

## m e m o r a n d u m

DATE: November 8, 2018 JOB #: 18042-0073  
TO: Jesse Herndon, P.E. – City of Ponderay  
CC: \_\_\_\_\_  
FROM: Matt Gibb  
SUBJECT: STCU Drainage Memo

Dear Jesse,

This memo describes the drainage impacts from the proposed STCU project and the design of the facilities used to mitigate this impact. The proposed project is located in Ponderay, Idaho at 477256 US Highway 95. The project is bounded by an existing parking lots to the north and east, Kootenai Cutoff Road to the south, and US Highway 95 to the west. The proposed improvements are a redevelopment of an existing commercial site (Payless Shoe Source). They include a new credit union branch with drive-through. The existing site will be demolished. A project vicinity map has been attached to this memo.

**Water Quality Treatment:** The area of pollutant-generating impervious surface (PGIS) will be approximately 15,819 square feet, which includes the parking lot and all hydraulically connected hardscape. The City of Ponderay requires the project to provide water quality treatment volume equal to the first one-half inch of runoff over the PGIS area (659 cubic feet). 676 cubic feet of swale volume has been set aside as shown to provide 8" of treatment depth. A Type 1 catch basin will be installed with its rim set to 8" above the swale bottom and will take overflow from larger storm events.

**Flow Control:** The new building will be approximately 4,115 square feet. The drive-through canopy is not included in the building area but is included in the PGIS area, since pollutants from under the canopy will likely make their way to the swale. The City of Ponderay requires the project to detain the difference between the pre- and post-developed 25-year design storm. All roof (non-pollutant generating) runoff will be piped to the proposed Type 1 catch basin as shown. The remainder of the site will reach the catch basin via overland flow across the parking lot and through the proposed swale. The catch basin outlet will have a 3.5" orifice that restricts outflow to the pre-development runoff rate (0.52 cfs). The outlet pipe will discharge runoff to an existing catch basin, which conveys runoff south to the Kootenai Cutoff Road/US Highway 95 storm system. Using the Modified Rational Method, it was determined that 372 cubic feet of swale volume is required to detain the 25-year post-development storm event. Since the proposed swale already contains 676 cubic feet for water quality treatment, no upsizing is required. Design calculations are attached.

**Construction Pollution Prevention:** A construction entrance, silt fence and inlet protection will be placed as shown before the start of construction activities. During construction, water trucks will be utilized for dust control, and street cleaning will occur as needed to minimize the offsite tracking of sediment.

If you have any questions, please feel free to contact me.

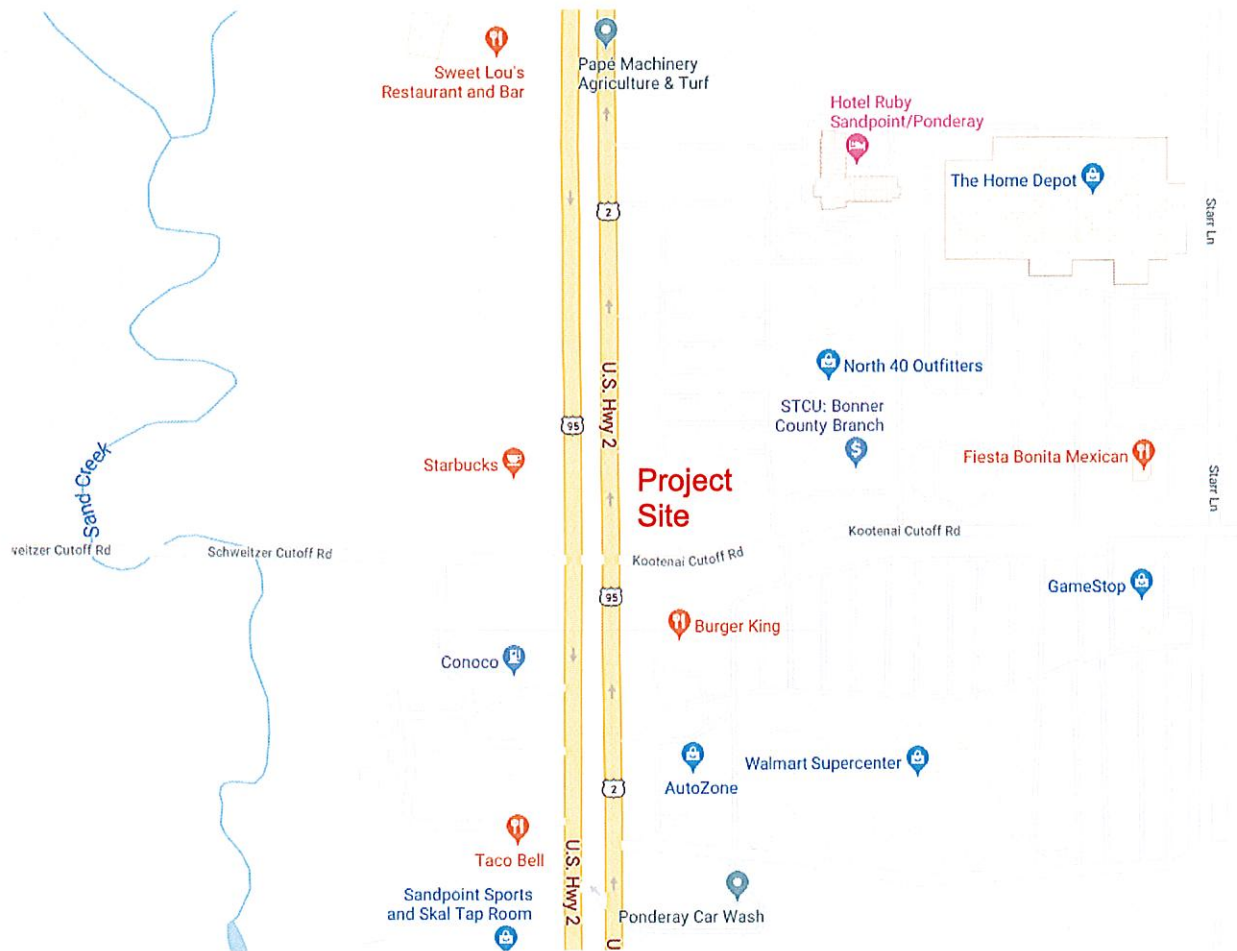
Sincerely,



Matt Gibb, P.E.  
Project Manager  
(509) 227-5721



## Vicinity Map



# Stormwater Facilities and Detention Basin Design

## Swale with Flow Restrictor

Date: 11/9/2018  
 Job No.: 18042-0073  
 Arch. Name:  
 Project: STCU Ponderay

### Description and Assumptions:

City of Ponderay  
 (See Project Location Map)  
 Design Frequency: 25 year  
 Basin Area < 10 acres, therefore use Rational Formula

$$Q = C \times I \times A \quad \text{where} \quad \begin{array}{l} Q = \text{Runoff in cubic feet per second} \\ C = \text{Runoff Coefficient} \\ I = \text{Rainfall Intensity in inches per hour} \\ A = \text{Contributing Area in acres} \end{array}$$

### 1 Determine Weighted Runoff Coefficient, C and Area, A

Sub-Area: Basin A - PRE

Total Drainage Area (A): 25,926 s.f. 0.5952 ac.  
 Total PGIS: - s.f. - ac.

| Surface Type            | Area (s.f.) | Area (ac.) | C*   | C*Area in acres |
|-------------------------|-------------|------------|------|-----------------|
| Parking/Driveway (PGIS) | -           | -          | 0.90 | -               |
| Sidewalk (PGIS)         | -           | -          | 0.90 | -               |
| Landscaping             | 25,926      | 0.60       | 0.30 | 0.18            |
| Roof (NPGIS)            | -           | -          | 0.90 | -               |
| TOTAL                   | 25,926      | 0.60       |      | 0.18            |

$$\text{Weighted Runoff Coefficient (C)} = (\text{sum CA})/(\text{sum A}) = 0.30$$

### 2 Determine Rainfall Intensity, I

\*From Equation 5-11, Page 5-21, "Spokane Regional Stormwater Manual"  
 Duration (in minutes) is based on the Time of Concentration, Tc

Reach 1: Overland Flow where Tc = Time of Concentration in minutes of the longest route that the flow will take  

$$Tc = \frac{L}{K \cdot \sqrt{S}}$$
 L = Length in feet  
 K = Ground Cover Coefficient (See Table 5-6, Page 5-22)  
 S = Average Slope in ft/ft

| L (ft) | K    | S     |
|--------|------|-------|
| 250    | 1200 | 0.013 |

Time of Concentration: 1.83 minutes

Time of Concentration: 5.00 minutes

Intensity is calculated as:  $I = \frac{m}{Tc^n}$

| m   | n    |
|-----|------|
| 6.8 | 0.53 |

$$I = 2.90 \text{ in./hr.}$$

### 3 Determine Peak Discharge, Q

$$\text{Peak 25 yr Discharge} = Q_{25} = CIA = 0.52 \text{ c.f.s.}$$

# Stormwater Facilities and Detention Basin Design

## Swale with Flow Restrictor

Date: 11/9/2018  
 Job No.: 18042-0073  
 Arch. Name:  
 Project: STCU Ponderay

### Description and Assumptions:

City of Ponderay  
 (See Project Location Map)  
 Design Frequency: 25 year  
 Basin Area < 10 acres, therefore use Rational Formula

$$Q = C \times I \times A \quad \text{where} \quad \begin{array}{l} Q = \text{Runoff in cubic feet per second} \\ C = \text{Runoff Coefficient} \\ I = \text{Rainfall Intensity in inches per hour} \\ A = \text{Contributing Area in acres} \end{array}$$

### 1 Determine Weighted Runoff Coefficient, C and Area, A

Sub-Area: Basin A - POST

Total Drainage Area (A): 25,926 s.f. 0.5952 ac.  
 Total PGIS: 15,819 s.f. 0.36 ac.

| Surface Type            | Area (s.f.) | Area (ac.) | C*   | C*Area in acres |
|-------------------------|-------------|------------|------|-----------------|
| Parking/Driveway (PGIS) | 11,254      | 0.26       | 0.90 | 0.23            |
| Sidewalk (PGIS)         | 4,565       | 0.10       | 0.90 | 0.09            |
| Landscaping             | 5,992       | 0.14       | 0.30 | 0.04            |
| Roof (NPGIS)            | 4,115       | 0.09       | 0.90 | 0.09            |
|                         | -           | -          |      | -               |
| TOTAL                   | 25,926      | 0.60       |      | 0.45            |

$$\text{Weighted Runoff Coefficient (C)} = (\text{sum CA})/(\text{sum A}) = 0.76$$

### 2 Determine Rainfall Intensity, I

\*From Equation 5-11, Page 5-21, "Spokane Regional Stormwater Manual"

Duration (in minutes) is based on the Time of Concentration, Tc

Reach 1: Overland Flow where Tc = Time of Concentration in minutes of the longest route that the flow will take  

$$T_c = \frac{L}{K \cdot \sqrt{S}}$$
  
 L = Length in feet  
 K = Ground Cover Coefficient (See Table 5-6, Page 5-22)  
 S = Average Slope in ft/ft

| L (ft) | K    | S     |
|--------|------|-------|
| 250    | 1200 | 0.013 |

Time of Concentration: 1.83 minutes

Time of Concentration: 5.00 minutes

Intensity is calculated as:  $I = \frac{m}{T_c^n}$

| m   | n    |
|-----|------|
| 6.8 | 0.53 |

I = 2.90 in./hr.

### 3 Determine Peak Discharge, Q

Peak 25 yr Discharge = Q25 = CIA = 1.31 c.f.s.



#### 4 Detention Basin Design using the Bowstring Method

Time Increment: 5 minutes  
 Time of Concentration: 5.00 minutes  
 Desired Outflow: 0.52 cfs  
 Runoff Coefficient: 0.761  
 Area: 0.60 acres

Single Depth Drywell(s)  
 0 Double Depth Drywell(s)

| Time (minutes) | Time (seconds) | Intensity (in/hr) | Q (cfs) | Volume In (cu.ft.) | Volume Out (cu.ft.) | Storage (cu.ft.) |
|----------------|----------------|-------------------|---------|--------------------|---------------------|------------------|
| 0              | 0              | -                 | -       | -                  | -                   | -                |
| 2              | 120            | 2.90              | 1.31    | 291                | 62                  | 229              |
| 5              | 300            | 2.90              | 1.31    | 528                | 156                 | 372              |
| 10             | 600            | 2.01              | 0.91    | 638                | 312                 | 326              |
| 15             | 900            | 1.62              | 0.73    | 735                | 468                 | 267              |
| 20             | 1200           | 1.39              | 0.63    | 820                | 624                 | 196              |
| 25             | 1500           | 1.23              | 0.56    | 896                | 780                 | 116              |
| 30             | 1800           | 1.12              | 0.51    | 966                | 936                 | 30               |
| 35             | 2100           | 1.03              | 0.47    | 1,031              | 1,092               | (61)             |
| 40             | 2400           | 0.96              | 0.44    | 1,091              | 1,248               | (157)            |
| 45             | 2700           | 0.90              | 0.41    | 1,148              | 1,404               | (256)            |
| 50             | 3000           | 0.86              | 0.39    | 1,202              | 1,560               | (358)            |
| 55             | 3300           | 0.81              | 0.37    | 1,253              | 1,716               | (463)            |
| 60             | 3600           | 0.78              | 0.35    | 1,302              | 1,872               | (570)            |
| 65             | 3900           | 0.74              | 0.34    | 1,349              | 2,028               | (679)            |
| 70             | 4200           | 0.72              | 0.32    | 1,395              | 2,184               | (789)            |
| 75             | 4500           | 0.69              | 0.31    | 1,438              | 2,340               | (902)            |
| 80             | 4800           | 0.67              | 0.30    | 1,481              | 2,496               | (1,015)          |
| 85             | 5100           | 0.65              | 0.29    | 1,522              | 2,652               | (1,130)          |
| 90             | 5400           | 0.63              | 0.28    | 1,561              | 2,808               | (1,247)          |
| 95             | 5700           | 0.61              | 0.28    | 1,600              | 2,964               | (1,364)          |
| 100            | 6000           | 0.59              | 0.27    | 1,638              | 3,120               | (1,482)          |

\*Check formula depending on  $t < \text{or} > T_c$

#### 5 Determine Treatment Volume Required by Basin

Total PGIS Area: 15,819 sf

Required Volume Vs. Provided Volume

Treatment Method: ☐ 1133A ☒ 1815A (same as first 1/2" method)

Required Treatment Volume from Basin: 659 cu. ft.

Treatment Volume Provided: 676 cu. ft.

Area Bottom Width: 10.0 ft.

Area Bottom Length: 95.5 ft.

Treatment Depth: 0.6 ft.

Side Slope (X:1): 3

Width at treatment depth: 13.6 ft

Length at treatment depth: 99.1 ft

Bioinfiltration Bottom Area: 955 sf

Bioinfiltration Top Area: 1,348 sf

Is the Bioinfiltration area large enough to hold the required treatment volume?

OK

#### 6 Determine Adequate Storage Volume for the 10 Year Storm

(Assume trapezoidal cross-section on bioretention area)

Required Detention Volume: 372 cu.ft.

(Maximum value from Step 4)

Detention Volume Provided: 768 cu.ft.

Area Bottom Width: 10.0 ft.

Area Bottom Length: 95.5 ft.

Detention Depth: 0.67 ft.

Side Slope (X:1): 3

Width at detention depth: 14.0 ft

Length at detention depth: 99.5 ft

Bioinfiltration Bottom Area: 955 sf

Bioinfiltration Top Area: 1,395 sf

Is the bioinfiltration area large enough to hold the required detention volume?

OK

## Orifice Outflow Calculations - Variable Head

Date: 11/8/2018  
Job No.: 18042-0073  
Architect: ALSC  
Project: STCU Ponderay  
Location: Ponderay, ID

### Inputs

Gravitational Constant: 32.2 ft/sec  
Coefficient of Discharge: 0.61  
Orifice Diameter: 3.5 in  
Orifice Diameter: 0.2916667 ft  
Orifice Area: 0.07 sq ft  
Starting Head: 0.1 ft  
Increment: 0.1 ft

### Head h (ft) Outflow Q (cfs)

|      |      |
|------|------|
| 0.10 | 0.10 |
| 0.20 | 0.15 |
| 0.30 | 0.18 |
| 0.40 | 0.21 |
| 0.50 | 0.23 |
| 0.60 | 0.25 |
| 0.70 | 0.27 |
| 0.80 | 0.29 |
| 0.90 | 0.31 |
| 1.00 | 0.33 |
| 1.10 | 0.34 |
| 1.20 | 0.36 |
| 1.30 | 0.37 |
| 1.40 | 0.39 |
| 1.50 | 0.40 |
| 1.60 | 0.41 |
| 1.70 | 0.43 |
| 1.80 | 0.44 |
| 1.90 | 0.45 |
| 2.00 | 0.46 |
| 2.10 | 0.47 |
| 2.20 | 0.49 |
| 2.30 | 0.50 |
| 2.40 | 0.51 |
| 2.50 | 0.52 |
| 2.60 | 0.53 |