



# Memorandum

Date: March 25, 2013

To: Bill Peacock, PE

From: John Patrouch, PE; Jake Dial, PE

Subject: **Design Report - Clarke Ave Lift Station Riverbank Stabilization**

## Project Description

The project area encompasses approximately 200 lineal feet between the City of Spokane (City) manholes 4300115CD and 4300215CD, immediately east of the Clarke Avenue Lift Station on City property. The project entails construction of temporary construction access routes, approximately 320 feet of riprap revetment, and site restoration. Site restoration will entail slope stabilization, planting of native trees and shrubs, and hydroseeding with a native grass seed mix. The purpose of the project is to stabilize the southern riverbank of the Spokane River (River) to prevent further erosion of soils beneath the City's existing 15-inch sanitary sewer line.

## Existing Conditions

The sewer main is located on the inside bend of the River at elevations between 1731 and 1729. The ordinary high-water mark within the project area has been estimated to be approximately elevation 1731. The soils within the project area consist of coarse sands and gravels. The sewer line is located within an approximately 20-foot high embankment with slopes between 1:1 (H:V) and 1.5:1. The embankment beneath the sewer line is presently being undercut by higher river flows, which will eventually expose the 15-inch sewer line.

## Design Alternatives

The location of the active sewer line within the embankment creates a high degree of risk for excavating into the hillside to install tiebacks. This degree of risk makes the installation of green stabilization structures; such as engineered log jams and soft armoring, less desirable. Therefore, a hand placed riprap revetment has been selected to stabilize the riverbank.

## Riprap Design

Riprap sizing has been based upon methods developed by the US Army Corps of Engineers (USACE) and the Federal Highway Administration (FHWA). River flows for the project were taken from US River Gauges 12422500. River gauge elevations were converted from the NGVD 1929 datum to the NAVD 88 datum to correspond with site survey information.

The river velocity selected for riprap sizing was based on the annual peak flows at the river gauge from 1891 through 2012. A Log Pearson distribution of these flows was used to estimate the five-year through 100-year flow rates. The mean peak flow at the river gauge is approximately 25,400 cubic feet per second (CFS) with a maximum peak flow of 49,000 CFS and a minimum peak flow of 7,610 CFS. The estimated five-year through 100-year flow rates have been provided in the following **Table 1**.

**Table 1 – Calculated River Flows**

Return Period	Flow Rate (CFS)
5-year	32,328
10-year	37,291
25-year	41,821
50-year	47,414
100-year	51,447

River velocities were calculated based upon a rectangular cross-section. Flow depth was based upon river gauge data and the width was measured from Google Earth. Calculations show that the mean peak river velocity is approximately 16.5 feet per second (FPS) and a velocity of approximately 20 FPS during the 5-year flow. Velocities calculated correspond to the center of the channel with higher velocities located along the outside bend of the river and lower velocities along the inside bend of the river.

The 5-year flow rate and velocity were initially selected for design. This decision was based upon providing a level of protection beyond the mean peak flow of 25,400 cfs and the economics and feasibility of installing larger riprap at the project site. However, investigation of the project area indicated that undercutting of the embankment is being caused by a backwater eddy and not by main channel flows. A backwater eddy has been observed in this location by river users and the eddy velocity was noted as being much less than those within the main channel.

The riprap design equation employed by the USACE is largely influenced by velocity. The  $D_{30}$  riprap size, of which 30 percent of the material is smaller than, corresponding to 16.5 FPS and 20 FPS is approximately 4 feet and 6.5 feet respectively. It was observed during the site investigation that boulders and cobble from approximately 12 to 30 inches were present at the water's edge. This information supported observations made from the river users. Therefore, a velocity of 10 FPS was selected for riprap design as it yielded a gradation that was comparable to the material observed along the shoreline.

The riprap gradation was calculated using FHA criteria to provide a minimum and maximum gradation. The calculated gradation was then adjusted to provide a ratio of the  $D_{85}/D_{15}$  sizes within the range of 1.5 to 2.5. Riprap design calculations have been provided as **Appendix A**.

### Appendix A Riprap Revetment Calculations

$$D_{30} = S_f C_s C_v C_T d \left( \sqrt{\frac{\gamma_w}{\gamma_s - \gamma_w} * \frac{VL}{\sqrt{K_1 g d}}} \right)^{2.5}$$

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#### Parameter Legend

D <sub>30</sub>	30% finer by weight; D30(min) ≥ D30
S <sub>f</sub>	Safety Factor ≥ 1.1
C <sub>s</sub>	Stability Factor 0.30 for angular rock 0.375 for rounded rock
C <sub>v</sub>	Velocity Distribution Coefficient 1.0 for straight channels, inside bends, & R/W >26 1.283-0.2log(R/W) for outside bends, R/W < 26 1.25 downstream of concrete channels & at end of dikes
C <sub>T</sub>	Blanket Thickness Coefficient
d	Local Depth
γ <sub>w</sub>	Unit Weight of Water
γ <sub>s</sub>	Unit Weight of Stone
VL	Local Depth Averaged Velocity
K <sub>1</sub>	Side-Slope Correction Factor
g	Gravity
Φ	Riprap Angle of Repose
θ	Angle of Slope
R/W	Ratio of Channel Bend to Channel Width

#### References:

- US Army Corps of Engineers: Technical Report CHL-98-20, July 1998
- US Army Corps of Engineers: EM 1110-2-1601, July 1991
- Federal Highway Administration: Hydraulic Engineering Circular 11, March 1989

## Appendix A Riprap Revetment Calculations

### Input Parameters

$S_f$	1.1
$C_s$	0.3
$C_v$	1
$C_T$	0.8
$d$	3
$\gamma_w$	62.4
$\gamma_s$	155
$VL$	10
$g$	32.2

$\Phi$	40
$\theta$	33.7
$R$	213
$W$	59

### Output

$R/W$	<u>3.610</u>		$K_1$	<u>0.505</u>
$S_f C_s C_v C_T d$	<u>0.792</u>		$\sqrt{\frac{\gamma_w}{\gamma_s - \gamma_w}}$	<u>0.821</u>
$\frac{VL}{\sqrt{K_1 g d}}$	<u>1.432</u>			
			$\left( \sqrt{\frac{\gamma_w}{\gamma_s - \gamma_w}} * \frac{VL}{\sqrt{K_1 g d}} \right)^{2.5}$	<u>1.498</u>
$D_{30}$	<u>1.2 FT</u>			
$D_{50} = 1.2 D_{30}$				
$D_{50}$	<u>1.4 FT</u>			

## Gradation Criteria

$D_{100}$ :	1.5 - 1.7 $D_{50}$	$D_{85}/D_{15}$	1.5 - 2.5
$D_{85}$ :	1.2 - 1.4 $D_{50}$		
$D_{50}$ :	1 - 1.15 $D_{50}$		
$D_{15}$ :	.4 - .6 $D_{50}$		

## Calculated Gradation

Size	Feet		Inches		Weight (Lbs)	
	Min	Max	Min	Max	Min	Max
$D_{100}$	2.1	2.4	25.6	29.0	173	196
$D_{85}$	1.7	2.0	20.5	23.9	139	162
$D_{50}$	1.4	1.6	17.1	19.6	116	133
$D_{30}$	1.2	1.4	14.2	16.4	96	111
$D_{15}$	0.6	0.9	6.8	10.3	46	69

$D_{85}/D_{15}$                       3                      2.3

## Adjusted Gradation

Size	Feet		Inches		Weight (Lbs)	
	Min	Max	Min	Max	Min	Max
$D_{100}$	2.1	2.4	25.6	29.0	173.3	196.4
$D_{85}$	1.7	2.0	20.5	23.9	138.6	161.8
$D_{50}$	1.4	1.6	17.1	19.6	115.5	132.9
$D_{30}$	1.2	1.4	14.2	16.4	96.3	110.7
$D_{15}$	0.7	1.3	8.2	15.9	55	108

$D_{85}/D_{15}$                       2.5                      1.5

**Appendix A Riprap Revetment Calculations**

Nominal Riprap Class by Median Particle Diameter	d <sub>15</sub>		d <sub>50</sub>		d <sub>85</sub>		d <sub>100</sub>		D <sub>85</sub> /D <sub>15</sub>		
	Class	Size	Min	Max	Min	Max	Min	Max	Min	Max	
I	6 in		3.7	5.2	5.7	6.9	7.8	9.2	12	2.1	1.8
II	9 in		5.5	7.8	8.5	10.5	11.5	14	18	2.1	1.8
III	12 in		7.3	10.5	11.5	14	15.5	18.5	24	2.1	1.8
IV	15 in		9.2	13	14.5	17.5	19.5	23	30	2.1	1.8
V	18 in		11	15.5	17	20.5	23.5	27.5	36	2.1	1.8
VI	21 in		13	18.5	20	24	27.5	32.5	42	2.1	1.8
VII	24 in		14.5	21	23	27.5	31	37	48	2.1	1.8
VIII	30 in		18.5	26	28.5	34.5	39	46	60	2.1	1.8
IX	36 in		22	31.5	34	41.5	47	55.5	72	2.1	1.8
X	42 in		25.5	36.5	40	48.5	54.5	64.5	84	2.1	1.8

Nominal Riprap Class by Median Particle Weight	W <sub>15</sub>		W <sub>50</sub>		W <sub>85</sub>		W <sub>100</sub>	
	Class	Weight	Min	Max	Min	Max	Min	Max
I	20 lb		4	12	15	27	39	64
II	60 lb		13	39	51	90	130	220
III	150 lb		32	93	120	210	310	510
IV	300 lb		62	180	240	420	600	1,000
V	1/4 ton		110	310	410	720	1,050	1,750
VI	3/8 ton		170	500	650	1,150	1,650	2,800
VII	1/2 ton		260	740	950	1,700	2,500	4,100
VIII	1 ton		500	1,450	1,900	3,300	4,800	8,000
IX	2 ton		860	2,500	3,300	5,800	8,300	13,900
X	3 ton		1,350	4,000	5,200	9,200	13,200	22,000



City of Spokane  
Wastewater Management Department  
**Clark Ave Lift Station  
Riverbank Restoration**

March 6, 2013

**Engineer's Cost Estimate**

Line	Section	Item Description	Unit	Quantity	Unit Price	Total Cost
1		Mobilization	LS	1	\$4,898.40	\$4,898.40
2		Project Documentation	LS	1	\$1,000.00	\$1,000.00
3		Project Survey & Stakeout	LS	1	\$2,449.20	\$2,449.20
4	2-03.5(1)	Construction Access Road	CY	110	\$13.00	\$1,430.00
5	2-03.5(2)	Construction Access Ramp	CY	60	\$18.00	\$1,080.00
6	2-03.5(3)	Key Trench	LF	125	\$30.00	\$3,750.00
8	2-03.5(4)	Restoration Embankment	CY	130	\$18.00	\$2,340.00
9	2-03.5(5)	Common Borrow, Incl. Haul	CY	20	\$15.00	\$300.00
10	6-04.5(1)	Retaining Wall	LS	1	\$500.00	\$500.00
11	2-12.5(1)	Permanent Erosion Control Fabric	SY	290	\$6.00	\$1,740.00
12	8-01.5(1)	Silt Fence	LF	250	\$4.50	\$1,125.00
13	8-01.5(2)	Erosion Control Blanket	SY	515	\$6.00	\$3,090.00
14	8-01.5(3)	Hydroseed	AC	0.12	\$425.00	\$51.00
15	8-02.5(1)	Topsoil, Incl. Haul	CY	60	\$4.80	\$288.00
16	8-02.5(2)	Live Pole	EA	86	\$40.00	\$3,440.00
17	8-02.5(3)	Plantings Zone B	SY	155	\$10.00	\$1,550.00
18	8-02.5(4)	Plantings Zone C	SY	105	\$10.00	\$1,050.00
19	8-15.5(1)	Riprap Revetment	Ton	375	\$70.00	\$26,250.00
20		Washington State Sales Tax (8.7% of Subtotal)				\$4,900.85
21		Bid Total (Subtotal + WSST)				\$61,232.45

## **ITEM 2-03 ROADWAY EXCAVATION AND EMBANKMENT**

### **2-03.1 DESCRIPTION**

Work shall conform to all requirements of the referenced section from WSDOT Standard Specifications as modified by the City of Spokane, except that any revisions written in this specification section shall supersede the WSDOT Standard Specifications as modified by the City of Spokane.

This Work consists of constructing temporary construction access road and ramp, key trench excavation, and embankment construction.

### **2-03.3 CONSTRUCTION REQUIREMENTS**

#### **2-03.3(1) Widening of Cuts**

**Replace this section in its entirety with the following:**

If routine cuts do not supply enough material to form the embankment, the Contractor shall obtain additional fill from offsite sources. Payment for this material shall be made under the bid item Common Borrow, Including Haul.

### **2-03.4 MEASUREMENT**

#### **2-03.4(1) Construction Access Road**

All excavated material for Construction Access Road will be measured by the Cubic Yard in the position it occupied before the excavation was performed. The original ground will be compared with the planned finished sections shown on the Plans.

Measurement shall not include the quantity of materials excavated without authorization beyond normal slope lines, or the quantity of material used for purposes other than those directed by the Engineer.

#### **2-03.4(2) Construction Access Ramp**

Embankment compaction for Construction Access Ramp will be measured by the Cubic Yard. Quantities will be determined based on a comparison of the original ground measurement with the finished embankment section as shown on the Plans. No allowance will be made for material that settles. Deduction shall be taken for the volume occupied by riprap revetment.

#### **2-03.4(3) Key Trench**

All excavated material for Key Trench will be measured by the Cubic Yard in the position it occupied before the excavation was performed. The original ground will be compared with the planned finished sections shown on the Plans.

Measurement shall not include the quantity of materials excavated without authorization beyond normal slope lines, or the quantity of material used for purposes other than those directed by the Engineer.



#### **2-03.4(4) Restoration Embankment**

Embankment compaction for Restoration Embankment will be measured by the Cubic Yard. Quantities will be determined based on a comparison of the original ground measurement with the finished embankment section as shown on the Plans. No allowance will be made for material that settles.

#### **2-03.4(5) Common Borrow, Incl. Haul**

Common Borrow, Incl. Haul will be measured by the Cubic Yard per truck ticket.

#### **2-03.5 METHOD OF PAYMENT**

**2-03.5(1)** The per Cubic Yard unit contract price for Construction Access Road shall be full compensation for all costs incurred for excavating, loading, placing, or otherwise disposing of the material.

**2-03.5(2)** The per Cubic Yard unit contract price for Construction Access Ramp shall be full compensation for all costs incurred for all material, labor, tools, equipment, and incidentals required.

**2-03.5(3)** The per Cubic Yard unit contract price for Key Trench shall be full compensation for all costs incurred for excavating, loading, placing, or otherwise disposing of the material.

**2-03.5(4)** The per Cubic Yard unit contract price for Restoration Embankment shall be full compensation for all costs incurred for all material, labor, tools, equipment, and incidentals required.

**2-03.5(5)** The per Cubic Yard unit contract price for Common Borrow, Incl. Haul shall be full compensation for all costs incurred for excavating, loading, hauling, placing, or otherwise disposing of the material.

**END OF ITEM 2-03**

## **ITEM 2-12 CONSTRUCTION GEOSYNTHETIC**

### **2-03.1 DESCRIPTION**

Work shall conform to all requirements of the referenced section from WSDOT Standard Specifications as modified by the City of Spokane, except that any revisions written in this specification section shall supersede the WSDOT Standard Specifications as modified by the City of Spokane.

This Work consists of installing geosynthetic for permanent erosion control between the riprap revetment and the riverbank.

### **2-12.2 MATERIALS**

Replace this section in its entirety with the following:

Construction geosynthetic used for permanent erosion control shall meet the requirements of Section 9-33.1, Table 4 and Table 5, for Non-Woven High Survivability, Drainage Class A.

Geosynthetic roll identification, storage, and handling shall be in conformance to ASTM D 4873. During periods of shipment and storage, the geosynthetic shall be stored off the ground. The geosynthetic shall be covered at all times during shipment and storage such that it is fully protected from ultraviolet radiation including sunlight, site construction damage, precipitation, chemicals that are strong acids or strong bases, flames including welding sparks, temperatures in excess of 160°F, and any other environmental condition that may damage the physical property values of the geosynthetic.

### **2-12.3 CONSTRUCTION REQUIREMENTS**

2-12.3(4) Permanent Erosion Control and Ditch Lining

**Remove the fourth paragraph in its entirety.**

### **2-12.4 MEASUREMENT**

#### **2-12.4(1) Permanent Erosion Control Fabric**

Permanent Erosion control Fabric will be measured by the Square Yard for the ground surface area actually covered.

### **2-12.5 METHOD OF PAYMENT**

**2-12.5(1)** The per Square Yard unit contract price for Permanent Erosion Control Fabric shall be full compensation for all labor and materials associated with this item.

**END OF ITEM 2-12**

## **ITEM 6-04 TIMBER STRUCTURES**

### **6-04.1 DESCRIPTION**

Work shall conform to all requirements of the referenced section from WSDOT Standard Specifications as modified by the City of Spokane, except that any revisions written in this specification section shall supersede the WSDOT Standard Specifications as modified by the City of Spokane.

This work consists of furnishing, and installing the retaining wall as shown on the Plans.

### **6-04.3 CONSTRUCTION REQUIREMENTS**

6-04.3(3) Shop Details

**Remove this section in its entirety.**

6-04.3(4) Field Treatment of Cut Surfaces, Bolt Holes, and Contact Surfaces

**Remove this section in its entirety.**

### **6-04.4 MEASUREMENT**

#### **6-04.4(1) Retaining Wall**

Silt Fence will be measured by Lump Sum.

### **6-04.5 METHOD OF PAYMENT**

**6-04.5(1)** The Lump Sum contract price for Retaining Wall shall be full pay for furnishing all labor, tools, equipment, and materials required to construct the Retaining Wall as shown in the Plans. Backfill for Retaining Wall shall be covered under Items 2-03.5(4)/(5) and 8-02.5(1).

**END OF ITEM 6-04**

## **ITEM 8-01 EROSION CONTROL AND WATER POLLUTION CONTROL**

### **8-01.1 DESCRIPTION**

Work shall conform to all requirements of the referenced section from WSDOT Standard Specifications as modified by the City of Spokane, except that any revisions written in this specification section shall supersede the WSDOT Standard Specifications as modified by the City of Spokane.

This work consists of furnishing, placing, inspecting, and maintaining erosion control devices in accordance with the Plans.

### **8-01.3 CONSTRUCTION REQUIREMENTS**

8-01.3(15) Maintenance

**Replace the second paragraph of this section in its entirety with the following:**

Erosion control BMP's shall be inspected on the schedule outlined in the Plans. Damage to or undercutting of BMP's shall be repaired immediately.

### **8-01.4 MEASUREMENT**

#### **8-01.4(1) Silt Fence**

Silt Fence will be measured by the Lineal Foot.

#### **8-01.4(2) Erosion Control Blanket**

Erosion Control Blanket will be measured by the Square Yard along the ground lope line of surface area covered and accepted.

#### **8-01.4(3) Hydroseed**

Hydroseed will be measured by the Acre as indicated in the Plans.

### **8-01.5 METHOD OF PAYMENT**

**8-01.5(1)** The per Ton unit contract price for Riprap Revetment shall be full pay for furnishing all labor, tools, equipment, and materials required to construct the riprap protection, except for excavation.

**8-01.5(2)** The per Square Yard unit contract price for Erosion Control Blanket shall be full pay for all equipment, labor, and materials to perform the Work as specified.

**8-01.5(3)** The per Acre unit contract price for Hydroseed shall be full pay for all equipment, labor, and materials to perform the Work as specified.

**END OF ITEM 8-01**

## **ITEM 8-02 ROADSIDE RESTORATION**

### **8-02.1 DESCRIPTION**

Work shall conform to all requirements of the referenced section from WSDOT Standard Specifications as modified by the City of Spokane, except that any revisions written in this specification section shall supersede the WSDOT Standard Specifications as modified by the City of Spokane.

This work consists of consists of furnishing and placing topsoil, and furnishing and planting bare root plants, and live poles.

### **8-02.4 MEASUREMENT**

#### **8-02.4(1) Topsoil, Incl. Haul**

Topsoil will be measured by the Cubic Yard in the haul conveyance at the point of delivery.

#### **8-02.4(2) Live Pole**

Live Pole will be measured per Each

#### **8-02.4(3) Plantings Zone B**

Plantings Zone B will be measured per Each

#### **8-02.4(4) Plantings Zone C**

Plantings Zone C will be measured per Each

### **8-02.5 METHOD OF PAYMENT**

**8-02.5(1)** The per Cubic Yard contract unit price for Topsoil, Incl. Haul shall be full pay for providing the topsoil, pre-excavation weed control, excavating, loading, hauling, stockpiling, weed control on stockpiles, and removal, placing, spreading, processing, and compacting topsoil.

**8-02.5(2)** The per Each contract unit price for Live Pole shall be full pay for all materials, labor, tools, equipment, and providing the pole, pole storage and protection, fertilizer and root dip, and stinger installation necessary to complete planting operations as specified.

**8-02.5(3)** The per Each contract unit price for Plantings Zone B shall be full pay for all materials, labor, tools, equipment, necessary for planting area preparation, planting, plant storage and protection, fertilizer, staking, and cleanup necessary to complete planting operations as specified.

**8-02.5(4)** The per Each contract unit price for Plantings Zone C shall be full pay for all materials, labor, tools, equipment, necessary for planting area preparation, planting, plant storage and protection, fertilizer, staking, and cleanup necessary to complete planting operations as specified.

**END OF ITEM 8-02**

## **ITEM 8-15 RIPRAP**

### **8-15.1 DESCRIPTION**

Work shall conform to all requirements of the referenced section from WSDOT Standard Specifications as modified by the City of Spokane, except that any revisions written in this specification section shall supersede the WSDOT Standard Specifications as modified by the City of Spokane.

This work consists of furnishing and placing riprap protection of the type specified at the locations and in conformity with the lines and dimensions shown in the Plans.

### **8-15.3 CONSTRUCTION REQUIREMENTS**

#### **8-15.3(1) Excavation for Riprap**

**Replace this section in its entirety with the following:**

The foundation for riprap shall be excavated as shown in the Plans or as directed by the Engineer. Foundation excavation will not commence until the foundation layout staking has been approved by the Engineer. Excavation below the level of the intersection of the slope to be protected and the adjacent original ground shall be classified, measured, and paid for as Key Trench in accordance with Section 2-03. All excavation or backfill above the level of the above described intersection and all dressing of the slope to be protected shall be included in the Contract price for riprap.

#### **8-15.3(3) Hand Placed Riprap**

Supplement this section with the following:

Void spaces in the riprap surface shall be filled with topsoil. Topsoil shall be measured and paid for in accordance with Section 8-02.

### **8-15.4 MEASUREMENT**

#### **8-15.4(1) Riprap Revetment**

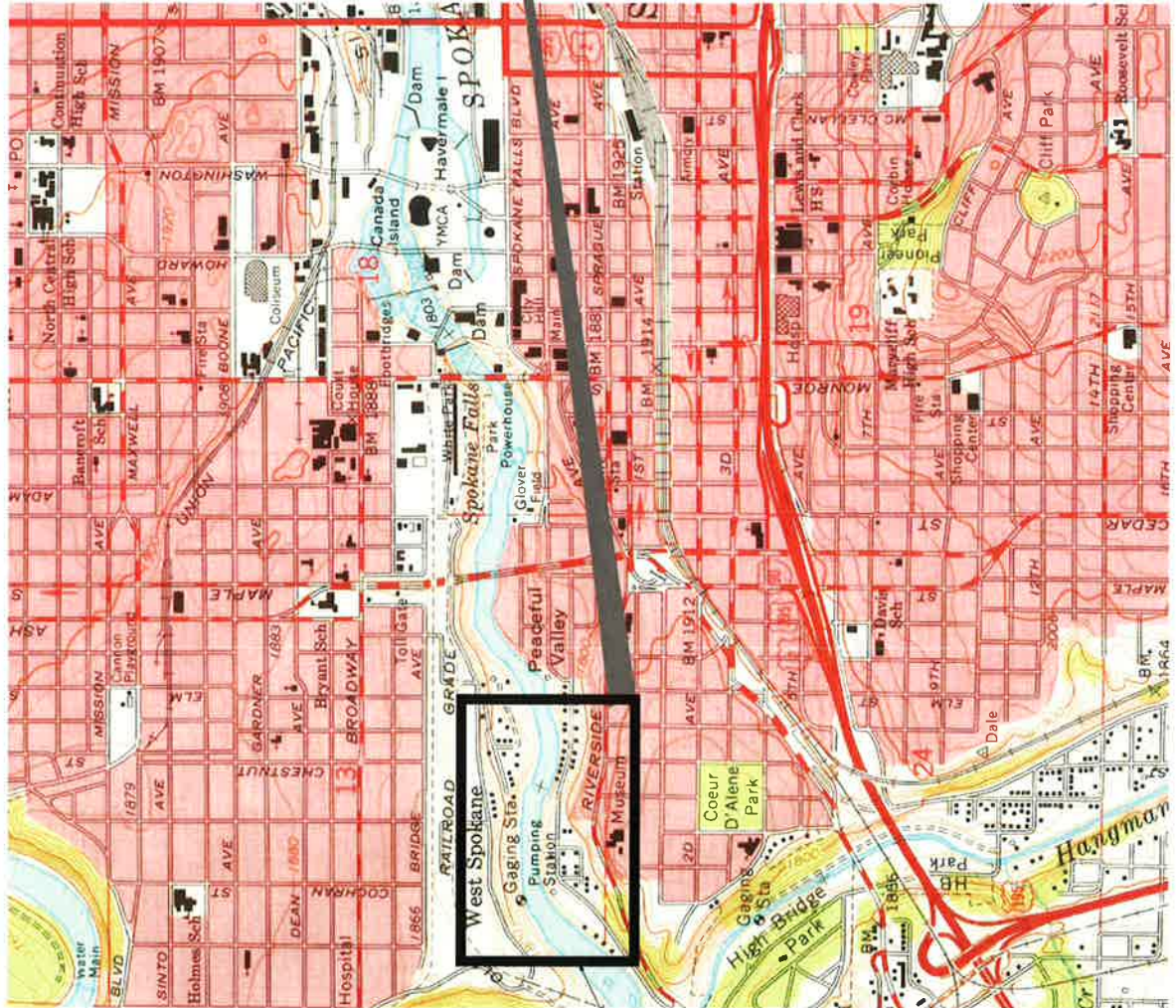
Riprap Revetment will be measured by the Ton.

### **8-15.5 METHOD OF PAYMENT**

**8-15.5(1)** The per Ton unit contract price for Riprap Revetment shall be full pay for furnishing all labor, tools, equipment, and materials required to construct the riprap protection, except for excavation.

**END OF ITEM 8-15**

SHEET TITLE	NO.
TITLE SHEET	G1.00
GENERAL NOTES	G1.01
EXISTING CONDITIONS & EROSION CONTROL PLAN	C1.00
SITE PLAN	C2.00
SECTION VIEWS	C3.00
RESTORATION PLAN	C4.00
DETAILS	C5.00



**NOTE:**  
CONTRACTOR ACCESS THROUGH CITY GATE AT THE WEST SIDE OF THE CLARK AVENUE

AFTER EXPECTED RAINFALL EVENTS TO ENSURE EROSION CONTROL MEASURES ARE IN WORKING CONDITION. ANY DAMAGED STRUCTURES SHALL BE IMMEDIATELY REPAIRED. IF IT IS DETERMINED AT THE INSPECTION THAT ADDITIONAL BMP MEASURES ARE NEEDED TO CONTROL STORMWATER AND EROSION THEY SHALL BE IMPLEMENTED IMMEDIATELY.

2. ALL TEMPORARY BMPS AND ACCUMULATED SEDIMENTS SHALL BE REMOVED OR STABILIZED IMMEDIATELY AFTER FINAL SITE STABILIZATION AND COMPLETION OF THE CONTRACT.
3. EQUIPMENT USED FOR THIS WORK MAY OPERATE BELOW THE OHWM. EQUIPMENT SHALL BE FREE OF EXTERNAL PETROLEUM BASED PRODUCTS OR ANY ACCUMULATION OF SOILS OR DEBRIS WHILE WORKING BELOW THE OHWM. EQUIPMENT SHALL BE CHECKED DAILY FOR LEAKS AND ANY NECESSARY REPAIRS SHALL BE COMPLETED PRIOR TO COMMENCING WORK ACTIVITIES ADJACENT TO THE RIVER.
4. DISTURBANCE OF THE RIVER BED AND BANKS SHALL BE LIMITED TO THAT NECESSARY TO CONSTRUCT THE PROJECT. AFFECTED RIVER BED AND BANK AND ASSOCIATED FILL SHALL BE STABILIZED TO PREVENT EROSION.

#### SPILL REPORTING

1. ANY SPILL OF FUEL, OIL, HYDRAULIC FLUID, SOLVENTS, PAINT, STORED CHEMICALS, TOXIC OR HAZARDOUS MATERIALS INTO THE GROUND, DRAINAGE STRUCTURES, OR INTO SURFACE WATERS OF THE STATE SHALL BE REPORTED TO THE OWNER IMMEDIATELY. CONTAINMENT AND CLEAN-UP EFFORTS SHALL BEGIN IMMEDIATELY AND BE IN ACCORDANCE WITH THE SPCC PLAN AS SPECIFIED IN THE SPECIFICATIONS. ALL OTHER WORK IN THE AFFECTED AREA SHALL BE STOPPED UNTIL ALL CLEAN-UP OF THE SPILL IS COMPLETED. CONTAINMENT AND CLEAN-UP SHALL TAKE PRECEDENCE OVER NORMAL WORK ACTIVITIES. NORMAL WORK ACTIVITIES WITHIN THE IMMEDIATE SPILL AREA SHALL BE STOPPED UNTIL THE CONTENTS, CLEAN-UP AND DISPOSAL METHODS ARE COMPLETED AS APPROVED BY THE OWNER.

WITH A MINIMUM DISTANCE OF 50 FEET FROM ANY SENSITIVE AREA AND ANY SURFACE WATERS OF THE STATE. ALL STATIONARY EQUIPMENT, STORAGE OF TOXIC MATERIALS, GAS AND OIL CONTAINERS, AND FUELING SERVICE AREAS SHALL BE PROVIDED WITH SPILL CONTAINMENT AS SPECIFIED BY THE SPILL PREVENTION, CONTROL, AND COUNTERMEASURES PLAN OF THE SPECIFICATIONS.

2. NO PETROLEUM PRODUCTS, FRESH CEMENT, LIME OR CONCRETE, CHEMICALS, OR OTHER TOXIC OR DELETERIOUS MATERIALS SHALL BE ALLOWED TO ENTER WATERS OF THE STATE.
3. THE DISCHARGE OF OIL, FUEL, OR CHEMICALS TO WATERS OF THE STATE, OR ONTO LAND WITH A POTENTIAL FOR ENTRY INTO STATE WATERS IS PROHIBITED.
4. NO EMULSIFIERS OR DISPERSANTS ARE TO BE USED IN WATERS OF THE STATE WITHOUT WRITTEN APPROVAL FROM THE DEPARTMENT OF ECOLOGY.
5. NO CLEANING SOLVENTS OR CHEMICALS UTILIZED FOR TOOL OR EQUIPMENT CLEANING MAY BE DISCHARGED TO THE GROUND OR WATERS OF THE STATE.
6. WASTE LIQUIDS SHALL BE STORED UNDER COVER, SUCH AS TARPAILINS OR ROOFS.
7. FUEL HOSES, OIL DRUMS, OIL OR FUEL TRANSFER VALVES AND FITTINGS, ETC., SHALL BE CHECKED DAILY FOR DRIPS OR LEAKS AND SHALL BE MAINTAINED AND STORED PROPERLY TO PREVENT SPILLS INTO WATERS OF THE STATE. ALL STAGING AND STORAGE SITES CONTAINING EQUIPMENT, FUEL, OIL, OR ANY OTHER TOXIC OR HAZARDOUS MATERIALS SHALL BE SECURED WITHIN THE DESIGNATED STAGING AREA.
8. THE CONTRACTOR IS RESPONSIBLE FOR CONCENTRATED WASTE OR SPILLED CHEMICALS AND THE CONTRACTOR SHALL TRANSPORT OFF SITE FOR DISPOSAL AT A FACILITY APPROVED BY THE DEPARTMENT OF ECOLOGY OR APPROPRIATE COUNTY HEALTH DEPARTMENT. THESE MATERIALS SHALL NOT BE DISCHARGED TO A SEWER WITH APPROVAL OF THE LOCAL SEWER AUTHORITY.

SHALL BE AS AVAILABLE FOR AS SHOWN ON ED TO THEIR PROJECT.

REQUIREMENTS HIGH WATER

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MPETENT AND NATIVE PLANT TIVE ASPECTS IPECIFICATION, ED PERSON(S) = ANY NATIVE ON.

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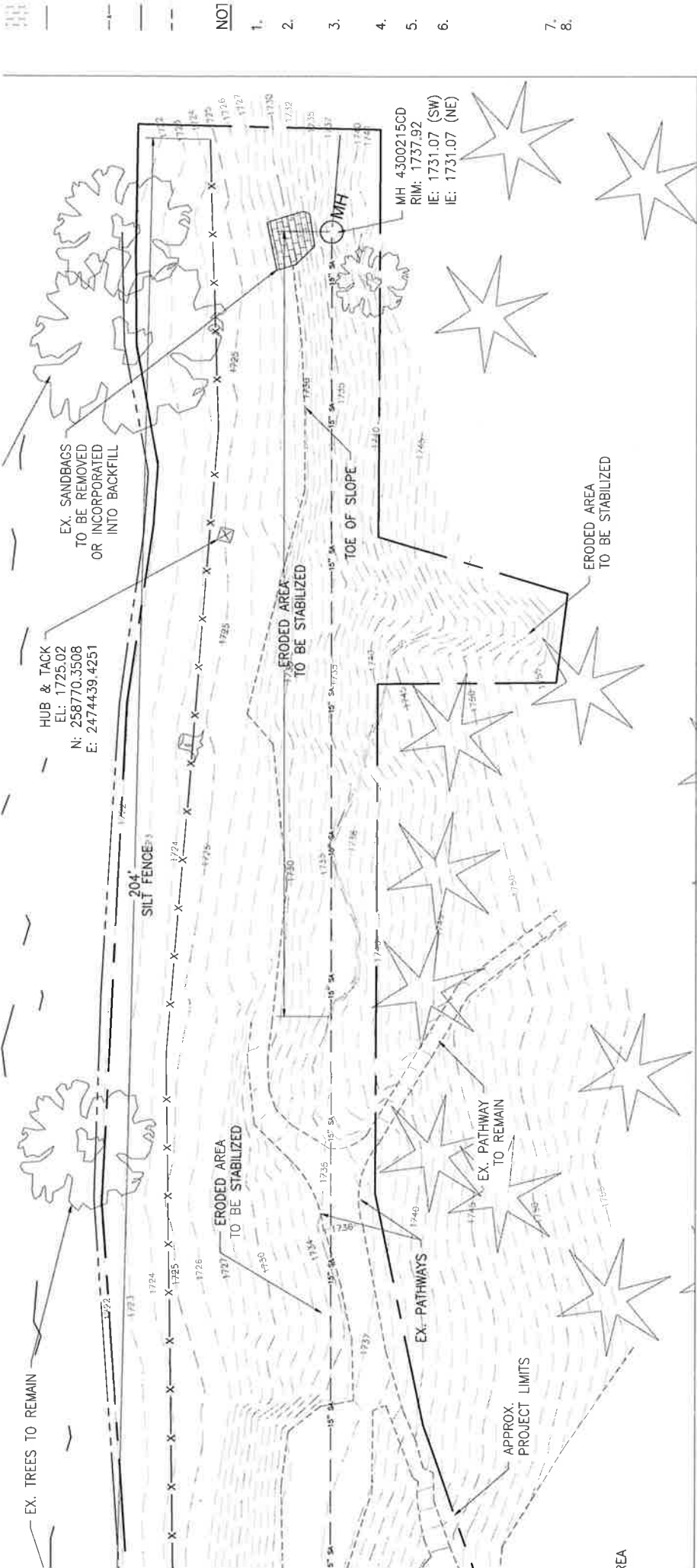
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JOINTS IN FILTER FABRIC SHALL BE SPICED AT POSTS. USE STAPLES, WIRE RINGS, SEWN IN POCKETS OR EQUIVALENT TO ATTACH FABRIC TO POSTS.

2"x2" BY 14 GAUGE WIRE OR EQUIVALENT, IF STANDARD STRENGTH FABRIC USED

2' MIN  
3' MAX

8" MIN  
12" MAX

6"

MINIMUM 4"x4" TRENCH

BACKFILL TRENCH WITH NATIVE SOIL OR 3/4"-1.5" WASHED GRAVEL

2"x2" WOOD POSTS, STEEL FENCE POSTS, REBAR, OR EQUIVALENT

6" MAX

POST SPACING MAY BE INCREASED TO 8' IF WIRE BACKING IS USED

FRONT VIEW

SIDE VIEW

NOTE:  
FILTER FABRIC FENCES SHALL BE INSTALLED AND IN WORKING CONDITION PRIOR TO ANY GROUND DISTURBANCE.

**SILT FENCE DETAIL**

SCALE NTS

**MAINTENANCE STANDARDS:**

1. SILT FENCES AND FILTER BARRIERS SHALL BE INSPECTED IMMEDIATELY AFTER RAINFALL AND AT LEAST DAILY DURING PROLONGED RAINFALL. ANY REPAIRS SHALL BE MADE IMMEDIATELY.
2. IF CONCENTRATED FLOWS ARE EVIDENT UP-HILL OF THE FENCE, THE FENCE SHOULD BE INTERCEPTED AND CONVEYED TO A SEDIMENT POND.
3. CONTRACTOR TO CHECK THE UPHILL SIDE OF THE FENCE FOR SIGNS OF FENCE CLOGGING AND ACTING AS A BARRIER TO FLOW AND CAUSING CHANNELIZATION OF FLOWS PARALLEL TO THE FENCE. IF THIS OCCURS, CONTRACTOR TO REPLACE THE FENCE AND REMOVE THE TRAPPED SEDIMENT.
4. SEDIMENT DEPOSITS SHALL EITHER BE REMOVED WHEN THE DEPOSITS ARE APPROXIMATELY ONE-THIRD THE HEIGHT OF THE SILT FENCE, OR A NEW FENCE SHALL BE INSTALLED.
5. IF THE FILTER FABRIC (GEOTEXTILE) HAS DETERIORATED DUE TO ULTIMATE BREAKDOWN, IT SHALL BE REPLACED.

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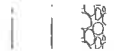
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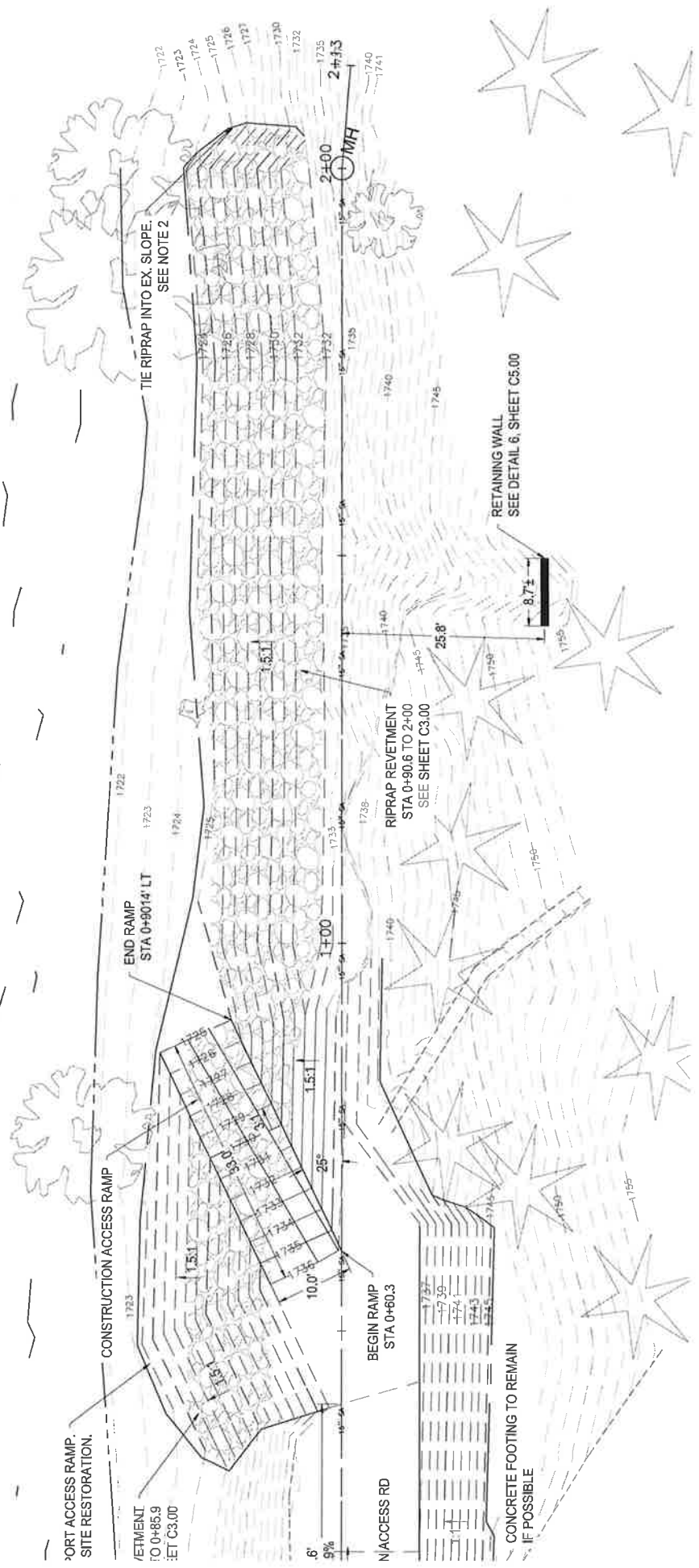
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- 4. N C
- 5. E C
- 6. F C
- 7. C C

RIVER FLOW  
 SPOKANE RIVER



RETAINING WALL  
 SEE DETAIL 6, SHEET C5.00

RIPRAP REVETMENT  
 STA 0+90.6 TO 2+00  
 SEE SHEET C3.00

TIE RIPRAP INTO EX. SLOPE.  
 SEE NOTE 2

PORT ACCESS RAMP.  
 SITE RESTORATION.

CONSTRUCTION ACCESS RAMP

END RAMP  
 STA 0+90.14' LT

BEGIN RAMP  
 STA 0+60.3

CONCRETE FOOTING TO REMAIN  
 IF POSSIBLE

8.7'

9%

N/ACCESS RD

1700

1735

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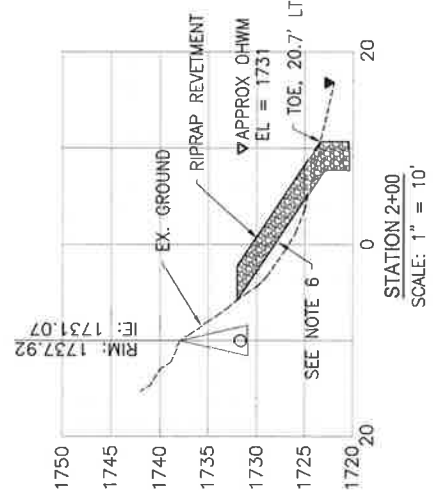
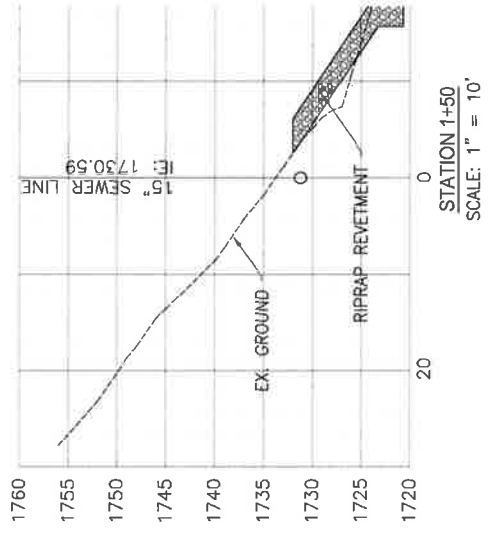
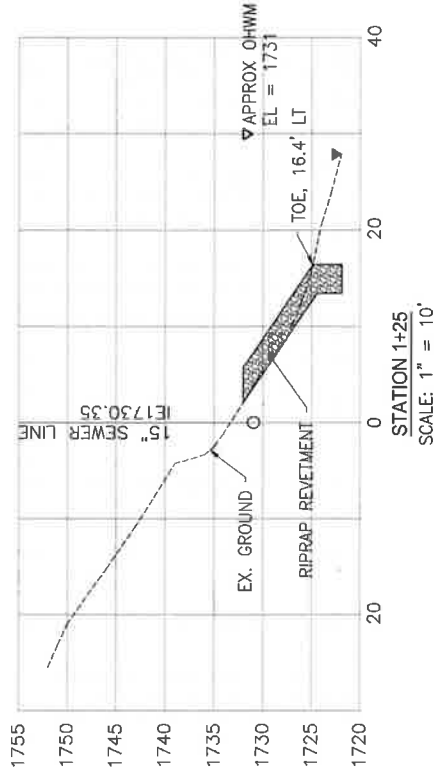
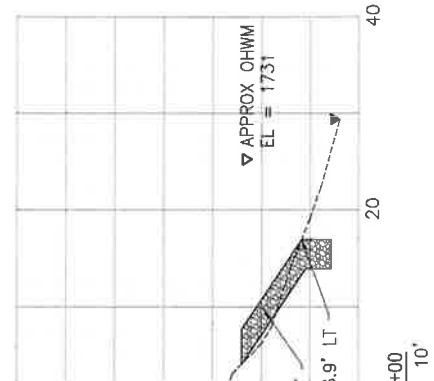
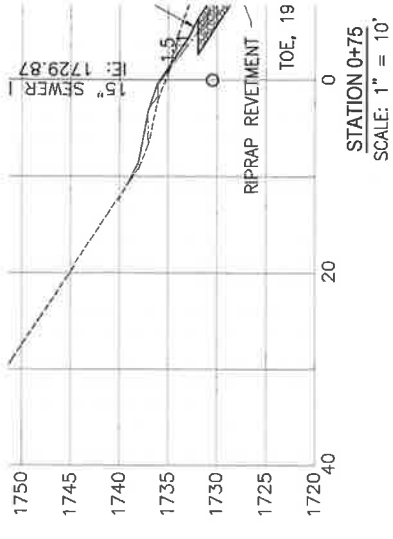
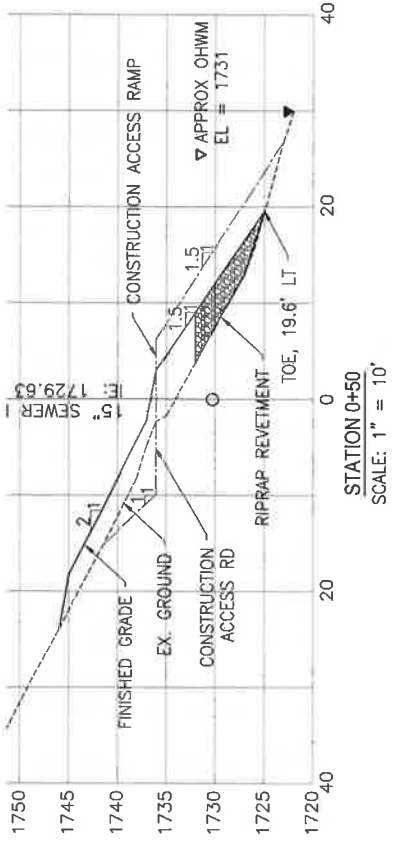
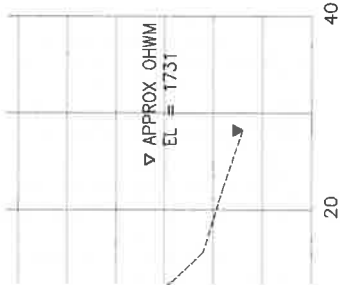
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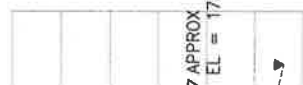
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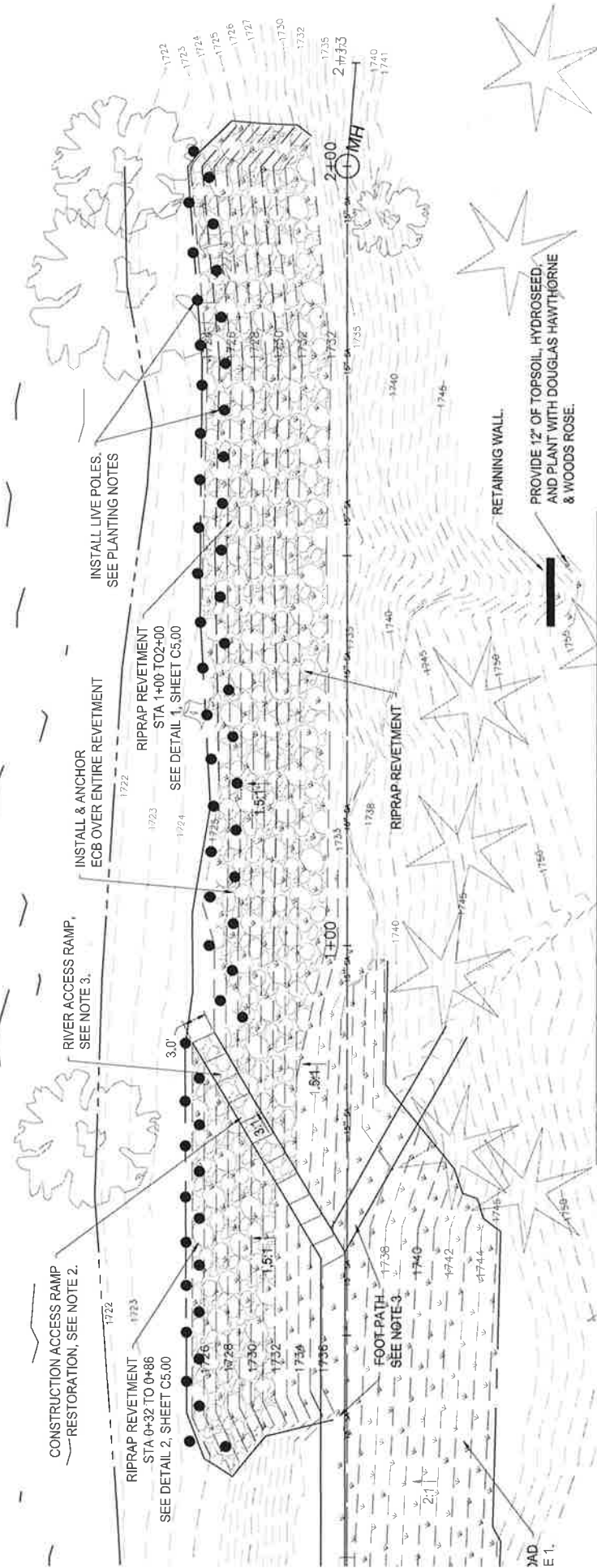


**NOTES:**

1. FINISHED GRADE, STA 0+00 TO STA 0+75, SEE RESTORATION PLAN, SHEET C4.00.
2. CONSTRUCTION ACCESS ROAD RESTORATION. SEE DETAIL 2, SHEET C5.00.
3. RIPRAP REVETMENT, STA 0+32 TO 0+90.6, SEE DETAIL 3, SHEET C5.00.
4. RIPRAP REVETMENT, STA 0+90.6 TO STA 2+00, SEE DETAIL 1, SHEET C5.00.
5. 15" SEWER LINE LOCATION AND ELEVATION HAVE BEEN PROVIDED FOR CONTRACTOR REFERENCE ONLY. CONTRACTOR TO PROTECT IN PLACE.
6. EXISTING SANDBAGS, STA 2+00, TO BE INCORPORATED INTO FILL OR REMOVED.



RIVER FLOW  
SPOKANE RIVER

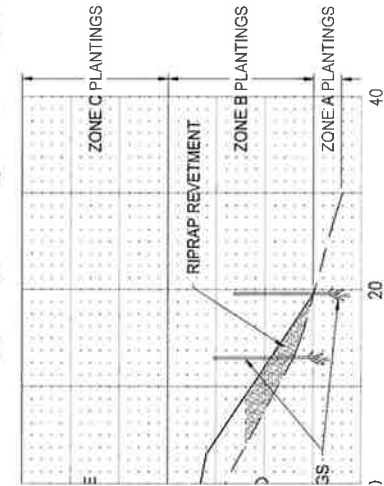


NOTE  
1. SEE SECTION 2  
2. SEE SECTION 3  
3. SEE SECTION 4  
4. SEE SECTION 5  
5. SEE SECTION 6

PLANTING NOTES:

1. ZONE A PLANTINGS APPLY FROM THE EDGE OF WATER TO ELEV. 1725. ZONE B PLANTINGS APPLY FROM ELEV. 1725 TO 1740. ZONE C PLANTINGS APPLY ABOVE ELEV. 1740.
2. A VARIETY OF SPECIES HAVE BEEN PROVIDED IN THE RIPARIAN PLANTING SCHEDULE TO ACCOMMODATE PLANT AVAILABILITY. PLANT PRIORITY SHALL BE GIVEN TO THOSE PLANTS WITH THE HIGHEST RELATIVE PERCENTAGE BY ZONE.
3. DISTURBED AREAS AND RIPRAP REVELTMENT SHALL BE HYDROSSEDED PRIOR TO INSTALLATION OF THE EROSION CONTROL BLANKET (ECB). WOODY PLANTS SHALL BE PLANTED AFTER ECB INSTALLATION.
4. BLACK COTTONWOODS AND OTHER SIMILAR TREES WITH WATER SEEKING ROOTS SHALL NOT BE PLANTED ABOVE THE SEWER LINE.
5. LIVE POLES TO BE INSTALLED BY METHOD OF STINGER AT TOE OF RIPRAP REVELTMENT AND UP SLOPE OF KEY TRENCH. POLES TO BE PLANTED IN TWO STAGGERED ROWS APPROXIMATELY 4' ON CENTER.
6. LIVE POLES ARE TO BE EMBEDDED SO THAT THE BASE OF THE POLE EXTENDS APPROXIMATELY 6" BELOW THE WATER TABLE AT THE TIME OF PLANTING. LIVE POLE TO BE 1/2" TO 2" IN DIAMETER.<sup>3</sup>
5. LIVE POLES TO CONSIST OF ZONE A PLANTINGS & BLACK COTTONWOOD IN ZONE B.
6. LIVE POLES FROM THE ZONE A PLANTINGS ARE TO BE INSTALLED AT THE TOE OF THE REVELTMENT AND ZONE B PLANTINGS SHALL BE INSTALLED WITHIN THE REVELTMENT.

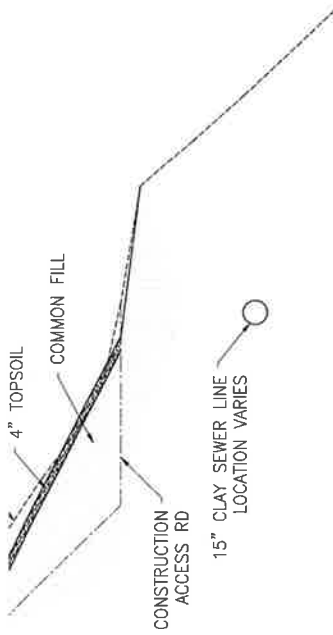
SPECIES		COMMON NAME	SHORELINE VEGETATIVE ZONE	RELATIVE PERCENT OF MIX BY ZONE
SCIENTIFIC NAME				
SALIX LUCIDA SSP. LASANDRA		PACIFIC WILLOW	A	70
SALIX PROLIKA		MACKENZIE WILLOW	A	30
ALNUS INCANA SSP. TENUIFOLIA		THIN LEAF ALDER	B	10
BETULA PAPIRIFERA		PAPER BIRCH	B	15
CORNUS SERICEA		RED-OSIER DOGWOOD	B	20
POPULUS BALSAMIFERA SSP. TRICHOCARPA		BLACK COTTONWOOD	B	15
RIBES AUREUM		GOLDEN CURRANT	B	15
RIBES LACUSTRE		SWAMP CURRANT	B	10
SALIX SCOULERIANA		SCOULER WILLOW	B	20
AMELANCHIER ALNIFOLIA		SASKATOON SERVICEBERRY	C	15
CRATEAGUS DOUGLASSII		DOUGLAS HAWTHORNE	C	10
PHYSOCARPUS MALVACEUS		MALLOW NINEBARK	C	10
PINUS PONDEROSA		PONDEROSA PINE	C	20
PRUNUS VIRGINIANA		COMMON CHOKECHERRY	C	15
ROSA WOODSII		WOOD'S ROSE	C	10
SYMPHICARPOS ALBUS		SNOWBERRY	C	10



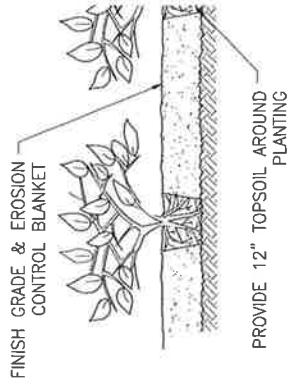
PLANTING ZONES

NAME	PERCENT BY WEIGHT
GRASS	10
SCUE	20
PINE	10
BLUEGRASS	20
HEATGRASS	30
SEED	10

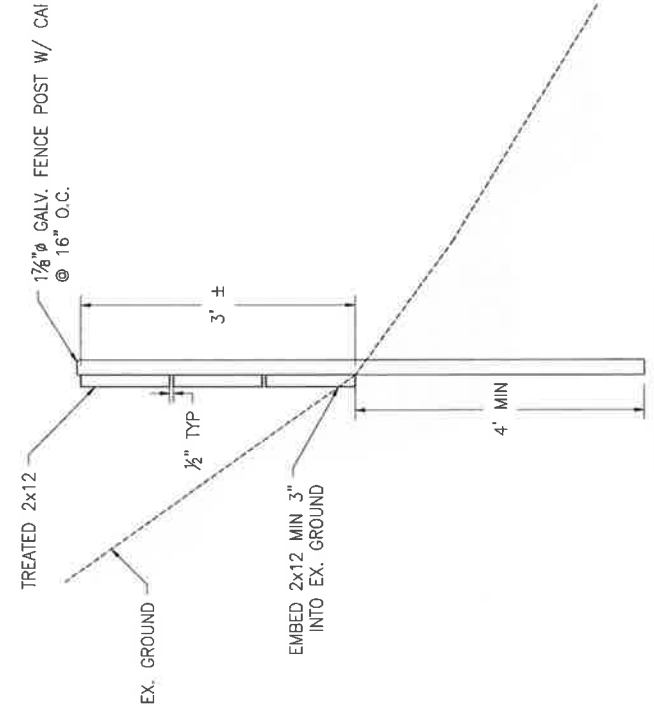
- 4. PLANT WOODY AREA TO SLOPE PER MANI
- 5. ECB SHALL BE PROF
- 6. PLANT WOODY SHRUI



**DETAIL 2: CONSTRUCTION ACCESS ROAD RESTORATION**  
 STA 0+00 TO STA 0+32  
 SCALE: N.T.S.



**DETAIL 5: WOODY SC**



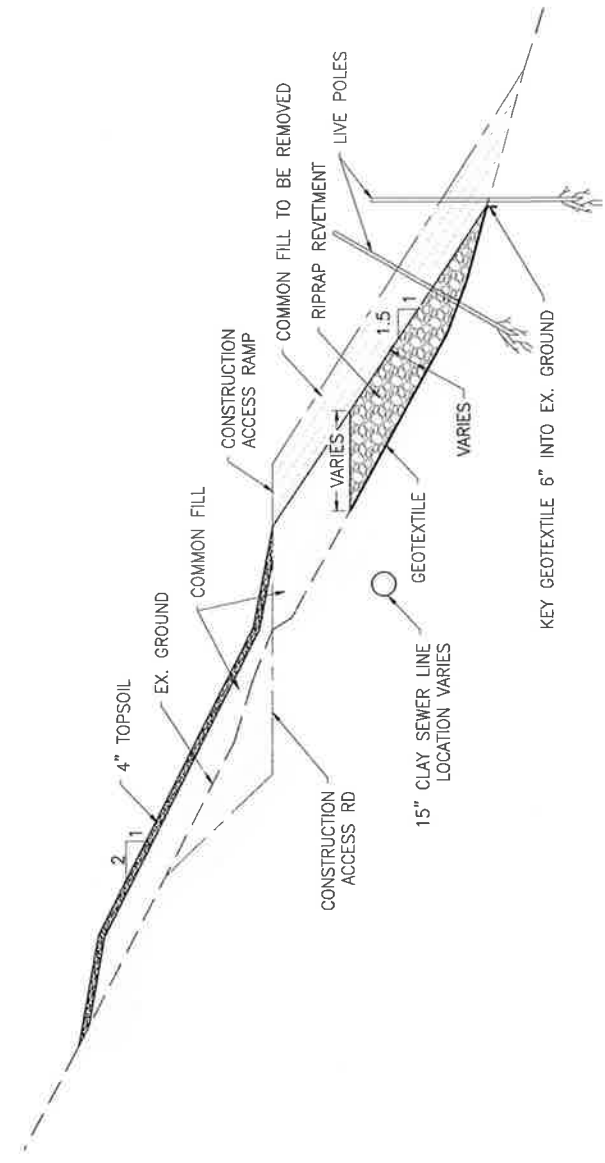
**DETAIL 6: RETAINING WALL**

- 3. GEOTEXTILE SHALL BE NON-WOVEN, HIGH SURVIVABILITY, DRAINAGE CLASS A.
- 4. VISIBLE GEOTEXTILE TO BE REMOVED PRIOR TO PLANTING.
- 5. RIPRAP TO BE 2' NOMINAL THICKNESS. INCREASE AS NECESSARY TO MAINTAIN 1.5:1 MAX SLOPE AND MATCH EXISTING GROUND. SEE GRADATION TABLE THIS SHEET.
- 6. RIPRAP VOIDS TO BE BACKFILLED WITH TOPSOIL AND HYDROSEEDED. COVER HYDROSEED WITH EROSION CONTROL BLANKET (ECB).
- 7. INSTALL LIVE POLES THROUGH ECB.
- 8. ECB SHALL BE PROPEX LANDLOK C2 OR EQUIVALENT. SECURE ECB TO SLOPE PER MANUFACTURER'S RECOMMENDATIONS.
- 9. PLANT ACCORDING TO RESTORATION PLAN.

- NOTES:**
- 1. WOODY PLANTS WILL CONSIST OF ZONE B & C PLANTINGS. SEE RIPARIAN PLANTING SCHEDULE, SHEET C4.00.
  - 2. WOODY PLANTS TO BE INSTALLED THROUGH ECB.
  - 3. PLANT SPACING SHALL BE IN ACCORDANCE WITH GOOD LANDSCAPING PRACTICES.



1T	
MAX	
197	
162	
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111	
108	



**DETAIL 3: RIPRAP REVETMENT & RESTORATION**  
 STA 0+32 TO STA 0+90.6  
 SCALE: N.T.S.

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