Engineered Log Jams for Geomorphic Processes and Habitat Complexity in Low Gradient Alluvial Valleys

Examples from TNC’s Ten Mile River Projects

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Large Wood Field School

11.12.2021

Google Earth

Low Gradient Alluvial Valleys

Hydrogeomorphic Features and Processes

- Floodplains – connectivity and complexity
- Sediment storage and transfer
- Riparian vegetation
- Large wood
- Groundwater and spring fed
- Entrenched channels (versus incised)

Salmonid Lifestage Utilization

- Winter and spring rearing and outmigration (high flow refugia, feeding, shelter)
- Summer rearing (in-channel complexity and shelter, flow quantity and quality)
- Migration and spawning (pools with shelter, well-defined riffles with appropriate hydraulics)

Legacy Sediment (Entrenchment) and Channel Simplification

- 5 to 15 feet of homogenous, silty sand - no buried soil layers or stratigraphy.
- Alluvial gravels, buried logs, intact tree roots below floodplain fine sediments. At existing channel elev.
- Flood and alluvial fan deposits from intense logging periods, cleared and smoothed for agriculture.
- Historic large wood removal
- Minimal wood recruitment and delivery to reaches

Goals and Design Objectives – Reach Based

Goals

- Significantly increase winter high flow refugia and rearing habitat for juvenile salmonids (with focus on coho).
- Improve in-channel complexity and cover for summer juvenile salmonid rearing.

Design Objectives

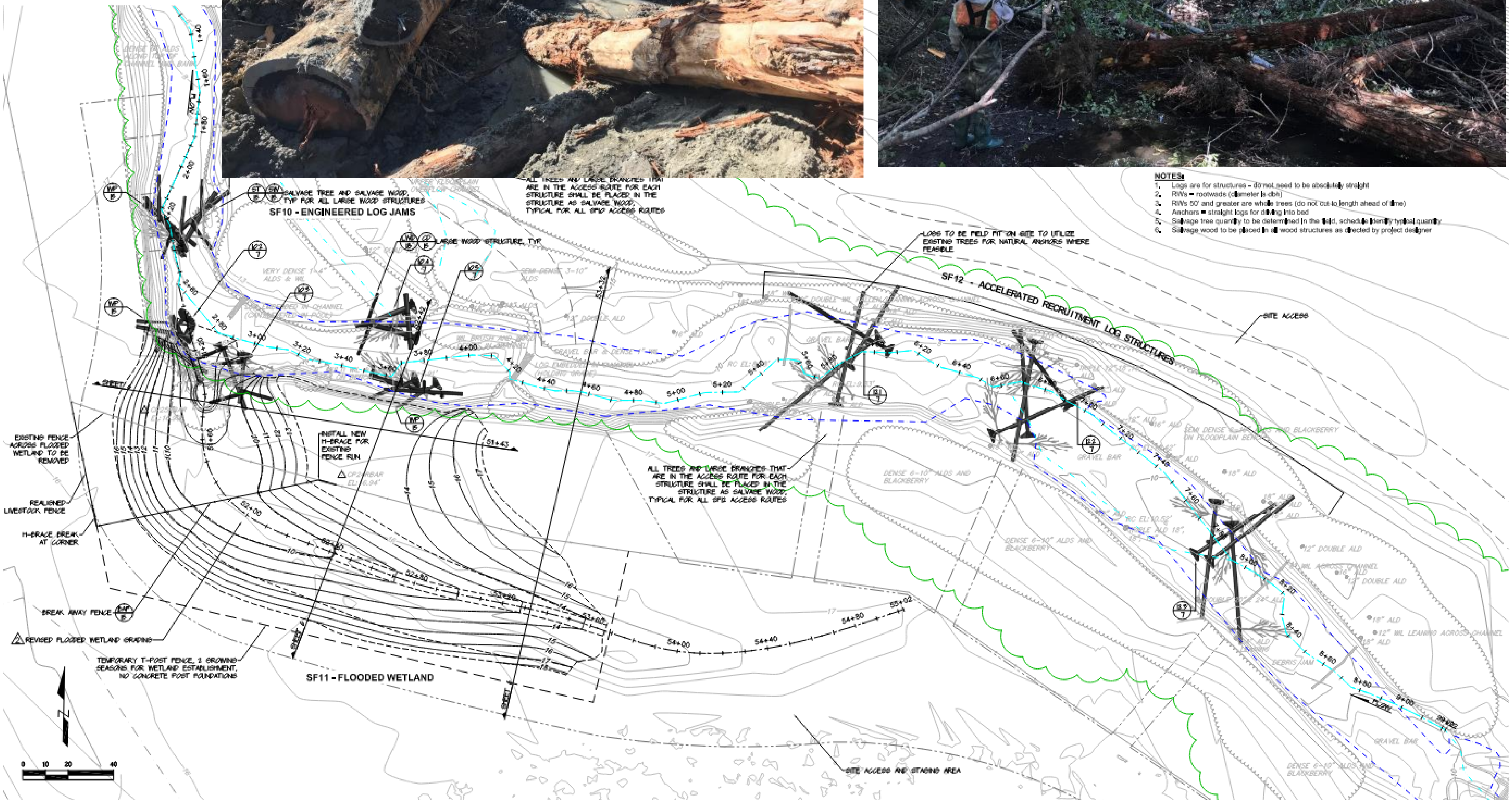
- Increase prevalence of low velocity (< 1 ft/sec) environments at range of winter flows.
- Increase number of deep pools with complex wood cover.
- Engage existing floodplain benches at lower winter flows.
- Drive channel widening and stable vegetated gravel bar formation.
- Accelerate natural recruitment of riparian trees.
- Trap and accumulate woody debris.
- Link accessibility to range of habitats.
- Use a range of large wood designs and techniques

South Fork Ten Mile – Stop 1 – Constructed 2018 & 2020

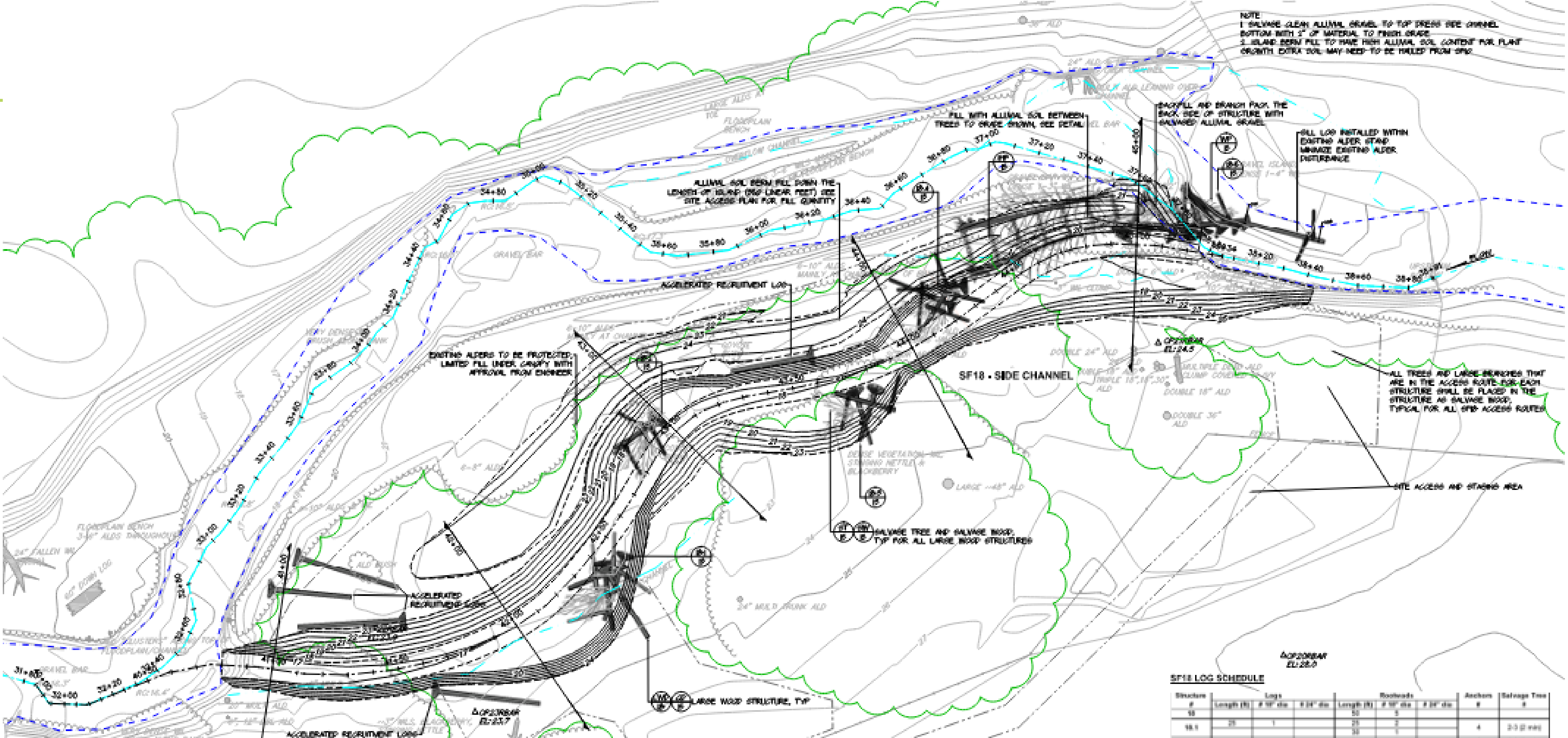
Cross-Channel Racking Jam

Meander Jam

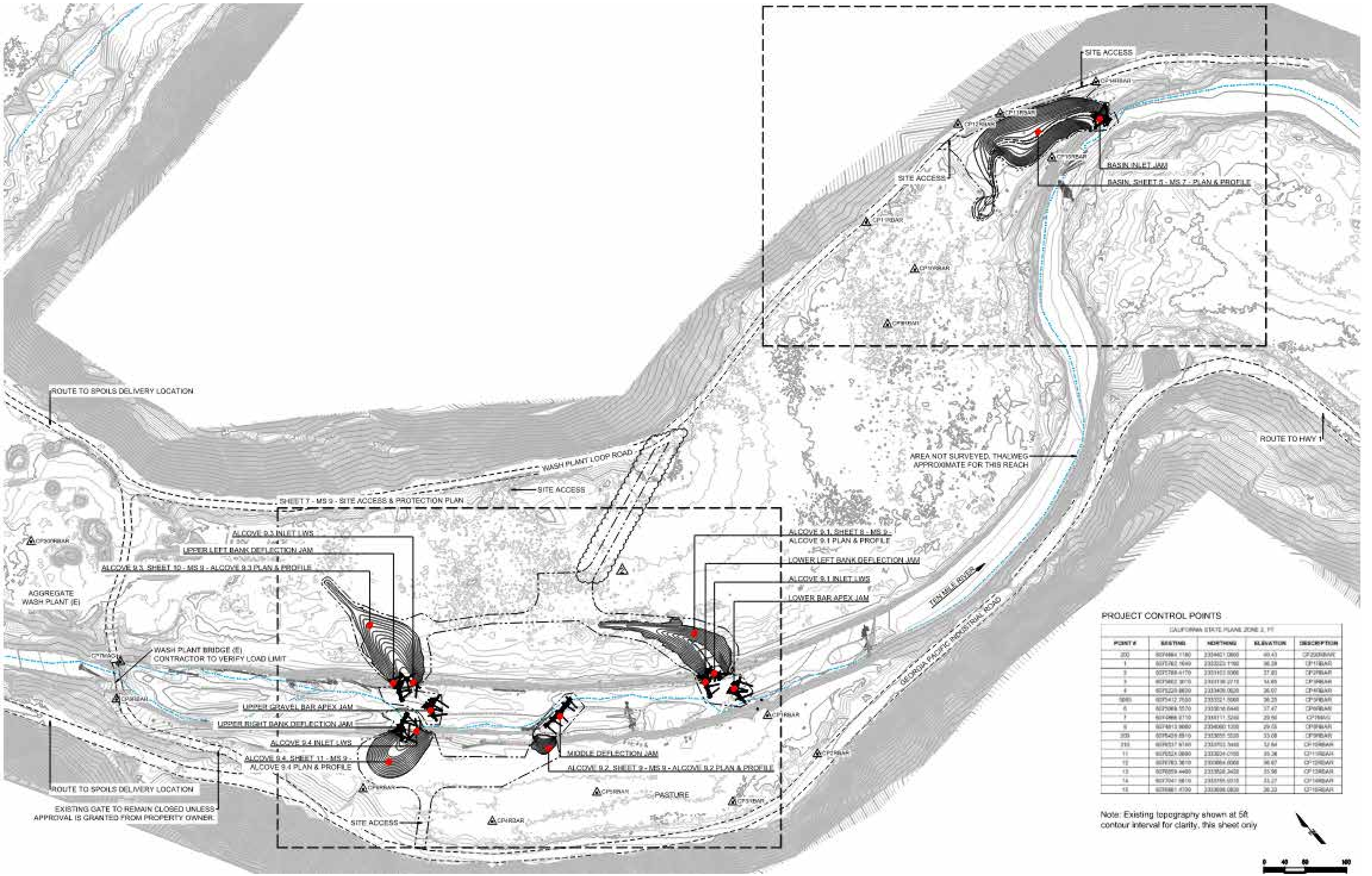
Off-channel flooded wetland and side channel complex



SALVAGE TREE AND SALVAGE WOOD, TYP FOR ALL LARGE WOOD STRUCTURES
SF10 - ENGINEERED LOG JAMS
ALL TREES AND LARGE BRANCHES THAT ARE IN THE ACCESS ROUTE FOR EACH STRUCTURE SHALL BE PLACED IN THE STRUCTURE AS SALVAGE WOOD, TYPICAL FOR ALL SF10 ACCESS ROUTES
LARGE WOOD STRUCTURE, TYP
LOGS TO BE FIELD FIT ON SITE TO UTILIZE EXISTING TREES FOR NATURAL ANCHORS WHERE FEASIBLE
SF12 - ACCELERATED RECRUITMENT LOG STRUCTURES
SITE ACCESS
NOTES:
1. Logs are for structures – do not need to be absolutely straight
2. RWs = rootwads (diameter is dbh)
3. RWs 50' and greater are whole trees (do not cut to length ahead of time)
4. Anchors = straight logs for driving into bed
5. Salvage tree quantity to be determined in the field, schedule identify typical quantity
6. Salvage wood to be placed in all wood structures as directed by project designer
EXISTING FENCE ACROSS FLOODED WETLAND TO BE REMOVED
INSTALL NEW H-BRACE FOR EXISTING FENCE RUN
REALIGNED LIVESTOCK FENCE
H-BRACE BREAK AT CORNER
ALL TREES AND LARGE BRANCHES THAT ARE IN THE ACCESS ROUTE FOR EACH STRUCTURE SHALL BE PLACED IN THE STRUCTURE AS SALVAGE WOOD, TYPICAL FOR ALL SF12 ACCESS ROUTES
BREAK AWAY FENCE
REVISED FLOODED WETLAND GRADING
TEMPORARY T-POST FENCE, 2 GROWING SEASONS FOR WETLAND ESTABLISHMENT, NO CONCRETE POST FOUNDATIONS
SF11 - FLOODED WETLAND
SITE ACCESS AND STAGING AREA
DENSE 6-10" ALDS AND BLACKBERRY
GRAVEL BAR
DEBRIS JAM


NOTE
1. SALVAGE CLEAN ALLUVIAL GRAVEL TO TOP DRESS SIDE CHANNEL BOTTOM WITH 1" OF MATERIAL TO FINISH GRADE.
2. ISLAND BERM FILL TO HAVE HIGH ALLUVIAL SOIL CONTENT FOR PLANT GROWTH. EXTRA SOIL MAY NEED TO BE HAULED FROM SF16.
BACKFILL AND BRANCH PACK THE BACK SIDE OF STRUCTURE WITH SALVAGED ALLUVIAL GRAVEL
FILL WITH ALLUVIAL SOIL BETWEEN TREES TO GRADE SHOWN, SEE DETAIL
SILL LOG INSTALLED WITHIN EXISTING ALDER STAND. MINIMIZE EXISTING ALDER DISTURBANCE
ALLUVIAL SOIL BERM FILL DOWN THE LENGTH OF ISLAND (550 LINEAR FEET) SEE SITE ACCESS PLAN FOR FILL QUANTITY
ACCELERATED RECRUITMENT LOG
EXISTING ALDERS TO BE PROTECTED, LIMITED FILL UNDER CANOPY WITH APPROVAL FROM ENGINEER
SF18 - SIDE CHANNEL
ALL TREES AND LARGE BRANCHES THAT ARE IN THE ACCESS ROUTE FOR EACH STRUCTURE SHALL BE PLACED IN THE STRUCTURE AS SALVAGE WOOD, TYPICAL FOR ALL SF18 ACCESS ROUTES
SITE ACCESS AND STAGING AREA
SALVAGE TREE AND SALVAGE WOOD, TYP FOR ALL LARGE WOOD STRUCTURES
LARGE WOOD STRUCTURE, TYP
ACCELERATED RECRUITMENT LOGS
SF18 LOG SCHEDULE


Mainstem Ten Mile – Stop 2 – Constructed 2021



PROJECT CONTROL POINTS

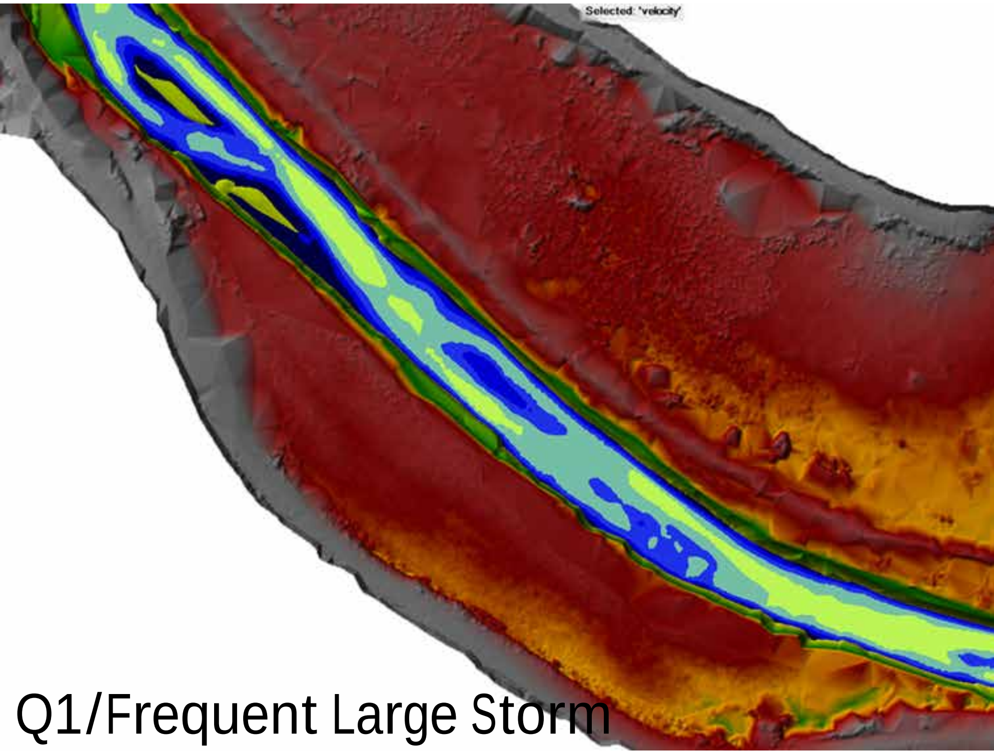
CALIFORNIA STATE PLANE ZONE 2, FT				
POINT #	EASTING	NORTHING	ELEVATION	DESCRIPTION
200	6074664.1160	2334621.0860	40.43	CP200REBAR
1	6075762.1640	2332223.1160	36.28	CP1REBAR
2	6075768.4170	2333103.5060	37.83	CP2REBAR
3	6075662.3070	2333136.2710	34.65	CP3REBAR
4	6075220.8820	2333405.0620	26.07	CP4REBAR
5085	6075412.7530	2333321.5060	36.23	CP5REBAR
6	6075068.5570	2333516.6440	37.47	CP6REBAR
7	6074968.0710	2333111.3260	29.56	CP7MAG
8	6074813.9060	2334060.1200	29.03	CP8REBAR
203	6075426.6910	2333655.5530	33.08	CP9REBAR
210	6076537.6160	2333703.5460	32.64	CP10REBAR
11	6076524.0660	2333624.0160	35.36	CP11REBAR
12	6076763.3610	2333864.6060	36.67	CP12REBAR
13	6076859.4460	2333528.3400	35.56	CP13REBAR
14	6077047.9810	2333755.0310	33.27	CP14REBAR
15	6076661.4700	2333698.0600	36.33	CP15REBAR

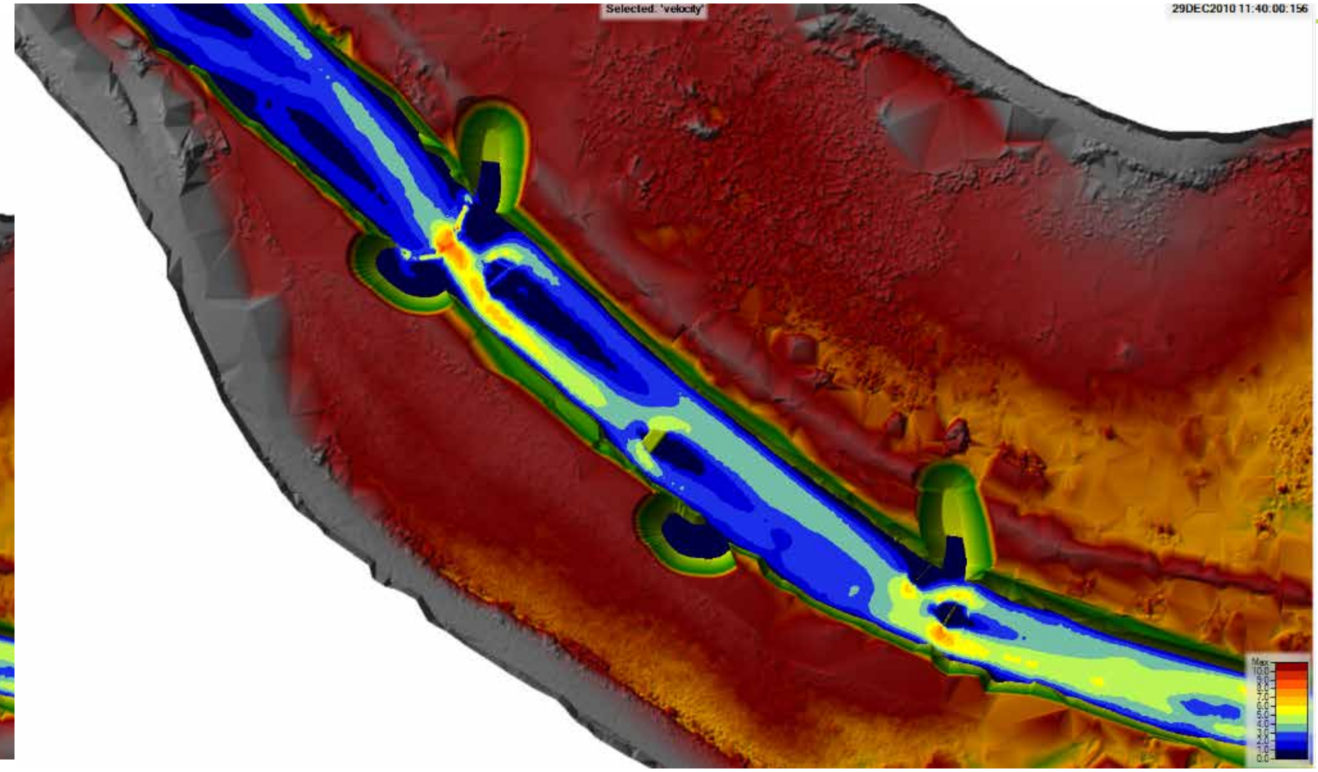
Note: Existing topography shown at 5ft contour interval for clarity, this sheet only

0 40 80 160

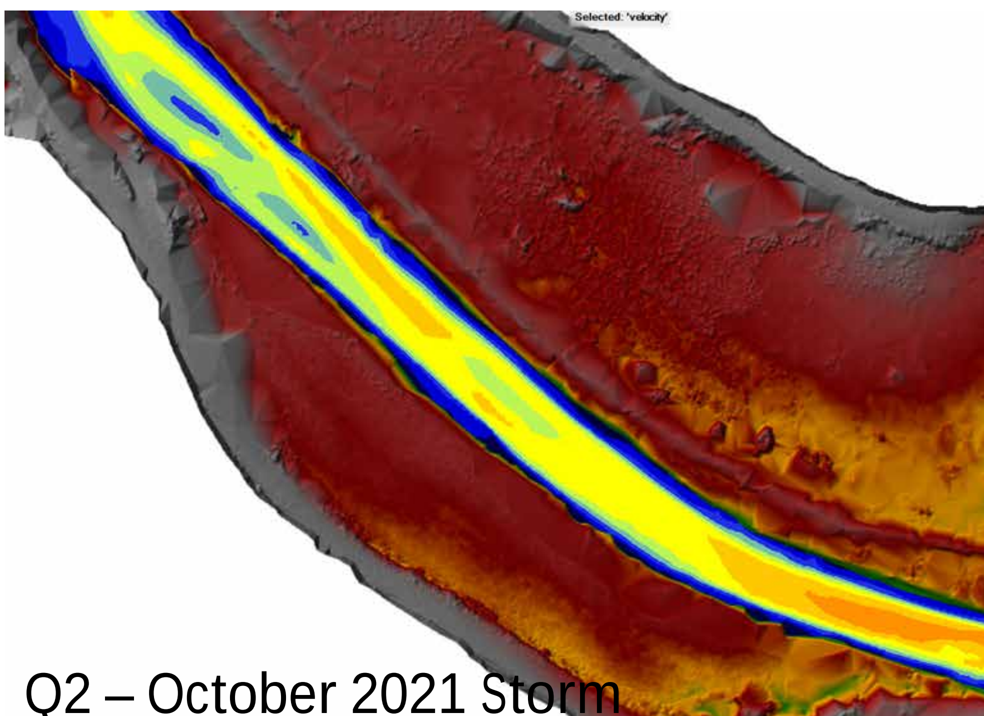
Pre-Project

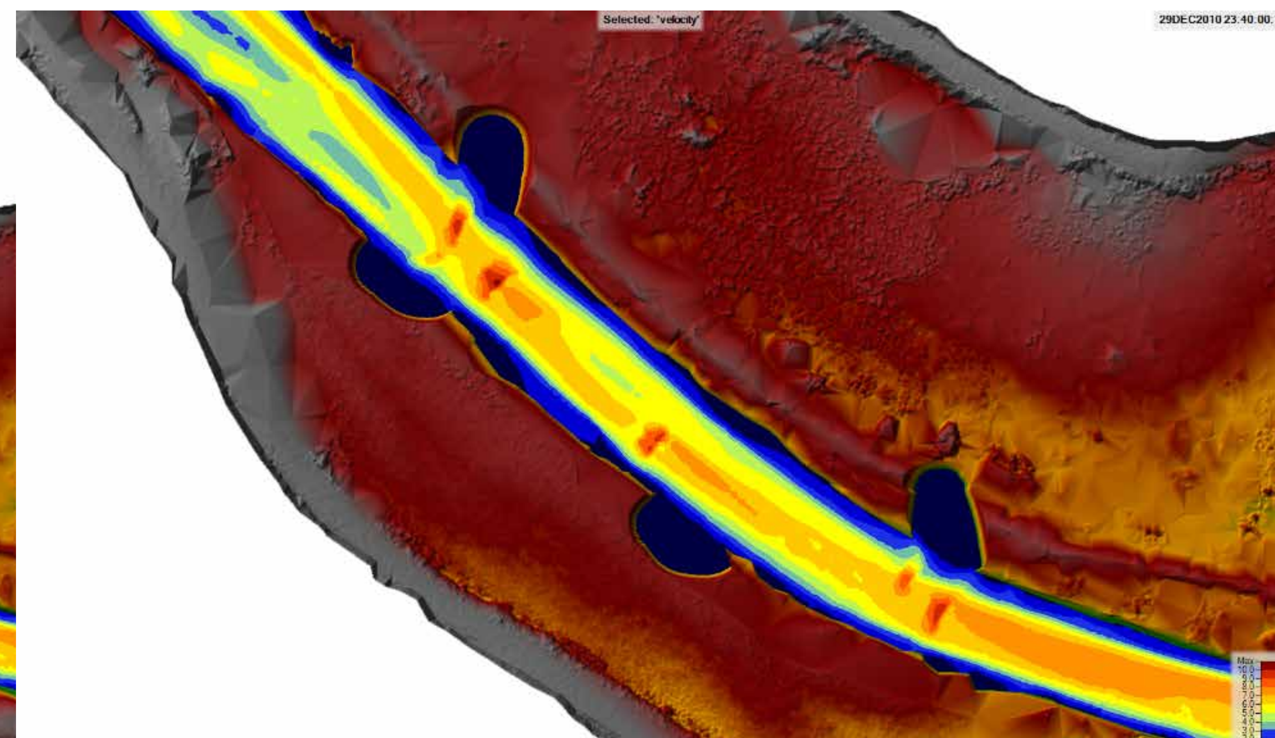
Preliminary Design



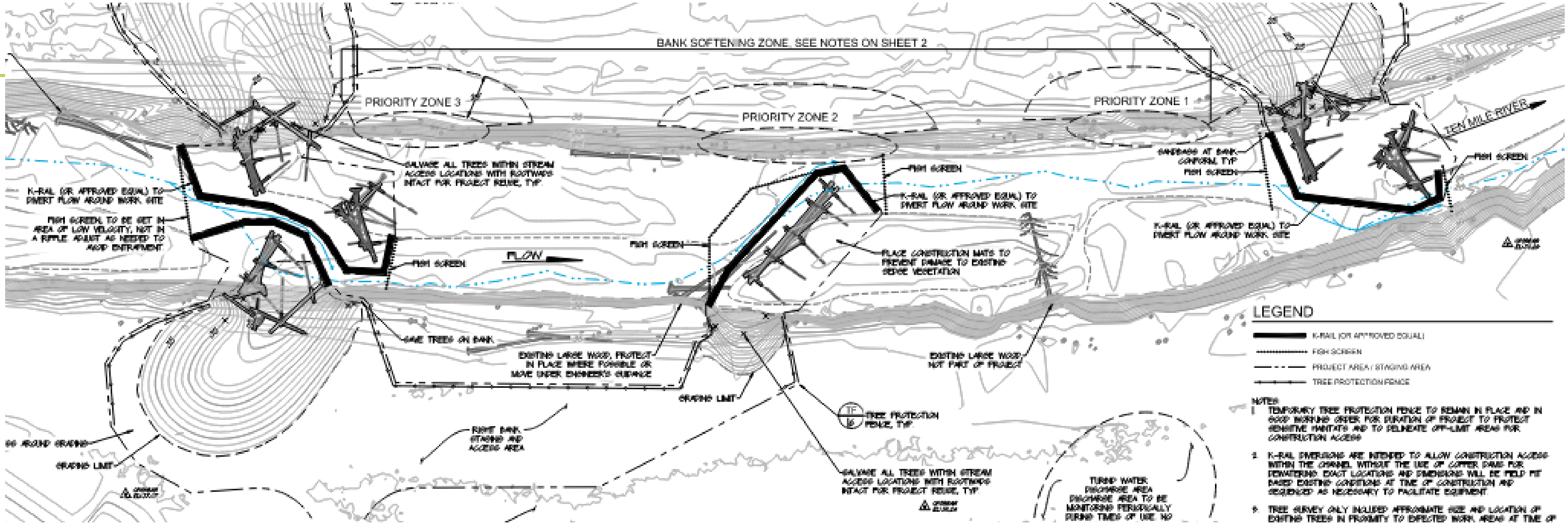


Q1/Frequent Large Storm



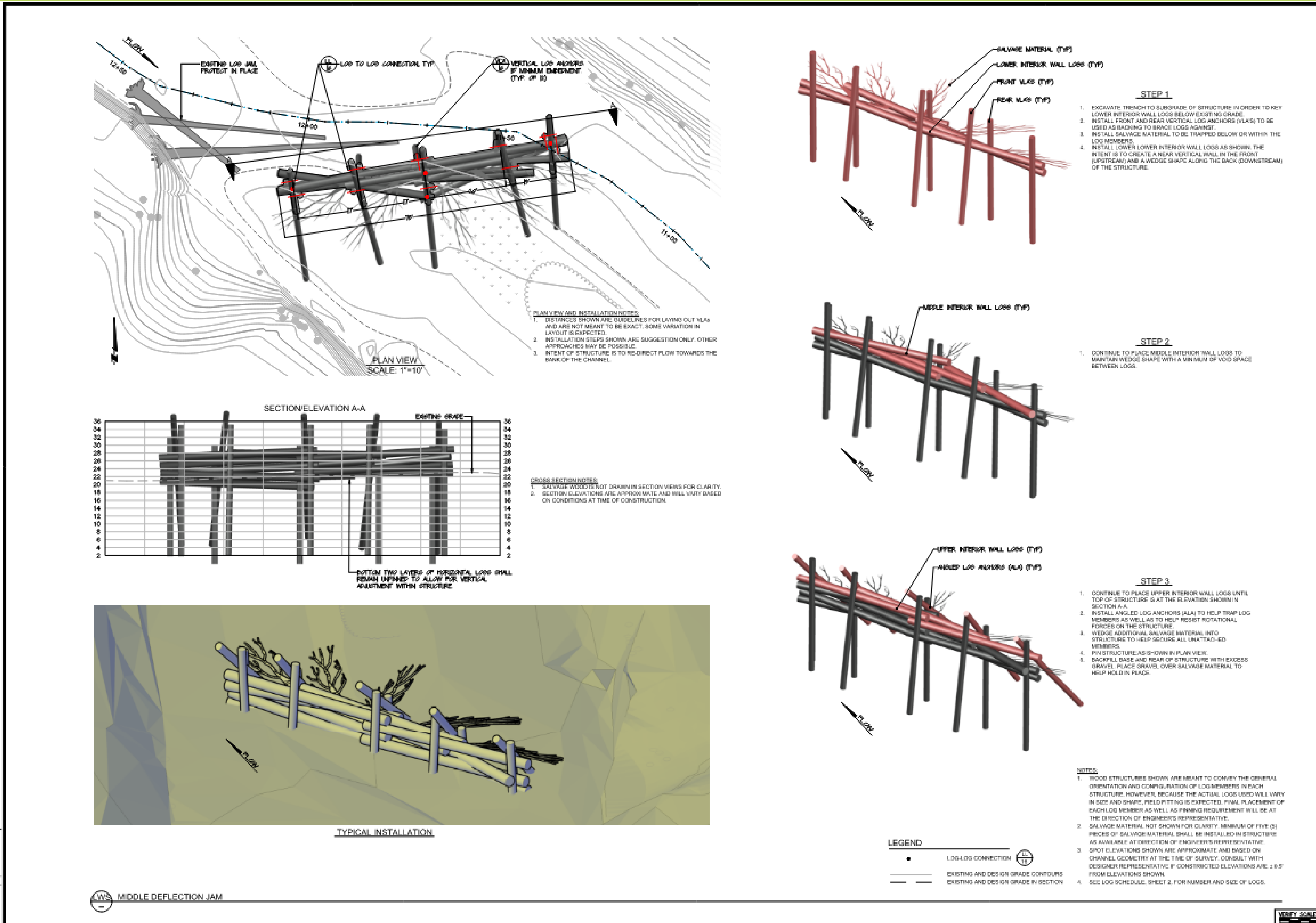


Q2 – October 2021 Storm


BANK SOFTENING ZONE, SEE NOTES ON SHEET 2
PRIORITY ZONE 3
PRIORITY ZONE 2
PRIORITY ZONE 1
TEN MILE RIVER
FLOW
K-RAIL (OR APPROVED EQUAL) TO DIVERT FLOW AROUND WORK SITE
FISH SCREEN, TO BE SET IN AREA OF LOW VELOCITY, NOT IN A RIFFLE. ADJUST AS NEEDED TO AVOID ENTRAINMENT
SALVAGE ALL TREES WITHIN STREAM ACCESS LOCATIONS WITH ROOTWADS INTACT FOR PROJECT REUSE, TYP.
FISH SCREEN
PLACE CONSTRUCTION MATS TO PREVENT DAMAGE TO EXISTING DENSE VEGETATION
SANDBAGS AT BANK CONFORM, TYP
SAVE TREES ON BANK
EXISTING LARGE WOOD, PROTECT IN PLACE WHERE POSSIBLE OR MOVE UNDER ENGINEER'S GUIDANCE
EXISTING LARGE WOOD NOT PART OF PROJECT
GRADING LIMIT
TREE PROTECTION FENCE, TYP.
RIGHT BANK STAGING AND ACCESS AREA
TURBID WATER DISCHARGE AREA
LEGEND
K-RAIL (OR APPROVED EQUAL)
FISH SCREEN
PROJECT AREA / STAGING AREA
TREE PROTECTION FENCE
NOTES:
1. TEMPORARY TREE PROTECTION FENCE TO REMAIN IN PLACE AND IN GOOD WORKING ORDER FOR DURATION OF PROJECT TO PROTECT SENSITIVE HABITATS AND TO DELINEATE OFF-LIMIT AREAS FOR CONSTRUCTION ACCESS
2. K-RAIL DIVERSIONS ARE INTENDED TO ALLOW CONSTRUCTION ACCESS WITHIN THE CHANNEL WITHOUT THE USE OF COFFER DAMS FOR DEWATERING. EXACT LOCATIONS AND DIMENSIONS WILL BE FIELD FIT BASED EXISTING CONDITIONS AT TIME OF CONSTRUCTION AND SEQUENCED AS NECESSARY TO FACILITATE EQUIPMENT.
3. TREE SURVEY ONLY INCLUDED APPROXIMATE SIZE AND LOCATION OF EXISTING TREES IN PROXIMITY TO EXPECTED WORK AREAS AT TIME OF


CAT

Engineered Log Jam Designs



Upstream Deflection and Bar Apex Jams

Deflection jam

Downstream Deflection and Bar Apex Jams

Go Big!