

LOW IMPACT DEVELOPMENT

HANDBOOK

2021

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1. Introduction

1.1 Purpose

The purpose of this handbook is to aide in understanding and complying with the Requirements of Hooper City Stormwater Program and fulfilling the regulations outlined in Utah’s Municipal Separate Storm Sewer System (MS4) permit. This information is to provide guidance for individuals involved in new development and redevelopment projects. Specific audiences include developers, designers, contractors, homeowners, and City staff that are responsible for plan-checking, permitting, and inspections. Material covered in this handbook provides information on the City’s project review and permitting process, identifies stormwater low impact development practices, and references source and treatment control BMP information.

1.2 Background

Polluted storm water runoff is often transported to municipal separate storm sewer systems (MS4s) and ultimately discharged into local rivers and streams without treatment. EPA’s Storm Water Phase II Rule establishes an MS4 storm water management program that is intended to improve the Nation’s waterways by reducing the quantity of pollutants that are introduced into storm sewer systems during storm events. Common pollutants include oil and grease from roadways, roadway salts and deicing materials, pesticides and fertilizers from lawns, sediment from construction sites, and carelessly discarded trash, such as cigarette butts, paper wrappers, and plastic bottles. When deposited into nearby waterways through MS4 discharges, these pollutants can impair the waterways, thereby discouraging use of the resource, contaminating water supplies, and interfering with the habitat for fish, other aquatic organisms, and wildlife.

In 1990, EPA promulgated rules establishing Phase I of the National Pollutant Discharge Elimination System (NPDES) storm water program. The Phase I program for MS4s requires operators of “medium” and “large” MS4s, that is, those that generally serve populations of 100,000 or greater, to implement a storm water management program as a means to control polluted discharges from these MS4s. The Storm Water Phase II Rule extends coverage of the NPDES storm water program to certain “small” MS4s but takes a slightly different approach to how the storm water management program is developed and implemented. Phase II communities are currently under regulations outlined in the general permit for discharge from Small Municipal Separate Storm Sewer Systems effective May 12, 2021.

1.3 Scope

The scope of this handbook is to provide information relative to the State of Utah UPDES permit section 4.2.5.1.3 which states “...the program shall include a process which requires the evaluation of Low Impact Development (LID) approach...”, furthermore, section 4.2.5.1.4 states

“If meeting the retention standards described in Part 4.2.5.1.2 is infeasible, a rationale shall be provided for the use of alternative design criteria. The new or redevelopment project must document and quantify that infiltration, evapotranspiration, and rainwater harvesting have been used to the maximum extent feasible and that full employment of these controls are infeasible due to constraints.”

2. Low Impact Development Principles and Stormwater Management Measures

2.1 What is Low Impact development

As defined in the State of Utah's "***A Guide to Low Impact Development within Utah***", "LID refers to engineered systems, either structural or natural, that use or mimic natural processes to promote infiltration, evapotranspiration, and/or reuse of storm water as close to its source as possible to protect water quality and aquatic habitat." Low Impact development generally targets minimizing runoff and may incorporate man made treatment or a combination of processes. This approach treats stormwater runoff as a beneficial resource instead of a nuisance. LID use and planning is a systematic approach to stormwater management that when planned, designed, constructed, and maintained appropriately, can result in improved stormwater quality, improved local water bodies, result in more attractive landscapes, improved wildlife habitats, and elevated lifestyle for all.

Low Impact Development is not a replacement for Flood Control. LID techniques target water quality. These standards should be followed in conjunction with flood control efforts.

2.2 Why use Low Impact development

Good LID planning generally focuses on reduced runoff within the site and ultimately require fewer structural best management practices. These practices reduce the amount of runoff generated during a storm event, alleviate downstream erosion, and filter out pollutants such as oil, bacteria, sediment, and nutrients. Proper planning for use of LID is essential for future land use and sustainable growth of the community. In developing a handbook, input from several disciplines such as planners, engineers, elected officials, developers, contractors, and other design professionals can be incorporated to allow proper planning.

2.3 Developing a Low Impact Development Plan

Project applicants for all developments and redevelopments will be required to incorporate stormwater mitigation measures into their design plans and submit the plans and supporting documentation to the City for review and approval. The design plans will be subjected to a review process prior to the issuance of approvals for permits.

The purpose of this manual is to provide information and standards that can be used to select the appropriate BMPs for a given site and to provide a standardized method for sizing the selected BMPs. This manual contains minimum standards and methods for sizing and designing LID facilities. This is a minimum standard. Other more rigorous methods may be used and will be evaluated on a case-by-case basis.

To develop a plan that works with the site and has a chance of functioning properly, it is imperative to include consideration in the conceptual design phase of the project. It is also important to have a general understanding of the specific site and any site constraints that might exist.

2.3.1 Determining Soil Characteristics

Soil characteristics play a major role in determining LID feasibility and sizing of facilities on a site. A basic soil evaluation will need to be conducted on each site. Hooper has elected to standardize based on the Natural Resource Conservation Service (NRCS) Hydrologic Soil Group (HSG) classifications. The NRCS system includes four hydrologic soil groups: A, B, C, and D as described below:

Group A is sand, loamy sand or sandy loam types of soils. It has low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravels and have a high rate of water transmission.

Group B is silt loam or loam. It has a moderate infiltration rate when thoroughly wetted and consists chiefly of or moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures.

Group C soils are sandy clay loam. They have low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine structure.

Group D soils are clay loam, silty clay loam, sandy clay, silty clay or clay. This HSG has the highest runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface and shallow soils over nearly impervious material.

Details of this classification can be found in “*Urban Hydrology for Small Watersheds*” published by the Engineering Division of the NRCS, United States Department of Agriculture Technical Release – 55.

Planning level soils analysis may be done utilizing information obtained from the National Cooperative Soil Survey. They have a web site that provides general information.

<https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>.

An on-site geotechnical evaluation should be conducted to confirm actual in-field soil types before completing a design. It is best to conduct geotechnical investigations as close to the actual location of the LID facility as possible.

2.3.2 Determining Water Table

Water table is also a major factor in determining feasibility and sizing of LID techniques that infiltrate. Shallow groundwater may severely hinder the effectiveness of infiltration. Shallow groundwater also increases the potential to introduce pollutants into the groundwater. A part of the

geotechnical investigation at a site should include an assessment of the high groundwater level. This should include a measurement of the existing water table at the time of the investigation.

2.3.3 Determining Existing Drainage Patterns

An assessment of the existing drainage system/patterns will also assist in locating/sizing LID facilities. A detailed site survey should be conducted and existing contours developed. Any existing storm drains should be identified, located, and elevations established. It is easier to mimic pre-development hydrology if existing drainage patterns can be maintained. Locating LID facilities generally works best by following natural patterns. An understanding of flow direction and locating natural storm drainage collection points can simplify LID design.

2.3.4 Determining Infiltration Rates

The bottom-line number that will dictate sizing of most LID facilities is the infiltration rate. There are many different and varied options for measuring/determining infiltration rates. To simplify the efforts, Hooper City has adopted the approach of using generalized hydraulic conductivity rates based on NRCS HSGs. This is a simplified approach. If a developer chooses to do a more detailed analysis by measuring infiltration rates in the field, these will be reviewed on a case-by-case basis. The type of LID facility proposed will dictate acceptable methods for determining the rate at which stormwater can be absorbed into the ground. The following table shall be used to size LID facilities unless a more stringent process is followed by the developer and infiltration rates are determined in the field.

Typical infiltration rates of various soil groups

Table 2-1: Hydraulic Conductivity of NRCS Soil Groups

NRCS HSG	Typical Soil Texture	Saturated Infiltration Rate (in./hr)	Porosity (Volume ratio)	Field Capacity (dimensionless)
A	Sand	8.0	0.437	0.062
A	Loamy sand	2.0	0.437	0.105
B	Sandy loam	1.0	0.435	0.190
B	Loam	0.5	0.463	0.232
C	Silt loam	0.25	0.501	0.284
C	Sandy clay loam	0.15	0.398	0.244
D	Clay loam and silty clay loam	<0.09	0.465	0.325
D	Clay	<0.05	0.475	0.378

(Taken from Design of Urban Stormwater Controls, a revision of the Water Environment Federation's (WEF's) and the American Society of Civil Engineer's (ASCE's) manual of practice titled *Urban Runoff Quality management (1998)*. Table 9.2, pg. 367)

2.3.5 Determining Water Quality Volume (WQV)

The *General Permit for Discharges from Small Municipal Separate Storm Sewer Systems (MS4s) UPDES Permit Number UTR0900000*, will require projects to “manage rainfall on-site, and prevent the off-site discharge of the precipitation from all rainfall events less than or equal to the 80th percentile rainfall event or a predevelopment hydrologic condition, whichever is less.” The volume of water generated from this 80th percentile event is being defined as the Water Quality Volume.

Table 2-2: 80th Percentile Precipitation Rates at Surrounding Weather Stations

Location	Station	Elevation	Years of Record	80 th Percentile Storm (inches)
Ogden Hinkley Airport	USW00024126	4470.1	68	0.49
Brigham City	USC00420928	4230	31	0.51
Weber Basin Pump Plant	USC00429346	4899.9	52	0.62
Salt Lake Airport	USW00024127	4225.07	71	0.45
Pine View Dam	USC00426869	4940	68	0.67

Elevations in Hooper range from 4240 in and around City Hall to 4215 out around the perimeter near the Great Salt Lake. To simplify calculations, **Hooper City has chosen to use 0.45 inches or 0.0375 feet** as the 80th percentile storm depth. Hooper is closest to the Salt Lake Airport in elevation, proximity to the Great Salt Lake and distance from the mountains.

The Water Quality Volume is calculated using the following equation:

$$WQV = R_v d A$$

Where:

WQV = 80th percentile volume, cf

R_v = Volumetric runoff coefficient, unitless

d = 80th percentile precipitation depth, ft (convert from inches to feet if required)

A = Project area or BMP drainage area, sf

The NRCS has developed regression equations to determine the runoff coefficient R_v . There are three equations based on soil type:

Table 2-3: Runoff Coefficient Equations Based on NRCS Soil Groups

NRCS Soil Group		
A	B	C/D
$R_{V-A} = 0.84i^{1.302}$	$R_{V-B} = 0.84i^{1.169}$	$R_{V-C/D} = 0.83i^{1.122}$

Note: “i” is runoff intensity, measured in in/hour

Using these equations, a WQV is calculated in cubic feet. This is the volume that needs to be retained (with no discharge) until it infiltrates or evapo-transpires.

2.4 Universal LID Best Management Practices

Not all LID BMPs include construction of a structure. Some LID BMPs involve the implementation of basic principles. These principles should be a general practice on all sites. If applicable and feasible for the given site conditions, the following measures are required and should be incorporated on all projects:

2.4.1 Eliminating Directly Connected Impervious Areas

One of the primary contributors to urban runoff is directly connected impervious areas or DCIAs. They affect both water quality and water volume. A directly connected impervious area is defined as a surface where stormwater conveys directly from an impervious area to a storm drain or waterway. Examples of directly connected impervious areas include; building downspouts that are piped to the gutter or storm drain pipe, and parking lots with inlets in the gutter that go straight to the storm drain pipe.

All new development should eliminate these direct connects and direct runoff through landscape areas and LID facilities whenever possible.

2.4.2 Utilizing Landscaped (Natural) Buffers

Much the same as eliminating DCIAs, maintaining landscaped buffers through which stormwater flows provides opportunities for natural filtering and infiltration that you don't get in a pipe or gutter. The best buffers are ones where the pre-development ground and vegetation are left undisturbed; however, it is recognized that a more groomed approach is desirable in many cases. Development is strongly encouraged to utilized landscape areas as buffers and direct stormwater to these landscaped areas. Stormwater can be collected in the landscaped areas after it has had a chance to filter/infiltrate.

3. BMP Prioritization and Selection

3.1 Best Management Practice Categories

Structural BMPs shall be designed to manage and capture stormwater runoff. Most long-term stormwater BMPs can fit into three general functional categories; BMPs that infiltrate, BMPs that harvest, and BMPs that filter. Some BMPs are hybrids that can accomplish more than one function at a time. The order of priority specified below shall apply to all projects. Each type of BMP shall be implemented to the maximum extent feasible when determining the appropriate BMPs for a project before moving to the next priority.

1. Infiltration
2. Harvesting
3. Filters that mimic natural processes/treatment facilities
4. Combination of any of the above

Because of the retention requirement, BMPs that infiltrate are given the highest priority and should be utilized until the WQV has been captured and stored. If it is not feasible to retain the entire WQV (feasibility is defined in section 3.1.1 below) then harvesting should be considered. Utah water rights laws limit the amount of stormwater that can be harvested and reused. If the WQV cannot be handled by the first two priorities, then treating and releasing may be considered. If partial or complete onsite compliance of any type is technically infeasible, the project Site and LID Plan shall be required to document an explanation of the reasons preventing this approach and the rationale for the chosen alternative controls on a case-by-case basis for the project. Projects that are part of a larger common plan of development may work together to create small regional facilities that service multiple phases of the same development. It should be noted however, that managing storm water as close to the source of the runoff is generally, the preferred alternative. Smaller volumes have more options.

Generally speaking, in residential construction, it is extremely difficult to manage storm water on individual private lots that rely on homeowners to operate and maintain facilities. This practice is strongly discouraged.

3.1.1 Preservation

Preservation BMPs are typically Non-structural. The following Non-structural BMPs have been adopted by the city

- Cluster Development
- Open Space Preservation
- Minimum Landscape Requirements
- Eliminate Directly Connected Impervious Areas
- Minimize Disturbance

- Minimize Soil Compaction
- Natural Buffers

3.1.2 Infiltration Feasibility

Infiltration will be considered feasible only when all of the following criteria can be met:

- The lowest elevation of all retention facilities shall be a minimum of five (5) feet above the measured water table
- Retention volumes must infiltrate or evaporate within three (3) days or 72 hours after a storm has subsided
- Retention facilities can be no closer than twenty (20) feet from the nearest structural foundation when there is no living space below ground level. When there is living space below ground level a thirty (30) foot distance shall be maintained.
- Retention facilities can be no closer to the right-of-way or edge of parking lots than five (5) feet unless the pavement section has been specifically designed to accommodate retention storage and saturated soil conditions.
- Retention facilities may not be built within the no build setback associated with live streams or water bodies.
- Retention facilities must be setback from the top of steep slopes (> 15%). The setback distance will be determined on a case-by-case basis by a licensed geotechnical engineer as part of a geotechnical report completed for that specific site.
- Retention facilities cannot be placed on slopes exceeding five (5) % or as recommended by a licensed geotechnical engineer.
- Retention shall not be allowed in areas where a licensed geotechnical engineer determines that infiltration would adversely impact the potential for geological hazards on the project site or on neighboring parcels of land.
- Retention shall not be allowed in a Drinking Water Well Source Protection Zones 1 and 2.
- Retention is considered not feasible in areas where land drains are required.

3.1.3 Retention/Infiltration

3.1.3.1 Infiltration basin

Description: Infiltration basin consists of an earthen basin constructed in naturally pervious soils with a flat bottom typically vegetated with dry-land grasses or irrigated turf grass. An infiltration basin functions by retaining the design runoff volume in

the basin and allowing the retained runoff to percolate into the underlying native soils or escape through evapo-transpiration over a specified period.

Application: Infiltration Basins are typically utilized for larger drainage areas.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Excellent
Nutrients	Excellent
Metals	Excellent
Bacteria	Excellent
Oil/Grease	Excellent

Design Criteria: The following criteria shall be met for all open infiltration basins:

Parameter	Requirement
Minimum depth to measured water table from the lowest elevation in the basin	5 feet
Maximum standing water time	72 hours
Maximum side slope	3 H: 1 V
Minimum freeboard	1 foot
Other	Must have a safe flood path to convey up to the 100-year storm safely to an established Right-of-way
WQV	As defined in Section 2.3.5
Maximum Infiltration Rate	As determined in Section 2.3.4

3.1.3.2 Infiltration Trenches

Description: Infiltration trenches, which are similar to basins, are long, narrow, gravel-filled trenches, often vegetated, that infiltrate stormwater runoff from small drainage areas. Infiltration trenches may include a shallow depression at the surface, but the majority of runoff is stored in the void space within the gravel and infiltrates through the sides and bottom of the trench.

Application: Infiltration trenches are commonly used for moderately sized drainage areas where the available footprint is narrow.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Excellent
Nutrients	Excellent
Metals	Excellent
Bacteria	Excellent
Oil/Grease	Excellent

Design Criteria: The following criteria shall be met for all infiltration trenches:

Parameter	Requirement
Minimum depth to the measured water table from the lowest elevation in the basin	5 feet
Minimum depth of trench	2 feet
Maximum longitudinal trench slope	1%
Minimum width	2 feet
WQV	As defined in Section 2.3.5
Maximum Infiltration Rate	As determined in Section 2.3.4

3.1.3.3 *Infiltration galleries*

Description: Infiltration galleries are similar to infiltration basins except they are underground. Several vendors offer prefabricated, modular infiltration galleries that provide subsurface storage and allow for infiltration. Infiltration galleries come in a variety of material types, shapes, and sizes.

Infiltration galleries are best served when there is an isolator row or pretreatment device. Maintaining underground retention without the isolator row or pretreatment can be problematic and costly.

Application: Infiltration Galleries are typically utilized for drainage areas between 5 and 50 acres.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Excellent
Nutrients	Excellent
Metals	Excellent
Bacteria	Excellent
Oil/Grease	Excellent

Design Criteria: The following criteria shall be met for all infiltration galleries:

Parameter	Requirement
Minimum depth to the measured water table from the lowest elevation in the basin	5 feet
Maximum standing water time	72 hours
Other	<ul style="list-style-type: none"> - Must have a safe flood path to convey up to the 100 year storm safely to an established Right-of-way - Must meet all the requirements of the manufacturer.
WQV	As defined in Section 2.3.5
Maximum Infiltration Rate	As determined in Section 2.3.4

3.1.3.4 *Constructed Wetlands (Direct discharge of unmanaged storm water to natural or existing wetlands is prohibited)*

Description: A constructed wetland is an artificial wetland created for the purpose of treating discharges such as municipal stormwater runoff. Constructed wetlands are engineered system that use natural functions of vegetation, soil, and organisms to treat water running through them. The wetlands should be designed to spread the flow, slow the velocity and maximize infiltration. The wetlands should also be designed to meet the specific needs of the water running through them including sediment removal, nutrient uptake, and heavy metals containment. Constructed wetlands may also serve a secondary purpose of providing habitat for native or migratory wildlife.

Application: Constructed wetlands can handle unlimited volumes of water provided there is a large enough footprint to process the flows. A good rule of thumb in sizing wetlands is to use 0.5% to 2.0% of the contributing drainage area for the wetland footprint (Tyndall & Bowman, 2016 – *A NRS Cost Tool Overview*). Constructed wetlands are typically not as effective when they are less than 0.25 acre in size.

Unmanaged storm water may not be discharged into existing or native wetlands!

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Excellent
Nutrients	Excellent
Metals	Excellent
Bacteria	Excellent
Oil/Grease	Excellent

Design Criteria: The following criteria shall be met for all constructed wetlands:

Parameter	Requirement
Maximum depth to the measured water table from the lowest elevation in the wetland	1.5 feet with no supplemental water
Supplemental water	To keep a wetland viable, it requires a consistent water source. Stormwater, by itself in Utah, does not usually provide adequate water source. It is very likely that supplemental water will be needed.
Hydraulic residence time	<u>> 48</u> hours to achieve 80% reduction in Nitrogen
WQV	As defined in Section 2.3.5
Maximum Infiltration Rate	As determined in Section 2.3.4

3.1.3.5 Combined Measures

Any of the above infiltration type BMPs may be combined with any other BMPs to fit the site and to meet the allowable discharge requirements.

3.1.4 Stormwater Harvesting

Stormwater Harvesting refers to a specific type of BMP that operates by capturing stormwater runoff and holding it for efficient use at a later time. In the State of Utah to collect, store, and place the captured stormwater to a beneficial use a person must register the use with the Utah Division of Water Rights. Here is a link to the State's registration website:

<http://www.waterrights.utah.gov/forms/rainwater.asp>

There are restrictions associated with rainwater harvesting in Utah. These include:

- A person may collect and store precipitation without registering in no more than two covered storage containers if neither covered container has a maximum storage capacity of greater than 100 gallons.
- The total allowed storage capacity with registration is no more than 2,500 gallons. Collection and use are limited to the same parcel of land on which the water is captured and stored.

There is no charge for this registration.

BMPs sized to capture the runoff produced from the 80th percentile storm event, or BMPs designed to capture less than this volume, if being used in conjunction with other BMPs, must drawdown their entire captured volume within 3 days of a likely storm event. This will assure adequate capacity is available for subsequent storms and will also minimize the potential for mosquito gestation.

In instances where the quantity of runoff from the 80th percentile storm event exceeds the volume of the collection tank, partial capture and use can also be achieved as part of a treatment train by directing the overflow to stable vegetated areas where erosion or suspension of sediment is not a factor or through a high flow natural filter type BMP to provide additional volume reduction and water quality treatment. Overflow from the tank directly into the storm drain system is not allowed.

Capture and use BMPs designed for these extended holding times will require additional treatment such as filtration or disinfection to protect the collection tanks from fouling, to prevent the breeding of vectors, and/or to improve the quality of water for reuse applications. These scenarios will be reviewed on a case-by-case basis

3.1.4.1 *Rain Barrels*

Description: Rain Barrels are structures designed to intercept and store runoff from rooftops to allow for its reuse and volume reduction. As storm water is stored it is typically reused for irrigation or other water needs. Rain barrels are typically above ground small structures that are directly connected to rooftop downspouts. In the State of Utah a person may collect and store rain water without registering in no more than two covered storage containers. The maximum storage capacity of any one container shall not be greater than 100 gallons.

Application: Rain Barrels are typically utilized on an individual residential home basis and are limited to no more than 200 gallons (no more than two containers with no more than 100 gallons per container) stored at a time.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Good*
Nutrients	Good*
Metals	Good*
Bacteria	Fair*
Oil/Grease	Excellent*

*Water Quality Effectiveness varies a lot for rain barrels depending on the reuse options implemented

Design Criteria: The following criteria shall be met for rain barrels:

Parameter	Requirement
Maximum Capture Volume without registration	200 gallons (no more than two containers with no more than 100 gallons per container)
Maximum Capture Volume with registration	2,500 gallons
WQV	As defined in Section 2.3.5

3.1.4.2 Cisterns

Description: Cisterns are similar to rain barrels and are designed to intercept and store runoff from rooftops to allow for its reuse and volume reduction. As storm water is stored it is typically reused for irrigation or other water needs. Cisterns are typically larger than rain barrels and have more storage capacity. In the State of Utah the total allowed storage capacity with registration is no more than 2,500 gallons. Collection and use are limited to the same parcel of land on which the water is captured and stored. Cisterns can be designed as either above or below ground structures. Above ground cisterns are to be secured in place and meet all applicable building standards.

Application: Cisterns are typically utilized on small commercial sites and are limited to no more than 2,500 gallons stored at a time.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Good*
Nutrients	Good*
Metals	Good*
Bacteria	Fair*
Oil/Grease	Excellent*

*Water Quality Effectiveness varies a lot for cisterns depending on the reuse options implemented

Design Criteria: The following criteria shall be met for rain barrels:

Parameter	Requirement
Maximum Capture Volume without registration	200 gallons
Maximum Capture Volume with registration	2,500 gallons
WQV	As defined in Section 2.3.5

3.1.5 Filters that Mimic Natural Processes

Filter facilities that are designed to mimic natural processes can be quite effective and add aesthetic value to a project. These facilities are landscaped shallow depressions that capture and filter stormwater runoff. As stormwater passes down through the planting soil, pollutants are filtered, adsorbed, and biodegraded by the soil and plants. Because they are not contained within an impermeable structure, they may allow for infiltration.

Projects that have demonstrated they cannot manage 100% of the water quality design volume onsite through infiltration and/or stormwater harvesting BMPs may manage the remaining volume using a high removal efficiency natural filter BMP with an underdrain system. A high removal efficiency natural filter BMP shall be sized to adequately capture **1.5** times the volume not managed through infiltration and/or capture and use.

3.1.5.1 Biofilter

Description: Most natural filter systems can be classified as biofilters. They normally consist of a ponding area, mulch layer, planting soils, plants, and in some cases an underdrain. Runoff that passes through a biofiltration system is treated by the natural

absorption and filtration characteristics of the plants, soils, and microbes with which the water contacts. Plants are used to increase infiltration and nutrient uptake.

Application: Biofilters are typically incorporated into site landscaping elements and are commonly used in park strips and parking lot islands

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Excellent
Nutrients	Excellent
Metals	Excellent
Bacteria	Excellent
Oil/Grease	Excellent

Design Criteria: The following criteria shall be met for biofilters:

Parameter	Requirement
Minimum depth to the measured water table from the lowest elevation in the basin	5 feet
Maximum standing water time	72 hours
Maximum ponding depth	1 foot
WQV	As defined in Section 2.3.5
Maximum Infiltration Rate	As determined in Section 2.3.4
Minimum freeboard	6 inches
Other	Must have a safe flood path to convey up to the 100-year storm safely to an established Right-of-way.

3.1.5.2 Rain Gardens

Rain gardens are simply gardens designed to capture and treat runoff. They are generally small and should not be used to treat impervious areas exceeding 4,000 square feet. Rain gardens most often utilize native plant species and soil amendments to encourage absorption of stormwater. For projects with impervious areas exceeding 4,000 square feet biofilters, planter boxes with infiltration, vegetated swales or natural buffer strips should be considered.

Parameter	Requirement
Minimum depth to the measured water table from the lowest elevation in the basin	5 feet
Maximum standing water time	72 hours
Maximum ponding depth	18 inches
Maximum side slopes	3H:1V
Minimum freeboard	6 inches
Other	Must have a safe flood path to convey up to the 100-year storm safely to an established Right-of-way.
WQV	As defined in Section 2.3.5
Maximum Infiltration Rate	As determined in Section 2.3.4

3.1.5.3 Vegetated Swales

Description: Vegetated swales are open, shallow channels with dense, low-lying vegetation covering the side slopes and bottom that collect and slowly convey runoff to downstream discharge points. An effective vegetated swale achieves uniform sheet flow through the densely vegetated area for a period of several minutes. The vegetation in the swale can vary depending on its location and is the choice of the designer. Most swales are grass-lined.

Application: Vegetated swales serve a dual function. They are used both as a minor treatment alternative and as a conveyance system. Vegetated swales may not be used along frontages for residential development. They are typically recommended for commercial or industrial sites to replace on-site piping.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Good
Nutrients	Fair
Metals	Good
Bacteria	Fair
Oil/Grease	Excellent

Design Criteria: The following criteria shall be met for vegetated swales:

Parameter	Requirement
Minimum depth to the measured water table from the lowest elevation in the basin	5 feet
Maximum longitudinal slope	5%
Maximum side slope	3H:1V
Maximum velocity	1.0 ft/s
Maximum flow depth	2/3 vegetation height
WQV	As defined in Section 2.3.5
Minimum freeboard	6 inches
Maximum Infiltration Rate	As determined in Section 2.3.4
Minimum residence time	5. min
Vegetative Cover	>65%

3.1.5.4 Filter or buffer strips

Description: Filter strips are vegetated areas designed to treat sheet flow runoff from adjacent impervious surfaces such as parking lots, or intensive landscaped areas such as golf courses. While some assimilation of dissolved constituents may occur, filter strips are generally more effective in trapping sediment and particulate-bound metals, nutrients, and pesticides. Filter strips are more effective when the runoff passes through the vegetation and thatch layer in the form of shallow, uniform flow. Filter strips are primarily used to pretreat runoff before it flows to an infiltration BMP or another natural filtration BMP.

Application: Most effective when inflow is not concentrated but comes in by sheet flow. Works well off parking lots with no curb and gutter.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Good
Nutrients	Fair
Metals	Good
Bacteria	Excellent
Oil/Grease	Excellent

Design Criteria: The following criteria shall be met for filter or buffer strips:

Parameter	Requirement
Minimum flow length	15 feet
Maximum longitudinal slope	5H:1V
Maximum flow velocity	1.0 ft/s
Maximum flow depth	2/3 vegetation height
Minimum freeboard	6 inches
Minimum vegetation cover	>65%
WQV	As defined in Section 2.3.5
Maximum Infiltration Rate	As determined in Section 2.3.4

3.1.5.5 Velocity Dissipaters

Description: Velocity dissipaters are BMPs designed to slow the velocity and minimize erosive action of flowing water. Check dams and level spreaders are two kinds of velocity dissipaters that are commonly used. Check dams are designed to create a series of step-downs with pools in between while level spreaders are designed like weirs to spread the flow out and to control water levels. Level spreaders are commonly used in wetland areas to maintain a uniform distribution of water and keep the flows from channelizing.

Application: Typically used in flow channels (concentrated flows) or to disperse water entering into a wetland area

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Good
Nutrients	Fair
Metals	Fair
Bacteria	Good
Oil/Grease	Fair

Design Criteria: The following criteria shall be met for velocity dissipaters:

Parameter	Requirement
Maximum flow velocity	1.0 f/s
Minimum freeboard	6 inches
WQV	As defined in Section 2.3.5
Maximum Infiltration Rate	As determined in Section 2.3.4

3.1.6 Man-made Treatment

3.1.6.1 Planter boxes (no infiltration)

Planter boxes are bioretention treatment control measures that are completely contained within an impermeable structure with an underdrain (they do not infiltrate). They are similar to bioretention facilities with underdrains except they are situated at or above ground and are bound by impermeable walls. Planter boxes may be placed adjacent to or near buildings, other structures, or sidewalks.

Application: Planter boxes are most commonly used in commercial or industrial development to manage runoff coming from large roof areas. When used to manage surface runoff at ground level, they may require pumping. If planter boxes are to be used in residential applications, they must be constructed using concrete or other permanent containment walls and should be constructed as part of the entire development drainage system. A residential development shall not require individual homeowners to build and maintain these facilities.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Excellent
Nutrients	Good
Metals	Excellent
Bacteria	Good
Oil/Grease	Excellent

Design Criteria: The following criteria shall be met for planter boxes with no infiltration:

Parameter	Requirement
Maximum standing water time	72 hours
Maximum ponding depth	1 foot
WQV	As defined in Section 2.3.5
Minimum freeboard	6 inches
Other	Must have a safe flood path to convey up to the 100-year storm safely to an established Right-of-way.

3.1.6.2 Filtration Cartridges – for commercial and industrial developments only

Description: Passing stormwater through a filtration fabric, plate, membrane, or device is a viable option for treating stormwater. It is generally expensive to purchase and maintain and is therefore not frequently used. Forcing the water through the medium also usually results in head loss. Various fabrics or media will be considered on a case-by-case basis to meet the needs of a project.

Application: Filtration cartridges are typically used when other options won't work. They are expensive to buy and maintain. They do have a relatively small footprint.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Excellent
Nutrients	Excellent
Metals	Excellent
Bacteria	Excellent
Oil/Grease	Excellent

Design Criteria: The following criteria shall be met for filtration cartridges:

Parameter	Requirement
Design per manufacturer's requirements	
WQV	As defined in Section 2.3.5

3.1.6.3 Hydrodynamic Separators

Description: Hydrodynamic separators are stormwater management devices that work primarily based on vortex and gravity principles to separate stormwater from the pollutants. They are generally designed as flow-through systems with either on-line or off-line storage of pollutants. They include chambers for settling and storage of pollutants and are often used in conjunction with other BMPs as pretreatment. They are not especially effective for the removal of fine materials or dissolved pollutants. On-line separators are more susceptible to scour or re-suspension of pollutants than systems that incorporate off-line storage. They are generally not designed to treat stormwater flows exceeding 25 cfs.

Application: Typically limited by flow rates. Small footprint, but normally require depth for pollutant storage.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Excellent
Nutrients	Good
Metals	Excellent
Bacteria	Fair
Oil/Grease	Good

Design Criteria: The following criteria shall be met for hydrodynamic separators:

Parameter	Requirement
Maximum flow rate for prefabricated units	25 cfs
Design per manufacturer's requirements	
Typically need a high flow bypass	
WQV	As defined in Section 2.3.5

3.1.6.4 *Safl Baffle or the Preserver Combined with Skimmers*

Description: Safl Baffles are a brand name product designed primarily as a post-construction retrofit pretreatment system. They require a sump structure. A specially designed perforated metal plate is installed inside a sump manhole or vault. Water flows through the plate. This action facilitates improved settling and re-suspension characteristics. Sediment removal rates are generally less than with hydrodynamic separators. These baffles are a fair low-cost alternative that require a minimal footprint. Sediments are stored in the lower reaches of the manhole or vault. Safl Baffles are not effective for floatables, therefore a skimmer must also be used when considering this option.

Application: Because of effectiveness rates and limitations of city staff in maintaining multiple facilities, use of the Safl baffles is limited to no more than 5 acres draining to one baffle and no more than three baffles being used in one development.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Good
Nutrients	Fair
Metals	Good
Bacteria	Fair
Oil/Grease	Poor*

*When used in conjunction with a skimmer their performance with oil/grease is “Good”

Design Criteria: The following criteria shall be met for Safl Baffles:

Parameter	Requirement
Maximum flow rate	50 cfs
Design per manufacturer’s requirements	
Removal efficiency goes down with higher flows	
WQV	As defined in Section 2.3.5

3.1.6.5 Skimmer

Description: Skimmers are designed to trap floatables in a holding facility until they can be removed by absorbent materials or a vactor truck. They can take many shapes and sizes. They can be prefabricated, or custom built to fit the needs of almost any project. They generally require a certain amount of standing water to maintain a seal so the floatables cannot escape. They also require relatively frequent inspection and maintenance because of small storage capacity. They work on the principle of baffles.

Application: Skimmers are typically not used as standalone treatment options. They are best utilized when floatables are a primary pollutant of concern.

Water Quality Effectiveness:

Target Pollutant	Relative Removal Effectiveness
Sediment	Poor
Nutrients	Poor
Metals	Poor
Bacteria	Poor
Oil/Grease	Good

Design Criteria:

Per Manufacturer’s recommendations

3.2 Sample Calculations

3.2.1 Calculating Size Requirements for Infiltration BMPs

The main challenge associated with infiltration BMPs is preventing system clogging and subsequent infiltration inhibition. In addition, infiltration BMPs must be designed to drain in a reasonable period of time so that storage capacity is available for subsequent storms and so

that standing water does not result in unwanted conditions. Infiltration BMPs should be designed according to the requirements listed in Table 4.1 and outlined in the following text:

Infiltration facilities must be sized to completely infiltrate the design capture volume within **72 hours**.

Step 1: Calculate the Design Volume

Infiltration facilities shall be sized to capture and infiltrate the design capture volume (V_{design}) based on the runoff produced from a 80th percentile storm event. The 80th percentile storm event is 0.69 inches or 0.057 feet.

$$V_{design} \text{ (cu ft)} = 0.057 \text{ (ft)} \times \text{Catchment Area (sq ft)}$$

Where:

$$\text{Catchment Area} = (\text{Impervious Area} \times 0.9) + [(\text{Pervious Area} + \text{Undeveloped Area}) \times 0.1]$$

For catchment areas given in acres, multiply the above equation by 43,560 sq. ft./acre.

Table 3-1: Infiltration BMP Design Criteria

Design Parameter	Unit	Basins and Trenches	Galleries	Hybrid Bioretention/ Dry Well
Design Capture Volume, V _{capture}	cubic feet	see section 2.3.5		
Design Surface Drawdown Time	hr	72		
Setbacks and Elevations	feet	In accordance with the Infiltration Feasibility Criteria, Section 3.1.2		
Pretreatment	-	Appropriate Treatment Control Measure shall be provided as pretreatment for all tributary surfaces other than roofs		
Hydraulic Conductivity, K _{sat,measured}	in/hr	In accordance with section 2.3.4 or as measured in the field by a certified hydrogeologist.		
Factor of Safety, FS ^a	-	3		
Facility geometry	-	Bottom slope ≤ 3% (basins); side slope shall not exceed 3:1 (H:V)	Flat bottom slope	Bioretention: Bottom slope ≤ 3%; side slope shall not exceed 3:1 Drywell: flat bottom
Ponding Depth	inch	18 (maximum) ^b		
Media Depth	feet	2 (min) 8 (max)	-	2 (min) 8 (max)
Gravel media diameter	inch	1 – 3	-	3/8 - 1
Inlet erosion control	-	Energy dissipater to reduce velocity		
Overflow device	-	Required if system is on-line and does not have an upstream bypass structure. Shall be designed to handle the peak storm flow in accordance with the Building and Safety code and requirements		

a: Listed FS values to be used only if soil infiltration / percolation test was performed and a detailed geotechnical report from a professional geotechnical engineer or engineering geologist is provided. A FS of 6 will be assigned if only a boring was done.

b: Ponding depth may vary for galleries (which have a storage depth) and may be different from one vendor to another. Ponding depth is not necessarily applicable to permeable pavement.

Step 2: Determine Infiltration Rate

The infiltration rate will decline between maintenance cycles as the surface becomes clogged with particulates and debris. It is important that adequate conservatism is incorporated in the sizing of facilities depending on a site's infiltration rate and expected surface loading. Where applicable, the measured infiltration rate discussed here is the infiltration rate of the underlying soils and not the infiltration rate of the filter media bed or engineered surface soils.

$$K_{sat, design} = K_{sat, measured} / FS$$

Where:

FS = Infiltration factor of safety, see Table 3.1

Step 3: Calculate the BMP Surface Area

Determine the size of the required infiltrating surface by assuming the water quality volume will fill the available ponding depth plus the void spaces based on the porosity of the gravel fill (normally about 30 - 40%⁴) or amended soil (normally about 20 – 30%).

Determine the minimum infiltrating surface area necessary to infiltrate the design volume

$$A_{min} = (WQV \times 12 \text{ in/ft}) / (T \times K_{sat, design})$$

Where:

A_{min} = Minimum infiltrating surface area (ft²),

T = Drawdown time (hours), 72 hours

For infiltration basins, the surface area should be calculated as the surface area at mid-ponding depth. For infiltration trenches, the surface area should be calculated at the bottom of the trench.

Step 4: Calculate the Total Storage Volume

Determine the storage volume of the infiltration unit to be filled with media for capturing the water quality volume.

$$V_{\text{storage}} = WQV / n$$

Where:

V_{storage} = Minimum media storage of the infiltration facility (ft³)

n = void ratio

Step 5: Calculate the Media Storage Depth

Determine the depth of the infiltration unit to be filled with media for capturing the design capture volume.

$$D_{\text{media}} = V_{\text{storage}} / A_{\text{min}}$$

Where:

D_{media} = Minimum media storage depth of the infiltration facility (ft)

D_{media} shall not be greater than 6 feet unless specifically approved in writing.

3.2.2 Stormwater Harvesting Calculations

Step 1: Perform site assessment to determine if harvesting is feasible such that the draw down can occur within 3 days. A site investigation may be necessary to understand if there is sufficient landscape to accommodate use.

Step 2: Determine the Water Quality Volume – See Section 2.3.5

3.2.3 Natural Filter Calculations

Natural filter facilities can be sized using one of two methods: a simple sizing method or a hydrologic routing modeling method. With either method the design capture volume must be completely infiltrated within the drawdown time shown in Table 3-1. Steps for the simple sizing method are provided below. BMPs should be designed according to the requirements listed in Table 3.2 and outlined in the following text. Swales and filter strips must be handled as indicated in the following sections.

Table 3-2: Natural Filter BMP Design Criteria

Design Parameter	Unit	Rain Garden	Planter Box	Biofilter	Vegetated Swale	Filter Strip
Water Quality Volume	Cubic feet	See Section 2.3.5			-	-
Design Drawdown Time	hr	72 (surface); 96 (total)			-	-
Factor of Safety	-	2			-	-
Soil Media Infiltration Rate	in/hr	5 (max)			-	-
Design Contact Time	min	-			≥ 7	
Slope in Flow Direction	%	-			1% (min) 6% (max)	2% (min) 33% (max)
Design Flow Velocity	ft/sec	-			≤ 1	
Maximum Ponding/Flow Depth	inch	18	12	18	5	1
Minimum Width	ft	2			2	15
Soil Depth	ft	2 (3 preferred) Topped with 3" of mulch			2	-
Underdrain	-	Slotted PVC pipe embedded in 12" gravel section and located 1" from bottom of facility		Slotted PVC pipe at least 2' above bottom of facility	N/A	Not required

Step 1: Calculate Design Volume

See Section 2.3.5

Step 2: Determine Infiltration Rate

See Section 2.3.4

Step 3: Calculate Ponding Depth

Select a ponding depth (d_p) that satisfies geometric criteria and is congruent with the constraints of the site. The ponding depth must satisfy the maximum ponding depth constraint shown in Table 4.2 as well as the following:

$$d_p \text{ (ft)} = (K_{\text{sat,design}} \times T) / 12$$

Where: d_p = Ponding depth (ft)

$K_{\text{sat,design}}$ = Design infiltration rate of filter media (in/hr)

T = Required surface drain time (hrs), from Table 4.2

Step 4: Calculate Surface Area

$$A_{\text{min}} = (V_{\text{design}}) / (T_{\text{fill}} \times K_{\text{sat}}/12) + d$$

Where:

A_{min} = Design infiltrating area (ft²)

T_{fill} = Time to fill to max ponding depth with water (hrs) [unless a hydrologic routing model is used, assume a maximum of 3 hours]

The calculated BMP surface area only considers the surface area of the BMP where infiltration through amended media can occur. The total footprint of the BMP should include a buffer for side slopes and freeboard.

3.2.4 Swale Sizing

Swales shall be designed with a trapezoidal channel shape with side slopes of 3:1 (H:V). They shall incorporate at least two feet of soil beneath the vegetated surface. Swale sizing will be determined on a case-by-case basis. As is the case with other biofiltration BMPs, the sizing criteria presented in Table 4-2 must be met.

3.2.5 Filter Strip Sizing

Because filter strips are most often used for pretreatment purposes, their design will depend on the desired flow-rate to be treated and the type of BMP downstream, among other factors.

As a result, filter strip sizing is not covered in this handbook, but will be determined on a case-by-case basis.

4. Regional Mitigation Measures

4.1 Regional Mitigation Measures

Regional mitigation shall only be utilized after on-site mitigation opportunities are exhausted. Regional mitigation may only be considered for developments that are part of a larger common plan of development (combining phases of a single master development). If on-site mitigation meets the minimum requirements no regional mitigation will be required. The following criteria shall be implemented in considering regional mitigation:

1. An agreement shall be obtained with the City and/or other partners for the design, sizing, construction and maintenance of the regional facility.
2. Locate regional projects within the boundary of the overall master development.
3. Locate regional projects within the same sub-watershed as the proposed project.
4. Regional projects may be completed on either private or public land.
5. Secure needed easements and rights to the property on which off-site projects are completed.
6. The regional facility shall be sized to accommodate the water quality needs of all interested parties.
7. Demonstrate that same level of water quality protection is achieved as if all the runoff were retained on-site.
8. Demonstrate that the off-site project when combined with on-site mitigation addresses the same volume of water that would have been addressed if BMPs were all constructed on-site.
9. All Maintenance Agreements in Perpetuity that would have been required for each separate facility shall be addressed in agreement(s) for the regional facility and shall be recorded with each parcel encompassed as part of the regional facility.

APPENDIX A

Municipal Ordinances

10-4A-14 Drainage

The Planning Commission shall not recommend approval of any Final Plat which does not make adequate provision for storm water for both flood water runoff control and water quality control including, but not limited to channels, catch basins, drywells detention ponds, retention facilities, low impact development and surface water treatment. Plans shall be reviewed for compliance with the Hooper City Development Standards and Specifications, or other standards as may be adopted. The storm water drainage system shall be separate and independent of the sanitary sewer system, the land drain system, and any other system. Storm drains, where required, shall be designed in accordance with the criteria provided below and a copy of design computations and water quality report in accordance with the City's Low Impact Development Handbook shall be submitted along with Construction Drawings. Inlets shall be provided so that surface water is not carried across or around any intersection, nor for a distance of more than four hundred (400) feet in gutters, regardless of the calculated gutter capacity. When calculations indicate that gutter capability is exceeded, catch basins shall be used to intercept flow. Catch basin shall be used to collect and convey storm water at intersections. Surface water drainage patterns of the project site shall be shown on a Grading and Drainage Plan defined later in this chapter.

In conjunction with the preparation of the Grading and Drainage Plan, the City Staff may require the applicant to meet with the Hooper City Public Works Director and others as needed in order to gain an understanding of existing upstream and downstream storm drainage, field drainage, and irrigation runoff issues so that these important considerations can be incorporated into the Plan. If the meeting is required, the Planning Commission shall not recommend Final Plat approval if this meeting has not occurred.

The applicant may be required by the Planning Commission, upon the recommendation of the City Staff, to carry away by pipe or open channel (Hooper or Howard Sloughs) any spring or surface water that may exist either previously to, or as a result of the development. Such drainage facilities shall be located in the road right-of-way where feasible, or in approved perpetual unobstructed easements of appropriate width and length, and shall be constructed in accordance with the development standards and specifications. Hooper City will not maintain storm drain facilities located on private property or beyond the City's right-of-way, including rear-lot drainage facilities, even those located within public utility easements.

Underground storm drain systems shall be constructed throughout the development and be connected to an approved out-fall. No outfall will be approved which does not allow for gravity flow to a discharge point that is high enough in elevation to prevent surcharging into the development's drainage system. In addition, the City reserves the right to dictate flowline elevations in the storm drain system that allow for an appropriate level of "freeboard" in the storm drain system or to pass "nuisance" water at a control structure.

Inspection of facilities within the City's right-of-way shall be conducted by the City. If a future connection to a public storm drain will be provided, as determined by the City Staff, the developer shall make arrangements for future storm water at the time the plat receives final approval. Provision for such connection shall be incorporated into the development plans.

No development shall be approved unless adequate drainage will be provided to an approved drainage watercourse or facility as determined by the City Staff based upon approved pipeline slopes and flowline elevations

A. Accommodation of Upstream Drainage Areas

Culverts or other drainage facilities shall be large enough to accommodate potential runoff from the entire upstream drainage area, whether inside or outside the development. The proposed drainage facilities shall be designed so that there is no negative impact on the upstream drainage through pipe size restrictions, abrupt grade changes, reverse grade, and so forth. The developer shall hire a qualified engineer to determine the necessary size of the facility, based on the provisions of the development standards and specifications assuming conditions of a ten-year year storm event for pipeline design and a one-hundred year storm event for detention basin design. The pipeline design shall also include capacity for other water from other sources besides storm events. The City Staff shall review and approve the design. Offsite drainage improvements, completed at the developer's expense, may be required in order to preserve the integrity of the existing drainage system.

B. Effect on Downstream Drainage Areas

To determine the effect the development will have on existing downstream drainage facilities outside the project area, the developer shall submit a storm water drainage study prepared by a qualified engineer. City and County storm drainage studies, together with the City's Storm Drain Master Plan, may serve as a guide to determine needed improvements. Where it is anticipated that the additional runoff will overload an existing downstream drainage facility, the Planning Commission may require the applicant to improve the facility in order to serve the development or provide additional on-site drainage facilities.

C. Flood Plain and Low Elevation Areas

The Planning Commission may, upon recommendation of the City Staff when determined necessary for the health, safety, or welfare of the present and future population of the area and for the conservation of water, drainage, and sanitary facilities, prohibit the development of any portion of the property which lies within the flood plain of any stream, lake or drainage course, or areas low in elevation having evidence of standing water or high groundwater. These flood plain and low-lying areas should be preserved from any and all disturbance or damage resulting from clearing, grading, or dumping of earth, waste material, or vegetative debris.

D. Dedication of Drainage Easements

Where a development is traversed by a watercourse, drainage way, or channel, there shall be provided a storm water easement or drainage right-of-way conforming substantially to the historic high water lines of such watercourse, as determined by the City Staff. Watercourses, drainageways, and channels shall be piped, with the exception of the Hooper and Howard Sloughs, it is desirable that these sloughs be maintained by an open channel with landscaped banks.

Where topography or other conditions make the inclusion of drainage facilities within road rights-of-way impractical, perpetual unobstructed easements at least twenty (20) feet in width for such drainage facilities shall be provided across property outside the road right-of-way lines. This requirement applies to piped drainage channels as well, with the final width, length, access surface, and location of the easement to be approved on a case-by-case basis. Such easements shall include satisfactory access to the road. Easements shall be indicated on the Final Plat and be dedicated to Hooper City, or other applicable entity.

Drainage shall be carried from the road to a natural watercourse or to other approved City drainage facilities. When a proposed drainage system will carry water across private land outside the development or to a private drainage facility, appropriate drainage easements and agreements must be secured during the Preliminary Plat phase of development and indicated on the plat.

The applicant shall dedicate to the City or other appropriate agency, by drainage or conservation easement of land on both sides of existing watercourses, to a distance to be determined by the Planning Commission and City Staff.

E. Drainage Ways and Irrigation Ditches

All existing drainage ditches within, abutting or adjacent to subdivisions or development, or impacted by new development, shall be piped in accordance with development standards and specifications. Notification and approval from irrigation companies for development may be required in certain circumstances as determined by the City if the development impacts irrigation works uses or access.

F. Drainage Facilities

All drainage facilities as herein required shall include considerations for both flood control and water quality control.

1. Flood control facilities shall be based upon estimates of peak and total discharges. Flood control facilities shall be designed by the Rational Method, or other methods as approved by the City Engineer. Flood control plans are to facilitate a 10-year, 1-hour storm event for pipeline design and a 100-year storm event for detention basin design. An off-site discharge rate to an approved storm drain outfall of 0.15 cfs per acre is the maximum allowed.
2. Detention basins are flood control facilities, and the design shall incorporate "bypass" or "short circuit" control boxes in lieu of "pass through" detention basin which shall not be approved. The control box will allow design storm flows and "nuisance" water to pass and will only fill the detention basin if the design storm is exceeded. An overflow shall also be included in the control box to prevent overtopping of the detention basin. Detention basin shall be landscaped in accordance with City landscaping standards and specifications.
3. Water quality control facilities shall be designed and constructed in accordance with the Hooper City Low Impact Development Handbook (handbook) and will consider both retention and water quality treatment methods as prescribed in the handbook.
4. Retention facilities are water quality facilities, and the design shall include measures targeted at mimicking predevelopment hydrologic discharge conditions.

G. Grading and Drainage Plan

1. The applicant shall submit a drainage plan to the City Staff prior to preliminary plat approval.
 - a. Upon review and acceptance of the drainage plan, the City may approve the final plat.
 - b. No grading, filling, clearing, or excavation of any kind shall be initiated until the City approves the drainage plan and an excavation permit, if required, is obtained from the Hooper City Public Works Director.
2. The drainage plan shall be drawn to scale and shall include, but not be limited to, the following:
 - a. Topography at 2-foot intervals. The proposed grading shall be indicated by solid-line contours superimposed on dashed-line contours of existing topography. In case of predominantly level topography throughout a development, one-foot (1') contour intervals may be required.
 - b. North arrow, road and lot layout, and development name.

- c. Location of all existing water courses, canals, ditches, land drains, springs, wells, culverts and storm drains.
- d. The flood hazard zone(s) if the development is in an area of special flood hazard.
- e. Wetlands delineation, if applicable.
- f. Essential elements, alignments, and functions of the proposed drainage system including, but not limited to, inlets, outlets, catch basins, manholes, , culverts, detention basins orifice plates, pumps, water quality features, retention and infiltration facilities necessary, outlets to off-site facilities, and off-site facilities planned to accommodate the project drainage.
- g. The drainage plan shall indicate by flow arrows, contours, spot elevations, or some other acceptable manner, where storm water will be routed for the property. It must show the location and size of any flows onto the site from outside the property boundaries as well as any discharges leaving the site. The drainage plan must be prepared in a way that prevents run-off onto adjacent properties. Rear-lot drainage facilities may be approved as an option but is rarely an acceptable alternative to grading with imported fill and/or retaining structures. The City does not maintain private rear-lot drainage facilities.
- h. When drainage courses and irrigation facilities exist on-site, the owner and/or applicant shall provide documentary evidence of consent to re-routings by all interested landowners and drainage and irrigation entities affected and having rights to, and in, such facilities; and
- i. Other supplemental data as may be required by the City Staff.

HISTORY

Amended by Ord. [O-2014-3](#) on 11/6/2014

APPENDIX B

Permit Applications, Review
Forms, and Checklists



STORM WATER QUALITY REPORT

Date: _____
Project Name: _____
Project ID: _____
Design Engineer: _____

Is the project within a watershed that is 303(d) listed?

If yes:

Name of Receiving Water(s): _____

Listed Impairment(s): _____

Does the watershed have an approved TMDL?

If yes:

Approved TMDL(s): _____

I have reviewed the storm water quality design and find this report to be complete, accurate, and current.

(Name), Project Manager

(Name), Permittee's Designated Storm Water Coordinator

(PE stamp required)

(Name), Permittee's Head of Maintenance



Project Information

Type of Project (New Development, Redevelopment): _____

Area of Land Disturbance (acre): _____

Project Impervious Area (acre): _____

Project Imperviousness (%): _____

Project Runoff Coefficient, R_v : _____

90th Percentile Storm Depth (in): _____

Project 90th Percentile Volume, V_{goal} (cf): _____

Groundwater Information

Depth to Groundwater (ft): _____

Historical High Depth to Groundwater, if known (ft): _____

Source: _____

Soil Information

Infiltration Rate (in/hr): _____

Source: _____

LID Drainage Areas

(add additional rows as needed)

Contributing Drainage Area	Area (acre)	Impervious Area (acre)	Imperviousness (%)	Runoff Coefficient, R_v	Water Quality Volume WQV (cf)
Total WQV (cf)					



LID BMP Design

(add additional rows as needed)

Contributing Drainage Area	LID BMP Type	Water Quality Volume WQV (cf)	Runoff Retained (cf)	Percent of Runoff Captured (%)
Total Volume Retained (cf)				

Percent of V_{goal} captured by LID BMPs: _____%

If 100% of V_{goal} is not captured, document and provide narrative of technical infeasibilities and/or alternate compliance measures below:

Describe additional storm water quality measures incorporated into the site:

SWPPP Preconstruction Submittal and Review Checklist

Name of Development:

Submittal Date:

Developer:

Phone:

Responsible Contact:

Phone:

Reviewed by _____ City (date): (name):

The following items shall be included on the SWPPP. **Check the spaces below indicating that each item is included or is not applicable, and then submit this form to Hooper City with the SWPPP.** Heading numbers correspond to sections in the Utah SWPPP Template. References are given from the Construction General Permit (primarily sections 2 and 7).

Included N/A SWPPP Requirement

1.1 – Storm Water Team

- | | | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Storm Water Team by name or position – 7.2.1 |
| <input type="checkbox"/> | <input type="checkbox"/> | Role or responsibilities of each team member – 7.2.1 |

2.2 - Nature of Construction Activity

- | | | |
|--------------------------|--------------------------|---------------------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | Nature of activity or project – 7.2.2 |
|--------------------------|--------------------------|---------------------------------------|

2.3 - Construction Site Estimates

- | | | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | Total area of site, area to be disturbed during course of the project – 7.2.2 |
| <input type="checkbox"/> | <input type="checkbox"/> | Maximum area to be disturbed at one time – 7.2.2 |

2.4 – Soils, Slopes, Vegetation, and Current Drainage Patterns

- | | | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Provide the range of soil particle sizes expected on the site – 2.1.1.b.ii.3 |
| <input type="checkbox"/> | <input type="checkbox"/> | Slopes and Drainage Patterns – 7.2.5.d |

2.5 – Emergency Related Projects – If Applicable

- | | | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | State the cause of the public emergency – 7.2.3 |
| <input type="checkbox"/> | <input type="checkbox"/> | Provide a description of the construction necessary to reestablish public services – 7.2.3 |

2.6 – Phase/Sequence of Construction Activity

- | | | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | Intended sequence of activities – 7.2.4 |
| <input type="checkbox"/> | <input type="checkbox"/> | Start date and duration of storm water control measure installation – 7.2.4.a |
| <input type="checkbox"/> | <input type="checkbox"/> | Commencement and duration of earth-disturbing activities – 7.2.4.b |
| <input type="checkbox"/> | <input type="checkbox"/> | Cessation, temporarily or permanently, of construction activities – 7.2.4.c |
| <input type="checkbox"/> | <input type="checkbox"/> | Final or temporary stabilization of exposed soils – 7.2.4.d |
| <input type="checkbox"/> | <input type="checkbox"/> | Removal of temporary storm water control measures – 7.2.4.e |

2.7 – Site Features and Sensitive Areas to be Protected

- Describe any unique features to be preserved or protected – 7.2.5.b

2.8 – Maps

- Site Maps – 7.2.5
- Direction of storm water flow and approximate slopes – 7.2.5.d
- Areas and timing of soil disturbance – 7.2.5.a.i
- Natural features to be preserved – 7.2.5.c
- Locations of major structural and non-structural BMPs – 7.2.5.g
- Locations of off-site material, waste, borrow or equipment – 7.2.5.a.vii
- Locations of all waters of the US including wetlands – 7.2.5.b
- Locations where storm water discharges to a surface water – 7.2.5.e.ii
- Locations of storm drain inlets – 7.2.5.e.i
- Locations of stockpiles – 7.2.5.a.iii
- Construction site exits – 7.2.5.a.v
- Locations of structures and impervious surfaces post-construction – 7.2.5.a.vi
- Locations of potential pollutant-generating activities – 7.2.5.f
- Locations where chemicals will be stored and used – 7.2.5.h

3.1 – Potential Sources of Pollution

- Potential sources of sediment – 7.2.5.f, 7.2.6
- Activity(ies)
- Control measure(s) to be used
- Timing
- Installation details
- Anticipated maintenance requirements

3.2 – Non-Storm Water Discharges

- Identify all sources of allowable non-storm water discharges – 7.2.7
- Describe management practices for non-storm water discharges
- Control measure(s) to be used
- Timing
- Installation details
- Anticipated maintenance requirements

3.3 – Buffer Documentation

- Is there a surface water within 50 feet of your construction activities? – 7.2.8
- Description of measures taken to protect buffer or equivalent buffer
- Control measure(s) to be used
- Timing
- Installation details
- Anticipated maintenance requirements
- Buffer exceptions?

4.1 – Minimize Disturbed Areas and Protect Natural Features and Soil

- Identify areas that are not to be disturbed – 2.1.1.a

4.2 – Establish Perimeter Controls and Sediment Barriers

- | | | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | Describe BMPs to be used to control sediment – 7.2.9.ii |
| <input type="checkbox"/> | <input type="checkbox"/> | Control measure(s) to be used |
| <input type="checkbox"/> | <input type="checkbox"/> | Timing |
| <input type="checkbox"/> | <input type="checkbox"/> | Installation details |
| <input type="checkbox"/> | <input type="checkbox"/> | Anticipated maintenance requirements |

4.3 – Retain Sediment on Site

- | | | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | Describe BMPs to be used to control sediment – 7.2.9.ii |
| <input type="checkbox"/> | <input type="checkbox"/> | Control measure(s) to be used |
| <input type="checkbox"/> | <input type="checkbox"/> | Timing |
| <input type="checkbox"/> | <input type="checkbox"/> | Installation details |
| <input type="checkbox"/> | <input type="checkbox"/> | Anticipated maintenance requirements |

4.4 – Establish Stabilized Construction Exits

- | | | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | Describe BMPs to be used to stabilize construction exits – 7.2.9.iii; 2.1.2.c |
| <input type="checkbox"/> | <input type="checkbox"/> | Control measure(s) to be used |
| <input type="checkbox"/> | <input type="checkbox"/> | Timing |
| <input type="checkbox"/> | <input type="checkbox"/> | Installation details |
| <input type="checkbox"/> | <input type="checkbox"/> | Anticipated maintenance requirements |

4.5 – Protect Slopes

- | | | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | Describe BMPs to be used to protect slopes – 2.1.2.e.i; 2.1.3.a |
| <input type="checkbox"/> | <input type="checkbox"/> | Control measure(s) to be used |
| <input type="checkbox"/> | <input type="checkbox"/> | Timing |
| <input type="checkbox"/> | <input type="checkbox"/> | Installation details |
| <input type="checkbox"/> | <input type="checkbox"/> | Anticipated maintenance requirements |

4.6 – Stockpiled Sediment or Soil

- | | | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Describe BMPs to be used to protect/contain stockpiled sediment or soils – 2.1.2.d |
| <input type="checkbox"/> | <input type="checkbox"/> | Control measure(s) to be used |
| <input type="checkbox"/> | <input type="checkbox"/> | Timing |
| <input type="checkbox"/> | <input type="checkbox"/> | Installation details |
| <input type="checkbox"/> | <input type="checkbox"/> | Anticipated maintenance requirements |

4.7 – Minimize Dust

- | | | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Describe BMPs to be used to control dust – 2.1.2.e |
| <input type="checkbox"/> | <input type="checkbox"/> | Control measure(s) to be used |
| <input type="checkbox"/> | <input type="checkbox"/> | Timing |
| <input type="checkbox"/> | <input type="checkbox"/> | Installation details |
| <input type="checkbox"/> | <input type="checkbox"/> | Anticipated maintenance requirements |

4.8 – Topsoil

- | | | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Describe BMPs to be used to preserve topsoil – 2.1.2.f |
| <input type="checkbox"/> | <input type="checkbox"/> | Control measure(s) to be used |

- | | | |
|--------------------------|--------------------------|--------------------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | Timing |
| <input type="checkbox"/> | <input type="checkbox"/> | Installation details |
| <input type="checkbox"/> | <input type="checkbox"/> | Anticipated maintenance requirements |

4.9 – Soil Compaction

- | | | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Describe BMPs to be used to minimize soil compaction – 2.1.2.g |
| <input type="checkbox"/> | <input type="checkbox"/> | Restrict vehicle/equipment use – 2.1.2.g.i |
| <input type="checkbox"/> | <input type="checkbox"/> | Use soil conditioning techniques – 2.1.2.g.ii |

4.10 – High Altitudes/Heavy Snows

- | | | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | Describe BMPs to be used to control snow melt – 2.1.2.i |
| <input type="checkbox"/> | <input type="checkbox"/> | Control measure(s) to be used |
| <input type="checkbox"/> | <input type="checkbox"/> | Timing |
| <input type="checkbox"/> | <input type="checkbox"/> | Installation details |
| <input type="checkbox"/> | <input type="checkbox"/> | Anticipated maintenance requirements |
| <input type="checkbox"/> | <input type="checkbox"/> | List dates when snow is expected |

4.11 – Linear Activities

- | | | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Describe BMPs to be used on linear projects where conventional methods don't apply – 2.1.2.b.i |
| <input type="checkbox"/> | <input type="checkbox"/> | Describe why you believe that perimeter controls are impractical |
| <input type="checkbox"/> | <input type="checkbox"/> | List Control measure(s) to be used instead |
| <input type="checkbox"/> | <input type="checkbox"/> | Timing |
| <input type="checkbox"/> | <input type="checkbox"/> | Installation details |
| <input type="checkbox"/> | <input type="checkbox"/> | Anticipated maintenance requirements |

4.12 – Chemical Treatment

- | | | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | Describe BMPs to be used to handle chemical treatments – 2.1.3.c and 7.2.9.b |
| <input type="checkbox"/> | <input type="checkbox"/> | Control measure(s) to be used |
| <input type="checkbox"/> | <input type="checkbox"/> | Timing |
| <input type="checkbox"/> | <input type="checkbox"/> | Installation details |
| <input type="checkbox"/> | <input type="checkbox"/> | Anticipated maintenance requirements |
| <input type="checkbox"/> | <input type="checkbox"/> | List all soil types where chemicals will be applied |
| <input type="checkbox"/> | <input type="checkbox"/> | List all treatment chemicals that will be used |
| <input type="checkbox"/> | <input type="checkbox"/> | List dosages for each chemical and how dosages will be regulated |
| <input type="checkbox"/> | <input type="checkbox"/> | Provide information from any applicable Material Safety Data Sheets (MSDS) |
| <input type="checkbox"/> | <input type="checkbox"/> | Describe how chemicals will be stored |
| <input type="checkbox"/> | <input type="checkbox"/> | Include copies of applicable manufacturer's specifications regarding chemical use |
| <input type="checkbox"/> | <input type="checkbox"/> | Include DWQ authorization if using cationic treatment chemicals |
| <input type="checkbox"/> | <input type="checkbox"/> | Provide schematic drawings of any chemically- enhance storm water controls |
| <input type="checkbox"/> | <input type="checkbox"/> | Describe personnel training that applies to chemical use |

4.13 – Stabilize Soils

- | | | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | Describe BMPs to be used to either temporarily or permanently stabilize soils – 2.2 and 7.2.9.c |
| <input type="checkbox"/> | <input type="checkbox"/> | Control measure(s) to be used |
| <input type="checkbox"/> | <input type="checkbox"/> | Timing |
| <input type="checkbox"/> | <input type="checkbox"/> | Installation details |

- Anticipated maintenance requirements
- Describe BMPs to be used to control dust – 2.1.2.e

4.14 – Final Stabilization

- Describe BMPs to be used to achieve final stabilization – 2.2.2
- Control measure(s) to be used
- Timing
- Installation details
- Anticipated maintenance requirements

5 – Pollution Prevention

- Describe BMPs to be used to achieve final stabilization – 2.3
- Control measure(s) to be used
- Timing
- Installation details
- Anticipated maintenance requirements

5.1 – Spill Prevention and Response

- Describe the Spill Prevention and Response Plan – 2.3.4
- Control measure(s) to be used
- Timing
- Installation details
- Anticipated maintenance requirements

5.2 – Construction and Domestic Waste

- Describe BMPs to handle construction and domestic waste – 2.3.3.c.v
- Control measure(s) to be used
- Timing
- Installation details
- Anticipated maintenance requirements

5.3 – Washing of Applicators and Containers used for Concrete, Paint or Other Materials

- Describe BMPs used to cleanup or washout concrete and paint equipment – 2.3.3.d
- Control measure(s) to be used
- Timing
- Installation details
- Anticipated maintenance requirements

5.4 – Establish Proper Building Material Staging Areas

- Describe BMPs to be used to properly handle and store building materials – 2.3.3.c.i
- Control measure(s) to be used
- Timing
- Installation details
- Anticipated maintenance requirements

5.5 – Establish Proper Equipment/Vehicle Fueling and Maintenance Practices

- | | | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Describe BMPs to be used to eliminate the discharge of fuels – 2.3.3.a |
| <input type="checkbox"/> | <input type="checkbox"/> | Control measure(s) to be used |
| <input type="checkbox"/> | <input type="checkbox"/> | Timing |
| <input type="checkbox"/> | <input type="checkbox"/> | Installation details |
| <input type="checkbox"/> | <input type="checkbox"/> | Anticipated maintenance requirements |

5.6 – Control Equipment/Vehicle Washing

- | | | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | Describe BMPs to be used to minimize the discharge of pollutants from equipment and vehicle washing – 2.3.3.b |
| <input type="checkbox"/> | <input type="checkbox"/> | Control measure(s) to be used |
| <input type="checkbox"/> | <input type="checkbox"/> | Timing |
| <input type="checkbox"/> | <input type="checkbox"/> | Installation details |
| <input type="checkbox"/> | <input type="checkbox"/> | Anticipated maintenance requirements |

5.7 – Pesticides, Herbicides, Insecticides, Fertilizers, and Landscape Materials

- | | | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Describe BMPs to be used to achieve final stabilization – 2.3.3.c.ii |
| <input type="checkbox"/> | <input type="checkbox"/> | Control measure(s) to be used |
| <input type="checkbox"/> | <input type="checkbox"/> | Timing |
| <input type="checkbox"/> | <input type="checkbox"/> | Installation details |
| <input type="checkbox"/> | <input type="checkbox"/> | Anticipated maintenance requirements |

5.8 – Other Pollution Prevention Practices

- | | | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Describe BMPs to be used to achieve final stabilization – 2.3.3.c.iv, 2.3.3.c.vi |
| <input type="checkbox"/> | <input type="checkbox"/> | Control measure(s) to be used |
| <input type="checkbox"/> | <input type="checkbox"/> | Timing |
| <input type="checkbox"/> | <input type="checkbox"/> | Installation details |
| <input type="checkbox"/> | <input type="checkbox"/> | Anticipated maintenance requirements |

6 - Inspections

- | | | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Inspection requirements – Section 4 |
| <input type="checkbox"/> | <input type="checkbox"/> | Qualifications of the inspector – 4.1.1 |
| <input type="checkbox"/> | <input type="checkbox"/> | Inspection Schedule and Procedures – 4.1.2 |
| <input type="checkbox"/> | <input type="checkbox"/> | Inspection report forms – 4.1.7.a |
| <input type="checkbox"/> | <input type="checkbox"/> | Inspection date – 4.1.7.a.i |
| <input type="checkbox"/> | <input type="checkbox"/> | UPDES CGP Tracking Number – 4.1.7.a.ii |
| <input type="checkbox"/> | <input type="checkbox"/> | Name, title and qualifications of inspector – 4.1.7.a.iii |
| <input type="checkbox"/> | <input type="checkbox"/> | Inspection Findings – 4.1.7.a.iv |
| <input type="checkbox"/> | <input type="checkbox"/> | Any corrective actions that may be required, including changes that need to be made to the SWPPP – with implementation dates – Section 5 |
| <input type="checkbox"/> | <input type="checkbox"/> | Requirements to keep records as part of SWPPP for at least 5 years – 4.1.7.c |
| <input type="checkbox"/> | <input type="checkbox"/> | Delegation of Authority documentation as applicable – Appendix F – 1.1.1 |

7 – Training and Recordkeeping

- | | | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Documentation of training or training log – 7.2.12 |
|--------------------------|--------------------------|--|

- | | | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | SWPPP Modification log – 7.4.3 |
| <input type="checkbox"/> | <input type="checkbox"/> | Log of rainfall events measuring 0.5 inches or greater – 4.1.2.b; 4.1.7 |
| <input type="checkbox"/> | <input type="checkbox"/> | Corrective Action log – 5.4.3 |

8 – Water Quality

- | | | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Show the location and describe any UIC Class 5 Injection Wells – 7.2.13 |
| <input type="checkbox"/> | <input type="checkbox"/> | Show the location and describe the nature of all discharges into surface waters within the project boundary – 7.2.5.a.iv |
| <input type="checkbox"/> | <input type="checkbox"/> | Identify Receiving Waters – 1.6 |
| <input type="checkbox"/> | <input type="checkbox"/> | Identify and document any discharges to impaired waters – 3.2 |
| <input type="checkbox"/> | <input type="checkbox"/> | Describe any dewatering practices and include permits as necessary – 1.3.5, 2.1.3.d |
| <input type="checkbox"/> | <input type="checkbox"/> | Describe any BMPs used to control storm water flowing onto or through the project – 2.1.1.b.i |
| <input type="checkbox"/> | <input type="checkbox"/> | Describe any Storm Water Inlet BMPs – 2.1.2.h |

9 – Post Construction BMPs

- | | | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | Describe all Post-construction BMPs to be installed during construction – |
| <input type="checkbox"/> | <input type="checkbox"/> | Control measure(s) to be used |
| <input type="checkbox"/> | <input type="checkbox"/> | Timing |
| <input type="checkbox"/> | <input type="checkbox"/> | Installation details |
| <input type="checkbox"/> | <input type="checkbox"/> | Anticipated maintenance requirements |

10 – Certification/Signatory Requirements

- | | | |
|--------------------------|--------------------------|------------------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | Is the SWPPP signed and certified? |
|--------------------------|--------------------------|------------------------------------|

Appendices

- | | | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | A – General Location Map |
| <input type="checkbox"/> | <input type="checkbox"/> | B – Maps – 7.2.5 |
| <input type="checkbox"/> | <input type="checkbox"/> | C – Copy of the current General Permit for Construction Activities – 7.2.16.b |
| <input type="checkbox"/> | <input type="checkbox"/> | D – Notice of Intent (N.O.I.) |
| <input type="checkbox"/> | <input type="checkbox"/> | E – Inspection Reports |
| <input type="checkbox"/> | <input type="checkbox"/> | F – Corrective Action Log |
| <input type="checkbox"/> | <input type="checkbox"/> | G – SWPPP Amendment Log |
| <input type="checkbox"/> | <input type="checkbox"/> | H – Subcontractor Certification/Agreements |
| <input type="checkbox"/> | <input type="checkbox"/> | I – Grading and Stabilization Activities Log |
| <input type="checkbox"/> | <input type="checkbox"/> | J – Training Log |
| <input type="checkbox"/> | <input type="checkbox"/> | K – Delegation of Authority |
| <input type="checkbox"/> | <input type="checkbox"/> | L – Additional Information |
| <input type="checkbox"/> | <input type="checkbox"/> | M – BMP Specifications |

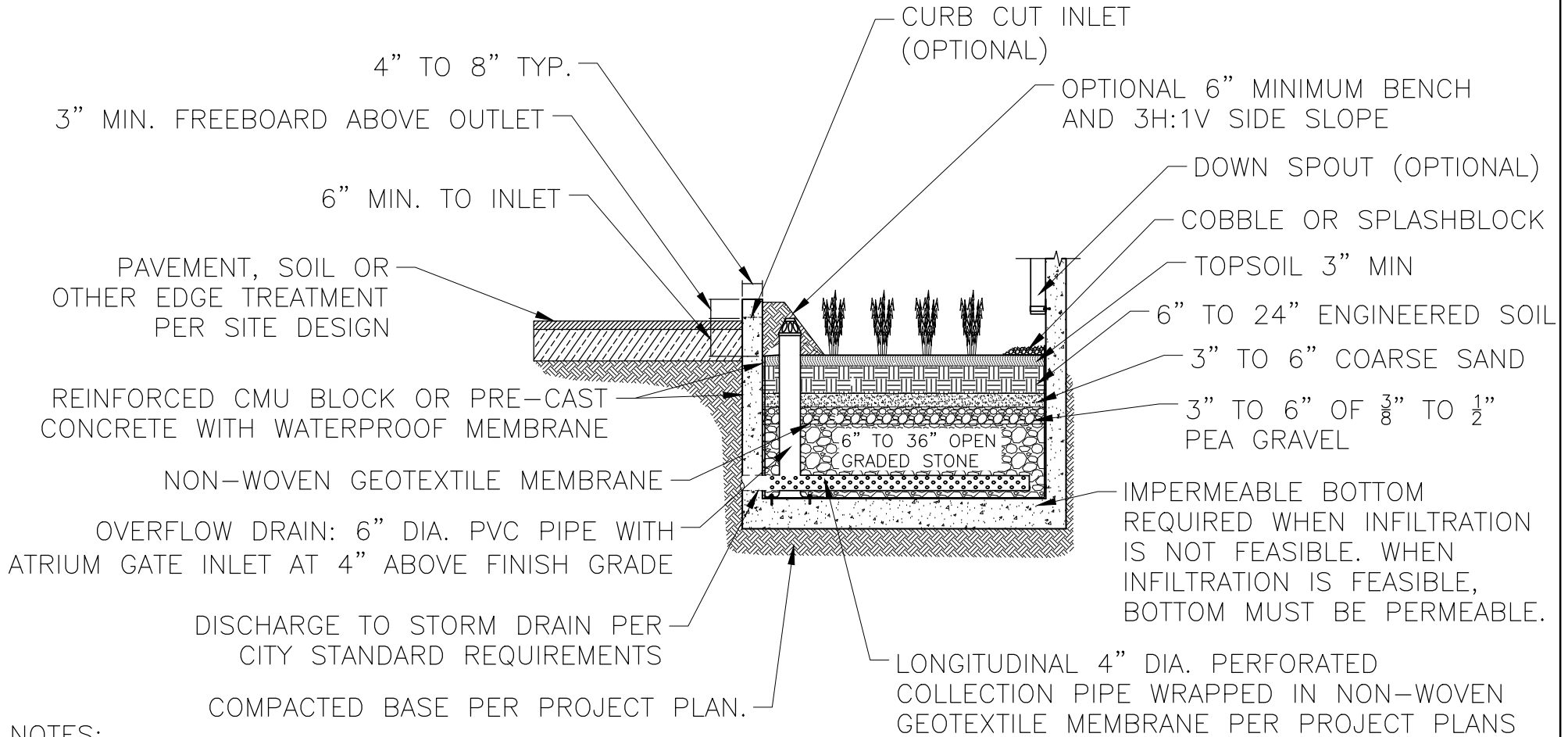
Other

- | | | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | Any requested variance of Permit requirements |
|--------------------------|--------------------------|---|

This document and attachments must be maintained by the MS4 for a period of five years or until construction is completed, whichever is longer. (4.2.4.3)

APPENDIX C

BMP Standard Details



NOTES:

1. AT LEAST 9 INCHES SHALL BE PROVIDED BETWEEN THE PLANTING SURFACE AND THE CREST OF EACH PLANTER.
2. PLANTERS SHALL NOT BE LOCATED ON UNEVEN OR SLOPED SURFACES.
3. TOP SOIL/PLANTING MIX IS AT LEAST 18" DEEP.
4. TOP SOIL CONTAINS NO MORE THAN 30% COMPOST.
5. DIRECT OVERFLOW DISCHARGE CITY STANDARD REQUIREMENTS.
6. SEE BIORETENTION CELL FACT SHEET FOR MORE INFORMATION.

* NOT TO SCALE

DEVELOPMENT STANDARDS
HOOPER CITY COPORATION

BIORETENTION CELL



J-U-B ENGINEERS, INC.

LAST UPDATE: 10/28/2021
PLOT DATE: 10/28/2021
FILE: LID

Plot Date: 10/28/2021 12:28 PM Plotted By: Mark Jenkins
 Date Created: 10/28/2021 J:\JUB\COM\CENTRAL\CLIENTS\UT\HOOPER\CITY\PROJECTS\STORMWATER PROGRAM\LD\MANUAL\BMPDETAILS\LID.DWG

RAIN BARRELS ARE APPROPRIATE WHERE THE FOLLOWING SITE CHARACTERISTICS ARE PRESENT:

1. ROOF AREAS WITH DOWNSPOUTS
2. A LEVEL, FIRM SURFACE FOR SUPPORT OF THE RAIN BARREL(S). RAIN BARRELS SHOULD ONLY BE ELEVATED WITH SOLID CONSTRUCTION MATERIALS AND KEPT AWAY FROM RETAINING WALLS AS A FULL 55-GALLON RAIN BARREL WILL WEIGH OVER 400 LBS.
3. AN AREA WHERE THE CAPTURED WATER CAN BE USED WITHIN A REASONABLE DISTANCE FROM THE RAIN BARREL(S)
4. DESIGN OF AN APPROPRIATE AREA FOR OVERFLOW FROM THE BARREL
5. UTAH LAW LIMITS HARVESTING TO NO MORE THAN TWO COVERED CONTAINERS AND NO CONTAINER LARGER THAN 100 GALLONS WITHOUT REGISTERING CONTAINERS

REQUIREMENTS BY ROOF/IMPERVIOUS SURFACE AREA	
ROOF/IMPERVIOUS AREA (SQ.FT.)	GALLONS OF STORAGE REQUIRED*
500-1,000	200**
1,001-1,500	440**

* OR EQUIVALENT CAPTURE USING LARGER RAIN BARRELS.

** MINIMUM LANDSCAPE AREA FOR 4 RAIN BARRELS SHALL BE 200 SQUARE FEET AND THE MINIMUM LANDSCAPE AREA FOR 8 RAIN BARRELS SHALL BE 400 SQUARE FEET.

DESIGN CRITERIA AND CONSIDERATIONS:

- SCREENS ARE PRESENT ON ALL RAIN BARREL INLETS TO REMOVE DEBRIS AND LARGER PARTICLES AS THE WATER ENTERS THE BARREL. REMOVABLE CHILD-RESISTANT COVERS AND MOSQUITO SCREENING ARE IN PLACE.
- BARREL IS CHILD SAFE: ACCESS IS CHILD-PROOF AND THE BARREL IS PROPERLY SITED AND ANCHORED ON A STABLE SURFACE TO PREVENT BARREL FROM TIPPING OVER. REMEMBER - EACH RAIN BARREL WEIGHS APPROXIMATELY 400 LBS WHEN FULL.
- ABOVE-GROUND BARRELS ARE NOT LOCATED ON UNEVEN OR SLOPED SURFACES; IF INSTALLED ON A SLOPED SURFACE, THE BASE WHERE THE BARREL IS INSTALLED HAS BEEN LEVELED USING APPROPRIATE CONSTRUCTION MATERIALS PRIOR TO INSTALLATION.
- INSTALLED RAIN BARRELS HAVE NOT BEEN PLACED ON ELEVATED PLATFORMS, DECKS OR PORCHES WITHOUT CONSULTING LOCAL BUILDING CODE OFFICIALS.
- OVERFLOW OUTLET IS PROVIDED AND DESIGNED TO DISPERSE OVERFLOW ONSITE AND THROUGH STABLE VEGETATED AREAS WHERE EROSION OR SUSPENSION OF SEDIMENT IS MINIMIZED.
- DISPERSION IS DIRECTED SO AS NOT TO KNOWINGLY CAUSE GEOTECHNICAL HAZARDS RELATED TO SLOPE STABILITY OR TRIGGERING EXPANSIVE (CLAYEY) SOIL MOVEMENT. OVERFLOW DISPERSION WILL TAKE PLACE AT LEAST 3 FEET AWAY FROM PUBLIC SIDEWALKS, AT LEAST 5 FEET AWAY FROM PROPERTY LINES AND FOUNDATIONS, AND AT LEAST 20 FEET FROM BUILDING FOUNDATIONS.
- RAIN BARRELS ARE OPAQUE AND DARK IN COLOR TO PREVENT UV LIGHT PENETRATION AND DISCOURAGE ALGAE GROWTH.
- BARREL PLACEMENT ALLOWS EASY ACCESS FOR REGULAR MAINTENANCE.

OPERATIONS AND MAINTENANCE

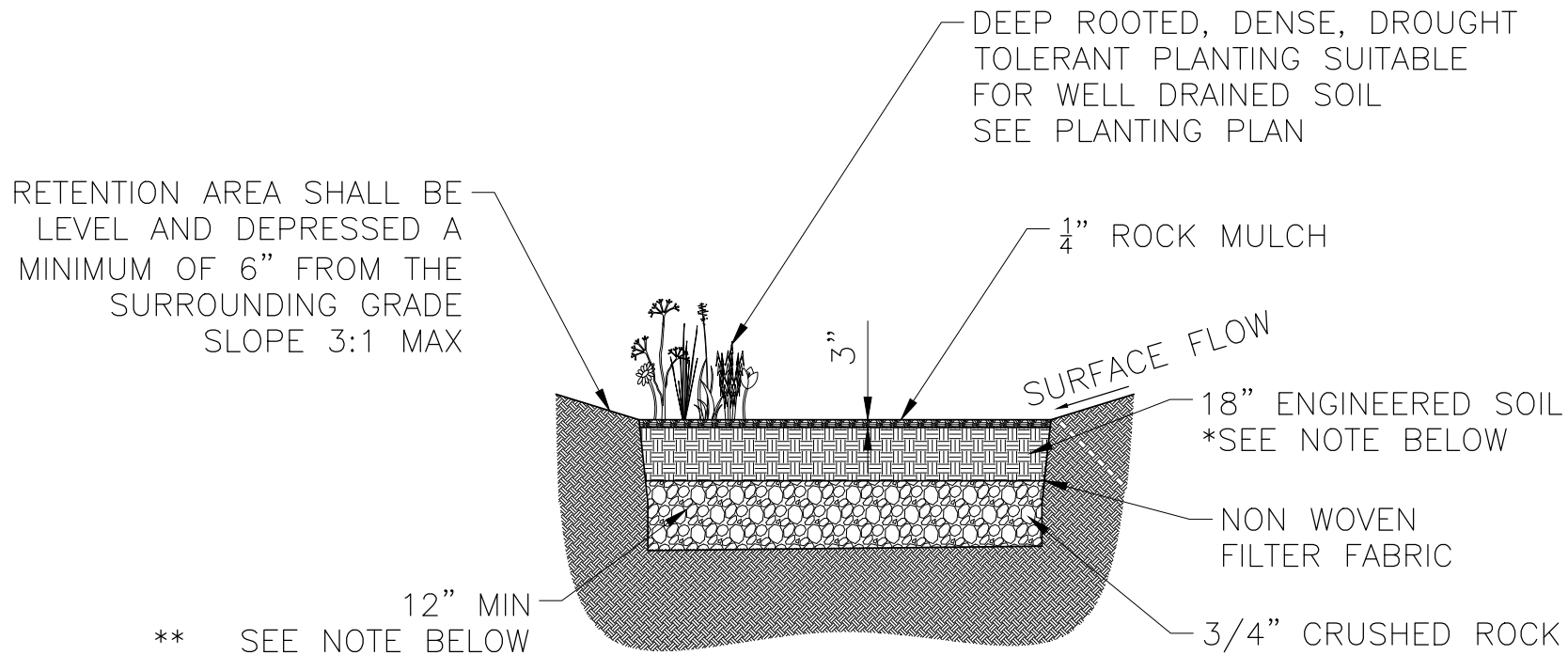
- RAIN BARREL COMPONENTS WILL BE INSPECTED 4 TIMES ANNUALLY AND FOLLOWING MAJOR STORM EVENTS. SCREENS, SPIGOTS, DOWNSPOUTS, AND LEADERS WILL BE REPAIRED OR REPLACED AS NEEDED.
- RAIN BARRELS WILL BE CLEANED AS NECESSARY TO PREVENT ALGAE GROWTH AND THE BREEDING OF VECTORS. CLEANING SHOULD ALWAYS TAKE PLACE ON A PERMEABLE SURFACE. IF VECTORS ARE BREEDING IN A RAIN BARREL, THE BARREL WILL BE DRAINED IMMEDIATELY.
- DURING DRY PERIODS, SPIGOT DRAINS WILL BE LEFT OPEN WHEN BARREL IS NOT IN USE.
- DISPERSION AREAS WILL BE MAINTAINED TO REMOVE TRASH AND DEBRIS, LOOSE VEGETATION. AREAS OF BARE SOIL SHOULD BE REHABILITATED TO MINIMIZE EROSION.
- WHERE POSSIBLE, EFFECTIVE ENERGY DISSIPATION AND UNIFORM FLOW SPREADING METHODS WILL BE USED TO PREVENT EROSION AND AID DISPERSION.
- IF ADEQUATE MOSQUITO CONTROL IS NOT IN PLACE AND WELL-MAINTAINED, RAIN BARRELS WILL BE EMPTIED AS NECESSARY TO PREVENT STANDING WATER FROM REMAINING IN A BARREL FOR MORE THAN 2 DAYS, THEREBY PREVENTING VECTORS FROM BREEDING. IF VECTOR BREEDING OCCURS AS A RESULT OF CONTAINED STORM WATER OR INADEQUATELY MAINTAINED BMPs, I UNDERSTAND THAT THE CITY HAS THE ABILITY TO FINE SITE OWNERS.
- RAIN GUTTERS WILL BE INSPECTED AND CLEANED AT LEAST TWICE ANNUALLY.

**DEVELOPMENT STANDARDS
HOOPER CITY CORPORATION**

**FACT SHEET
RAIN BARREL**



J-U-B ENGINEERS, INC.
LAST UPDATE: 10/28/2021
FILE: JLD



*BIORETENTION "ENGINEERED SOIL" LAYER SHALL BE MINIMUM 18" DEEP "SANDY LOAM" SOIL MIX WITH NO MORE THAN 5% CLAY CONTENT. THE MIX SHALL CONTAIN 50-60% SAND, 20-30% COMPOST OR HARDWOOD MULCH, AND 20-30% TOPSOIL.

**3/4" CRUSHED ROCK LAYER SHALL BE A MINIMUM 12" BUT MAY BE DEEPENED TO INCREASE THE INFILTRATION AND STORAGE ABILITY OF THE BASIN.

* NOT TO SCALE

DEVELOPMENT STANDARDS
HOOPER CITY CORPORATION

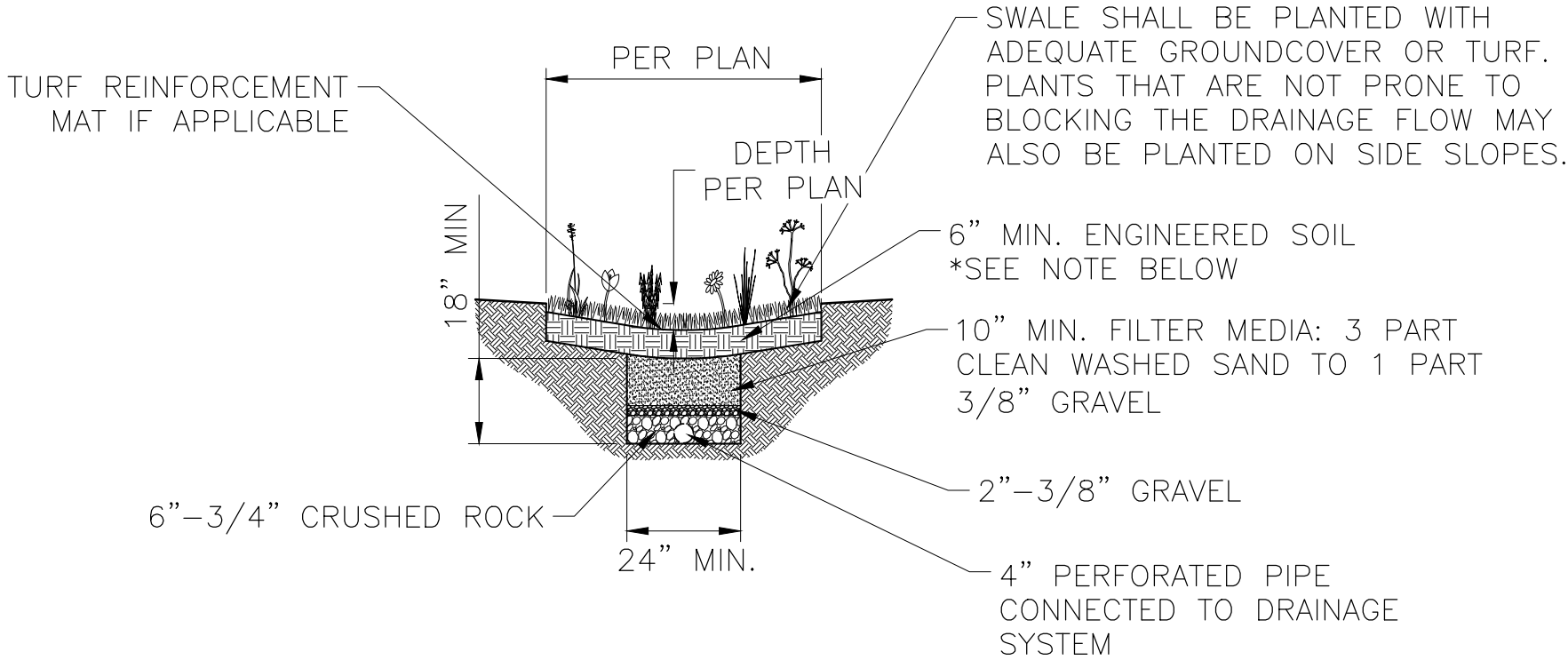


J-U-B ENGINEERS, INC.

RAIN GARDEN

LAST UPDATE: 10/28/2021
PLOT DATE: 10/28/2021
FILE: LID

Plot Date: 10/28/2021 12:28 PM Plotted By: Mark Jenkins
Date Created: 10/28/2021 \\JUB.COM\CENTRAL\CLIENTS\UT\HOOPER\PROJECTS\STORMWATER PROGRAM\LID\MANUAL\LID\DETAILS\LID.DWG



- NOTES:
- *"ENGINEERED SOIL" LAYER SHALL BE MINIMUM 6" DEEP "SANDY LOAM" SOIL MIX WITH NO MORE THAN 5% CLAY CONTENT. THE MIX SHALL CONTAIN 50-60% SAND, 20-30% COMPOST OR HARDWOOD MULCH, AND 20-30% TOPSOIL.
 - VEGETATED SWALES ON GRADES OF MORE THAN 2.5% MUST INSTALL CHECK DAMS TO LIMIT THE SLOPE OF THE SWALE TO 2.5% UNLESS OTHERWISE APPROVED BY THE DIRECTOR OF ENGINEERING SERVICES.
 - NO FILTER FABRIC IS TO BE USED IN THIS SECTION.

* NOT TO SCALE



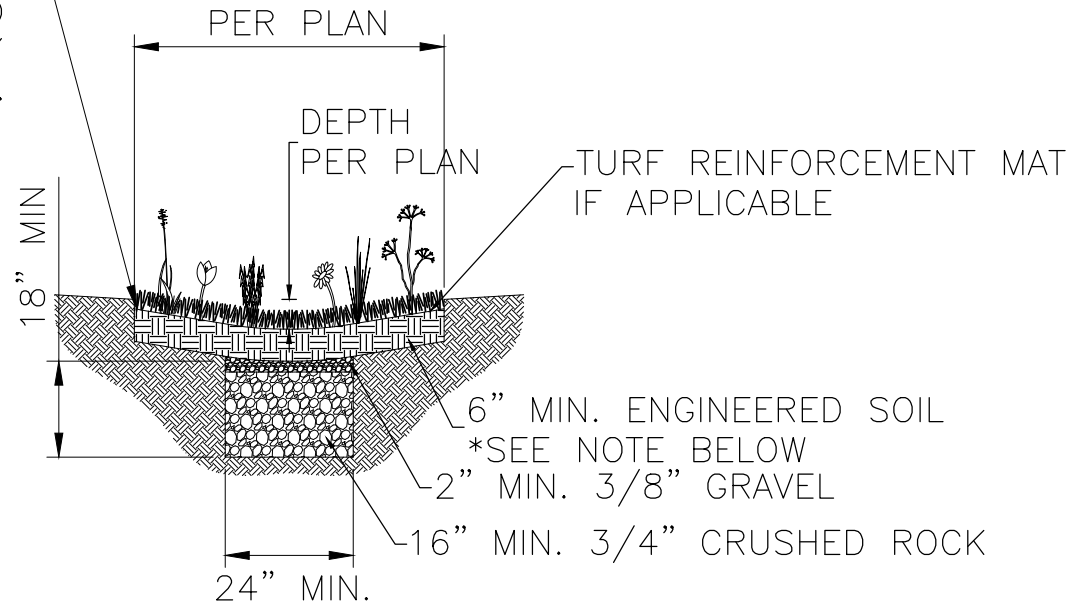
DEVELOPMENT STANDARDS
HOOPER CITY CORPORATION
VEGETATED SWALE
CLAYEY SOILS (NO INFILTRATION)

Plot Date: 10/28/2021 12:29 PM Plotted By: Mark Jenkins
 Date Created: 10/28/2021 J:\JUB\CENTRAL\CLIENTS\UT HOOPER\PROJECTS\STORMWATER PROGRAM\LD\MANUAL\BMPDETAILS\LD.DWG

LAST UPDATE: 10/28/2021
 PLOT DATE: 10/28/2021
 FILE: LD

J-U-B ENGINEERS, INC.

SWALE SHALL BE PLANTED WITH ADEQUATE GROUND COVER OR TURF. PLANTS THAT ARE NOT PRONE TO BLOCKING THE DRAINAGE FLOW MAY ALSO BE PLANTED ON SIDE SLOPES.



- NOTES:
1. *"ENGINEERED SOIL" LAYER SHALL BE MINIMUM 6" DEEP "SANDY LOAM" SOIL MIX WITH NO MORE THAN 5% CLAY CONTENT. THE MIX SHALL CONTAIN 50-60% SAND, 20-30% COMPOST OR HARDWOOD MULCH, AND 20-30% TOPSOIL.
 2. VEGETATED SWALES ON GRADES OF MORE THAN 2.5% MUST INSTALL CHECK DAMS TO LIMIT THE SLOPE OF THE SWALE TO 2.5% UNLESS OTHERWISE APPROVED BY THE DIRECTOR OF ENGINEERING SERVICES.
 3. NO FILTER FABRIC IS TO BE USED IN THIS SECTION.

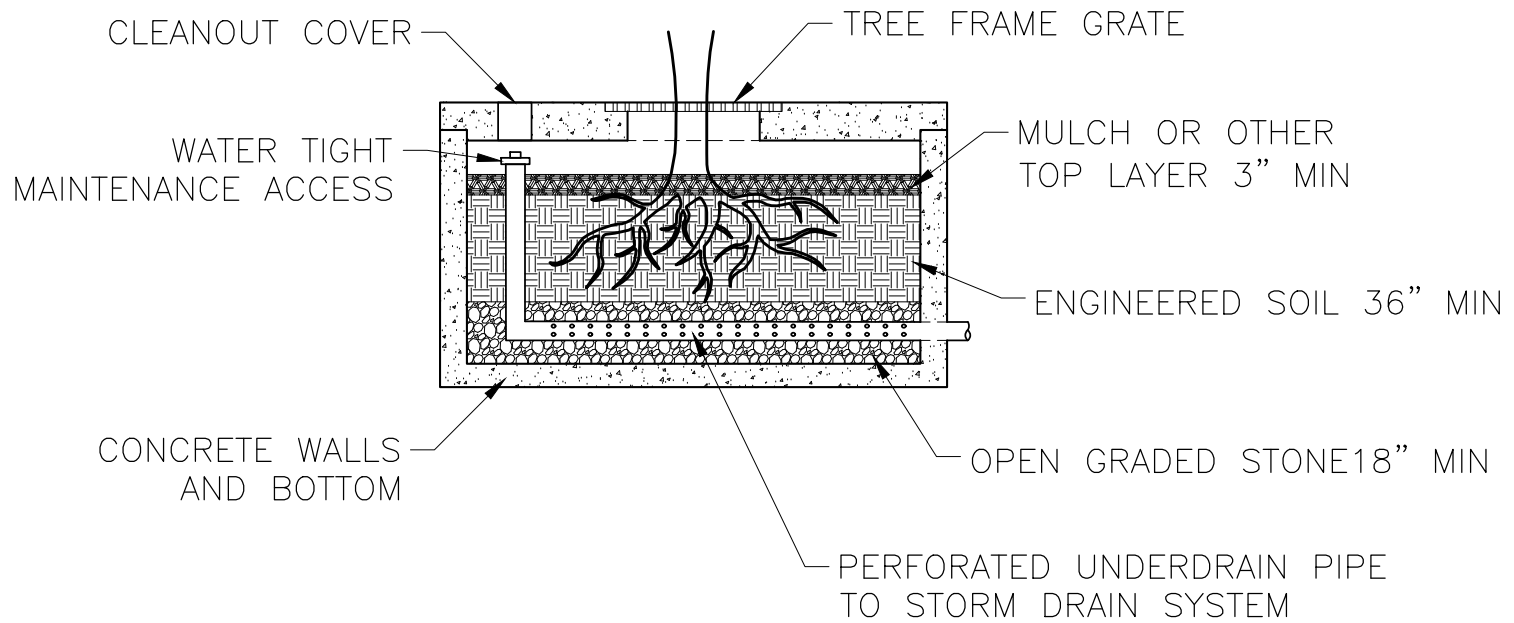
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J-U-B ENGINEERS, INC.

DEVELOPMENT STANDARDS
HOOPER CITY COPORATION
VEGETATED SWALE
SANDY SOILS (INFILTRATION ALLOWED)

LAST UPDATE: 10/28/2021
PLOT DATE: 10/28/2021
FILE: LID



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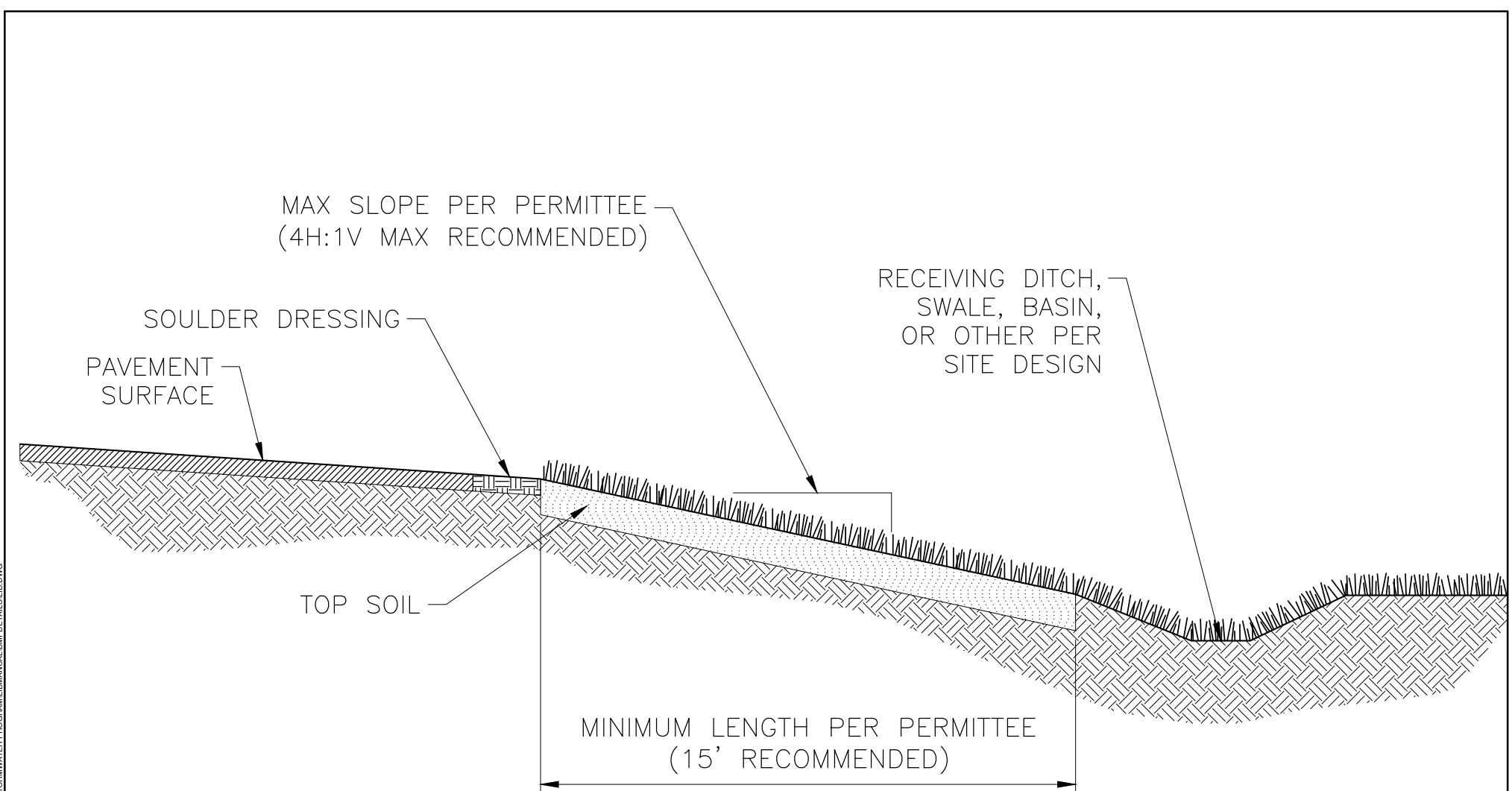
DEVELOPMENT STANDARDS
HOOPER CITY CORPORATION

TREE BOX FILTER



J-U-B ENGINEERS, INC.

LAST UPDATE: 10/28/2021
PLOT DATE: 10/28/2021
FILE: LID



NOTES:

1. DIMENSIONS SHOWN MAY VARY BASED ON SITE CONDITIONS

* NOT TO SCALE

DEVELOPMENT STANDARDS
HOOPER CITY CORPORATION

VEGETATED STRIP



J-U-B ENGINEERS, INC.

LAST UPDATE: 10/28/2021
PLOT DATE: 10/28/2021
FILE: LID

Plot Date: 10/28/2021 12:29 PM Plotted By: Mark Jenkins
 Date Created: 10/28/2021 \\JUB.COM\CENTRAL\Clients\UT\HOOPER\CITY PROJECTS\STORMWATER PROGRAM\LID\MANUAL\BMPDETAILS\LID.DWG

APPENDIX D

80th Percentile Storm
Event Calculation

80th Percentile Storm Calculation

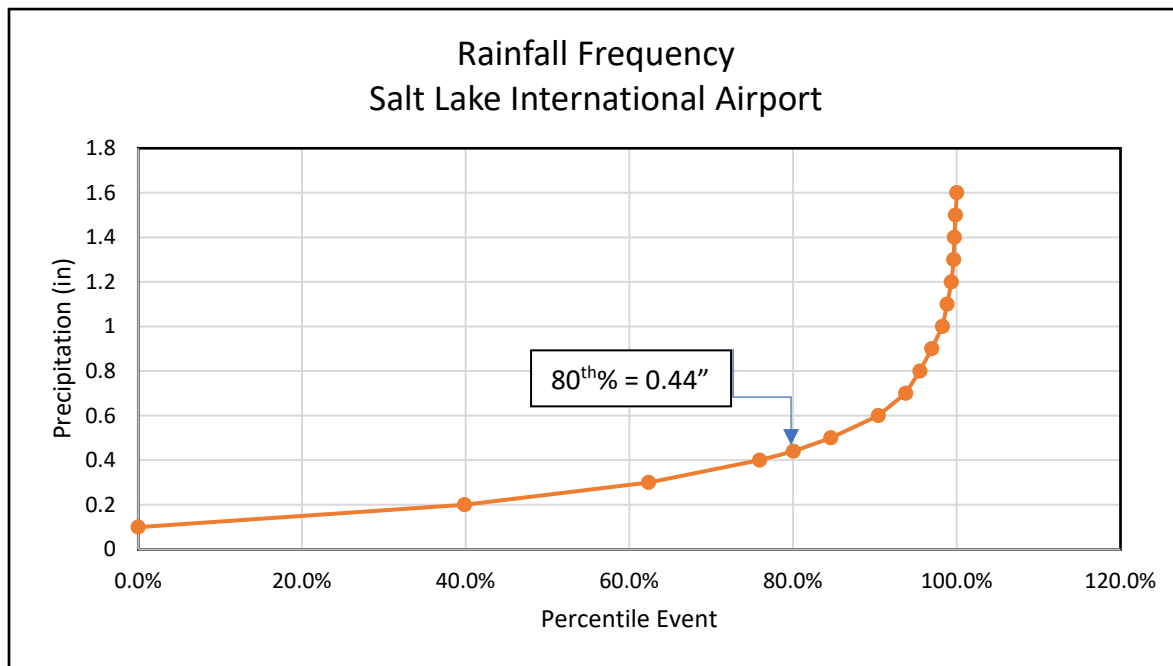
Data for these calculations was taken from the Utah Climate Center.

Station Name	SALT LAKE CITY INTL AP
Station ID	USW00024127
Latitude	40.7781
Longitude	-111.969
Elevation	4225.1 ft
Period of Records Utilized	May 1985 to April 2016

Data Summary:

Rainfall (in)	Number of Storms Greater than or equal to	Percentile storm	Rainfall (in)	Number of Storms Greater than or equal to	Percentile storm
0.1	1379	0.0	0.9	42	97%
0.2	829	39.9%	1.0	24	98.3%
0.3	519	62.4%	1.1	16	98.8%
0.4	332	75.9%	1.2	9	99.3%
0.5	212	84.6%	1.3	5	99.6%
0.6	132	90.4%	1.4	4	99.7%
0.7	86	93.8%	1.5	2	99.9%
0.8	62	95.5%	1.6	0	

Graph:



APPENDIX E

Prescriptive BMP Fact Sheet for
Small Scale Residential Development

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[INSERT APPROVAL CHECKLIST HERE]

Appendix E: Small Scale Residential Prescriptive Measures

Small Scale Residential BMP Fact Sheets

The following pages provide fact sheets with recommended criteria for the design and implementation of various residential BMPs. These fact sheets have been designed in a simplified, user-friendly way with the intent of achieving optimal performance of the measures. The siting, design, and maintenance requirements in the fact sheets are not exhaustive. Alternative designs may be approved by the City based on site specific conditions if equivalent pollutant removal performance is provided. New BMPs that are equivalent to those included are acceptable if approved by the City. All BMPs must be designed and implemented to be in full compliance with all applicable sections of the most recent municipal code, including site drainage requirements per the City Building code.

The following BMPs for small scale residential projects are included in this Appendix:

- Rain Barrels and Small Cisterns
- Permeable Pavements (or Porous Pavement Systems)
- Planter Boxes
- Rain Gardens
- Dry Wells

Following the BMP Fact Sheets, a reference section with resources for additional information is provided. Applicable vendor information has also been provided.

RAIN BARREL FACT SHEET



Rain barrels capture runoff from roof downspouts during storms and temporarily store that runoff for later use. They are low-cost, effective, and easily maintained devices that can be sized for a specific volume of water. Retained water may be used for garden watering, and other outdoor non-potable uses. Rain barrel storage can reduce the amount of stormwater pollutants that are picked up and conveyed to local streams and the ocean. In addition, harvested water conserves precious City-supplied potable water and, if directed to unpaved surfaces, can recharge groundwater. Rain barrels are typically made of heavy duty plastic and can range in size from the standard 55 gallons to more than 80 gallons.

How many rain barrels do I need?

The number of rain barrels required to capture runoff from a given roof or impervious area is shown in the following table.

Are Rain Barrels Feasible at My Residence?

Rain barrels are appropriate where the following site characteristics are present:

- Roof areas with downspouts are required.
- A level, firm surface for support of the rain barrel(s) is required. Rain barrels should only be elevated with solid construction materials and kept away from retaining walls as a full 55-gallon rain barrel will weigh over 400 lbs.
- An area where the captured water can be used is required to be present within a reasonable distance from the rain barrel(s).
- Design of an appropriate area for overflow from the barrel is necessary.
- Utah Law limits harvesting to no more than two covered containers and no container larger than 100 gallons without registering containers.

Roof or Impervious Area (sq. ft.)	Gallons of Storage Required*
500 – 1,000	220**
1,001 – 1,500	440**

* Or equivalent capture using larger rain barrels.

** Minimum landscape area for 4 rain barrels shall be 200 square feet and the minimum landscape area for 8 rain barrels shall be 400 square feet.

Design Criteria and Considerations

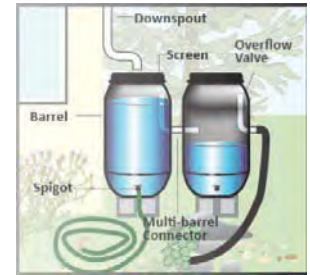
(check all that apply)

- Screens are present on all rain barrel inlets to remove debris and larger particles as the water enters the barrel. Removable child-resistant covers and mosquito screening are in place.
- Barrel is child safe: access is child-proof and the barrel is properly sited and anchored on a stable surface to prevent barrel from tipping over. Remember – each rain barrel weighs approximately 400 lbs when full!
- Above-ground barrels are not located on uneven or sloped surfaces; if installed on a sloped surface, the

base where the barrel is installed has been leveled using appropriate construction materials prior to installation.

- Installed rain barrels have not been placed on elevated platforms, decks or porches without consulting local building code officials.
- Overflow outlet is provided and designed to disperse overflow onsite and through stable vegetated areas where erosion or suspension of sediment is minimized.

- Dispersion is directed so as not to knowingly cause geotechnical hazards related to slope stability or triggering expansive (clayey) soil movement. Overflow dispersion will take place at least 3 feet away from public



Rain Barrel Setup

sidewalks, at least 5 feet away from property lines and foundations, and at least 10 feet from building foundations.

- Rain barrels are opaque and dark in color to prevent UV light penetration and discourage algae growth.
- Barrel placement allows easy access for regular maintenance.

Operations and Maintenance (check all that apply)

- Rain barrel components will be inspected 4 times annually and following major storm events. Screens, spigots, downspouts, and leaders will be repaired or replaced as needed.
- Rain barrels will be cleaned as necessary to prevent algae growth and the breeding of vectors. Cleaning should always take place on a permeable surface. If vectors are breeding in a rain barrel, the barrel will be drained immediately.
- During dry periods, spigot drains will be left open when barrel is not in use.
- Dispersion areas will be maintained to remove trash and debris, loose vegetation. Areas of bare soil should be rehabilitated to minimize erosion.

- Where possible, effective energy dissipation and uniform flow spreading methods will be used to prevent erosion and aid dispersion.
- If adequate mosquito control is not in place and well-maintained, rain barrels will be emptied as necessary to prevent standing water from remaining in a barrel for more than 3 days, thereby preventing vectors from breeding. If vector breeding occurs as a result of contained storm water or inadequately maintained BMPs, I understand that the City has the ability to fine site owners.
- Rain gutters will be inspected and cleaned at least twice annually.

Owner Certification

"As the owner of the project property, I hereby certify that the above information is true, accurate, and complete, to the best of my knowledge."

Owner Signature

Date

PERMEABLE PAVEMENT FACT SHEET



Permeable Paver Driveway
Photo Credit: City of Los Angeles

Permeable pavement contains pores or separation joints that permits non-concentrated water to flow through and seep directly into a base material. Permeable pavement systems include porous asphalt and concrete, permeable pavers (i.e. permeable interlocking concrete pavers), and restrained systems (plastic or concrete grid systems with gravel-filled voids). These systems reduce runoff and encourage infiltration of stormwater into surrounding soils.

Installing permeable pavement reduces stormwater quantity and filters out contaminants that would otherwise run off into storm drains, creeks, and waterways. This improves water quality, reduces runoff velocity and volume, and can encourage groundwater recharge. Permeable pavement is available in many different types that offer environmentally friendly and aesthetically pleasing options for driveways, walkways, parking areas, and patios.

Is Permeable Pavement Feasible at My Residence?

Permeable pavement is appropriate where the following site characteristics are present

- Permeable pavements should work well on most residential sites where paved surfaces such as patios and driveways exist. Areas with slopes greater than 3 percent may not be appropriate.
- If the permeable pavement is designed to receive runoff other than incidental rainfall (e.g. roof) it should be installed at least 5 feet from public sidewalks and 10 feet from building foundations.
- Promoting infiltration should be avoided under permeable pavements at sites with expansive, clay-rich soils, or soils susceptible to tunnel erosion.
- At sites with certain characteristics that do not permit infiltration, an underdrain system can be installed to route the water to a storm drain or other BMP (i.e. rain garden). This type of system provides temporary storage, slows runoff, and filters some pollutants.
- There are many types of permeable pavements, including pour-in-place concrete or asphalt, unit paver blocks, and granular materials. Modular types, such as stone or brick pavers and open cell pavers, tend to be good options for residential projects. The use of the surface (i.e. vehicles, foot traffic, recreation), site conditions, aesthetic qualities, price, and maintenance requirements should be considered during the design process.

How Much Permeable Pavement Do I Need?

Permeable pavement should be sized to capture the runoff produced from the design storm within the gravel subbase of the pavement. This will ensure the capture and infiltration of the design storm volume. The following table should be used as minimum sizing guidance for permeable pavement.

Contributing Area (ft ²)	Permeable Pavement Area 1ft Gravel Subbase (ft ²)	Permeable Pavement Area 2ft Gravel Subbase (ft ²)
500 – 1000	90	50
1001 – 1500	150	80
1501 – 2000	210	110
2001 – 2500*	280	140

* Projects adding roof or impervious areas in excess of 2,500 sq. ft. shall add 60 sq. ft. of permeable pavement (with 1' of gravel subbase) or 30 sq. ft. of permeable pavement (with 2' of gravel subbase) per every 500 sq. ft. of addition.

Design Criteria and Considerations

When installing permeable pavement, the following criteria should be adhered to unless otherwise permitted by the City. The owner should check all boxes that will be complied with.

- Installed subsurface is an open-graded base of crushed stone, which has 35 to 45 percent pore space, to allow for adequate drainage and storage.
- Site soils have adequate drainage (at least 0.5 inches per hour) and depth to groundwater (5 feet) if water will infiltrate from the open-graded base into site soils.
- Infiltration will not cause geotechnical hazards related to expansive soil movement, tunnel erosion, or slope stability.
- If infiltration hazards are a concern, an underdrain has been installed to drain water into a storm drain inlet or onsite BMP.
- Slope is not greater than 3 percent.
- Flow directed to permeable pavement is dispersed so as not to be concentrated at a small area of pavement.
- Pavers have a minimum thickness of 80 mm (3.14 inches).
- Pre-fabricated products have been installed per all appropriate manufacturer's specifications. If required, sub-grade soil has been compacted in accordance with product installation specifications.
- Project is in full compliance with all applicable sections of the current municipal code, including disabled access requirements and site drainage requirements.

Operations and Maintenance

Once permeable pavement is installed, the following criteria should be adhered to. The owner should check all boxes that will be complied with.

- Pavement will be inspected after rains for pooling or other visible problems. Surface clogging or movement of modular pavers can cause problems with both drainage and pavement function. Missing sand or gravel between pavers will be replaced as necessary.
- Pavement will be inspected for vegetation. Depending on the type of pavement and growth, vegetation may need to be removed.
- Home owners have talked with the contractor or manufacturer for additional maintenance requirements for their specific installation. Permeable pavement can involve significant maintenance, depending on the type of pavement installed.



Grass Paver Block Walkway
Photo Credit: City of Los Angeles

Owner Certification "As the owner of the project property, I hereby certify that the above information is true, accurate, and complete, to the best of my knowledge."

Owner Signature

Date

PLANTER BOX FACT SHEET



Planter boxes function as soil and plant-based filtration devices that remove pollutants through a variety of physical, biological, and chemical treatment processes. The components normally consist of a ponding area, mulch layer, planting soils, plantings, drainage layer, and an outlet drain. As stormwater passes down through the planting soil, pollutants are filtered by the soil and plants.



Photo Credit: Deco Alfresco

Planter boxes at residential locations should be placed beneath rain gutter downspouts, or they may be placed directly beneath roof drip lines where rain gutters are not present so as to directly capture runoff from the roof. The overflow outlet should discharge away from the building to ensure water does not percolate into footings or foundations. Planter boxes can be designed as a single linear trough or a series of "pots" of various shapes and sizes.

Are Planter Boxes Feasible at My Residence?

Planter boxes are appropriate where the following site characteristics are present:

- Roof areas with downspouts, or roof areas without downspouts that drain runoff to impervious surfaces.
- A level, firm surface away from retaining wall structures for support of the planter(s). Planters should only be elevated with solid construction materials.

How Large Does My Planter Box Need to Be?

The total size of planter(s) necessary to capture run-off from a given roof area is shown in the table to the right. The table assumes a minimum planter depth of 2.5 feet, with 2 feet of soil and 0.5 feet of storage space, or 'free-board', above the soil surface.

Roof Area Tributary to Planter Boxes (sq.ft.)	Total Surface Area of Planter(s) (sq.ft.)
500 – 1,000	32
1,001 – 1,500	52
1,501 – 2,000	108
2,001 – 2,500*	168

• Projects adding roof or impervious areas in excess of 2,500 sq. ft. shall add 20 sq. ft. of planter box surface area per every 500 sq. ft. of additional area.

The table assumes that all runoff generated from the roof area will be directed to the planter(s). If a planter only extends across a fraction of a roof drip line for which it was designed to capture all runoff one of the following methods shall be implemented:

- Additional planters shall be installed to extend across the entire roof drip line.
- Gutters or other devices shall be installed on the tributary roof to direct all runoff to the planter(s).
- Additional UD BMPs shall be implemented to capture the runoff unaccounted for by the planter(s).

Design Criteria and Considerations

When installing a planter box, the following criteria should be adhered to unless otherwise permitted by Riverdale City. The owner should check all boxes that will be complied with.

- At locations without rain gutters, planters are placed directly below roof drip lines to capture runoff as efficiently as possible.
- At least 6 inches of storage is present between the planting surface and the crest of each planter.
- At locations implementing multiple planters, planters are placed directly adjacent to one another so as to minimize the impervious space between planters.
- Planters are not located on uneven or sloped surfaces.
- Planting soil is at least 2 feet deep.
- Planting soil contains no more than 30% compost.

- Planters have not been installed on elevated platforms, decks or porches without consulting local building code officials.
- The project is in full compliance with all applicable sections of the current municipal code, including drainage requirements per the Riverdale City Code.

Photo Credit: City of Los Angeles



Operations and Maintenance

Once a planter box is installed, the following criteria should be adhered to. The owner should check all boxes that will be complied with.

- Planters will undergo annual plant and soil maintenance typical of landscape care procedures to ensure optimum filtration, storage, and drainage capabilities.
- Following rain events, planters will be inspected to ensure that standing water is

not present in the planter for more than 72 hours (3 days). Ponded water that is not completely drained after 72 hours can cause vector breeding. If vector breeding occurs as a result of contained stormwater or inadequately maintained BMPs, I understand that the City has the ability to fine site owners.

- Pesticide additives will not be used in the planters.

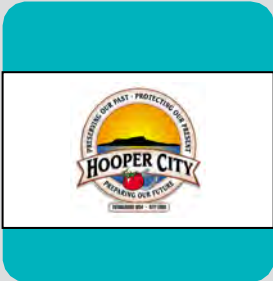
Owner Certification

"As the owner of the project property, I hereby certify that the above information is true, accurate, and complete, to the best of my knowledge."

Owner Signature

Date

RAIN GARDEN FACT SHEET



Rain gardens are simply gardens designed to capture and treat runoff. Stormwater runoff from impervious surfaces is directed toward a depression in the ground, which is planted with flood and drought-resistant plants. As the water nourishes the plants, the garden stores, evaporates, and infiltrates rainwater, reducing runoff and pollutant loads.

Rain gardens are a low-cost, effective, and aesthetically pleasing way to reduce the amount of stormwater that runs off your property and washes pollutants into storm drains, local streams, and the ocean. They are most often planted with native species. While mitigating the environmental impacts of land development, rain gardens also provide attractive landscaping and habitat for birds, butterflies, and other animals.



Photo Credit: City of Los Angeles

Are Rain Gardens Feasible at My Residence?

Rain gardens are appropriate where the following site characteristics are present:

- Edge of rain gardens should be installed at least 10 feet from building foundations, 5 feet from public sidewalks, 10 feet from property lines, and in an area where potential overflow will not run onto neighboring properties. Rain gardens may be located closer than the above mentioned criteria provided
 - 1) A geotechnical report is submitted and approved or;
 - 2) A impermeable liner is installed to prevent infiltration under these facilities, and an over flow drain pipe to the street is installed
- Ground adjacent to the building should slope away at a 2% minimum. The rain garden area should receive full sunlight throughout most of the day. A downspout extension or bioswale can be used to convey rain from a roof directly into a rain garden. They are also appropriately sited downstream from a rain barrel overflow line.
- Do not site rain gardens above septic systems.
- The site should have well-drained soil and be relatively flat. Soil amendments can improve infiltration in areas with poor drainage.
- A front or back yard can work well for a rain garden, but look for areas where the slope naturally takes the stormwater. Areas where water naturally flows or ponds are ideal locations for a rain garden. Work with the site drainage and hydrology.
- Areas highlighted in Figures E-1 through E-3 are not ideal for rain gardens and must be approved by the City prior to installation. Areas highlighted in Figures E-4 require soils amendments to increase the natural soils infiltration abilities.

How Large Does My Rain Garden Need to Be?

Rain gardens should not exceed 300 square feet, and the contributing impervious area should not be more than 4,000 square feet. A general recommendation for a garden with a 6-inch ponding depth is to size the rain garden to approximately 6% of the contributing area. The infiltration rate of water into the soil will affect how the rain garden should be sized; rain gardens will need to be larger in areas with slower infiltration. The following table can be used as general guidance.

Contributing Area (sq.ft.)	Rain Garden Area (sq.ft.)
500 – 700	36
701 – 900	48
901 – 1100	60
1101 – 1300	72
1301 – 1500	84
1501 – 2000*	105

* Projects adding roof or impervious areas in excess of 2,000 sq. ft. shall add 30 sq. ft. of rain garden surface area per every 500 sq. ft. of additional area

Design Criteria and Considerations

When installing a rain garden, the following criteria should be adhered to unless otherwise permitted by Riverdale City. The owner should check all boxes that will be complied with.

- Location is at least 10 feet from home foundations, 5 feet from public sidewalks, 10 feet from property lines and in an area where potential overflow will not run onto neighboring properties. Rain gardens may be located closer than the above mentioned criteria provided.
 - 1) A geotechnical report is submitted and approved by Riverdale City or;
 - 2) A impermeable liner is installed to prevent infiltration under these facilities, and an overflow drain pipe to the street is installed.
- Rain Garden has been located to intercept and collect runoff via a downspout or adjacent impervious area. The rain garden is not located underneath the canopy of existing trees.
- Rain garden is appropriately sized to the soil type and drainage area.

- Rain garden is not located over septic systems or shallow utilities. Utilities have been located before digging by calling Blue Stakes, 411. Rain garden is not located within 50 feet of steep slopes (>25%). The rain garden has been built on a relatively flat area.

- Permits are not required for typical residential landscaping projects. If you plan on making major landscaping modifications such as moving more than 50 cubic yards of soil or altering 1 acre or more, contact the City for further assistance.
- An overflow has been incorporated in the rain garden such that excess water will flow into another pervious area and away from the home's foundation or neighboring property.
 - Detention and infiltration do not (knowingly) cause geotechnical hazards related to slope stability or triggering expansive (clayey) soil movement.
 - Drought and flood resistant native plant species are used whenever possible. Invasive or pest species have been avoided. A listing of resources where information on native plant species can be found is in the reference section.

Operations and Maintenance

Once a rain garden is installed, the following criteria should be adhered to. The owner should check all boxes that will be complied with.

- Rain gardens will be irrigated deeply once a week during dry months to encourage root growth and keep plants strong, especially while plants are being established. Plants will be inspected for health and weeds will be removed as often as necessary.
- Rain gardens will be monitored after storm events for signs of overflow. If overflow occurs significantly or often, the size and/or depth of the garden may need to be increased, or other actions to increase infiltration (e.g., soil amendments, underdrain installation) may be necessary.
- Signs of erosion will be repaired immediately. Further erosion can be prevented by reinforcing the

surrounding area with groundcover or using energy dispersion techniques on downspouts.

- Infiltration effectiveness and excess sediment deposition will be monitored annually, preferably prior to the start of the rainy season.
- Standing water will not remain in a rain garden for more than 3 days. Extended periods of flooding will not only kill vegetation, but may result in the breeding of mosquitos or other vectors. If vector breeding occurs at a site as a result of contained stormwater or inadequately maintained BMPs, I understand that the City has the ability to fine site owners.
- Rain gutters and downspouts will be inspected and cleaned at least twice annually.

Owner Certification

"As the owner of the project property, I hereby certify that the above information is true, accurate, and complete, to the best of my knowledge."

Owner Signature

Date

DRY WELL FACT SHEET



Prefabricated Dry Well
Photo Credit: Canale Landscaping

A dry well is a bored, drilled, or driven shaft or hole designed specifically for the infiltration of stormwater. Simple dry wells may consist of a small excavated pit filled with gravel media, while more advanced dry wells typically consist of a prefabricated storage chamber or perforated pipe segment placed in the ground. These latter types of dry wells offer more storage capacity per unit area since they are not typically filled with media and also conserve land area since they may be buried completely in the ground.

Dry wells are situated to capture runoff from roofs or other impervious areas. They can easily be designed to be directly connected to rain gutter systems to capture runoff from rooftops. Once filled with stormwater, dry wells can accept water at the same rate at which they can dissipate water.

Is a Dry Well Feasible at My Residence?

Dry wells are appropriate where the following site characteristics are present:

- Roof areas with downspouts or other impervious areas are required.
- Sites must have soils suitable for infiltration, with a minimum saturated hydraulic conductivity of 0.3 in/hr.
- Edge of dry wells should be installed at least 25 feet from building foundations, 3 feet from public sidewalks, 10 feet from property lines and an overflow drain pipe to the street is required. Dry wells may be located closer than the above mentioned criteria provided a geotechnical report is submitted and approved by LADBS.
- Do not site rain gardens above septic systems.
- An overflow area that drains to the street is required.

How Large Does My Dry Well Need To Be?

A dry well should be sized to capture the runoff produced from the design storm over the connected impervious area, with account taken for any gravel or fill material that is used. This will ensure the capture and infiltration of the design storm volume. The following table should be used as minimum sizing guidance for dry wells.

Contributing Area (ft ²)	Dry Well Volume - Without Fill (gallons)	Dry Well Volume - Including Gravel Fill (gallons)
500 – 1000	250	600
1001 – 1500	400	1,000
1501 – 2000	550	1,400
2001 – 2500*	700	1,800

* Projects adding roof or impervious areas in excess of 2,500 sq. ft. shall add 150 gallons of dry well volume (without fill) or 400 gallons of dry well volume (with gravel fill) per every 500 sq. ft. of additional area.

Design Criteria and Considerations



Installed Dry Well Schematic

Image Credit: ABHL Landscape Architects

When installing a dry well, the following criteria should be adhered to unless otherwise permitted by the City. The owner should check all boxes that will be complied with.

- Edge of dry wells should be installed at least 25 feet from building foundations, 3 feet from public sidewalks, 10 feet from property lines and an overflow drain pipe to the street is required. Dry wells may be located closer than the above mentioned criteria provided a geotechnical report is submitted and approved.
- Dry well has been properly located and installed to intercept and collect runoff via a downspout from a roof or adjacent impervious area.
- Dry well is appropriately sized in accordance with the sizing table above.
- For dry wells with gravel fill, gravel used is 2" or greater diameter stone.
- The soil under the dry well has been over-excavated to at least one foot in depth. The soil has been replaced uniformly without compaction, or amended with 15-30% of coarse sand and replaced without compaction.
- A fine mesh screen has been installed on the inlet to prevent sediment and debris from entering the dry well.
- An observation well has been incorporated into the dry well design. The observation well consists of a slotted or perforated pipe (typically PVC), 4-6 inches in diameter, capped with an above-ground, sealable lid.
- An overflow has been incorporated in the dry well such that excess water will flow into the storm drain system or another pervious area and away from any nearby foundations or neighboring properties.
- Detention and filtration do not (knowingly) cause geotechnical hazards related to slope stability or triggering expansive (clayey) soil movement.

Operations and Maintenance

Once a dry well is installed, the following criteria should be adhered to. The owner should check all boxes that will be complied with.

- Water level, drawdown time, and evidence of clogging will be monitored monthly during the rainy season.
- Standing water will not remain in an exposed dry well for more than 3 days. Extended periods of flooding may result in the breeding of mosquitoes or other vectors. If vector breeding occurs at a site as a result of contained stormwater or inadequately maintained BMPs, I understand that the City has the ability to fine site owners.
- Rain gutters and downspouts will be inspected and cleaned at least twice annually.
- If the dry well ever becomes plugged and overflows on a continual basis, the dry well will be excavated and removed. The dry well will be repaired or replaced as necessary, and gravel media fill will be cleaned or replaced to enhance the infiltration capacity.

Owner Certification

"As the owner of the project property, I hereby certify that the above information is true, accurate, and complete, to the best of my knowledge."

Owner Signature

Date

**Only to be used for Single Family Residences
(Less than 1 acre and not in an ESA)**

**STORMWATER OBSERVATION REPORT FORM
LOW IMPACT DEVELOPMENT (LID)**

STORMWATER OBSERVATION means the visual observation of the stormwater related Best Management Practices (BMPs) for conformance with the approved LID Plan at significant construction stages and at completion of the project.

STORMWATER OBSERVATION must be performed by the contractor responsible for the approved LID Plan or designated staff in their employment. Homeowner can also perform the Stormwater Observation if no licensed contractor was involved.

STORMWATER OBSERVATION REPORT must be signed by the contractor responsible for the approved LID Plan and submitted to the City prior to the issuance to the certificate of occupancy. Homeowner can sign the Stormwater Observation Report if no licensed contractor was involved.

Project Address:	Building Permit No.:
Name Contractor or Owner responsible for the approved LID Plan:	Phone Number:
Name of LID Plan Observer:	Phone Number:

I declare that the following statements are true to the best of my knowledge:

1. I am responsible for the approved LID Plan, and
2. I, or designated staff under my responsible charge, has performed the required site visits at each significant construction stage and at completion to verify that the best management practices as shown on the approved plan have been constructed and installed in accordance with the approved LID Plan.

Signature

Date

Contractor/Architect/Engineer License

Appendix E: Small Scale Residential Prescriptive Measures

References

Additional Manuals

Many LID manuals exist that offer additional insight and information with regards to residential BMP implementation. The following manuals may be consulted to obtain more information on LID practices:

- County of Los Angeles, 2009. Low Impact Development Standards Manual. January 2009
- Pima County Low Impact Development and Green Infrastructure Guidance Manual, March 2015
- Low Impact Development Handbook for the State of Alabama
- Clean Water Services Low Impact Development Approaches Handbook, July 2009

Web Resources

A host of information is available on the world wide web to help homeowners design and implement LID BMPs. The following is a brief list of agencies and websites devoted to the protection and conservation of our water resources:

- Council for Watershed Health (www.watershedhealth.org)
- The Low Impact Development Center (www.lowimpactdevelopment.org)
- Metro Blooms (Rain garden installation video and information) (<http://metroblooms.org>)
- Rainwater Harvesting for Drylands and Beyond by Brad Lancaster (www.harvestingrainwater.com)
- The Center for Watershed Protection (www.cwp.org)
- The U.S. Environmental Protection Agency (www.epa.gov/owow/NPS/lid)

Appendix E: Small Scale Residential Prescriptive Measures

Vendor Information

A short list of potential product vendors is provided below. The City does not endorse any specific product or vendor.

Rain Barrels and Planter Boxes:

- Gutter Guy (www.gutterguyonline.com)
- Rain Harvest (www.rainbarrelprogram.org/urc)
- Mark's Barrel Company (marksbarrelcompany.com/basea/2010/05/05/rain-barrel-love-in-utah)
- The Home Depot (www.homedepot.com)
- Rain Barrels International (www.rainbarrelsintl.com)
- City Rain Barrel Program (<http://cityrainbarrelprogram.org>)
- Lowes (www.lowes.com)
- Simply Rain Barrels (www.simplyrainbarrels.com)
- WalMart (www.walmart.com)
- Water Tanks (www.watertanks.com)

Dry Wells and Underground Storage Solutions:

- Advanced Drainage Systems, Inc. (www.ads-pipe.com)
- Contech Stormwater Solutions (www.contech-cpi.com)
- Cultec, Inc. (www.cultec.com)
- HydroLogic Solutions (www.hydrologicsolutions.com)
- Invisible Structures, Inc. (www.invisiblestructures.com)
- NDS (www.ndspro.com)
- StormTech, Inc. (www.stormtech.com)
- Tensar Technologies, Inc. (www.tensarcorp.com)
- Triton Stormwater Solutions (www.tritonsws.com)

Permeable Pavement:

- Invisible Structures, Inc. (www.invisiblestructures.com)
- Geofill Cellular Concrete (www.geofill.com)
- The Home Depot (www.homedepot.com)
- Lowes (www.lowes.com)
- PermaPave (www.permapave.com)
- TerraFirm Enterprises (www.terrafirmenterprises.com)
- Uni-Group U.S.A. (www.uni-groupusa.org)
- Pave Drain (www.pavedrain.com)

APPENDIX F

Maintenance Agreement
Template

When recorded, mail to:

Hooper City Corp.
5580 West 4600 South
Hooper, Utah 84315

Affects Parcel No(s): _____

**HOOPER CITY
STORMWATER FACILITIES
MAINTENANCE AGREEMENT**

This Stormwater Facilities Maintenance Agreement (“Agreement”) is made and entered into this _____ day of _____, 20_____, by and between Hooper City, a Utah municipal corporation (“City”), and

_____ (“Owner”).

RECITALS

WHEREAS, the City is authorized and required to regulate and control the disposition of storm and surface waters within the City, as set forth in the Hooper City Stormwater Ordinance, as amended (“Ordinance”), adopted pursuant to the Utah Water Quality Act, as set forth in *Utah Code Ann.* §§ 19-5-101, *et seq.*, as amended (“Act”); and

WHEREAS, the Owner hereby represents and acknowledges that it is the owner in fee simple of certain real property more particularly described in Exhibit “A,” attached hereto and incorporated herein by this reference (“Property”); and

WHEREAS, the Owner desires to build or develop the Property and/or to conduct certain regulated construction activities on the Property which will alter existing storm and surface water conditions on the Property and/or adjacent lands; and

WHEREAS, in order to accommodate and regulate these anticipated changes in existing storm and surface water flow conditions, the Owner desires to build and maintain at Owner’s expense a storm and surface water management facility or improvements (“Stormwater Facilities”); and

WHEREAS, the Stormwater Facilities are more particularly described and shown in the final site plan or subdivision approved for the Property and related engineering drawings, and any amendments thereto, which plans and drawings are on file with the City and are hereby incorporated herein by this reference (“Development Plan”); and

WHEREAS, as a condition of Development Plan approval, and as required as part of the City’s Small MS4 UPDES General Permit from the State of Utah, Owner is required to enter into this Agreement addressing the maintenance requirements for the Stormwater Facilities and control measures installed on the Property.

NOW, THEREFORE, in consideration of the benefits received and to be received by the Owner, its successors and assigns, as a result of the City's approval of the Development Plan, and the mutual covenants contained herein, the parties agree as follows:

1. Construction of Stormwater Facilities. The Owner shall, at its sole cost and expense, construct the Stormwater Facilities in strict accordance with the plans and specifications identified in the Development Plan and any amendments thereto which have been approved by the City.

2. Maintenance of Stormwater Facilities. The Owner shall, at its sole cost and expense, adequately maintain the Stormwater Facilities. Owner's maintenance obligations shall include all pipes and channel built to convey stormwater, as well as all structures, improvements, and vegetation provided to control the quantity and quality of the stormwater. Adequate maintenance, for purposes of this Agreement, is defined as good working condition so that the Stormwater Facilities are performing their design functions. The Owner shall, at its sole cost and expense, perform all work necessary to keep the Stormwater Facilities in good working condition. In the event that a maintenance schedule is set forth in the Development Plan, such maintenance schedule shall be followed.

3. Annual Inspection of Stormwater Facilities. The Owner shall, at its sole cost and expense, inspect the Stormwater Facilities. The purpose of the inspection is to assure safe and proper functioning of the Stormwater Facilities. The annual inspection shall cover all aspects of the Stormwater Facilities, including, but not limited to, the structural improvements, berms, outlet structure, pond areas, access roads, vegetation, landscaping, etc. Deficiencies shall be noted and repaired. The Owner shall also certify as to whether adequate maintenance has been performed and whether the structural controls are operating as designed to protect water quality.

4. City Oversight Inspection Authority. The Owner hereby grants permission to the City, its authorized agents and employees, to enter upon the Property and to inspect the Stormwater Facilities whenever deemed necessary by the City. Such inspections shall be conducted in a reasonable manner and at reasonable times, as determined appropriate by the City. The purpose of the inspection shall be to determine and ensure that the Stormwater Facilities are being adequately maintained, are continuing to perform in an adequate manner, and are in compliance with the Act, the Ordinance, and the Development Plan.

5. Notice of Deficiencies. If the City finds that the Stormwater Facilities contain any defects or are not being maintained adequately, the City shall send Owner written notice of the defects or deficiencies and provide Owner with a reasonable time to cure such defects or deficiencies. Such notice shall be hand-delivered to the Owner or sent certified mail to the Owner at the Property address.

6. Owner to Make Repairs. The Owner shall, at its sole cost and expense, make such repairs, changes or modifications to the Stormwater Facilities as may be determined as reasonably necessary by the City within the required cure period to ensure that the Stormwater Facilities are adequately maintained and continue to operate as designed and approved.

7. City's Corrective Action Authority. In the event the Owner fails to adequately maintain the Stormwater Facilities in good working condition acceptable to the City, after due notice of deficiencies as provided in Section 5, the City may enter upon the Property and take whatever steps necessary to correct deficiencies and to charge the costs of such repairs to the Owner. It is expressly understood and agreed that the City is under

no obligation to maintain or repair the Stormwater Facilities, and in no event shall this Agreement be construed to impose any such obligation on the City. The actions described in this Section are in addition to and not in lieu of any and all legal remedies available to the

City as provided by law for Owner's failure to remedy deficiencies or any other failure to perform under the terms and conditions of this Agreement.

8. Reimbursement of Costs. In the event the City, pursuant to this Agreement, performs work of any nature, or expends any funds in performance of said work for labor, use of equipment, supplies, materials, and the like, the Owner shall reimburse the City upon demand, within thirty (30) days of receipt thereof for all actual costs incurred by the City. After said thirty (30) days, such amount shall be deemed delinquent and shall be subject to interest at the rate of ten percent (10%) per annum. Owner shall also be liable for any collection costs, including attorneys' fees and court costs, incurred by the City in collection of delinquent payments.

9. Successor and Assigns. This Agreement shall be recorded in the Weber County Recorder's Office and the covenants and agreements contained herein shall run with the land and whenever the Property shall be held, sold, conveyed or otherwise transferred, it shall be subject to the covenants, stipulations, agreements and provisions of this Agreement which shall apply to, bind and be obligatory upon the Owner hereto, its successors and assigns, and shall bind all present and subsequent owners of the Property described herein.

10. Severability Clause. The provisions of this Agreement shall be severable and if any phrase, clause, sentence or provision is declared unconstitutional, or the applicability thereof to the Owner, its successors and assigns, is held invalid, the remainder of this Covenant shall not be affected thereby.

11. Utah Law and Venue. This Agreement shall be interpreted under the laws of the State of Utah. Any and all suits for any claims or for any and every breach or dispute arising out of this Agreement shall be maintained in the appropriate court of competent jurisdiction in Weber County, Utah.

12. Indemnification. This Agreement imposes no liability of any kind whatsoever on the City, and the Owner agrees to hold the City harmless from any liability in the event the Stormwater Facilities fail to operate properly. The Owner shall indemnify and hold the County harmless for any and all damages, accidents, casualties, occurrences, or claims

which might arise or be asserted against the City from the construction, presence, existence, or maintenance of the stormwater Facilities.

13. Amendments. This Agreement shall not be modified except by written instrument executed by the City and the Owner of the Property at the time of modification, and no modification shall be effective until recorded in the Weber County Recorder's Office.

14. Subordination Requirement. If there is a lien, trust deed or other property interest recorded against the Property, the trustee, lien holder, etc., shall be required to execute a subordination agreement or other acceptable recorded document agreeing to subordinate their interest to the Agreement.

[Signature page to follow]

IN WITNESS WHEREOF, the parties have executed this Agreement as of the date first set forth above.

“City”
Hooper City

By: _____
Title: _____

“Owner”

By: _____
Print Name: _____
Title: _____

CITY ACKNOWLEDGMENT

STATE OF UTAH)
 : ss.
COUNTY OF WEBER)

On the ____ day of _____, 20____, personally appeared before me _____, who being duly sworn, did say that he/she is the _____ of **HOOPER CITY**, a municipal corporation of the State of Utah, and that the foregoing instrument was signed in his/her capacity as land use authority on behalf of the City for approval of Stormwater Facilities Maintenance Agreements.

Notary Public

My Commission Expires: _____ Residing at: _____

OWNER ACKNOWLEDGMENT

Note: If Owner is a corporation, limited liability company, partnership, trust or other legal entity, rather than an individual, a separate applicable acknowledgement must be provided.

STATE OF UTAH)
 : ss.
COUNTY OF WEBER)

On the ____ day of _____, 20____, personally appeared before me _____, who being duly sworn, did say that he/she is the legal property owner of record of the property subject to this Maintenance Agreement and that he/she has executed this Agreement with full authority to do so.

Notary Public

My Commission Expires: _____ Residing at: _____

Exhibit "A"
Property Legal Description