A Guide to Drainage Charge Credits

A drainage charge credit is a reduction in the drainage charge to a property based on the implementation and continuing proper operation of a storm water management practice. Customers are encouraged to adopt sustainable methods of storm water management that reduce storm water flows to the drainage system, enhance the natural environment, and protect against flooding and sewer overflows. The installation of storm water practices that result in a measurable reduction in volume and/or peak flow rates will qualify the property owner for a credit to their bill. This guide provides an overview of the types of credits available for common storm water practices.

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What is a Storm Water Practice?

Storm water practices are designed or constructed to reduce or control the volume and rate at which storm water leaves a site. Storm water practices can be structural or non-structural. Storm water practices may use vegetation, soils, and other elements to restore some of the natural processes that reduce runoff. Examples of storm water practices include disconnected downspouts, rain gardens, bioretention practices, permeable pavement, green roofs, and detention ponds.

1. *Disconnected Downspout*
2. *Bioretention in an Open Space*
3. *Bioretention in Parking Lots*
4. *Subsurface Detention Storage*
5. *Traditional Detention Basin*

Removing Impervious Cover

Reducing a drainage charge does not necessarily require implementation of a structural storm water practice. By simply reducing the impervious cover on a property, customers reduce the amount of storm water leaving their property and thus reduce their drainage charge. Examples of impervious cover reduction include removal of asphalt or concrete parking spaces and replacing the impervious cover.

Note: Because the drainage charge is calculated using the amount of impervious cover on a site, the removal of impervious cover is not considered a drainage charge credit but rather an adjustment to the impervious area.

IMPORTANT:
Removal of excess parking requires zoning review by the City's Building Safety Engineering & Environmental Department (BSEED).

Drainage Charge Credits

The amount of the drainage charge credit is determined based on how well a customer can control the volume and peak flow characteristics of their runoff. Credits of up to 80% of the total drainage charge bill may be earned for reductions of:

- Annual Volume of Flow (40%)
- Peak Flow Rate (40%)

The maximum total drainage charge credit is 80%.

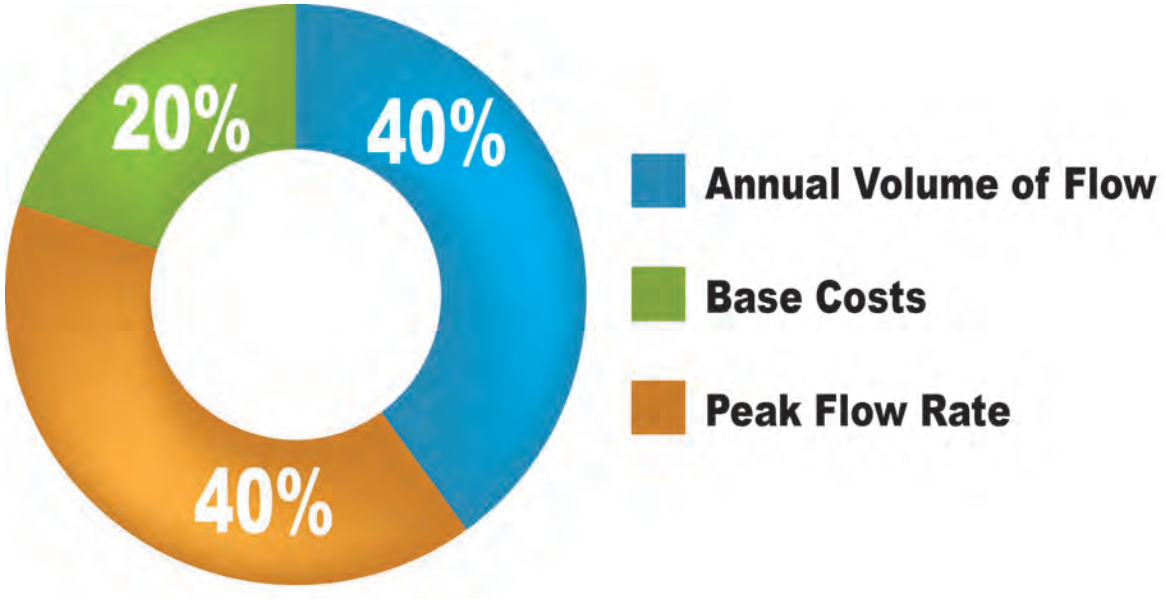


Figure 1: Drainage Charge Credits

Volume-Related Costs

The vast majority of storm water that enters Detroit's combined sewer system reaches the wastewater treatment plant (WWTP). Detroit's share of the cost associated with running the regional WWTP is based on the total volume of flow from the City. In addition, some components of the cost associated with combined sewer overflow control (CSO), facilities such as chemical use and power use, are also related to flow volume. Efforts that customers make to reduce the total volume of flow that is handled by the sewer system over the course of the year helps to reduce these costs to DWSD.

Detroit's Wastewater Treatment Plant

Peak Flow Rate Related Costs

Detroit has invested approximately $1 billion in CSO facilities since the 1990's. These facilities treat overflows caused by large storm events. Detroit faces the prospect of being mandated to invest up to $2 billion in additional costs (based on 2010 reports) to control additional CSO points along the Detroit and Rouge Rivers if storm water management measures prove insufficient to prevent overflows.

When customers implement measures to limit the peak rate of flow from their properties to the sewer system it helps to reduce the need for these facilities. The majority of peak flow related costs are for the construction and ongoing operation expense of the CSO facilities.

Conner Creek CSO

Base Costs

In addition to the costs associated with the WWTP and the CSO facilities, DWSD operates an extensive system of sewers and pump stations. These system elements are necessary to make centralized sewer and storm water management services available. The systems must be maintained in order to be ready to serve each property in the City. In addition, there are various costs associated with administering the drainage charge system such as data management, billing, customer service, and credit administration.

Volume Credit

Volume-based drainage charge credits are determined based on the average annual volume reductions that result from managing storm water on-site. The annual runoff volume is computed prior to and after construction of the storm water practice. The volume credit is calculated as the fraction of average annual runoff volume that is reduced as a result of implementing storm water practices on-site.

$$\%\,Volume\ Credit = \frac{Average\ Annual\ Runoff\ Volume\ Retained}{Total\ \ Average\ Annual\ Runoff\ Volume}$$

As the maximum credit that can be earned for volumetric control is 40 percent, the result of the above equation is multiplied by 40 percent. The credit is prorated based on how much of the site is managed.

Peak Flow Credit

Peak flow-related drainage charge credits are based on the ability of the site to control peak flows of storm water. Generally this credit is earned by the construction of an above or below ground detention system. In order to qualify for a peak credit, the detention system MUST have a controlled outlet. Once the system has a controlled outlet, the peak flow credit is calculated as the fraction of the volume associated with a 100-year, 24-hour rain event that is detained.

In order to earn a peak flow credit, the outlet capacity for the managed portion of the site must be limited to 0.15 cfs/acre.

$$\%\ Peak\ Flow\ Credit = \frac{Storage\ Volume\ Provided}{100-yr, 24-hr\ Storage\ Volume\ Required}$$

As the maximum credit that can be earned for peak flow control is 40 percent, the result of the above equation is multiplied by 40 percent. The credit is prorated based on how much of the site is managed.

How Much Credit Will Various Practices Accomplish?

Various types of storm water practices are able to control either annual volume, peak flow or both. Table 1 identifies anticipated ranges of credit that various common storm water practices can earn. The credit applies to the area draining to the storm water practice. Each of the storm water practices are described in the following sections.

DID YOU KNOW?

Retention is the process of permanently keeping storm water from leaving a property. It can be accomplished through infiltration, evaporation, transpiration (water uptake through plants) or water reuse. This process helps to remove volumes of storm water from the sewer system. ***It is through retention that a site achieves a volumetric credit.***

Detention is the process of temporarily storing storm water runoff to mitigate sewer overflows. This process helps reduce the flow rate (volume per unit time) of storm water through the sewer system. This storm water is later released into the system after the rainfall or storm melt subsides. ***It is through detention that a property qualifies for a peak flow credit.***

TABLE 1 - Credits for Various Storm Water Practices			
Practice Type	Volume Credit	Peak Flow Credit	Potential Credit for Area Managed (%)
Downspout disconnection	✓		**0-40**
Disconnected impervious area	✓		**0-40**
Bioretention	✓	✓	**0-80**
Detention basins		✓	**0-40**
Subsurface detention storage		✓	**0-40**
Permeable pavement	✓	✓	**0-80**
Green roof	✓		**0-30**
Water harvesting*	✓	✓	**0-80**
**For water harvesting, peak flow volume evaluated on a case-by-case basis.*			

Downspout Disconnection

Downspout disconnection is the process of disconnecting roof downspouts from the sewer system and redirecting the roof runoff onto pervious surfaces, most commonly a lawn. This reduces the amount of directly connected impervious area in a drainage area.

Typically an existing downspout is cut above ground level. An elbow and an extension are then added to the downspout in order to divert rainwater and snowmelt away from the building or structure and onto the ground. The abandoned drain pipe is then capped. A splash pad may also be attached at the end of the downspout extension to prevent erosion in garden areas and help direct the flow of water.

Required: Disconnected downspouts must be directed to pervious or lawn areas that will not result in flooding, icing hazards or discharge to public right of ways and/or neighboring properties. They must be properly extended away from the building foundation.

Increasing a credit: The credit for downspout disconnection (non-residential) is directly related to the size of the lawn area or the type of outlet location (lawn or bioretention area). Larger lawn areas and more highly designed storm water practices will result in a larger credit.

Extended Downspout

Disconnected Impervious Area

When impervious surface areas such as roofs, driveways, sidewalks, and parking lots are directed to pervious areas that allow for infiltration, customers may qualify for a disconnected impervious area credit. The pervious area to which storm water is directed may be a grass lawn or vegetated landscaped area.

Required: Disconnected impervious areas must be directed to pervious or lawn areas that will not result in flooding, icing hazards or discharge to public right of ways and/or neighboring properties.

Increasing a credit: The credit for disconnected impervious areas is directly related to the size of the pervious vegetated area. Larger ratios of pervious area to impervious area will result in higher credit percentages.

Bioretention

Bioretention in an Open Space

Bioretention is typically sited in an area of natural or constructed depression and consists of vegetation, a ponding area, mulch layer, and planting or engineered soil media and released through an underdrain. The vegetation may include perennials, grasses, shrubs, and trees. It typically incorporates a vegetated groundcover or mulch that can withstand urban environments and tolerate periodic inundation and dry periods. Runoff intercepted by the practice is temporarily captured in the depression and then infiltrated into the underlying soil. Flow that doesn't infiltrate is filtered through the soil (often engineered soil) media. Pretreatment of storm water flowing into the bioretention area is recommended to remove large debris, trash, and larger particulates. Pretreatment may include a grass filter strip, sediment forebay, or grass swale. Ponding areas can be designed to provide detention.

Required: Bioretention systems must promote infiltration and evapotranspiration. However the system must also be able to drain below the ground surface within 24 hours.

Increasing a credit: The credit for bioretention systems is most directly related to the size (area and volume) of the bioretention relative to the tributary area. For example, if the drainage area relative to the bioretention area is five times the size of the bioretention, it will result in a larger credit than if the drainage area is 10 times the size of the bioretention area.

Bioretention in Planter Boxes

Bioretention Islands in Parking Lots

Bioretention between Parking Lot Aisles

Variations of bioretention include bioretention planter boxes, bioretention islands in parking lots or parking lot aisles.

Detention Basins

Detention is a storm water management practice that temporarily stores runoff volume and slowly releases it to the sewer system with a controlled outlet. Detention systems include dry detention and wet detention where the control structure is offset from the bottom of the basin which creates a landscape feature such as a permanent wet pool.

Traditional Dry Detention Basin

Required: Detention basins must have a controlled outlet to be eligible for a credit.

Increasing a credit: The credit for detention basins is based on the volume of the detention basin relative to the volume of a 100-year storm. The larger the basin, the larger the credit. Water stored in a detention basin can also be reused for irrigation, which would result in a volume credit.

Subsurface Detention Storage

Underground detention performs the same function as a detention basin. Storm water (and snowmelt) is routed to underground vaults or a system of large-diameter or low-profile storage pipes. Pipe or manufactured systems can be used. As with detention basins, a controlled outlet is required. In some cases where soils have available infiltration capacity, these systems can double as infiltration galleries. Alternatively, they can function as cisterns which enable water reuse.

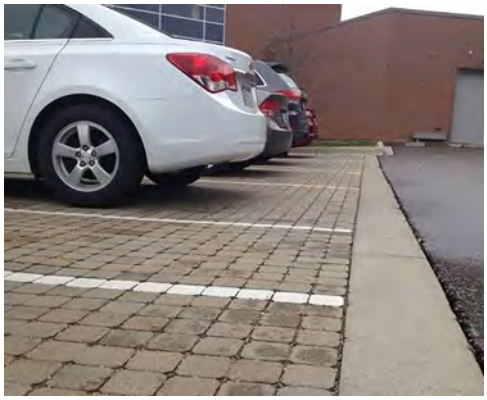
Subsurface Detention Storage

Required: Subsurface detention basins must have a controlled outlet to be eligible for a credit. Pretreatment is required to prevent a buildup of solids and other debris in the subsurface detention.

Increasing a credit: The credit for subsurface detention is based on the volume of the detention relative to the volume of a 100-year storm. The larger the detention, the larger the credit.

Permeable Pavement

Permeable pavement is sometimes used in highly impervious areas to help infiltrate storm water runoff that would otherwise enter the sewer system. This practice includes an aggregate stone layer to provide both structural support and volume storage, and a porous pavement layer that allows runoff to infiltrate. Because it can replace traditional impervious pavement, permeable pavement is an effective option for parking lots in urban areas.



Permeable Pavement

Required: A stone/aggregate layer to control storm water. To be eligible for credits, installations must follow important design considerations.

Increasing a credit: The depth of stone under a parking area significantly affects the volume available to manage storm water. The more storage volume, the larger the credit will be. The stone storage area, if properly sized, can also be used for roof drains and other impervious surfaces.

Green Roof

Green Roofs

Green roofs are used to introduce vegetation onto sections of roof tops to absorb and filter rainfall. Between rain events, some of the rain water is held in the plants and evaporates. At a minimum, a green roof consists of a waterproof membrane and root barrier system to protect the roof structure, a drainage layer, filter fabric, a lightweight soil media, and vegetation that filters, absorbs, and retains/ detains the rainfall. The overall thickness of a green roof commonly ranges from two to six inches. A green roof may be connected to other storm water practices such as a bioretention, bioswale, or cistern.

Green roofs are most often applied to buildings with flat roofs, but can be installed on roofs with slopes with the use of mesh, stabilization panels, fully contained trays, or battens.

Increasing a credit: The credit associated with a green roof is dependent on size of the green roof area and depth of the media. The larger these two are, the more significant the credit.

Water Harvesting (Reuse)

Water harvesting practices are generally used to collect storm water runoff from impervious areas and store it in large cisterns (for commercial properties), smaller rain barrels (for residential properties), or ponds. Runoff can then be used in non-potable applications such as watering vegetation or greywater systems. Cisterns as well as smaller rainwater harvesting systems can be constructed above or below ground depending on the space constraints of the site.

Required: Any non-residential water reuse system must include a means of using the water on a routine basis and a means to measure the water used OR measure the residual flow to the sewer system.

Increasing a credit: Reuse systems are only as effective as the ability to use the water. The credit will be increased if more uses for the stored water are identified. For example, some industrial customers

Cistern

Irrigation Pond

are reusing storm water for the facility's industrial processes. This likely requires sufficient treatment of the water for the desired purpose.

Full or Partial Site Credits

DWSD does not require storm water from the entire site to be managed in order to take advantage of the credit system. However, drainage credits will be calculated for that fraction of a property that is "managed", meaning the area where storm water runoff is directed to a storm water practice. Runoff from an "unmanaged" area of a property will not be eligible for a drainage credit. Figure 2 represents these concepts.

For the example in Figure 2, the portion of the site that is tributary to the storm water practice would be eligible for a credit. The unmanaged portion (shaded area) would not be eligible for a credit.

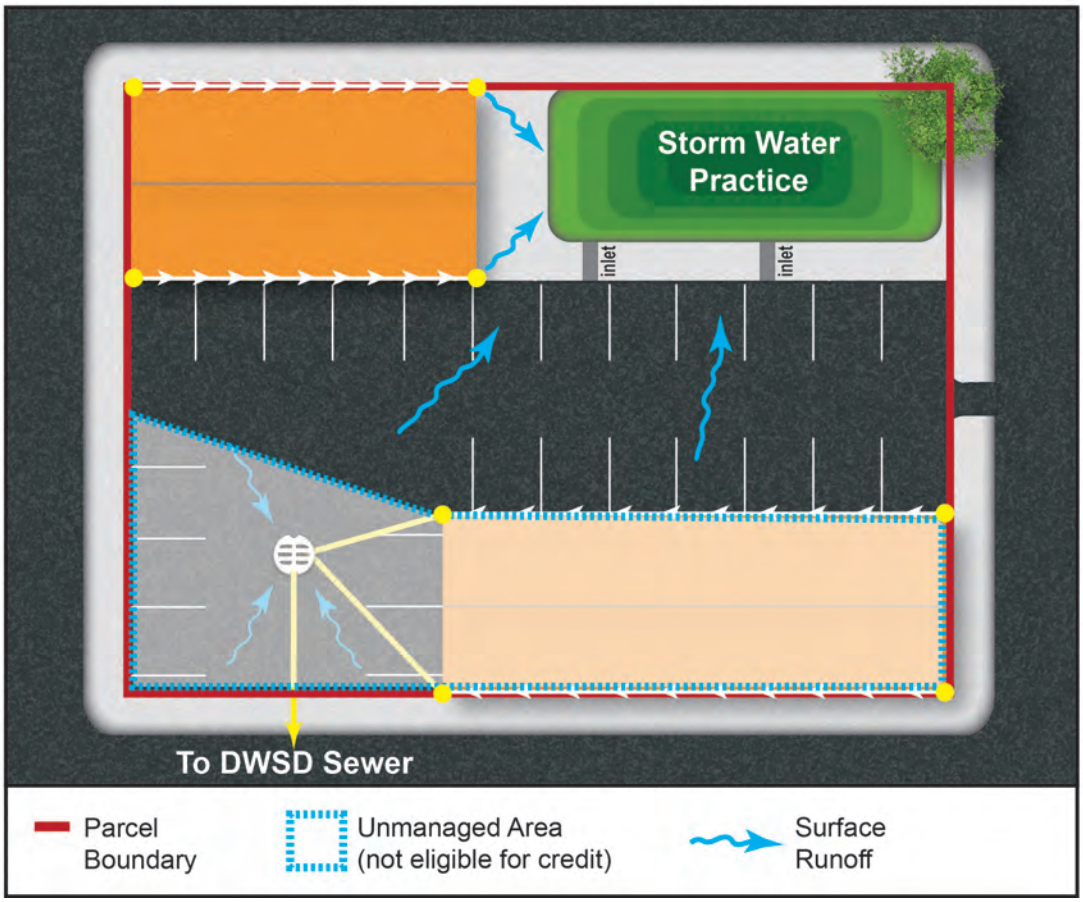


Figure 2: Managed versus Unmanaged Area

EXAMPLE: Due to topography, storm water runoff from six impervious acres of a 10 impervious acre site is directed to a bioretention that infiltrates 70% of the runoff draining to it. The bioretention is eligible for volume credits. It does not earn a peak flow credit as it has no detention capabilities. The storm water runoff from the other four impervious areas is not managed. Therefore, 60% of this site is considered "managed".

The credit is calculated as shown in Table 2:

TABLE 2 - Partial Site Credits					
Area	Credit Type	Practice Performance (%)	Impervious Area (acres)	Credit Calculation	Credit Amount (%)
Managed Area	Volume	70	6	(6/10) * 0.7 * 0.4	17
Non-managed	None	0	0	N/A	0
				Total	17

Multiple Credits

In cases where more than one storm water practice is present, the credit will be determined based on the total site's potential to manage storm water. The customer can earn multiple credits.

Note: While multiple credits can be given to eligible properties, the total credit to any property cannot exceed 80 percent of the drainage charge for that property.

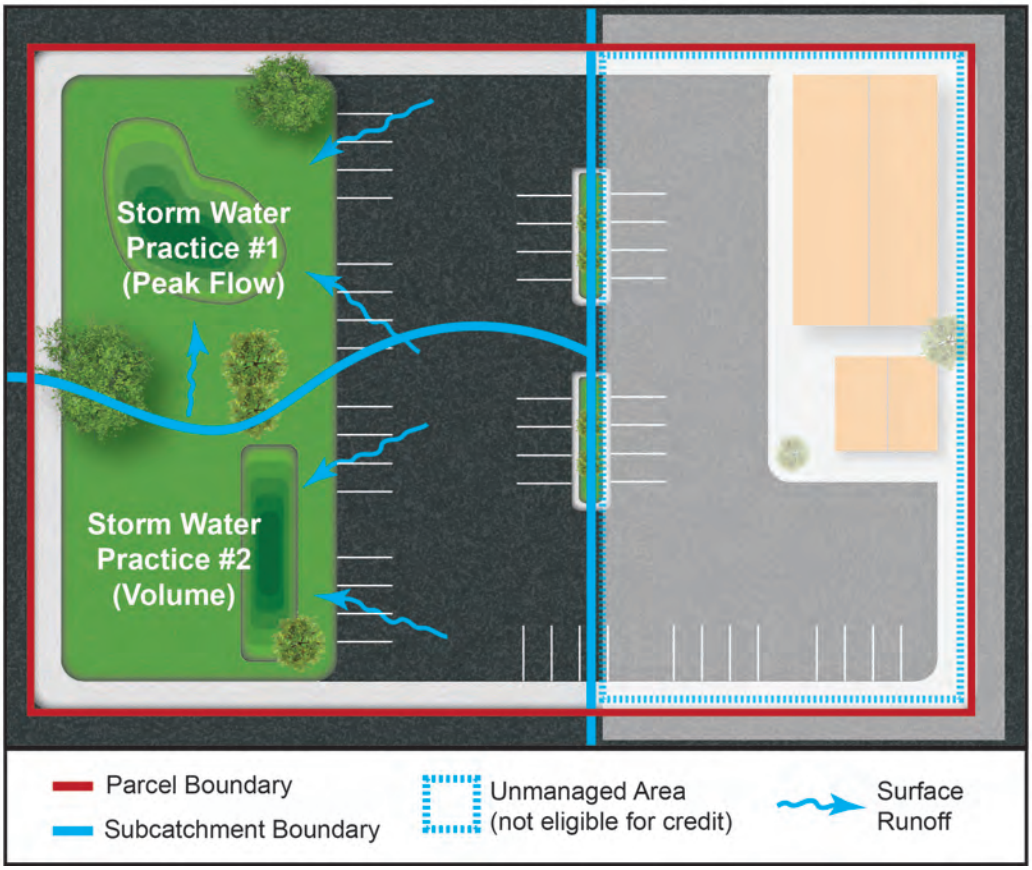


Figure 3: Multiple Credits

EXAMPLE: A property has three subcatchments, all of which drain to different locations. Runoff from the first (#1) subcatchment is conveyed to a detention basin that can detain 80 percent of the 100-year, 24-hour storm event volume. This practice is eligible for peak flow credit. Runoff from the second (#2) subcatchment is conveyed to a bioretention practice that can retain 90 percent of the annual rainfall volume. This practice is eligible for a volume credit since it reduces runoff volume by infiltration. Runoff from the third (#3) subcatchment is not managed (i.e., sent to the storm sewer).

TABLE 3 - Multiple Credits

Subcatchment	Credit Type	Practice Performance (%)	Impervious Area (acres)	Credit Calculation	Credit Amount (%)
Detention Basin	Peak Flow	80	2.3	(2.3/8.7) * 0.8 * 0.4	8
Bioretention	Volume	90	2.4	(2.4/8.7) * 0.9 * 0.4	10
Not Managed	None	0	4.0	N/A	0
Total			8.7		18

Shared Storm Water Practices

DWSD allows the location of the storm water practice to be on a separate parcel from where the storm water is generated. There are two circumstances where this may happen:

- A single property owner owns multiple parcels
- Multiple property owners construct a shared storm water practice

Situation #1: Single Property Owner

Required: A single property owner with multiple adjacent parcels must:

- Collapse parcels OR have consistent owner names and addresses on each parcel; and
- Group the parcels for billing purposes.

Situation #2: Multiple Property Owners

Required: A legal agreement between the property owners documenting that this is a shared storm water practice.

DWSD will assess the practice performance and, if credit requirements are achieved by a joint practice, each property owner will be granted a credit for their contributing impervious area.

Note: DWSD encourages cost-sharing to support the design, construction, and maintenance of shared storm water practices. DWSD will not intervene in private transactions associated with financing and maintenance. DWSD will apply credits to the properties whose flow is managed.

EXAMPLE: Four individual properties have entered into an agreement whereby a single detention basin will control peak flow from each of their properties. The detention basin is sized to detain 60 percent of the 100-year runoff volume from all impervious cover on each property. Therefore, the properties are eligible for the peak flow rate credit. Because the detention basin has no infiltration capabilities, no property will receive volume credits. With the information below, the total credits allocated to each property are calculated.

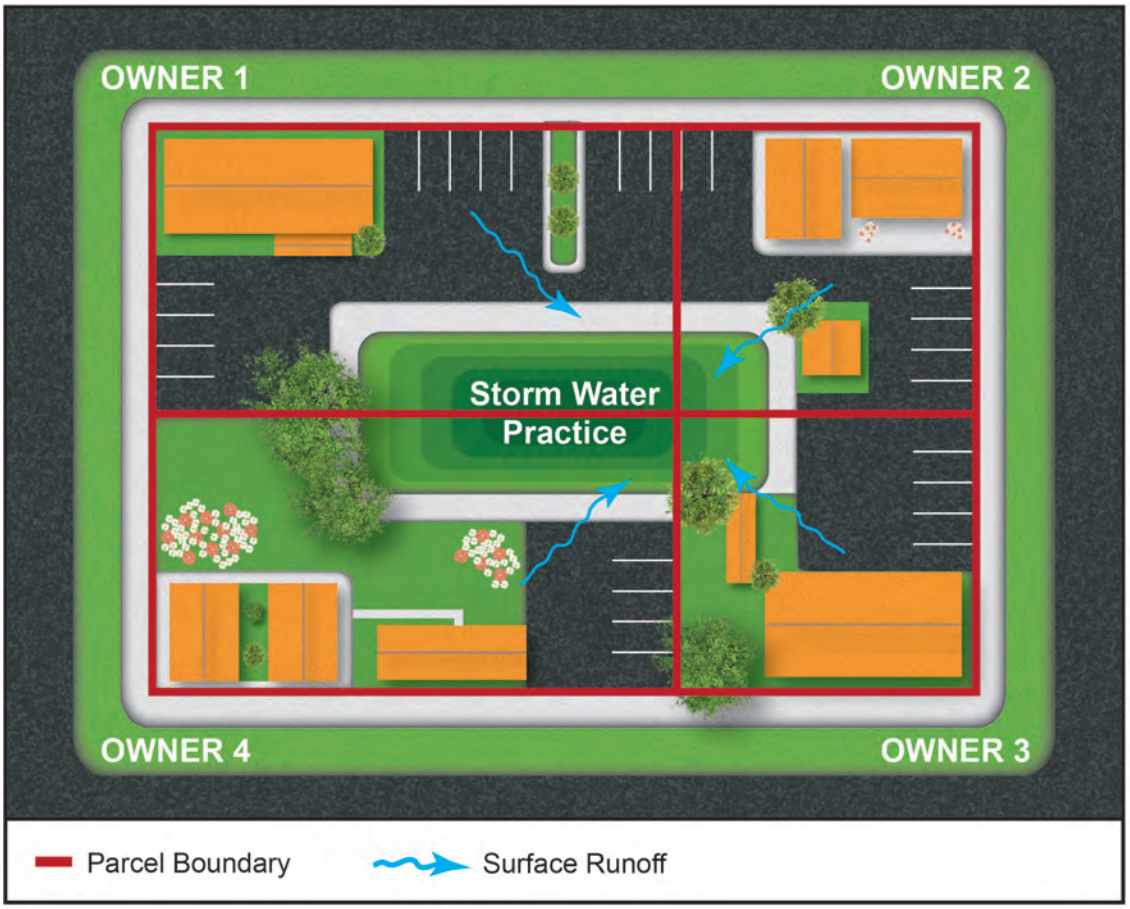


Figure 4: Shared Ownership of Storm Water Practice

TABLE 4 - Shared Ownership of a Storm Water Practice					
Owner # Calculation	Credit Type	Practice Performance (%)	Impervious Area (Acres)	Credit Calculation	Credit Amount (%)
1	Peak	60	3	(3/3) * 0.6 * 0.4	24
2	Peak	60	2	(2/2) * 0.6 * 0.4	24
3	Peak	60	2	(2/2) * 0.6 * 0.4	24
4	Peak	60	2.1	(2.1/2.1) * 0.6 * 0.4	24

Note: All impervious area on each site is controlled.

How to Get a Drainage Charge Credit

In order to be eligible for a drainage charge credit, the storm water practice must be approved by DWSD. To obtain a drainage charge credit, the property owner will need to meet eligibility requirements, apply for and receive an approval from DWSD, and fulfill on-going operations and maintenance (O&M) requirements. The customer's name must be on the account.

To be eligible for a credit, the storm water practices must:

- Reduce annual runoff volume and/or control peak flow rate;
- Be documented in terms of design and performance in a manner acceptable to DWSD;
- Comply with all applicable city, county, state, and federal construction, building, and storm water codes and permits;
- Be fully installed and functioning properly;
- Not create a safety hazard or nuisance; and
- Be located on a property that is geographically located within DWSD's Drainage Service Area.