

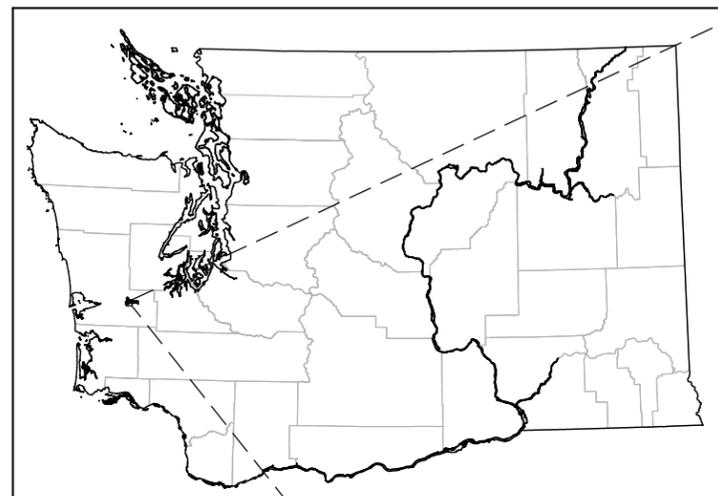
KEYS ROAD FLOOD PROTECTION

PHASE I FINAL DESIGN

GRAYS HARBOR COUNTY

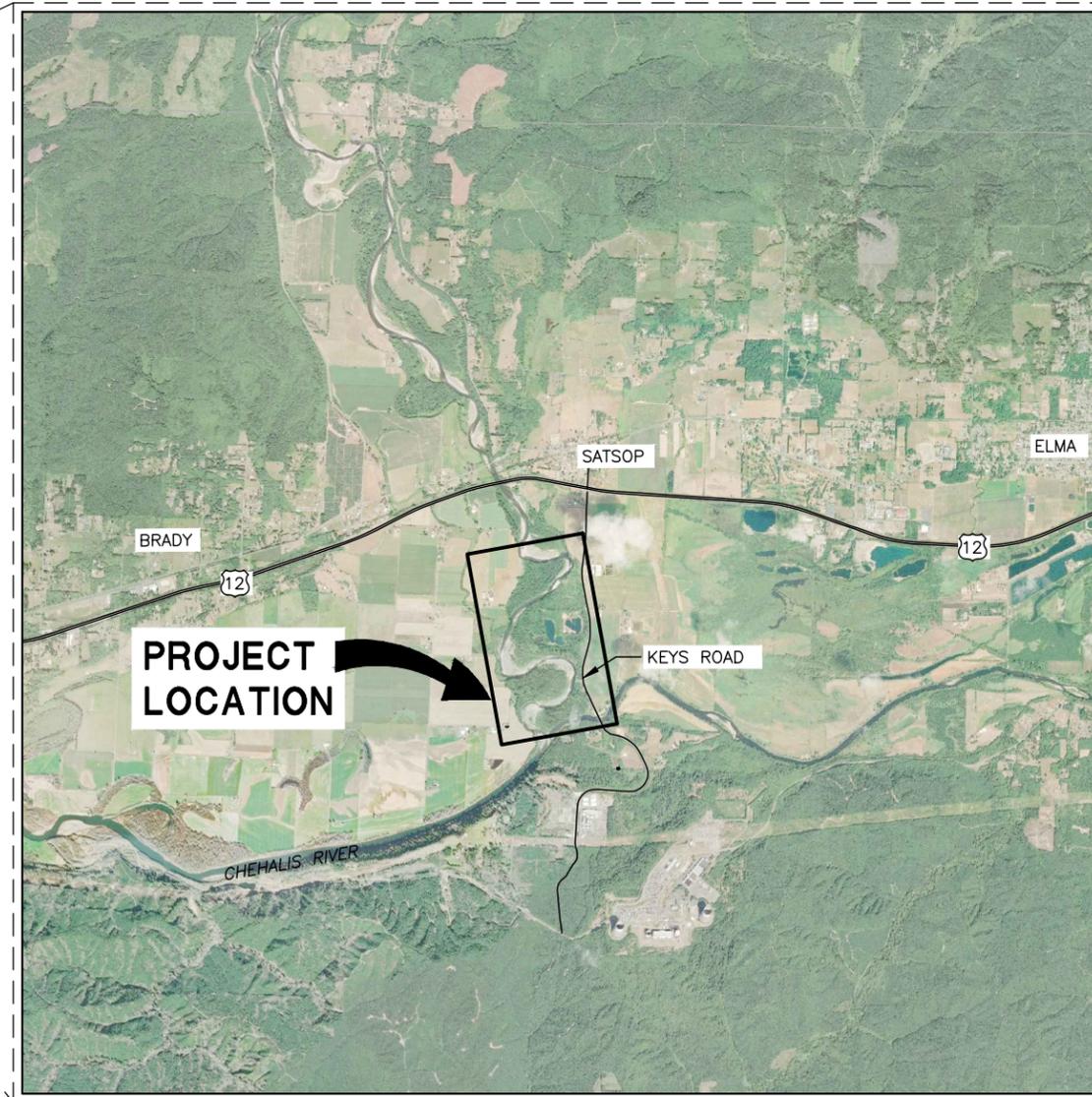
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WASHINGTON STATE

SCALE: 1" = 50 MILES



PROJECT LOCATION MAP

SCALE: 1" = 1 MILE

CONTACT INFORMATION

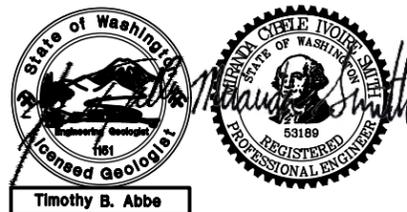
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GRAYS HARBOR COUNTY

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NAME OR INITIALS AND DATE	GEOGRAPHIC INFORMATION
DESIGNED MT, RLE, MS	LATITUDE 46°58'55.71"N
CHECKED MT, RLE	LONGITUDE 123°28'56.2"W
DRAWN MS, KP	TN/SC/RG T17N/S6/R6W
CHECKED MT, RLE	DATE 6/11/2020

KEYS ROAD FLOOD PROTECTION

COVER SHEET

1

SHEET 1 OF 32

Jun 11, 2020 PHASE I FINAL DESIGN

GENERAL NOTES

1. THESE PLANS HAVE BEEN PREPARED FOR THE EXCLUSIVE USE OF GRAYS HARBOR COUNTY, HEREAFTER REFERRED TO AS "OWNER" AND "CONTRACTOR" AND THEIR AUTHORIZED AGENTS.
2. NATURAL SYSTEMS DESIGN HEREAFTER REFERRED TO AS "ENGINEER" IS RESPONSIBLE FOR THE PREPARATION OF THESE ORIGINAL PLANS AND ASSOCIATED SPECIFICATIONS; AND WILL NOT BE RESPONSIBLE FOR, OR LIABLE FOR, UNAUTHORIZED CHANGE, OR USE, OF THESE PLANS WHICH INCLUDES ALTERATION, DELETION, OR EDITING OF THIS DOCUMENT WITHOUT EXPLICIT WRITTEN PERMISSION FROM THE ENGINEER. ANY OTHER UNAUTHORIZED USE OF THIS DOCUMENT IS PROHIBITED.
3. MINOR MODIFICATIONS ARE EXPECTED TO SUIT JOB SITE DIMENSIONS OR CONDITIONS. SUCH MODIFICATIONS SHALL BE INCLUDED AS PART OF THE WORK. THE OWNER, ENGINEER AND APPROPRIATE REGULATORY AGENCIES SHALL BE NOTIFIED OF ANY OWNER-AUTHORIZED CHANGE RESULTING IN MORE THAN A 10% DESIGN CHANGE OF PROPOSED FOOTPRINT OR THAT SIGNIFICANTLY AFFECTS THE INTENDED BENEFIT OR FUNCTION OF A PROJECT ELEMENT.
4. THE LOCATION OF ALL FEATURES SHOWN IS APPROXIMATE.
5. THE CONTRACTOR AGREES TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; AND FURTHER AGREES THAT THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS IN ACCORDANCE WITH THE PROVISIONS OUTLINED BY THE PROJECT CONTRACT AND SPECIFICATIONS.
6. ALL IMPROVEMENTS SHALL BE ACCOMPLISHED UNDER THE APPROVAL, INSPECTION, AND TO THE SATISFACTION OF THE OWNER. IMPROVEMENT CONSTRUCTION SHALL COMPLY WITH THESE PLANS AND THE WASHINGTON STATE DEPARTMENT OF TRANSPORTATION (WASHDOT) STANDARD PLANS FOR CONSTRUCTION OF ROAD, BRIDGE, AND MUNICIPAL CONSTRUCTION, CURRENT EDITION UNLESS NOTED OTHERWISE. ALL REFERENCES TO THE "STANDARD SPECIFICATIONS" SHALL MEAN THE WASHINGTON STATE DEPARTMENT OF TRANSPORTATION (WASHDOT) STANDARD SPECIFICATIONS FOR CONSTRUCTION OF LOCAL STREETS AND ROADS, CURRENT EDITION. CONSTRUCTION NOT SPECIFIED ON THESE PLANS SHALL CONFORM TO THE REQUIREMENTS OF THE STANDARD SPECIFICATIONS. THE CONTRACTOR IS OBLIGATED TO BE FAMILIAR WITH APPLICABLE SECTIONS OF THE STANDARD SPECIFICATIONS NOT DISCUSSED IN THE GENERAL NOTES. THE CONTRACT SPECIAL PROVISIONS SHALL SUPERSEDE THOSE OF THE STANDARD SPECIFICATIONS WHERE DISCREPANCIES OCCUR.
7. IT IS THE RESPONSIBILITY OF THE CONTRACTOR AND SUBCONTRACTOR(S) TO EXAMINE THE PROJECT SITE PRIOR TO THE OPENING OF BID PROPOSALS. THE CONTRACTOR SHALL BECOME FAMILIAR WITH THE CONDITIONS UNDER WHICH THE WORK IS TO BE PERFORMED, SUCH AS THE NATURE AND LOCATION OF THE WORK; AND THE GENERAL AND LOCAL CONDITIONS, PARTICULARLY THOSE AFFECTING THE AVAILABILITY OF TRANSPORTATION, THE DISPOSAL, HANDLING, AND STORAGE OF MATERIALS, AVAILABILITY OF LABOR, WATER, ELECTRICITY, ROADS, THE UNCERTAINTIES OF WEATHER, THE CONDITIONS OF THE GROUND, SURFACE AND SUBSURFACE MATERIALS, GROUNDWATER, THE EQUIPMENT AND FACILITIES NEEDED FOR AND DURING THE PERFORMANCE OF THE WORK, AND THE COSTS THEREOF. ANY FAILURE BY THE CONTRACTOR AND SUBCONTRACTOR(S) TO ACQUAINT THEMSELVES WITH ALL THE AVAILABLE INFORMATION WILL NOT RELIEVE THE CONTRACTOR AND SUBCONTRACTOR(S) FROM RESPONSIBILITY FOR PROPERLY ESTIMATING THE DIFFICULTY AND COST OF SUCCESSFULLY PERFORMING THE WORK.
8. THE CONTRACTOR IS RESPONSIBLE FOR REVIEWING THE CONTRACT DOCUMENTS AND FOR ALL SUBMITTALS REQUIRED TO THE OWNER FOR REVIEW AND ACCEPTANCE.

PERMIT NOTES

1. EVERY REASONABLE EFFORT SHALL BE MADE TO CONDUCT THE ACTIVITIES SHOWN IN THESE PLANS, IN A MANNER THAT MINIMIZES THE ADVERSE IMPACT ON WATER QUALITY, FISH AND WILDLIFE, AND THE NATURAL ENVIRONMENT.
2. PERMITS ARE ANTICIPATED TO HAVE BEEN ISSUED PRIOR TO CONSTRUCTION. NOTICE TO PROCEED WILL NOT BE PROVIDED UNTIL PERMITS ARE IN HAND AND THESE PLANS HAVE BEEN VETTED AGAINST THOSE PERMITS.
3. ALL WORK WILL BE IN COMPLIANCE WITH PERMIT CONDITIONS ISSUED BY PERTINENT REGULATORY AGENCIES. IT IS THE CONTRACTOR'S RESPONSIBILITY TO HAVE COPIES OF ALL PERMITS ON THE JOB SITE, UNDERSTAND AND COMPLY WITH ALL PERMIT CONDITIONS.
4. ALL WORK THAT DISTURBS THE SUBSTRATE, BANK, OR SHORE OF A WATERS OF THE STATE THAT CONTAINS FISH LIFE SHALL BE CONDUCTED ONLY DURING THE WORK PERIOD FOR THAT WATERBODY AS ALLOWED BY RELEVANT HYDRAULIC WORK PERMITS. THOSE PORTIONS OF THE PROJECT WORK THAT OCCUR OUTSIDE OR ABOVE THE ORDINARY HIGH WATER MARK (ABOVE THE USACE JURISDICTIONAL LINE) ARE NOT SUBJECT TO THE WORK PERIODS DESCRIBED ABOVE UNLESS SPECIFIED IN THE RELEVANT PERMITS.
5. ALL ACTIVITIES THAT INVOLVE WORK ADJACENT TO, OR WITHIN THE WETTED CHANNEL SHALL, AT ALL TIMES, REMAIN CONSISTENT WITH ALL APPLICABLE WATER QUALITY STANDARDS; EFFLUENT LIMITATION; AND STANDARDS OF PERFORMANCE, PROHIBITIONS, PRETREATMENT STANDARDS, AND MANAGEMENT PRACTICES ESTABLISHED PURSUANT TO THE CLEAN WATER ACT OR PURSUANT TO APPLICABLE STATE AND LOCAL LAW.
6. IF AT ANY TIME, AS A RESULT OF PROJECT ACTIVITIES, FISH ARE OBSERVED IN DISTRESS, A

FISH KILL OCCURS, OR WATER QUALITY PROBLEMS DEVELOP (INCLUDING EQUIPMENT LEAKS OR SPILLS), OPERATIONS SHALL CEASE AND THE OWNER SHALL BE NOTIFIED IMMEDIATELY.

7. IF, DURING CONSTRUCTION, ARCHAEOLOGICAL REMAINS ARE ENCOUNTERED, CONSTRUCTION IN THE VICINITY SHALL BE HALTED, AND THE STATE OFFICE OF HISTORIC PRESERVATION AND THE OWNER SHALL BE NOTIFIED IMMEDIATELY.

SURVEY NOTES

1. UNLESS NOTED OTHERWISE ON THE PLANS, THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF ALL EXISTING SURVEY MONUMENTS AND OTHER SURVEY MARKERS DURING CONSTRUCTION.
2. THE CONTRACTOR SHALL MAINTAIN A SET OF PLANS ON THE JOB SHOWING "AS-CONSTRUCTED" CHANGES MADE TO DATE. UPON COMPLETION OF THE PROJECT, THE CONTRACTOR SHALL SUPPLY TO OWNER A SET OF PLANS, MARKED UP TO THE SATISFACTION OF THE OWNER, REFLECTING THE AS-CONSTRUCTED MODIFICATIONS.
3. ELEVATIONS SHOWN ON THE PLANS FOR PIPE INVERTS, TOPS OF BANKS, THALWEG, GRADE CONTROLS, ETC., ARE BASED UPON THE TOPOGRAPHIC INFORMATION SHOWN ON THE PLANS. THE CONTRACTOR SHALL VERIFY ALL NECESSARY SURFACE ELEVATIONS IN THE FIELD AND NOTIFY THE OWNER OF ANY DISCREPANCIES, WHICH MIGHT AFFECT PROPER OPERATION OF THE NEW FACILITIES BEFORE BREAKING GROUND AND PRIOR TO FACILITY INSTALLATION. THE OWNER SHALL BE CONTACTED IN THE EVENT ELEVATIONS ARE INCORRECT SO THAT THE PROPER ADJUSTMENTS CAN BE MADE BY ENGINEER PRIOR TO THE INSTALLATION OF THE FACILITIES, AS SET FORTH IN THE SPECIAL PROVISIONS.
4. LIDAR FOR THIS PROJECT WAS PROVIDED BY ANCHOR QEA AND WAS COLLECTED AS PART OF THE CHEHALIS BASIN LIDAR ACQUISITION AND IS REPRESENTATIVE OF 2017 CONDITIONS. THE VERTICAL DATUM IS NAVD88 GEOID12B. THE HORIZONTAL DATUM IS NAD83 (2011) WASHINGTON STATE PLANE SOUTH, US SURVEY FEET.

EROSION, SEDIMENT CONTROL AND WATER MANAGEMENT NOTES

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR IMPLEMENTING ALL TEMPORARY EROSION CONTROL MEASURES. THE EROSION CONTROL MEASURES SHALL BE IN ACCORDANCE WITH ALL FEDERAL, STATE, AND LOCAL REQUIREMENTS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE MAINTENANCE AND PERFORMANCE OF THE TEMPORARY EROSION CONTROL MEASURES THROUGHOUT THE DURATION OF THE PROJECT.
2. A SEDIMENT AND EROSION CONTROL PLAN WILL BE DEVELOPED BY THE CONTRACTOR AND SUBMITTED FOR APPROVAL BY OWNER AND/OR THE ENGINEER BEFORE ANY CONSTRUCTION MAY BEGIN. THE SEDIMENT AND EROSION CONTROL PLAN WILL IDENTIFY BEST MANAGEMENT PRACTICES TO ENSURE THAT THE TRANSPORT OF SEDIMENT TO SURFACE WATERS, DRAINAGE SYSTEMS, AND ADJACENT PROPERTIES IS MINIMIZED.
3. ACTIVITIES SHALL BE DESIGNED AND CONSTRUCTED TO AVOID AND MINIMIZE ADVERSE IMPACTS TO WATERS OF THE UNITED STATES TO THE MAXIMUM EXTENT PRACTICAL THROUGH THE USE OF PRACTICAL ALTERNATIVES. ALTERNATIVES THAT SHALL BE CONSIDERED INCLUDE THOSE THAT MINIMIZE THE NUMBER AND EXTENT OF IN-WATER WORK AND EQUIPMENT CROSSINGS OF WETTED CHANNELS.
4. AT NO TIME SHALL SEDIMENT-LADEN WATER BE DISCHARGED OR PUMPED DIRECTLY INTO THE SUBJECT RIVER, STREAM, OR WETLAND. WATER SHALL BE DISCHARGED IN ACCORDANCE WITH REQUIREMENTS SET FORTH IN THE PROJECT PERMITS AND / OR SPECIFICATIONS.
5. IF HIGH WATER LEVEL CONDITIONS THAT CAUSE SILTATION OR EROSION ARE ENCOUNTERED DURING CONSTRUCTION, WORK SHALL STOP UNTIL THE WATER LEVEL SUBSIDES.
6. PERMIT CONDITIONS CONTAIN SPECIFIC REQUIREMENTS FOR THE CONTROL OF EROSION AND TURBIDITY FROM PROJECT OPERATIONS. TURBIDITY WILL BE MONITORED ON A FREQUENT BASIS BY THE PROJECT MANAGEMENT AND INSPECTION STAFF ON-SITE. TURBIDITY AMOUNTS IN EXCESS OF THE PERMITTED CONCENTRATIONS AND/OR DURATIONS WILL CAUSE WORK TO BE STOPPED UNTIL IMPROVED PRACTICES ARE IN EFFECT AND THE PROBLEMS CONTROLLED. THE CONTRACTOR IS COMPLETELY RESPONSIBLE FOR ANY PROJECT DELAYS THAT OCCUR BY NATURE OF THIS FAILURE TO ADEQUATELY CONTAIN SEDIMENT ON-SITE.
7. CONTRACTOR SHALL LIMIT MACHINERY MOVEMENT TO CONSTRUCTION AREAS DEFINED ON SITE PLAN OR IDENTIFIED AS ACCEPTABLE BY THE ENGINEER OR OWNER.
8. ALL EXTERNAL GREASE AND OIL SHALL BE PRESSURE-WASHED OFF THE EQUIPMENT PRIOR TO TRANSPORT TO THE SITE.
9. ALL EQUIPMENT OPERATING BELOW OHWM SHALL UTILIZE READILY BIODEGRADABLE VEGETABLE-BASED HYDRAULIC FLUIDS.
10. THE CONTRACTOR IS RESPONSIBLE TO ENSURE THAT NO PETROLEUM PRODUCTS, HYDRAULIC FLUID, SEDIMENTS, SEDIMENT-LADEN WATER, CHEMICALS, OR ANY OTHER TOXIC OR DELETERIOUS MATERIALS ARE ALLOWED TO ENTER OR LEACH INTO THE SUBJECT RIVER, STREAM, OR WETLAND.
11. THE CONTRACTOR SHALL HAVE AN EMERGENCY SPILL KIT ONSITE AT ALL TIMES.
12. NO TREES OR WETLAND VEGETATION SHALL BE REMOVED UNLESS THEY ARE SHOWN AND

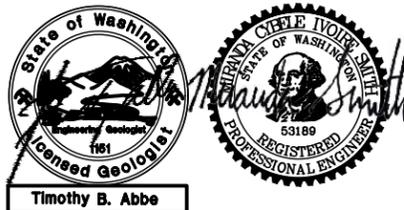
NOTED TO BE REMOVED ON THE PLANS OR AS DIRECTLY SPECIFIED ON-SITE BY THE PROJECT MANAGEMENT STAFF. ALL TREES CONFLICTING WITH GRADING SHALL BE REMOVED. NO GRADING SHALL TAKE PLACE WITHIN THE DRIP LINE OF TREES NOT TO BE REMOVED UNLESS OTHERWISE APPROVED.

13. FOLLOWING CONSTRUCTION, SITE RESTORATION WILL INCLUDE ESTABLISHING LONG-TERM EROSION PROTECTION MEASURES. THESE MEASURES WILL INCLUDE PLANTINGS, EROSION CONTROL FABRIC, SEED, AND MULCH. EQUIPMENT AND EXCESS SUPPLIES WILL BE REMOVED AND THE WORK AREA WILL BE CLEANED. MAINTENANCE ACTIVITIES FOR THE NEWLY CONSTRUCTED RESTORATION PROJECTS ARE ANTICIPATED TO OCCUR PERIODICALLY.

CONSTRUCTION NOTES

1. CONTRACT DOCUMENTS REFER TO THESE PLANS.
2. CONTRACTOR SHALL FURNISH ALL MATERIALS, EQUIPMENT, AND LABOR NECESSARY TO COMPLETE ALL WORK AS INDICATED IN THE CONTRACT DOCUMENTS.
3. CONSTRUCTION HOURS SHALL BE WEEKDAYS BETWEEN 7:00 A.M. AND 6:30 P.M. UNLESS PRIOR APPROVAL IS RECEIVED FROM THE OWNER.
4. ANY DISCREPANCIES ARE TO BE BROUGHT TO THE ATTENTION OF THE OWNER PRIOR TO PROCEEDING WITH THE WORK.
5. THE CONTRACTOR SHALL INSTALL ALL EQUIPMENT AND MATERIALS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS UNLESS SPECIFICALLY INDICATED OTHERWISE BY THE OWNER OR WHERE LOCAL CODES OR REGULATIONS TAKE PRECEDENCE.
6. ALL WORK PERFORMED AND MATERIALS INSTALLED SHALL BE IN STRICT ACCORDANCE WITH ALL APPLICABLE CODES, REGULATIONS, AND ORDINANCES.
7. THE CONTRACTOR SHALL SUPERVISE AND DIRECT THE WORK USING THE BEST SKILLS AND ATTENTION. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ALL CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES, AND PROCEDURES AND FOR COORDINATING ALL PORTIONS OF THE WORK UNDER THIS CONTRACT.
8. THE CONTRACTOR SHALL MAKE ALL NECESSARY PROVISIONS TO PROTECT EXISTING IMPROVEMENTS, ROADWAY, DRAINAGE WAYS, PRIVATE BRIDGE, CULVERTS, AND VEGETATION UNTIL SUCH ITEMS ARE TO BE DISTURBED OR REMOVED AS INDICATED ON THE CONTRACT DOCUMENTS.
9. THE CONTRACTOR SHALL KEEP THE JOB SITE CLEAN AND HAZARD FREE. CONTRACTOR SHALL DISPOSE OF ALL DIRT, DEBRIS, AND RUBBISH FOR THE DURATION OF THE WORK. UPON COMPLETION OF WORK, CONTRACTOR SHALL REMOVE ALL MATERIAL AND EQUIPMENT NOT SPECIFIED AS REMAINING ON THE PROPERTY.
10. NOTES AND DETAILS ON THE PLANS SHALL TAKE PRECEDENCE OVER GENERAL NOTES HEREIN.
11. DIMENSIONS CALLOUTS SHALL TAKE PRECEDENCE OVER SCALES SHOWN ON THE PLANS.
12. THE PLANS REPRESENT THE FINISHED STRUCTURE. THEY DO NOT INDICATE THE METHOD OF ALL CONSTRUCTION. THE CONTRACTOR SHALL PROVIDE ALL MEASURES NECESSARY TO PROTECT THE STRUCTURES, WORKS, AND THE PUBLIC DURING CONSTRUCTION.
13. MATERIAL SHALL NOT BE STORED OUTSIDE OF IDENTIFIED STAGING AREAS. THE CONTRACTOR SHALL USE ONLY DESIGNATED SPECIFIC SITES FOR STORAGE OF EQUIPMENT AND MATERIALS AS SHOWN ON THESE PLANS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE SECURITY OF ALL EQUIPMENT AND MATERIALS.

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NAME OR INITIALS AND DATE		GEOGRAPHIC INFORMATION	
DESIGNED	MT, RLE, MS	LATITUDE	46°58'55.71"N
CHECKED	MT, RLE	LONGITUDE	123°28'56.2"W
DRAWN	MS, KP	TN/SC/RG	T17N/S6/R6W
CHECKED	MT, RLE	DATE	6/11/2020

KEYS ROAD FLOOD PROTECTION

GENERAL NOTES

2
SHEET 2 OF 32

Jun 11, 2020 PHASE I FINAL DESIGN

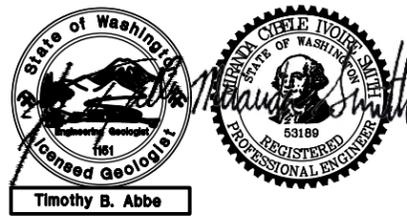
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GENERAL QUANTITIES			
ITEM #	DESCRIPTION	QUANTITY	UNITS
1	MOBILIZATION	1	LS
2	TEMPORARY EROSION AND SEDIMENT CONTROL	1	LS
3	TEMPORARY CONSTRUCTION ACCESS AND STAGING	1	LS
4	SITE ISOLATION	1	LS
5	RELIEF CHANNEL RM 1.0 - EXCAVATION, HAUL, AND SPREAD	10000	CY
6	TYPE 1 APEX ELJ	7	EA
7	TYPE 2 APEX ELJ	1	EA
8	TYPE 1 DEFLECTOR ELJ	9	EA
9	FLOODPLAIN ROUGHNESS TRIANGULAR ELJ	7	EA
10	TYPE 1 SETBACK REVETMENT ELJ	6	EA
11	TYPE 2 SETBACK REVETMENT ELJ	12	EA
12	BANK RIPRAP REMOVAL	1	LS
13	SEEDING AND MULCHING	1	LS
...	HYDROSEEDING/MULCHING WITH NATIVE UPLAND SEED MIX	2.75	AC
...	TEMPORARY SEEDING AND MULCHING	2.25	AC
...	MULCH, DELIVERED AND STOCKPILED	195	CY
<i>Optional Additive</i>			
1	SITE ISOLATION FOR TIMER COMPLEX ELJ	1	LS
2	TIMBER COMPLEX ELJ	4	EA

MATERIALS QUANTITY TABLE			
LOG ID	DIA*	LENGTH**	QTY
RB-5	22-26	50	28
RB-4	22-26	40	78
B-4	22-26	40	75
RB-3	22-26	30	18
RD-5	18-22	50	38
D-5	18-22	50	14
RD-4	18-22	40	68
RD-3	18-22	30	40
RD-2	18-22	20	16
RE-4	16-20	30	18
E-5	16-20	50	0
E-4	16-20	40	25
E-3	16-20	30	24
RF-4	14-18	40	13
RF-3	14-18	30	47
RF-2	14-18	20	2
PE-4 ***	18	40	126
PE-3 ***	18	30	328
RACKING	6-12	20-40	5,114
SLASH (CY)	1-3	-	3,475
RC-36	36	-	216
RC-28	28	-	72
* MINIMUM DIAMETER AT BREAST HEIGHT (1" PER 10' MAXIMUM TAPER)			
** TOTAL LENGTH INCLUDING ROOTWAD			
*** TURNED WOOD PILES - DIA (IN) IS BUTT DIAMETER WITH BARK OFF			

STRUCTURE STAKEOUT POINT TABLE

Raw Description	Elevation	Northing	Easting	Raw Description	Elevation	Northing	Easting	Raw Description	Elevation	Northing	Easting
01-A1-1	14.081	615961.2470	895529.4979	04-A1-1	21.370	616373.5131	893697.8277	07-SB2-1	18.243	615866.3481	896429.7293
01-A1-2	13.417	616013.1287	895520.7088	04-A1-2	16.725	616331.4875	893730.1497	07-SB2-2	18.895	615849.3635	896413.1526
01-A2-1	14.604	615965.8235	895775.0602	04-D1-1	16.911	615999.2008	895945.1041	08-D1-1	16.524	619272.4138	896209.0369
01-A2-2	12.427	615995.5011	895766.5823	04-D1-2	19.778	615982.8681	895997.9995	08-D1-2	23.072	619234.9243	896249.6487
01-D1-1	10.489	615532.8462	896272.8769	04-FP-1	24.503	615816.0809	893955.6647	08-SB2-1	22.666	615915.3108	896440.0095
01-D1-2	19.824	615489.4165	896307.0800	04-FP-2	24.720	615828.7775	893976.0665	08-SB2-2	19.128	615898.5382	896423.4483
01-FP-1	24.901	615656.5065	894075.2054	04-SB2-1	18.397	615705.5741	896392.3050	09-D1-1	17.785	619378.3959	896041.9548
01-FP-2	25.513	615668.4162	894096.0440	04-SB2-2	17.836	615688.9898	896375.2103	09-D1-2	26.296	619374.8477	896097.2340
01-SB2-1	28.672	615543.7818	896337.9553	04-TC-1	8.736	615481.7412	896281.6165	09-SB1-1	22.892	615966.1489	896457.8544
01-SB2-2	27.325	615527.3323	896320.8951	04-TC-2	16.494	615414.3062	896250.3278	09-SB1-2	18.920	615941.7662	896409.8765
01-TC-1	5.269	615261.9142	896195.7937	05-A1-1	16.219	616396.9455	893812.0446	10-SB2-1	34.537	618960.3917	896370.4523
01-TC-2	11.936	615187.8078	896203.9547	05-A1-2	17.622	616360.8435	893850.9337	10-SB2-2	34.483	618941.3353	896356.3108
02-A1-1	14.153	615937.9901	895228.6760	05-D1-1	20.522	616765.2941	893843.6865	11-SB2-1	33.898	619018.8083	896375.4837
02-A1-2	16.139	615989.8877	895219.4805	05-D1-2	25.943	616716.6888	893817.1622	11-SB2-2	35.745	618999.4824	896361.5070
02-D1-1	14.765	615731.5050	896241.6006	05-FP-1	24.106	615933.0294	893915.9899	12-SB1-1	32.159	619077.5878	896394.4156
02-D1-2	24.717	615688.4802	896276.5343	05-FP-2	24.220	615948.6507	893934.5512	12-SB1-2	34.362	619053.4518	896346.5873
02-FP-1	24.297	615709.6296	893999.2137	05-SB2-1	16.796	615768.2931	896403.2462	13-SB2-1	32.607	619132.2379	896389.9248
02-FP-2	24.667	615733.8370	894002.6387	05-SB2-2	16.518	615751.4774	896386.2346	13-SB2-2	32.899	619113.0080	896375.8985
02-SB2-1	24.602	615598.7454	896364.4388	06-A1-1	28.003	616520.8169	893732.4330	14-SB2-1	30.500	619187.1202	896394.1836
02-SB2-2	24.367	615582.1725	896347.1683	06-A1-2	16.747	616488.6762	893774.2089	14-SB2-2	30.093	619167.6978	896380.1480
02-TC-1	7.191	615339.3900	896212.6223	06-D1-1	21.559	616968.9710	893918.7306	15-SB1-1	32.092	619237.6938	896407.9794
02-TC-2	5.228	615265.8146	896202.2039	06-D1-2	23.751	616920.0871	893892.1700	15-SB1-2	30.615	619213.4699	896360.2199
03-A1-1	21.820	616266.2820	893893.6310	06-FP-1	23.410	616042.2239	893901.0510	16-SB2-1	30.471	619284.4246	896402.8571
03-A1-2	23.120	616222.8376	893923.2374	06-FP-2	23.942	616041.7711	893925.0449	16-SB2-2	30.147	619264.9284	896388.7984
03-D1-1	17.056	615880.7034	896125.0678	06-SB1-1	19.180	615819.6796	896428.4283	17-SB2-1	31.796	619334.5618	896407.0608
03-D1-2	25.720	615859.0177	896176.0188	06-SB1-2	16.186	615795.5273	896380.9175	17-SB2-2	30.320	619315.1405	896393.0971
03-FP-1	25.237	615817.6933	894023.4427	07-A1-1	16.603	616566.8093	893834.9288	18-SB1-1	33.193	619391.1264	896423.5845
03-FP-2	25.351	615794.5340	894030.0262	07-A1-2	17.982	616541.3849	893880.8561	18-SB1-2	31.360	619366.6971	896375.9542
03-SB1-1	21.168	616557.1730	896389.3192	07-D1-1	18.672	619088.9155	896235.2262				
03-SB1-2	20.077	616333.5580	896341.5225	07-D1-2	31.614	619034.2676	896244.2614				
03-TC-1	9.090	615414.6896	896236.3622	07-FP-1	22.962	616124.4089	893883.5069				
03-TC-2	9.644	615341.2158	896225.7166	07-FP-2	23.487	616136.1080	893904.8170				



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CHECKED	MT, RLE		LATITUDE 46°58'55.71"N
DRAWN	MS, KP		LONGITUDE 123°28'56.2"W
CHECKED	MT, RLE		TN/SC/RG T17N/S6/R6W
			DATE 6/11/2020

KEYS ROAD FLOOD PROTECTION

QUANTITIES AND STAKEOUT POINTS

GENERAL LEGEND

- PROPERTY LINE
- GAS --- GAS --- GAS LINE
- RIGHT OF WAY LINE
- ===== EXISTING ROAD
- ===== ACCESS ROAD
- CL CL CLEARING LIMIT
- GL GL GRADING LIMIT
- EX EX EXCAVATION LIMIT
- - - -5- - - - EXISTING MAJOR CONTOUR
- - - -1- - - - EXISTING MINOR CONTOUR
- 5 PROPOSED MAJOR CONTOUR
- 1 PROPOSED MINOR CONTOUR
- > > > EXISTING FLOW
- OHWM OHWM EXISTING OHWM
- OHWM OHWM PROPOSED OHWM
- 2-YR 2-YEAR FLOOD BOUNDARY
- 100-YR 100-YEAR FLOOD BOUNDARY
- WL WL EXISTING WETLAND
- WL WL PROPOSED WETLAND
- W W W EXISTING WATER
- W W W PROPOSED WATER
- EXISTING FENCE



STAKEOUT POINT LOCATION



DEMOLITION/REMOVAL AREA



ENGINEERED LOGJAM (ELJ)
TYPE 1 APEX



ENGINEERED LOGJAM (ELJ)
TYPE 2 APEX



ENGINEERED LOGJAM (ELJ)
TYPE 1 DEFLECTOR



ENGINEERED LOGJAM (ELJ)
FLOODPLAIN ROUGHNESS



ENGINEERED LOGJAM (ELJ)
TYPE 1 SETBACK REVETMENT



ENGINEERED LOGJAM (ELJ)
TYPE 2 SETBACK REVETMENT



ENGINEERED LOGJAM (ELJ)
TIMBER COMPLEX UNIT

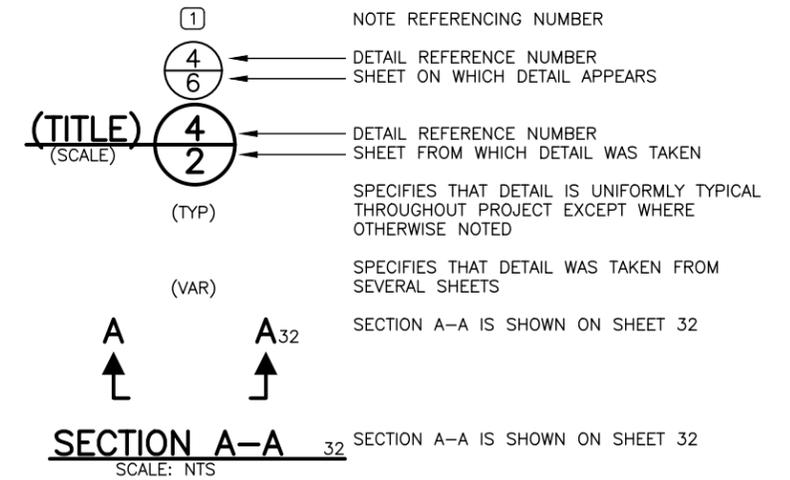
TEMPORARY EROSION CONTROL LEGEND

- SB SB SILT BOOM
- BN BN BLOCK NETS
- SF SF SILT FENCE
- SW SW STRAW WATTLE
- DEWATERING LINE DISCHARGE
- PROPOSED STAGING AREA
- BULK BAG COFFERDAM
- TEMPORARY ACCESS ROAD
- TEMPORARY ACCESS BRIDGE
- PUMP DISCHARGE OUTLET
- DEWATERING PUMP

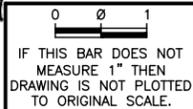
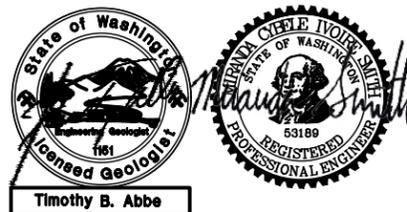
RESTORATION LEGEND

- EMERGENT SCRUB SHRUB WETLAND REVEGETATION AREA
- TREE AND SHRUB REVEGETATION AREA
- GRASS AND FORBE HYDROSEED APPLICATION AREA

DETAIL AND SECTION REFERENCING



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NAME OR INITIALS AND DATE	GEOGRAPHIC INFORMATION
DESIGNED MT, RLE, MS	LATITUDE 46°58'55.71"N
CHECKED MT, RLE	LONGITUDE 123°28'56.2"W
DRAWN MS, KP	TN/SC/RG T17N/S6/R6W
CHECKED MT, RLE	DATE 6/11/2020

KEYS ROAD FLOOD PROTECTION

LEGEND

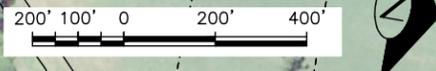
Jun 11, 2020 PHASE I FINAL DESIGN



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Jun 11, 2020 PHASE I FINAL DESIGN

Timothy B. Abbe

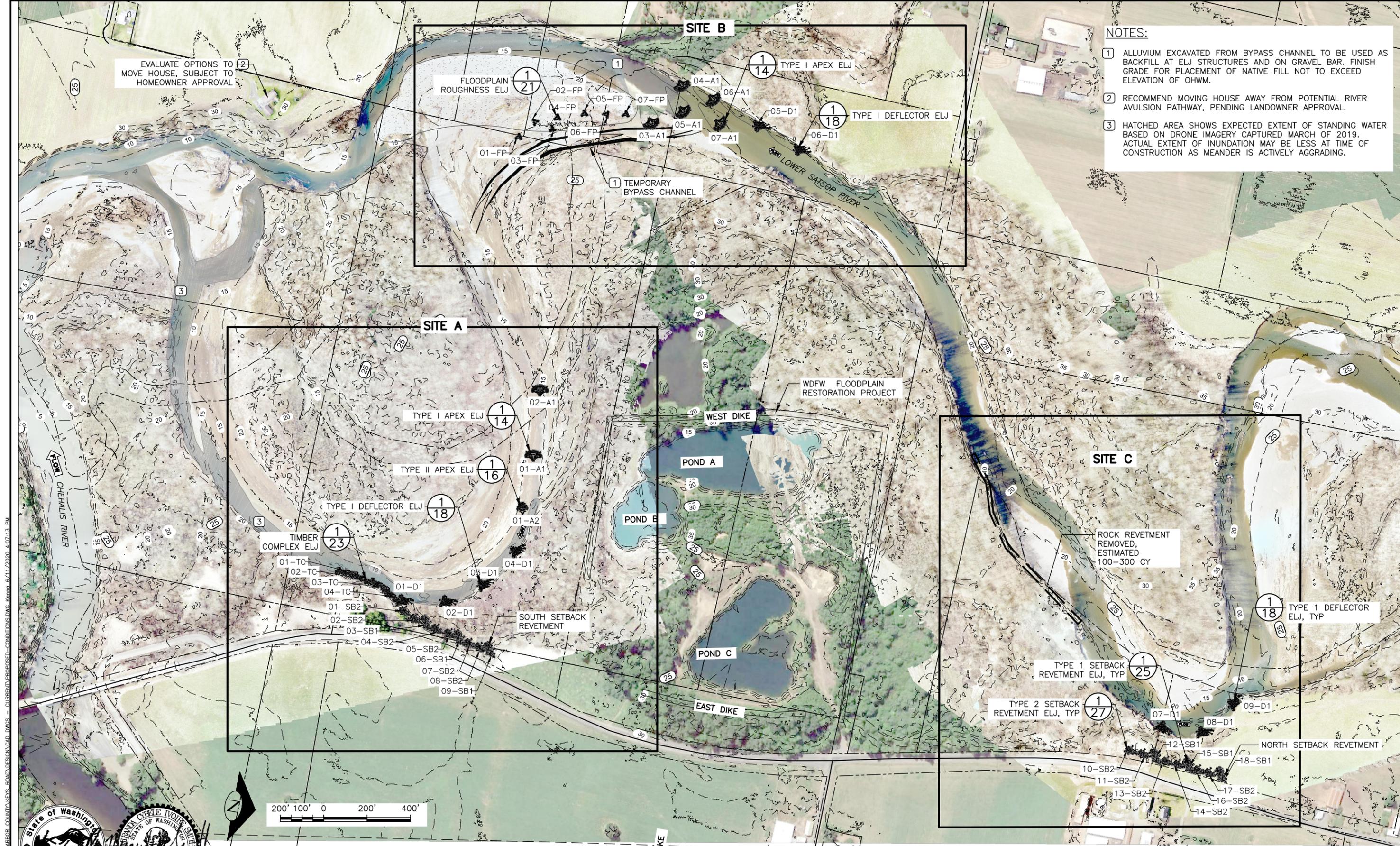


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CHECKED	MT, RLE	DATE	6/11/2020

KEYS ROAD FLOOD PROTECTION

EXISTING CONDITIONS

5
 SHEET 5 OF 32



- NOTES:**
- 1 ALLUVIUM EXCAVATED FROM BYPASS CHANNEL TO BE USED AS BACKFILL AT ELJ STRUCTURES AND ON GRAVEL BAR. FINISH GRADE FOR PLACEMENT OF NATIVE FILL NOT TO EXCEED ELEVATION OF OHWM.
 - 2 RECOMMEND MOVING HOUSE AWAY FROM POTENTIAL RIVER AVULSION PATHWAY, PENDING LANDOWNER APPROVAL.
 - 3 HATCHED AREA SHOWS EXPECTED EXTENT OF STANDING WATER BASED ON DRONE IMAGERY CAPTURED MARCH OF 2019. ACTUAL EXTENT OF INUNDATION MAY BE LESS AT TIME OF CONSTRUCTION AS MEANDER IS ACTIVELY AGGRADING.

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Jun 11, 2020 PHASE I FINAL DESIGN

Timothy B. Abbe
Professional Engineer

Gregory S. Iverson
Professional Engineer

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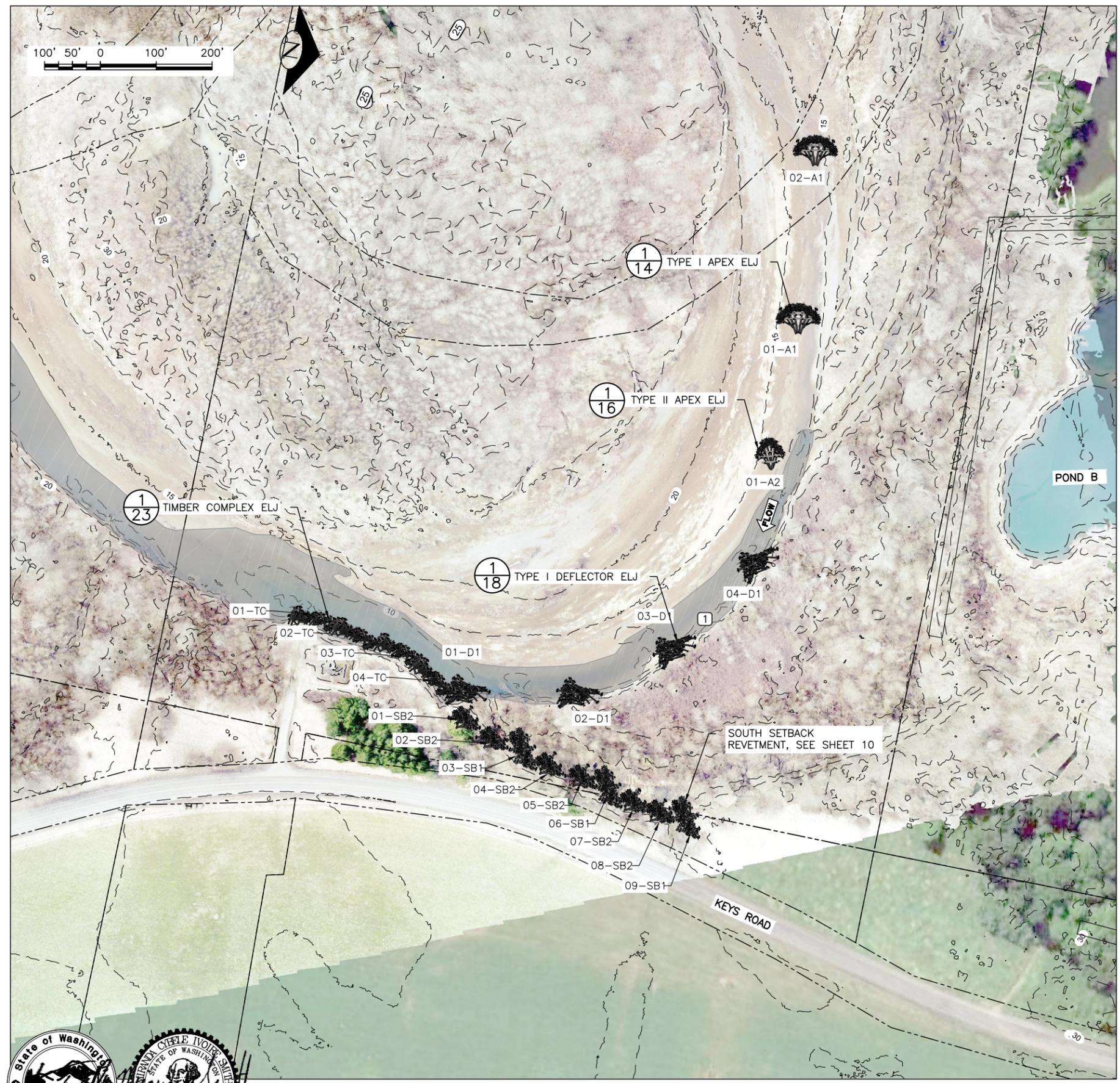


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CHECKED MT, RLE	DATE 6/11/2020

KEYS ROAD FLOOD PROTECTION

PROPOSED CONDITIONS

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NOTES:

- 1 HATCHED AREA SHOWS EXPECTED EXTENT OF STANDING WATER BASED ON DRONE IMAGERY CAPTURED MARCH OF 2019. ACTUAL EXTENT OF INUNDATION MAY BE LESS AT TIME OF CONSTRUCTION AS MEANDER IS ACTIVELY AGGRADING.
2. ELJ STRUCTURE SCHEDULE AND EXCAVATION QUANTITIES HAVE BEEN CALCULATED USING 2017 LIDAR TOPOGRAPHY AND ARE APPROXIMATE AS THE CHANNEL HAS CHANGED. BED ELEVATION OF APEX ELJS ARE TO BE SET APPROXIMATELY EQUAL TO THE ADJACENT THALWEG ELEVATION OF THE CHANNEL.

ELJ STRUCTURE SCHEDULE – SITE A APEX ELJS				
ELJ ID	EXISTING GRADE ELEVATION (FT)	ELJ BED ELEVATION (FT)	EXCAVATION DEPTH (FT)	EXCAVATION QTY. (CY)
01-A2	13.75	10.50	3.25	121
01-A1	OCCUPIES THALWEG		-	-
02-A1	OCCUPIES THALWEG		-	-

Timothy B. Abbe

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CHECKED MT, RLE	DATE 6/11/2020

KEYS ROAD FLOOD PROTECTION

PROPOSED CONDITIONS SITE A

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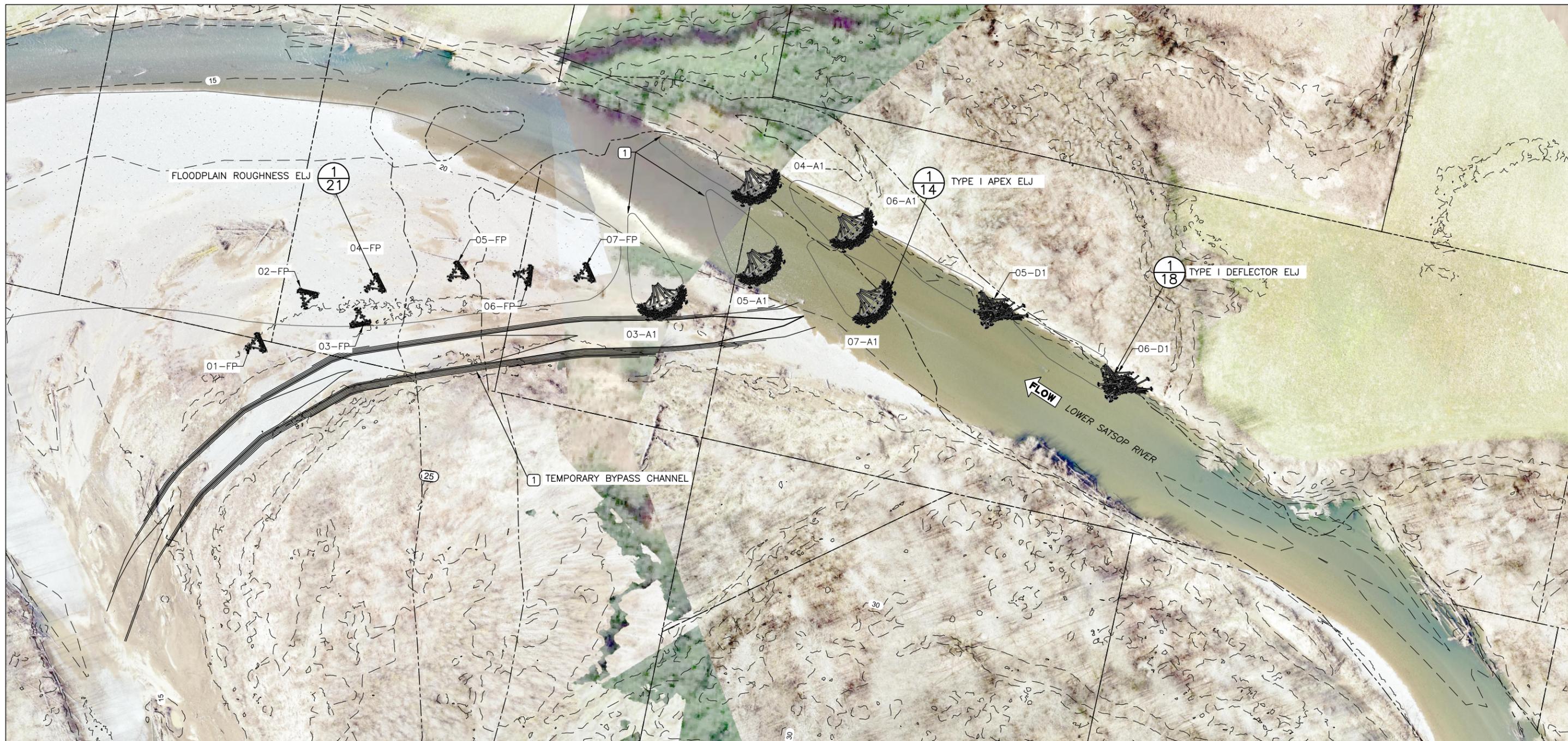
ELJ STRUCTURE SCHEDULE – SITE B APEX ELJS

ELJ ID	EXISTING GRADE ELEVATION (FT)	ELJ BED ELEVATION (FT)	EXCAVATION DEPTH (FT)	EXCAVATION QTY. (CY)
03-A1	22.75	16	6.75	687
04-A1	17.00	16	1.00	102
05-A1	16.50	16	0.50	51
06-A1	17.50	16.5	1.00	102
07-A1	OCCUPIES THALWEG		-	-

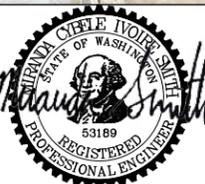
NOTES:

- ALLUVIUM EXCAVATED FROM BYPASS CHANNEL TO BE USED AS BACKFILL AT ELJ STRUCTURES AND ON GRAVEL BAR. FINISH GRADE FOR PLACEMENT OF NATIVE FILL NOT TO EXCEED ELEVATION OF OHWM.
- ELJ STRUCTURE SCHEDULE AND EXCAVATION QUANTITIES HAVE BEEN CALCULATED USING 2017 LIDAR TOPOGRAPHY AND ARE APPROXIMATE AS THE CHANNEL HAS CHANGED. BED ELEVATION OF APEX ELJS ARE TO BE SET APPROXIMATELY EQUAL TO THE ADJACENT THALWEG ELEVATION OF THE CHANNEL.

75' 0 75' 150'



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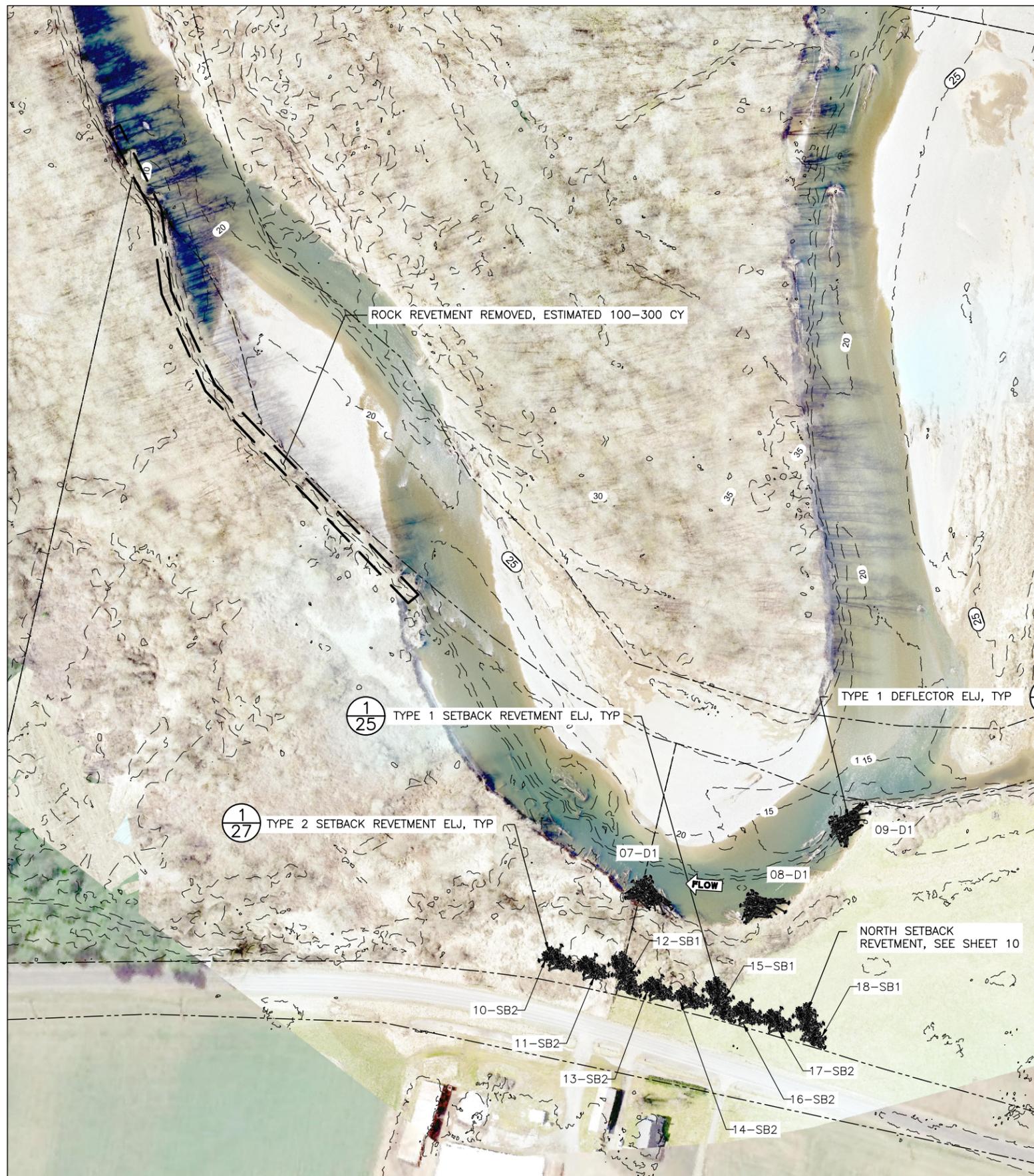
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CHECKED MT, RLE	DATE 6/11/2020

KEYS ROAD FLOOD PROTECTION

PROPOSED CONDITIONS SITE B

8
SHEET 8 OF 32

Jun 11, 2020 PHASE I FINAL DESIGN



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Timothy B. Abbe

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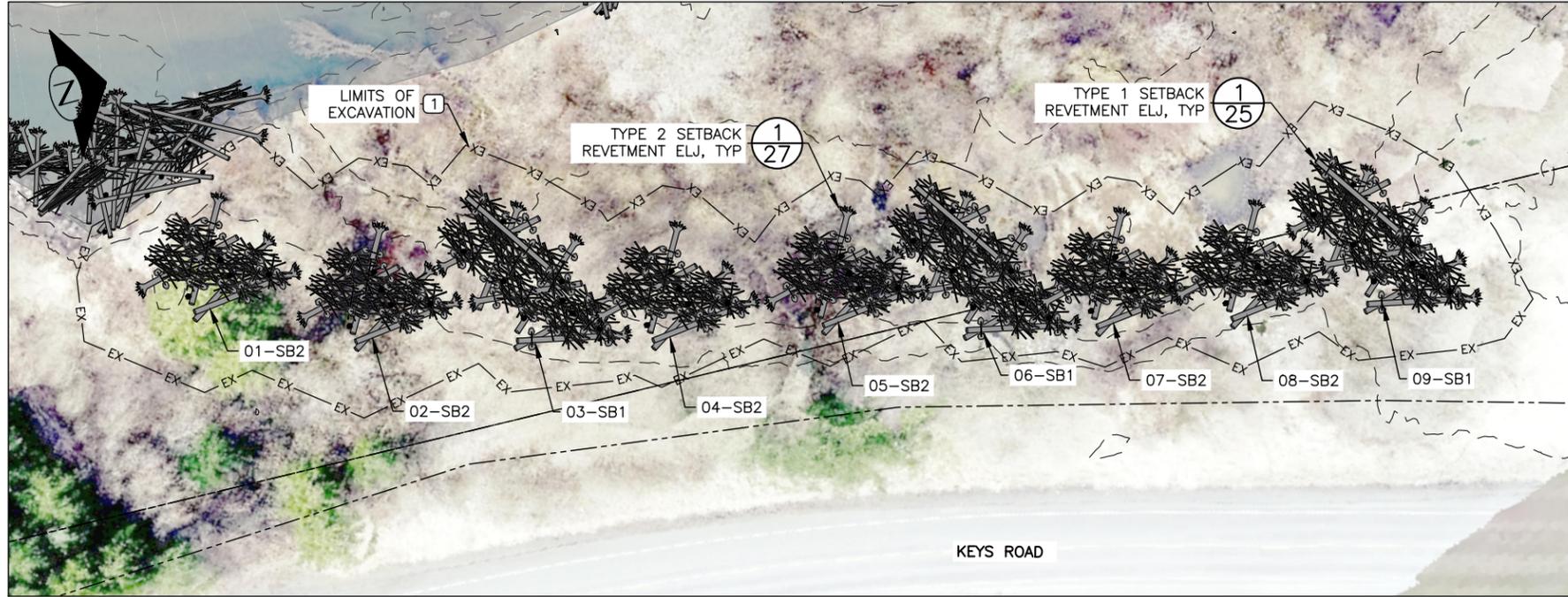


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KEYS ROAD FLOOD PROTECTION

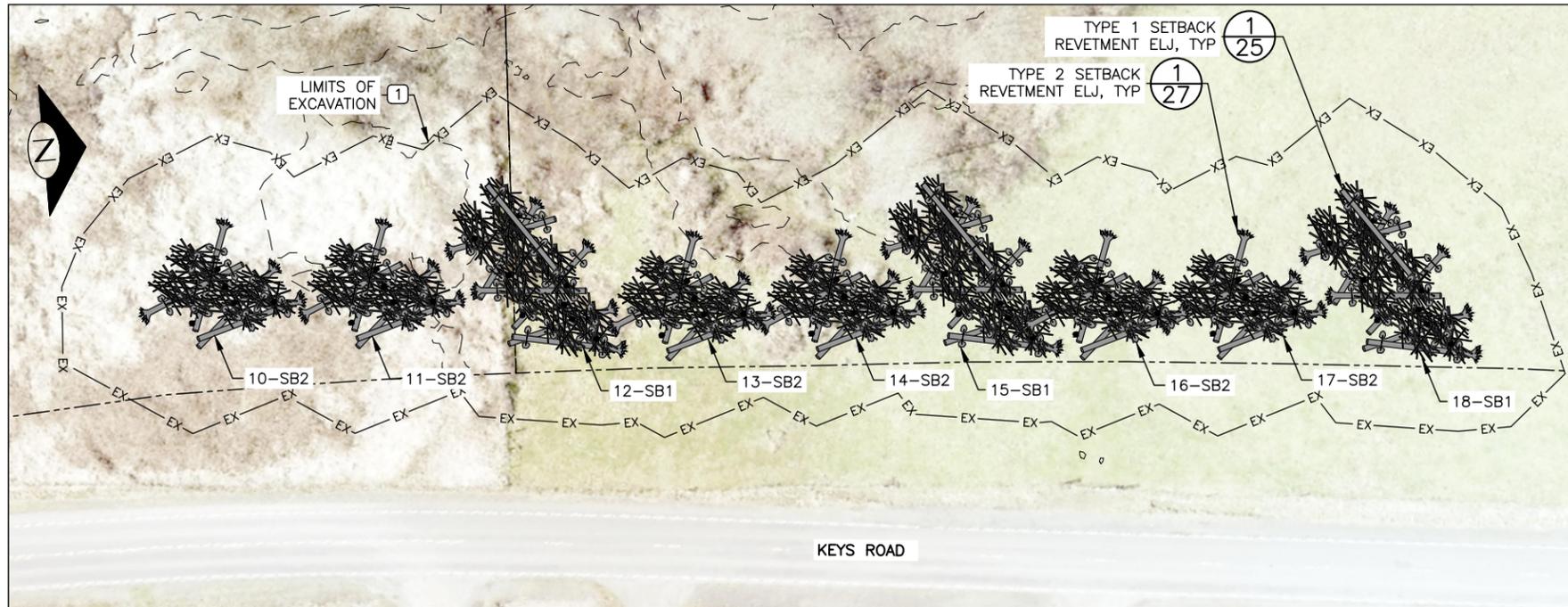
PROPOSED CONDITIONS SITE C

Jun 11, 2020 PHASE I FINAL DESIGN



SOUTH SETBACK REVETMENT

SCALE: 1:30



NORTH SETBACK REVETMENT

SCALE: 1:30

ELJ STRUCTURE SCHEDULE				
ELJ ID	EXISTING GRADE ELEVATION (FT)	ELJ BED ELEVATION (FT)	EXCAVATION DEPTH (FT)	EXCAVATION QTY. (CY)
01-SB2	25.9	11	15	1,805
02-SB2	26.0	12	14	1,675
03-SB1	20.0	12	8	945
04-SB2	19.2	12	7	540
05-SB2	17.9	12	6	435
06-SB1	16.1	12	4	366
07-SB2	18.0	12	6	403
08-SB2	19.9	12	8	649
09-SB1	21.3	12	9	1,273
10-SB2	34.0	16	18	2,438
11-SB2	34.0	16	18	2,381
12-SB1	32.0	16	16	2,705
13-SB2	32.0	16	16	1,950
14-SB2	30.0	16	14	1,536
15-SB1	32.0	16	16	2,713
16-SB2	32.0	16	16	1,870
17-SB2	32.0	16	16	1,945
18-SB1	32.0	16	16	3,397

NOTES:

1. EXCAVATION LIMITS WERE DETERMINED FOLLOWING OSHA GUIDANCE FOR OPEN PIT WITHOUT SHORING AT 1.5:1 SIDE SLOPES.
2. EXCAVATION QUANTITIES HAVE BEEN CALCULATED AS BANK CUBIC YARDS USING 2017 LIDAR TOPOGRAPHY, EXCAVATION DEPTHS SHOWN IN THE STRUCTURE SCHEDULE, AND OSHA GUIDANCE FOR 1.5:1 SIDE SLOPES.
3. EXCAVATED AREAS ARE TO BE REHABILITATED UPON DEMOBILIZATION AS DESCRIBED ON SHEET 31.

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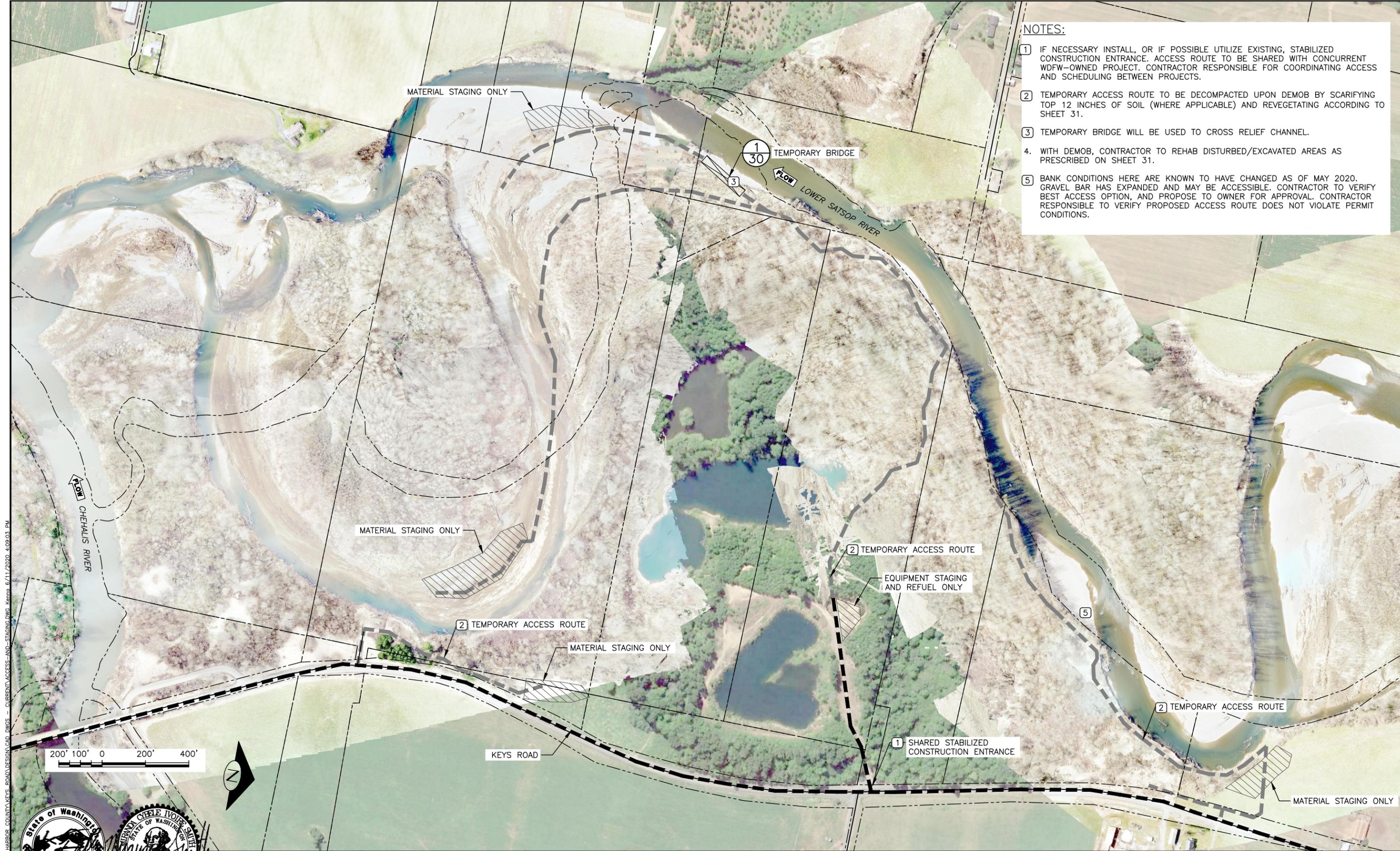
NAME OR INITIALS AND DATE	GEOGRAPHIC INFORMATION
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CHECKED MT, RLE	DATE 6/11/2020

KEYS ROAD FLOOD PROTECTION

SETBACK REVETMENT ELJ SCHEDULE

10
SHEET 10 OF 32

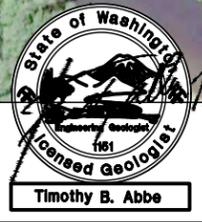
Jun 11, 2020 PHASE I FINAL DESIGN



- NOTES:**
- 1 IF NECESSARY INSTALL, OR IF POSSIBLE UTILIZE EXISTING, STABILIZED CONSTRUCTION ENTRANCE. ACCESS ROUTE TO BE SHARED WITH CONCURRENT WDFW-OWNED PROJECT. CONTRACTOR RESPONSIBLE FOR COORDINATING ACCESS AND SCHEDULING BETWEEN PROJECTS.
 - 2 TEMPORARY ACCESS ROUTE TO BE DECOMPACTED UPON DEMOB BY SCARIFYING TOP 12 INCHES OF SOIL (WHERE APPLICABLE) AND REVEGETATING ACCORDING TO SHEET 31.
 - 3 TEMPORARY BRIDGE WILL BE USED TO CROSS RELIEF CHANNEL.
 4. WITH DEMOB, CONTRACTOR TO REHAB DISTURBED/EXCAVATED AREAS AS PRESCRIBED ON SHEET 31.
 - 5 BANK CONDITIONS HERE ARE KNOWN TO HAVE CHANGED AS OF MAY 2020. GRAVEL BAR HAS EXPANDED AND MAY BE ACCESSIBLE. CONTRACTOR TO VERIFY BEST ACCESS OPTION, AND PROPOSE TO OWNER FOR APPROVAL. CONTRACTOR RESPONSIBLE TO VERIFY PROPOSED ACCESS ROUTE DOES NOT VIOLATE PERMIT CONDITIONS.

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KEYS ROAD FLOOD PROTECTION

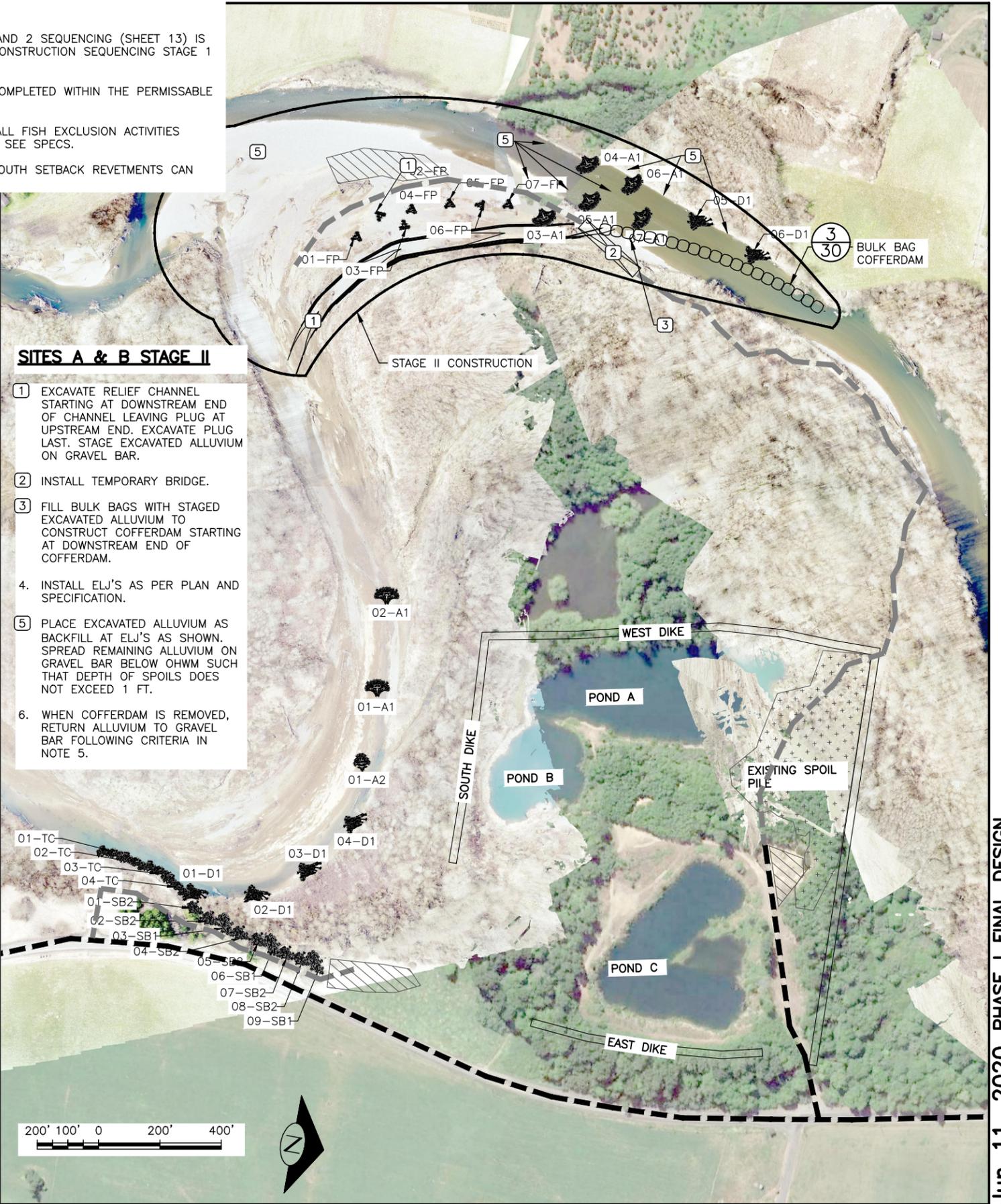
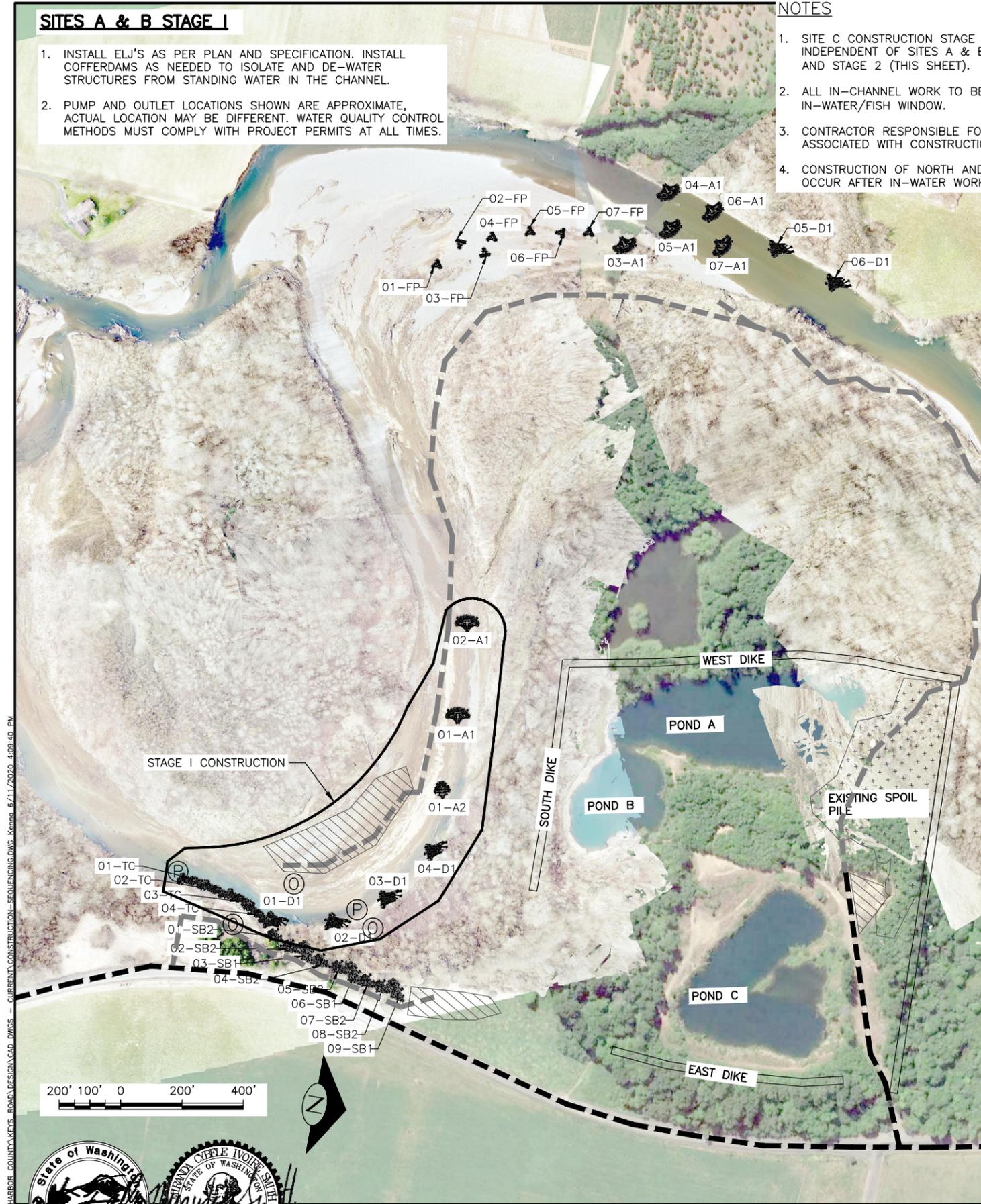
ACCESS AND STAGING

SITES A & B STAGE I

1. INSTALL ELJ'S AS PER PLAN AND SPECIFICATION. INSTALL COFFERDAMS AS NEEDED TO ISOLATE AND DE-WATER STRUCTURES FROM STANDING WATER IN THE CHANNEL.
2. PUMP AND OUTLET LOCATIONS SHOWN ARE APPROXIMATE, ACTUAL LOCATION MAY BE DIFFERENT. WATER QUALITY CONTROL METHODS MUST COMPLY WITH PROJECT PERMITS AT ALL TIMES.

NOTES

1. SITE C CONSTRUCTION STAGE 1 AND 2 SEQUENCING (SHEET 13) IS INDEPENDENT OF SITES A & B CONSTRUCTION SEQUENCING STAGE 1 AND STAGE 2 (THIS SHEET).
2. ALL IN-CHANNEL WORK TO BE COMPLETED WITHIN THE PERMISSABLE IN-WATER/FISH WINDOW.
3. CONTRACTOR RESPONSIBLE FOR ALL FISH EXCLUSION ACTIVITIES ASSOCIATED WITH CONSTRUCTION. SEE SPECS.
4. CONSTRUCTION OF NORTH AND SOUTH SETBACK REVETMENTS CAN OCCUR AFTER IN-WATER WORK.



SITES A & B STAGE II

- 1 EXCAVATE RELIEF CHANNEL STARTING AT DOWNSTREAM END OF CHANNEL LEAVING PLUG AT UPSTREAM END. EXCAVATE PLUG LAST. STAGE EXCAVATED ALLUVIUM ON GRAVEL BAR.
- 2 INSTALL TEMPORARY BRIDGE.
- 3 FILL BULK BAGS WITH STAGED EXCAVATED ALLUVIUM TO CONSTRUCT COFFERDAM STARTING AT DOWNSTREAM END OF COFFERDAM.
4. INSTALL ELJ'S AS PER PLAN AND SPECIFICATION.
- 5 PLACE EXCAVATED ALLUVIUM AS BACKFILL AT ELJ'S AS SHOWN. SPREAD REMAINING ALLUVIUM ON GRAVEL BAR BELOW OHWM SUCH THAT DEPTH OF SPOILS DOES NOT EXCEED 1 FT.
6. WHEN COFFERDAM IS REMOVED, RETURN ALLUVIUM TO GRAVEL BAR FOLLOWING CRITERIA IN NOTE 5.

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Timothy B. Abbe

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NAME OR INITIALS AND DATE
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CHECKED MT, RLE
DRAWN MS, KP
CHECKED MT, RLE

GEOGRAPHIC INFORMATION
LATITUDE 46°58'55.71"N
LONGITUDE 123°28'56.2"W
TN/SC/RG 117N/S6/R6W
DATE 6/11/2020

KEYS ROAD FLOOD PROTECTION

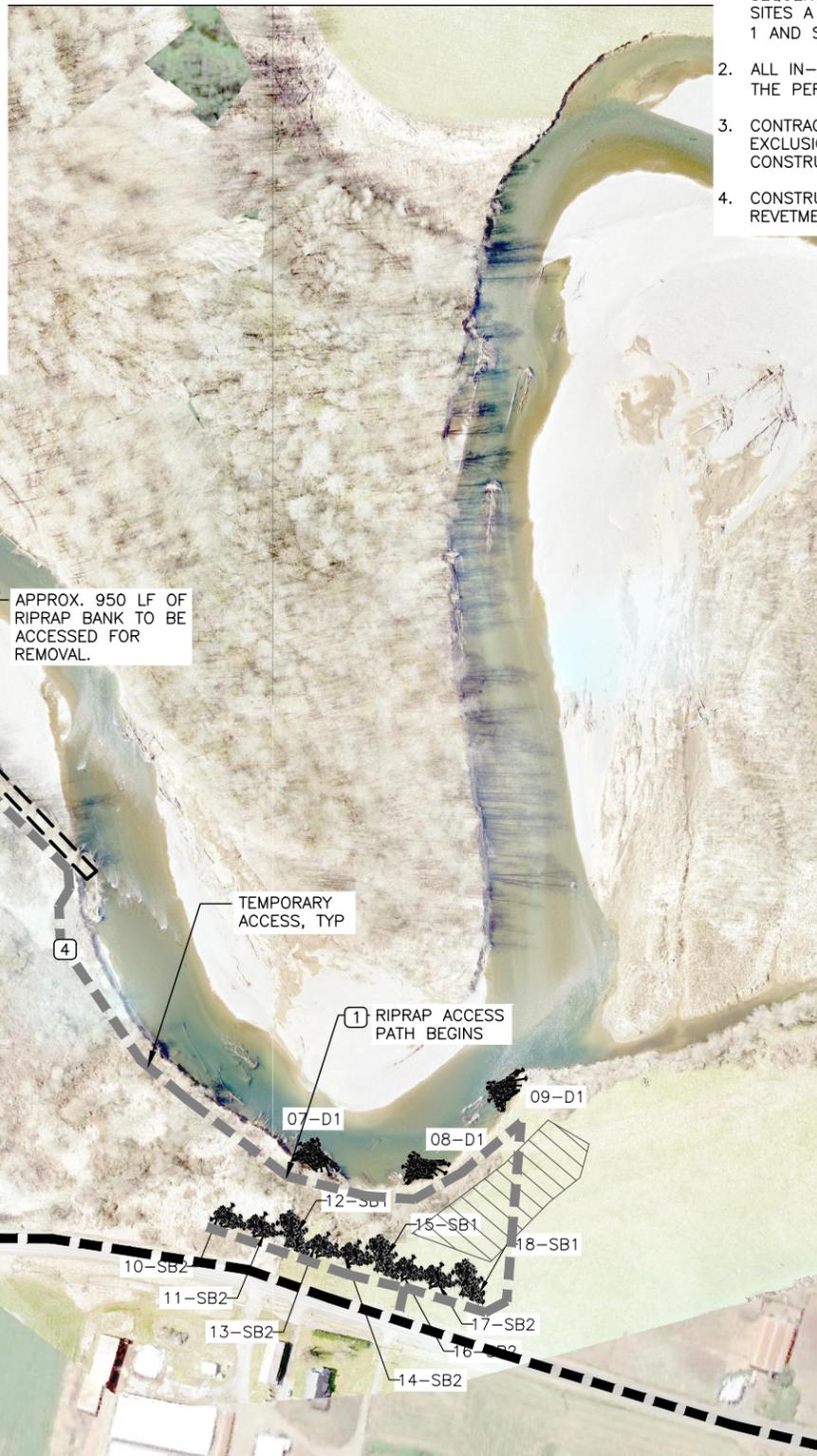
SITES A & B CONSTRUCTION SEQUENCING AND TESC

12
SHEET 12 OF 32

Jun 11, 2020 PHASE I FINAL DESIGN

SITE C STAGE I

1. TEMPORARY ACCESS BEYOND THIS POINT TO MINIMIZE DISTURBANCE TO RIPARIAN VEGETATION. NO MATURE RIPARIAN TREES TO BE CLEARED. BANK CONDITIONS BEYOND HERE ARE KNOWN TO HAVE CHANGED AS OF MAY 2020. GRAVEL BAR ADJACENT TO RIPRAP BANK HAS EXPANDED AND MAY BE ACCESSIBLE. CONTRACTOR TO VERIFY BEST ACCESS OPTION, AND PROPOSE TO OWNER FOR APPROVAL. CONTRACTOR RESPONSIBLE TO VERIFY PROPOSED ACCESS ROUTE DOES NOT VIOLATE ANY PERMIT CONDITIONS.
2. FROM TOP OF BANK, REMOVE RIPRAP (ESTIMATED 100-300 CY) AS POSSIBLE WITHOUT EXCAVATION OF BANK.
3. RIPRAP MAY BE SALVAGED FOR CONSTRUCTION OF ROCK COLLARS.
4. REHAB TEMPORARY ACCESS ROUTE FOLLOWING RIPRAP REMOVAL. NO FURTHER ACCESS ALLOWED.

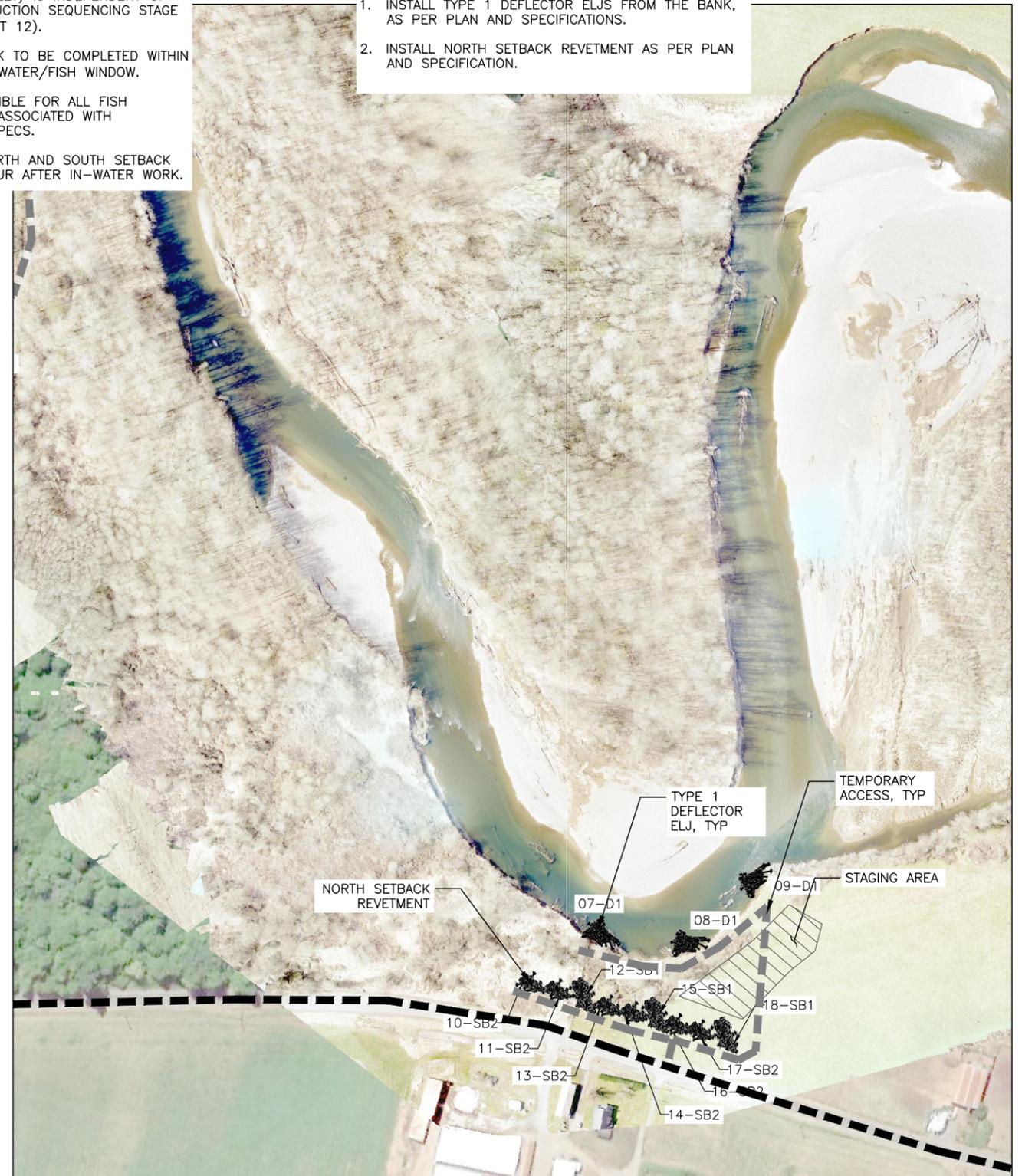


NOTES

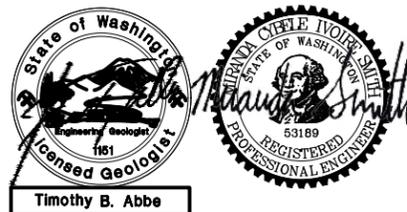
1. SITE C CONSTRUCTION STAGE 1 AND 2 SEQUENCING (THIS SHEET) IS INDEPENDENT OF SITES A & B CONSTRUCTION SEQUENCING STAGE 1 AND STAGE 2 (SHEET 12).
2. ALL IN-CHANNEL WORK TO BE COMPLETED WITHIN THE PERMISSABLE IN-WATER/FISH WINDOW.
3. CONTRACTOR RESPONSIBLE FOR ALL FISH EXCLUSION ACTIVITIES ASSOCIATED WITH CONSTRUCTION. SEE SPECS.
4. CONSTRUCTION OF NORTH AND SOUTH SETBACK REVETMENTS CAN OCCUR AFTER IN-WATER WORK.

SITE C STAGE II

1. INSTALL TYPE 1 DEFLECTOR ELJS FROM THE BANK, AS PER PLAN AND SPECIFICATIONS.
2. INSTALL NORTH SETBACK REVETMENT AS PER PLAN AND SPECIFICATION.



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CHECKED MT, RLE	DATE 6/11/2020

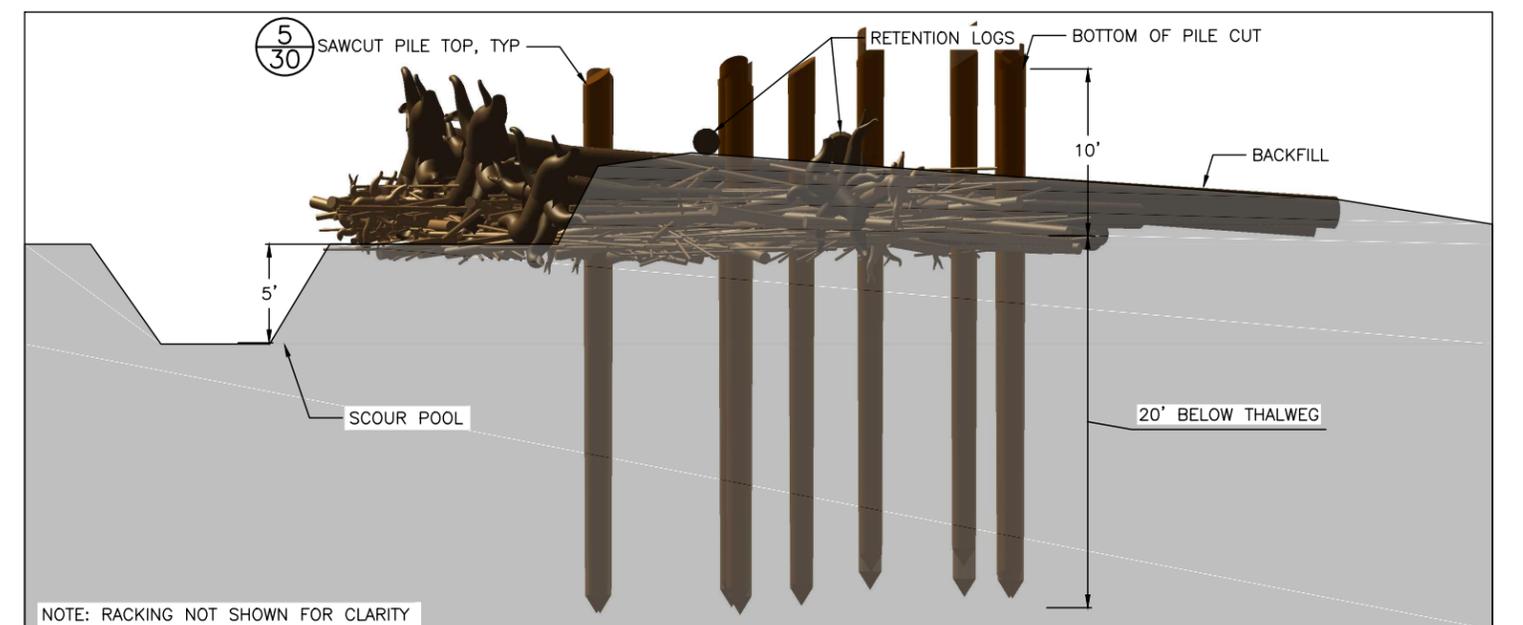
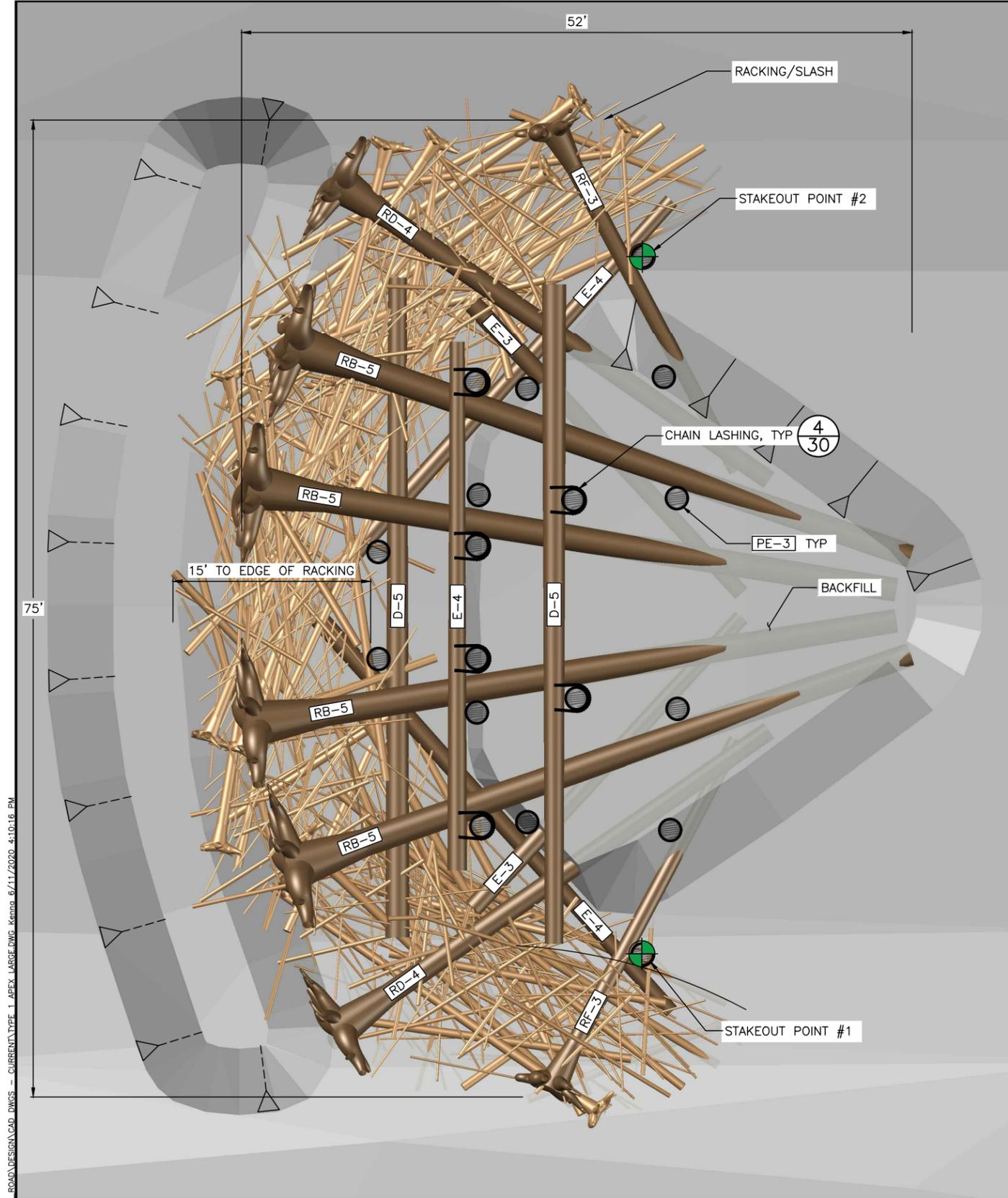
KEYS ROAD FLOOD PROTECTION

SITE C CONSTRUCTION SEQUENCING AND TESC

13
SHEET **13** OF **32**



Jun 11, 2020 PHASE I FINAL DESIGN

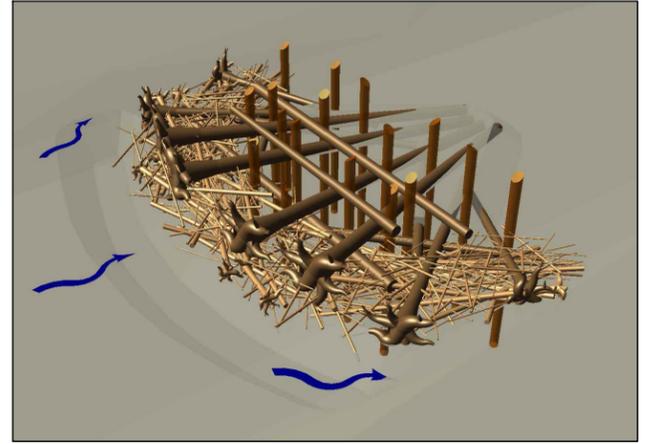


- TYPE 1 APEX ELJ PROFILE**
SCALE: 1" = 5'
- NOTES:**
- ALL LOGS SHALL BE DOUGLAS FIR, OR WESTERN RED CEDAR.
 - ALL PILES SHALL BE ROUND, UNTREATED TIMBER PILES AND SHALL BE DOUGLAS FIR. PILES SHALL BE FREE FROM DEFECTS, CRACKS, AND SPLITTING AT THE TIME OF DRIVING.
 - LOGS WITH ROOTWADS SHALL HAVE A DIAMETER AS SHOWN MEASURED AT DBH, DEFINED AS 4.5 FEET ABOVE GROUND WHEN TREE WAS STANDING.
 - THE CONTRACTOR SHALL PLACE LOGS AS ILLUSTRATED ON THIS SHEET UNLESS DIRECTED OTHERWISE BY THE CONTRACTING OFFICER.
 - SOIL EXCAVATED DURING CONSTRUCTION SHALL BE REPLACED TO ORIGINAL GROUND FOLLOWING PLACEMENT OF ALL LOGS.
 - THE LOCATIONS SHOWN IN THE PLANS ARE APPROXIMATE AND MAY BE ADJUSTED IN THE FIELD BY THE CONTRACTING OFFICER.
 - RACKING LOGS SHALL CONSIST OF TREES WITH BRANCHES HAVING A BASE DIAMETER OF 6-12 INCHES AND A LENGTH OF 20-40 FT. RACKING MATERIAL SHALL OCCUR WITH EACH LAYER TO ENSURE THAT RACKING MATERIAL EXTENDS THROUGH THE STRUCTURE AND IS PINNED BY SUBSEQUENT LAYERS. SLASH MATERIAL SHALL CONSIST OF LIMBS AND BRANCHES AND A BASE DIAMETER BETWEEN 1 AND 3 INCHES. SLASH MATERIAL SHALL BE PLACED AS DIRECTED BY THE CONTRACTING OFFICER. QUANTITY OF RACKING LOGS AND SLASH MATERIAL PER STRUCTURE ARE SHOWN IN LOG SCHEDULE. RACKING AND SLASH MATERIAL SHALL BE DOUGLAS FIR, PONDEROSA PINE, WESTERN RED CEDAR, OR WESTERN LARCH TREES.
 - RETENTION LOGS TO BE INSTALLED TO HOLD RACKING MATERIAL IN PLACE AT THE DIRECTION OF THE CONTRACTING OFFICER.
 - CONNECT LOGS WITH WRAPPED CHAIN CONNECTION WHERE INDICATED ON THE DRAWINGS. SEE DETAILS.
 - AT LOCATIONS WHERE SITE CONDITIONS ALLOW (IN DRY OR LIMITED DEWATERING), SCOUR POOL TO BE EXCAVATED. EXCAVATED ALLUVIUM TO BE PLACED BEHIND THE STRUCTURE AS DIRECTED BY THE CONTRACTING OFFICER. EXTENTS AND LOCATION OF THE SCOUR POOL IS APPROXIMATE AND TO BE ADJUSTED IN THE FIELD BY THE CONTRACTING OFFICER.
 - EXISTING WOODY MATERIAL AT THE STRUCTURE CONSTRUCTION SITE SHALL BE MOVED OR PROTECTED FROM CONSTRUCTION ACTIVITIES AND THEN INCORPORATED INTO THE STRUCTURE AS DIRECTED BY THE CONTRACTING OFFICER.

TYPE 1 APEX ELJ LOG SCHEDULE

LOG ID	DIA* (INCHES)	LENGTH ** (FEET)	ROOTWAD (Y/N)	QUANTITY PER STRUCTURE	NOTES
RB-5	22-26	50	Y	4	
RD-4	18-22	40	Y	2	
D-5	18-22	50	N	2	
E-4	16-20	40	N	3	
E-3	16-20	30	N	2	
RF-3	14-18	30	Y	2	
PE-3 ***	18	30	N	18	
RACKING	6-12	20-40	N	150	TREES WITH BRANCHES
SLASH	1-3	-	-	50 CY	LIMBS AND BRANCHES

* MINIMUM DIAMETER AT BREAST HEIGHT (1" PER 10' MAXIMUM TAPER)
 ** TOTAL LENGTH INCLUDING ROOTWAD
 *** TURNED PILES - DIA (IN) IS BUTT DIAMETER



State of Washington
 Licensed Geologist
 Timothy B. Abbe

Suprema Circle Ivoire Smith
 53189
 REGISTERED PROFESSIONAL ENGINEER

TYPE 1 APEX ELJ PLAN
SCALE: 1" = 5'

0 5 10'
SCALE: 1"=5'-0"

Natural Systems Design

NAME OR INITIALS AND DATE	GEOGRAPHIC INFORMATION
DESIGNED MT, RLE, MS	LATITUDE 46°58'55.71"N
CHECKED MT, RLE	LONGITUDE 123°28'56.2"W
DRAWN MS, KP	TN/SC/RG T17N/S6/R6W
CHECKED MT, RLE	DATE 6/11/2020

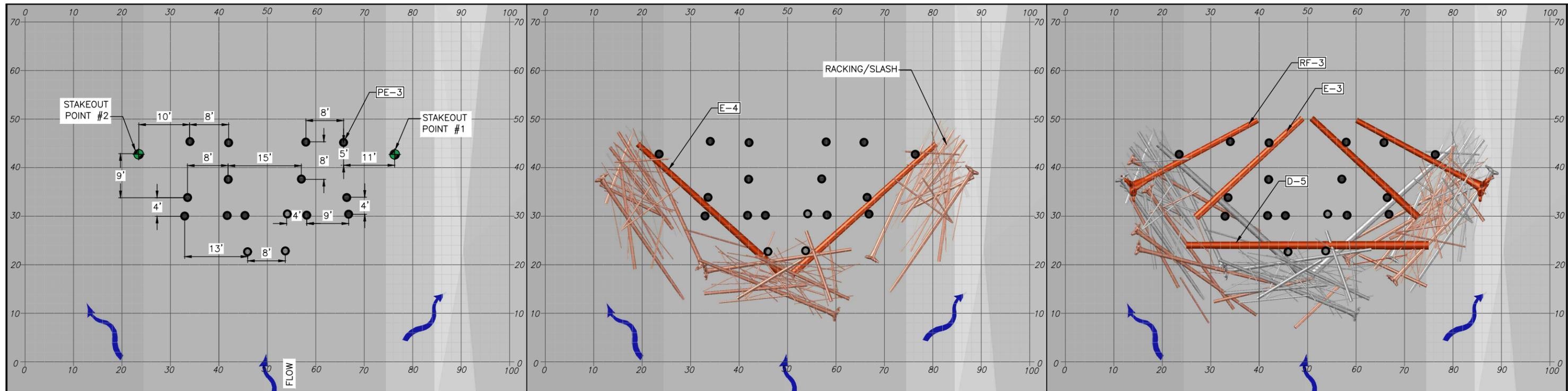
KEYS ROAD FLOOD PROTECTION

TYPE 1 APEX ELJ DETAIL

14
SHEET 14 OF 32

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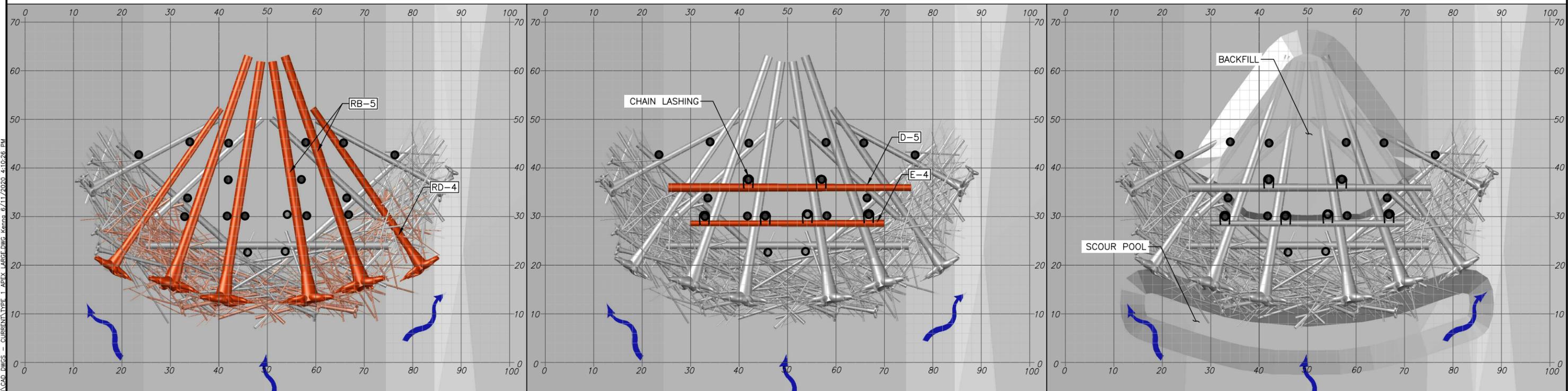
Jun 11, 2020 PHASE I FINAL DESIGN



LAYER 1
1. INSTALL 18 PILES

LAYER 2
1. PLACE 2 LOG MEMBERS BETWEEN PILES
2. ADD RACKING/SLASH IN FRONT OF PILES

LAYER 3
1. PLACE 3 LOG MEMBERS AND 2 ROOTWAD MEMBERS BETWEEN PILES
2. PLACE RACKING/SLASH

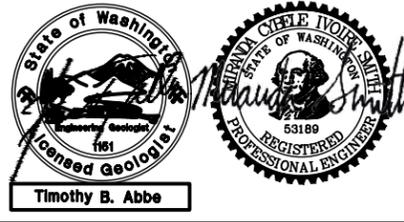


LAYER 4
1. PLACE 6 ROOTWAD MEMBERS
2. PLACE RACKING/SLASH

LAYER 5
1. PLACE 2 LOG MEMBERS
2. PLACE CHAIN LASHING IN LOCATIONS SHOWN

LAYER 6
1. EXCAVATE SCOUR POOL
2. BACKFILL STRUCTURE

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IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT PLOTTED TO ORIGINAL SCALE.



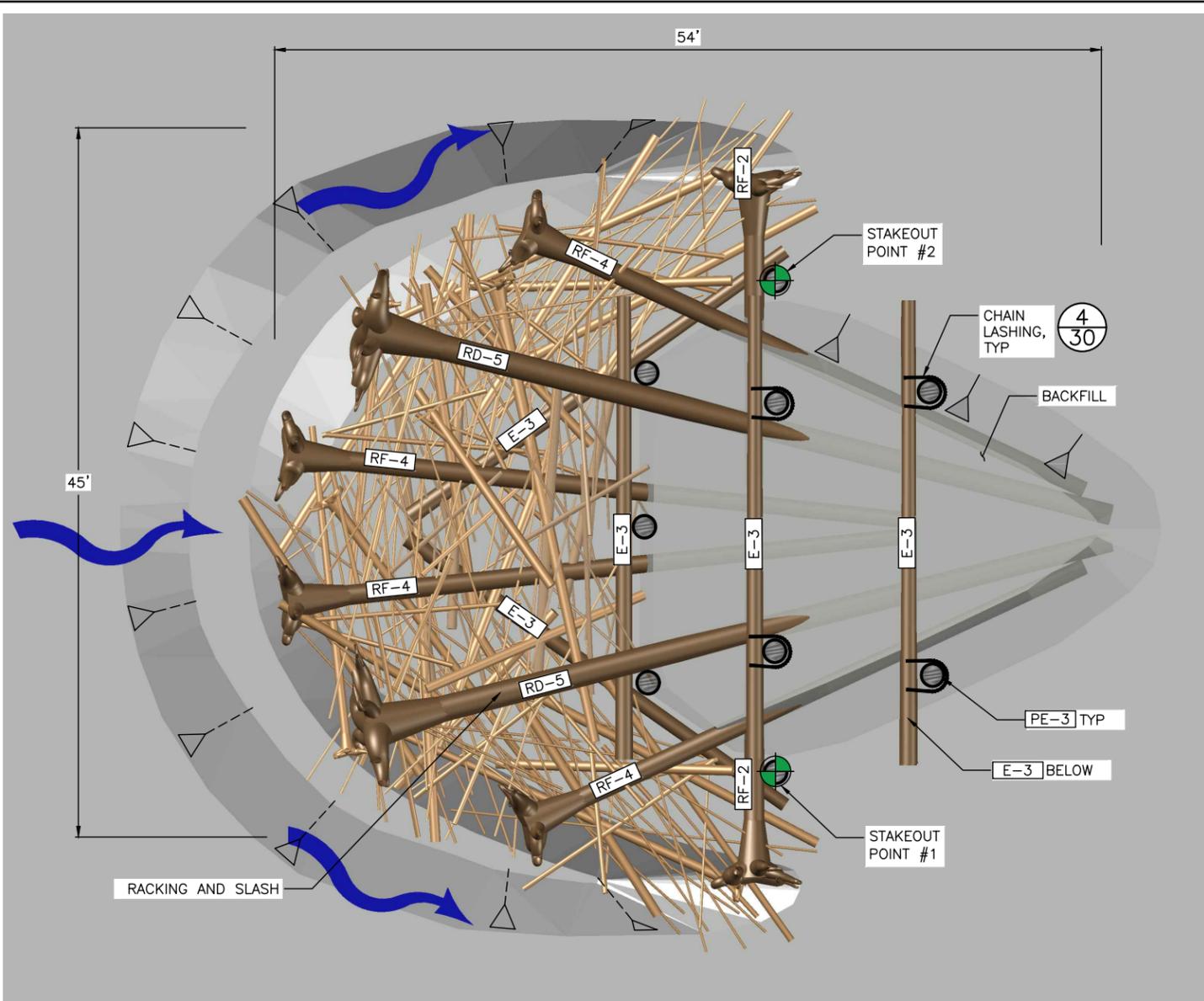
NAME OR INITIALS AND DATE		GEOGRAPHIC INFORMATION	
DESIGNED	MT, RLE, MS	LATITUDE	46°58'55.71"N
CHECKED	MT, RLE	LONGITUDE	123°28'56.2"W
DRAWN	MS, KP	TN/SC/RG	T17N/S6/R6W
CHECKED	MT, RLE	DATE	6/11/2020

KEYS ROAD FLOOD PROTECTION

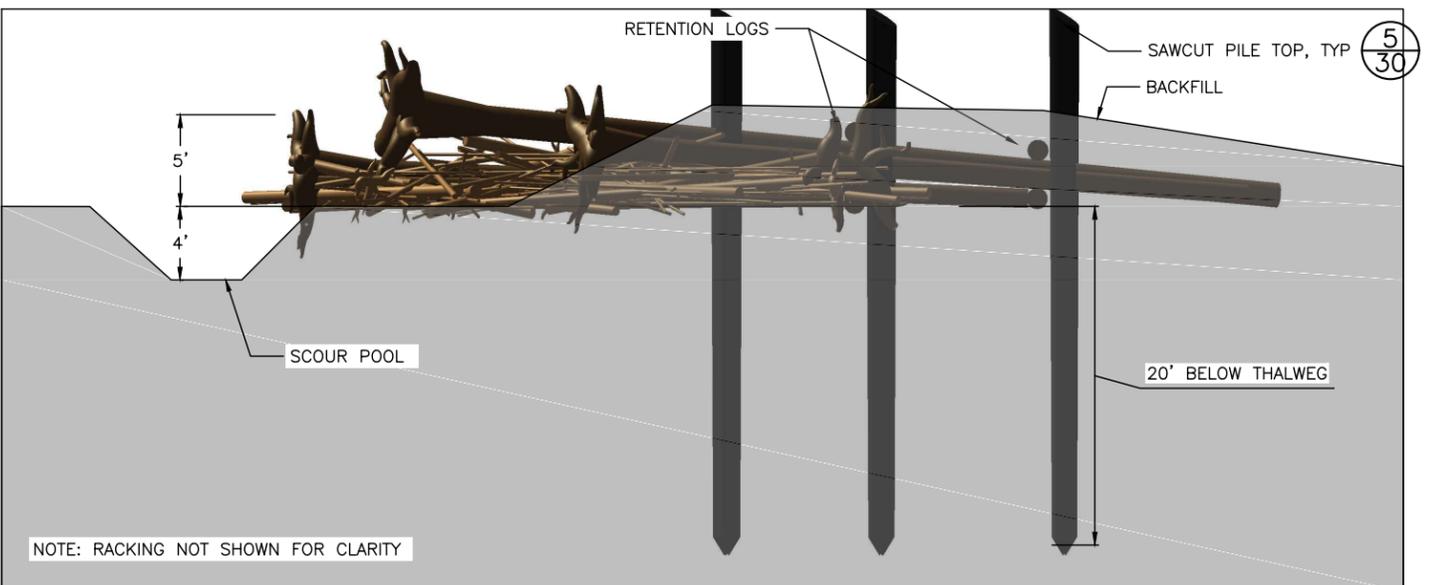
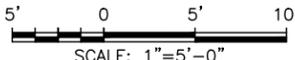
TYPE 1 APEX ELJ LAYERING PLAN

15
SHEET **15** OF **32**

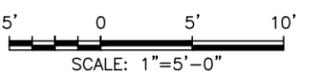
Jun 11, 2020 PHASE I FINAL DESIGN



TYPE 2 APEX ELJ PLAN
SCALE: 1" = 5'



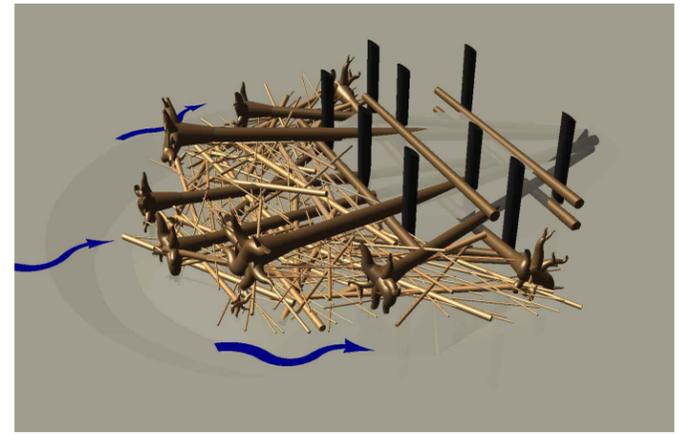
TYPE 2 APEX ELJ PROFILE
SCALE: 1" = 5'



NOTES

1. ALL LOGS SHALL BE DOUGLAS FIR OR WESTERN RED CEDAR.
2. ALL PILES SHALL BE ROUND, UNTREATED TIMBER PILES AND SHALL BE DOUGLAS FIR. PILES SHALL BE FREE FROM DEFECTS, CRACKS, AND SPLITTING AT THE TIME OF DRIVING.
3. LOGS WITH ROOTWADS SHALL HAVE A DIAMETER AS SHOWN MEASURED AT DBH, DEFINED AS 4.5 FEET ABOVE GROUND WHEN TREE WAS STANDING.
4. THE CONTRACTOR SHALL PLACE LOGS AS ILLUSTRATED ON THIS SHEET UNLESS DIRECTED OTHERWISE BY THE CONTRACTING OFFICER.
5. SOIL EXCAVATED DURING CONSTRUCTION SHALL BE REPLACED TO ORIGINAL GROUND FOLLOWING PLACEMENT OF ALL LOGS.
6. THE LOCATIONS SHOWN IN THE PLANS ARE APPROXIMATE AND MAY BE ADJUSTED IN THE FIELD BY THE CONTRACTING OFFICER.
7. THE LOCATION SHOWN ON THE SHEET IS APPROXIMATE AND MAY BE ADJUSTED IN THE FIELD BY THE CONTRACTING OFFICER.
8. RACKING LOGS SHALL CONSIST OF TREES WITH BRANCHES HAVING A BASE DIAMETER OF 6-12 INCHES AND A LENGTH OF 20-40 FT. RACKING MATERIAL SHALL OCCUR WITH EACH LAYER TO ENSURE THAT RACKING MATERIAL EXTENDS THROUGH THE STRUCTURE AND IS PINNED BY SUBSEQUENT LAYERS. SLASH MATERIAL SHALL CONSIST OF LIMBS AND BRANCHES AND A BASE DIAMETER BETWEEN 1 AND 3 INCHES. SLASH MATERIAL SHALL BE PLACED AS DIRECTED BY THE CONTRACTING OFFICER. QUANTITY OF RACKING LOGS AND SLASH MATERIAL PER STRUCTURE ARE SHOWN IN LOG SCHEDULE. RACKING AND SLASH MATERIAL SHALL BE DOUGLAS FIR, PONDEROSA PINE, WESTERN RED CEDAR, OR WESTERN LARCH TREES.
9. RETENTION LOGS TO BE INSTALLED TO HOLD RACKING MATERIAL IN PLACE AT THE DIRECTION OF THE CONTRACTING OFFICER.
10. CONNECT LOGS WITH WRAPPED CHAIN CONNECTION WHERE INDICATED ON THE DRAWINGS. SEE DETAILS.
11. AT LOCATIONS WHERE SITE CONDITIONS ALLOW (IN DRY OR LIMITED DEWATERING), SCOUR POOL TO BE EXCAVATED. EXCAVATED ALLUVIUM TO BE PLACED BEHIND THE STRUCTURE AS DIRECTED BY THE CONTRACTING OFFICER. EXTENTS AND LOCATION OF THE SCOUR POOL IS APPROXIMATE AND TO BE ADJUSTED IN THE FIELD BY THE CONTRACTING OFFICER.
12. EXISTING WOODY MATERIAL AT THE STRUCTURE CONSTRUCTION SITE SHALL BE MOVED OR PROTECTED FROM CONSTRUCTION ACTIVITIES AND THEN INCORPORATED INTO THE STRUCTURE AS DIRECTED BY THE CONTRACTING OFFICER.

TYPE 2 APEX ELJ PERSPECTIVE
NOT TO SCALE



LOG ID	DIA* (INCHES)	LENGTH ** (FEET)	ROOTWAD (Y/N)	QUANTITY PER STRUCTURE	NOTES
RD-5	18-22	50	Y	2	
E-3	16-20	30	N	6	
RF-4	14-18	40	Y	4	
RF-2	14-18	20	Y	2	
PE-3 ***	18	30	N	9	
RACKING	6-12	20-40	N	100	TREES WITH BRANCHES
SLASH	1-3	-	-	30 CY	LIMBS AND BRANCHES

* MINIMUM DIAMETER AT BREST HEIGHT (1" PER 10' MAXIMUM TAPER)
 ** TOTAL LENGTH INCLUDING ROOTWAD
 *** TURNED PILES - DIA (IN) IS BUTT DIAMETER

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0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT PLOTTED TO ORIGINAL SCALE.



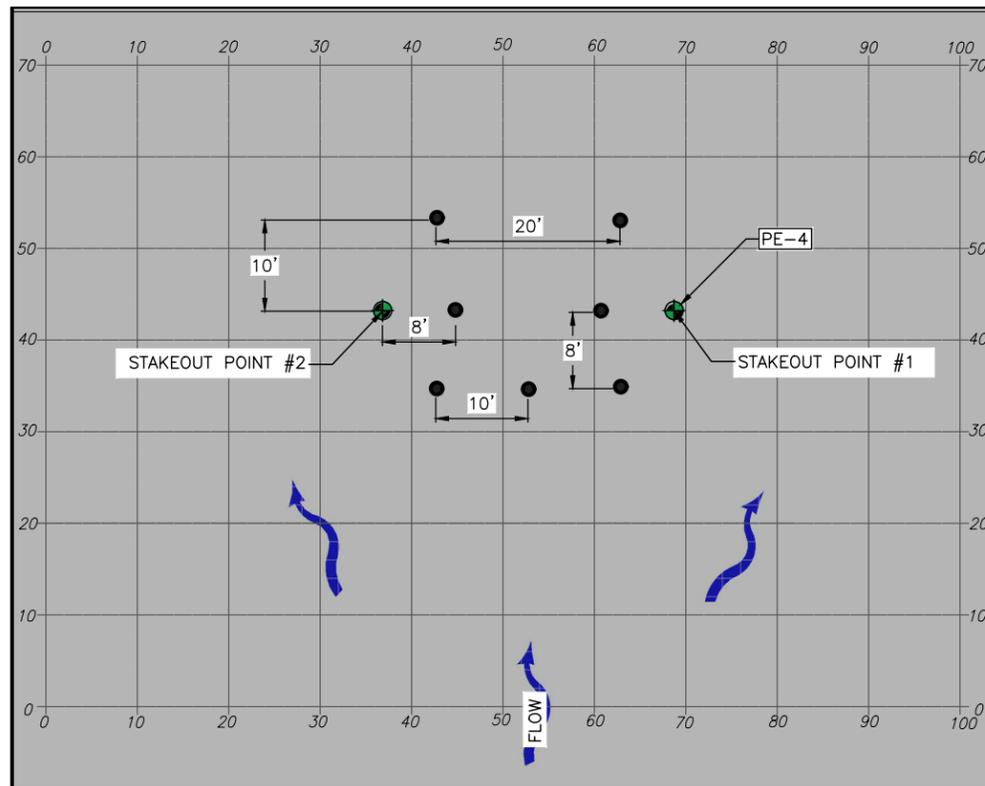
NAME OR INITIALS AND DATE		GEOGRAPHIC INFORMATION	
DESIGNED	MT, RLE, MS	LATITUDE	46°58'55.71"N
CHECKED	MT, RLE	LONGITUDE	123°28'56.2"W
DRAWN	MS, KP	TN/SC/RG	T17N/S6/R6W
CHECKED	MT, RLE	DATE	6/11/2020

KEYS ROAD FLOOD PROTECTION

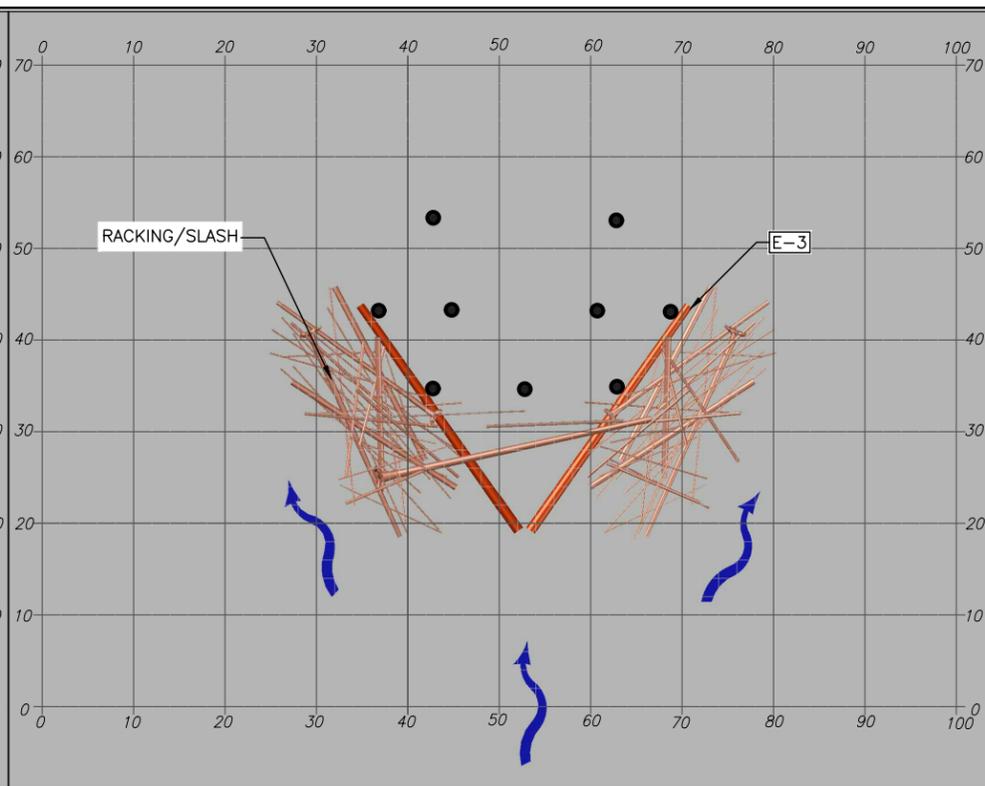
TYPE 2 APEX ELJ DETAIL

16
SHEET 16 OF 32

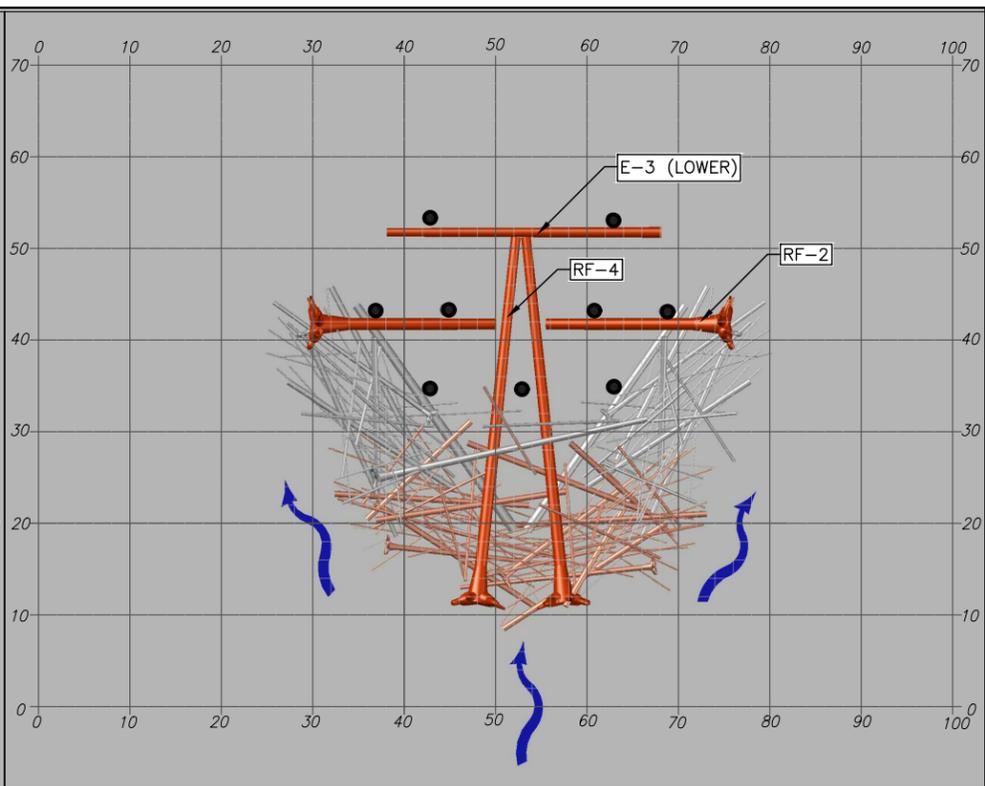
Jun 11, 2020 PHASE I FINAL DESIGN



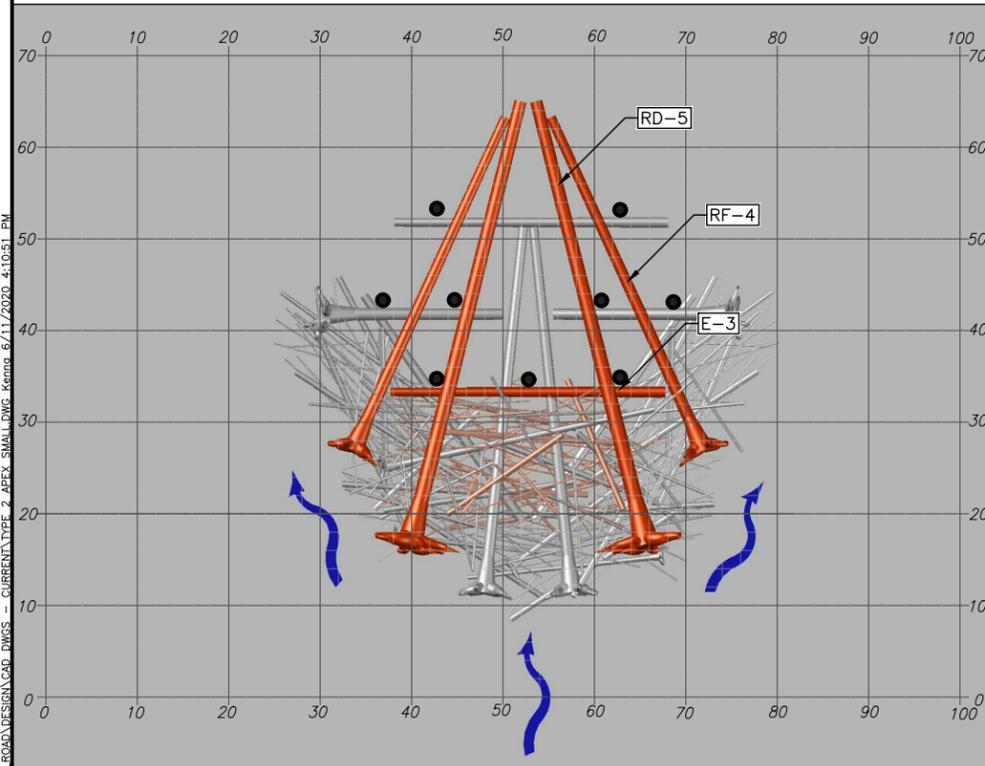
LAYER 1
1. INSTALL 9 PILES



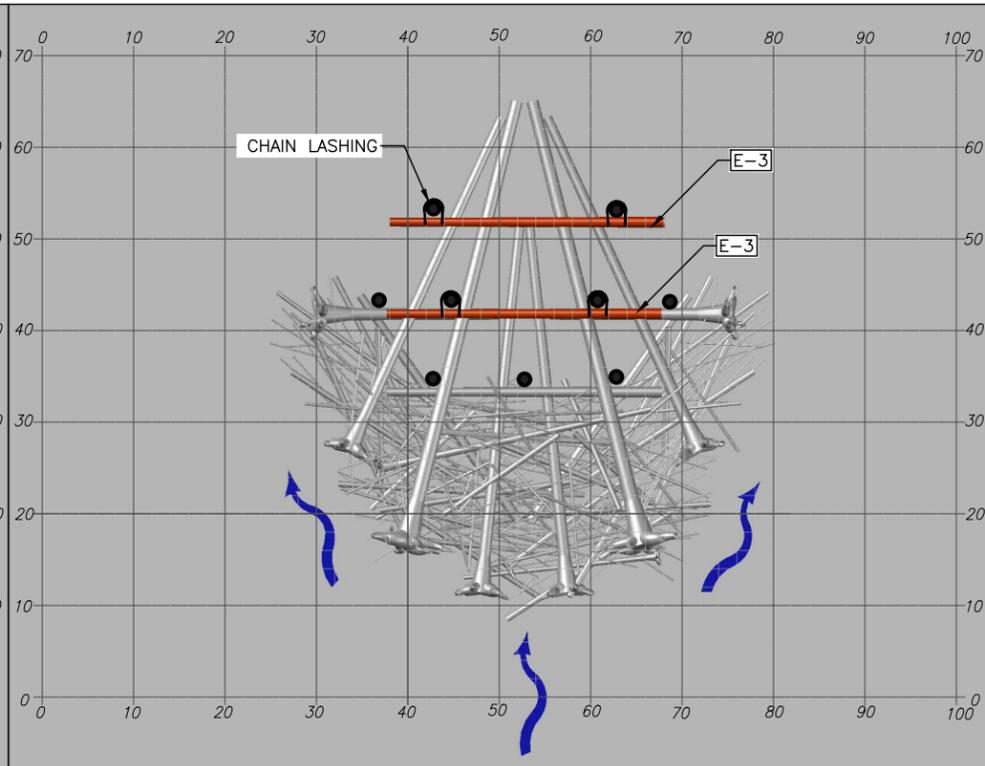
LAYER 2
1. PLACE 2 LOG MEMBERS
2. ADD RACKING/SLASH



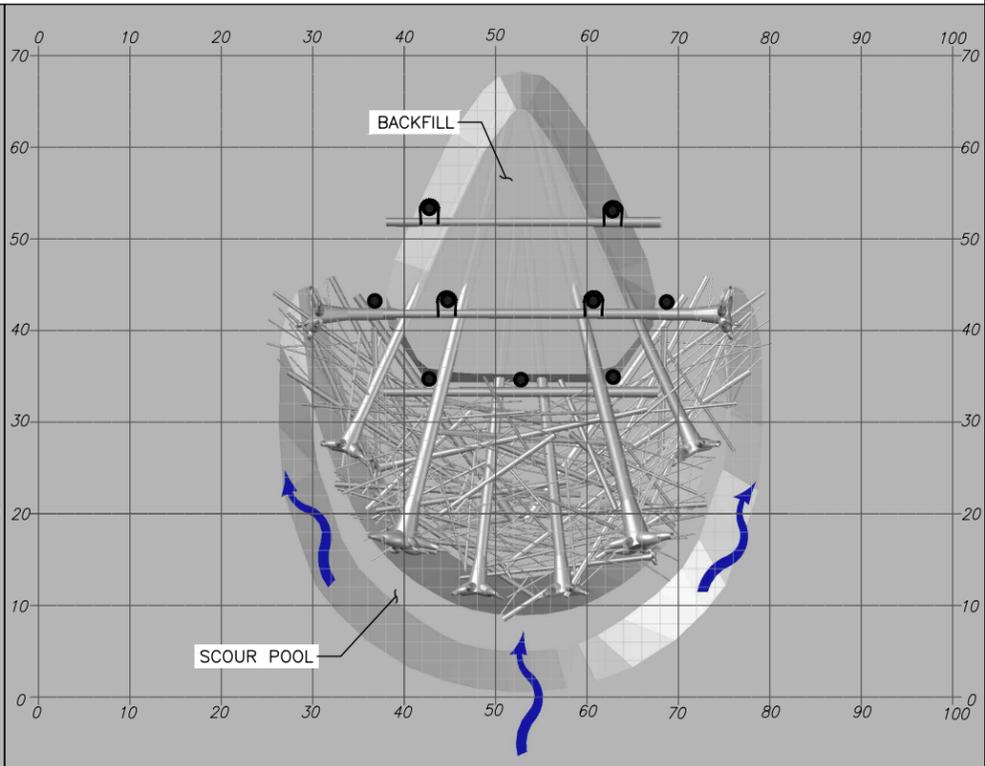
LAYER 3
1. PLACE 4 ROOTWAD MEMBERS AND 1 LOG MEMBER
2. PLACE RACKING/SLASH



LAYER 4
1. PLACE 1 E-3 LOG MEMBER THEN 4 ROOTWAD MEMBERS
2. PLACE RACKING/SLASH

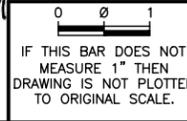
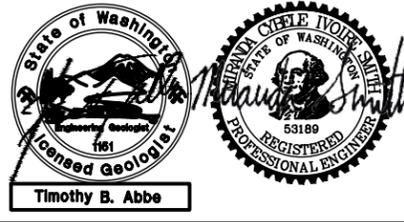


LAYER 5
1. PLACE 2 LOG MEMBERS
2. PLACE CHAIN LASHING IN LOCATIONS SHOWN



LAYER 6
1. EXCAVATE SCOUR POOL
2. BACKFILL STRUCTURE

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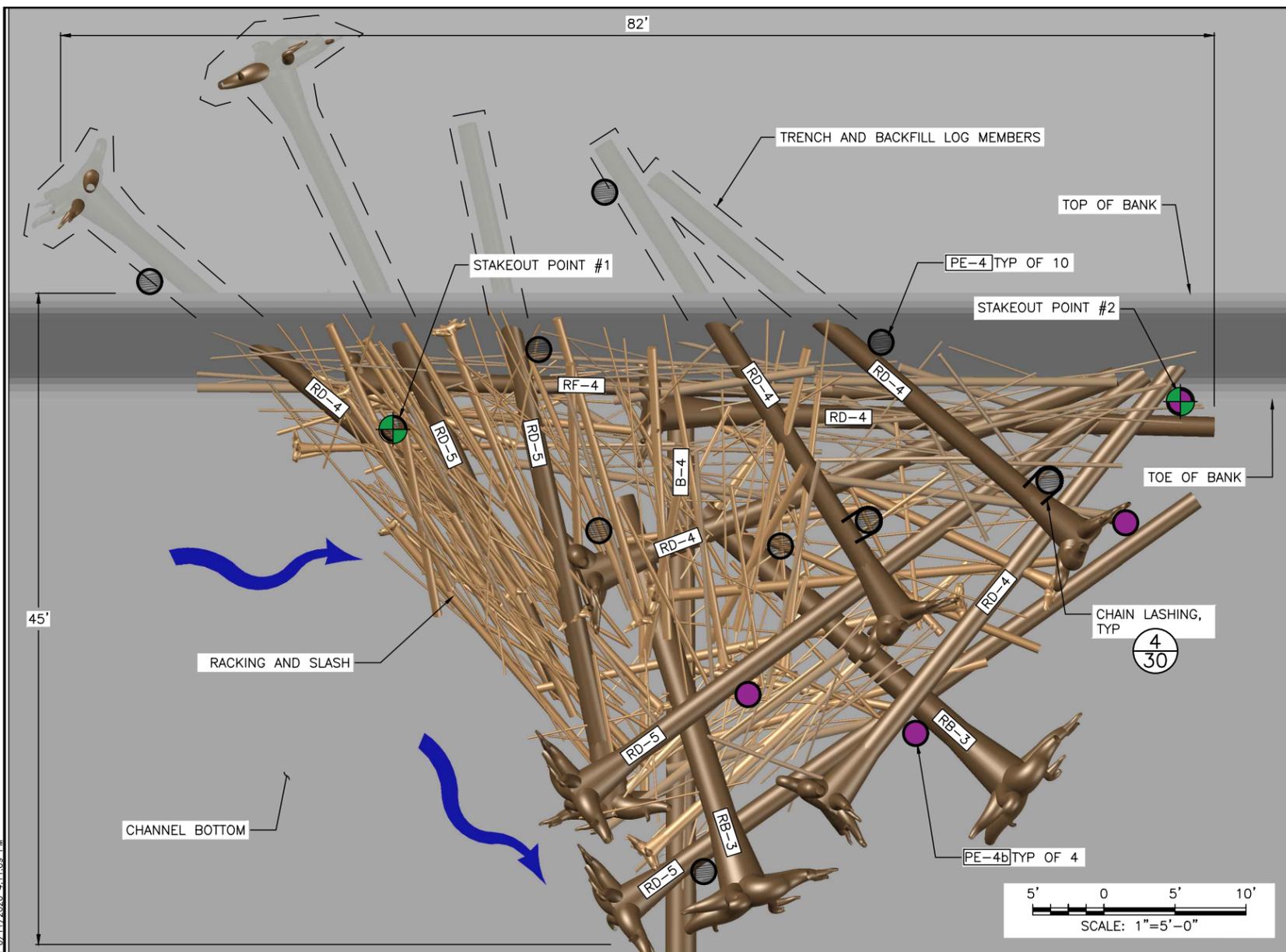
NAME OR INITIALS AND DATE		GEOGRAPHIC INFORMATION	
DESIGNED	MT, RLE, MS	LATITUDE	46°58'55.71"N
CHECKED	MT, RLE	LONGITUDE	123°28'56.2"W
DRAWN	MS, KP	TN/SC/RG	T17N/S6/R6W
CHECKED	MT, RLE	DATE	6/11/2020

KEYS ROAD FLOOD PROTECTION

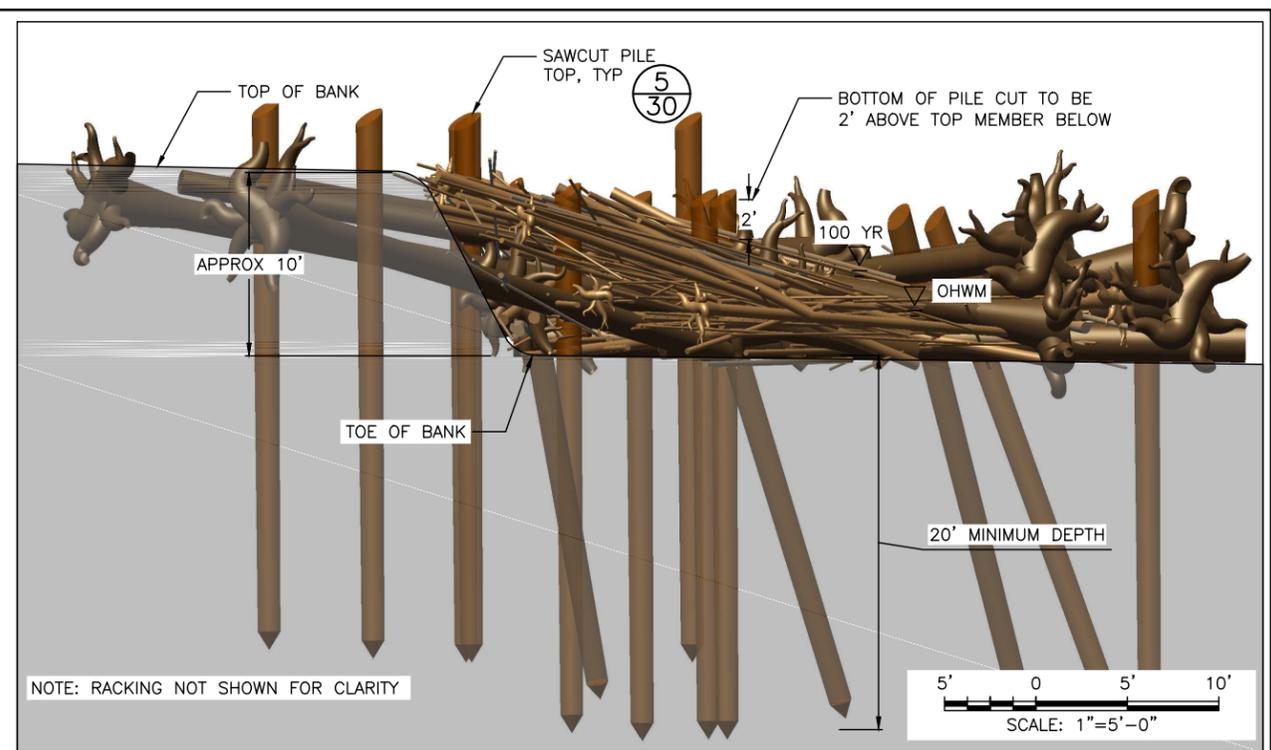
TYPE 2 APEX ELJ LAYERING PLAN

17
SHEET 17 OF 32

Jun 11, 2020 PHASE I FINAL DESIGN



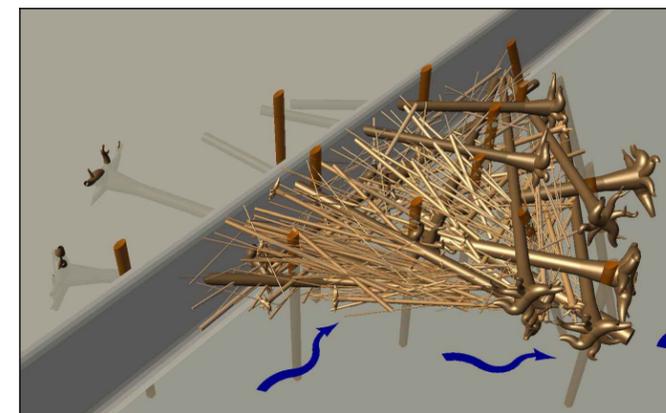
TYPE 1 DEFLECTOR ELJ PLAN
SCALE: 1" = 5'



TYPE 1 DEFLECTOR ELJ PROFILE
SCALE: 1" = 5'

NOTES:

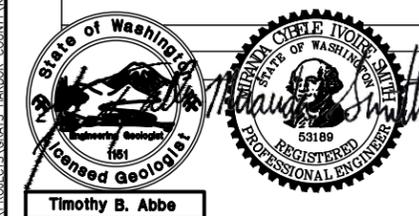
- ALL LOGS SHALL BE DOUGLAS FIR OR WESTERN RED CEDAR.
- ALL PILES SHALL BE ROUND, UNTREATED TIMBER PILES AND SHALL BE DOUGLAS FIR. PILES SHALL BE FREE FROM DEFECTS, CRACKS, AND SPLITTING AT THE TIME OF DRIVING.
- LOGS WITH ROOTWADS SHALL HAVE A DIAMETER AS SHOWN MEASURED AT DBH, DEFINED AS 4.5 FEET ABOVE GROUND WHEN TREE WAS STANDING.
- THE CONTRACTOR SHALL PLACE LOGS AS ILLUSTRATED ON THIS SHEET UNLESS DIRECTED OTHERWISE BY THE CONTRACTING OFFICER.
- SOIL EXCAVATED DURING CONSTRUCTION SHALL BE REPLACED TO ORIGINAL GROUND FOLLOWING PLACEMENT OF ALL LOGS.
- THE LOCATIONS SHOWN ON THE PLANS ARE APPROXIMATE AND MAY BE ADJUSTED IN THE FIELD BY THE CONTRACTING OFFICER.
- RACKING LOGS SHALL CONSIST OF TREES WITH BRANCHES HAVING A BASE DIAMETER OF 6-12 INCHES AND A LENGTH OF 20-40 FT. RACKING MATERIAL SHALL OCCUR WITH EACH LAYER TO ENSURE THAT RACKING MATERIAL EXTENDS THROUGH THE STRUCTURE AND IS PINNED BY SUBSEQUENT LAYERS. SLASH MATERIAL SHALL CONSIST OF LIMBS AND BRANCHES AND A BASE DIAMETER BETWEEN 1 AND 3 INCHES. SLASH MATERIAL SHALL BE PLACED AS DIRECTED BY THE CONTRACTING OFFICER. QUANTITY OF RACKING LOGS AND SLASH MATERIAL PER STRUCTURE ARE SHOWN IN LOG SCHEDULE. RACKING AND SLASH MATERIAL SHALL BE DOUGLAS FIR, PONDEROSA PINE, WESTERN RED CEDAR, OR WESTERN LARCH TREES.
- RETENTION LOGS TO BE INSTALLED TO HOLD RACKING MATERIAL IN PLACE AT THE DIRECTION OF THE CONTRACTING OFFICER.
- PILES TO BE DRIVEN IN A BATTER (NON-VERTICAL) CONFIGURATION AS SHOWN ON PLANS OR AS DIRECTED BY THE CONTRACTING OFFICER. BATTER ANGLE MUST EQUAL OR EXCEED 20 DEGREES FROM VERTICAL.
- CONNECT LOGS WITH WRAPPED CHAIN CONNECTION WHERE INDICATED ON THE DRAWINGS.
- AT LOCATIONS WHERE SITE CONDITIONS ALLOW (IN DRY OR LIMITED DEWATERING), SCOUR POOL TO BE EXCAVATED. EXCAVATED ALLUVIUM TO BE PLACED BEHIND THE STRUCTURE AS DIRECTED BY THE CONTRACTING OFFICER. EXTENTS AND LOCATION OF THE SCOUR POOL IS APPROXIMATE AND TO BE ADJUSTED IN THE FIELD BY THE CONTRACTING OFFICER.
- EXISTING WOODY MATERIAL AT THE STRUCTURE CONSTRUCTION SITE SHALL BE MOVED OR PROTECTED FROM CONSTRUCTION ACTIVITIES AND THEN INCORPORATED INTO THE STRUCTURE AS DIRECTED BY THE CONTRACTING OFFICER.



TYPE 1 DEFLECTOR ELJ PERSPECTIVE
NOT TO SCALE

TYPE 1 DEFLECTOR ELJ LOG SCHEDULE					
LOG ID	DIA* (INCHES)	LENGTH ** (FEET)	ROOTWAD (Y/N)	QUANTITY PER STRUCTURE	NOTES
RB-3	22-26	30	Y	2	
B-4	22-26	40	N	1	
RD-5	18-22	50	Y	4	
RD-4	18-22	40	Y	6	
RF-4	14-18	40	Y	1	
PE-4 ***	18	40	N	10	
PE-4b ***	18	40	N	4	INSTALL PILE AT 15 TO 20 DEGREES FROM VERTICAL
RACKING	6-12	20-40	N	120	TREES WITH BRANCHES
SLASH	1-3	-	-	40 CY	LIMBS AND BRANCHES

* MINIMUM DIAMETER AT BREAST HEIGHT (1" PER 10' MAXIMUM TAPER)
 ** TOTAL LENGTH INCLUDING ROOTWAD
 *** TURNED PILES - DIA (IN) IS BUTT DIAMETER



IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT PLOTTED TO ORIGINAL SCALE.



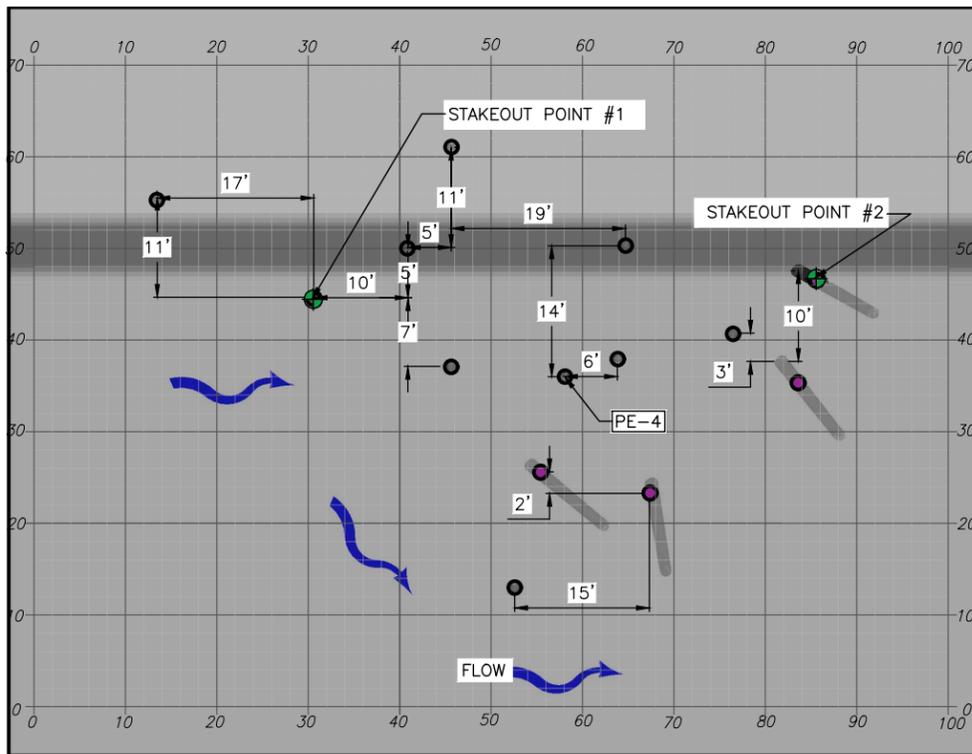
NAME OR INITIALS AND DATE		GEOGRAPHIC INFORMATION	
DESIGNED	MT, RLE, MS	LATITUDE	46°58'55.71"N
CHECKED	MT, RLE	LONGITUDE	123°28'56.2"W
DRAWN	MS, KP	TN/SC/RG	T17N/S6/R6W
CHECKED	MT, RLE	DATE	6/11/2020

KEYS ROAD FLOOD PROTECTION

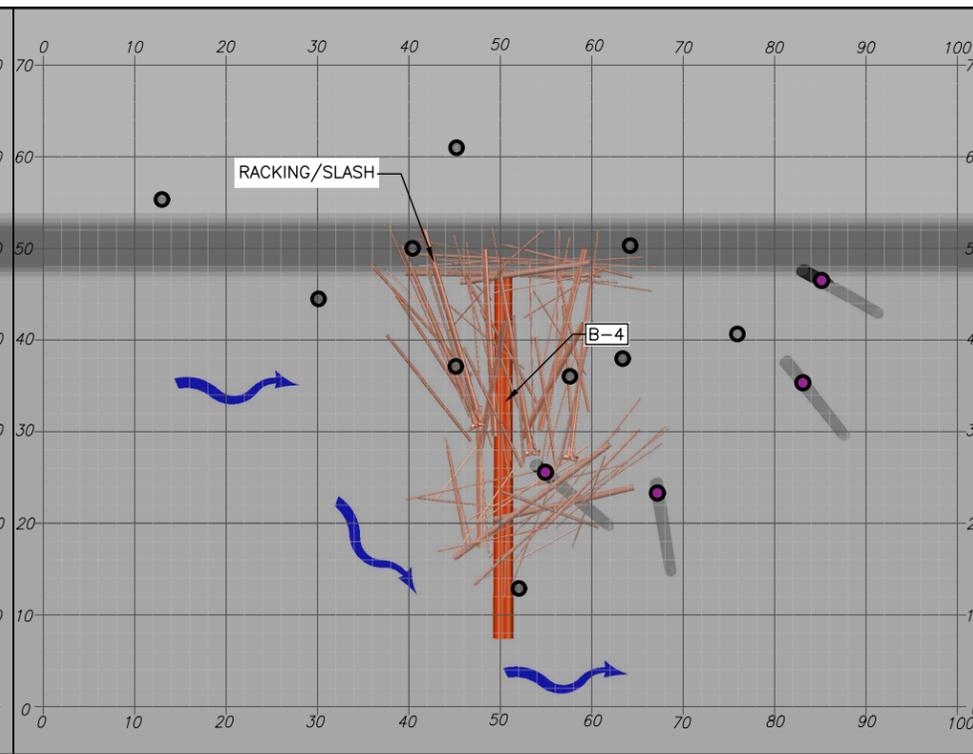
TYPE 1 DEFLECTOR ELJ DETAIL

18
SHEET 18 OF 32

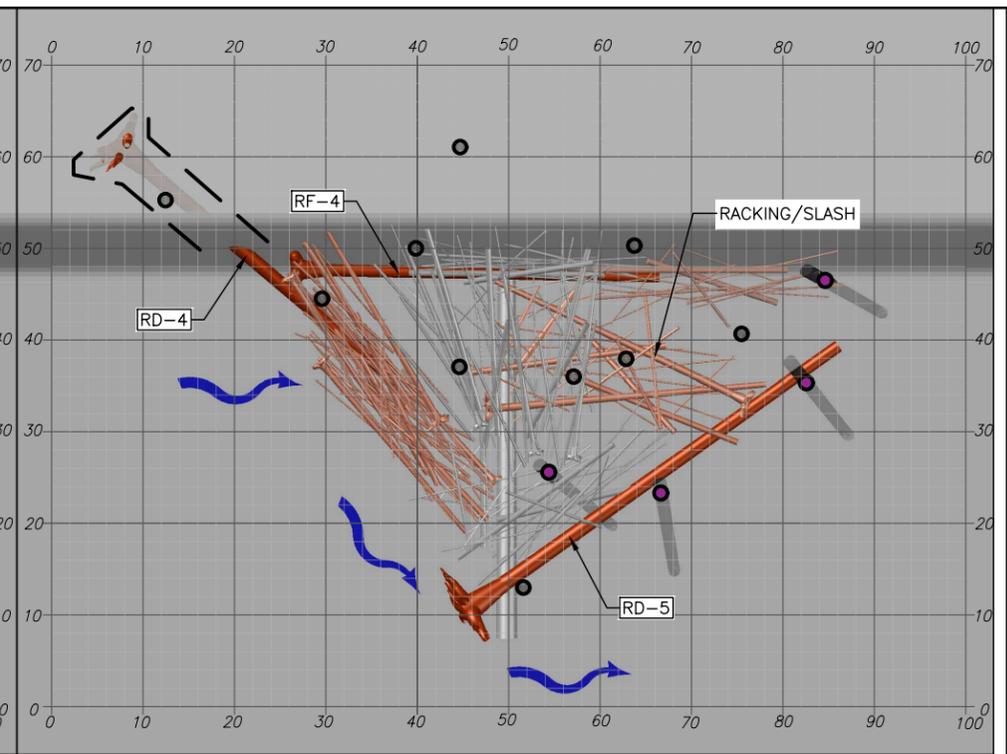
Jun 11, 2020 PHASE I FINAL DESIGN



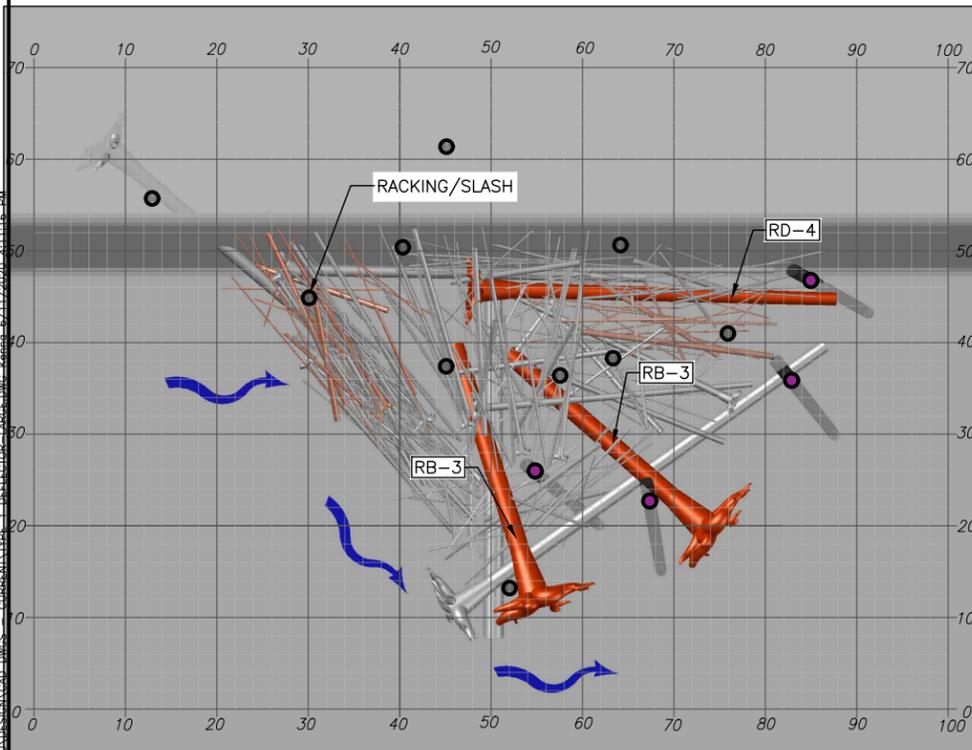
LAYER 1
1. INSTALL 14 PILES



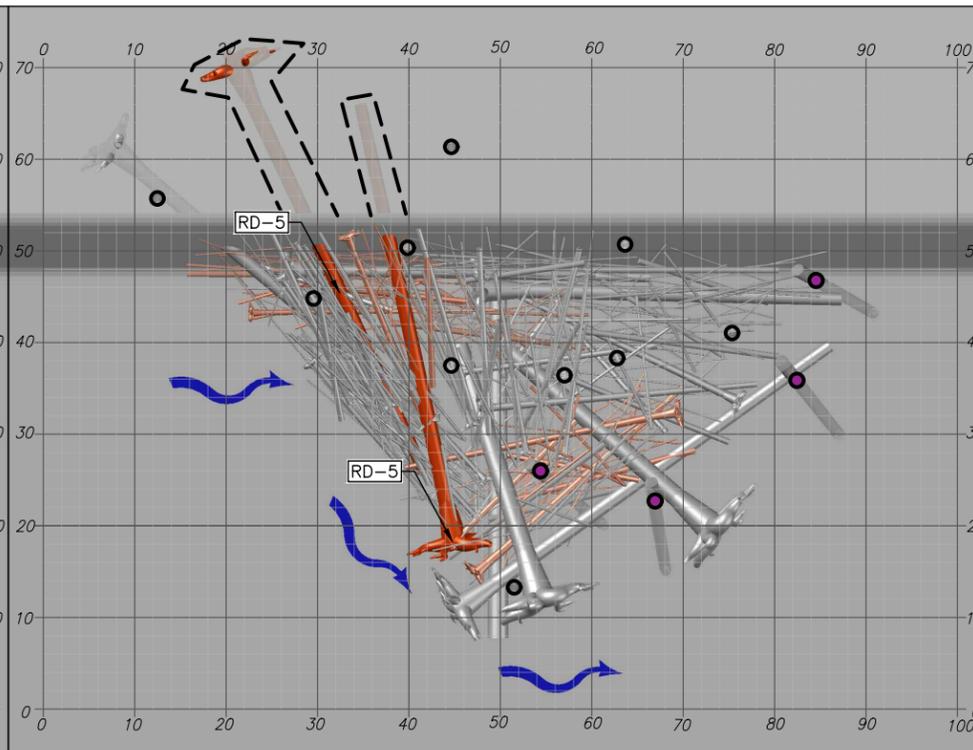
LAYER 2
1. PLACE 1 LOG MEMBER
2. PLACE RACKING/SLASH



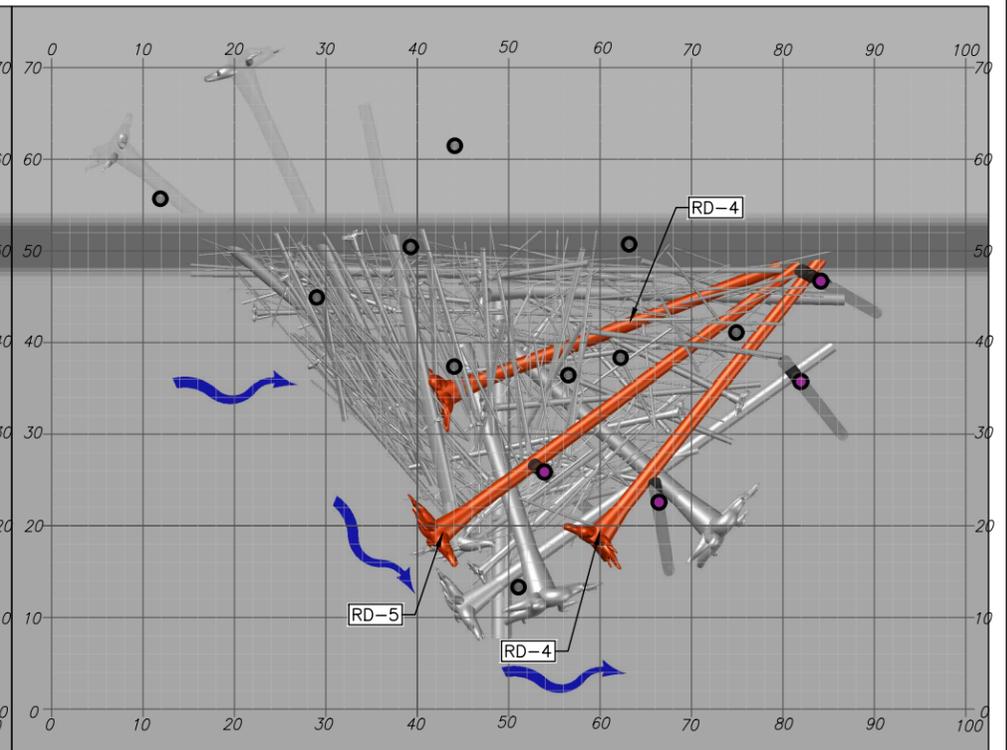
LAYER 3
1. EXCAVATE TRENCH FOR 1 ROOTWAD MEMBER
2. PLACE 3 ROOTWAD MEMBERS, 1 IN TRENCH
3. BACKFILL TRENCH
4. PLACE RACKING/SLASH



LAYER 4
1. PLACE 3 ROOTWAD MEMBERS
2. PLACE RACKING/SLASH



LAYER 5
1. EXCAVATE TRENCH FOR 2 ROOTWAD MEMBERS
2. PLACE 2 ROOTWAD MEMBERS
3. BACKFILL TRENCHES
4. PLACE RACKING/SLASH



LAYER 6
1. PLACE 5 ROOTWAD MEMBERS
2. BACKFILL STRUCTURE



0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT PLOTTED TO ORIGINAL SCALE.

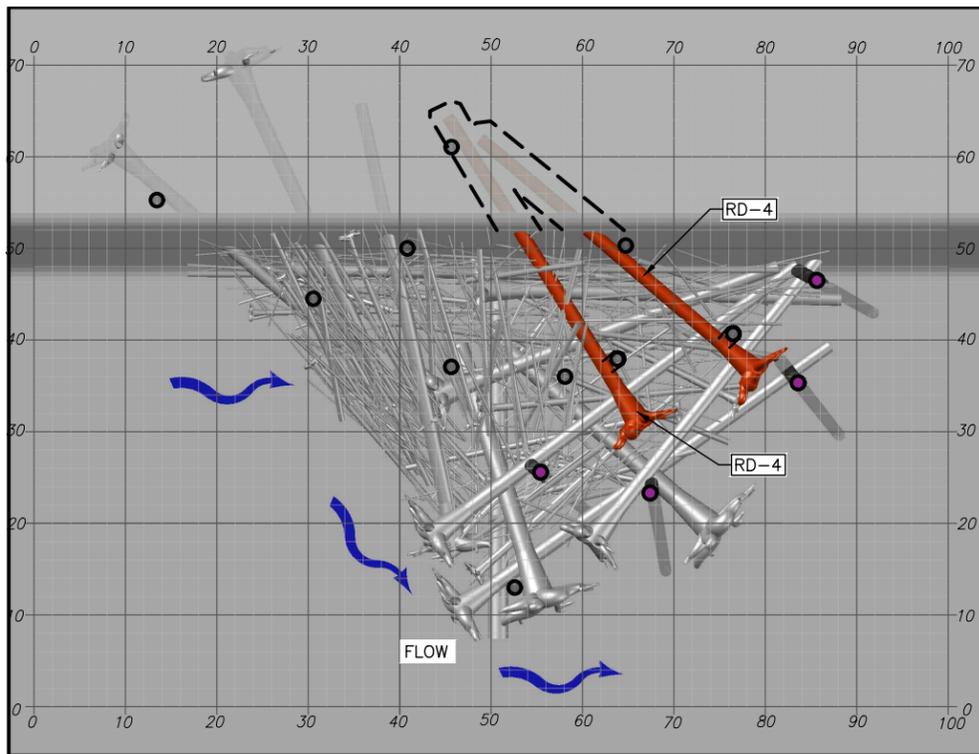


NAME OR INITIALS AND DATE		GEOGRAPHIC INFORMATION	
DESIGNED	MT, RLE, MS	LATITUDE	46°58'55.71"N
CHECKED	MT, RLE	LONGITUDE	123°28'56.2"W
DRAWN	MS, KP	TN/SC/RG	T17N/S6/R6W
CHECKED	MT, RLE	DATE	6/11/2020

KEYS ROAD FLOOD PROTECTION

TYPE 1 DEFLECTOR ELJ LAYERING PLANS

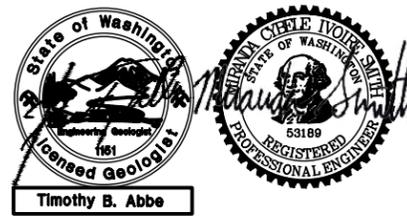
Jun 11, 2020 PHASE I FINAL DESIGN



LAYER 7

1. EXCAVATE TRENCHES FOR 2 ROOTWAD MEMBERS
2. PLACE 2 ROOTWAD MEMBERS
3. BACKFILL TRENCHES
4. PLACE CHAIN LASHINGS IN LOCATIONS SHOWN

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0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT PLOTTED TO ORIGINAL SCALE.



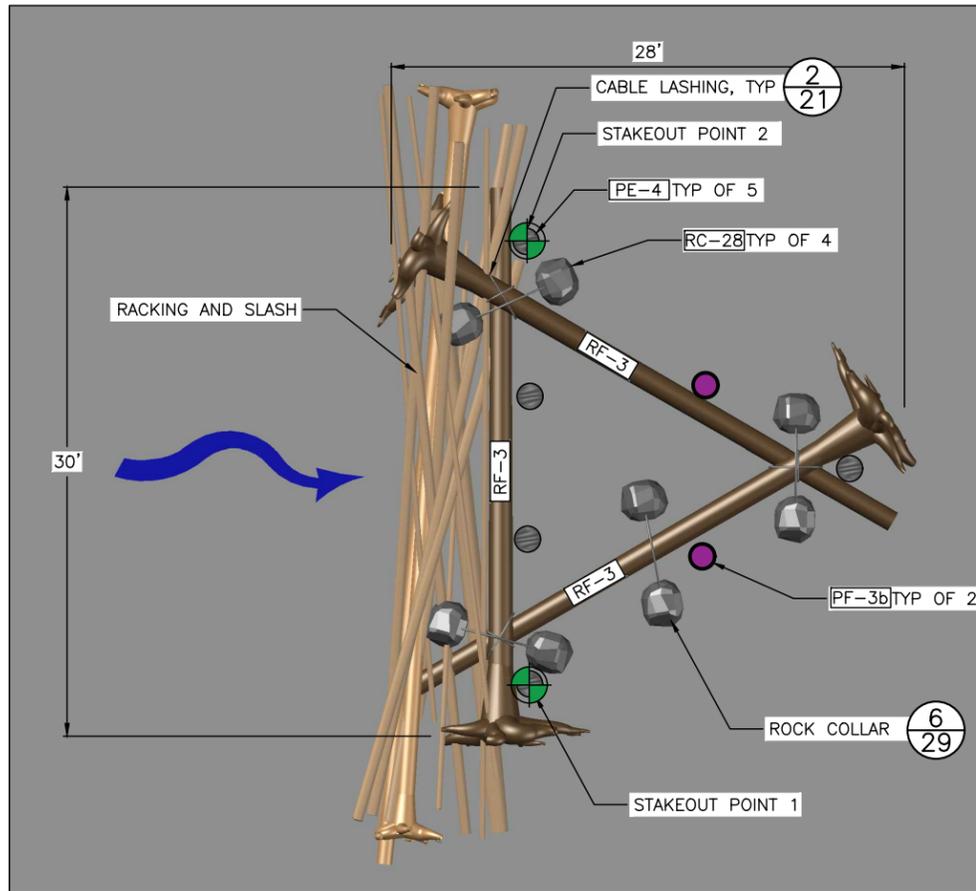
NAME OR INITIALS AND DATE	GEOGRAPHIC INFORMATION
DESIGNED MT, RLE, MS	LATITUDE 46°58'55.71"N
CHECKED MT, RLE	LONGITUDE 123°28'56.2"W
DRAWN MS, KP	TN/SC/RG T17N/S6/R6W
CHECKED MT, RLE	DATE 6/11/2020

KEYS ROAD FLOOD PROTECTION

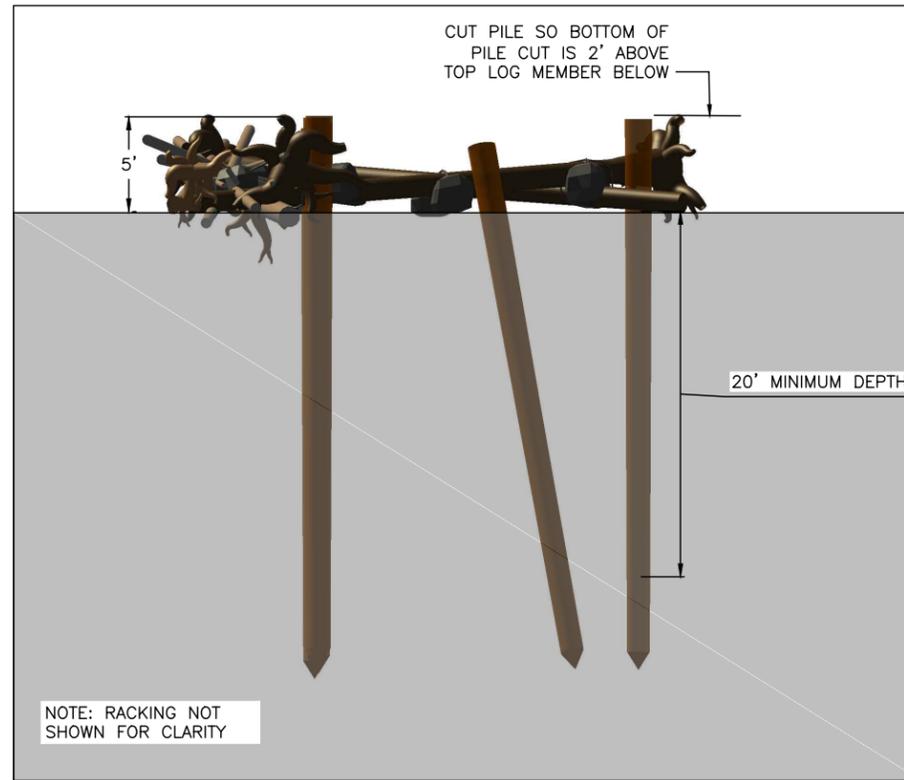
TYPE 1 DEFLECTOR ELJ LAYERING PLANS 2

20
SHEET 20 OF 32

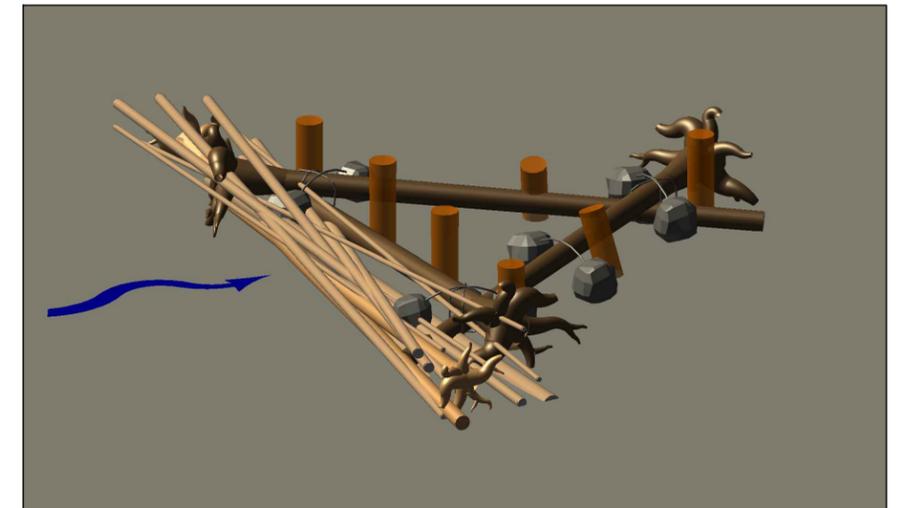
Jun 11, 2020 PHASE I FINAL DESIGN



FLOODPLAIN ROUGHNESS ELJ PLAN
SCALE: 1" = 5'



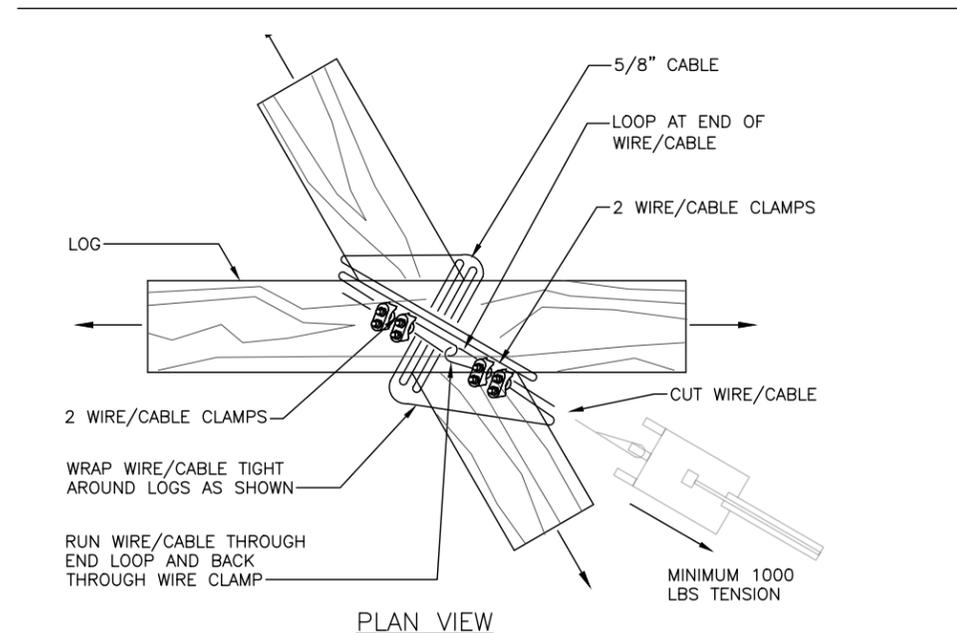
FLOODPLAIN ROUGHNESS ELJ PROFILE
SCALE: 1" = 5'



NOTES

1. ALL LOGS SHALL BE DOUGLAS FIR OR WESTERN RED CEDAR.
2. ALL PILES SHALL BE ROUND, UNTREATED TIMBER PILES AND SHALL BE DOUGLAS FIR. PILES SHALL BE FREE FROM DEFECTS, CRACKS, AND SPLITTING AT THE TIME OF DRIVING.
3. LOGS WITH ROOTWADS SHALL HAVE A DIAMETER AS SHOWN MEASURED AT DBH, DEFINED AS 4.5 FEET ABOVE GROUND WHEN TREE WAS STANDING.
4. THE CONTRACTOR SHALL PLACE LOGS AS ILLUSTRATED ON THIS SHEET UNLESS DIRECTED OTHERWISE BY THE CONTRACTING OFFICER.
5. SOIL EXCAVATED DURING CONSTRUCTION SHALL BE REPLACED TO ORIGINAL GROUND FOLLOWING PLACEMENT OF ALL LOGS.
6. THE LOCATIONS SHOWN ON THE PLANS ARE APPROXIMATE AND MAY BE ADJUSTED IN THE FIELD BY THE CONTRACTING OFFICER.
7. RACKING LOGS SHALL CONSIST OF TREES WITH BRANCHES HAVING A BASE DIAMETER OF 6-12 INCHES AND A LENGTH OF 20-40 FT. RACKING MATERIAL SHALL OCCUR WITH EACH LAYER TO ENSURE THAT RACKING MATERIAL EXTENDS THROUGH THE STRUCTURE AND IS

8. RETENTION LOGS TO BE INSTALLED TO HOLD RACKING MATERIAL IN PLACE AT THE DIRECTION OF THE CONTRACTING OFFICER.
9. PILES TO BE DRIVEN IN A BATTER (NON-VERTICAL) CONFIGURATION AS SHOWN ON PLANS OR AS DIRECTED BY THE CONTRACTING OFFICER. BATTER ANGLE MUST EQUAL OR EXCEED 20 DEGREES FROM VERTICAL.
10. WOODY MATERIAL AT THE STRUCTURE CONSTRUCTION SITE SHALL BE MOVED OR PROTECTED FROM CONSTRUCTION ACTIVITIES AND THEN INCORPORATED INTO THE STRUCTURE AS DIRECTED BY THE CONTRACTING OFFICER.
11. TRIANGLE FRAME UNITS SHALL BE LASHED AT LOG INTERSECTIONS.

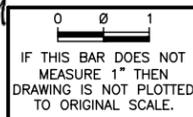
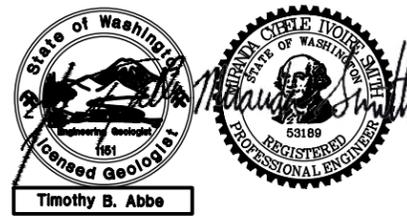


CABLE LASHING
SCALE: NOT TO SCALE

LOG ID	DIA* (INCHES)	LENGTH ** (FEET)	ROOTWAD (Y/N)	QUANTITY PER STRUCTURE	NOTES
RF-3	14-18	30	Y	3	
PE-3 ***	18	30	N	5	
PE-3b ***	18	30	N	2	INSTALL PILE AT 15 TO 20 DEGREES FROM VERTICAL
RC-28	-	-	-	4	ROCK COLLAR WITH 28" DIAMETER BOULDERS
RACKING	6-12	20-40	Y/N	12	TREES WITH BRANCHES
SLASH	1-3	-	-	5 CY	LIMBS AND BRANCHES

* MINIMUM DIAMETER AT BREAST HEIGHT (1" PER 10' MAXIMUM TAPER)
 ** TOTAL LENGTH INCLUDING ROOTWAD
 *** TURNED PILES - DIA (IN) IS BUTT DIAMETER

FLOODPLAIN ROUGHNESS ELJ
SCALE: AS SHOWN



NAME OR INITIALS AND DATE	GEOGRAPHIC INFORMATION
DESIGNED MT, RLE, MS	LATITUDE 46°58'55.71"N
CHECKED MT, RLE	LONGITUDE 123°28'56.2"W
DRAWN MS, KP	TN/SC/RG T17N/S6/R6W
CHECKED MT, RLE	DATE 6/11/2020

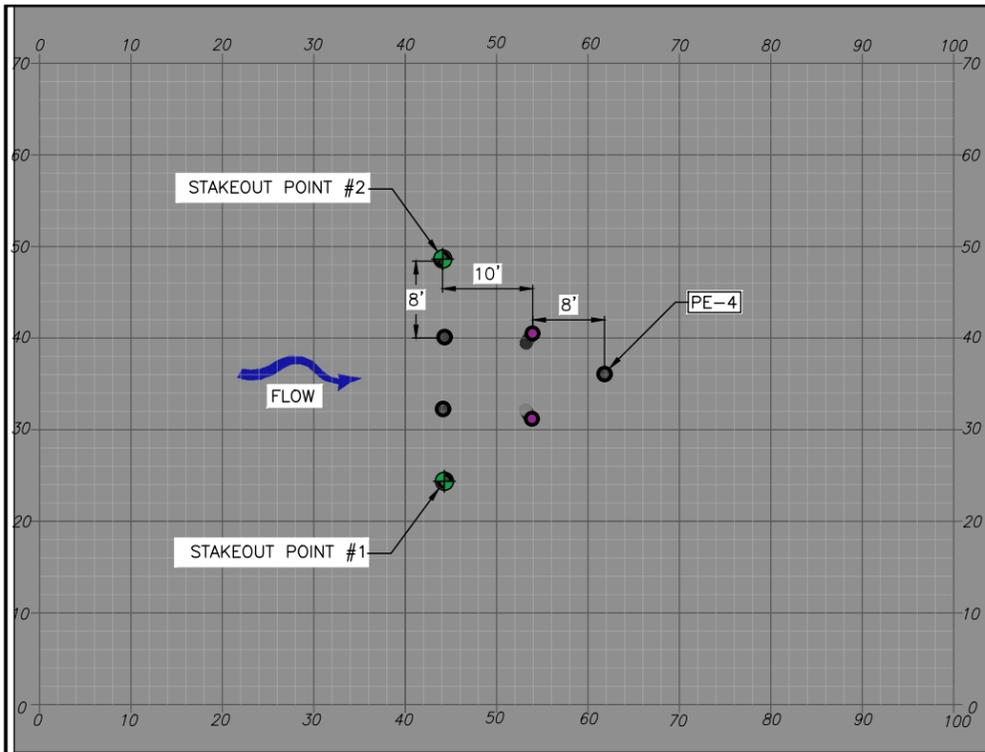
KEYS ROAD FLOOD PROTECTION

FLOODPLAIN ROUGHNESS ELJ DETAILS

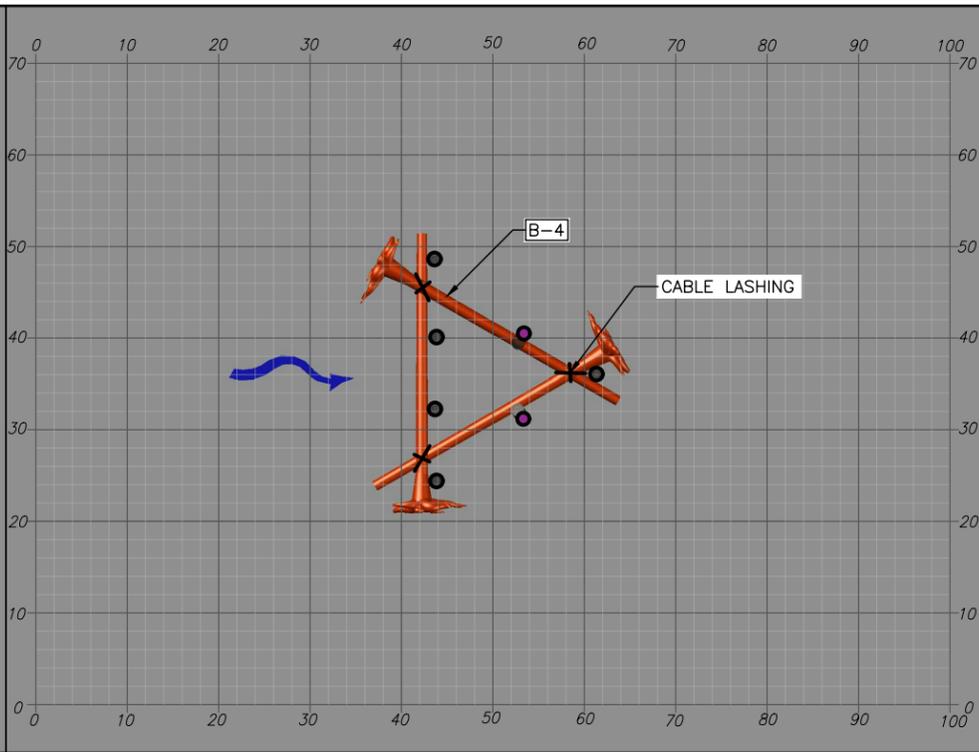
1/21

21
SHEET 21 OF 32

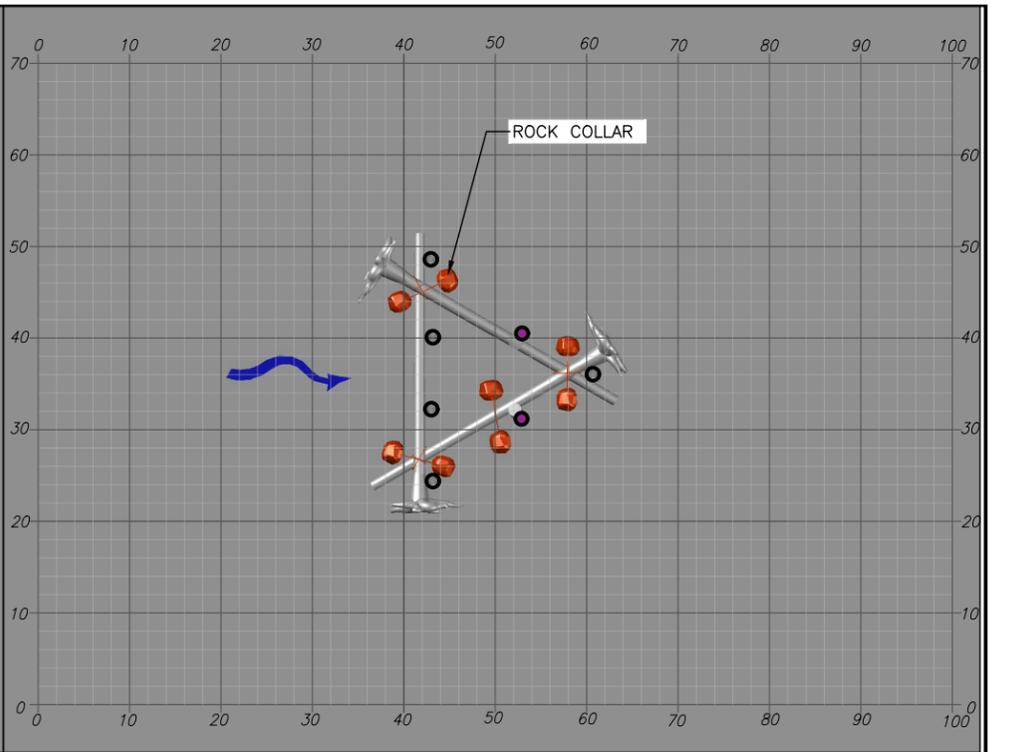
Jun 11, 2020 PHASE I FINAL DESIGN



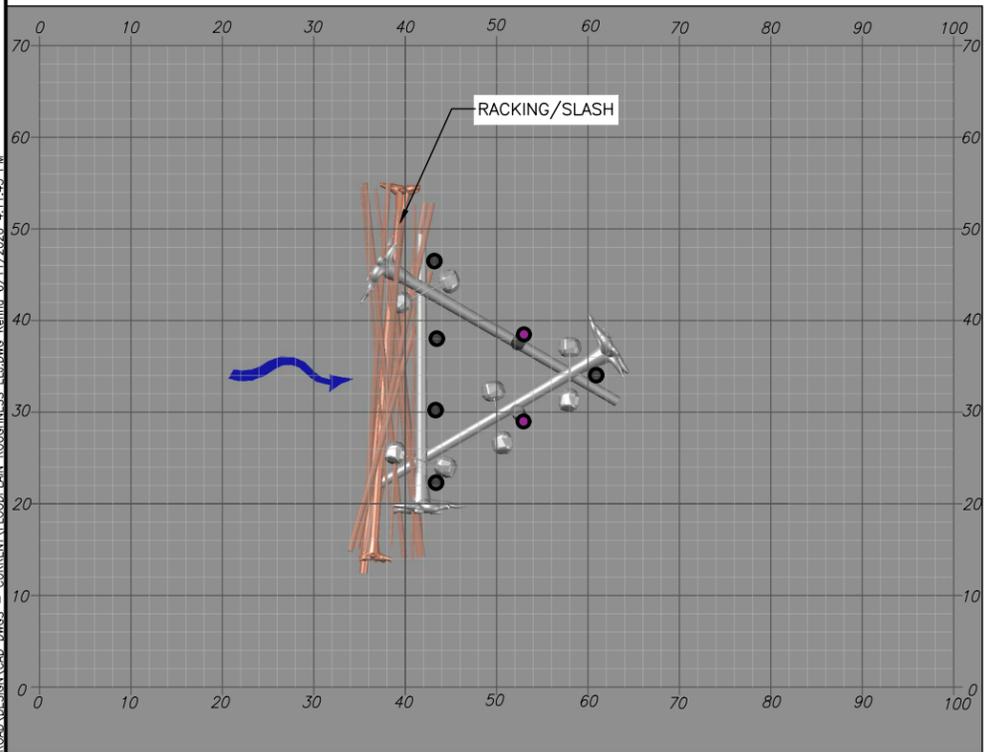
LAYER 1
1. INSTALL 7 PILES



LAYER 2
1. PLACE 3 ROOTWAD MEMBERS
2. CABLE LASH ROOTWAD INTERSECTIONS

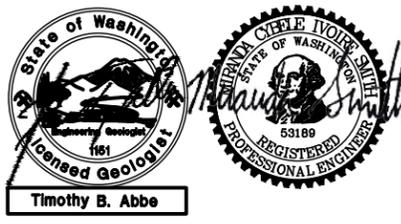


LAYER 3
1. PLACE 4 ROCK COLLARS AS SHOWN



LAYER 4
1. PLACE RACKING/SLASH BY INTERWEAVING WITH ROOTWADS AND ROCK COLLARS

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0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT PLOTTED TO ORIGINAL SCALE.



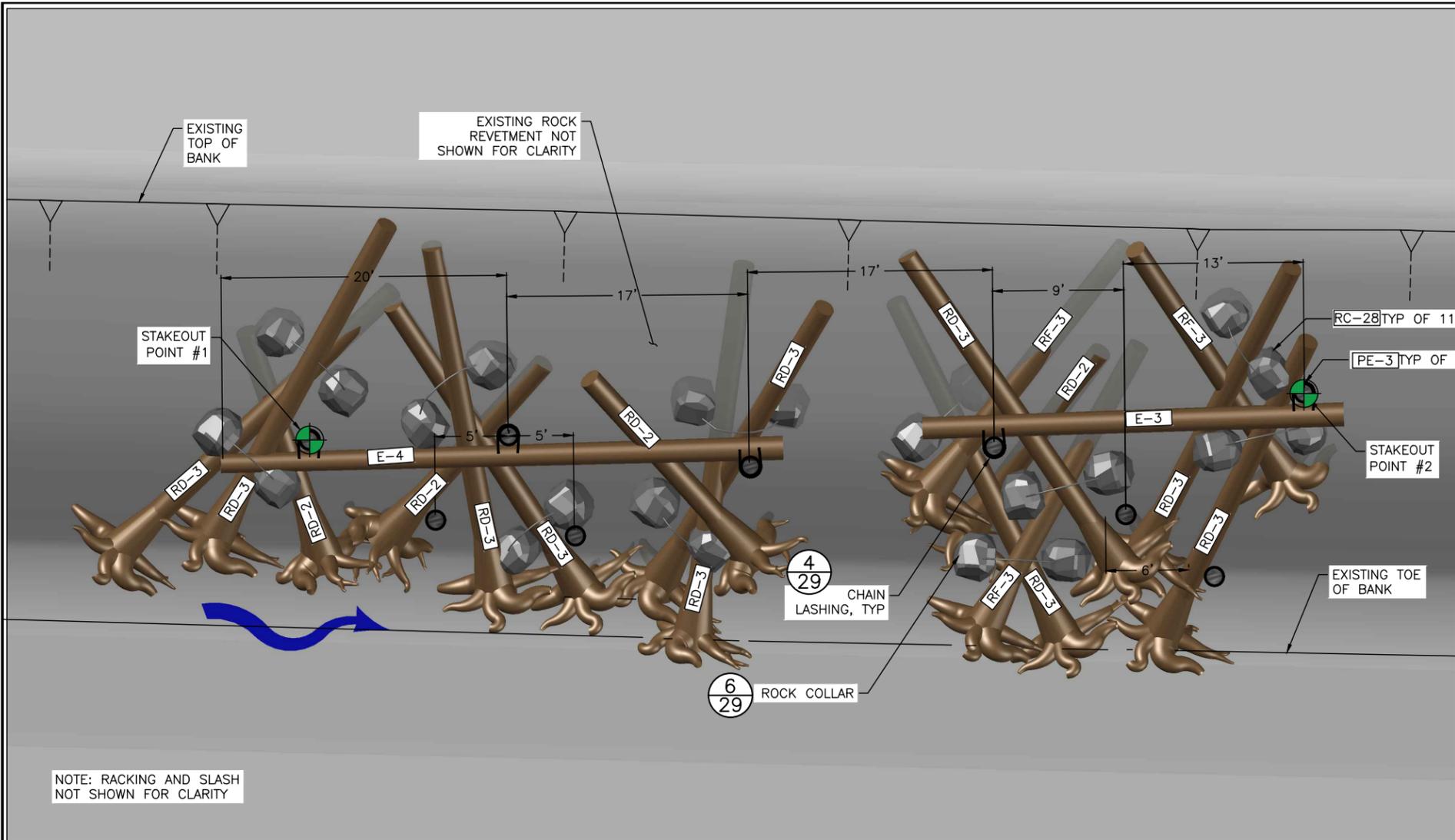
NAME OR INITIALS AND DATE	GEOGRAPHIC INFORMATION
DESIGNED MT, RLE, MS	LATITUDE 46°58'55.71"N
CHECKED MT, RLE	LONGITUDE 123°28'56.2"W
DRAWN MS, KP	TN/SC/RG T17N/S6/R6W
CHECKED MT, RLE	DATE 6/11/2020

KEYS ROAD FLOOD PROTECTION

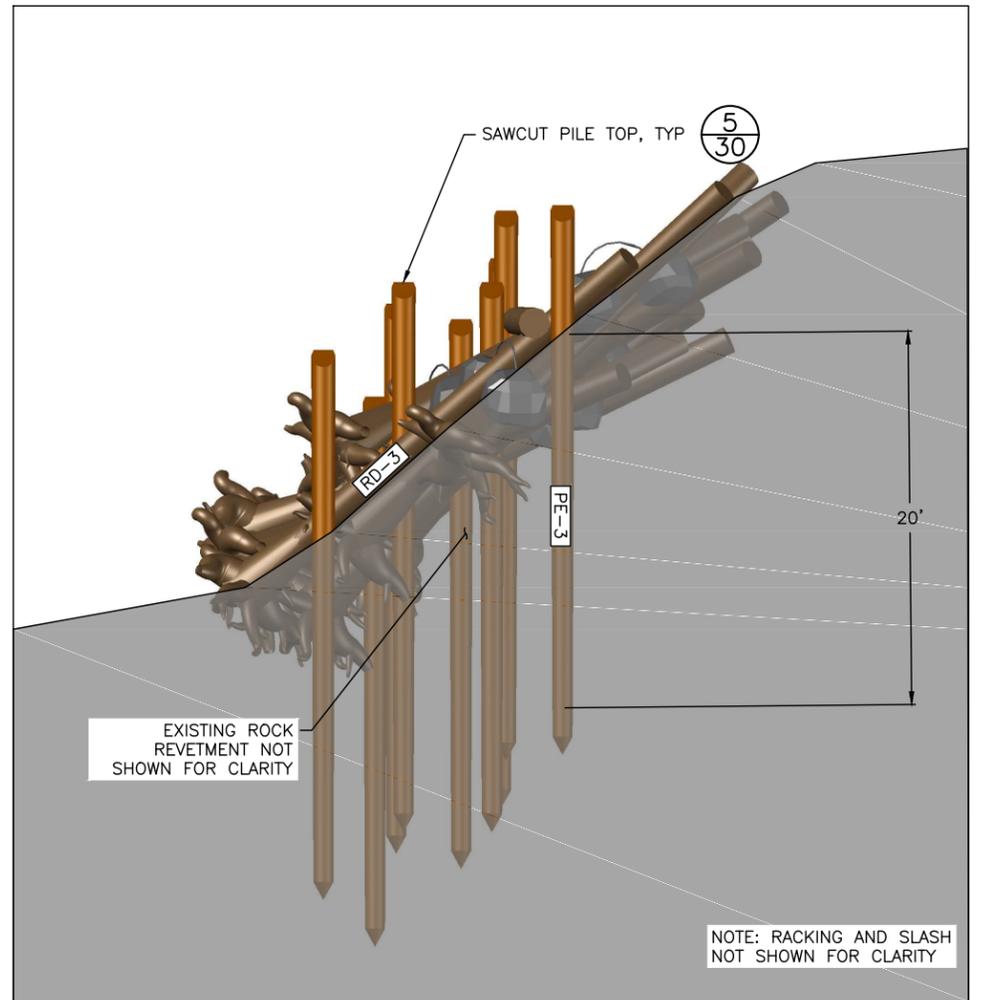
FLOODPLAIN ROUGHNESS ELJ DETAILS

22
SHEET 22 OF 32

Jun 11, 2020 PHASE I FINAL DESIGN



TIMBER COMPLEX UNIT PLAN
SCALE: 1"=5'



TIMBER COMPLEX PERSPECTIVE
SCALE: 1"=5'

NOTE: RACKING AND SLASH NOT SHOWN FOR CLARITY

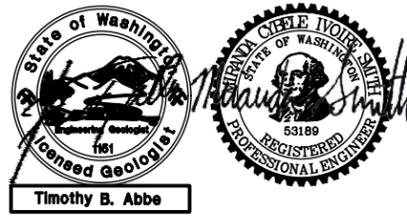
NOTE: RACKING AND SLASH NOT SHOWN FOR CLARITY

NOTES:

1. ALL LOGS SHALL BE DOUGLAS FIR OR WESTERN RED CEDAR.
2. ALL PILES SHALL BE ROUND, UNTREATED TIMBER PILES AND SHALL BE DOUGLAS FIR. PILES SHALL BE FREE FROM DEFECTS, CRACKS, AND SPLITTING AT THE TIME OF DRIVING.
3. LOGS WITH ROOTWADS SHALL HAVE A DIAMETER AS SHOWN MEASURED AT DBH, DEFINED AS 4.5 FEET ABOVE GROUND WHEN TREE WAS STANDING.
4. THE CONTRACTOR SHALL PLACE LOGS AS ILLUSTRATED ON THIS SHEET UNLESS DIRECTED OTHERWISE BY THE CONTRACTING OFFICER.
5. SOIL EXCAVATED DURING CONSTRUCTION SHALL BE REPLACED TO ORIGINAL GROUND FOLLOWING PLACEMENT OF ALL LOGS.
6. THE LOCATIONS SHOWN ON THE PLANS ARE APPROXIMATE AND MAY BE ADJUSTED IN THE FIELD BY THE CONTRACTING OFFICER.
7. RACKING LOGS SHALL CONSIST OF TREES WITH BRANCHES HAVING A BASE DIAMETER OF 6-12 INCHES AND A LENGTH OF 20-40 FT. RACKING MATERIAL SHALL OCCUR WITH EACH LAYER TO ENSURE THAT RACKING MATERIAL EXTENDS THROUGH THE STRUCTURE AND IS PINNED BY SUBSEQUENT LAYERS. SLASH MATERIAL SHALL CONSIST OF LIMBS AND BRANCHES AND A BASE DIAMETER BETWEEN 1 AND 3 INCHES. SLASH MATERIAL SHALL BE PLACED AS DIRECTED BY THE CONTRACTING OFFICER. QUANTITY OF RACKING LOGS AND SLASH MATERIAL PER STRUCTURE ARE SHOWN IN LOG SCHEDULE. RACKING AND SLASH MATERIAL SHALL BE DOUGLAS FIR, PONDEROSA PINE, WESTERN RED CEDAR, OR WESTERN LARCH TREES.
8. RETENTION LOGS TO BE INSTALLED TO HOLD RACKING MATERIAL IN PLACE AT THE DIRECTION OF THE CONTRACTING OFFICER.
9. TIMBER COMPLEX CONSTRUCTION SITE CURRENTLY HAS ROCK REVETMENT ALONG THE BANK. EXISTING ROCK MATERIAL SHALL BE MOVED SO THAT PILES MAY BE DRIVEN INTO THE BED. ROCK THAT MEETS SIZE SPECIFICATIONS SHOULD BE SALVAGED TO CONSTRUCT ROCK COLLARS.

TIMBER COMPLEX ELJ LOG SCHEDULE					
LOG ID	DIA* (INCHES)	LENGTH ** (FEET)	ROOTWAD (Y/N)	QUANTITY PER STRUCTURE	NOTES
RD-3	18-22	30	Y	10	
RD-2	18-22	20	Y	4	
E-4	16-20	40	N	1	
E-3	16-20	30	N	1	
RF-3	14-18	30	Y	3	
PE-3 ***	18	30	N	9	
RC-28	-	-	-	11	ROCK COLLAR WITH 28" DIAMETER BOULDERS
RACKING	6-12	20-40	N	160	TREES WITH BRANCHES
SLASH	1-3	-	N	150 CY	LIMBS AND BRANCHES

* MINIMUM DIAMETER AT BREAST HEIGHT (1" PER 10' MAXIMUM TAPER)
 ** TOTAL LENGTH INCLUDING ROOTWAD
 *** TURNED PILES - DIA (IN) IS BUTT DIAMETER



0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT PLOTTED TO ORIGINAL SCALE.



NAME OR INITIALS AND DATE		GEOGRAPHIC INFORMATION	
DESIGNED	MT, RLE, MS	LATITUDE	46°58'55.71"N
CHECKED	MT, RLE	LONGITUDE	123°28'56.2"W
DRAWN	MS, KP	TN/SC/RG	T17N/S6/R6W
CHECKED	MT, RLE	DATE	6/11/2020

KEYS ROAD FLOOD PROTECTION

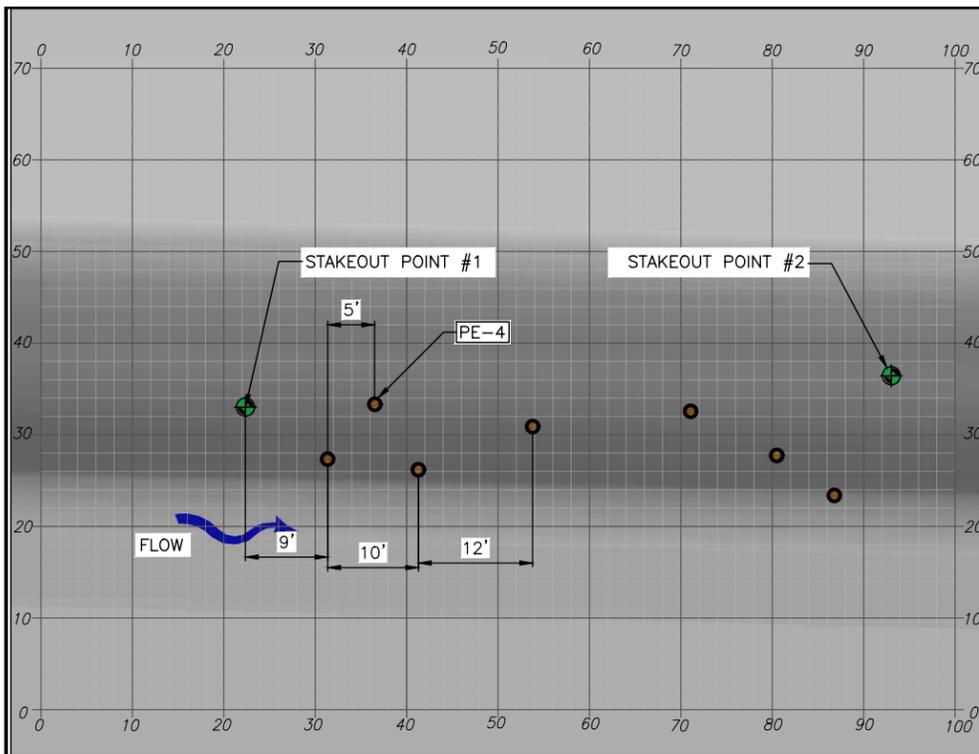
TIMBER COMPLEX

23

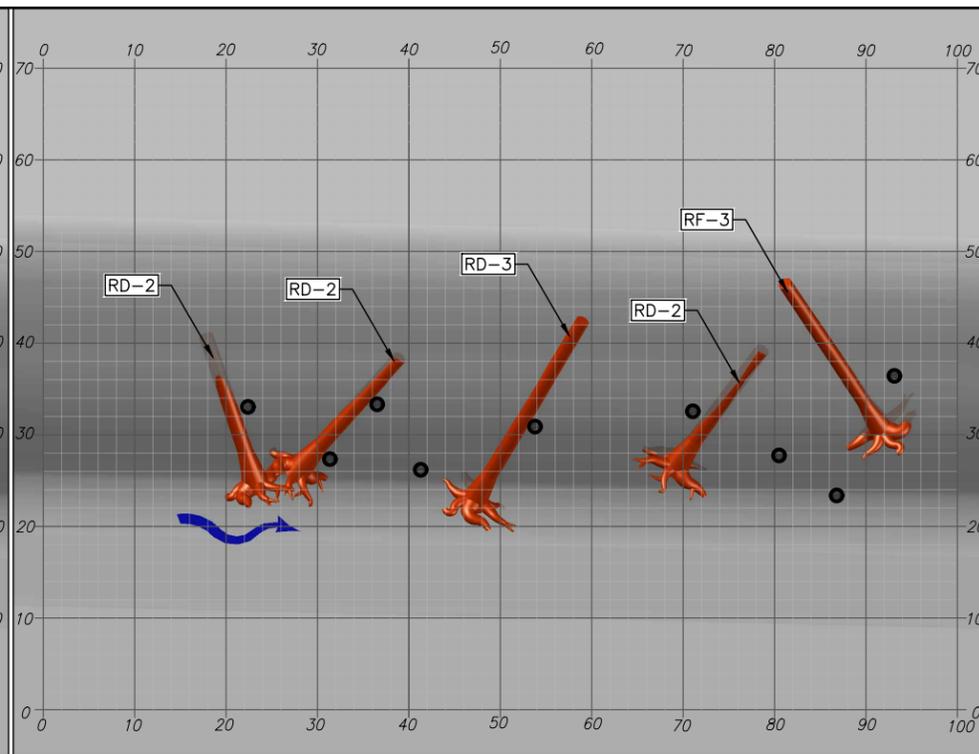
SHEET **23** OF **32**

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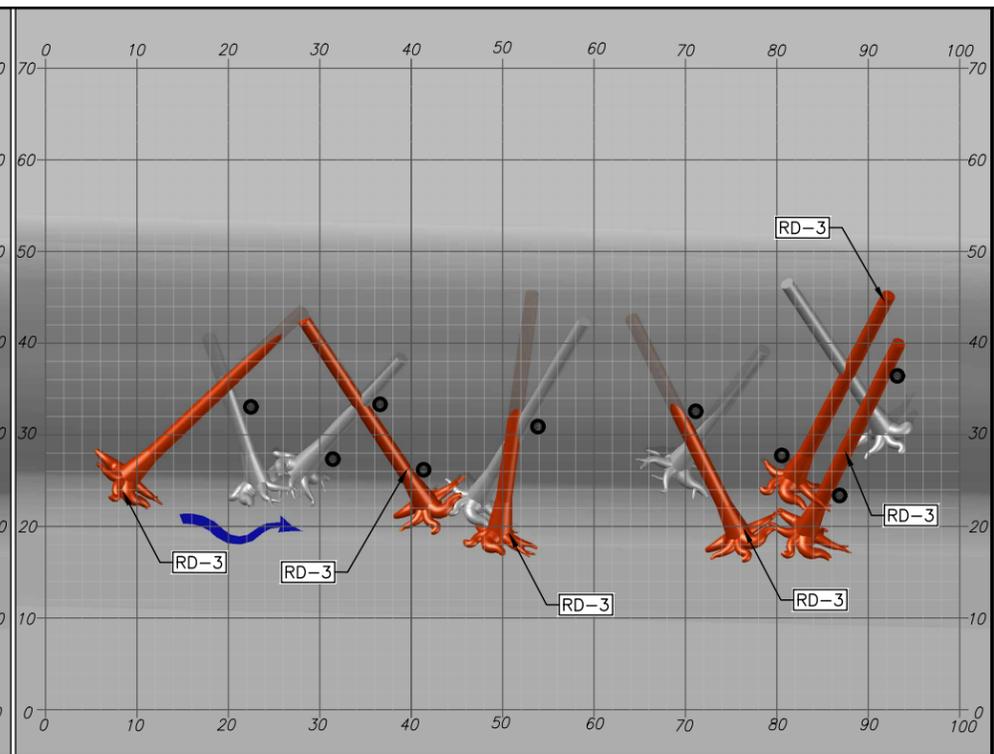
Jun 11, 2020 PHASE I FINAL DESIGN



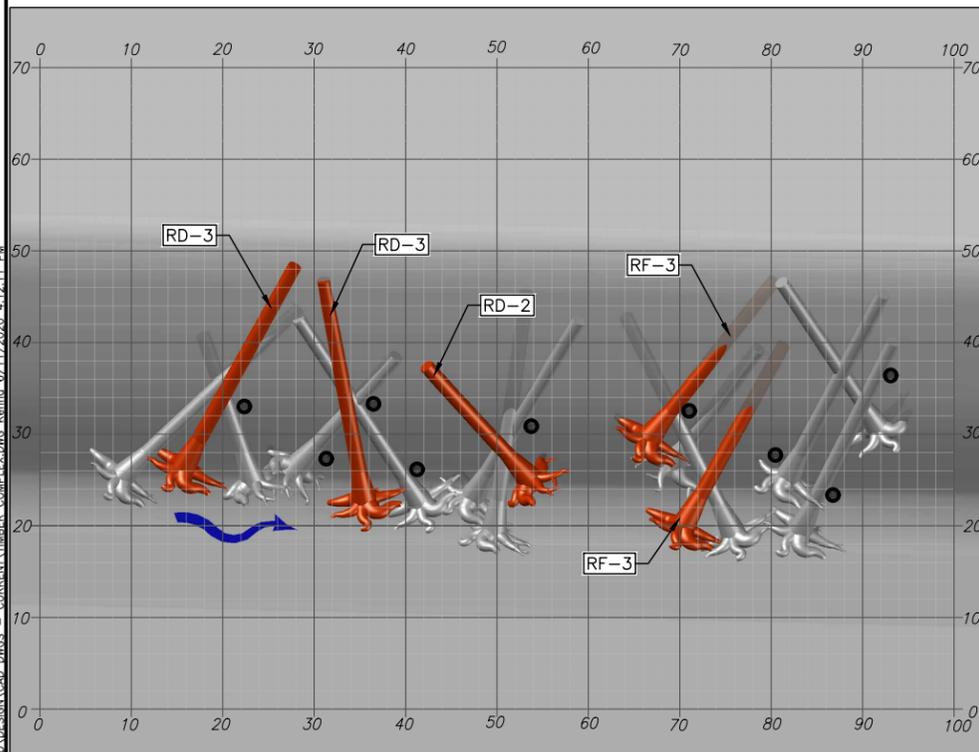
LAYER 1
1. INSTALL 9 PILES



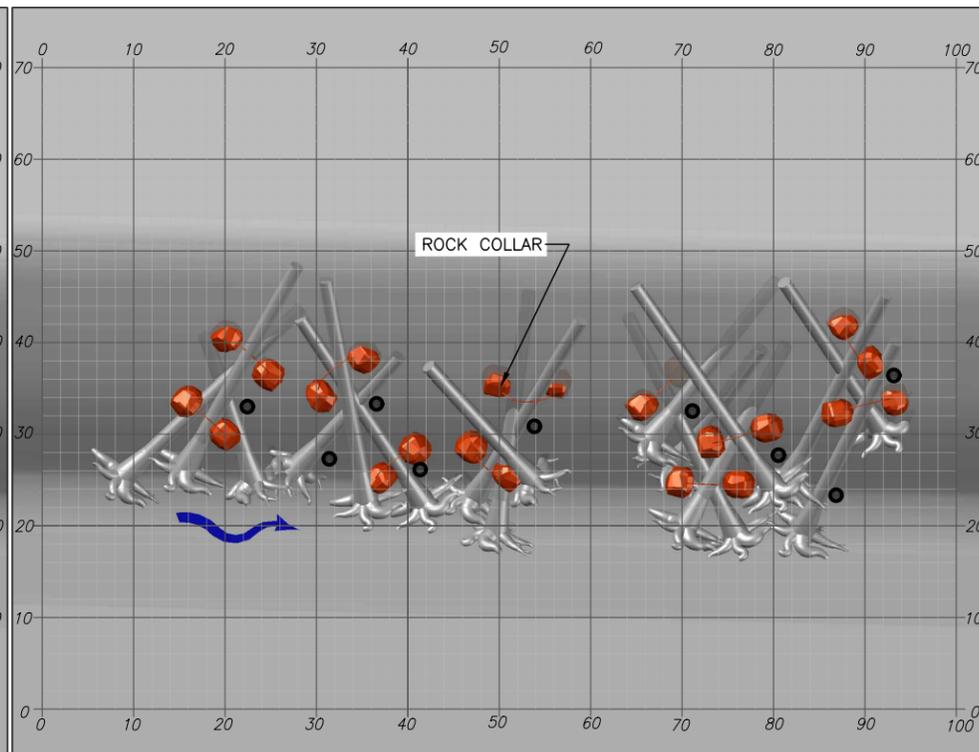
LAYER 2
1. PLACE 5 ROOTWAD MEMBERS
2. PLACE RACKING/SLASH (NOT SHOWN)



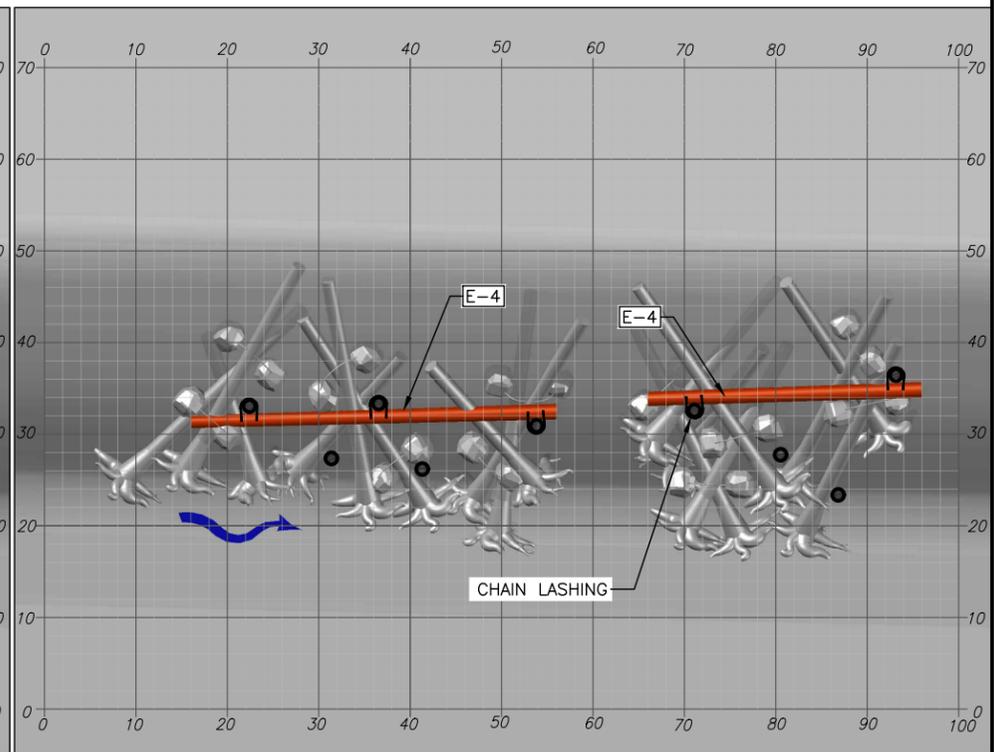
LAYER 3
1. PLACE 6 ROOTWAD MEMBERS
2. PLACE RACKING/SLASH (NOT SHOWN)



LAYER 4
1. PLACE 5 ROOTWAD MEMBERS

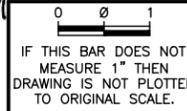
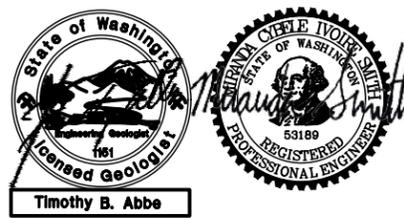


LAYER 5
1. PLACE 11 ROCK COLLARS



LAYER 6
1. PLACE 2 LOG MEMBERS
2. PLACE CHAIN LASHING

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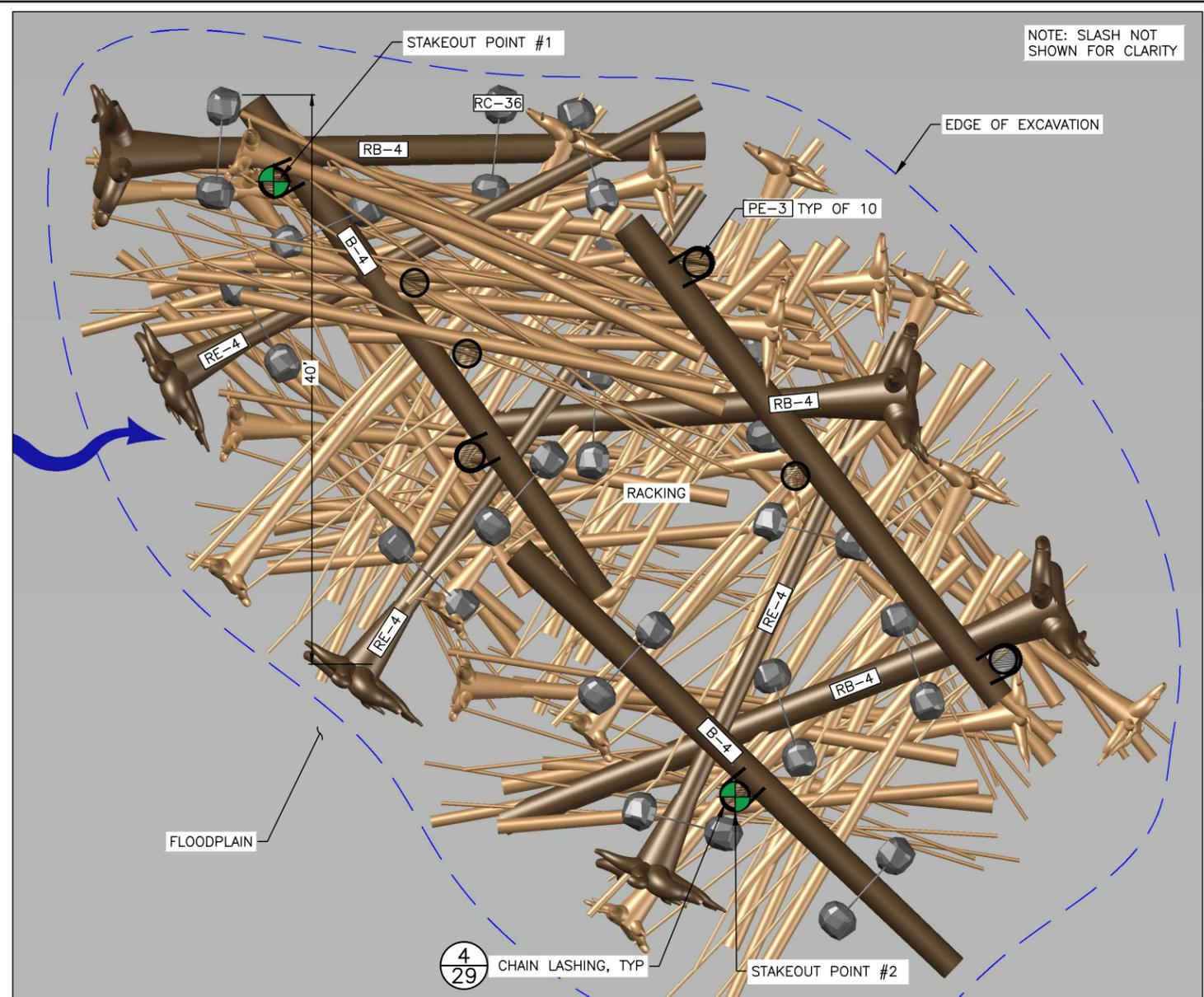
NAME OR INITIALS AND DATE		GEOGRAPHIC INFORMATION	
DESIGNED	MT, RLE, MS	LATITUDE	46°58'55.71"N
CHECKED	MT, RLE	LONGITUDE	123°28'56.2"W
DRAWN	MS, KP	TN/SC/RG	T17N/S6/R6W
CHECKED	MT, RLE	DATE	6/11/2020

KEYS ROAD FLOOD PROTECTION

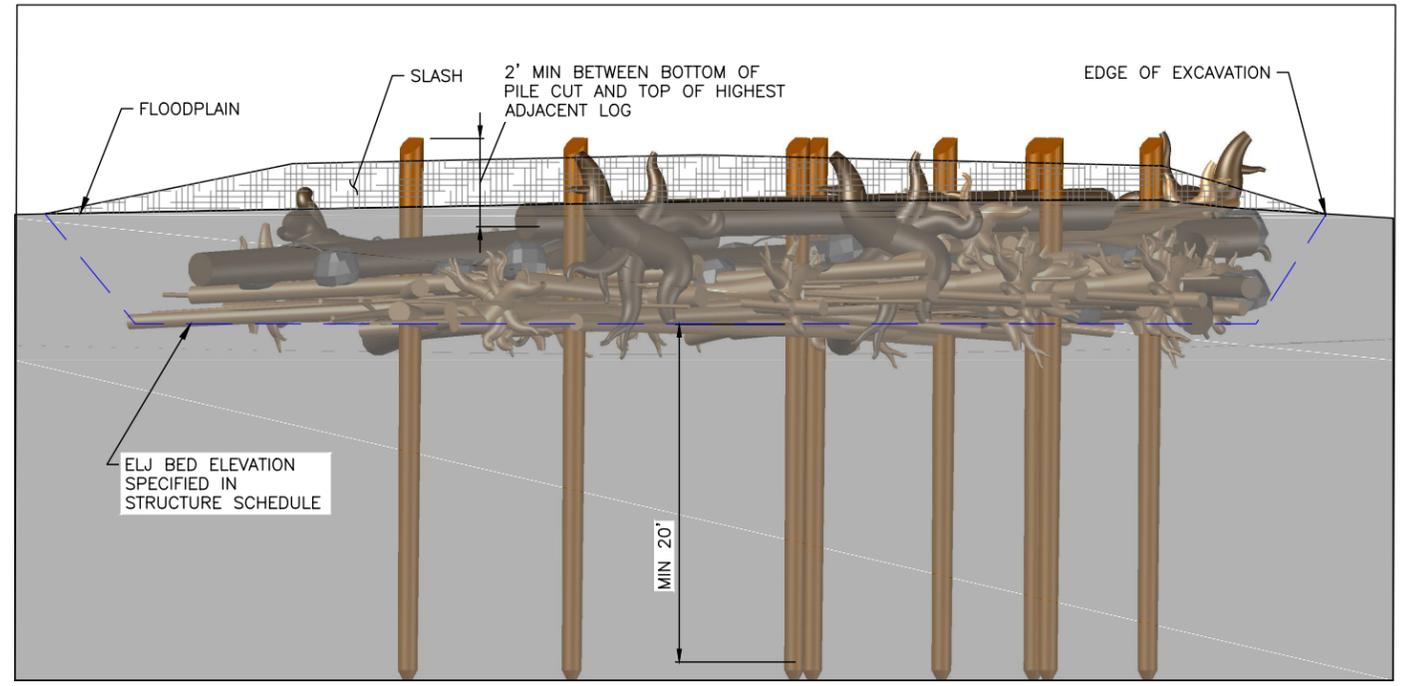
TIMBER COMPLEX

24
SHEET 24 OF 32

Jun 11, 2020 PHASE I FINAL DESIGN



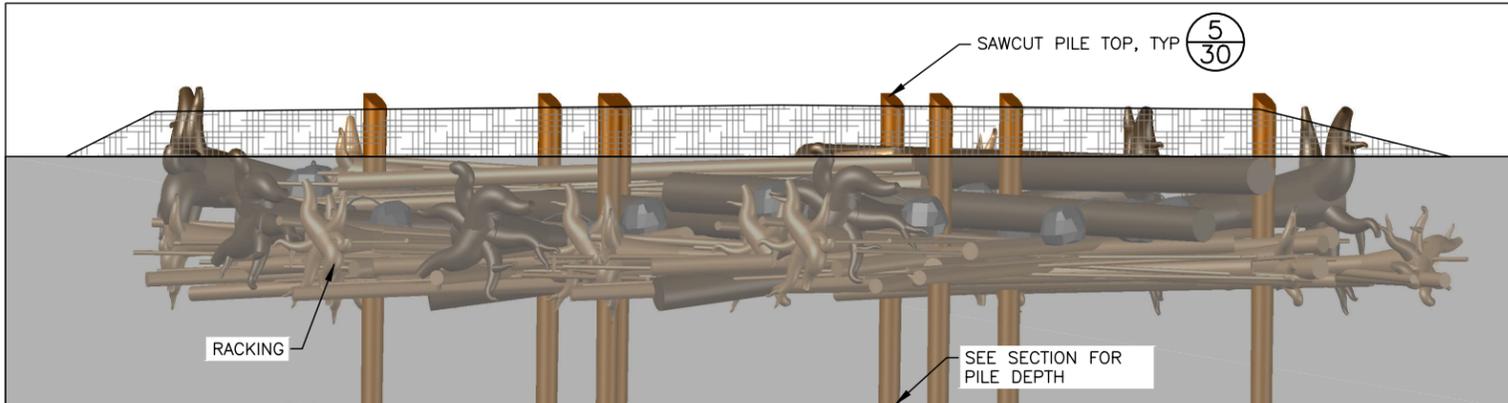
TYPE 1 SETBACK REVETMENT PLAN
SCALE: 1" = 5'



TYPE 1 SETBACK REVETMENT ELJ SECTION
SCALE: NTS

NOTES:

- EXCAVATION SPOILS SHALL BE STAGED WITHIN THE WORK AREA AND OUTSIDE FLOWING WATER. SPOILS SHALL BE STOCKPILED TO ALLOW LOG LAYER PLACEMENT AND CONSTRUCTION ACCESS.
- BACKFILL EXTENTS VARY AND TO BE CONSTRUCTED WITH NATIVE ALLUVIUM FROM EXCAVATION SPOILS.
- FINAL REVETMENT HEIGHT TO BE ACHIEVED AS SPECIFIED REGARDLESS OF ACTUAL LOG DIAMETERS USED OR STACKING ARRANGEMENT.
- ALL LARGE WOOD DIMENSIONS DO NOT INCLUDE BARK THICKNESS.
- COVER TOP OF BACKFILL AREA AND BASE OF STRUCTURES WITH LOOSE WOOD DEBRIS AND CHIPS. MIX 6 INCHES OF LOOSE WOOD INTO UPPER 2 FT ON BACKFILL
- THE LOCATIONS SHOWN ON THE PLANS ARE APPROXIMATE AND MAY BE ADJUSTED IN THE FIELD BY THE CONTRACTING OFFICER.
- RACKING AND SLASH PLACEMENT SHALL OCCUR ACCORDING TO LAYERING PLAN. RACKING AND SLASH QUANTITIES ARE SHOWN IN THE LOG SCHEDULE.
- THE CONTRACTOR SHALL FIELD VERIFY WITH THE ENGINEER ALL PILE LOCATIONS, LENGTHS, WIDTHS AND ELEVATIONS PRIOR TO EXCAVATION, ASSEMBLY AND INSTALLATION OF EACH STRUCTURE.
- LOCATIONS FOR ALL STRUCTURE PLACEMENTS WILL BE STAKED IN FIELD BY THE ENGINEER PRIOR TO START OF CONSTRUCTION AT EACH SITE.
- EXCAVATION LIMITS SHALL BE FIELD VERIFIED BY THE ENGINEER PRIOR TO EXCAVATION COMMENCING AND PLACEMENT OF ANY LARGE WOOD.
- WOOD PLACEMENT IN EACH REVETMENT LAYER SHALL BE FIELD VERIFIED BY ENGINEER PRIOR TO BACKFILLING.



TYPE 1 SETBACK REVETMENT ELJ SIDE PROFILE
SCALE: 1" = 5'

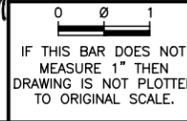
TYPE 1 SETBACK REVETMENT ELJ LOG SCHEDULE					
LOG ID	DIA* (INCHES)	LENGTH ** (FEET)	ROOTWAD (Y/N)	QUANTITY PER STRUCTURE	NOTES
RB-4	22-26	40	Y	3	
B-4	22-26	40	N	3	
RE-4	16-20	40	Y	3	
PE-3 ***	18	30	N	8	
RC-36	-	-	-	16	ROCK COLLAR WITH 36" DIAMETER BOULDERS
RACKING	6-12	20-40	N	160	TREES WITH BRANCHES
SLASH	1-3	-	N	150 CY	LIMBS AND BRANCHES

* MINIMUM DIAMETER AT BREAST HEIGHT (1" PER 10' MAXIMUM TAPER)
 ** TOTAL LENGTH INCLUDING ROOTWAD
 *** TURNED PILES - DIA (IN) IS BUTT DIAMETER

TYPE 1 SETBACK REVETMENT DETAILS (1/25)
SCALE: AS NOTED

State of Washington
 Timothy B. Abbe
 Licensed Geologist

Supernatural
 Registered Professional Engineer
 53189



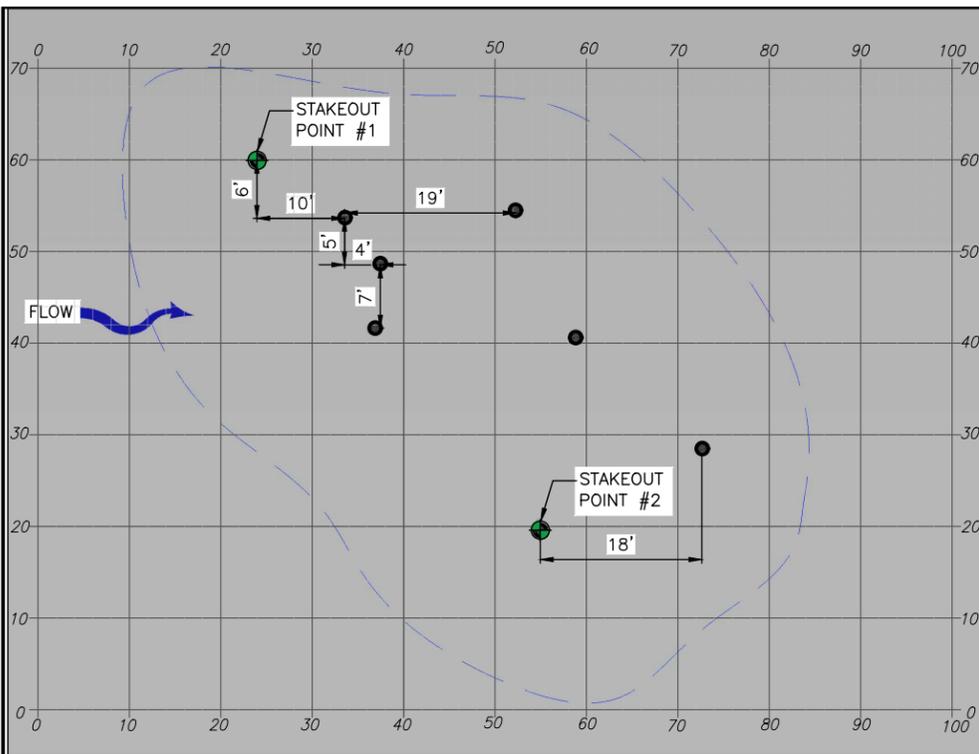
NAME OR INITIALS AND DATE	GEOGRAPHIC INFORMATION
DESIGNED MT, RLE, MS	LATITUDE 46°58'55.71"N
CHECKED MT, RLE	LONGITUDE 123°28'56.2"W
DRAWN MS, KP	TN/SC/RG T17N/S6/R6W
CHECKED MT, RLE	DATE 6/11/2020

KEYS ROAD FLOOD PROTECTION

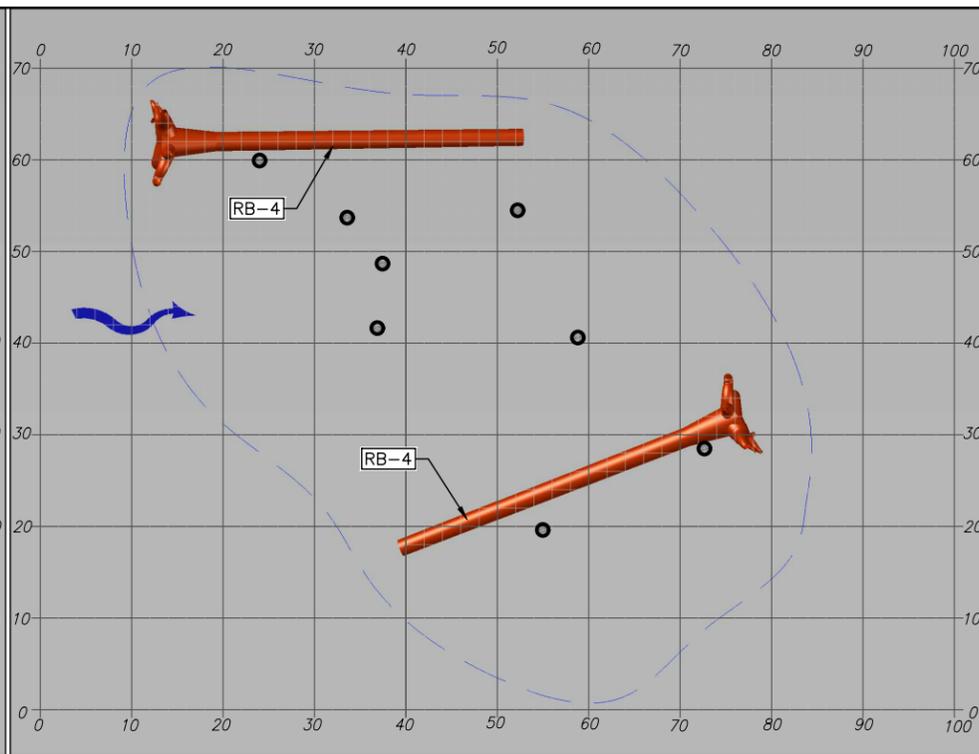
TYPE 1 SETBACK REVETMENT

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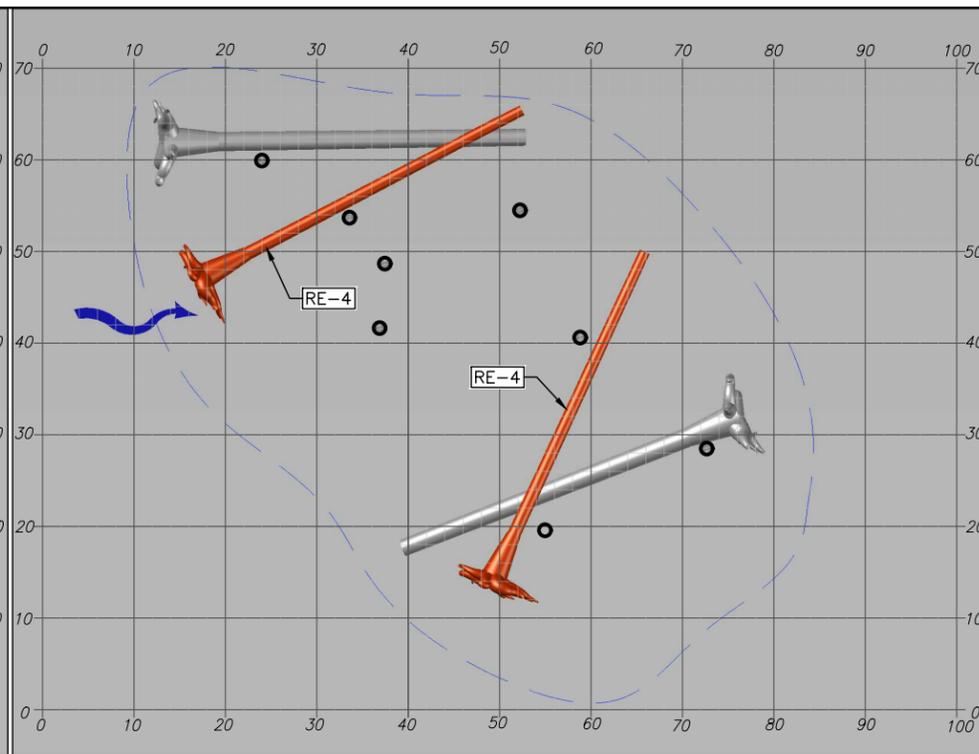
Jun 11, 2020 PHASE I FINAL DESIGN



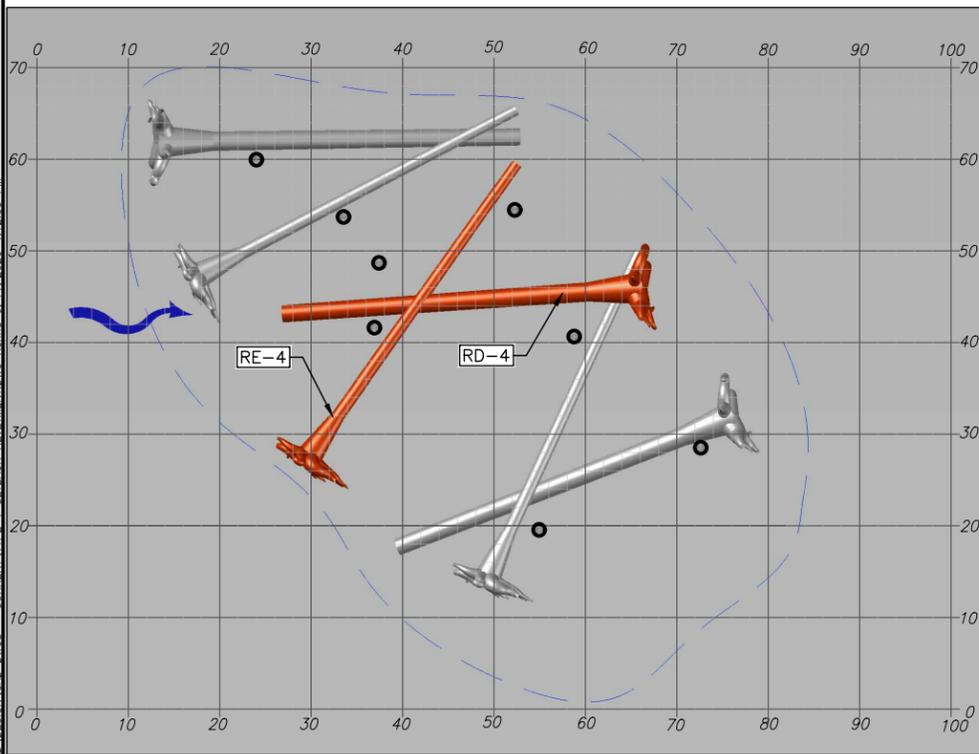
LAYER 1
1. INSTALL 8 PILES



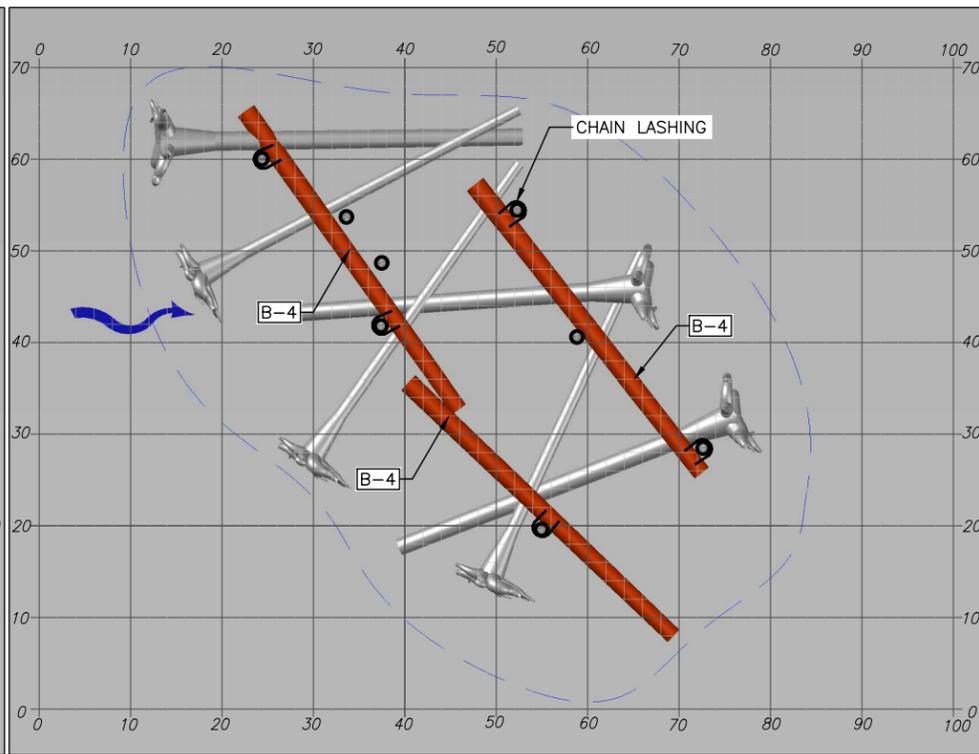
LAYER 2
1. PLACE 2 ROOTWAD MEMBERS
2. PLACE RACKING/SLASH (NOT SHOWN)



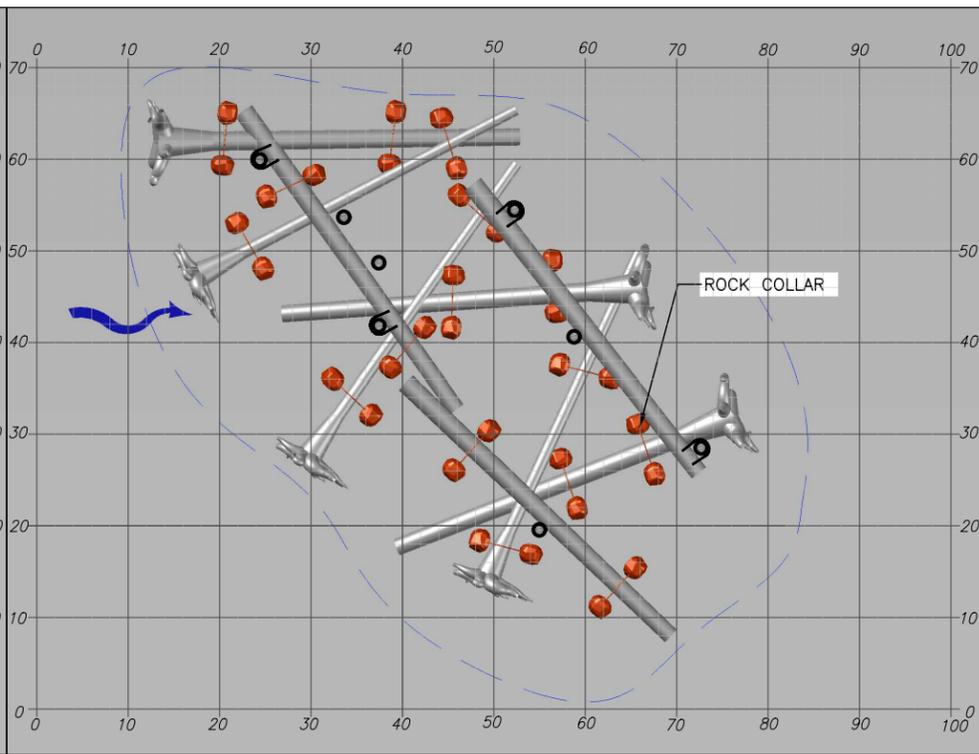
LAYER 3
1. PLACE 2 ROOTWAD MEMBERS
2. PLACE RACKING/SLASH (NOT SHOWN)



LAYER 4
1. PLACE 2 ROOTWAD MEMBERS
2. PLACE RACKING/SLASH (NOT SHOWN)



LAYER 5
1. PLACE 3 LOG MEMBERS
2. ADD CHAIN LASHING



LAYER 6
1. PLACE 16 ROCK COLLARS

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IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT PLOTTED TO ORIGINAL SCALE.



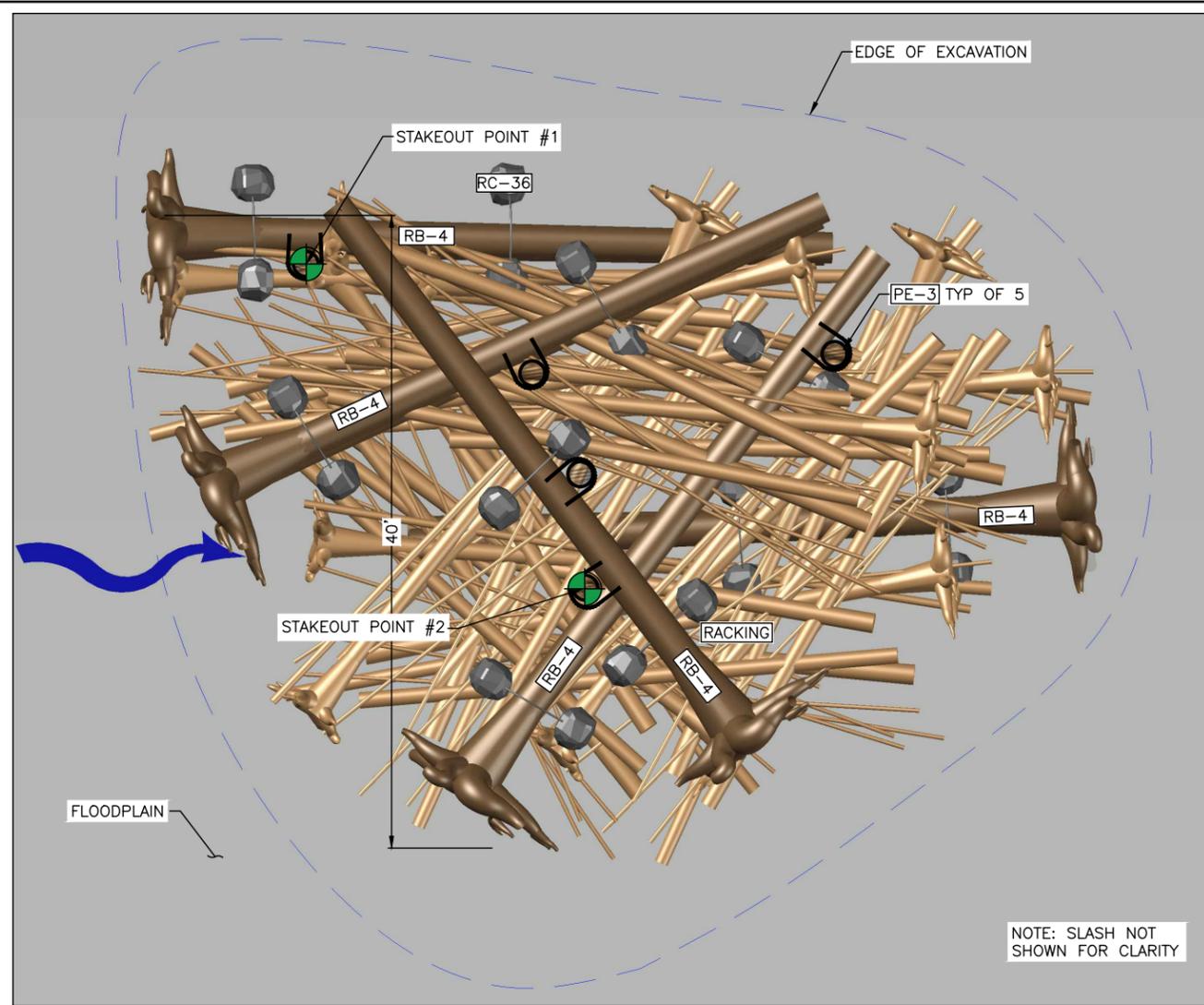
NAME OR INITIALS AND DATE		GEOGRAPHIC INFORMATION	
DESIGNED	MT, RLE, MS	LATITUDE	46°58'55.71"N
CHECKED	MT, RLE	LONGITUDE	123°28'56.2"W
DRAWN	MS, KP	TN/SC/RG	T17N/S6/R6W
CHECKED	MT, RLE	DATE	6/11/2020

KEYS ROAD FLOOD PROTECTION

TYPE 1 SETBACK REVETMENT LAYERING PLAN

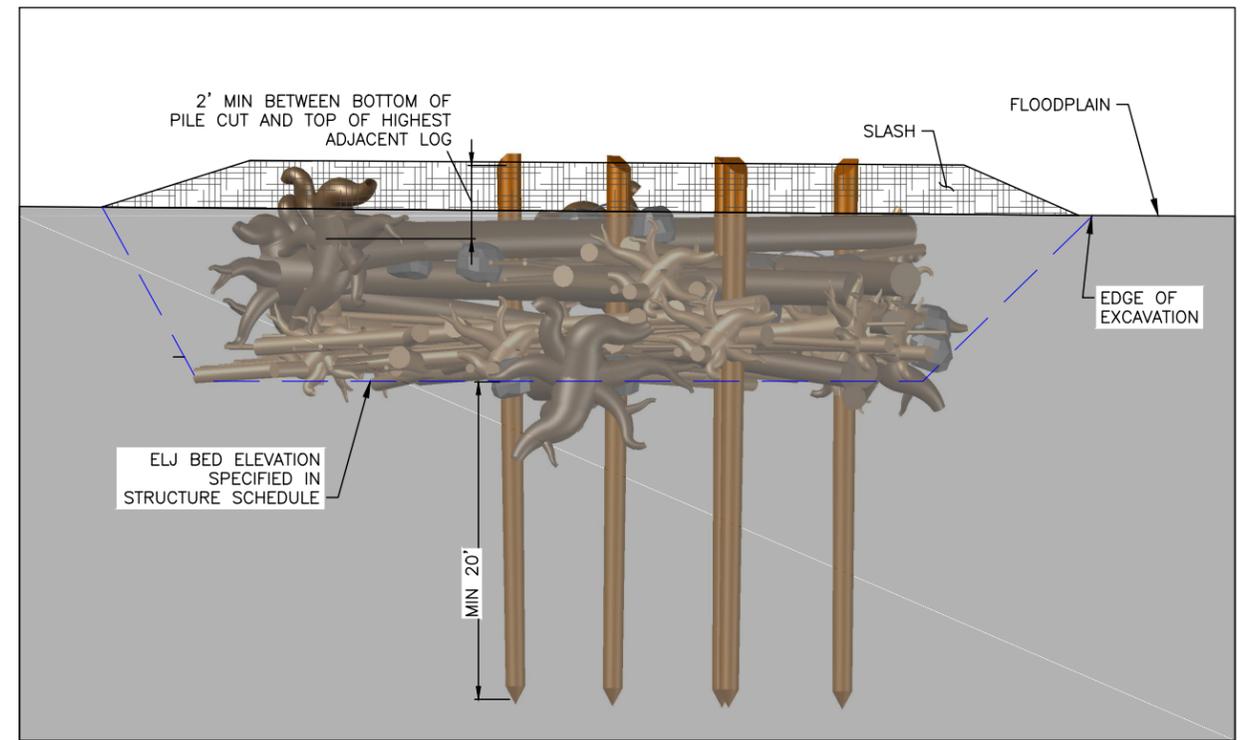
26
SHEET **26** OF **32**

Jun 11, 2020 PHASE I FINAL DESIGN



TYPE 2 SETBACK REVETMENT PLAN

SCALE: 1" = 5'



TYPE 2 SETBACK REVETMENT ELJ SECTION

SCALE: NTS

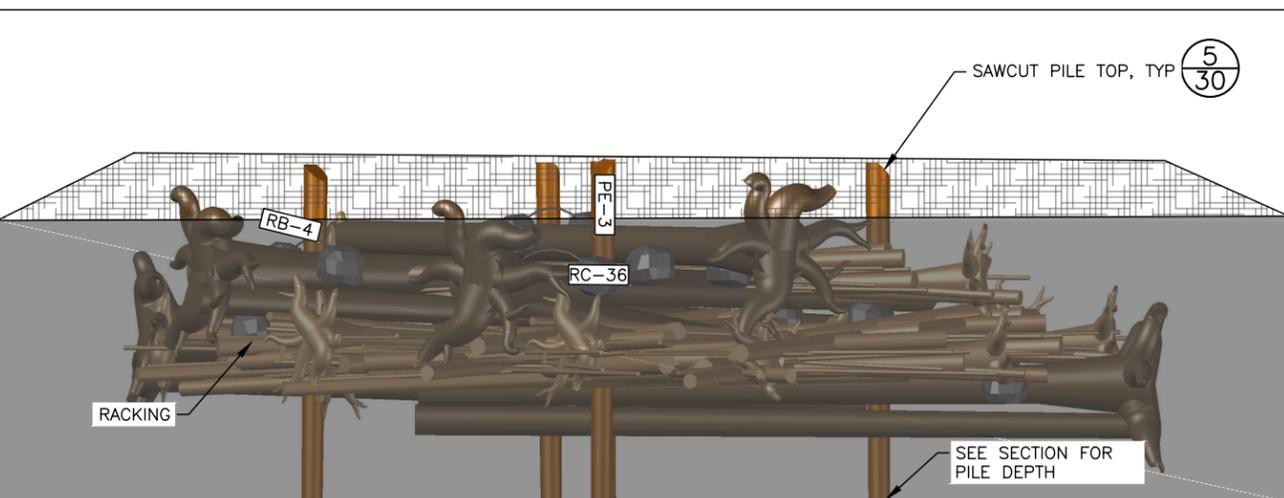
NOTES:

1. EXCAVATION SPOILS SHALL BE STAGED WITHIN THE WORK AREA AND OUTSIDE FLOWING WATER. SPOILS SHALL BE STOCKPILED TO ALLOW LOG LAYER PLACEMENT AND CONSTRUCTION ACCESS.
2. BACKFILL EXTENTS VARY AND TO BE CONSTRUCTED WITH NATIVE ALLUVIUM FROM EXCAVATION SPOILS.
3. FINAL REVETMENT HEIGHT TO BE ACHIEVED AS SPECIFIED REGARDLESS OF ACTUAL LOG DIAMETERS USED OR STACKING ARRANGEMENT.
4. ALL LARGE WOOD DIMENSIONS DO NOT INCLUDE BARK THICKNESS.
5. COVER TOP OF BACKFILL AREA AND BASE OF STRUCTURES WITH LOOSE WOOD DEBRIS AND CHIPS. MIX 6 INCHES OF LOOSE WOOD INTO UPPER 2 FT ON BACKFILL.
6. THE LOCATIONS SHOWN ON THE PLANS ARE APPROXIMATE AND MAY BE ADJUSTED IN THE FIELD BY THE CONTRACTING OFFICER.
6. RACKING AND SLASH PLACEMENT SHALL OCCUR ACCORDING TO LAYERING PLAN. RACKING AND SLASH QUANTITIES ARE SHOWN IN THE LOG SCHEDULE.
7. THE CONTRACTOR SHALL FIELD VERIFY WITH THE ENGINEER ALL PILE LOCATIONS, LENGTHS, WIDTHS AND ELEVATIONS PRIOR TO EXCAVATION, ASSEMBLY AND INSTALLATION OF EACH STRUCTURE.
8. LOCATIONS FOR ALL STRUCTURE PLACEMENTS WILL BE STAKED IN FIELD BY THE ENGINEER PRIOR TO START OF CONSTRUCTION AT EACH SITE.
9. EXCAVATION LIMITS SHALL BE FIELD VERIFIED BY THE ENGINEER PRIOR TO EXCAVATION COMMENCING AND PLACEMENT OF ANY LARGE WOOD.
10. WOOD PLACEMENT IN EACH REVETMENT LAYER SHALL BE FIELD VERIFIED BY ENGINEER PRIOR TO BACKFILLING.

TYPE 2 SETBACK REVETMENT ELJ LOG SCHEDULE

LOG ID	DIA* (INCHES)	LENGTH ** (FEET)	ROOTWAD (Y/N)	QUANTITY PER STRUCTURE	NOTES
RB-4	22-26	40	Y	5	
B-4	22-26	40	N	4	
PE-3 ***	18	40	N	5	
RC-36	-	-	-	10	ROCK COLLAR WITH 36" DIAMETER BOULDERS
RACKING	6-12	20-40	N	100	TREES WITH BRANCHES
SLASH	1-3	-	N	100 CY	LIMBS AND BRANCHES

* MINIMUM DIAMETER AT BREAST HEIGHT (1" PER 10' MAXIMUM TAPER)
 ** TOTAL LENGTH INCLUDING ROOTWAD
 *** TURNED PILES - DIA (IN) IS BUTT DIAMETER



TYPE 2 SETBACK REVETMENT ELJ SIDE PROFILE

SCALE: 1" = 5'

TYPE 2 SETBACK REVETMENT DETAILS

SCALE: AS NOTED

Timothy B. Abbe
 Registered Professional Engineer
 State of Washington
 License No. 53189

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT PLOTTED TO ORIGINAL SCALE.

GRAYS HARBOR COUNTY
 1854

Natural Systems Design

NAME OR INITIALS AND DATE	GEOGRAPHIC INFORMATION
DESIGNED MT, RLE, MS	LATITUDE 46°58'55.71"N
CHECKED MT, RLE	LONGITUDE 123°28'56.2"W
DRAWN MS, KP	TN/SC/RG T17N/S6/R6W
CHECKED MT, RLE	DATE 6/11/2020

KEYS ROAD FLOOD PROTECTION

TYPE 2 SETBACK REVETMENT

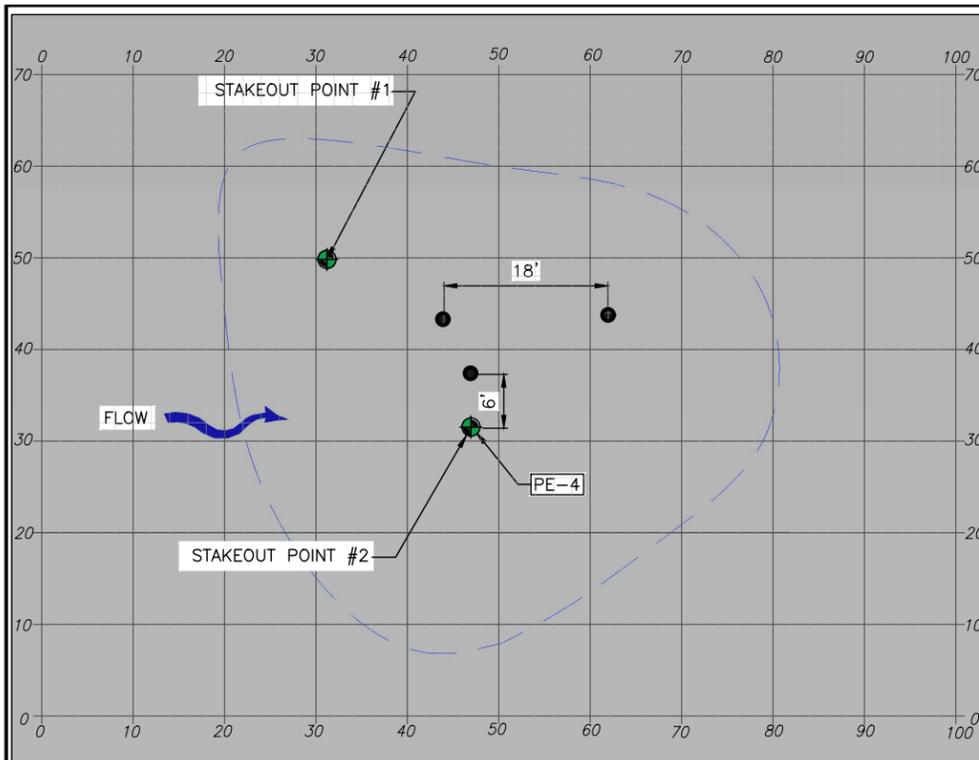
1/27

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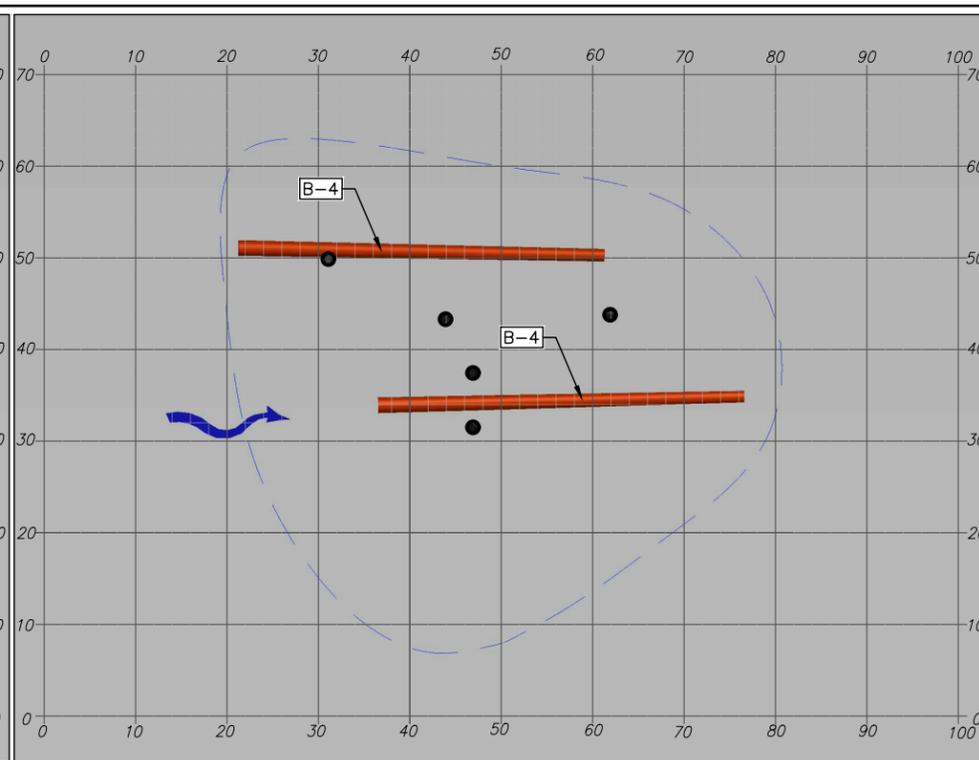
SHEET 27 OF 32

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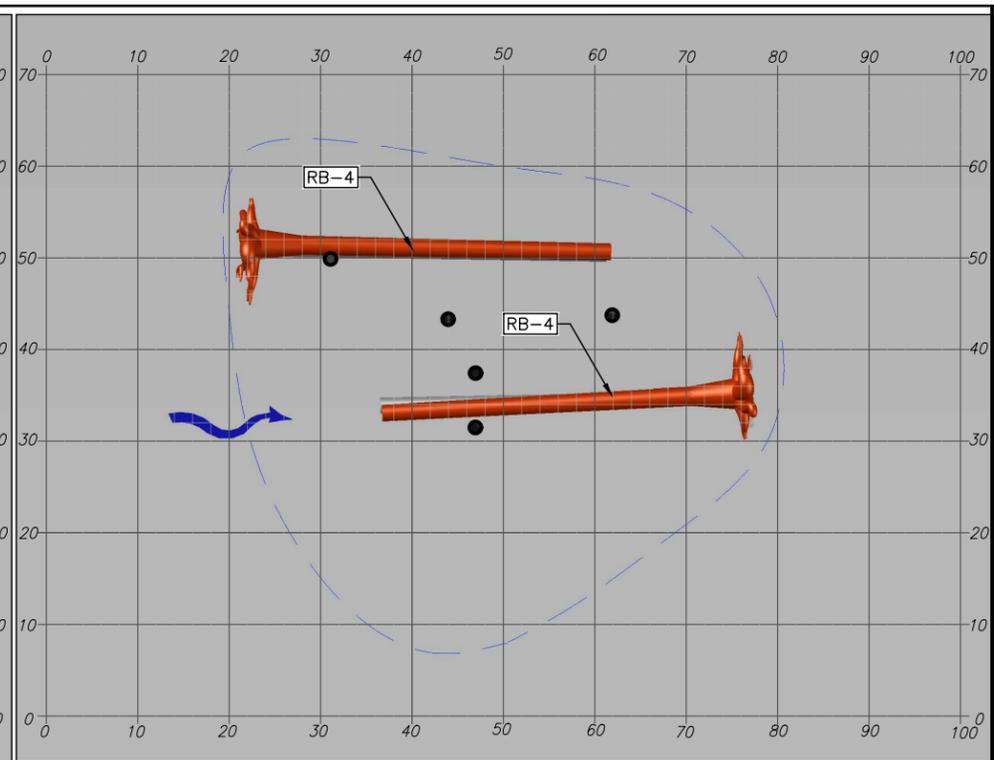
Jun 11, 2020 PHASE I FINAL DESIGN



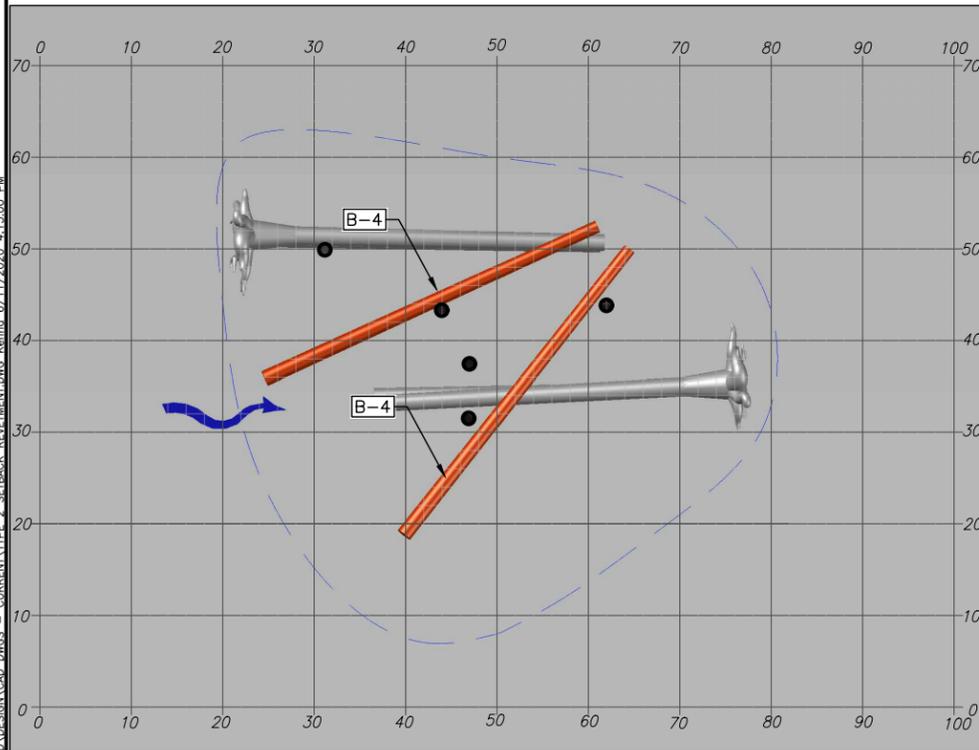
LAYER 1
1. INSTALL 5 PILES



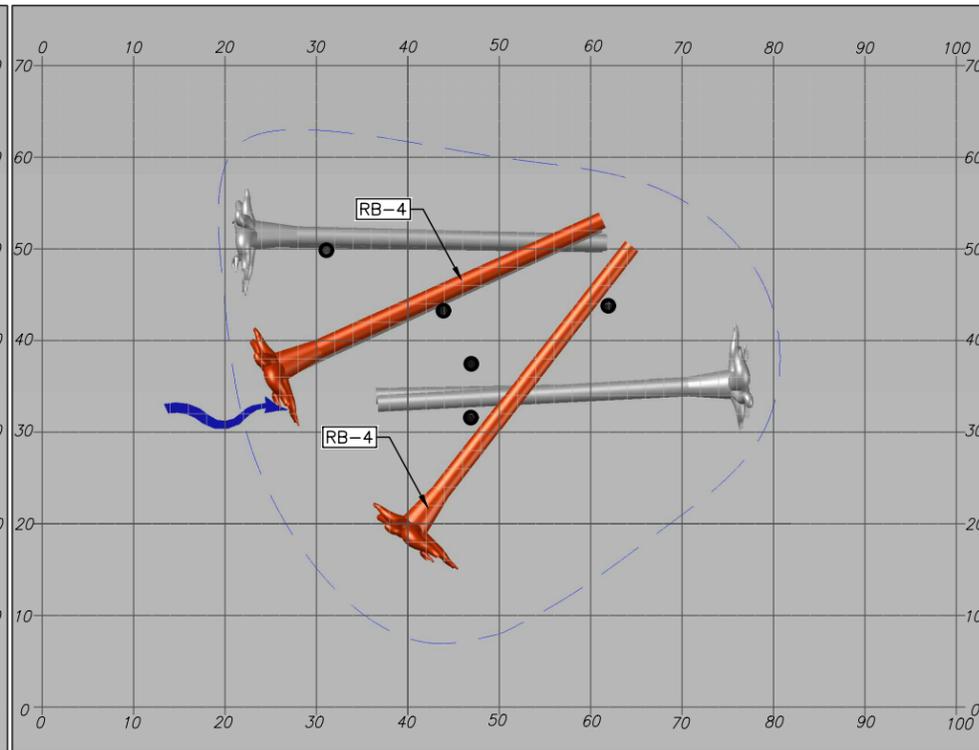
LAYER 2
1. PLACE 2 LOG MEMBERS
2. PLACE RACKING/SLASH (NOT SHOWN)



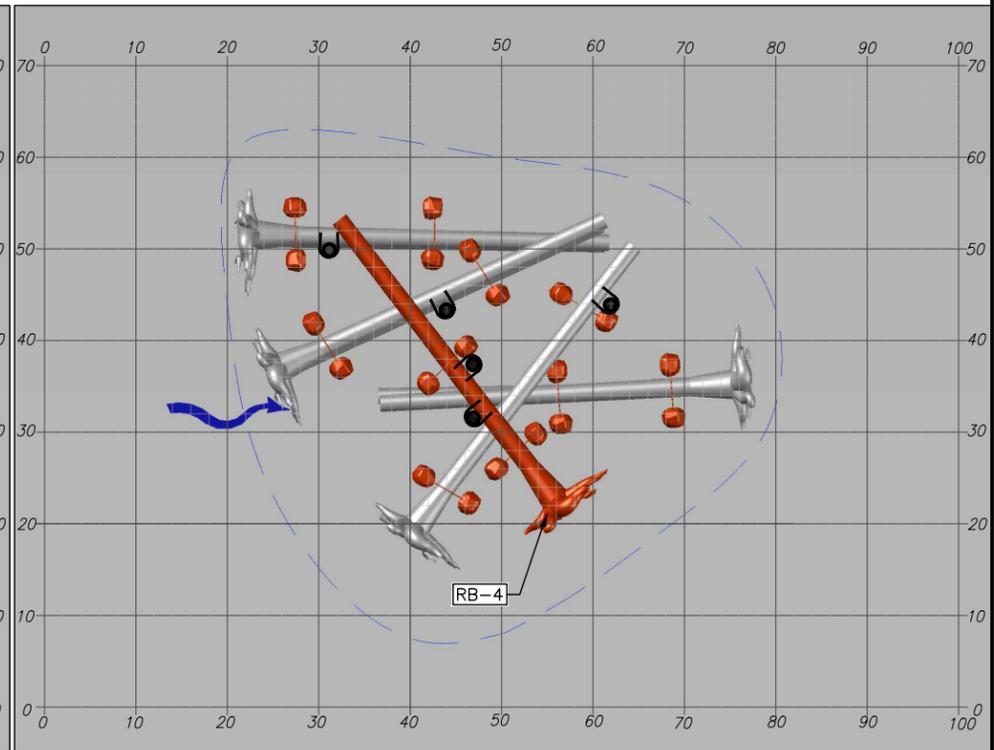
LAYER 3
1. PLACE 2 ROOTWAD MEMBERS
2. PLACE RACKING/SLASH (NOT SHOWN)



LAYER 4
1. PLACE 2 LOG MEMBERS
2. PLACE RACKING/SLASH (NOT SHOWN)

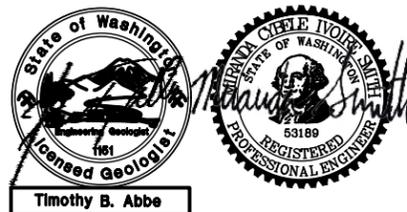


LAYER 5
1. PLACE 2 ROOTWAD MEMBERS



LAYER 6
1. PLACE 1 ROOTWAD MEMBER
2. PLACE CHAIN LASHING
3. PLACE 10 ROCK COLLARS

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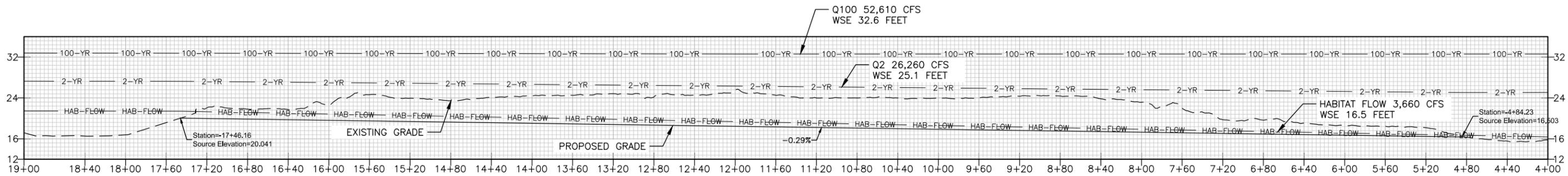
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DRAWN	MS, KP	TN/SC/RG	T17N/S6/R6W
CHECKED	MT, RLE	DATE	6/11/2020

KEYS ROAD FLOOD PROTECTION

TYPE 2 SETBACK REVETMENT LAYERING PLANS

28
SHEET **28** OF **32**

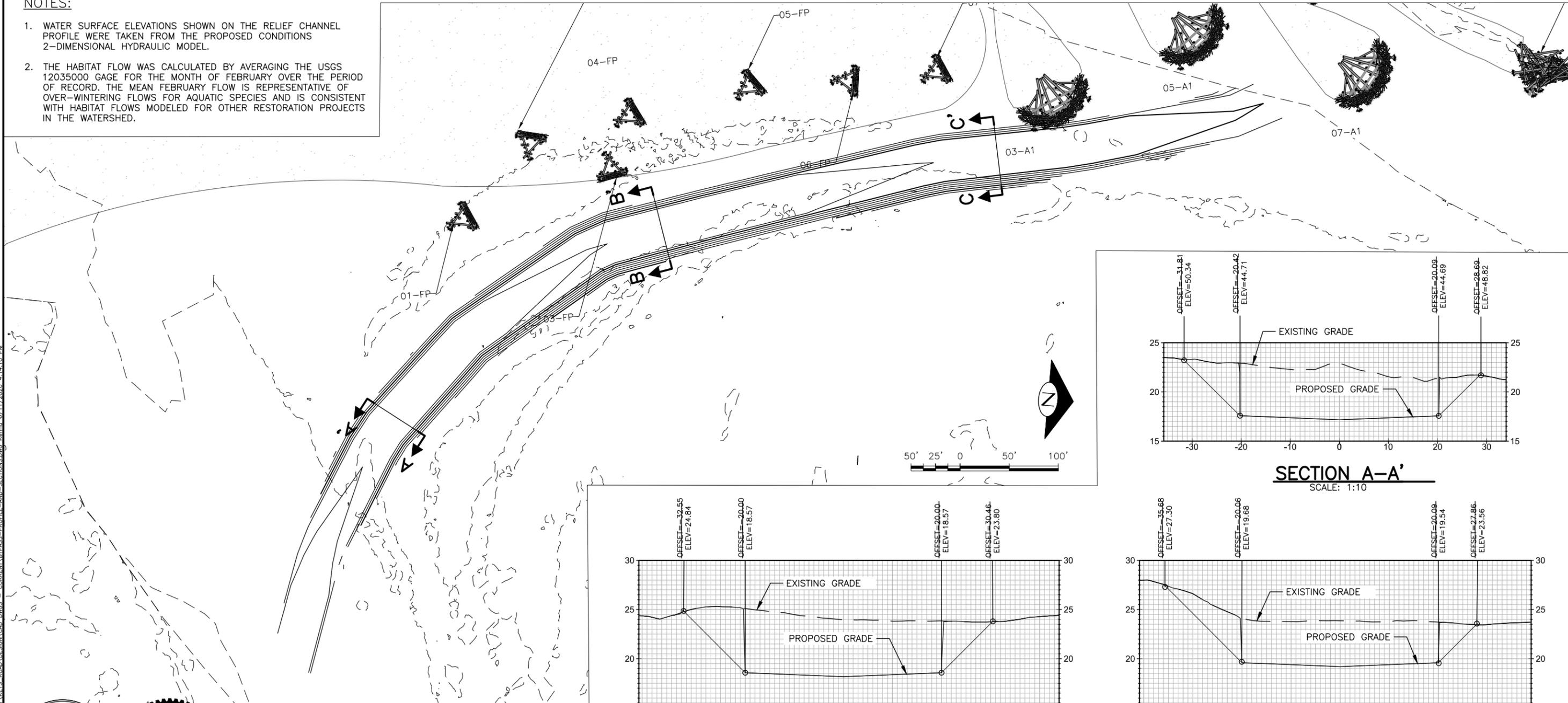
Jun 11, 2020 PHASE I FINAL DESIGN



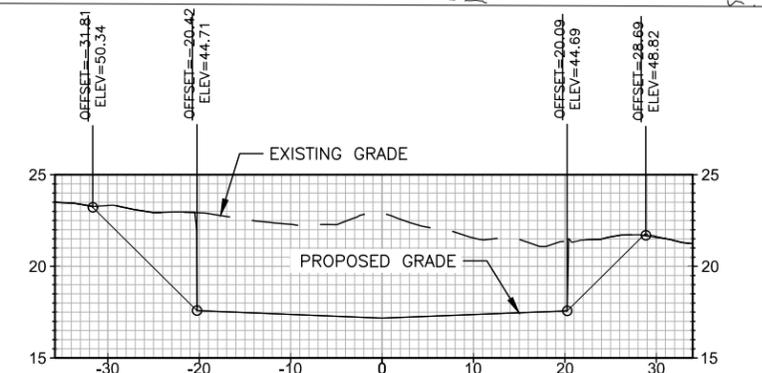
BYPASS CHANNEL PROFILE
SCALE: 1:50

NOTES:

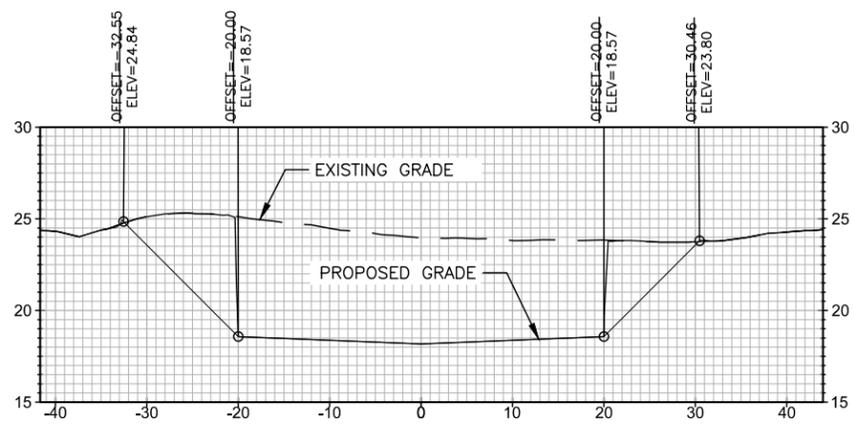
1. WATER SURFACE ELEVATIONS SHOWN ON THE RELIEF CHANNEL PROFILE WERE TAKEN FROM THE PROPOSED CONDITIONS 2-DIMENSIONAL HYDRAULIC MODEL.
2. THE HABITAT FLOW WAS CALCULATED BY AVERAGING THE USGS 12035000 GAGE FOR THE MONTH OF FEBRUARY OVER THE PERIOD OF RECORD. THE MEAN FEBRUARY FLOW IS REPRESENTATIVE OF OVER-WINTERING FLOWS FOR AQUATIC SPECIES AND IS CONSISTENT WITH HABITAT FLOWS MODELED FOR OTHER RESTORATION PROJECTS IN THE WATERSHED.



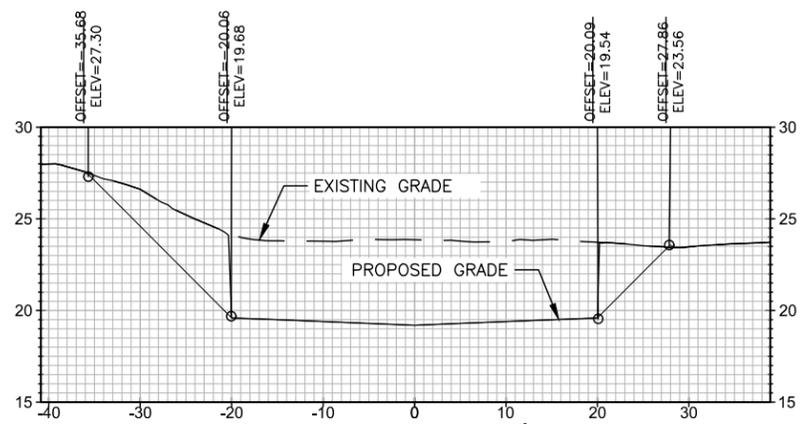
BYPASS CHANNEL PLAN VIEW
SCALE: 1:50



SECTION A-A'
SCALE: 1:10



SECTION B-B'
SCALE: 1:10



SECTION C-C'
SCALE: 1:10

Timothy B. Abbe
REGISTERED PROFESSIONAL ENGINEER
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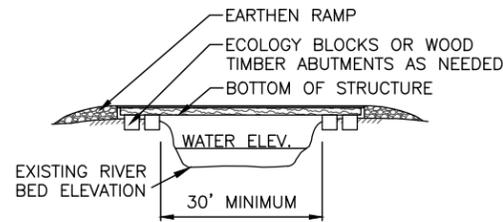
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KEYS ROAD FLOOD PROTECTION

BYPASS CHANNEL PROFILE AND SECTIONS

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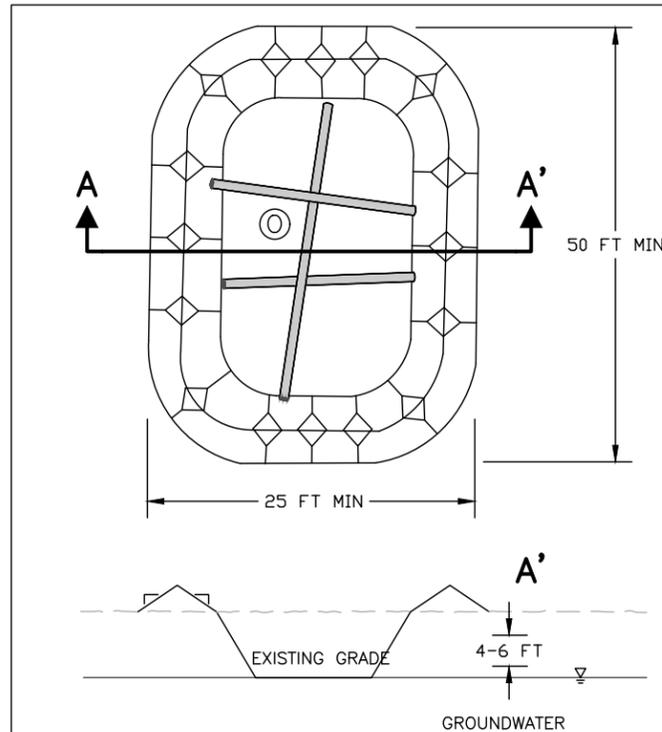
Jun 11, 2020 PHASE I FINAL DESIGN



NOTES:

1. CONTRACTOR TO DESIGN TEMPORARY BRIDGE.
2. BRIDGE SHALL BE LOCATED SUCH THAT ONLY ONE SPAN IS USED TO ELIMINATE IMPACTS TO SUBSTRATE OF CHANNEL.
3. END OF BRIDGE SHALL BEAR ON HIGH BANKS WITH SUFFICIENT BEARING CAPACITY TO PREVENT SLOUGHING OR COLLAPSE OF SIDE CHANNEL BANKS.
4. CONCRETE ECOLOGY BLOCKS OR WOOD ABUTMENTS MAY BE USED TO SUPPORT ENDS OF TEMPORARY BRIDGE AS NEEDED.
5. BRIDGES MAY BE CONSTRUCTED FROM LOGS, RAIL CAR BEDS OR APPROVED EQUAL AND DECKED WITH STEEL SHEET, WOOD LAGGING OR APPROVED EQUAL.

TEMPORARY BRIDGE DETAILS (1/30)
NOT TO SCALE

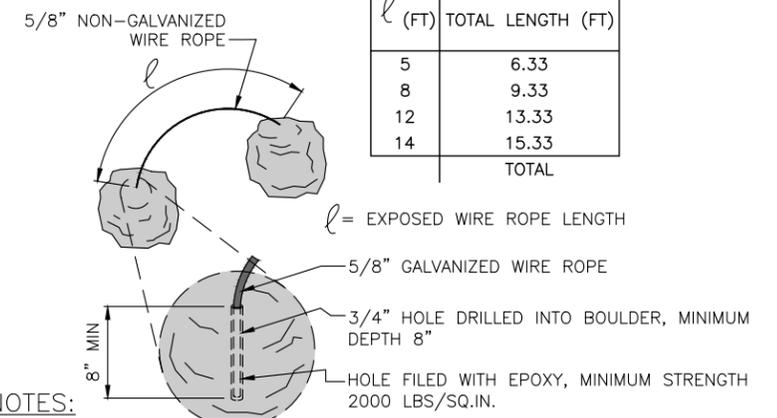


NOTES:

1. CONTAINMENT POND LOCATION TO BE DETERMINED BY CONTRACTOR.
2. POND WALLS WILL BE CONSTRUCTED FROM ONSITE NATIVE MATERIAL.
3. POND WILL BE ISOLATED FROM FLOWING WATERS.
4. CONTRACTOR SHALL MAINTAIN POND TO REDUCE RISK OF POND FAILURE.
5. FOLLOWING USE, MATERIALS SHALL BE RETURNED TO GRAVEL BAR AND SPREAD EVENLY.
6. PUMP OUTLET SECURED TO CROSS LOGS.



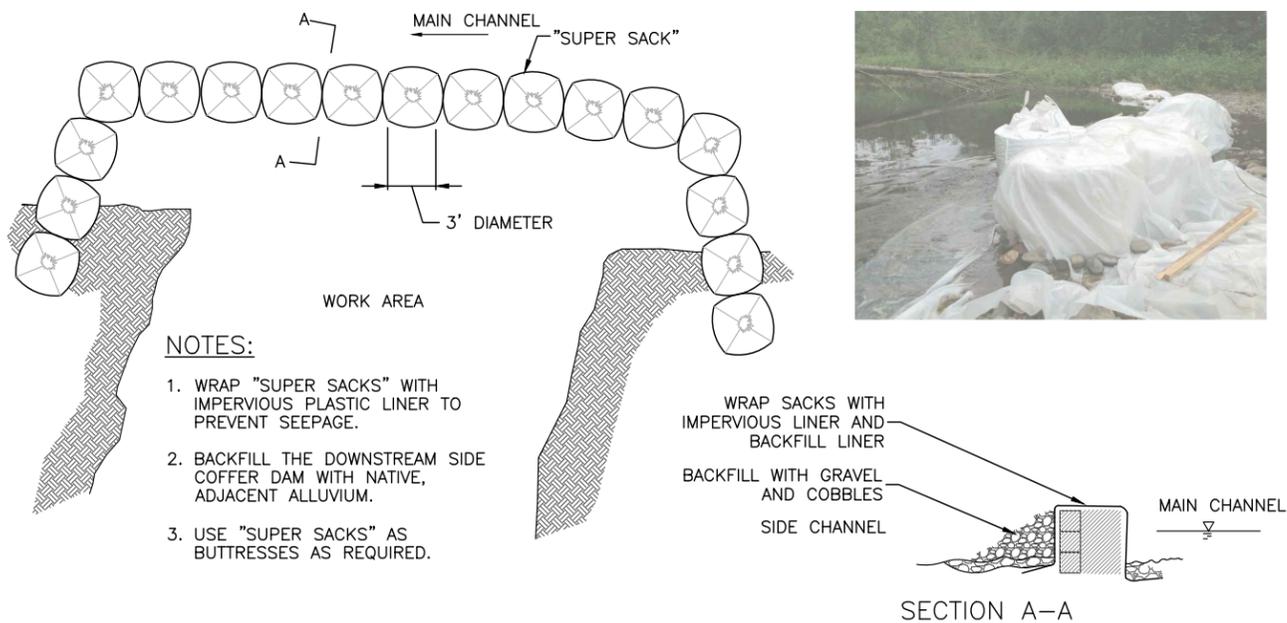
PUMP OUTLET CONTAINMENT POND DETAILS (2/30)
SCALE: NTS



NOTES:

1. SEE ELJ STRUCTURE DETAIL FOR MINIMUM AVERAGE BOULDER DIAMETER TO BE USED PER STRUCTURE TYPE.
2. FOLLOWING EPOXY CURE, EACH ROCK COLLAR SHALL BE TESTED TO ENSURE PROPER BONDING.
3. THE DRILL HOLES MUST BE THOROUGHLY CLEANED OF ALL ROCK POWDER AND DRIED. THE RESIN WILL NOT PROPERLY ADHERE TO THE ROCK IF THE HOLE IS INADEQUATELY CLEANED OR IS WET. CLEANING IS DONE BY POURING WATER INTO THE HOLE WHILE PLUNGING IT WITH A CIRCULAR NYLON BRUSH. THE HOLE IS CLEAN WHEN THE WATER PLUNGES OUT CLEAR AND FREE OF SEDIMENT. ALLOWING 24 HOURS FOR DRILL HOLES TO DRY AFTER CLEANING IS USUALLY SUFFICIENT.
4. THE CABLE MUST BE CUT CLEANLY SO THAT THE END CAN BE INSERTED INTO THE TIGHT FITTING ROCK HOLE.
5. THE CABLE SURFACE TO BE BONDED SHOULD BE FREE OF DIRT AND GREASE. HOT DIP GALVANIZED CABLE IS RECOMMENDED.
6. THE HOLE MUST BE SUFFICIENTLY FILLED WITH RESIN SO THAT WHEN THE CABLE IS INSERTED, A SMALL AMOUNT OF RESIN WILL BE DISPLACED OUT OF THE TOP OF THE HOLE. ONCE THE CABLE IS INSERTED IN THE HOLE, IT SHOULD NOT BE DISTURBED UNTIL THE RESIN HAS CURED.
7. FOLLOW RESIN MANUFACTURING RECOMMENDATIONS FOR USE.

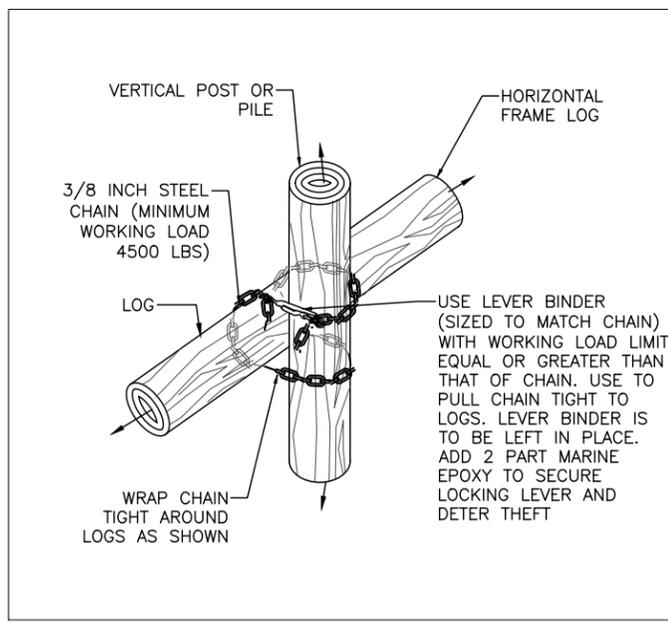
ROCK COLLAR DETAIL (6/30)
NOT TO SCALE



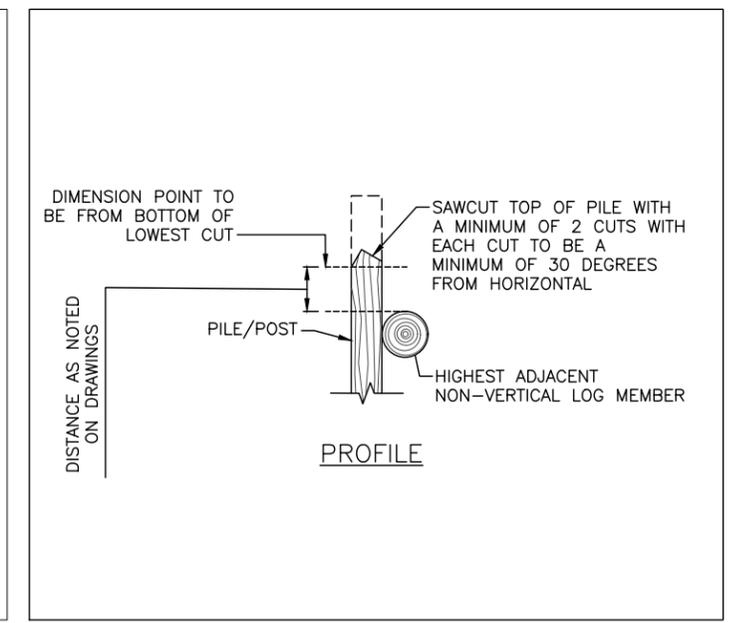
NOTES:

1. WRAP "SUPER SACKS" WITH IMPERVIOUS PLASTIC LINER TO PREVENT SEEPAGE.
2. BACKFILL THE DOWNSTREAM SIDE COFFER DAM WITH NATIVE, ADJACENT ALLUVIUM.
3. USE "SUPER SACKS" AS BUTTRESSES AS REQUIRED.

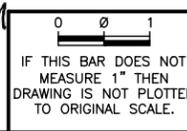
COFFERDAM DETAILS (3/30)
NOT TO SCALE



CHAIN LASHING DETAIL (4/30)
NOT TO SCALE



SAWCUT POST TOP DETAIL (5/30)
NOT TO SCALE



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KEYS ROAD FLOOD PROTECTION

CONSTRUCTION DETAILS

30
SHEET 30 OF 32

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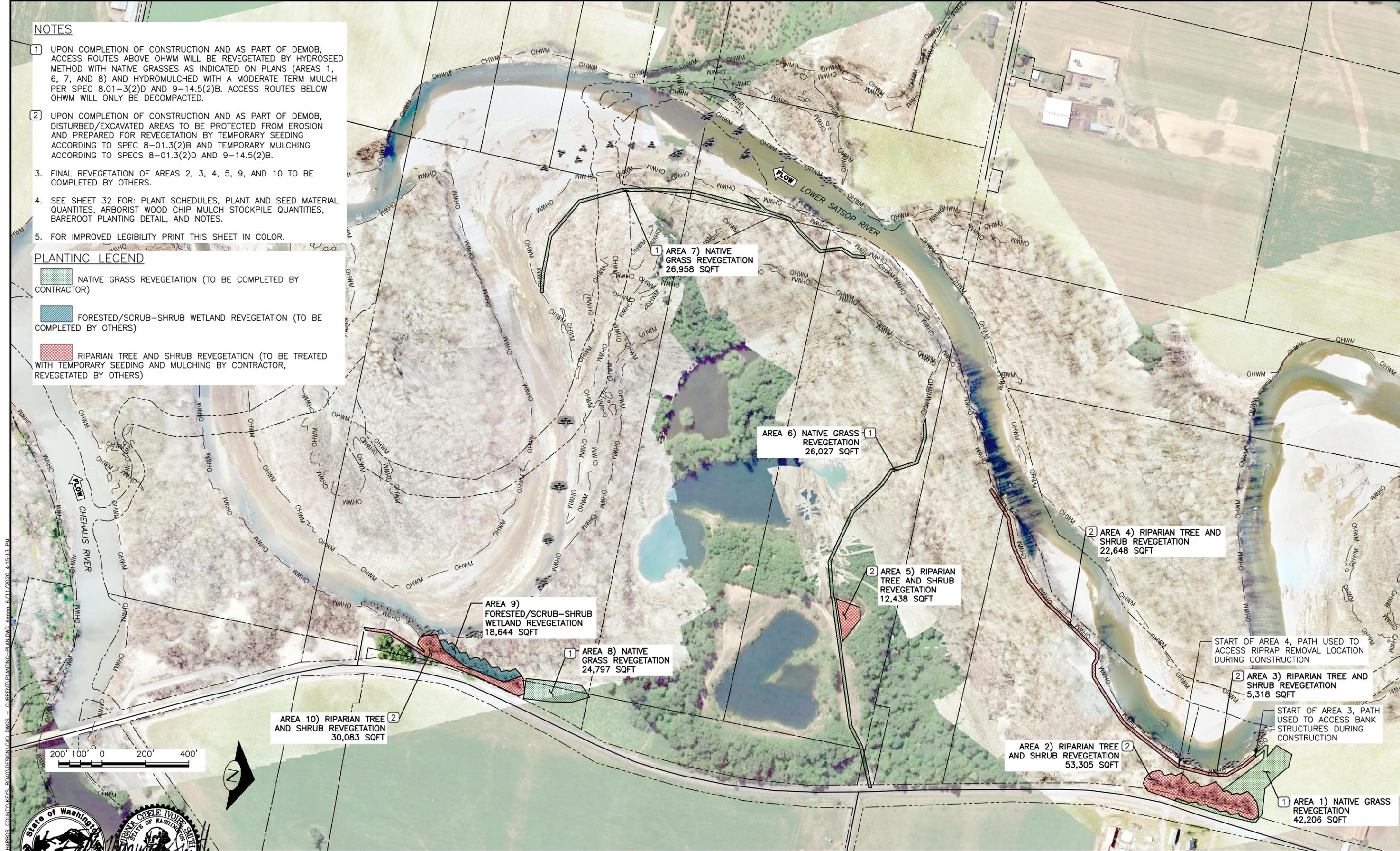
Jun 11, 2020 PHASE I FINAL DESIGN

NOTES

1. UPON COMPLETION OF CONSTRUCTION AND AS PART OF DEMOB, ACCESS ROUTES ABOVE OHWM WILL BE REVEGETATED BY HYDROSEED METHOD WITH NATIVE GRASSES AS INDICATED ON PLANS (AREAS 1, 6, 7, AND 8) AND HYDROMULCHED WITH A MODERATE TERM MULCH PER SPEC 8.01-3(2)D AND 9-14.5(2)B. ACCESS ROUTES BELOW OHWM WILL ONLY BE DECOMPACTED.
2. UPON COMPLETION OF CONSTRUCTION AND AS PART OF DEMOB, DISTURBED/EXCAVATED AREAS TO BE PROTECTED FROM EROSION AND PREPARED FOR REVEGETATION BY TEMPORARY SEEDING ACCORDING TO SPEC 8-01.3(2)B AND TEMPORARY MULCHING ACCORDING TO SPECS 8-01.3(2)D AND 9-14.5(2)B.
3. FINAL REVEGETATION OF AREAS 2, 3, 4, 5, 9, AND 10 TO BE COMPLETED BY OTHERS.
4. SEE SHEET 32 FOR: PLANT SCHEDULES, PLANT AND SEED MATERIAL QUANTITIES, ARBORIST WOOD CHIP MULCH STOCKPILE QUANTITIES, BAREROOT PLANTING DETAIL, AND NOTES.
5. FOR IMPROVED LEGIBILITY PRINT THIS SHEET IN COLOR.

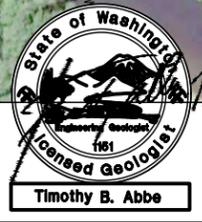
PLANTING LEGEND

-  NATIVE GRASS REVEGETATION (TO BE COMPLETED BY CONTRACTOR)
-  FORESTED/SCRUB-SHRUB WETLAND REVEGETATION (TO BE COMPLETED BY OTHERS)
-  RIPARIAN TREE AND SHRUB REVEGETATION (TO BE TREATED WITH TEMPORARY SEEDING AND MULCHING BY CONTRACTOR, REVEGETATED BY OTHERS)



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Jun 11, 2020 PHASE I FINAL DESIGN



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KEYS ROAD FLOOD PROTECTION

REVEGETATION PLAN

PLANT SCHEDULES

RIPARIAN TREE AND SHRUB REVEGETATION AREAS - 98,072 SQFT (2.25 ACRES) TOTAL								
PLANT COMMUNITY	LAYER	SPECIES	COMMON NAME	BAREROOT MATERIAL SIZE	AVG. SPACING	QTY.	NOTES	
Area 2) Riparian Tree and Shrub Revegetation Area 53,305 sq ft	Tree	<i>Alnus rubra</i>	red alder	18-24"	9	197	Plant in clusters throughout	
		<i>Pseudotsuga menziesii</i>	Douglas-fir	18-24"	12	222	Plant in clusters throughout	
			Subtotals				419	
	Shrub	<i>Corylus cornuta</i>	beaked hazelnut	12-18"	8	250	Plant in single species clusters of 7-15 plants	
		<i>Rubus parviflorus</i>	thimbleberry	12-18"	4	666	Plant in single species clusters of 7-15 plants	
<i>Symphoricarpos albus</i>		snowberry	12-18"	4	833	Plant in single species clusters of 7-15 plants		
		Subtotals				1749		
		Area 2 Total				2,168		
Area 3) Riparian Tree and Shrub Revegetation Area 5,318 sq ft	Tree	<i>Alnus rubra</i>	red alder	18-24"	9	20	Plant in clusters throughout	
		<i>Pseudotsuga menziesii</i>	Douglas-fir	18-24"	12	22	Plant in clusters throughout	
			Subtotals				42	
	Shrub	<i>Corylus cornuta</i>	beaked hazelnut	12-18"	8	25	Plant in single species clusters of 7-15 plants	
		<i>Rubus parviflorus</i>	thimbleberry	12-18"	4	66	Plant in single species clusters of 7-15 plants	
<i>Symphoricarpos albus</i>		snowberry	12-18"	4	83	Plant in single species clusters of 7-15 plants		
		Subtotals				174		
		Area 3 Total				216		
Area 4) Riparian Tree and Shrub Revegetation Area 22,648 sq ft	Tree	<i>Alnus rubra</i>	red alder	18-24"	9	84	Plant in clusters throughout	
		<i>Pseudotsuga menziesii</i>	Douglas-fir	18-24"	12	94	Plant in clusters throughout	
			Subtotals				178	
	Shrub	<i>Corylus cornuta</i>	beaked hazelnut	12-18"	8	106	Plant in single species clusters of 7-15 plants	
		<i>Rubus parviflorus</i>	thimbleberry	12-18"	4	283	Plant in single species clusters of 7-15 plants	
<i>Symphoricarpos albus</i>		snowberry	12-18"	4	354	Plant in single species clusters of 7-15 plants		
		Subtotals				743		
		Area 4 Total				921		
Area 5) Riparian Tree and Shrub Revegetation Area 12,438 sq ft	Tree	<i>Alnus rubra</i>	red alder	18-24"	9	46	Plant in clusters throughout	
		<i>Pseudotsuga menziesii</i>	Douglas-fir	18-24"	12	52	Plant in clusters throughout	
			Subtotals				98	
	Shrub	<i>Corylus cornuta</i>	beaked hazelnut	12-18"	8	58	Plant in single species clusters of 7-15 plants	
		<i>Rubus parviflorus</i>	thimbleberry	12-18"	4	155	Plant in single species clusters of 7-15 plants	
<i>Symphoricarpos albus</i>		snowberry	12-18"	4	194	Plant in single species clusters of 7-15 plants		
		Subtotals				407		
		Area 5 Total				505		
Area 10) Riparian Tree and Shrub Revegetation Area 30,083 sq ft	Tree	<i>Alnus rubra</i>	red alder	18-24"	9	111	Plant in clusters throughout	
		<i>Pseudotsuga menziesii</i>	Douglas-fir	18-24"	12	125	Plant in clusters throughout	
			Subtotals				236	
	Shrub	<i>Corylus cornuta</i>	beaked hazelnut	12-18"	8	141	Plant in single species clusters of 7-15 plants	
		<i>Rubus parviflorus</i>	thimbleberry	12-18"	4	376	Plant in single species clusters of 7-15 plants	
<i>Symphoricarpos albus</i>		snowberry	12-18"	4	470	Plant in single species clusters of 7-15 plants		
		Subtotals				987		
		Area 10 Total				1,223		
FORESTED/SCRUB-SHRUB WETLAND REVEGETATION AREA - 18,644 SQFT (0.43 ACRES) TOTAL								
PLANT COMMUNITY	LAYER	SPECIES	COMMON NAME	BAREROOT MATERIAL SIZE	AVG. SPACING	QTY.	NOTES	
Area 9) Forested/Scrub-Shrub Wetland Revegetation Area 18,644 sq ft	Tree	<i>Alnus rubra</i>	red alder	18-24"	9	138	Plant in clusters throughout	
				Subtotals			138	
	Sub-canopy	<i>Salix lasiandra</i>	Pacific willow	12-18"	8	102	Plant in clusters throughout	
				Subtotals			102	
		Shrub	<i>Cornus sericea</i>	redosier dogwood	12-18"	6	104	Plant in single species clusters of 7-15 plants
<i>Rubus spectabilis</i>	salmonberry		12-18"	4	291	Plant in single species clusters of 7-15 plants		
<i>Symphoricarpos albus</i>	snowberry		12-18"	4	233	Plant in single species clusters of 7-15 plants		
		Subtotals				628		
Ground	<i>Carex obnupta</i>	slough sedge	6-12"	1.5	829	Plant in large swaths as continuation of existing emergent layer		
			Subtotals			829		
			Area 9 Total				1,697	

SEEDING TABLE FOR NATIVE GRASS REVEGETATION AREAS (1.6,7,8)

Species	Common Name	% of mix by weight	% purity	% germination	seeding rate - PLS lbs/acre for pure single species seeding	PLS lbs/acre seeding rate for mix	Total PLS lbs	% PLS/bulk pound	Bulk planting rate lbs/acre	Total bulk seed (lbs)
<i>Elymus glaucus</i>	blue wildrye	30	95	85	12	3.60	9.90	80.75	4.46	12.26
<i>Festuca rubra</i>	native red fescue	30	95	85	4	1.20	3.30	80.75	1.49	4.09
<i>Bromus carinatus</i>	California brome	20	95	85	8	1.60	4.40	80.75	1.98	5.45
<i>Deschampsia cespitosa</i>	tufted hairgrass	10	90	85	1.5	0.15	0.41	76.5	0.20	0.54
<i>Elymus lanceolatus ssp. psammophilus</i>	streambank wheatgrass	10	90	85	8	0.80	2.20	76.5	1.05	2.88
							20.21		9.17	25.21
Area to be seeded (acres)		2.75								

Seed mix (Native Upland Mix) can be purchased from Direct Seed Sales Inc. 425-466-1350

BAREROOT PLANT QUANTITIES

Species	Common Name	Bareroot Size	Total Quantity
<i>Alnus rubra</i>	red alder	18-24"	596
<i>Carex obnupta</i>	slough sedge	6-12"	829
<i>Cornus sericea</i>	redosier dogwood	12-18"	104
<i>Corylus cornuta</i>	beaked hazelnut	12-18"	580
<i>Pseudotsuga menziesii</i>	Douglas-fir	18-24"	515
<i>Rubus parviflorus</i>	thimbleberry	12-18"	1546
<i>Rubus spectabilis</i>	salmonberry	12-18"	291
<i>Salix lasiandra</i>	Pacific willow	12-18"	102
<i>Symphoricarpos albus</i>	snowberry	12-18"	2167
		Bareroot Plant Total Qty	6,730

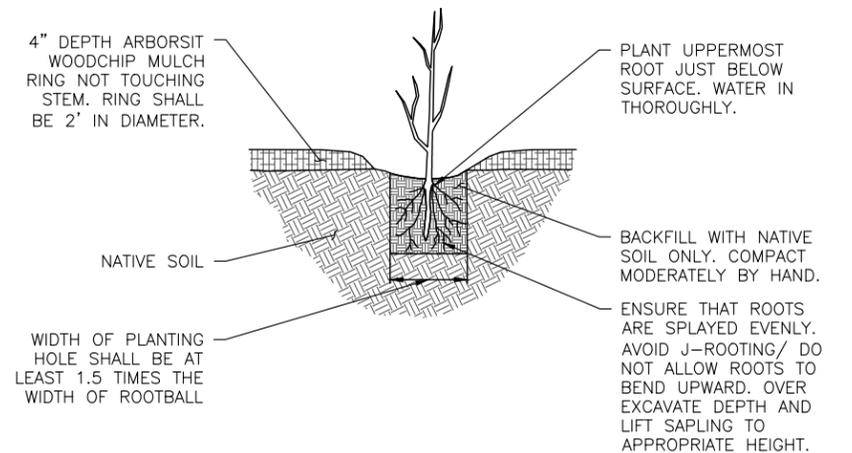
MULCH STOCKPILE QUANTITIES

Mulch Stockpile Per Planting Area (CY)	
Area 1	na
Area 2	84
Area 3	8
Area 4	36
Area 5	20
Area 6	na
Area 7	na
Area 8	na
Area 9	na
Area 10	47
Total	195

Mulch to be planted in ring around each plant. Rings shall be 2' diameter, 4" depth (0.04CY per plant).

NOTES

- ARRANGE AND INSTALL PLANTS IN LARGER HOMOGENOUS GROUPS OF LIKE SPECIES AND AFFILIATES RATHER THAN A HETEROGENOUS MIXTURE OF ALL SPECIES THROUGHOUT, TO MIMIC NATURAL COLONIZATION PATTERNS AND TYPICAL PLANT ESTABLISHMENT IN RIPARIAN AREAS. FOR EXAMPLE, SALMONBERRY TYPICALLY GROWS IN DENSE MONOTYPIC PATCHES ASSOCIATED WITH RED ALDER STANDS, AND NOT AS A SINGLE PLANT MIXED EVENLY WITH 4 OTHER SPECIES.
- PLANTS ARE TO BE PLACED USING AVERAGE SPACING AS INDICATED IN THE PLANT SCHEDULES AS A GUIDELINE. VARIATION AROUND THE AVERAGES INDICATED IS TO BE USED.
- ARBORIST WOOD CHIP MULCH (PER SPECIFICATION AND DETAIL) RINGS WILL BE PLACED FOR EACH PLANT INSTALLED WITHIN THE RIPARIAN TREE AND SHRUB REVEGETATION AREAS AT A 4" DEPTH, IN A 2' DIAMETER CIRCLE AROUND THE BASE OF EACH PLANT. QUANTITY PER PLANT IS 1.1 CUBIC FEET (0.04 CUBIC YARDS). MULCH SHALL NOT BE PLACED AGAINST STEM OF THE PLANTS.
- MULCH TO BE STOCKPILED BY CONTRACTOR AREAS 2,3,4,5,10 FOR PLANT INSTALLATION AND MULCH PLACEMENT BY OTHERS. STOCKPILE LOCATIONS TO BE IDENTIFIED IN THE FIELD AND APPROVED BY CONTRACTING OFFICER.



BAREROOT PLANTING DETAIL

SCALE: 1" = 10'

1/32

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DRAWN MS, KP	TN/SC/RG T17N/S6/R6W
CHECKED MT, RLE	DATE 6/11/2020

KEYS ROAD FLOOD PROTECTION

PLANT SCHEDULE

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Jun 11, 2020 PHASE I FINAL DESIGN