STORM DRAINS CONNECT
STREETS TO CREEKS
OURS TO PROTECT



RAIN RUNOFF TREATMENT • TRATAMIENTO DE LA ESCORRENTÍA DE LLUVIA
ROADSIDE BIORETENTION
STREETSTOCREEKS.ORG/LID
L.I.D.

L I D

LOW IMPACT DEVELOPMENT

OWNER'S MAINTENANCE GUIDE

ADDITIONAL RESOURCES

Request an informational site visit with your local agency.

For LID Feature Factsheets & the Approved Plant List:
www.streetstocreeks.org/lid-for-owners

E.P.A. General LID Information visit:
www.epa.gov/nps/urban-runoff-low-impact-development

Health & Safety Tip: If standing water is in your feature for longer than 72 hours, check out msmosquito.org for services.

LID is infrastructure that treats, stores and slows stormwater runoff before it enters local creeks and waterways.

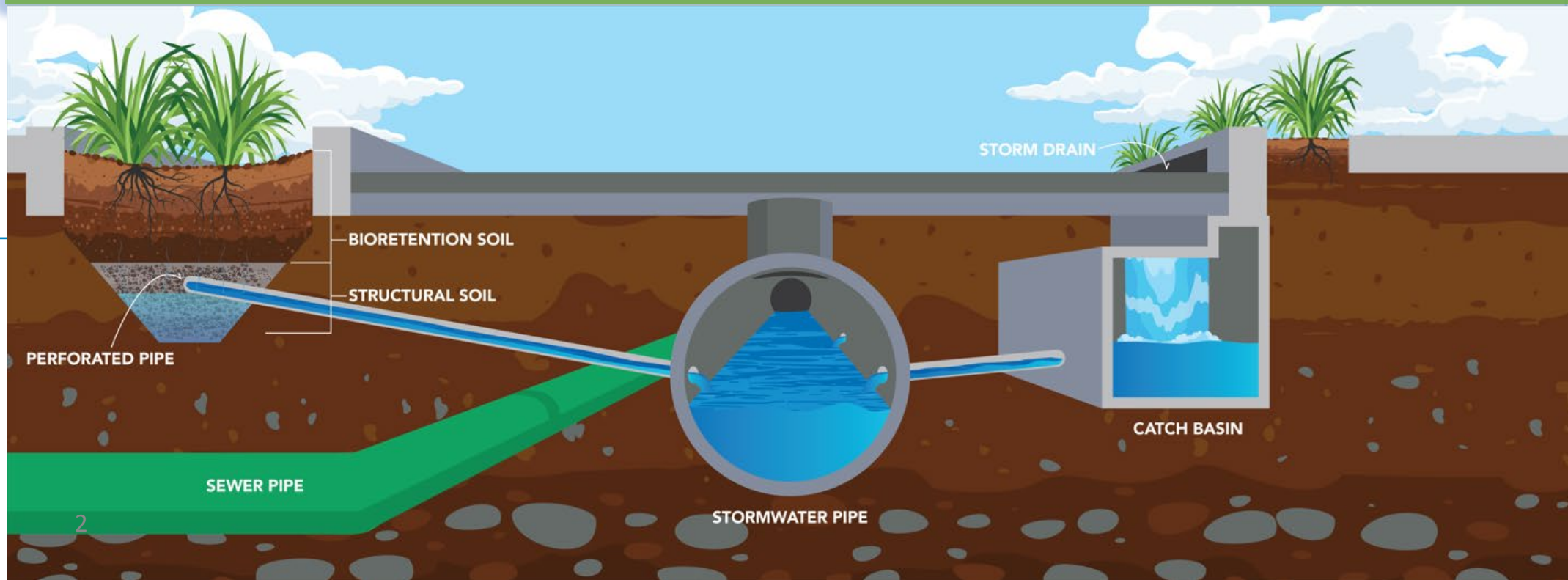


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WHAT ARE LID FEATURES & WHY DO WE NEED THEM?

In healthy natural areas, soil and vegetation act like a sponge, absorbing rainwater and slowly releasing it into creeks, aquifers, and the atmosphere. When natural areas are developed, the land's ability to absorb and store rainwater is greatly reduced. Rain falling on impervious surfaces such as roofs, roads, parking lots, and driveways runs off faster and in greater amounts than it would under natural conditions. Large quantities of fast-flowing stormwater pick up pollutants such as motor oil, heavy metals, dust, feces, fertilizers, and microplastics, and carry them through the storm drain system directly to local creeks and the Russian River without treatment. These pollutants and the large quantity of runoff cause major issues for our creeks, wildlife and public health.

Luckily, there are solutions that allow for necessary development without causing stormwater issues. **Low-Impact Development (LID) features are engineered landscape areas designed to capture and treat stormwater runoff.** They allow stormwater to slow down, spread out, and soak into the ground while filtering out pollutants. LID features are a requirement of any new development that creates or replaces more than 10,000 square feet of impervious surfaces. Aside from their hydrological benefits, LID features help decrease erosion of creek banks and can be beautiful landscape additions that provide valuable wildlife habitat.

Common examples of LID features include roadside bioretention planters, rain gardens, vegetated swales, and permeable pavement. Let's look at the two most common types: vegetated features and permeable hardscaping. Additional resources and factsheets can be found at https://www.streetstocreeks.org/lid.

Routine maintenance of LID features protects local water quality, groundwater supplies, public health, infrastructure, and wildlife.



LID PREVENTS COSTLY PROBLEMS

Roofs, parking lots, streets, and other impervious surfaces alter natural hydrology, increasing the volume and velocity of stormwater runoff. This creates many costly impacts including flooding, potholes, damage to structures, streambank erosion, turbid water and habitat degradation. Well-maintained LID features help prevent these issues and provide other benefits as well.

Did you know that this:



Can contribute to this:



Graphic courtesy of Slow it. Spread it. Sink it. Store it! Second Edition June 2015. Sonoma Resource Conservation District and the Resource Conservation District of Santa Cruz County.

BENEFITS of LID

- ✓ Filters out pollutants
- ✓ Reduces flooding
- ✓ Prevents streambank erosion
- ✓ Replenishes groundwater supply
- ✓ Creates pollinator & bird habitat
- ✓ Beautifies urban areas



OWNER'S RESPONSIBILITY

It is the property owner's responsibility to maintain LID features, so they function as originally designed. LID features are a condition of approval for qualifying development. Maintenance is required for the life of the development by the local California Regional Water Quality Control Board and the Environmental Protection Agency (EPA) under the Clean Water Act.

Maintenance responsibility is attached to the property and transfers with changes in ownership. **This guide will help you stay in compliance.**

INSPECTIONS & REPORTING

Typically, inspections are performed annually by agency staff. If corrective actions are needed, the property owner will be contacted.
Corrective actions must be completed within the timeline specified by the agency or prior to the first rain of the wet season, whichever is sooner.

In some cases, depending on the type, age, and location of the feature, **you may be asked to complete a "self-inspection" or have your feature serviced** by a certified third-party contractor.

If needed, agency staff will initiate and approve self-inspections. Self-inspections are a simple process to complete and take a few minutes per feature. agency staff will send maps, a short inspection checklist, and instructions. Most homeowners can easily complete inspections themselves and submit results back to the agency inspector within an hour.

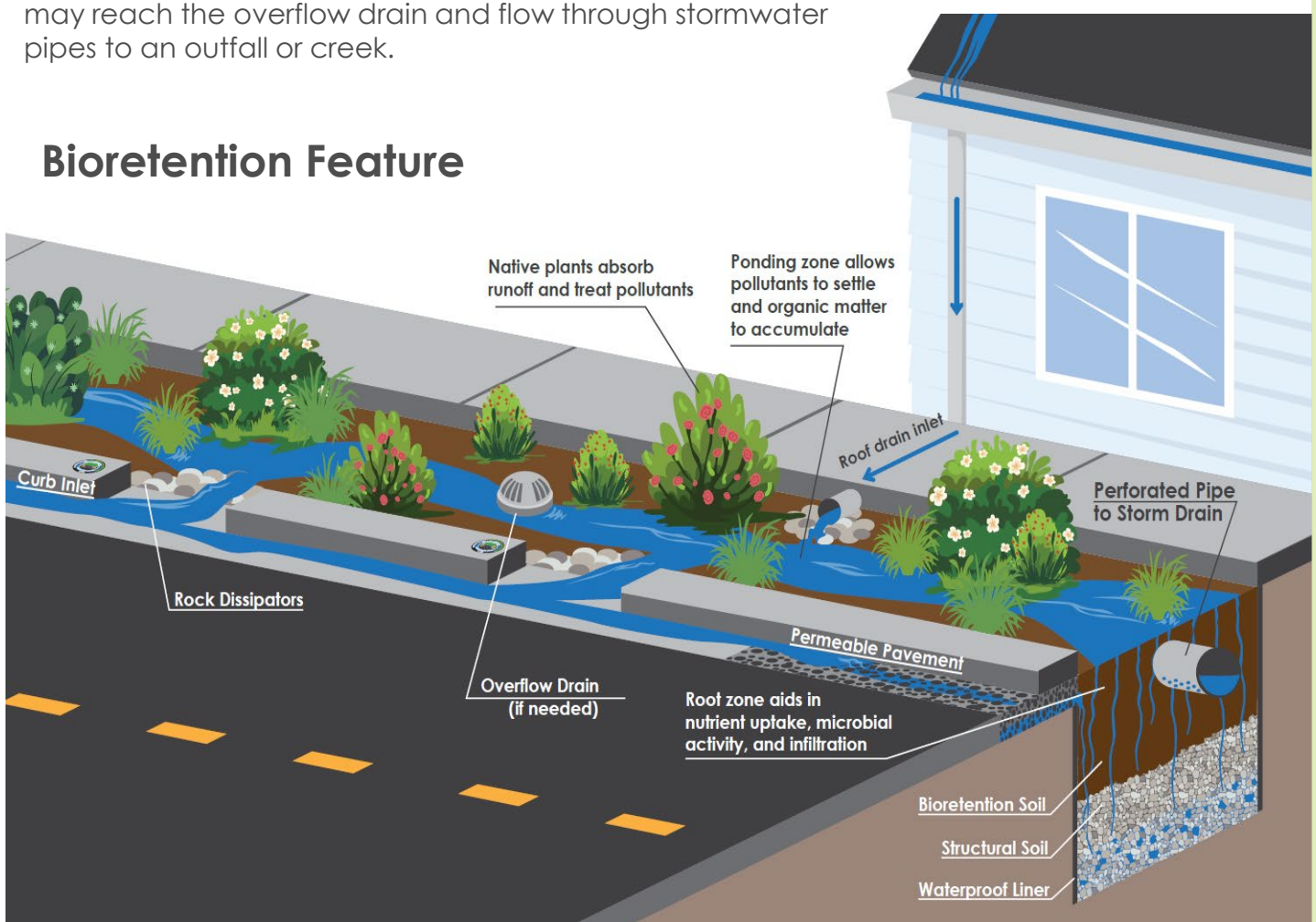
AN EXAMPLE OF GOOD MAINTENANCE....



FACTSHEET: VEGETATED LID FEATURES

Vegetated LID features use **plants and special engineered soil** to absorb and filter stormwater. Roadside bioretention basins, rain gardens and vegetated swales are common examples of vegetated LID features. They may be contained within a concrete barrier or a simple depression graded into the surrounding landscape. Vegetated features will have an inlet such as a curb or roof drain inlet, or permeable pavement that allows stormwater to flow into the feature. Plant roots and engineered soil do the filtering. It is desirable for water to pond in the features for a short time, but it should drain within 72 hours to prevent mosquito breeding. During large rain events, stormwater may reach the overflow drain and flow through stormwater pipes to an outfall or creek.

Bioretention Feature



THE RIGHT PLANTS ARE ESSENTIAL

The name says it all…**vegetation is key to the proper function of vegetated LID features!** The LID Technical Design Manual contains a list of approved plants, chosen specifically for their ability to filter out common pollutants and withstand flooding and drought. Most are native plants, and many offer additional habitat benefits too.

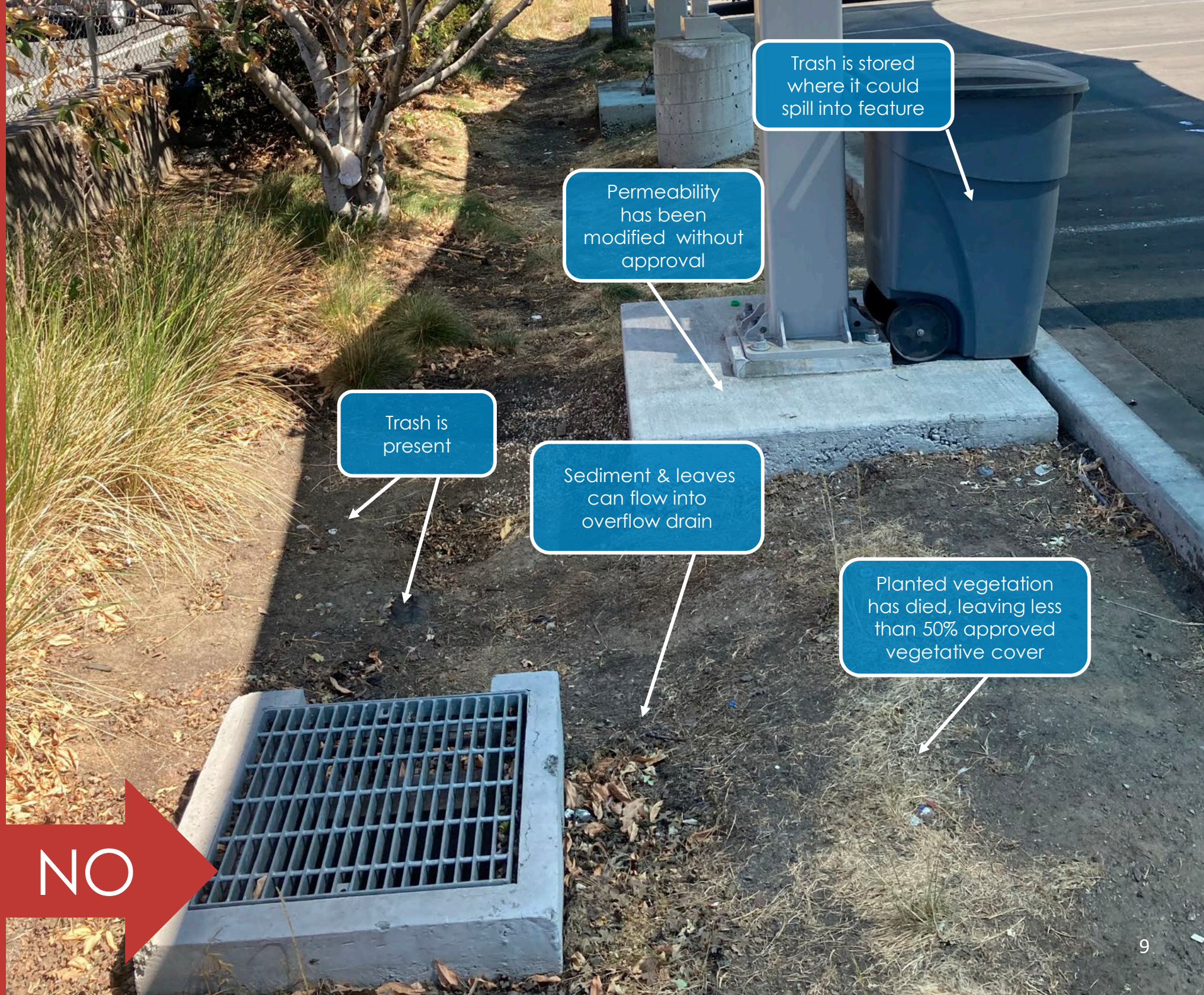
Only plants from the Approved Plant List are allowed, unless you get specific approval for alternative plants from your local stormwater authority & the Regional Water Quality Control Board.

It's a common misconception that LID plants don't need irrigation. Most need regular water during the first few summers, and once mature, may still need weekly to monthly dry-season irrigation. For recommendations on how much to water your plants, visit: www.srcity.org/3446/Watering-Recommendations.

AN OUNCE OF PREVENTION

Regular maintenance of your LID feature will save money and time and will prevent the need to restore or replace the feature later. The maintenance recommendations in this guide will help you keep your LID feature in compliance & thriving.


YES
Vegetative cover is greater than 50%
Overflow Drain is unobstructed
Approved plants are diverse & healthy, providing habitat & filtration
Weeds have been hand pulled & no weed liner is present
Interlocking Arbor Mulch prevents erosion
No sediment buildup, leaves or trash present
GOOD MAINTENANCE



NON-COMPLIANT FEATURE

NO

VEGETATED LID FEATURES

DO…

- ✓ **Choose approved plants** from the Approved Plant List, found at: streetstocreeks.org/lid-for-owners.
- ✓ **Maintain at least 50% vegetative cover** (weeds & trees don't count!).
- ✓ **Irrigate** plants, as needed in the dry season, & during root establishment.
- ✓ **Hand-pull weeds.**
- ✓ **Use arbor or vineyard mulch** that interlocks, is rough-cut & less likely to float.
- ✓ **Clear inlets** of sediment, trash, & leaf debris before the wet season to allow water to flow in.
- ✓ **Clean out overflow drain** so it flows freely.

DON'T…

- ✗ Modify or alter the LID without approval from your local agency.
- ✗ Install plants not on the Approved Plant List.
- ✗ Cut desired vegetation too short or too often.
- ✗ Let vegetation die off or fall below 50% coverage.
- ✗ Use herbicides.
- ✗ Add weed cloth or large quantities of rock.
- ✗ Use evenly cut wood chips which float & clog drains.
- ✗ Allow sediment to build up.
- ✗ Alter grade or remove cobble at curb inlets.
- ✗ Allow regular foot traffic that may compress engineered soils.

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VEGETATED LID FEATURES

GENERAL MAINTENANCE GUIDANCE

Follow these general maintenance guidelines for vegetated Low Impact Development (LID) features on your property.

ACTIVITY	NOTES	HOW OFTEN?	IDEAL SEASON(S) SPRING	SUMMER	FALL	WINTER
Remove **trash** and debris	Clean out any trash that may have accumulated. Put trash in garbage and any leaves or dead plant material into the compost.	Monthly and after every major storm	●	●	●	●
Remove accumulated **sediment**	Use a shovel or wet/dry vac to remove accumulated sediment at the inlets or bottom of feature. If sedimentation is severe, coordinate with City/County to help identify potential sources. If clogged with sediment, top layer of engineered soil may need to be replaced to maintain drainage.	When sediment reaches 2" in depth, or once a year		●	●	
Water plants	Ensure irrigation timer is working and properly programmed for weather conditions. Run system to check for leaks or breaks and repair. Hand water regularly if there is no irrigation system. Visit srcity.org/WateringRecommendations, or other local water agency, for watering details.	Dry season, and especially when plants are young	●	●	●	
Remove **weeds**	Hand pull weeds, making sure to remove the root. It is easiest to pull weeds while young. Use of herbicides is strictly prohibited.	Monthly in growing season, ideally before weeds make seeds	●	●		
Replace **plants** that have not done well	Replace plants that have died with plants from the original approved planting plan or equivalents from the Regional LID Manual Approved Plant List. Feature requires a minimum of 50% vegetation.	Replace as needed, inspect 1x/year	●		●	
Inspect and maintain **structures** such as inlets and overflow drain	Clear any plants that have grown over the inlets or drain. Remove any leaves, sediment, mulch, or other debris that may be clogging inlets/drains/splash pads. Make sure drainage grates are in place and in good repair.	As needed, inspect 1x/year			●	
Check plastic **liner** (if applicable)	If there is a plastic liner, check that it is still attached to the sidewalls of the planters. If it is not attached, it will need repair because water can flow underneath the liner and cause problems.	As needed, inspect 1x/year			●	
Clean up **grasses** and grass-like plants	Rake out dead material from grasses/sedges/rushes, and if needed, trim to appropriate length. To maintain long term health do not cut too short or too often.	As needed, inspect 1x/year	●			
Prune trees and shrubs	Prune up lower branches of trees to maintain sidewalk clearance. Deadhead or lightly trim shrubs, thinning if needed to maintain sunlight to understory plants.	As needed, inspect 1x/year				●
Add non-floatable **mulch**	If soil looks bare, add 2-3" of non-floatable mulch such as arbor mulch. Avoid evenly cut wood chip mulch, which floats & can cause clogging. Make sure mulch is pulled away from plant stems.	As needed, inspect 1x/year	●	●		

THE RIGHT PLANTS IN THE RIGHT PLACES

Here are commonly used species from the Approved Plant List. Increase curb appeal in your LID feature by using a variety of species including flowering plants. Plants in the low zone do most of the filtering, so you'll want to make sure plantings are densest there. Find the Approved Plant List at https://www.streetstocreeks.org/lid-for-owners.

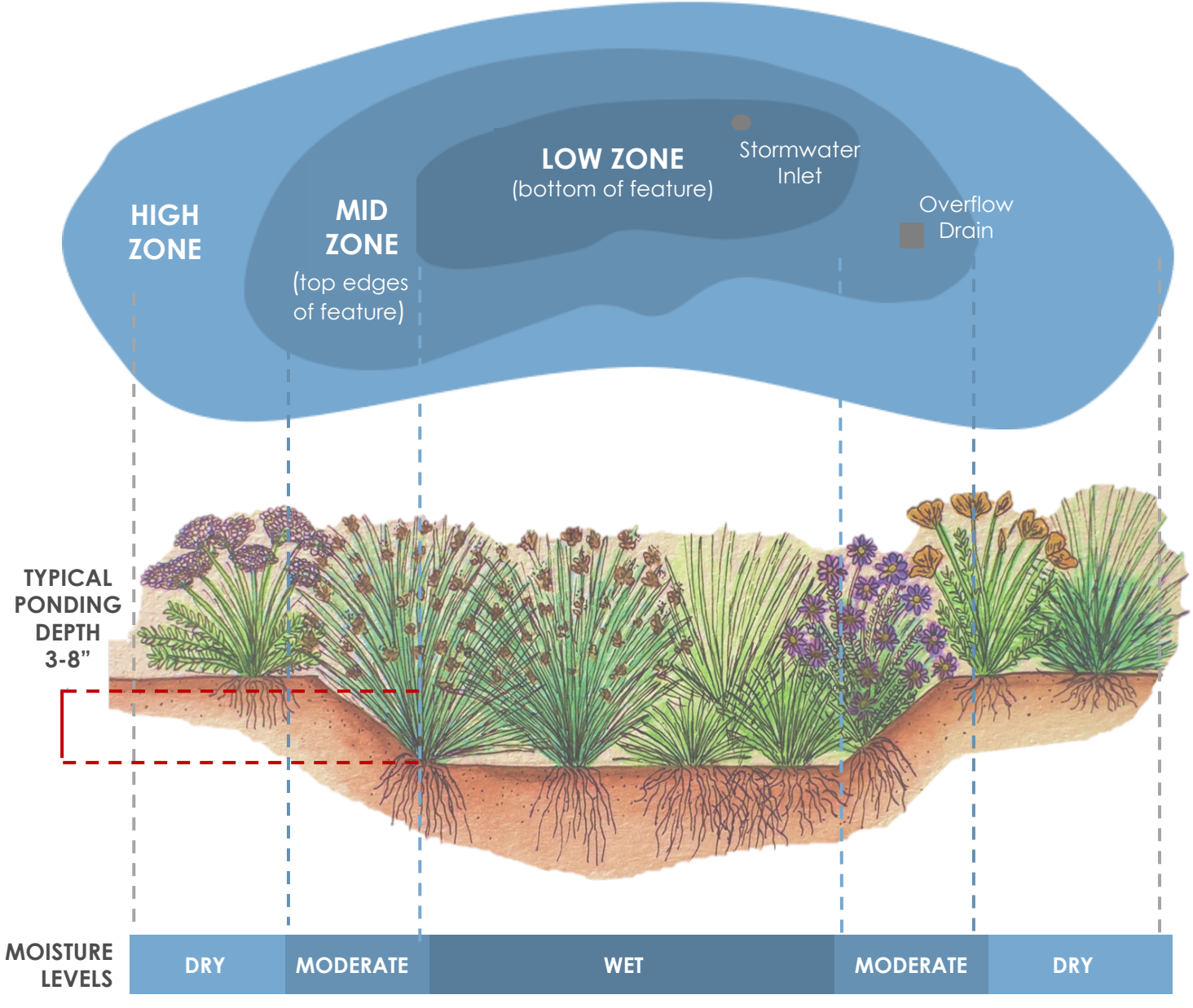


Illustration by Ashley Sporleder

LOW ZONE



Santa Barbara Sedge
Carex Barbarae



California Meadow Sedge
Carex Pansa



Grey Rush
Juncus Patens

MID ZONE



Douglas Iris
Iris Douglasiana



Sticky Monkey Flower
Mimulus Qurantiacus



Native Aster Species
Aster Spp.

HIGH ZONE



Cleveland Sage
Salvia Clevelandii



Manzanita
Arctostaphylos Spp.



Deer Grass
Muhlenbergia Rigens



Camas Lily
Camassia Leichtilinii



Yarrow Cultivars
Achillea Millefolium



California Fescue
Festuca Californica



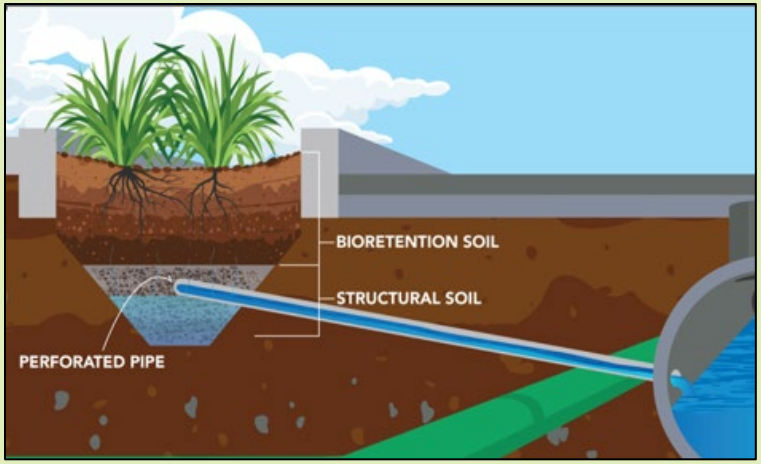
California Lilac
Ceanothus Spp.



California Fuchsia
Epilobium Canum



Blue Bunchgrass
Festuca Idahoensis



Bioretention soil is designed to filter stormwater coming off roadways & impermeable surfaces.



This LID feature under construction shows structural components that are not visible once it is completed.

SOIL, MULCH & ROCK

Bioretention Soil

Soil within an LID feature is engineered to absorb and filter storm water. If bioretention soil is altered, the property owner will be required to replace the feature, at their expense, to the original design plan.

Interlocking Mulch



Mulch used to replenish groundcover must be interlocking, and rough cut. **Arbor or Vineyard** mulches are recommended and reduce the likelihood of it being transported to the storm drain.

Cobble and Rock

Cobble placed around inlets are energy dissipators. They slow the force of water flowing into the LID feature thereby reducing erosion within the feature. Cobble captures sediment and trash from road surfaces. It is important that this cobble remains in place.

Cobble and/or rock may be used in lieu of mulch. If used, it is imperative that the slope of the feature is maintained, the rocks do not inhibit the flow of stormwater into the feature, restrict designed infiltration rate or block the overflow drain.

Cobble placed at curb inlets reduce erosion within an LID feature.



PLANT CARE & ALTERATIONS

Plant Care

All plants need air, sunlight, water and nutrients to survive, but not every plant needs the *same* care. Although it is easier to over prune plants to reduce the frequency of care, it can lead to premature die off. To prevent having to revegetate an LID feature, please follow specific plant care recommendations for the plants living in your LID feature.

Herbicides

Herbicides **shall not be used** in an LID feature. LID features are designed to remove pollutants before stormwater enters the storm drain system. If added, herbicides create the potential for harmful chemicals to enter the storm drain system and inevitably the creeks.

Alterations

Any modification of LID **requires prior approval** from both your agency and the local Regional Water Quality Control Board. Walkways, paving stones, or structures that inhibit the infiltration of stormwater are **not allowed** otherwise. Contact your local agency to submit a project specific request to deviate from a constructed LID design before altering or deviating from the original design of the LID feature. Modifications without prior approval will be subject to corrective actions to return the LID feature back to the original design at the owner's expense.

Weed Liner

Weed liner is **not allowed** in LID features. Although it reduces unwanted vegetation, it will clog, reducing the function of LID features. If weed liner is used, you will be required to remove it.



The Common Rushes in this Bioretention feature have been pruned appropriately.



Weed liner is not allowed in LID.



Modifications **require prior approval** and are subject to corrective actions to replace the LID back to the original design.

LID features are designed to remove pollutants before stormwater enters the storm drain system. They are an extension of the storm drain.

Only rain down the storm drain!

FACTSHEET: PERMEABLE HARDSCAPING

Permeable hardscaping contains **pores or separation joints** that allow water to flow through an **infiltration bed of gravel or drain rock**. Types of permeable pavement include porous asphalt and concrete, open joint or interlocking pavers, and plastic or concrete grid systems with gravel-filled or plant-filled voids. Permeable hardscaping can be found in parking lots, driveways, sidewalks, patios, or sometimes in street gutters as part of a vegetated roadside bioretention basin.

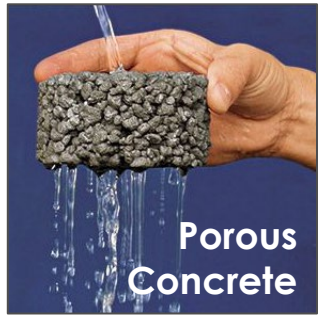
PREVENT CLOGGING

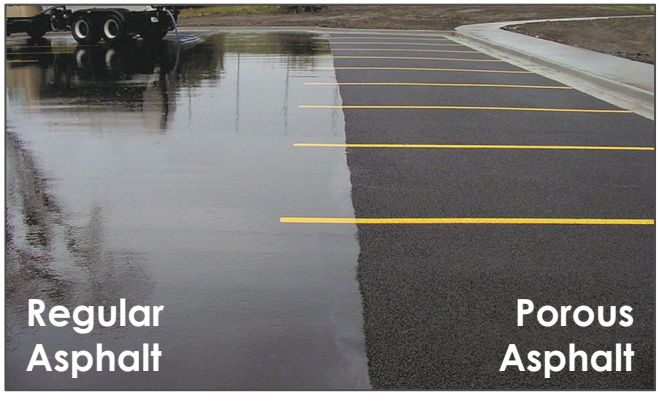
The most important maintenance for permeable hardscaping is keeping excess sediment out of the pore spaces. Keeping sediment from washing onto permeable hardscaping is the easiest form of preventative maintenance. Use a high-powered wet vacuum 1-2 times per year to remove sediment. Reach out to your local agency for the most effective cleaning methods.

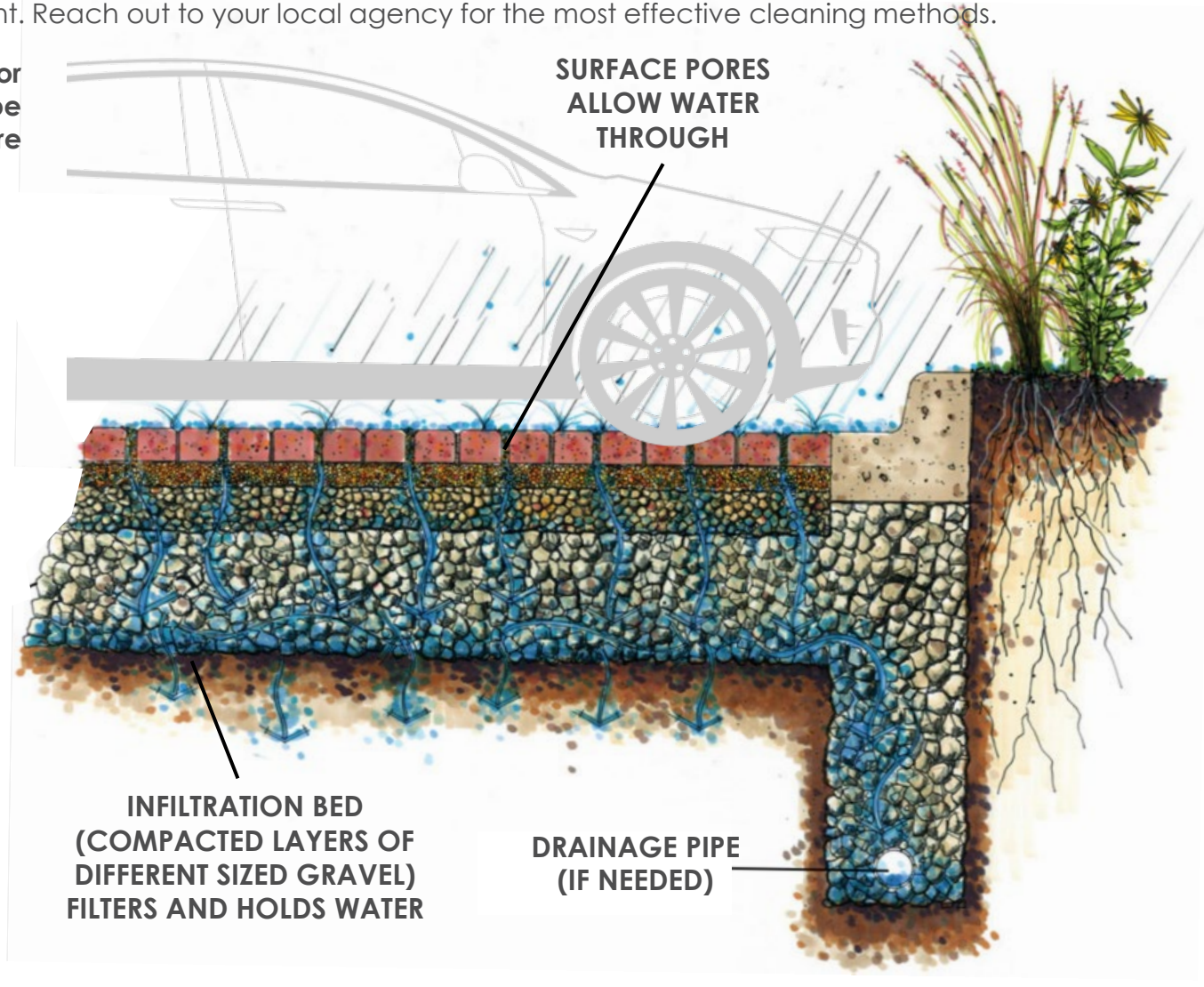
If sediment builds up in the surface pores or below in the gravel bed and cannot be cleaned out, the feature may require replacement.

EXAMPLES









PERMEABLE HARDSCAPING MAINTENANCE

Permeable Pavement allows stormwater to flow into Roadside Bioretention features.

YES

Pore spaces are free of sediment. Pavement has no runoff during low-intensity storms.

NO

Sediment is clogging pore spaces, Reducing the flow of water into the feature.

DO…

- ✓ **Prevent** oil & automotive fluid drips; **clean up** spills immediately.
- ✓ **Prevent soil washout onto the pavement** by maintaining adjacent landscaped areas.
- ✓ **Clean up small amounts of sediment & leaves ASAP** using a wet/dry vacuum.
- ✓ **Hand pull weeds** & remove sediment to inhibit weed growth.
- ✓ **Use a tarp** under any landscaping materials that must be stored on permeable hardscaping, or store materials elsewhere.
- ✓ **Remove deeper sediment** at least semi-annually.
- ✓ **Clean drop inlets** twice per year (if present).

DON'T…

- ✗ Allow leaking vehicles to remain unprotected on permeable pavement.
- ✗ Power wash to clean permeable pavement. This cleaning method forces dirt & debris deeper into void spaces.
- ✗ Allow soil/mulch storage or construction staging on unprotected permeable hardscaping.
- ✗ Allow sediment to build up.
- ✗ Use herbicides to remove weeds.
- ✗ Wash mud from your vehicle, tools, or other surfaces onto permeable hardscaping.
- ✗ Repair vehicles on top of permeable hardscaping.

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PERMEABLE HARDSCAPING

GENERAL MAINTENANCE GUIDANCE

Follow these general maintenance guidelines for vegetated Low Impact Development (LID) features on your property.

ACTIVITY	NOTES	HOW OFTEN?	IDEAL SEASON(S) SPRING	SUMMER	FALL	WINTER
Check adjacent landscaping for washout potential	If any bare spots or eroded areas are observed within nearby planted areas, they should be replanted/mulched/stabilized ASAP. If any washout does occur it should be cleaned off the pavement immediately to prevent further clogging of the pores.	As needed	●	●	●	●
Use a wet/dry vac (such as a shop vac) for **quick cleanups**	If you notice small amounts of sediment or leaves have been deposited on your permeable pavement, a quick cleanup using a household wet/dry vac can prevent bigger cleanups later.	As needed	●	●	●	●
Remove **weeds**	It is easiest to remove any weeds growing in the joints or pore spaces of your permeable hardscaping while they are still small. Use of herbicides is strictly prohibited.	2x/year	●			●
Remove **deeper sediment** with a commercial vacuum sweeper	For large areas, hire a commercial vacuum sweeper truck. For small areas, walk-behind vacuum sweepers are available for rent at some local equipment rental companies. Ensure that your machine uses vacuum action, not high-pressure air or water as this can drive sediment deeper. Grid pavers with large open spaces do not require vac sweeping.	1x /year in fall for low traffic areas 2+x/year for high traffic areas	●		●	
Inspect/clean **inlet** structures draining to the infiltration beds	If there are curb cuts or pipes that bring water to your permeable hardscaping, check that they are clean. This will help prevent sediment buildup and save on cleaning later.	2x/year	●		●	
Inspect/clean subdrain **outlets** (if applicable)	If your structure has subdrains, find the outlets and make sure they are not blocked.	1x/year			●	
Test for permeability	If water is flowing across permeable pavement during low intensity storms or standing on the porous pavement 30 minutes after a rain event, it's time for a deep clean.	1x/year				●

MAINTENANCE RECOMMENDATION

Use a high-powered wet vacuum 1-2 times per year to remove sediment. Reach out to your local agency for the most effective cleaning methods.

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TREE POD BIOFILTER FEATURES

GENERAL MAINTENANCE GUIDANCE

Follow these general maintenance guidelines for vegetated Low Impact Development (LID) features on your property.

ACTIVITY	NOTES	HOW OFTEN?	IDEAL SEASON(S)			
			SPRING	SUMMER	FALL	WINTER
Remove **trash** and debris	Clean out any trash that may have accumulated. Put trash in garbage and any leaves or dead plant material into the compost.	Monthly and after every major storm	✓	✓	✓	✓
Remove accumulated **sediment**	Use a shovel or wet/dry vac to remove any accumulated sediment at the inlets or bottom of feature. If sedimentation is severe, coordinate with City/County to help identify potential sources. If clogged with sediment, top layer of engineered soil may need to be replaced to maintain drainage.	When sediment reaches 2" in depth, or once a year		✓	✓	
Water plants	Ensure irrigation timer is working and properly programmed for weather conditions. Run system to check for leaks or breaks and repair. Hand water regularly if there is no irrigation system. Visit srcity.org/WateringRecommendations, or other local water agency, for watering details.	Dry season, and especially when plants are young	✓	✓	✓	
Remove **weeds**	Hand pull weeds, making sure to remove the root. It is easiest to pull weeds while young. Use of herbicides is strictly prohibited.	Monthly in growing season, ideally before weeds make seeds	✓	✓		
Prune trees and shrubs	Prune up lower branches of trees to maintain sidewalk clearance. Deadhead or lightly trim shrubs, thinning if needed to maintain sunlight to understory plants.	As needed, inspect 1x/year				✓

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FLOW THROUGH PLANTER FEATURES

GENERAL MAINTENANCE GUIDANCE

Follow these general maintenance guidelines for vegetated Low Impact Development (LID) features on your property.

ACTIVITY	NOTES	HOW OFTEN?	IDEAL SEASON(S) SPRING	SUMMER	FALL	WINTER
Remove **trash** and debris	Clean out any trash that may have accumulated. Put trash in garbage and any leaves or dead plant material into the compost.	Monthly and after every major storm	●	●	●	●
Remove accumulated **sediment**	Use a shovel or wet/dry vac to remove accumulated sediment at the inlets or bottom of feature. If sedimentation is severe, coordinate with City/County to help identify potential sources. If clogged with sediment, top layer of engineered soil may need to be replaced to maintain drainage.	When sediment reaches 2" in depth, or once a year		●	●	
Water plants	Ensure irrigation timer is working and properly programmed for weather conditions. Run system to check for leaks or breaks and repair. Hand water regularly if there is no irrigation system. Visit srcity.org/WateringRecommendations, or other local water agency, for watering details.	Dry season, and especially when plants are young	●	●	●	
Remove **weeds**	Hand pull weeds, making sure to remove the root. It is easiest to pull weeds while young. Use of herbicides is strictly prohibited.	Monthly in growing season, ideally before weeds make seeds	●	●		
Replace **plants** that have not done well	Replace plants that have died with plants from the original approved planting plan or equivalents from the Regional LID Manual Approved Plant List. Feature requires a minimum of 50% vegetation.	Replace as needed, inspect 1x/year	●		●	
Inspect and maintain **structures** such as inlets and overflow drain	Clear any plants that have grown over the inlets or drain. Remove any leaves, sediment, mulch, or other debris that may be clogging inlets/drains/splash pads. Make sure drainage grates are in place and in good repair.	As needed, inspect 1x/year			●	
Check plastic **liner** (if applicable)	If there is a plastic liner, check that it is still attached to the sidewalls of the planters. If it is not attached, it will need repair because water can flow underneath the liner and cause problems.	As needed, inspect 1x/year			●	
Clean up **grasses** and grass-like plants	Rake out dead material from grasses/sedges/rushes, and if needed, trim to appropriate length. To maintain long term health do not cut too short or too often.	As needed, inspect 1x/year	●			
Prune trees and shrubs	Prune up lower branches of trees to maintain sidewalk clearance. Deadhead or lightly trim shrubs, thinning if needed to maintain sunlight to understory plants.	As needed, inspect 1x/year				●
Add non-floatable **mulch**	If soil looks bare, add 2-3" of non-floatable mulch such as arbor mulch. Avoid evenly cut wood chip mulch, which floats & can cause clogging. Make sure mulch is pulled away from plant stems.	As needed, inspect 1x/year	●	●		



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LID

Decals that identify LID features may be available in your jurisdiction.

For more information and resources visit:
streetstocreeks.org/lid