Volume II
Fact Sheets

1.1 Facts Sheets

Control Design	Example	Fact Sheet
1	Site Control	Green Roof
		Rainwater Harvesting
		Pervious Pavement
		Bioretention
		Oil/Grit Separators
2	Roadway Controls	Gutter Filter
		Sand Filter
		Bioswale
3	End of Pipe Controls	Constructed Wetland
		Wet Pond
		Detention Basin
		Mechanical Treatment Facility

Student Engineering Associates
University of Utah
Department of Civil & Environmental Engineering
201 Presidents Circle
Salt Lake City, Utah 84112

SCM: Green Roofs

http://www.toronto.ca/greenroofs/images/2_tbg_gr.jpg

DESCRIPTION

Vegetated green roofs are constructed on new roofs or retrofitted on existing roofs and consist of a soil layer on an impermeable membrane. Vegetation is planted in this soil layer to mimic pre-development site conditions and remove airborne particles. According to Green Roof Utah, "10.76 ft^2 of grass roof can remove up to 4.4lbs of airborne particles from the air every year". By imitating nature, vegetated green roofs reduce both total discharge and peak discharge from the roof. Green roofs are also effective for reducing the temperature of the air above the roof, which reduces the cost of electricity.

According to Environment Canada, "it was found that a typical one story building with a grass roof and 3.9 inches of growing medium would result in a 25 percent reduction in summer cooling needs". Figure 3.1 is a picture of a green roof design that is located downtown on the Salt Lake City LDS Conference Center. There are many creative ways to set-up a green roof, and this image is just one of them.

http://blog.cunysustainablecities.org/wp-content/uploads/2009/08/greenroof.jpg

DESIGN CRITERIA

- GREEN ROOFS ARE NOT TO EXCEED 40 DEGREES. THE STEEPER THE ROOF, THE LESS STABLE THE SOIL AND VEGETATION WILL BE. [1]
- REDUCE PEAK STORMWATER DISCHARGE AND TOTAL RUNOFF VOLUME
- PROTECT PROPERTY FROM LEAKS AND FLOOD DAMAGE

http://www.the-green-house.net/gallery/green-roofs/green_roofs_2.jpg

ADVANTAGES

- Can reduce total stormwater runoff by 25 percent.
- Reduces energy cost over the lifetime of a roof
- Replaces conventional roofs, which can be a source of pollutants.
- A longer lifespan than conventional roofs
- Reduces risk of downstream flooding and property damage
- Less prone to leaks than conventional roofs
- Aesthetically pleasing

DISADVANTAGES

- Sometimes difficult to retrofit to add green roofs
- Cannot be used on roofs with slopes greater than 40%
- Intensive green roofs (more than 6 inches of growing medium) can be quite expensive
- All green roofs require yearly maintenance and may require extensive maintenance for roofs with thicker soil layers [1]

APPLICATION

Green roofs are able to be built with new construction or retrofitted to existing buildings. They are most commonly used on buildings with flat roofs. In order to retrofit an existing building with a green roof, a structural engineer must certify that the building's structure can support the additional loads from the soil and vegetation. Many existing buildings can support lightweight green roofs without modification but extensive green roofs may require significant modification.

[1] Environmental Protection Agency. (2008) National Pollutant Discharge Elimination System (NPDES) Menu of Best Management Practices. [Online]. http://cfpub.epa.gov/npdes/

x

TARGET POLLUTANTS

Green roofs lessen pollutant loading in runoff by removing organic matter, suspended solids, and sometimes nutrients. These pollutants are removed by soil filtration or plant uptake.

FLOW RATE

Green roofs lessen flow rate in stormwater runoff because some of the water is absorbed by the plants and suspended in the void spaces of the soil.

MAINTAINANCE

All green roofs require yearly maintenance and may require extensive maintenance for roofs with thicker soil layers. The only maintenance green roofs require is regular landscaping and periodic inspections for leaks.

SCM: Rainwater Harvesting

http://img4-3.sunset.timeinc.net/i/2009/01/rain-water-0109/rainwater-storage-tanks-l.jpg

DESCRIPTION

Rainwater Harvesting (RWH) is a way for property owners to collect rainwater using a cistern or rain barrel for further use. Rainwater collected can be stored underground or above ground. RWH in Utah does not require a water right, but the property owner must register their RWH system with the Utah Division of Water Rights. According to Utah Senate Bill 32, underground containers must not exceed 2,500 gallons, and above ground, systems must not exceed two 100 gallon containers.

http://flxxrainwater.com/pics/800/cistern.jpg

DESIGN CRITERIA

- SIZING. RAINWATER TANK SIZING ACCOUNTS FOR VARYING PRECIPITATION LEVELS, CAPTURED RUNOFF, LOW WATER CUT-OFF VOLUME, DYNAMIC WATER LEVELS OF STORMS, SEASONAL AND ANNUAL DEMANDS, ETC. [1]
- OVERFLOW. CISTERNS AND RAIN BARRELS ARE NOT SIZED TO HANDLE ALL STORMS SO AN OVERFLOW PROVISION MUST BE PROVIDED.

http://www.lakecountyil.gov/Stormwater/LakeCountyWatersheds/BMPs/PublishingImages/Cistern_Ryerson.jpg

JORDAN RIVER
OUR RIVER ~ OUR FUTURE

ADVANTAGES

- Lowers potable water usage
- May lower monthly water utility bill if charged by volume
- Reduces runoff volume and direct pollutant loading
- Reduces surface discharge rates
- Allows citizens to become more involved in urban water management by letting them collect rainwater

DISADVANTAGES

- If not treated, harvested rainwater uses are limited to irrigation and flushing toilets.
- Potential complexity of advanced RWH systems
- High initial cost of RWH systems much greater than treated water (payback periods are much longer than design life)
- Above-ground cisterns and rain barrels must be emptied for winter so they do not freeze and crack

APPLICATION

Harvesting is usually done where there is already an impermeable surface such as a rooftop or pavement. Therefore it is a viable option as a retrofit for stormwater control. Simple systems can be as little as placing a barrel under a downspout from gutters. Complex systems involve underground cisterns, first-flush diverters, pumps, filters, treatment, etc. Therefore, the cost of a system can vary greatly depending on the intended use of the water.

JORDAN RIVER COMMISSION

[1] WaterAid. (2010) WaterAid. [Online]. www.wateraid.org/uk/

x

TARGET POLLUTANTS

Trash and organic matter are trapped in screens before reaching the cistern or rain barrel. For most uses of harvested water, nutrients and suspended solids will not be discharged to the storm drain. In some cases oil and grease may still be discharged to storm drains.

FLOW RATE

RWH decreases flow rate by capturing some of the runoff water. The overall amount of water in streams is decreased so the flow rate decreases.

MAINTAINANCE

Regular maintenance for RWH systems includes cleaning the cistern at least yearly and , if used, replacing pumps every 5 to 10 years.

SCM: Permeable Pavement

http://farm6.staticflickr.com/5285/5283775378_3fd16f5776_z.jpg

DESCRIPTION

Permeable pavement is a pavement surface that is designed to provide surface infiltration of water. Permeable pavement is most often applied in parking lots, but it can be applied in driveways, paths, and sidewalks. Currently there are three common types of permeable pavement: permeable concrete, permeable asphalt, and paving stones. All of these permeable materials allow stormwater to infiltrate the surface area. This technique is meant to control stormwater at the source, reduce runoff, and improve water quality by filtering pollutants in the substrata layers [1]. The key differences between permeable pavement and conventional pavement are that the top layer of permeable pavement allows the passage of water and there is a reservoir layer of porous soil below to hold water until it can infiltrate.

DESIGN CRITERIA

THE REQUIREMENTS OF THE RESERVOIR LAYER IS DETERMINED BY:

- RUNOFF STORAGE NEEDS
- SOIL INFILTRATION RATE
- DEPTH TO WATER TABLE
- FROST DEPTH CONDITIONS
- STRUCTURAL REQUIREMENTS

http://www.llpelling.com/wp-content/uploads/2011/10/Porous-Asphalt.jpg

JORDAN RIVER
OUR RIVER ~ OUR FUTURE

ADVANTAGES

- Recharges the ground water
- Durable and cost competitive alternative to conventional pavement
- Rough surface increases vehicle and pedestrian traction
- Reduced stresses due to freeze/thaw cycle than conventional pavements
- Up to 80 percent total suspended solids (TSS) reductions
- Can reduce additional expenditures and land consumption for conventional stormwater control infrastructure

DISADVANTAGES

- Usually not suitable for high volume applications
- Lower structural support capacity than conventional pavements of the same size
- Additional pavement depth is often required
- Not suitable for stormwater hotspots
- Cannot use sand or much salt for ice removal
- Can clog and reduce infiltration rates over time
- Tend to freeze faster than conventional pavements

APPLICATION

Permeable pavement can be applied to new projects or retrofits. It is most commonly used as a parking surface but can also be used for roads. It requires a thicker overall pavement thickness than conventional pavement because it requires a reservoir layer of porous material below the hard surface. This reservoir must be thick enough to contain the entire design storm so that water does not remain in the top layer when it freezes.

JORDAN RIVER COMMISSION

[1] Environmental Protection Agency. (2009) National Pollutant Discharge Elimination System (NPDES) Menu of Best Management Practices. [Online]. www.cfpub.epa.gov

http://www.motherearthnews.com/uploadedImages/articles/issues/2009-04-01/MEN-AM09-ghi_pervious_concrete.jpg

TARGET POLLUTANTS

Because permeable pavement does not discharge to storm drains, it effectively lessens pollutant loading from key pollutants. Pollutants that potentially can be removed through the use of permeable pavement are trash, organic matter, suspended solids, oil, and grease.

FLOW RATE

Permeable pavement reduces the flow rate of stormwater runoff because all of the runoff from storms infiltrates the ground through the pavement. Permeable pavement surfaces do not usually require a backup storm drain but storms exceeding the design storm will pond or back up into the surface layer.

MAINTAINANCE

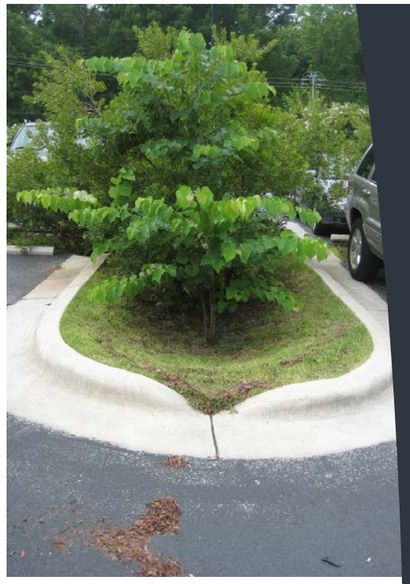
Adequate maintenance is required to ensure long-term performance. To ensure efficient infiltration, periodic vacuum sweeping must be done to removes surface clogging caused by organic matter and sediment. Periodic vacuum sweeping should be done once or twice a year according to the Columbia Stormwater Management Guidebook and one these sweepings should occur immediately following winter.

SCM: Bioretention

DESCRIPTION

Bioretention is a landscaping feature that can be constructed in and around parking lots and other paved surfaces. They provide on-site treatment of stormwater runoff. Bioretention works by capturing surface runoff into shallow landscaping depressions. These depressions are filled with plants and a soil media that treat stormwater before it infiltrates.

The soil media acts as a filter as the water percolates through. These SCMs operate as a forested ecosystem would for natural stormwater control and pollution removal. [1]



DESIGN CRITERIA

- SLOPE. BIORETENTION AREAS ARE BEST APPLIED TO RELATIVELY SHALLOW SLOPES (LESS THAN ABOUT FIVE PERCENT).
- SOIL/fiLTER MEDIA COMPOSITION. THE MEDIA COMPOSITION IS A MIXTURE OF UTELITE OR GRAVEL AND TOPSOIL.
- VEGETATION. IN ARID CLIMATES, BIORETENTIONS SHOULD BE LANDSCAPED WITH DROUGHT-TOLERANT SPECIES.

JORDAN RIVER
OUR RIVER ~ OUR FUTURE

ADVANTAGES

- Good SCM for retrofit applications and highly urbanized settings
- Can be applied in many climatologic and geologic environments
- Good for hotspots if a geotextile fabric liner is implemented
- Reduces thermal pollution and urban heat island effect.
- Has aesthetic value
- Can recharge the groundwater table
- Good for snow storage if salt-tolerant vegetation is planted
- Reduces peak discharge and runoff volume
- Breaks down some pollutants, removes others
- Recreates natural hydrologic conditions
- Reduces/eliminates drainage infrastructure

DISADVANTAGES

- Limited to sites no greater than about five acres
- Best applied to shallow slopes of about five percent or less
- Must be separated from the GWT to reduce groundwater contamination
- Takes up five to ten percent of the impervious area draining into it
- Landscaping is critical for proper functioning
- Requires frequent maintenance

APPLICATION

Bioretention cells must be applied where slopes are relatively flat, allowing infiltration without significant surface flow. They also require that the groundwater table not be too close to the surface because this would limit infiltration. This measure requires a bioretention surface area to be about 5-10% of the size of the impervious surface that runs off to it.

JORDAN RIVER COMMISSION

[1] Environmental Protection Agency. (2008) National Pollutant Discharge Elimination System (NPDES) Menu of Best Management Practices. [Online]. http://cfpub.epa.gov/npdes/

TARGET POLLUTANTS

Pollutants that are applicable to the Jordan River that are treated or removed by this measure are trash, organic matter, nutrients, oil and grease, and suspended solids.

FLOW RATE

Bioretention decreases flow rate in stormwater runoff because for most storms all of the water is infiltrated to the soil. Only very intense storms overflow into conventional storm drains.

MAINTAINANCE

Maintenance for Bioretention Cells include regular landscaping to remove trash and other unwanted material and to ensure that plants are healthy and unwanted plant species are not taking over.

SCM: Oil/Grit Separator

http://www.oilandwaterseparator.com/Graphics/Abbey%20Hospital%20019.jpg

DESCRIPTION

Oil and grit separators remove oil, grease, and coarse sediments on site. They are multi-chambered and are often used for pretreatment for filtration SCMs. These do not have a very high capacity and thus are used most where storm events are small and infrequent.

DESIGN CRITERIA

- DRAINAGE AREA. INLETS ARE GENERALLY RECOMMENDED FOR USE IN LOCATIONS WITH ONE ACRE OR LESS OF IMPERVIOUS DRAINAGE AREA. [1]
- LOCATION. INLETS SHOULD BE PLACED SO THAT THEY MAY EASILY INTEGRATE WITH THE STORM DRAIN NETWORK. IT IS RECOMMENDED THAT OIL AND GRIT SEPARATORS BE USED IN OFF-LINE CONFIGURATIONS, SUCH THAT THEY RECEIVE ONLY THE FIRST FLUSH. [1]

http://www.conteches.com/Portals/0/Images/applications/product-application-summary/vortclarex_ows.jpg

ADVANTAGES

- Requires little space
- Is easy to install in a retrofit application
- Last a long time when maintained

DISADVANTAGES

- The chambers must be cleaned often
- They are not effective at removing soluble pollutants
- Only suitable for small areas (one acre or less)
- More expensive than other SCMs

http://www.hyndsenv.co.nz/ViewProduct.aspx?Id=2

APPLICATION

Oil and grit separators are usually applied as a retrofit because they are relatively expensive for the amount of benefit that they provide but require very little space. The only requirement is a small area to place the separator. They also have significantly more rigorous maintenance than other SCMs. In contexts where more area is available, other stormwater control measures are often more feasible than Oil and Grease separators.

[1] Environmental Protection Agency. (2008) National Pollutant Discharge Elimination System (NPDES) Menu of Best Management Practices. [Online]. http://cfpub.epa.gov/npdes/

TARGET POLLUTANTS

Target pollutants that are removed by Oil and Grease Separators are organic matter, suspended solids, trash, oil and grease.

FLOW RATE

Flow rate of storm runoff is not affected by Oil and Grease Separators. The device does not detain water or infiltrate it but only separates some pollutants and then discharges water to the storm drain.

MAINTAINANCE

It is recommended that water quality inlets are inspected at the beginning of each season and after each storm event. Oil and grease separators should also be cleaned a minimum of two times during the wet season and it has been shown that more frequent cleaning can increase the efficiency of these inlets. Maintenance can also be cumbersome because the oil collected from the separators must be disposed of separately from normal trash.

SCM: Gutter Filter

(Source: www.ence.umd.edu)

DESCRIPTION

Gutter filters are precast concrete gutter vaults that treat runoff by rapid filtering through gravel and sand. They are installed in place of normal gutters in closed-section roadways, adjacent to a channelizing device such as a curb or traffic barrier, as seen in the figure to the left. Gutter filters improve water quality through physical and chemical processes. The filter is a flow-through device and does not provide detention or retention storage.

However, movement through the gravel and filter medium may reduce the peak discharge rate. Gutter filters are similar to exfiltration trenches sometimes used in open drainage systems where a curb and grate are not needed to direct the runoff to the gravel trench containing the underdrain.

(Source: http://www.wilmingtonnc.gov)

JORDAN RIVER
OUR RIVER ~ OUR FUTURE

DESIGN CRITERIA

• MATERIALS LIKE GRAVEL, SAND, AND CONCRETE ARE REQUIRED

• IN AREAS THAT LACK HYDRAULIC HEAD, PUMPS ARE REQUIRED

• MUST BE SITUATED TO PROVIDE SAFE AND READY ACCESS FOR MAINTENANCE WORKERS AND VEHICLES

ADVANTAGES

• No restrictions on flow path length
• Medium water quality effectiveness
• Can work in concert with other SCM's
• Aesthetically neutral
• Reduces peak discharge

DISADVANTAGES

• Roadway must be straight
• Requires regular maintenance
• Has no storage capacity

APPLICATION

Gutter filters are applicable stormwater control measures in areas that require extra time of filtration of roadway stormwater runoff. Since gutter filters do not have any storage capacity, their application is limited to pre-treatment and diverting the stormwater off of the roadway and to a discharge point.

JORDAN RIVER COMMISSION

TARGET POLLUTANTS

- TSS
- Bacteria
- Organic matter

FLOW RATE

Gutter filters only modestly reduce the peak discharge rate from storms. As long as the storm intensity is less than the design intensity of the gutter filtration system, then no ponding or backup will occur.

MAINTENANCE

- Clear trash debris biweekly
- Remove debris from the void spaces four times per year
- Inspect concrete annually
- Check for evidence of clogging annually

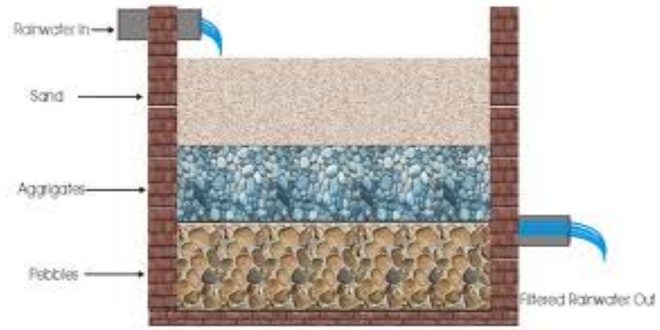
SCM: Surface Sand Filter

(Source: www.ci.sandy.or.us)

DESCRIPTION

A surface sand filter is a flow-through system designed to improve water quality from impervious drainage areas by filtering runoff through sand. It consists of one or more sedimentation and filtration chambers or areas to treat runoff. Pollutant removal in sand filters occurs primarily through straining and sedimentation. Treated effluent is collected by underdrain piping and discharging to the existing stormwater collection system.

A sand filter occupies a small footprint compared to its drainage area.



(Source: http://kscst.org.in)

DESIGN CRITERIA

• ROADWAY MUST BE STRAIGHT

• MUST BE INSTALLED IN SHOULDERS OR BREAKDOWN LANES

• DESIGNS FOR ARID CLIMATES NEED TO ACCOUNT FOR INCREASED SEDIMENT ACCUMULATION

JORDAN RIVER
OUR RIVER ~ OUR FUTURE

ADVANTAGES

- Can be designed so no pumping is required
- Occupies a small space relative to drainage area
- Materials are relatively inexpensive and found locally
- Aesthetically pleasing
- Removes TSS, metals, and bacteria

DISADVANTAGES

- Low volume capacity
- Low peak discharge
- Does not perform well in cold climates

APPLICATION

Surface sand filters are an applicable stormwater control measure for use in roadway controls when there is limited area that can be used for the filtration system. They perform better in humid and warm climates as opposed to arid climates with large temperature swings.

JORDAN RIVER COMMISSION

TARGET POLLUTANTS

- TSS
- Metals
- Oxygen depleting substances
- Bacteria

FLOW RATE

Surface sand filters do not supply substantial storage for stormwater. Since they do not supply substantial stormwater storage volume, surface sand filters do not significantly impact the peak discharge rate.

MAINTENANCE

- Clear large debris monthly
- Remove sediment from sediment chamber annually
- Annually check the integrity of concrete structures

SCM: Bioswale

(Source: www.windsorheights.org)

DESIGN CRITERIA

• DRAINAGE AREA LESS THAN 5 ACRES

• SHALLOW SIDE SLOPES OF LESS THAN 5%

• BIOSWALES MUST BE VEGETATED WITH APPROPRIATELY SELECTED PLANTS

• RESIDENCE TIME MUST BE GREATER THAN NINE MINUTES

(Source: http://www.co.washington.or.us)

DESCRIPTION

Bioswales are landscape features designed to remove silt or pollution from stormwater. They usually consist of a drainage course with sides that slope gently downward. The drainage course can have any arrangement of vegetation, soil, and stones. If there is adequate space, the swale is designed to meander in order to maximize time that water is in the swale. Some bioswales are simply rain gardens that do not have a storm drain because the flows do not require drainage in addition to the ground.

(Source: http://ecosrq.com)

JORDAN RIVER
OUR RIVER ~ OUR FUTURE

ADVANTAGES

• Biological breakdown of organic pollutants including the removal of pathogens
• Silt settles from water and reduces turbidity
• Metals and inorganic compounds are removed or reduced
• Removes oil and grease effectively
• Recharges groundwater

DISADVANTAGES

• Requires significant space
• Costs $3-10 per square foot
• Treatment is ineffective if stormwater volume exceeds design volume

APPLICATION

Bioswales are applicable stormwater control measures for use in controlling roadway stormwater runoff.

JORDAN RIVER COMMISSION

They are effective at reducing the peak discharge as well as at treating contaminants and removing pollutants.

TARGET POLLUTANTS

- TSS
- Oil and Grease
- Heavy Metals
- Nutrients

FLOW RATE

Bioswales are highly effective at reducing the peak discharge rate from roadway stormwater runoff. The storage capacity can be adjusted. Capacity depends on the available area for the bioswale and the grade surrounding the swale.

MAINTENANCE

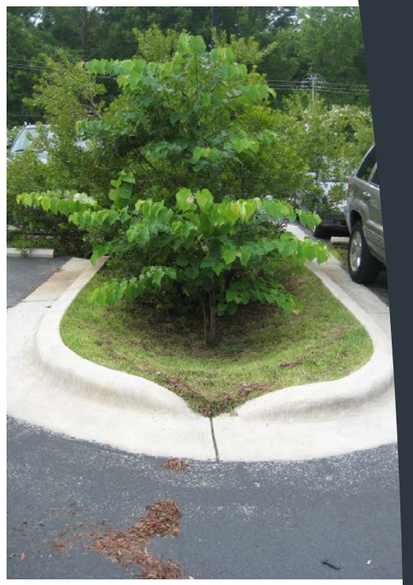
- Remove debris that accumulates in the cell and control structures
- Replace dead or dying plants
- Replenish and revitalize the mulch layer
- Stabilize any eroded areas

SCM: Constructed Wetland

DESCRIPTION

Constructed wetlands are marshy areas that are used to effectively manage stormwater and restore a riparian zone. The wetland provides an area for stormwater to be discharged, where it comes in contact with vegetation that aids in suspended solid, nutrient, and heavy metal removal. This marshy area also serves as an area for migratory birds, mammals, and aquatic life to reside.

.



DESIGN CRITERIA

- DESIGNED FOR A 100 YEAR, 24 HOUR STORM EVENT
- REMOVAL OF 85% OF SUSPENDED SOLIDS
- REMOVAL OF 55% OF NITROGEN
- 75% EFFICIENCY REMOVAL OF PHOSPHOROUS
- 65% OF HEAVY METAL REMOVAL TO INCLUDE COPPER AND ZINC
- STEEP CONSTRUCTED EDGES TO RESIST PHRAGMITES INVASION
- 3 FOOT DEPTH AT DEEPEST POINT

JORDAN RIVER
OUR RIVER ~ OUR FUTURE

ADVANTAGES

- High removal rate of all contaminants
- Natural stormwater solution
- Creates recreational and habitat opportunities
- Aesthetic Appeal
- Invasive species resistance

.

DISADVANTAGES

- Large footprint
- Not feasible in densely developed areas
- Nutrient release may occur during winter
- Overgrowth can lead to reduced hydraulic capacity

APPLICATION

Constructed wetlands can be used over a broad range of storm frequencies and sizes, drainage areas, and land use types.

JORDAN RIVER COMMISSION

They are more optimal in large, open rural areas. Urbanized areas are more restrictive due to a lack of space.

Constructed wetlands are often utilized as retention basins for stormwater drainage areas.

• Emphasis on double use for aesthetic amenity and educational purposes
• Typically used for watersheds of more than ten acres and less than one square mile
• Help eliminate invasive species, while also promoting growth of native species
• Need a consistent base flow throughout the year

TARGET POLLUTANTS

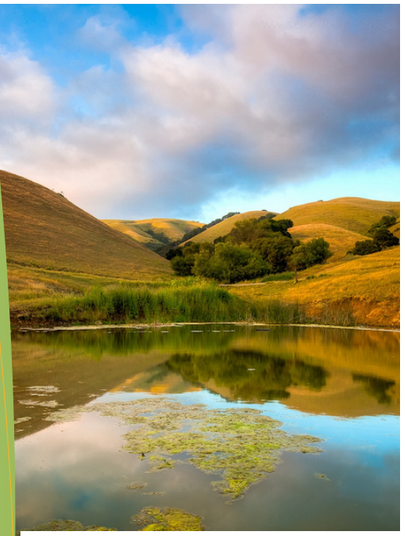
- Suspended Solids
- Nutrients
  - Phosphorous
  - Nitrogen
- Heavy Metals
  - Zinc
  - Copper
  - Ect.

FLOW RATE

The wetland must be able to accommodate the 100 year, 24 hour storm event and extended periods of dryness. The wetland was sized to accommodate extreme rainfall, while the natural spring will provide a base flow during extended dry periods. The peak flow was determined to be 26.2 cubic feet per second.

MAINTAINANCE

Maintenance costs average $1500 per year for an extended stormwater wetland. This includes debris removal, dredging the pretreatment areas, invasive species monitoring, and vegetation rehabilitation. Cost can vary depending on the year and storm quantity and quality.



Source: www.flickr.com/photos/flopper

SCM: Wet Ponds

DESCRIPTION

Wet ponds are constructed basins that collect stormwater in a permanent pool. Ponds remove solid stormwater pollution by allowing for settling over time as the water is retained before outflow and removes nutrients through biological uptake. Wet ponds differ from constructed wetlands in that they are usually deeper and use less vegetation. Wet ponds are among the most widely used stormwater practices due to the relatively low cost and high performance.

Source: www.utahbirds.org/counties/saltlake/SandyUrbanFishery.jpeg

DESIGN CRITERIA

• SIZED TO TREAT 85% OF ANNUAL RUNOFF

• USE DRAWDOWN TIME OF 48 HRS

• WATER DEPTH < 8 FEET

• WETLAND VEGETATION OCCUPYING NO MORE THAN 25% OF SURFACE AREA

• INCLUDE ENERGY DISSIPATION IN THE INLET DESIGN

• INCLUDE A RAMP FOR MAINTENANCE ACCESS

Source: TC-20

ADVANTAGES

• Wet ponds can provide substantial aesthetic/recreational value and wetlands habitat
• Can provide significant water quality improvement
• Can control channel erosion
• Viewed as a public amenity when integrated into a park setting

DISADVANTAGES

• Mosquito breeding ground
• Large footprint
• Baseflow required to maintain water level
• Cannot be placed on steep slopes

APPLICATION

Wet ponds can be used over a broad range of storm frequencies and sizes, drainage areas and land use types. .

Although they have limited applicability in highly urbanized areas, due to size, they have few other limitations.

Wet ponds are often utilized in smaller sub-watersheds and are particularly appropriate for residential areas.

• Emphasis on double use for aesthetic amenity
• Typically used for watersheds of more than ten acres and less than one square mile
• Need for high level of dissolved contaminant and/or sediment capture
• Where base flow is fairly consistent year round

TARGET POLLUTANTS

Highly Effective For:
Sediment, Trash, Metals, Bacteria, Oil and Grease, and Organics

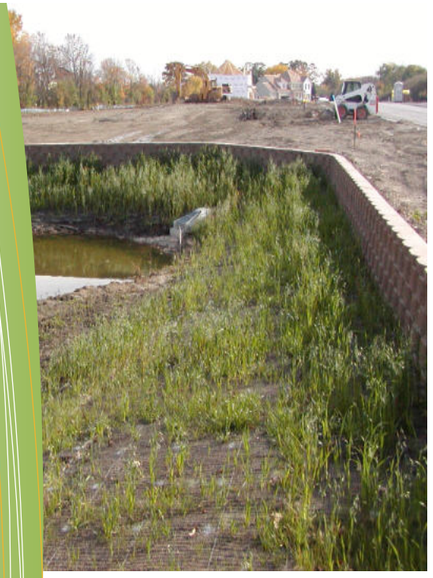
Effective For:
Nutrients

FLOW RATE

The volume of the pond should be design to accommodate at least a 48 hour retention time based on base flow rates and/or design storm values depending on whether a inline or off-line design is used.

MAINTENANCE

To ensure proper treatment performance and habitat, wet ponds will require semiannual inspection for burrows, sediment accumulation, structural integrity of the outlet, and litter accumulation.

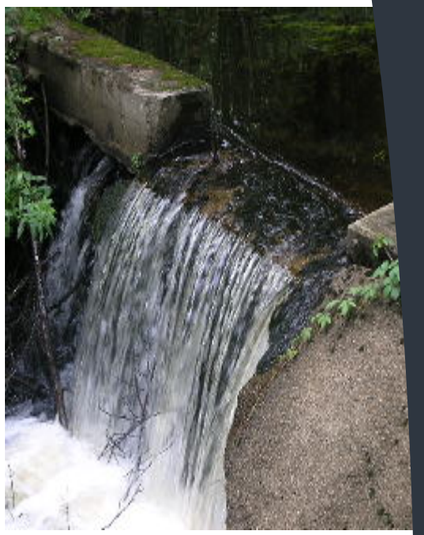


SCM: Detention Basin

DESCRIPTION

Rainwater collected during a storm travels along impervious surfaces and gutters before it is drained into inlets and storm pipes. As it travels it collects contaminants and debris such as nutrients, oils, suspended solids, and plant matter. The purpose of daylighting the pipe is to redirect the contaminated storm water at the end of the storm drain system into a vegetated detendtion basin.

When the stormwater is detained the contaminants have more time to settle, be adsorbed by retention and bioretention, and get caught by catchments. The result is that less contaminants affecting dissolved oxygen levels will be prevented from entering the Jordan River.



DESIGN CRITERIA

• REDUCE CONTAMINANTS

• DETAIN 10-YR STORM EVENT

• RESTORE TO NATIVE HABITAT.

• SERVE AS AN EXAMPLE TO OTHER DEVELOPERS

• EDUCATE THE PUBLIC WITH SIGNS AND POSTINGS

JORDAN RIVER
OUR RIVER ~ OUR FUTURE

ADVANTAGES

- Removal of most contaminants
- Natural stormwater solution
- Creates recreational and habitat opportunities
- Aesthetic Appeal
- Invasive species resistance
- Low operational maintenance

APPLICATION

The detention basin has the ability to act as a wetland that can treat for contaminants. It is most ideal to place them between storm water outlet strucures and bodies of water such as the Jordan River. Because it requires a large amount of space this is not as suitable to an urban environment, but rather a suburban or a rural environment.

JORDAN RIVER COMMISSION

DISADVANTAGES

- Does not treat to the same levels as a treatment facility could
- Requires designated land space
- Overgrowth can lead to reduced hydraulic capacity
- Requires regular maintenance and upkeep to prevent invasive species from overtaking habitat.

Student Engineering Associates
University of Utah
Department of Civil & Environmental Engineering
201 Presidents Circl
Salt Lake City, Utah 84112

TARGET POLLUTANTS

- Suspended Solids
- Nutrients
  - Phosphorous
  - Nitrogen
- Organic/Inorganic Debris
  - Leaves
  - Yard Clippings
  - Trash

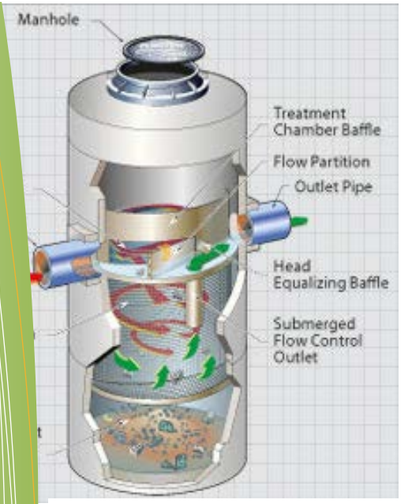
FLOW RATE

The detention basin must be able to accommodate a 10 year, 24 hour storm event and extended periods of dryness. Any rainfall over this amount has the potential of being untreated. However since the first flush will be treated this is not of majore concern. The peak flow was determined to be 7.5 cubic feet per second.

MAINTAINANCE

Vegetation may have to be trimmed or cut during certain times of the year in order to keep the flow path unobstructed. Any trash collected must also be manually removed from any catchment areas.

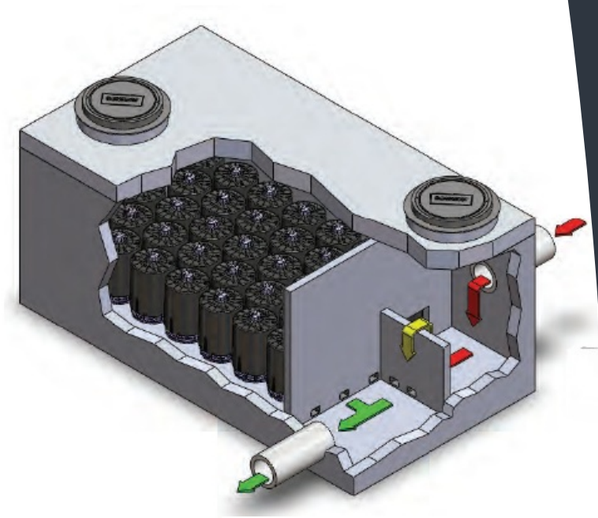
SCM: Mechanical Treatment



Source: stormwater360.co.nz

DESCRIPTION

Mechanical stormwater treatment systems include settling tanks, filter assemblies, and continuous deflective separation devices (CDS), among others. These systems use new technologies that allow for maximum treatment capacity in minimum space and allow for customization to remove target contaminants. This makes them especially suitable for highly developed urbanized areas where a small footprint is necessary.



Source: conteches.com

DESIGN CRITERIA

• SIZED TO TREAT 85% OF ANNUAL RUNOFF

• REMOVAL RATE OF 85% OF TOTAL SUSPENDED SOLIDS

• INCLUDE AN INTERNAL BYPASS

• MAINTENANCE INTERVALS DETERMINED DURING FIRST YEAR OF INSTALLATION

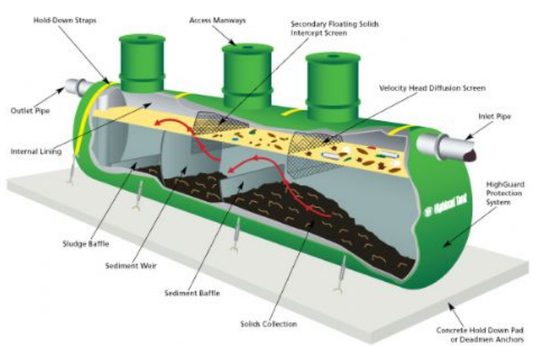
JORDAN RIVER
OUR RIVER ~ OUR FUTURE

ADVANTAGES

• Can be tailored to remove certain contaminants
• High performance
• Small footprint

DISADVANTAGES

• Non-natural solution
• Does not provide reduction in stormwater volume
• High capital and maintenance cost



Source: highlandtank.com

APPLICATION

The mechanical treatment systems are best suited for dense urban areas where space is a concern and constructed wetlands or wet ponds are not feasible. .

The most widely used application for these systems include small point source locations such as parking lots or storm drains when stormwater pollution is needed to be controlled at the source.

JORDAN RIVER COMMISSION

• Most come pre-designed and ready for installation
• Removes 85% of suspended solids and debris
• Removes oil and grease
• Can also be tailored to remove nutrients

TARGET POLLUTANTS

Highly Effective For:

Sediment, Trash, Metals, Bacteria, Oil and Grease, Organics, and Nutrients

FLOW RATE

The flow rates vary widely depending on application and design. The range of flow rates can be from under one cfs to 25 cfs depending on the type of system.

MAINTENANCE

Required maintenance for mechanical systems involves periodically removing debris and sediment to ensure proper operation. The maintenance intervals can be determined for a specific location after a period of use.