Final Report

University District South Stormwater Site Suitability Assessment for Stormwater Management Design Planning

Prepared For:
City of Spokane

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TABLE OF CONTENTS

INTRODUCTION

Project Goal and Objectives

The City of Spokane is planning for future stormwater improvements in the University District (Figure 1). In support of this effort, the City has requested that HDR identify areas that are suitable for locating best management practices (BMPs), in public, private, and shared areas. This goal was achieved by meeting the following objectives:

- BMP Palette – Identify BMPs that are preferential for managing stormwater in the University District
- Site Suitability Assessment - Define a site suitability criteria for assessing whether BMPs can be constructed at a specific location based on the site characteristics. The assessment was developed to align with the City's' requirements for managing stormwater including the National Pollutant Discharge Elimination System (NPDES) municipal stormwater (MS4) permit, sole source aquifer protection, and the underground injection control (UIC) rule. These requirements are defined in the Spokane Regional Stormwater Manual (Spokane County, City of Spokane, and City of Spokane Valley, 2008) and the Ecology Guidance Manual for UIC Wells that Manage Stormwater (Ecology, 2006).
- BMP Classification System - Define a BMP classification system that groups BMPs based on a hierarchy of preferred methods for discharging treated stormwater
- Site Characteristic Maps - Develop maps that identify the site characteristics needed to assess the suitability of a site for locating each classification of BMPs
- Locate, Select, and Size BMPs - Identify locations where BMPs could be located and size the BMP to manage stormwater from the contributing basin area. Identify BMP locations on maps along with whether the area is public, private, or shared.
- Final Report - Develop a final report that summarizes the work completed, recommendations for locating BMPs based on the information available, and identify additional information and work needed to achieve the project goal

Project Location

The University District is located in downtown Spokane. This area is generally bound to the south by I-90, the north by Sinto Avenue (and Sharp Avenue), the west by Division Street (and Browne Street), and to the east by the Spokane River, the BNSF Railroad Tracks, and the Hamilton Street I-90 interchange. This project focuses on the portion of the University District that is located south of the Spokane River (See Figure 1, red boundary) which is referred to as the University District South in this report.

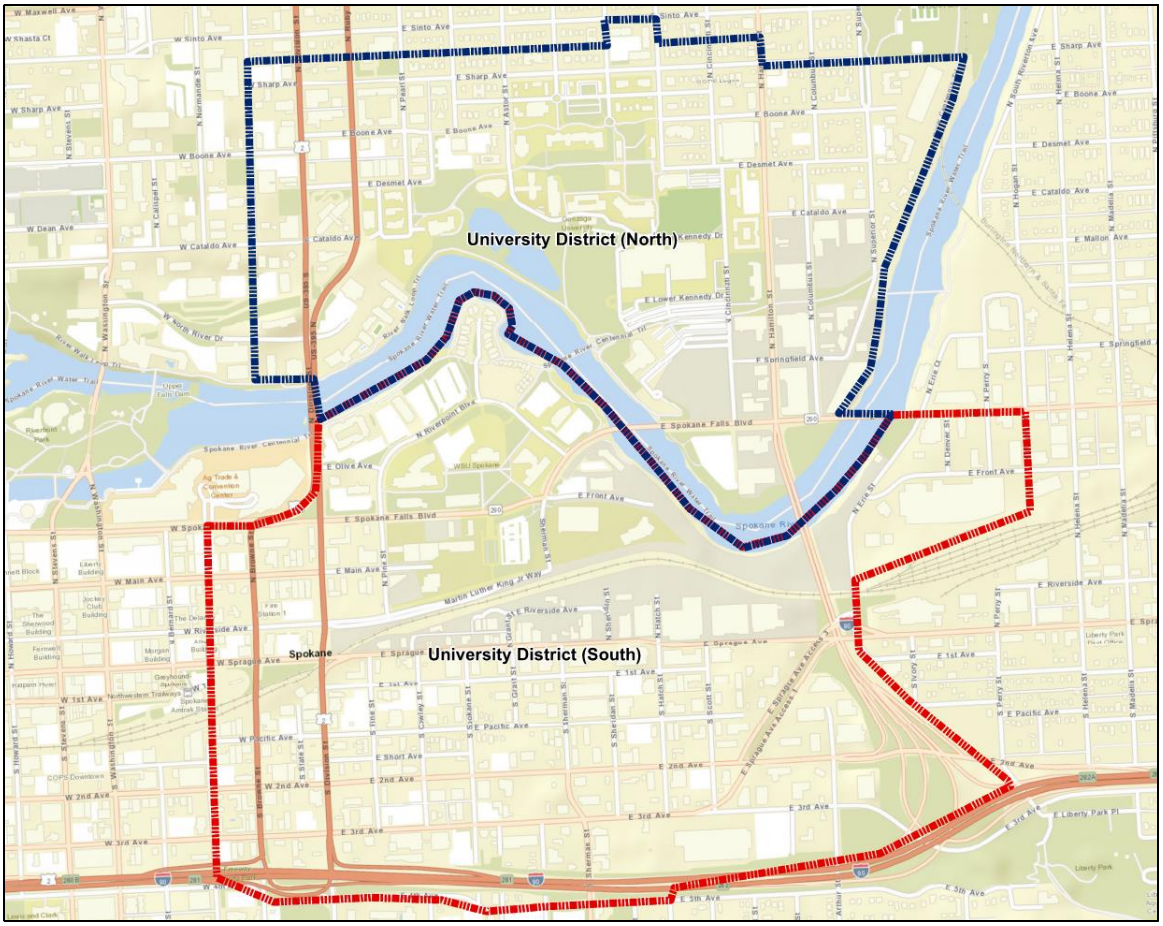


Figure 1. Boundaries of University District North and South

UNIVERSITY DISTRICT MISSION

The Mission of the University District is described on their website as: *"…. to grow business and education in the area while simultaneously creating a healthy and prosperous region. The objective of the University District is to achieve sustainable and highest/best use of the land and river; to engage higher educational institutions; to support competitive opportunities for business and foster entrepreneurship and innovation; and to promote a place of opportunity for all"* (The University District, 2018).

UNIVERSITY DISTRICT STORMWATER MANAGEMENT VISION

The University District vision for stormwater management builds upon the overall mission of the district. Specifically, the principal elements of EcoDistricts which emphasize the integration of stormwater management in the surrounding landscape and the use of green infrastructure (GI) and shared spaces throughout an area. These elements are discussed further in the following sections.

EcoDistricts

EcoDistricts is a nonprofit organization that assists communities in developing equitable, sustainable, and resilient neighborhoods through its programs and certification standard. Communities which use these programs or meet the certification standard are referred to as "EcoDistricts". A district which meets the EcoDistrict designation implements sustainable measures in all areas of the "triple bottom line" which include:

- **Environmentally:** Implement urban development techniques that create the lowest possible environmental impact.
- **Socially:** Create walkable neighborhoods with a diversity of housing types that allow people of all abilities access to basic resources and improve quality of life.
- **Economically:** Ensure economic sustainability by implementing environmental and social systems that provide lasting economic benefits.

These sustainable measures are accomplished through efforts in four core areas: carbon neutral buildings, zero carbon transportation, green infrastructure, and compact, complete neighborhoods (Bennett, 2009).

In the context of stormwater management, an Ecodistrict approach implements measures that: preserve natural hydrologic flows; conserve and restore of habitats and wetlands; provide stormwater flow control and runoff treatment; and retaining the 95th percentile stormwater event on site. An additional element of the EcoDistrict approach is to use landscape features to develop stormwater solutions and integrate nature into urban environments by incorporating best management practices (BMPs) into public spaces. This approach increases the green ratio and reduces stormwater runoff while creating interesting and visually appealing areas.

Note: This EcoDistrict approach aligns with many of the City's requirements for managing stormwater as defined in the Phase II NPDES MS4 permit (Ecology, 2012)*, the UIC rule* (Ecology, 2006)*, and sole source aquifer protection* (Spokane County, City of Spokane, and City of Spokane Valley, 2008)*. As such, using an EcoDistrict approach will support the city in meeting these stormwater management requirements.*

Common measures that support the EcoDistrict approach to managing stormwater include the use of green infrastructure and shared spaces. Both are the focus of the rest of this section.

Green Infrastructure (GI)

Green infrastructure (GI) is a term that can encompass a wide array of stormwater management practices that strive to protect, restore, or mimic the natural water cycle (American Rivers, 2017). Of particular interest to this project are GI best management practices (BMPs). Primary characteristics of these BMPs including replicating the natural functions of landscape by integrating functions like storage, detention, infiltration, evaporation, and transpiration, or uptake by plants. These BMPs are sized to perform stormwater flow control and/or runoff treatment up to the design storm required by regulators and then excess stormwater is rerouted to overflow devices during higher rainfall events to prevent flooding conditions. Dry wells and storm sewer networks are commonly used as an overflow devices.

Cisterns are an example of a GI BMP that are common in EcoDistricts. These BMPs collect treated stormwater runoff which can then be used for non-potable water needs (National Capital Planning Commission, 2014). Other examples of GI BMPs include permeable pavement which increases the pervious area and bioretention areas or bio-infiltration swales which replicate the natural functions of the andscape. Additional examples of GI BMPs are defined in the BMP Palette section of this report.

Shared Spaces

Shared spaces typically refer to areas shared by people and traffic (Hamilton-Baillie, 2008) or areas shared by a community, such as an elementary school's playing fields open to the public (Barton, 2000). In either case, shared spaces are important to achieving the EcoDistrict “triple bottom line” in the University District. Shared spaces increase community connectivity and local autonomy (Barton, 2000). Common examples of shared spaces within EcoDistricts include areas within the right-of-way, parks, libraries, schools, or vacant lots.

In the context of this project, shared spaces for stormwater management are those areas within the right-of-way (i.e., sidewalks, roads, alleys) or other facilities shared by a community which are used to provide some sort of stormwater management (e.g. parking lots and undeveloped land). For example, a shared space might include a bioretention area in the planter strip that is constructed between a sidewalk and a roadway. Alternatively, a shared space could involve a rain garden (bioretention BMP) installed at a library. The rain garden would be maintained by the library and provide stormwater management as well as an educational feature for the library and the public. Examples of shared spaces where GI has been installed in EcoDistricts are shown in Figure 2.

Note: For this project, BMPs were only located in areas within the ROW or on undeveloped land. The reference to shared spaces at public locations such as libraries, school, and parks is included to provide a complete definition of shared spaces as a reference for future projects.

Right of Way: Bike Lane or Medians
Leeds, England

Schools
Sidwell Middle School (Biohabitats, 2018)

Parks
Rodney Cook Sr. Park (EcoDistricts, 2017)

Libraries
Vancouver Public Library (Hydrotech)

Open Spaces along Roads
Mount Alvernia Bioretention Swale

Community Gardens
Millvale Eco-District

Figure 2. Eco-District Case Studies where Green Infrastructure BMPs were Located in Shared Spaces

BMP PALETTE

The BMP palette is a list of BMPs that are preferred for managing stormwater in the University District. These BMPs were selected because:

- The BMP characteristics are consistent with green infrastructure BMPs
- The BMP provides the level of treatment and/or flow control necessary to meet the Phase II NPDES MS 4 permit and UIC rule requirements for the University District
- The BMP can be constructed in ultra-urban area like the University District which are typically constrained by space and higher ratio of impervious areas compared to pervious areas (National Research Council, 2008)

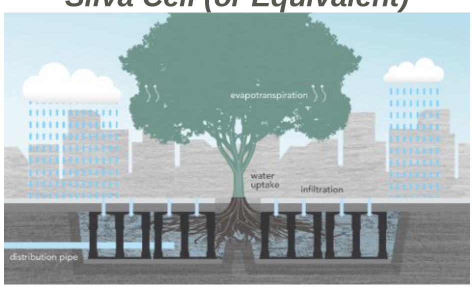
The BMP Palette is comprised of the BMPs listed below. A description and pictures of each BMP is provided on the following pages. BMP highlights are also included that specify the BMP classification category, whether the BMP is considered a GI BMP, and the Ecology approved functions (i.e., runoff treatment and flow control). Specific sizing information for each BMP is included in Appendix C and discussed in detail the *Locate and Size BMP Section* of this report.

- Bioretention
- Bio-infiltration: Vegetated
- Bio-infiltration: Non-Vegetated
- Infiltration Trench
- Permeable Pavement
- Pave Drain (or equivalent system)
- Cisterns
- Modular Wetlands (or equivalent system)
- Silva Cells (or equivalent system)

Table 1. Overview of BMP Palette

BMP Name	BMP Description	BMP Highlights
Bioretention  *Picture Source: City of Spokane*	Bioretention areas are shallow landscaped depressions that use engineered soil mix and plants to provide runoff treatments and flow control. Runoff typically enters the BMP through curb cuts. This BMP is limited to a maximum ponding depth of 6 inches (for the water quality event) and a total BMP depth of 1.5-foot pond. These BMPs contain a layer of treatment soil media at a minimum depth fo 18-inched. The maximum BMP side slopes are 3:1 or may be vertical if the BMP is located in a vault (WSDOT, 2014). Treated stormwater either infiltrates into the existin soils or is conveyed to a storm sewer.	BMP Class: ☑ A ☑ B ☑ C ☑ D ☑ Green Infrastructure BMP ☐ Proprietary Product **Ecology-Approved Function** ☑ Flow Control ☑ Runoff Treatment: ☑ Basic ☑ Metals ☐ Oils ☐ Phosphorus
Bio-Infiltration: Vegetated  *Picture Source: Aimee Navickis-Brasch*	Bio-infiltration ponds or swales combine grasses or other vegetation and soils to remove stormwater pollutants by filtration, soil sorption, and uptake of vegetation. Runoff typically enters the BMP through curb cuts. The pond depth is less than 1.5 feet and the maximum ponding depth is 6 inches for the water quality event. This BMP may include a drywell, set 6 inches above the bottom of the pond, which acts as an overflow during rainfall events that exceed the water quality event. The swale bottom is ≤ 1% with max 3:1 side slope (Ecology, 2004). This BMP is sized using a single event model and the 6 month 24 hour event.	BMP Class: ☑ A ☑ B ☑ C ☑ D ☑ Green Infrastructure BMP ☐ Proprietary Product **Ecology-Approved Function** ☑ Flow Control ☑ Runoff Treatment: ☑ Basic ☑ Metals ☑ Oils ☐ Phosphorus
Bio-Infiltration: Non-Vegetated  *Picture Source:* *(Watershed Management Group, 2012)*	Non-vegetated ponds are the similar to bio-infiltration ponds except vegetation is replaced with rock. This BMP is designed to resemble a dry river bed. This BMP is sized following the same procedures as vegetated bio-infiltration.	BMP Highlights BMP Class: ☑ A ☑ B ☑ C ☑ D ☑ Green Infrastructure BMP ☐ Proprietary Product **Ecology-Approved Function** ☑ Flow Control ☑ Runoff Treatment: ☑ Basic ☑ Metals ☑ Oils ☐ Phosphorus

BMP Name	BMP Description	BMP Highlights
Infiltration Trench  *Picture Source: (SuDS Wales, 2018)*	Infiltration trenches are long, narrow, stone-filled trench used for collection, temporary storage, and infiltration of stormwater runoff. This BMP is often located beneath parking areas or adjacent to linear contributing areas such as roads. Infiltration trenches are best suited for locations without curbs which allows runoff to sheet flow into the BMP. A vegetated filter strip (VFS) upstream of the BMP provides pre-treatment which reduces the BMP maintenance cycle. This BMP is used to provide both flow control and runoff treatment. Infiltration trenches must have a minimum width of 2 feetand a maximum bottom slope of 3%. Infiltration trenches are sized to contain the 10-year 24-hour event with 1-foot a freeboard (WSDOT, 2014) using a single event model.	BMP Class: ☑ A ☑ B ☑ C ☑ D ☑ Green Infrastructure BMP ☐ Proprietary Product **Ecology Approved Function** ☑ Flow Control ☑ Runoff Treatment: ☑ Basic ☑ Metals ☐ Oils ☑ Phosphorus **treatment credit where underlying soils meet treatment criteria*
Permeable Pavement  *Picture Source: (The Spokesman Review, 2016)*	Permeable concrete or asphalt surfaces are an open graded pavement mix placed in a manner that results in a high degree of interstitial spaces within the cemented aggregate. This allows runoff to infiltrate through the pavement and into the sub-soils or an underdrain is located under the pavement which conveys runoff to a storm sewer system. In some locations, the BMP is limited to pedestrian paths and light to medium-load roadways or parking areas (WSDOT, 2014). The pavement slope should be ≤1%.	BMP Class: ☑ A ☑ B ☑ C ☑ D ☑ Green Infrastructure BMP ☐ Proprietary Product **Ecology-Approved Function** ☑ Flow Control ☐ Runoff Treatment*: ☐ Basic ☐ Metals ☐ Oils ☐ Phosphorus **treatment credit where underlying soils meet treatment criteria*
Pave Drain (or Equivalent)  *Picture Source: (Rosewood Community Council, 2012)*	Pave Drain is a proprietary permeable concrete block system. This BMP allows runoff to infiltration between the blocks and the arch design provides temporary storage of stormwater before infiltrating into the sub-soils or runoff maybe collected in an underdrain and conveyed to a storm sewer. The arched reservoir can hold approximately 1" of water per square foot. This product must be placed on a stable base, typically on slopes less than 5%, and can be used in parking lots, low speed roadways, alley ways, emergency access lanes, intersections, and residential driveways.	BMP Class: ☑ A ☑ B ☑ C ☑ D ☑ Green Infrastructure BMP ☑ Proprietary Product **Ecology-Approved Function** ☑ Flow Control ☐ Runoff Treatment*: ☐ Basic ☐ Metals ☐ Oils ☐ Phosphorus **treatment credit where underlying soils meet treatment criteria*

BMP Name	BMP Description	BMP Highlights
Cistern  *Picture Source: (Contech, 2018)*	Cisterns are used to collect runoff from conveyance pipes including roofs. Most cisterns are constructed of plastic, steel, or concrete. Cisterns can provide flow control benefits by capturing, storing, and reuse which slows the release of stormwater runoff rates. Standard manufacturer's sizes range from approximately 2000 gallons to 22,500 gallons, and cisterns are sized based upon volume of runoff from the contributing basin area and the targeted discharge flow rate. They may be installed below or above ground. This BMP does not provide treatment instead a runoff treatment BMP should be located upstream of the cistern and prior to discharging into the cistern.	BMP Class: ☐ A ☐ B ☑ C ☑ D ☑ Green Infrastructure BMP ☐ Proprietary Product **Ecology-Approved Function** ☑ Flow Control ☐ Runoff Treatment: ☐ Basic ☐ Metals ☐ Oils ☐ Phosphorus
Modular Wetland (or Equivalent)  *Picture Source: (Bio Clean, 2018)*	Modular wetlands are a versatile biofiltration system that allow for stormwater management in ultra-urban areas. This BMP can be configured to accept flow through curb cute, grates, vaults, and downspouts. Treatment is provided as runoff enters a pre-treatment chamber, then flows horizontally through the wetland media, and discharge through an outlet pipe with an orifice plate to control the flow of water (Bio Clean, 2018). Runoff is typically discharged to a storm sewer or a detention BMP such as the cistern. This BMP is sized based on a contributing basin area hydraulic loading of 1 gpm per sqft of wetland cell surface area.	BMP Class: ☐ A ☐ B ☑ C ☑ D ☑ Green Infrastructure BMP ☑ Proprietary Product **Ecology-Approved Function** ☑ Flow Control ☑ Runoff Treatment: ☑ Basic ☑ Metals ☐ Oils ☑ Phosphorus
Silva Cell (or Equivalent)  *Picture Source: (Deeproot, 2018)*	Silva Cell is approved by Ecology as functionally equivalent to a bioretention cell and should be designed using the same methods. The cells can be configured to provide storage for infiltration or detention and release to storm sewers or infiltration into the ground. This BMP provides large volumes underground for stormwater management through absorption, evapotranspiration, and interception (Deeproot, 2018). Treatment occurs as runoff flows through bioretention soils and flow rates are reduced through infiltration. Silva cell comes in 3 sizes (min. 10 cells per application). Each cell = 10 sqft of treatment area.	BMP Class: ☑ A ☑ B ☑ C ☑ D ☑ Green Infrastructure BMP ☑ Proprietary Product **Ecology-Approved Function** ☑ Flow Control ☑ Runoff Treatment: ☑ Basic ☑ Metals ☐ Oils ☐ Phosphorus

SITE SUITABILITY ASSESSMENT

A site suitability assessment was performed for the purpose of identifying potential areas for locating BMPs in the University District South. The site suitability assessment process essentially compares the site characteristics required to locate a BMP to the actual characteristics at the proposed site. If the actual site characteristics meet or exceed the required characteristics, the site is considered suitable for locating the BMP and the next step is to select and size a BMP. If the actual site characteristics do not meet the required characteristics, the site is not suitable for locating the BMP. The site suitability assessment process was developed to guide decisions that will determine suitability. The selected process is illustrated in Appendix A (Figure 3). The primary components of the assessment process are summarized below and the remainder of this section provides a discussion on each component.

- Define a <u>BMP classification system</u> that groups BMPs based on a hierarchy of preferred methods for discharging treated stormwater
- Define a <u>site suitability criteria</u> that identifies the site characteristics required for locating each BMP classification at a proposed site and meets the City's' NPDES MS4, UIC rule, and sole source aquifer protection requirements for stormwater management. These requirements are defined in the Spokane Regional Stormwater Manual (Spokane County, City of Spokane, and City of Spokane Valley, 2008) and the Ecology Guidance Manual for UIC Wells that Manage Stormwater (Ecology, 2006).
- Develop <u>maps that identify the site characteristics</u> needed to assess whether the site is suitable for locating each classification of BMPs

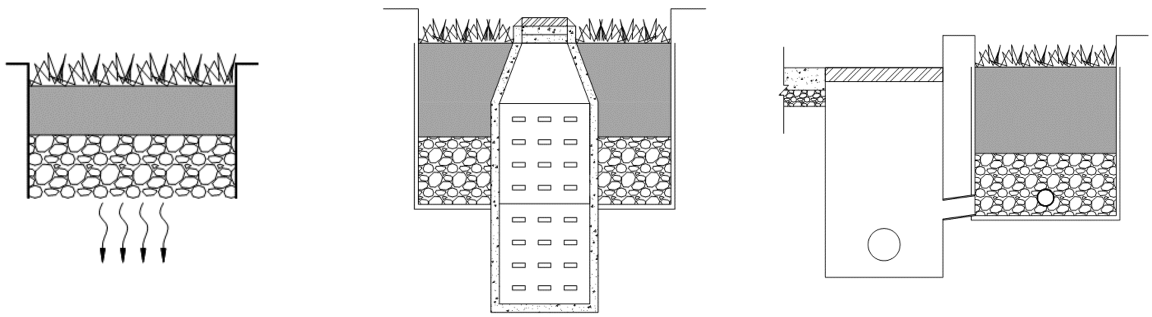
BMP Classification System

The BMP classification system groups BMPs based on a hierarchy of preferred methods for discharging treated stormwater runoff (Figure 4). Discharge methods identified for this project include: infiltration, infiltration via drywell, and discharge to storm or combined sewer. The following outlines four BMP classifications relative to the site suitability:

- **Class A BMP:** Site is Suitable for BMPs that infiltrate treated runoff
- **Class B BMP:** Site is suitable for BMPs that discharge treated runoff to a drywell
- **Class C BMP:** Site is suitable for BMPs that discharge treated runoff to a storm sewer
- **Class D BMP:** Site is suitable for BMPs that discharge treated runoff to a combined sewer

The BMPs are listed in order of preference. Class A BMPs are the most preferred because these BMPs manage stormwater by mimicking that natural processes, specifically infiltrating the runoff contributing to the BMP. Class C and D BMPs are the least preferred because runoff treated from these BMPs are collected and conveyed to another location which alters the natural hydrology of the site. This process of BMP selection is consistent the selection process outlined in the Ecology Stormwater Management Manuals.

The first step in the site suitability assessment is to determine which BMP Classification is suitable for the proposed site. The site suitability criteria is specific to each BMP class and the assessment starts with Class A BMPs and then proceeds to the next class until a the site is determined suitable for locating that BMP Class. If the site is not suitable for any of the BMP classifications, then it is assumed that the site is not suitable for managing stormwater on-site and off-site options should be considered.



Class A BMPs | Class B BMPs | Class C & D BMPs

Figure 4. Example of BMP Classifications

NPDES and UIC Requirements

The site suitability criteria defined for each class of BMP aligns with the City's requirements for stormwater management as defined in the Phase II NPDES MS4 permit (Ecology, 2012), the Eastern Washington Stormwater Management Manual (Ecology, 2004), and the Ecology Guidance Document for UIC wells that Manage Stormwater (Ecology, 2006). Specifically, the site suitability criteria for Class A and B BMPs is the same criteria that is used to determine whether the site characteristics are suitable for locating an infiltration BMP in the Spokane Regional Stormwater Manual (Spokane County, City of Spokane, and City of Spokane Valley, 2008). In addition, the criteria defined in the UIC guidance document for determining the pre-treatment and vadose zone requirements for stormwater runoff to drywells, is also embedded in the site suitability criteria for this project. However the criteria with respect to UICs has been simplified. For this project BMPs will always be located upstream of a drywell and provide treatment of runoff from the water quality rainfall event (6 month 24 hour), which is equivalent to the volume of runoff from 91% of the rainfall events, prior to discharging to drywells. As such, the vadose zone requirements are achieved with this upstream BMP and only a 5-foot separation is required between the base of the drywell and groundwater or the impermeable layer. With this approach it is not necessary to assess the vadose zone treatment capacity relative to the pollutant loading to determine the pretreatment requirements or assess whether a separation greater than 5-feet is required between the base of the drywell and the groundwater or impermeable layer elevation. Instead a BMP is selected that provides the required treatment for the UIC based on the pollutant loading at the project site (Map 8) and the required treatment is provided before runoff is discharged to the UIC.

Site Characteristic Maps

The site characteristics necessary to conduct the site suitability assessment for the University District South were identified on Maps to streamline the assessment process. A total of tens maps were developed which are located in Appendix A and briefly described in Table 2. The sources of information used to develop the maps is located in Appendix B.

Table 2. List of Maps Developed and Application in Site Suitability Assessment

Map Title & Description
Map 1. Project Location Map Map illustrates the limits for the University District North and South
Map 2. Land Areas Identifies areas that are public, private, and shared. Where: • Public areas are owned by government agencies (i.e. City of Spokane) • Private areas are owned by other than government agencies, including Avista • Potential shared areas include: ROW (planter strip, bike lane buffer, median), Undeveloped Land/Open spaces along roads/highways, Publicly owned land
Map 3. Locations Not Suitable for Infiltration BMPs Includes land areas that are either protected or considered unbuildable areas for BMPs. These items are part of SSC and only apply to BMPs that infiltrate. This includes the location of the following items: Contaminated soils, Wetlands, 100 year flood zone, Railroad Right-of-Way, Slopes >15%, Existing buildings and minimum building setbacks, and drain tile buffers *Note: Ecology defines constraints regarding the location of a BMP with respect to drinking wells and native plant/growth protection areas. However, none were located within the project area.*
Map 4. Depth to Groundwater Includes groundwater level information such as: • Depth to groundwater measurements obtained during geotechnical borings for the City • High-level groundwater depth for the area according to Web Soil Survey • Locations of historic lakes circa 1883, where groundwater elevations are expected to be closer to the surface
Map 5. Depth to Impermeable Layer Includes information regarding depth to impermeable layers, such as: • Reported location of geotechnical borings and associated depth to impermeable measurements taken during borings • Profile of impermeable layers, along sewer alignments in the University District South • High-level depth to bedrock for according to Web Soil Survey
Map 6. Saturated Hydraulic Conductivity (Ksat) Includes Ksat data for the project area, such as: • High-level Ksat according to geotechnical studies and Web Soil Survey • Calculated Ksat values from geotechnical study data using the D200 Method (Spokane County, City of Spokane, and City of Spokane Valley, 2008) The Ksat for the project area is assumed to be greater than 14-inches/hour. This assumption is consistent with Ksat values reported by soil web survey as well findings reported in geotechnical studies (see appendix B for a full list of the geotechnical reports).

Map 7. Existing Stormwater Features This map identifies the location of existing stormwater features for the purpose of determining where BMPs are needed (areas without BMPs). This map is also used to assess site suitability for class C and D BMPs (identify whether a storm or combined sewer system is located near the project site. Catch basins, drywells, outfalls, clean water connections, etc. are also shown.
Map 8. Runoff Treatment Requirements Map 8 identifies the runoff treatment requirements based on the land use as defined in the NPDES MS4 permit and the UIC rule. The treatment classes for parking lots was determined by counting the number of parking spaces (using Google Earth) and estimating the number of trip ends based on whether parking is provided for commercial or residential areas. For example, it was assumed that commercial businesses have more trip ends than residences.
Map 9. Contributing Basin Areas The basin areas for proposed BMPs were delineated for undeveloped land and areas within the city ROW (sidewalks and roads). The delineation was determined using the topography information provided by the City of Spokane. The basin information was then used to size the proposed BMPs. The delineated areas did not include any run-on from other areas including roofs drains and alleys.
Map 10. Proposed BMP Locations This map identifies the sites that are suitable for locating a BMP along with the BMP identification number. Specific sizing information for each BMP is located in Appendix D.

SELECT AND SIZE BMPS

Once a site was determined suitable for a BMP classification, the next step was to select a BMP from the BMP palette. Then the runoff treatment required at the proposed site was identified (Map 8) and compared to the Ecology approved BMP runoff treatment function. If the required treatment was not provided by the BMP, another BMP was selected. If the required treatment was provided, the next step was to size the BMP. Appendix C defines the methods for sizing BMPs. The BMP were designed using graphs with predetermined sizing information for a range of basins and infiltration rates. After the BMP was sized, the proposed BMP location and contributing basin area were identified on Map 10 and the BMP sizing information was summarized in Appendix D Table.

A note about saturated hydraulic conductivity (Ksat) vs infiltration rate for this project:
Infiltration rates are typically determined by field measurements or calculated using Darcy's Law which relies on knowledge of Ksat and the groundwater elevation. For this project, limited data was located that defined the infiltration rate, Ksat, and/or depth to groundwater (during traditionally high ground elevations) in the University District. Since infiltration rates from the proposed site are needed to size BMPs, the rate was assumed to be 1.5-in/hr for all the BMPs. This assumption seems reasonable because most of the BMPs include a layer of treatment soil and the design or long term infiltration rate for this soil is 1.5-in/hr as defined the Eastern Washington Low Impact Development Manual (AHBL & HDR, 2013). For Class C/D BMPs this assumption should provide a representative BMP size. For Class A/B BMPs, the BMP size may need to be adjusted once additional subsurface information is measured for a proposed site.

ADDITIONAL INFORMATION NEEDED

More information is needed to that defines the ground water depth, infiltration rate, and Ksat for the University District South. Specifically: 1) install monitoring wells and record groundwater elevations for more than one year and 2) conduct in-situ testing to determine area infiltration rates and/or use soil sample gradations from the area to calculate Ksat using the D200 method (Spokane County, City of Spokane, and City of Spokane Valley, 2008).

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APPENDIX A. MAPS

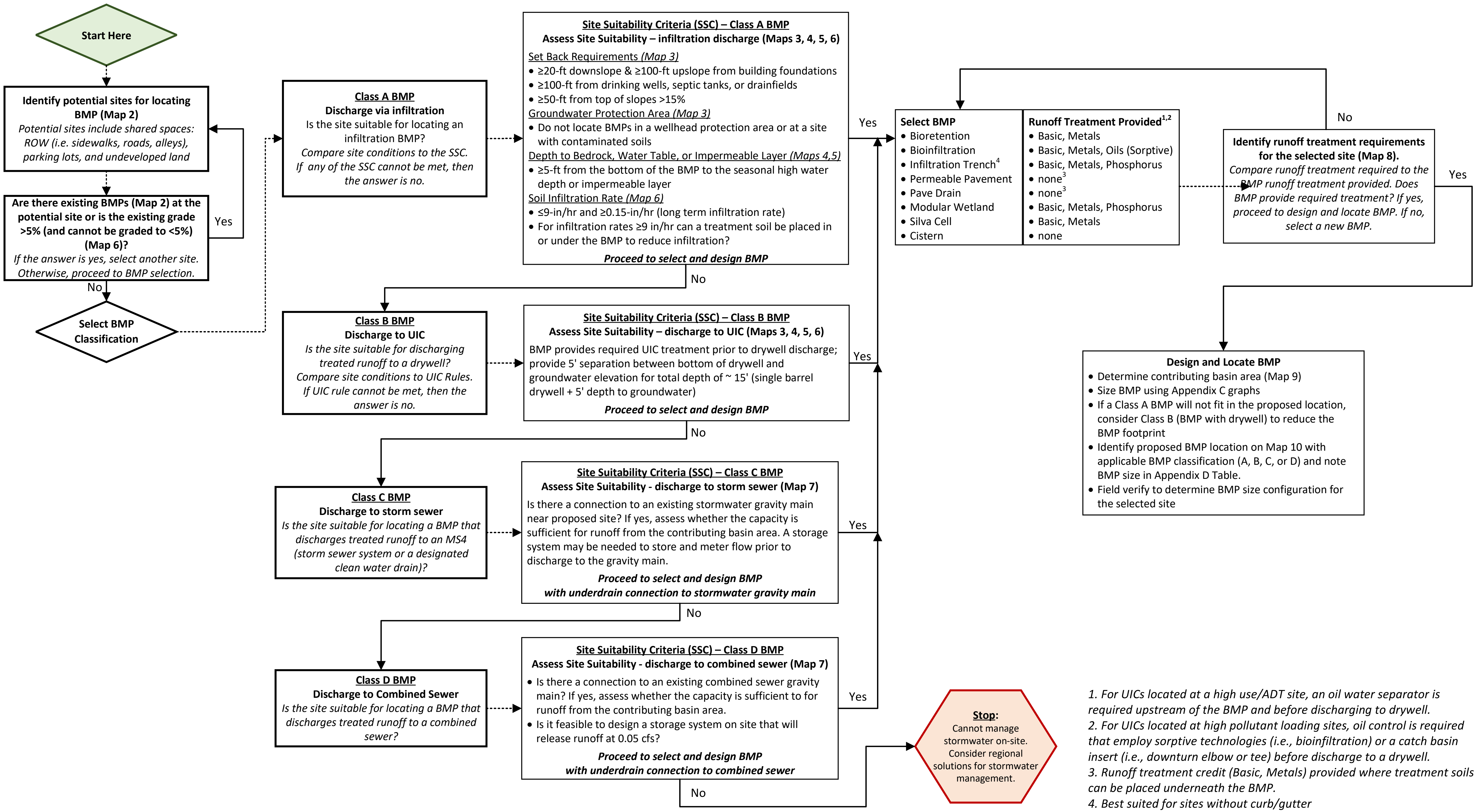
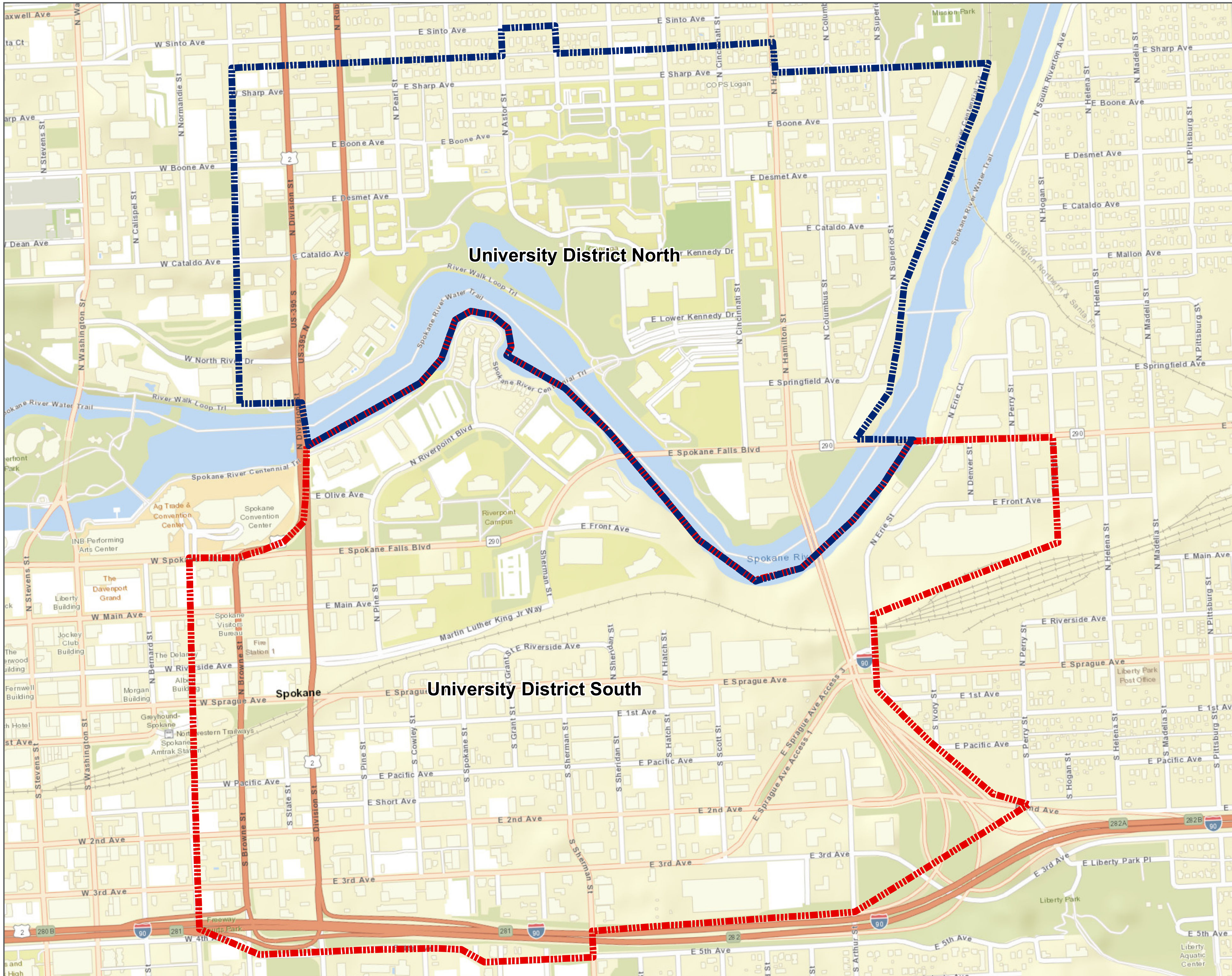
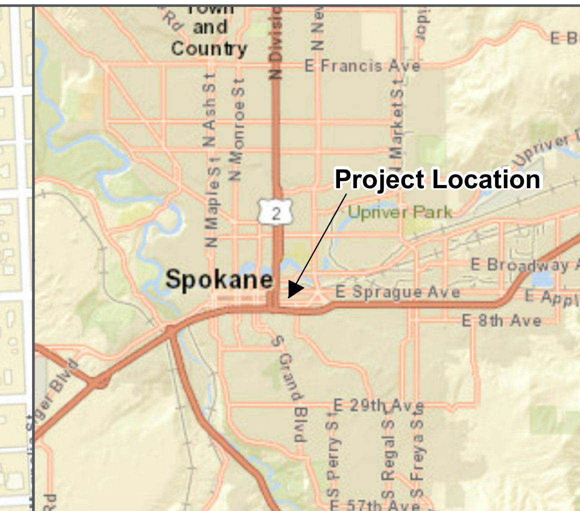


Figure 3. Site Suitability Assessment for Locating BMPs in the University District South





UNIVERSITY DISTRICT SOUTH: STORMWATER SITE SUITABILITY ASSESSMENT

Map 1: Project Location

Legend

- University District North
- University District South - Project Area

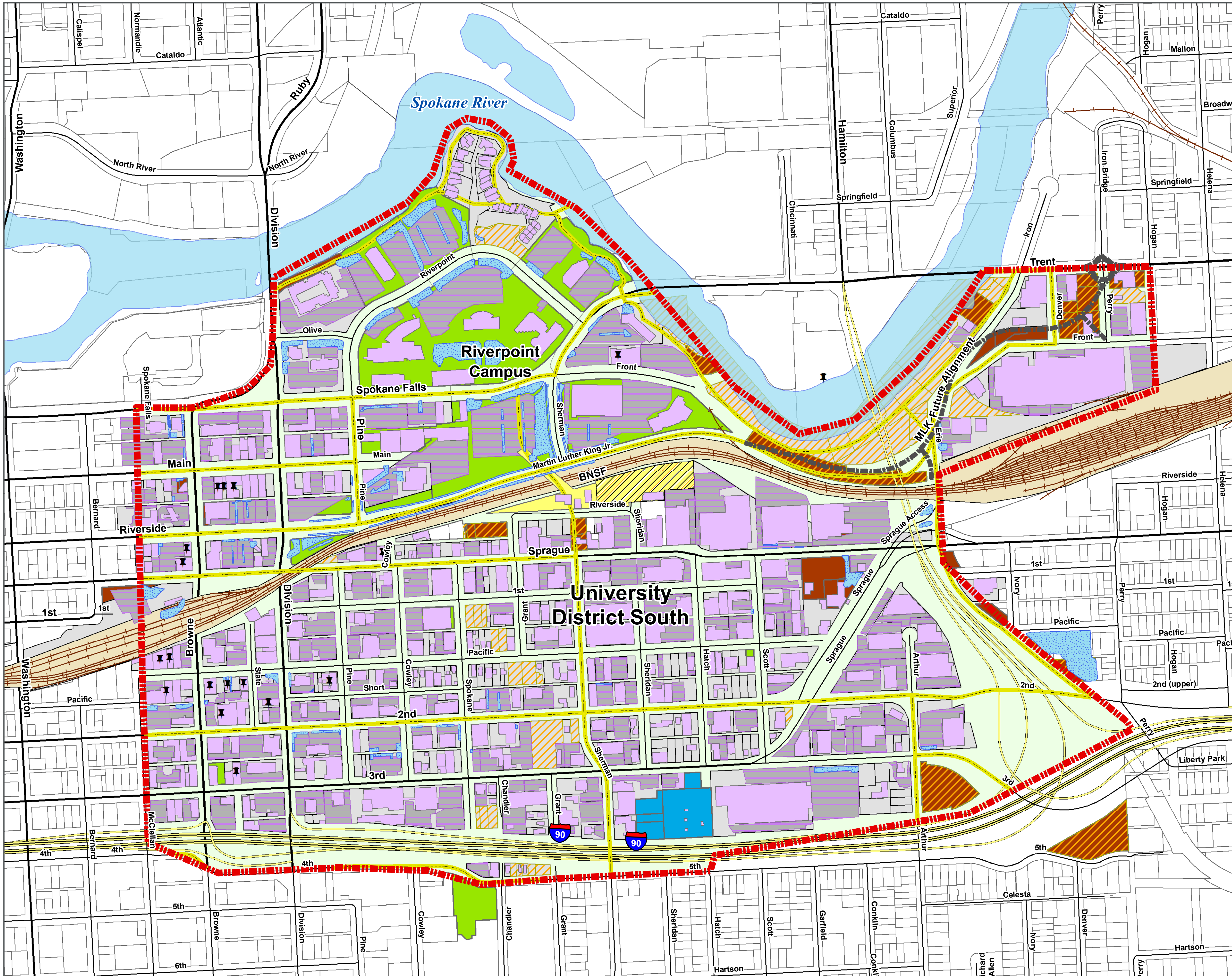
DATA SOURCES:
ESRI basemaps
www.spokaneudistrict.org

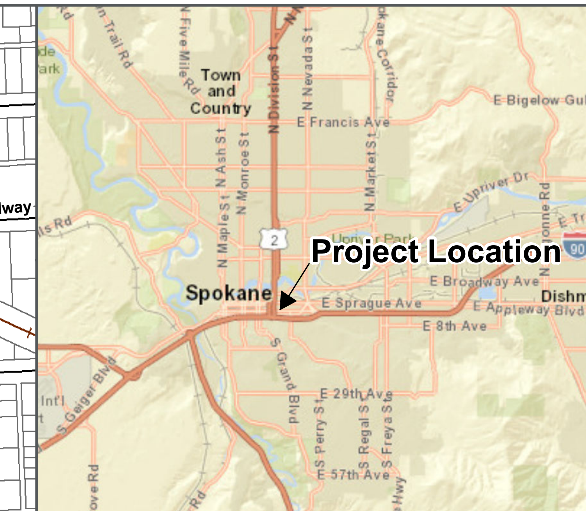
0 375 750 1,500 Feet

Date: 3/16/2018

HDR

PATH: G:\PROJECTS\WASHINGTON\CITY_OF_SPOKANE_003124\UNIV_DIST_SOUTH_SW_10091890\7.2_WP\MAP_DOCS\MAP1OVERVIEW_ESRI.MXD - USER: EDICUS - DATE: 3/16/2018





UNIVERSITY DISTRICT SOUTH: STORMWATER SITE SUITABILITY ASSESSMENT

Map 2: Land Areas

LEGEND

- Project Location
- Historic Site
- Future Alignment of MLK Blvd
- Railroad ROW
- Proposed Bike Path
- Parking Lot Footprint
- Building Footprint
- Undeveloped
- Catalyst Project - Stage 1
- Catalyst Project - Pedestrian Bridge and Landing
- Existing BMP - Varying Types
- Potential Shared Space in city ROW (Roads, Sidewalks, and Alleys)

Parcels by Ownership Type

- Avista
- City of Spokane
- Potential Shared Space (Publicly Owned)
- Private

DATA SOURCES:
Spokane County Assessor
City of Spokane GIS
www.catalystspokane.com
Spokane Historic Preservation Office

0 300 600 1,200 Feet

Date: 6/14/2018

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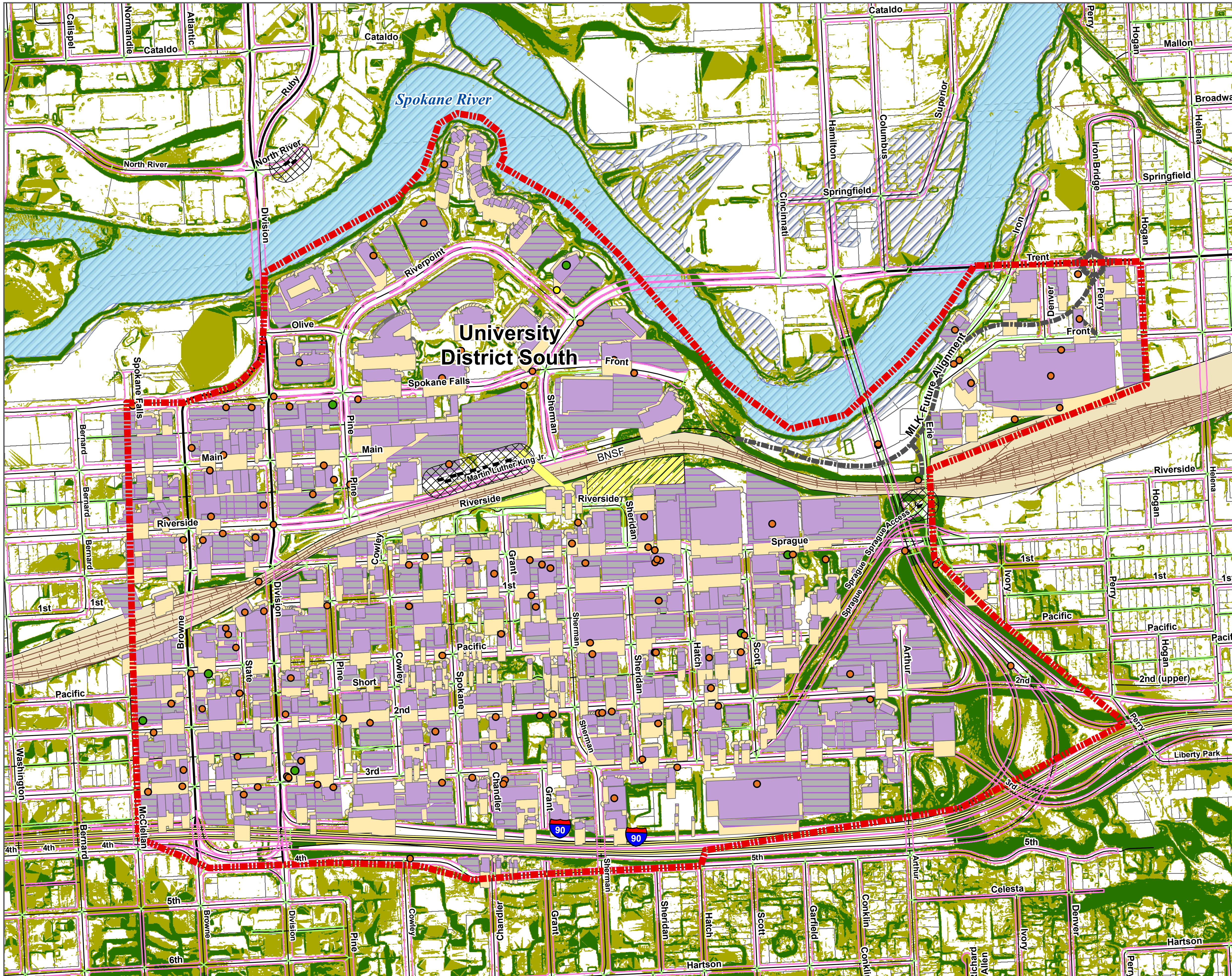

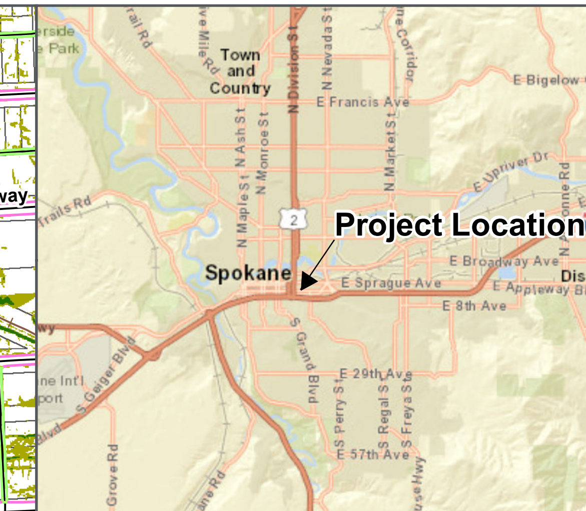

UNIVERSITY DISTRICT SOUTH: STORMWATER SITE SUITABILITY ASSESSMENT

Map 3: Locations Not Suitable for Infiltration BMPs

- Project Location
- Future Alignment of MLK Blvd
- Building Footprints
- Parking Lot Footprints
- Catalyst Project - Stage 1
- Catalyst Project - Pedestrian Bridge and Landing
- FEMA 100 Year Flood Zone
- Drain Tile Buffer
- No Curb
- Curb Present

Slope

- Potentially Suitable for Locating Class 'A' or Class 'B' BMP
- Slopes 5 - 15%
- Slopes >15%

Dept of Ecology Contaminated Site Status

- Awaiting Cleanup
- Cleanup Started
- Unknown Status

DATA SOURCES:
City of Spokane GIS
WA Department of Ecology

0 300 600 1,200 Feet

Date: 6/14/2018

HDR

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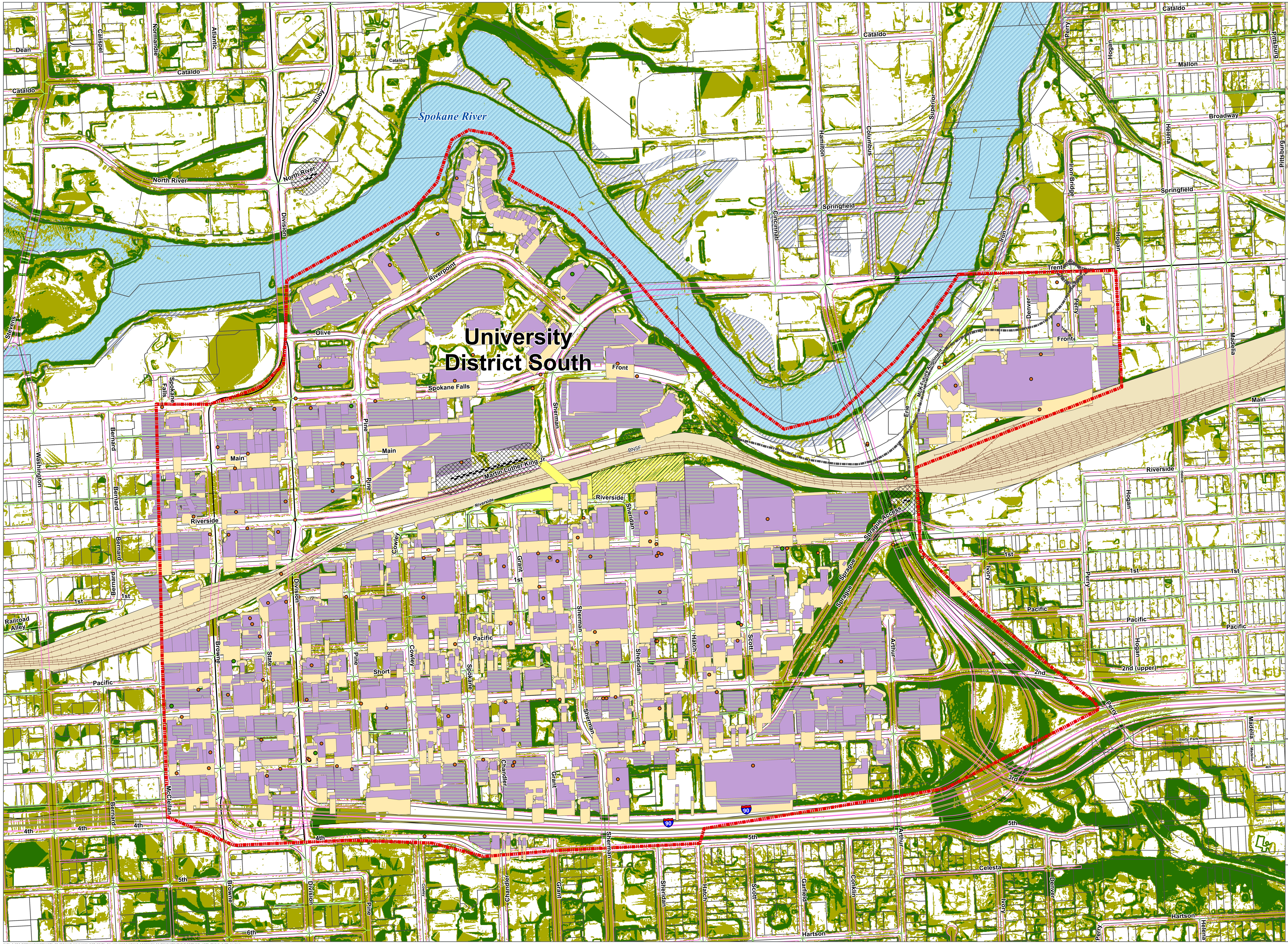
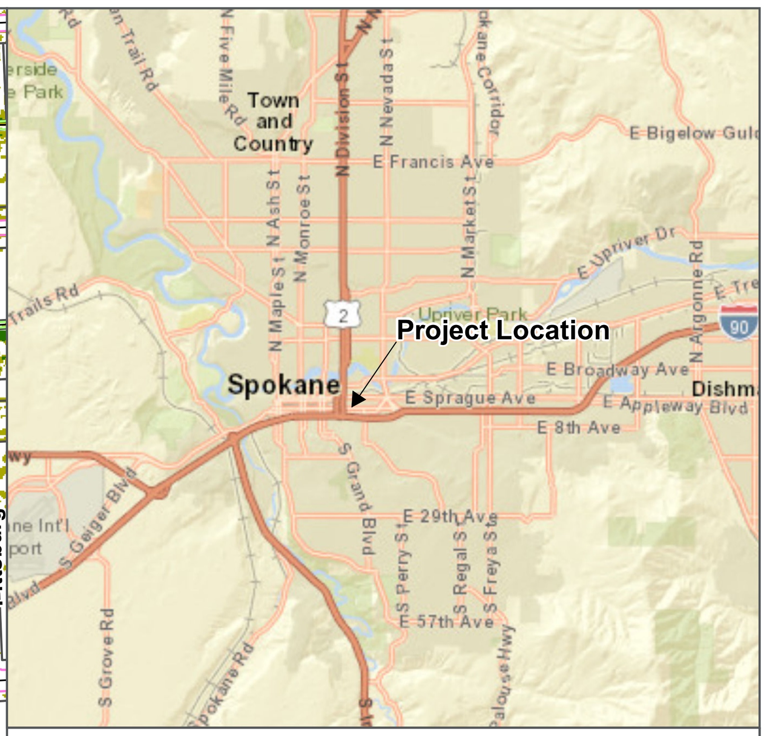




UNIVERSITY DISTRICT SOUTH: STORMWATER SITE SUITABILITY ASSESSMENT

Map 3: Locations Not Suitable for Infiltration BMPs

LEGEND

- Project Location
- Future Alignment of MLK Blvd
- Railroad ROW
- Catalyst Project - Stage 1
- Catalyst Project - Pedestrian Bridge and Landing
- Building Footprints
- Parking Lot Footprints
- Minimum Building Offset
- No Curb
- Curb Present
- FEMA 100 Year Flood Zone
- Drain Tile Buffer

Slope

- Potentially Suitable for Locating Class 'A' or Class 'B' BMP
- Slopes 5 - 15%
- Slopes >15%

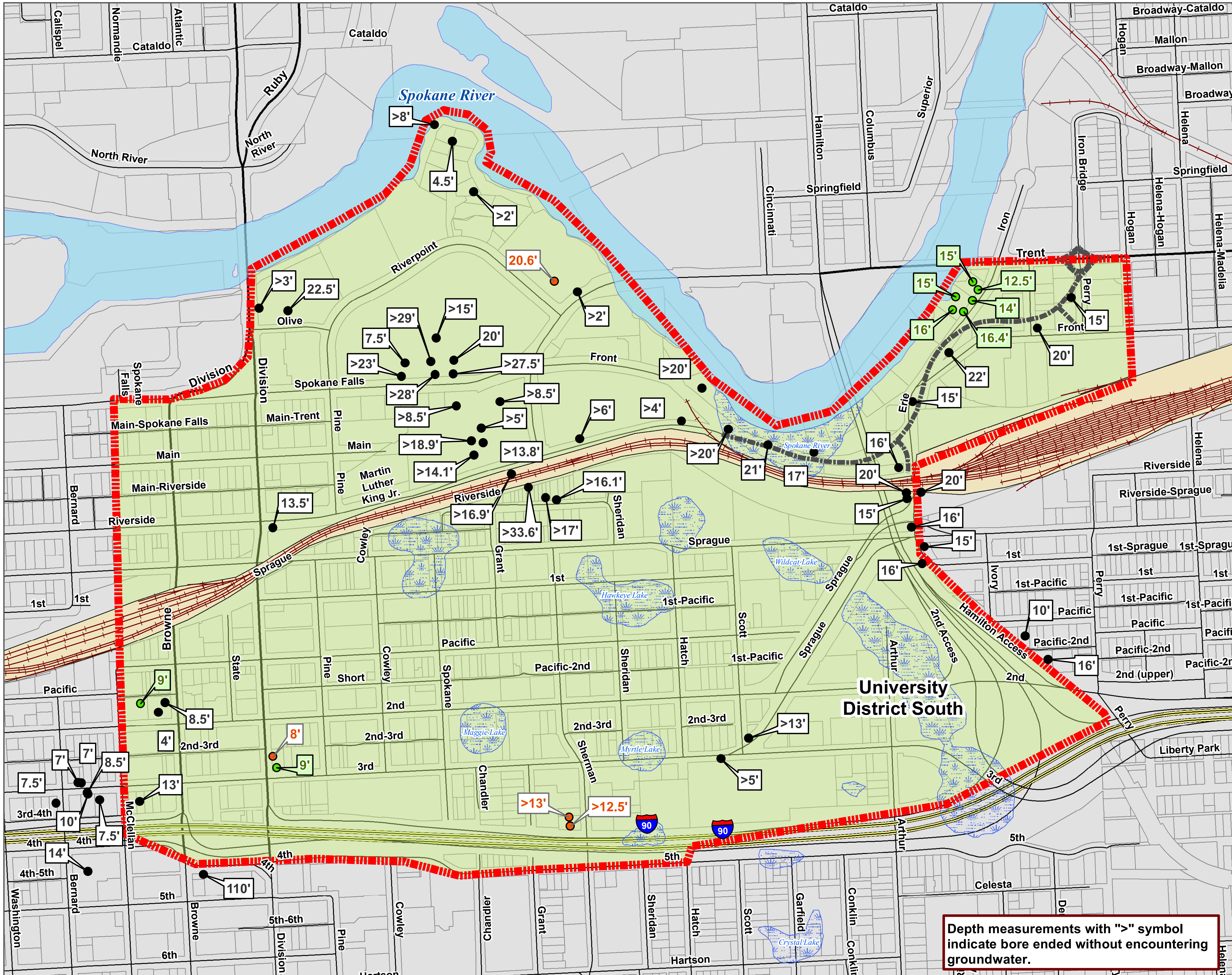
Dept of Ecology Contaminated Site Status

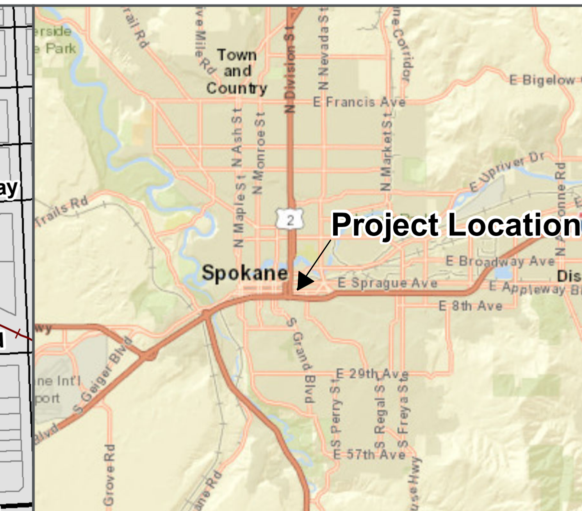
- Awaiting Cleanup
- Cleanup Started
- Unknown Status

DATA SOURCES:
City of Spokane GIS
WA Department of Ecology

0 250 500 1,000 Feet

Date: 6/14/2018





UNIVERSITY DISTRICT SOUTH: STORMWATER SITE SUITABILITY ASSESSMENT

Map 4: Depth to Groundwater

Legend

- Project Location
- Future Alignment of MLK Blvd
- Railroad ROW
- Historic Lake circa 1883 - assume high groundwater

Ground Water Measurement Taken

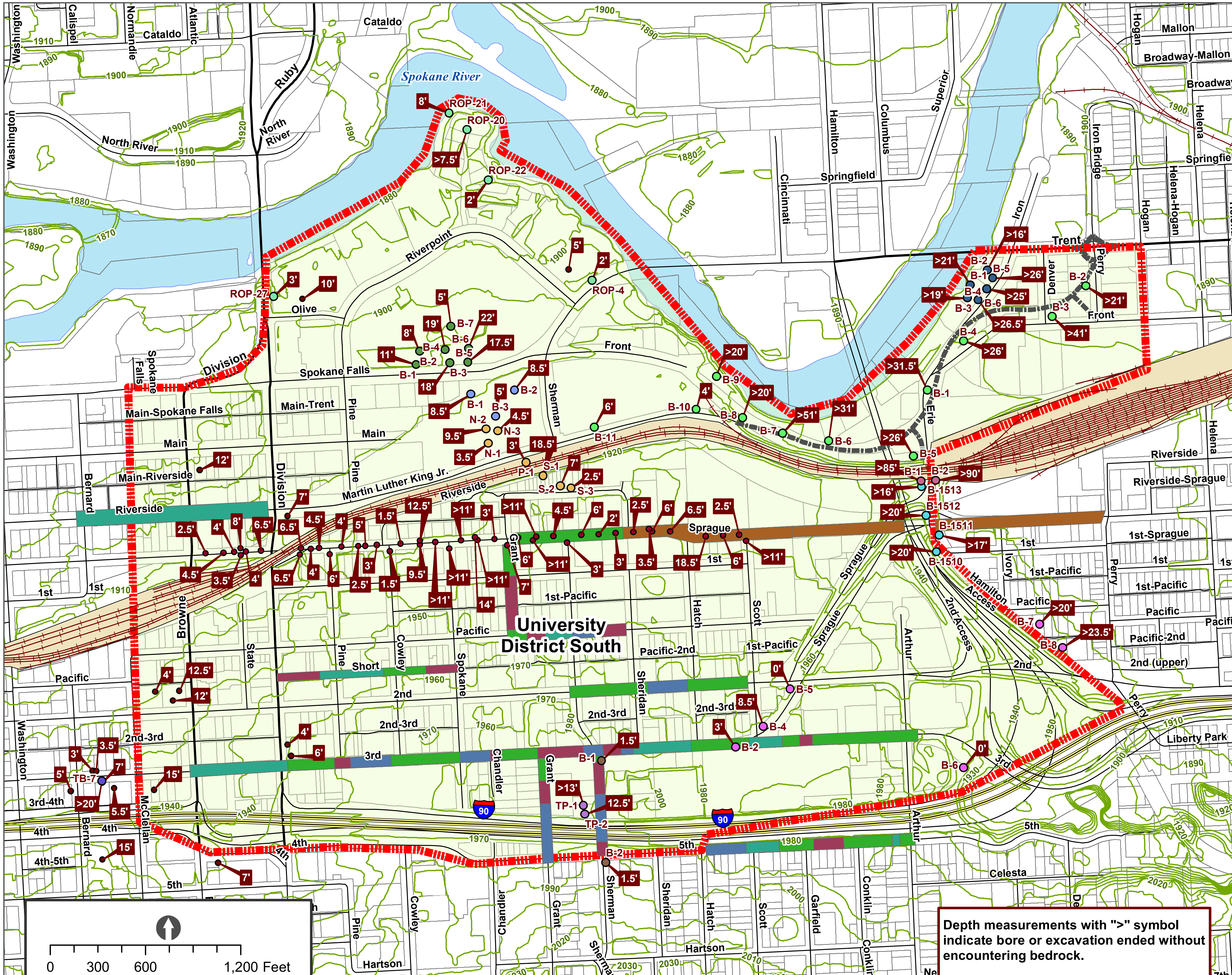
- April or May
- March or June
- Summer, Fall, Winter, or Unknown
- Depth >/= 6.5ft per Soil Web Survey

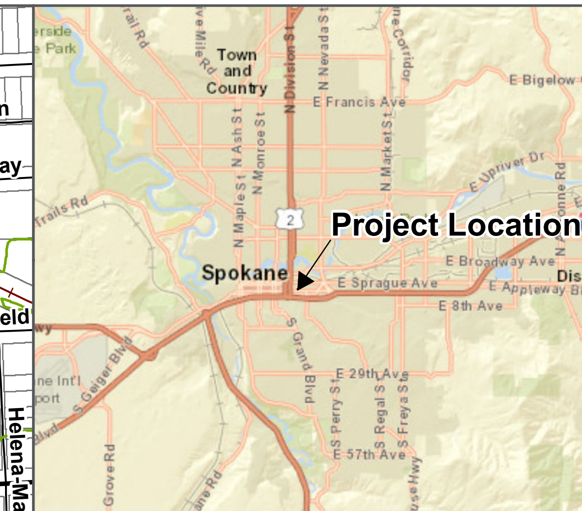
DATA SOURCES:
City of Spokane GIS
City of Spokane Stormwater GeoReports
City of Spokane Infiltration Research for Downtown Area

0 300 600 1,200 Feet

Date: 6/14/2018

PATH: G:\PROJECTS\WASHINGTON\CITY_OF_SPOKANE_003124\UNIV_DIST_SOUTH_SW_10091890\7.2_WIP\MAP_DOCS\MAP4GROUNDWATERDEPTH.MXD - USER: EDICUS - DATE: 6/14/2018





UNIVERSITY DISTRICT SOUTH: STORMWATER SITE SUITABILITY ASSESSMENT

Map 5A: Depth to Impermeable Layer

- Surface Contour 10' Interval
- MLK Future Alignment

Geotech Report

- 3rd at Cedar and McClellan
- Biomedical and Health Sciences Bldg Geotech
- CSO Basin 33-1 Budinger and Associates
- Erie Street
- Erie from 1st to MLK Stormwater
- MLK Phase II - GCR Geotechnical Conditions Report
- Riverpoint Geotech
- SE Blvd 29th and Sherman Geotech Report
- STM096 Trent Ave directly across from Riverpoint
- Sherman, 336 S Geotech
- U-District Bridge
- Union Basin

Bedrock Depth per Sewer Records

- 0/At Surface
- 0 to 5ft
- 5 to 10ft
- >5ft
- >10ft
- >/= 6.5ft per Soil Web Survey

DATA SOURCES:
City of Spokane GIS
City of Spokane Stormwater GeoReports
City of Spokane Infiltration Research for Downtown Area

Date: 6/14/2018

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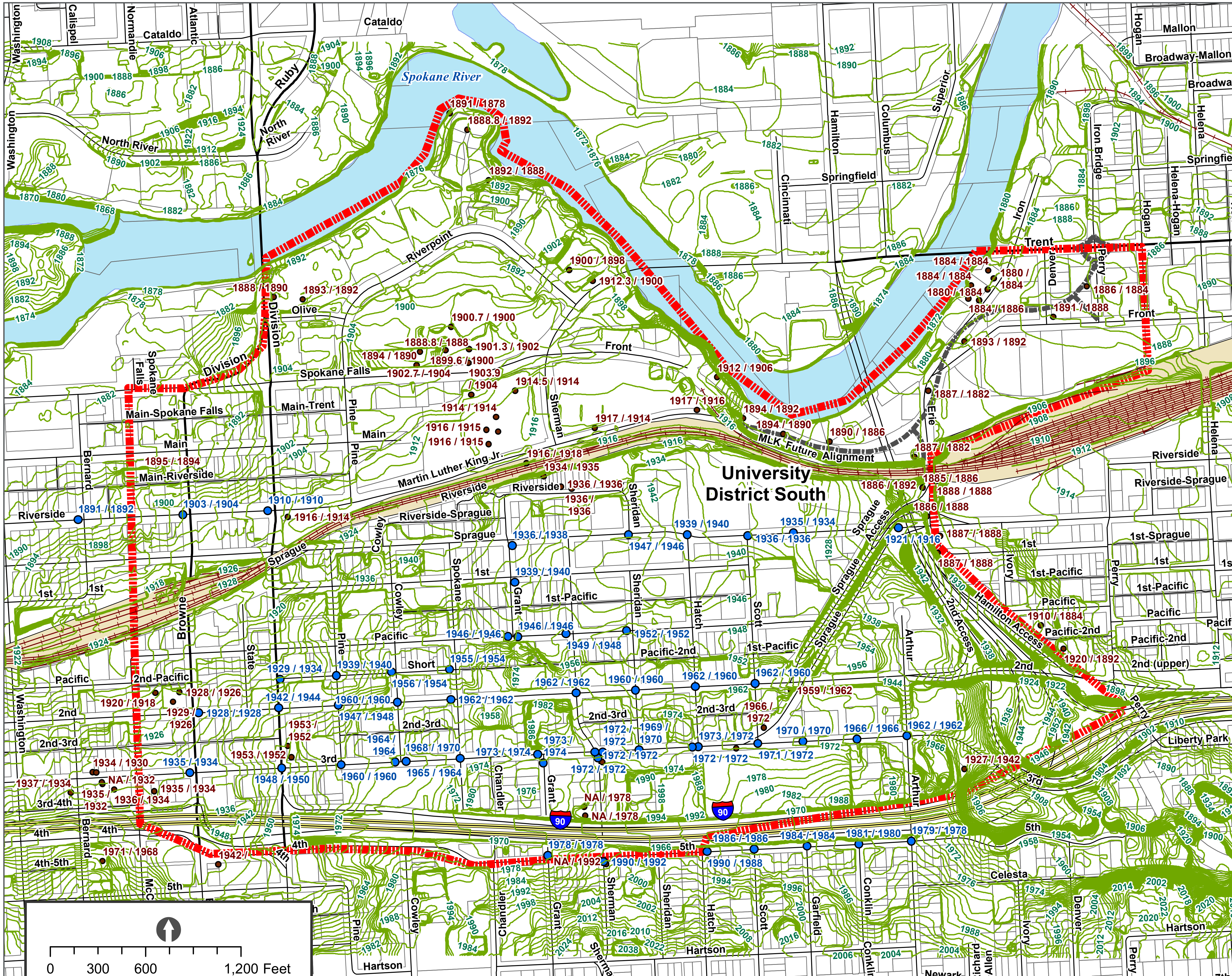

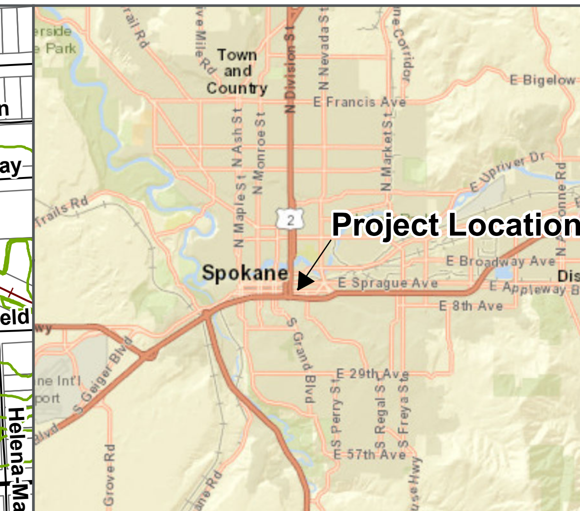

UNIVERSITY DISTRICT SOUTH:
STORMWATER SITE SUITABILITY ASSESSMENT

Map 5B: Surface Elevations

- Project Location
- MLK Future Alignment
- 2' contour
- Elevation from Geotech Reports
- Elevation From Historic Sewer Records

Elevations are labeled as follows:
Field Measurement/Contour Elevation

Surface elevations were taken from 1898 to 2015.
The elevations taken from the Historic Sewer Records were originally taken using NAD27 coordinates, and have been adjusted to NAD83 by subtracting 13 from the value.
Contour elevations are based on 2007 topography data provided by City of Spokane GIS.

DATA SOURCES:
City of Spokane GIS
City of Spokane Stormwater GeoReports
City of Spokane Infiltration Research for Downtown Area

Date: 6/14/2018

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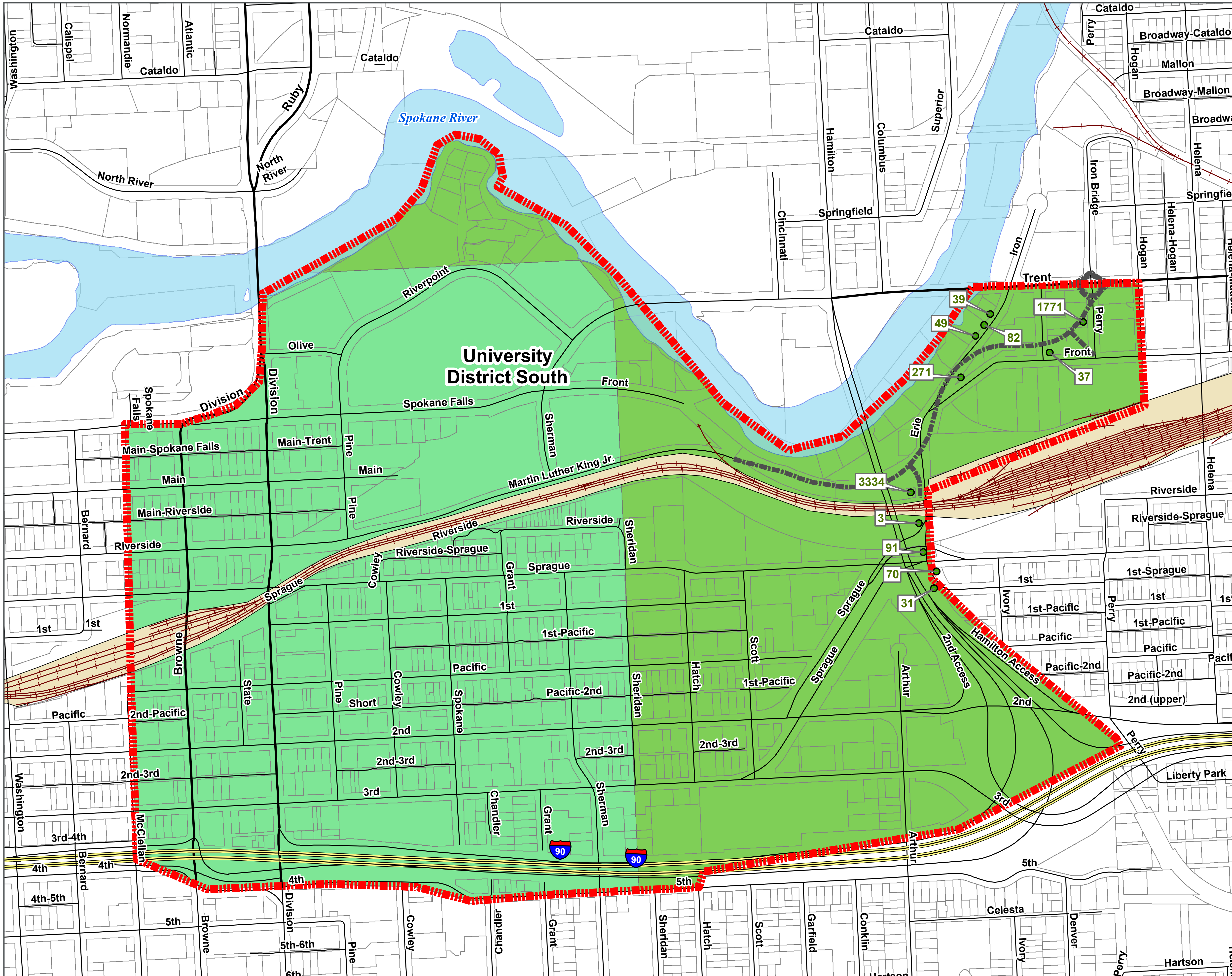
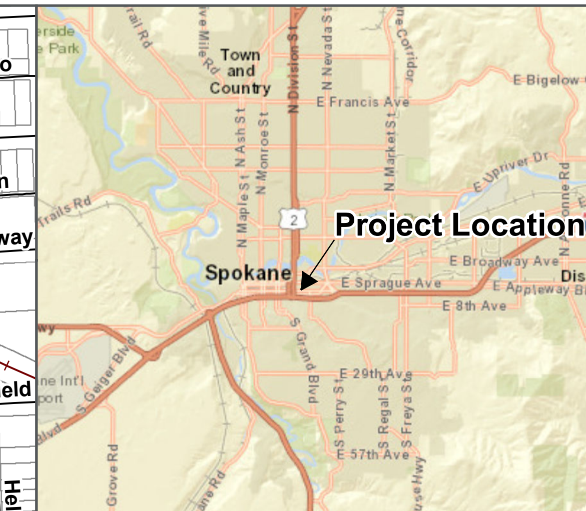




UNIVERSITY DISTRICT SOUTH: STORMWATER SITE SUITABILITY ASSESSMENT

Map 6: Saturated Hydraulic Conductivity

Legend

- Project Location
- Future Alignment of MLK Blvd
- Railroad ROW

Ksat

- Ksat >14 inches/hour (per Budinger Report)
- Ksat >14 inches/hour (assumed based on soils similar to Budinger Report)
- Measurement point (Ksat calculated using D200 method from geotechnical reports)

DATA SOURCES:
City of Spokane GIS
City of Spokane Stormwater GeoReports
City of Spokane Infiltration Research for Downtown Area

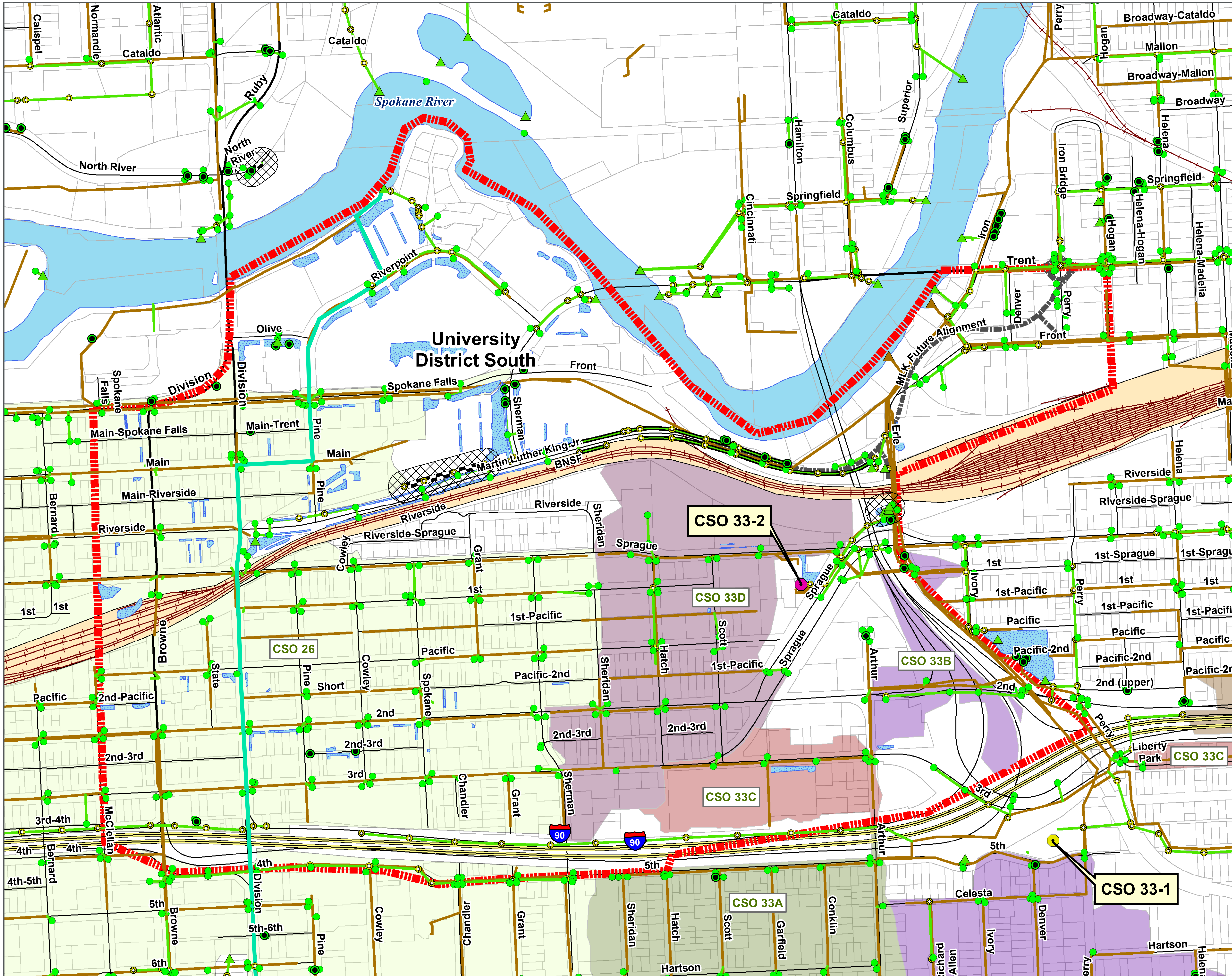
0 300 600 1,200 Feet

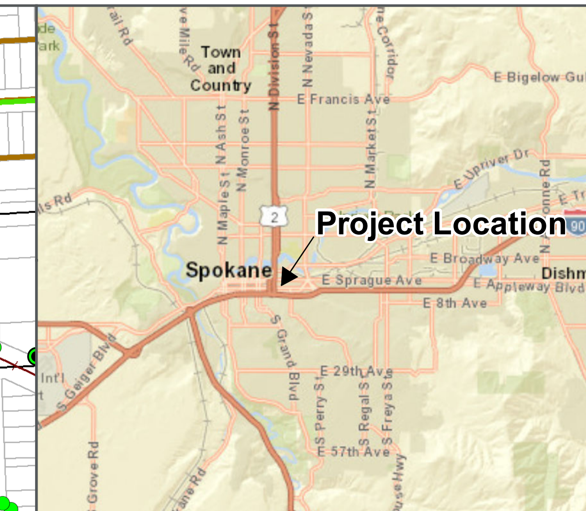
Date: 6/14/2018

PATH: G:\PROJECTS\WASHINGTON\CITY_OF_SPOKANE_003124\UNIV_DIST_SOUTH_SW_10091890\7.2_WIP\MAP_DOCS\MAP4SATURATEDHYDRAULIC.MXD - USER: EDICUS - DATE: 6/14/2018

UNIVERSITY DISTRICT SOUTH: STORMWATER SITE SUITABILITY ASSESSMENT

Map 7: Existing Stormwater Features





Project Location
Future Alignment of MLK Blvd
Railroad ROW
DrainTile
Drain Tile 100ft buffer
Clean Water Drain - Cowley Creek
Existing BMP - Varying Types
Stormwater Drywell
Stormwater Inlet
Stormwater Manhole
Stormwater Outfall
Stormwater Infiltrator
Stormwater Gravity Main
Combined Sewer Gravity Main
Sanitary Sewer Outfall

Basin Name

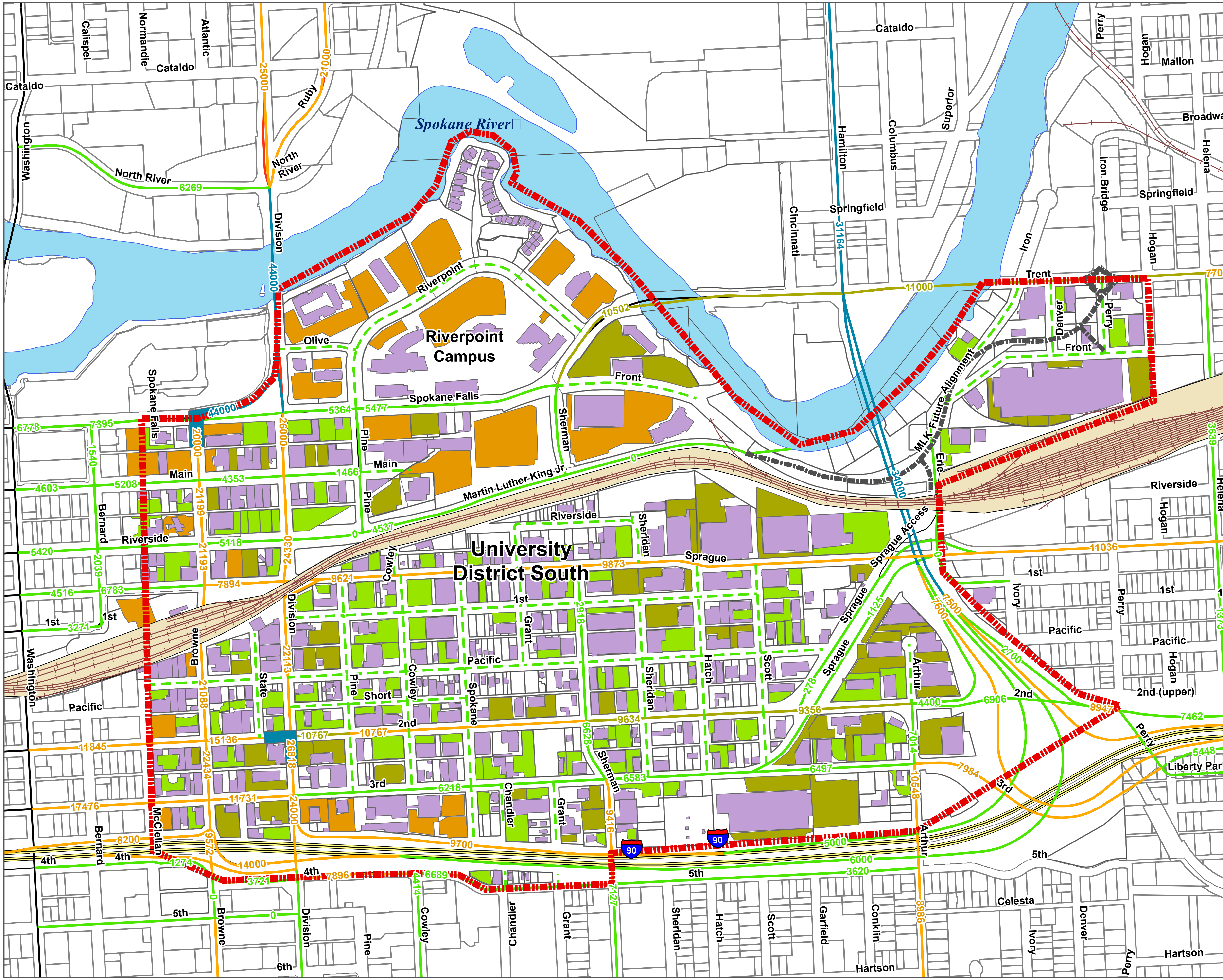
CSO 26
CSO 33A
CSO 33B
CSO 33C
CSO 33D
CSO 34
CSO Completed
CSO In Progress

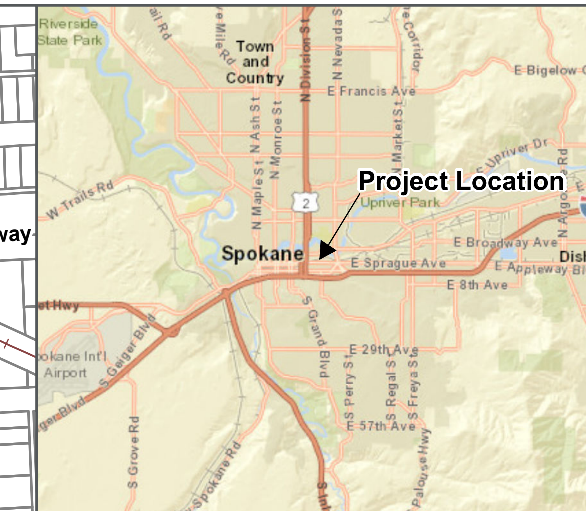
DATA SOURCES: City of Spokane GIS

0 300 600 1,200 Feet

Date: 6/19/2018

PATH: G:\PROJECTS\WASHINGTON\CITY_OF_SPOKANE_003124\UNIV_DIST_SOUTH_SW_10091890\7.2_WP\MAP_DOCS\MAP7EXISTINGSTORMWATER.MXD - USER: EDICUS - DATE: 6/19/2018





UNIVERSITY DISTRICT SOUTH: STORMWATER SITE SUITABILITY ASSESSMENT

Map 8: Runoff Treatment Requirements

LEGEND

- Project Location
- Future Alignment of MLK Blvd
- Railroad ROW
- Building Footprint

Treatment Class - Parking Lots

- Basic
- Basic, Metals
- Basic, Metals, Oil Control (Sorptive)
- Assumed no treatment required based on existing conditions

Treatment Class-Streets and Intersections

- Basic (Assumed)
- Basic
- Basic, Metals
- Basic, Metals, Oil Control (Sorptive)
- Basic, Metals, Oil Control (Oil Water Separator)

UIC Pollutant Loading Classification System:

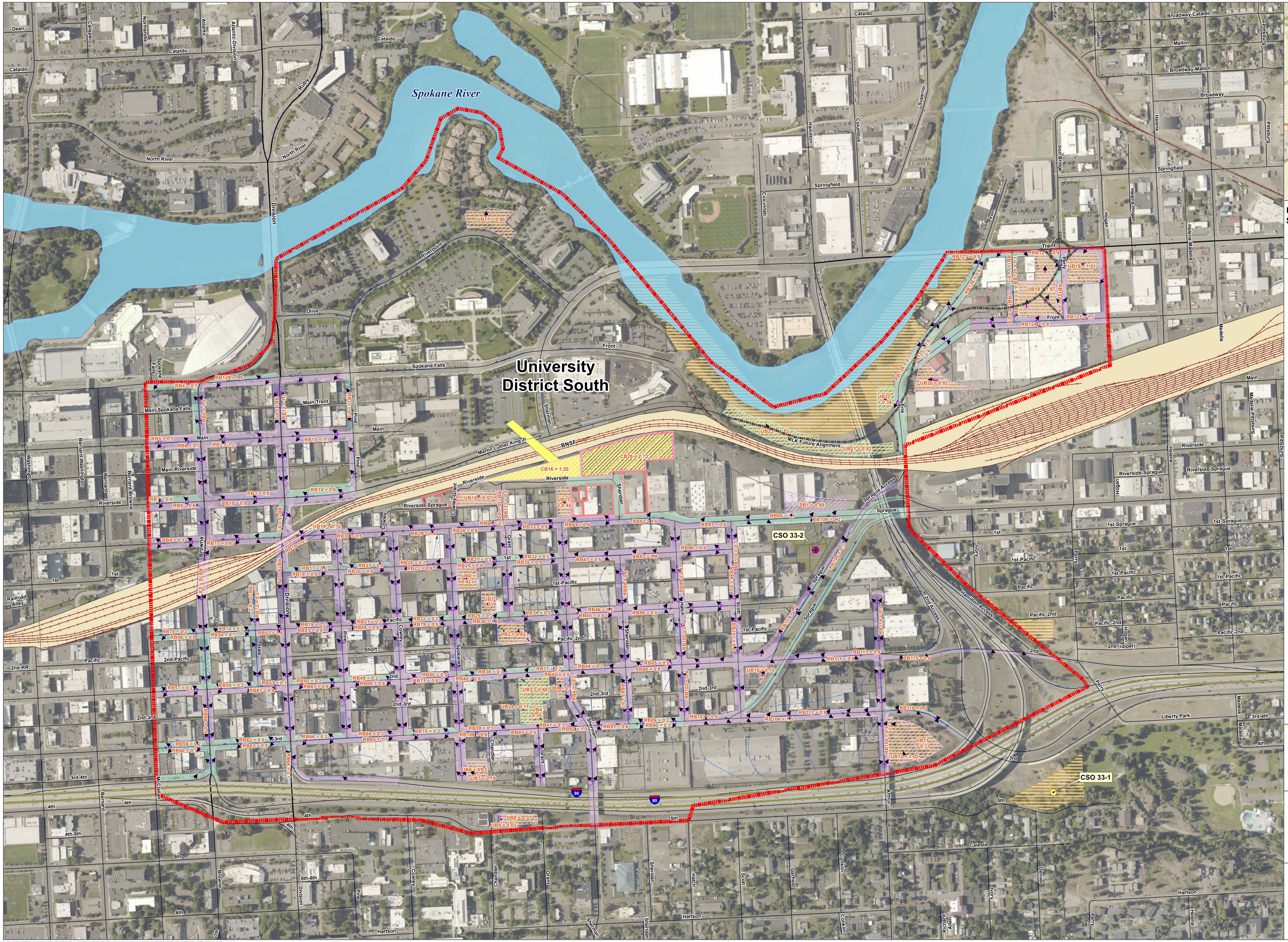
Low = Basic
Medium = Basic, Metals
High = Basic, Metals, Oil Control (Sorptive)
High Use/ADT Sites = Basic, Metals, Oil Control (Oil Water Separator)

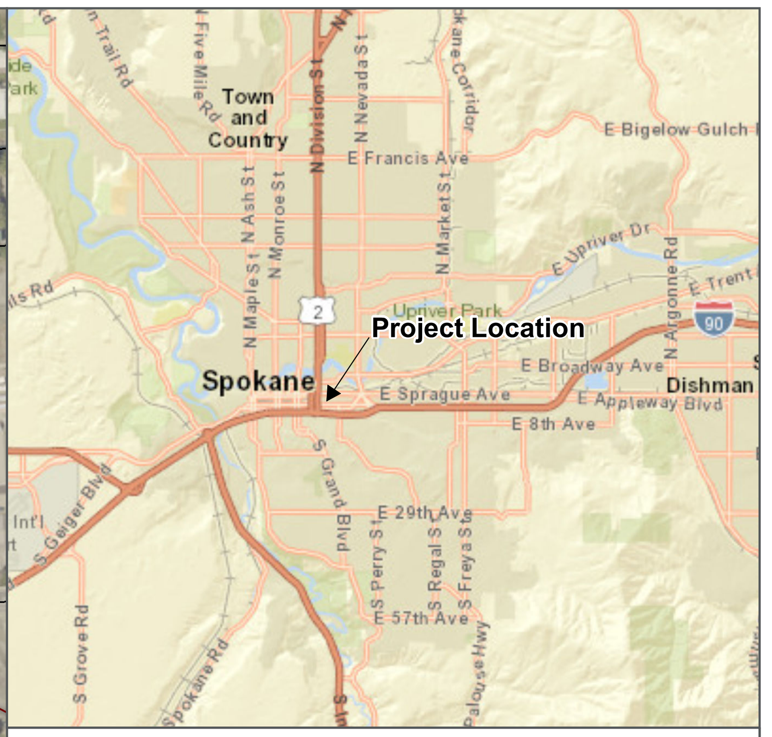
DATA SOURCES:
City of Spokane GIS
Spokane County Assessor Parcels

0 300 600 1,200 Feet

Date: 6/14/2018

PATH: G:\PROJECTS\WASHINGTON\CITY_OF_SPOKANE_003124\UNIV_DIST_SOUTH_SW_10091890\7.2_WIP\MAP_DOCS\MAP8RUNOFFTREATMENTREQUIREMENTS.MXD - USER: EDICUS - DATE: 6/14/2018





UNIVERSITY DISTRICT SOUTH: STORMWATER SITE SUITABILITY ASSESSMENT

Map 9: Contributing Basin Areas

LEGEND

- Project Location
- Future Alignment of MLK Blvd
- Railroad ROW
- Catalyst Project - Stage 1
- Catalyst Project - Pedestrian Bridge and Landing
- Developed Parcel
- Undeveloped Parcel
- Avista Development
- Local Flow Direction
- Flow Direction

ROW Basin Delineation

- No BMP Located
- BMP Located

Undeveloped Basin Delineation

- No BMP Located
- BMP Located

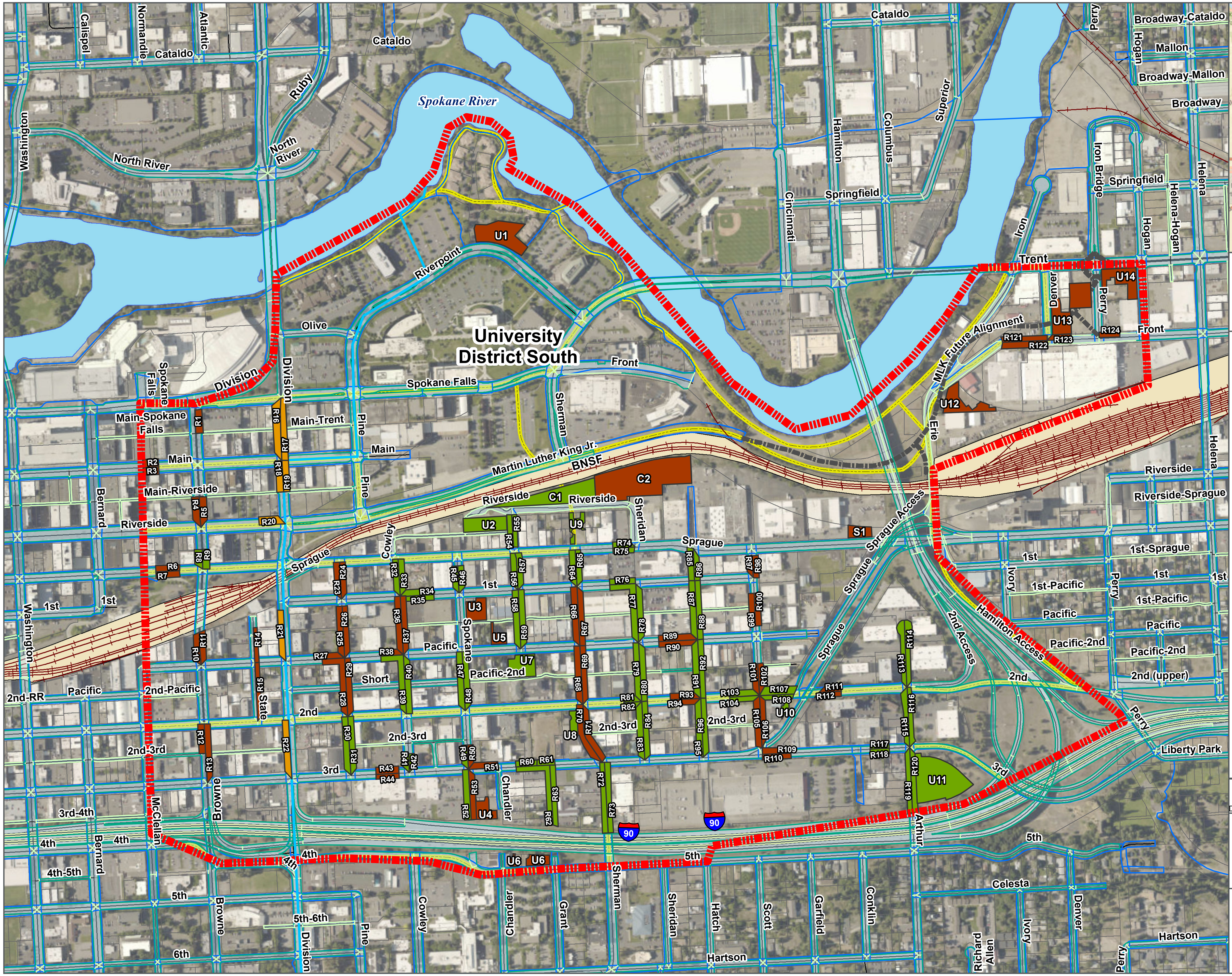
CSO Tank Location

- Completed
- In Progress

DATA SOURCES:
City of Spokane GIS
www.catalystspokane.com
Spokane County Assessor

0 250 500 1,000 Feet

Date: 6/14/2018



UNIVERSITY DISTRICT SOUTH:
STORMWATER SITE SUITABILITY ASSESSMENT

Map 10: Proposed BMP Locations

LEGEND

- Project Location
- Railroad ROW
- Future Alignment of MLK Blvd
- CowleyCreekCleanWaterDrain
- Proposed Bike Path
- Sidewalk
- Pavement

Curbline

- No Curb
- Curb Present

BMP Classification - Undeveloped Parcels

- Class "A"
- Class "D"

BMP Classification - ROW

- Class "A"
- Class "C"
- Class "D"

DATA SOURCES: City of Spokane GIS

0 300 600 1,200 Feet

Date: 6/14/2018

HDR

PATH: G:\PROJECTS\WASHINGTON\CITY_OF_SPOKANE_003124\UNIV_DIST_SOUTH_SW_10091890\7.2_WP\MAP_DOCS\MAP12PROPOSEDBMP.MXD - USER: EDICUS - DATE: 6/14/2018

APPENDIX B. MAPS SOURCE OF INFORMATION

Map #	Map Title	Source
1	Project Location Map	ESRI Basemap Service; http://www.spokaneudistrict.org/map
2	Depth to Groundwater	City of Spokane GIS; City of Spokane Stormwater GeoReports; Infiltration Research for Downtown Area; Soil Web Survey
3	Depth to Impermeable Layer	City of Spokane GIS; City of Spokane Stormwater GeoReports; Infiltration Research for Downtown Area; Soil Web Survey
4	Saturated Hydraulic Conductivity	City of Spokane GIS; City of Spokane Stormwater GeoReports; Infiltration Research for Downtown Area
5	Land Areas	Spokane County Assessor; City of Spokane GIS; www.catalystspokane.com; Spokane Historic Preservation Office; City of Spokane GIS; ESRI Imagery Service
6	Locations Not Suitable for Infiltration BMPs	City of Spokane GIS; WA Department of Ecology; Spokane Regional Stormwater Manual; Ecology UIC Manual; and the Ecology Stormwater Management Manual for Eastern Washington
7	Existing Stormwater Features	City of Spokane GIS; Google Earth; and observations during site visit
8	Runoff Treatment Requirements	City of Spokane GIS; Spokane Regional Stormwater Manual; Ecology UIC Manual; and the Ecology Stormwater Management Manual for Eastern Washington
9	Undeveloped Land Areas	*Map deleted; incorporated information into Map 5*
10	UIC Requirements	*Map deleted; incorporated information into Map 8*
11	Contributing Basin Areas	Spokane County Assessor; City of Spokane GIS; www.catalystspokane.com
12	Proposed BMP Locations	City of Spokane GIS

Summary of Notes for Maps 4, 5, 6

Report	Project Number	Bore Date	BoreID	Location	Depth to Ground Water	Depth to Impermeable Layer (Basalt)	Infiltration Notes	SoilType	Reference		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	%Fines	Hydraulic Conductivity (in/hr)	Soil Classification	Reference
CSO Basin 33-1 Budinger and Associates	H14573	01/16/2014	B-1	821 E 3RD AVE WEST END	NONE OBSERVED	SEE B-4 UNDETERMINED			Figure 4-1													
	H14573	01/16/2014	B-2	922 E 3RD AVE, WEST END	>5/end of bore	3		Crushed gravel fill to 1ft. 1-2ft Silty Sand with Gravel. 2-3ft Silt	Figure 4-2, page 12													
	H14573	01/16/2018	B-3	922 E 3RD AVE EAST END	NONE OBSERVED	SEE B-2 UNDETERMINED			Figure 4-3 pg 13													
	H14573	01/15/2014	B-4	803 E 3RD AVE NORTH SIDE OF SPRAGUE	>13/end of bore	8.5		Gravel with sand fill to 1ft. 1-3.5 Silty Sand with Gravel, coarse to fine, subrounded. 3.5-4.5ft boulder. 4.5-8.5 silt. 8.5 to >13ft basalt	figure 4-4, pg 14													
	H14573	01/16/2014	B-5	810 E 2ND AVE NORTH SIDE OF SPRAGUE	N	AT SURFACE																
	H14573	01/16/2018	B-6	SOUTH SIDE OF 3RD AVE NORTH OF I90 OVERPASS	N	AT SURFACE																
	H14573	01/15/2018	B-7	1214 E PACIFIC AVE	10	>20FT/end of boring	200 gal at 49 gal/minute, drained in 35 seconds.	0 TO 10FT SILT (fill). 10 TO 20FT Gravel with Sand fine subrounded	Fig 4-7, pg 17													
	H14573	01/15/2014	B-8	1231 E 2ND AVE	16	>23.5FT/end of boring	200 gal at 44 gal/minute, drained in 50 seconds.	0 to 1.5 silty sand w/gravel and debris (fill). 1.5 to 7.5 Gravel with sand, silt, debris (asphalt fragments) coarse to fine, subrounded. 7.5 to 16 silt, rapid dilatency (volcanic ash) (fill). 16 to 23.5 Gravel with Sand, coarse to fine, subrounded	Fig 4-8, pg 18													
3rd at Cedar and McClellan	S09306	10/20/2009	TB-7	3rd Ave east of Bernard on east bound sidewalk	8.5	>20FT/end of boring		0-7ft fill:gravel, some sand, occasional cobbles (subrounded) some small silt. 7-8.5 boulder (basaltic) and gravel. 8.5 to 12ft gravel, some sand, small amount of cobbles (subrounded) trace silt, occasional boulders. 12 to 17ft gravel, some sand (medium to coarse, subangular to subrounded) small amount silt, trace cobbles, occasional boulders. 17 to >20ft clayey gravel (coarse, poorly graded, angular) some cobbles, occasional boulders.	Fig 4-2, pg 12		38.0	26.1	0.1	n/a	53.0	34.0	13.0	13.0			Silty Gravel with Sand(GM)	Fig 5, pg 13
Erie from 1st to MLK Stormwater	H14572	1/7/2014	B-1510	SW corner of Erie St and 1st St	16	>20FT/end of boring		0-6ft gravel with sand, silt, and cobbles, subrounded to angular (fill). 6 - 11ft Gravel with sand, cobbles, silt and clay subrounded. 11->20ft Gravel with sand and cobbles, subrounded	Fig 3-10, pg 11		38.0	8.8	2.7	0.6	56.3	37.7	6.0	6.0	6.0	31	Well-graded gravel with silty clay and sand (GW-GC)	Table 1, pg 3; Figure 5 pg 16
	H14572	1/6/2014	B-1511	E side of Erie St, S of Sprague overpass	15	>17ft/end of boring		0-3ft silty gravel with sand and cobbles, angular to subrounded(fill). 3-4ft gravel with sand, silt and cobbles, angular to subrounded (possible fill) 4->17ft Gravel with sand and cobbles, well graded, subrounded	Fig 3-11, pg 12		38.0	7.2	2.8	0.8	55.3	40.8	3.9	3.9	3.9	70	Well-graded gravel with sand (GW)	Table 1, pg 3; Figure 5 pg 16
	H14572	1/6/2014	B-1512	E side of Erie St, N of Sprague overpass	16	>20FT/end of boring		0-3.5ft Gravel with sand, silt, and cobbles, poorly graded, subrounded to angular, (possible fill). 3.5 to >20ft Gravel with sand and cobbles, trace silt, poorly graded (coarse), subrounded	Fig 3-12, pg 13		76.2	10.5	3.4	1.3	62.1	34.3	3.4	3.4	3.4	91	Poorly Graded gravel with sand (GP)	Table 1, pg 3; Figure 5 pg 16
	H14572	1/6/2014	B-1513	NW corner of Erie St and Sprague Way	15	>16ft/end of bore		0-3ft gravel with sand, silt, and cobbles subrounded to angular (fill). 3-5ft gravel with sand, silt, and cobbles, subrounded, (possible fill). 5-8.5ft gravel with sand, silt and cobbles, poorly graded (coarse) subrounded. 8.5-16 gravel with sand and cobbles, trace silt, poorly graded (coarse) subrounded	Fig 3-13, pg 14		25.4	4.3	1.2		37.3	42.7	20.0	20.0	20.0	3.25	**Sample depth 6.5ft** Silty sand with gravel (SM)	Table 1, pg 3; Figure 5 pg 16
	H14572	1/6/2014	B-1513	NW corner of Erie St and Sprague Way	15	>16ft/end of bore		0-3ft gravel with sand, silt, and cobbles subrounded to angular (fill). 3-5ft gravel with sand, silt, and cobbles, subrounded, (possible fill). 5-8.5ft gravel with sand, silt and cobbles, poorly graded (coarse) subrounded. 8.5-16 gravel with sand and cobbles, trace silt, poorly graded (coarse) subrounded	Fig 3-13, pg 14		38.0	4.3	1.5	0.1	37.3	53.4	9.3	9.3	9.3	14	**Sample depth 9.0 ft** Poorly graded sand with silty clay and gravel (SP-SC)	Table 1, pg 3; Figure 5 pg 16
U-District Bridge		9/12/2011	N-1	North landing	>14.1/end of bore	3.5		6-8inches topsoil -black silty with trace sand and organic matter (roots) (medium stiff, moist). 6in to 3.5ft brown silt with sand and occasional fine gravel (medium stiff, moist)	Fig A-3, pg 39													
		9/12/2011	N-2	North landing	>18.9/end of bore	9.5		see Soil Classification	Fig A-4, pg 40						See Figure A-10, pg 47 for chart						Silty fine gravel with sand	Fig A-10, pg 47
		9/12/2011	N-3	North landing	>13.8/end of bore	4.5		see Soil Classification	Fig A-5, pg 41												Silty fine to coarse gravel with sand	Fig A-10, pg 47
		9/9/2011	P-1	Midspan pier	>16.9/end of bore	3		0-1ft brown silty fine to coarse sand with occasional gravel (medium dense, moist). 1-3ft black silty fine to coarse gravel with sand (medium dense, moist)	Fig A-6, pg 42													
		9/28/2011	S-1	South landing	>33.6/end of bore	18.5		see Soil Classification	Fig A-7, pg 43,44						See Figure A-11, pg 49 for chart						Silty fine to coarse sand with gravel	Fig A-11, pg 49
		9/28/2011	S-2	South landing	>17/end of bore	7		see Soil Classification	Fig A-8, pg 45												Silty fine to coarse gravel with sand	Fig A-11, pg 49
		9/28/2011	S-3	South landing	>16.1/end of bore	2.5		0-2.5ft Brown silty fine gravel with sand. >2.5ft basalt	Fig A-9, pg 46												Silty fine gravel with sand	Fig A-11, pg 49
Union Basin	H15242	5/6/2015	1	Central area of site	15	>21/end of bore			Fig 4-1, pg 13						See page 2, Subsurface conditions, areas were "deemed unsuitable for infiltration".							
	H15242	5/6/2015	2	north area of site	15	>16ft/end of bore			Fig 4-2, pg 14													
	H15242	5/6/2015	3	South area of site	16	>19ft/end of bore			Fig 4-3, pg 15													
	H15242	5/14/2015	4	Center area of site, NW side of N Erie st	14	>25/end of bore			Fig 4-4, pg 16		76.8	18.4	5.1	0.7	70.0	25.3	3.6	3.6	3.6	82	Well Graded gravel with sand (GW)	Table 1, pg 3; Figure 6 pg 20
	H15242	5/14/2015	5	north area of site, adjacent to NW side of N Erie St	12.5	>26/end of bore			Fig 4-5, pg 17		76.8	16.4	4.8	0.6	69.7	24.6	5.3	5.3	5.3	40		Table 1, pg 3; Figure 6 pg 20
	H15242	5/14/2015	6	south area of site, adjacent to NW side of N Erie St	16.4	>26.5/end of bore			Fig 4-6, pg 18		76.8	13.0	3.4	0.5	63.8	31.1	4.7	4.7	4.7	50	Well Graded gravel with sand (GW)	Table 1, pg 3; Figure 6 pg 20
MLK Phase II - GCR Geotechnical Conditions Report	S13254	9/6/2013	B-1	south of the intersection of Erie St and Front Ave	15	>31.5/end of bore			Fig 4-1, pg 17		4.8	0.1			0.0				51.2	na		
	S13254	9/9/2013	B-2	Perry St between Front and Trent	15	>21/end of bore			Fig 4-2, pg 18		37.5	17.2	9.5	2.9	86.0				0.7	1700	Well-Graded gravel (GW)	Table 1, pg 34; Figure 6-1
	S13254	9/9/2013	B-3	Denver St at Front Ave	20	>41/end of bore			Fig 4-3, pg 19		75.0	19.0	5.6	0.1	73.0				5.5	37		Table 1, pg 34; Figure 6-1
	S13254	9/10/2013	B-4	NE of the intersection of Erie St and Front Ave	22	>26/end of bore			Fig 4-4, pg 20		37.5	15.1	6.7	1.5	79.0				1.9	270	Well-Graded gravel with sand (GW)	Table 1, pg 34; Figure 6-1

Summary of Notes for Maps 4, 5, 6

Report	Project Number	Bore Date	BoreID	Location	Depth to Ground Water	Depth to Impermeable Layer (Basalt)	Infiltration Notes	SoilType	Reference		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	%Fines	Hydraulic Conductivity (in/hr)	Soil Classification	Reference
MLK Phase II - GCR Geotechnical Conditions Report	S13254	9/10/2013	B-5/ sampling depth 9.5	NW of the railroad bridge over Erie st	16	>26/end of bore			Fig 4-5, pg 21		1.2	0.1							52.0	na	Sandy silty clay (CL-ML)	Depth 9.5, figure 6-1; table 1 pg 34
	S13254	9/10/2013	B-5/ sampling depth 14.5	NW of the railroad bridge over Erie st	16	>26/end of bore			Fig 4-5, pg 21		75.0	15.1	6.8	3.2	84.0				0.5	3300	Poorly graded gravel with sand (GP)	Depth 14.5, figure 6-2 ; table 1 pg 34
	S13254	9/11/2013	B-6	W of Hamilton bridge, SE corner parcel 35174.0606	17	>31/end of bore			Fig 4-6 pg 22		75.0	8.6	2.2	0.1	57.0							Figure 6-2
	S13254	9/12/2013	B-7	Near river, south center of parcel 35174.0606	21	>51/end of bore			Fig 4-7, pg 23													
	S13254	9/12/2013	B-8	south center edge of parcel 35174.0009	>20/end of bore	>20/end of bore			Figure 4-8, pg 24													
	S13254	9/12/2013	B-9	30ft east of railroad tunnel entrance east end	No Free Groundwater Observed	>20/end of bore			Fig 4-9, pg 25													
	S13254	9/12/2013	B-10	SE edge of parcel 35175.0034	No Free Groundwater Observed	4			Fig 4-10													
	S13254	9/16/2013	B-11	50ft east of existing MLK westbound east of Sherman	No Free Groundwater Observed	6			Fig 4-11													
Sherman, 336 S Geotech		3/25/2003	TP-1	336 S Sherman	NONE OBSERVED	>13/end of bore		Silty sand and silty gravel	pg 28													
		3/25/2003	TP-2	336 S Sherman	NONE OBSERVED	12.5		Silty sand and silty gravel	pg 29													
Biomedical and Health Sciences Bldg Geotech	0403-028-00	12/14/2009	B-1		>23/end of bore	11		Silty fine to medium sand with gravel (fill)	A-3, pg 32													
	0403-028-00	12/14/2009	B-2		7.5	8		Silty fine to coarse sand with fine gravel and debris (fill)	A-4, pg 33													
	0403-028-00	12/16/2009	B-3		>28/end of bore	18		Silty medium to coarse sand with gravel (fill)	A-5, pg 34													
	0403-028-00	12/15/2009	B-4		>29/end of bore	19		Silty fine to coarse sand with fine gravel and debris (fill)	A-6, pg 35													
	0403-028-00	12/15/2009	B-5		>27.5/end of bore	17.5		Silty fine to medium sand with gravel (fill)	A-7, pg 36													
	0403-028-00	12/15/2009	B-6		20	22		Silty fine to medium sand with gravel (fill)	A-8, pg 37													
	0403-028-00	12/16/2009	B-7		>15/end of bore	5		Silty fine to medium sand with gravel (fill)	A-9, pg 38													
Erie Street	S03177	7/28/2004	B-1	SW of Erie and RR crossing	20	>85/end of bore		Gravel, some silt or sand	Fig 4-1, pg 8													
	S03177	7/28/2004	B-2	SE of Erie and RR crossing	20	>90/end of bore		Gravel, some sand	Fig 4-2, pg 16													
STM096 Trent Ave directly across from Riverpoint		7/10/2001	B-1		>8.5/end of bore	8.5	See percolation test Table A-1, pg 13	Basalt shot rock with boulders (fill)	Fig A-3, pg 16													
		7/10/2001	B-2		>8.5/end of bore	8.5	See percolation test Table A-2, pg 13	Fine to coarse sand with silt and gravel and boulders(fill)	Fig A-4, pg 17													
		7/10/2001	B-3		>5/end of bore	5		Fine to coarse sand with silt and gravel (fill)	Fig A-5, pg 18													
SE Blvd 29th and Sherman Geotech Report		10/31/2005	B-1	Sherman St northbound lane 150ft S of 3rd ave	NONE OBSERVED	1.5		pavement, gravel, impermeable rock at 1.5ft	Fig A-2, pg 21													
		10/31/2005	B-2	Sherman St northbound lane 75ft S of 5th Ave	NONE OBSERVED	1.5		pavement, gravel, impermeable rock at 1.5ft	Fig A-3, pg 22													
Riverpoint Geotech		8/10/1984	ROP-21		>8	8		basalt rubble fill to 4ft, sandy gravel to 8	pg 46	Used test pit data only, map for other bore points is unreadable.												
		8/10/1984	ROP-20		4.5	>7.5/end of bore		basalt rubble fill to 3ft, sandy gravel to 6.5	pg 45													
		8/10/1984	ROP-22		>2	2		Silty sand and gravel	pg 47													
		8/10/1984	ROP-27		>3	3		gravelly sand fill	pg 52													
		8/8/1984	ROP-4		>2	2		gravelly sand fill	pg 29													
I-90 Latah to Liberty Park Illumination Rebuild			A-73-76																			
			A-74-67																			

APPENDIX C. BMP SIZING SUMMARY

This section provides a summary of the methods and assumptions used to size the BMPs for this study. The BMPs were sized using a single event model and the SCS Type IA rainfall event *(except where noted).* All contributing basin areas were assumed to be impervious with a Curve Number equal to 98. Specific details about the assumptions made to design each BMP are described in the subsequent sections.

The BMPs that were sized for this study include:

- Bioretention and Bioinfiltration Ponds in a Vault without an Overflow
- Bioretention and Bio-Infiltration Ponds in a Vault with an Overflow
- Infiltration Trench
- Permeable Pavement
- Pave Drain (or equivalent other)
- Silva Cell (or equivalent other)
- Modular Wetland (or equivalent other)
- Cistern

Bioretention and Bio-Infiltration Vault Ponds without Overflow

Bioretention and bio-infiltration vault ponds without an overflow were sized to infiltrate the entire volume of runoff contributing to the basin area. The assumptions used to size the ponds are outlined in Table C1. The ponds were sized using a combination of infiltration rates and contributing basin areas. The respective pond base area (footprint) is summarized in Table C2 and Figure C1.

Table C1. Bioretention & Bio-Infiltration Vault Pond Sizing Assumptions

BMP Design Variables	Design Assumptions
BMP Ponding Depth vs. Storm Event	≤6-inches, 6 month 24 hour event ~12-inches, 10 year 24 hour event Designed to not overtop 100-year 24-hour event
Media Depth	18 inches
Porosity of Media	40%
BMP Length	Variable
BMP Width	Variable
BMP Depth (max ponding depth above media)	18 inch
Side Slopes	0%, vaults wall are vertical
Overflow Depth	None

Table C2. Bioretention & Bio-Infiltration Vault Pond Summary of Sizing

Vault Bioretention & Bio-infiltration Pond without Overflow Base Area for 6 inch Maximum Ponding Depth (sq.ft.) with No Side Slopes						
Basin Area	0.10 AC	0.25 AC	0.50 AC	0.75 AC	1.0 AC	1.5 AC
Infiltration Rate (In/hr)	Pond Base Area (sqft)					
0	370	925	1850	2775	3700	5550
0.25	270	675	1350	2025	2700	4050
0.5	210	525	1050	1575	2100	3150
1.00	153	383	765	1148	1530	2295
1.50	124	310	620	930	1240	1860
3.00	87	218	435	653	870	1305

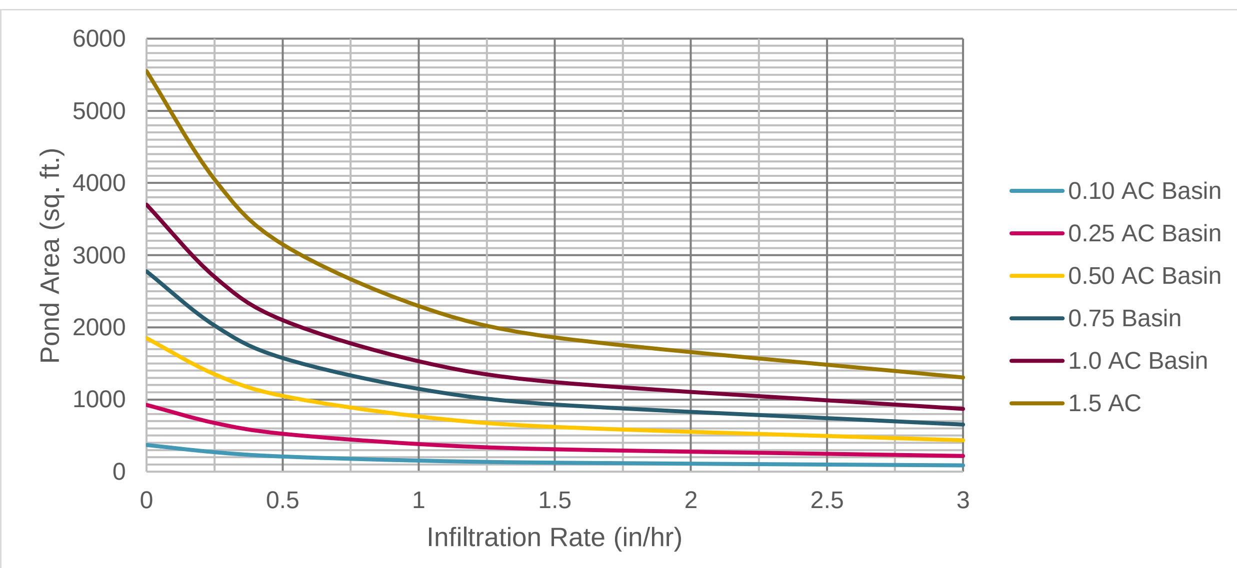


Figure C1. Vault Bioretention & Bio-Infiltration Pond Summary of Sizing

Bioretention and Bio-Infiltration Vault Ponds with Overflow

Bioretention and bio-infiltration vault ponds were sized with an overflow to receive runoff from the contributing basin. The assumptions used to size the ponds are outlined in the Table C3. The ponds were sized using a combination of infiltration rates and contributing basin areas. The respective pond base area (footprint) is summarized in Table C4 and Figure C2.

Table C3. Bioretention & Bio-Infiltration Vault Pond Sizing Assumptions

BMP Design Variables	Design Assumptions
Design Pond Depth vs. Storm Event	≤6-inches, 6 month 24 hour event
Media Depth	18 inches
Porosity of Media	40%
BMP Length	Variable
BMP Width	Variable
BMP Depth (max ponding depth above media)	18 inch
Side Slopes	0%, vaults wall are vertical
Overflow Depth	≥6 inches
Note: A cistern or other detention is needed to retain the 10 year 24 hour storm on site.	

Table C4. Bioretention & Bio-Infiltration Vault Pond Summary of Sizing

Vault Bioretention & Bio-infiltration Pond with Overflow Base Area for 6 inch Maximum Ponding Depth (sq.ft.) with No Side Slopes						
Basin Area	0.10 AC	0.25 AC	0.50 AC	0.75 AC	1.0 AC	1.5 AC
Infiltration Rate (In/hr)	Pond Base Area (sqft)					
0	250	625	1250	1875	2500	3750
0.25	150	375	750	1125	1500	2250
0.5	108	270	540	810	1080	1620
1.00	76	190	380	570	760	1140
1.50	62	155	310	465	620	930
3.00	43	108	215	323	430	650

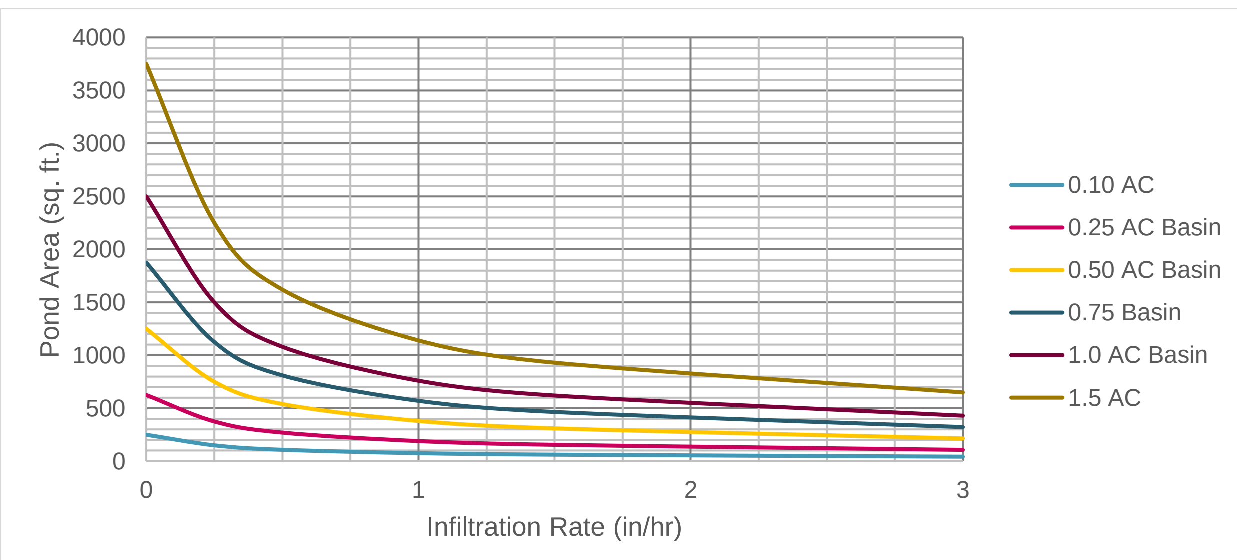


Figure C2. Vault Bioretention & Bio-Infiltration Pond Summary of Sizing

Infiltration Trench

Infiltration trenches are long, narrow, stone-filled trench used for collection, temporary storage, and infiltration of stormwater runoff (Figure C3). This BMP was sized to infiltrate the entire volume of runoff contributing to the basin area. A vegetated filter strip (VFS) should be located upstream of the trench to provide pre-treatment for 30% of the of runoff volume which reduces the maintenance cycle of the BMP. The VFS should be located parallel to and the same length as the infiltration trench. The assumptions used to size the infiltration trench and VFS are outlined in Table C5 and Table C6. The infiltration trench was sized using a combination of infiltration rates and contributing basin areas. The respective BMP base area (footprint) is summarized in Table C7 and Figure C4.

Table C5. Infiltration Trench Sizing Assumptions

BMP Design Variables	Design Assumptions
Design Ponding Depth vs. Storm Event	24-inches, 10 year 24 hour event Designed to not overtop 100-year 24-hour event
Freeboard Above Design Ponding Depth	12 inches
Media (Stone) Depth	18 inches
Void Ratio (WSDOT, 2014)	35%
BMP Length	Variable
BMP Width	2 feet
BMP Depth	3 feet

Table C6. Vegetated Filter Strip (VFS) Sizing Assumptions

VFS Design Criteria	*Narrow Area VFS* (Spokane County, City of Spokane, and City of Spokane Valley, 2008)
Assumed Maximum Width of Contributing Impervious Area	30 feet
Pretreatment	30% of PGIS
Width of Impervious Area Treated	10 feet
BMP Width Required	4 feet
BMP Length	Match Infiltration Trench

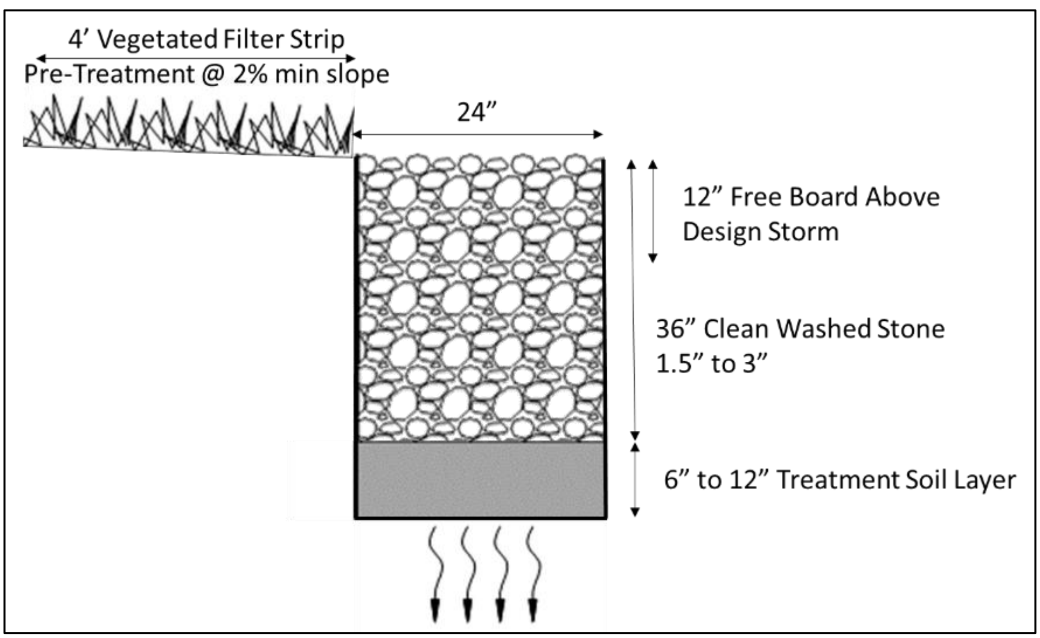


Figure C3. Infiltration Trench General Schematic

Table C7. Infiltration Trench Summary of Sizing

Infiltration Trench Base Area for 24 inch Maximum Ponding Depth (sq.ft.) plus 12-inch freeboard						
Basin Area	0.10 AC	0.25 AC	0.50 AC	0.75 AC	1.0 AC	1.5 AC
Infiltration Rate (In/hr)	Infiltration Trench Base Area (sqft)					
0	920	2310	4600	6900	9200	13800
0.25	564	1402	2820	4230	5640	8460
0.5	408	1020	2040	3060	4080	6120
1.00	282	704	1410	2115	2820	4230
1.50	225	564	1125	1688	2250	3375
3.00	154	385	770	1155	1540	2310

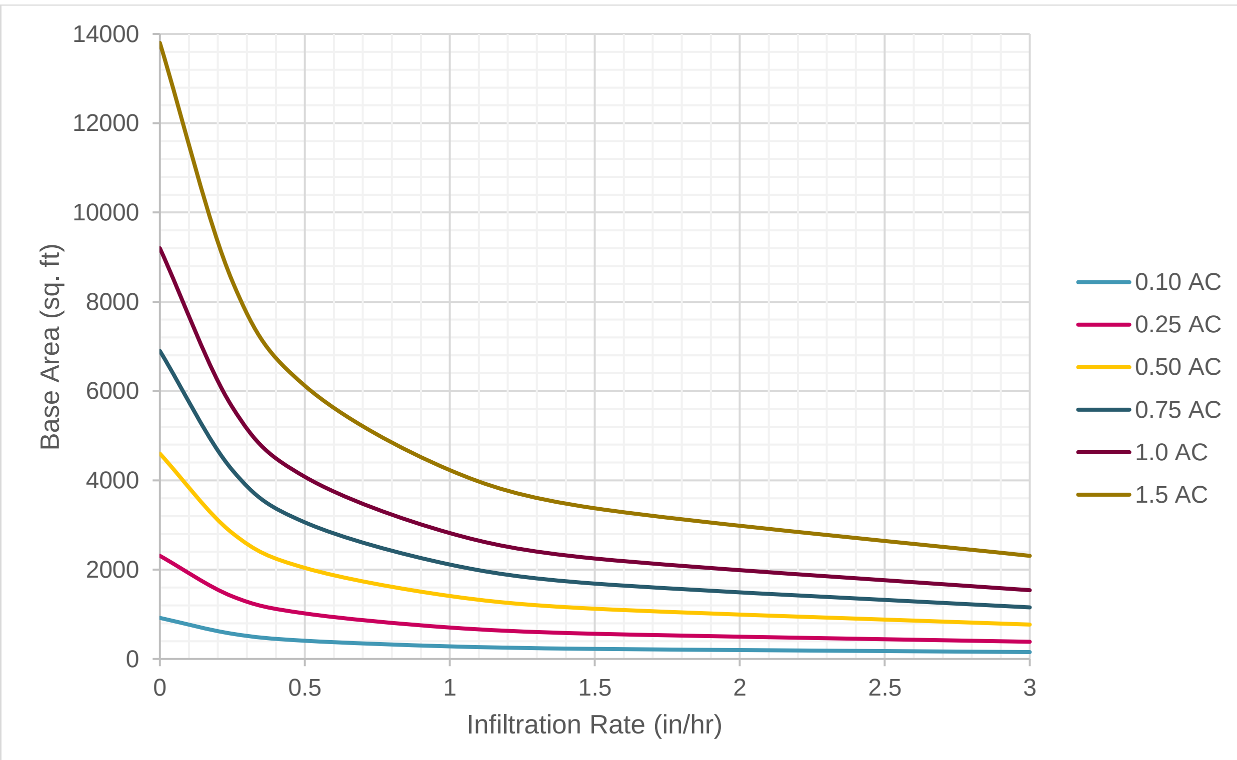


Figure C4. Infiltration Trench Summary of Sizing

Permeable Pavement

Permeable pavement surfaces are an open graded pavement mix placed in a manner that results in a high degree of interstitial spaces within the cemented aggregate, which allow runoff to infiltrate through the pavement and into the sub-soils. Aggregate below the pavement provides temporary storage for runoff before infiltration into the sub-soils. This BMP was sized to infiltrate the entire volume of runoff from the contributing basin area or convey the volume of runoff to a storm or combined sewer. The assumptions used to size the permeable pavement are outlined in Table C8. This BMP was sized using a combination of infiltration rates and contributing basin areas. The respective base area (footprint) is summarized in Table C9 and Figure C5.

Table C8. Permeable Pavement Sizing Assumptions

BMP Design Variables	Design Assumptions
Design Ponding Depth vs. Storm Event	24-inches, 10 year 24 hour event
Allowable Ponding Depth	24 inch
Design Storm Event and Type	SCS Type IA 10 year 24-hour
Void Ratio of Aggregate	30%
Aggregate Depth Below Pavement	2 feet
BMP Length x Width	Variable x Variable

Table C9. Permeable Pavement Summary of Sizing

Permeable Pavement Base Area for 24 inch Max Ponding Depth (sqft.) for 10-year 24-hour storm						
Basin Area	0.10 AC	0.25 AC	0.50 AC	0.75 AC	1.0 AC	1.5 AC
Infiltration Rate (In/hr)	Permeable Pavement Base Area (sqft)					
0	920	2310	4600	6900	9200	13800
0.25	564	1402	2820	4230	5640	8460
0.50	408	1020	2040	3060	4080	6120
1.00	282	704	1410	2115	2820	4230
1.50	225	564	1125	1688	2250	3375
3.00	154	385	770	1155	1540	2310
Note: Runoff treatment credit (basic, metals) is only provided if a layer of treatment soil is placed below the BMP (and below underdrain) or the UIC vadose zone soil treatment capacity requirements are met						

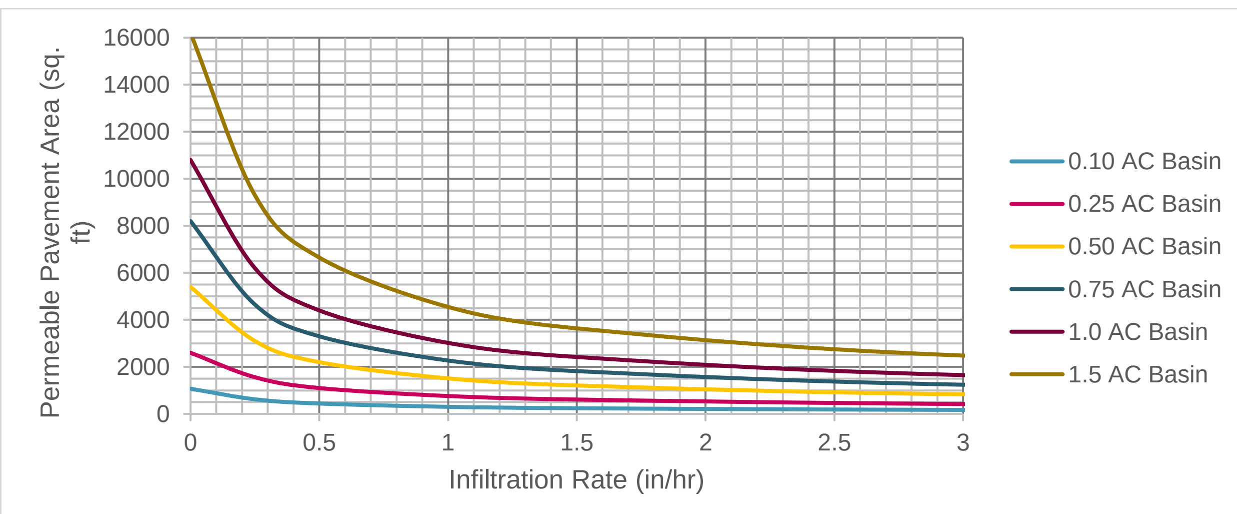


Figure C5. Permeable Pavement Summary of Sizing

Pave Drain

Pave Drain (or equivalent system) is a proprietary permeable concrete block system which allows runoff to infiltrate into the ground through the concrete blocks. Pave Drain is designed with an arch under the block to increase the temporary storage area for runoff. The sizing for this BMP assumes (Table C10) that the entire volume of runoff from the contributing basin area will infiltrate into the ground or be conveyed to a storm or combined sewer. The footprint of the system was sized for the volume of the 10-year 24-hour storm event. Table C11 and Figure C6 display the sizing for a combinations of infiltration rates and contributing basin areas.

Table C10. Pave Drain Sizing Assumptions

BMP Design Variables	Design Assumptions
Design Ponding Depth vs. Storm Event	Depth of stone plus arch; 10-year 24-hour event
Arch Volume	0.095 cft per paver
Depth of #2 Clean Stone Below Pave Drain	24 inches
Void Ratio of #2 Clean Stone	40%
BMP Length	Variable
BMP Width	Variable
Note: Runoff treatment credit (basic, metals) is only provided if a layer of treatment soil is placed below the BMP (and below underdrain) or the UIC vadose zone soil treatment capacity requirements are met	

Table C11. Pave Drain Summary of Sizing

PaveDrain Base Area for 24 inch Max Ponding Depth (sq.ft.) for 10 year 24 hour						
Basin Area	0.10 AC	0.25 AC	0.50 AC	0.75 AC	1.0 AC	1.5 AC
Infiltration Rate (In/hr)	Permeable Pavement Base Area (sqft)					
0	800	2000	4000	6000	8000	12000
0.25	460	1150	2300	3450	4600	6900
0.5	320	800	1600	2400	3200	4800
1	225	563	1125	1688	2250	3375
1.5	185	463	925	1388	1850	2775
3	130	325	650	975	1300	1950

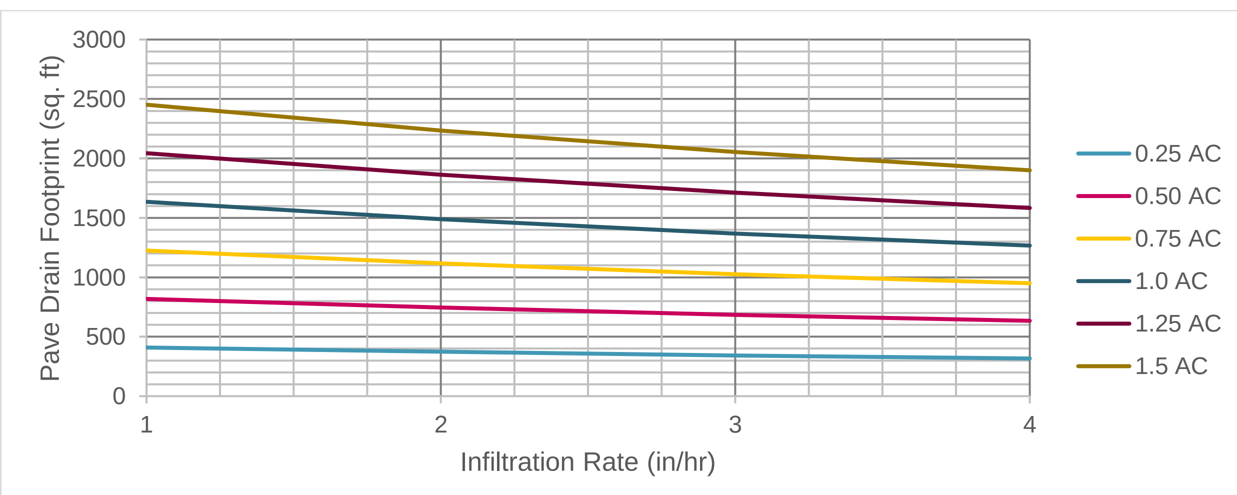


Figure C7. Pave Drain Summary of Sizing

Silva Cell

Silva Cells (or equivalent system) are modular, proprietary products which can be sized to provide storage for infiltration or detention, or to convey runoff to a storm or combined sewer. The Silva Cells were sized following the same methods as are used to design bioretention ponds. In this report, the Silva cells were designed to retain and infiltrate the 10-year, 24 hour storm on-site. The assumptions used to size the Silva Cell are outlined in Table C12 below. Table C13 and Figure 8 summarize the BMP base area (footprint) of different Silva Cell configurations for various basin areas and infiltration rates.

Table C12. Silva Cell Sizing Assumptions

BMP Design Variables	Design Assumptions
Design Ponding Depth vs. Storm Event	12 inch, 10 year 24-hour event
Media Depth	18 inches
Void Ratio	40%
BMP Length	Variable
BMP Width	Variable
BMP Configuration (Height)	3X Configuration (43 inches)

Table C13. Silva Cell Summary of Sizing

Silva Cell without Overflow Footprint for 12 inch Maximum Ponding Depth (sq.ft.) and 3X Silva Cell Size						
Basin Area (AC)	0.1	0.25	0.5	0.75	1	1.5
Infiltration Rate (in/hr)	Silva Cell Footprint (sq. ft)					
0	404	1010	2020	3030	4040	6060
0.25	270	675	1350	2025	2700	4050
0.5	204	510	1020	1530	2040	3060
1	146	365	730	1095	1460	2190
1.5	120	300	600	900	1200	1800
3	58	145	290	435	580	870

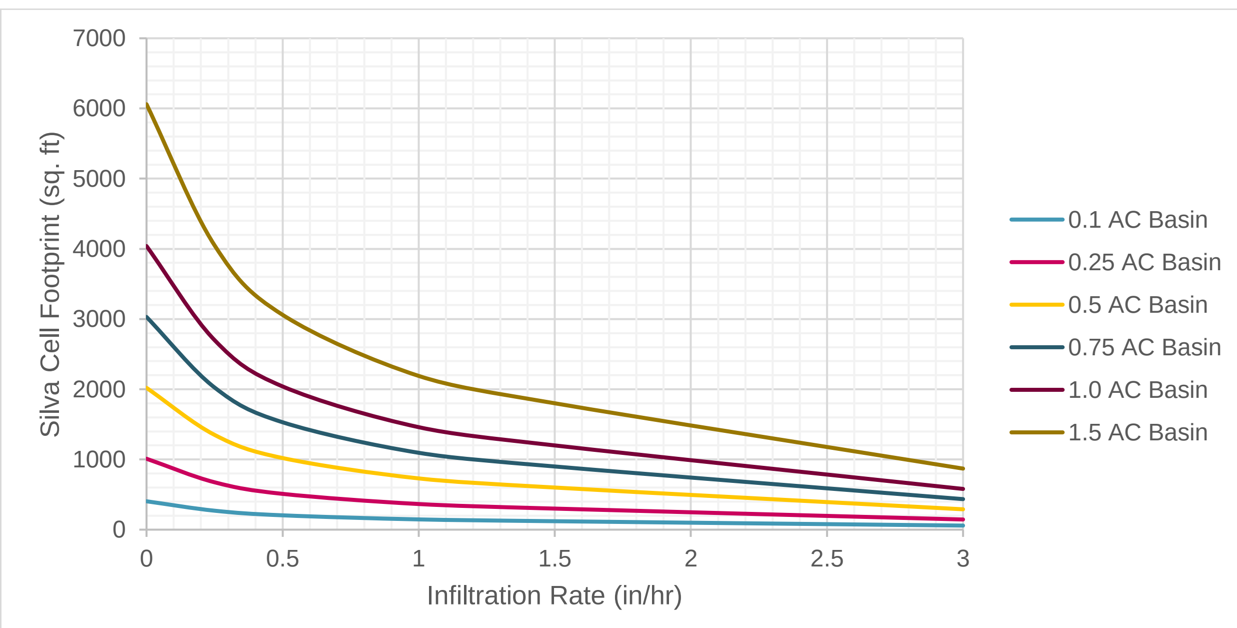


Figure C8. Silva Cell Summary of Sizing

Modular Wetland

Modular wetlands are bioretention systems that provide treatment and flow control. For this report, modular wetlands were sized with an overflow. Table C14 includes design assumptions provided to Bio Clean to obtain standard MWS Linear sizes and soil depth requirements needed for various basin areas. Table C15 and Figure C9 display the footprint of different modular wetland sizes for various basin areas.

Table C14. Modular Wetland Design Criteria

BMP Design Variables	Design Assumptions
Overflow Design Storm	>6 month 24 hour and up to 100 year 24 hour
Modular Wetland Design Storm	6 month 24 hour
Note: A cistern or other detention is needed to retain the 10 year 24 hour storm on site.	

Table C15. Modular Wetland Summary of Sizing

Modular Wetland with Overflow Footprint (sq. ft) Provided by Bio Clean for Various Basin Areas			
Basin Area (AC)	Footprint (ft^2)	Depth Required; Rim to Outlet IE (ft)	MWS Standard Size
0.25	117	4.85	MWS 8 - 12
0.5	189	5.1	MWS 8 - 20
0.75	225	5.9	MWS 8 - 24
1	225	7.0	MWS 8 - 24
1.25	450	5.4	2 x MWS 8 - 24
1.5	450	5.9	2 x MWS 8 - 24

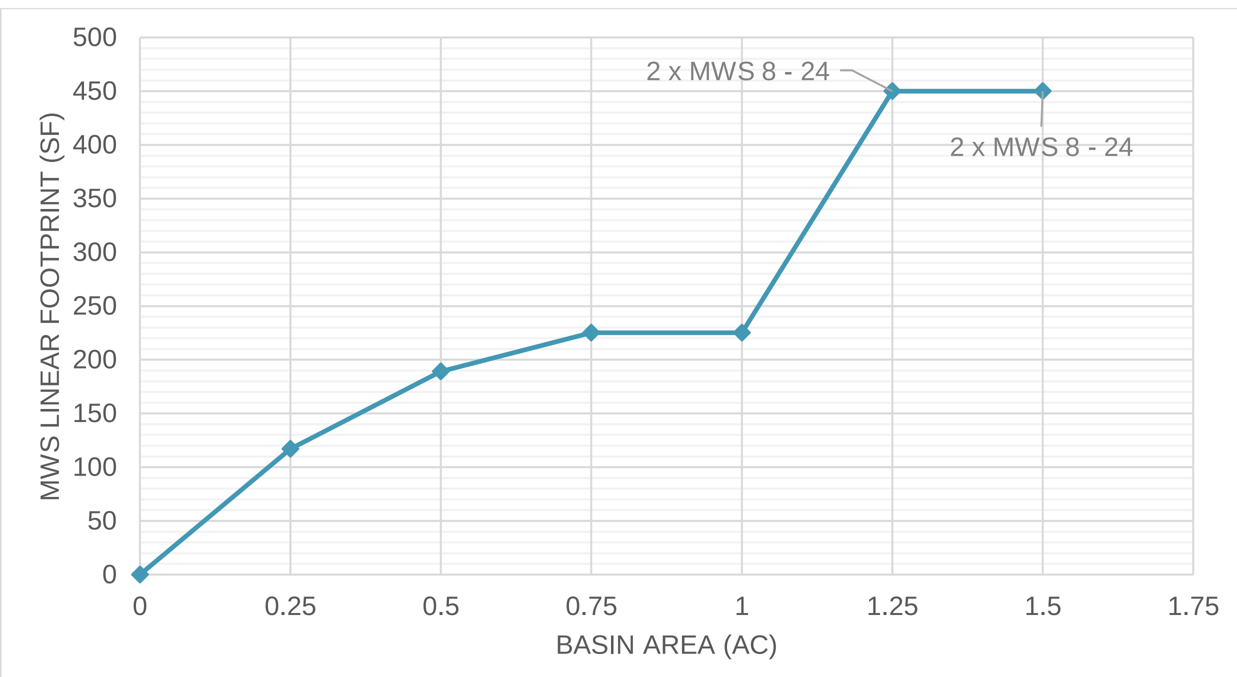


Figure C9. Modular Wetland Summary of Sizing

Cistern

Cisterns provides storage of stormwater runoff which is released to a storm or combined sewer system. Cisterns maybe designed with a discharge structure (e.g., weir or orifice) which will release flows a predetermined rate. Cisterns are available in standard manufacturing sizes ranging from 2,000 to 22,500 gallons. The assumptions used to size the cisterns are outlined in Table C16. Table C17 and Figure C10 displays the cistern sizes required for a basin area, as well as common standard cistern sizes for reference.

Table C16. Cistern Sizing Assumptions

BMP Design Variables	Design Assumptions
Maximum Discharge Rate	0.05 cfs
Design Storm Retention Volume	10 year 24-hour

Table C17. Cistern Summary of Sizing

Cistern Maximum Discharge of 0.05 cfs for 10-year, 24-hour Storm Event	
Basin Area (AC)	Volume (Gallons)
0.1	48
0.2	1,249
0.25	2,162
0.5	8,191
0.75	16,240
1	27,117

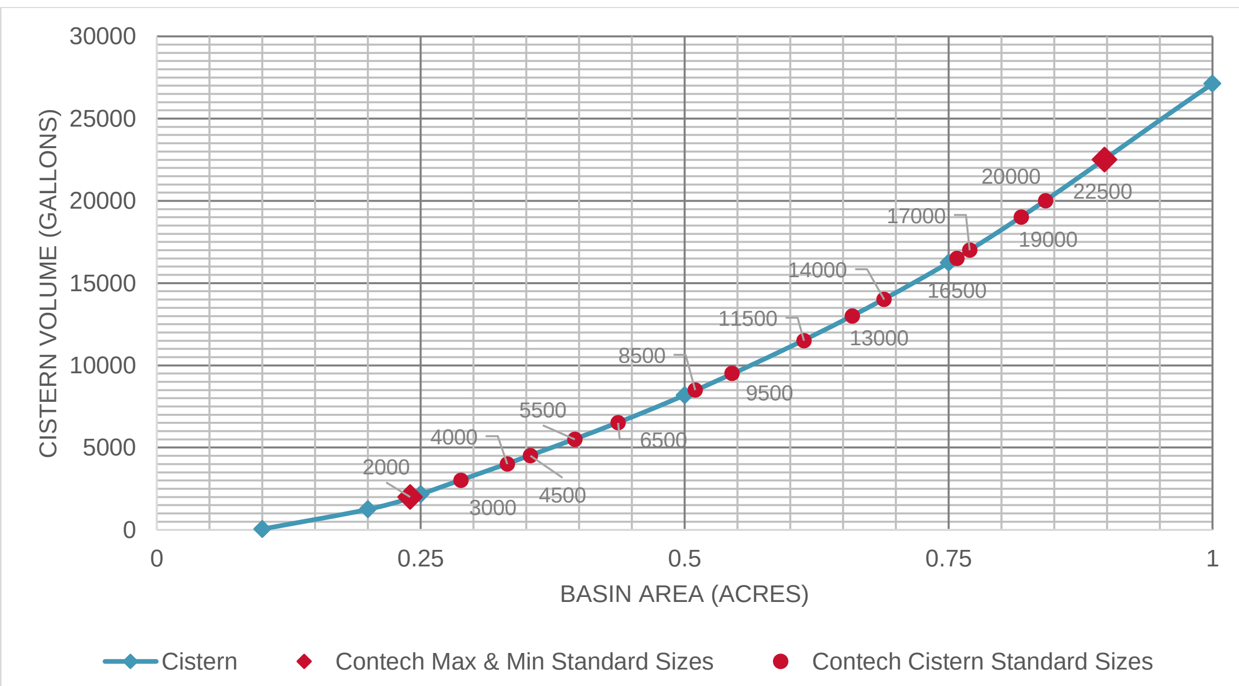


Figure C10. Cistern Sizing Summary: Basin Area vs. Cistern Volume

APPENDIX D. RECOMMENDED BMP SIZES AND LOCATIONS

BMP Name	BMP Classification	Basin ID	Basin Area (ac)	Classification Justification	Basin Location	Runoff Treatment	Detention	Largest BMP Type	Footprint (sq. ft)	Second Largest BMP Type	Footprint (sq. ft)	Smallest BMP Type	Footprint (sq. ft)
R1	A	RB0	1.3	No evidence of depth to impermeable layer or groundwater around or on site	Intersection of Spokane Falls Blvd and Browne	Basic, metals, oil control (sorptive)	None	Permeable pavement	2925	PaveDrain	2405	ModWet	450
R2	A	RB5	0.3	No evidence of depth to impermeable layer or groundwater around or on site	Main St between Bernard and Browne - north side of street	Basic	None	Permeable pavement	675	PaveDrain	555	Bioretention/Bioinfiltration Vault with Overflow	186
R3	A	RB6	0.7	No evidence of depth to impermeable layer or groundwater around or on site	Main St between Bernard and Browne - south side of street	Basic	None	Permeable pavement	1575	PaveDrain	1295	ModWet	225
R4	A	RB6	0.7	No evidence of depth to impermeable layer or groundwater around or on site	Northwest intersection of Riverside and Browne - west half of street	Basic, metals, oil control (sorptive)	None	Permeable pavement	1575	PaveDrain	1295	ModWet	225
R5	A	RB2	1.2	No evidence of depth to impermeable layer or groundwater around or on site	Northwest intersection of Riverside and Browne - east half of street	Basic, metals, oil control (sorptive)	None	Permeable pavement	2700	PaveDrain	2220	ModWet	450
R6	A	RB9	0.3	No evidence of depth to impermeable layer or groundwater around or on site	Sprague Ave between Bernard and Brown - north half of street	Basic	None	Permeable pavement	675	PaveDrain	555	Bioretention/Bioinfiltration Vault with Overflow	186
R7	A	RB76	0.8	No evidence of depth to impermeable layer or groundwater around or on site	Sprague Ave between Bernard and Brown - south half of street	Basic	None	Permeable pavement	1800	PaveDrain	1480	ModWet	225
R9	D	RB10	0.9	Known depth to impermeable layer around site is not sufficient	North side Browne Sprague intersection - west half of street	Basic, metals, oil control (sorptive)	Cistern; 22,500 gallon	Permeable pavement with underdrain	2025	PaveDrain with underdrain	1665	ModWet	225
R8	D	RB8	0.6	Known depth to impermeable layer around site is not sufficient	North side Browne Sprague intersection - east half of street	Basic, metals, oil control (sorptive)	Cistern; 11,500 gallon	Permeable pavement with underdrain	1350	PaveDrain with underdrain	1110	ModWet	225
R10	A	RB76	0.8	No evidence of depth to impermeable layer or groundwater around or on site	North side of Browne Pacific intersection - west half of street	Basic, metals, oil control (sorptive)	None	Permeable pavement	1800	PaveDrain	1480	ModWet	225
R11	A	RB77	0.6	No evidence of depth to impermeable layer or groundwater around or on site	North side of Browne Pacific intersection - east half of street	Basic, metals, oil control (sorptive)	None	Permeable pavement	1350	PaveDrain	1110	ModWet	225
R12	A	RB58	0.5	Known depth to impermeable layer around or on site is sufficient	South side of Browne 2nd intersection - west half of street	Basic, metals, oil control (sorptive)	None	Permeable pavement	1125	PaveDrain	925	ModWet	189
R13	A	RB61	0.9	Known depth to impermeable layer around or on site is sufficient	South side of Browne 2nd intersection - east half of street	Basic, metals, oil control (sorptive)	None	Permeable pavement	2025	PaveDrain	1665	ModWet	225
R16	C	RB1	0.3	No evidence of depth to impermeable layer or groundwater around or on site	Division between Main and Spokane Falls Blvd - west half of street	Basic, metals, oil control (sorptive)	Cistern; 4,000 gallon	Permeable pavement with underdrain	675	PaveDrain with underdrain	555	Bioretention/Bioinfiltration Vault with Overflow	186
R17	C	RB12	1.3	No evidence of depth to impermeable layer or groundwater around or on site	Division between Main and Spokane Falls Blvd - east half of street	Basic, metals, oil control (sorptive)	Cisterns; (2) 13,000 gallon	Permeable pavement with underdrain	2925	PaveDrain with underdrain	2405	ModWet	450
R15	A	RB52	0.6	No evidence of depth to impermeable layer or groundwater around or on site	State St between 2nd and Pacific - east half of the street	Basic (assumed)	None	Permeable pavement	1350	PaveDrain	1110	ModWet	225
R14	A	RB72	0.3	No evidence of depth to impermeable layer or groundwater around or on site	State St north of Pacific - east half of the street	Basic (assumed)	None	Permeable pavement	675	PaveDrain	555	Bioretention/Bioinfiltration Vault with Overflow	186
R19	C	RB13	1.1	No evidence of depth to impermeable layer or groundwater around or on site	Division St south of Main - east side of street	Basic, metals, oil control (sorptive)	Cisterns; (2) 11,500 gallon	Permeable pavement with underdrain	2475	PaveDrain with underdrain	2035	ModWet	450
R18	C	RB2	1.2	No evidence of depth to impermeable layer or groundwater around or on site	Division St south of Main - west side of street	Basic, metals, oil control (sorptive)	Cisterns; (2) 11,500 gallon	Permeable pavement with underdrain	2700	PaveDrain with underdrain	2220	ModWet	450
R20	C	RB3	0.5	Known depth to impermeable layer around or on site is sufficient	Riverside east of Division - north half of street	Basic (assumed)	Cistern; 8,500 gallon	Permeable pavement with underdrain	1125	PaveDrain with underdrain	925	ModWet	189
R21	C	RB78	0.6	No evidence of depth to impermeable layer or groundwater around or on site	Division between Pacific and 1st - west half of street	Basic, metals, oil control (sorptive)	Cistern; 11,500 gallon	Permeable pavement with underdrain	1350	PaveDrain with underdrain	1110	ModWet	225
R22	C	RB61	0.9	Known depth to impermeable layer around or on site is sufficient	Division between 2nd and 3rd - west half of street	Basic, metals, oil control (sorptive)	Cistern; 22,500 gallon	Permeable pavement with underdrain	2025	PaveDrain with underdrain	1665	ModWet	225
R23	A	RB16	0.7	Known depth to impermeable layer around or on site is sufficient	Pine between Sprague and 1st - west half	Basic (assumed)	None	Permeable pavement	1575	PaveDrain	1295	ModWet	225
R25	A	RB18	0.8	No evidence of depth to impermeable layer or groundwater around or on site	Pine between Pacific and 1st - east half	Basic (assumed)	None	Permeable pavement	1800	PaveDrain	1480	ModWet	225
R28	A	RB51	0.8	Known depth to impermeable layer around or on site is sufficient	Pine between Pacific and 2nd - west half, Pacific east of Pine - south half	Basic (assumed)	None	Permeable pavement	1800	PaveDrain	1480	ModWet	225
R27	A	RB19	0.2	No evidence of depth to impermeable layer or groundwater around or on site	Pacific east of Pine - north half	Basic (assumed)	None	Permeable pavement	450	PaveDrain	370	ModWet	117
R29	A	RB48	0.8	Known depth to impermeable layer around or on site is sufficient	Pine between Pacific and 2nd - east half	Basic (assumed)	None	Permeable pavement	1800	PaveDrain	1480	ModWet	225
R26	A	RB20	0.8	No evidence of depth to impermeable layer or groundwater around or on site	Pine between Pacific and 1st - west half	Basic (assumed)	None	Permeable pavement	1800	PaveDrain	1480	ModWet	225
R24	A	RB30	0.5	Known depth to impermeable layer around or on site is sufficient	Pine between Sprague and 1st - east half	Basic (assumed)	None	Permeable pavement	1125	PaveDrain	925	ModWet	189

BMP Name	BMP Classification	Basin ID	Basin Area (ac)	Classification Justification	Basin Location	Runoff Treatment	Detention	Largest BMP Type	Footprint (sq. ft)	Second Largest BMP Type	Footprint (sq. ft)	Smallest BMP Type	Footprint (sq. ft)
R30	D	RB67	0.8	Known depth to impermeable layer around site is not sufficient	Pine between 2nd and 3rd - west half	Basic (assumed)	Cistern; 19,000 gallon	Permeable pavement with underdrain	1800	PaveDrain with underdrain	1480	ModWet	225
R31	D	RB69	0.8	Known depth to impermeable layer around site is not sufficient	Pine between 2nd and 3rd - east half	Basic (assumed)	Cistern; 19,000 gallon	Permeable pavement with underdrain	1800	PaveDrain with underdrain	1480	ModWet	225
R33	D	RB29	0.6	Known depth to impermeable layer around site is not sufficient	Cowley between Sprague and 1st - east half	Basic (assumed)	Cistern; 11,500 gallon	Permeable pavement with underdrain	1350	PaveDrain with underdrain	1110	ModWet	225
R36	A	RB20	0.8	No evidence of depth to impermeable layer or groundwater around or on site	Cowley between 1st and Pacific - west half	Basic (assumed)	None	Permeable pavement	1800	PaveDrain	1480	ModWet	225
R32	D	RB30	0.5	Known depth to impermeable layer around site is not sufficient	Cowley between Sprague and 1st - west half	Basic (assumed)	Cistern; 8,500 gallon	Permeable pavement with underdrain	1125	PaveDrain with underdrain	925	ModWet	189
R37	A	RB23	0.8	No evidence of depth to impermeable layer or groundwater around or on site	Cowley between 1st and Pacific - east half	Basic (assumed)	None	Permeable pavement	1800	PaveDrain	1480	ModWet	225
R34	D	RB28	0.2	Area above historic lake; potential high groundwater	1st east of Cowley - north half	Basic (assumed)	Cistern; 2,000 gallon	Permeable pavement with underdrain	450	PaveDrain with underdrain	370	ModWet	117
R35	D	RB23	0.8	Area above historic lake; potential high groundwater	1st east of Cowley - south half	Basic (assumed)	Cistern; 19,000 gallon	Permeable pavement with underdrain	1800	PaveDrain with underdrain	1480	ModWet	225
R39	D	RB48	0.8	Known depth to impermeable layer around site is not sufficient	Cowley between Pacific and 2nd - west half, Pacific west of Cowley - south half	Basic (assumed)	Cistern; 19,000 gallon	Permeable pavement with underdrain	1800	PaveDrain with underdrain	1480	ModWet	225
R40	D	RB80	0.5	Known depth to impermeable layer around site is not sufficient	Cowley between Pacific and 2nd - east half	Basic (assumed)	Cistern; 8,500 gallon	Permeable pavement with underdrain	1125	PaveDrain with underdrain	925	ModWet	189
R38	A	RB21	0.2	No evidence of depth to impermeable layer or groundwater around or on site	Pacific west of Cowley - north half	Basic (assumed)	None	Permeable pavement	450	PaveDrain	370	ModWet	117
R41	D	RB69	0.8	Known depth to impermeable layer around site is not sufficient	Cowley north of 3rd - west half	Basic (assumed)	Cistern; 19,000 gallon	Permeable pavement with underdrain	1800	PaveDrain with underdrain	1480	ModWet	225
R43	A	RB68	0.3	Known depth to impermeable layer around or on site is sufficient	3rd between Pine and Cowley - north half	Basic	None	Permeable pavement	675	PaveDrain	555	Bioretention/Bioinfiltration Vault with Overflow	186
R44	A	RB65	1.7	Known depth to impermeable layer around or on site is sufficient	3rd between Pine and Cowley - south half	Basic	None	Permeable pavement	3825	PaveDrain	3145	ModWet	450
R42	D	RB71	0.8	Known depth to impermeable layer around site is not sufficient	Cowley north of 3rd - east half	Basic	Cistern; 19,000 gallon	Permeable pavement with underdrain	1800	PaveDrain with underdrain	1480	ModWet	225
R46	D	RB26	0.6	Area above historic lake; potential high groundwater	Spokane St north of 1st - east half	Basic (assumed)	Cistern; 11,500 gallon	Permeable pavement with underdrain	1350	PaveDrain with underdrain	1110	ModWet	225
R45	D	RB29	0.6	Area above historic lake; potential high groundwater	Spokane St north of 1st - west half	Basic (assumed)	Cistern; 11,500 gallon	Permeable pavement with underdrain	1350	PaveDrain with underdrain	1110	ModWet	225
R47	D	RB79	0.5	Known depth to impermeable layer around site is not sufficient	Spokane St between Pacific and 2nd - west half	Basic (assumed)	Cistern; 8,500 gallon	Permeable pavement with underdrain	1125	PaveDrain with underdrain	925	ModWet	189
R48	D	RB36	1.2	Known depth to impermeable layer around site is not sufficient	Spokane St between Pacific and 2nd - east half	Basic (assumed)	Cisterns; (2) 11,500 gallon	Permeable pavement with underdrain	2700	PaveDrain with underdrain	2220	ModWet	450
R50	A	RB40	0.6	Known depth to impermeable layer around or on site is sufficient	Spokane St north of 3rd - east half	Basic (assumed)	None	Permeable pavement	1350	PaveDrain	1110	ModWet	225
R51	A	RB39	0.3	Known depth to impermeable layer around or on site is sufficient	3rd east of Spokane St - north half	Basic	None	Permeable pavement	675	PaveDrain	555	Bioretention/Bioinfiltration Vault with Overflow	186
R52	D	RB65	1.7	Known depth to impermeable layer around site is not sufficient	Spokane St south of 3rd - west half	Basic (assumed)	Cisterns; (2) 22,500 gallon	Permeable pavement with underdrain	3825	PaveDrain with underdrain	3145	ModWet	450
R53	A	RB106	0.4	Known depth to impermeable layer around or on site is sufficient	Spokane St south of 3rd - east half	Basic (assumed)	None	Permeable pavement	900	PaveDrain	740	ModWet	189
R49	D	RB71	0.8	Known depth to impermeable layer around site is not sufficient	Spokane St north of 3rd - west half	Basic (assumed)	Cistern; 19,000 gallon	Permeable pavement with underdrain	1800	PaveDrain with underdrain	1480	ModWet	225
R56	D	RB26	0.6	Known depth to impermeable layer around site is not sufficient	Grant between Sprague and 1st - west half	Basic (assumed)	Cistern; 11,500 gallon	Permeable pavement with underdrain	1350	PaveDrain with underdrain	1110	ModWet	225
R57	D	RB33	0.6	Known depth to impermeable layer around site is not sufficient	Grant between Sprague and 1st - east half	Basic (assumed)	Cistern; 11,500 gallon	Permeable pavement with underdrain	1350	PaveDrain with underdrain	1110	ModWet	225
R58	D	RB24	0.8	Known depth to impermeable layer around site is not sufficient	Grant between 1st and Pacific - west half	Basic (assumed)	Cistern; 19,000 gallon	Permeable pavement with underdrain	1800	PaveDrain with underdrain	1480	ModWet	225
R59	D	RB35	0.9	Known depth to impermeable layer around site is not sufficient	Grant between 1st and Pacific - east half	Basic (assumed)	Cistern; 22,500 gallon	Permeable pavement with underdrain	2025	PaveDrain with underdrain	1665	ModWet	225
R54	D	RB125	0.15	Known depth to impermeable layer around site is not sufficient	Grant north of Sprague - west half	Basic (assumed)	Cistern; 2,000 gallon	Permeable pavement with underdrain	337.5	PaveDrain with underdrain	277.5	Bioretention/Bioinfiltration Vault with Overflow	93

BMP Name	BMP Classification	Basin ID	Basin Area (ac)	Classification Justification	Basin Location	Runoff Treatment	Detention	Largest BMP Type	Footprint (sq. ft)	Second Largest BMP Type	Footprint (sq. ft)	Smallest BMP Type	Footprint (sq. ft)
R55	D	RB126	0.14	Known depth to impermeable layer around site is not sufficient	Grant north of Sprague - east half	Basic (assumed)	Cistern; 2,000 gallon	Permeable pavement with underdrain	315	PaveDrain with underdrain	259	Bioretention/Bioinfiltration Vault with Overflow	86.8
R64	D	RB33	0.6	Known depth to impermeable layer around site is not sufficient	Sherman north of 1st - west half	Basic	Cistern; 11,500 gallon	Permeable pavement with underdrain	1350	PaveDrain with underdrain	1110	ModWet	225
R66	A	RB35	0.9	Known depth to impermeable layer around or on site is sufficient	Sherman between 1st and Pacific - west half	Basic	None	Permeable pavement	2025	PaveDrain	1665	ModWet	225
R67	A	RB46	0.5	Known depth to impermeable layer around or on site is sufficient	Sherman between 1st and Pacific - east half	Basic	None	Permeable pavement	1125	PaveDrain	925	ModWet	189
R65	D	RB81	0.4	Known depth to impermeable layer around site is not sufficient	Sherman north of 1st - east half	Basic	Cistern; 6,500 gallon	Permeable pavement with underdrain	900	PaveDrain with underdrain	740	ModWet	189
R68	A	RB36	1.1	Known depth to impermeable layer around or on site is sufficient	Sherman between Pacific and 2nd - west	Basic	None	Permeable pavement	2475	PaveDrain	2035	ModWet	450
R70	A	RB42	0.5	Known depth to impermeable layer around or on site is sufficient	Sherman between 2nd and 3rd - west half	Basic	None	Permeable pavement	1125	PaveDrain	925	ModWet	189
R71	A	RB43	0.2	Known depth to impermeable layer around or on site is sufficient	Sherman between 2nd and 3rd - east half	Basic	None	Permeable pavement	450	PaveDrain	370	ModWet	117
R69	A	RB45	0.8	Known depth to impermeable layer around or on site is sufficient	Sherman between Pacific and 2nd - east	Basic	None	Permeable pavement	1800	PaveDrain	1480	ModWet	225
R73	D	RB91	0.6	Known depth to impermeable layer around site is not sufficient	Sherman south of 3rd - east half	Basic, metals, oil control (sorptive)	Cistern; 11,500 gallon	Permeable pavement with underdrain	1350	PaveDrain with underdrain	1110	ModWet	225
R72	D	RB92	1	Known depth to impermeable layer around site is not sufficient	Sherman south of 3rd - west half	Basic, metals, oil control (sorptive)	Cisterns; (2) 8,500 gallon	Permeable pavement with underdrain	2250	PaveDrain with underdrain	1850	ModWet	225
R60	D	RB39	0.3	Known depth to impermeable layer around site is not sufficient	3rd east of Grant - north half	Basic	Cistern; 4,000 gallon	Permeable pavement with underdrain	675	PaveDrain with underdrain	555	Bioretention/Bioinfiltration Vault with Overflow	186
R62	D	RB93	0.5	Known depth to impermeable layer around site is not sufficient	Grant south of 3rd - west half	Basic (assumed)	Cistern; 8,500 gallon	Permeable pavement with underdrain	1125	PaveDrain with underdrain	925	ModWet	189
R61	D	RB41	0.3	Known depth to impermeable layer around site is not sufficient	3rd east of Grant - north half	Basic	Cistern; 4,000 gallon	Permeable pavement with underdrain	675	PaveDrain with underdrain	555	Bioretention/Bioinfiltration Vault with Overflow	186
R63	D	RB92	1	Known depth to impermeable layer around site is not sufficient	Grant south of 3rd - east half	Basic (assumed)	Cisterns; (2) 8,500 gallon	Permeable pavement with underdrain	2250	PaveDrain with underdrain	1850	ModWet	225
R75	D	RB81	0.4	Known depth to impermeable layer on site is not sufficient	Sprague east of Sheridan - south half	Basic, metals, oil control (sorptive)	Cistern; 6,500 gallon	Permeable pavement with underdrain	900	PaveDrain with underdrain	740	ModWet	189
R74	D	RB94	2.7	Known depth to impermeable layer on site is not sufficient	Sprague east of Sheridan - north half	Basic, metals, oil control (sorptive)	Cisterns; (4) 16,500 gallon	Permeable pavement with underdrain	6075	PaveDrain with underdrain	4995	ModWet	675
R77	D	RB47	0.5	Area above historic lake; potential high groundwater	Sheridan south of 1st - west half, 1st east of Sheridan - south half	Basic (assumed)	Cistern; 8,500 gallon	Permeable pavement with underdrain	1125	PaveDrain with underdrain	925	ModWet	189
R76	D	RB82	1	Area above historic lake; potential high groundwater	1st east of Sheridan - north half	Basic (assumed)	Cisterns; (2) 8,500 gallon	Permeable pavement with underdrain	2250	PaveDrain with underdrain	1850	ModWet	225
R78	D	RB84	0.2	Area above historic lake; potential high groundwater	Sheridan between 1st and Pacific - east half	Basic (assumed)	Cistern; 2,000 gallon	Permeable pavement with underdrain	450	PaveDrain with underdrain	370	ModWet	117
R79	D	RB45	0.8	Known depth to impermeable layer around site is not sufficient	Sheridan between Pacific and 2nd - west half	Basic (assumed)	Cistern; 19,000 gallon	Permeable pavement with underdrain	1800	PaveDrain with underdrain	1480	ModWet	225
R80	D	RB85	0.5	Known depth to impermeable layer around site is not sufficient	Sheridan between Pacific and 2nd - east half	Basic (assumed)	Cistern; 8,500 gallon	Permeable pavement with underdrain	1125	PaveDrain with underdrain	925	ModWet	189
R83	D	RB87	0.7	Known depth to impermeable layer around site is not sufficient	Sheridan between 2nd and 3rd - west half	Basic (assumed)	Cistern; 16,500 gallon	Permeable pavement with underdrain	1575	PaveDrain with underdrain	1295	ModWet	225
R84	D	RB88	0.8	Known depth to impermeable layer around site is not sufficient	Sheridan between 2nd and 3rd - east half	Basic (assumed)	Cistern; 19,000 gallon	Permeable pavement with underdrain	1800	PaveDrain with underdrain	1480	ModWet	225
R81	D	RB44	0.2	Known depth to impermeable layer on site is not sufficient	2nd east of Sheridan - north half	Basic, metals	Cistern; 2,000 gallon	Permeable pavement with underdrain	450	PaveDrain with underdrain	370	ModWet	117
R82	D	RB87	0.7	Known depth to impermeable layer on site is not sufficient	2nd east of Sheridan - south half	Basic, metals	Cistern; 16,500 gallon	Permeable pavement with underdrain	1575	PaveDrain with underdrain	1295	ModWet	225
R85	D	RB82	1	Area above historic lake; potential high groundwater	Hatch between Sprague and 1st - west half	Basic (assumed)	Cisterns; (2) 8,500 gallon	Permeable pavement with underdrain	2250	PaveDrain with underdrain	1850	ModWet	225
R86	D	RB96	0.4	Area above historic lake; potential high groundwater	Hatch between Sprague and 1st - east half	Basic (assumed)	Cistern; 6,500 gallon	Permeable pavement with underdrain	900	PaveDrain with underdrain	740	ModWet	189
R87	D	RB83	0.8	Area above historic lake; potential high groundwater	Hatch between 1st and Pacific - west half	Basic (assumed)	Cistern; 19,000 gallon	Permeable pavement with underdrain	1800	PaveDrain with underdrain	1480	ModWet	225

BMP Name	BMP Classification	Basin ID	Basin Area (ac)	Classification Justification	Basin Location	Runoff Treatment	Detention	Largest BMP Type	Footprint (sq. ft)	Second Largest BMP Type	Footprint (sq. ft)	Smallest BMP Type	Footprint (sq. ft)
R88	D	RB99	0.8	Area above historic lake; potential high groundwater	Hatch between 1st and Pacific - east half	Basic (assumed)	Cistern; 19,000 gallon	Permeable pavement with underdrain	1800	PaveDrain with underdrain	1480	ModWet	225
R89	A	RB83	0.8	Known depth to impermeable layer around or on site is sufficient	Pacific west of Hatch - north half	Basic (assumed)	None	Permeable pavement	1800	PaveDrain	1480	ModWet	225
R90	A	RB86	0.5	Known depth to impermeable layer around or on site is sufficient	Pacific west of Hatch - south half	Basic (assumed)	None	Permeable pavement	1125	PaveDrain	925	ModWet	189
R91	D	RB86	0.5	Known depth to impermeable layer around site is not sufficient	Hatch between Pacific and 2nd - west half	Basic (assumed)	Cistern; 8,500 gallon	Permeable pavement with underdrain	1125	PaveDrain with underdrain	925	ModWet	189
R92	D	RB100	0.7	Known depth to impermeable layer around site is not sufficient	Hatch between Pacific and 2nd - east half	Basic (assumed)	Cistern; 16,500 gallon	Permeable pavement with underdrain	1575	PaveDrain with underdrain	1295	ModWet	225
R93	A	RB85	0.5	Known depth to impermeable layer around or on site is sufficient	2nd west of Hatch - north half	Basic, metals	None	Permeable pavement	1125	PaveDrain	925	ModWet	189
R94	A	RB88	0.8	Known depth to impermeable layer around or on site is sufficient	2nd west of Hatch - south half	Basic, metals	None	Permeable pavement	1800	PaveDrain	1480	ModWet	225
R95	D	RB88	0.8	Known depth to impermeable layer around site is not sufficient	Hatch between 2nd and 3rd - west half	Basic (assumed)	Cistern; 19,000 gallon	Permeable pavement with underdrain	1800	PaveDrain with underdrain	1480	ModWet	225
R96	D	RB102	0.4	Known depth to impermeable layer around site is not sufficient	Hatch between 2nd and 3rd - east half	Basic (assumed)	Cistern; 6,500 gallon	Permeable pavement with underdrain	900	PaveDrain with underdrain	740	ModWet	189
R98	A	RB110	0.7	Known depth to impermeable layer around or on site is sufficient	Scott north of 1st - east half	Basic (assumed)	None	Permeable pavement	1575	PaveDrain	1295	ModWet	225
R97	A	RB97	0.4	Known depth to impermeable layer around or on site is sufficient	Scott north of 1st - west half	Basic (assumed)	None	Permeable pavement	900	PaveDrain	740	ModWet	189
R99	A	RB98	0.2	No evidence of depth to impermeable layer or groundwater around or on site	Scott between 1st and Pacific - west half	Basic (assumed)	None	Permeable pavement	450	PaveDrain	370	ModWet	117
R100	A	RB100	0.7	No evidence of depth to impermeable layer or groundwater around or on site	Scott between 1st and Pacific - east half	Basic (assumed)	None	Permeable pavement	1575	PaveDrain	1295	ModWet	225
R101	A	RB101	0.4	No evidence of depth to impermeable layer or groundwater around or on site	Scott north of 2nd - west half	Basic (assumed)	None	Permeable pavement	900	PaveDrain	740	ModWet	189
R102	A	RB110	0.7	No evidence of depth to impermeable layer or groundwater around or on site	Scott north of 2nd - east half	Basic (assumed)	None	Permeable pavement	1575	PaveDrain	1295	ModWet	225
R107	D	RB107	1.5	Known depth to impermeable layer around site is not sufficient	2nd east of Scott - north half	Basic, metals	Cisterns; (2) 16,500 gallon	Permeable pavement with underdrain	3375	PaveDrain with underdrain	2775	ModWet	450
R108	D	RB111	0.9	Known depth to impermeable layer around site is not sufficient	2nd east of Scott - south half	Basic, metals	Cistern; 22,500 gallon	Permeable pavement with underdrain	2025	PaveDrain with underdrain	1665	ModWet	225
R105	A	RB103	0.6	Known depth to impermeable layer around or on site is sufficient	Scott south of 2nd - west half	Basic (assumed)	None	Permeable pavement	1350	PaveDrain	1110	ModWet	225
R106	A	RB111	0.9	Known depth to impermeable layer around or on site is sufficient	Scott south of 2nd - east half	Basic (assumed)	None	Permeable pavement	2025	PaveDrain	1665	ModWet	225
R103	D	RB101	0.4	Known depth to impermeable layer around site is not sufficient	2nd west of Scott - north half	Basic, metals	Cistern; 6,500 gallon	Permeable pavement with underdrain	900	PaveDrain with underdrain	740	ModWet	189
R104	D	RB103	0.6	Known depth to impermeable layer around site is not sufficient	2nd west of Scott - south half	Basic, metals	Cistern; 11,500 gallon	Permeable pavement with underdrain	1350	PaveDrain with underdrain	1110	ModWet	225
R109	A	RB112	0.9	Known depth to impermeable layer around or on site is sufficient	3rd east of Sprague Scott intersection - north half	Basic	None	Permeable pavement	2025	PaveDrain	1665	ModWet	225
R110	A	RB104	1.3	Known depth to impermeable layer around or on site is sufficient	3rd east of Sprague Scott intersection - south half	Basic	None	Permeable pavement	2925	PaveDrain	2405	ModWet	450
R111	A	RB113	0.8	No evidence of depth to impermeable layer or groundwater around or on site	2nd east of Sprague - north half	Basic, metals	None	Permeable pavement	1800	PaveDrain	1480	ModWet	225
R112	A	RB111	0.9	No evidence of depth to impermeable layer or groundwater around or on site	2nd east of Sprague - south half	Basic, metals	None	Permeable pavement	2025	PaveDrain	1665	ModWet	225
R113	D	RB113	0.8	Area above historic lake; potential high groundwater	Arthur north of 2nd - west half	Basic (assumed)	Cistern; 19,000 gallon	Permeable pavement with underdrain	1800	PaveDrain with underdrain	1480	ModWet	225
R114	D	RB114	0.3	Area above historic lake; potential high groundwater	Arthur north of 2nd - east half	Basic (assumed)	Cistern; 4,000 gallon	Permeable pavement with underdrain	675	PaveDrain with underdrain	555	Bioretention/Bioinfiltration Vault with Overflow	186
R115	D	RB112	0.9	Known depth to impermeable layer around site is not sufficient	Arthur between 2nd and 3rd - west half	Basic	Cistern; 22,500 gallon	Permeable pavement with underdrain	2025	PaveDrain with underdrain	1665	ModWet	225
R116	D	RB115	0.8	Known depth to impermeable layer around site is not sufficient	Arthur between 2nd and 3rd - east half	Basic	Cistern; 19,000 gallon	Permeable pavement with underdrain	1800	PaveDrain with underdrain	1480	ModWet	225

BMP Name	BMP Classification	Basin ID	Basin Area (ac)	Classification Justification	Basin Location	Runoff Treatment	Detention	Largest BMP Type	Footprint (sq. ft)	Second Largest BMP Type	Footprint (sq. ft)	Smallest BMP Type	Footprint (sq. ft)
R118	D	RB104	1.3	Known depth to impermeable layer around site is not sufficient	3rd west of Arthur - south half	Basic	Cisterns; (2) 13,000 gallon	Permeable pavement with underdrain	2925	PaveDrain with underdrain	2405	ModWet	450
R117	D	RB112	0.9	Known depth to impermeable layer around site is not sufficient	3rd west of Arthur - north half	Basic	Cistern; 22,500 gallon	Permeable pavement with underdrain	2025	PaveDrain with underdrain	1665	ModWet	225
R120	D	RB105	0.5	Known depth to impermeable layer around site is not sufficient	Arthur south of 3rd - east half	Basic, metals, oil control (sorptive)	Cistern; 8,500 gallon	Permeable pavement with underdrain	1125	PaveDrain with underdrain	925	ModWet	189
R119	D	RB104	1.3	Known depth to impermeable layer around site is not sufficient	Arthur south of 3rd - west half	Basic, metals, oil control (sorptive)	Cisterns; (2) 13,000 gallon	Permeable pavement with underdrain	2925	PaveDrain with underdrain	2405	ModWet	450
R122	A	RB124	0.8	Known depth to impermeable layer around or on site is sufficient	Front west of Denver - south half	Basic (assumed)	None	Permeable pavement	1800	PaveDrain	1480	ModWet	225
R121	A	RB118	0.4	Known depth to impermeable layer around or on site is sufficient	Front west of Denver - north half	Basic (assumed)	None	Permeable pavement	900	PaveDrain	740	ModWet	189
R123	A	RB122	0.4	Known depth to impermeable layer around or on site is sufficient	Front east of Denver - north half	Basic (assumed)	None	Permeable pavement	900	PaveDrain	740	ModWet	189
R124	A	RB123	1.1	Known depth to impermeable layer around or on site is sufficient	Front east of Perry - north half	Basic (assumed)	None	Permeable pavement	2475	PaveDrain	2035	ModWet	450
U1	A	UB17	0.98	No evidence of depth to impermeable layer or groundwater around or on site	Riverpoint	Undeveloped; assume basic for developed conditions	none	Permeable pavement	2203	PaveDrain	1811	Modular Wetland	225
U2	D	UB15	0.57	Area above historic lake; potential high groundwater	Southwest of intersection of Riverside and Grant	Undeveloped; assume basic for developed conditions	Cistern; 11,500 gallons	Permeable pavement with underdrain	1284	PaveDrain with underdrain	1056	Modular Wetland	225
U3	A	UB0	0.42	No evidence of depth to impermeable layer or groundwater around or on site	Southeast of intersection of 1st and Spokane	Undeveloped; assume basic for developed conditions	none	Permeable pavement	942	PaveDrain	776	Modular Wetland	189
U4	A	UB6, UB7	0.42	No evidence of depth to impermeable layer or groundwater around or on site	Southeast of intersection of 3rd and Spokane	Undeveloped; assume basic for developed conditions	none	Permeable pavement	942	PaveDrain	776	Modular Wetland	189
U5	A	UB1	0.31	No evidence of depth to impermeable layer or groundwater around or on site	North of Pacific between Spokane and Grant	Undeveloped; assume basic for developed conditions	none	Permeable pavement	696	PaveDrain	573	Modular Wetland	189
U6	A	UB8, UB9	0.4	Depth to impermeable layer is 5-10 feet on site	North of 5th between Chandler and Grant	Undeveloped; assume basic for developed conditions	none	Permeable pavement	898	PaveDrain	739	Modular Wetland	189
U7	D	UB2	0.62	Known depth to impermeable layer around site is not sufficient	South of the intersection of Pacific and Grant	Undeveloped; assume basic for developed conditions	Cistern; 13,000 gallons	Permeable pavement with underdrain	1396	PaveDrain with underdrain	1148	Modular Wetland	225
U8	D	UB5	0.17	Known depth to impermeable layer around site is not sufficient	Southwest of the intersection of 2nd and Sherman	Undeveloped; assume basic for developed conditions	Cistern; 2,000 gallons	Permeable pavement with underdrain	384	PaveDrain with underdrain	315	Modular Wetland	117
U10	D	UB10	0.1	Known depth to impermeable layer around site is not sufficient	South of 2nd between Scott and Sprague Access	Undeveloped; assume basic for developed conditions	Cistern; 2,000 gallons	Permeable pavement with underdrain	225	PaveDrain with underdrain	185	Bioretention/Bioinfiltration Vault with Overflow	62
U9	D	UB13	0.45	Known depth to impermeable layer around site is not sufficient	North of the intersection of Sprague and Sherman	Undeveloped; assume basic for developed conditions	Cistern; 8,500 gallons	Permeable pavement with underdrain	1010	PaveDrain with underdrain	832	Modular Wetland	189
U11	D	UB11, UB12	1.75	Known depth to impermeable layer around site is not sufficient	Southeast of intersection of 3rd and Arthur	Undeveloped; assume basic for developed conditions	Cisterns; (2) 22,500 gallon	Permeable pavement with underdrain	3938	PaveDrain with underdrain	3238	Modular Wetland	450
U12	A	UB20	0.82	No evidence of depth to impermeable layer or groundwater around or on site	Intersection of Erie and future MLK Alignment	Undeveloped; assume basic for developed conditions	none	Permeable pavement	1843	PaveDrain	1515	Modular Wetland	225
U13	A	UB18	1.87	No evidence of depth to impermeable layer or groundwater around or on site	North of Front between Denver and Perry	Undeveloped; assume basic for developed conditions	none	Permeable pavement	4208	PaveDrain	3460	Modular Wetland	450
U14	A	UB19	1.01	No evidence of depth to impermeable layer or groundwater around or on site	South of Trent between Perry and Hogan	Undeveloped; assume basic for developed conditions	none	Permeable pavement	2273	PaveDrain	1869	Modular Wetland	450
C1	D	CB16	1.2	Known depth to impermeable layer around or on site is not sufficient	North of Riverside between Grant and Sheridan	Undeveloped; assume basic for developed conditions	Cisterns; (2) 11,500 gallon	Permeable pavement with underdrain	2700	PaveDrain with underdrain	2220	Modular Wetland	450
C2	A	CB25	2.73	No evidence of depth to impermeable layer or groundwater around or on site	North of intersection of Riverside and Sheridan	Undeveloped; assume basic for developed conditions	Cisterns; (2) 22,500 gallon, (1) 2,000 gallon	Permeable pavement	6143	PaveDrain	5051	Modular Wetland ((3) MWS 8-34)	675
S1	A	SB1	0.88	Known depth to impermeable layer on site is >5 feet	North of Sprague between Scott and Sprague Access	Basic	none	Permeable pavement	1978	PaveDrain	1626	Modular Wetland	225
U6	A	UB8, UB9	0.4	Depth to impermeable layer is 5-10 feet on site	North of 5th between Chandler and Grant	Undeveloped; assume basic for developed conditions	none	Permeable pavement	898	PaveDrain	739	Modular Wetland	189