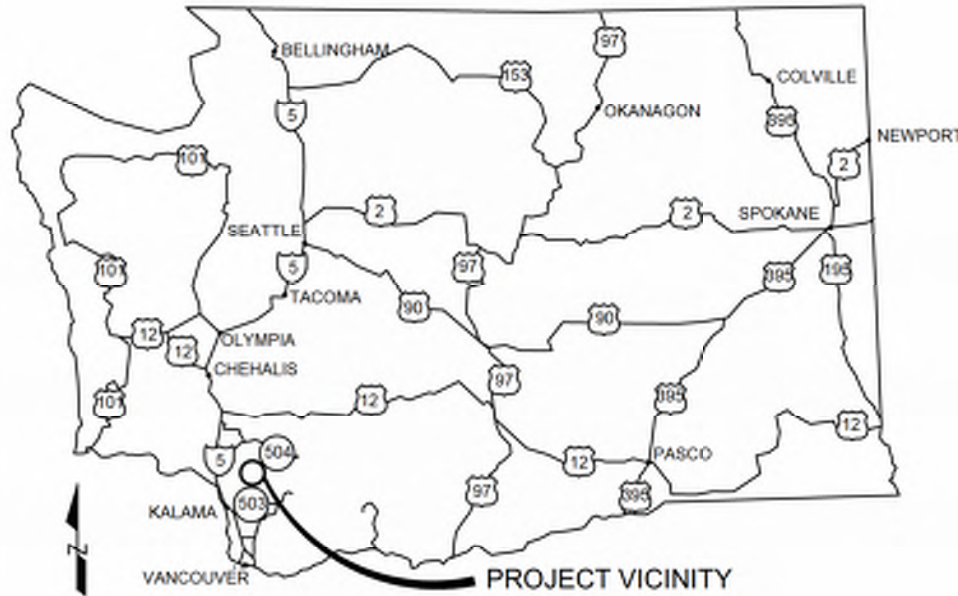


SOUTH FORK TOUTLE RIVER HEADWATERS DESIGN

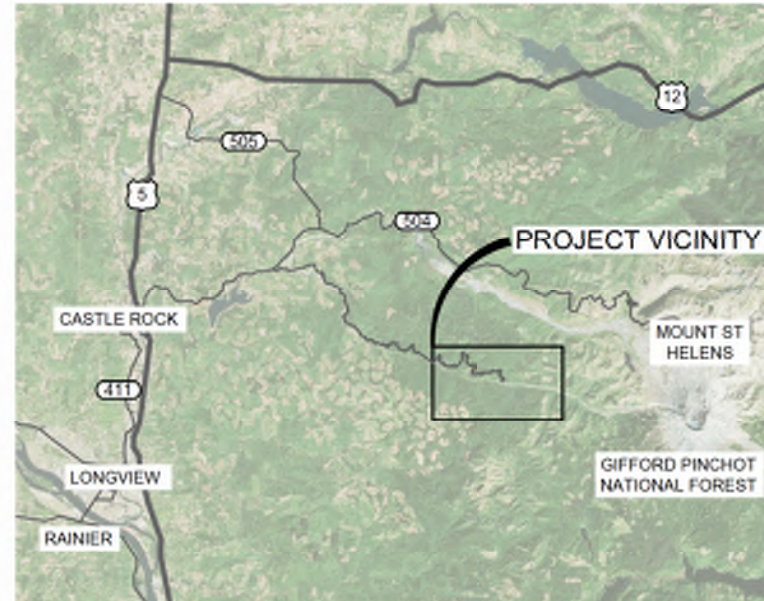
FINAL DESIGN
NOVEMBER 2024

#20200001

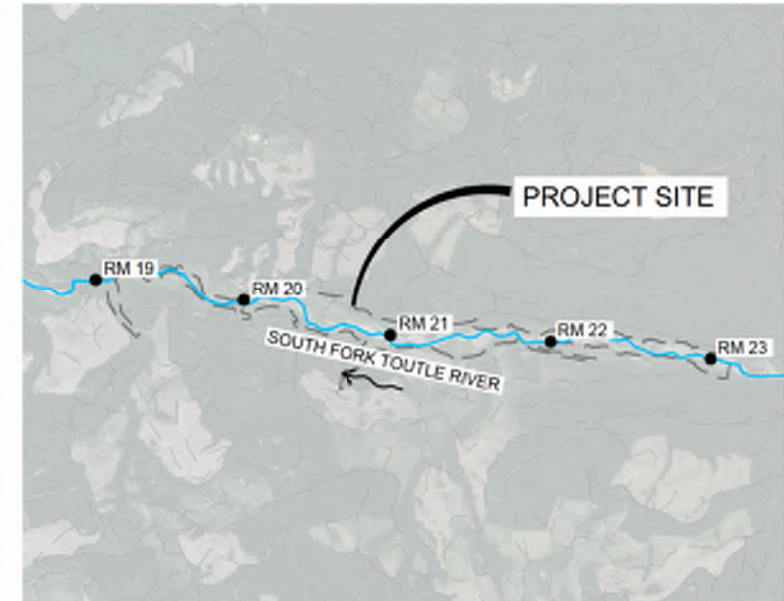
COWLITZ COUNTY, WASHINGTON



REGIONAL MAP
NTS



PROJECT VICINITY
NTS



PROJECT SITE
NTS

SHEET INDEX

SHEET NO.	NAME	SHEET DESCRIPTION
1	G1.0	COVER SHEET
2	G1.1	GENERAL NOTES & LEGEND
3	G1.2	HIP CONSERVATION MEASURES 1
4	G1.3	HIP CONSERVATION MEASURES 2
5	C1.0	EXISTING CONDITIONS OVERVIEW
6	C2.0	ACCESS, STAGING, AND HELICOPTER OVERVIEW
7	C2.1	ACCESS STAGING AND HELICOPTER PLAN - REACH A
8	C2.2	ACCESS STAGING AND HELICOPTER PLAN - REACH B
9	C2.3	ACCESS STAGING AND HELICOPTER PLAN - REACH C
10	C2.4	ACCESS, STAGING, AND HELICOPTER PLAN - REACH D
11	C3.0	SITE OVERVIEW
12	C3.1	SF TOUTLE PLAN - STA 39+00 TO 58+00
13	C3.2	SF TOUTLE PLAN - STA 58+00 TO 75+00
14	C3.3	SF TOUTLE PLAN - STA 75+00 TO 93+00
15	C3.4	SF TOUTLE PLAN - STA 93+00 TO 112+00
16	C3.5	SF TOUTLE PLAN - STA 112+00 TO 130+00
17	C3.6	SF TOUTLE PLAN - STA 130+00 TO 148+00
18	C3.7	SF TOUTLE PLAN - STA 148+00 TO 165+00
19	C3.8	SF TOUTLE PLAN - STA 165+00 TO 183+50
20	C3.9	SF TOUTLE PLAN - STA 183+50 TO 202+50
21	C3.10	SF TOUTLE PLAN - STA 202+00 TO 220+00
22	C3.11	SF TOUTLE PLAN - STA 220+00 TO 238+50
23	C3.12	SF TOUTLE PLAN - STA 238+50 TO 256+50
24	C3.13	BEAR CREEK PLAN - STA 2+00 TO 21+00
25	C4.0	SF TOUTLE PROFILE STA 39+00 TO 99+00
26	C4.1	SF TOUTLE PROFILE STA 99+00 TO 159+00
27	C4.2	SF TOUTLE PROFILE STA 159+00 TO 219+00
28	C4.3	SF TOUTLE PROFILE STA 219+00 TO 257+00
29	C4.4	TRIBUTARY PROFILES

SHEET INDEX

SHEET NO.	NAME	SHEET DESCRIPTION
30	C5.0	FLOODPLAIN GRADING CROSS SECTION 1
31	C5.1	FLOODPLAIN GRADING CROSS SECTION 2
32	C5.2	TYPICAL CHANNEL FILL SECTION AND PROFILE
33	C6.0	WHS TYPE 1 & 2 DETAILS
34	C6.1	WHS TYPE 3 & 4 DETAILS
35	C6.2	WHS TYPE 5 DETAIL
36	C6.3	WHS TYPE 6 DETAIL
37	C6.4	WHS TYPE 7 DETAIL
38	C6.5	WHS TYPE 8 DETAIL
39	C6.6	WHS TYPE 9 DETAIL
40	C6.7	WHS TYPE 10 DETAIL
41	C6.8	WHS TYPE 11 DETAIL
42	C6.9	WHS TYPE 12 & 13 DETAILS
43	C6.10	WHS TYPE 14 & 15 DETAILS
44	C6.11	WHS TYPE 16 DETAIL
45	C6.12	WHS TYPE 17 DETAIL
46	C6.13	WHS HARDWARE & BALLAST DETAILS
47	C7.0	CONSTRUCTION SEQUENCING & WATER MANAGEMENT - OVERVIEW
48	C7.1	CONSTRUCTION SEQUENCING & WATER MANAGEMENT - REACH A
49	C7.2	CONSTRUCTION SEQUENCING & WATER MANAGEMENT - REACH B
50	C7.3	CONSTRUCTION SEQUENCING & WATER MANAGEMENT - REACH C
51	C7.4	DIVERSION CHANNEL SEQUENCING
52	ESC1.0	ESC DETAILS
53	L1.0	PLANTING PLAN - REACH A
54	L1.1	PLANTING PLAN - REACH B
55	L1.2	PLANTING PLAN - REACH C
56	L1.3	PLANTING PLAN - REACH D
57	L1.4	PLANTING PLAN - PLANTING DETAIL

PROJECT TEAM

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PROJECT INFO

SPATIAL REFERENCE

HORIZONTAL: NAD83 WASHINGTON STATE PLANE SOUTH,
US SURVEY FT
VERTICAL: NAVD83
LIDAR: TOPOGRAPHIC LIDAR FLOWN BY USGS AUGUST
2022 (MOSBRUCKER, 2023)

PROJECT SITE LOCATION:

COUNTY, STATE: COWLITZ COUNTY, WA
LATITUDE: 46°13'43"N
LONGITUDE: 122°26'23"W
WATERBODY: SOUTH FORK TOUTLE RIVER



LOWER COLUMBIA FISH
ENHANCEMENT GROUP
SOUTH FORK TOUTLE RIVER
HEADWATERS DESIGN
COWLITZ COUNTY, WA

COVER SHEET

REVISION NUMBER

No.	Date	Revision

Drawn By LH, LE	Designed By LE	Checked By CL
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Scale 1" = 100'

JOB NO.
20200001

SHEET NO.
G1.0

1 OF 57

1. LIDAR TOPOGRAPHY FROM USGS 2022 DATA ACQUISITION: MOSBRUCKER A.R., 2023, AUGUST, 2022, AIRBORNE LIDAR SURVEY OF MOUNT ST. HELENS CRATER, UPPER NORTH FORK TOUTLE RIVER, AND SOUTH FORK TOUTLE RIVER: U.S. GEOLOGICAL SURVEY DATA RELEASE, DOI: 10.5066/P9ASCFOQ.
2. AERIAL IMAGERY DERIVED FROM 2023 GEOTERRA FLIGHT.
3. HORIZONTAL DATUM IS NAD83 WASHINGTON STATE PLANE SOUTH, US SURVEY FT.
4. VERTICAL DATUM IS NAVD83, FT.
5. ALL SCALES SHOWN ARE FOR 22" X 34" SHEETS.
6. ORDINARY HIGH WATER IS DERIVED FROM EXISTING CONDITIONS HYDRAULIC MODEL 2-YEAR RECURRENCE FLOOD EVENT (4520 CFS).
7. ALL EQUIPMENT SHALL BE WASHED PRIOR TO MOBILIZATION TO THE SITE TO MINIMIZE THE INTRODUCTION OF FOREIGN MATERIALS AND FLUIDS TO THE PROJECT SITE. ALL EQUIPMENT SHALL BE FREE OF OIL, HYDRAULIC FLUID, AND DIESEL FUEL LEAKS. TO PREVENT INVASION OF NOXIOUS WEEDS OR THE SPREAD OF WHIRLING DISEASE SPORES. ALL EQUIPMENT SHALL BE CLEANED TO REMOVE MUD AND SOIL PRIOR TO MOBILIZATION INTO THE PROJECT AREA. IT WILL BE THE CONTRACTOR'S RESPONSIBILITY TO ENSURE THAT THESE AND ANY ADDITIONAL POLLUTION CONTROL MEASURES HAVE BEEN TAKEN PER THE SPECIFICATIONS.
8. THERE WILL BE A SCHEDULED TIME FOR INSPECTION OF ALL EQUIPMENT THAT IS MOBILIZED TO THE SITE BY THE ENGINEER OR OPR.
9. ALL WORK SHALL CONFORM TO THE PLANS & SPECIFICATIONS UNLESS INDICATED OTHERWISE BY CONTRACT DOCUMENTS.
10. EARTHWORK QUANTITIES ARE BASED ON BANK VOLUMES BETWEEN EXISTING GRADE AND FINISH GRADE SURFACES. CONTRACTOR SHALL ALLOW FOR EXPANSION OF EXCAVATED MATERIAL AND COMPACTION OF PLACED MATERIAL AT NO ADDITIONAL COST.

1. DRIVING DIRECTIONS:
FOLLOW I-5 N
TAKE EXIT 49 FROM I-5 N TOWARD CASTLE ROCK TOUTLE
CONTINUE ON WA-504 E/MT ST HELENS WAY NE
TURN RIGHT ONTO S TOUTLE RD
RIGHT ON 4100 RD LOGGING ROAD
CONTINUE FOR APPROXIMATELY 15 MILE TO SITE
2. CONTRACTOR SHALL SUBMIT A SITE ACCESS PLAN TO OPR FOR APPROVAL PRIOR TO MOBILIZATION.
3. APPROVED CONTRACTOR STAGING AREAS ARE SHOWN ON SHEETS C2.0-C2.4.
4. ACCESS TO/ALONG ROADWAYS SHALL BE MAINTAINED AT ALL TIMES.
5. ALL EQUIPMENT, MATERIALS, AND PERSONNEL SHALL REMAIN WITHIN AREAS IDENTIFIED FOR DISTURBANCE IN THE PLANS AND WORK AREA BOUNDARIES FLAGGED BY THE OPR PRIOR TO MOBILIZATION.
6. THE CONTRACTOR SHALL KEEP THE WORK AREAS IN NEAT CONDITION, FREE OF DEBRIS AND LITTER FOR THE DURATION OF THE PROJECT.
7. CONTRACTOR SHALL MAINTAIN COMMUNICATION IN LOGGING ROADS WITH CB RADIO (CHANNEL B).
8. THE CONTRACTOR SHALL ONLY CLEAR AND GRADE ACCESS ROUTES IDENTIFIED IN THE PLANS UNLESS OTHERWISE DIRECTED BY THE OPR.
9. ALL DISTURBED AREAS INCLUDING ROADS, DRIVEWAYS AND ACCESS ROUTES SHALL BE RESTORED TO ORIGINAL CONDITION OR BETTER. AREAS SHALL BE DECOMPACTED, ROUGHENED WITH SLASH AT OPR'S DIRECTION, AND REVEGETATED PER PLANS. CONTRACTOR SHALL SEED DISTURBED AREAS PER PLANS AND SECTION 8-01.
10. ALL DISTURBED AREAS OUTSIDE THE LIMITS OF DISTURBANCE SHALL BE RESTORED TO ORIGINAL CONDITION OR BETTER AT NO ADDITIONAL COST TO THE OWNER.

ALL IN-WATER GRADING SHALL BE LIMITED TO WDFW APPROVED IN-WATER WINDOW OF JULY 16 - SEPTEMBER 15. HELICOPTER PLACEMENT MAY BE COMPLETED OUTSIDE THIS WINDOW AS DIRECTED BY THE OPR AND APPROVED BY WDFW. DATES ARE SUBJECT TO CHANGE AS PERMITS ARE FINALIZED. REFER TO PROJECT PERMITS.

LOCATION	CUT VOLUME (CY)	FILL VOLUME (CY)	MATERIAL
REACH A - SIDE CHANNEL CONNECTION	185	185	NATIVE ALLUVIUM
REACH B - SIDE CHANNEL CONNECTION	190	190	NATIVE ALLUVIUM
REACH C - IN CHANNEL FILL	0	20,470	NATIVE ALLUVIUM
REACH C - FLOODPLAIN CUT	32,725	0	NATIVE ALLUVIUM
REACH C - BERM	0	2,300	NATIVE ALLUVIUM
REACH C - CONTINGENCY CUT AREA	5,730	0	NATIVE ALLUVIUM
TOTALS	33,100	23,145	DOES NOT INCLUDE CONTINGENCY CUT AREA

WHS TYPE	WHS QTY	MATERIALS PER STRUCTURE								
		FULL TREE W/O RW	FULL TREE W/ RW	MEDIUM LOG	SMALL LOG	PILE	SUPER XL LOG W/ RW	XL LOG W/ RW	LARGE LOG W/ RW	SLASH (CY)
HELICOPTER SLASH BUNDLE DROPS	65									VARIABLE
LOOSE HELICOPTER WOOD (SMALL LOGS)	120				1					
LOOSE HELICOPTER WOOD (MEDIUM LOGS)	214			1						
LOOSE HELICOPTER WOOD (FULL TREES)	759	1								
LOOSE HELICOPTER WOOD (LARGE LOGS)	52								1	
LOOSE WOOD	672	1								
LOOSE LARGE WOOD	79								1	
LOOSE XL WOOD	63							1		
LOOSE SUPER XL WOOD	17						1			
FLOODPLAIN PIER LOG	496					1				
PINNED WOOD	136	2			4					
FLOODPLAIN HELICOPTER JAM	77	4		8						
SMALL FLOODPLAIN JAM	120	5			6					5
SMALL HELICOPTER JAM	51	6		8						
MODERATE MARGIN JAM	18		3	9	20	6				20
MODERATE APEX JAM	44		3	9	20	6				20
LARGE APEX JAM	11	2	3	14	30	8				40
LARGE DEFLECTOR JAM	31	2	3	14	30	8				40
LARGE HELICOPTER JAM	47	10	3	20						
LARGE DRIFT WOOD PILE JAM	13	26		24						
CHANNEL SPANNING JAM	2	14	15	2	60	10		1	2	60
ISLAND FORMING JAM	2	22	10		60	22	1			60
HELICOPTER CHANNEL SPANNING JAM	1	48								
TOTAL GROUND PLACED QUANTITIES (INCLUDING HELICOPTER STAGED WOOD)		1,700	362	1,150	4,004	1,268	19	65	83	3,760
TOTAL HELICOPTER PLACED QUANTITIES		2,229	141	2,490	120				52	
TOTAL QUANTITIES		3,929	503	3,640	4,124	1,268	19	65	135	3,760

WHS TYPE	WHS QUANTITY								
	REACH A	REACH B	REACH C	REACH D	BEAR CREEK	HARRINGTON CREEK	LITTLE COW SPRINGS	LITTLE COW CREEK	CADDIS CREEK
LOOSE WOOD		276	396						
LOOSE LARGE WOOD		10	69						
LOOSE XL WOOD		50	13						
LOOSE SUPER XL WOOD		17							
FLOODPLAIN PIER LOG		215	281						
PINNED WOOD		56	80						
SMALL FLOODPLAIN JAM	6	47	67						
MODERATE MARGIN JAM	3	8	7						
MODERATE APEX JAM	5	11	28						
LARGE APEX JAM	2	4	5						
LARGE DEFLECTOR JAM	6	16	9						
LARGE DRIFT PILE JAM				13					
CHANNEL SPANNING JAM	2								
ISLAND FORMING JAM		2							
HELICOPTER SLASH BUNDLE DROP					22	5	5	11	22
LOOSE HELICOPTER WOOD (SMALL LOGS)							60		60
LOOSE HELICOPTER WOOD (MEDIUM LOGS)	28				153		15		18
LOOSE HELICOPTER WOOD (FULL TREES)	38	33	19	516	105	15		33	
LOOSE HELICOPTER WOOD (LARGE LOGS)				52					
FLOODPLAIN HELICOPTER JAM	10	4	7	56					
SMALL HELICOPTER JAM	4	1		45		1			
LARGE HELICOPTER JAM	3			40	4				
CHANNEL SPANNING HELICOPTER JAM	1								

	2 FOOT EX MINOR CONTOUR LINE
	10 FOOT EX MAJOR CONTOUR LINE
	RESTORATION AREA
	REACH BREAK
	RIVER CENTERLINE
	TRIBUTARY CENTERLINE
	PARCEL BOUNDARY
	ACCESS ROAD
	ORDINARY HIGH WATER
	WETLANDS
	DNR LOG HARVEST AREA
	DNR STAGING AREA
	HELICOPTER WOOD STAGING AREA
	GROUND BASED WOOD STAGING AREA
	TRUCKED WOOD STAGING AREA
	MACHINE ACCESS ROUTE
	ACCESS AND WOOD HAUL ROUTE
	2 FOOT MINOR CONTOUR LINE
	2 FOOT MAJOR CONTOUR LINE
	FILL AREA
	CUT AREA
	HELICOPTER WOOD PLACEMENT
	DO NOT DISTURB
	POTENTIAL BOULDER HARVEST AREA
	LEAVE POOL
	TEMPORARY EARTHEN DAM
	COFFER DAM FOR PARTIAL ISOLATION
	DIVERSION CHANNEL ALIGNMENT
	EXCAVATED DIVERSION CHANNEL
	WET WATER CROSSING (FORD)
	HAND PLANTING AREA
	HELICOPTER WILLOW DROP AREA
	EROSION CONTROL SEEDING AREA

BROADCAST WOOD LOADING	
....	FLOODPLAIN PIER LOGS
5	SMALL FLOODPLAIN JAM
6	MODERATE MARGIN JAM
7	MODERATE APEX JAM
8	LARGE APEX JAM
9	LARGE DEFLECTOR JAM
10	CHANNEL SPANNING JAM
11	ISLAND FORMING JAM
	LARGE, XL OR SUPER XL LOG
	LOOSE HELICOPTER WOOD
13	FLOODPLAIN HELICOPTER JAM
14	SMALL HELICOPTER JAM
15	LARGE HELICOPTER JAM
16	WOOD DRIFT PILE
17	CHANNEL SPANNING HELICOPTER JAM

AC	ACRE
APPROX	APPROXIMATE
BDA	BEAVER DAM ANALOGUE
BMP	BEST MANAGEMENT PRACTICE
CFS	CUBIC FEET PER SECOND
CHNL	CHANNEL
CL	CENTERLINE
CONSTR	CONSTRUCTION
CY	CUBIC YARD
DBH	DIAMETER AT BREAST HEIGHT
DEPT	DEPARTMENT
DES	WASHINGTON DEPARTMENT OF ENTERPRISE SERVICES
DIA	DIAMETER
DNR	DEPARTMENT OF NATURAL RESOURCES
EG	EXISTING GRADE/GROUND
ELEV, EL	ELEVATION
EPA	UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
ESA	ENDANGERED SPECIES ACT
ESC	EROSION AND SEDIMENT CONTROL
EX	EXISTING
FG	FINISHED GRADE/GROUND
FT	FEET
GB	GRADE BREAK
HIP	HABITAT IMPROVEMENT PROGRAM
IN	INCHES
IWW	IN WATER WORK
IWWW	IN WATER WORK WINDOW
LCFEG	LOWER COLUMBIA FISH ENHANCEMENT GROUP
M	METER
MAX	MAXIMUM
MIN	MINIMUM
MT	MOUNT
N/A	NOT AVAILABLE
NAD83	NORTH AMERICAN DATUM (1983)
NAVD88	NORTH AMERICAN VERTICAL DATUM (1988)
NIC	NOT IN CONTRACT
NMFS	NATIONAL MARINE FISHERIES SERVICE
NTS	NOT TO SCALE
OD	OUTSIDE DIAMETER
OHW	ORDINARY HIGH WATER
OPR	OWNER'S PROJECT REPRESENTATIVE
OR	OREGON
PLS	PURE LIVE SEED
QTY	QUANTITY
RD	ROAD
RM	RIVER MILE
RW	ROOTWAD
S	SLOPE
SEC	SECOND
SF	SQUARE FEET
SF	SOUTH FORK
SHT	SHEET
SPEC	SPECIFICATION
ST	SAINT
STA	STATION
STHD	SOUTH FORK TOUTLE HEADWATERS DESIGN
TEMP	TEMPORARY
TESC	TEMPORARY EROSION AND SEDIMENT CONTROL
TOB	TOP OF BANK
TOE	TOE OF SLOPE
TOP	TOP OF SLOPE
TYP	TYPICAL
USGS	UNITED STATES GEOLOGICAL SURVEY
W2R	WOLF WATER RESOURCES
W	WITH
WO	WITHOUT
WA	WASHINGTON
WDFW	WASHINGTON DEPARTMENT OF FISH AND WILDLIFE
WHS	WOOD HABITAT STRUCTURE
WSE	WATER SURFACE ELEVATION
XL	EXTRA LARGE
YR	YEAR



REVISION NUMBER		
No	Date	Revision

Date	Designed By
11/11/2024	LE
Drawn By	Checked By
LH, LE	CL

SCALE	

JOB NO. 20200001

SHEET NO. G.1.1

2 OF 57

DOCUMENTATION: TO BE POSTED ONSITE BY THE CONTRACTOR IN A LOCATION VISIBLE TO THE PUBLIC.

- NAME(S), PHONE NUMBER(S), AND ADDRESS(ES) OF THE PERSON(S) RESPONSIBLE FOR OVERSIGHT.
- A DESCRIPTION OF HAZARDOUS MATERIALS THAT WILL BE USED, INCLUDING INVENTORY, STORAGE, AND HANDLING PROCEDURES.
- PROCEDURES TO CONTAIN AND CONTROL A SPILL OF ANY HAZARDOUS MATERIAL GENERATED, USED OR STORED ON-SITE, INCLUDING NOTIFICATION OF PROPER AUTHORITIES.
- A STANDING ORDER TO CEASE WORK IN THE EVENT OF HIGH FLOWS EXCEPT AS NECESSARY TO MINIMIZE RESOURCE DAMAGE (ABOVE THOSE ADDRESSED IN THE DESIGN AND IMPLEMENTATION PLANS) OR EXCEEDANCE OF TAKE OR WATER QUALITY LIMITATIONS.

1) TIMING OF IN-WATER WORK: FORMAL RECOMMENDATIONS PUBLISHED BY STATE AGENCIES SUCH AS THE OREGON DEPARTMENT OF FISH AND WILDLIFE (ODFW), WASHINGTON DEPARTMENT OF FISH AND WILDLIFE (WDFW), IDAHO DEPARTMENT OF FISH AND GAME (IDFG), AND MONTANA FISH WILDLIFE AND PARKS (MFWP), OR INFORMAL RECOMMENDATIONS FROM THE APPROPRIATE STATE FISHERY BIOLOGIST IN REGARD TO THE TIMING OF IN-WATER WORK, WILL BE FOLLOWED.

- 2) CONTAMINANTS:** THERE ARE NO KNOWN CONTAMINANTS ON THE SITE

- 1) SENSITIVE RESOURCE AREAS, SUCH AS AREAS BELOW ORDINARY HIGH WATER (OHW), SPAWNING AREAS, SPRINGS, AND WETLANDS;
- 2) EQUIPMENT ENTRY AND EXIT POINTS;
- 3) ROAD AND STREAM CROSSING ALIGNMENTS;
- 4) STAGING, STORAGE, AND STOCKPILE AREAS; AND
- 5) NO-HERBICIDE-APPLICATION AREAS AND BUFFERS.

- 1) EXISTING ACCESS ROADS AND PATHS WILL BE PREFERENTIALLY USED WHENEVER POSSIBLE, AND THE NUMBER AND LENGTH OF TEMPORARY ACCESS ROADS AND PATHS THROUGH RIPARIAN AREAS AND FLOODPLAINS WILL BE MINIMIZED TO LESSEN SOIL DISTURBANCE, SOIL COMPACTION, AND IMPACTS TO VEGETATION.
- 2) VEHICLE USE AND HUMAN ACTIVITIES, INCLUDING WALKING IN AREAS OCCUPIED BY ESA-LISTED SPECIES, WILL BE MINIMIZED.
- 3) TEMPORARY ACCESS ROADS AND PATHS WILL NOT BE BUILT ON SLOPES WHERE GRADE, SOIL, OR OTHER FEATURES SUGGEST A LIKELIHOOD OF EXCESSIVE EROSION OR FAILURE. IF SLOPES ARE STEEPER THAN 30%, THE ROAD WILL BE DESIGNED BY A CIVIL ENGINEER WITH EXPERIENCE IN STEEP ROAD DESIGN.
- 4) THE REMOVAL OF RIPARIAN VEGETATION DURING CONSTRUCTION OF TEMPORARY ACCESS ROADS WILL BE MINIMIZED. WHEN TEMPORARY VEGETATION REMOVAL IS REQUIRED, VEGETATION SHALL BE PLACED ASIDE FOR USE AS SLASH WHEN DECOMMISSIONING ROUTE.
- 5) AT PROJECT COMPLETION, ALL TEMPORARY ACCESS ROADS AND PATHS WILL BE DECOMPACTED AND RESHAPED TO MATCH THE ORIGINAL CONTOUR; AND THE SOIL WILL BE STABILIZED AND REVEGETATED. THE CONTRACTOR IS RESPONSIBLE FOR STABILIZING ANY SLOPES OVER 10% WITH NATIVE GRASS SEED AND STRAW. THE SPONSOR WILL REVEGETATE ALL OTHER AREAS.
- 6) HELICOPTER FLIGHT PATTERNS WILL BE ESTABLISHED IN ADVANCE, AND LOCATED TO AVOID TERRESTRIAL ESA-LISTED SPECIES OR BALD OR GOLDEN EAGLES, INCLUDING THEIR OCCUPIED HABITAT AND APPROPRIATE BUFFERS. DURING SENSITIVE LIFE STAGES (I.E. NESTING AND CRITICAL BREEDING PERIODS). SEE SPECIES-SPECIFIC CONSERVATION MEASURES FOR EACH LISTED SPECIES THAT MAY OCCUR WITHIN THE PROJECT AREA FOR MORE INFORMATION.

- 1) EXISTING STREAM CROSSINGS, FORDS, OR BEDROCK WILL BE USED WHENEVER POSSIBLE.
- 2) IF AN EXISTING STREAM CROSSING IS NOT ACCESSIBLE, TEMPORARY CROSSINGS WILL BE INSTALLED. TREATED WOOD SHALL NOT BE USED ON TEMPORARY BRIDGE CROSSINGS OR IN LOCATIONS IN CONTACT WITH OR OVER WATER.
- 3) FOR PROJECTS THAT REQUIRE EQUIPMENT AND VEHICLES TO CROSS IN THE WET:
 - a. THE LOCATION AND NUMBER OF ALL WET CROSSINGS MUST BE APPROVED BY THE SPONSOR AND CLEARLY INDICATED ON DESIGN DRAWINGS.
 - b. VEHICLES AND MACHINERY WILL CROSS STREAMS AT RIGHT ANGLES TO THE MAIN CHANNEL WHEREVER POSSIBLE.
 - c. NO STREAM CROSSINGS WILL OCCUR 300 FEET UPSTREAM OR 100-FEET DOWNSTREAM OF AN EXISTING REDD OR SPAWNING FISH.
 - d. AFTER PROJECT COMPLETION, TEMPORARY STREAM CROSSINGS WILL BE OBLITERATED, AND THE BANKS RESTORED.

- 1) STAGING AREAS (USED FOR CONSTRUCTION EQUIPMENT STORAGE, VEHICLE STORAGE, FUELING, SERVICING, AND HAZARDOUS MATERIAL STORAGE) WILL BE 150 FEET OR MORE FROM ANY NATURAL WATERBODY OR WETLAND, OR ON AN ADJACENT ESTABLISHED ROAD AREA IN A LOCATION AND MANNER THAT WILL PRECLUDE EROSION INTO, OR CONTAMINATION OF, THE STREAM OR FLOODPLAIN. STAGING AREAS MAY BE CLOSER THAN 150 FEET IF THE AREA IS ABOVE (ELEVATION) THE 100-YR FLOODPLAIN AND SPILL PREVENTION MEASURES ARE APPROVED BY THE EC LEAD.
- 2) NATURAL MATERIALS USED FOR IMPLEMENTATION OF AQUATIC RESTORATION, SUCH AS LARGE WOOD GRAVEL, AND BOULDERS, MAY BE STAGED WITHIN 150 FEET IF CLEARLY INDICATED IN PLANS. RECOMMEND REFERRING TO AREA AS "NATURAL MATERIAL STOCKPILE AREA" WITH A NOTE THAT STATES VEHICLE STORAGE, EQUIPMENT STORAGE, HAZARDOUS MATERIALS, FUELING, AND SERVICING NOT PERMITTED IN THIS AREA.
- 3) ANY LARGE WOOD, TOPSOIL, AND NATIVE CHANNEL MATERIAL DISPLACED BY CONSTRUCTION WILL BE STOCKPILED FOR USE DURING SITE RESTORATION AT A SPECIFICALLY IDENTIFIED AND FLAGGED AREA. ANY MATERIAL NOT USED IN RESTORATION, AND NOT NATIVE TO THE FLOODPLAIN, WILL BE REMOVED TO A LOCATION OUTSIDE OF THE 100-YEAR FLOODPLAIN FOR DISPOSAL.

- 1) STORED, FUELED, AND MAINTAINED IN A VEHICLE STAGING AREA LOCATED 150 FEET OR MORE FROM ANY NATURAL WATER BODY OR WETLAND, OR ON AN ADJACENT, ESTABLISHED ROAD AREA;
- 2) REFUELED IN A VEHICLE STAGING AREA LOCATED 150 FEET OR MORE FROM A NATURAL WATERBODY OR WETLAND, OR IN AN ISOLATED HARD ZONE, SUCH AS A PAVED PARKING LOT OR ADJACENT, ESTABLISHED ROAD (THIS MEASURE APPLIES ONLY TO GAS OR DIESEL-POWERED EQUIPMENT WITH TANKS LARGER THAN 5 GALLONS);
- 3) BIODEGRADABLE LUBRICANTS AND FLUIDS SHALL BE USED ON EQUIPMENT OPERATING IN THE STREAM CHANNEL AND LIVE WATER.
- 4) INSPECTED DAILY FOR FLUID LEAKS BEFORE LEAVING THE VEHICLE STAGING AREA FOR OPERATION WITHIN 150 FEET OF ANY NATURAL WATER BODY OR WETLAND; AND
- 5) THOROUGHLY CLEANED BEFORE OPERATION BELOW ORDINARY HIGH WATER (OHW), AND AS OFTEN AS NECESSARY DURING OPERATION, TO REMAIN FREE OF GREASE

1) TEMPORARY EROSION CONTROL BMPs.

- a. TEMPORARY EROSION CONTROL BMPs SHALL BE IN PLACE BEFORE ANY SIGNIFICANT ALTERATION OF THE ACTION SITE, AND SHALL BE APPROPRIATELY INSTALLED DOWNSLOPE OF PROJECT ACTIVITY WITHIN THE RIPARIAN BUFFER AREA UNTIL SITE REHABILITATION IS COMPLETE.
- b. IF THERE IS A POTENTIAL FOR ERODED SEDIMENT TO ENTER THE STREAM, SEDIMENT BARRIERS WILL BE INSTALLED AND MAINTAINED FOR THE DURATION OF PROJECT IMPLEMENTATION.
- c. TEMPORARY EROSION CONTROL MEASURES MAY INCLUDE SEDGE MATS, FIBER WATTLES, SILT FENCES, JUTE MATTING, WOOD FIBER MULCH WITH SOIL BINDER, OR GEOTEXTILES AND GEOSYNTHETIC FABRIC. BIODEGRADABLE NETTING MAY BE USED SO THAT THEY CAN DECOMPOSE ON SITE.
- d. SOIL STABILIZATION UTILIZING WOOD FIBER MULCH AND TACKIFIER (HYDRO-APPLIED) MAY BE USED TO REDUCE EROSION OF BARE SOIL IF THE MATERIALS ARE NOXIOUS-WEED-FREE AND NONTOXIC TO AQUATIC AND TERRESTRIAL ANIMALS, SOIL MICROORGANISMS, AND VEGETATION.
- e. SEDIMENT WILL BE REMOVED FROM EROSION CONTROL BMP ONCE IT HAS REACHED 1/3 OF THE EXPOSED HEIGHT OF THE BMP.
- f. ONCE THE SITE IS STABILIZED FOLLOWING CONSTRUCTION, TEMPORARY EROSION CONTROL BMPs WILL BE REMOVED. FOR ADDITIONAL INFORMATION AND SUPPLIERS OF BIODEGRADABLE HYDRAULIC FLUIDS, MOTOR OIL, LUBRICANT, OR GREASE, SEE ENVIRONMENTALLY ACCEPTABLE LUBRICANTS BY THE U.S. EPA (2011); E.G., MINERAL OIL, POLYGLYCOL, VEGETABLE OIL, SYNTHETIC ESTER, MOBIL® BIODEGRADABLE HYDRAULIC OILS, TOTAL® HYDRAULIC FLUID, TERRESOLVE TECHNOLOGIES LTD.® BIOBASED BIODEGRADABLE LUBRICANTS, COUGAR LUBRICATION® 2XT BIO ENGINE OIL, SERIES 4300 SYNTHETIC BIO-DEGRADABLE HYDRAULIC OIL, 8060-2 SYNTHETIC BIO-DEGRADABLE GREASE NO. 2, ETC.

2) EMERGENCY EROSION CONTROL BMPs. THE FOLLOWING MATERIALS FOR EMERGENCY EROSION CONTROL WILL BE AVAILABLE AT THE WORK SITE:

- a. A SUPPLY OF SEDIMENT CONTROL MATERIALS; AND
- b. AN OIL-ABSORBING FLOATING BOOM WHENEVER SURFACE WATER IS PRESENT.

- 1) NO WIND ABATEMENT MEASURES ARE NECESSARY ON THIS PROJECT.
- 2) DUST-ABATEMENT ADDITIVES AND STABILIZATION CHEMICALS (TYPICALLY MAGNESIUM CHLORIDE, CALCIUM CHLORIDE SALTS, OR LIGNIN SULFONATE) WILL NOT BE APPLIED WITHIN 25 FEET OF A NATURAL WATERBODY OR WETLAND AND WILL BE APPLIED SO AS TO MINIMIZE THE LIKELIHOOD THAT THEY WILL ENTER STREAMS. APPLICATIONS OF LIGNIN SULFONATE WILL BE LIMITED TO A MAXIMUM RATE OF 0.5 GALLONS PER SQUARE YARD OF ROAD SURFACE, ASSUMING A 50:50 (LIGNIN SULFONATE TO WATER) SOLUTION.
- 3) APPLICATION OF DUST ABATEMENT CHEMICALS WILL BE AVOIDED DURING OR JUST BEFORE WET WEATHER AND AT STREAM CROSSINGS OR OTHER AREAS THAT COULD RESULT IN UNFILTERED DELIVERY OF THE DUST ABATEMENT CHEMICALS TO A WATERBODY (TYPICALLY THESE WOULD BE AREAS WITHIN 25 FEET OF A NATURAL WATERBODY OR WETLAND; DISTANCES MAY BE GREATER WHERE VEGETATION IS SPARSE OR SLOPES ARE STEEP).
- 4) SPILL CONTAINMENT EQUIPMENT WILL BE AVAILABLE DURING APPLICATION OF DUST ABATEMENT CHEMICALS.
- 5) PETROLEUM-BASED PRODUCTS WILL NOT BE USED FOR DUST ABATEMENT.

- 1) A DESCRIPTION OF HAZARDOUS MATERIALS THAT WILL BE USED, INCLUDING INVENTORY, STORAGE, AND HANDLING PROCEDURES, WILL BE AVAILABLE ON-SITE.
- 2) WRITTEN PROCEDURES FOR NOTIFYING ENVIRONMENTAL RESPONSE AGENCIES WILL BE POSTED AT THE WORK SITE. FOR ADDITIONAL INFORMATION AND SUPPLIERS OF BIODEGRADABLE HYDRAULIC FLUIDS, MOTOR OIL, LUBRICANT, OR GREASE, SEE, ENVIRONMENTALLY ACCEPTABLE LUBRICANTS BY THE U.S. EPA (2011). E.G., MINERAL OIL, POLYGLYCOL, VEGETABLE OIL, SYNTHETIC ESTER, MOBIL® BIODEGRADABLE HYDRAULIC OILS, TOTAL® HYDRAULIC FLUID, TERRESOLVE TECHNOLOGIES LTD.® BIOBASED BIODEGRADABLE LUBRICANTS, COUGAR LUBRICATION® 2XT BIO ENGINE OIL, SERIES 4300 SYNTHETIC BIO-DEGRADABLE HYDRAULIC OIL, 8060-2 SYNTHETIC BIO-DEGRADABLE GREASE NO. 2, ETC.
- 3) SPILL CONTAINMENT KITS (INCLUDING INSTRUCTIONS FOR CLEANUP AND DISPOSAL) ADEQUATE FOR THE TYPES AND QUANTITY OF HAZARDOUS MATERIALS USED AT THE SITE WILL BE AVAILABLE AT THE WORK SITE. EACH EXCAVATOR WORKING NEAR OR BELOW OHW WILL HAVE A SPILL CONTAINMENT KIT MOUNTED ON THE EQUIPMENT.
- 4) WORKERS WILL BE TRAINED IN SPILL CONTAINMENT PROCEDURES AND WILL BE INFORMED OF THE LOCATION OF SPILL CONTAINMENT KITS.
- 5) ANY WASTE LIQUIDS GENERATED AT THE STAGING AREAS WILL BE TEMPORARILY STORED UNDER AN IMPERVIOUS COVER, SUCH AS A TARPAULIN, UNTIL THEY CAN BE PROPERLY TRANSPORTED TO, AND DISPOSED OF, AT A FACILITY THAT IS APPROVED FOR RECEIPT OF HAZARDOUS MATERIALS.
- 6) PUMPS USED ADJACENT TO WATER SHALL USE SPILL CONTAINMENT SYSTEMS.

- 1) PRIOR TO ENTERING THE SITE, ALL VEHICLES AND EQUIPMENT WILL BE POWER-WASHED, ALLOWED TO DRY FULLY, AND INSPECTED TO MAKE SURE NO PLANTS, SOIL, OR OTHER ORGANIC MATERIAL ADHERES TO THE SURFACE.
- 2) WATERCRAFT, WADERS, BOOTS, AND ANY OTHER GEAR TO BE USED IN OR NEAR WATER WILL BE INSPECTED FOR AQUATIC INVASIVE SPECIES. WADING BOOTS WITH FELT SOLES ARE NOT TO BE USED DUE TO THEIR PROPENSITY FOR AIDING IN THE TRANSFER OF INVASIVE SPECIES UNLESS DECONTAMINATION PROCEDURES ARE USED.

ANY WORK AREA REQUIRING EXCAVATION OR MOBILIZATION OF SEDIMENT WITHIN THE WEIETED CHANNEL WILL BE ISOLATED FROM THE ACTIVE STREAM WHENEVER ESA-LISTED FISH ARE REASONABLY CERTAIN TO BE PRESENT, OR IF THE WORK AREA IS LESS THAN 300-FEET UPSTREAM FROM KNOWN ESA-LISTED FISH SPAWNING HABITATS. IF THE WORK AREA ISOLATION PRACTICES WOULD CAUSE GREATER IMPACTS THAN IT WOULD PREVENT, IS LOCATED IN DEEP OR SWIFTLY FLOWING WATER, OR IF FISH CAN BE EFFECTIVELY EXCLUDED BY NETS OR SCREENS, THEN A VARIANCE TO NOT ISOLATE THE WORK AREA MAY BE PURSUED. WORK AREA ISOLATION & FISH SALVAGE ACTIVITIES ARE CONSIDERED INCIDENTAL TO CONSTRUCTION-RELATED ACTIVITIES AND SHALL OCCUR DURING THE STATE RECOMMENDED IN-WATER WORK WINDOWS. WHEN WORK AREA ISOLATION IS REQUIRED, DESIGN PLANS WILL INCLUDE ALL ISOLATION ELEMENTS: FISH RELEASE AREAS, A PUMP TO BE USED TO DEWATER THE ISOLATION AREA, AND, WHEN FISH ARE PRESENT, A FISH SCREEN THAT MEETS NMF'S FISH SCREEN CRITERIA (NMF'S 2011, OR MOST CURRENT). WIDER MESH SCREENS MAY BE USED AFTER ALL FISH HAVE BEEN REMOVED FROM THE ISOLATED AREA. WORK AREA ISOLATION AND FISH CAPTURE ACTIVITIES TAKE PLACE DURING PERIODS OF THE COOLEST AIR AND WATER TEMPERATURES POSSIBLE, NORMALLY EARLY IN THE MORNING VERSUS LATE IN THE DAY, AND DURING CONDITIONS APPROPRIATE TO MINIMIZE STRESS TO FISH SPECIES PRESENT. A FISH BIOLOGIST WILL DETERMINE HOW TO REMOVE ESA-LISTED FISH, WITH LEAST HARM TO THE FISH, BEFORE IN-WATER WORK BEGINS. THIS WILL INVOLVE EITHER PASSIVE MOVEMENT OF FISH OUT OF THE PROJECT REACH THROUGH SLOW DEWATERING, OR ACTIVELY REMOVING THE FISH FROM THE PROJECT REACH. SHOULD ACTIVE REMOVAL BE WARRANTED, A FISH BIOLOGIST WILL CLEAR THE AREA OF FISH BEFORE THE SITE IS DEWATERED USING ONE OR MORE OF A VARIETY OF METHODS INCLUDING SEINING, DIPPING, OR ELECTROFISHING, DEPENDING ON SPECIFIC SITE CONDITIONS. IN AREAS OCCUPIED BY LARVAL LAMPREY, TO THE EXTENT POSSIBLE, SALVAGE USING GUIDANCE SET FORTH IN USFWS 2010 OR MOST RECENT GUIDANCE. DEPENDENT UPON SITE CONDITIONS, A FISH BIOLOGIST WILL CONDUCT OR SUPERVISE THE FOLLOWING:

- 1) SLOWLY REDUCE WATER FROM THE WORK AREA TO ALLOW SOME FISH TO LEAVE THE WORK AREA VOLUNTARILY;
 - a) IF DEWATERED AREA CONTAINS LARGE FINE/ SANDY SEDIMENT DEPOSITS, LARVAL LAMPREY COULD BE PRESENT, AND POTENTIALLY IN LARGE NUMBERS. IF SO, CONSIDER ELECTROFISHING USING LAMPREY ELECTROFISHING SETTINGS (WHICH DO NOT AFFECT BONY FISH) PRIOR TO OR DURING DRAWDOWN. SEE SECTION FURTHER DOWN ON LAMPREY CONSERVATION MEASURES AND ELECTROFISHING GUIDELINES.
- 2) INSTALL BLOCK NETS;
 - a) BLOCK NETS WILL BE INSTALLED AT UPSTREAM AND DOWNSTREAM LOCATIONS AND MAINTAINED IN A SECURED POSITION TO EXCLUDE FISH FROM ENTERING THE PROJECT AREA.
 - b) BLOCK NETS WILL BE SECURED TO THE STREAM CHANNEL BED AND BANKS UNTIL FISH CAPTURE AND TRANSPORT ACTIVITIES ARE COMPLETE. BLOCK NETS MAY BE LEFT IN PLACE FOR THE DURATION OF THE PROJECT TO EXCLUDE FISH.
 - c) IF BLOCK NETS REMAIN IN PLACE MORE THAN ONE DAY, THE NETS WILL BE MONITORED AT LEAST DAILY TO ENSURE THEY ARE SECURED TO THE BANKS AND FREE OF ORGANIC ACCUMULATION. IF THE PROJECT IS WITHIN BULL TROUT SPAWNING AND REARING HABITAT, THE BLOCK NETS MUST BE CHECKED EVERY 4 HOURS FOR FISH IMPINGEMENT ON THE NET. LESS FREQUENT INTERVALS MUST BE APPROVED THROUGH A VARIANCE REQUEST.
 - d) NETS WILL BE MONITORED HOURLY ANYTIME THERE IS INSTREAM DISTURBANCE.
- 3) CAPTURE FISH THROUGH SEINING, AND RELOCATE TO STREAMS;
 - a) WHILE DEWATERING, ANY REMAINING FISH WILL BE COLLECTED BY HAND OR DIP NETS.
 - b) SEINES WITH A MESH SIZE TO ENSURE CAPTURE OF THE RESIDING ESA-LISTED FISH WILL BE USED.
 - c) MINNOW TRAPS MAY BE LEFT IN PLACE OVERNIGHT AND USED IN CONJUNCTION WITH SEINING.
- 4) ELECTROFISH TO CAPTURE AND RELOCATE FISH NOT CAUGHT DURING SEINING, NMFS ELECTROFISHING GUIDELINES SHALL BE USED. THIS STEP IS TO BE USED AS A LAST RESORT; AFTER ALL PASSIVE TECHNIQUES HAVE BEEN EXHAUSTED.
- 5) CONTINUE TO SLOWLY DEWATER THE STREAM REACH;
- 6) COLLECT ANY REMAINING FISH IN COLD-WATER BUCKETS AND RELOCATE TO THE STREAM;
 - a) LIMIT THE TIME FISH WOULD BE IN A TRANSPORT BUCKET , AND RELEASE THEM AS QUICKLY AS POSSIBLE;
 - b) THE NUMBER OF FISH WITHIN A BUCKET WILL BE LIMITED, AND FISH WILL BE OF RELATIVELY COMPARABLE SIZE TO MINIMIZE PREDATION;
 - c) AERATORS FOR BUCKETS WILL BE USED, OR THE BUCKET'S WATER WILL BE FREQUENTLY CHANGED WITH COLD, CLEAR, WATER AT 15 MINUTE, OR MORE-FREQUENT, INTERVALS.
 - d) BUCKETS WILL BE KEPT IN SHADED AREAS; OR IF IN EXPOSED AREAS, COVERED BY A CANOPY.
 - e) DEAD FISH WILL NOT BE STORED IN TRANSPORT BUCKETS BUT WILL BE LEFT ON THE STREAMBANK TO AVOID MORTALITY COUNTING ERRORS.

- 1) INITIAL SITE SURVEYS AND EQUIPMENT SETTINGS
 - a) IN ORDER TO AVOID CONTACT WITH SPAWNING ADULTS OR ACTIVE REDDS, RESEARCHERS MUST CONDUCT A CAREFUL VISUAL SURVEY OF THE AREA TO BE SAMPLED BEFORE BEGINNING ELECTROFISHING.
 - b) PRIOR TO THE START OF SAMPLING AT A NEW LOCATION, WATER TEMPERATURE AND CONDUCTIVITY MEASUREMENTS SHALL BE TAKEN TO EVALUATE ELECTROFISHER SETTINGS AND ADJUSTMENTS.
 - c) NO ELECTROFISHING SHOULD OCCUR WHEN WATER TEMPERATURES ARE ABOVE 18°C OR ARE EXPECTED TO RISE ABOVE THIS TEMPERATURE PRIOR TO CONCLUDING THE ELECTROFISHING SURVEY.
 - d) WHENEVER POSSIBLE, A BLOCK NET SHOULD BE PLACED BELOW THE AREA BEING SAMPLED TO CAPTURE STUNNED FISH THAT MAY DRIFT DOWNSTREAM.
 - e) EQUIPMENT MUST BE IN GOOD WORKING CONDITION AND OPERATORS SHOULD GO THROUGH THE MANUFACTURER'S PRESEASON CHECKS, ADHERE TO ALL PROVISIONS, AND RECORD MAJOR MAINTENANCE WORK IN A LOGBOOK.
 - f) EACH ELECTROFISHING SESSION MUST START WITH ALL SETTINGS (VOLTAGE, PULSE WIDTH, AND PULSE RATE) SET TO THE MINIMUMS NEEDED TO CAPTURE FISH. THESE SETTINGS SHOULD BE GRADUALLY INCREASED ONLY TO THE POINT WHERE FISH ARE IMMOBILIZED AND CAPTURED, AND GENERALLY NOT ALLOWED TO EXCEED CONDUCTIVITY-BASED MAXIMA.

- 2) ELECTROFISHING TECHNIQUE
- SAMPLING SHOULD BEGIN USING STRAIGHT DC. THE POWER NEEDS TO REMAIN ON UNTIL THE FISH IS NETTED WHEN USING STRAIGHT DC. IF FISH CAPTURE IS UNSUCCESSFUL WITH INITIAL LOW VOLTAGE, GRADUALLY INCREASE VOLTAGE SETTINGS WITH STRAIGHT DC.
 - IF FISH CAPTURE IS NOT SUCCESSFUL WITH THE USE OF STRAIGHT DC, THEN SET THE ELECTROFISHER TO LOWER VOLTAGES WITH PDC. IF FISH CAPTURE IS UNSUCCESSFUL WITH LOW VOLTAGES, INCREASE PULSE WIDTH, VOLTAGE, AND PULSE FREQUENCY (DURATION, AMPLITUDE, AND FREQUENCY).

- c) ELECTROFISHING SHOULD BE PERFORMED IN A MANNER THAT MINIMIZES HARM TO THE FISH. STREAM SEGMENTS SHOULD BE SAMPLED SYSTEMATICALLY, MOVING THE ANODE CONTINUOUSLY IN A HERRINGBONE PATTERN (WHERE FEASIBLE) THROUGH THE WATER. CARE SHOULD BE TAKEN WHEN FISHING IN AREAS WITH HIGH FISH CONCENTRATIONS, STRUCTURE (WOOD, UNDERCUT BANKS) AND IN SHALLOW WATERS WHERE MOST BACKPACK ELECTROFISHING FOR JUVENILE SALMONIDS OCCURS. VOLTAGE GRADIENTS MAY BE HIGH WHEN ELECTRODES ARE IN SHALLOW WATER WHERE BOUNDARY LAYERS (WATER SURFACE AND SUBSTRATE) TEND TO INTENSIFY THE ELECTRICAL FIELD.
- d) DO NOT ELECTROFISH IN ONE LOCATION FOR AN EXTENDED PERIOD (E.G., UNDERCUT BANKS) AND REGULARLY CHECK BLOT NETS FOR IMMOBILIZED FISH.
- e) FISH SHOULD NOT MAKE CONTACT WITH THE ANODE. THE ZONE OF POTENTIAL INJURY FOR FISH IS 0.5 M FROM THE ANODE.
- f) ELECTROFISHING CREWS SHOULD BE GENERALLY OBSERVANT OF THE CONDITION OF THE FISH AND CHANGE OR TERMINATE SAMPLING WHEN EXPERIENCING PROBLEMS WITH FISH RECOVERY TIME, BANDING, INJURY, MORTALITY, OR OTHER INDICATIONS OF FISH STRESS.
- g) NETTERS SHOULD NOT ALLOW THE FISH TO REMAIN IN THE ELECTRICAL FIELD ANY LONGER THAN NECESSARY BY REMOVING STUNNED FISH FROM THE WATER IMMEDIATELY AFTER NETTING.
- 3) SAMPLE PROCESSING AND RECORD KEEPING
 - a) FISH SHOULD BE PROCESSED AS SOON AS POSSIBLE AFTER CAPTURE TO MINIMIZE STRESS. THIS MAY REQUIRE A LARGER CREW SIZE.
 - b) ALL SAMPLING PROCEDURES MUST HAVE A PROTOCOL FOR PROTECTING HELD FISH. SAMPLERS MUST BE AWARE OF THE CONDITIONS IN THE CONTAINERS HOLDING FISH, AIR PUMPS, WATER TRANSFERS, ETC., SHOULD BE USED AS NECESSARY TO MAINTAIN SAFE CONDITIONS. ALSO, LARGE FISH SHOULD BE KEPT SEPARATE FROM SMALLER PREY-SIZED FISH TO AVOID PREDATION DURING CONTAINMENT.
 - c) FISH SHOULD BE OBSERVED FOR GENERAL CONDITION AND INJURIES (E.G., INCREASED RECOVERY TIME, DARK BANDS, AND VISUALLY OBSERVABLE SPINAL INJURIES). EACH FISH SHOULD BE COMPLETELY REVIVED BEFORE RELEASING AT THE LOCATION OF CAPTURE. A PLAN FOR ACHIEVING EFFICIENT RETURN TO APPROPRIATE HABITAT SHOULD BE DEVELOPED BEFORE EACH SAMPLING SESSION. ALSO, EVERY ATTEMPT SHOULD BE MADE TO PROCESS AND RELEASE ESA-LISTED SPECIMENS FIRST.
 - d) PERTINENT WATER QUALITY (E.G., CONDUCTIVITY AND TEMPERATURE) AND SAMPLING NOTES (SHOCKER SETTINGS, FISH CONDITION/INJURIES/MORTALITIES) SHOULD BE RECORDED IN A LOGBOOK TO IMPROVE TECHNIQUE AND HELP TRAIN NEW OPERATORS. IT IS IMPORTANT TO NOTE THAT RECORDS OF INJURIES OR MORTALITIES PERTAIN TO THE ENTIRE ELECTROFISHING SURVEY, INCLUDING THE FISH SAMPLE WORK-UP.
 - e) THE ANODE WILL NOT INTENTIONALLY CONTACT FISH.
 - f) ELECTROFISHING SHOULD NOT BE CONDUCTED WHEN THE WATER CONDITIONS ARE TURBID AND VISIBILITY IS POOR. FOR EXAMPLE, WHEN THE SAMPLER CANNOT SEE THE STREAM BOTTOM IN ONE FOOT OF WATER.
 - g) IF MORTALITY OR OBVIOUS INJURY (DEFINED AS DARK BANDS ON THE BODY, SPINAL DEFORMATIONS, DE-SCALING OF 25% OR MORE OF BODY, AND TORPIDITY OR INABILITY TO MAINTAIN UPRIGHT ATTITUDE AFTER SUFFICIENT RECOVERY TIME) OCCURS DURING ELECTROFISHING, OPERATIONS WILL BE IMMEDIATELY DISCONTINUED, MACHINE SETTINGS, WATER TEMPERATURE, AND CONDUCTIVITY CHECKED, AND PROCEDURES ADJUSTED OR ELECTROFISHING POSTPONED TO REDUCE MORTALITY.

2) **DEWATERING:** DEWATERING, WHEN NECESSARY, WILL BE CONDUCTED OVER A SUFFICIENT PERIOD OF TIME TO ALLOW SPECIES TO NATURALLY MIGRATE OUT OF THE WORK AREA AND WILL BE LIMITED TO THE SHORTEST LINEAR EXTENT PRACTICABLE.

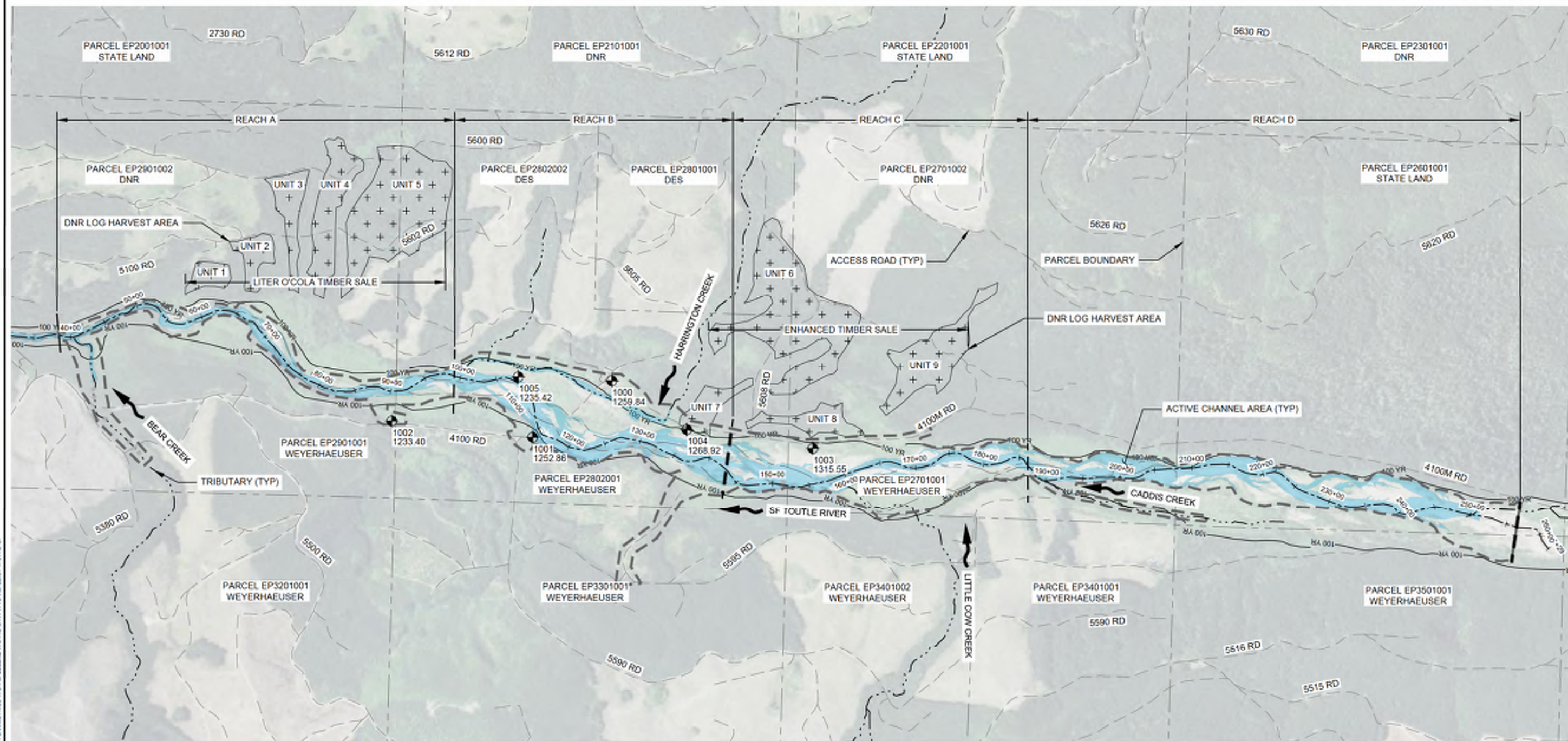
- 1) DIVERSION AROUND THE CONSTRUCTION SITE MAY BE ACCOMPLISHED WITH A COFFERDAM AND A BYPASS CULVERT OR PIPE, OR A LINED, NON-ERODIBLE DIVERSION DITCH. WHERE GRAVITY FEED IS NOT PRACTICAL, A PUMP MAY BE USED, BUT MUST BE OPERATED IN SUCH A WAY AS TO AVOID REPETITIVE DEWATERING AND REWATERING OF THE SITE. IMPOUNDMENT BEHIND THE COFFERDAM MUST OCCUR SLOWLY THROUGH THE TRANSITION, WHILE CONSTANT FLOW IS DELIVERED TO THE DOWNSTREAM REACHES.
- 2) ALL PUMPS WILL HAVE FISH SCREENS TO AVOID JUVENILE FISH IMPINGEMENT OR ENTRAINMENT, AND WILL BE OPERATED IN ACCORDANCE WITH NMFS'S CURRENT FISH SCREEN CRITERIA (NMFS 2011, OR MOST RECENT VERSION). IF THE PUMPING RATE EXCEEDS 3 CUBIC FEET PER SECOND (CFS), A NMFS ENGINEERING REVIEW WILL BE NECESSARY. IF THE SCREEN IS IN AN ISOLATED AREA WITH NO FISH (SALMONIDS OR LARVAL LAMPREY), A LARGER MESH SCREEN MAY BE USED.
- 3) DISSIPATION OF FLOW ENERGY AT THE BYPASS OUTFLOW WILL BE PROVIDED TO PREVENT DAMAGE TO RIPARIAN VEGETATION AND/OR STREAM CHANNEL.
- 4) SEEPAGE WATER WILL BE PUMPED TO A TEMPORARY STORAGE AND TREATMENT SITE OR INTO UPLAND AREAS TO ALLOW WATER TO PERCOLATE THROUGH SOIL OR TO FILTER THROUGH VEGETATION PRIOR TO REENTERING THE STREAM CHANNEL.
- 5) IN AREAS OCCUPIED BY LARVAL LAMPREY, TO THE EXTENT POSSIBLE, SALVAGE USING GUIDANCE DESCRIBED IN ABOVE SECTION "CONSERVATION MEASURES FOR SALVAGE OF NATIVE FISH, LAMPREY AND MUSSELS" (WHICH IS BASED ON USFWS 2010) OR MOST RECENT GUIDANCE.
- 6) IN AREAS OCCUPIED BY NATIVE FRESHWATER MUSSELS, TO THE EXTENT POSSIBLE, SALVAGE USING GUIDANCE DEVELOPED BY THE XERES SOCIETY (BLEVINS ET AL. 2018, 2019).

3) **SALVAGE OF NATIVE FISH, LAMPREY AND MUSSELS:** IN ADDITION TO CONSERVATION RECOMMENDATIONS FOR SALMONIDS, ADDITIONAL EFFORTS WILL BE EMPLOYED TO SALVAGE OTHER NATIVE SPECIES. THE FOLLOWING GUIDELINES ARE DRAFT FROM THE U.S. FISH AND WILDLIFE SERVICE, WITH ASSISTANCE FROM THE XERCES SOCIETY, AND WILL BE USED AS APPROPRIATE AND TO THE EXTENT POSSIBLE

- 1) CONDUCT NATIVE MUSSEL AND LAMPREY PRESENCE/ ABSENCE, APPROXIMATE NUMBERS FOR SALVAGE TO AID IN PLANNING FOR SALVAGE. PRE-SELECT SITE WHERE SALVAGED MUSSELS WILL BE RELOCATED. SUGGESTED DRAWDOWN: THIS ORDER SHOULD BE ADJUSTED FOR SITE-SPECIFIC CONDITIONS AND NUMBERS OF SPECIES AND INDIVIDUALS. FOR EXAMPLE, IF YOU ONLY HAVE A SMALL NUMBER OF MUSSELS OR VERY LIMITED LARVAL LAMPREY HABITAT, IT MAY BE MOST EFFICIENT TO SALVAGE ONLY DURING DRAWDOWN. IF DRAWDOWN OCCURS DURING COOL, WET WEATHER, AND THE AREA WILL BE REWATERED WITHIN 24-48 HOURS, MUSSELS AND LARVAL LAMPREY MAY SURVIVE IN THE SEDIMENTS, AND NOT REQUIRE SALVAGE. CONVERSELY, IF CONDITIONS ARE WARM OR HOT, LAMPREY CAN EXPIRE WITHIN A COUPLE OF HOURS, DEPENDING ON YOUR SITE AND CIRCUMSTANCES. OTHER ADJUSTMENTS MAY ALSO BE NECESSARY. A GENERALIZED ORDER PRIOR TO DRAWDOWN IS:
- a) SALVAGE FRESH WATER MUSSELS BY HAND, LOCATING BY SNORKELING OR WADING. IF MUSSELS ARE NUMEROUS (OR STAFF IS LIMITED), IT MAY BE NECESSARY TO DO THIS STEP IN THE DAYS BEFORE DRAWDOWN, AS RELOCATION/PLACEMENT CAN BE TIME CONSUMING. SALVAGE LARVAL

- b) LAMPREY BY E-FISHER UNDER WATERED CONDITIONS WITH LAMPREYSPECIFIC SETTINGS.
- c) SALVAGE BONY FISH AFTER LAMPREY WITH NETS OR BY E-FISHER WITH APPROPRIATE SETTINGS.
- c) IF THERE ARE SUFFICIENT NUMBERS OF PEOPLE AND EQUIPMENT, SOME PEOPLE CAN BE DRYSHOCKING DEWATERED AREAS, WHILE OTHERS ARE REMOVING REMAINING MUSSELS, AND OTHERS ARE SALVAGING SALMON.
- 3) CONTINUE SALVAGE LARVAL LAMPREY AND FW MUSSELS BY HAND DURING AND AFTER DRAWDOWN, AS WATER RECEDES AND LAMPREY CONTINUE TO EMERGE FROM SEDIMENTS AND OVERLOOKED MUSSELS BECOME VISIBLE. LARVAL LAMPREY MAY EMERGE HOURS AFTER DEWATERING OCCURS.
- 4) TO ENCOURAGE LARVAL LAMPREY EMERGENCE, "DRY SHOCK" IN AREAS OF FINE/SANDY DEPOSITS THAT ARE LIKELY TO HAVE HIGH LARVAL LAMPREY DENSITIES.
- 5) HOLD ALL FISH IN BUCKETS, FINE MESH BASKETS OR TANKS WITH ADEQUATE TEMPERATURES, SPACE AND OXYGEN. RELEASE ALL FISH THROUGHOUT THE SALVAGE PROCESS IN APPROPRIATE HABITATS TO MINIMIZE STRESS, THERMAL SHOCK AND PREDATION RISK. HOLD MUSSELS IN COOLERS AS DESCRIBED BELOW AND RELOCATE MUSSELS IN A PRE-SELECTED APPROPRIATE HABITAT. PLACEMENT OF EACH INDIVIDUAL IS NEEDED TO ALLOW MUSSELS TO RE-ESTABLISH BURROW INTO THE NEW HABITAT. ELECTROFISHING SETTINGS FOR LARVAL LAMPREY
- 1) ELECTROFISHING SHOULD BE PERFORMED IN A MANNER THAT MINIMIZES HARM TO FISHES. HANDLING TECHNIQUES AS DESCRIBED IN NMFS ELECTROFISHING GUIDELINES ARE PROTECTIVE OF LAMPREY. IF THERE IS A CONFLICT BETWEEN CONSERVATION MEASURES FOR ESA-LISTED SALMONIDS AND LAMPREY/MUSSELS NOTIFY EC LEAD AND PRIORITIZE PROTECTIONS TOWARDS THE ESA-LISTED FISH.
- 2) GENERALLY THREE TYPES OF ELECTROFISHERS ARE SUITABLE FOR LARVAL LAMPREY SAMPLING:
 - a) ABP-2 "WISCONSIN" ELECTROFISHER (ETS ELECTROFISHING, VERONA, WI)
 - b) SMITH-ROOT LR-24 MODEL ELECTROFISHER WITH LAMPREY SETTINGS.
 - c) SMITH ROOT APEX BACKPACK ELECTROFISHER WITH LAMPREY SETTINGS.
- 3) ELECTROFISHERS USED FOR LARVAL LAMPREY SAMPLING SHOULD BE SET WITH TWO WAVE FORMS, A LOWER FREQUENCY "TICKLE" WAVE FORM TO COAX LARVAL LAMPREYS OUT OF THE SUBSTRATE AND A HIGHER FREQUENCY "STUN" WAVE FORM TO IMMOBILIZE LARVAL LAMPREYS FOR NETTING.
- 4) EFFECTIVE SAMPLING INVOLVES THIS 2-STAGE METHOD (TABLE 2):
 - a) FIRST STAGE: USE 125V DIRECT CURRENT WITH A 25 PERCENT DUTY CYCLE APPLIED AT A SLOW RATE OF 3 PULSES PER SECOND, TO INDUCE LARVAL LAMPREYS TO EMERGE FROM THE SEDIMENT. AT LOW WATER TEMPERATURE (<10°C), VOLTAGE MAY NEED TO BE RAISED (150- 200V) TO MAINTAIN ITS EFFECTIVENESS (GRADUALLY INCREASE VOLTAGE TO FIND THE APPROPRIATE SETTING TO AVOID THE RISK OF ELECTRONARCOSIS).
 - b) USE A PATTERN OF 3 SLOW PULSES FOLLOWED BY A SKIPPED PULSE (BURSTED PULSE) HELPS LARVAL LAMPREYS TO EMERGE.
 - c) SECOND STAGE: IMMEDIATELY AFTER LARVAL LAMPREYS EMERGE, USE A FAST PULSE SETTING OF 30 PULSES PER SECOND TO IMMOBILIZE AND NET THEM. IT IS NOT NECESSARY TO STUN LAMPREY FOR NETTING FOR EXPERIENCED NETTERS.
- 5) AVOID EXPOSING LARVAL LAMPREYS TO EXTENDED PERIODS OF ELECTROFISHING AS IT HAS ALSO BEEN LINKED TO ELECTRONARCOSIS. RECOVERY FROM ELECTRONARCOSIS TAKES ABOUT 15 MINUTES.
- 6) USE DIP NETS TO CAPTURE LARVAL LAMPREYS WHERE THEY ARE READILY VISIBLE. WHERE NOT VISIBLE, SEINES MAY BE EFFECTIVE. USING FINE MESH NETS TO "SWEEP" THE WATER ("BLIND-NETTING") MAY INCREASE THE NUMBER OF SMALL LARVAE COLLECTED.
- 7) WITHIN EACH REACH, ELECTROFISHING SHOULD BE CONDUCTED IN A DOWNSTREAM TO UPSTREAM DIRECTION (FOR THE PURPOSE OF REDUCING TURBIDITY/MAINTAINING VISIBILITY) WITH ONE PERSON OPERATING THE ELECTROFISHER AND AT LEAST ONE PERSON NETTING LARVAL LAMPREYS. EACH REACH SHOULD BE THOROUGHLY AND SLOWLY SAMPLED (60-90 SEC/M), WITH MORE EFFORT DIRECTED AT SUITABLE LAMPREY REARING HABITAT AND LESS EFFORT IN AREAS WITH HARD SUBSTRATES OR HIGH WATER VELOCITY.
- 8) USING THE 2-STAGE METHOD DESCRIBED ABOVE, THE ELECTROFISHER SHOULD MAINLY BE OPERATE IN THE LOWER FREQUENCY OUTPUT MODE TO IRRITATE LARVAL LAMPREYS OUT OF THE SUBSTRATE. WHEN NECESSARY, THE HIGHER FREQUENCY MODE SHOULD BE ACTIVATED FOR CAPTURING EMERGENT LARVAL LAMPREYS.
- 9) MULTIPLE ELECTROFISHING PASSES SHOULD BE MADE TO ENSURE A MORE COMPLETE REMOVAL OF LARVAL LAMPREYS. A FIFTEEN MINUTE BREAK BETWEEN PASSES SHOULD BE TAKEN TO REDUCE THE CHANCE OF ELECTRONARCOSIS. SOME RESEARCH INDICATED ON AVERAGE, ONLY 30% LAMPREY EMERGE PER PASS, THUS THE NEED FOR MULTIPLE PASSES.
- 10) POST-DRAWDOWN: LARVAL LAMPREY MAY CONTINUE TO EMERGE FROM SEDIMENTS AFTER DRAWDOWN. THE FOLLOWING "DRY-SHOCKING" GUIDELINES CAN BE USED TO ENCOURAGE LARVAE TO EMERGE FROM THE SEDIMENTS SO THEY CAN BE SALVAGED.
 - a) DURING AND AFTER DEWATERING, DEWATERED AREAS WHERE LAMPREY MAY BE BURROWED SHOULD BE SHOCKED, AKA "DRY-SHOCKING." DRY SHOCK IN DEPOSITIONAL AREAS OF FINE AND SANDY SEDIMENT FOR LARVAL LAMPREY. JUVENILES (EYED MIGRANTS) AND ADULTS ARE SOMETIMES FOUND BURIED IN ROCKIER AREAS, AND THOSE AREAS SHOULD ALSO BE SHOCKED IF OTHER THESE LIFE STAGES MAY BE PRESENT.
 - b) DRY-SHOCK A SQUARE METER AT A TIME. PLACE THE ANODES ABOUT 1 METER APART AND TICKLE-PULSE FOR 60 TO 90 SECONDS. REMOVE EMERGED LAMPREY ONCE THE SHOCKING HAS STOPPED. MOVE TO NEXT SQUARE METER AND CONTINUE. ADJUST TO LOCAL CONDITIONS IN SOME INSTANCES, 60 SECONDS OF SHOCKING WILL BE SUFFICIENT. IN OTHER AREAS 90 SECONDS IS NEEDED. IN COLD TEMPERATURES, IT CAN BE BENEFICIAL TO RAISE THE VOLTAGE TO INCREASE EFFICIENCY. A GENERAL GUIDELINE IS AT TEMPERATURES LESS THAN 10°C, THE VOLTAGE CAN BE INCREASED TO 150-175 V. IF EMERGENCE IS REALLY SLOW (OR ON THE LAST SALVAGE PASS PRIOR TO COMPLETE DEWATERING), THE VOLTAGE CAN BE INCREASED TO 200 V INITIALLY. AND UP TO 400 V IF LOWER VOLTAGE IS NOT EFFECTIVE (DRY SHOCKING ONLY).

4) **FISH SALVAGE NOTICE:** MONITORING AND RECORDING OF FISH PRESENCE, HANDLING, AND MORTALITY MUST OCCUR FOR THE DURATION OF THE ISOLATION, SALVAGE, ELECTROFISHING, DEWATERING, AND DEWATERING OPERATIONS. ONCE OPERATIONS ARE COMPLETED, A SALVAGE REPORT WILL DOCUMENT PROCEDURES USED, ANY FISH INJURIES OR DEATHS (INCLUDING NUMBERS OF FISH AFFECTED), AND CAUSES OF ANY DEATHS.



SCALE: 1"=700'

1. PARCEL DATA OBTAINED FROM COWLITZ COUNTY.
2. ACTIVE CHANNEL AREA DERIVED FROM EXISTING HYDRAULIC MODEL 2-YEAR RECURRENCE FLOOD EVENT (4520 CFS).

--- --	RESTORATION AREA
- - - -	REACH BREAK
————	RIVER CENTERLINE
- . . . -	TRIBUTARY CENTERLINE
— — — —	PARCEL BOUNDARY
- - - -	ACCESS ROAD
100 YR 50 YR	FEMA ZONE A FLOODPLAIN
Active Channel Area	ACTIVE CHANNEL AREA
+ + +	DNR LOG HARVEST AREA
Star Symbol	SURVEY TEMP REFERENCE POINT

DESCRIPTION	NORTHING	EASTING	ELEVATION
1000	333358.97	1150112.19	1259.84
1001	332600.26	1149045.92	1252.86
1002	332819.58	1147150.35	1233.40
1003	332450.64	1152819.81	1315.55
1004	332703.94	1151123.34	1288.92
1005	333412.71	1148852.86	1235.42

*SURVEY TEMP REFERENCE POINTS MAY BE LOCATED ± 12 FT HORIZONTALLY AND ± 2 FT VERTICALLY FROM STATED POSITION. OPR TO SURVEY/REFINE REFERENCE POINTS DURING SITE LAYOUT. CONTRACTOR TO VERIFY AND ESTABLISH CONTROL IN THE FIELD.



SCALE

REVISION NUMBER[illegible]

Code 11/11/2024	Designed By LE
Drawn By LM, LE	Checked By CL

JOB NO. 20200001

SHEET NO.

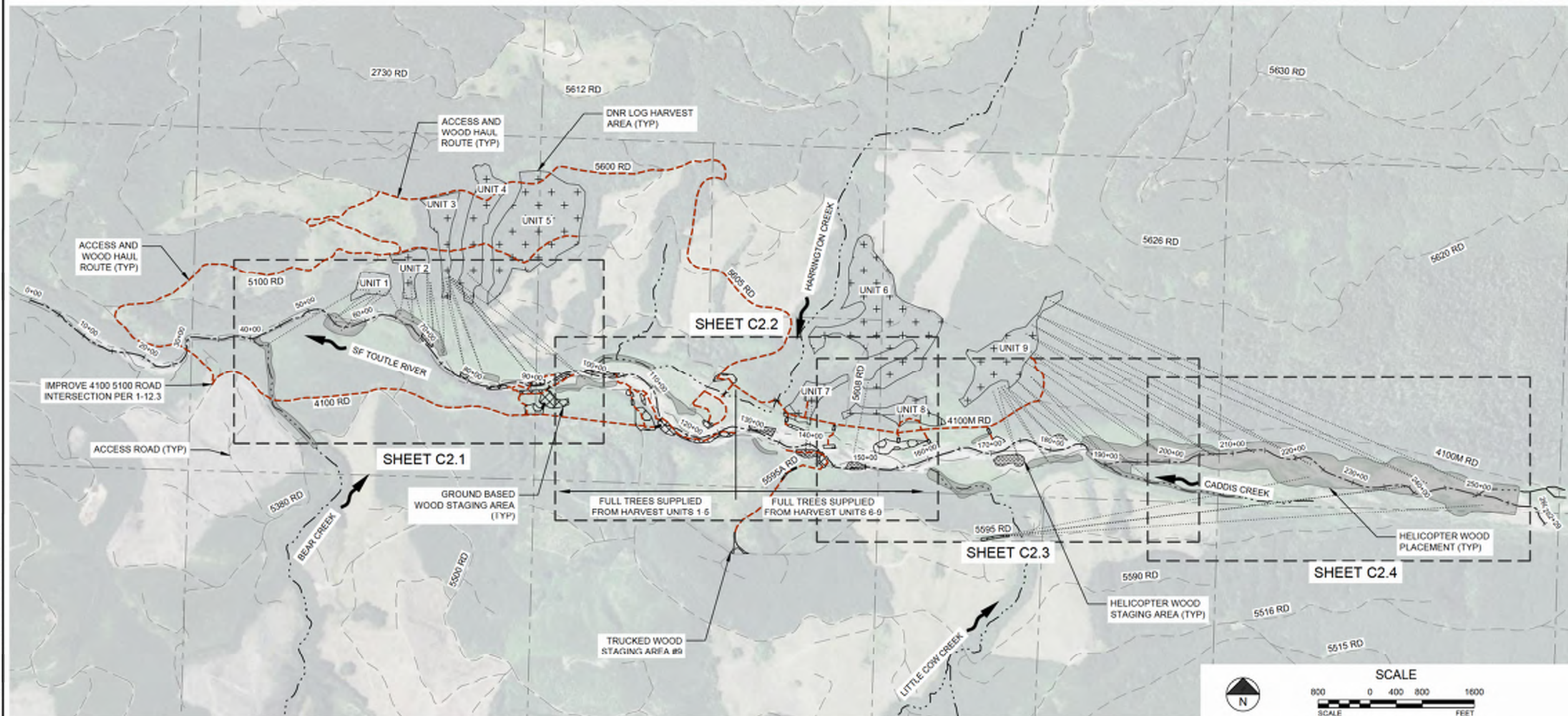
5 of 57



LOWER COLUMBIA FISH
ENHANCEMENT GROUP
SOUTH FORK TOUTLE RIVER
HEADWATERS DESIGN
COWLITZ COUNTY, WA

ACCESS, STAGING,
AND HELICOPTER
OVERVIEW

REVISION NUMBER		
No.	Date	Description
1	11/11/2024	Design By LE
2		Checked By CL
3		
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ACCESS, STAGING, AND HELICOPTER OVERVIEW

SCALE: 1"=800'

NOTES:

- THE WORK AREAS ARE LOCATED IN A DYNAMIC RIVER AND FLOODPLAIN THAT FREQUENTLY MOVES AND CHANGES DURING HIGH FLOW EVENTS. THE CONTRACTOR SHALL EXPECT CONDITIONS TO BE DIFFERENT THAN THOSE SHOWN ON THESE SHEETS AND WILL ADJUST WORK ACCESS PLANS ACCORDINGLY.
- MACHINE ACCESS ROUTES AND STAGING AREAS ARE APPROXIMATE AND SHALL BE MODIFIED IN THE FIELD AS NECESSARY AND AT THE DIRECTION OF THE OPR.
- HELICOPTER WOOD PLACEMENT AND STAGING AREAS SHALL BE CONSTRUCTED/IMPLEMENTED BY AN INDEPENDENT PARTY PRIOR TO, OR IN CONCERT WITH, CONTRACTOR ACCESS AND IMPLEMENTATION. THE CONTRACTOR SHALL UTILIZE DECKED WOOD IN HELICOPTER WOOD STAGING AREAS FOR CONSTRUCTION OF WHS AS SHOWN ON THE SITE PLAN SHEETS. THE CONTRACTOR SHALL NOT ACCESS NOR DISTURB HELICOPTER WOOD PLACEMENT AREAS.
- SEE SITE PLANS ON SHEETS C3.1-C3.13 AND WHS DETAILS ON SHEETS C6.9-C6.12 FOR HELICOPTER WOOD PLACEMENT.
- CONTRACTOR SHALL OBTAIN ALL NECESSARY DNR FOREST PRACTICES PERMITS PRIOR TO BEGINNING WORK.
- THE CONTRACTOR IS RESPONSIBLE FOR HAULING ALL LOGS DECKED WITHIN HELICOPTER AND TRUCK BASED STAGING AREAS TO A TEMPORARY GROUND BASED WOOD STAGING AREA AND OR THE FINAL WOOD PLACEMENT LOCATION. THE CONTRACTOR MAY HAUL LOGS ALONG DESIGNATED ACCESS AND WOOD HAUL ROUTES. WOOD SHALL NOT BE HAULED ACROSS THE TOUTLE RIVER UNLESS APPROVED BY THE OPR OR THE WOOD PLACEMENT IS WITHIN A GRADING AREA.
- THE CONTRACTOR SHALL HAUL OR YARD ALL WOOD DECKED IN THE DNR LOG HARVEST AREAS TO THEIR RESPECTIVE TRUCKED WOOD OR GROUND BASED STAGING AREA PER SECTION 2-04.
- FULL TREES TRUCKED FROM DNR LOG HARVEST AREAS #1 THROUGH #5 SHALL BE MIN 90' LONG WITH BRANCHES BROKEN OR CUT OFF. THESE TREES SHALL BE USED APPROXIMATELY BETWEEN STATIONS 40+00 TO 128+00. FULL TREES FROM DNR LOG HARVEST AREAS #6 THROUGH #9 SHALL BE FULL LENGTH WITH BRANCHES INTACT WHERE POSSIBLE. AVERAGE LENGTH IS 120-140'. THESE TREES SHALL BE USED UPSTREAM OF STATION 128+00.

LEGEND:

---	RIVER CENTERLINE
---	TRIBUTARY CENTERLINE
---	PARCEL BOUNDARY
---	ACCESS ROAD
+	DNR LOG HARVEST AREA
+	DNR STAGING AREA
+	HELICOPTER WOOD STAGING AREA
+	GROUND BASED WOOD STAGING AREA
+	TRUCKED WOOD STAGING AREA
+	ACCESS AND WOOD HAUL ROUTE
+	HELICOPTER FLIGHT PATH
+	HELICOPTER WOOD PLACEMENT

DEFINITIONS:

DNR LOG HARVEST AREA: FOR REFERENCE, LOGS TO BE HARVESTED BY INDEPENDENT PARTY PRIOR TO CONSTRUCTION. LOGS SHALL BE HAULED FROM THESE LOCATIONS.

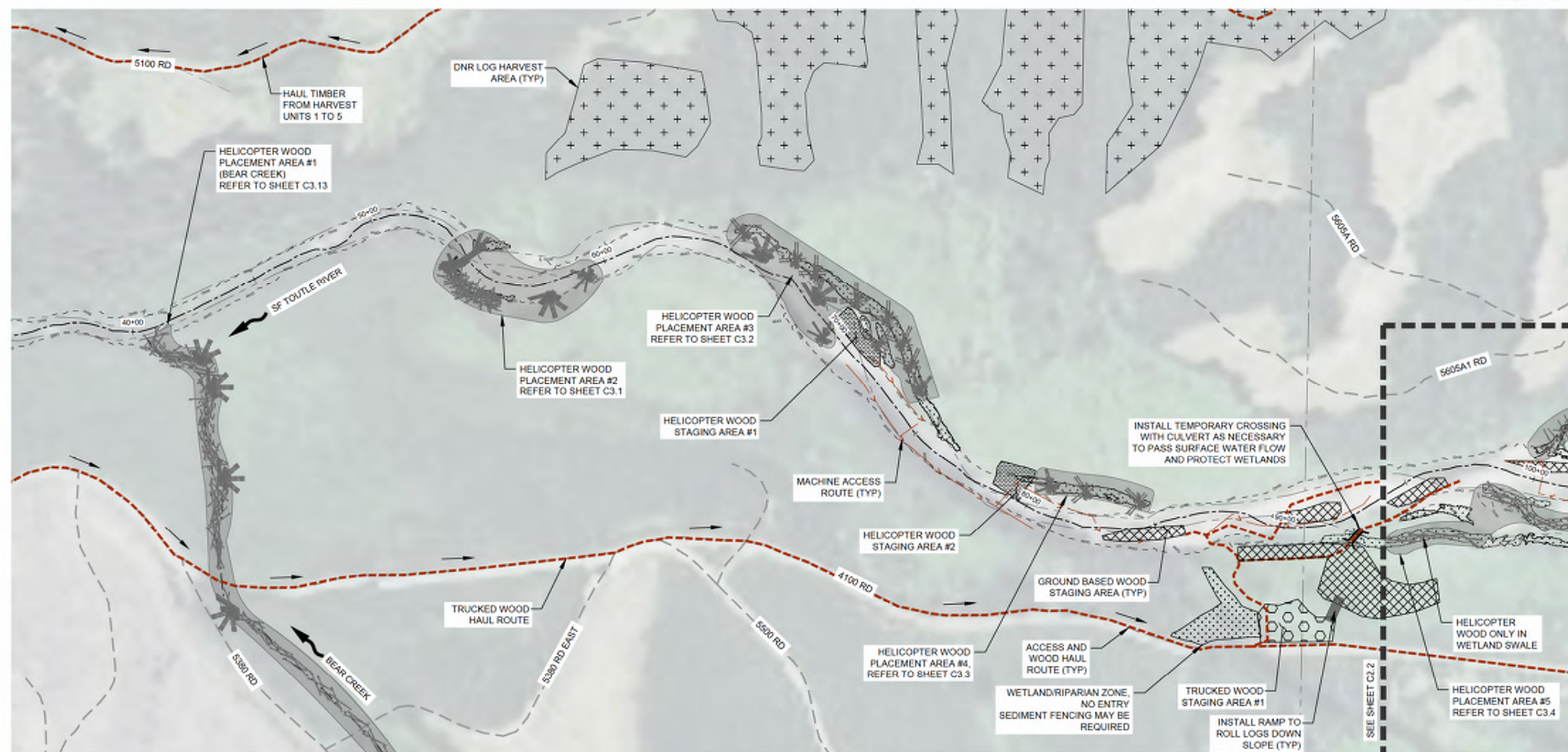
DNR STAGING AREA: AREA WHERE WOOD WILL BE DECKED BY AN INDEPENDENT PARTY PRIOR TO CONSTRUCTION. THE CONTRACTOR SHALL HAUL WOOD FROM THESE LOCATIONS.

HELICOPTER WOOD STAGING AREA: AREA WHERE WOOD WILL BE DECKED BY HELICOPTER TRANSPORTATION IN THE FLOODPLAIN PRIOR TO AND/OR DURING CONSTRUCTION.

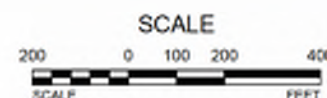
TRUCKED WOOD STAGING AREA: AREA WHERE WOOD WILL BE DECKED BY THE CONTRACTOR PRIOR TO THE IN WATER WORK WINDOW. WOOD TO BE HAULED BY TRUCK OR DRAGGED FROM DNR LOG HARVEST AREAS AND OR IMPORTED BY THE OWNER.

HELICOPTER WOOD PLACEMENT AREA: AREA WHERE WOOD WILL BE DIRECTLY PLACED IN THE SF TOUTLE CHANNEL AND FLOODPLAIN LOOSE AND IN WHS.

GROUND BASED WOOD STAGING AREA: TEMPORARY/OPTIONAL WOOD STAGING AREAS USED BY THE CONTRACTOR. THE CONTRACTOR MAY HAUL WOOD FROM TRUCKED WOOD AND HELICOPTER WOOD STAGING LOCATIONS TO THESE AREAS PRIOR TO FINAL WOOD PLACEMENT IF DESIRED.



SCALE: 1"=200'



WOOD STAGING AREA SUMMARY								
STAGING AREA TYPE	STAGING AREA ID	FULL TREE W/O RW	FULL TREE W/ RW	MEDIUM LOG	SMALL LOG	PILE	SPECIALTY XL LOGS	SLASH (CY)
HELICOPTER	1	6	9	42	90	24	-	120
	2	16	18	16	90	18	-	100
TRUCK	1	52	51	130	376	90	6	410

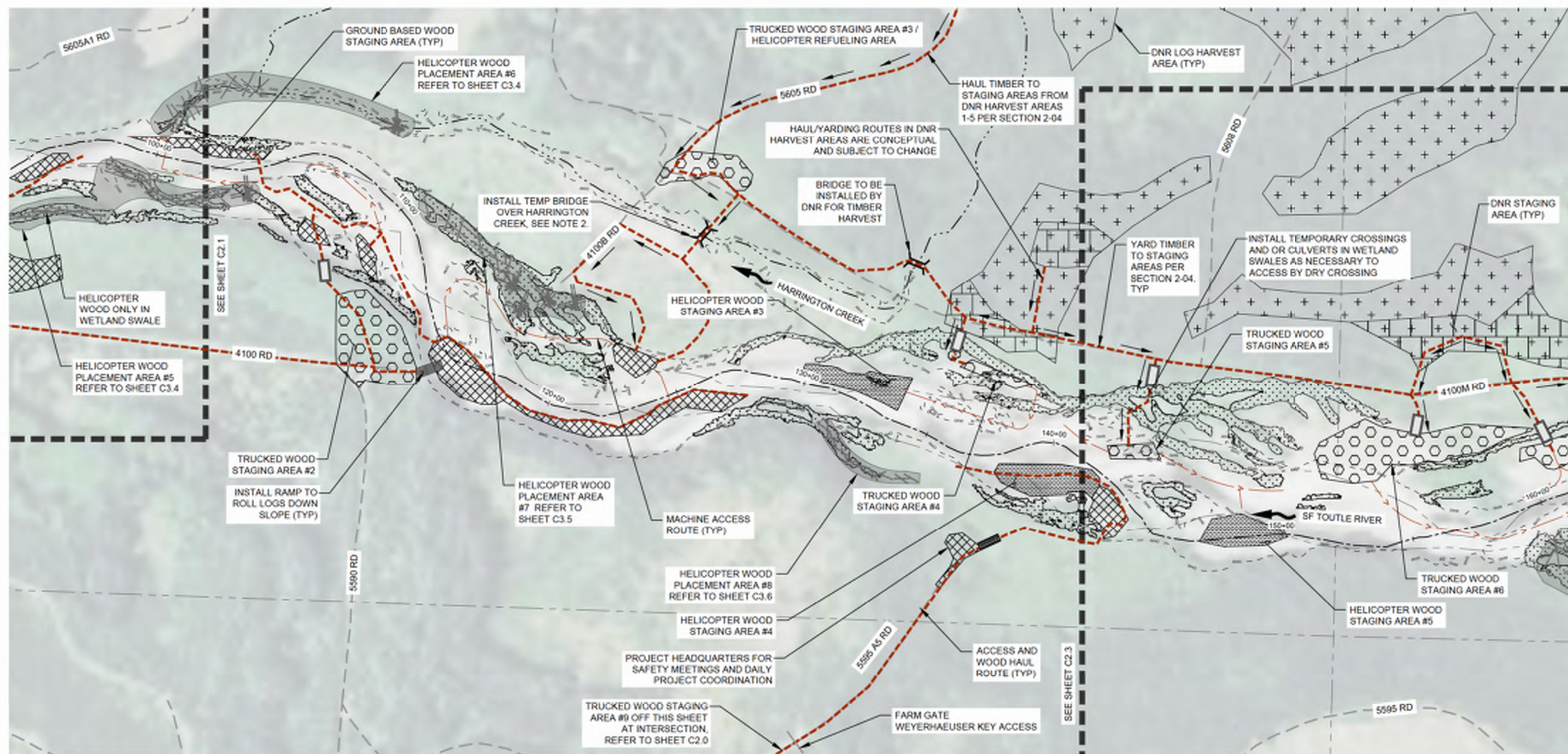
HELICOPTER WOOD PLACEMENT AREA SUMMARY					
PLACEMENT AREA ID	FULL TREE W/D RW	FULL TREE W/ RW	MEDIUM LOG	SMALL LOG	SLASH BUNDLES
1	145	12	233	-	22
2	92	3	56	-	-
3	64	6	120	-	-
4	14	-	24	-	-
5	35	-	8	-	-

LEGEND:

	RIVER CENTERLINE
	TRIBUTARY CENTERLINE
	PARCEL BOUNDARY
	ACCESS ROAD
	ORDINARY HIGH WATER
	WETLANDS
	DNR LOG HARVEST AREA
	DNR STAGING AREA
	HELICOPTER WOOD STAGING AREA
	GROUND BASED WOOD STAGING AREA
	TRUCKED WOOD STAGING AREA
	MACHINE ACCESS ROUTE
	ACCESS AND WOOD HAUL ROUTE
	HELICOPTER WOOD PLACEMENT
	LOG RAMP
	STABILIZED CONSTRUCTION RAMP
	TEMP CROSSING

NOTES:

1. REFER TO ACCESS, STAGING AND HELICOPTER NOTES ON SHEET C2.0



SCALE

200 0 100 200 400

SCALE FEET

WOOD STAGING AREA SUMMARY								
STAGING AREA TYPE	STAGING AREA ID	FULL TREE W/O RW	FULL TREE W/ RW	MEDIUM LOG	SMALL LOG	PILE	SPECIALTY XL LOG	SLASH
HELICOPTER	3	90	22	41	202	78	-	180
	4	114	12	56	210	95	-	205
TRUCK	2	264	61	198	862	224	53	650
	3	125	21	78	272	56	-	255
	4	88	21	83	244	58	-	250
	5	77	9	32	136	33	-	115
	6	409	54	172	712	217	-	560
	9	-	-	-	-	-	108	-

1. REFER TO ACCESS, STAGING AND HELICOPTER NOTES ON SHEET C2.0.
2. THE CONTRACTOR SHALL INSTALL A TEMPORARY BRIDGE OVER HARRINGTON CREEK FOR MACHINE ACCESS AND HAUL OF FULL TREES AND OTHER WOOD ALONG THE 4100B ROAD TO GROUND BASED STAGING AREAS IN THE FLOODPLAIN.
3. ALL SPECIALTY XL LOGS WILL BE INITIALLY STAGED IN TRUCKED WOOD STAGING AREAS #1, #2 #9 AND #10. THE CONTRACTOR SHALL Haul SPECIALTY XL LOGS FROM THESE LOCATIONS TO THE FLOODPLAIN AS DESCRIBED IN 2-04.3(1).

HELICOPTER WOOD PLACEMENT AREA SUMMARY					
PLACEMENT AREA ID	FULL TREE W/O RW	FULL TREE W/ RW	MEDIUM LOG	SMALL LOG	SLASH BUNDLES
6	21	-	8	-	5
7	30	-	32	-	-
8	-	-	15	80	5

	RIVER CENTERLINE
	TRIBUTARY CENTERLINE
	PARCEL BOUNDARY
	ACCESS ROAD
	ORDINARY HIGH WATER
	WETLANDS
	DNR LOG HARVEST AREA
	DNR STAGING AREA
	HELICOPTER WOOD STAGING AREA
	GROUND BASED WOOD STAGING AREA
	TRUCKED WOOD STAGING AREA
	MACHINE ACCESS ROUTE
	ACCESS AND WOOD HAUL ROUTE
	HELICOPTER WOOD PLACEMENT
	LOG RAMP
	STABILIZED CONSTRUCTION RAMP
	TEMP CROSSING



LOWER COLUMBIA FISH
ENHANCEMENT GROUP
SOUTH FORK TOUTLE RIVER
HEADWATERS DESIGN
COWLITZ COUNTY, WA

ACCESS STAGING
AND HELICOPTER
PLAN - REACH C

REVISION NUMBER

No.	Date	Revised
1	11/11/2024	Designed By LE
2		Drawn By LH, LE
3		Checked By CL

Date: 11/11/2024

Drawn By LH, LE

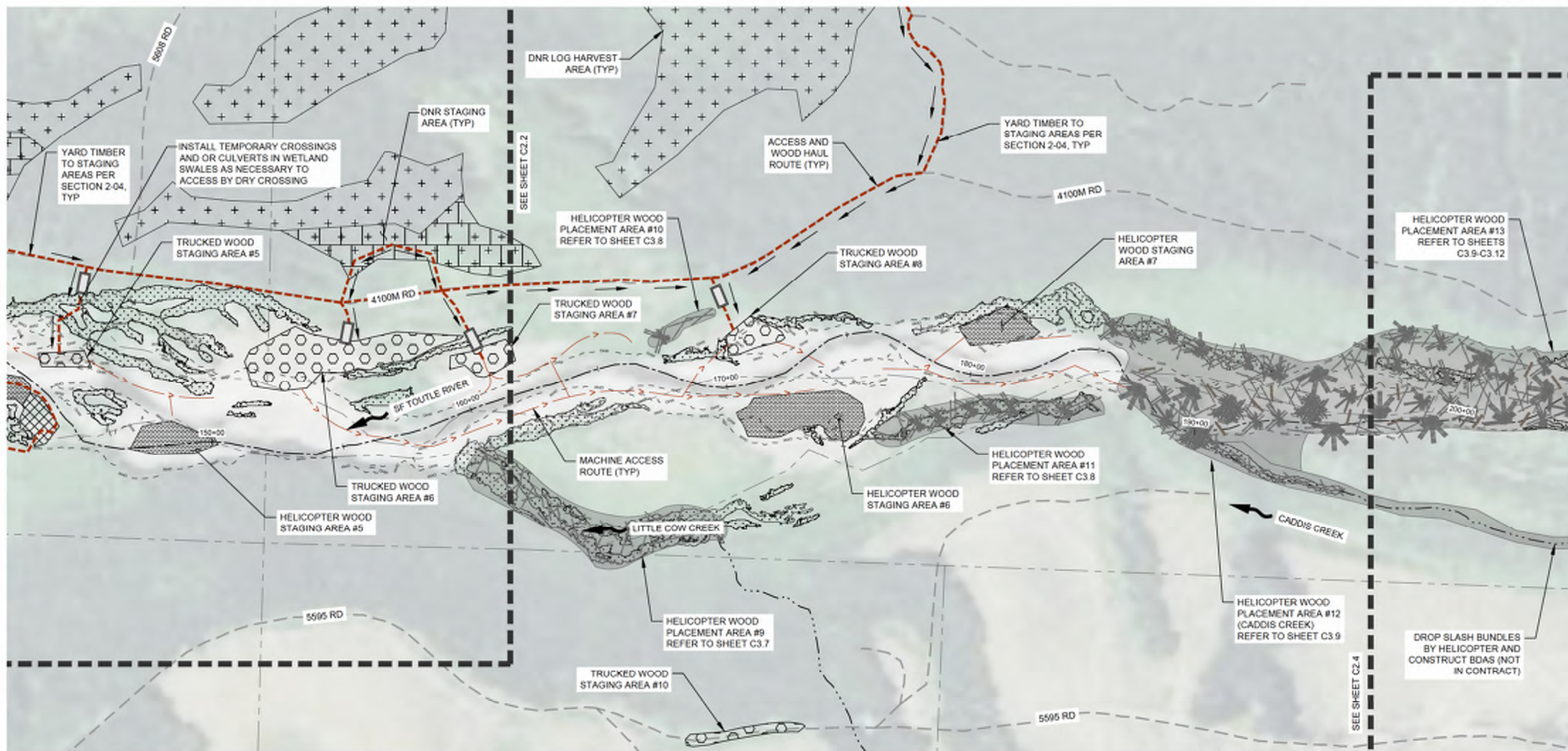
Checked By CL

SCALE: 1"=200'

JOB NO. 20200001

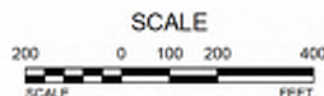
SHEET NO. C2.3

9 OF 57



ACCESS STAGING AND HELICOPTER PLAN - REACH C

SCALE: 1"=200'



WOOD STAGING AREA SUMMARY								
STAGING AREA TYPE	STAGING AREA ID	FULL TREE W/O RW	FULL TREE W/ RW	MEDIUM LOG	SMALL LOG	PILE	SPECIALTY XL LOG	SLASH (CY)
HELICOPTER	5	49	15	55	152	47	-	150
	6	153	30	115	362	111	-	350
	7	68	12	46	146	43	-	135
TRUCK	7	108	12	36	178	73	-	135
	8	83	15	50	172	81	-	145
	10	-	-	-	-	-	52	-

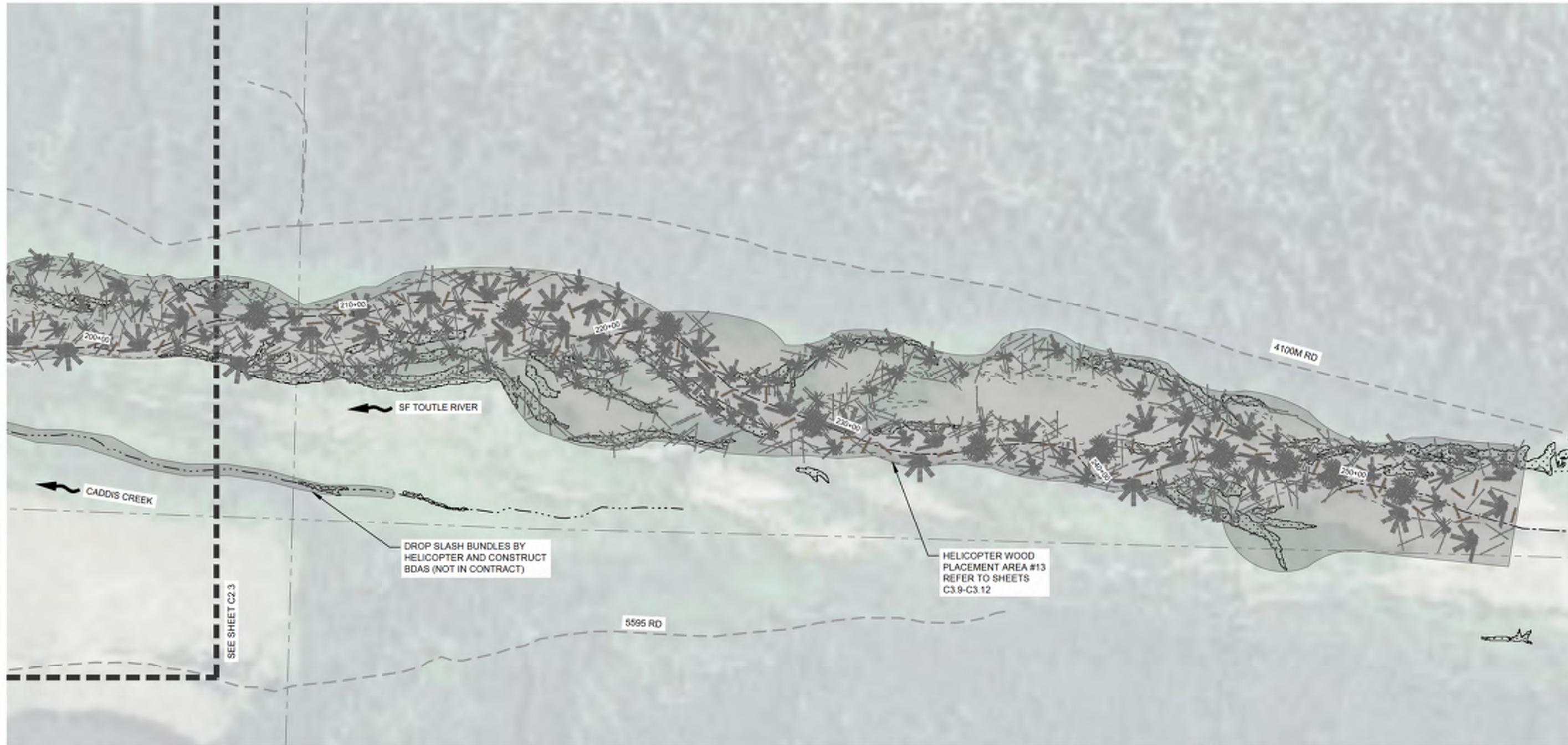
HELICOPTER WOOD PLACEMENT AREA SUMMARY					
PLACEMENT AREA ID	FULL TREE W/O RW	FULL TREE W/ RW	MEDIUM LOG	SMALL LOG	SLASH BUNDLE
9	33	-	-	-	11
10	8	-	8	-	-
11	39	-	48	-	-
12	-	-	18	60	22

NOTES:

1. REFER TO ACCESS, STAGING AND HELICOPTER NOTES ON SHEET C2.0.

LEGEND:

- RIVER CENTERLINE
- - - - - TRIBUTARY CENTERLINE
- - - - - PARCEL BOUNDARY
- - - - - ACCESS ROAD
- - - - - ORDINARY HIGH WATER
- - - - - WETLANDS
- + + + DNR LOG HARVEST AREA
- + + + DNR STAGING AREA
- + + + HELICOPTER WOOD STAGING AREA
- + + + GROUND BASED WOOD STAGING AREA
- + + + TRUCKED WOOD STAGING AREA
- + + + MACHINE ACCESS ROUTE
- + + + ACCESS AND WOOD HAUL ROUTE
- + + + HELICOPTER WOOD PLACEMENT
- + + + LOG RAMP
- + + + STABILIZED CONSTRUCTION RAMP
- + + + TEMP CROSSING



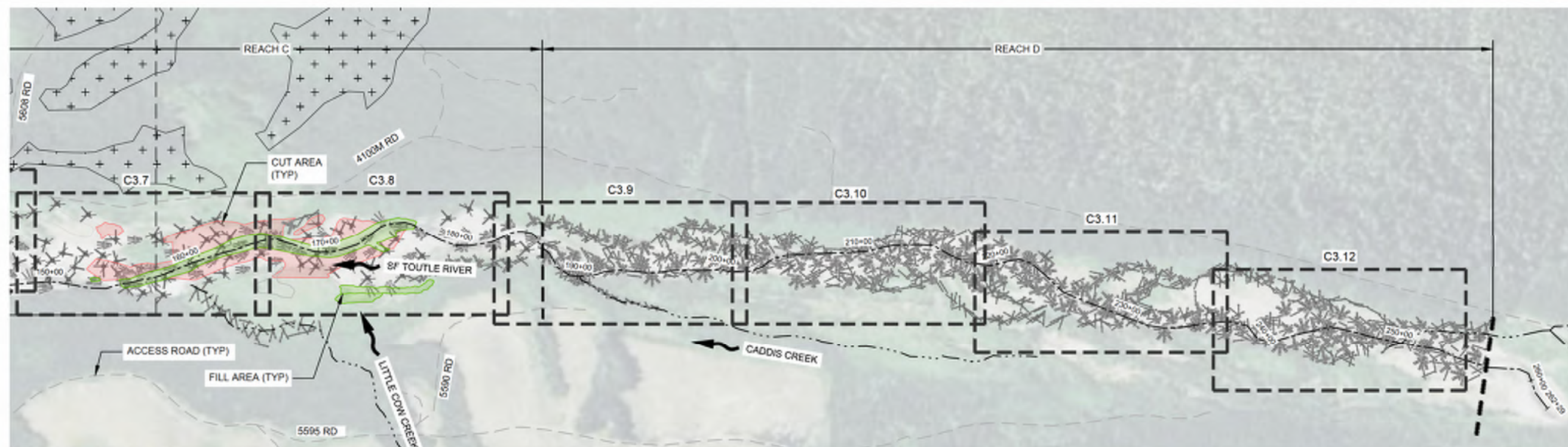
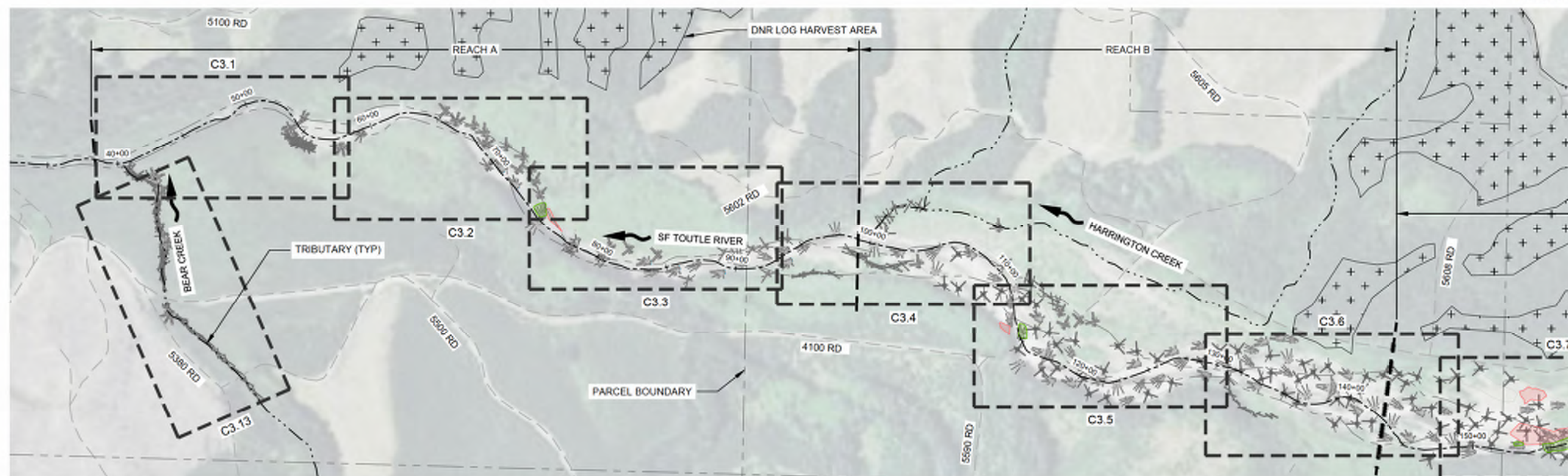
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HELICOPTER WOOD PLACEMENT AREA SUMMARY				
PLACEMENT AREA ID	FULL TREE W/O RW	FULL TREE W/ RW	MEDIUM LOG	SPECIALTY XL LOG
13	1748	120	1920	52

1. REFER TO ACCESS, STAGING AND HELICOPTER NOTES ON SHEET C2.0.

LEGEND:

	RIVER CENTERLINE
	TRIBUTARY CENTERLINE
	PARCEL BOUNDARY
	ACCESS ROAD
	ORDINARY HIGH WATER
	WETLANDS
	DNR LOG HARVEST AREA
	DNR STAGING AREA
	HELICOPTER WOOD STAGING AREA
	GROUND BASED WOOD STAGING AREA
	TRUCKED WOOD STAGING AREA
	MACHINE ACCESS ROUTE
	ACCESS AND WOOD HAUL ROUTE
	HELICOPTER WOOD PLACEMENT



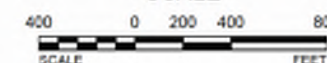
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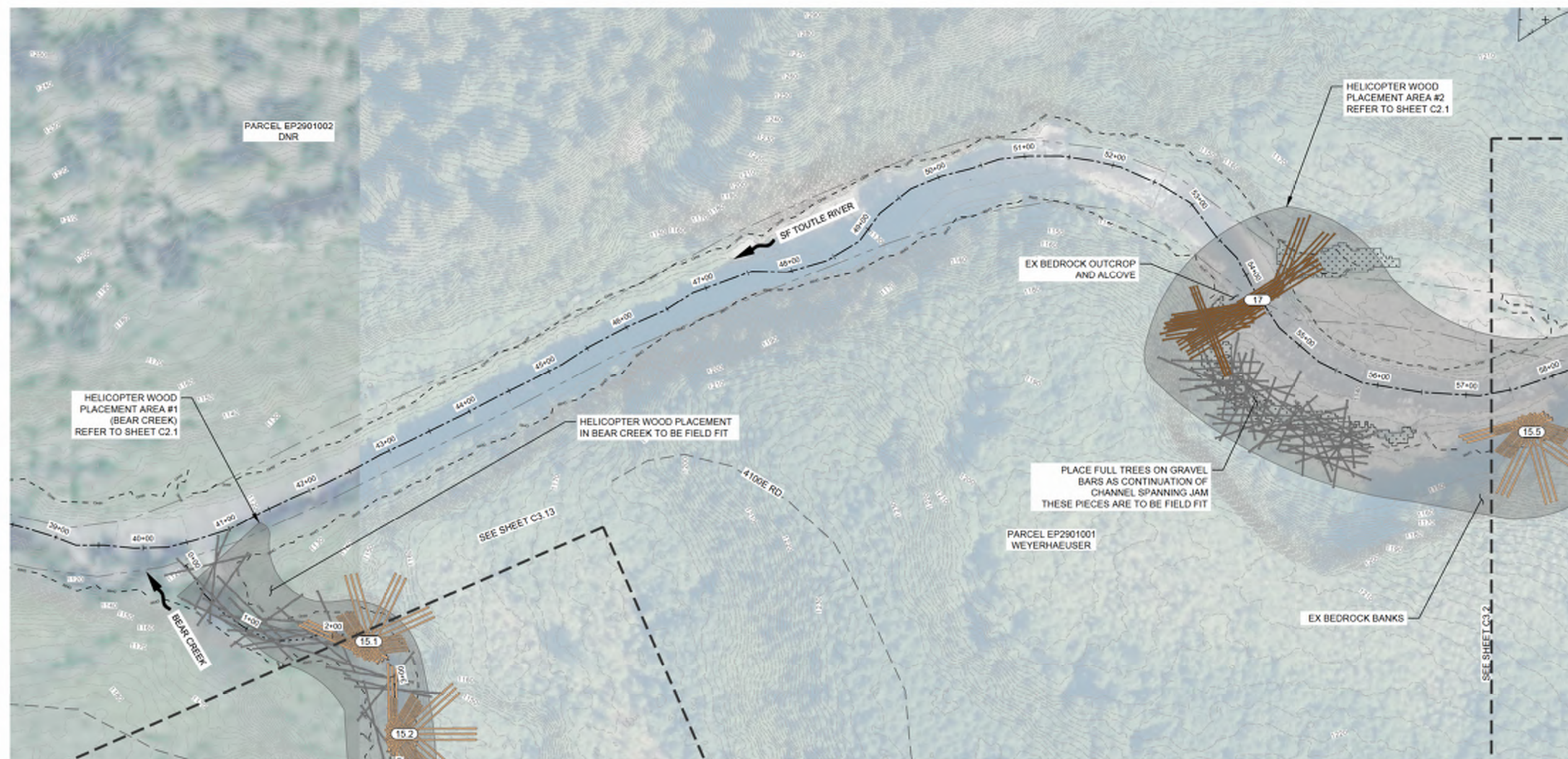
1. PARCEL DATA OBTAINED FROM COWLITZ COUNTY.
2. SEE SHEET C3.1-C3.13 FOR PROPOSED GRADING AND WHS PLACEMENT.

	REACH BREAK
	RIVER CENTERLINE
	TRIBUTARY CENTERLINE
	PARCEL BOUNDARY
	ACCESS ROAD
	DNR LOG HARVEST AREA
	FILL AREA
	CUT AREA



SCALE





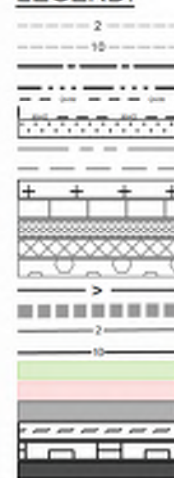
SF TOUTLE PLAN - STA 39+00 TO 58+00

SCALE: 1"=60'

NOTES:

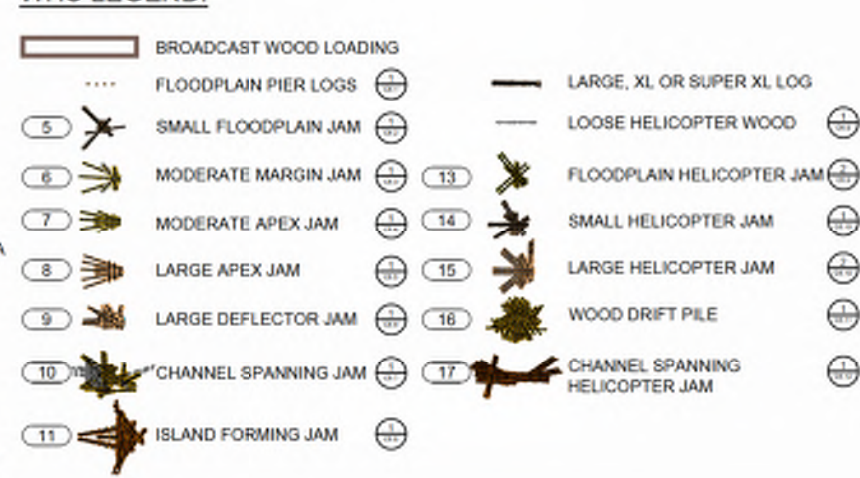
1. AVOID DISTURBANCE TO AREAS OF EXISTING VEGETATION IDENTIFIED BY OPR. PRESERVE EXISTING TREES/VEGETATION IN EXCAVATION, FILL, HAULING AND STAGING AREAS. WHERE DISTURBANCE TO EXISTING VEGETATION IS UNAVOIDABLE, SALVAGE AND RE-USE FOR SITE RESTORATION AT DIRECTION OF OPR.
2. PLACE 10 LOOSE FULL TREES AND 2 PINNED WOOD STRUCTURES (WHS 4) PER ACRE IN BROADCAST WOOD LOADING AREAS AS DIRECTED BY THE OPR. WOOD NOT SHOWN FOR CLARITY AND TO ALLOW FIELD FIT PLACEMENT.
3. WHERE BOULDERS ARE FOUND DURING EXCAVATION, TEMPORARILY STOCKPILE AND PRIORITIZE THEIR USE FOR CHANNEL FILL AND BALLAST ON WHS AS DIRECTED BY OPR.
4. SEE SHEETS C7.0-C7.3 FOR CONSTRUCTION SEQUENCING AND WATER MANAGEMENT PLAN.
5. HELICOPTER JAMS DENOTED WITH AN "F" SHALL BE FIELD FIT. CONSTRUCTION OF HELICOPTER JAMS NOT DENOTED WITH AN "F" SHALL BE DIRECTED BY THE OPR IN THE FIELD.

LEGEND:

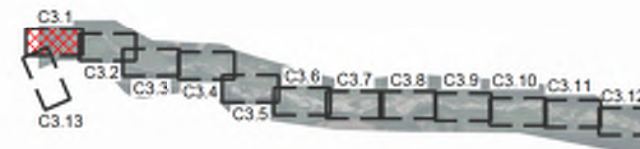
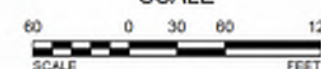


2 FOOT EX MINOR CONTOUR LINE
10 FOOT EX MAJOR CONTOUR LINE
RIVER CENTERLINE
TRIBUTARY CENTERLINE
ORDINARY HIGH WATER
WETLANDS
PARCEL BOUNDARY
ACCESS ROAD
DNR HARVEST AREA
DNR STAGING AREA
HELICOPTER WOOD STAGING AREA
GROUND BASED WOOD STAGING AREA
TRUCKED WOOD STAGING AREA
MACHINE ACCESS ROUTE
ACCESS AND WOOD HAUL ROUTE
2 FOOT MINOR CONTOUR LINE
10 FOOT MAJOR CONTOUR LINE
FILL AREA
CUT AREA
HELICOPTER WOOD PLACEMENT
DO NOT DISTURB
POTENTIAL BOULDER HARVEST AREA
LEAVE POOL

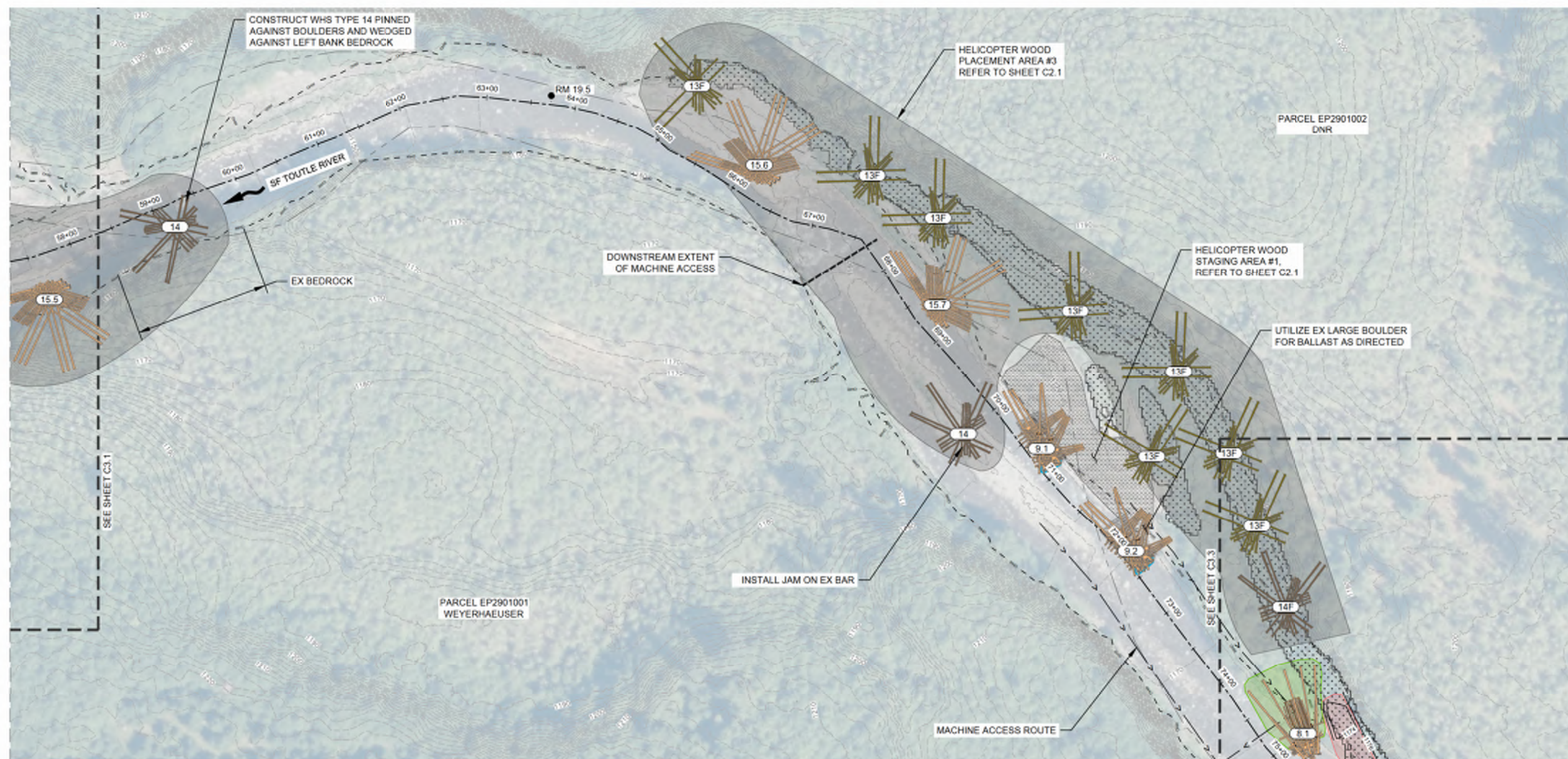
WHS LEGEND:



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LOCATION MAP



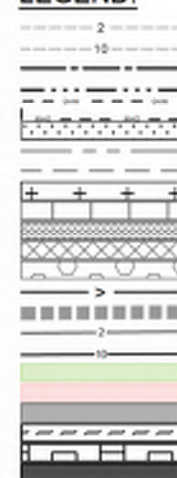
SF TOUTLE PLAN - STA 58+00 TO 75+00

SCALE: 1"=60'

NOTES:

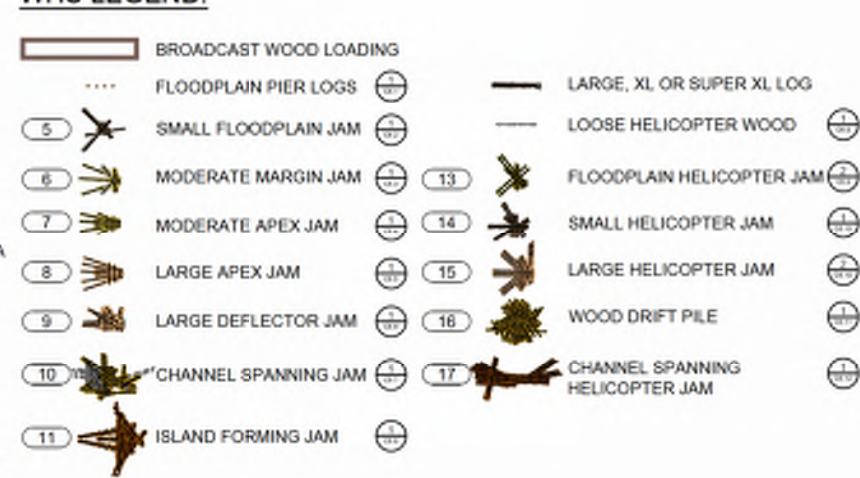
1. AVOID DISTURBANCE TO AREAS OF EXISTING VEGETATION IDENTIFIED BY OPR. PRESERVE EXISTING TREES/VEGETATION IN EXCAVATION, FILL, HAULING AND STAGING AREAS. WHERE DISTURBANCE TO EXISTING VEGETATION IS UNAVOIDABLE, SALVAGE AND RE-USE FOR SITE RESTORATION AT DIRECTION OF OPR.
2. PLACE 10 LOOSE FULL TREES AND 2 PINNED WOOD STRUCTURES (WHS 4) PER ACRE IN BROADCAST WOOD LOADING AREAS AS DIRECTED BY THE OPR. WOOD NOT SHOWN FOR CLARITY AND TO ALLOW FIELD FIT PLACEMENT.
3. WHERE BOULDERS ARE FOUND DURING EXCAVATION, TEMPORARILY STOCKPILE AND PRIORITIZE THEIR USE FOR CHANNEL FILL AND BALLAST ON WHS AS DIRECTED BY OPR.
4. SEE SHEETS C7.0-C7.3 FOR CONSTRUCTION SEQUENCING AND WATER MANAGEMENT PLAN.
5. HELICOPTER JAMS DENOTED WITH AN "F" SHALL BE FIELD FIT. CONSTRUCTION OF HELICOPTER JAMS NOT DENOTED WITH AN "F" SHALL BE DIRECTED BY THE OPR IN THE FIELD.

LEGEND:

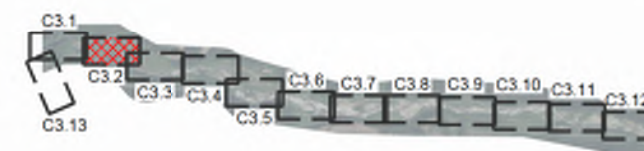
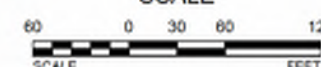


2 FOOT EX MINOR CONTOUR LINE
10 FOOT EX MAJOR CONTOUR LINE
RIVER CENTERLINE
TRIBUTARY CENTERLINE
ORDINARY HIGH WATER
WETLANDS
PARCEL BOUNDARY
ACCESS ROAD
DNR HARVEST AREA
DNR STAGING AREA
HELICOPTER WOOD STAGING AREA
GROUND BASED WOOD STAGING AREA
TRUCKED WOOD STAGING AREA
MACHINE ACCESS ROUTE
ACCESS AND WOOD HAUL ROUTE
2 FOOT MINOR CONTOUR LINE
10 FOOT MAJOR CONTOUR LINE
FILL AREA
CUT AREA
HELICOPTER WOOD PLACEMENT
DO NOT DISTURB
POTENTIAL BOULDER HARVEST AREA
LEAVE POOL

WHS LEGEND:



SCALE



LOCATION MAP



LOWER COLUMBIA FISH
ENHANCEMENT GROUP
SOUTH FORK TOUTLE RIVER
HEADWATERS DESIGN
COWLITZ COUNTY, WA

SF TOUTLE PLAN - STA
75+00 TO 93+00

REVISION NUMBER

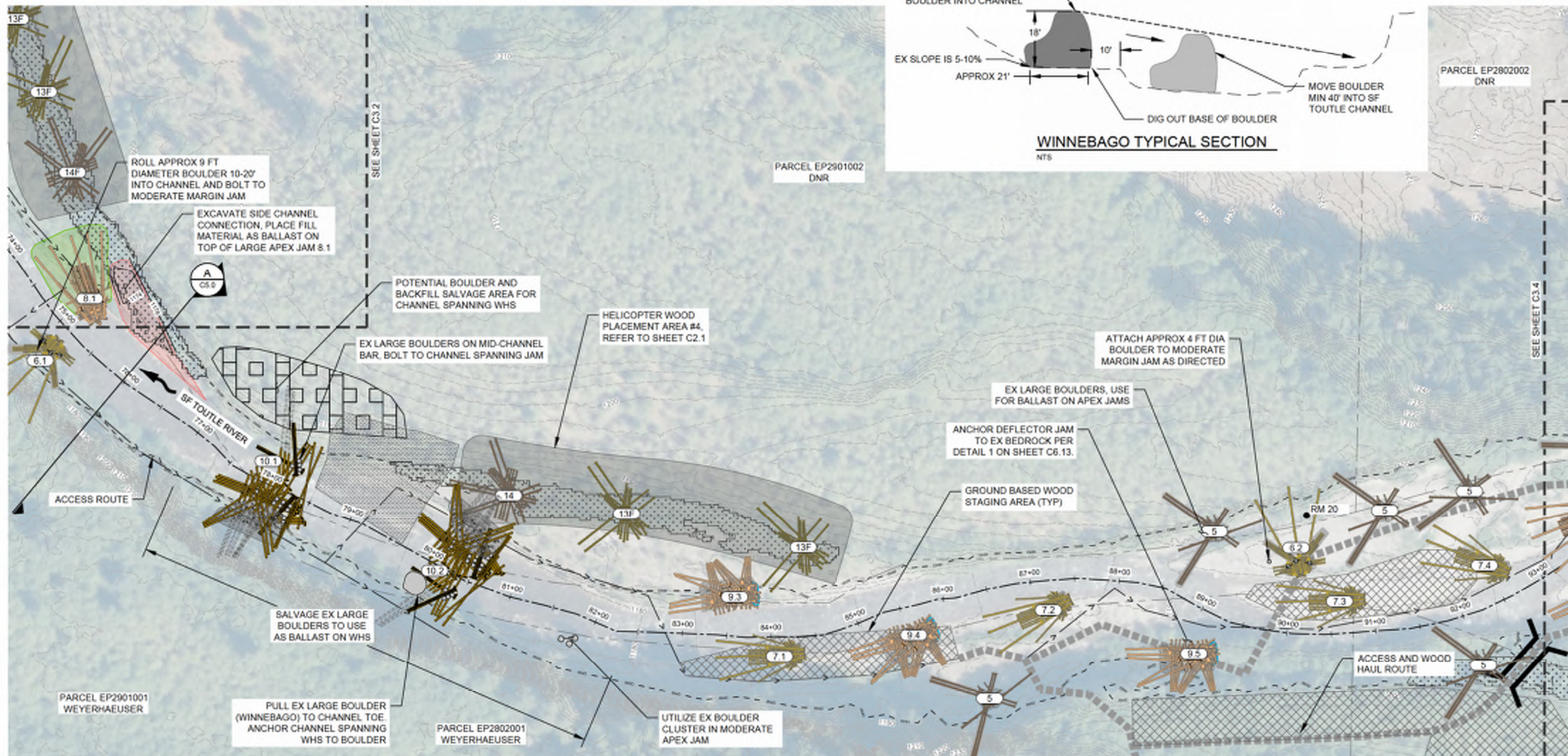
No.	Date	Revised
1	11/11/2024	Designed By LE
2		Drawn By LH, LE
3		Checked By OL

SCALE 1" = 100'

JOB NO. 20200001

SHEET NO. C3.3

14 OF 57



SF TOUTLE PLAN - STA 75+00 TO 93+00

SCALE: 1"=60'

NOTES:

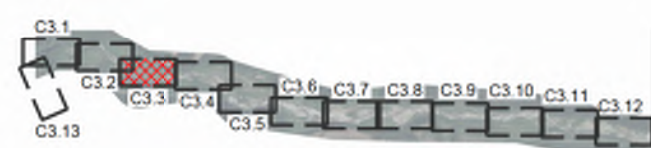
1. AVOID DISTURBANCE TO AREAS OF EXISTING VEGETATION IDENTIFIED BY OPR. PRESERVE EXISTING TREES/VEGETATION IN EXCAVATION, FILL, HAULING AND STAGING AREAS. WHERE DISTURBANCE TO EXISTING VEGETATION IS UNAVOIDABLE, SALVAGE AND RE-USE FOR SITE RESTORATION AT DIRECTION OF OPR.
2. PLACE 10 LOOSE FULL TREES AND 2 PINNED WOOD STRUCTURES (WHS 4) PER ACRE IN BROADCAST WOOD LOADING AREAS AS DIRECTED BY THE OPR. WOOD NOT SHOWN FOR CLARITY AND TO ALLOW FIELD FIT PLACEMENT.
3. WHERE BOULDERS ARE FOUND DURING EXCAVATION, TEMPORARILY STOCKPILE AND PRIORITIZE THEIR USE FOR CHANNEL FILL AND BALLAST ON WHS AS DIRECTED BY OPR.
4. SEE SHEETS C7.0-C7.3 FOR CONSTRUCTION SEQUENCING AND WATER MANAGEMENT PLAN.
5. HELICOPTER JAMS DENOTED WITH AN "F" SHALL BE FIELD FIT. CONSTRUCTION OF HELICOPTER JAMS NOT DENOTED WITH AN "F" SHALL BE DIRECTED BY THE OPR IN THE FIELD.

LEGEND:

2	2 FOOT EX MINOR CONTOUR LINE
10	10 FOOT EX MAJOR CONTOUR LINE
	RIVER CENTERLINE
	TRIBUTARY CENTERLINE
	ORDINARY HIGH WATER
	WETLANDS
	PARCEL BOUNDARY
	ACCESS ROAD
	DNR HARVEST AREA
	DNR STAGING AREA
	HELICOPTER WOOD STAGING AREA
	GROUND BASED WOOD STAGING AREA
	TRUCKED WOOD STAGING AREA
	MACHINE ACCESS ROUTE
	ACCESS AND WOOD HAUL ROUTE
	2 FOOT MINOR CONTOUR LINE
	10 FOOT MAJOR CONTOUR LINE
	FILL AREA
	CUT AREA
	HELICOPTER WOOD PLACEMENT
	DO NOT DISTURB
	POTENTIAL BOULDER HARVEST AREA
	LEAVE POOL

WHS LEGEND:

	BROADCAST WOOD LOADING		LARGE, XL OR SUPER XL LOG
5	FLOODPLAIN PIER LOGS		LOOSE HELICOPTER WOOD
6	SMALL FLOODPLAIN JAM	13	FLOODPLAIN HELICOPTER JAM
7	MODERATE MARGIN JAM	14	SMALL HELICOPTER JAM
8	MODERATE APEX JAM	15	LARGE HELICOPTER JAM
9	LARGE APEX JAM	16	WOOD DRIFT PILE
10	LARGE DEFLECTOR JAM	17	CHANNEL SPANNING HELICOPTER JAM
11	CHANNEL SPANNING JAM		
	ISLAND FORMING JAM		



LOCATION MAP

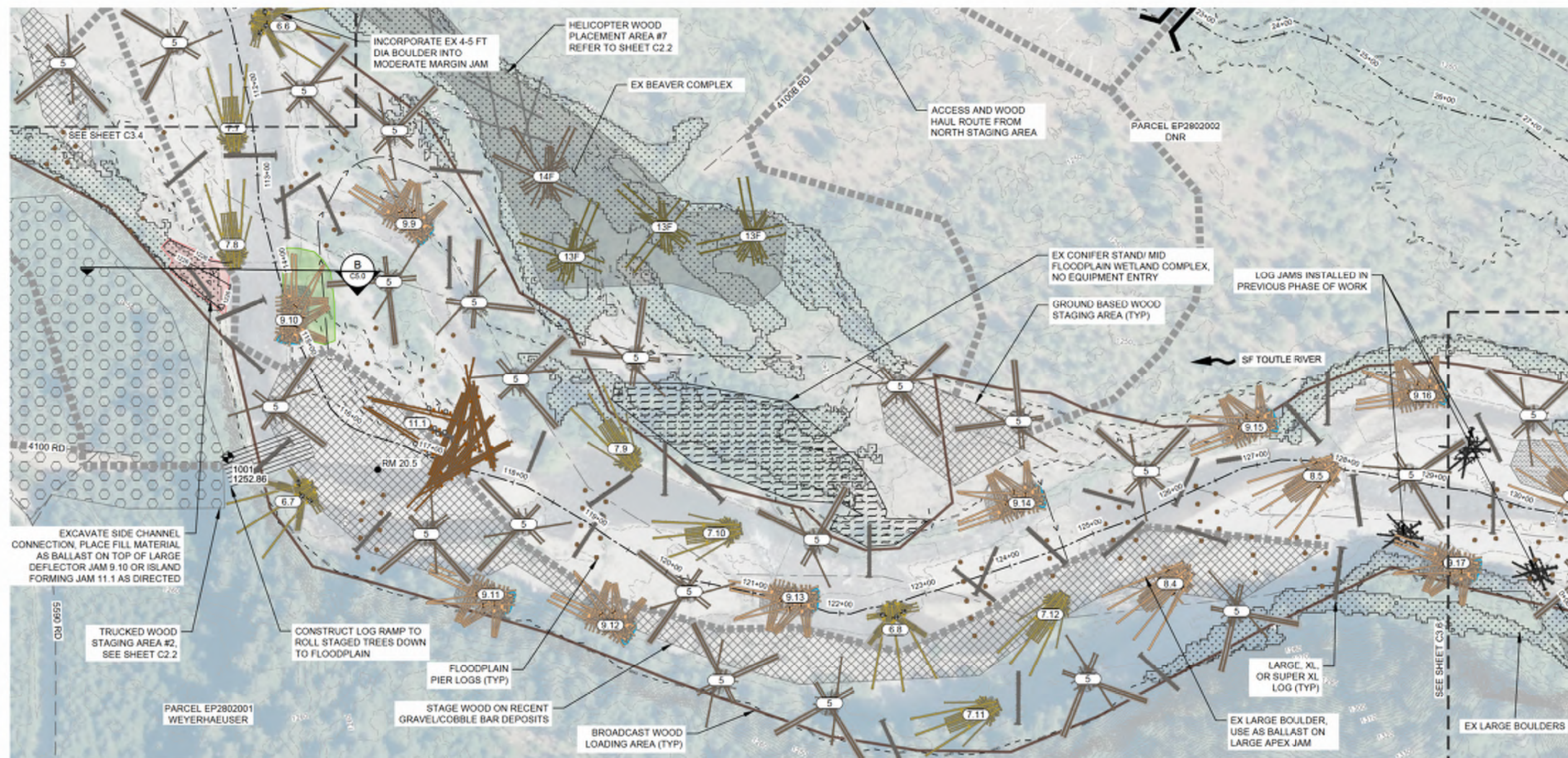


LOWER COLUMBIA FISH
ENHANCEMENT GROUP
SOUTH FORK TOUTLE RIVER
HEADWATERS DESIGN
COWLITZ COUNTY, WA

SF TOUTLE PLAN - STA
93+00 TO 112+00

REVISION NUMBER

No.	Date	Revision



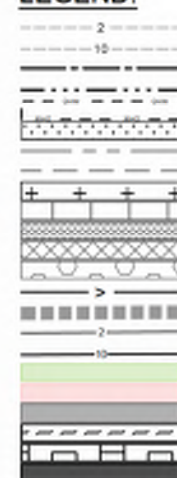
SF TOUTLE PLAN - STA 112+00 TO 130+00

SCALE: 1"=60'

NOTES:

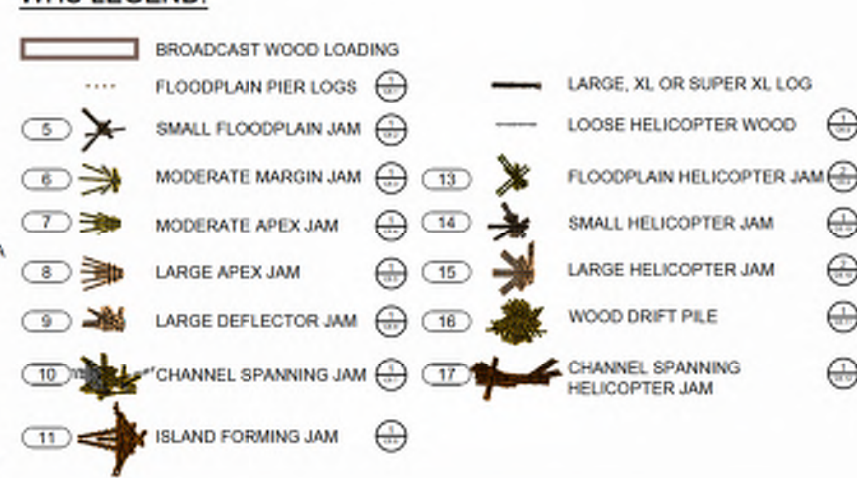
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2. PLACE 10 LOOSE FULL TREES AND 2 PINNED WOOD STRUCTURES (WHS 4) PER ACRE IN BROADCAST WOOD LOADING AREAS AS DIRECTED BY THE OPR. WOOD NOT SHOWN FOR CLARITY AND TO ALLOW FIELD FIT PLACEMENT.
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4. SEE SHEETS C7.0-C7.3 FOR CONSTRUCTION SEQUENCING AND WATER MANAGEMENT PLAN.
5. HELICOPTER JAMS DENOTED WITH AN "F" SHALL BE FIELD FIT. CONSTRUCTION OF HELICOPTER JAMS NOT DENOTED WITH AN "F" SHALL BE DIRECTED BY THE OPR IN THE FIELD.

LEGEND:

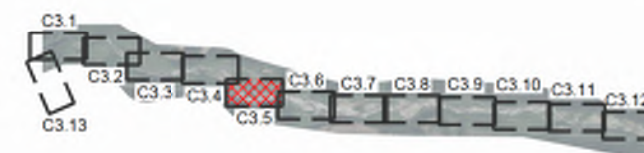
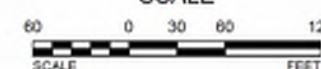


2 FOOT EX MINOR CONTOUR LINE
10 FOOT EX MAJOR CONTOUR LINE
RIVER CENTERLINE
TRIBUTARY CENTERLINE
ORDINARY HIGH WATER
WETLANDS
PARCEL BOUNDARY
ACCESS ROAD
DNR HARVEST AREA
DNR STAGING AREA
HELICOPTER WOOD STAGING AREA
GROUND BASED WOOD STAGING AREA
TRUCKED WOOD STAGING AREA
MACHINE ACCESS ROUTE
ACCESS AND WOOD HAUL ROUTE
2 FOOT MINOR CONTOUR LINE
10 FOOT MAJOR CONTOUR LINE
FILL AREA
CUT AREA
HELICOPTER WOOD PLACEMENT
DO NOT DISTURB
POTENTIAL BOULDER HARVEST AREA
LEAVE POOL

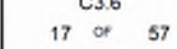
WHS LEGEND:



SCALE



LOCATION MAP

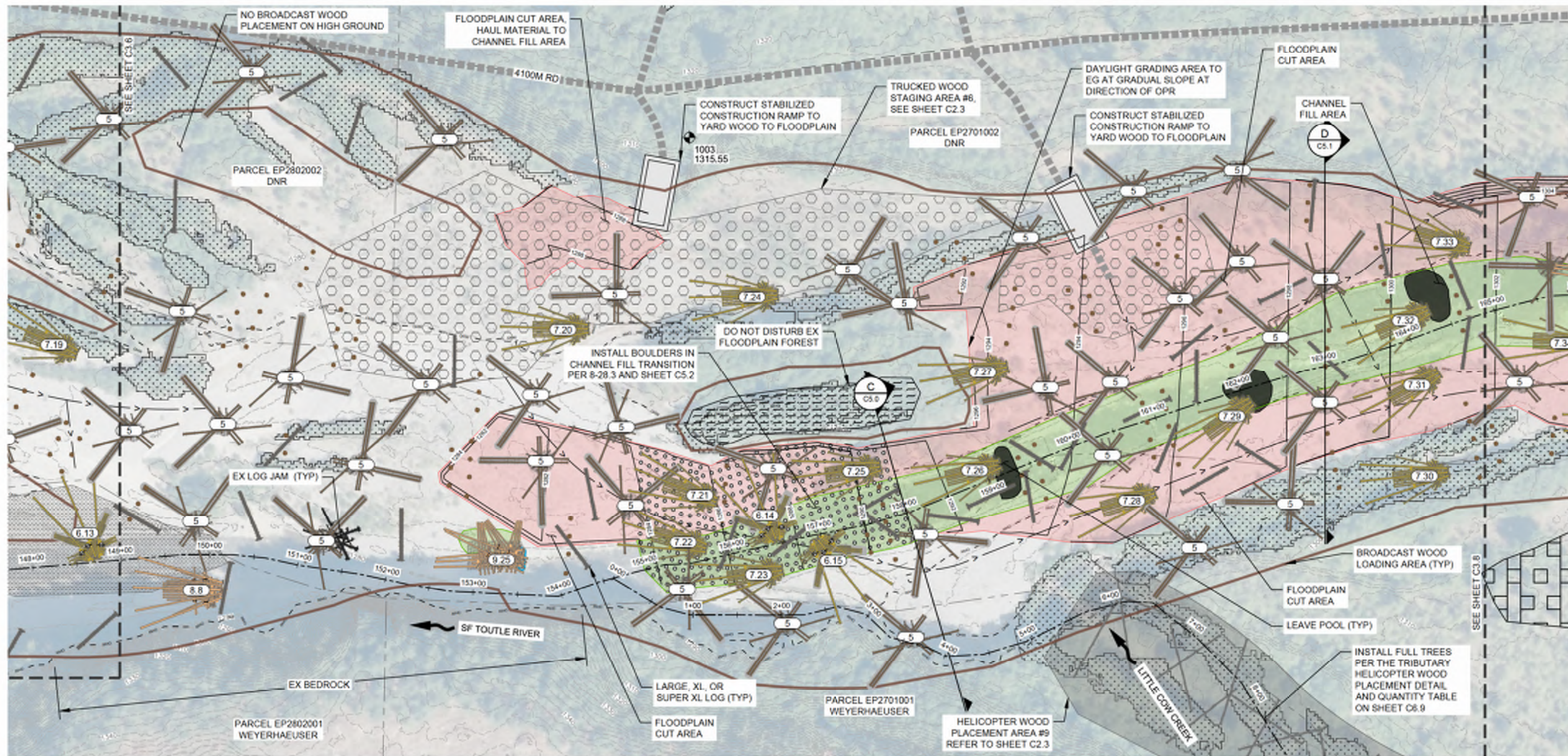




LOWER COLUMBIA FISH
ENHANCEMENT GROUP
SOUTH FORK TOUTLE RIVER
HEADWATERS DESIGN
COWLITZ COUNTY, WA

SF TOUTLE PLAN - STA
148+00 TO 165+00

REVISION NUMBER	
No.	Date
1	11/11/2024
2	11/11/2024
3	11/11/2024
4	11/11/2024
5	11/11/2024
6	11/11/2024
7	11/11/2024
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52	11/11/2024
53	11/11/2024
54	11/11/2024
55	11/11/2024
56	11/11/2024
57	11/11/2024



SF TOUTLE PLAN - STA 148+00 TO 165+00

SCALE: 1"=60'

NOTES:

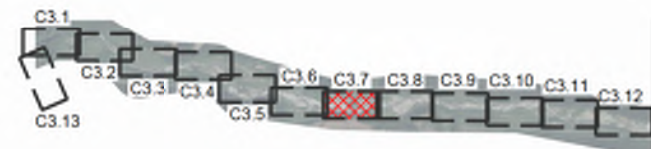
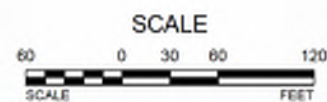
1. AVOID DISTURBANCE TO AREAS OF EXISTING VEGETATION IDENTIFIED BY OPR. PRESERVE EXISTING TREES/VEGETATION IN EXCAVATION, FILL, HAULING AND STAGING AREAS. WHERE DISTURBANCE TO EXISTING VEGETATION IS UNAVOIDABLE, SALVAGE AND RE-USE FOR SITE RESTORATION AT DIRECTION OF OPR.
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5. HELICOPTER JAMS DENOTED WITH AN "F" SHALL BE FIELD FIT. CONSTRUCTION OF HELICOPTER JAMS NOT DENOTED WITH AN "F" SHALL BE DIRECTED BY THE OPR IN THE FIELD.

LEGEND:

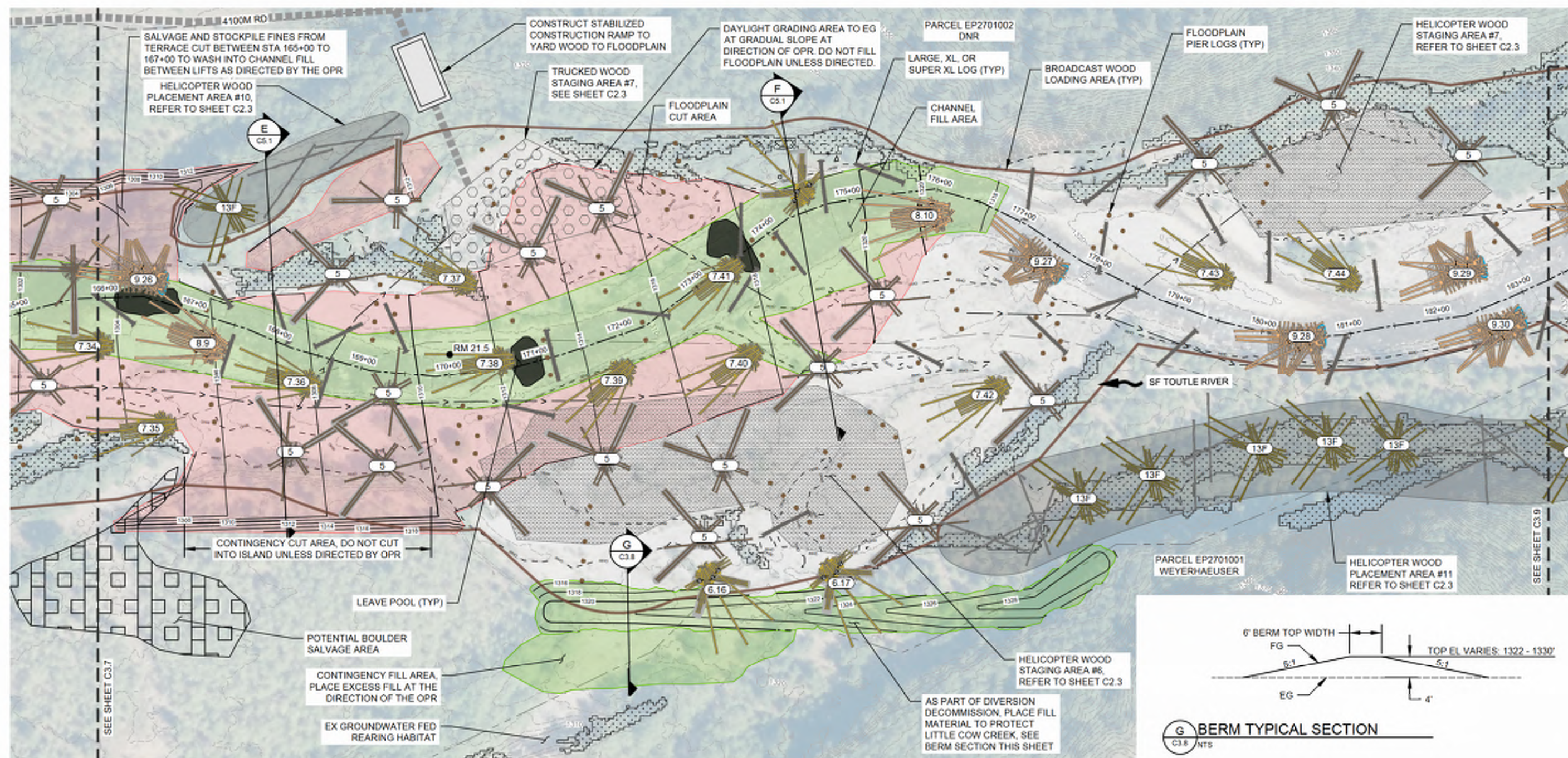
2	2 FOOT EX MINOR CONTOUR LINE
10	10 FOOT EX MAJOR CONTOUR LINE
	RIVER CENTERLINE
	TRIBUTARY CENTERLINE
	ORDINARY HIGH WATER
	WETLANDS
	PARCEL BOUNDARY
	ACCESS ROAD
	DNR HARVEST AREA
	DNR STAGING AREA
	HELICOPTER WOOD STAGING AREA
	GROUND BASED WOOD STAGING AREA
	TRUCKED WOOD STAGING AREA
	MACHINE ACCESS ROUTE
	ACCESS AND WOOD HAUL ROUTE
	2 FOOT MINOR CONTOUR LINE
	10 FOOT MAJOR CONTOUR LINE
	FILL AREA
	CUT AREA
	HELICOPTER WOOD PLACEMENT
	DO NOT DISTURB
	POTENTIAL BOULDER HARVEST AREA
	LEAVE POOL

WHS LEGEND:

	BROADCAST WOOD LOADING
5	FLOODPLAIN PIER LOGS
6	SMALL FLOODPLAIN JAM
7	MODERATE MARGIN JAM
8	MODERATE APEX JAM
9	LARGE APEX JAM
10	LARGE DEFLECTOR JAM
11	CHANNEL SPANNING JAM
12	ISLAND FORMING JAM
13	LARGE, XL, OR SUPER XL LOG
14	LOOSE HELICOPTER WOOD
15	FLOODPLAIN HELICOPTER JAM
16	SMALL HELICOPTER JAM
17	LARGE HELICOPTER JAM
18	WOOD DRIFT PILE
19	CHANNEL SPANNING HELICOPTER JAM



LOCATION MAP



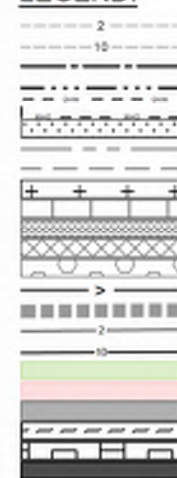
SF TOUTLE PLAN - STA 165+00 TO 183+50

SCALE: 1"=60'

NOTES:

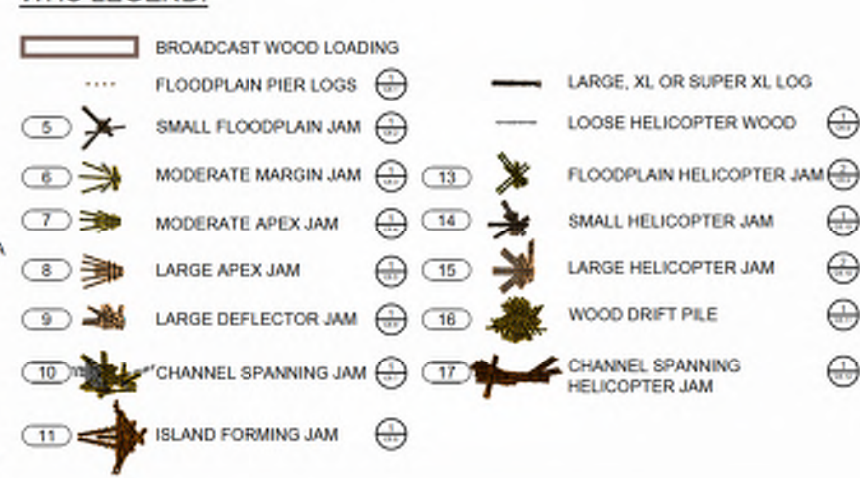
1. AVOID DISTURBANCE TO AREAS OF EXISTING VEGETATION IDENTIFIED BY OPR. PRESERVE EXISTING TREES/VEGETATION IN EXCAVATION, FILL, HAULING AND STAGING AREAS. WHERE DISTURBANCE TO EXISTING VEGETATION IS UNAVOIDABLE, SALVAGE AND RE-USE FOR SITE RESTORATION AT DIRECTION OF OPR.
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LEGEND:



2 FOOT EX MINOR CONTOUR LINE
10 FOOT EX MAJOR CONTOUR LINE
RIVER CENTERLINE
TRIBUTARY CENTERLINE
ORDINARY HIGH WATER
WETLANDS
PARCEL BOUNDARY
ACCESS ROAD
DNR HARVEST AREA
DNR STAGING AREA
HELICOPTER WOOD STAGING AREA
GROUND BASED WOOD STAGING AREA
TRUCKED WOOD STAGING AREA
MACHINE ACCESS ROUTE
ACCESS AND WOOD HAUL ROUTE
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FILL AREA
CUT AREA
HELICOPTER WOOD PLACEMENT
DO NOT DISTURB
POTENTIAL BOULDER HARVEST AREA
LEAVE POOL

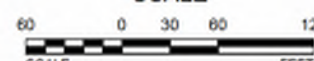
WHS LEGEND:



G BERM TYPICAL SECTION



SCALE



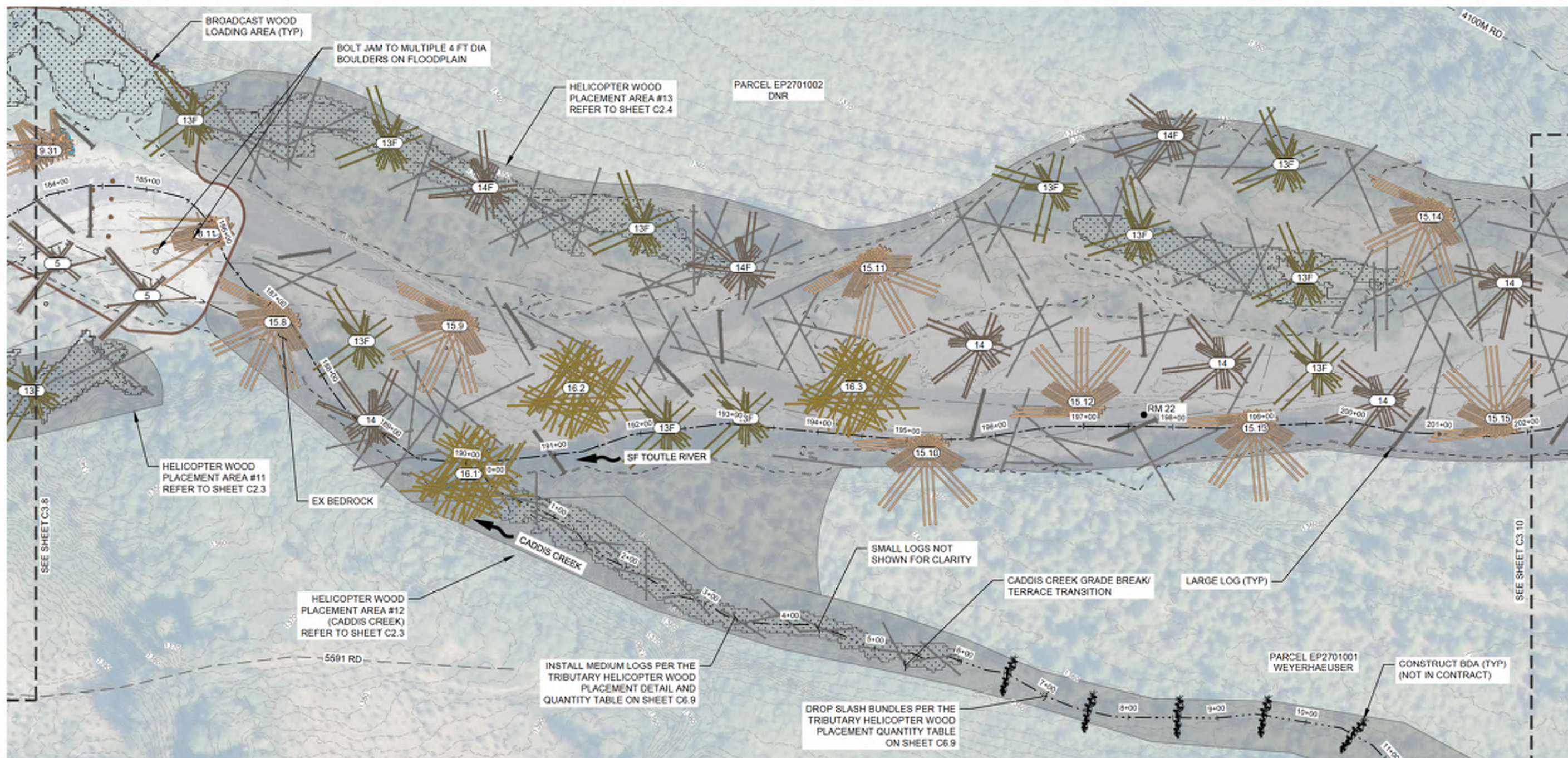
LOCATION MAP



LOWER COLUMBIA FISH
ENHANCEMENT GROUP
SOUTH FORK TOUTLE RIVER
HEADWATERS DESIGN
COWLITZ COUNTY, WA

SF TOUTLE PLAN - STA
183+50 TO 202+50

REVISION NUMBER		
No.	Date	Description
1	11/11/2024	Designed By LE
2		Drawn By LH, LE
3		Checked By OL
SCALE		
JOB NO. 20200001		
SHEET NO. C3.9		
20 OF 57		



SF TOUTLE PLAN - STA 183+50 TO 202+50

SCALE: 1"=60'

NOTES:

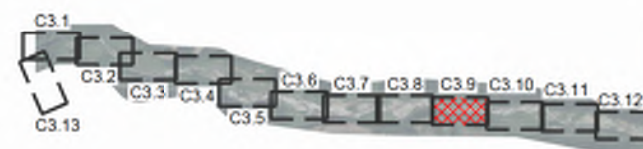
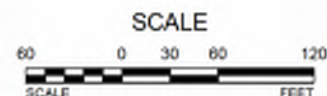
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3. WHERE BOULDERS ARE FOUND DURING EXCAVATION, TEMPORARILY STOCKPILE AND PRIORITIZE THEIR USE FOR CHANNEL FILL AND BALLAST ON WHS AS DIRECTED BY OPR.
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5. HELICOPTER JAMS DENOTED WITH AN "F" SHALL BE FIELD FIT. CONSTRUCTION OF HELICOPTER JAMS NOT DENOTED WITH AN "F" SHALL BE DIRECTED BY THE OPR IN THE FIELD.

LEGEND:

2	2 FOOT EX MINOR CONTOUR LINE
10	10 FOOT EX MAJOR CONTOUR LINE
	RIVER CENTERLINE
	TRIBUTARY CENTERLINE
	ORDINARY HIGH WATER
	WETLANDS
	PARCEL BOUNDARY
	ACCESS ROAD
	DNR HARVEST AREA
	DNR STAGING AREA
	HELICOPTER WOOD STAGING AREA
	GROUND BASED WOOD STAGING AREA
	TRUCKED WOOD STAGING AREA
	MACHINE ACCESS ROUTE
	ACCESS AND WOOD HAUL ROUTE
	2 FOOT MINOR CONTOUR LINE
	10 FOOT MAJOR CONTOUR LINE
	FILL AREA
	CUT AREA
	HELICOPTER WOOD PLACEMENT
	DO NOT DISTURB
	POTENTIAL BOULDER HARVEST AREA
	LEAVE POOL

WHS LEGEND:

	BROADCAST WOOD LOADING
5	FLOODPLAIN PIER LOGS
6	SMALL FLOODPLAIN JAM
7	MODERATE MARGIN JAM
8	MODERATE APEX JAM
9	LARGE APEX JAM
10	LARGE DEFLECTOR JAM
11	CHANNEL SPANNING JAM
12	ISLAND FORMING JAM
13	LARGE, XL OR SUPER XL LOG
14	LOOSE HELICOPTER WOOD
15	FLOODPLAIN HELICOPTER JAM
16	SMALL HELICOPTER JAM
17	LARGE HELICOPTER JAM
18	WOOD DRIFT PILE
19	CHANNEL SPANNING HELICOPTER JAM



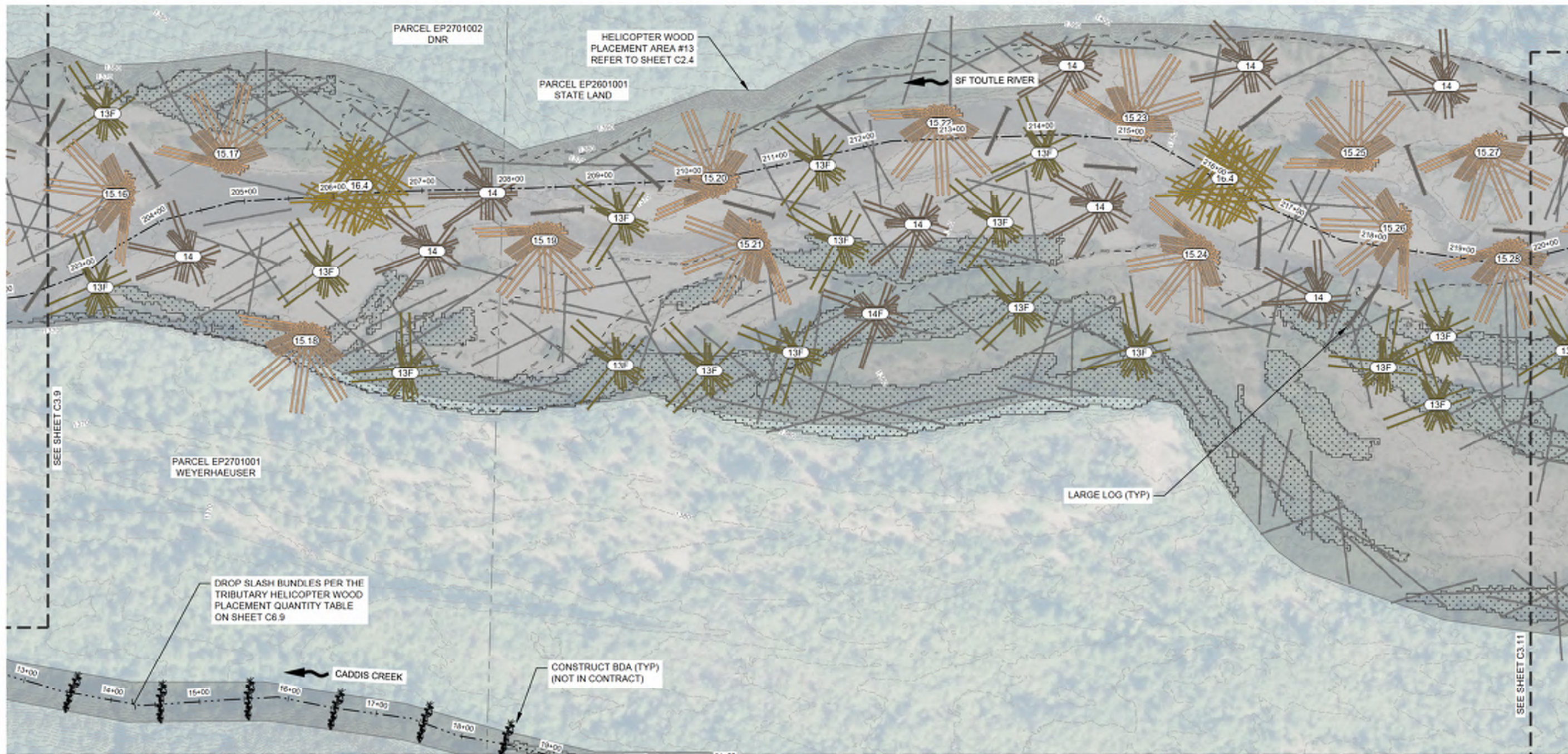
LOCATION MAP



LOWER COLUMBIA FISH
ENHANCEMENT GROUP
SOUTH FORK TOUTLE RIVER
HEADWATERS DESIGN
COWLITZ COUNTY, WA

SF TOUTLE PLAN - STA
202+00 TO 220+00

REVISION NUMBER	
No.	Date
1	11/11/2024
2	11/11/2024
3	11/11/2024
4	11/11/2024
5	11/11/2024
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55	11/11/2024
56	11/11/2024
57	11/11/2024



SF TOUTLE PLAN - STA 202+00 TO 220+00

SCALE: 1"=40'

NOTES:

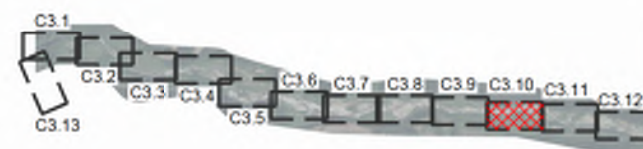
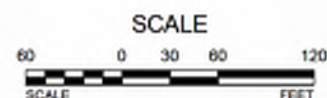
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LEGEND:

2	2 FOOT EX MINOR CONTOUR LINE
10	10 FOOT EX MAJOR CONTOUR LINE
	RIVER CENTERLINE
	TRIBUTARY CENTERLINE
	ORDINARY HIGH WATER
	WETLANDS
	PARCEL BOUNDARY
	ACCESS ROAD
	DNR HARVEST AREA
	DNR STAGING AREA
	HELICOPTER WOOD STAGING AREA
	GROUND BASED WOOD STAGING AREA
	TRUCKED WOOD STAGING AREA
	MACHINE ACCESS ROUTE
	ACCESS AND WOOD HAUL ROUTE
	2 FOOT MINOR CONTOUR LINE
	10 FOOT MAJOR CONTOUR LINE
	FILL AREA
	CUT AREA
	HELICOPTER WOOD PLACEMENT
	DO NOT DISTURB
	POTENTIAL BOULDER HARVEST AREA
	LEAVE POOL

WHS LEGEND:

	BROADCAST WOOD LOADING
5	FLOODPLAIN PIER LOGS
6	SMALL FLOODPLAIN JAM
7	MODERATE MARGIN JAM
8	MODERATE APEX JAM
9	LARGE APEX JAM
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14	SMALL HELICOPTER JAM
15	LARGE HELICOPTER JAM
16	WOOD DRIFT PILE
17	CHANNEL SPANNING HELICOPTER JAM
	LARGE, XL OR SUPER XL LOG
	LOOSE HELICOPTER WOOD



LOCATION MAP



LOWER COLUMBIA FISH
ENHANCEMENT GROUP
SOUTH FORK TOUTLE RIVER
HEADWATERS DESIGN
COWLITZ COUNTY, WA

SF TOUTLE PLAN - STA
220+00 TO 238+50

REVISION NUMBER

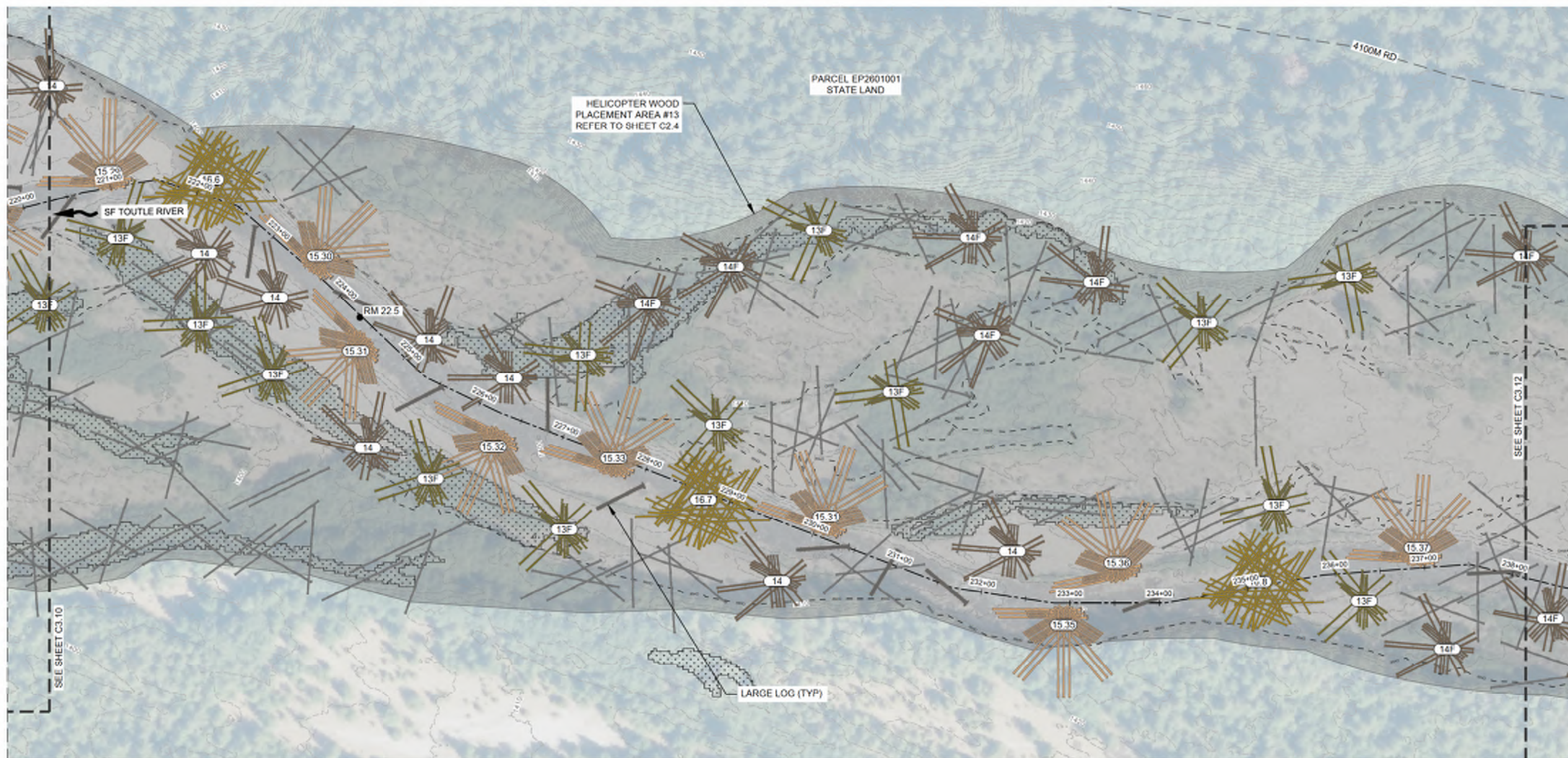
No.	Date	Revised

Date	11/11/2024	Designed By	LE
Drawn By	LH, LE	Checked By	DL

JOB NO. 20200001

SHEET NO. C3.11

22 OF 57



SF TOUTLE PLAN - STA 220+00 TO 238+50

SCALE: 1"=60'

NOTES:

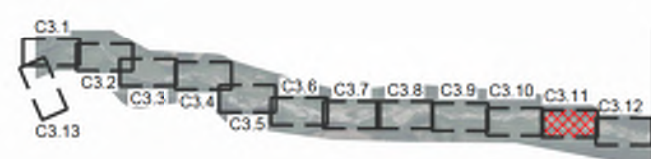
1. AVOID DISTURBANCE TO AREAS OF EXISTING VEGETATION IDENTIFIED BY OPR. PRESERVE EXISTING TREES/VEGETATION IN EXCAVATION, FILL, HAULING AND STAGING AREAS. WHERE DISTURBANCE TO EXISTING VEGETATION IS UNAVOIDABLE, SALVAGE AND RE-USE FOR SITE RESTORATION AT DIRECTION OF OPR.
2. PLACE 10 LOOSE FULL TREES AND 2 PINNED WOOD STRUCTURES (WHS 4) PER ACRE IN BROADCAST WOOD LOADING AREAS AS DIRECTED BY THE OPR. WOOD NOT SHOWN FOR CLARITY AND TO ALLOW FIELD FIT PLACEMENT.
3. WHERE BOULDERS ARE FOUND DURING EXCAVATION, TEMPORARILY STOCKPILE AND PRIORITIZE THEIR USE FOR CHANNEL FILL AND BALLAST ON WHS AS DIRECTED BY OPR.
4. SEE SHEETS C7.0-C7.3 FOR CONSTRUCTION SEQUENCING AND WATER MANAGEMENT PLAN.
5. HELICOPTER JAMS DENOTED WITH AN "F" SHALL BE FIELD FIT. CONSTRUCTION OF HELICOPTER JAMS NOT DENOTED WITH AN "F" SHALL BE DIRECTED BY THE OPR IN THE FIELD.

LEGEND:

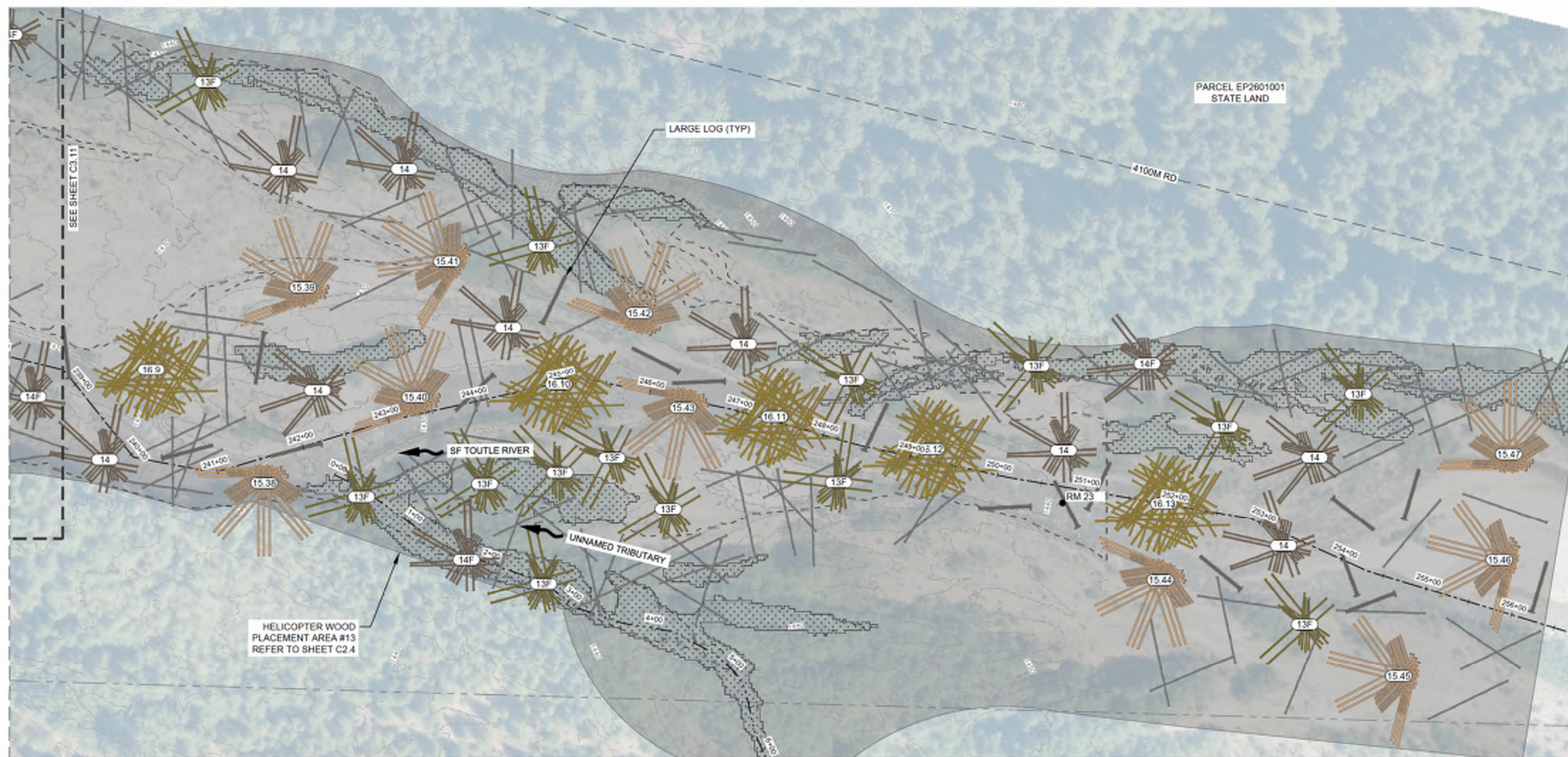
2	2 FOOT EX MINOR CONTOUR LINE
10	10 FOOT EX MAJOR CONTOUR LINE
	RIVER CENTERLINE
	TRIBUTARY CENTERLINE
	ORDINARY HIGH WATER
	WETLANDS
	PARCEL BOUNDARY
	ACCESS ROAD
	DNR HARVEST AREA
	DNR STAGING AREA
	HELICOPTER WOOD STAGING AREA
	GROUND BASED WOOD STAGING AREA
	TRUCKED WOOD STAGING AREA
	MACHINE ACCESS ROUTE
	ACCESS AND WOOD HAUL ROUTE
	2 FOOT MINOR CONTOUR LINE
	10 FOOT MAJOR CONTOUR LINE
	FILL AREA
	CUT AREA
	HELICOPTER WOOD PLACEMENT
	DO NOT DISTURB
	POTENTIAL BOULDER HARVEST AREA
	LEAVE POOL

WHS LEGEND:

	BROADCAST WOOD LOADING		LARGE, XL OR SUPER XL LOG
5	SMALL FLOODPLAIN JAM	13	FLOODPLAIN HELICOPTER JAM
6	MODERATE MARGIN JAM	14	SMALL HELICOPTER JAM
7	MODERATE APEX JAM	15	LARGE HELICOPTER JAM
8	LARGE APEX JAM	16	WOOD DRIFT PILE
9	LARGE DEFLECTOR JAM	17	CHANNEL SPANNING HELICOPTER JAM
10	CHANNEL SPANNING JAM		
11	ISLAND FORMING JAM		



LOCATION MAP

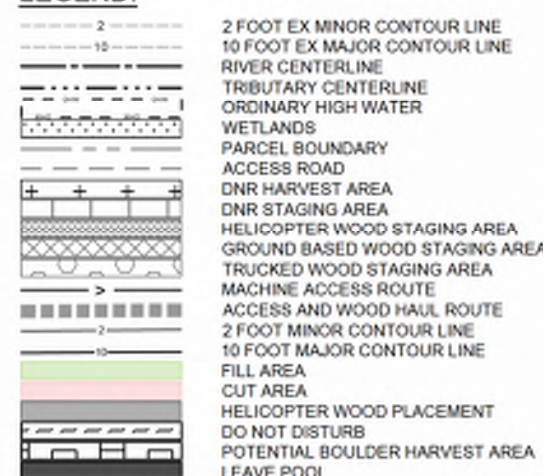


SF TOUTLE PLAN - STA 238+50 TO 256+50

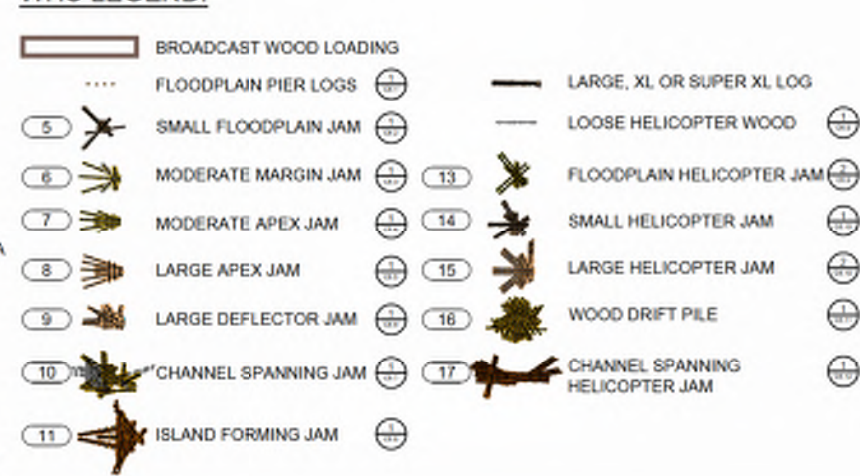
SCALE: 1"=60'

1. AVOID DISTURBANCE TO AREAS OF EXISTING VEGETATION IDENTIFIED BY OPR. PRESERVE EXISTING TREES/VEGETATION IN EXCAVATION, FILL, HAULING AND STAGING AREAS. WHERE DISTURBANCE TO EXISTING VEGETATION IS UNAVOIDABLE, SALVAGE AND RE-USE FOR SITE RESTORATION AT DIRECTION OF OPR.
2. PLACE 10 LOOSE FULL TREES AND 2 PINNED WOOD STRUCTURES (WHS 4) PER ACRE IN BROADCAST WOOD LOADING AREAS AS DIRECTED BY THE OPR. WOOD NOT SHOWN FOR CLARITY AND TO ALLOW FIELD FIT PLACEMENT.
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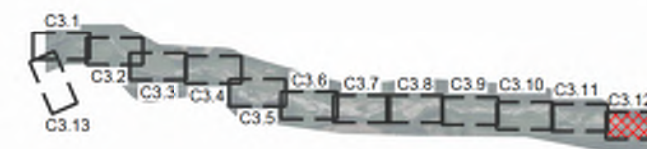
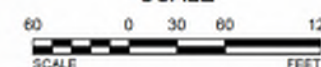
LEGEND:



WHS LEGEND:



SCALE

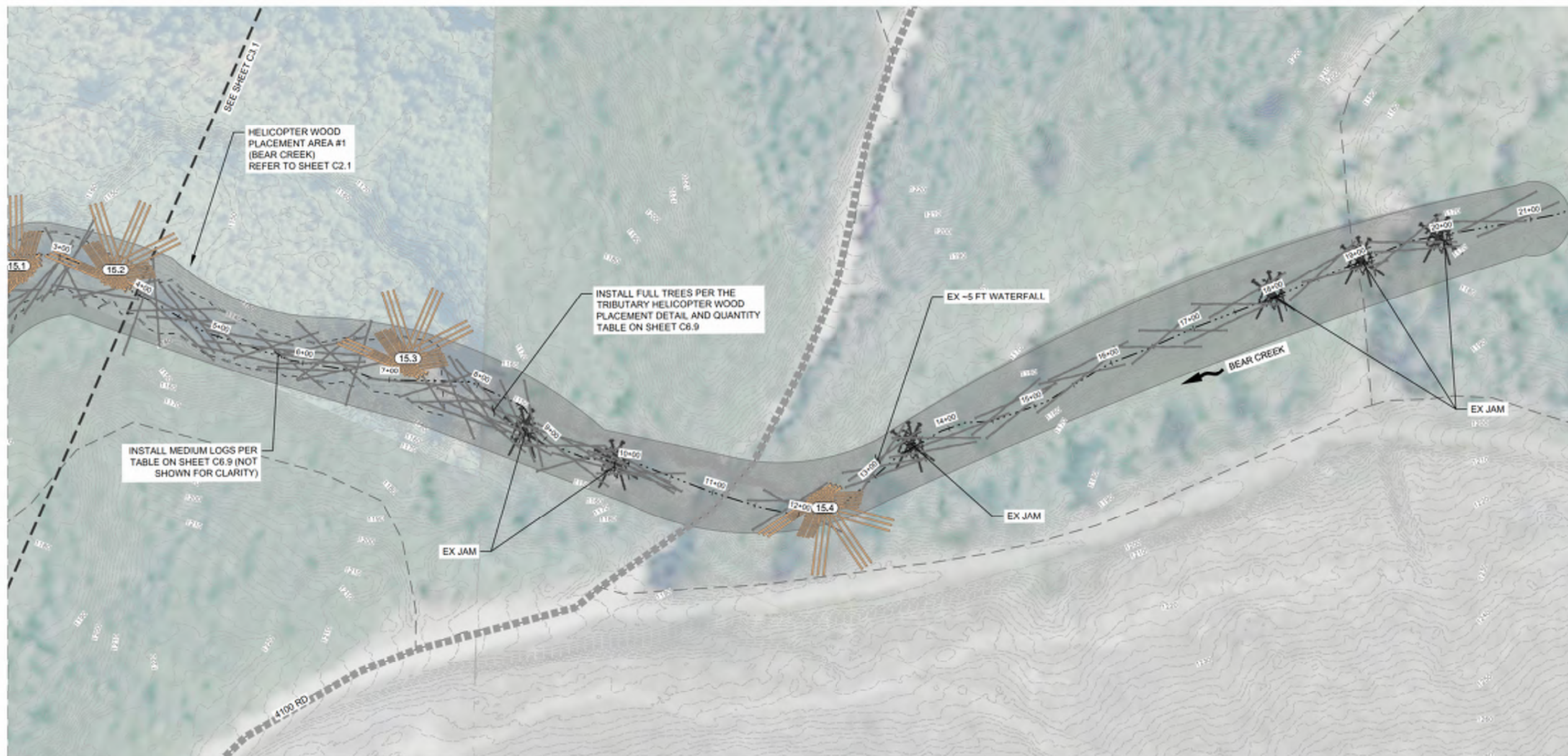


LOCATION MAP



LOWER COLUMBIA FISH
ENHANCEMENT GROUP
SOUTH FORK TOUTLE RIVER
HEADWATERS DESIGN
COWLITZ COUNTY, WA

BEAR CREEK PLAN -
STA 2+00 TO 21+00



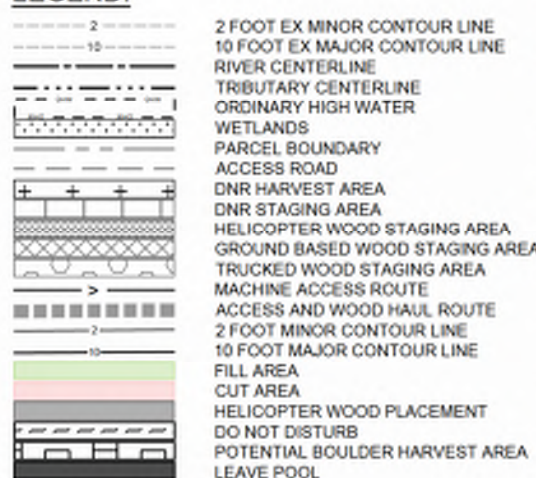
BEAR CREEK PLAN - STA 2+00 TO 21+00

SCALE: 1"=60'

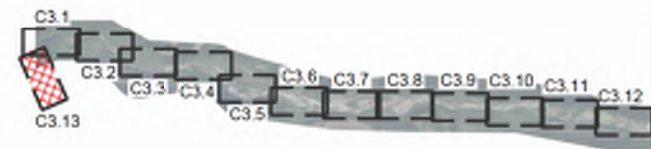
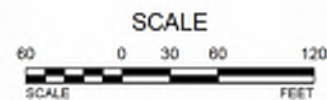
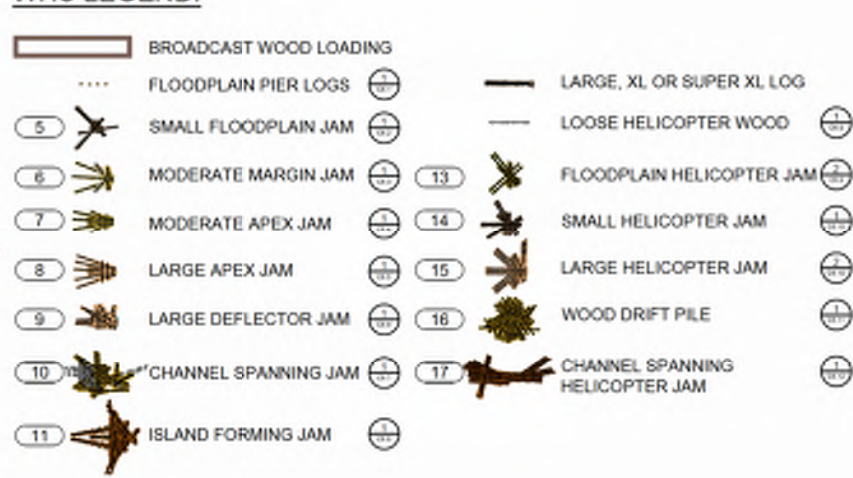
NOTES:

1. AVOID DISTURBANCE TO AREAS OF EXISTING VEGETATION IDENTIFIED BY OPR. PRESERVE EXISTING TREES/VEGETATION IN EXCAVATION, FILL, HAULING AND STAGING AREAS. WHERE DISTURBANCE TO EXISTING VEGETATION IS UNAVOIDABLE, SALVAGE AND RE-USE FOR SITE RESTORATION AT DIRECTION OF OPR.
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LEGEND:



WHS LEGEND:



LOCATION MAP

REVISION NUMBER

No.	Date	Revised By	Checked By
1	11/11/2024	LE	LE
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JOB NO.
20200001
SHEET NO.
C3.13
24 OF 57

REVISION NUMBER	
No.	Description

Date 11/11/2024	Designed By LE
Drawn By LH, LE	Checked By CL

SCALE: 

JOB NO. 20200001

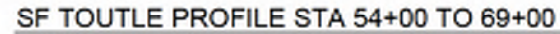
SHEET NO. C4.0

25 OF 57



HORIZONTAL SCALE: 1" = 60'
VERTICAL SCALE: 1" = 15'

1. MODERATE JAMS, SMALL JAMS AND LOOSE WOOD ARE NOT DISPLAYED FOR PROFILE CLARITY.
2. ELEVATIONS ARE IN FEET RELATIVE TO NAVD88.
3. EG TOPOGRAPHY DERIVED FROM USGS 2022 LIDAR DATA.
4. OHW DERIVED FROM EXISTING HYDRAULIC MODEL 2-YEAR RECURRENCE FLOOD EVENT (4520 CFS).

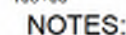


SF TOUTLE PROFILE STA 69+00 TO 84+00

HORIZONTAL SCALE: 1" = 60'
VERTICAL SCALE: 1" = 15'



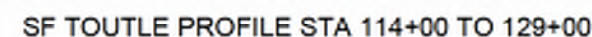
HORIZONTAL SCALE: 1" = 60'
VERTICAL SCALE: 1" = 15'



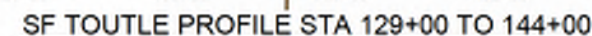
- NOTES:
1. MODERATE JAMS, SMALL JAMS AND LOOSE WOOD ARE NOT DISPLAYED FOR PROFILE CLARITY.
 2. ELEVATIONS ARE IN FEET RELATIVE TO NAVD83.
 3. EG TOPOGRAPHY DERIVED FROM USGS 2022 LIDAR DATA.
 4. OHW DERIVED FROM EXISTING HYDRAULIC MODEL 2-YEAR RECURRENT FLOOD EVENT (4520 CFS).
 5. CHANNEL FILL SHALL TARGET 1' BELOW DISPLAYED AVERAGE VALLEY ELEVATION.

LEGEND

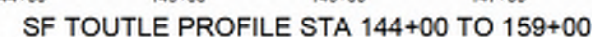
FILL



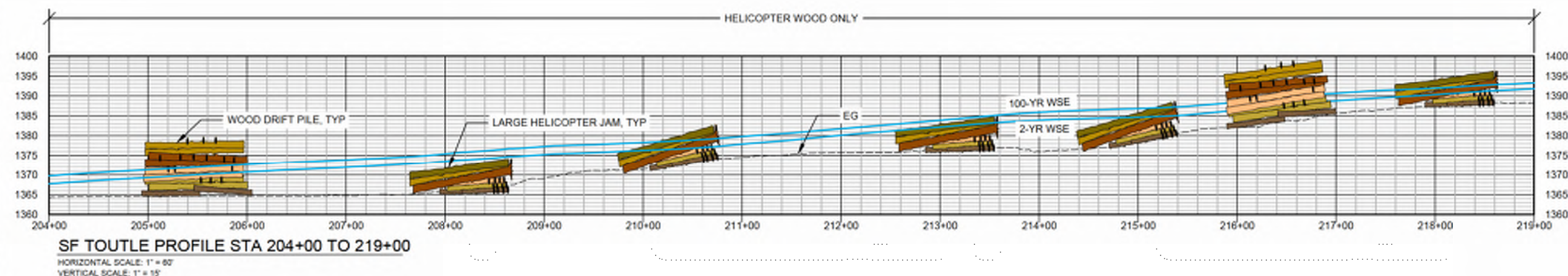
HORIZONTAL SCALE: 1" = 60'
VERTICAL SCALE: 1" = 15'

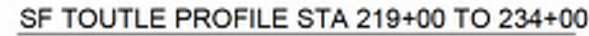


HORIZONTAL SCALE: 1" = 60'
VERTICAL SCALE: 1" = 15'

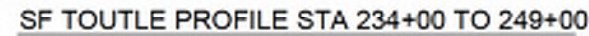


HORIZONTAL SCALE: 1" = 60'
VERTICAL SCALE: 1" = 15'

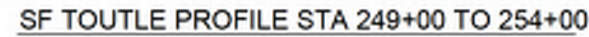


[illegible]

HORIZONTAL SCALE: 1" = 60'
VERTICAL SCALE: 1" = 15'



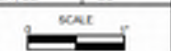
HORIZONTAL SCALE: 1" = 60'
VERTICAL SCALE: 1" = 15'



HORIZONTAL SCALE: 1" = 60'
VERTICAL SCALE: 1" = 15'

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3. EG TOPOGRAPHY DERIVED FROM USGS 2022 LIDAR DATA.
4. CHW DERIVED FROM EXISTING HYDRAULIC MODEL 2-YEAR RECURRENCE FLOOD EVENT (4520 CFS).

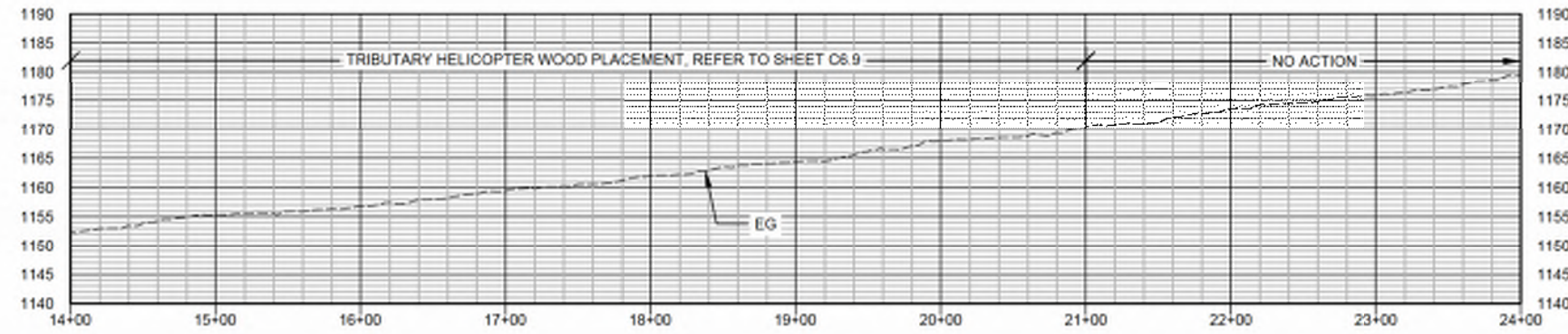
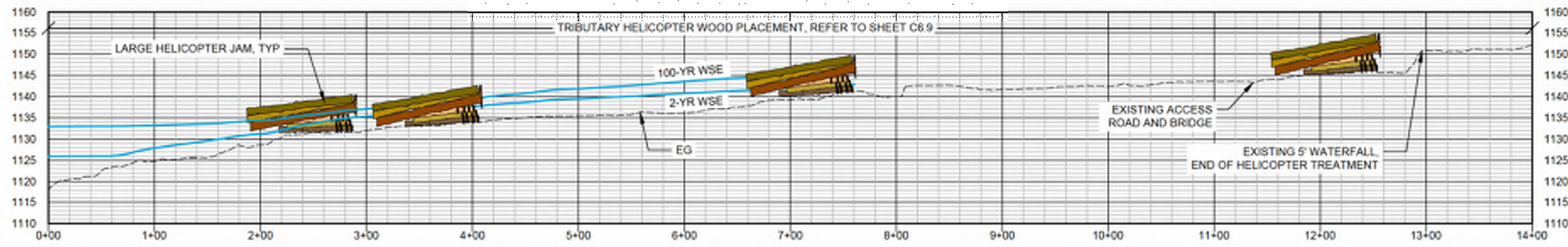
FILL



JOB NO.
20200001

C4.3

REVISION NUMBER	
No.	Description
Date 11/11/2024	Designed By LE
Drawn By LH, LE	Checked By OL
SCALE 	
JOB NO. 20200001	
SHEET NO. C4.4	
29 OF 57	

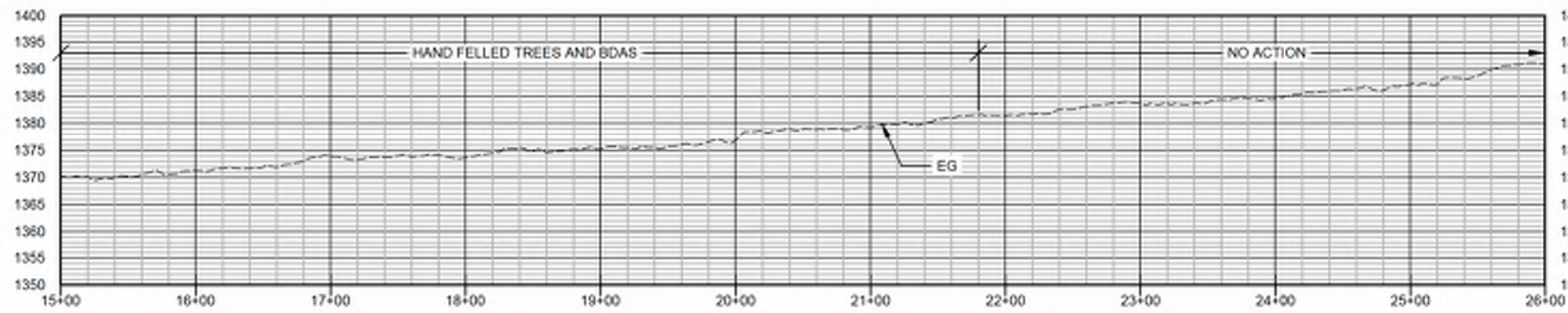
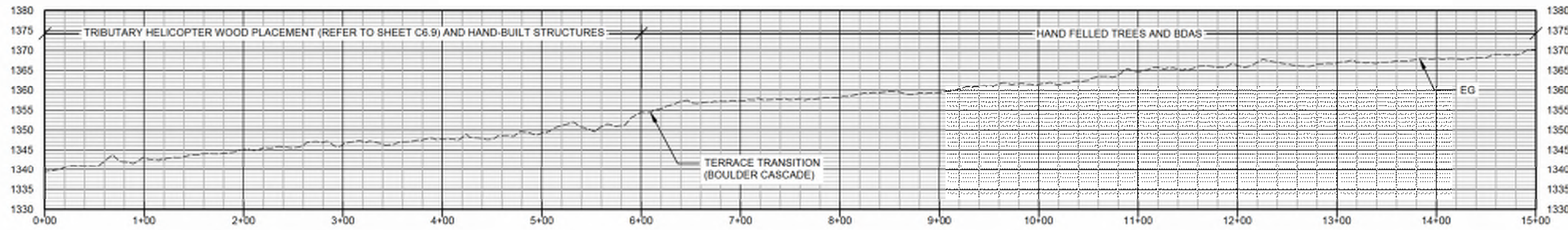


NOTES:

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2. ELEVATIONS ARE IN FEET RELATIVE TO NAVD88.
3. EG TOPOGRAPHY DERIVED FROM USGS 2022 LIDAR DATA.
4. CHW DERIVED FROM EXISTING HYDRAULIC MODEL 2-YEAR RECURRENCE FLOOD EVENT (4520 CFS).

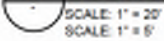
BEAR CREEK PROFILE STA 0+00 TO 24+00

HORIZONTAL SCALE: 1" = 60'
VERTICAL SCALE: 1" = 15'



CADDIS CREEK PROFILE STA 0+00 TO 26+00

HORIZONTAL SCALE: 1" = 60'
VERTICAL SCALE: 1" = 60'



1. SECTIONS ARE LOOKING UPSTREAM.
2. ELEVATIONS ARE IN FEET RELATIVE TO NAVD88.
3. EG TOPOGRAPHY DERIVED FROM USGS 2022 LIDAR DATA.

REVISION NUMBER	
No.	Description

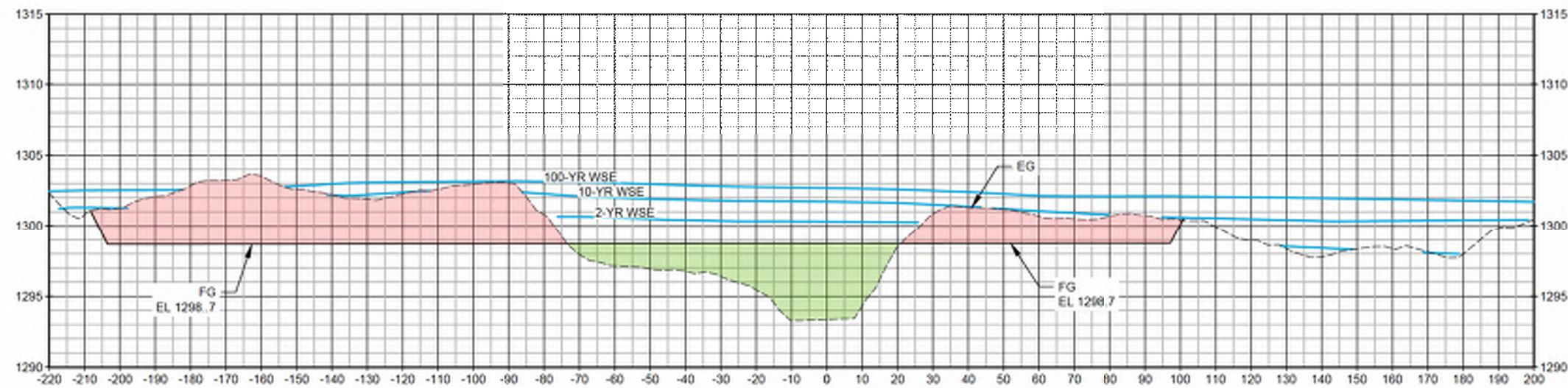
Date 11/11/2024	Designed By LE
Drawn By LH, LE	Checked By CL

SCALE 0' 1"

JOB NO. 202000001

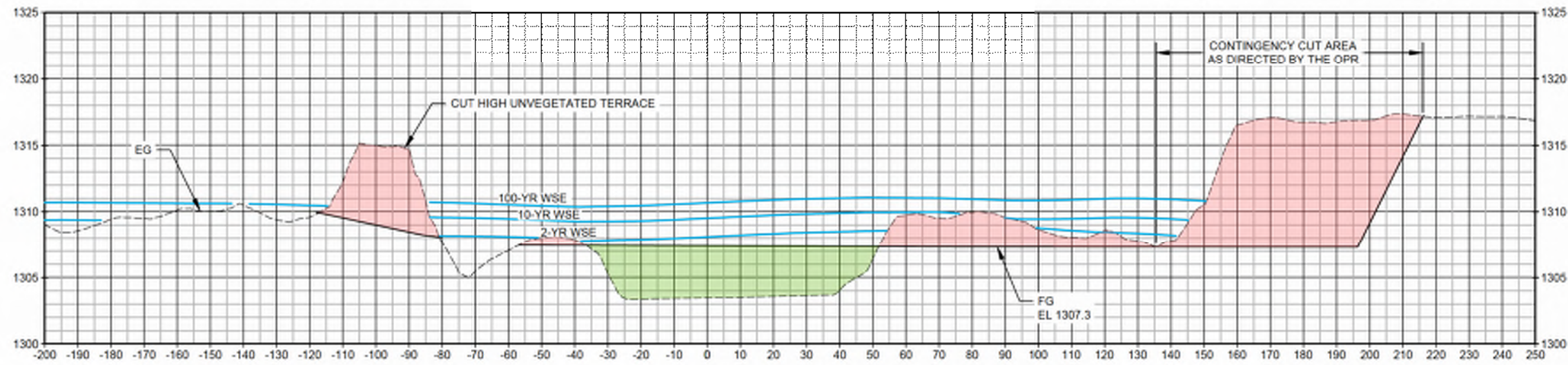
SHEET NO. C5.1

31 OF 57



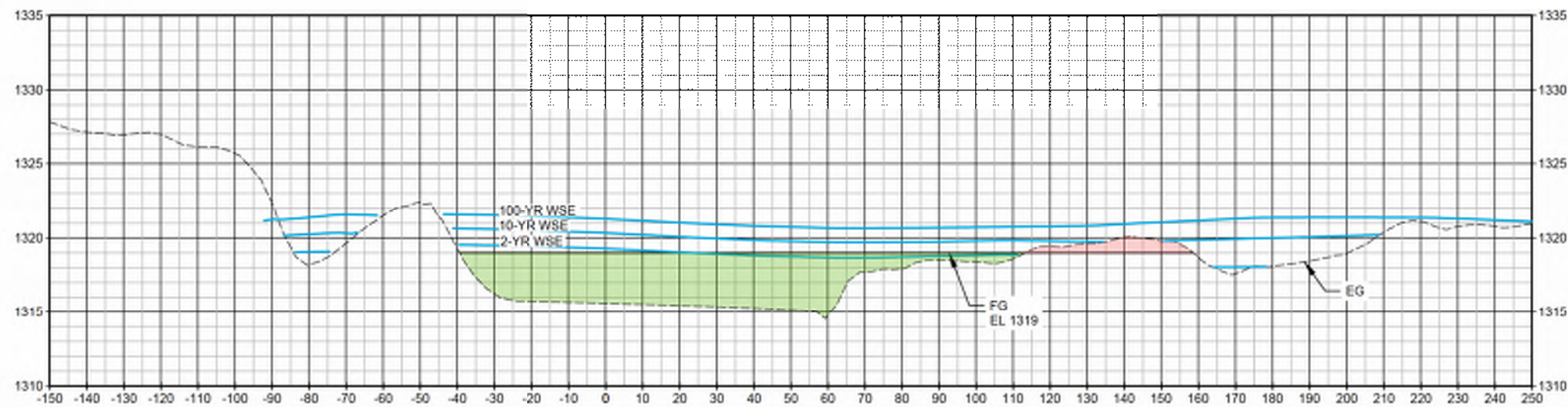
SECTION: SF TOUTLE - STA 163+00

SCALE: 1" = 20'
SCALE: 1" = 8'



SECTION: SF TOUTLE - STA 168+00

SCALE: 1" = 20'
SCALE: 1" = 5'



 SECTION: SF TOUTLE - STA 174+40

SCALE: 1" = 20'
SCALE: 1" = 5'

ORG: L:\Share\PC\MQ02200001-3F Route Headers\CWD-GREYTRCA.R - 5TND- PROFILES AND SECTIONS.BG 0688 9999
DATE Nov 11 2004 10:14n 8B7E5 X:73W:25N KATHE-DONNA KATHO-WASHERMAN KATHO-WARD-COMPTON KATHO-WARD-ARACAO



LOWER COLUMBIA FISH
ENHANCEMENT GROUP
SOUTH FORK TOUTLE RIVER
HEADWATERS DESIGN
COWLITZ COUNTY, WA

TYPICAL CHANNEL
FILL SECTION AND
PROFILE

REVISION NUMBER

No.	Date	Description

Date: 11/11/2024
Designed By: LE
Drawn By: LH, LE
Checked By: CL

SCALE
0' 10' 20'

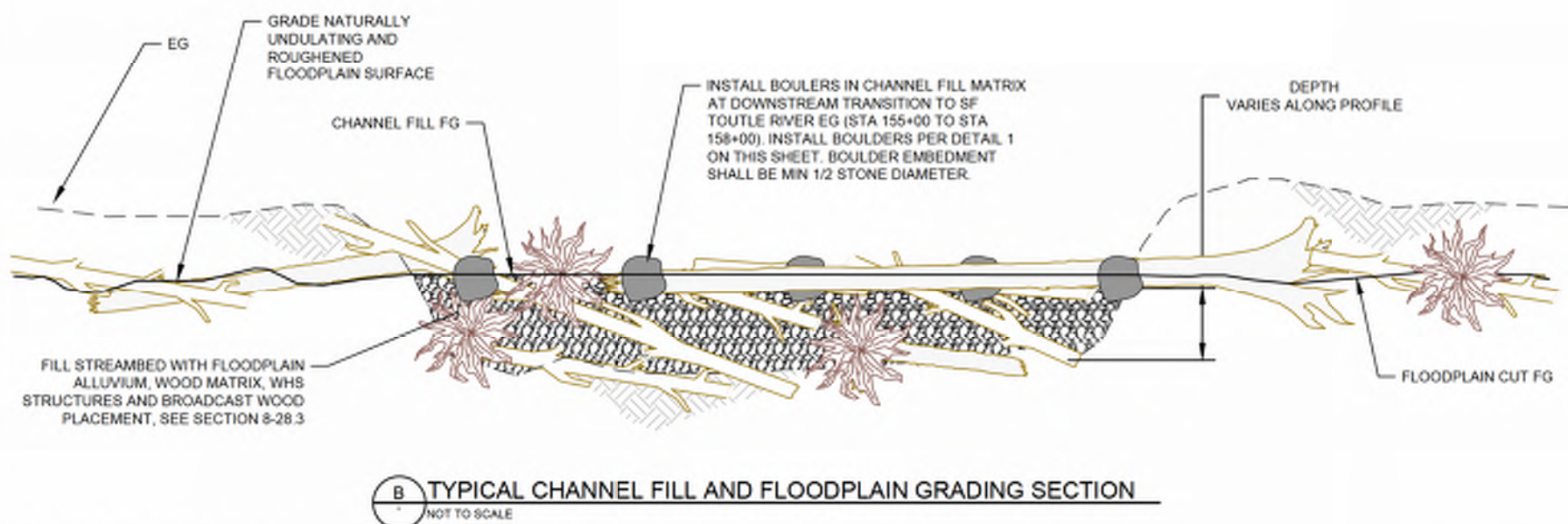
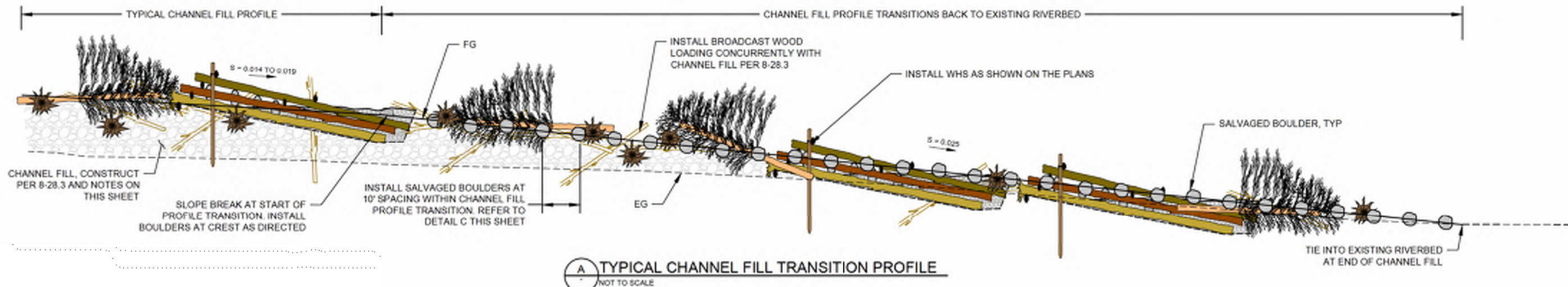
JOB NO.

20200001

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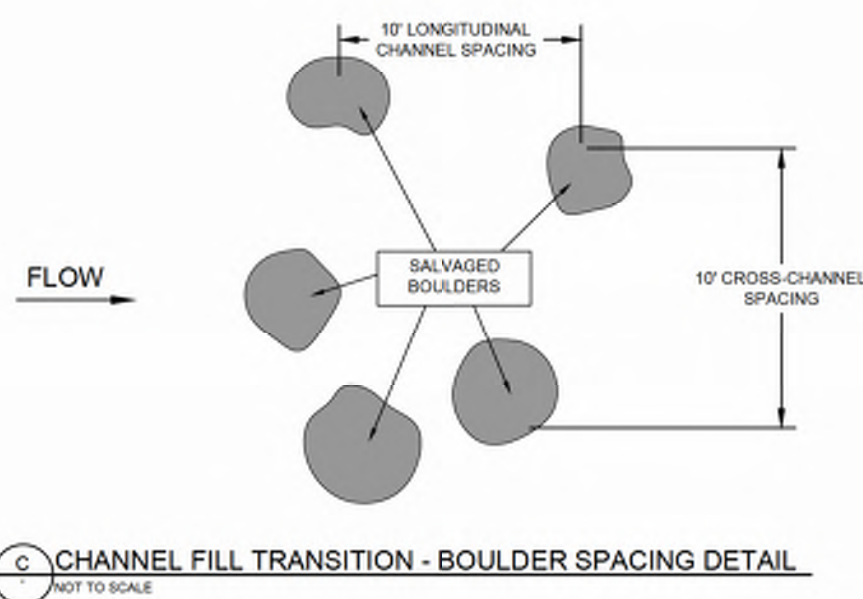
C5.2

32 OF 57



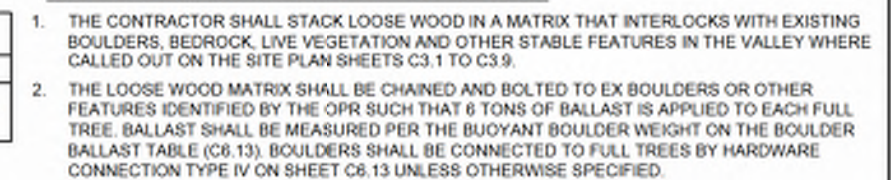
CHANNEL FILL NOTES:

- CHANNEL FILL SHALL CONSIST OF GRAVELS, COBBLES AND BOULDERS ENCOUNTERED DURING FLOODPLAIN EXCAVATION DURING THIS PROJECT AND SHALL BE CONSTRUCTED PER SECTION 8-28.3.
- CONTRACTOR SHALL PRIORITIZE USE OF LARGER COBBLES AND BOULDERS ENCOUNTERED DURING GRADING ACTIVITIES FOR USE IN CHANNEL FILL. CONTRACTOR SHALL COORDINATE WITH ENGINEER AND/OR OPR TO VISUALLY INSPECT THE PROPOSED FILL MATERIAL PRIOR TO PLACING IN CHANNEL.
- ALL FILL MATERIAL SHALL BE PLACED IN SUCH A MANNER THAT ALL VOIDS ARE FILLED WITH THE FINER MATERIALS TO PROVIDE A WELL GRADED COMPACT MASS.
- CHANNEL FILL SHALL BE PLACED AFTER AND CONCURRENTLY WITH INSTALLATION OF LARGE WOOD STRUCTURES WITHIN THE CHANNEL.
- CHANNEL FILL SHALL BE PLACED TO THE ELEVATIONS AND EXTENTS SHOWN ON THE PLANS. CHANNEL FILL SHALL BE PLACED IN 24-INCH LIFTS AND COMPACTED WITH MACHINE TRACKS OR EXCAVATOR BUCKET TO FIRM CONDITION. FOLLOWING COMPACTION OF EACH LIFT, INDIVIDUAL WOOD PIECES SHALL BE PLACED AT VARIOUS ANGLES AND DEPTHS TO FORM COMPLEX WOOD-COBBLE MATRIX. REPEAT FOR EACH LAYER OF CHANNEL FILL.
- BETWEEN EACH 24-INCH LIFT, PLACE AND PUMP WASH NATIVE FINES INTO THE ROCK MATRIX UNTIL WATER NO LONGER INFILTRATES OR FINES ARE NO LONGER RETAINED. REFER TO SECTION 8-28.
- FINISH GRADE TOLERANCE IN THE CHANNEL AND BANKS SHALL GENERALLY ALLOW FOR LARGER ROCK TO PROTRUDE ABOVE THE STATED FINISH GRADE.
- LARGER ALLUVIUM MATERIAL (I.E. BOULDERS/COBBLE) SHALL BE PRIORITIZED FOR CHANNEL FILL BETWEEN STATION 155+00 TO 158+00 WHERE THE PROFILE STEEPENS TO MEET EXISTING GRADE IN THE SF TOUTLE RIVER. LIKEWISE, LARGE WOOD PLACEMENT SHALL BE MOST DENSE IN THIS ZONE. THE CONTRACTOR SHALL COORDINATE WITH THE ENGINEER AND OR OPR BEFORE CONSTRUCTING THE TRANSITION.



BOULDER PLACEMENT NOTES

- PLACE SALVAGED BOULDERS AS DIRECTED BY OPR ON THE DOWNSTREAM TIE-IN OF SF TOUTLE RIVER CHANNEL FILL BETWEEN STATION 155+00 TO 158+00.
- STAGGER AND VARY BOULDER PLACEMENT AND EMBEDMENT DEPTHS TO MIMIC NATURAL STREAMS AND TO BREAK UP CURRENTS AS DIRECTED BY OPR. GENERAL BOULDER SPACING IS ONE BOULDER PER APPROX. 100 SQUARE FEET, THIS IS EQUIVALENT TO 10 FOOT ON CENTER SPACING.
- MINIMUM EMBEDMENT DEPTH IS 1/2 DIAMETER OF BOULDER.
- BOULDER SIZES VARY BASED ON AVAILABILITY OF SALVAGED BOULDERS IN THE FLOODPLAIN AND ENCOUNTERED DURING EXCAVATION.





LOWER COLUMBIA FISH
ENHANCEMENT GROUP
**SOUTH FORK TOUTLE RIVER
HEADWATERS DESIGN**
COWLITZ COUNTY, WA

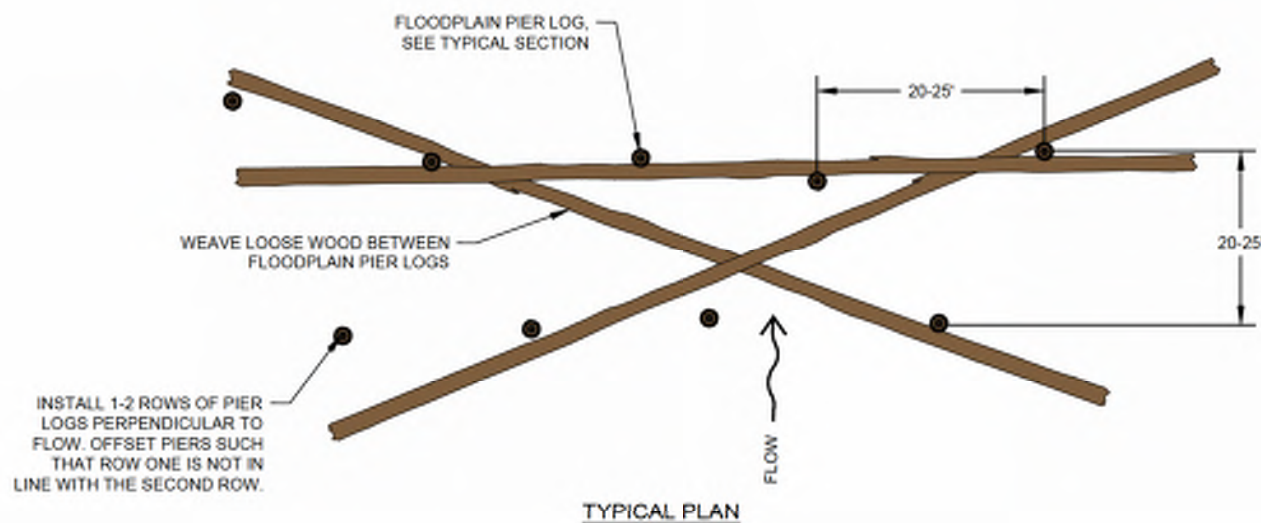
**WHS TYPE 3 & 4
DETAILS**

REVISION NUMBER

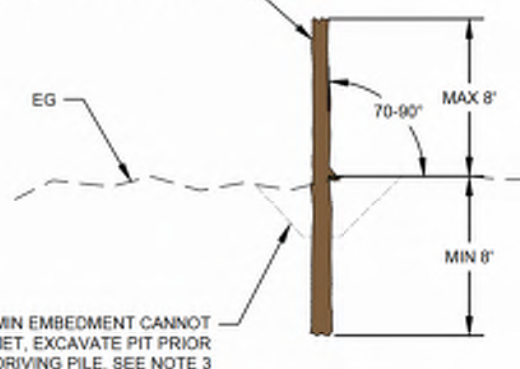
No.	Date	Revised
1	11/11/2024	Designed By LE
2		Checked By CL

Scale: 1" = 10'

JOB NO. 20200001
SHEET NO. C6.1



EMBED LOG BY DRIVING, PILE DRIVING OR HAMMERING WITH EXCAVATOR BUCKET INTO GROUND



1 WHS TYPE 3 - FLOODPLAIN PIER LOG
NOT TO SCALE

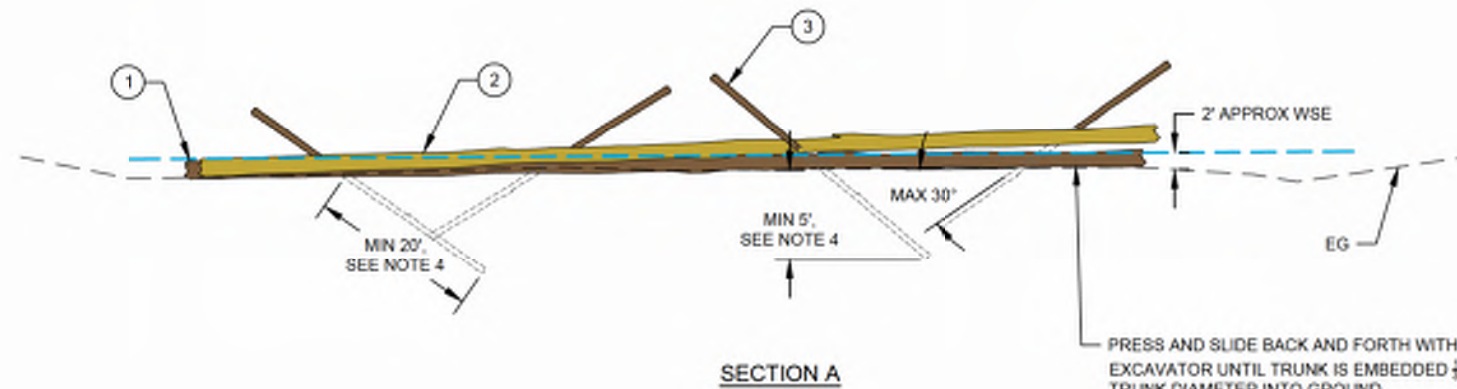
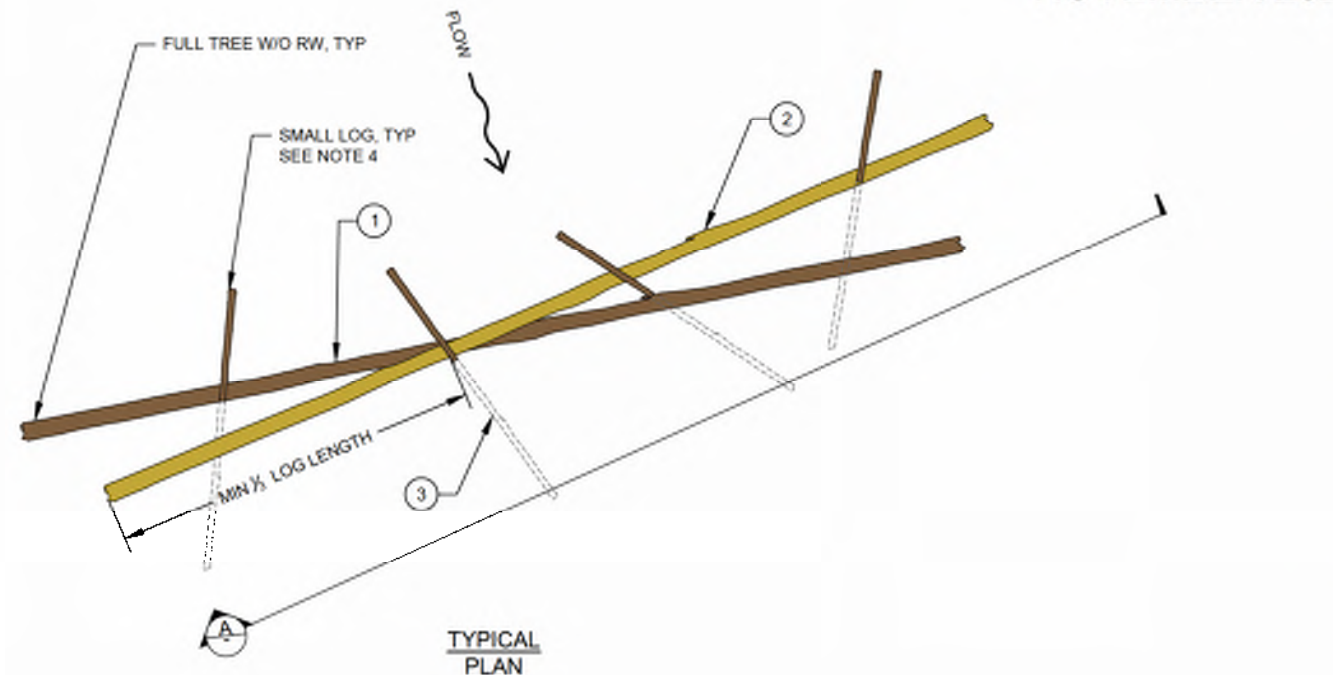
PINNED WOOD

PIECE SUMMARY

PIECE	QTY	LENGTH	DBH
PILE	1	16'	10 - 16"

FLOODPLAIN PIER LOG INSTALLATION NOTES:

1. THE INTENT OF FLOODPLAIN PIER LOGS IS TO ACCUMULATE AND STORE MOBILE WOOD, DEBRIS & SEDIMENT DURING FLOOD EVENTS AND ACCELERATE THE FORMATION OF STABLE JAMS AND VEGETATION. FLOODPLAIN PIER LOGS MIMIC A STANDING FOREST THAT HAS NOT BEEN ABLE TO ESTABLISH SINCE THE MT ST HELENS ERUPTION.
2. FLOODPLAIN PIER LOGS SHALL BE PLACED VERTICALLY AND EMBEDDED BY PILE DRIVING WITH AN IMPACT DRIVER OR VIBRATORY HEAD UNTIL REFUSAL. PILES MUST BE EMBEDDED BY MIN 8'.
3. IF MIN EMBEDMENT CANNOT BE ACHIEVED, THE CONTRACTOR SHALL EXCAVATE A STARTER PIT MIN 4' DEEP WITH SUFFICIENT SIDE SLOPES TO PREVENT SIGNIFICANT SIDE SLUMPING. DRIVE THE PILE INTO THIS PIT, BACKFILL THE PIT AND COMPACT TO ENSURE FLOODPLAIN PIER LOGS HAVE A MIN OF 8' OF TOTAL BURIAL DEPTH.
4. PIER LOGS SHOULD BE PLACED IN 1-2 ROWS DEEP ORIENTED PERPENDICULAR TO FLOW AND AT THE DIRECTION OF THE OPR. LOGS SHOULD BE SPACED APPROX. 20' ON CENTER AS SHOWN ON THE SITE PLAN SHEETS C3.1 TO C3.9.
5. INSTALL PIER LOGS IN ROWS 3, 4 OR 5 PIERS LONG AS SHOWN ON THE SITE PLAN SHEETS OR AS OTHERWISE DIRECTED BY THE OPR.



2 WHS TYPE 4 - PINNED WOOD
NOT TO SCALE

PINNED WOOD

PIECE SUMMARY

PIECE	QTY	LENGTH	DBH
FULL TREE W/O RW	2	MIN 90'	MIN 18"
SMALL LOG	4	20-40'	9-12"
EXCAVATION (CY)	30	N.A.	N.A.

WOOD LEGEND



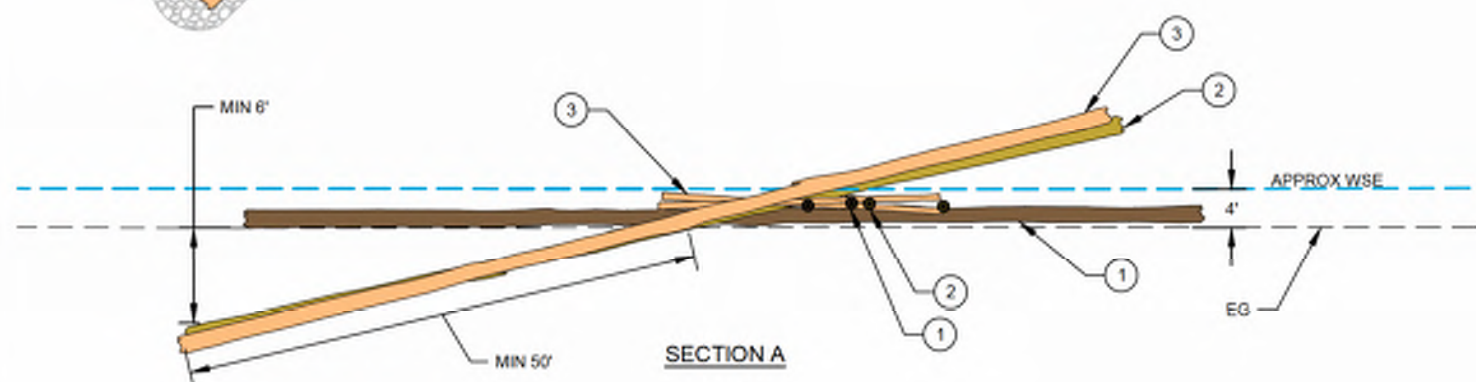
PINNED WOOD INSTALLATION NOTES:

1. THE INTENT OF PINNED WOOD IS TO PROVIDE FLOODPLAIN AND CHANNEL ROUGHNESS THAT ENCOURAGES VEGETATION ESTABLISHMENT AND SEDIMENT DEPOSITION. THESE STRUCTURES ARE INTENDED TO BE STABLE UNDER LOW ENERGY CONDITIONS ONLY.
2. PINNED WOOD IS PLACED AT A DENSITY OF 2 WHS PER ACRE IN BROADCAST WOOD LOADING AREAS SHOWN ON THE SITE PLAN SHEETS. PLACE WHS ON THE FLOODPLAIN, IN HIGH FLOW SIDE CHANNELS AND IN REGIONS WITH GENERALLY LOW VELOCITY SHALLOW WATER AS DIRECTED BY THE OPR.
3. PLACE TWO FULL TREES ON THE FLOODPLAIN WITH ONE TREE STACKED ON TOP OF THE OTHER SUCH THAT A MINIMUM OF 1/3 OF THE TOP TREE LENGTH IS ELEVATED ABOVE GROUND. THE STACKING ANGLE MAY VARY AND BE ADJUSTED TO FIT FIELD CONDITIONS.
4. THE CONTRACTOR SHALL EXCAVATE FOUR TRENCHES ON THE DOWNSTREAM SIDE OF THE STRUCTURE FOR PLACEMENT OF SMALL LOGS THAT PIN THE FULL TREES INTO PLACE. THE TRENCHES SHALL BE MIN 20' LONG AND 5' DEEP AND SHOULD BE ORIENTED SO THAT SMALL LOGS OPPOSE HYDRAULIC FORCES THAT WOULD OTHERWISE PUSH THE FULL TREES DOWNSTREAM. ALTERNATIVELY, THE CONTRACTOR CAN USE A PILE DRIVER TO DRIVE THESE SMALL LOGS AT AN ANGLE IF THEY CAN ACHIEVE SIMILAR DEPTHS/LENGTHS OF BURIAL.
5. PLACE SMALL LOGS SO THAT THE END IS BURIED MIN 5' DEEP AND FOR MIN 20' OF LENGTH, BACKFILL THE TRENCH AND COMPACT WITH BUCKET.

1 DENOTES PLACEMENT ORDER

1. SMALL JAMS ARE INTENDED TO BE SIMPLE AND COST EFFICIENT STRUCTURES WHOSE ORIENTATION AND SHAPE CAN BE MODIFIED TO FIT FIELD CONDITIONS. THE JAMS PROVIDE A MODERATE LEVEL OF STABILITY THAT WILL ACCUMULATE/TRAP MOBILE WOOD, SORT SEDIMENT, DEVELOP POOLS AND DIVERSIFY HYDRAULICS TO PROVIDE SHELTER FROM HIGH WINTER VELOCITIES.
2. FULL TREES AND SMALL LOGS SHALL BE PLACED SEQUENTIALLY AS SHOWN ON THIS SHEET. SLASH SHALL BE WOVEN INTO STRUCTURE BETWEEN EACH LAYER AND IS NOT SHOWN FOR CLARITY. CONSTRUCTION SEQUENCING IS AS FOLLOWS:
 - 2.1. THE CONTRACTOR SHALL PLACE ONE FULL TREE FLUSH WITH THE EXISTING GROUND AND STABILIZE THE MEMBER WITH 2 FULL TREES STACKING/INTERLOCKING ON TOP SUCH THAT THEY PIN THE BOTTOM TREE INTO PLACE.
 - 2.2. THE CONTRACTOR SHALL EXCAVATE TWO TRENCHES MIN 50' LONG AND MIN 6' DEEP ON THE DEEP END AND PLACE THE SECOND AND THIRD LAYER FULL TREES IN THE TRENCHES. BACKFILL THE FULL TREES WITH ALLUVIUM AND COMPACT WITH BUCKET OR BY TRACKING IN LIFTS NOT TO EXCEED 24"
3. QUANTITIES AND BURIAL REQUIREMENTS SPECIFIED HERE SHALL BE MAINTAINED, BUT THE FULL TREE ORIENTATIONS MAY BE MODIFIED IN THE FIELD TO FIT RIVER CONDITIONS AS SPECIFIED BY THE OPR.
4. APPROX. 5 CY SLASH AND 6 SMALL LOGS SHALL BE PLACED AND WOVEN WITHIN STRUCTURE TO FILL VOID SPACE.
5. SMALL JAMS SHALL BE PLACED ON THE FLOODPLAIN, IN CHANNEL FILL AND FLOODPLAIN GRADING AREAS, AND ON GRAVEL BARS AS SHOWN ON THE SITE PLAN SHEETS.

 LAYER 1 FULL TREE
 LAYER 2 FULL TREE
 LAYER 3 FULL TREE
 SMALL LOG
 1 DENOTES PLACEMENT ORDER



1 WHS TYPE 5 - SMALL FLOODPLAIN JAM
NOT TO SCALE

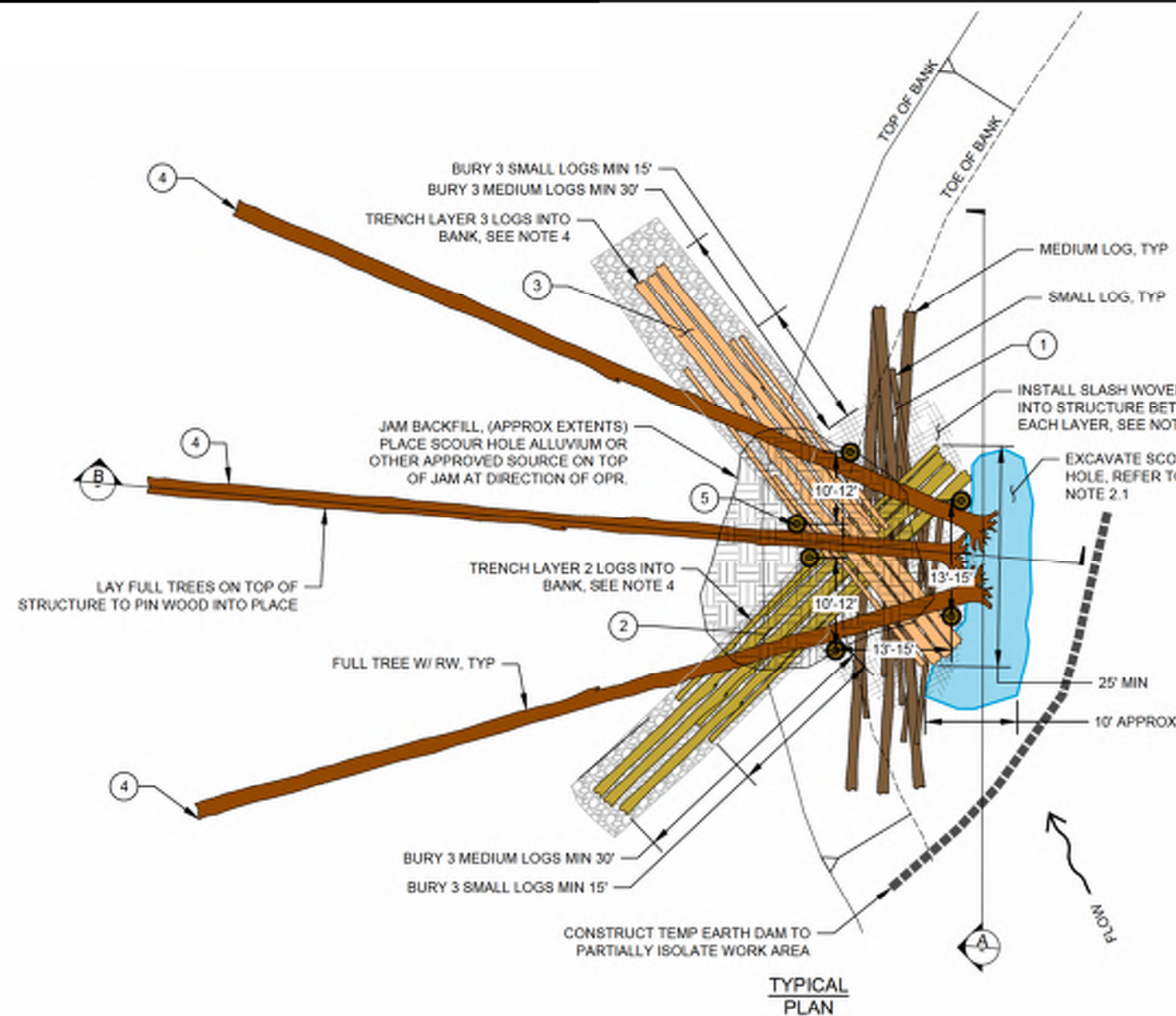
PIECE SUMMARY

PIECE SUMMARY			
PIECE	QTY	LENGTH	DBH
FULL TREE W/O RW	5	MIN 90'	MIN 18"
SMALL LOG	6	20'-40'	8"-12"
SLASH (CY)	5	0-20'	<9"
EXCAVATION (CY)	50	N.A.	N.A.



LOWER COLUMBIA FISH
ENHANCEMENT GROUP
SOUTH FORK TOUTLE RIVER
HEADWATERS DESIGN
COWLITZ COUNTY, WA

WHS TYPE 6 DETAIL



1 WHS TYPE 6 - MODERATE MARGIN JAM
NOT TO SCALE

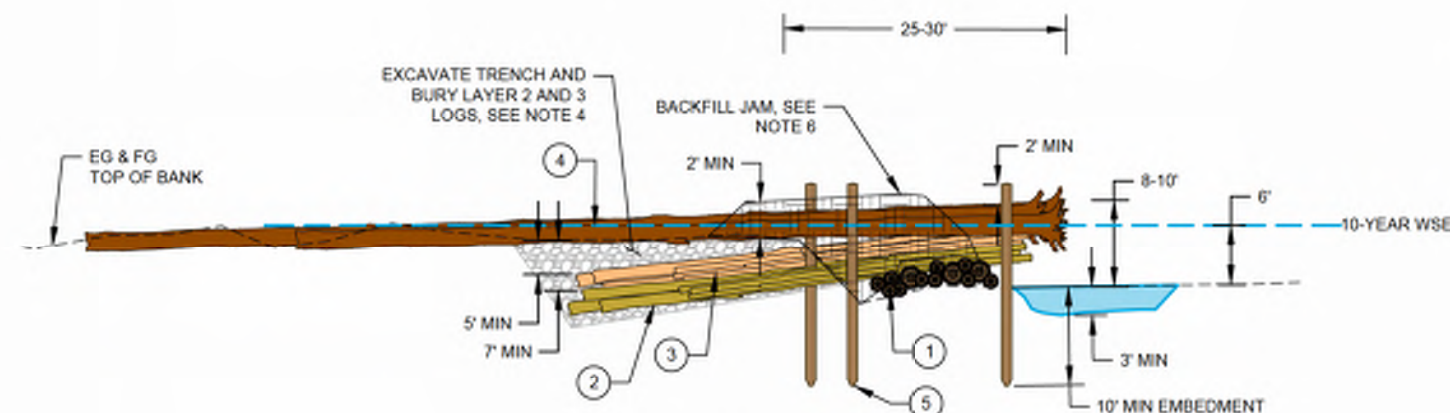
MARGIN JAM SEQUENCING AND INSTALLATION NOTES:

- THE INTENT OF THE MODERATE MARGIN JAM IS TO REDUCE HIGH CHANNEL VELOCITIES, SORT SPAWNING GRAVELS, DEVELOP POOL AND LOW VELOCITY REFUGE AREAS, RAISE WATER SURFACE ELEVATIONS AND DISSIPATE HYDRAULICS.
- PILES, FULL TREES, MEDIUM LOGS AND SMALL LOGS SHALL BE PLACED SEQUENTIALLY AS SHOWN ON THIS SHEET. SLASH SHALL BE WOVEN INTO STRUCTURE BETWEEN EACH LAYER AND IS NOT SHOWN FOR CLARITY. CONSTRUCTION SEQUENCING IS AS FOLLOWS:
 - EXCAVATE SCOUR HOLE AND PLACE ALLUVIUM UPSTREAM OF THE MARGIN JAM AS A TEMPORARY EARTHEN DAM TO PARTIALLY ISOLATE WORK SITE FROM RIVER FLOW.
 - PLACE 3 MEDIUM LOGS AND 8 SMALL LOGS STACKED AND INTERLOCKED AT THE TOE OF BANK GENERALLY ORIENTED PARALLEL TO THE BANK.
 - EXCAVATE TRENCH MIN 30' LONG, 10' WIDE AND 6'-8' DEEP AT THE DEEP END FOR BURIAL OF LAYER 2 LOGS.
 - PLACE LAYER 2 LOGS (3 MEDIUM AND 6 SMALL LOGS) IN TRENCH SUCH THAT THEY REST ON TOP OF LAYER 1 LOGS AND PIN THEM INTO THE CHANNEL BED. ACHIEVE MINIMUM BURIAL AND BACKFILL WITH ALLUVIUM. COMPACT TO FIRM UNYIELDING CONDITION AND WASH IN FINES TO INCREASE BACKFILL DENSITY IN LIFTS NOT TO EXCEED 24".
 - EXCAVATE TRENCH MIN 30' LONG, 10' WIDE AND 4'-6' DEEP AT THE DEEP END FOR BURIAL OF LAYER 3 LOGS.
 - PLACE LAYER 3 LOGS (3 MEDIUM AND 6 SMALL LOGS) IN TRENCH SUCH THAT THEY STACK ON LAYER 2 LOGS AND PIN THEM INTO PLACE. ACHIEVE MIN BURIAL, BACKFILL AND COMPACT PER NOTE 2.4 ABOVE.
 - LAY 3 FULL TREES WITH ROOTWADS ON TOP OF THE STRUCTURE TO PIN ALL LAYERS INTO PLACE.
 - EMBED PILES BETWEEN LOGS AS SHOWN TO SECURE LAYERS AND PREVENT ROTATION. DIG STARTER PITS/TRENCHES AS NECESSARY TO ACHIEVE MIN EMBEDMENT DEPTHS.
 - REMOVE EARTHEN DAM AND PLACE ALLUVIUM AS JAM BACKFILL AS SHOWN
- PILES TO BE DRIVEN WITH EXCAVATOR MOUNTED VIBRATORY OR IMPACT STYLE PILE DRIVER. CONTRACTOR SHALL EXCAVATE A STARTER TRENCH OR PIT TO THE ESTIMATED SCOUR DEPTH (5') AND THEN DRIVE PILES INTO THIS PIT TO ACHIEVE MINIMUM EMBEDMENT. CONTRACTOR SHALL REPLACE AND COMPACT EXCAVATED MATERIAL PER NOTE 2.4 ABOVE.
- MEDIUM LOGS IN LAYER 2 SHALL BE BURIED FOR MIN 30' OF THEIR LENGTH AS SHOWN WITH SOIL BACKFILLED ON TOP OF THE LOG TO MIN DEPTH OF 7'. LAYER 3 LOGS SHALL BE BURIED FOR MIN 30' OF THEIR LENGTH TO A MINIMUM DEPTH OF 5' AS MEASURED FROM THE TOP OF THE LOG AT THE DEEPEST END.
- INSTALL SMALL LOGS (RACKING) AND SLASH BETWEEN FULL TREES AT EACH STEP. SLASH SHALL HAVE IRREGULAR AND NATURAL APPEARANCE AND NOT BE NEATLY STACKED. SMALL LOGS AND SLASH SHALL BE OF THE QUANTITY DISPLAYED IN THE PIECE SUMMARY OR TO FILL VOIDS BETWEEN LOGS AND ROOTWAD AT FACE OF STRUCTURE.
- NATIVE ALLUVIUM EXCAVATED FROM SCOUR HOLE, OR FROM AN APPROVED ALTERNATE LOCATION, SHALL BE PLACED ON TOP OF THE STRUCTURE AFTER BACKFILL AND COMPACTION AS SHOWN. THIS BALLAST IS NOT INCLUDED IN MINIMUM EMBEDMENT DEPTHS.
- MODERATE MARGIN JAMS SHALL BE PLACED BURIED INTO CHANNEL BANKS WHERE FLOW IS CHANNELIZED AND BANKS ARE MIN 4' HIGH. THE JAMS SHOULD BE PREFERENTIALLY LOCATED WHERE LARGE BOULDERS ARE AVAILABLE TO SALVAGE AS BALLAST.
- THE CONTRACTOR SHALL INSTALL MODERATE APEX JAMS IN LOCATIONS SHOWN ON THE SITE PLAN SHEETS, BUT THESE LOCATIONS MAY BE SHIFTED AT THE DIRECTION OF THE OPR TO MATCH RIVER CONDITIONS AT THE TIME OF CONSTRUCTION. MODERATE APEX JAMS ARE IDENTICAL IN EFFORT AND QUANTITIES TO THE MODERATE MARGIN JAM AND MAY BE SUBSTITUTED FOR A MODERATE MARGIN JAM AT THE DIRECTION OF THE OPR.

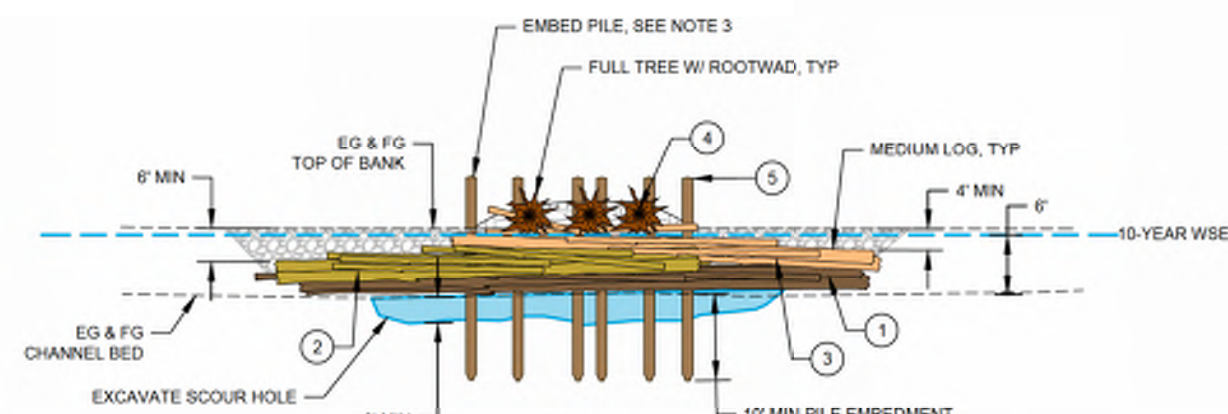
WOOD LEGEND



SECTION B



SECTION A



MODERATE MARGIN JAM

PIECE SUMMARY			
PIECE	QTY	LENGTH	DBH
FULL TREE W/ RW	3	MIN 90'	MIN 18"
MEDIUM LOG	9	40'-60'	MIN 12"
SMALL LOG	20	20'-40'	9"-12"
PILE	6	25'	10"-16"
SLASH (CY)	20	0-20'	<9"
EXCAVATION (CY)	140	N.A	N.A

REVISION NUMBER

No.	Date	Revised

Date: 11/11/2024
Designed By: LE
Drawn By: LH, LE
Checked By: CL

SCALE: 1" = 10'

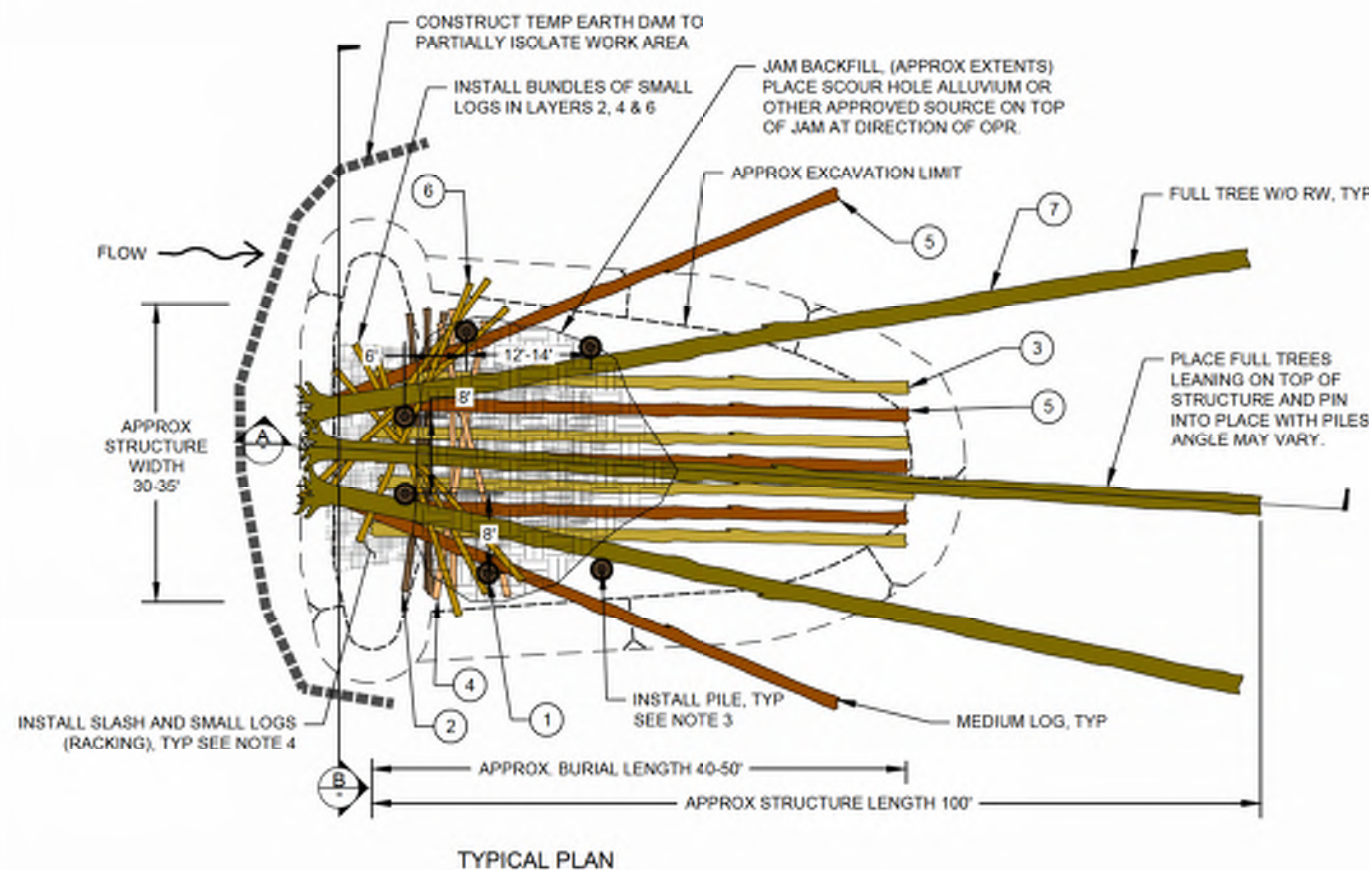
JOB NO.: 20200001

SHEET NO.: C6.3



LOWER COLUMBIA FISH
ENHANCEMENT GROUP
SOUTH FORK TOUTLE RIVER
HEADWATERS DESIGN
COWLITZ COUNTY, WA

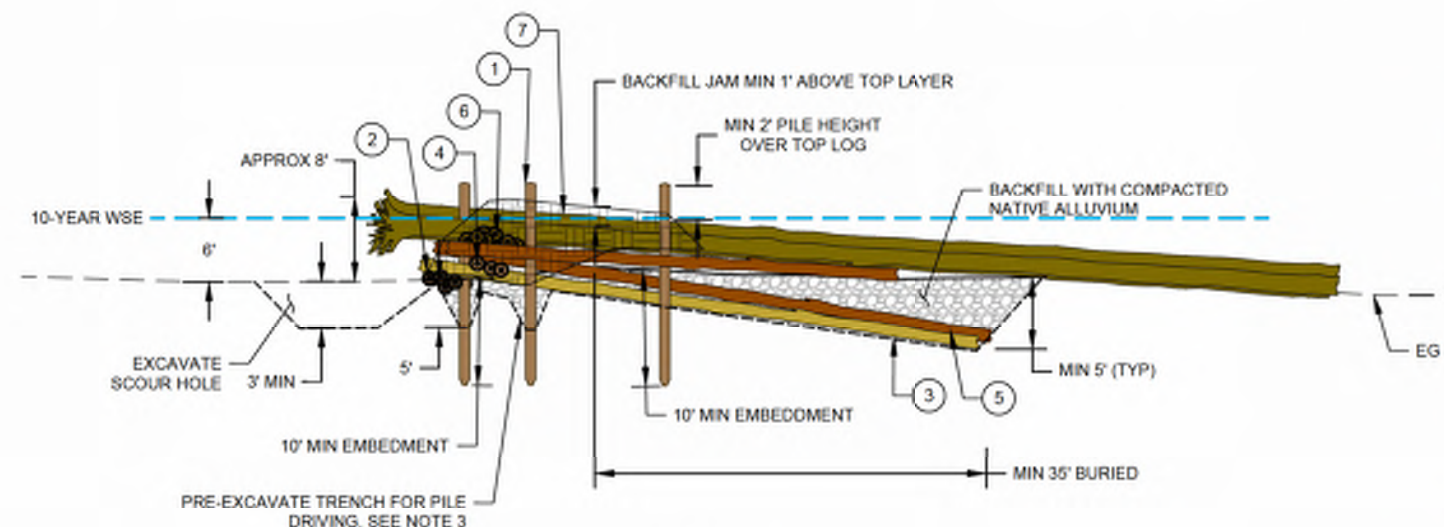
WHS TYPE 7
DETAIL



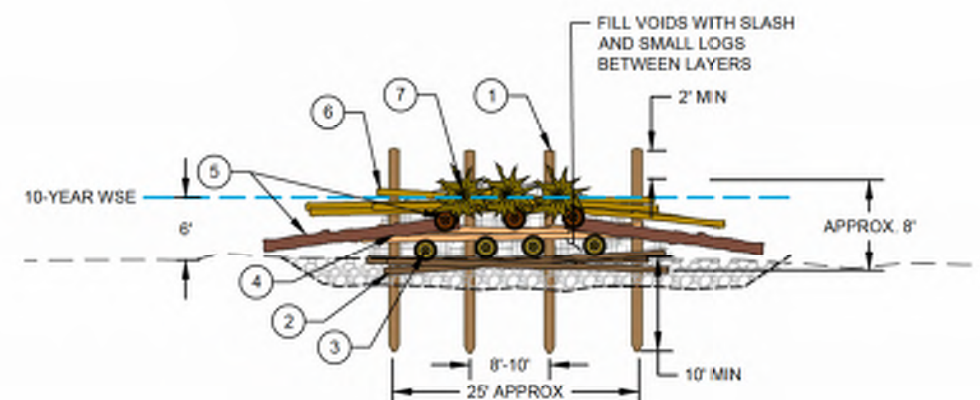
1 WHS TYPE 7 - MODERATE APEX JAM
NOT TO SCALE

APEX JAM SEQUENCING AND INSTALLATION NOTES:

- MODERATE APEX JAMS ARE INTENDED TO DISSIPATE HIGH-VELOCITIES, SPLIT FLOW, ENCOURAGE LOCAL DEPOSITION AND EROSION TO DIVERSIFY AQUATIC HABITAT AND CAPTURE/ACCUMULATE WOOD AND SEDIMENT TO DEVELOP PROTECTED ISLANDS WHERE VEGETATION CAN ESTABLISH/PERSIST.
- PILES, FULL TREES, MEDIUM LOGS AND SMALL LOGS SHALL BE PLACED SEQUENTIALLY AS SHOWN ON THIS SHEET. SLASH SHALL BE WOVEN INTO STRUCTURE BETWEEN EACH LAYER AND IS NOT SHOWN FOR CLARITY. CONSTRUCTION SEQUENCING IS AS FOLLOWS:
 - EXCAVATE SCOUR HOLE AND PLACE ALLUVIUM UPSTREAM OF THE JAM AS A TEMPORARY EARTHEN DAM TO PARTIALLY ISOLATE WORK SITE FROM RIVER FLOW.
 - EXCAVATE PIT MIN 35' LONG, 30' WIDE AND 4' DEEP AT THE DEEP END FOR BURIAL OF LAYER 3 AND LAYER 5 LOGS.
 - EMBED PILES AT THE FACE OF THE STRUCTURE AND WITHIN BURIED PIT TO ACHIEVE MIN EMBEDMENT DEPTH AS SHOWN.
 - PLACE 4-6 SMALL LOGS AND 10 CY SLASH IN LAYER 2 AT THE UPSTREAM END OF THE PIT AND WEAVE BETWEEN PILES.
 - INSTALL 4 MEDIUM LOGS ON TOP OF THE LAYER 2 SMALL LOGS TO PIN THEM DOWN. LAY LOGS INTO EXCAVATED PIT SUCH THAT AT THE DEEP END LOGS ARE BURIED WITH A 5' THICK LAYER OF ALLUVIUM MEASURED FROM THE TOP OF THE LOG.
 - PLACE 4-6 SMALL LOGS AND 10 CY SLASH CROSSED ON TOP OF THE LAYER 3 MEDIUM LOGS AND WOVEN BETWEEN PILES AS SHOWN.
 - INSTALL 3 MEDIUM LOGS AS LAYER 5 ON TOP OF THE LAYER 4 SMALL LOGS AND WEDGE INTO PIT BETWEEN PILES AND LAYER 3 LOGS.
 - ACHIEVE MINIMUM BURIAL AND BACKFILL WITH ALLUVIUM. COMPACT TO FIRM UNYIELDING CONDITION AND WASH IN FINES TO INCREASE BACKFILL DENSITY IN LIFTS NOT TO EXCEED 24".
 - PLACE 8-10 SMALL LOGS IN LAYER 6 INTERLOCKED WITH PILES AND AT VARYING ANGLES TO EXTEND THE FACE WIDTH OF THE STRUCTURE.
 - LAY 3 FULL TREES WITH ROOTWADS ON TOP OF THE STRUCTURE TO PIN ALL LAYERS INTO PLACE. WEAVE THESE TREES BETWEEN PILES AS SHOWN.
 - REMOVE EARTHEN DAM AND PLACE ALLUVIUM AS JAM BACKFILL AS SHOWN.
- PILES TO BE DRIVEN WITH EXCAVATOR MOUNTED VIBRATORY OR IMPACT STYLE PILE DRIVER. CONTRACTOR SHALL EXCAVATE A STARTER TRENCH OR PIT TO THE ESTIMATED SCOUR DEPTH (5') AND THEN DRIVE PILES INTO THIS PIT TO ACHIEVE MINIMUM EMBEDMENT. CONTRACTOR SHALL REPLACE AND COMPACT EXCAVATED MATERIAL PER NOTE 2.8.
- INSTALL SMALL LOGS (RACKING) AND SLASH BETWEEN FULL TREES AT EACH STEP. SLASH SHALL HAVE IRREGULAR AND NATURAL APPEARANCE AND NOT BE NEATLY STACKED. SMALL LOGS AND SLASH SHALL BE OF THE QUANTITY DISPLAYED IN THE PIECE SUMMARY OR TO FILL VOIDS BETWEEN LOGS AND ROOTWAD AT FACE OF STRUCTURE.
- NATIVE ALLUVIUM EXCAVATED FROM SCOUR HOLE, OR FROM AN APPROVED ALTERNATE LOCATION, SHALL BE PLACED ON TOP OF THE STRUCTURE AFTER BACKFILL AND COMPACTION AS SHOWN. THIS BALLAST IS NOT INCLUDED IN MINIMUM EMBEDMENT DEPTHS.
- MODERATE APEX JAMS SHALL BE PLACED ON GRAVEL BARS, AT THE HEAD OF SMALL ISLANDS, ALONG CHANNEL MARGINS AND WITHIN THE MAINSTEM CHANNEL WHERE THE CHANNEL IS FILLED.
- THE CONTRACTOR SHALL INSTALL MODERATE APEX JAMS IN LOCATIONS SHOWN ON THE SITE PLAN SHEETS, BUT THESE LOCATIONS MAY BE SHIFTED MODESTLY AT THE DIRECTION OF THE OPR TO MATCH RIVER CONDITIONS AT THE TIME OF CONSTRUCTION. MODERATE APEX JAMS ARE IDENTICAL IN EFFORT AND QUANTITIES TO THE MODERATE MARGIN JAM AND MAY BE SUBSTITUTED FOR A MODERATE MARGIN JAM AT THE DIRECTION OF THE OPR.



SECTION A



SECTION B

WOOD LEGEND



MODERATE APEX JAM

PIECE SUMMARY			
PIECE	QTY	LENGTH	DBH
FULL TREE W/ RW	3	MIN 90'	MIN 18"
MEDIUM LOG	9	40'-60'	MIN 12"
SMALL LOG	20	20'-40'	9"-12"
PILE	6	25'	10"-16"
SLASH (CY)	20	0-20'	<9"
EXCAVATION (CY)	140	35'	N.A.

REVISION NUMBER

No.	Date	Revised
1	11/11/2024	Designed By LE
2		Drawn By LH, LE
3		Checked By CL

Scale: 1" = 10'

JOB NO. 20200001

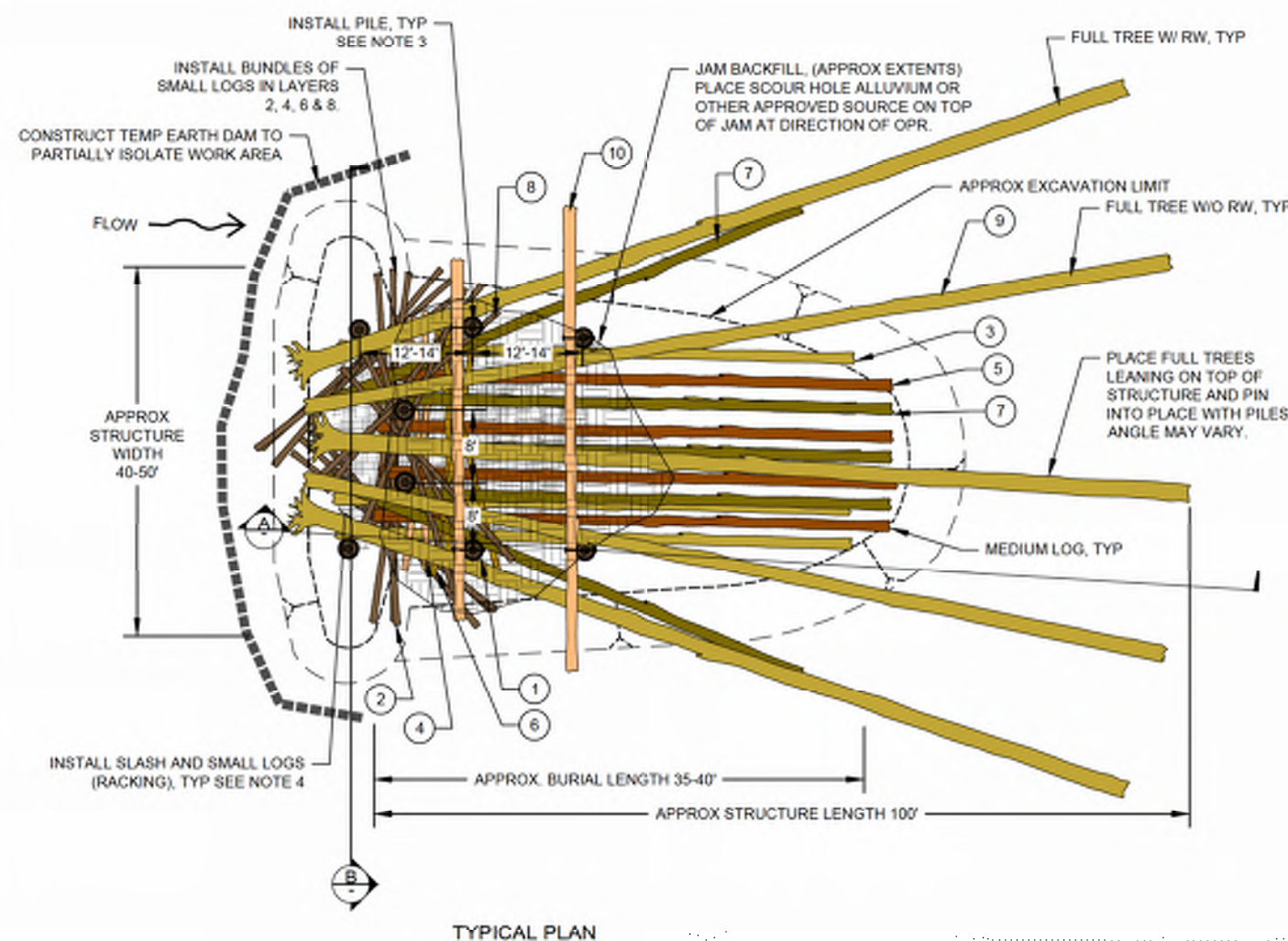
SHEET NO. C6.4

37 OF 57



LOWER COLUMBIA FISH
ENHANCEMENT GROUP
**SOUTH FORK TOUTLE RIVER
HEADWATERS DESIGN**
COWLITZ COUNTY, WA

**WHS TYPE 8
DETAIL**

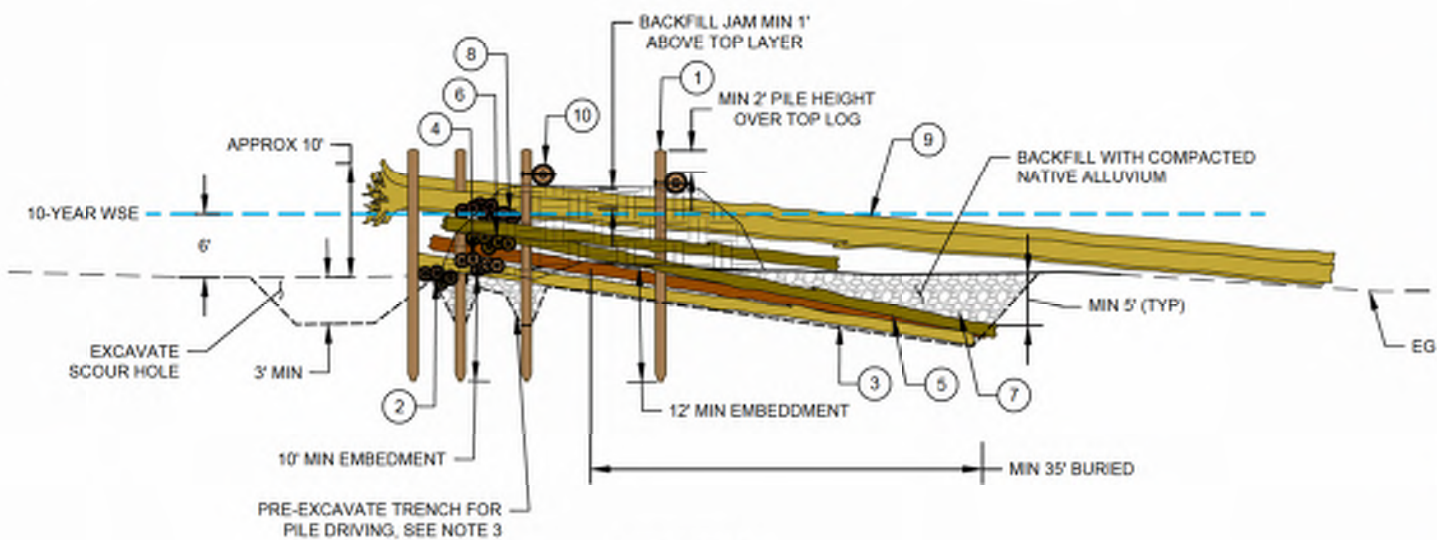


TYPICAL PLAN

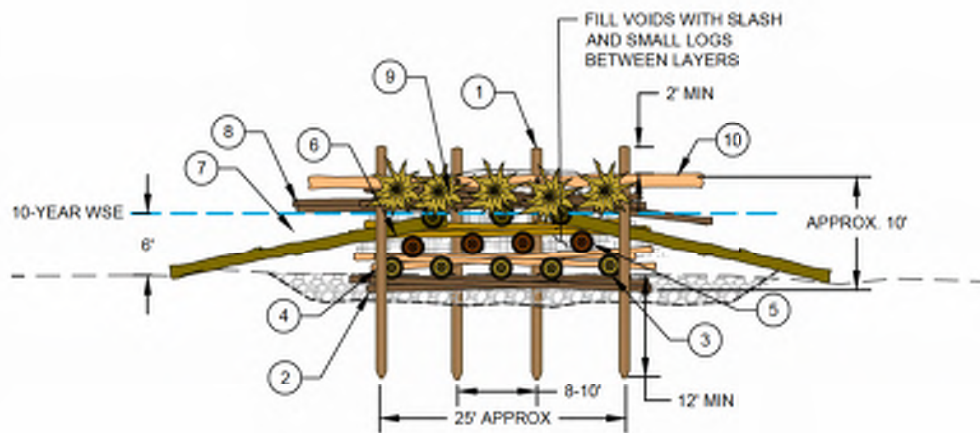
1 WHS TYPE 8 - LARGE APEX JAM
NOT TO SCALE

APEX JAM SEQUENCING AND INSTALLATION NOTES:

1. LARGE APEX JAMS ARE INTENDED TO DISSIPATE HIGH-VELOCITIES, SPLIT FLOW, ENCOURAGE LOCAL DEPOSITION AND EROSION TO DIVERSIFY AQUATIC HABITAT AND CAPTURE/ACCUMULATE WOOD AND SEDIMENT TO DEVELOP PROTECTED ISLANDS WHERE VEGETATION CAN ESTABLISH/PERSIST.
2. PILES, FULL TREES, MEDIUM LOGS AND SMALL LOGS SHALL BE PLACED SEQUENTIALLY AS SHOWN ON THIS SHEET. SLASH SHALL BE WOVEN INTO STRUCTURE BETWEEN EACH LAYER AND IS NOT SHOWN FOR CLARITY. CONSTRUCTION SEQUENCING IS AS FOLLOWS:
 - 2.1. EXCAVATE SCOUR HOLE AND PLACE ALLUVIUM UPSTREAM OF THE WHS AS A TEMPORARY EARTHEN DAM TO PARTIALLY ISOLATE WORK SITE FROM RIVER FLOW.
 - 2.2. EXCAVATE PIT MIN 40' LONG, 35' WIDE AND 4' DEEP AT THE DEEP END FOR BURIAL OF LAYER 3, LAYER 5 AND LAYER 7 LOGS.
 - 2.3. EMBED PILES AT THE FACE OF THE STRUCTURE AND WITHIN BURIED PIT TO ACHIEVE 12' MIN EMBEDMENT DEPTH AS SHOWN.
 - 2.4. PLACE 6-8 SMALL LOGS AND 10 CY SLASH IN LAYER 2 AT THE UPSTREAM END OF THE PIT AND WEAVE BETWEEN PILES.
 - 2.5. INSTALL 5 MEDIUM LOGS AND 10 CY SLASH ON TOP OF THE LAYER 2 SMALL LOGS TO PIN THEM DOWN. LAY LOGS INTO EXCAVATED PIT SUCH THAT AT THE DEEP END LOGS ARE BURIED WITH A 5' THICK LAYER OF ALLUVIUM MEASURED FROM THE TOP OF THE LOG.
 - 2.6. PLACE 4-6 SMALL LOGS AND 10 CY SLASH CROSSED ON TOP OF THE LAYER 3 MEDIUM LOGS AND WOVEN BETWEEN PILES AS SHOWN.
 - 2.7. INSTALL 4 MEDIUM LOGS ON TOP OF THE LAYER 4 SMALL LOGS AND WEDGE INTO PIT BETWEEN PILES AND LAYER 3 LOGS.
 - 2.5. PLACE 4-6 SMALL LOGS AND 10 CY SLASH CROSSED ON TOP OF THE LAYER 3 MEDIUM LOGS AND WOVEN BETWEEN PILES AS SHOWN.
 - 2.6. INSTALL 3 MEDIUM LOGS AS LAYER 7 ON TOP OF THE LAYER 6 SMALL LOGS AND WEDGE INTO PIT BETWEEN PILES AND LAYER 5 LOGS.
 - 2.7. ACHIEVE MINIMUM BURIAL AND BACKFILL WITH ALLUVIUM. COMPACT TO FIRM UNYIELDING CONDITION AND WASH IN FINES TO INCREASE BACKFILL DENSITY IN LIFTS NOT TO EXCEED 24".
 - 2.8. PLACE 12-14 SMALL LOGS IN LAYER 8 INTERLOCKED WITH PILES AND AT VARYING ANGLES TO EXTEND THE FACE WIDTH OF THE STRUCTURE.
 - 2.9. LAY 5 FULL TREES WITH ROOTWADS ON TOP OF THE STRUCTURE TO PIN ALL
- 2.10. LAYERS INTO PLACE. WEAVE THESE TREES BETWEEN PILES AS SHOWN.
- 2.11. INSTALL TWO MEDIUM CROSS LOGS OVER FULL TREES BRACED AGAINST PILES. COORDINATE WITH OWNER TO SECURE THESE BRACING LOGS WITH HARDWARE CONNECTIONS.
3. PILES TO BE DRIVEN WITH EXCAVATOR MOUNTED VIBRATORY OR IMPACT STYLE PILE DRIVER. CONTRACTOR SHALL EXCAVATE A STARTER TRENCH OR PIT TO THE ESTIMATED SCOUR DEPTH (7') AND THEN DRIVE PILES INTO THIS PIT TO ACHIEVE MINIMUM EMBEDMENT. CONTRACTOR SHALL REPLACE AND COMPACT EXCAVATED MATERIAL PER NOTE 2.8.
4. REMOVE EARTHEN DAM AND PLACE ALLUVIUM AS JAM BACKFILL AS SHOWN.
4. INSTALL SMALL LOGS (RACKING) AND SLASH BETWEEN FULL TREES AT EACH STEP. SLASH SHALL HAVE IRREGULAR AND NATURAL APPEARANCE AND NOT BE NEATLY STACKED. SMALL LOGS AND SLASH SHALL BE OF THE QUANTITY DISPLAYED IN THE PIECE SUMMARY OR TO FILL VOIDS BETWEEN LOGS AND ROOTWAD AT FACE OF STRUCTURE.
5. NATIVE ALLUVIUM EXCAVATED FROM SCOUR HOLE, OR FROM AN APPROVED ALTERNATE LOCATION, SHALL BE PLACED ON TOP OF THE STRUCTURE AFTER BACKFILL AND COMPACTION AS SHOWN. THIS BALLAST IS NOT INCLUDED IN MINIMUM EMBEDMENT DEPTHS.
6. LARGE APEX JAMS SHALL BE PLACED ON GRAVEL BARS, AT THE HEAD OF SMALL ISLANDS, ALONG CHANNEL MARGINS AND WITHIN THE MAINSTEM CHANNEL. LARGE JAMS ARE LOCATED WITHIN AREAS OF HIGH VELOCITIES AND DEEP WATER WITH SIGNIFICANT DRAG AND LIFT FORCES.
7. THE CONTRACTOR SHALL INSTALL LARGE APEX JAMS IN LOCATIONS SHOWN ON THE SITE PLAN SHEETS. THESE LOCATIONS MAY BE SHIFTED AT THE DIRECTION OF THE OPR TO MATCH RIVER CONDITIONS AT THE TIME OF CONSTRUCTION. LARGE APEX JAMS ARE IDENTICAL IN EFFORT AND QUANTITIES TO THE LARGE DEFLECTOR JAMS AND MAY BE SUBSTITUTED FOR A LARGE DEFLECTOR JAM AT THE DIRECTION OF THE OPR.

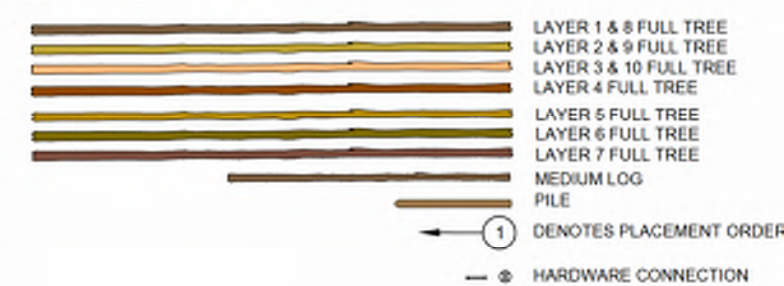


SECTION A



SECTION B

WOOD LEGEND



LARGE APEX JAM

PIECE SUMMARY

PIECE	QTY	LENGTH	DBH
FULL TREE W/O RW	2	MIN 90'	MIN 18"
FULL TREE W/ RW	3	MIN 90'	MIN 18"
MEDIUM LOG	14	40'-60'	MIN 12"
SMALL LOG	30	20'-40'	9"-12"
PILE	8	25'	10"-16"
SLASH (CY)	40	0-20'	<9"
HARDWARE CONNECTION TYPE II	4	N.A.	N.A.
EXCAVATION (CY)	180	40	N.A.

REVISION NUMBER

No.	Date	Revised

Date: 11/11/2024
Drawn By: LH, LE
Checked By: CL

SCALE: 1" = 10'

JOB NO. 20200001

SHEET NO. C6.5



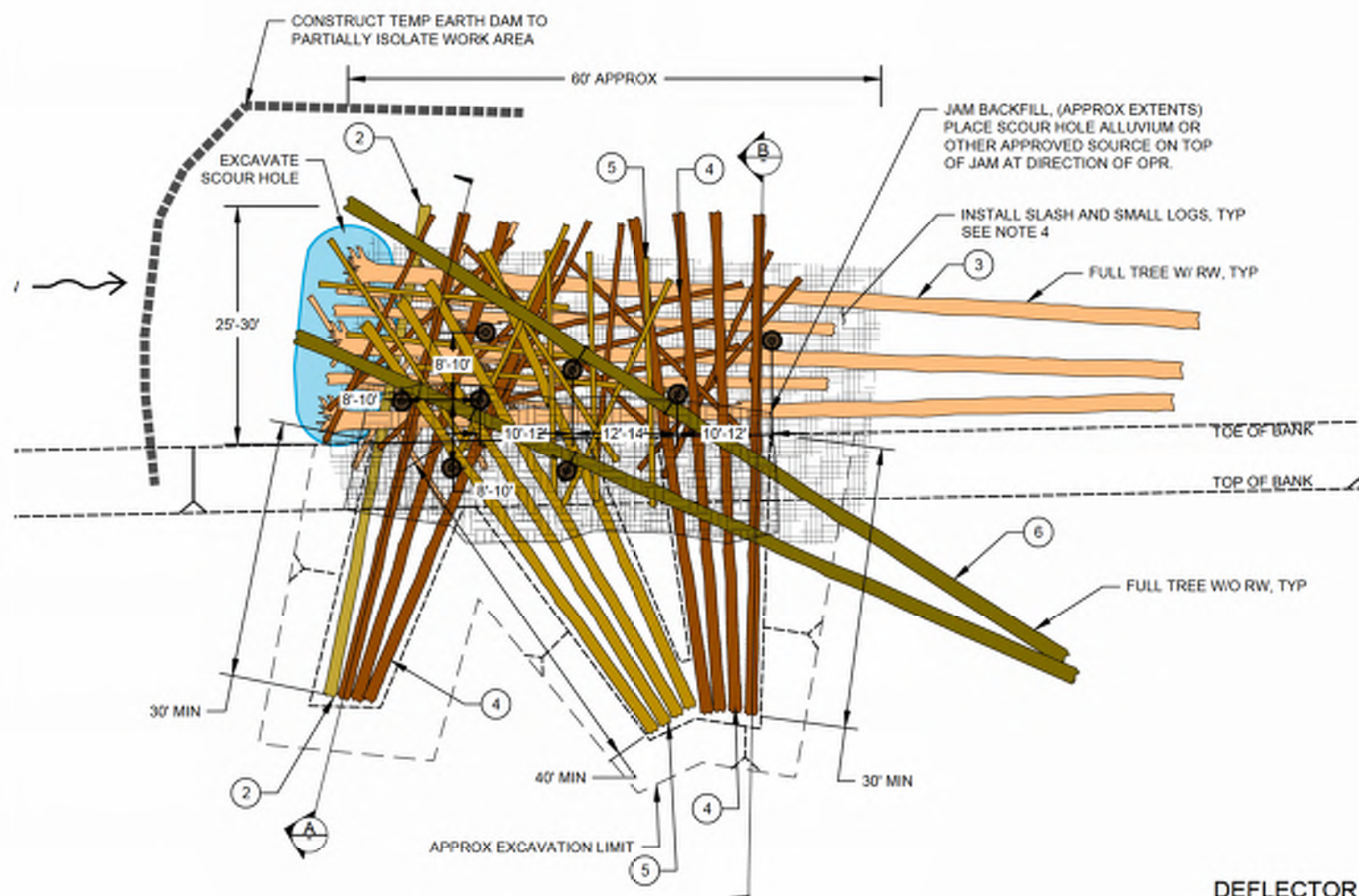
LOWER COLUMBIA FISH
ENHANCEMENT GROUP
SOUTH FORK TOUTLE RIVER
HEADWATERS DESIGN
COWLITZ COUNTY, WA

WHS TYPE 9
DETAIL

REVISION NUMBER

No.	Date	Revised
1	11/11/2024	Designed By LE
2		Drawn By LH, LE
3		Checked By CL

Scale: 1" = 10'
Job No: 20200001
Sheet No: C6.6



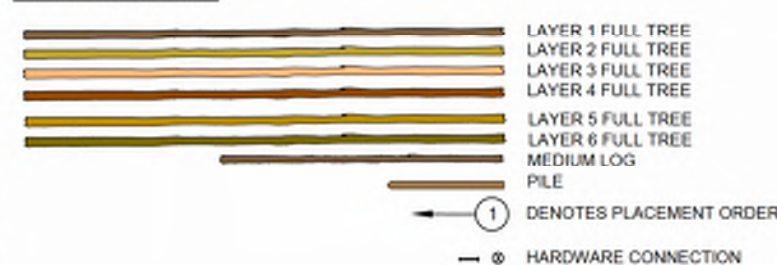
TYPICAL PLAN

1 WHS TYPE 9 - LARGE DEFLECTOR JAM
NOT TO SCALE

LARGE DEFLECTOR JAM

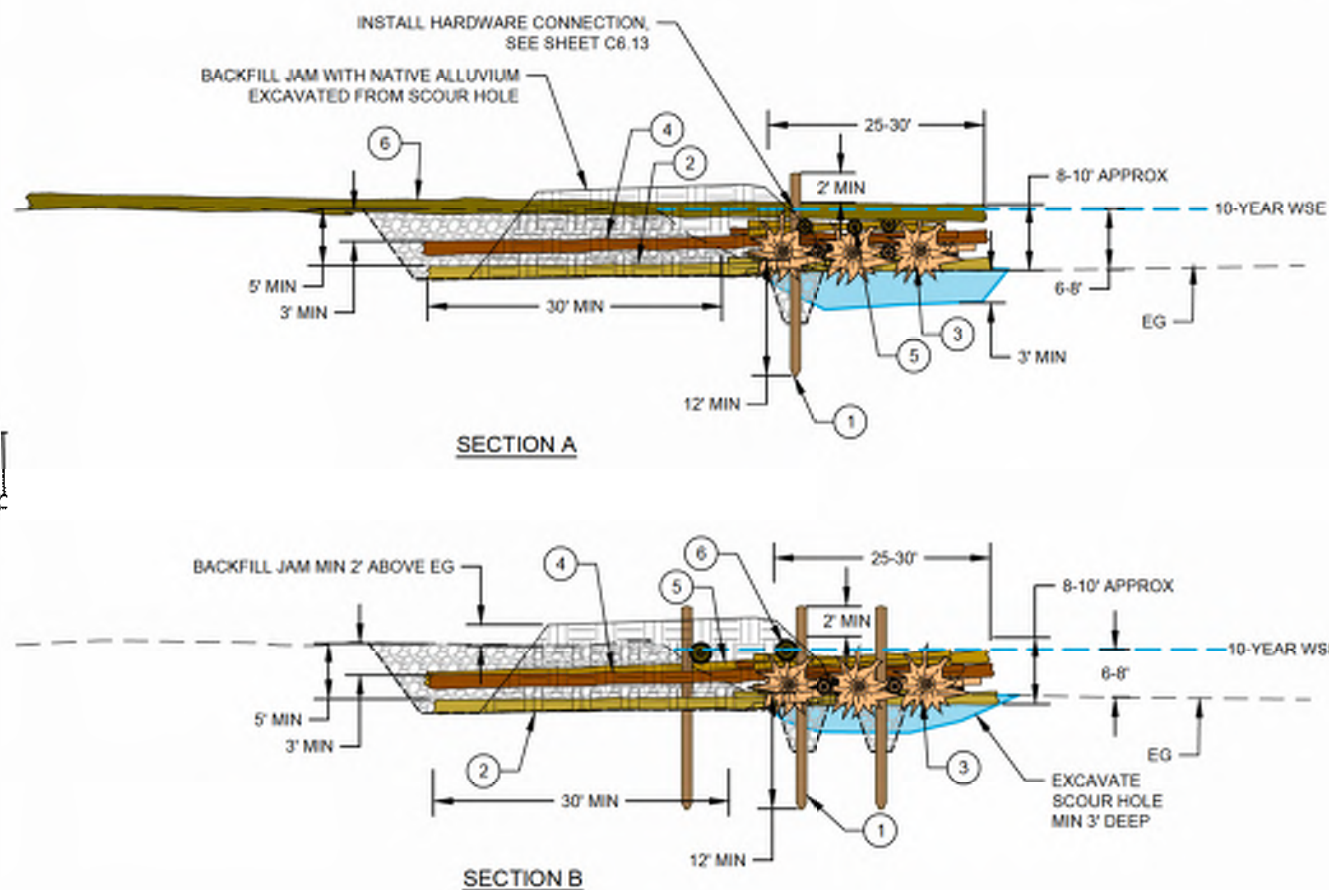
PIECE SUMMARY			
PIECE	QTY	LENGTH	DBH
FULL TREE W/O RW	2	MIN 90'	MIN 18"
FULL TREE W/ RW	3	MIN 90'	MIN 18"
MEDIUM LOG	14	40'-60'	MIN 12"
SMALL LOG	30	20'-40'	9'-12"
SLASH (CY)	40	0-20'	<9"
PILE	8	25'	10'-16"
HARDWARE CONNECTION TYPE II	4	N.A.	N.A.
EXCAVATION (CY)	180	N.A.	N.A.

WOOD LEGEND



DEFLECTOR JAM SEQUENCING AND INSTALLATION NOTES:

1. LARGE DEFLECTOR JAMS ARE INTENDED TO DISSIPATE HIGH-VELOCITIES, ENCOURAGE LOCAL DEPOSITION AND EROSION TO DIVERSIFY AQUATIC HABITAT AND CAPTURE/ACCUMULATE WOOD.
2. PILES, FULL TREES, MEDIUM LOGS AND SMALL LOGS SHALL BE PLACED SEQUENTIALLY AS SHOWN ON THIS SHEET. SLASH SHALL BE WOVEN INTO STRUCTURE BETWEEN EACH LAYER AND IS NOT SHOWN FOR CLARITY. CONSTRUCTION SEQUENCING IS AS FOLLOWS:
 - 2.1. EXCAVATE SCOUR HOLE AND PLACE ALLUVIUM UPSTREAM OF THE WHS AS A TEMPORARY EARTHEN DAM TO PARTIALLY ISOLATE WORK SITE FROM RIVER FLOW.
 - 2.2. EXCAVATE PITS FOR BURIAL OF LAYER 2, 4 & 5 LOGS. STOCKPILE MATERIAL ADJACENT FOR BACKFILL.
 - 2.3. EMBED PILES ON BANK AND IN CHANNEL AS SHOWN TO ACHIEVE 12" MIN EMBEDMENT DEPTH AS MEASURED FROM THE EXISTING GRADE SURFACE.
 - 2.4. PLACE ONE MEDIUM LOG AND 20 CY SLASH IN LAYER ONE JUST DOWNSTREAM OF THE EXCAVATED SCOUR HOLE. SLASH SHOULD BE DOWNSTREAM OF THE MEDIUM LOG AND HEAVIER ON THE BANKLINE THAN OUT IN THE CHANNEL.
 - 2.5. PLACE 3 FULL TREES W/ RW'S AND 2 MEDIUM LOGS ON TOP OF THE LAYER 1 LOG TO PIN IT INTO PLACE. ROOTWADS SHOULD BE OVER THE EXCAVATED SCOUR HOLE AND TREES/LOGS ORIENTED PARALLEL TO THE CHANNEL BANK.
 - 2.6. PLACE 12 SMALL LOGS AND REMAINING SLASH IN LAYER 3 WOVEN BETWEEN PILES AND PREVIOUSLY PLACED LAYER 3 LOGS/TREES.
 - 2.7. INSTALL 7 MEDIUM LOGS ON TOP OF THE LAYER 3 SMALL LOGS TO PIN THEM DOWN INTO PLACE. LAY LOGS INTO EXCAVATED PIT SUCH THAT AT THE DEEP END LOGS ARE BURIED WITH A MIN 3" THICK LAYER OF ALLUVIUM MEASURED FROM THE TOP OF THE LOG.
 - 2.8. PLACE 10 SMALL LOGS AS PART OF LAYER 4 CROSSED ON TOP OF THE LAYER 4 MEDIUM LOGS AND WOVEN BETWEEN PILES AS SHOWN.
 - 2.9. INSTALL 4 MEDIUM LOGS AS LAYER 5 ON TOP OF THE LAYER 4 SMALL LOGS AND WEDGE BETWEEN PILES AS SHOWN. MEDIUM LOGS SHALL BE BURIED MIN 3' WITH ALLUVIUM ON THE DEEP END MEASURED FROM THE TOP OF THE LOG.
 - 2.10. ACHIEVE MINIMUM BURIAL AND BACKFILL WITH ALLUVIUM. COMPACT TO FIRM UNYIELDING CONDITION AND WASH IN FINES TO INCREASE BACKFILL DENSITY IN LIFTS NOT TO EXCEED 24".
 - 2.11. PLACE 8 SMALL LOGS IN LAYER 6 ON TOP OF THE LAYER 5 MEDIUM LOGS AND WOVEN BETWEEN PILES.
 - 2.12. INSTALL 2 FULL TREES RESTING ON TOP OF THE LAYER 6 SMALL LOGS TO PIN THEM INTO PLACE. WEDGE FULL TREES BETWEEN PILES SUCH THAT THERE ARE TWO POINTS OF CONTACT WITH PILES, MINIMUM ONE PILE ON THE DOWNSTREAM AND ONE ON THE UPSTREAM SIDE OF EACH TREE.
- 2.13. REMOVE EARTHEN DAM AND PLACE ALLUVIUM AS JAM BACKFILL AS SHOWN.
- 2.14. COORDINATE WITH OWNER TO INSTALL HARDWARE CONNECTIONS ON THE FULL TREES PER DETAILS ON SHEET C6.13.
3. PILES TO BE DRIVEN WITH EXCAVATOR MOUNTED VIBRATORY OR IMPACT STYLE PILE DRIVER. CONTRACTOR SHALL EXCAVATE A STARTER TRENCH OR PIT TO THE ESTIMATED SCOUR DEPTH (8') AND THEN DRIVE PILES INTO THIS PIT TO ACHIEVE MINIMUM EMBEDMENT. CONTRACTOR SHALL REPLACE AND COMPACT EXCAVATED MATERIAL PER NOTE 2.8.
4. INSTALL SMALL LOGS (RACKING) AND SLASH BETWEEN FULL TREES AT EACH STEP. SLASH SHALL HAVE IRREGULAR AND NATURAL APPEARANCE AND NOT BE NEATLY STACKED. SMALL LOGS AND SLASH SHALL BE OF THE QUANTITY DISPLAYED IN THE PIECE SUMMARY OR TO FILL VOIDS BETWEEN LOGS AND ROOTWAD AT FACE OF STRUCTURE.
5. NATIVE ALLUVIUM EXCAVATED FROM SCOUR HOLE, OR FROM AN APPROVED ALTERNATE LOCATION, SHALL BE PLACED ON TOP OF THE STRUCTURE AFTER BACKFILL AND COMPACTION AS SHOWN. THIS BALLAST IS NOT INCLUDED IN MINIMUM EMBEDMENT DEPTHS.
6. DEFLECTOR JAMS SHALL BE PLACED ON CHANNEL MARGINS BURIED INTO CHANNEL BANKS THAT ARE MIN 4' TALL. THESE STRUCTURES ARE LOCATED WITHIN CONFINED CHANNELS WITH HIGH VELOCITIES, DEEP WATER AND SIGNIFICANT DRAGLIFT FORCES.
7. THE CONTRACTOR SHALL INSTALL LARGE DEFLECTOR JAMS IN LOCATIONS SHOWN ON THE SITE PLAN SHEETS. THESE LOCATIONS MAY BE SHIFTED AT THE DIRECTION OF THE OPR TO MATCH RIVER CONDITIONS AT THE TIME OF CONSTRUCTION. LARGE APEX JAMS ARE IDENTICAL IN EFFORT AND QUANTITIES TO THE LARGE DEFLECTOR JAMS AND MAY BE SUBSTITUTED FOR A LARGE DEFLECTOR JAM AT THE DIRECTION OF THE OPR.



SECTION A

SECTION B



D2 WATER RESOURCES, INC.
1 SE WATER AVE. SUITE #160
PORTLAND, OR 97214



LOWER COLUMBIA FISH
ENHANCEMENT GROUP
11018 NE 51ST CIRCLE
VANCOUVER, WA 98662

LOWER COLUMBIA FISH
ENHANCEMENT GROUP

**SOUTH FORK TOUTLE RIVER
HEADWATERS DESIGN**

COWLITZ COUNTY, WA

WHS TYPE 10 DETAIL

REVISION NUMBER

Nr.	Name	Gelehrten

Date	Designed By
11/11/2024	LF

Drawn By LH, LE	Checked By CL
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SCALE

[illegible]

JOB NO. 20200001

SHEET NO.

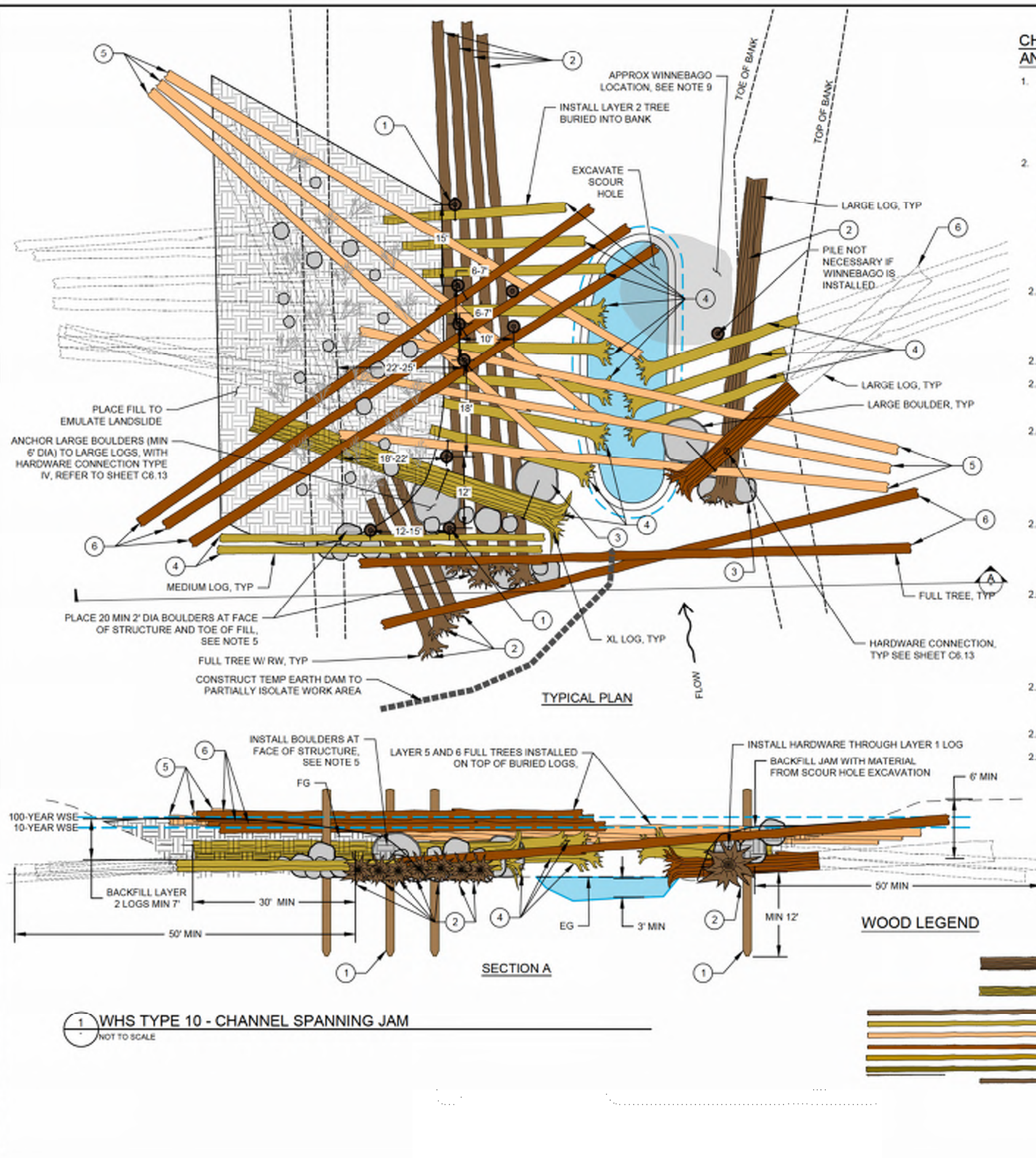
C6.7

40 of 57

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1. CHANNEL SPANNING JAMS ARE INTENDED TO DISSIPATE HIGH-VELOCITIES, ENCOURAGE LOCAL DEPOSITION AND EROSION TO DIVERSIFY AQUATIC HABITAT AND CREATE PROTECTED REGIONS FOR FISH TO REST AND REAR. THESE JAMS ARE LOCATED IN NARROW HIGH ENERGY RIVER REACHES WITH LITTLE OFF-CHANNEL OR RESTING HABITAT FOR FISH.
2. PILES, FULL TREES, MEDIUM LOGS AND SMALL LOGS SHALL BE PLACED SEQUENTIALLY AS SHOWN ON THIS SHEET. SLASH SHALL BE WOVEN INTO STRUCTURE BETWEEN EACH LAYER AND IS NOT SHOWN FOR CLARITY. WORK ON THE CHANNEL SPANNING JAM SHALL BE COMPLETED IN TWO PHASES FROM EACH RIVER BANK. THE CONTRACTOR SHALL COORDINATE WITH OPR TO DEVELOP A CONSTRUCTION SEQUENCING PLAN THAT IS FEASIBLE FOR WATER MANAGEMENT. GENERAL CONSTRUCTION SEQUENCING IS AS FOLLOWS ASSUMING THE RIVER LEFT SIDE OF THE JAM AS SHOWN ON THIS SHEET IS CONSTRUCTED FIRST:
 - 2.1. EXCAVATE SCOUR HOLE AND PLACE ALLUVIUM UPSTREAM OF THE WHS AS A TEMPORARY EARTHEN DAM TO PARTIALLY ISOLATE WORK SITE FROM RIVER FLOW. CONSTRUCT EARTHEN BERM TO DIRECT FLOW TO THE OPPOSITE SIDE OF THE RIVER CHANNEL FROM THE SIDE BEING CONSTRUCTED.
 - 2.2. EMBED PILES ON BANK AND IN CHANNEL AS SHOWN TO ACHIEVE 12" MIN EMBEDMENT DEPTH.
 - 2.3. EXCAVATE TRENCH NECESSARY TO BURY LAYER 2 FULL TREES AS SHOWN. PLACE LAYER 2 FULL TREES IN EXCAVATED TRENCH AND FLUSH WITH THE CHANNEL BED ORIENTED WITH ROOTWADS FACING UPSTREAM.
 - 2.4. SALVAGE AND PLACE LARGE BOULDERS (2) AS SHOWN TO PIN LAYER 2 LOGS INTO THE CHANNEL BANK. INSTALL OTHER BOULDERS AT FACE OF STRUCTURE AS SHOWN AND DIRECTED BY THE OPR TO PROTECT THE STRUCTURE FROM EROSION AND SCOUR. BOULDERS SHOULD BE INSTALLED TO CREATE A HARDENED TOE AT THE UPSTREAM FACE OF THE STRUCTURE DOWNSTREAM OF LAYER 2 FULL TREE ROOTWADS.
 - 2.5. EXCAVATE PIT MIN 7" DEEP AND WITH LENGTH MATCHING THE DETAIL FOR PLACEMENT OF LAYER 4 FULL TREES, XL LOG AND MEDIUM LOGS. INSTALL LAYER 4 FULL TREES SUCH THAT ROOTWADS EXTEND INTO THE CHANNEL AND THE LOGS HAVE CONTACT WITH LAYER 2 FULL TREES TO PIN THEM TO THE CHANNEL BED.
 - 2.6. BACKFILL LAYER 4 FULL TREES AND INSTALL FILL OVER STRUCTURE THAT EXTENDS MIN 30" INTO THE CHANNEL MEASURED FROM THE TOE OF BANK. FILL TO BE SOURCED LOCALLY AT THE DIRECTION OF THE OPR AND SHALL CONSIST OF LARGE COBBLES AND BOULDERS TOP DRESSED WITH SOIL. COMPACT TO FIRM UNYIELDING CONDITION AND WASH IN FINES TO INCREASE BACKFILL DENSITY IN LIFTS NOT TO EXCEED 24".
 - 2.7. PLACE LAYER 5 FULL TREES ON TOP OF FILL RESTING ON TOP OF LAYER 4 TREES AND WOVEN BETWEEN PILES. THIS STEP FINISHES PHASE ONE (RIVER LEFT) OF THE STRUCTURE.
 - 2.8. MOBILIZE EQUIPMENT AND MATERIALS TO RIVER RIGHT TO CONSTRUCT THAT SIDE OF THE STRUCTURE.
 - 2.9. REMOVE EARTHEN DAM AND REORIENT THE COFFER DAM TO DIRECT WATER TO THE RECENTLY CONSTRUCTED WHS ON RIVER LEFT. COMPLETE OTHER NECESSARY WATER MANAGEMENT ACTIONS TO PARTIALLY ISOLATE RIVER RIGHT FROM FLOW.

PIECE SUMMARY			
PIECE	QTY	LENGTH	DBH
FULL TREE	14	MIN 90'	MIN 18"
FULL TREE W/ RW	15	MIN 90'	MIN 18"
LARGE LOG W/ RW	2	60'	MIN 36"
XL LOG W/ RW	1	60'	MIN 45"
MEDIUM LOG	2	40'-60'	MIN 12"
SMALL LOG	60	20'-40'	9"-12"
SLASH (CY)	60	0-20'	<6"
PILE	10	25'	10"-16"
BOULDERS	20	N.A.	MIN 2'
LARGE BOULDERS	3	N.A.	MIN 6'
HARDWARE CONNECTION TYPE II	6	N.A.	N.A.
HARDWARE CONNECTION TYPE III	3	N.A.	N.A.
EXCAVATION (CY)	400	N.A.	N.A.

[illegible]



LOWER COLUMBIA FISH
ENHANCEMENT GROUP
SOUTH FORK TOUTLE RIVER
HEADWATERS DESIGN
COWLITZ COUNTY, WA

WHS TYPE 11 DETAIL

REVISION NUMBER

No.	Date	Description

Date: 11/11/2024
Designed By: LE
Drawn By: LH, LE
Checked By: CL

SCALE: 1" = 10'

JOB NO.: 20200001

SHEET NO.: C6.8

ISLAND FORMING JAM INSTALLATION AND SEQUENCING NOTES:

- PILES, FULL TREES, MEDIUM LOGS AND SMALL LOGS SHALL BE PLACED SEQUENTIALLY AS SHOWN ON THIS SHEET. SLASH SHALL BE WOVEN INTO STRUCTURE BETWEEN EACH LAYER AND IS NOT SHOWN FOR CLARITY.
 - INSTALL LAYER 1 FULL TREES PERPENDICULAR TO RIVER FLOW AND OVERLAPPING SUCH THAT THE MEMBERS INTERLOCK WITH EACH OTHER AND STACK. STAGGER THE ENDS 2-5 FEET SO THEY ARE NOT PERFECTLY ALIGNED.
 - EXCAVATE TRENCHES AS SHOWN TO PLACE LAYER 2 FULL TREES AND SUPER XL LOG. MEET MINIMUM BURIAL REQUIREMENTS SPECIFIED ON THIS SHEET.
 - MEASURE TRENCH DEPTH TO ENSURE BACKFILL REQUIREMENTS ARE MET AND INSTALL LAYER 2 FULL TREES AND SUPER XL LOG IN TRENCHES AS SHOWN. THE CONTRACTOR MUST RECEIVE APPROVAL FROM OPR PRIOR TO BACKFILL AND COMPACTION OF THESE MEMBERS.
 - ACHIEVE MINIMUM BURIAL AND BACKFILL WITH ALLUVIUM. COMPACT TO FIRM UNYIELDING CONDITION AND WASH IN FINES TO INCREASE BACKFILL DENSITY IN LIFTS NOT TO EXCEED 24".
 - SALVAGE AND PLACE BOULDERS BRACED AGAINST LAYER 1 AND LAYER 2 FULL TREES AND THE SUPER XL LOG TO PREVENT ROTATION AND SLIDING AT THE DIRECTION OF THE OPR.
 - INSTALL PILES AS SHOWN AND AS DIRECTED BY THE OPR TO A MINIMUM EMBEDMENT DEPTH OF 12'. PILES SHOULD BE ARRANGED IN FRONT OF THE LAYER 1 FULL TREES IN A MATRIX THAT ALLOWS FULL TREES IN LAYERS 4, 5, AND 6 TO BE WOVEN BETWEEN THE PILES. ALTERNATIVELY, THE CONTRACTOR MAY INSTALL PILES AFTER PLACEMENT OF LAYER 4, 5 AND 6 FULL TREES IF DEMONSTRATED THAT THIS IS MORE EFFECTIVE.
 - INSTALL LAYER 4 FULL TREES ANGLED ACROSS THE FACE OF THE STRUCTURE AS SHOWN AND BRACED AGAINST PILES TO PREVENT SLIDING AND ROTATION.
- INSTALL LAYER 5 AND 6 FULL TREES ANGLED ACROSS THE FACE OF THE STRUCTURE AS SHOWN AND BRACED AGAINST PILES TO PREVENT SLIDING AND ROTATION. THESE TREES SHALL OVERLAP AND BE STACKED ON TOP OF PREVIOUS LAYERS.
- INSTALL THREE PILES ON UPSTREAM END OF STRUCTURE SUCH THAT THE PILES PIN LAYER 6 LOGS INTO PLACE AND ENSURE LOG TO PILE CONTACT.
- PILES TO BE DRIVEN WITH EXCAVATOR MOUNTED VIBRATORY OR IMPACT STYLE PILE DRIVER. CONTRACTOR SHALL EXCAVATE A STARTER TRENCH OR PIT TO THE ESTIMATED SCOUR DEPTH (7') AND THEN DRIVE PILES INTO THIS PIT TO ACHIEVE MINIMUM EMBEDMENT. CONTRACTOR SHALL REPLACE AND COMPACT EXCAVATED MATERIAL PER NOTE 1.4.
- INSTALL SMALL LOGS (RACKING) AND SLASH BETWEEN FULL TREES AT EACH STEP. SLASH SHALL HAVE IRREGULAR AND NATURAL APPEARANCE AND NOT BE NEATLY STACKED. SMALL LOGS AND SLASH SHALL BE OF THE QUANTITY DISPLAYED IN THE PIECE SUMMARY OR TO FILL VOIDS BETWEEN LOGS AND ROOTWAD AT FACE OF STRUCTURE.
- LAYER 2 FULL TREES W/ ROOTWADS AND SUPER XL LOG SHALL BE BURIED THEIR FULL LENGTH (DO NOT BURY ROOTWAD) WITH A MIN AVERAGE BACKFILL DEPTH OF 5' MEASURED FROM THE TOP OF THE LOG ON THE SMALL END.
- BOULDERS SHALL BE SALVAGED ON SITE AT THE DIRECTION OF THE OPR AND SHALL BE PLACED ADJACENT TO AND ON TOP OF LOGS AS SHOWN. VARIABLE DIAMETER BOULDERS ARE PERMISSIBLE AT THE DIRECTION OF THE OPR.

ISLAND FORMING JAM

PIECE SUMMARY

PIECE	QTY	LENGTH	DBH
FULL TREE	22	MIN 90'	MIN 18"
FULL TREE W/ RW	10	MIN 90'	MIN 18"
SUPER XL LOG W/ RW	1	60'	MIN 45"
SMALL LOG	60	20'-40'	9"-12"
SLASH (CY)	60	0-20'	<6"
PILE	22	25'	10"-16"
BOULDERS	7	N.A.	MIN 4'
EXCAVATION (CY)	300	N.A.	N.A.

WOOD LEGEND



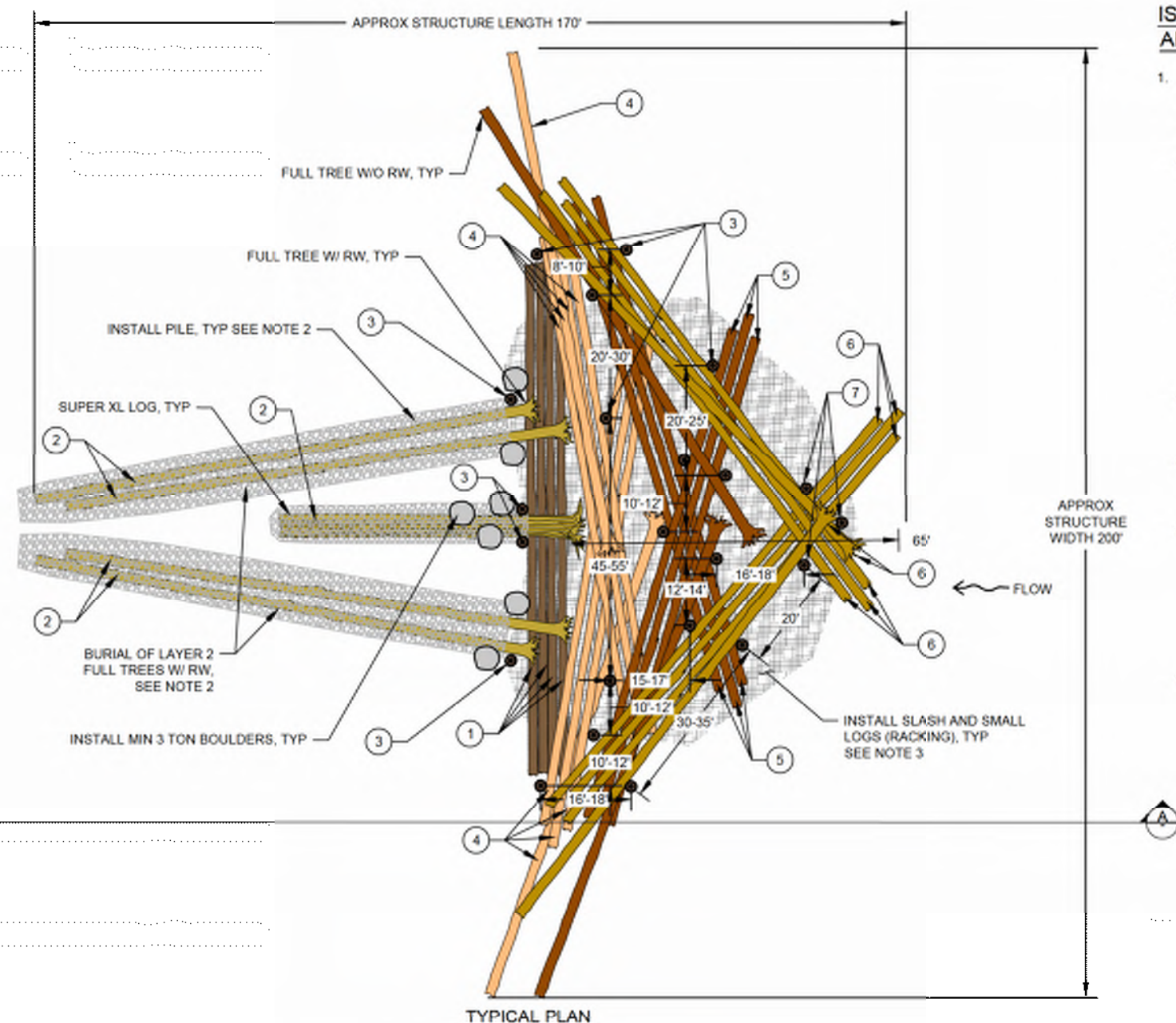
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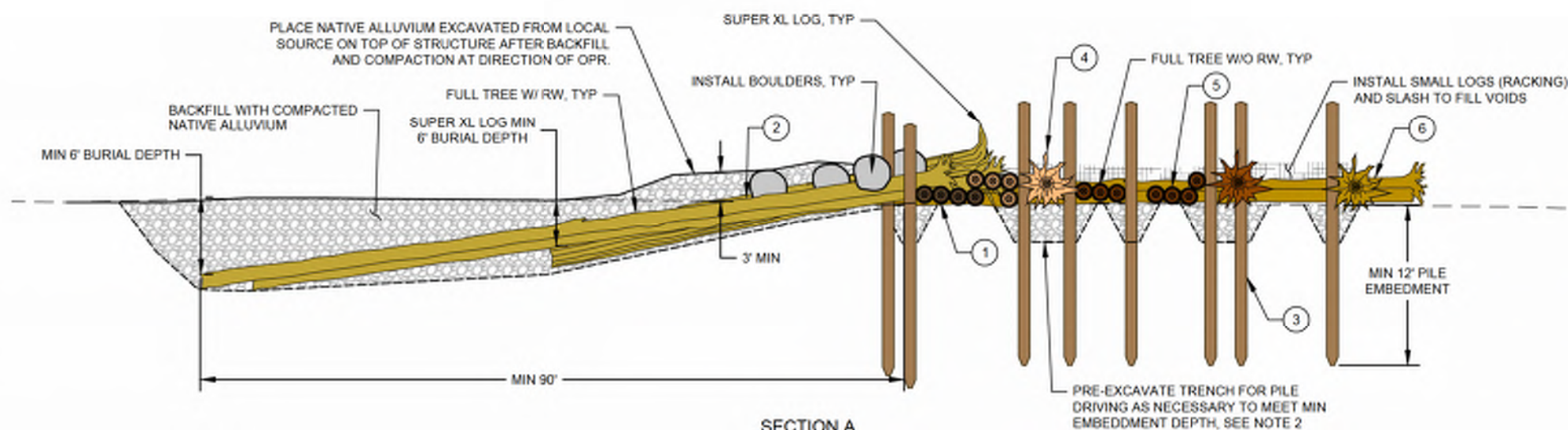
BOULDER



DENOTES PLACEMENT ORDER



TYPICAL PLAN



SECTION A

1 WHS TYPE 11 - ISLAND FORMING JAM

NOT TO SCALE



WOLF WATER RESOURCES, INC.
1501 SE WATER AVE. SUITE #160
PORTLAND, OR 97214
503.207.9933

LOWER COLUMBIA FISH
ENHANCEMENT GROUP
11015 NE 51ST CIRCL
VANCOUVER, WA 98682
360.882.6601

LOWER COLUMBIA FISH
ENHANCEMENT GROUP
SOUTH FORK TOUTLE RIVER
HEADWATERS DESIGN
COWLITZ COUNTY, WA

WHS TYPE 12 & 13
DETAILS

REVISION NUMBER

No.	Date	Revised

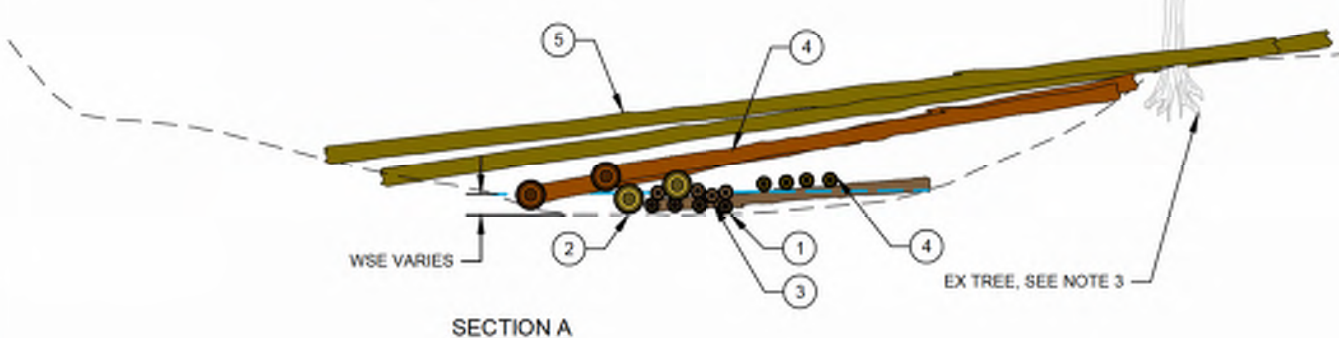
Date: 11/11/2024
Designed By: LE
Drawn By: LH, LE
Checked By: CL

SCALE
1" = 10'

JOB NO.
20200001

SHEET NO.
C6.9

42 OF 57



1 WHS TYPE 12 - TRIBUTARY HELICOPTER WOOD PLACEMENT

TRIBUTARY HELICOPTER WOOD PLACEMENT INSTALLATION NOTES:

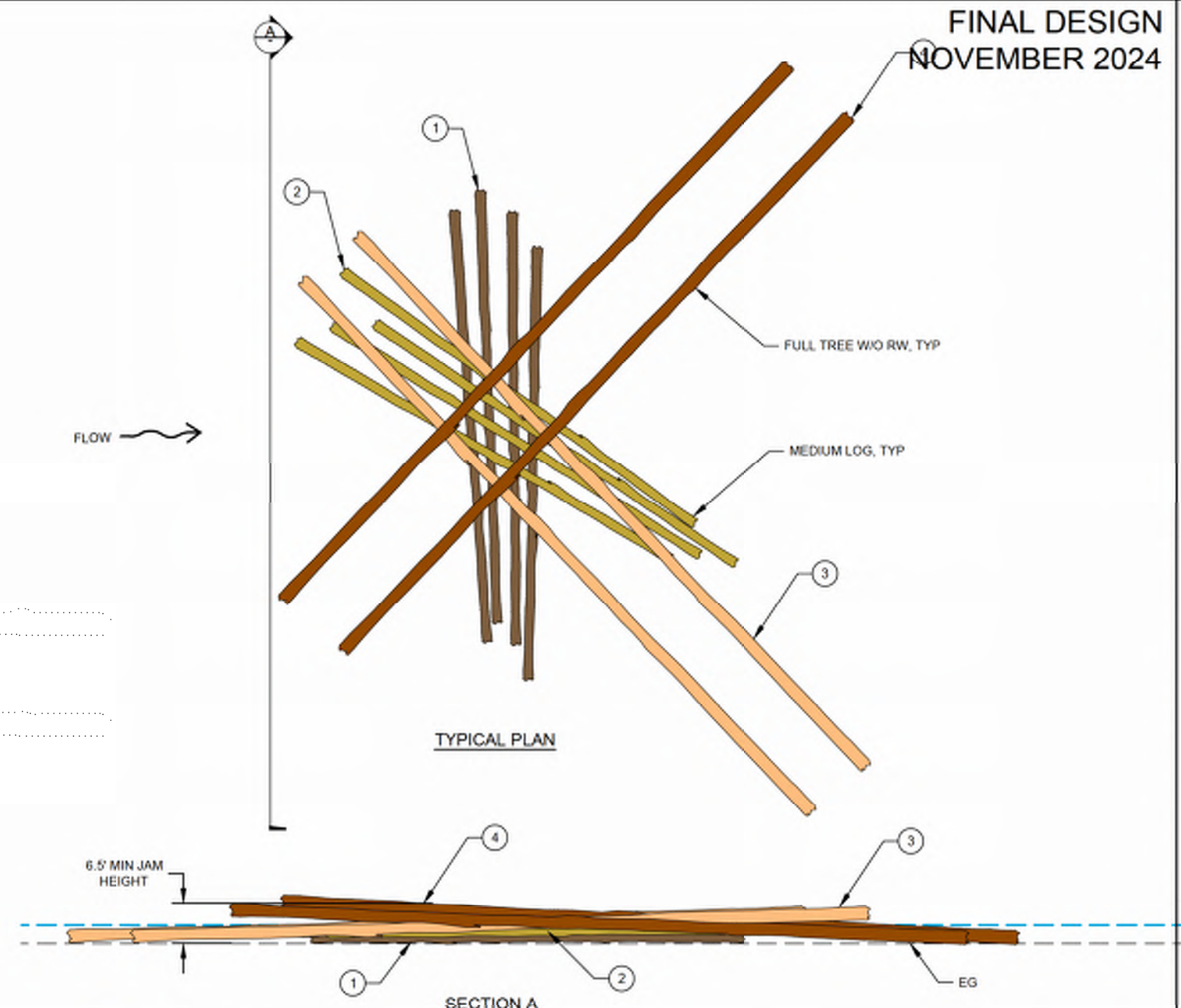
1. TRIBUTARY HELICOPTER WOOD PLACEMENT SHALL CONSIST OF FULL TREES, MEDIUM LOGS AND SMALL LOGS PER TABLE 1 ON THIS SHEET.
2. LOGS SHALL BE PLACED IN MULTIPLE HELICOPTER TURNS AT THE DIRECTION OF THE OPR TO ACHIEVE AN INTERLOCKED AND OVERLAPPING MATRIX OF WOOD WITH SOME MEMBERS IN THE CHANNEL AND OTHER MEMBERS LEANING DOWN FROM THE CHANNEL BANK AS SHOWN IN THIS DETAIL.
3. BRACE LOGS AND FULL TREES AGAINST EXISTING LIVE TREES ON THE BANKS WHERE POSSIBLE.
4. SMALL LOGS AND SLASH BUNDLES NOT SHOWN FOR CLARITY.
5. SLASH BUNDLES SHALL BE THE MAXIMUM SIZE BUNDLE OF BRANCHES, TREE TOPS AND ORGANIC DEBRIS THAT CAN BE TRANSPORTED AND DROPPED BY HELICOPTER IN ONE TURN.

WOOD LEGEND



TABLE 1- TRIBUTARY HELICOPTER WOOD LOADING SUMMARY

TRIBUTARY NAME	SF TOUTLE RIVER STATION	TOTAL TREATED STREAM LENGTH (FT)	FULL TREES PER 100 FEET	MEDIUM LOGS PER 100 FEET	SMALL LOGS PER 100 FEET	TOTAL FULL TREES	TOTAL MEDIUM LOGS	TOTAL SMALL LOGS	TOTAL SLASH BUNDLES
BEAR CREEK (0+00 - 12+00)	41+00	1300	6	9	0	78	117	0	13
BEAR CREEK (12+00 - 21+00)	41+00	900	3	4	0	27	36	0	9
HARRINGTON CREEK	100+00	500	3	0	0	15	0	0	5
LITTLE COW SPRINGS	130+00	500	0	3	12	0	15	60	5
LITTLE COW CREEK	155+00	1100	3	0	0	33	0	0	11
CADDIS CREEK (0+00 - 6+00)	190+00	600	0	3	10	0	18	60	6
CADDIS CREEK (6+00 - 22+00)	190+00	1600	0	0	0	0	0	0	16



2 WHS TYPE 13 - FLOODPLAIN HELICOPTER JAM

NOT TO SCALE

FLOODPLAIN HELICOPTER JAM INSTALLATION NOTES:

1. FULL TREES AND MEDIUM LOGS SHALL BE PLACED SEQUENTIALLY AS SHOWN ON THIS SHEET.
2. WOOD SHALL BE CONSTRUCTED BY HELICOPTER PLACEMENT IN FOUR TURNS.
 - A. TURN #1 - PLACE 3-4 PARALLEL MEDIUM LOGS TO FORM THE STRUCTURE FOUNDATION.
 - B. TURN #2 - PLACE 3-4 MEDIUM LOGS ON TOP OF LAYER 1 MEDIUM LOGS.
 - C. TURN #3-4 - PLACE 2 FULL TREES LEANING ON TOP OF OTHER LOGS TO PIN WOOD DOWN. PULL BUTTS OF LOGS TO DOWNSTREAM SIDE OF STRUCTURE.
3. FULL TREES SHALL HAVE BRANCHES ATTACHED, THESE ARE NOT SHOWN FOR CLARITY.
4. FLOODPLAIN JAMS SHALL BE PLACED IN SIDE CHANNELS AND LOW ELEVATION FLOODPLAIN AREAS AS SHOWN ON THE PLANS.

FLOODPLAIN HELICOPTER JAM

PIECE	QTY	LENGTH	DBH
FULL TREE W/O RW	4	MIN 90'	MIN 18"
MEDIUM LOG	8	40'-60'	MIN 12"

FINAL DESIGN
NOVEMBER 2024



WOLF WATER RESOURCES, INC.
1501 SE WATER AVE. SUITE #160
PORTLAND, OR 97214
503.207.9933

LOWER COLUMBIA FISH
ENHANCEMENT GROUP
11015 NE 51ST CIRCL
VANCOUVER, WA 98662
360.882.6601

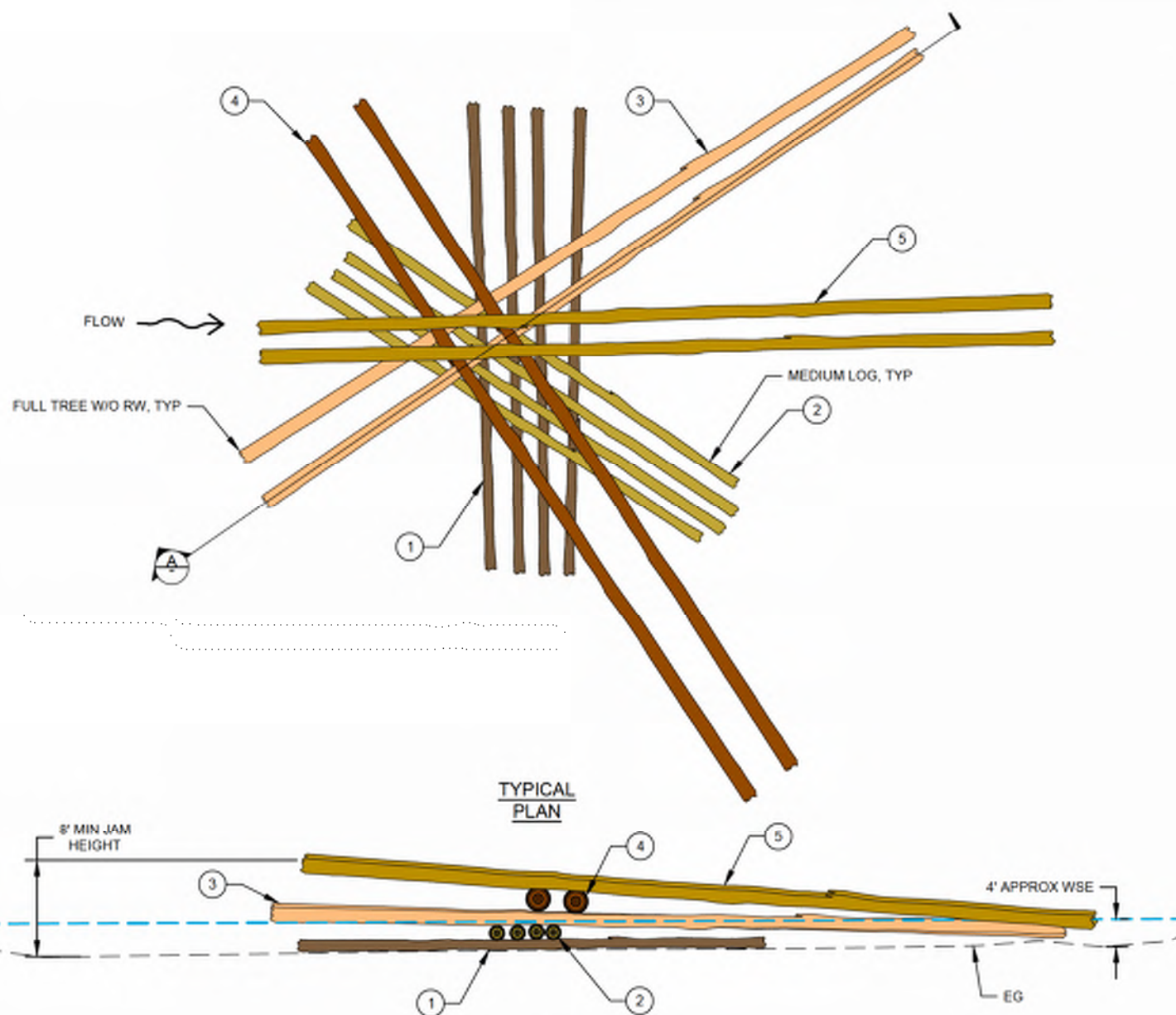
LOWER COLUMBIA FISH
ENHANCEMENT GROUP
SOUTH FORK TOUTLE RIVER
HEADWATERS DESIGN
COWLITZ COUNTY, WA

WHS TYPE 14 &
15 DETAILS

REVISION NUMBER

No.	Date	Revised
1	11/11/2024	Designed By LE
2		Checked By CL
3		
4		
5		
6		
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JOB NO. 20200001
SHEET NO. C6.10
43 OF 57



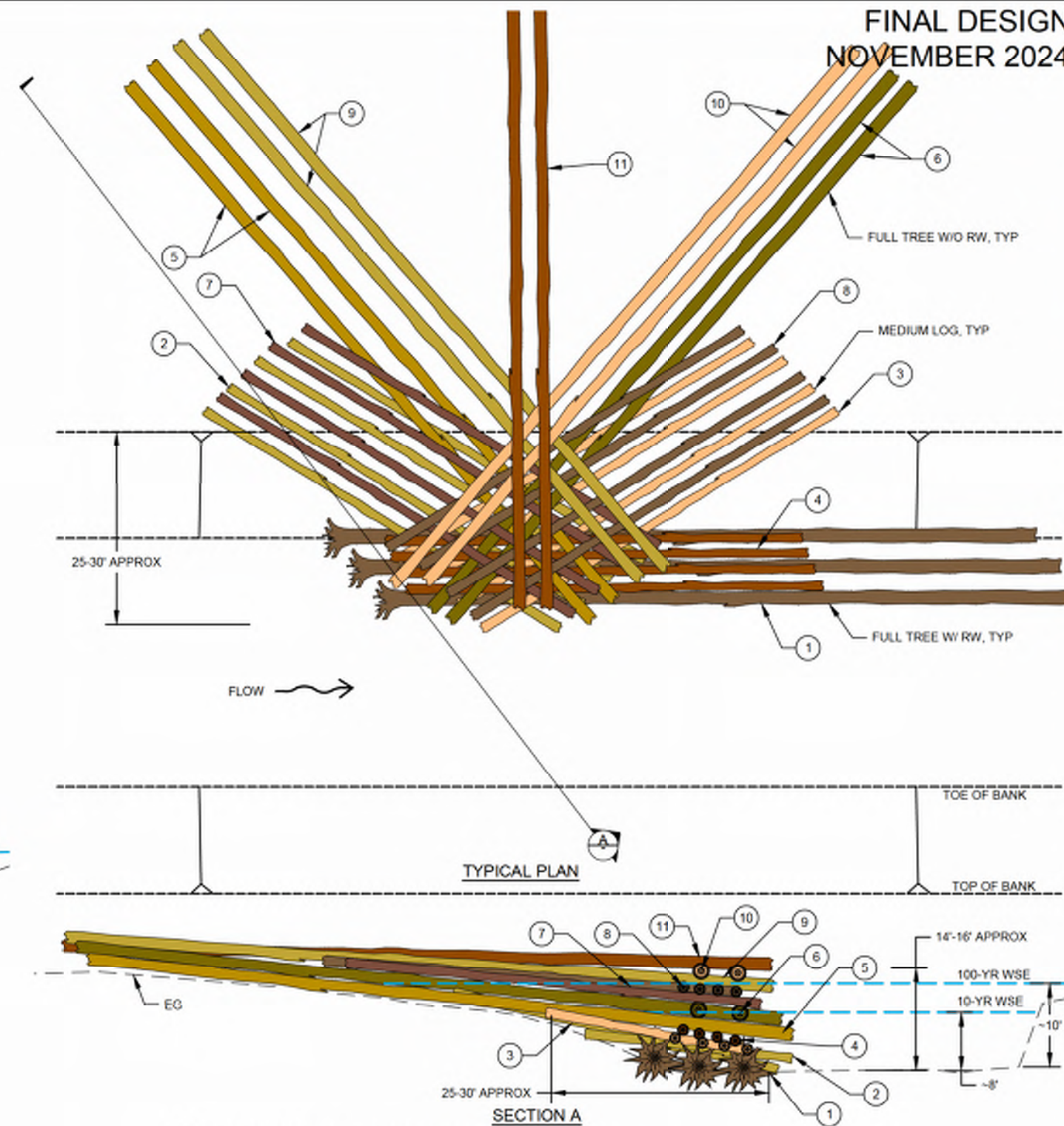
1 WHS TYPE 14 - SMALL HELICOPTER JAM
NOT TO SCALE

SMALL HELICOPTER JAM

PIECE	QTY	LENGTH	DBH
FULL TREE W/O RW	6	MIN 90'	MIN 18"
MEDIUM LOG	8	40'-60'	MIN 12"

SMALL HELICOPTER JAM INSTALLATION NOTES:

- FULL TREES, MEDIUM LOGS, AND SMALL LOGS SHALL BE PLACED SEQUENTIALLY AS SHOWN ON THIS SHEET. LOGS SHALL BE PLACED BY HELICOPTER.
- WOOD SHALL BE CONSTRUCTED BY HELICOPTER PLACEMENT IN FOUR LOADS/TURNS.
 - TURN #1 - PLACE 4 MEDIUM LOGS AS LAYER 1.
 - TURN #2 - PLACE 4 MEDIUM LOGS AS LAYER 2.
 - TURN #3 - PLACE 2 FULL TREES LEANING ON TOP OF THE MEDIUM LOGS AS LAYER #3.
 - TURN #4 - PLACE 2 FULL TREES LEANING PERPENDICULAR TO AND ON TOP OF THE LAYER 3 FULL TREES.
 - TURN #5 - PLACE 2 FULL TREES LEANING AGAINST PILED LAYERS SUCH THAT ALL WOOD BELOW IS PINNED BY THE TOP OF LOGS.
- FULL TREES SHALL HAVE BRANCHES ATTACHED, THESE ARE NOT SHOWN FOR CLARITY.



2 WHS TYPE 15 - LARGE HELICOPTER JAM
NOT TO SCALE

LARGE HELICOPTER JAM INSTALLATION NOTES:

- FULL TREES AND MEDIUM LOGS SHALL BE PLACED SEQUENTIALLY AS SHOWN ON THIS SHEET. LOGS SHALL BE PLACED BY HELICOPTER.
- BRACE LOGS AND FULL TREES AGAINST EXISTING LIVE TREES ON THE BANKS WHERE POSSIBLE.
- WOOD SHALL BE CONSTRUCTED BY HELICOPTER PLACEMENT IN 14 LOADS/TURNS.
 - TURN #1-2 - PLACE 3 FULL TREES W/ ROOTWADS, PARALLEL TO FLOW IN THE CHANNEL.
 - TURN #3 - PLACE 4 MEDIUM LOGS IN LAYER 2 AS SHOWN.
 - TURN #4 - PLACE 4 MEDIUM LOGS PERPENDICULAR TO PREVIOUSLY PLACED LOGS IN LAYER 3 AS SHOWN.
 - TURN #5 - PLACE 4 MEDIUM LOGS IN LAYER 4, PARALLEL TO FLOW IN CHANNEL.
 - TURN #6 - PLACE 2 FULL TREES IN LAYER 5, LEANING ON TOP OF LOGS FROM THE CHANNEL BANK.
 - TURN #7 - PLACE 2 FULL TREES IN LAYER 6, LEANING ON TOP OF LOGS FROM THE CHANNEL BANK.
 - TURN #8 - PLACE 4 MEDIUM LOGS IN LAYER 7 AS SHOWN.
 - TURN #9 - PLACE 4 MEDIUM LOGS PERPENDICULAR TO PREVIOUSLY PLACED LOGS IN LAYER 6 AS SHOWN.
 - TURN #10 - PLACE 2 FULL TREES IN LAYER 8, LEANING ON TOP OF LOGS FROM THE CHANNEL BANK.
 - TURN #11 - PLACE 2 FULL TREES IN LAYER 10, LEANING ON TOP OF LOGS FROM THE CHANNEL BANK.
 - TURN #12 - PLACE 2 FULL TREES IN LAYER 11, PERPENDICULAR TO FLOW.
- FULL TREES SHALL HAVE BRANCHES ATTACHED, THESE ARE NOT SHOWN FOR CLARITY.

LARGE HELICOPTER JAM

PIECE	QTY	LENGTH	DBH
FULL TREE W/O RW	10	MIN 90'	MIN 18"
FULL TREE W/ RW	3	MIN 90'	MIN 18"
MEDIUM LOG	20	40'-60'	MIN 12"



LOWER COLUMBIA FISH
ENHANCEMENT GROUP
SOUTH FORK TOUTLE RIVER
HEADWATERS DESIGN
COWLITZ COUNTY, WA

WHS TYPE 16 DETAIL

LARGE HELICOPTER DRIFT PILE JAM INSTALLATION NOTES:

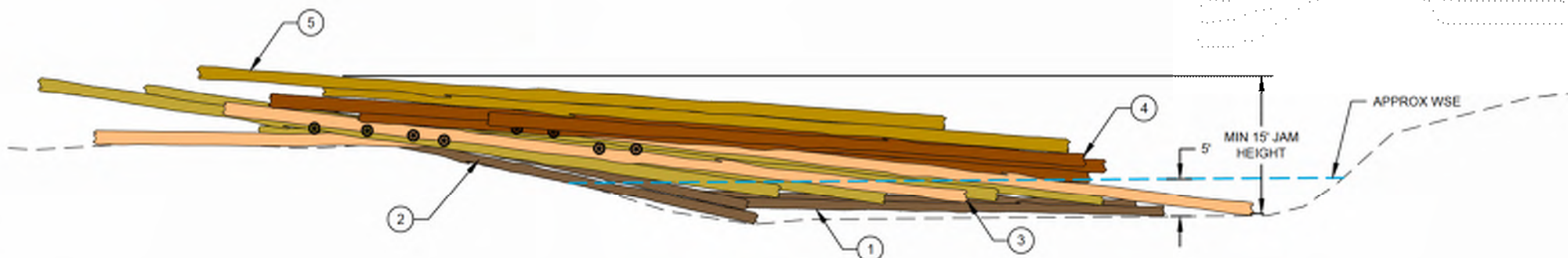
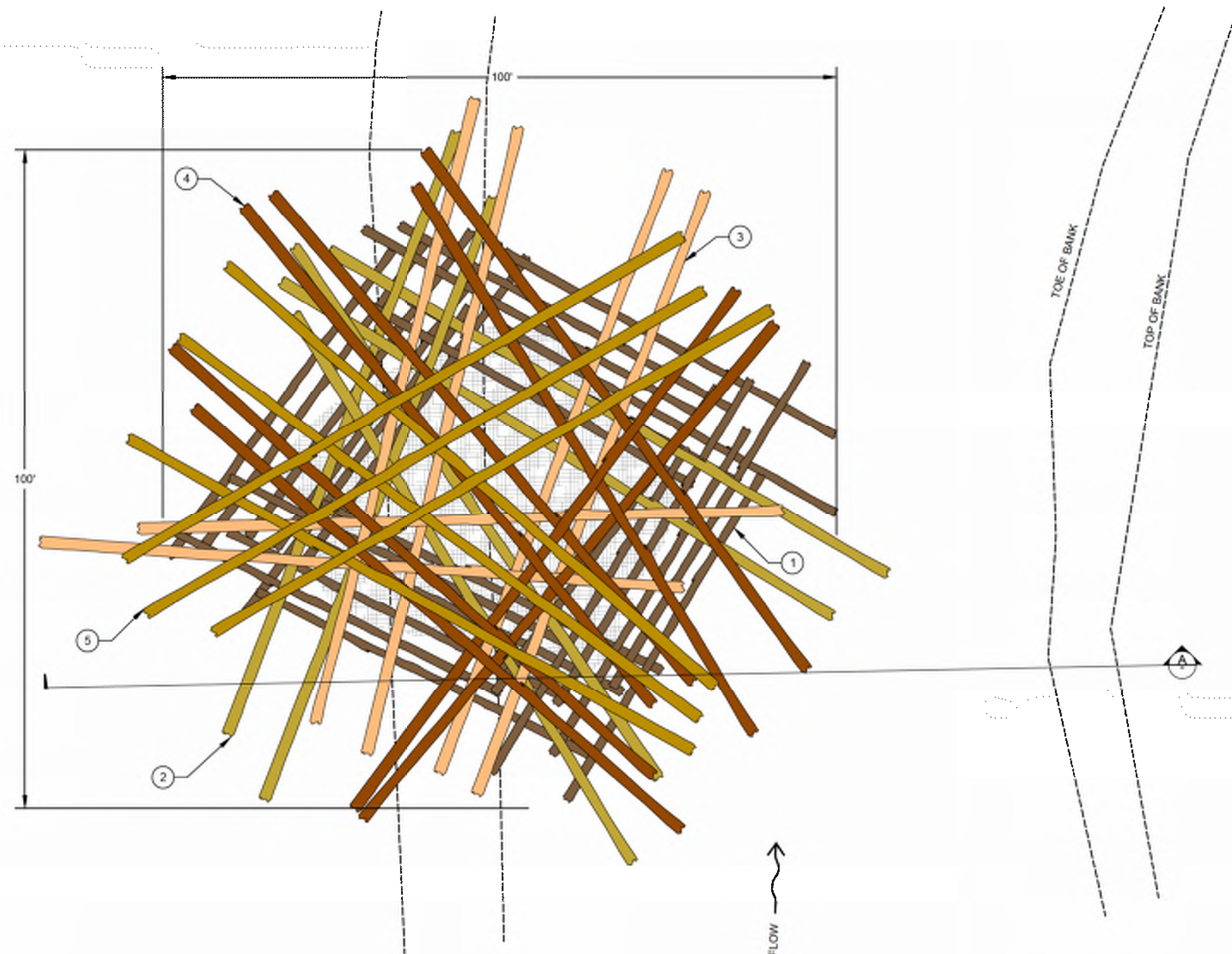
- FULL TREES AND MEDIUM LOGS SHALL BE PLACED SEQUENTIALLY AS SHOWN ON THIS SHEET. LOGS SHALL BE PLACED BY HELICOPTER.
- WOOD SHALL BE CONSTRUCTED BY HELICOPTER PLACEMENT IN FIVE LAYERS AND 20 TURNS.
 - TURN #1-8 - PLACE 24 MEDIUM LOGS IN LAYER 1 AS SHOWN.
 - TURN #9-11 - PLACE 6 FULL TREES IN LAYER 2 AS SHOWN.
 - TURN #12-14 - PLACE 6 FULL TREES IN LAYER 3 AS SHOWN.
 - TURN #15-17 - PLACE 6 FULL TREES IN LAYER 4 AS SHOWN.
 - TURN #18-20 - PLACE 6 FULL TREES IN LAYER 5 AS SHOWN.
- FULL TREES AND MEDIUM LOGS SHALL BE PLACED PARALLEL WITHIN TURNS AND PERPENDICULAR TO WOOD PLACED PRIOR.
- FULL TREES SHALL HAVE BRANCHES ATTACHED, THESE ARE NOT SHOWN FOR CLARITY.

LARGE DRIFT PILE JAM

PIECE SUMMARY			
PIECE	QTY	LENGTH	DBH
FULL TREE W/O RW	26	MIN 90'	MIN 18"
MEDIUM LOG	24	40'-60'	MIN 12"

WOOD LEGEND

- LAYER 1 FULL TREE
- LAYER 2 FULL TREE
- LAYER 3 FULL TREE
- LAYER 4 FULL TREE
- LAYER 5 FULL TREE
- MEDIUM LOG
- ① DENOTES PLACEMENT ORDER



1 WHS TYPE 16 - LARGE HELICOPTER DRIFT PILE JAM
NOT TO SCALE

REVISION NUMBER

No.	Date	Revised

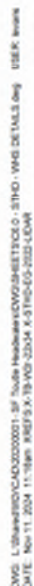
Date: 11/11/2024
Designed By: LE
Drawn By: LH, LE
Checked By: CL

SCALE: 1" = 10'

JOB NO. 20200001

SHEET NO. C6.11

44 OF 57





LOWER COLUMBIA FISH
ENHANCEMENT GROUP
SOUTH FORK TOUTLE RIVER
HEADWATERS DESIGN
COWLITZ COUNTY, WA

WHS HARDWARE &
BALLAST DETAILS

REVISION NUMBER

No.	Date	Revised

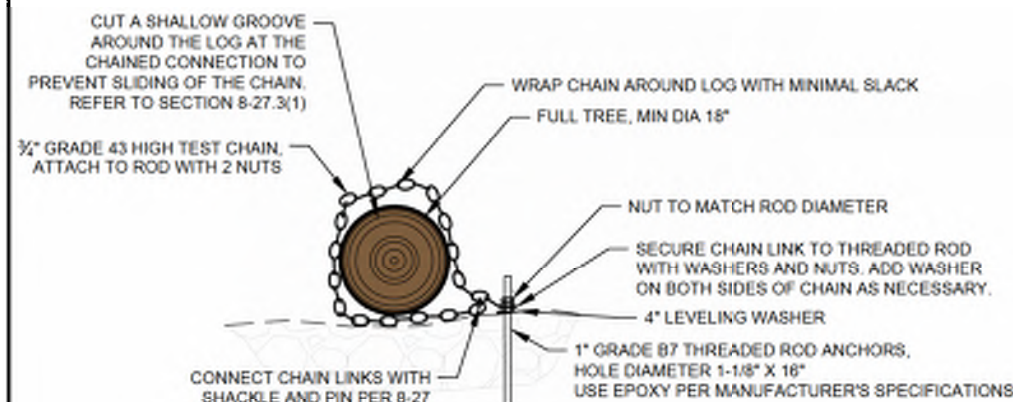
Date: 11/11/2024
Designed By: LE
Drawn By: LH, LE
Checked By: CL

SCALE
1" = 10'

JOB NO.
20200001

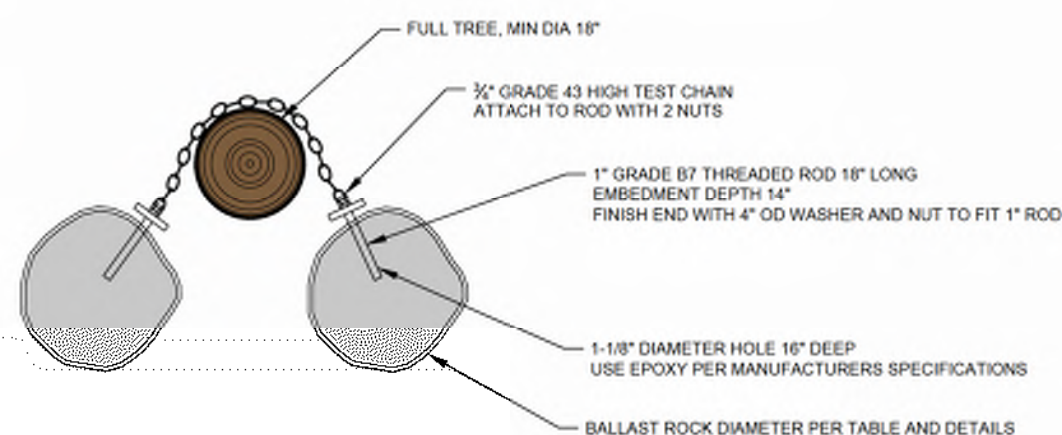
SHEET NO.
C6.13

46 OF 57



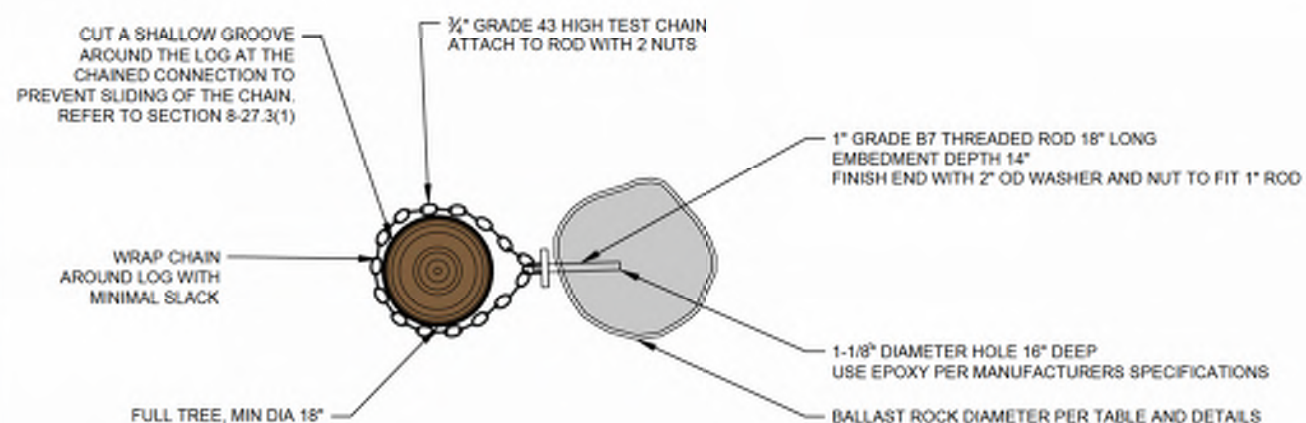
1 TYPICAL HARDWARE CONNECTION TYPE I

NOT TO SCALE



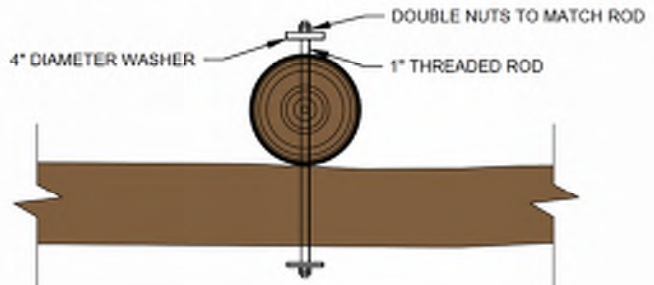
2 TYPICAL HARDWARE CONNECTION TYPE II

NOT TO SCALE



3 TYPICAL HARDWARE CONNECTION TYPE III

NOT TO SCALE



4 TYPICAL HARDWARE CONNECTION TYPE IV

NOT TO SCALE

HARDWARE HAUL QUANTITIES PER WHS

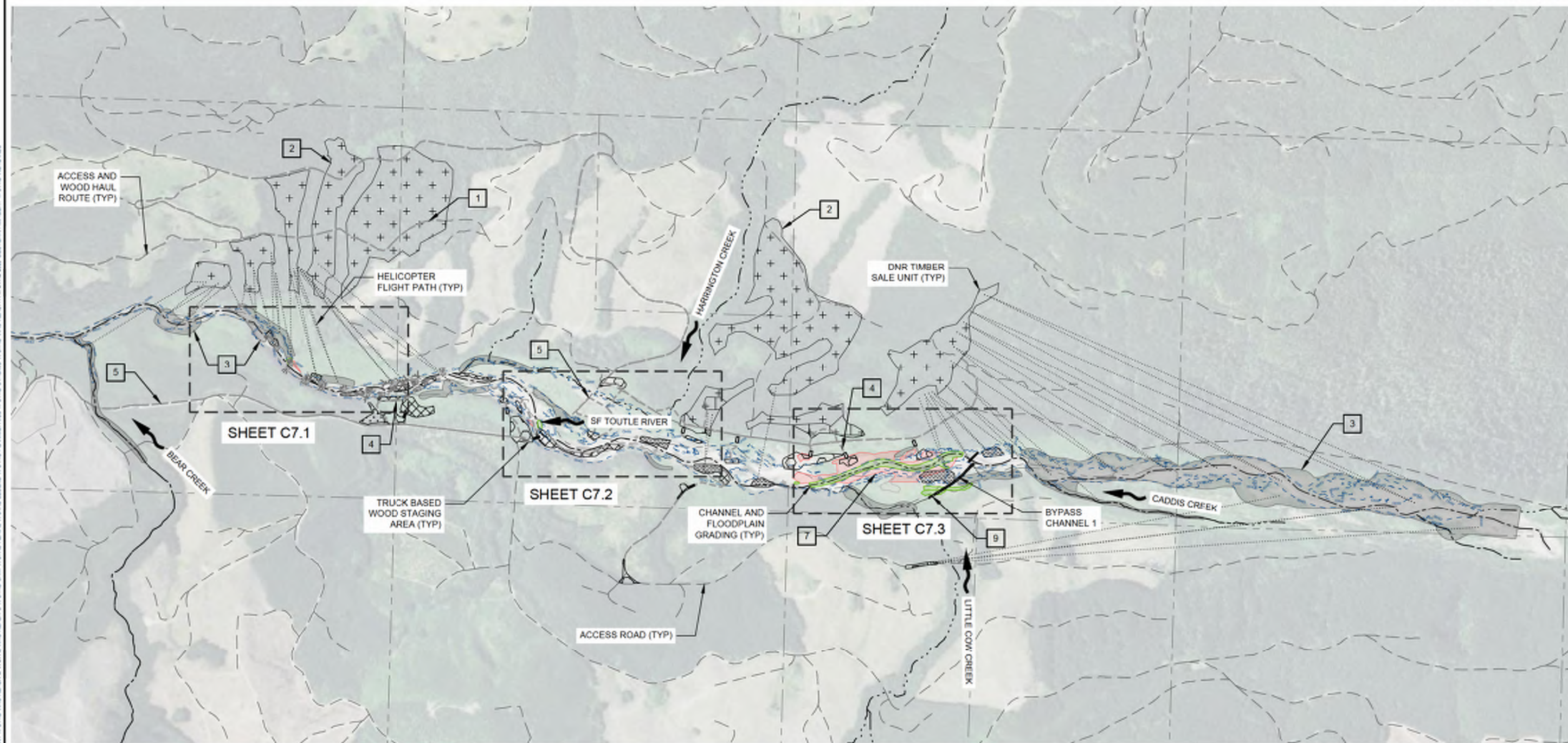
WHS TYPE	THREADED ROD LENGTH (FT)	CHAIN LENGTH (FT)
LARGE JAM	12	0
CHANNEL SPANNING JAM	96	40
WOOD MATRIX STA 103+50 TO 107+00	400	500
BEDROCK AND MISC BOULDERS	100	100

BOULDER BALLAST EQUIVALENTS TABLE

BOULDER DIAMETER FEET	BOULDER DRY WEIGHT TON	BUOYANT BOULDER WEIGHT TON	EQUIVALENT NUMBER OF PILES EMBEDDED MIN 5' BELOW SCOUR #	EQUIVALENT NUMBER OF PILES EMBEDDED MIN 7' BELOW SCOUR #	EQUIVALENT LENGTH OF MEDIUM LOG BURIAL PER SPECIFIED BACKFILL DEPTH BELOW						
					2 FOOT DEPTH	2.5 FOOT DEPTH	3 FOOT DEPTH	3.5 FOOT DEPTH	4 FOOT DEPTH	5 FOOT DEPTH	6 FOOT DEPTH
2	0.3	0.2	0.1	0.0	3	2	2	2	2	1	1
2.5	0.6	0.3	0.1	0.1	5	4	3	3	3	2	2
3	1.0	0.6	0.2	0.1	8	6	5	5	4	3	3
3.5	1.6	0.9	0.4	0.2	12	10	8	7	6	5	4
4	2.4	1.4	0.5	0.3	18	15	12	11	9	8	6
5	5	2.7	1	0.5	35	28	23	20	18	14	12
6	8	4.7	2	1	60	48	40	34	30	24	20
7	13	8	3	2	95	76	63	54	48	38	32
8	20	11	5	3	141	113	94	81	71	57	47
10	36	22	9	5	275	220	184	158	138	110	92

BOULDER BALLAST NOTES

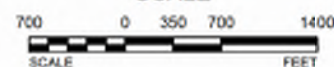
- AT THE DIRECTION OF THE OPR, SALVAGED BOULDERS THAT ARE CONNECTED WITH HARDWARE TO WHS STRUCTURES MAY BE APPLIED AS BALLAST TO SATISFY BURIAL REQUIREMENTS SPECIFIED FOR THE STRUCTURE. BOULDER BALLAST CAN BE SUBSTITUTED FOR AN EQUIVALENT WEIGHT OF BALLAST THAT WOULD OTHERWISE BE MET FROM LOG BURIAL/BACKFILL. SIMILARLY, BOULDERS MAY BE SUBSTITUTED FOR AN EQUIVALENT BALLAST ACHIEVED FROM PILE EMBEDMENT PER THE BOULDER BALLAST EQUIVALENTS TABLE ON THIS SHEET.
- THE CONTRACTOR MAY NOT REDUCE BURIAL REQUIREMENTS NOR REDUCE THE NUMBER OF PILES IN A STRUCTURE UNLESS APPROVED BY THE OPR.
- FOR THIS SUBSTITUTION TO BE APPROVED BY THE OPR, BOULDERS MUST BE WEIGHED IN THE FIELD, OR AN AVERAGE DIAMETER CALCULATED, AND CONVERTED TO BOULDER DRY WEIGHT USING THE BOULDER BALLAST EQUIVALENTS TABLE. THE "BUOYANT WEIGHT" IS THE ACTUAL WEIGHT ACTING ON THE STRUCTURE WHILE THE BOULDER IS SUBMERGED.
- THE CONTRACTOR SHALL REFERENCE THE APPROPRIATE ROW IN THE BOULDER BALLAST EQUIVALENTS TABLE FOR THE DRY WEIGHT OR BOULDER DIAMETER MATCHING THE SALVAGED BOULDER IN QUESTION. THE EQUIVALENT MEDIUM LOG BURIAL LENGTH TO ACHIEVE THAT BALLAST SHALL BE SELECTED FROM THE TABLE; THIS BURIAL LENGTH MAY BE REMOVED FROM BURIAL/BACKFILL REQUIREMENTS UPON APPROVAL FROM THE OPR. FOR EXAMPLE, IF A MEDIUM LOG WAS SPECIFIED TO HAVE 5' OF AVERAGE BURIAL DEPTH FOR 30 FEET OF ITS LENGTH, AND A SALVAGED BOULDER WAS EQUIVALENT IN MASS TO 10 FEET OF BURIAL LENGTH AT THAT DEPTH, THE MEDIUM LOG WOULD ONLY NEED BURIAL FOR 20 FEET OF ITS LENGTH.
- THE NUMBER OF HARDWARE CONNECTED PILES MAY BE REDUCED AT THE DIRECTION OF THE OPR IN A SIMILAR MANNER TO THE PROCESS DESCRIBED IN NOTE #4.
- THE BURIAL DEPTHS SPECIFIED IN THE BOULDER BALLAST EQUIVALENTS TABLE ARE AVERAGE DEPTHS RATHER THAN THE DEPTH MEASURED AT THE DEEPEST POINT OF BACKFILL.
- BOULDERS CANNOT BE SUBSTITUTED FOR PILE EMBEDMENT UNLESS PILES ARE CONNECTED WITH HARDWARE TO WHS STRUCTURES.
- THE BALLAST EQUIVALENTS TABLE WAS CALCULATED WITH ASSUMED TYPICAL CONDITIONS FOR BOULDER DENSITY, BACKFILL DENSITY, PILE SKIN FRICTION AND BACKFILLED LOG SIZE. THESE CONDITIONS MAY DIFFER IN THE FIELD. THE OPR MAY SPECIFY ADJUSTED BALLAST REQUIREMENTS TO MATCH FIELD CONDITIONS. ASSUMPTIONS ARE LISTED HERE:
 - BOULDER DRY WEIGHT ASSUMES A UNIT WEIGHT OF 146 LB PER CUBIC FOOT.
 - THE EQUIVALENT NUMBER OF EMBEDDED PILES ARE CALCULATED FROM PILE SKIN FRICTION ASSUMING A 1.5 FACTOR FOR THE COEFFICIENT OF LATERAL EARTH PRESSURE INFORMED BY PILE DRIVING TESTS.
 - EQUIVALENT BACKFILL LENGTH ASSUMES BACKFILL IS WITH LARGE COBBLE WITH UNIT WEIGHT OF 142 LB PER CUBIC FOOT. THE TYPICAL LOG TO BE BACKFILLED IS A MEDIUM LOG WITH AVERAGE 12" DIAMETER.



SCALE: 1"=700'



SCALE



PHASE I: TIMBER HARVEST AND HELICOPTER PLACEMENT (BEFORE WW)

- ☐ CONSTRUCT ACCESS AND HAUL ROADS WITHIN DNR TIMBER SALE UNITS. IMPROVE EXISTING FOREST ROADS INCLUDING THE 4100 RD, 5100 RD AND 4100M RD AS NECESSARY TO HAUL INTACT 90' LONG LOGS TO PROPOSED GROUND BASED STAGING AREAS SHOWN IN SHEETS C2.1-C2.4.
- ☐ HARVEST TIMBER FROM DNR TIMBER SALE UNITS. DECK AND STAGE TREES FOR GROUND-BASED AND HELICOPTER TRANSPORTATION TO STAGING AREAS SHOWN IN SHEETS C2.1-C2.4.
- ☐ CONSTRUCT ALL WHS WITHIN HELICOPTER PLACEMENT AREAS AND TRANSPORT TREES VIA HELICOPTER TO THE HELICOPTER BASED STAGING AREAS SHOWN IN SHEETS C2.1-C2.4. REFER TO ACCESS, STAGING AND HELICOPTER PLANS.

PHASE II- WHS CONSTRUCTION AND GRADING (BEFORE IWW)

- ☐ CONSTRUCT FLOODPLAIN STAGING AREAS AND WOOD HAUL/YARD ROUTES, MOBILIZE EQUIPMENT.
- ☐ HAUL TREES ALONG THE 5100, 4100 AND 4100M ROADS TO DESIGNATED TRUCK BASED STAGING AREAS. YARD TREES WITH GRAPPLE SKIDDER TO DESIGNATED STAGING AREAS SHOWN IN SHEETS C2.1-C2.4.
- ☐ CONSTRUCT WHS STRUCTURES THAT CAN BE ACCESSED WITHOUT WATER CROSSINGS AND ARE LOCATED OUTSIDE OF EXISTING WETLANDS AND WATERS. WHS STRUCTURE CONSTRUCTION SHOULD GENERALLY START WITHIN REACH A PROGRESS UPSTREAM.
- ☐ CONSTRUCT FLOODPLAIN CUT AREAS CONCURRENTLY. STAGE CUT MATERIAL ADJACENT TO CHANNEL FILL AREAS.

IN-WATER WORK WINDOW BEGINS (JULY 16TH)

- ☐ CONSTRUCT WHS STRUCTURES LOCATED WITHIN WATERS. WHS STRUCTURE CONSTRUCTION SHOULD GENERALLY BEGIN IN REACH A AND PROGRESS UPSTREAM.
 - ☐ CONSTRUCT DIVERSION CHANNEL AND GRADUALLY DEWATER THE MAINSTEM TOUTLE RIVER CONCURRENTLY WITH FISH SALVAGE. CONSTRUCT CHANNEL FILL AND ASSOCIATED WHS STRUCTURES WITHIN DEWATERED REACH.
- WWW WORK WINDOW ENDS
- ☐ CONSTRUCT EROSION CONTROL MEASURES. CLEAN SITE AND DEMOBILIZE.

LEGEND:

- | | |
|---|--------------------------------|
|  | RIVER CENTERLINE |
|  | TRIBUTARY CENTERLINE |
|  | PARCEL BOUNDARY |
|  | ACCESS ROAD |
|  | DNR LOG HARVEST AREA |
|  | DNR STAGING AREA |
|  | HELICOPTER WOOD STAGING AREA |
|  | GROUND BASED WOOD STAGING AREA |
|  | TRUCKED WOOD STAGING AREA |
|  | ACCESS AND WOOD HAUL ROUTE |
|  | HELICOPTER FLIGHT PATH |
|  | HELICOPTER WOOD PLACEMENT |
|  | FILL AREA |
|  | CUT AREA |
|  | DENOTES CONSTRUCTION SEQUENCE |



LOWER COLUMBIA FISH
ENHANCEMENT GROUP
**SOUTH FORK TOUTLE RIVER
HEADWATERS DESIGN**
COWLITZ COUNTY, WA

**CONSTRUCTION
SEQUENCING &
WATER MANAGEMENT -
REACH A**

REVISION NUMBER

No.	Date	Revised

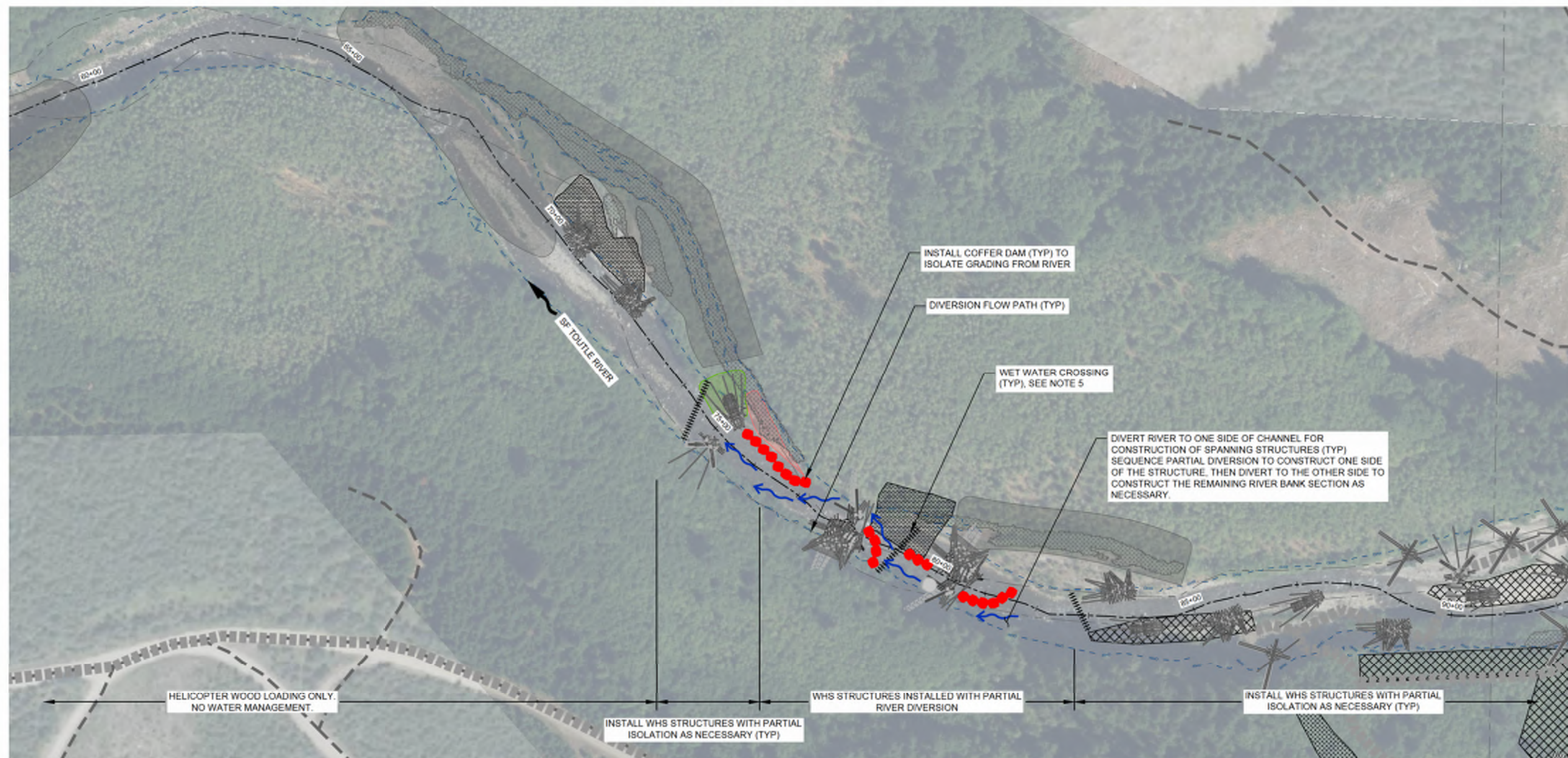
Date: 11/11/2024
Drawn By: LH, LE
Designed By: LE
Checked By: CL

SCALE
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FEET

JOB NO.
20200001

SHEET NO.
C7.1

48 OF 57



CONSTRUCTION SEQUENCING & WATER MANAGEMENT - REACH A

SCALE: 1"=100'

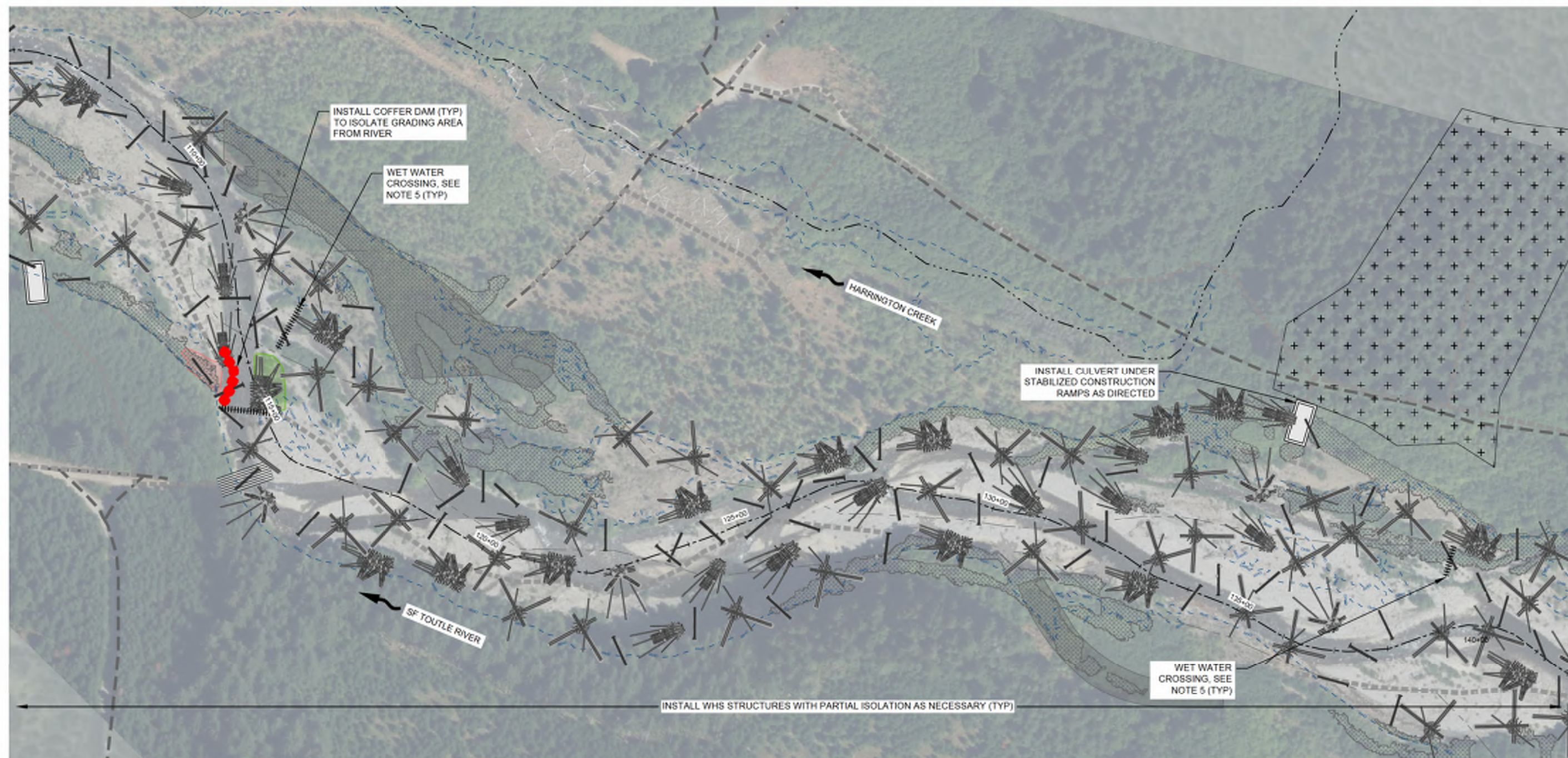
NOTES:

- CONTRACTOR SHALL BE RESPONSIBLE FOR WORK AREA ISOLATION AND/OR STREAM DIVERSIONS FOR THE PURPOSES OF WATER QUALITY PROTECTION, TURBIDITY CONTROL AND PROTECTION OF AQUATIC LIFE AND HABITAT DURING CONSTRUCTION.
- COFFER DAMS AND RIVER FLOW PATHS ON THIS SHEET SHOW CONCEPTUAL STREAM DIVERSION ALIGNMENTS THAT COULD BE USED TO MANAGE TOUTLE RIVER WATER DURING GRADING ACTIVITIES AND WHS CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SUBMITTING AN UPDATED STREAM DIVERSION AND WATER MANAGEMENT PLAN PRIOR TO DIVERTING ANY FLOW FROM THE TOUTLE RIVER.
- THE CONTRACTOR SHALL CONSTRUCT BYPASS CHANNELS PER SEQUENCING ON SHEET C7.4 AND IN SUCH A WAY THAT WATER IS GRADUALLY DIVERTED FROM THE MAINSTEM TOUTLE RIVER SO THAT FISH SALVAGE EFFORTS CAN BE THOROUGH AND COMPLETE.
- IN SOME LOCATIONS, WHS STRUCTURES ARE INSTALLED WITHIN OR ADJACENT TO THE THE MAINSTEM TOUTLE RIVER WITHOUT DIVERTING RIVER FLOW. STRUCTURES INSTALLED IN THE ACTIVE RIVER CHANNEL SHALL BE PARTIALLY ISOLATED FROM RIVER FLOW WITH AN EARTHEN

- COFFER DAM OR EQUIVALENT AND CONSTRUCTED IN SUCH A WAY THAT MINIMIZES TURBIDITY AND IMPACTS TO FISH AND WILDLIFE AND SHALL MEET WATER QUALITY STANDARDS.
- WET WATER CROSSINGS (FORDS) AND/OR TEMPORARY BRIDGES MAY BE NECESSARY IN SOME LOCATIONS TO TEMPORARILY ACCESS FLOODPLAIN ACROSS THE CHANNEL. THE CONTRACTOR SHALL NOT HAUL EARTHEN MATERIAL OR FUEL ACROSS THE WET WATER CROSSINGS UNLESS APPROVED BY THE OPR AND SHALL MINIMIZE USE OF THESE LOCATIONS TO THE GREATEST EXTENT POSSIBLE.

LEGEND:

- RIVER CENTERLINE
- TRIBUTARY CENTERLINE
- PARCEL BOUNDARY
- ACCESS ROAD
- ORDINARY HIGH WATER
- WETLANDS
- DNR LOG HARVEST AREA
- FILL AREA
- CUT AREA
- TEMPORARY EARTHEN DAM
- COFFER DAM FOR PARTIAL ISOLATION
- DIVERSION CHANNEL ALIGNMENT
- EXCAVATED DIVERSION CHANNEL
- WET WATER CROSSING (FORD)
- BYPASS FLOW PATH



SCALE: 1"=100'

1. CONTRACTOR SHALL BE RESPONSIBLE FOR WORK AREA ISOLATION AND/OR STREAM DIVERSIONS FOR THE PURPOSES OF WATER QUALITY PROTECTION, TURBIDITY CONTROL AND PROTECTION OF AQUATIC LIFE AND HABITAT DURING CONSTRUCTION.
2. COFFER DAMS AND RIVER FLOW PATHS ON THIS SHEET SHOW CONCEPTUAL, STREAM DIVERSION ALIGNMENTS THAT COULD BE USED TO MANAGE TOUTLE RIVER WATER DURING GRADING ACTIVITIES AND WHS CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SUBMITTING AN UPDATED STREAM DIVERSION AND WATER MANAGEMENT PLAN PRIOR TO DIVERTING ANY FLOW FROM THE TOUTLE RIVER.
3. THE CONTRACTOR SHALL CONSTRUCT BYPASS CHANNELS PER SEQUENCING ON SHEET C7.4 AND IN SUCH A WAY THAT WATER IS GRADUALLY DIVERTED FROM THE MAINSTEM TOUTLE RIVER SO THAT FISH SALVAGE EFFORTS CAN BE THOROUGH AND COMPLETE.
4. IN SOME LOCATIONS, WHS STRUCTURES ARE INSTALLED WITHIN OR ADJACENT TO THE MAINSTEM TOUTLE RIVER WITHOUT DIVERTING RIVER FLOW. STRUCTURES INSTALLED IN THE ACTIVE RIVER CHANNEL SHALL BE PARTIALLY ISOLATED FROM RIVER FLOW WITH AN EARTHEN

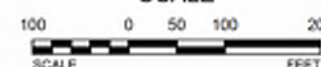
COFFER DAM OR EQUIVALENT AND CONSTRUCTED IN SUCH A WAY THAT MINIMIZES TURBIDITY AND IMPACTS TO FISH AND WILDLIFE AND SHALL MEET WATER QUALITY STANDARDS.

5. WET WATER CROSSINGS (FORDS) AND/OR TEMPORARY BRIDGES MAY BE NECESSARY IN SOME LOCATIONS TO TEMPORARILY ACCESS FLOODPLAIN ACROSS THE CHANNEL. THE CONTRACTOR SHALL NOT HAUL EARTHEN MATERIAL OR FUEL ACROSS THE WET WATER CROSSINGS UNLESS APPROVED BY THE OPR AND SHALL MINIMIZE USE OF THESE LOCATIONS TO THE GREATEST EXTENT POSSIBLE.

	RIVER CENTERLINE
	TRIBUTARY CENTERLINE
	PARCEL BOUNDARY
	ACCESS ROAD
	ORDINARY HIGH WATER
	WETLANDS
	DNR LOG HARVEST AREA
	FILL AREA
	CUT AREA
	TEMPORARY EARTHEN DAM
	COFFER DAM FOR PARTIAL ISOLATION
	DIVERSION CHANNEL ALIGNMENT
	EXCAVATED DIVERSION CHANNEL
	WET WATER CROSSING (FORD)
	BYPASS FLOW PATH



SCALE





HORIZONTAL SCALE: 1" = 60'
VERTICAL SCALE: 1" = 30'



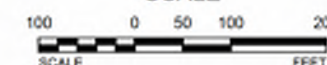
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RIVER CENTERLINE
 TRIBUTARY CENTERLINE
 PARCEL BOUNDARY
 ACCESS ROAD
 ORDINARY HIGH WATER
 WETLANDS
 DNR LOG HARVEST AREA
 FILL AREA
 CUT AREA
 TEMPORARY EARTHEN DAM
 COFFER DAM FOR PARTIAL ISOLATION
 DIVERSION CHANNEL ALIGNMENT
 EXCAVATED DIVERSION CHANNEL
 WET WATER CROSSING (FORD)
 BYPASS FLOW PATH



SCALE



CONSTRUCTION SEQUENCING & WATER MANAGEMENT - REACH C

SCALE: 1"=100'

NOTES:

1. CONTRACTOR SHALL BE RESPONSIBLE FOR WORK AREA ISOLATION AND/OR STREAM DIVERSIONS FOR THE PURPOSES OF WATER QUALITY PROTECTION, TURBIDITY CONTROL AND PROTECTION OF AQUATIC LIFE AND HABITAT DURING CONSTRUCTION.
2. COFFER DAMS AND RIVER FLOW PATHS ON THIS SHEET SHOW CONCEPTUAL STREAM DIVERSION ALIGNMENTS THAT COULD BE USED TO MANAGE TOUTLE RIVER WATER DURING GRADING ACTIVITIES AND WHS CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SUBMITTING AN UPDATED STREAM DIVERSION AND WATER MANAGEMENT PLAN PRIOR TO DIVERTING ANY FLOW FROM THE TOUTLE RIVER.
3. THE CONTRACTOR SHALL CONSTRUCT BYPASS CHANNELS PER SEQUENCING ON SHEET C7.4 AND IN SUCH A WAY THAT WATER IS GRADUALLY DIVERTED FROM THE MAINSTEM TOUTLE RIVER SO THAT FISH SALVAGE EFFORTS CAN BE THOROUGH AND COMPLETE.
4. IN SOME LOCATIONS, WHS STRUCTURES ARE INSTALLED WITHIN OR ADJACENT TO THE MAINSTEM TOUTLE RIVER WITHOUT DIVERTING RIVER FLOW. STRUCTURES INSTALLED IN THE ACTIVE RIVER CHANNEL SHALL BE PARTIALLY ISOLATED FROM RIVER FLOW WITH AN EARTHEN

- COFFER DAM OR EQUIVALENT AND CONSTRUCTED IN SUCH A WAY THAT MINIMIZES TURBIDITY AND IMPACTS TO FISH AND WILDLIFE AND SHALL MEET WATER QUALITY STANDARDS.
5. WET WATER CROSSINGS (FORDS) AND/OR TEMPORARY BRIDGES MAY BE NECESSARY IN SOME LOCATIONS TO TEMPORARILY ACCESS FLOODPLAIN ACROSS THE CHANNEL. THE CONTRACTOR SHALL NOT HAUL EARTHEN MATERIAL OR FUEL ACROSS THE WET WATER CROSSINGS UNLESS APPROVED BY THE OPR AND SHALL MINIMIZE USE OF THESE LOCATIONS TO THE GREATEST EXTENT POSSIBLE.
6. EARTHEN DAMS CONSTRUCTED WITH CLEAN RIVER ALLUVIUM SHALL BE INSTALLED ON THE DOWNSTREAM SIDE OF BYPASS CHANNELS AS NECESSARY TO DIVERT FLOW INTO BYPASS CHANNEL 1. THESE DAMS SHALL BE USED TO FULLY DIVERT FLOW INTO THE BYPASS CHANNELS AND MAY BE USED AS TEMPORARY ACCESS ROUTES FOR EQUIPMENT TO CROSS THE RIVER. EARTHEN DAMS SHALL ONLY BE CONSTRUCTED AFTER FISH SALVAGE ACTIVITIES ARE COMPLETE AND WITH APPROVAL FROM THE OPR.

[illegible]

Date 11/11/2024	Designed By LF
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Drawn By LH-LE	Checked By CL
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SCALE

Page 10 of 10

JOB NO. 20200001

SHEET NO.

C7.3

50 OF 57

FINAL DESIGN
NOVEMBER 2024



LOWER COLUMBIA FISH
ENHANCEMENT GROUP

**SOUTH FORK TOUTLE RIVER
HEADWATERS DESIGN**

COWLITZ COUNTY, WA

DIVERSION CHANNEL SEQUENCING

REVISION NUMBER

[illegible]

Code	Designed By
11/11/2024	LE

Drawn by LH, LE	Checked by OL
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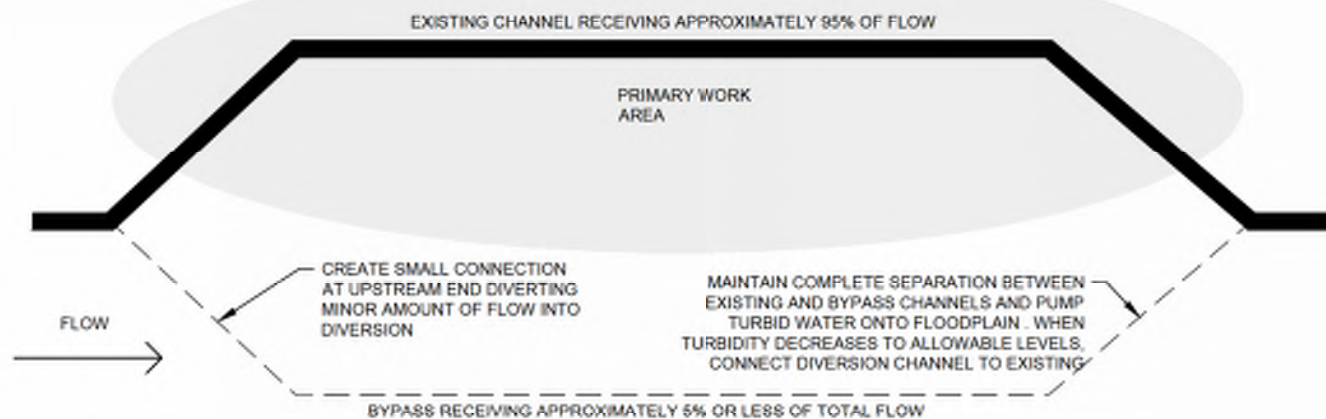
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51 of 57

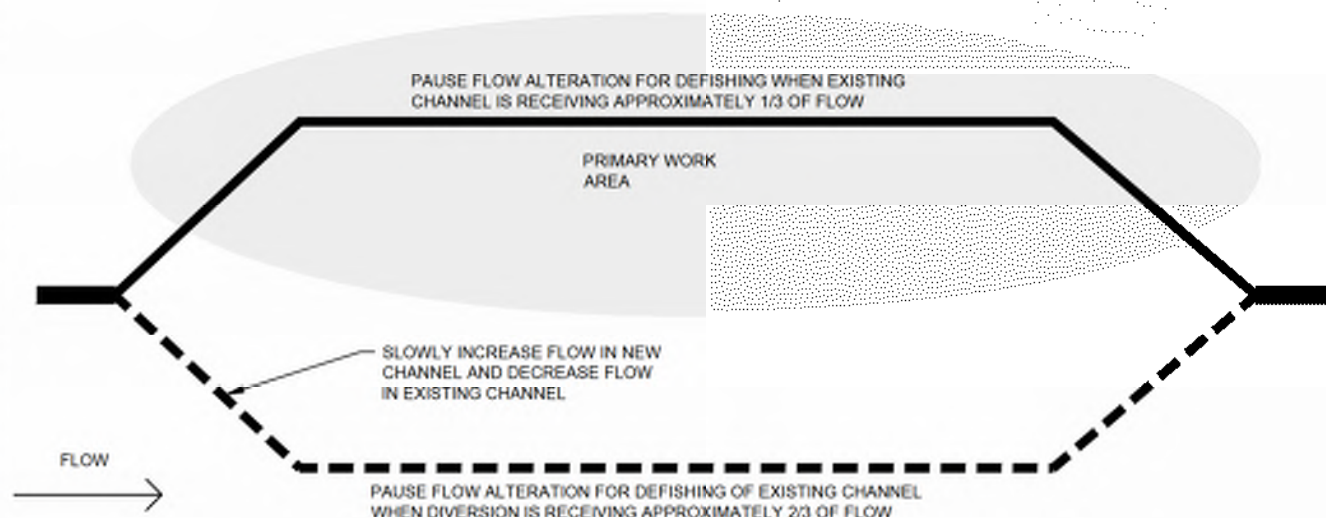
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NOTES:

1. USE PUMPED WATER APPLIED TO DIVERSION CHANNEL TO FLUSH TURBIDITY FROM DIVERSION CHANNEL. ALTERNATIVELY, A SMALL OPENING CAN BE MADE IN THE UPSTREAM DIVERSION TO ALLOW A MINOR AMOUNT OF FLOW FROM THE RIVER TO ENTER THE DIVERSION 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 DIVERSION 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 DIVERSION VS. FLOW RATE IN THE EXISTING CHANNEL. AFTER MIXING AT THE DOWNSTREAM CONNECTION, FLOW IN THE RIVER CHANNEL SHALL MEET WATER QUALITY STANDARDS FOR MAXIMUM TURBIDITY AS REQUIRED BY PERMIT REQUIREMENTS (SEE HIP CONSERVATION MEASURES).
3. FOLLOWING OPEN CONNECTION, MONITOR TURBIDITY OF WATER IN THE RIVER AS REQUIRED BY PERMIT REQUIREMENTS. INCREMENTALLY INCREASE UPSTREAM CONNECTION TO 1/3 OF TOTAL FLOW AS TURBIDITY OF WATER AT MONITORING STATION DECREASES TO ALLOWABLE LEVELS.

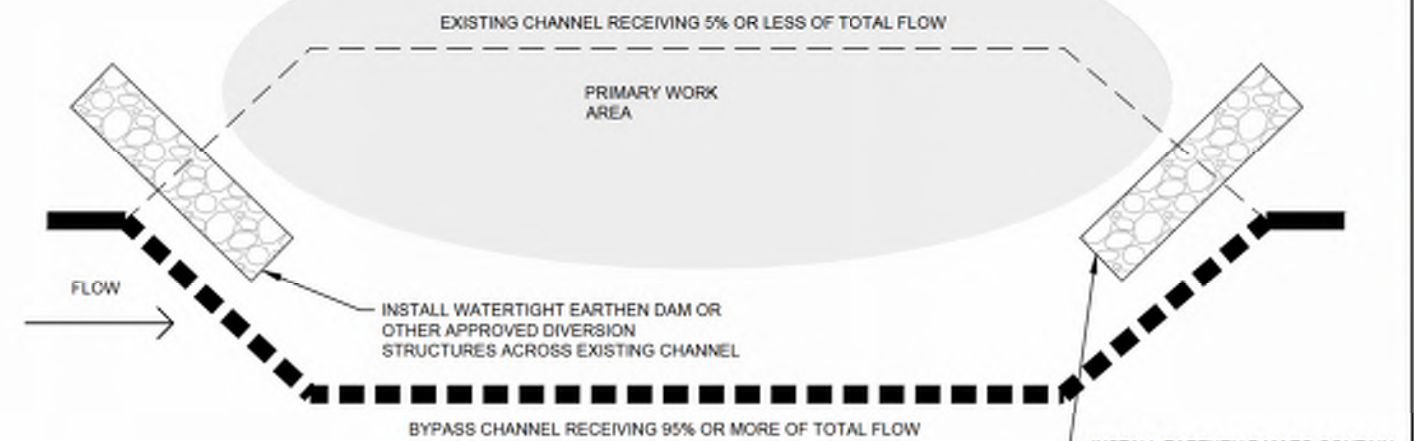
STEP 1



NOTES:

1. SLOWLY INCREASE THE AMOUNT OF FLOW ENTERING THE DIVERSION CHANNEL. THE OPR 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 2/3 OF THE FLOW IS IN THE NEW CHANNEL, PAUSE WORK THAT INCREASES FLOW RATE IN THE NEW CHANNEL TO ALLOW DEFISHING OF THE OLD CHANNEL.

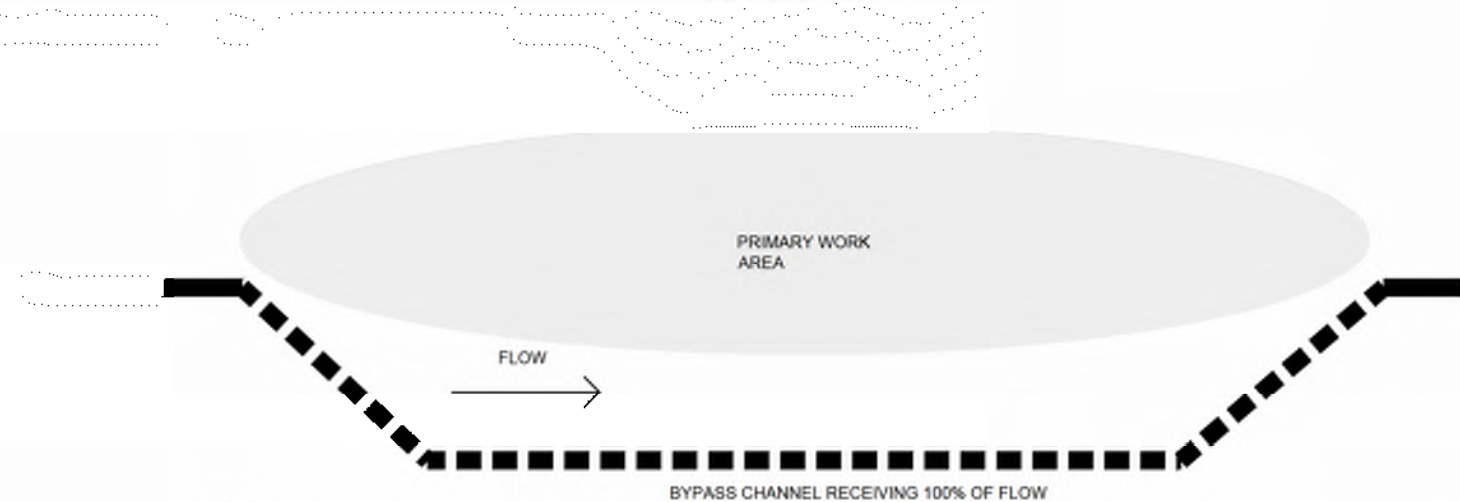
STEP 2



NOTES

1. AFTER DEFISHING OF EXISTING CHANNEL IS COMPLETE AS DETERMINED BY THE OPR. RESUME WORK TO SLOWLY INCREASE AMOUNT OF TOTAL FLOW ENTERING THE DIVERSION CHANNEL.
2. INSTALL TEMPORARY EARTHEN DIVERSION DAM ACROSS UPSTREAM END OF EXISTING CHANNEL TO COMPLETE DIVERSION. INSTALL TEMPORARY COFFER DAM AT DOWNSTREAM END OF EXISTING CHANNEL TO CONTAIN TURBID WATER GENERATED DURING IN-CHANNEL WORK ACTIVITIES.

STEP 3



NOTES

1. WORK IN EXISTING CHANNEL AS SHOWN IN PLANS.
2. WHEN WORK IN EXISTING CHANNEL IS COMPLETE, REPEAT SEQUENCE IN REVERSE TO DIVERT WATER FROM DIVERSION CHANNEL TO EXISTING CHANNEL.

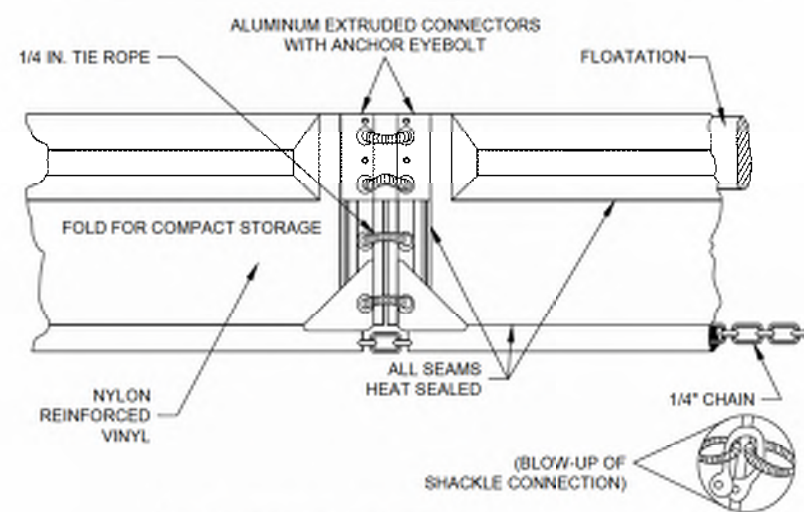
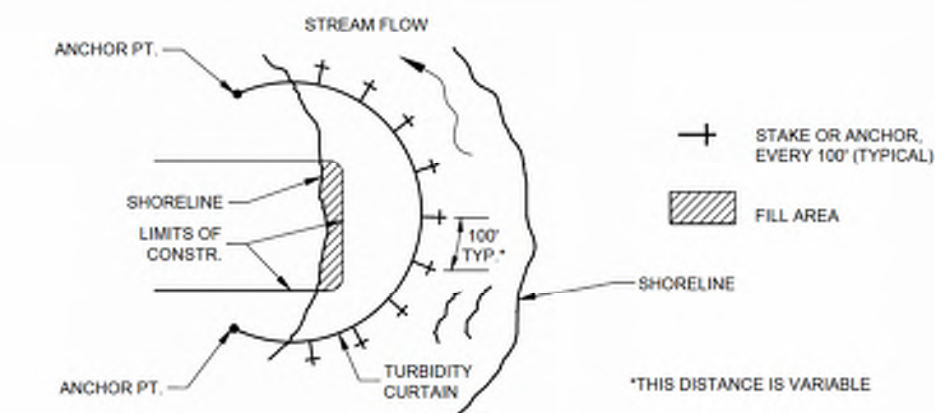
STEP 4

GENERAL NOTES:

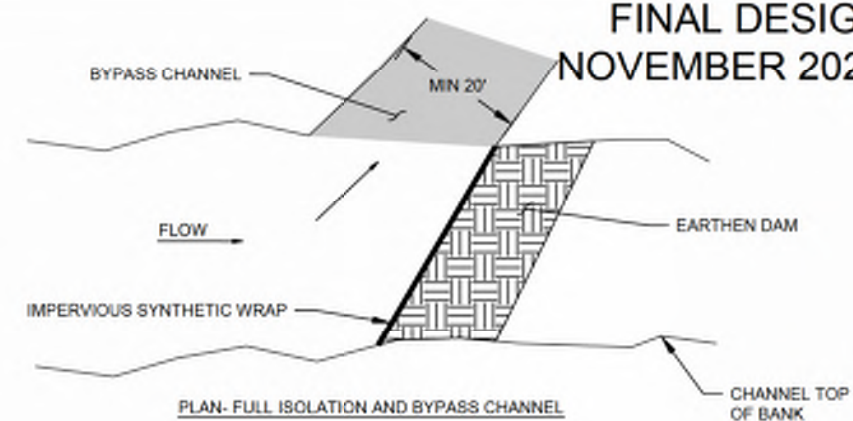
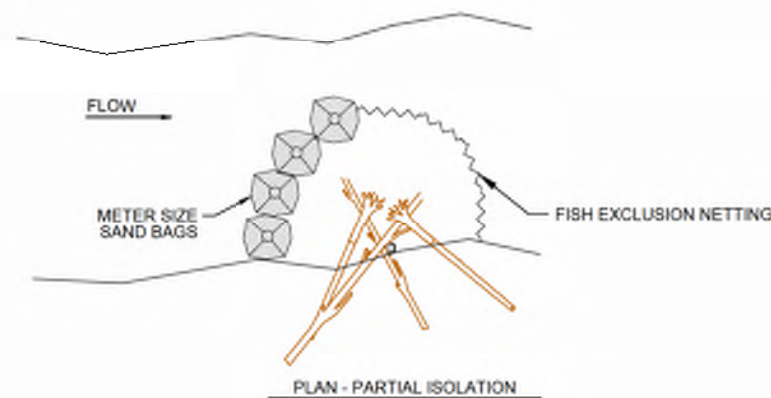
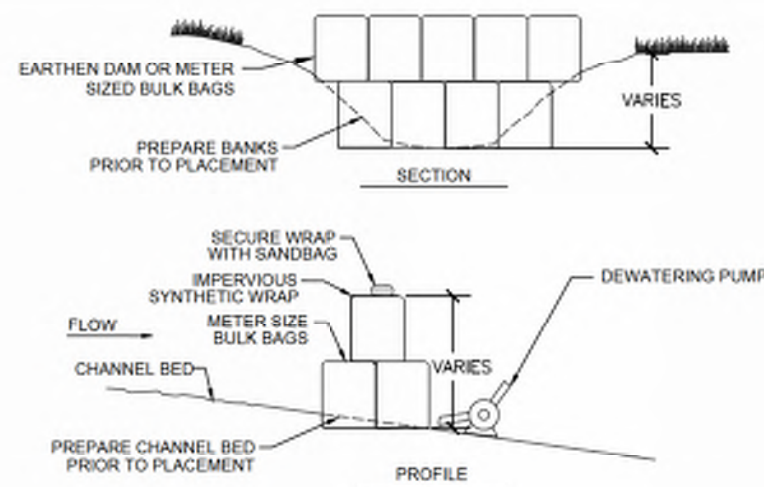
- 1.1. BYPASS CHANNELS SHALL BE CONSTRUCTED AND IMPLEMENTED FROM STARTING AT THE DOWNSTREAM MOST DIVERSION CHANNEL AND PROGRESSING UPSTREAM. BYPASS CHANNEL IS SHOWN IN THE SITE PLAN SHEETS.

REACH C MONTHLY FLOW DURATION STATISTICS DURING IWW

PERCENT OF TIME EXCEEDED	SF TOUTLE DISCHARGE (CFS)			
	JULY	AUGUST	SEPTEMBER	OCTOBER
5%	106	51	116	342
25%	66	40	40	97
50%	50	35	31	49
75%	41	31	27	33
95%	34	26	23	23

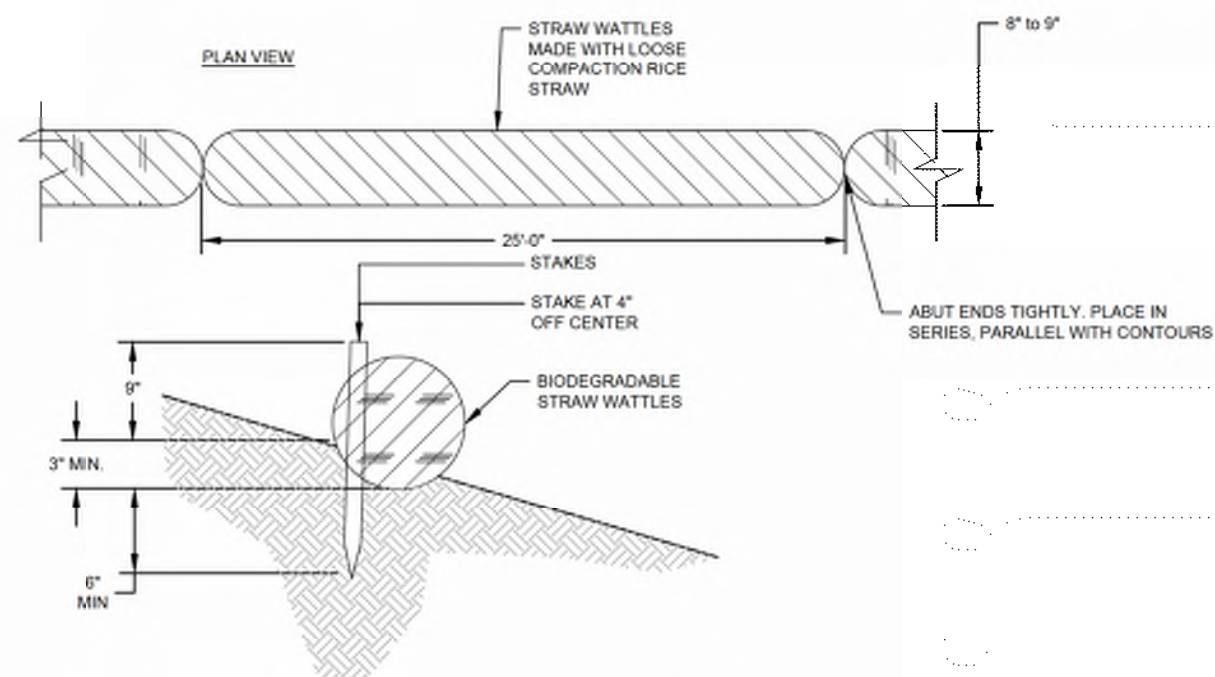


A TURBIDITY CURTAIN
52 NOT TO SCALE



- NOTES

1. CONSTRUCTION CREWS SHALL INSTALL BULK BAG COFFER DAMS AS NECESSARY FOR PARTIAL OR FULL ISOLATION DURING INSTALLATION OF WHS STRUCTURES.
2. TO DIVERT FLOW FROM THE MAINSTEM TOUTLE RIVER INTO BYPASS CHANNELS CONSTRUCT AN EARTHEN DAM MINIMUM 20' WIDE TO BLOCK WATER AND PROVIDE A RIVER CROSSING ACCESS PATH. EARTHEN DAMS SHALL BE CONSTRUCTED OF CLEAN ALLUVIUM SALVAGED DURING EXCAVATION. USE AN IMPERVIOUS SYNTHETIC LINER TO REDUCE PERMEABILITY OF EARTHEN DAMS ON THEIR UPSTREAM END.
3. HEIGHT OF THE BULK BAG COFFER DAMS AND OR EARTHEN DAMS SHALL BE HIGH ENOUGH TO PREVENT BYPASS FLOWS FROM ENTERING THE ISOLATED WORK AREA. DAM HEIGHTS AND MATERIALS SHALL BE INCLUDED IN THE CONTRACTOR'S WORK CONTAINMENT AND DEWATERING PLAN.



C STRAW WATTLE
52 NOT TO SCALE

HAND PLANTING AND HELICOPTER WILLOW DROP AREAS ARE NOT IN CONTRACT

FINAL DESIGN
NOVEMBER 2024



LOWER COLUMBIA FISH
ENHANCEMENT GROUP
**SOUTH FORK TOUTLE RIVER
HEADWATERS DESIGN**
COWLITZ COUNTY, WA

PLANTING PLAN -
REACH A

REVISION NUMBER

No.	Date	Revised

Date: 11/11/2024
Drawn By: LH, LE
Checked By: CL

SCALE
0 100 200 400
FEET

JOB NO.
20200001

SHEET NO.
L1.0

53 OF 57



PLANTING PLAN - REACH A

SCALE: 1"=200'

NOTES:

- EXISTING VEGETATED AREAS THAT ARE DAMAGED DURING CONSTRUCTION SHALL BE RESTORED TO THEIR ORIGINAL CONDITION. PLANT DISTURBED AREAS AS SPECIFIED PER THE EROSION CONTROL SEED SCHEDULE DISPLAYED ON SHEET L1.4.
- WEEDY OR EXOTIC INVASIVE SPECIES, PARTICULARLY SCOTCH BROOM SHALL BE REMOVED BY MANUAL OR CHEMICAL MEANS (AS APPROVED BY REGULATORY AGENCIES AND THE OPR) PRIOR TO PLANT INSTALLATION.
- INSTALL LIVE STAKES BEHIND MODERATE AND LARGE WHS AS SPECIFIED PER THE LIVE STAKE SCHEDULE DISPLAYED ON SHEET L1.4.
- BUNDLES OF WILLOW STAKES SHALL BE DISTRIBUTED VIA HELICOPTER AT A DENSITY OF 1000 LIVE STAKES PER ACRE WITHIN THE HELICOPTER DROP AREAS SHOWN. GROUND CREWS SHALL LIGHTLY DISTRIBUTE LIVE STAKES AFTER THE WILLOW BUNDLES HAVE BEEN PLACED.
- PLANTING SHOULD OCCUR AFTER CONSTRUCTION, BETWEEN DECEMBER AND MARCH TO TAKE ADVANTAGE OF BARE-ROOT PLANT MATERIAL.
- PLANTING LOCATIONS SHOWN ON PLANTING PLANS ARE APPROXIMATE, BASED ON ANTICIPATED SITE CONDITIONS. ACTUAL PLANTING LOCATIONS MAY VARY FROM THOSE SHOWN DUE TO FINAL SITE CONDITIONS AND LOCATIONS OF EXISTING VEGETATION. VARIATIONS FROM THE PLANTING PLAN SHALL BE APPROVED BY THE OPR.

LEGEND:

---	RIVER CENTERLINE
---	TRIBUTARY CENTERLINE
---	PARCEL BOUNDARY
---	ACCESS ROAD
---	ORDINARY HIGH WATER
+	DNR LOG HARVEST AREA
●	HAND PLANTING AREA
●	HELICOPTER WILLOW DROP AREA
■	EROSION CONTROL SEEDING AREA



SCALE
200 0 100 200 400
FEET

HAND PLANTING AND HELICOPTER WILLOW DROP AREAS ARE NOT IN CONTRACT

FINAL DESIGN
NOVEMBER 2024



LOWER COLUMBIA FISH
ENHANCEMENT GROUP
SOUTH FORK TOUTLE RIVER
HEADWATERS DESIGN
COWLITZ COUNTY, WA

PLANTING PLAN -
REACH B

REVISION NUMBER

No.	Date	Description

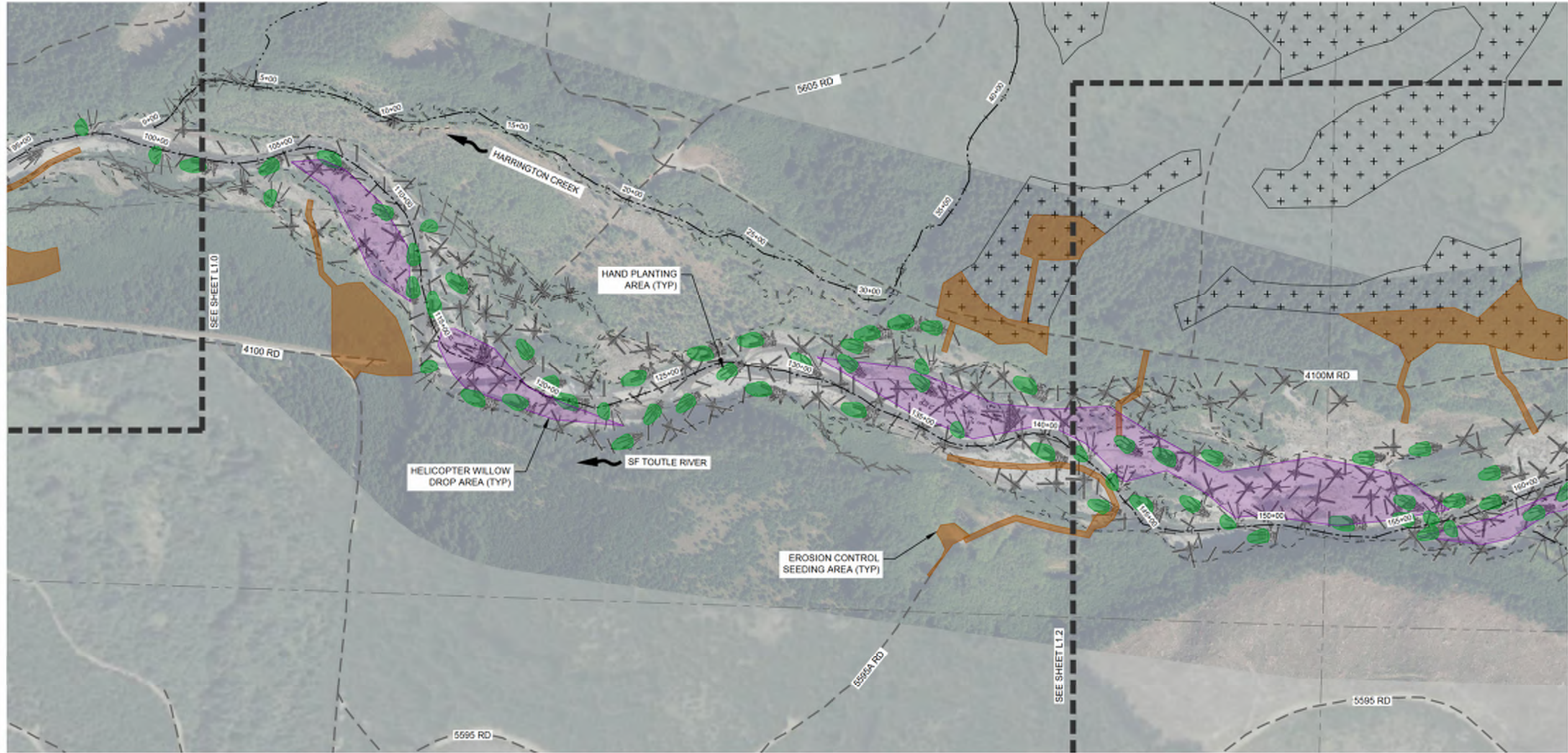
Date: 11/11/2024
Drawn By: LH, LE
Designed By: LE
Checked By: CL

SCALE
0 100 200 400
FEET

JOB NO.
20200001

SHEET NO.
L1.1

54 OF 57



PLANTING PLAN - REACH B

SCALE: 1"=200'

NOTES:

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- PLANTING LOCATIONS SHOWN ON PLANTING PLANS ARE APPROXIMATE, BASED ON ANTICIPATED SITE CONDITIONS. ACTUAL PLANTING LOCATIONS MAY VARY FROM THOSE SHOWN DUE TO FINAL SITE CONDITIONS AND LOCATIONS OF EXISTING VEGETATION. VARIATIONS FROM THE PLANTING PLAN SHALL BE APPROVED BY THE OPR.

LEGEND:

- RIVER CENTERLINE
- TRIBUTARY CENTERLINE
- PARCEL BOUNDARY
- ACCESS ROAD
- ORDINARY HIGH WATER
- DNR LOG HARVEST AREA
- HAND PLANTING AREA
- HELICOPTER WILLOW DROP AREA
- EROSION CONTROL SEEDING AREA



SCALE
200 0 100 200 400
FEET

HAND PLANTING AND HELICOPTER WILLOW DROP AREAS ARE NOT IN CONTRACT

FINAL DESIGN
NOVEMBER 2024



LOWER COLUMBIA FISH
ENHANCEMENT GROUP
SOUTH FORK TOUTLE RIVER
HEADWATERS DESIGN
COWLITZ COUNTY, WA

PLANTING PLAN -
REACH C

REVISION NUMBER

No.	Date	Revised
1	11/11/2024	Designed By LE
2		Drawn By LH, LE
3		Checked By CL

SCALE

0 100 200 400

FEET

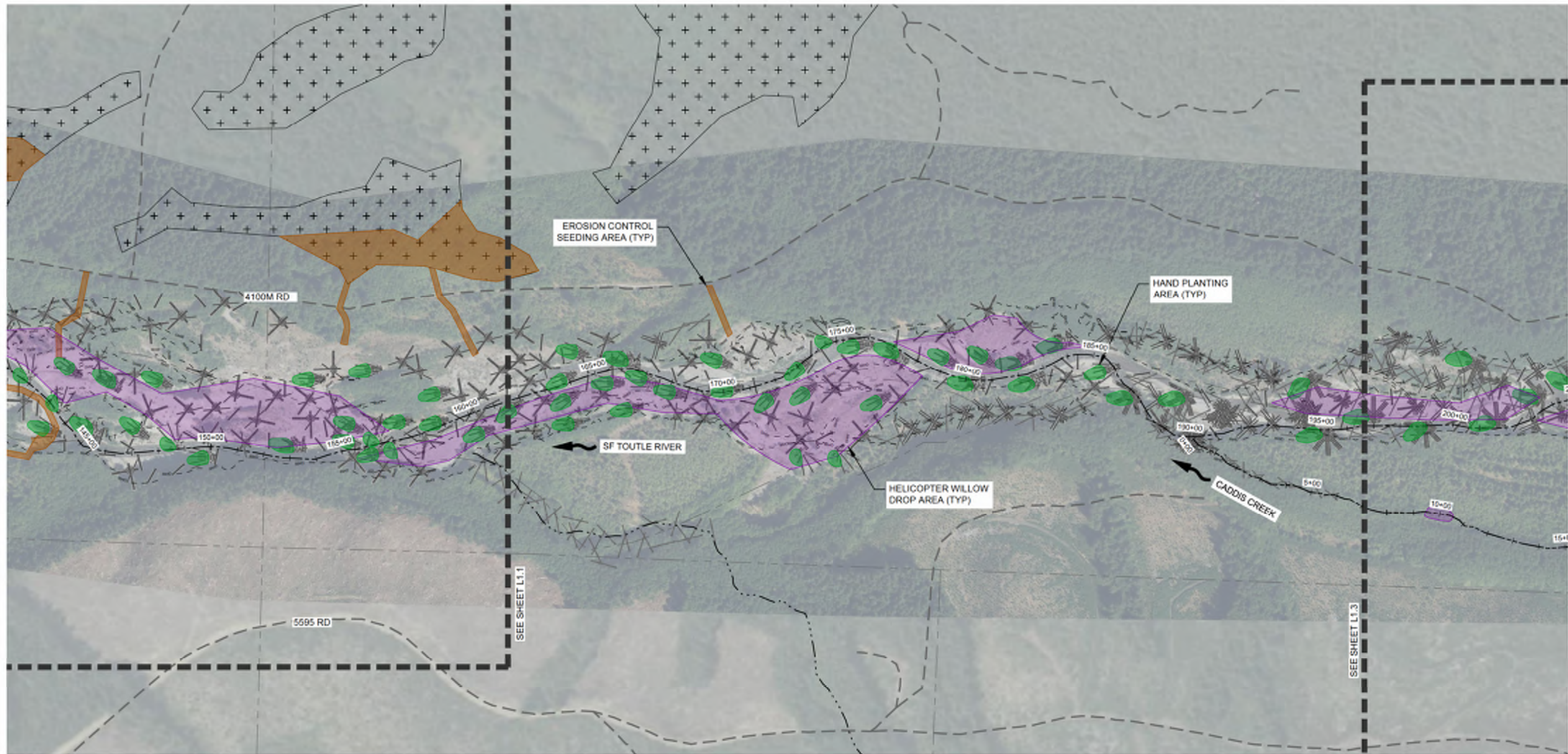
JOB NO.

20200001

SHEET NO.

L1.2

55 OF 57



PLANTING PLAN - REACH C

SCALE: 1"=200'

NOTES:

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- RIVER CENTERLINE
- TRIBUTARY CENTERLINE
- PARCEL BOUNDARY
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- EROSION CONTROL SEEDING AREA



SCALE

200 0 100 200 400
FEET

HAND PLANTING AND HELICOPTER WILLOW DROP AREAS ARE NOT IN CONTRACT

FINAL DESIGN
NOVEMBER 2024



LOWER COLUMBIA FISH
ENHANCEMENT GROUP
SOUTH FORK TOUTLE RIVER
HEADWATERS DESIGN
COWLITZ COUNTY, WA

PLANTING PLAN -
REACH D

REVISION NUMBER

No.	Date	Revised

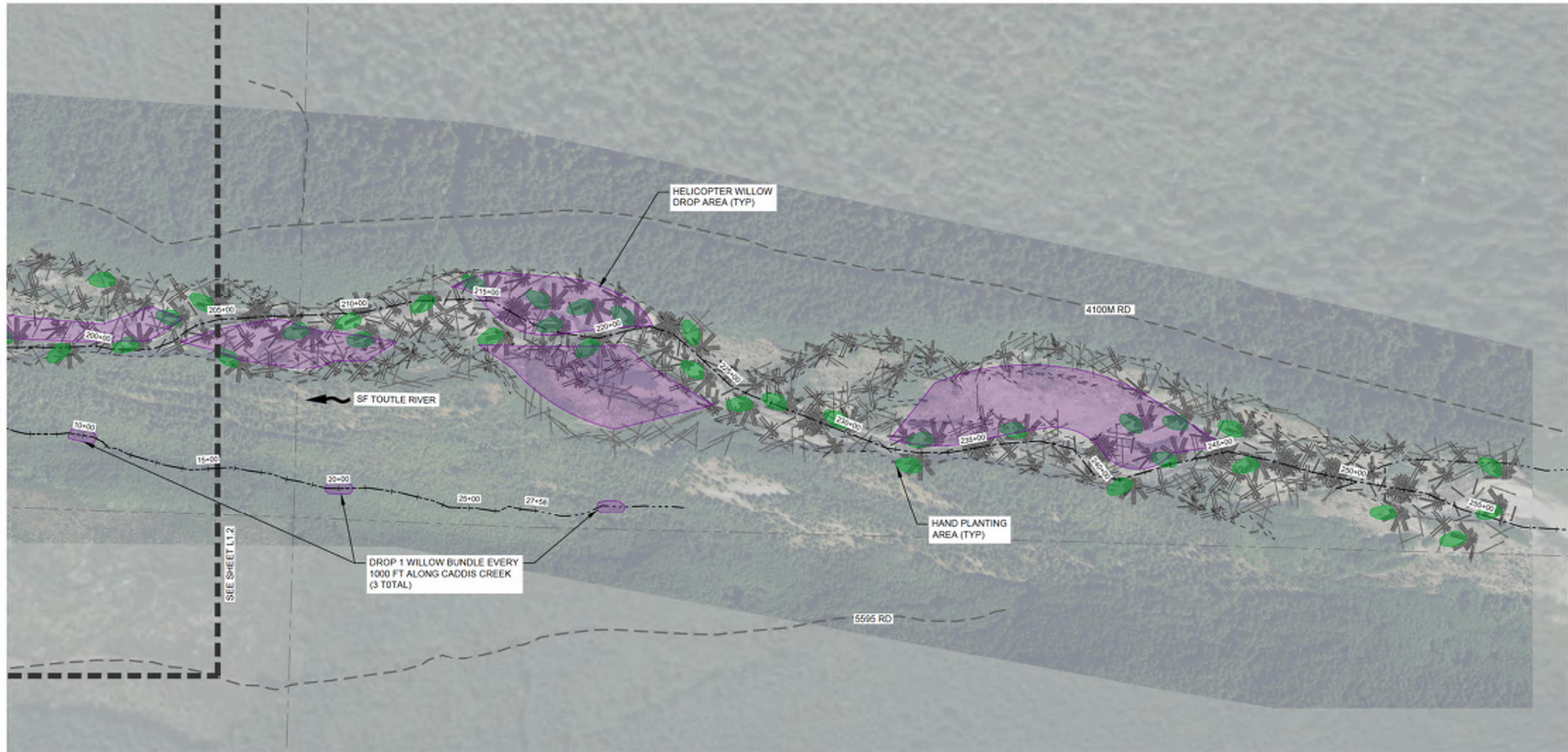
Date: 11/11/2024
Drawn By: LH, LE
Checked By: CL

SCALE
0 100 200 400
FEET

JOB NO.
20200001

SHEET NO.
L1.3

56 OF 57



PLANTING PLAN - REACH D

SCALE: 1"=200'

NOTES:

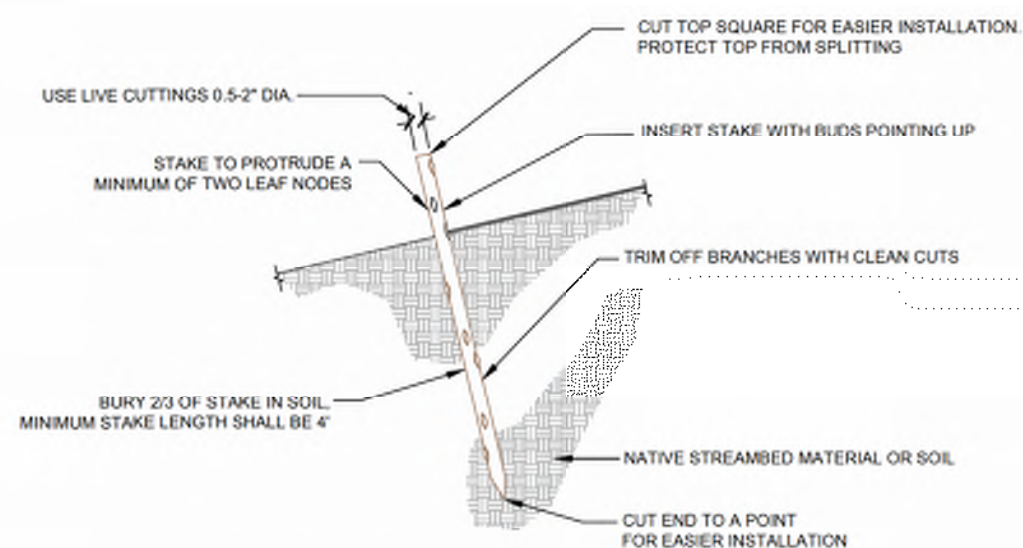
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- EROSION CONTROL SEEDING AREA



SCALE
200 0 100 200 400
FEET



1 LIVE STAKE DETAIL
SCALE: NTS

AREA: 10.8 AC

COMMON NAME	BOTANICAL NAME	PLANTING TYPE	STEMS/ ACRE
PACIFIC WILLOW	<i>Salix lucida</i>	LIVE STAKES	400
BLACK COTTONWOOD	<i>Populus trichocarpa</i>	LIVE STAKES	800
RED-OSIER DOGWOOD	<i>Cornus sericea</i>	LIVE STAKES	600
SANDBAR WILLOW	<i>Salix exigua ssp melanopsis</i>	LIVE STAKES	600
SCOULER WILLOW	<i>Salix scouleriana</i>	LIVE STAKES	300
SITKA WILLOW	<i>Salix sitchensis</i>	LIVE STAKES	300
TOTAL STEM DENSITY			3000

AREA: 0.75 AC

COMMON NAME	BOTANICAL NAME	STOCK	PLS/ACRE
BLUE WILD RYE	<i>Elymus glaucus</i>	SEED	24
TUFTED HAIRGRASS	<i>Deschampsia cespitosa</i>	SEED	24
CALIFORNIA BROME	<i>Bromus vulgaris</i>	SEED	24
SPIKE BENTGRASS	<i>Agrostis exarata</i>	SEED	8
TOTAL PLS/ ACRE			80