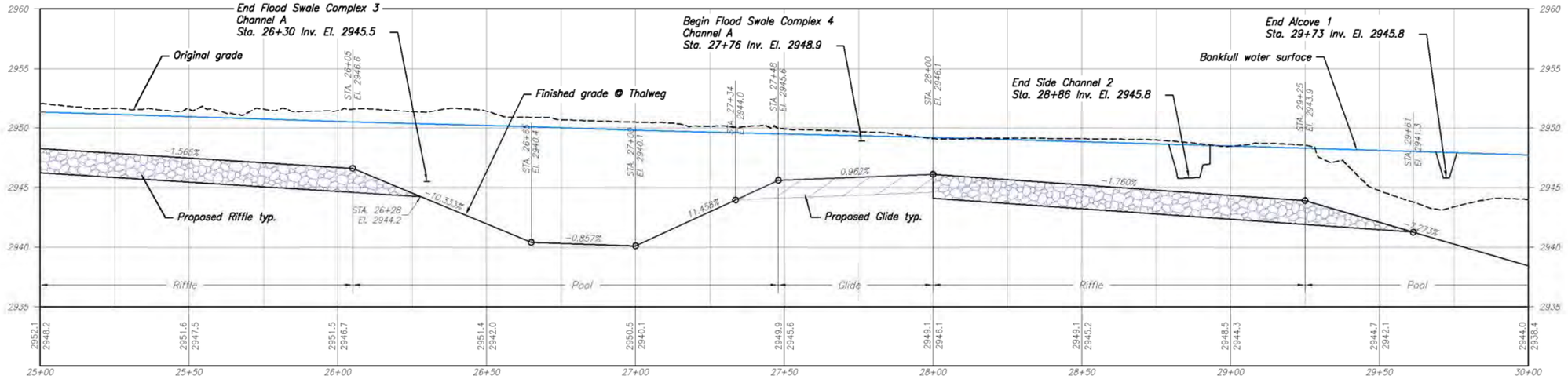

MAIN CHANNEL – THALWEG PROFILE
STA 25+00 TO STA 30+00

HORIZONTAL SCALE
20 0 20 40 60
SCALE OF FEET

VERTICAL SCALE
5 0 5 10 15
SCALE OF FEET

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BUREAU OF RECLAMATION
COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

Jeffrey J. Fegitko P.E.	DESIGNED
JH	DRAWN
Mike Knutson P.E.	CHECKED
Jeffrey J. Fegitko P.E.	TECH. APPR.
Steve Montague–Acting	APPROVED
	ADMIN APPROVAL – PROGRAM MANAGER
BOISE, IDAHO	2015–08–14

MAIN CHANNEL
STA. 25+00 TO
STA. 30+00

PLAN AND PROFILE

1678–100–2041

SHEET 5 OF 10

DATE AND TIME PLOTTED
MAY 26, 2015 17:07
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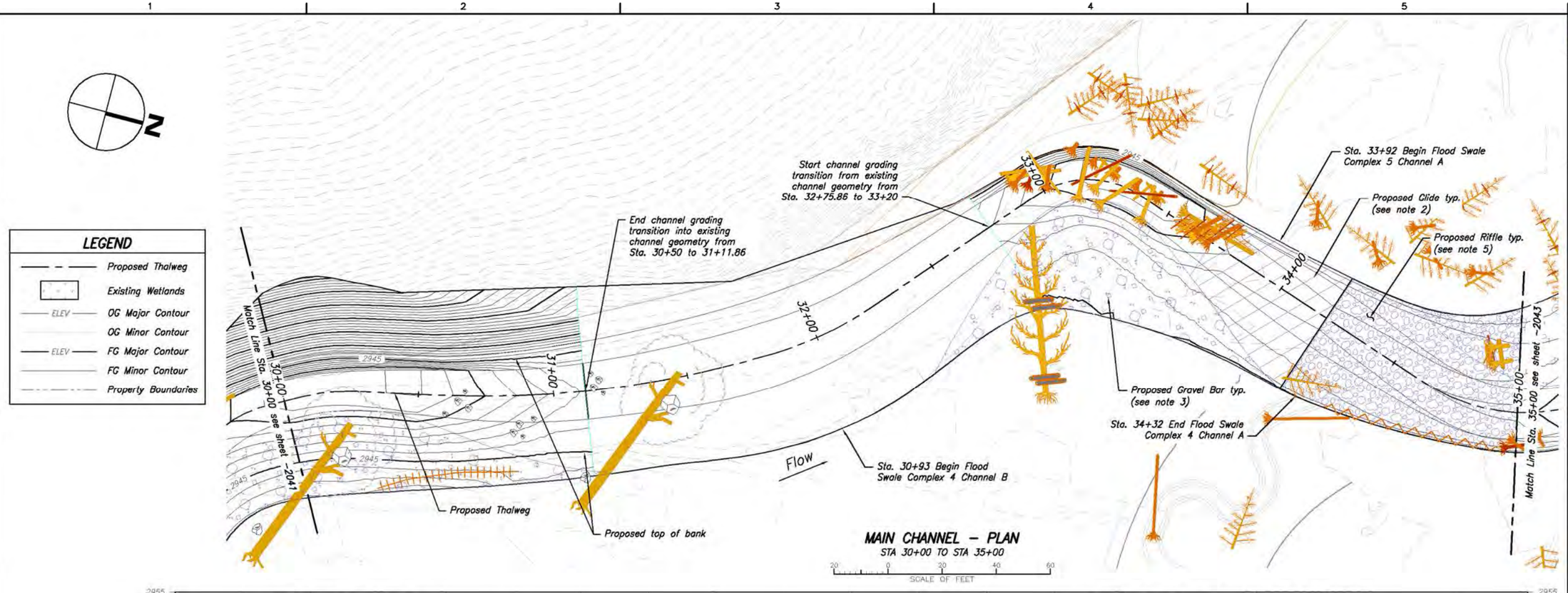
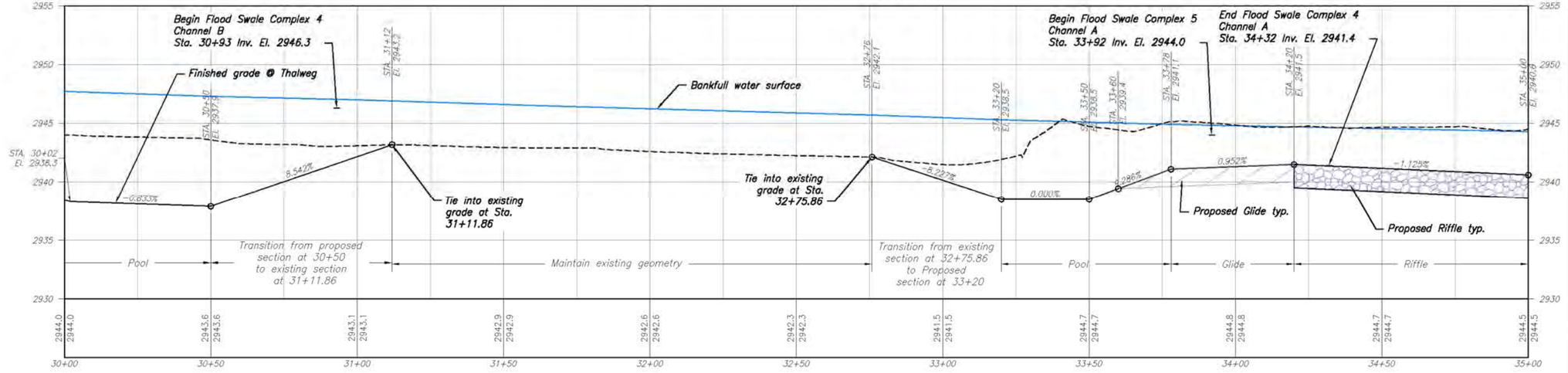
MBENGSTROM

CAD SYSTEM
AutoCAD Rel. 19.1s
CAD FILENAME
PLAN AND PROFILE SHEETS – MAIN CHANNEL.DWG



MAIN CHANNEL – PLAN
STA 30+00 TO STA 35+00

20 0 20 40 60
SCALE OF FEET



MAIN CHANNEL – THALWEG PROFILE
STA 30+00 TO STA 35+00

HORIZONTAL SCALE
20 0 20 40 60
SCALE OF FEET

VERTICAL SCALE
5 0 5 10 15
SCALE OF FEET

NOTES:

1. Cross sections are shown at all major vertical grade breaks shown in profile view. Sections can be found on sheets –2047 and –2059.
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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

Jeffrey J Fealko P.E.
DESIGNED
JH
DRAWN
Mike Knutson P.E.
CHECKED
Jeffrey J Fealko P.E.
TECH. APPR.
Steve Montague–Acting
APPROVED
ADMIN APPROVAL – PROGRAM MANAGER
BOISE, IDAHO 2015–09–14

MAIN CHANNEL
STA. 30+00 TO
STA. 35+00

PLAN AND PROFILE

1678–100–2042
SHEET 6 OF 10

DATE AND TIME PLOTTED
MAY 26, 2015 17:07
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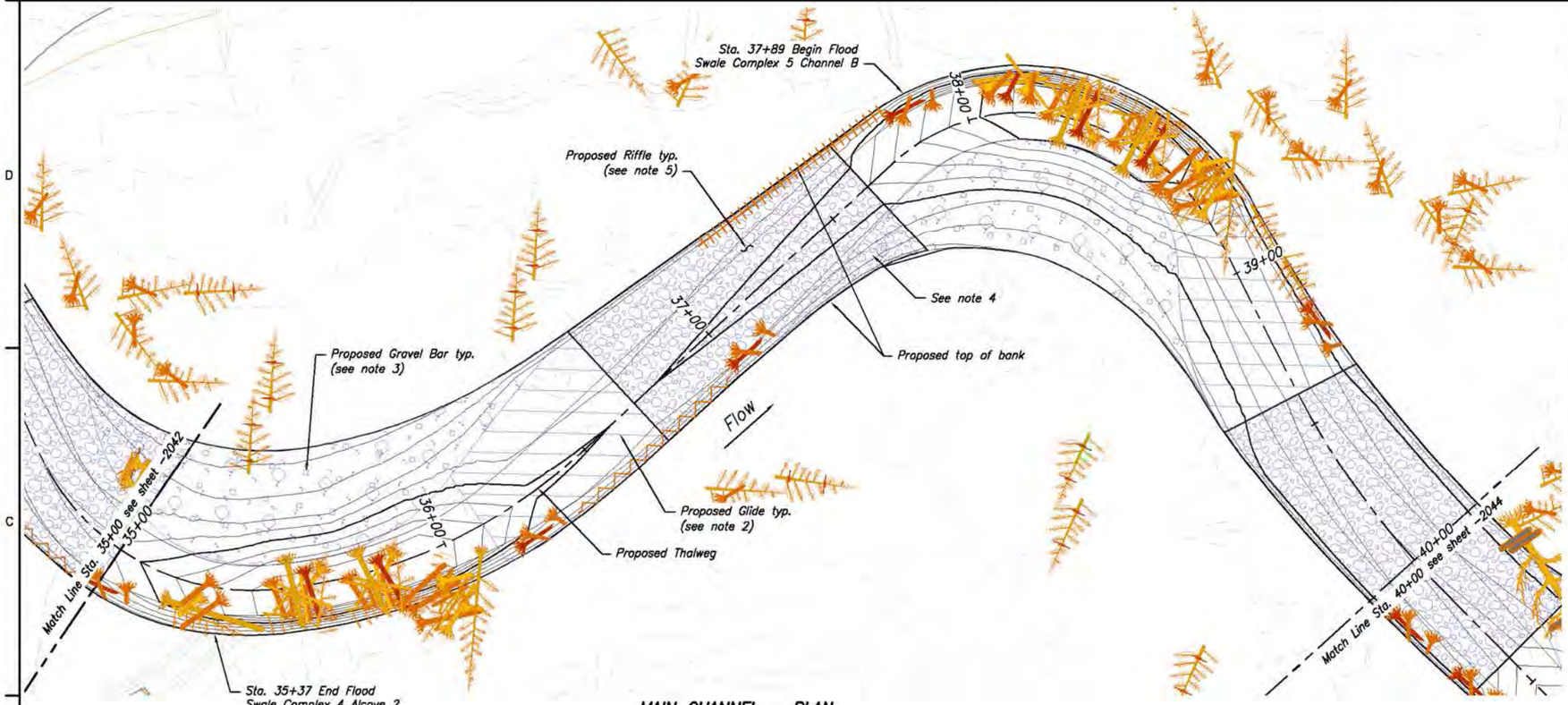
CAD SYSTEM
AutoCAD Rel. 19.1s
CAD FILENAME
PLAN AND PROFILE SHEETS – MAIN CHANNEL.DWG



MAIN CHANNEL – PLAN
STA 35+00 TO STA 40+00

SCALE OF FEET

LEGEND

- Proposed Thalweg
- Existing Wetlands
- ELEV — OG Major Contour
- OG Minor Contour
- ELEV — FG Major Contour
- FG Minor Contour
- Property Boundaries

N

NOTES:

1. Cross sections are shown at all major vertical grade breaks shown in profile view. Sections can be found on sheets –2047 and –2059.
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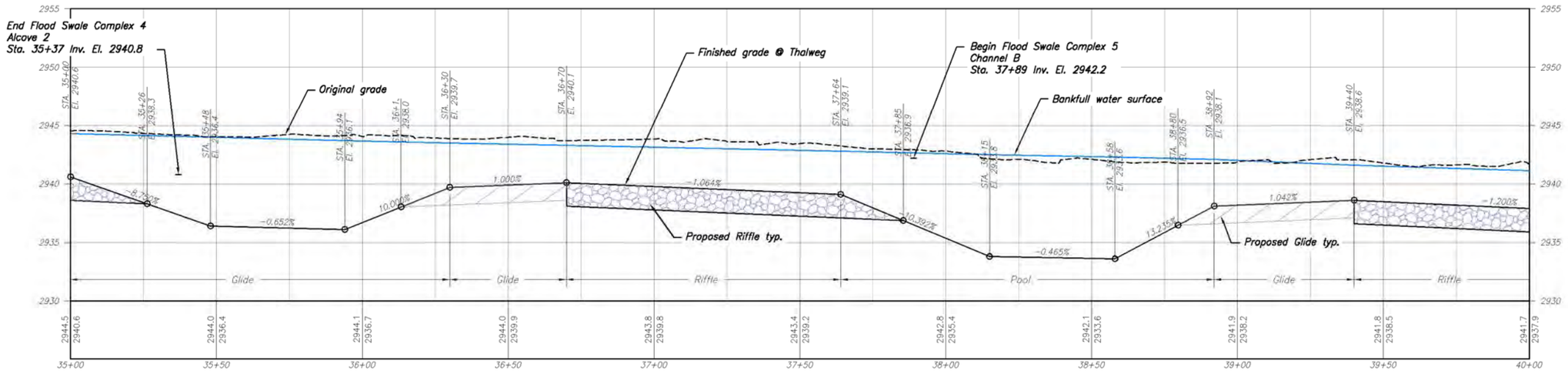
6. For large woody material structures see sheets –2116 to –2127.



MAIN CHANNEL – THALWEG PROFILE
STA 35+00 TO STA 40+00

HORIZONTAL SCALE — SCALE OF FEET

VERTICAL SCALE — SCALE OF FEET

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

Jeffrey J. Fealko P.E.	DESIGNED
JH	DRAWN
Mike Knutson P.E.	CHECKED
Jeffrey J. Fealko P.E.	TECH. APPR.
Steve Montague–Acting	APPROVED
ADMIN APPROVAL – PROGRAM MANAGER	
BOISE, IDAHO	2015–09–14

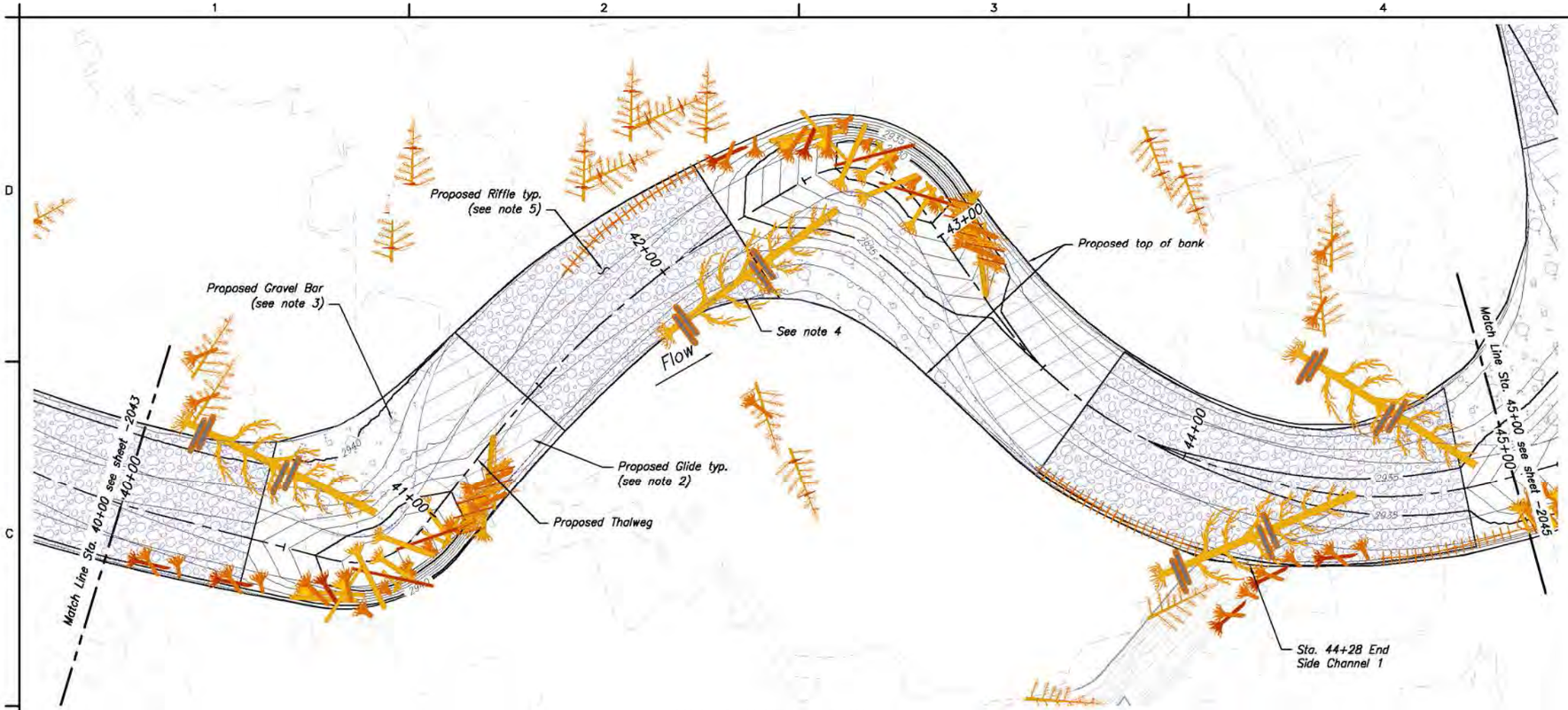
MAIN CHANNEL
STA. 35+00 TO
STA. 40+00

PLAN AND PROFILE

1678–100–2043
SHEET 7 OF 10

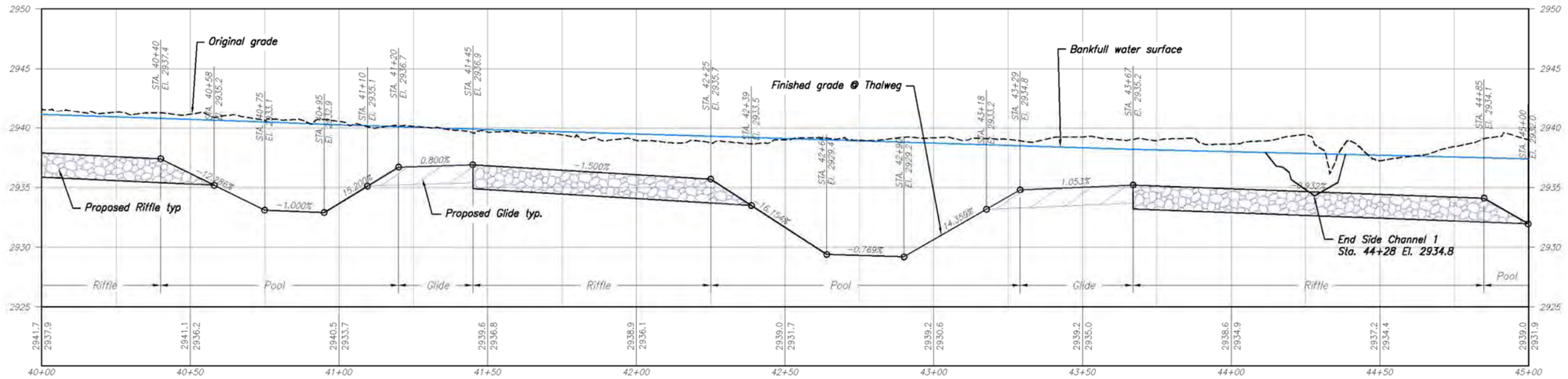
DATE AND TIME PLOTTED
MAY 26, 2015 17:07
PLOTTED BY
MBENGSTROM

CAD SYSTEM
AutoCAD Rel. 19.1s
CAD FILENAME
PLAN AND PROFILE SHEETS – MAIN CHANNEL.DWG



MAIN CHANNEL – PLAN
STA 40+00 TO STA 45+00

20 0 20 40 60
SCALE OF FEET



MAIN CHANNEL – THALWEG PROFILE
STA 40+00 TO STA 45+00

HORIZONTAL SCALE
20 0 20 40 60
SCALE OF FEET

VERTICAL SCALE
5 0 5 10 15
SCALE OF FEET

LEGEND

- Proposed Thalweg
- Existing Wetlands
- ELEV — OG Major Contour
- OG Minor Contour
- ELEV — FG Major Contour
- FG Minor Contour
- Property Boundaries

N

NOTES:

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

Jeffrey J. Fealko P.E.	DESIGNED
JH	DRAWN
Mike Knutsen P.E.	CHECKED
Jeffrey J. Fealko P.E.	FIELD APPR.
Steve Montague–Acting	APPROVED
	ADMIN APPROVAL – PROGRAM MANAGER
BOISE, IDAHO	2015–09–14

MAIN CHANNEL
STA. 40+00 TO
STA. 45+00

PLAN AND PROFILE

1678–100–2044
SHEET 8 OF 10

DATE AND TIME PLOTTED
MAY 26, 2015 17:07
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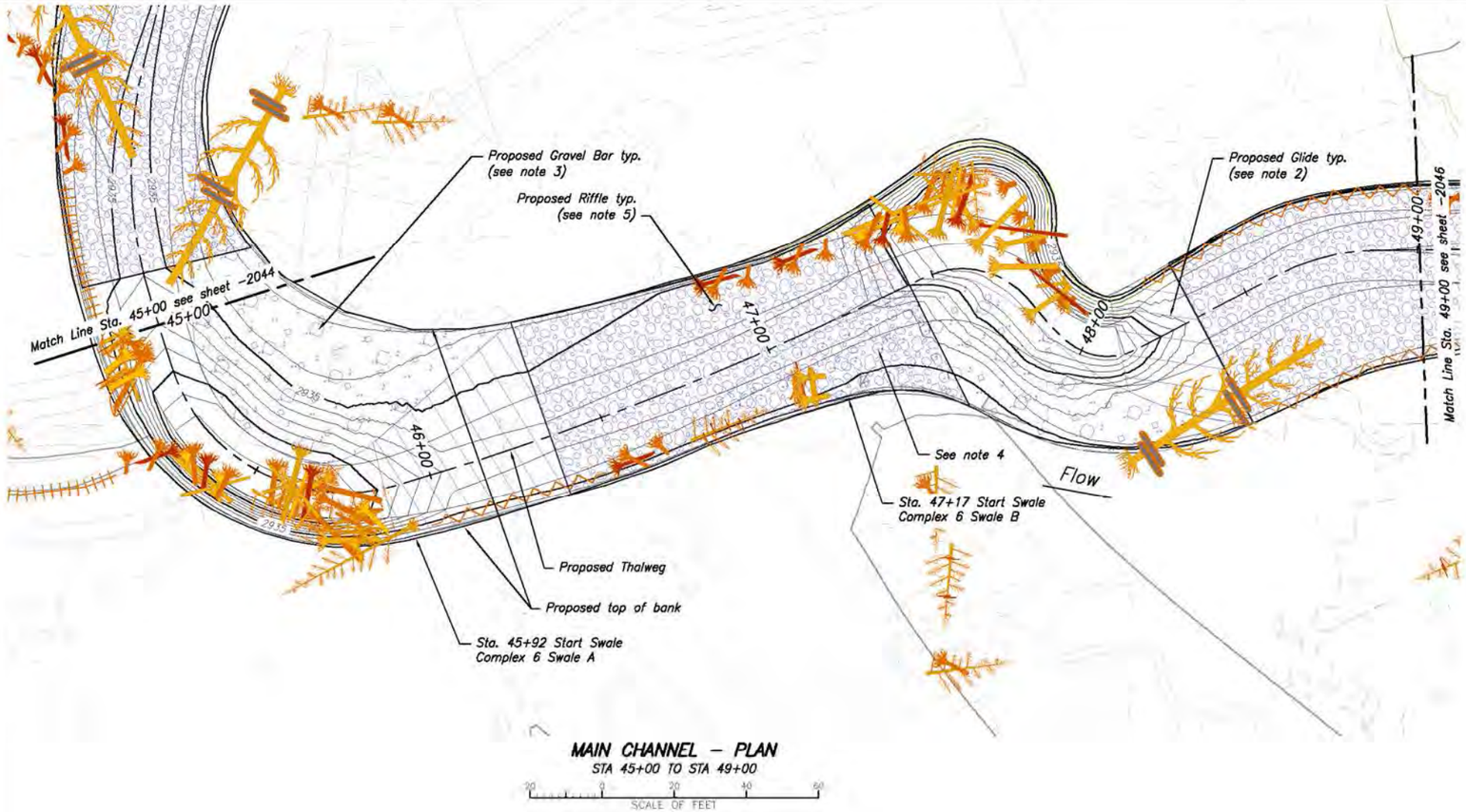
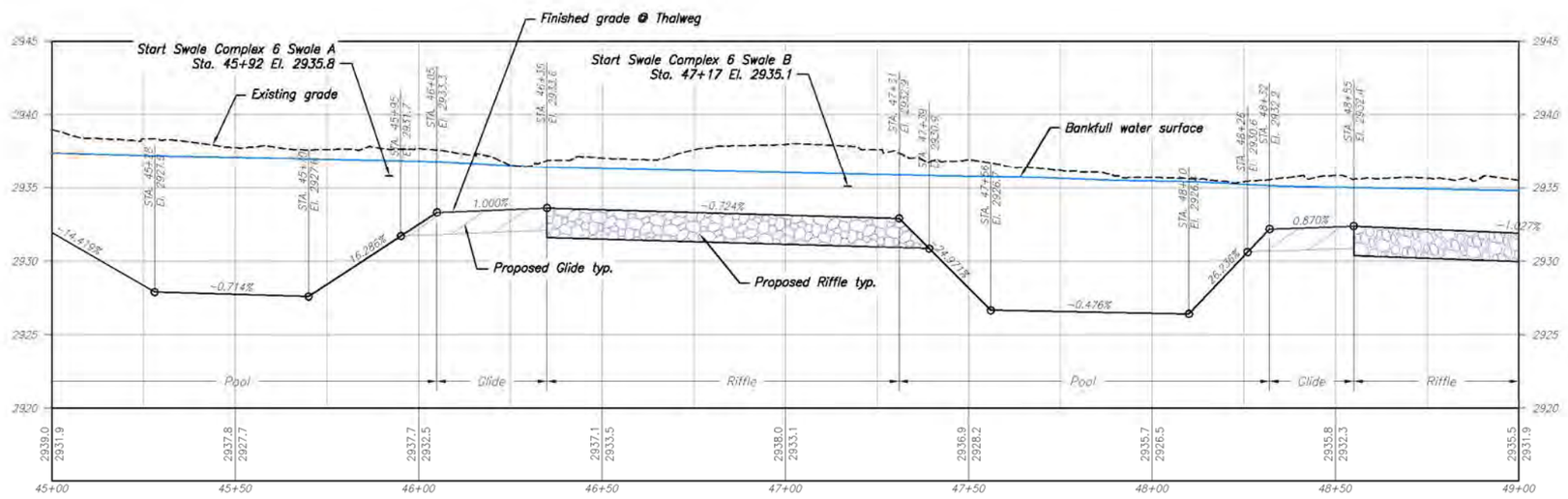
MBERGSTROM

CAD SYSTEM
AutoCAD Rel. 19.1s
CAD FILENAME
PLAN AND PROFILE SHEETS – MAIN CHANNEL.DWG



MAIN CHANNEL – PLAN
STA 45+00 TO STA 49+00

SCALE OF FEET: 20 0 20 40 60



MAIN CHANNEL – THALWEG PROFILE
STA 45+00 TO STA 49+00

HORIZONTAL SCALE: 20 0 20 40 60 SCALE OF FEET

VERTICAL SCALE: 5 0 5 10 15 SCALE OF FEET

LEGEND

- Proposed Thalweg
- Existing Wetlands
- ELEV — OG Major Contour
- OG Minor Contour
- ELEV — FG Major Contour
- FG Minor Contour
- Property Boundaries

N

NOTES:

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BUREAU OF RECLAMATION
COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

Jeffrey J. Fegiko P.E.	DESIGNED
JH	DRAWN
Mike Knutson P.E.	CHECKED
Jeffrey J. Fegiko P.E.	TECH. APPR.
Steve Montague–Acting	APPROVED (COMM. APPROVAL = PROGRAM MANAGER)
BOISE, IDAHO	2015-09-14

MAIN CHANNEL
STA. 45+00 TO
STA. 49+00

PLAN AND PROFILE

1678–100–2045

SHEET 9 OF 10

DATE AND TIME PLOTTED:
MAY 28, 2015 17:01
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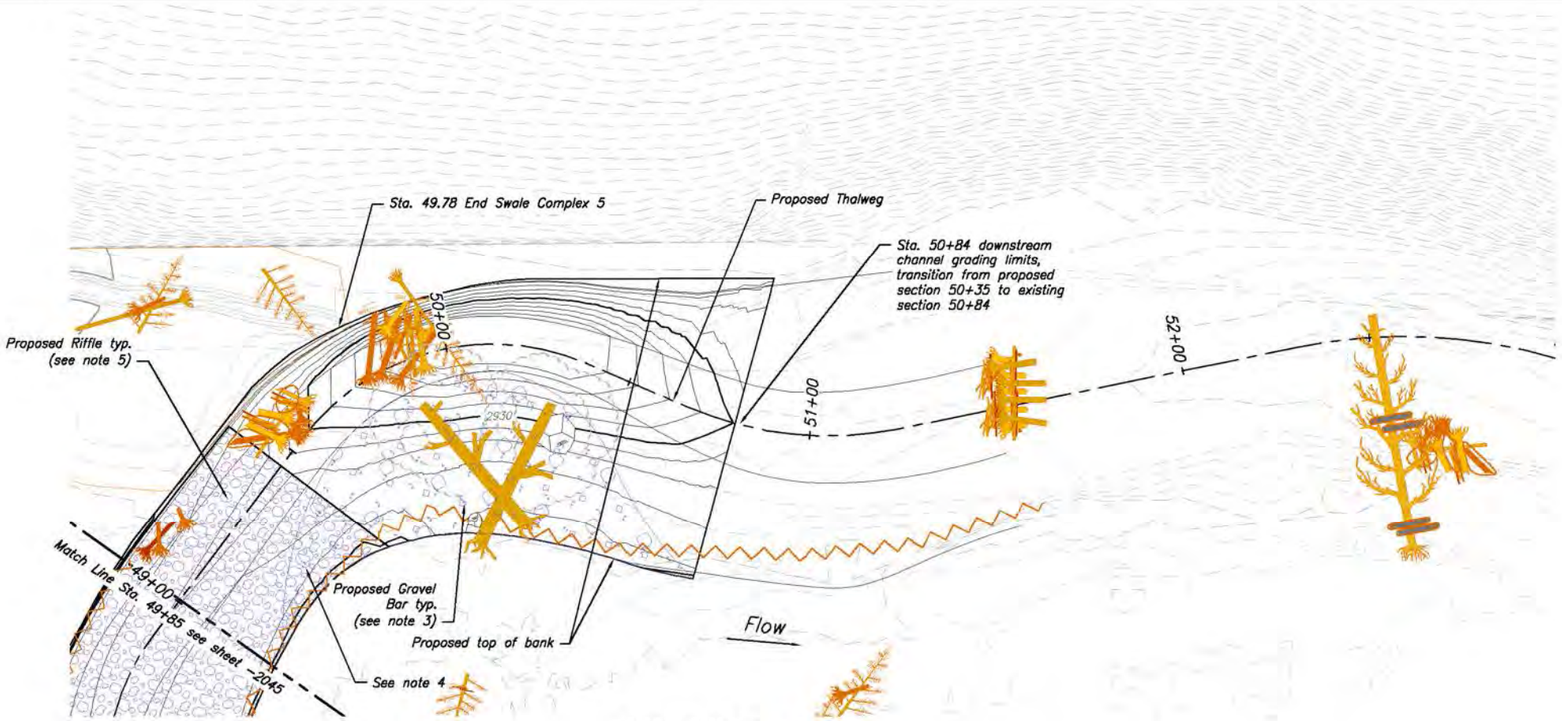
MBERGSTROM

CAD SYSTEM:
AutoCAD Rel. 19.1s
CAD FILENAME:
PLAN AND PROFILE SHEETS – MAIN CHANNEL.DWG

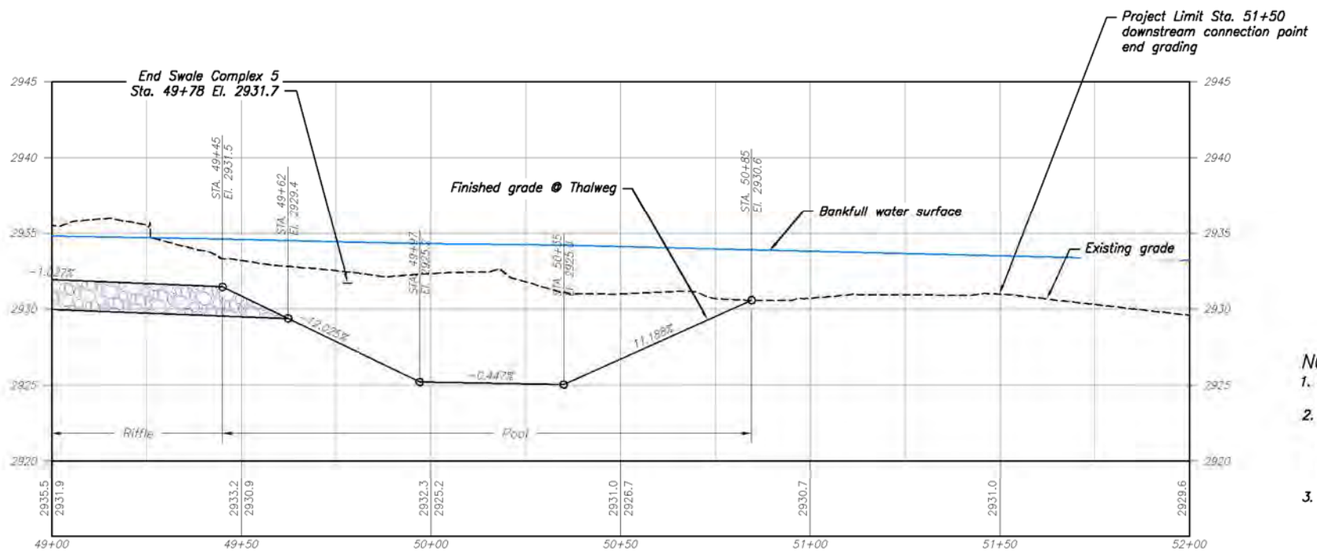


MAIN CHANNEL – PLAN
STA 49+00 TO STA 51+50
SCALE OF FEET



LEGEND

- Proposed Thalweg
- Existing Wetlands
- ELEV — OG Major Contour
- OG Minor Contour
- ELEV — FG Major Contour
- FG Minor Contour
- Property Boundaries



MAIN CHANNEL – THALWEG PROFILE
STA 49+00 TO STA 51+50
HORIZONTAL SCALE — SCALE OF FEET
VERTICAL SCALE — SCALE OF FEET

NOTES:

1. Cross sections are shown at all major vertical grade breaks shown in profile view. Sections can be found on sheets -2047 and -2059.
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BUREAU OF RECLAMATION
COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

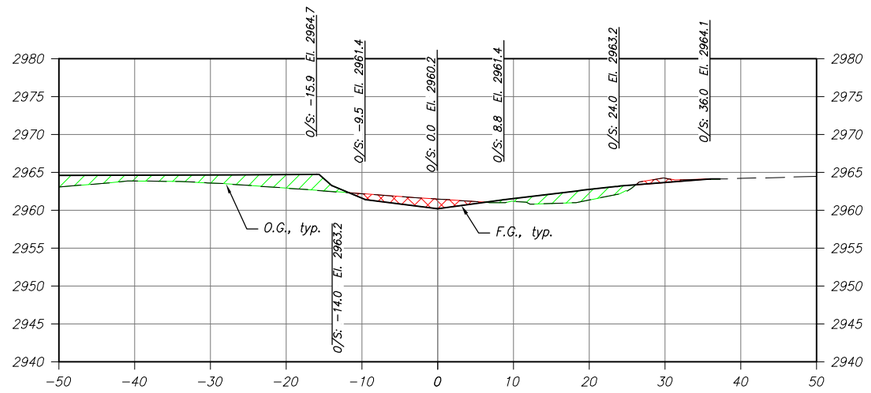
Jeffrey J. Fedko P.E.
DESIGNED
JH
DRAWN
Mike Knutson P.E.
CHECKED
Jeffrey J. Fedko P.E.
TECH. APPR.
Steve Montague-Acting
APPROVED
ADMIN APPROVAL – PROGRAM MANAGER
BOISE, IDAHO 2015-09-14

MAIN CHANNEL
STA. 49+00 TO
STA. 51+50

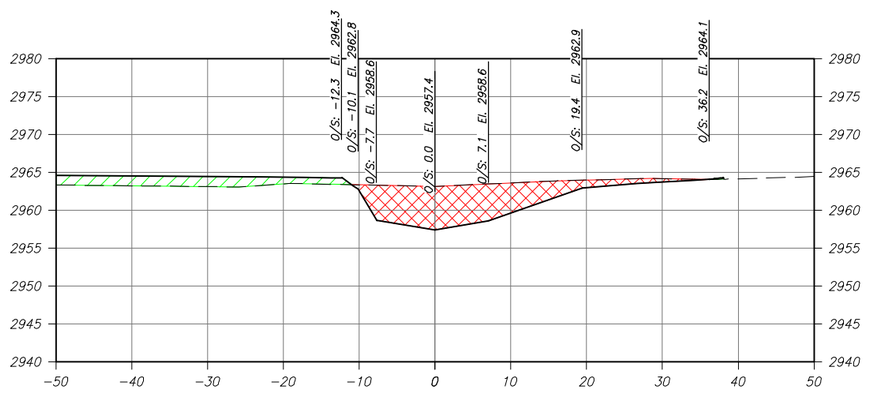
PLAN AND PROFILE

1678-100-2046
SHEET 10 OF 10

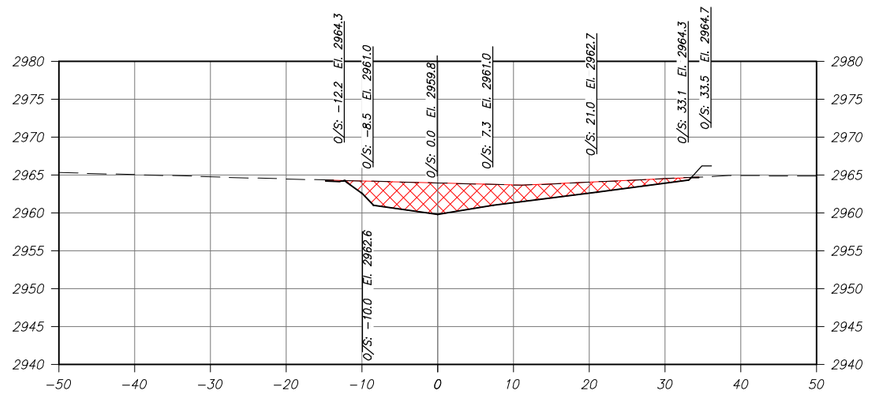
DATE AND TIME PLOTTED MAY 26, 2015 17:07
PLOTTED BY MBERGSTROM
CAD SYSTEM AutoCAD Rel. 19.1s
CAD FILENAME PLAN AND PROFILE SHEETS – MAIN CHANNEL.DWG



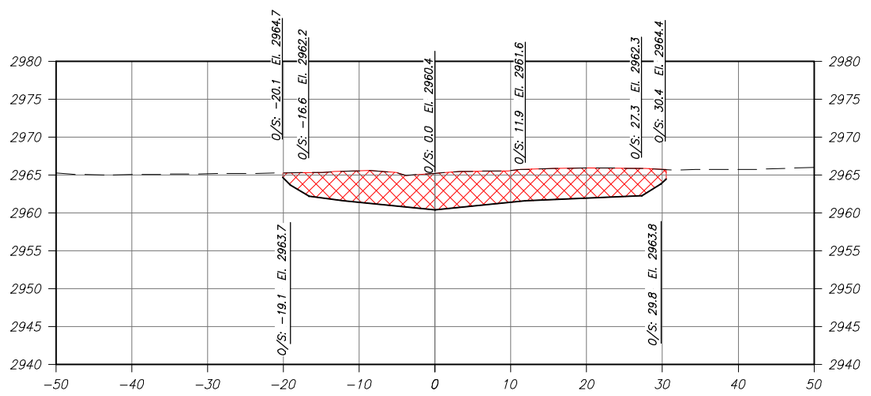
STA. 6+50



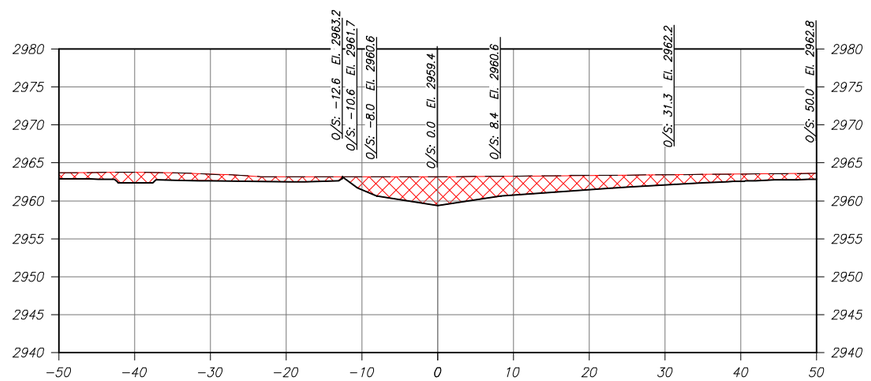
STA. 7+09



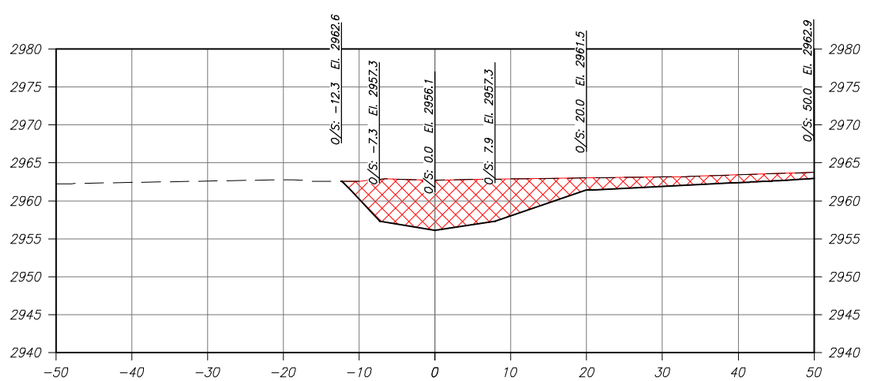
STA. 7+40



STA. 8+00



STA. 8+80



STA. 9+25

Cut

Fill

MAIN CHANNEL CROSS SECTION STA. 6+50 TO 9+25

SCALE OF FEET

NOTES:

1. Cross sections face downstream. Cross section centerline station is located along the thalweg alignment.
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DATE AND TIME PLOTTED
JUNE 15, 2015 10:11
PLOTTED BY
JHOADE

CAD SYSTEM
AutoCAD Rel. 20.0s
CAD FILENAME
CROSS SECTIONS.DWG

RECLAMATION
Managing Water in the West

ALWAYS THINK SAFETY

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

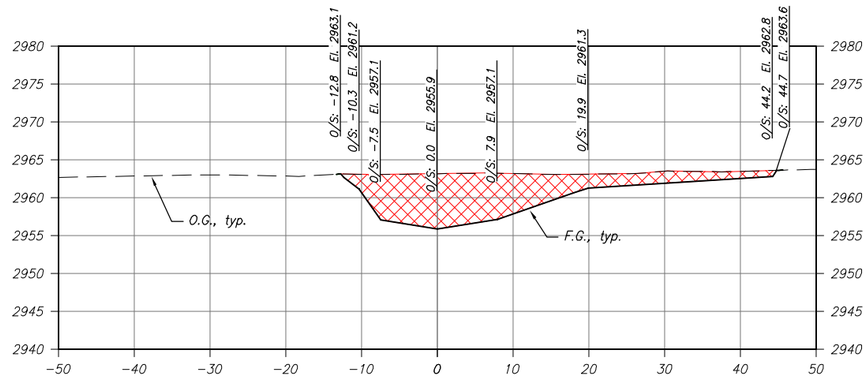
Jeffrey J Fealko P.E.
DESIGNED
JH
DRAWN
Mike Knutson P.E.
CHECKED
Jeffrey J Fealko P.E.
TECH. APPR.
Steve Montague–Acting
APPROVED
ADMIN. APPROVAL – PROGRAM MANAGER
BOISE, ID 2015–09–14

MAIN CHANNEL
STA. 6+50 TO 9+25

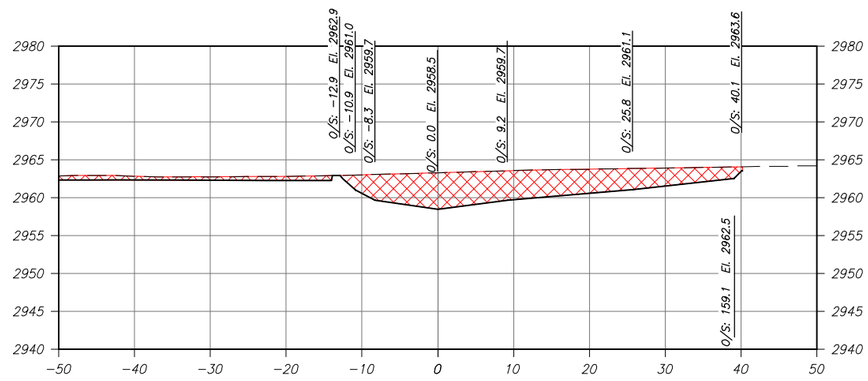
CROSS SECTIONS

1678–100–2047

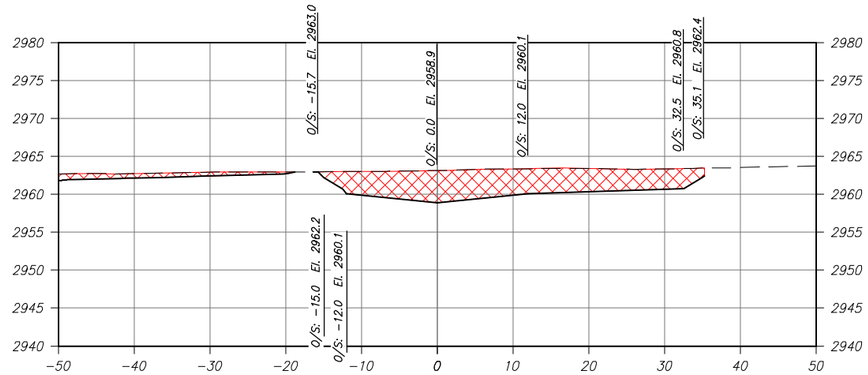
SHEET 1 OF 13



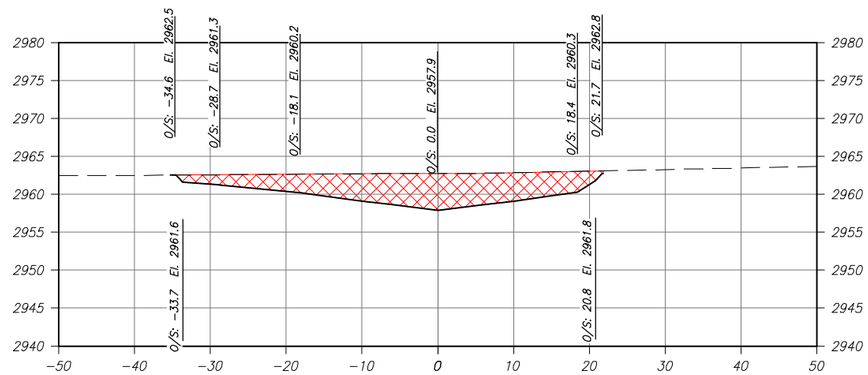
STA. 9+55



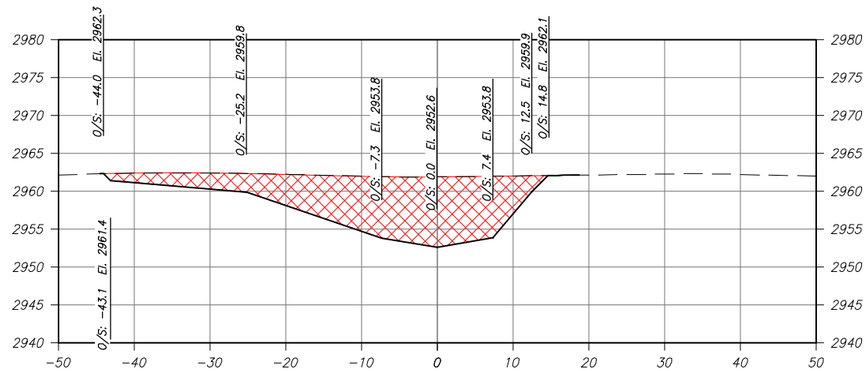
STA. 9+80



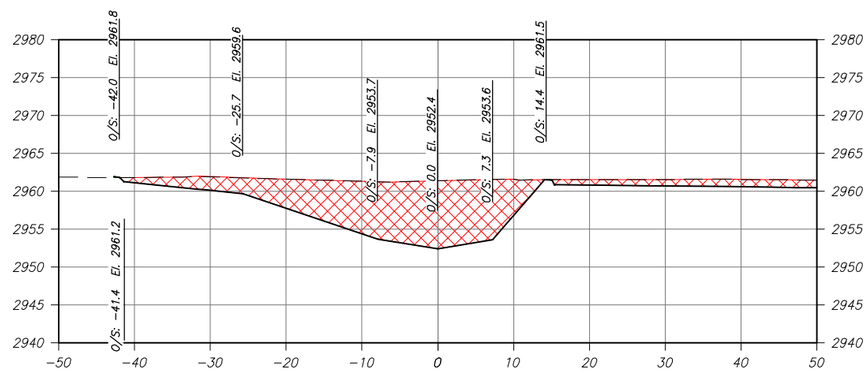
STA. 10+23



STA. 11+00



STA. 11+66



STA. 12+00

Cut

Fill

MAIN CHANNEL CROSS SECTION STA. 9+55 TO 12+00

10 0 10 20 30
SCALE OF FEET

NOTES:

1. Cross sections face downstream. Cross section centerline station is located along the thalweg alignment.
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COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT PARCEL 3

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BOISE, ID
2015-09-14

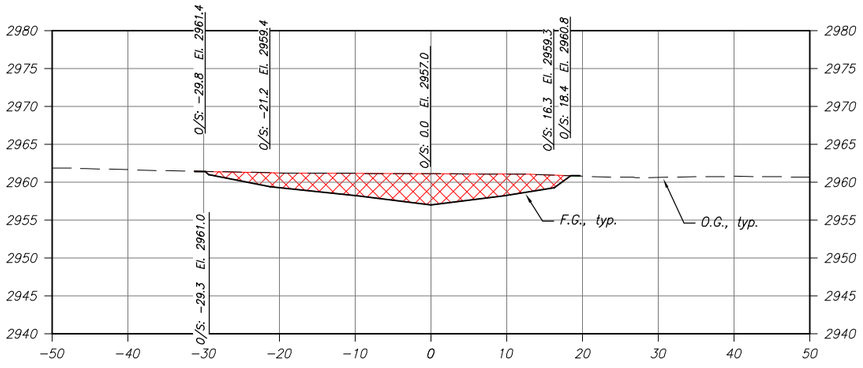
MAIN CHANNEL STA. 9+55 TO 12+00

CROSS SECTIONS

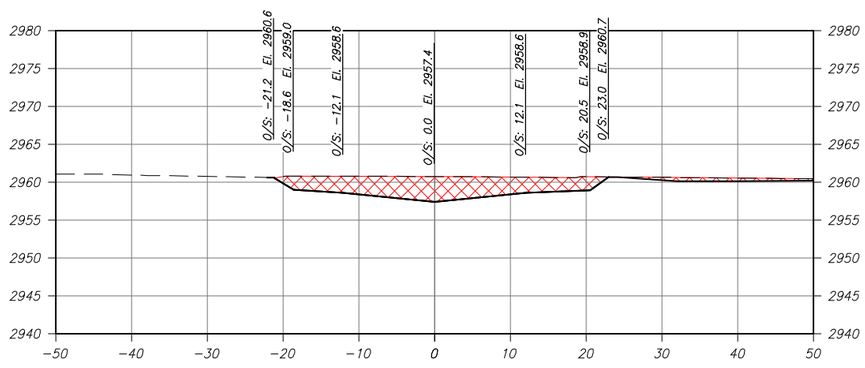
1678-100-2048
SHEET 2 OF 13

DATE AND TIME PLOTTED
AUGUST 13, 2015 15:38
PLOTTED BY
JHOVDE

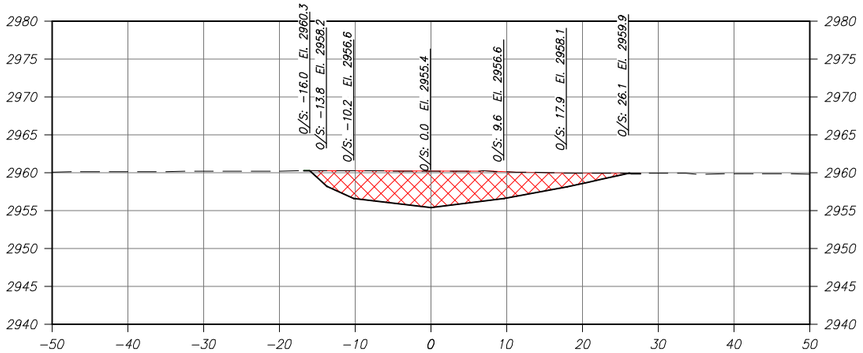
CAD SYSTEM
AutoCAD Rel. 20.0s
CAD FILENAME
1678-100-MCXS.DWG



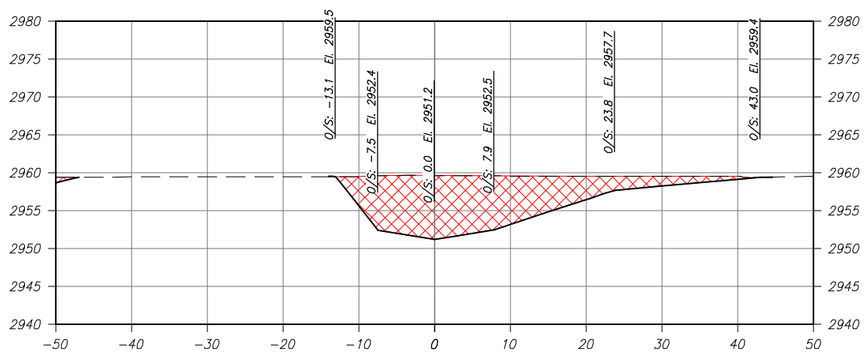
STA. 12+45



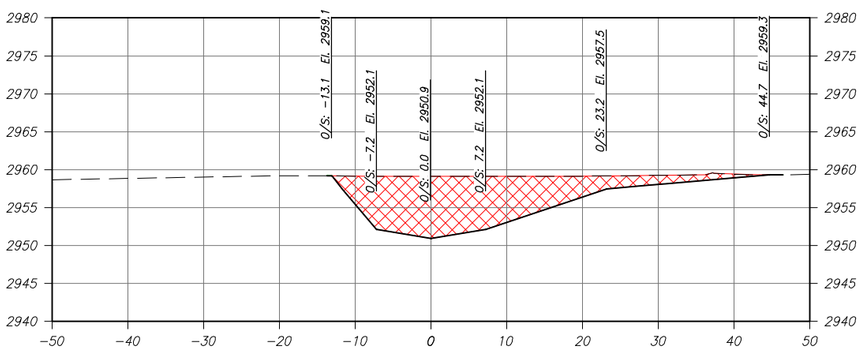
STA. 12+90



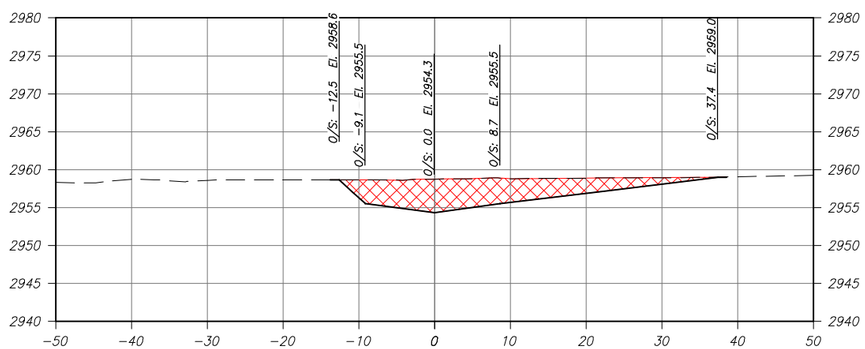
STA. 13+90



STA. 14+50



STA. 14+87



STA. 15+30

Cut

Fill

MAIN CHANNEL CROSS SECTION STA. 12+45 TO 15+30

10 0 10 20 30
SCALE OF FEET

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COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

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Steve Montague-Acting
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BOISE, ID 2015-09-14

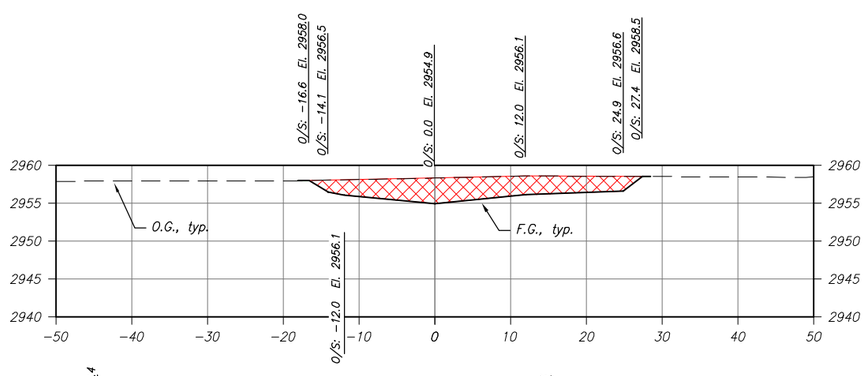
MAIN CHANNEL
STA. 12+45 TO 15+30

CROSS SECTIONS

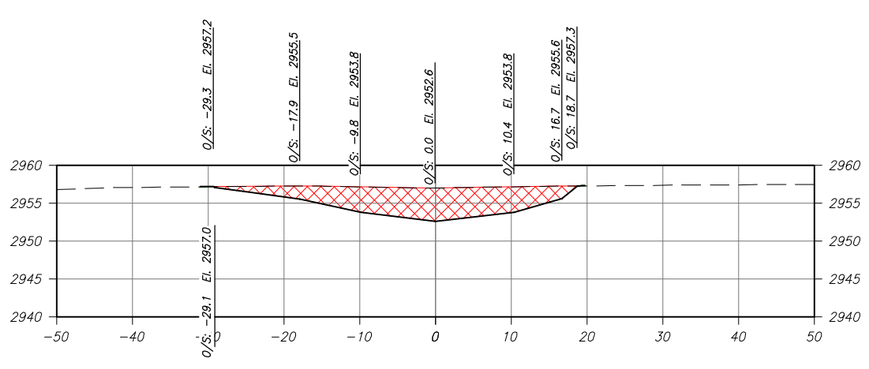
1678-100-2049
SHEET 3 OF 13

DATE AND TIME PLOTTED
AUGUST 13, 2015 15:40
PLOTTED BY
JHOVDE

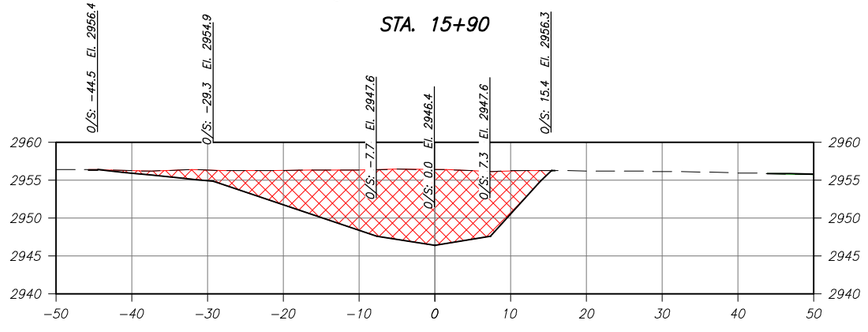
CAD SYSTEM
AutoCAD Rel. 20.0s
CAD FILENAME
1678-100-MCXS.DWG



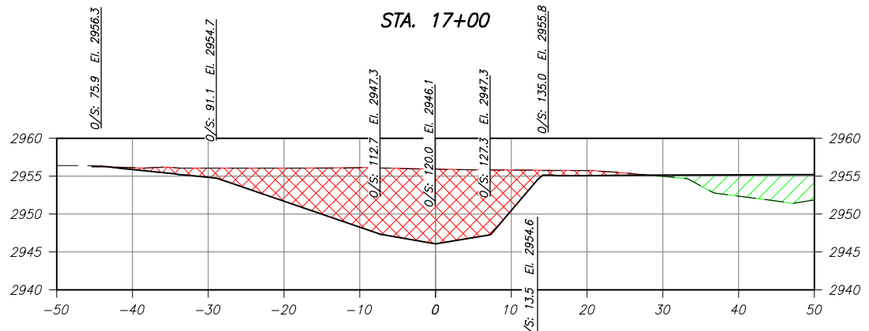
STA. 15+90



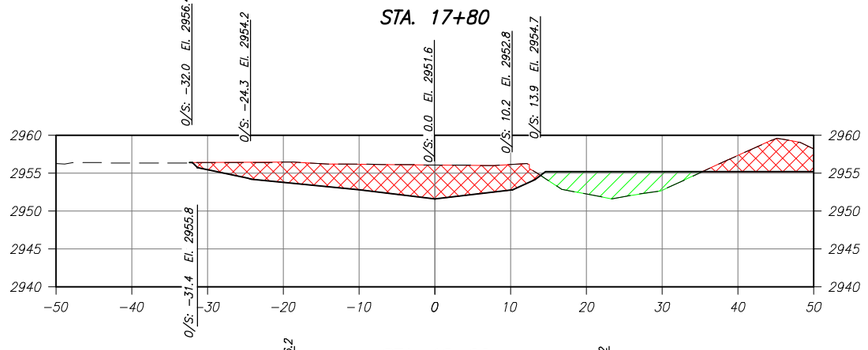
STA. 17+00



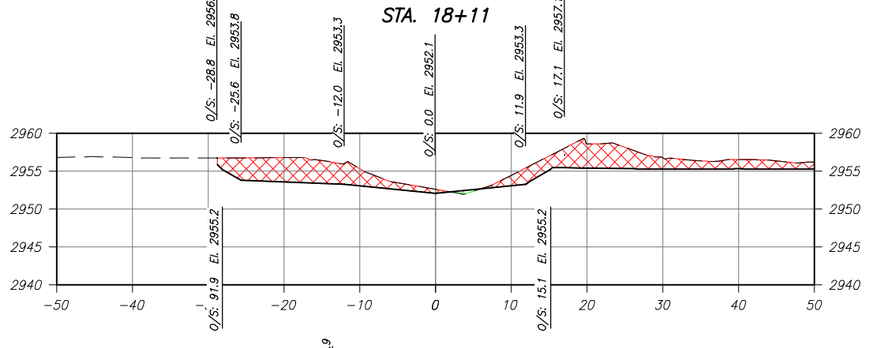
STA. 17+80



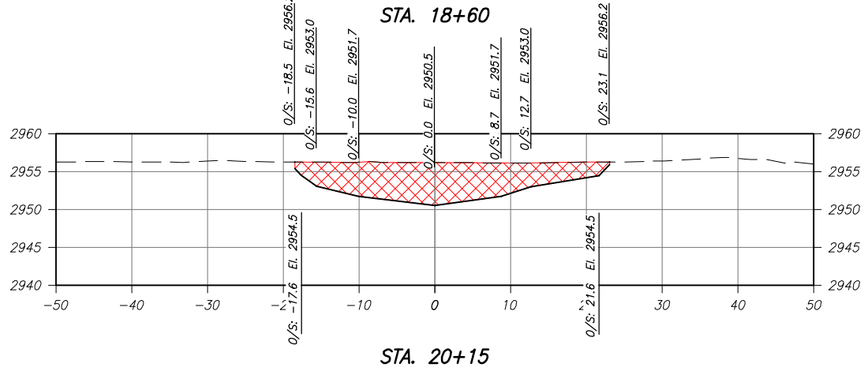
STA. 18+11



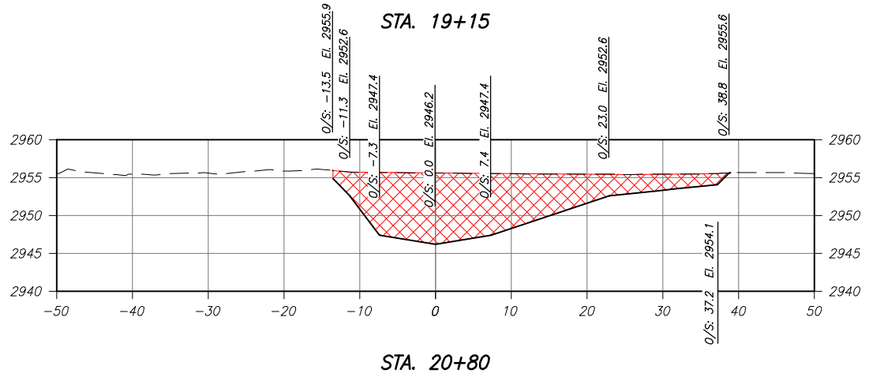
STA. 18+60



STA. 19+15



STA. 20+15



STA. 20+80

Cut

Fill

MAIN CHANNEL CROSS SECTION STA. 15+90 TO 20+80

10 0 10 20 30
SCALE OF FEET

Notes

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COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

Jeffrey J Fealko P.E.
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Steve Montague-Acting
APPROVED
ADMIN APPROVAL - PROGRAM MANAGER
BOISE, ID 2015-09-14

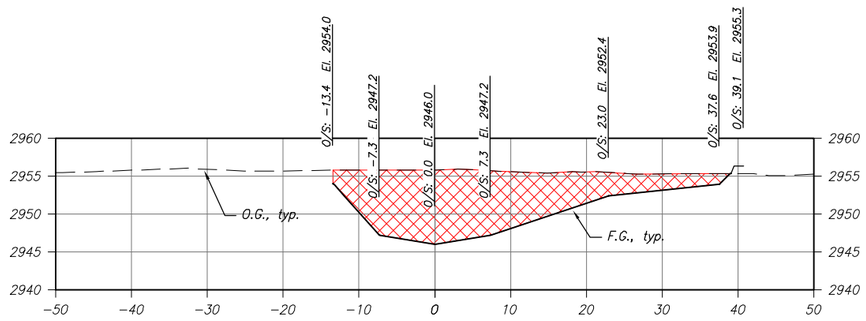
MAIN CHANNEL
STA. 15+90 TO 20+80

CROSS SECTIONS

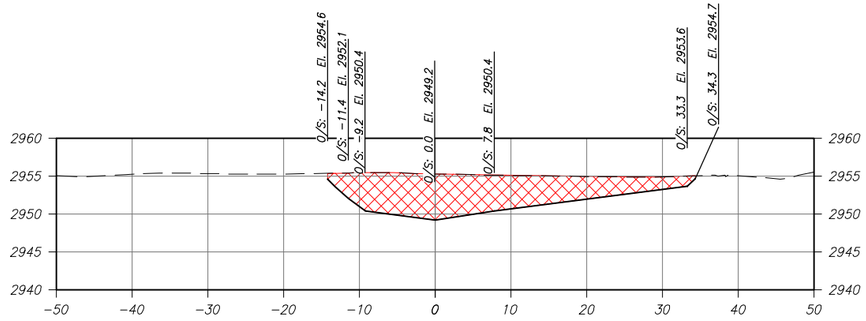
1678-100-2050
SHEET 4 OF 13

DATE AND TIME PLOTTED
AUGUST 13, 2015 15:48
PLOTTED BY
JHOVDE

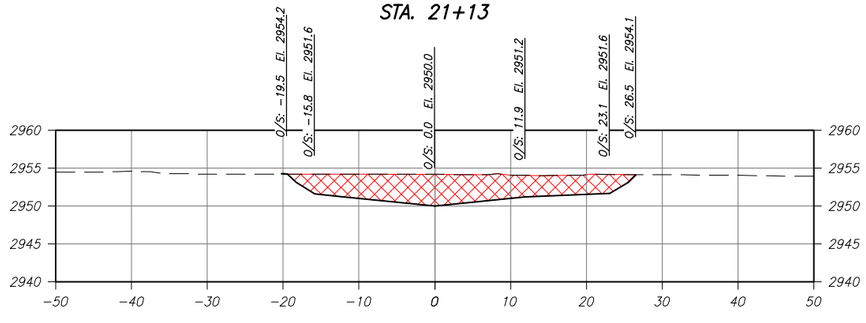
CAD SYSTEM
AutoCAD Rel. 20.0s
CAD FILENAME
1678-100-MCXS.DWG



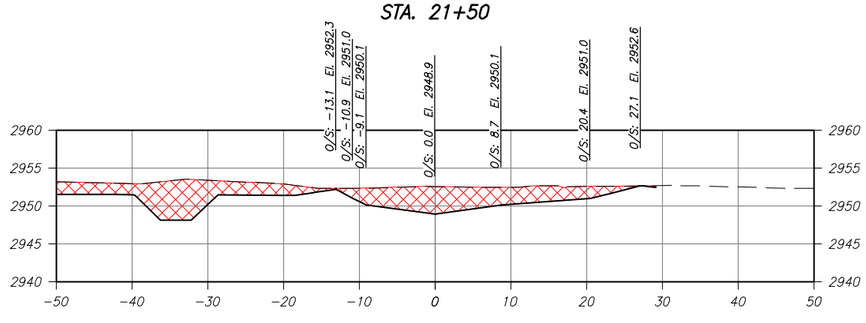
STA. 21+13



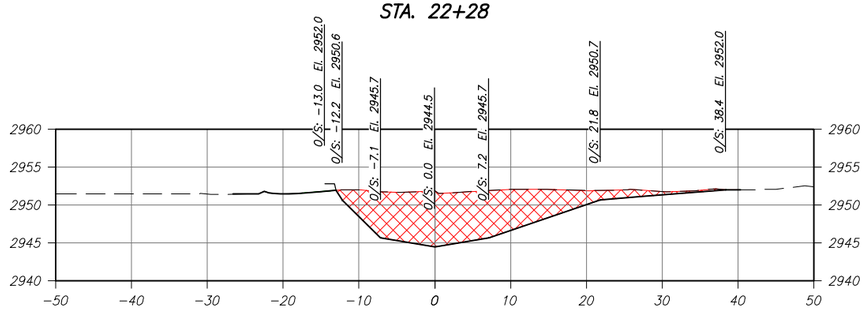
STA. 21+50



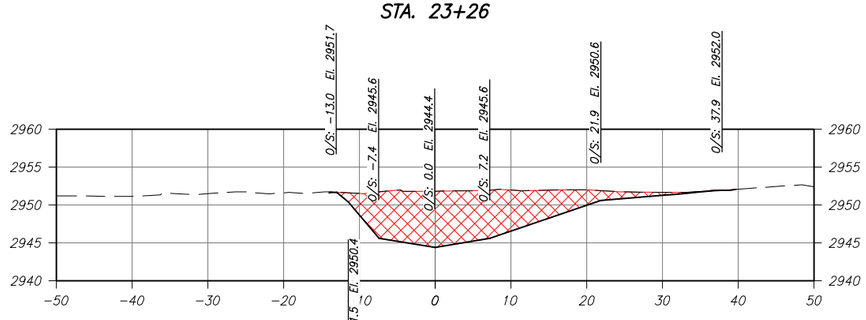
STA. 22+28



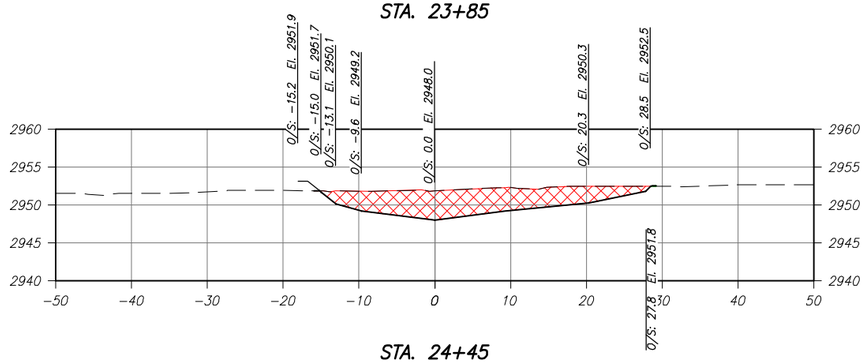
STA. 23+26



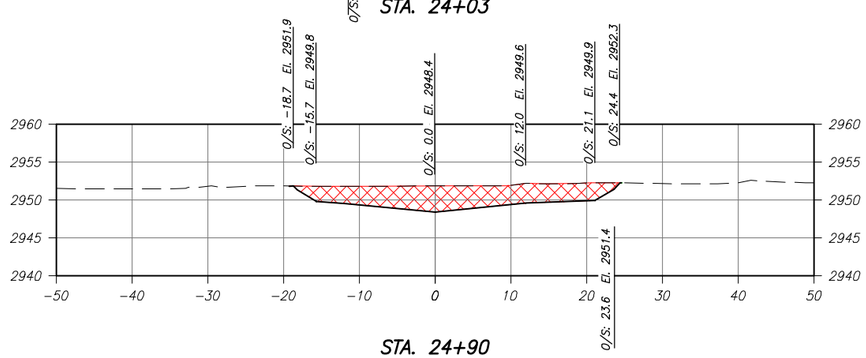
STA. 23+85



STA. 24+03



STA. 24+45



STA. 24+90

Cut

Fill

MAIN CHANNEL CROSS SECTION STA. 21+13 TO 24+90

10 0 10 20 30
SCALE OF FEET

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GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

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Steve Montague-Acting
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BOISE, ID 2015-09-14

MAIN CHANNEL
STA. 21+13 TO 24+90

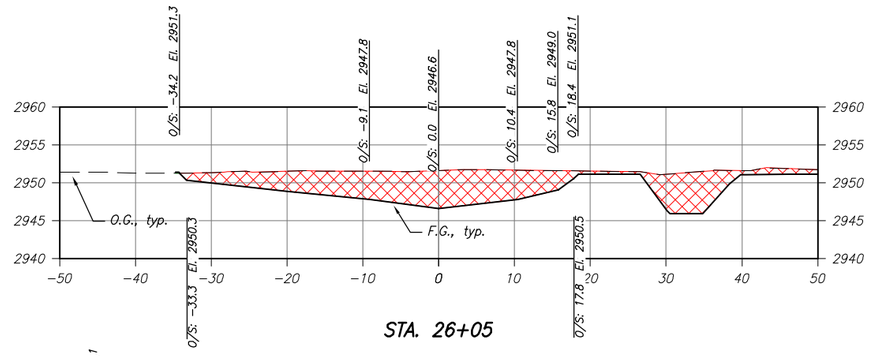
CROSS SECTIONS

1678-100-2051

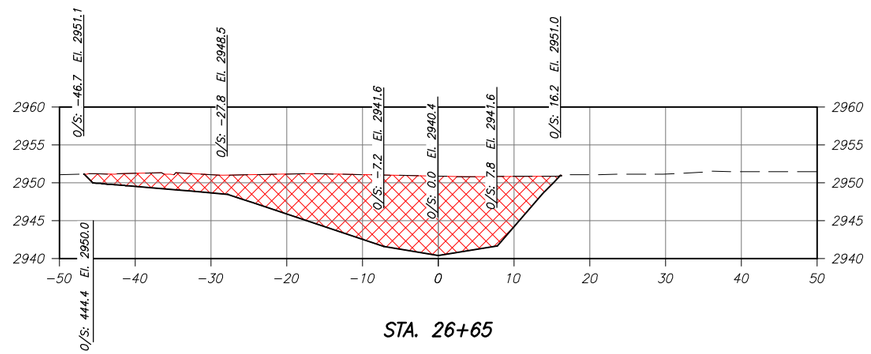
SHEET 5 OF 13

DATE AND TIME PLOTTED
AUGUST 13, 2015 15:50
PLOTTED BY
JHOVDE

CAD SYSTEM
AutoCAD Rel. 20.0s
CAD FILENAME
1678-100-MCXS.DWG



STA. 26+05



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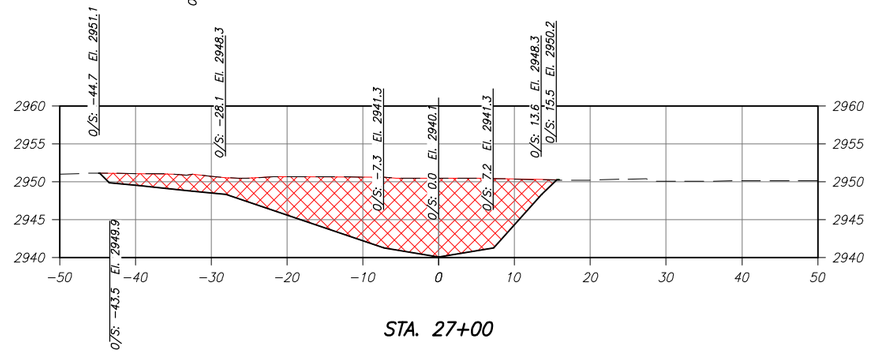
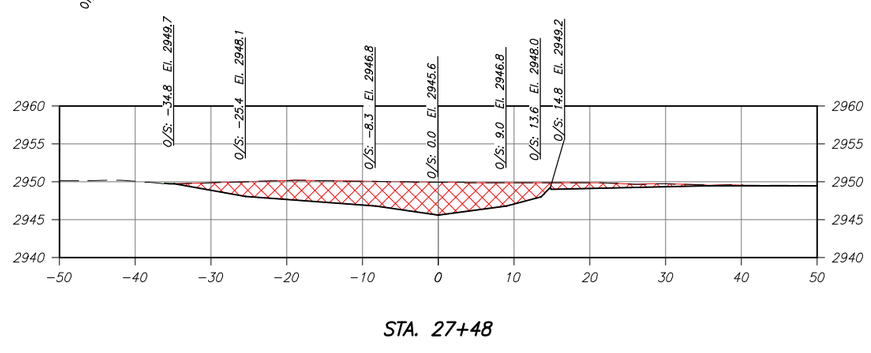
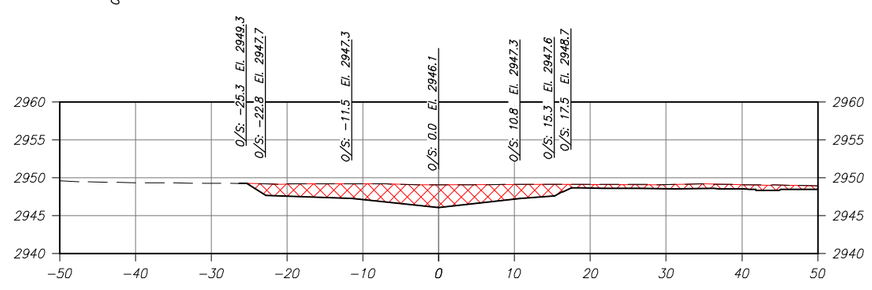


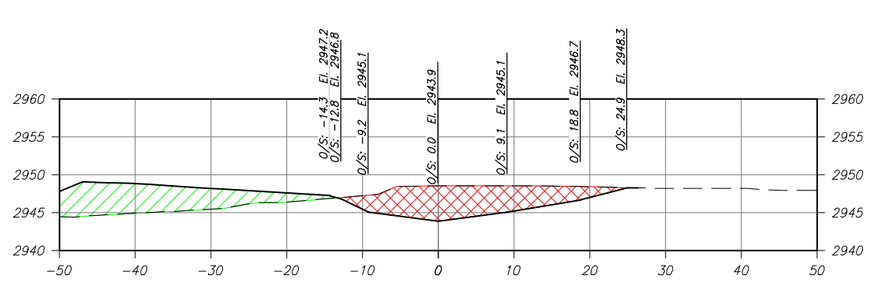
STA. 27+00



STA. 27+48



STA. 28+00



STA. 29+25

Cut

Fill

MAIN CHANNEL CROSS SECTION
STA. 26+05 TO 29+25

10 0 10 20 30
SCALE OF FEET

Notes

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GRANDE RONDE SUBBASIN

CC–44 PHASE III HABITAT ENHANCEMENT
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ADMIN. APPROVAL – PROGRAM MANAGER
BOISE, ID 2015–09–14

MAIN CHANNEL
STA. 26+05 TO 29+25

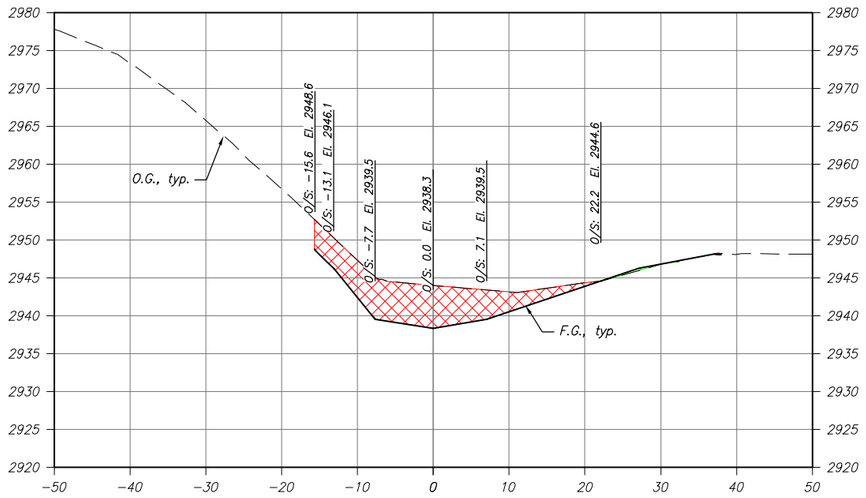
CROSS SECTIONS

1678–100–2052

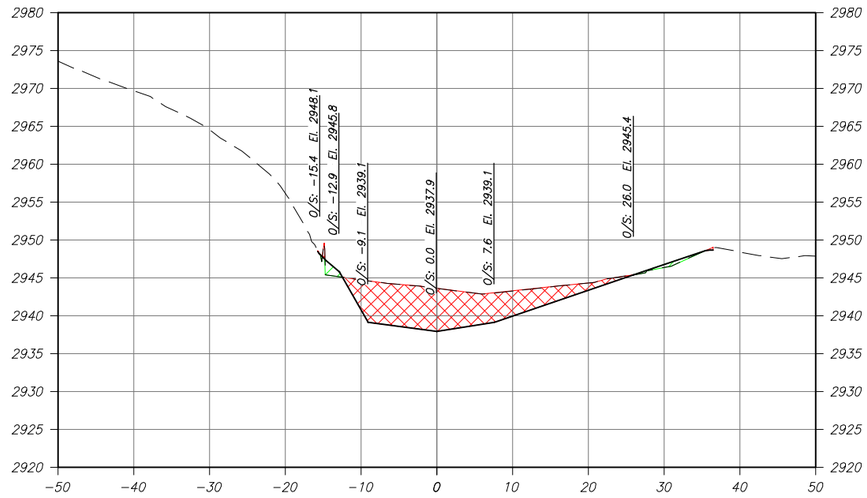
SHEET 6 OF 13

DATE AND TIME PLOTTED
AUGUST 13, 2015 16:07
PLOTTED BY
JHOVDE

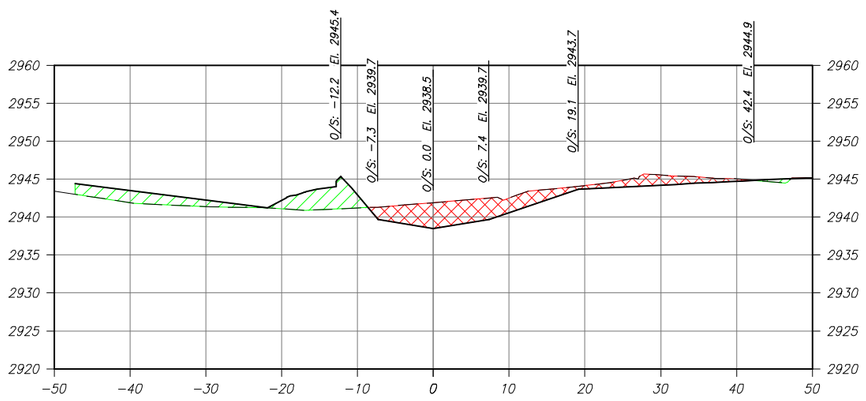
CAD SYSTEM
AutoCAD Rel. 20.0s
CAD FILENAME
1678–100–MCXS.DWG



STA. 30+02



STA. 30+50



STA. 33+20

Cut

Fill

MAIN CHANNEL CROSS SECTION STA. 30+02 TO 33+20

10 0 10 20 30
SCALE OF FEET

Notes

1. Cross sections face downstream. Cross section centerline station is located along the thalweg alignment.
2. Y-axis is elevation, X-axis is distance in feet along a chord perpendicular to the thalweg. The zero station shown on these cross sections represents the thalweg alignment.
3. Constructed channel shall transition smoothly between cross sectional geometries shown within these cross sections. Cross section geometry shown represents one point in a smooth transition.
4. Cross-sections are to be used to stake out the channel offsets at the vertical grade breaks of the channel profile.

DATE AND TIME PLOTTED
AUGUST 13, 2015 16:09
PLOTTED BY
JHOVDE

CAD SYSTEM
AutoCAD Rel. 20.0s
CAD FILENAME
1678-100-MCXS.DWG

RECLAMATION
Managing Water in the West

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BUREAU OF RECLAMATION

COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

Jeffrey J Fealko P.E.
DESIGNED
JH
DRAWN
Mike Knutson P.E.
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Jeffrey J Fealko P.E.
TECH. APPR.
Steve Montague-Acting
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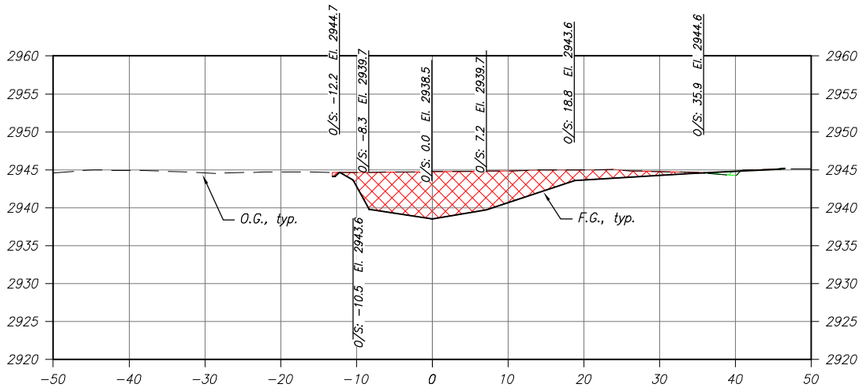
ADMIN APPROVAL - PROGRAM MANAGER
BOISE, ID 2015-09-14

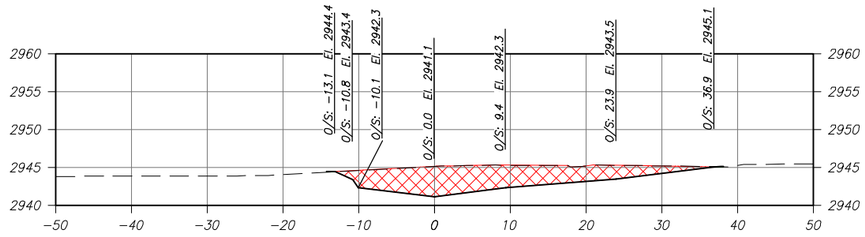
MAIN CHANNEL
STA. 30+02 TO 33+20

CROSS SECTIONS

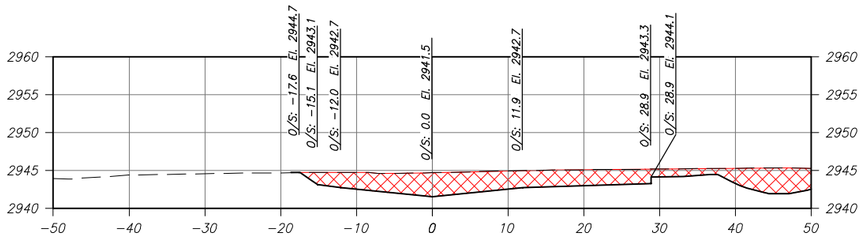
1678-100-2053
SHEET 7 OF 13



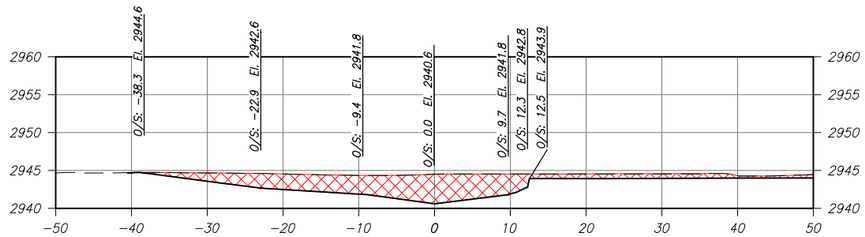
STA. 33+50



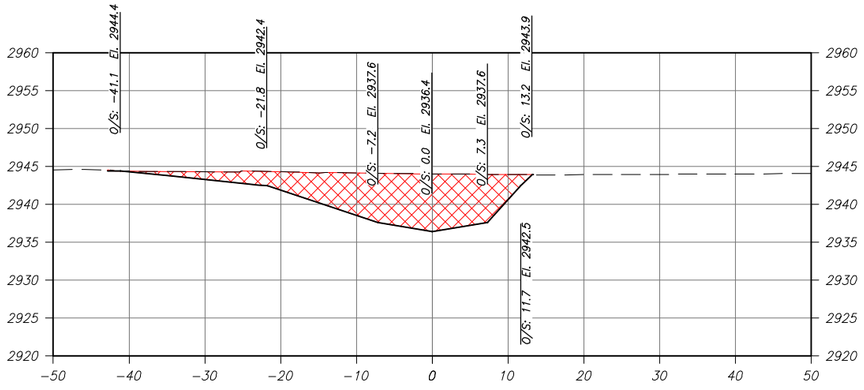
STA. 33+78



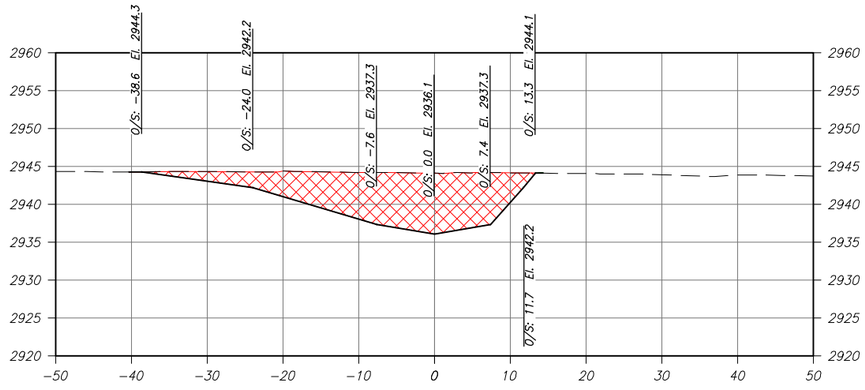
STA. 34+20



STA. 35+00



STA. 35+48



STA. 35+94

Cut

Fill

MAIN CHANNEL CROSS SECTION STA. 33+50 TO 35+94

10 0 10 20 30
SCALE OF FEET

Notes

1. Cross sections face downstream. Cross section centerline station is located along the thalweg alignment.
2. Y-axis is elevation, X-axis is distance in feet along a chord perpendicular to the thalweg. The zero station shown on these cross sections represents the thalweg alignment.
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COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT PARCEL 3

Jeffrey J Fealko P.E.
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BOISE, ID 2015-09-14

MAIN CHANNEL STA. 33+50 TO 35+94

CROSS SECTIONS

1678-100-2054
SHEET 8 OF 13

DATE AND TIME PLOTTED
AUGUST 13, 2015 16:13
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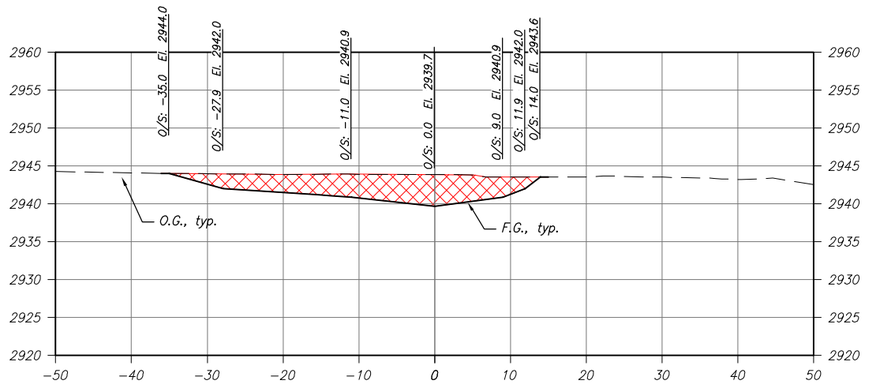
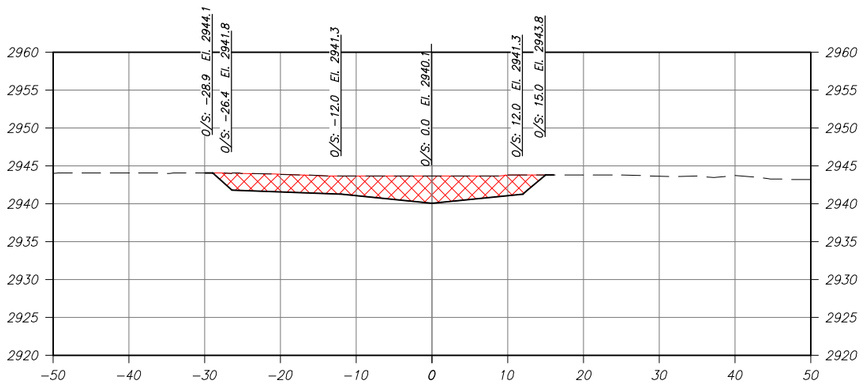
JHOVDE

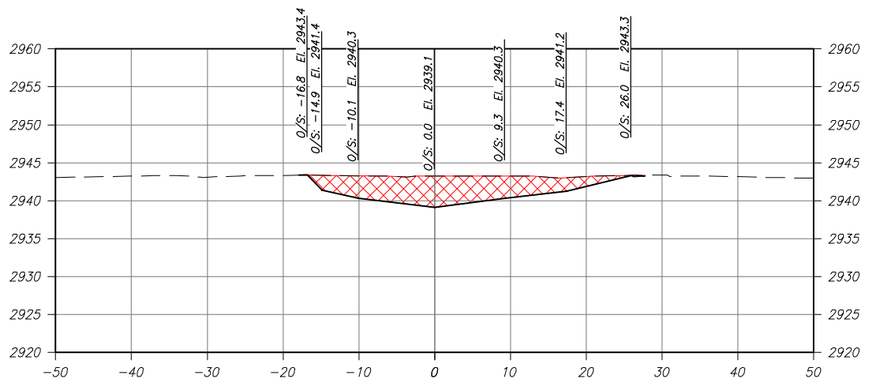
CAD SYSTEM
AutoCAD Rel. 20.0s
CAD FILENAME
1678-100-MCXS.DWG



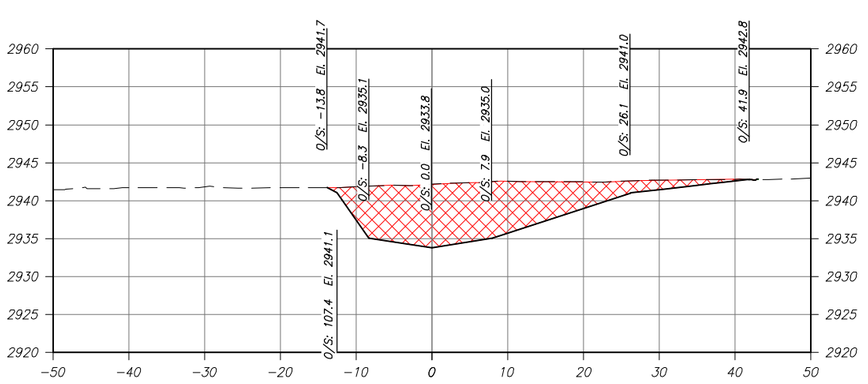
STA. 36+30



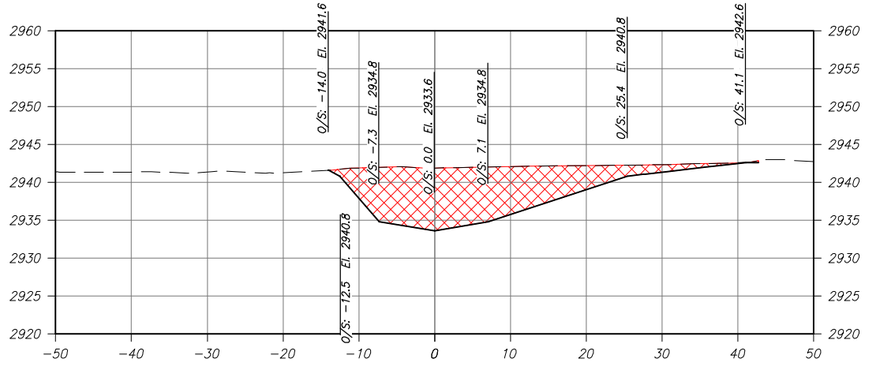
STA. 36+70



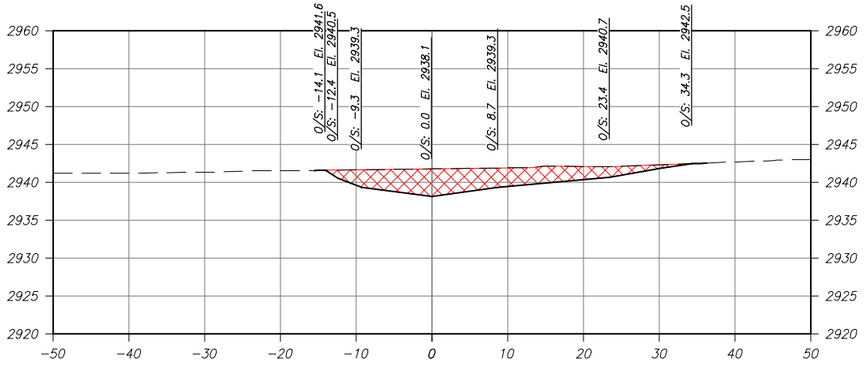
STA. 37+64



STA. 38+15



STA. 38+58



STA. 38+92

Cut

Fill

MAIN CHANNEL CROSS SECTION STA. 36+30 TO 38+92

10 0 10 20 30
SCALE OF FEET

Notes

1. Cross sections face downstream. Cross section centerline station is located along the thalweg alignment.
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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

Jeffrey J Fealko P.E.
DESIGNED
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DRAWN
Mike Knutson P.E.
CHECKED
Jeffrey J Fealko P.E.
TECH. APPR.
Steve Montague-Acting
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BOISE, ID 2015-09-14

MAIN CHANNEL
STA. 36+30 TO 38+92

CROSS SECTIONS

1678-100-2055
SHEET 9 OF 13

DATE AND TIME PLOTTED
AUGUST 13, 2015 16:15
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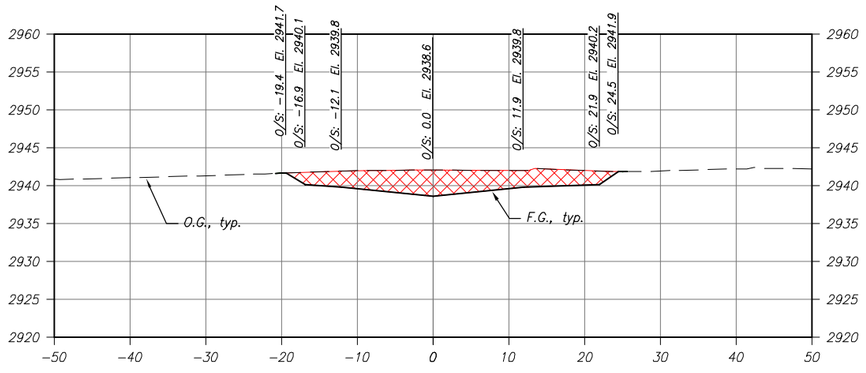
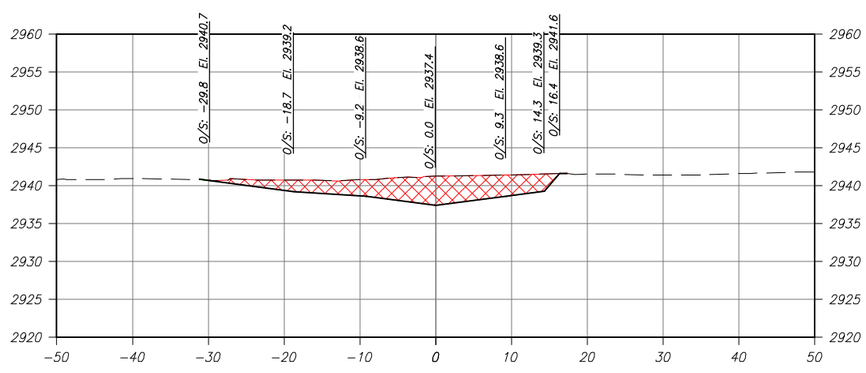
JHOVDE

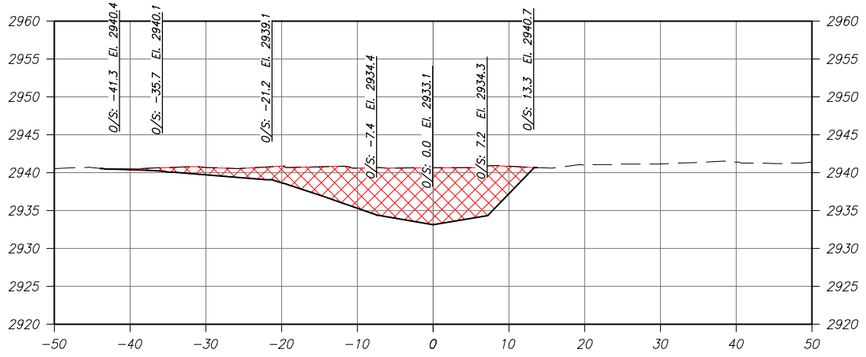
CAD SYSTEM
AutoCAD Rel. 20.0s
CAD FILENAME
1678-100-MCXS.DWG



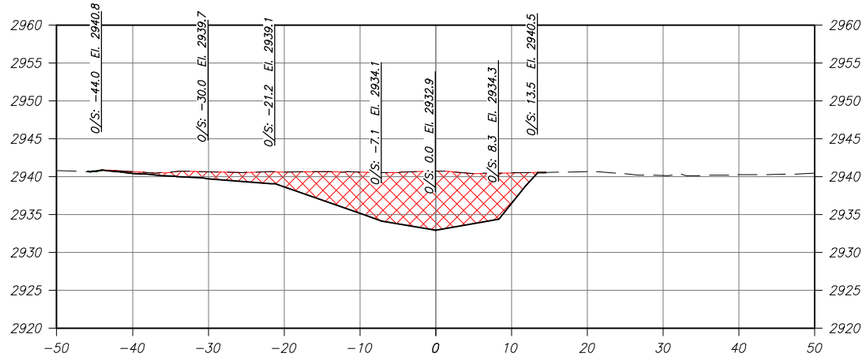
STA. 39+40



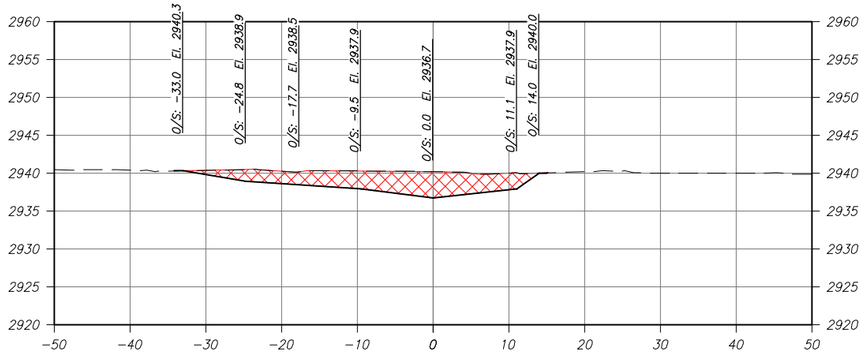
STA. 40+40



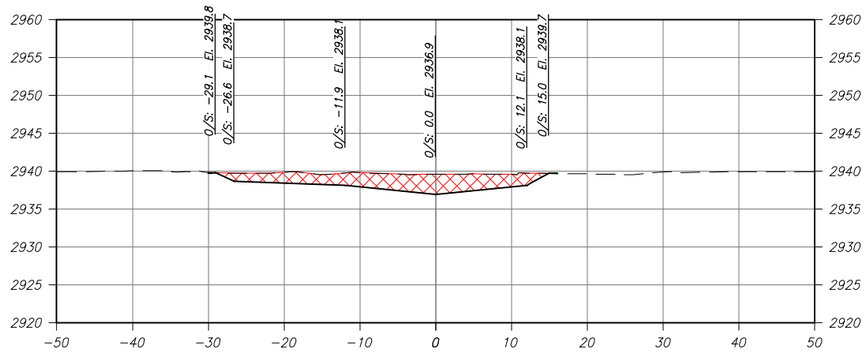
STA. 40+75



STA. 40+95



STA. 41+20



STA. 41+45

Cut

Fill

MAIN CHANNEL CROSS SECTION STA. 39+40 TO 41+45

10 0 10 20 30
SCALE OF FEET

Notes

1. Cross sections face downstream. Cross section centerline station is located along the thalweg alignment.
2. Y-axis is elevation, X-axis is distance in feet along a chord perpendicular to the thalweg. The zero station shown on these cross sections represents the thalweg alignment.
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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT PARCEL 3

Jeffrey J Fealko P.E.	DESIGNED
JH	DRAWN
Mike Knutson P.E.	CHECKED
Jeffrey J Fealko P.E.	TECH. APPR.
Steve Montague-Acting	APPROVED
	ADMIN. APPROVAL - PROGRAM MANAGER
BOISE, ID	2015-09-14

MAIN CHANNEL STA. 39+40 TO 41+45

CROSS SECTIONS

1678-100-2056

SHEET 10 OF 13

DATE AND TIME PLOTTED
AUGUST 13, 2015 16:17
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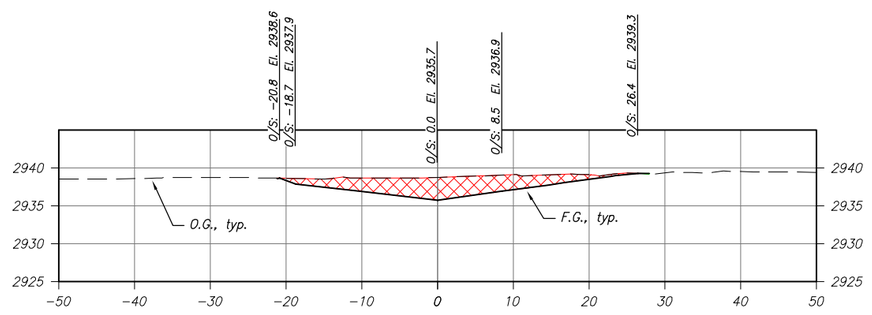
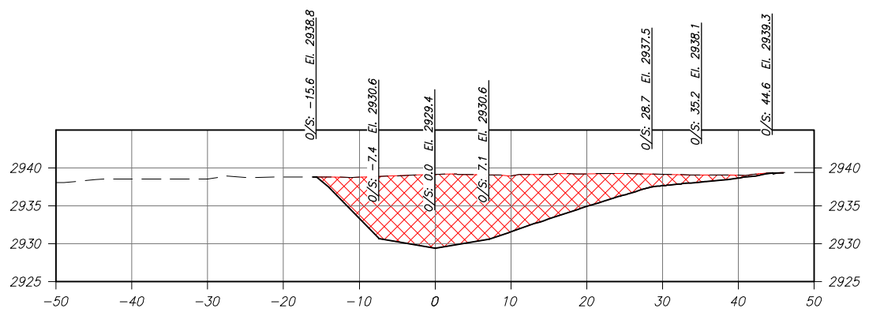
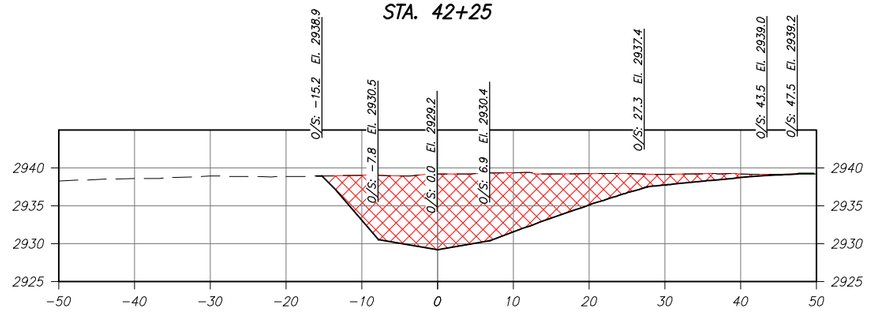
CAD SYSTEM
AutoCAD Rel. 20.0s
CAD FILENAME
1678-100-MCXS.DWG



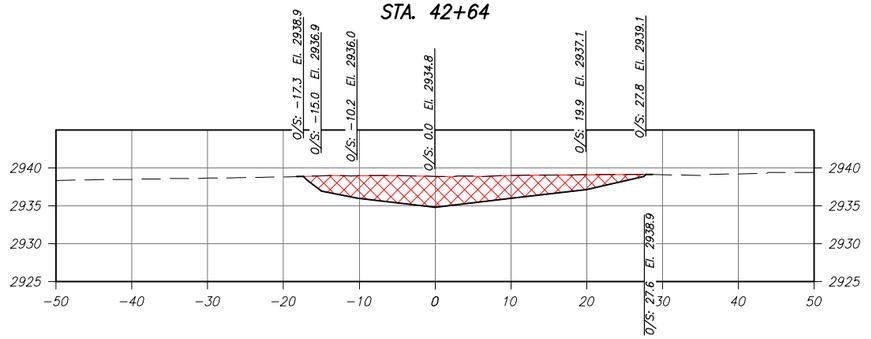
STA. 42+25



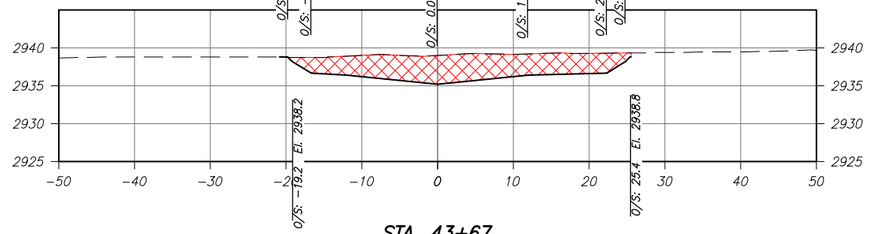
STA. 42+64



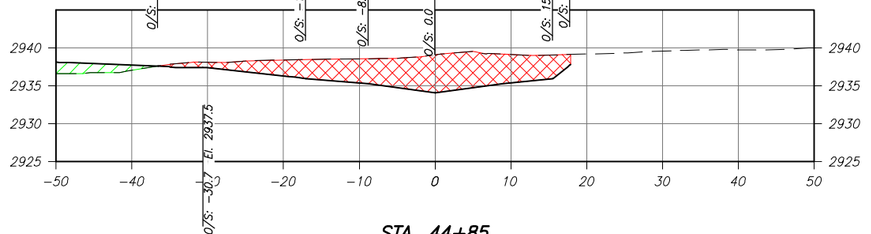
STA. 42+90



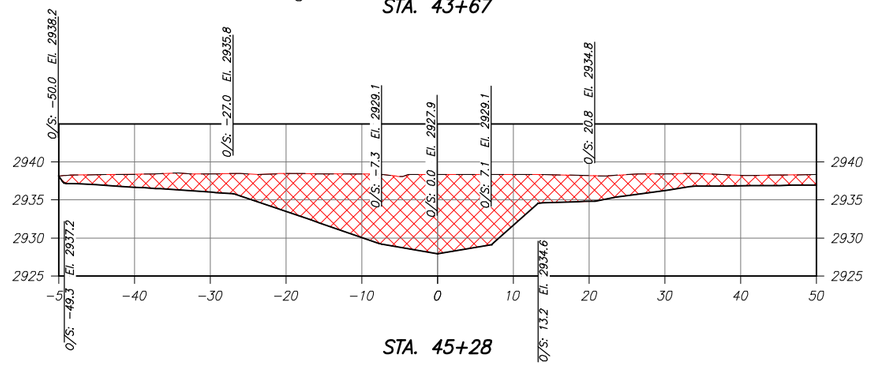
STA. 43+29



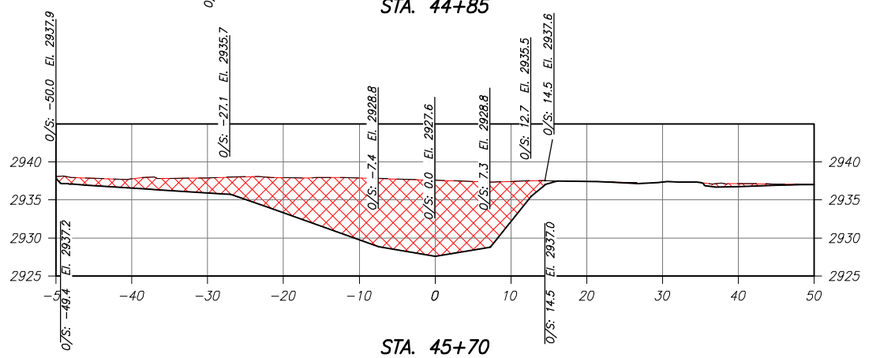
STA. 43+67



STA. 44+85



STA. 45+28



STA. 45+70

Cut

Fill

MAIN CHANNEL CROSS SECTION STA. 42+25 TO 45+70

SCALE OF FEET
10 0 10 20 30

Notes

1. Cross sections face downstream. Cross section centerline station is located along the thalweg alignment.
2. Y-axis is elevation, X-axis is distance in feet along a chord perpendicular to the thalweg. The zero station shown on these cross sections represents the thalweg alignment.
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COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT PARCEL 3

DESIGNED	Jeffrey J Fealko P.E.
DRAWN	JH
CHECKED	Mike Knutson P.E.
TECH. APPR.	Jeffrey J Fealko P.E.
APPROVED	Steve Montague-Acting
ADMIN. APPROVAL - PROGRAM MANAGER	
BOISE, ID	2015-09-14

MAIN CHANNEL STA. 42+25 TO 45+70

CROSS SECTIONS

1678-100-2057

SHEET 11 OF 13

DATE AND TIME PLOTTED
AUGUST 13, 2015 16:18
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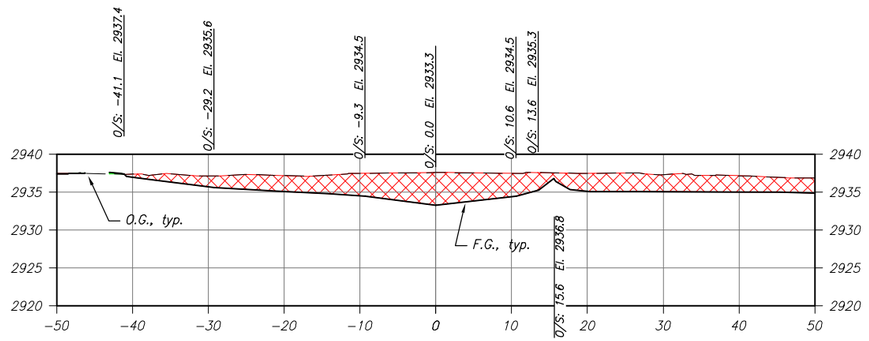
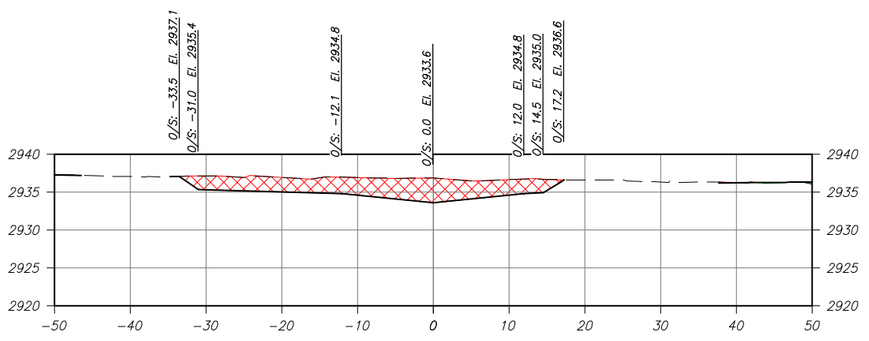
JHOGE

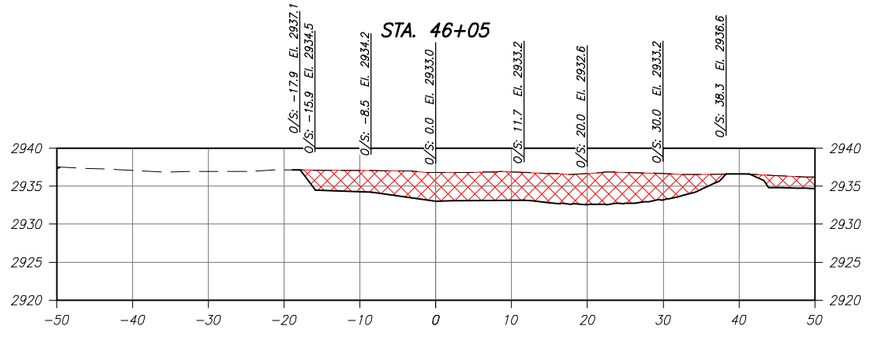
CAD SYSTEM
AutoCAD Rel. 20.0s
CAD FILENAME
1678-100-MCXS.DWG



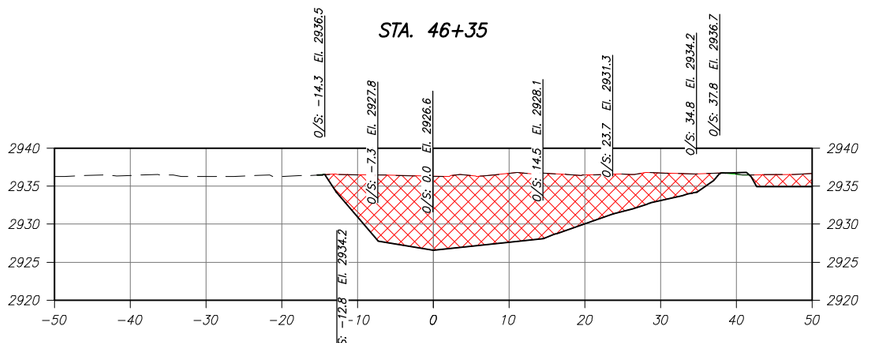
STA. 46+05



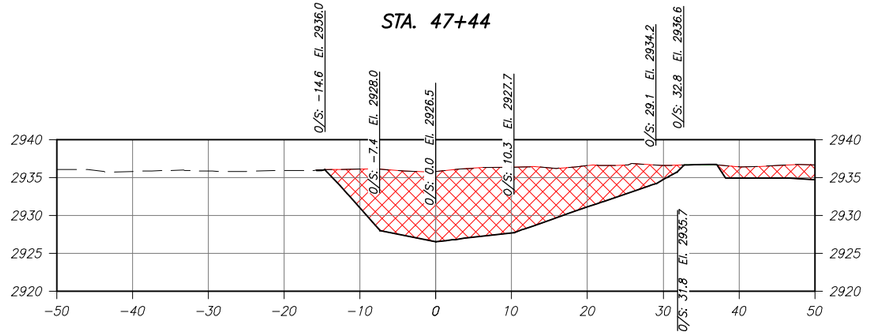
STA. 46+35



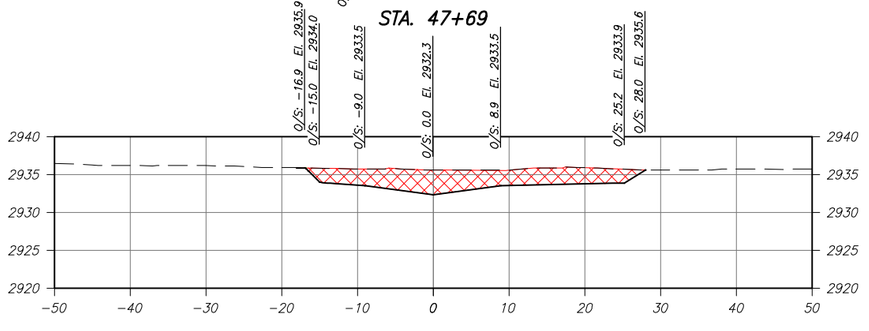
STA. 47+44



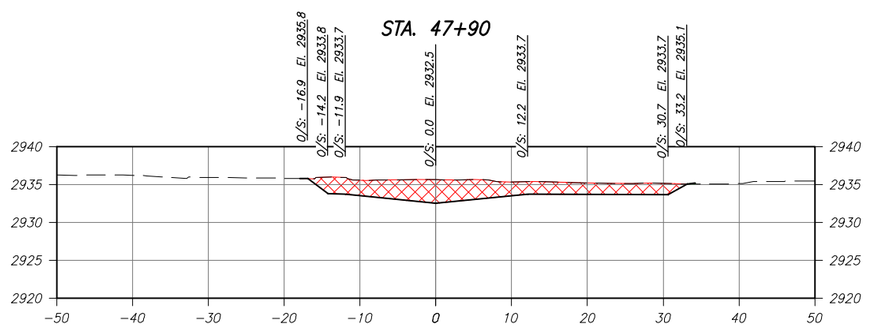
STA. 47+69



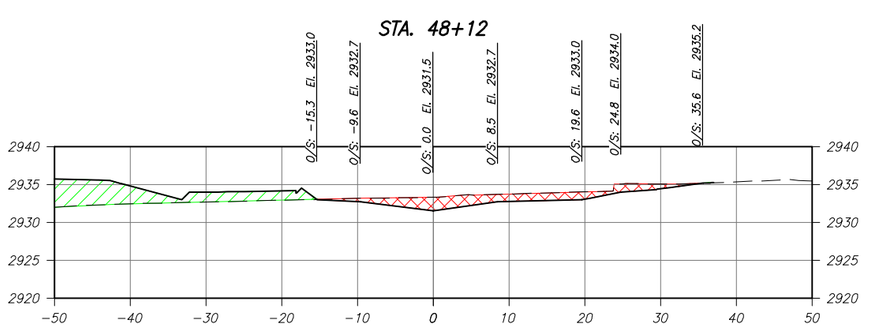
STA. 47+90



STA. 48+12



STA. 48+35



STA. 49+45

Cut

Fill

MAIN CHANNEL CROSS SECTION STA. 46+05 TO 49+45

10 0 10 20 30
SCALE OF FEET

Notes

1. Cross sections face downstream. Cross section centerline station is located along the thalweg alignment.
2. Y–axis is elevation, X–axis is distance in feet along a chord perpendicular to the thalweg. The zero station shown on these cross sections represents the thalweg alignment.
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AUGUST 13, 2015 16:19
PLOTTED BY
JHOVDE

CAD SYSTEM
AutoCAD Rel. 20.0s
CAD FILENAME
1678-100-MCXS.DWG

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Managing Water in the West

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BUREAU OF RECLAMATION

COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

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Mike Knutson P.E.
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Jeffrey J Fealko P.E.
TECH. APPR.
Steve Montague–Acting
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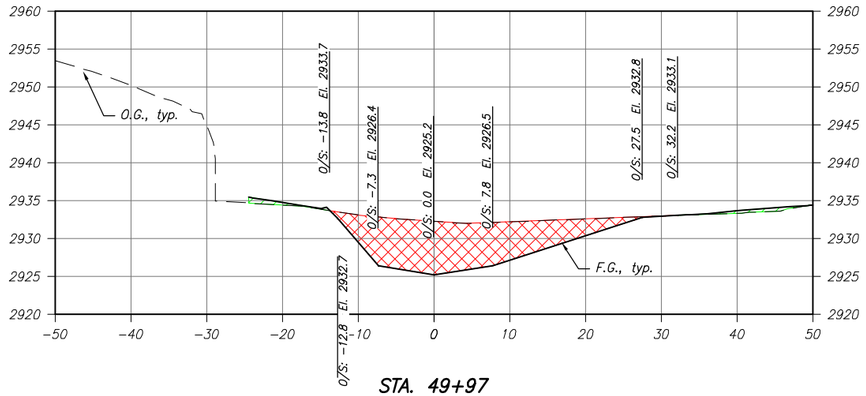
ADMIN. APPROVAL – PROGRAM MANAGER
BOISE, ID 2015-09-14

MAIN CHANNEL
STA. 46+05 TO 49+45

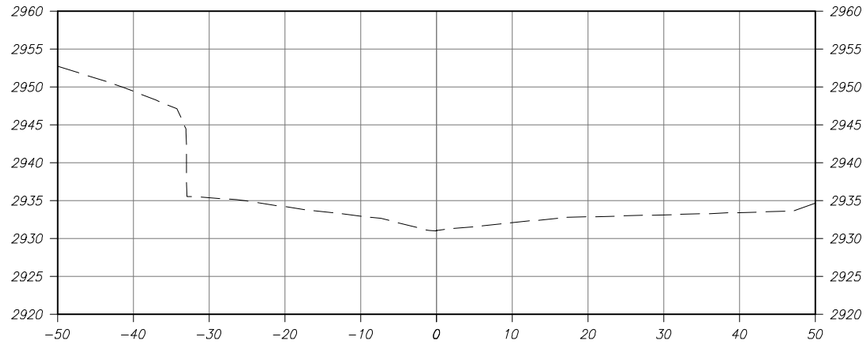
CROSS SECTIONS

1678–100–2058

SHEET 12 OF 13



STA. 49+97



STA. 50+35

Cut

Fill

MAIN CHANNEL CROSS SECTION
STA. 49+97

10 0 10 20 30
SCALE OF FEET

NOTES:

1. Cross sections face downstream. Cross section centerline station is located along the thalweg alignment.
2. Y-axis is elevation, X-axis is distance in feet along a chord perpendicular to the thalweg. The zero station shown on these cross sections represents the thalweg alignment.
3. Constructed channel shall transition smoothly between cross sectional geometries shown within these cross sections. Cross section geometry shown represents one point in a smooth transition.
4. Cross-sections are to be used to stake out the channel offsets at the vertical grade breaks of the channel profile.

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

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Steve Montague-Acting
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BOISE, ID 2015-09-14

MAIN CHANNEL
STA. 49+97 TO 50+35

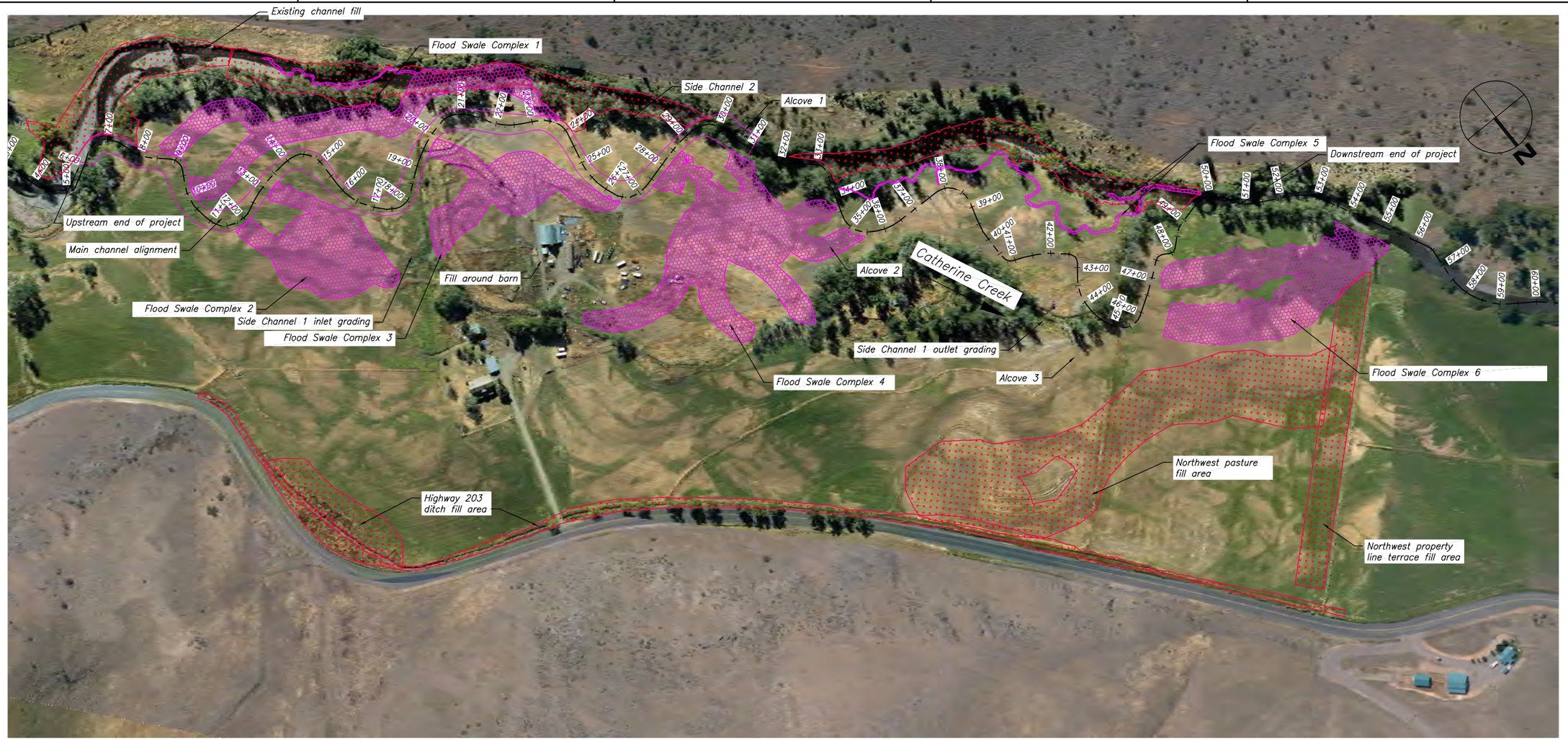
CROSS SECTIONS

1678-100-2059

SHEET 13 OF 13

DATE AND TIME PLOTTED
AUGUST 13, 2015 16:20
PLOTTED BY
JHOVDE

CAD SYSTEM
AutoCAD Rel. 20.0s
CAD FILENAME
1678-100-MCXS.DWG



PARCEL 3 TOPSOIL PLACEMENT AREAS

150 0 150 300 450
SCALE OF FEET

TOPSOIL NOTES:

1. Strip topsoil from borrow areas shown on the drawings.
2. Remove topsoil to depths directed by COR. Soil may contain grass vegetation and roots where sod mats cannot be effectively removed. Avoid visible noxious weed plants and roots.
4. Transport and stockpile topsoil as necessary prior to final hauling and placing.
5. Transport and place topsoil for the upper 6 to 12 inches of topsoil areas shown on this drawing. The measurement of 6 to 12 inches of placement shall be after compaction by a single pass over the soil with excavator tracks or similar equipment to produce a firm layer of top soil.
6. Do not compact topsoil in stockpile.
7. Protect stockpile from contamination and erosion.

LEGEND

12" Topsoil Placement Areas (21,171 cubic yards)

6" Topsoil Placement Areas (9,557 cubic yards)

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GRANDE RONDE SUBBASIN
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PARCEL 3

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TOPSOIL PLACEMENT AREAS

PLAN

1678-100-2060

SHEET 1

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SEPTEMBER 14, 2015 10:24
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CAD FILENAME
1678-100-2060.DWG



SOD SALVAGE AND TRANSPLANT NOTES:

1. Salvage all sod mats and woody vegetation within any of the areas shown on this drawing and reuse in the project as direct by the Contracting Officer.
2. Separate the soil layer below the sod mats from gravel layers and separately stock pile in a location agreed upon by the landowner and contractor. This soil will be spread on the re-contoured flood plain or other locations on site as depicted.
3. Moisten harvest sites for sod mats throughout the top eight (8) inches prior to harvest.
4. Harvest sod mats by skimming a six- to ten-inch deep mat from the ground surface. Depth of cut will be determined by soil depth and rooting depth as directed by Contracting officer. Length and width of mats shall be determined by the bucket width such that a section of mat can be handled and transported to storage and final placement as one intact unit.
5. Harvest equipment shall approach vegetation at right angle to the flowing river channel such that the scooping action is towards the bank and away from the water to prevent turbidity. At no time should the bucket with loose material be suspended over flowing water to prevent dropping material into water and causing turbidity.
6. Sod mats can be stored up to two weeks provided they are watered daily to keep the roots moist. Depending on the storage site and weather, mats may require more frequent watering to ensure roots do not dry out.
7. Store on disturbed ground where the sod mat can be kept moist as directed by the C.O.
8. Mats stored no more than two or three days can be stacked on top of each other, while mats stored longer should be laid out flat with the edges close together. Both must be watered daily.
9. Stockpile salvaged riparian vegetation out of the way of construction traffic in such a manner that it can be picked up and transported to its final placement.
10. Topsoil will be obtained from the excavated areas shown on this drawing.
11. Apply 6 inches of topsoil on finish grade of the flood swale complex excavation areas.
12. Apply 12 inches of topsoil on finish grade of the existing channel fill areas, the ditch fill area, and the excess fill material areas.
13. Place sod mats in locations as directed by the Contracting Officer. Sod mats with majority of upland grass species will be laid over smoothed and lightly scarified soil layer at the top of banks as directed by the Contracting Officer.

PARCEL 3 SOD SALVAGE AREAS

150 0 150 300 450
SCALE OF FEET

LEGEND

Sod Salvage Areas

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GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

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SOD SALVAGE AREAS

PLAN

1678-100-2061

SHEET 1 OF 1

DATE AND TIME PLOTTED
AUGUST 26, 2015 14:38
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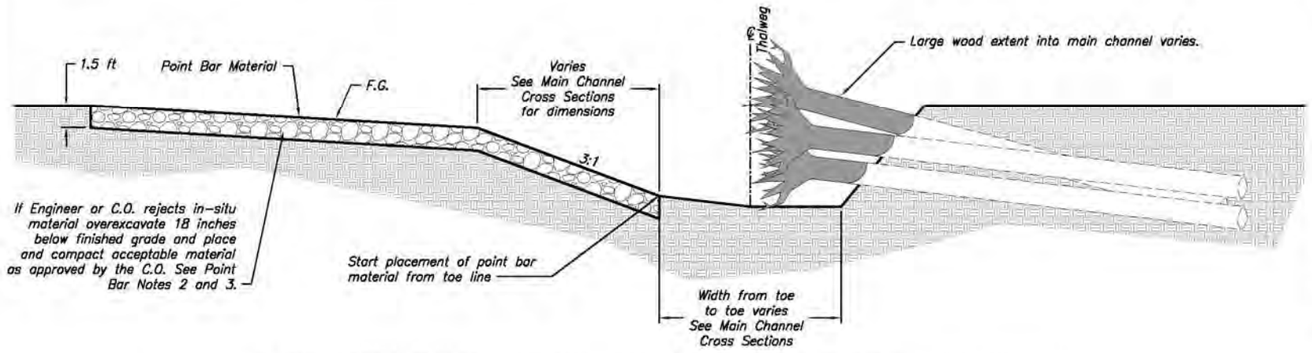
JBACKOUS

CAD SYSTEM
AutoCAD Rel. 20.0s
CAD FILENAME
1678-100-EM_RECOVER.DWG

TYPICAL POINT BAR MATERIAL AND PLACEMENT DETAILS

POINT BAR OVERVIEW:
Point bars are located at inside of meander bends and consist of mobile alluvium that is stored by the stream and mobilized in large storm events. This material replenishes glide and riffle material.



TYPICAL POINT BAR POOL SECTION – FOR AREAS WITH UNSUITABLE IN-SITU MATERIAL

NOT TO SCALE

VOLUMES OF PLACED POINT BAR MATERIAL (IF REQUIRED)				VOLUMES OF PLACED POINT BAR MATERIAL (IF REQUIRED)				VOLUMES OF PLACED POINT BAR MATERIAL (IF REQUIRED)			
Point Bar Number	Approximate Main Channel Thalweg Alignment Station	Bar Location (Left or Right)	Placed Point Bar Material (CY)	Point Bar Number	Approximate Main Channel Thalweg Alignment Station	Bar Location (Left or Right)	Placed Point Bar Material (CY)	Point Bar Number	Approximate Main Channel Thalweg Alignment Station	Bar Location (Left or Right)	Placed Point Bar Material (CY)
1	6+90	Right	114	7	24+00	Right	128	13	40+90	Left	83
2	9+25	Right	149	8	26+80	Left	206	14	42+75	Right	104
3	11+75	Left	173	9	30+00	Right	105	15	45+50	Left	155
4	14+50	Right	184	10	33+25	Right	125	16	48+00	Right	92
5	18+00	Left	206	11	35+75	Left	180	17	50+00	Right	188
6	20+90	Right	171	12	38+40	Right	143				

POINT BAR NOTES:
1. *Refer to Main Channel Cross Section sheets for design elevations and offsets of pool sections.*
2. *Engineer or C.O. shall inspect suitability of in-situ material and accept or reject in-situ material based on the acceptable in-situ point bar material gradation shown on this sheet.*
3. *If in-situ material does not meet the specified gradation Contractor shall overexcavate unsuitable material as shown in the typical point bar pool section and replace with specified point bar material (See placed point bar material gradation this sheet) to design finish grade.*
4. *Point Bar material shall meet the gradations (in-situ or placed) on this sheet and shall be well-mixed.*
5. *Point Bars to be machine compacted with specification as directed by C.O.*

ACCEPTABLE IN-SITU POINT BAR MATERIAL	
Percent Passing	Size Class
100%	12 inches
84%	2 inches – 6 inches
50%	0.5 inch – 3 inches
16%	0.08 inch – 1 inch

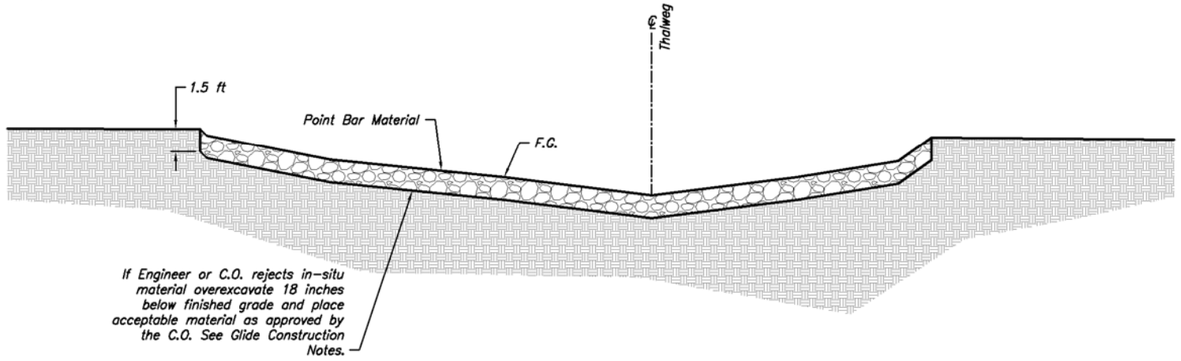
PLACED POINT BAR MATERIAL	
Percent Passing	Size Class
100%	12 inches
84%	3 inches – 6 inches
50%	1 inches – 3 inches
16%	0.25 inches – 1 inches
10%	< 0.5 inches

GRADATION NOTES:
1. *Percent passing size class is based on the nominal diameter of rock.*
2. *Nominal diameter shall be measured as the intermediate axis where the small and large axis shall not be more than 3 times less than or greater than the nominal diameter.*
2. *Acceptable placed point bar material may be created from stockpiles of various sized screened materials. One example that creates an acceptable placed point bar material is shown below. The C.O. and Engineer shall work with the Contractor to develop an acceptable mixture to meet the requirements above.*
3. *All stockpiles shall be well graded containing equal amounts of material within the range of each size class.*

EXAMPLE STOCKPILE MIX RATIOS FOR PLACED POINT BAR MATERIAL		
Stock Pile Size Class	Mix Percentage (By Volume)	Mix Ratios (By Parts)
6 – 12 inches	10%	1
3 – 6 inches	20%	2
1 – 3 inches	40%	4
0 – 3 inches	30%	3

TYPICAL GLIDE MATERIAL AND PLACEMENT DETAILS

GLIDE OVERVIEW:
Glide features are located between pools and riffles and are formed by mobile bed material. Glide features are used for spawning by salmon and steelhead, which require clean, sub-rounded alluvium of specific size. Glide features will not be overly compacted and will contain minimum fines.



TYPICAL GLIDE MATERIAL SECTION – FOR AREAS WITH UNSUITABLE IN-SITU MATERIAL

NOT TO SCALE

VOLUMES OF PLACED GLIDE MATERIAL (IF REQUIRED)			VOLUMES OF PLACED GLIDE MATERIAL (IF REQUIRED)			VOLUMES OF PLACED GLIDE MATERIAL (IF REQUIRED)		
Glide Number	Approximate Main Channel Thalweg Alignment Station	Placed Point Bar Material (CY)	Glide Number	Approximate Main Channel Thalweg Alignment Station	Placed Point Bar Material (CY)	Glide Number	Approximate Main Channel Thalweg Alignment Station	Placed Point Bar Material (CY)
1	7+40	115	6	21+50	146	11	38+92	93
2	9+80	94	7	24+45	85	12	41+20	45
3	12+45	93	8	27+48	100	13	43+29	76
4	15+30	111	9	33+78	90	14	46+05	65
5	18+60	111	10	36+30	76	15	48+32	53

GLIDE CONSTRUCTION NOTES:
1. *Excavate native material to design grade. Rip and uncompact in-situ material so it is unconsolidated for a depth of 18 inches below the finished grade.*
2. *C.O. or Engineer shall accept or reject glide material after it has been uncompacted.*
3. *If in-situ material is accepted by C.O. or Engineer leave material in its unconsolidated condition.*
4. *Replace unsuitable glide material with material that meets placed glide gradation as shown on this sheet*
5. *For unsuitable material overexcavate glide areas shown on Drawings to 1.5-feet below finish grade.*
6. *Place glide material meeting the specifications below for placed material directly upstream of riffles and feather into pool for a natural appearance, as shown in plans and as directed by the C.O.*
7. *Glide material will be clean and sub-rounded to rounded native gravel and cobble with minimal fines as approved by C.O.*
8. *Spread glide material with minimal compaction.*

ACCEPTABLE IN-SITU GLIDE MATERIAL	
Percent Passing	Size Class
100%	12 inches
84%	3 inches – 6 inches
50%	1 inch – 4 inches
16%	0.08 inch – 1 inch

PLACED GLIDE MATERIAL	
Percent Passing	Size Class
100%	12 inches
84%	3 inches – 6 inches
50%	1 inches – 3 inches
16%	0.25 inches – 1 inches
10%	< 0.5 inches

GRADATION NOTES:
1. *Percent passing size class is based on the nominal diameter of rock.*
2. *Nominal diameter shall be measured as the intermediate axis where the small and large axis shall not be more than 3 times less than or greater than the nominal diameter.*
2. *Acceptable placed glide material may be created from stockpiles of various sized screened materials. One example that creates an acceptable placed glide material is shown below. The C.O. and Engineer shall work with the Contractor to develop an acceptable mixture to meet the requirements above.*
3. *All stockpiles shall be well graded containing equal amounts of material within the range of each size class.*

EXAMPLE STOCKPILE MIX RATIOS FOR PLACED POINT BAR MATERIAL		
Stock Pile Size Class	Mix Percentage (By Volume)	Mix Ratios (By Parts)
6 – 12 inches	10%	1
3 – 6 inches	20%	2
1 – 3 inches	40%	4
0 – 3 inches	30%	3

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GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3 – TYPICAL POOL AND GLIDE MATERIAL SECTIONS

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BOISE, IDAHO 2015–09–14

TYPICAL POINT BAR AND GLIDE MATERIAL SECTIONS

DETAILS

1678–100–2062
SHEET 1 OF 2

DATE AND TIME PLOTTED
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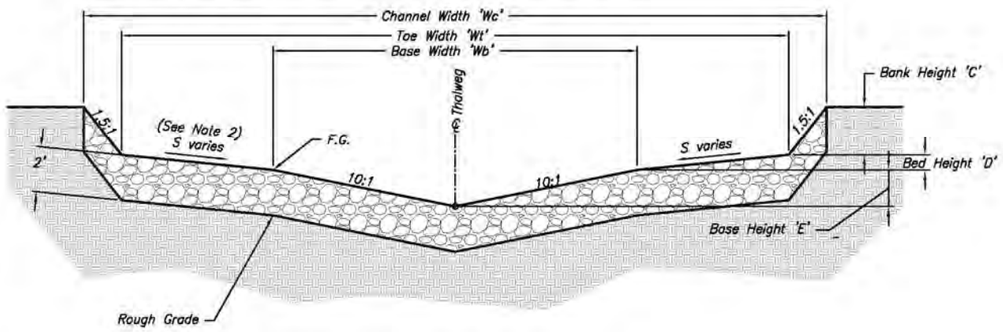
Not Plotted

CAD SYSTEM
AUTOCAD
CAD FILENAME
UNKNOWN

RIFFLE OVERVIEW

Riffle features are intended to mimic a natural stream channel. Riffles are to be constructed to be stable and to provide hydraulic roughness and fish resting areas through small pocket pool development. Riffles are to be constructed such that low flows remain on the surface.



TYPICAL RIFFLE CREST CROSS SECTION

NOT TO SCALE

MAIN CHANNEL – RIFFLE CREST CROSS SECTIONS

Station	Channel Width 'Wc' (ft)	Toe Width 'Wt' (ft)	Base Width 'Wb' (ft)	Bank Height 'C' (ft)	Bed Height 'D' (ft)	Base Height 'E' (ft)	Riffle Crest Elevation (ft NAVD 88)	Riffle Matrix Mix Volume (CY)	Small Boulders (Each)	Large Boulders (Each)
5+85	Match Existing							239	14	10
8+00	49	44	24	1.6	0.5	1.2	2960.40	293	16	11
10+23	50	45	24	1.6	0.5	1.2	2958.90	315	18	13
12+90	44	39	24	1.5	0.4	1.2	2957.40	335	19	13
15+90	44	39	24	1.5	0.4	1.2	2954.90	400	22	15
19+15	43	38	24	1.5	0.4	1.2	2952.10	320	18	13
22+28	44	39	24	1.5	0.4	1.2	2950.00	315	18	13
24+90	43	38	24	1.5	0.3	1.2	2948.40	403	22	15
28+00	43	38	24	1.5	0.4	1.2	2946.10	392	22	15
31+63	Match Existing									
34+20	49	44	24	1.5	0.5	1.2	2941.50	298	17	12
36+70	48	43	24	1.5	0.5	1.2	2940.10	299	17	12
39+40	42	38	24	1.4	0.4	1.2	2938.60	345	19	13
41+45	42	38	24	1.4	0.4	1.2	2936.90	273	15	11
43+67	42	38	24	1.4	0.4	1.2	2935.20	407	23	16
46+35	54	50	24	1.4	0.7	1.2	2933.60	354	20	14
48+35	54	50	24	1.4	0.7	1.2	2932.50	336	19	13

NOTES:

1. *Overexcavate by 2–feet and replace with riffle material and specification as shown on Dwg. –2063.*
2. *Side slopes vary per guidance in table and location of channel thalweg as shown on grading sheets. A low flow channel is created by side slopes and finish grading – See Typical Riffle Construction Dwg. –2063 and grading plans.*
3. *Typical section shown at Riffle Crest locations, (where the thalweg is in the center of the channel). Riffle crest location is typically the widest location on the riffle length and should transition to next section as shown on the grading plans*
4. *Refer to Main Channel Cross Section sheets for design elevations and offsets at riffle crest locations.*

RIFFLE MATRIX MIX

Percent Passing	Size Class
D100	10 inches – 12 inches
D84	7 inches – 10 inches
D50	3 inches – 5 inches
D16	0.5 inch – 2 inches
D10	<0.08 inch

RIFFLE BOULDER CLASSIFICATIONS

Boulder Size	Size Class
Small	12 inches – 24 inches
Large	24 inches – 48 inches

GRADATION NOTES:

1. *Percent passing size class is based on the nominal diameter of rock.*
2. *Nominal diameter shall be measured as the intermediate axis where the small and large axis shall not be more than 3 times less than or greater than the nominal diameter.*
2. *Acceptable riffle material may be created from stockpiles of various sized screened materials. One example that creates an acceptable riffle matrix material is shown to the right. The C.O. and Engineer shall work with the Contractor to develop an acceptable mixture to meet the requirements above.*
3. *All stockpiles shall be well graded containing equal amounts of material within the range of each size class.*

EXAMPLE STOCKPILE MIX RATIOS FOR RIFFLE MATRIX MATERIAL

Stock Pile Size Class	Mix Percentage (By Volume)	Mix Ratios (By Parts)
9 – 12 inches	10%	2
6 – 9 inches	15%	3
3 – 6 inches	30%	6
1 – 3 inches	30%	6
0.08 – 1 inches	5%	1
< 0.08 inches	10%	2

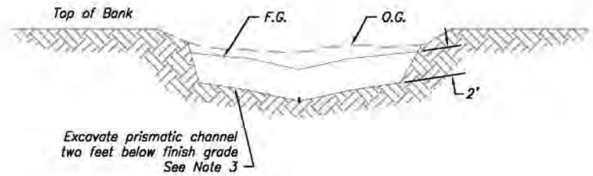
RIFFLE CONSTRUCTION NOTES:

1. *Stockpile engineered fill material per design specifications. Materials are to be stockpiled in the immediate project area or transported from the sorting area as needed.*
2. *Treat existing channel bed by removing organics and creating a prismatic working surface following thalweg and design contours on grading sheets.*
3. *Import well–mixed engineered riffle matrix material. Compact matrix material in 12–inch lifts using 300 Series Excavator, or similar equipment. Track on matrix material sufficiently to compact material. Add a layer of additional fines on the surface. Wash fines into matrix material using a trash pump and 2–inch fire hose with a nozzle until water ponds on the surface and approved by the C.O.*
4. *Repeat riffle matrix construction in another 12–inch lift to design channel thalweg elevation and shape.*
5. *Place boulders in the riffles by embedding a minimum of 50% of boulder diameter into the riffle, compact per specifications, and top dress as directed by the C.O.*

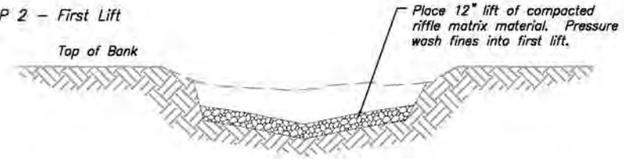
RIFFLE CONSTRUCTION STEPS

NOT TO SCALE

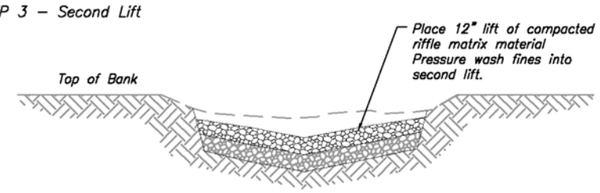
STEP 1 – Rough Grade



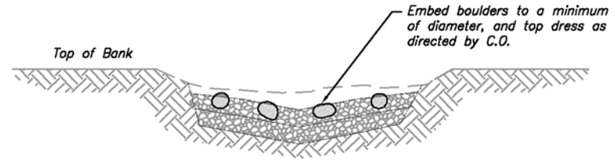
STEP 2 – First Lift



STEP 3 – Second Lift



STEP 4 – Boulder Placement and Top Dressing





EXAMPLE CONSTRUCTED RIFFLE

Note boulder features, thalweg transition, and bank roughness
(Photo – Shitike Creek Restoration Project – Courtesy of S. Welch)

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CC-44 PHASE III- HABITAT ENHANCEMENT
PARCEL 3

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RIFFLE AND GLIDE CONSTRUCTION

DETAILS

1678–100–2063

SHEET 2 OF 2

DATE AND TIME PLOTTED: Not Plotted
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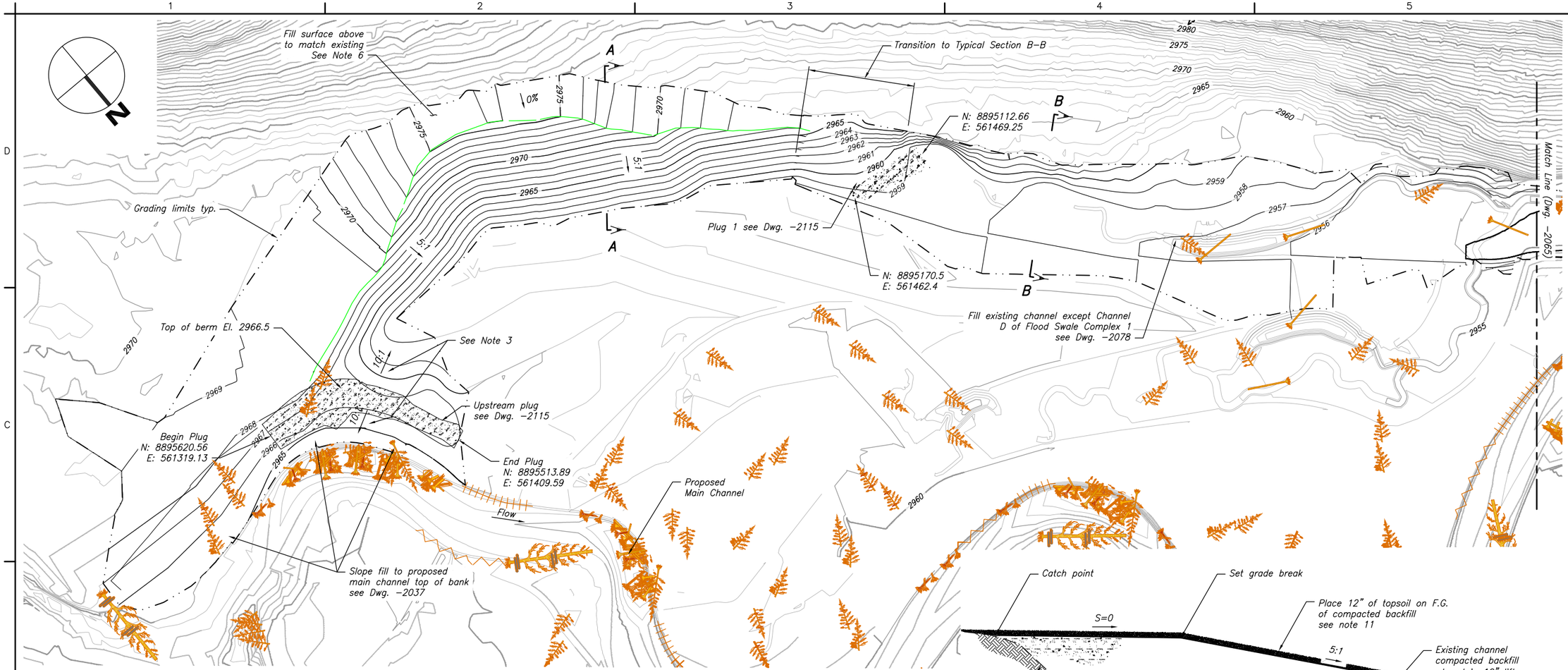
CAD FILENAME: DRAWING

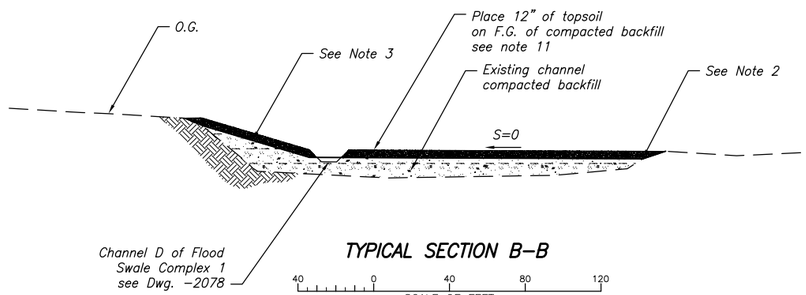


EXISTING CHANNEL FILL PLAN

40 0 40 80 120
SCALE OF FEET

TYPICAL SECTION A–A

40 0 40 80 120
SCALE OF FEET



TYPICAL SECTION B–B

40 0 40 80 120
SCALE OF FEET

NOTES:

1. All work shown on this sheet shall be completed in construction year 2 during the in water work period.
2. Fill boundary is intended to match the right top of bank of the existing channel. Stake out shall be field verified by C.O. prior to installation of compacted channel backfill.
3. Slope of existing channel fill material varies. Slope compacted channel fill material from left edge of Flood Swale Complex 1, channel D, to top of left bank of existing channel.
4. Remove organic debris in existing channel and stockpile as directed by the C.O. prior to placement of compacted backfill.
5. Collect boulders in existing channel and stockpile as directed by C.O. prior to placement of compacted backfill.
6. All sloped material shall be graded to meet the natural existing topography unless indicated otherwise.
7. Flood Swale Complex 1 Drawings supersede this drawing if elevations are contrary to the elevations shown on this drawing.
8. Fill placed in the existing channel to create a flow plug shall be material as specified on sheet –2115.
9. Fill material shall be a well graded mix and be near optimum moisture content for compaction. Fill material shall be approved by the C.O.
10. Place fill material in 12–inch maximum lifts, and compact thoroughly. No testing of compacted density will be performed; acceptance will be by the Contracting Officer observing fill placement and compaction effort. The intent of compaction will be to achieve approximately 85% relative density.
11. Grading contours are for compacted fill. An additional 12" will be added by topsoil.

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GRANDE RONDE SUBBASIN

CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

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BOISE, ID	2015–09–14

EXISTING CHANNEL FILL

PLAN AND SECTIONS

1678–100–2064

SHEET 1 OF 3

DATE AND TIME PLOTTED
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PLOTTED BY
Not Plotted

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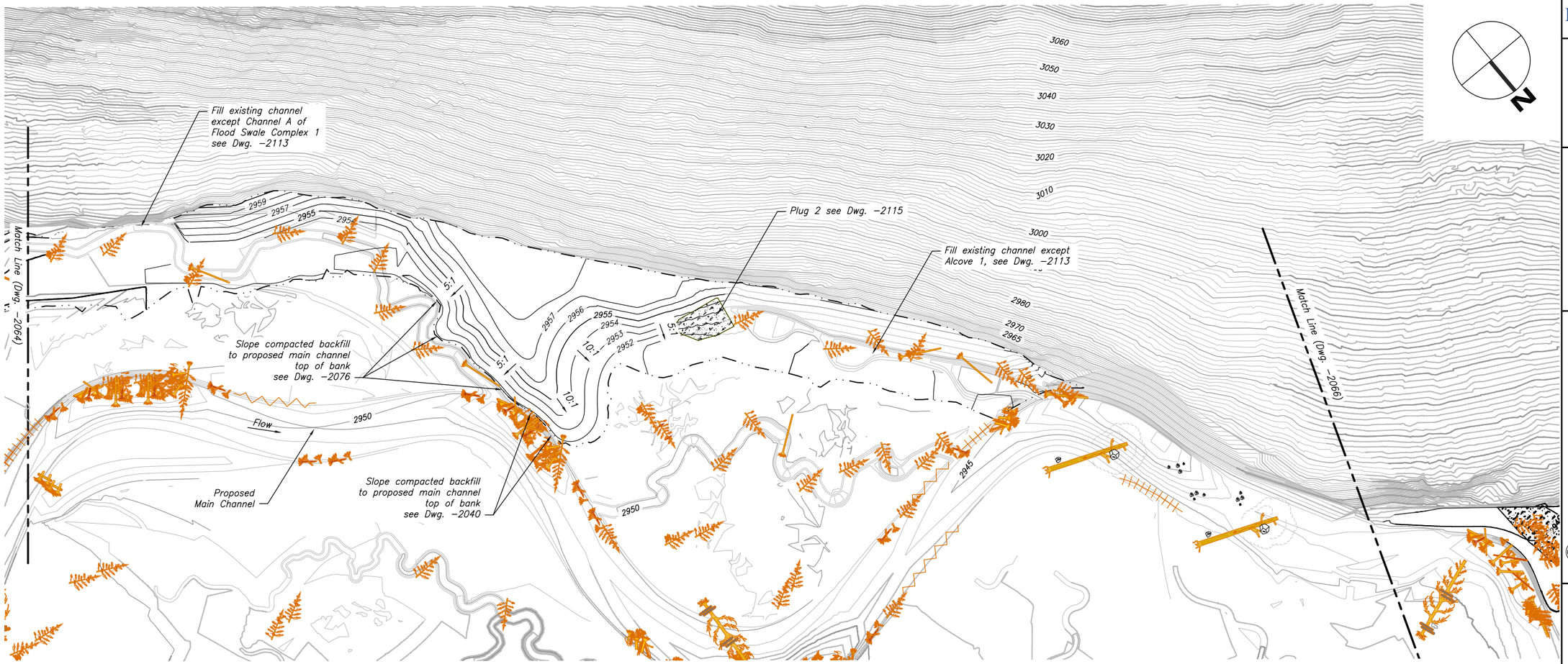

EXISTING CHANNEL FILL PLAN

40 0 40 80 120
SCALE OF FEET

NOTES:

1. All work shown on this sheet shall be completed in construction year 2 during the in water work period.
2. Fill Boundary is intended to match the right top of bank of the existing channel. Stake out shall be field verified by C.O. prior to installation of channel fill material.
3. Slope of existing channel fill material varies. Slope channel fill material from left edge of Flood Swale Complex 1, channel A, to existing ground at 5:1 or as indicated on this drawing.
4. All sloped material shall be graded to meet the natural existing topography unless indicated otherwise.
5. Channel shaping drawings; Plan and Profile, cross sections, typical sections or any related design, supersede this drawing if elevations are contrary to the elevations shown on this drawing.
6. Fill placed in the existing channel to create a flow plug shall be material as specified on sheet –2115.
7. Fill material shall be a well graded mix and be near optimum moisture content for compaction. Fill material shall be approved by the C.O. before placement.
8. Place material in 12–inch maximum lifts, and compacted thoroughly. No testing of compacted density will be performed; acceptance will be by the Contracting Officer observing fill placement and compaction effort. The intent of compaction will be to achieve approximately 85% relative density.
9. Grading contours are for compacted fill. An additional 12" will be added by topsoil.

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

DESIGNED	Jeffrey J Fealko P.E.
DRAWN	JET/DB/KK
CHECKED	Mike Knutson P.E.
TECH. APPR.	Jeffrey J Fealko P.E.
APPROVED ADMIN APPROVAL – PROGRAM MANAGER	Steve Montague–Acting
BOISE, ID	2015–09–14

EXISTING CHANNEL FILL

PLAN

1678–100–2065

SHEET 2 OF 3

DATE AND TIME PLOTTED
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PLOTTED BY
Not Plotted

CAD SYSTEM
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CAD FILENAME
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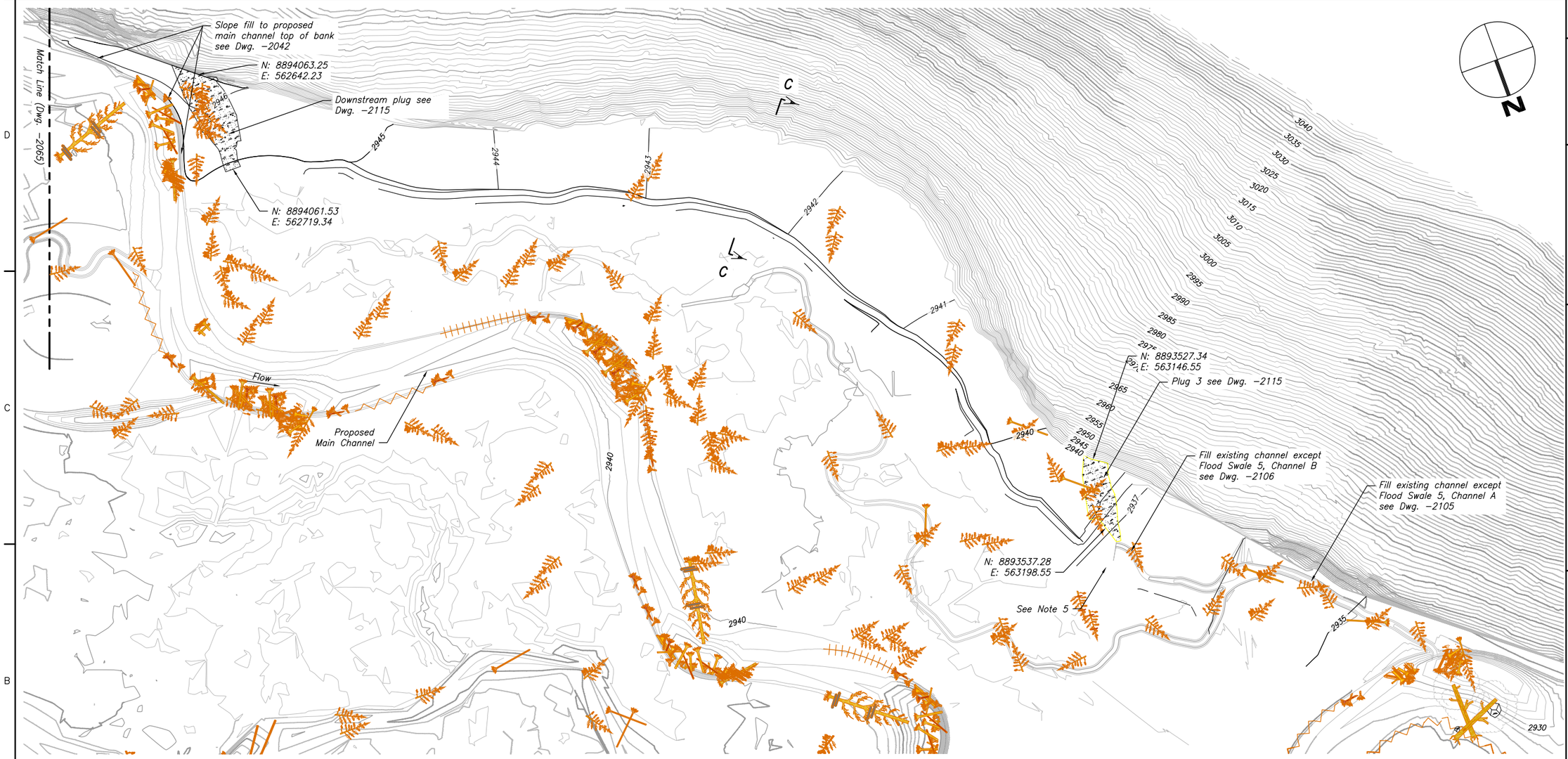
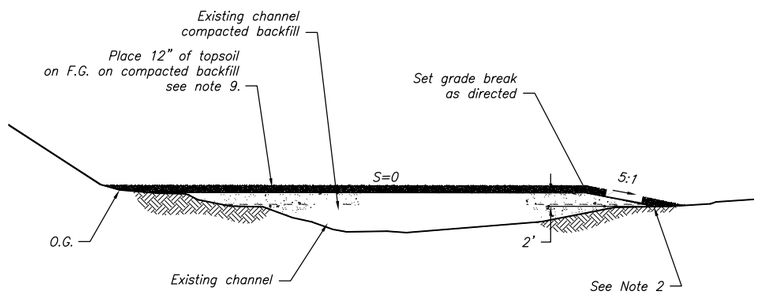


EXISTING CHANNEL FILL PLAN

40 0 40 80 120
SCALE OF FEET



TYPICAL SECTION C–C

Points 166 through 189

10 0 10 20 30
SCALE OF FEET

NOTES:

1. All work shown on this sheet shall be completed in construction year 2 during the in water work period.
2. Fill boundary is intended to match the right top of bank of the existing channel. Stake out shall be field verified by C.O. prior to installation of compacted channel backfill.
3. Fill to existing grade with a cross sectional slope of zero. Fill surface to match elevation at catch point of existing grade, see TYPICAL SECTION C–C, this sheet.
4. All sloped material shall be graded to meet the natural existing topography unless indicated otherwise.
5. Flood Swale Complex 5 Drawings supersede this drawing if elevations are contrary to the elevations shown on this drawing.
6. Fill placed in the existing channel to create a flow plug shall be material as specified on sheet –2115.
7. Fill material shall be a well graded mix and be near optimum moisture content for compaction. Fill material shall be approved by the C.O. before placement at each plug.
8. Place fill material in 12–inch maximum lifts, and compact thoroughly. No testing of compacted density will be performed; acceptance will be by the C.O. observing fill placement and compaction effort. The intent of compaction will be to achieve approximately 85% relative density.
9. Grading contours are for compacted fill. An addition 12" will be added by topsoil.

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GRANDE RONDE SUBBASIN

CC–44 PHASE III HABITAT ENHANCEMENT PARCEL 3

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ADMIN APPROVAL – PROGRAM MANAGER	
BOISE, ID	2015–09–14

EXISTING CHANNEL FILL

PLAN AND SECTION

1678–100–2066

SHEET 3 OF 3

DATE AND TIME PLOTTED
Not Plotted
PLOTTED BY
Not Plotted

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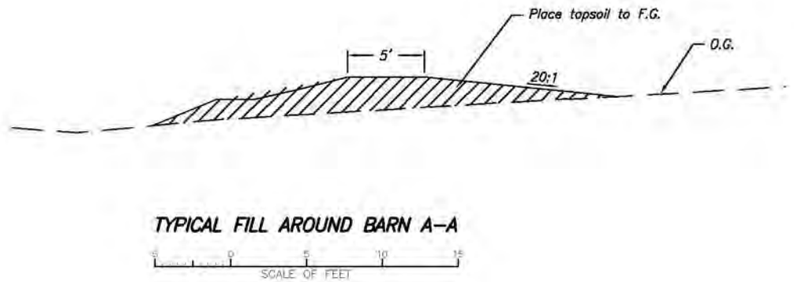
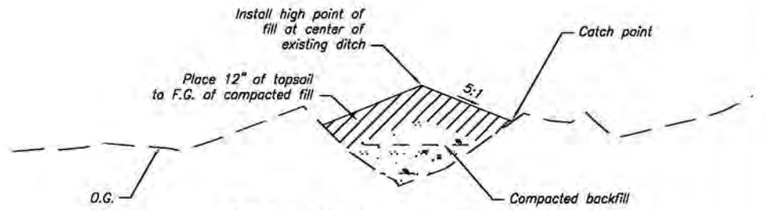


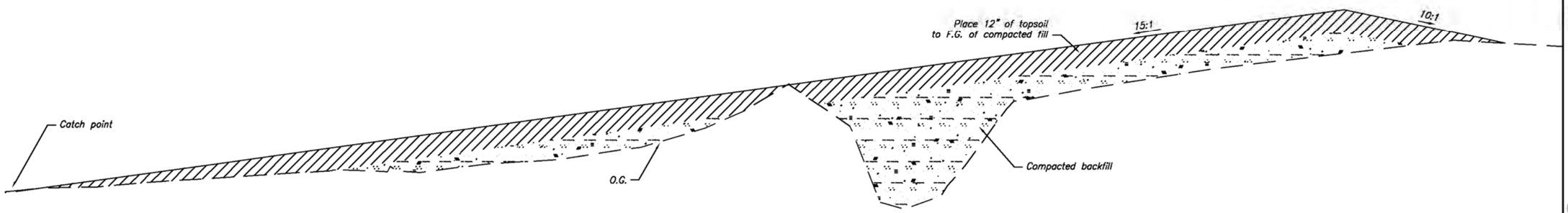
TYPICAL FILL AROUND BARN A–A

SCALE OF FEET



TYPICAL HIGHWAY 203 DITCH FILL B–B

SCALE OF FEET

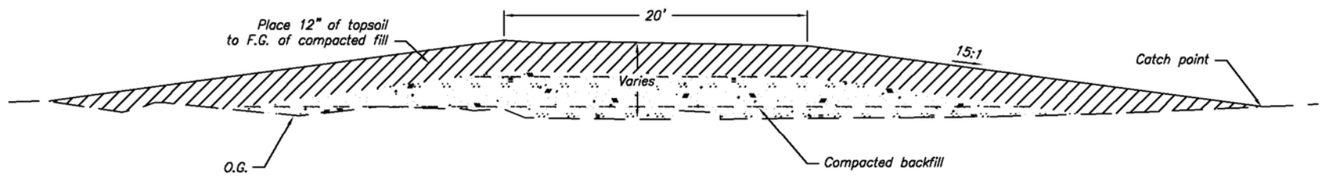


TYPICAL HIGHWAY 203 NE CORNER DITCH FILL B'–B'

SCALE OF FEET

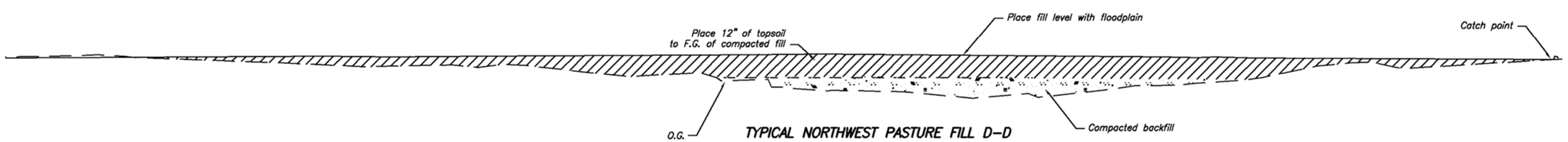
NOTES:

1. Clear and grub extents of where excess material/spoils areas are shown on Dwgs. –2060 and –2033 through 2036.
2. Salvage sod and transplant over fill material. See Dwg. –2060 for Sod Salvage and Transplant Notes.
3. Place fill material in 12–inch maximum lifts, and compacted thoroughly. No testing of compacted density will be performed; acceptance will be by the Contracting Officer observing fill placement and compaction effort. The intent of compaction will be to achieve approximately 85% relative density. See Dwg. –2028 for General Fill Note.
3. Place 12 inches of topsoil on compacted fill material as approved by the C.O. See Dwg. –2061 for Topsoil Notes.



TYPICAL NORTHWEST PROPERTY LINE FILL C–C

SCALE OF FEET



TYPICAL NORTHWEST PASTURE FILL D–D

SCALE OF FEET

DATE AND TIME PLOTTED
AUGUST 12, 2015 14:37
PLOTTED BY
JBACONGUIS

CAD SYSTEM
AutoCAD Rel. 20.0s
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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

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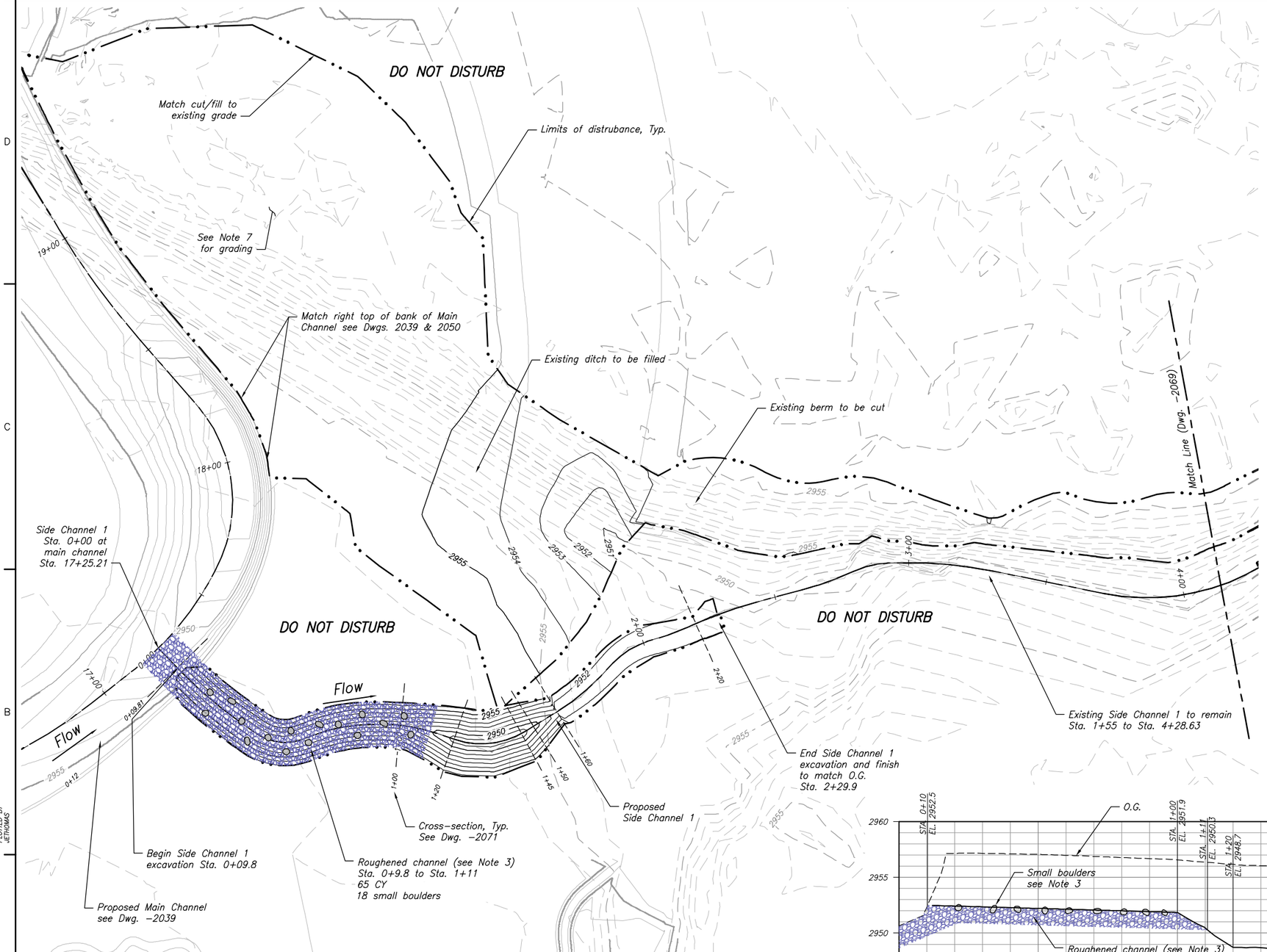
Mike Knutson P.E.	CHECKED
Jeffrey J Fealko P.E.	TECH. APPR.
Steve Montague–Acting	APPROVED ADMIN APPROVAL – PROGRAM MANAGER
BOISE, IDAHO	2015–09–14

EXCESS FILL AREAS

DETAILS

1678–100–2067

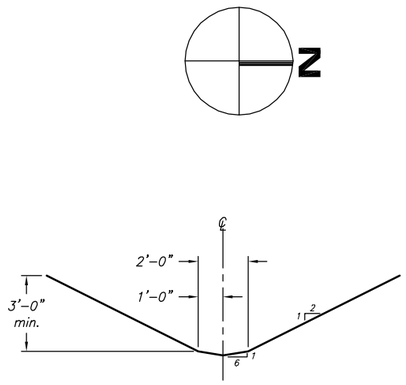
SHEET 1 OF 1



SIDE CHANNEL 1 – PLAN

STA 0+00 TO STA 2+50

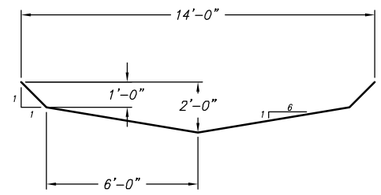
20 0 20 40 60
SCALE OF FEET



TYPICAL SECTION

STA 0+09 TO STA 1+50

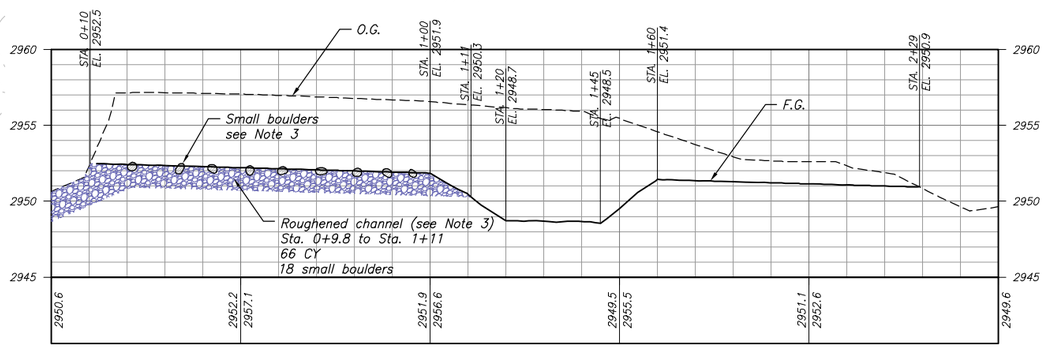
3 0 3 6 9
SCALE OF FEET



TYPICAL SECTION

STA 1+60 TO END

3 0 3 6 9
SCALE OF FEET



SIDE CHANNEL 1 – PROFILE

STA 0+00 TO STA 2+50

HORIZONTAL SCALE
20 0 20 40 60
SCALE OF FEET

VERTICAL SCALE
5 0 5 10 15
SCALE OF FEET

NOTES:

1. Salvage and transplant sod along the excavation extents of Side Channel 1. See Dwg. -2028 for Sod Salvage and Transplant notes.
2. Place salvaged sod on channel side slopes.
3. The roughened channel shall be constructed utilizing the same methods and materials as a riffle (see Dwg. 2063) except boulder sizes. Boulders shall be all small boulders. Additional boulders placed as directed by C.O.R.
4. See Dwg. -2028 for General Fill note for compaction requirements.
5. Cross sections are shown at all major vertical grade breaks shown in profile view. Sections can be found on sheets -2071.
6. For large woody material structures see sheets -2116 to -2127.
7. Grade ditch fill using a constant slope from top of right bank of Main Channel to limits of disturbance as shown on drawing above.

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

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Steve Montague-Acting	APPROVED ADMIN. APPROVAL - PROGRAM MANAGER
BOISE, ID	2015-09-14

SIDE CHANNEL 1

PLAN, PROFILE, & SECTIONS
STA 0+00 TO STA 2+50

1678-100-2068

SHEET 1 OF 4

DATE AND TIME PLOTTED JULY 25, 2015 16:51
PLOTTED BY JETHOMAS

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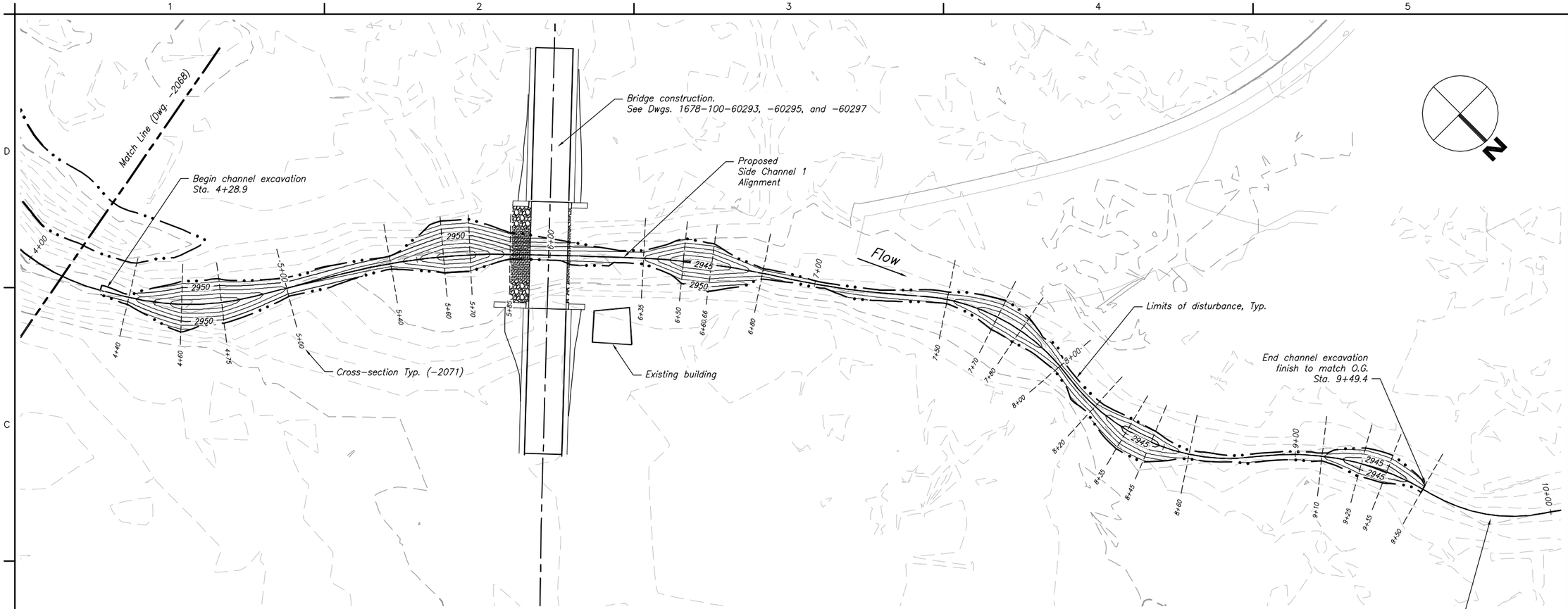


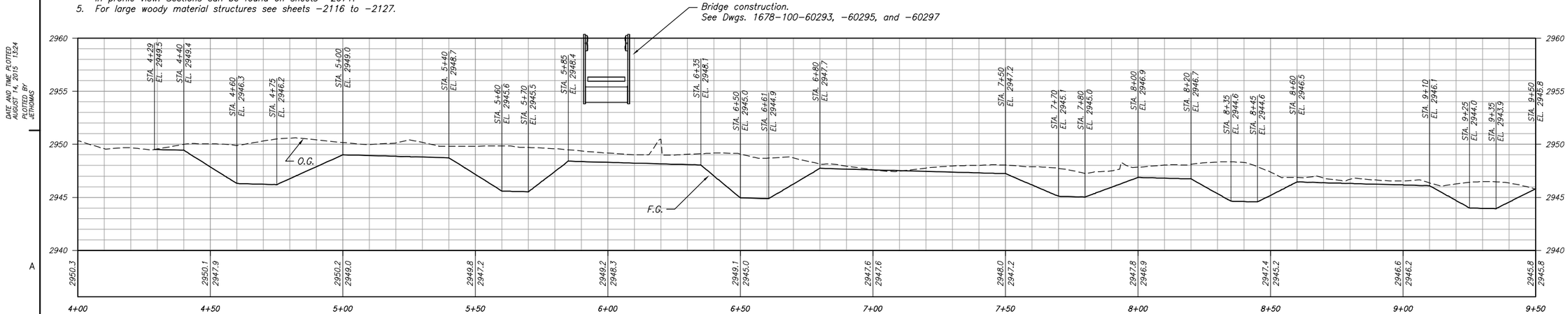
SIDE CHANNEL 1 – PLAN

STA 4+00 TO STA 9+50

20 0 20 40 60
SCALE OF FEET

NOTES:

1. Salvage and transplant sod along the excavation extents of Side Channel 1. See Dwg. -2028 for Sod Salvage and Transplant notes.
2. Place salvaged sod on channel side slopes.
3. See Dwg. -2028 for General Excavation and Finish Grading Notes.
4. Cross sections are shown at all major vertical grade breaks shown in profile view. Sections can be found on sheets -2071.
5. For large woody material structures see sheets -2116 to -2127.



SIDE CHANNEL 1 – PROFILE

STA 4+00 TO STA 9+50

HORIZONTAL SCALE
20 0 20 40 60
SCALE OF FEET

VERTICAL SCALE
5 0 5 10 15
SCALE OF FEET

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GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

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JET	DRAWN
Mike Knutson P.E.	CHECKED
Jeffrey J Fealko P.E.	TECH. APPR.
Steve Montague-Acting	APPROVED
	ADMIN. APPROVAL - PROGRAM MANAGER
BOISE, ID	2015-09-14

SIDE CHANNEL 1

PLAN & PROFILE STA 4+00 TO STA 9+50

1678-100-2069

SHEET 2 OF 4

DATE AND TIME PLOTTED
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PLOTTED BY
JETHOMAS

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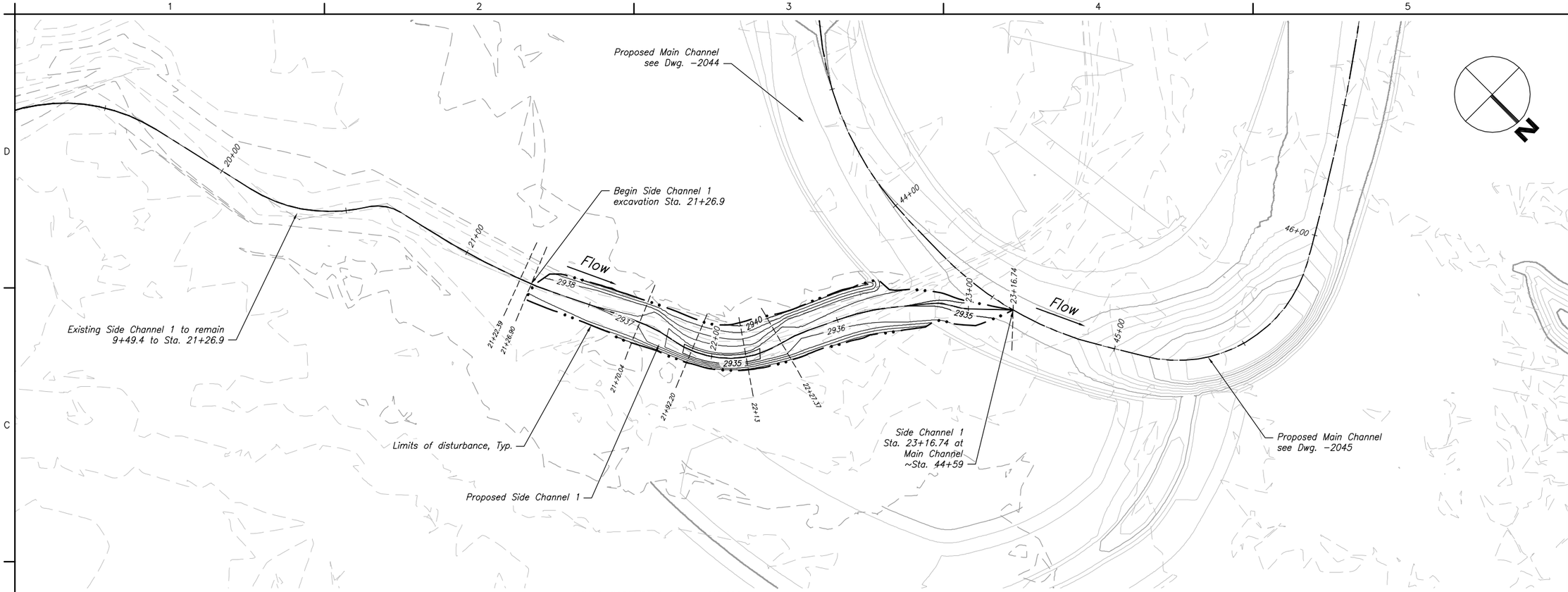
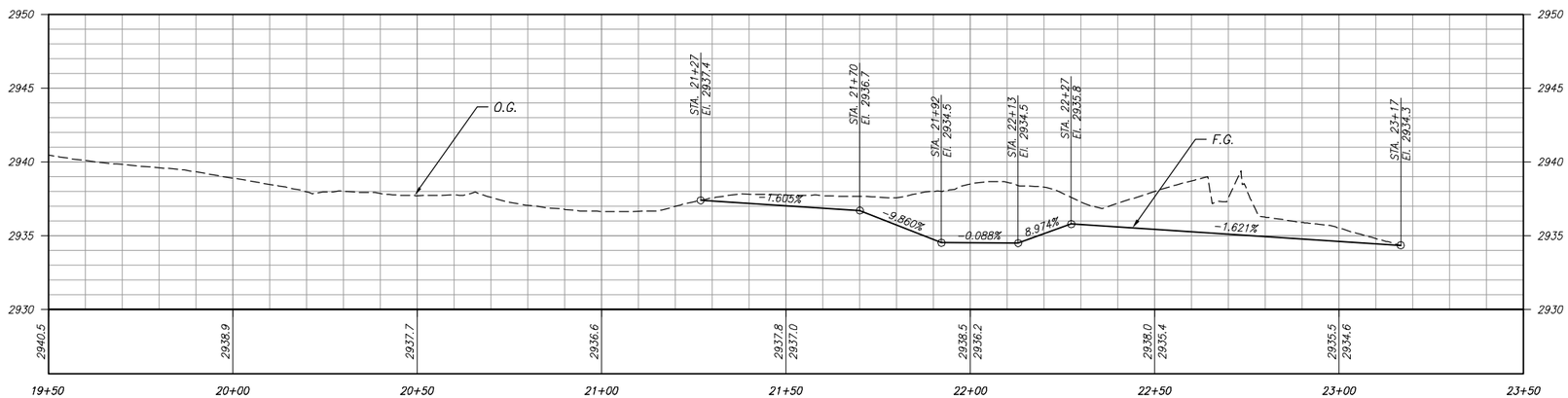


SIDE CHANNEL 1 – PLAN
STA 19+50 TO STA 23+50

20 0 20 40 60
SCALE OF FEET



SIDE CHANNEL 1 – PROFILE
STA 19+50 TO STA 23+50

HORIZONTAL SCALE
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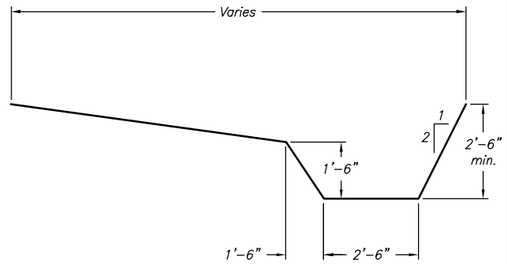
SCALE OF FEET

VERTICAL SCALE
5 0 5 10 15
SCALE OF FEET



SIDE CHANNEL 1
POOL SECTION
STA 21+92.2 TO 22+13

2 0 2 4 6
SCALE OF FEET

NOTES:
1. Salvage and transplant sod along the excavation extents of Side Channel 1. See Dwg. –2028 for Sod Salvage and Transplant notes.
2. Place salvaged sod on channel side slopes.
3. See Dwg. –2028 for General Excavation and Finish Grading Notes.
4. Cross sections are shown at all major vertical grade breaks shown in profile view. Sections can be found on sheets –2071.
5. For large woody material structures see sheets –2116 to –2127.

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

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APPROVED	Steve Montague–Acting
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BOISE, ID	2015–09–14

SIDE CHANNEL 1

PLAN, PROFILE & SECTION STA 21+92.2 TO STA 22+13

1678–100–2070

SHEET 3 OF 4

DATE AND TIME PLOTTED
AUGUST 14, 2015 13:43
PLOTTED BY
JETHOMAS

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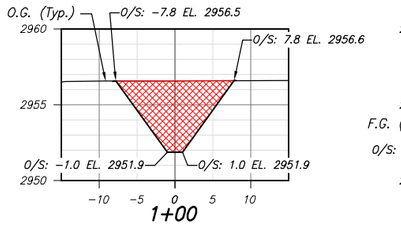

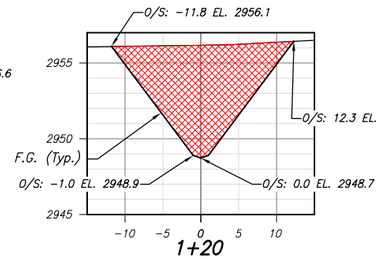

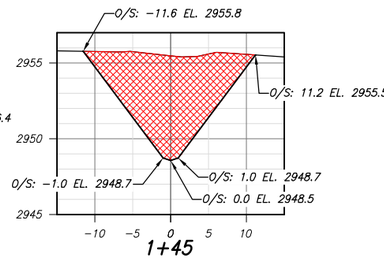

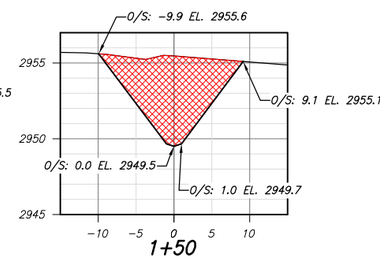

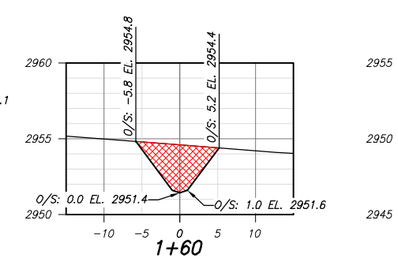

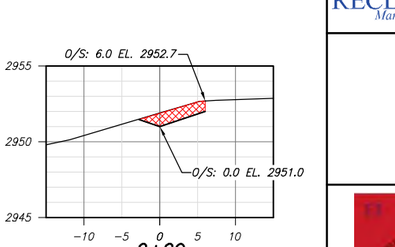

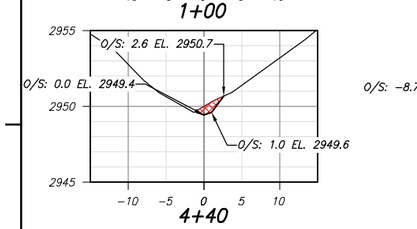

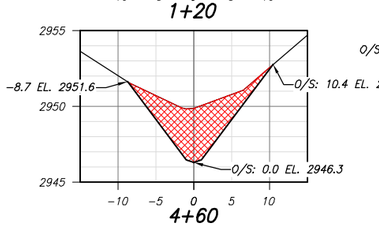

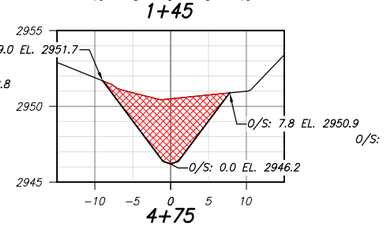

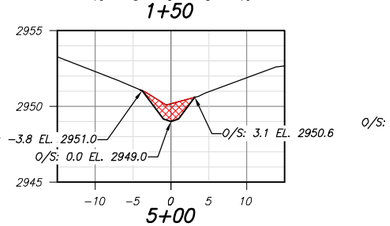

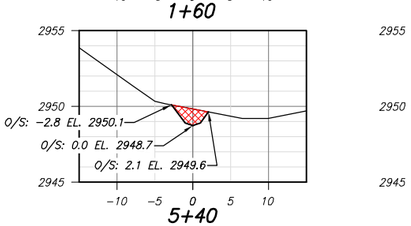

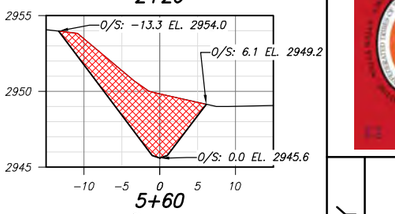

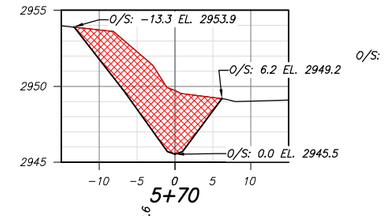

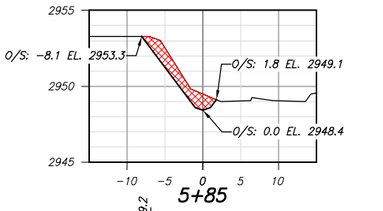

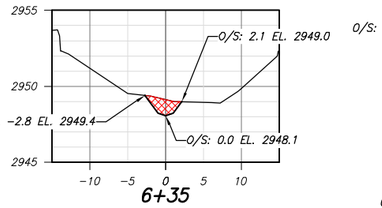

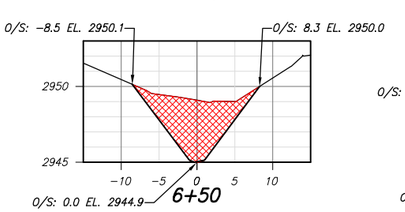

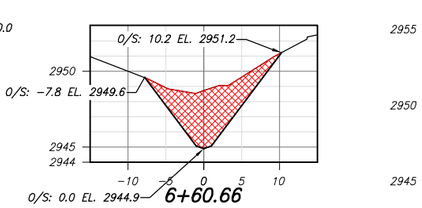

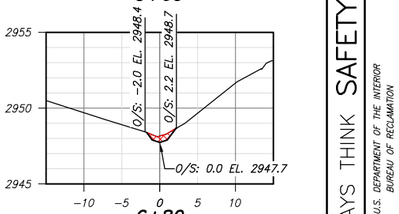

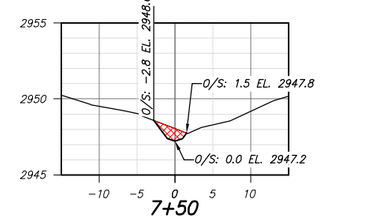

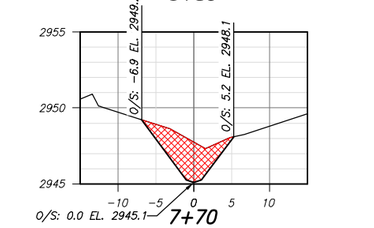

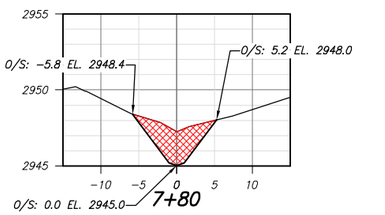

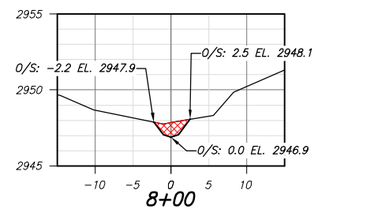

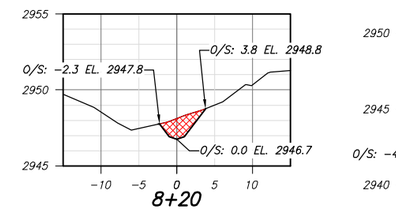

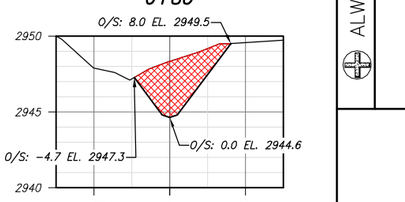

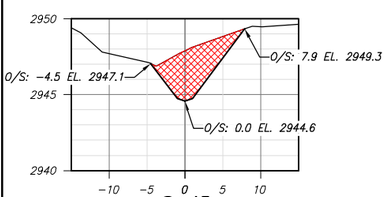

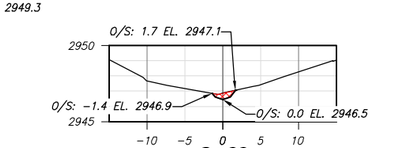

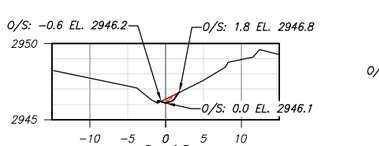

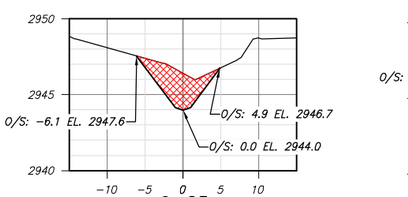

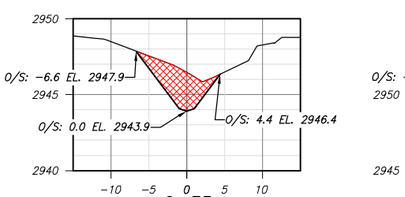

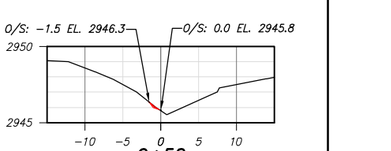

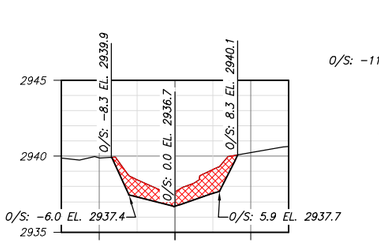

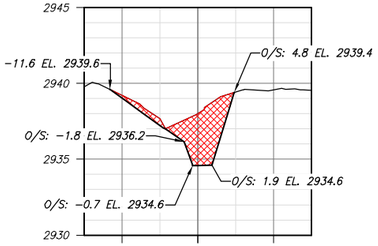

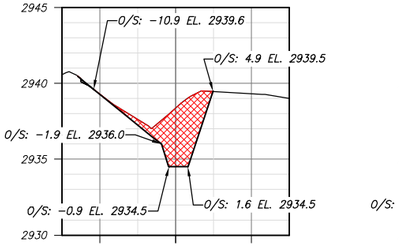

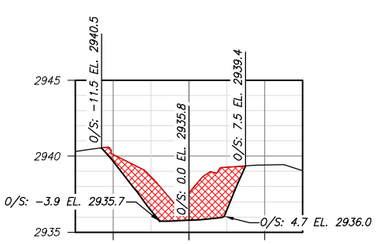

CUT

NOTES:

1. Cross sections face downstream. Cross section centerline station is located along the thalweg alignment.
2. Y-axis is elevation, X-axis is distance in feet along a chord perpendicular to the thalweg. The zero station shown on these cross sections represents the thalweg alignment.
3. Constructed channel shall transition smoothly between cross sectional geometries shown within these cross sections. Cross section geometry shown represents one point in a smooth transition.
4. Cross-sections are to be used to stake out the channel offsets at the vertical grade breaks of the channel profile.

SIDE CHANNEL 1 CROSS SECTIONS

10 0 10 20 30
SCALE OF FEET

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

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BOISE, ID	2015-09-14

SIDE CHANNEL 1

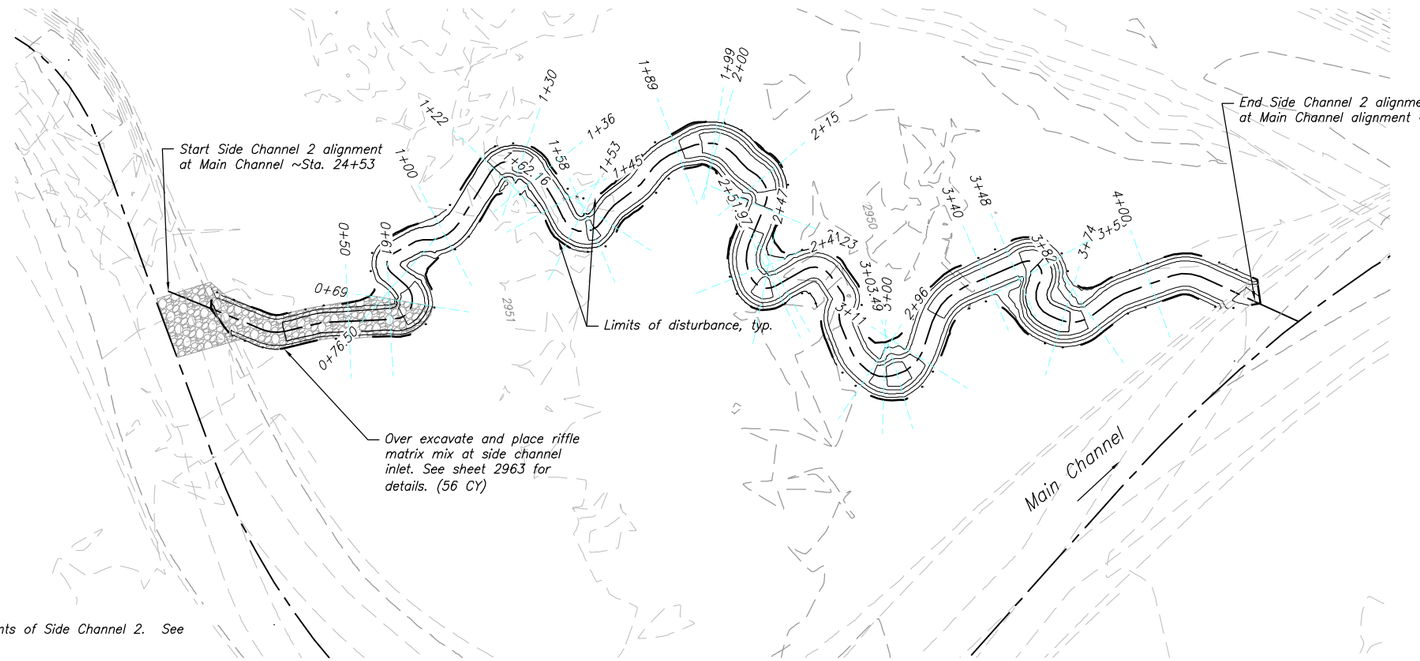
CROSS SECTIONS

1678-100-2071

SHEET 4 OF 4

DATE AND TIME PLOTTED
AUGUST 14, 2015 13:49
PLOTTED BY
JETHOMAS

CAD SYSTEM
AutoCAD Rel. 20.0s
CAD FILENAME
28_1678-100-SC1.DWG

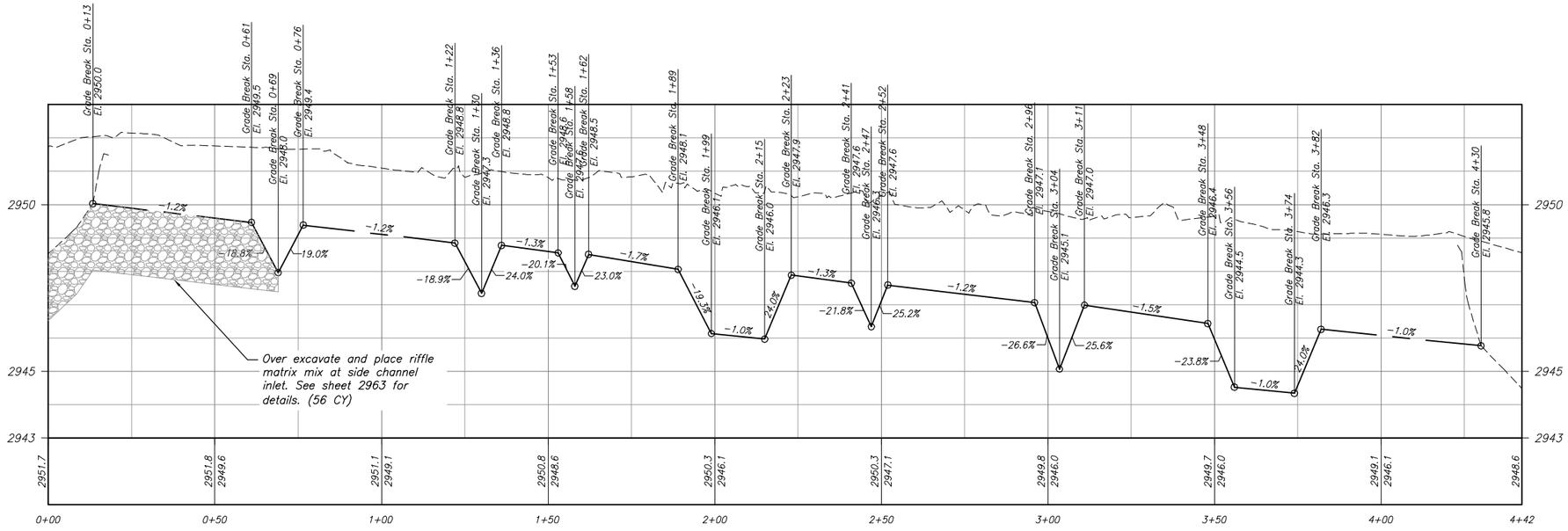


SIDE CHANNEL 2 PLAN

20 0 20 40 60
SCALE OF FEET

NOTES::

1. Salvage and transplant sod along the excavation extents of Side Channel 2. See Dwg. –2028 for Sod Salvage and Transplant notes.
2. Place salvaged sod on channel side slopes.
3. See Dwg. –2028 for General Excavation and Finish Grading Notes.
4. Cross sections are shown at all major vertical grade breaks shown in profile view. Sections can be found on sheets –2073.
5. For large woody material structures see sheets –2116 to –2127.
6. Riffles shall be graded to design elevations as shown on plans. Contracting Officer shall accept or reject riffle bed material based on the gradation shown on sheet –2063. If rejected, material shall be over excavated and rebuilt with acceptable material as shown on sheet –2063.



SIDE CHANNEL 2 PROFILE

20 0 20 40 60
SCALE OF FEET

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SIDE CHANNEL 2

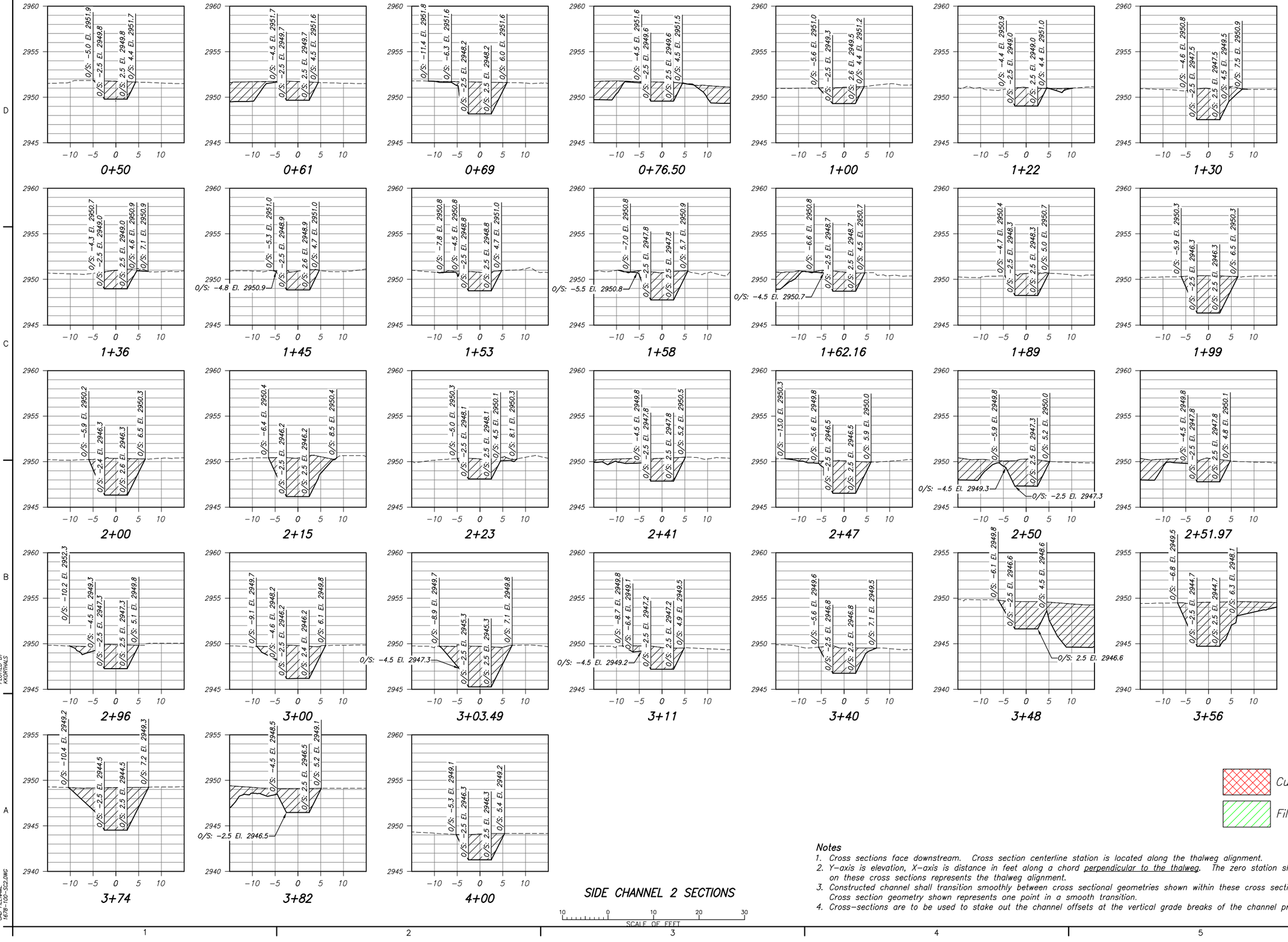
PLAN AND PROFILE VIEW

1678–100–2072

SHEET 1 OF 2

DATE AND TIME PLOTTED
AUGUST 14, 2015 12:07
PLOTTED BY
KKORTHALS

CAD SYSTEM
AutoCAD Rel. 20.0s
CAD FILENAME
1678–100–SC2.DWG



SIDE CHANNEL 2 SECTIONS

SCALE OF FEET
10 0 10 20 30

Notes

1. Cross sections face downstream. Cross section centerline station is located along the thalweg alignment.
2. Y-axis is elevation, X-axis is distance in feet along a chord perpendicular to the thalweg. The zero station shown on these cross sections represents the thalweg alignment.
3. Constructed channel shall transition smoothly between cross sectional geometries shown within these cross sections. Cross section geometry shown represents one point in a smooth transition.
4. Cross-sections are to be used to stake out the channel offsets at the vertical grade breaks of the channel profile.

DATE AND TIME PLOTTED
AUGUST 14, 2015 12:08
PLOTTED BY
KKORTHALS

CAD SYSTEM
AutoCAD Rel. 20.0s
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SIDE CHANNEL 2

SECTION VIEW

1678-100-2073
SHEET 2 OF 2

Start Channel D spring channel

Start Swale B and Channel B at Main Channel ~Sta. 8+74

Start Swale A and Channel A at Main Channel ~Sta. 9+84

End Channel B at Channel A ~Sta. 4+19

Pool

End Swale B at Swale A ~Sta. 2+75

Flow

End Channel D spring channel at Channel A ~Sta. 11+38

Start Channel C with Pool at Channel A ~Sta. 7+30

End Channel C with pool at Channel A ~Sta. 9+56

End Channel A and Swale A at Main Channel ~Sta. 23+81

N

NOTES:

1. Salvage sod within the excavation extents of swale alignments. See Dwg. –2028 for Sod Salvage and Transplant Notes.
2. Place 6 inches of topsoil on finish grade of swale side slopes.
3. Place sod mats on swale side slopes.
4. See Dwg. –2028 for General Excavation and Finish Grade Notes.
5. Alignment station labels removed for clarity, see Dwgs. –2075 through –2078 for channel stationing.
6. Two alignments are shown, one for the swale grading feature, and one for the channel feature.
7. "Swales" are the excavated floodplain areas.
8. "Channels" are excavated into the "swale" features.
9. Salvaged sod mats shall be placed throughout the swale complexes as directed by the Contracting Officer to provide immediate vegetation and floodplain roughness. The top of sod mats shall be placed at the final design elevations.
10. Swale complex channels shown in profile are average gradient and shall have pools excavated at the outside of meander bends as directed by the Contracting Officer. Pools shall vary from 1 to 3 feet deep.
11. Swale complex ponds shall be excavated to a minimum depth of 3 feet below encountered groundwater or as directed by the Contracting Officer.

FLOOD SWALE COMPLEX 1 – PLAN

40 0 40 80 120
SCALE OF FEET

DATE AND TIME PLOTTED
AUGUST 11, 2015 09:18
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AHATCH

CAD SYSTEM
AutoCAD Rel. 20.0s
CAD FILENAME
1678-100-SWC1.DWG

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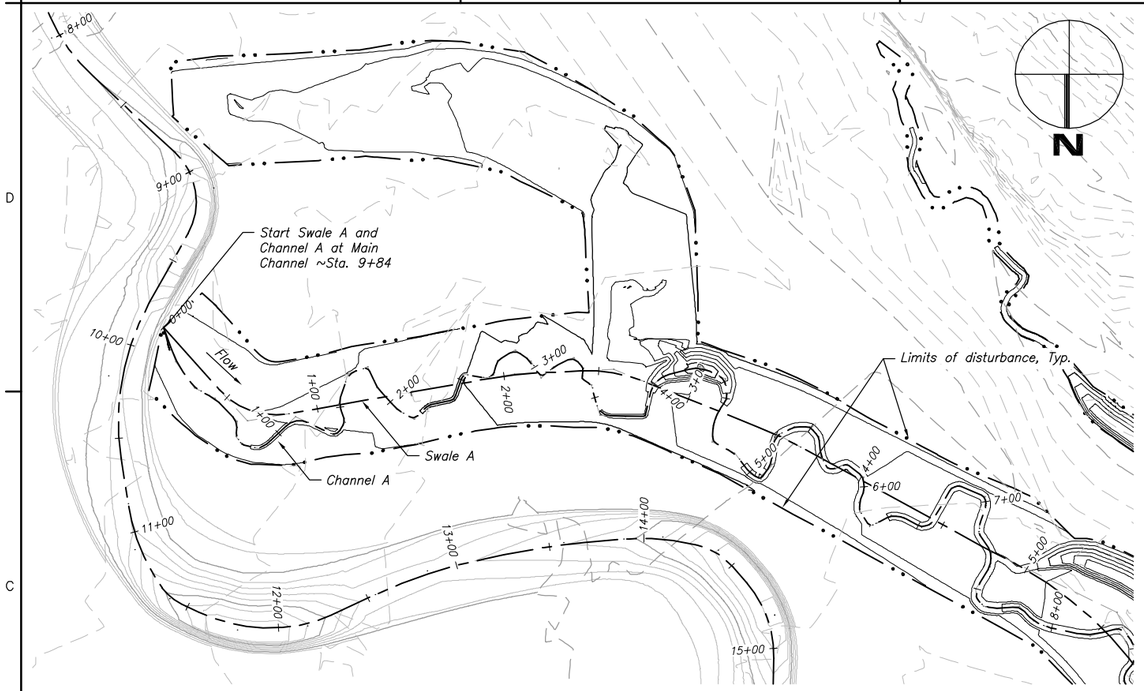
FLOOD SWALE COMPLEX 1

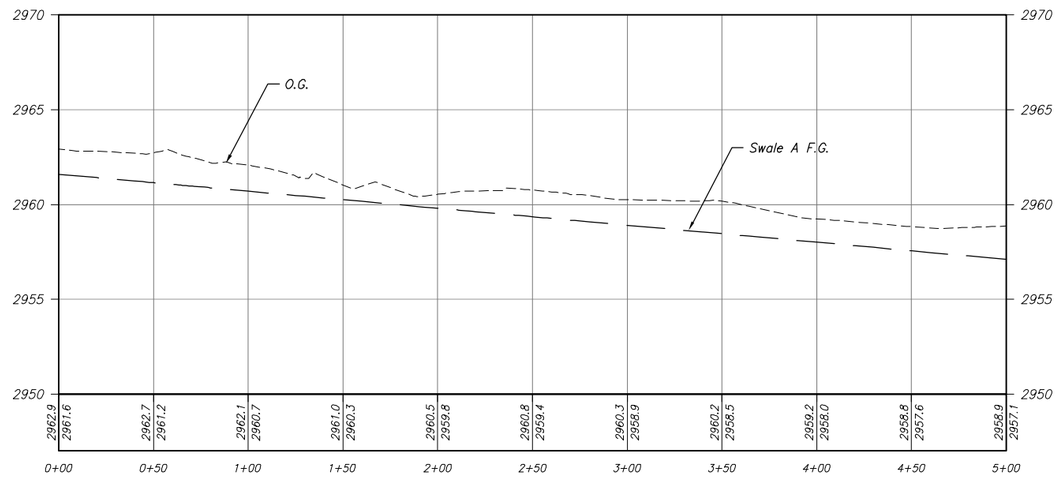
PLAN

1678-100-2074
SHEET 1 OF 8

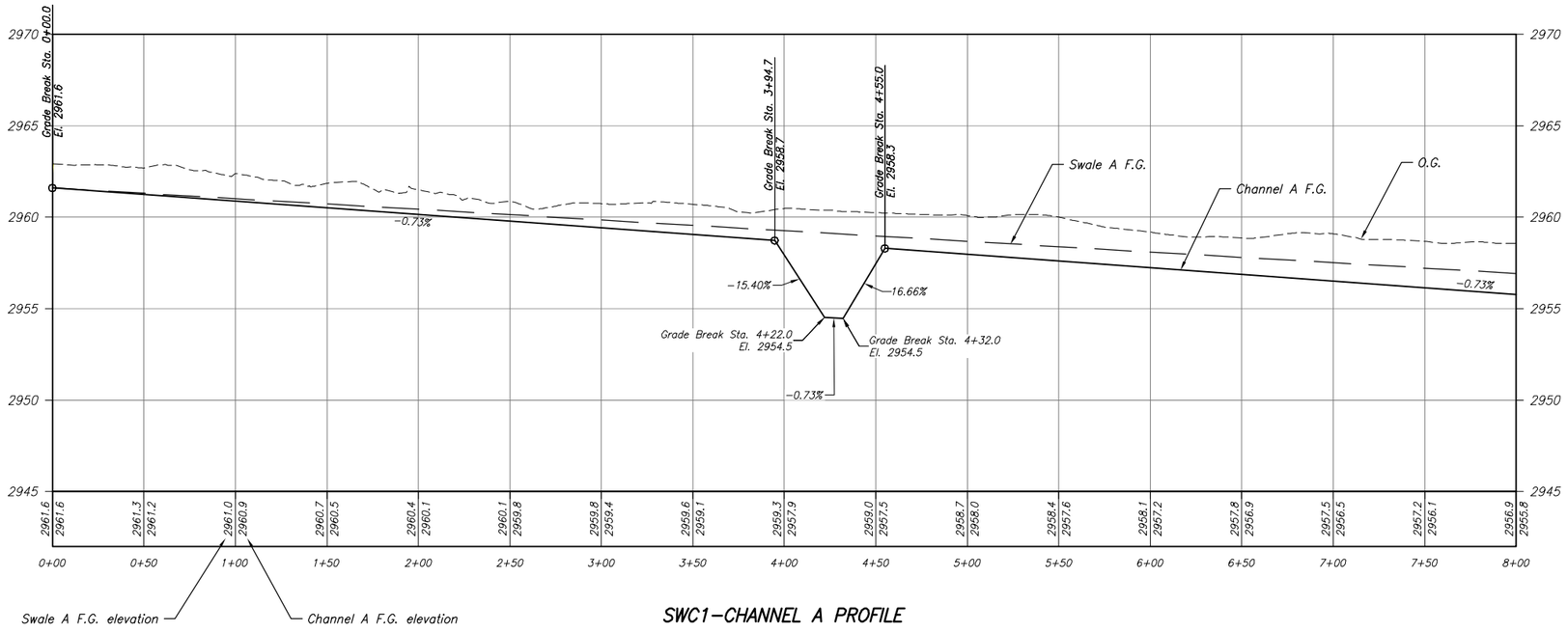


FLOOD SWALE COMPLEX 1
CHANNEL A
SWALE A

40 0 40 80 120
SCALE OF FEET



SWC1–SWALE A PROFILE



SWC1–CHANNEL A PROFILE

1 0 5 10 15
SCALE OF FEET
VERTICAL SCALE

40 0 40 80 120
SCALE OF FEET
HORIZONTAL SCALE

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FLOOD SWALE COMPLEX 1
SWALE A
CHANNEL A

PLAN AND PROFILES

1678–100–2075
SHEET 2 OF 8

DATE AND TIME PLOTTED
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AHATCH

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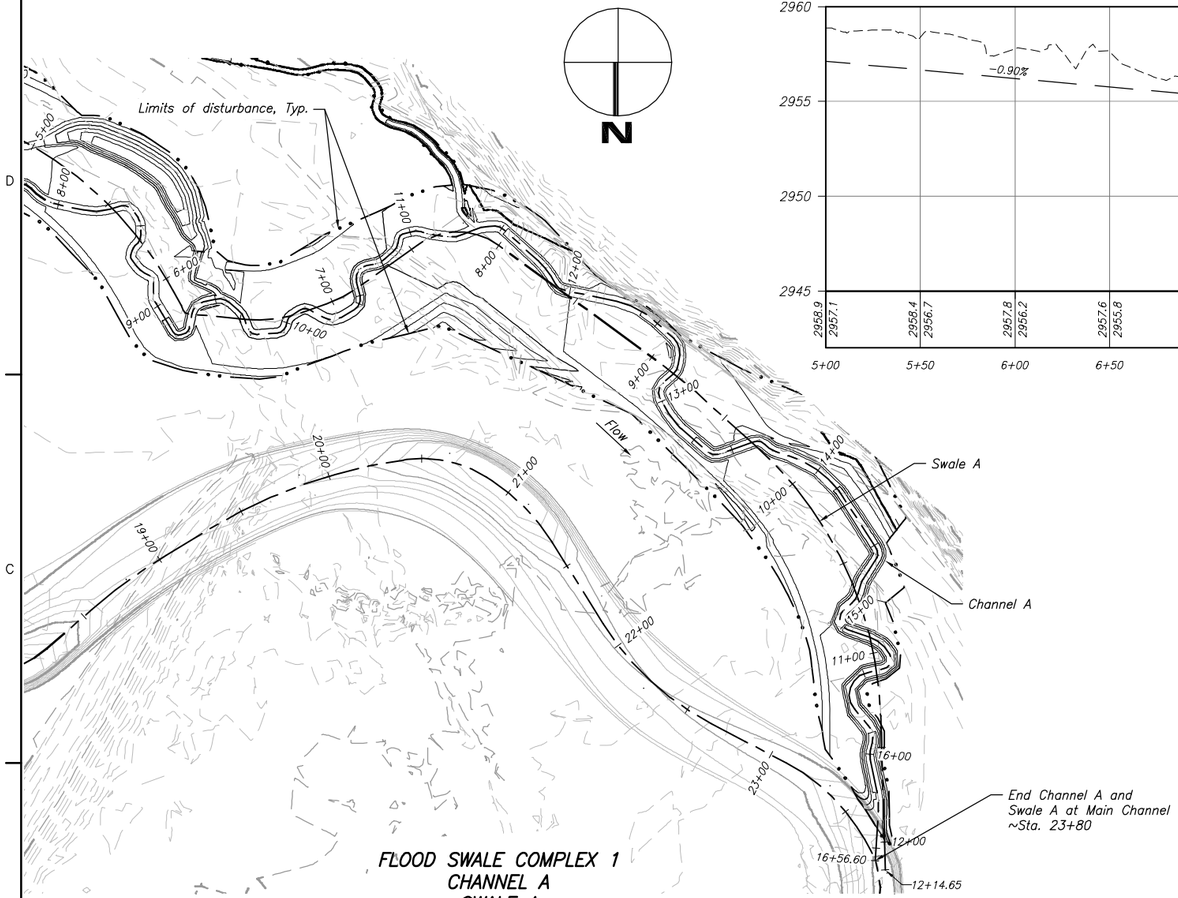
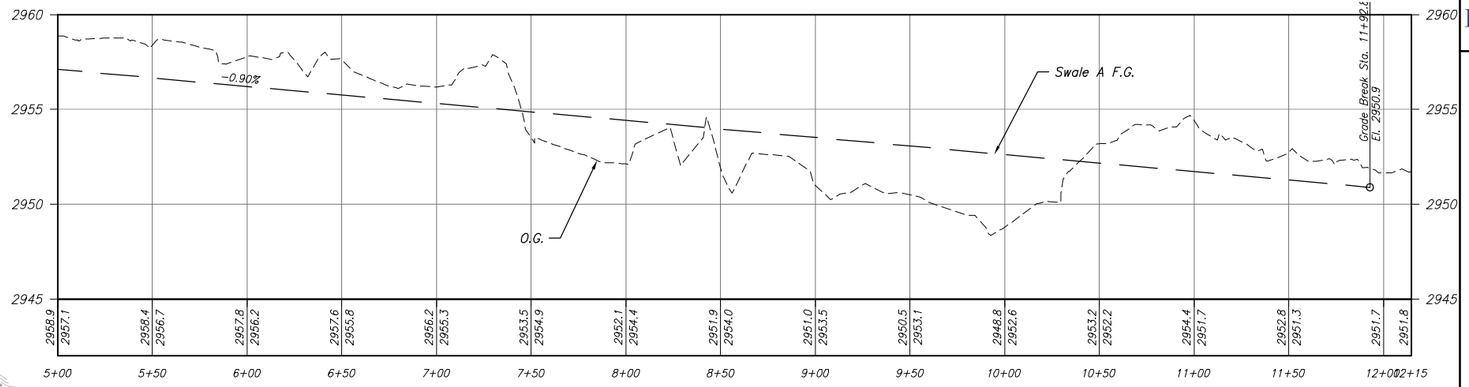
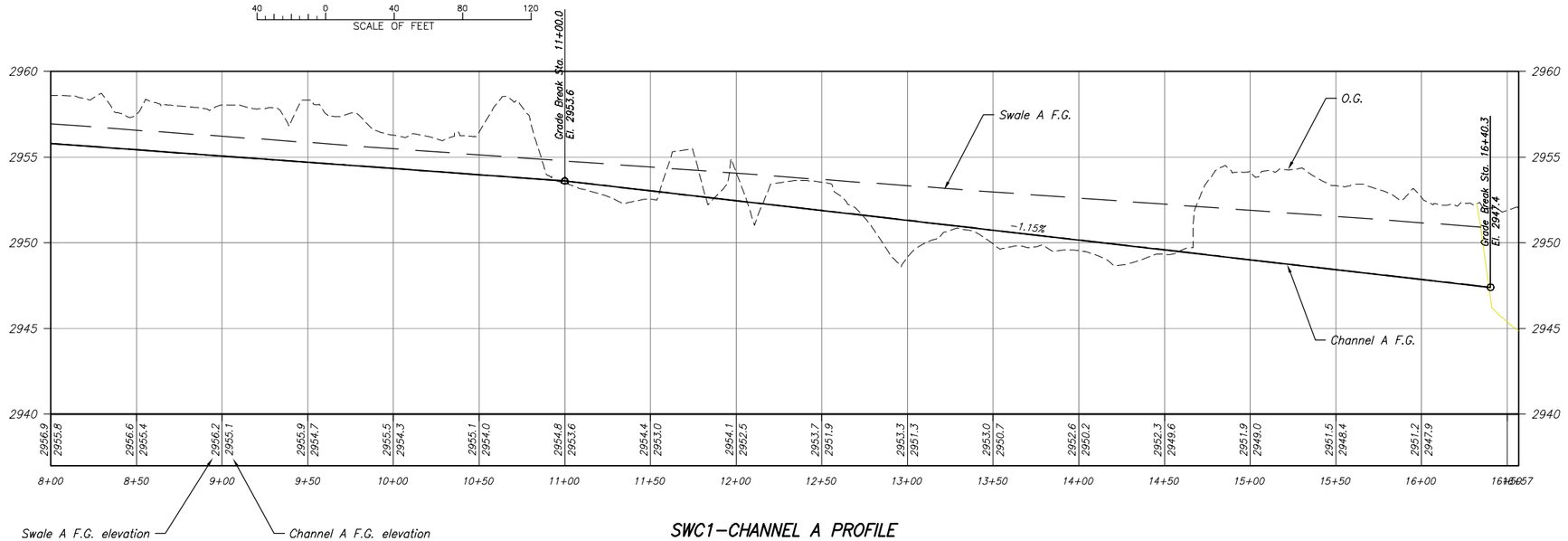


FLOOD SWALE COMPLEX 1
CHANNEL A
SWALE A

40 0 40 80 120
SCALE OF FEET



SWC1–SWALE A PROFILE



SWC1–CHANNEL A PROFILE

1 0 5 10 15
SCALE OF FEET
VERTICAL SCALE

40 0 40 80 120
SCALE OF FEET
HORIZONTAL SCALE

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CC-44 PHASE III HABITAT ENHANCEMENT
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BOISE, ID	2015-09-14

FLOOD SWALE COMPLEX 1
SWALE A
CHANNEL A

PLAN AND PROFILES

1678–100–2076

SHEET 3 OF 8

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AHATCH

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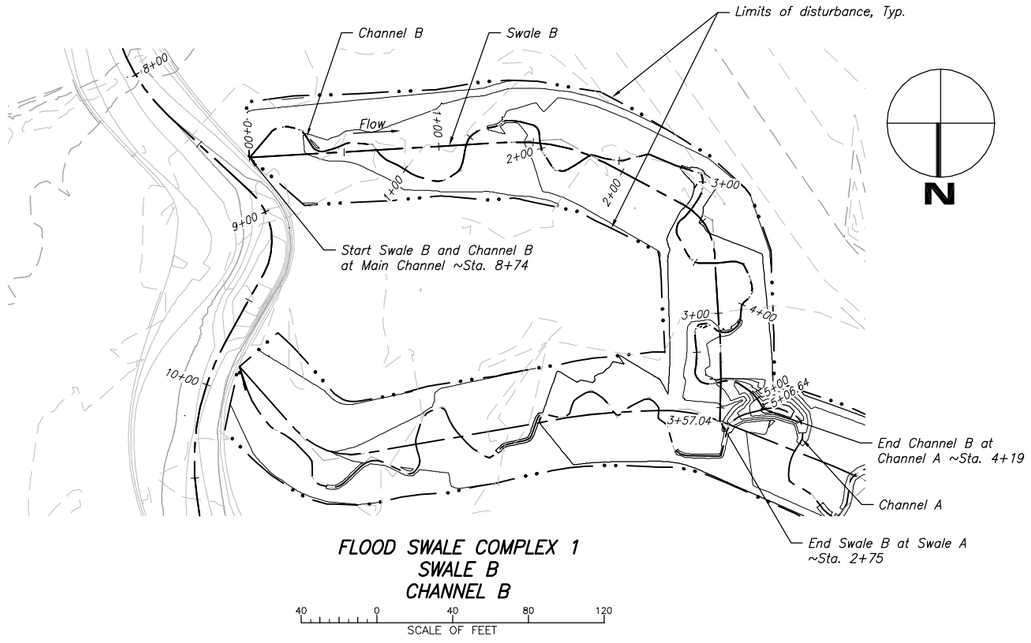
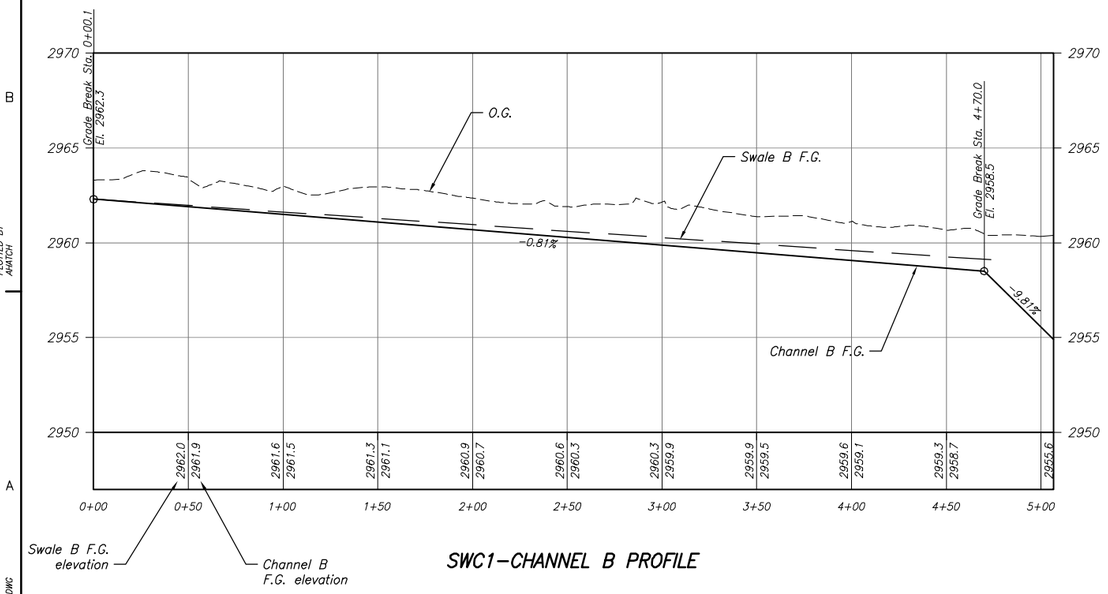
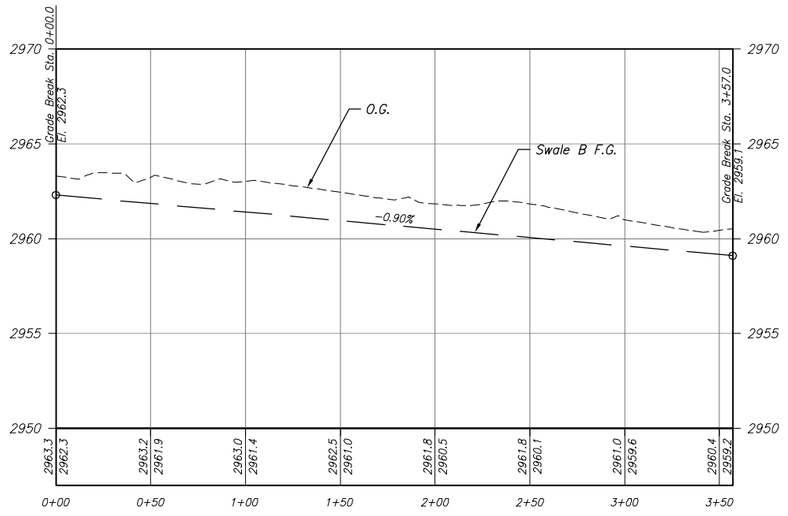


FLOOD SWALE COMPLEX 1
SWALE B
CHANNEL B

40 0 40 80 120
SCALE OF FEET



SWC1–CHANNEL B PROFILE



SWC1–SWALE B PROFILE

1 0 5 10 15
SCALE OF FEET
VERTICAL SCALE

40 0 40 80 120
SCALE OF FEET
HORIZONTAL SCALE

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FLOOD SWALE COMPLEX 1
SWALE B
CHANNEL B

PLAN AND PROFILES

1678–100–2077

SHEET 4 OF 8

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AHATCH

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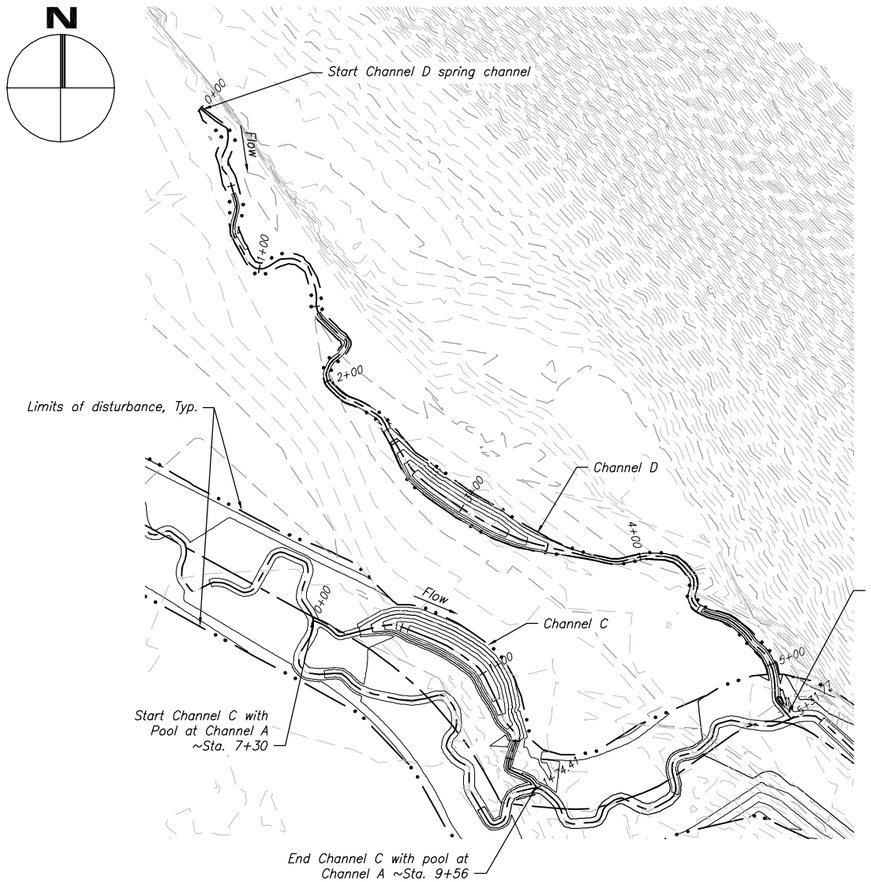
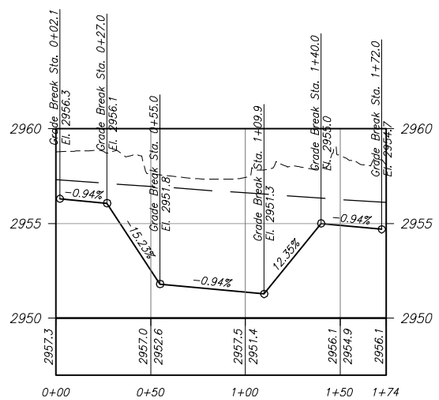


SWALE COMPLEX 1
CHANNEL C
CHANNEL D

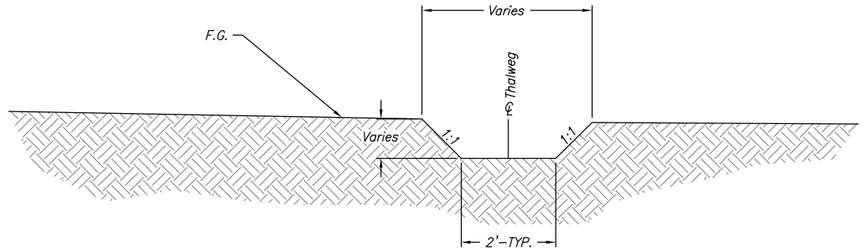
40 0 40 80 120
SCALE OF FEET



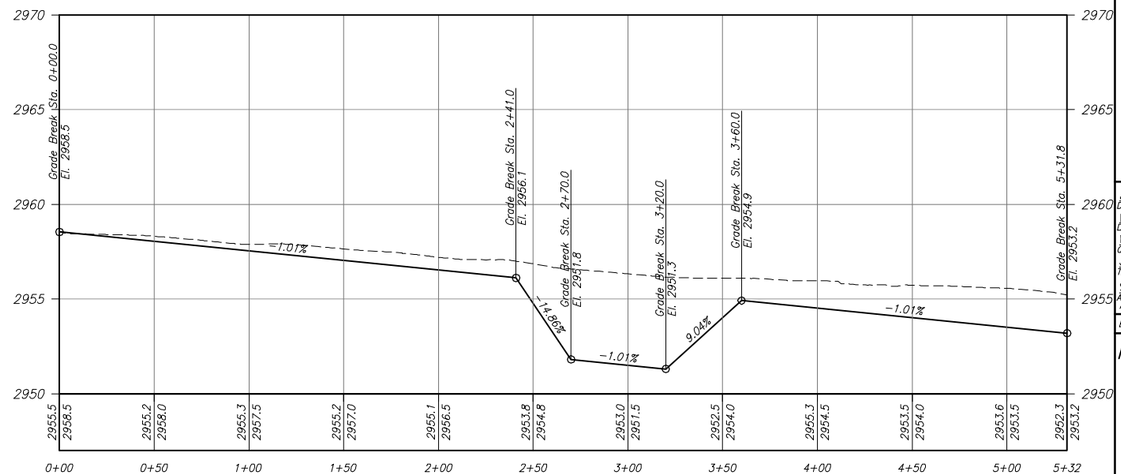
SWC1–CHANNEL C WITH POOL PROFILE

1 0 5 10 15
SCALE OF FEET
VERTICAL SCALE

40 0 40 80 120
SCALE OF FEET
HORIZONTAL SCALE



CHANNEL C/D TYPICAL SECTION
NOT TO SCALE



SWC1–CHANNEL D SPRING CHANNEL PROFILE

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

DESIGNED	Jeffrey J Fealko P.E.
DRAWN	DB/AH/KK/JET
CHECKED	Mike Knutson P.E.
TECH. APPR.	Jeffrey J Fealko P.E.
APPROVED	Steve Montague–Acting
	ADMIN. APPROVAL – PROGRAM MANAGER
BOISE, ID	2015-09-14

FLOOD SWALE COMPLEX 1
CHANNEL C
CHANNEL D

PLAN AND PROFILES

1678–100–2078

SHEET 5 OF 8

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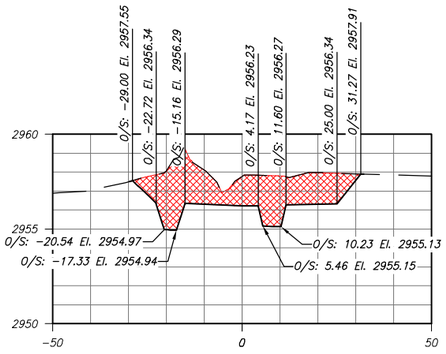

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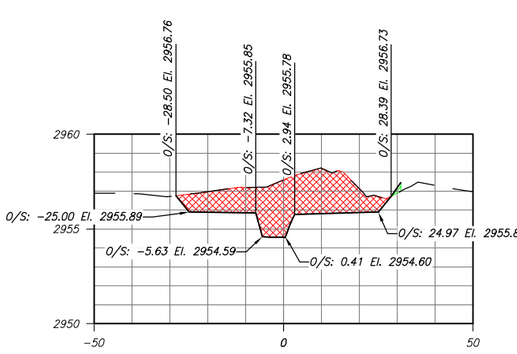

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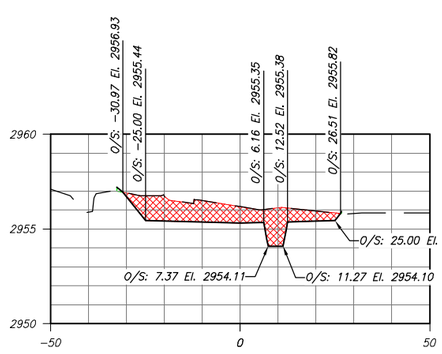

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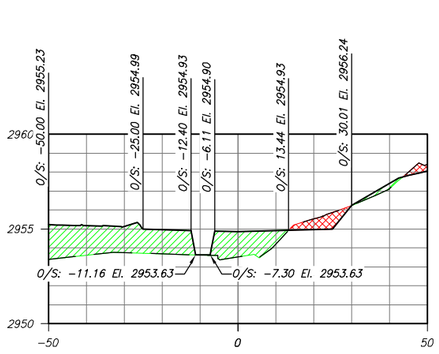

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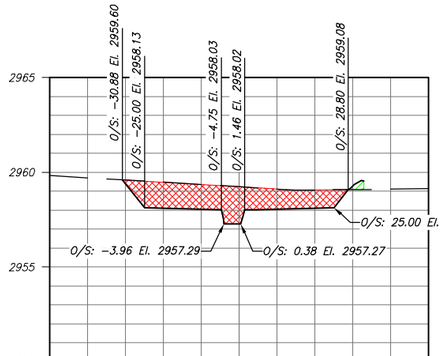

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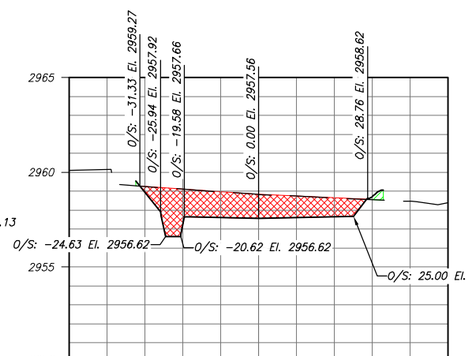

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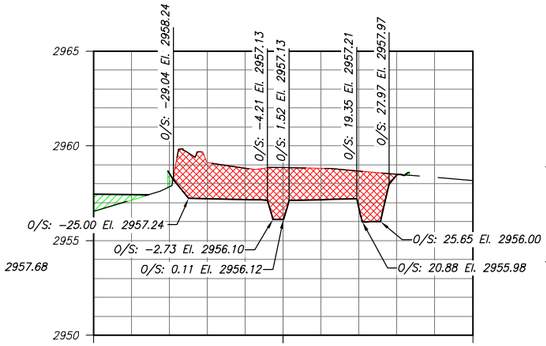

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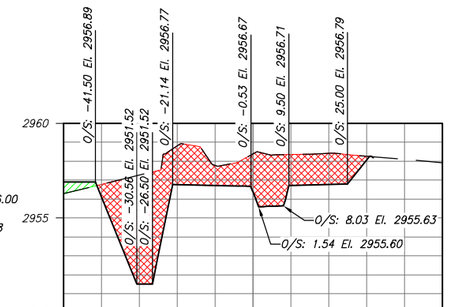

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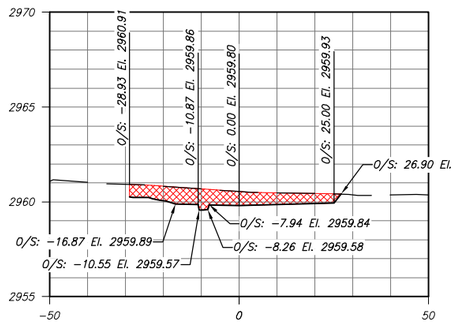

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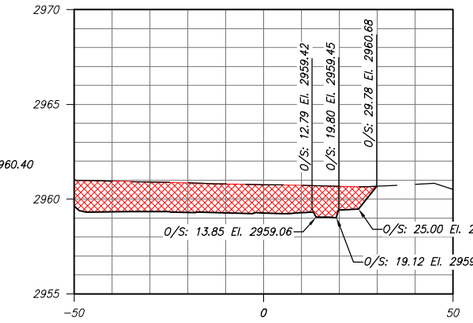

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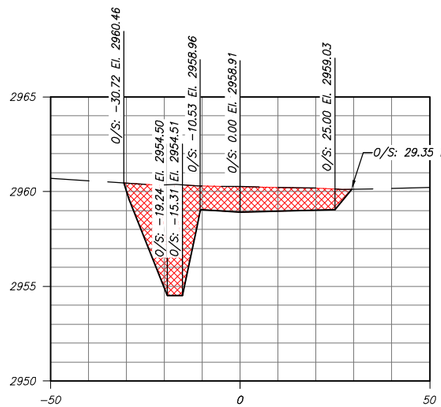

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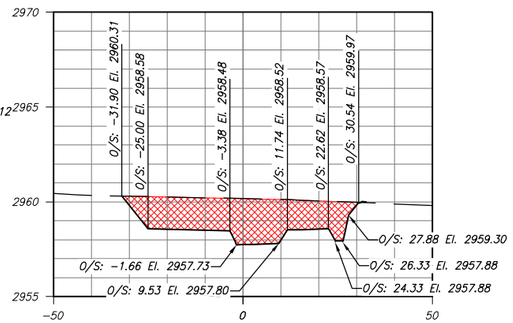

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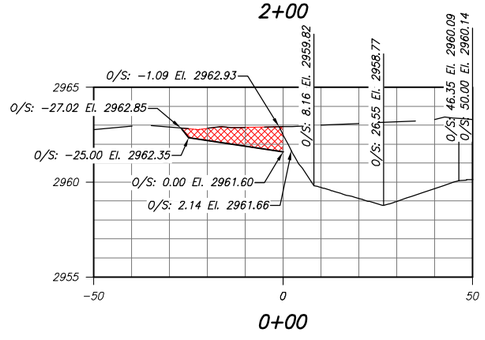

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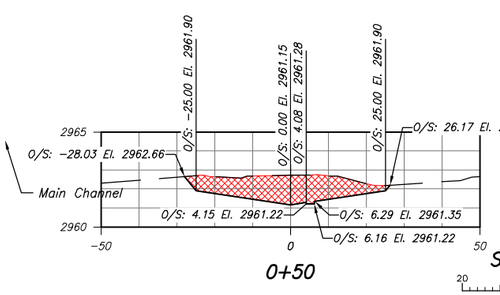

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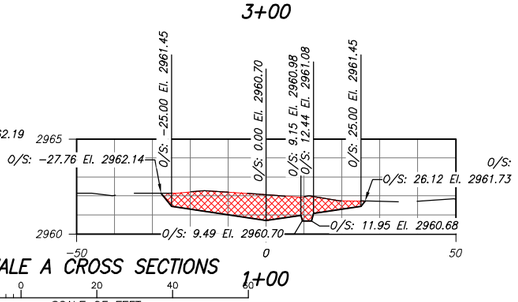

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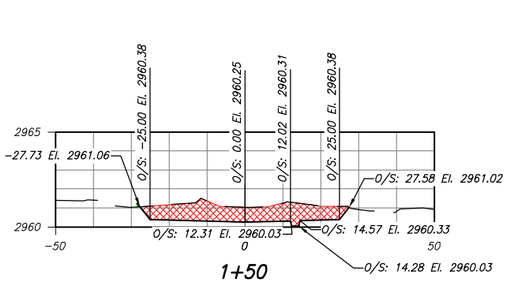

1+50

SWALE A CROSS SECTIONS

20 0 20 40 60
SCALE OF FEET

NOTES:

1. Cross sections face downstream. Cross section centerline station is located along the thalweg alignment.
2. Y–axis is elevation, X–axis is distance in feet along a chord perpendicular to the thalweg. The zero station shown on these cross sections represents the thalweg alignment.
3. Constructed channel shall transition smoothly between cross sectional geometries shown within these cross sections. Cross section geometry shown represents one point in a smooth transition.
4. Cross–sections are to be used to stake out the channel offsets at the vertical grade breaks of the channel profile.

CUT

Fill

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

Jeffrey J Fealko P.E.
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Mike Knutson P.E.
CHECKED
Jeffrey J Fealko P.E.
TECH. APPR.
Steve Montague–Acting
APPROVED
ADMIN APPROVAL – PROGRAM MANAGER

BOISE, ID 2015–09–14

FLOOD SWALE COMPLEX 1
SWALE A

CROSS SECTIONS

1678–100–2079

SHEET 6 OF 8

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AUGUST 13, 2015 10:44
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AutoCAD Rel. 20.0s
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CUT

Fill

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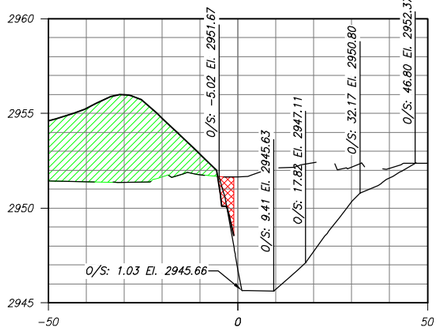

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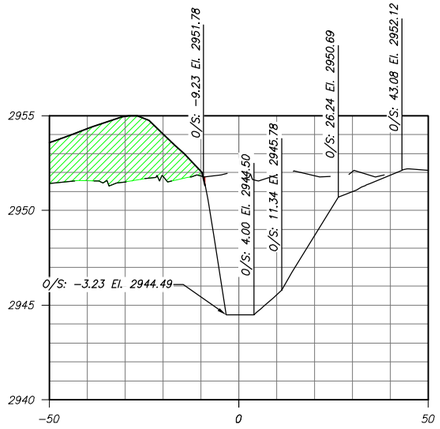

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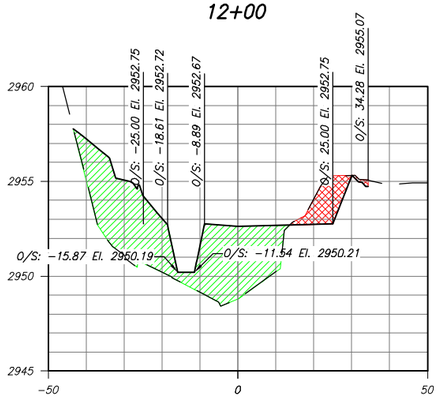

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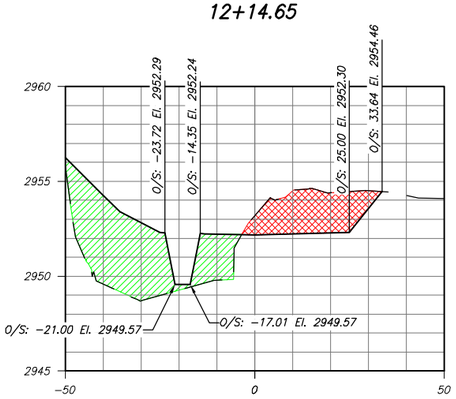

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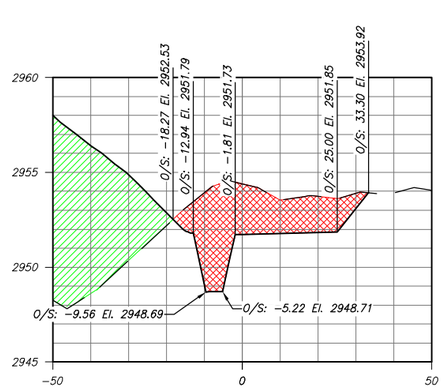

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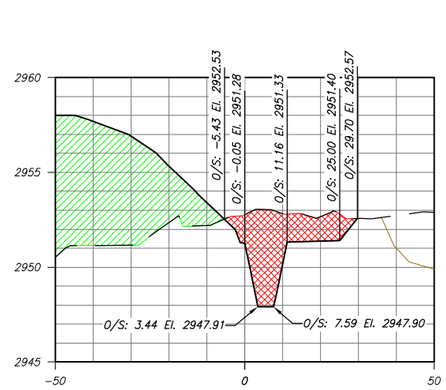

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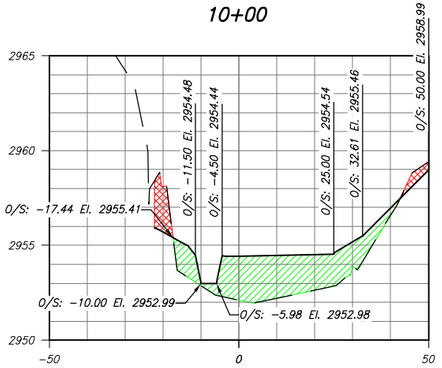

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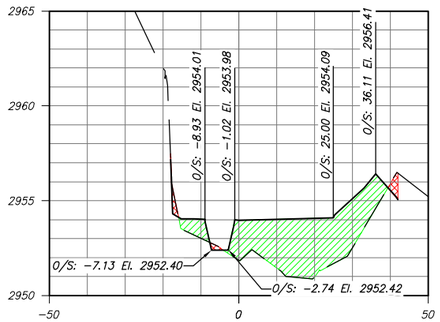

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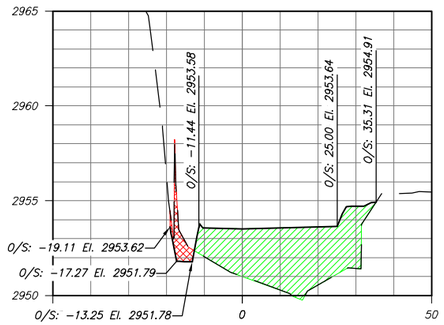

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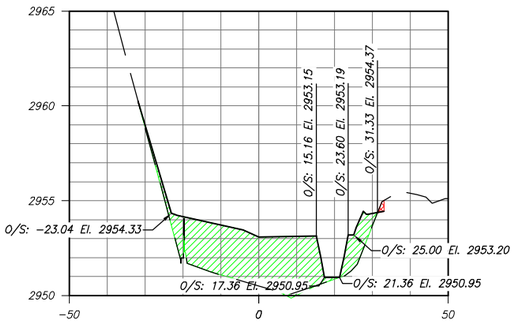

9+50

SWALE A CROSS SECTIONS

20 0 20 40 60
SCALE OF FEET

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

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CHECKED
Jeffery J Fealko P.E.
TECH. APPR.
Steve Montague–Acting
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BOISE, ID 2015–09–14

FLOOD SWALE COMPLEX 1
SWALE A

CROSS SECTIONS

1678–100–2080
SHEET 7 OF 8

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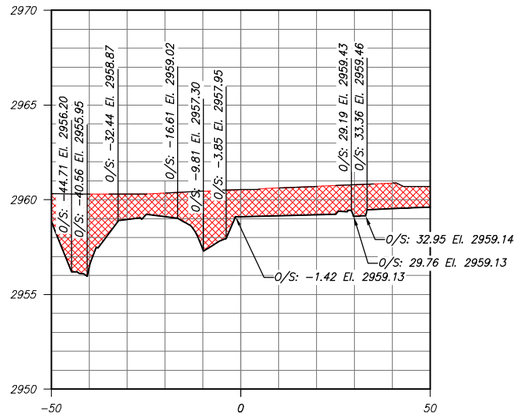

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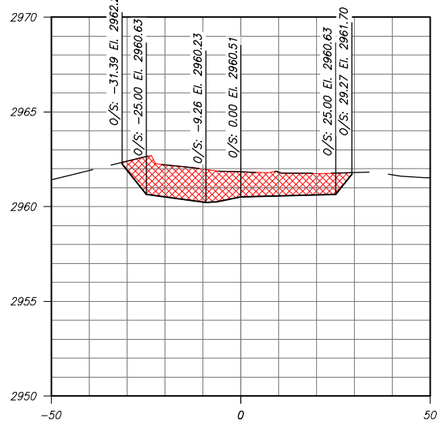

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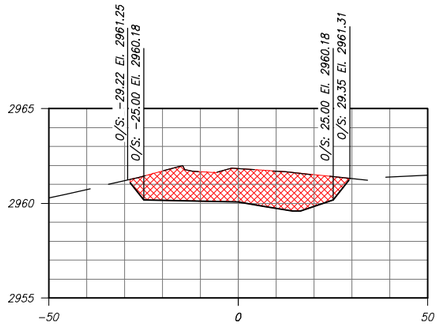

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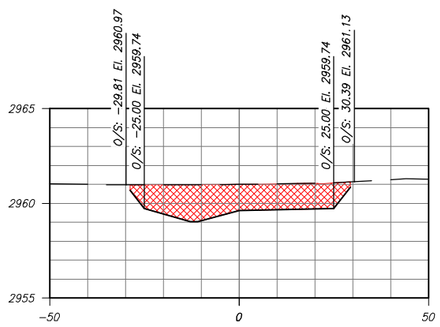

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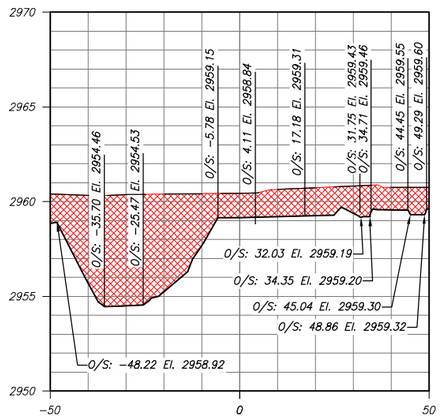

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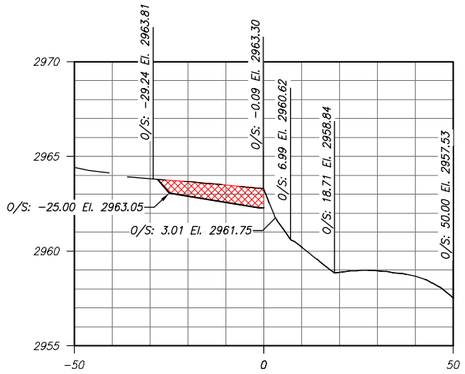

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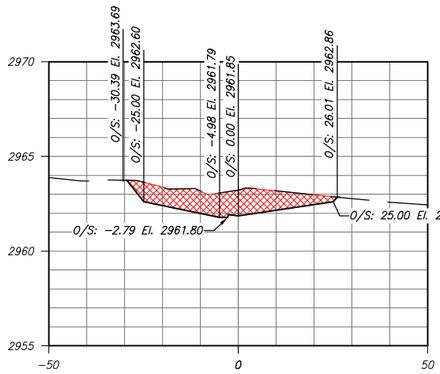

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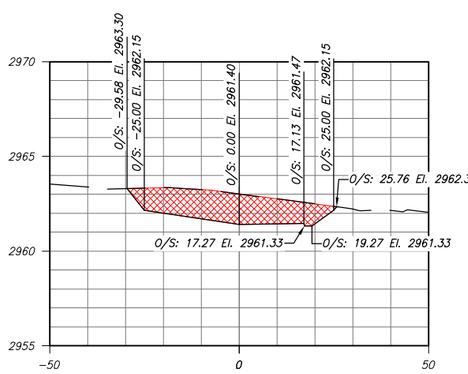

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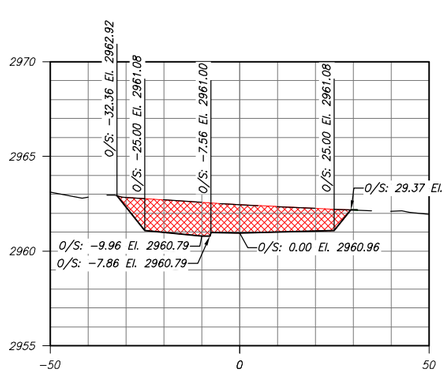

1+50

SWALE B CROSS SECTIONS

20 0 20 40 60
SCALE OF FEET

NOTES:

1. Cross sections face downstream. Cross section centerline station is located along the thalweg alignment.
2. Y−axis is elevation, X−axis is distance in feet along a chord perpendicular to the thalweg. The zero station shown on these cross sections represents the thalweg alignment.
3. Constructed channel shall transition smoothly between cross sectional geometries shown within these cross sections. Cross section geometry shown represents one point in a smooth transition.
4. Cross−sections are to be used to stake out the channel offsets at the vertical grade breaks of the channel profile.

CUT

Fill

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Steve Montague−Acting
APPROVED
ADMIN APPROVAL − PROGRAM MANAGER
BOISE, ID 2015−09−14

FLOOD SWALE COMPLEX 1
SWALE B

CROSS SECTIONS

1678−100−2081
SHEET 8 OF 8

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AHATCH

CAD SYSTEM
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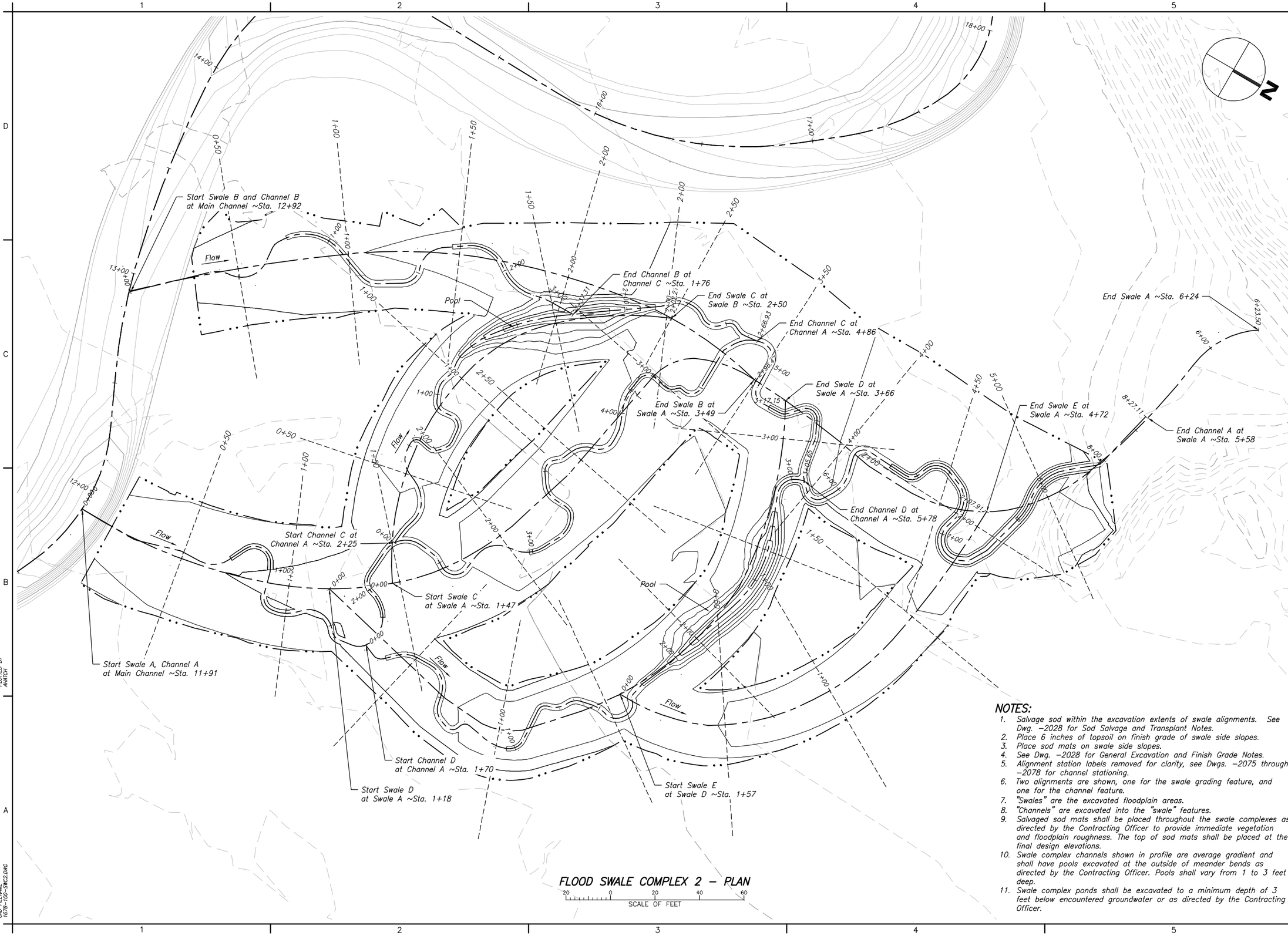

FLOOD SWALE COMPLEX 2 – PLAN

20 0 20 40 60
SCALE OF FEET

NOTES:

1. Salvage sod within the excavation extents of swale alignments. See Dwg. –2028 for Sod Salvage and Transplant Notes.
2. Place 6 inches of topsoil on finish grade of swale side slopes.
3. Place sod mats on swale side slopes.
4. See Dwg. –2028 for General Excavation and Finish Grade Notes.
5. Alignment station labels removed for clarity, see Dwgs. –2075 through –2078 for channel stationing.
6. Two alignments are shown, one for the swale grading feature, and one for the channel feature.
7. "Swales" are the excavated floodplain areas.
8. "Channels" are excavated into the "swale" features.
9. Salvaged sod mats shall be placed throughout the swale complexes as directed by the Contracting Officer to provide immediate vegetation and floodplain roughness. The top of sod mats shall be placed at the final design elevations.
10. Swale complex channels shown in profile are average gradient and shall have pools excavated at the outside of meander bends as directed by the Contracting Officer. Pools shall vary from 1 to 3 feet deep.
11. Swale complex ponds shall be excavated to a minimum depth of 3 feet below encountered groundwater or as directed by the Contracting Officer.

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BOISE, ID	2015–09–14

FLOOD SWALE COMPLEX 2

PLAN

1678–100–2082

SHEET 1 OF 8

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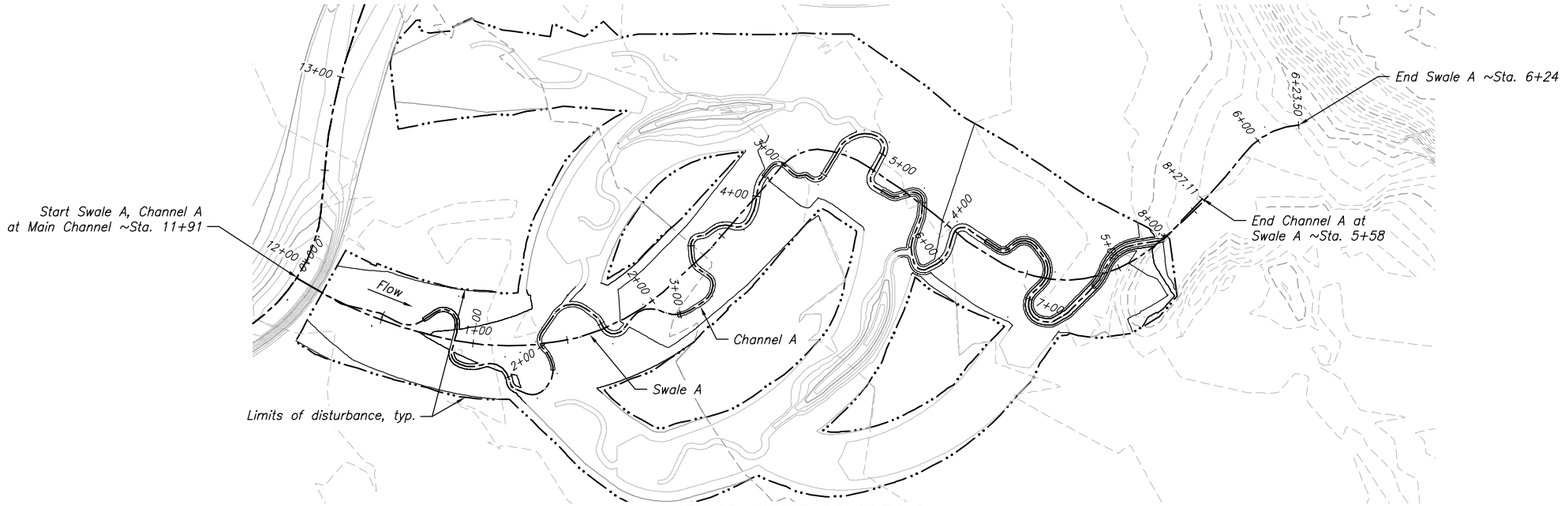

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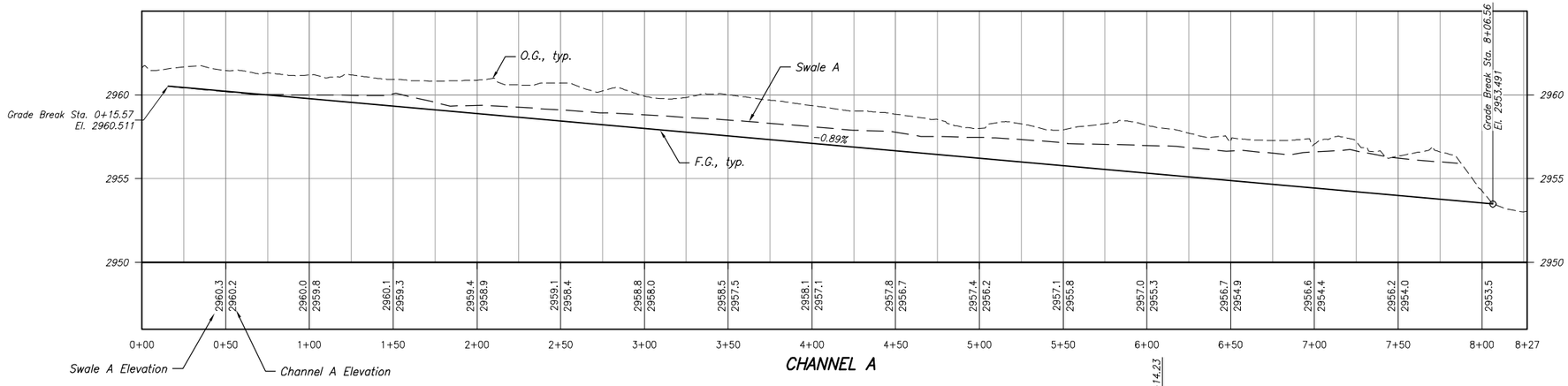
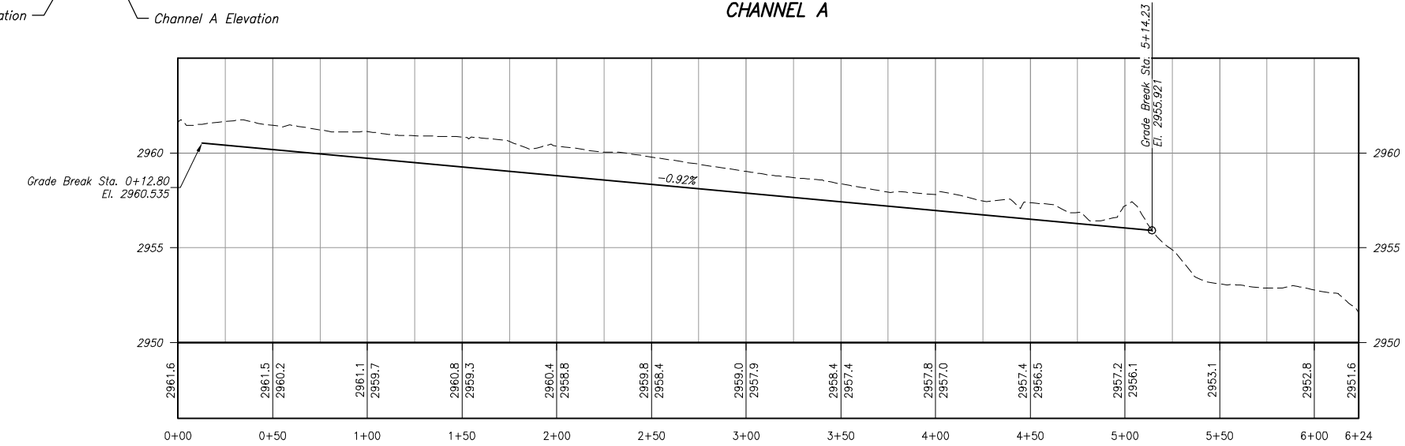
FLOOD SWALE COMPLEX 2
SWALE A
CHANNEL A

SCALE OF FEET: 20 0 20 40 60



CHANNEL A



SWALE A

SCALE OF FEET: 1 0 5 10 15
VERTICAL SCALE

SCALE OF FEET: 40 0 40 80 120
HORIZONTAL SCALE

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COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

Jeffrey J Fealko P.E.
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Steve Montague–Acting
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BOISE, ID 2015-09-14

FLOOD SWALE COMPLEX 2
SWALE A
CHANNEL A

PLAN AND PROFILES

1678–100–2083
SHEET 2 OF 8

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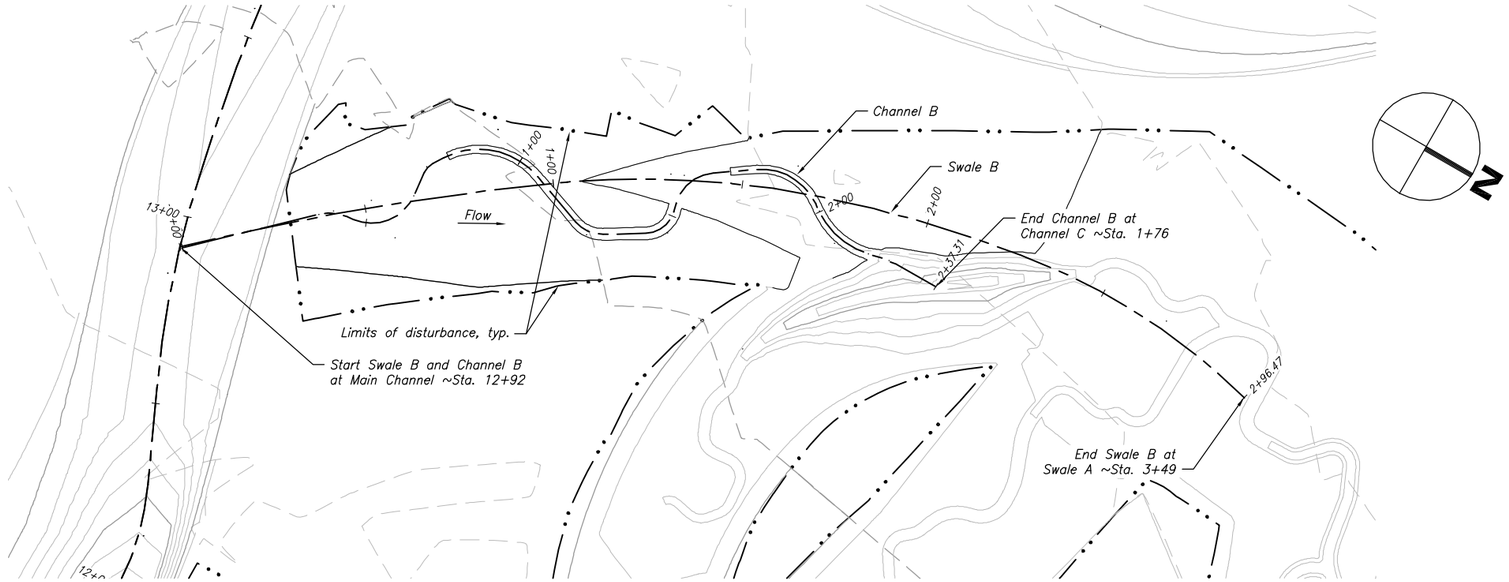
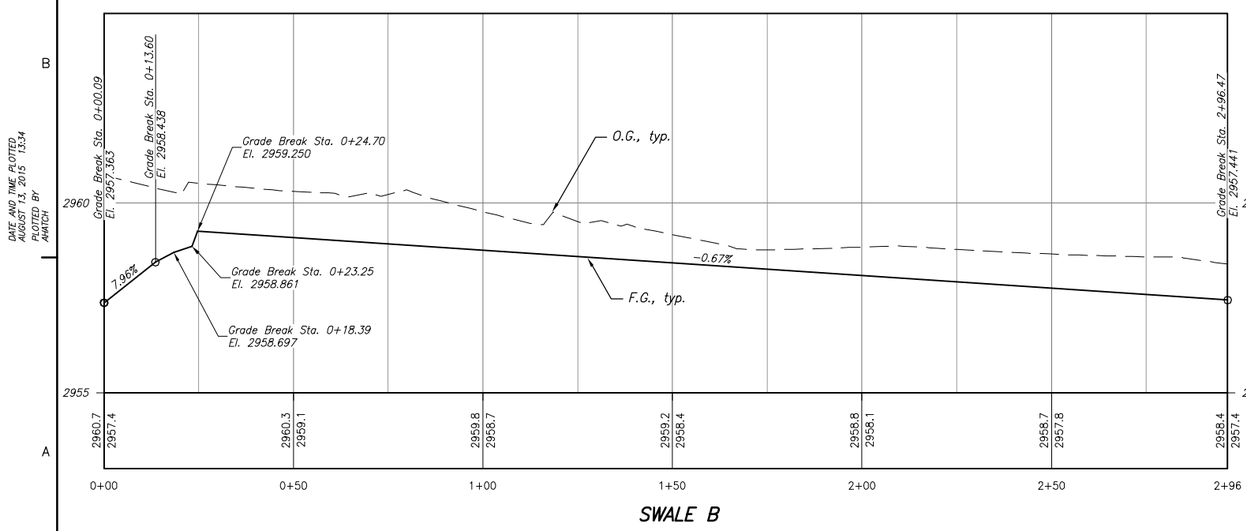
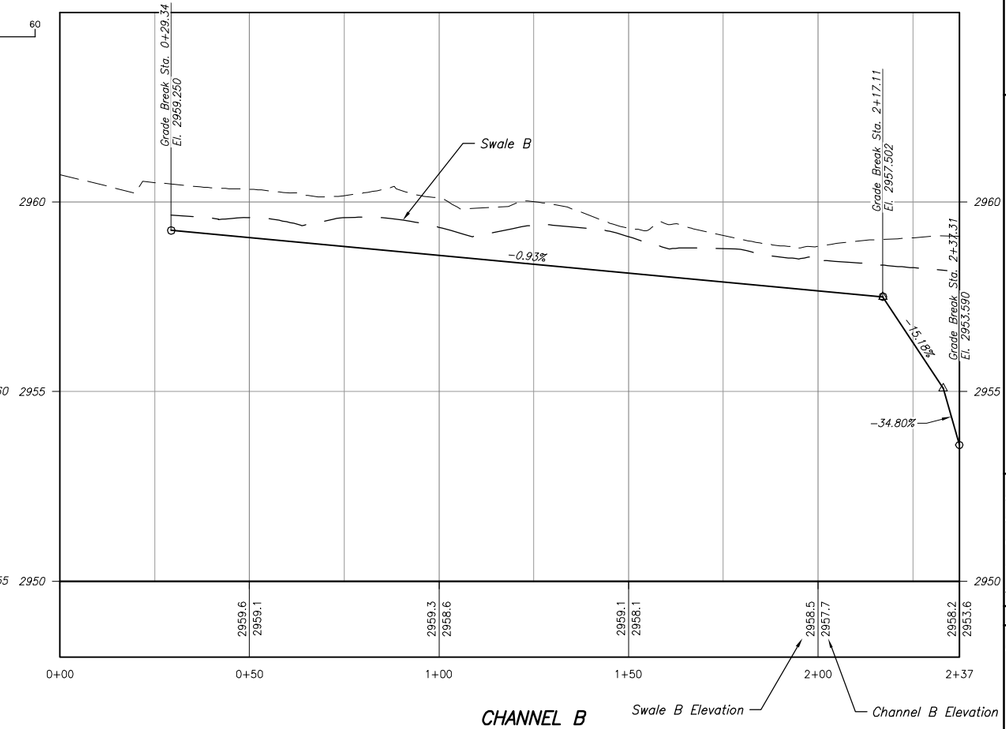


SWALE COMPLEX 2
SWALE B
CHANNEL B

20 0 20 40 60
SCALE OF FEET



SWALE B



CHANNEL B

1 0 1 2 3 4 5
SCALE OF FEET
VERTICAL SCALE

20 0 20 40 60
SCALE OF FEET
HORIZONTAL SCALE

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FLOOD SWALE COMPLEX 2
SWALE B
CHANNEL B

PLAN AND PROFILES

1678-100-2084
SHEET 3 OF 8

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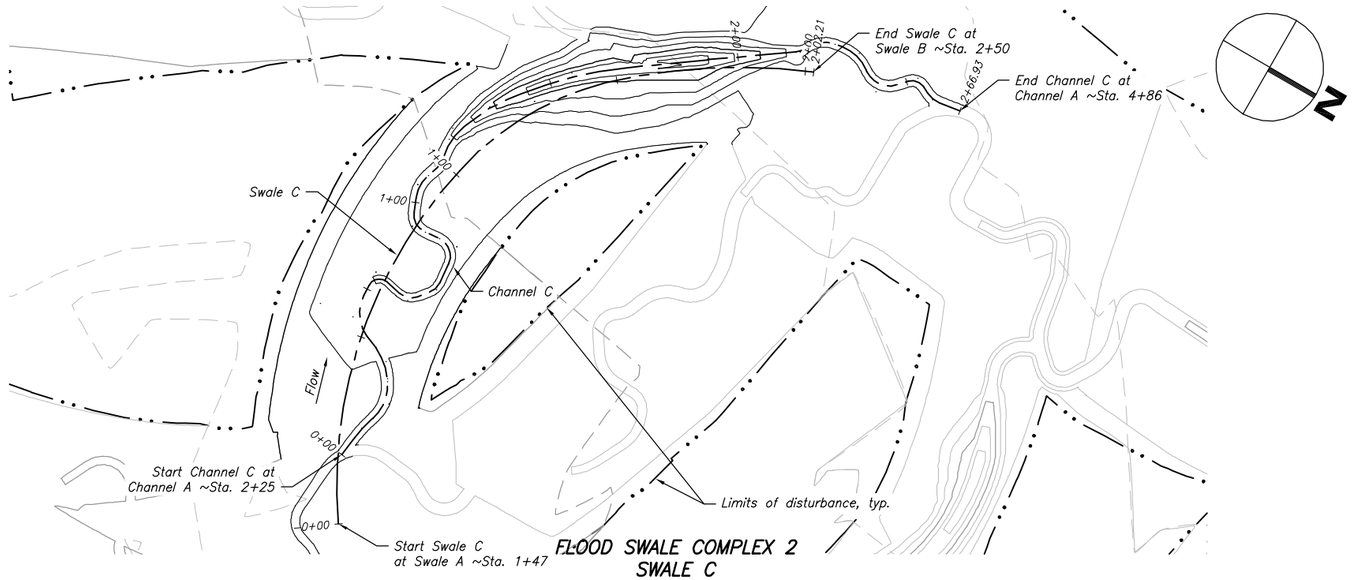
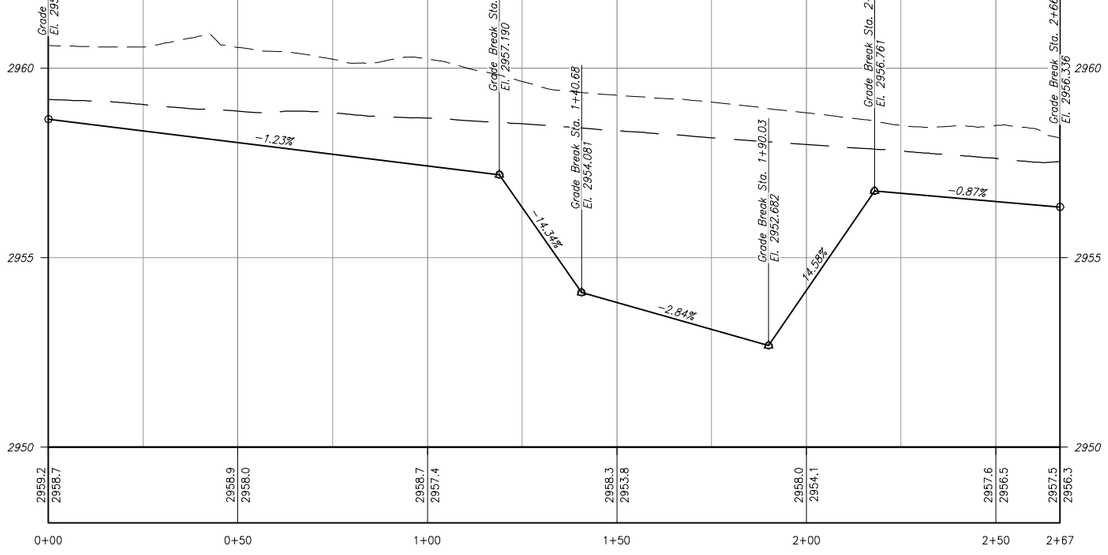
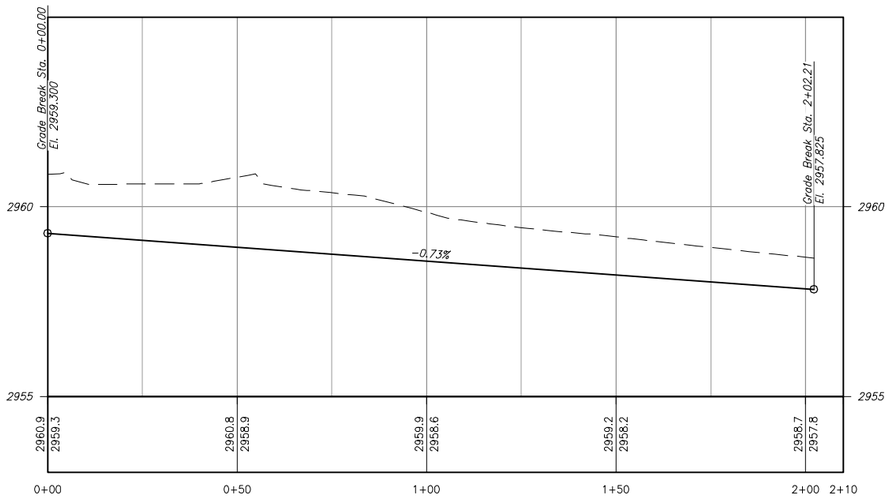


FLOOD SWALE COMPLEX 2
SWALE C
CHANNEL C

SCALE OF FEET: 20 0 20 40 60



CHANNEL C



SWALE C

SCALE OF FEET: 1 0 1 2 3 4 5
VERTICAL SCALE

SCALE OF FEET: 20 0 20 40 60
HORIZONTAL SCALE

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BOISE, ID 2015-09-14

FLOOD SWALE COMPLEX 2
SWALE C
CHANNEL C

PLAN AND PROFILES

1678-100-2085
SHEET 4 OF 8

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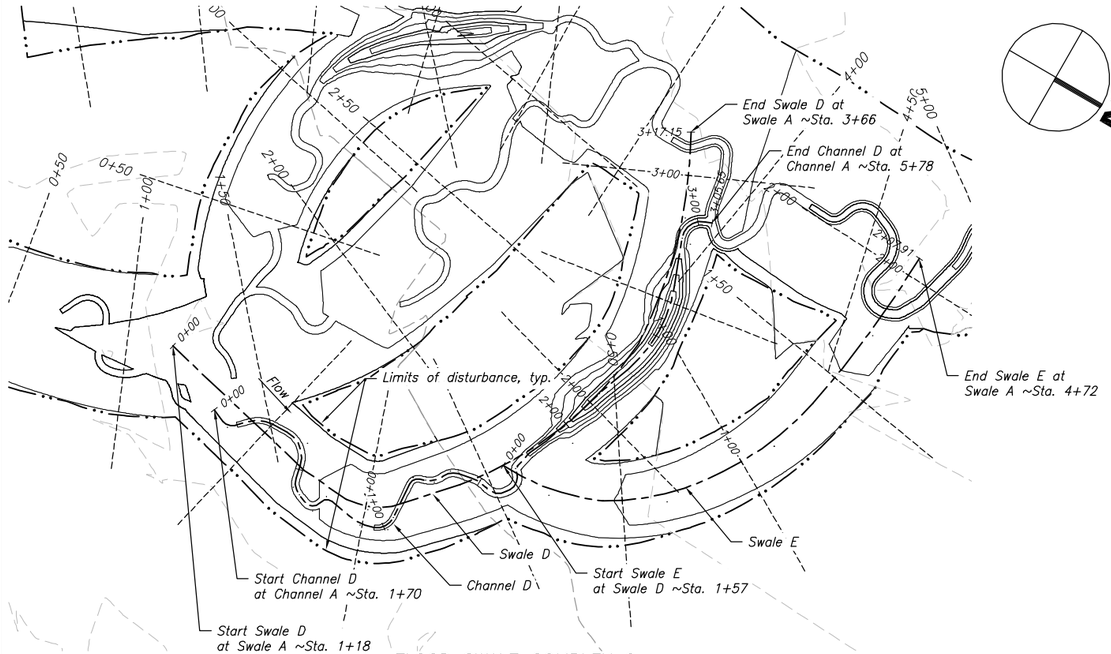
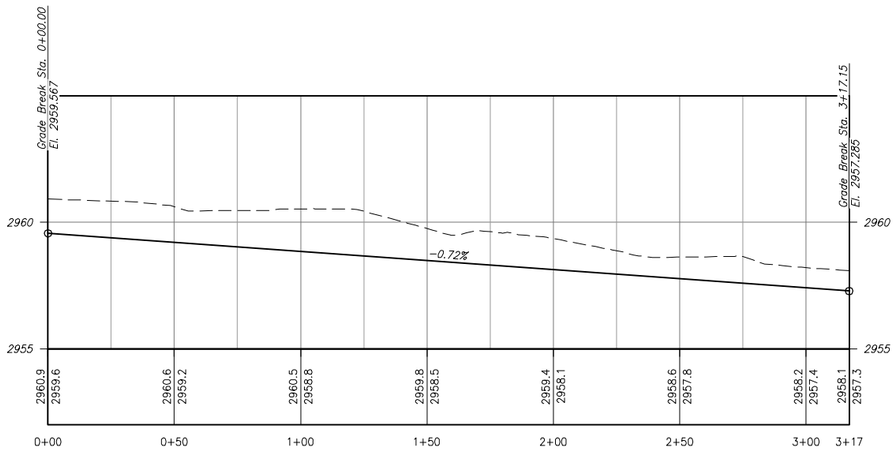
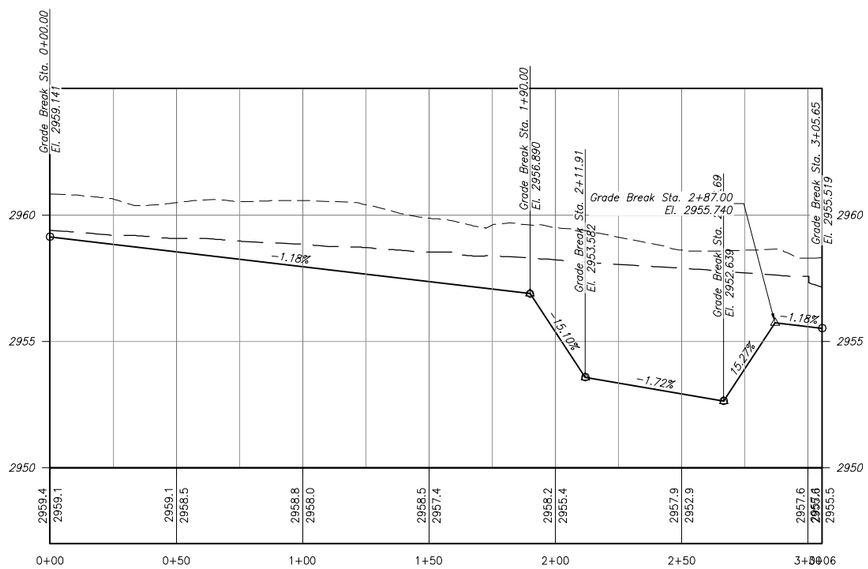


FLOOD SWALE COMPLEX 2
SWALE D
SWALE E
CHANNEL D

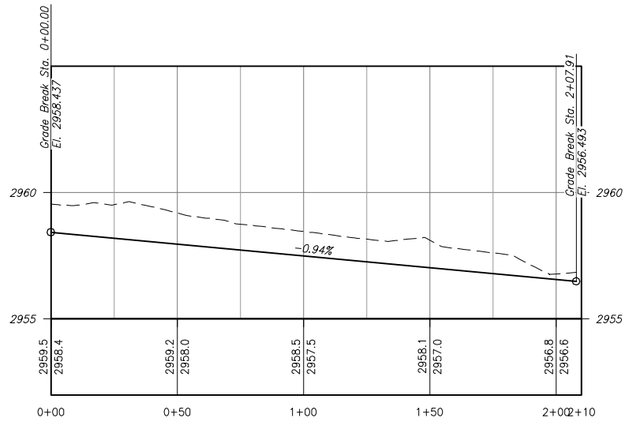
30 0 30 60 90
SCALE OF FEET



SWALE D



CHANNEL D



SWALE E

3 0 3 6 9
SCALE OF FEET
VERTICAL SCALE

30 0 30 60 90
SCALE OF FEET
HORIZONTAL SCALE

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BOISE, ID 2015–09–14

FLOOD SWALE COMPLEX 2
SWALE D
SWALE E
CHANNEL D

PLAN AND PROFILES

1678–100–2086
SHEET 5 OF 8

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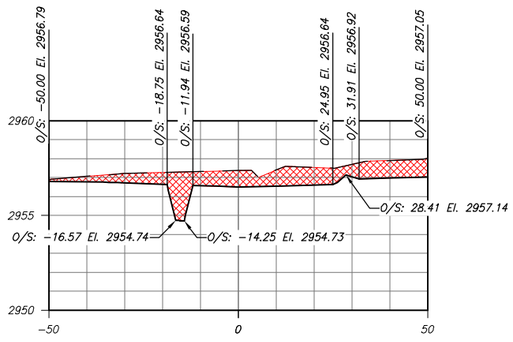

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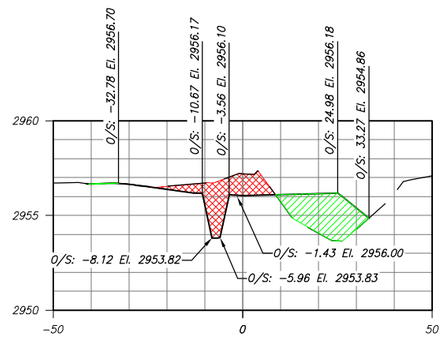

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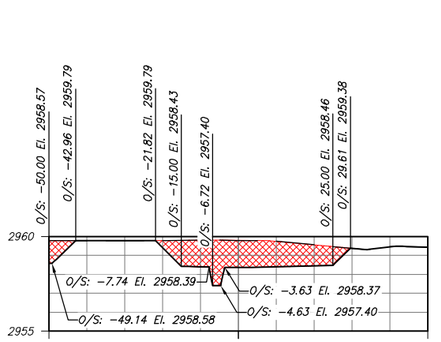

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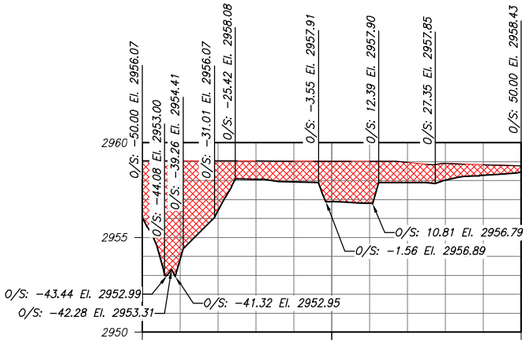

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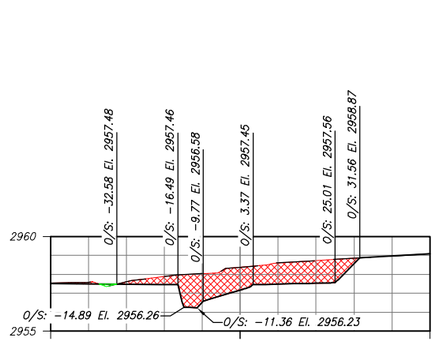

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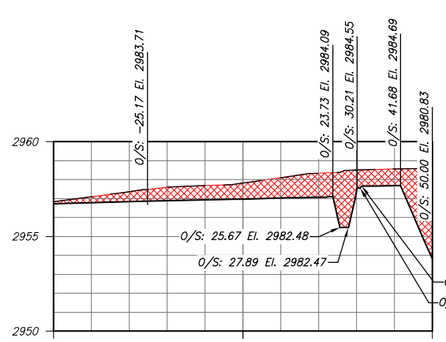

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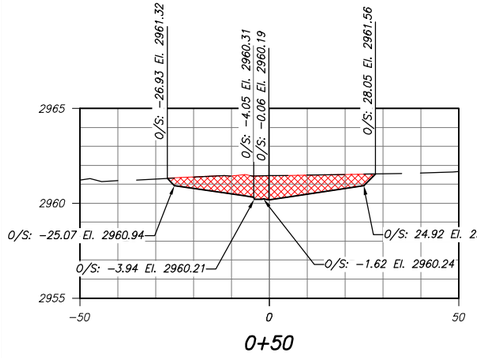

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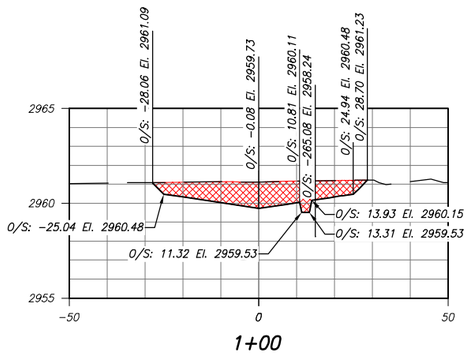

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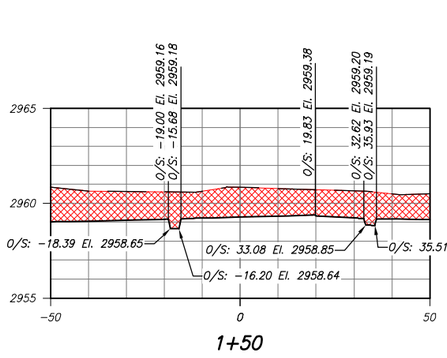

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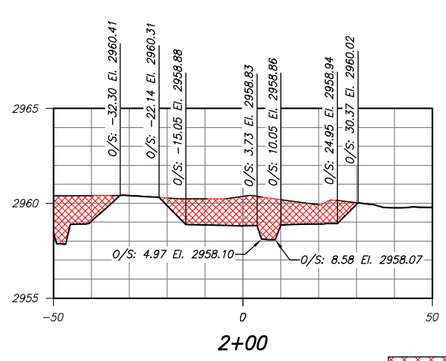

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SWALE A CROSS SECTIONS

SCALE OF FEET: 20 0 20 40 60

NOTES:
1. See Dwg. −2047 for cross−section notes
2. Cross−sections that do not daylight to original ground connect to other swale features.

Cut

Fill

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COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC−44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

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Steve Montague−Acting
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BOISE, ID 2015−09−14

FLOOD SWALE COMPLEX 2
SWALE A

CROSS SECTIONS

1678−100−2087

SHEET 6 OF 8

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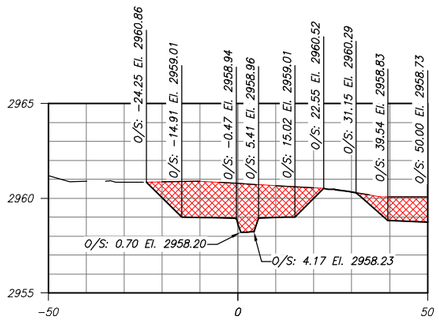

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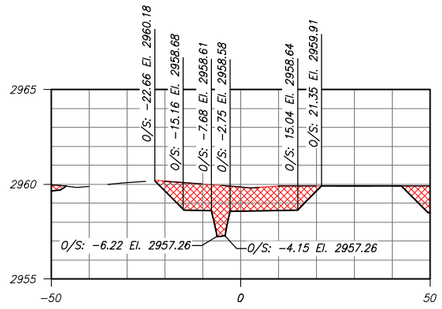

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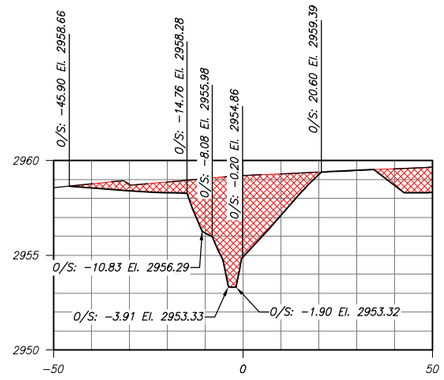

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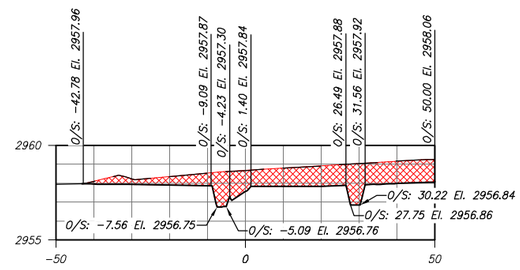

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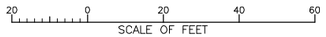
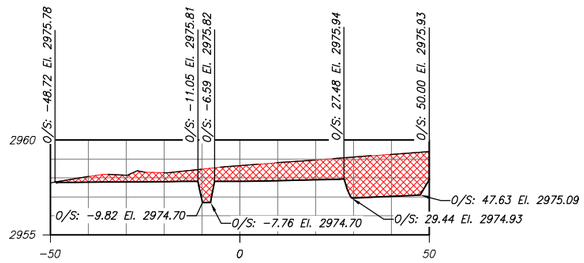
SWALE C CROSS SECTIONS





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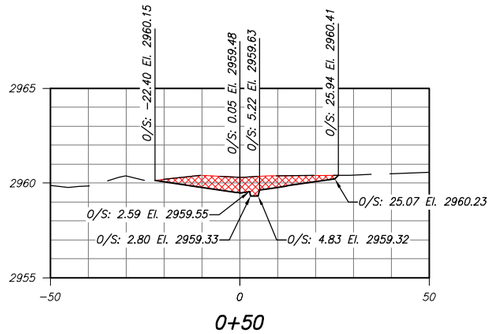

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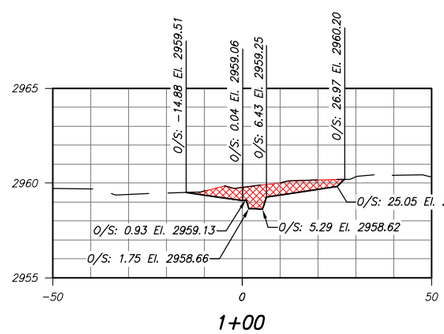

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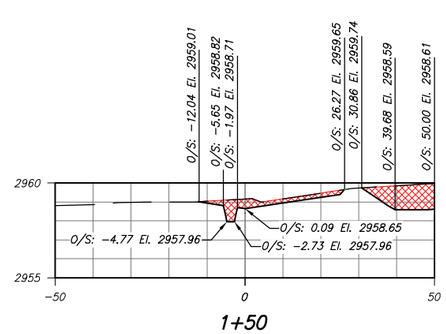

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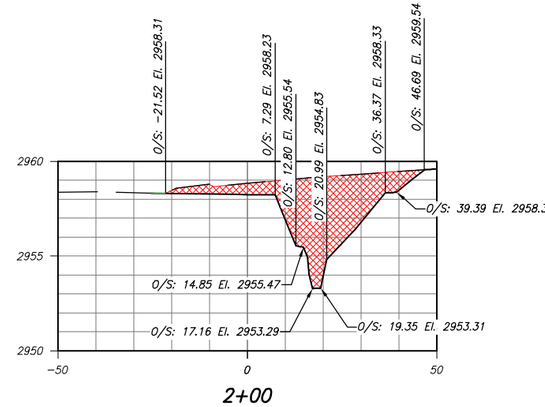

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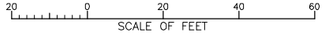
SWALE B CROSS SECTIONS



NOTES:

1. See Dwg. −2047 for cross-section notes
2. Cross-sections that do not daylight to original ground connect to other swale features.

Cut

Fill

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GRANDE RONDE SUBBASIN

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Steve Montague-Acting
APPROVED
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BOISE, ID
2015-09-14

FLOOD SWALE COMPLEX 2
SWALE B
SWALE C

CROSS SECTIONS

1678-100-2088

SHEET 7 OF 8

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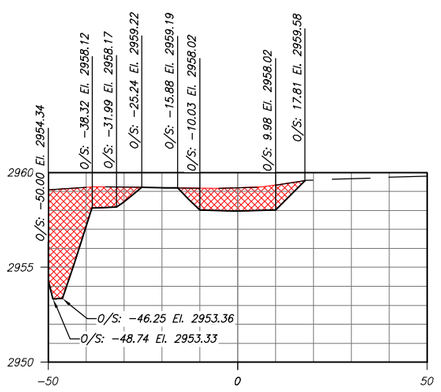

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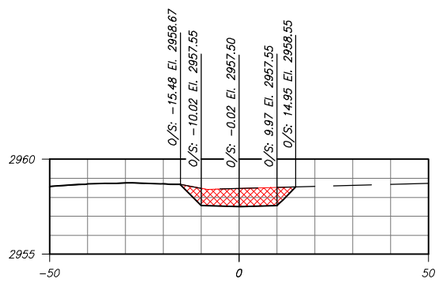

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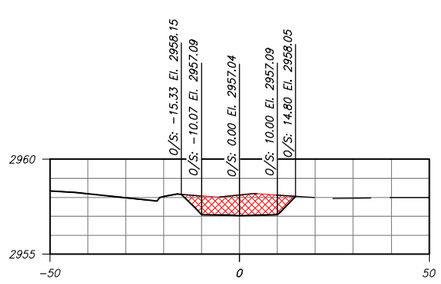

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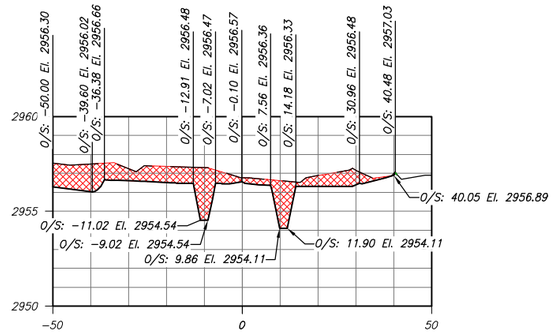

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SWALE E CROSS SECTIONS

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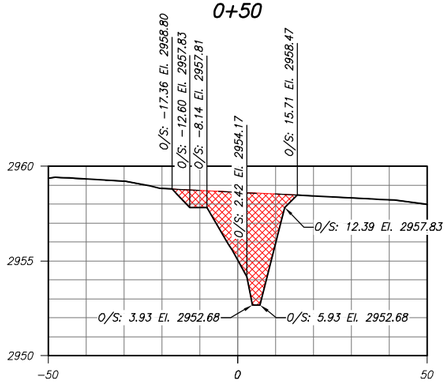
SCALE OF FEET



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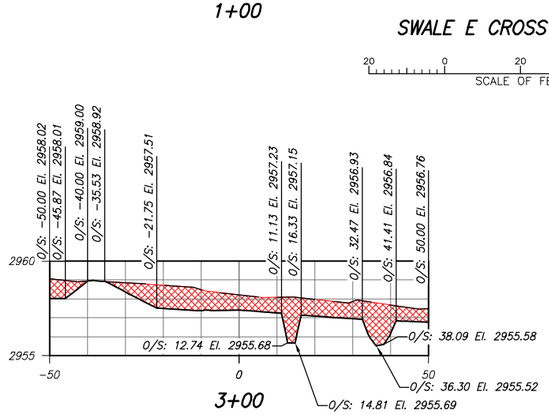

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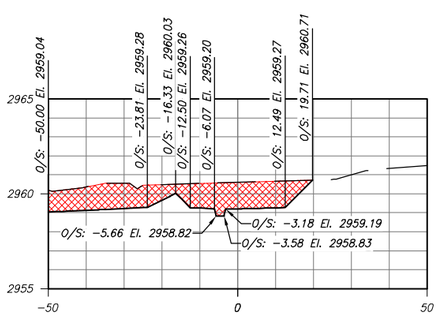

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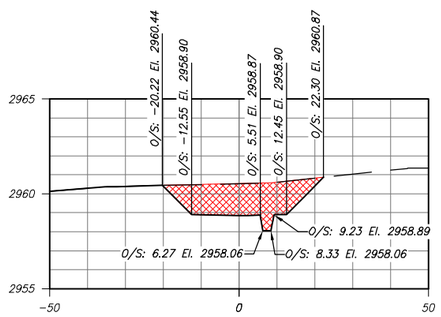

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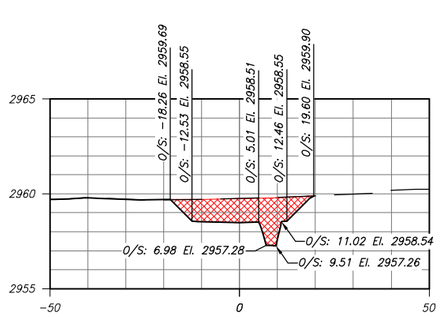

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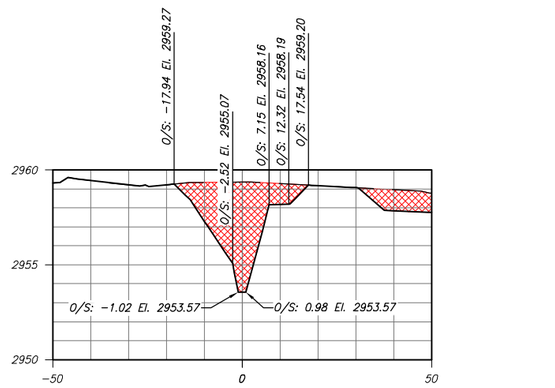

2+00

SWALE D CROSS SECTIONS

20 0 20 40 60
SCALE OF FEET

NOTES:

1. See Dwg. -2047 for cross-section notes
2. Cross-sections that do not daylight to original ground connect to other swale features.

Cut

Fill

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

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2015-09-14

FLOOD SWALE COMPLEX 2
SWALE D
SWALE E

CROSS SECTIONS

1678-100-2089

SHEET 8 OF 8

DATE AND TIME PLOTTED
AUGUST 14, 2015 09:31
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CAD SYSTEM
AutoCAD Rel. 20.0s
CAD FILENAME
1678-100-SWC2.DWG

Start Swale A Alignment at Main Channel ~Sta. 19+66

Start Channel B Alignment at Channel A ~Sta. 2+29

Start Channel A Alignment at Main Channel ~Sta. 19+48

End Swale B Alignment Start Swale C Alignment at Swale A ~Sta. 1+96

Start Swale B Alignment at Side Channel Sta. 2+24

End Channel B Alignment Sta 3+42 at Channel A ~Sta. 6+04

End Swale C Alignment at Swale A ~Sta. 4+34

End Swale A Alignment at Main Channel Alignment ~Sta. 26+36 and Swale A Sta. 6+32

End Channel A Alignment Sta. 8+58

Tie–in to main channel bank grading

Channel A

Channel B

Swale A

Swale B

Swale C

Swale A Flow

Swale B Flow

Swale C Flow

DO NOT DISTURB

Limits of disturbance, typ.

Pool

NOTES:

1. Two alignments are shown: one for the swale grading feature and one for the channel feature.
2. "Swales" are the excavated floodplain areas.
3. "Channels" are excavated into the swale feature.
4. Place 6 inches of topsoil on finish grade of swale side slopes.
5. Place sod mats from other parts of the project on swale side slopes.
6. See Dwg. –2028 for General Excavation and Finish Grade Notes.
9. Salvaged sod mats shall be placed throughout the swale complexes as directed by the Contracting Officer to provide immediate vegetation and floodplain roughness. The top of sod mats shall be placed at the final design elevations.
10. Swale complex channels shown in profile are average gradient and shall have pools excavated at the outside of meander bends as directed by the Contracting Officer. Pools shall vary from 1 to 3 feet deep.
11. Swale complex ponds shall be excavated to a minimum depth of 3 feet below encountered groundwater or as directed by the Contracting Officer.

FLOOD SWALE COMPLEX 3 – PLAN

20 0 20 40 60
SCALE OF FEET

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BOISE, ID	2015–09–14

FLOOD SWALE COMPLEX 3

PLAN

1678–100–2090

SHEET 1 OF 4

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JULY 31, 2015 08:06
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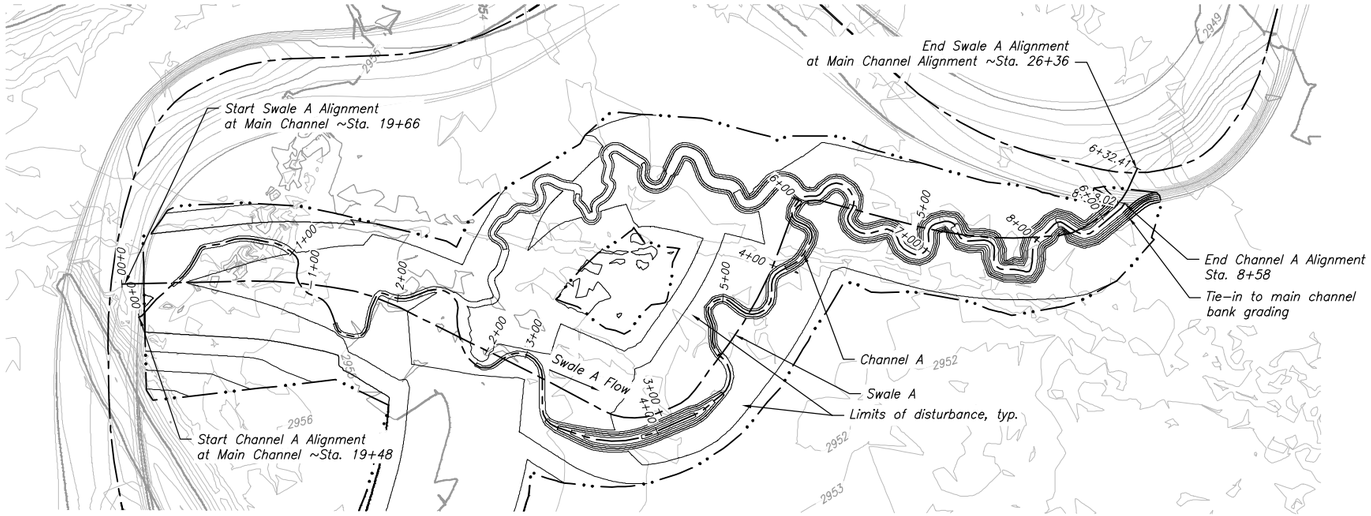
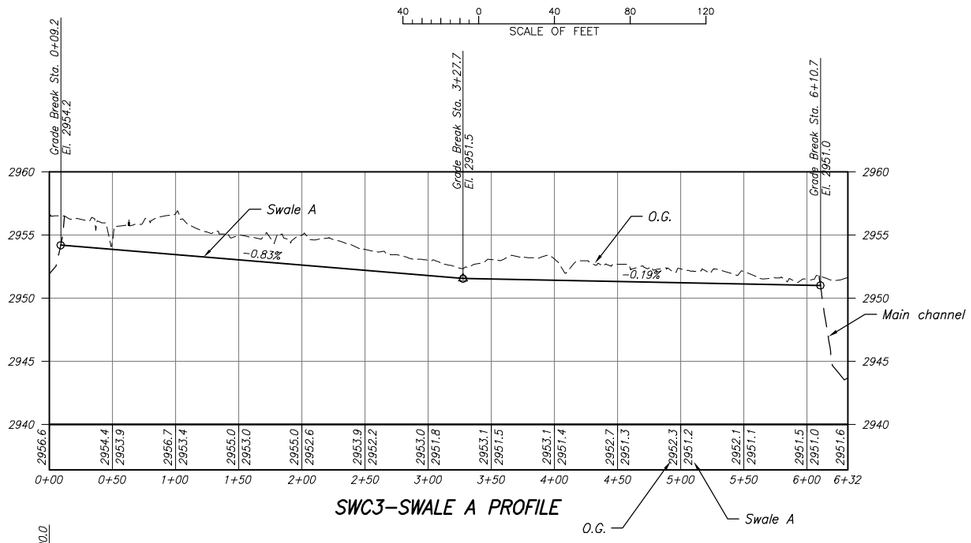
1678–100–SWC3.DWG

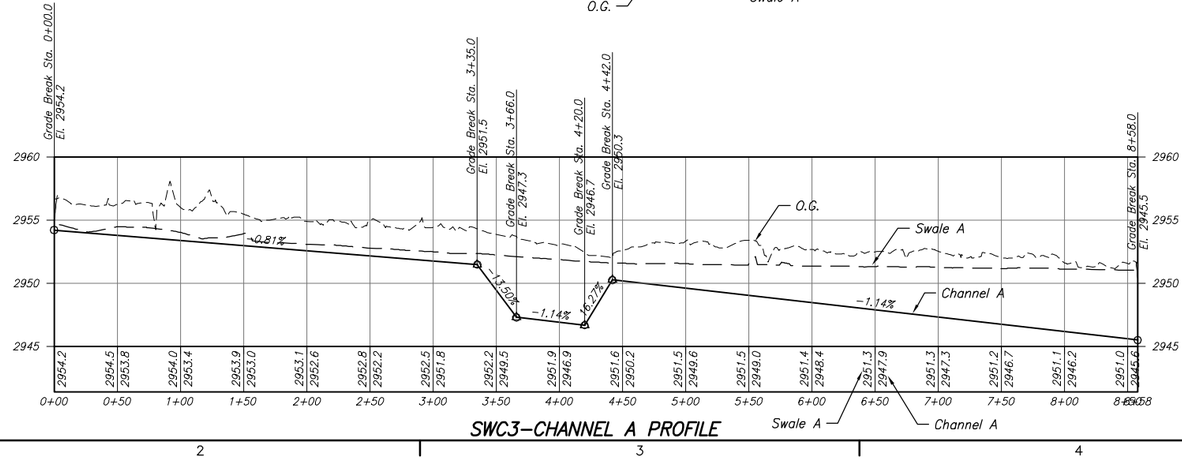


FLOOD SWALE COMPLEX 3
SWALE A
CHANNEL A

SCALE OF FEET: 40 0 40 80 120



SWC3–SWALE A PROFILE



SWC3–CHANNEL A PROFILE

SCALE OF FEET: 6 0 6 12 18
VERTICAL SCALE

SCALE OF FEET: 60 0 60 120 180
HORIZONTAL SCALE

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GRANDE RONDE SUBBASIN
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FLOOD SWALE COMPLEX 3
SWALE A
CHANNEL A

PLAN AND PROFILES

1678–100–2091

SHEET 2 OF 4

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AUGUST 14, 2015 10:11
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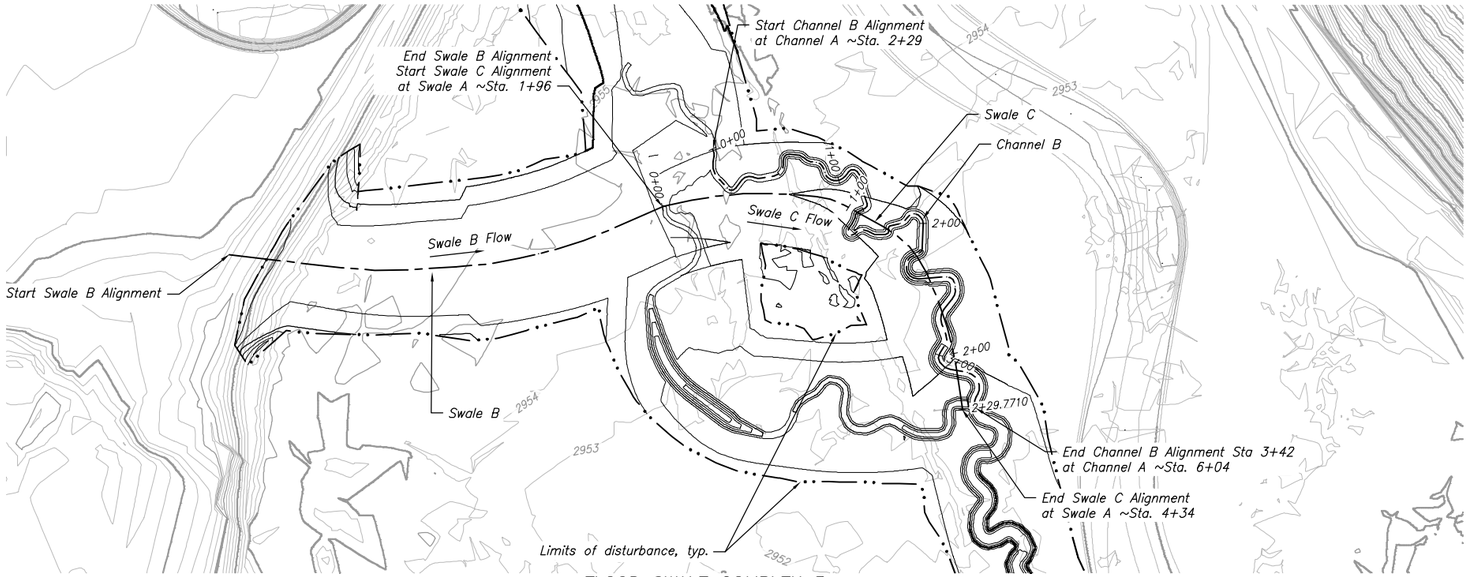
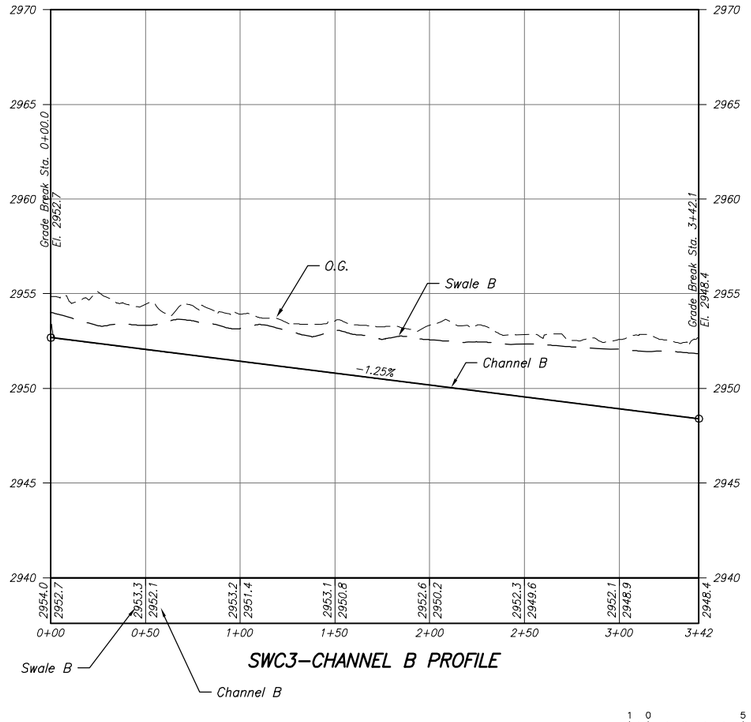
CAD FILENAME
1678–100–SWC3.DWG

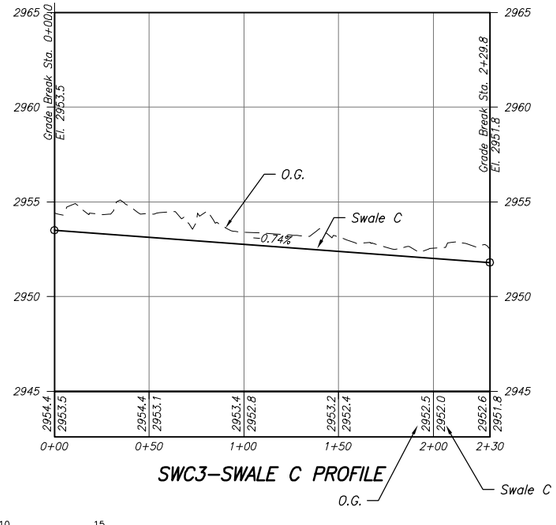


FLOOD SWALE COMPLEX 3
SWALE B
SWALE C
CHANNEL B

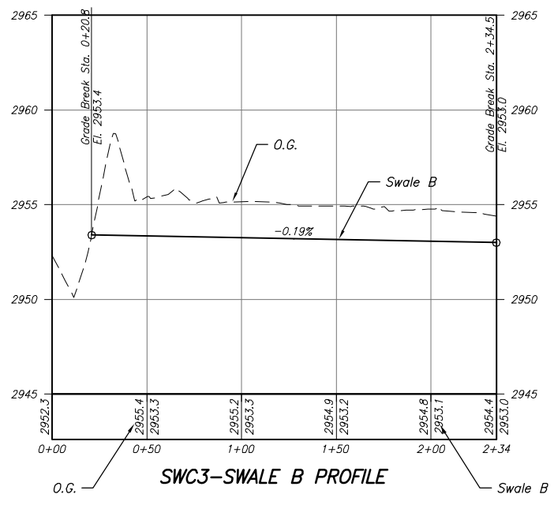
40 0 40 80 120
SCALE OF FEET



SWC3–CHANNEL B PROFILE



SWC3–SWALE C PROFILE



SWC3–SWALE B PROFILE

1 0 5 10 15
SCALE OF FEET
VERTICAL SCALE

40 0 40 80 120
SCALE OF FEET
HORIZONTAL SCALE

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GRANDE RONDE SUBBASIN
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FLOOD SWALE COMPLEX 3
SWALE B
SWALE C
CHANNEL B

PLAN AND PROFILES

1678–100–2092
SHEET 3 OF 4

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AUGUST 14, 2015 10:16
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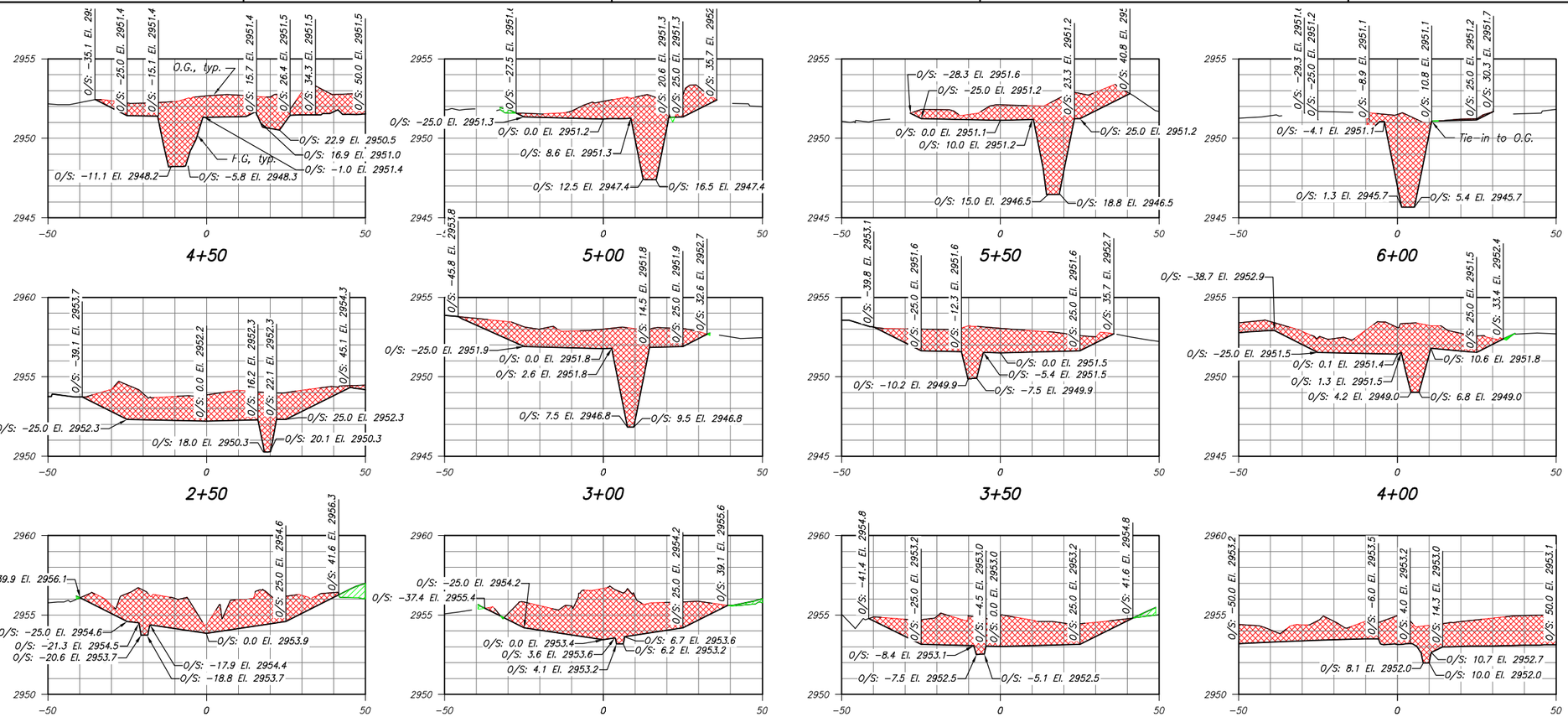
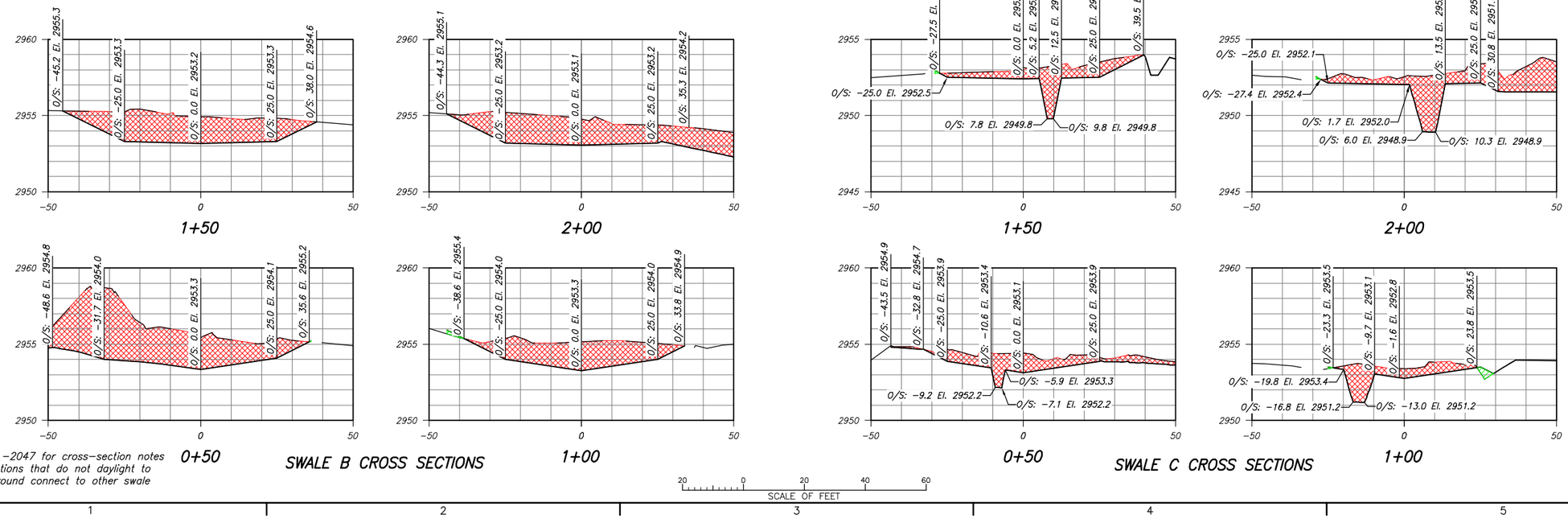
CAD FILENAME
1678–100–SWC3.DWG



SWALE A CROSS SECTIONS



SWALE B CROSS SECTIONS

SWALE C CROSS SECTIONS

Cut

Fill

NOTES:
1. See Dwg. −2047 for cross−section notes
2. Cross−sections that do not daylight to original ground connect to other swale features.

SCALE OF FEET

DATE AND TIME PLOTTED
AUGUST 14, 2015 10:21
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CAD FILENAME
1678−100−SWC3.DWG

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Steve Montague−Acting
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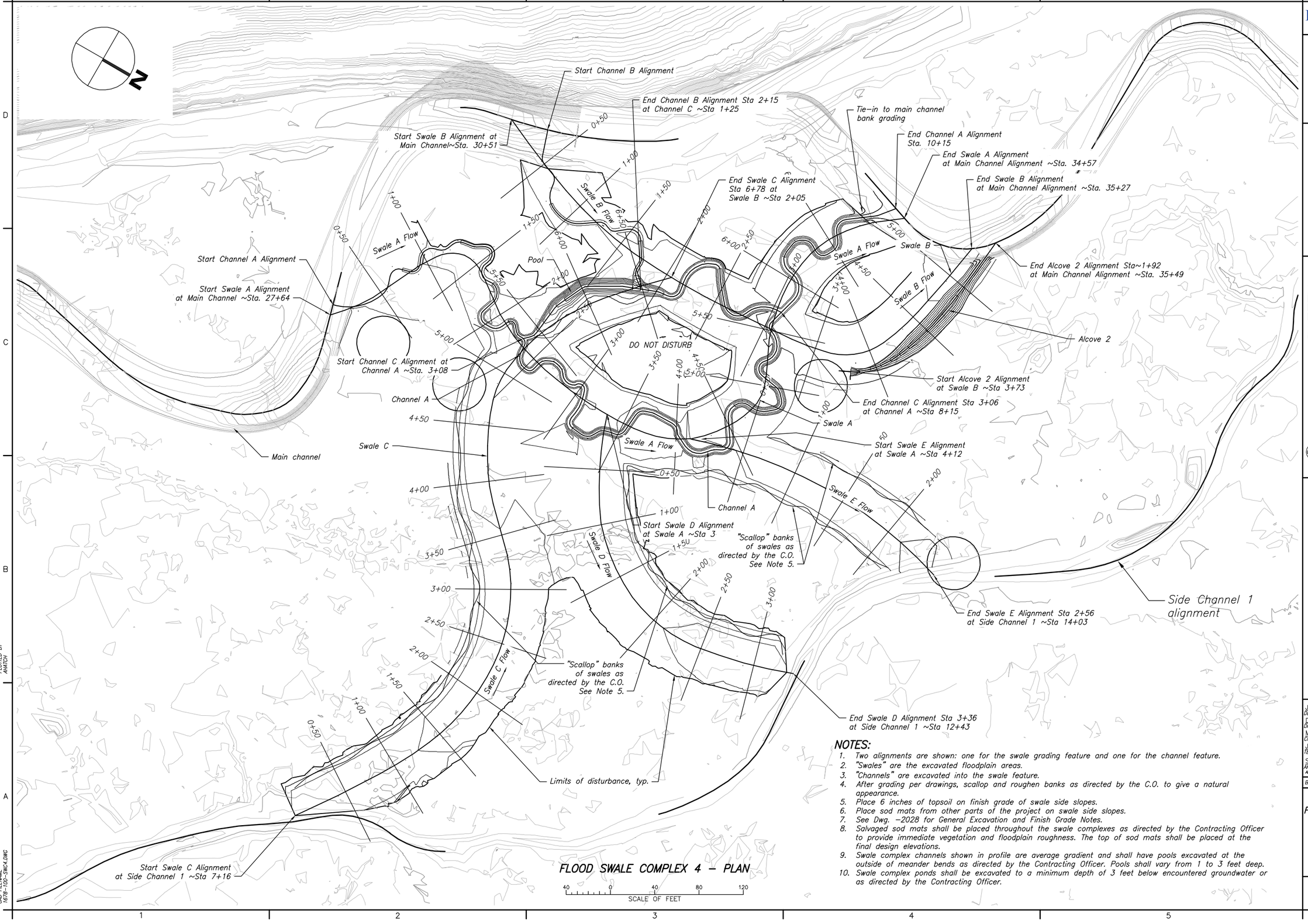
BOISE, ID 2015−09−14

FLOOD SWALE COMPLEX 3
SWALE A
SWALE B
SWALE C

CROSS SECTIONS

1678−100−2093

SHEET 4 OF 4



FLOOD SWALE COMPLEX 4 – PLAN

40 0 40 80 120
SCALE OF FEET

NOTES:

1. Two alignments are shown: one for the swale grading feature and one for the channel feature.
2. "Swales" are the excavated floodplain areas.
3. "Channels" are excavated into the swale feature.
4. After grading per drawings, scallop and roughen banks as directed by the C.O. to give a natural appearance.
5. Place 6 inches of topsoil on finish grade of swale side slopes.
6. Place sod mats from other parts of the project on swale side slopes.
7. See Dwg. –2028 for General Excavation and Finish Grade Notes.
8. Salvaged sod mats shall be placed throughout the swale complexes as directed by the Contracting Officer to provide immediate vegetation and floodplain roughness. The top of sod mats shall be placed at the final design elevations.
9. Swale complex channels shown in profile are average gradient and shall have pools excavated at the outside of meander bends as directed by the Contracting Officer. Pools shall vary from 1 to 3 feet deep.
10. Swale complex ponds shall be excavated to a minimum depth of 3 feet below encountered groundwater or as directed by the Contracting Officer.

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
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BOISE, ID	2015–09–14

FLOOD SWALE COMPLEX 4

PLAN

1678–100–2094

SHEET 1 OF 9

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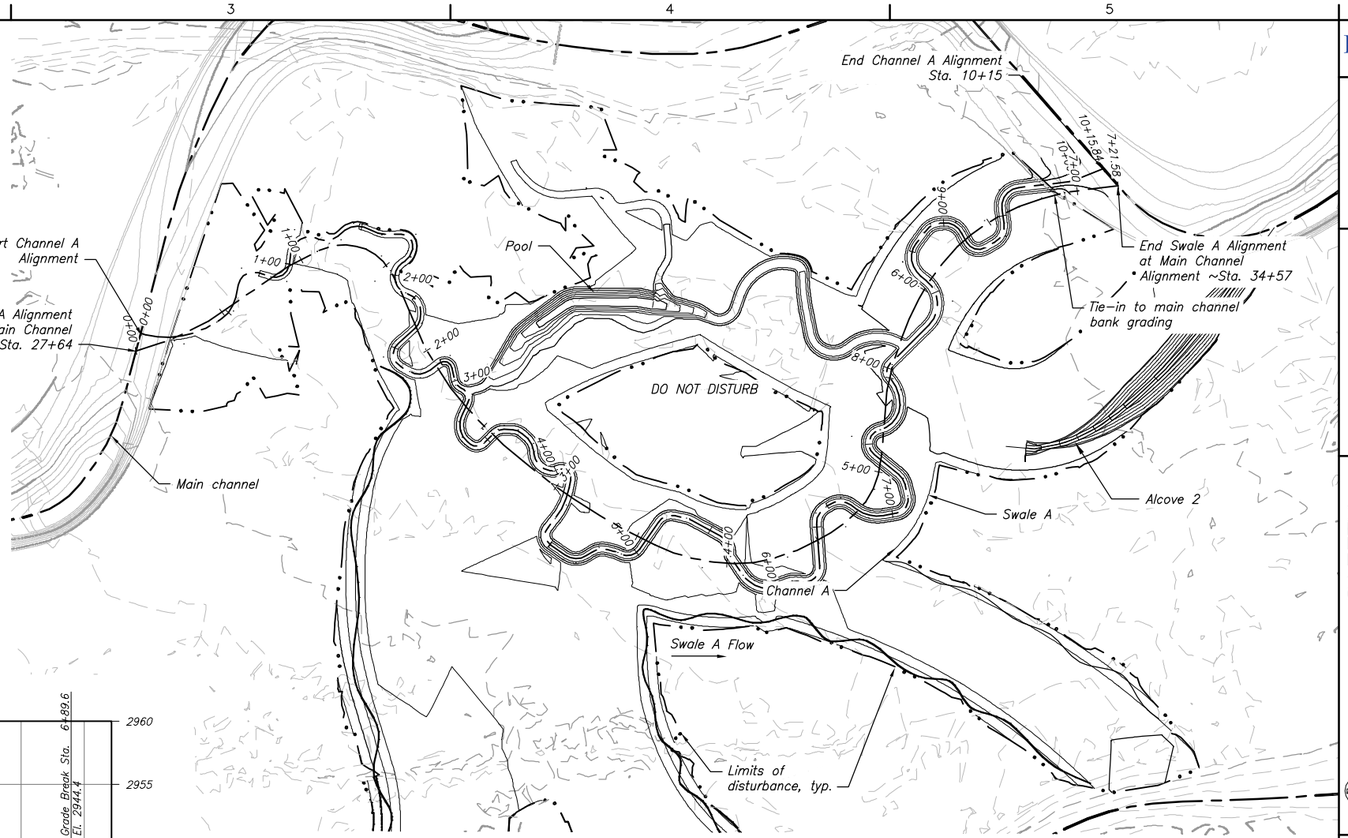
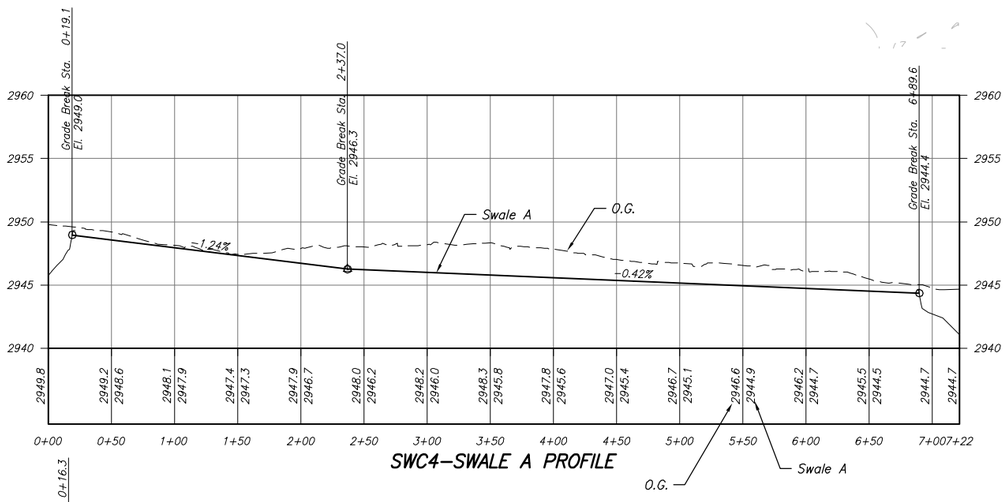
CAD FILENAME
1678-100-SWC4.DWG

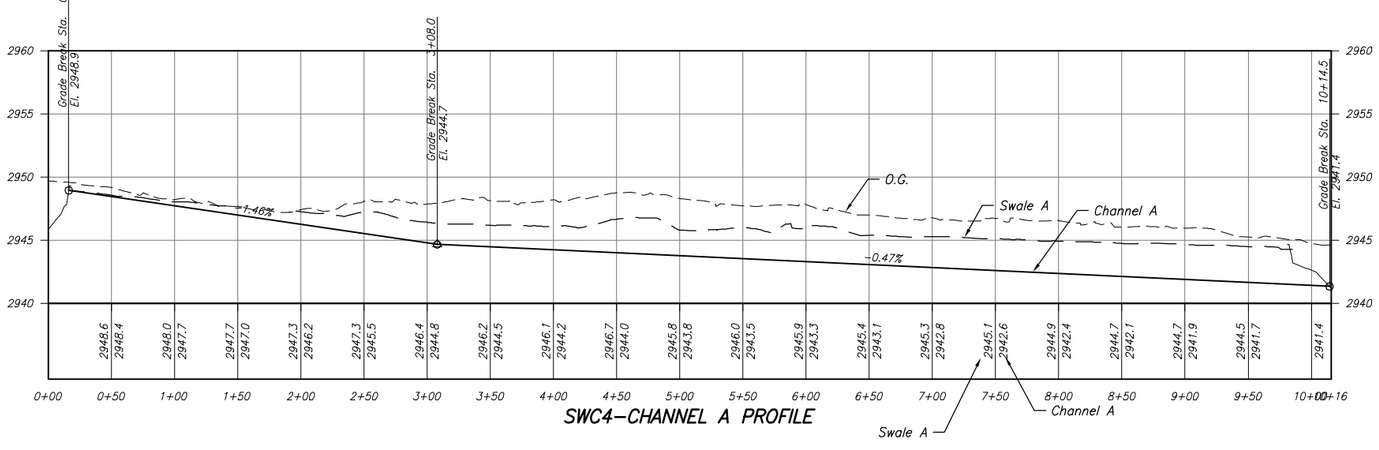


FLOOD SWALE COMPLEX 4
CHANNEL A
SWALE A

40 0 40 80 120
SCALE OF FEET



SWC4–SWALE A PROFILE



SWC4–CHANNEL A PROFILE

60 0 60 120 180
SCALE OF FEET
HORIZONTAL SCALE

6 0 6 12 18
SCALE OF FEET
VERTICAL SCALE

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GRANDE RONDE SUBBASIN
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FLOOD SWALE COMPLEX 4
CHANNEL A
SWALE A

PLAN AND PROFILES

1678–100–2095

SHEET 2 OF 9

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AUGUST 13, 2015 09:38
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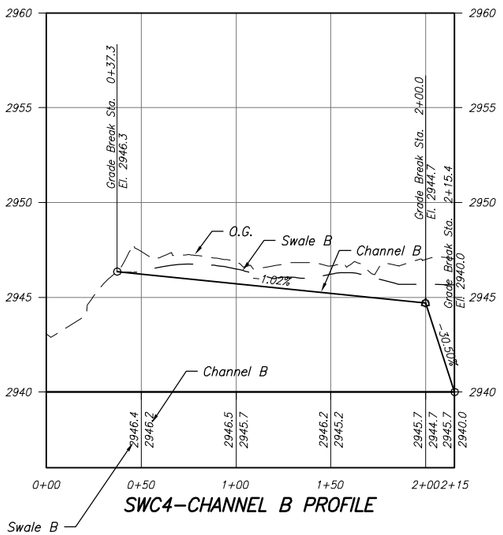
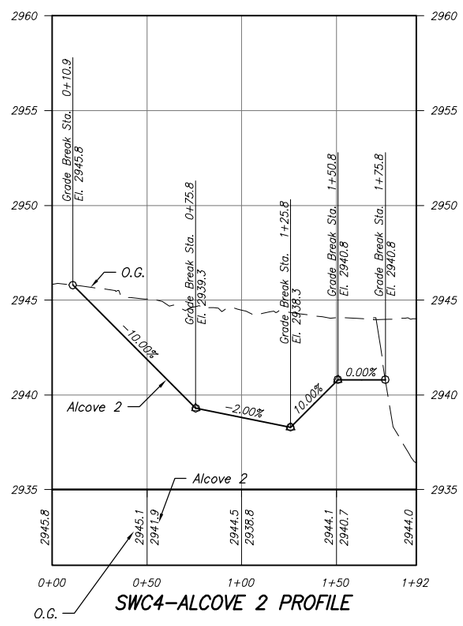
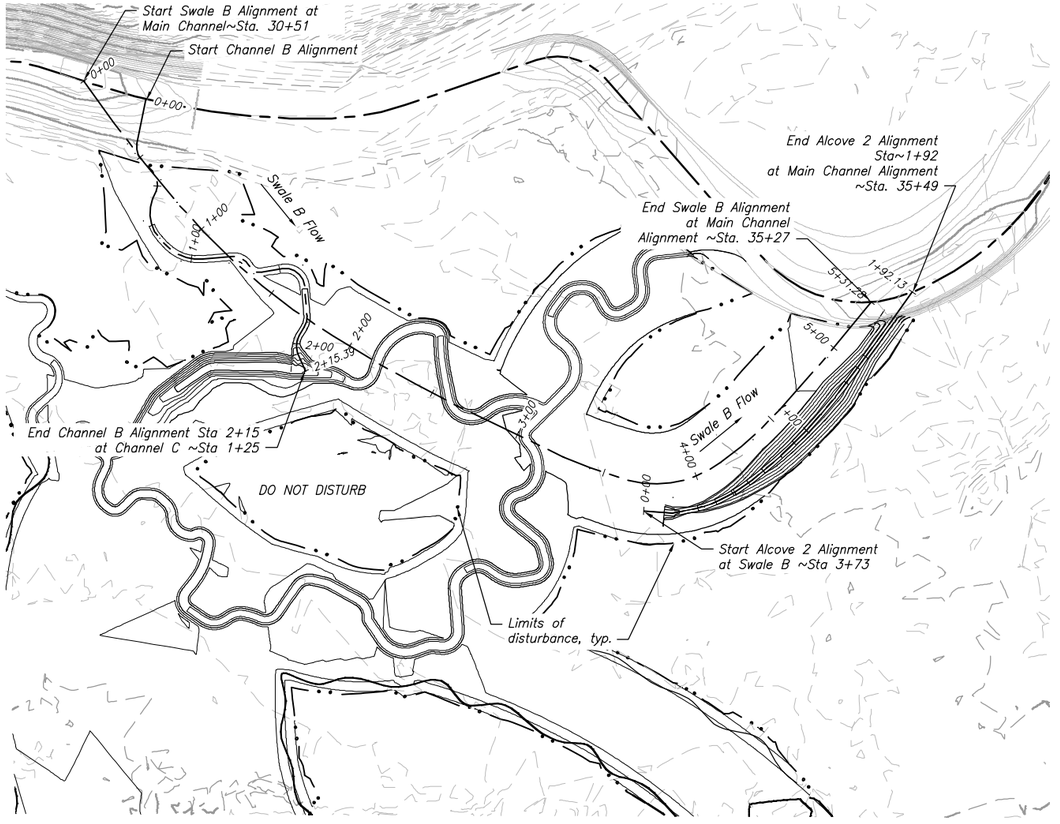
CAD FILENAME
1678–100–SWC4.DWG

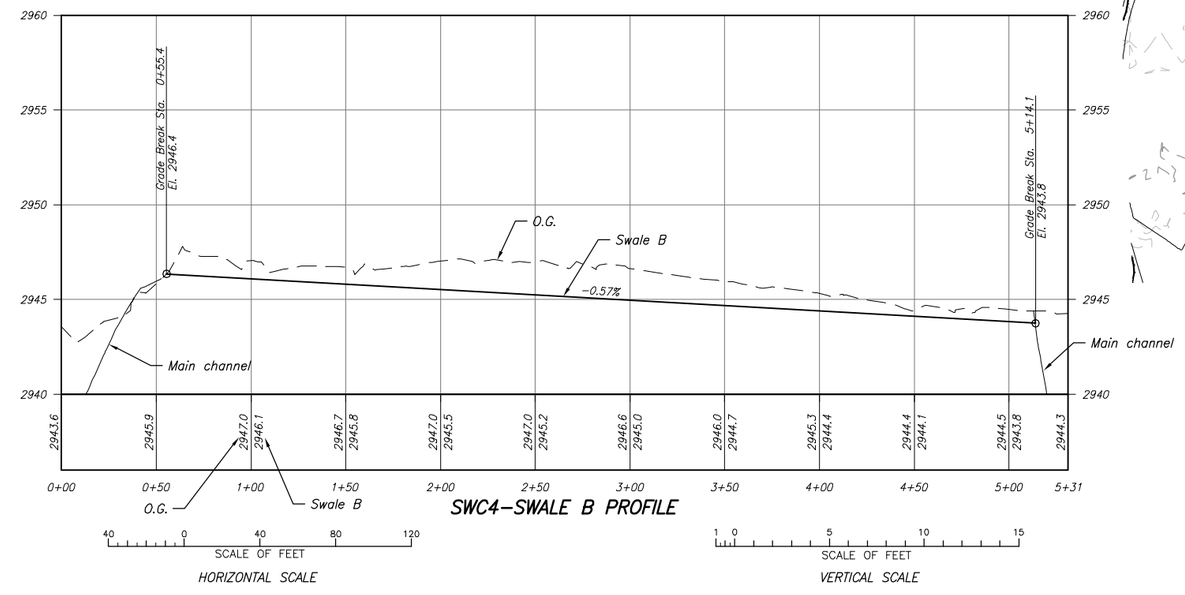


SWC4–CHANNEL B PROFILE



SWC4–ALCOVE 2 PROFILE





SWC4–SWALE B PROFILE

40 0 40 80 120
SCALE OF FEET
HORIZONTAL SCALE

1 0 5 10 15
SCALE OF FEET
VERTICAL SCALE

FLOOD SWALE COMPLEX 4
CHANNEL B
SWALE B
ALCOVE 2

40 0 40 80 120
SCALE OF FEET

NOTES:

1. Salvaged sod mats shall be placed throughout the swale complexes as directed by the Contracting Officer to provide immediate vegetation and floodplain roughness. The top of sod mats shall be placed at the final design elevations.
2. Swale complex channels shown in profile are average gradient and shall have pools excavated at the outside of meander bends as directed by the Contracting Officer. Pools shall vary from 1 to 3 feet deep.
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PARCEL 3

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BOISE, ID 2015-09-14

FLOOD SWALE COMPLEX 4
CHANNEL B
SWALE B
ALCOVE 2

PLAN AND PROFILES

1678–100–2096

SHEET 3 OF 9

DATE AND TIME PLOTTED
AUGUST 13, 2015 09:39
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CAD SYSTEM
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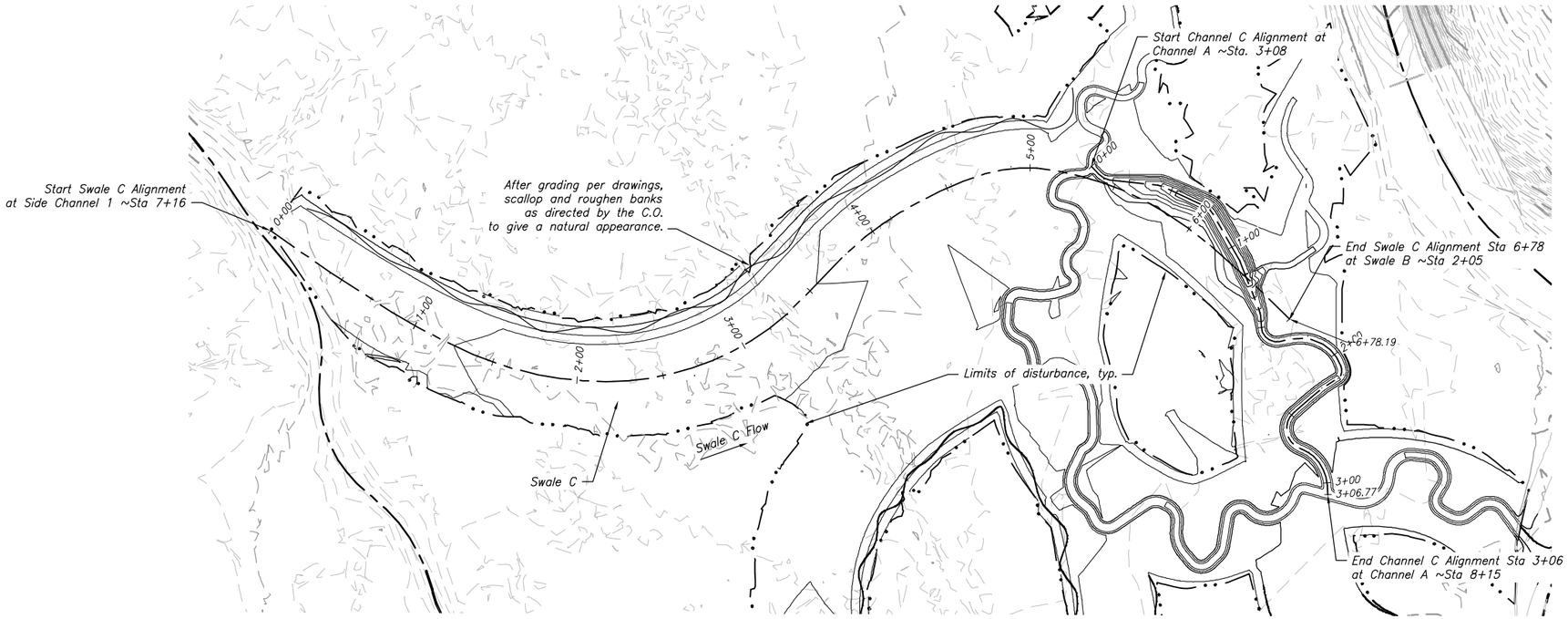
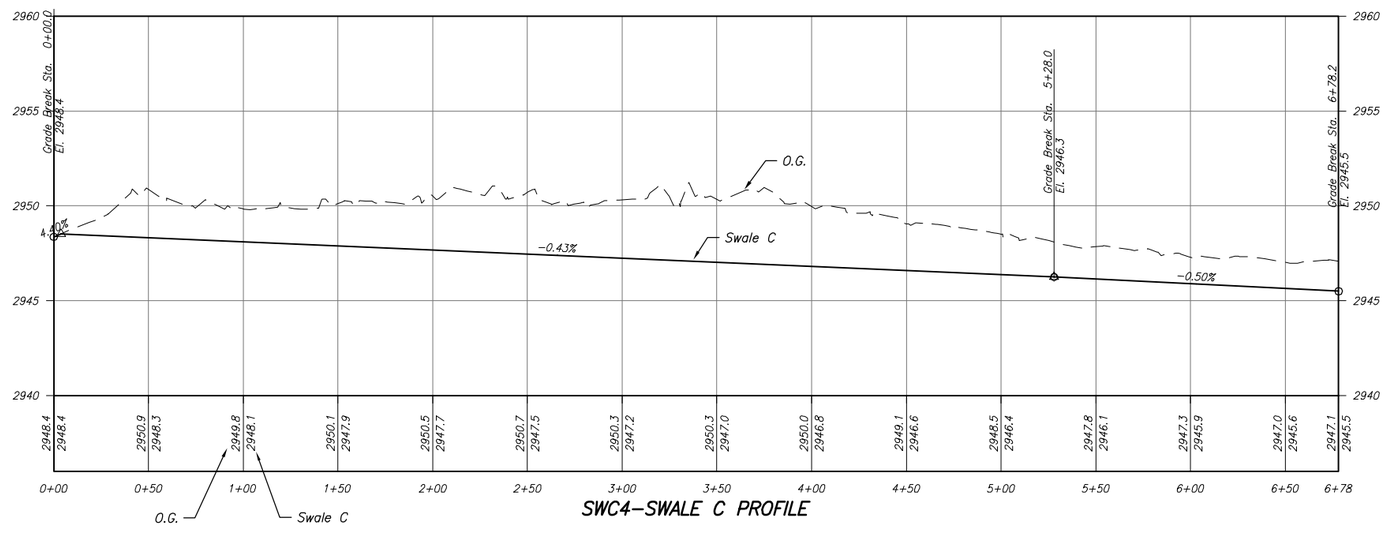


NOTES:

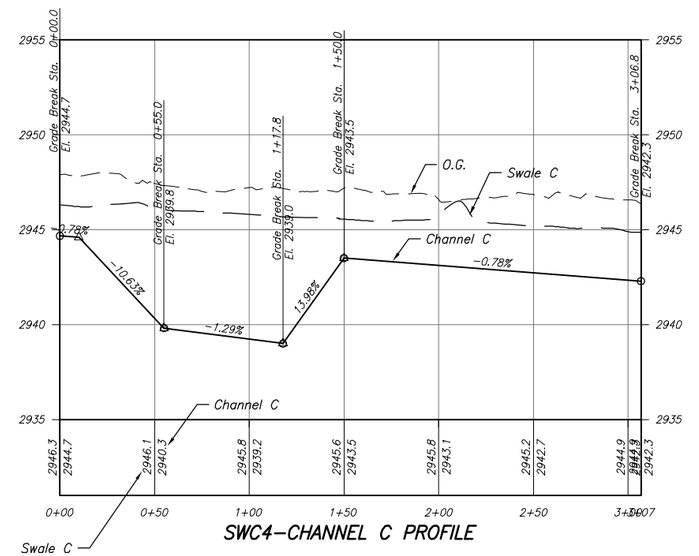
1. Salvaged sod mats shall be placed throughout the swale complexes as directed by the Contracting Officer to provide immediate vegetation and floodplain roughness. The top of sod mats shall be placed at the final design elevations.
2. Swale complex channels shown in profile are average gradient and shall have pools excavated at the outside of meander bends as directed by the Contracting Officer. Pools shall vary from 1 to 3 feet deep.
3. Swale complex ponds shall be excavated to a minimum depth of 3 feet below encountered groundwater or as directed by the Contracting Officer.

FLOOD SWALE COMPLEX 4
CHANNEL C
SWALE C

40 0 40 80 120
SCALE OF FEET



SWC4–SWALE C PROFILE



SWC4–CHANNEL C PROFILE

40 0 40 80 120
SCALE OF FEET
HORIZONTAL SCALE

1 0 5 10 15
SCALE OF FEET
VERTICAL SCALE

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CC-44 PHASE III HABITAT ENHANCEMENT
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Steve Montague–Acting
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BOISE, ID 2015-09-14

FLOOD SWALE COMPLEX 4
CHANNEL C
SWALE C

PLAN AND PROFILES

1678–100–2097

SHEET 4 OF 9

DATE AND TIME PLOTTED
AUGUST 13, 2015 09:42
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AHATCH

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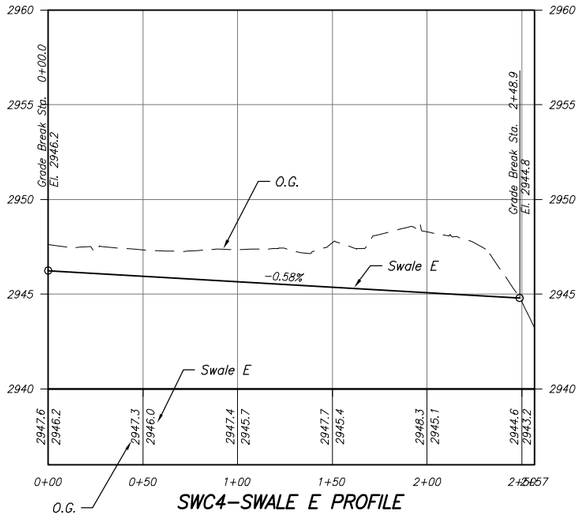
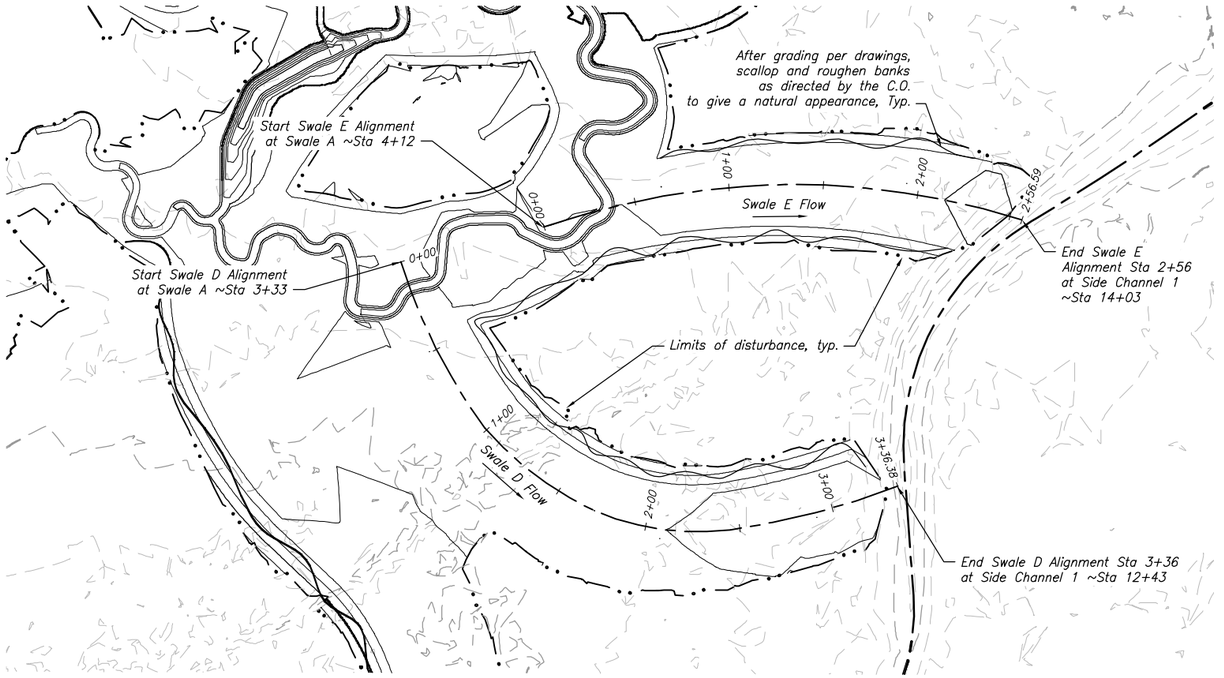
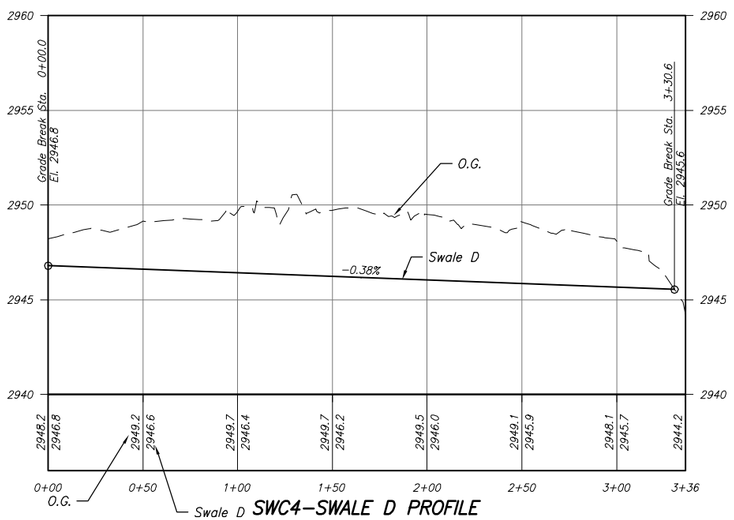


SWC4–SWALE E PROFILE





SWC4–SWALE D PROFILE

40 0 40 80 120
SCALE OF FEET
HORIZONTAL SCALE

1 0 5 10 15
SCALE OF FEET
VERTICAL SCALE

FLOOD SWALE COMPLEX 4
SWALE D
SWALE E

40 0 40 80 120
SCALE OF FEET

NOTES:

1. Salvaged sod mats shall be placed throughout the swale complexes as directed by the Contracting Officer to provide immediate vegetation and floodplain roughness. The top of sod mats shall be placed at the final design elevations.
2. Swale complex channels shown in profile are average gradient and shall have pools excavated at the outside of meander bends as directed by the Contracting Officer. Pools shall vary from 1 to 3 feet deep.
3. Swale complex ponds shall be excavated to a minimum depth of 3 feet below encountered groundwater or as directed by the Contracting Officer.

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

Jeffrey J Fealko P.E.
DESIGNED
DB/AH/JH
DRAWN
Mike Knutson P.E.
CHECKED
Jeffrey J Fealko P.E.
TECH. APPR.
Steve Montague–Acting
APPROVED
ADMIN. APPROVAL – PROGRAM MANAGER
BOISE, ID 2015–09–14

FLOOD SWALE COMPLEX 4
SWALE D
SWALE E

PLAN AND PROFILES

1678–100–2098

SHEET 5 OF 9

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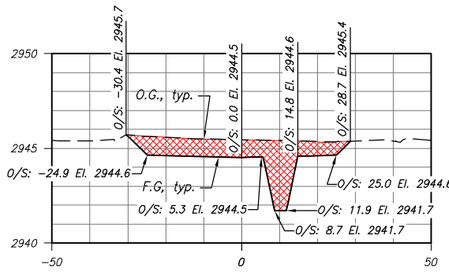

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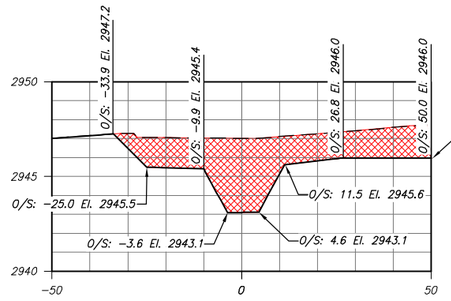

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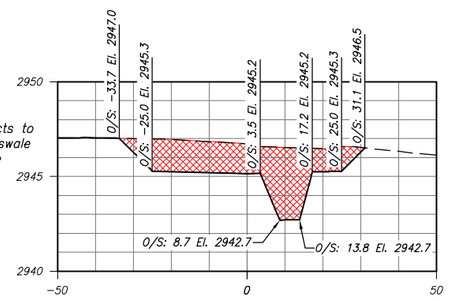

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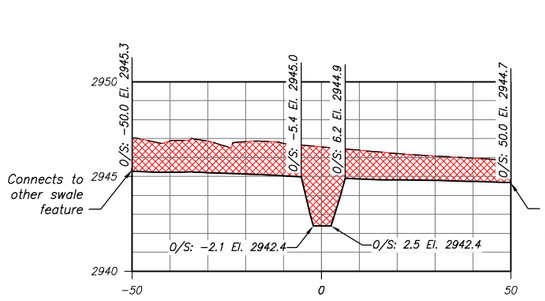

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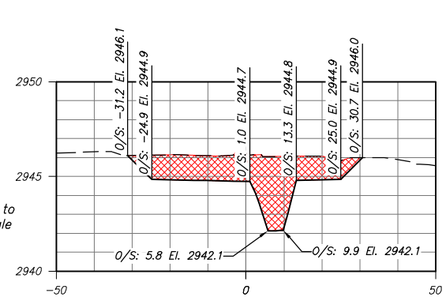

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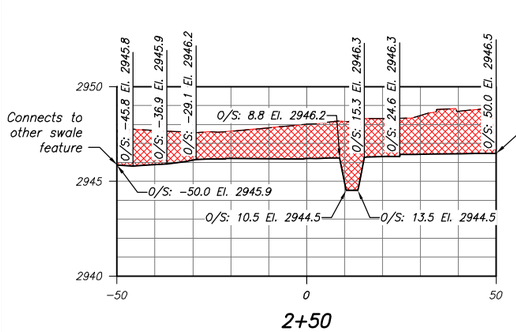

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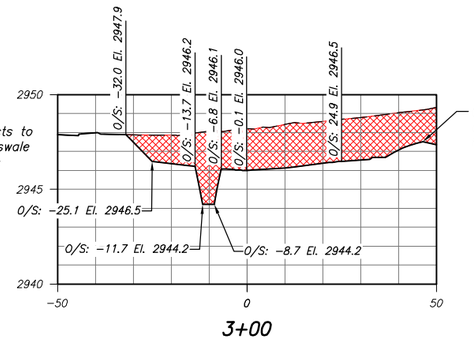

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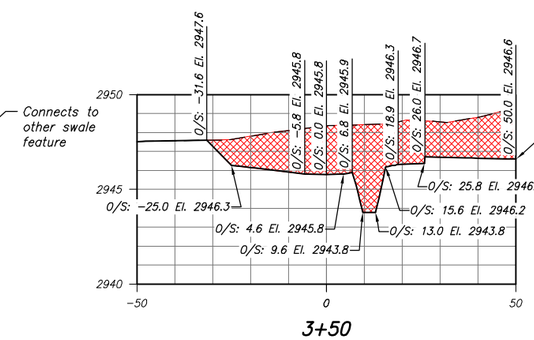

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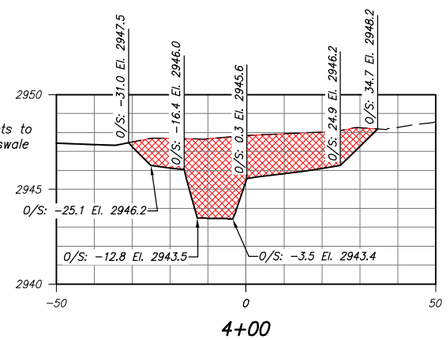

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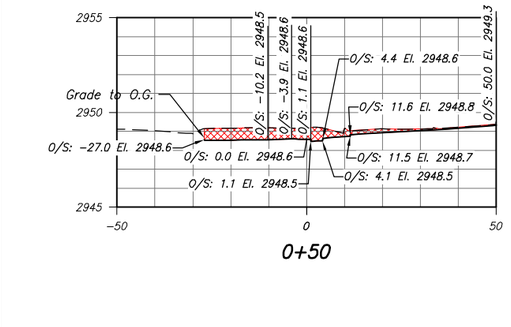

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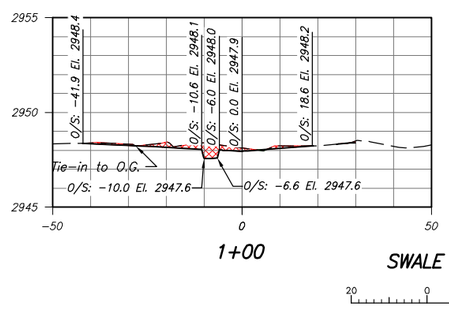

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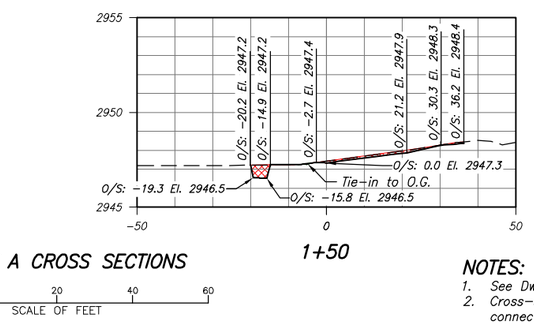

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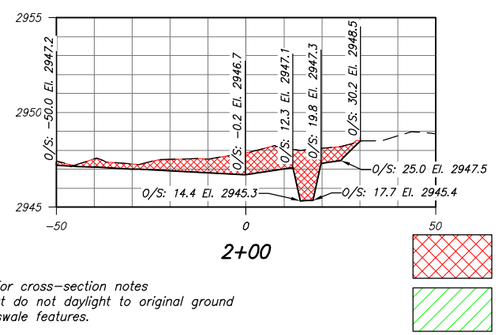

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SWALE A CROSS SECTIONS

SCALE OF FEET: 20 0 20 40 60

Cut

Fill

NOTES:

1. See Dwg. −2047 for cross-section notes
2. Cross-sections that do not daylight to original ground connect to other swale features.

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COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT PARCEL 3

DESIGNED	Jeffrey J Fealko P.E.
DRAWN	DB/AH/JH
CHECKED	Mike Knutson P.E.
TECH. APPR.	Jeffrey J Fealko P.E.
APPROVED	Steve Montague−Acting
ADMIN. APPROVAL − PROGRAM MANAGER	
BOISE, ID	2015−09−14

FLOOD SWALE COMPLEX 4 SWALE A

CROSS SECTIONS

1678−100−2099

SHEET 6 OF 9

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AUGUST 13, 2015 09:45
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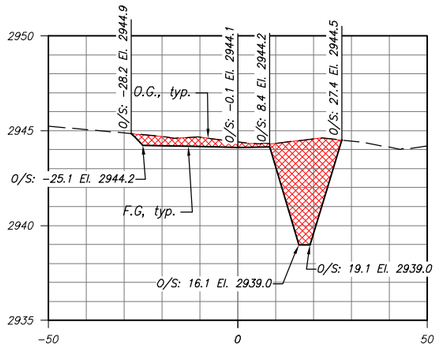

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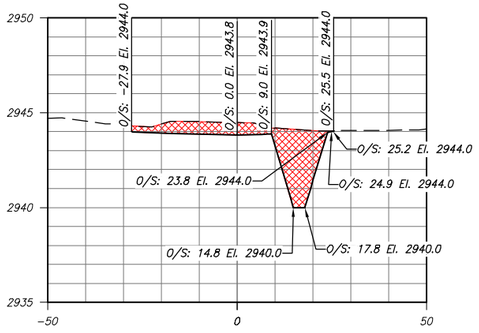

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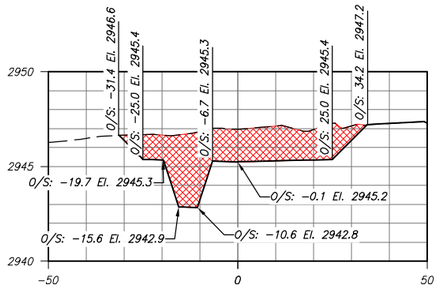

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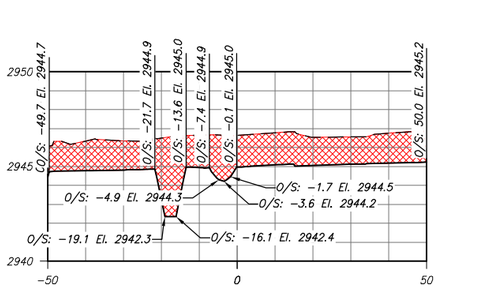

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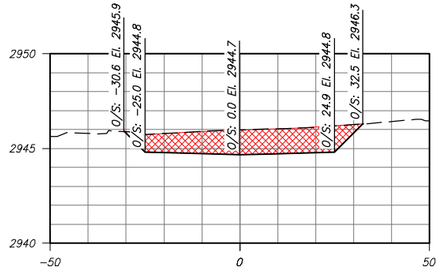

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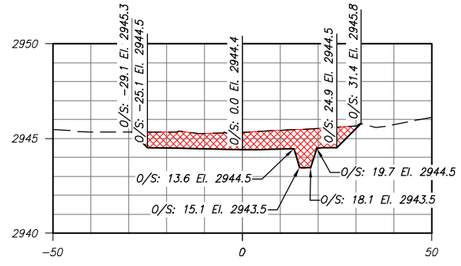

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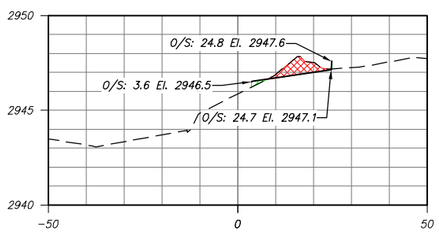

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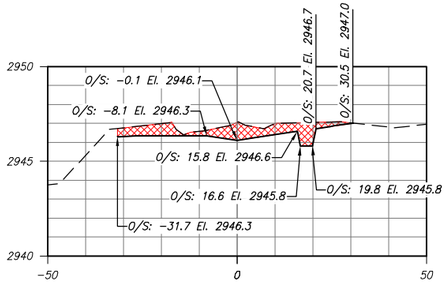

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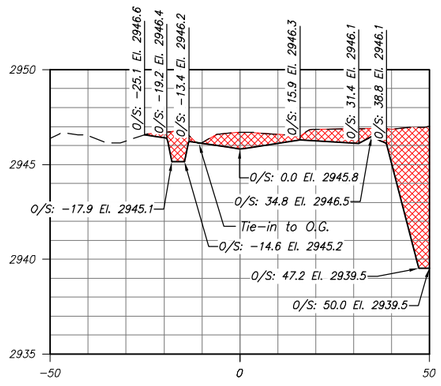

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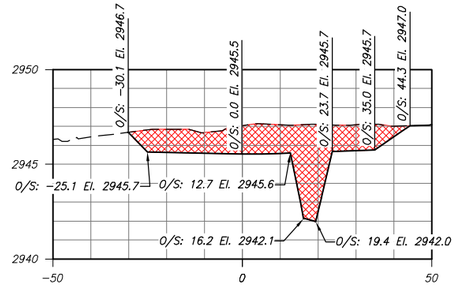

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NOTES:

1. See Dwg. −2047 for cross−section notes
2. Cross−sections that do not daylight to original ground connect to other swale features.

SWALE B CROSS SECTIONS

20 0 20 40 60
SCALE OF FEET

Cut

Fill

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COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC−44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

Jeffrey J Fealko P.E.
DESIGNED
DB/AH/JH
DRAWN
Mike Knutson P.E.
CHECKED
Jeffrey J Fealko P.E.
TECH. APPR.
Steve Montague−Acting
APPROVED
ADMIN. APPROVAL − PROGRAM MANAGER
BOISE, ID
2015−09−14

FLOOD SWALE COMPLEX 4
SWALE A
SWALE B

CROSS SECTIONS

1678−100−2100
SHEET 7 OF 9

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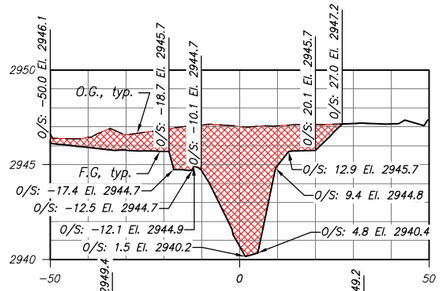

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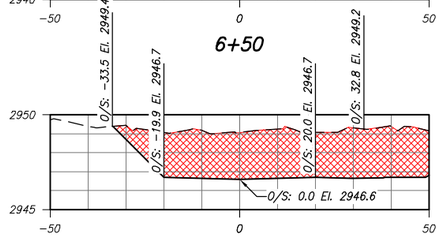

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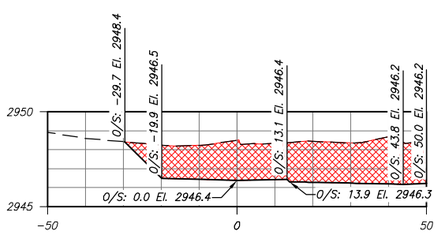

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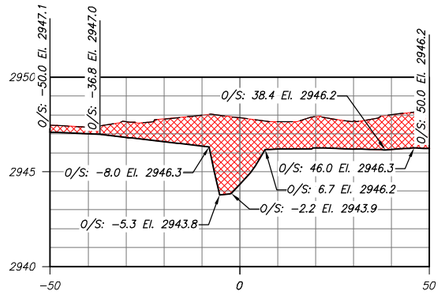

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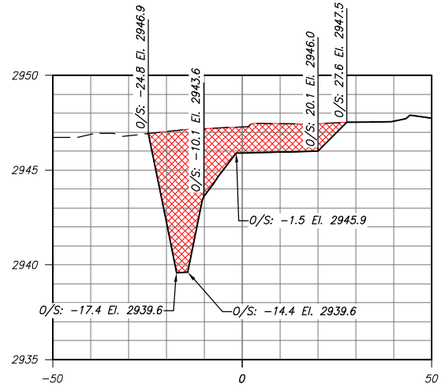

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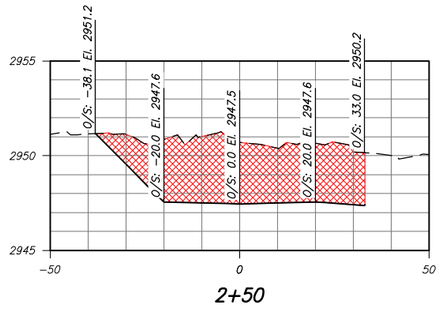

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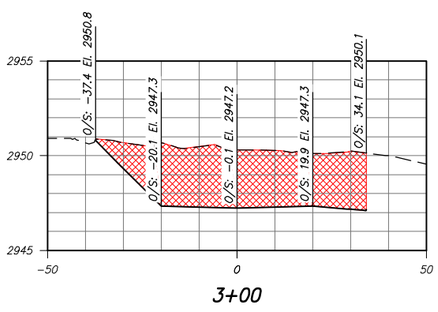

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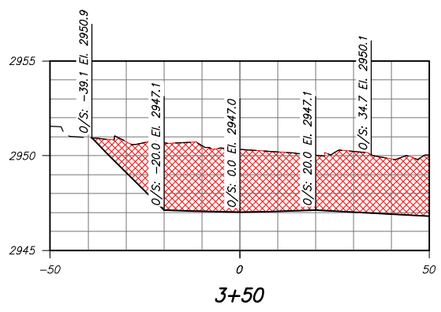

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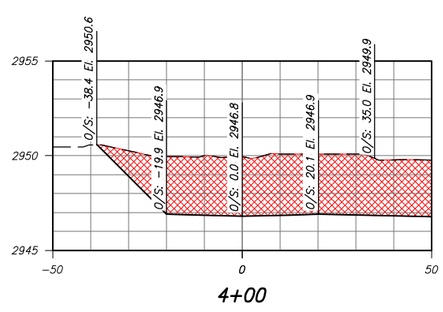

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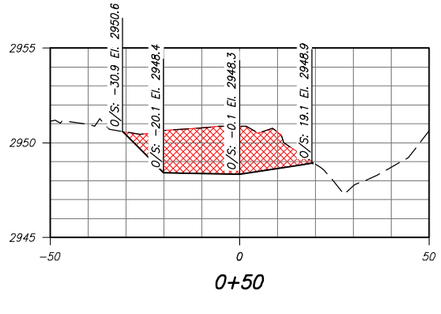

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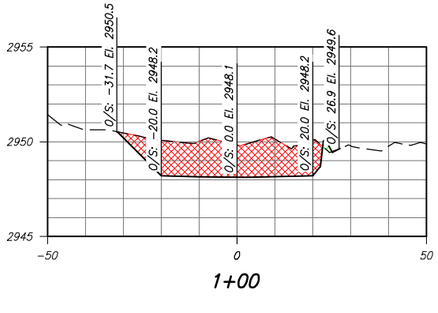

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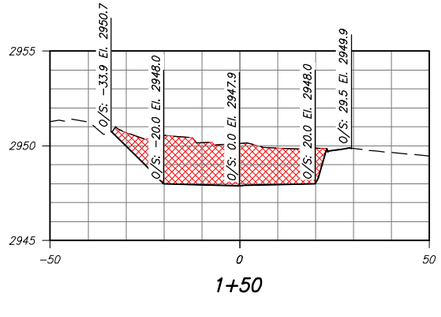

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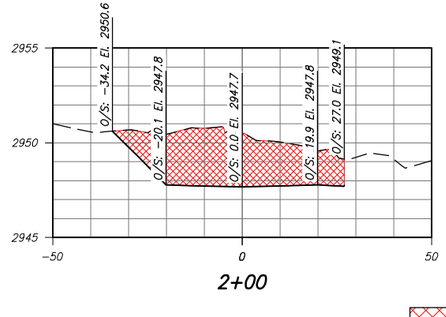

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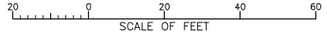
SWALE C CROSS SECTIONS



Cut

Fill

NOTES:

1. See Dwg. -2047 for cross-section notes
2. Cross-sections that do not daylight to original ground connect to other swale features.

RECLAMATION
Managing Water in the West

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COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

Jeffrey J Fealko P.E.
DESIGNED
DB/AH/JH
DRAWN
Mike Knutson P.E.
CHECKED
Jeffrey J Fealko P.E.
TECH. APPR.
Steve Montague-Acting
APPROVED
ADMIN APPROVAL - PROGRAM MANAGER
BOISE, ID 2015-09-14

FLOOD SWALE COMPLEX 4
SWALE C

CROSS SECTIONS

1678-100-2101

SHEET 8 OF 9

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AUGUST 13, 2015 09:47
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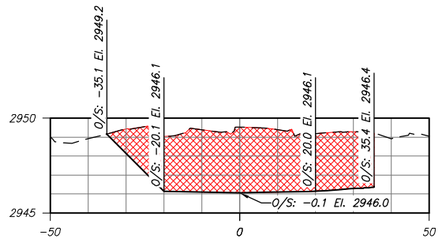

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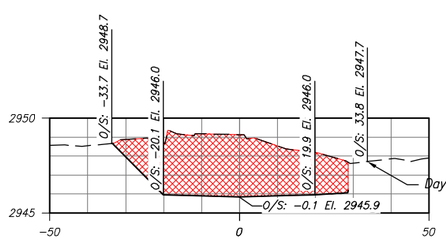

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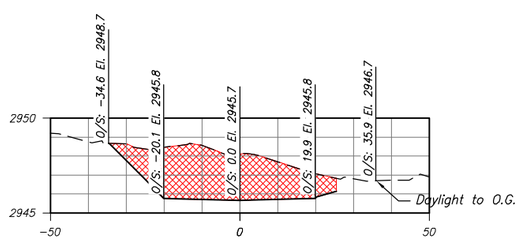

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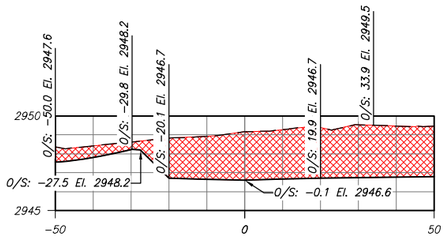

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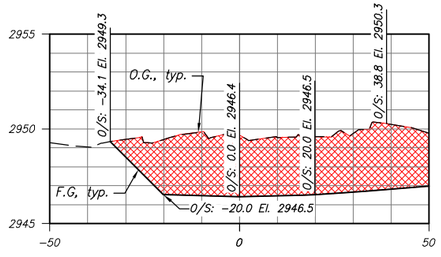

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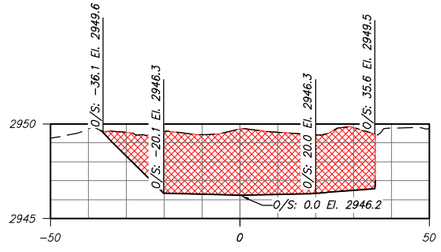

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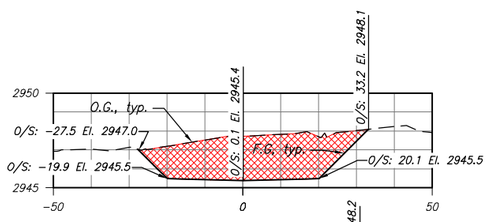
SWALE D SECTIONS



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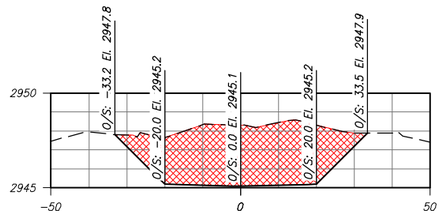

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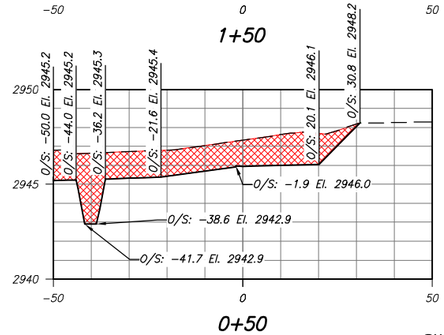

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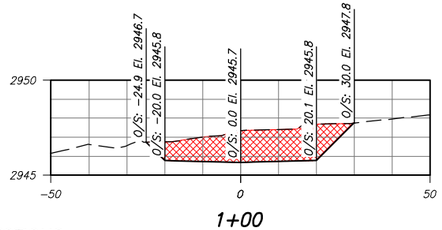

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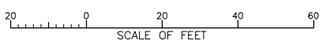
SWALE E SECTIONS

NOTES:

1. See Dwg. −2047 for cross−section notes
2. Cross−sections that do not daylight to original ground connect to other swale features, except where an offset and elevation label is shown to daylight to O.G.



Cut

Fill

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC−44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

Jeffrey J Fealko P.E.	DESIGNED
DB/AH/JH	DRAWN
Mike Knutson P.E.	CHECKED
Jeffrey J Fealko P.E.	TECH. APPR.
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BOISE, ID	2015−09−14

FLOOD SWALE COMPLEX 4
SWALE D
SWALE E

CROSS SECTIONS

1678−100−2102

SHEET 9 OF 9

DATE AND TIME PLOTTED
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PLOTTED BY
AHATCH

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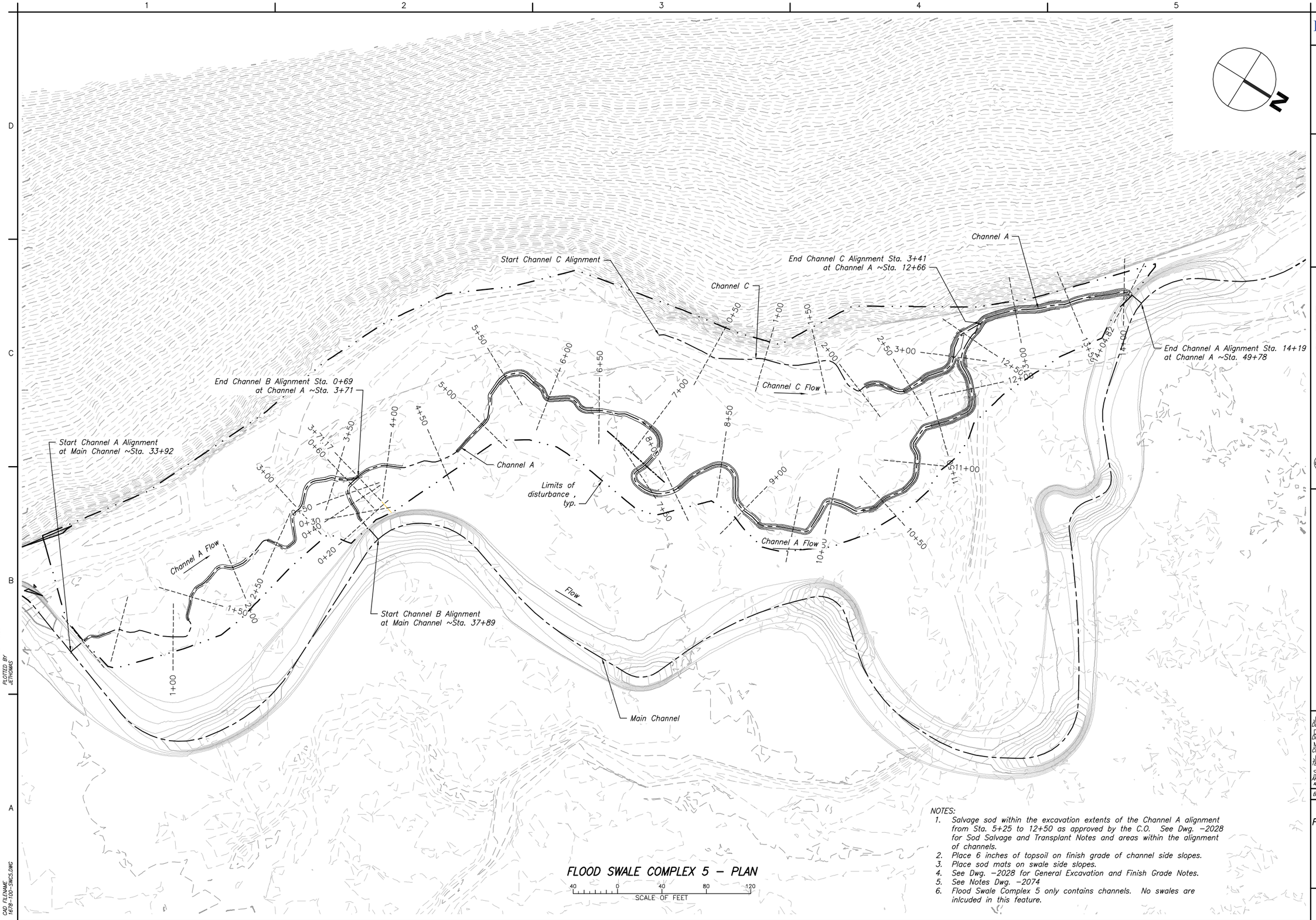
1678−100−SNC4.DWG



FLOOD SWALE COMPLEX 5 – PLAN

40 0 40 80 120
SCALE OF FEET

NOTES:

1. Salvage sod within the excavation extents of the Channel A alignment from Sta. 5+25 to 12+50 as approved by the C.O. See Dwg. –2028 for Sod Salvage and Transplant Notes and areas within the alignment of channels.
2. Place 6 inches of topsoil on finish grade of channel side slopes.
3. Place sod mats on swale side slopes.
4. See Dwg. –2028 for General Excavation and Finish Grade Notes.
5. See Notes Dwg. –2074
6. Flood Swale Complex 5 only contains channels. No swales are inlcuded in this feature.

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GRANDE RONDE SUBBASIN

CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

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BOISE, ID 2015–09–14

FLOOD SWALE COMPLEX 5

PLAN

1678–100–2103
SHEET 1 OF 6

DATE AND TIME PLOTTED
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PLOTTED BY
JETHOMAS

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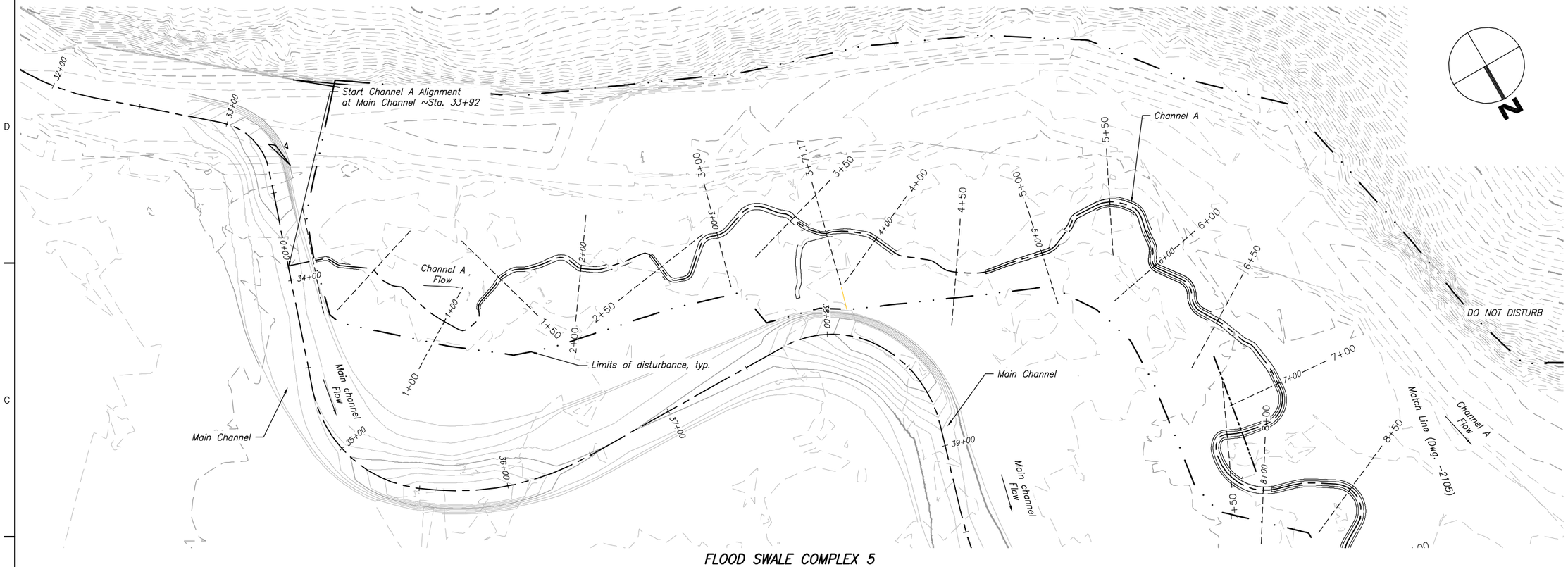
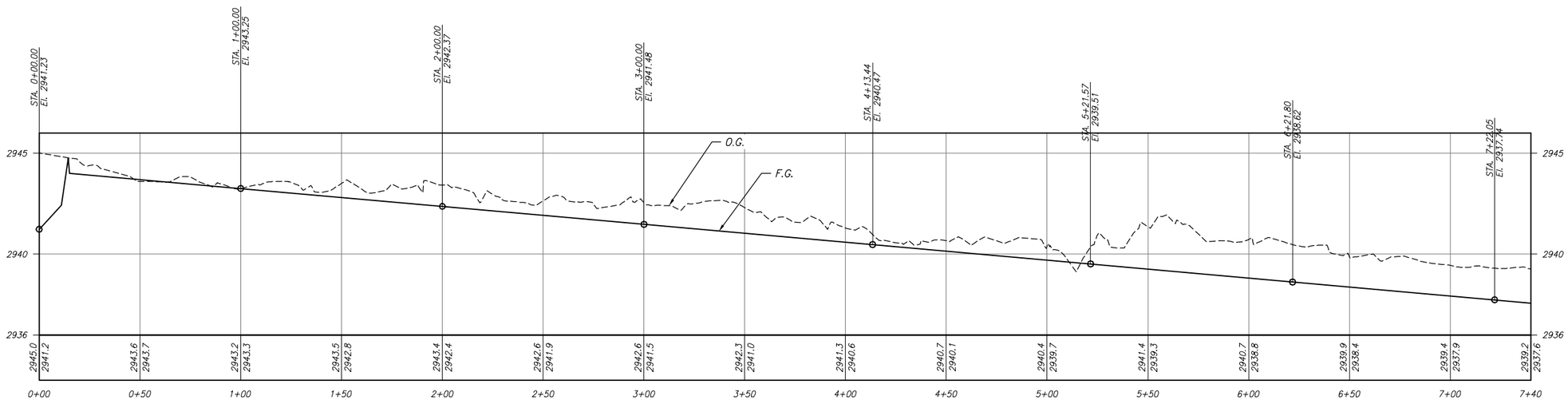


FLOOD SWALE COMPLEX 5
CHANNEL A
STA 0+00 TO STA 7+40



CHANNEL A PROFILE
STA. 0+00 TO STA 7+40

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GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

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FLOOD SWALE COMPLEX 5
CHANNEL A

PLAN AND PROFILE

1678–100–2104
SHEET 2 OF 6

DATE AND TIME PLOTTED
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PLOTTED BY
JETHOMAS

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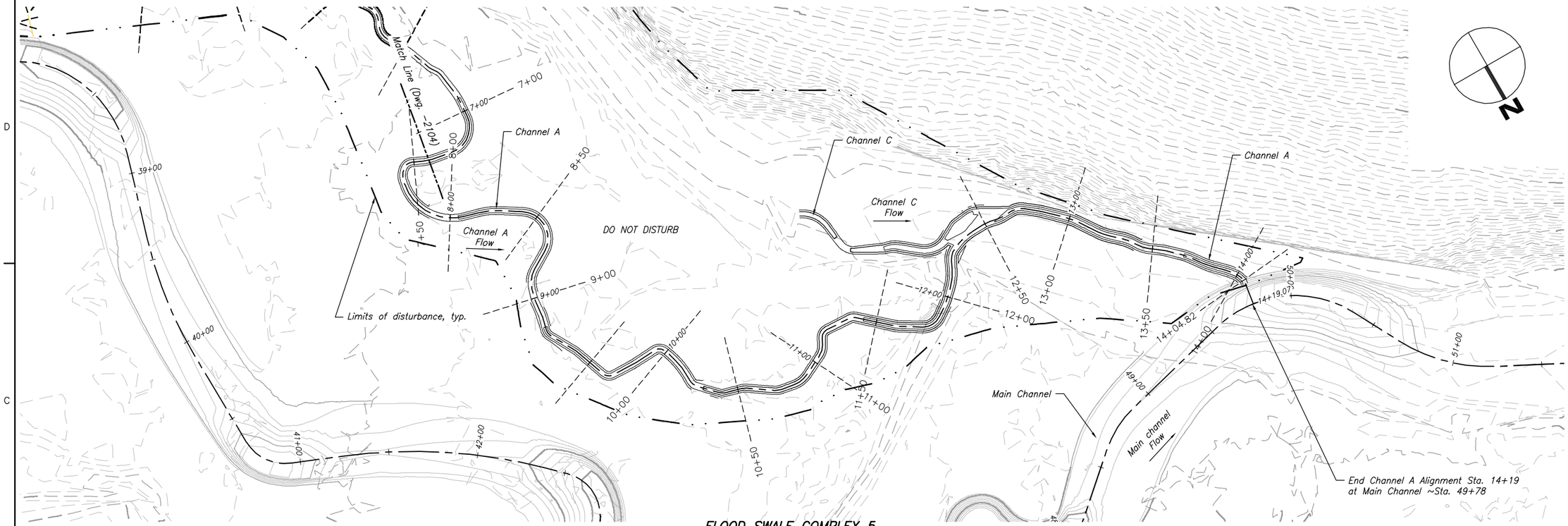
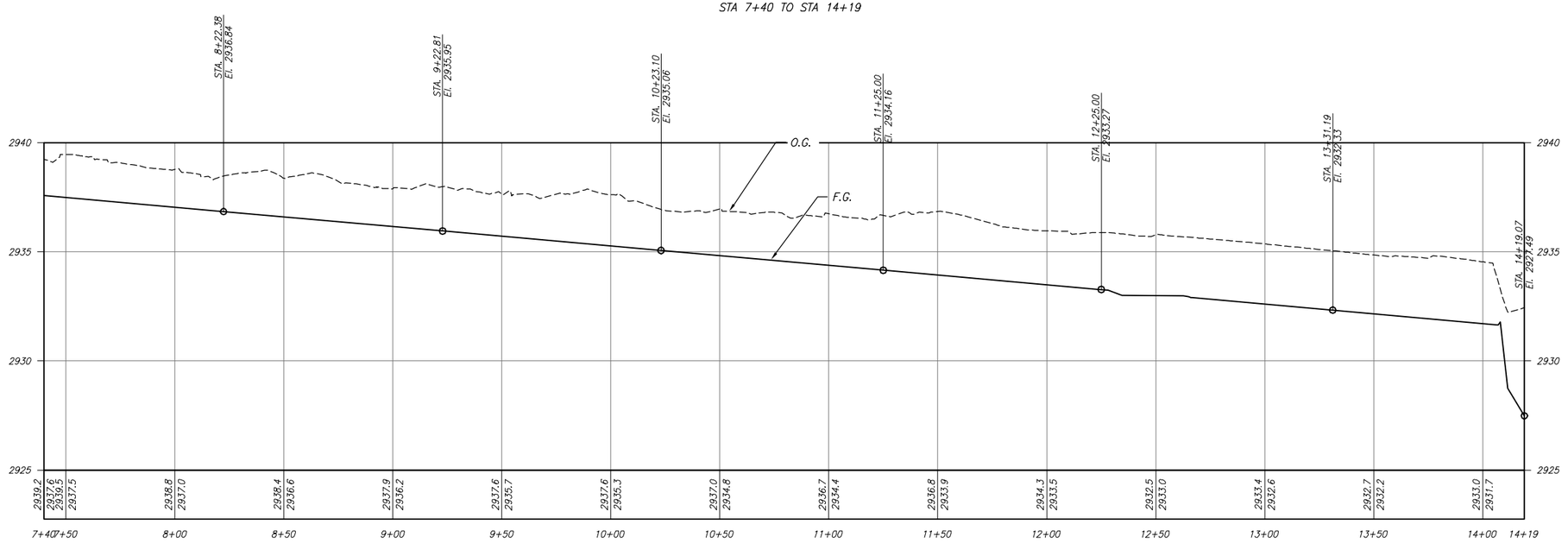


FLOOD SWALE COMPLEX 5
CHANNEL A
STA 7+40 TO STA 14+19



CHANNEL A PROFILE
STA 7+40 TO STA 14+19

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

Jeffrey J Fealko P.E.	DESIGNED
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Mike Knutson P.E.	CHECKED
Jeffrey J Fealko P.E.	TECH. APPR.
Steve Montague–Acting	APPROVED
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BOISE, ID	2015-09-14

FLOOD SWALE COMPLEX 5
CHANNEL A

PLAN AND PROFILE

1678–100–2105

SHEET 3 OF 6

DATE AND TIME PLOTTED
AUGUST 14, 2015 11:47
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AHATCH

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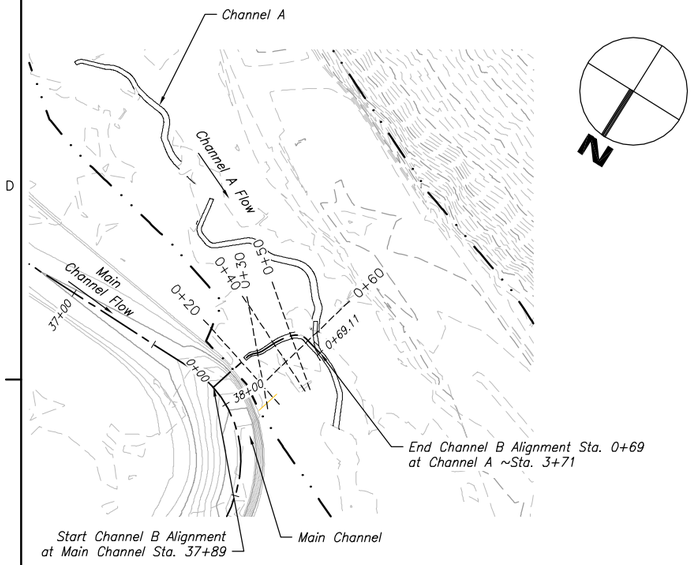
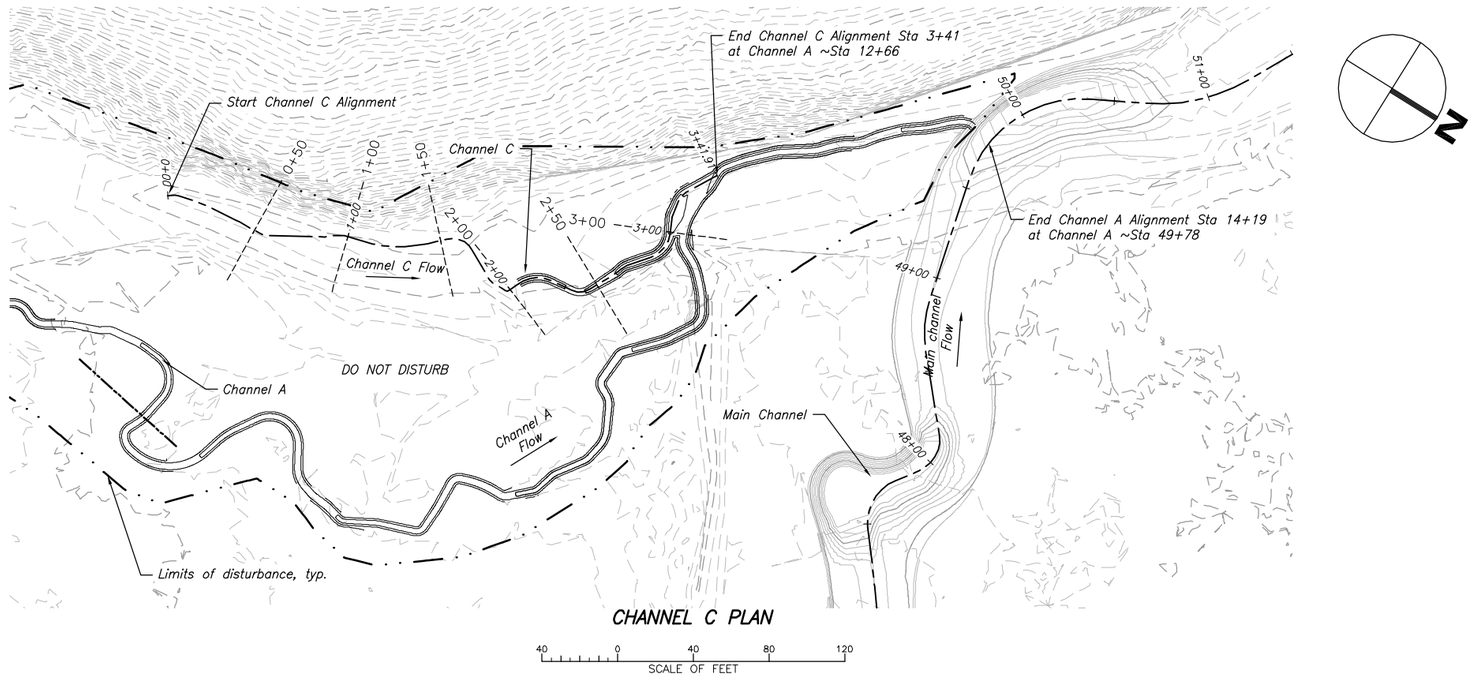


CHANNEL B PLAN

40 0 40 80 120
SCALE OF FEET



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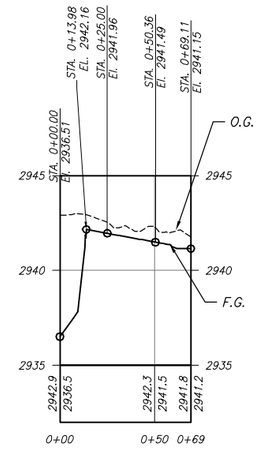
SCALE OF FEET



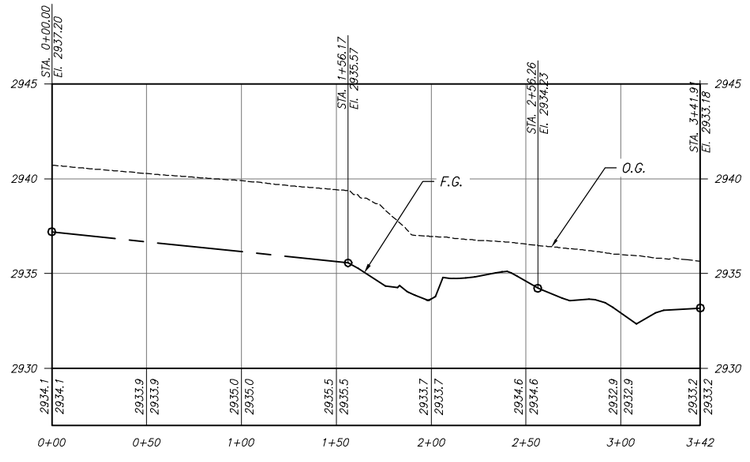
CHANNEL B PLAN

HORIZONTAL SCALE

40 0 40 80 120
SCALE OF FEET

VERTICAL SCALE

4 0 4 8 12
SCALE OF FEET



CHANNEL C PLAN

HORIZONTAL SCALE

40 0 40 80 120
SCALE OF FEET

VERTICAL SCALE

4 0 4 8 12
SCALE OF FEET

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GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

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CHECKED	Mike Knutson P.E.
TECH. APPR.	Jeffrey J Fealko P.E.
APPROVED	Steve Montague–Acting
	ADMIN. APPROVAL – PROGRAM MANAGER
	BOISE, ID 2015–09–14

FLOOD SWALE COMPLEX 5
CHANNEL B
CHANNEL C

PLANS AND PROFILES

1678–100–2106

SHEET 4 OF 6

DATE AND TIME PLOTTED
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AHATCH

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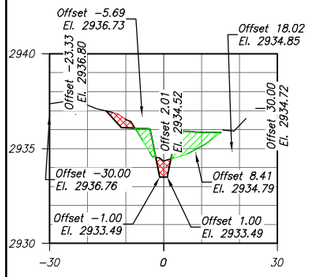

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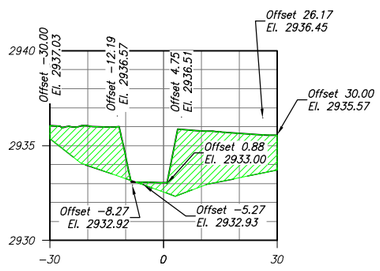

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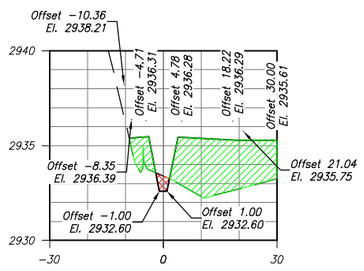

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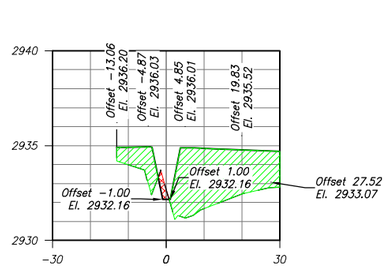

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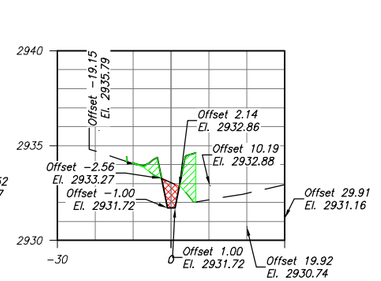

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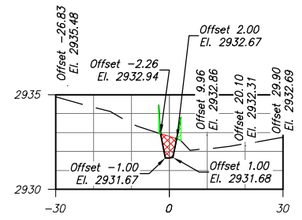

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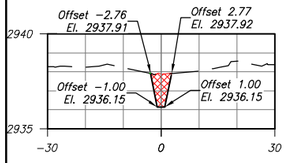

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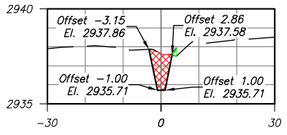

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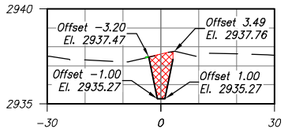

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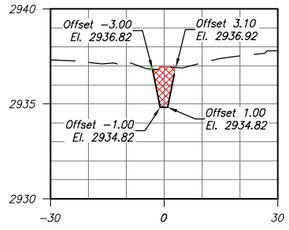

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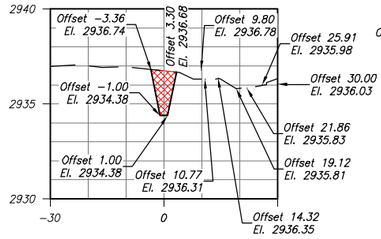

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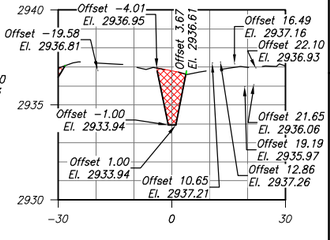

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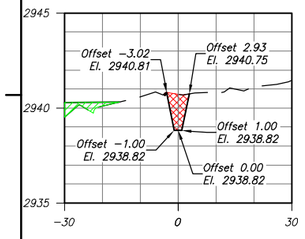

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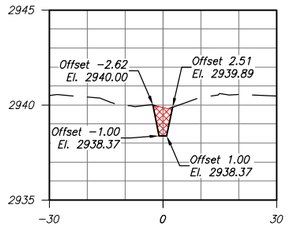

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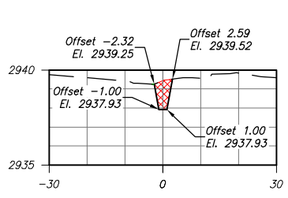

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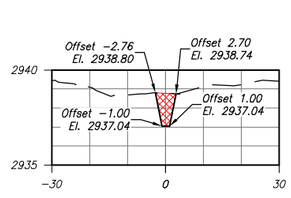

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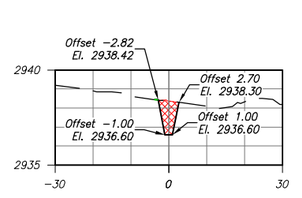

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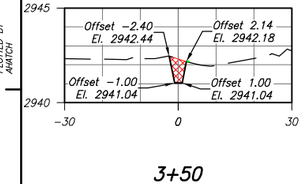

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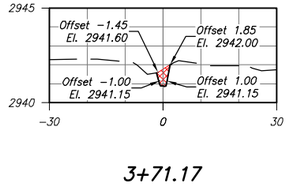

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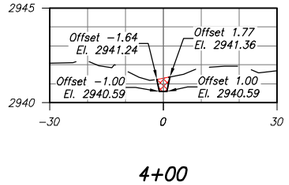

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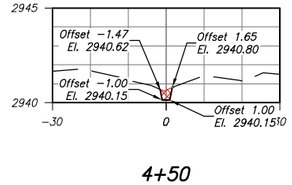

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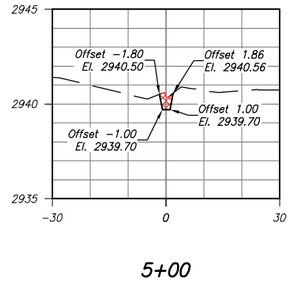

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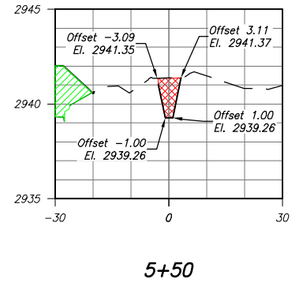

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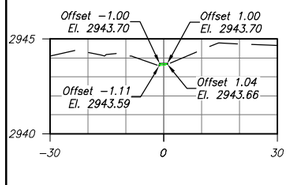

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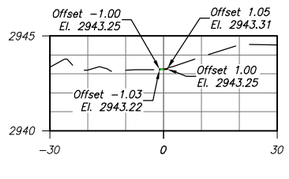

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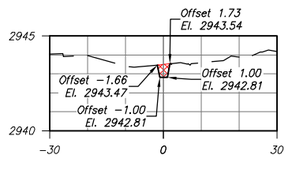

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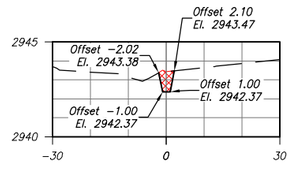

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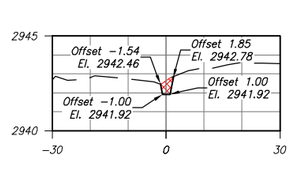

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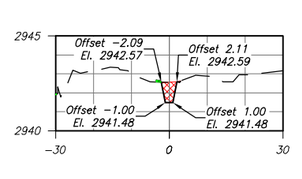

3+00

Cut

Fill

NOTES:
1. See Dwg. −2047 for cross−section notes
2. Cross−sections that do not daylight to original ground connect to other swale features.

CHANNEL A CROSS SECTIONS

20 0 20 40 60
SCALE OF FEET

DATE AND TIME PLOTTED
AUGUST 14, 2015 13:51
PLOTTED BY
AHATCH

CAD SYSTEM
AutoCAD Rel. 20.0s
CAD FILENAME
1678−100−SWC5.DWG

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Managing Water in the West

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COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC−44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

Jeffrey J Fealko P.E.
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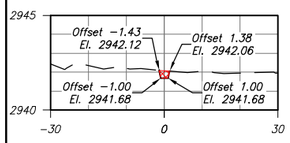
DB/AH/JH
DRAWN
Mike Knutson P.E.
CHECKED
Jeffrey J Fealko P.E.
TECH. APPR.
Steve Montague−Acting
APPROVED
ADMIN APPROVAL − PROGRAM MANAGER
BOISE, ID 2015−08−14

FLOOD SWALE COMPLEX 5
CHANNEL A

CROSS SECTIONS

1678−100−2107
SHEET 5 OF 6



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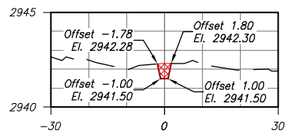

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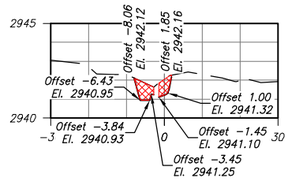

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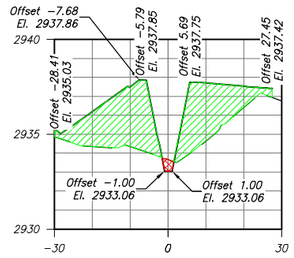

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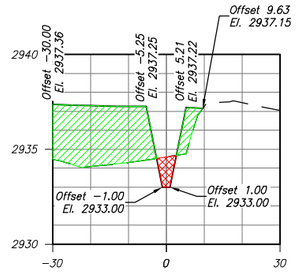

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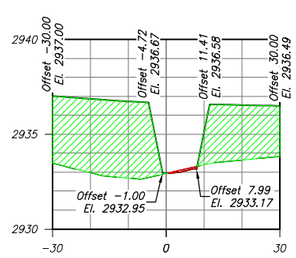

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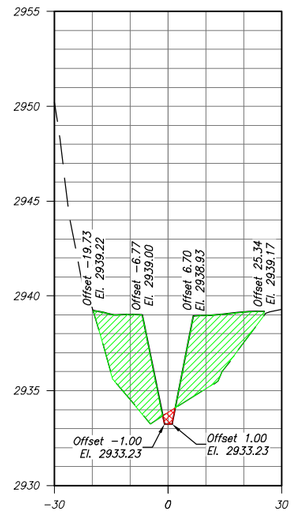
0+20

0+30

CHANNEL B CROSS SECTIONS

20 0 20 40 60
SCALE OF FEET



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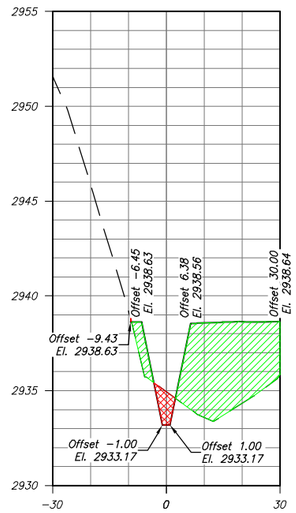

1+00

1+50

CHANNEL C CROSS SECTIONS

20 0 20 40 60
SCALE OF FEET

Cut

Fill

NOTES:
1. See Dwg. −2047 for cross−section notes
2. Cross−sections that do not daylight to original ground connect to other swale features.

DATE AND TIME PLOTTED
AUGUST 14, 2015 14:01
PLOTTED BY
AHATCH

CAD SYSTEM
AutoCAD Rel. 20.0s
CAD FILENAME
1678-100-SWC5.DWG

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COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC−44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

Jeffrey J Fealko P.E.
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Mike Knutson P.E.
CHECKED
Jeffrey J Fealko P.E.
TECH. APPR.
Steve Montague−Acting
APPROVED
ADMIN. APPROVAL − PROGRAM MANAGER

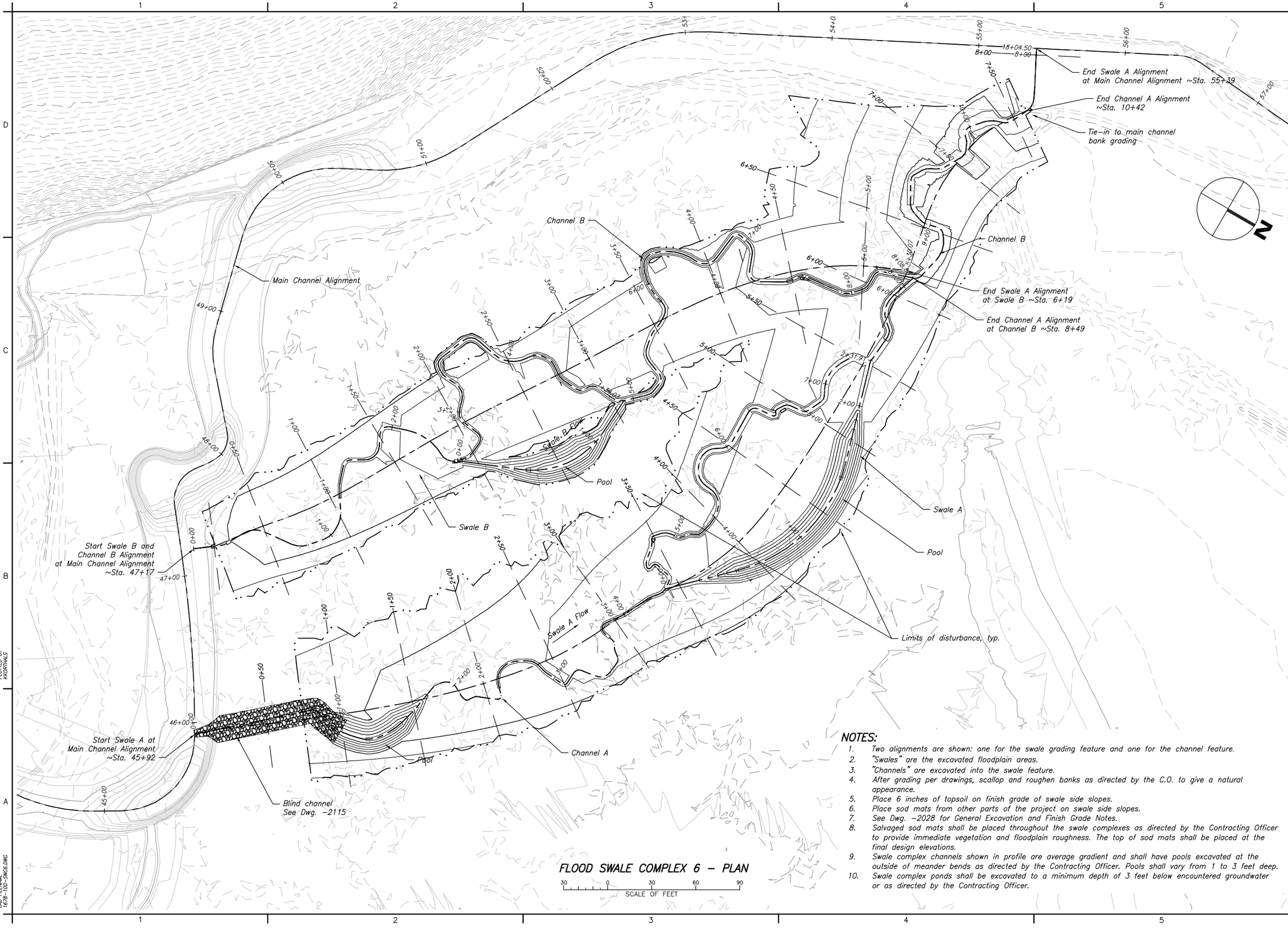
BOISE, ID 2015−09−14

FLOOD SWALE COMPLEX 5
CHANNEL B
CHANNEL C

CROSS SECTIONS

1678−100−2108

SHEET 6 OF 6



FLOOD SWALE COMPLEX 6 – PLAN

30 0 30 60 90
SCALE OF FEET

NOTES:

1. Two alignments are shown: one for the swale grading feature and one for the channel feature.
2. "Swales" are the excavated floodplain areas.
3. "Channels" are excavated into the swale feature.
4. After grading per drawings, scallop and roughen banks as directed by the C.O. to give a natural appearance.
5. Place 6 inches of topsoil on finish grade of swale side slopes.
6. Place sod mats from other parts of the project on swale side slopes.
7. See Dwg. –2028 for General Excavation and Finish Grade Notes.
8. Salvaged sod mats shall be placed throughout the swale complexes as directed by the Contracting Officer to provide immediate vegetation and floodplain roughness. The top of sod mats shall be placed at the final design elevations.
9. Swale complex channels shown in profile are average gradient and shall have pools excavated at the outside of meander bends as directed by the Contracting Officer. Pools shall vary from 1 to 3 feet deep.
10. Swale complex ponds shall be excavated to a minimum depth of 3 feet below encountered groundwater or as directed by the Contracting Officer.

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

Jeffrey J Fealko P.E.	DESIGNED
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Mike Knutson P.E.	CHECKED
Jeffrey J Fealko P.E.	TECH. APPR.
Steve Montague–Acting	APPROVED
	ADMIN. APPROVAL – PROGRAM MANAGER
BOISE, ID	2015–09–14

FLOOD SWALE COMPLEX 6

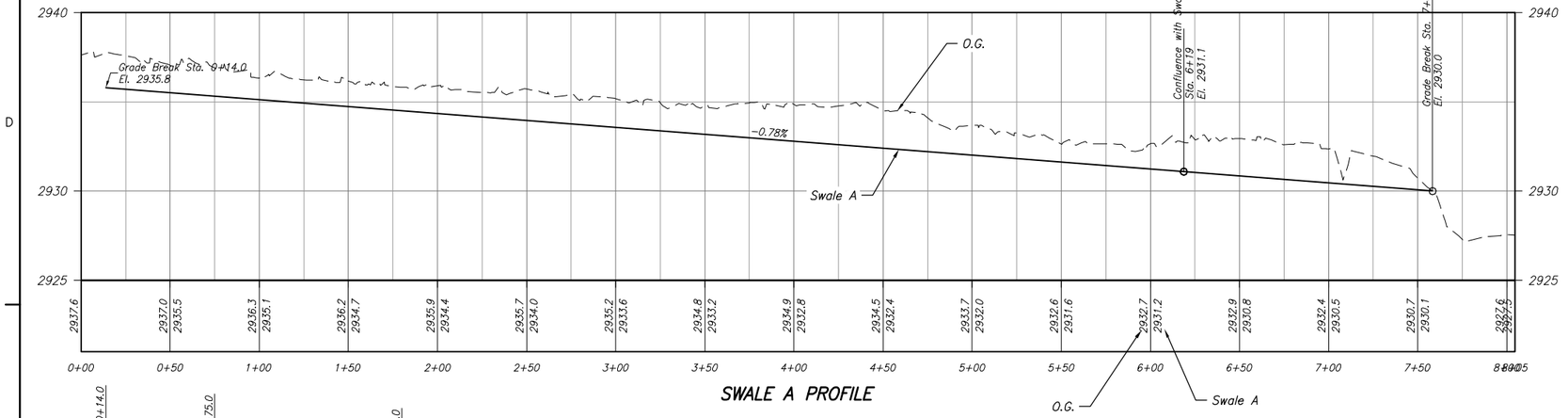
PLAN

1678–100–2109

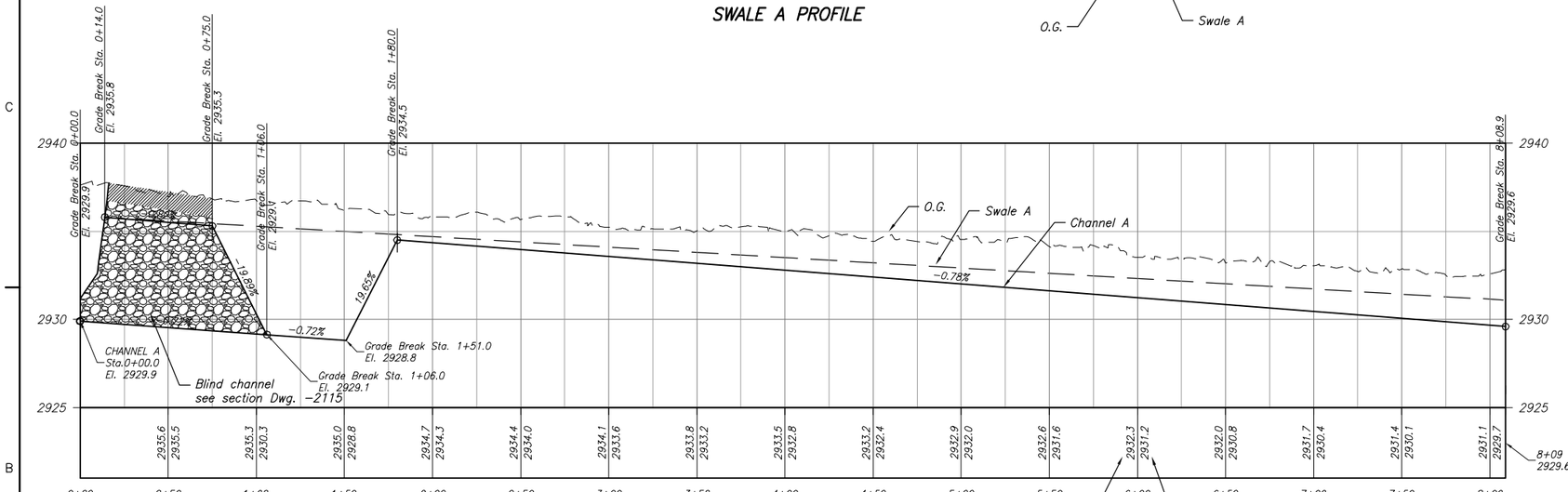
SHEET 1 OF 4

DATE AND TIME PLOTTED
JULY 31, 2015 09:00
PLOTTED BY
KKOMTHALS

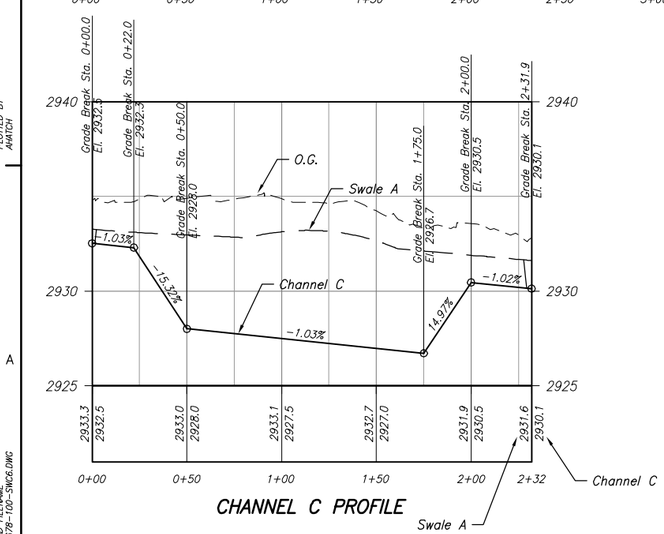
CAD SYSTEM
AutoCAD Rel. 20.0s
CAD FILENAME
1678–100–SWC6.DWG



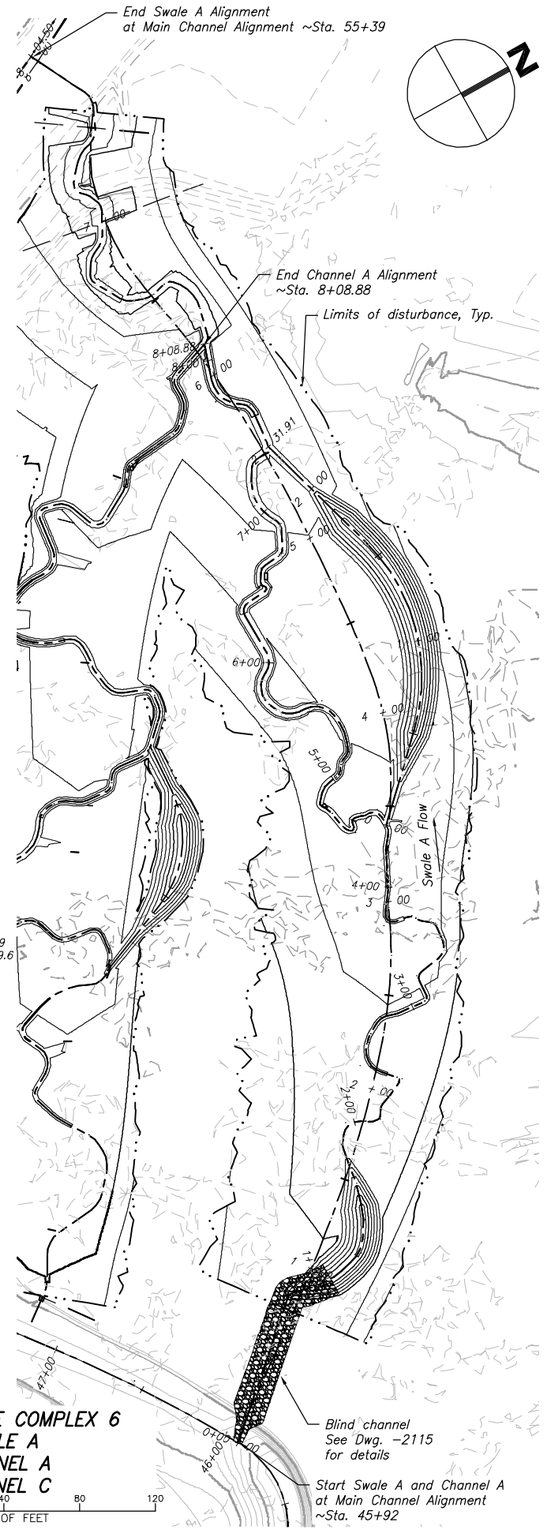
SWALE A PROFILE



CHANNEL A PROFILE



CHANNEL C PROFILE



FLOOD SWALE COMPLEX 6
SWALE A
CHANNEL A
CHANNEL C

40 0 40 80 120
SCALE OF FEET

HORIZONTAL SCALE

VERTICAL SCALE

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

Jeffrey J Fealko P.E.	DESIGNED
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Mike Knutson P.E.	CHECKED
Jeffrey J Fealko P.E.	TECH. APPR.
Steve Montague-Acting	APPROVED
	ADMIN. APPROVAL - PROGRAM MANAGER
BOISE, ID	2015-09-14

FLOOD SWALE COMPLEX 6
SWALE A
CHANNEL A
CHANNEL C

PLAN AND PROFILES

1678-100-2110

SHEET 2 OF 4

DATE AND TIME PLOTTED
AUGUST 14, 2015 14:44
PLOTTED BY
AHATCH

CAD SYSTEM
AutoCAD Rel. 20.0s
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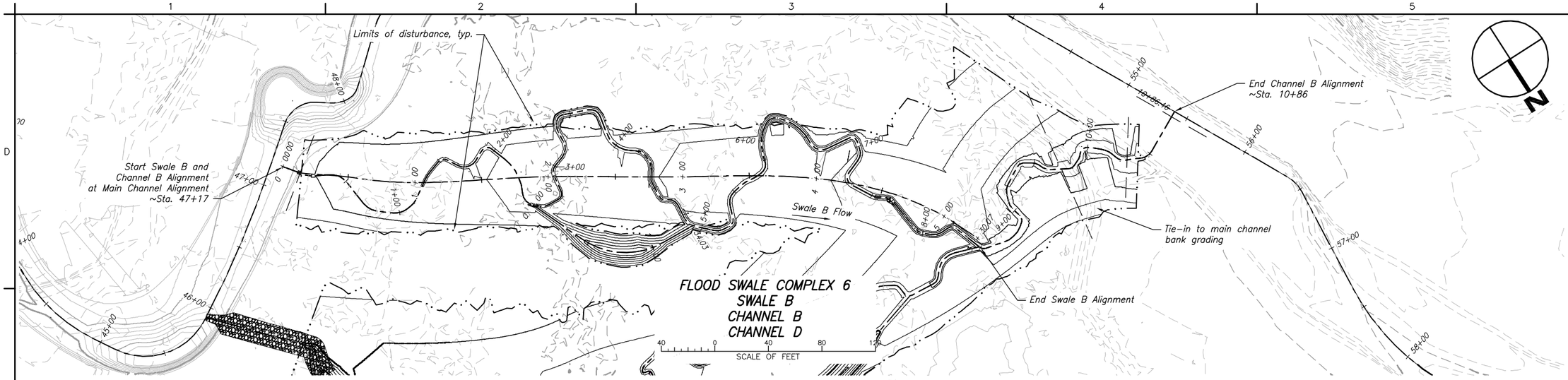
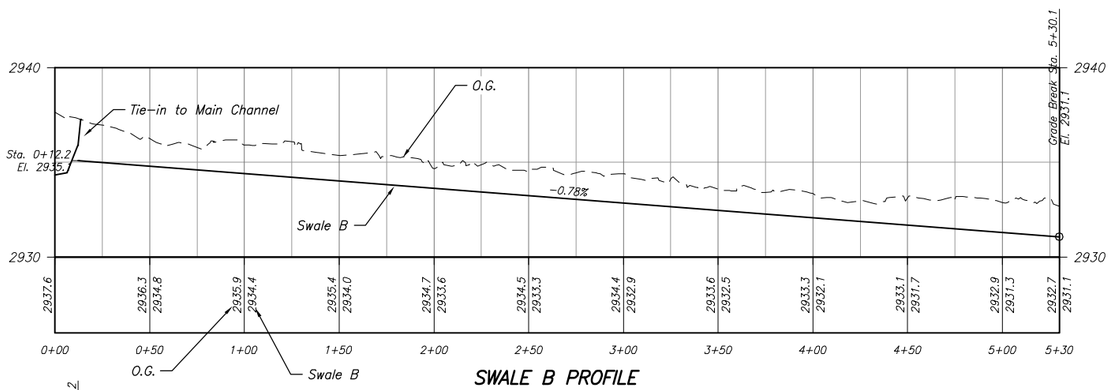
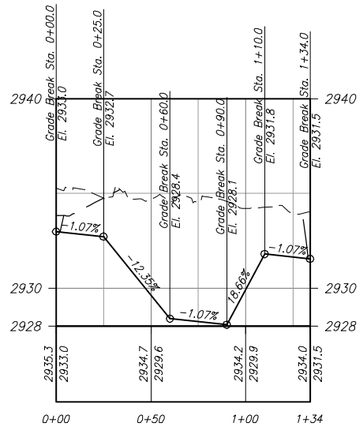
1678-100-SNC6.DWG

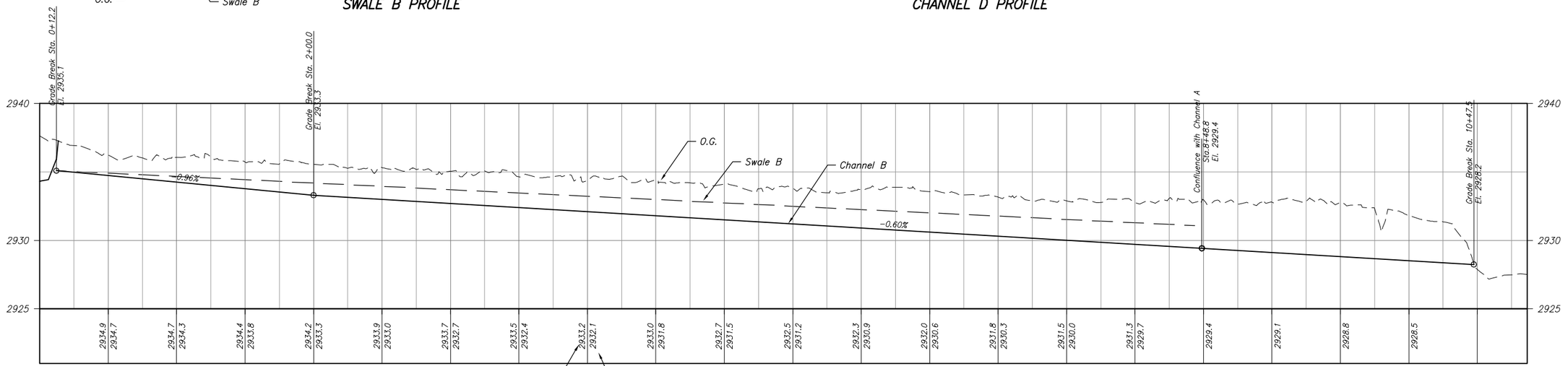




SWALE B PROFILE



CHANNEL D PROFILE



CHANNEL B PROFILE

HORIZONTAL SCALE

VERTICAL SCALE

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

DESIGNED	Jeffrey J Fealko P.E.
DRAWN	DB/AH/JH
CHECKED	Mike Knutson P.E.
TECH. APPR.	Jeffrey J Fealko P.E.
APPROVED ADMIN. APPROVAL - PROGRAM MANAGER	Steve Montague-Acting
BOISE, ID	2015-09-14

FLOOD SWALE COMPLEX 6
SWALE B
CHANNEL B
CHANNEL D

PLAN AND PROFILES

1678-100-2111

SHEET 3 OF 4

DATE AND TIME PLOTTED
AUGUST 14, 2015 14:48
PLOTTED BY
AHATCH

CAD SYSTEM
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CAD FILENAME
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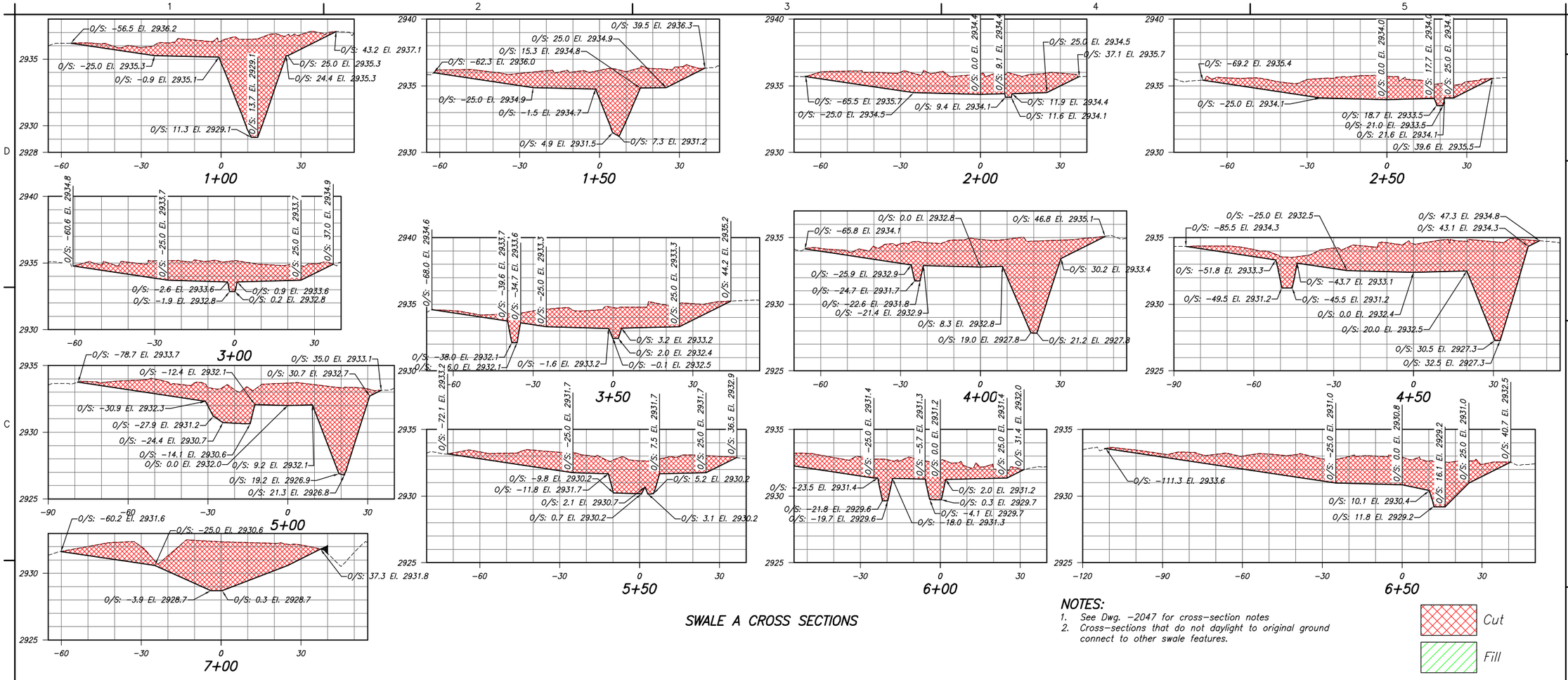
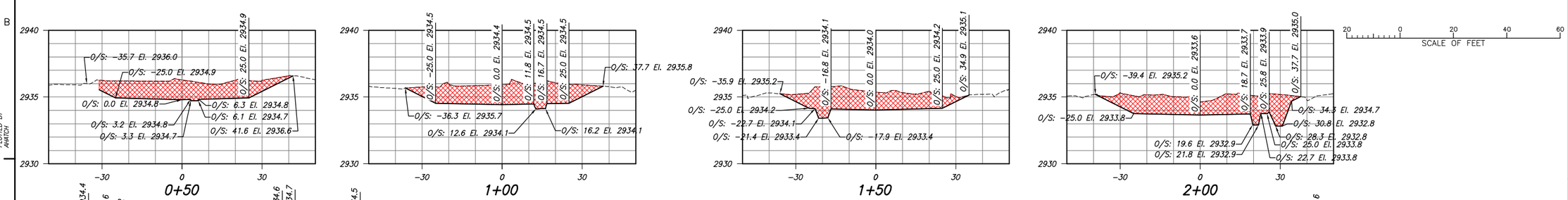


SWALE A CROSS SECTIONS

NOTES:
1. See Dwg. -2047 for cross-section notes
2. Cross-sections that do not daylight to original ground connect to other swale features.

Cut

Fill



SWALE B CROSS SECTIONS

DATE AND TIME PLOTTED: AUGUST 14, 2015 15:04
PLOTTED BY: AHATCH
CAD SYSTEM: AutoCAD Rel. 20.0s
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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

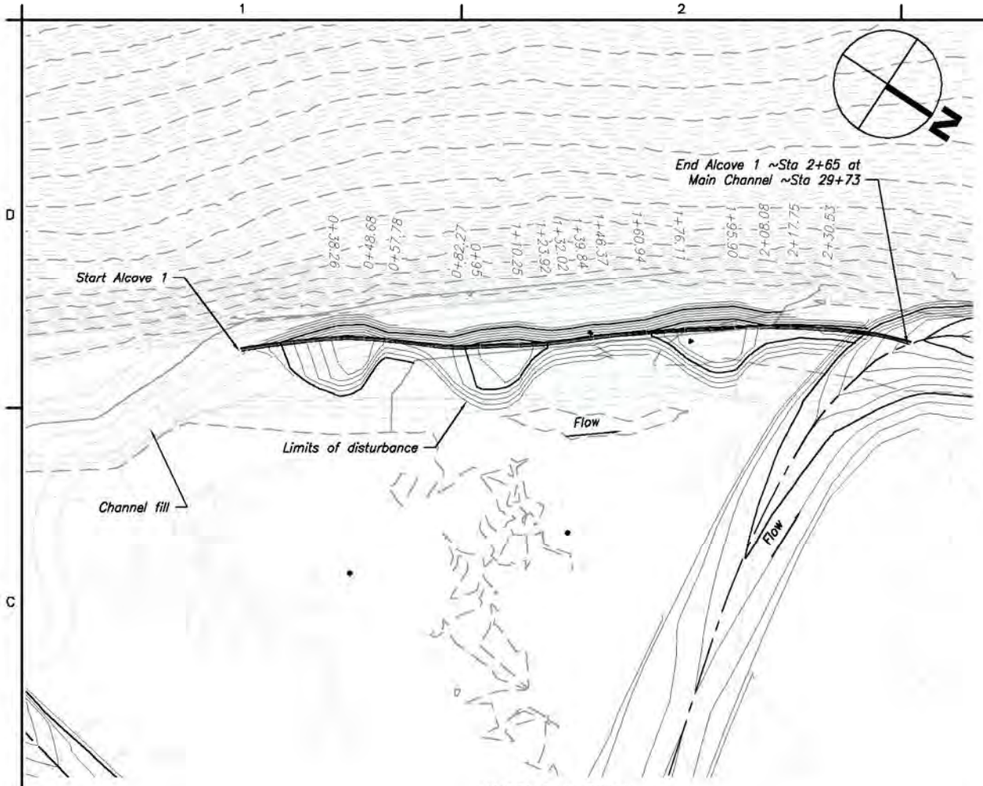
Jeffrey J Fealko P.E.	DESIGNED
DB/AH/JH	DRAWN
Mike Knutson P.E.	CHECKED
Jeffrey J Fealko P.E.	TECH. APPR.
Steve Montague-Acting	APPROVED
ADMIN. APPROVAL - PROGRAM MANAGER	
BOISE, ID	2015-09-14

FLOOD SWALE COMPLEX 6

CROSS SECTIONS

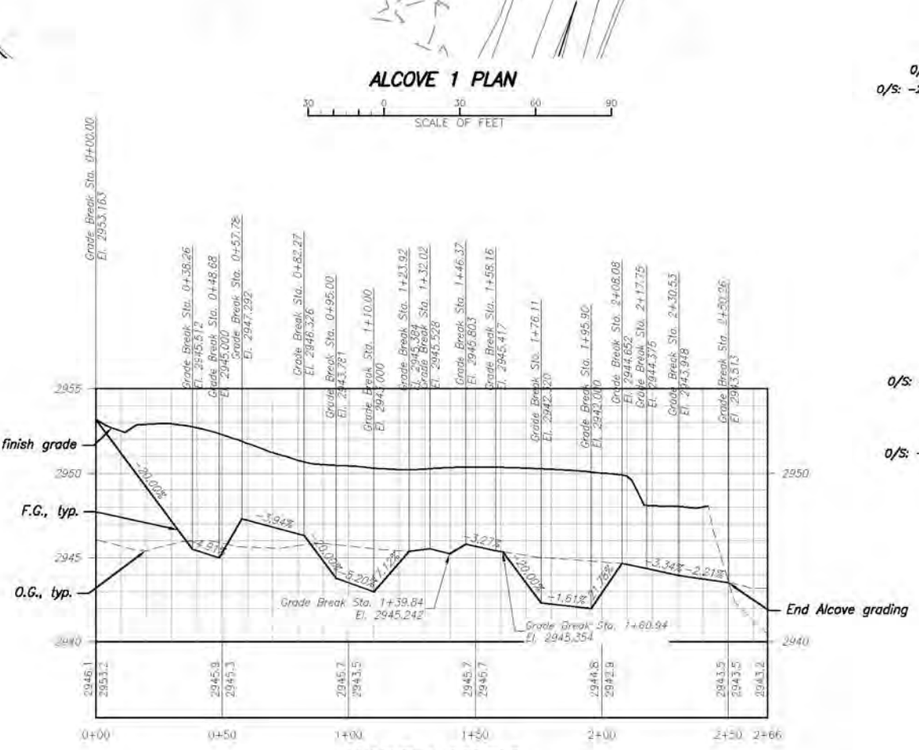
1678-100-2112

SHEET 4 OF 4



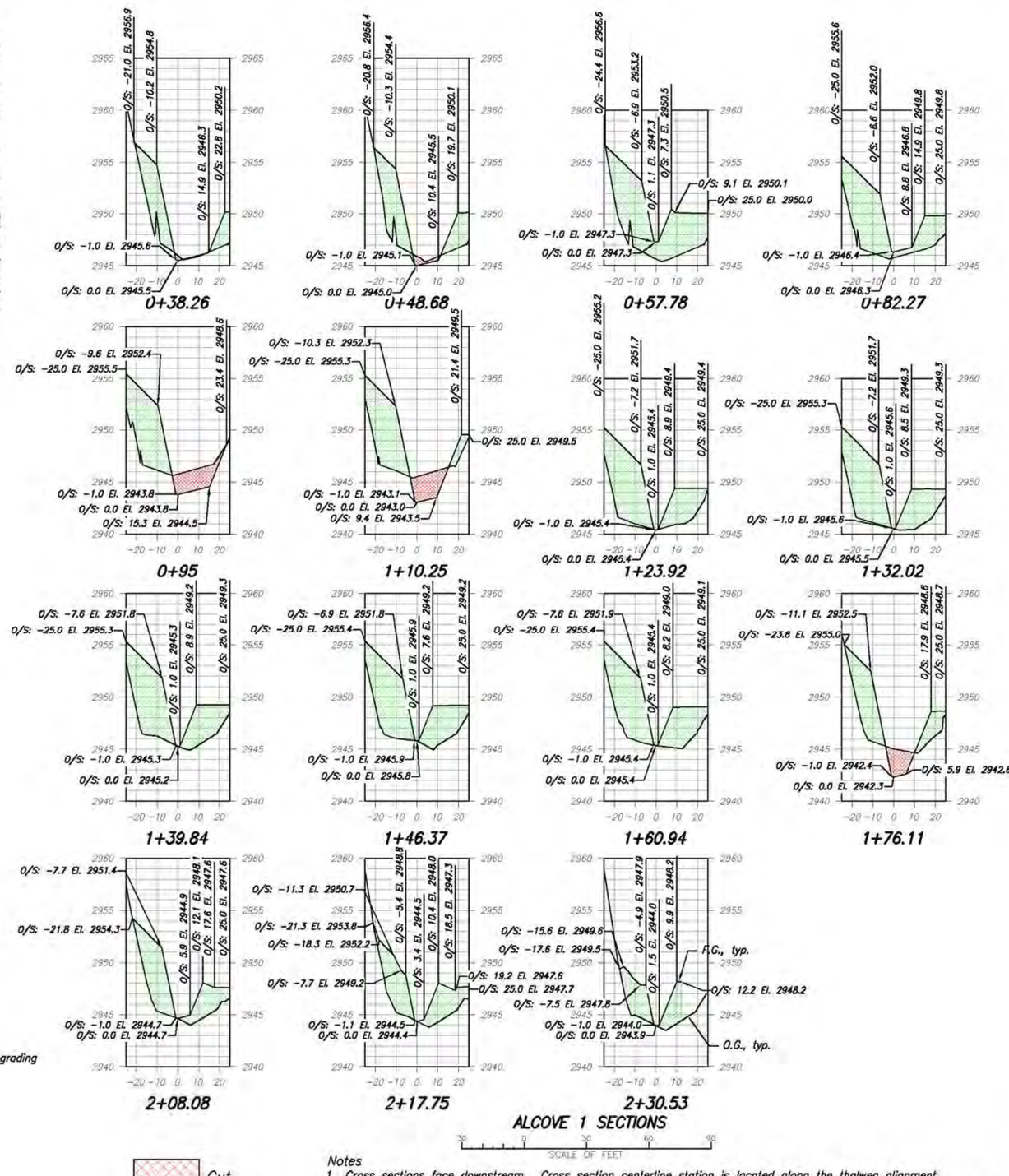
ALCOVE 1 PLAN

SCALE OF FEET



ALCOVE 1 PROFILE

SCALE OF FEET



Cut

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ALCOVE 1 SECTIONS

SCALE OF FEET

Notes

1. Cross sections face downstream. Cross section centerline station is located along the thalweg alignment.
2. Y-axis is elevation, X-axis is distance in feet along a chord perpendicular to the thalweg. The zero station shown on these cross sections represents the thalweg alignment.
3. Constructed channel shall transition smoothly between cross sectional geometries shown within these cross sections. Cross section geometry shown represents one point in a smooth transition.
4. Cross-sections are to be used to stake out the channel offsets at the vertical grade breaks of the channel profile.

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

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KK
DRAWN
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CHECKED
Jeffrey J. Fegitko P.E.
TECH. APPR.
Steve Montague-Acting
APPROVED
(CHIEF, HYDRAUL. + PROGRAM MANAGER)
BOISE, IDAHO 2015-09-14

ALCOVE 1

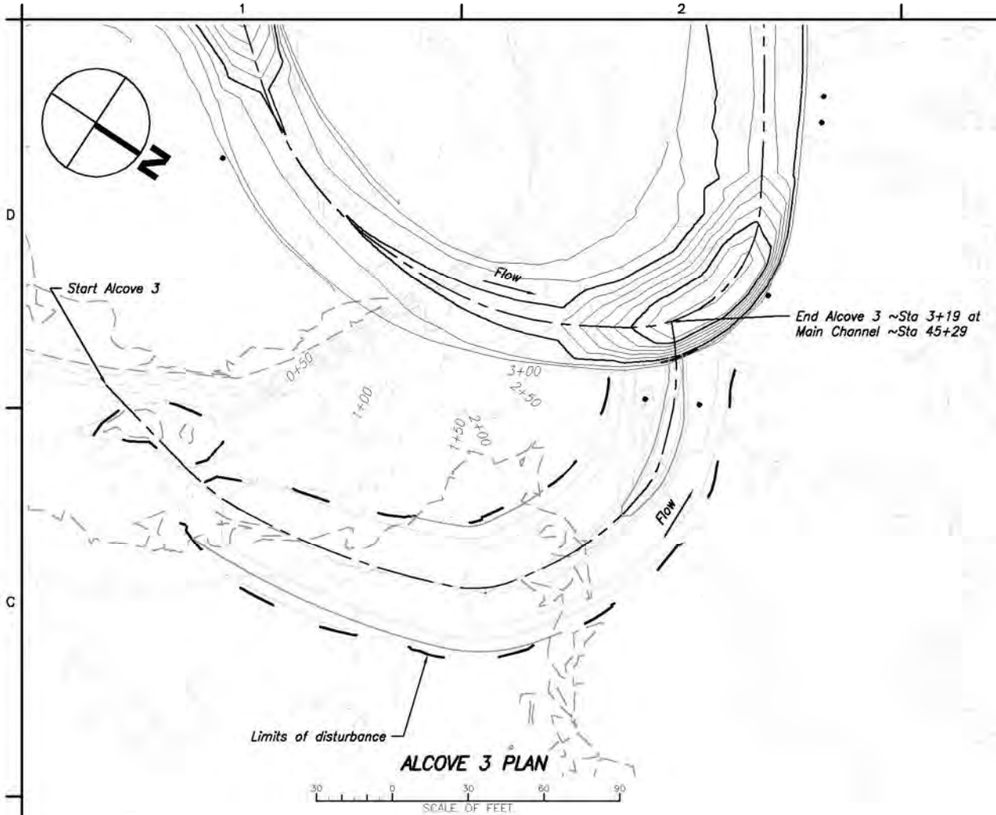
PLAN, PROFILE, AND SECTIONS

1678-100-2113

SHEET 1 OF 1

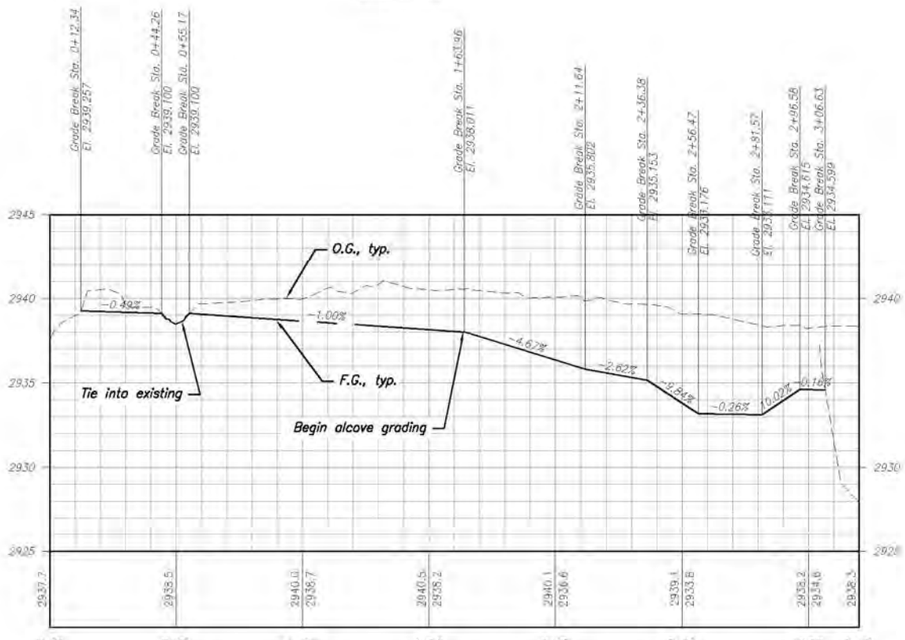
DATE AND TIME PLOTTED:
AUGUST 14, 2015 15:21
PLOTTED BY:
KKORTHALS

CAD SYSTEM
AutoCAD Rel. 20.0s
CAD FILENAME
1678-100-4C.dwg



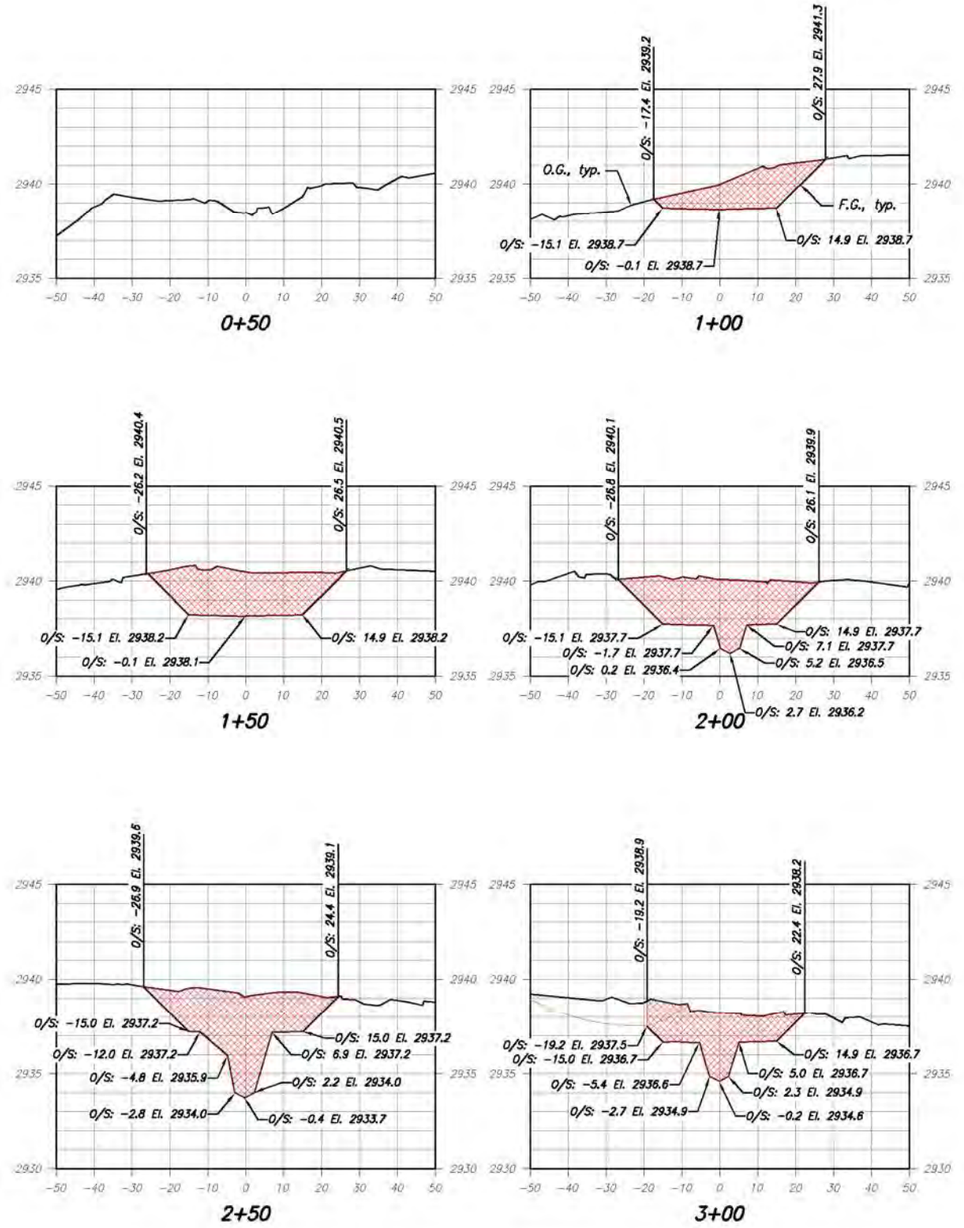
ALCOVE 3 PLAN

SCALE OF FEET



ALCOVE 3 PROFILE

SCALE OF FEET



ALCOVE 3 SECTIONS

SCALE OF FEET

Cut

Fill

NOTES:

1. Cross sections face downstream. Cross section centerline station is located along the thalweg alignment.
2. Y-axis is elevation, X-axis is distance in feet along a chord perpendicular to the thalweg. The zero station shown on these cross sections represents the thalweg alignment.
3. Constructed channel shall transition smoothly between cross sectional geometries shown within these cross sections. Cross section geometry shown represents one point in a smooth transition.
4. Cross-sections are to be used to stake out the channel offsets at the vertical grade breaks of the channel profile.

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

Jeffrey J. Fealko P.E.	DESIGNED
KH	DRAWN
Mike Knutson P.E.	CHECKED
Jeffrey J. Fealko P.E.	TECH. APPR.
Steve Montague–Acting	APPROVED (CMH APPROVAL - PROGRAM MANAGER)
BOISE, IDAHO	2015-09-14

ALCOVE 3

PLAN, PROFILE, AND SECTIONS

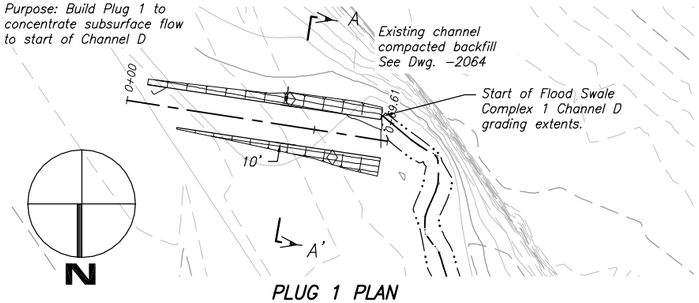
1678–100–2114

SHEET 1 OF 1

DATE AND TIME PLOTTED: AUGUST 14, 2015 15:28
PLOTTED BY: JHOVDE

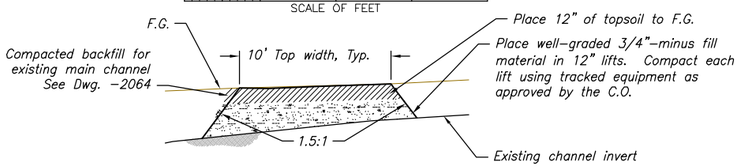
CAD SYSTEM: AutoCAD Rel. 20.0s
DRG. FILENAME: 1678-100-4C.DWG

Purpose: Build Plug 1 to concentrate subsurface flow to start of Channel D



PLUG 1 PLAN

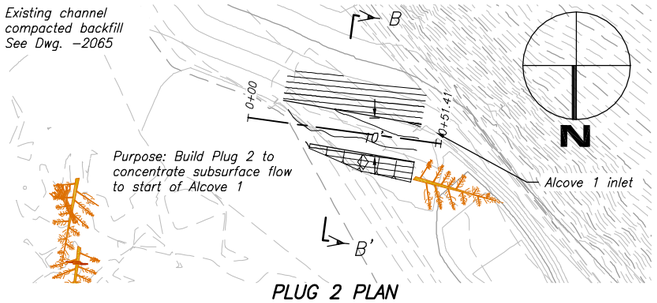
SCALE OF FEET: 10 0 10 20 30



PLUG 1 SECTION A–A'

NOT TO SCALE

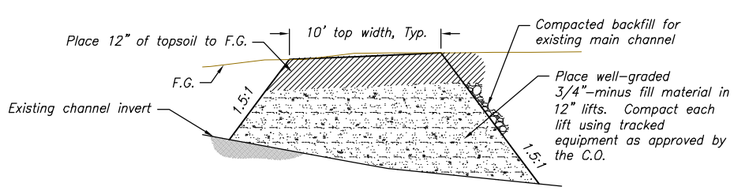
Existing channel compacted backfill See Dwg. –2065



Purpose: Build Plug 2 to concentrate subsurface flow to start of Alcove 1

PLUG 2 PLAN

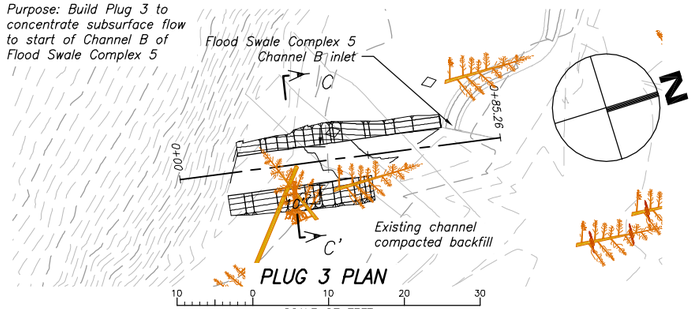
SCALE OF FEET: 10 0 10 20 30



PLUG 2 SECTION B–B'

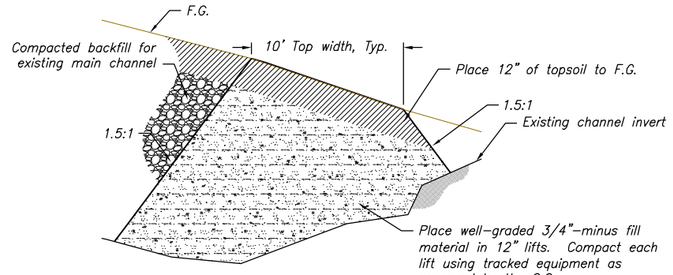
NOT TO SCALE

Purpose: Build Plug 3 to concentrate subsurface flow to start of Channel B of Flood Swale Complex 5



PLUG 3 PLAN

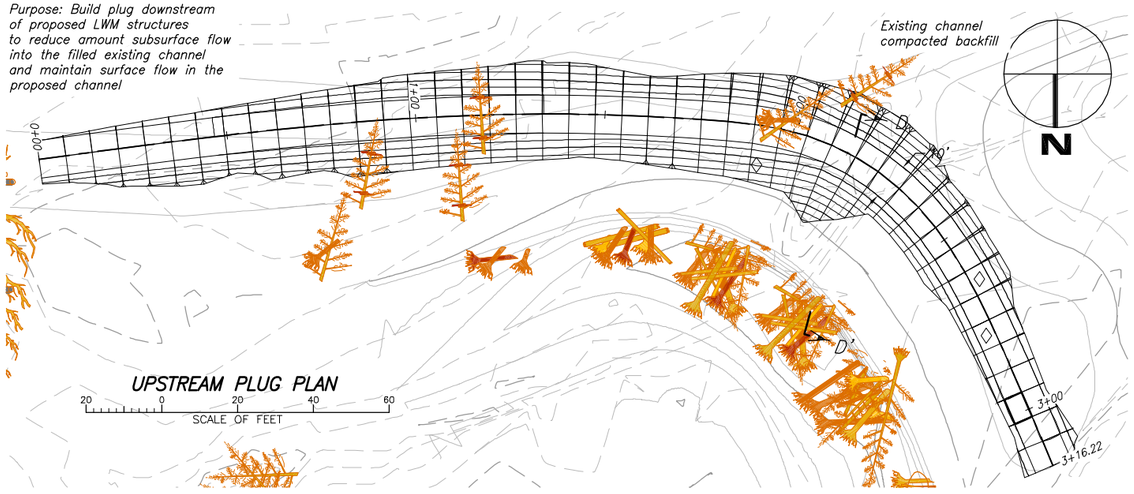
SCALE OF FEET: 10 0 10 20 30



PLUG 3 SECTION C–C'

NOT TO SCALE

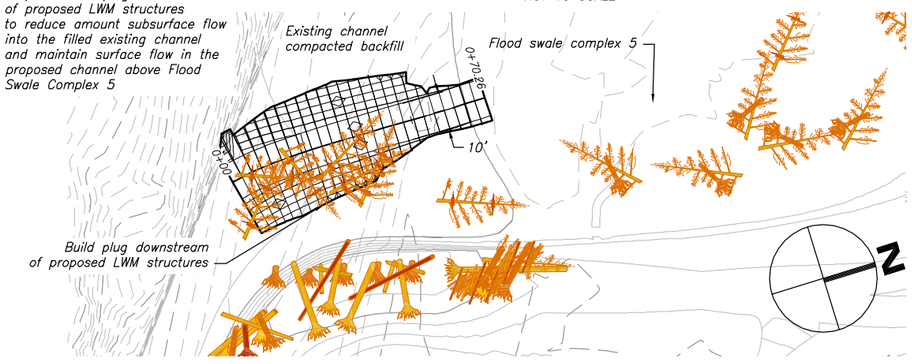
Purpose: Build plug downstream of proposed LWM structures to reduce amount subsurface flow into the filled existing channel and maintain surface flow in the proposed channel



UPSTREAM PLUG PLAN

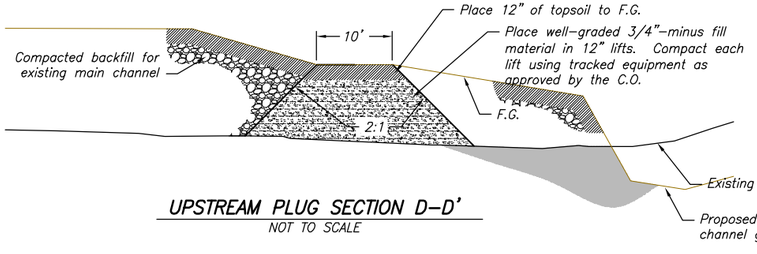
SCALE OF FEET: 20 0 20 40 60

Purpose: Build plug downstream of proposed LWM structures to reduce amount subsurface flow into the filled existing channel and maintain surface flow in the proposed channel above Flood Swale Complex 5



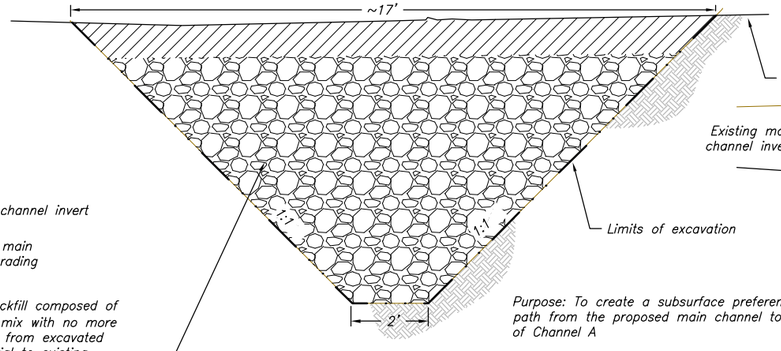
DOWNSTREAM PLUG PLAN

SCALE OF FEET: 20 0 20 40 60



UPSTREAM PLUG SECTION D–D'

NOT TO SCALE

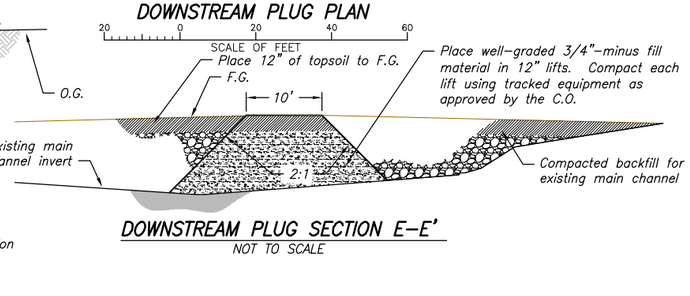


Compacted backfill composed of gravel/cobble mix with no more than 5% fines from excavated channel material to existing floodplain elevation. Place material in 12" lifts and compact using tracked equipment as approved by the C.O.

Purpose: To create a subsurface preferential flow path from the proposed main channel to the inlet of Channel A

BLIND CHANNEL
FLOOD SWALE COMPLEX 6 SWALE A/CHANNEL A
TYPICAL SECTION

NOT TO SCALE



DOWNSTREAM PLUG SECTION E–E'

NOT TO SCALE

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COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

Jeffrey J. Fealko, P.E.
DESIGNED
DB
DRAWN
Mike Knutson, P.E.
CHECKED
Jeffrey J. Fealko, P.E.
TECH. APPR.
Steve Montague, P.E. – Acting
APPROVED
ADMIN. APPROVAL – PROGRAM MANAGER
BOISE, ID
2015–09–14

EXISTING CHANNEL FILL PLUGS AND BLIND CHANNEL

DETAILS

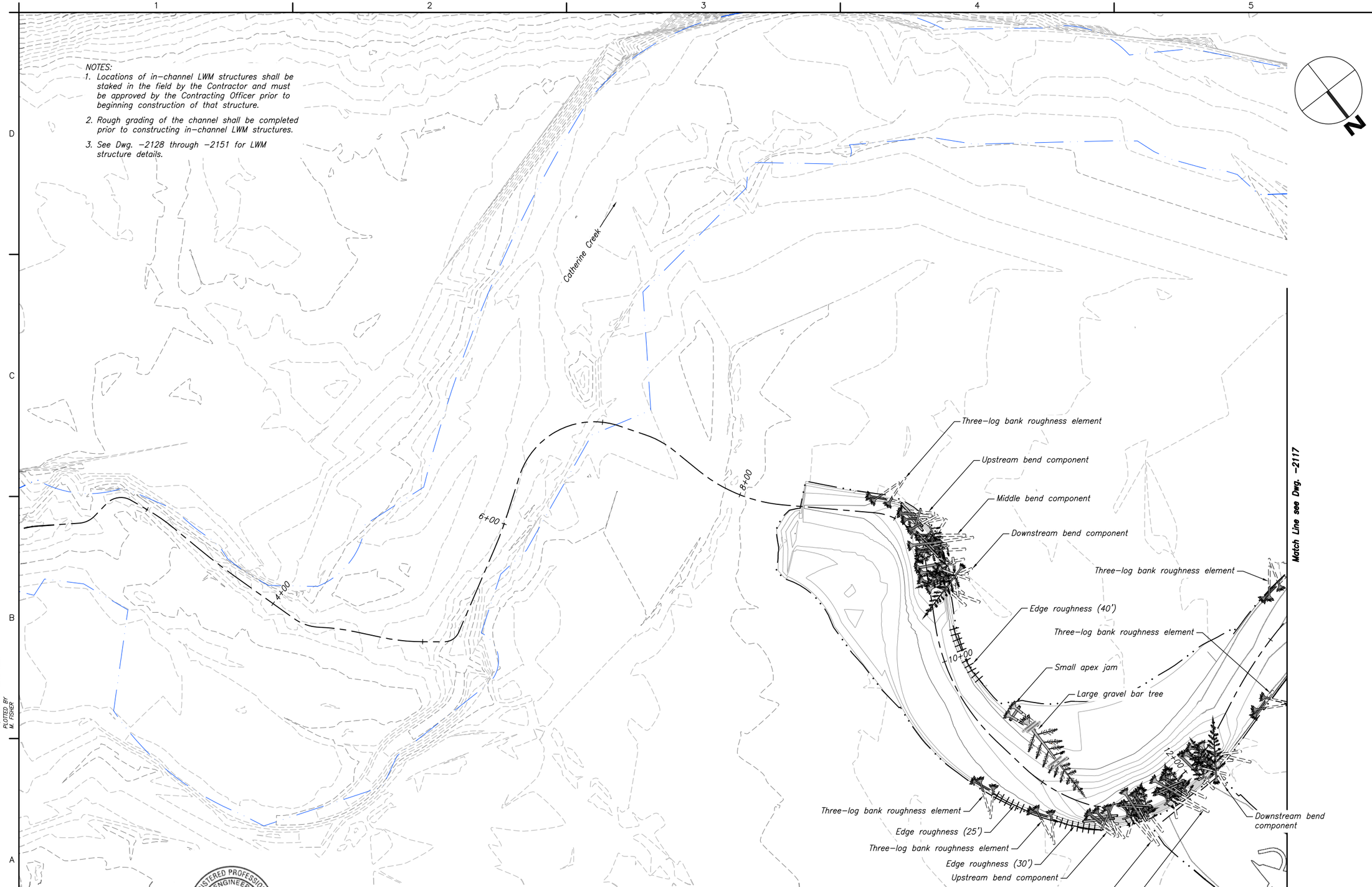
1678–100–2115

SHEET 1 OF 1

DATE AND TIME PLOTTED
Not Plotted
PLOTTED BY
Not Plotted

CAD SYSTEM
AUTOCAD
CAD FILENAME
UNKNOWN

NOTES:
1. Locations of in-channel LWM structures shall be staked in the field by the Contractor and must be approved by the Contracting Officer prior to beginning construction of that structure.
2. Rough grading of the channel shall be completed prior to constructing in-channel LWM structures.
3. See Dwg. -2128 through -2151 for LWM structure details.



LWM PLAN YEAR 1 2+50 TO 13+00

30 0 30 60 90
SCALE OF FEET

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
9/11/15
RENEWAL DATE: 12/31/2015

DATE AND TIME PLOTTED: September 11, 2015 15:01
PLOTTED BY: M. FISHER

CAD SYSTEM: AutoCAD Civil 3D 2014
CAD FILENAME: CC44_Parcel_3_LWM_Plan.dwg

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Managing Water in the West

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

X Jay Hovde
ACCEPTED

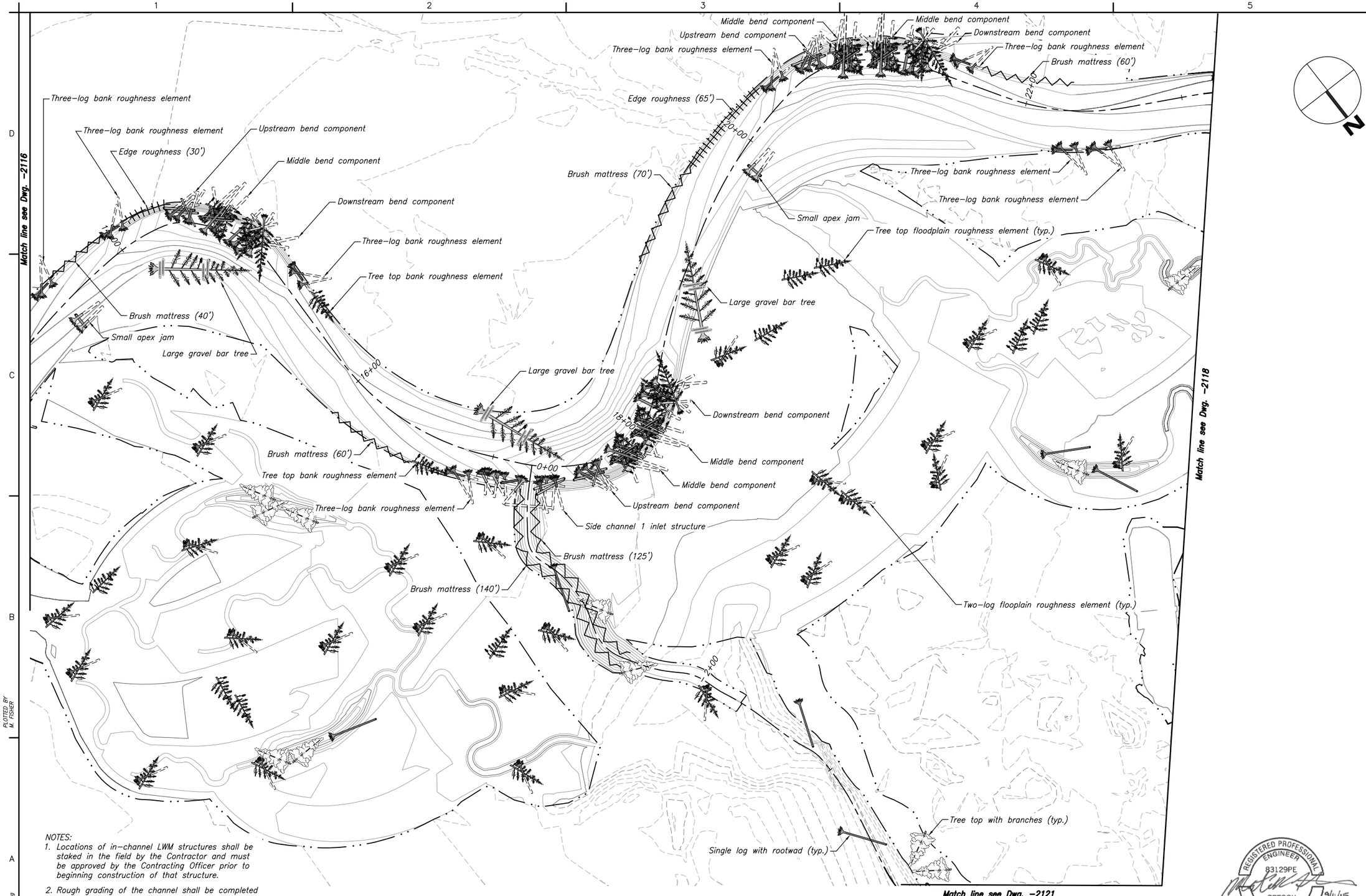
BOISE, ID 2015-09-11

LWM PLAN

YEAR 1
2+50 TO 13+00

1678-100-2116

SHEET 1 OF 12



NOTES:

1. Locations of in-channel LWM structures shall be staked in the field by the Contractor and must be approved by the Contracting Officer prior to beginning construction of that structure.
2. Rough grading of the channel shall be completed prior to constructing in-channel LWM structures.
3. See Dwg. -2128 through -2151 for LWM structure details.
4. Floodplain and side channel LWM shall be placed as directed by the Contracting Officer; no survey staking is required.

LWM PLAN YEAR 1 13+00 TO 23+00

30 0 30 60 90

SCALE OF FEET

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
9/11/15

RENEWAL DATE: 12/31/2015

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GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

X Jay Hovde
ACCEPTED

BOISE, ID 2015-09-11

LWM PLAN

YEAR 1
13+00 TO 23+00

1678-100-2117

SHEET 2 OF 12

DATE AND TIME PLOTTED
September 11, 2015 15:01
PLOTTED BY
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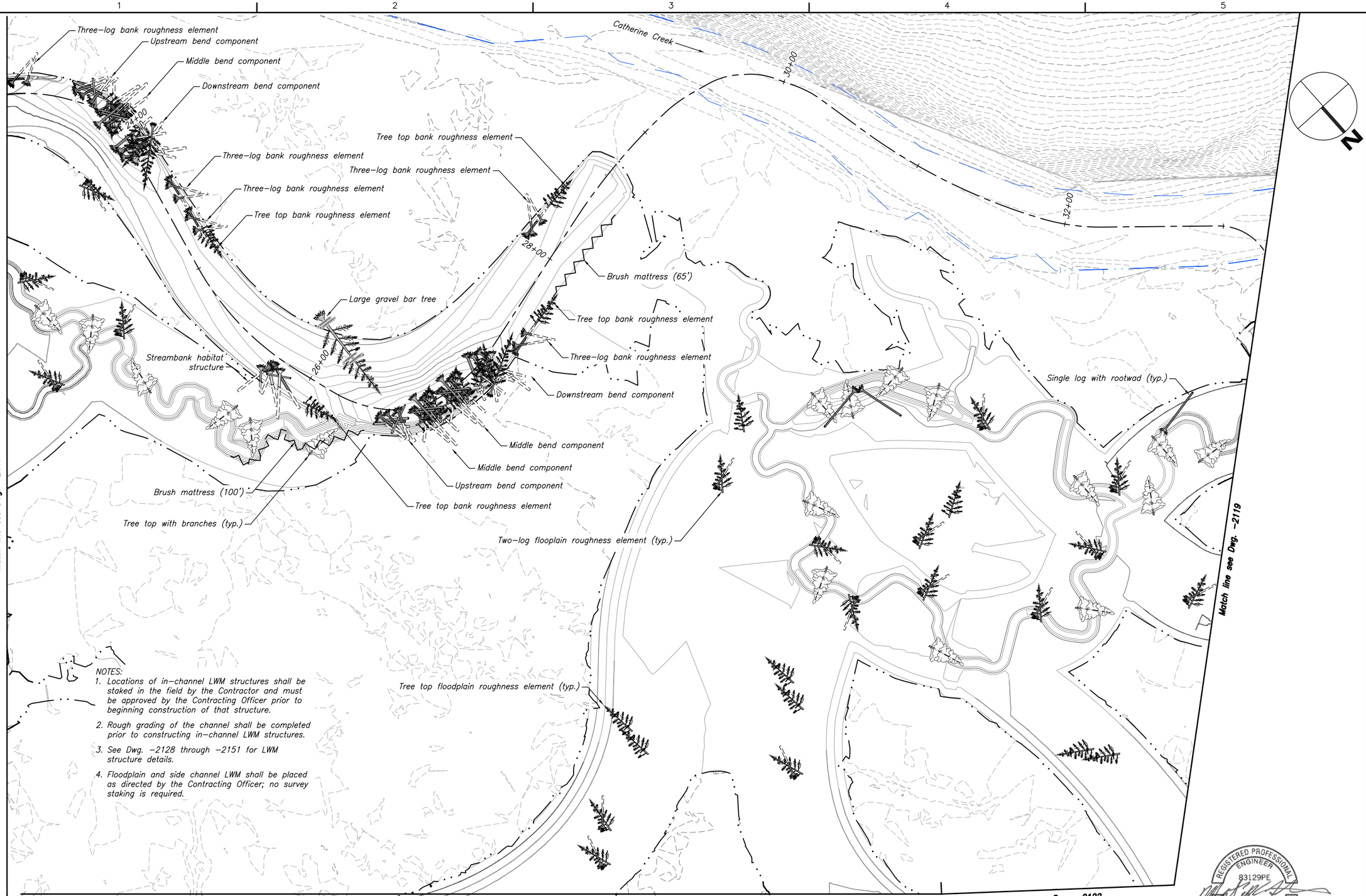
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Parcel_3_LWM_Plan.dwg



NOTES:

1. Locations of in–channel LWM structures shall be staked in the field by the Contractor and must be approved by the Contracting Officer prior to beginning construction of that structure.
2. Rough grading of the channel shall be completed prior to constructing in–channel LWM structures.
3. See Dwg. –2128 through –2151 for LWM structure details.
4. Floodplain and side channel LWM shall be placed as directed by the Contracting Officer; no survey staking is required.

LWM PLAN YEAR 1 23+00 TO 33+00

30 0 30 60 90
SCALE OF FEET

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2006
MARTIN K. FISHER
9/11/15

RENEWAL DATE: 12/31/2015

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GRANDE RONDE SUBBASIN

CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015–09–11

LWM PLAN

YEAR 1
23+00 TO 33+00

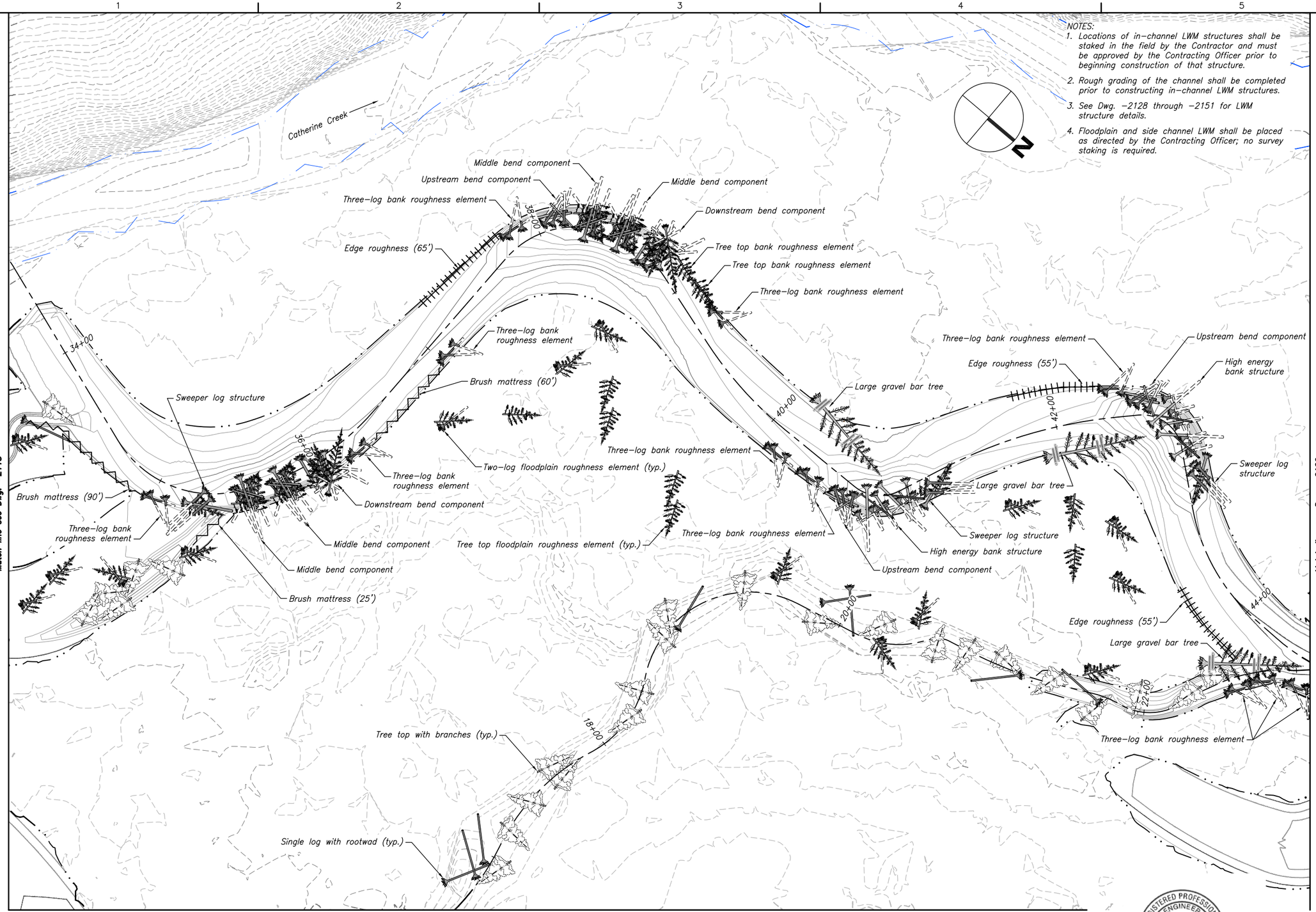
1678–100–2118

SHEET 3 OF 12

DATE AND TIME PLOTTED
September 11, 2015 15:01
PLOTTED BY
M. FISHER

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Parcel_3_LWM_Plan.dwg

NOTES:
1. Locations of in-channel LWM structures shall be staked in the field by the Contractor and must be approved by the Contracting Officer prior to beginning construction of that structure.
2. Rough grading of the channel shall be completed prior to constructing in-channel LWM structures.
3. See Dwg. -2128 through -2151 for LWM structure details.
4. Floodplain and side channel LWM shall be placed as directed by the Contracting Officer; no survey staking is required.



LWM PLAN YEAR 1 33+00 TO 44+50

30 0 30 60 90
SCALE OF FEET

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
9/11/15
RENEWAL DATE: 12/31/2015

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CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015-09-11

LWM PLAN

YEAR 1
33+00 TO 44+50

1678-100-2119

SHEET 4 OF 12

DATE AND TIME PLOTTED
September 11, 2015 15:01
PLOTTED BY
M. FISHER

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Parcel_3_LWM_Plan.dwg

Catherine Creek

50+00

48+00

46+00

High energy bank structure

Middle bend component

Upstream bend component

Three–log bank roughness element

Three–log bank roughness element

Large gravel bar tree

Small apex jam

Tree top bank roughness element

Three–log bank roughness element

Brush mattress (50')

Large gravel bar tree

Edge roughness (40')

Downstream bend component

Middle bend component

Upstream bend component

Three log bank roughness element

Streambank habitat structure

Edge roughness (60')

Tree top floodplain roughness element (typ.)

Two–log floodplain roughness element (typ.)

Tree top with branches (typ.)

Match line see Dwg. –2119

N

NOTES:

1. Locations of in–channel LWM structures shall be staked in the field by the Contractor and must be approved by the Contracting Officer prior to beginning construction of that structure.
2. Rough grading of the channel shall be completed prior to constructing in–channel LWM structures.
3. See Dwg. –2128 through –2151 for LWM structure details.
4. Floodplain and side channel LWM shall be placed as directed by the Contracting Officer; no survey staking is required.

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
9/14/15

RENEWAL DATE: 12/31/2015

LWM PLAN YEAR 1 44+50 TO 51+00

30 0 30 60 90
SCALE OF FEET

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CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

X Jay Hovde
ACCEPTED

BOISE, ID 2015–09–11

LWM PLAN

YEAR 1
44+50 TO 51+00

1678–100–2120

SHEET 5 OF 12

DATE AND TIME PLOTTED
September 11, 2015 15:01
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M. FISHER

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AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Parcel_3_LWM_Plan.dwg

Match line see Dwg. –2117

Match line see Dwg. –2118

4+00

6+00

8+00

10+00

12+00

Tree top with branches (typ.)

Single log with rootwad (typ.)

Two–log floodplain roughness element (typ.)

Tree top floodplain roughness element (typ.)

Small apex jam

N

Match line see Dwg. –2122

NOTES:
1. See Dwg. –2128 through –2151 for LWM structure details.
2. Floodplain and side channel LWM shall be placed as directed by the Contracting Officer; no survey staking is required.

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2006
MARTIN K. FISHER
3/11/15

RENEWAL DATE: 12/31/2015

LWM PLAN YEAR 1 SIDE CHANNEL 1

30 0 30 60 90
SCALE OF FEET

DATE AND TIME PLOTTED
September 11, 2015 15:02
PLOTTED BY
M. FISHER

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Parcel_3_LWM_Plan.dwg

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CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

X Jay Hovde
ACCEPTED

BOISE, ID 2015–09–11

LWM PLAN

YEAR 1
SIDE CHANNEL 1

1678–100–2121

SHEET 6 OF 12

Match line see Dwg. –2118

Match line see Dwg. –2119

Match line see Dwg. –2121

14+00

16+00

Single log with rootwad (typ.)

Tree top with branches (typ.)

NOTES:
1. See Dwg. –2128 through –2151 for LWM structure details.
2. Floodplain and side channel LWM shall be placed as directed by the Contracting Officer; no survey staking is required.

LWM PLAN YEAR 1 SIDE CHANNEL 1

30 0 30 60 90
SCALE OF FEET

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
9/14/15
RENEWAL DATE: 12/31/2015

N

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CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

X Jay Hovde
ACCEPTED

BOISE, ID 2015–09–11

LWM PLAN

YEAR 1
SIDE CHANNEL 1

1678–100–2122

SHEET 7 OF 12

DATE AND TIME PLOTTED
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PLOTTED BY
M. FISHER

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Parcel_3_LWM_Plan.dwg

Tree top floodplain roughness element (typ.)

Two–log floodplain roughness element (typ.)

Middle bend component

Middle bend component

Upstream bend component

Three log bank roughness element

Three log bank roughness element

Downstream bend component

Streambank habitat structure

Edge roughness (55')

8+00

6+00

4+00

Large gravel bar tree

Brush mattress (80')

Large gravel bar tree

Place 4 full trees 25' (min.) length with branches on top of existing LWM jam as directed by the C.O., no excavation shall be preformed, care shall be taken to avoid damage to existing trees and the existing LWM jam.

Upstream bend component

Upstream bend component

Tree top with branches (typ.)

14+00

10+00

12+00

Year 1 LWM structure (typ.)

Match line see Dwg. –2124

N

NOTES:

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3. See Dwg. –2128 through –2151 for LWM structure details.
4. Floodplain and side channel LWM shall be placed as directed by the Contracting Officer; no survey staking is required.

LWM PLAN YEAR 2 3+00 TO 14+25

30 0 30 60 90

SCALE OF FEET

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
9/11/15

RENEWAL DATE: 12/31/2015

DATE AND TIME PLOTTED
September 11, 2015 15:08
PLOTTED BY
M. FISHER

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Parcel_3_LWM_Plan_Yr2.dwg

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GRANDE RONDE SUBBASIN
CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

x Jay Hovde
ACCEPTED

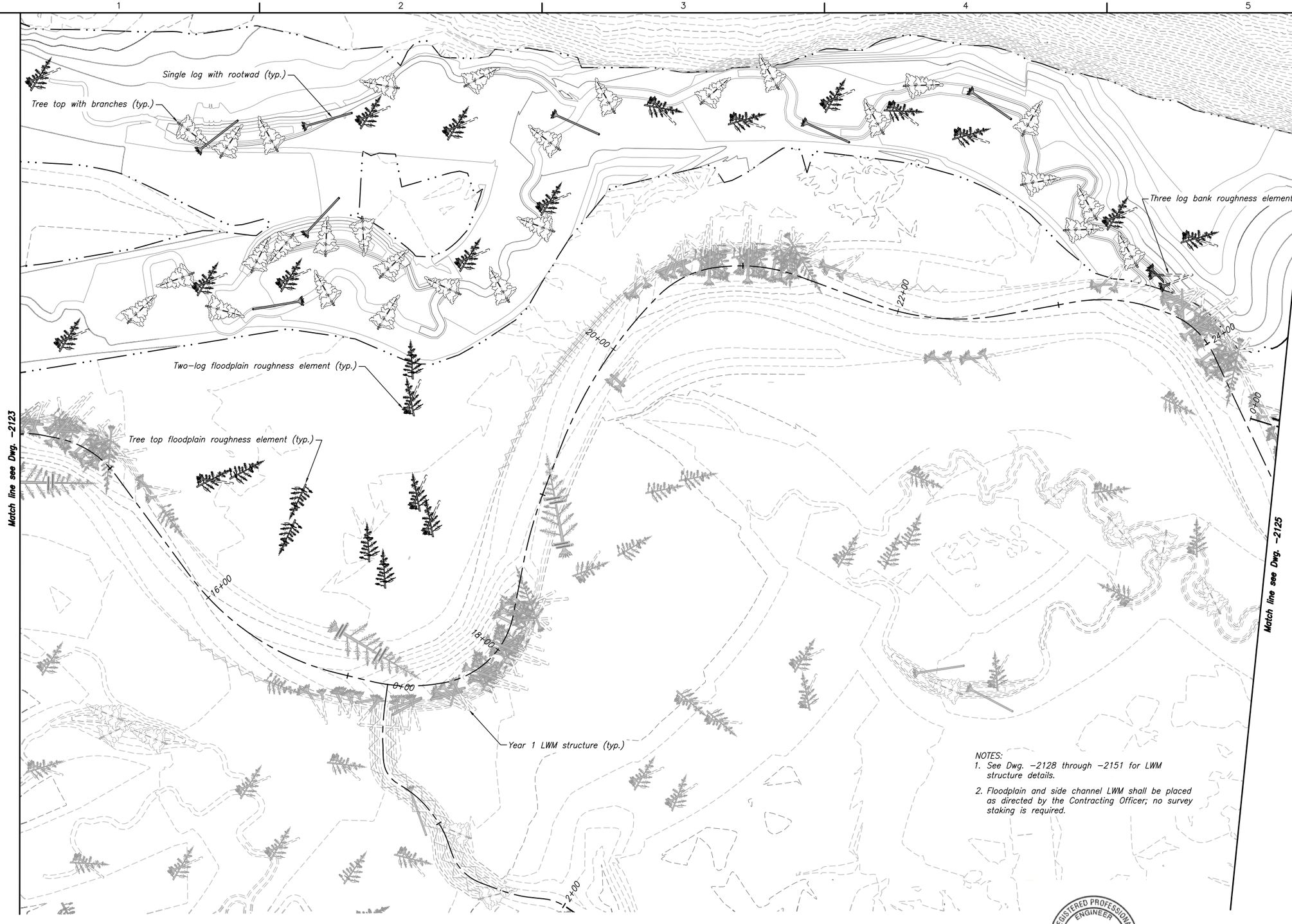
BOISE, ID 2015–09–11

LWM PLAN

YEAR 2
3+00 TO 14+25

1678–100–2123

SHEET 8 OF 12



NOTES:
1. See Dwg. -2128 through -2151 for LWM structure details.
2. Floodplain and side channel LWM shall be placed as directed by the Contracting Officer; no survey staking is required.

LWM PLAN YEAR 2 14+25 TO 25+00

30 0 30 60 90
SCALE OF FEET

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
9/14/15
RENEWAL DATE: 12/31/2015

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GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015-09-11

LWM PLAN

YEAR 2
14+25 TO 25+00

1678-100-2124

SHEET 9 OF 12

DATE AND TIME PLOTTED
September 11, 2015 15:09
PLOTTED BY
M. FISHER

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Parcel_3_LWM_Plan_Yr2.dwg

NOTES:
1. Locations of in-channel LWM structures shall be staked in the field by the Contractor and must be approved by the Contracting Officer prior to beginning construction of that structure.
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3. See Dwg. -2128 through -2151 for LWM structure details.
4. Floodplain and side channel LWM shall be placed as directed by the Contracting Officer; no survey staking is required.

N

Single log with rootwad (typ.)
Tree top with branches (typ.)
Streambank habitat structure
Two-log floodplain roughness element (typ.)
Three log bank roughness element
Sweeper log structure
30+00
Habitat boulder, 2'-4' diameter, embed ⅓ - ½ of diameter (12 total this sheet)
32+00
Upstream bend component
Field-fit on-site walnut tree
Edge roughness (50')
Brush mattress (40')
Field-fit on-site walnut tree
Tree top floodplain roughness element (typ.)
Brush mattress (45')
Brush mattress (45')
28+00
High energy bank structure
Sweeper log structure
Large gravel bar tree
34+00
Small apex jam
26+00
Year 1 LWM structure (typ.)

Match line see Dwg. -2124

Match line see Dwg. -2126

LWM PLAN YEAR 2 25+00 TO 35+50

30 0 30 60 90
SCALE OF FEET

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
9/11/15
RENEWAL DATE: 12/31/2015

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COLUMBIA/SNAKE RIVER SALMON RECOVERY GROUP
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015-09-11

LWM PLAN

YEAR 2
25+00 TO 35+50

1678-100-2125
SHEET 10 OF 12

DATE AND TIME PLOTTED
September 11, 2015 15:09
PLOTTED BY
M. FISHER

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Parcel_3_LWM_Plan_Yr2.dwg

NOTES:
1. See Dwg. –2128 through –2151 for LWM structure details.
2. Floodplain and side channel LWM shall be placed as directed by the Contracting Officer; no survey staking is required.

Match line see Dwg. –2125

Tree top floodplain roughness element (typ.)

Tree top with branches (typ.)

Single log with rootwad (typ.)

Two–log floodplain roughness element (typ.)

Brush mattress (30')

38+00

36+00

40+00

42+00

20+00

Year 1 LWM structure (typ.)

N

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2006
MARTIN K. FISHER
9/14/15

RENEWAL DATE: 12/31/2015

LWM PLAN YEAR 2 35+50 TO 44+00

30 0 30 60 90
SCALE OF FEET

DATE AND TIME PLOTTED
September 11, 2015 15:09
PLOTTED BY
M. FISHER

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Parcel_3_LWM_Plan_Yr2.dwg

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CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015–09–11

LWM PLAN

YEAR 2
35+50 TO 44+00

1678–100–2126

SHEET 11 OF 12

NOTES:
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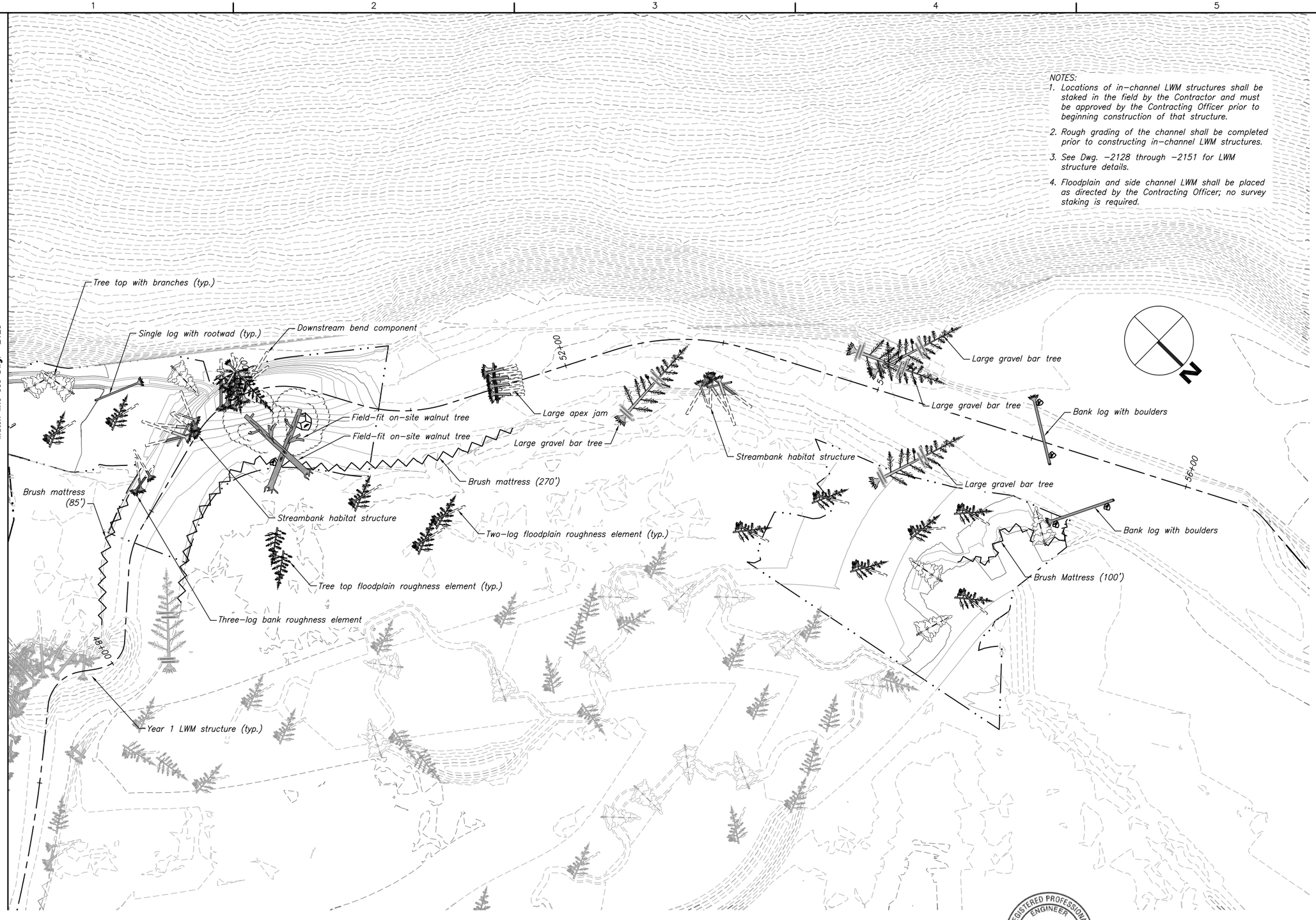
3. See Dwg. -2128 through -2151 for LWM structure details.
4. Floodplain and side channel LWM shall be placed as directed by the Contracting Officer; no survey staking is required.



LWM PLAN YEAR 2 46+25 TO 57+00

30 0 30 60 90
SCALE OF FEET

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2006
MARTIN K. FISHER
9/11/15

RENEWAL DATE: 12/31/2015

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GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

X Jay Hovde
ACCEPTED

BOISE, ID 2015-09-11

LWM PLAN

YEAR 2
46+25 TO 57+00

1678-100-2127

SHEET 12 OF 12

DATE AND TIME PLOTTED
September 11, 2015 15:09
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M. FISHER

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CAD FILENAME
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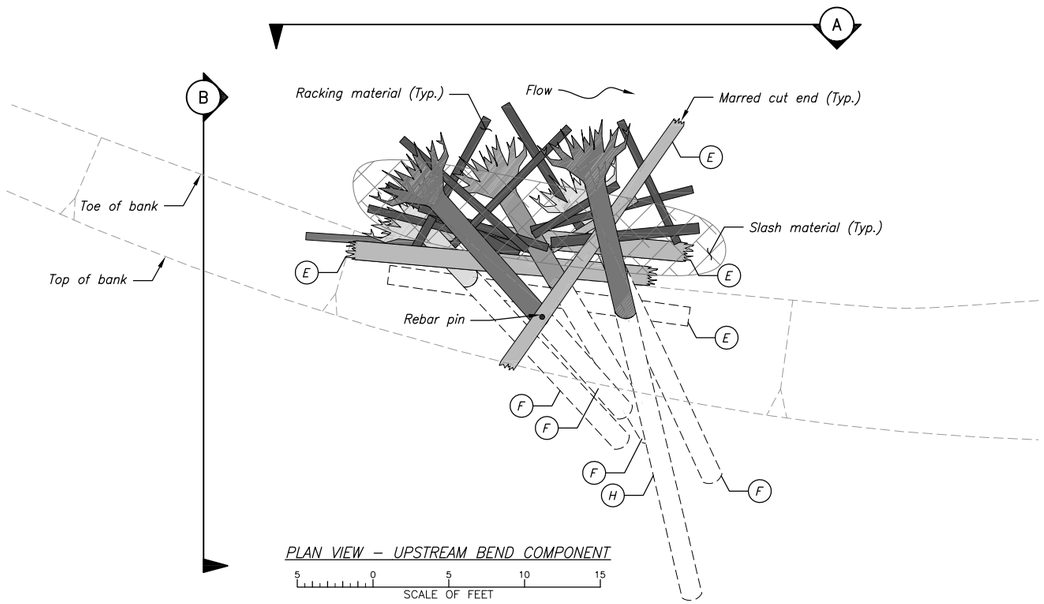
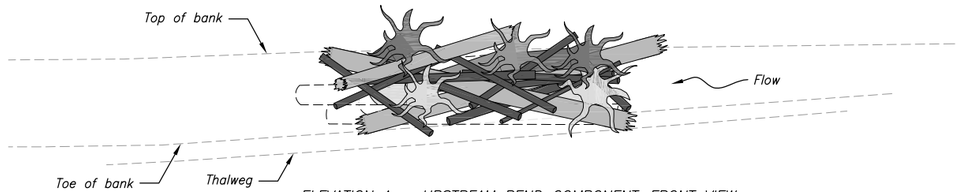


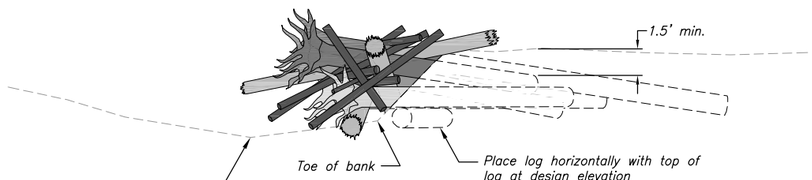
PLAN VIEW – UPSTREAM BEND COMPONENT

5 0 5 10 15
SCALE OF FEET



ELEVATION A – UPSTREAM BEND COMPONENT FRONT VIEW

5 0 5 10 15
SCALE OF FEET



ELEVATION B – UPSTREAM BEND COMPONENT SIDE VIEW

5 0 5 10 15
SCALE OF FEET

NOTES:

1. All logs shall come from fir, pine, or spruce trees.
2. The diameter of logs without rootwads shall be measured at the smallest cut end.
3. The exact location of each upstream bend component shall be staked by the Contractor and approved by the Contracting Officer prior to constructing a specific structure.
4. Rough grading of channel shall be completed prior to constructing in-channel LWM structures.
5. Cut ends of logs that will be exposed at structure completion shall be marred prior to installation. The Contractor shall use an excavator, bulldozer, or other heavy equipment to tear apart wood fibers at the cut end of the log to create the appearance of a log that has naturally broken apart.
6. Racking and slash material shall be incorporated into each upstream bend component by weaving it in between placed logs, placing it in voids, pressing it into the bank, or otherwise including it in the structure as directed by the Contracting Officer. Racking material as shown on this sheet is schematic only and not intended to represent the actual location or orientation of individual pieces.
7. The amount of slash placed in each structure shall be as directed by the Contracting Officer and may vary from structure to structure. The cost of providing and placing slash is not part of the unit cost of constructing this structure. All costs associated with obtaining and placing slash shall be part of the bid item "Slash Material".
8. Rebar pins shall be #6 rebar (minimum). To install rebar pins drill a ¾" diameter (or equal to nominal diameter of rebar if a size larger than #6 is used) pilot hole through both logs. Rebar pin shall extend completely through both logs and be finished flush with the top log.
9. Backfill structure using soil excavated to place logs unless the Contracting Officer determines the native soil is unsuitable for backfill and suitable soil must be imported. Place soil for backfill in 1 foot maximum lifts. Compact each lift using mechanical equipment such as an excavator bucket or equipment tracking.

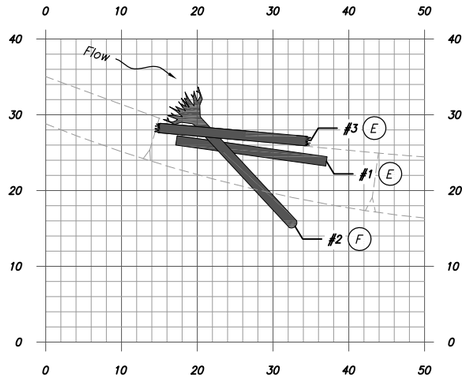
UPSTREAM BEND COMPONENT CONSTRUCTION DETAILS

STRUCTURE STATION	DESIGN ELEVATION
5+05*	2961.0'
5+15*	2961.0'
6+55	2960.7'
9+10	2958.8'
11+40	2957.3'
14+45	2954.0'
17+60	2950.5'
20+60	2950.0'
23+65	2948.2'
26+55	2944.0'
33+00	2941.4'
38+10	2937.0'
40+65	2937.0'
42+55	2934.5'
45+35	2929.5'
47+50	2931.6'

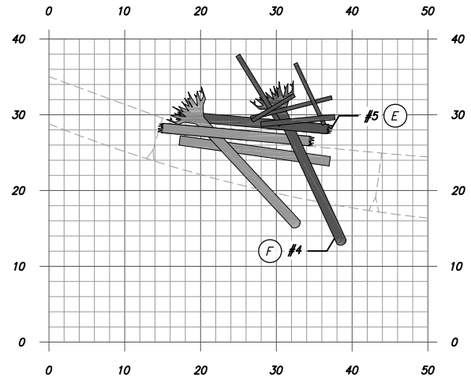
* Structures are located in side channel excavated during phase 3 (stationing is approximate)

RIGHT BANK CONSTRUCTION SEQUENCE

Step 1: Excavate as necessary to place log #1 (footer log) at design elevation. Excavate trench for log #2 and rest it horizontally on top of log #1. Rest log #3 on top of log #2, angled so the downstream end rests on streambed near toe of bank.



Step 2: Excavate as necessary to place log #4; resting it on previously placed logs. Place log #5 as shown, resting it on top of log #4 with the upstream end under the rootwad of log #2 (this will require careful manipulation of log). Incorporate approximately one-third of racking material into structure as directed by the Contracting Officer.



Construction sequencing continued on Dwg. –2129

UPSTREAM BEND COMPONENT MATERIAL SCHEDULE

ITEM	DESCRIPTION	QUANTITY
Log type (E)	20'–25' long, 12" dia. log	4
Log type (F)	20' long, 12" DBH log with rootwad	4
Log type (H)	30' long, 18" DBH log with rootwad	1
Small racking material	6'–15' long, 3"–8" dia. log	8
Large racking material	6'–15' long, 8"–12" dia. log	8
Slash material (see note 7)	Tree tops, limbs with branches and needles	As Directed

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2006
MARTIN K. FISHER
9/14/15

RENEWAL DATE: 12/31/2015

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GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT PARCEL 3

N. TRUSCOTT
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015-09-11

LWM DETAILS

UPSTREAM BEND COMPONENT

1678-100-2128

SHEET 1 OF 24

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TRUSCOTT, NIC

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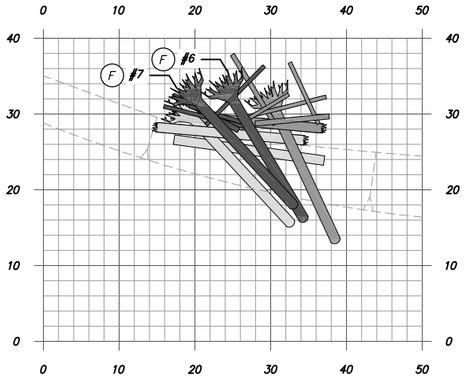
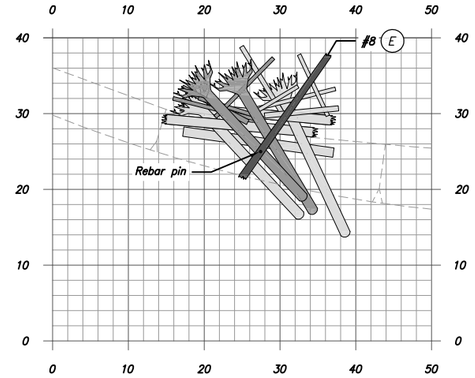
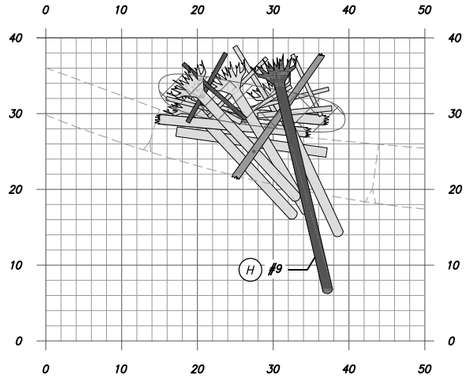
Step 3: Place approximately one-third of racking material as directed by the Contracting Officer. Excavate as necessary to place log #6, angling it into the bank on a minimum slope of 6H:1V. Place log #7 as shown, resting it on previously placed logs.



Step 4: Rest log #8 on top of previously placed logs in the approximate orientation shown. The downstream end of the log shall be angled toward the streambed. Install rebar pin at location shown.

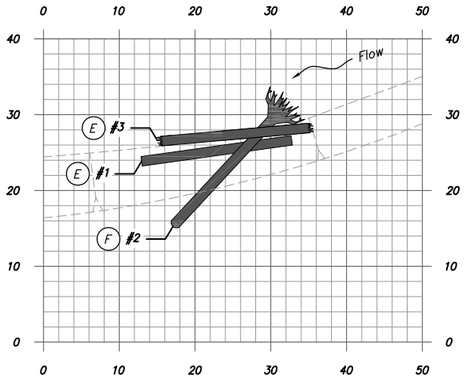


Step 5: Incorporate remaining racking material and slash material as directed by the Contracting Officer. Place log #9 as shown angling it into the bank on a slope of at least 7H:1V then backfill structure to original bank.

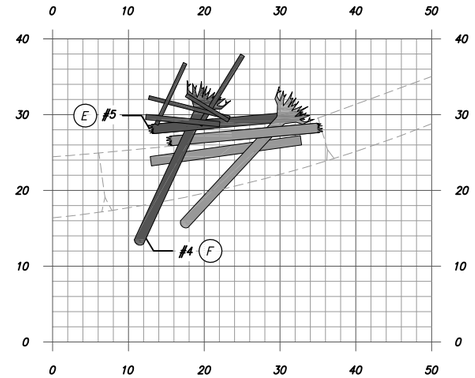


LEFT BANK CONSTRUCTION SEQUENCE

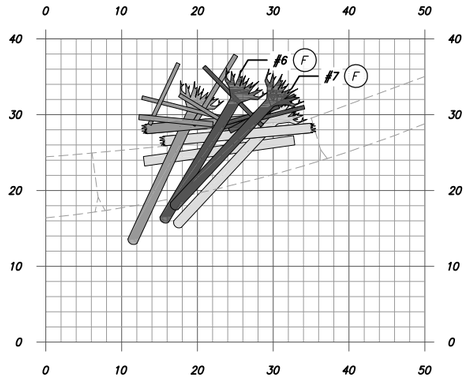
Step 1: Excavate as necessary to place log #1 (footer log) at design elevation. Excavate trench for log #2 and rest it horizontally on top of log #1. Rest log #3 on top of log #2, angled so the downstream end rests on streambed near toe of bank.



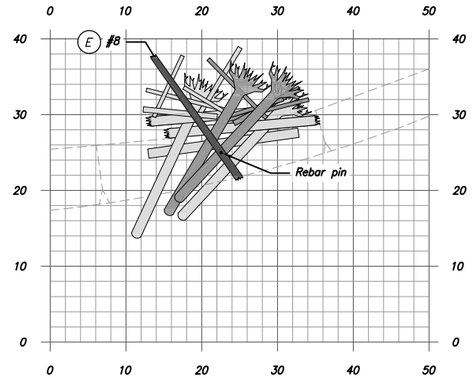
Step 2: Excavate as necessary to place log #4; resting it on previously placed logs. Place log #5 as shown, resting it on top of log #4 with the upstream end under the rootwad of log #2 (this will require careful manipulation of log). Incorporate approximately one-third of racking material into structure as directed by the Contracting Officer.



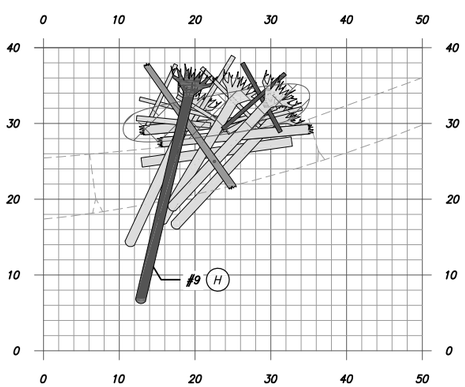
Step 3: Place approximately one-third of racking material as directed by the Contracting Officer. Excavate as necessary to place log #6, angling it into the bank on a minimum slope of 6H:1V. Place log #7 as shown, resting it on previously placed logs.



Step 4: Rest log #8 on top of previously placed logs in the approximate orientation shown. The downstream end of the log shall be angled toward the streambed. Install rebar pin at location shown.



Step 5: Incorporate remaining racking material and slash material as directed by the Contracting Officer. Place log #9 as shown angling it into the bank on a slope of at least 7H:1V then backfill structure to original bank.



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GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015-09-11

LWM DETAILS

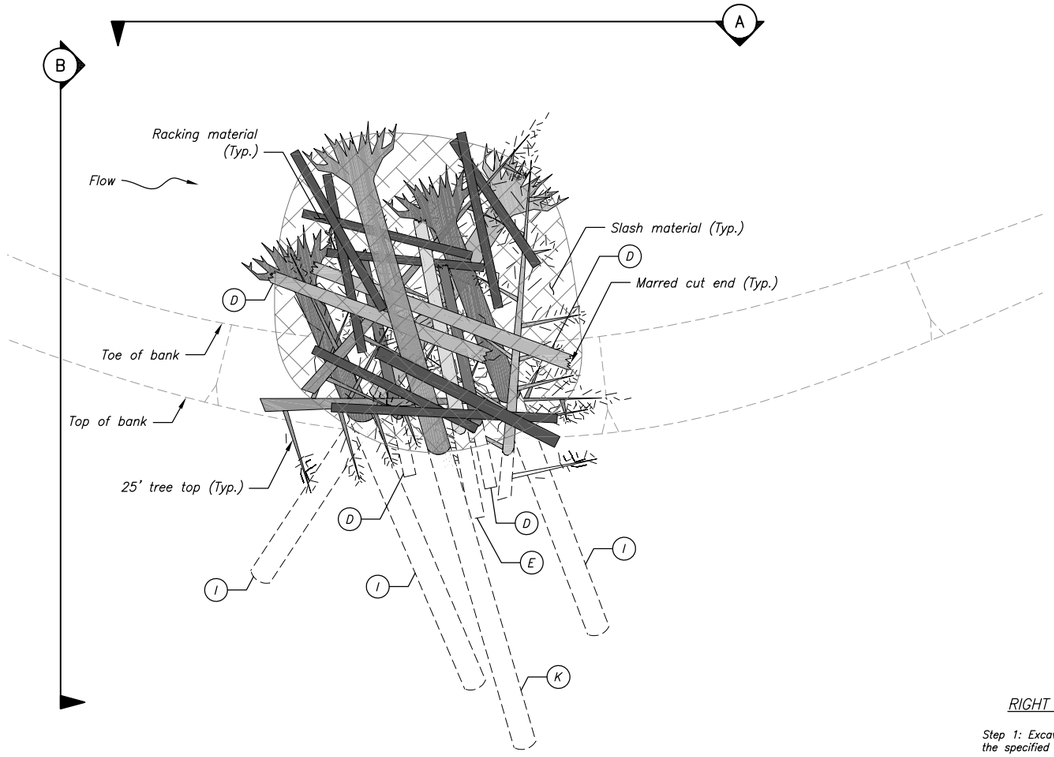
UPSTREAM BEND COMPONENT

1678-100-2129

SHEET 2 OF 24

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
9/14/15

RENEWAL DATE: 12/31/2015



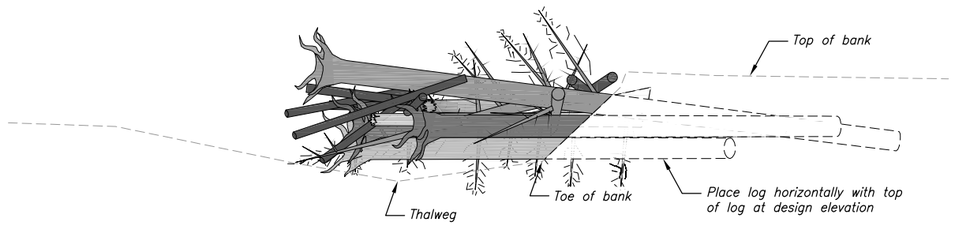
PLAN VIEW – MIDDLE BEND COMPONENT

5 0 5 10 15
SCALE OF FEET



ELEVATION A – MIDDLE BEND COMPONENT FRONT VIEW

5 0 5 10 15
SCALE OF FEET

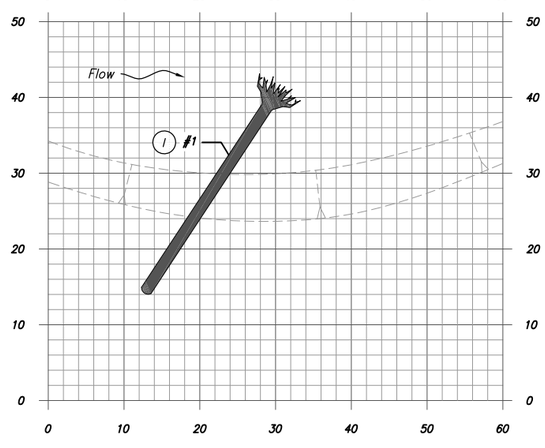


ELEVATION B – MIDDLE BEND COMPONENT SIDE VIEW

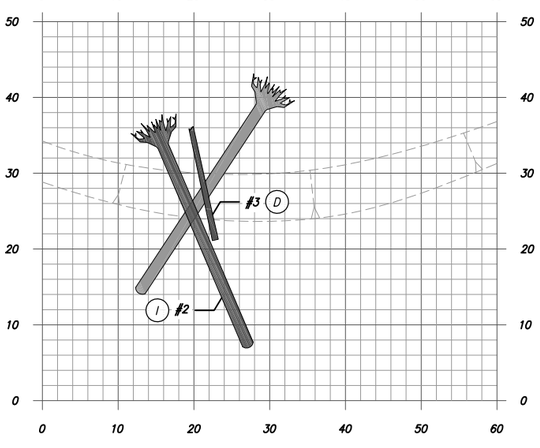
5 0 5 10 15
SCALE OF FEET

RIGHT BANK CONSTRUCTION SEQUENCE

Step 1: Excavate trench to install log #1 horizontally with the top of the log at the specified design elevation.



Step 2: Excavate as necessary to place logs #2 and #3, resting each on top of log #1 and sitting horizontally as shown.



NOTES:

1. *All logs shall come from fir, pine, or spruce trees.*
2. *The diameter of logs without rootwads shall be measured at the smallest cut end.*
3. *Tree tops shall come from Douglas fir, grand fir, or spruce trees and shall be installed within 30 days of harvest.*
4. *Tree tops shall be handled with care to minimize breaking of branches. The Contracting Officer may reject any tree tops that have lost significant amounts of branches.*
5. *The exact location of each middle bend component shall be staked by the Contractor and approved by the Contracting Officer prior to constructing a specific structure.*
6. *Rough grading of channel shall be completed prior to constructing in-channel LWM structures.*
7. *Cut ends of logs that will be exposed at structure completion shall be marred prior to installation. The Contractor shall use an excavator, bulldozer, or other heavy equipment to tear apart wood fibers at the exposed cut end(s) of the log to create the appearance of a log that has naturally broken apart.*
8. *Racking and slash material shall be incorporated into each middle bend component by weaving it in between placed logs, placing it in voids, pressing it into the bank, or otherwise including it in the structure as directed by the Contracting Officer. Racking material as shown on this sheet is schematic only and not intended to represent the exact location or orientation of individual pieces.*
9. *The amount of slash placed in each structure shall be as directed by the Contracting Officer and may vary from structure to structure. The cost of providing and placing slash is not part of the unit cost of constructing this structure. All costs associated with obtaining and placing slash shall be part of the bid item "Slash Material".*
10. *Backfill structure using soil excavated to place logs unless the Contracting Officer determines the native soil is unsuitable for backfill and suitable soil must be imported. Place soil for backfill in 1 foot maximum lifts. Compact each lift using mechanical equipment such as an excavator bucket or equipment tracking.*

MIDDLE BEND COMPONENT MATERIAL SCHEDULE

ITEM	DESCRIPTION	QUANTITY
Log type (D)	15'–20' long, 12" dia. log	4
Log type (E)	20'–25' long, 12" dia. log	1
Log type (I)	30' long, 18" DBH log with rootwad	3
Log type (K)	40' long, 18" DBH log with rootwad	1
Tree top	25' long tree top with full branches	3
Small racking material	6'–15' long, 3"–8" dia. log	8
Large racking material	6'–15' long, 8"–12" dia. log	8
Slash material (see note 9)	Tree tops, limbs with branches and needles	As Directed

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2006
MARTIN K. FISHER
9/11/15

RENEWAL DATE: 12/31/2015

MIDDLE BEND COMPONENT CONSTRUCTION DETAILS

STRUCTURE STATION	DESIGN ELEVATION
6+80	2961.5'
7+00	2960.5'
9+25	2958.9'
11+65	2955.6'
11+85	2955.3'
14+65	2953.9'

MIDDLE BEND COMPONENT CONSTRUCTION DETAILS

STRUCTURE STATION	DESIGN ELEVATION
17+85	2950.6'
18+05	2950.0'
20+80	2950.0'
21+05	2950.0'
23+90	2947.5'
26+80	2944.0'

MIDDLE BEND COMPONENT CONSTRUCTION DETAILS

STRUCTURE STATION	DESIGN ELEVATION
26+95	2944.0'
35+55	2939.6'
35+75	2939.6'
38+30	2937.0'
38+50	2937.0'
45+60	2931.8'
47+60	2930.2'

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GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

X Jay Hovde
ACCEPTED

BOISE, ID 2015-09-11

LWM DETAILS

MIDDLE BEND COMPONENT

1678-100-2130

SHEET 3 OF 24

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September 11, 2015 15:13
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TRUSCOTT, NIC

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CAD FILENAME
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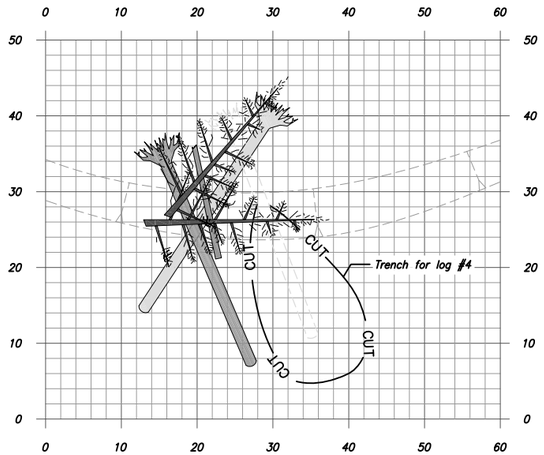
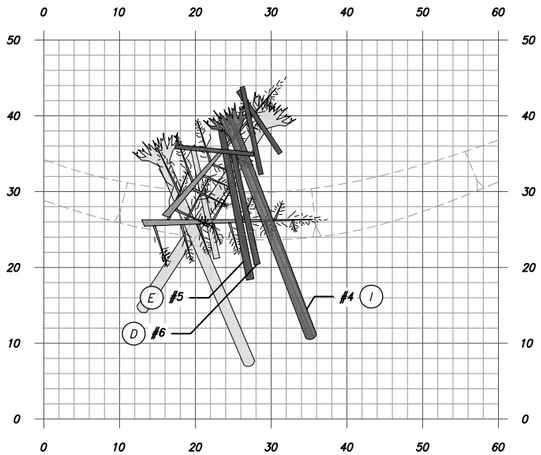
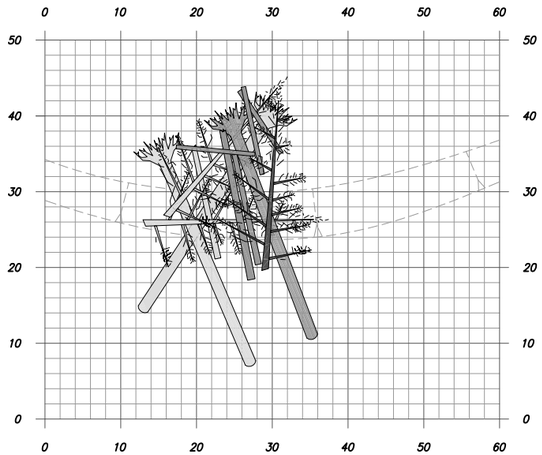
Step 3: Excavate trench for log #4 (see step 4 for placement details) then place two 25' tree tops as shown, resting each on top of log #2.



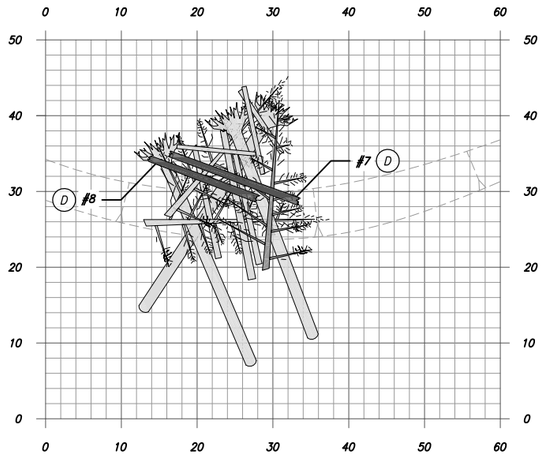
Step 4: Place logs #4, #5, and #6 by placing them so they rest on top of previously placed logs and extend horizontally into the bank. Incorporate approximately one-third of the racking material as directed by the Contracting Officer.



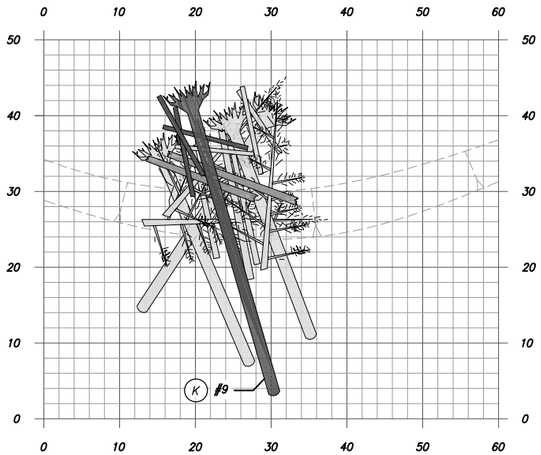
Step 5: Place a 25' tree top as shown, resting it on top of previously placed logs.



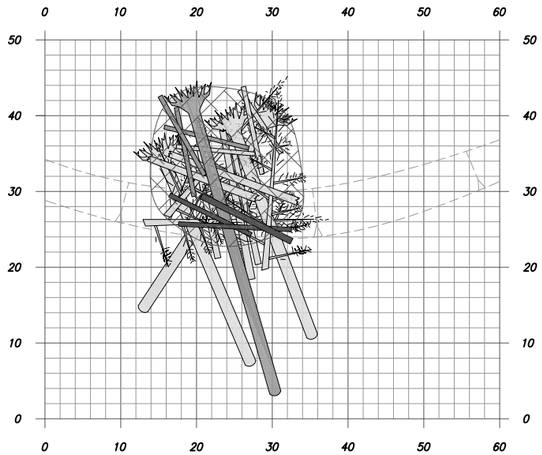
Step 6: Rest logs #7 and #8 on top of previously placed logs as shown.



Step 7: Incorporate another one-third of racking material as directed by the Contracting Officer, then place log #9 as shown, angled on a 8H:1V slope into the bank.



Step 8: Backfill structure to original bank and incorporate remaining racking material and all slash material into the structure as directed by the Contracting Officer.



REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
3/4/15

RENEWAL DATE: 12/31/2015

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GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

X Jay Hovde
ACCEPTED

BOISE, ID 2015-09-11

LWM DETAILS

MIDDLE BEND COMPONENT

1678-100-2131

SHEET 4 OF 24

DATE AND TIME PLOTTED
September 11, 2015 15:13
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TRUSCOTT, NIC

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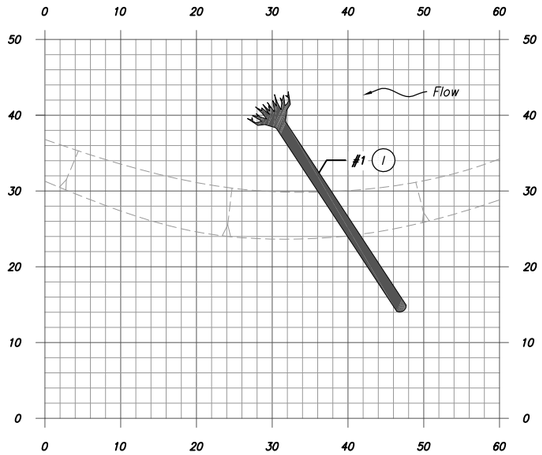
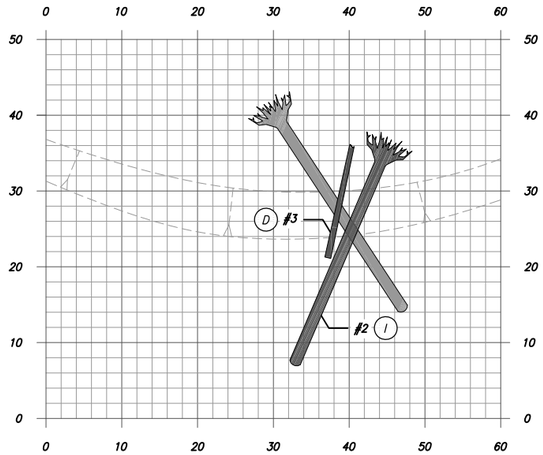
LEFT BANK CONSTRUCTION SEQUENCE

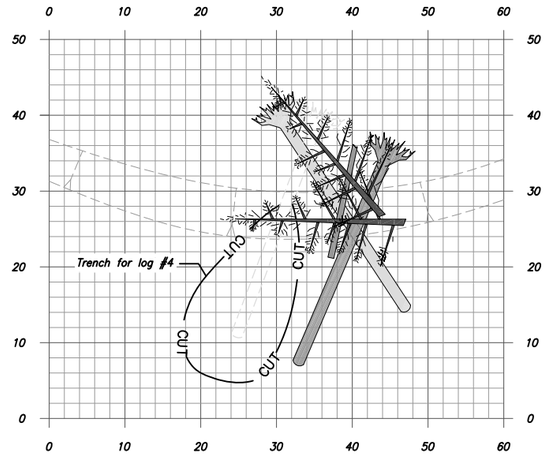
Step 1: Excavate trench to install log #1 horizontally with the top of the log at the specified design elevation.



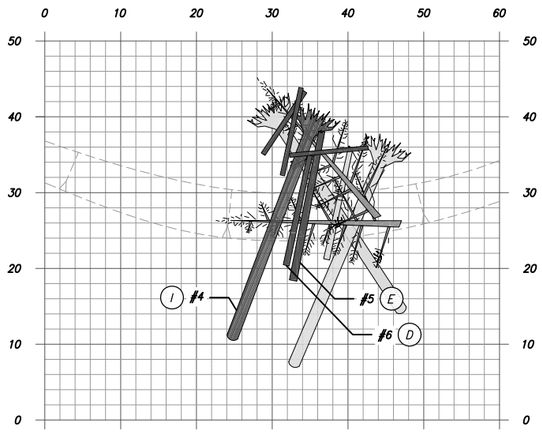
Step 2: Excavate as necessary to place logs #2 and #3, resting each on top of log #1 and sitting horizontally as shown.



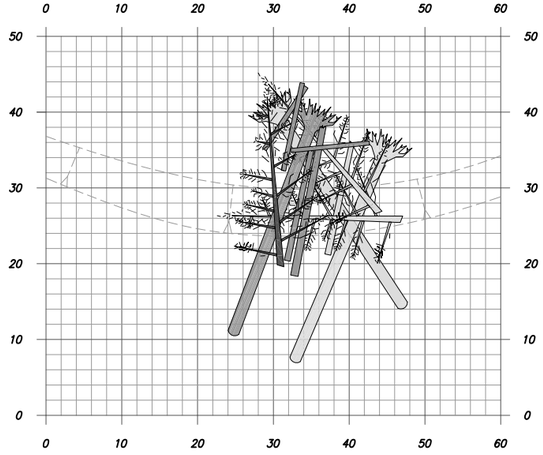
Step 3: Excavate trench for log #4 (see step 4 for placement details) then place two 25' tree tops as shown, resting each on top of log #2.



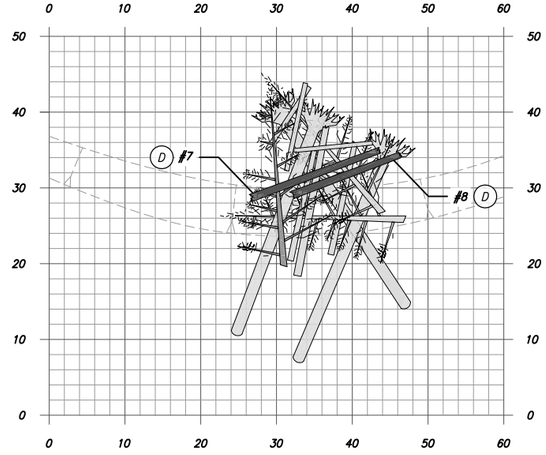
Step 4: Place logs #4, #5, and #6 by placing them so they rest on top of previously placed logs and extend horizontally into the bank. Incorporate approximately one-third of the racking material as directed by the Contracting Officer.



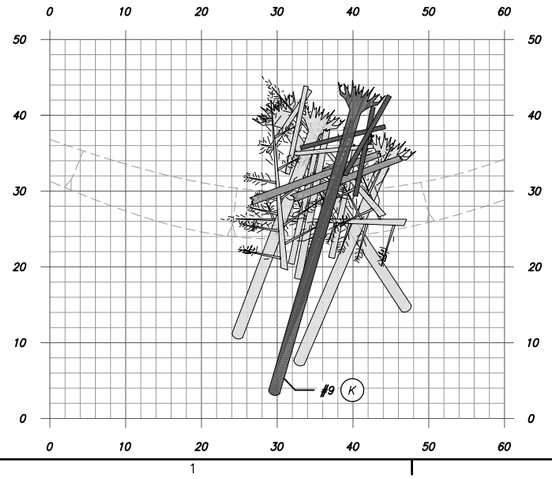
Step 5: Place a 25' tree top as shown, resting it on top of previously placed logs.



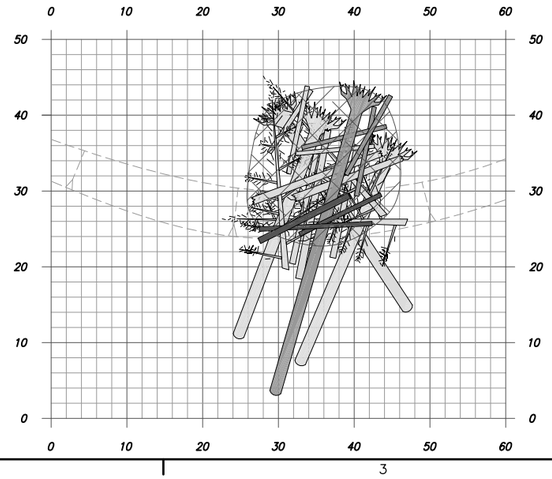
Step 6: Rest logs #7 and #8 on top of previously placed logs as shown.



Step 7: Incorporate another one-third of racking material as directed by the Contracting Officer, then place log #9 as shown, angled on a 8H:1V slope into the bank.



Step 8: Backfill structure to original bank and incorporate remaining racking material and all slash material into the structure as directed by the Contracting Officer.



RENEWAL DATE: 12/31/2015

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

X Jay Hovde
ACCEPTED

BOISE, ID 2015-09-11

LWM DETAILS

MIDDLE BEND COMPONENT

1678-100-2132

SHEET 5 OF 24

DATE AND TIME PLOTTED
September 11, 2015 15:13
PLOTTED BY
TRUSCOTT, NIC

CAD SYSTEM
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CAD FILENAME
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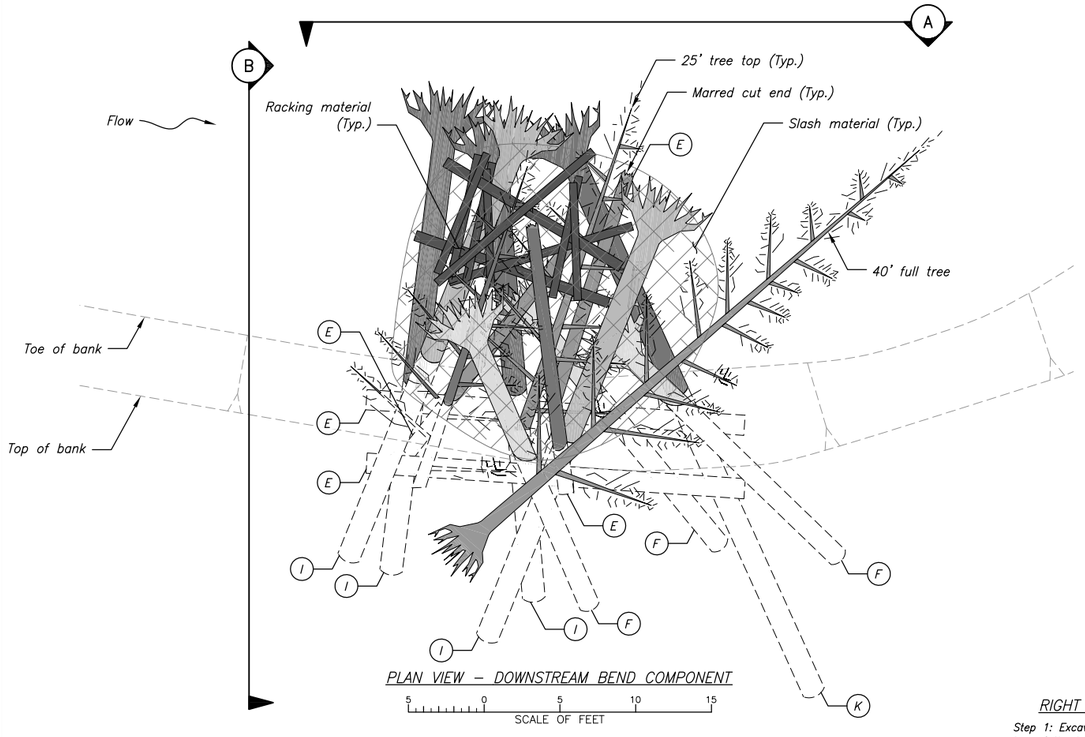
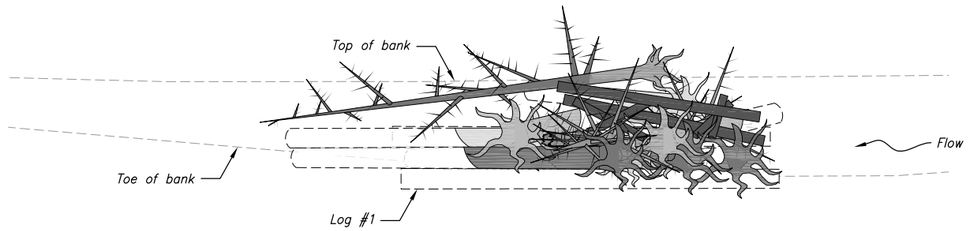


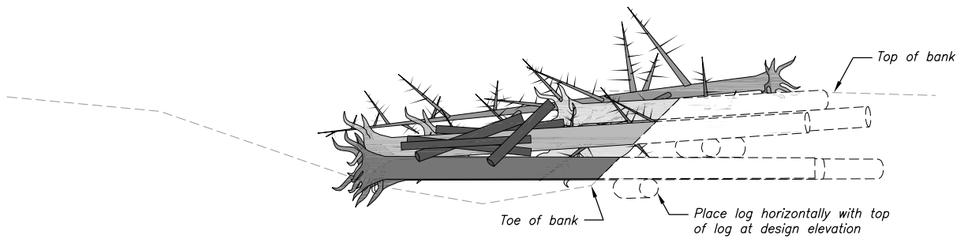
PLAN VIEW – DOWNSTREAM BEND COMPONENT

5 0 5 10 15
SCALE OF FEET



ELEVATION A – DOWNSTREAM BEND COMPONENT FRONT VIEW

5 0 5 10 15
SCALE OF FEET



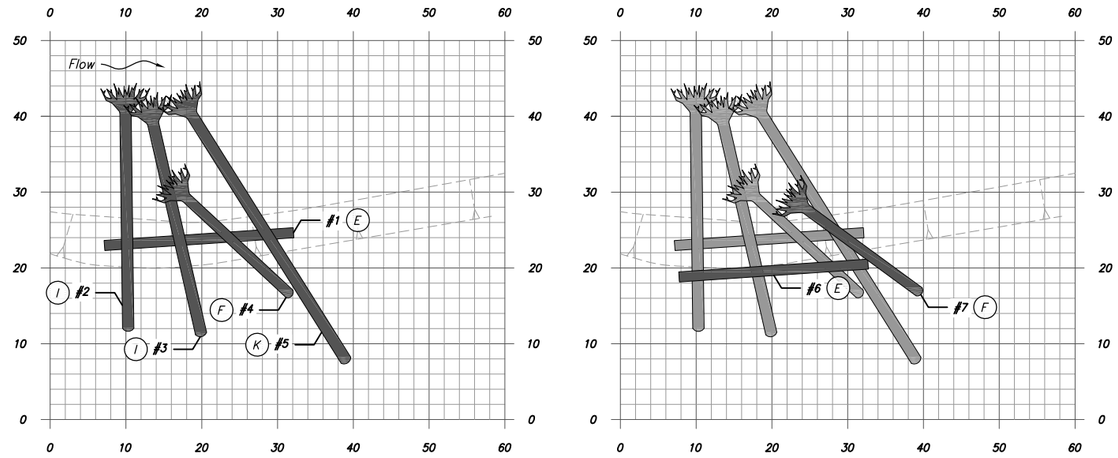
ELEVATION B – DOWNSTREAM BEND COMPONENT SIDE VIEW

5 0 5 10 15
SCALE OF FEET

RIGHT BANK CONSTRUCTION SEQUENCE

Step 1: Excavate as necessary to place log #1 (footer log) horizontally with the top of the log at the design elevation. Excavate as necessary to place logs #2 – #5 horizontally, resting them on top of log #1. Placing logs #2 – #5 may require a counterweight placed on the cut end to hold them in place until backfilled.

Step 2: Place logs #6 and #7 in the orientations shown, resting them on top of previously placed logs (should be close to horizontal). This may require partial backfill of previously placed logs to hold logs in place.



NOTES:

1. *All logs shall come from fir, pine, or spruce trees.*
2. *The diameter of logs without rootwads shall be measured at the smallest cut end.*
3. *Tree tops and full trees shall come from Douglas fir, grand fir, or spruce trees and shall be installed within 30 days of harvest.*
4. *Tree tops and full trees shall be handled with care to minimize breaking of branches. The Contracting Officer may reject any tree tops or full trees that have lost significant amounts of branches.*
5. *The exact location of each downstream bend component shall be staked by the Contractor and approved by the Contracting Officer prior to constructing a specific structure.*
6. *Rough grading of channel shall be completed prior to constructing in–channel LWM structures.*
7. *Cut ends of logs that will be exposed at structure completion shall be marred prior to installation. The Contractor shall use an excavator, bulldozer, or other heavy equipment to tear apart wood fibers at the exposed cut end(s) of the log to create the appearance of a log that has naturally broken apart.*
8. *Racking and slash material shall be incorporated into each downstream bend component by weaving it in between placed logs, placing it in voids, pressing it into the bank, or otherwise including it in the structure as directed by the Contracting Officer. Racking material as shown on this sheet is schematic only and not intended to represent the actual location or orientation of individual pieces.*
9. *The amount of slash placed in each structure shall be as directed by the Contracting Officer and may vary from structure to structure. The cost of providing and placing slash is not part of the unit cost of constructing this structure. All costs associated with obtaining and placing slash shall be part of the bid item "Slash Material".*
10. *Backfill structure using soil excavated to place logs unless the Contracting Officer determines the native soil is unsuitable for backfill and suitable soil must be imported. Place soil for backfill in 1 foot maximum lifts. Compact each lift using mechanical equipment such as an excavator bucket or equipment tracking.*

DOWNSTREAM BEND COMPONENT MATERIAL SCHEDULE

ITEM	DESCRIPTION	QUANTITY
Log type (E)	20–25' long, 12" dia. log	5
Log type (F)	20' long, 12" DBH log with rootwad	3
Log type (I)	30' long, 18" DBH log with rootwad	4
Log type (K)	40' long, 18" DBH log with rootwad	1
Tree top	25' long tree top	2
Full tree	40' long full tree	1
Small racking material	6'–15' long, 3"–8" dia. log	10
Large racking material	6'–15' long, 8"–12" dia. log	10
Slash material (see note 9)	Tree tops, limbs with branches and needles	As Directed

DOWNSTREAM BEND COMPONENT CONSTRUCTION DETAILS

STRUCTURE STATION	DESIGN ELEVATION
7+25	2958.8'
9+45	2957.2'
12+10	2954.5'
14+85	2952.6'
18+25	2948.5'
21+25	2948.3'

DOWNSTREAM BEND COMPONENT CONSTRUCTION DETAILS

STRUCTURE STATION	DESIGN ELEVATION
24+10	2946.3'
27+15	2942.9'
36+00	2937.8'
38+70	2935.6'
45+80	2930.2'
49+95	2928.0'

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2006
MARTIN K. FISHER
9/14/15

RENEWAL DATE: 12/31/2015

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GRANDE RONDE SUBBASIN

CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015–09–11

LWM DETAILS

DOWNSTREAM BEND COMPONENT

1678–100–2133

SHEET 6 OF 24

DATE AND TIME PLOTTED
September 11, 2015 15:14
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TRUSCOTT, NIC

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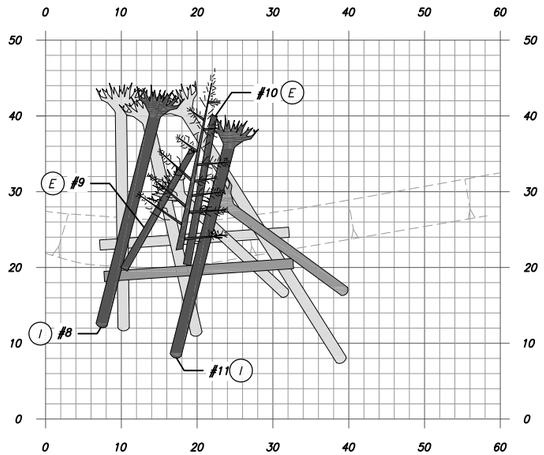
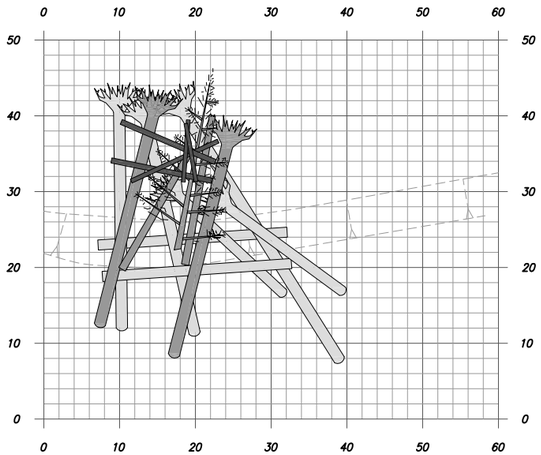
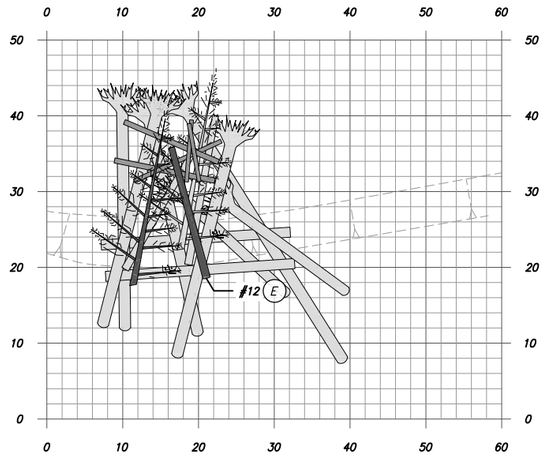
Step 3: Place logs #8 – #11 as shown, resting them on previously placed logs. Place a 25' tree top as shown, resting it on previously placed logs.



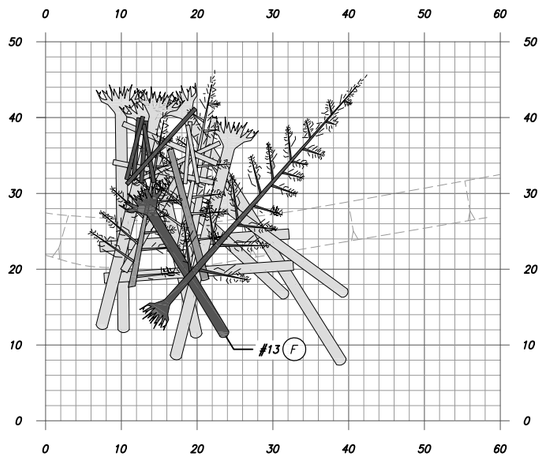
Step 4: Incorporate approximately half of the racking material as directed by the Contracting Officer.



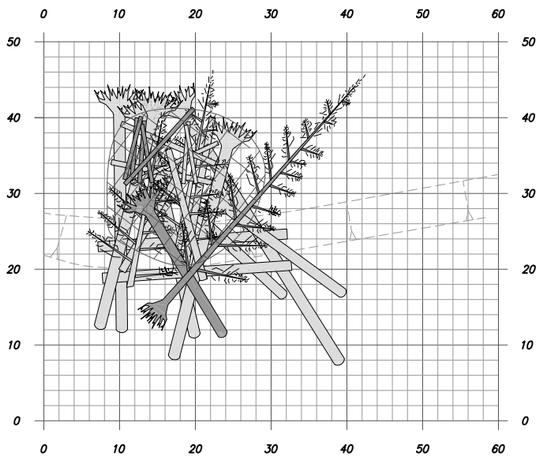
Step 5: Rest log #12 and a 25' tree top on previously placed logs then partially backfill the structure to the top of logs that have been placed.



Step 6: Place log #13 by resting it on previously placed logs. Incorporate remaining racking material and backfill the structure to existing bank; compact lifts by tracking back and forth with heavy equipment. Rest a 40' full tree on top of the bank as shown with its rootwad on the top of bank and angled upstream.



Step 7: Incorporate slash material into the structure as directed by the Contracting Officer.



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GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

X Jay Hovde
ACCEPTED

BOISE, ID 2015-09-11

LWM DETAILS

DOWNSTREAM BEND COMPONENT

1678-100-2134

SHEET 7 OF 24

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
9/14/15

RENEWAL DATE: 12/31/2015

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TRUSCOTT, NIC

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CAD FILENAME
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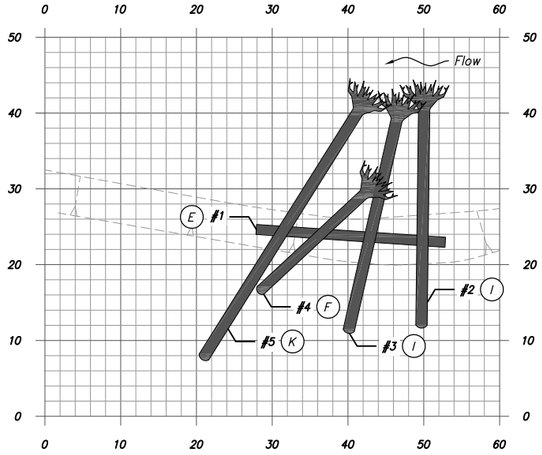
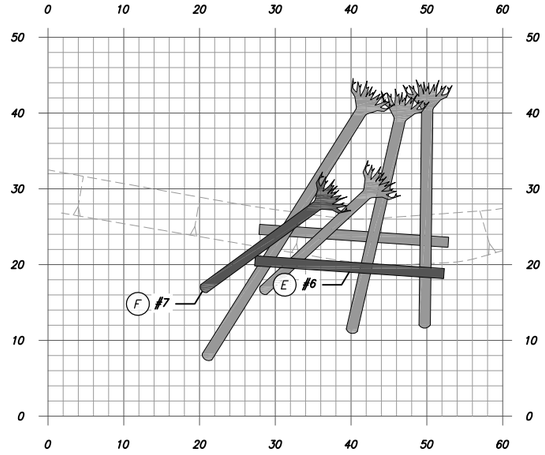
LEFT BANK CONSTRUCTION SEQUENCE

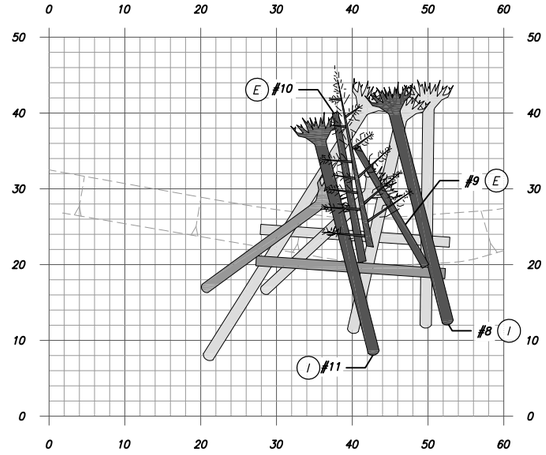
Step 1: Excavate as necessary to place log #1 (footer log) horizontally with the top of the log at the design elevation. Excavate as necessary to place logs #2 – #5 horizontally, resting them on top of log #1. Placing logs #2 – #5 may require a counterweight placed on the cut end to hold them in place until backfilled.



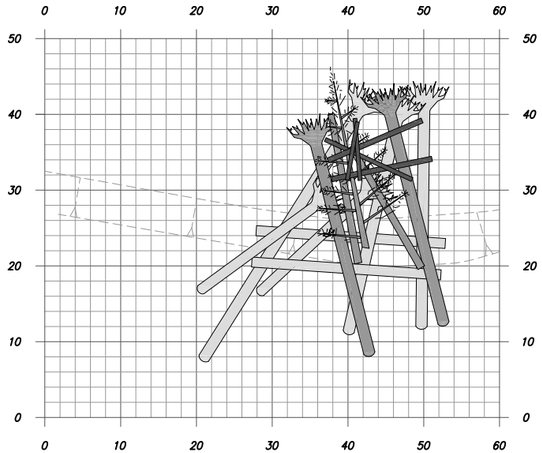
Step 2: Place logs #6 and #7 in the orientations shown, resting them on top of previously placed logs (should be close to horizontal). This may require partial backfill of previously placed logs to hold logs in place.



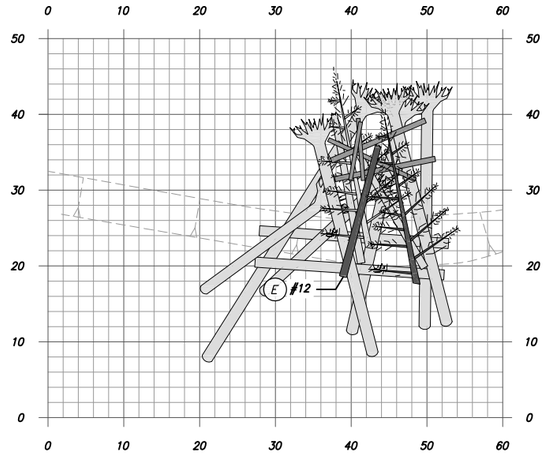
Step 3: Place logs #8 – #11 as shown, resting them on previously placed logs. Place a 25' tree top as shown, resting it on previously placed logs.



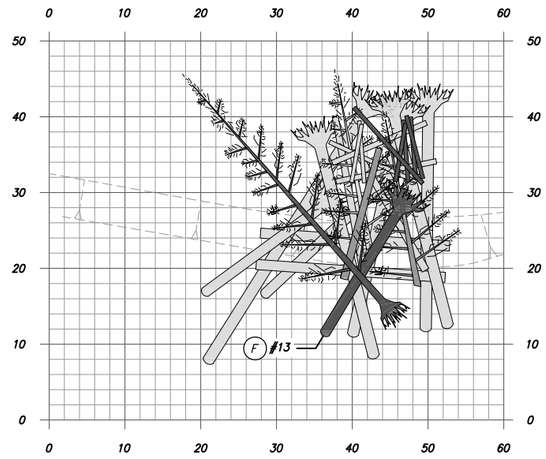
Step 4: Incorporate approximately half of the racking material as directed by the Contracting Officer.



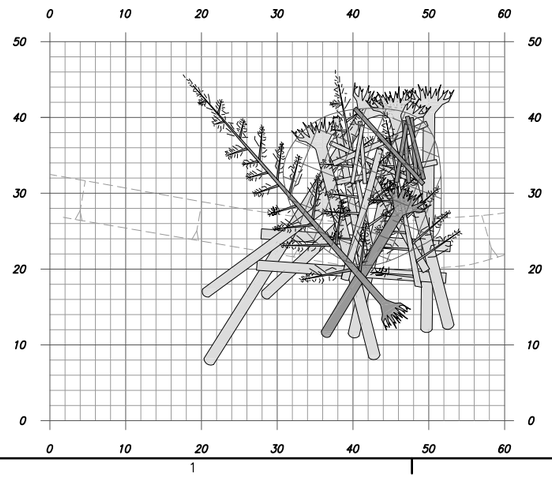
Step 5: Rest log #12 and a 25' tree top on previously placed logs then partially backfill the structure to the top of logs that have been placed.



Step 6: Place log #13 by resting it on previously placed logs. Incorporate remaining racking material and backfill the structure to existing bank; compact lifts by tracking back and forth with heavy equipment. Rest a 40' full tree on top of the bank as shown with its rootwad on the top of bank and angled upstream.



Step 7: Incorporate slash material into the structure as directed by the Contracting Officer.



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CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

X Jay Hovde
ACCEPTED

BOISE, ID 2015-09-11

LWM DETAILS

DOWNSTREAM BEND COMPONENT

1678-100-2135

SHEET 8 OF 24

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
9/14/15

RENEWAL DATE: 12/31/2015

DATE AND TIME PLOTTED
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TRUSCOTT, NIC

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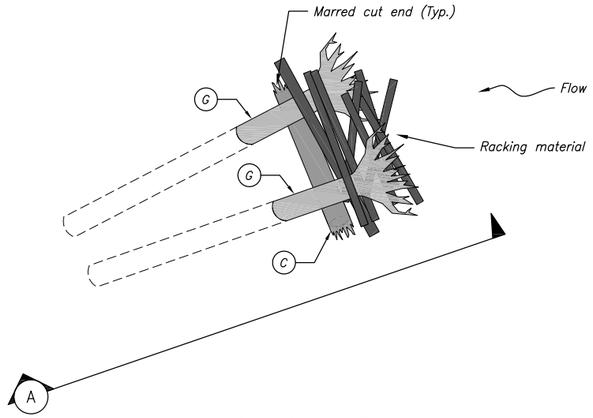
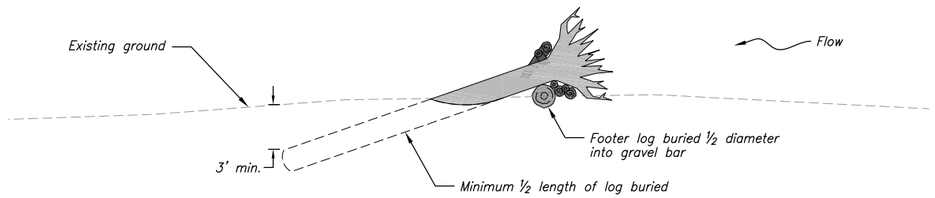


PLAN VIEW – SMALL APEX JAM

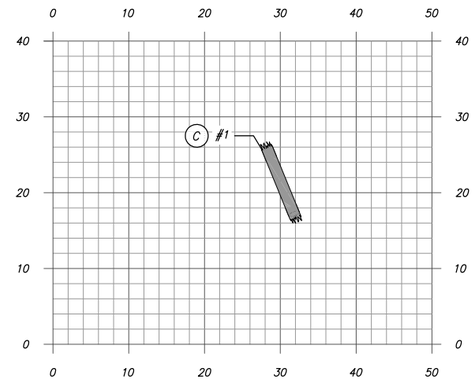
5 0 5 10 15
SCALE OF FEET



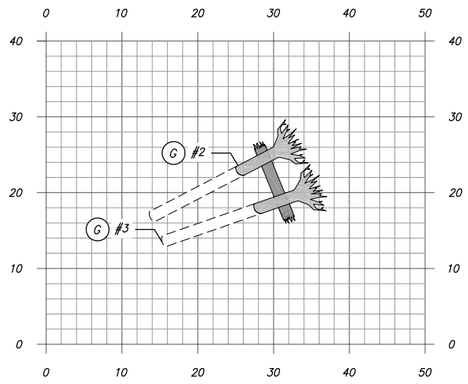
ELEVATION A – SMALL APEX JAM SIDE VIEW

5 0 5 10 15
SCALE OF FEET

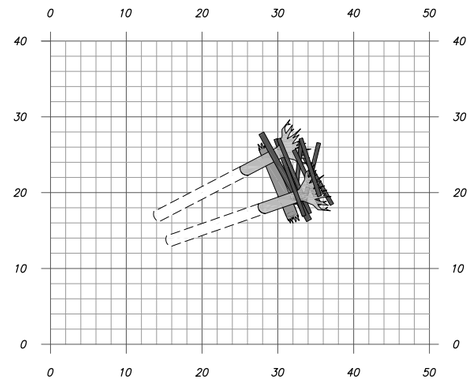
Step 1: Place footer log, buried ½ diameter into gravel bar.



Step 2: Place 2 logs with rootwads over footer log and bury cut ends into gravel bar.



Step 3: Incorporate racking material.



NOTES:

1. All logs shall come from fir, pine, or spruce trees.
2. The diameter of logs without rootwads shall be measured at the smallest cut end.
3. The exact location of each small apex jam shall be staked by the Contractor and approved by the Contracting Officer prior to constructing a specific structure.
4. Rough grading of channel shall be completed prior to constructing in–channel LWM structures.
5. Cut ends of logs that will be exposed at structure completion shall be marred prior to installation. The Contractor shall use an excavator, bulldozer, or other heavy equipment to tear apart wood fibers at the exposed cut end(s) of the log to create the appearance of a log that has naturally broken apart.
6. Racking material shall be incorporated into each small apex jam by weaving it in between placed logs, placing it in voids, pressing it into the bank, or otherwise including it in the structure as directed by the Contracting Officer. Racking material as shown on this sheet is schematic only and not intended to represent the actual location or orientation of individual pieces.
7. Backfill structure using soil excavated to place logs unless the Contracting Officer determines the native soil is unsuitable for backfill and suitable soil must be imported. Place soil for backfill in 1 foot maximum lifts. Compact each lift using mechanical equipment such as an excavator bucket or equipment tracking.

SMALL APEX JAM SCHEDULE

ITEM	DESCRIPTION	QUANTITY
Log type (C)	10' long, 18" dia. log	1
Log type (G)	20' long, 18" DBH log with rootwad	2
Small racking material	6'–15' long, 3"–8" dia. log	5
Large racking material	6'–15' long, 8"–12" dia. log	5

SMALL APEX JAM STRUCTURE STATION
10+50
13+50
19+85
26+35
34+80
47+20

REGISTERED PROFESSIONAL ENGINEER 83129PE OREGON JULY 14, 2006 MARTIN K. FISHER 9/14/15

RENEWAL DATE: 12/31/2015

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GRANDE RONDE SUBBASIN

CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

M. FISHER
DRAWN

X Jay Hovde
ACCEPTED

BOISE, ID 2015–09–11

LWM DETAILS

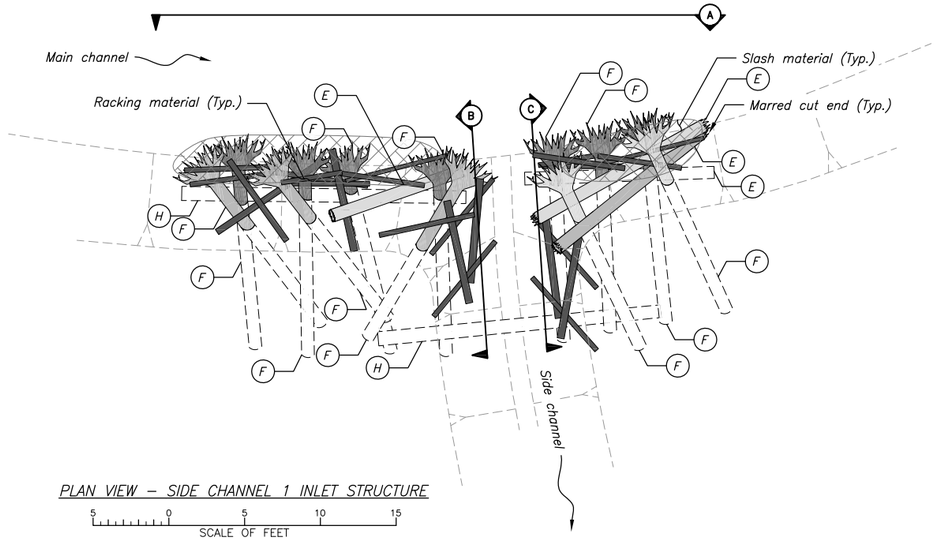
SMALL APEX JAM

1678–100–2136

SHEET 9 OF 24

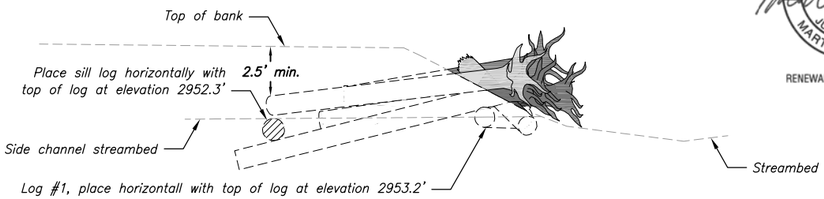
DATE AND TIME PLOTTED
September 11, 2015 15:27
PLOTTED BY
TRUSCOTT, NIC

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Parcel_3_LWM_SmallApex_Details.dwg



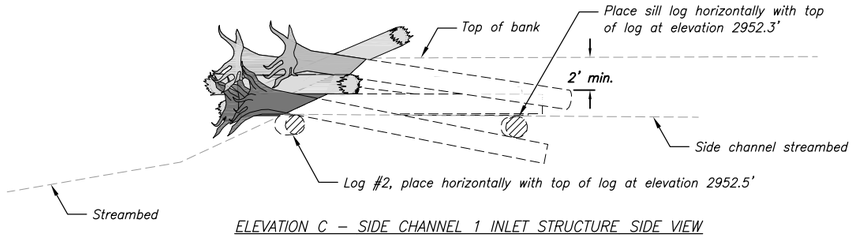
PLAN VIEW – SIDE CHANNEL 1 INLET STRUCTURE

5 0 5 10 15
SCALE OF FEET



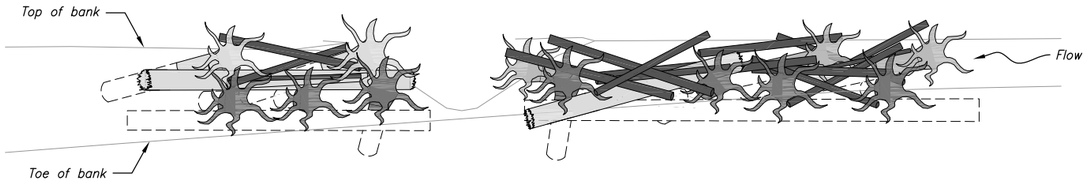
ELEVATION B – SIDE CHANNEL 1 INLET STRUCTURE SIDE VIEW

5 0 5 10 15
SCALE OF FEET



ELEVATION C – SIDE CHANNEL 1 INLET STRUCTURE SIDE VIEW

5 0 5 10 15
SCALE OF FEET



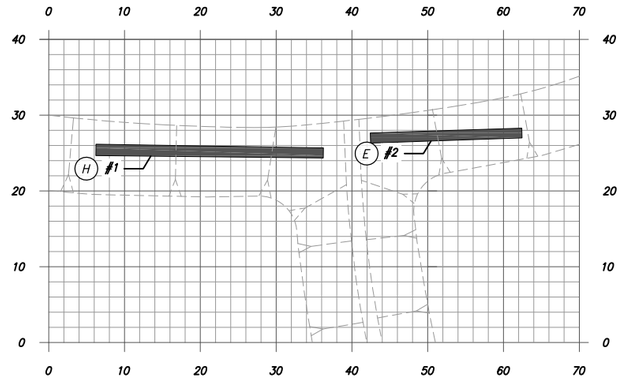
ELEVATION A – SIDE CHANNEL 1 INLET STRUCTURE FRONT VIEW

5 0 5 10 15
SCALE OF FEET

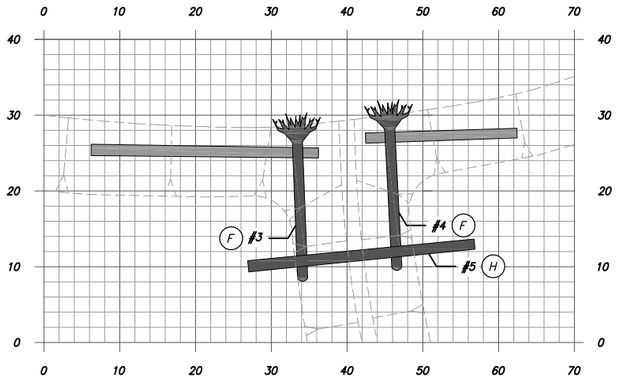
NOTES:

1. All logs shall come from fir, pine, or spruce trees.
2. The diameter of logs without rootwads shall be measured at the smallest cut end.
3. The exact location of the side channel 1 inlet structure shall be staked by the Contractor and approved by the Contracting Officer prior to construction of this structure.
4. Rough grading of channel and side channel shall be completed prior to constructing this structure.
5. Cut ends of logs that will be exposed at structure completion shall be marred prior to installation. The Contractor shall use an excavator, bulldozer, or other heavy equipment to tear apart wood fibers at the exposed cut end(s) of the log to create the appearance of a log that has naturally broken apart.
6. Racking and slash material shall be incorporated into the side channel 1 inlet structure by weaving it in between placed logs, placing it in voids, pressing it into the bank, or otherwise including it in the structure as directed by the Contracting Officer. Racking material as shown on this sheet is schematic only and not intended to represent the actual location or orientation of individual pieces.
7. The amount of slash placed in this structure shall be as directed by the Contracting Officer. The cost of providing and placing slash is not part of the unit cost of constructing this structure. All costs associated with obtaining and placing slash shall be part of the bid item "Slash Material".
8. Backfill structure using soil excavated to place logs unless the Contracting Officer determines the native soil is unsuitable for backfill and suitable soil must be imported. Place soil for backfill in 1 foot maximum lifts. Compact each lift using mechanical equipment such as an excavator bucket or equipment tracking.

Step 1: Place log #1 horizontally as shown with the top of the log at elevation 2953.2'. Place log #2 horizontally as shown with the top of the log at elevation 2952.5'.



Step 2: Place logs #3 and #4 as shown, approximately parallel to the side channel streambed and angled into the ground such that log #5 can sit horizontally on top of logs #3 and #4 with the top of log #5 sitting at the elevation of the side channel streambed.



SIDE CHANNEL 1 INLET STRUCTURE MATERIAL SCHEDULE

ITEM	DESCRIPTION	QUANTITY
Log type (E)	20'–25' long, 12" dia. log	4
Log type (F)	20' long, 12" DBH log with rootwad	12
Log type (H)	30' long, 18" dia. log	2
Small racking material	6'–15' long, 3"–8" dia. log	15
Large racking material	6'–15' long, 8"–12" dia. log	15
Slash material (see note 7)	Tree tops, limbs with branches and needles	As Directed

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
9/14/15
RENEWAL DATE: 12/31/2015

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COLUMBIA/SNAKE RIVER SALMON RECOVERY GROUP
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

X Jay Hovde
ACCEPTED

BOISE, ID 2015-09-11

LWM DETAILS

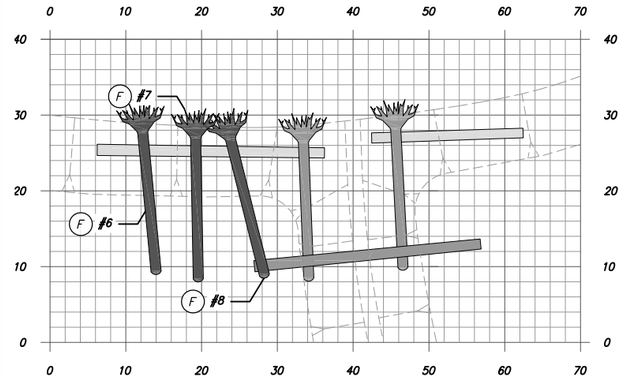
SIDE CHANNEL 1 INLET STRUCTURE

1678-100-2137
SHEET 10 OF 24

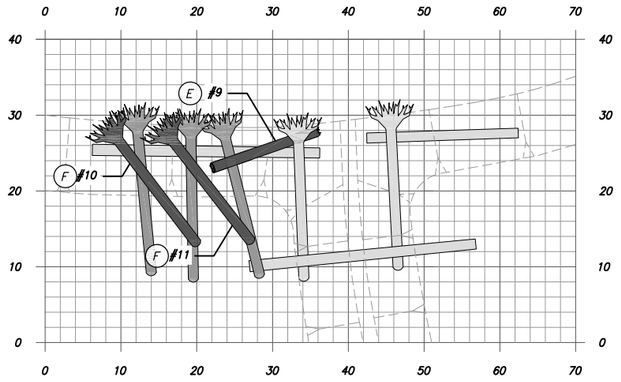
DATE AND TIME PLOTTED
September 11, 2015 15:27
PLOTTED BY
TRUSCOTT, NIC

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Phase_3-4_LWM_SCS_Inlet_Details.dwg

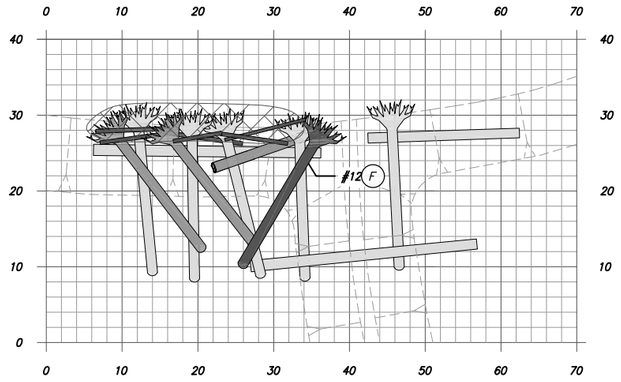
Step 3: Excavate as necessary to place logs #6–8 as shown. All logs shall rest on log #1; logs #6 and #8 shall be placed horizontally, log #7 shall be placed angled into the ground on a 7H:1V slope.



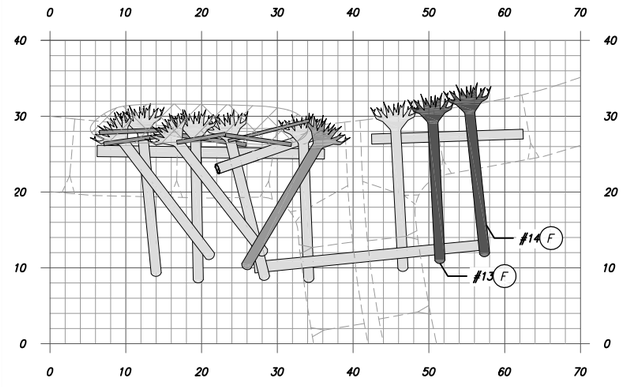
Step 4: Place log #9 as shown, resting it on top of log #8 and threading the downstream end under the rootwad of log #3. Place logs #10–11 as shown, angled into the bank on a slope of 7H:1V.



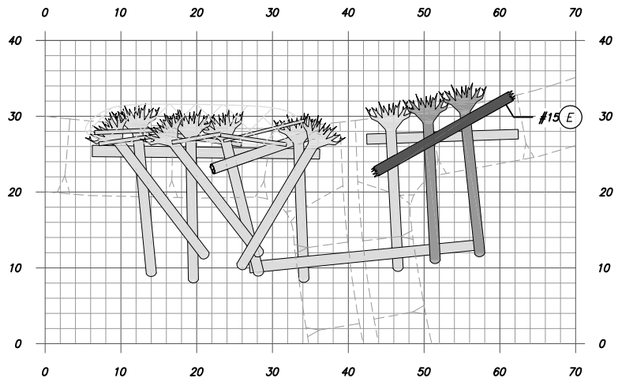
Step 5: Place log #12 as shown, resting it on previously placed logs. Incorporate racking and slash material into the upstream portion of the structure then backfill to the existing bankline, compacting moderately in 1' lifts.



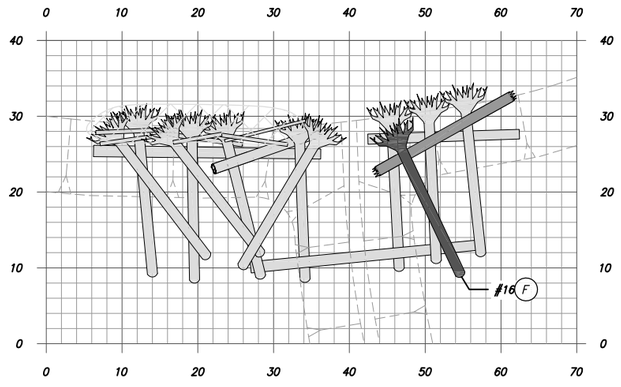
Step 6: Excavate as necessary to place logs #13 and #14 as shown, resting them on previously placed logs.



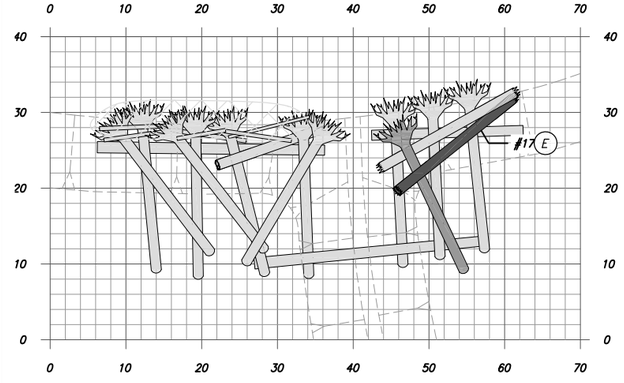
Step 7: Rest log #15 on top of previously placed logs.



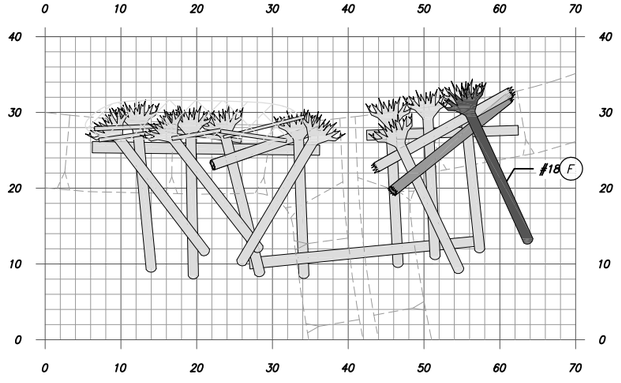
Step 8: Place log #16 as shown, resting it on previously placed logs.



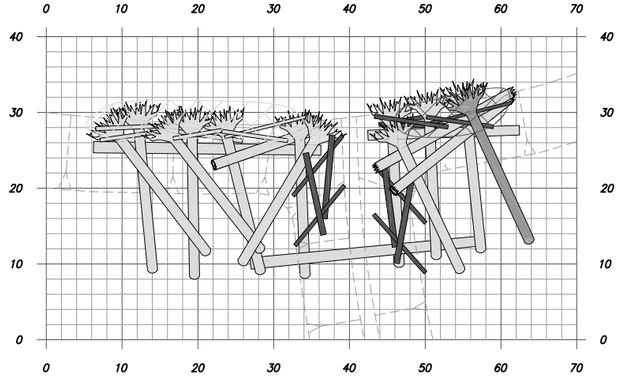
Step 9: Place log #17 in the orientation shown; rest the log on top of log #16 and thread the downstream end of the log so it sits under log #15.



Step 10: Excavate as necessary to place log #18, resting it on top of previously placed logs and angling it into the bank on a slope of 8H:1V.



Step 11: Incorporate racking and slash material into the downstream portion of the structure and on each side of the side channel inlet then backfill to the existing bankline.



REGISTERED PROFESSIONAL ENGINEER
83129PE
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JULY 14, 2006
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9/14/15

RENEWAL DATE: 12/31/2015

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

X Jay Hovde
ACCEPTED

BOISE, ID 2015-09-11

LWM DETAILS

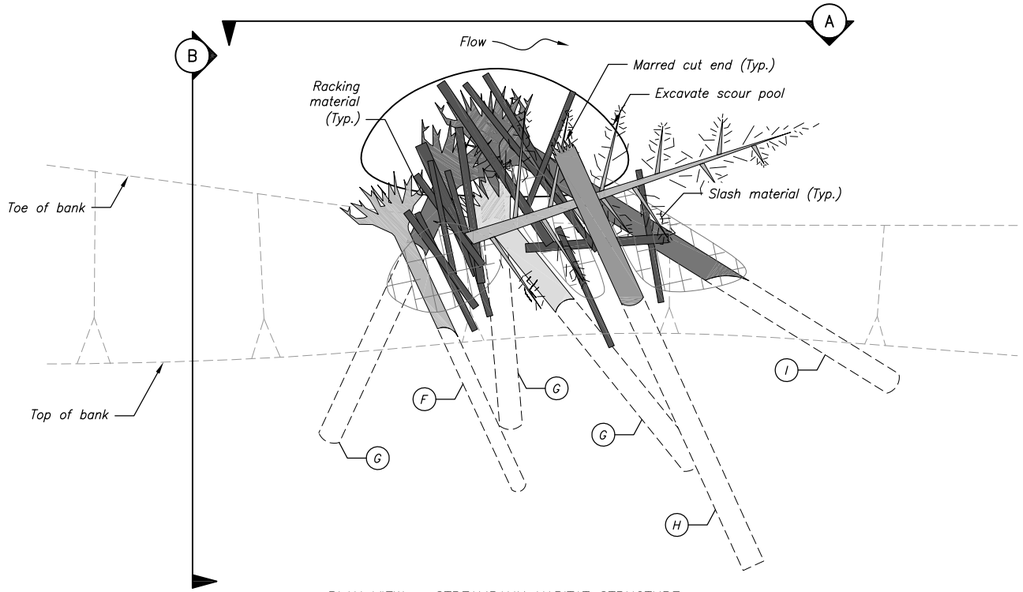
SIDE CHANNEL 1 INLET STRUCTURE

1678-100-2138

SHEET 11 OF 24

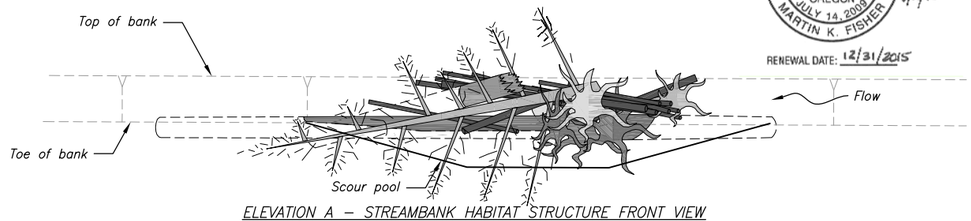
DATE AND TIME PLOTTED
September 11, 2015 15:28
PLOTTED BY
TRUSCOTT, NIC

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Phase_3-4_LWM_SCS_Inlet_Details.dwg



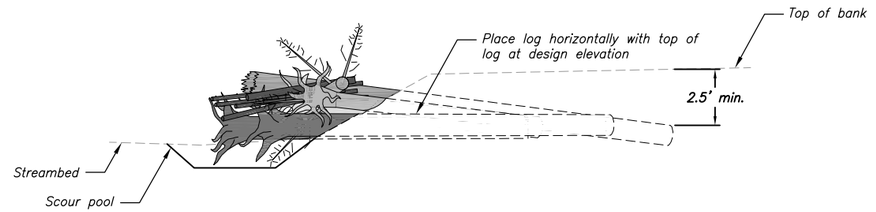
PLAN VIEW – STREAMBANK HABITAT STRUCTURE

SCALE OF FEET 5 0 5 10 15



ELEVATION A – STREAMBANK HABITAT STRUCTURE FRONT VIEW

SCALE OF FEET 5 0 5 10 15



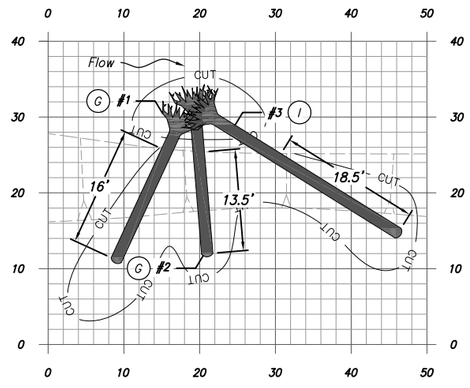
ELEVATION B – STREAMBANK HABITAT STRUCTURE SIDE VIEW

SCALE OF FEET 5 0 5 10 15

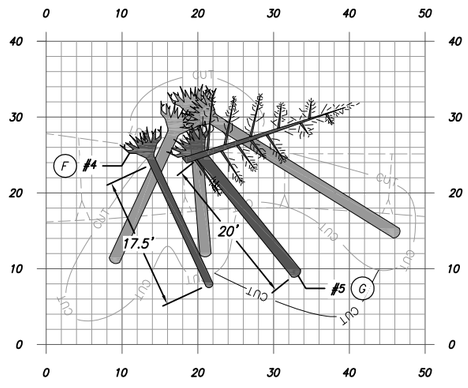
REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
3/4/15
RENEWAL DATE: 12/31/2015

RIGHT BANK CONSTRUCTION SEQUENCE

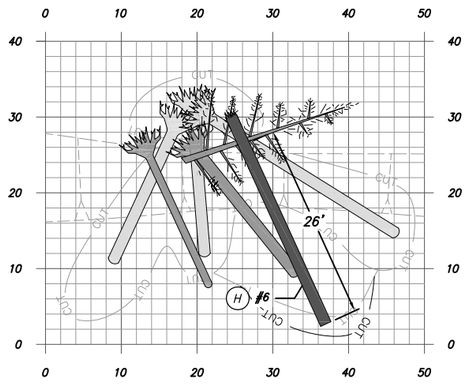
Step 1: Excavate scour pool as directed by Contracting Officer, then excavate trenches for bottom layer of logs; place logs horizontally at the elevation shown on this sheet.



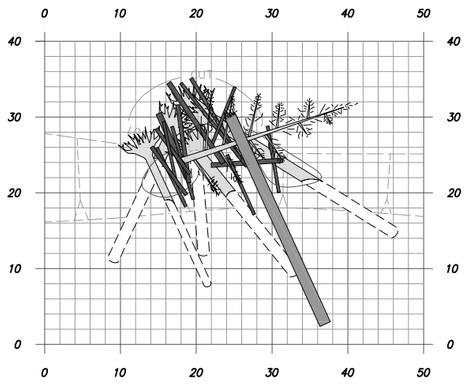
Step 2: Expand trench if necessary, then place logs #4 and #5 in the orientation shown; angled into the bank on a minimum slope of 10H:1V. Rest tree top on top of log #5, angling it the tip into the streambed on the downstream end.



Step 3: Expand trench if necessary to place log #6; rest log #6 on top of tree top and angle into the bank on a minimum slope of 10H:1V.



Step 4: Incorporate racking and slash material into structure by weaving it between logs and pressing pieces into the bank. Backfill the trench to the original bank line.



NOTES:

1. *All logs shall come from fir, pine, or spruce trees.*
2. *The diameter of logs without rootwads shall be measured at the smallest cut end.*
3. *The exact location of each streambank habitat structure shall be staked by the Contractor and approved by the Contracting Officer prior to constructing a specific structure.*
4. *Rough grading of channel shall be completed prior to constructing in–channel LWM structures.*
5. *Cut ends of logs that will be exposed at structure completion shall be marred prior to installation. The Contractor shall use an excavator, bulldozer, or other heavy equipment to tear apart wood fibers at the exposed cut end(s) of the log to create the appearance of a log that has naturally broken apart.*
6. *Racking and slash material shall be incorporated into each streambank habitat structure by weaving it in between placed logs, placing it in voids, pressing it into the bank, or otherwise including it in the structure as directed by the Contracting Officer. Racking material as shown on this sheet is schematic only and not intended to represent the actual location or orientation of individual pieces.*
7. *The amount of slash placed in each structure shall be as directed by the Contracting Officer and may vary from structure to structure. The cost of providing and placing slash is not part of the unit cost of constructing this structure. All costs associated with obtaining and placing slash shall be part of the bid item "Slash Material".*
8. *Backfill structure using soil excavated to place logs unless the Contracting Officer determines the native soil is unsuitable for backfill and suitable soil must be imported. Place soil for backfill in 1 foot maximum lifts. Compact each lift using mechanical equipment such as an excavator bucket or equipment tracking.*

STREAMBANK HABITAT STRUCTURE MATERIAL SCHEDULE

ITEM	DESCRIPTION	QUANTITY
Log type (F)	20' long, 12" DBH log with rootwad	1
Log type (G)	20' long, 18" DBH log with rootwad	3
Log type (H)	30' long, 18" dia. log	1
Log type (I)	30' long, 18" DBH log with rootwad	1
Tree top	25' long tree top with full branches	1
Small racking material	6'–15' long, 3"–8" dia. log	8
Large racking material	6'–15' long, 8"–12" dia. log	8
Slash material (see note 7)	Tree tops, limbs with branches and needles	As Directed

STREAMBANK HABITAT STRUCTURE CONSTRUCTION DETAILS

STRUCTURE STATION	DESIGN ELEVATION
7+55	2962.7'
25+80	2948.2'
29+20	2946.7'
45+05	2935.0'
49+55	2932.0'
53+00	2931.1'

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015–09–11

LWM DETAILS

STREAMBANK HABITAT STRUCTURE

1678–100–2139

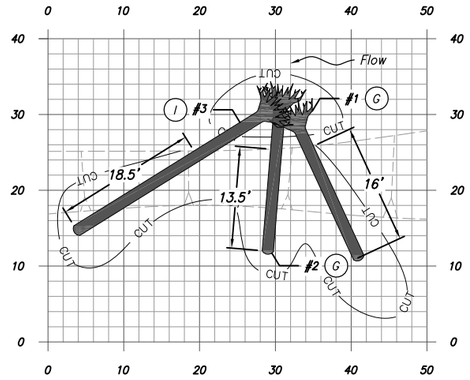
SHEET 12 OF 24

DATE AND TIME PLOTTED
September 11, 2015 15:28
PLOTTED BY
TRUSCOTT, NIC

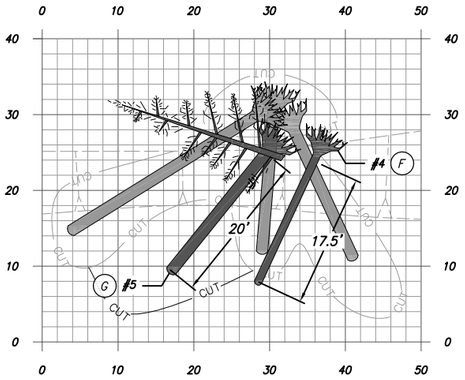
CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Parcel_3_LWM_Strmbnk_Hab_Details.dwg

LEFT BANK CONSTRUCTION SEQUENCE

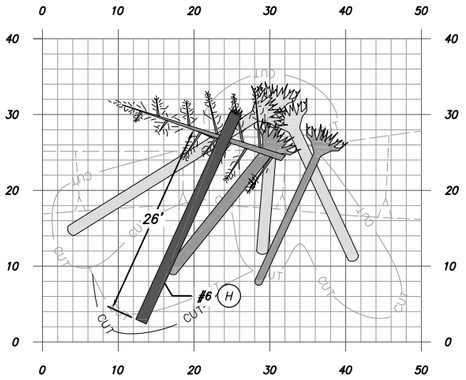
Step 1: Excavate scour pool as directed by Contracting Officer, then excavate trenches for bottom layer of logs; place logs horizontally at the elevation shown on this sheet.



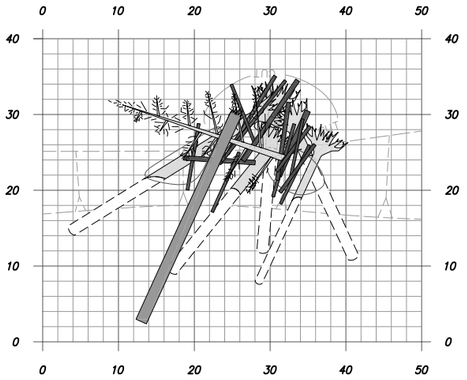
Step 2: Expand trench if necessary, then place logs #4 and #5 in the orientation shown; angled into the bank on a minimum slope of 10H:1V. Rest tree top on top of log #5, angling it the tip into the streambed on the downstream end.



Step 3: Expand trench if necessary to place log #6; rest log #6 on top of tree top and angle into the bank on a minimum slope of 10H:1V.



Step 4: Incorporate racking and slash material into structure by weaving it between logs and pressing pieces into the bank. Backfill the trench to the original bank line.



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GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
9/14/15

RENEWAL DATE: 12/31/2015

N. TRUSCOTT
DRAWN

X Jay Hovde
ACCEPTED

BOISE, ID *2015-09-11*

LWM DETAILS

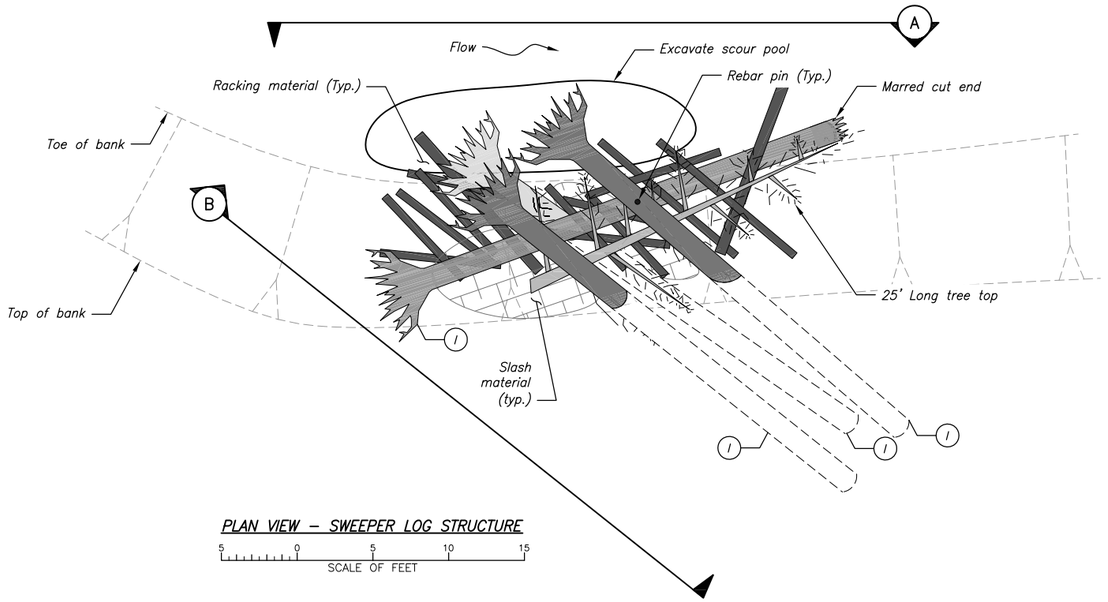
STREAMBANK HABITAT STRUCTURE

1678-100-2140

SHEET 13 OF 24

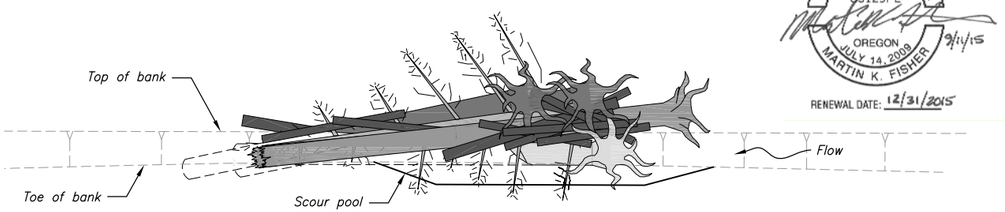
DATE AND TIME PLOTTED
September 11, 2015 15:28
PLOTTED BY
TRUSCOTT, NIC

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Parcel_3_LWM_Strmbnk_Hab_Details.dwg



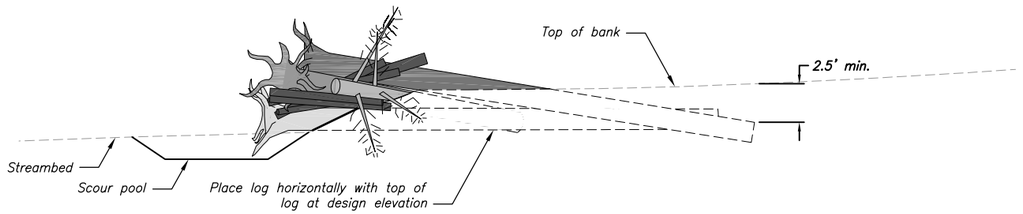
PLAN VIEW – SWEEPER LOG STRUCTURE

SCALE OF FEET 5 0 5 10 15



ELEVATION A – SWEEPER LOG STRUCTURE FRONT VIEW

SCALE OF FEET 5 0 5 10 15



ELEVATION B – SWEEPER LOG STRUCTURE SIDE VIEW

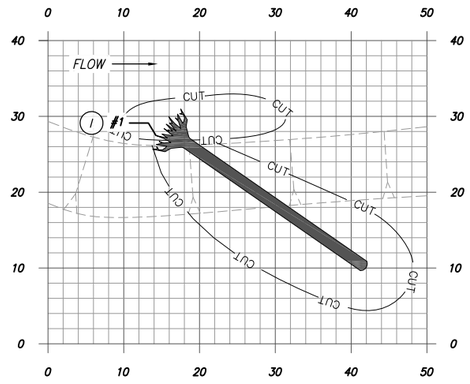
SCALE OF FEET 5 0 5 10 15

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2006
MARTIN K. FISHER
3/4/15

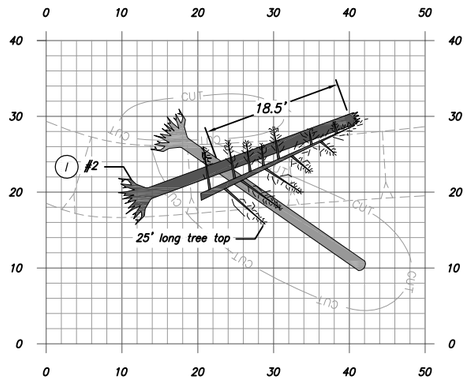
RENEWAL DATE: 12/31/2015

RIGHT BANK (REGULAR) CONSTRUCTION SEQUENCE

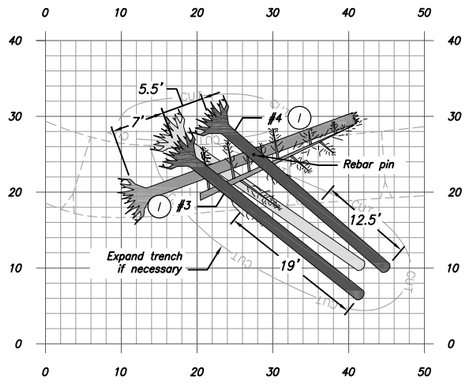
Step 1: Excavate scour pool as directed by Contracting Officer and trench for log #1; place log horizontally at elevation identified on this sheet. Rootwad shall sit just past the toe of bank.



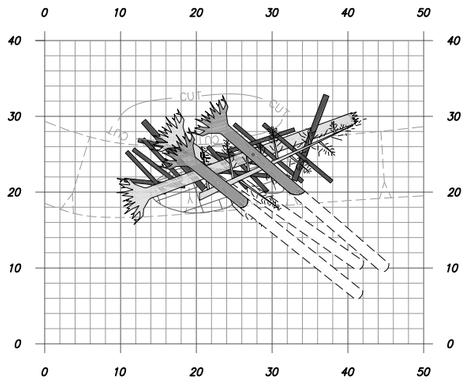
Step 2: Place log #2 with rootwad on or near the top of bank with the cut end angled towards the streambed in the downstream direction. Position 25' long tree top with full branches on the bank side of log #2.



Step 3: Expand trench if necessary to make room for logs #3 and #4; logs shall rest on top of log #2 and hold the tree top in place. Logs shall be angled into bank with a minimum of 2.5' of cover at their cut ends. Pin log #4 to log #2 with rebar pin.



Step 4: Incorporate racking and slash material into structures by weaving it between logs and pressing pieces into the bank. Backfill the excavated trench compacting moderately in 1' lifts to the original bank line.



NOTES:

1. *Two variations of this structure are shown in the Drawings: regular and reverse orientations. Regular orientation is shown on this Dwg., see Dwg. –2142 for construction sequence for left bank and reverse orientations.*
2. *All logs shall come from fir, pine, or spruce trees.*
3. *Tree tops shall come from Douglas fir, grand fir, or spruce trees and shall be installed within 30 days of harvest.*
4. *Tree tops shall be handled with care to minimize breaking of branches. The Contracting Officer may reject any tree tops that have lost significant amounts of branches.*
5. *The exact location of each sweeper log structure shall be staked by the Contractor and approved by the Contracting Officer prior to constructing a specific structure.*
6. *Rough grading of channel shall be completed prior to constructing in–channel LWM structures.*
7. *Cut ends of logs that will be exposed at structure completion shall be marred prior to installation. The Contractor shall use an excavator, bulldozer, or other heavy equipment to tear apart wood fibers at the exposed cut end(s) of the log to create the appearance of a log that has naturally broken apart.*
8. *Racking and slash material shall be incorporated into each sweeper log structure by weaving it in between placed logs, placing it in voids, pressing it into the bank, or otherwise including it in the structure as directed by the Contracting Officer. Racking material as shown on this sheet is schematic only and not intended to represent the exact location or orientation of individual pieces.*
9. *The amount of slash placed in each structure shall be as directed by the Contracting Officer and may vary from structure to structure. The cost of providing and placing slash is not part of the unit cost of constructing this structure. All costs associated with obtaining and placing slash shall be part of the bid item "Slash Material".*
10. *Rebar pins shall be #6 rebar (minimum). To install rebar pins drill a ¾" diameter (or equal to nominal diameter of rebar if a size larger than #6 is used) pilot hole through both logs. Rebar pin shall extend completely through both logs and be finished flush with the top log.*
11. *Backfill structure using soil excavated to place logs unless the Contracting Officer determines the native soil is unsuitable for backfill and suitable soil must be imported. Place soil for backfill in 1 foot maximum lifts. Compact each lift using mechanical equipment such as an excavator bucket or equipment tracking.*

SWEEPER LOG STRUCTURE SCHEDULE

ITEM	DESCRIPTION	QUANTITY
Log type (1)	30' long, 18" DBH log with rootwad	4
Tree top	25' long tree top with full branches	1
Small racking material	6'–15' long, 3"–8" dia. log	8
Large racking material	6'–15' long, 8"–12" dia. log	8
Slash material (see note 9)	Tree tops, limbs with branches and needles	As Directed

SWEEPER LOG STRUCTURE CONSTRUCTION DETAILS

STRUCTURE STATION (ORIENTATION)	DESIGN ELEVATION
29+70 (REVERSE)	2942.8'
33+65 (REGULAR)	2942.0'
35+25 (REVERSE)	2940.7'
41+20 (REGULAR)	2938.5'
43+10 (REGULAR)	2934.3'

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015–09–11

LWM DETAILS

SWEEPER LOG STRUCTURE

1678–100–2141

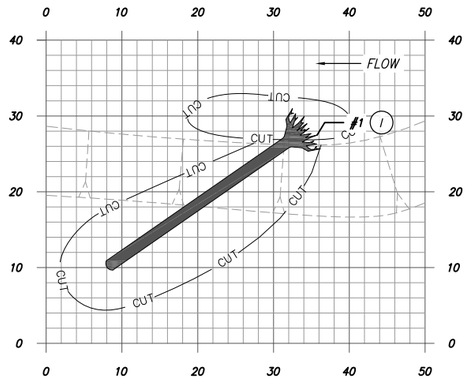
SHEET 14 OF 24

DATE AND TIME PLOTTED
September 11, 2015 15:28
PLOTTED BY
TRUSCOTT, NIC

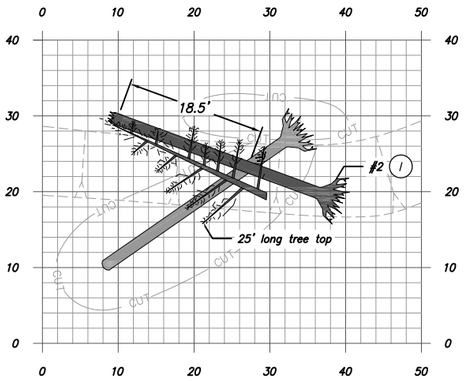
CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Parcel_3_LWM_Sweeper_Details.dwg

LEFT BANK (REGULAR) CONSTRUCTION SEQUENCE

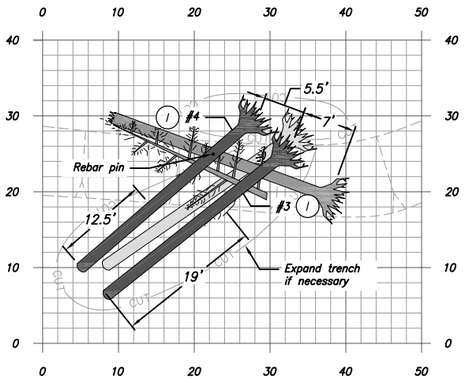
Step 1: Excavate scour pool as directed by Contracting Officer and trench for log #1; place log horizontally at elevation identified on this sheet. Rootwad shall sit just past the toe of bank.



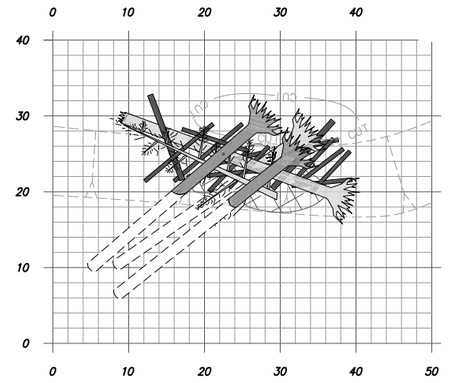
Step 2: Place log #2 with rootwad on or near the top of bank with the cut end angled towards the streambed in the downstream direction. Position 25' long tree top with full branches on the bank side of log #2.



Step 3: Expand trench if necessary to make room for logs #3 and #4; logs shall rest on top of log #2 and hold the tree top in place. Logs shall be angled into bank with a minimum of 2.5' of cover at their cut ends. Pin log #4 to log #2 with rebar pin.

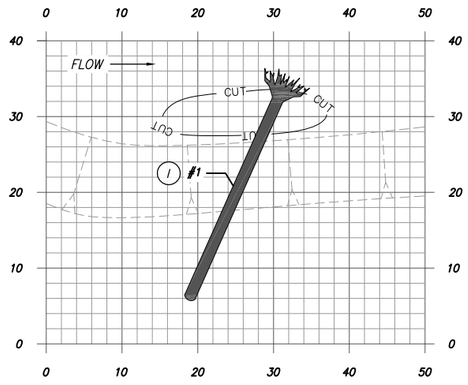


Step 4: Incorporate racking and slash material into structures by weaving it between logs and pressing pieces into the bank. Backfill the excavated trench compacting moderately in 1' lifts to the original bank line.

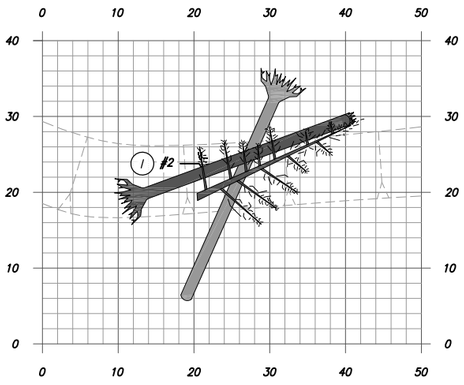


RIGHT BANK (REVERSE) CONSTRUCTION SEQUENCE

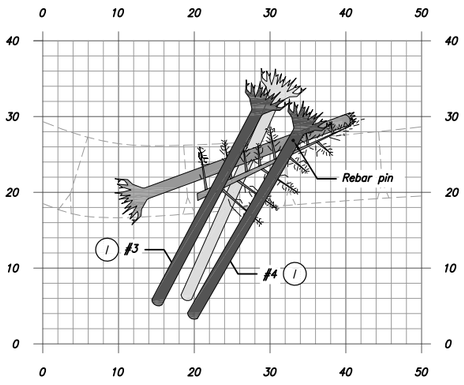
Step 1: Excavate scour pool as directed by Contracting Officer and trench for log #1; place log horizontally at elevation identified on this sheet.



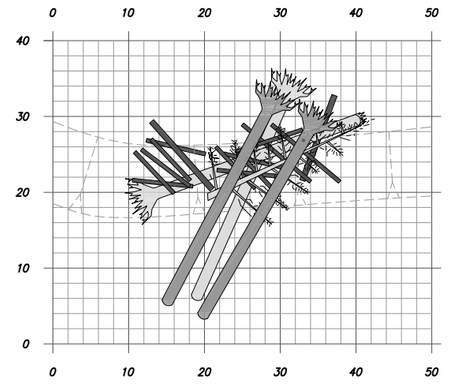
Step 2: Place log #2 with rootwad on or near the top of bank with the cut end angled towards the streambed in the downstream direction. Position 25' long tree top with full branches on the bank side of log #2.



Step 3: Expand trench if necessary to make room for logs #3 and #4; logs shall rest on top of log #2 and hold the tree top in place. Logs shall be angled into bank with a minimum of 2.5' of cover at their cut ends. Pin log #4 to log #2 with rebar pin.

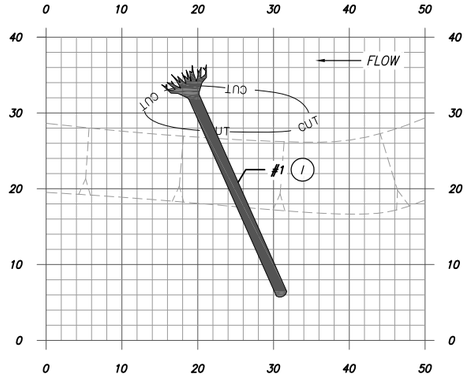


Step 4: Incorporate racking and slash material into structures by weaving it between logs and pressing pieces into the bank. Backfill the excavated trench compacting moderately in 1' lifts to the original bank line.

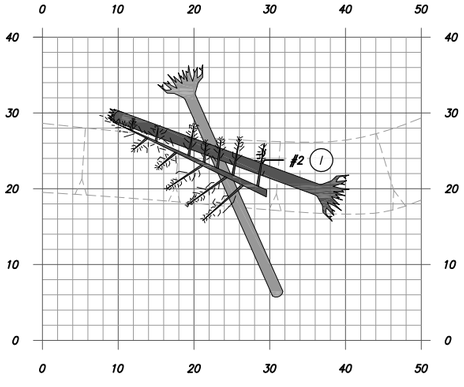


LEFT BANK (REVERSE) CONSTRUCTION SEQUENCE

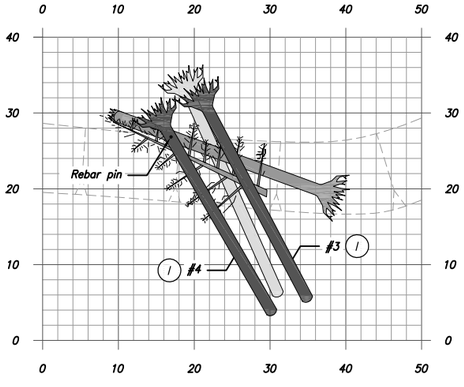
Step 1: Excavate scour pool as directed by Contracting Officer and trench for log #1; place log horizontally at elevation identified on this sheet.



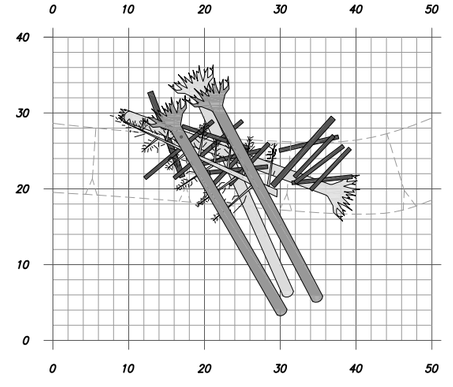
Step 2: Place log #2 with rootwad on or near the top of bank with the cut end angled towards the streambed in the downstream direction. Position 25' long tree top with full branches on the bank side of log #2.



Step 3: Expand trench if necessary to make room for logs #3 and #4; logs shall rest on top of log #2 and hold the tree top in place. Logs shall be angled into bank with a minimum of 2.5' of cover at their cut ends. Pin log #4 to log #2 with rebar pin.



Step 4: Incorporate racking and slash material into structures by weaving it between logs and pressing pieces into the bank. Backfill the excavated trench compacting moderately in 1' lifts to the original bank line.



REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
9/11/15
RENEWAL DATE: 12/31/2015

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GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015-09-11

LWM DETAILS

SWEEPER LOG STRUCTURE

1678-100-2142

SHEET 15 OF 24

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September 11, 2015 15:28
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TRUSCOTT, NIC

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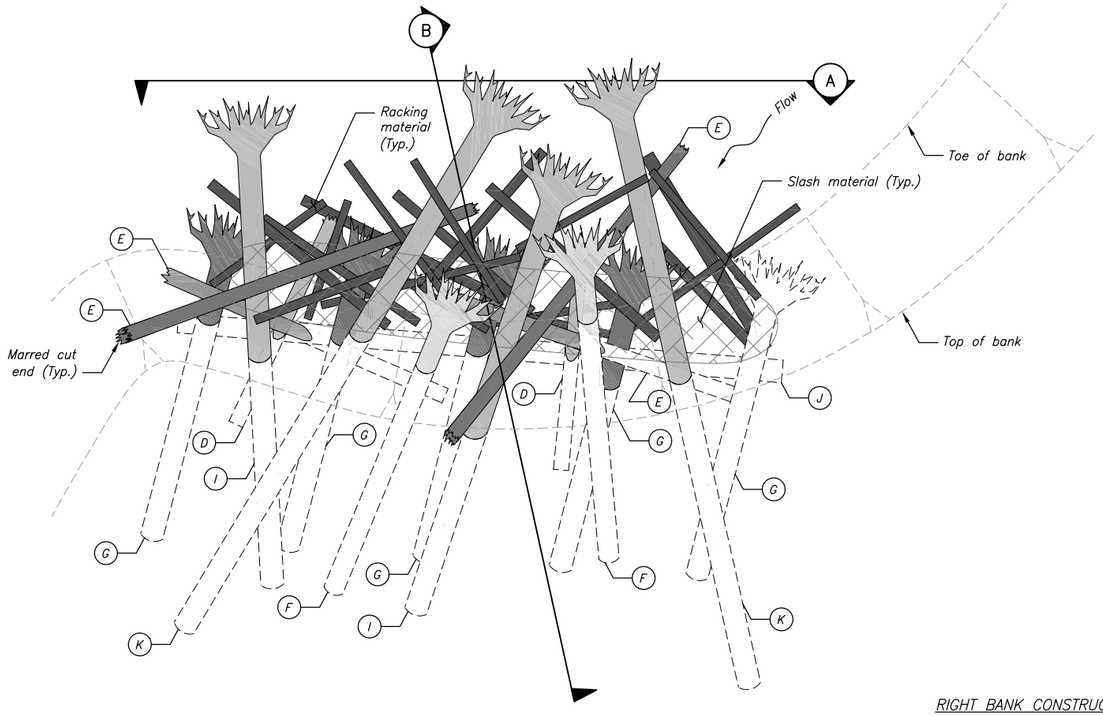
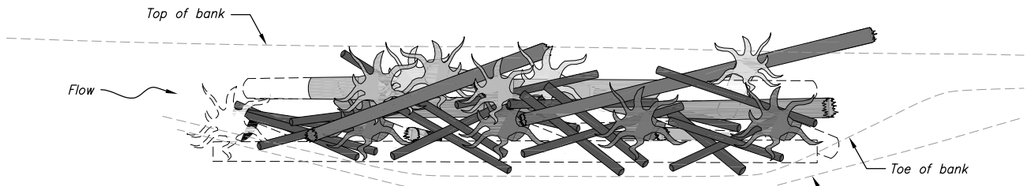
CC44_Parcel_3_LWM_Sweeper_Details.dwg



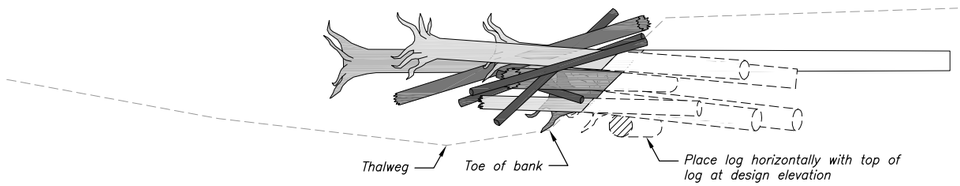
PLAN VIEW – HIGH ENERGY BANK STRUCTURE

5 0 5 10 15
SCALE OF FEET



ELEVATION A – HIGH ENERGY BANK STRUCTURE FRONT VIEW

5 0 5 10 15
SCALE OF FEET



ELEVATION B – HIGH ENERGY BANK STRUCTURE SIDE VIEW

5 0 5 10 15
SCALE OF FEET

NOTES:

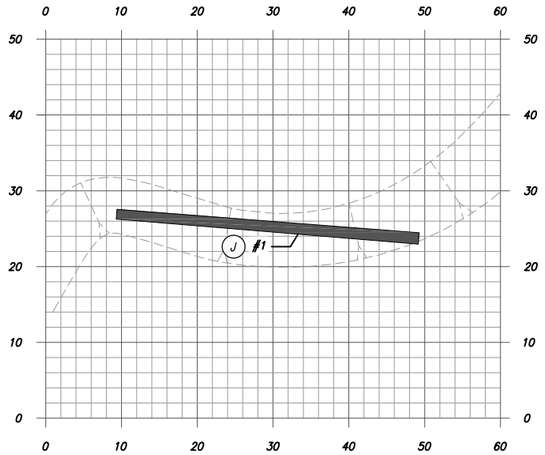
1. All logs shall come from fir, pine, or spruce trees.
2. The diameter of logs without rootwads shall be measured at the smallest cut end.
3. The exact location of each high energy bank structure shall be staked by the Contractor and approved by the Contracting Officer prior to constructing a specific structure.
4. Rough grading of channel shall be completed prior to constructing in-channel LWM structures.
5. Cut ends of logs that will be exposed at structure completion shall be marred prior to installation. The Contractor shall use an excavator, bulldozer, or other heavy equipment to tear apart wood fibers at the cut end of the log to create the appearance of a log that has naturally broken apart.
6. Racking and slash material shall be incorporated into each high energy bank structure by weaving it in between placed logs, placing it in voids, pressing it into the bank, or otherwise including it in the structure as directed by the Contracting Officer. Racking material as shown on this sheet is schematic only and not intended to represent the actual location or orientation of individual pieces.
7. The amount of slash placed in each structure shall be as directed by the Contracting Officer and may vary from structure to structure. The cost of providing and placing slash is not part of the unit cost of constructing this structure. All costs associated with obtaining and placing slash shall be part of the bid item "Slash Material".
8. Backfill structure using soil excavated to place logs unless the Contracting Officer determines the native soil is unsuitable for backfill and suitable soil must be imported. Place soil for backfill in 1 foot maximum lifts. Compact each lift using mechanical equipment such as an excavator bucket or equipment tracking.

HIGH ENERGY BANK STRUCTURE MATERIAL SCHEDULE

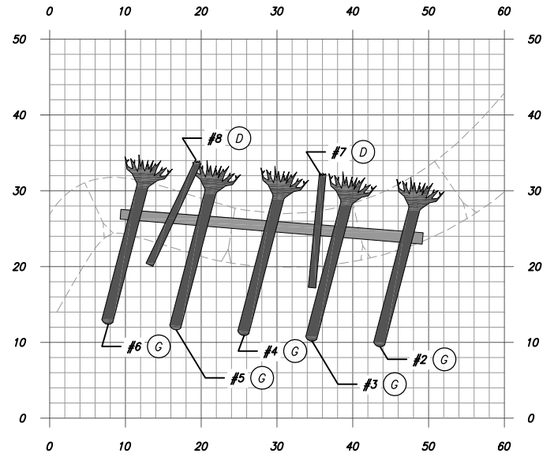
ITEM	DESCRIPTION	QUANTITY
Log type (D)	15'–20' long, 12" dia. log	2
Log type (E)	20'–25' long, 12" dia. log	4
Log type (F)	20' long, 12" DBH log with rootwad	2
Log type (G)	20' long, 18" DBH log with rootwad	5
Log type (I)	30' long, 18" DBH log with rootwad	2
Log type (J)	40' long, 18" dia. log	1
Log type (K)	40' long, 18" DBH log with rootwad	2
Small racking material	6'–15' long, 3"–8" dia. log	15
Large racking material	6'–15' long, 8"–12" dia. log	15
Slash material (see note 7)	Tree tops, limbs with branches and needles	As Directed

RIGHT BANK CONSTRUCTION SEQUENCE

Step 1: Excavate as necessary to place log #1 (footer log) with top of log at design elevation.



Step 2: Excavate as necessary to place logs #2–#8. Logs shall be placed horizontally.



Construction sequencing continued on Dwg. –2144

HIGH ENERGY BANK STRUCTURE CONSTRUCTION DETAILS

STRUCTURE STATION	DESIGN ELEVATION
33+30	2939.5'
40+80	2934.5'
42+75	2932.0'
47+75	2929.1'

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
9/14/15
RENEWAL DATE: 12/31/2015

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GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

X Jay Hovde
ACCEPTED

BOISE, ID 2015-09-11

LWM DETAILS

HIGH ENERGY BANK STRUCTURE

1678-100-2143

SHEET 16 OF 24

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September 11, 2015 15:32
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TRUSCOTT, NIC

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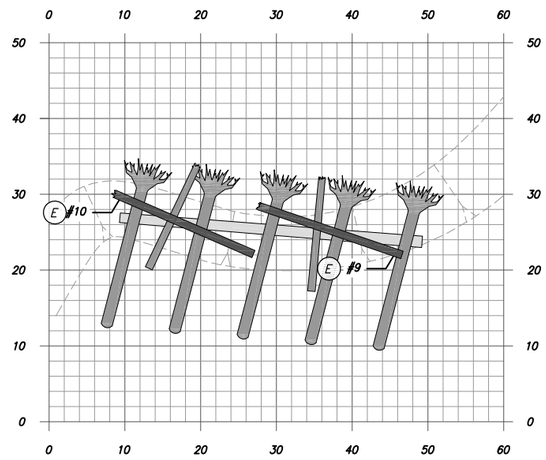
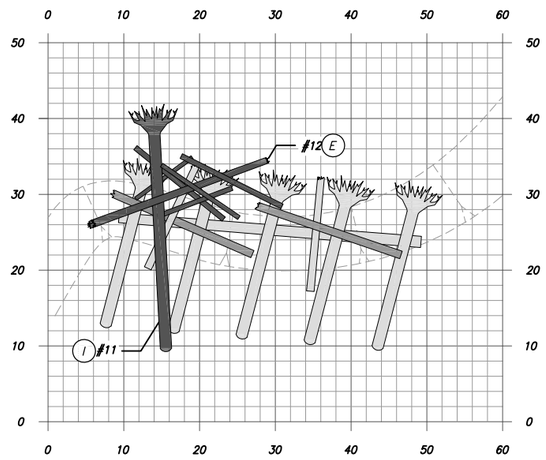
CAD FILENAME
CC44_Phase_3-4_LWM_High_Energy_Bank_Details.dwg

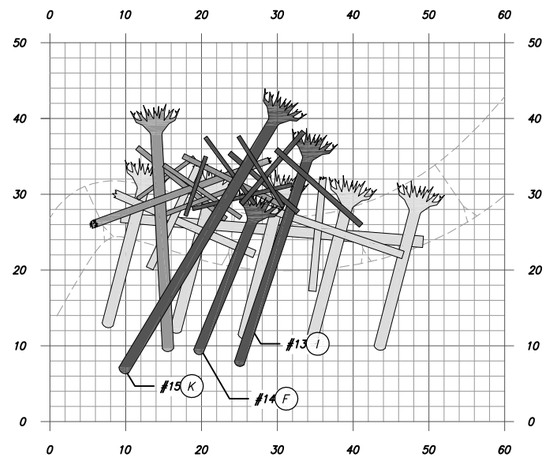
Step 3: Place logs #9 and #10 as shown, resting them on previously placed logs.



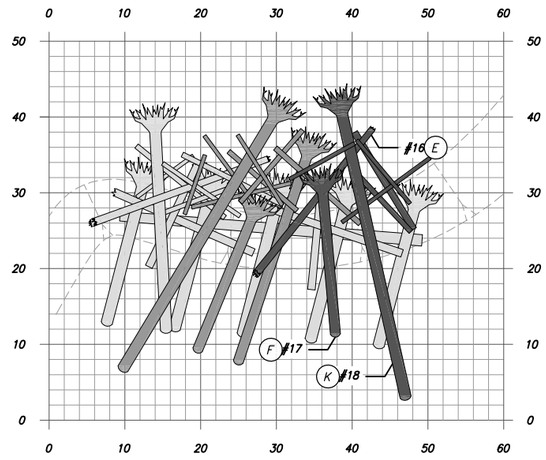
Step 4: Place #11 in the orientation shown, angling it on an 8H:1V slope into the bank. Rest log #12 on top of log #11 with the upstream end angled toward the streambed. Incorporate approximately one-third of the racking material into the structure as directed by the Contracting Officer while completing this step.



Step 5: Expand excavation as necessary to place logs #13–#15. Logs #13 and #15 shall rest on top of previously place logs; angle log #14 on a slope of 8H:1V into the bank. Incorporate approximately one-third of the racking material into the structure as directed by the Contracting Officer while completing this step.



Step 6: Place log #16 as shown, resting it on top of previously placed logs and angling the upstream end toward the streambed. Place logs #17 and #18 horizontally, resting each on top of previously placed logs. Incorporate remaining racking material and slash material into the structure as directed by the Contracting Officer then backfill structure to original bank.



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GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015-09-11

LWM DETAILS

HIGH ENERGY
BANK STRUCTURE

1678-100-2144

SHEET 17 OF 24

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
9/14/15

RENEWAL DATE: 12/31/2015

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September 11, 2015 15:32
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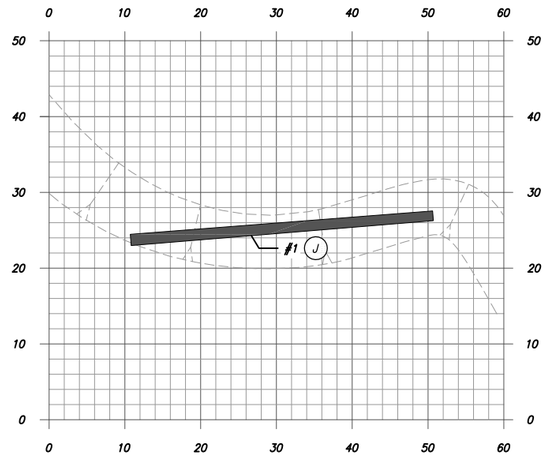
TRUSCOTT, NIC

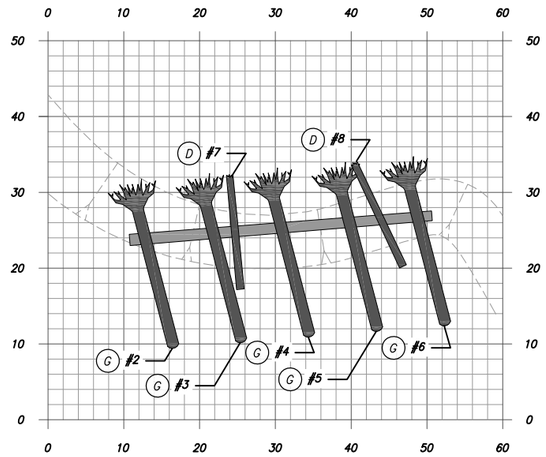
CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Phase_3-4_LWM_High_Energy_BankStructure_Details.dwg

LEFT BANK CONSTRUCTION SEQUENCE

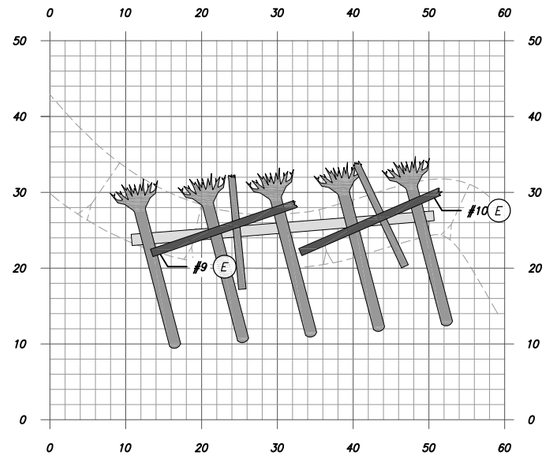
Step 1: Excavate as necessary to place log #1 (footer log) with top of log at design elevation.



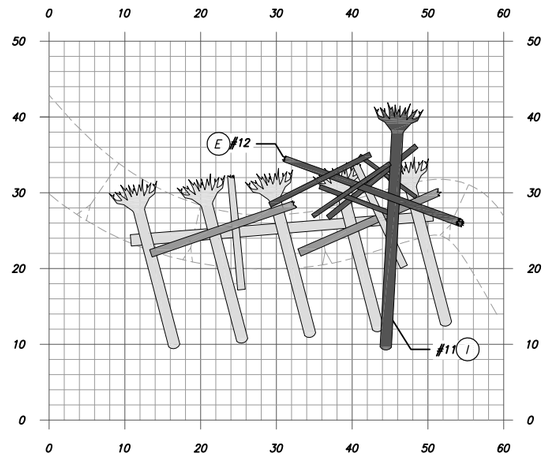
Step 2: Excavate as necessary to place logs #2–#8. Logs shall be placed horizontally.



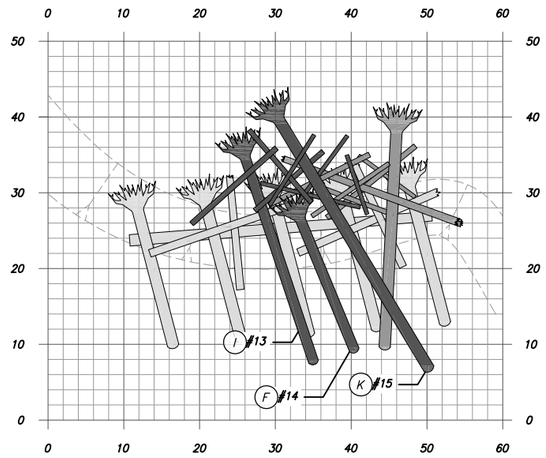
Step 3: Place logs #9 and #10 as shown, resting them on previously placed logs.



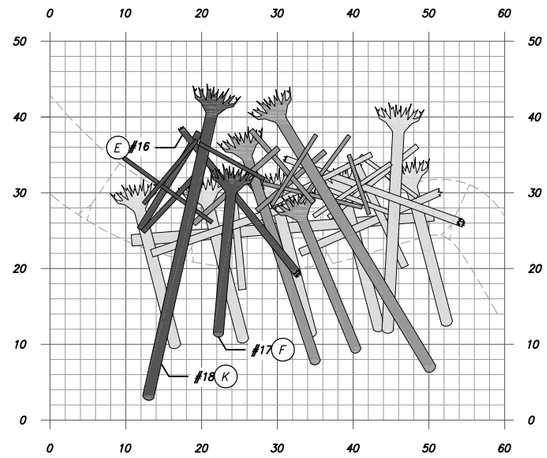
Step 4: Place #11 in the orientation shown, angling it on an 8H:1V slope into the bank. Rest log #12 on top of log #11 with the upstream end angled toward the streambed. Incorporate approximately one–third of the racking material into the structure as directed by the Contracting Officer while completing this step.



Step 5: Expand excavation as necessary to place logs #13–#15. Logs #13 and #15 shall rest on top of previously place logs; angle log #14 on a slope of 8H:1V into the bank. Incorporate approximately one–third of the racking material into the structure as directed by the Contracting Officer while completing this step.



Step 6: Place log #16 as shown, resting it on top of previously placed logs and angling the upstream end toward the streambed. Place logs #17 and #18 horizontally, resting each on top of previously placed logs. Incorporate remaining racking material and slash material into the structure as directed by the Contracting Officer then backfill structure to original bank.



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RENEWAL DATE: 12/31/2015

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GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015-09-11

LWM DETAILS

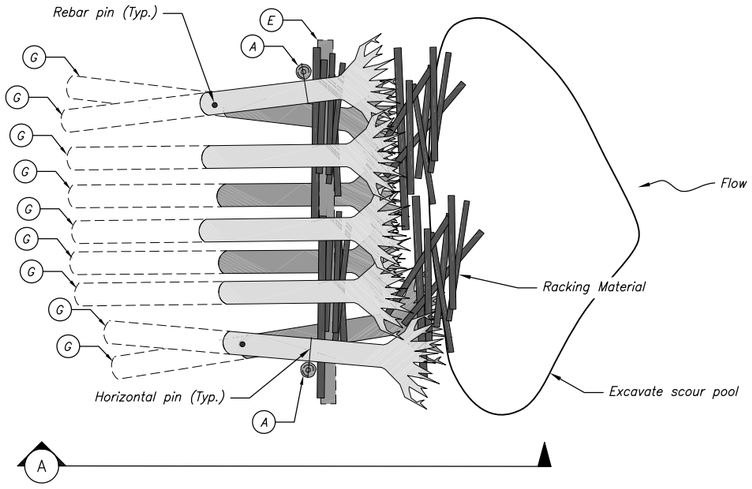
HIGH ENERGY
BANK STRUCTURE

1678-100-2145

SHEET 18 OF 24

DATE AND TIME PLOTTED
September 11, 2015 15:33
PLOTTED BY
TRUSCOTT, NIC

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Phase_3-4_LWM_High_Energy_BankStructure_Details.dwg



PLAN VIEW – LARGE APEX JAM

5 0 5 10 15
SCALE OF FEET

NOTES:

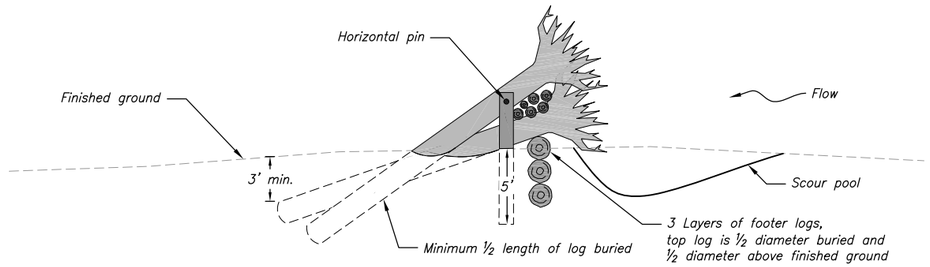
1. All logs shall come from fir, pine, or spruce trees.
2. The diameter of logs without rootwads shall be measured at the smallest cut end.
3. The exact location of the large apex jam shall be staked by the Contractor and approved by the Contracting Officer prior to constructing it.
4. Cut ends of logs that will be exposed at structure completion shall be marred prior to installation. The Contractor shall use an excavator, bulldozer, or other heavy equipment to tear apart wood fibers at the exposed cut end(s) of the log to create the appearance of a log that has naturally broken apart.
5. Racking and slash material shall be incorporated into the large apex jam by weaving it in between placed logs, placing it in voids, or otherwise including it in the structure as directed by the Contracting Officer. Racking material as shown on this sheet is schematic only and not intended to represent the actual location or orientation of individual pieces.
6. Rebar pins shall be #6 rebar (minimum). To install rebar pins drill a ¾" diameter (or equal to nominal diameter of rebar if a size larger than #6 is used) pilot hole through both logs. Rebar pin shall extend completely through both logs and be finished flush with the top log.
7. Horizontal pins shall be 1" diameter all–thread. Drill 1 ¼" hole through vertical log and top layer log with rootwad. Insert 1" diameter all–thread through hole. Place washer at each end and secure with nut at each end. Cut excess length of all–thread so end is flush with nut.
8. Backfill structure using soil excavated to place logs unless the Contracting Officer determines the native soil is unsuitable for backfill and suitable soil must be imported. Place soil for backfill in 1 foot maximum lifts. Compact each lift using mechanical equipment such as an excavator bucket or equipment tracking.

LARGE APEX JAM SCHEDULE

ITEM	DESCRIPTION	QUANTITY
Log type (A)	10' long, 12" dia. log	2
Log type (E)	20'–25' long, 12" dia. log	3
Log type (G)	20' long, 18" DBH log with rootwad	9
Small racking material	6'–15' long, 3"–8" dia. log	20
Large racking material	6'–15' long, 8"–12" dia. log	20

LARGE APEX JAM CONSTRUCTION DETAILS
STRUCTURE STATION

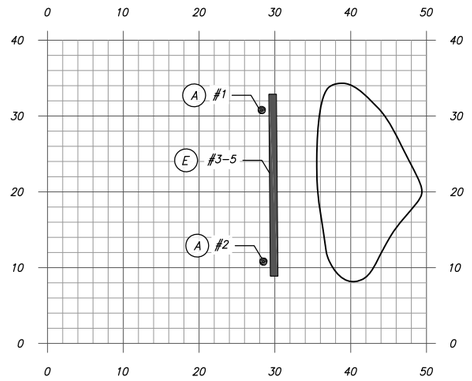
51+50



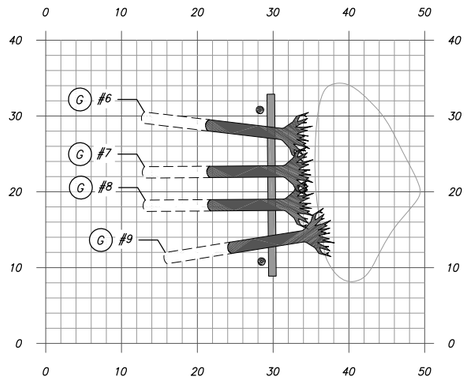
ELEVATION A – LARGE APEX JAM SIDE VIEW

5 0 5 10 15
SCALE OF FEET

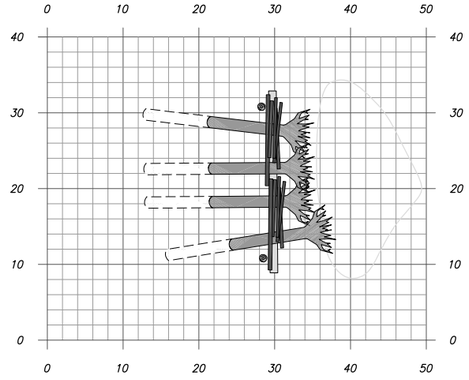
Step 1: Place footer logs and vertical piling logs then backfill to existing channel bed. Excavate scour pool to dimensions directed by Contracting Officer after footer logs and pilings have been placed.



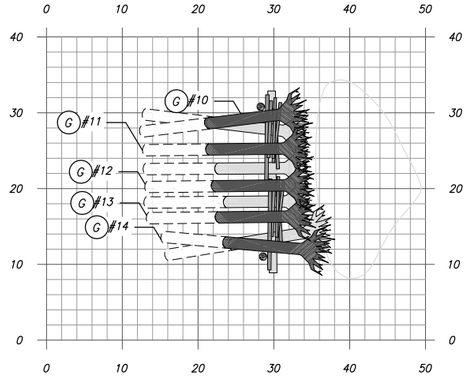
Step 2: Place lower row of apex jam logs with rootwads.



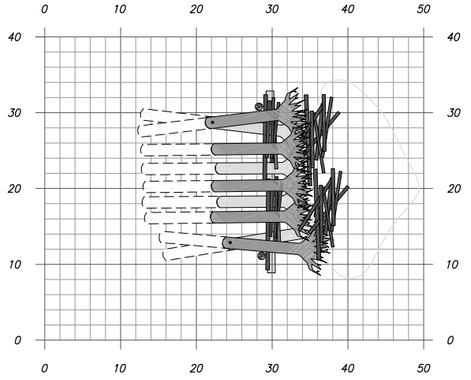
Step 3: Place racking material over lower row of apex jam logs and in front of vertical piling logs.



Step 4: Place second layer of apex jam logs with rootwads.



Step 5: Place racking material in front of apex jam. Install 2 rebar pins, 1 at each location where upper layer log with rootwad crosses lower layer log with rootwad. Install 2 horizontal pins, 1 connecting each pile to adjacent log with rootwad.



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GRANDE RONDE SUBBASIN

CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

M. FISHER
DRAWN

X Jay Hovde
ACCEPTED

BOISE, ID 2015–09–11

LWM DETAILS

LARGE APEX JAM

1678–100–2146

SHEET 19 OF 24

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September 11, 2015 15:33
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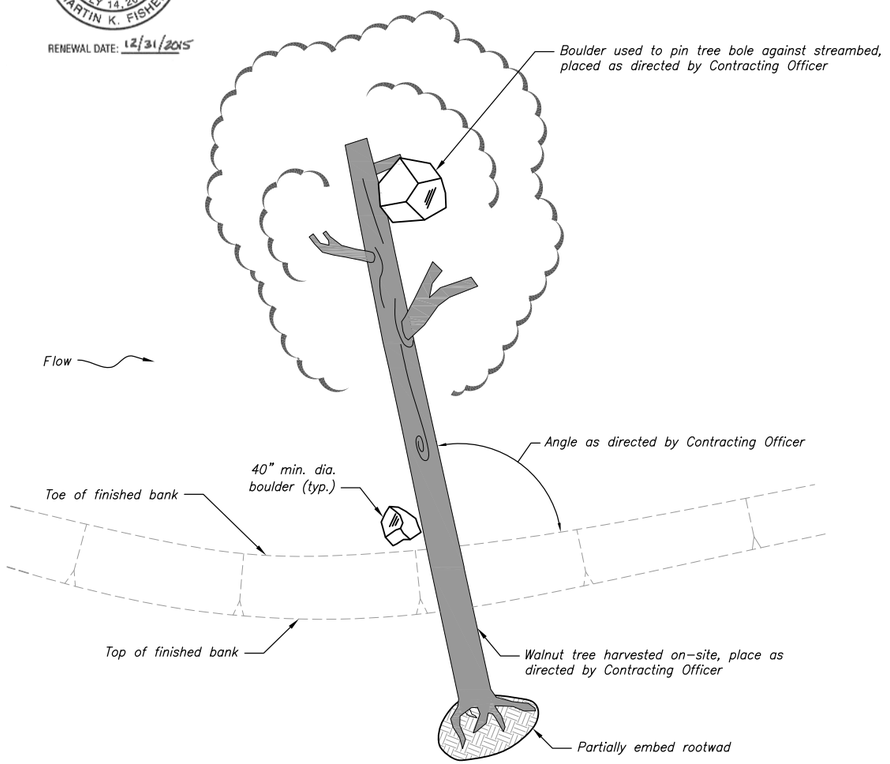
TRUSCOTT, WC

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Parcel_3_LWM_BIOApex_Details.dwg

ONSITE WALNUT TREE PLACEMENT DETAIL

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
9/11/15
RENEWAL DATE: 12/31/2015

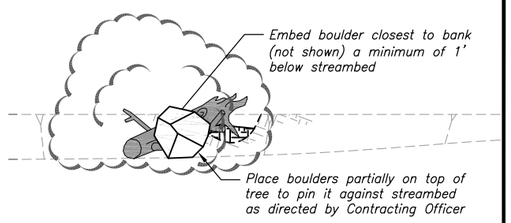


PLAN VIEW – ONSITE WALNUT TREE PLACEMENT

N.T.S.

ONSITE WALNUT TREE PLACEMENT CONSTRUCTION DETAILS

STRUCTURE	STATION
As Directed (x4)	



ELEVATION VIEW – ONSITE WALNUT TREE PLACEMENT

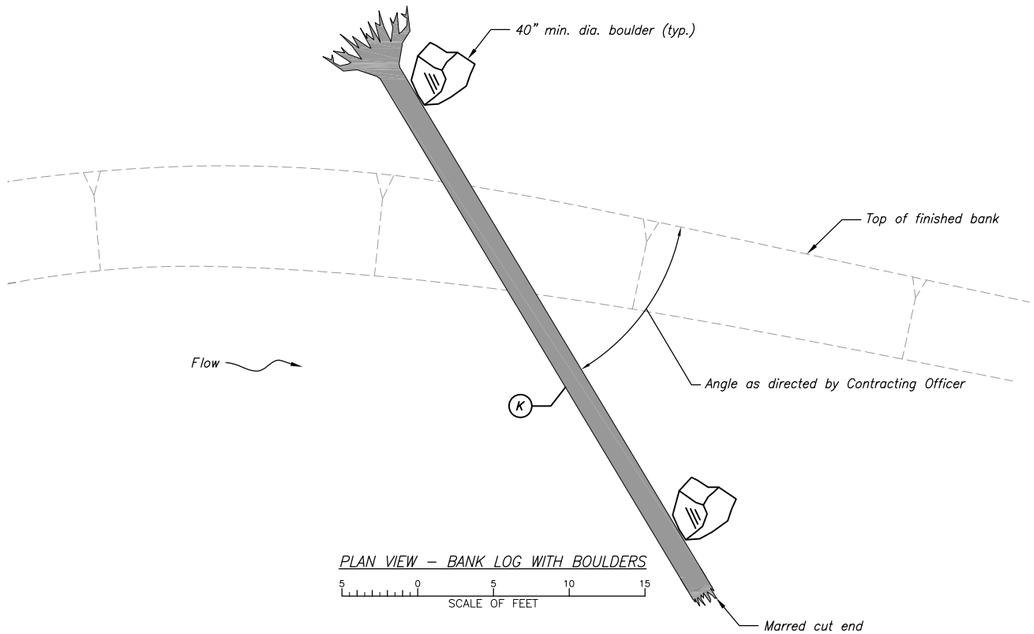
10 0 10 20 30
SCALE OF FEET

ON-SITE FIELD-FIT TREE MATERIAL SCHEDULE

ITEM	DESCRIPTION	QUANTITY
Black walnut tree	Length and DBH vary, identified by C.O.	1
Boulder	40" min. dia.	2

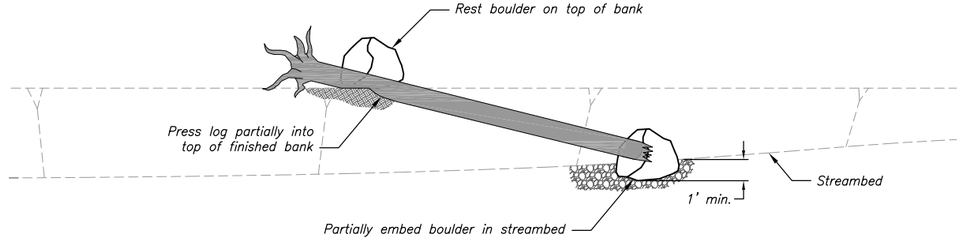
Notes:
1. Onsite walnut tree placements shall be placed as directed by the Contracting Officer.
2. All logs for field-fit on-site trees shall come from the project site. The Contractor will be required to transport and place logs as directed by the Contracting Officer.
3. The Contracting Officer will identify trees for harvest; trees are walnut and range from approximately 36" to 60" DBH. Trees shall be limbed and trimmed as directed by the Contracing Officer prior to placement.
4. Boulders shall be placed as directed by the Contracting Officer. Two large boulders are available for salvage and use from on-site. On-site boulder diameters range from approximately 4' to over 8' in diameter. Placing the boulders as directed by the Contracting Officer will required careful manipulation with heavy equipment. Boulders shall be placed at least partially on top of each tree to hold it down.
5. Imported boulders shall be naturally occurring or processed stone that is competent and free of seams, cracks, or other defects. Boulders shall be generally spherical and have a minimum diameter of 40" as determined by averaging the measured lengths along the three major axes.

BANK LOG WITH BOULDERS DETAIL



PLAN VIEW – BANK LOG WITH BOULDERS

5 0 5 10 15
SCALE OF FEET



ELEVATION VIEW – BANK LOG WITH BOULDERS

5 0 5 10 15
SCALE OF FEET

Notes:
1. Bank logs with boulders shall be constructed as shown on this sheet unless otherwise directed by the Contracting Officer.
2. The exact location of each bank log with boulders shall be determined by the Contracting Officer.
3. Logs shall come from fir, pine, or spruce trees.
4. The cut end of the log shall be marred prior to installation. The Contractor shall use an excavator, bulldozer, or other heavy equipment to tear apart wood fibers at the cut end of the log to create the appearance of a log that has naturally broken apart.
5. Boulders shall be naturally occurring or processed stone that is competent and free of seams, cracks, or other defects. Boulders shall be generally spherical and have a minimum diameter of 40" as determined by averaging the measured lengths along the three major axes.

BANK LOG WITH BOULDERS MATERIAL SCHEDULE

ITEM	DESCRIPTION	QUANTITY
Log type (K)	40' long, 18" DBH log with rootwad	1
Boulder	40" min. dia.	2

BANK LOG WITH BOULDERS CONSTRUCTION DETAILS

STRUCTURE	STATION
55+00	
55+30	

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GRANDE RONDE SUBBASIN

CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

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x Jay Hovde
ACCEPTED

BOISE, ID 2015-09-11

LWM DETAILS

ONSITE WALNUT TREE PLACEMENT & BANK LOG WITH BOULDERS

1678-100-2147

SHEET 20 OF 24

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September 11, 2015 15:33
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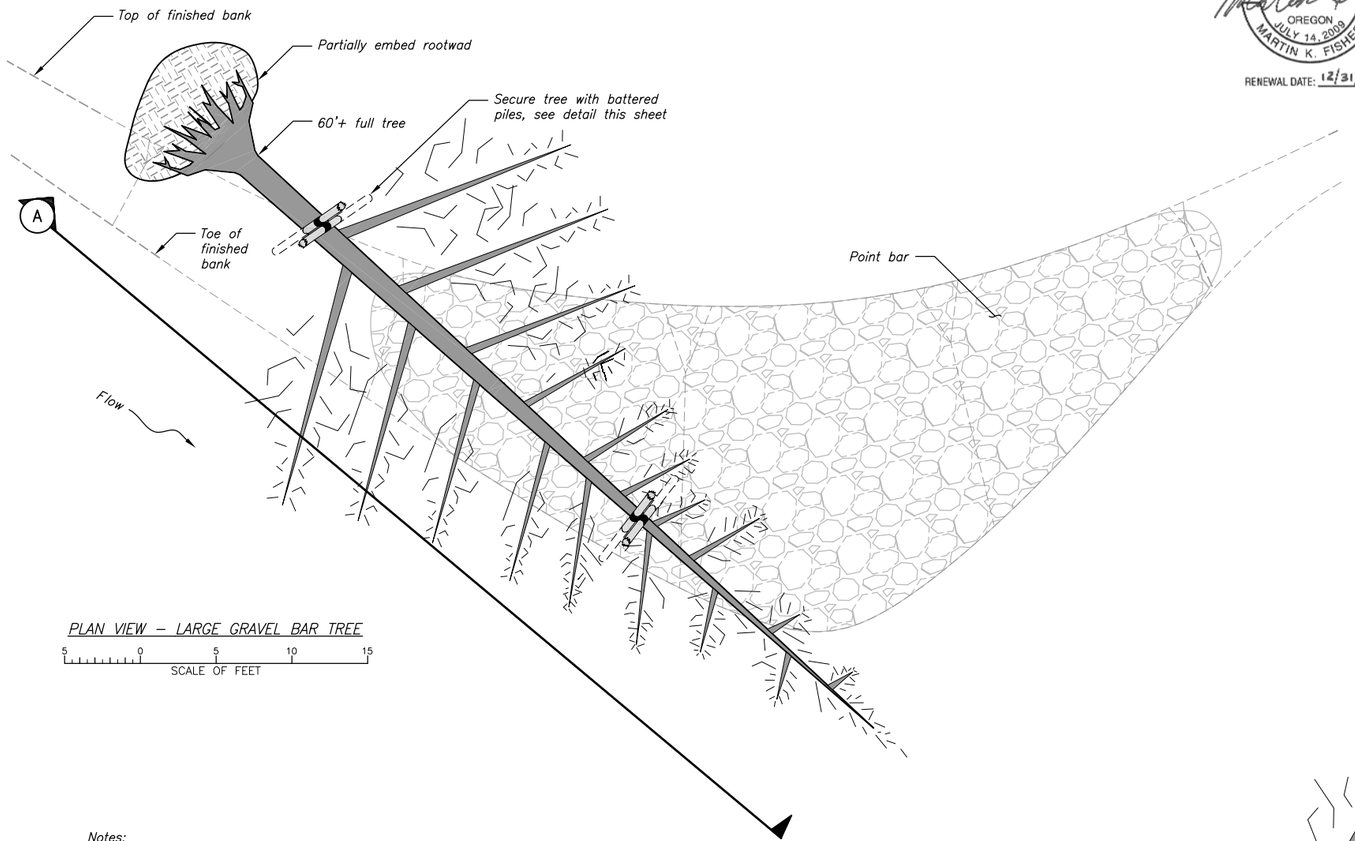
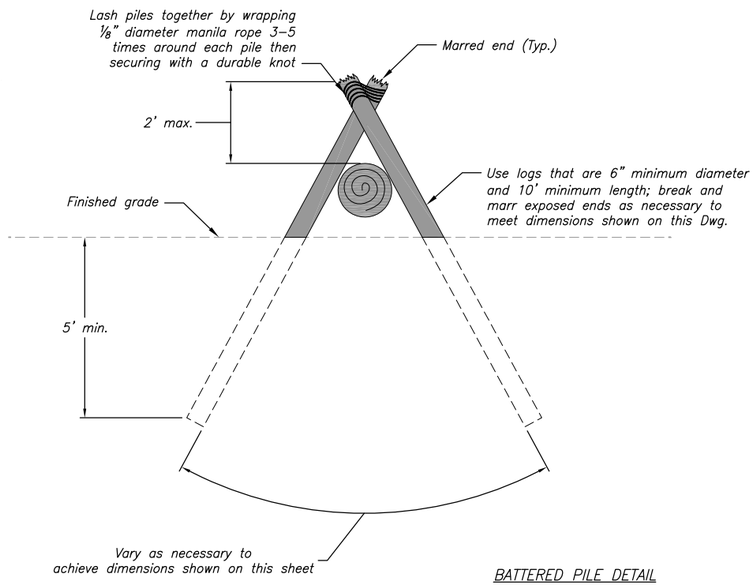
CAD FILENAME
CC44_Parcel_3_LWM_Tree_Boulder_Details2.dwg



PLAN VIEW – LARGE GRAVEL BAR TREE

5 0 5 10 15
SCALE OF FEET



BATTERED PILE DETAIL

2 0 2 4 6
SCALE OF FEET

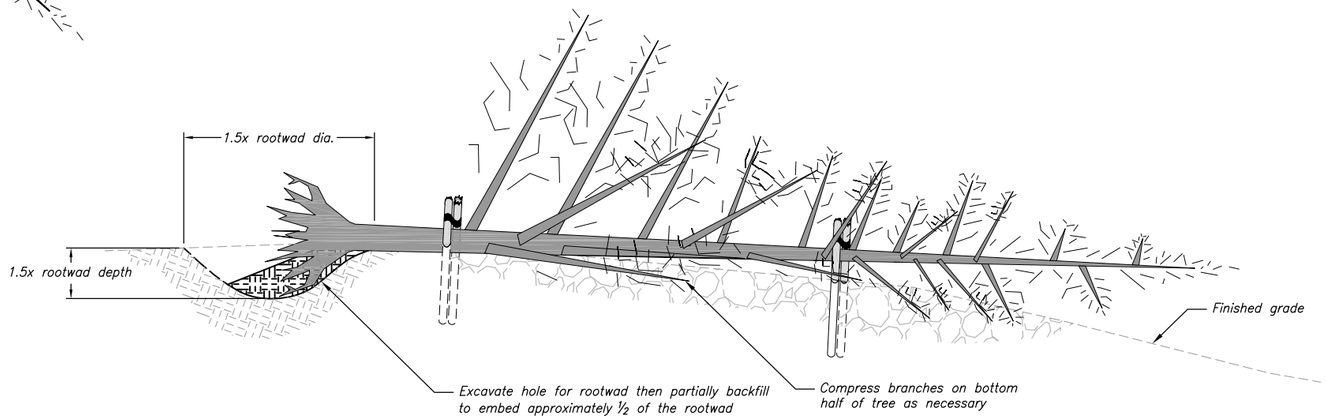
REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
9/14/15
RENEWAL DATE: 12/31/2015

Notes:

1. The exact location of each large gravel bar tree shall be staked by the Contractor and approved by the Contracting Officer prior to constructing a specific structure.
2. Trees shall be a minimum length of 60', shall be Douglas fir, grand fir, or spruce trees and shall be installed within 30 days of harvest.
3. Trees shall be handled with care to minimize breaking of branches. The Contracting Officer may reject any trees that have lost significant amounts of branches.
4. Rough grading of channel shall be completed prior to constructing in-channel LWM structures.
5. Piles shall be 6" minimum diameter logs with a minimum length of 10'. Piles may be installed by driving (using a small pile driver or excavator-mounted driving attachment), augering, or excavating.
6. Piles shall be embedded at least 5' below the finished ground surface; piles shall be lashed together with manila rope as shown in the battered pile detail on this sheet.
7. Cut ends of piles that will be exposed at structure completion shall be marred prior to installation. The Contractor shall use an excavator, bulldozer, or other heavy equipment to tear apart wood fibers at the exposed cut end(s) of the log to create the appearance of a log that has naturally broken apart.
8. Excavate as necessary to embed half of the rootwad.

ON-SITE FIELD-FIT TREE MATERIAL SCHEDULE

ITEM	DESCRIPTION	QUANTITY
Pile-log	10' min. length, 6" dia. log	4
Large gravel bar tree	60' min. length full tree with branches	1



ELEVATION A – LARGE GRAVEL BAR TREE

5 0 5 10 15
SCALE OF FEET

LARGE GRAVEL BAR TREE CONSTRUCTION DETAILS

STRUCTURE STATION	
4+20	40+25
8+50	42+00
11+00	44+20
14+50	44+60
17+00	48+25
19+00	52+60
26+00	53+90
32+80	54+00
	54+30

LARGE GRAVEL BAR TREE DETAILS

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CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
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x Jay Hovde
ACCEPTED

BOISE, ID 2015-09-11

LWM DETAILS

LARGE GRAVEL BAR TREE

1678-100-2148

SHEET 21 OF 24

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TRUSCOTT, NIC

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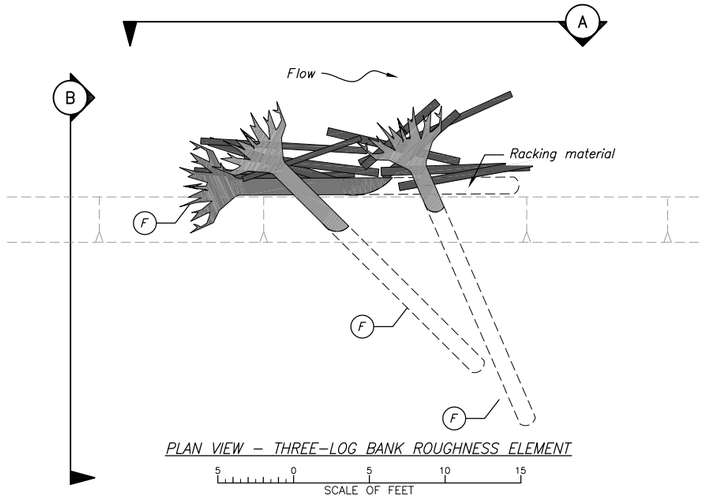
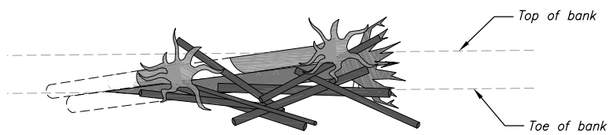
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_Parcel_3_LWM_Margin_Tree_Details.dwg

THREE–LOG BANK ROUGHNESS ELEMENT DETAIL



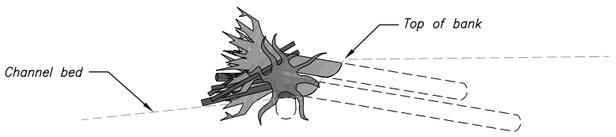
PLAN VIEW – THREE–LOG BANK ROUGHNESS ELEMENT

5 0 5 10 15
SCALE OF FEET



ELEVATION VIEW – THREE–LOG BANK ROUGHNESS ELEMENT

5 0 5 10 15
SCALE OF FEET



SECTION VIEW – THREE–LOG BANK ROUGHNESS ELEMENT

5 0 5 10 15
SCALE OF FEET

NOTES:
1. Three–log bank roughness elements shall be constructed as shown on this sheet unless otherwise directed by the Contracting Officer.
2. All logs shall come from fir, pine, or spruce trees.
3. The exact location of each bank roughness elements shall be staked by the Contractor and approved by the Contracting Officer prior to constructing a specific structure.
4. Rough grading of channel shall be completed prior to constructing in–channel LWM structures.
5. Racking and slash material shall be incorporated into each three–log bank roughness element by weaving it in between placed logs, placing it in voids, pressing it into the bank, or otherwise including it in the structure as directed by the Contracting Officer. Racking material as shown on this sheet is schematic only and not intended to represent the actual location or orientation of individual pieces.
6. Backfill structure using soil excavated to place logs unless the Contracting Officer determines the native soil is unsuitable for backfill and suitable soil must be imported. Place soil for backfill in 1 foot maximum lifts. Compact each lift using mechanical equipment such as an excavator bucket or equipment tracking.

THREE–LOG BANK ROUGHNESS ELEMENT MAIN CHANNEL STRUCTURE STATION (BANK)

6+15 (L)	24+75 (L)
6+35 (L)	27+50 (R)
8+90 (L)	28+15 (L)
10+75 (R)	35+05 (R)
11+10 (R)	36+25 (R)
12+60 (R)	37+10 (R)
13+25 (L)	37+90 (L)
13+50 (L)	39+30 (L)
14+05 (L)	40+15 (R)
15+25 (L)	40+45 (R)
16+85 (R)	42+40 (L)
20+40 (L)	44+50 (R)
21+60 (L)	46+60 (R)
22+30 (R)	47+00 (L)
22+45 (R)	47+25 (L)
23+30 (L)	49+15 (L)
24+50 (L)	

THREE–LOG BANK ROUGHNESS ELEMENT SIDE CHANNEL 1 STATION (BANK)

22+65 (R)	22+80 (R)

THREE–LOG BANK ROUGHNESS ELEMENT FLOOD SWALE COMPLEX 1 – CHANNEL A STATION (BANK)

16+25 (L)

THREE–LOG BANK ROUGHNESS ELEMENT SIDE CHANNEL 2 STATION (BANK)

4+25 (L)

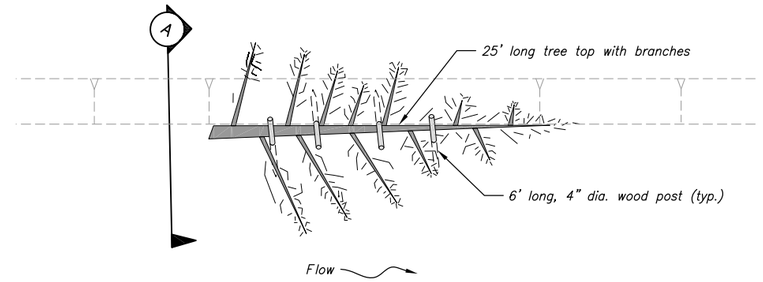
THREE–LOG BANK ROUGHNESS ELEMENT ALCOVE 3 STATION (BANK)

2+95 (R)

THREE–LOG BANK ROUGHNESS ELEMENT

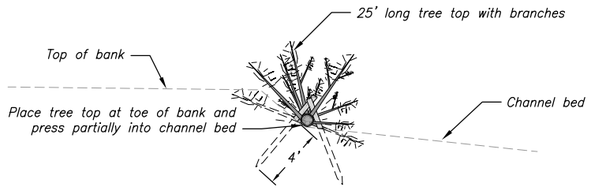
ITEM	DESCRIPTION	QUANTITY
Log type (F)	20' long, 12" DBH log with rootwad	3
Small racking material	6'–15' long, 3"–8" dia. log	5
Large racking material	6'–15' long, 8"–12" dia. log	5

TREE TOP BANK ROUGHNESS ELEMENT DETAIL



PLAN VIEW – TREE TOP BANK ROUGHNESS ELEMENT

5 0 5 10 15
SCALE OF FEET



ELEVATION VIEW – TREE TOP BANK ROUGHNESS ELEMENT

5 0 5 10 15
SCALE OF FEET

Notes:
1. Tree top bank roughness elements shall be constructed as shown on this sheet unless otherwise directed by the Contracting Officer.
2. Tree tops shall come from Douglas fir, grand fir, or spruce trees and shall be installed within 30 days of harvest.
3. Tree tops shall be handled with care to minimize breaking of branches. The Contracting Officer may reject any tree tops that have lost significant amounts of branches.
4. Wood posts may be installed by driving (using a small pile driver or excavator–mounted driving attachment), augering, or excavating.
5. The exact location of each bank roughness elements shall be staked by the Contractor and approved by the Contracting Officer prior to constructing a specific structure.
6. Rough grading of channel shall be completed prior to constructing in–channel LWM structures.

TREE TOP BANK ROUGHNESS ELEMENT MAIN CHANNEL STRUCTURE STATION (BANK)

15+45 (L)	28+35 (L)
16+60 (R)	38+90 (L)
24+90 (L)	39+10 (L)
26+15 (R)	46+80 (R)
27+70 (R)	

TREE TOP BANK ROUGHNESS DETAIL

ITEM	DESCRIPTION	QUANTITY
Tree top	25' long tree top with branches	1
Wood post	6' long, 4" dia. log	4

REGISTERED PROFESSIONAL ENGINEER
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9/4/15

RENEWAL DATE: 12/31/2015

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GRANDE RONDE SUBBASIN

CC–44 PHASE III HABITAT ENHANCEMENT PARCEL 3

N. TRUSCOTT
DRAWN

X Jay Hovde
ACCEPTED

BOISE, ID 2015–09–11

LWM DETAILS

BANK ROUGHNESS ELEMENTS

1678–100–2149

SHEET 22 OF 24

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September 11, 2015 15:33
PLOTTED BY
TRUSCOTT, NIC

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
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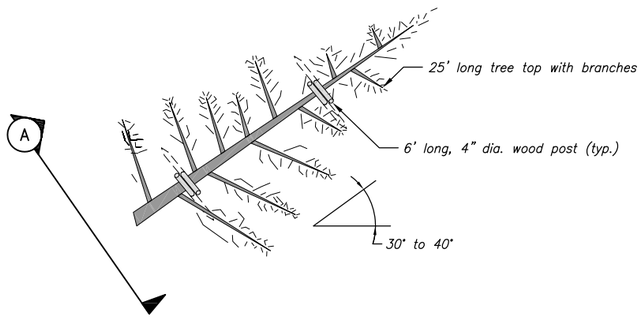
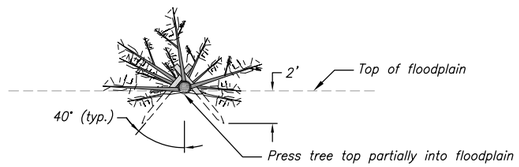
TREE TOP FLOODPLAIN ROUGHNESS ELEMENT DETAIL



PLAN VIEW – TREE TOP FLOODPLAIN ROUGHNESS ELEMENT

5 0 5 10 15
SCALE OF FEET



ELEVATION VIEW – TREE TOP FLOODPLAIN ROUGHNESS ELEMENT

5 0 5 10 15
SCALE OF FEET

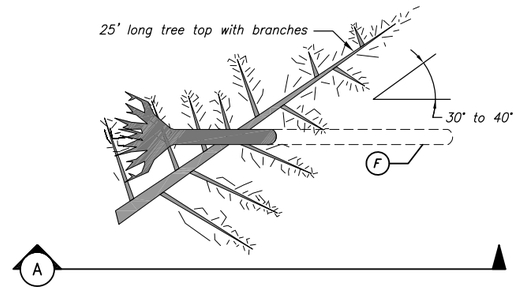
Notes:

1. *Tree top floodplain roughness elements shall be constructed as shown on this sheet unless otherwise directed by the Contracting Officer.*
2. *Tree tops shall come from Douglas fir, grand fir, or spruce trees and shall be installed within 30 days of harvest.*
4. *Tree tops shall be handled with care to minimize breaking of branches. The Contracting Officer may reject any tree tops that have lost significant amounts of branches.*
5. *Wood posts may be installed by driving (using a small pile driver or excavator–mounted driving attachment), augering or excavating.*
6. *Tree top floodplain roughness elements shall be installed in groups and shall be "shingled" together such that the downstream element is protected from floodplain flow by the element immediately upstream.*
7. *The exact location of each tree top floodplain roughness element shall be determined by the Contracting Officer.*

TREE TOP FLOODPLAIN ROUGHNESS ELEMENT

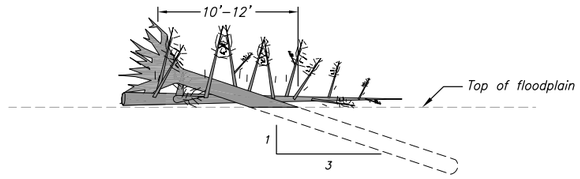
ITEM	DESCRIPTION	QUANTITY
Tree top	25' long tree top with branches	1
Wood post	6' long, 4" dia. log	4

TWO–LOG FLOODPLAIN ROUGHNESS ELEMENT DETAIL



PLAN VIEW – TWO–LOG FLOODPLAIN ROUGHNESS ELEMENT

5 0 5 10 15
SCALE OF FEET



ELEVATION VIEW – TWO–LOG FLOODPLAIN ROUGHNESS ELEMENT

5 0 5 10 15
SCALE OF FEET

Notes:

1. *Two–log floodplain roughness elements shall be constructed as shown on this sheet unless otherwise directed by the Contracting Officer.*
2. *Logs with rootwads shall come from fir, pine, or spruce trees.*
3. *Tree tops shall come from Douglas fir, grand fir, or spruce trees and shall be installed within 30 days of harvest.*
4. *Tree tops shall be handled with care to minimize breaking of branches. The Contracting Officer may reject any tree tops that have lost significant amounts of branches.*
5. *Two–log floodplain roughness elements shall be installed in groups and shall be "shingled" together such that the downstream element is protected from floodplain flow by the element immediately upstream.*
6. *The exact location of each two–log floodplain roughness element shall be determined by the Contracting Officer.*
7. *Backfill using soil excavated to place logs unless the Contracting Officer determines the native soil is unsuitable for backfill and suitable soil must be imported. Place soil for backfill in 1 foot maximum lifts. Compact each lift using mechanical equipment such as an excavator bucket or equipment tracking.*

TWO–LOG FLOODPLAIN ROUGHNESS ELEMENT

ITEM	DESCRIPTION	QUANTITY
Log type (F)	15'–20' long, 12" dia. log	1
Tree top	25' long tree top with branches	1

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
9/14/15

RENEWAL DATE: 12/31/2015

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GRANDE RONDE SUBBASIN

CC–44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

X Jay Hovde
ACCEPTED

BOISE, ID 2015–09–11

LWM DETAILS

FLOODPLAIN ROUGHNESS ELEMENTS

1678–100–2150

SHEET 23 OF 24

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CAD SYSTEM
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BRUSH MATTRESS DETAIL
N.T.S.

BRUSH MATTRESS MATERIAL SCHEDULE (PER 10 FT LENGTH)

ITEM	DESCRIPTION	QUANTITY
Live Cuttings	4' long, live willow cutting	20
Dead Brush Layer	6" thick layer of dead brush when compressed	~0.8 CY

Notes:
1. Brush mattress shall be composed of a 6 inch layer of dead branches of native species, between two layers of live cuttings. Live cuttings will be supplied by the Contracting Officer.
2. A trench shall be excavated at location identified in these plans so the bottom of the brush mattress is within the saturation zone.
3. Live cuttings shall be placed every 12 inches for the entire length of trench. Live cuttings shall be installed with buds oriented upward.
4. Dead branches shall be placed uniformly along the trench on top of the live cuttings to a compressed depth of 6 inches.
5. A top layer of live cuttings shall be placed every 12 inches along the length of the brush mattress. Live cuttings shall be installed with buds oriented upward.
6. Soil shall be backfilled in 6 inch lifts. The first lift shall be washed into the brush mat with water to eliminate voids. Supplemental lifts shall be compacted.
7. The exact location of each occurrence of brush mattress shall be staked by the Contractor and approved by the Contracting Officer prior to constructing a particular occurrence.
8. Rough grading of channel shall be completed prior to constructing in-channel LWM structures.

BRUSH MATTRESS LOCATIONS – MAIN CHANNEL

FROM	TO	LENGTH	BANK
7+70	8+30	80'	R
13+55	13+95	40'	L
16+00	16+55	60'	R
19+00	19+70	70'	L
21+65	22+30	60'	L
27+80	28+45	65'	R
28+40	28+80	40'	L
34+25	34+95	90'	R
36+35	36+95	60'	R
45+95	46+45	50'	R
48+25	49+00	85'	L
48+40	51+55	270'	R

BRUSH MATTRESS LOCATIONS
FLOOD SWALE COMPLEX 3 – CHANNEL A

FROM	TO	LENGTH	BANK
7+70	8+55	100'	R

BRUSH MATTRESS LOCATIONS
FLOOD SWALE COMPLEX 5 – CHANNEL A

FROM	TO	LENGTH	BANK
0+10	0+40	30'	R

BRUSH MATTRESS LOCATIONS
FLOOD SWALE COMPLEX 6 – CHANNEL A

FROM	TO	LENGTH	BANK
9+60	10+40	100'	R

BRUSH MATTRESS LOCATIONS – SIDE CHANNEL 1

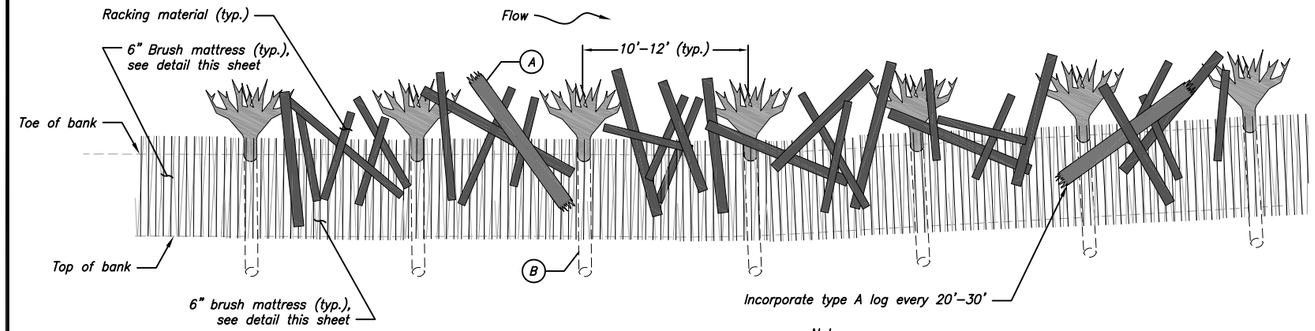
FROM	TO	LENGTH	BANK
0+15	1+50	140'	R
0+20	1+50	125'	L

BRUSH MATTRESS LOCATIONS – SIDE CHANNEL 2

FROM	TO	LENGTH	BANK
0+15	0+60	45'	L
0+20	0+65	45'	R

BRUSH MATTRESS LOCATIONS – ALCOVE 2

FROM	TO	LENGTH	BANK
1+55	1+80	25'	R

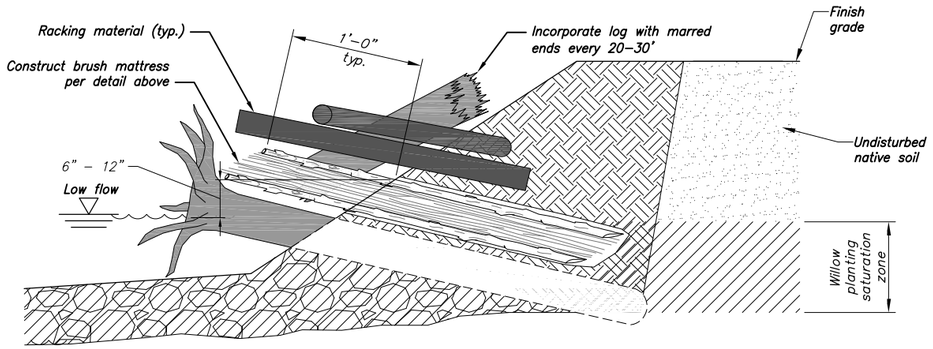


EDGE ROUGHNESS PLAN VIEW

5 0 5 10 15
SCALE OF FEET

Notes:
1. A trench shall be excavated at location identified in these plans so the bottom of the brush mattress layer is within the saturation zone.
2. Place logs with rootwads on the bottom of the trench, then place a 3" lift of soil on top of the logs with rootwads.
3. Live cuttings shall be placed every 12 inches for the entire length of trench. Live cuttings shall be installed with buds oriented upward.
4. Dead branches shall be placed uniformly along the trench on top of the live cuttings to a compressed depth of 6 inches.
5. A top layer of live cuttings shall be placed every 12 inches along the length of the brush mattress. Live cuttings shall be installed with buds oriented upward.
6. Racking material and logs with marred ends shall be incorporated into the trench as it is backfilled. Racking material and logs with marred ends shall be placed in various orientations to provide an irregular face on the bank of the channel.
7. Soil shall be backfilled in 6 inch lifts. The first lift shall be washed into the brush mat with water to eliminate voids. Supplemental lifts shall be compacted.
8. The exact location of each occurrence of edge roughness shall be staked by the Contractor and approved by the Contracting Officer prior to constructing a particular occurrence.
9. Rough grading of channel shall be completed prior to constructing in-channel LWM structures.

Notes:
1. All logs shall come from Douglas fir, lodgepole pine, or ponderosa pine.
2. Embedded logs with rootwads shall be placed approximately every 10'–12' on center and placed with their rootwads oriented slightly upstream.
3. Logs shall be placed such that approximately ⅓ of the total length (including rootwad) is exposed. logs shall be placed on a slope of approximately 10H:1V into the bank.
4. Logs shall be placed prior to the layer of brush mattress.



EDGE ROUGHNESS DETAIL
N.T.S.

EDGE ROUGHNESS MATERIAL SCHEDULE (PER 10 FT LENGTH)

ITEM	DESCRIPTION	QUANTITY
Log type (A)	10' long, 12" dia. log	⅓ (1 every 20'–30')
Log type (B)	10' long, 12" DBH log with rootwad	1
Live cuttings	4' long, live willow cutting	20
Dead brush layer	6" thick layer of dead brush when compressed	~0.8 CY
Small racking material	6'–15' long, 3"–8" dia. log	5
Large racking material	6'–15' long, 8"–12" dia. log	5

EDGE ROUGHNESS LOCATIONS – ALCOVE 3

FROM	TO	LENGTH	BANK
2+35	2+90	60'	R

EDGE ROUGHNESS LOCATIONS – MAIN CHANNEL

FROM	TO	LENGTH	BANK
7+80	8+45	55'	L
9+80	10+25	40'	L
10+80	11+05	25'	R
11+15	11+40	30'	R
14+10	14+35	30'	L
19+70	20+30	65'	L
30+35	30+85	50'	R
37+15	37+80	65'	L
41+75	42+25	55'	L
43+65	44+15	55'	R
44+60	44+95	40'	R

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN
CC-44 PHASE III HABITAT ENHANCEMENT
PARCEL 3

N. TRUSCOTT
DRAWN

x Jay Hovde
ACCEPTED

BOISE, ID 2015-09-11

LWM DETAILS

BRUSH MATTRESS & EDGE ROUGHNESS

1678-100-2151

SHEET 24 OF 24

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TRUSCOTT, NIC

CAD SYSTEM
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CAD FILENAME
CC44_Parcel_3_LWM_Edge_Rough_Details.dwg

APPENDIX E

HABITAT UPLIFT MODELING – CC-44 PROJECT: SOUTHERN CROSS PROJECT AREA

RECLAMATION
Managing Water in the West

Habitat Uplift Modeling – CC-44 Project: Southern Cross Project Area

Catherine Creek, Oregon
Pacific Northwest Region
Technical Report No. SRH-2016-18



Catherine Creek within the CC-44 Project, Upstream of the Southern Cross Property

U.S. Department of the Interior
Bureau of Reclamation
Technical Service Center
Denver, CO

July 2016

Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Peer Review Certification: This document has been peer reviewed and is believed to be in accordance with the service agreement and standards of the profession.

PREPARED BY:

DATE: 7/21/2016

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DATE: 7/21/16

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DATE: 7/21/16

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1 Introduction

At the request of the Bureau of Reclamation's (Reclamation) Resource and Technical Services (RTS) in the Pacific Northwest (PN) Regional Office, Habitat Suitability Index (HSI) modeling analyses were performed by Reclamation's Sedimentation and River Hydraulics Group at the Technical Service Center (TSC) on Catherine Creek in northeast Oregon. The HSI modeling was performed near/around River Mile 44 on a project area referred to as CC-44, southeast of Union, OR (Figure 1). As part of meeting the Reasonable and Prudent Alternatives set forth in the 2010 Federal Columbia River Power System Biological Opinion, habitat enhancement features have been proposed and constructed within the CC-44 project area. This study, in particular, focuses on what is referred to as the Southern Cross property within the CC-44 project area (Figure 1).

The analysis presented in this report compares the habitat suitability between existing and proposed conditions based on the hydraulic results of a 2D numerical model, SRH-2D (Lai, 2008; http://www.usbr.gov/pmts/sediment/model/srh2d/index.html). In January of 2016, the TSC performed a numerical hydraulic modeling study for the PN Region to compare the hydraulics at CC-44 for existing and proposed conditions at the Southern Cross property. At various flows, the hydraulic modeling results investigated the spatial distribution of flow depth, velocity, shear stress, and critical grain size at incipient motion for various proposed design layouts of side channels, floodplain channels, floodplain swales, and Large Woody Material (LWM) structures in what are identified as the Smith and Southern Cross properties of the CC-44 project area. The results for depth, velocity, and critical grain size were utilized as input data for this report. Kimbrel (2016) discusses the hydraulic modeling methods and results in more detail.

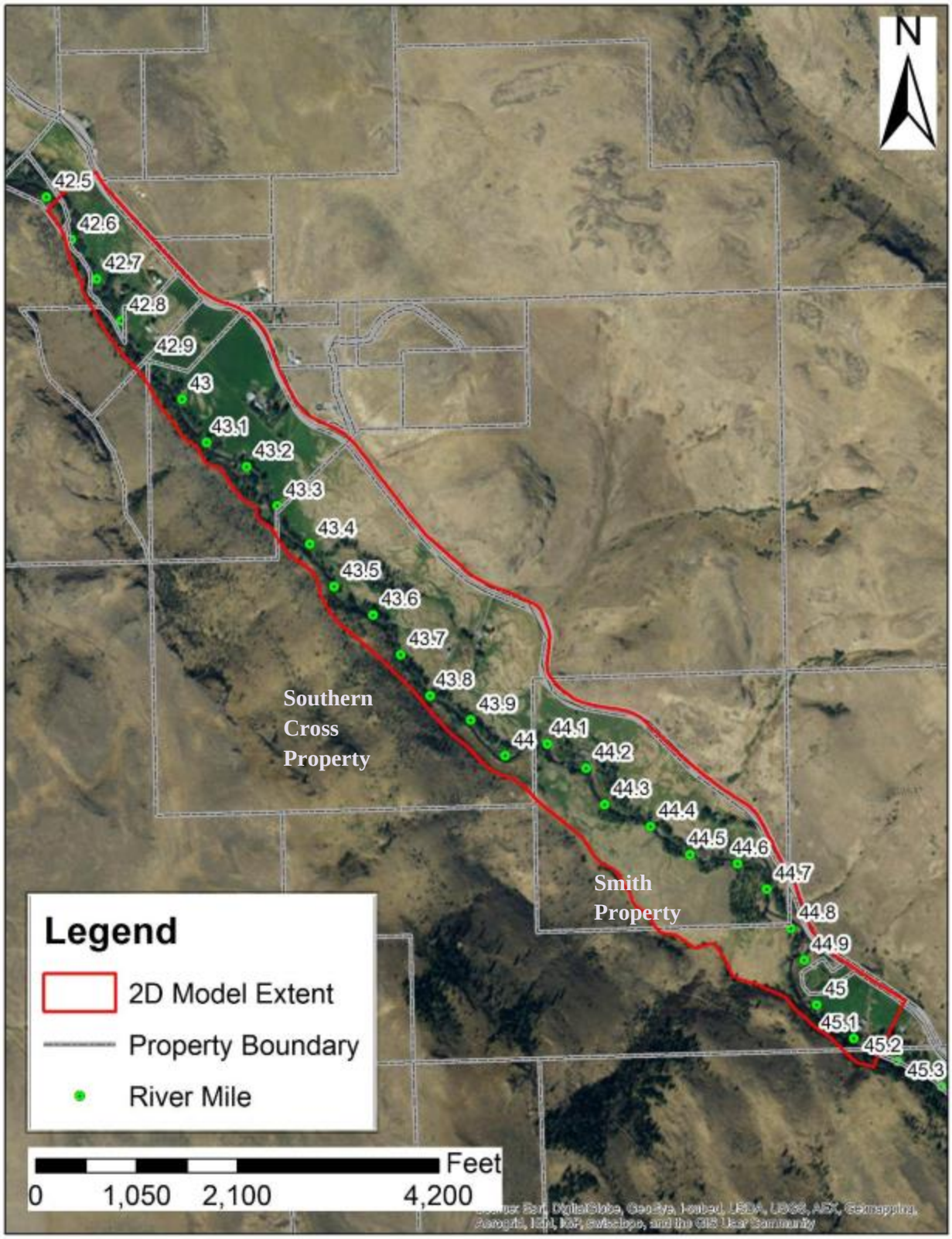


Figure 1. Catherine Creek CC-44 Project Area Location (Kimbrel, 2016)

2 Methods

Habitat uplift modeling for the study area was based on habitat suitability indices (HSI) developed for multiple life stages of two salmonid species (Chinook and Steelhead), and 2D hydraulic modeling results for the existing and proposed (final design) project conditions. The hydraulic modeling was completed by Reclamation's TSC staff, and was based on a combination of LiDAR data, topographic survey data for the existing conditions geometry. For the proposed conditions geometry additional channel, side channel, floodplain, and LWM designs were incorporated into the model. The hydrologic inputs were developed by RTS staff from a stream gage within 1 mile of the upstream boundary. The gage is operated by the Oregon Department of Water Resources (Catherine Creek near Union, OR). Point-based hydraulic modeling results were converted to gridded (Raster) values with a spatial resolution of 2 ft. The analysis area was clipped to the Southern Cross Project Area. The results were translated into life stage specific habitat suitability scores, which were then mapped and summed across the analysis area. The spatial analysis of the habitat suitability scores was completed utilizing an ArcGIS model builder (Version 10.2.2). Schematics of all analyses presented in the following sections are included in Appendix A. The results of all habitat models (by species, life stage, season, and discharge) were mapped for both pre- and post-project conditions.

2.1 Chinook Juvenile Habitat

Juvenile Chinook was the most intensively modeled Chinook life stage. This is a result of juvenile rearing being a limiting factor, their long freshwater residence times, and the relative abundance of data for this life stage. Two seasonal analyses were completed for juvenile Chinook habitat suitability: summer and winter.

Summer juvenile habitat was modeled following the results of Holecek (2009) as interpreted into HSIs by Favrot and Jonasson (2014). This study was undertaken during the summer in Big Creek, Idaho. Summer habitat was analyzed at three discharge levels (18, 40 and 60 cfs) to estimate late summer habitat availability ranging from a typical August 1st discharge (60 cfs) down to the 95% exceedance flow (18 cfs). Winter juvenile habitat was modeled using data from Favrot and Jonasson (2014). The benefits here are that Favrot and Jonasson (2014) studied juveniles in the winter and on Catherine Creek, therefore, there is little concern about differing conditions between the study data and where the findings are being implemented.

Winter habitat availability was modeled at a full range of flows (Table 1) to estimate habitat during a longer and more hydrologically variable season. In addition, the availability of near stagnant depth-averaged velocities (0-to-0.1 m/s, or 0-to-0.33 ft/s) for winter juvenile Chinook rearing habitat was modeled during low flow conditions (18 cfs). Fish biologists within the Grande Ronde basin have locally observed the utilization of habitat for this particular species and life stage under these flow conditions (Scott Favrot, personal communication).

Table 1. Discharges used in winter juvenile habitat modeling.

Discharge Identifier	Discharge (cfs)
95% Exceedance (base flow)	18
Est. Average Feb. 1 Discharge	40
Est. Average March & Aug. 1 Discharge	60
Est. Average April 1 Discharge	120
Est. Average May 1 Discharge	280
5% Exceedance	450
1.25-year	565
100-year	1,622

Water depth (Figure 2 and Figure 3), depth average velocity (Figure 4 and Figure 5), and cover (Figure 6) were used to assess habitat quality using the results of Holecek (2009) and Favrot and Jonasson (2014). The equation for this metric is:

$$WUA = \sum A * V_i * D_i * C_i$$

Where A is area, V_i is the HSI velocity index, D_i is the HSI depth index, and C_i is the HSI cover index, and WUA is the weighted usable area.

Values for the indices were linearly interpolated to increase the resolution of the curves and then averaged appropriately to represent the range of depths, velocities, and cover. The reported and modeled HSI values are presented in Figure 2 through Figure 6. The output depths and velocities from the hydraulic modeling results were used to "look up" the corresponding index values. Cover was taken into account in the form of dense vegetation and LWM. LWM was assumed to provide the best habitat conditions. In this case, a cover HSI was introduced based on proximity to cover and was dependent on the season (summer or winter). During the summer season, the cover analysis assumed that having dense vegetation and LWM within 3.28 ft (1 meter) achieves a HSI of 1, with all other values being 0. Similarly, the winter conditions assumed that having dense vegetation and LWM within 3.28 ft achieved an HSI of 1. However, Favrot and Jonasson (2014) awards partial utilization at distances greater than 3.28 ft from cover. The HSI values attributed to winter cover are presented in Figure 6. The index values were then multiplied to form a composite suitability index (CSI). The CSI was then multiplied by the planform area of each grid cell (that represent velocity and depth values) and summed to obtain a WUA. When summed together over the project area, the WUA indicates how many total acres of suitable habitat are available. A comparison of pre-project to post-project values indicates the total habitat uplift obtained via habitat enhancement.

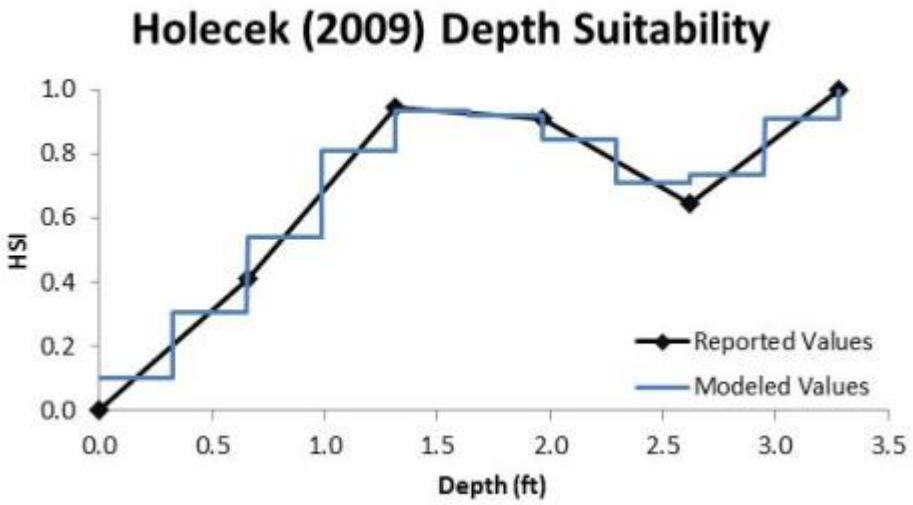


Figure 2. Flow depth suitability index for summer juvenile Chinook rearing habitat.

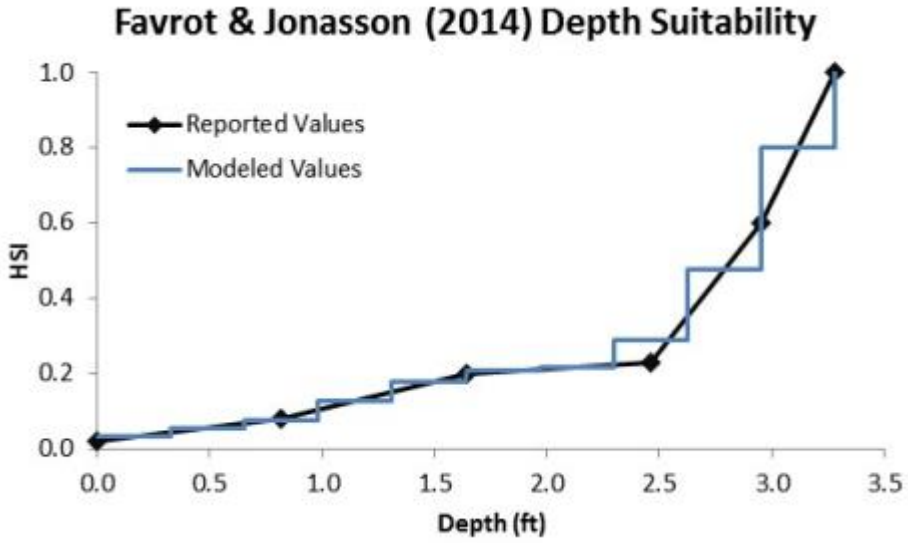


Figure 3. Flow depth suitability index for winter juvenile Chinook rearing habitat.

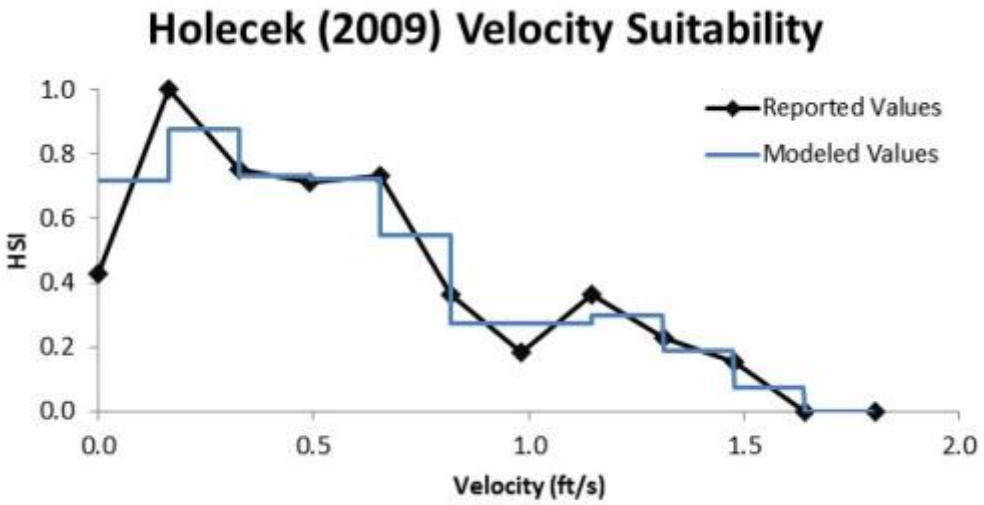


Figure 4. Depth average velocity suitability index for summer juvenile Chinook rearing habitat.

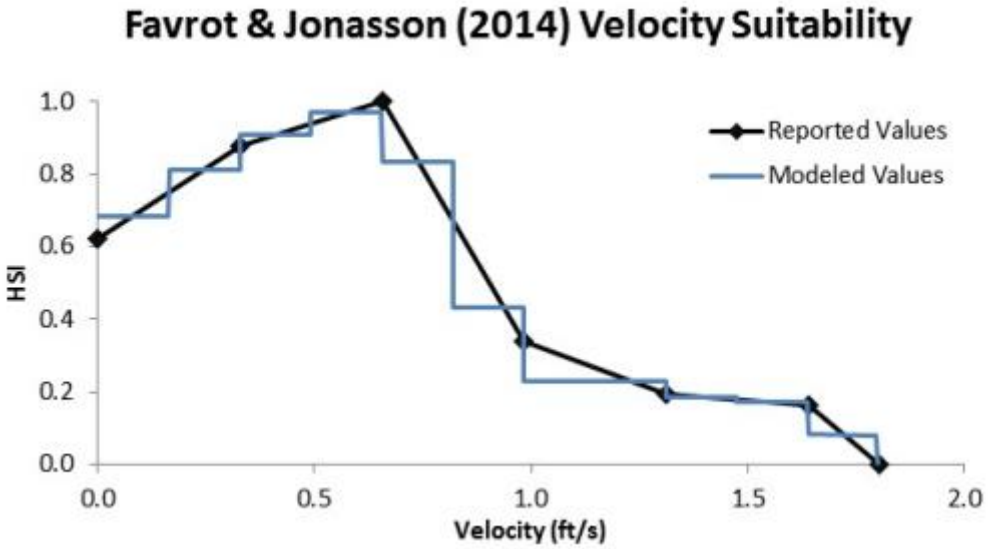


Figure 5. Depth average velocity suitability index for winter juvenile Chinook rearing habitat.

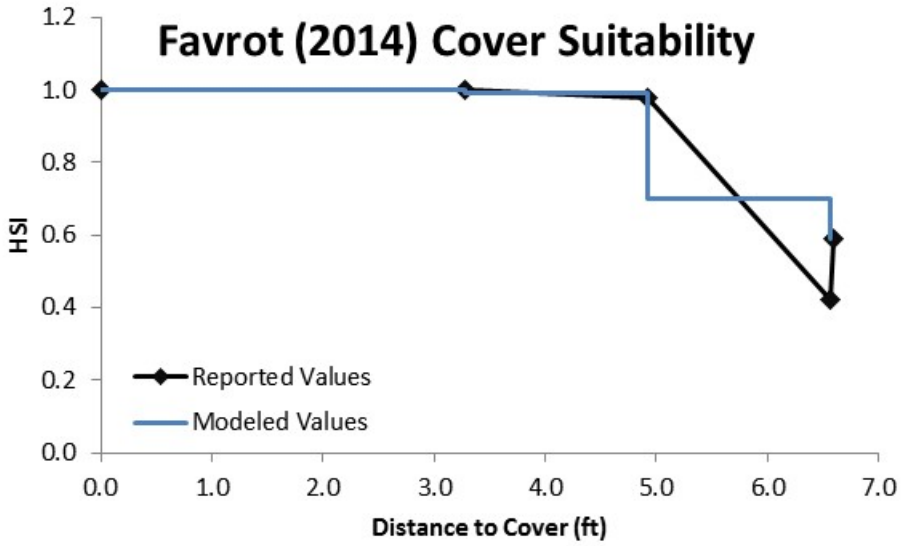


Figure 6. Cover suitability index for winter juvenile Chinook rearing habitat.

2.2 Steelhead Juvenile Habitat

The same methods were used to model Steelhead habitat as was shown for Chinook, including life stages and discharges. The only expected differences are the HSI curves. Depth and velocity habitat suitability curves from Maret et al. (2006) were applied to summer juvenile Steelhead, as shown in Figure 7 and Figure 8, respectively. Like Chinook, Favrot (2014) suitability curves were applied to winter juvenile Steelhead habitat. Based on available data, it was assumed that juvenile Steelhead behavior would be similar to juvenile Chinook behavior in the winter.

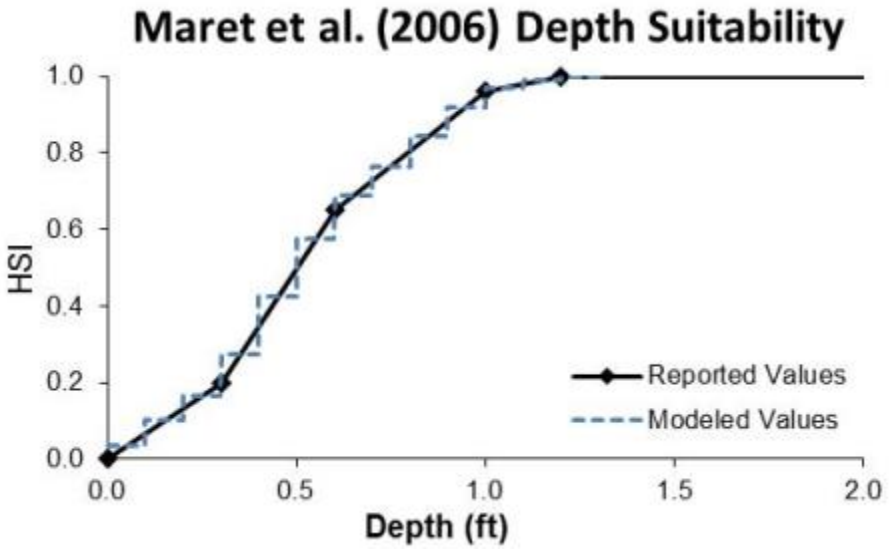


Figure 7. Flow depth suitability index for summer juvenile Steelhead rearing habitat.

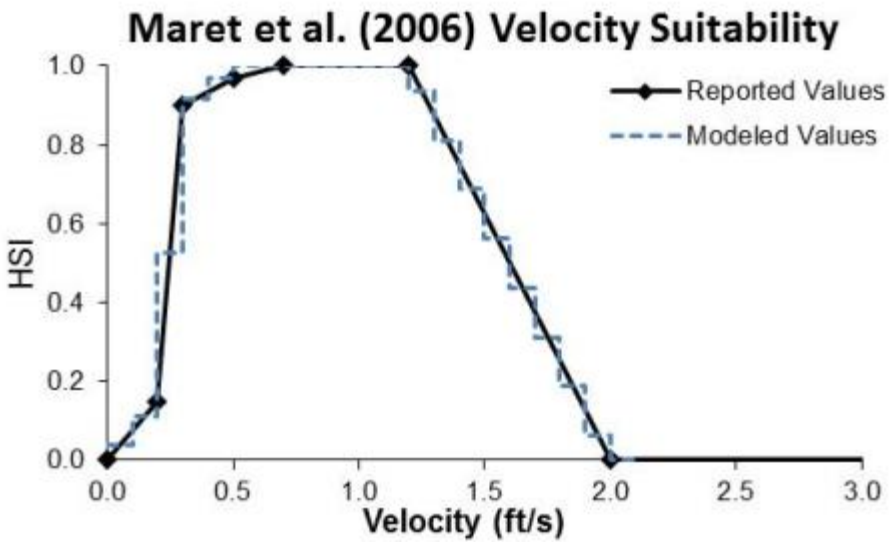


Figure 8. Depth average velocity suitability index for summer juvenile Steelhead rearing habitat.

2.3 Chinook and Steelhead Adult Habitat

The same methods were used to model both adult Steelhead and adult Chinook habitat, including HSI criteria and discharge values.

2.3.1 Spawning

Spawning area was modeled following methodology from Raleigh (1986) by using critical shear stress (at 1.25-year discharge) as a surrogate for the median bed material (spawning gravel) size. The optimal size ranged from 2 to 11 cm. Water velocity, best from 0.4 to 2.4 ft/s, and depth greater than 0.98 ft at base flow (18 cfs) was used to refine the estimates of best spawning habitat area. Areas that fit both these conditions were summated to determine the total change in area of suitable spawning habitat.

2.3.2 Adult Holding

Adult holding habitat was modeled at 18 and 40 cfs to estimate typical conditions adults encounter in August and September. Areas matching optimal conditions, conditions greater than 2 ft deep with less than 1.2 ft/s of velocity, were multiplied together and mapped to indicate the total amount of optimal adult holding area in both pre- and post-project conditions.

2.3.3 Fish Passage

Fish passage was modeled using the base flow discharge (18 cfs). The intent was to indicate areas where depths are not of sufficient depth (9 inches) to pass adult fish. Areas where there is not sufficient passage depths across and entire cross-section would be of concern.

3 Results

The following paragraphs present the results of the above analysis criterion. As the HSI curves for juvenile Chinook and juvenile Steelhead differ, corresponding results are presented separately. Many of the analyses for each species (e.g. spawning habitat, fish passage, etc.) include the same parameters; therefore the results will be discussed together in Section 3.4. Please note that all figures are presented at the end of the section for readability.

3.1 Total Wetted Area

The total wetted area in the proposed design condition increased at all discharge values because of the increased sinuosity and additional side channels. Table 2 presents the total wetted area in acres for the existing and proposed conditions in the Southern Cross area. Table 2 also presents the percent increase in wetted area between the two conditions. Also observed with the Southern Cross proposed condition is that the percent increase in wetted area increases as the flow discharge increases. Maps spatially presenting the total wetted area are included in Appendix B – Total Wetted Area Maps.

Table 2. Wetted area results for existing and proposed conditions, Southern Cross area

	Total Wetted Area		
Discharge (cfs)	Existing (acres)	Proposed (acres)	% Increase
18	3.8	4.0	4%
40	4.3	5.6	29%
60	4.6	6.1	34%
120	5.2	7.2	39%
280	5.9	9.9	69%
450	6.6	15.9	140%
565	8.6	20.8	143%

3.2 WUA for Summer Juvenile Chinook

The WUA results for juvenile Chinook during summer conditions are presented in Table 3 and in Figure 9 through Figure 11. Not only does the WUA significantly increase for proposed conditions, but also the quality of habitat noticeably increases. The spatial results show pool habitat on the outside of meander bends, which provides ideal habitat for juvenile Chinook.

Table 3. Weighted useable area results for summer juvenile Chinook habitat

	Summer Chinook WUA (acres)		
Discharge (cfs)	Existing	Proposed	% Increase
18	0.05	0.72	1309%
40	0.06	0.81	1170%
60	0.07	0.79	1005%

3.3 WUA for Summer Juvenile Steelhead

The WUA results for juvenile Steelhead during summer conditions are presented in tabular form in Table 4 and spatially in Figure 12 through Figure 14. The increase in WUA for proposed conditions was significant. However, the increase in WUA for Steelhead was smaller compared to Chinook, which is likely due to the HSI values associated with lower velocities. Maret et al. (2006) curves for Steelhead assign a low HSI value of 0.2 or lower for velocities lower than 0.3 ft/s, whereas Holecek (Chinook) set HSI values equal to 1.0 at 0.16 ft/s. Similar to Chinook, the results also show an increase in habitat quality, with pools present on the outside of meander bends for the Southern Cross conditions.

Table 4. Weighted usable area results for summer juvenile Steelhead habitat

	Summer Steelhead WUA (acres)		
Discharge (cfs)	Existing	Proposed	% Increase
18	0.07	0.44	570%
40	0.13	0.89	582%
60	0.16	1.12	590%

3.4 Chinook & Steelhead, Winter, Fish Passage, Adult Holding, and Spawning

As discussed in Section 2 – **Methods**, the analysis for winter juvenile, fish passage, holding, and spawning habitat were the same for Chinook and Steelhead. Therefore, the results are presented together.

3.4.1 Winter Juvenile Habitat

The tabular WUA results for juvenile habitat during winter conditions are presented in Table 5, while the spatial results are presented in Figure 15 through Figure 21. A large increase in WUA occurred between the existing and Southern Cross conditions; however, WUA did not steadily increase with discharge. The variability in WUA is likely due to the increased velocities associated with higher flow rates.

Furthermore, an increase in wetted area occurs for the larger flow events, creating more wetted area. However, low flow velocities in shallow reaches and high flow velocities in deep reaches results in a

decrease in usable habitat. The decrease in WUA at higher flows is especially evident in the existing conditions. As the flow rate increases and the in-channel velocities increase, the channel becomes inhabitable for juvenile Chinook and Steelhead species.

Table 5. Weighted usable area results for winter juvenile Chinook and Steelhead habitat

	Winter Chinook & Steelhead WUA (acres)		
Discharge (cfs)	Existing	Proposed	% Increase
18	0.07	0.58	680%
40	0.06	0.74	1051%
60	0.06	0.80	1307%
120	0.04	0.72	1529%
280	0.04	0.48	1166%
450	0.03	0.51	1393%
565	0.05	0.59	1137%

The tabular results of low velocity habitat availability for juveniles during winter conditions are presented in Table 6, while the spatial results are presented in Figure 22.

Table 6. Area results of low velocity habitat for winter juvenile Chinook rearing

	Winter Chinook Overwintering (acres)		
Discharge (cfs)	Existing	Proposed	% Increase
18	0.96	2.06	114%

3.4.2 Adult Fish Passage, Holding, and Spawning Habitat

As discussed in the Methods section of the report, adult fish passage, holding, and spawning habitat followed the same criteria for both Chinook and Steelhead species. The analyses were conducted by separating cells into suitable and not suitable area. Table 7 lists the tabular results, while Figure 23 through Figure 26 displays the spatial results for both existing and proposed conditions.

As anticipated, the area of fish passage and holding habitat increased for the proposed conditions. The pools that are intended to form on outside of the meander bends provides sufficient depth and lower velocities for fish passage and adult holding. The spatial results for adult fish passage, Figure 23, indicate that the area of available fish passage has significantly increased. However, the fish passage zones are not continuous in both the main channel and side channels. In many cases, there is a narrow channel connecting the pools; however, it is not consistent throughout the reach and typically about 4 ft wide.

Interestingly, the area of spawning habitat decreased from 0.21 acres to 0.13 acres (38% decrease) between existing and proposed conditions. Due to the formation of pools, the optimal spawning velocities and depths did not occur in the same locations. Appropriate depths (greater than 0.98 ft)

occurred in the pools, which are located on the outside of the meander bends. At these locations, the velocities were typically less than 0.4 ft/s. Optimal velocities (0.4 to 2.4 ft/s) occurred in the riffles, or the straight river sections between the pools where depths are typically shallow and velocities are relatively swift. In this case, the pool-riffle sequence increases the adult fish passage and holding habitat, but does not increase the area of spawning habitat for adult Steelhead and Chinook salmon.

Table 7. Adult habitat area results for existing and proposed conditions.

Parameter	Existing (acres)	Proposed (acres)	% Change
Spawning	0.21	0.13	-38%
Fish Passage	0.56	1.83	224%
Holding at Q = 18 cfs	0.04	0.89	2330%
Holding at Q = 40 cfs	0.06	1.03	1616%

3.5 HSI Maps

The spatial results for all habitat conditions are included below in Figure 9 through Figure 25.

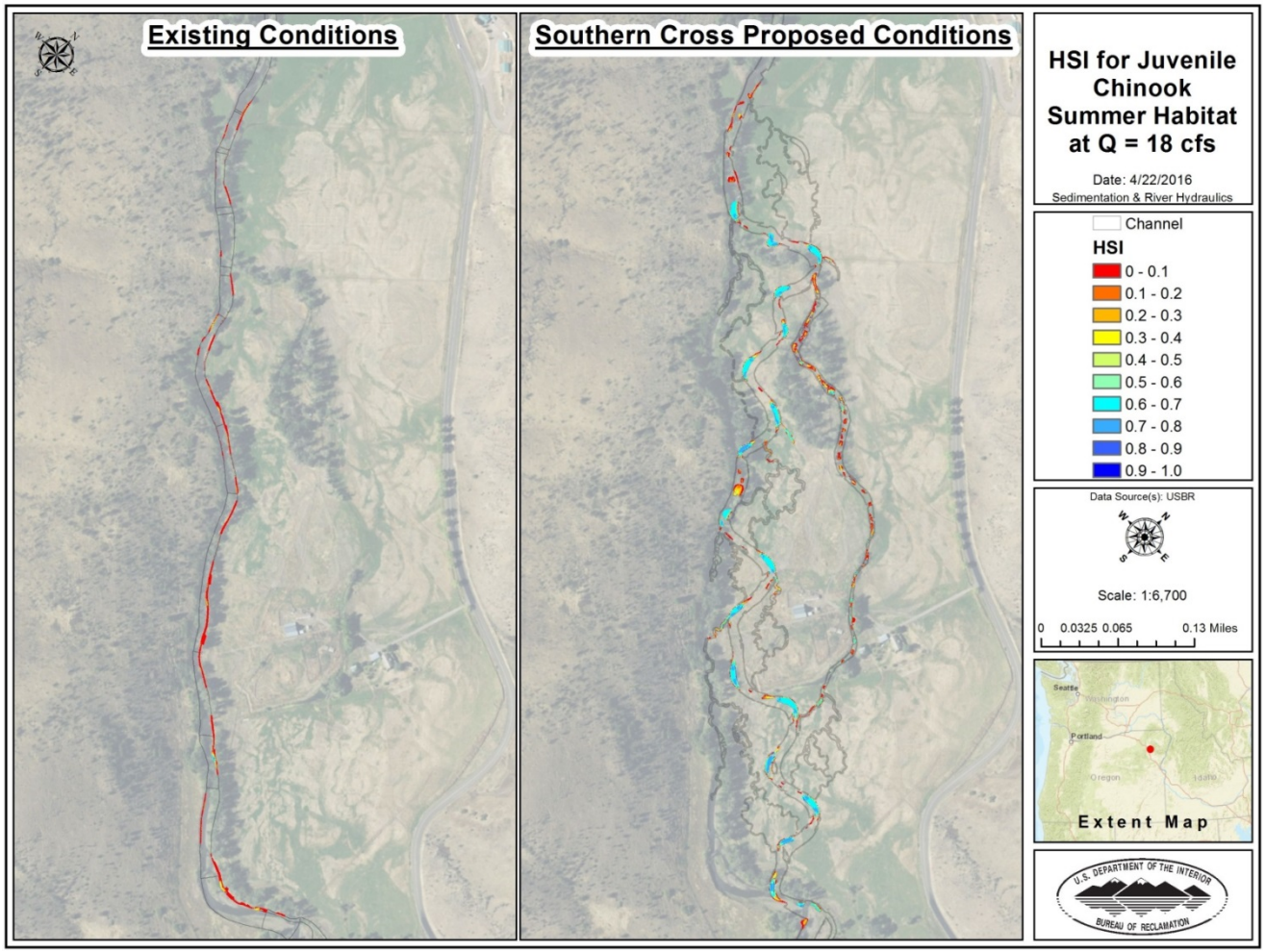

Existing Conditions
Southern Cross Proposed Conditions
HSI for Juvenile Chinook Summer Habitat at Q = 18 cfs
Date: 4/22/2016
Sedimentation & River Hydraulics
Channel
HSI
0 - 0.1
0.1 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
0.5 - 0.6
0.6 - 0.7
0.7 - 0.8
0.8 - 0.9
0.9 - 1.0
Data Source(s): USBR
Scale: 1:6,700
0 0.0325 0.065 0.13 Miles
Extent Map
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Figure 9

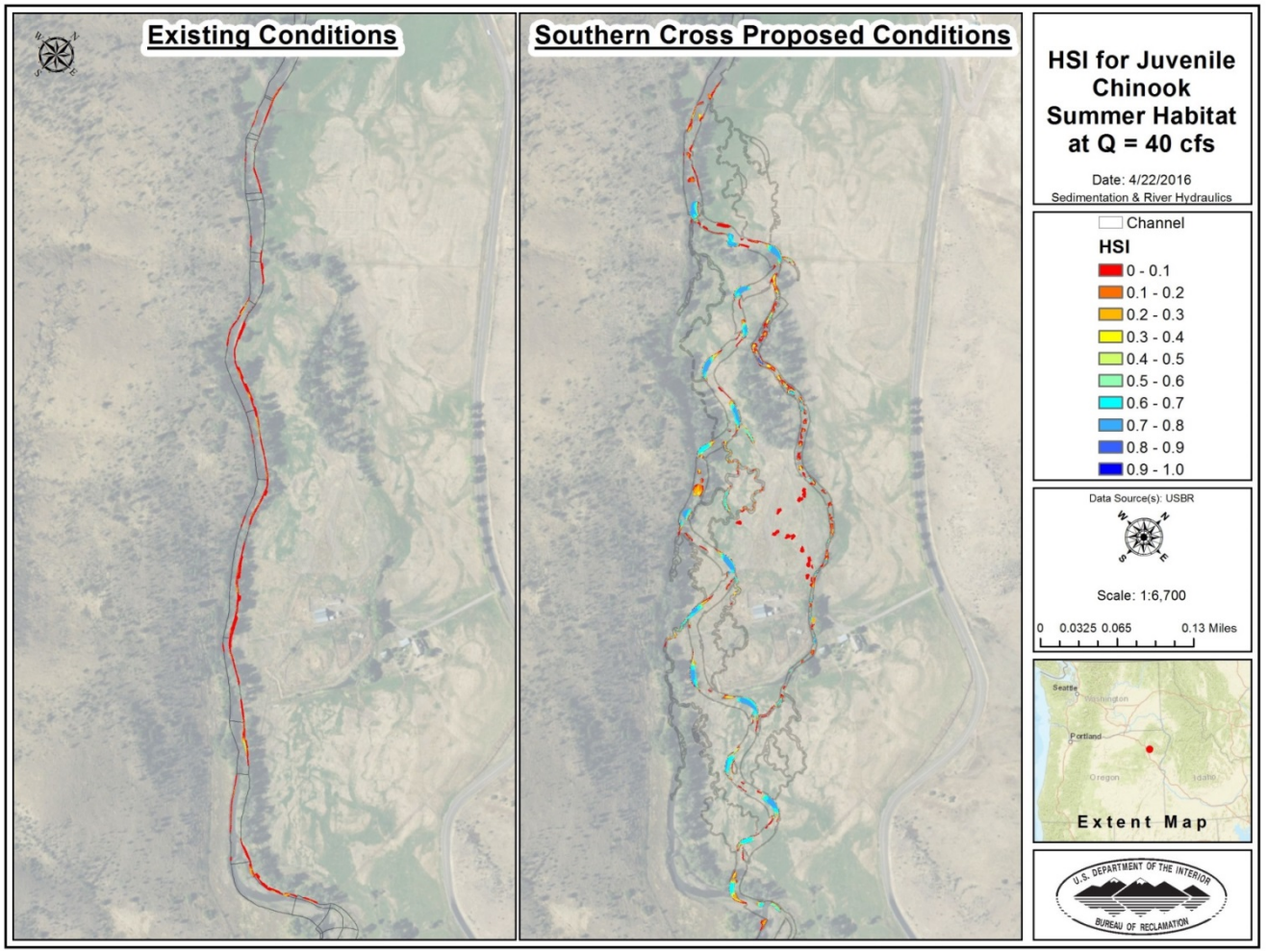

Existing Conditions
Southern Cross Proposed Conditions
HSI for Juvenile Chinook Summer Habitat at Q = 40 cfs
Date: 4/22/2016
Sedimentation & River Hydraulics
Channel
HSI
0 - 0.1
0.1 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
0.5 - 0.6
0.6 - 0.7
0.7 - 0.8
0.8 - 0.9
0.9 - 1.0
Data Source(s): USBR
Scale: 1:6,700
0 0.0325 0.065 0.13 Miles
Seattle
Washington
Portland
Oregon
Idaho
Extent Map
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Figure 10

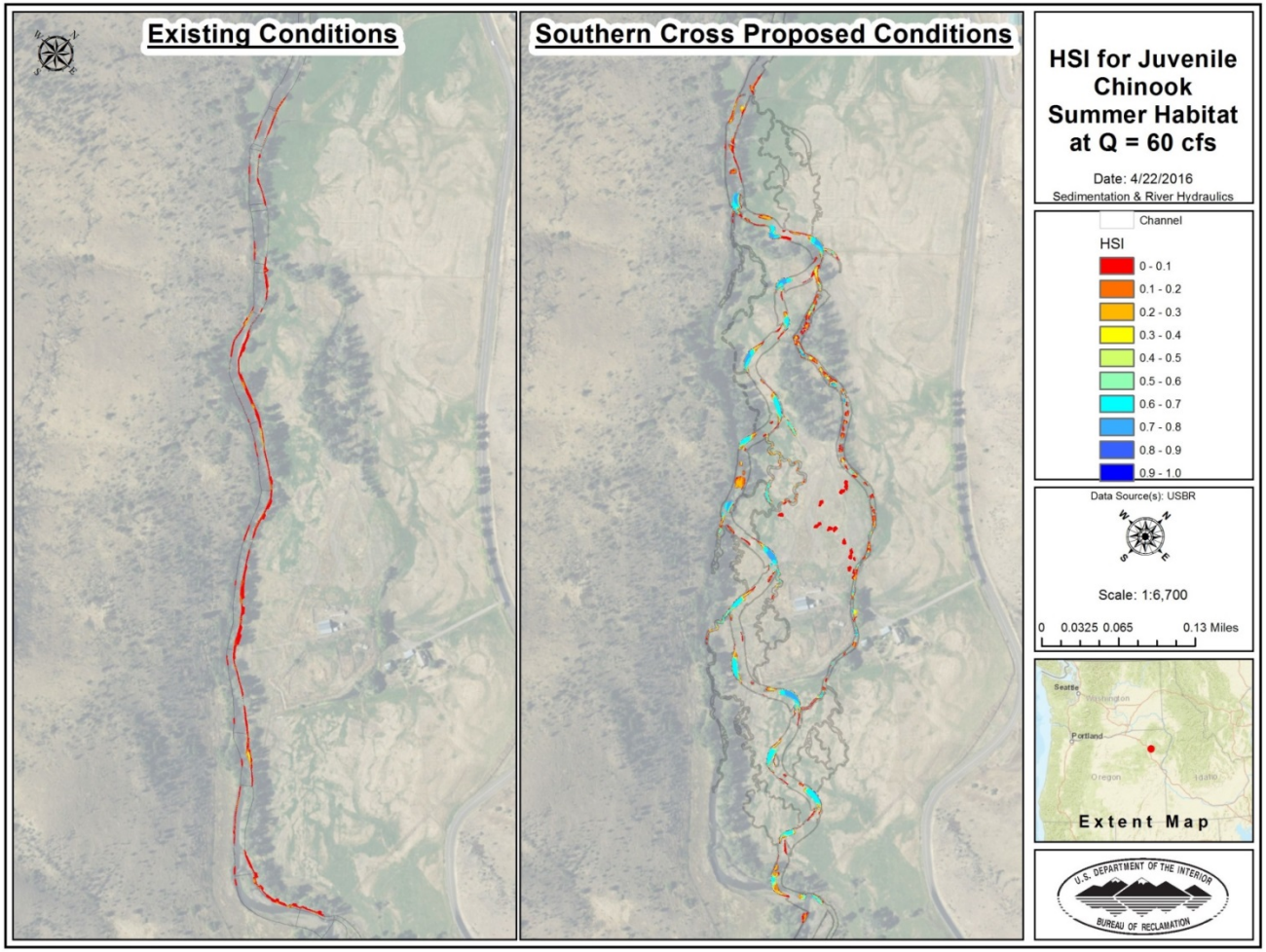
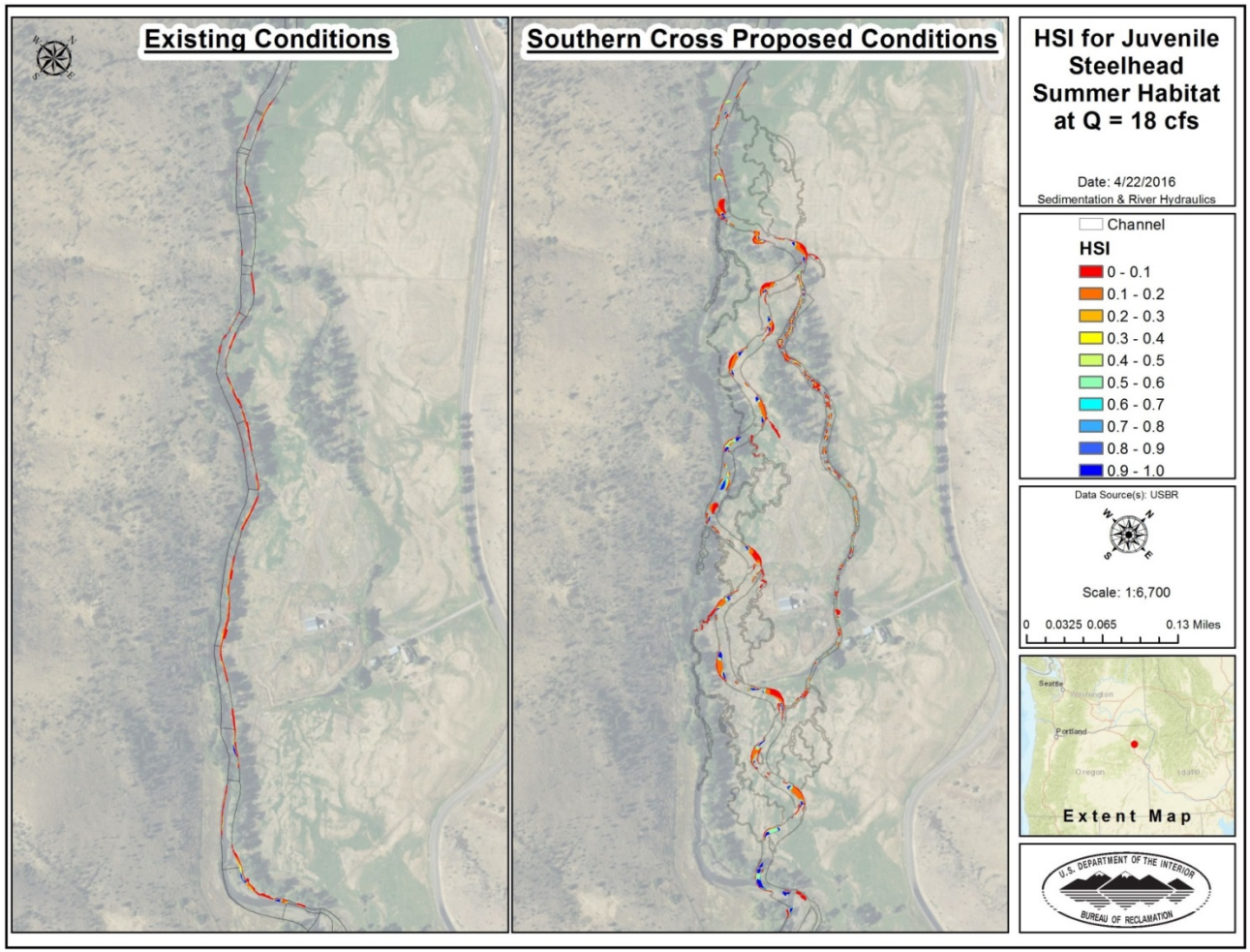

Existing Conditions
Southern Cross Proposed Conditions
HSI for Juvenile Chinook Summer Habitat at Q = 60 cfs
Date: 4/22/2016
Sedimentation & River Hydraulics
Channel
HSI
0 - 0.1
0.1 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
0.5 - 0.6
0.6 - 0.7
0.7 - 0.8
0.8 - 0.9
0.9 - 1.0
Data Source(s): USBR
Scale: 1:6,700
0 0.0325 0.065 0.13 Miles
Seattle
Portland
Oregon
Idaho
Extent Map
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Figure 11


Existing Conditions
Southern Cross Proposed Conditions
HSI for Juvenile Steelhead Summer Habitat at Q = 18 cfs
Date: 4/22/2016
Sedimentation & River Hydraulics
Channel
HSI
0 - 0.1
0.1 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
0.5 - 0.6
0.6 - 0.7
0.7 - 0.8
0.8 - 0.9
0.9 - 1.0
Data Source(s): USBR
Scale: 1:6,700
0 0.0325 0.065 0.13 Miles
Seattle
Portland
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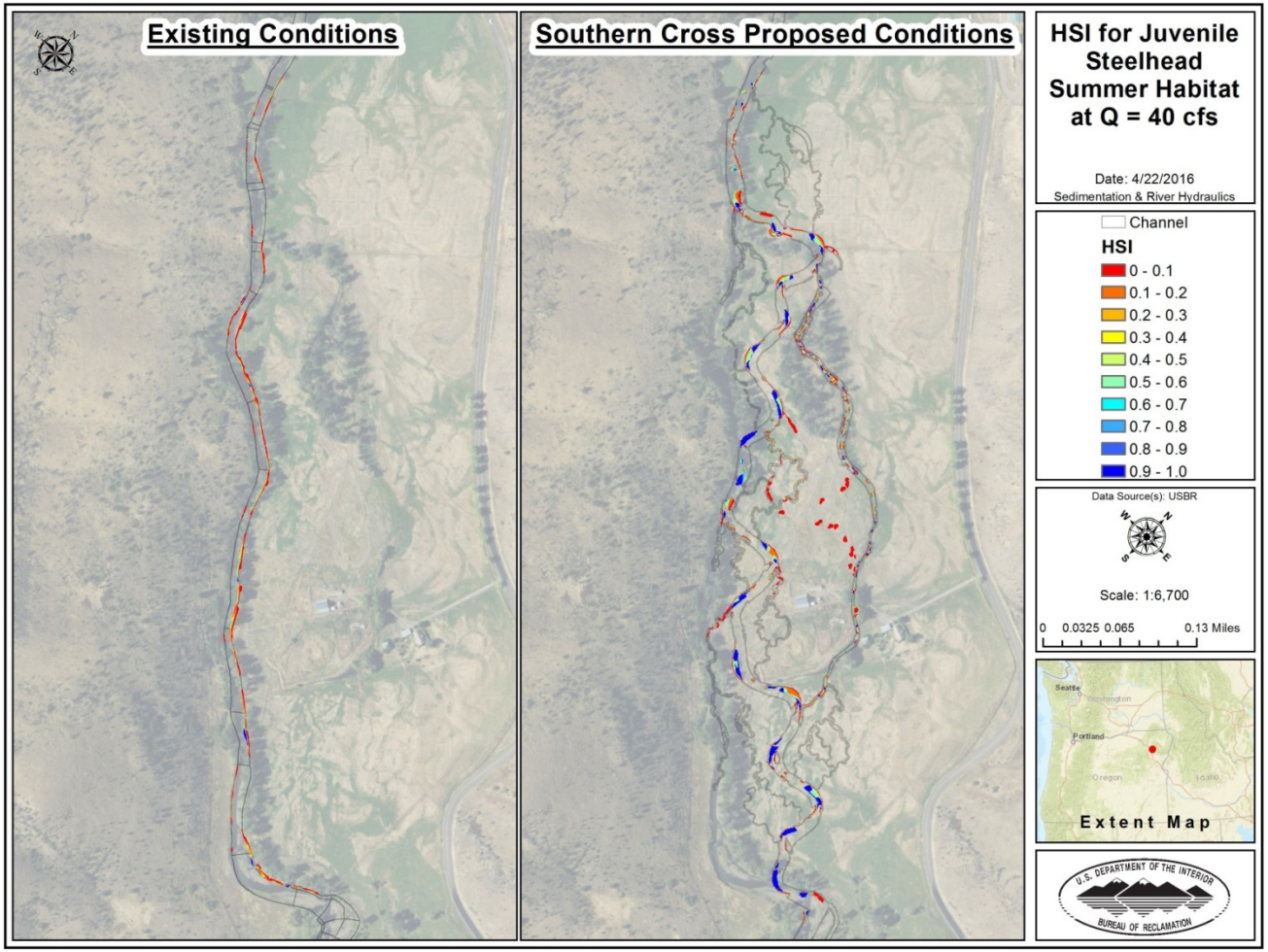
Idaho
Extent Map
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Figure 12


Existing Conditions
Southern Cross Proposed Conditions
HSI for Juvenile Steelhead Summer Habitat at Q = 40 cfs
Date: 4/22/2016
Sedimentation & River Hydraulics
Channel
HSI
0 - 0.1
0.1 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
0.5 - 0.6
0.6 - 0.7
0.7 - 0.8
0.8 - 0.9
0.9 - 1.0
Data Source(s): USBR
Scale: 1:6,700
0 0.0325 0.065 0.13 Miles
Seattle
Portland
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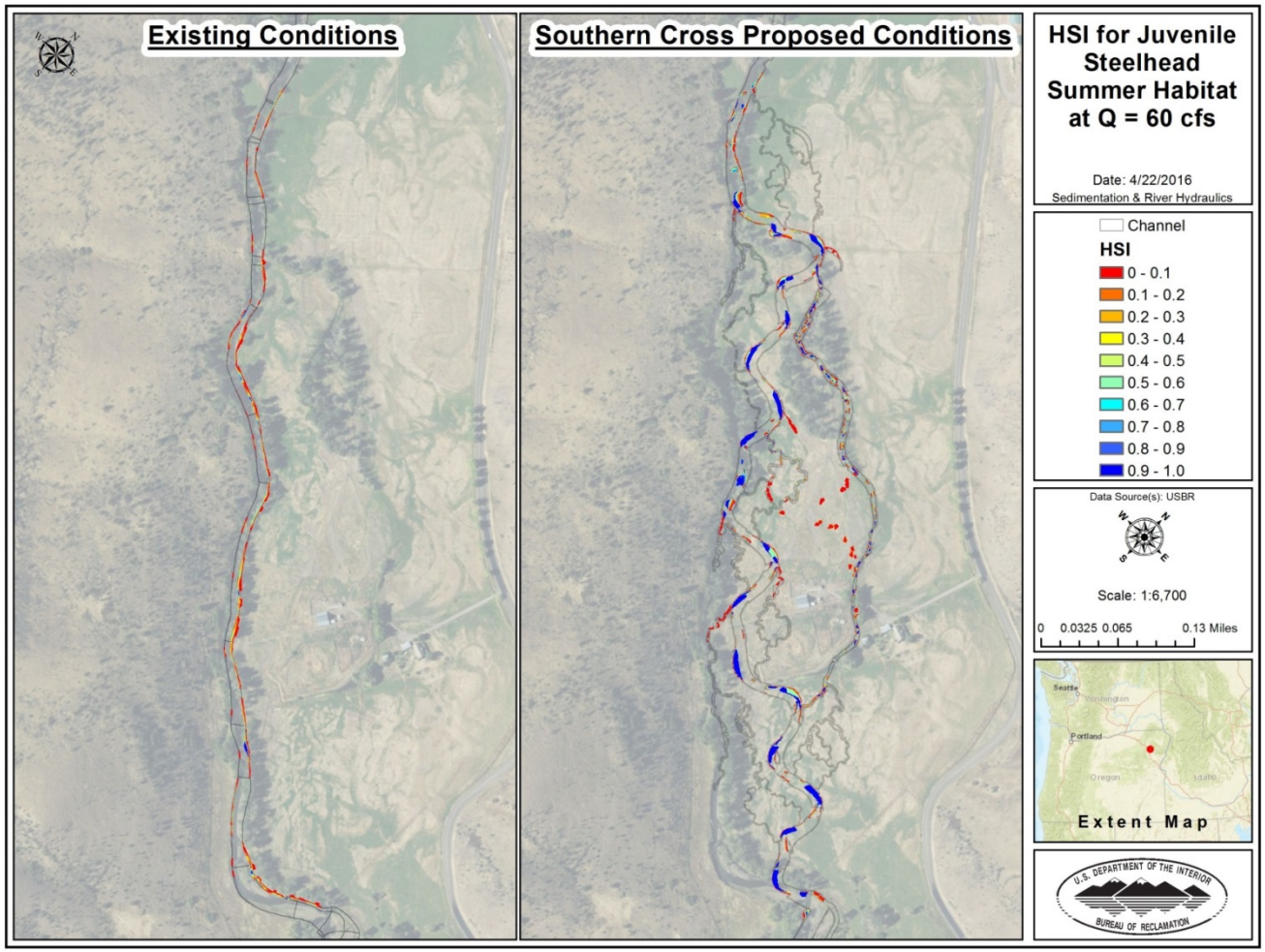
Extent Map
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Figure 13


Existing Conditions
Southern Cross Proposed Conditions
HSI for Juvenile Steelhead Summer Habitat at Q = 60 cfs
Date: 4/22/2016
Sedimentation & River Hydraulics
Channel
HSI
0 - 0.1
0.1 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
0.5 - 0.6
0.6 - 0.7
0.7 - 0.8
0.8 - 0.9
0.9 - 1.0
Data Source(s): USBR
Scale: 1:6,700
0 0.0325 0.065 0.13 Miles
Seattle
Washington
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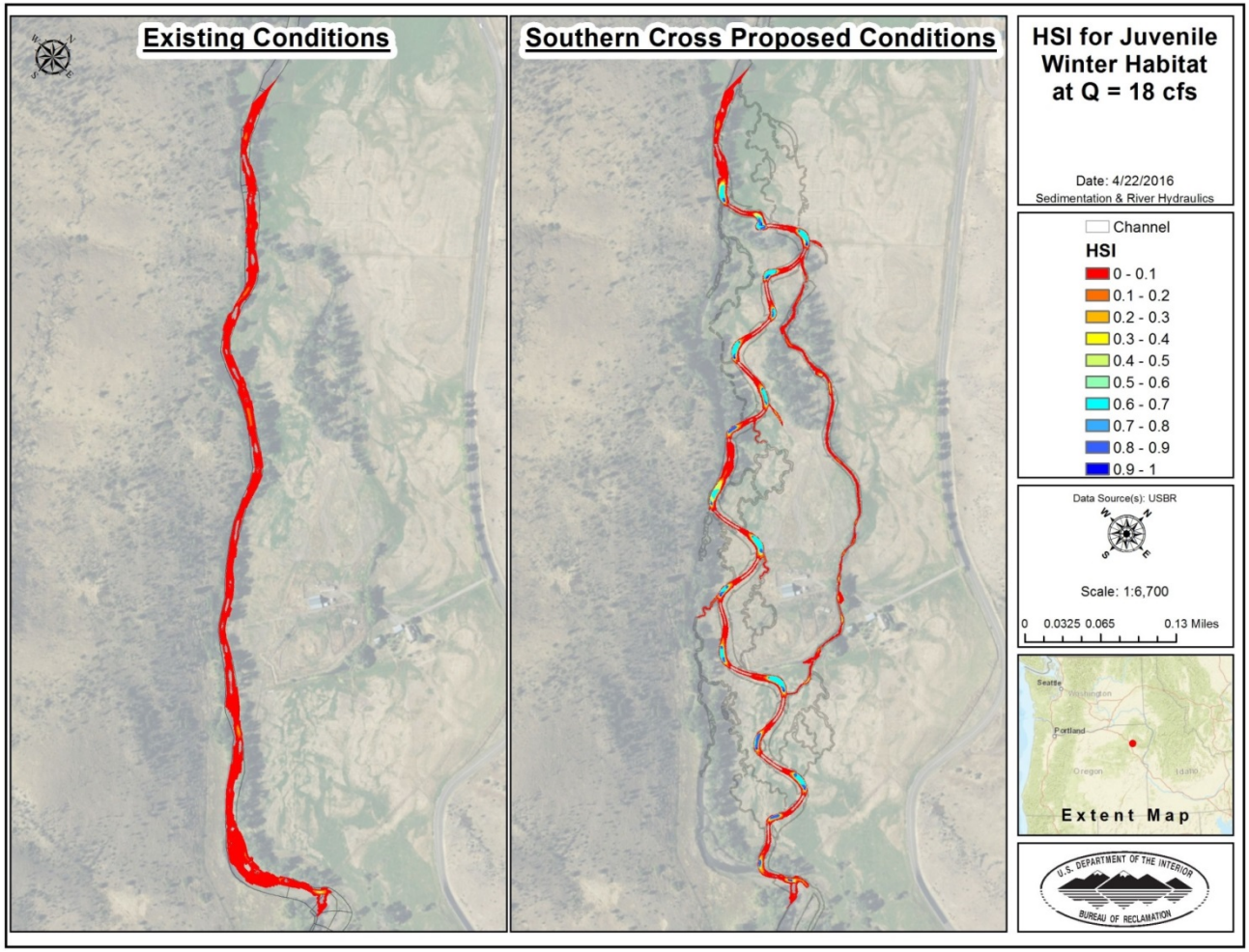
Extent Map
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Figure 14


Existing Conditions
Southern Cross Proposed Conditions
HSI for Juvenile Winter Habitat at Q = 18 cfs
Date: 4/22/2016
Sedimentation & River Hydraulics
Channel
HSI
0 - 0.1
0.1 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
0.5 - 0.6
0.6 - 0.7
0.7 - 0.8
0.8 - 0.9
0.9 - 1
Data Source(s): USBR
Scale: 1:6,700
0 0.0325 0.065 0.13 Miles
Seattle
Washington
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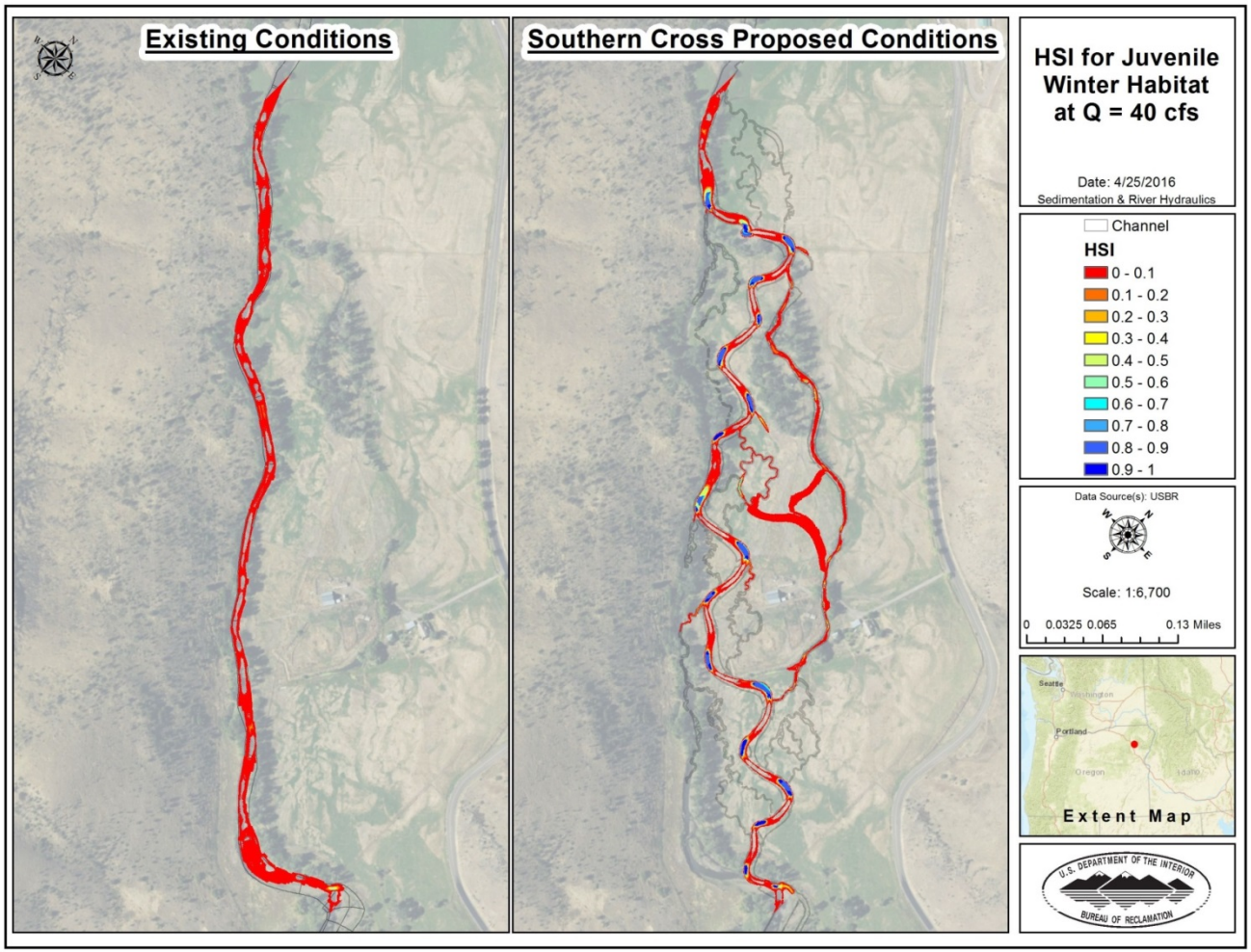
Extent Map
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Figure 15


Existing Conditions
Southern Cross Proposed Conditions
HSI for Juvenile Winter Habitat at Q = 40 cfs
Date: 4/25/2016
Sedimentation & River Hydraulics
Channel
HSI
0 - 0.1
0.1 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
0.5 - 0.6
0.6 - 0.7
0.7 - 0.8
0.8 - 0.9
0.9 - 1
Data Source(s): USBR
Scale: 1:6,700
0 0.0325 0.065 0.13 Miles
Seattle
Portland
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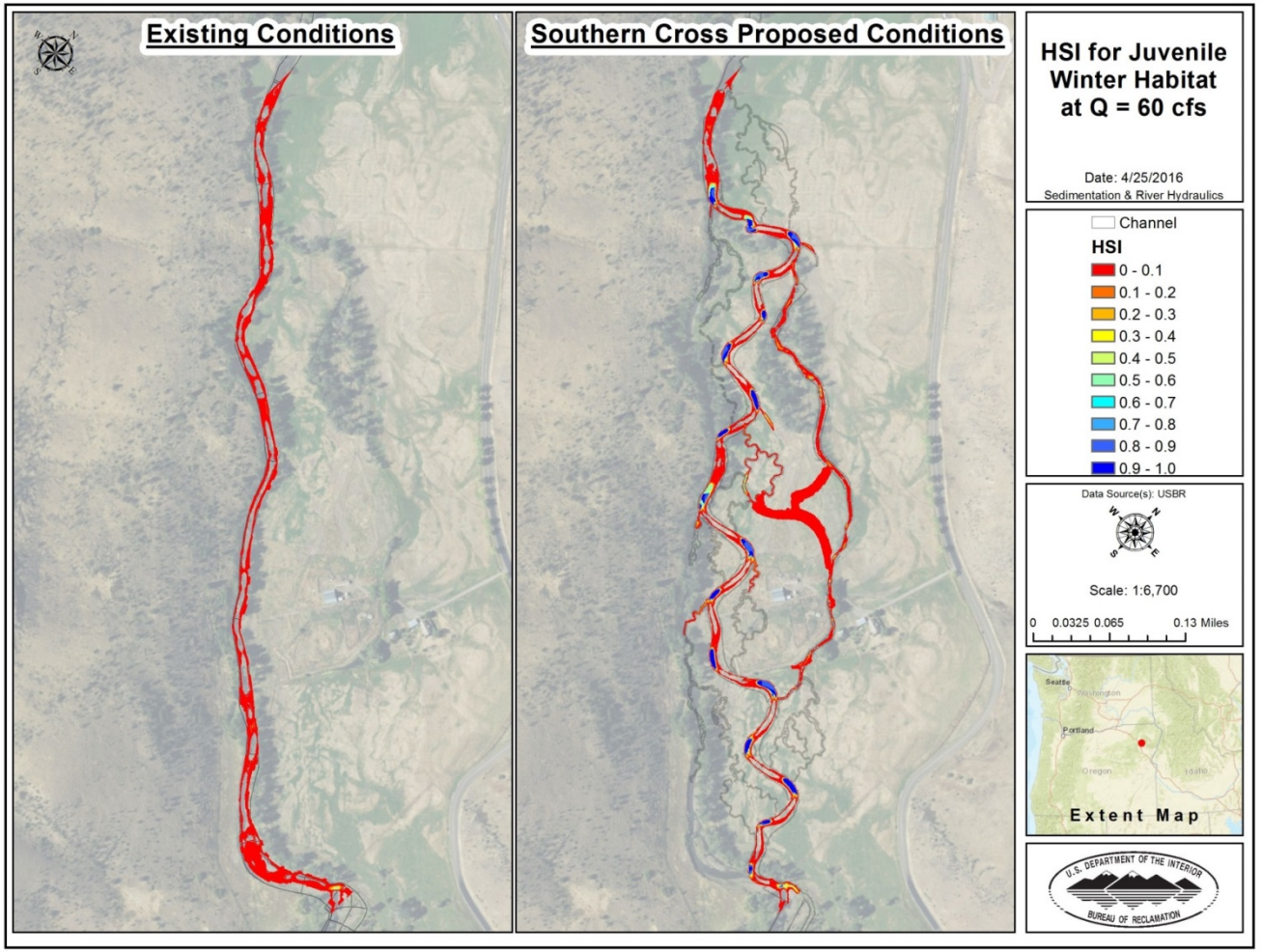
Idaho
Extent Map
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Figure 16


Existing Conditions
Southern Cross Proposed Conditions
HSI for Juvenile Winter Habitat at Q = 60 cfs
Date: 4/25/2016
Sedimentation & River Hydraulics
Channel
HSI
0 - 0.1
0.1 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
0.5 - 0.6
0.6 - 0.7
0.7 - 0.8
0.8 - 0.9
0.9 - 1.0
Data Source(s): USBR
Scale: 1:6,700
0 0.0325 0.065 0.13 Miles
Seattle
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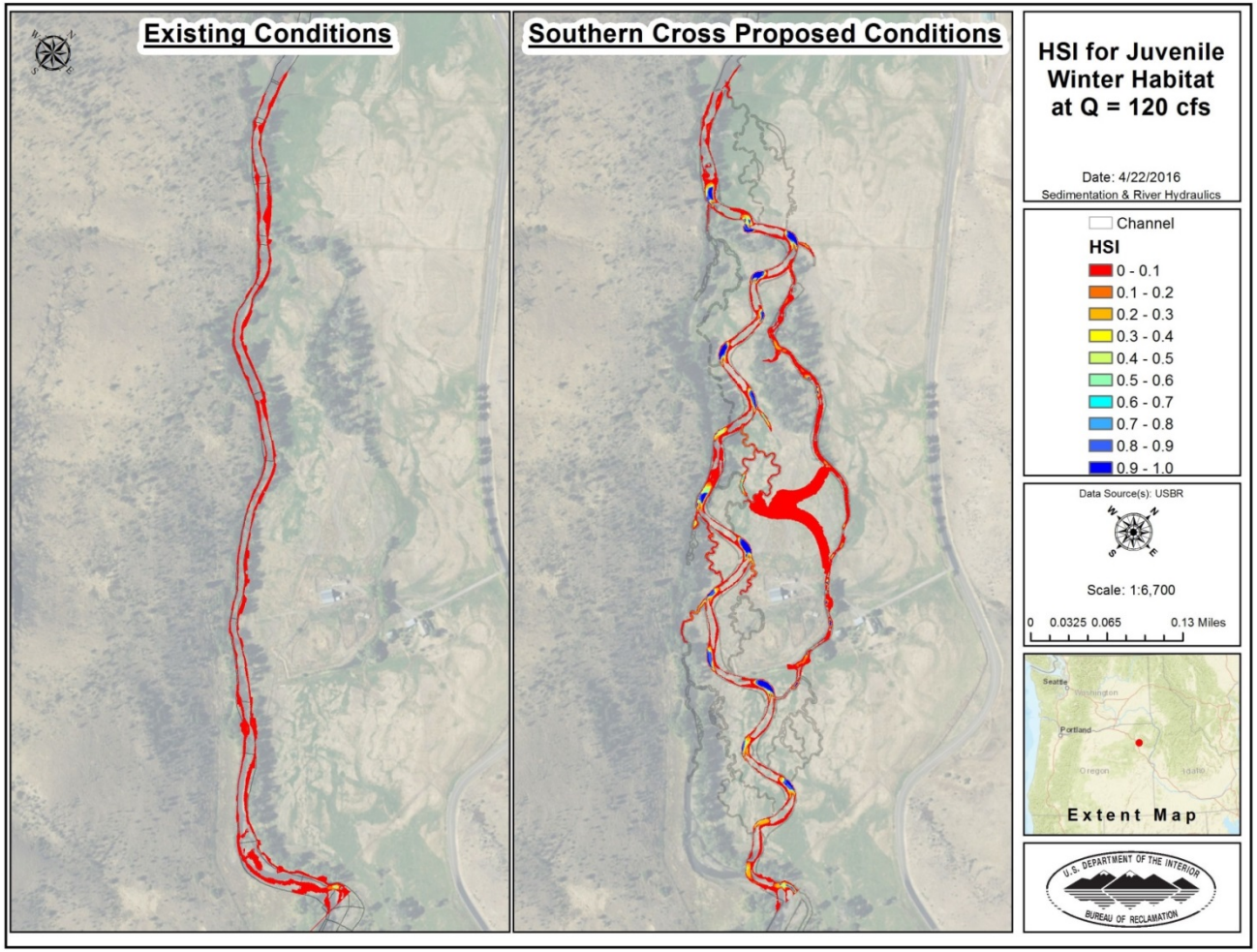
Extent Map
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Figure 17


Existing Conditions
Southern Cross Proposed Conditions
HSI for Juvenile Winter Habitat at Q = 120 cfs
Date: 4/22/2016
Sedimentation & River Hydraulics
Channel
HSI
0 - 0.1
0.1 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
0.5 - 0.6
0.6 - 0.7
0.7 - 0.8
0.8 - 0.9
0.9 - 1.0
Data Source(s): USBR
Scale: 1:6,700
0 0.0325 0.065 0.13 Miles
Seattle
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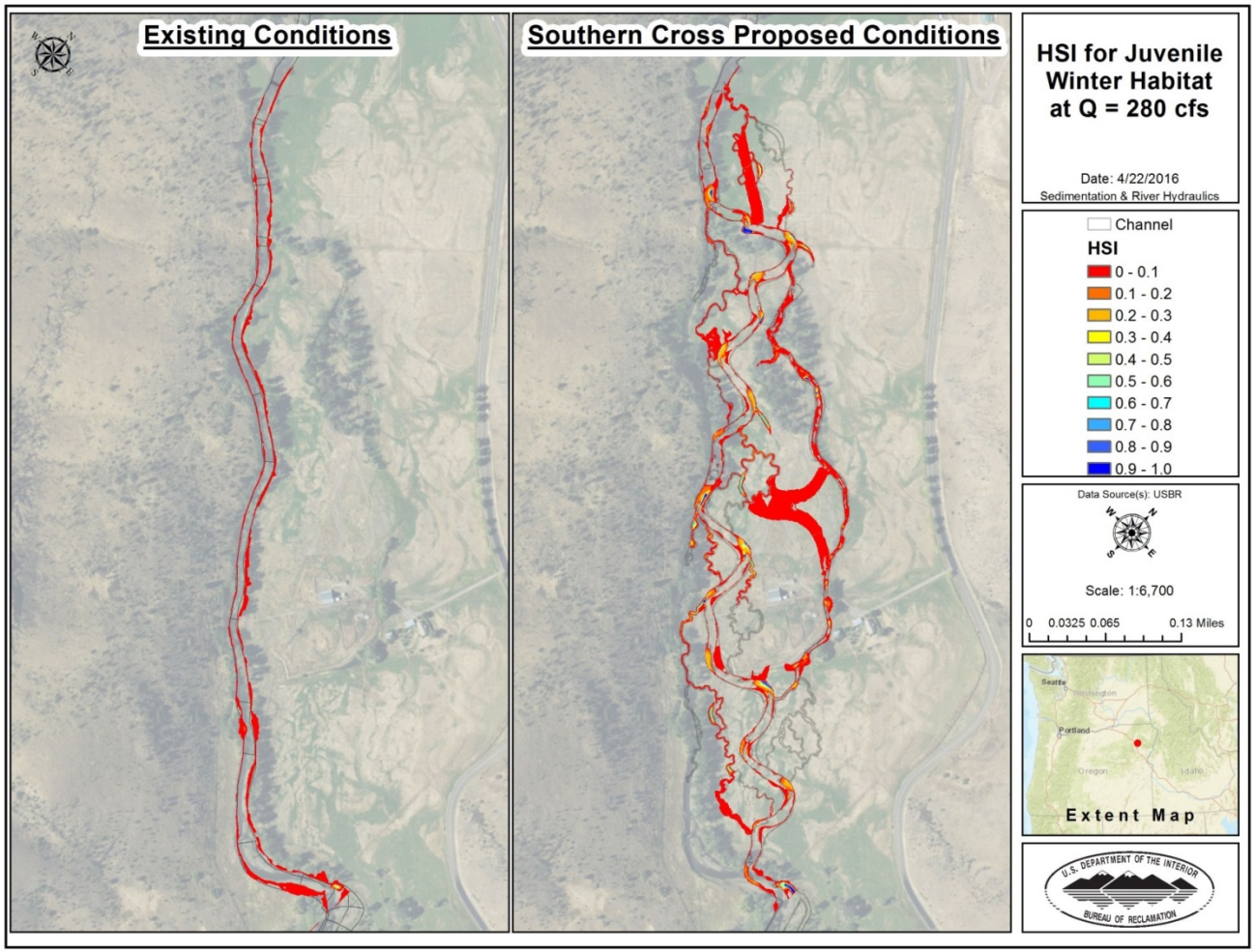
Extent Map
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Figure 18


Existing Conditions
Southern Cross Proposed Conditions
HSI for Juvenile Winter Habitat at Q = 280 cfs
Date: 4/22/2016
Sedimentation & River Hydraulics
Channel
HSI
0 - 0.1
0.1 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
0.5 - 0.6
0.6 - 0.7
0.7 - 0.8
0.8 - 0.9
0.9 - 1.0
Data Source(s): USBR
Scale: 1:6,700
0 0.0325 0.065 0.13 Miles
Seattle
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Idaho
Extent Map
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Figure 19

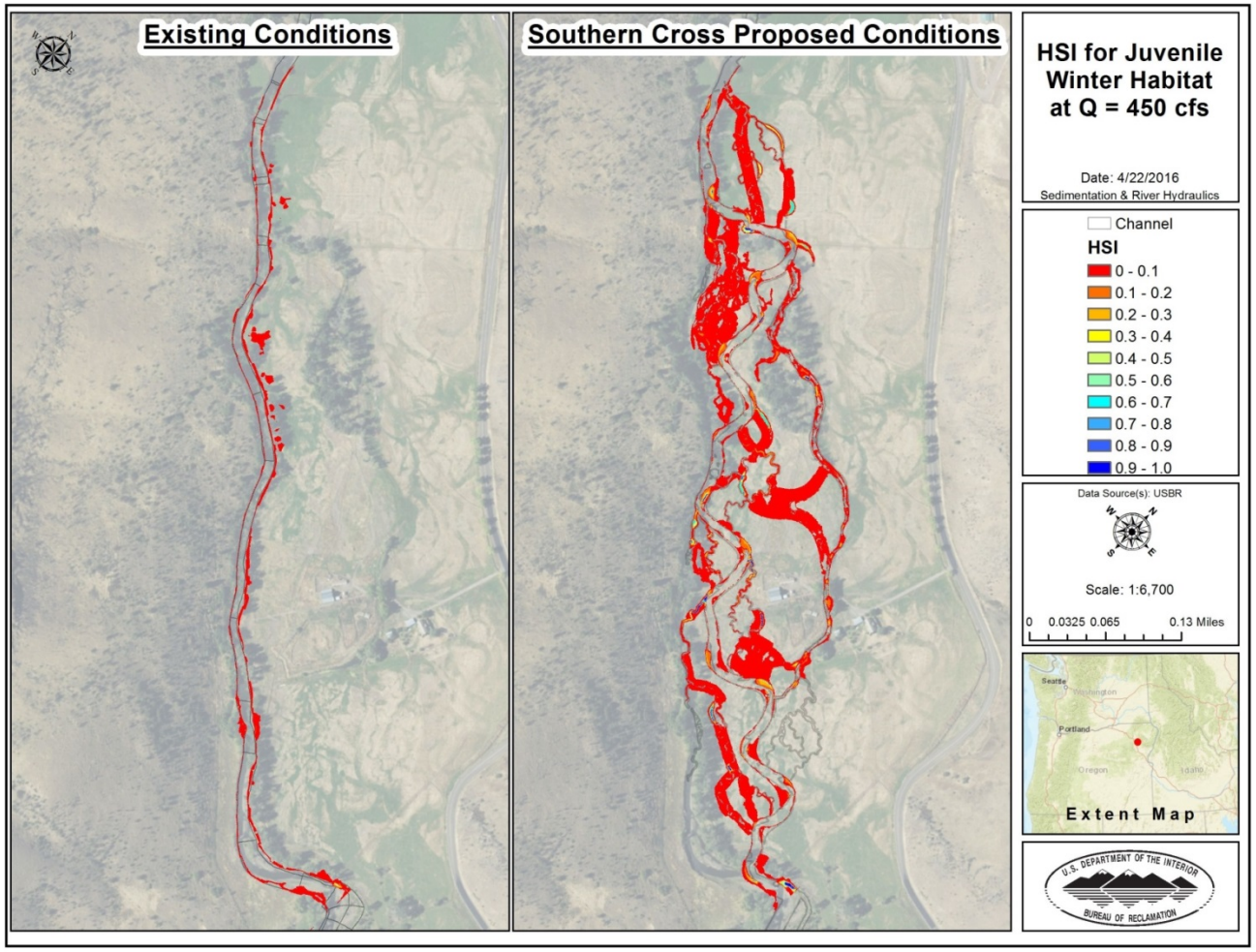
Existing Conditions
Southern Cross Proposed Conditions
HSI for Juvenile Winter Habitat at Q = 450 cfs
Date: 4/22/2016
Sedimentation & River Hydraulics
Channel
HSI
0 - 0.1
0.1 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
0.5 - 0.6
0.6 - 0.7
0.7 - 0.8
0.8 - 0.9
0.9 - 1.0
Data Source(s): USBR
Scale: 1:6,700
0 0.0325 0.065 0.13 Miles
Seattle
Portland
Oregon
Idaho
Extent Map
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Figure 20

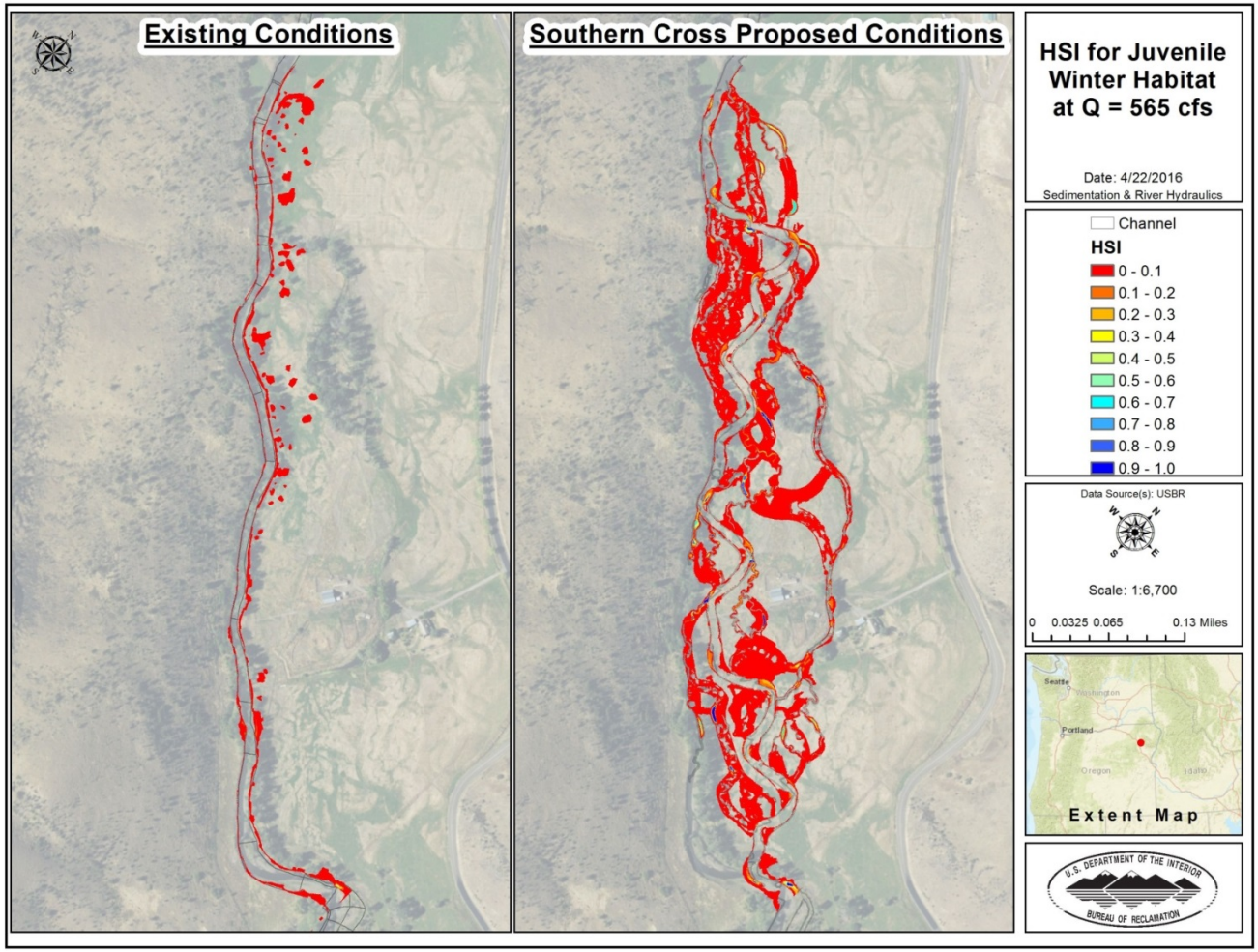
Existing Conditions
Southern Cross Proposed Conditions
HSI for Juvenile Winter Habitat at Q = 565 cfs
Date: 4/22/2016
Sedimentation & River Hydraulics
Channel
HSI
0 - 0.1
0.1 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
0.5 - 0.6
0.6 - 0.7
0.7 - 0.8
0.8 - 0.9
0.9 - 1.0
Data Source(s): USBR
Scale: 1:6,700
0 0.0325 0.065 0.13 Miles
Seattle
Portland
Oregon
Extent Map
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Figure 21

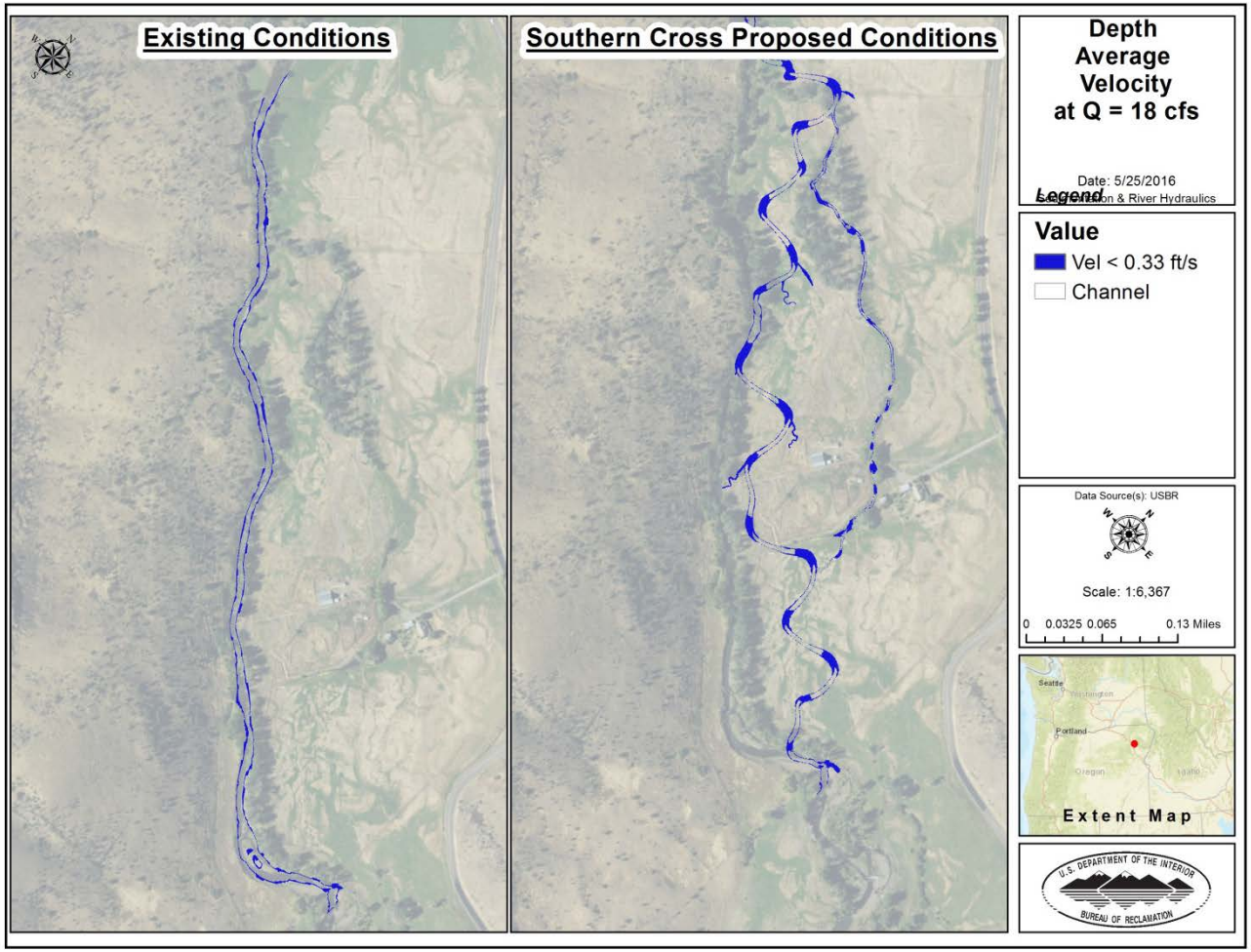
Existing Conditions
Southern Cross Proposed Conditions
Depth Average Velocity at Q = 18 cfs
Date: 5/25/2016
Legend
Value
Vel < 0.33 ft/s
Channel
Data Source(s): USBR
Scale: 1:6,367
0 0.0325 0.065 0.13 Miles
Extent Map
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Figure 22

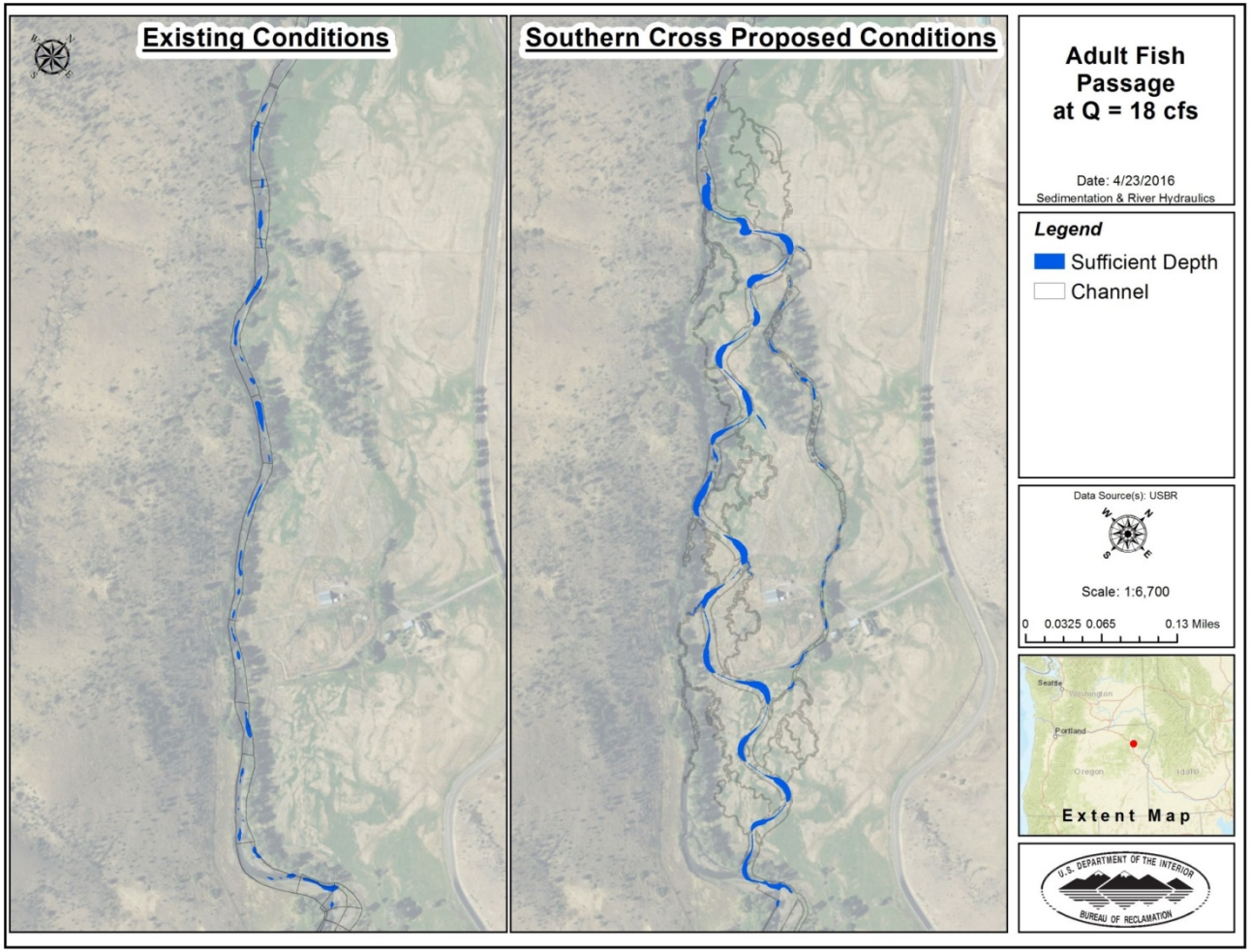
Existing Conditions
Southern Cross Proposed Conditions
Adult Fish Passage at Q = 18 cfs
Date: 4/23/2016
Sedimentation & River Hydraulics
Legend
Sufficient Depth
Channel
Data Source(s): USBR
Scale: 1:6,700
0 0.0325 0.065 0.13 Miles
Seattle
Portland
Oregon
Idaho
Extent Map
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Figure 23

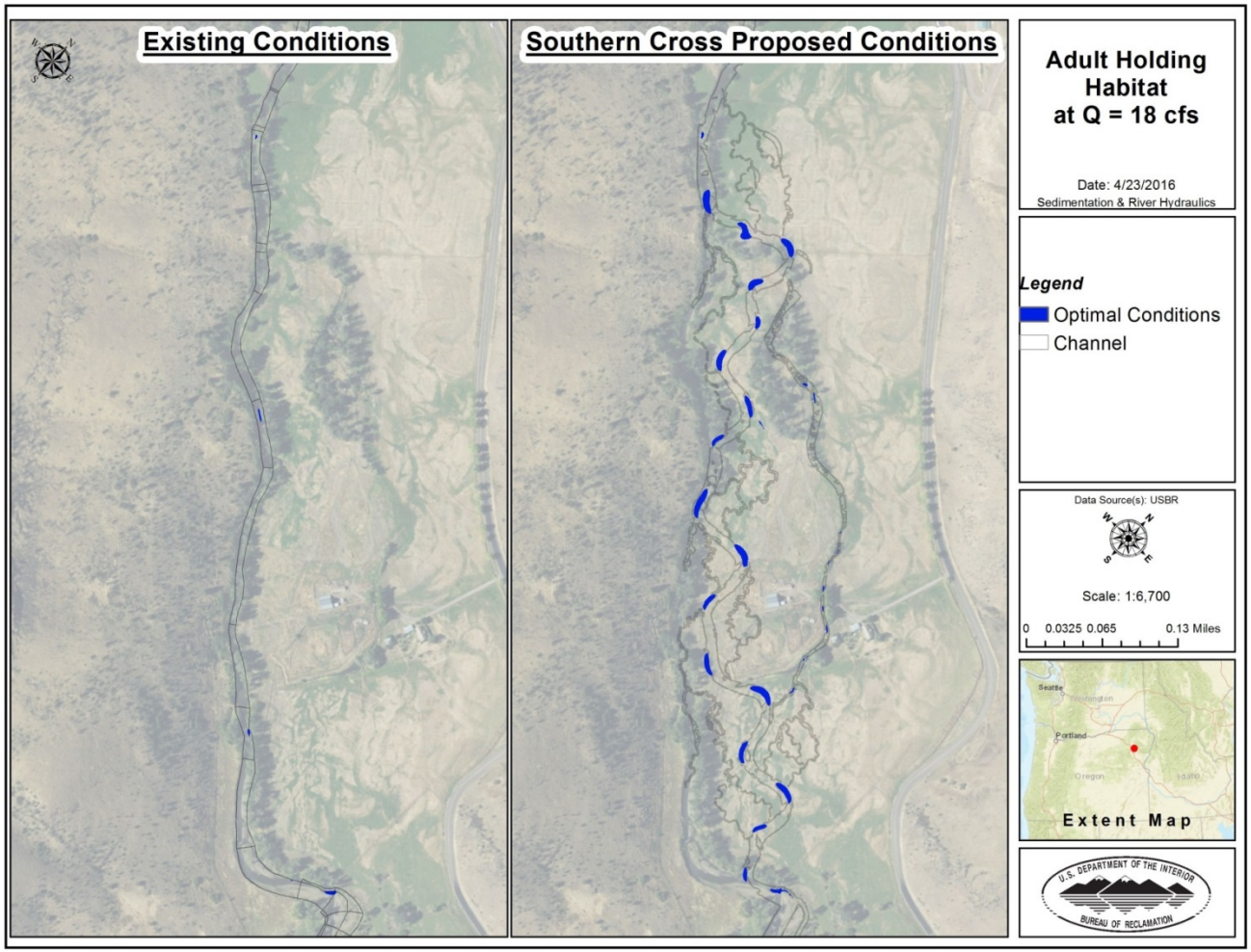
Existing Conditions
Southern Cross Proposed Conditions
Adult Holding Habitat at Q = 18 cfs
Date: 4/23/2016
Sedimentation & River Hydraulics
Legend
Optimal Conditions
Channel
Data Source(s): USBR
Scale: 1:6,700
0 0.0325 0.065 0.13 Miles
Seattle
Portland
Oregon
Idaho
Extent Map
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Figure 24

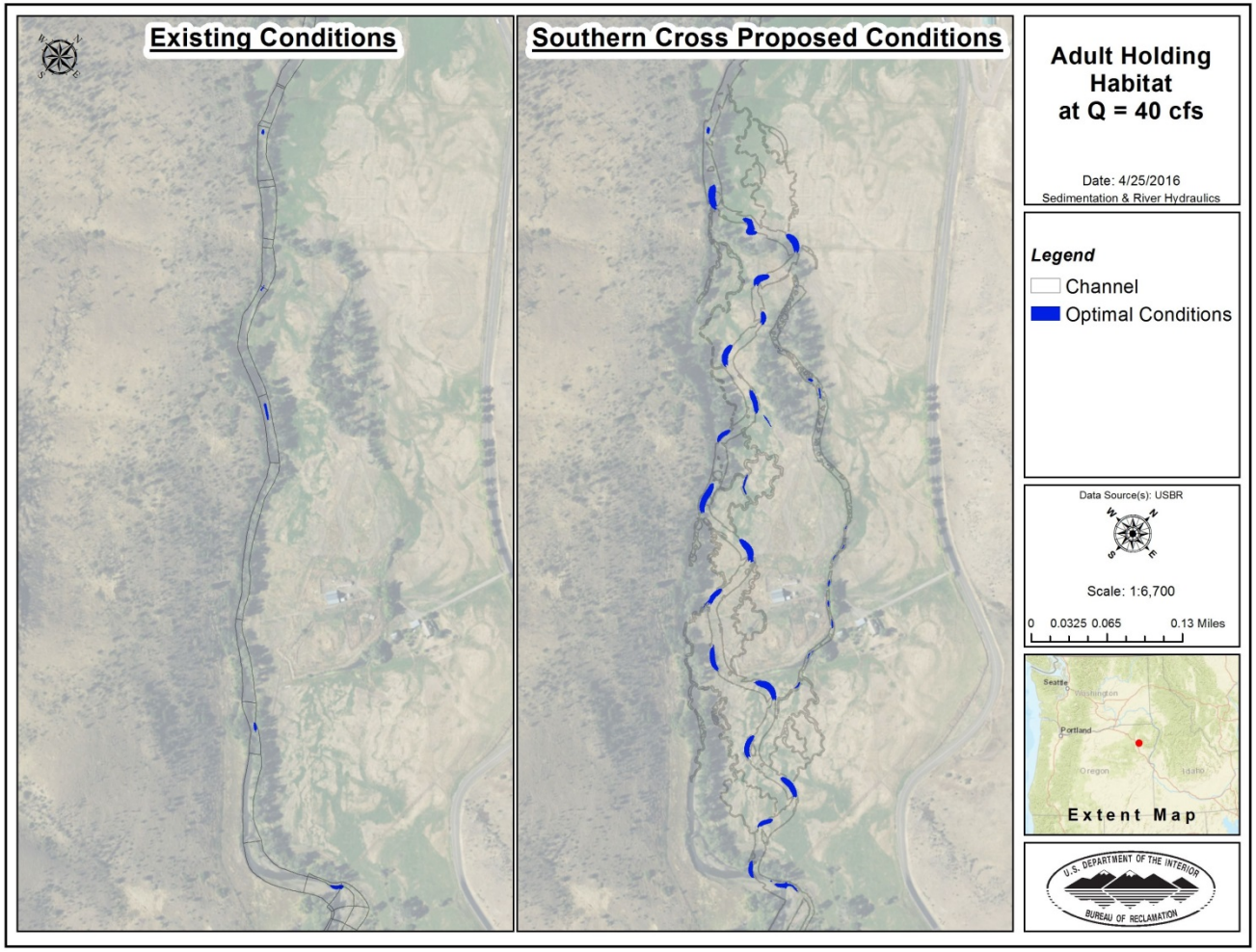
Existing Conditions
Southern Cross Proposed Conditions
Adult Holding Habitat at Q = 40 cfs
Date: 4/25/2016
Sedimentation & River Hydraulics
Legend
Channel
Optimal Conditions
Data Source(s): USBR
Scale: 1:6,700
0 0.0325 0.065 0.13 Miles
Seattle
Portland
Oregon
Idaho
Extent Map
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Figure 25

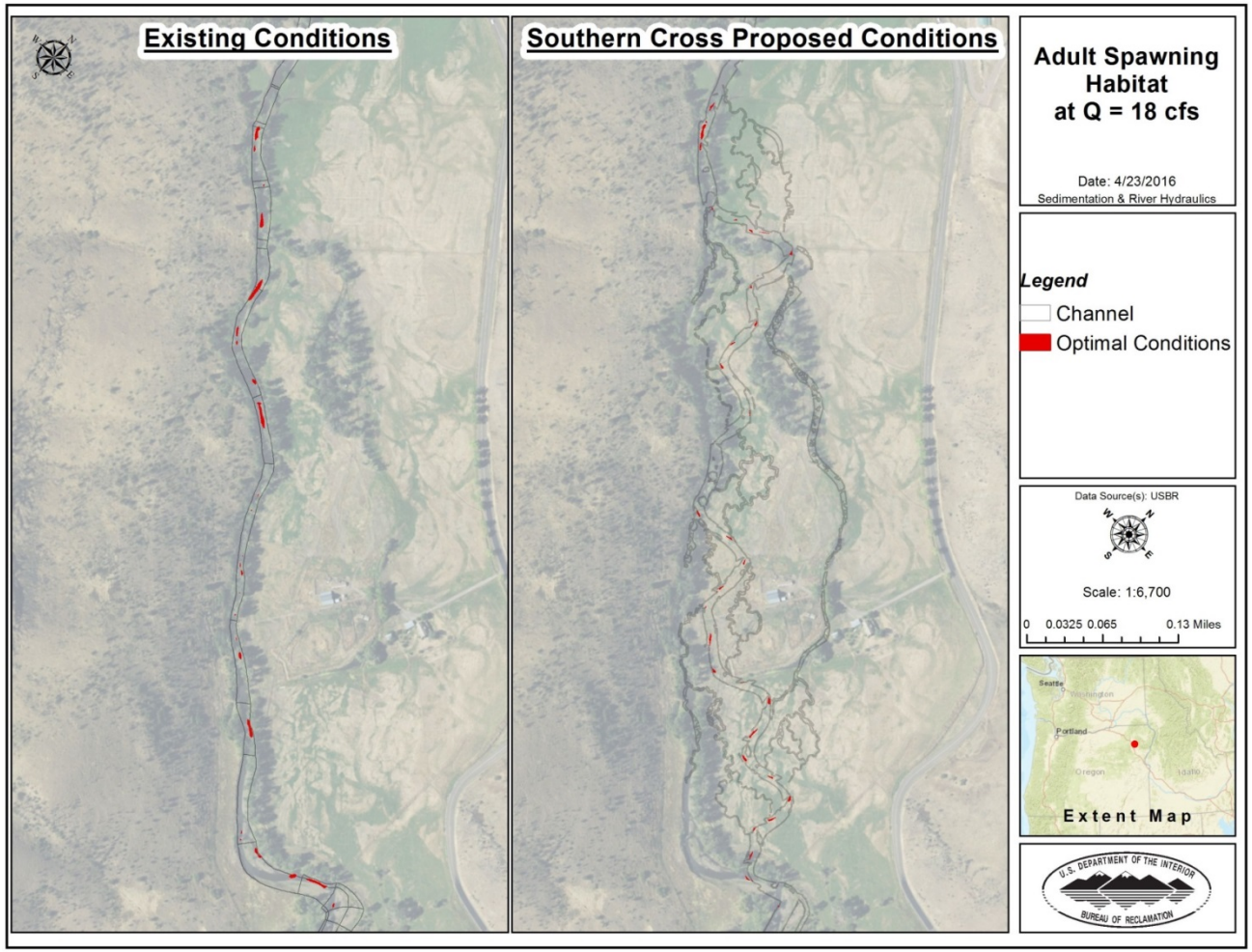
Existing Conditions
Southern Cross Proposed Conditions
Adult Spawning Habitat at Q = 18 cfs
Date: 4/23/2016
Sedimentation & River Hydraulics
Legend
Channel
Optimal Conditions
Data Source(s): USBR
Scale: 1:6,700
0 0.0325 0.065 0.13 Miles
Seattle
Portland
Oregon
Idaho
Extent Map
U.S. DEPARTMENT OF THE INTERIOR
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Figure 26

4 Summary & Conclusion

A Habitat Suitability Index modeling analysis was performed by Reclamation TSC staff to compare the habitat uplift for Chinook salmon and Steelhead trout under existing and proposed conditions in the Southern Cross property area, within the Catherine Creek River Mile 44 (CC-44) Project Area. With the pool-riffle sequencing and increased floodplain connectivity under the proposed conditions, results show that habitat quality/quantity greatly increased for juvenile life stages between both species. Habitat also significantly increased for adult holding and adult fish passage; however, results show a decrease in adult spawning habitat under proposed conditions. The riffle-pool sequence divides optimal velocity and depth conditions. Additionally, areas of adult fish passage are often disconnected, making continual passage challenging at low flows.

5 References

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Appendix A - ArcGIS Model Builder Schematics

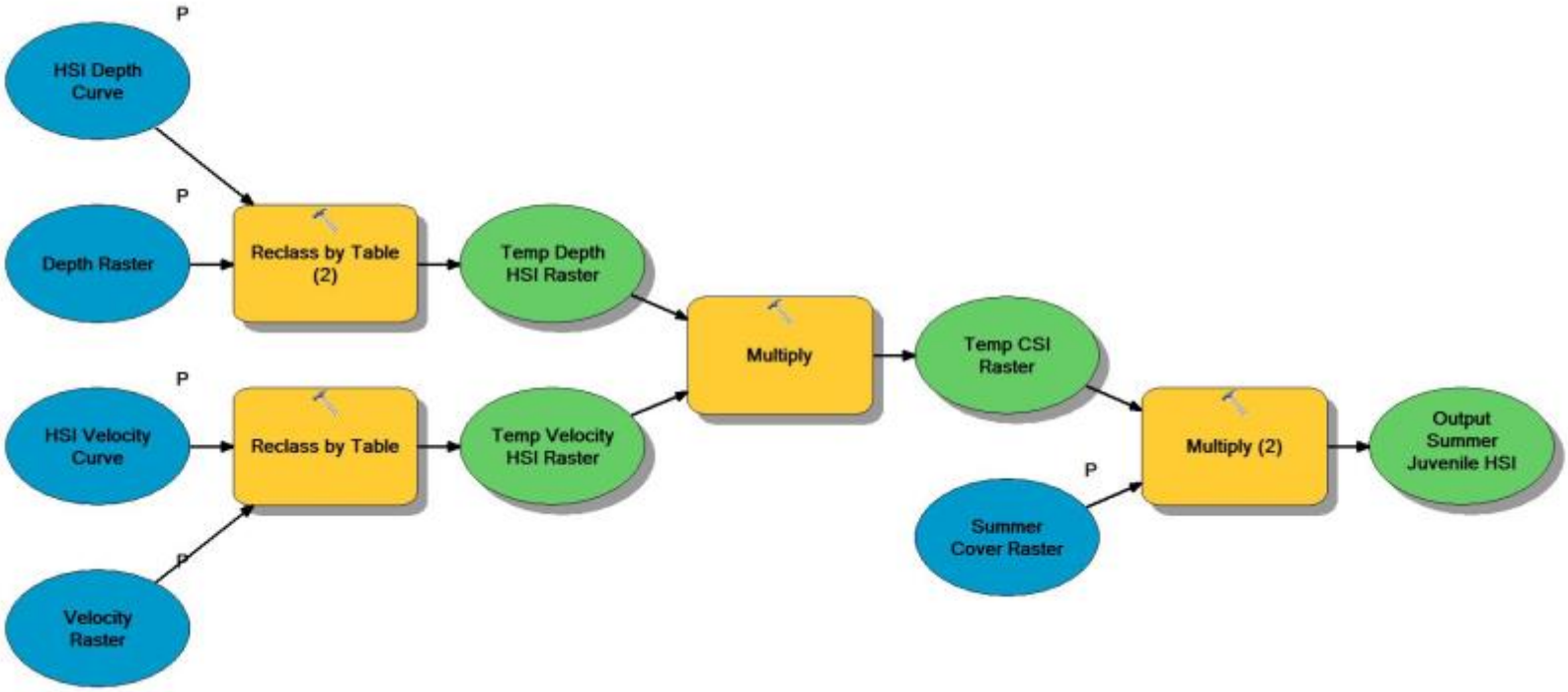


Figure 27. Model builder schematic for summer WUA analysis

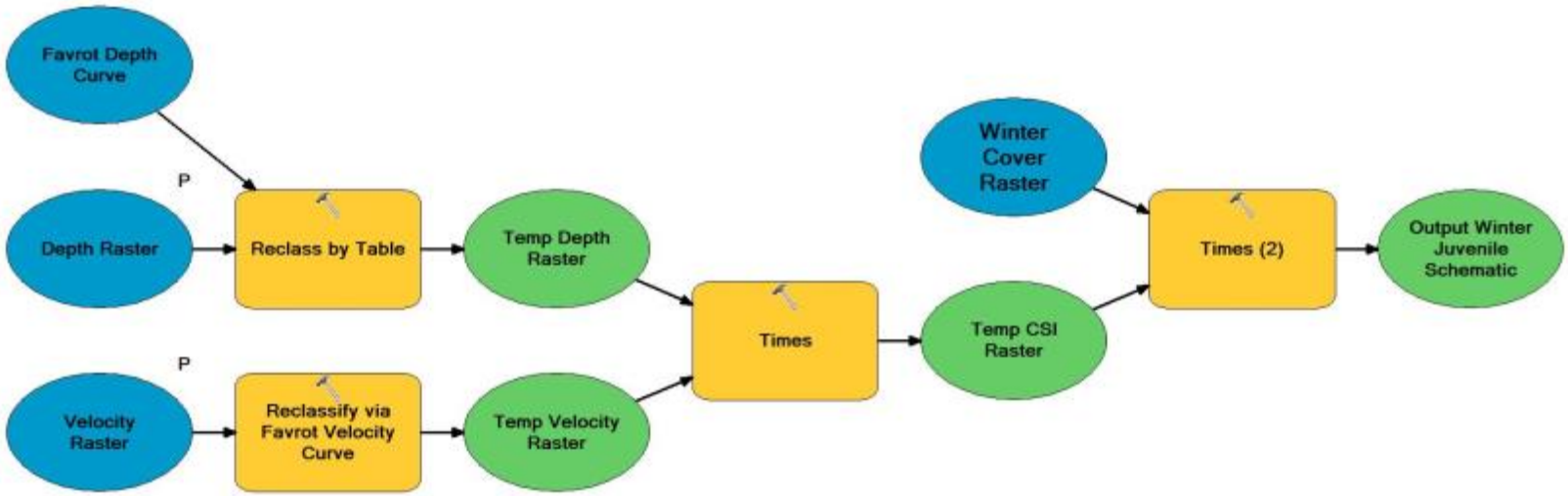


Figure 28. Model builder schematic for winter WUA analysis

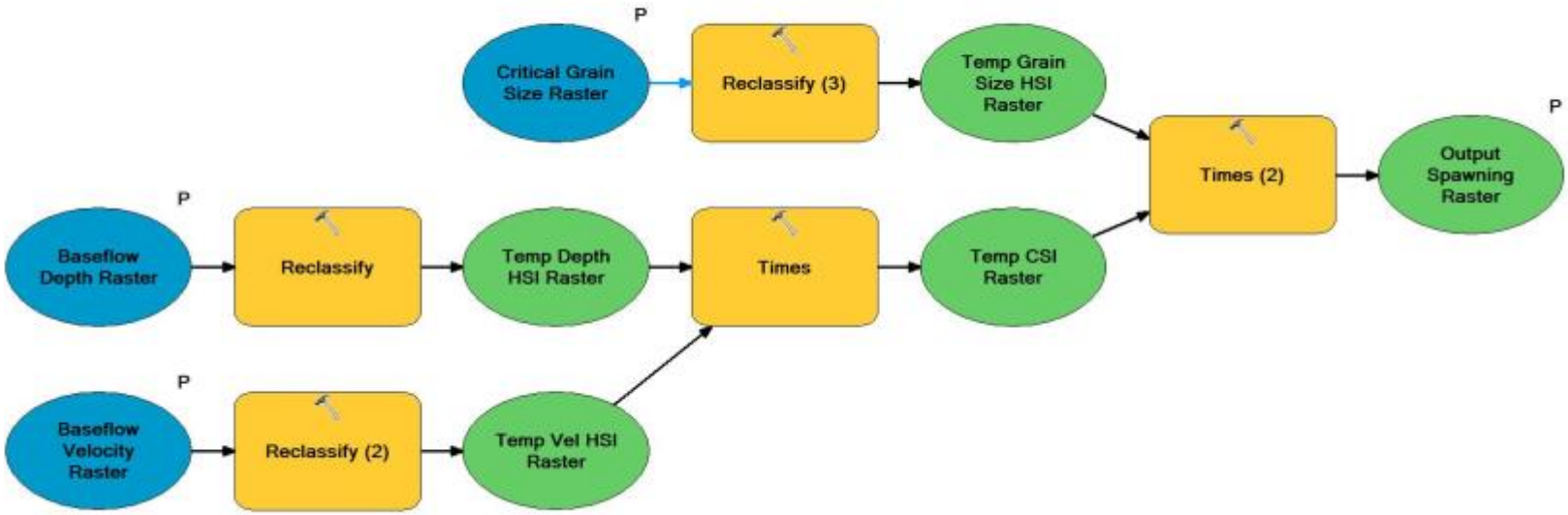


Figure 29. Model builder schematic for spawning habitat analysis.

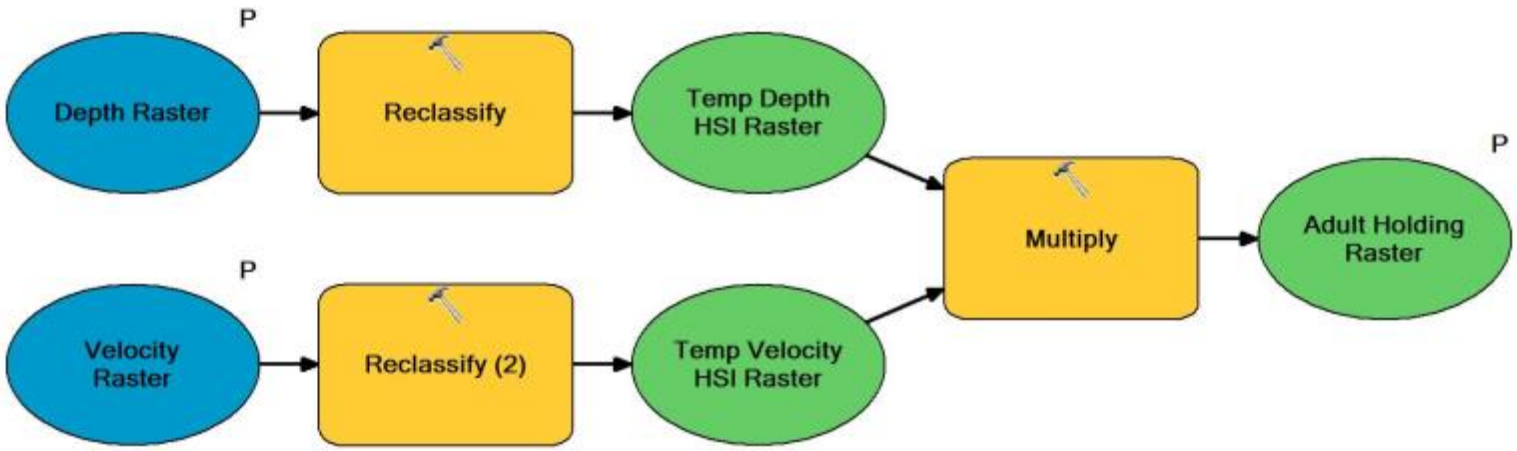


Figure 30. Model builder schematic for adult holding analysis.

Appendix B – Total Wetted Area Maps

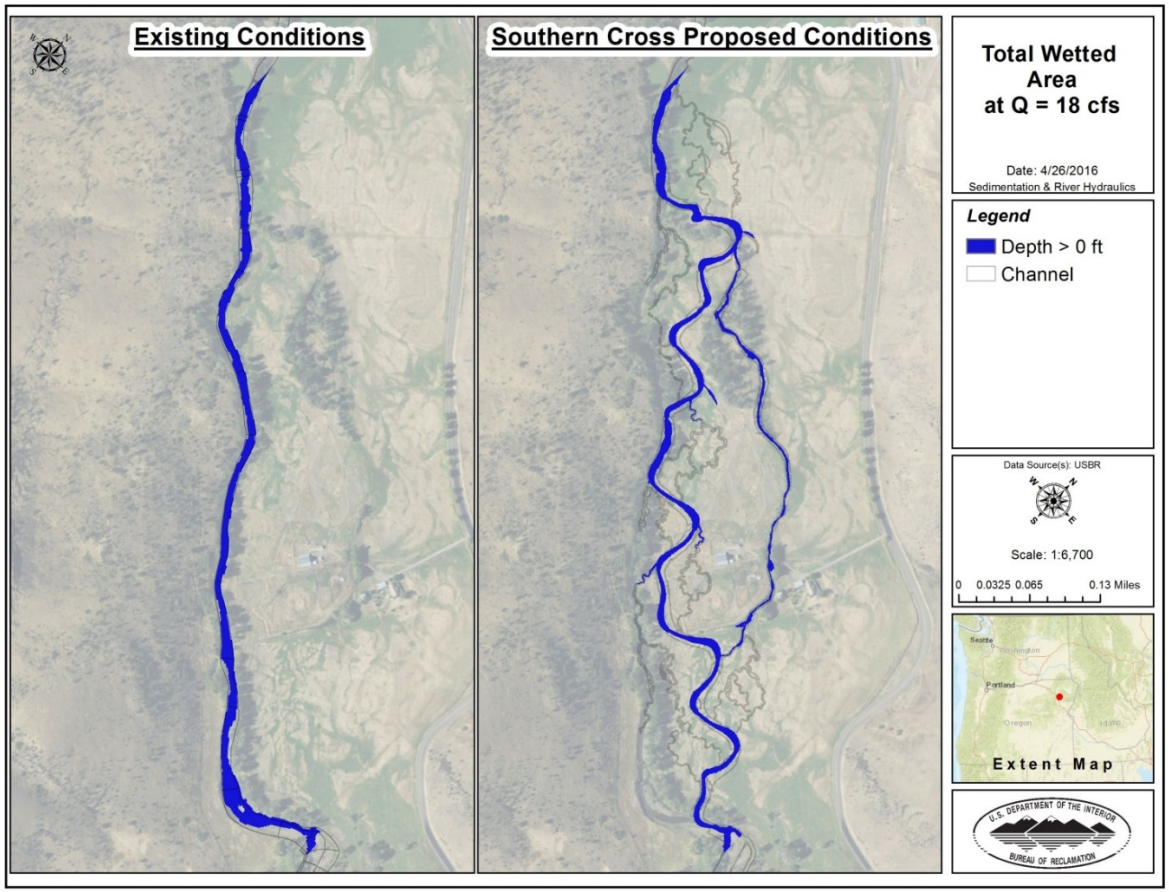


Figure 31. Total Wetted Area at Q = 18 cfs

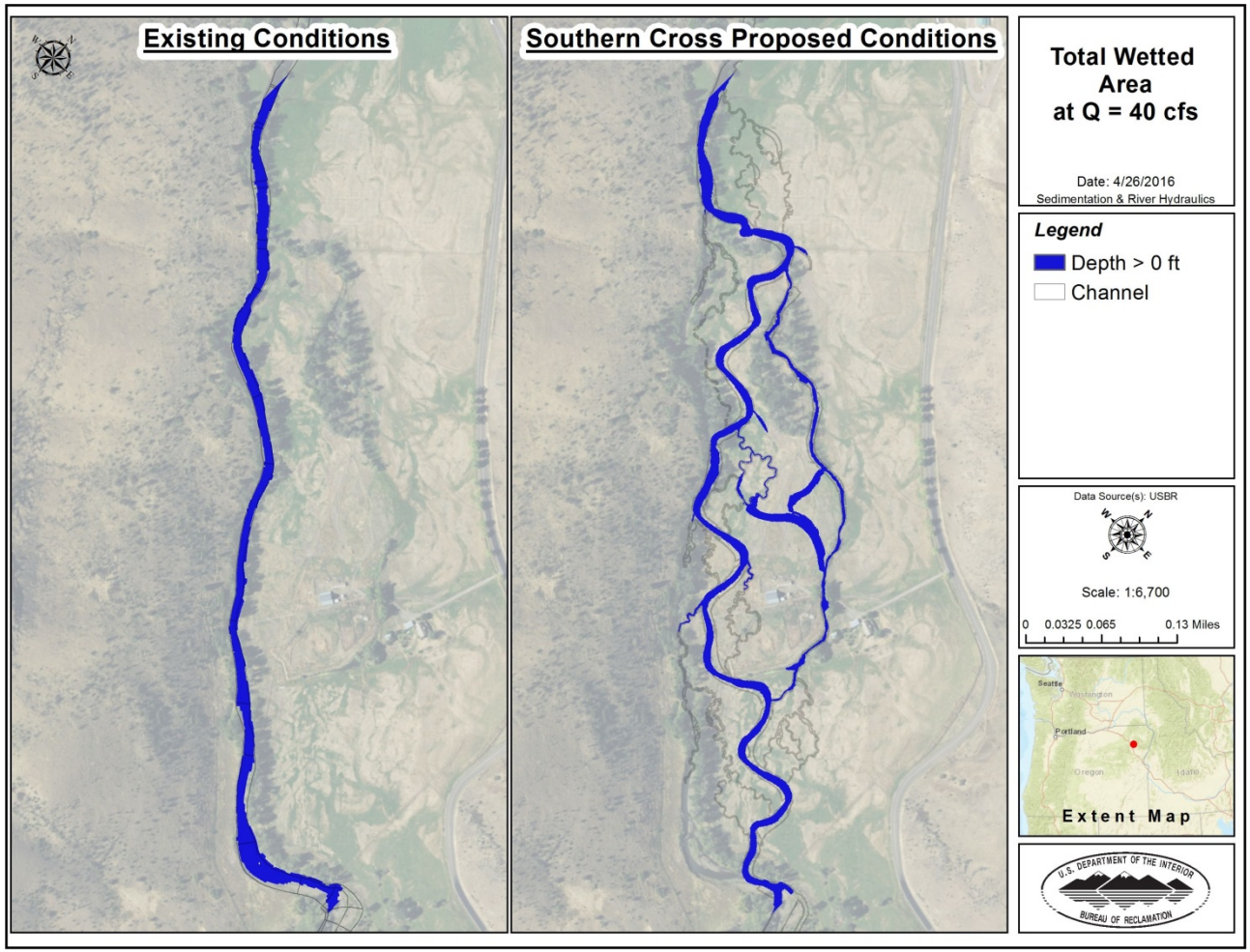


Figure 32. Total Wetted Area at Q = 40 cfs

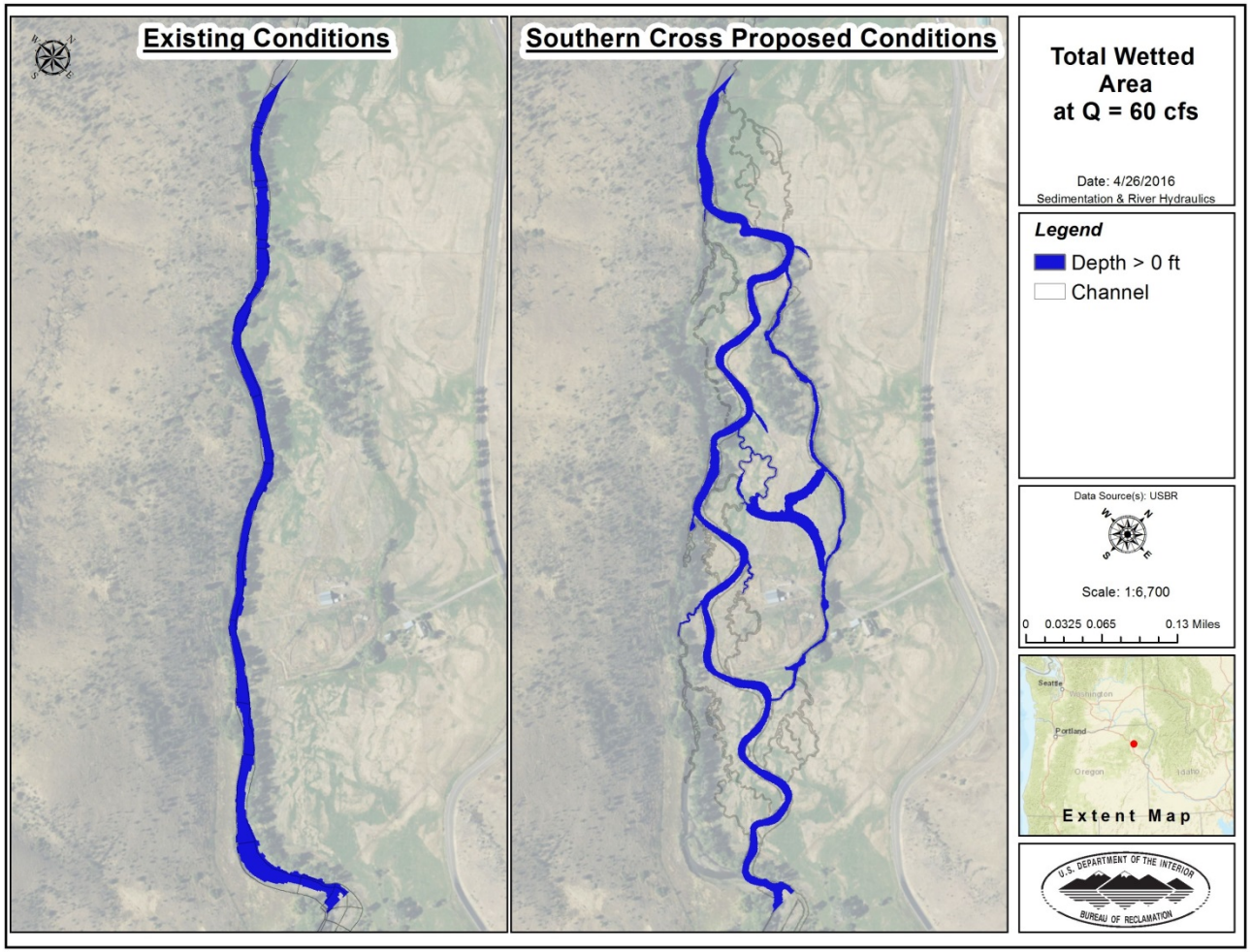


Figure 33. Total Wetted Area at Q = 60 cfs

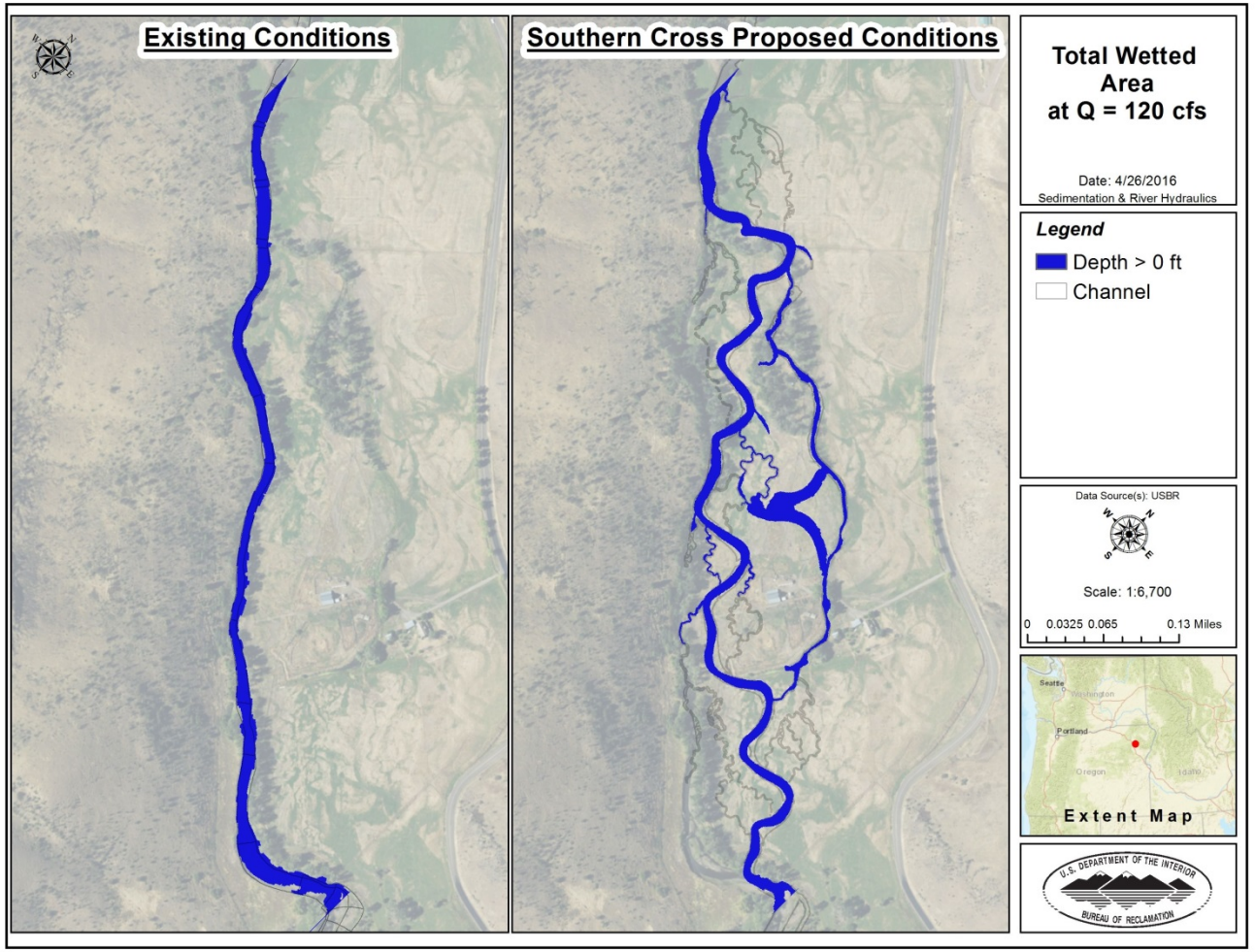


Figure 34. Total Wetted Area at Q = 120 cfs

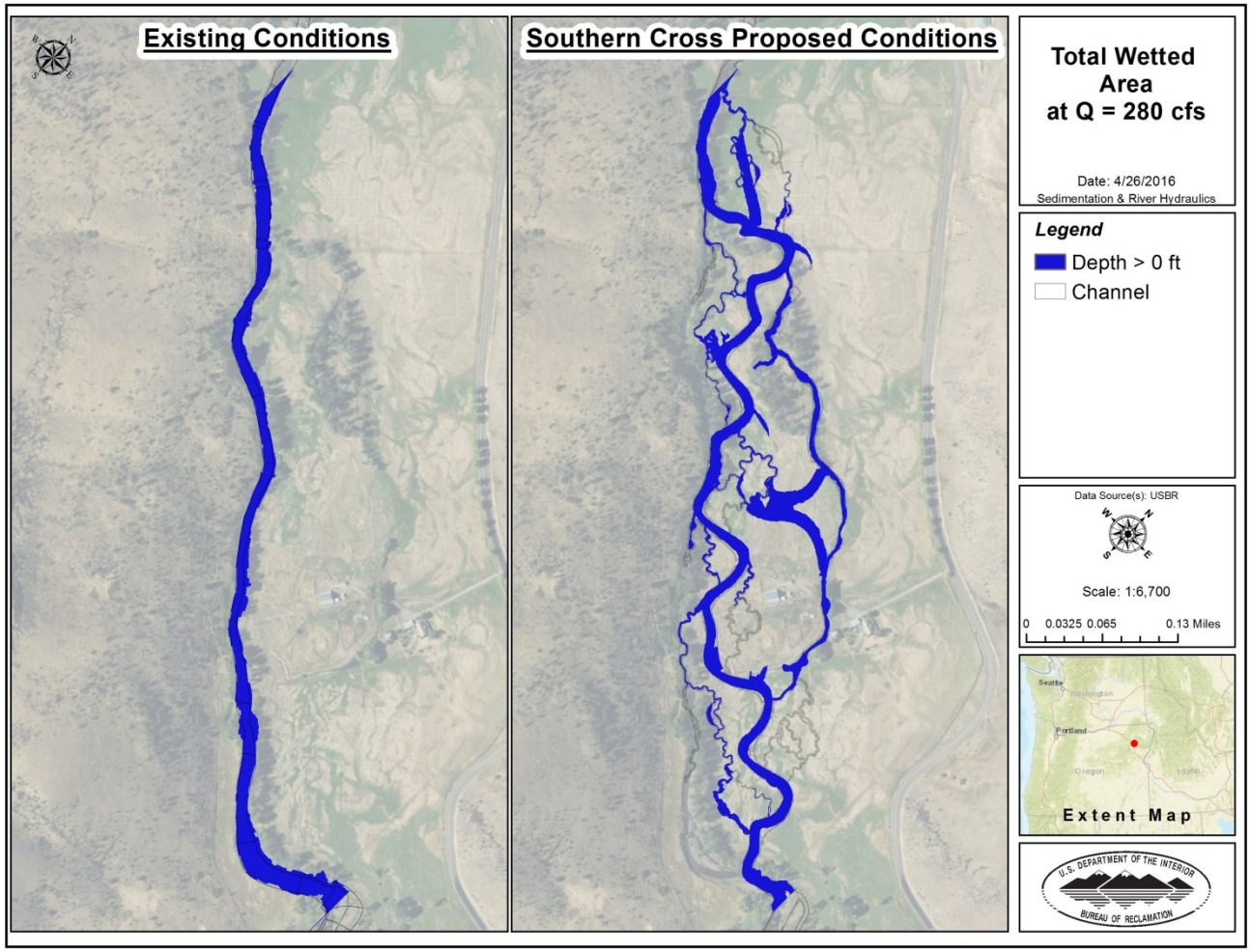


Figure 35. Total Wetted Area at Q = 280 cfs

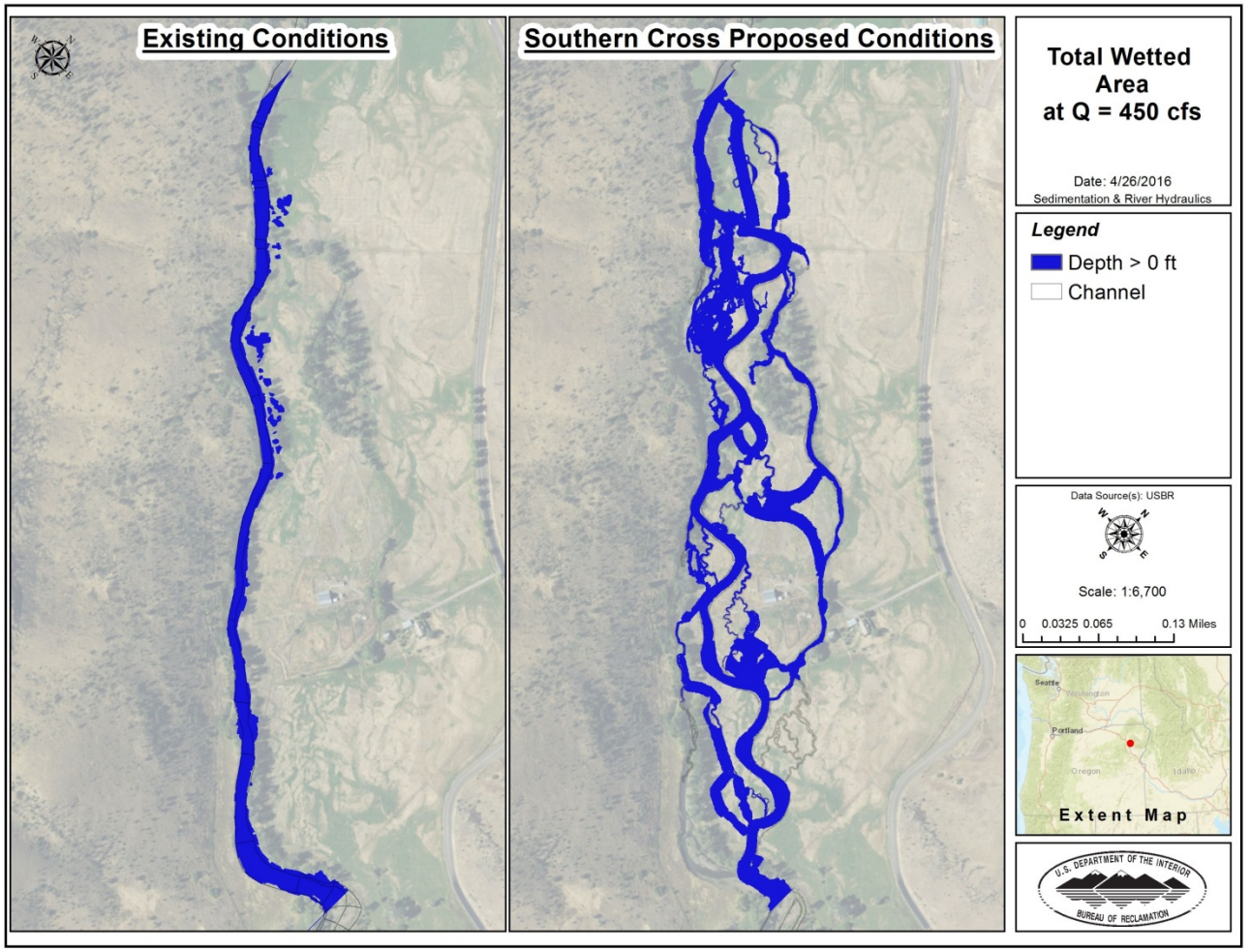


Figure 36. Total Wetted Area at Q = 450 cfs

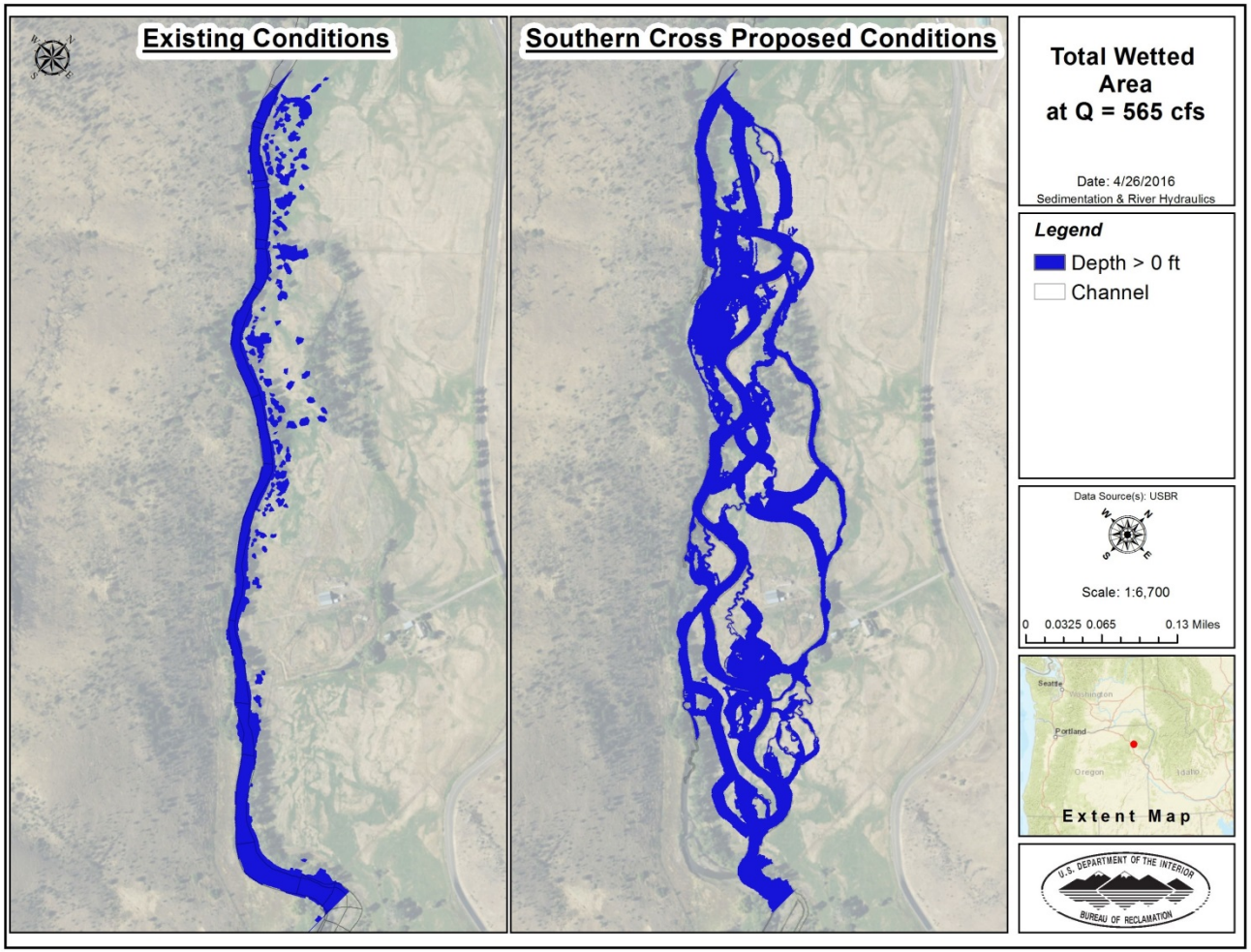
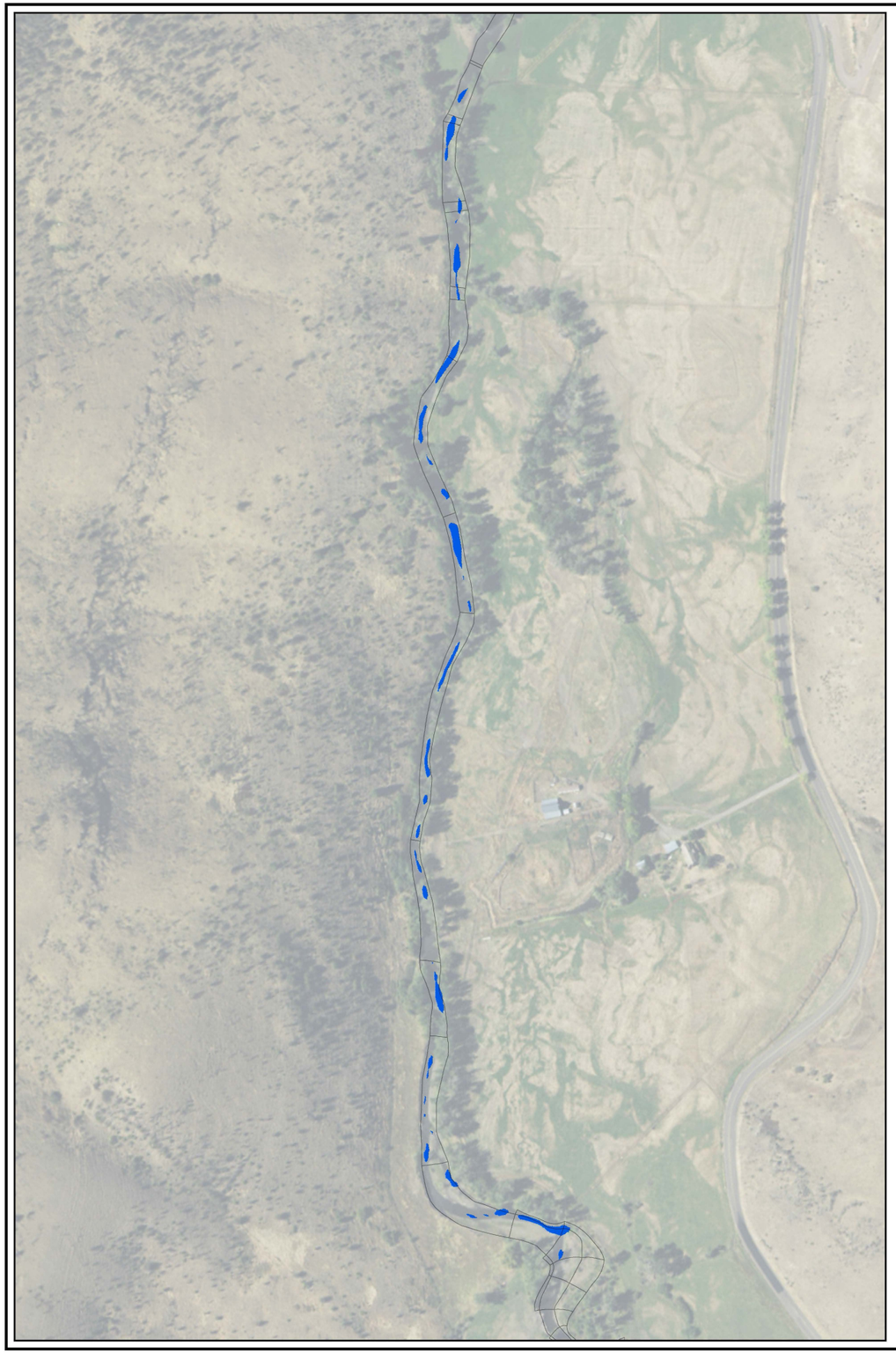
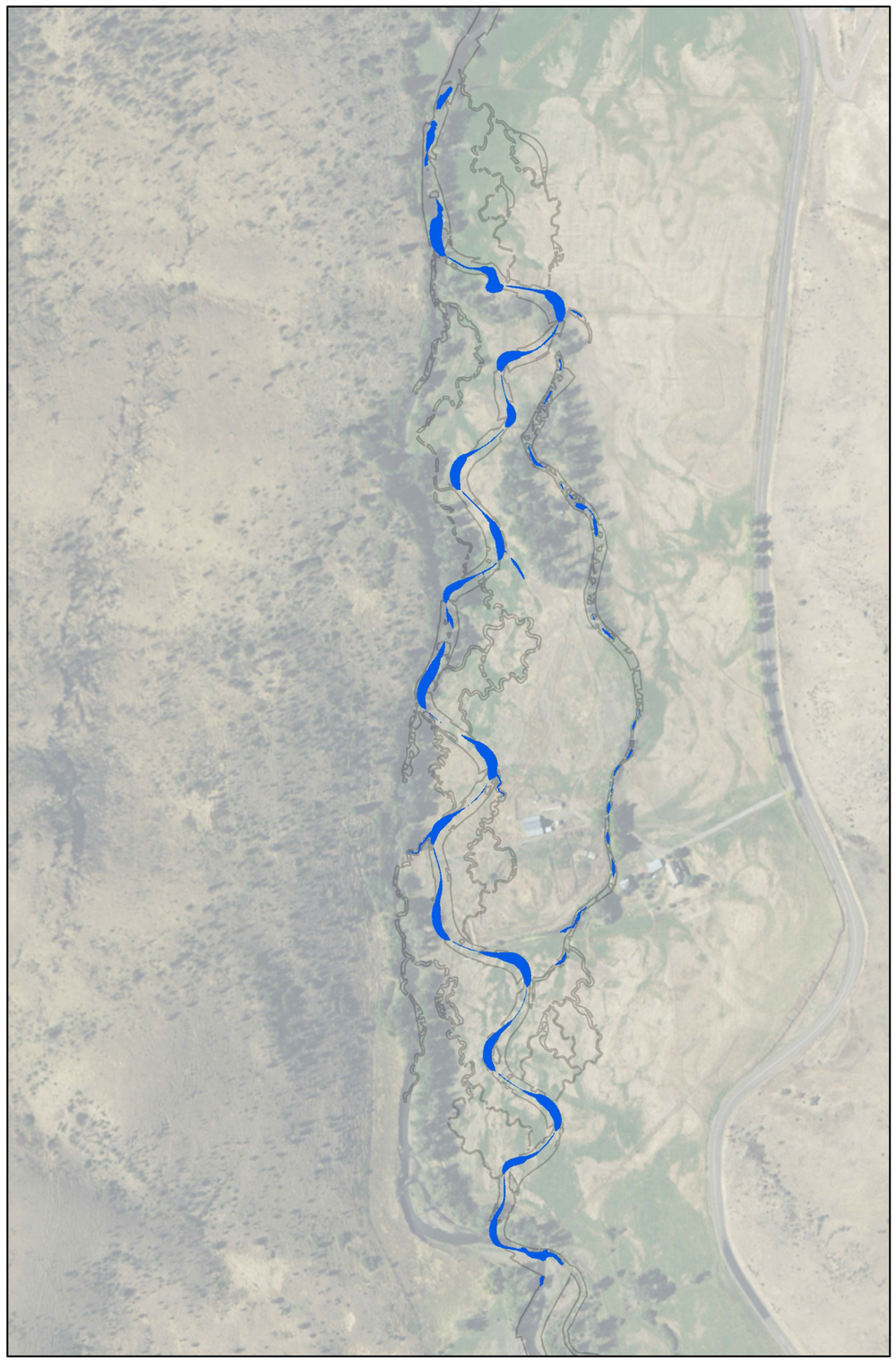


Figure 37. Total Wetted Area at Q = 565 cfs

Appendix C – Tabloid Maps





Adult Fish Passage at Q = 18 cfs

Date: 7/22/2016

Sedimentation and River Hydraulics Group

Legend

- Sufficient Depth
- Channel

Data Source(s): USBR

Scale: 1:5,000

0 0.04 0.08 0.16 Miles

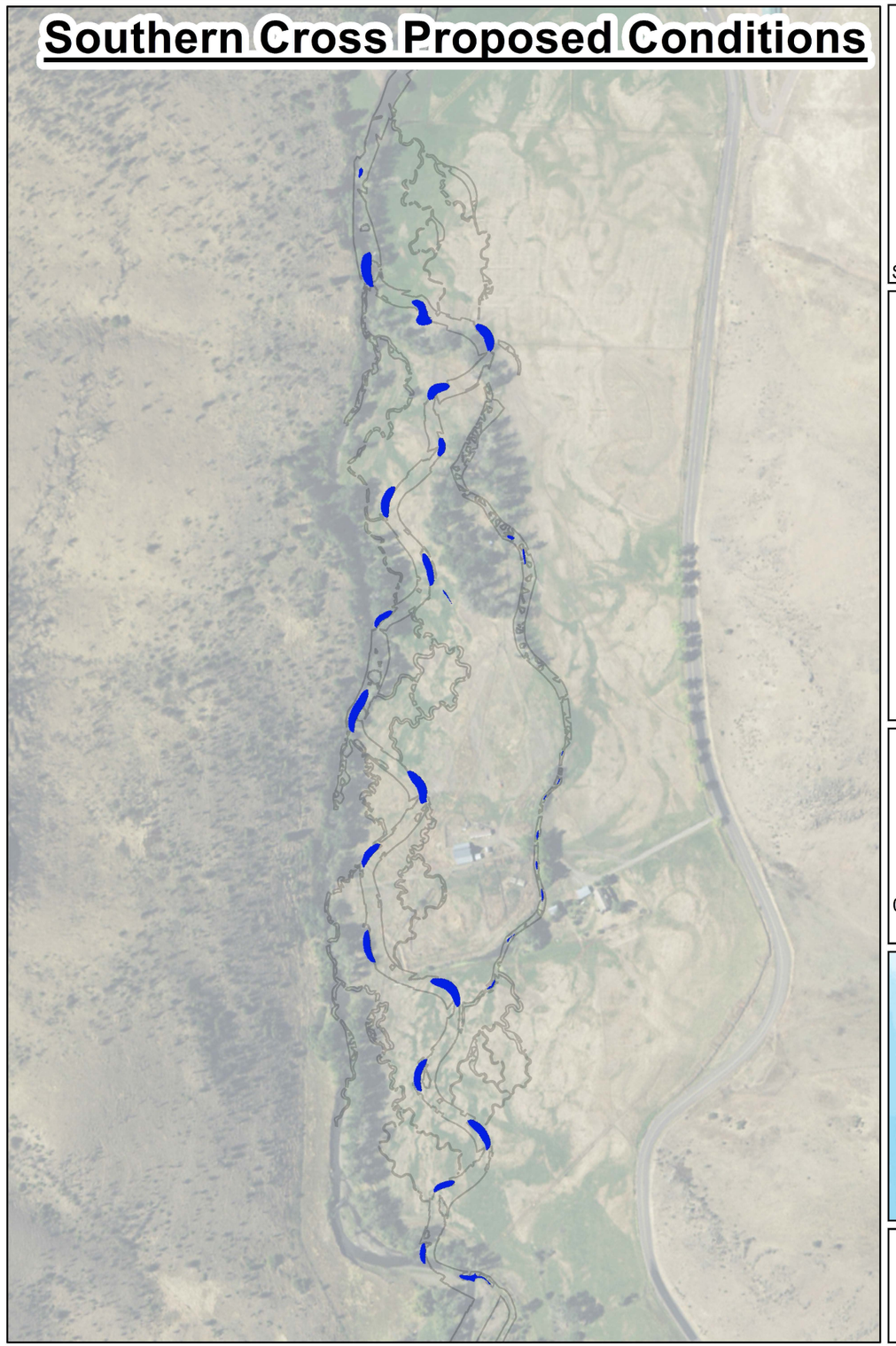


U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Existing Conditions



Southern Cross Proposed Conditions



Adult Holding Habitat at Q = 18 cfs

Date: 7/22/2016

Sedimentation and River Hydraulics Group

Legend

- Optimal Conditions
- Channel

Data Source(s): USBR

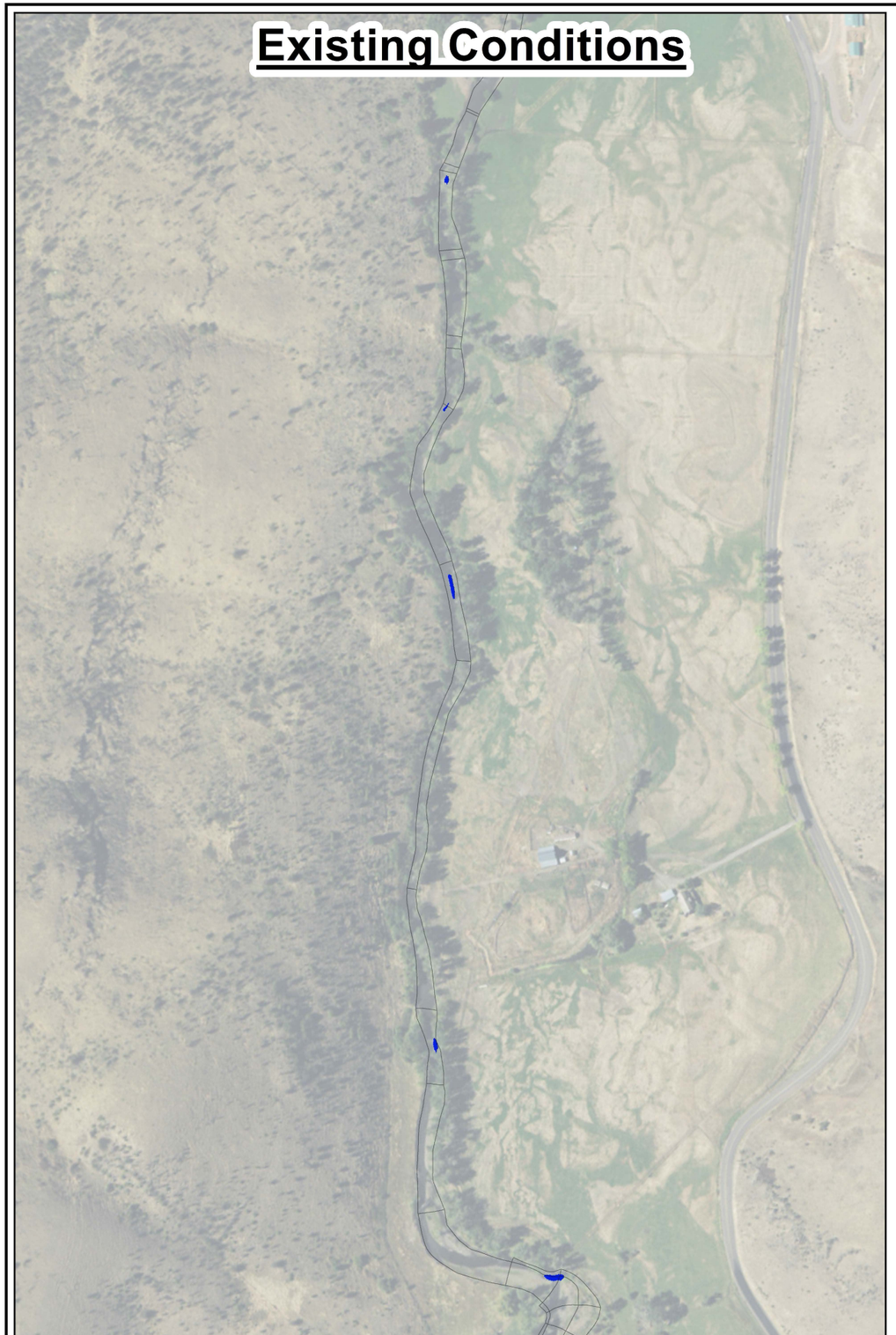
Scale: 1:5,000

0 0.04 0.08 0.16 Miles

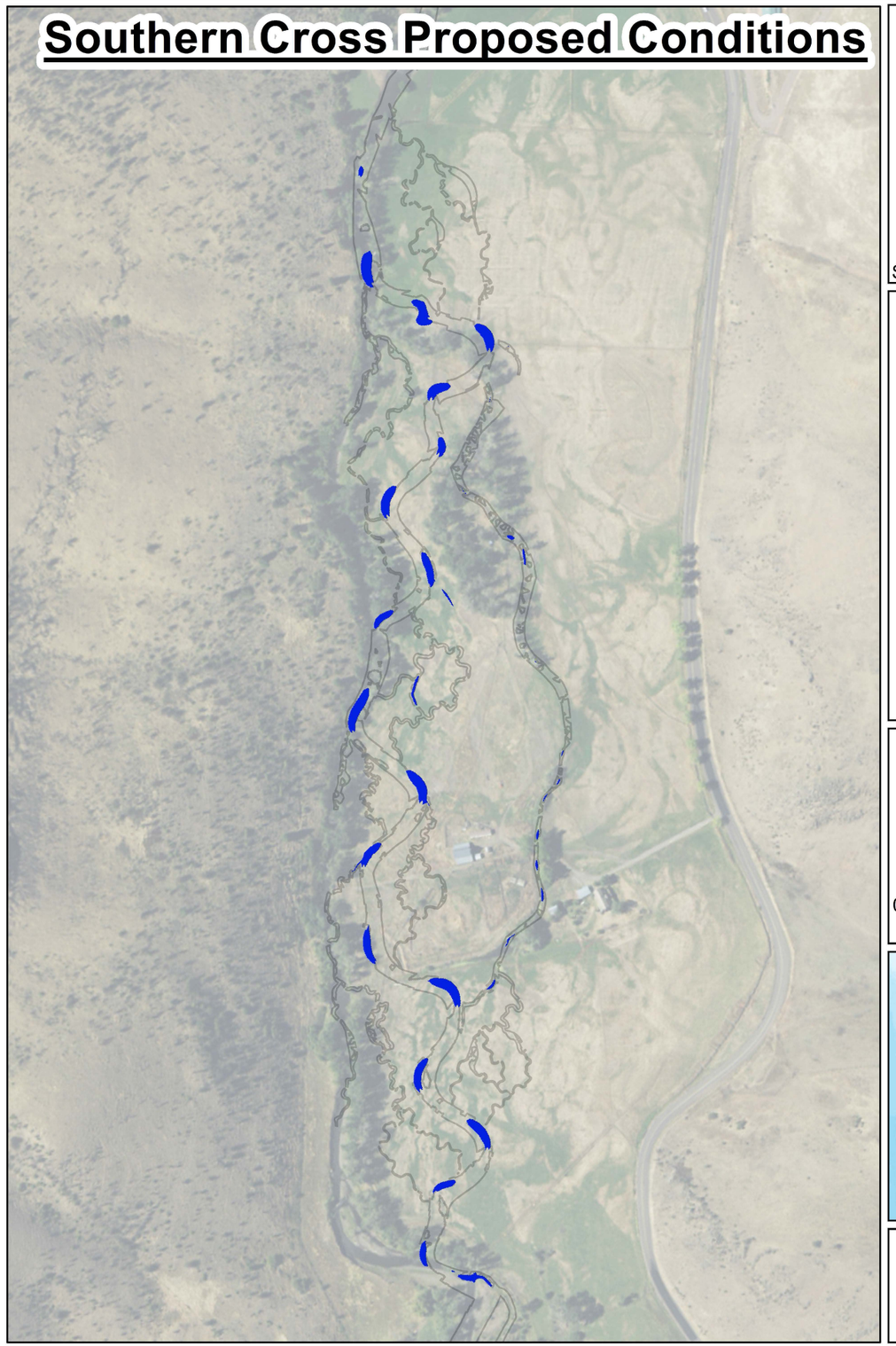


U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Existing Conditions



Southern Cross Proposed Conditions



Adult Holding Habitat at Q = 40 cfs

Date: 7/22/2016

Sedimentation and River Hydraulics Group

Legend

Optimal Conditions

Channel

Data Source(s): USBR

N

W E

S

Scale: 1:5,000

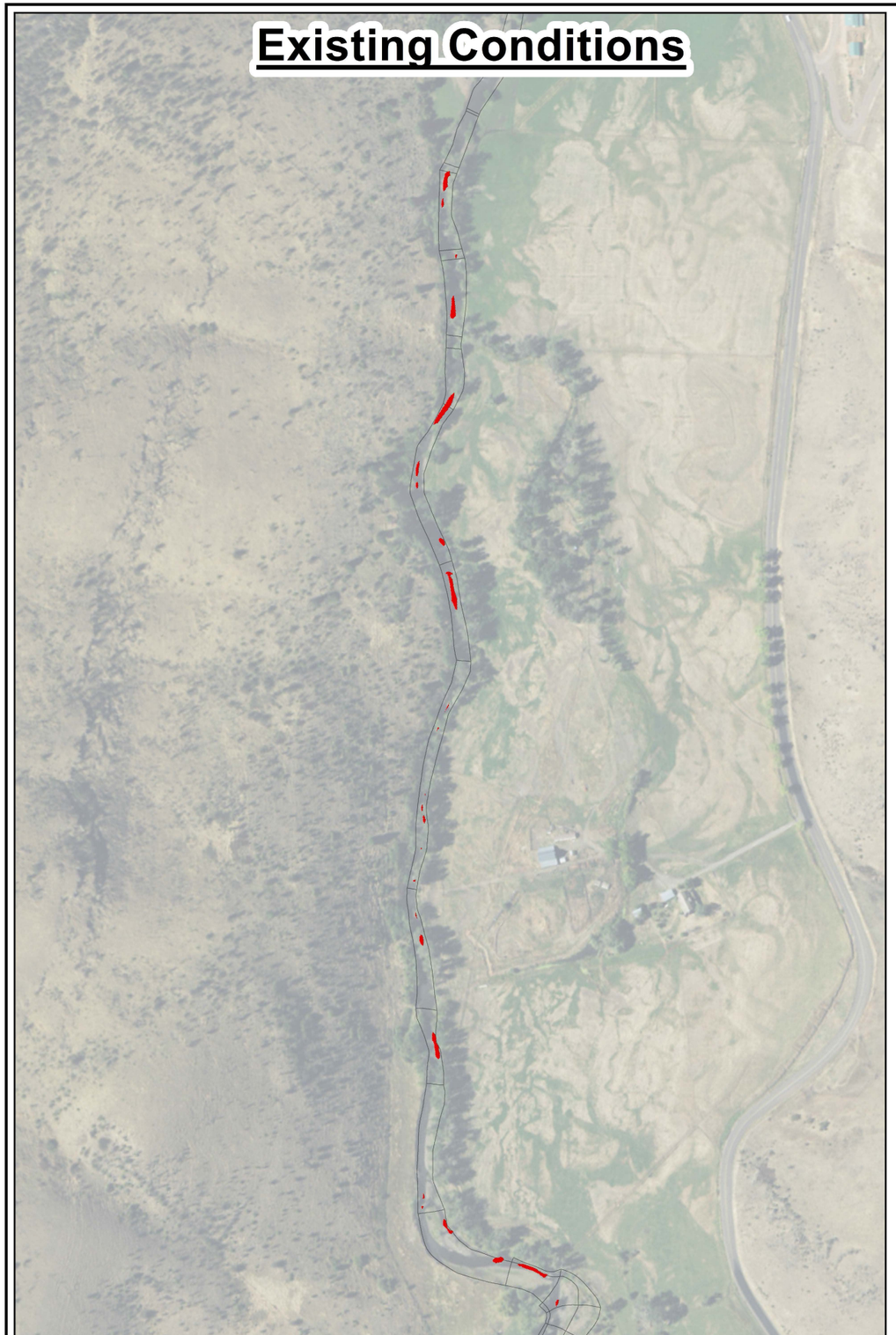
0 0.04 0.08 0.16 Miles



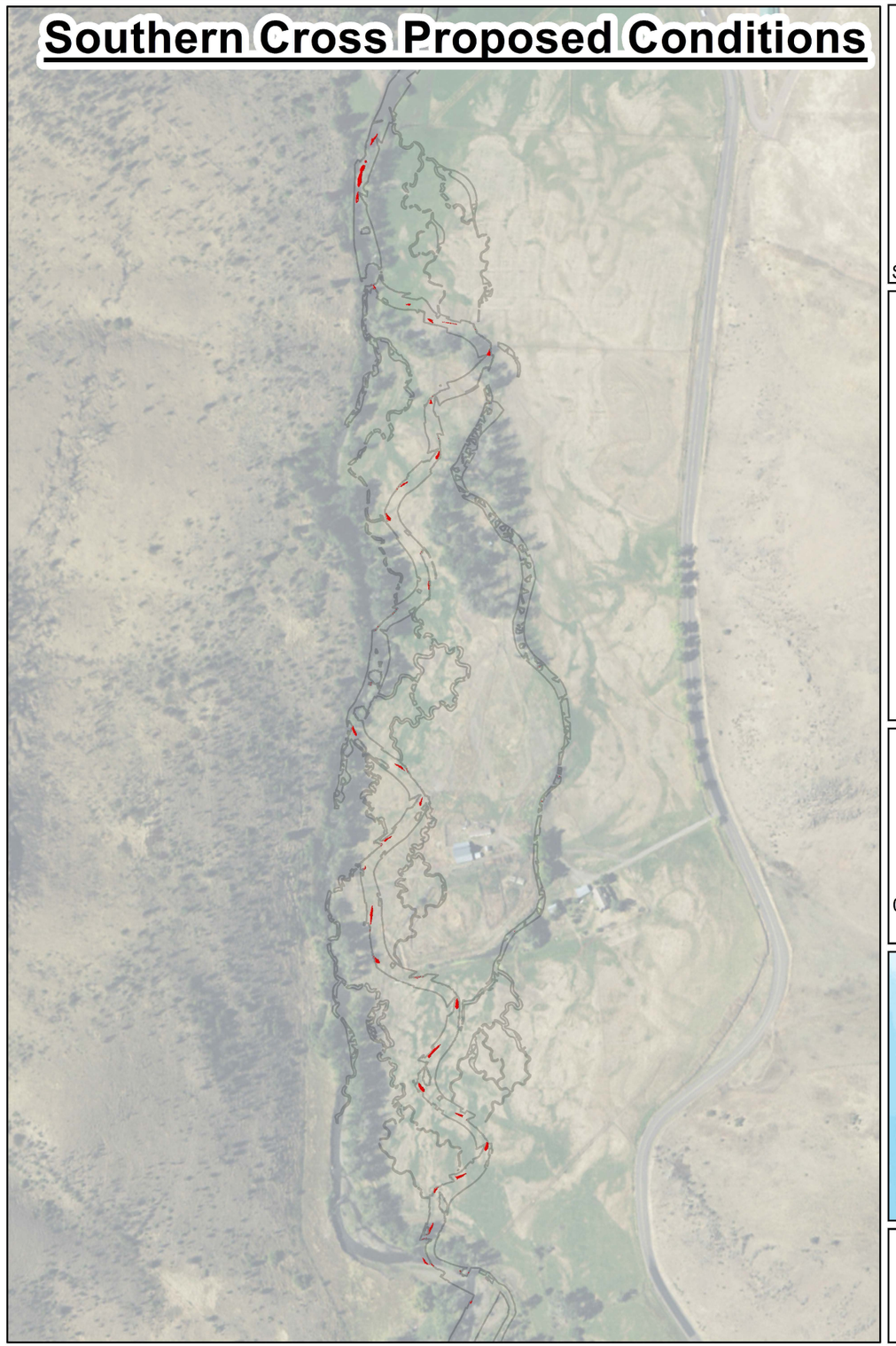
U.S. DEPARTMENT OF THE INTERIOR

BUREAU OF RECLAMATION

Existing Conditions



Southern Cross Proposed Conditions



Adult Spawning Habitat at Q = 18 cfs

Date: 7/22/2016

Sedimentation and River Hydraulics Group

Legend

Optimal Conditions

Channel

Data Source(s): USBR

Scale: 1:5,000

0 0.04 0.08 0.16 Miles

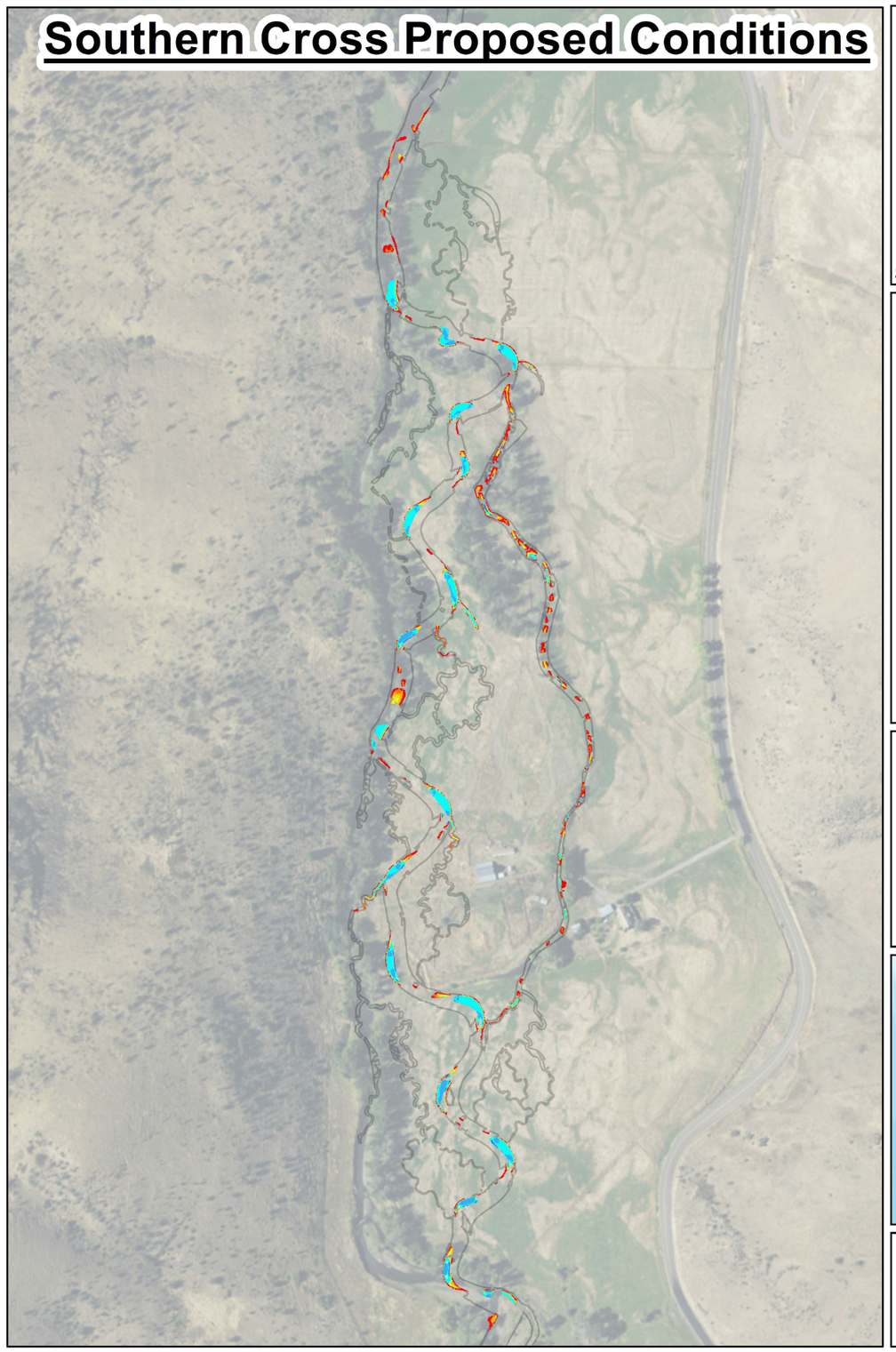


U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Existing Conditions



Southern Cross Proposed Conditions



HSI for Juvenile Chinook Summer Habitat at Q = 18 cfs

Date: 7/22/2016

Sedimentation and River Hydraulics Group

HSI

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.6
- 0.6 - 0.7
- 0.7 - 0.8
- 0.8 - 0.9
- 0.9 - 1.0
- Channel

Data Source(s): USBR

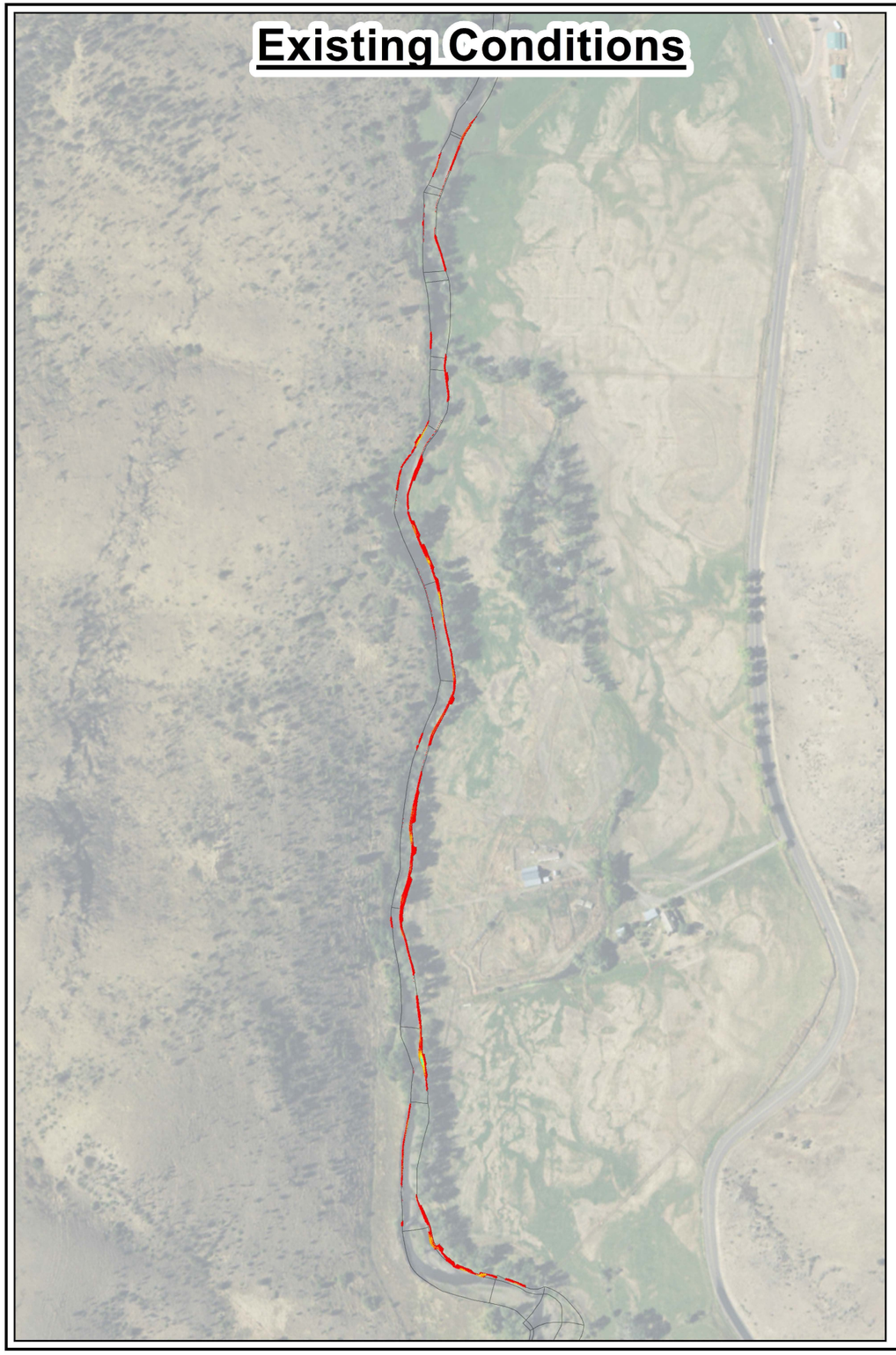
Scale: 1:5,023

0 0.04 0.08 0.16 Miles

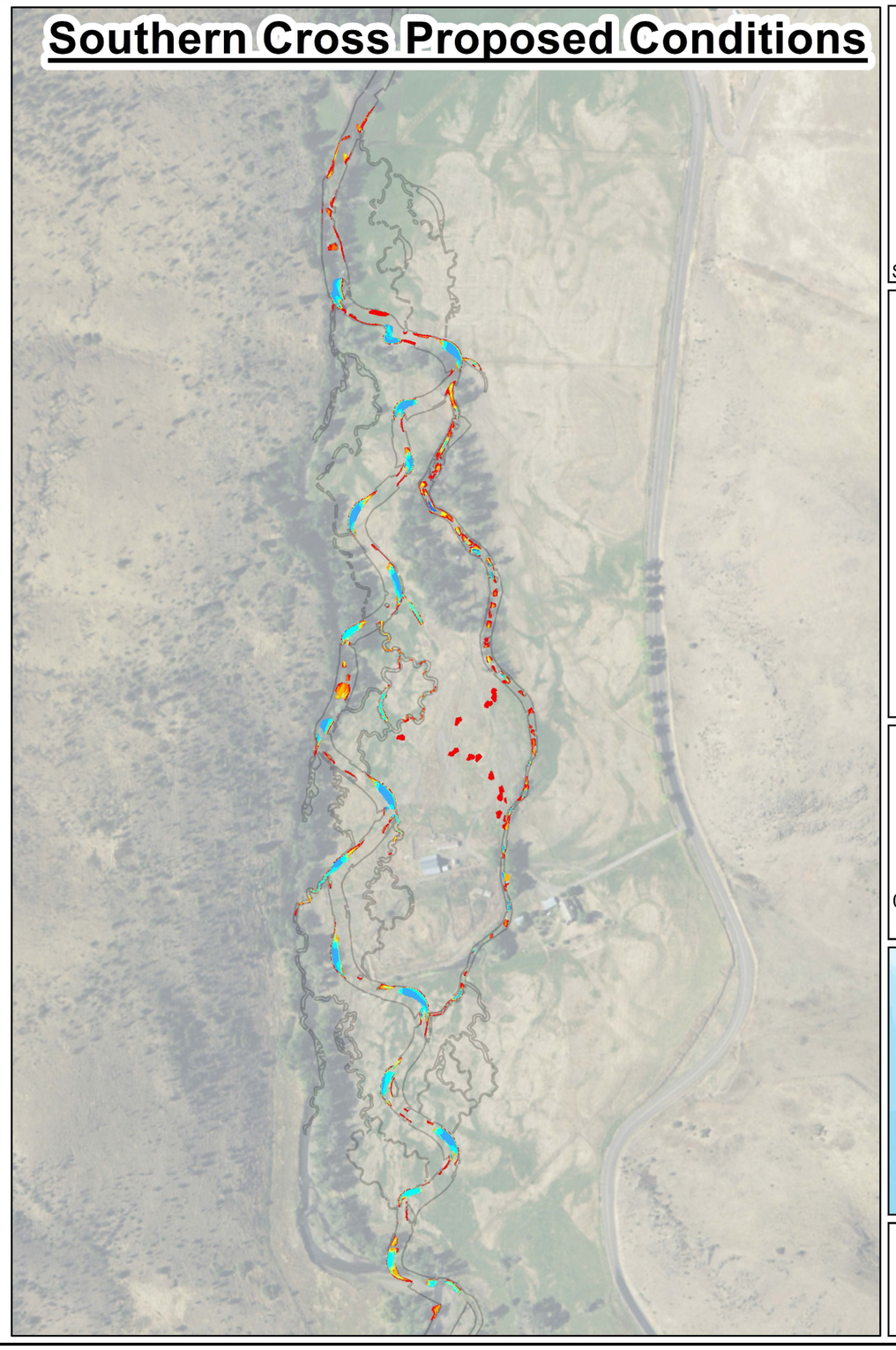


U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Existing Conditions



Southern Cross Proposed Conditions



HSI for Juvenile Chinook Summer Habitat at Q = 40 cfs

Date: 7/22/2016

Sedimentation and River Hydraulics Group

HSI

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.6
- 0.6 - 0.7
- 0.7 - 0.8
- 0.8 - 0.9
- 0.9 - 1.0
- Channel

Data Source(s): USBR

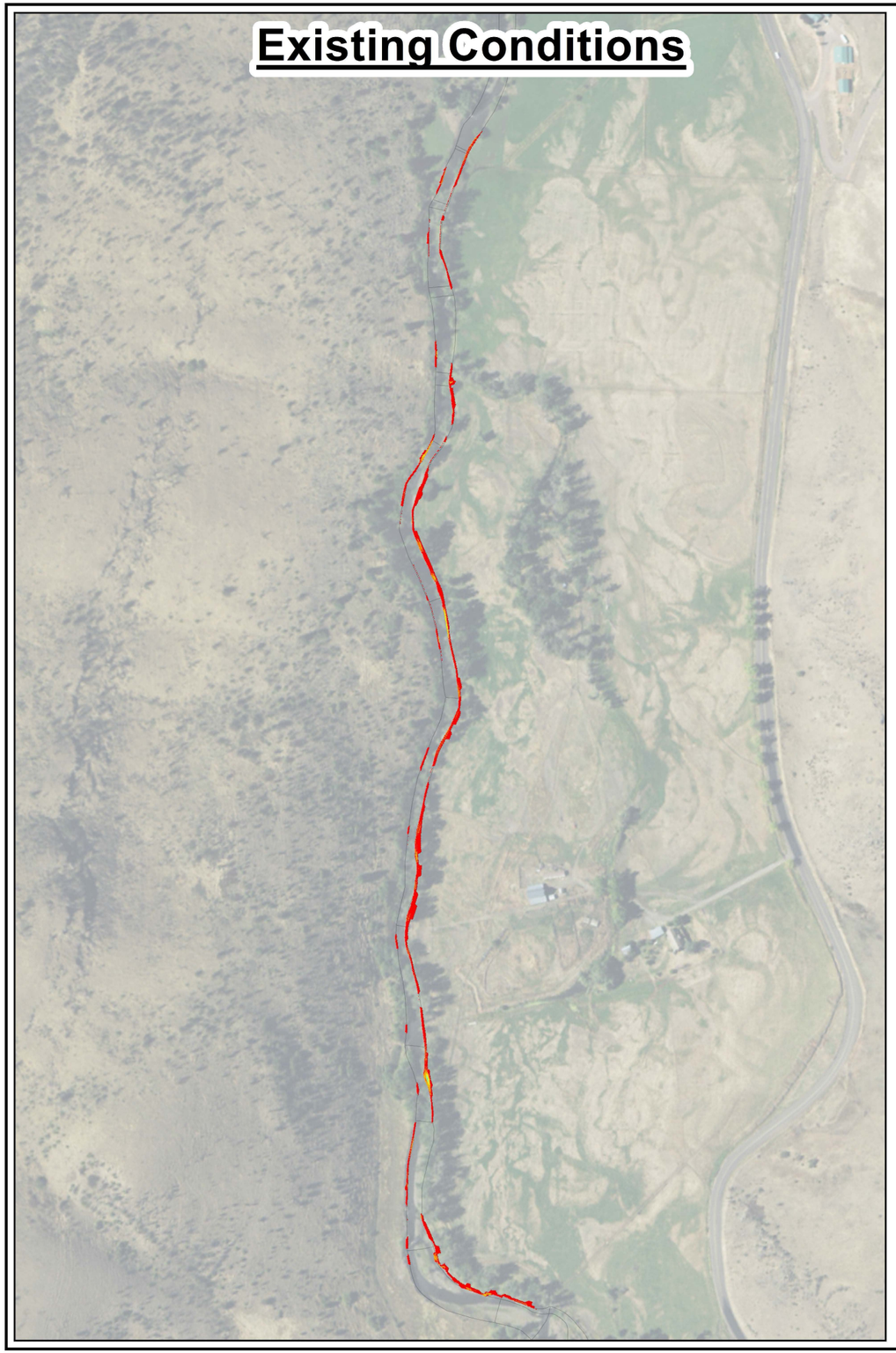
Scale: 1:5,023

0 0.04 0.08 0.16 Miles

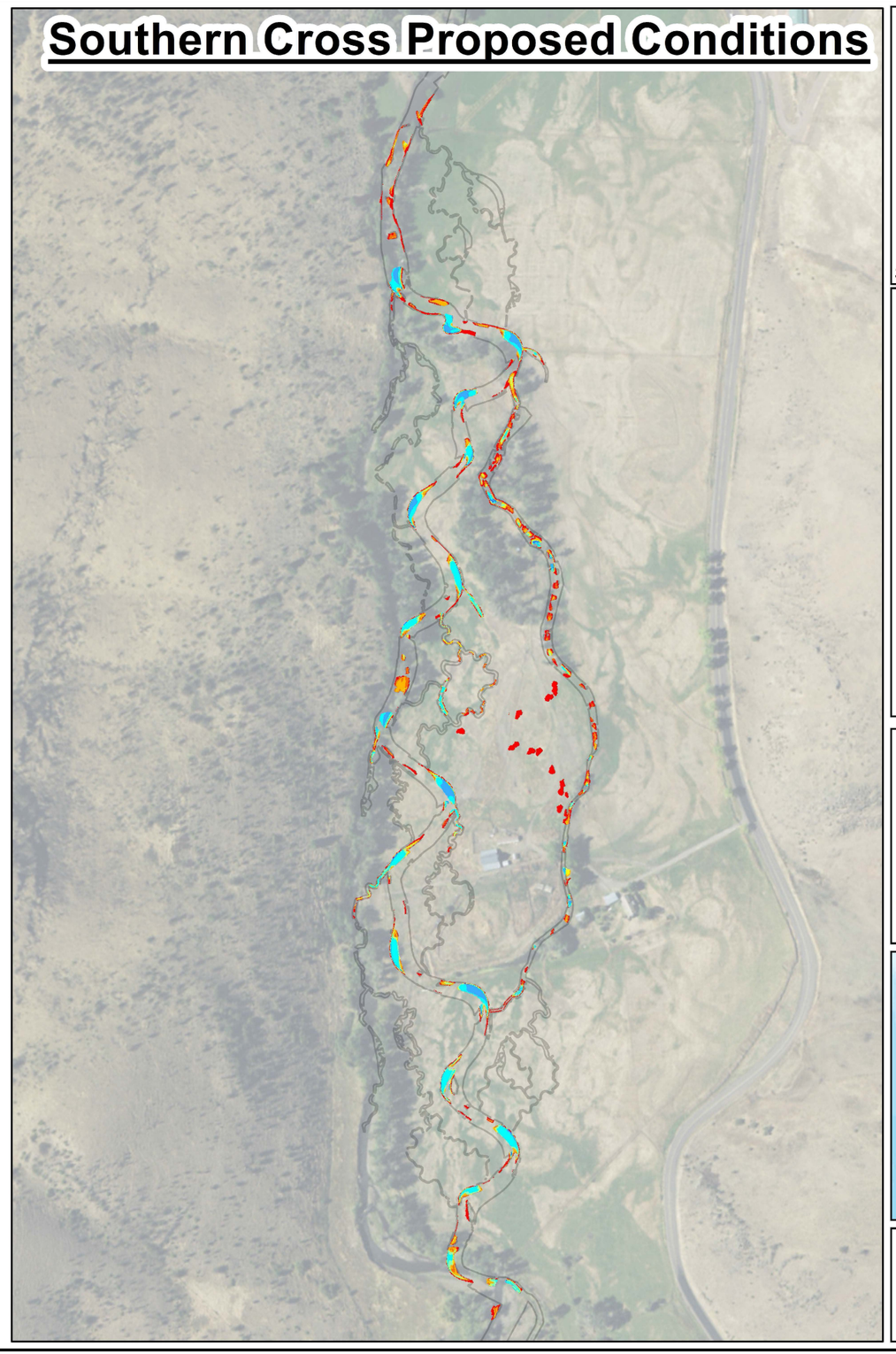


U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Existing Conditions



Southern Cross Proposed Conditions



HSI for Juvenile Chinook Summer Habitat at Q = 60 cfs

Date: 7/22/2016

Sedimentation and River Hydraulics Group

HSI

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.6
- 0.6 - 0.7
- 0.7 - 0.8
- 0.8 - 0.9
- 0.9 - 1.0
- Channel

Data Source(s): USBR

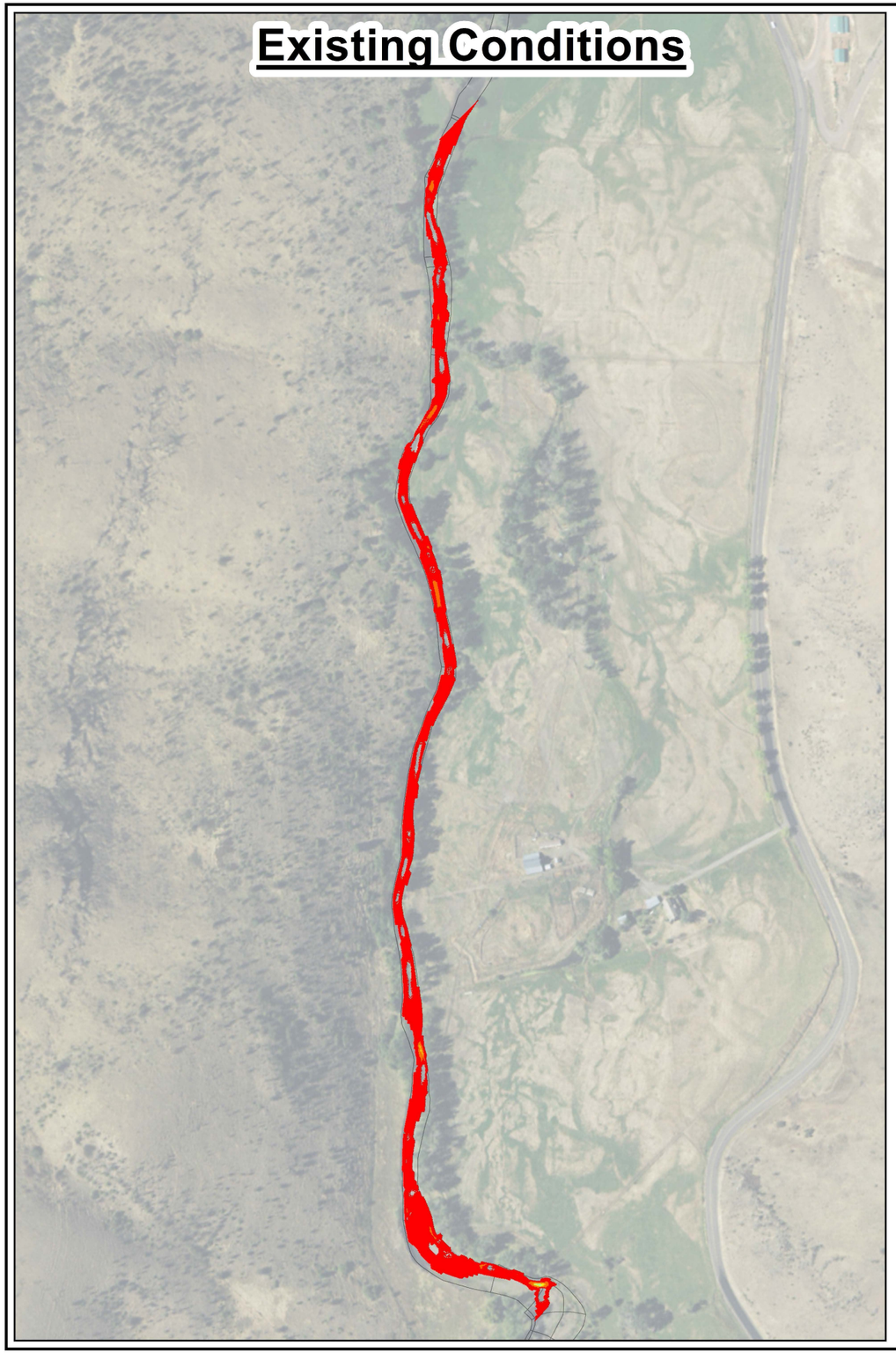
Scale: 1:5,000

0 0.04 0.08 0.16 Miles

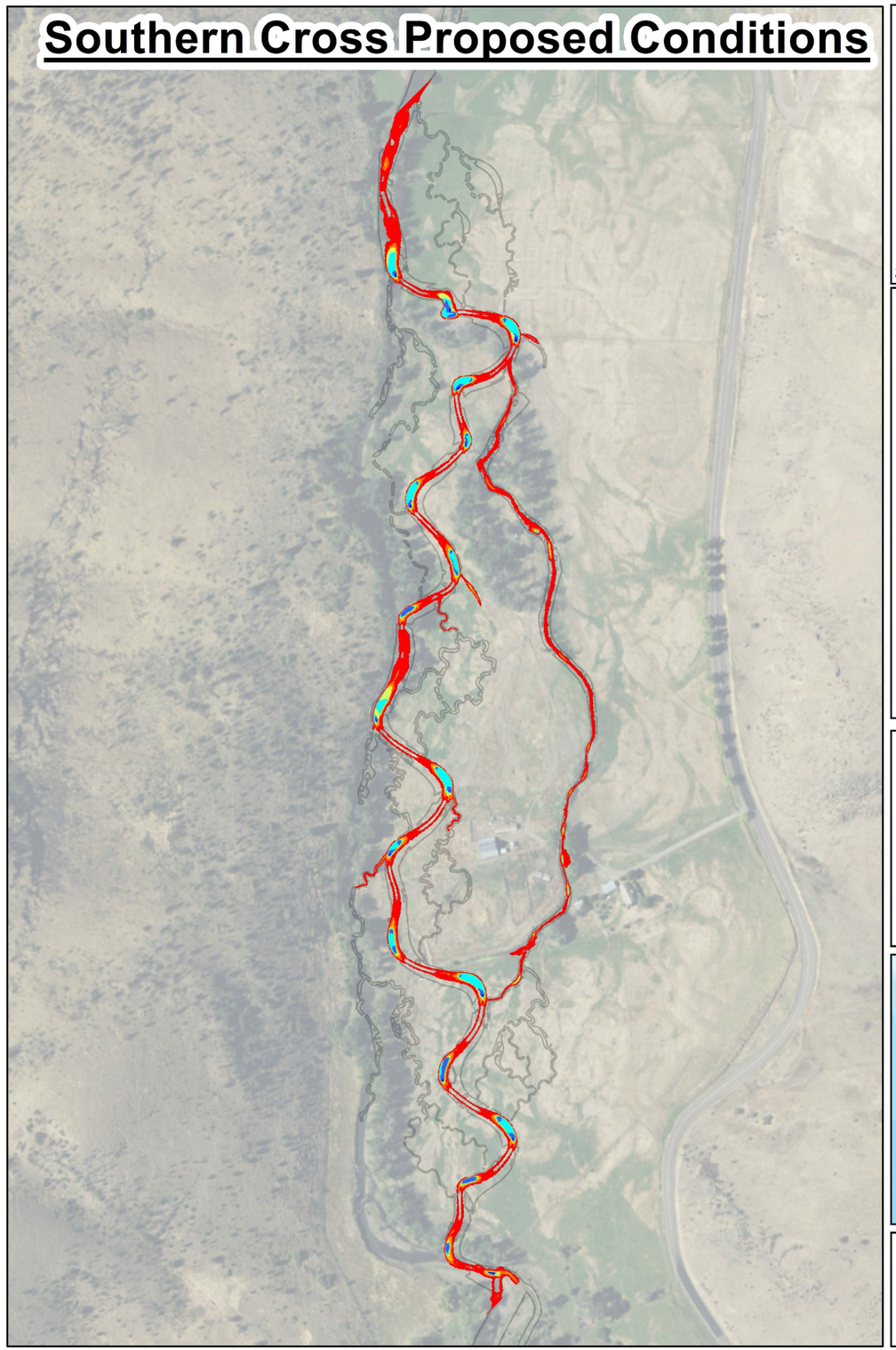


U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Existing Conditions



Southern Cross Proposed Conditions



HSI for Juvenile Winter Habitat at Q = 18 cfs

Date: 7/22/2016

Sedimentation and River Hydraulics Group

- Channel

HSI

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.6
- 0.6 - 0.7
- 0.7 - 0.8
- 0.8 - 0.9
- 0.9 - 1

Data Source(s): USBR

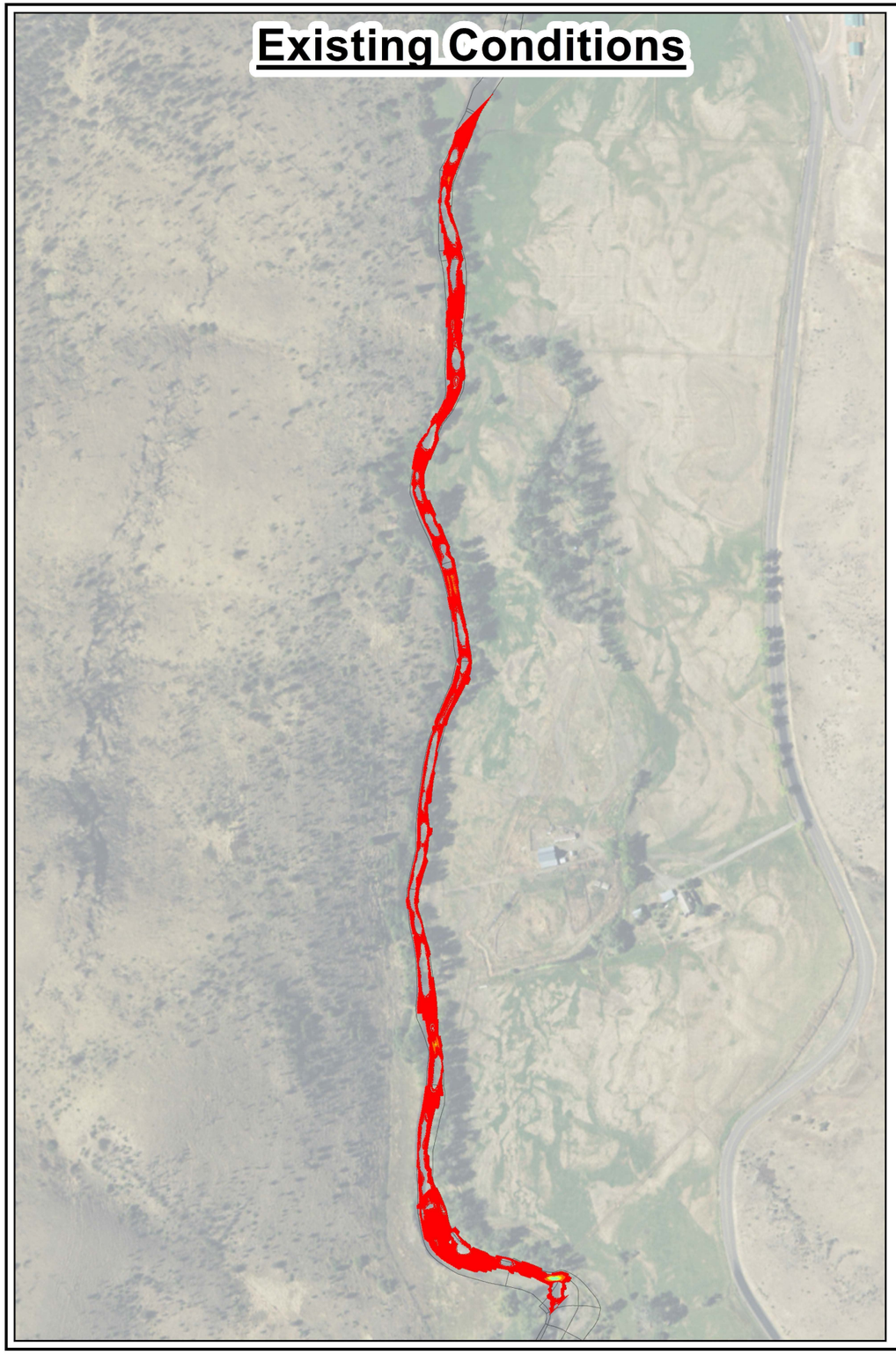
Scale: 1:5,000

0 0.04 0.08 0.16 Miles

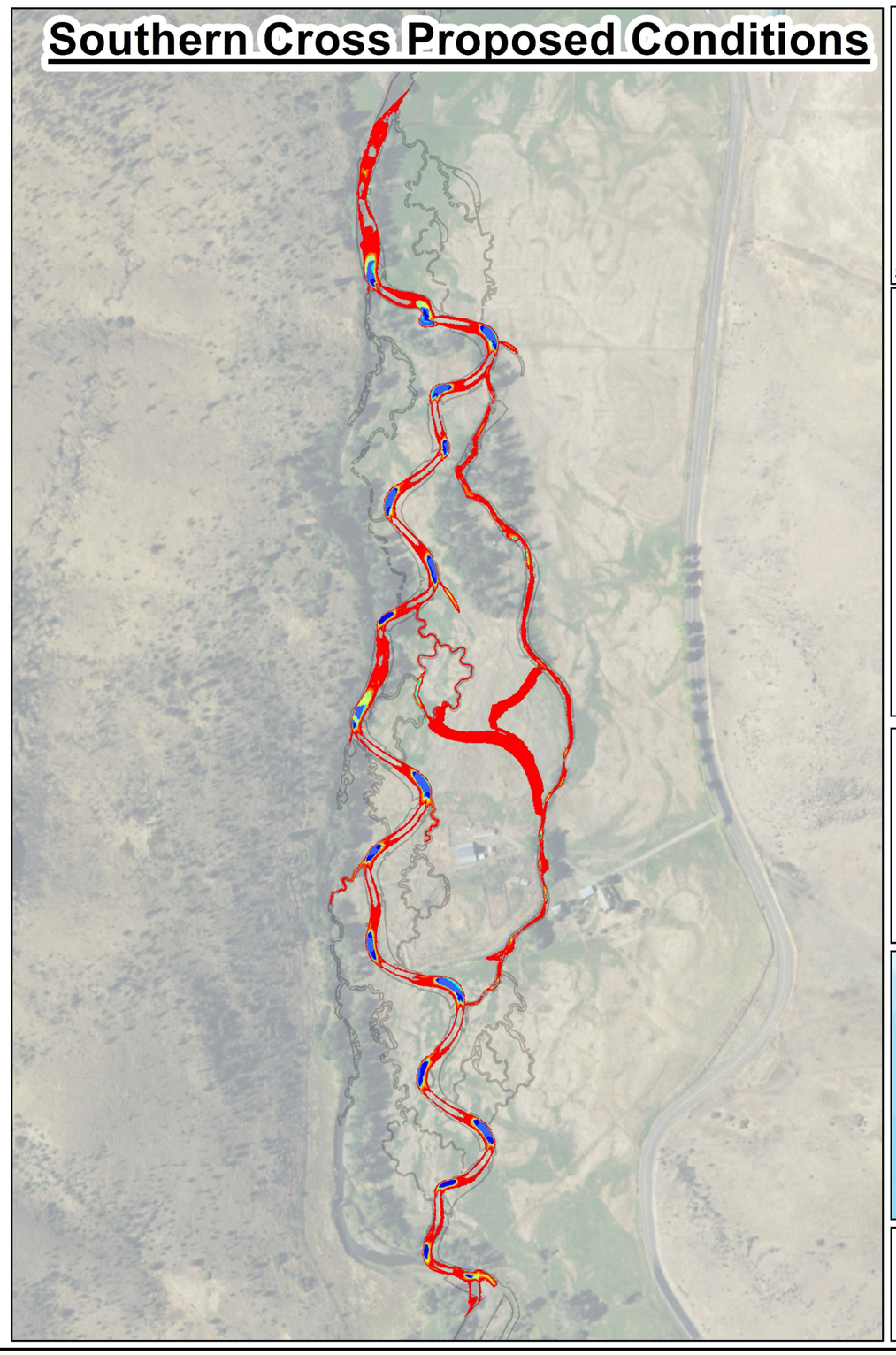


U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Existing Conditions



Southern Cross Proposed Conditions



HSI for Juvenile Winter Habitat at Q = 40 cfs

Date: 7/22/2016

Sedimentation and River Hydraulics Group

- Channel

HSI

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.6
- 0.6 - 0.7
- 0.7 - 0.8
- 0.8 - 0.9
- 0.9 - 1

Data Source(s): USBR

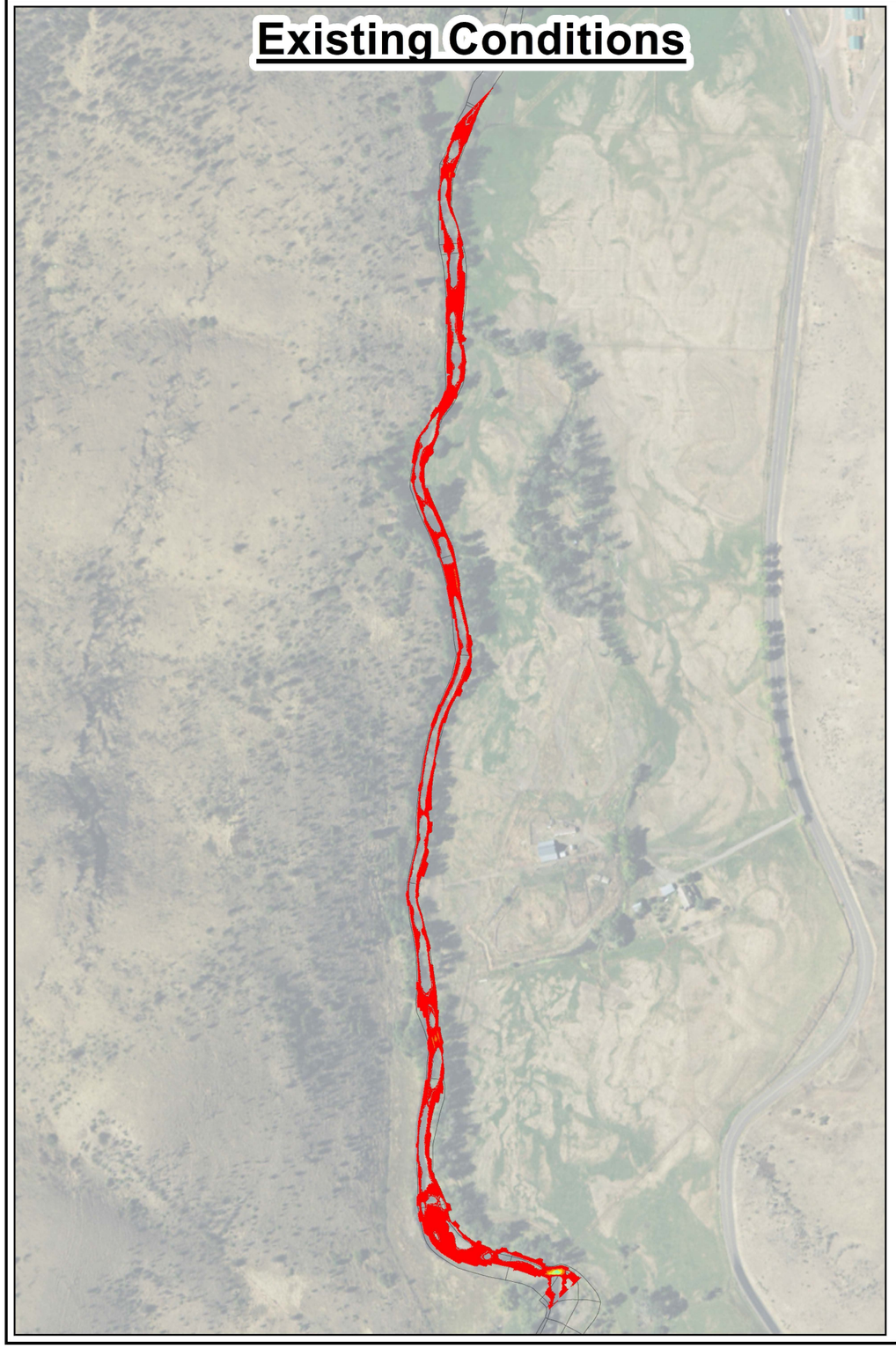
Scale: 1:5,000

0 0.04 0.08 0.16 Miles

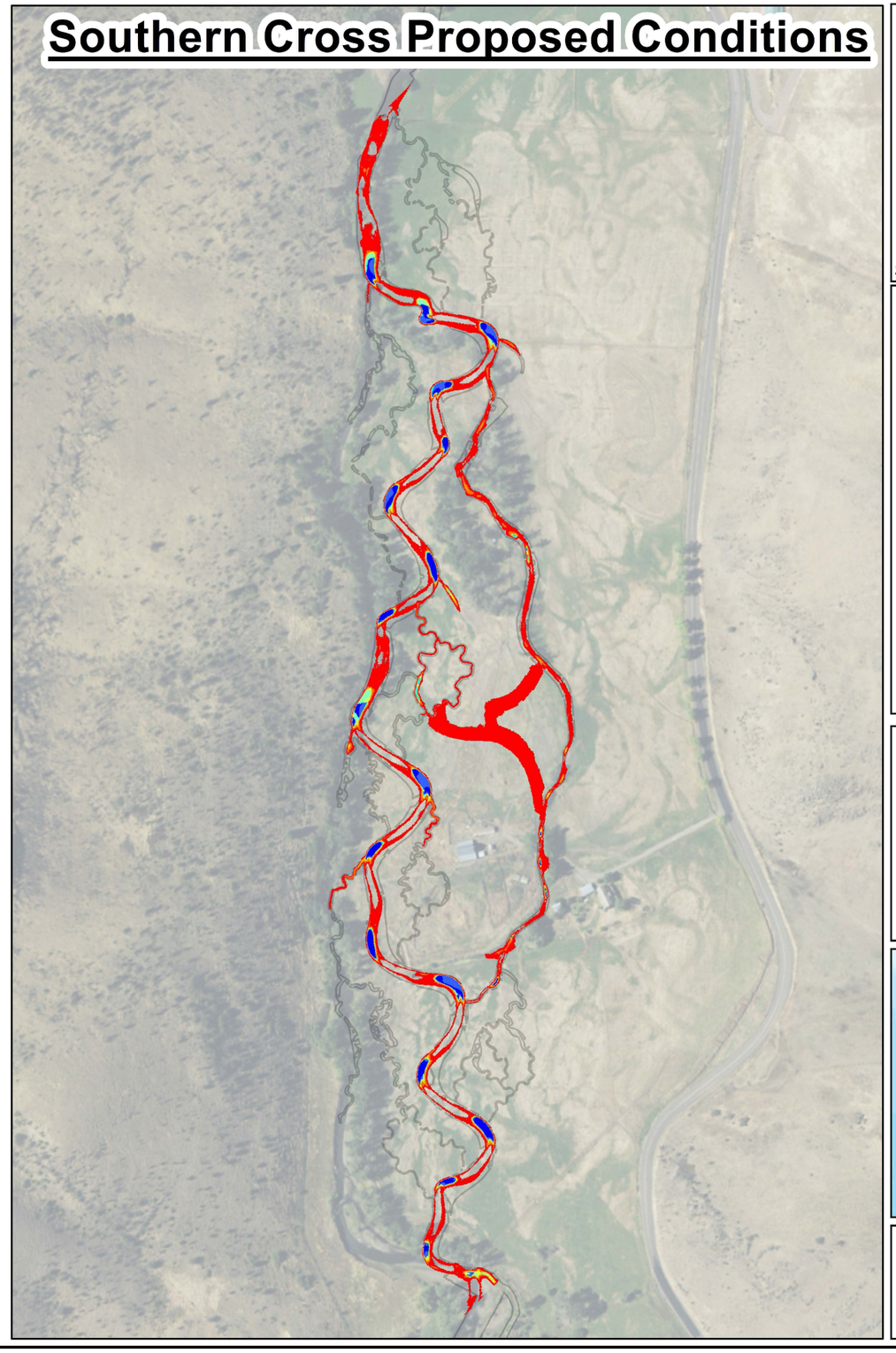


U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Existing Conditions



Southern Cross Proposed Conditions



HSI for Juvenile Winter Habitat at Q = 60 cfs

Date: 7/22/2016

Sedimentation and River Hydraulics Group

- Channel

HSI

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.6
- 0.6 - 0.7
- 0.7 - 0.8
- 0.8 - 0.9
- 0.9 - 1.0

Data Source(s): USBR

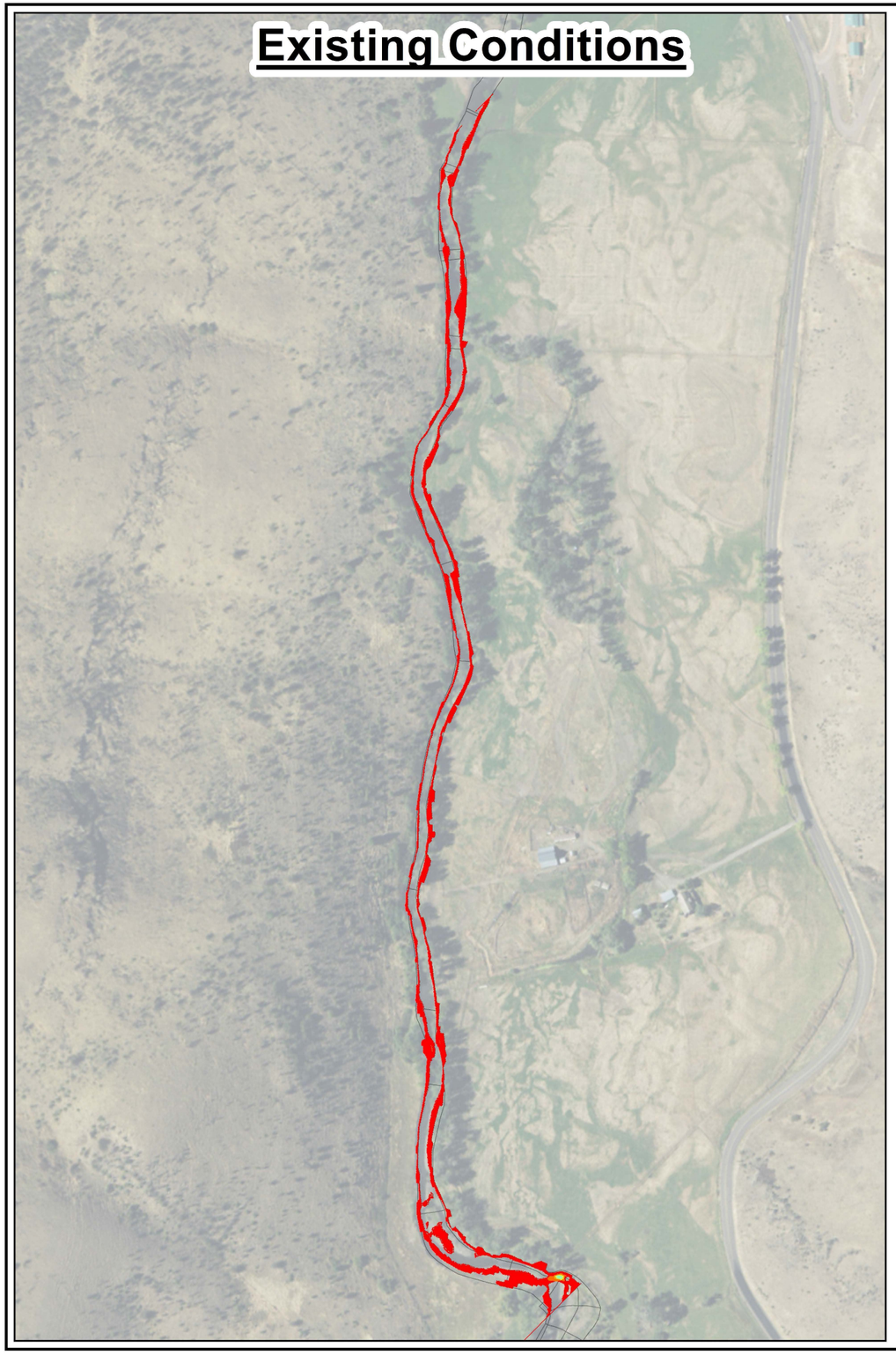
Scale: 1:5,000

0 0.04 0.08 0.16 Miles

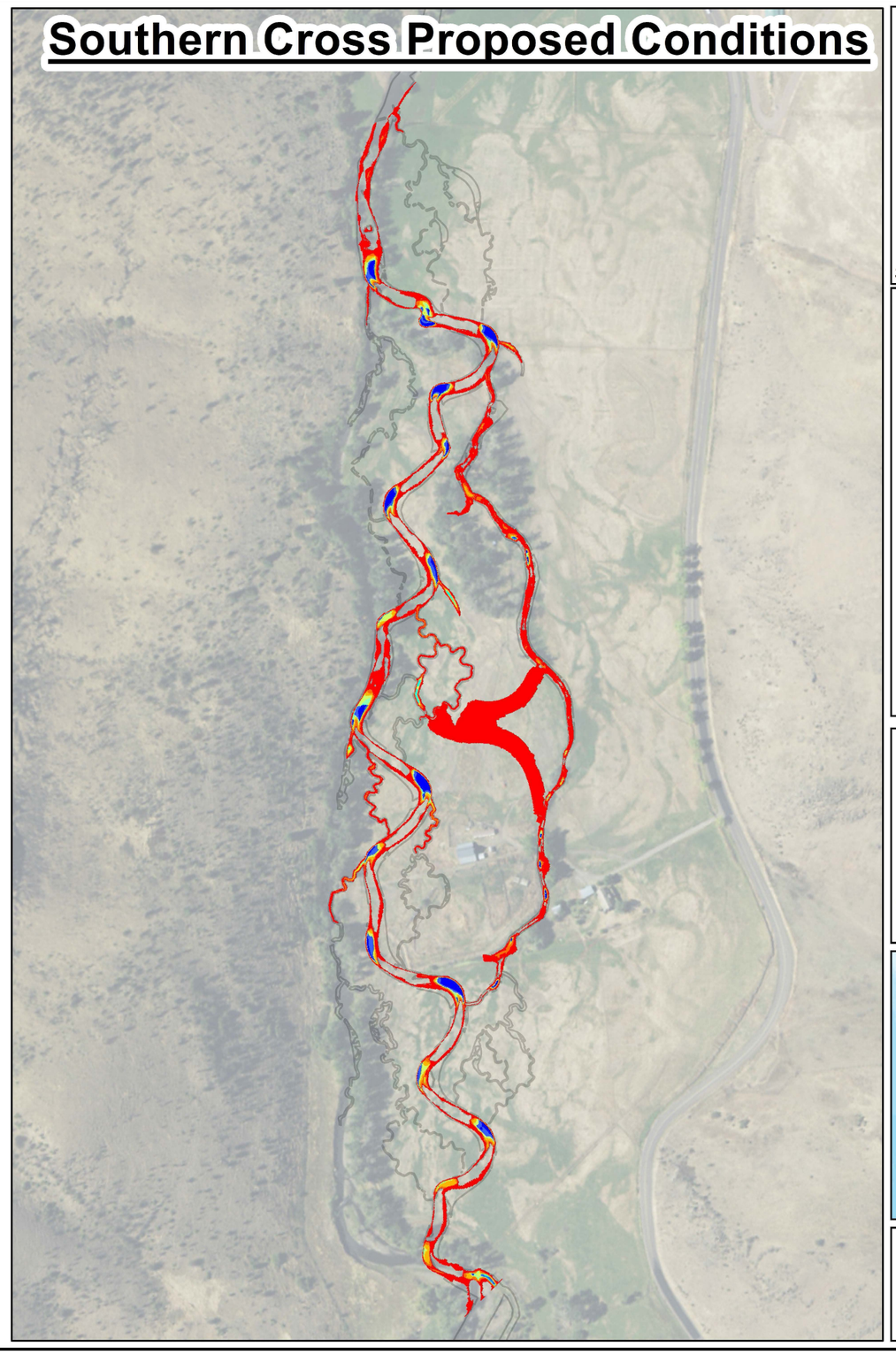


U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Existing Conditions



Southern Cross Proposed Conditions



HSI for Juvenile Winter Habitat at Q = 120 cfs

Date: 7/22/2016

Sedimentation and River Hydraulics Group

- Channel

HSI

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.6
- 0.6 - 0.7
- 0.7 - 0.8
- 0.8 - 0.9
- 0.9 - 1.0

Data Source(s): USBR

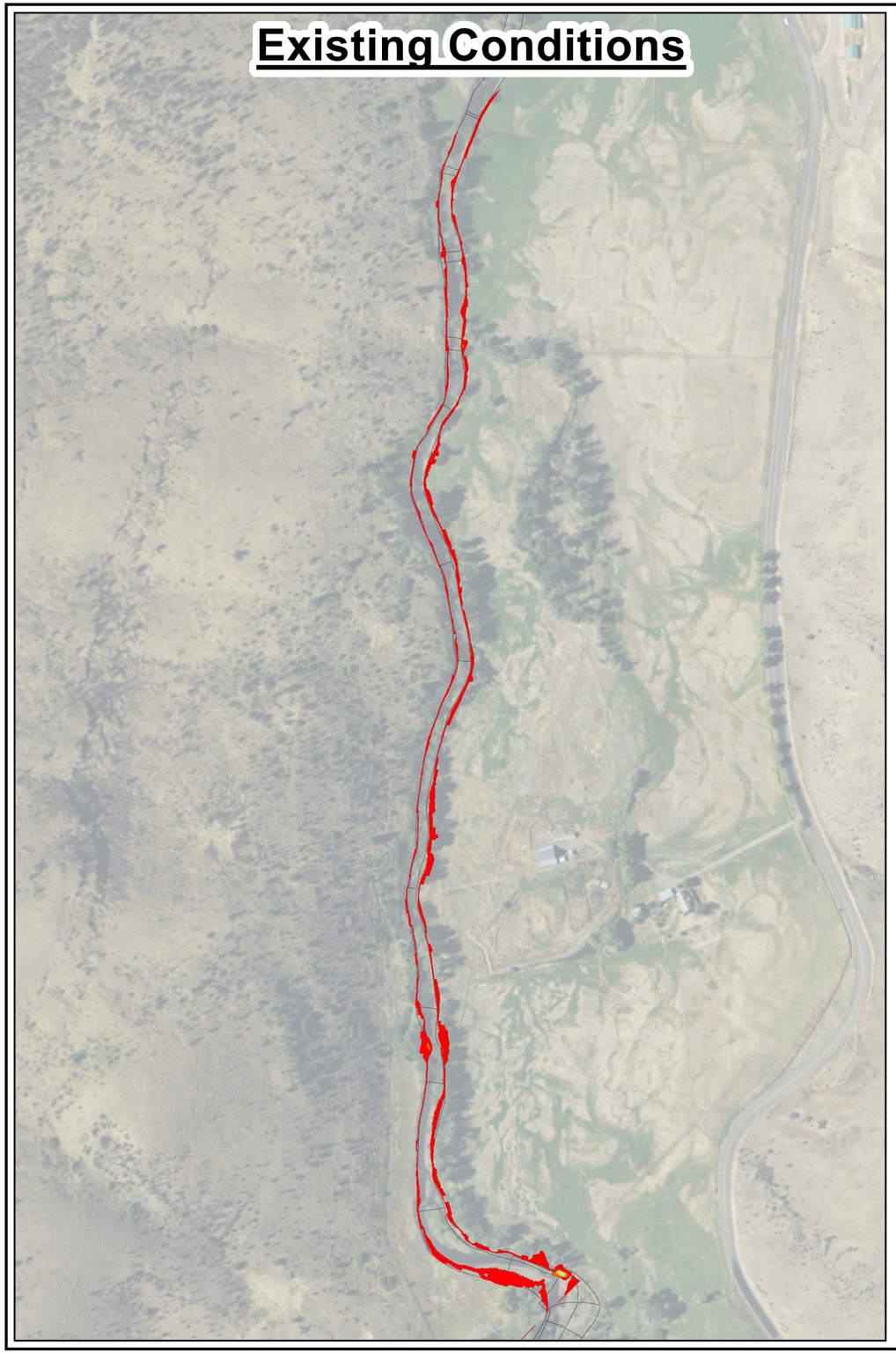
Scale: 1:5,000

0 0.04 0.08 0.16 Miles

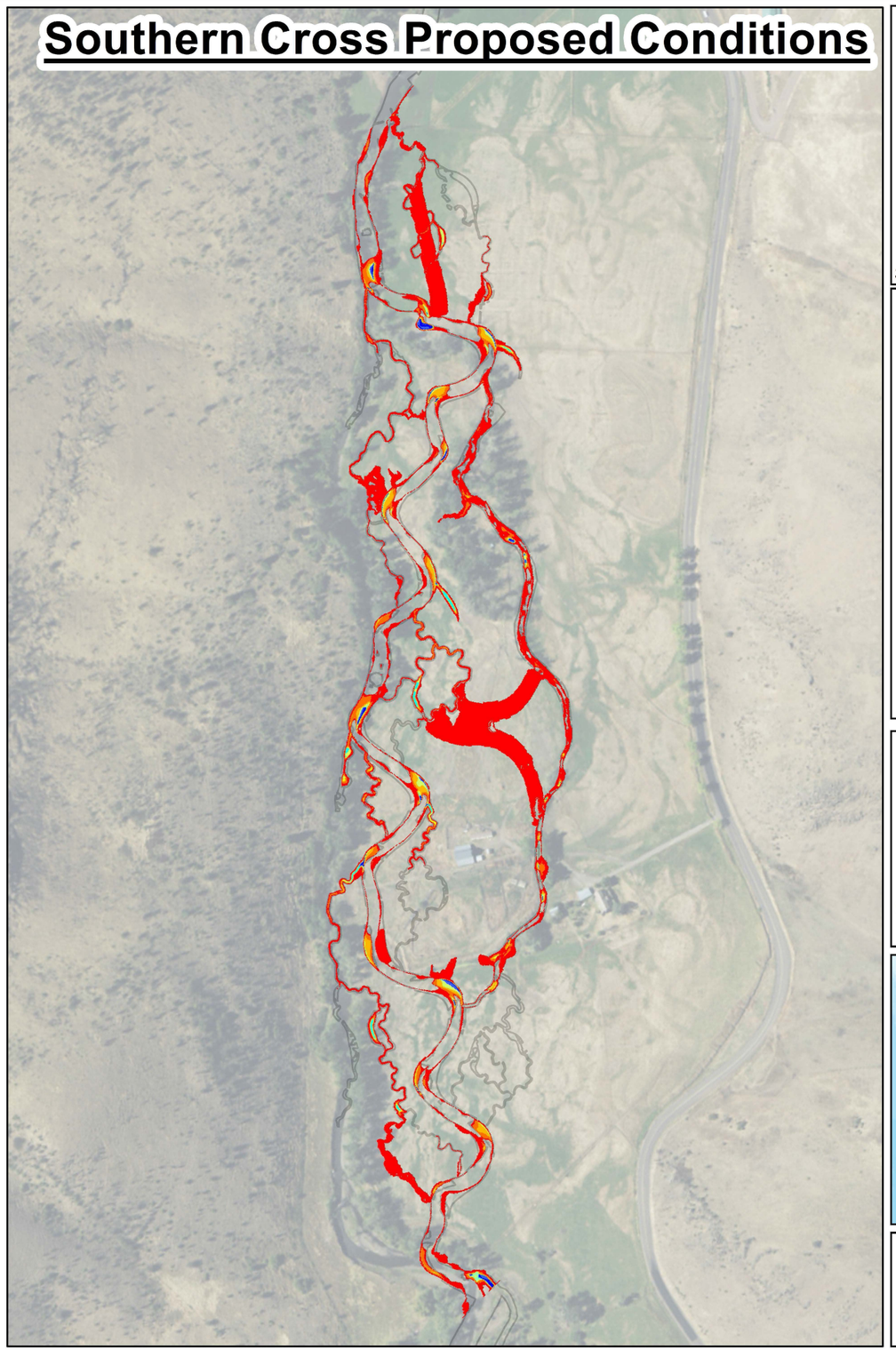


U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Existing Conditions



Southern Cross Proposed Conditions



HSI for Juvenile Winter Habitat at Q = 280 cfs

Date: 7/22/2016

Sedimentation and River Hydraulics Group

- Channel

HSI

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.6
- 0.6 - 0.7
- 0.7 - 0.8
- 0.8 - 0.9
- 0.9 - 1.0

Data Source(s): USBR

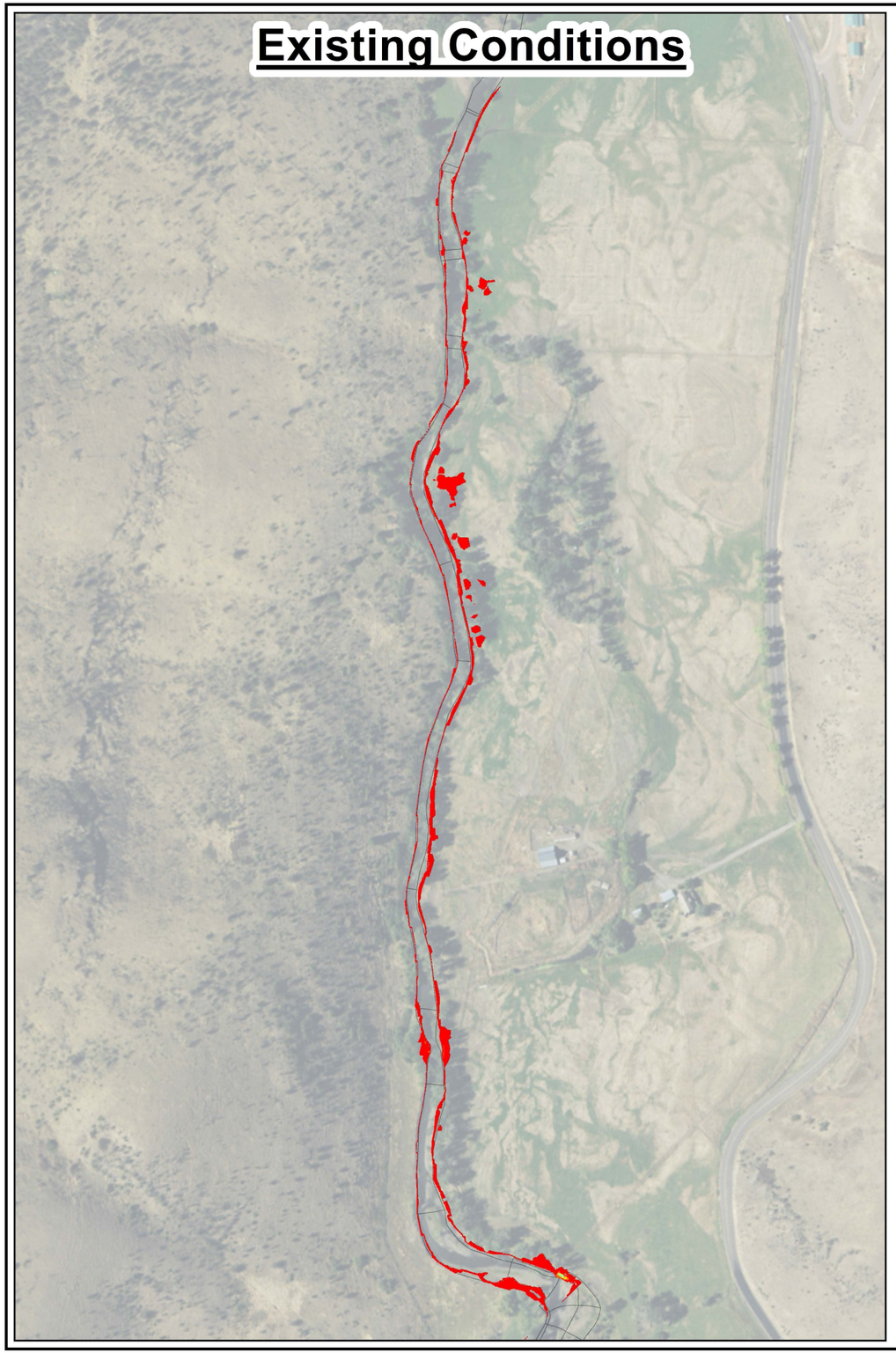
Scale: 1:5,023

0 0.04 0.08 0.16 Miles

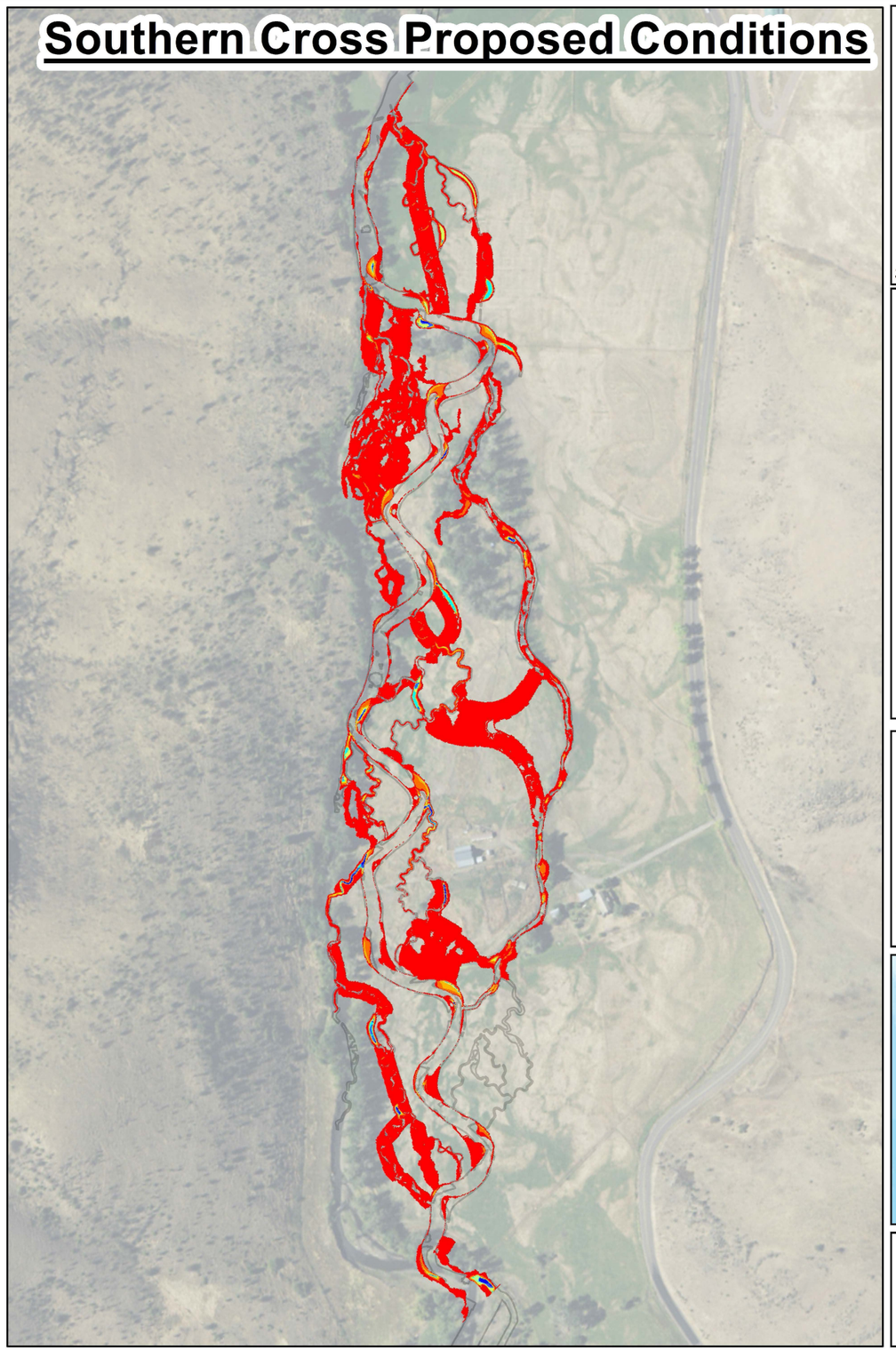


U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Existing Conditions



Southern Cross Proposed Conditions



HSI for Juvenile Winter Habitat at Q = 450 cfs

Date: 7/22/2016

Sedimentation and River Hydraulics Group

- Channel

HSI

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.6
- 0.6 - 0.7
- 0.7 - 0.8
- 0.8 - 0.9
- 0.9 - 1.0

Data Source(s): USBR

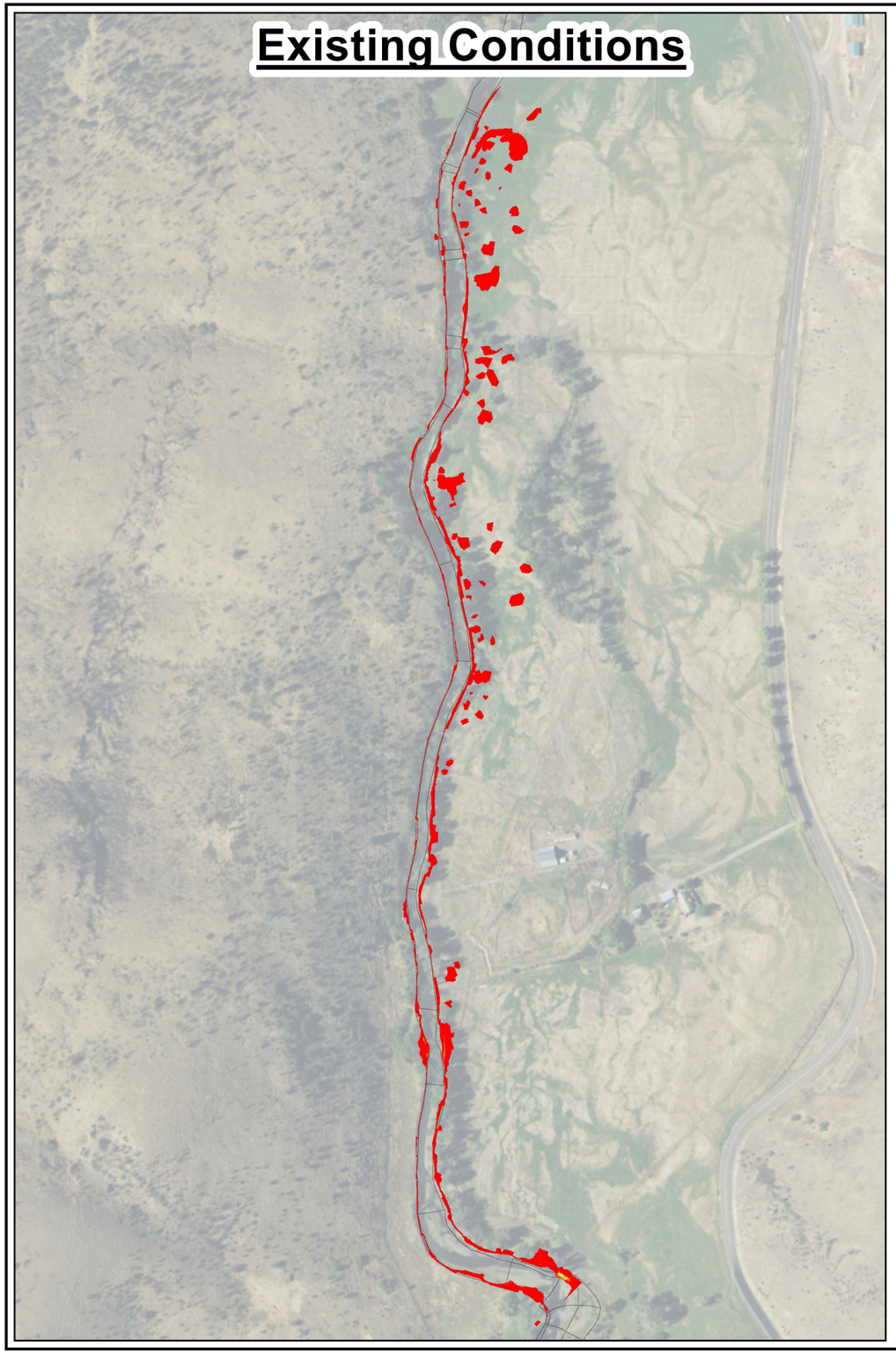
Scale: 1:5,000

0 0.04 0.08 0.16 Miles

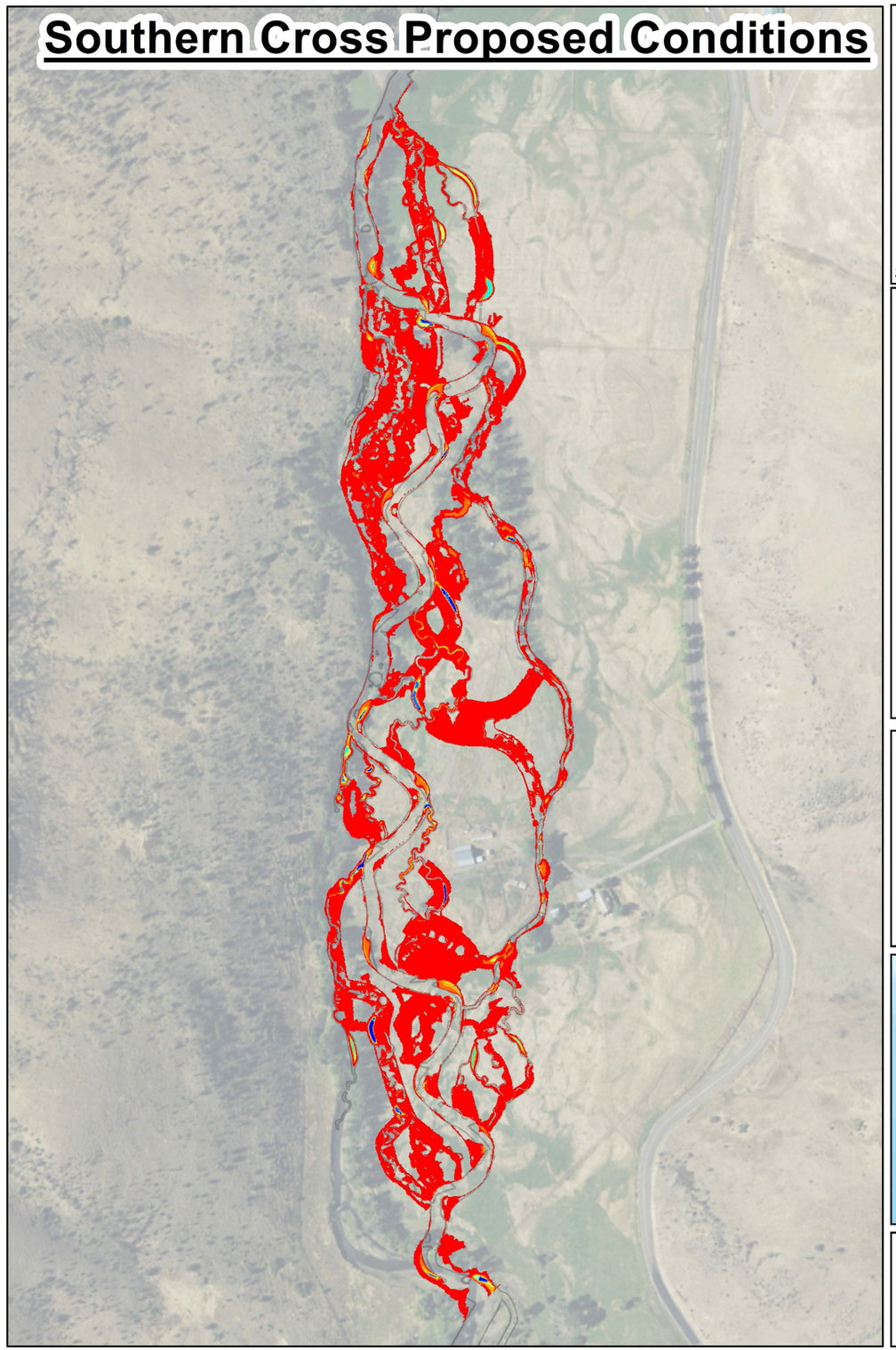


U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Existing Conditions



Southern Cross Proposed Conditions



HSI for Juvenile Winter Habitat at Q = 565 cfs

Date: 7/22/2016

Sedimentation and River Hydraulics Group

- Channel

HSI

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.6
- 0.6 - 0.7
- 0.7 - 0.8
- 0.8 - 0.9
- 0.9 - 1.0

Data Source(s): USBR

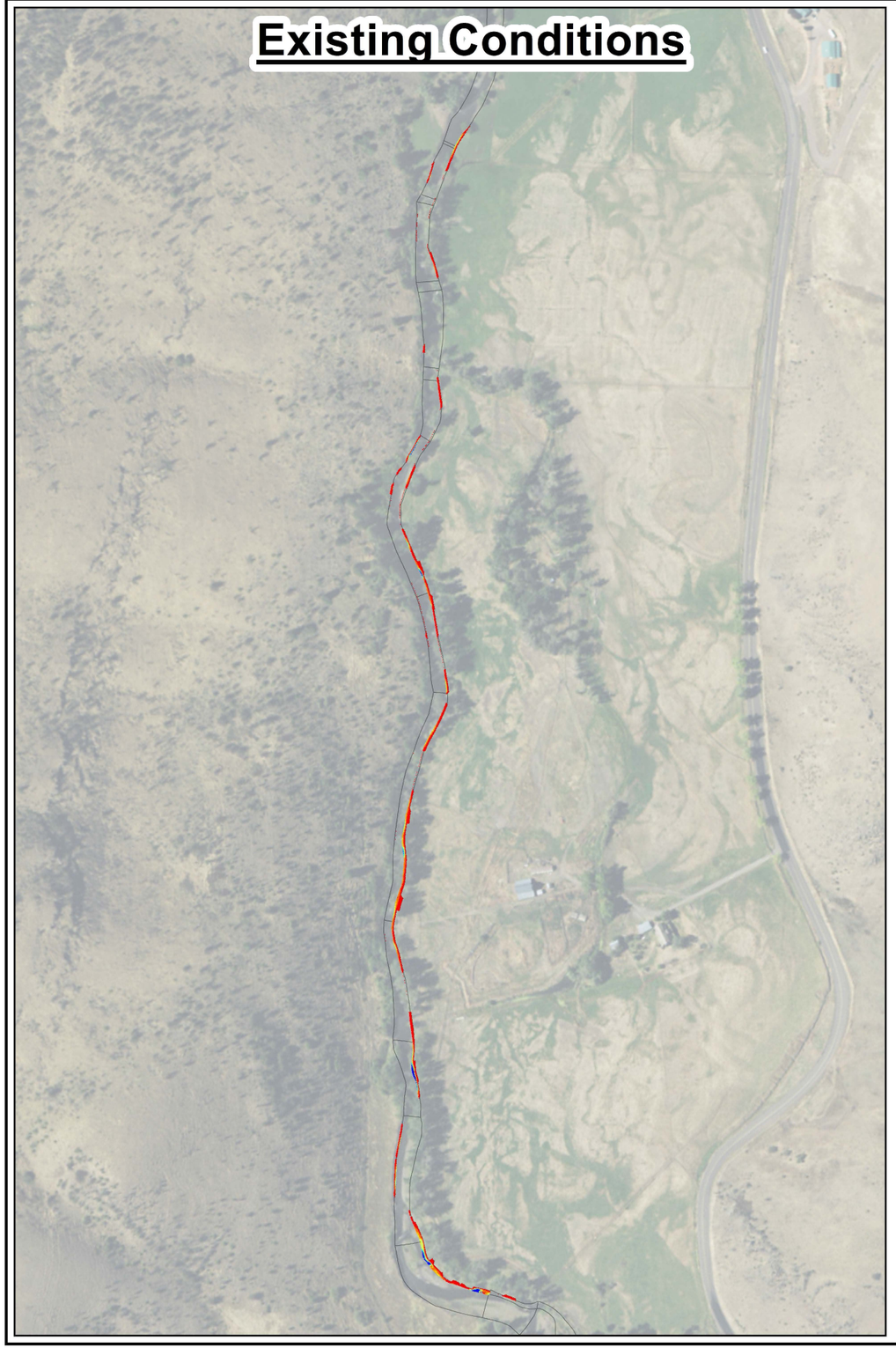
Scale: 1:5,000

0 0.04 0.08 0.16 Miles

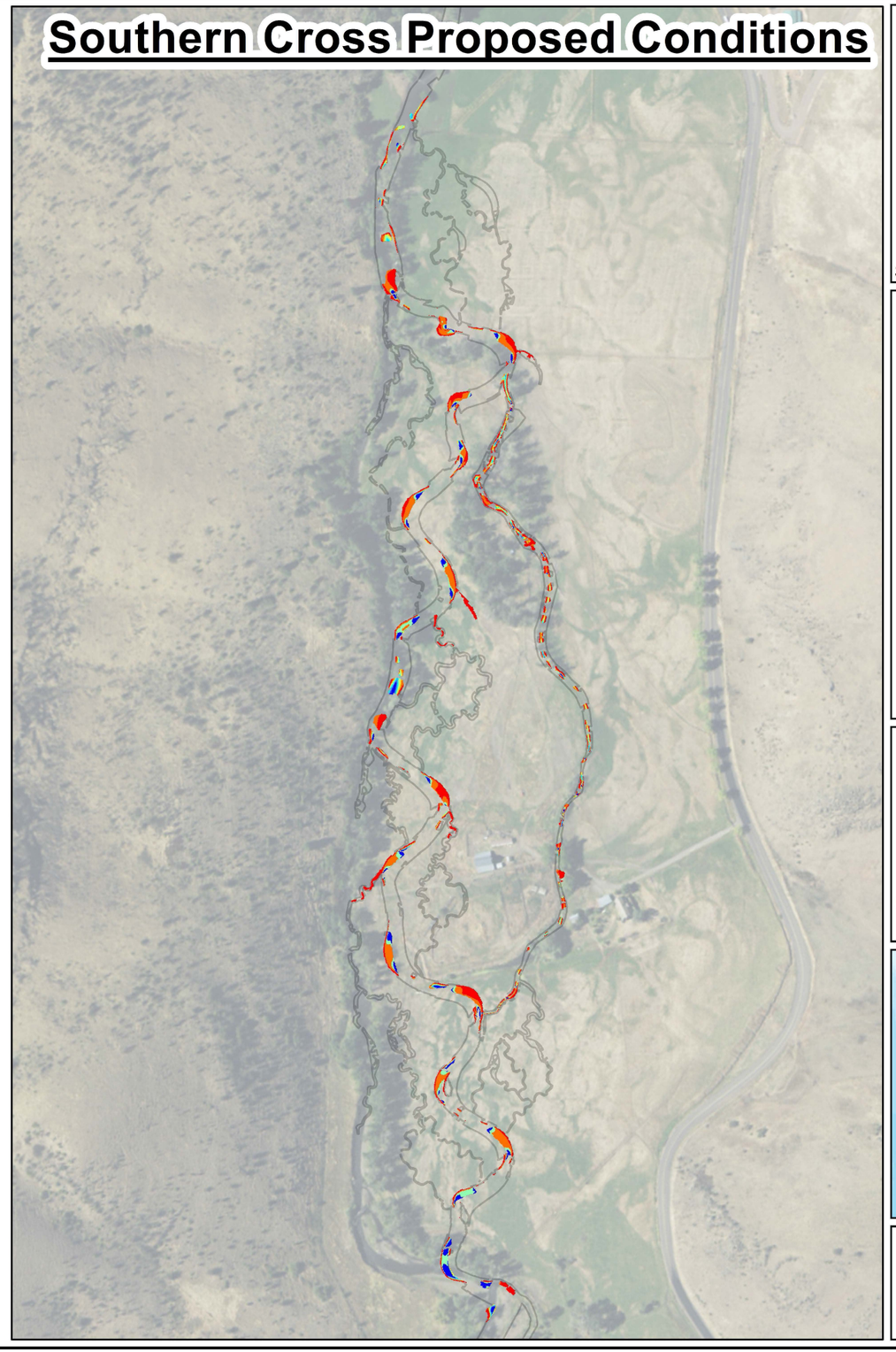


U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Existing Conditions



Southern Cross Proposed Conditions



HSI for Juvenile Steelhead Summer Habitat at Q = 18 cfs

Date: 7/22/2016

Sedimentation and River Hydraulics Group

Channel

HSI

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.6
- 0.6 - 0.7
- 0.7 - 0.8
- 0.8 - 0.9
- 0.9 - 1.0

Data Source(s): USBR

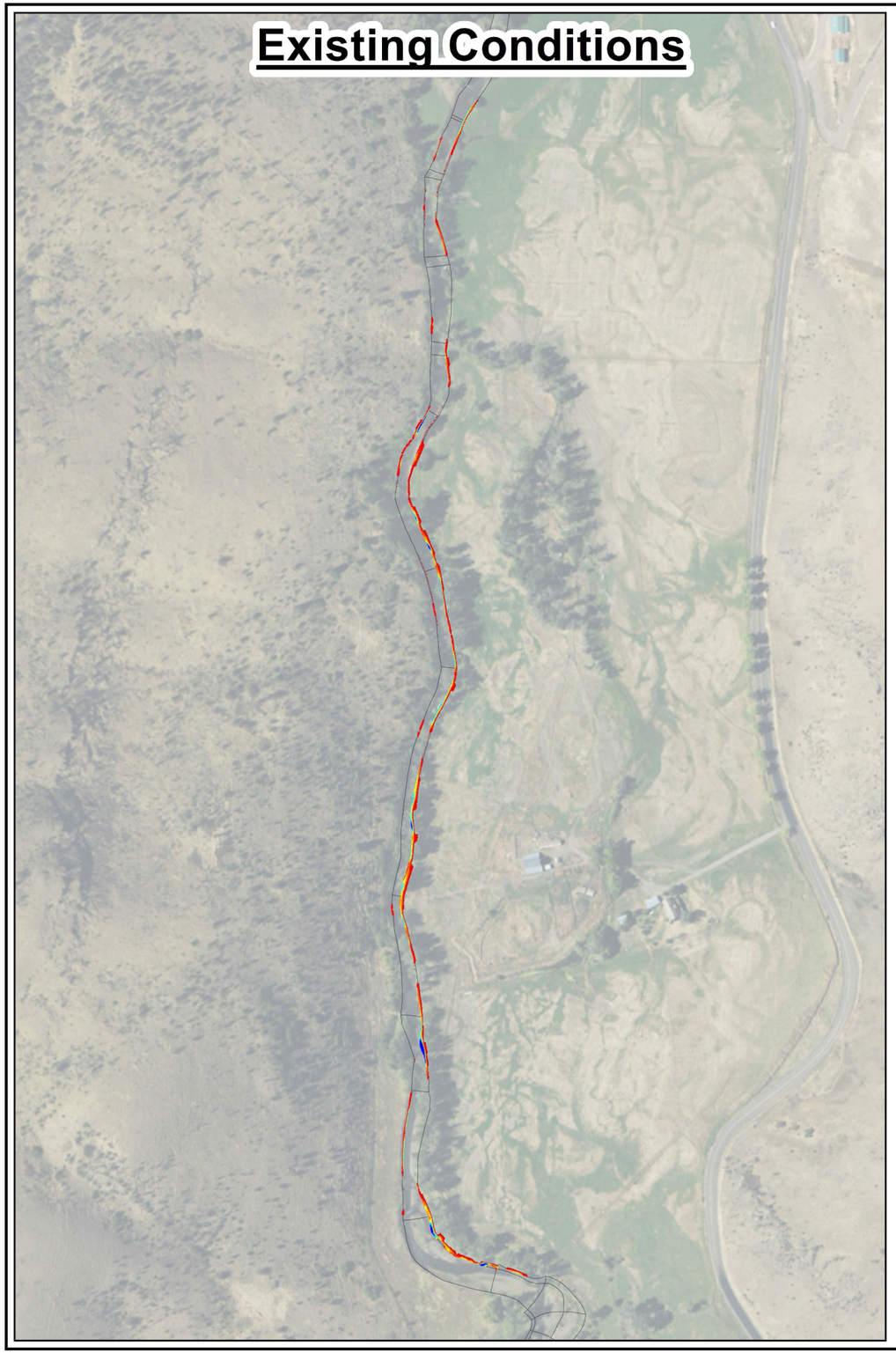
Scale: 1:5,000

0 0.04 0.08 0.16 Miles

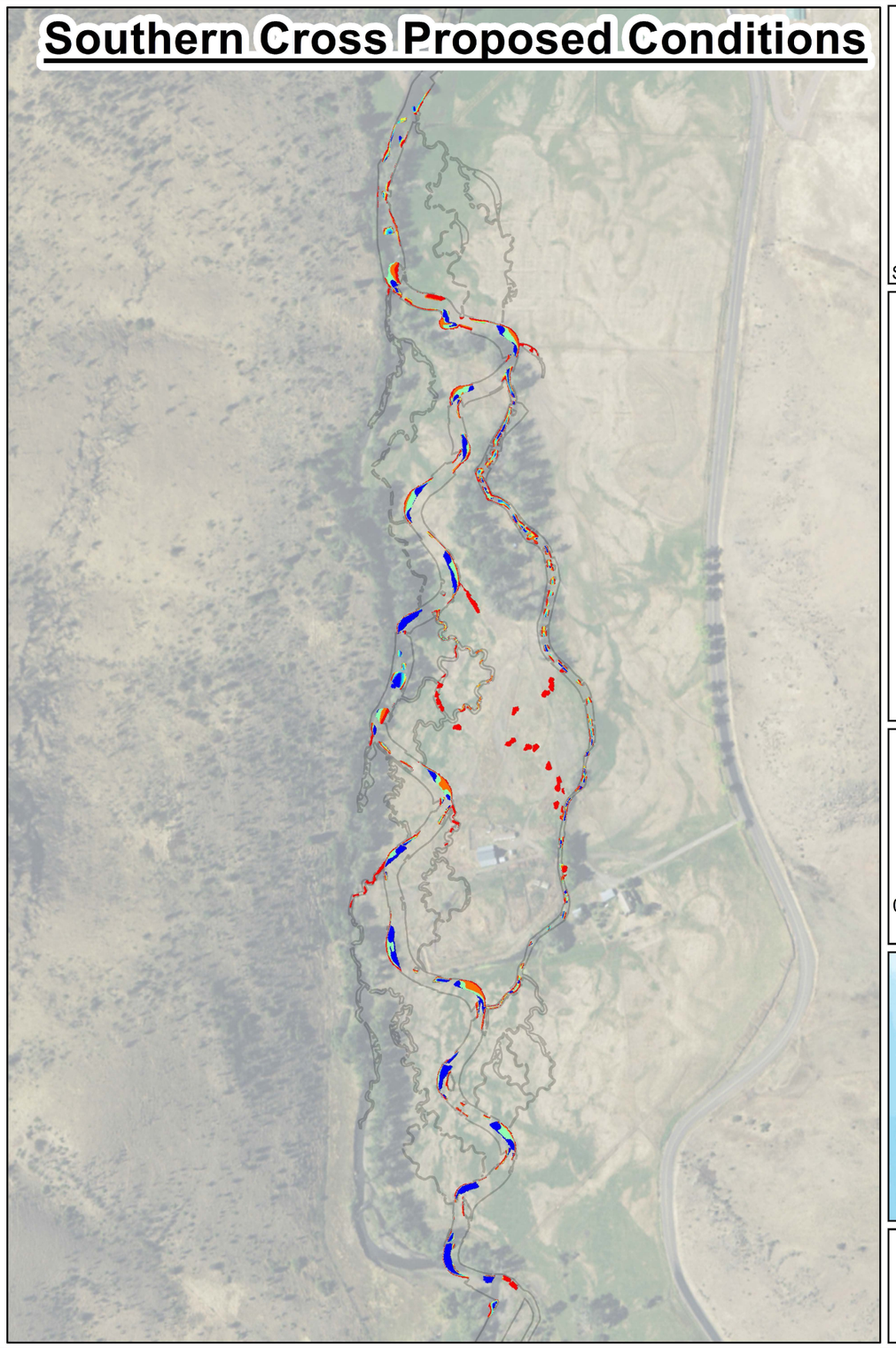


U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Existing Conditions



Southern Cross Proposed Conditions



HSI for Juvenile Steelhead Summer Habitat at Q = 40 cfs

Date: 7/22/2016

Sedimentation and River Hydraulics Group

- Channel

HSI

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.6
- 0.6 - 0.7
- 0.7 - 0.8
- 0.8 - 0.9
- 0.9 - 1.0

Data Source(s): USBR

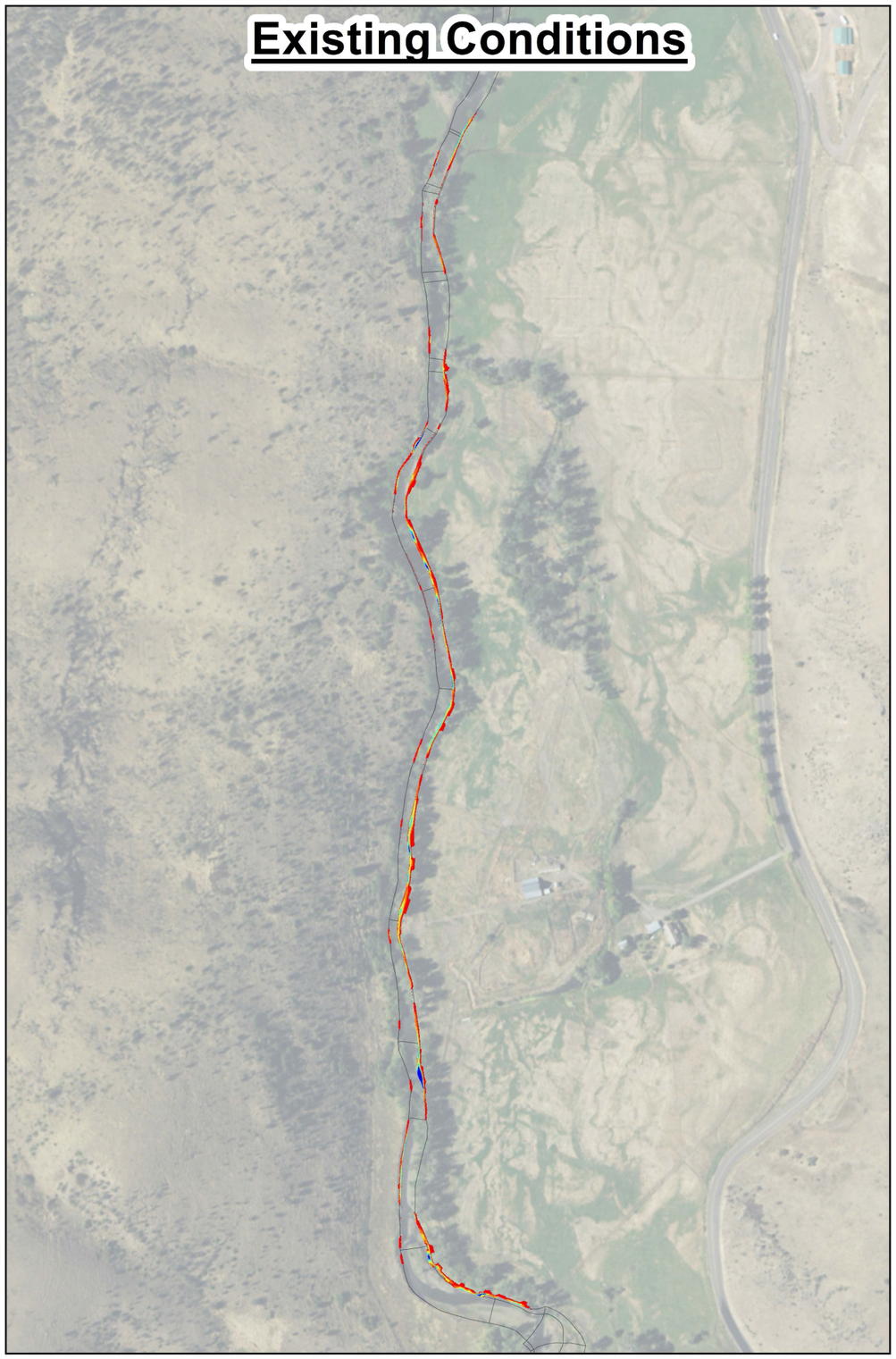
Scale: 1:5,000

0 0.04 0.08 0.16 Miles

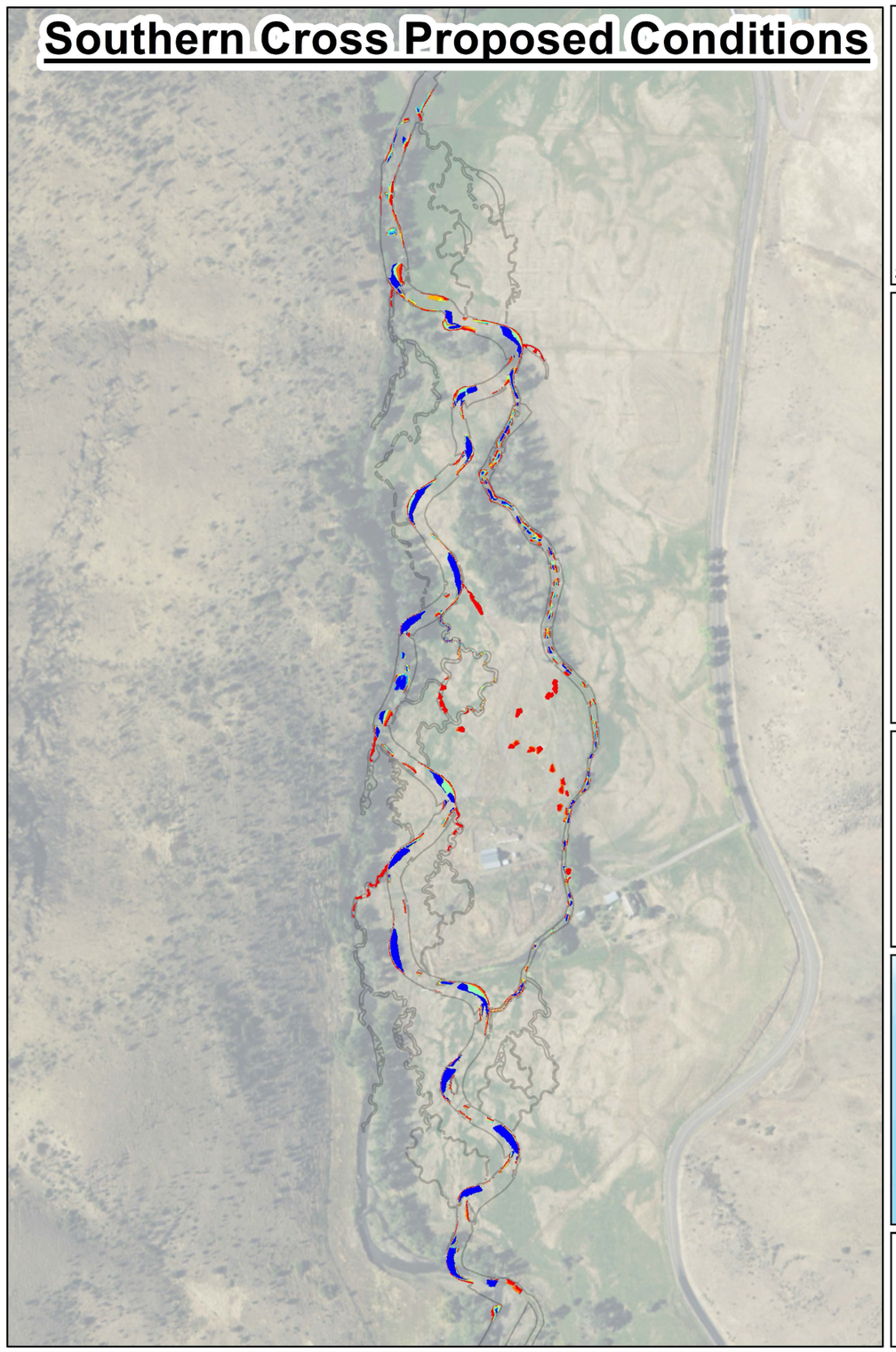


U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Existing Conditions



Southern Cross Proposed Conditions



HSI for Juvenile Steelhead Summer Habitat at Q = 60 cfs

Date: 7/22/2016

Sedimentation and River Hydraulics Group

- Channel

HSI

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.6
- 0.6 - 0.7
- 0.7 - 0.8
- 0.8 - 0.9
- 0.9 - 1.0

Data Source(s): USBR

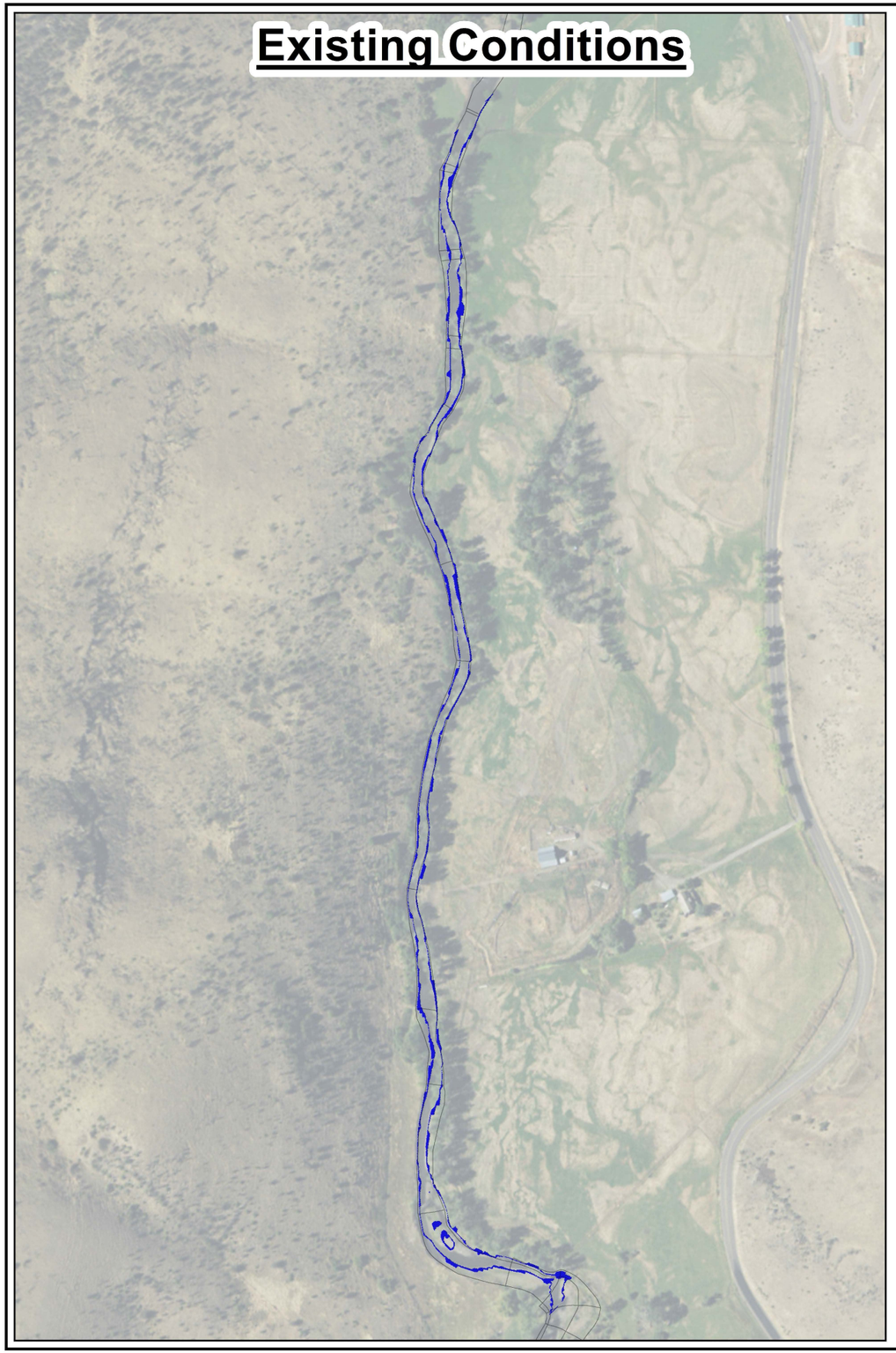
Scale: 1:5,000

0 0.04 0.08 0.16 Miles

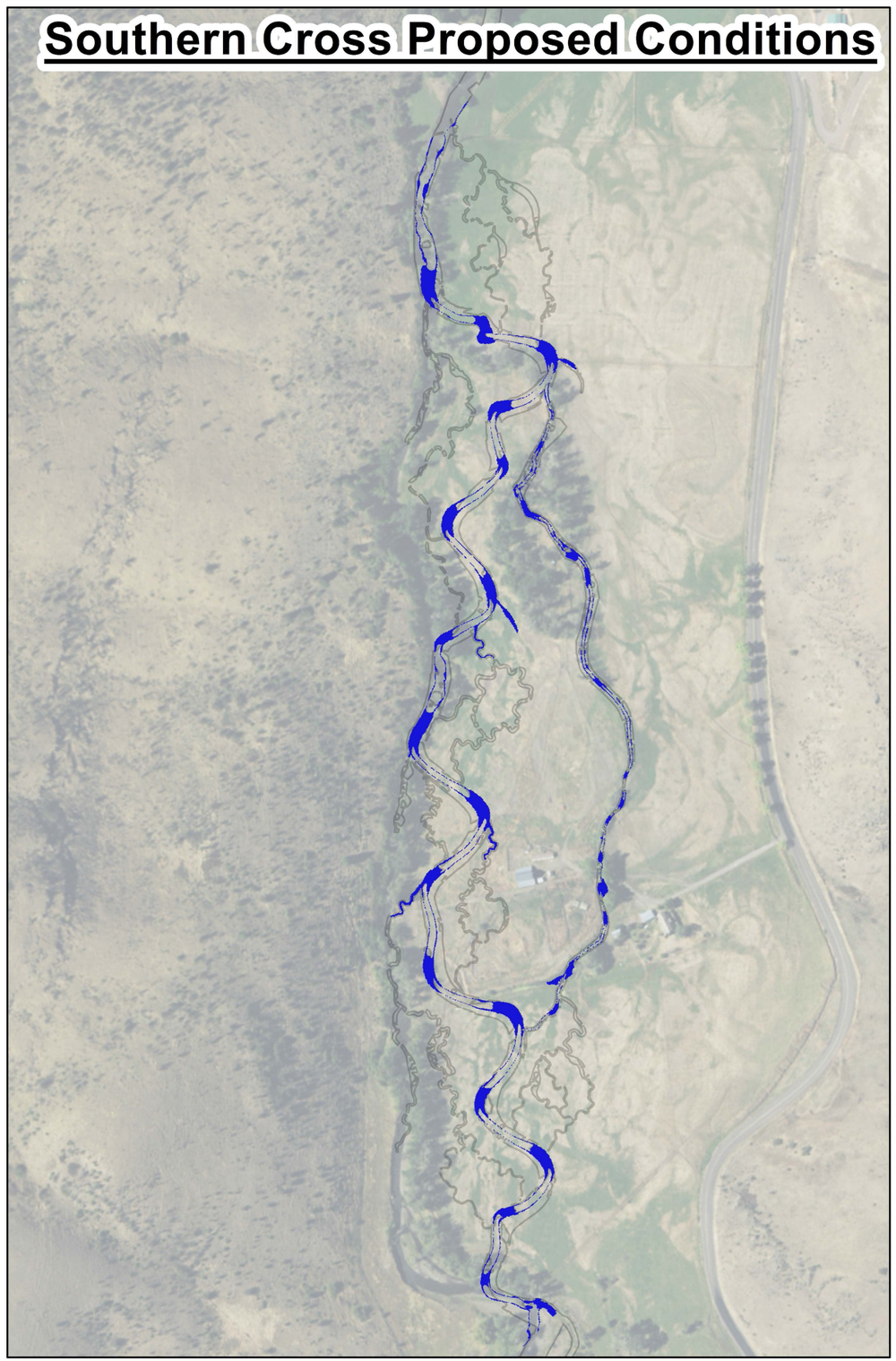


U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Existing Conditions



Southern Cross Proposed Conditions



Depth Average Velocity at Q = 18 cfs

Date: 7/22/2016

Sedimentation and River Hydraulics Group

Legend

- Vel < 0.33 ft/s
- Channel

Data Source(s): USBR

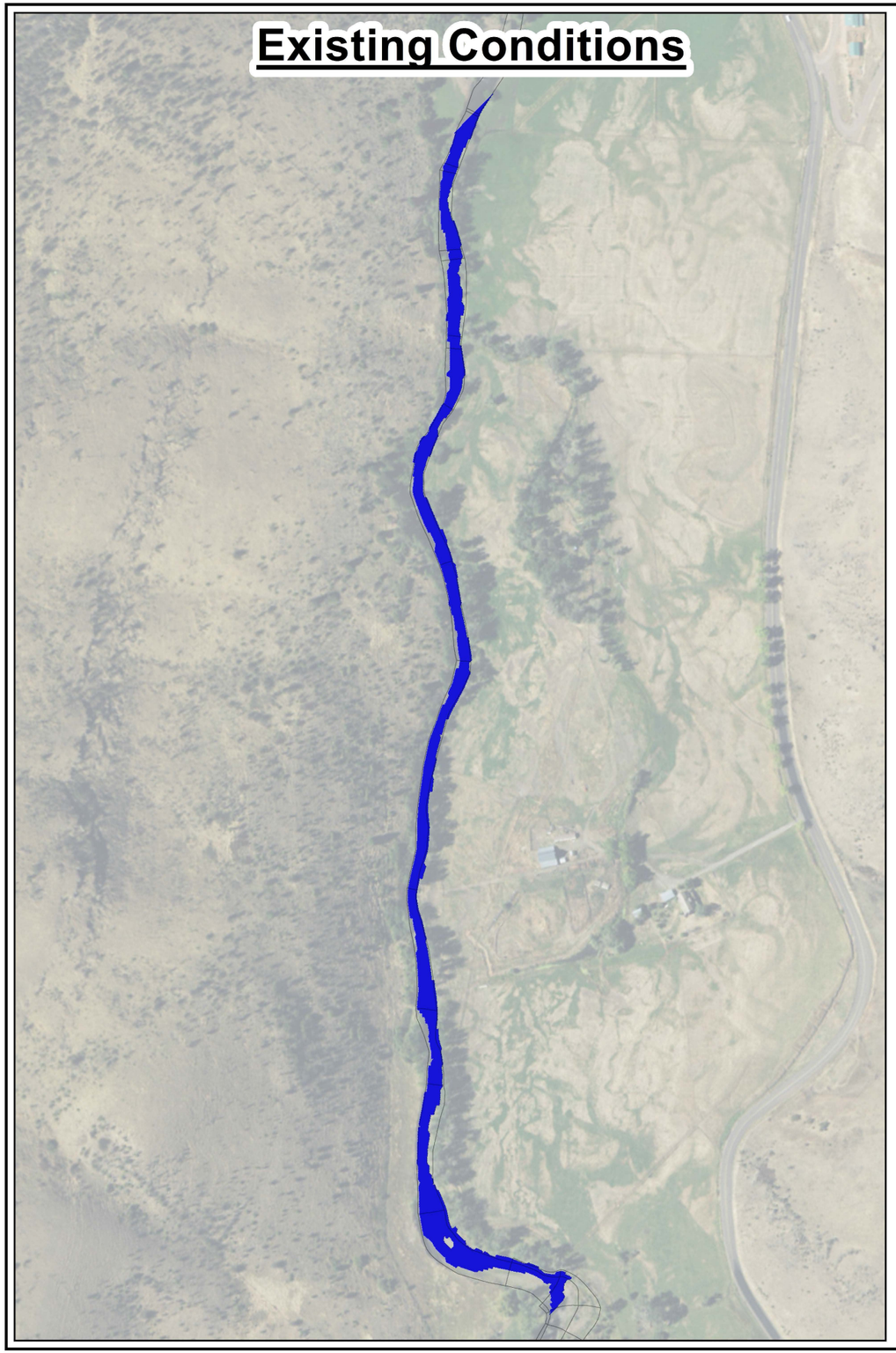
Scale: 1:5,000

0 0.04 0.08 0.16 Miles

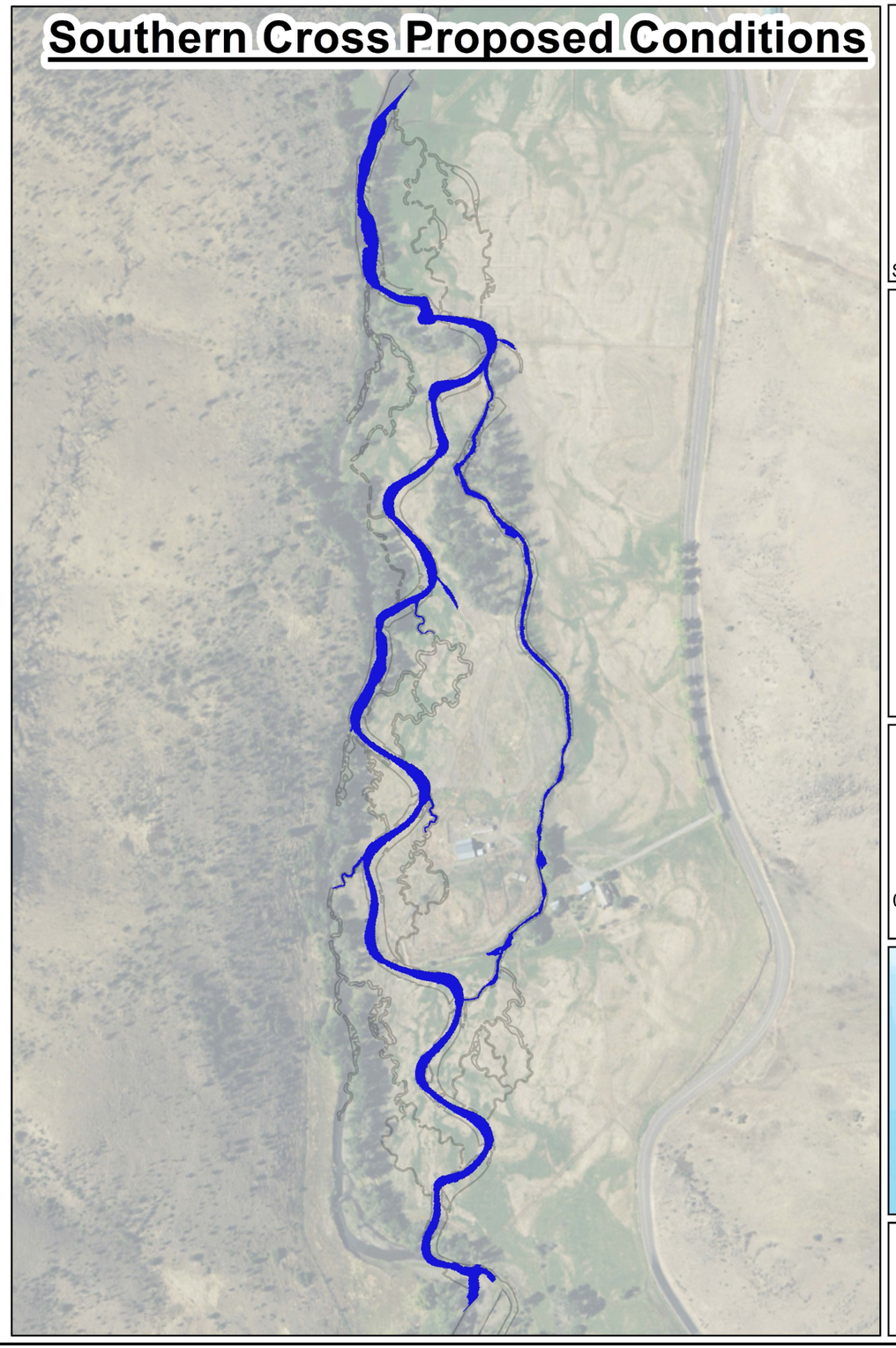


U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Existing Conditions



Southern Cross Proposed Conditions



Total Wetted Area at Q = 18 cfs

Date: 7/22/2016

Sedimentation and River Hydraulics Group

Legend

Depth > 0 ft

Channel

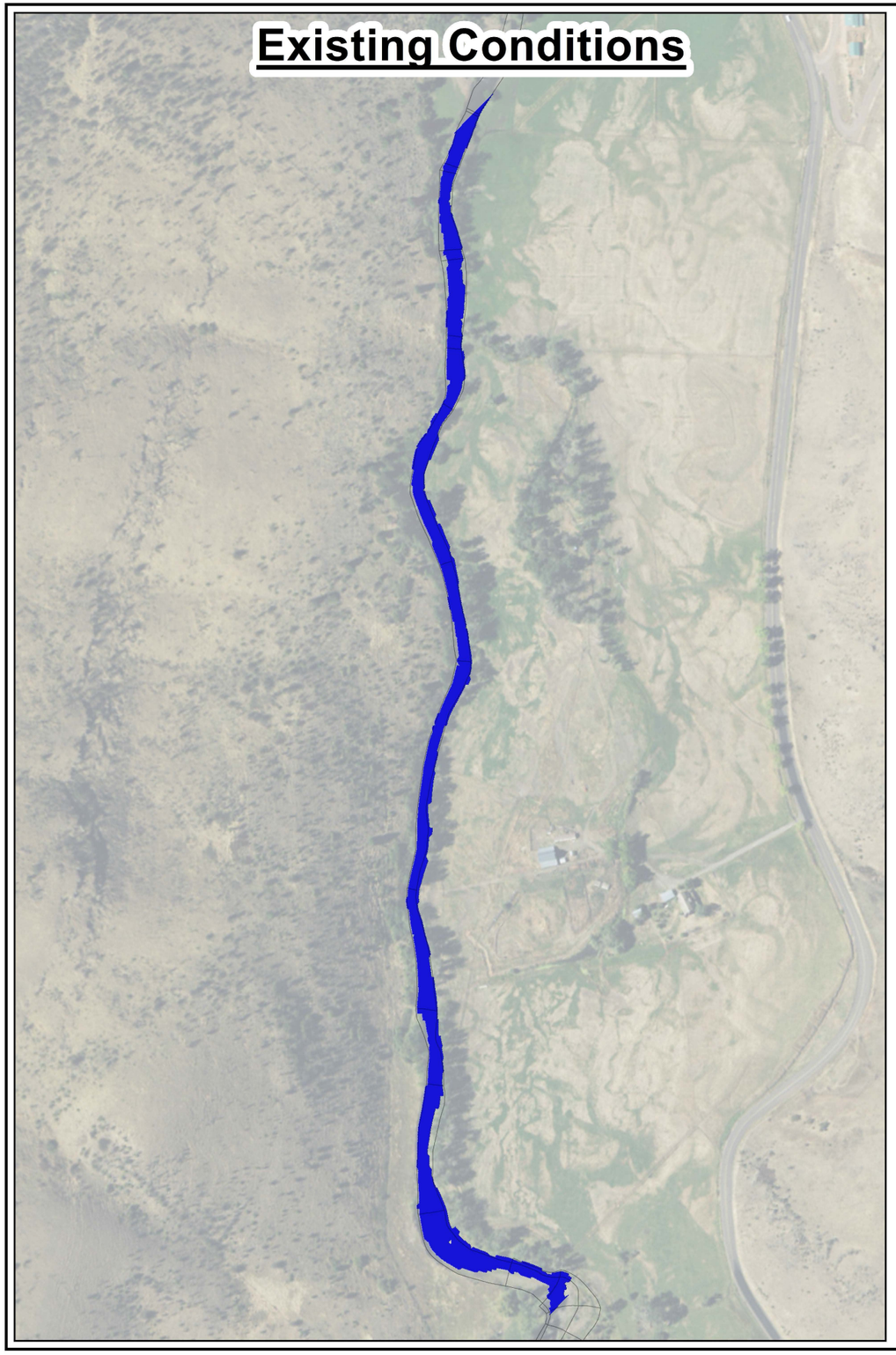
Data Source(s): USBR

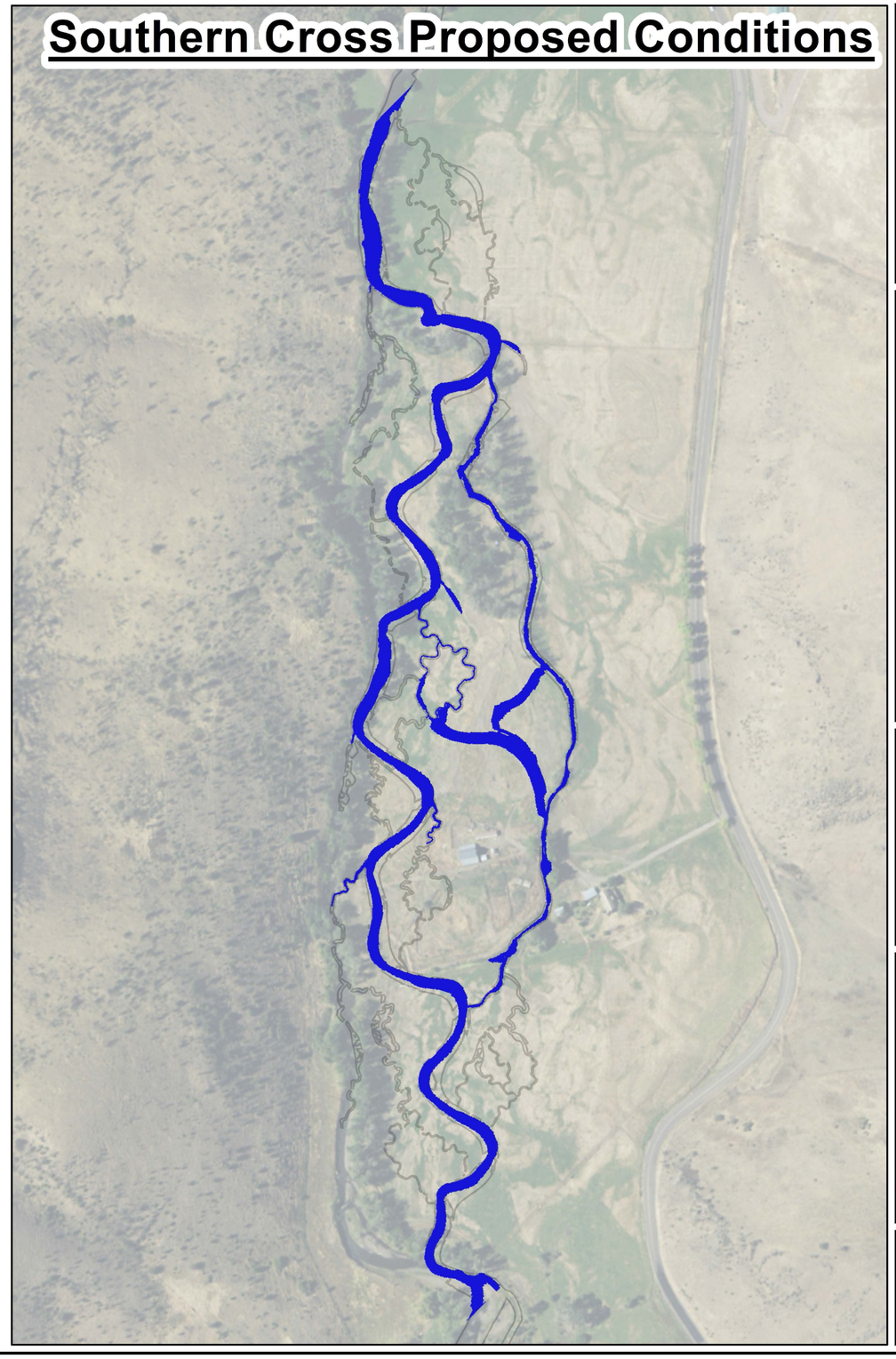
Scale: 1:5,000

0 0.04 0.08 0.16 Miles



U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION





Total Wetted Area at Q = 40 cfs

Date: 7/22/2016

Sedimentation and River Hydraulics Group

Legend

Depth > 0 ft

Channel

Data Source(s): USBR

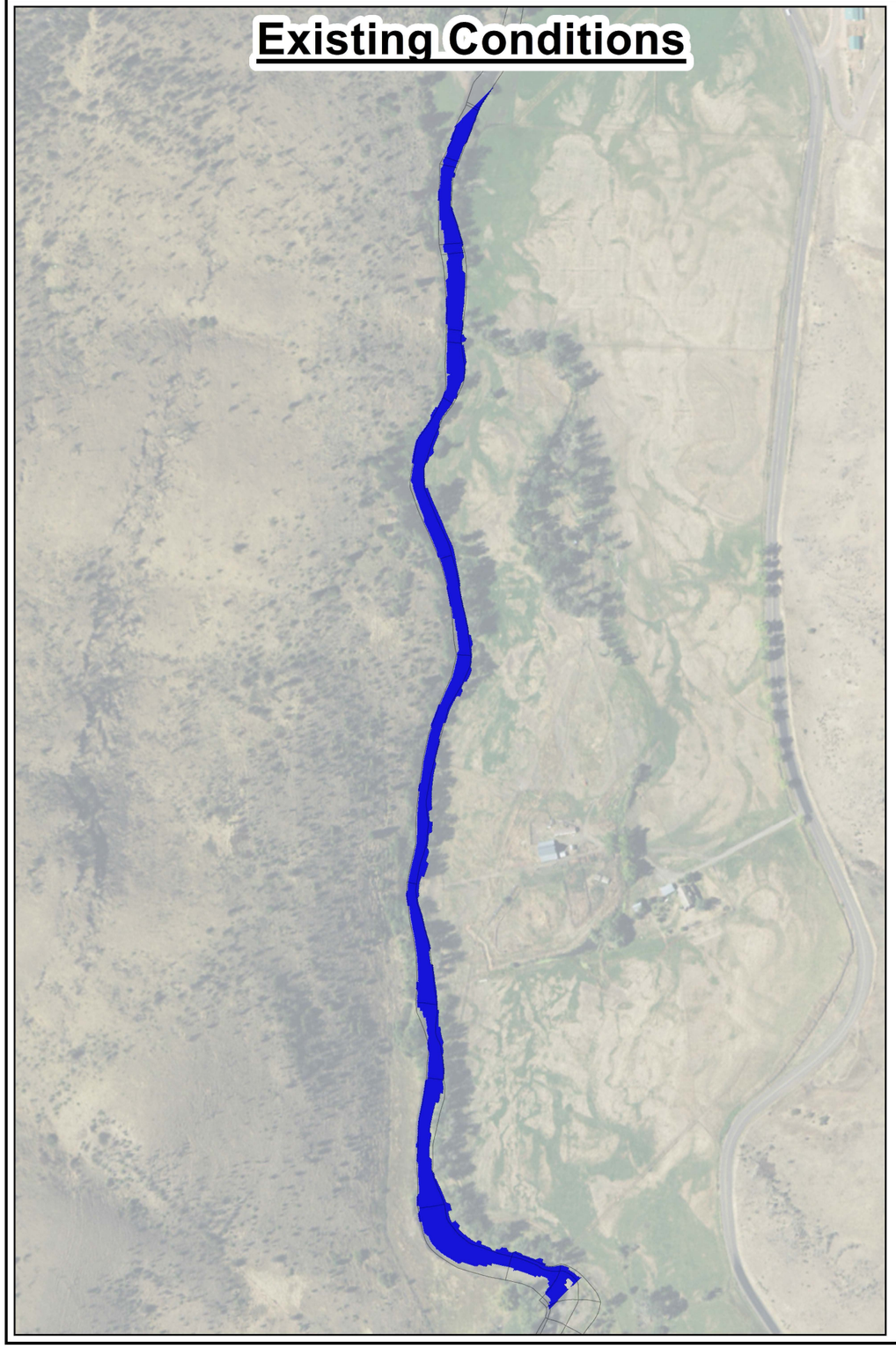
Scale: 1:5,000

0 0.04 0.08 0.16 Miles

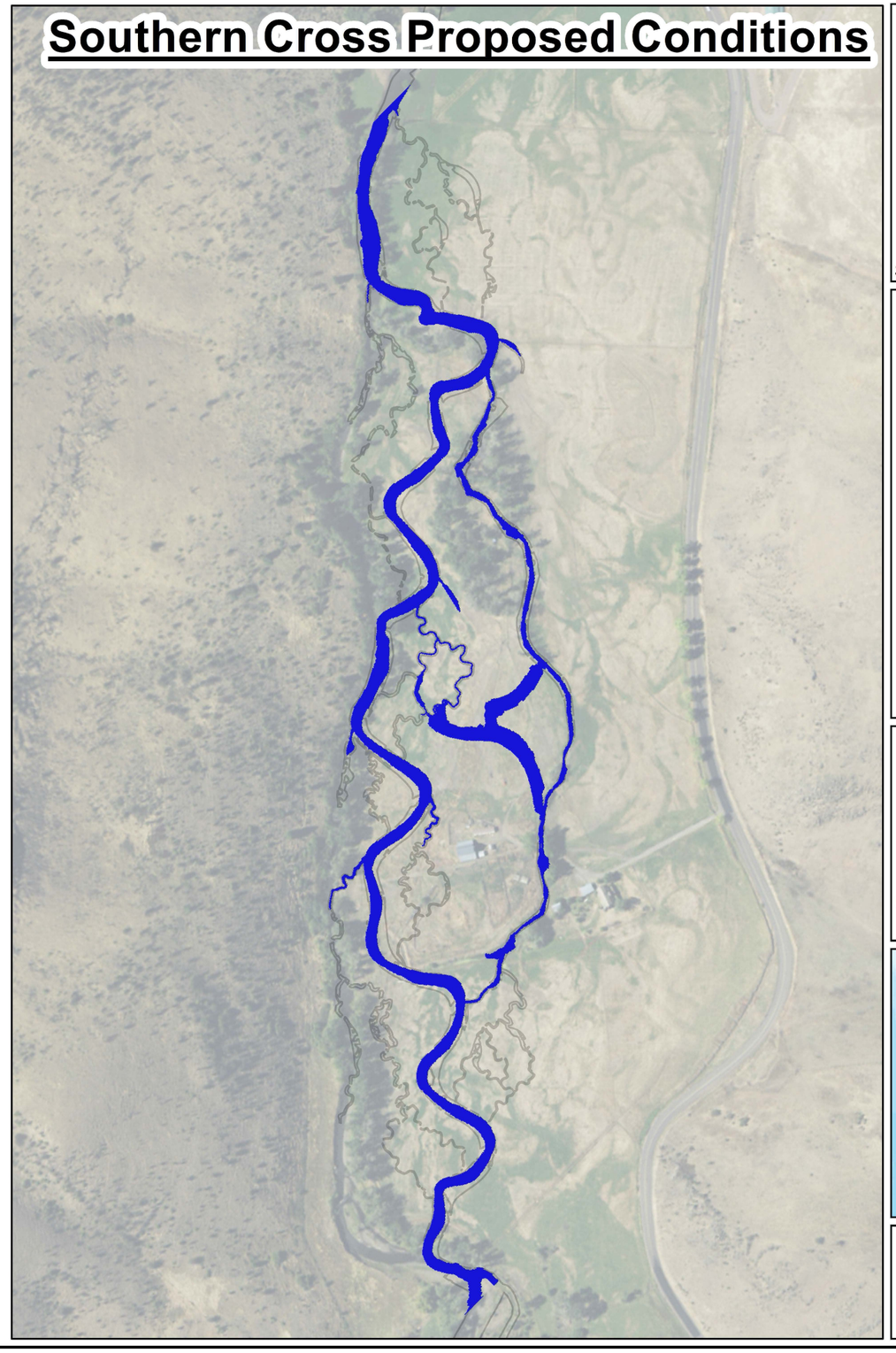


U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Existing Conditions



Southern Cross Proposed Conditions



Total Wetted Area at Q = 60 cfs

Date: 7/22/2016

Sedimentation and River Hydraulics Group

Legend

Depth > 0 ft

Channel

Data Source(s): USBR

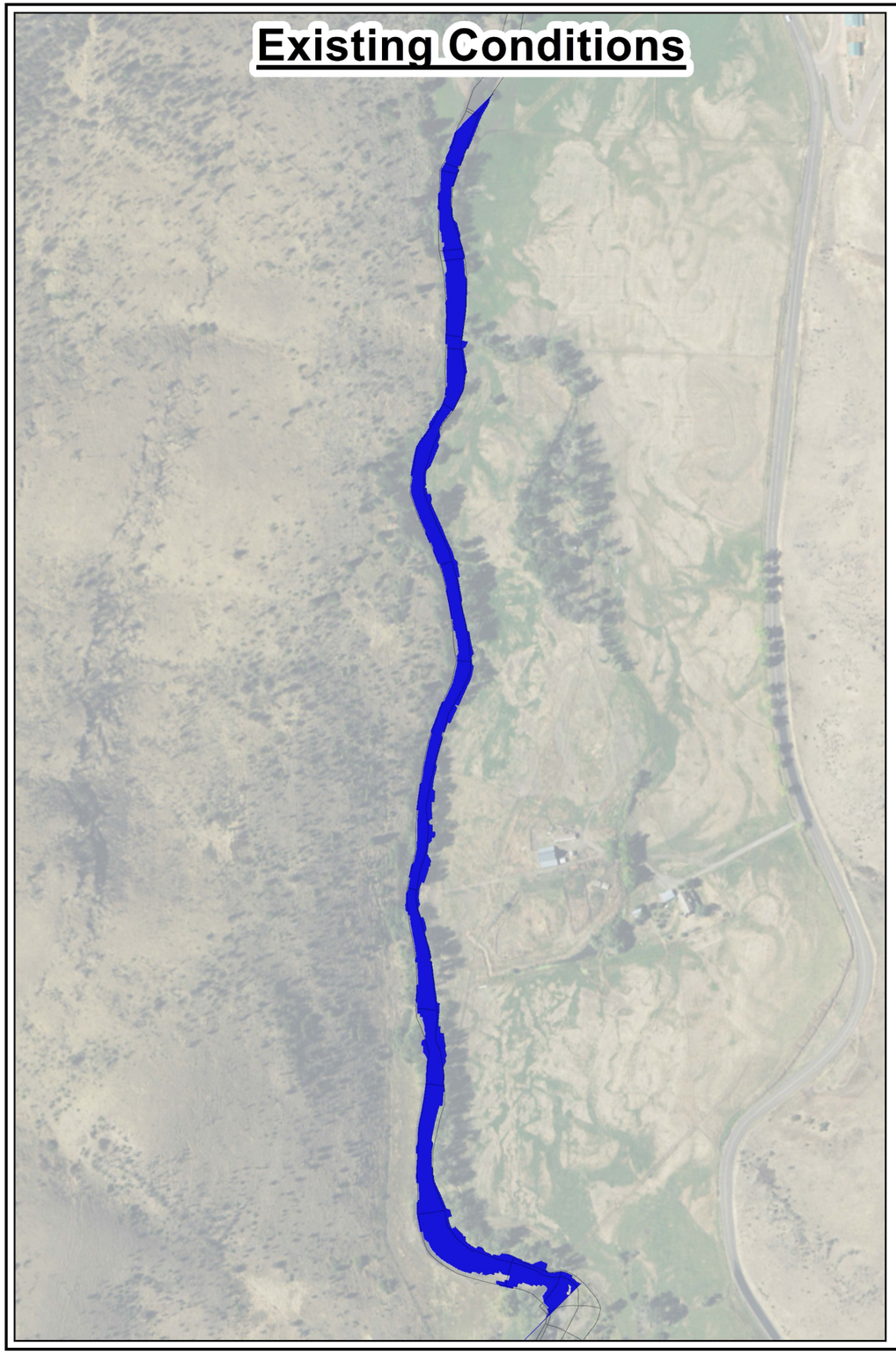
Scale: 1:5,000

0 0.04 0.08 0.16 Miles

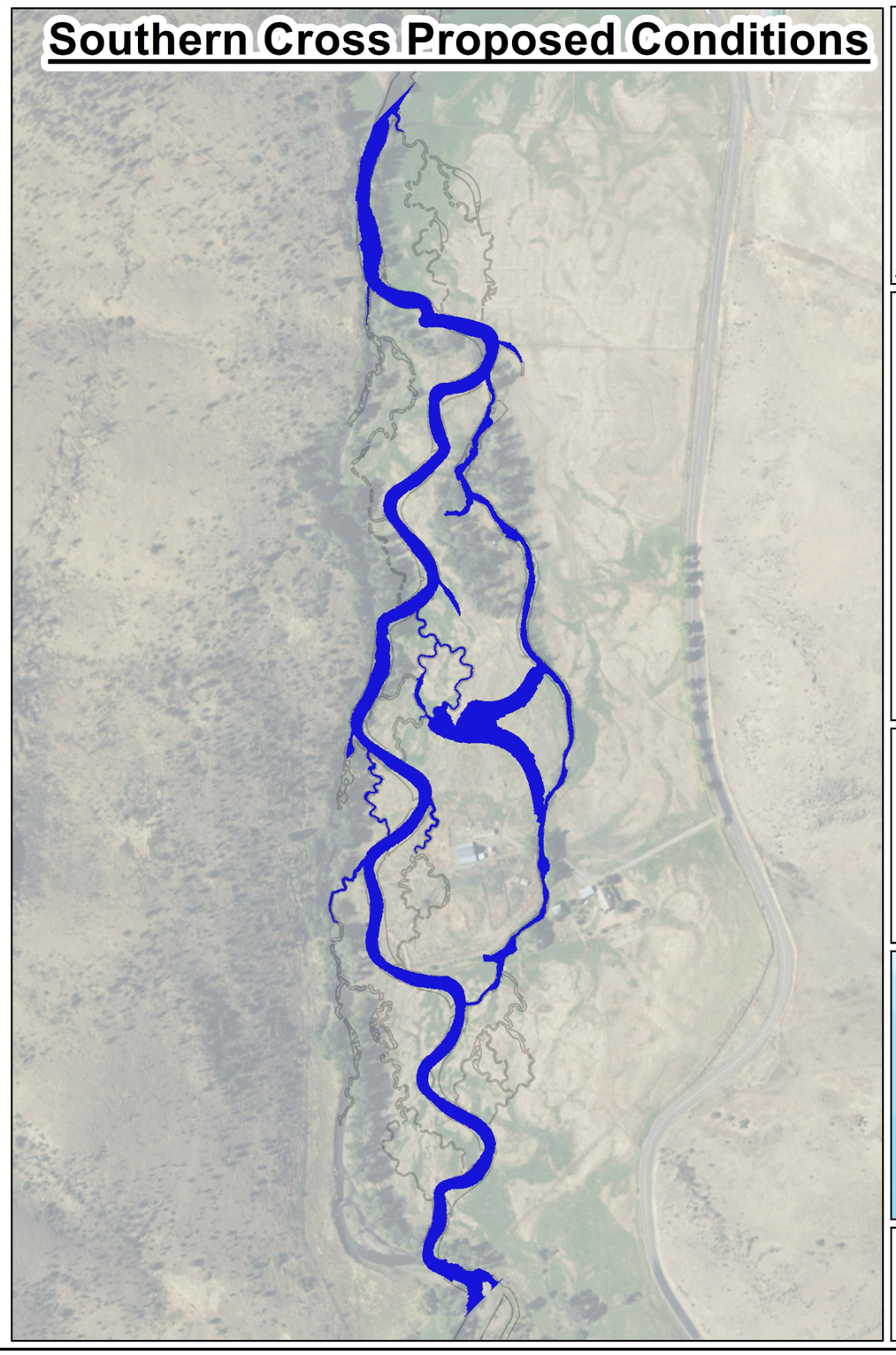


U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Existing Conditions



Southern Cross Proposed Conditions



Total Wetted Area at Q = 120 cfs

Date: 7/22/2016

Sedimentation and River Hydraulics Group

Legend

- Depth > 0 ft
- Channel

Data Source(s): USBR

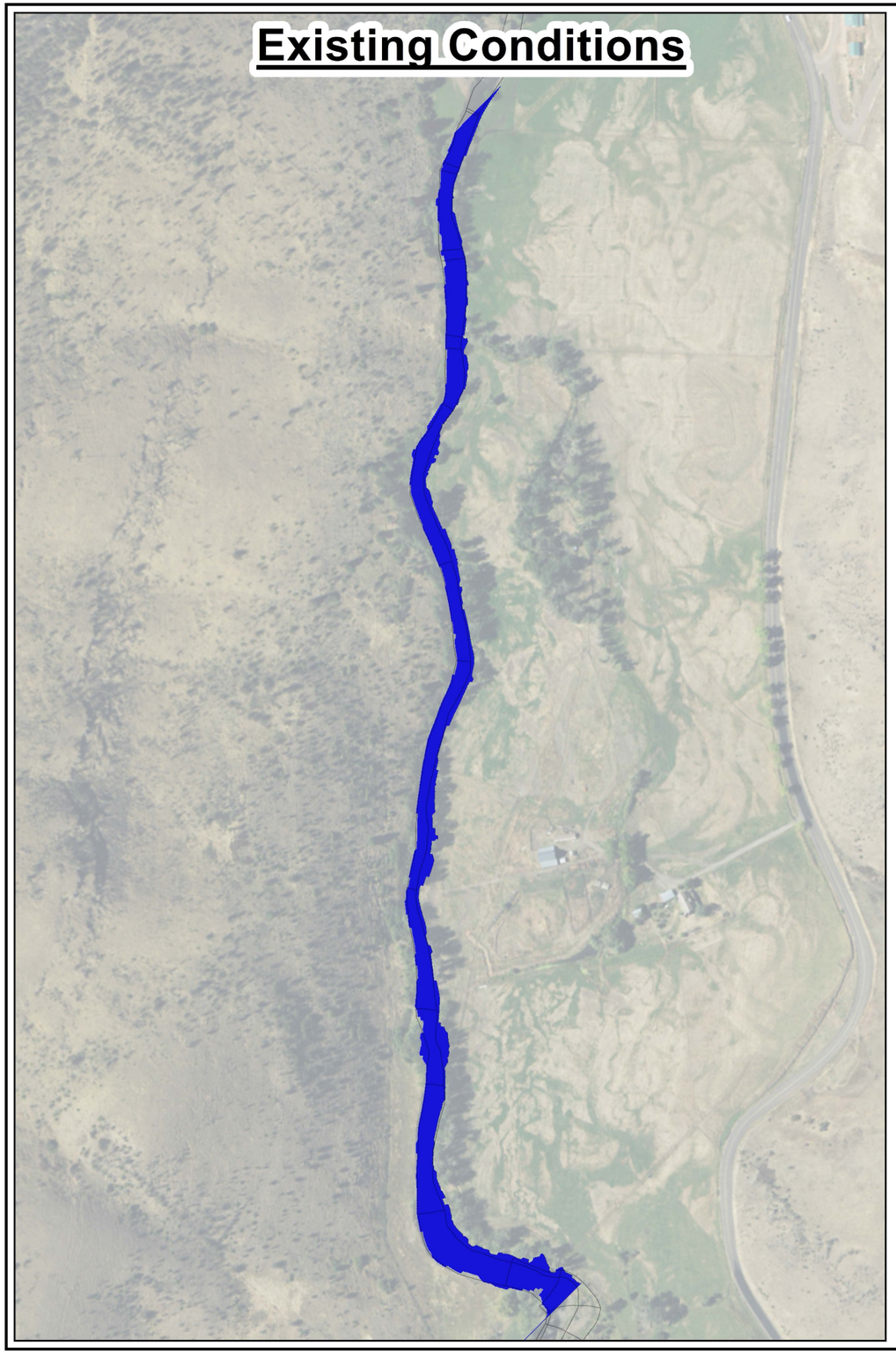
Scale: 1:5,000

0 0.04 0.08 0.16 Miles

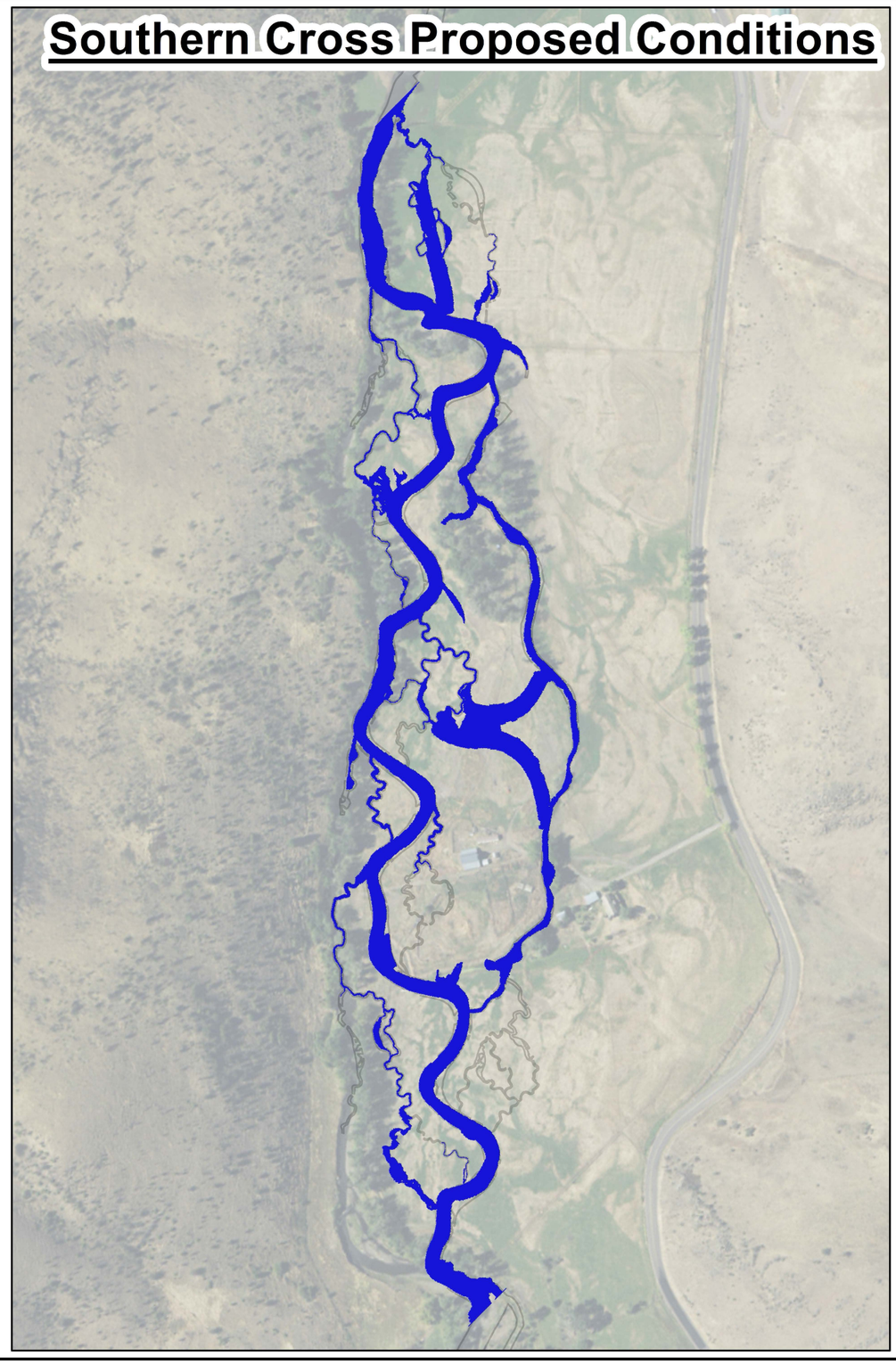


U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Existing Conditions



Southern Cross Proposed Conditions



Total Wetted Area at Q = 280 cfs

Date: 7/22/2016

Sedimentation and River Hydraulics Group

Legend

Depth > 0 ft

Channel

Data Source(s): USBR

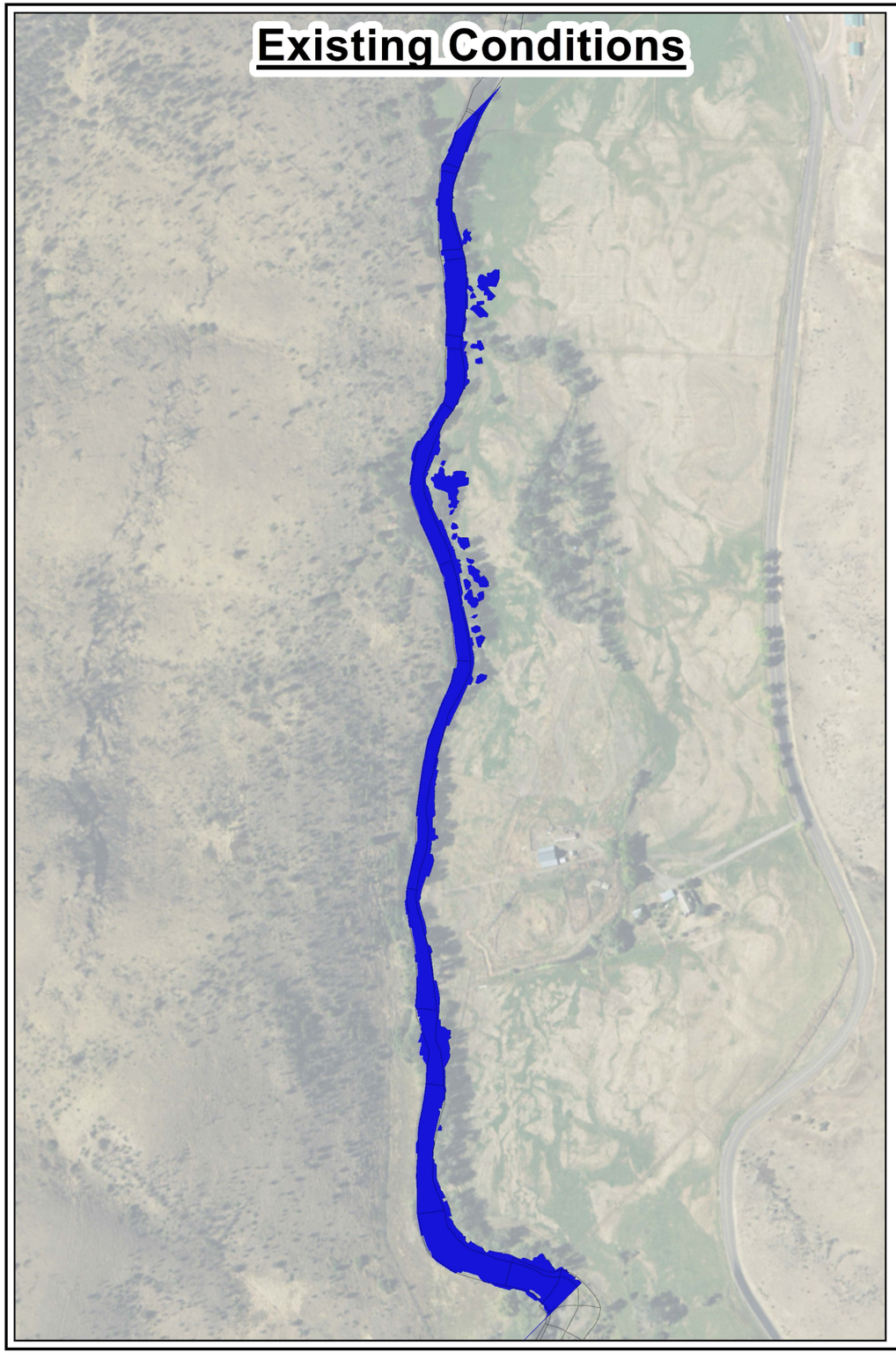
Scale: 1:5,000

0 0.04 0.08 0.16 Miles

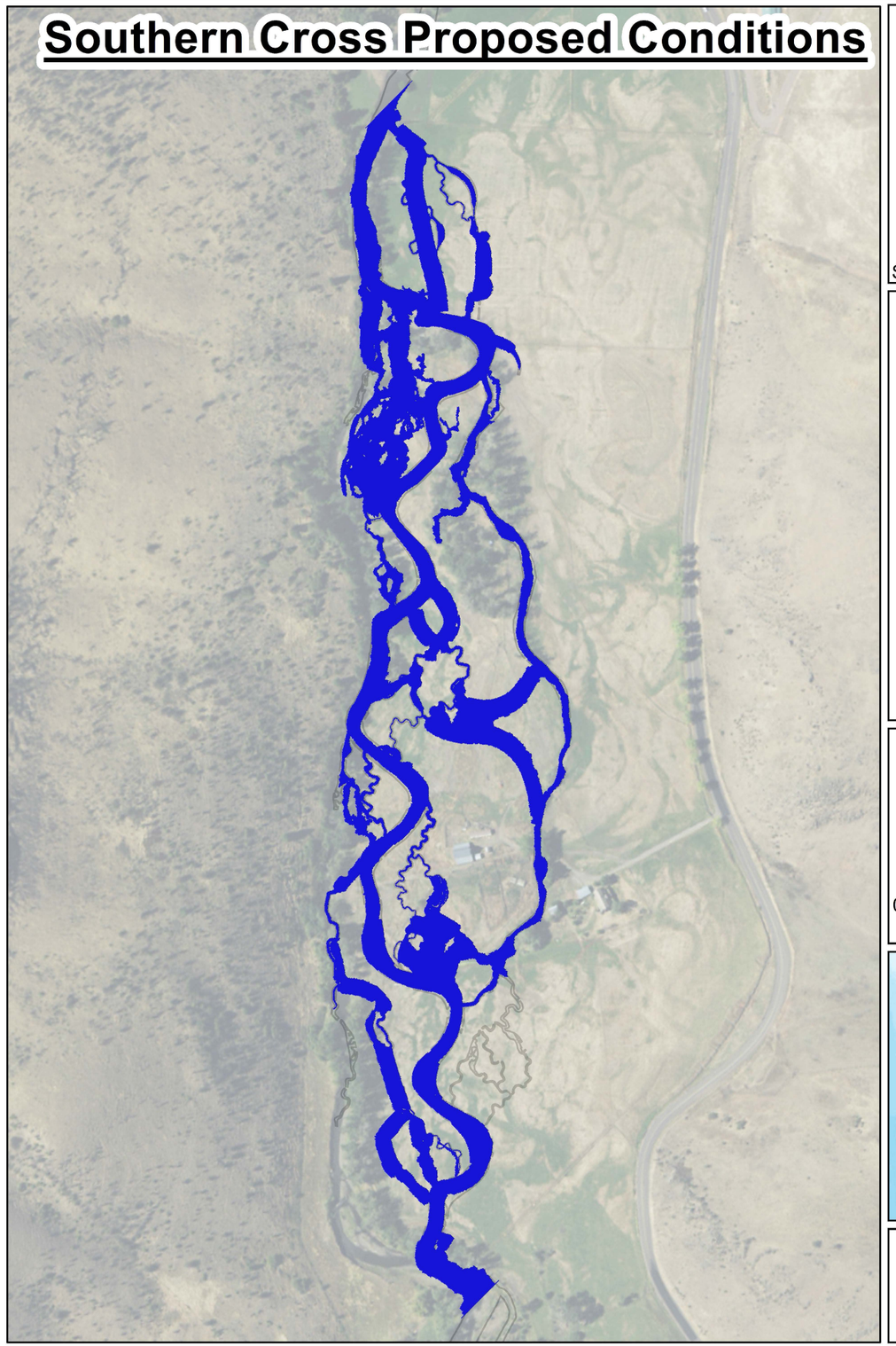


U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Existing Conditions



Southern Cross Proposed Conditions



Total Wetted Area at Q = 450 cfs

Date: 7/22/2016

Sedimentation and River Hydraulics Group

Legend

- Depth > 0 ft
- Channel

Data Source(s): USBR

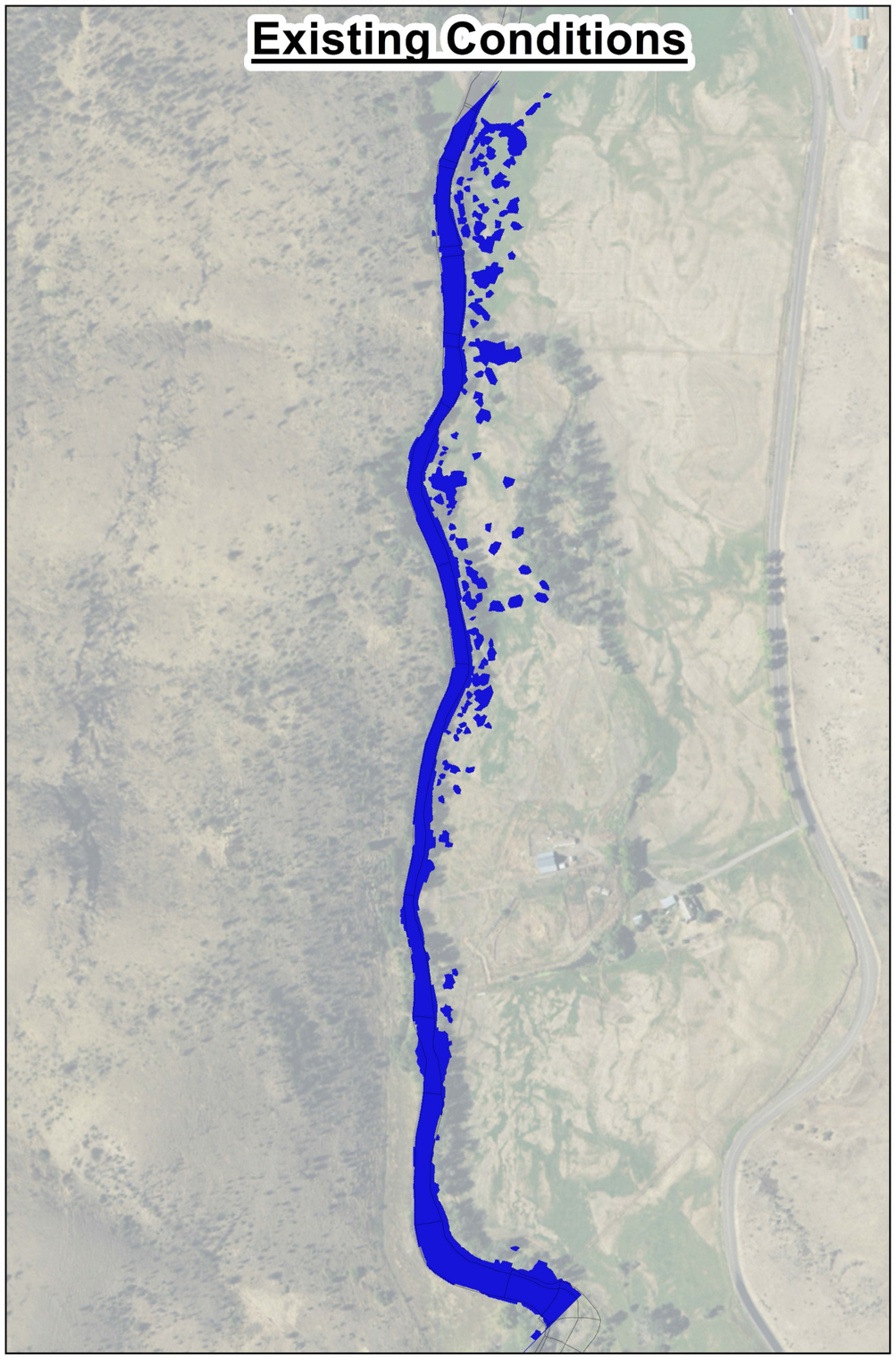
Scale: 1:5,000

0 0.04 0.08 0.16 Miles

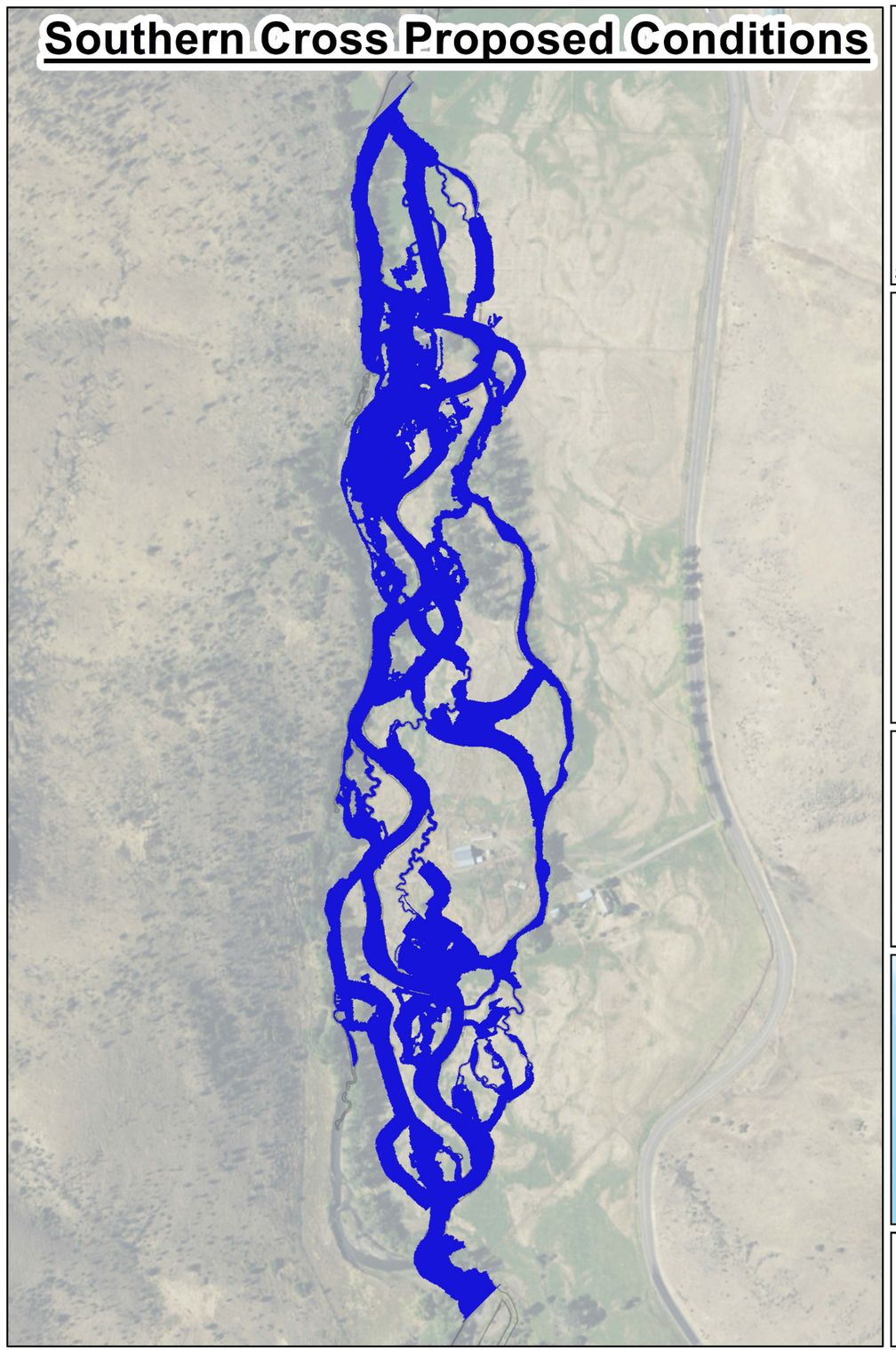


U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Existing Conditions



Southern Cross Proposed Conditions



Total Wetted Area at Q = 565 cfs

Date: 7/22/2016

Sedimentation and River Hydraulics Group

Legend

- Depth > 0 ft
- Channel

Data Source(s): USBR

Scale: 1:5,000

0 0.04 0.08 0.16 Miles



U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

APPENDIX F

PARCEL 3 PLANTING PLANS

Year 2 planting

Year 2 planting

Year 2 planting

Wet Crossing "A"

Flow Direction

Scale

0 200 Feet

CC44 Phase IV
Southern Cross Planting Map 1

- Zone 1-Point Bar Willows (.9 acres)
- Zone 2-Floodplain Forest (13.8 acres)
- Zone 3-Riffle Zone (1.2 acres)
- Zone 4-Upland Zone (1.2 acres)
- Zone 5-Floodplain Trees (41.75 acres)
- Zone 6-Willow Whips (4932 feet)
- Future Willow Stool Bed (.6 acres)
- Constructed Channel
- Low Flow Channel (95% Exceedance Interval)
- 1.25 Year Inundation

Planting Prescription

- Zone 1-Dig 4-5' trench or circular hole, plant willow cuttings at 4' variable width spacing.
- Zone 2-Plant containers at 8' variable width spacing. Over-excavate hole 4-6". Scalp soil approx. 1.5' diameter around hole and top dress with bark mulch 4"-6" deep.
- Zone 3-Plant containers at 8' variable width spacing. Over-excavate hole 4-6". Scalp soil approx. 1.5' diameter around hole and top dress with bark mulch 4"-6" deep.
- Zone 4- Plant containers at 8' variable width spacing. Over-excavate hole 4-6". Scalp soil approx. 1.5' diameter around hole and top dress with bark mulch 4"-6" deep.
- Zone 5- Plant live willows on the north and downstream side of floodplain trees at 5' variable width spacing.
- Zone 6- Willow whips: Auger live willow whips to the maximum depth possible using hand held chainsaw auger for whips planted within wood structures, plant 2'to 4' apart. Plant willow whips on south side of side channel 3' apart, on north side of side channel plant 6' apart.
- Prior to installation of containerized plants, cleanly prune any broken branches and scarify outer 1" of rootball. Cleanly prune broken, dead, or diseased roots.
- Broadcast seed/harrow all disturbed areas within construction zone with native seed/sedge mix.
- Backfill all containerized planting holes 4"-6" with bark mulch.

Species List

Zone 1-Coyote, Booth, and McKenzie willows. Live cuttings.

Zone 2-Black Hawthorn, Speckled Alder, Red Osier Dogwood, Black Cottonwood, Water Birch, Golden Currant, Rose, Elderberry, Snowberry, Mock Orange, Cascara, Chokecherry, Ninebark, Serviceberry. 1 gallon containers and cones.

Zone 3-Black Hawthorn, Speckled Alder, Red Osier Dogwood, Black Cottonwood, Water Birch. 1 gallon containers.

Zone 4-Ponderosa Pine, Ninebark, Snowberry. 1 gallon containers and cones.

Zone 5-Coyote, Booth, and McKenzie willows. Live cuttings.

Zone 6-Coyote, Booth, and McKenzie willows. Live cuttings.

Year 2 planting

Flow Direction

0 Scale 200 Feet

CC44 Phase IV
Southern Cross Planting Map 2

- Zone 1-Point Bar Willows (.9 acres)
- Zone 2-Floodplain Forest (13.8 acres)
- Zone 3-Riffle Zone (1.2 acres)
- Zone 4-Upland Zone (1.6 acres)
- Zone 5-Floodplain Trees (41.75 acres)
- Zone 6-Willow Whips (4932 feet)
- Future Willow Stool Bed (.6 acres)
- Constructed Channel
- Low Flow Channel (95% Exceedance Interval)
- 1.25 Year Inundation

Species List

Zone 1-Coyote, Booth, and McKenzie willows. Live cuttings.

Zone 2-Black Hawthorn, Speckled Alder, Red Osier Dogwood, Black Cottonwood, Water Birch, Golden Currant, Rose, Elderberry, Snowberry, Mock Orange, Cascara, Chokecherry, Ninebark, Serviceberry. 1 gallon containers and cones.

Zone 3-Black Hawthorn, Speckled Alder, Red Osier Dogwood, Black Cottonwood, Water Birch. 1 gallon containers.

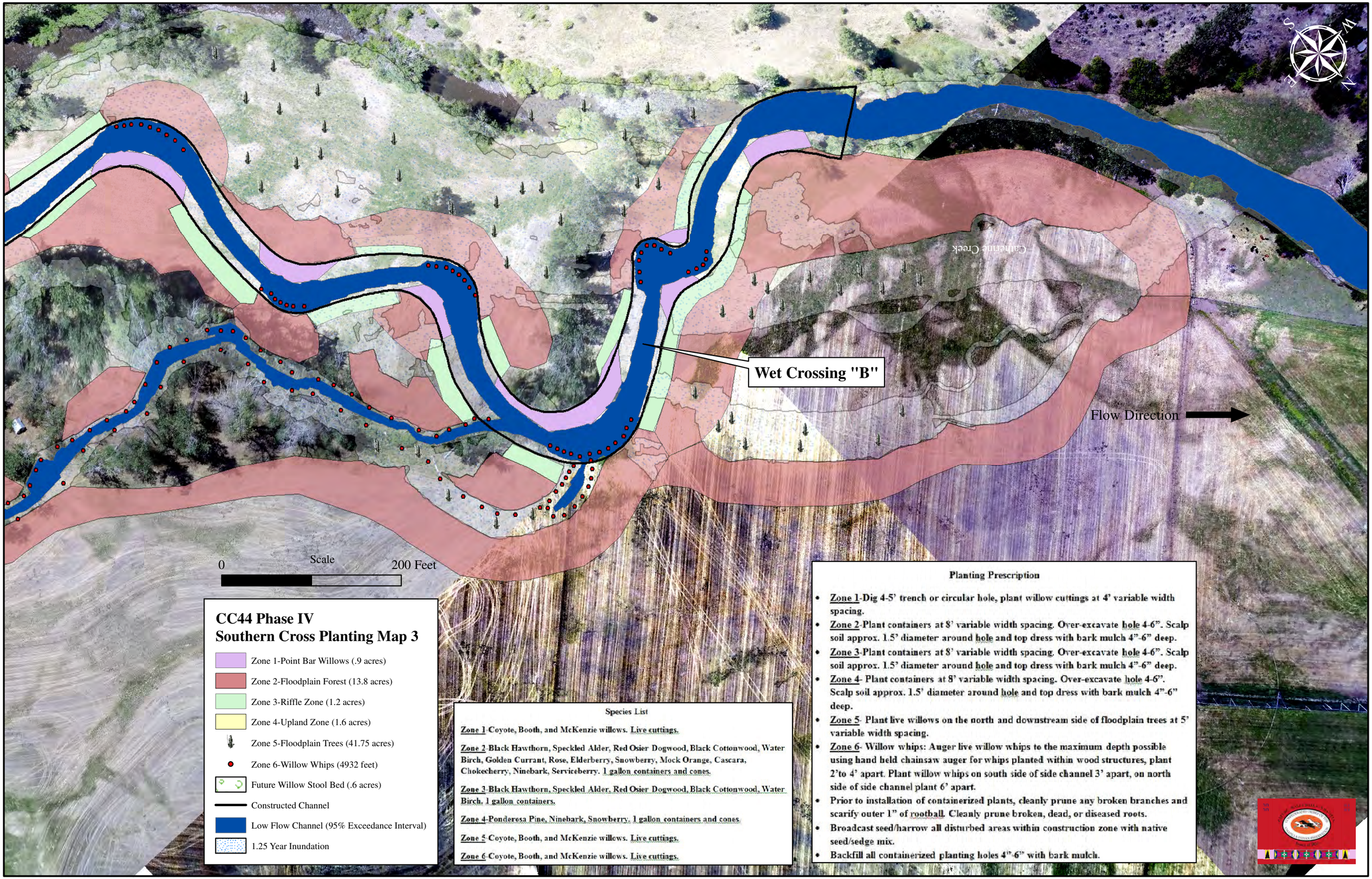
Zone 4-Ponderosa Pine, Ninebark, Snowberry. 1 gallon containers and cones.

Zone 5-Coyote, Booth, and McKenzie willows. Live cuttings.

Zone 6-Coyote, Booth, and McKenzie willows. Live cuttings.

Planting Prescription

- Zone 1-Dig 4-5' trench or circular hole, plant willow cuttings at 4' variable width spacing.
- Zone 2 Plant containers at 8' variable width spacing. Over-excavate hole 4-6". Scalp soil approx. 1.5' diameter around hole and top dress with bark mulch 4"-6" deep.
- Zone 3-Plant containers at 8' variable width spacing. Over-excavate hole 4-6". Scalp soil approx. 1.5' diameter around hole and top dress with bark mulch 4"-6" deep.
- Zone 4- Plant containers at 8' variable width spacing. Over-excavate hole 4-6". Scalp soil approx. 1.5' diameter around hole and top dress with bark mulch 4"-6" deep.
- Zone 5- Plant live willows on the north and downstream side of floodplain trees at 5' variable width spacing.
- Zone 6- Willow whips: Auger live willow whips to the maximum depth possible using hand held chainsaw auger for whips planted within wood structures, plant 2'to 4' apart. Plant willow whips on south side of side channel 3' apart, on north side of side channel plant 6' apart.
- Prior to installation of containerized plants, cleanly prune any broken branches and scarify outer 1" of rootball. Cleanly prune broken, dead, or diseased roots.
- Broadcast seed/harrow all disturbed areas within construction zone with native seed/sedge mix.
- Backfill all containerized planting holes 4"-6" with bark mulch.



CC44 Phase IV
Southern Cross Planting Map 3

- Zone 1-Point Bar Willows (.9 acres)
- Zone 2-Floodplain Forest (13.8 acres)
- Zone 3-Riffle Zone (1.2 acres)
- Zone 4-Upland Zone (1.6 acres)
- Zone 5-Floodplain Trees (41.75 acres)
- Zone 6-Willow Whips (4932 feet)
- Future Willow Stool Bed (.6 acres)
- Constructed Channel
- Low Flow Channel (95% Exceedance Interval)
- 1.25 Year Inundation

Species List

Zone 1-Coyote, Booth, and McKenzie willows. Live cuttings.

Zone 2-Black Hawthorn, Speckled Alder, Red Osier Dogwood, Black Cottonwood, Water Birch, Golden Currant, Rose, Elderberry, Snowberry, Mock Orange, Cascara, Chokecherry, Ninebark, Serviceberry. 1 gallon containers and cones.

Zone 3-Black Hawthorn, Speckled Alder, Red Osier Dogwood, Black Cottonwood, Water Birch. 1 gallon containers.

Zone 4-Ponderosa Pine, Ninebark, Snowberry. 1 gallon containers and cones.

Zone 5-Coyote, Booth, and McKenzie willows. Live cuttings.

Zone 6-Coyote, Booth, and McKenzie willows. Live cuttings.

Planting Prescription

- Zone 1-Dig 4-5' trench or circular hole, plant willow cuttings at 4' variable width spacing.
- Zone 2-Plant containers at 8' variable width spacing. Over-excavate hole 4-6". Scalp soil approx. 1.5' diameter around hole and top dress with bark mulch 4"-6" deep.
- Zone 3-Plant containers at 8' variable width spacing. Over-excavate hole 4-6". Scalp soil approx. 1.5' diameter around hole and top dress with bark mulch 4"-6" deep.
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- Prior to installation of containerized plants, cleanly prune any broken branches and scarify outer 1" of rootball. Cleanly prune broken, dead, or diseased roots.
- Broadcast seed/harrow all disturbed areas within construction zone with native seed/sedge mix.
- Backfill all containerized planting holes 4"-6" with bark mulch.

APPENDIX G

PARCELS 1 AND 2 FINAL DESIGN PLANS

GRANDE RONDE SUBBASIN FISH HABITAT RESTORATION

CATHERINE CREEK CC-44 PHASE IV HABITAT ENHANCEMENT PLANS - PARCELS 1 & 2

CONSTRUCTION DRAWINGS

PREPARED FOR:
UNION SOIL AND WATER CONSERVATION DISTRICT
KATE FRENYEA
10507 N. MCALISTER RD., ROOM 7
LA GRANDE, OR 97850
PH: 541-963-1313
EMAIL: KFRENYEA@UNIONSWCD.ORG

PREPARED BY:
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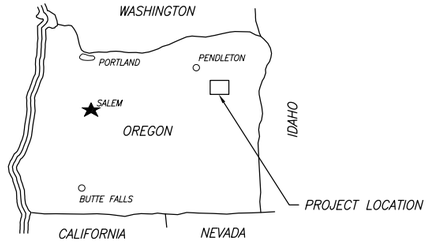
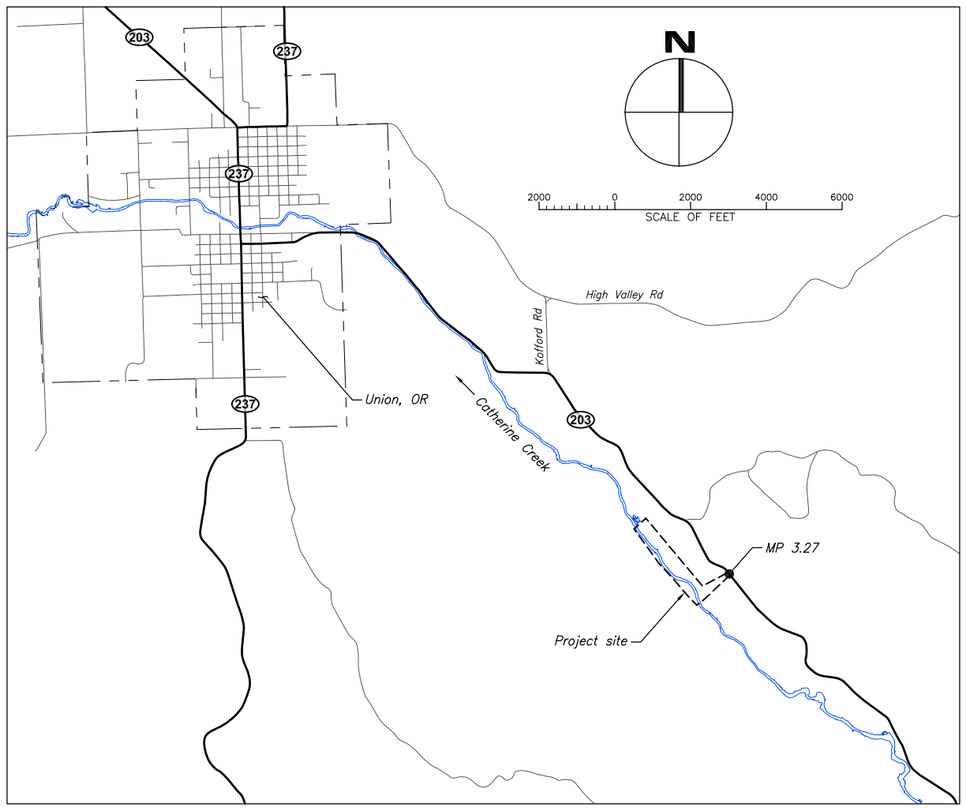
MARTIN FISHER, PE
711 CAPITOL WAY S, SUITE 650
OLYMPIA, WA 98501
PH: 360-357-4684
EMAIL: MARTIN.FISHER@ICFI.COM

PARTNERS:
OREGON DEPARTMENT OF FISH AND WILDLIFE
CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION
BONNEVILLE POWER ADMINISTRATION
US DEPARTMENT OF THE INTERIOR – BUREAU OF RECLAMATION
GRANDE RONDE MODEL WATERSHED



SITE SUMMARY
T4S, R40E, SEC.34
UNION COUNTY, OR
45°10'10.22"N 117°47'58.49"W



VICINITY MAP

SHEET INDEX		
Sheet Number	Drawing Number	Sheet Title
GENERAL		
1	1678-100-2321	Cover Sheet
2	1678-100-2322	General Notes & Quantities
ACCESS & STAGING		
3	1678-100-2323	Access & Staging Plan
DEWATERING PLAN		
4	1678-100-2324	Dewatering Plan
5	1678-100-2325	Dewatering Plan
GRADING DETAILS		
6	1678-100-2326	Side Channel Plan & Profile
7	1678-100-2327	Side Channel Cross-Sections & Livestock Crossing Details
8	1678-100-2328	Right Bank Fill
9	1678-100-2329	Alcove Excavation
10	1678-100-2330	Alcove Inlet Fill Placement
LWM PLAN		
11	1678-100-2331	LWM Plan
12	1678-100-2332	LWM Plan
13	1678-100-2333	LWM Plan
LWM DETAILS		
14	1678-100-2334	Type A Habitat Structure
15	1678-100-2335	Type A Habitat Structure
16	1678-100-2336	Type B Habitat Structure
17	1678-100-2337	Type C Habitat Structure
18	1678-100-2338	Type C Habitat Structure
19	1678-100-2339	Type D Habitat Structure
20	1678-100-2340	Type E Habitat Structure
21	1678-100-2341	Type E Habitat Structure
22	1678-100-2342	Type F Habitat Structure
23	1678-100-2343	Type F Habitat Structure
24	1678-100-2344	60' Full Tree Details
25	1678-100-2345	Edge Roughness & Willow Trench Details

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
EXPIRES: 12/31/2017

RECLAMATION
Managing Water in the West

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U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLUMBIA/SNAKE SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE IV HABITAT ENHANCEMENT
PARCELS 1 & 2

N. TRUSCOTT
DRAWN

X
ACCEPTED

BOISE, ID 2016-04-01

COVER SHEET

1678-100-2321

SHEET 1 OF 2

DATE AND TIME PLOTTED
4/1/2016 11:32 AM
PLOTTED BY
Truscott, Nic

CAD SYSTEM
AUTOCAD Civil 3D 2014
CAD FILENAME
CC44_PCL_1_2_Front.dwg

GENERAL NOTES:

1. Work shown on these Drawings will be performed for the Union Soil and Water Conservation District (USWCD), herein referred to as "Contracting Agency." Contact information for Contracting Agency's representative is included on Dwg. 1678-100-2321. Contracting Agency's representative (or other persons assigned by Contracting Agency to act as Contracting Agency's representative) are herein referred to as the "Contracting Officer."
2. The Drawings contained within should not be applied to any project except the one specified; specifically the habitat enhancements on Catherine Creek within the project boundary for CC-44 PHASE IV – Parcels 1 & 2 as seen on the cover sheet.
3. Elevations and distances shown are in feet and decimals.
4. Horizontal datum is US State Plane Coordinate System, Oregon North Zone, NAD 83, International Feet. The vertical datum is NAVD 88, feet.
5. Topographic mapping within streambanks of the project area is based on surveys performed with ground survey equipment. Topographic mapping outside of the streambanks is based on LiDAR imaging. Due to continued erosion of the streambank the geometry of the stream banks at the time of construction could be different than shown on these Drawings.
6. Existing underground utility locations have not been completely identified and may not be shown on these plans. The Contractor is responsible to locate utilities prior to construction and protect utilities during construction. The telephone number for the one call center for utility locates is 1-800-332-2344 or 811.
7. The Contractor shall pursue work in a continuous and diligent manner to ensure a timely completion of the project.
8. The Contractor shall be responsible for the general safety during construction, and all work shall conform to pertinent safety regulations and codes. The Contractor shall be solely and completely responsible for compliance with all applicable provisions of OSHA and OAR Chapter 437, in the construction practices for all employees directly engaged in the construction of this project.
9. All material and workmanship furnished on or for the project must meet the minimum requirements of project permits, approving agencies, specifications as set forth herein, or whichever is more restrictive.
10. Contractor shall be responsible for obtaining, at Contractor's expense, all construction permits as required by local, state, and federal agencies. Contractor shall provide all material, labor, and equipment required to comply with all applicable permit conditions and requirements.
11. Contractor shall confirm the access point, route(s), and locations of temporary staging areas with the Contracting Officer prior to transporting materials and equipment to the project site.
12. Prior to commencement of work, Contractor shall provide the Contracting Agency with a detailed construction schedule and work plan for approval. The Contractor shall not begin any construction work until the project schedule and work plan are approved by the Contracting Officer.
13. All construction shall be coordinated with the Contracting Officer so that the quality of work can be checked for approval.
14. All work within the actively flowing channel or side channels of Catherine Creek shall occur within the allowable in-water work window (July 1 – August 15).
15. The Contractor shall notify the Contracting Officer a minimum of 5 working days in advance of cofferdam construction to coordinate fish removal. The Contracting Agency will be responsible for all fish removal and handling.
16. Fish exclusion shall be conducted in this project area prior to any dewatering activities or construction within or directly connected to the channel.
17. The Contractor shall install and maintain appropriate sediment control devices throughout the entire project site. Temporary construction and permanent erosion control measures shall be designed, constructed, and maintained in accordance with all applicable local, state, and federal regulations.
18. Dewatering of work areas shall be performed to the the extent that at LWM structures standing water is no deeper than the diameter of the log(s) on the lowest layer of the structure. Discharge from dewatering within the work area shall be routed to floodplain areas or other drainages that do not flow directly back to Catherine Creek to allow the removal of fine sediments or other contaminant prior to reentering Catherine Creek. All pumps used for dewatering of areas in or directly connected to the active channel shall have screened intakes that meet Oregon Department of Fish and Wildlife specifications and National Oceanic and Atmospheric Administration juvenile fish screening criteria.
19. Construction shall avoid disturbance to existing riparian vegetation unless shown on these Drawings or approved by the Contracting Officer.
20. The Engineers responsible for the preparation of these Drawings and Specifications will not be responsible for, or liable for, unauthorized changes to, or use of, these Drawings. All changes to constructed features that vary from the Drawings and Specifications must be in writing and approved by the Engineer responsible for the preparations of the Drawings and Specifications.
21. Record Drawings (As-Built Drawings) shall be accurately recorded by the Contractor for future use, reference, and monitoring. The Contractor shall be responsible to accurately record any alterations from the Drawings with red pen on a set of hand marked record drawings. Submittal of Record Drawings is a condition of final acceptance.

SUMMARY OF QUANTITIES

BID ITEM	QUANTITY	UNIT	DESCRIPTION
1	Lump Sum	LS	Mobilization
2	Lump Sum	LS	Environmental Controls (SWPPP, ESC, Etc.)
3	Lump Sum	LS	Unimproved Access Roads
4	50	SY	Access Road Stabilization
5	2	EA	Temporary HDPE Culvert
6	Lump Sum	LS	Temporary Bridge Crossing
7	Lump Sum	LS	Cofferdams
8	Lump Sum	LS	Dewatering
9	1,400	CY	Channel Excavation
10	160	CY	Fill Placement – Shown on Plans
11	1,240	CY	Fill Placement – Directed by Contracting Officer
12	20	CY	Side Channel Inlet Scour Protection
13	4	EA	Type A LWM Structure
14	1	EA	Type B LWM Structure
15	1	EA	Type C LWM Structure
16	3	EA	Type D LWM Structure
17	1	EA	Type E LWM Structure
18	3	EA	Type F LWM Structure
19	54	EA	20' Long, 12" DBH Log with Rootwad
20	7	EA	30' Long, 18" DBH Log with Rootwad
21	33	EA	25' Tree Top
22	3	EA	40' Full Tree
23	2	EA	60' Full Tree
24	60	CY	Slash Material
25	25	EA	Large Racking Material
26	50	EA	Small Racking Material
27	33	EA	Boulder
28	165	LF	Edge Roughness
29	230	LF	Willow Trench
30	1	EA	Stabilized Livestock Crossing
31	0.90	ACRE	Access Road Seeding
32	1.8	TON	Straw Mulch
33	Lump Sum	LS	Site Cleanup and Repair
34	20	HOURS	Backhoe (Full Size)
35	20	HOURS	Trackhoe (200 Series)
36	40	HOURS	Equipment and Personnel for Fence Removal
37	20	HOURS	Dump Truck (Off-Road)

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
EXPIRES: 12/31/2017

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GRANDE RONDE SUBBASIN

CC-44 PHASE IV HABITAT ENHANCEMENT
PARCELS 1 & 2

N. TRUSCOTT
DRAWN

X
ACCEPTED

BOISE, ID 2016-04-01

GENERAL NOTES & QUANTITIES

1678-100-2322

SHEET 2 OF 2

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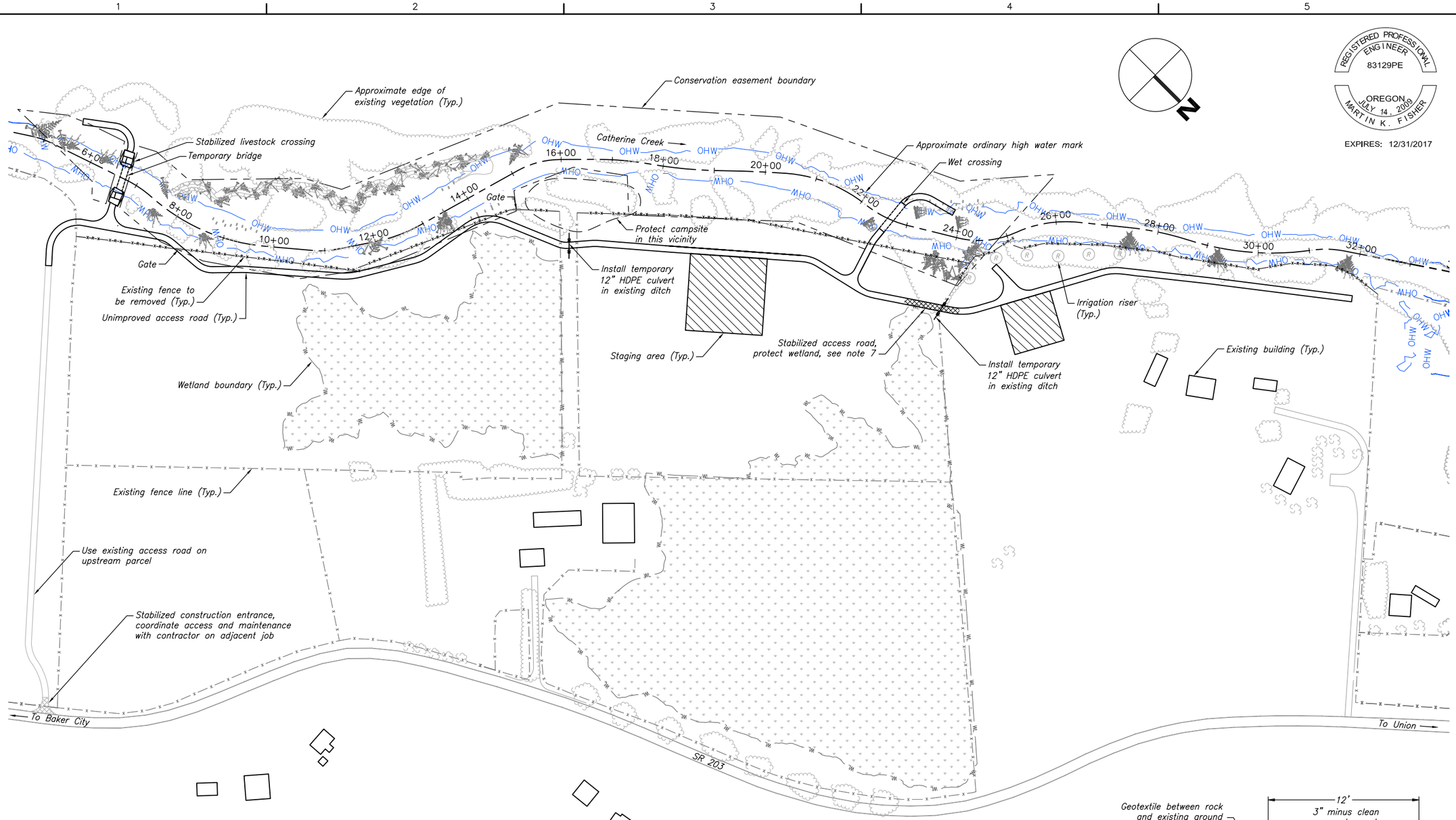

ACCESS & STAGING PLAN

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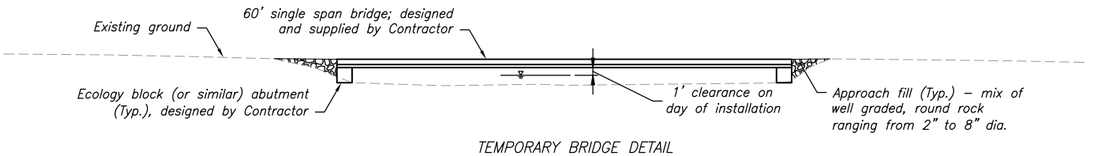
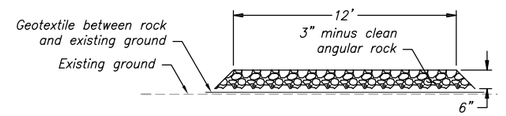
SCALE OF FEET



TEMPORARY BRIDGE DETAIL



STABILIZED ACCESS ROAD DETAIL

NOTES:

1. The Contracting Officer may adjust access road locations from the locations shown here based on field conditions, landowner input, or other restrictions.
2. The Contractor shall supply a structurally sound 60' single span bridge to access the left bank of the creek. Contractor shall submit a bridge installation plan and shop drawings for review and approval by the Contracting Officer prior to mobilization to the site.
3. Flows in Catherine Creek shall be 150 cubic feet per second (CFS) or less when installing the temporary bridge.
4. The Contractor shall construct the stabilized livestock crossing after removal of the temporary bridge.
5. The Contractor will be required to establish access roads through existing fence lines in several locations. When an access road must cross an existing fence line the Contractor shall temporarily remove fencing for access and restore the fence line to existing or better condition upon completion.
6. Fence locations shown on this sheet are approximate. Access points through fences shall be flagged by the Contractor and approved by the Contracting Officer who will verify locations with the property owners.
7. The exact location of unimproved access roads shall be staked by the Contractor for review and approval by the Contracting Officer prior to use; if necessary, adjustments will be made to avoid damage to existing vegetation and wetlands. While every effort will be made to minimize establishment of access roads through wet areas, this may be unavaoidable in some areas. When an access road must pass through wet or sensitive areas, the Contractor shall construct a stabilized access road for the portion of the road passing through the sensitive or wet area. All stabilized access roads shall be fully removed upon completion of the project.

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CC-44 PHASE IV HABITAT ENHANCEMENT
PARCELS 1 & 2

N. TRUSCOTT
DRAWN

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BOISE, ID 2016-04-01

ACCESS & STAGING PLAN

1678-100-2323

SHEET 1 OF 1

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Truscott, Nic

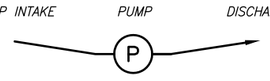
CAD SYSTEM
AUTOCAD Civil 3D 2014
CAD FILENAME
CC44_PCL_1_2_Access_Staging.dwg

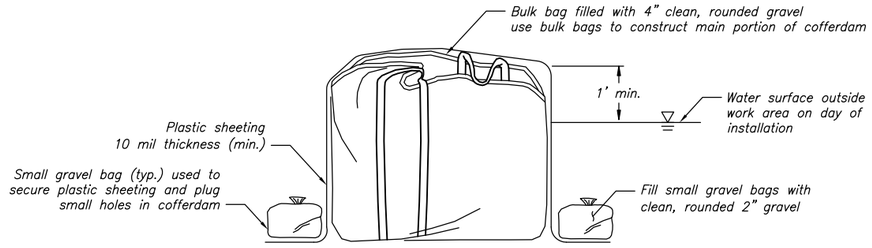


Match Line see Dwg. -2325

PUMP NOTES:

1. Pump intakes shall be screened for fish protection per ODFW requirements.
2. Water pumped from inside cofferdams shall not be discharged directly to flowing surface waters or wetlands.





DEWATERING PLAN – STA. 3+50 TO 18+00

50 0 50 100 150
SCALE OF FEET

DEWATERING NOTES:

1. Cofferdams shall be used to isolate work areas from the actively flowing channel and for dewatering groundwater in work areas.
2. The Contractor shall submit a Dewatering Plan for review and approval by the Contracting Officer a minimum of 10 working days prior to beginning work.
3. Cofferdams may be constructed as shown on these drawings. Alternative methods of cofferdam construction are allowable if they provide similar or better performance than the method shown here, and if approved by the Contracting Officer.

REGISTERED PROFESSIONAL ENGINEER
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EXPIRES: 12/31/2017

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GRANDE RONDE SUBBASIN

CC-44 PHASE IV HABITAT ENHANCEMENT
PARCELS 1 & 2

N. TRUSCOTT
DRAWN

X
ACCEPTED

BOISE, ID 2016-04-01

DEWATERING PLAN

STA. 3+50 TO 18+00

1678-100-2324

SHEET 1 OF 2

DATE AND TIME PLOTTED
4/1/2016 11:34 AM
PLOTTED BY
Truscott, Nic

CAD SYSTEM
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CAD FILENAME
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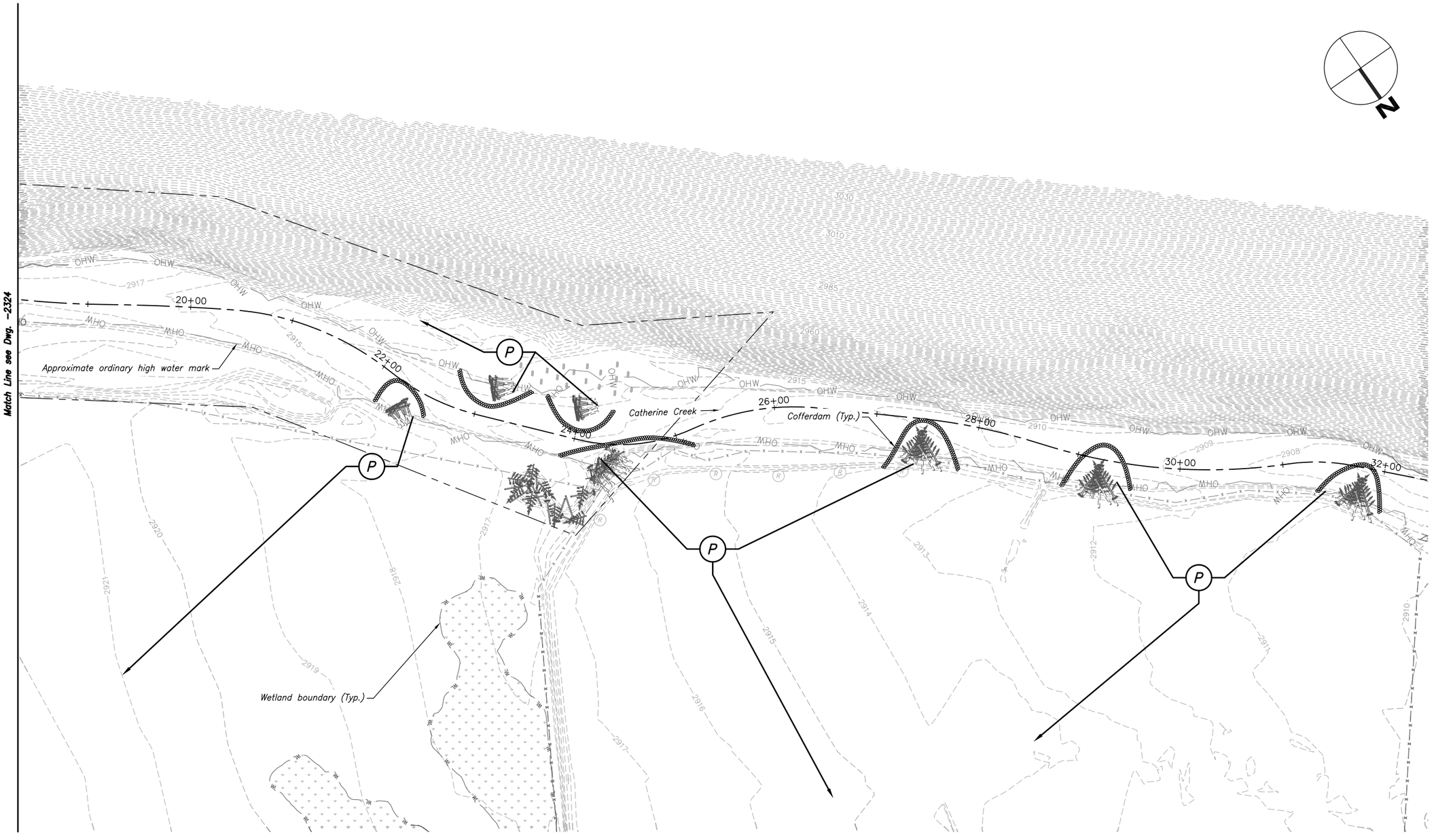

PUMP NOTES:

1. Pump intakes shall be screened for fish protection per ODFW requirements.
2. Water pumped from inside cofferdams shall not be discharged directly to flowing surface waters or wetlands.

PUMP INTAKE — PUMP (P) — DISCHARGE

REGISTERED PROFESSIONAL ENGINEER
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MARTIN K. FISHER

EXPIRES: 12/31/2017

DEWATERING PLAN – STA. 18+00 TO 32+00

50 0 50 100 150
SCALE OF FEET

DEWATERING NOTES:

1. Cofferdams shall be used to isolate work areas from the actively flowing channel and for dewatering groundwater in work areas.
2. The Contractor shall submit a Dewatering Plan for review and approval by the Contracting Officer a minimum of 10 working days prior to beginning work.
3. Cofferdams may be constructed as shown on these drawings. Alternative methods of cofferdam construction are allowable if they provide similar or better performance than the method shown here, and if approved by the Contracting Officer.

DATE AND TIME PLOTTED
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CAD SYSTEM
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CC44_PCL_1_2_Dewatering.dwg

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CC-44 PHASE IV HABITAT ENHANCEMENT
PARCELS 1 & 2

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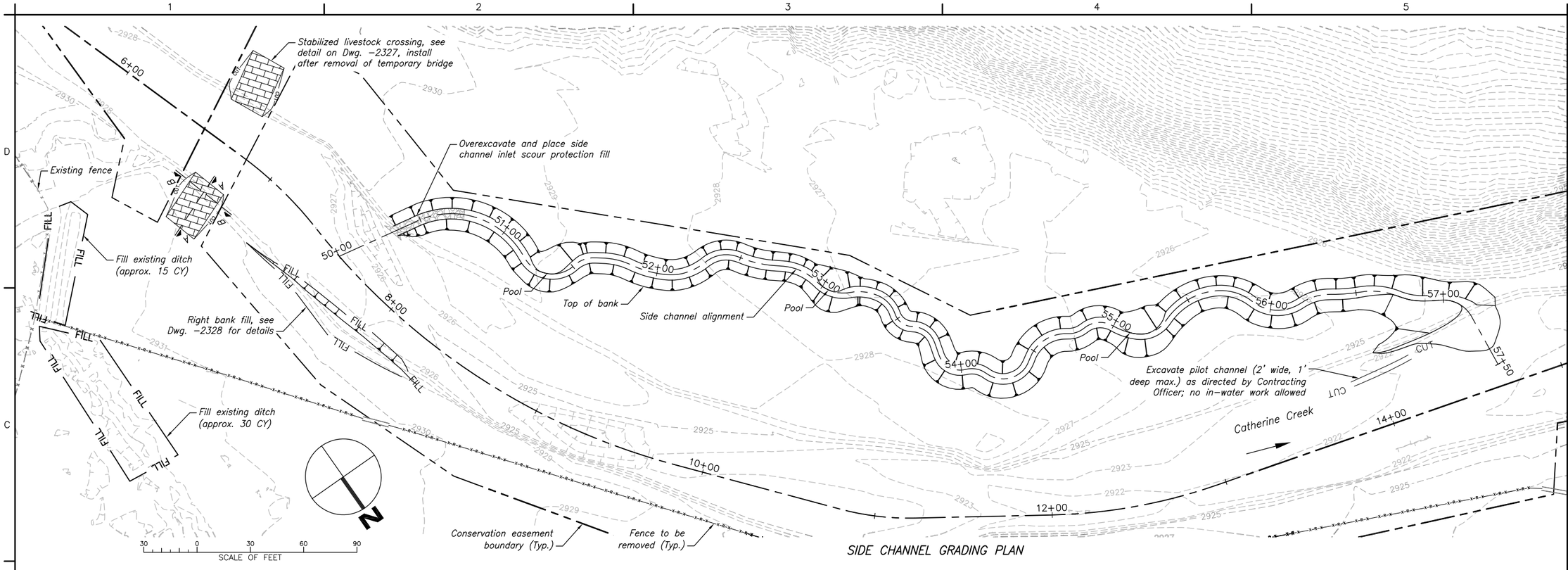
BOISE, ID 2016-04-01

DEWATERING PLAN

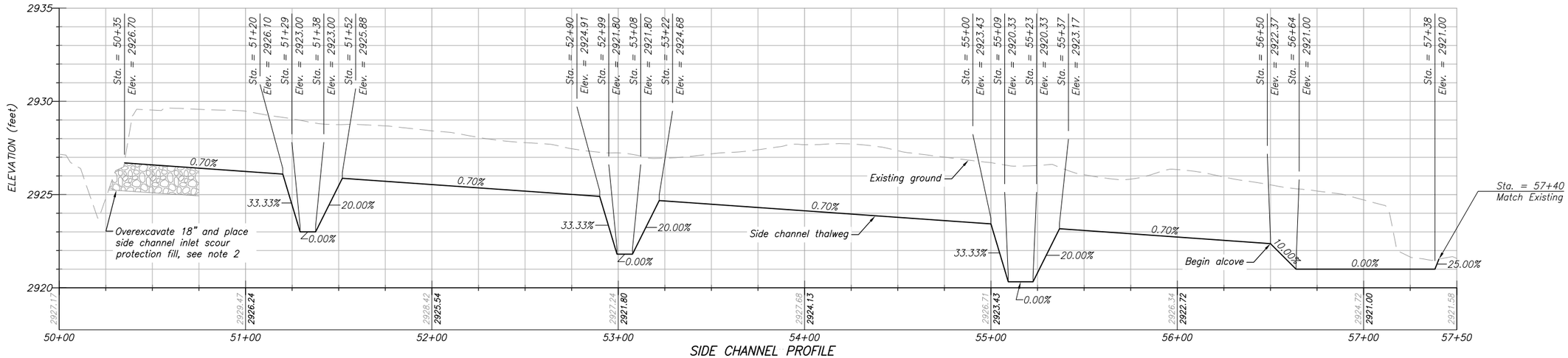
STA. 18+00 TO 32+00

1678-100-2325

SHEET 2 OF 2



SIDE CHANNEL GRADING PLAN



SIDE CHANNEL PROFILE

NOTES:

1. Due to the time that has passed since the topographic survey was performed, there will be some locations where the ground topography on the day of construction will not match the topography shown on this sheet. The Contracting Officer will coordinate with the Contractor to make slight adjustments to the location and/or layout to accommodate changes to the topography.
2. Side channel inlet scour protection fill shall be placed and compacted in a single lift. Side channel inlet scour protection fill shall have the following gradation:

Diameter	Percent passing
12"	100
8"	80–90
3"	40–60
¼"	5–20
Fines	10 max.

REGISTERED PROFESSIONAL ENGINEER
83129PE
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JULY 14, 2009
MARTIN K. FISHER

EXPIRES: 12/31/2017

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CC–44 PHASE IV HABITAT ENHANCEMENT
PARCELS 1 & 2

N. TRUSCOTT
DRAWN

X
ACCEPTED

BOISE, ID 2016–04–01

GRADING DETAILS

SIDE CHANNEL PLAN & PROFILE

1678–100–2326

SHEET 1 OF 5

DATE AND TIME PLOTTED
April 1, 2016 11:46
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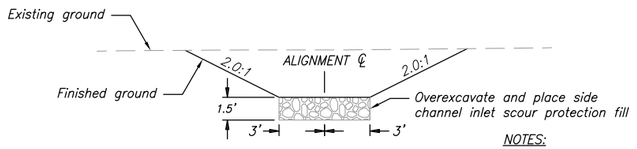
TRUSCOTT, NIC

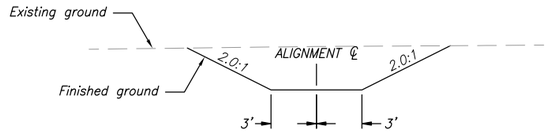
CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_PCL_1_2_GP.dwg



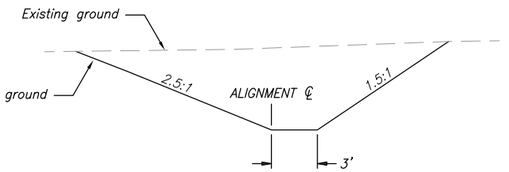
Side Channel Inlet Typical Section
Sta. 50+35 to 50+75

NOTES:
1. Side channel inlet scour protection fill shall be placed and compacted in a single lift. Side channel inlet scour protection fill shall have the following gradation:

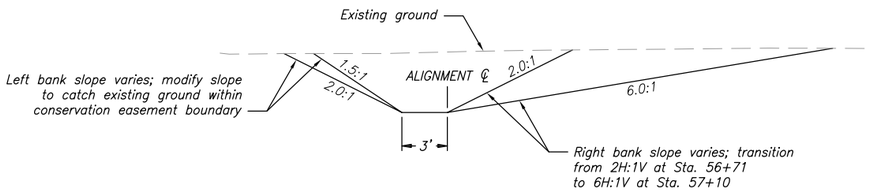
Diameter	Percent passing
12"	100
8"	80–90
3"	40–60
¼"	5–20
Fines	10 max.



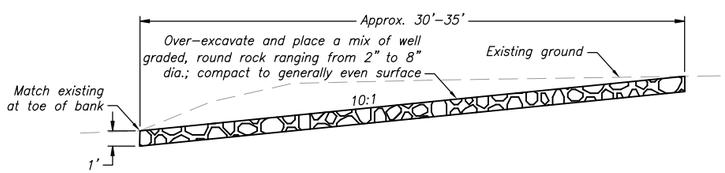
Side Channel Typical Section
Sta. 50+75 to 51+20
Sta. 51+52 to 52+90
Sta. 53+22 to 55+00
Sta. 55+37 to 56+50



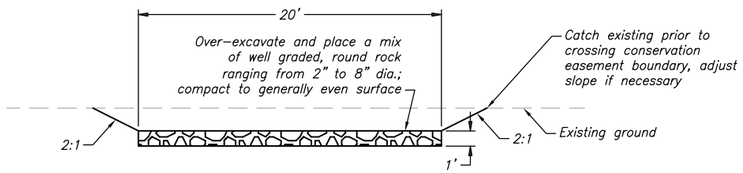
Side Channel Pool Typical Section
Sta. 51+29 to 51+38
Sta. 52+99 to 53+08
Sta. 55+09 to 55+23



Side Channel Alcove Variable Section
Sta. 56+64 to 57+10



STABILIZED LIVESTOCK CROSSING SECTION A



STABILIZED LIVESTOCK CROSSING SECTION B

SIDE CHANNEL CROSS–SECTIONS & LIVESTOCK CROSSING DETAILS

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
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GRANDE RONDE SUBBASIN

CC–44 PHASE IV HABITAT ENHANCEMENT
PARCELS 1 & 2

M. FISHER
DRAWN

X
ACCEPTED

BOISE, ID 2016–04–01

GRADING DETAILS

SIDE CHANNEL CROSS–SECTIONS & LIVESTOCK CROSSING DETAILS

1678–100–2327

SHEET 2 OF 5

DATE AND TIME PLOTTED
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Truscott, Nic

CAD SYSTEM
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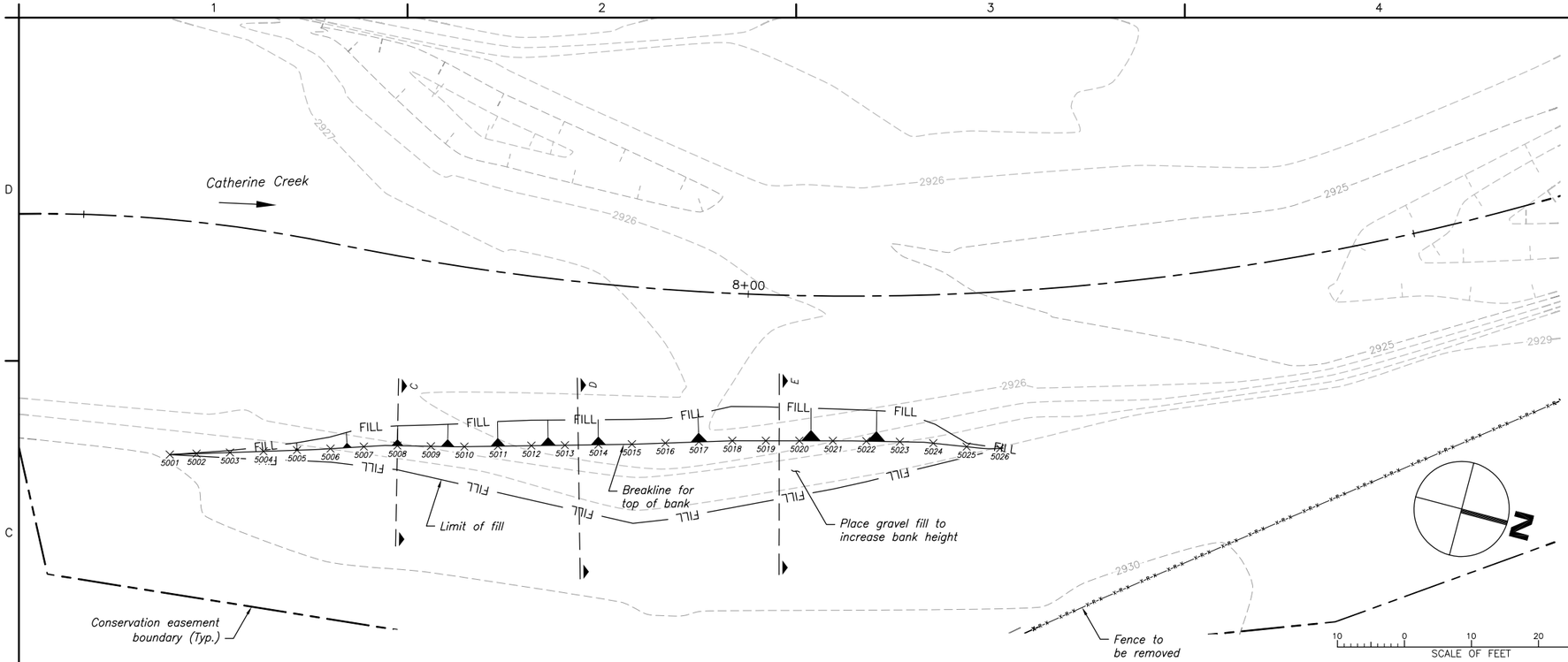

Breakline Points			
Point #	Northing	Easting	Elevation
5001	563,888.16	8,893,001.23	2929.96
5002	563,891.99	8,893,000.07	2929.89
5003	563,896.77	8,892,998.62	2929.81
5004	563,901.56	8,892,997.18	2929.73
5005	563,906.35	8,892,995.73	2929.64
5006	563,911.12	8,892,994.23	2929.55
5007	563,915.87	8,892,992.67	2929.46
5008	563,920.66	8,892,991.25	2929.38
5009	563,925.51	8,892,990.06	2929.36
5010	563,930.36	8,892,988.83	2929.34
5011	563,935.18	8,892,987.48	2929.32
5012	563,939.99	8,892,986.13	2929.31
5013	563,944.80	8,892,984.78	2929.29
5014	563,949.62	8,892,983.44	2929.27
5015	563,954.43	8,892,982.09	2929.25
5016	563,959.22	8,892,980.64	2929.24
5017	563,964.01	8,892,979.20	2929.22
5018	563,968.79	8,892,977.75	2929.20
5019	563,973.63	8,892,976.48	2929.19
5020	563,978.46	8,892,975.20	2929.17
5021	563,983.30	8,892,973.93	2929.15
5022	563,988.14	8,892,972.69	2929.13
5023	563,993.00	8,892,971.51	2929.12
5024	563,997.88	8,892,970.44	2929.10
5025	564,002.82	8,892,969.67	2929.08
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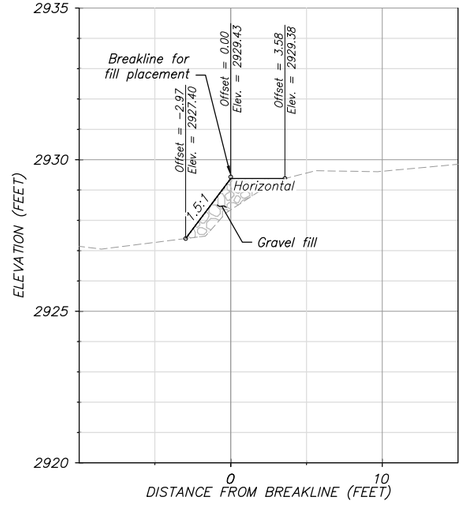
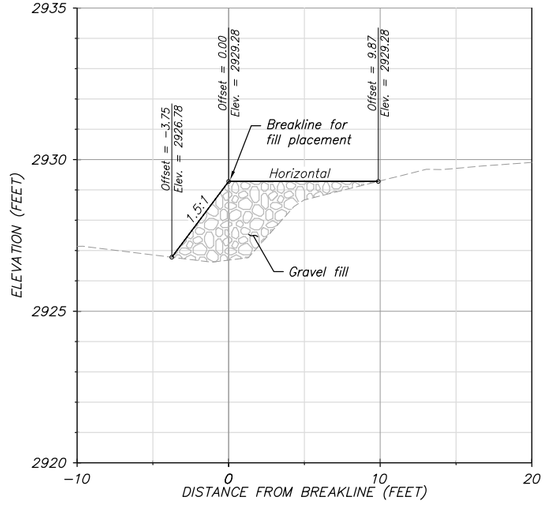
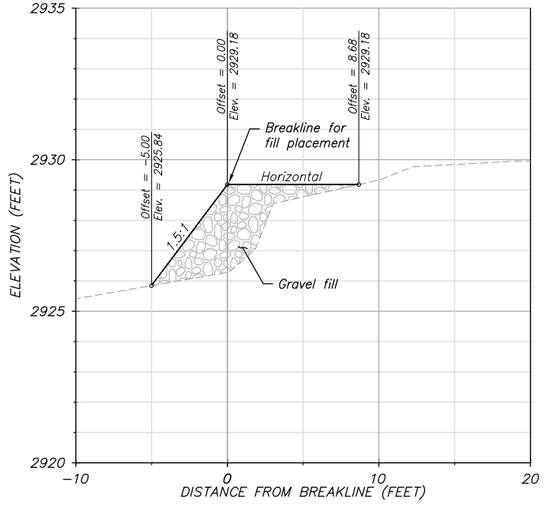


SECTION C



SECTION D



SECTION E

NOTES:

1. Due to the time that has passed since the topographic survey was performed, there will be some locations where the ground topography on the day of construction will not match the topography shown on this sheet. The Contracting Officer will coordinate with the Contractor to make slight adjustments to the earthwork to accommodate changes to the topography.
2. Contractor shall use the points on this sheet to stakeout the loction of the breakline at the finished top of bank. Fill from the breakline to the existing bank shall be placed and compacted in lifts of no more than 12". Finished ground shall be horizontal from the breakline to the point where fill catches existing ground.
3. Gravel fill shall come from material excavated on-site and shall be a mix of fines, sand, gravel, and cobble material. If native material does not meet this description, the Contractor shall sort excavated material into stockpiles of small cobble and gravel, and sands/fines, then mix at approximately a 1:1 ratio to achieve a suitable mix for gravel fill. The Contracting Officer will determine if native material is suitable and therefore if sorting, stockpiling, and mixing is required.

GRADING DETAILS – RIGHT BANK FILL

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER

EXPIRES: 12/31/2017

RECLAMATION
Managing Water in the West

ICF INTERNATIONAL

Union Soil and Water Conservation District

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE IV HABITAT ENHANCEMENT
PARCELS 1 & 2

M. FISHER
DRAWN

X
ACCEPTED

BOISE, ID 2016-04-01

GRADING DETAILS

RIGHT BANK FILL

1678-100-2328

SHEET 3 OF 5

DATE AND TIME PLOTTED
4/7/2016 11:57 AM
PLOTTED BY
Truscott, Nic

CAD SYSTEM
AUTOCAD Civil 3D 2014
CAD FILENAME
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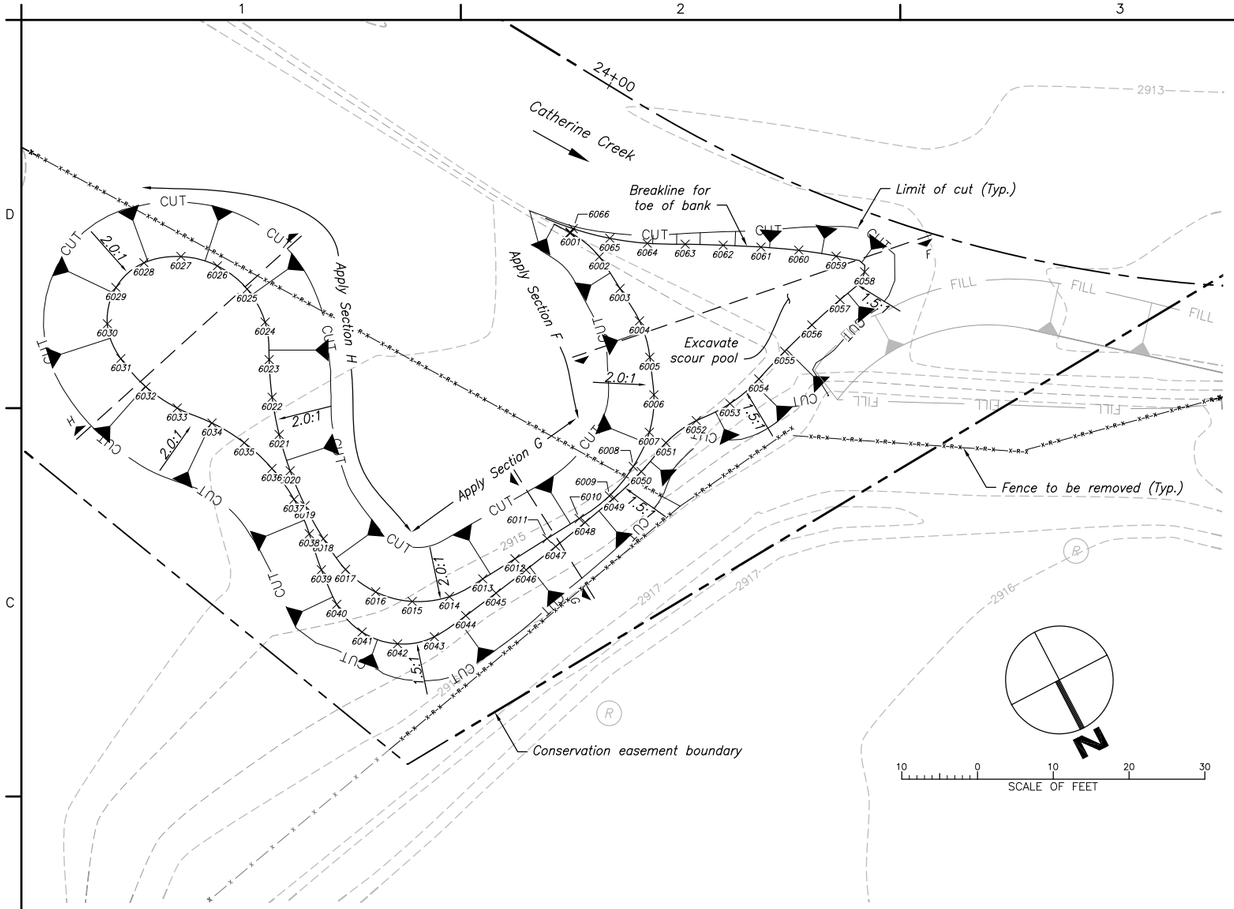
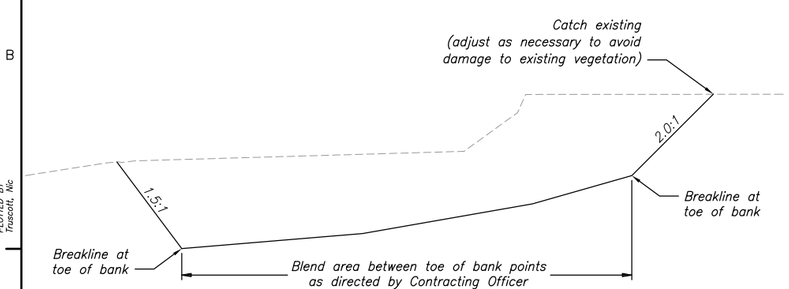
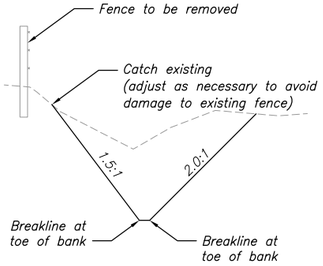


Breakline Points			
Point #	Northing	Easting	Elevation
6005	565,104.18	8,891,921.94	2912.73
6006	565,108.84	8,891,923.74	2912.47
6007	565,112.94	8,891,926.56	2912.20
6008	565,115.97	8,891,930.52	2912.00
6009	565,117.95	8,891,935.09	2912.00
6010	565,118.77	8,891,940.01	2912.00
6011	565,119.17	8,891,945.00	2912.00
6012	565,119.58	8,891,949.98	2912.00
6013	565,119.98	8,891,954.97	2912.00
6014	565,120.02	8,891,959.95	2912.00
6015	565,118.32	8,891,964.62	2912.00
6016	565,114.99	8,891,968.31	2912.00
6017	565,110.52	8,891,970.48	2912.00
6018	565,105.58	8,891,971.21	2912.00
6019	565,100.58	8,891,971.35	2912.00
6020	565,095.60	8,891,970.96	2912.00
6021	565,090.69	8,891,970.05	2912.00
6022	565,085.90	8,891,968.61	2912.04
6023	565,081.30	8,891,966.67	2912.20
6024	565,076.66	8,891,964.86	2912.37
6025	565,071.70	8,891,964.95	2912.54
6026	565,067.18	8,891,967.02	2912.70
6027	565,063.87	8,891,970.71	2912.87
6028	565,062.35	8,891,975.43	2912.96
6029	565,063.54	8,891,980.21	2912.80
6030	565,067.26	8,891,983.43	2912.63
6031	565,072.16	8,891,983.97	2912.46
6032	565,077.00	8,891,982.75	2912.30
6033	565,081.38	8,891,980.38	2912.13
6034	565,085.25	8,891,977.21	2912.00
6035	565,089.52	8,891,974.63	2912.00
6036	565,094.22	8,891,972.96	2912.00

Breakline Points			
Point #	Northing	Easting	Elevation
6037	565,099.17	8,891,972.25	2912.00
6038	565,104.15	8,891,972.55	2912.00
6039	565,109.09	8,891,973.33	2912.00
6040	565,114.07	8,891,973.64	2912.00
6041	565,118.85	8,891,972.35	2912.00
6042	565,122.40	8,891,968.91	2912.00
6043	565,123.82	8,891,964.17	2912.00
6044	565,123.25	8,891,959.21	2912.00
6045	565,122.44	8,891,954.28	2912.00
6046	565,121.56	8,891,949.36	2912.00
6047	565,120.61	8,891,944.45	2912.00
6048	565,119.58	8,891,939.55	2912.00
6049	565,118.48	8,891,934.68	2912.00
6050	565,117.04	8,891,929.89	2912.00
6051	565,115.18	8,891,925.25	2912.00
6052	565,114.43	8,891,920.34	2912.00
6053	565,114.49	8,891,915.35	2911.51
6054	565,113.35	8,891,910.49	2910.99
6055	565,111.70	8,891,905.77	2910.70
6056	565,110.25	8,891,900.99	2910.50
6057	565,109.01	8,891,896.14	2910.50
6058	565,107.26	8,891,891.58	2910.50
6059	565,103.68	8,891,893.97	2910.61
6060	565,100.70	8,891,897.98	2911.32
6061	565,098.04	8,891,902.22	2912.01
6062	565,095.52	8,891,906.53	2912.28
6063	565,093.10	8,891,910.91	2912.55
6064	565,090.69	8,891,915.29	2912.83
6065	565,087.82	8,891,919.38	2913.10
6066	565,084.47	8,891,923.09	2913.37



SECTION F



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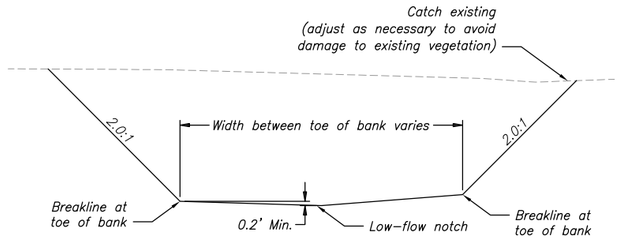

SECTION H

NOTES:

1. *Due to the time that has passed since the topographic survey was performed, there will be some locations where the ground topography on the day of construction will not match the topography shown on this sheet. The Contracting Officer will coordinate with the Contractor to make slight adjustments to the earthwork to accommodate changes to the topography.*
2. *Contractor shall use the points on this sheet to stakeout the location of the breakline at the toe of bank. Apply typical section templates as identified on this sheet. Adjust side slopes as necessary to avoid impacts to existing vegetation.*
3. *Existing site features including but not limited to fences and irrigation system components that are to remain after completion of this project, but must be removed temporarily to construct the work shown on these Drawings, shall be replaced and/or repaired by the Contractor as directed by the Contracting Officer. Payment for equipment, materials, and labor necessary for replacement or repair of existing site features temporarily removed to allow construction shall be through one or more of the hourly bid items for this project (Bid Items 34, 35, 36, and 37) as directed by the Contracting Officer after coordinating with the Contractor to determine equipment and materials to use and amount of labor necessary. Existing site features including but not limited to fences and irrigation system components outside any specific area of impact necessary to construct the work shown on these Drawings shall be protected, and any damage that occurs to these site features shall be repaired by the Contractor as directed by the Contracting Officer at no additional cost to the Contracting Agency.*

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2006
MARTIN K. FISHER

EXPIRES: 12/31/2017

GRADING DETAILS – ALCOVE EXCAVATION

RECLAMATION
Managing Water in the West

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Union Soil and Water Conservation District

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COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE IV HABITAT ENHANCEMENT
PARCELS 1 & 2

M. FISHER
DRAWN

X
ACCEPTED

BOISE, ID 2016-04-01

GRADING DETAILS

ALCOVE EXCAVATION

1678-100-2329

SHEET 4 OF 5

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Truscott, Nic

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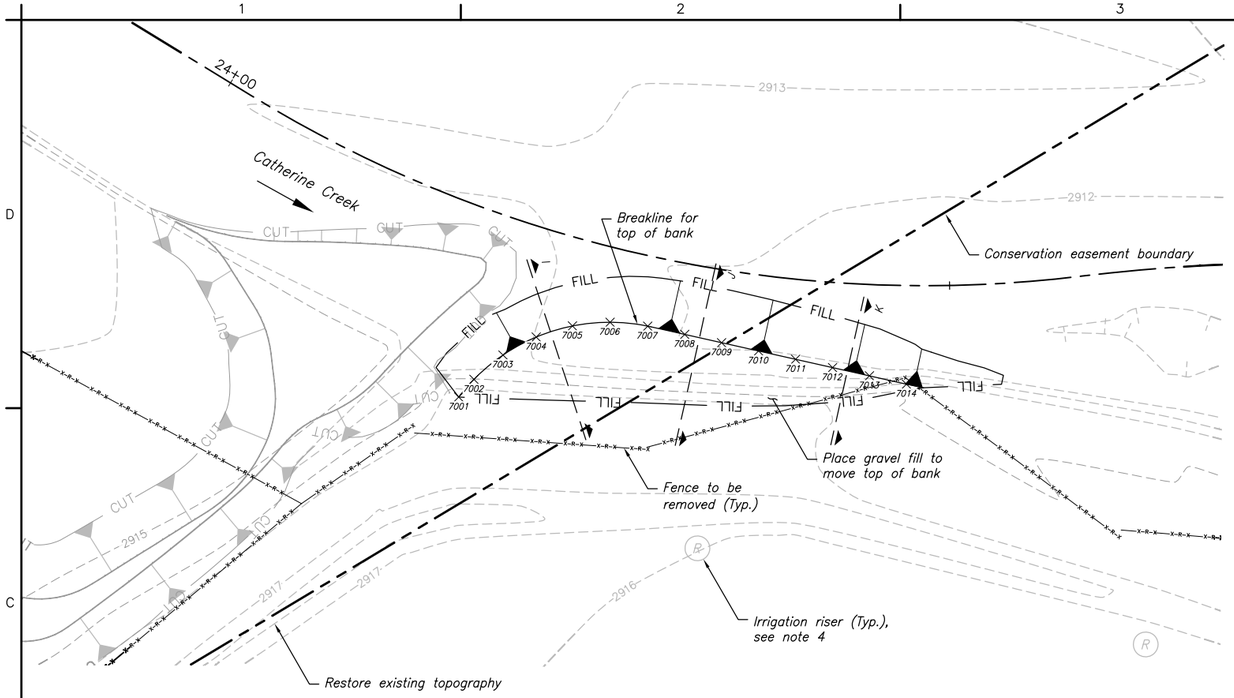
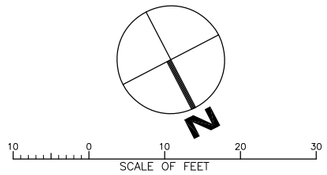
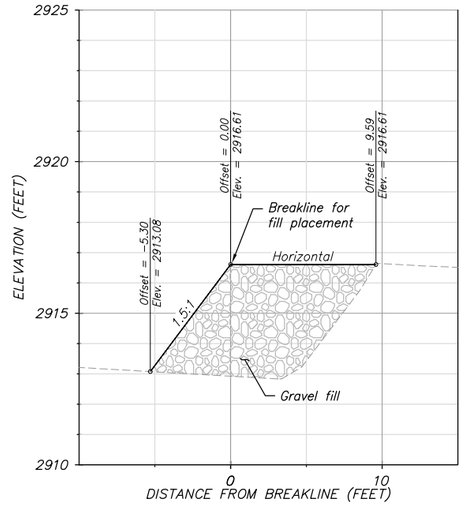


Breakline Points			
Point #	Northing	Easting	Elevation
7001	565,120.55	8,891,902.55	2916.77
7002	565,119.41	8,891,899.68	2916.73
7003	565,118.33	8,891,894.81	2916.67
7004	565,118.24	8,891,889.82	2916.63
7005	565,119.14	8,891,884.91	2916.56
7006	565,121.00	8,891,880.27	2916.53
7007	565,123.74	8,891,876.10	2916.50
7008	565,126.96	8,891,872.28	2916.48
7009	565,130.18	8,891,868.45	2916.45
7010	565,133.40	8,891,864.63	2916.34
7011	565,136.62	8,891,860.80	2916.10
7012	565,139.84	8,891,856.98	2915.86
7013	565,143.06	8,891,853.15	2915.49
7014	565,146.28	8,891,849.32	2914.90

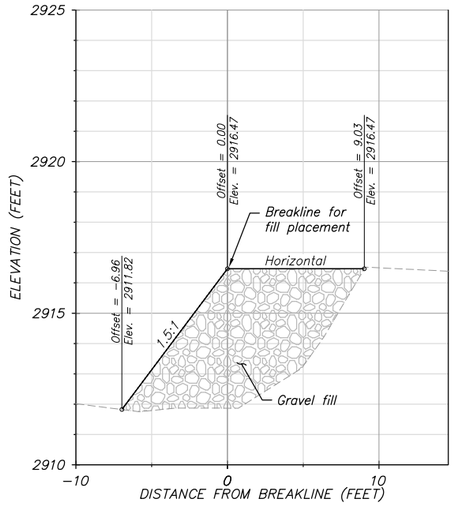


NOTES:

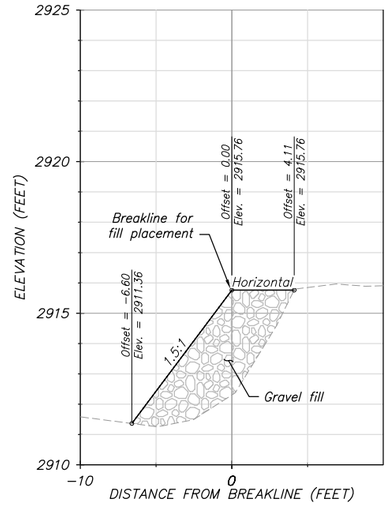
1. Due to the time that has passed since the topographic survey was performed, there will be some locations where the ground topography on the day of construction will not match the topography shown on this sheet. The Contracting Officer will coordinate with the Contractor to make slight adjustments to the earthwork to accommodate changes to the topography.
2. Contractor shall use the points on this sheet to stakeout the loction of the breakline at the finished top of bank. Fill from the breakline to the existing bank shall be placed and compacted in lifts of no more than 12". Finished ground shall be horizontal from the breakline to the point where fill catches existing ground.
3. Gravel fill shall come from material excavated on-site and shall be a mix of fines, sand, gravel, and cobble material. If native material does not meet this description, the Contractor shall sort excavated material into stockpiles of small cobble and gravel, and sands/fines, then mix at approximately a 1:1 ratio to achieve a suitable mix for gravel fill. The Contracting Officer will determine if native material is suitable and therefore if sorting, stockpiling, and mixing is required.
4. Existing site features including but not limited to fences and irrigation system components that are to remain after completion of this project, but must be removed temporarily to construct the work shown on these Drawings, shall be replaced and/or repaired by the Contractor as directed by the Contracting Officer. Payment for equipment, materials, and labor necessary for replacement or repair of existing site features temporarily removed to allow construction shall be through one or more of the hourly bid items for this project (Bid Items 34, 35, 36, and 37) as directed by the Contracting Officer after coordinating with the Contractor to determine equipment and materials to use and amount of labor necessary. Existing site features including but not limited to fences and irrigation system components outside any specific area of impact necessary to construct the work shown on these Drawings shall be protected, and any damage that occurs to these site features shall be repaired by the Contractor as directed by the Contracting Officer at no additional cost to the Contracting Agency.



SECTION I



SECTION J



SECTION K

GRADING DETAILS – ALCOVE INLET FILL PLACEMENT

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
EXPIRES: 12/31/2017

RECLAMATION
Managing Water in the West

ICF INTERNATIONAL

Union Soil and Water Conservation District

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BUREAU OF RECLAMATION
COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE IV HABITAT ENHANCEMENT
PARCELS 1 & 2

M. FISHER
DRAWN

X
ACCEPTED

BOISE, ID 2016-04-01

GRADING DETAILS

ALCOVE INLET FILL PLACEMENT

1678-100-2330

SHEET 5 OF 5

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4/7/2016 11:58 AM
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Trascott, Nic

CAD SYSTEM
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CAD FILENAME
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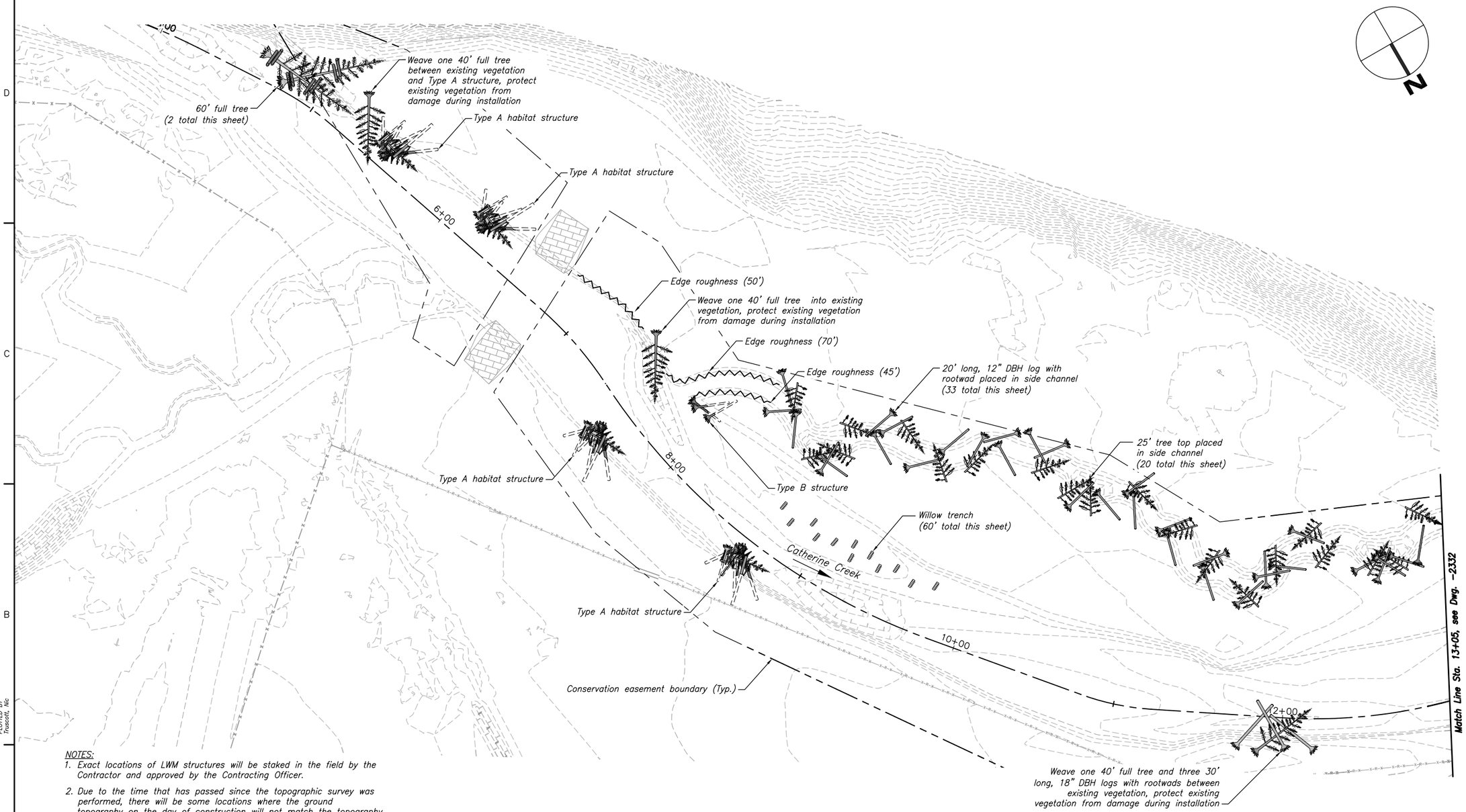

NOTES:

1. Exact locations of LWM structures will be staked in the field by the Contractor and approved by the Contracting Officer.
2. Due to the time that has passed since the topographic survey was performed, there will be some locations where the ground topography on the day of construction will not match the topography shown on this sheet. The Contracting Officer will coordinate with the Contractor to make slight adjustments to the LWM structure location and/or layout to accommodate changes to the topography.
3. See Dwg. -2344 for 60' full tree details.
4. See Dwg. -2334 and -2335 for Type A habitat structure details.
5. See Dwg. -2345 for edge roughness and willow trench details.
6. See Dwg. -2336 for Type B habitat structure details.

LWM PLAN – STA. 4+00 TO 13+05

30 0 30 60 90
SCALE OF FEET

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER

EXPIRES: 12/31/2017

RECLAMATION
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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE IV HABITAT ENHANCEMENT
PARCELS 1 & 2

M. FISHER
DRAWN

X
ACCEPTED

BOISE, ID 2016-04-01

LWM PLAN

STA. 4+00 TO 13+05

1678-100-2331

SHEET 1 OF 3

DATE AND TIME PLOTTED
4/11/2016 12:02 PM
PLOTTED BY
Truscott, Nic

CAD SYSTEM
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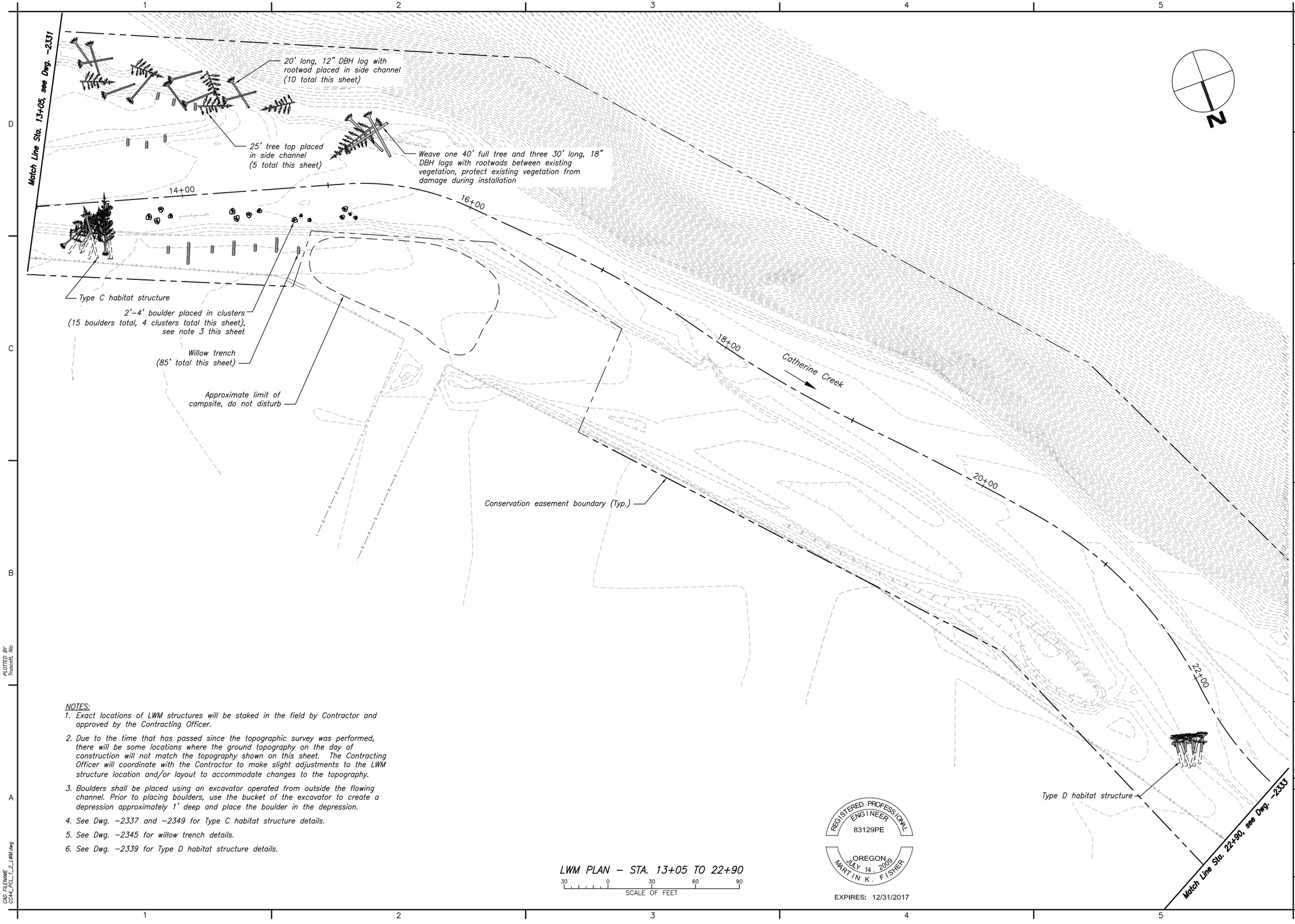

NOTES:

1. Exact locations of LWM structures will be staked in the field by Contractor and approved by the Contracting Officer.
2. Due to the time that has passed since the topographic survey was performed, there will be some locations where the ground topography on the day of construction will not match the topography shown on this sheet. The Contracting Officer will coordinate with the Contractor to make slight adjustments to the LWM structure location and/or layout to accommodate changes to the topography.
3. Boulders shall be placed using an excavator operated from outside the flowing channel. Prior to placing boulders, use the bucket of the excavator to create a depression approximately 1' deep and place the boulder in the depression.
4. See Dwg. -2337 and -2349 for Type C habitat structure details.
5. See Dwg. -2345 for willow trench details.
6. See Dwg. -2339 for Type D habitat structure details.

LWM PLAN – STA. 13+05 TO 22+90

30 0 30 60 90

SCALE OF FEET

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER

EXPIRES: 12/31/2017

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE IV HABITAT ENHANCEMENT
PARCELS 1 & 2

M. FISHER
DRAWN

X
ACCEPTED

BOISE, ID 2016-04-01

LWM PLAN

STA. 13+05 TO 22+90

1678-100-2332

SHEET 2 OF 3

DATE AND TIME PLOTTED
4/11/2016 12:02 PM
PLOTTED BY
Trascatt, Nic

CAD SYSTEM
AUTOCAD Civil 3D 2014
CAD FILENAME
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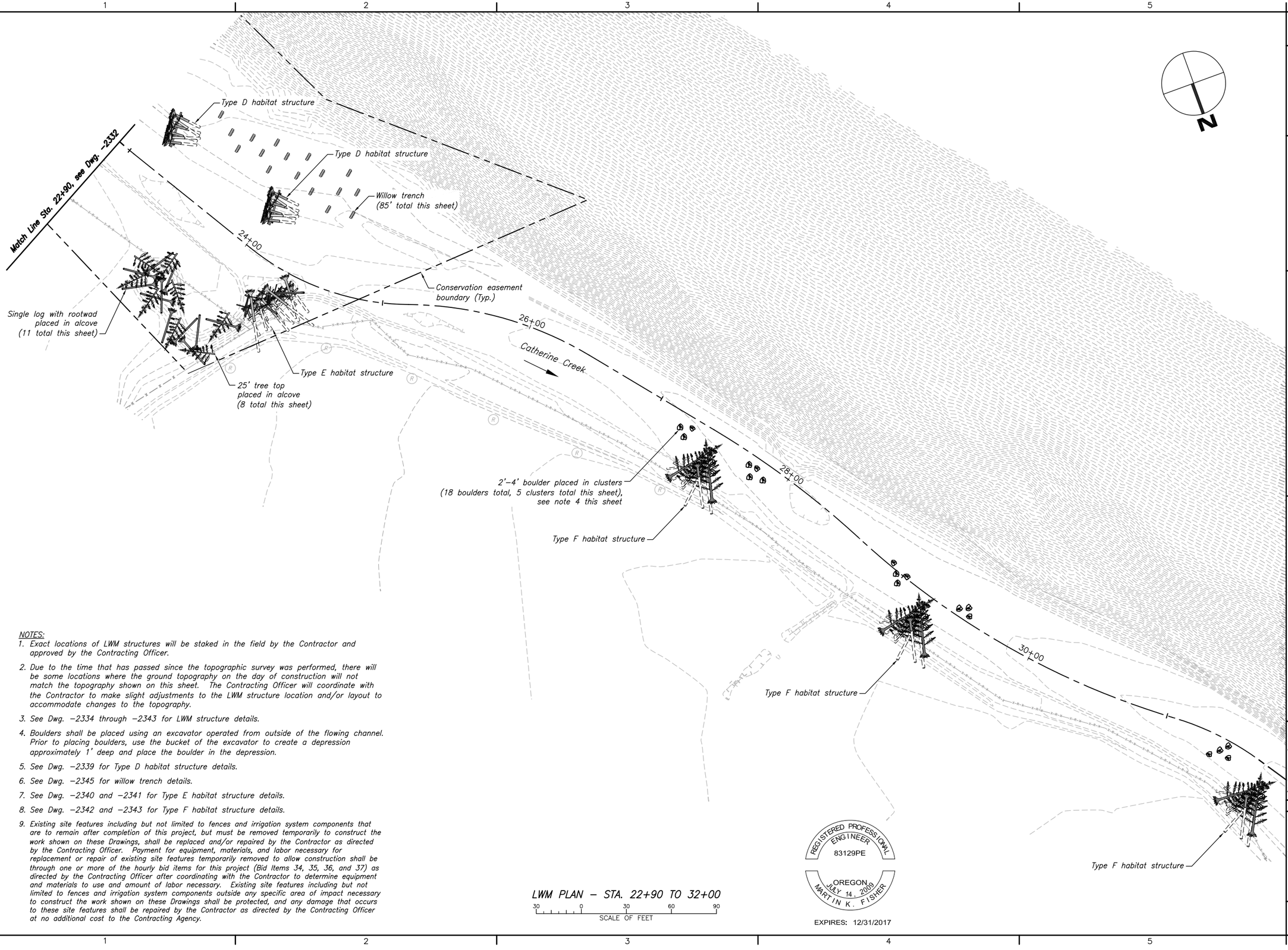

NOTES:

1. Exact locations of LWM structures will be staked in the field by the Contractor and approved by the Contracting Officer.
2. Due to the time that has passed since the topographic survey was performed, there will be some locations where the ground topography on the day of construction will not match the topography shown on this sheet. The Contracting Officer will coordinate with the Contractor to make slight adjustments to the LWM structure location and/or layout to accommodate changes to the topography.
3. See Dwg. –2334 through –2343 for LWM structure details.
4. Boulders shall be placed using an excavator operated from outside of the flowing channel. Prior to placing boulders, use the bucket of the excavator to create a depression approximately 1' deep and place the boulder in the depression.
5. See Dwg. –2339 for Type D habitat structure details.
6. See Dwg. –2345 for willow trench details.
7. See Dwg. –2340 and –2341 for Type E habitat structure details.
8. See Dwg. –2342 and –2343 for Type F habitat structure details.
9. Existing site features including but not limited to fences and irrigation system components that are to remain after completion of this project, but must be removed temporarily to construct the work shown on these Drawings, shall be replaced and/or repaired by the Contractor as directed by the Contracting Officer. Payment for equipment, materials, and labor necessary for replacement or repair of existing site features temporarily removed to allow construction shall be through one or more of the hourly bid items for this project (Bid Items 34, 35, 36, and 37) as directed by the Contracting Officer after coordinating with the Contractor to determine equipment and materials to use and amount of labor necessary. Existing site features including but not limited to fences and irrigation system components outside any specific area of impact necessary to construct the work shown on these Drawings shall be protected, and any damage that occurs to these site features shall be repaired by the Contractor as directed by the Contracting Officer at no additional cost to the Contracting Agency.

LWM PLAN – STA. 22+90 TO 32+00

30 0 30 60 90
SCALE OF FEET

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER

EXPIRES: 12/31/2017

RECLAMATION
Managing Water in the West

ICF INTERNATIONAL

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BUREAU OF RECLAMATION
COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC–44 PHASE IV HABITAT ENHANCEMENT
PARCELS 1 & 2

M. FISHER
DRAWN

X
ACCEPTED

BOISE, ID 2016–04–01

LWM PLAN

STA. 22+90 TO 32+00

1678–100–2333

SHEET 3 OF 3

DATE AND TIME PLOTTED
4/7/2016 12:03 PM
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Trascott, Nic

CAD SYSTEM
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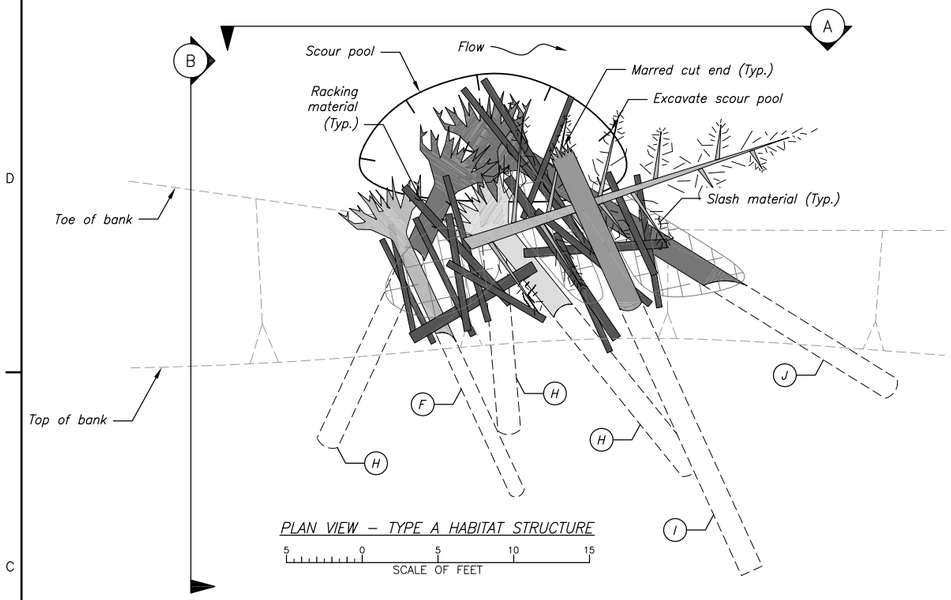
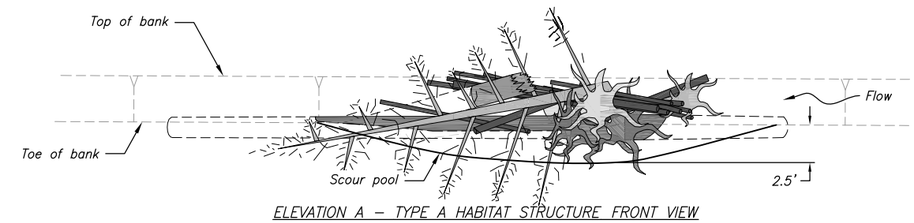


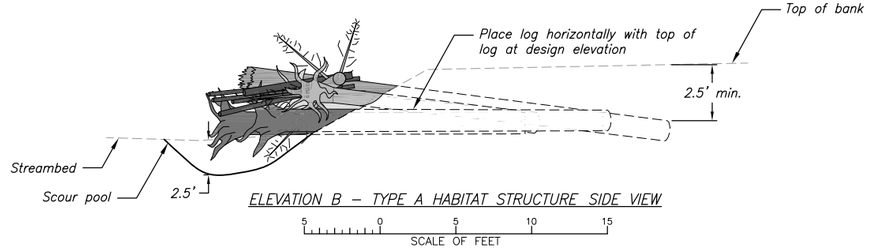
PLAN VIEW – TYPE A HABITAT STRUCTURE

SCALE OF FEET 5 0 5 10 15



ELEVATION A – TYPE A HABITAT STRUCTURE FRONT VIEW

SCALE OF FEET 5 0 5 10 15



ELEVATION B – TYPE A HABITAT STRUCTURE SIDE VIEW

SCALE OF FEET 5 0 5 10 15

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER

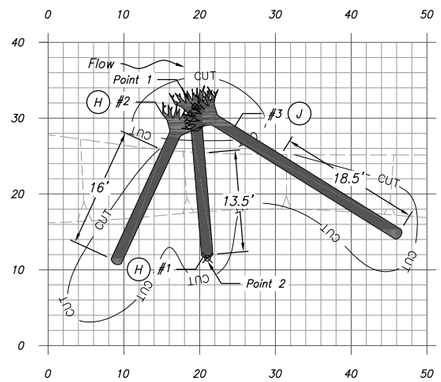
EXPIRES: 12/31/2017

TYPE A HABITAT STRUCTURE CONSTRUCTION DETAILS

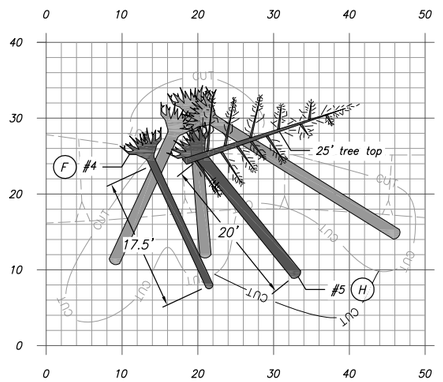
STRUCTURE STATION	DESIGN ELEVATION	POINT 1 NORTHING	POINT 1 EASTING	POINT 2 NORTHING	POINT 2 EASTING
5+50	2929.5'	563,722.18	8,893,010.33	563,712.22	8,892,992.99
6+30	2928.8'	563,787.80	8,892,981.98	563,780.36	8,892,963.41
7+50	2928.2'	563,924.59	8,892,979.29	563,929.75	8,892,998.61
8+60	2926.9'	564,027.76	8,892,943.70	564,035.86	8,892,961.98

RIGHT BANK CONSTRUCTION SEQUENCE

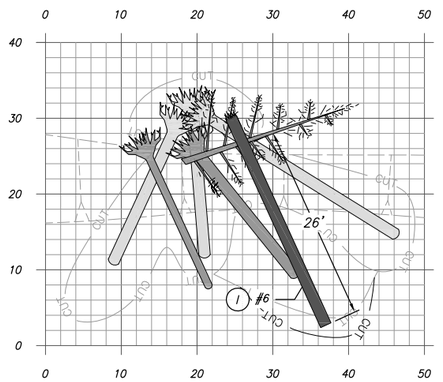
Step 1: Excavate scour pool as directed by Contracting Officer, then excavate trenches for bottom layer of logs; place logs horizontally at the elevation shown on this sheet. The top of log #1 shall sit at the elevation listed on this sheet, and points 1 & 2 shall be at the coordinates listed on this sheet.



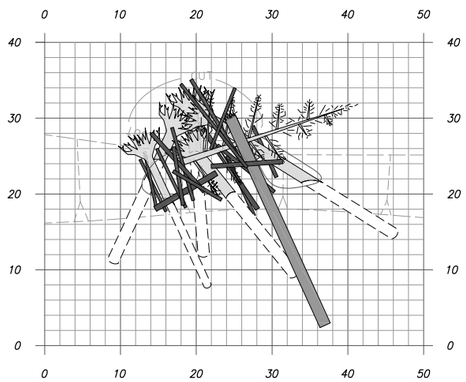
Step 2: Expand trench if necessary, then place logs #4 and #5 in the orientation shown; angled into the bank on a minimum slope of 10H:1V. Rest tree top on top of log #5, angling it the tip into the streambed on the downstream end.



Step 3: Expand trench if necessary to place log #6; rest log #6 on top of tree top and angle into the bank on a minimum slope of 10H:1V.



Step 4: Incorporate racking and slash material into structure by weaving it between logs and pressing pieces into the bank. Backfill the trench to the original bank line.



NOTES:

1. *All logs shall come from fir, pine, or spruce trees.*
2. *The diameter of logs without rootwads shall be measured at the smallest cut end.*
3. *The exact location of each Type A Habitat Structure shall be staked by the Contractor and approved by the Contracting Officer prior to constructing a specific structure.*
4. *Rough grading of channel shall be completed prior to constructing in–channel LWM structures.*
5. *Cut ends of logs that will be exposed at structure completion shall be marred prior to installation. The Contractor shall use an excavator, bulldozer, or other heavy equipment to tear apart wood fibers at the exposed cut end(s) of the log to create the appearance of a log that has naturally broken apart.*
6. *Racking and slash material shall be incorporated into each Type A Habitat Structure by weaving it in between placed logs, placing it in voids, pressing it into the bank, or otherwise including it in the structure as directed by the Contracting Officer. Racking material as shown on this sheet is schematic only and not intended to represent the actual location or orientation of individual pieces.*
7. *The amount of slash placed in each structure shall be as directed by the Contracting Officer and may vary from structure to structure. The cost of providing and placing slash is not part of the unit cost of constructing this structure. All costs associated with obtaining and placing slash shall be part of the bid item "Slash Material".*
8. *Prior to backfilling the structure, the Contracting Officer will incorporate live willow stakes into the structure. The Contractor shall accomodate the placement of live willow stakes and avoid damaging them during backfill.*
9. *Backfill structure using soil excavated to place logs unless the Contracting Officer determines the native soil is unsuitable for backfill and suitable soil must be imported. Place soil for backfill in 1 foot maximum lifts. Compact each lift using mechanical equipment such as an excavator bucket or equipment tracking.*

TYPE A HABITAT STRUCTURE MATERIAL SCHEDULE

ITEM	DESCRIPTION	QUANTITY
Log type (F)	20' long, 12" DBH log with rootwad	1
Log type (H)	20' long, 18" DBH log with rootwad	3
Log type (I)	30' long, 18" dia. log	1
Log type (J)	30' long, 18" DBH log with rootwad	1
Tree top	25' long, 6" dia. tree top with full branches	1
Small racking material	8'–15' long, 4"–8" dia. log	8
Large racking material	12'–20' long, 8"–12" dia. log	5
Slash material (see note 7)	Tree tops, limbs with branches and needles	As Directed

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GRANDE RONDE SUBBASIN

CC–44 PHASE IV HABITAT ENHANCEMENT PARCELS 1 & 2

N. TRUSCOTT
DRAWN

X
ACCEPTED

BOISE, ID 2016–04–01

LWM DETAILS

TYPE A HABITAT STRUCTURE

1678–100–2334

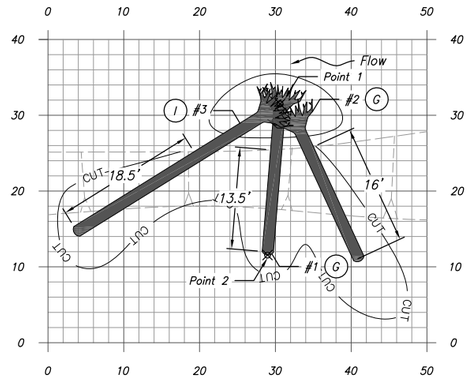
SHEET 1 OF 12

DATE AND TIME PLOTTED
April 1, 2016 11:38
PLOTTED BY
TRUSCOTT, NIC

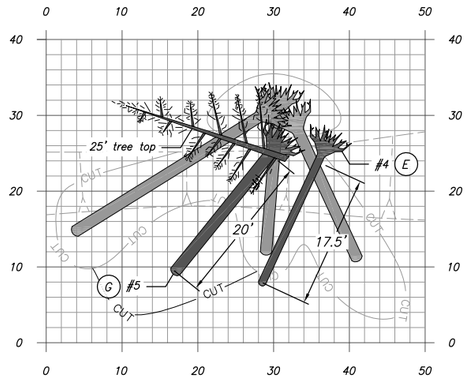
CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_PCL_1_2_Strmbnk_Hab_Details.dwg

LEFT BANK CONSTRUCTION SEQUENCE

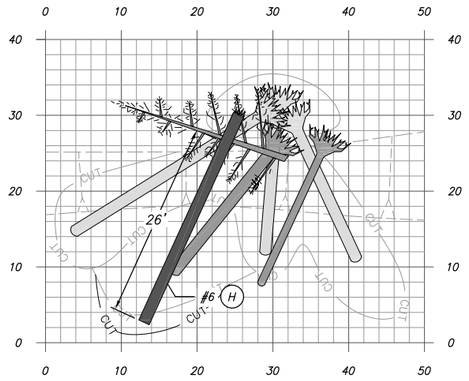
Step 1: Excavate scour pool as directed by Contracting Officer, then excavate trenches for bottom layer of logs; place logs horizontally at the elevation shown on this sheet. The top of log #1 shall sit at the elevation listed on this sheet, and points 1 & 2 shall be at the coordinates listed on this sheet.



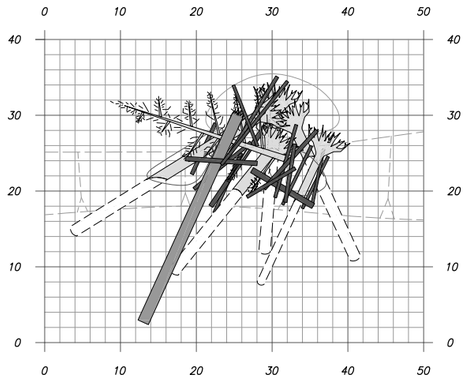
Step 2: Expand trench if necessary, then place logs #4 and #5 in the orientation shown; angled into the bank on a minimum slope of 10H:1V. Rest tree top on top of log #5, angling it the tip into the streambed on the downstream end.



Step 3: Expand trench if necessary to place log #6; rest log #6 on top of tree top and angle into the bank on a minimum slope of 10H:1V.



Step 4: Incorporate racking and slash material into structure by weaving it between logs and pressing pieces into the bank. Backfill the trench to the original bank line.



REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER

EXPIRES: 12/31/2017

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GRANDE RONDE SUBBASIN

CC-44 PHASE IV HABITAT ENHANCEMENT
PARCELS 1 & 2

N. TRUSCOTT
DRAWN

X
ACCEPTED

BOISE, ID *2016-04-01*

LWM DETAILS

TYPE A HABITAT STRUCTURE

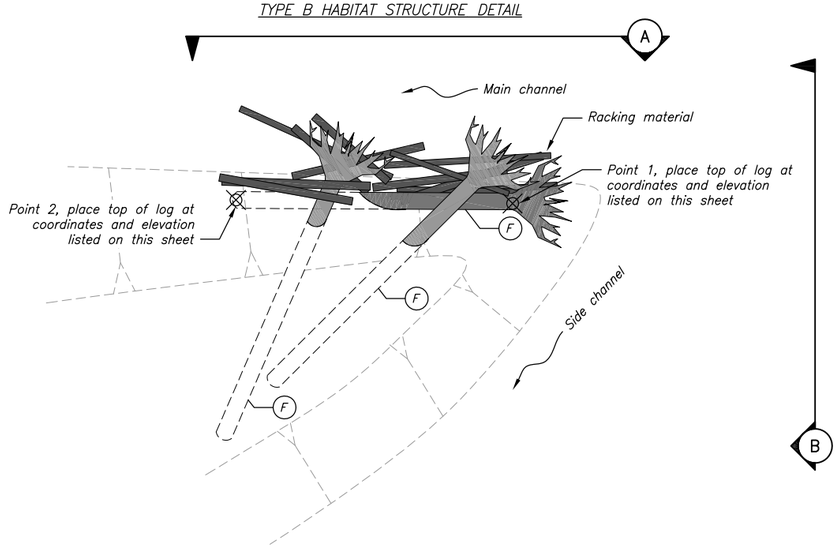
1678-100-2335

SHEET 2 OF 12

DATE AND TIME PLOTTED
April 1, 2016 11:38
PLOTTED BY
TRUSCOTT, NIC

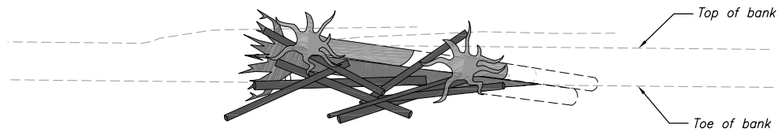
CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_PCL_1_2_Strmbnk_Hab_Details.dwg

TYPE B HABITAT STRUCTURE DETAIL



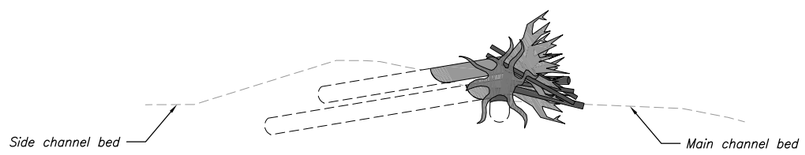
PLAN VIEW – TYPE B HABITAT STRUCTURE

5 0 5 10 15
SCALE OF FEET



ELEVATION VIEW – TYPE B HABITAT STRUCTURE

5 0 5 10 15
SCALE OF FEET



SECTION VIEW – TYPE B HABITAT STRUCTURE

5 0 5 10 15
SCALE OF FEET

NOTES:

1. All logs shall come from fir, pine, or spruce trees.
2. The Contractor shall use the points and elevations listed on this sheet to place logs for the Type B habitat structure.
3. Rough grading of side channel shall be completed prior to constructing in–channel LWM structures.
4. Racking material shall be incorporated into the Type B habitat structure by weaving it in between placed logs, placing it in voids, pressing it into the bank, or otherwise including it in the structure as directed by the Contracting Officer. Racking material as shown on this sheet is schematic only and not intended to represent the actual location or orientation of individual pieces.
5. Prior to backfilling the structure, the Contracting Officer will incorporate live willow stakes into the structure. The Contractor shall accomodate the placement of live willow stakes and avoid damaging them during backfill.
6. Backfill structure using soil excavated to place logs unless the Contracting Officer determines the native soil is unsuitable for backfill and suitable soil must be imported. Place soil for backfill in 1 foot maximum lifts. Compact each lift using mechanical equipment such as an excavator bucket or equipment tracking.

TYPE B HABITAT STRUCTURE

ITEM	DESCRIPTION	QUANTITY
Log type (F)	20' long, 12" DBH log with rootwad	3
Small racking material	8'–15' long, 4"–8" dia. log	8
Large racking material	12'–20' long, 8"–12" dia. log	4

TYPE B HABITAT STRUCTURE CONSTRUCTION DETAILS

	POINT 1			POINT 2		
STRUCTURE STATION	NORTHING	EASTING	ELEVATION	NORTHING	EASTING	ELEVATION
7+90	563,939.87	8,892,924.26	2928.7'	563,956.70	8,892,917.19	2927.0'

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER

EXPIRES: 12/31/2017

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GRANDE RONDE SUBBASIN

CC–44 PHASE IV HABITAT ENHANCEMENT
PARCELS 1 & 2

N. TRUSCOTT
DRAWN

X
ACCEPTED

BOISE, ID 2016–04–01

LWM DETAILS

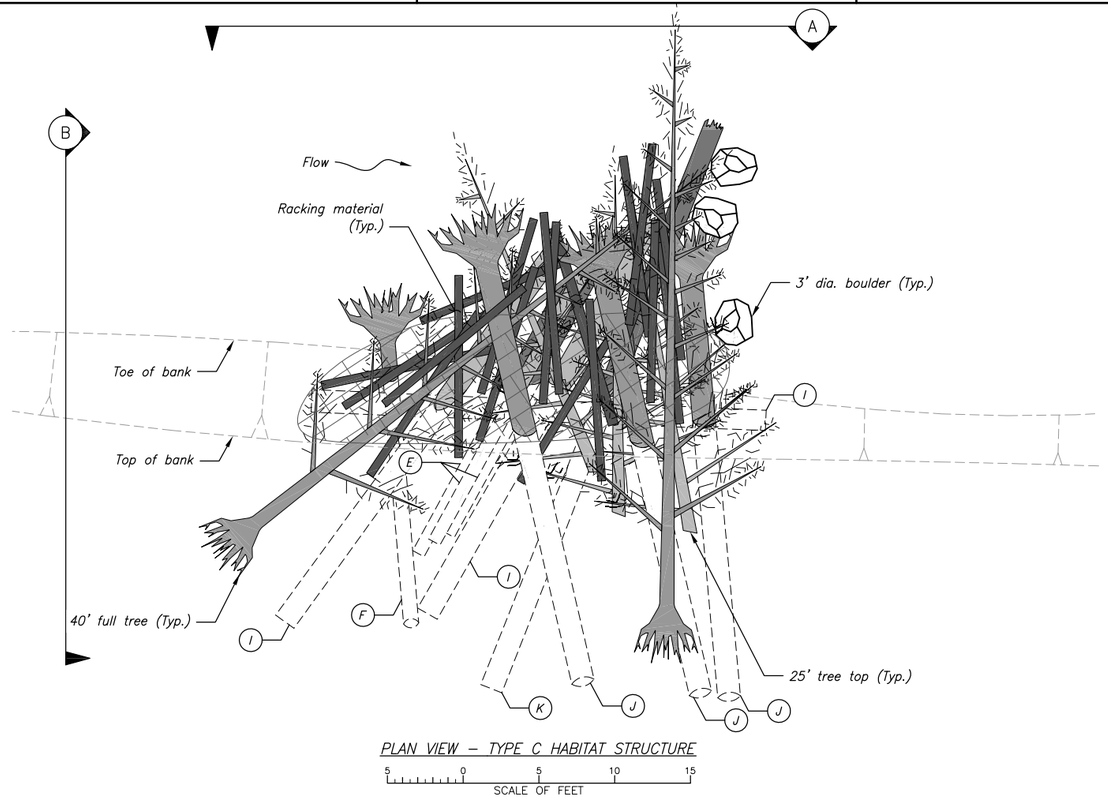
TYPE B HABITAT STRUCTURE

1678–100–2336

SHEET 3 OF 12

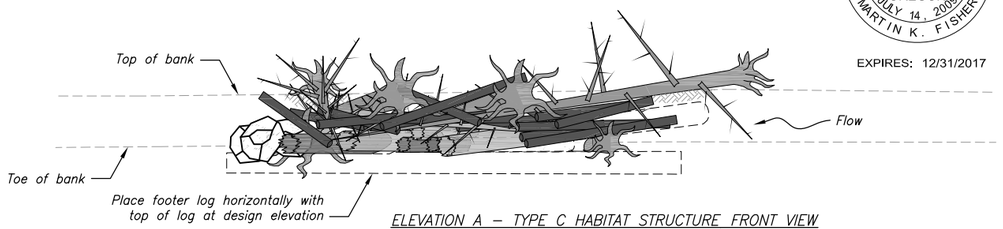
DATE AND TIME PLOTTED
April 1, 2016 11:38
PLOTTED BY
TRUSCOTT, NIC

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_PCL_1_2_LWM_3–log_Details.dwg



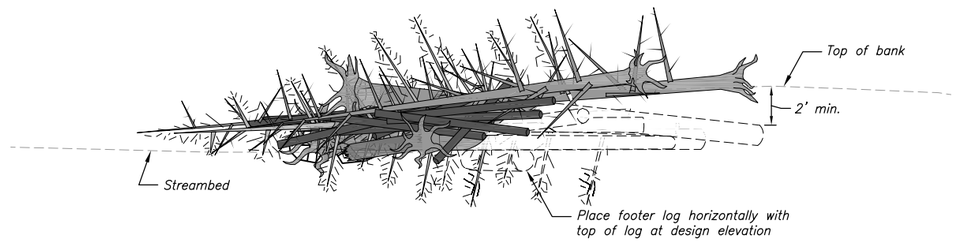
PLAN VIEW – TYPE C HABITAT STRUCTURE

SCALE OF FEET 5 0 5 10 15



ELEVATION A – TYPE C HABITAT STRUCTURE FRONT VIEW

SCALE OF FEET 5 0 5 10 15



ELEVATION B – TYPE C HABITAT STRUCTURE SIDE VIEW

SCALE OF FEET 5 0 5 10 15

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
EXPIRES: 12/31/2017

NOTES:

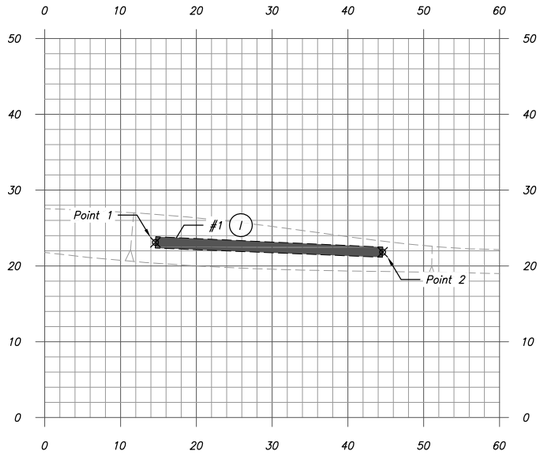
1. *All logs shall come from fir, pine, or spruce trees.*
2. *The diameter of logs without rootwads shall be measured at the smallest cut end.*
3. *Tree tops and full trees shall come from Douglas fir, grand fir, or spruce trees and shall be installed within 30 days of harvest.*
4. *Tree tops and full trees shall be handled with care to minimize breaking of branches. The Contracting Officer may reject any tree tops or full trees that have lost significant amounts of branches.*
5. *The exact location of the Type C Habitat Structure shall be staked by the Contractor and approved by the Contracting Officer prior to construction.*
6. *Cut ends of logs that will be exposed at structure completion shall be marred prior to installation. The Contractor shall use an excavator, bulldozer, or other heavy equipment to tear apart wood fibers at the exposed cut end(s) of the log to create the appearance of a log that has naturally broken apart.*
7. *Racking and slash material shall be incorporated into the Type C Habitat Structure by weaving it in between placed logs, placing it in voids, pressing it into the bank, or otherwise including it in the structure as directed by the Contracting Officer. Racking material as shown on this sheet is schematic only and not intended to represent the exact location or orientation of individual pieces.*
8. *The amount of slash placed in each structure shall be as directed by the Contracting Officer and may vary from structure to structure. The cost of providing and placing slash is not part of the unit cost of constructing this structure. All costs associated with obtaining and placing slash shall be part of the bid item "Slash Material".*
9. *The cost of providing and placing boulders in this structure is incidental to the cost for the bid item "Type C Habitat Structure."*
10. *Prior to backfilling the structure, the Contracting Officer will incorporate live willow stakes into the structure. The Contractor shall accomodate the placement of live willow stakes and avoid damaging them during backfill.*
11. *Backfill structure using soil excavated to place logs unless the Contracting Officer determines the native soil is unsuitable for backfill and suitable soil must be imported. Place soil for backfill in 1 foot maximum lifts. Compact each lift using mechanical equipment such as an excavator bucket or equipment tracking.*

TYPE C HABITAT STRUCTURE MATERIAL SCHEDULE

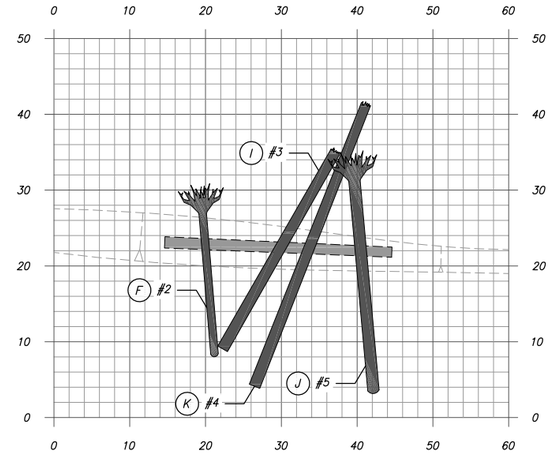
ITEM	DESCRIPTION	QUANTITY
Log type (E)	20' long, 12" dia. log	3
Log type (F)	20' long, 12" DBH log with rootwad	1
Log type (I)	30' long, 18" dia. log with	3
Log type (J)	30' long, 18" DBH log with rootwad	3
Log type (K)	40' long, 18" dia. log	1
Tree top	25' long tree top with full branches	3
Full tree	40' long, 12" DBH full tree with branches	2
Small racking material	8'–15' long, 4"–8" dia. log	10
Large racking material	12'–20' long, 8"–12" dia. log	10
Slash material (see note 8)	Tree tops, limbs with branches and needles	As Directed
Boulder	3' dia. boulder	3

CONSTRUCTION SEQUENCE

Step 1: Excavate as necessary to place footer log such that the top of the footer log is at the elevation listed in the table on this sheet and each end of the footer log is at the coordinates listed in the table on this sheet.



Step 2: Rest logs #2 through #5 on top of log #1 as shown. Logs shall sit horizontal.



TYPE C HABITAT STRUCTURE CONSTRUCTION DETAILS

STRUCTURE STATION	DESIGN ELEVATION	POINT 1 NORTHING	POINT 1 EASTING	POINT 2 NORTHING	POINT 2 EASTING
13+45	2921.5'	564,338.72	8,892,611.06	564,349.16	8,892,582.94

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GRANDE RONDE SUBBASIN

CC-44 PHASE IV HABITAT ENHANCEMENT
PARCELS 1 & 2

N. TRUSCOTT
DRAWN

X
ACCEPTED

BOISE, ID 2016-04-01

LWM DETAILS

TYPE C HABITAT STRUCTURE

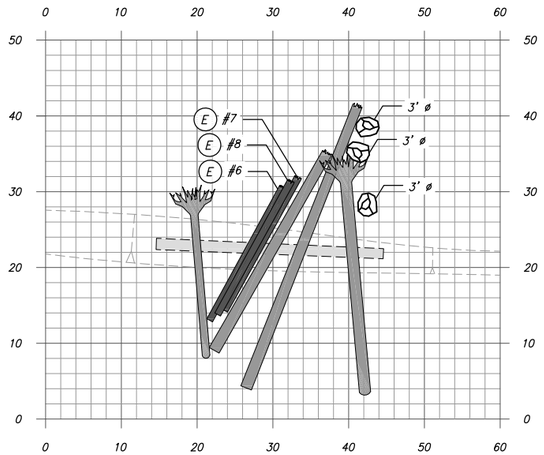
1678-100-2337

SHEET 4 OF 12

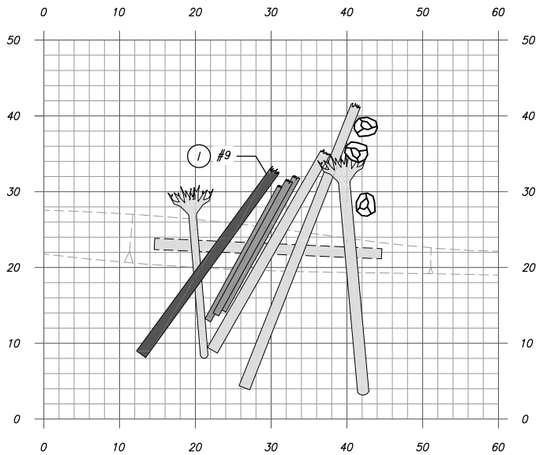
DATE AND TIME PLOTTED
April 1, 2016 11:39
PLOTTED BY
TRUSCOTT, NIC

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_PCL_1_2_LWM_Bank_Stab_Details.dwg

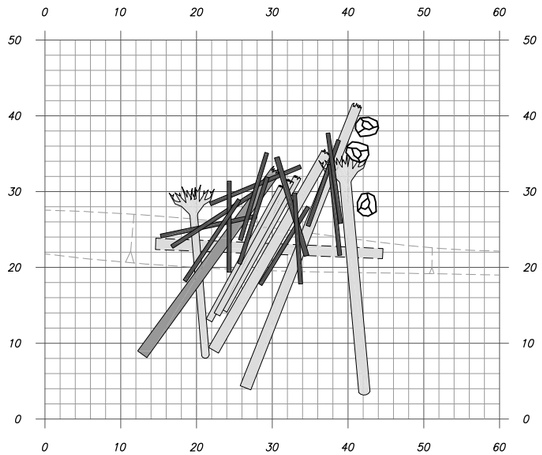
Step 3: Place logs #6 and #7 as shown, resting horizontally on top of log #1, then place log #8 as shown, resting it on top of logs #6 and #7. Place three 3' diameter boulders as shown, embedding them approximately 1' into the streambed.



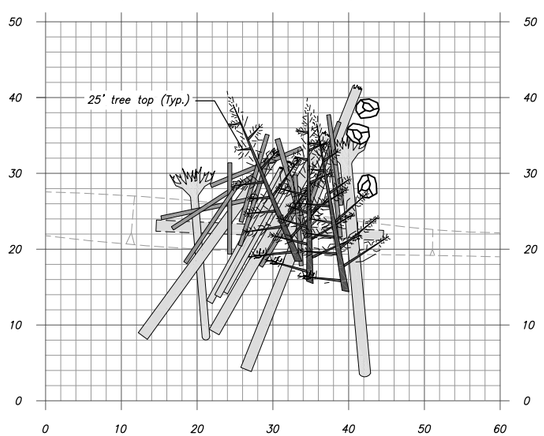
Step 4: Place log #9 in the orientation shown, resting it on log #2 and angling the downstream end toward the streambed.



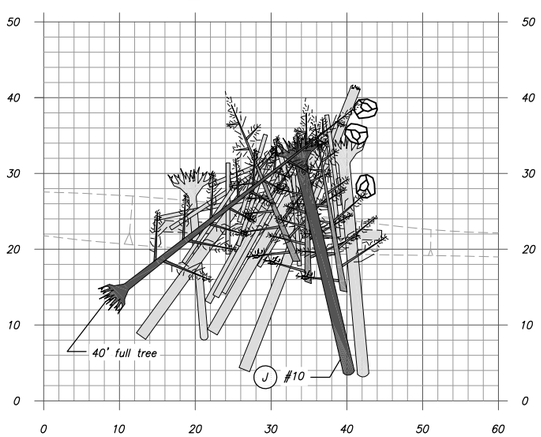
Step 5: Incorporate approximately ¾ of the racking material into the structure.



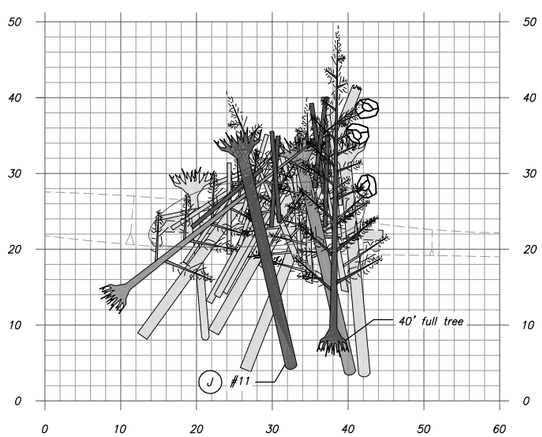
Step 6: Place three 25' tree tops as shown, resting them on top of previously placed logs.



Step 7: Place log #8 as shown, angling it into the bank on a minimum slope of 10H:1V. Partially backfill upstream portion of the structure to allow placement of a 40' full tree as shown; the rootwad of the tree shall sit partially embedded on top of the backfilled bank with the tip angled toward the streambed.



Step 8: Incorporate remaining racking material into structure. Place log #11 as shown, resting it on top of previously placed logs and angling it into the bank on a minimum slope of 10H:1V. Backfill remainder of structure and place a 40' full tree as shown with the rootwad partially embedded on the bank and the tip angled toward the streambed. Incorporate slash into the structure as directed by the Contracting Officer.



REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
EXPIRES: 12/31/2017

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GRANDE RONDE SUBBASIN

CC-44 PHASE IV HABITAT ENHANCEMENT
PARCELS 1 & 2

N. TRUSCOTT
DRAWN

X
ACCEPTED

BOISE, ID 2016-04-01

LWM DETAILS

TYPE C HABITAT STRUCTURE

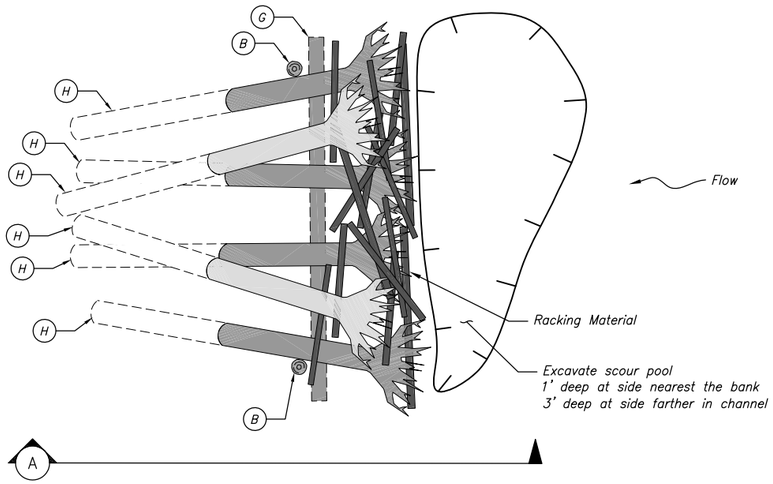
1678-100-2338

SHEET 5 OF 12

DATE AND TIME PLOTTED
April 1, 2016 11:39
PLOTTED BY
TRUSCOTT, NIC

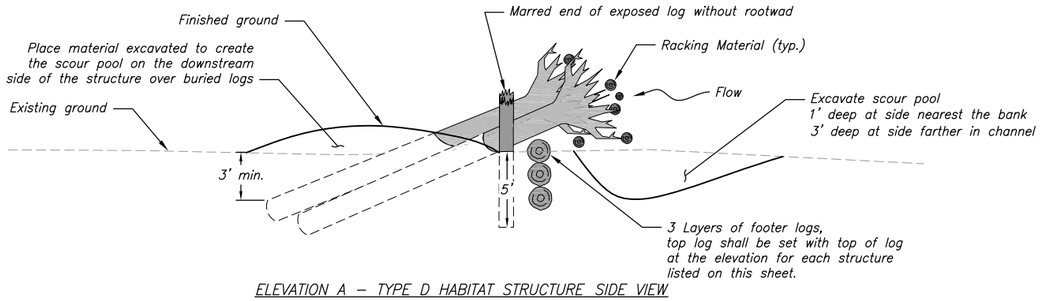
CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_PG1_1_2_LWM_Bank_Stab_Details.dwg

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
EXPIRES: 12/31/2017



PLAN VIEW – TYPE D HABITAT STRUCTURE

5 0 5 10 15
SCALE OF FEET



ELEVATION A – TYPE D HABITAT STRUCTURE SIDE VIEW

5 0 5 10 15
SCALE OF FEET

NOTES:

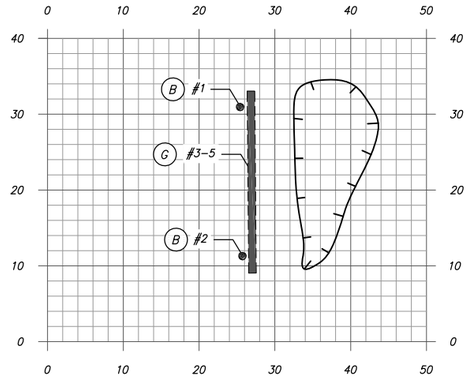
1. All logs shall come from fir, pine, or spruce trees.
2. The diameter of logs without rootwads shall be measured at the smallest cut end.
3. The exact location of each Type D habitat structure shall be staked by the Contractor and approved by the Contracting Officer prior to constructing it.
4. Cut ends of logs that will be exposed at structure completion shall be marred prior to installation. The Contractor shall use an excavator, bulldozer, or other heavy equipment to tear apart wood fibers at the exposed cut end(s) of the log to create the appearance of a log that has naturally broken apart.
5. Racking material shall be incorporated into the Type D habitat structure by either placing it on the upstream side of the structure against the rootwads, or weaving it in between the upstream end of placed logs as shown on this sheet and as directed by the Contracting Officer. Racking material shown on this sheet is schematic only, and not intended to represent the actual location or orientation of all individual pieces.
6. Backfill structure using streambed material excavated to place logs. Place streambed material for backfill in 1 foot maximum lifts. Compact each lift using mechanical equipment such as an excavator bucket.

TYPE D HABITAT STRUCTURE SCHEDULE

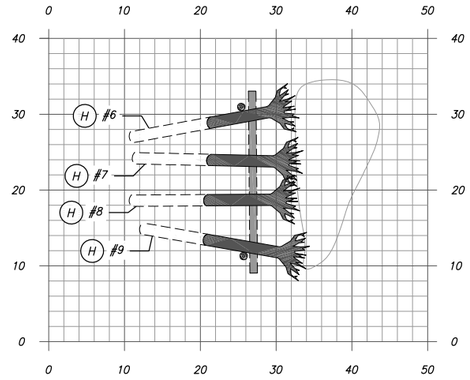
ITEM	DESCRIPTION	QUANTITY
Log type (B)	10' long, 12" dia. log	2
Log type (F)	25' long, 12" dia. log	3
Log type (G)	20' long, 18" DBH log with rootwad	6
Small racking material	8'–15' long, 4"–8" dia. log	10
Large racking material	12'–20' long, 8"–12" dia. log	5

STRUCTURE STATION	DESIGN ELEVATION	POINT 1 NORTHING	POINT 1 EASTING	POINT 2 NORTHING	POINT 2 EASTING
22+40	2914.5'	564,926.30	8,892,022.19	564,932.90	8,891,999.11
23+10	2913.8'	564,991.46	8,891,935.17	564,972.17	8,891,920.89
24+00	2913.3'	565,062.61	8,891,891.34	565,043.33	8,891,877.06

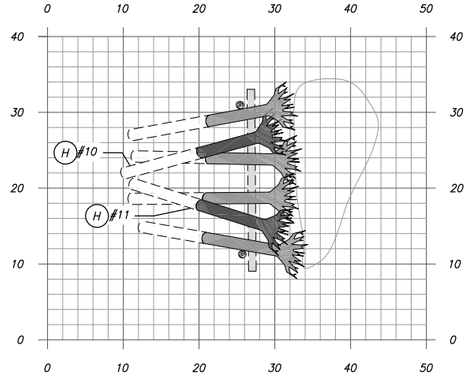
Step 1: Place footer logs such that the top of the highest footer log is at the elevation listed in the table on this sheet and each end of the top footer log is at the coordinates listed in the table on this sheet. Place vertical piling logs and backfill to original channel bed elevation and grades. Excavate scour pool after footer logs and pilings have been backfilled.



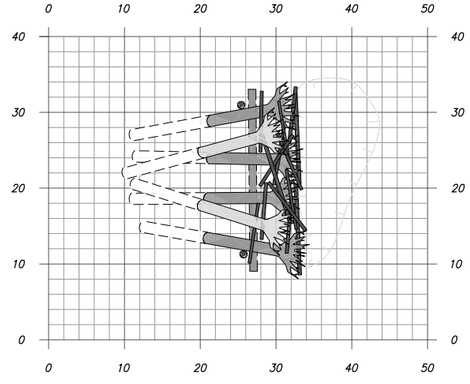
Step 2: Place 4 Type H logs over footer logs, with outside logs touching vertical piling logs previously installed.



Step 3: Place second layer of Type H logs.



Step 4: Place racking material on the upstream side of apex jam and woven between key logs in the upstream part of the apex jam.



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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE IV HABITAT ENHANCEMENT
PARCELS 1 & 2

M. FISHER
DRAWN

X
ACCEPTED

BOISE, ID 2016-04-01

LWM DETAILS

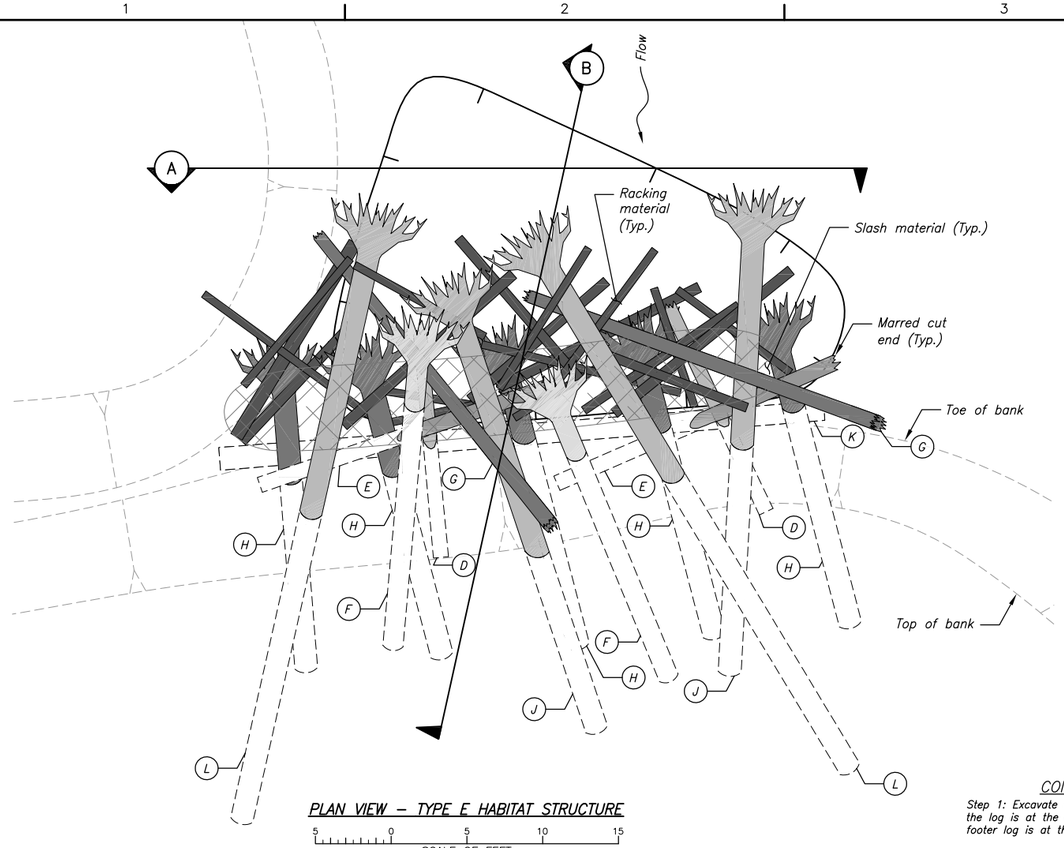
TYPE D HABITAT STRUCTURE

1678-100-2339

SHEET 6 OF 12

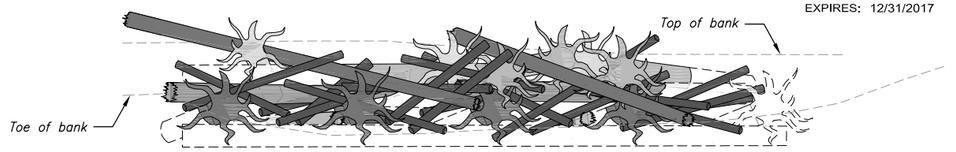
DATE AND TIME PLOTTED
April 1, 2016 11:39
PLOTTED BY
TRUSCOTT, NIC

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_PCL_1-2_LWM_LIA.dwg



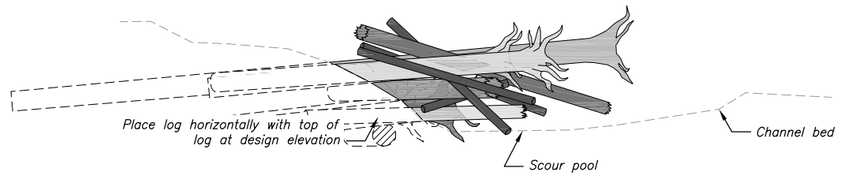
PLAN VIEW – TYPE E HABITAT STRUCTURE

SCALE OF FEET



ELEVATION A – TYPE E HABITAT STRUCTURE FRONT VIEW

SCALE OF FEET



ELEVATION B – TYPE E HABITAT STRUCTURE SIDE VIEW

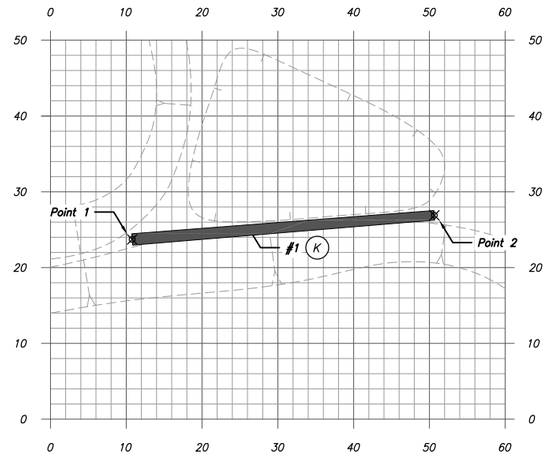
SCALE OF FEET

NOTES:

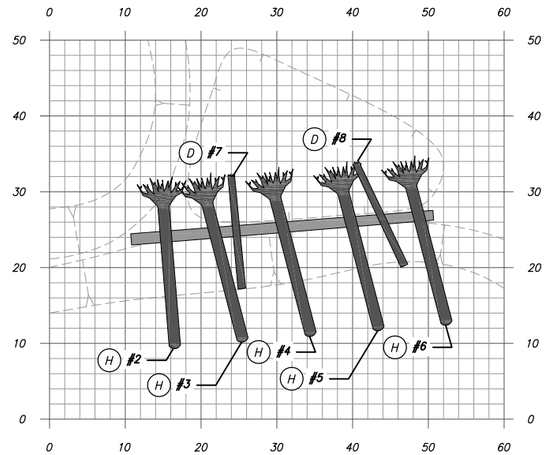
1. All logs shall come from fir, pine, or spruce trees.
2. The diameter of logs without rootwads shall be measured at the smallest cut end.
3. The exact location of the Type E Habitat Structure shall be staked by the Contractor and approved by the Contracting Officer prior to constructing a specific structure.
4. Rough grading of alcove and scour pool shall be completed prior to constructing the Type E Habitat Structure.
5. Excavation for the Type E Habitat Structure will likely uncover existing irrigation lines. The Contractor shall re-route irrigation lines encountered so that embedded logs do not contact irrigation lines.
6. Cut ends of logs that will be exposed at structure completion shall be marred prior to installation. The Contractor shall use an excavator, bulldozer, or other heavy equipment to tear apart wood fibers at the cut end of the log to create the appearance of a log that has naturally broken apart.
7. Racking and slash material shall be incorporated into the Type E Habitat Structure by weaving it in between placed logs, placing it in voids, pressing it into the bank, or otherwise including it in the structure as directed by the Contracting Officer. Racking material as shown on this sheet is schematic only and not intended to represent the actual location or orientation of individual pieces.
8. The amount of slash placed in each structure shall be as directed by the Contracting Officer and may vary from structure to structure. The cost of providing and placing slash is not part of the unit cost of constructing this structure. All costs associated with obtaining and placing slash shall be part of the bid item "Slash Material".
8. Prior to backfilling the structure, the Contracting Officer will incorporate live willow stakes into the structure. The Contractor shall accomodate the placement of live willow stakes and avoid damaging them during backfill.
9. Backfill structure using soil excavated to place logs unless the Contracting Officer determines the native soil is unsuitable for backfill and suitable soil must be imported. Place soil for backfill in 1 foot maximum lifts. Compact each lift using mechanical equipment such as an excavator bucket or equipment tracking.

CONSTRUCTION SEQUENCE

Step 1: Excavate as necessary to place log #1 (footer log) such that the top of the log is at the elevation listed in the table on this sheet and each end of the footer log is at the coordinates listed in the table on this sheet.



Step 2: Excavate as necessary to place logs #2–#8. Logs shall be placed horizontally.



TYPE E HABITAT STRUCTURE MATERIAL SCHEDULE

ITEM	DESCRIPTION	QUANTITY	ITEM	DESCRIPTION	QUANTITY
Log type (D)	15' long, 12" dia. log	2	Small racking material	8'–15' long, 4"–8" dia. log	15
Log type (E)	20' long, 12" dia. log	2	Large racking material	12'–20' long, 8"–12" dia. log	15
Log type (F)	20' long, 12" DBH log with rootwad	2	Slash material (see note 8)	Tree tops, limbs with branches and needles	As Directed
Log type (G)	25' long, 12" dia. log	2			
Log type (H)	20' long, 18" DBH log with rootwad	5			
Log type (J)	30' long, 18" DBH log with rootwad	2			
Log type (K)	40' long, 18" dia. log	1			
Log type (L)	40' long, 18" DBH log with rootwad	2			

TYPE E HABITAT STRUCTURE CONSTRUCTION DETAILS

STRUCTURE STATION	DESIGN ELEVATION	POINT 1 NORTHING	POINT 1 EASTING	POINT 2 NORTHING	POINT 2 EASTING
24+30	2911.2'	565,115.91	8,891,928.71	565,112.14	8,891,888.88

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
EXPIRES: 12/31/2017

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE IV HABITAT ENHANCEMENT
PARCELS 1 & 2

N. TRUSCOTT
DRAWN

X
ACCEPTED

BOISE, ID 2016-04-01

LWM DETAILS

TYPE E HABITAT STRUCTURE

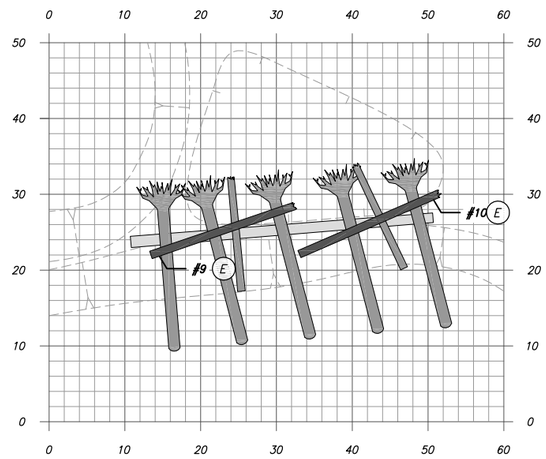
1678-100-2340

SHEET 7 OF 12

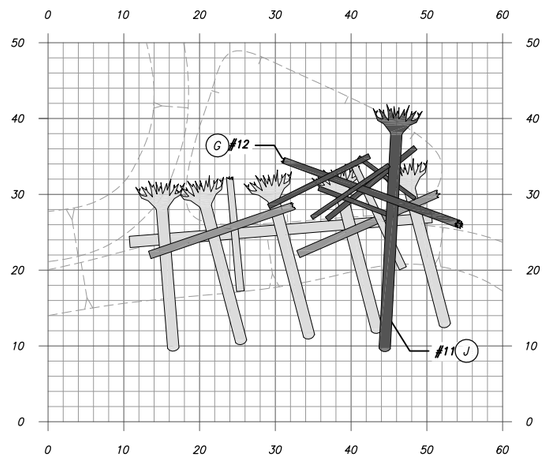
DATE AND TIME PLOTTED
April 1, 2016 12:06
PLOTTED BY
TRUSCOTT, NIC

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_PG1_1_2_HEB_Details.dwg

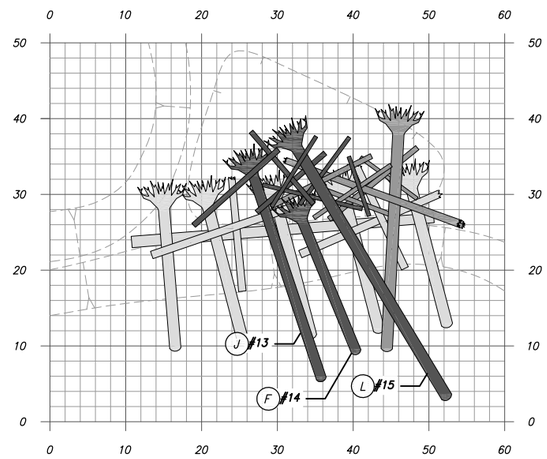
Step 3: Place logs #9 and #10 as shown, resting them on previously placed logs.



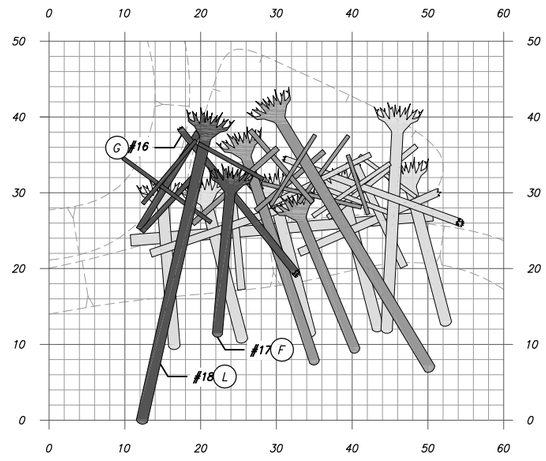
Step 4: Place #11 in the orientation shown, angling it on an 8H:1V slope into the bank. Rest log #12 on top of log #11 with the upstream end angled toward the streambed. Incorporate approximately one-third of the racking material into the structure as directed by the Contracting Officer while completing this step.



Step 5: Expand excavation as necessary to place logs #13-#15. Logs #13 and #15 shall rest on top of previously place logs; angle log #14 on a slope of 8H:1V into the bank. Incorporate approximately one-third of the racking material into the structure as directed by the Contracting Officer while completing this step.



Step 6: Place log #16 as shown, resting it on top of previously placed logs and angling the upstream end toward the streambed. Place logs #17 and #18 horizontally, resting each on top of previously placed logs. Incorporate remaining racking material and slash material into the structure as directed by the Contracting Officer then backfill structure to original bank.



REGISTERED PROFESSIONAL ENGINEER
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EXPIRES: 12/31/2017

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GRANDE RONDE SUBBASIN

CC-44 PHASE IV HABITAT ENHANCEMENT PARCELS 1 & 2

N. TRUSCOTT
DRAWN

X
ACCEPTED

BOISE, ID 2016-04-01

LWM DETAILS

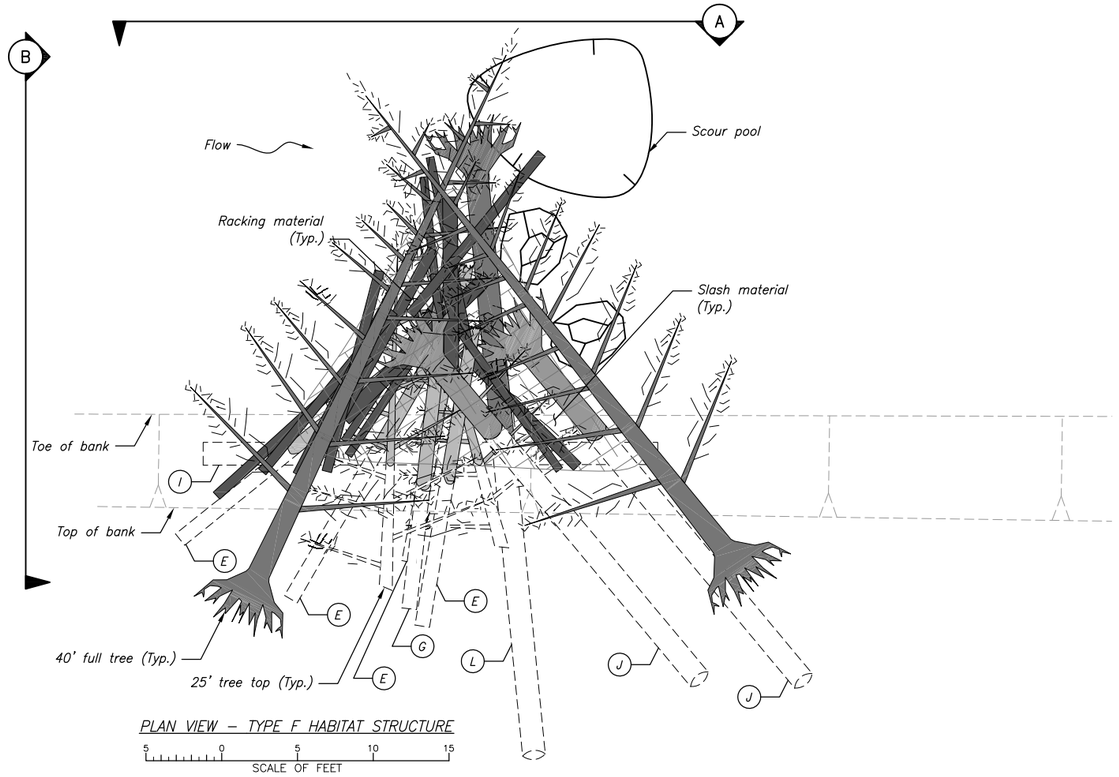
TYPE E HABITAT STRUCTURE

1678-100-2341

SHEET 8 OF 12

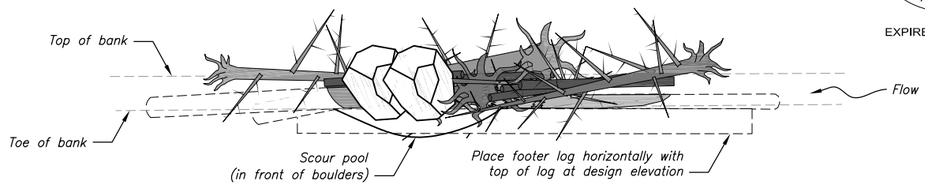
DATE AND TIME PLOTTED
April 1, 2016 11:39
PLOTTED BY
TRUSCOTT, NIC

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_PCL_1_2_HEB_Details.dwg



PLAN VIEW – TYPE F HABITAT STRUCTURE

5 0 5 10 15
SCALE OF FEET



ELEVATION A – TYPE F HABITAT STRUCTURE FRONT VIEW

5 0 5 10 15
SCALE OF FEET



ELEVATION B – TYPE F HABITAT STRUCTURE SIDE VIEW

5 0 5 10 15
SCALE OF FEET

NOTES:

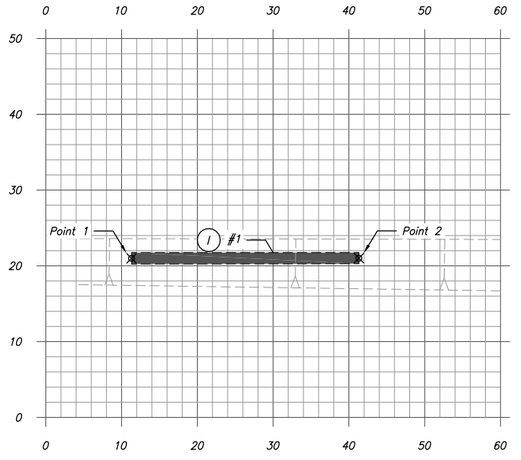
1. *All logs shall come from fir, pine, or spruce trees.*
2. *The diameter of logs without rootwads shall be measured at the smallest cut end.*
3. *Tree tops and full trees shall come from Douglas fir, grand fir, or spruce trees and shall be installed within 30 days of harvest.*
4. *Tree tops and full trees shall be handled with care to minimize breaking of branches. The Contracting Officer may reject any tree tops or full trees that have lost significant amounts of branches.*
5. *The exact location of each Type F Habitat Structure shall be staked by the Contractor and approved by the Contracting Officer prior to constructing a specific structure.*
6. *Cut ends of logs that will be exposed at structure completion shall be marred prior to installation. The Contractor shall use an excavator, bulldozer, or other heavy equipment to tear apart wood fibers at the exposed cut end(s) of the log to create the appearance of a log that has naturally broken apart.*
7. *Racking and slash material shall be incorporated into each Type F Habitat Structure by weaving it in between placed logs, placing it in voids, pressing it into the bank, or otherwise including it in the structure as directed by the Contracting Officer. Racking material as shown on this sheet is schematic only and not intended to represent the exact location or orientation of individual pieces.*
8. *The amount of slash placed in each structure shall be as directed by the Contracting Officer and may vary from structure to structure. The cost of providing and placing slash is not part of the unit cost of constructing this structure. All costs associated with obtaining and placing slash shall be part of the bid item "Slash Material".*
9. *The cost of providing and placing boulders in this structure is incidental to the cost for the bid item "Type C Habitat Structure."*
10. *Prior to backfilling the structure, the Contracting Officer will incorporate live willow stakes into the structure. The Contractor shall accomodate the placement of live willow stakes and avoid damaging them during backfill.*
11. *Backfill structure using soil excavated to place logs unless the Contracting Officer determines the native soil is unsuitable for backfill and suitable soil must be imported. Place soil for backfill in 1 foot maximum lifts. Compact each lift using mechanical equipment such as an excavator bucket or equipment tracking.*

TYPE F HABITAT STRUCTURE MATERIAL SCHEDULE

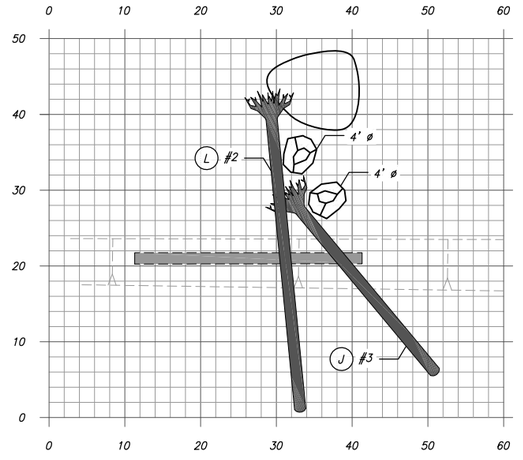
ITEM	DESCRIPTION	QUANTITY
Log type (E)	20' long, 12" dia. log	4
Log type (G)	25' long, 12" dia. log	1
Log type (I)	30' long, 18" dia. log	1
Log type (J)	30' long, 18" DBH log with rootwad	2
Log type (L)	40' long, 18" DBH log with rootwad	1
Tree top	25' long tree top with full branches	2
Full tree	40' long, 12" DBH full tree with branches	2
Small racking material	8'–15' long, 4"–8" dia. log	10
Large racking material	12'–20' long, 8"–12" dia. log	5
Slash material (see note 8)	Tree tops, limbs with branches and needles	As Directed
Boulder	4' dia. boulder	2

CONSTRUCTION SEQUENCE

Step 1: Excavate as necessary to place footer log such that the top of the log is at the elevation listed in the table on this sheet and each end of the footer log is at the coordinates listed in the table on this sheet.



Step 2: Excavate scour pool as directed by Contracting officer. Rest log #2 on top of log #1 as shown and angled into the bank on a 30H:1V slope. Place two 4' diameter boulders as shown, embedding each a approximately 1' into the streambed. Place log #3 as shown, resting on top of log #1 and angled into the bank on a 25H:1V slope.



TYPE F HABITAT STRUCTURE CONSTRUCTION DETAILS

STRUCTURE STATION	DESIGN ELEVATION	POINT 1 NORTHING	POINT 1 EASTING	POINT 2 NORTHING	POINT 2 EASTING
27+50	2910.4'	565,303.51	8,891,692.64	565,327.29	8,891,674.36
29+25	2910.2'	565,448.23	8,891,594.54	565,472.19	8,891,576.48
31+80	2908.4'	565,635.10	8,891,422.03	565,659.71	8,891,410.31

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
EXPIRES: 12/31/2017

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE IV HABITAT ENHANCEMENT
PARCELS 1 & 2

N. TRUSCOTT
DRAWN

X
ACCEPTED

BOISE, ID 2016-04-01

LWM DETAILS

TYPE F HABITAT STRUCTURE

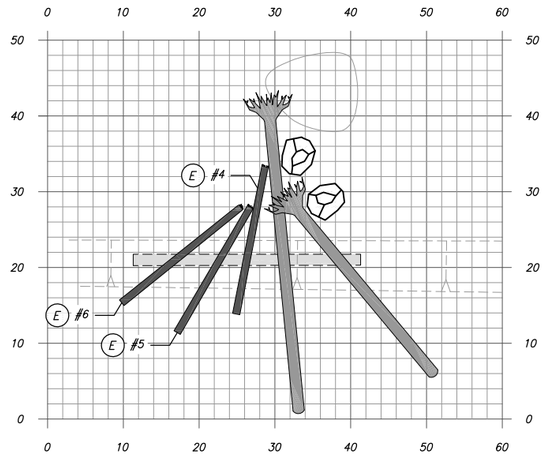
1678-100-2342

SHEET 9 OF 12

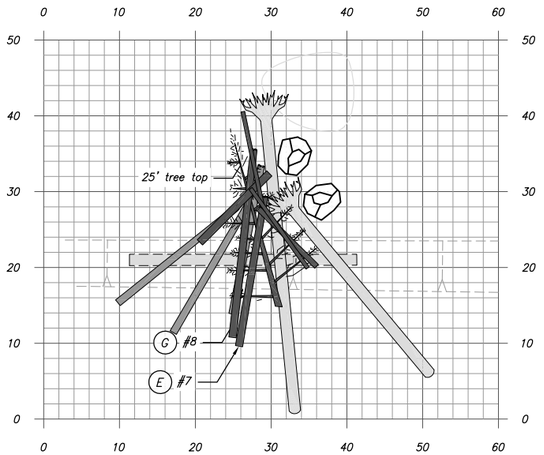
DATE AND TIME PLOTTED
April 1, 2016 12:22
PLOTTED BY
TRUSCOTT, NIC

CAD SYSTEM
AutoCAD Civil 3D 2014
CAD FILENAME
CC44_PCL_1_2_Lrg_Stmbnk_Hab_Details.dwg

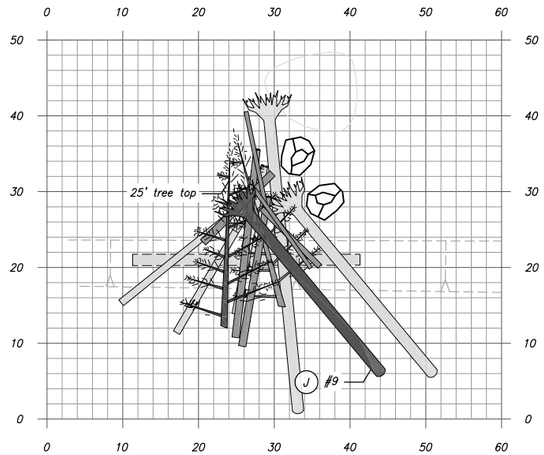
Step 3: Place logs #4 – #6 as shown, resting each horizontally on top of log #1.



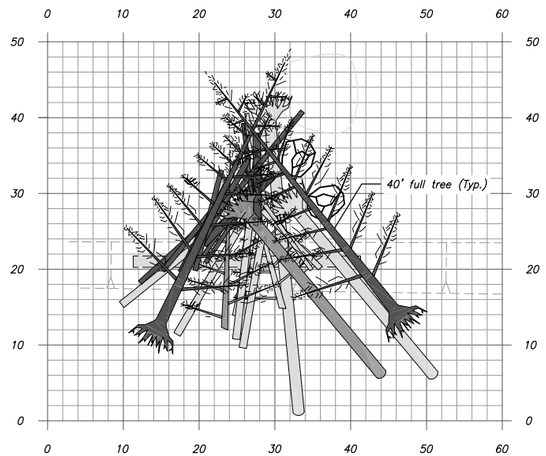
Step 4: Rest a 25' tree top then logs #7 and #8 on top of previously placed logs. Incorporate approximately ½ of the racking material into the structure at this time.



Step 5: Rest a 25' tree top on top of previously placed logs as shown. Place log #9 on top of all previously placed material and angled into the bank on a 7.5H:1V slope. Backfill the structure to the existing bankline.



Step 6: Incorporate remaining racking material into the structure. Place two 40' full trees as shown with the rootwads on top of the bank and tops angled toward the creek bed.



REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
EXPIRES: 12/31/2017

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FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC-44 PHASE IV HABITAT ENHANCEMENT
PARCELS 1 & 2

N. TRUSCOTT
DRAWN

X
ACCEPTED

BOISE, ID 2016-04-01

LWM DETAILS

TYPE F HABITAT STRUCTURE

1678-100-2343

SHEET 10 OF 12

DATE AND TIME PLOTTED
April 1, 2016 11:40
PLOTTED BY
TRUSCOTT, NIC

CAD SYSTEM
AutoCAD Civil 3D 2014
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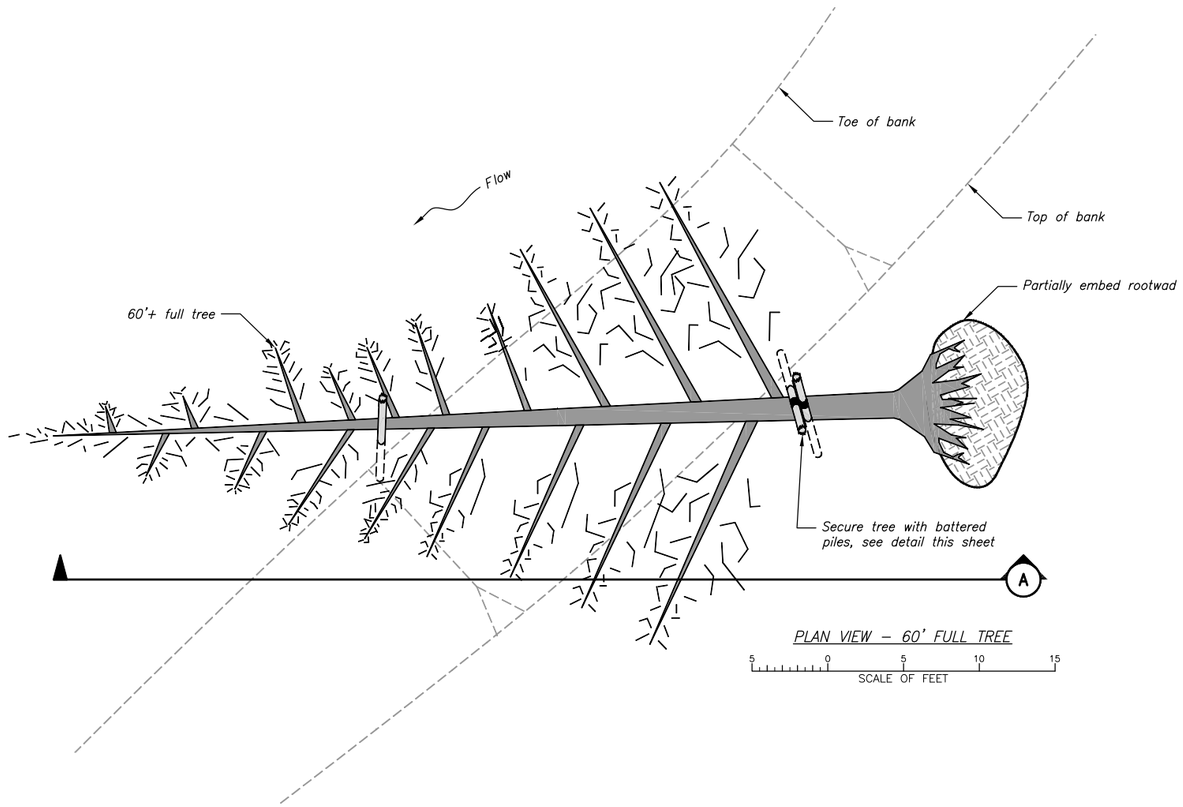
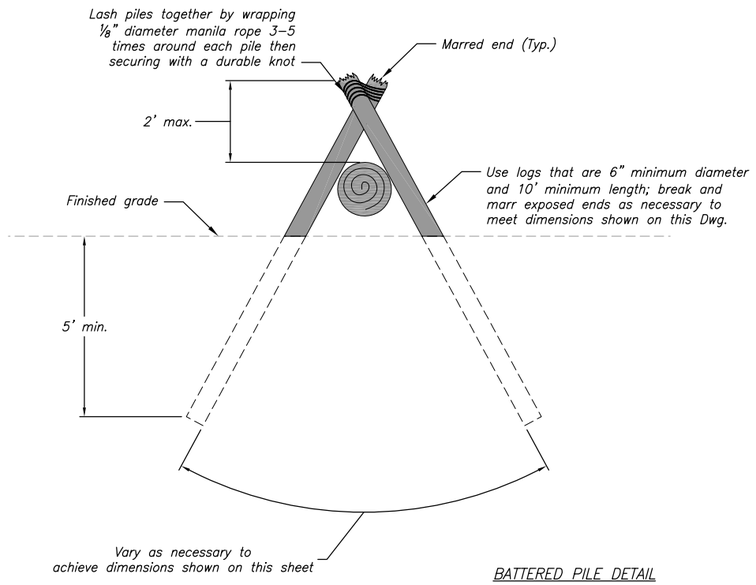


PLAN VIEW – 60' FULL TREE

5 0 5 10 15
SCALE OF FEET



BATTERED PILE DETAIL

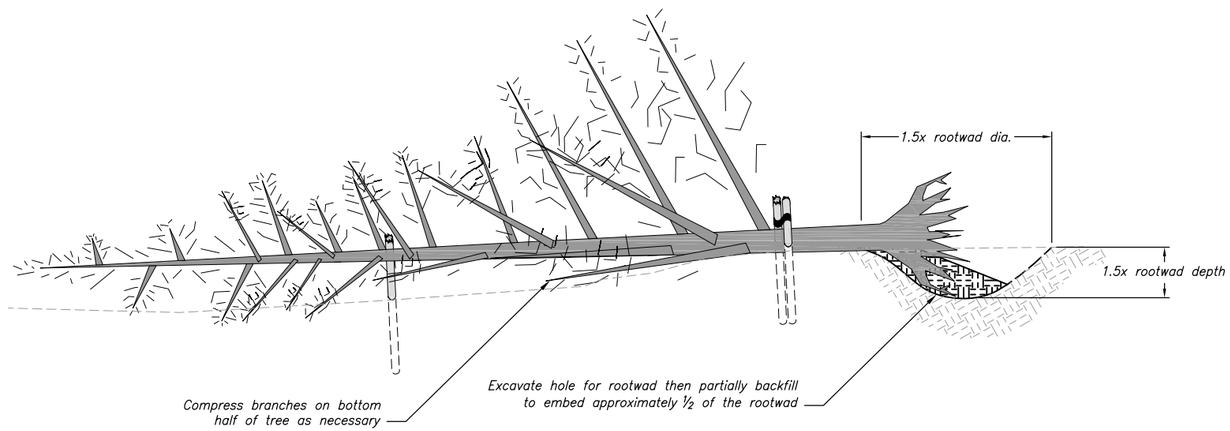
4 0 4 8 12
SCALE OF FEET

Notes:

1. The exact location of each 60' full tree shall be staked by the Contractor and approved by the Contracting Officer prior to constructing.
2. Each tree shall be a minimum length of 60' long and shall have a minimum DBH of 18". Trees shall be Douglas fir, grand fir, or spruce trees and shall be installed within 30 days of harvest. Each tree shall come with a rootwad that is at least twice the diameter of the DBH.
3. Tree shall be handled with care to minimize breaking of branches. The Contracting Officer may reject any trees that have lost significant amounts of branches.
4. Piles shall be 6" minimum diameter logs with a minimum length of 10'. Piles may be installed by driving (using a small pile driver or excavator–mounted driving attachment), augering, or excavating.
5. Piles shall be embedded at least 5' below the finished ground surface; piles shall be lashed together with manila rope as shown in the battered pile detail on this sheet.
6. Cut ends of piles that will be exposed at structure completion shall be marred prior to installation. The Contractor shall use an excavator, bulldozer, or other heavy equipment to tear apart wood fibers at the exposed cut end(s) of the log to create the appearance of a log that has naturally broken apart.
7. Excavate as necessary to embed half of the rootwad.

60' FULL TREE MATERIAL SCHEDULE

ITEM	DESCRIPTION	QUANTITY
Pile–log	10' min. length, 6" dia. log	3
60' full tree	60' min. length, 18" min. DBH full tree with branches	1



ELEVATION A – 60' FULL TREE

5 0 5 10 15
SCALE OF FEET

60' FULL TREE CONSTRUCTION DETAILS

STRUCTURE STATION
4+70
4+85

60' FULL TREE DETAILS

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER
EXPIRES: 12/31/2017

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COLUMBIA/SNAKE RIVER SALMON RECOVERY PROGRAM
FCRPS HABITAT IMPROVEMENT PROGRAM

GRANDE RONDE SUBBASIN

CC–44 PHASE IV HABITAT ENHANCEMENT
PARCELS 1 & 2

N. TRUSCOTT
DRAWN

X
ACCEPTED

BOISE, ID 2016–04–01

LWM DETAILS

60' FULL TREE DETAILS

1678–100–2344

SHEET 11 OF 12

DATE AND TIME PLOTTED
April 1, 2016 11:40
PLOTTED BY
TRUSCOTT, NIC

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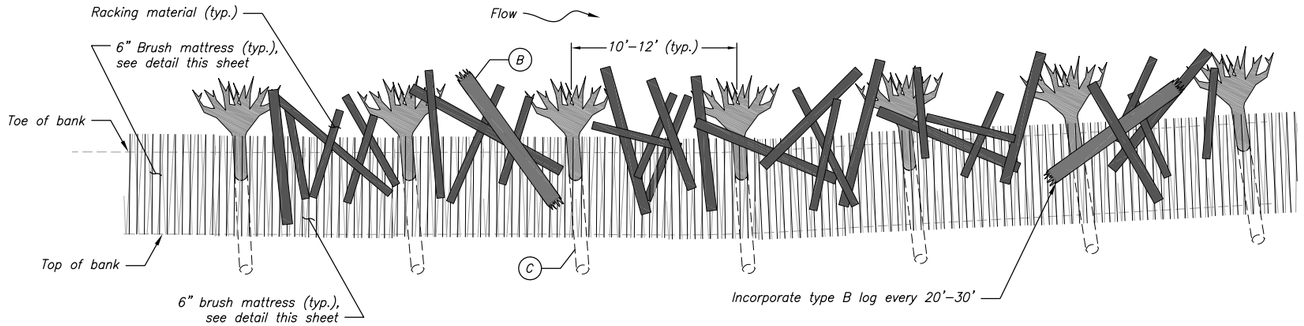


EDGE ROUGHNESS PLAN VIEW

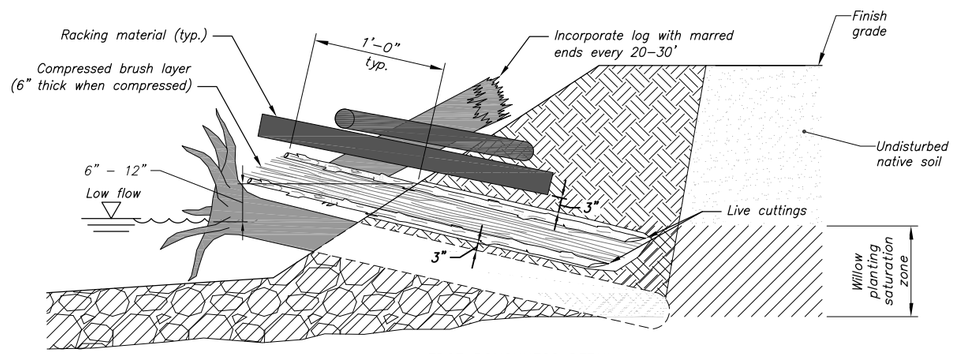
5 0 5 10 15
SCALE OF FEET

NOTES:

1. A trench shall be excavated at location identified in these plans so the bottom of the brush mattress layer is within the saturation zone.
2. Place logs with rootwads on the bottom of the trench, then place a 3" lift of soil on top of the logs with rootwads.
3. All logs shall come from fir, pine, or spruce trees.
4. Embedded logs with rootwads shall be placed approximately every 10'–12' on center and placed with their rootwads oriented slightly upstream.
5. Logs shall be placed such that approximately ⅓ of the total length (including rootwad) is exposed. Logs shall be placed on a slope of approximately 10H:1V into the bank.
6. Live cuttings shall be placed every 12 inches for the entire length of trench. Live cuttings shall be installed with buds oriented outward.
7. Dead branches shall be placed uniformly along the trench on top of the live cuttings to a compressed depth of 6 inches.
8. A top layer of live cuttings shall be placed every 12 inches along the length of the edge roughness. Live cuttings shall be installed with buds oriented outward.
9. Place a lift of 3" of soil on top of the upper layer of live cuttings then thoroughly water in the lift and gently tamp to ensure soil is in direct contact with live cuttings.
10. Following watering–in, the trench shall be backfilled. Soil shall be placed and compacted in 6 inch lifts.
11. Racking material and logs with marred ends shall be incorporated into the trench as it is backfilled. Racking material and logs with marred ends shall be placed in various orientations to provide an irregular face on the bank of the channel.
12. The exact location of each occurrence of edge roughness shall be staked by the Contractor and approved by the Contracting Officer prior to constructing a particular occurrence.
13. Rough grading of the side channel and inlet shall be completed prior to constructing edge roughness.

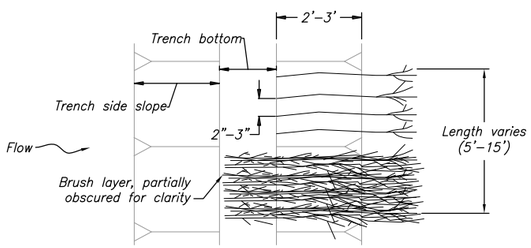
EDGE ROUGHNESS MATERIAL SCHEDULE (PER 10 FT LENGTH)

ITEM	DESCRIPTION	QUANTITY
Log type (B)	10' long, 12" dia. log	⅓ (1 every 20'–30')
Log type (C)	10' long, 12" DBH log with rootwad	1
Live cuttings	4' long, live willow cutting	20
Dead brush layer	6" thick layer of dead brush when compressed	~0.8 CY
Small racking material	8'–15' long, 4"–8" dia. log	5
Large racking material	12'–20' long, 8"–12" dia. log	5



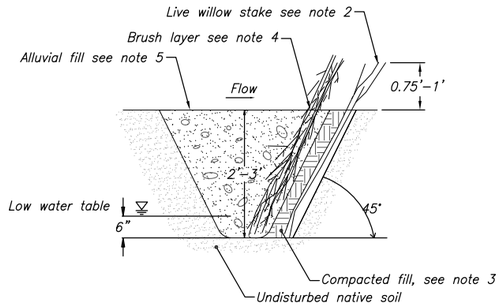
EDGE ROUGHNESS DETAIL

N.T.S.



WILLOW TRENCH PLAN VIEW

N.T.S.



WILLOW TRENCH SECTION VIEW

N.T.S.

NOTES:

1. Excavate trench to 6" below low water table.
2. Place a row of live stakes spaced approximately 2"–3" on center. Rest the live stakes on the downstream exposed face of the excavated trench with their buds oriented upward.
3. Place a lift of soil (6" min.) over the live stakes and compact material against stakes with the bucket of an excavator.
4. Place a layer of brush consisting of live and dead stems and branches against the compacted soil. Branches shall be ½" to 4" diameter and sufficient length to protrude 2'–4' above finished ground surface. Brush layer shall be a minimum of 6" thick when compressed.
5. Backfill remainder of trench in 1' maximum lifts, compacting each with the bucket of an excavator.
6. Use any remaining material to create microtopography as directed by the Contracting Officer.

REGISTERED PROFESSIONAL ENGINEER
83129PE
OREGON
JULY 14, 2009
MARTIN K. FISHER

EXPIRES: 12/31/2017

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CC–44 PHASE IV HABITAT ENHANCEMENT
PARCELS 1 & 2

N. TRUSCOTT
DRAWN

X
ACCEPTED

BOISE, ID 2016–04–01

LWM DETAILS

EDGE ROUGHNESS & WILLOW TRENCH DETAILS

1678–100–2345

SHEET 12 OF 12

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TRUSCOTT, NIC

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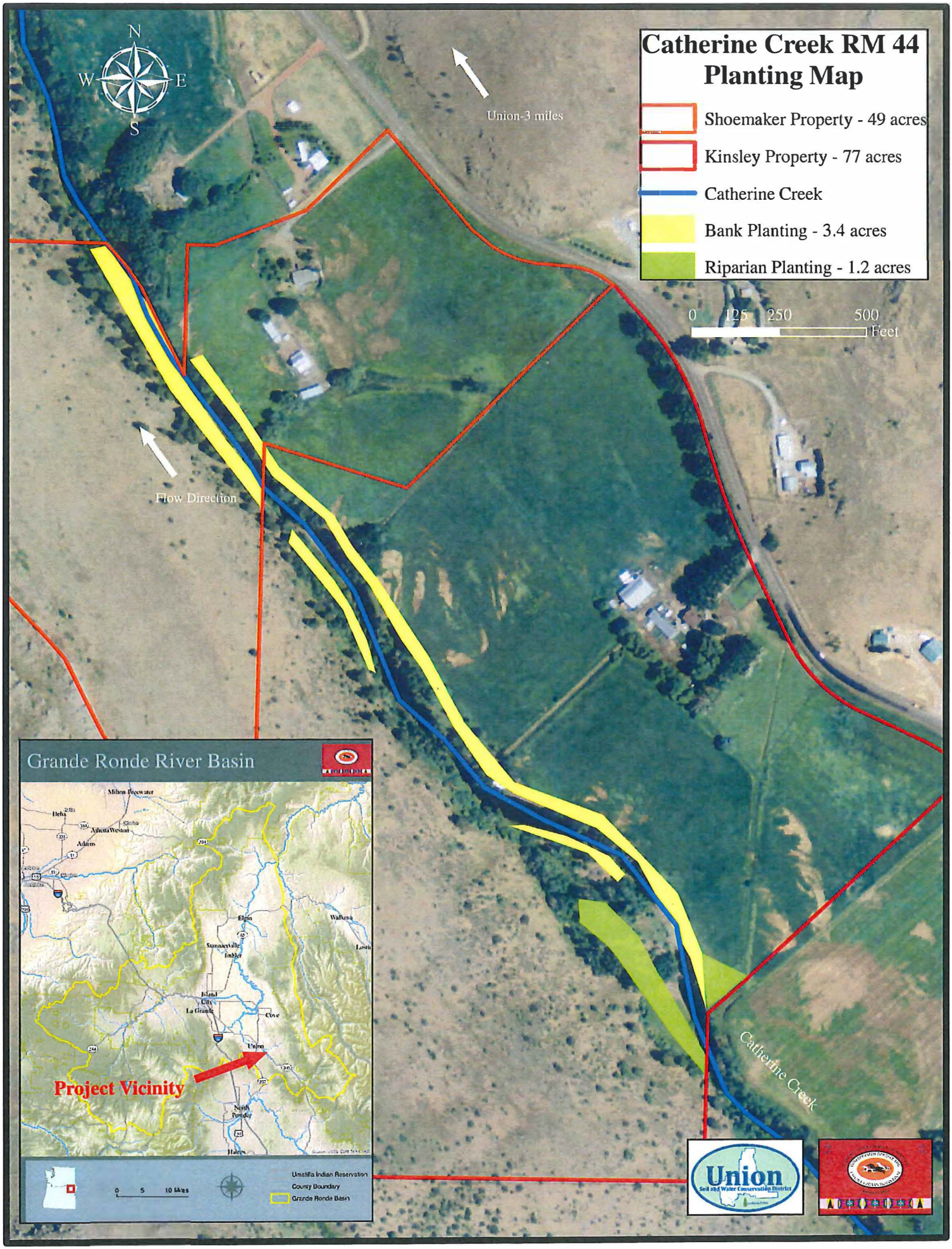
APPENDIX H

PARCELS 1 AND 2 PLANTING PLANS


Catherine Creek RM 44
Planting Map
Shoemaker Property - 49 acres
Kinsley Property - 77 acres
Catherine Creek
Bank Planting - 3.4 acres
Riparian Planting - 1.2 acres
0 125 250 500
Feet
N
W
E
S
Union-3 miles
Flow Direction
Catherine Creek
Grande Ronde River Basin
Project Vicinity
Umatilla Indian Reservation
County Boundary
Grande Ronde Basin
Union
Soil and Water Conservation District

APPENDIX I

LARGE WOOD RISK ASSESSMENT

INTRODUCTION

The U.S. Bureau of Reclamation (BOR) has been working collaboratively with representatives from the Oregon Department of Fish and Wildlife (ODFW), Union Soil and Water Conservation District (USWCD), and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) to develop feasible plans for the Catherine Creek River Mile 44 (CC-44) Channel Restoration Project Phases III and IV including restoration activities on parcels 1, 2, 3, and 4 (Project). This reach-based restoration project would address multiple limiting biologic factors in Catherine Creek to improve habitat and passage for fish listed by the Endangered Species Act (ESA). The Project would address many of the recommended restoration activities in the Grande Ronde Subbasin Plan (Northwest Power and Conservation Council 2004), Federal Columbia River Power System (FCRPS) Biological Opinion (BiOp) (U.S. Fish and Wildlife Service 2000), and the Northeast Oregon Snake River Recovery Plan (National Marine Fisheries Service 2010).

Multiple site visits with USWCD and Reclamation, CTUIR, Bonneville Power Administration (BPA), ODFW, and U.S. Fish and Wildlife Service (USFWS) were conducted to aid in production of Phase I and Phase II through IV restoration actions proposed between river mile (RM) 42.7 and RM 46.1 (Project Reach). Conceptual design for the Project specifically addresses previously identified limiting factors specified in the main body of this report. Phases III and IV of the Project involve restoring historical channel planform and constructing multiple riffles and LWM-enhanced pools throughout the reach, as well as establishing side-channel and backwater habitat areas and floodplain reconnection. The third phase of implementation is located on Parcels 4 and 3 and is scheduled for construction during the summer of 2015, winter of 2015 and summer of 2016. Phase IV is located on Parcels 1 and 2 (Construction scheduled for 2016).

PURPOSE OF RISK BASED ASSESSMENT

In September 2014, Reclamation implemented a Large Woody Material – Risk Based Design Guidelines that assesses risk associated with any proposed LWM structure for a stream and fish habitat related project (Reclamation, 2014). These design guidelines will be followed for Phases III and IV of the Project. These remaining phases of the Project contain multiple LWM structures that will require a risk assessment to determine minimum design guidelines for stability of the proposed LWM structures. This document assesses the risk for each proposed structure or complex of structures associated with the Project in relation to public safety and property damage.

RISK ASSESSMENT

Risk associated with the design and installation of large wood structures throughout the Project is based on four factors related to Reach User Characteristics.

Reach User Characteristics

The reach user characteristics document the typical river use and human interaction through the documented reach. Characteristics of use include frequency of use, skill level of users, availability of access to the site, and the presence of children on the reach. For the purpose of this risk assessment parcels 1-4 were combined when assessing reach user characteristics as the user characteristics do not change throughout the reach.

Catherine Creek through the Project area, parcels 1, 2, 3, and 4, has very low human use. There is no known recreational use of Catherine Creek through the project reach for rafting or kayaking. It is possible that the reach sees the rare fisherman, hunter or summer tuber within the project reach. The main use of the river occurs in consistent crossing locations used by the landowners and land managers to access the south side of their properties to manage the land and livestock that utilize both sides of the valley. Rating the frequency of use from low (0) to high (10) it is approximated that the level of use is relatively low and given a score of 2. Although the users of this reach are familiar with Catherine Creek and its characteristics their water recreational skill level is estimated to be fairly low since they are typically untrained and don't routinely partake in the associated activities. The water recreational skill level of the typical user of Catherine Creek within the reach is estimated to be low (beginner) and was given a rating value of 8, on a scale of 0-10 where 0 is an advanced water user. The reach is located in a rural setting and sits entirely on private property with no good public access upstream or downstream of the site. Highway 203 does come close to the project area (over 1 mile upstream) but access is down a steep, rocky and brushy slope that is not conducive to human access. Due to the limited access upstream and downstream of the project site the access is rated as poor and was given a rating of 2, on a scale of 0-10 where 0 is very poor access. The only children likely present within the system would be children associated with the landowners, and land managers. It is assumed that children would typically be under the supervision of an adult during their interaction with Catherine Creek and that their presence would be on a limited basis. The highest potential for child access is on parcel 2 where the landowners talk about grandchildren utilizing the right bank and main channel immediately upstream of their summer recreational area. Child presence was given a rating of 3 since it is possible that children interact with Catherine Creek, but on a limited basis, but typically in conjunction with an adult being present and during summer low flow periods. The average rating for the user characteristics of the project reach is 3.8, which is a fairly low risk.

Property/Project Characteristics

The property risk characteristics are associated with in-channel structures, floodplain structures, and the land use. In-channel structures would include infrastructure like bridges, piers, diversion structures, etc. The more in-channel structures present the higher risk to damage of one of these structures with the placement of LWM structures. Placement of LWM structures create a potential flooding risk to floodplain structures (houses, barns, etc.) if these structures fail and create blockages within the channel corridor. The more buildings and structures the higher the property damage risk. Property damage risk is associated with the potential damages and what

effects that would have on the land and land users. National forest land would typically have a low rating since those lands are generally natural and predominately unmaintained, whereas an urban area would be associated with a high risk to property damage due to the value of land and associated owners.

Looking at potential risk associated with property it is broken down into three categories. In-channel structures within the Project consist of hardened crossings for livestock and vehicular access and one clear spanning bridge across Side Channel 1 on Parcel 3. Downstream of the project site the next piece of infrastructure is the adult collection facility maintained by the CTUIR. This structure is approximately 0.3 miles downstream and consists of a concrete vertical grade control which could likely pass floating wood debris. Downstream of the adult collection facility the next structure is the state ditch diversion dam 0.3 miles downstream of the collection facility. This diversion dam is likely to pass wood debris. Approximately 1.5 miles downstream of the state ditch diversion is the first major piece of infrastructure which is the Highway 203 crossing of Catherine Creek on the east side of Union, Oregon. Due to the low amount of debris catching infrastructures within a mile of the Project the in-channel structures are rated as low risk and were given a rating of 2. Floodplain structures located throughout the Project typically consist of four residential houses, and miscellaneous outbuildings. There are relatively few floodplain structures and they were given a risk rating of 3 given their typical location outside of the existing 100-year floodplain. Property damage to the land based on land use was given a rating of 5 for the Project area. This medium risk rating is based on the current land use through the majority of the Project of agricultural use and ranching use. The installation of new irrigation infrastructure increases this risk. The average rating for property risk is 3.3 which is low-moderate risk.

Stream Response Potential

This property damage risks increase depending on the potential for a stream to respond to changes due to placement of LWM structures. Stream response is based on five factors including: stream type, riparian corridor, bed scour potential, hydrologic regime, and susceptibility to bank erosion.

Catherine Creek located within the project reach can be described predominately as a response reach, where low stream gradients are present and the channel is accessing substantial floodplain area in relationship to the confined transport reach upstream of the Project. The response potential of this area was rated as a moderately high response reach and was given a numerical rating of 7. The associated riparian corridor through the Project is narrow, but continuous. The following phases of the project will be establishing a wider riparian corridor downstream, but it will take time for it to develop and be able to resist rapid change. The riparian corridor was given a numerical rating of 5 since it is continuous but narrow. The channel bed through the Project consists of large gravels and small cobbles with an estimated median grain size of 70 mm. Downstream of the Project the channel becomes more confined and channelized forming a larger armor layer within the bed making it resistant to scour. Stream response potential for the Project was given a numerical rating of 5 since we are located within a gravel and cobble bed

that can scour, but often creates armor layers that aid in resisting scour. Catherine Creek is currently located within a snowmelt dominated regime where peak discharges occur through the Project from May through June. Climate change could like slowly convert this system from a snowmelt dominated system to a rain on snow system, but the timeline associated with climate change will likely extend that hydrologic regime shift past the effective life span of the proposed wood structures. For these reasons the Project was given a numerical hydrologic regime risk rating of 2 since snowmelt dominated systems tend to be fairly predictable in both timing and quantity of discharge. Catherine Creek is composed of moderately erosion resistant material as described in the Catherine Creek Tributary Reach Assessment. Based on Reclamation's assessment bank erosion was given a numerical risk factor rating of 5. The average score for stream response potential is 4.8.

Structure Characteristics

Structures were evaluated on a per structure or per complex of structures to determine the risk associated with the structure characteristics. The Project was broken down into 109 structures or structure complexes. Each complex was evaluated on the six structure characteristics including: channel activity, is the structure located on the outside of a bend, the strainer potential associated with the structure, upstream egress potential, upstream site distance and visibility of the structure and the depth and velocity adjacent or through the structure. These ratings can be found in the included public safety risk matrices for all structures and structure complexes.

Summary

The risk assessment analyzed risk at 109 large wood complex sites throughout Phases 3 and 4 of the CC-44 Restoration project. These sites ranged in property damage risks from "low" for floodplain and side channel wood and "moderate" for main channel wood. Public safety risk varied from "low" to "high" based on the wood structures location. These risk ratings required the design engineer to design key components of the structures to be stable at the 10-, 25-, or 50-year flood events based on the risk level. Minimum factors of safety vary depending upon the risk rating, but vary between 1.25 and 1.75. A summary table of the calculated factors of safety for each structure type can be found below. The following sheets show the property damage risk and public safety risk for the 109 structures.

Project Site	LWM Structure Type	Peak Flow Used for Design	Calculated FOS (Bouyancy)	Calculated FOS (Sliding)	C
Parcel 4	Side Channel Inlet	100-year	2.1	4.6	
Parcel 4	Streambank Habitat	100-year	1.5	3.5	
Parcel 4	Tight Radius Bend	100-year	2.5	2.9	
Parcel 4	Mild Radius Bend	100-year	2.2	3.1	
Parcel 4	Sweeper Log	100-year	1.9	2.4	

Project Site	**LWM Structure Type**	**Peak Flow Used for Design**	**Calculated FOS (Bouyancy)**	**Calculated FOS (Sliding)**	**C**
Parcel 4	High Energy Bank	100-year	2.6	9.1	
Parcel 4	Small Apex Jam	100-year	1.7	2.8	
Parcel 4	Large Apex Jam	100-year	2.3	3.7	
Parcel 3	Upstream Bend Component	100-year	2.2	3.0	
Parcel 3	Middle Bend Component	100-year	2.7	2.4	
Parcel 3	Downstream Bend Component	100-year	2.5	2.4	
Parcel 3	Small Apex Jam	100-year	1.7	2.8	
Parcel 3	Large Apex Jam	100-year	2.3	3.7	
Parcel 3	Side Channel 1 Inlet	100-year	5.0	10.4	
Parcel 3	Streambank Habitat	100-year	1.5	3.5	
Parcel 3	Sweeper Log	100-year	1.9	2.4	
Parcel 3	High Energy Bank	100-year	2.6	9.1	
Parcels 1 & 2	Type A LWM	100-year	1.5	2.9	
Parcels 1 & 2	Type B LWM	100-year	1.8	1.9	
Parcels 1 & 2	Type C LWM	100-year	2.5	3.3	
Parcels 1 & 2	Type D LWM	100-year	2.3	3.7	
Parcels 1 & 2	Type E LWM	100-year	2.6	9.1	
Parcels 1 & 2	Type F LWM	100-year	1.6	1.5	

Large Woody Material - Risk Assessment Workbook

Project Name	CC-44	**Site**	Catherine Creek Phases III -IV
Project Numbe	0528-021-00	**Structure**	Multiple
Watercorse	Catherine Creek	**Analyst**	Jeff Fealko
		Latest Revision	3/31/2015

Workbook Description

Filename: D:\BOD\Appendix C LWM Risk Assessment\[Large Woody Material - Risk Assessment.xlsx]Summary

Page Number:	Sheet Titles:
1	Large Woody Material - Risk Assessment Workbook
2	Public Saftey Risk Matrix
3	Property Damage Risk Matrix
4	Property Damage - Channel
5	Property Damage - Side Channels and Floodplain
6	Public Saftey - Site 1
7	Public Saftey - Site 2
8	Public Saftey - Site 3
9	Public Saftey - Site 4
10	Public Saftey - Site 5
11	Public Saftey - Site 6
12	Public Saftey - Site 7
13	Public Saftey - Site 8
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108	Public Saftey - Site 103
109	Public Saftey - Site 104
110	Public Saftey - Site 105
111	Public Saftey - Site 106
112	Public Saftey - Site 107
113	Public Saftey - Site 108
114	Public Saftey - Site 109
115	LWM Design Guideline Rules
116	LWM Risk Assessment Summary

Public Saftey Risk Matrix

Project Name	CC-44	**Site**	Catherine Creek
Project Number	0528-021-00	**Structure**	Multiple
Watercorse	Catherine Creek	**Analyst**	Jeff Fealko
		Latest Revision	3/31/2015

Structure Characteristics

Score	Factor	Description
	Active Channel	This factor rate the level of use that can be expected within the project reach by recreationalists and is typically for those floating the river in a water craft; however, it can also account for people using the project reach for swimming and other in-river activities, as appropriate. Initially, potential use should be estimated through interviews of local user groups and a review of pertinent published guides and internet sources.
	Outside of Bend	This factor rates the location of the LWM structure design inside or outside of a bend. This factor rates the likelihood or potential that a recreationalist may be forced into the structure by the primary stream forces or flow characteristics within the channel. The smaller the radius of curvature of the bend (greater the tortuosity) or the greater percentage of stream momentum concentrated in the direction of the LWM structure, the higher this rating shall be.
	Strainer Potential	This factor rates the potential for a structure to pin or entrap a person against it. Structures that have some porosity or protrusions may have a higher potential to pin or entrap an individual. LWM elements may be designed to provide an amount of porosity with elements that are meant to snag flotsam in the river to enhance the habitat complexity and formation. LWM structures such as these would be rated high. Some LWM structures are filled with rock material creating a nearly solid structure and can contain smooth outer edges designed as hydraulic features for restoration needs. These structures can be rated low and the rating is dependent on the actual design features.
	Egress Potential	This factor rates the ease of avoidance for a person floating or swimming in the area of the structure. This includes avoiding the structure in terms of potential stream currents upstream and at the structure. Additionally, this factor should rate the ability to get around the structure through a clear navigable or walkable path. In a narrow stream with a LWM structure that extends significantly into the stream current, this factor could be rated high. For a wide river with uniform flow current and a small LWM structure placed on one bank, this factor could be rated low. Additional bank condition factors to consider might be a deeply incised channel or a channel with dense thorny vegetation on its banks where exiting and walking around a structure may be difficult. In these particular situations, the factor may be rated higher.
	Sight Distance	This factor rates the ability for recreationalists to see the structure and have the time to move away as they approach from upstream. This factor rates both the ability to see the structure from upstream as well as the rate at which one approaches. This factor should be considered for periods in which recreationalists are either known or thought to utilize the stream reach (i.e., spring or summer rafting season, or fall fishing season). Sight distance should consider obstructions to view, slope of river upstream, velocity of river, width of river, and length of approach from LWM structure location when readily visible. A LWM structure located immediately around a bend with limited ability to see in a swift stream would be rated high for this factor. A LWM structure located in a straight and wide reach of a slow moving river that is clearly seen at all river flows could be rated low for this factor.
	Depth x Velocity	This factor rates channel approach velocity and depth to define the safety of standing and moving away or around the structure. For a situation where a person swimming in the stream and approaching the structure can reasonably stand and walk around the structure, a low rating could be applied. For any structure in which wading in the river as one approaches or arrives at the structure is difficult, a high rating would likely apply. As a guide, a low rating could result from a velocity depth product of 0 to 2, a moderate rating could result from a velocity-depth product of 3 to 5, and a high rating could result from a velocity-depth product of 6 and above. However, the individual rating for this factor must be made by the design team for reasonable case specific circumstances to be encountered.
0.0	**Total**	
0.0	**Average Score**	

Reach-User Characteristics

Score	Factor	Description
2	Frequency of Use	This factor rates the level of use that can be expected within the project reach by recreationalists and is typically for those floating the river in a water craft; however, it can also account for people using the project reach for swimming and other in-river activities, as appropriate. Initially, potential use should be estimated through interviews of local user groups and a review of pertinent published guides and internet sources. For example, a reach of river that is frequented by an established guide company for use of inner-tubing or that is frequently used by the general public for such purposes would be rated high. Similarly, if the reach is known for intense fishing or is listed as such within fishing guides or other sources, it would be rated a high score. Conversely, a reach of river where use is unknown and not documented as being used by anyone could be rated low.
8	Skill Level	This factor rates the risk associated with the recreational skill level of users in the project reach and can be applied to people floating the reach or by swimming ability in locations where public tend to swim. For people floating the reach, craft type and safety equipment use could be factored into the risk assessment (i.e., low-skilled inner-tubers to highly-trained whitewater boaters). For example, a reach that is used by a range of individuals in which limited or no knowledge of river safety is practiced would be rated as low skill level and would likely receive a high numerical rating as having a greater risk hazard. Conversely, a reach that is only used by highly advanced and trained boaters with proper safety equipment would be rated as high skill level and could receive a lower numerical rating as having a lesser risk hazard if LWM conditions were already expected to be encountered in the reach.
2	Access	This factor rates the risk of having the public recreating in the project reach by accessibility. A reach with good access that is provided by a public boat ramp or park could be rated as high. A reach with access from nearby bridges or non-public, but utilized locations might be considered moderate, and a site with no nearby access provided by public roads and difficult terrain may be rated as low. Good access would receive a higher numerical risk rating, whereas poor access would receive a lower numerical risk rating. Individual ratings must be decided by the project design team and be based on local research of reach use.
3	Child Presence	This factor rates the public safety risk at the project reach for the presence of children and is used to factor locations where children are known to be present and may be prone to investigate LWM structures to play on or near. As an example, a reach located adjacent to a summer camp for children would likely have a high numerical risk rating. Conversely, a location with difficult access and not near any location where children are known to be present would likely have a low numerical risk rating. Individual ratings must be decided by the project design team and be based on local research of local known uses.
15.0	**Total**	
3.8	**Average Score**	

Property Damage Risk Matrix

Project Name: CC-44
Project Number: 0528-021-00
Watercorse: Catherine Creek

Site: Catherine Creek Phases III -
Structure: Multiple
Analyst: Jeff Fealko
Latest Revision: 3/31/2015

Stream Response Potential

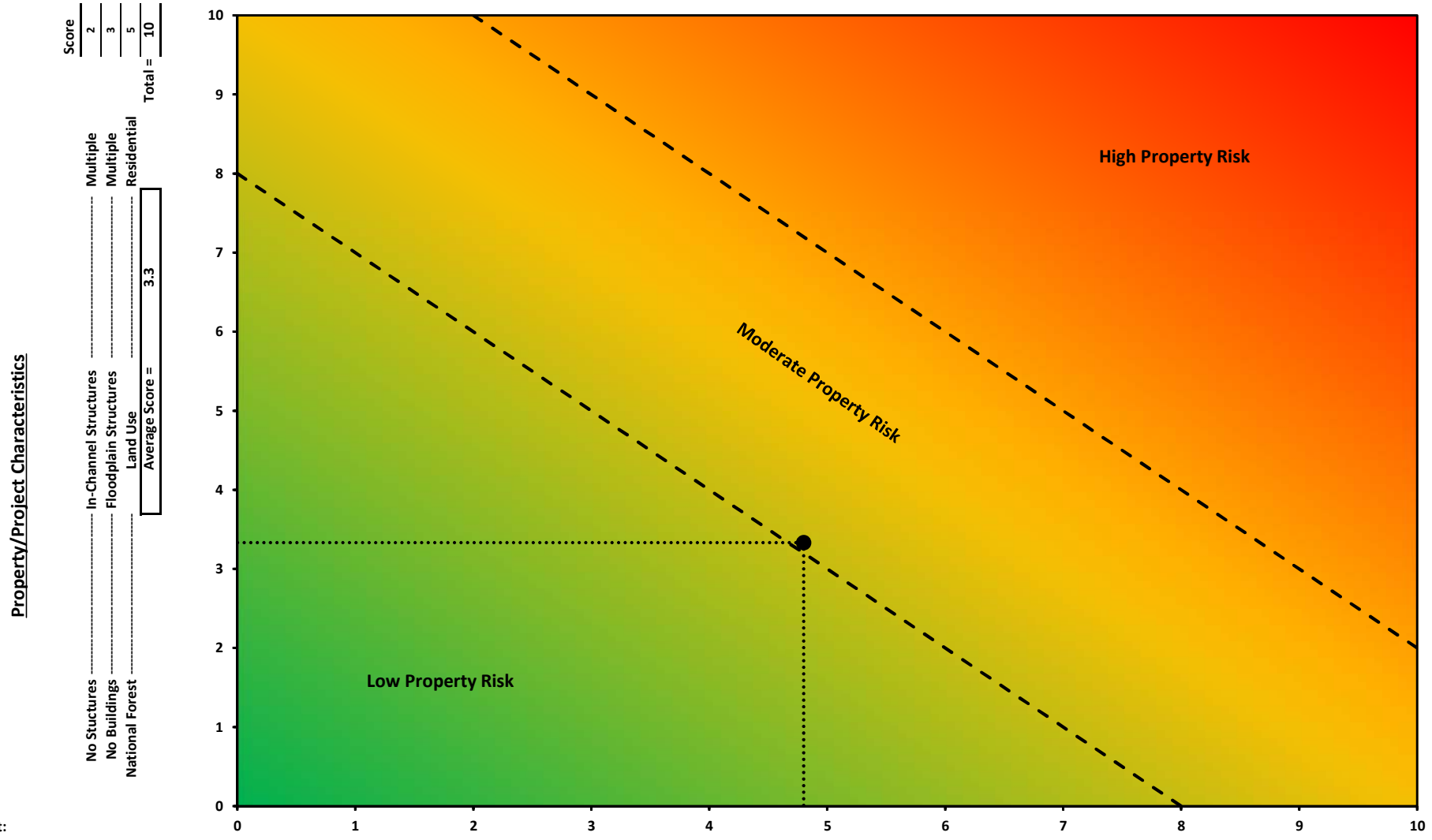
Score	Factor	Description
7	Stream Type	This factor rates the potential for stream response based on the stream's type and slope within the project reach. Identification of the stream type can be used to determine a stream's potential sensitivity to disturbance. Using Montgomery and Buffington's classification system (Montgomery and Buffington 1998) or other methods, one can estimate a stream's physical sensitivity to change. A project located in a source reach with a bedrock channel and a high slope may be rated as having a very low sensitivity. A project located in a response reach within an alluvial channel and low slope may be rated as having a high sensitivity. Individual ratings must be decided by the project design team.
5	Riparian Corridor	This factor rates the project reach's ability to respond to change through natural riparian resilience. The capacity of the stream to absorb disturbances without harm to habitat or property, often referred to as resilience, generally increases with the width of the riparian corridor (USFWS 2009). Additionally, the probability that the stream may be adversely affected increases when the riparian corridor is narrow or discontinuous. A project in a location with a relatively wide riparian corridor in comparison to stream width would be rated low. Whereas, the risk associated with morphologic response is greatest in urban and levee-confined streams that lack the space necessary to respond to disturbances (USFWS 2009). Individual ratings must be decided by the project design team.
5	Bed Scour	This factor rates the project reach's physical susceptibility to bed changes. Channels with highly mobile or erodible bed material such as sand or loose gravel will respond to disturbance more rapidly and to a greater degree than those with less erodible bed material. Coarse sediment, particularly immobile material such as boulders, creates streams with much lower scour risk. Individual ratings must be decided by the project design team.
2	Hydrologic Regime	This factor rates the stream's temporal hydrologic variability. Stream systems with evidence of high variability in their hydrograph have a much greater potential for system response and hence a relatively lower channel stability (USFWS 2009). For example, spring-fed stream systems that have little discharge variability and hence are highly stable and predictable and would be rated low. In contrast, convective thunderstorm-driven hydrology that results in streams with high variability and more frequent high flows could be rated high. Additionally, streams that show evidence of hydrologic regime shift from climate change or other factors such as from snowmelt driven to rain-on-snow events are especially susceptible to change and should be rated high. Individual ratings must be decided by the project design team.
5	Bank Erosion Potential	This factor rates the project reach's physical susceptibility to bank erosion based upon bank material composition. Bank erosion is lower in channels with naturally non-erodible bank materials, such as rock or highly cohesive clay. Conversely, erosion is higher in channels with banks that are highly erodible due to their material composition such as sand or loosely deposited alluvium. This factor rates the project reach's physical susceptibility to bank changes. Individual ratings must be decided by the project design team.
24.0	**Total**	
4.8	**Average Score**	

Property/Project Characteristics

Score	Factor	Description
2	In-channel Structures	This factor weighs the amount, type, and vulnerability of inchannel structures present in or near the project to LWM. In-channel structures can include bridges, piers, docks, intakes, pumps, fish screens, and any other placed features in the channel area. The distance for evaluation of structures upstream and downstream of the LWM project must be decided by the design team and based on physical conditions and project stakeholder consideration. A project with no structures located in the determined damage area of a project could be rated as 0. A project that has multiple vulnerable structures in the determined potential damage area or a structure with multiple piers and no freeboard could be rated 10. Individual ratings must be decided by the project design team. The decisions on the distance to consider for potential damages needs to be clearly documented by the design team.
3	Flooplain Structures	This factor weighs the amount, type, and vulnerability of structures within the 100-year floodplain influenced by the project to flood changes. A project that has no constructed structures in the 100-year floodplain could be rated low. A project that has multiple residences within the 100-year floodplain and at or only minimally above it could be rated high. Individual ratings must be decided by the project design team.
5	Land Use	This factor attempts to determine the property damage potential by land use category. A qualitative assessment is performed by the design team and is based on project stakeholder input. Flood prone land uses that are highly susceptible to either flood effects or channel migration would receive higher ratings than natural land uses. For example, an area in which floodplains are used for agricultural of high value crops that are grown during a common flood season may receive a higher rating than an area where natural uses are predominant. As another example, a project that is completely located on National Forest lands may be rated as low. A project that is within an urban area with exposed channel banks could be rated as high. Significant farm land or rural residential may receive a moderate rating. Individual ratings must be decided by the project design team.
10.0	**Total**	
3.3	**Average Score**	

Property Damage Risk Matrix

Structure Description: Main Channel



Project: CC-44

Evaluator: Jeff Fealko

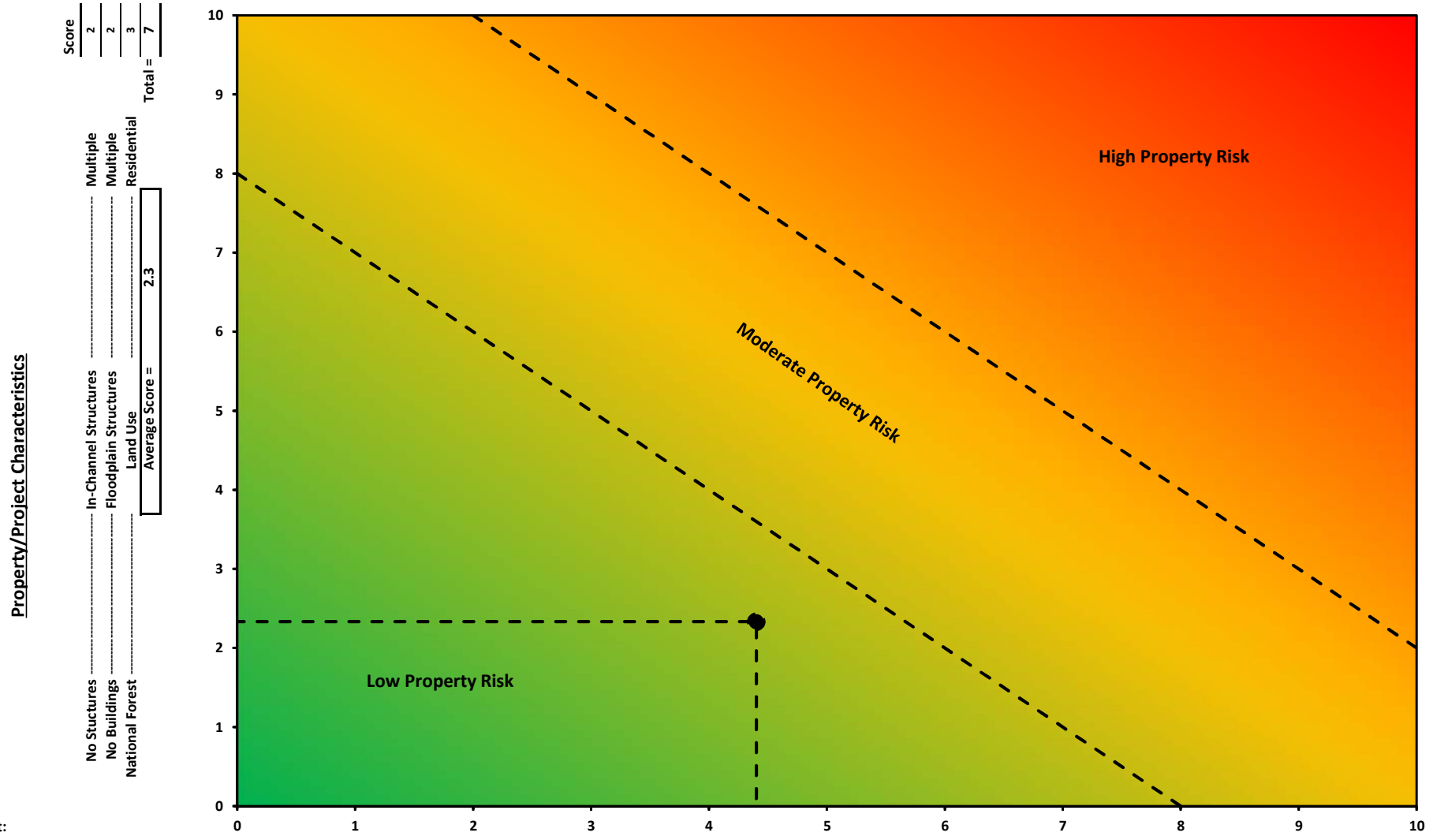
Concurrence:

Date: 3/31/2015

					Score
Stream Type:	Bedrock (source >10%)	Transport (3-10%)	Response (<3%)		7
Riparian Corridor:	Contious/Wide	Discontinuos/narrow	Urbanized/Levee Confined		5
Bed Scour:	Boulder/Clay bed	Gravel/Cobble	Sand/Silt		5
Hydrologic Regime:	Spring-fed	Snowmelt	Rain	Rain-on-Snow	Thunderstorm	3
Bank Erosion:	Naturally Non-erodable	Erosion Resistant	Highly Erodable		5
		Average Score =	5.0	Total Score =	25

Property Damage Risk Matrix

Structure Description: SC and Floodplain



Stream Type:	Bedrock (source >10%)		Transport (3-10%)	Response (<3%)	5
Riparian Corridor:	Contious/Wide		Discontinuos/narrow	Urbanized/Levee Confined	4
Bed Scour:	Boulder/Clay bed		Gravel/Cobble	Sand/Silt	5
Hydrologic Regime:	Spring-fed	Snowmelt	Rain	Rain-on-Snow	Thunderstorm	2
Bank Erosion:	Naturally Non-erodable		Erosion Resistant	Highly Erodable	6
			Average Score = 4.4	Total Score =	22

Project: CC-44

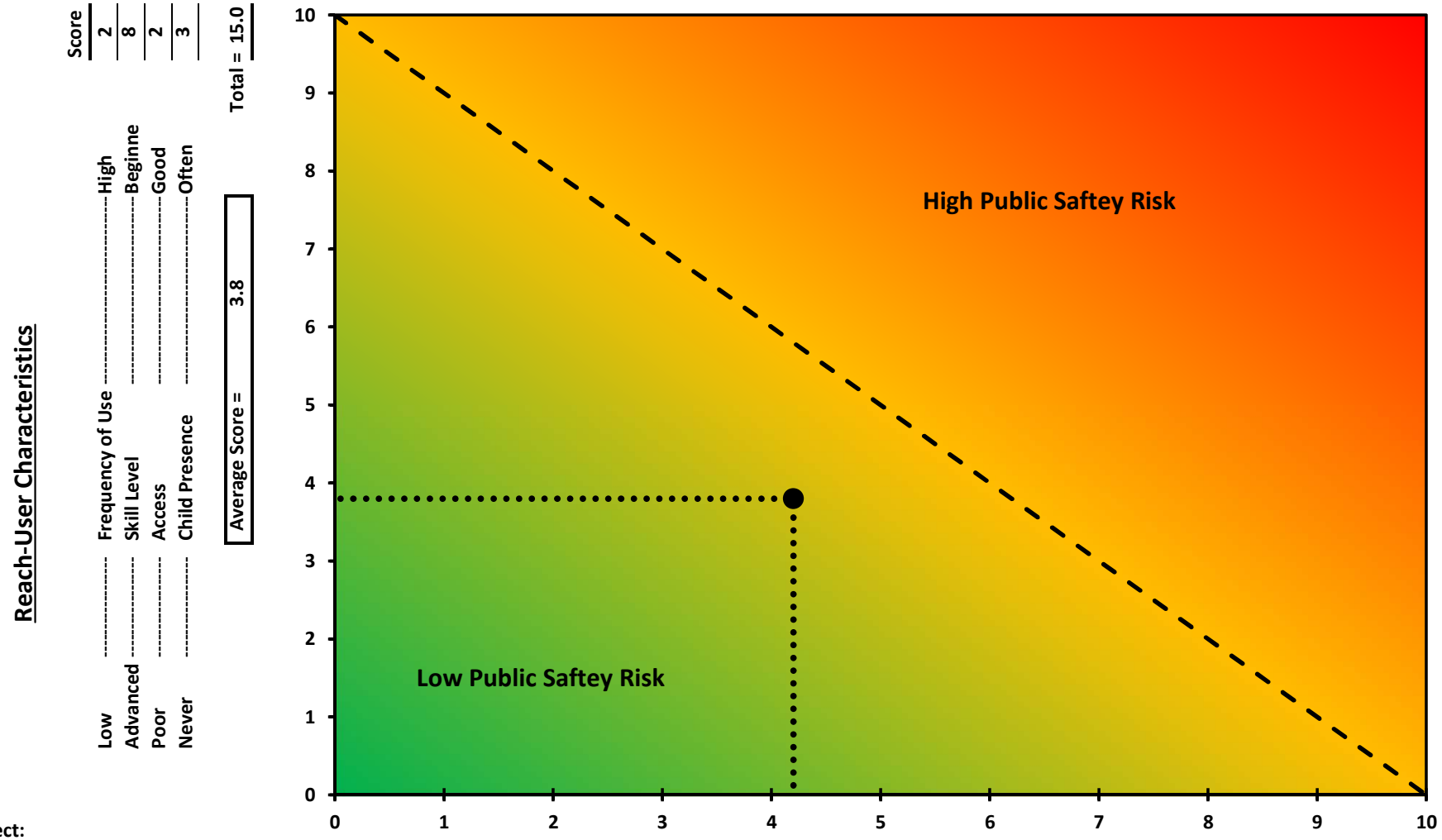
Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

Public Saftey Risk Matrix

Structure Location: Site 1



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

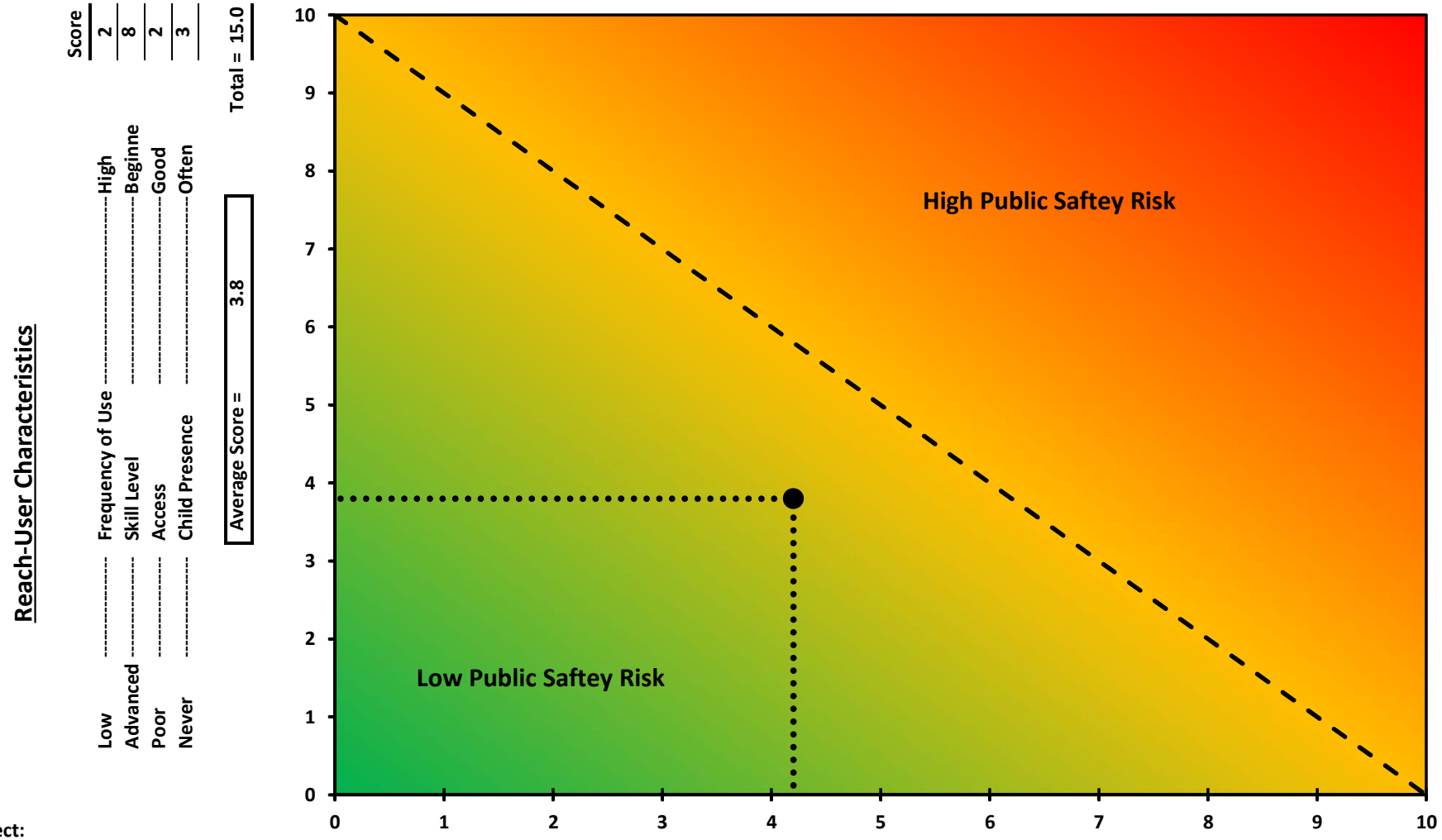
					Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	8
Low	Strainer Potential	High	2
High	Egress Potential	Low	3
High	Sight Distance	Low	2
Low	Depth x Velocity	High	6

Average Score = 4.2

Total Score = 25.0

Public Saftey Risk Matrix

Structure Location: Site 2



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

Structure Characteristics

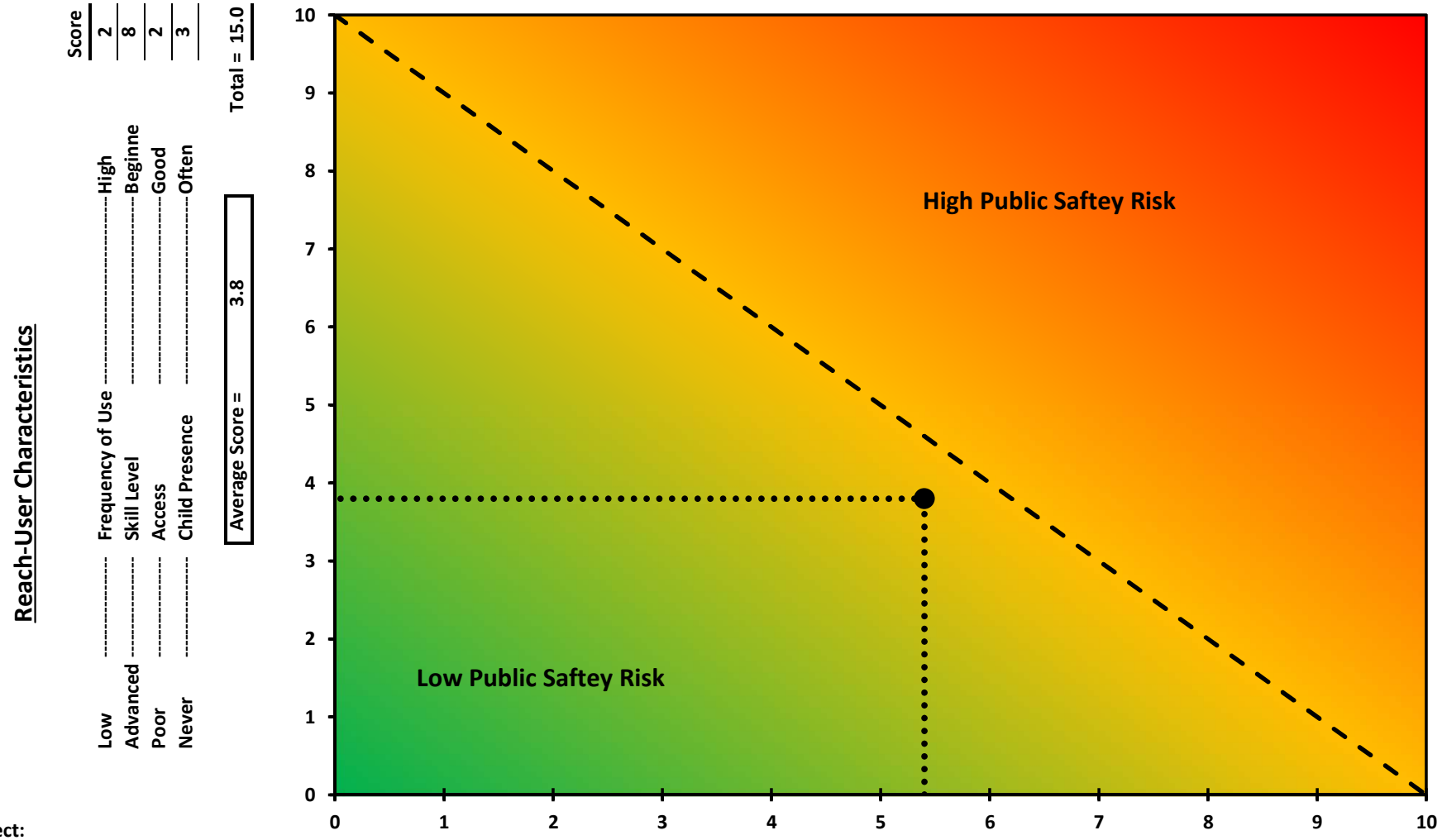
			Score
No	Active Channel?	Yes	7
No	Outside of Bend?	Yes	6
Low	Strainer Potential	High	3
High	Egress Potential	Low	2
High	Sight Distance	Low	3
Low	Depth x Velocity	High	4

Average Score = 4.2

Total Score = 25.0

Public Saftey Risk Matrix

Structure Location: Site 3



Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

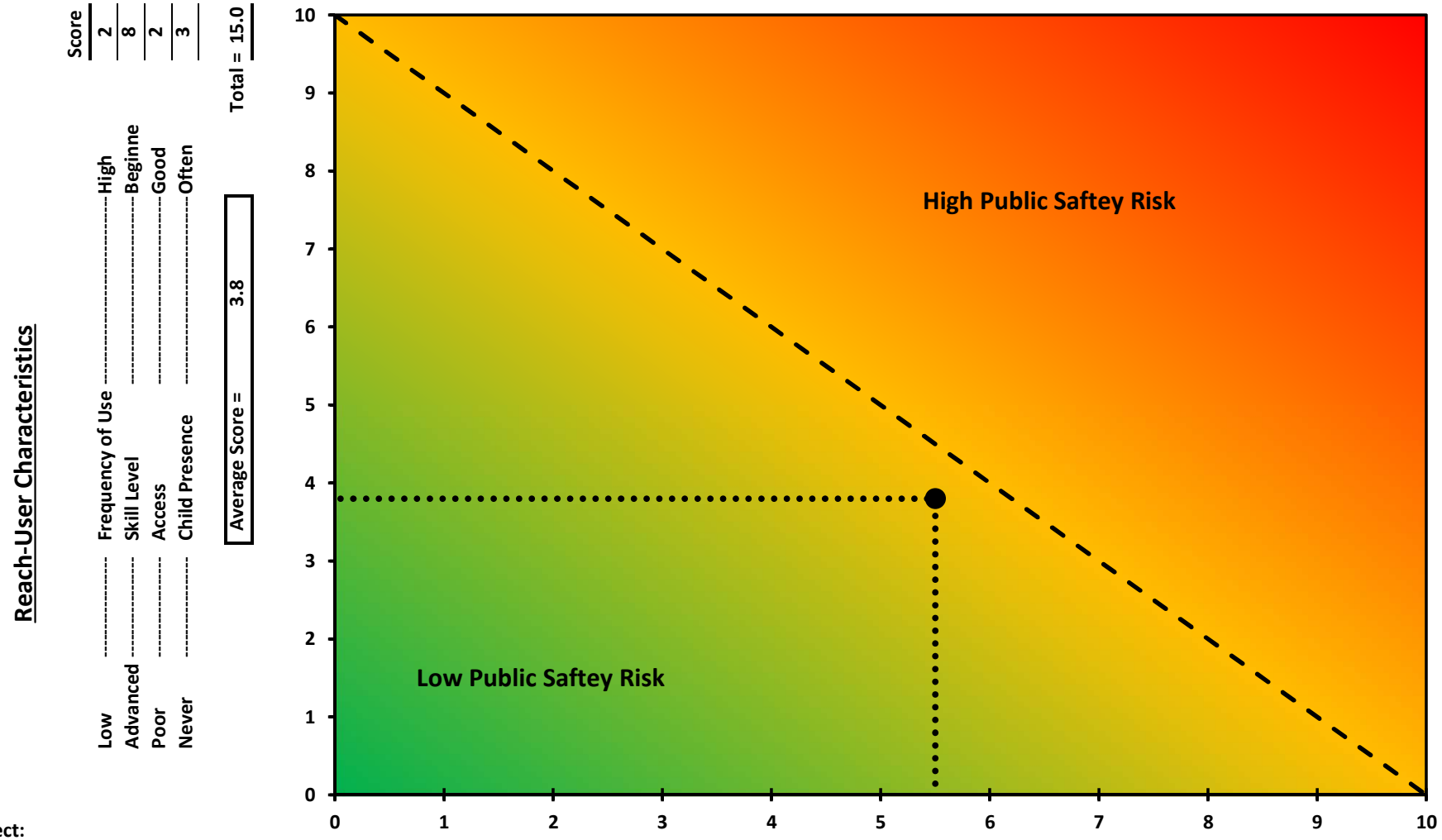
					Score
No	----------	Active Channel?	----------	Yes	8
No	----------	Outside of Bend?	----------	Yes	9
Low	----------	Strainer Potential	----------	High	7
High	----------	Egress Potential	----------	Low	1
High	----------	Sight Distance	----------	Low	1
Low	----------	Depth x Velocity	----------	High	6

Average Score = 5.4

Total Score = 32.0

Public Saftey Risk Matrix

Structure Location: Site 4



Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

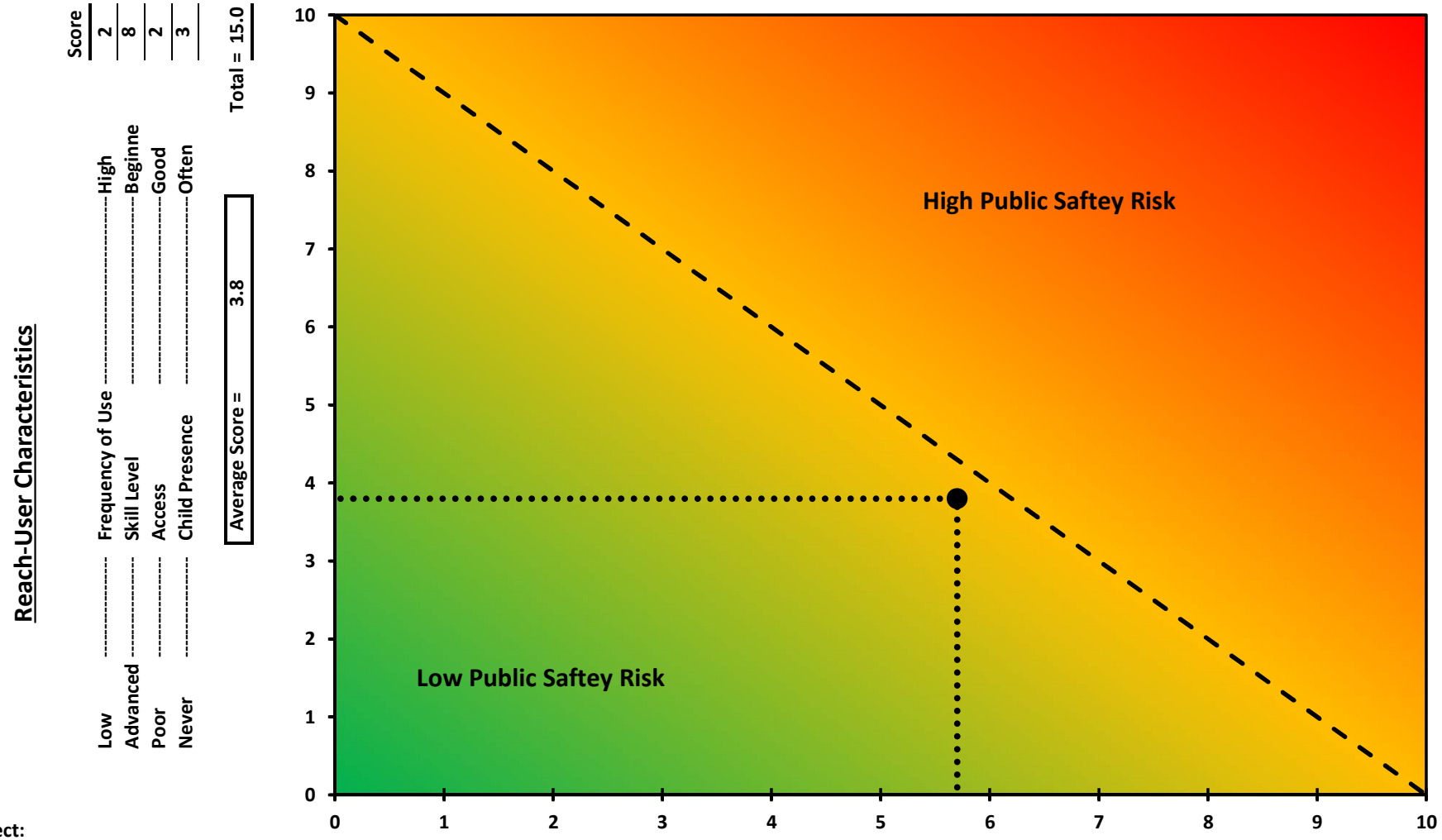
					Score
No	----------	Active Channel?	----------	Yes	5
No	----------	Outside of Bend?	----------	Yes	5
Low	----------	Strainer Potential	----------	High	4
High	----------	Egress Potential	----------	Low	8
High	----------	Sight Distance	----------	Low	6
Low	----------	Depth x Velocity	----------	High	5

Average Score = 5.5

Total Score = 33.0

Public Saftey Risk Matrix

Structure Location: Site 5



Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

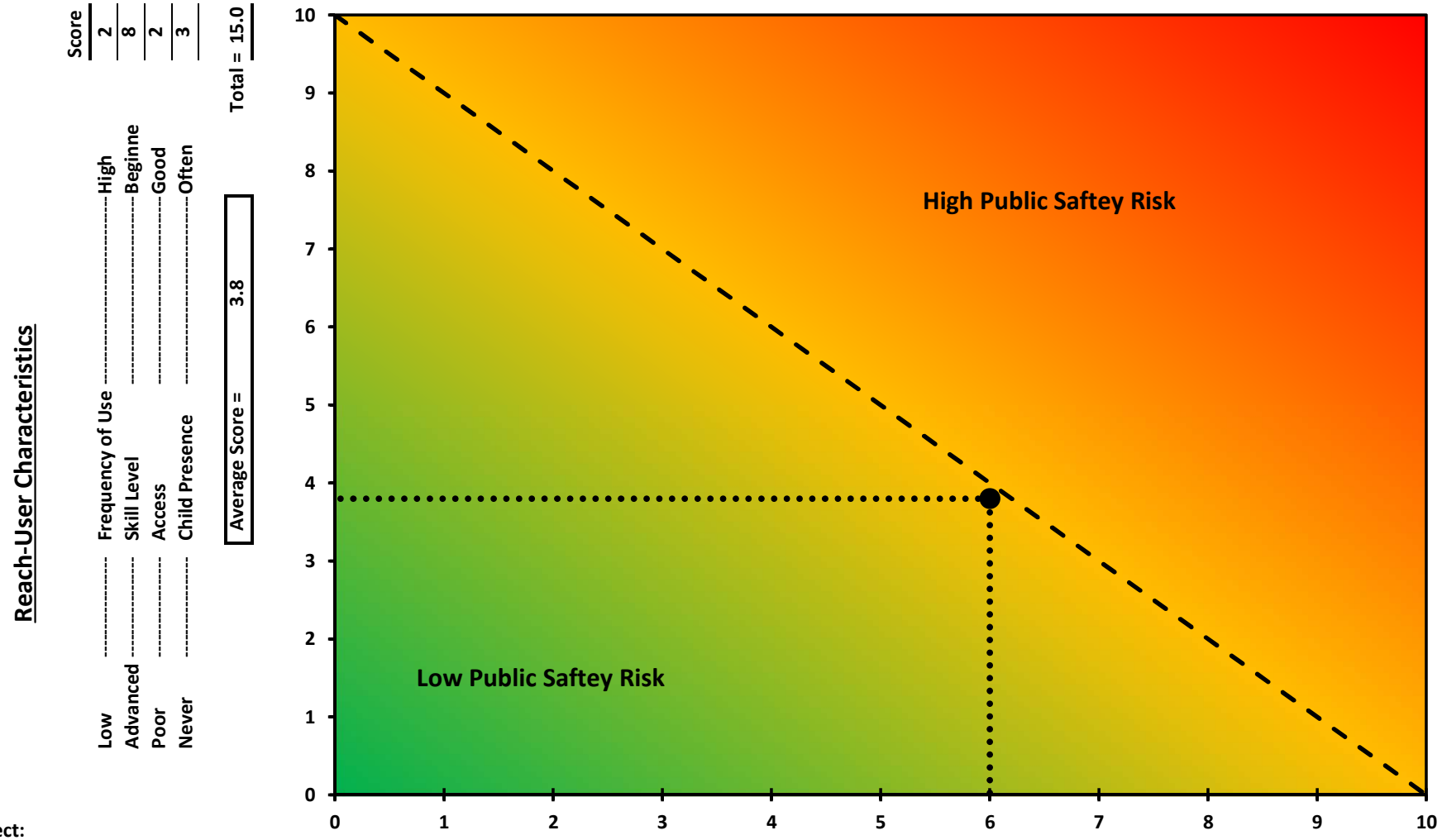
					Score
No	----------	Active Channel?	----------	Yes	7
No	----------	Outside of Bend?	----------	Yes	10
Low	----------	Strainer Potential	----------	High	3
High	----------	Egress Potential	----------	Low	4
High	----------	Sight Distance	----------	Low	3
Low	----------	Depth x Velocity	----------	High	7

Average Score = 5.7

Total Score = 34.0

Public Saftey Risk Matrix

Structure Location: Site 6



Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

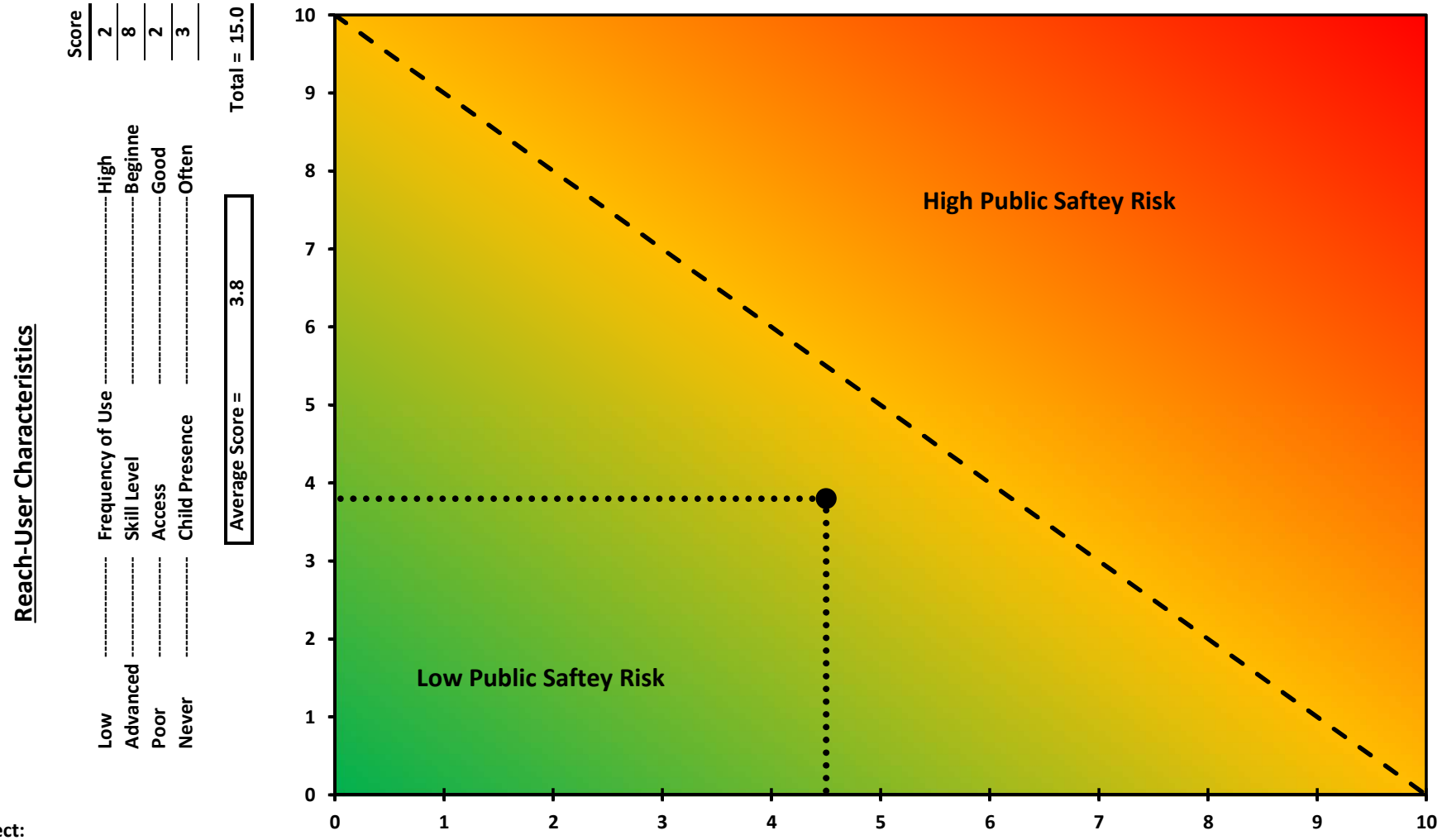
					Score
No	----------	Active Channel?	----------	Yes	8
No	----------	Outside of Bend?	----------	Yes	9
Low	----------	Strainer Potential	----------	High	6
High	----------	Egress Potential	----------	Low	4
High	----------	Sight Distance	----------	Low	3
Low	----------	Depth x Velocity	----------	High	6

Average Score = 6.0

Total Score = 36.0

Public Saftey Risk Matrix

Structure Location: Site 7



Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

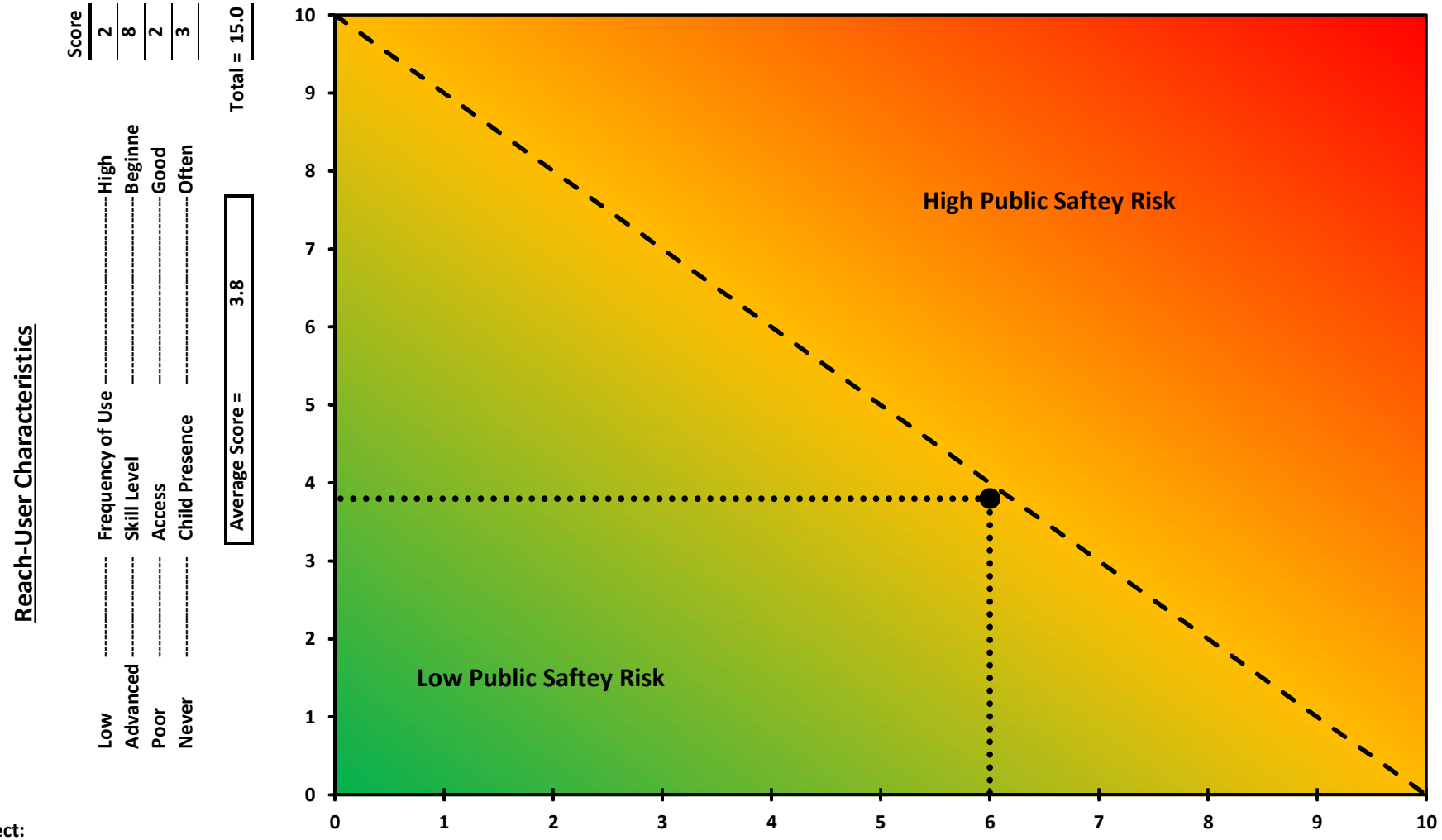
					Score
No	----------	Active Channel?	----------	Yes	6
No	----------	Outside of Bend?	----------	Yes	7
Low	----------	Strainer Potential	----------	High	3
High	----------	Egress Potential	----------	Low	3
High	----------	Sight Distance	----------	Low	5
Low	----------	Depth x Velocity	----------	High	3

Average Score = 4.5

Total Score = 27.0

Public Saftey Risk Matrix

Structure Location: Site 8



Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

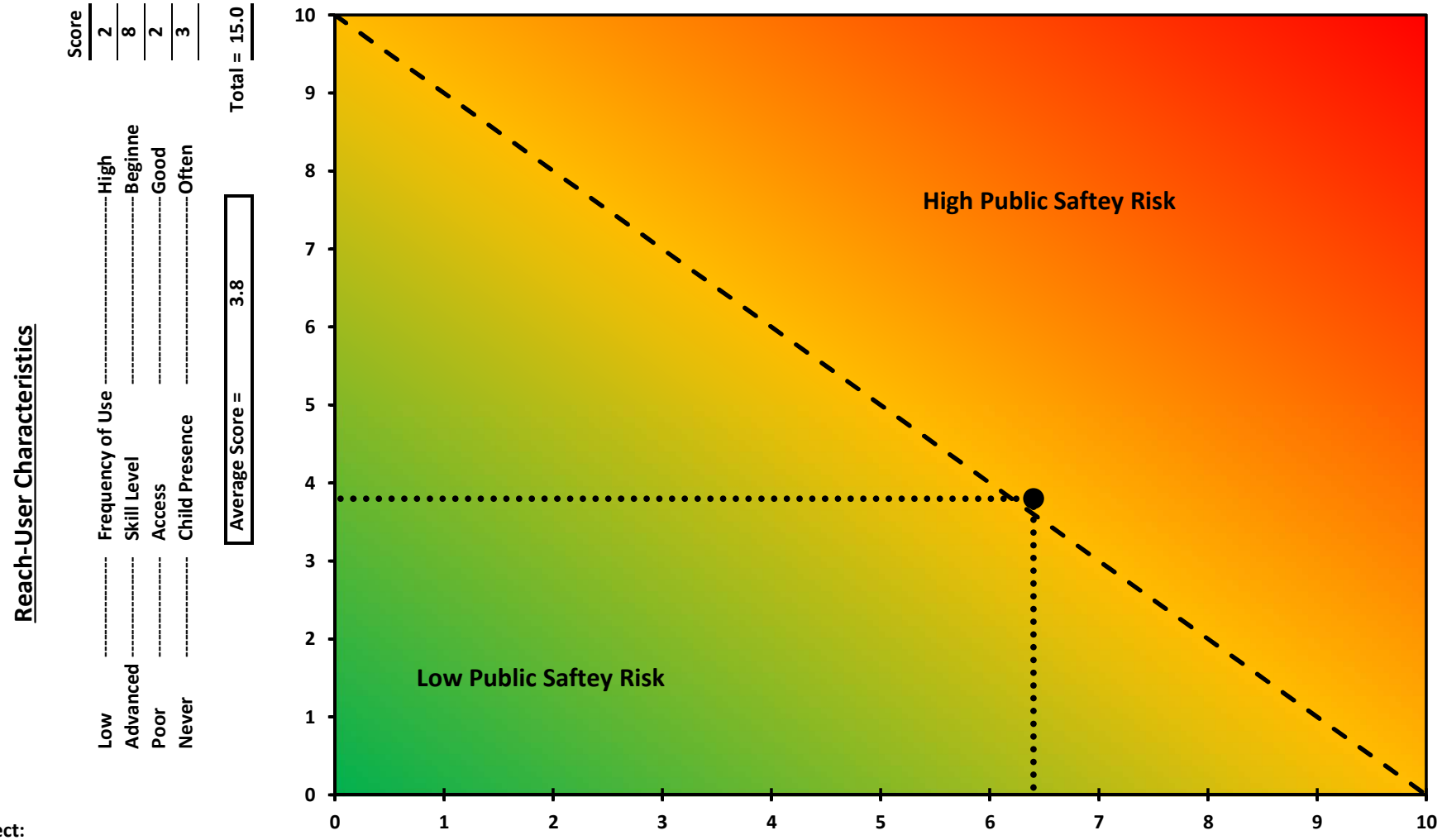
					Score
No	----------	Active Channel?	----------	Yes	7
No	----------	Outside of Bend?	----------	Yes	8
Low	----------	Strainer Potential	----------	High	5
High	----------	Egress Potential	----------	Low	4
High	----------	Sight Distance	----------	Low	6
Low	----------	Depth x Velocity	----------	High	6

Average Score = 6.0

Total Score = 36.0

Public Saftey Risk Matrix

Structure Location: Site 9



Reach-User Characteristics

			Score
Low	---------- Frequency of Use ----------	High	2
Advanced	---------- Skill Level ----------	Beginne	8
Poor	---------- Access ----------	Good	2
Never	---------- Child Presence ----------	Often	3

Total = 15.0

Average Score = 3.8

					Score
No	----------	Active Channel?	----------	Yes	7
No	----------	Outside of Bend?	----------	Yes	9
Low	----------	Strainer Potential	----------	High	5
High	----------	Egress Potential	----------	Low	5
High	----------	Sight Distance	----------	Low	7
Low	----------	Depth x Velocity	----------	High	5

Average Score = 6.4

Total Score = 38.0

Project:
CC-44

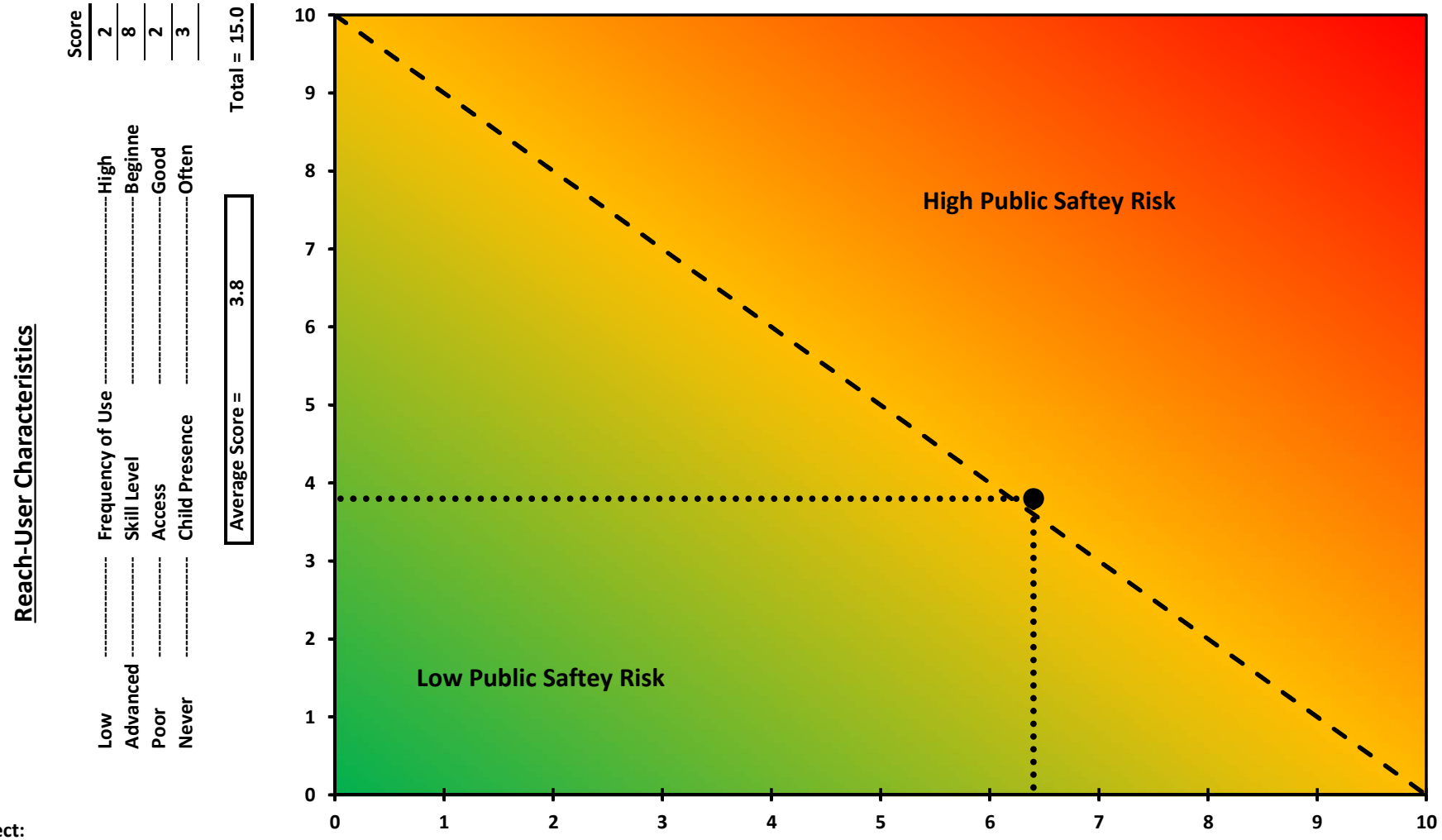
Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

Public Saftey Risk Matrix

Structure Location: Site 10



Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

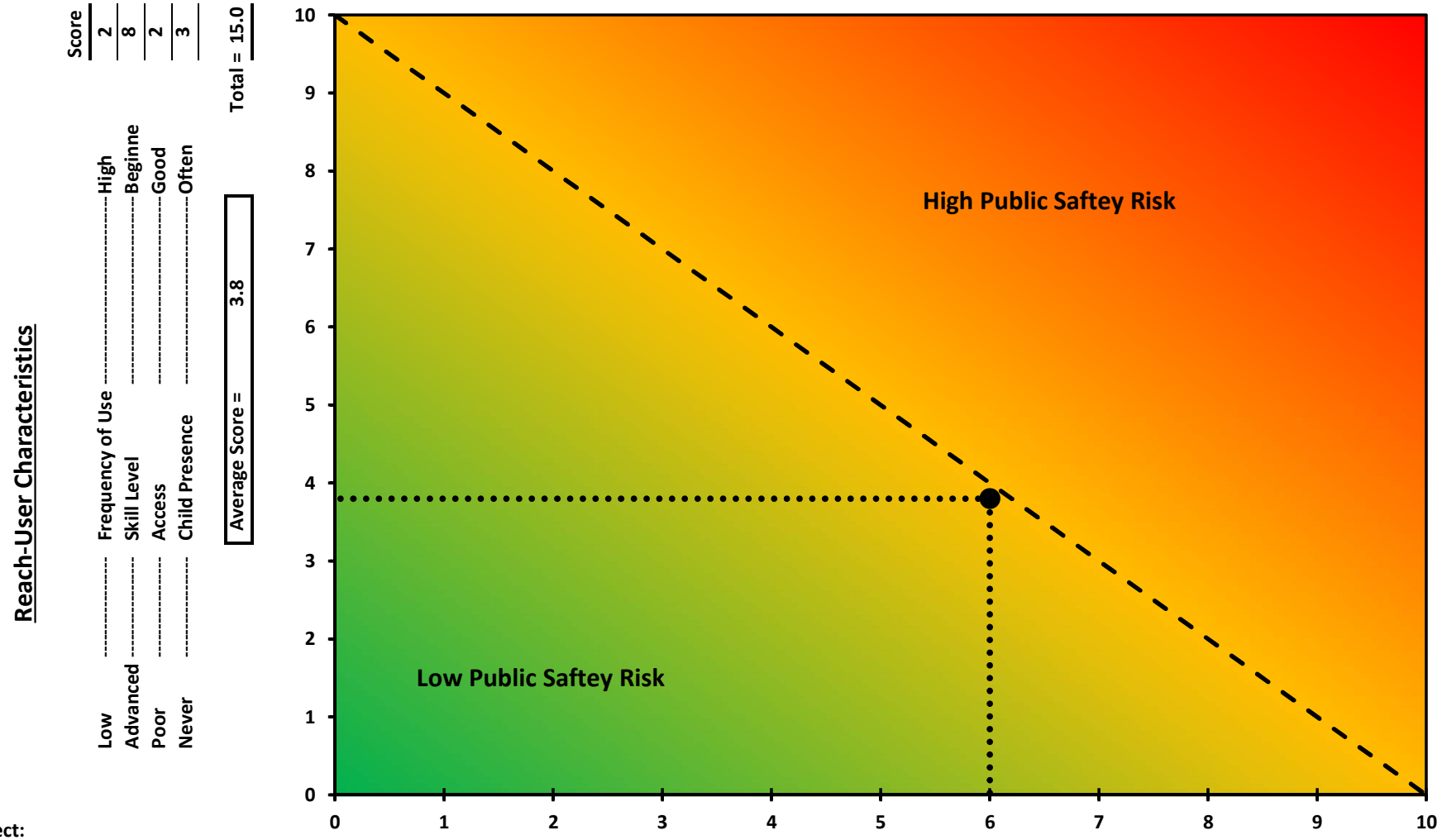
			Score
No	Active Channel?	Yes	7
No	Outside of Bend?	Yes	9
Low	Strainer Potential	High	7
High	Egress Potential	Low	3
High	Sight Distance	Low	5
Low	Depth x Velocity	High	7

Average Score = 6.4

Total Score = 38.0

Public Saftey Risk Matrix

Structure Location: Site 11



Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

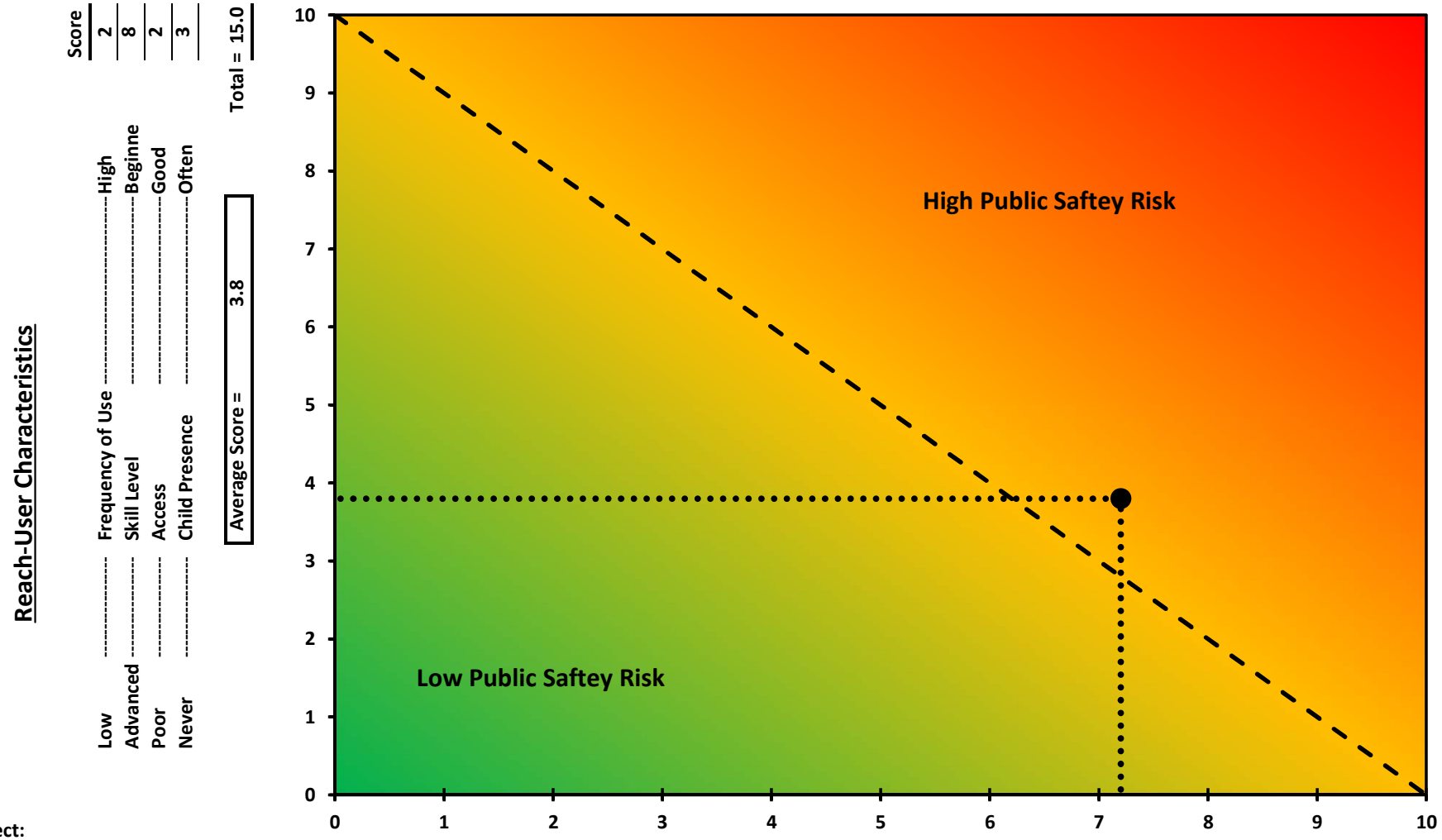
					Score
No	----------	Active Channel?	----------	Yes	7
No	----------	Outside of Bend?	----------	Yes	8
Low	----------	Strainer Potential	----------	High	5
High	----------	Egress Potential	----------	Low	4
High	----------	Sight Distance	----------	Low	6
Low	----------	Depth x Velocity	----------	High	6

Average Score = 6.0

Total Score = 36.0

Public Saftey Risk Matrix

Structure Location: Site 12



Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

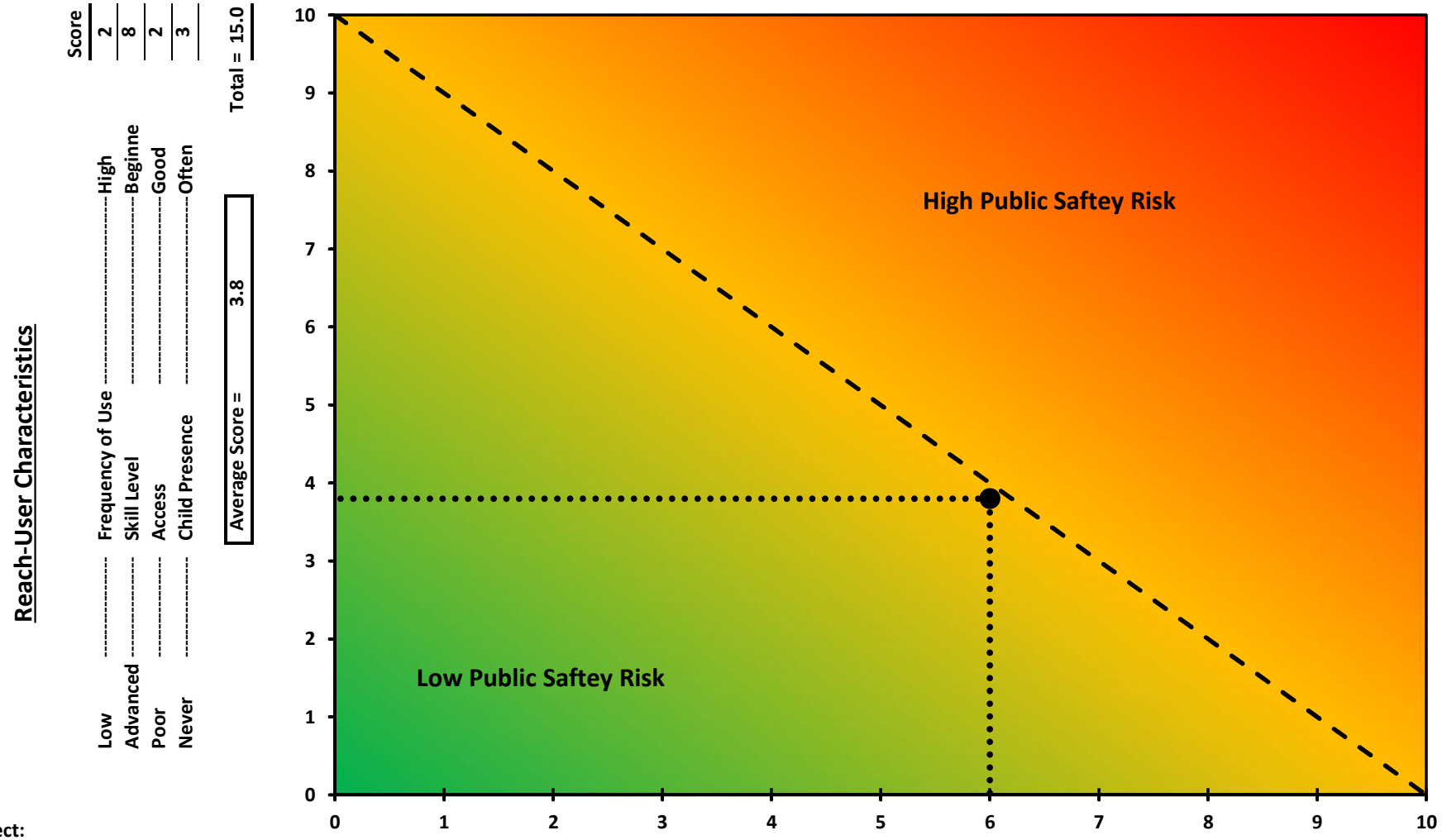
					Score
No	----------	Active Channel?	----------	Yes	7
No	----------	Outside of Bend?	----------	Yes	9
Low	----------	Strainer Potential	----------	High	6
High	----------	Egress Potential	----------	Low	7
High	----------	Sight Distance	----------	Low	7
Low	----------	Depth x Velocity	----------	High	7

Average Score = 7.2

Total Score = 43.0

Public Saftey Risk Matrix

Structure Location: Site 13



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

Structure Characteristics

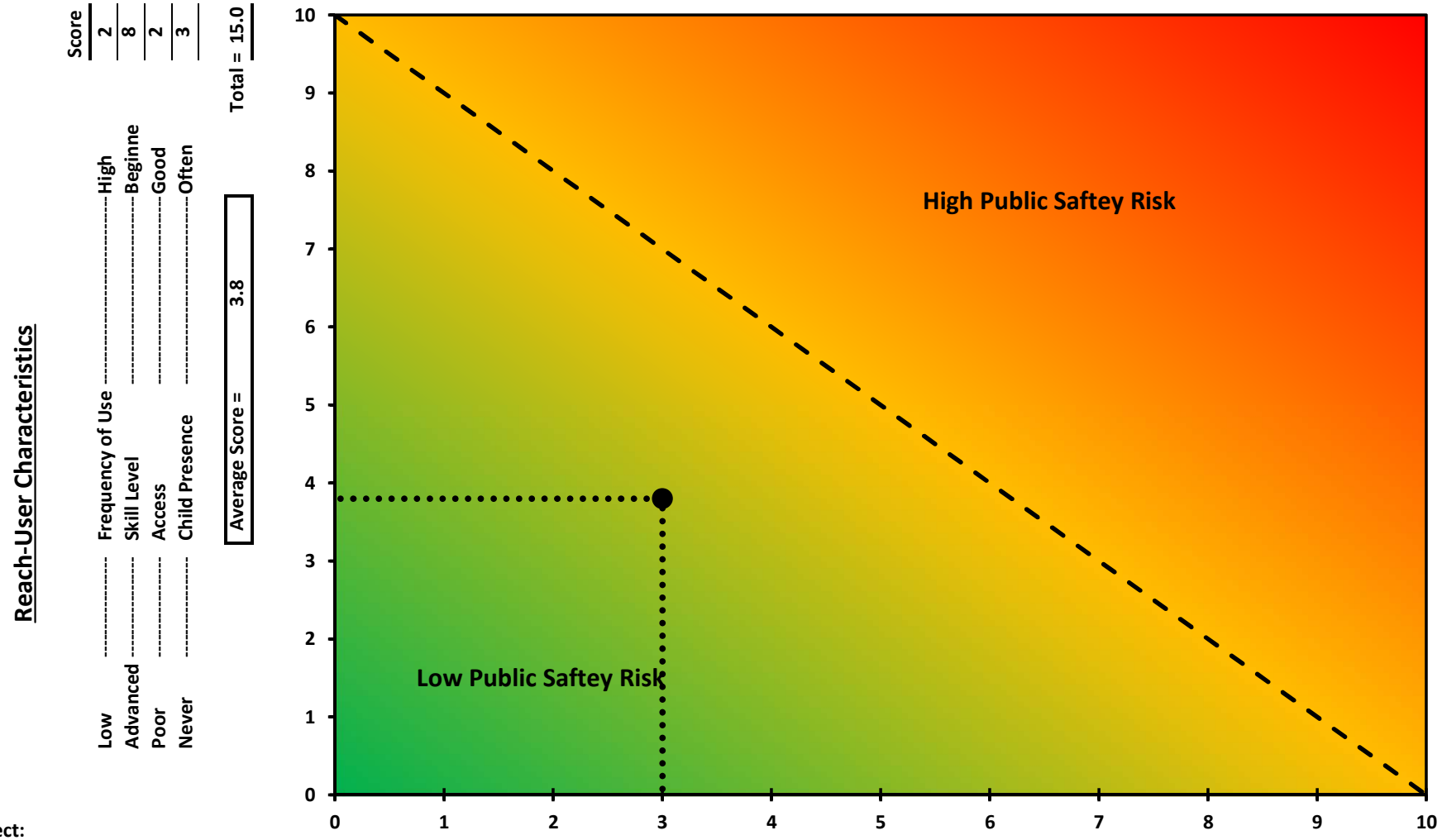
			Score
No	Active Channel?	Yes	7
No	Outside of Bend?	Yes	9
Low	Strainer Potential	High	7
High	Egress Potential	Low	3
High	Sight Distance	Low	2
Low	Depth x Velocity	High	8

Average Score = 6.0

Total Score = 36.0

Public Saftey Risk Matrix

Structure Location: Site 14



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Average Score = 3.8

Total = 15.0

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

Structure Characteristics

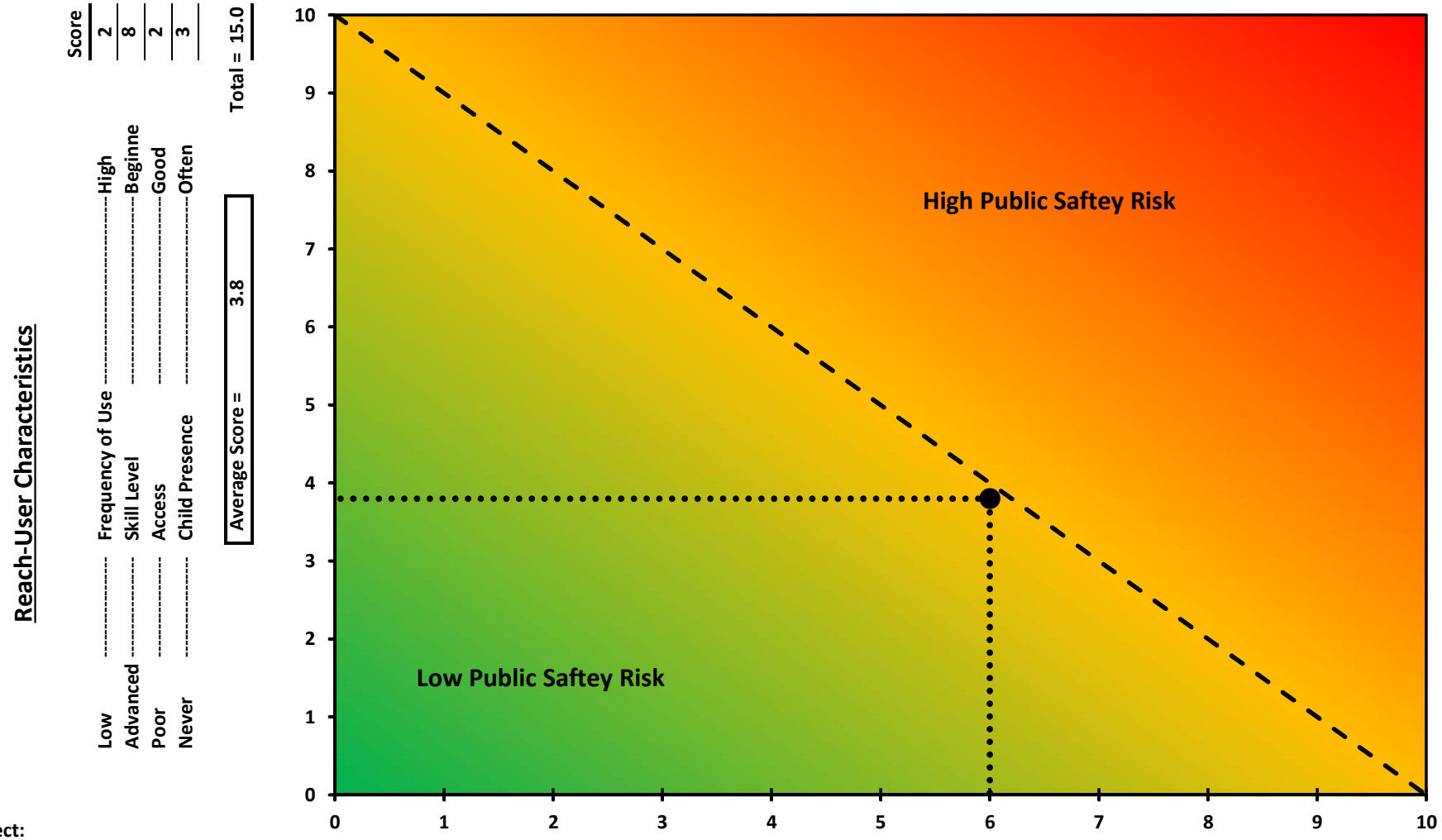
			Score
No	Active Channel?	Yes	5
No	Outside of Bend?	Yes	2
Low	Strainer Potential	High	2
High	Egress Potential	Low	2
High	Sight Distance	Low	3
Low	Depth x Velocity	High	4

Average Score = 3.0

Total Score = 18.0

Public Saftey Risk Matrix

Structure Location: Site 15



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

Structure Characteristics

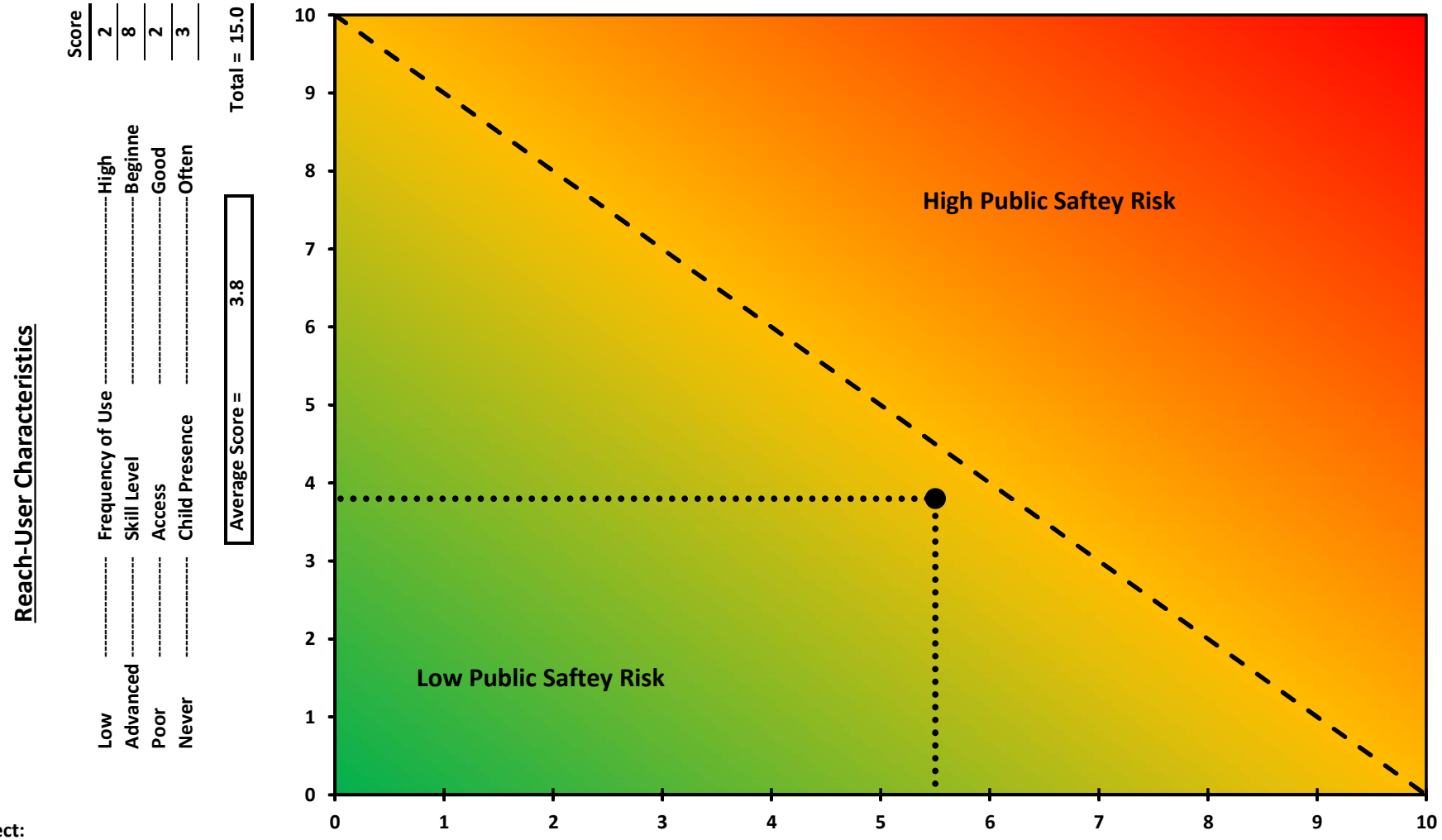
			Score
No	Active Channel?	Yes	8
No	Outside of Bend?	Yes	9
Low	Strainer Potential	High	7
High	Egress Potential	Low	2
High	Sight Distance	Low	2
Low	Depth x Velocity	High	8

Average Score = 6.0

Total Score = 36.0

Public Saftey Risk Matrix

Structure Location: Site 16



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

Structure Characteristics

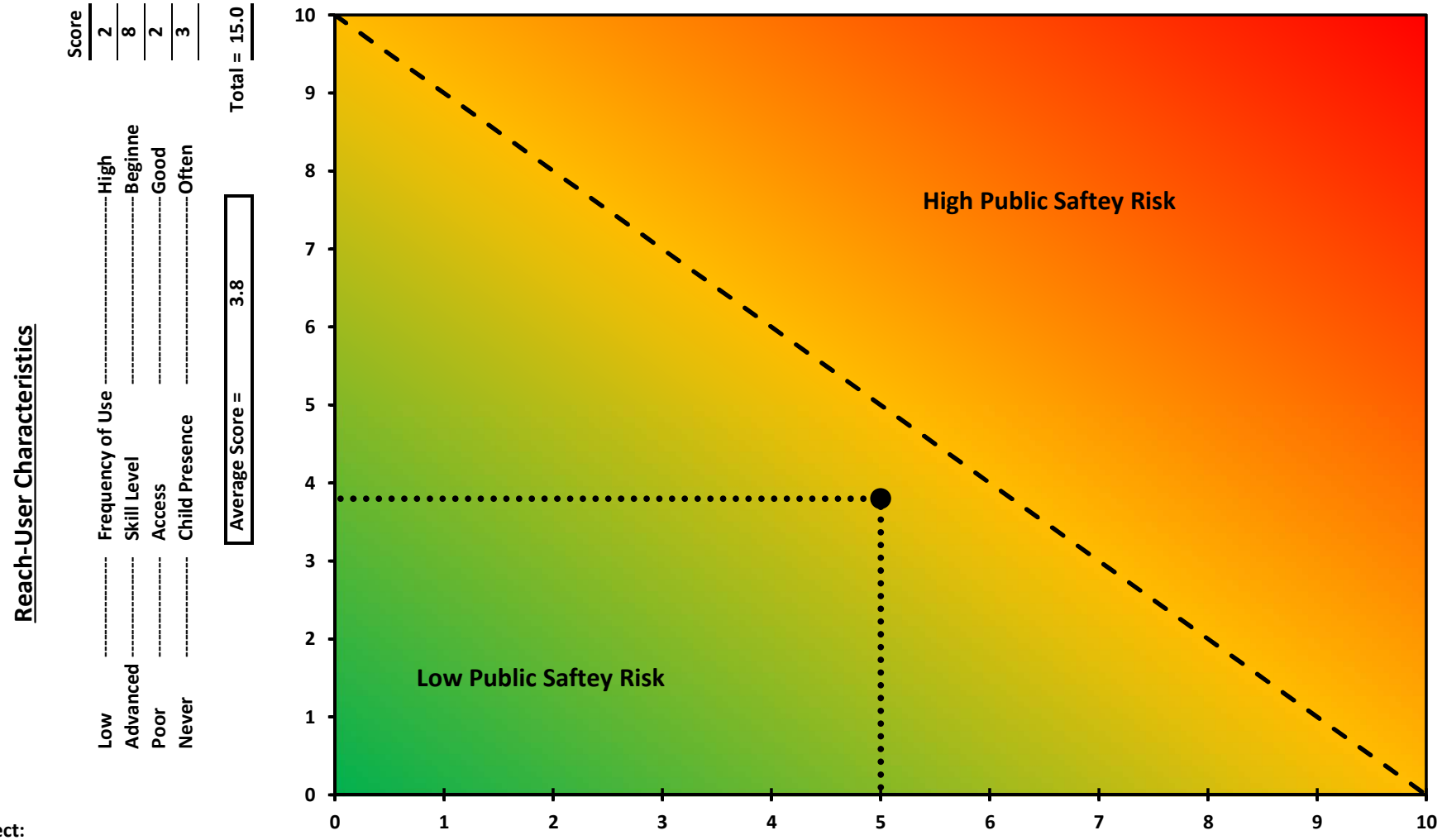
			Score
No	Active Channel?	Yes	7
No	Outside of Bend?	Yes	9
Low	Strainer Potential	High	6
High	Egress Potential	Low	2
High	Sight Distance	Low	2
Low	Depth x Velocity	High	7

Average Score = 5.5

Total Score = 33.0

Public Saftey Risk Matrix

Structure Location: Site 17



Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

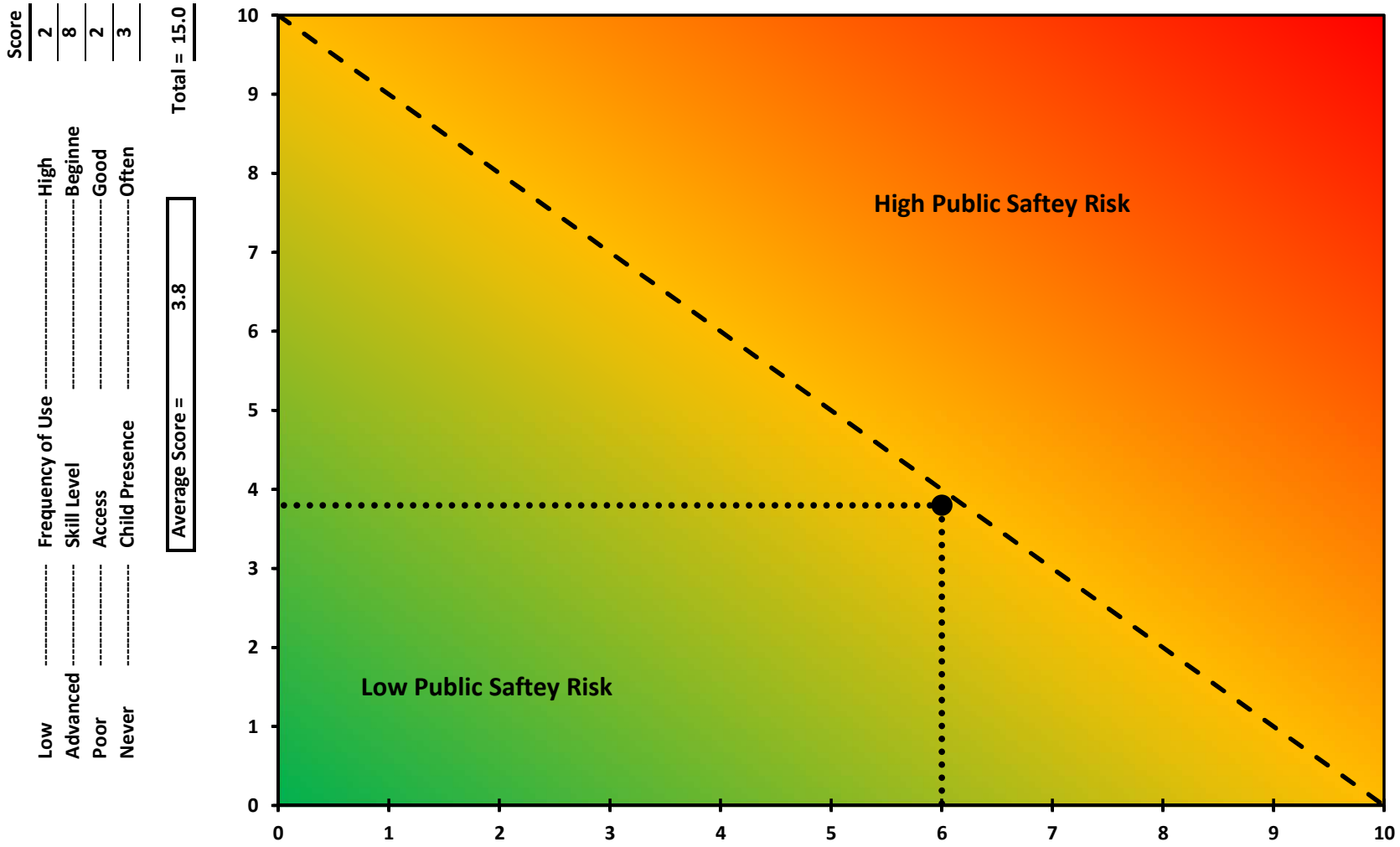
					Score
No	----------	Active Channel?	----------	Yes	8
No	----------	Outside of Bend?	----------	Yes	3
Low	----------	Strainer Potential	----------	High	5
High	----------	Egress Potential	----------	Low	2
High	----------	Sight Distance	----------	Low	5
Low	----------	Depth x Velocity	----------	High	7

Average Score = 5.0

Total Score = 30.0

Public Saftey Risk Matrix

Structure Location: Site 18



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

Structure Characteristics

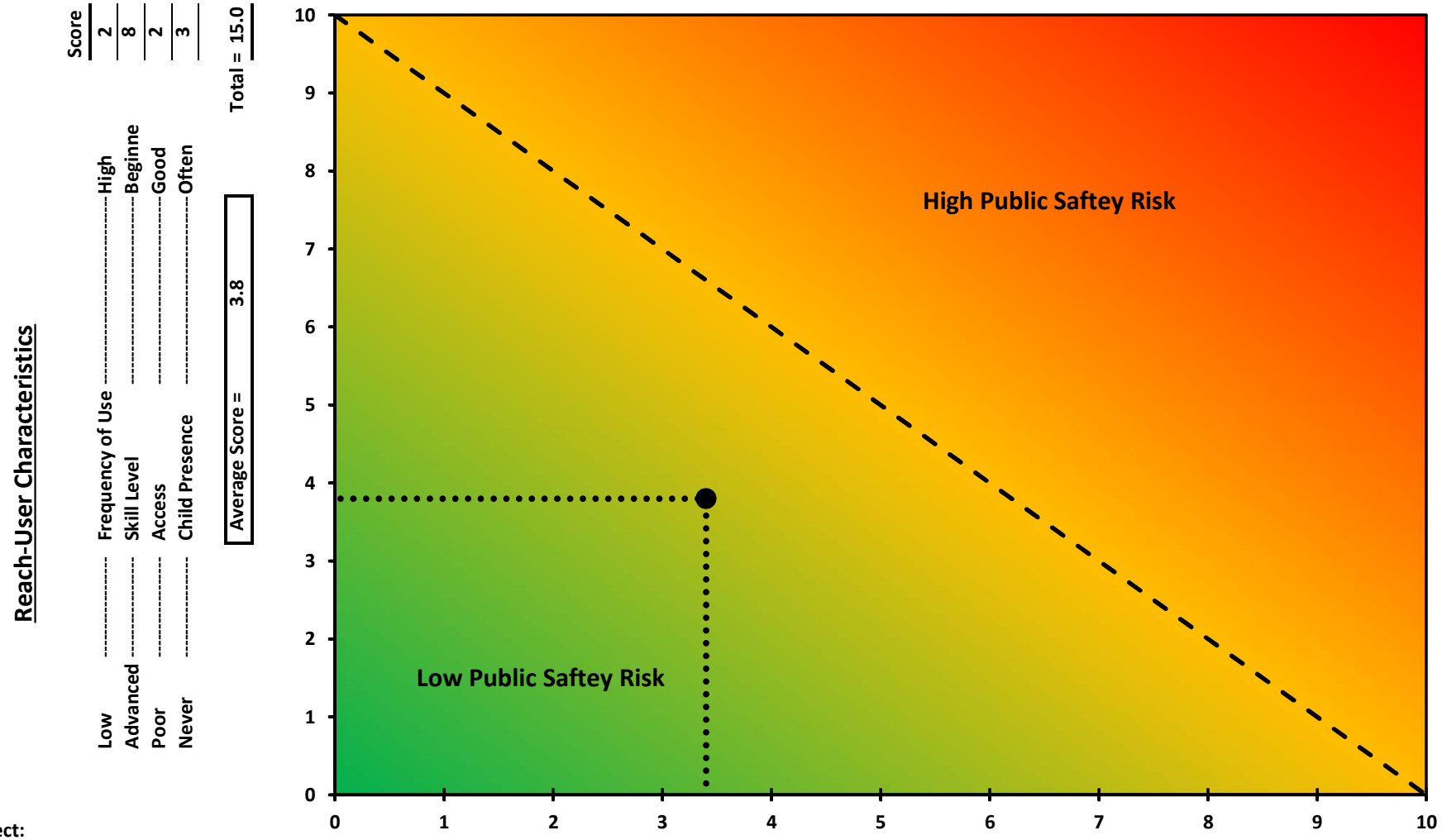
			Score
No	Active Channel?	Yes	7
No	Outside of Bend?	Yes	7
Low	Strainer Potential	High	7
High	Egress Potential	Low	2
High	Sight Distance	Low	5
Low	Depth x Velocity	High	8

Average Score = 6.0

Total Score = 36.0

Public Saftey Risk Matrix

Structure Location: Site 19



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

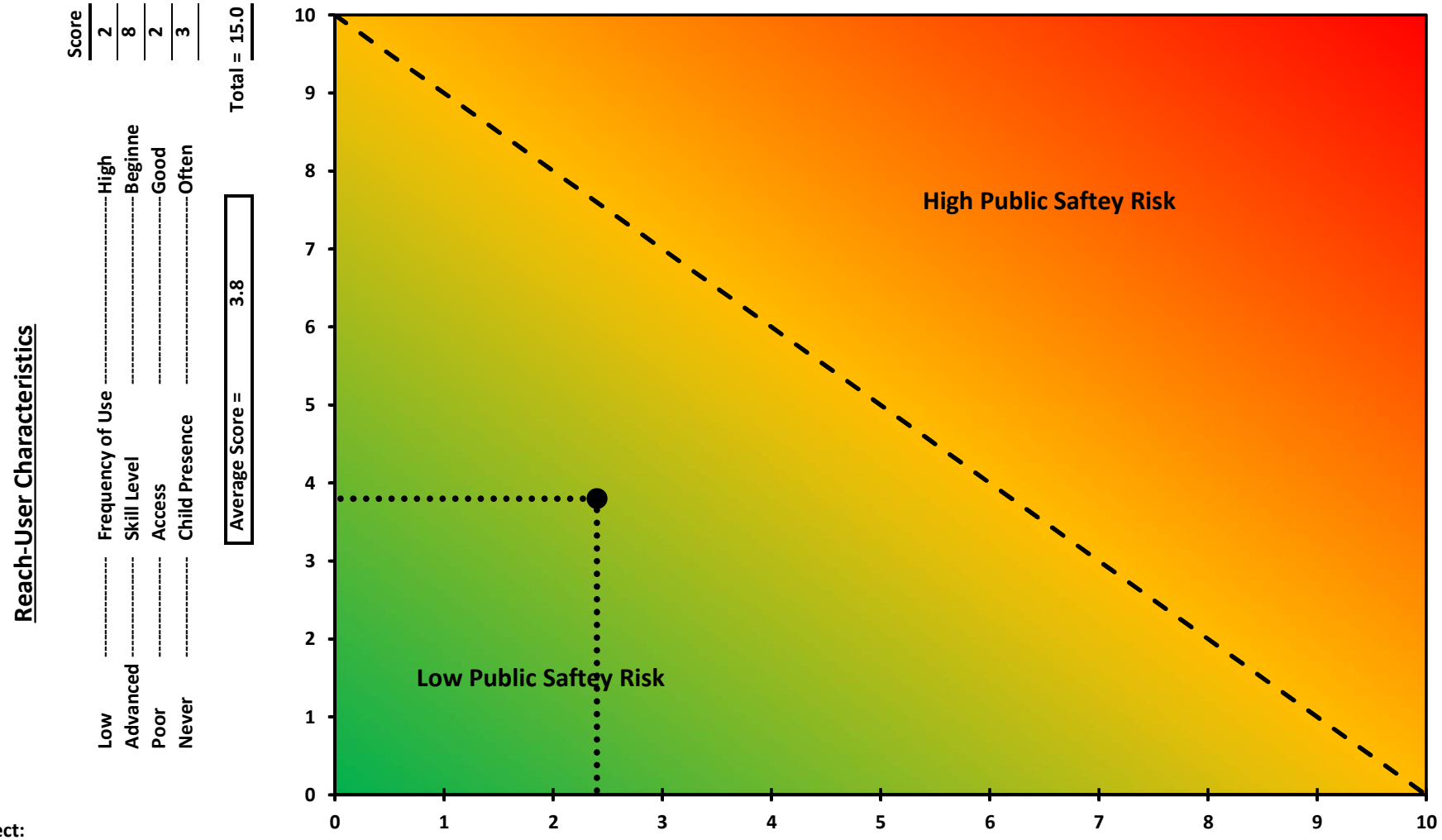
					Score
No	Active Channel?	Yes	5
No	Outside of Bend?	Yes	2
Low	Strainer Potential	High	2
High	Egress Potential	Low	2
High	Sight Distance	Low	8
Low	Depth x Velocity	High	1

Average Score = 3.4

Total Score = 20.0

Public Saftey Risk Matrix

Structure Location: Site 20



Reach-User Characteristics

			Score
Low	Frequency of Use	High	2
Advanced	Skill Level	Beginne	8
Poor	Access	Good	2
Never	Child Presence	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

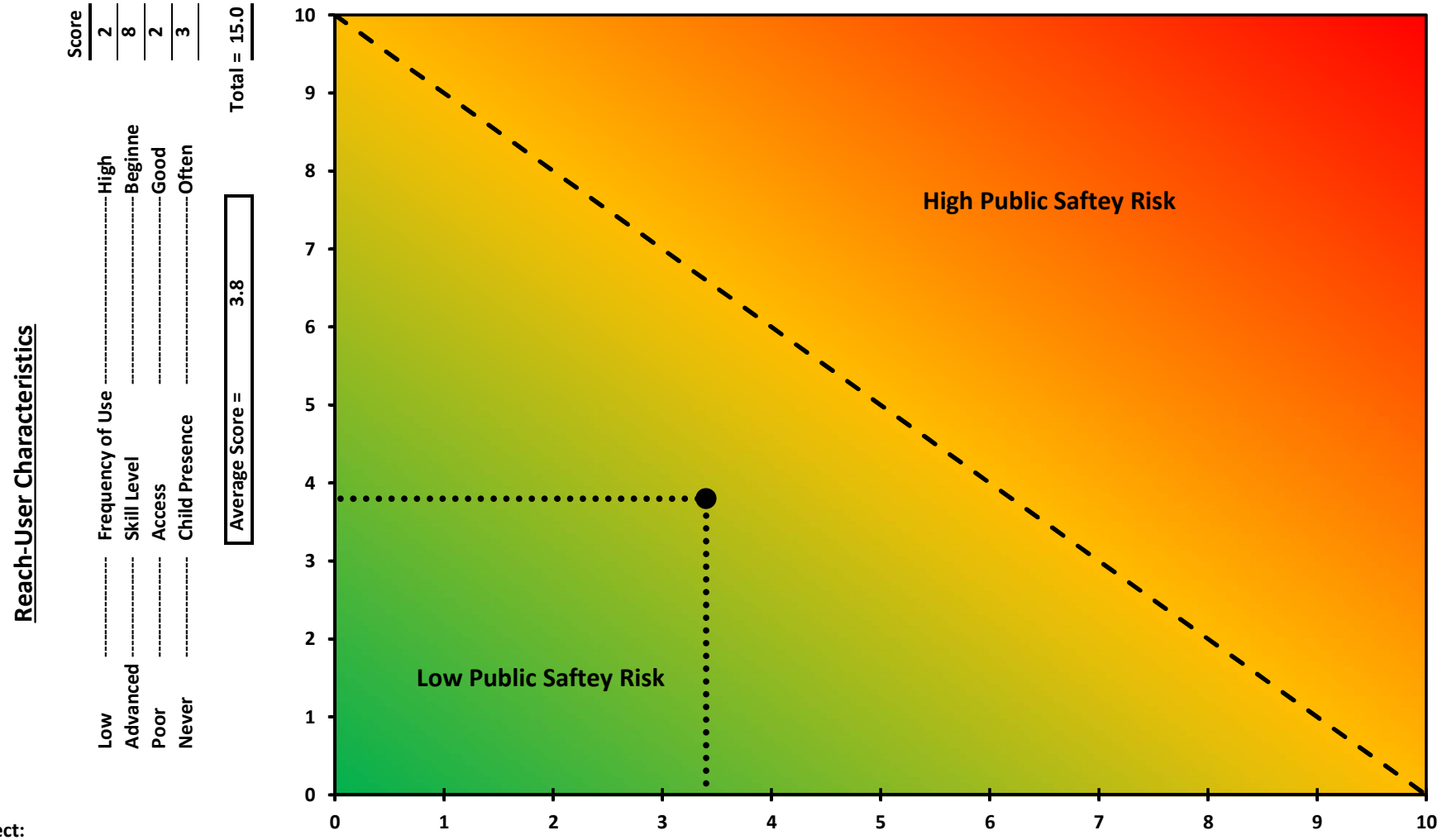
					Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	1
Low	Strainer Potential	High	3
High	Egress Potential	Low	2
High	Sight Distance	Low	2
Low	Depth x Velocity	High	2

Average Score = 2.4

Total Score = 14.0

Public Saftey Risk Matrix

Structure Location: Site 21



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

					Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	7
Low	Strainer Potential	High	3
High	Egress Potential	Low	2
High	Sight Distance	Low	2
Low	Depth x Velocity	High	2

Average Score = 3.4

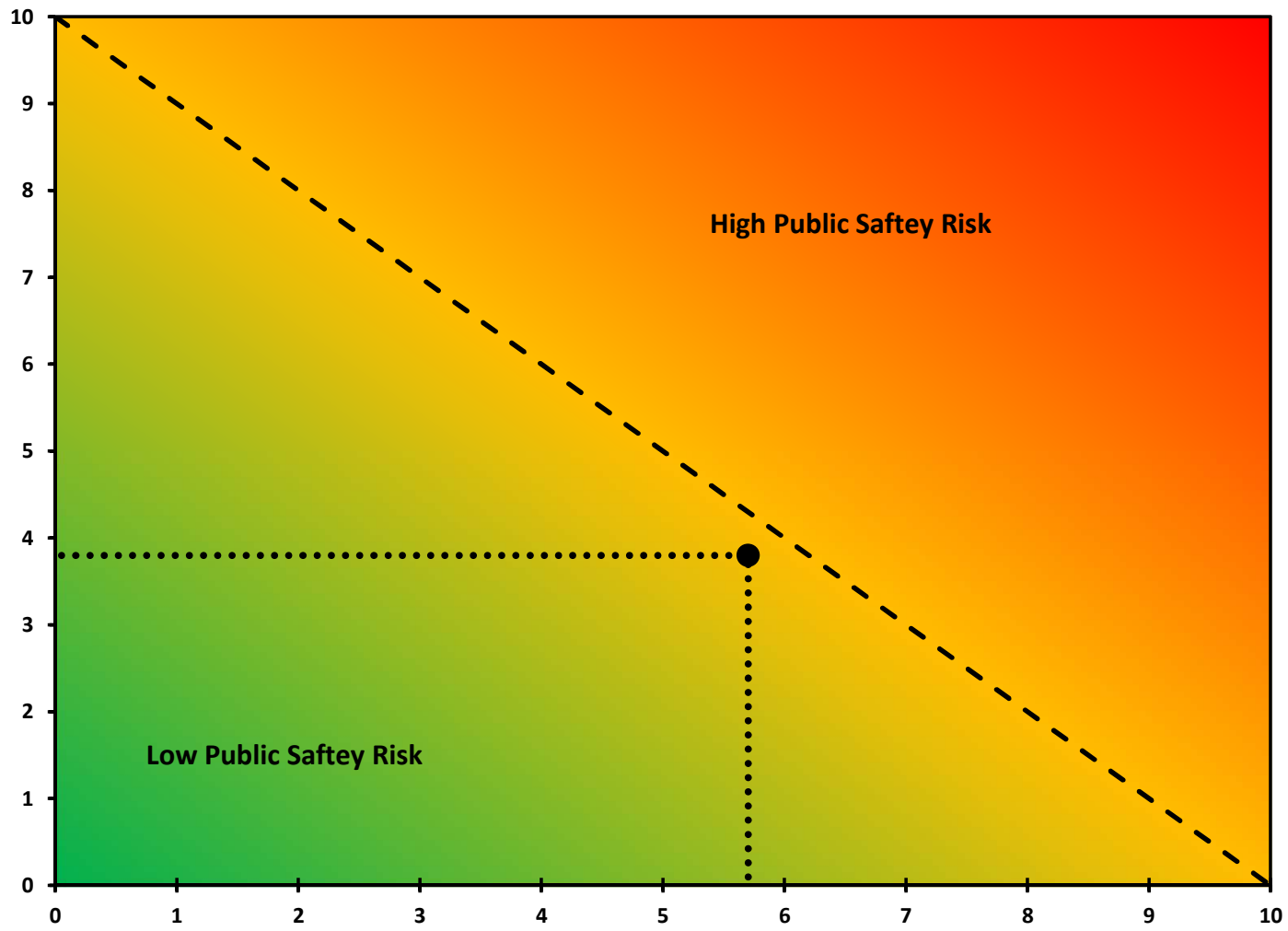
Total Score = 20.0

Public Saftey Risk Matrix

Structure Location: Site 22

Reach-User Characteristics

			Score
Frequency of Use	High	Low	2
Skill Level	Beginne	Advanced	8
Access	Good	Poor	2
Child Presence	Often	Never	3
		Total =	15.0
		Average Score =	3.8



Structure Characteristics

					Score
No	----------	Active Channel?	----------	Yes	7
No	----------	Outside of Bend?	----------	Yes	9
Low	----------	Strainer Potential	----------	High	6
High	----------	Egress Potential	----------	Low	3
High	----------	Sight Distance	----------	Low	2
Low	----------	Depth x Velocity	----------	High	7
		Average Score =			5.7
				Total Score =	34.0

Project:
CC-44

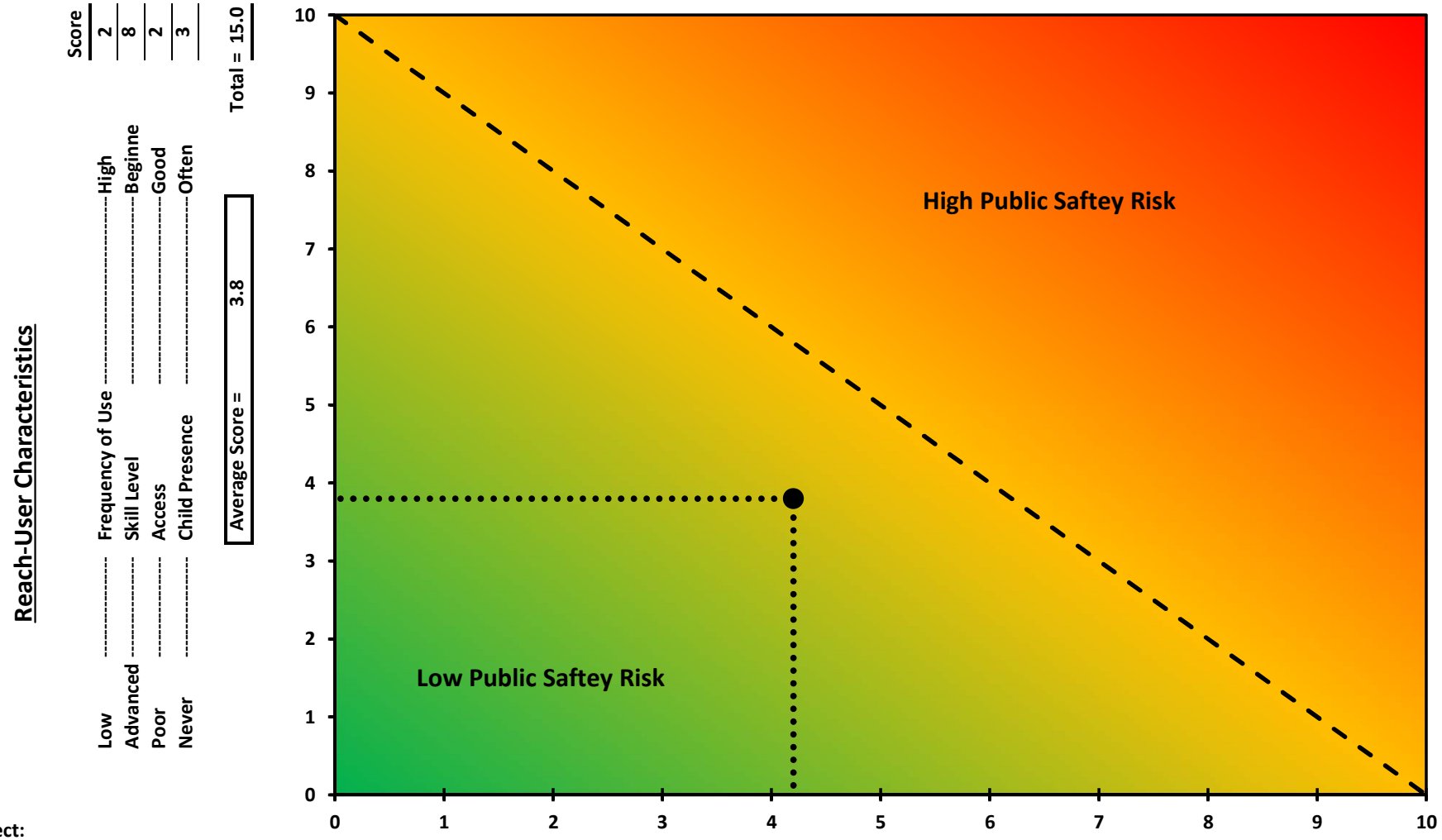
Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

Public Saftey Risk Matrix

Structure Location: Site 23



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

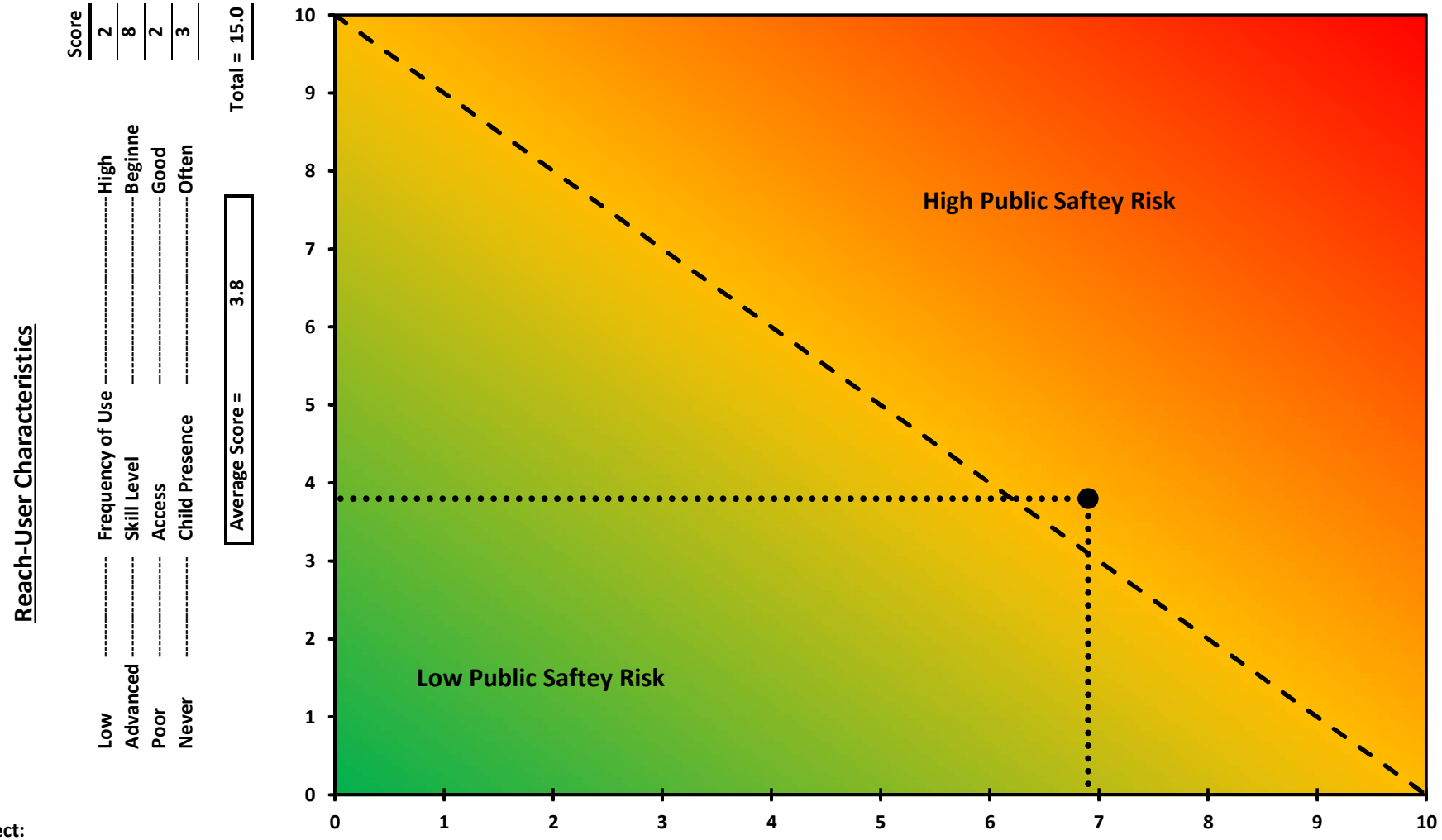
					Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	7
Low	Strainer Potential	High	3
High	Egress Potential	Low	3
High	Sight Distance	Low	3
Low	Depth x Velocity	High	5

Average Score = 4.2

Total Score = 25.0

Public Saftey Risk Matrix

Structure Location: Site 24



Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

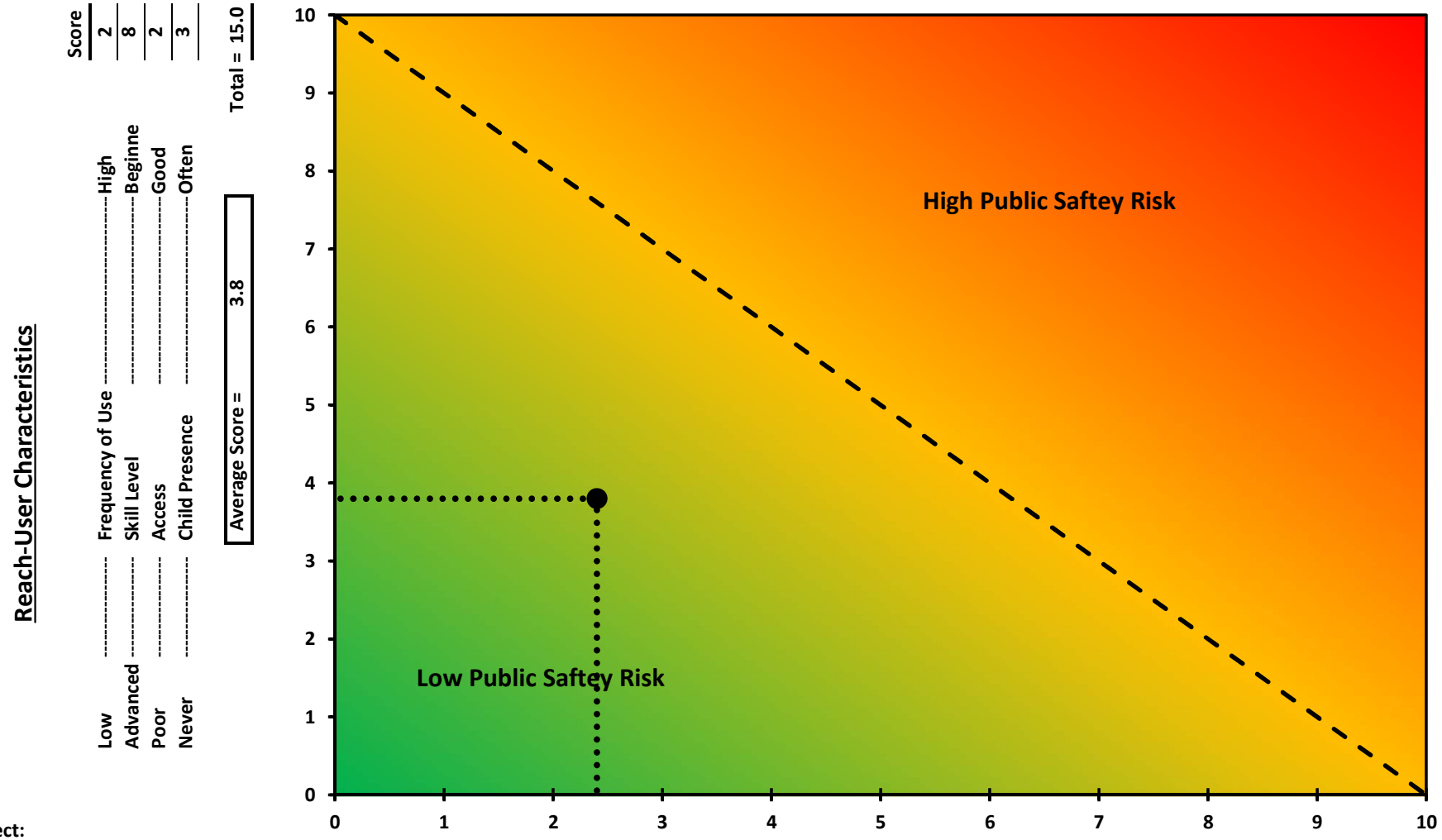
			Score
No	Active Channel?	Yes	7
No	Outside of Bend?	Yes	9
Low	Strainer Potential	High	9
High	Egress Potential	Low	4
High	Sight Distance	Low	5
Low	Depth x Velocity	High	7

Average Score = 6.9

Total Score = 41.0

Public Saftey Risk Matrix

Structure Location: Site 25



Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

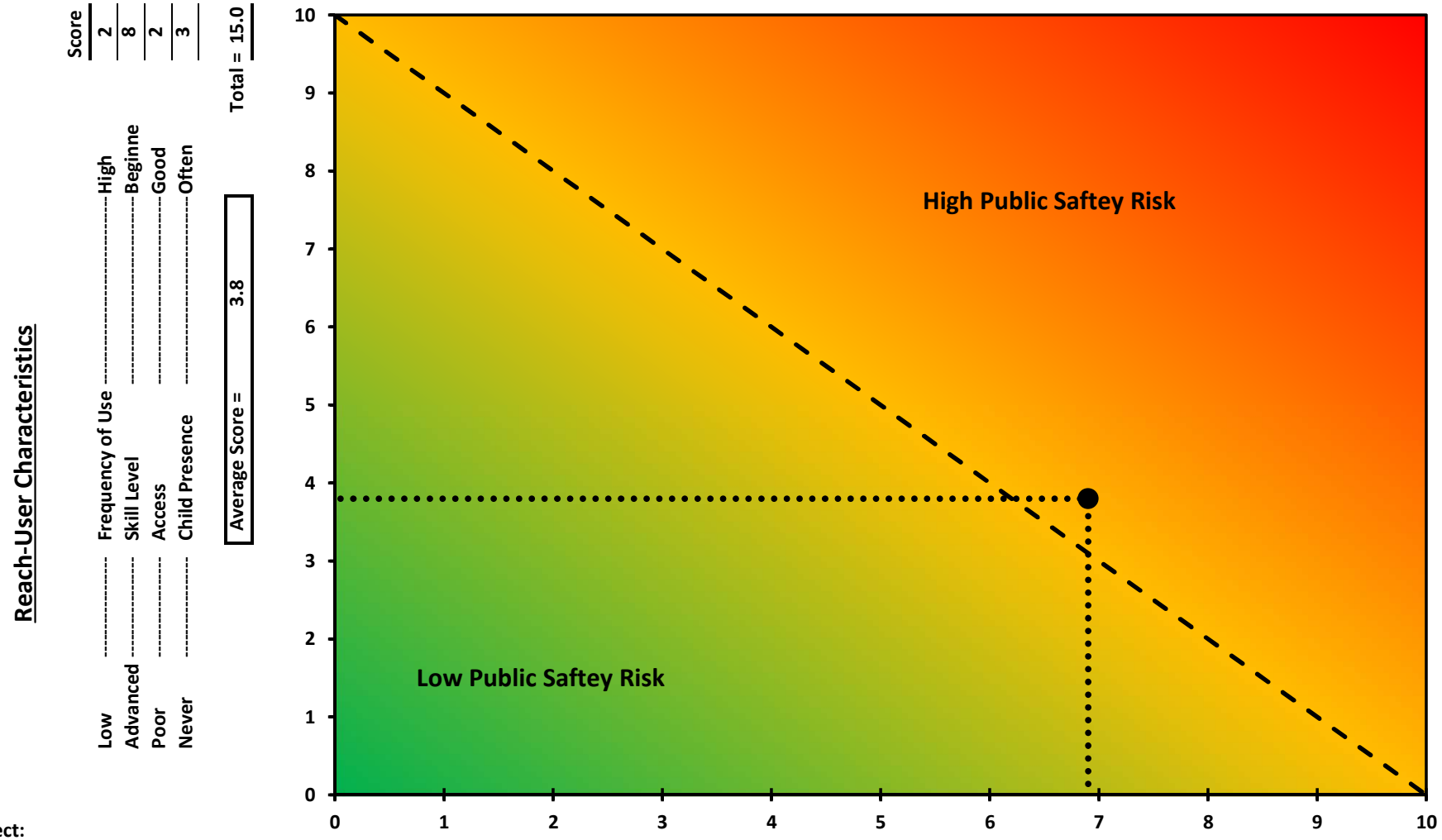
					Score
No	----------	Active Channel?	----------	Yes	4
No	----------	Outside of Bend?	----------	Yes	1
Low	----------	Strainer Potential	----------	High	3
High	----------	Egress Potential	----------	Low	2
High	----------	Sight Distance	----------	Low	2
Low	----------	Depth x Velocity	----------	High	2

Average Score = 2.4

Total Score = 14.0

Public Saftey Risk Matrix

Structure Location: Site 26



Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

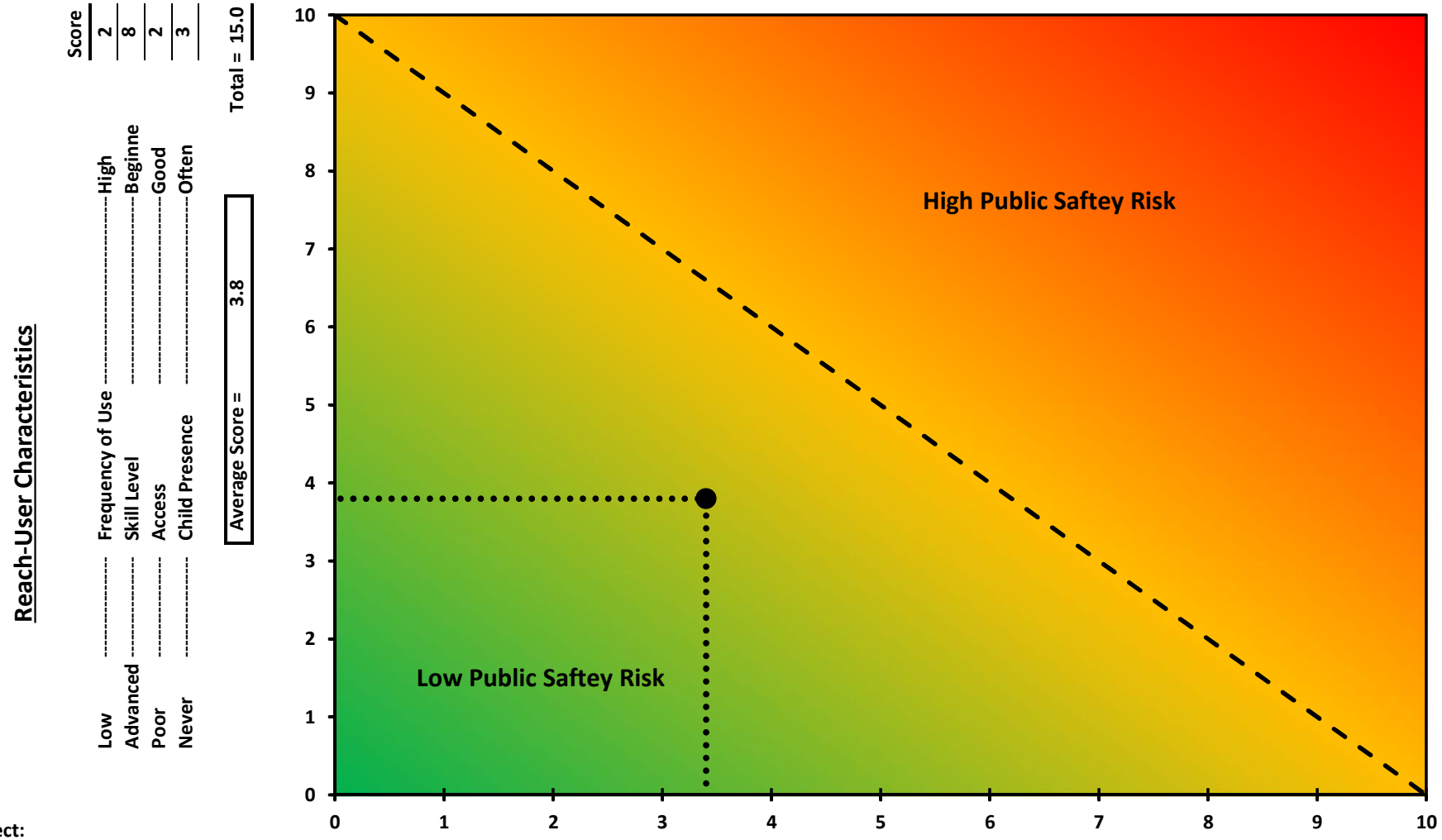
				Score
No	Active Channel?	Yes		7
No	Outside of Bend?	Yes		9
Low	Strainer Potential	High		9
High	Egress Potential	Low		4
High	Sight Distance	Low		5
Low	Depth x Velocity	High		7

Average Score = 6.9

Total Score = 41.0

Public Saftey Risk Matrix

Structure Location: Site 27



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Average Score = 3.8

Total = 15.0

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

Structure Characteristics

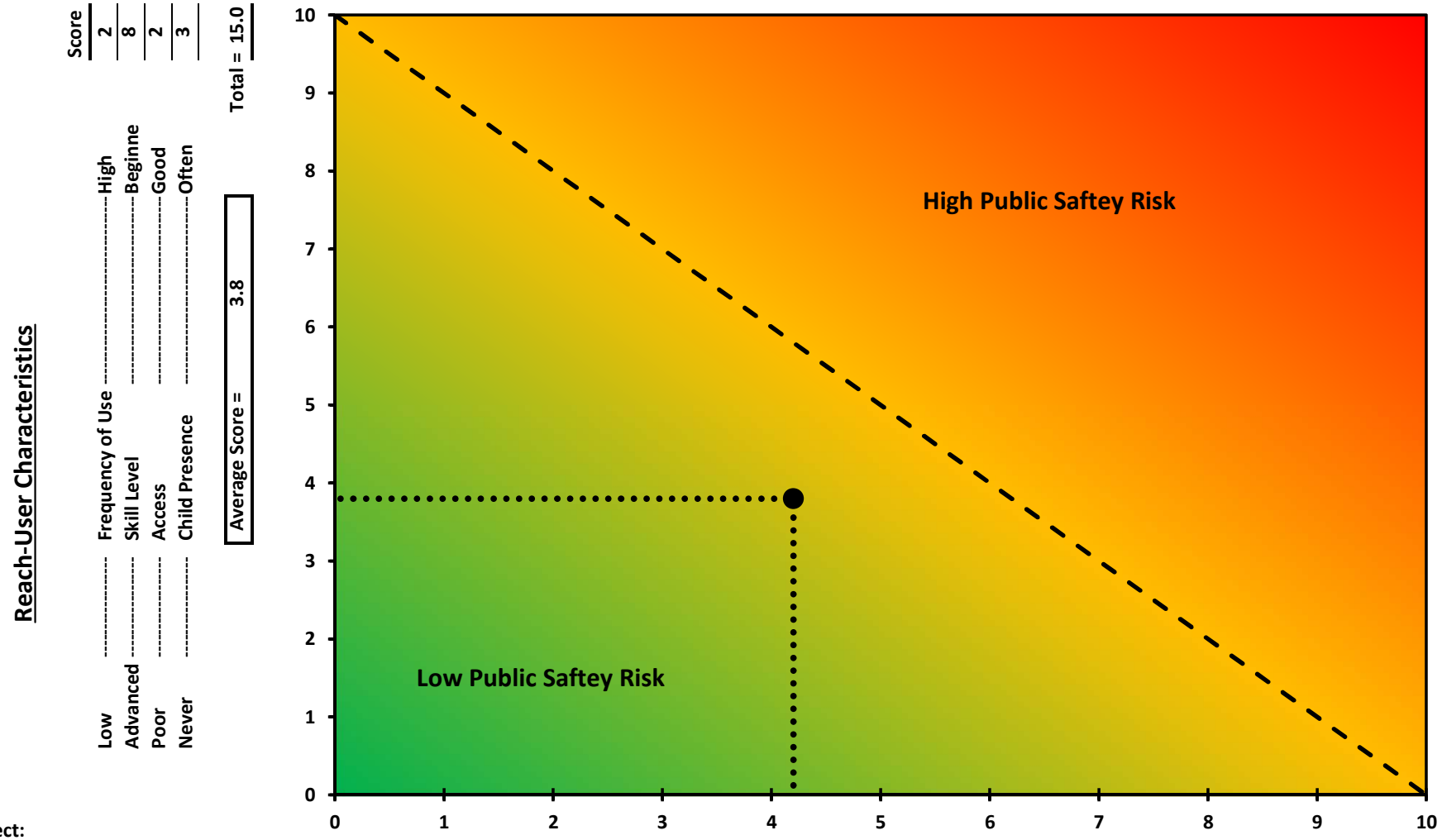
			Score
No	Active Channel?	Yes	5
No	Outside of Bend?	Yes	2
Low	Strainer Potential	High	4
High	Egress Potential	Low	3
High	Sight Distance	Low	3
Low	Depth x Velocity	High	3

Average Score = 3.4

Total Score = 20.0

Public Saftey Risk Matrix

Structure Location: Site 28



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

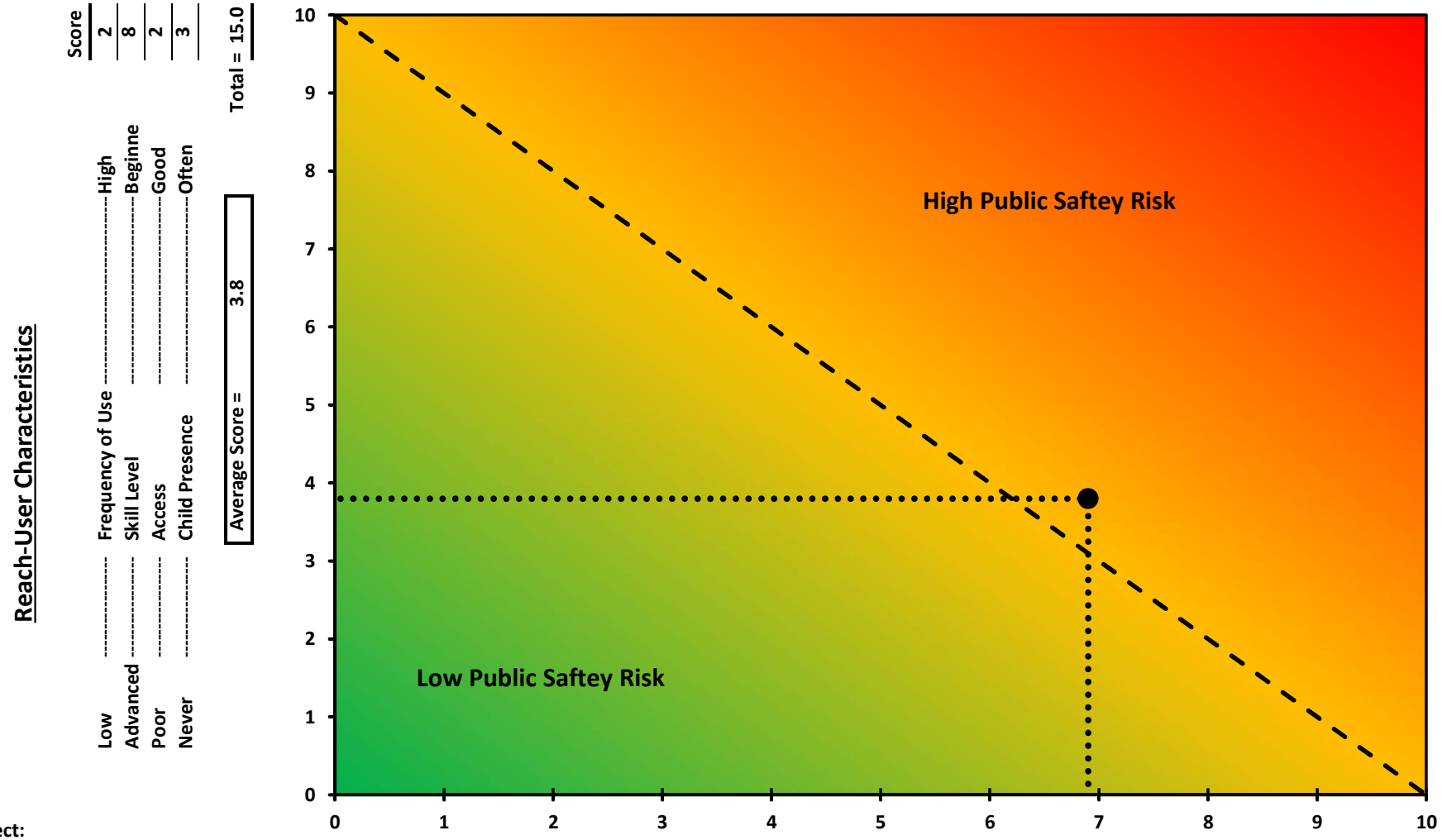
					Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	7
Low	Strainer Potential	High	3
High	Egress Potential	Low	3
High	Sight Distance	Low	3
Low	Depth x Velocity	High	5

Average Score = 4.2

Total Score = 25.0

Public Saftey Risk Matrix

Structure Location: Site 29



Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

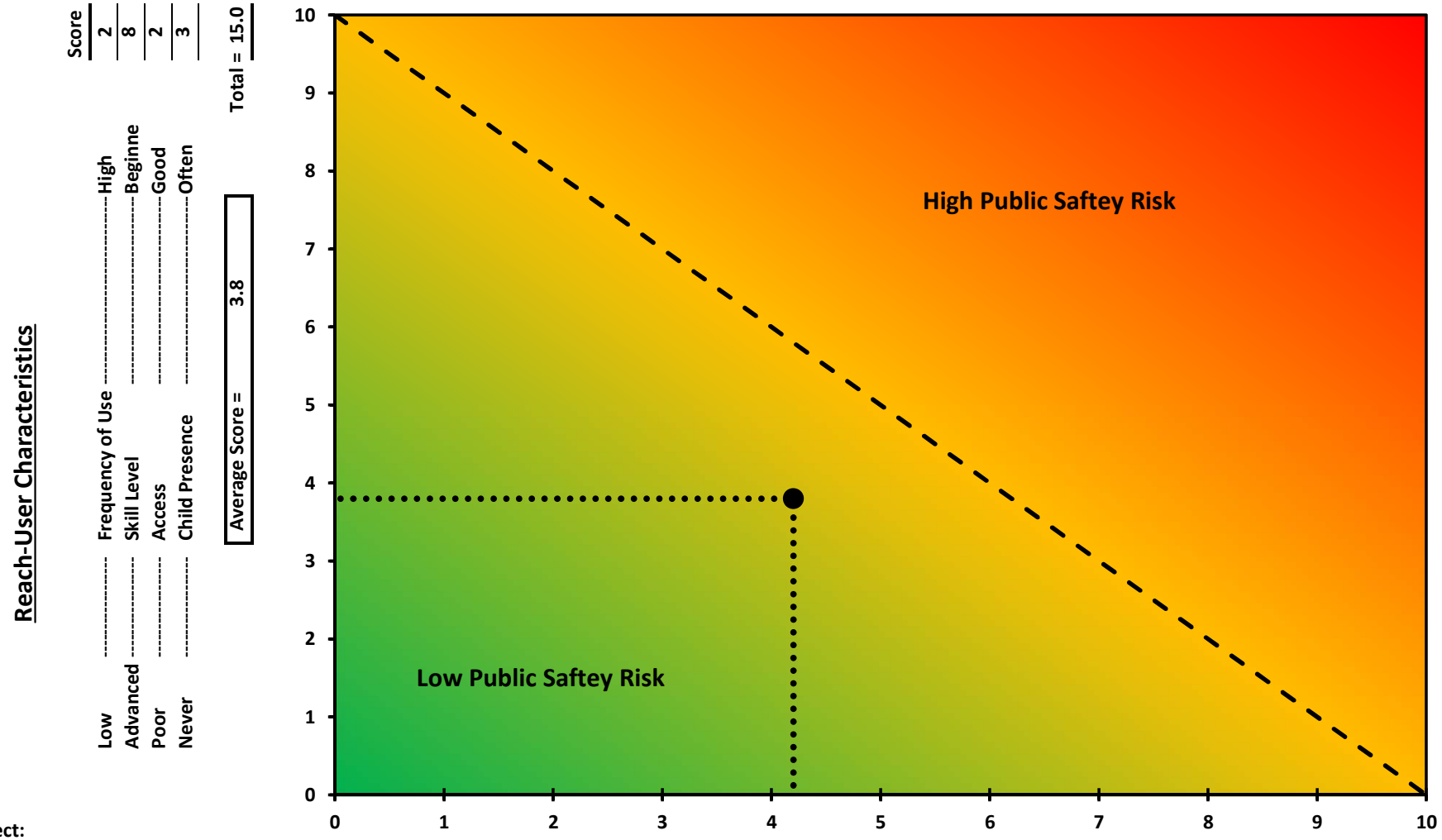
			Score
No	Active Channel?	Yes	7
No	Outside of Bend?	Yes	9
Low	Strainer Potential	High	9
High	Egress Potential	Low	4
High	Sight Distance	Low	5
Low	Depth x Velocity	High	7

Average Score = 6.9

Total Score = 41.0

Public Saftey Risk Matrix

Structure Location: Site 30



Reach-User Characteristics

			Score
Low	Frequency of Use	High	2
Advanced	Skill Level	Beginne	8
Poor	Access	Good	2
Never	Child Presence	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

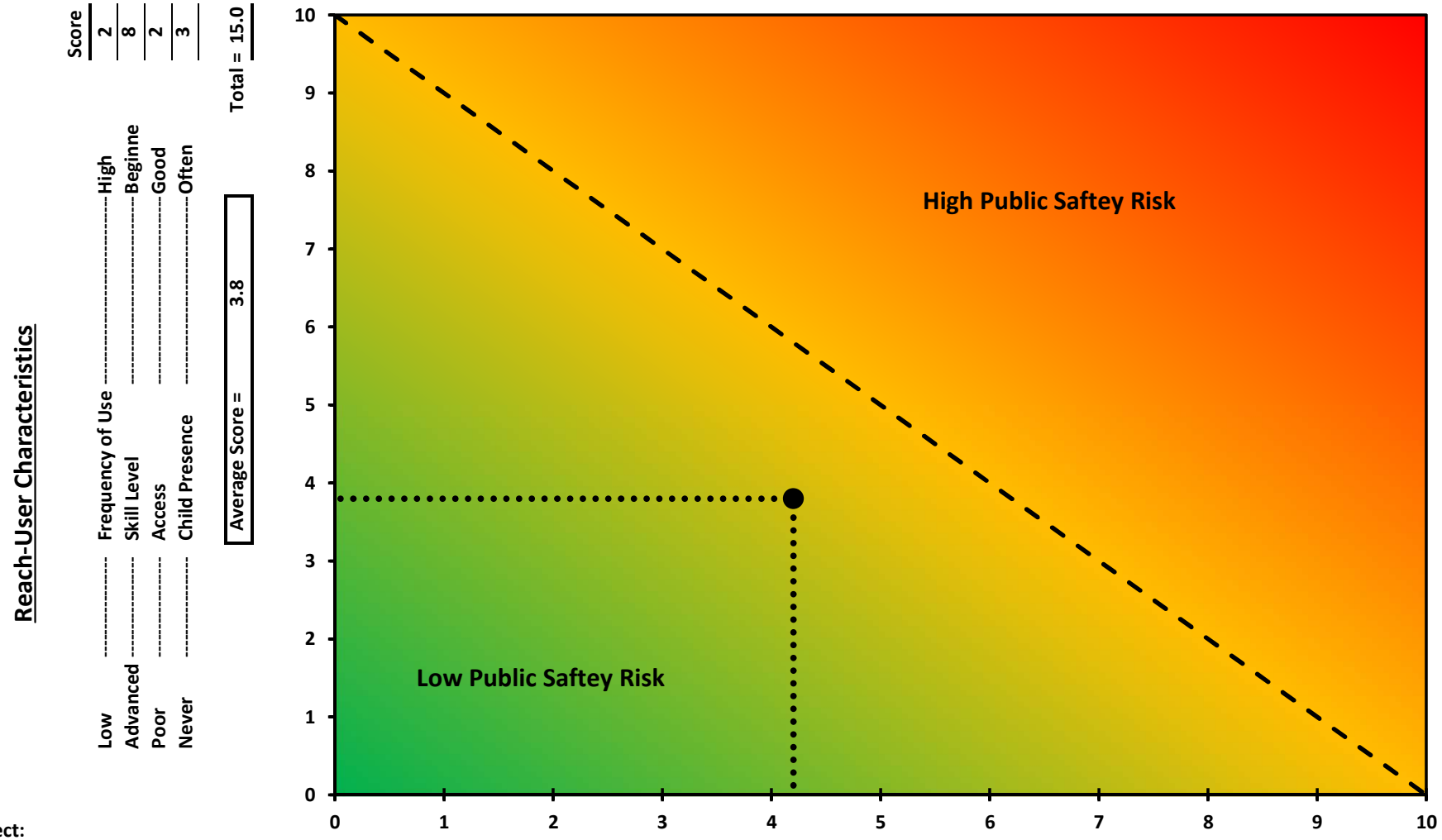
					Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	7
Low	Strainer Potential	High	3
High	Egress Potential	Low	3
High	Sight Distance	Low	3
Low	Depth x Velocity	High	5

Average Score = 4.2

Total Score = 25.0

Public Saftey Risk Matrix

Structure Location: Site 31



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

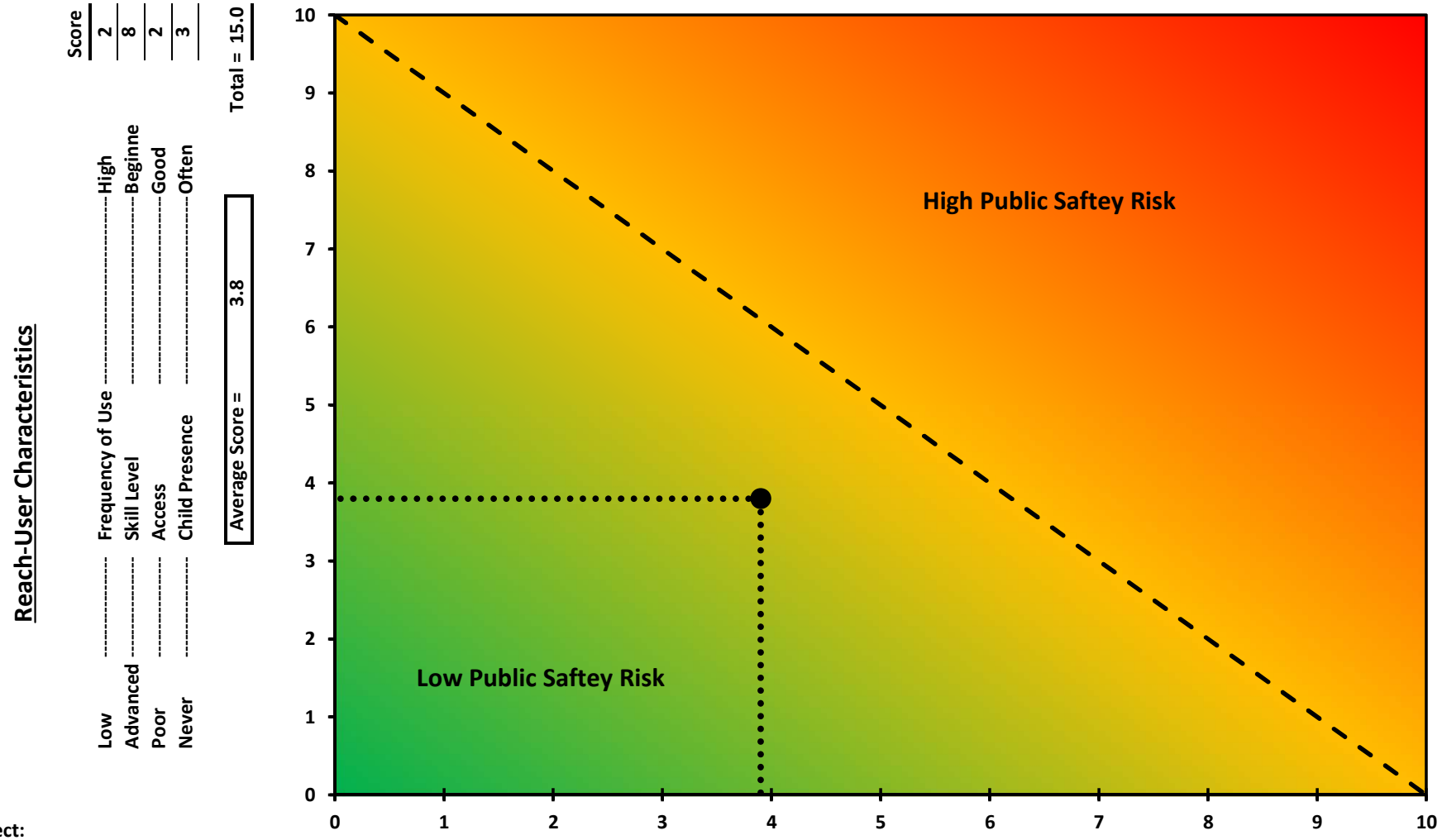
					Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	7
Low	Strainer Potential	High	3
High	Egress Potential	Low	3
High	Sight Distance	Low	3
Low	Depth x Velocity	High	5

Average Score = 4.2

Total Score = 25.0

Public Saftey Risk Matrix

Structure Location: Site 32



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

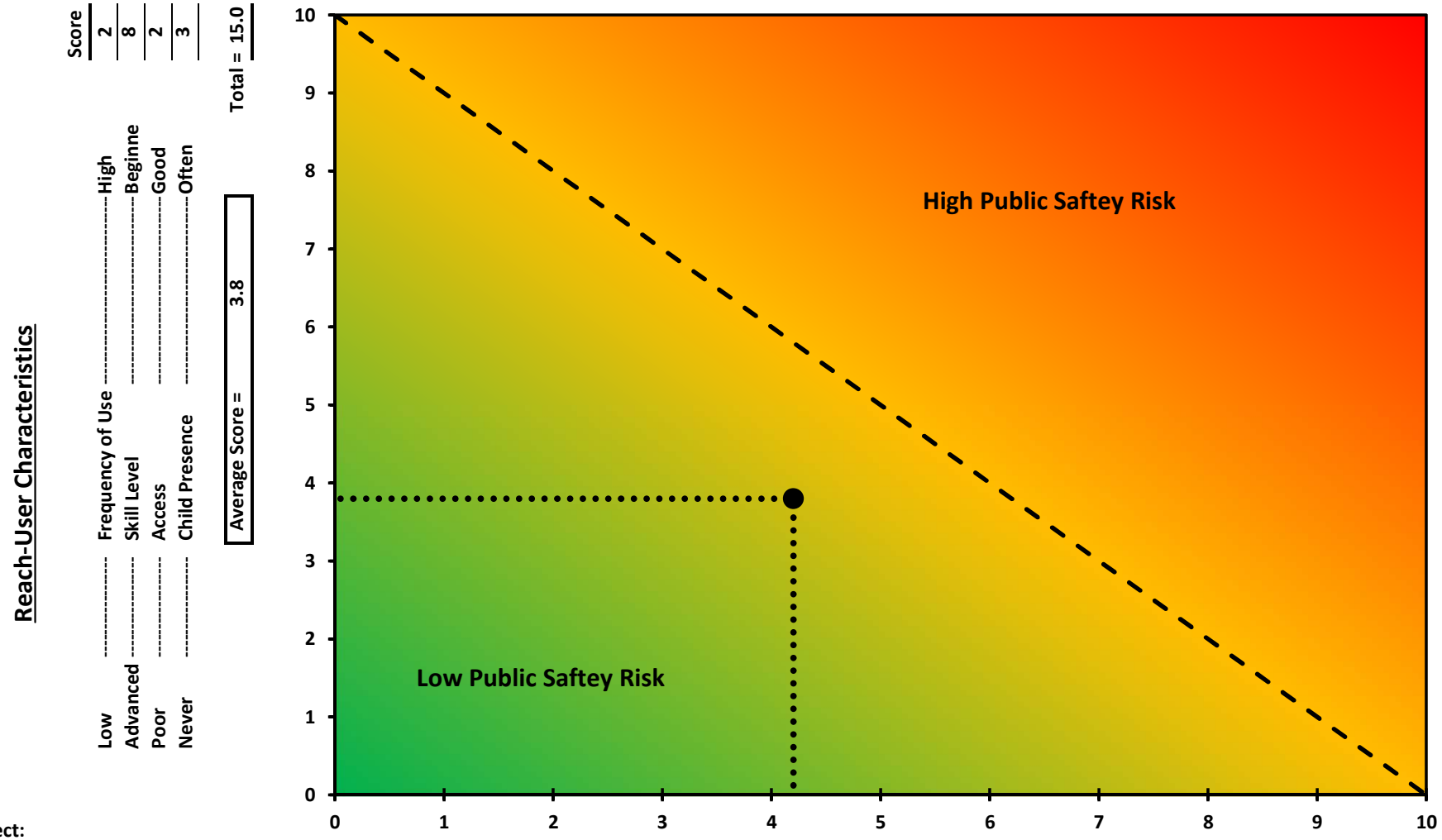
				Score
No	Active Channel?	Yes		5
No	Outside of Bend?	Yes		3
Low	Strainer Potential	High		3
High	Egress Potential	Low		4
High	Sight Distance	Low		4
Low	Depth x Velocity	High		4

Average Score = 3.9

Total Score = 23.0

Public Saftey Risk Matrix

Structure Location: Site 33



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

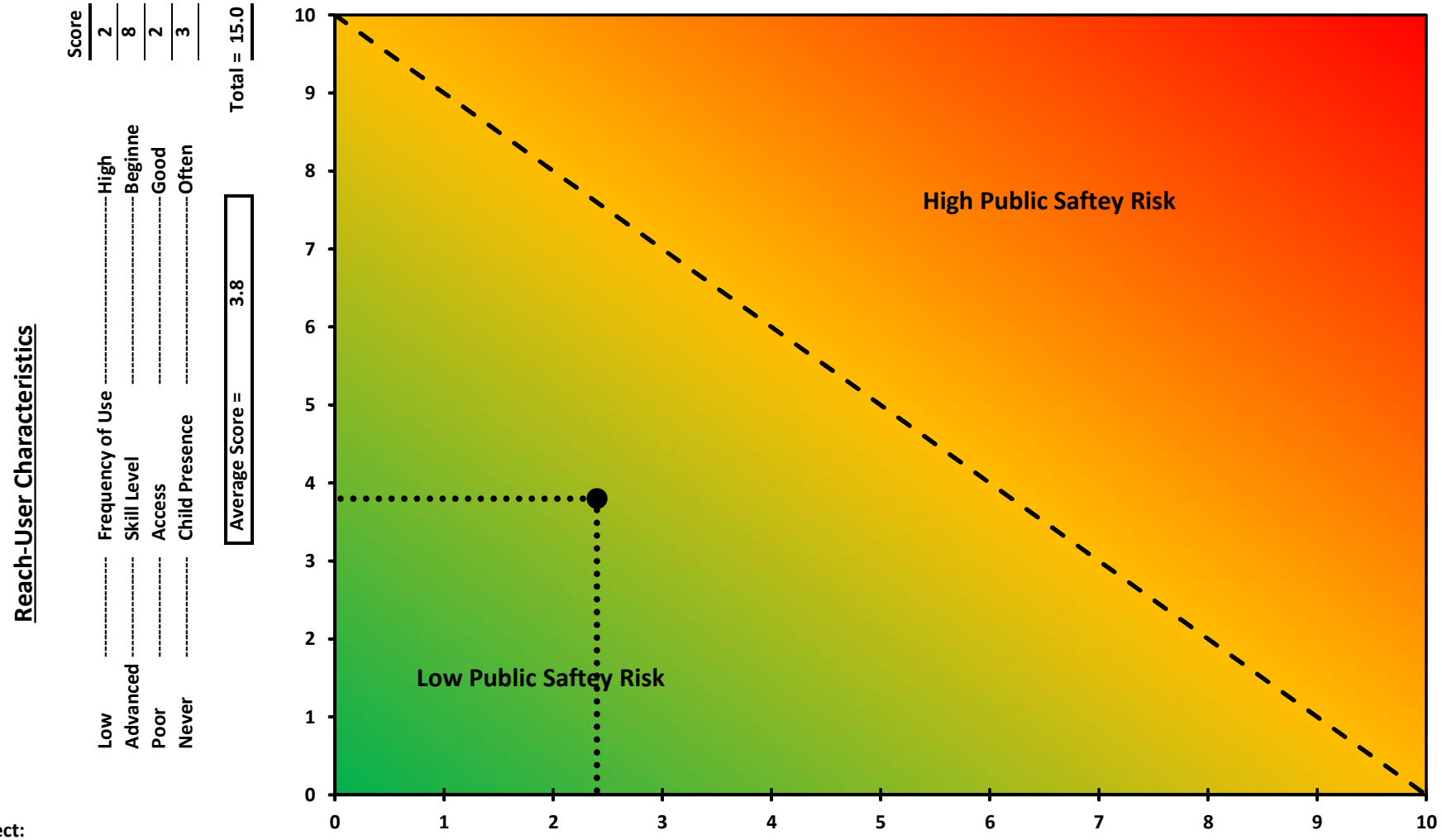
					Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	7
Low	Strainer Potential	High	3
High	Egress Potential	Low	3
High	Sight Distance	Low	3
Low	Depth x Velocity	High	5

Average Score = 4.2

Total Score = 25.0

Public Saftey Risk Matrix

Structure Location: Site 34



Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

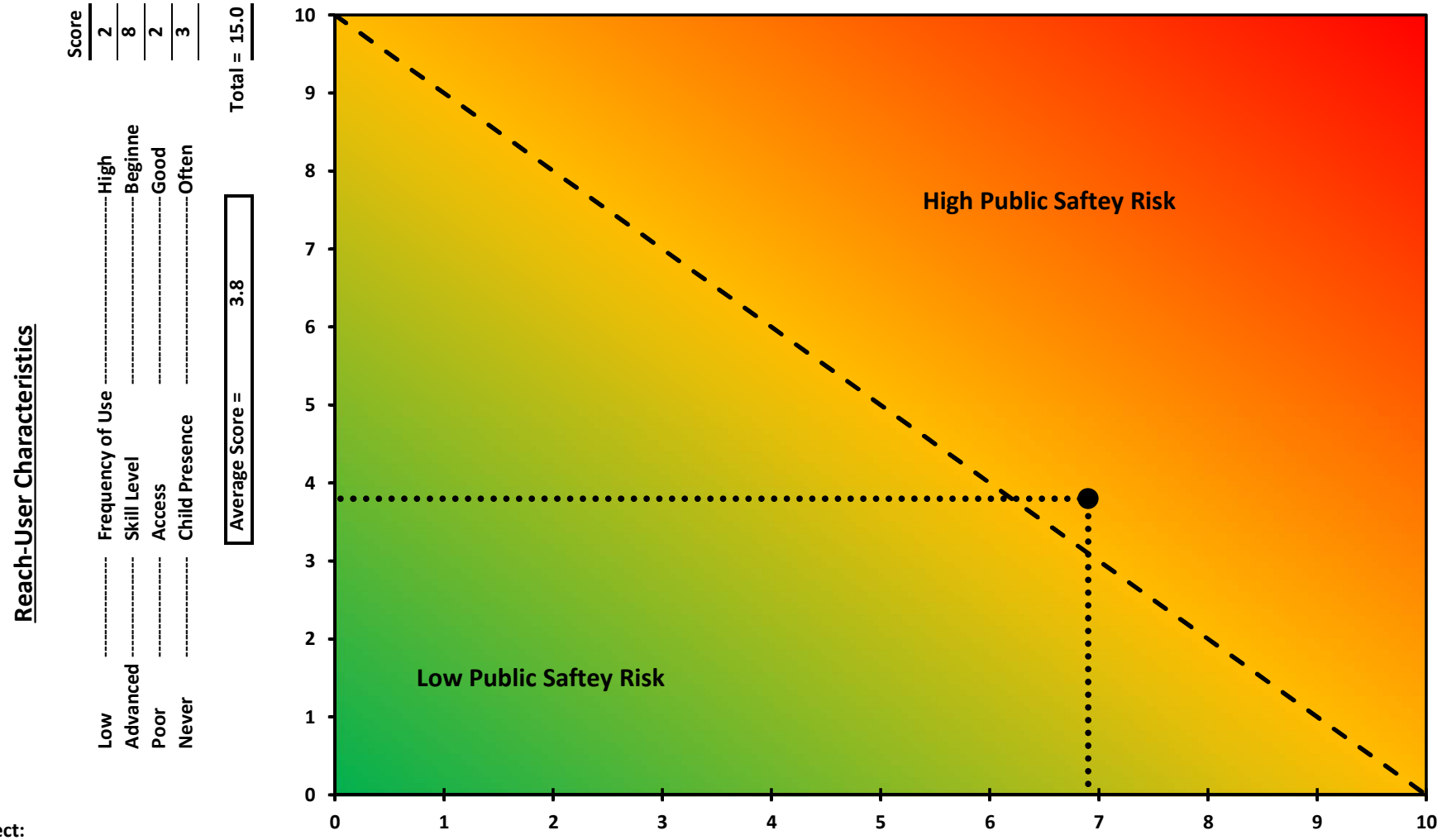
					Score
No	----------	Active Channel?	----------	Yes	4
No	----------	Outside of Bend?	----------	Yes	1
Low	----------	Strainer Potential	----------	High	3
High	----------	Egress Potential	----------	Low	2
High	----------	Sight Distance	----------	Low	2
Low	----------	Depth x Velocity	----------	High	2

Average Score = 2.4

Total Score = 14.0

Public Saftey Risk Matrix

Structure Location: Site 35



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

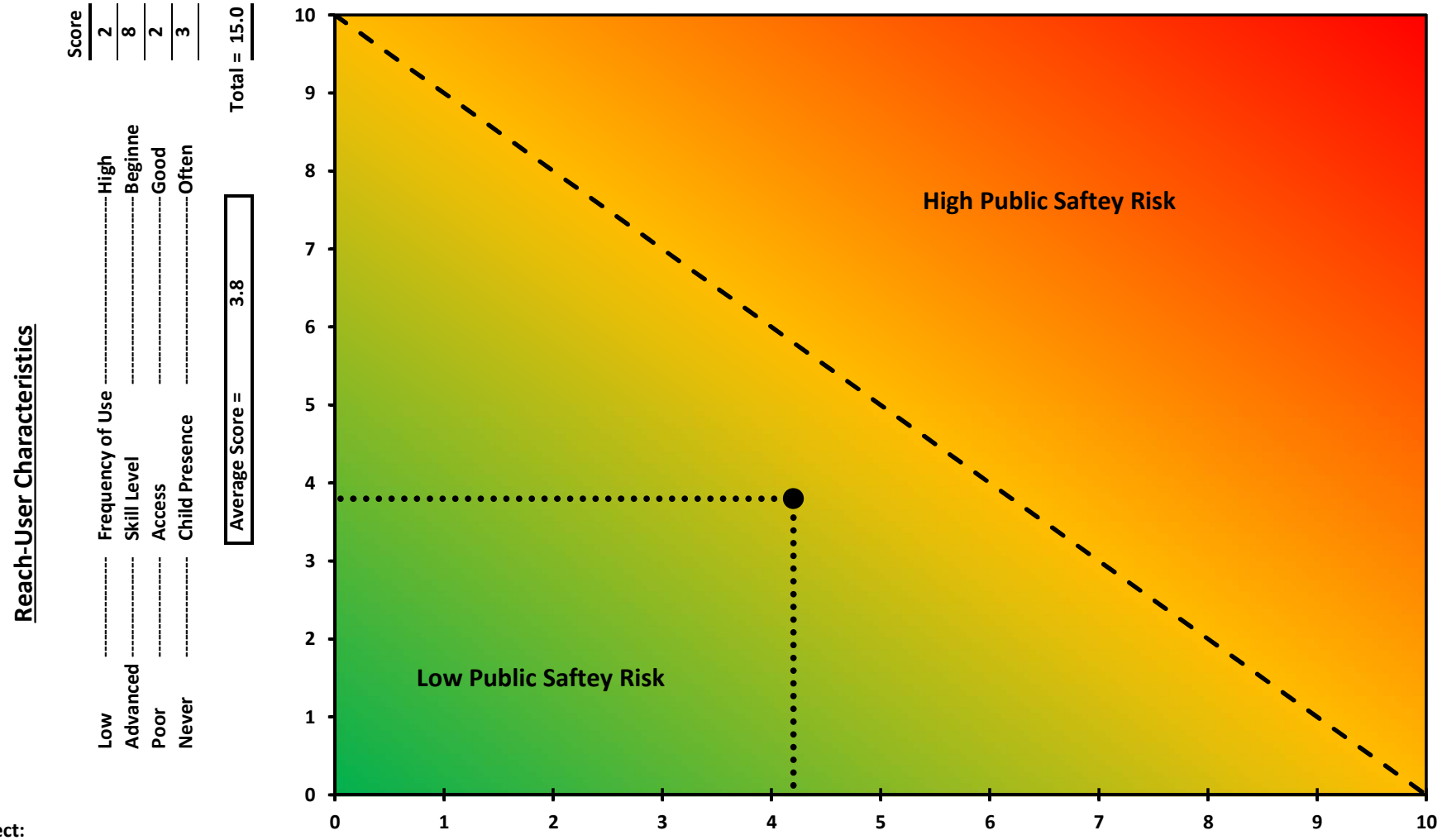
				Score
No	Active Channel?	Yes		7
No	Outside of Bend?	Yes		9
Low	Strainer Potential	High		9
High	Egress Potential	Low		4
High	Sight Distance	Low		5
Low	Depth x Velocity	High		7

Average Score = 6.9

Total Score = 41.0

Public Saftey Risk Matrix

Structure Location: Site 36



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Average Score = 3.8

Total = 15.0

Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

Structure Characteristics

			Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	7
Low	Strainer Potential	High	3
High	Egress Potential	Low	3
High	Sight Distance	Low	3
Low	Depth x Velocity	High	5

Average Score = 4.2

Total Score = 25.0

Public Saftey Risk Matrix

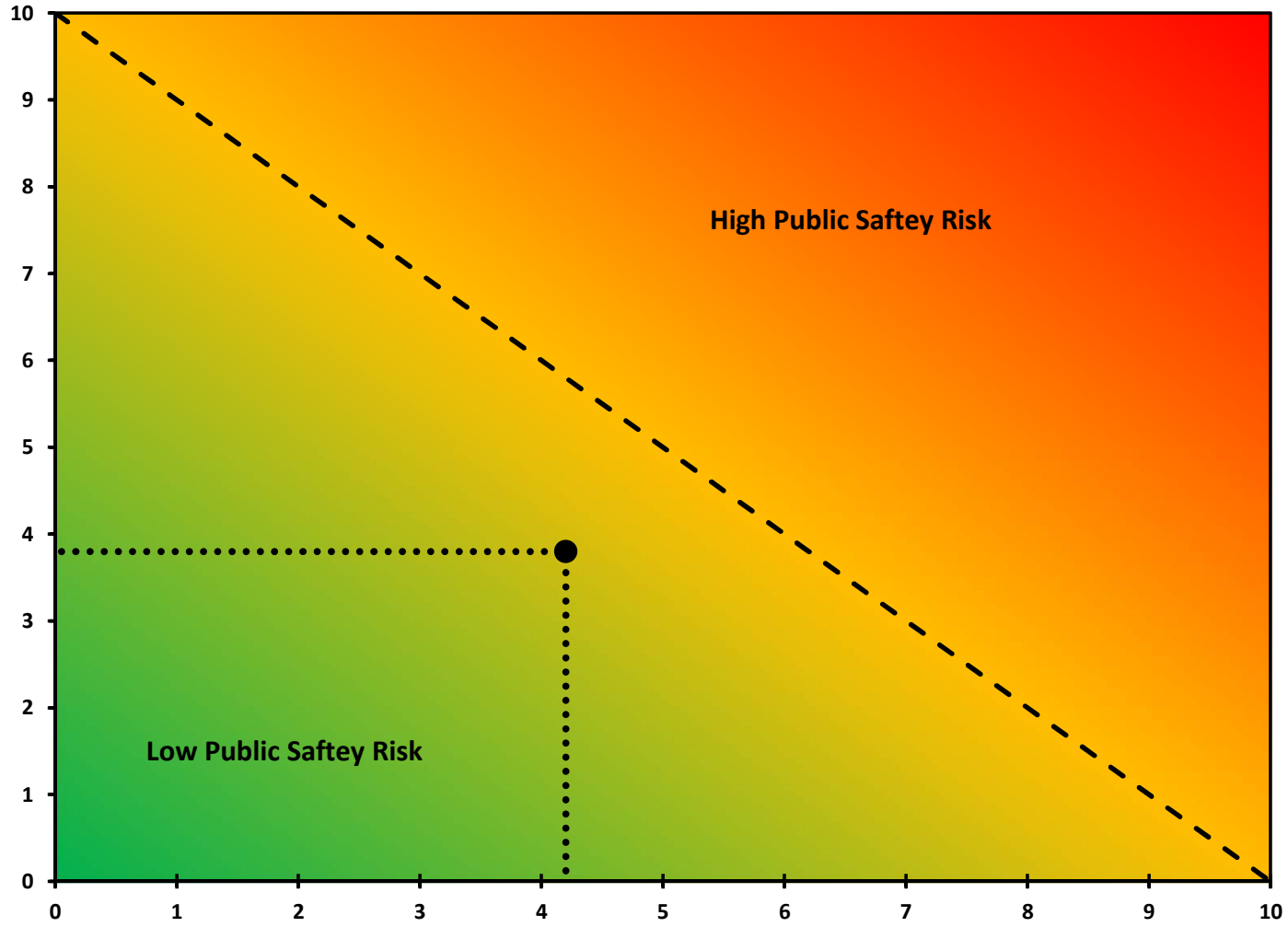
Structure Location: Site 37

Reach-User Characteristics

			Score
Frequency of Use	High	Low	2
Skill Level	Beginne	Advanced	8
Access	Good	Poor	2
Child Presence	Often	Never	3

Total = 15.0

Average Score = 3.8



Structure Characteristics

					Score
No	Active Channel?	Yes			4
No	Outside of Bend?	Yes			7
Low	Strainer Potential	High			3
High	Egress Potential	Low			3
High	Sight Distance	Low			3
Low	Depth x Velocity	High			5

Average Score = 4.2

Total Score = 25.0

Project:
CC-44

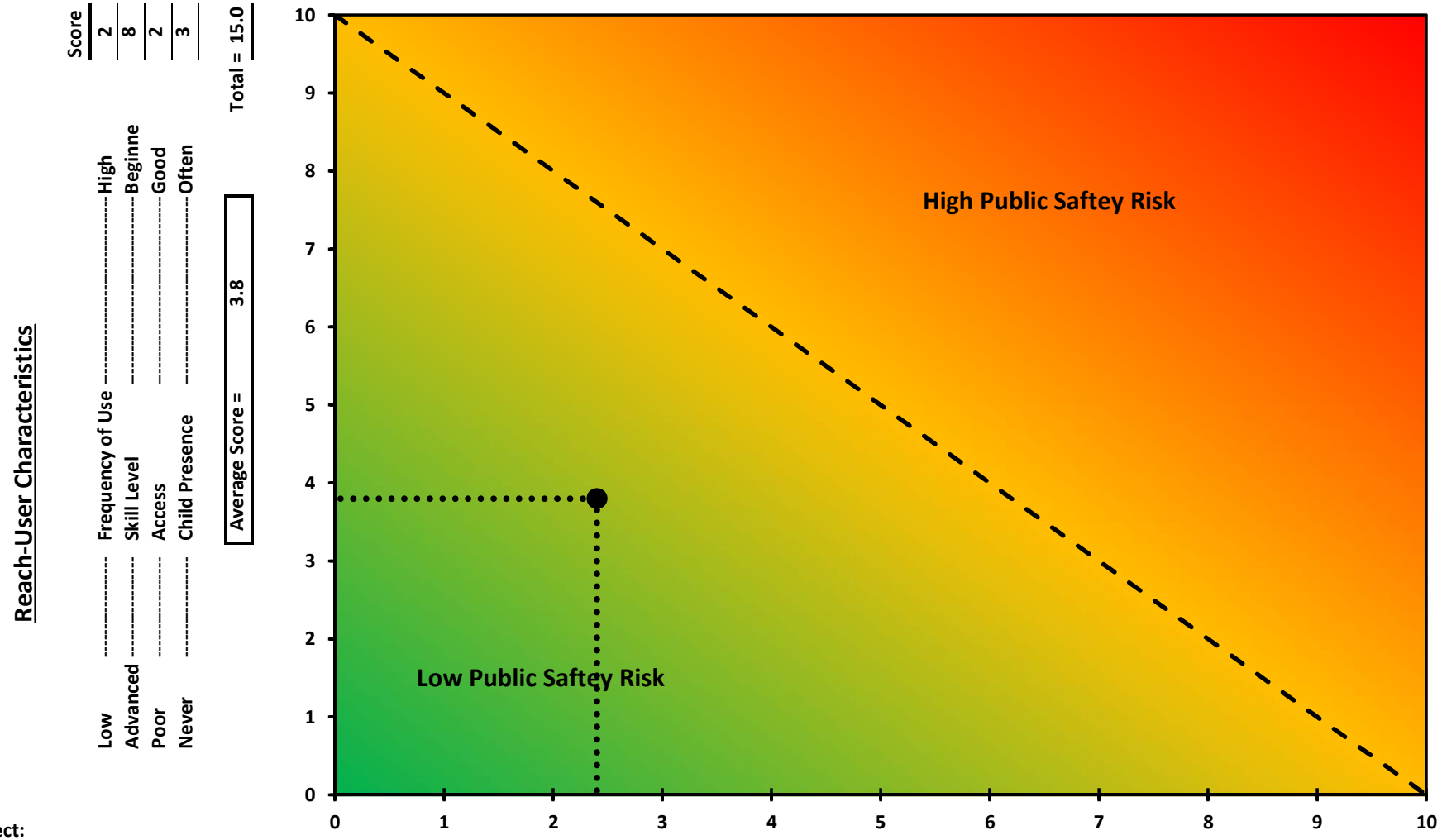
Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

Public Saftey Risk Matrix

Structure Location: Site 38



Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

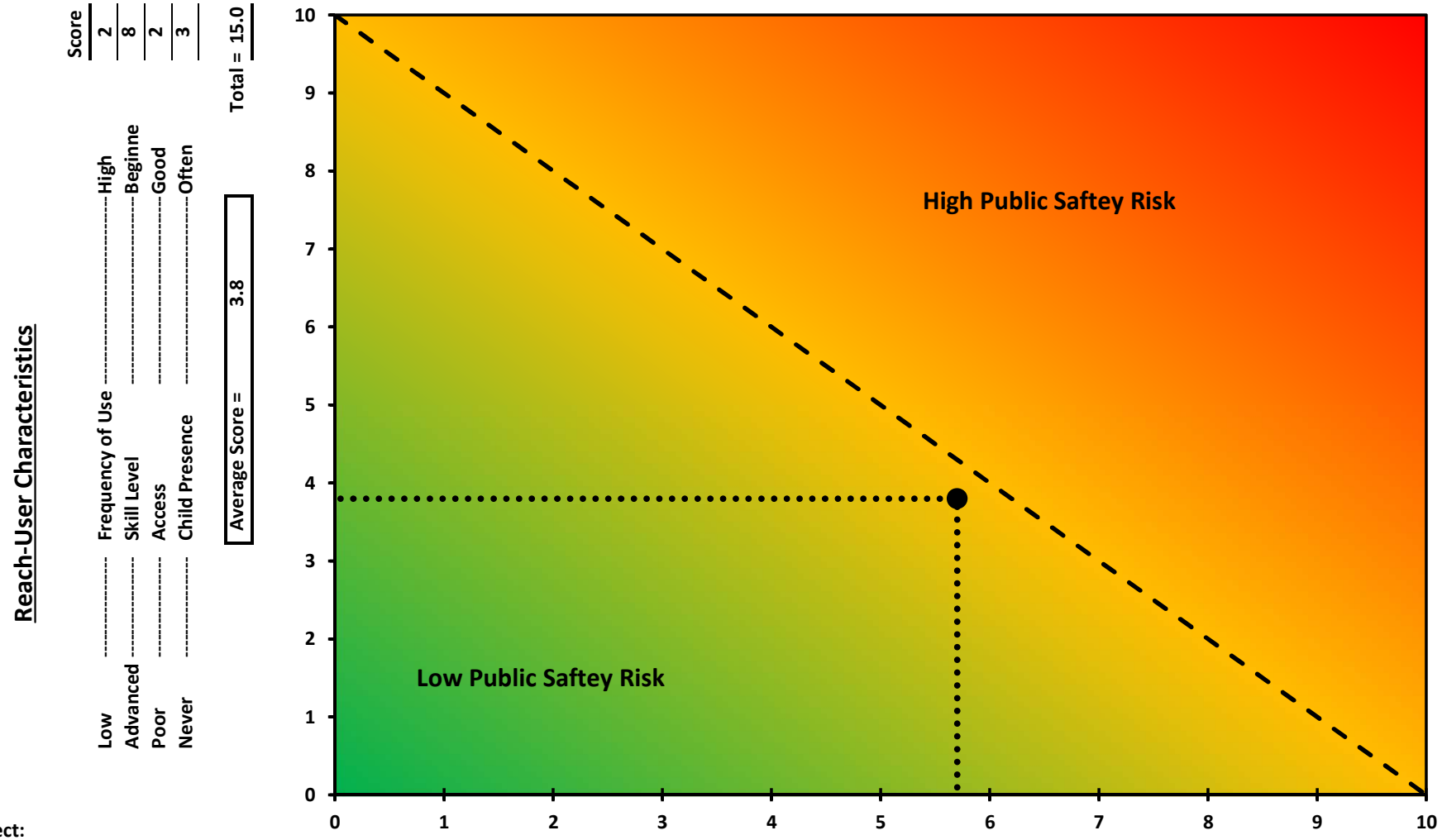
					Score
No	----------	Active Channel?	----------	Yes	4
No	----------	Outside of Bend?	----------	Yes	1
Low	----------	Strainer Potential	----------	High	3
High	----------	Egress Potential	----------	Low	2
High	----------	Sight Distance	----------	Low	2
Low	----------	Depth x Velocity	----------	High	2

Average Score = 2.4

Total Score = 14.0

Public Saftey Risk Matrix

Structure Location: Site 39



Reach-User Characteristics

			Score
Low	Frequency of Use	High	2
Advanced	Skill Level	Beginne	8
Poor	Access	Good	2
Never	Child Presence	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

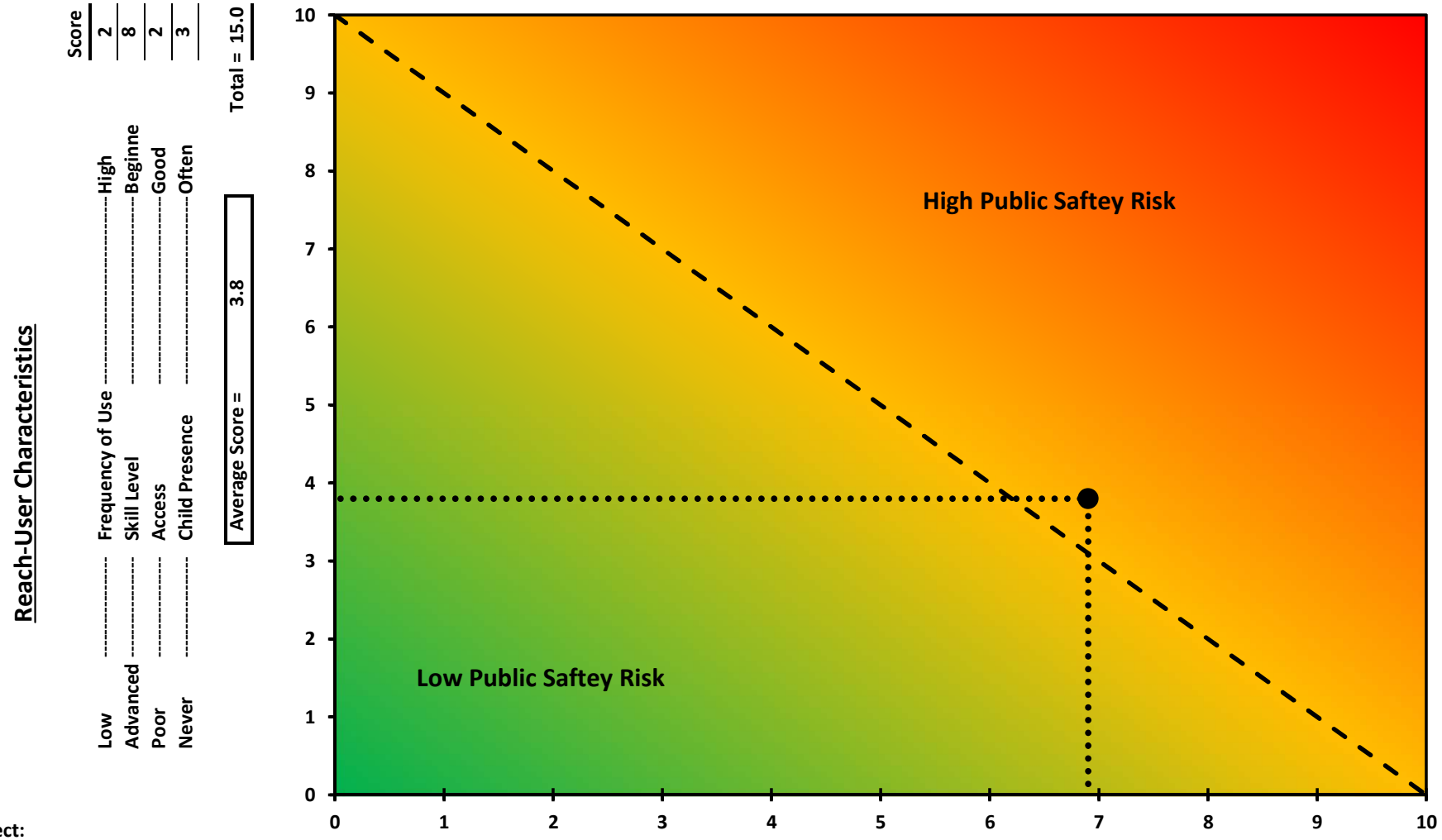
					Score
No	----------	Active Channel?	----------	Yes	7
No	----------	Outside of Bend?	----------	Yes	9
Low	----------	Strainer Potential	----------	High	3
High	----------	Egress Potential	----------	Low	3
High	----------	Sight Distance	----------	Low	5
Low	----------	Depth x Velocity	----------	High	7

Average Score = 5.7

Total Score = 34.0

Public Saftey Risk Matrix

Structure Location: Site 40



Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

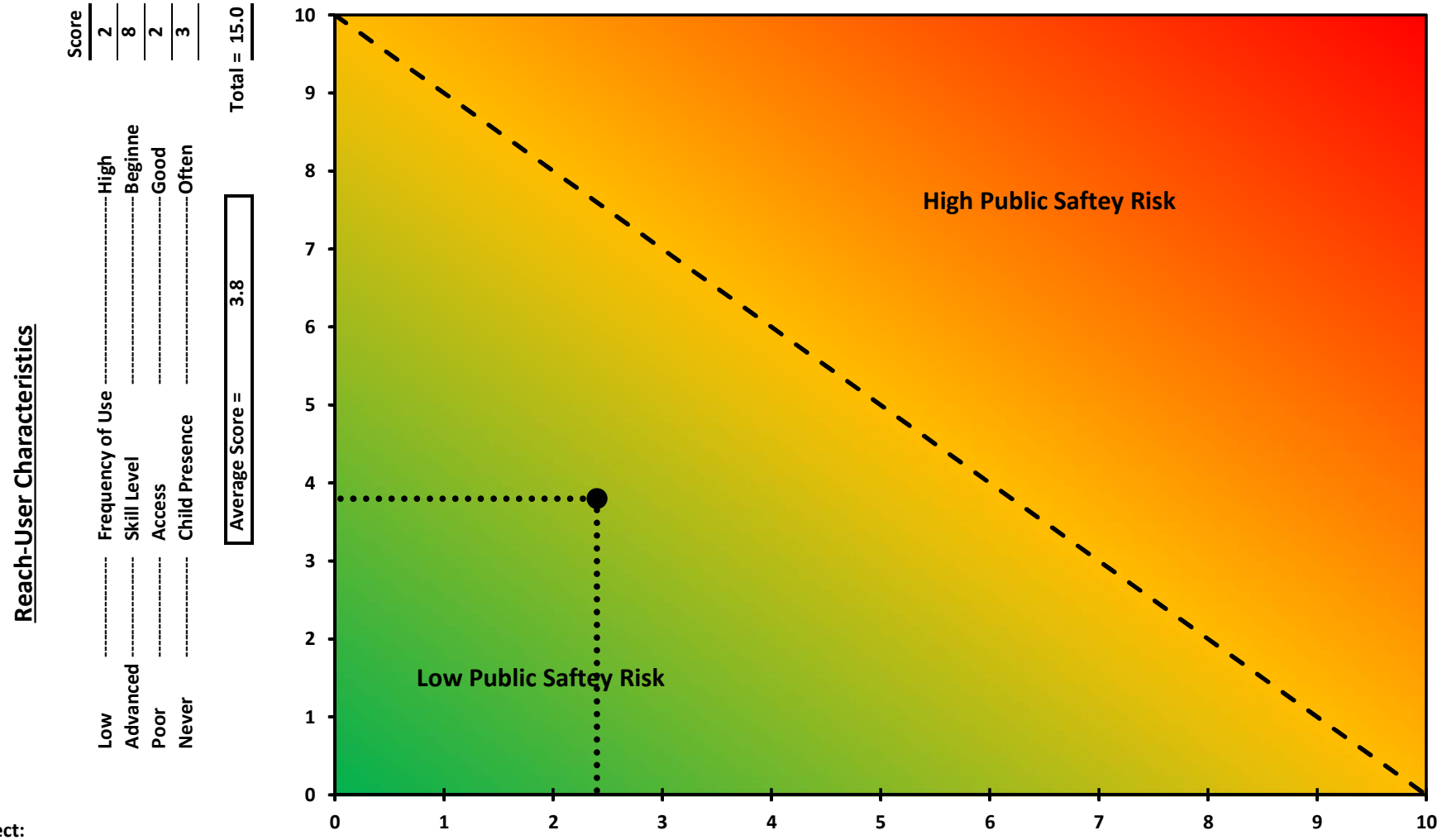
					Score
No	----------	Active Channel?	----------	Yes	7
No	----------	Outside of Bend?	----------	Yes	9
Low	----------	Strainer Potential	----------	High	9
High	----------	Egress Potential	----------	Low	4
High	----------	Sight Distance	----------	Low	5
Low	----------	Depth x Velocity	----------	High	7

Average Score = 6.9

Total Score = 41.0

Public Saftey Risk Matrix

Structure Location: Site 41



Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

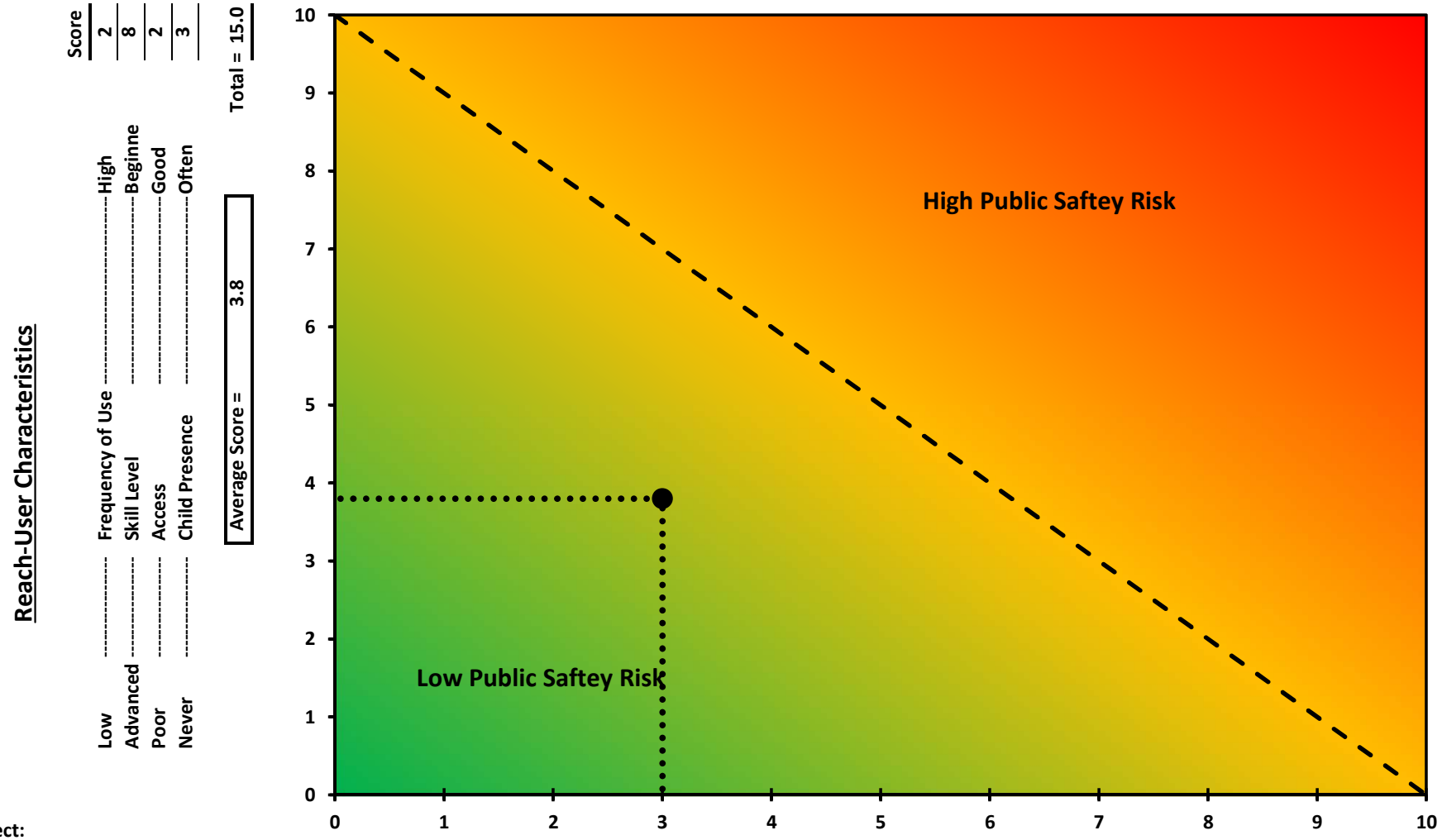
					Score
No	----------	Active Channel?	----------	Yes	4
No	----------	Outside of Bend?	----------	Yes	1
Low	----------	Strainer Potential	----------	High	3
High	----------	Egress Potential	----------	Low	2
High	----------	Sight Distance	----------	Low	2
Low	----------	Depth x Velocity	----------	High	2

Average Score = 2.4

Total Score = 14.0

Public Saftey Risk Matrix

Structure Location: Site 42



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Average Score = 3.8

Total = 15.0

Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

Structure Characteristics

			Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	2
Low	Strainer Potential	High	2
High	Egress Potential	Low	3
High	Sight Distance	Low	5
Low	Depth x Velocity	High	2

Average Score = 3.0

Total Score = 18.0

Public Saftey Risk Matrix

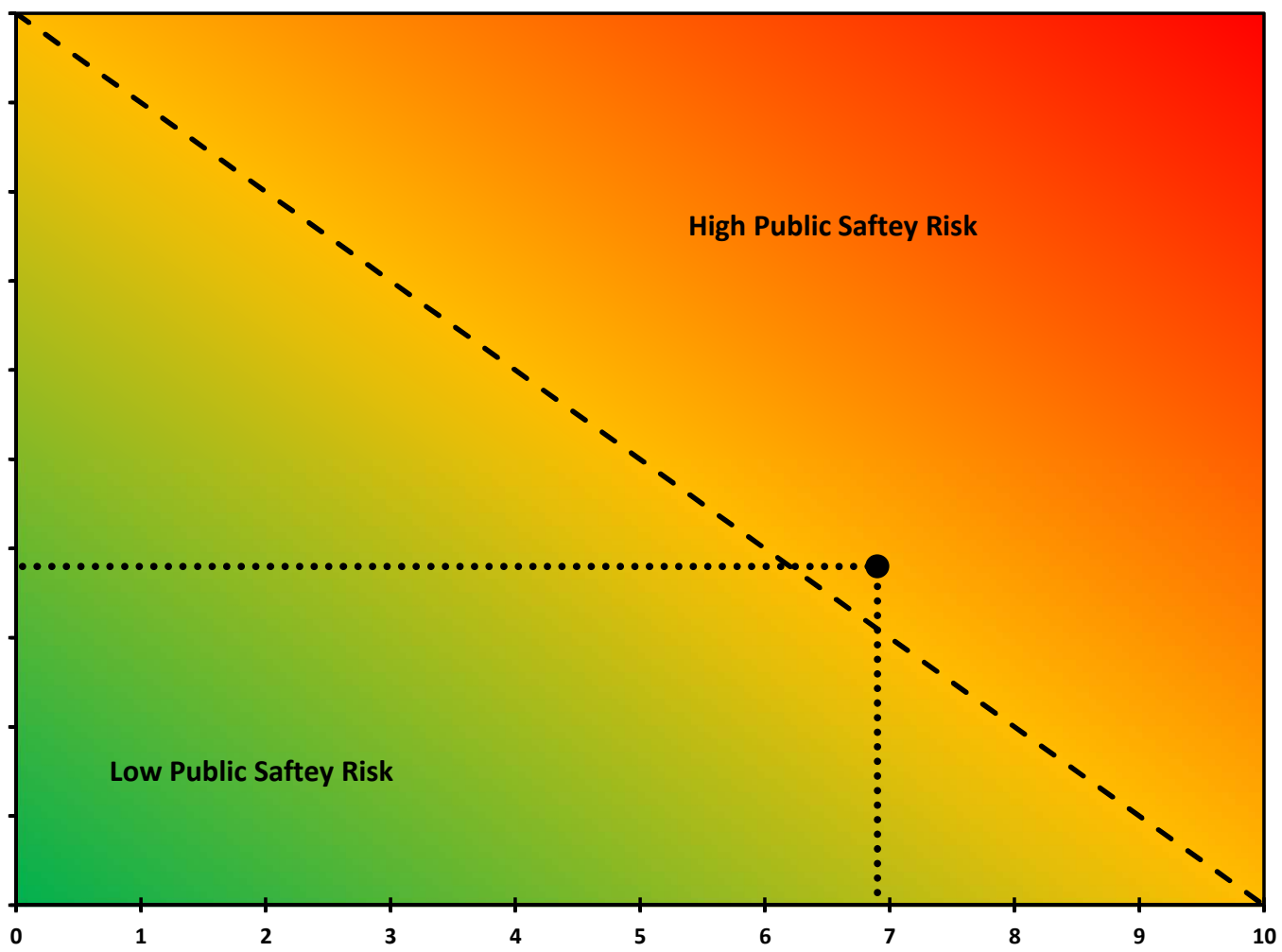
Structure Location: Site 43

Reach-User Characteristics

			Score
Frequency of Use	High	Low	2
Skill Level	Beginne	Advanced	8
Access	Good	Poor	2
Child Presence	Often	Never	3

Total = 15.0

Average Score = 3.8



Structure Characteristics

					Score
No	----------	Active Channel?	----------	Yes	7
No	----------	Outside of Bend?	----------	Yes	9
Low	----------	Strainer Potential	----------	High	9
High	----------	Egress Potential	----------	Low	4
High	----------	Sight Distance	----------	Low	5
Low	----------	Depth x Velocity	----------	High	7

Average Score = 6.9

Total Score = 41.0

Project:
CC-44

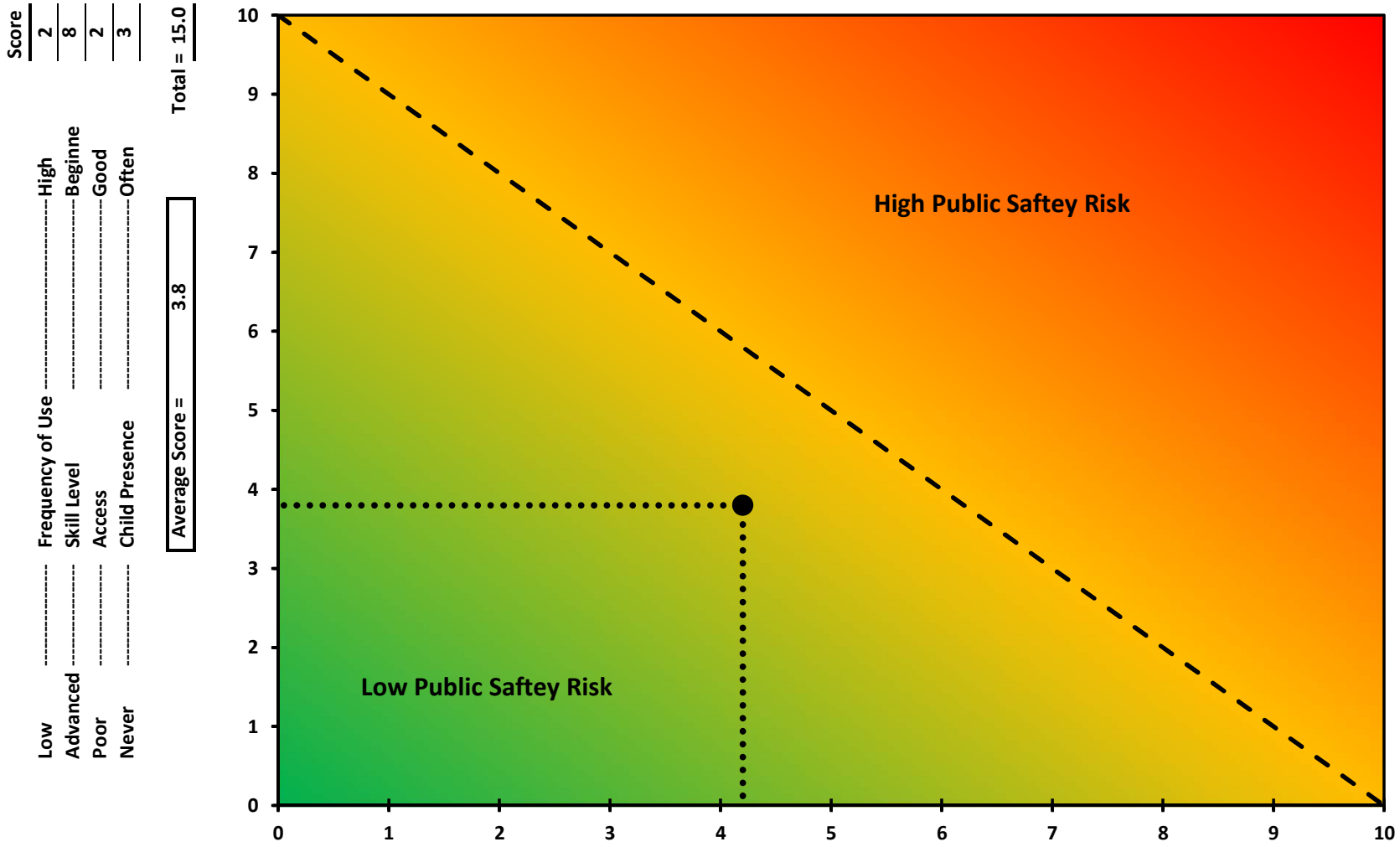
Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

Public Saftey Risk Matrix

Structure Location: Site 44



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

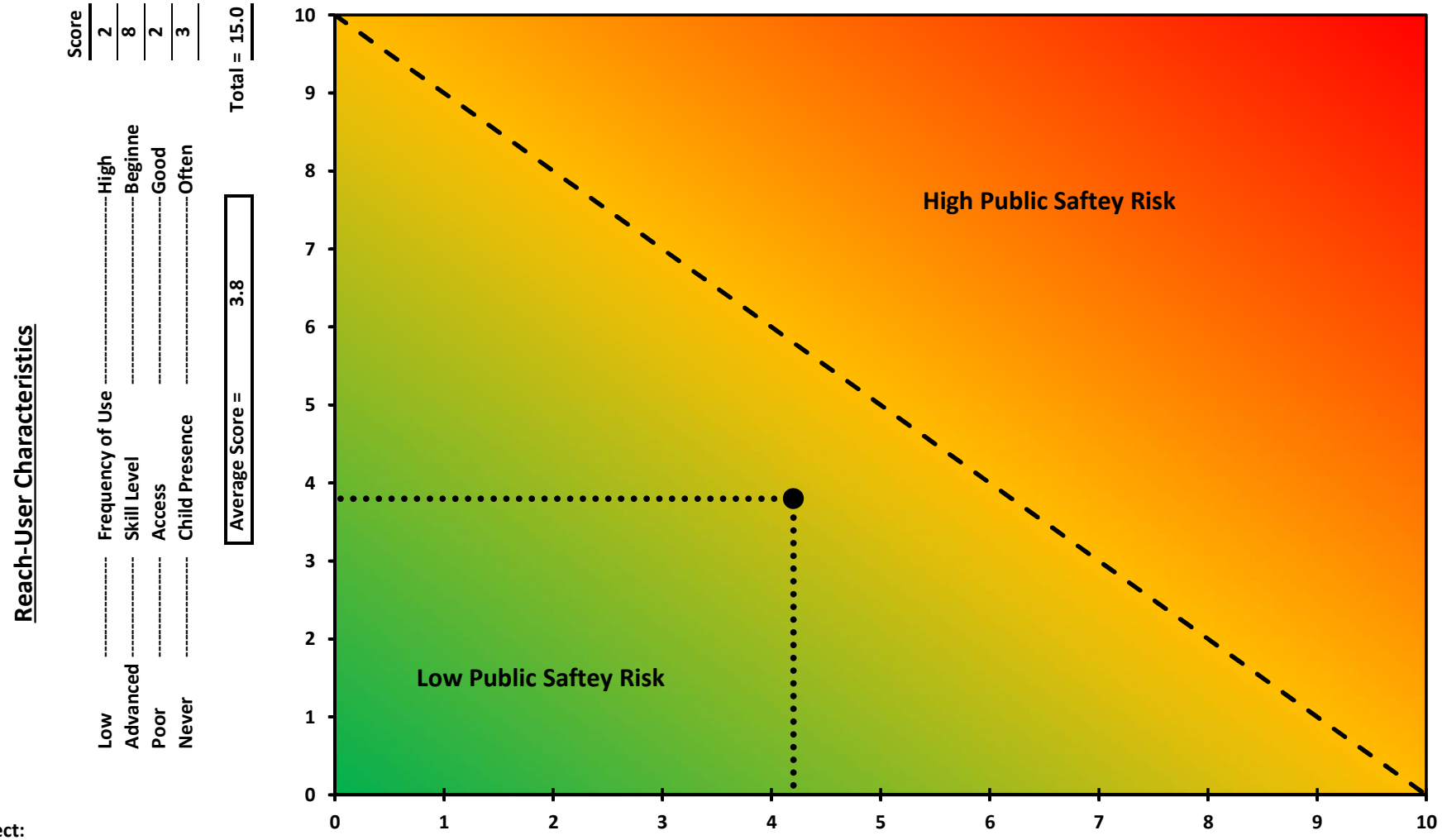
					Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	7
Low	Strainer Potential	High	3
High	Egress Potential	Low	3
High	Sight Distance	Low	3
Low	Depth x Velocity	High	5

Average Score = 4.2

Total Score = 25.0

Public Saftey Risk Matrix

Structure Location: Site 45



Reach-User Characteristics

			Score
Low	Frequency of Use	High	2
Advanced	Skill Level	Beginne	8
Poor	Access	Good	2
Never	Child Presence	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

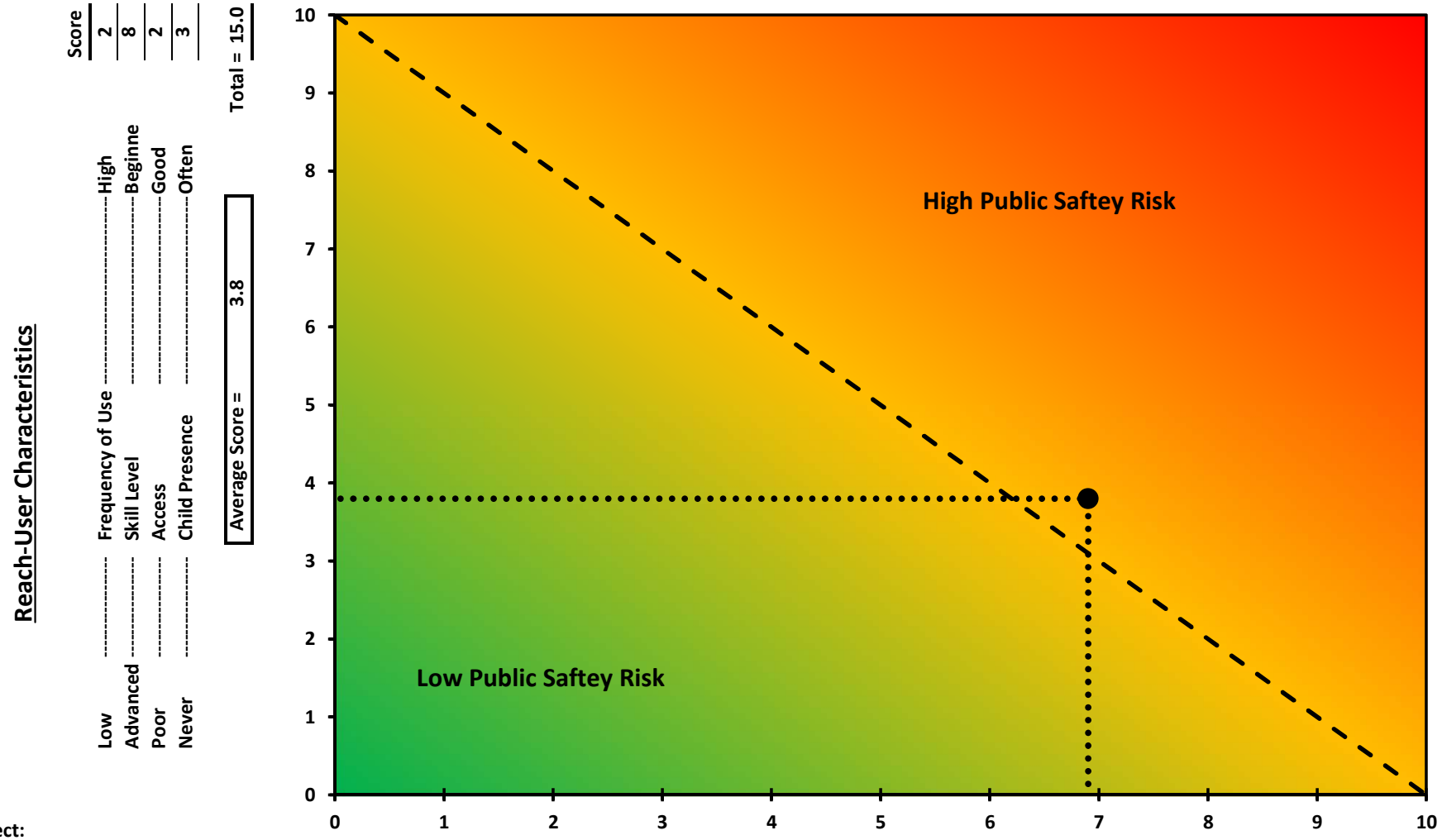
			Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	7
Low	Strainer Potential	High	3
High	Egress Potential	Low	3
High	Sight Distance	Low	3
Low	Depth x Velocity	High	5

Average Score = 4.2

Total Score = 25.0

Public Saftey Risk Matrix

Structure Location: Site 46



Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

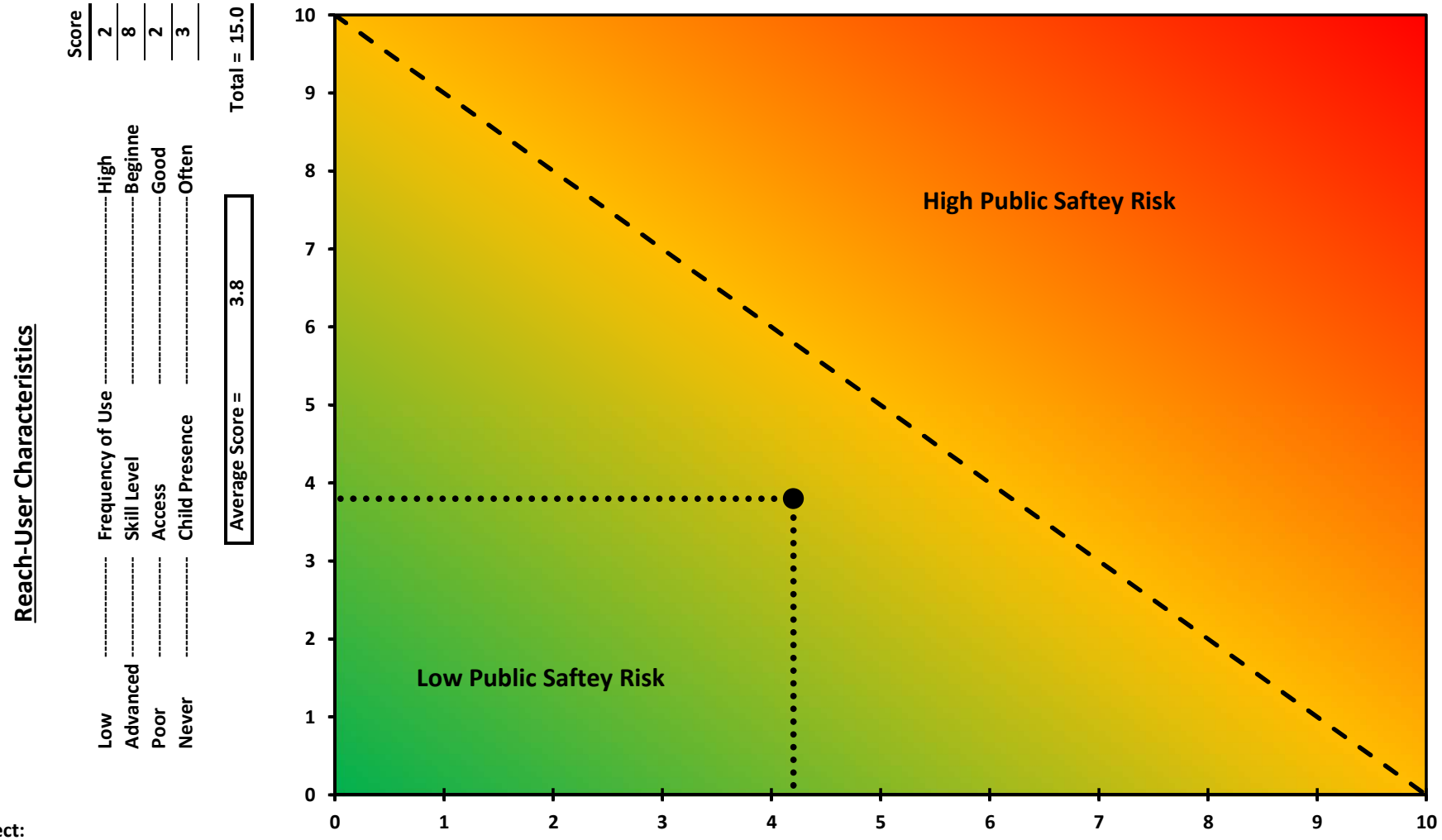
			Score
No	Active Channel?	Yes	7
No	Outside of Bend?	Yes	9
Low	Strainer Potential	High	9
High	Egress Potential	Low	4
High	Sight Distance	Low	5
Low	Depth x Velocity	High	7

Average Score = 6.9

Total Score = 41.0

Public Saftey Risk Matrix

Structure Location: Site 47



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

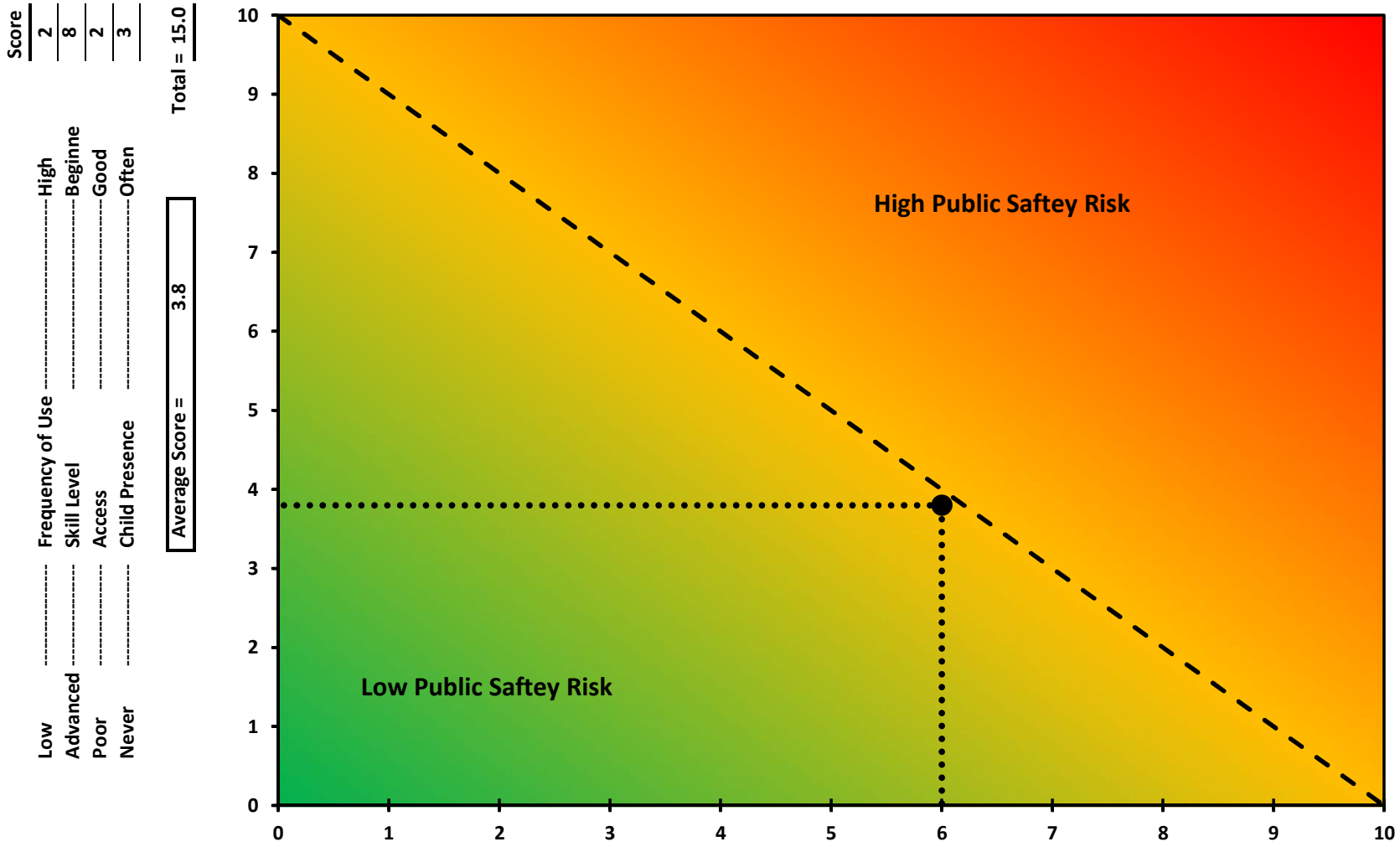
					Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	7
Low	Strainer Potential	High	3
High	Egress Potential	Low	3
High	Sight Distance	Low	3
Low	Depth x Velocity	High	5

Average Score = 4.2

Total Score = 25.0

Public Saftey Risk Matrix

Structure Location: Site 48



Reach-User Characteristics

			Score
Low	Frequency of Use	High	2
Advanced	Skill Level	Beginne	8
Poor	Access	Good	2
Never	Child Presence	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

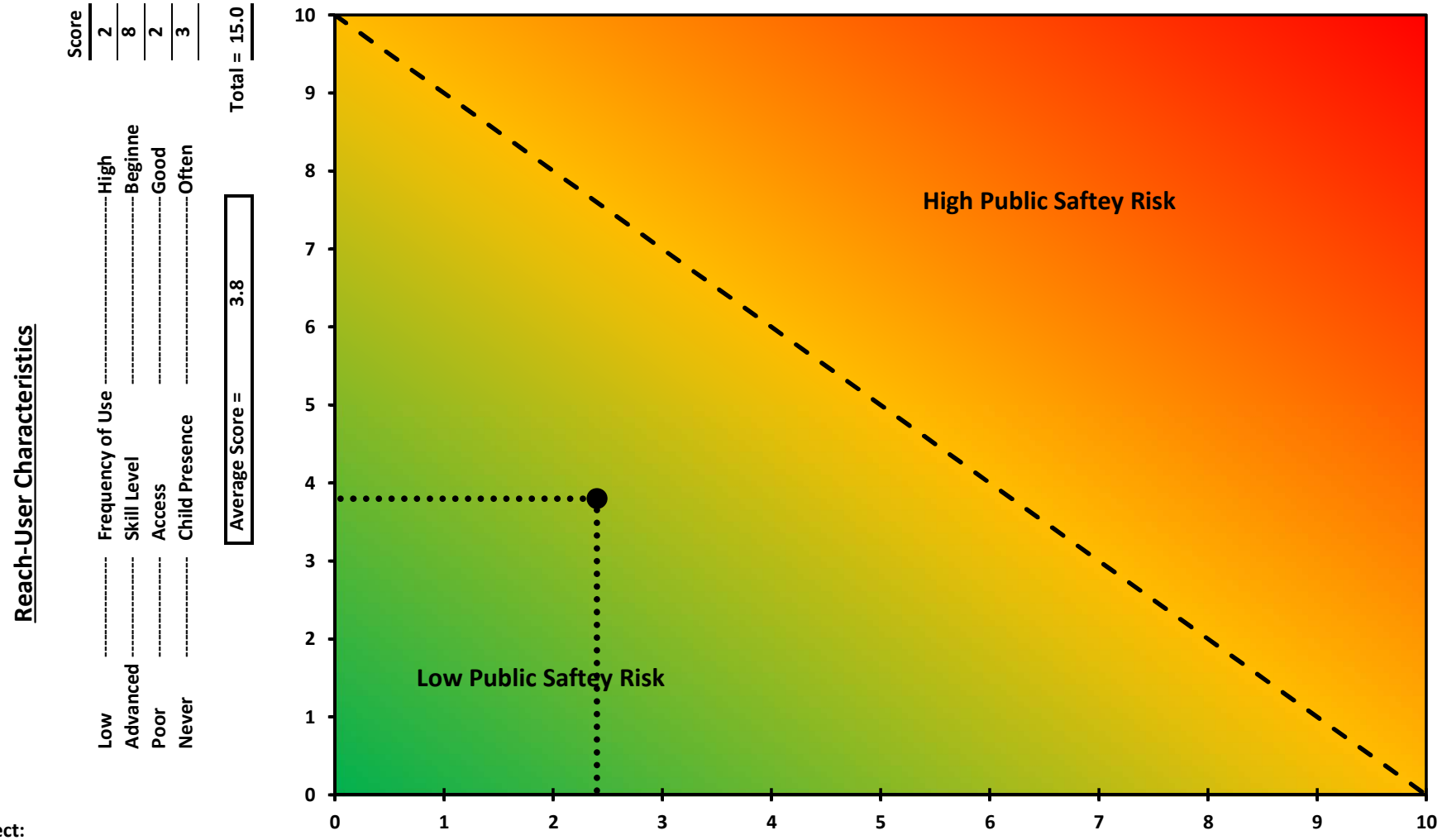
					Score
No	Active Channel?	Yes	6
No	Outside of Bend?	Yes	7
Low	Strainer Potential	High	7
High	Egress Potential	Low	4
High	Sight Distance	Low	5
Low	Depth x Velocity	High	7

Average Score = 6.0

Total Score = 36.0

Public Saftey Risk Matrix

Structure Location: Site 49



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

Structure Characteristics

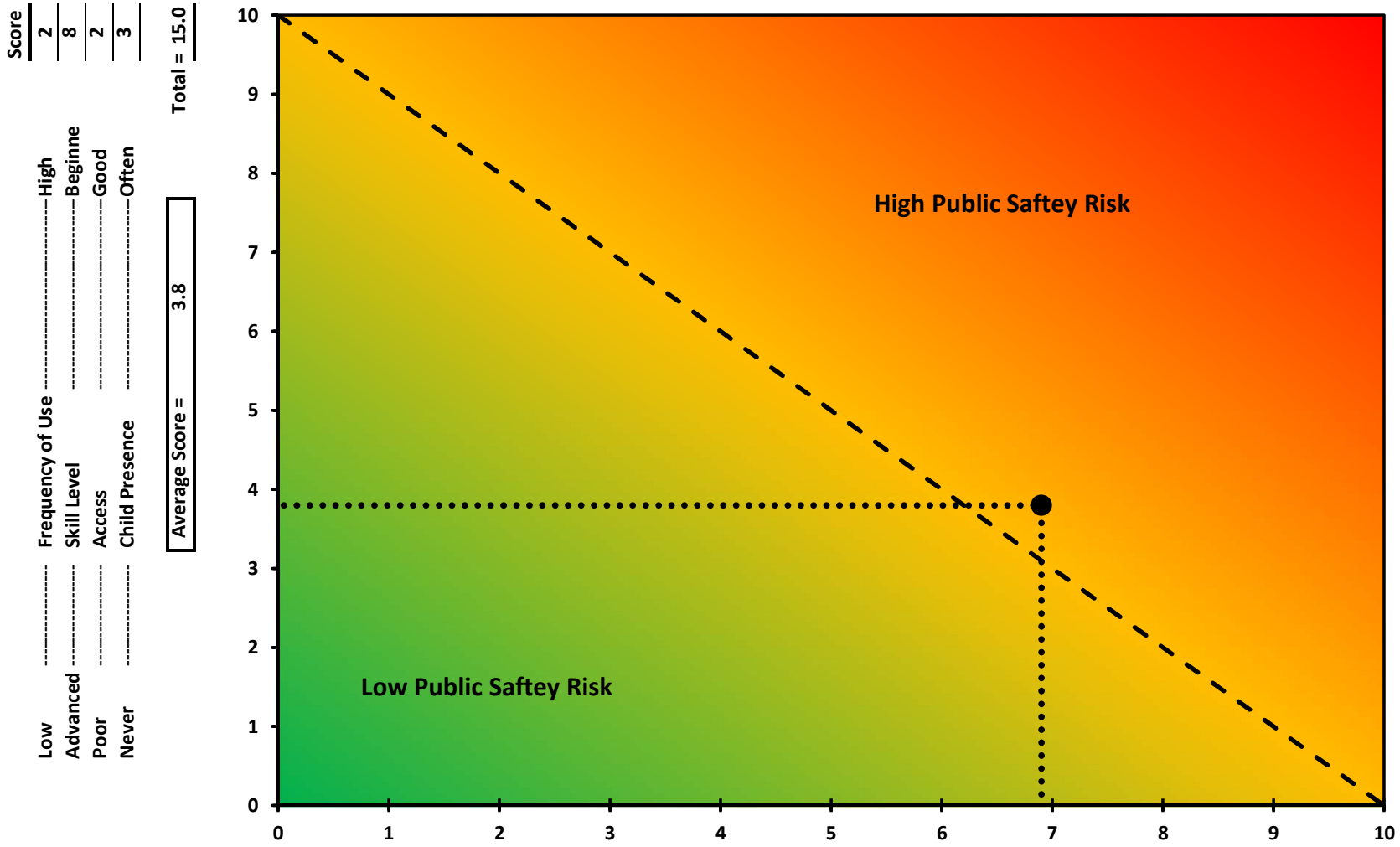
			Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	1
Low	Strainer Potential	High	3
High	Egress Potential	Low	2
High	Sight Distance	Low	2
Low	Depth x Velocity	High	2

Average Score = 2.4

Total Score = 14.0

Public Saftey Risk Matrix

Structure Location: Site 50



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

Structure Characteristics

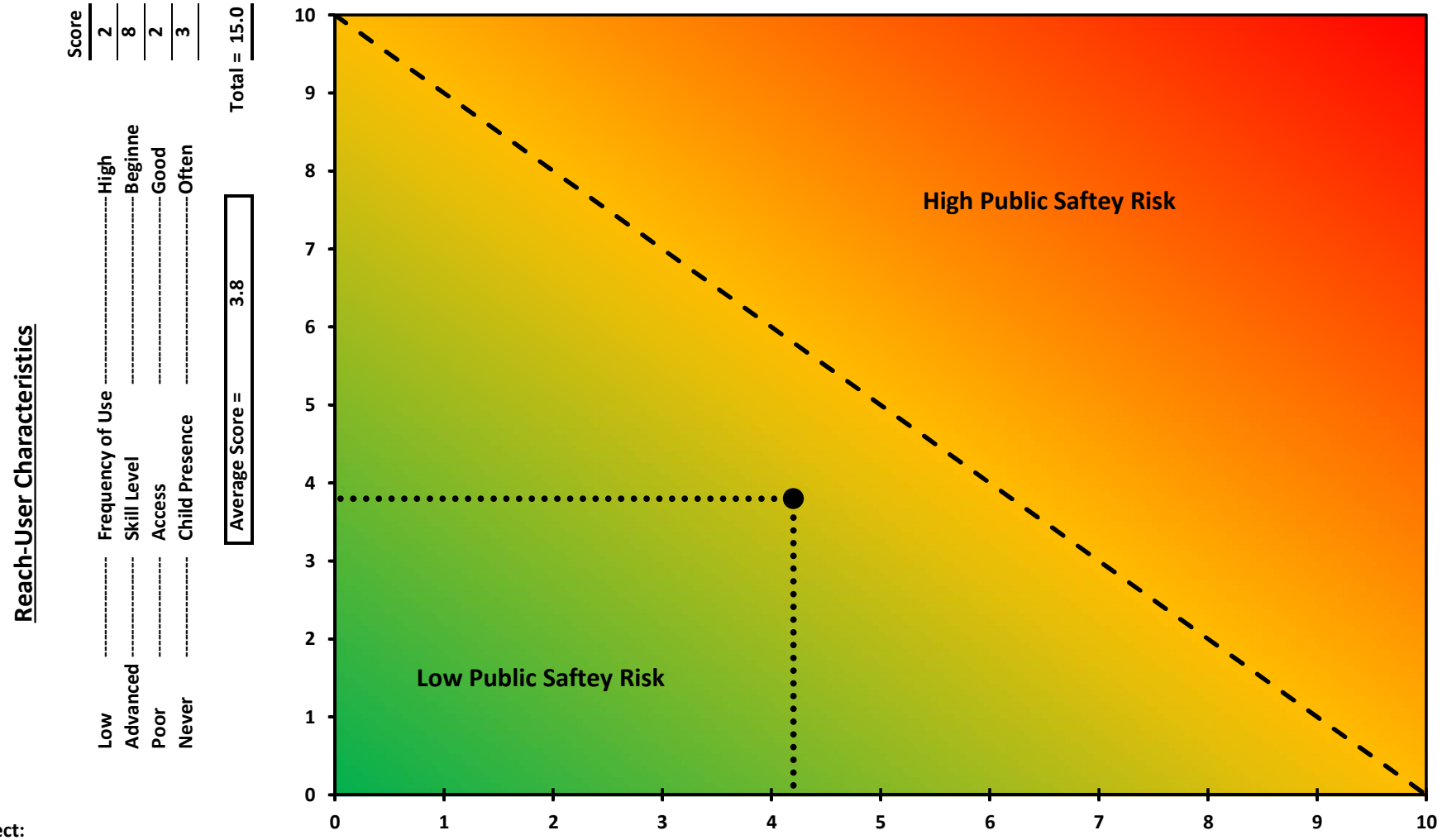
			Score
No	Active Channel?	Yes	7
No	Outside of Bend?	Yes	9
Low	Strainer Potential	High	9
High	Egress Potential	Low	4
High	Sight Distance	Low	5
Low	Depth x Velocity	High	7

Average Score = 6.9

Total Score = 41.0

Public Saftey Risk Matrix

Structure Location: Site 51



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

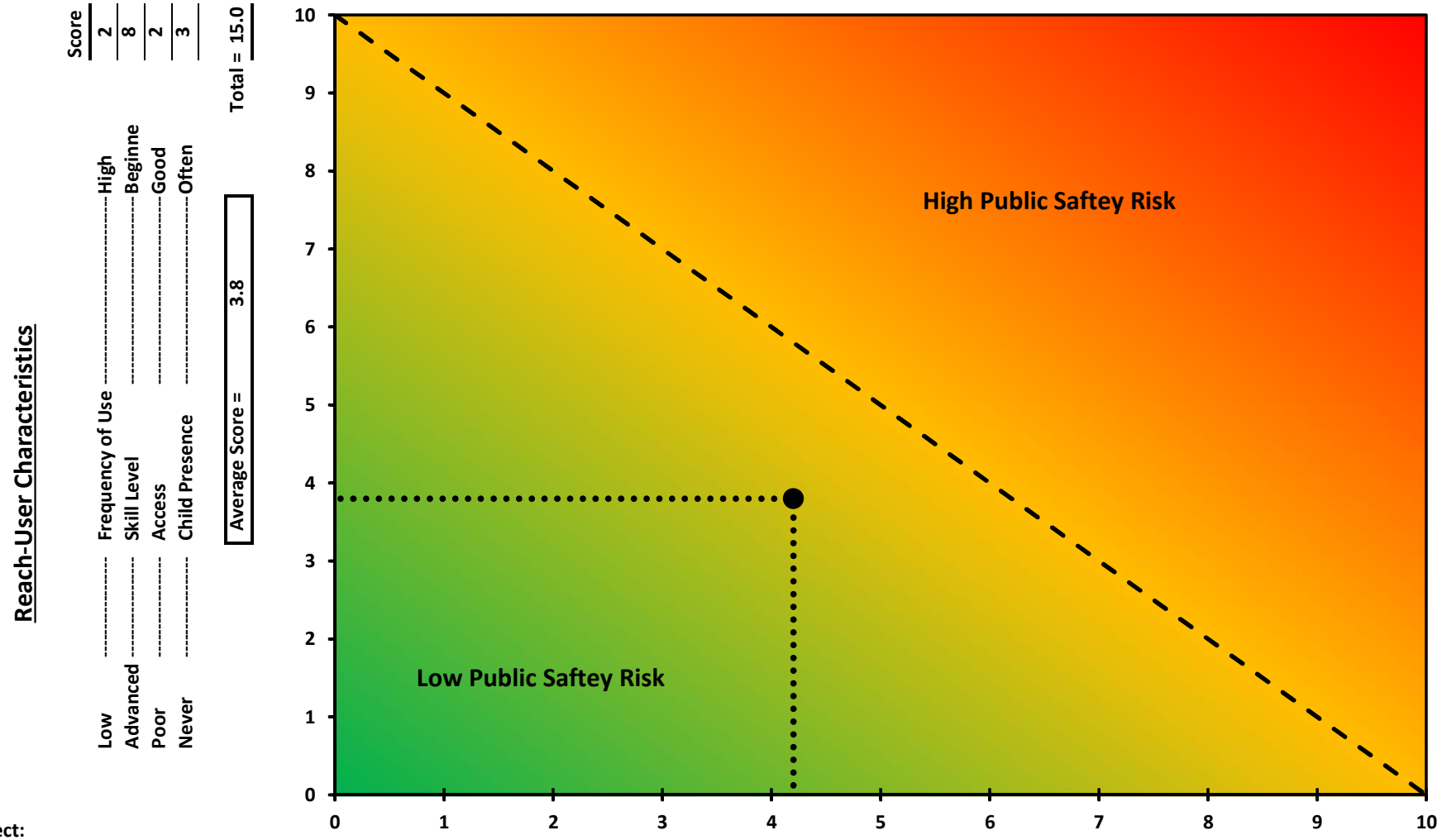
					Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	7
Low	Strainer Potential	High	3
High	Egress Potential	Low	3
High	Sight Distance	Low	3
Low	Depth x Velocity	High	5

Average Score = 4.2

Total Score = 25.0

Public Saftey Risk Matrix

Structure Location: Site 52



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

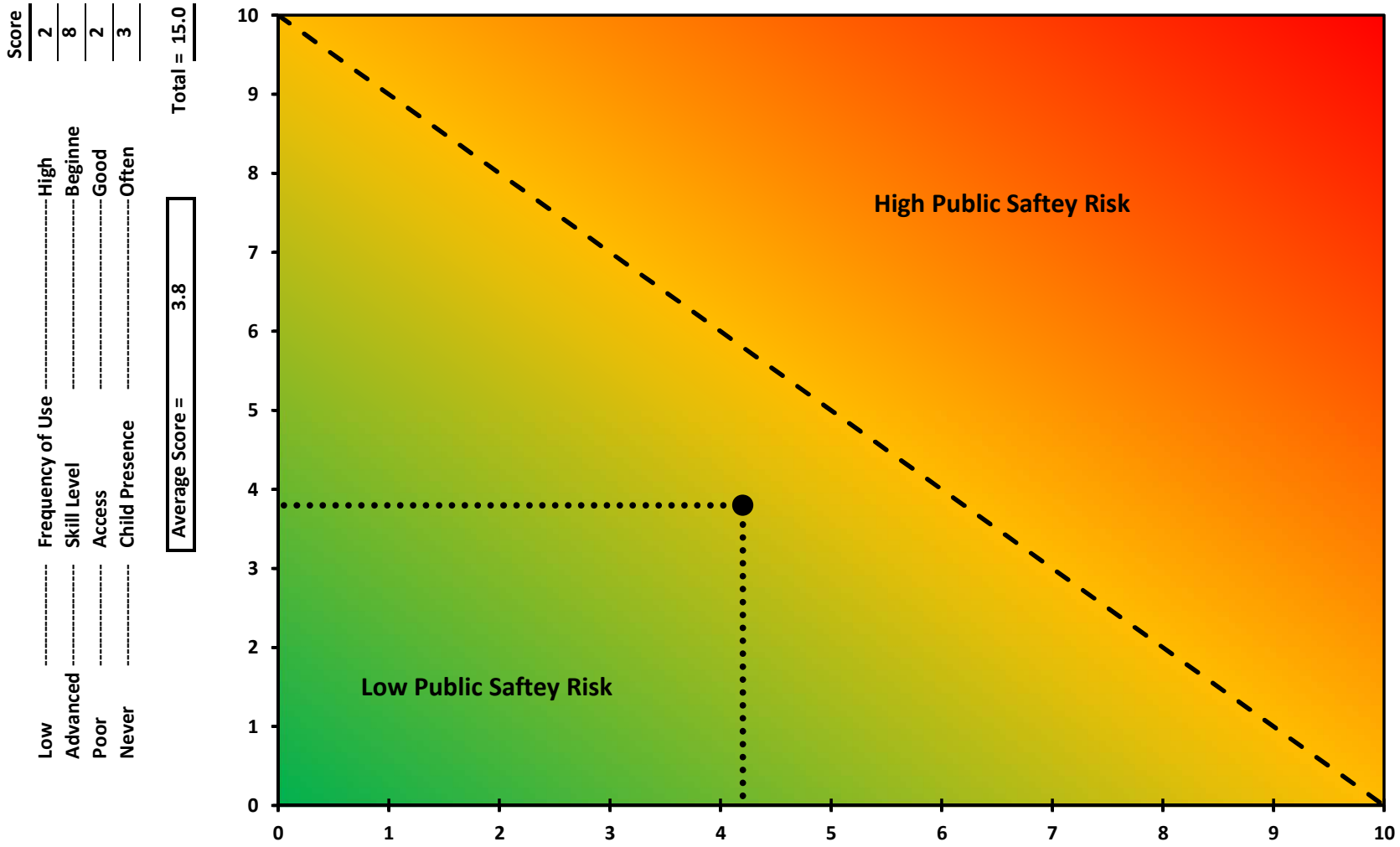
					Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	7
Low	Strainer Potential	High	3
High	Egress Potential	Low	3
High	Sight Distance	Low	3
Low	Depth x Velocity	High	5

Average Score = 4.2

Total Score = 25.0

Public Saftey Risk Matrix

Structure Location: Site 53



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Average Score = 3.8

Total = 15.0

Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

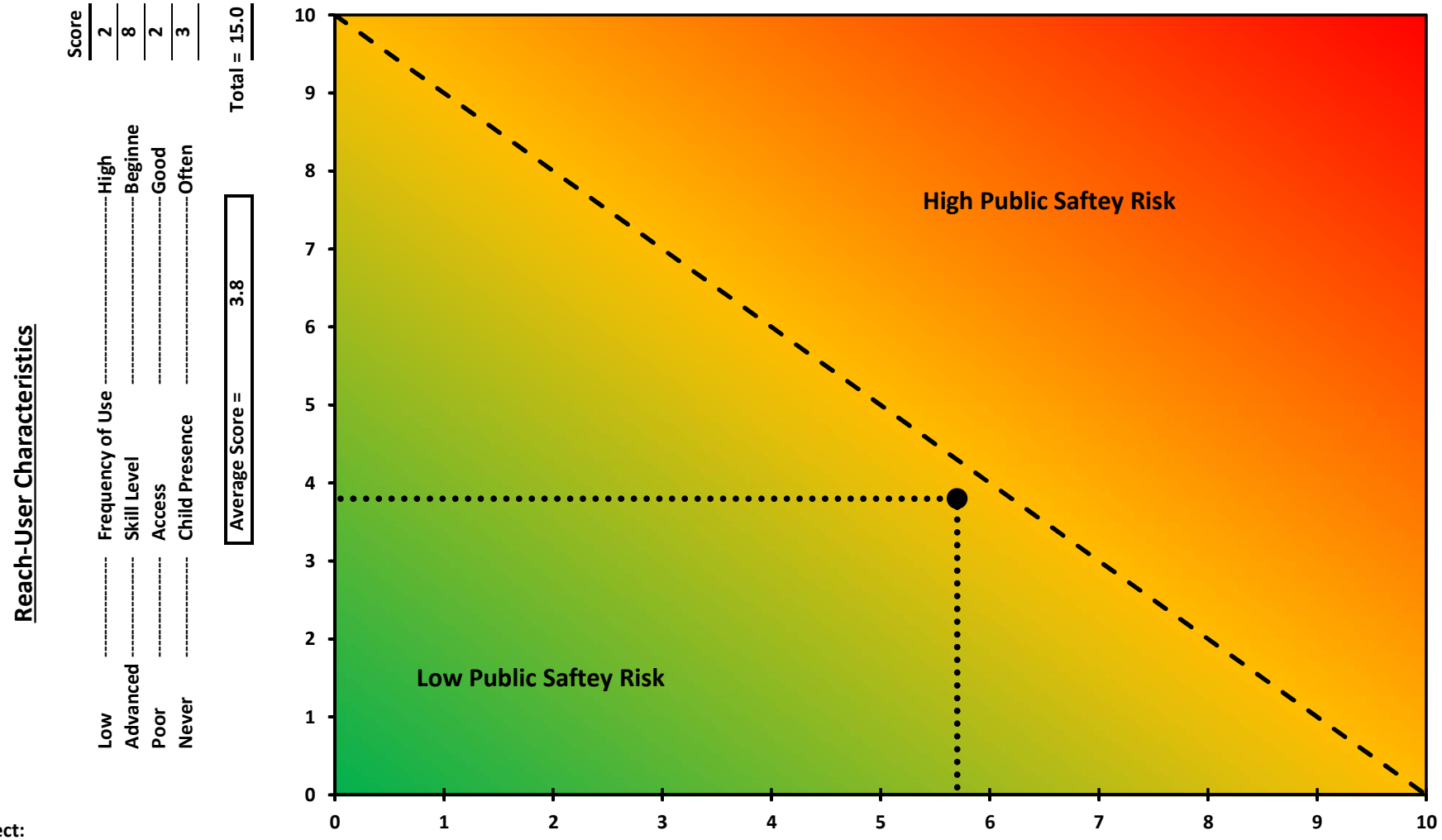
					Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	7
Low	Strainer Potential	High	3
High	Egress Potential	Low	3
High	Sight Distance	Low	3
Low	Depth x Velocity	High	5

Average Score = 4.2

Total Score = 25.0

Public Saftey Risk Matrix

Structure Location: Site 54



Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

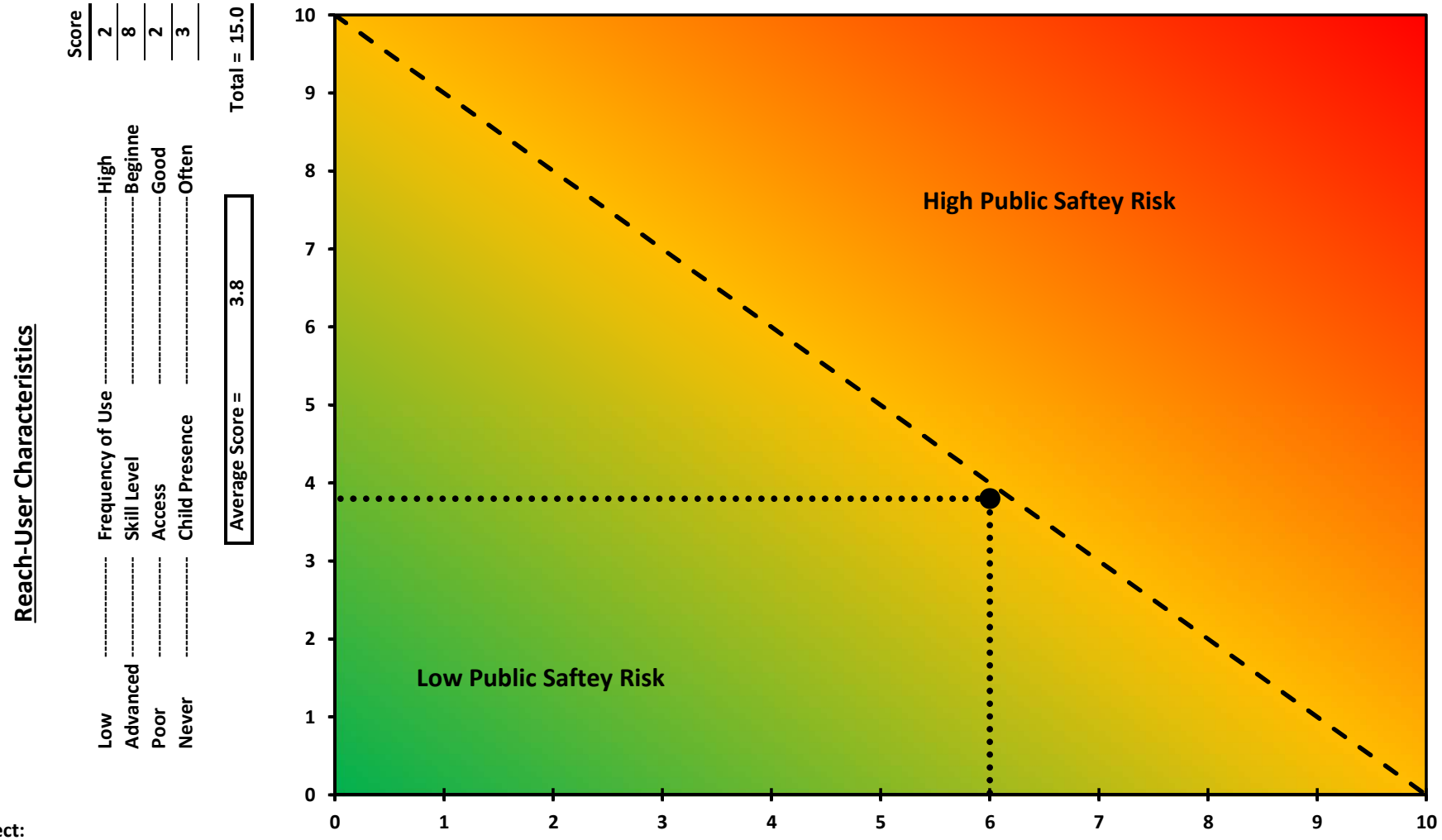
				Score
No	Active Channel?	Yes		4
No	Outside of Bend?	Yes		9
Low	Strainer Potential	High		7
High	Egress Potential	Low		4
High	Sight Distance	Low		3
Low	Depth x Velocity	High		7

Average Score = 5.7

Total Score = 34.0

Public Saftey Risk Matrix

Structure Location: Site 55



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

Structure Characteristics

			Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	5
Low	Strainer Potential	High	8
High	Egress Potential	Low	7
High	Sight Distance	Low	7
Low	Depth x Velocity	High	5

Average Score = 6.0

Total Score = 36.0

Public Saftey Risk Matrix

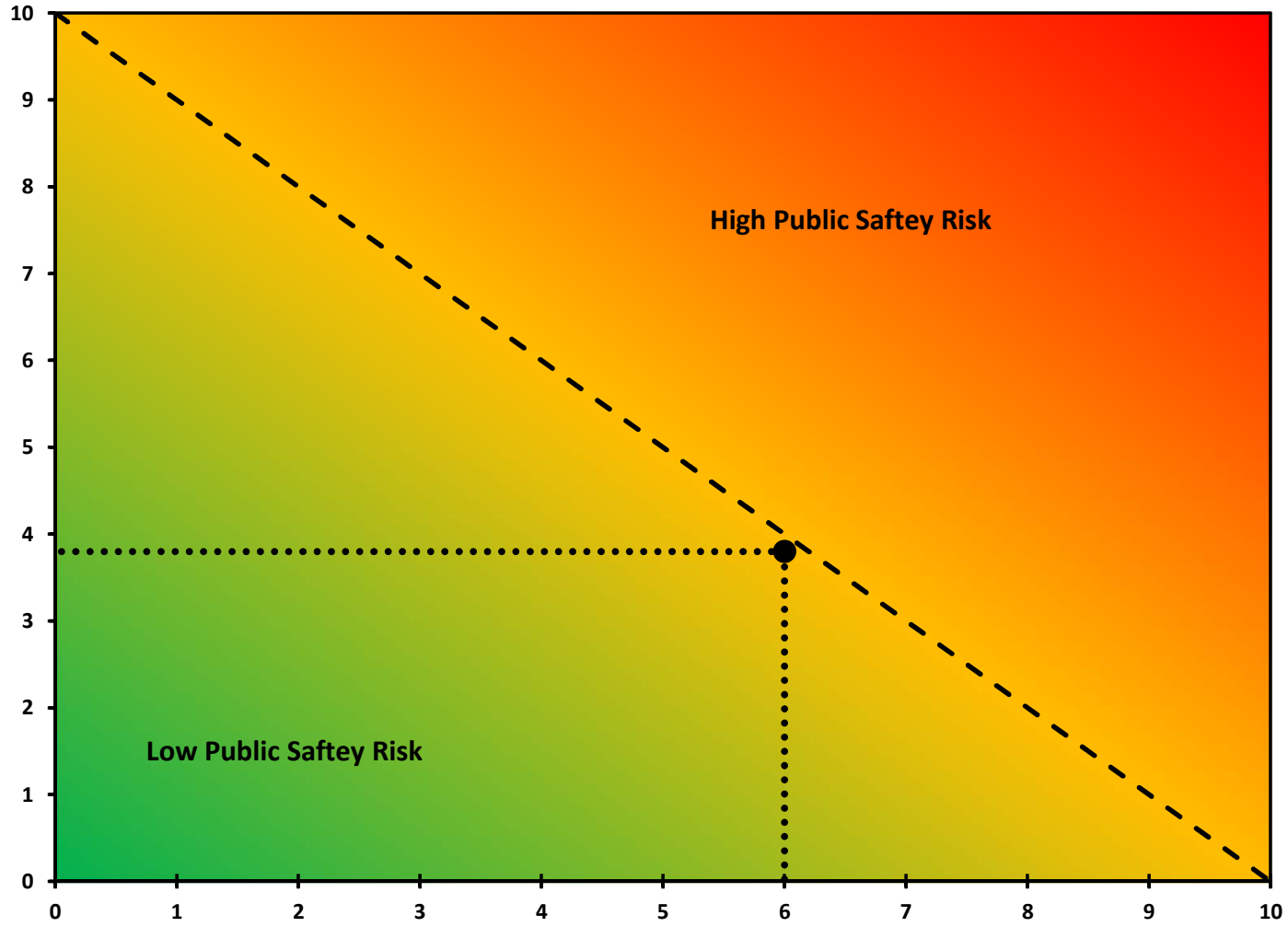
Structure Location: Site 56

Reach-User Characteristics

			Score
Frequency of Use	High	Low	2
Skill Level	Beginne	Advanced	8
Access	Good	Poor	2
Child Presence	Often	Never	3

Total = 15.0

Average Score = 3.8



Structure Characteristics

					Score
No	Active Channel?	Yes			4
No	Outside of Bend?	Yes			5
Low	Strainer Potential	High			8
High	Egress Potential	Low			7
High	Sight Distance	Low			7
Low	Depth x Velocity	High			5

Average Score = 6.0

Total Score = 36.0

Project:
CC-44

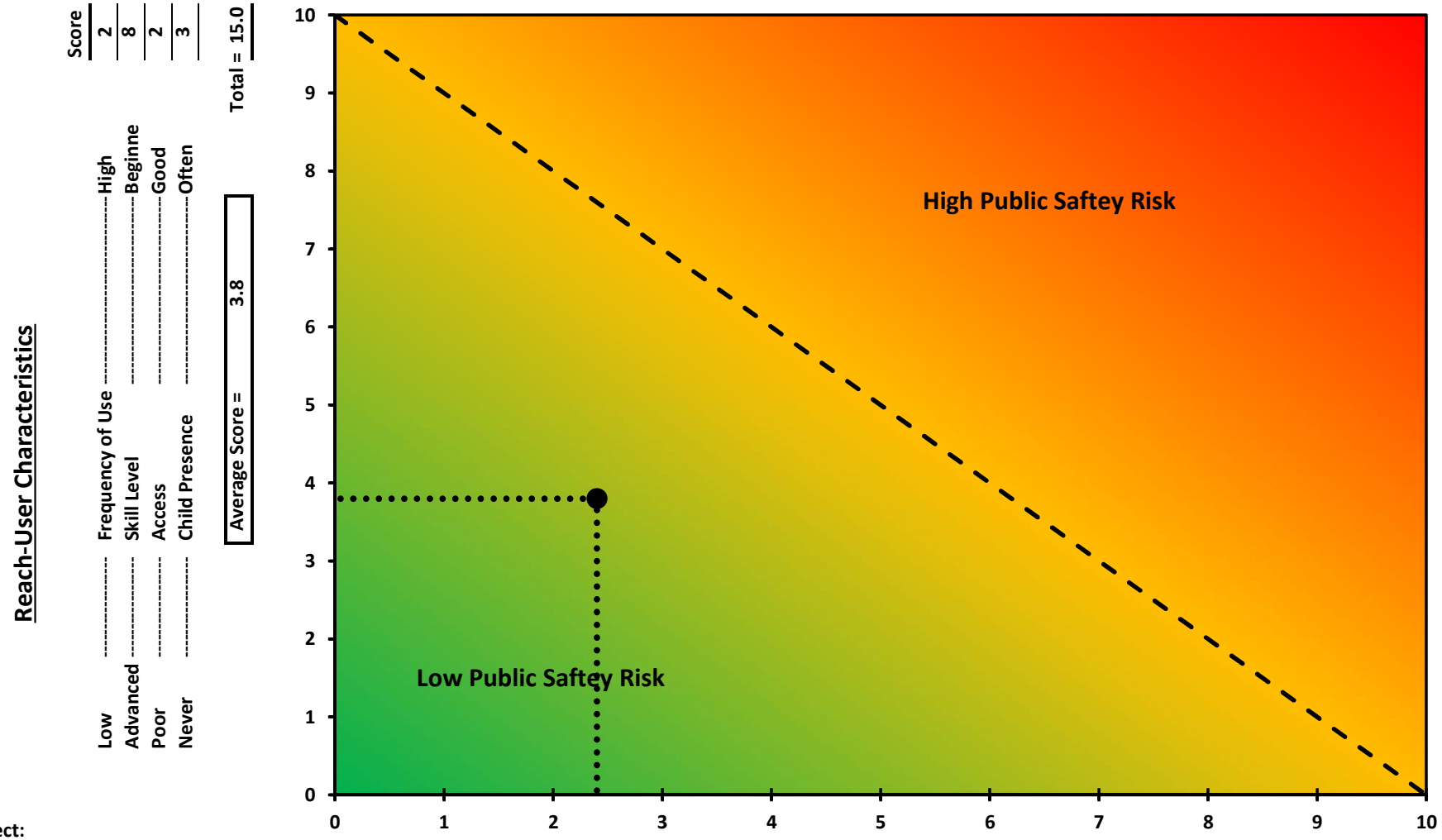
Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

Public Saftey Risk Matrix

Structure Location: Site 57



Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

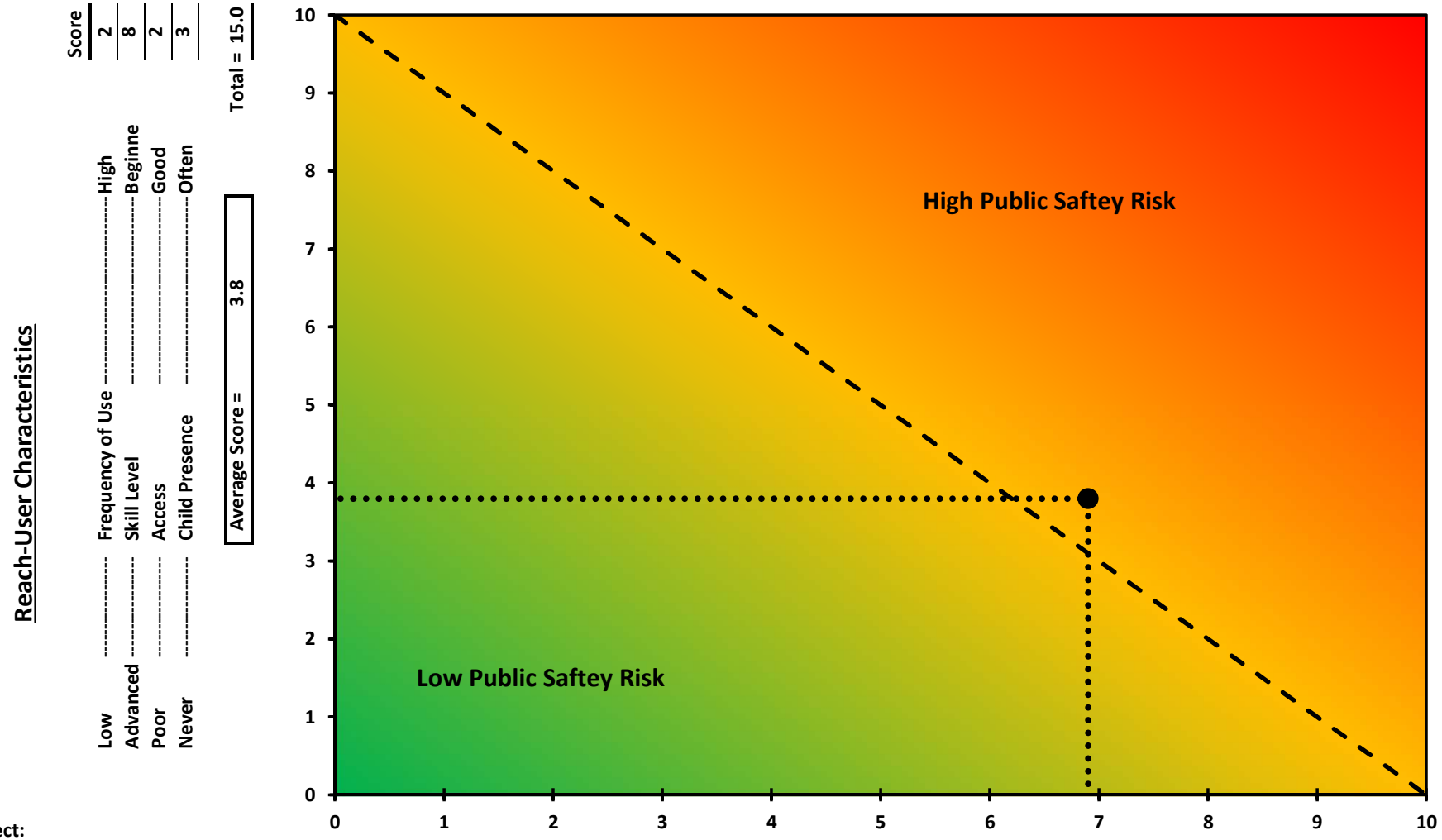
					Score
No	----------	Active Channel?	----------	Yes	4
No	----------	Outside of Bend?	----------	Yes	1
Low	----------	Strainer Potential	----------	High	3
High	----------	Egress Potential	----------	Low	2
High	----------	Sight Distance	----------	Low	2
Low	----------	Depth x Velocity	----------	High	2

Average Score = 2.4

Total Score = 14.0

Public Saftey Risk Matrix

Structure Location: Site 58



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Structure Characteristics

					Score
No	----------	Active Channel?	----------	Yes	7
No	----------	Outside of Bend?	----------	Yes	9
Low	----------	Strainer Potential	----------	High	9
High	----------	Egress Potential	----------	Low	4
High	----------	Sight Distance	----------	Low	5
Low	----------	Depth x Velocity	----------	High	7

Average Score = 6.9

Total Score = 41.0

Project:
CC-44

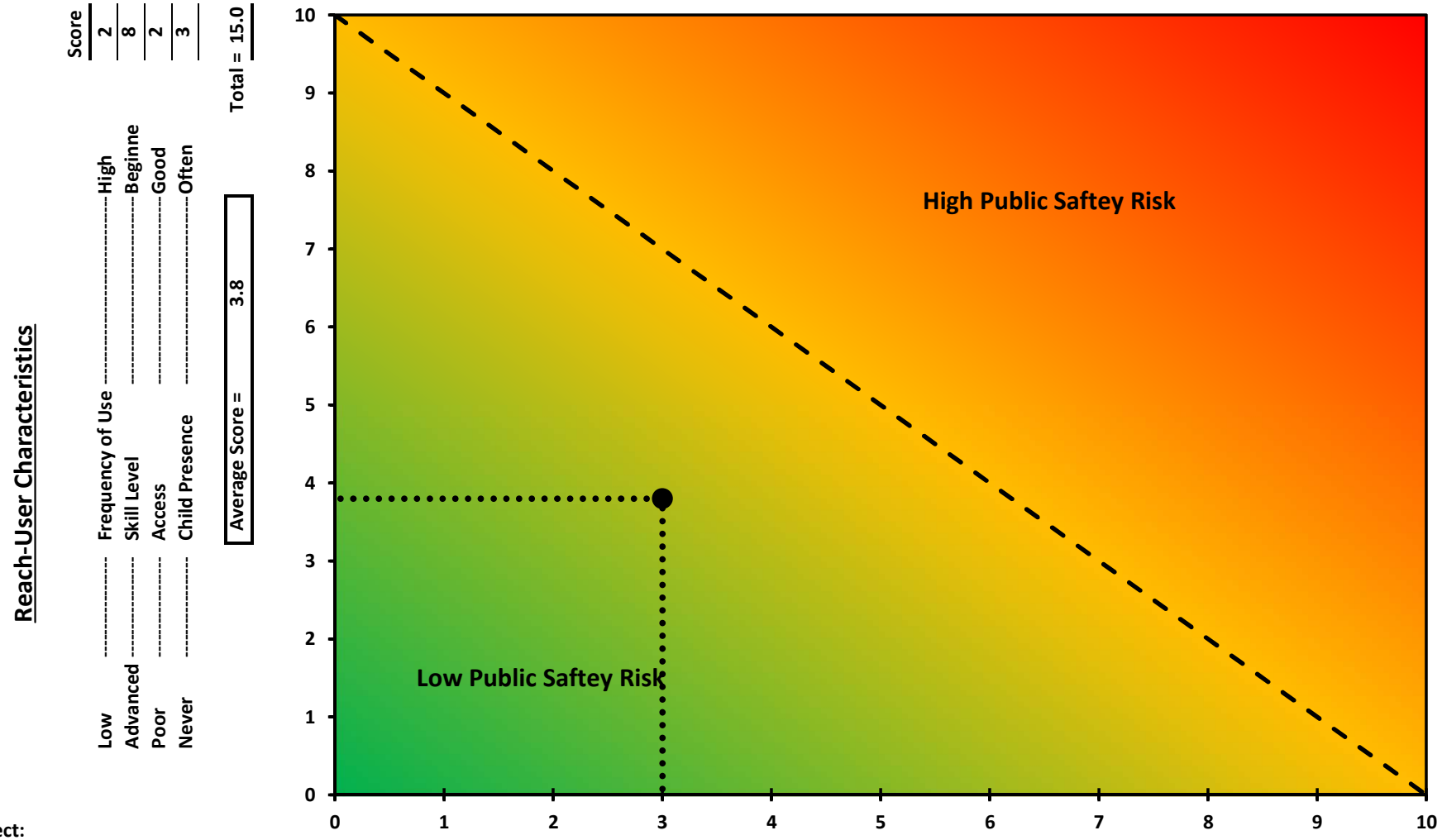
Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

Public Saftey Risk Matrix

Structure Location: Site 59



Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

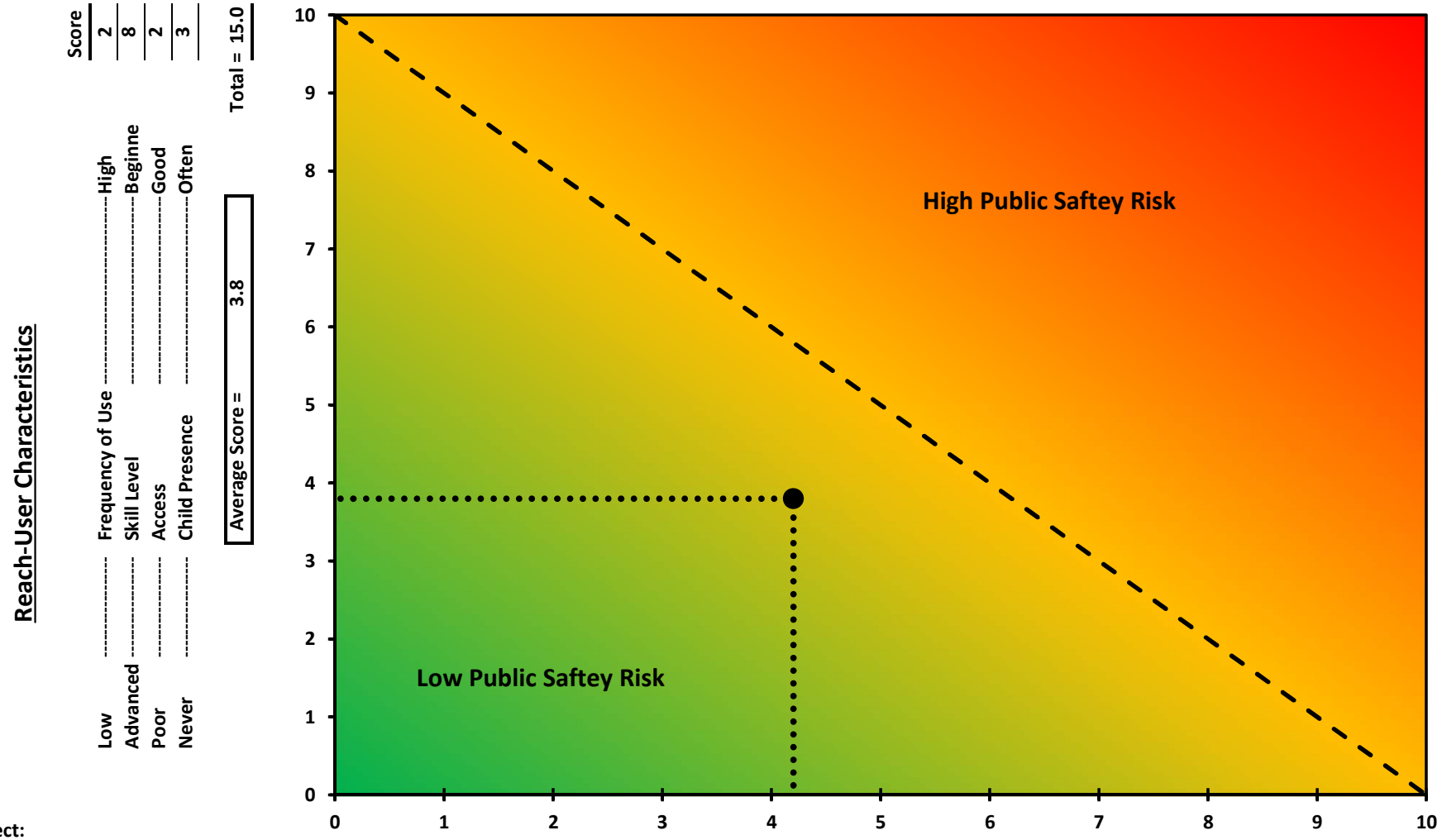
					Score
No	----------	Active Channel?	----------	Yes	4
No	----------	Outside of Bend?	----------	Yes	2
Low	----------	Strainer Potential	----------	High	2
High	----------	Egress Potential	----------	Low	3
High	----------	Sight Distance	----------	Low	5
Low	----------	Depth x Velocity	----------	High	2

Average Score = 3.0

Total Score = 18.0

Public Saftey Risk Matrix

Structure Location: Site 60



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

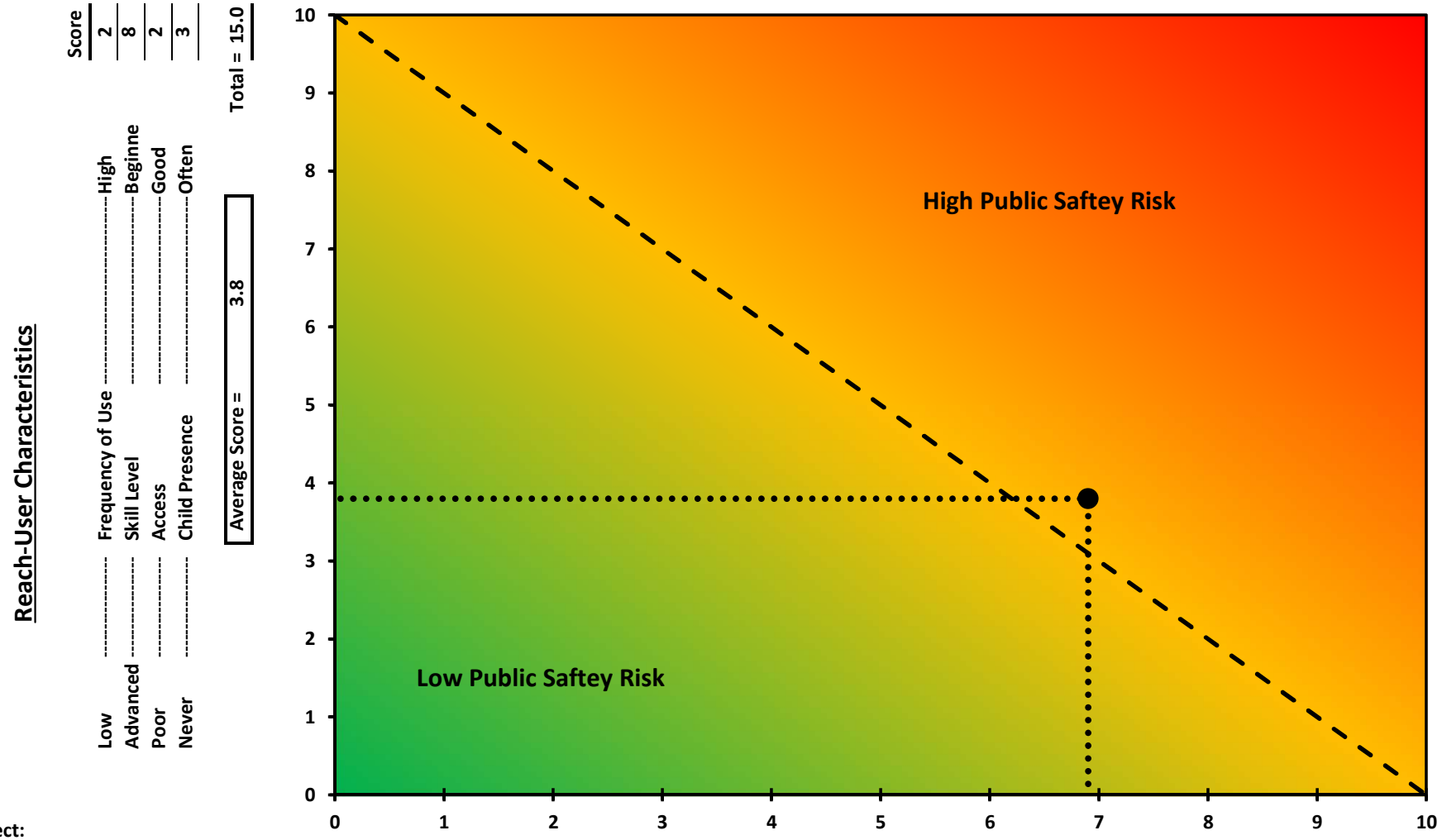
					Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	7
Low	Strainer Potential	High	3
High	Egress Potential	Low	3
High	Sight Distance	Low	3
Low	Depth x Velocity	High	5

Average Score = 4.2

Total Score = 25.0

Public Saftey Risk Matrix

Structure Location: Site 61



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

Structure Characteristics

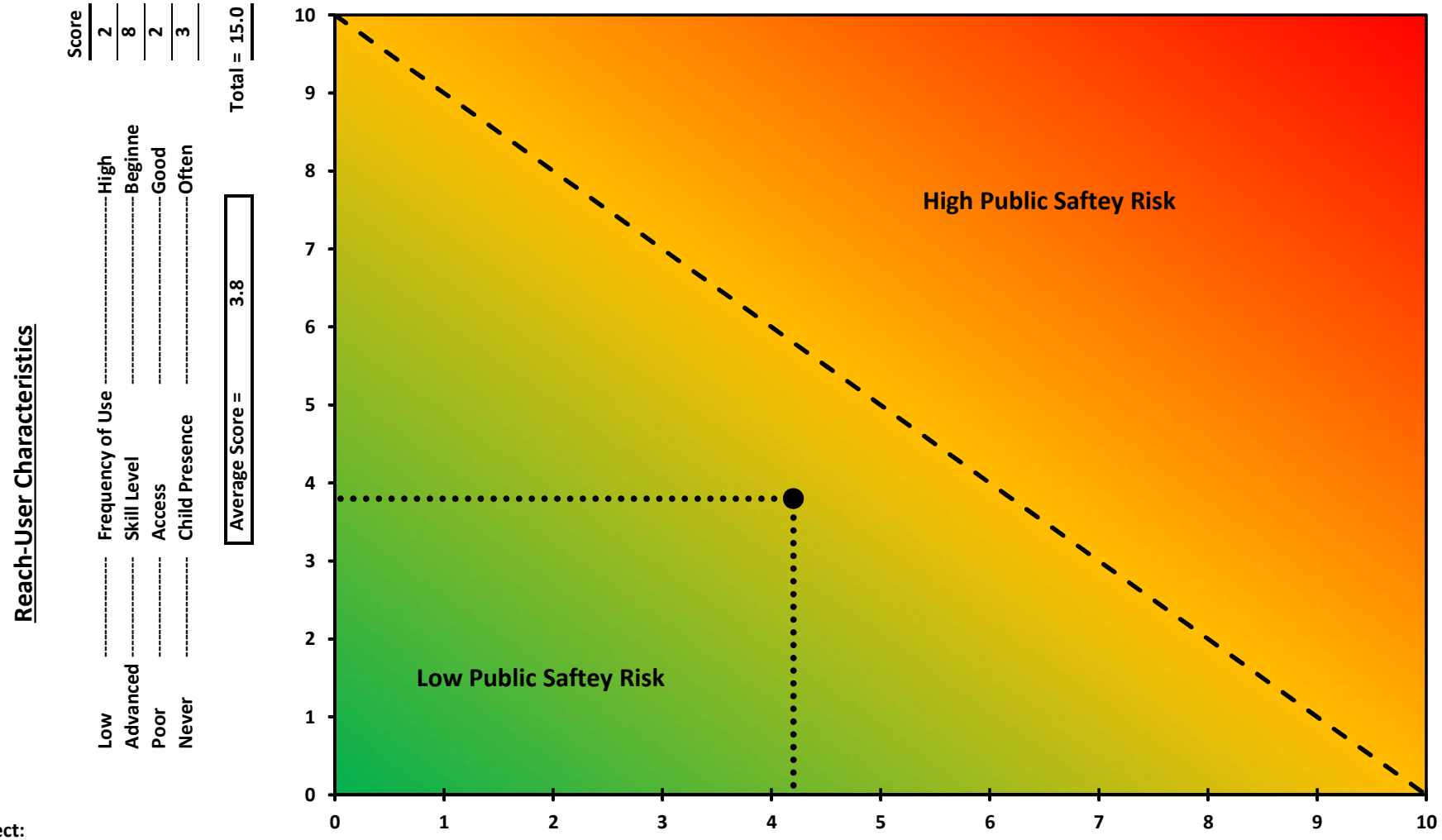
			Score
No	Active Channel?	Yes	7
No	Outside of Bend?	Yes	9
Low	Strainer Potential	High	9
High	Egress Potential	Low	4
High	Sight Distance	Low	5
Low	Depth x Velocity	High	7

Average Score = 6.9

Total Score = 41.0

Public Saftey Risk Matrix

Structure Location: Site 62



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

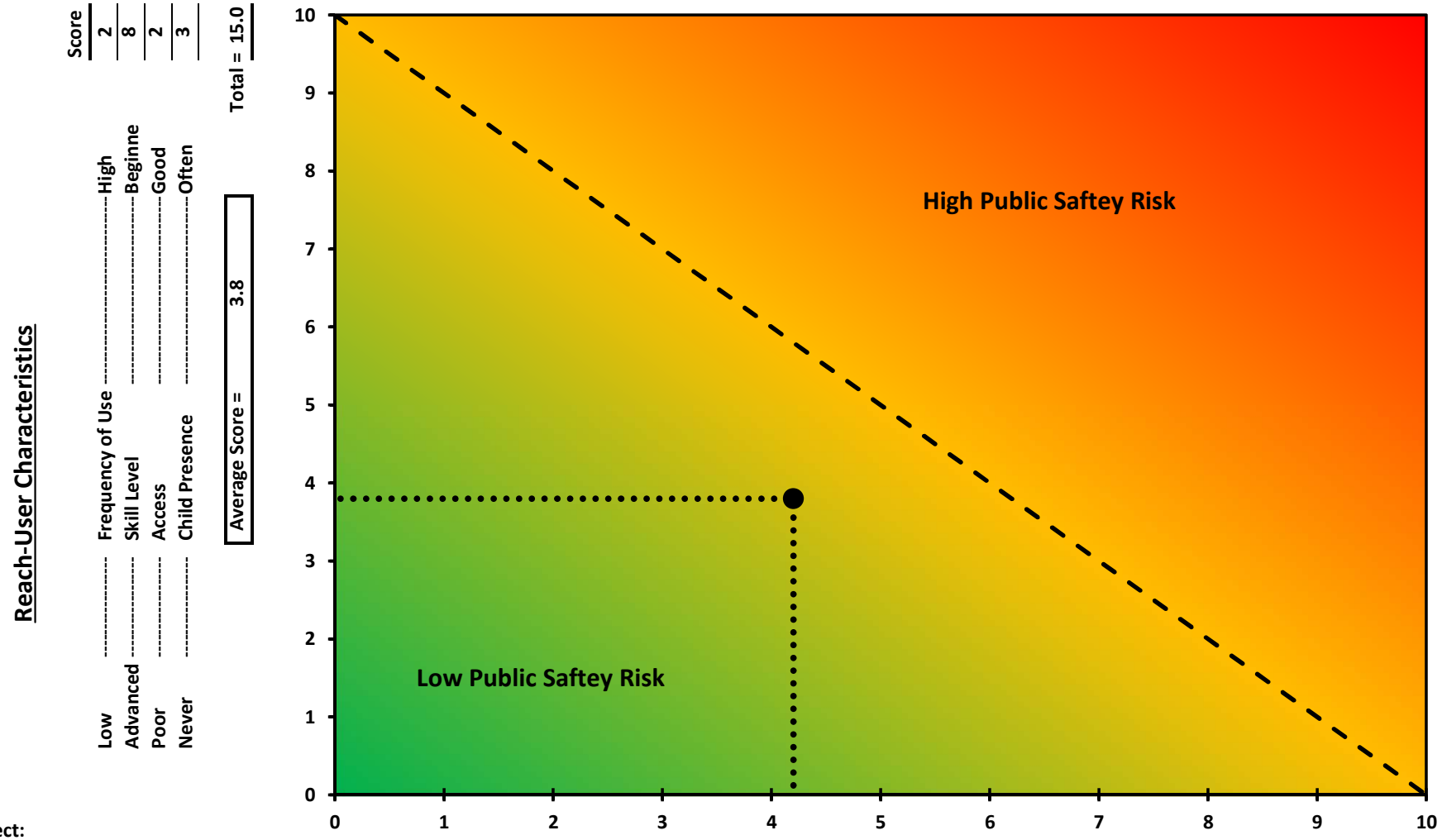
					Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	7
Low	Strainer Potential	High	3
High	Egress Potential	Low	3
High	Sight Distance	Low	3
Low	Depth x Velocity	High	5

Average Score = 4.2

Total Score = 25.0

Public Saftey Risk Matrix

Structure Location: Site 63



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

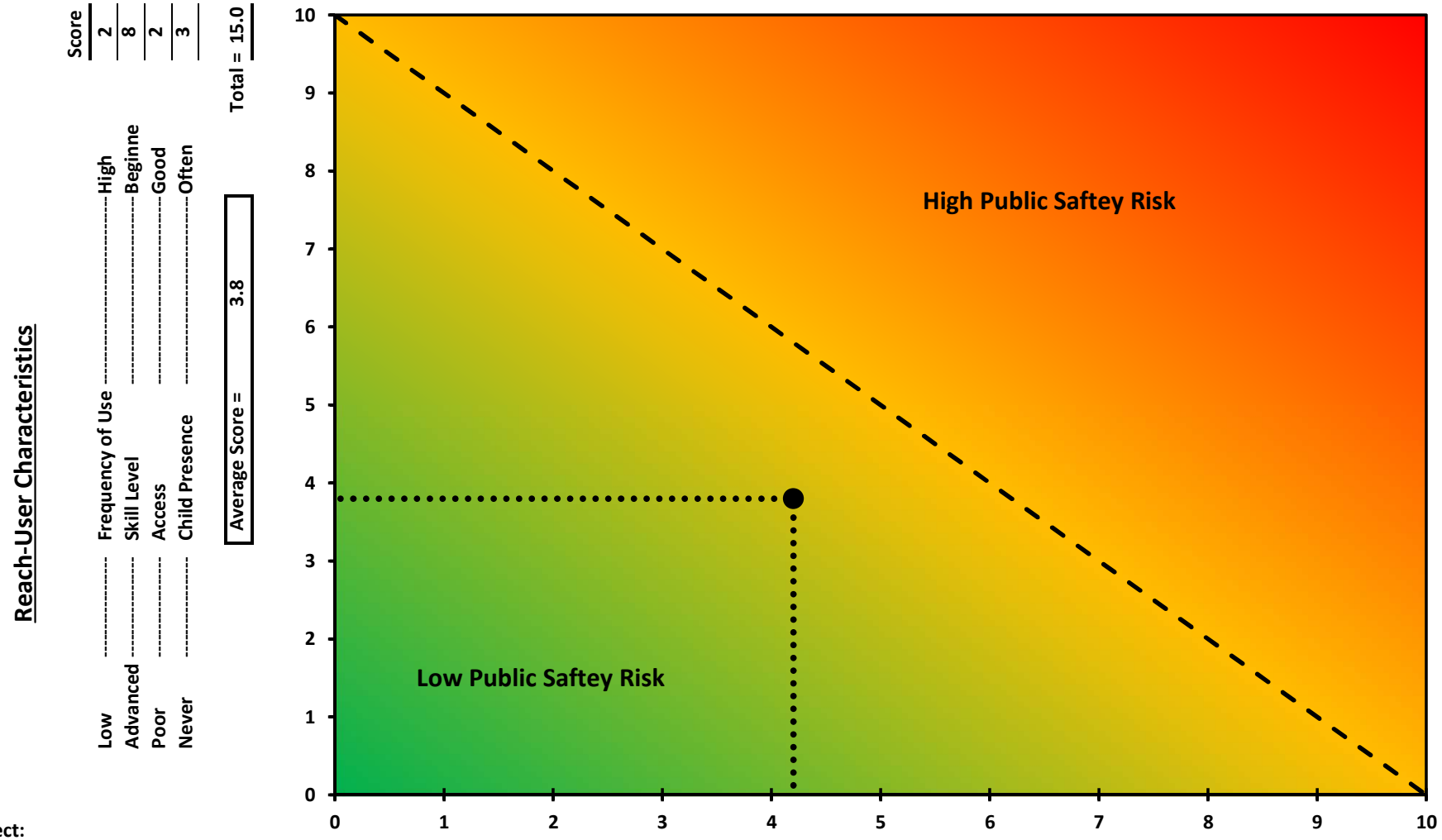
					Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	7
Low	Strainer Potential	High	3
High	Egress Potential	Low	3
High	Sight Distance	Low	3
Low	Depth x Velocity	High	5

Average Score = 4.2

Total Score = 25.0

Public Saftey Risk Matrix

Structure Location: Site 64



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

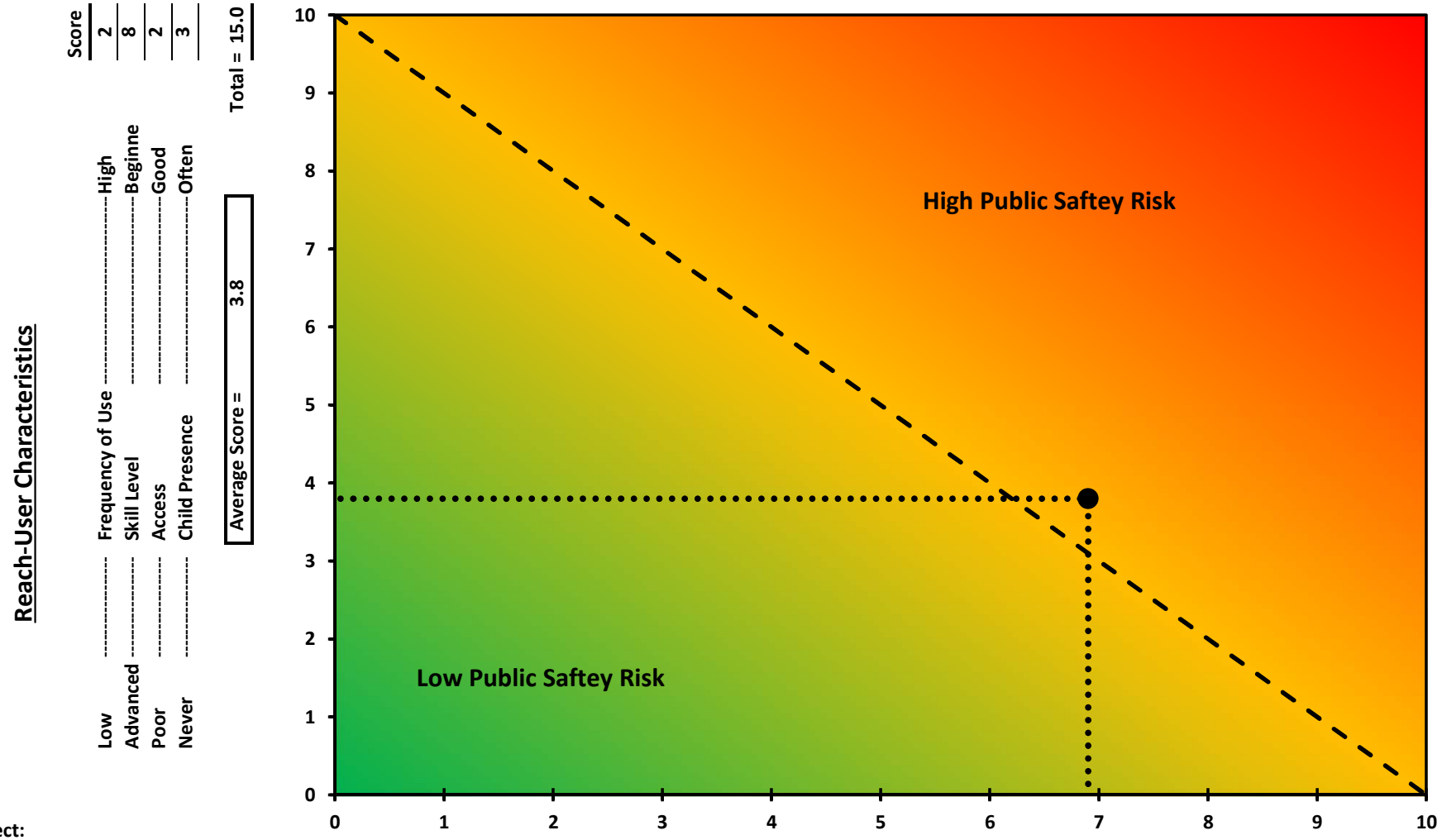
					Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	7
Low	Strainer Potential	High	3
High	Egress Potential	Low	3
High	Sight Distance	Low	3
Low	Depth x Velocity	High	5

Average Score = 4.2

Total Score = 25.0

Public Saftey Risk Matrix

Structure Location: Site 65



Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

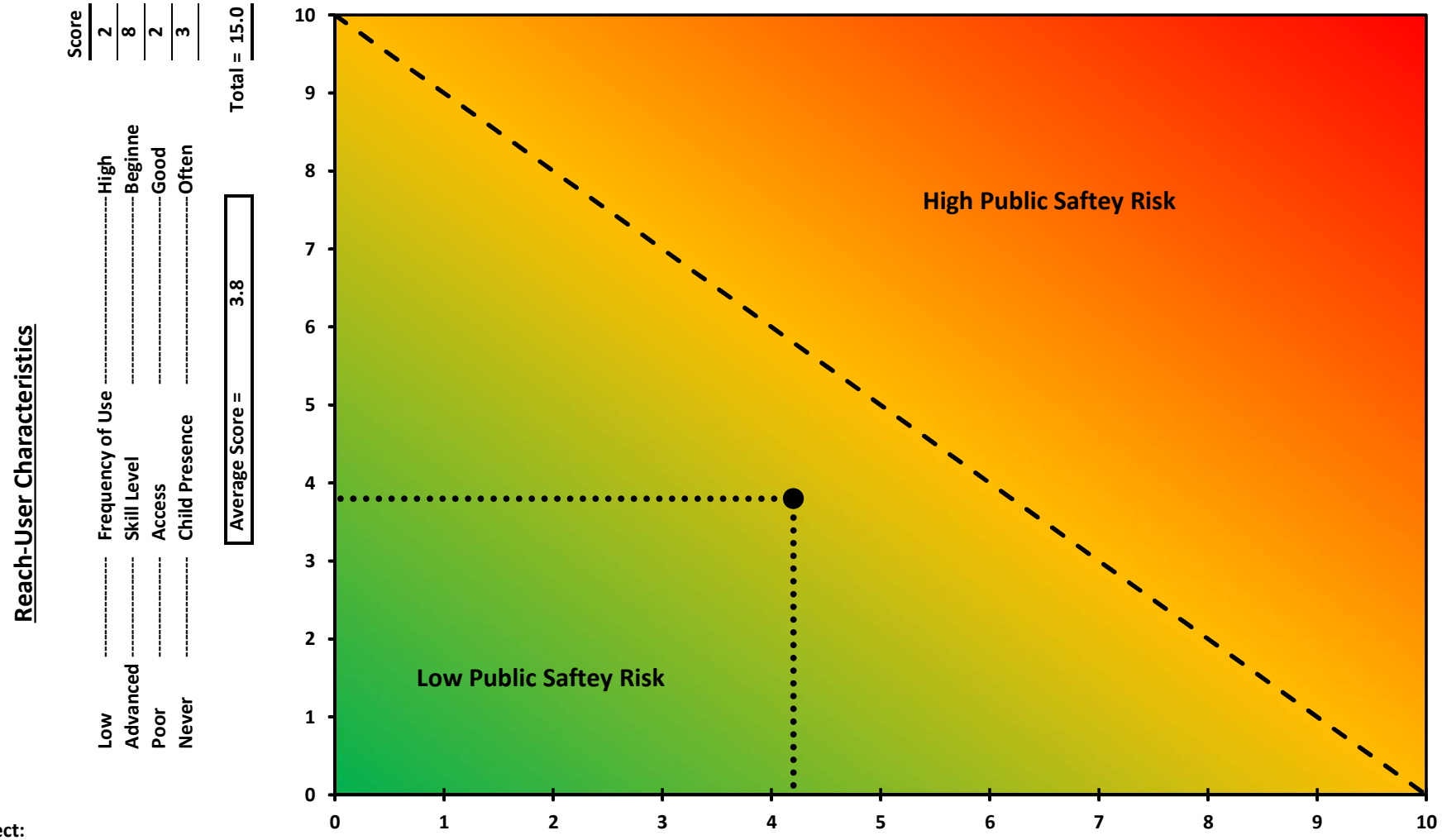
				Score
No	Active Channel?	Yes		7
No	Outside of Bend?	Yes		9
Low	Strainer Potential	High		9
High	Egress Potential	Low		4
High	Sight Distance	Low		5
Low	Depth x Velocity	High		7

Average Score = 6.9

Total Score = 41.0

Public Saftey Risk Matrix

Structure Location: Site 66



Reach-User Characteristics

			Score
Low	Frequency of Use	High	2
Advanced	Skill Level	Beginne	8
Poor	Access	Good	2
Never	Child Presence	Often	3

Total = 15.0

Average Score = 3.8

Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

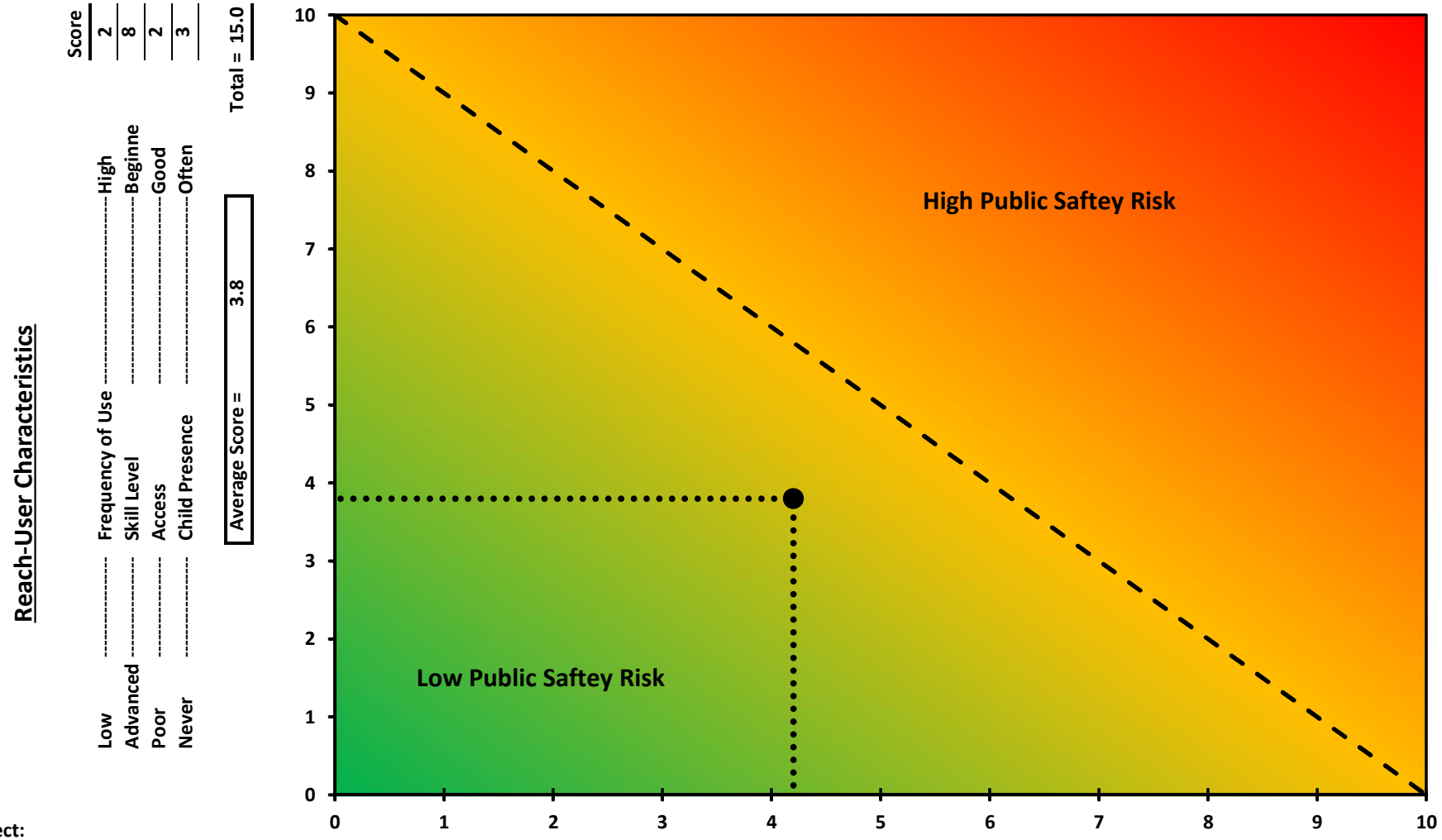
					Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	7
Low	Strainer Potential	High	3
High	Egress Potential	Low	3
High	Sight Distance	Low	3
Low	Depth x Velocity	High	5

Average Score = 4.2

Total Score = 25.0

Public Saftey Risk Matrix

Structure Location: Site 67



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

Structure Characteristics

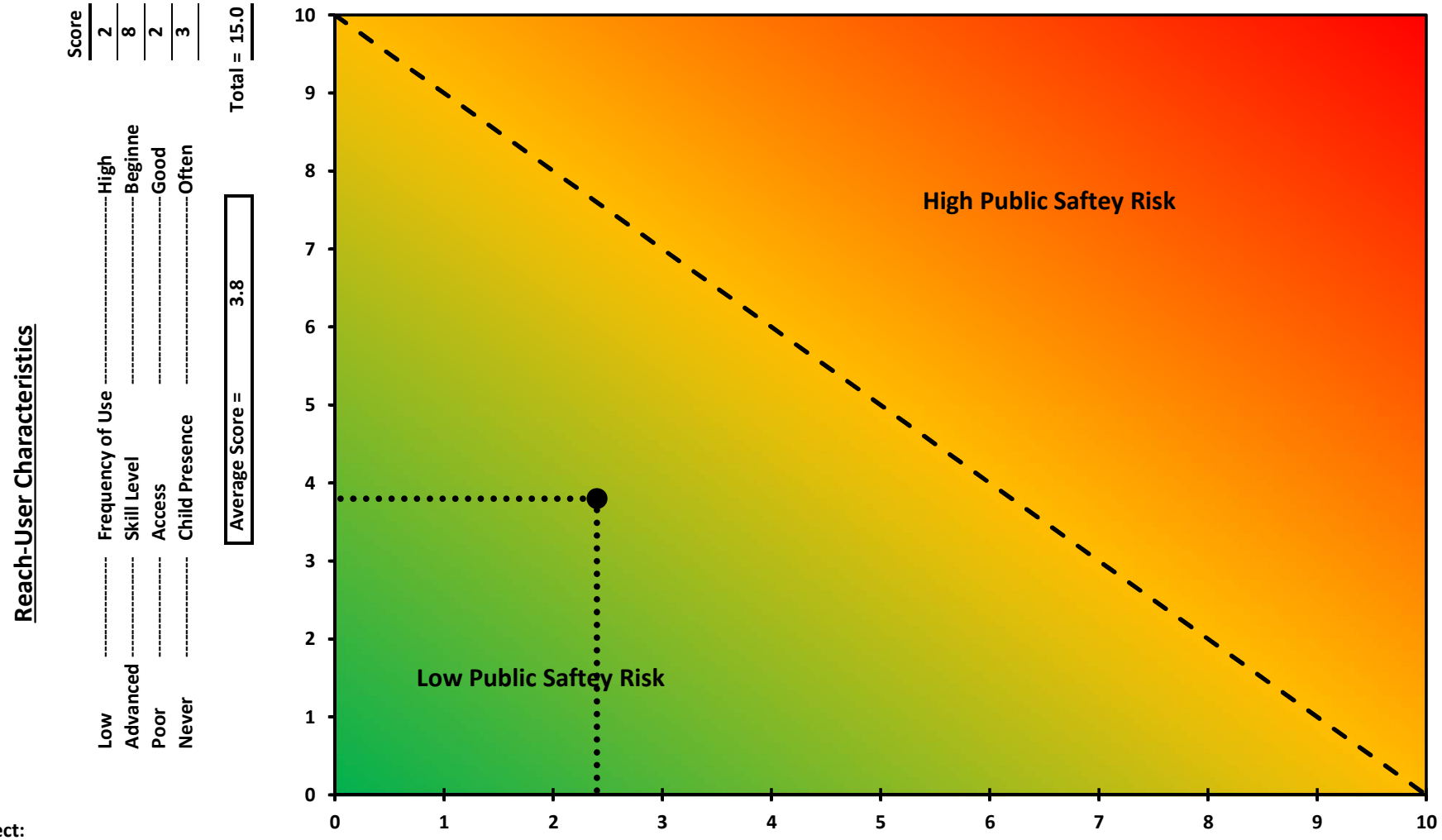
			Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	7
Low	Strainer Potential	High	3
High	Egress Potential	Low	3
High	Sight Distance	Low	3
Low	Depth x Velocity	High	5

Average Score = 4.2

Total Score = 25.0

Public Saftey Risk Matrix

Structure Location: Site 68



Reach-User Characteristics

			Score
Low	Frequency of Use	High	2
Advanced	Skill Level	Beginne	8
Poor	Access	Good	2
Never	Child Presence	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

Structure Characteristics

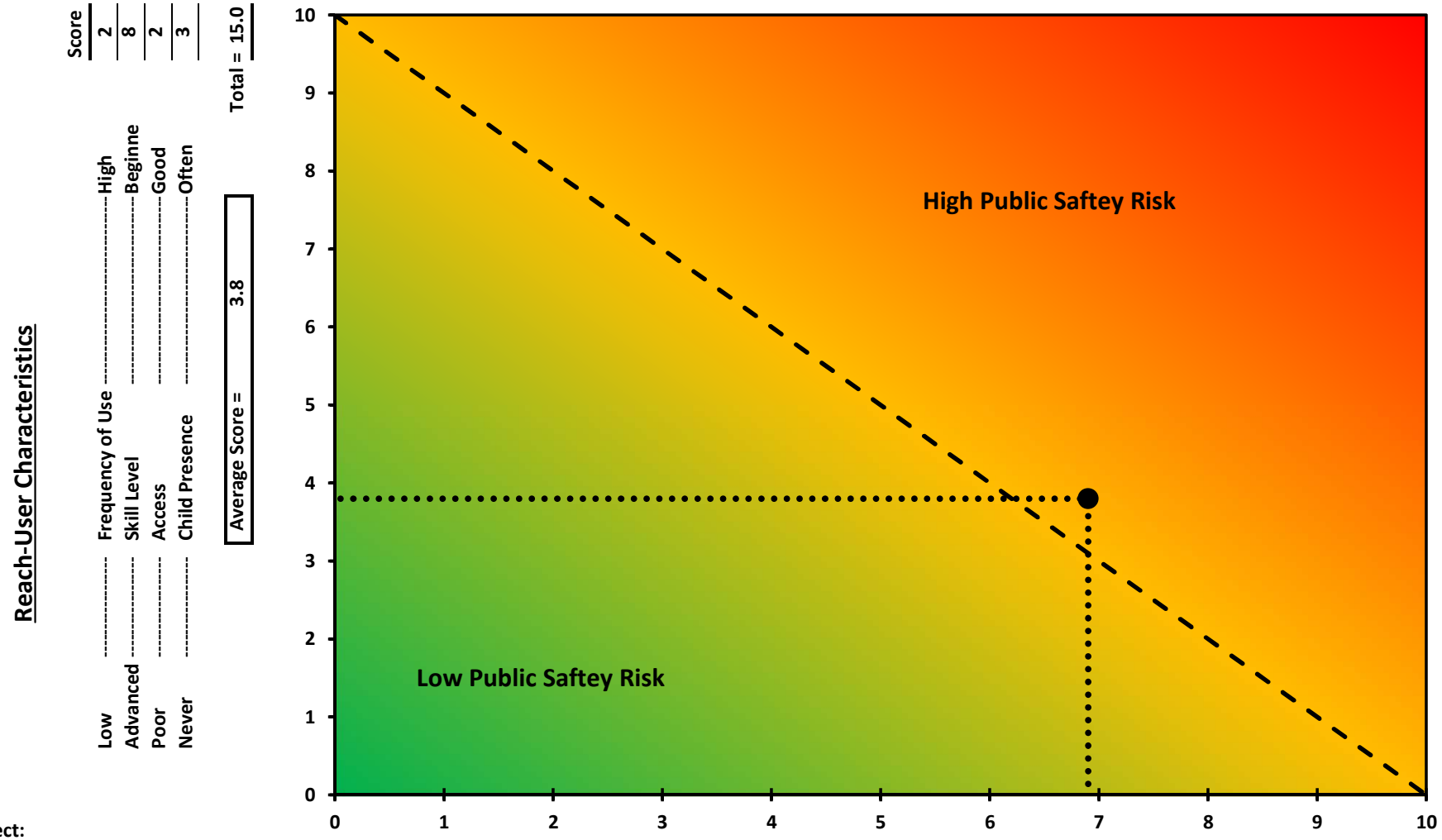
			Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	1
Low	Strainer Potential	High	3
High	Egress Potential	Low	2
High	Sight Distance	Low	2
Low	Depth x Velocity	High	2

Average Score = 2.4

Total Score = 14.0

Public Saftey Risk Matrix

Structure Location: Site 69



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

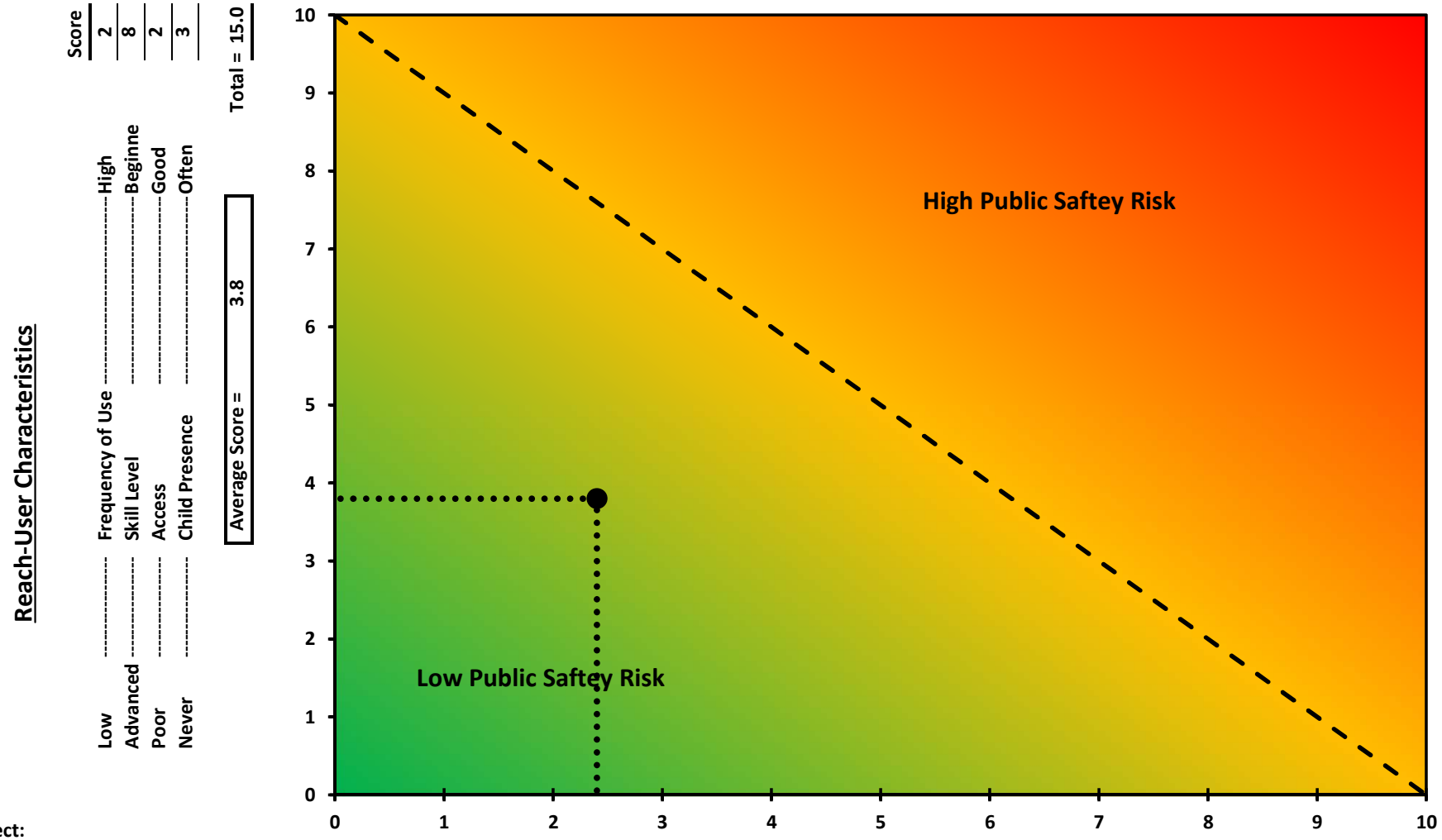
			Score
No	Active Channel?	Yes	7
No	Outside of Bend?	Yes	9
Low	Strainer Potential	High	9
High	Egress Potential	Low	4
High	Sight Distance	Low	5
Low	Depth x Velocity	High	7

Average Score = 6.9

Total Score = 41.0

Public Saftey Risk Matrix

Structure Location: Site 70



Reach-User Characteristics

			Score
Low	Frequency of Use	High	2
Advanced	Skill Level	Beginne	8
Poor	Access	Good	2
Never	Child Presence	Often	3

Average Score = 3.8

Total = 15.0

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

Structure Characteristics

			Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	1
Low	Strainer Potential	High	3
High	Egress Potential	Low	2
High	Sight Distance	Low	2
Low	Depth x Velocity	High	2

Average Score = 2.4

Total Score = 14.0

Public Saftey Risk Matrix

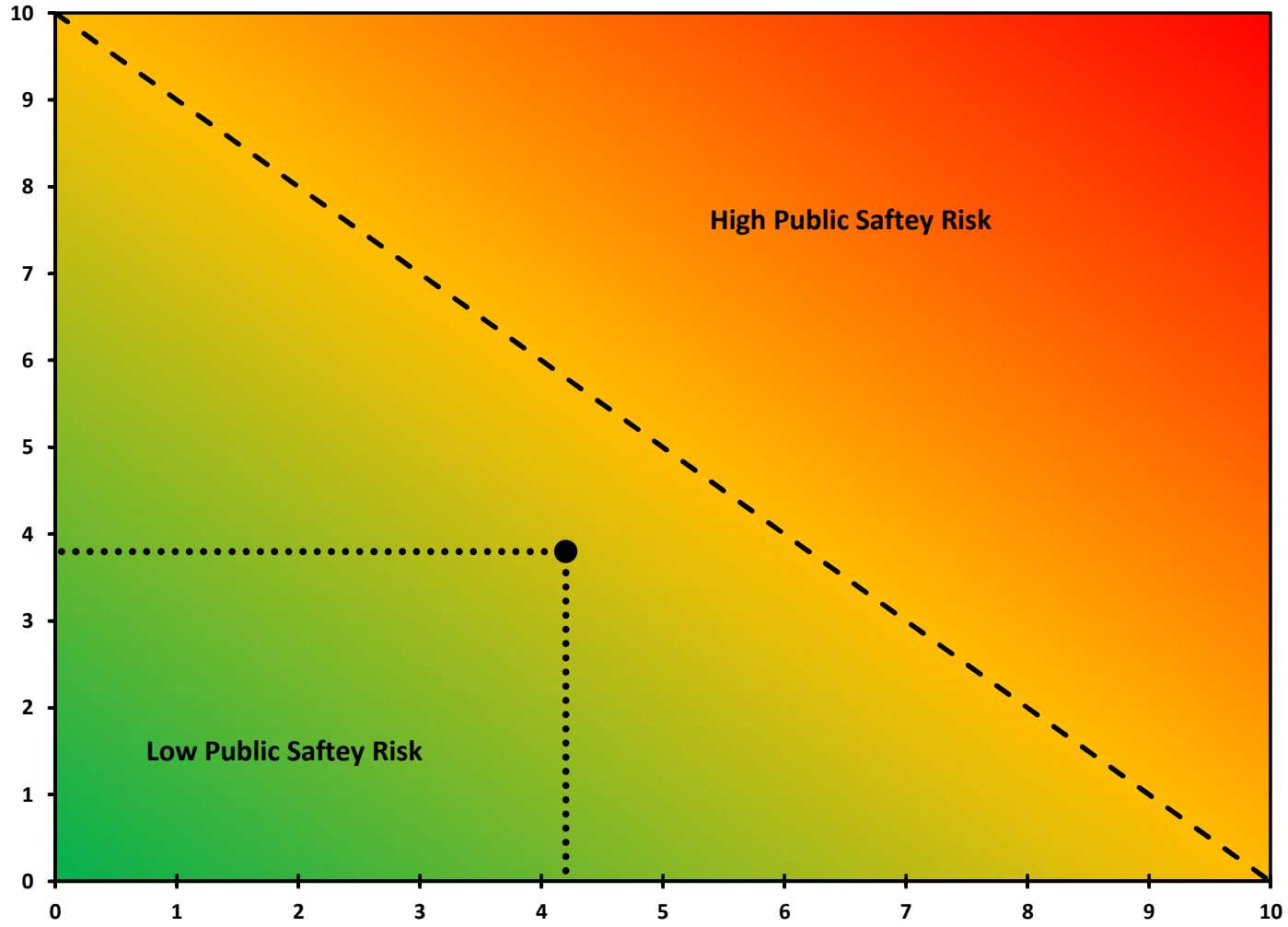
Structure Location: Site 71

Reach-User Characteristics

			Score
Frequency of Use	High	Low	2
Skill Level	Beginne	Advanced	8
Access	Good	Poor	2
Child Presence	Often	Never	3

Total = 15.0

Average Score = 3.8



Structure Characteristics

					Score
No	Active Channel?	Yes			4
No	Outside of Bend?	Yes			7
Low	Strainer Potential	High			3
High	Egress Potential	Low			3
High	Sight Distance	Low			3
Low	Depth x Velocity	High			5

Average Score = 4.2

Total Score = 25.0

Project:
CC-44

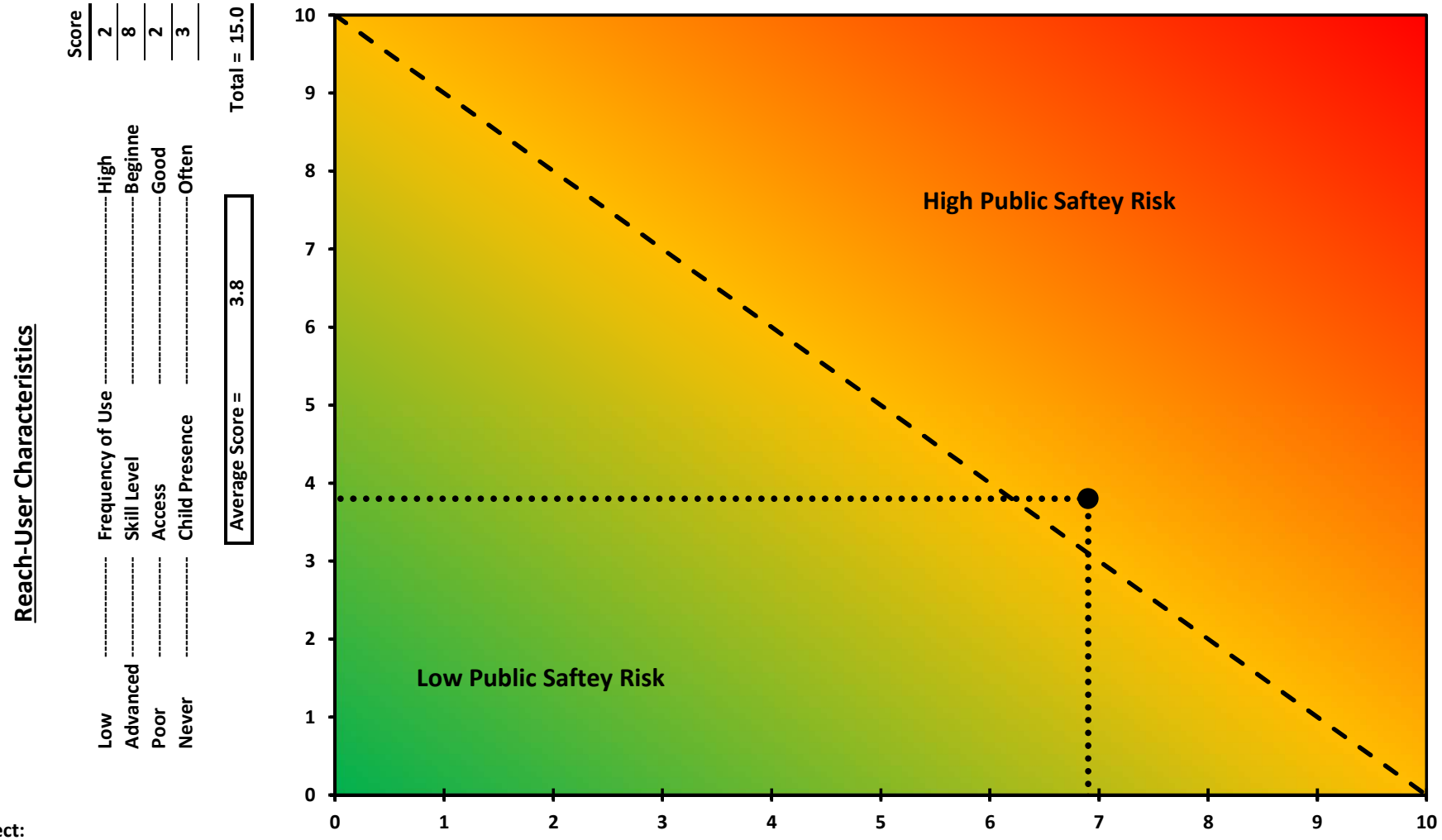
Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

Public Saftey Risk Matrix

Structure Location: Site 72



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

Structure Characteristics

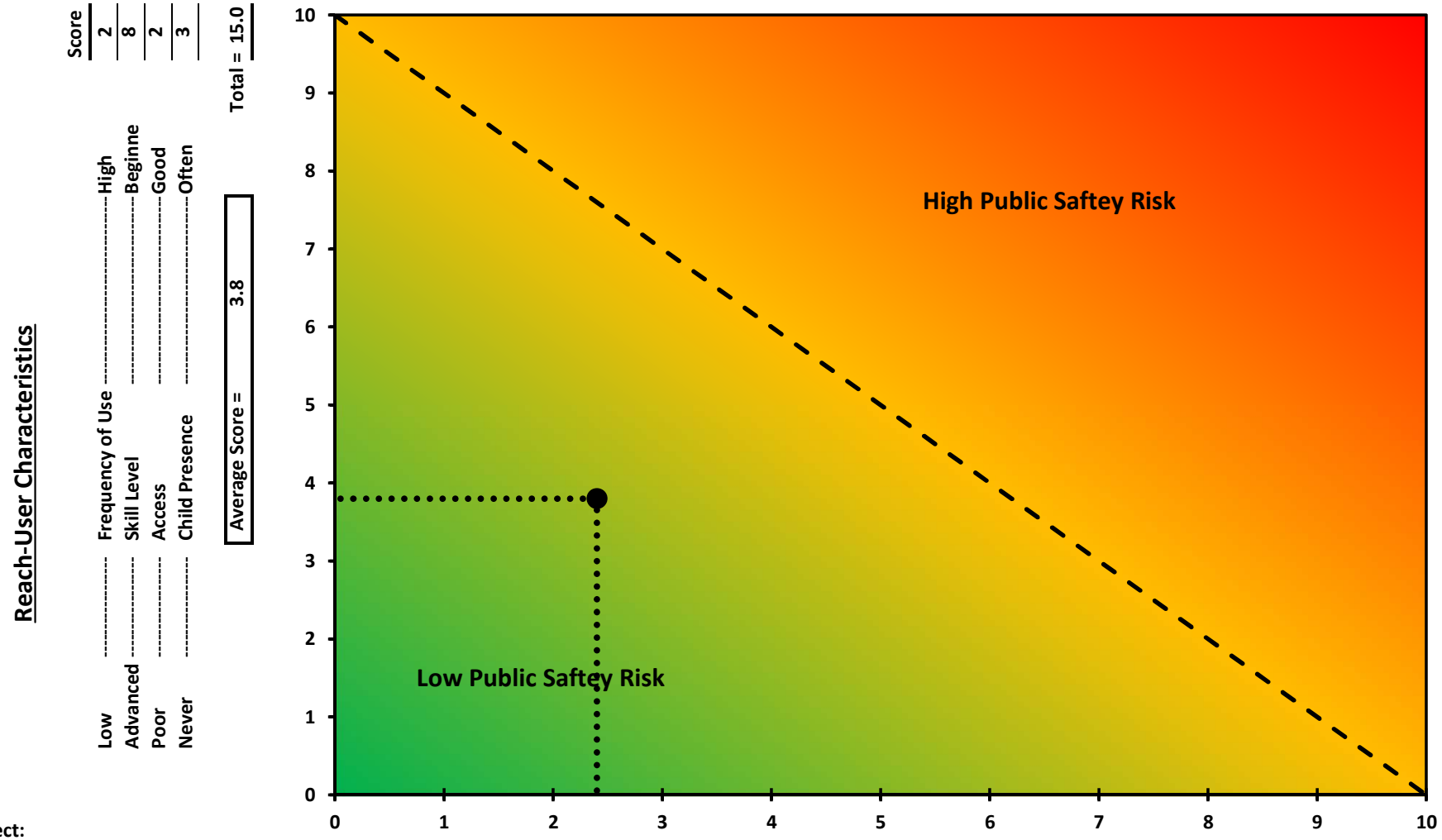
			Score
No	Active Channel?	Yes	7
No	Outside of Bend?	Yes	9
Low	Strainer Potential	High	9
High	Egress Potential	Low	4
High	Sight Distance	Low	5
Low	Depth x Velocity	High	7

Average Score = 6.9

Total Score = 41.0

Public Saftey Risk Matrix

Structure Location: Site 73



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

Structure Characteristics

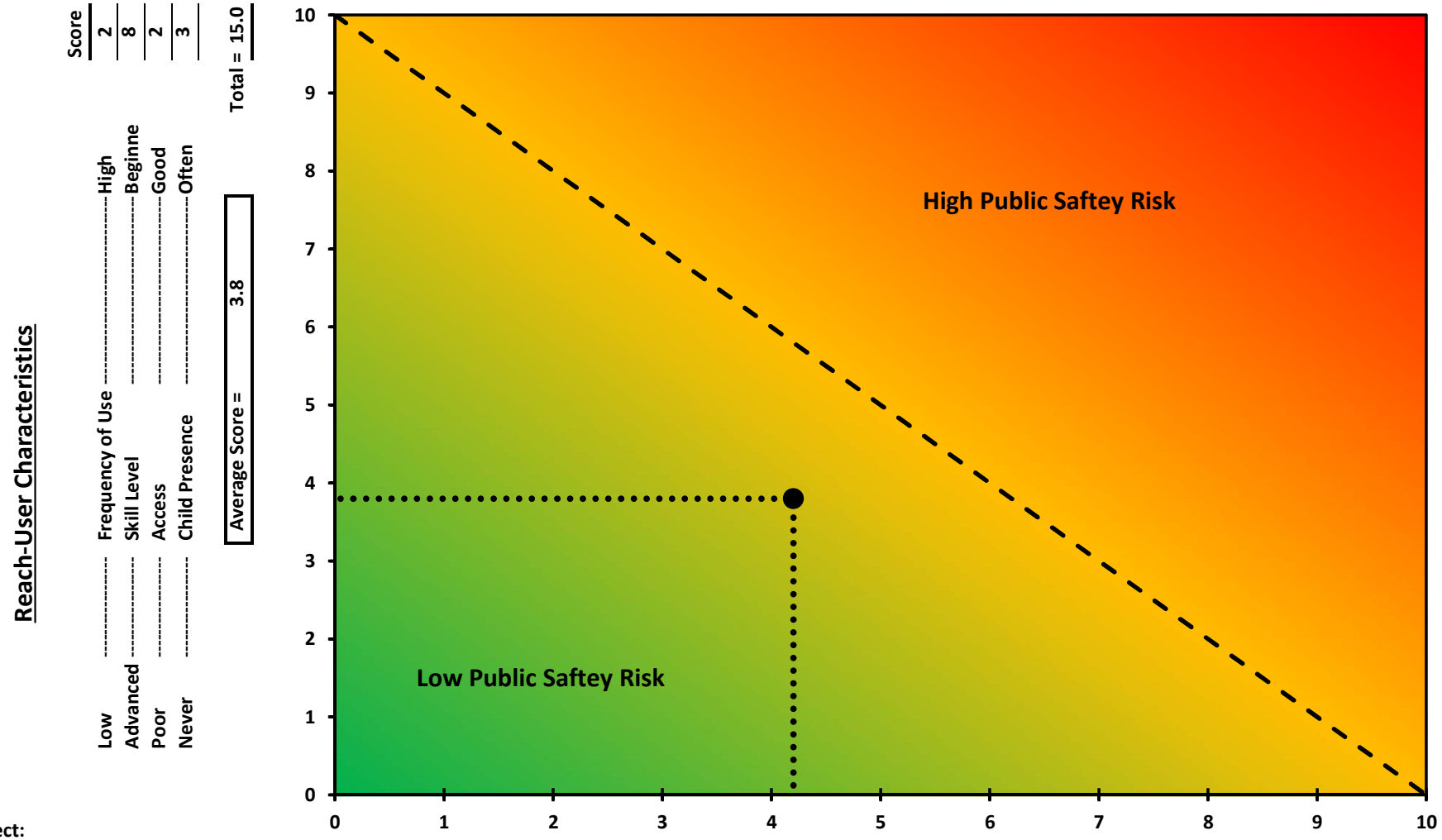
			Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	1
Low	Strainer Potential	High	3
High	Egress Potential	Low	2
High	Sight Distance	Low	2
Low	Depth x Velocity	High	2

Average Score = 2.4

Total Score = 14.0

Public Saftey Risk Matrix

Structure Location: Site 74



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

Structure Characteristics

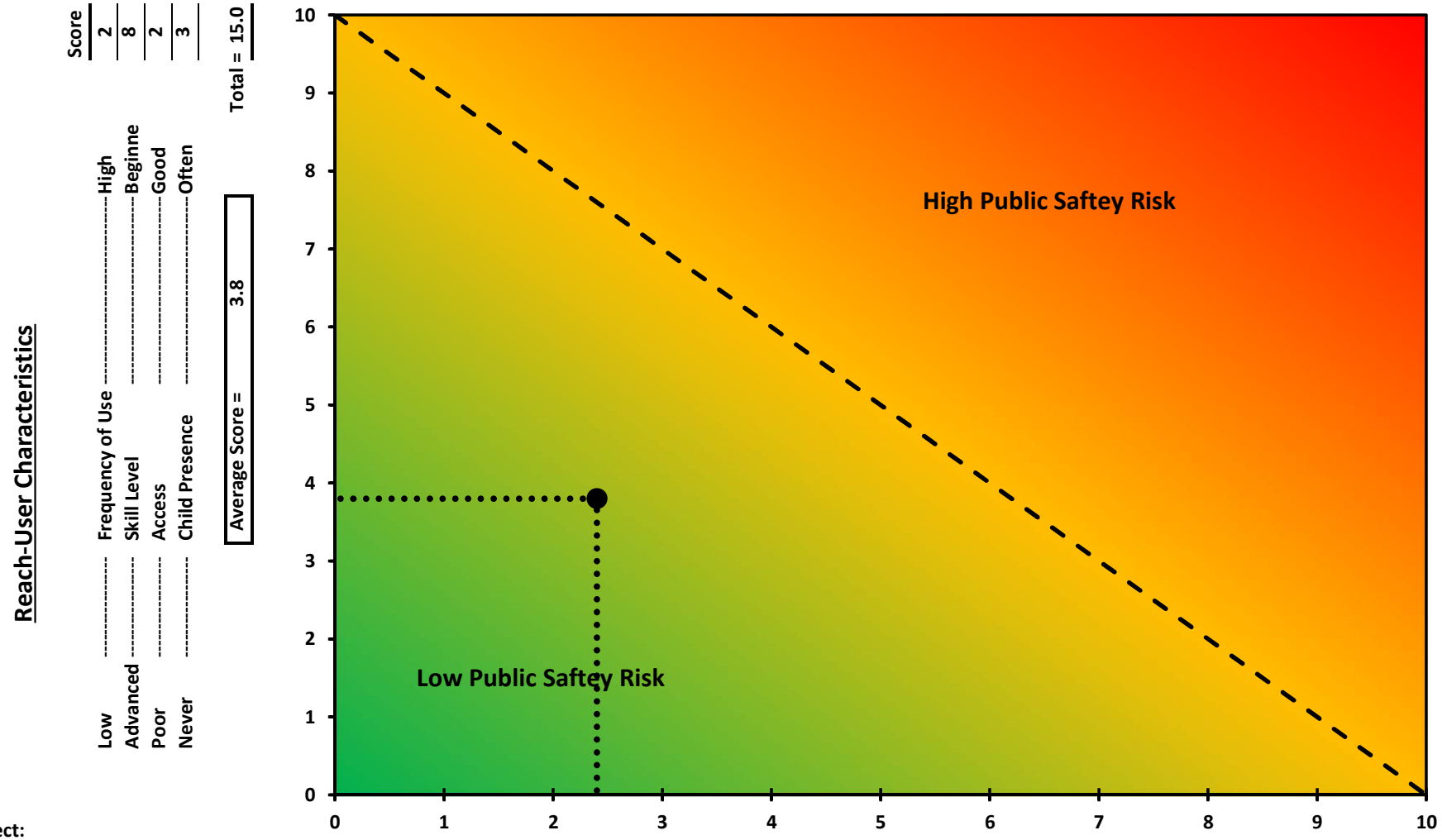
			Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	7
Low	Strainer Potential	High	3
High	Egress Potential	Low	3
High	Sight Distance	Low	3
Low	Depth x Velocity	High	5

Average Score = 4.2

Total Score = 25.0

Public Saftey Risk Matrix

Structure Location: Site 75



Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

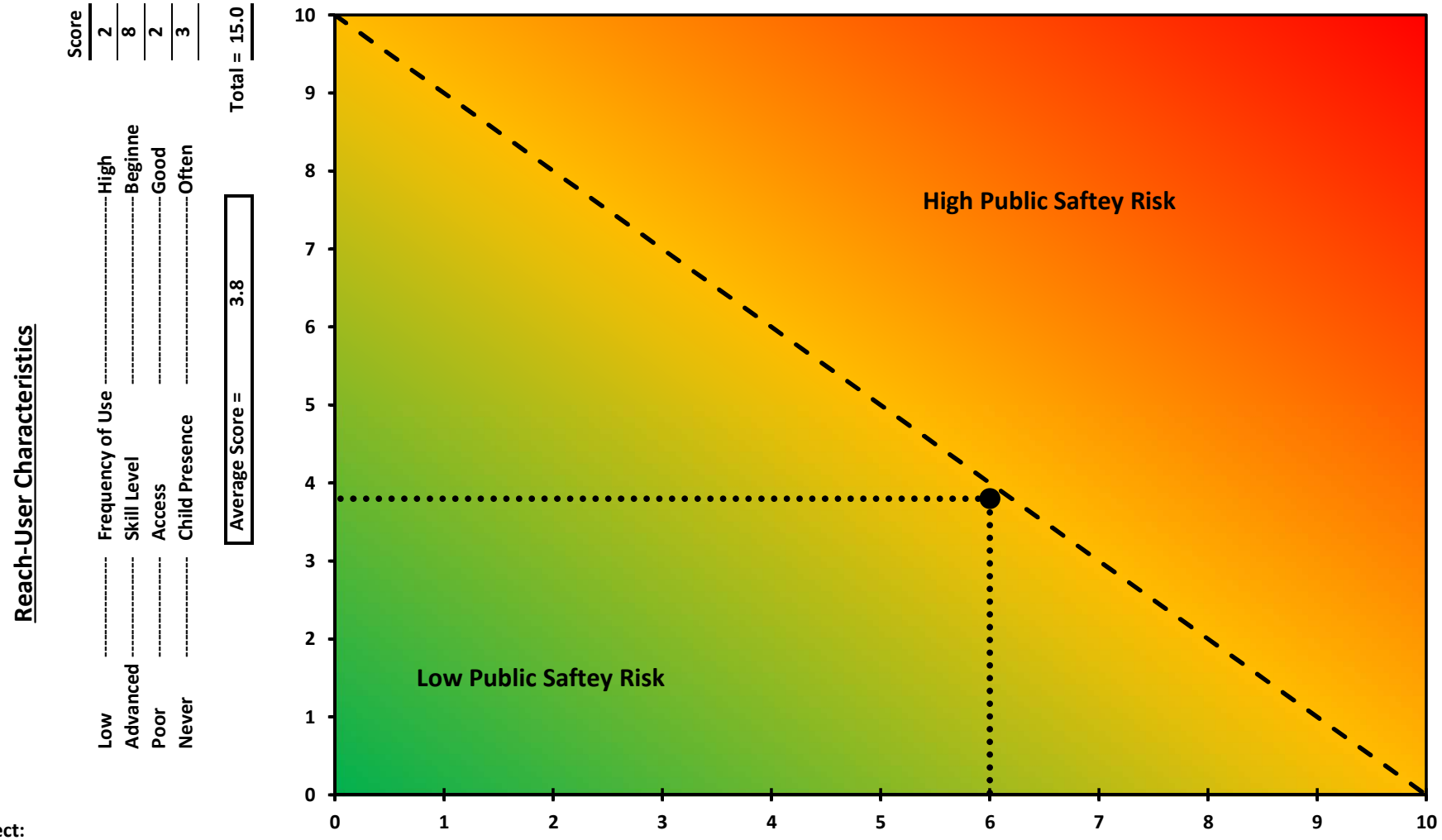
					Score
No	----------	Active Channel?	----------	Yes	4
No	----------	Outside of Bend?	----------	Yes	1
Low	----------	Strainer Potential	----------	High	3
High	----------	Egress Potential	----------	Low	2
High	----------	Sight Distance	----------	Low	2
Low	----------	Depth x Velocity	----------	High	2

Average Score = 2.4

Total Score = 14.0

Public Saftey Risk Matrix

Structure Location: Site 76



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

Structure Characteristics

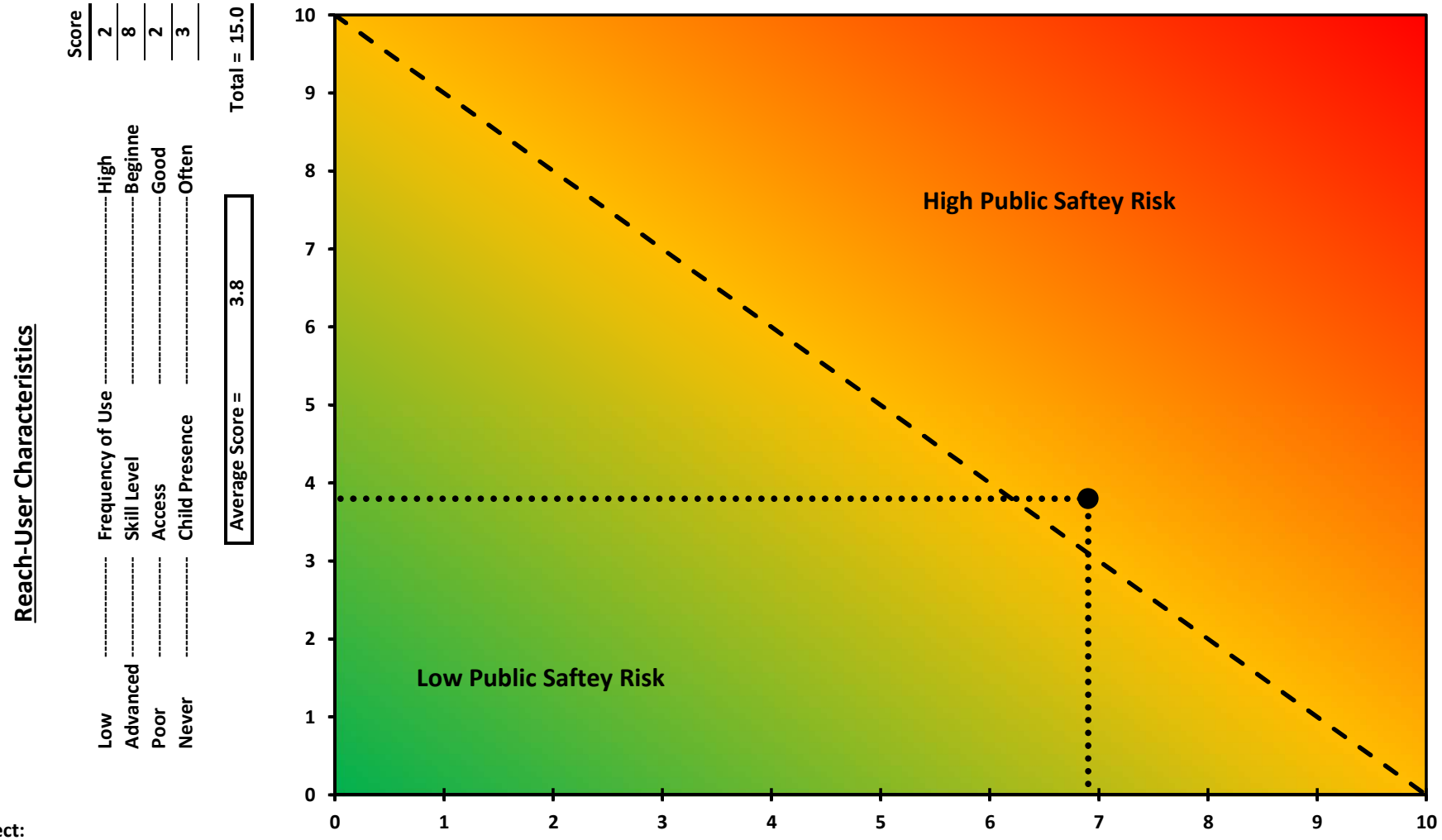
			Score
No	Active Channel?	Yes	6
No	Outside of Bend?	Yes	7
Low	Strainer Potential	High	7
High	Egress Potential	Low	4
High	Sight Distance	Low	5
Low	Depth x Velocity	High	7

Average Score = 6.0

Total Score = 36.0

Public Saftey Risk Matrix

Structure Location: Site 77



Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

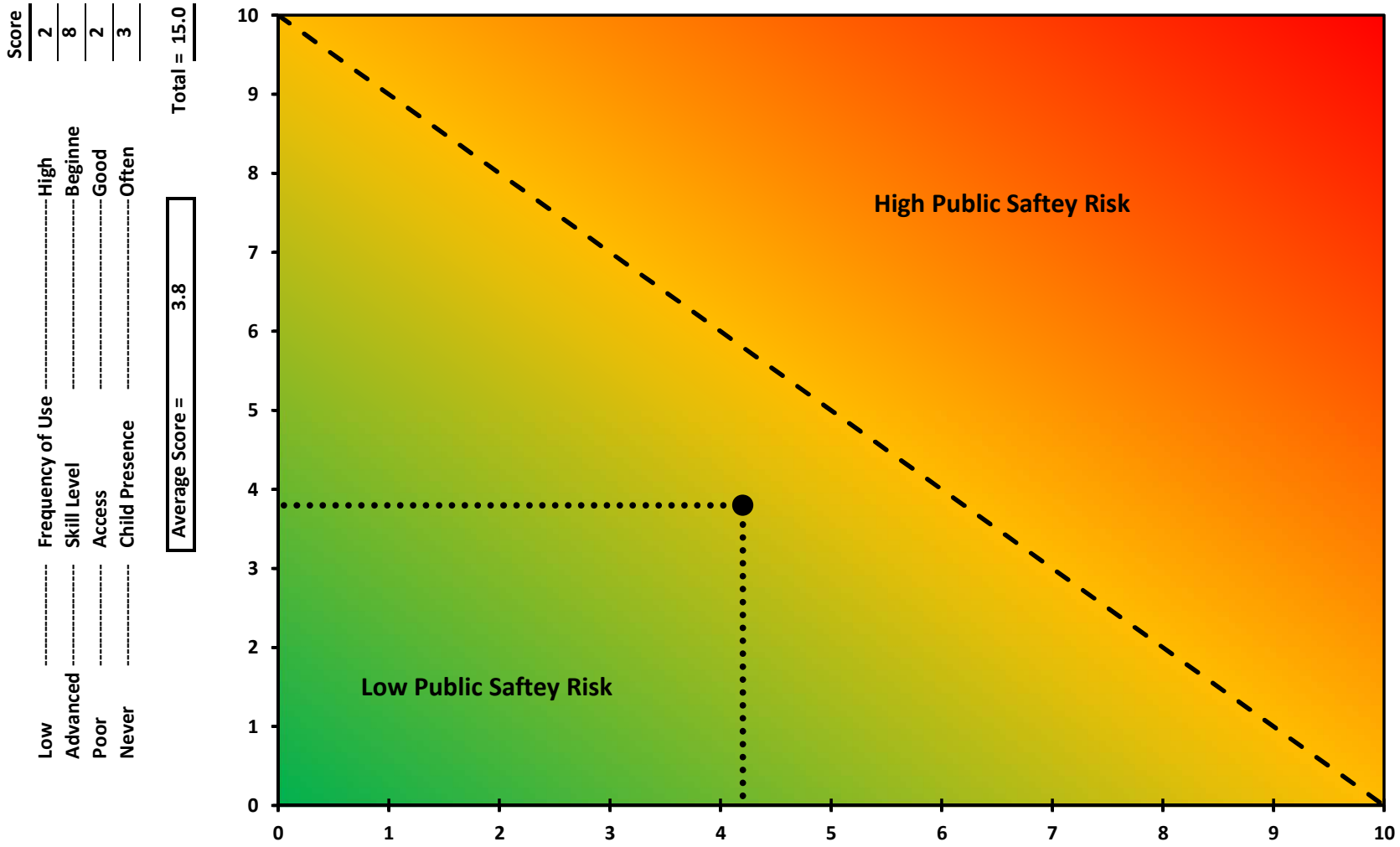
			Score
No	Active Channel?	Yes	7
No	Outside of Bend?	Yes	9
Low	Strainer Potential	High	9
High	Egress Potential	Low	4
High	Sight Distance	Low	5
Low	Depth x Velocity	High	7

Average Score = 6.9

Total Score = 41.0

Public Saftey Risk Matrix

Structure Location: Site 78



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

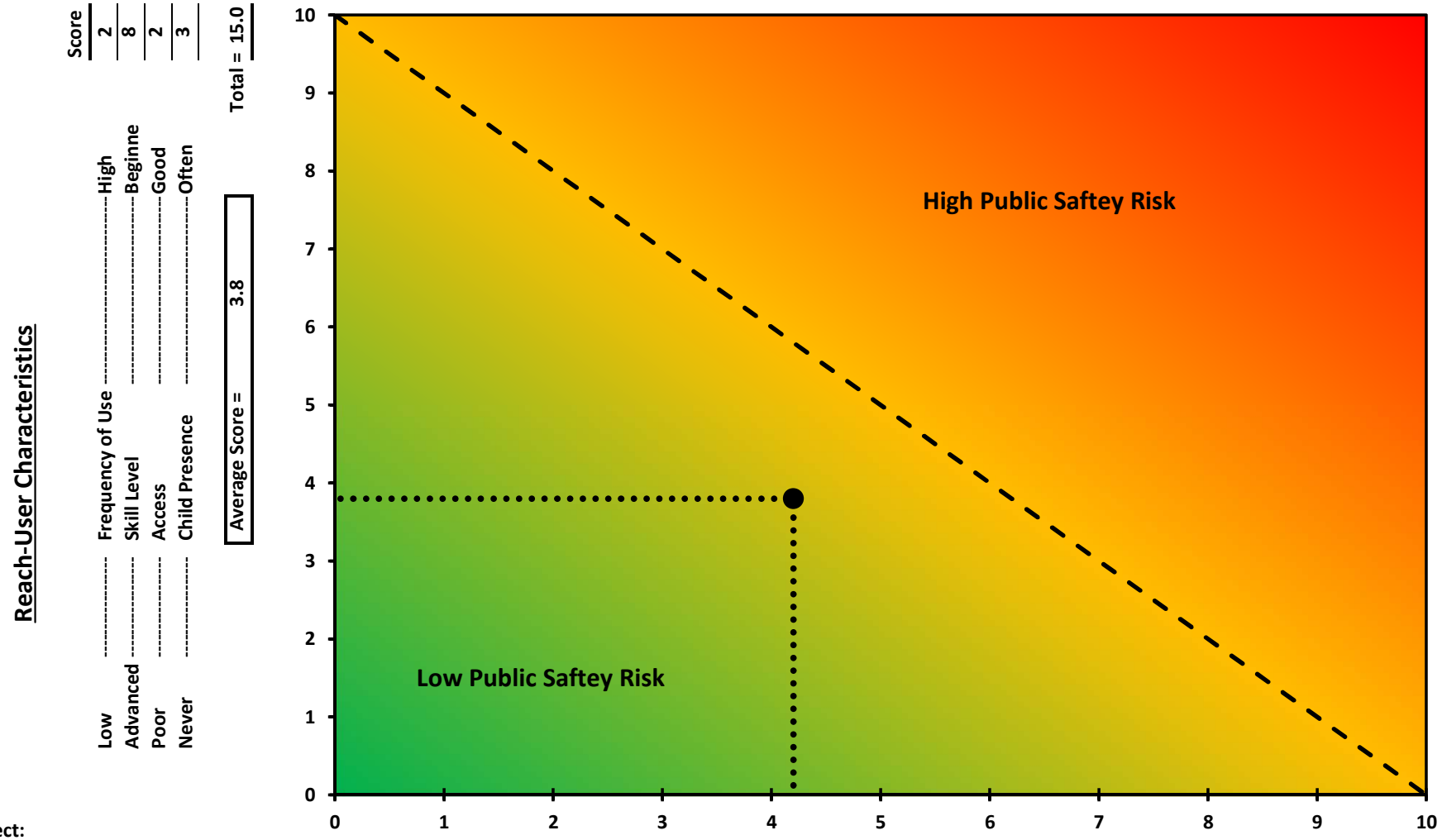
					Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	7
Low	Strainer Potential	High	3
High	Egress Potential	Low	3
High	Sight Distance	Low	3
Low	Depth x Velocity	High	5

Average Score = 4.2

Total Score = 25.0

Public Saftey Risk Matrix

Structure Location: Site 79



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

Structure Characteristics

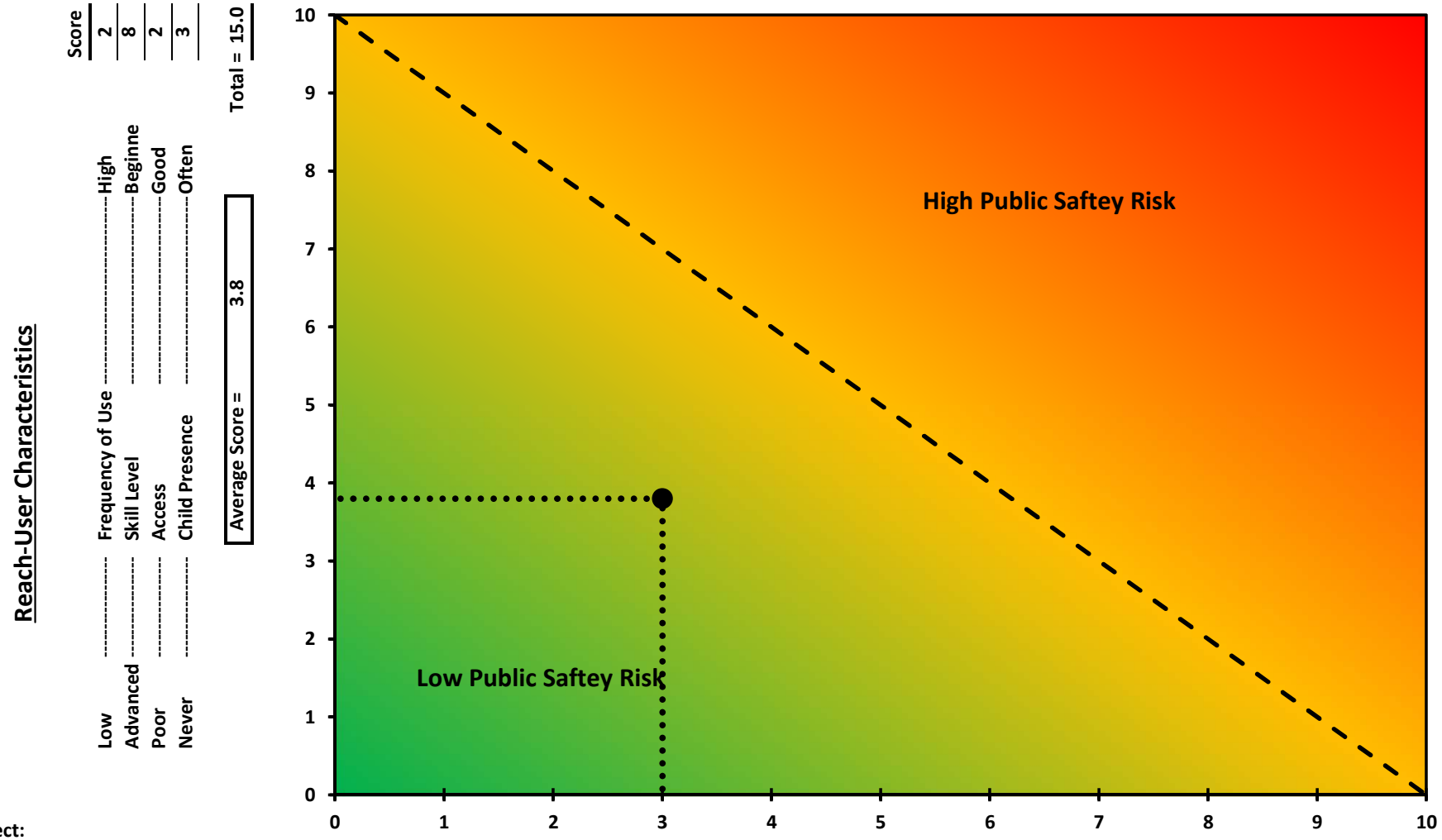
			Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	7
Low	Strainer Potential	High	3
High	Egress Potential	Low	3
High	Sight Distance	Low	3
Low	Depth x Velocity	High	5

Average Score = 4.2

Total Score = 25.0

Public Saftey Risk Matrix

Structure Location: Site 80



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

Structure Characteristics

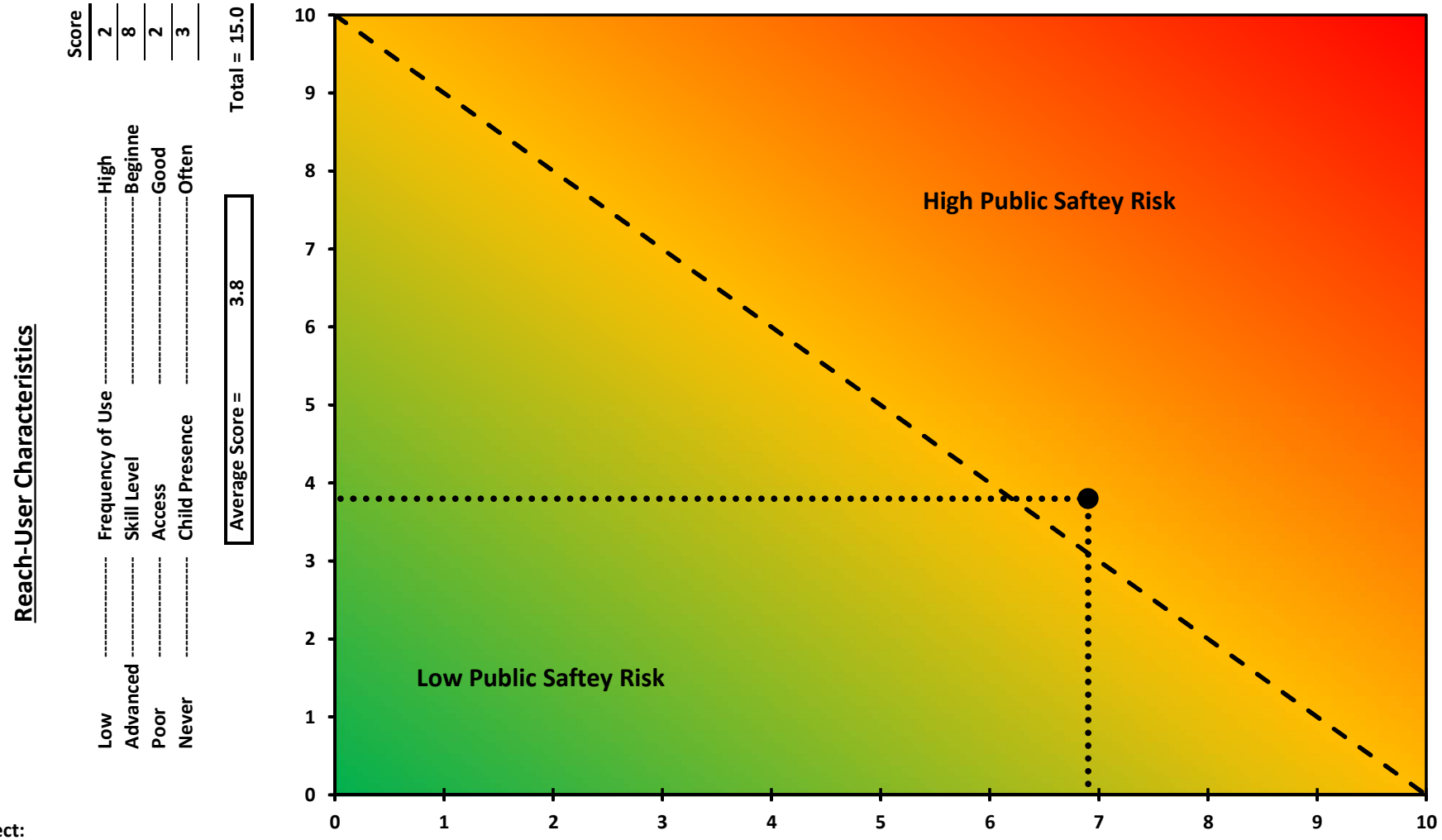
			Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	2
Low	Strainer Potential	High	2
High	Egress Potential	Low	3
High	Sight Distance	Low	5
Low	Depth x Velocity	High	2

Average Score = 3.0

Total Score = 18.0

Public Saftey Risk Matrix

Structure Location: Site 81



Reach-User Characteristics

			Score
Frequency of Use	High	Low	2
Skill Level	Beginne	Advanced	8
Access	Good	Poor	2
Child Presence	Often	Never	3

Total = 15.0

Average Score = 3.8

Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

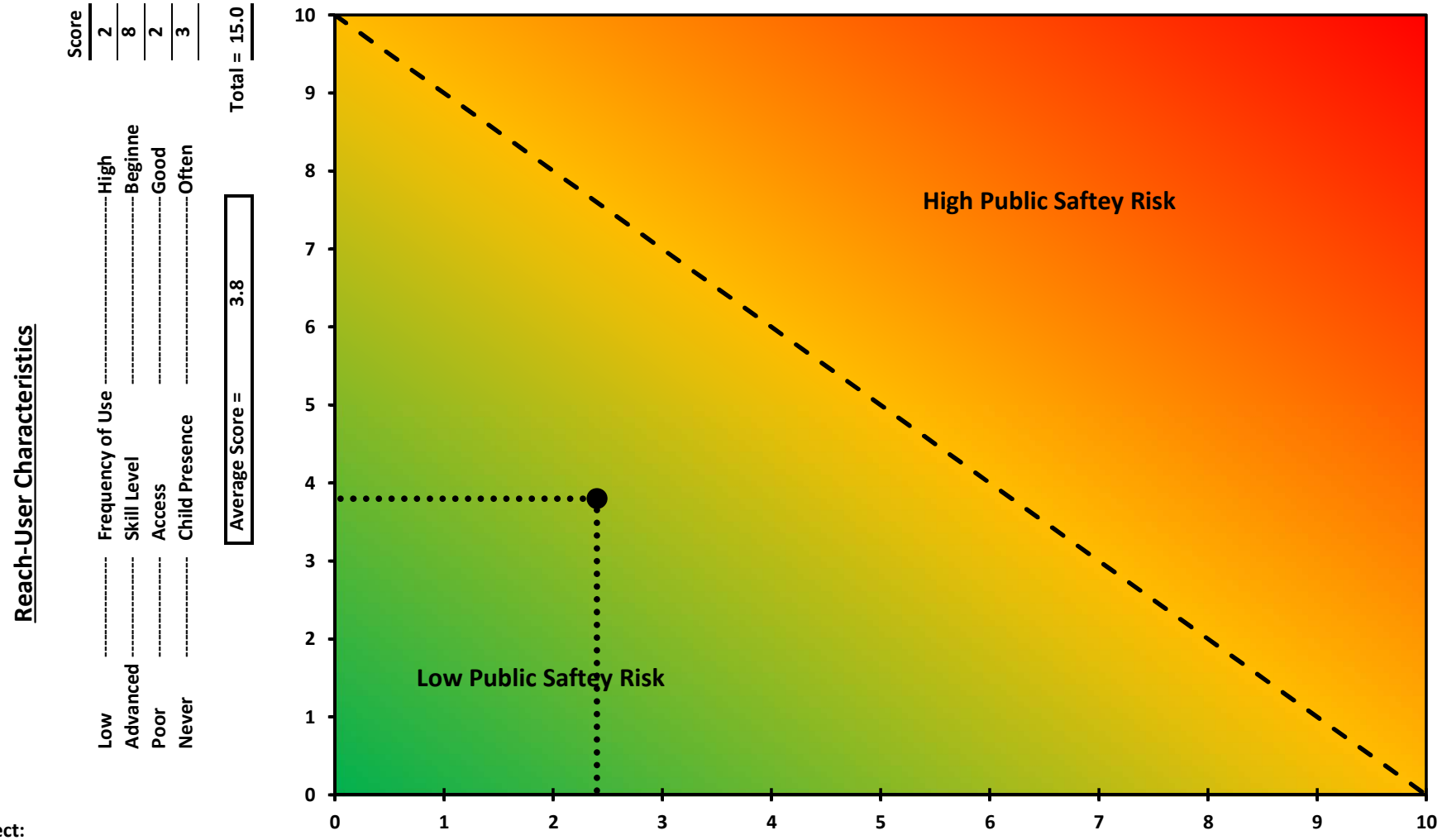
			Score
No	Active Channel?	Yes	7
No	Outside of Bend?	Yes	9
Low	Strainer Potential	High	9
High	Egress Potential	Low	4
High	Sight Distance	Low	5
Low	Depth x Velocity	High	7

Average Score = 6.9

Total Score = 41.0

Public Saftey Risk Matrix

Structure Location: Site 82



Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

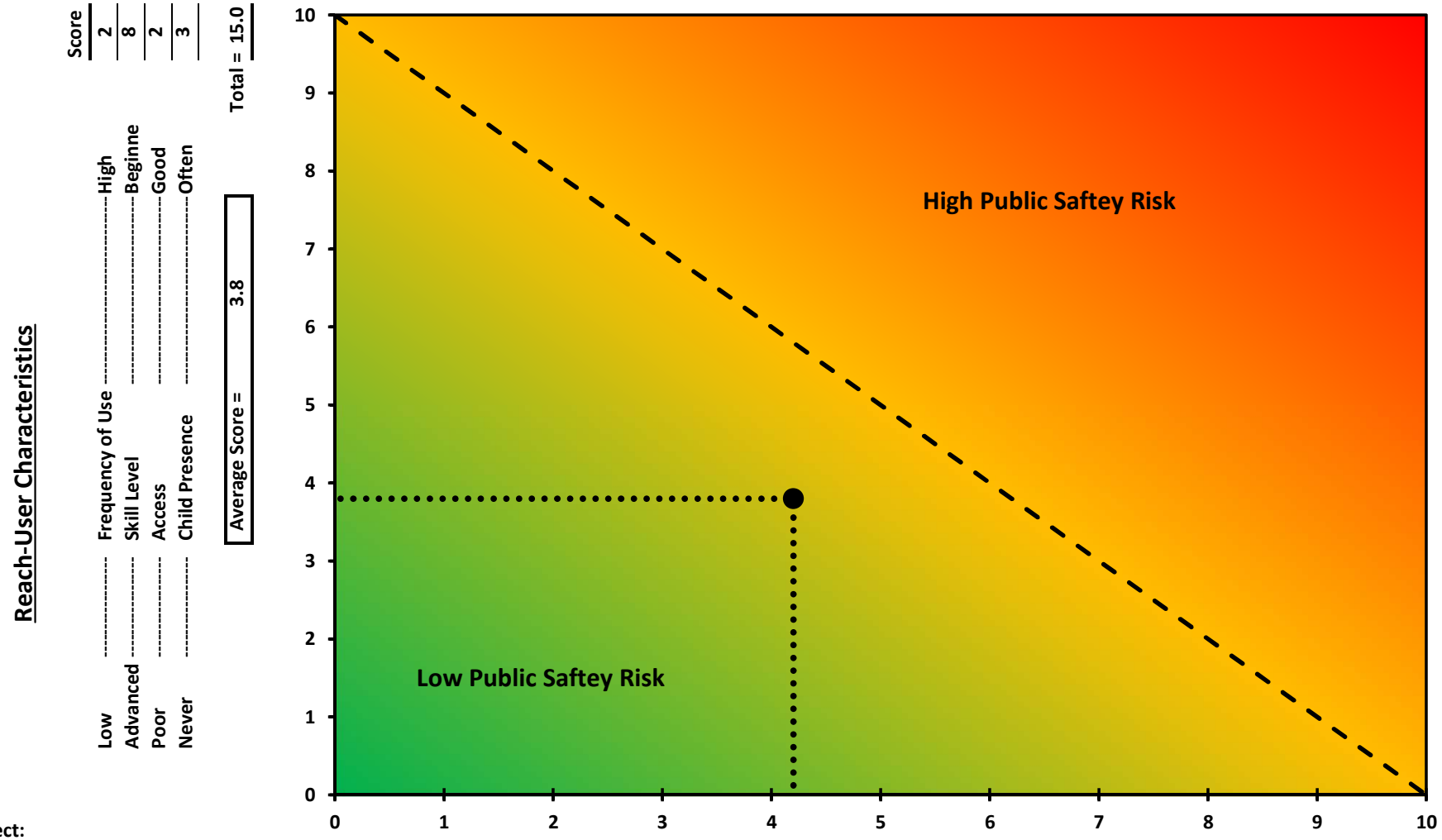
					Score
No	----------	Active Channel?	----------	Yes	4
No	----------	Outside of Bend?	----------	Yes	1
Low	----------	Strainer Potential	----------	High	3
High	----------	Egress Potential	----------	Low	2
High	----------	Sight Distance	----------	Low	2
Low	----------	Depth x Velocity	----------	High	2

Average Score = 2.4

Total Score = 14.0

Public Saftey Risk Matrix

Structure Location: Site 83



Reach-User Characteristics

			Score
Low	Frequency of Use	High	2
Advanced	Skill Level	Beginne	8
Poor	Access	Good	2
Never	Child Presence	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

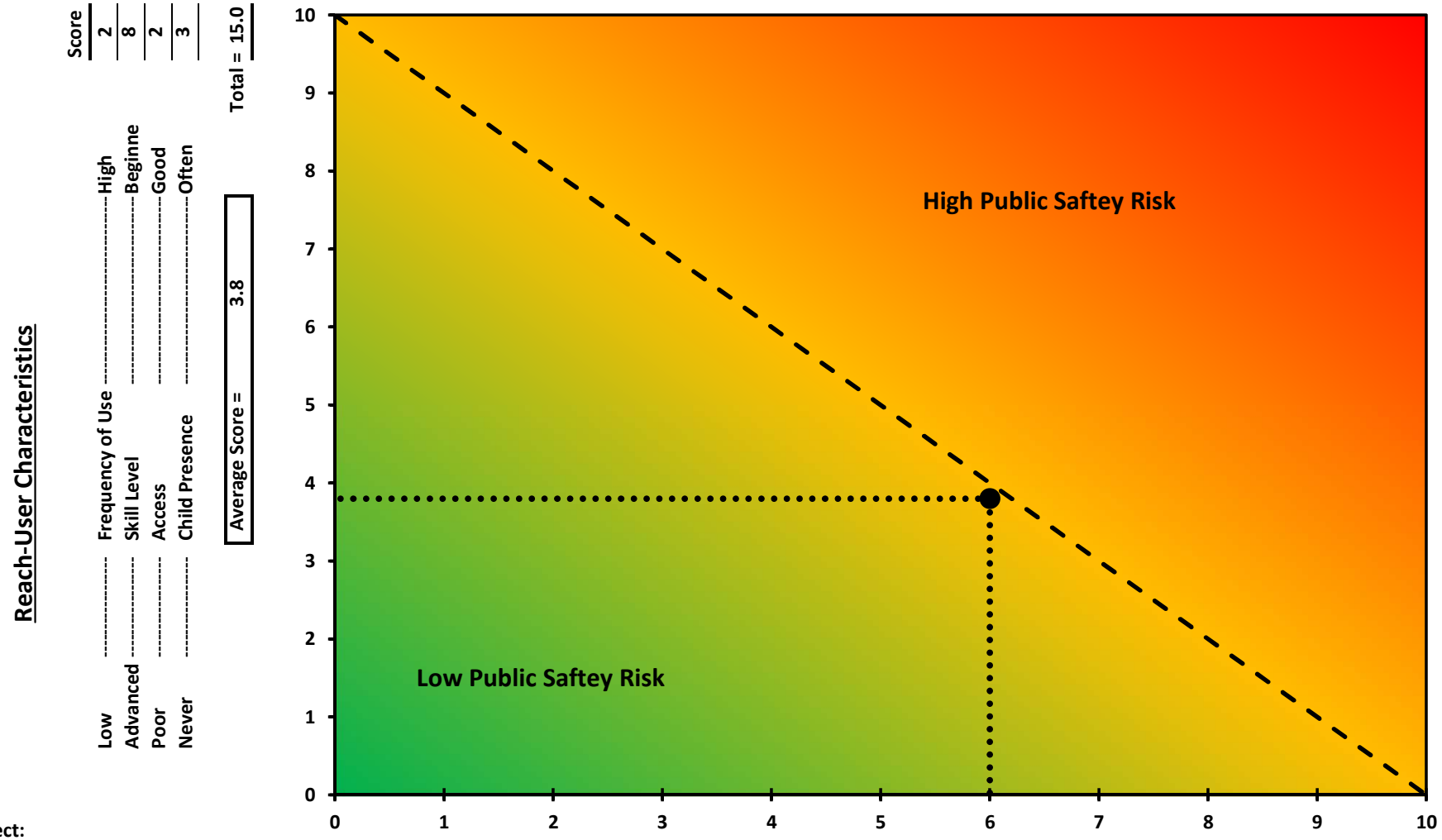
					Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	7
Low	Strainer Potential	High	3
High	Egress Potential	Low	3
High	Sight Distance	Low	3
Low	Depth x Velocity	High	5

Average Score = 4.2

Total Score = 25.0

Public Saftey Risk Matrix

Structure Location: Site 84



Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

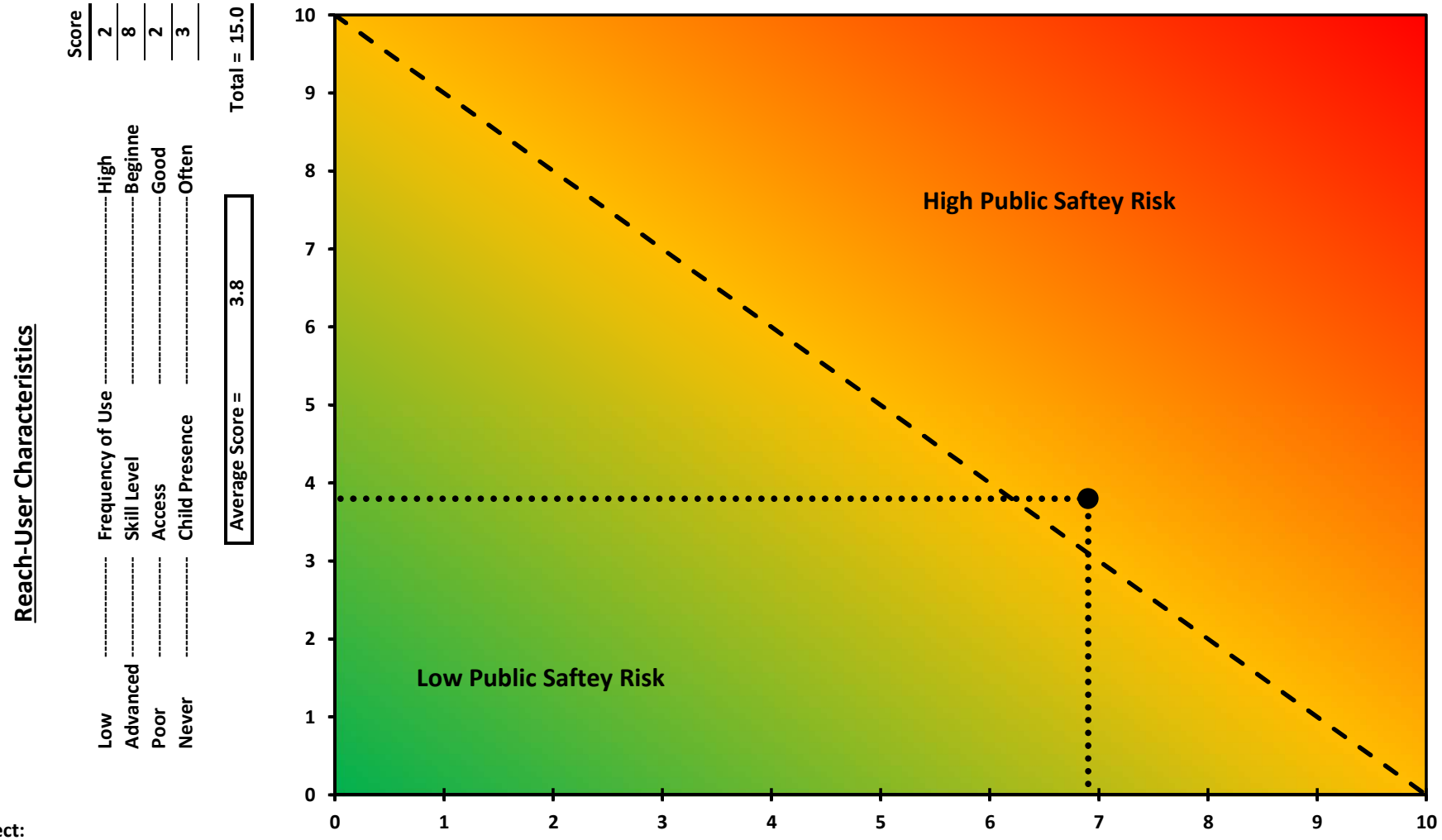
				Score
No	Active Channel?	Yes		6
No	Outside of Bend?	Yes		7
Low	Strainer Potential	High		7
High	Egress Potential	Low		4
High	Sight Distance	Low		5
Low	Depth x Velocity	High		7

Average Score = 6.0

Total Score = 36.0

Public Saftey Risk Matrix

Structure Location: Site 85



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

Structure Characteristics

			Score
No	Active Channel?	Yes	7
No	Outside of Bend?	Yes	9
Low	Strainer Potential	High	9
High	Egress Potential	Low	4
High	Sight Distance	Low	5
Low	Depth x Velocity	High	7

Average Score = 6.9

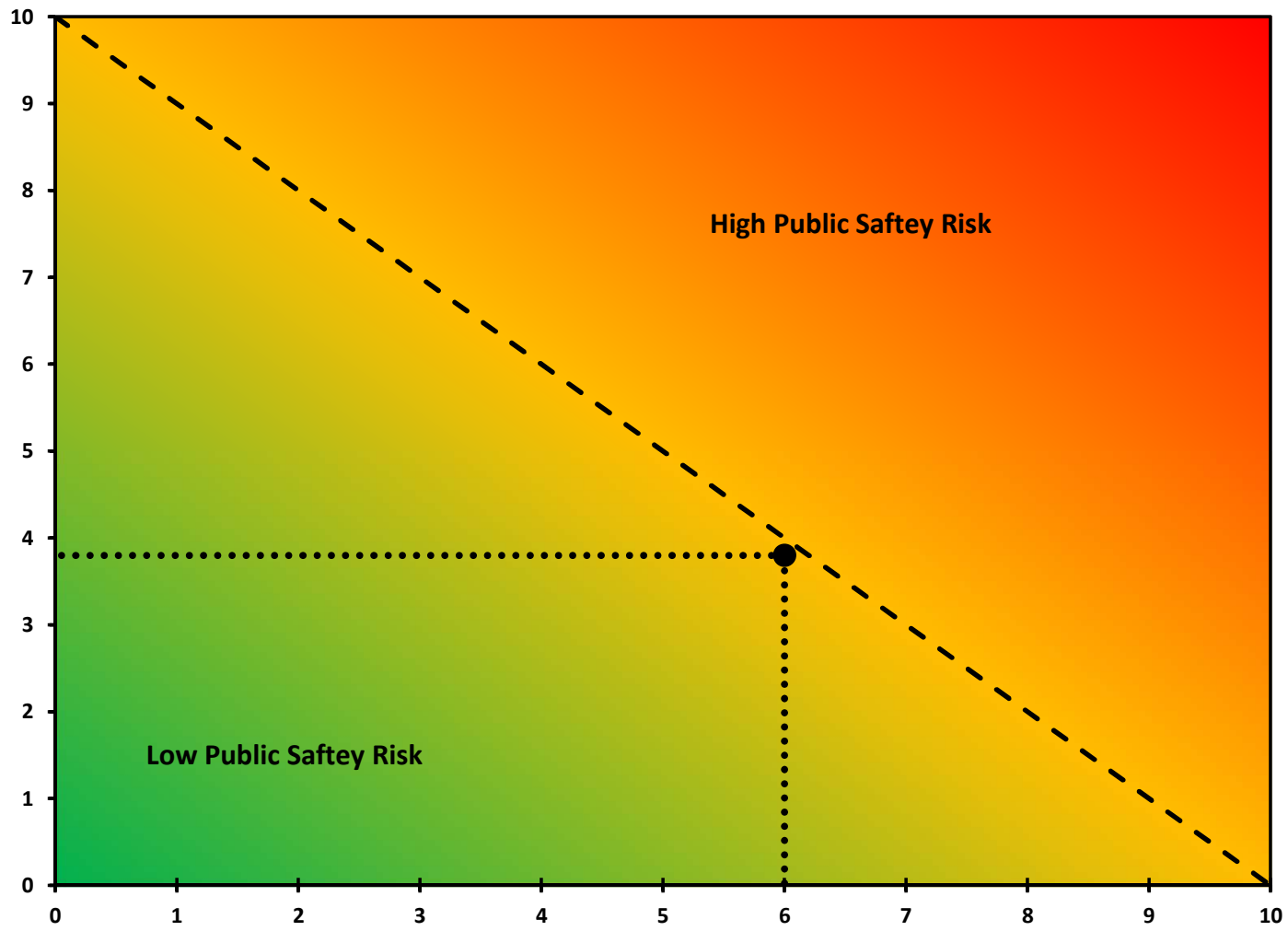
Total Score = 41.0

Public Saftey Risk Matrix

Structure Location: Site 86

Reach-User Characteristics

			Score
Frequency of Use	High	Low	2
Skill Level	Beginne	Advanced	8
Access	Good	Poor	2
Child Presence	Often	Never	3
		Total =	15.0
		Average Score =	3.8



Structure Characteristics

					Score
No	----------	Active Channel?	----------	Yes	4
No	----------	Outside of Bend?	----------	Yes	5
Low	----------	Strainer Potential	----------	High	8
High	----------	Egress Potential	----------	Low	7
High	----------	Sight Distance	----------	Low	7
Low	----------	Depth x Velocity	----------	High	5
		Average Score =	6.0	Total Score =	36.0

Project:
CC-44

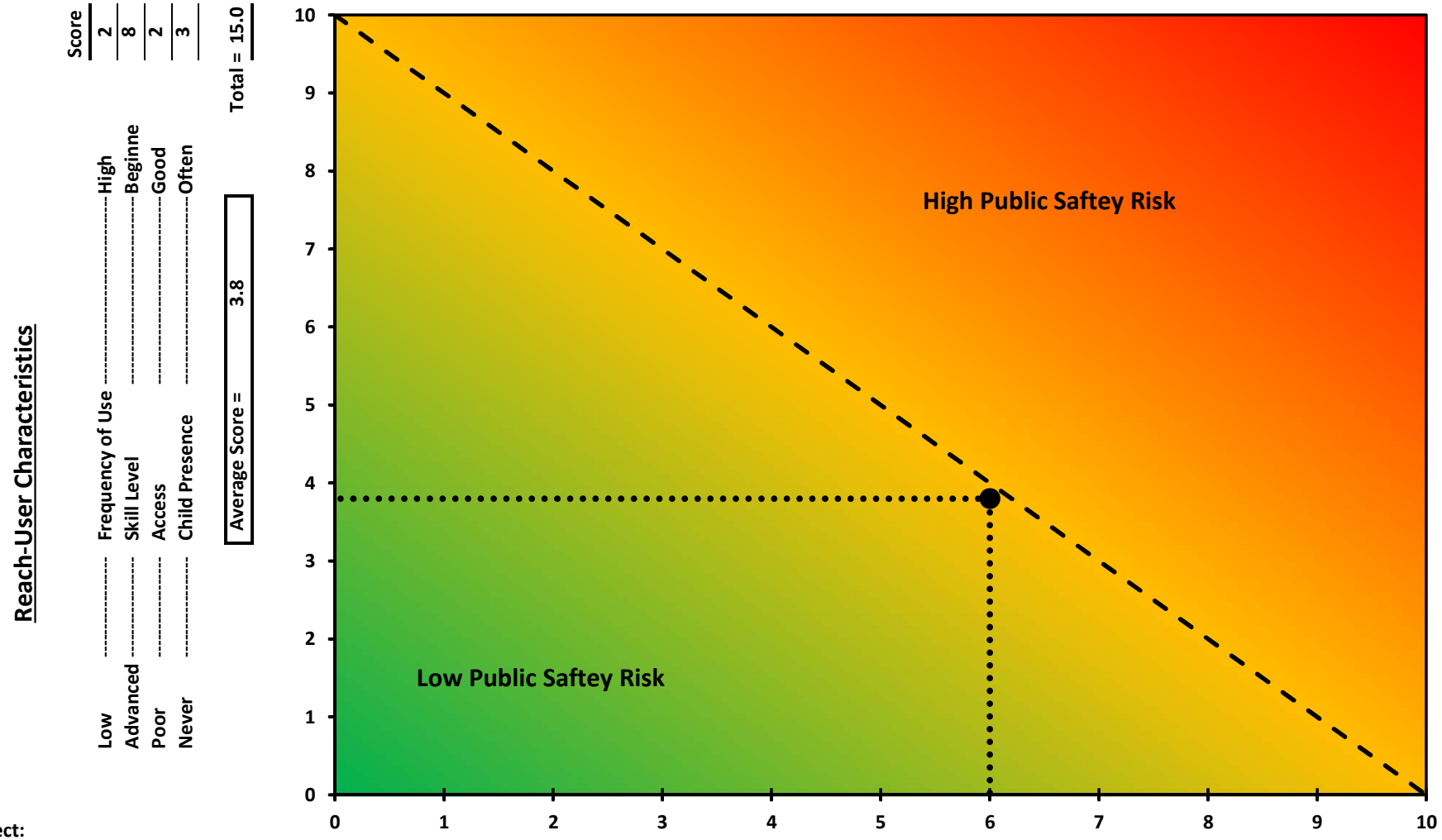
Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

Public Saftey Risk Matrix

Structure Location: Site 87



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

Structure Characteristics

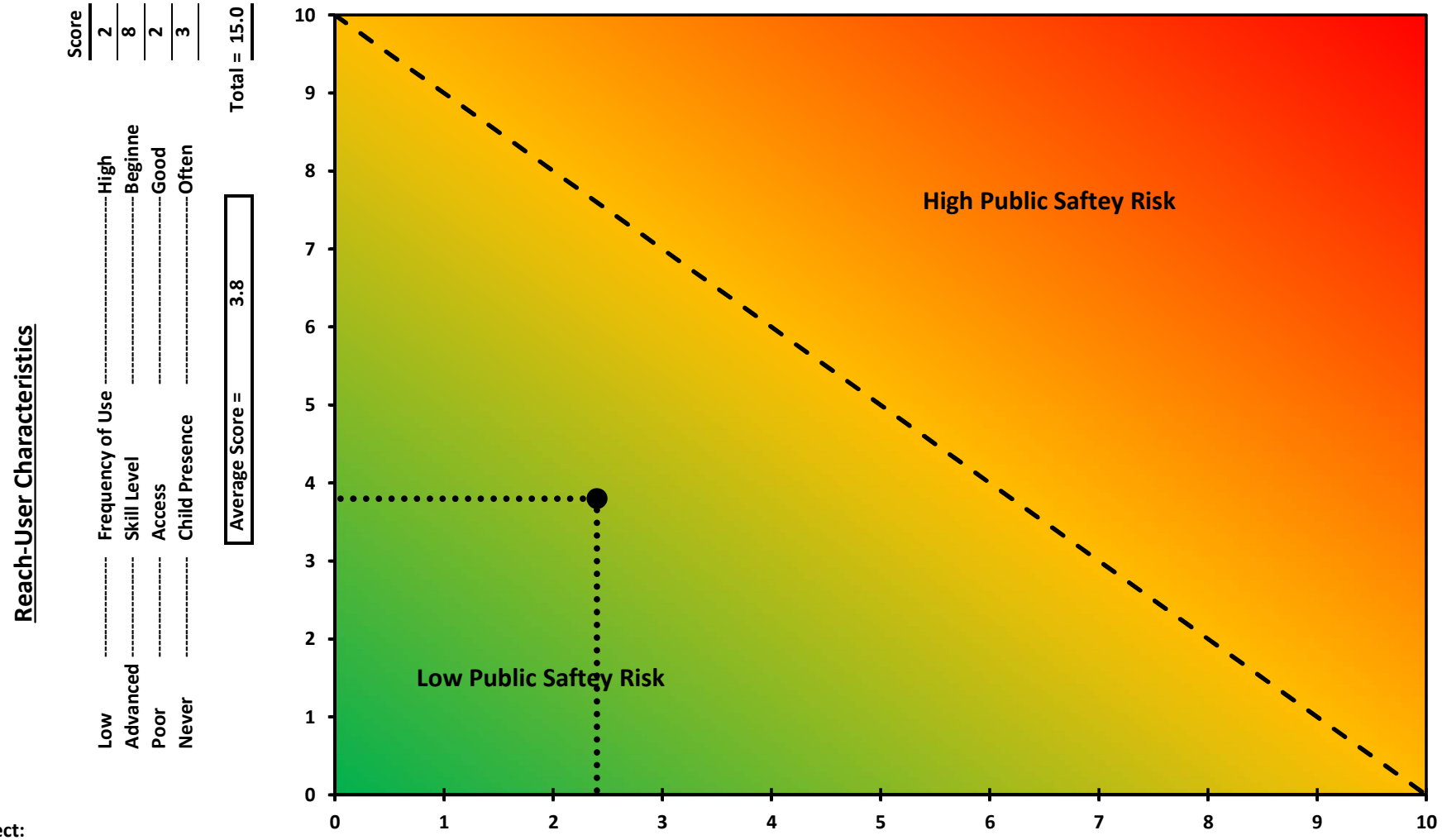
			Score
No	Active Channel?	Yes	7
No	Outside of Bend?	Yes	5
Low	Strainer Potential	High	6
High	Egress Potential	Low	4
High	Sight Distance	Low	8
Low	Depth x Velocity	High	6

Average Score = 6.0

Total Score = 36.0

Public Saftey Risk Matrix

Structure Location: Site 88



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

Structure Characteristics

			Score
No	Active Channel?	Yes	4
No	Outside of Bend?	Yes	1
Low	Strainer Potential	High	3
High	Egress Potential	Low	2
High	Sight Distance	Low	2
Low	Depth x Velocity	High	2

Average Score = 2.4

Total Score = 14.0

Public Saftey Risk Matrix

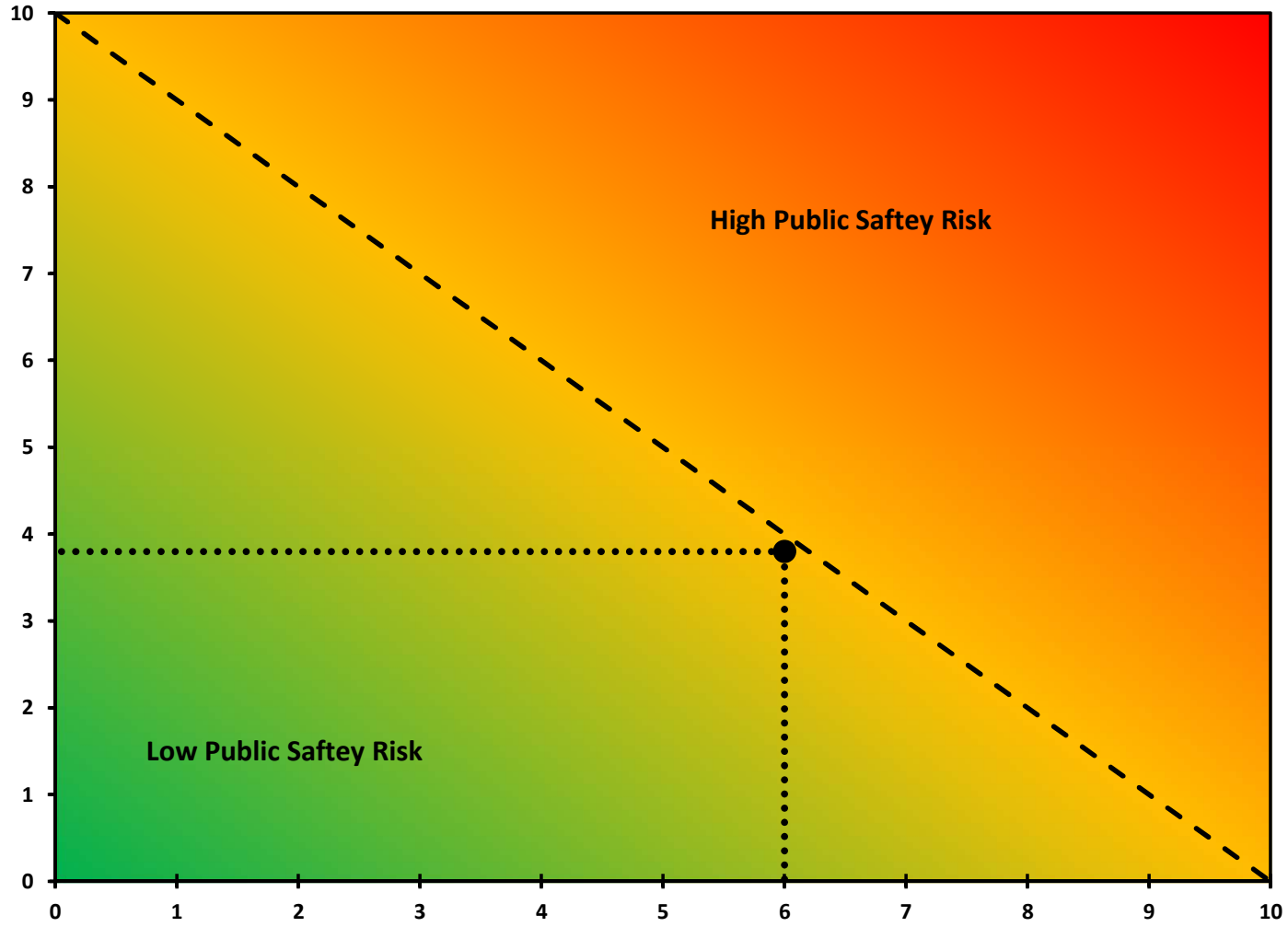
Structure Location: Site 89

Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8



Structure Characteristics

					Score
No	----------	Active Channel?	----------	Yes	6
No	----------	Outside of Bend?	----------	Yes	7
Low	----------	Strainer Potential	----------	High	7
High	----------	Egress Potential	----------	Low	4
High	----------	Sight Distance	----------	Low	5
Low	----------	Depth x Velocity	----------	High	7

Average Score = 6.0

Total Score = 36.0

Project:
CC-44

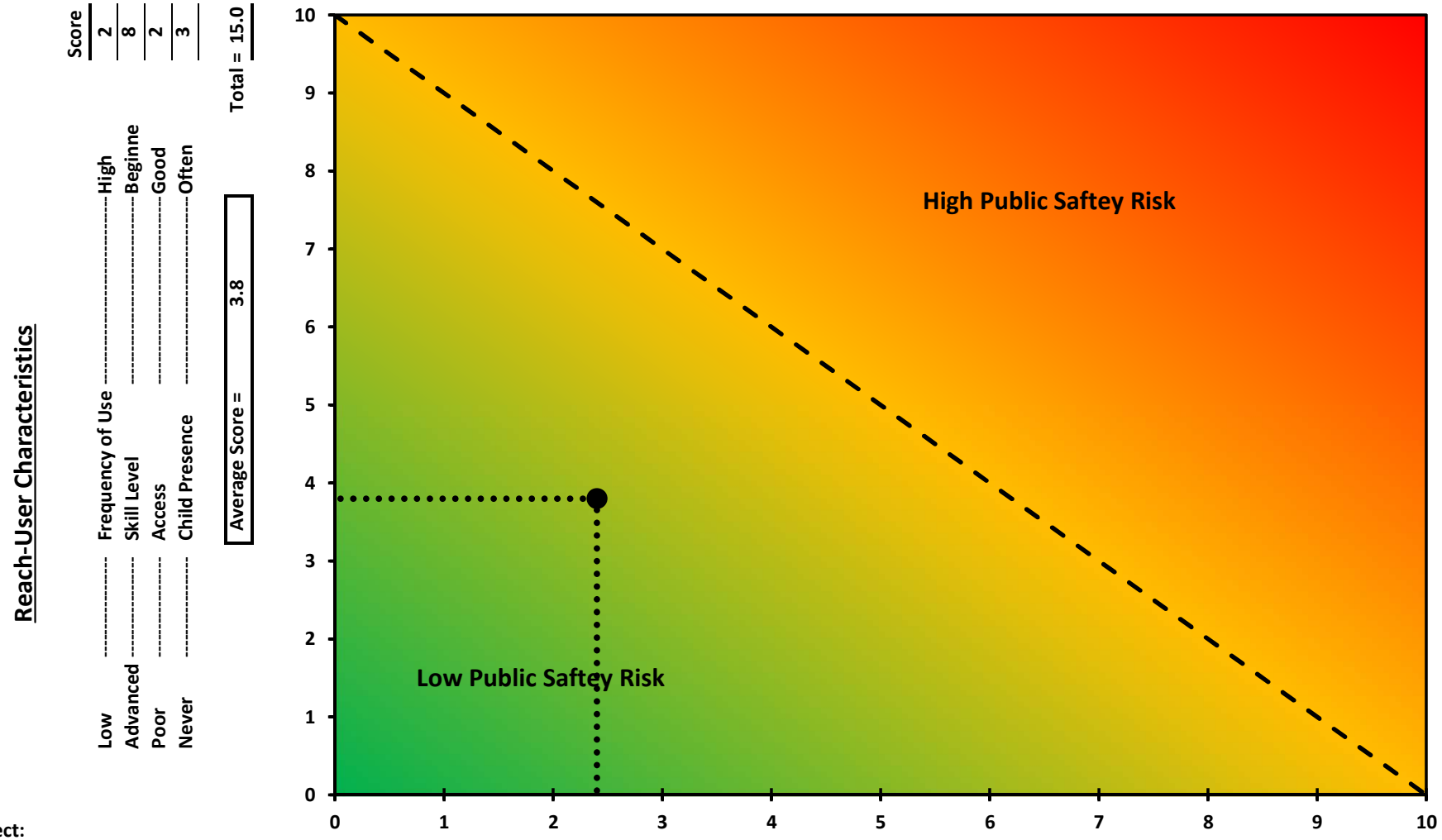
Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

Public Saftey Risk Matrix

Structure Location: Site 90



Reach-User Characteristics

			Score
Low	---------- Frequency of Use ----------	High	2
Advanced	---------- Skill Level ----------	Beginne	8
Poor	---------- Access ----------	Good	2
Never	---------- Child Presence ----------	Often	3

Total = 15.0

Average Score = 3.8

Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

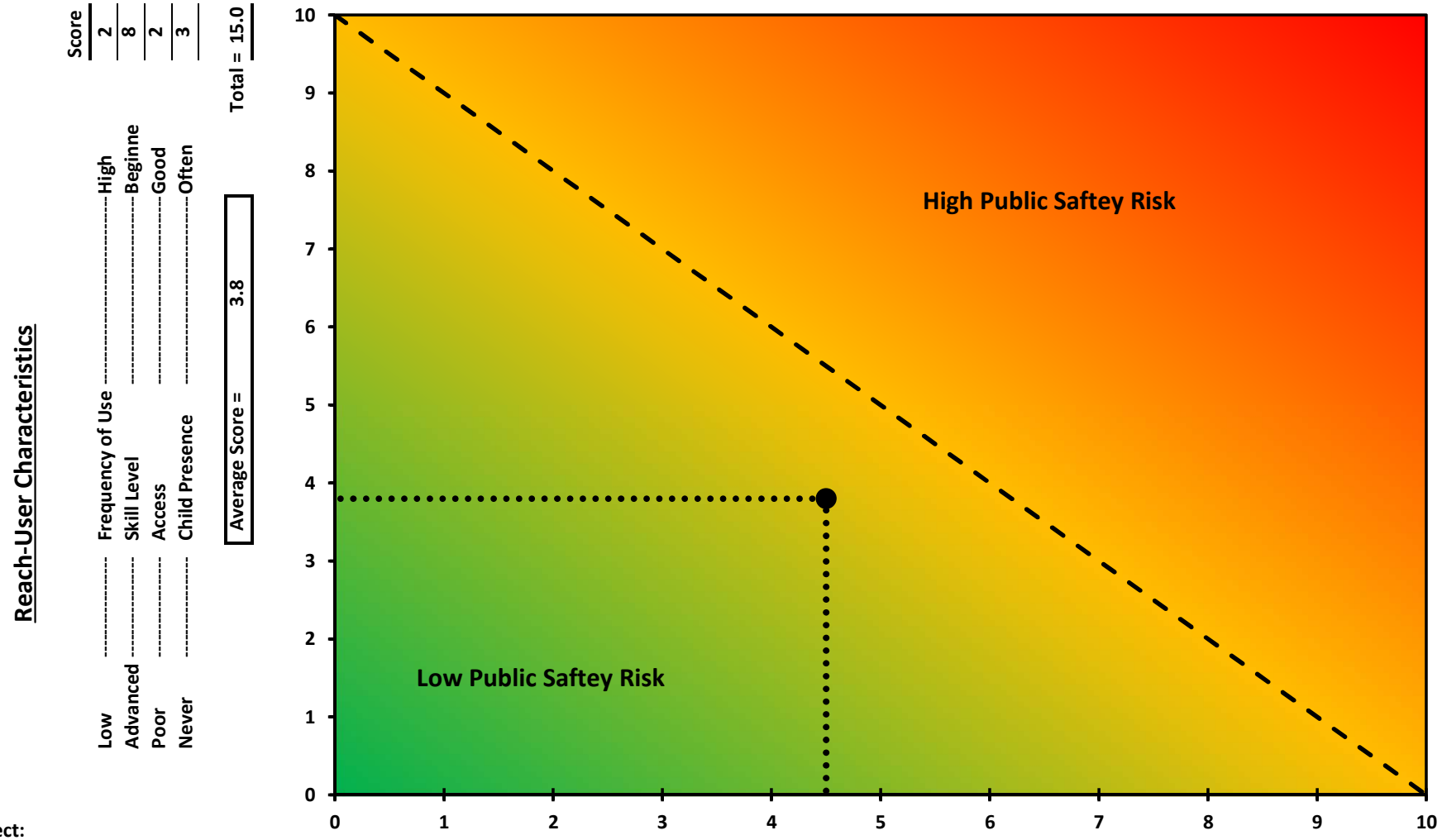
					Score
No	----------	Active Channel?	----------	Yes	4
No	----------	Outside of Bend?	----------	Yes	1
Low	----------	Strainer Potential	----------	High	3
High	----------	Egress Potential	----------	Low	2
High	----------	Sight Distance	----------	Low	2
Low	----------	Depth x Velocity	----------	High	2

Average Score = 2.4

Total Score = 14.0

Public Saftey Risk Matrix

Structure Location: Site 91



Reach-User Characteristics

			Score
Low	Frequency of Use	High	2
Advanced	Skill Level	Beginne	8
Poor	Access	Good	2
Never	Child Presence	Often	3

Total = 15.0

Average Score = 3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

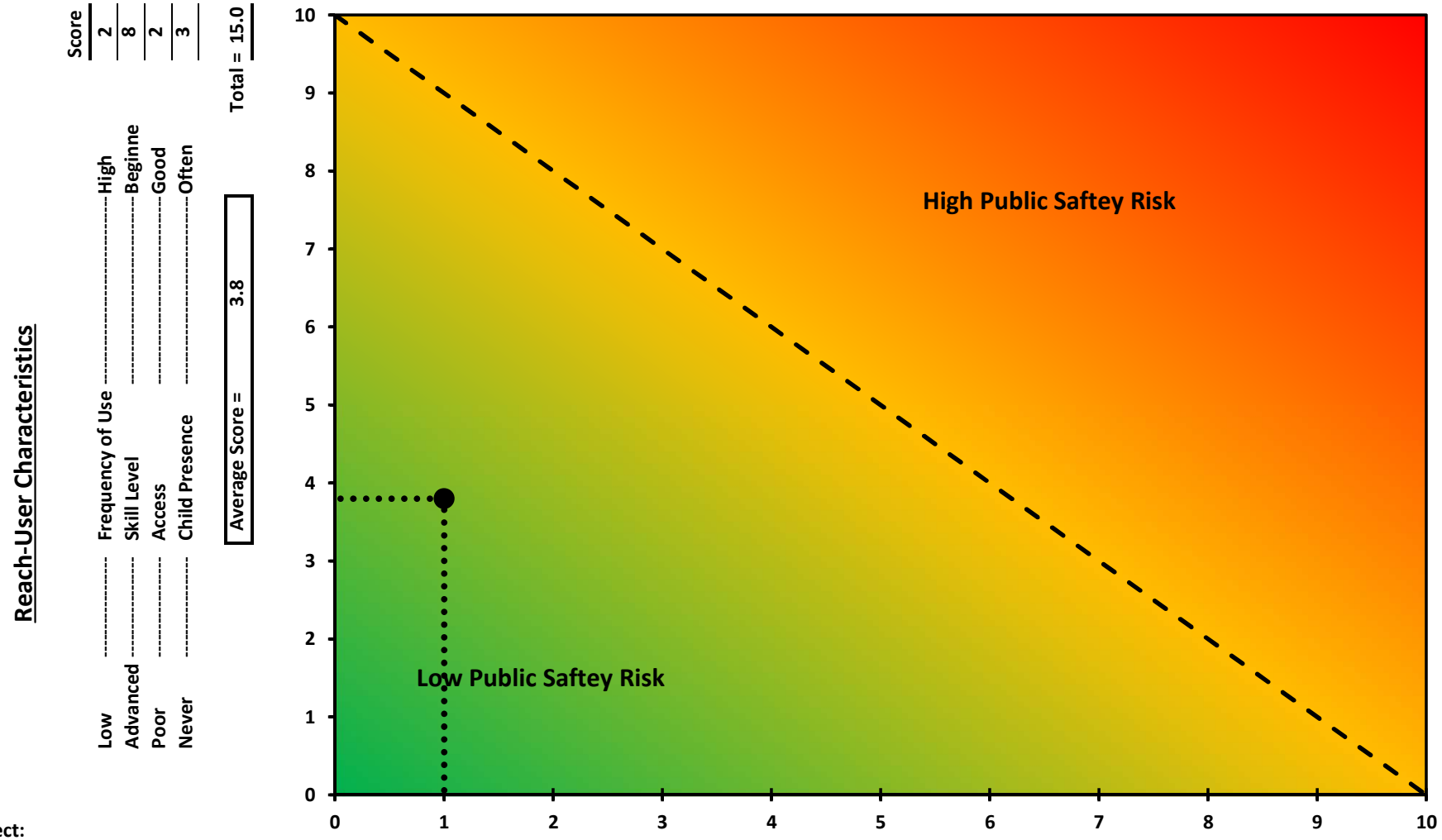
					Score
No	Active Channel?	Yes	3
No	Outside of Bend?	Yes	5
Low	Strainer Potential	High	7
High	Egress Potential	Low	2
High	Sight Distance	Low	8
Low	Depth x Velocity	High	2

Average Score = 4.5

Total Score = 27.0

Public Saftey Risk Matrix

Structure Location: Site 92



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginne	8
Access	Poor	Good	2
Child Presence	Never	Often	3

Total = 15.0

Average Score = 3.8

Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

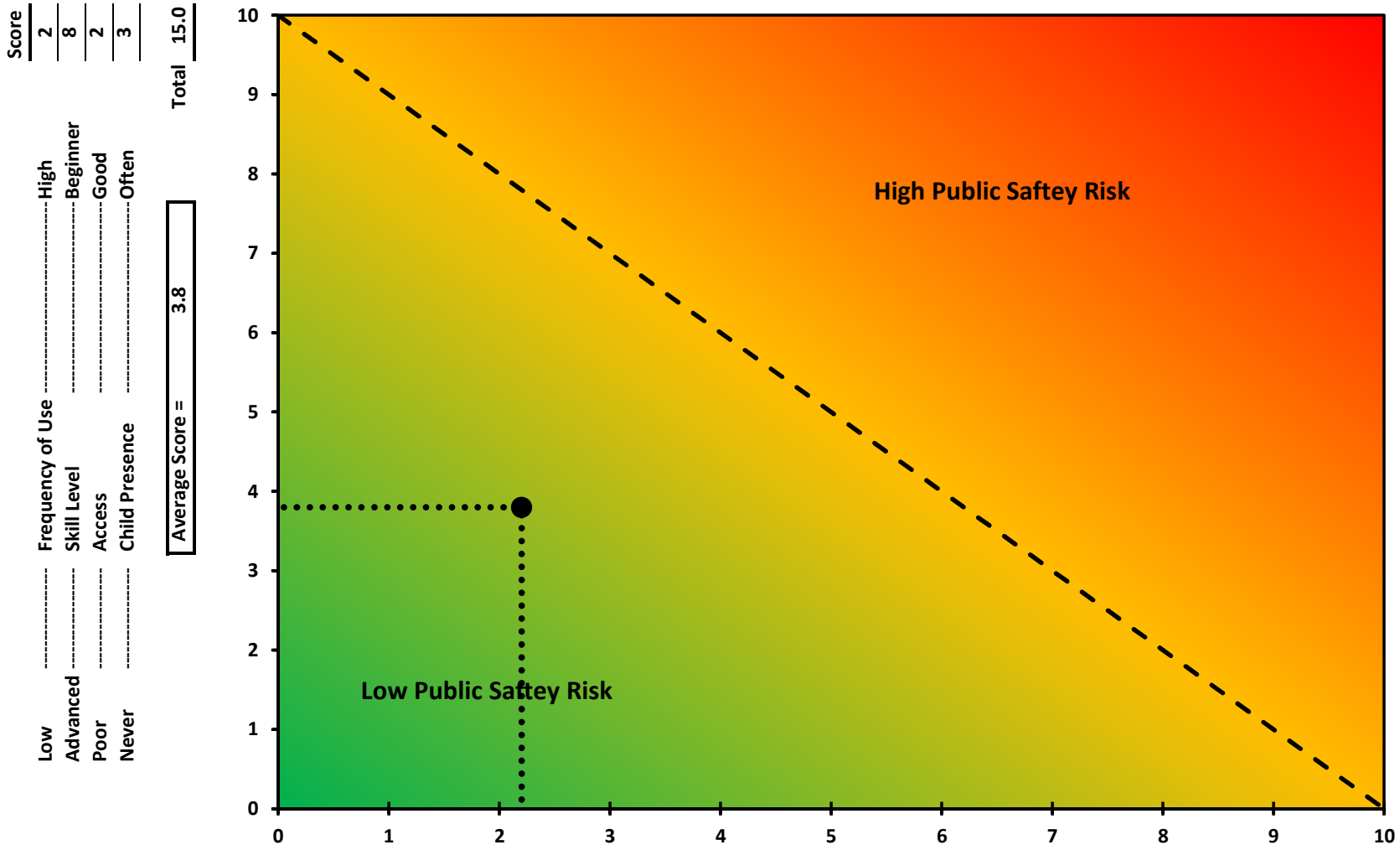
					Score
No	Active Channel?	Yes	1
No	Outside of Bend?	Yes	1
Low	Strainer Potential	High	1
High	Egress Potential	Low	1
High	Sight Distance	Low	1
Low	Depth x Velocity	High	1

Average Score = 1.0

Total Score = 6.0

Public Saftey Risk Matrix

Structure Location: Site 93



Reach-User Characteristics

			Score
Low	Frequency of Use	High	2
Advanced	Skill Level	Beginner	8
Poor	Access	Good	2
Never	Child Presence	Often	3
		Total	15.0
		Average Score =	3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

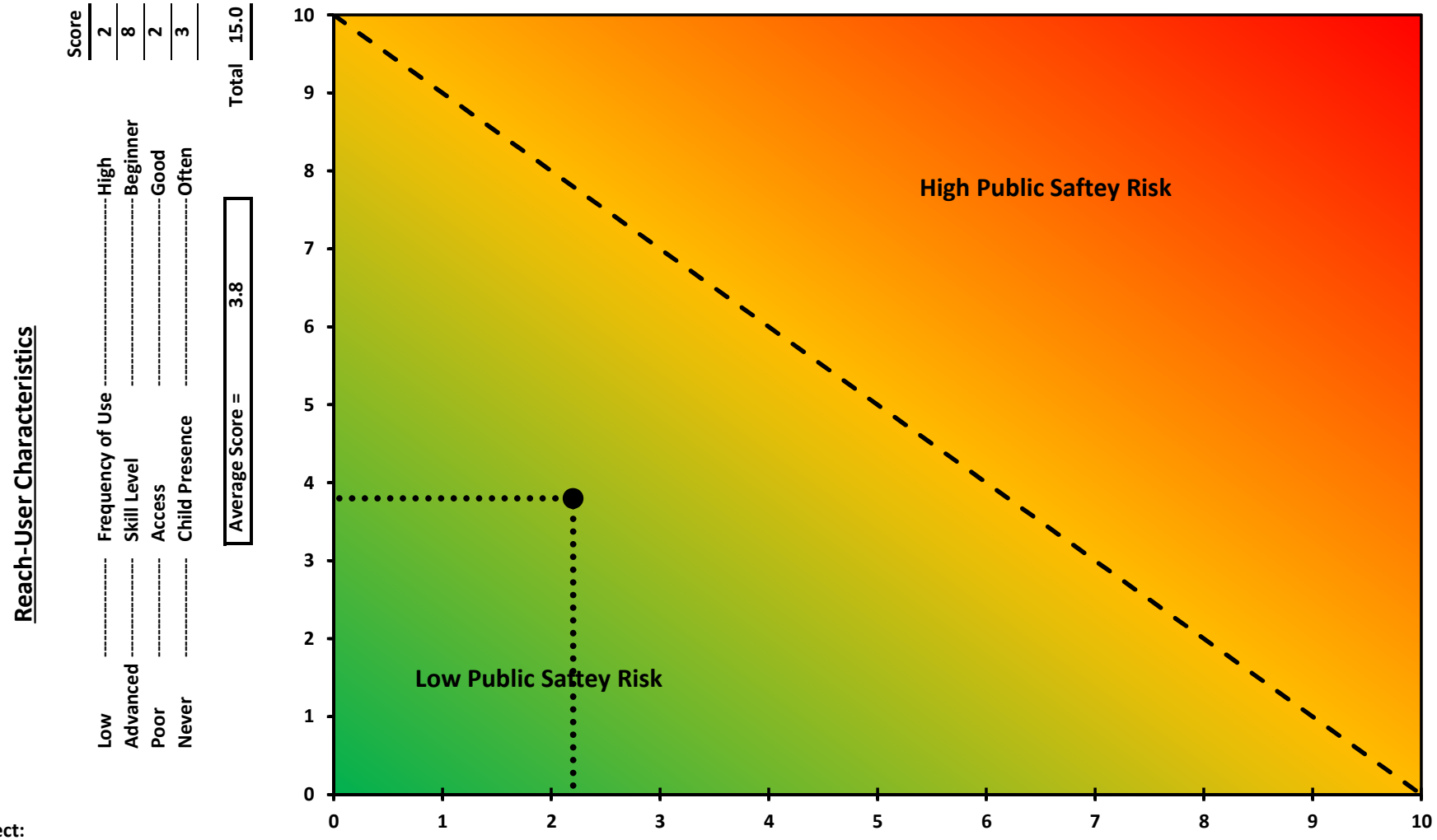
Date: 3/31/2015

Structure Characteristics

					Score
No	----------	Active Channel?	----------	Yes	2
No	----------	Outside of Bend?	----------	Yes	3
Low	----------	Strainer Potential	----------	High	2
High	----------	Egress Potential	----------	Low	1
High	----------	Sight Distance	----------	Low	3
Low	----------	Depth x Velocity	----------	High	2
			Average Score =	2.2	Total Score = 13.0

Public Saftey Risk Matrix

Structure Location: Site 94



Reach-User Characteristics

			Score
Low	Frequency of Use	High	2
Advanced	Skill Level	Beginner	8
Poor	Access	Good	2
Never	Child Presence	Often	3
		Total	15.0
		Average Score =	3.8

Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

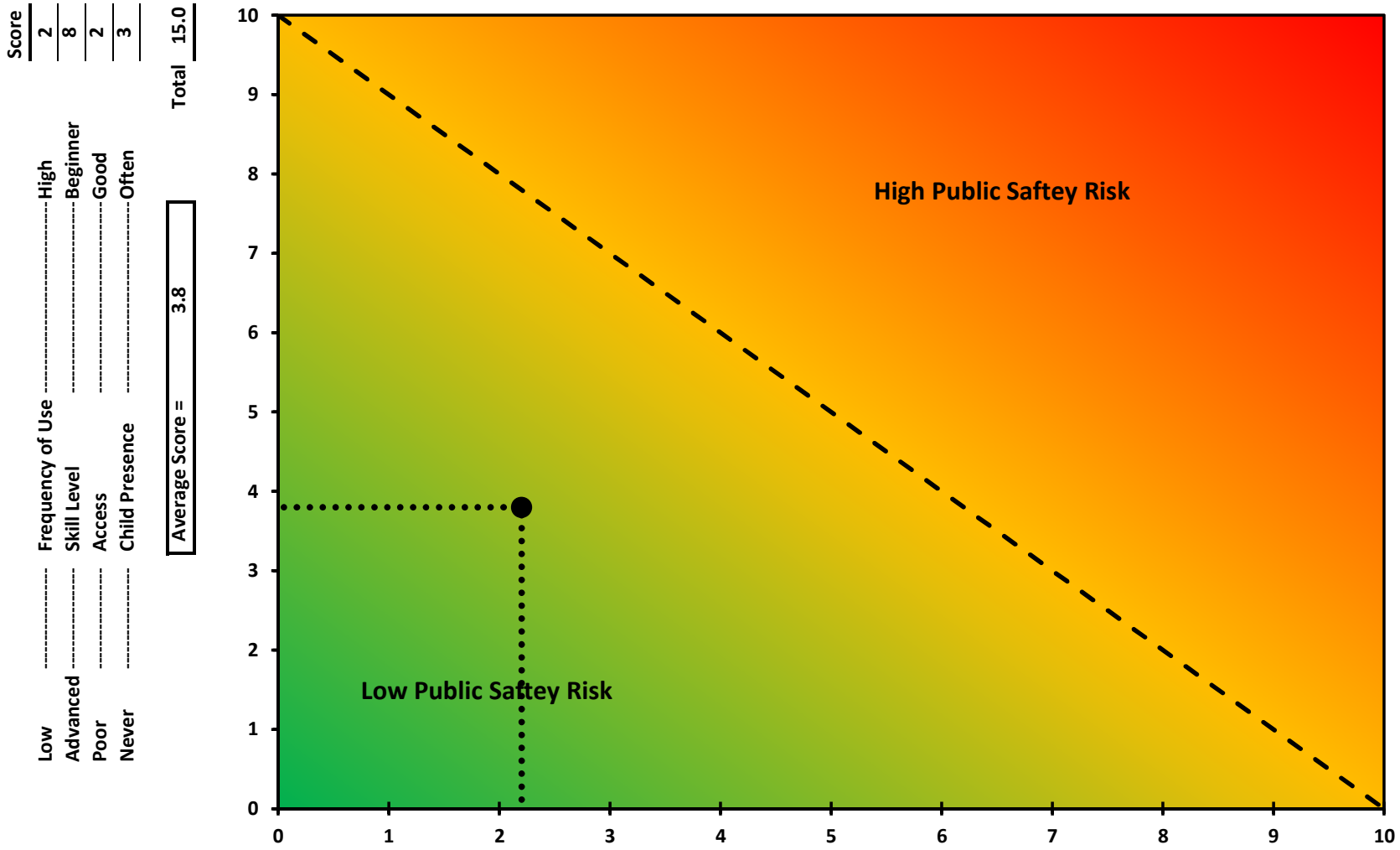
Date:
3/31/2015

Structure Characteristics

			Score
No	Active Channel?	Yes	2
No	Outside of Bend?	Yes	3
Low	Strainer Potential	High	2
High	Egress Potential	Low	1
High	Sight Distance	Low	3
Low	Depth x Velocity	High	2
	Average Score =	2.2	
	Total Score =		13.0

Public Saftey Risk Matrix

Structure Location: Site 95



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginner	8
Access	Poor	Good	2
Child Presence	Never	Often	3
		Total	15.0
		Average Score =	3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

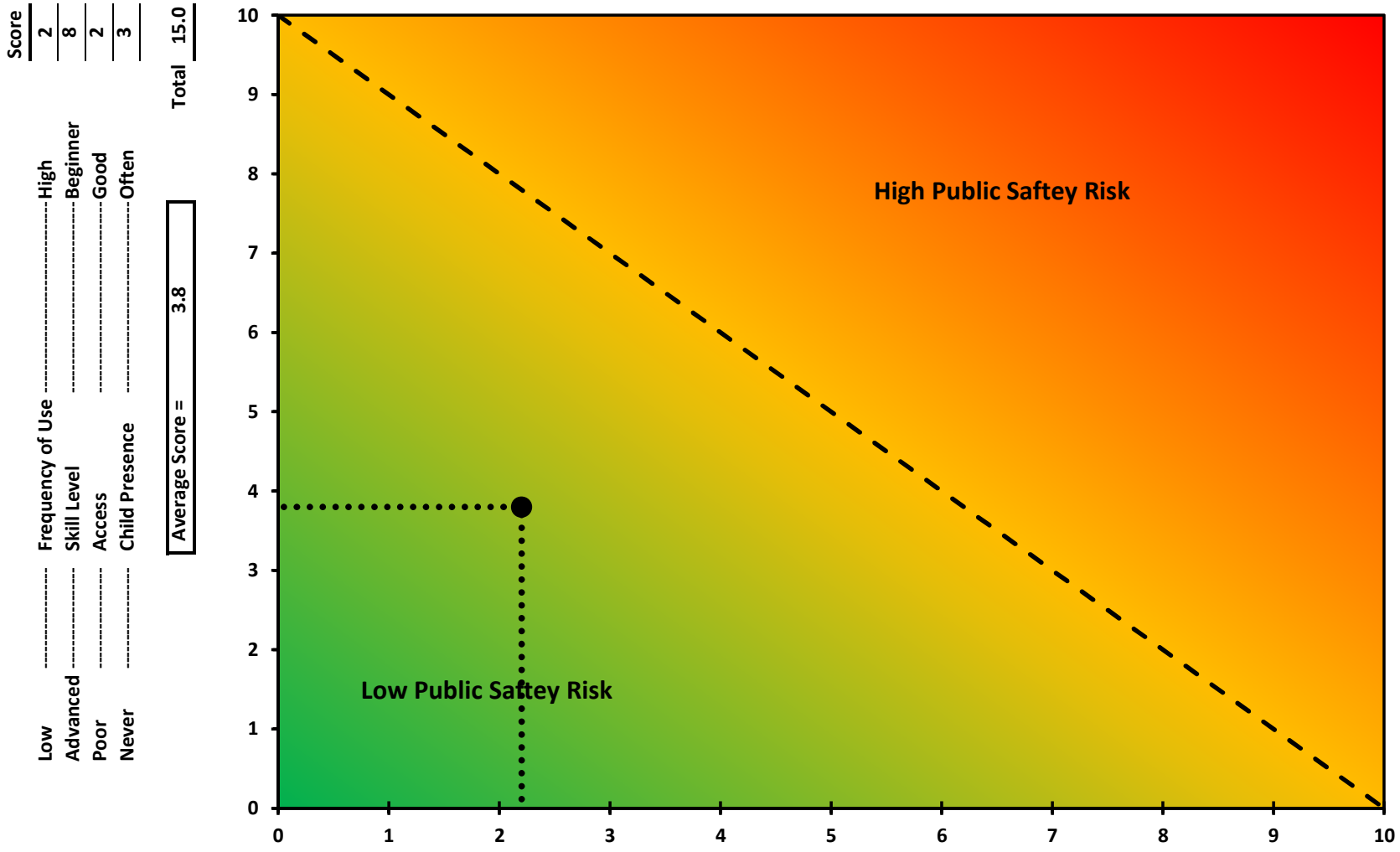
Date: 3/31/2015

Structure Characteristics

			Score
No	Active Channel?	Yes	2
No	Outside of Bend?	Yes	3
Low	Strainer Potential	High	2
High	Egress Potential	Low	1
High	Sight Distance	Low	3
Low	Depth x Velocity	High	2
	Average Score =	2.2	Total Score = 13.0

Public Saftey Risk Matrix

Structure Location: Site 96



Reach-User Characteristics

			Score
Low	Frequency of Use	High	2
Advanced	Skill Level	Beginner	8
Poor	Access	Good	2
Never	Child Presence	Often	3
		Total	15.0
		Average Score =	3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

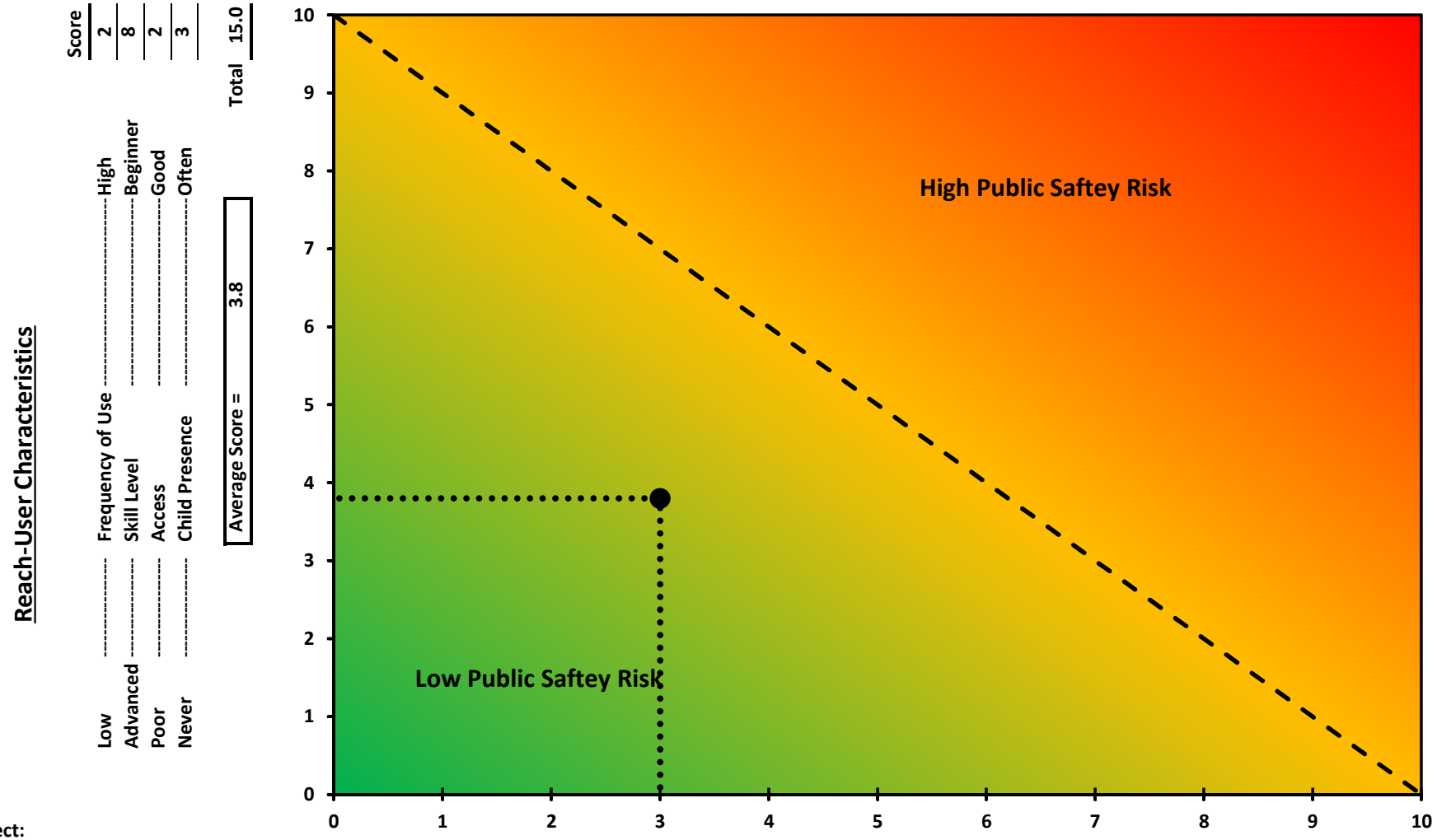
Date: 3/31/2015

Structure Characteristics

			Score
No	Active Channel?	Yes	2
No	Outside of Bend?	Yes	3
Low	Strainer Potential	High	2
High	Egress Potential	Low	1
High	Sight Distance	Low	3
Low	Depth x Velocity	High	2
	Average Score =	2.2	Total Score = 13.0

Public Saftey Risk Matrix

Structure Location: Site 97



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginner	8
Access	Poor	Good	2
Child Presence	Never	Often	3
		Total	15.0
		Average Score =	3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

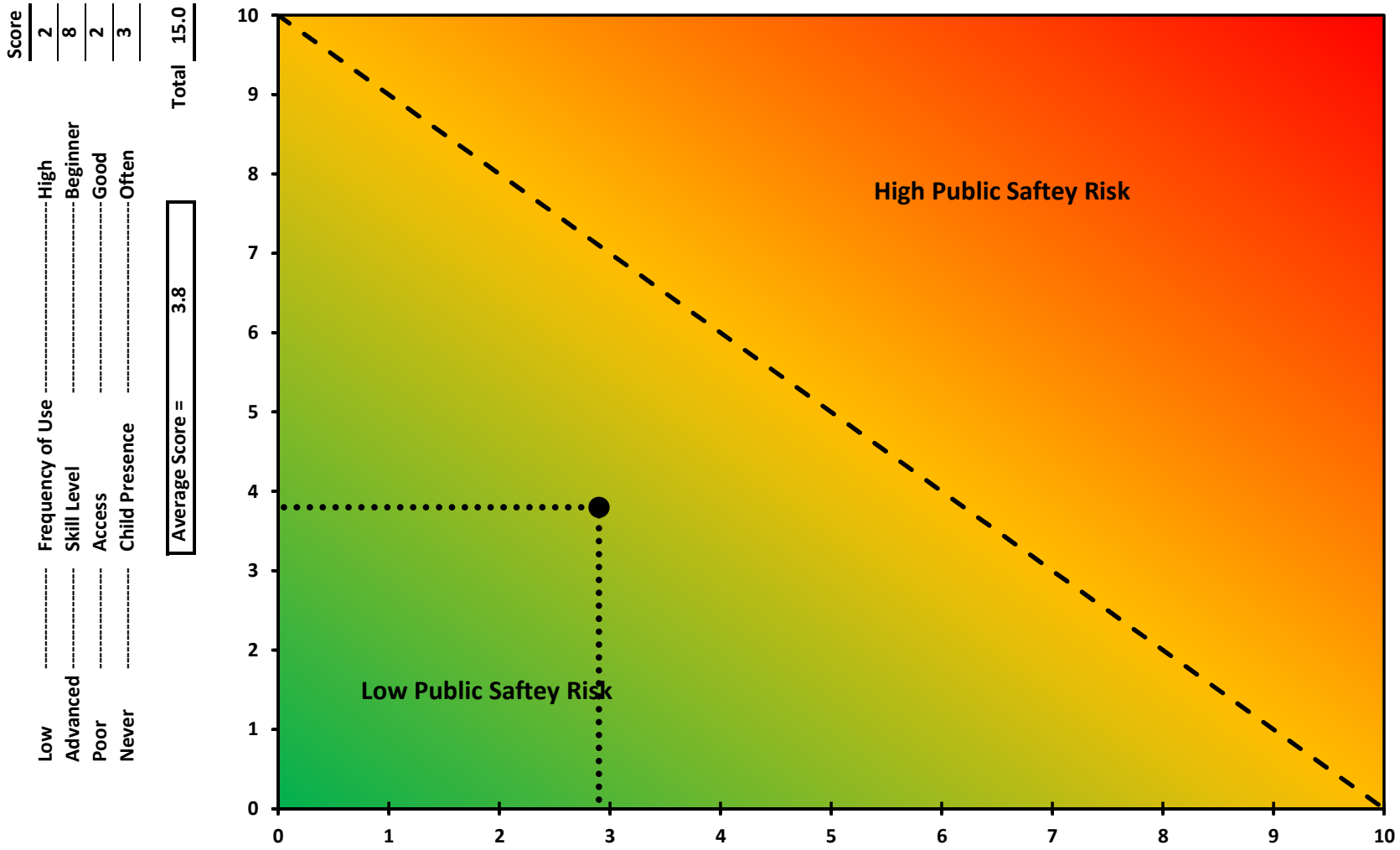
Date: 3/31/2015

Structure Characteristics

			Score
No	Active Channel?	Yes	2
No	Outside of Bend?	Yes	7
Low	Strainer Potential	High	2
High	Egress Potential	Low	2
High	Sight Distance	Low	3
Low	Depth x Velocity	High	2
	Average Score =	3.0	
	Total Score =		18.0

Public Saftey Risk Matrix

Structure Location: Site 98



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginner	8
Access	Poor	Good	2
Child Presence	Never	Often	3
		Total	15.0
		Average Score =	3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

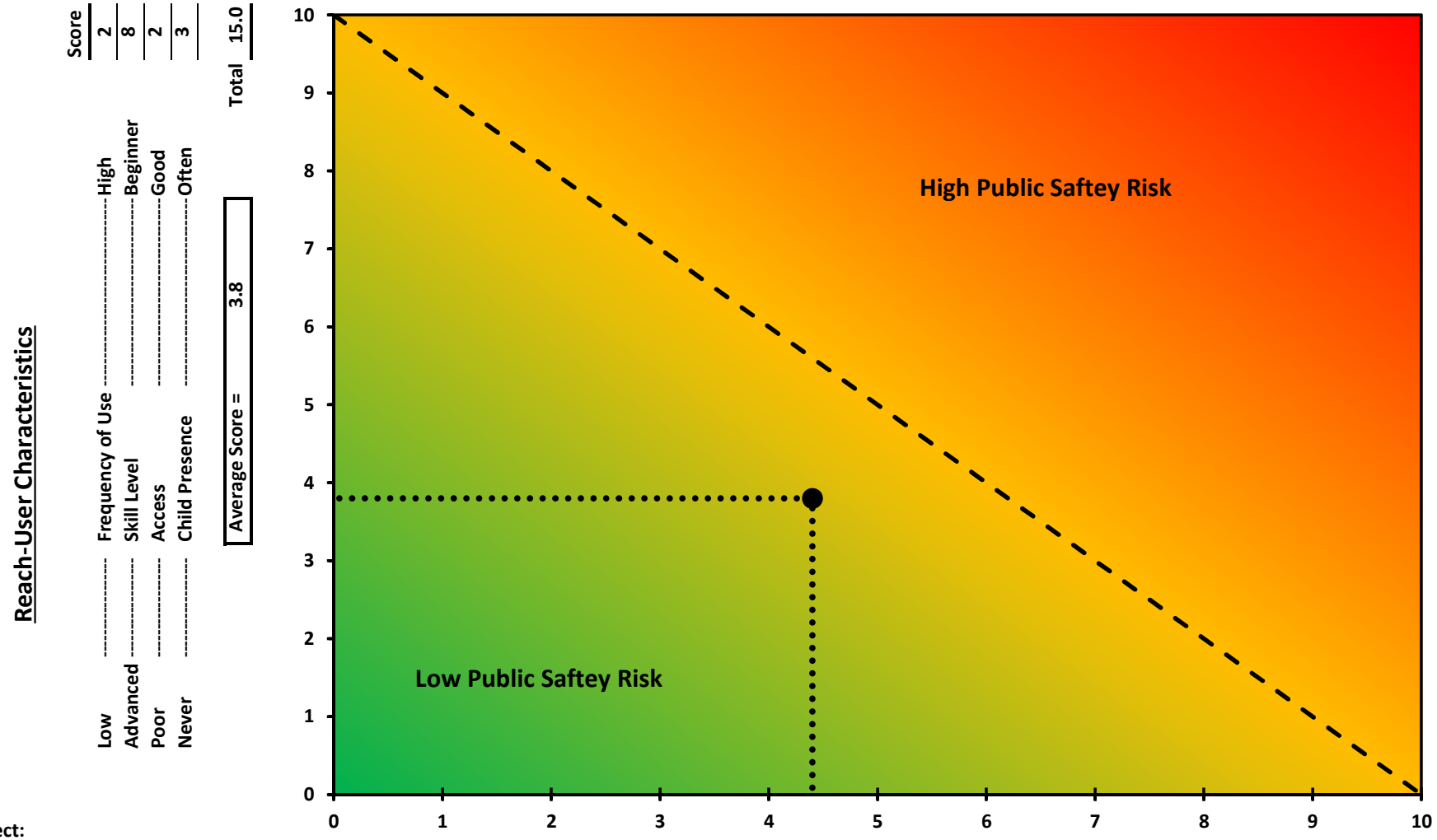
Date: 3/31/2015

Structure Characteristics

			Score
No	Active Channel?	Yes	5
No	Outside of Bend?	Yes	3
Low	Strainer Potential	High	2
High	Egress Potential	Low	2
High	Sight Distance	Low	3
Low	Depth x Velocity	High	2
	Average Score =	2.9	Total Score = 17.0

Public Saftey Risk Matrix

Structure Location: Site 99



Reach-User Characteristics

			Score
Low	----------	High	2
Advanced	----------	Beginner	8
Poor	----------	Good	2
Never	----------	Often	3
		Total	15.0
		Average Score =	3.8

Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

Structure Characteristics

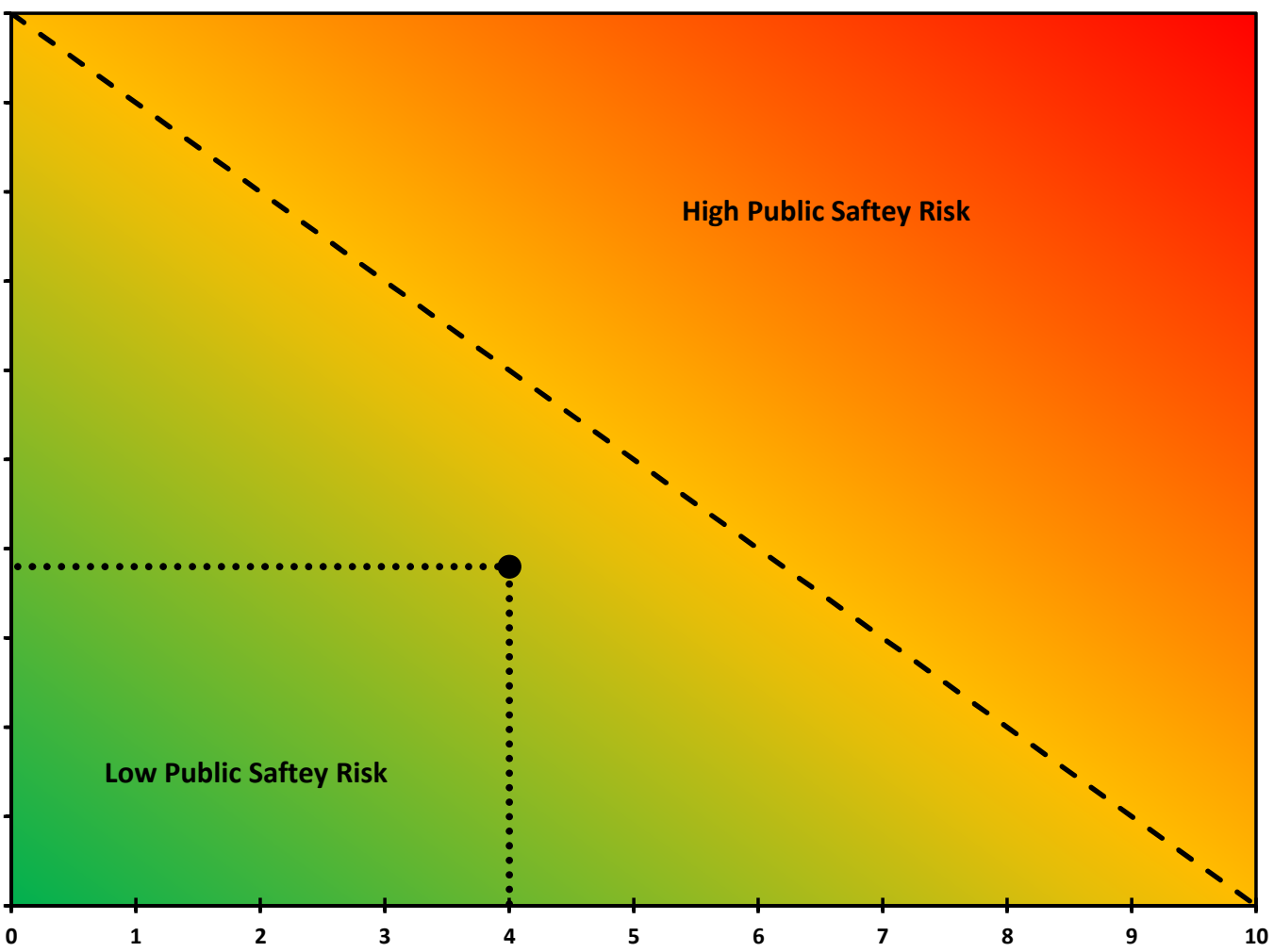
					Score
No	----------	Active Channel?	----------	Yes	5
No	----------	Outside of Bend?	----------	Yes	7
Low	----------	Strainer Potential	----------	High	4
High	----------	Egress Potential	----------	Low	5
High	----------	Sight Distance	----------	Low	3
Low	----------	Depth x Velocity	----------	High	2
		Average Score =	4.4	Total Score =	26.0

Public Saftey Risk Matrix

Structure Location: Site 100

Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginner	8
Access	Poor	Good	2
Child Presence	Never	Often	3
		Total	15.0
		Average Score =	3.8



Structure Characteristics

					Score
No	----------	Active Channel?	----------	Yes	5
No	----------	Outside of Bend?	----------	Yes	7
Low	----------	Strainer Potential	----------	High	4
High	----------	Egress Potential	----------	Low	3
High	----------	Sight Distance	----------	Low	3
Low	----------	Depth x Velocity	----------	High	2
			Average Score =	4.0	Total Score = 24.0

Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

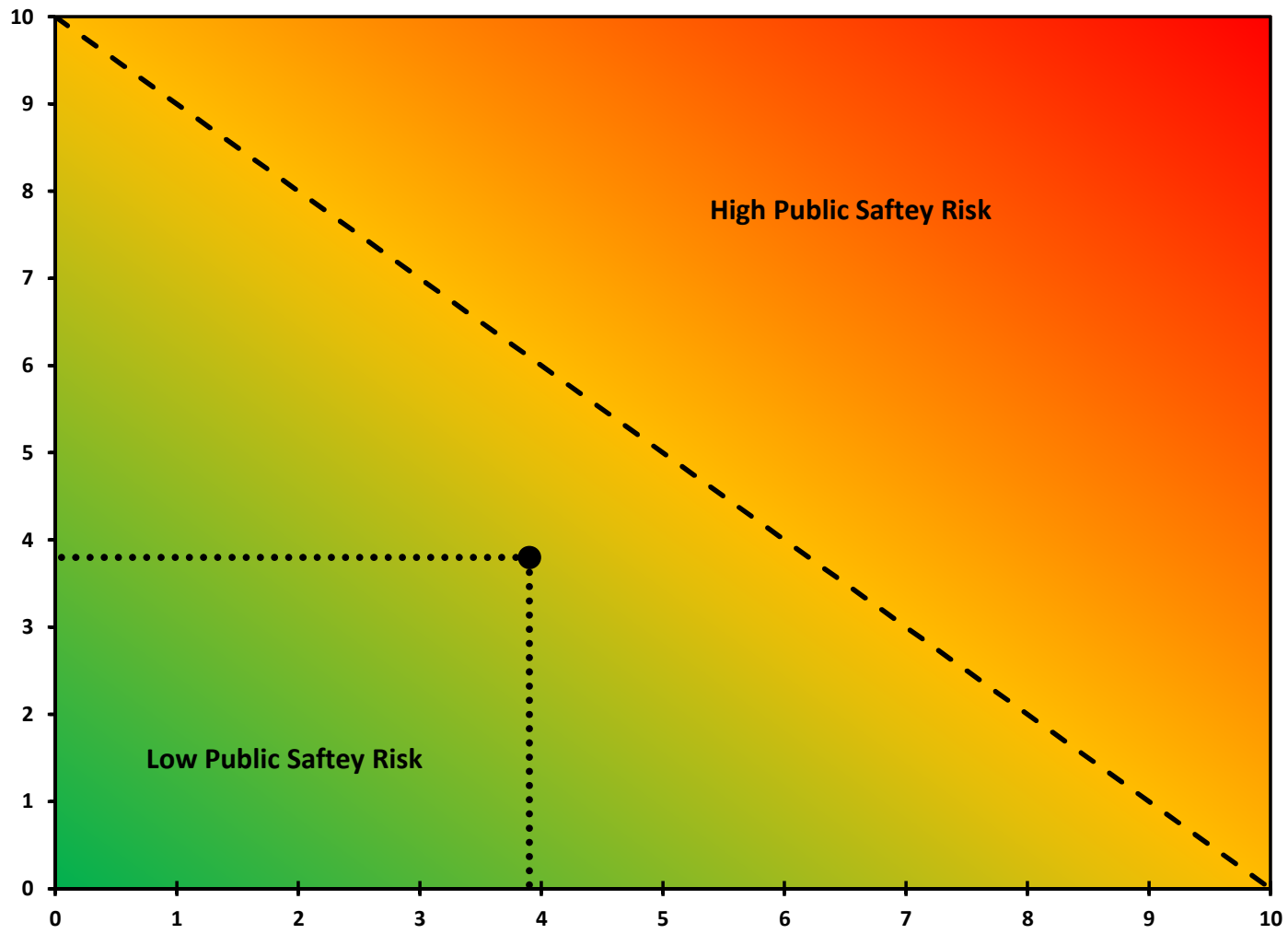
Date:
3/31/2015

Public Saftey Risk Matrix

Structure Location: Site 101

Reach-User Characteristics

			Score
Frequency of Use	High	Low	2
Skill Level	Beginner	Advanced	8
Access	Good	Poor	2
Child Presence	Often	Never	3
		Total	15.0
		Average Score =	3.8



Structure Characteristics

					Score
No	----------	Active Channel?	----------	Yes	5
No	----------	Outside of Bend?	----------	Yes	3
Low	----------	Strainer Potential	----------	High	4
High	----------	Egress Potential	----------	Low	3
High	----------	Sight Distance	----------	Low	6
Low	----------	Depth x Velocity	----------	High	2
			Average Score =	3.9	Total Score = 23.0

Project:
CC-44

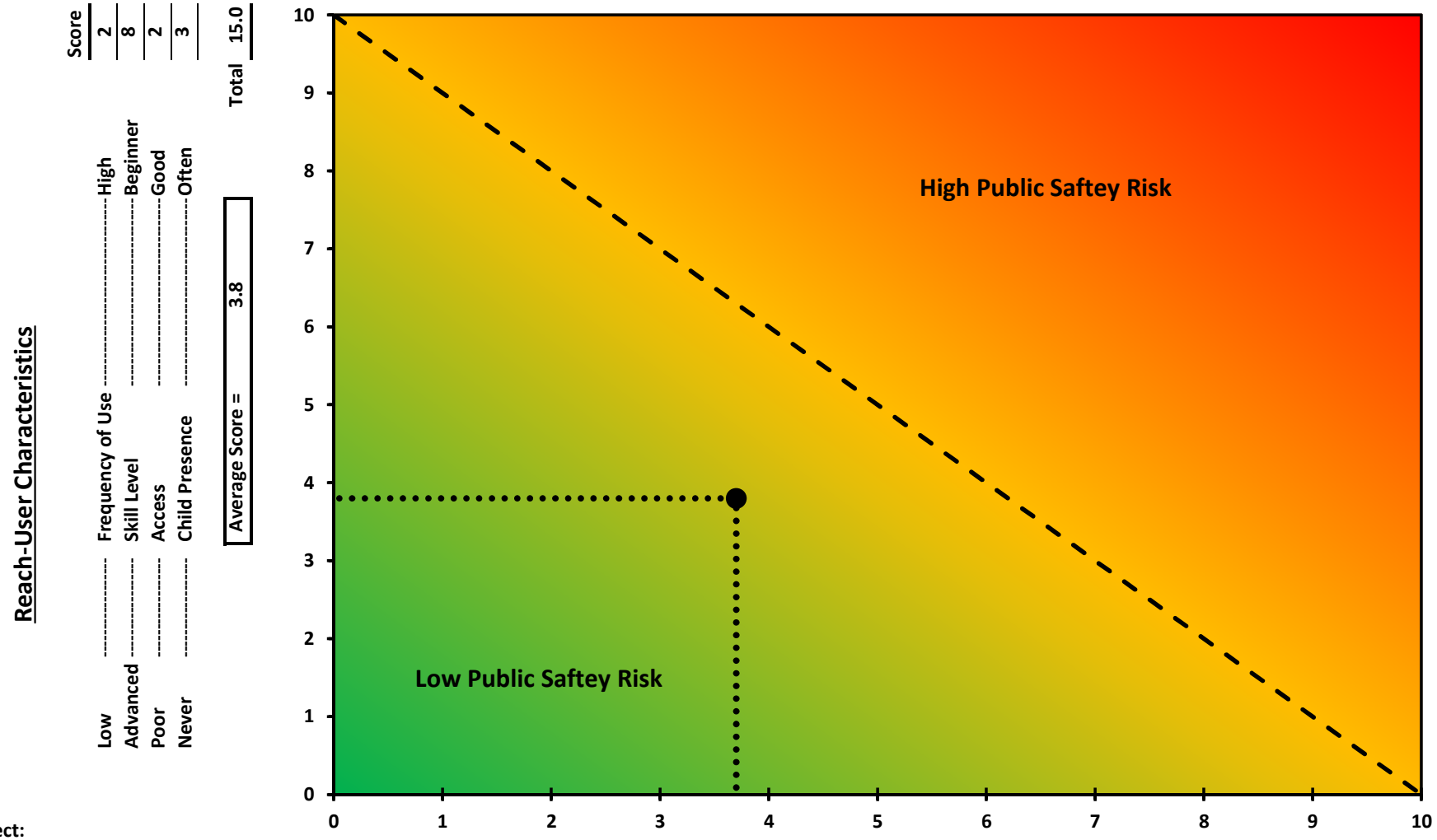
Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

Public Saftey Risk Matrix

Structure Location: Site 102



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginner	8
Access	Poor	Good	2
Child Presence	Never	Often	3
		Total	15.0
		Average Score =	3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

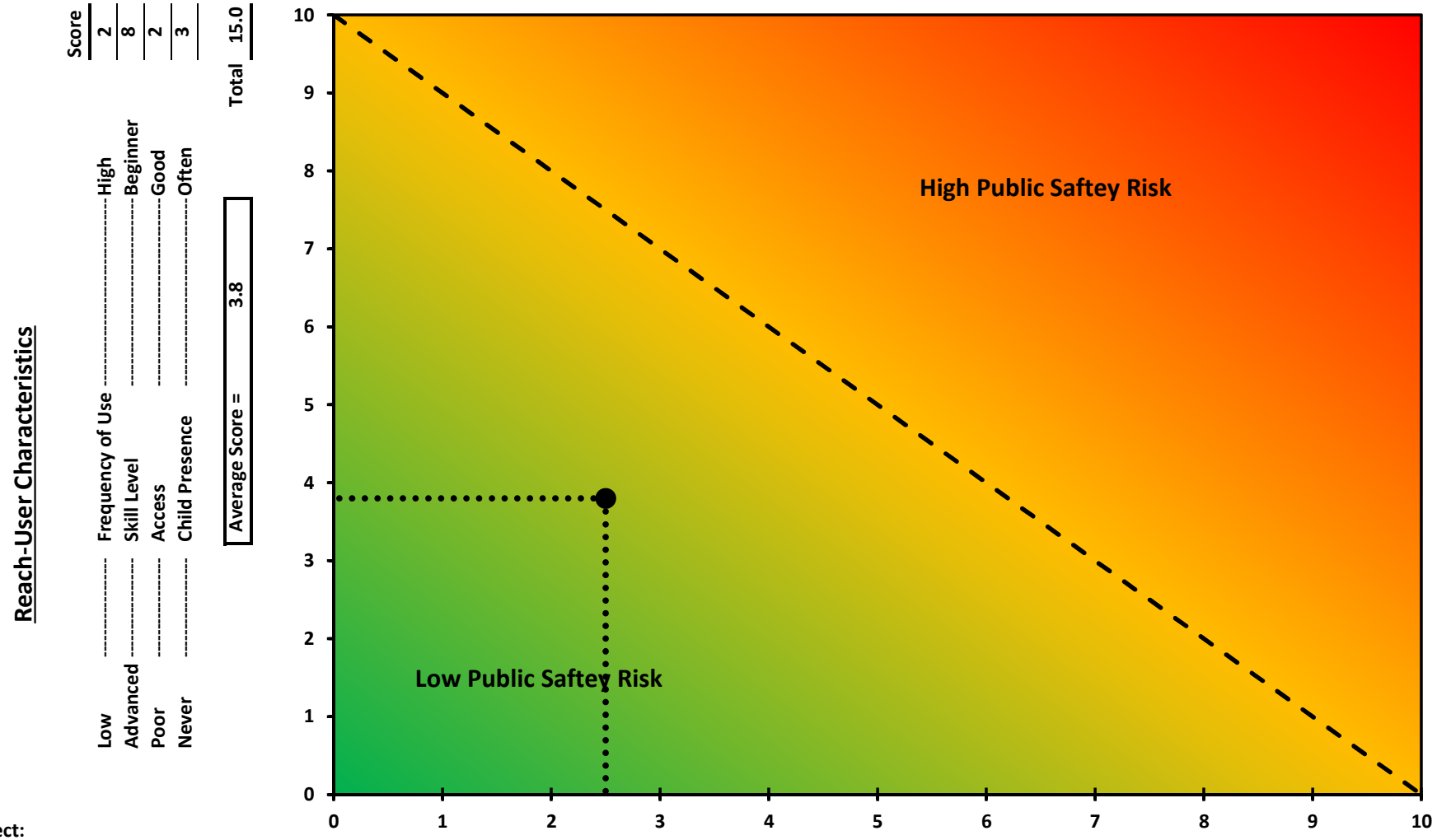
Date: 3/31/2015

Structure Characteristics

			Score
No	Active Channel?	Yes	5
No	Outside of Bend?	Yes	4
Low	Strainer Potential	High	4
High	Egress Potential	Low	3
High	Sight Distance	Low	4
Low	Depth x Velocity	High	2
	Average Score =	3.7	
	Total Score =		22.0

Public Saftey Risk Matrix

Structure Location: Site 103



Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

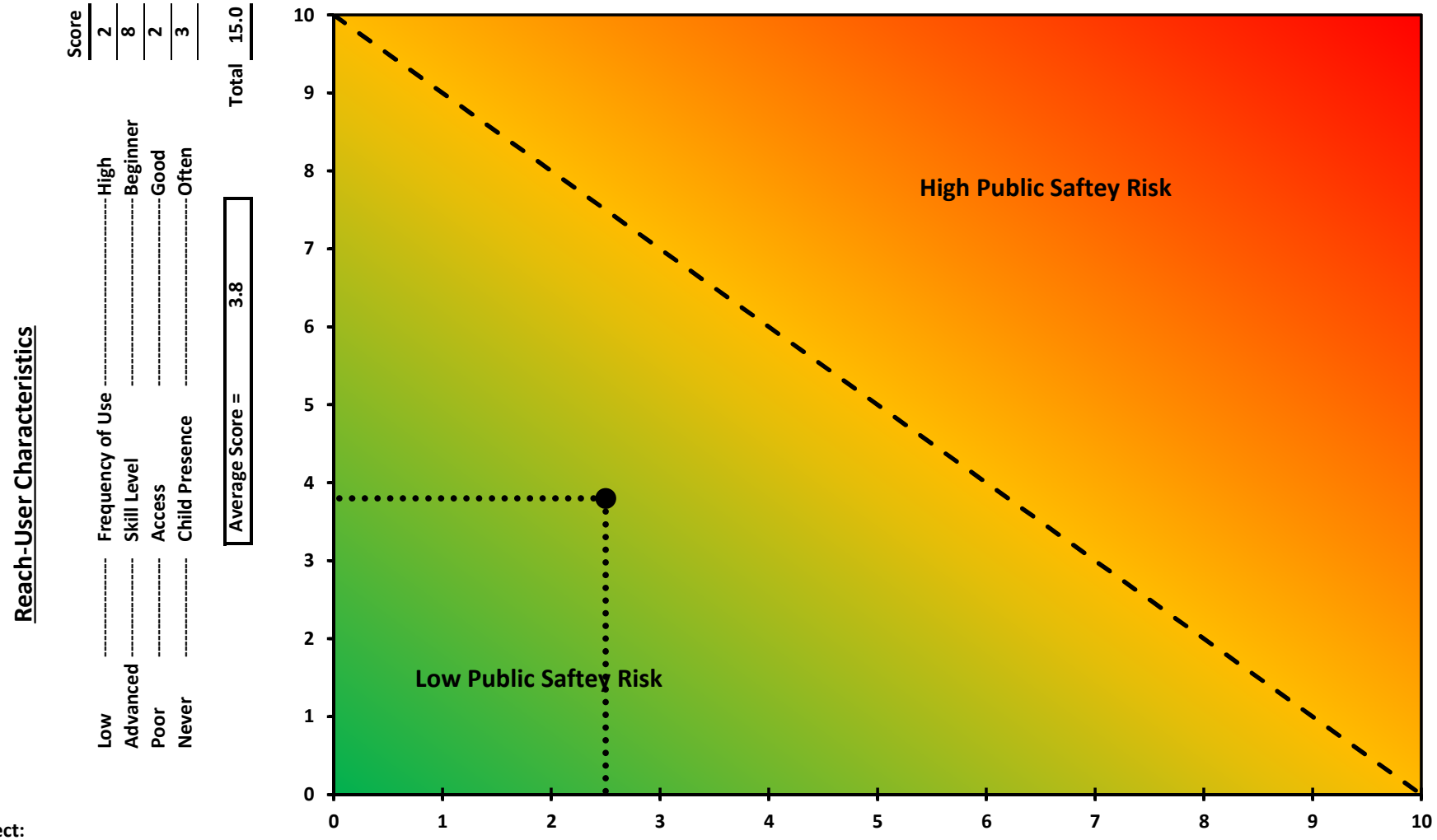
					Score
No	----------	Active Channel?	----------	Yes	3
No	----------	Outside of Bend?	----------	Yes	3
Low	----------	Strainer Potential	----------	High	2
High	----------	Egress Potential	----------	Low	3
High	----------	Sight Distance	----------	Low	2
Low	----------	Depth x Velocity	----------	High	2

Average Score = 2.5

Total Score = 15.0

Public Saftey Risk Matrix

Structure Location: Site 104



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginner	8
Access	Poor	Good	2
Child Presence	Never	Often	3
		Total	15.0
		Average Score =	3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

Structure Characteristics

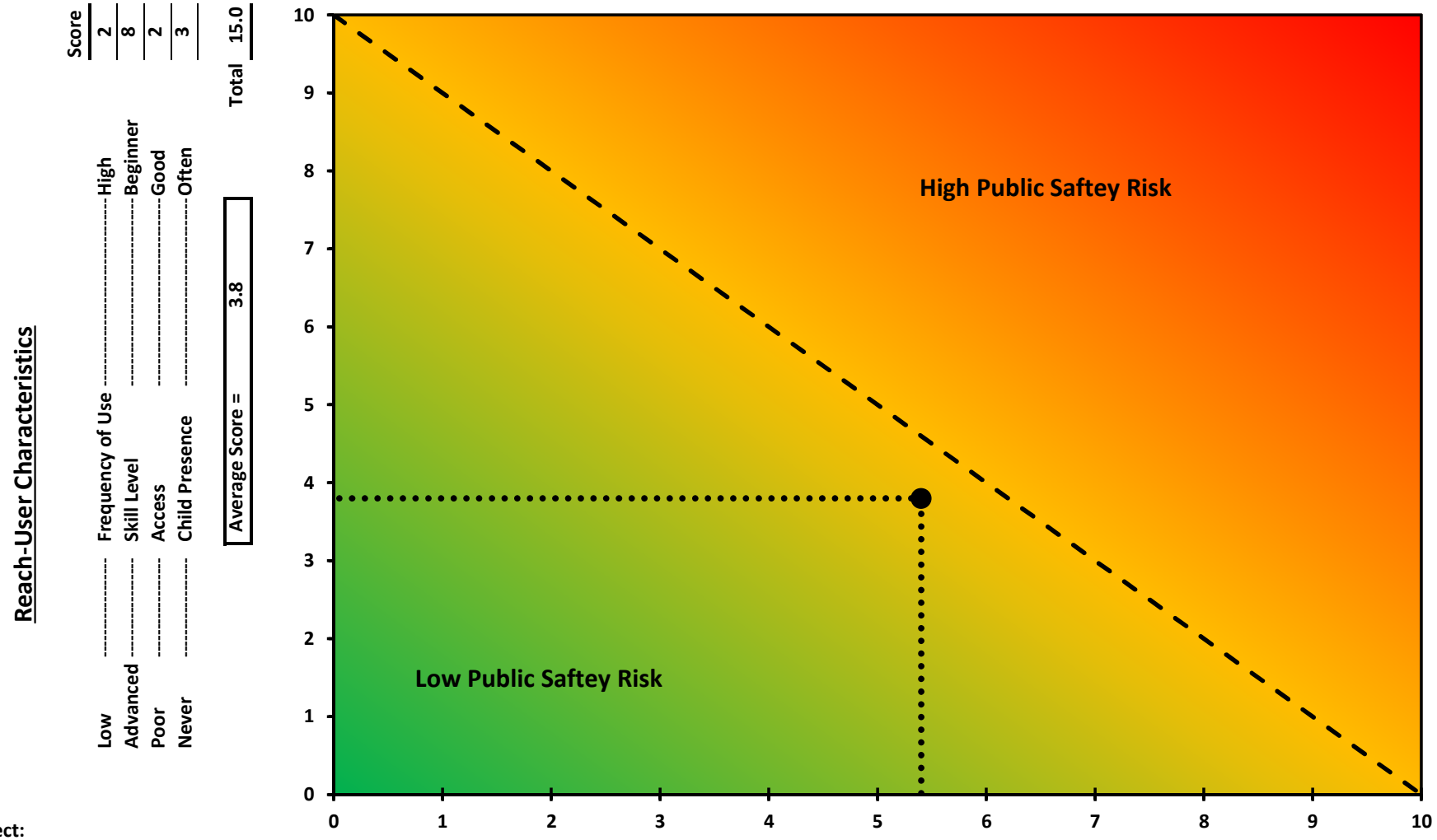
			Score
No	Active Channel?	Yes	3
No	Outside of Bend?	Yes	3
Low	Strainer Potential	High	2
High	Egress Potential	Low	3
High	Sight Distance	Low	2
Low	Depth x Velocity	High	2

Average Score = 2.5

Total Score = 15.0

Public Saftey Risk Matrix

Structure Location: Site 105



Reach-User Characteristics

			Score
Low	---------- Frequency of Use ----------	High	2
Advanced	---------- Skill Level ----------	Beginner	8
Poor	---------- Access ----------	Good	2
Never	---------- Child Presence ----------	Often	3

Total 15.0

Average Score = 3.8

					Score
No	----------	Active Channel?	----------	Yes	6
No	----------	Outside of Bend?	----------	Yes	7
Low	----------	Strainer Potential	----------	High	4
High	----------	Egress Potential	----------	Low	5
High	----------	Sight Distance	----------	Low	4
Low	----------	Depth x Velocity	----------	High	6

Average Score = 5.4

Total Score = 32.0

Project:
CC-44

Evaluator:
Jeff Fealko

Concurrence:

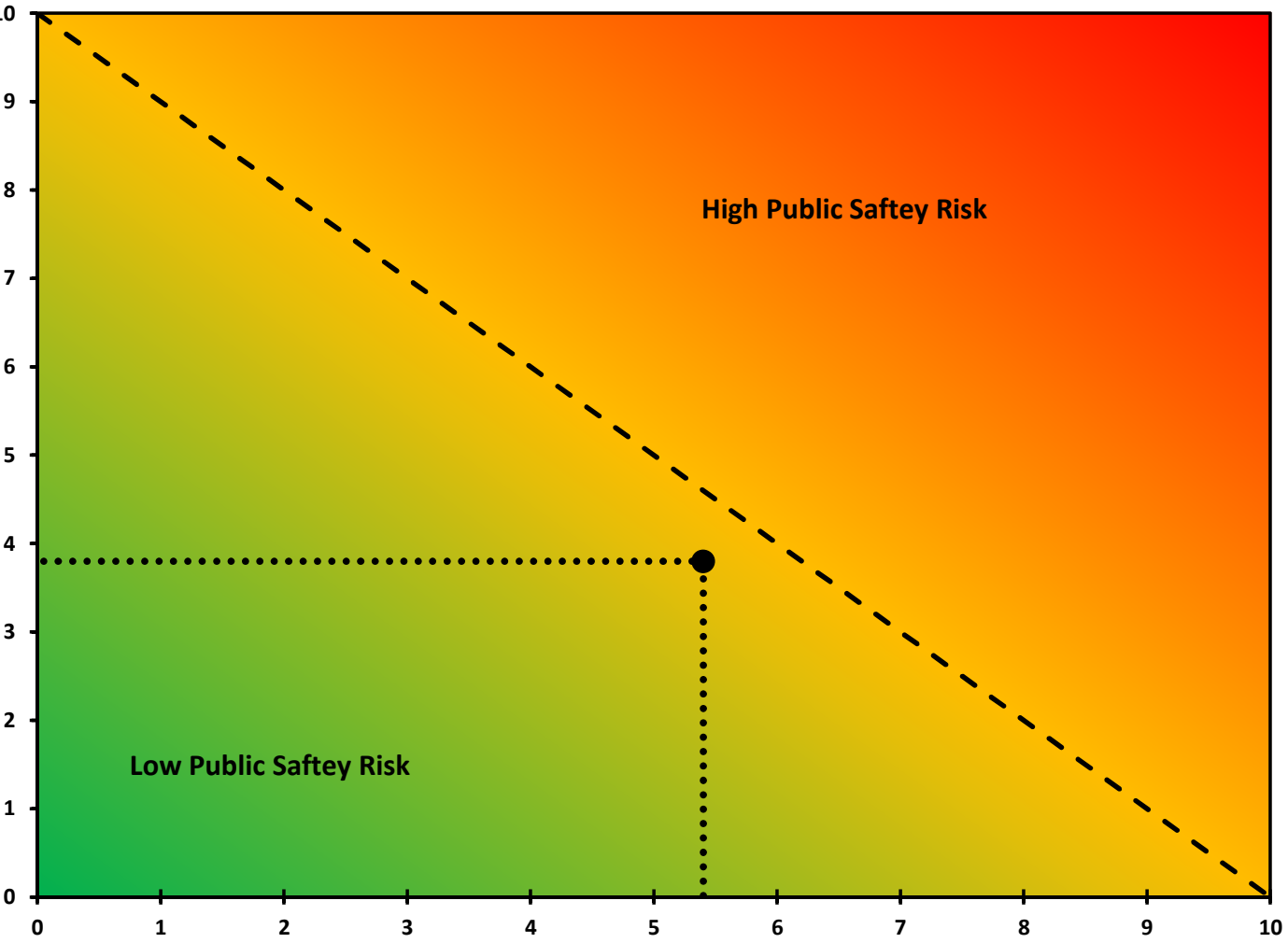
Date:
3/31/2015

Public Saftey Risk Matrix

Structure Location: Site 106

Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginner	8
Access	Poor	Good	2
Child Presence	Never	Often	3
		Total	15.0
		Average Score =	3.8



Structure Characteristics

					Score
No	----------	Active Channel?	----------	Yes	7
No	----------	Outside of Bend?	----------	Yes	5
Low	----------	Strainer Potential	----------	High	6
High	----------	Egress Potential	----------	Low	4
High	----------	Sight Distance	----------	Low	4
Low	----------	Depth x Velocity	----------	High	6
			Average Score =	5.4	Total Score = 32.0

Project:
CC-44

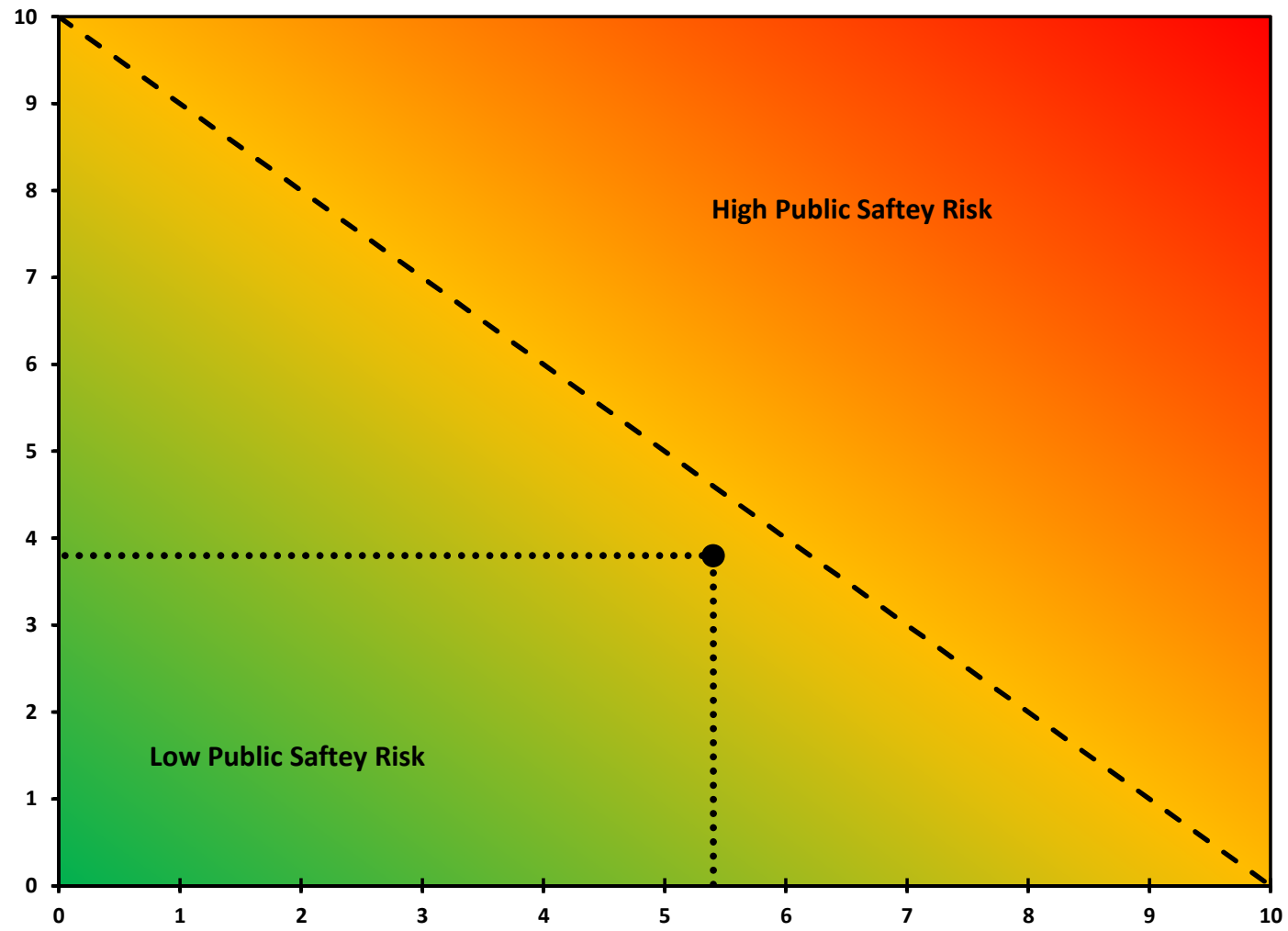
Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

Public Saftey Risk Matrix

Structure Location: Site 107



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginner	8
Access	Poor	Good	2
Child Presence	Never	Often	3
		Total	15.0
		Average Score =	3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

Structure Characteristics

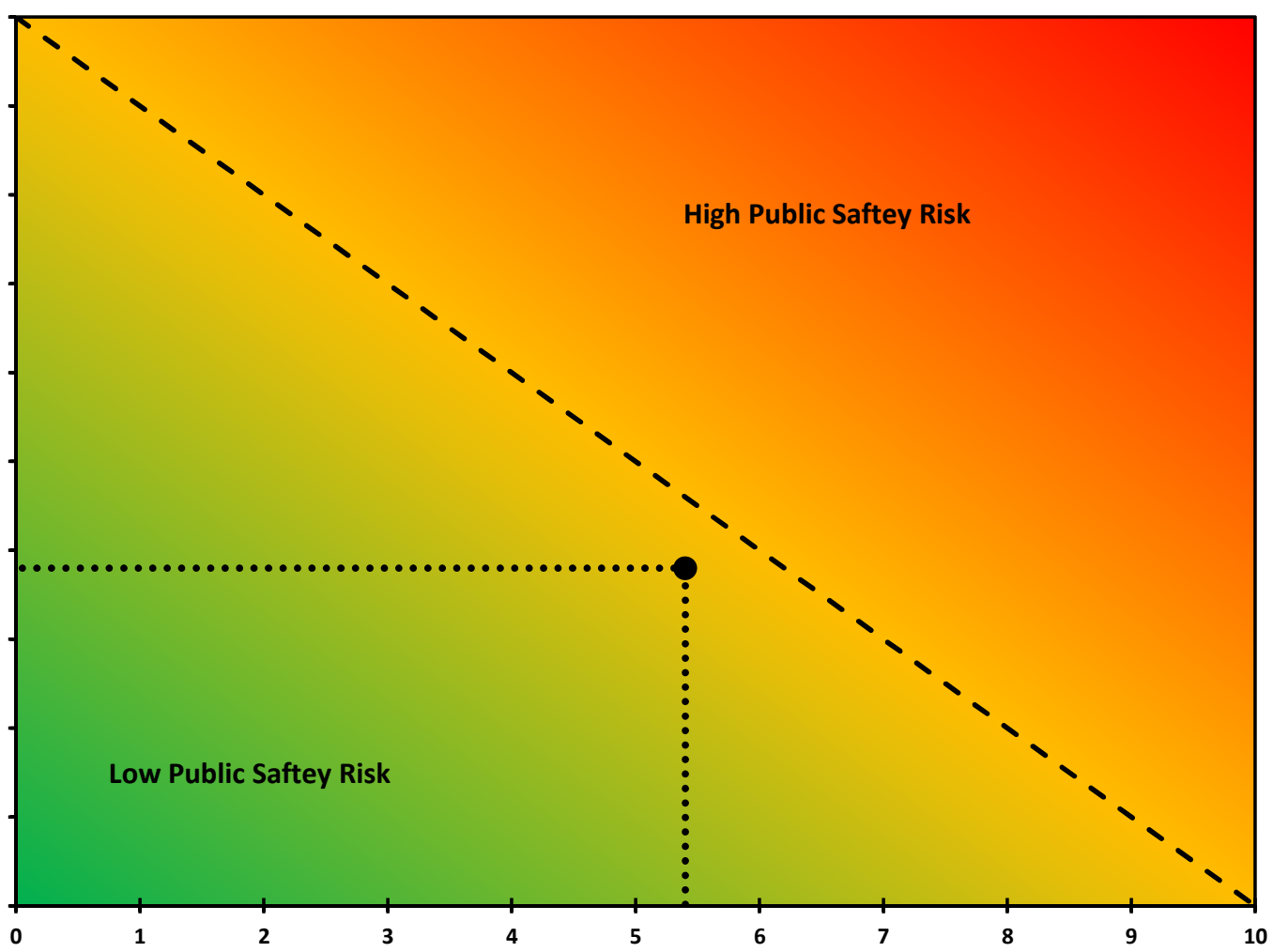
			Score
No	Active Channel?	Yes	7
No	Outside of Bend?	Yes	5
Low	Strainer Potential	High	6
High	Egress Potential	Low	4
High	Sight Distance	Low	4
Low	Depth x Velocity	High	6
	Average Score =	5.4	Total Score = 32.0

Public Saftey Risk Matrix

Structure Location: Site 108

Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginner	8
Access	Poor	Good	2
Child Presence	Never	Often	3
		Total	15.0
		Average Score =	3.8



Structure Characteristics

					Score
No	----------	Active Channel?	----------	Yes	7
No	----------	Outside of Bend?	----------	Yes	5
Low	----------	Strainer Potential	----------	High	6
High	----------	Egress Potential	----------	Low	4
High	----------	Sight Distance	----------	Low	4
Low	----------	Depth x Velocity	----------	High	6
			Average Score =	5.4	Total Score = 32.0

Project:
CC-44

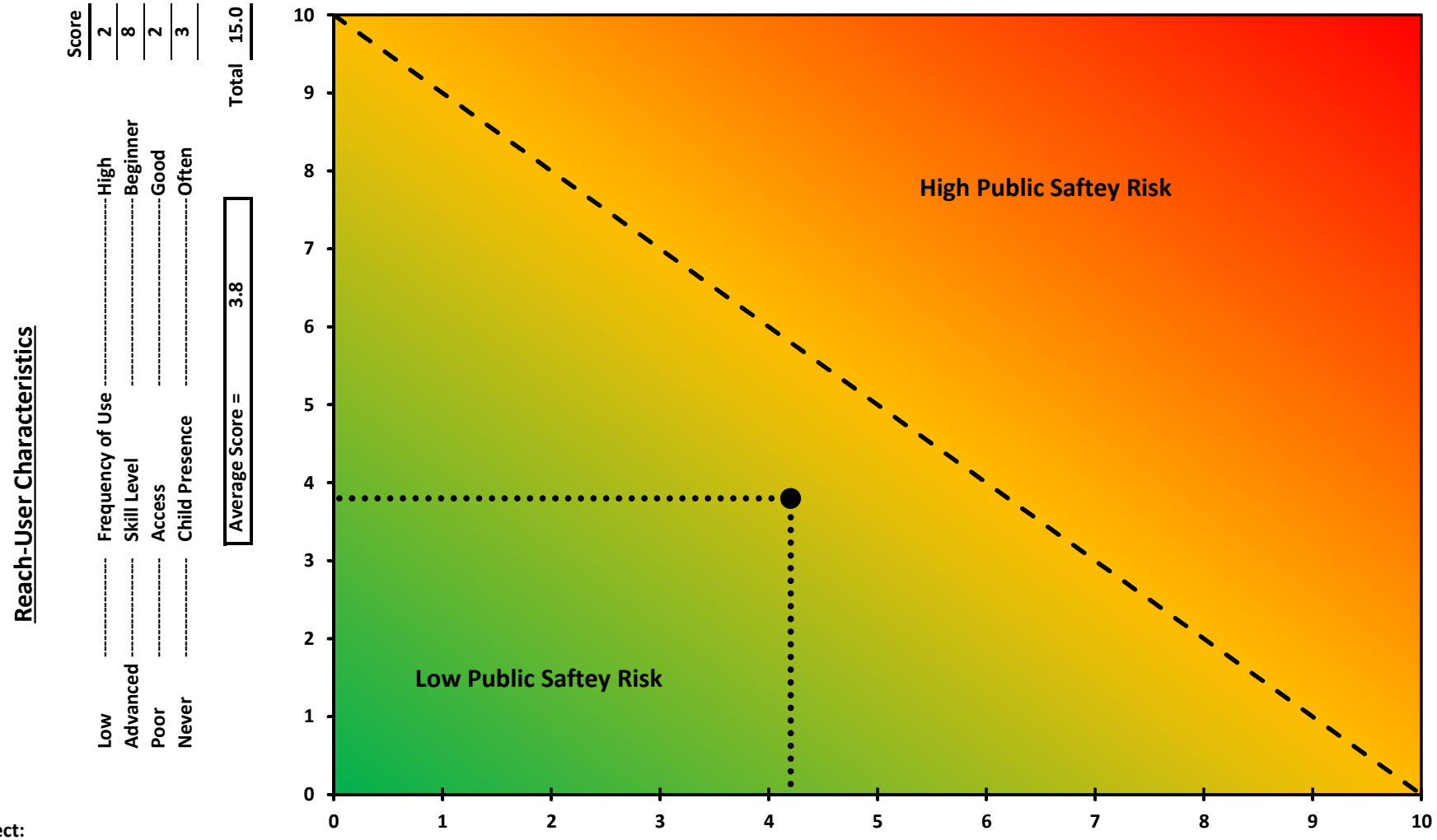
Evaluator:
Jeff Fealko

Concurrence:

Date:
3/31/2015

Public Saftey Risk Matrix

Structure Location: Site 109



Reach-User Characteristics

			Score
Frequency of Use	Low	High	2
Skill Level	Advanced	Beginner	8
Access	Poor	Good	2
Child Presence	Never	Often	3
		Total	15.0
		Average Score =	3.8

Project: CC-44

Evaluator: Jeff Fealko

Concurrence:

Date: 3/31/2015

Structure Characteristics

			Score
No	Active Channel?	Yes	3
No	Outside of Bend?	Yes	3
Low	Strainer Potential	High	9
High	Egress Potential	Low	3
High	Sight Distance	Low	4
Low	Depth x Velocity	High	3
	Average Score =	4.2	
	Total Score =		25.0

LWM Design Guideline Rules

Project Name:	CC-44	**Site:**	Catherine Creek Phases III -IV
Project Number:	0528-021-00	**Structure:**	Multiple
Watercorse:	Catherine Creek	**Analyst:**	Jeff Fealko
		Latest Revision:	3/31/2015

Large Woody Materials Risk Assessment Design Guidelines - Minimum Recommended Factors of Safety						
Public Saftey Risk	**Property Damage Risk**	**Ref.**	**Stability Design Flow Criteria**	**$FOS_{sliding}$**	**$FOS_{bouyancy}$**	**$FOS_{rotation}$ $FOS_{overtuning}$**
High	High	High-High	100-year	1.75	2.0	1.75
High	Moderate	High-Moderate	50-year	1.5	1.75	1.5
High	Low	High-Low	25-year	1.5	1.75	1.5
Low	High	Low-High	100-year	1.75	2.0	1.75
Low	Moderate	Low-Moderate	25-year	1.5	1.75	1.5
Low	Low	Low-Low	10-year	1.25	1.5	1.25

Large Woody Materials Risk Assessment Design Guidelines - Recommended Assessment Levels							
Public Saftey Risk	**Property Damage Risk**	**Ref.**	**Stability Design Flow Criteria**	**River Use Survey Needs**	**Geomorphic Assessment Needs**	**Design Team Needs**	**Hydraulic Model Requirements**
High	High	High-High	100-year	Public Interview	Reach Scale	PE, FG, FB, HE	2 dimensional
High	Moderate	High-Moderate	50-year	Public Interview	Rapid	PE, FG, FB, HE	2 dimensional
High	Low	High-Low	25-year	Public Interview	Rapid	PE, FG, FB	2 dimensional
Low	High	Low-High	100-year	Literature Review	Reach Scale	PE, FG, FB, HE	2 dimensional
Low	Moderate	Low-Moderate	25-year	Literature Review	Rapid	PE, FG, FB	1 dimensional
Low	Low	Low-Low	10-year	Literature Review	Rapid	PE, FB	No requirement

LWM Risk Assessment Summary

Project Name: CC-44
Project Number: 0528-021-00
Watercorse: Catherine Creek

Site: Catherine Creek Phases III -IV
Structure: Multiple
Analyst: Jeff Fealko
Latest Revision: 3/31/2015

Large Woody Material Site Information			LWM - Risk Assessment Ratings						LWM - Risk Assessment Requirements				Engineering Design				
Site Number	Parcel	Site Description	Property Characteristics	Stream Response Potential	Property Damage Risk	Reach User Characteristics	Structure Characteristics	Public Safety	River Use Survey	Geomorphic Assessment	Design Team Needs	Hydraulic Model Requirements	Hydraulic Design Event	FOS (Sliding)	FOS (Bouyancy)	FOS (Rotation)	FOS (Overturning)
Site 1	4	Sta. 3+00 Left bank side channel inlet structure	3.3	5.0	Moderate	3.8	4.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 2	4	Sta. 4+75 - 6+50 Right bank streambank habitat structures (3)	3.3	5.0	Moderate	3.8	4.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 3	4	Sta. 5+50 Left bank small apex jams (2)	3.3	5.0	Moderate	3.8	5.4	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 4	4	Sta. 7+00 Right bank tight radius bend structure	3.3	5.0	Moderate	3.8	5.5	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 5	4	Sta. 7+60 Right bank small apex jam	3.3	5.0	Moderate	3.8	5.7	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 6	4	Sta. 9+75 Left bank high energy bank structure	3.3	5.0	Moderate	3.8	6.0	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 7	4	Sta. 10+60 Right bank mild radius bend structure	3.3	5.0	Moderate	3.8	4.5	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 8	4	Sta. 12+00 Center of channel large apex jam	3.3	5.0	Moderate	3.8	6.0	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 9	4	Sta. 14+50 Left bank mild radius bend structure	3.3	5.0	Moderate	3.8	6.4	High	Public Interview	Rapid	PE, FG, FB, HE	2-D	100-Year	1.5	1.75	1.5	1.5
Site 10	4	Sta. 15+00 Right bank high energy bank structure (2)	3.3	5.0	Moderate	3.8	6.4	High	Public Interview	Rapid	PE, FG, FB, HE	2-D	100-Year	1.5	1.75	1.5	1.5
Site 11	4	Sta. 18+00 Left bank complex (tight radius structure, sweeper log structure)	3.3	5.0	Moderate	3.8	6.0	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 12	4	Sta. 18+50 Right bank high energy bank structure	3.3	5.0	Moderate	3.8	7.2	High	Public Interview	Rapid	PE, FG, FB, HE	2-D	100-Year	1.5	1.75	1.5	1.5
Site 13	4	Sta. 22+70 Right bank tight radius bend structure	3.3	5.0	Moderate	3.8	6.0	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 14	4	Sta. 25+00 Right bank small apex jams (2)	3.3	5.0	Moderate	3.8	3.0	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 15	4	Sta. 26+70 Left bank high energy bank structure and stream habitat structure	3.3	5.0	Moderate	3.8	6.0	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 16	4	Sta. 29+00 Left bank mild radius bend structure	3.3	5.0	Moderate	3.8	5.5	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 17	4	Sta. 31+00 Left bank complex (small apex jams (2), large apex jam (1)	3.3	5.0	Moderate	3.8	5.0	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 18	4	Sta. 33+50 Right bank mild radius bend structure	3.3	5.0	Moderate	3.8	6.0	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 19	4	All side channel and floodplain wood	2.3	4.4	Low	3.8	3.4	Low	Literature Review	Rapid	PE, FG, FB	1-D	10-Year	1.25	1.5	1.25	1.25
Site 20	4	SC Sta. 4+20 Left bank large gravel bar tree	3.3	5.0	Moderate	3.8	2.4	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 21	4	SC Sta. 5+00 Right bank (2) upstream bend components on Smith Side Channel 4 Alcove	3.3	5.0	Moderate	3.8	3.4	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 22	3	Sta. 5+35 Right bank 4 full trees on top of existing jam	3.3	5.0	Moderate	3.8	5.7	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 23	3	Sta. 6+10 Left bank 3 log bank structure (2)	3.3	5.0	Moderate	3.8	4.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 24	3	Sta. 7+00 Left bank pool complex (1-Upper, 2-Middle, 1-Down, 1-Streambank Habitat Structure)	3.3	5.0	Moderate	3.8	6.9	High	Public Interview	Rapid	PE, FG, FB, HE	2-D	100-Year	1.5	1.75	1.5	1.5
Site 25	3	Sta. 8+50 Right bank large gravel bar tree	3.3	5.0	Moderate	3.8	2.4	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 26	3	Sta. 9+10 Left bank pool complex (1-3 log structure, 1-Upper, 1-Middle, 1-Down)	3.3	5.0	Moderate	3.8	6.9	High	Public Interview	Rapid	PE, FG, FB, HE	2-D	100-Year	1.5	1.75	1.5	1.5
Site 27	3	Sta. 10+50 Left bank small apex jam and large gravel bar tree	3.3	5.0	Moderate	3.8	3.4	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 28	3	Sta. 10+80 Right bank 2-3 log bank structures	3.3	5.0	Moderate	3.8	4.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 29	3	Sta. 12+00 Right bank pool complex (1-Upper, 2-Middle, 1-Down)	3.3	5.0	Moderate	3.8	6.9	High	Public Interview	Rapid	PE, FG, FB, HE	2-D	100-Year	1.5	1.75	1.5	1.5
Site 30	3	Sta. 12+60 Right bank 3 log bank structure	3.3	5.0	Moderate	3.8	4.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 31	3	Sta. 13+50 Left bank 3 log structure	3.3	5.0	Moderate	3.8	4.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 32	3	Sta. 13+60 Right bank small apex jam	3.3	5.0	Moderate	3.8	3.9	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 33	3	Sta. 14+00 Left bank 3 log structure	3.3	5.0	Moderate	3.8	4.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 34	3	Sta. 14+10 Right bank large gravel bar tree	3.3	5.0	Moderate	3.8	2.4	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 35	3	Sta. 14+90 Left bank pool complex (1-Upper, 1-Middle, 1-Down)	3.3	5.0	Moderate	3.8	6.9	High	Public Interview	Rapid	PE, FG, FB, HE	2-D	100-Year	1.5	1.75	1.5	1.5
Site 36	3	Sta. 15+30 Left bank 3 log structure, tree top bank roughness	3.3	5.0	Moderate	3.8	4.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 37	3	Sta. 16+60 Right bank tree top bank roughness, 3 log structure	3.3	5.0	Moderate	3.8	4.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 38	3	Sta. 17+00 Left bank large gravel bar tree	3.3	5.0	Moderate	3.8	2.4	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 39	3	Sta. 17+15 Right bank side channel 1 inlet structure	3.3	5.0	Moderate	3.8	5.7	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 40	3	Sta. 18+00 Right bank pool complex (1-Upper, 2-Middle, 1-Down)	3.3	5.0	Moderate	3.8	6.9	High	Public Interview	Rapid	PE, FG, FB, HE	2-D	100-Year	1.5	1.75	1.5	1.5
Site 41	3	Sta. 19+00 Right bank large gravel bar tree	3.3	5.0	Moderate	3.8	2.4	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 42	3	Sta. 19+90 Right bank small apex jam	3.3	5.0	Moderate	3.8	3.0	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 43	3	Sta. 21+00 Left bank pool complex (1-3 log structure, 1-Upper, 2-Middle, 1-Down, 1-3 log structure)	3.3	5.0	Moderate	3.8	6.9	High	Public Interview	Rapid	PE, FG, FB, HE	2-D	100-Year	1.5	1.75	1.5	1.5
Site 44	3	Sta. 22+30 Right bank 2-3 log structures	3.3	5.0	Moderate	3.8	4.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 45	3	Sta. 23+50 Left bank 3 log structure	3.3	5.0	Moderate	3.8	4.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 46	3	Sta. 24+00 Left bank pool complex (1-Upper, 1-Middle, 1-Down)	3.3	5.0	Moderate	3.8	6.9	High	Public Interview	Rapid	PE, FG, FB, HE	2-D	100-Year	1.5	1.75	1.5	1.5
Site 47	3	Sta. 24+50 Left bank 2-3 log structure, 1-tree top bank roughness	3.3	5.0	Moderate	3.8	4.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 48	3	Sta. 25+80 Right bank 1-streambank habitat structure, 1-tree top bank roughness	3.3	5.0	Moderate	3.8	6.0	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 49	3	Sta. 26+00 Left bank large gravel bar tree	3.3	5.0	Moderate	3.8	2.4	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 50	3	Sta. 27+00 Right bank pool complex (1-Upper, 2-Middle, 1-Down)	3.3	5.0	Moderate	3.8	6.9	High	Public Interview	Rapid	PE, FG, FB, HE	2-D	100-Year	1.5	1.75	1.5	1.5
Site 51	3	Sta. 27+50 Right bank 1-3 log structure, 1-tree top bank roughness	3.3	5.0	Moderate	3.8	4.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 52	3	Sta. 28+10 Left bank 1-3 log structure, 1-tree top bank roughness	3.3	5.0	Moderate	3.8	4.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 53	3	Sta. 29+00 Left bank 1-3 log structure, 1-streambank habitat structure	3.3	5.0	Moderate	3.8	4.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 54	3	Sta. 29+80 Left bank sweeper log structure	3.3	5.0	Moderate	3.8	5.7	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 55	3	Sta. 29+90 Right bank field fit whole tree	3.3	5.0	Moderate	3.8	6.0	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 56	3	Sta. 31+10 Right bank field fit whole tree	3.3	5.0	Moderate	3.8	6.0	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 57	3	Sta. 32+75 Right bank large gravel bar tree	3.3	5.0	Moderate	3.8	2.4	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 58	3	Sta. 33+10 Left bank pool complex (1-Upper, 2-High Energy, 1-Sweeper log)	3.3	5.0	Moderate	3.8	6.9	High	Public Interview	Rapid	PE, FG, FB, HE	2-D	100-Year	1.5	1.75	1.5	1.5
Site 59	3	Sta. 34+90 Left bank small apex jam	3.3	5.0	Moderate	3.8	3.0	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 60	3	Sta. 35+00 Right bank 1-3 log structure, 1-sweeper log	3.3	5.0	Moderate	3.8	4.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5

LWM Risk Assessment Summary

Project Name: CC-44
Project Number: 0528-021-00
Watercorse: Catherine Creek

Site: Catherine Creek Phases III -IV
Structure: Multiple
Analyst: Jeff Fealko
Latest Revision: 3/31/2015

Large Woody Material Site Information			LWM - Risk Assessment Ratings						LWM - Risk Assessment Requirements				Engineering Design				
Site Number	Parcel	Site Description	Property Characteristics	Stream Response Potential	Property Damage Risk	Reach User Characteristics	Structure Characteristics	Public Safety	River Use Survey	Geomorphic Assessment	Design Team Needs	Hydraulic Model Requirements	Hydraulic Design Event	FOS (Sliding)	FOS (Bouyancy)	FOS (Rotation)	FOS (Overturning)
Site 61	3	Sta. 35+70 Right bank pool complex (2-Middle, 1-Down)	3.3	5.0	Moderate	3.8	6.9	High	Public Interview	Rapid	PE, FG, FB, HE	2-D	100-Year	1.5	1.75	1.5	1.5
Site 62	3	Sta. 36+20 Right bank 3 log structure	3.3	5.0	Moderate	3.8	4.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 63	3	Sta. 37+00 Right bank 3 log structure	3.3	5.0	Moderate	3.8	4.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 64	3	Sta. 37+90 Left bank 3 log structure	3.3	5.0	Moderate	3.8	4.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 65	3	Sta. 38+50 Left bank pool complex (1-Upper, 2-Middle, 1-Down)	3.3	5.0	Moderate	3.8	6.9	High	Public Interview	Rapid	PE, FG, FB, HE	2-D	100-Year	1.5	1.75	1.5	1.5
Site 66	3	Sta. 39+00 Left bank 2-tree top bank roughness, 1-3 log structure	3.3	5.0	Moderate	3.8	4.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 67	3	Sta. 40+10 Right bank 2-3 log structures	3.3	5.0	Moderate	3.8	4.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 68	3	Sta. 40+20 Left bank large gravel bar tree	3.3	5.0	Moderate	3.8	2.4	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 69	3	Sta. 41+00 Right bank pool complex (1-Upper, 2-High Energy, 1-Sweeper Log)	3.3	5.0	Moderate	3.8	6.9	High	Public Interview	Rapid	PE, FG, FB, HE	2-D	100-Year	1.5	1.75	1.5	1.5
Site 70	3	Sta. 42+00 Right bank large gravel bar tree	3.3	5.0	Moderate	3.8	2.4	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 71	3	Sta. 42+30 Left bank 3 log structure	3.3	5.0	Moderate	3.8	4.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 72	3	Sta. 42+60 Left bank pool complex (1-Upper, 2-High Energy, 1-Sweeper)	3.3	5.0	Moderate	3.8	6.9	High	Public Interview	Rapid	PE, FG, FB, HE	2-D	100-Year	1.5	1.75	1.5	1.5
Site 73	3	Sta. 44+00 Right bank large gravel bar tree	3.3	5.0	Moderate	3.8	2.4	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 74	3	Sta. 44+30 Right bank 3-3 log structure	3.3	5.0	Moderate	3.8	4.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 75	3	Sta. 44+60 Left bank large gravel bar tree	3.3	5.0	Moderate	3.8	2.4	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 76	3	Sta. 45+00 Right bank stream bank habitat	3.3	5.0	Moderate	3.8	6.0	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 77	3	Sta. 45+50 Right bank pool complex (1-Upper, 1-Middle, 1-Down)	3.3	5.0	Moderate	3.8	6.9	High	Public Interview	Rapid	PE, FG, FB, HE	2-D	100-Year	1.5	1.75	1.5	1.5
Site 78	3	Sta. 46+60 Right bank 1-3 log structure, 1-tree top bank roughness	3.3	5.0	Moderate	3.8	4.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 79	3	Sta. 47+00 Left bank 2-3 log structure	3.3	5.0	Moderate	3.8	4.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 80	3	Sta. 47+15 Right bank small apex jam	3.3	5.0	Moderate	3.8	3.0	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 81	3	Sta. 47+55 Left bank pool complex (1-Upper, 1-Middle, 2-High Energy)	3.3	5.0	Moderate	3.8	6.9	High	Public Interview	Rapid	PE, FG, FB, HE	2-D	100-Year	1.5	1.75	1.5	1.5
Site 82	3	Sta. 48+10 Right bank large gravel bar tree	3.3	5.0	Moderate	3.8	2.4	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 83	3	Sta. 49+10 Left bank 3 log structure	3.3	5.0	Moderate	3.8	4.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 84	3	Sta. 49+50 Left bank streambank habitat	3.3	5.0	Moderate	3.8	6.0	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 85	3	Sta. 50+00 Left bank pool complex (1-Down)	3.3	5.0	Moderate	3.8	6.9	High	Public Interview	Rapid	PE, FG, FB, HE	2-D	100-Year	1.5	1.75	1.5	1.5
Site 86	3	Sta. 50+00 Right bank 2-Field fit whole trees	3.3	5.0	Moderate	3.8	6.0	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 87	3	Sta. 51+60 Center of channel large apex jam	3.3	5.0	Moderate	3.8	6.0	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 88	3	Sta. 52+50 Right bank large gravel bar tree	3.3	5.0	Moderate	3.8	2.4	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 89	3	Sta. 53+00 Right bank streambank habitat	3.3	5.0	Moderate	3.8	6.0	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 90	2	SC Sta. 55+10 Right bank large gravel bar tree	3.3	5.0	Moderate	3.8	2.4	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 91	3	All wood located within side channel 1 and side channel 2	2.3	4.4	Low	3.8	4.5	Low	Literature Review	Rapid	PE, FG, FB	1-D	10-Year	1.25	1.5	1.25	1.25
Site 92	3	All floodplain wood located within swale complexes and floodplain roughness	2.3	4.4	Low	3.8	1.0	Low	Literature Review	Rapid	PE, FG, FB	1-D	10-Year	1.25	1.5	1.25	1.25
Site 93	2	Sta. 5+40 Left bank 60-ft Margin tree	3.3	5.0	Moderate	3.8	2.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 94	2	Sta. 5+60 Left bank 1-whole tree, 1-Type A	3.3	5.0	Moderate	3.8	2.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 95	2	Sta. 50+60 Right bank margin tree	3.3	5.0	Moderate	3.8	2.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 96	2	Sta. 6+15 Left bank Type-A	3.3	5.0	Moderate	3.8	2.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 97	2	Sta. 7+50 Left bank whole tree passive anchor	3.3	5.0	Moderate	3.8	3.0	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 98	2	Sta. 7+60 Right bank Type-A	3.3	5.0	Moderate	3.8	2.9	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 99	2	Sta. 8+70 Right bank Type-A	3.3	5.0	Moderate	3.8	4.4	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 100	2	Sta. 12+00 Right bank 4 log passive anchor placement	3.3	5.0	Moderate	3.8	4.0	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 101	2	Sta. 13+40 Right bank Type-C	3.3	5.0	Moderate	3.8	3.9	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 102	2	Sta. 22+50 Right bank Type-D	3.3	5.0	Moderate	3.8	3.7	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 103	2	Sta. 23+00 Left bank Type-D	3.3	5.0	Moderate	3.8	2.5	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 104	2	Sta. 24+00 Left bank Type-D	3.3	5.0	Moderate	3.8	2.5	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 105	1	Sta. 24+40 Right bank Type-E	3.3	5.0	Moderate	3.8	5.4	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 106	1	Sta. 27+40 Right bank Type-F	3.3	5.0	Moderate	3.8	5.4	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 107	1	Sta. 29+20 Right bank Type-F	3.3	5.0	Moderate	3.8	5.4	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 108	1	Sta. 31+60 Right bank Type-F	3.3	5.0	Moderate	3.8	5.4	Low	Literature Review	Rapid	PE, FG, FB	1-D	25-year	1.5	1.75	1.5	1.5
Site 109	2	All wood located within left bank side channel	2.3	4.4	Low	3.8	4.2	Low	Literature Review	Rapid	PE, FG, FB	1-D	10-Year	1.25	1.5	1.25	1.25

APPENDIX J

HYDRAULICS

RECLAMATION

Managing Water in the West

Catherine Creek Numerical Hydraulic Modeling Study – CC-44 Smith and Southern Cross Project Areas

Catherine Creek – Reach 4, Union County, Oregon
Pacific Northwest Region

Report SRH-2016-07

U.S. Department of the Interior
Bureau of Reclamation
Technical Service Center
Denver, Colorado

January 2016

Mission Statements

The U.S. Department of the Interior protects America's natural resources and heritage, honors our cultures and tribal communities, and supplies the energy to power our future.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Peer Review Certification: This document has been peer reviewed and is believed to be in accordance with the service agreement and standards of the profession.

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1 Introduction and Background

At the request of the Bureau of Reclamation's (Reclamation) Resource and Technical Services (RTS) in the Pacific Northwest (PN) Regional Office, steady-state two-dimensional (2D) numerical hydraulic modeling simulations were performed by Reclamation's Sedimentation and River Hydraulics Group at the Technical Service Center (TSC) on Catherine Creek in northeast Oregon. The 2D hydraulic modeling was performed at a location referred to as Catherine Creek River Mile 44 (CC-44) project area (Figure 1), southeast of Union, OR, where aquatic habitat enhancement projects are proposed.

The main objective of this study was to provide RTS staff with model results of flow depth, velocity, shear stress, and critical grain size at incipient motion for various proposed design layouts of side channels, floodplain channels, floodplain swales, and Large Woody Material (LWM) structures in what are identified as the Smith and Southern Cross properties of the CC-44 project area. Proposed design layouts were developed by RTS staff as part of meeting the Reasonable and Prudent Alternatives set forth in the 2010 Federal Columbia River Power System Biological Opinion (BiOp). This report documents the modeling development and simulations in the CC-44 project area.

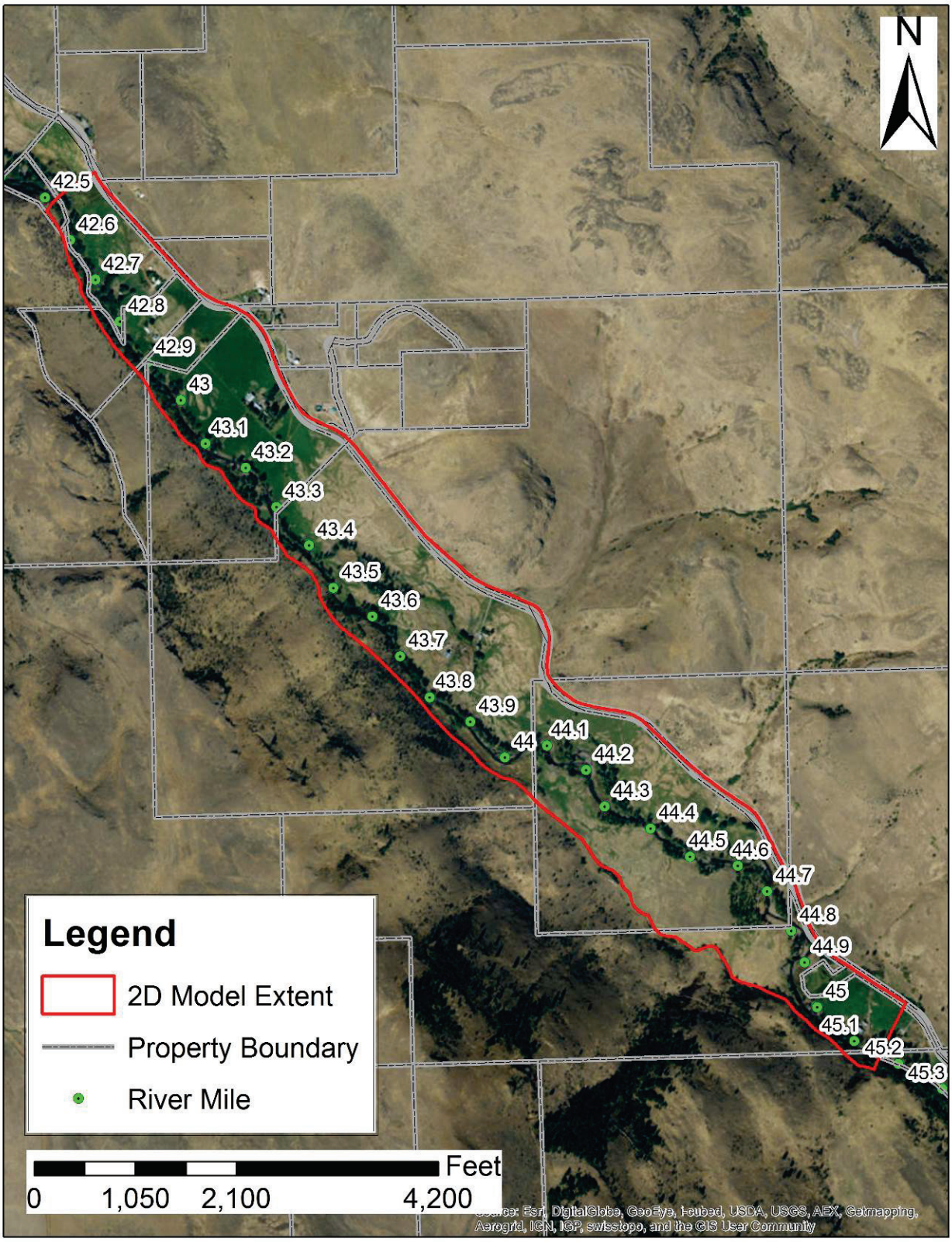

Figure 1 – Catherine Creek CC-44 Project Area Showing Smith and Southern Cross Properties

2 Hydraulic Modeling Methodology

2.1 Model Selection

The numerical model utilized for this assessment was the fixed bed version of SRH-2D (Lai, 2008; http://www.usbr.gov/pmts/sediment/model/srh2d/index.html), a two-dimensional (2D) depth-averaged hydraulic model specifically focused on the flow hydraulics of river systems. SRH-2D adopts a zonal approach for coupled modeling of channels and floodplains. A river system is broken down into modeling zones (delineated based on natural features such as topography, vegetation, and bed roughness), each with unique parameters such as flow resistance. One of the main features of SRH-2D is the use of an unstructured hybrid mixed element mesh, which is based on the arbitrarily shaped element method of Lai (2000) for geometric representation. This meshing strategy is flexible enough to facilitate the implementation of the zonal modeling concept, allowing for greater modeling detail in areas of interest ultimately leading to increased modeling efficiency through a compromise between solution accuracy and computing demand. Other notable capabilities of SRH-2D include the following (Lai, 2008):

- SRH-2D solves the 2D depth-averaged dynamic wave equations (St. Venant equations) using a finite volume numerical methodology;
- Both steady and unsteady flows may be simulated;
- An implicit scheme is used for time integration to achieve solution robustness and efficiency;
- All flow regimes (i.e. subcritical, transcritical, and supercritical) may be simulated simultaneously without the need for special treatments;
- SRH-2D contains a robust and seamless wetting-drying algorithm; and,
- Solution domain may include a combination of main channels, overland flow, and floodplains.

2.2 Hydrology

A flood frequency of peak discharge values was previously performed and provided by RTS staff for the hydraulic modeling runs (CC-44 Diversion and Roughened Channel 30% Design Drawings, 11-15-2013 and Kimbrel, 2014). Additional simulation discharges were requested by RTS staff for further analysis. The flood frequency discharge values are presented in Table 1.

Table 1 – Catherine Creek Flood Frequency Discharges Provided by Reclamation RTS Staff

Return Period or Flow Identifier	Discharge (ft^3/s)
95% Exceedance	18
40 cfs	40
60 cfs	60
120 cfs	120
280 cfs	280
5% Exceedance	450
1.25-year	565
OHW (1.5-year)	659
2-year	770
10-year	1,185
25-year	1,370
100-year	1,622

2.3 Model Surface Geometry

ESRI ArcGIS Terrains, Triangular Irregular Networks (TINs), and Rasters were used to represent the topographic surface containing the channel and floodplain ground elevations in the project area. The Terrain was used to assign elevations to each node the in the 2D model mesh, from which the numerical modeling computations were performed.

2.3.1 Existing Conditions Topography

The existing conditions ArcGIS Raster included Light Detection and Ranging (LiDAR) data collected in 2009 in the floodplain area (Watershed Sciences, 2009), on-the-ground Global Positioning System (GPS) channel survey data collected in 2012 by Anderson Perry and Associates, Inc. (AP) and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR), RTS AutoCAD design layouts of LWM structures installed in 2013 and 2014, and AP design layouts of a diversion intake, roughened channel, and additional LWM structures installed in late 2014 and modeled in the 2014 CC-44 modeling study (see Kimbrel, 2014). The resolution of the Raster is represented as 1-foot by 1-foot grid cells. Figure 2 presents the Existing Conditions Topography used for the modeling efforts in this study.

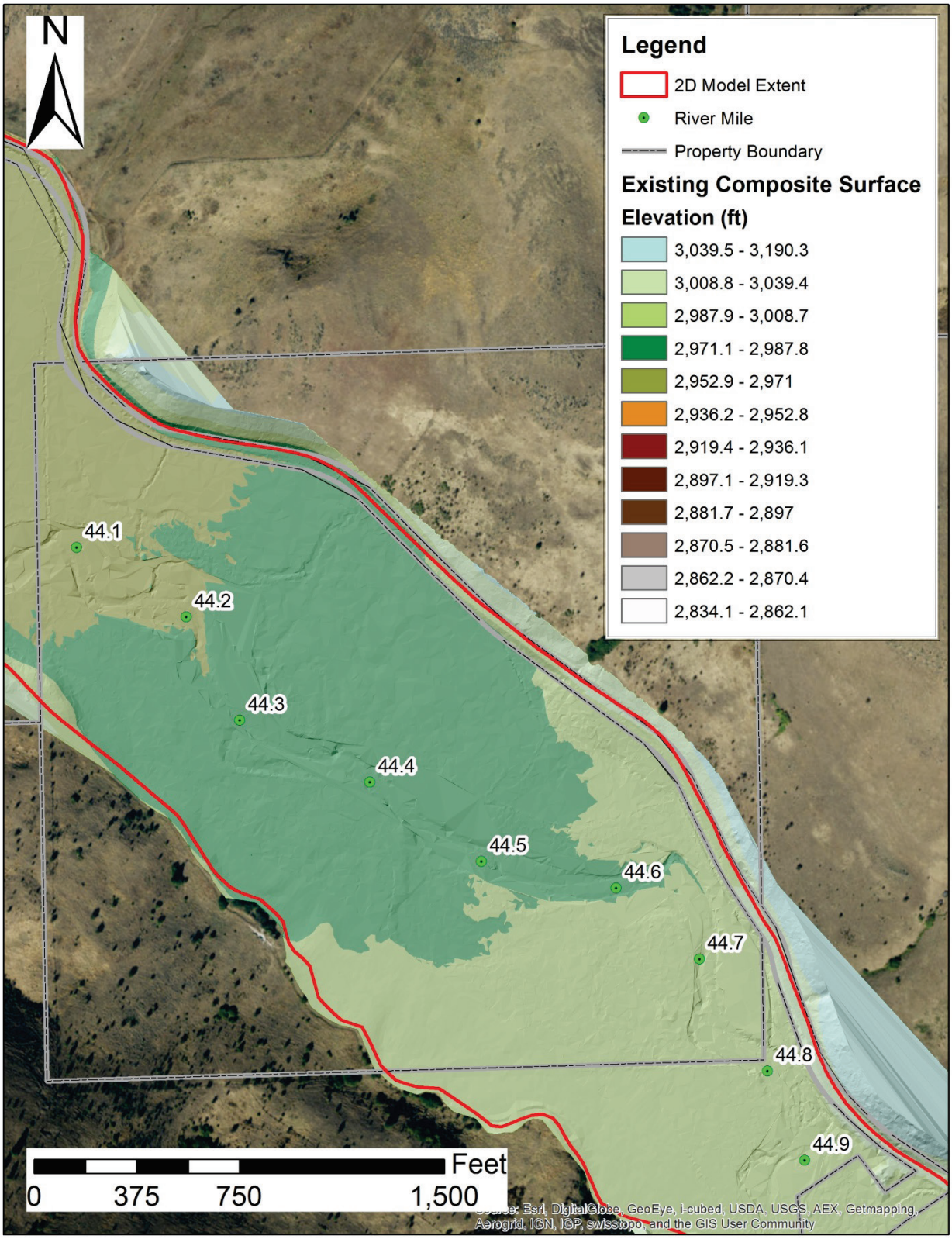

Figure 2 – Existing Conditions Topography – Example Location in CC-44 Project Area

2.3.2 Proposed Conditions Topography

Two separate design phases were designated for the CC-44 project area; the first, designated as Phase 3, was located within the Smith Property (See Figure 1), and the second, designated as Phase 4, was located within the Southern Cross Property (See Figure 1). Phases 3 and 4 each consisted of four design model iterations (80%, 90% version 1, 90% version 2, and Final).

For a given design model iteration, an AutoCAD LandXML surface was provided by RTS staff with the proposed layout of side channels, floodplain channels, floodplain swales, and LWM features. The LandXML surface was then converted to an ESRI ArcGIS TIN surface for further model mesh development. SRH-2D does not currently have the ability to model porosity (i.e. zero interstitial flow between log members is assumed through all LWM structures). Therefore, the LWM structures were represented with a combination methods: 1) increasing Manning roughness and 2) raising the topography to match the footprint and invert of the LWM structures. Figure 3 shows an example of a proposed design surface on the Smith Property, including the footprint locations of the proposed LWM features.

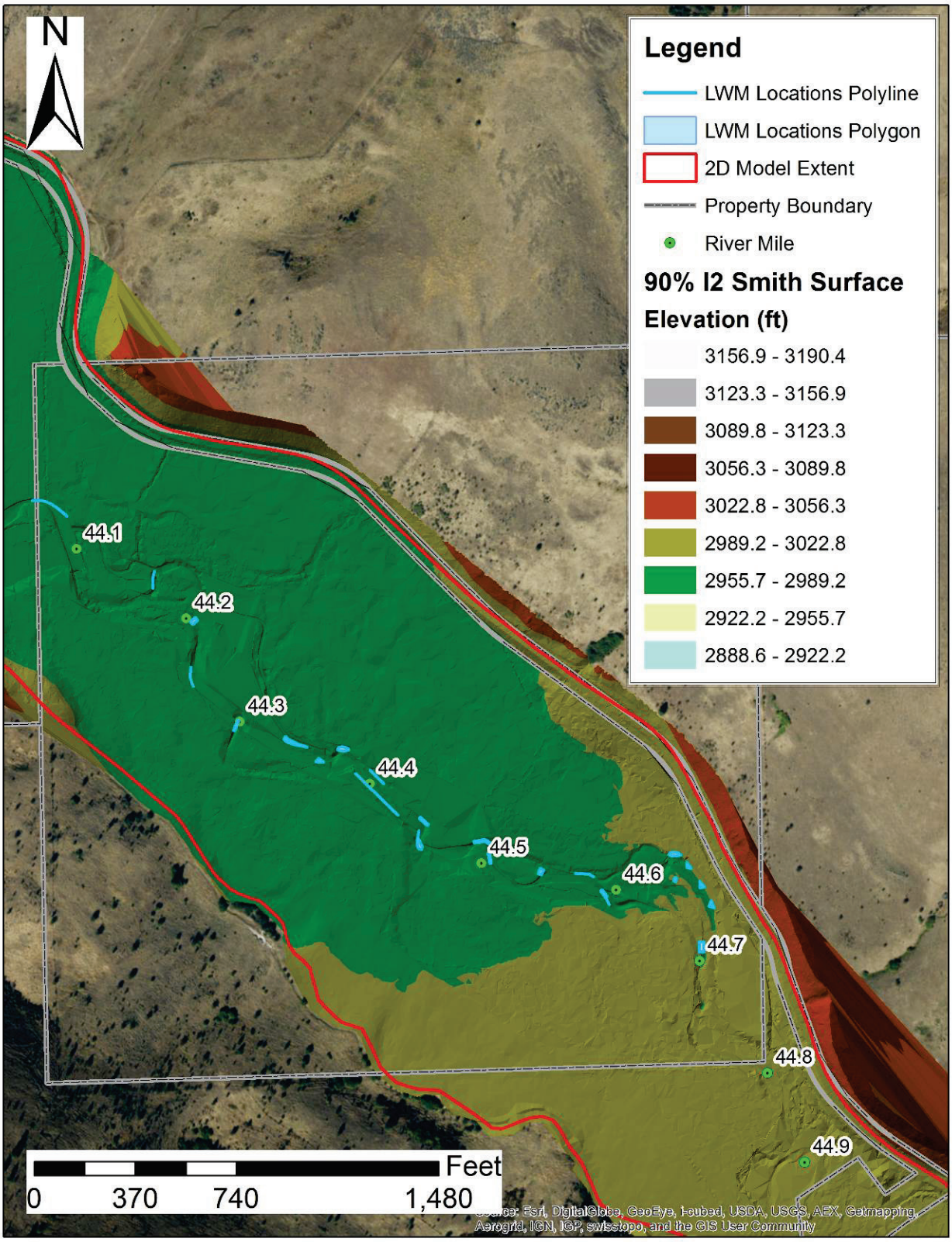

Figure 3 – Proposed Conditions Topography – Smith Property during the 90% Design Phase

2.4 Model Mesh

The unstructured model mesh had a node density of up to 0.4 feet within proposed side channels and floodplain structures, decreasing in density to 40 feet on the edge of the model domain boundary. Element size (node density) in the main channel through the Smith and Southern Cross property areas is generally 2 feet in the transverse direction and 4 feet in the longitudinal direction. The small mesh density around the proposed diversion intake, roughened channel, and LWM features was intended to represent the features with as much detail as possible without compromising computational run times. The final model mesh had a total of 464,833 nodes and 536,685 elements. Figure 4 presents an example area of the model mesh layout within the Southern Cross Property where a side channel connection is proposed. In addition, the nodestrings which track flow are shown as red lines.

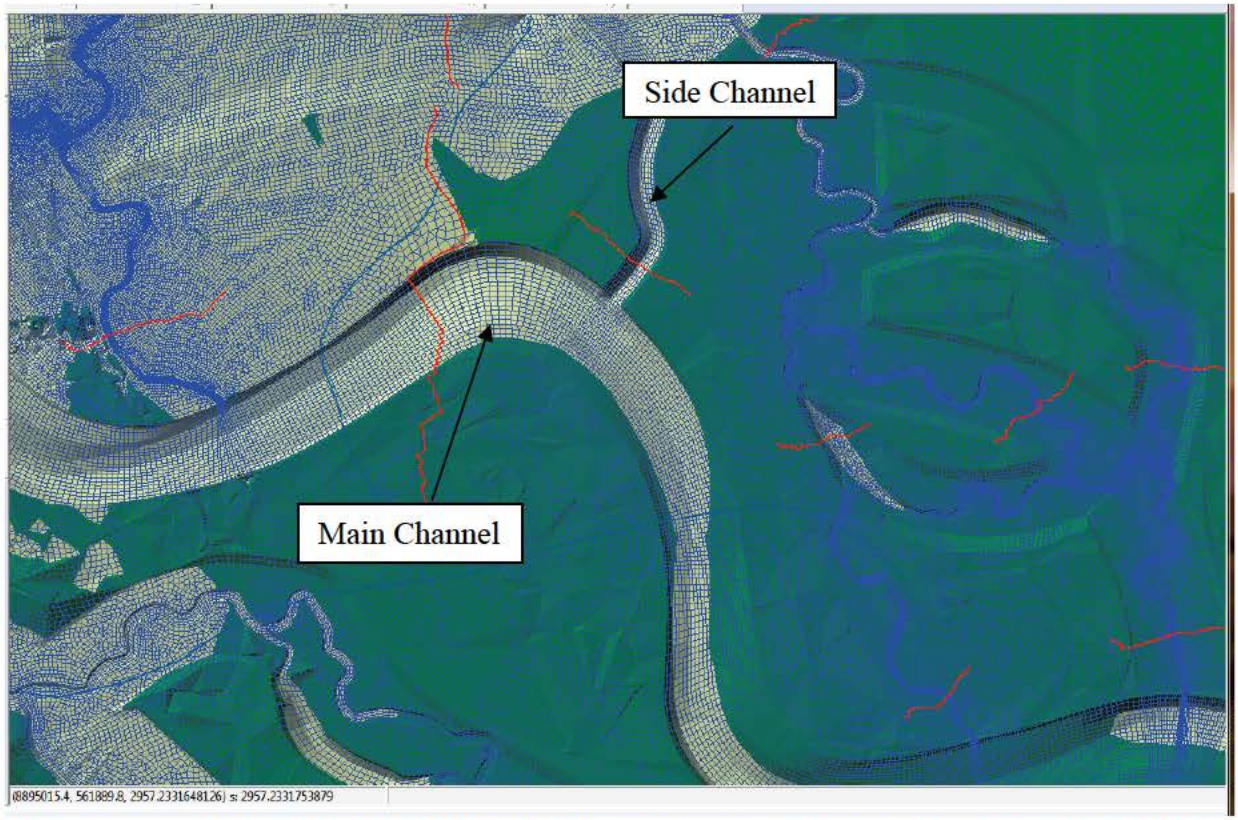

Figure 4 – Proposed Conditions Model Mesh Layout and Density – Example Location in CC-44 Project Area

2.5 Model Boundary Conditions

The upstream boundary for the 2D model utilized steady-state inflows from the estimated flood frequency events shown in Table 1. The downstream boundary utilized output from a one-dimensional (1D) HEC-RAS model developed for the Catherine Creek Reach 3 & 4 Assessments (Kimbrel, 2012a). The cross-section utilized in the HEC-RAS model is located at station 225300. The stage-discharge relationship used for the 2D model downstream boundary is presented in Table 2.

Table 2 – Downstream Model Boundary Stage-Discharge Table

Identifier	Discharge (ft^3/s)	Stage (ft)
95% Exceedance	18	2897.3
40 cfs	40	2897.5
60 cfs	60	2897.6
120 cfs	120	2898.0
280 cfs	280	2898.6
5% Exceedance	450	2899.1
1.25-year	565	2899.4
OHW (1.5-year)	659	2899.6
2-year	770	2899.9
10-year	1,185	2900.7
25-year	1,370	2901.0
100-year	1,622	2901.3

2.6 Sediment Data

Two different sets of sediment data were available for erosion/deposition analyses in the CC-44 project area. The first was five bed material bulk samples collected by the Oregon Department of Fish and Wildlife (ODFW) along Catherine Creek in December 2012. The second was two longitudinal point bar pebble counts collected upstream and downstream of the diversion by Reclamation TSC and RTS staff in December 2013. Figure 5 presents the location of the seven total sediment samples in the CC-44 project area. Figure 6 presents the particle size distribution for the seven sediment samples. Results show the ODFW sample median (d_{50}) particle sizes are smaller than the pebble count median particle sizes. This difference in median particle sizes is due to the ODFW bed material samples including both the armored surface layer and finer sub-surface bed layer, whereas the pebble counts only account for the armored surface layer of the bed. For particle sizes above 70% cumulative passing (or d_{70}), both sample types become more similar. The median particle size (d_{50}) for all the samples mostly fall into the 32 to 64 mm range, which is the size range for very coarse gravel.

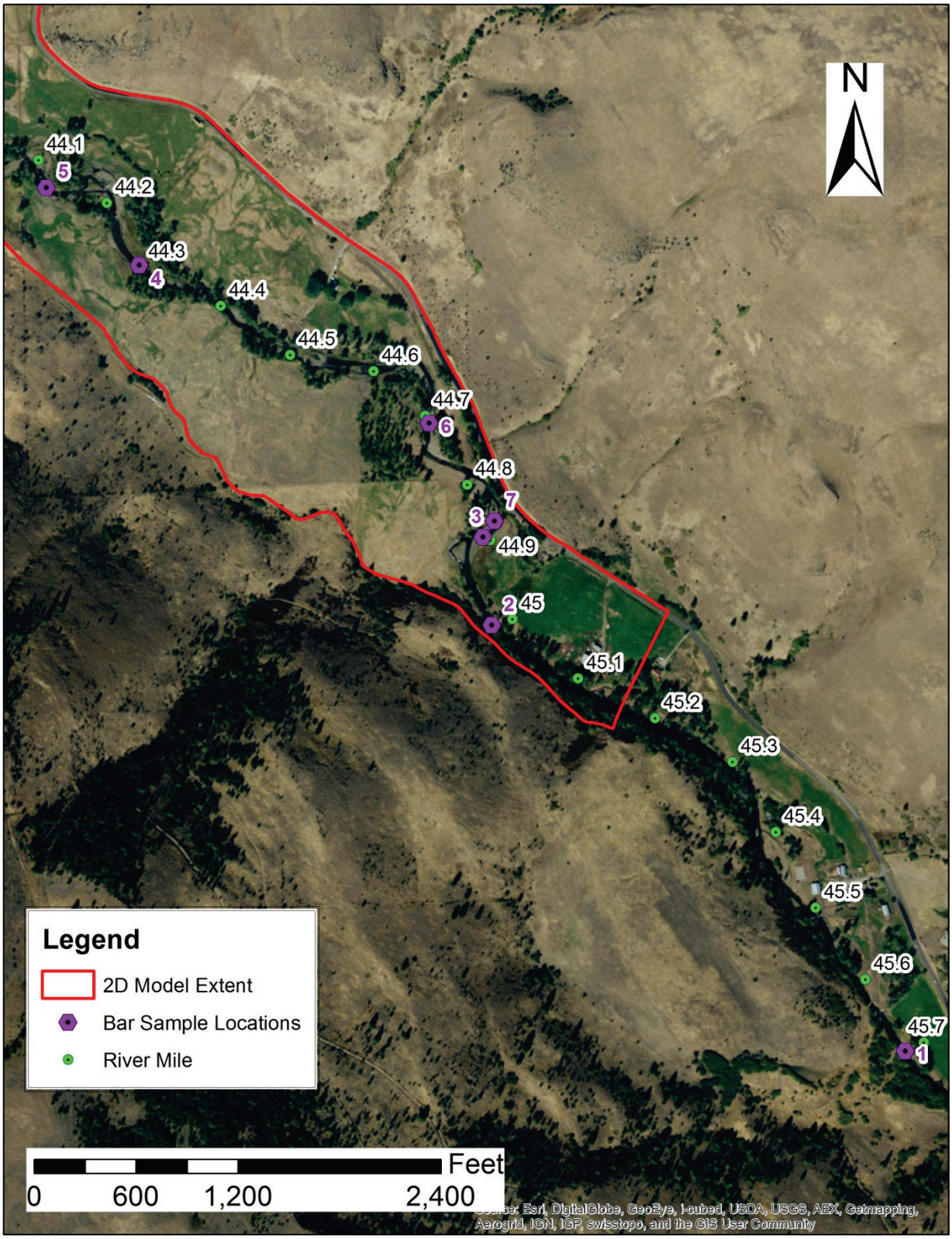

Figure 5 – Map of Sediment Sample Locations (1 through 5 are ODFW Bulk Samples, 6 and 7 are Reclamation Pebble Counts)

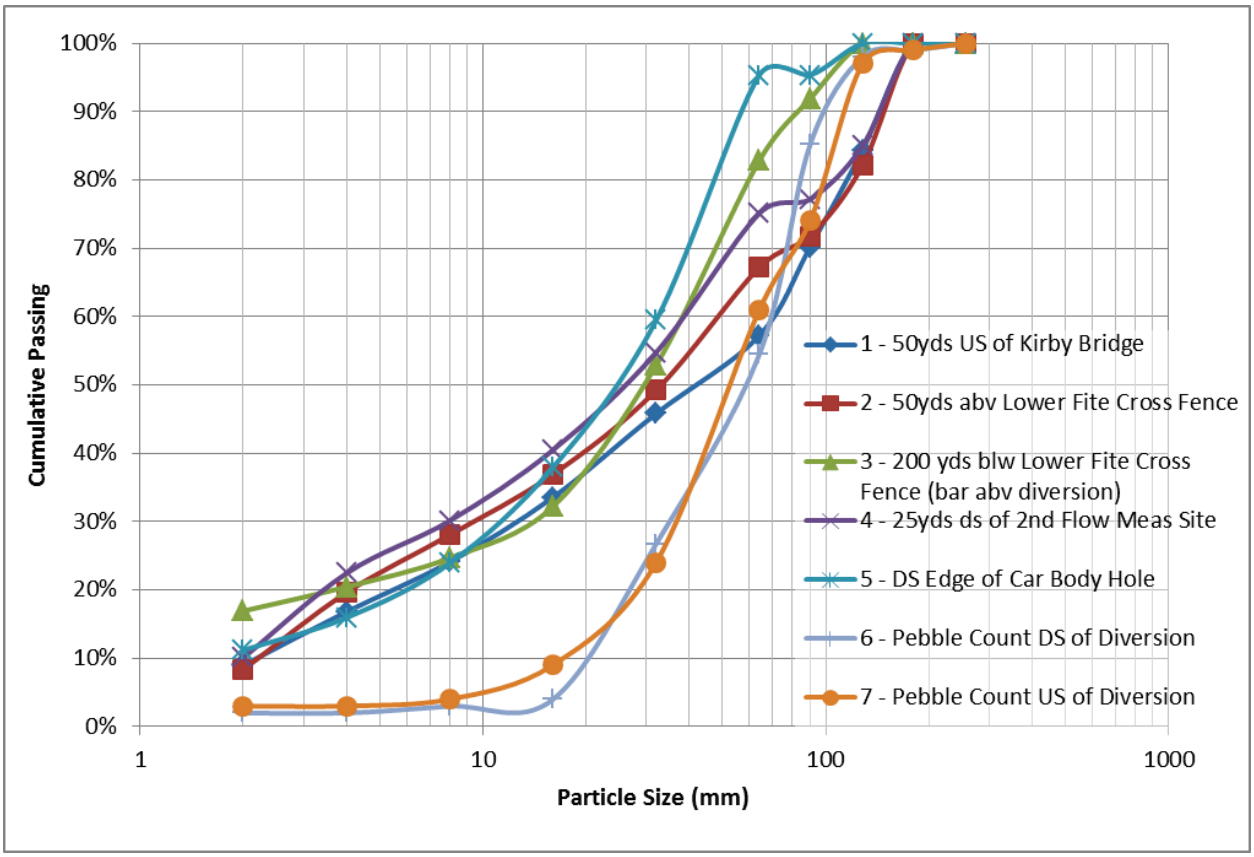

Figure 6 – Sediment Particle Size Distributions of ODFW Bed Material (1-5) and Reclamation Pebble Count Samples (6 and 7)

2.7 Model Calibration and Roughness

Model roughness areas were delineated according to aerial photography interpretations. Roughness values were initially assigned to be consistent with the previous hydraulic modeling study (Kimbrel, 2012a). Calibration of the 2D model to observed water surface elevations was performed in the previous CC-44 2D modeling study (Kimbrel, 2014) utilizing nine GPS surveyed high water marks collected on April 25, 2012 by PN RTS staff. These high water marks were collected during a mean-discharge of 669 ft^3/s recorded at the Catherine Creek near Union, Oregon stream gage. Based on previous experience with 1D and 2D hydraulic modeling studies (e.g. Kimbrel, 2012b), the channel roughness values in the 2D hydraulic model calibrated to a lower roughness, from a Manning roughness value of $n = 0.036$ to a roughness value of $n = 0.025$, based on the average difference between surveyed and modeled water surface elevations (see Kimbrel, 2014). In this study, the Manning roughness value during the lowest flow (18 ft^3/s) was set to a higher roughness value $n = 0.065$. This higher roughness value was based on the Manning-Strickler equation (Strickler, 1923):

$$n = 0.039 d_{50}^{1/6} \quad \textbf{1}$$

Equation 1 gives a roughness value of $n = 0.075$ for a median particle size diameter of 50 mm, which is a value within the range of median particle sizes sampled in 2012 and 2013 (See Sediment Data Section). The computed roughness value of $n = 0.075$ was reduced to a value of $n = 0.065$, given the 2D model's geometric ability to account for form roughness (i.e., energy losses around bends and in eddies). The channel roughness value for flows in between the lowest (18 ft^3/s) and 5% exceedance (450 ft^3/s) was linearly interpolated to adjust between the Manning-Strickler approximation and the calibrated roughness value determined at higher flows (Figure 7).

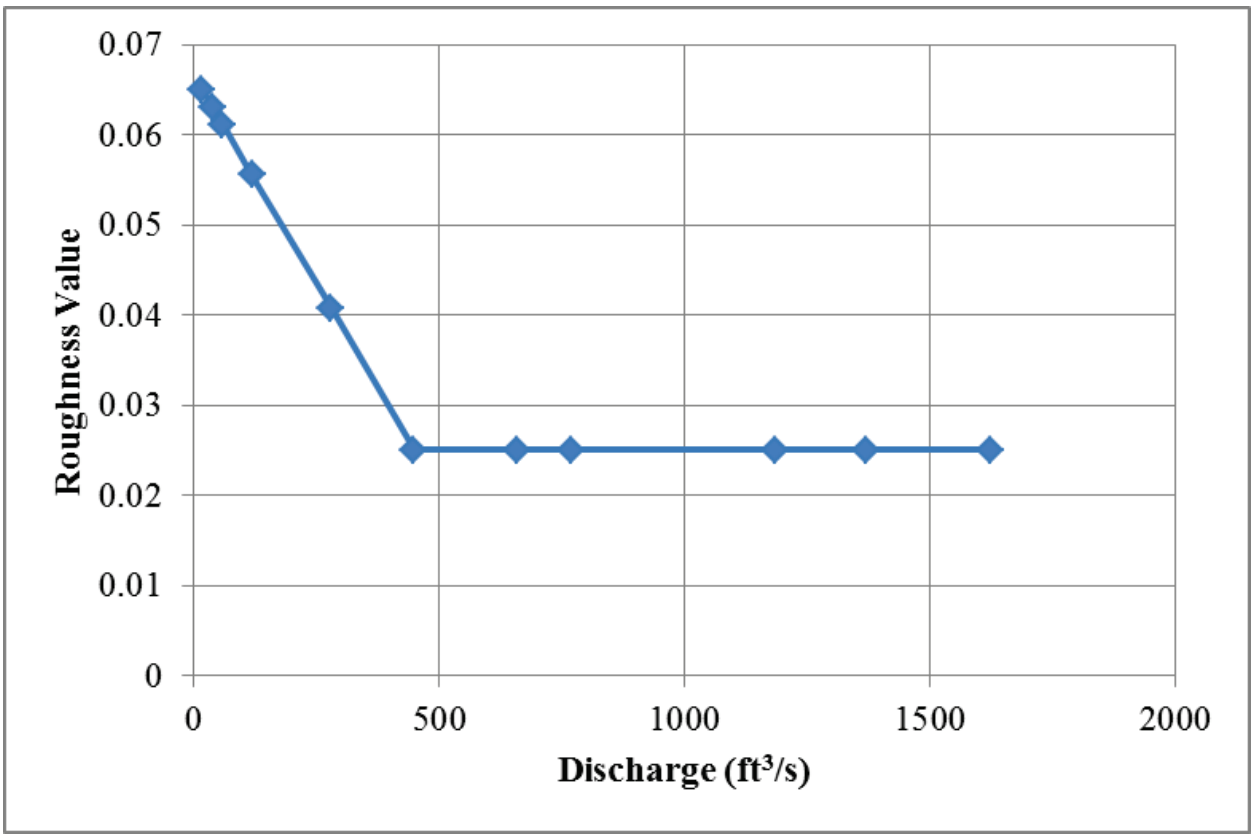

Figure 7 – Relationship of Model Channel Roughness Value vs. Model Discharge

For the LWM features, roughness values were assigned based on professional judgment and other 2D hydraulic modeling studies performed by TSC staff where similar types of features were modeled. If the LWM features were simulated by obstruction only in the model mesh, the Manning roughness value was set at $n = 0.025$, which is the same roughness as the channel during high flows, given that obstruction was the primary driver of flow re-direction. If the ELJ features were simulated by roughness only and no obstruction, the Manning roughness value was set at 0.2. The assigned material types and their corresponding Manning roughness values are presented below and illustrated in Figure 8:

- Material #1: Low Flow and Calibrated Channel Roughness (0.025 to 0.065, depending of discharge)
- Material #2: Dense floodplain (e.g. trees) vegetation (0.08)
- Material #3: Relatively sparse (agricultural or pasture areas assuming no crops) vegetation (0.045)
- Material #4: LWM structure, obstruction only (0.025)
- Material #5: Roads (0.025)
- Material #6: Side Channel 3 (0.065, assumed based on large roughness elements in design)
- Material #7: LWM structure, roughness only (0.2)

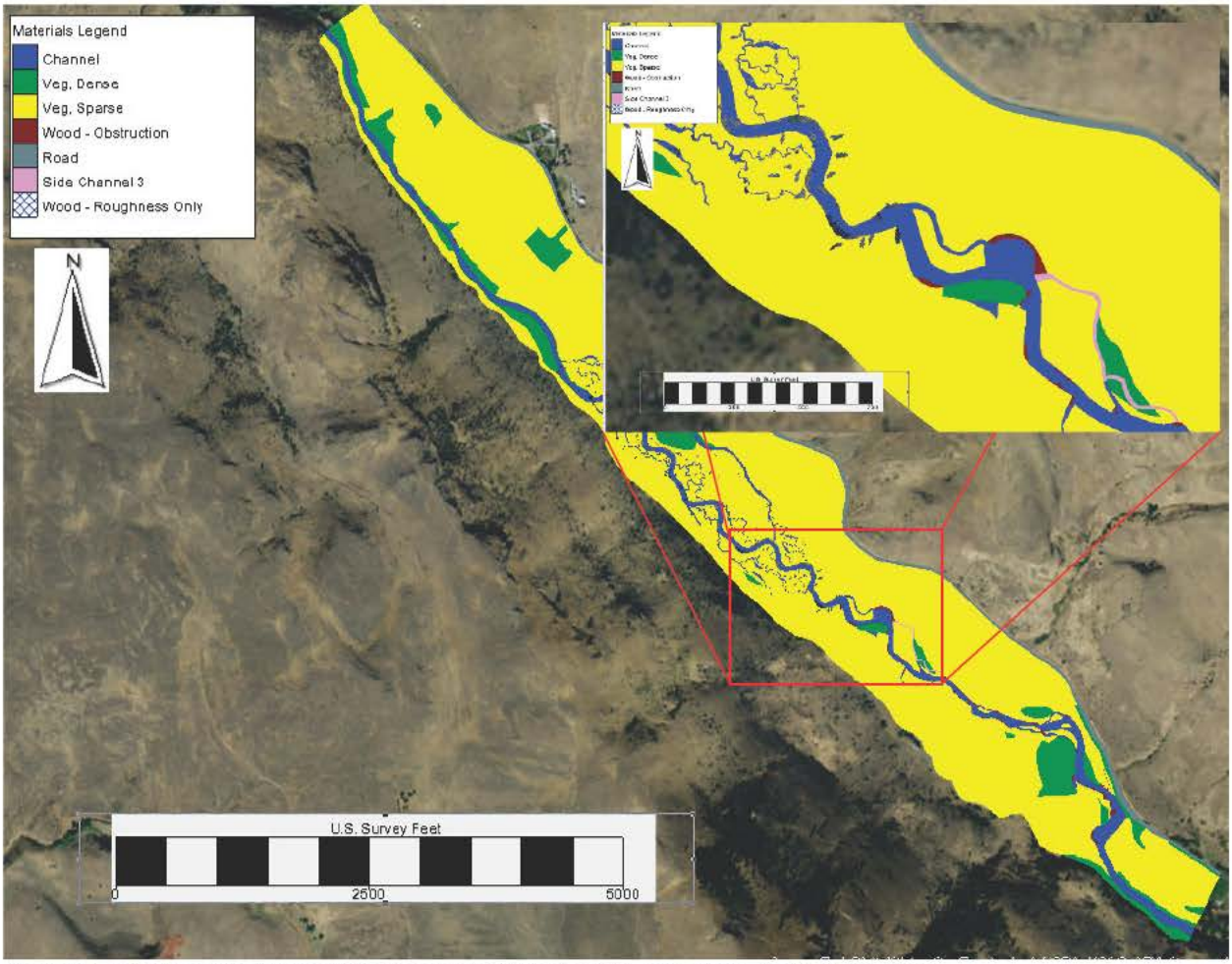

Figure 8 –Roughness Delineations for 2D Model Domain in the CC-44 Project Area

2.8 Dimensionless Shear Stress Computations

To provide the ability to assess the potential of future geomorphic change (erosion/deposition), flow competence (particle mobility), and the stability of the proposed features in the project area, the SRH-2D morphological analysis module (Lai, 2008) was used to assess dimensionless shear stress, τ_i* (Shields, 1936), derived from hydraulic modeling results and the median grain size (d_{50}) of the pebble count particle size distributions, and critical particle size (d_c) given a critical dimensionless shear stress, τ_c*, equal to a value of 0.04 (Lai, 2008), which is identified as the threshold of particle motion in prior studies (e.g. Shields, 1936). These data are available in a text file and GIS format for each design iteration and each discharge. Figure 9 presents an example graphical representation of dimensionless shear stress in plan view within the Project Area at 1.5-year return period discharge. Areas in of active flow that are in orange and red indicate motion of the median particle size (d_{50}) for the given peak discharge.

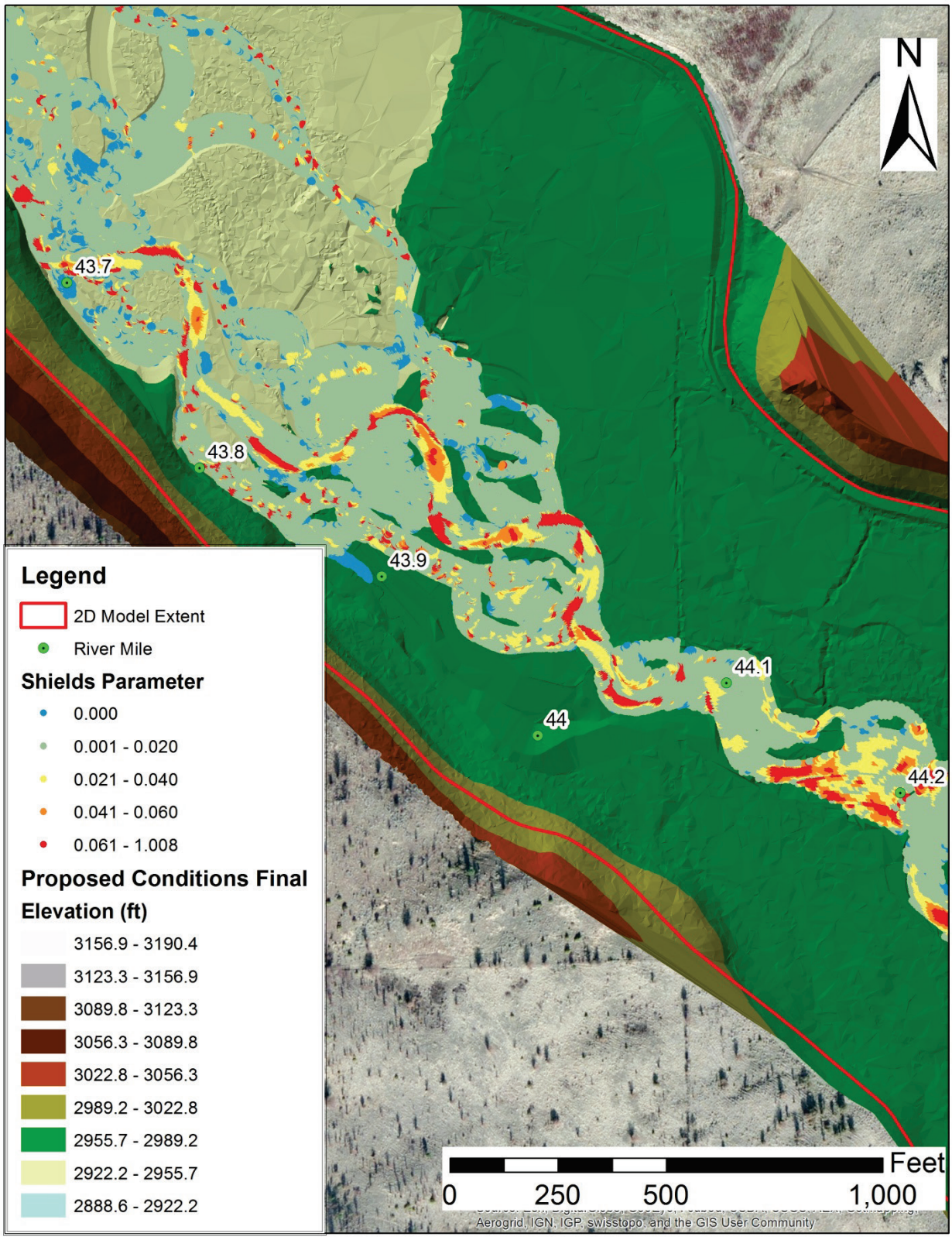

Figure 9 – Example Location in the Project Area Representing Dimensionless Shear Stress

3 Results and Discussion

For this modeling study, the existing conditions (without any proposed features) in the project area were modeled for each of the steady-state discharges shown in Table 1 as a means of comparison to the proposed conditions model results for the equivalent discharge. Using the proposed conditions topography, modeling scenarios were performed to provide results to assess the changes in inundation (water surface elevation or depth), velocities, and shear stresses in the project area. TSC staff performed a cursory review of the modeling results for each design model iteration. This cursory review was performed in order to verify model adequacy given the proposed design inputs. Changes in depth, velocity, and inundation were assessed in ArcGIS. As an example, Figure 10 presents the change in inundation extent for the 2-year discharge between the Existing Conditions and the Final Design in the Smith Property Area of the Project.

For each design iteration, modeling results in ArcGIS and text file format were submitted to RTS staff, which was used by RTS staff for further evaluation of the projects goals and objectives. No interpretations or discussion of the design project performance for a given design iteration is provided in this report, as the scope of this study was limited to model development and simulation to provide results for interpretation by the RTS design team. The following model limitations were provided to designers for further consideration in developing/assessing design features based on SRH-2D results:

1. The SRH-2D model was applied to a fixed, static-bed condition, which only provides hydraulic model results at one instant in time. The geomorphic changes and evolution, such as the aggradation and degradation or the lateral channel changes of the project area were not predicted over the course of several years to assess design performance in the long-term.
2. SRH-2D is a depth-averaged two-dimensional hydraulic model, and does not simulate secondary currents outside of the channel bend, or vertically plunging flows at obstructions, which have an effect in increasing shear stress and therefore the detection and presence of erosion and scour in pools and near obstructions.

Further application of the SRH-2D modeling results to inform habitat enhancement project goals and objectives can be referenced in the RTS design reports.

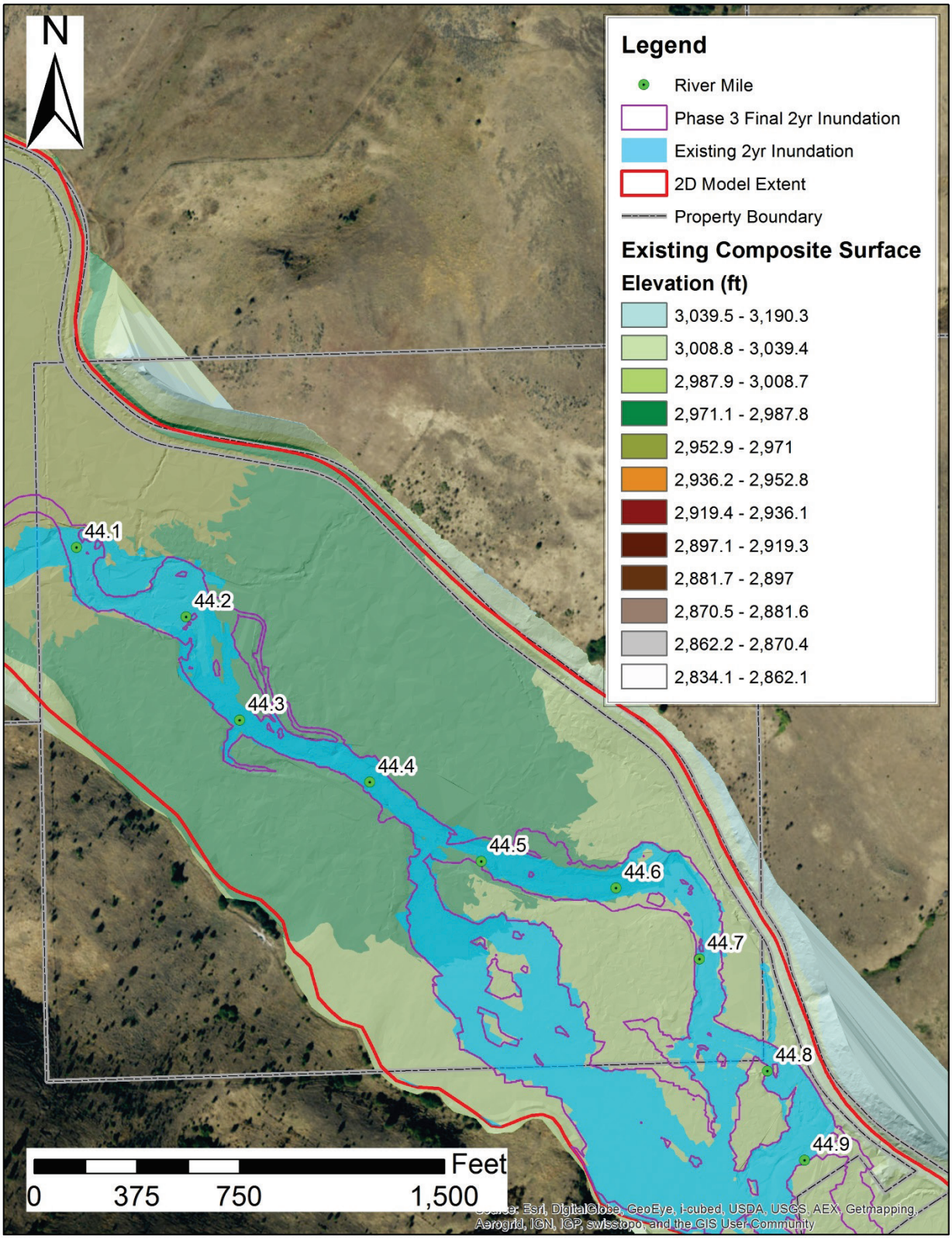

Figure 10 – Inundation Map of Existing and Proposed Conditions for a 2-year Discharge in the CC-44 Smith Property Area.

4 References

Parenthetical Reference	Bibliographic Citation
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