

Green Infrastructure Design Guide

First Edition | 2019

Operation and Maintenance Overview









Maintaining Urban Green Infrastructure

- Maintaining green infrastructure is not unlike providing health care for ourselves. For example, it is recommended for people to get health and dental check-ups/cleanings on a regular basis.
- With proper and regular care, stormwater facilities can last for decades and continually provide water quality and flow reduction benefits.
- Without reminders for regular green infrastructure maintenance, it is sometimes easy to neglect ongoing care or simply not care for it in the correct way. This, of course, can ultimately lead to problems.
- The purpose of Operation and Maintenance within this guidebook is to provide landscape contractors, designers, municipal staff, and the community-at-large with simple and user-friendly recommendations and reminders on how provide for the successful long-term function of built urban green infrastructure systems in San Mateo County.

What This Guidebook Covers vs. C.3 Regulated Project Guide

- The Operation and Maintenance within this guidebook is a supplement document to the overarching C.3 Regulated Project Guide.
- For the more day-to-day guidance on green infrastructure maintenance the guidance within the following pages is the preferable resource to follow.
- This guidebook aims to provide very specific and detailed recommendations on how to maintain urban green infrastructure without the being too technical in nature.
- The guidance within this guidebook is primarily focused on small to moderately sized ultra-urban landscaped-based green infrastructure facilities that employ biofiltration and pervious paving applications.





Operations and Maintenance

Subsections Summaries

Section 6.1 Introduction describes the common types of green infrastructure maintenance issues found in San Mateo County, what do prepare for when conducting site maintenance, and types of green infrastructure maintenance programs.

Section 6.2 Hardscape and Functional Maintenance Activities describes maintenance issues found with the hardscape and functional elements of green infrastructure facilities such as sediment and trash removal, pervious paving cleaning, erosion control and troubleshooting too much or too little standing water within landscape areas.

Section 6.3 Landscape-Related Maintenance Activities illustrates landscape maintenance related activities such as mulch application, irrigation system checks and repairs, trimming plant material, plant replacement, weeding, fertilization, and maintaining site safety, visibility, and site aesthetics.

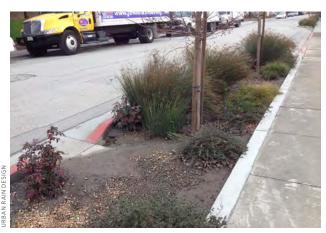
Section 6.4 Maintenance Quality Observation Levels provides guidance to determine maintenance activities based on observed levels of needs.

Section 6.5 Annual Maintenance Actions provides a suggested detailed annual maintenance plan a for both hardscape/functional activities and landscape-related activities.

Section 6.6 Annual Landscape & Hardscape Maintenance Schedule illustrates a suggested an annual maintenance checklist by month for both hardscape/functional activities and landscape-related activities.

Appendix 5 of this guidebook also includes sample maintenance plans for green infrastructure landscape areas and pervious paving applications.

6.1 Operations and Maintenance



Street sediment takes over this landscape on a regular basis without adequate prevention and maintenance.



A River rock used to minimize erosion inhibits flow and creates sediment accumulation that is difficult to remove.

Sediment Removal Needs

- Inadequate or missing hardscape forebays at curb cut locations to help collect sediment.
- Little or no drop in grade between curb cuts and landscape areas which causes sediment to accumulate.
- Too infrequent of maintenance schedule for removing both sediment and trash which causes further accumulation of material.
- Cobble/river rock placed at curb cut entrances causes sediment to build up between rock void space, promotes weed growth, and can inhibit the flow of stormwater if the cobble is placed above the grade of the runoff flow line.

Hardscape/Structural Maintenance Needs

- Inadequate or missing hardscape forebays at curb cut locations to help control erosion and ease sediment removal.
- Missing check dams/weirs to help retain water at desired ponding depths.
- Poorly constructed curb cuts that do not easily allow water to enter the landscape because of hardscape grading issues.
- Poorly installed overflow outlets which may need replacement to assure the desired control of water retention.

Landscape Related Maintenance Needs

- Landscape related maintenance issues of green infrastructure facilities in San Mateo County are quite numerous.
- Private green infrastructure maintenance does not seem to suffer as much in the form of lack of frequency of maintenance (as many private property owners have established maintenance crews that visit sites regularly), but more so the poor execution of landscape maintenance.
- Public green infrastructure, such as green streets, suffer from both lack of frequency and poor execution. The most significant landscape maintenance issues in the form of poor maintenance execution.
- Inadequate or missing mulch layer, wrong type of mulch material, and incorrect placement of mulch material.
- No replacement of dead plant material/poor plant coverage.
- Exposed/broken irrigation systems and improper irrigation coverage.
- Excessive trimming of plant material and/or wrong timing to trim plant material.



Excessive plant trimming has caused severe plant dieback and eventual plant death.



▲ Lack of mulch exposes the soil to erosion, causes plant stress, and can expose drip irrigation lines.



▲ This newly installed green infrastructure facility will need regular care in the first years of establishment to ensure optimum performance and a healthy start.



Bay-Friendly Landscape Guidelines should be embraced by both municipal staff and the general public.

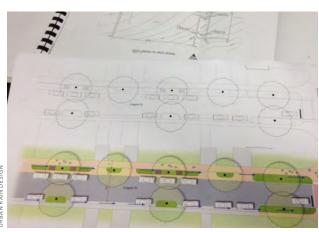
Early Maintenance Intervention for Newly Built Projects

- It is important to make sure that there is a high-level of maintenance conducted during the first years of post-construction establishment to assure that these facilities have the best start in life.
- Having a strong maintenance plan, an agreed upon and responsible party for maintenance services, and an engaged owner of the facilities (whether private or public), is absolutely necessary.
- Even better than your standard agreement-based maintenance plan would be an "Early Intervention Maintenance Plan," which would aggressively monitor and perform maintenance for the first two years of a facilities life.

Bay-Friendly Landscape Guidelines

Because green infrastructure is based upon mimicking natural hydrologic systems using a landscaped approach, it is highly recommended that maintenance staff utilize **Bay-Friendly Landscape Guidelines** as promoted by ReScape California.

- 1. Landscape Locally
- 2. Less Landscape Sent to the Landfill
- 3. Nurture the Soil
- 4. Conserve Water
- 5. Conserve Energy
- 6. Protect Water and Air Quality
- 7. Protect and Maintain Wildlife Habitat



▲ Obtain and review all design plans and maintenance logs prior to going to the project site for maintenance activity. Contact project designers with any questions.



▲ Providing extensive photo documentation of after-construction condition and ongoing maintenance activities is a critical tool for observing changes at the project site.

What To Do Before and While at the Project Site

- Check weather conditions to make sure that there are ideal conditions for maintenance. There should be no landscape maintenance when the soil is saturated.
- Check design plans to understand design intent, plant species used, and site grading. It is also useful if digging is required and determine the location of unseen elements such as irrigation lines, underdrains, overflow pipes, etc.
- If possible, meet with the designers to talk over the project's design intent.
- Check maintenance logs to see when past maintenance has been performed, including the last scheduled maintenance activity.
- Notify property owner(s)/city agency and get permission to enter and perform maintenance activities.
- If using a volunteer crew to perform maintenance activities, coordinate with any individuals.
- Visit the site beforehand and determine what tools/safety equipment will be needed for maintenance activities.
- Determine appropriate disposal sites for any debris/landscape materials.

6.1 Operations and Maintenance

Photo Documentation of Maintenance Activities

- It is vital that photographs should be taken after the project has been completed, at the commencement of the maintenance period.
- Documentation of the existing conditions establishes a maintenance benchmark before damage, disrepair or neglect compromise the appearance and function of the site.

Safety and Hazard Considerations

- To create a safe environment, warning signage should be placed to alert vehicles to the presence of maintenance personnel.
 Additionally, personnel can wear bright clothing and safety vests while working in these conditions.
- Personnel should wear appropriate clothing, footwear, hand protection, and depending on type of maintenance activity, eye and ear protection.
- In the case of injury, first aid supplies should be readily available.
 Any injured personnel should be immediately evaluated for the necessity of ceasing work and obtaining professional medical help.
- These safety considerations are not holistic. Any maintenance program responsible for the stormwater facilities should have effective safety procedures in place.



Data Logs

In addition to photo documentation, maintenance activities should be recorded in written form (i.e. a data log). Information in data logs provides a reference of maintenance activity at a site. If maintenance crews or key personnel changes, the new personnel can access maintenance history, including the types of tasks usually performed on site, typical problems encountered and solutions. Additionally, longstanding maintenance crews don't have to rely on memory to recall maintenance history.

Information typically recorded in data logs includes the following:

- Changes that have been made (i.e. dead plant replaced, irrigation sprinkler head repaired)
- Supplies needed at the next maintenance visit (i.e. quantity of mulch required to restore depleted levels)
- Notate things that need to be closely monitored over the next several site visits (i.e. a struggling shrub gradually being shaded by a maturing tree that may require replacement)



▲ Public works often maintain green infrastructure but are encouraged to seek specific green infrastructure training.



▲ The general public can help maintain green infrastructure facilities as part of an "Adopt-a Rain Garden" campaign.

Types of Maintenance Programs

Many property owners, cities, or agencies utilize one or multiple types of programs to assure the best possible performance of their projects. Below lists a few of the most common types of maintenance programs.

Private Maintenance Crews

 The advantage of using private landscape contractors is that they are professionally licensed to perform landscape maintenance, offer competitive fees for completing work, and can meet the staffing needs in providing maintenance for multiple projects.

Public Maintenance Crews

 While it may be easier to have "in-house" crews work on green infrastructure maintenance, limited budgets and staff shortages are common place.

Adopt-A-Rain Garden Public/Private Partnerships

- Adopt-a-Rain Garden allows interested citizens to volunteer and perform selective green infrastructure maintenance activities such as weeding, plant trimming, sediment and trash removal, and simple observation of performance under the guidance of city staff.
- This type of maintenance program will likely require at least one trained city/agency staff person in green infrastructure maintenance to coordinate the Adopt-a-Rain Garden program.

6.1 Operations and Maintenance

Gardening/Sustainability Clubs

 School, church, or UC Master Gardeners are always recruiting individuals to help with community-based volunteer efforts. This type of maintenance program will likely require at least one trained club/program staff person in green infrastructure maintenance to coordinate the group effort.

Skills Training and Employment for Disadvantaged Citizens

- There are cities throughout California that are helping disadvantaged and/or homeless individuals find employment by offering paid job skills training for city beautification/maintenance.
- Davis, California currently offers a program that provides employment skills training and employment opportunities to persons experiencing homelessness—helping them become selfsufficient, more-connected members of the community.

Green Infrastructure Maintenance Training Opportunities

- The National Certification of Green Infrastructure (NCGIP) sets national certification standards for green infrastructure construction, inspection, and maintenance workers.
- The program provides specific green infrastructure training in the form of workshops to interested agencies and includes a standardized exam for certification.
- See www.ngicp.org for additional inforamtion on this national program.



▲ The Davis "Pathways to Employment" program helps the homeless find paid work for streetscape maintenance.



▲ Organized groups, such as the UC Master Gardener Program can provide highly-trained volunteer personnel.

AVIS ENTERPRISE



A stormwater curb extension curb cut full of sediment accumulation.



▲ River rock used to minimize erosion creates pockets of sediment accumulation that is difficult to remove.

Sediment and Trash Accumulation

- Sediment is small particulate matter such as soil, small leaf debris, gravel, and road particulates. In addition, pollutants such as oil, grease, metals, and other compounds are often found bound to the sediment load.
- Sediment can build up over time creating difficult conditions for plant growth, reduce the porosity of both vegetated or pervious paving systems, and can impede the flow of runoff into vegetated systems.
- Sediment is more prominent and problematic with street and parking lot conditions.
- Some streets and/or parking lots have higher sediment loads than other based on the surrounding conditions and the amount of tree canopy cover.
- Common failures of stormwater facilities is having the entry points of stormwater blocked with debris. In fact, just one-quarter inch of sediment or debris build-up can prohibit the flow of runoff into a stormwater facility.
- The best means to remove debris from curb cuts is by using nonmechanical tools such as rakes, shovels, and by hand grabbers to lift and remove debris.

Sediment Forebays

- Sediment forebays are areas immediately downstream of stormwater entry points that allows sediment loads to be deposited prior to entering a landscape system.
- Sediment forebays are extremely important to limit the amount of sediment impacting vegetated stormwater facilities.
- Typically made of a concrete slab, pavers, or other hardscape structure, the sediment forebay is a smooth level area that can easily allow for a flat-bed shovel, rake, or broom to lift out sediment. Alternatively, the hardscape forebay allows for a vacuum hose (e.g. Vactor®) to suction sediment.
- The use of river rock, or cobble, is NOT recommended for a sediment forebay at stormwater entry points. While cobbles may be useful for erosion control, the uneven surface provides desirable conditions for weed growth, and does not allow for easy removal of the sediment.
- Sediment forebays are often recessed 2 to 3 inches below the entry area of stormwater flow to provide capacity for some sediment to build up on the hardscape slab.

Maintenance Schedule

 It is best if sediment and trash be removed on a monthly basis and during dry conditions to minimize the potential for compacting soil during the removal process.



Helpful Tips

Identify off-site sediment sources early on, notify the municipality, and ultimately have the property owner address the stormwater runoff and sedimentation issue.

Also, regular street sweeping and leaf pickup by property owners or municipal staff can dramatically reduce the amount of sediment.

Organizing regular neighborhood trash pickup, gutter sweeping, and other maintenance events.



This stormwater planter features a concrete sediment forebay that can be cleaned easily using a flat-bed shovel.

RBAN RAIN DESIGN



Sediment build-up within the joints of interlocking concrete pavers.



▲ The void space of pervious concrete should be free of sediment and debris by regular sweeping or blowing.

Pervious Paving Sweeping Maintenance

 Permeable paving areas are to be kept free of all trash a debris to maintain permeability.

Interlocking Joint Concrete Unit Pavers

- Proper maintenance of permeable pavers ensures that water may still permeate the paver joints at the designed infiltration rate.
- The surface of permeable pavers must be cleaned regularly to remove fine debris and organic material that may otherwise become lodged between pavers.
- Sweeping and blowing are two suitable cleaning methods. Pavers may also be cleaned with water and brushes, followed by the lowpressure hosing of the surface.
- Despite regular surface maintenance, eventually the aggregatefilled joints may become clogged. An annual infiltration test will determine if the aggregate requires replacement.

Pervious Concrete

- To maintain the permeability of pervious concrete, sediment must be removed or captured before it can infiltrate too deeply into the pervious concrete matrix.
- Routine maintenance include sweeping or blowing and will keep pavement clear of particulates.
- Where routine sweeping or vacuuming has been neglected, power washing may be necessary to restore adequate infiltration to the pavement. Power washing shall occur periodically.





A Without a hard splash pad, the soil downstream of this weir is experiencing significant erosion.



▲ It appears that the placement of rock prevents erosion, but runoff is moving around the rock and eroding soil.

Soil Erosion at Entry Points of Runoff

- Stormwater flow points such as curb cuts, trench drains, roof downspouts, and downstream check dams and weirs are common areas to find evidence of soil erosion.
- Erosion is often exasperated in areas of moderate to steeper slopes downstream from curb cuts.
- Simply applying a layer of pea gravel mulch or installing a modular concrete splash pad downstream of check dams, weirs, or curb cuts can often remedy areas of erosion.
- In areas of steep slopes adjacent to curb cuts, a concrete pad and side walls may need to be constructed to control the direction of water flow and dissipate energy.
- Disconnecting roof downspouts should be observed frequently for erosion. Hard surface splash zones can dissipate the vertical energy of water from the downspouts.
- Using concrete, metal, stone, and other hardscape materials can be added as a maintenance activity to better route and/or control the energy of water into landscape areas.

Maintenance Schedule

 Routine inspection prior to the oncoming wet season, and after heavy rainfall events, should be done at curb cuts, check dams, weirs, and downspout disconnection areas to notice any signs of erosion of soil or plant damage.



▲ This is a better curb cut option with hardscape walls and pea gravel mulch to control erosion.



A concrete splash pad and pea gravel mulch at the spill point of water reduces the potential of erosion.



A roof downspout uses a metal channel to direct roof stormwater into a planter area. It is critical that the planter maintains a rock mulch or concrete splash pad to dissipate the vertical energy of water spilling into the landscape area.



A concrete forebay at the street curb cut is placed lower than the gutter grade to disperse water flow.



▲ Smaller rock at the flow line of a vegetated swale reduces to potential of erosion.



▲ This stormwater curb extension suffers from poor infiltration to the point where standing water occurs frequently enough to allow for algae growth and invasive plant species to take over the landscape.



▲ Conversely, this stormwater curb extension has no check dams and is graded to retain little stormwater. As a result, most of the runoff simply enters the inlet without any ponding of water.

Troubleshooting Too Much Standing Water

- It may be necessary to adjust the overflow structure to retain less water and promote more evapotranspiration.
- The soil grade may need to be raised to retain less water and the overall footprint of the green infrastructure facility may need to be expanded.
- With projects that utilize an underdrain system, there also might be an issue of runoff not being able to enter the underdrain system due to a clogged condition.

Troubleshooting Too Little Standing Water

- In most instances it is due to have the overflow structure placed at too low of a grade to retain much water.
- It may be possible to either raise the overflow structure to increase capacity or install check dams around the overflow structure or at locations upstream.
- If water is entering underdrain systems at too fast of a rate, it is also possible to install a reduced diameter orifice at the end of the system.

Maintenance Schedule

 Routine inspection prior to the oncoming wet season, and after heavy rainfall events, should be done at curb cuts, check dams, weirs, and downspout disconnection areas to notice any signs of erosion of soil or plant damage.



▲ A rain garden without regular mulch replacement results in plant desiccation and exposed drip irrigation lines.



▲ This green street unfortunately uses organic mulch in the flow path of water which will in time float away.

The Benefits of Using Mulch

- Mulch benefits plant health, conserves water, and reduces maintenance requirements.
- A mulch layer insulates the soil, keeping it cool and alleviating evaporation from its surface. With a soil that remains moist and cool, plants experience less stress.
- Mulch suppresses weed growth, reducing the amount of manpower required to physically remove the weeds.
- Mulch ensures that soil remains nurtured which in turn supports a healthy landscape. The benefits of mulch far outweigh the costs of its upkeep.

Mulch Application

- Sustain no less than 3 inches deep of mulch material.
- Mulch is not required in areas where plant foliage completely covers the soil surface.
- It is critical that the mulch material not impede the flow of water through curb cuts. Make sure that the grade of the soil is low enough to add the mulch layer, but not impede water flow.

Maintenance Schedule

 Mulch levels should be monitored during scheduled site visits occur, or at a minimum of twice per year. After large storm events, mulch should be added or redistributed if mulch has been reduced to less than 3 inches deep.

Common Types of Mulch Material

Bark mulch

 Bark mulch is shredded or tumbled to a uniform size. It contributes to the organic material in a soil, is readily available, inexpensive and handles foot traffic well.

Arbor mulch

 Arbor mulch is composed of tree trimmings from both hard and soft wood that is ground into a consistent size. Arbor mulch's irregularity helps the mulch "knit" together and resist floating. Despite the resistance to floating, arbor mulch should also be placed above the wetted zone of stormwater facilities.

Pea gravel/Small-size crushed rock

 Pea gravel is an effective option for stormwater planters because of its weight helps prevent it from washing away. Similar to other mulches, pea gravel helps to maintain soil moisture though it does not contribute organic material to the soil.



A This green street uses pea gravel mulch in the flow path of water and organic mulch on upland side slopes.



Uniform Bark Mulch



Irregular Arbor Mulch



Pea Gravel



▲ Pea gravel mulch used on both the side slopes and wetted area of a vegetated swale prevents erosion.

ANNERS AN

▲ A poorly managed irrigation schedule and/or duration causes wasteful water runoff.



▲ Poorly performing irrigation can also quickly cause plant death from under-watering or lack of coverage.

Irrigation System Checks and Repairs

 To ensure that the landscape has the best chance to thrive both the irrigation schedule and overall functional components should be checked regularly by a qualified professional landscape contractor.

Checking Irrigation Schedule

- Irrigation scheduling involves determining the frequency and duration of watering intervals.
- Site characteristics like weather conditions, soil infiltration rates and drainage patterns affect this determination.
- Other scheduling factors include the watering requirements for a hydrozone and the application rate and distribution uniformity of an irrigation system within that hydrozone.
- Irrigation frequency (number of days/per week) should be based on seasonal evapotranspiration (ET) data (available through CIMIS).
- Irrigation duration (number of minutes per watering) within each hydrozone shall be based on the soil infiltration rate, species water requirement and rooting depth within the hydrozone.

Checking Irrigation Coverage

- The landscape contractor should maintain the irrigation system for optimum performance, as per manufacturer's specifications, by inspecting the entire system on an ongoing basis.
- This includes cleaning and adjusting all spray and bubbler heads, drip emitters and valves for proper coverage and adjusting for any and all overspray/runoff onto adjacent impermeable surfaces.
- Runoff of water from irrigation systems into or onto streets, sidewalks, stairs, or gutters is not permitted.
- It is important to check irrigation coverage to ensure that plants have enough water distributed to the root zone.

Irrigation System Repair

 Any irrigation components that are damaged should be replaced or repaired as soon as possible as to not stress plants or waste water.

Maintenance Schedule

• Every month during the season of operation, the irrigation system be observed for proper schedule, coverage, and any possible repairs needed. A more extensive annual irrigation system check should be performed prior to the start of the dry season in April.



A green street with exposed drip irrigation lines and valve box is very susceptible to breakage.



▲ This landscape is not trimmed excessively and left to grow more informally.



▲ Even more formal planting arrangements can by trimmed lightly to achieve desired form.

Proper Plant Trimming

- Bay-Friendly Landscaping suggests that plant trimming and pruning should complement the natural form and strengthen the structural integrity of the plant.
- Creating straight line hedges and topping plants, especially at the wrong time of year, does more harm than good.
- Selective trimming and pruning techniques of plant material can maintain adequate sight visibility, help spur new growth and flowering, and allow for better flow of stormwater throughout the landscape.

Seasonal Trimming

- Late winter or early spring, before bud break, is typically the best time to prune many species because new tissue forms rapidly at this time.
- Early summer-blooming shrubs should be pruned to early spring, prior to bud set, or in summer immediately following flowering.
 For shrubs that bloom in late summer or fall on current year's growth, prune in winter.

Reducing Size and Controlling Form Pruning

- Shrubs and groundcovers should only be pruned as required for safety, visibility, and plant health.
- Deciduous shrubs require maintenance pruning to keep them healthy and in scale with their surroundings.

Ornamental Grasses, Rushes, and Sedges Trimming

- Perennial ornamental grasses need to be sheared to maintain their appearance. Foliage should remain throughout winter. Once the grass begins to push new growth, cut back foliage to a height of 6 to 8 inches.
- Evergreen ornamental grasses should not be cut back annually. Instead, rake or comb through foliage with a rubber coated glove to remove spent foliage.
- Evergreen grass-like plants may also be raked or combed with a rubber coated glove to remove spent foliage.
- Rushes and sedges that are commonly planted in the wetter and lowest elevation stormwater facilities, should only be trimmed to avoid the plants flopping over and creating overcrowding conditions.
- If trimming is required for this reason, then only trim a maximum of 1/3 off of the top of the plants per year.

Maintenance Schedule

 During quarterly site visits, the maintenance staff should determine if pruning is required. Dead, broken or diseased branches need to be removed immediately. Shrubs and groundcovers should be trimmed back from sidewalks, curbs, and paved areas on a quarterly basis. Seasonal pruning depends on the flowering time of the shrub in question.



▲ Unfortunately, many rushes and sedges are severely cut back to the ground. Eventually these plants will die.



▲ If trimming is needed for rushes, cut back foliage to maintain a height of at least 12-18 inches.



A heavily pruned tree weakens the structure, reduces the canopy, and is aesthetically unpleasing.



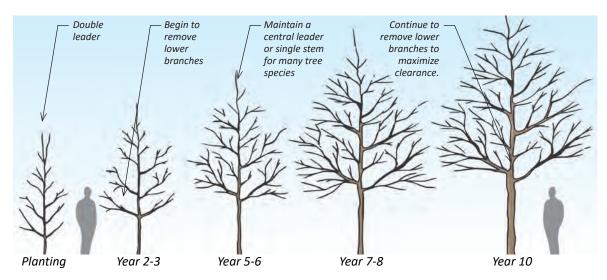
▲ Proper pruning of trees allows for better form, increases site visibility, and strengthens the structure of the tree.

Tree Pruning

- Trees require pruning to develop and maintain a healthy structure, to keep them free of disease and pests, and to keep roadways and walkways clear of obstructions.
- Young trees need to be pruned annually for up to five years after planting. The goal is to create a tree that has a strong central trunk with lateral branches spaced vertically and horizontally.
- Trees of all ages need to be regularly inspected for crossing, weak, diseased or dead branches so that they may be removed.
- No more than 20% of its live foliage should be removed or else cause unnecessary stress to a tree.
- In addition to tree structure and health, branches need to be trimmed so that they do not impede pedestrian or vehicular traffic.
- Trees should also be pruned to provide access to buildings, utilities and other sites, as needed.
- Tree pruning needs to be performed by trained, experienced personnel. While pruning occurs, the presence of an I.S.A.-certified arborist or tree worker is recommended.

Maintenance Schedule

 During semi-annual visits, monitor any broken or fallen branches need to be removed from trees. Arborists will best determine the appropriate months in which tree pruning should occur.

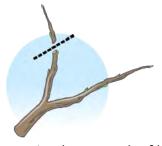


At time of planting, limit pruning. Remove only dead or broken branches. Where multiple leaders occur, reduce to a single top. Remove also narrow, V-shaped crotches. When pruning, avoid removing more than 1/3 of the total number of branches at one time. If the tree is weak, prune even less. Avoid damage to the trunk over the entire life of the tree.





▲ Thinning cuts remove branches at their points of origin or attachment. Used in moderation, thinning cuts reduce shrub density without stimulating regrowth. Make thinning cuts just above parent or side branches and roughly parallel to them.



▲ Heading cuts stimulate growth of buds closest to the wound. The direction in which the top remaining bud is pointing will determine the direction of new growth. Make heading cuts selectively to reduce tree/shrub height and retain natural form. For heading cuts, prune a quarter inch above the bud, sloping down and away from it.

▲ This vegetated swale contains less than 70% coverage of plant material and needs additional plant material added.



▲ This rain garden achieves 100% plant coverage within the landscape.

Plant Replacement Policy

- Any trees, shrubs or groundcovers found to be dead, damaged or missing are to be replaced with a plant that is identical in species and cultivar to the original.
- Once a plant is discovered dead, damaged or missing, the plant should be replaced as soon as possible.
- It is also important to determine why a plant or plant(s) have died so that any potential fixable causes (i.e. lack of water, too much water, etc.) can be remedied.
- It is important to maintain at least a 70% plant coverage within landscaped stormwater facilities.
- If by visual assessment, the landscape is determined to have inadequate plant coverage, add plants until the minimum or desirable coverage is achieved.
- Plants may need to be replaced if environmental conditions change such as solar exposure.

Landscape Succession

- As stormwater landscapes mature over time, some plants species may outperform others from the initial installation date or plants simply die out.
- Changing micro-climate conditions may require that selective removal and replacement of plants be made.
- Rarely is there a need to perform a complete replacement of plant material unless there is a significant change in the site conditions.
- The most common type of plant succession is where tree canopy expands over time and begins to create increasingly shady conditions for understory shrubs, groundcovers, and grass-like plants.
- Understory plants that initially may have been planted in full sun conditions now have to adapt to part-shade to full-shade conditions. Some plant species are just not that adaptable to sun conditions and may need to be replaced.
- The situation can be reversed as well if a once deep shade condition (next to a tall building or under a large mature tree) changes and suddenly becomes a full-sun condition. Then shadetolerant understory plants might need to be replaced with more sun tolerant species.



▲ Planted in 2005, this green street planted a series of street trees in full-sun conditions.



▲ Shown in 2016, this same project's tree canopy growth is so robust that it will eventually require new re-planted shade-tolerant understory plants.

QUADRIGA, INC.

6 2 Operations and Maintenance

Landscape-Related Maintenance Activities



▲ Without regular weeding maintenance, a stormwater landscape can auickly be overtaken by undesirable plants.



▲ Hand weeding, on a regular basis, is the most desirable method for controlling weeds.

Hand Weeding

- Hand weeding is the preferred maintenance approach to controlling weeds over using herbicides.
- A consistent weeding schedule must be maintained, so that weed growth does not reach a point where herbicide use would be required.
- When pulling weeds, it is critical to remove as much of the root system as possible as new weeds can grow from root remnants left behind in the soil.

Hand Weeding Schedule

 Weeding shall occur during regular site visits, or at a minimum of four times per year. All visible weeds are to be removed.

Herbicide Use

- Herbicide use should be only used as a method of last resort in response to stormwater landscape taken over by weeds.
- Herbicide use shall follow all State restrictions and Manufacturer's directions. Do not use herbicides 48 hours before predicted rain events or use until 48 hours after rain events. Restricted chemical herbicides may not be used under any circumstances.

Pesticide Use

- Bay-Friendly Landscaping emphasizes Integrated Pest Management (IPM) practices to control pests and diseases in the landscape.
- IPM uses cultural, mechanical, physical and biological control methods before using pesticides.
- Chemical controls are applied ONLY when monitoring indicates that preventative and non-chemical methods are not keeping pests below acceptable levels.
- When pesticides are required, the least toxic and least persistent pesticide that will provide adequate pest control is to be applied.

Chemical Use Record-Keeping and Reporting

 All herbicide and pest management activities should be documented and reported to the Project Site Owner.



Common Invasive Species



Cortaderia selloana Pampas Grass



Genista monspessulana



Ligustrum sinense Privet



Stipa tenuissima Mexican Feathergrass



Cytisus scoparius Scotch Broom



Hedera helix English Ivy



Phyllostachys spp. Bamboo



Vinca minor Periwinkle



A rain garden with compacted soils cannot maintain long term function.



A landscape with adequate mulch reduces the potential for soil structure damage.

General Soil Management

- Landscape-based stormwater facilities depend on soils that are biologically active and held together by plant roots.
- Maintenance activities are to be implemented to nurture biological activity, provide organic material and protect soil from damage.
 The most common type of soil damage includes over-compaction and soil erosion.
- Soil should be protected from compaction by assuring the pedestrian and vehicular traffic be confined to paved areas.
- Soil shall be protected from erosion by maintaining a vegetative cover over the soil to a possible extent and maintaining a 3-inch layer of mulch.

Soil Analysis Determines Fertilizer Application

- A healthy landscape, consistent with Bay-Friendly Landscaping, relies on organic fertilizers and soil amendments from natural sources that release elements slowly, which is preferred.
- Soil samples of the landscape need to be submitted annually for testing to an accredited and approved testing laboratory.
- An appropriate amount of fertilizer should be applied to supply the specified quantity of nutrient as determined by soil analysis and/or plant tissue analysis.
- Fertilizers shall be applied on a prescription basis only.



▲ Choose low-growing plant material and place trees outside of the site distance triangle.



▲ This green street allows for street trees to be limbed up to provide adequate height clearance for pedestrians.

Visibility Throughout Site

- Safety in a landscape is dependent on visibility throughout a site.
- As a rule, there should be a window of visibility between 3 and 7 feet above the ground plane where pedestrians and/or vehicles are present. This requires shrubs, grasses and groundcovers to be kept to a height of 3 feet.
- Select smaller plant species and cultivars that have a maximum height less than or equal to 3 feet.
- Trees need to be pruned so that their lowest branches are at a height greater than or equal to 7 feet.

Site Triangles

- Visibility needs to be maintained at street intersections to maintain pedestrian and vehicular sight lines.
- Planting within the determined sight triangle must be lower than three feet or limbed to a height greater than 7 feet.

Aesthetics

- An ample layer of mulch creates visual uniformity and neatness in the landscape.
- The correct trimming of shrubs and grasses strengthens health and maintains the natural form of the plant. Similarly, a tree that has be pruned to maintain strong structure is aesthetically pleasing.
- Inadequate plant coverage within a stormwater facility compromises not only functionality but also compromises aesthetics.

Operations and Maintenance 6.3

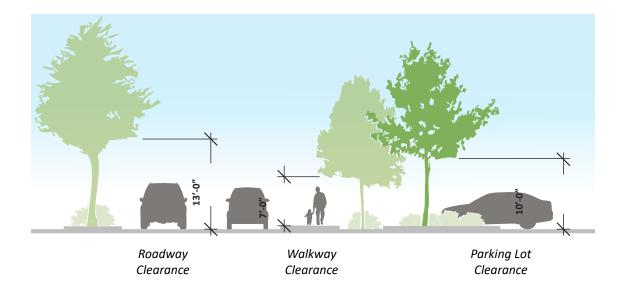
Landscape-Related Maintenance Activities



Trees within site triangle shall have a clearance of 7'-0" minimum between lowest part of canopy and sidewalk, and 13'-0" minimum between lowest part of canopy and the street per relevant jurisdiction.

Shrubs and groundcover within site triangle are not to exceed 3'-0" in height per relevant jurisdiction.

Line of sight





▲ Keeping plant material below 3 feet high at intersections provides a safe visibility triangle.



▲ The selective trimming of plants, allowing them to grow naturally, complements the natural form of the plant.

6.4 Operations and Maintenance Maintenance Quality Observation Levels

MULCH APPLICATION

Good, Continue Maintenance Routine



Condition: A 3-inch layer of mulch is maintained and kept at proper distances from shrub and tree plantings.

Continued Actions: Twice yearly observation for adequate mulch coverage.

Mediocre, Modify Maintenance Routine



Condition: The mulch layer is depleted. Mulch has been knocked or washed out of the landscape

Immediate Actions: Add or redistribute bark mulch where it has been reduced to less than 3 inches deep. Place mulch that has been knocked or washed out of planters back into place.

Poor, Overhaul Maintenance Routine



Condition: Mulch layer is absent.

Immediate Actions: Add a 3-inch layer of mulch. If mulch was once present, determine if a new type of mulch is needed to ensure longevity.

HAND WEEDING

Good, Continue Maintenance Routine



Condition: Little to no weeds visible within the planting area, sidewalks, gutters and pavement.

Continued Action: Quarterly hand weeding, or as necessary.

Mediocre, Modify Maintenance Routine



Condition: Several weeds can be found throughout the site.

Immediate Actions: Remove all visible weeds located in planted areas, sidewalks, gutters and pavement. Remove as much of the root system as possible. Dispose of weeds off-site.

Poor, Overhaul Maintenance Routine



Condition: Landscape is overrun with weeds.

Immediate Actions: Remove all visible weeds by hand, if possible. Herbicides should be used only as a last resort. Use only the least toxic herbicides. Develop a plan with the Owner before use.

6.4 Operations and Maintenance Maintenance Quality Observation Levels

PLANT COVERAGE

Good, Continue Maintenace Routine



Condition: Landscape achieves 100% plant coverage.

Continued Action: Monthly observation for proper coverage. Twice yearly plant addition in April and October, as necessary.

Mediocre, Modify Maintenance Routine



Condition: Landscape has about 70% plant coverage, achieving the minimum requirement for functionality.

Immediate Actions: If, by visual assessment, the planter is determined to have inadequate plant coverage, schedule the installation of additional plants. Refer to as-built drawings for plant species and size.

Poor, Overhaul Maintenance Routine



Condition: Landscape has less than 70% plant coverage.

Immediate Actions: Schedule the installation of additional plants. Refer to as-built drawings for plant species and size. Replace ill-adapted plants with a species better adapted to permanently altered environmental conditions.

PLANT HEALTH

Good, Continue Maintenance Routine



Condition: All plants are healthy, disease-free and suited to the environmental conditions.

Continued Action: Monthly site inspection for any plants that are dead, damaged, diseased, stressed or missing.

Mediocre, Modify Maintenance Routine



Condition: Few plants show signs of struggle, disease, pest-infestation or are broken.

Immediate Action: Analyze struggling plants for cause of struggle and correct. Remove struggling plants unlikely to recover or plants likely to infect surrounding plants. Replace with a healthy plant.

Poor, Overhaul Maintenance Routine



Condition: Plants are unhealthy, damaged, missing or dead.

Immediate Action: Analyze struggling plants for cause of struggle and correct, if possible. Remove struggling plants unlikely to recover or plants likely to infect surrounding plants. Replace with a healthy plant.

6.4 Operations and Maintenance Maintenance Quality Observation Levels

OVERALL TREE HEALTH

Good, Continue Maintenance Routine



Condition: Trees of all ages are healthy. Branches are strong and are pruned as necessary to reduce weight.

Continued Actions: Monthly removal of unhealthy branches and suckers, as necessary. Branch reduction once yearly in early June, as necessary.

Mediocre, Modify Maintenance Routine



Condition: Trees show signs of struggle, trunk/root damage, weak branches or have suckers growing.

Immediate Actions: Analyze trees for cause of struggle and correct. Remove dead, damaged or diseased branches of trees. Adjust tree grates. Provide adequate space for surface roots to grow. Remove suckers.

Poor, Overhaul Maintenance Routine



Condition: Trees are unhealthy, damaged, missing or dead

Immediate Actions: Analyze trees for cause of struggle and correct. Remove trees unlikely to recover. Replace removed or missing trees with a healthy tree.

VISUAL SAFETY & PUBLIC SAFETY

Good, Continue Maintenance Routine



Condition: Visibility is maintained throughout the site including proper clearances and site triangles.

Continued Actions: Monthly observation of site visibility. Monthly removal of vegetation that interferes with public safety, as necessary.

Mediocre, Modify Maintenance Routine



Condition: Plant material partially obstructs visibility. Safety is compromised.

Immediate Action: Trim any tree branches or shrubs that interfere with public safety, including visibility clearances.

Poor, Overhaul Maintenance Routine



Condition: Overgrowth results in poor visibility. The site is perceived as unsafe.

Immediate Action: Trim any tree branches or shrubs that interfere with public safety, including visibility clearances.

STRUCTURAL TREE PRUNING

Good, Continue Maintenance Routine



Condition: Young trees are structurally pruned annually. Branch structure is strong.

Continued Action: Annual pruning of trees up to 5 years old: Prune spring- and winter-flowering shrubs and trees in June; Prune summer- and fall-flowering shrubs and trees in December

Mediocre, Modify Maintenance Routine



Condition: Young trees aren't pruned annually. Branch structure is impacted.

Scheduled Action: Instate annual pruning for the remaining years of young tree development.

Poor, Overhaul Maintenance Routine



Condition: Young trees are never structurally pruned. Branch structure is poor and cannot be sustained.

Immediate Action: Determine if branch structure can be corrected without compromising tree health. If not, monitor branches for weaknesses necessitating removal and replacement of tree.

TRIMMING GRASSES AND GRASS-LIKE PLANTS

Good, Continue Maintenance Routine



Condition: Plants appear natural in appearance and are lightly trimmed to maintain at least 12 inches of height.

Continued Action: Seasonal trimming, as necessary.

Mediocre, Modify Maintenance Routine



Condition: Plants are overly or improperly trimmed.

Immediate Action: Stop trimming procedure to allow for plants to regenerate leaves, and evaluate future trimming procedures.

Poor, Overhaul Maintenance Routine



Condition: Plants are excessively and improperly pruned.

Immediate Action: If improper trimming has resulted in severely compromised plant structure or plant death, replace plants and evaluate future trimming procedures.

BAN RAIN DE

TRIMMING FOR PEDESTRIAN CIRCULATION

Good, Continue Maintenance Routine



Condition: Plants are in scale with their surroundings and do not impede pedestrian circulation.

Continued Action: Monthly pruning, as necessary.

Mediocre, Modify Maintenance Routine



Condition: Slight overgrowth overlaps walkway edges.

Immediate Action: Trim shrub branches and groundcovers back from all sidewalks, curbs and paved areas. Cut the edges of groundcovers at an angle for a more natural appearance and healthier plants.

Poor, Overhaul Maintenance Routine



Condition: Pervasive overgrowth crowds landscape area and pedestrian walks.

Immediate Action: Trim shrub branches and groundcovers back from all sidewalks, curbs and paved areas. Cut the edges of groundcovers at an angle for a more natural appearance and healthier plants.

IRRIGATION SCHEDULING

Good, Continue Maintenance Routine



Condition: Irrigation schedule matches the seasonal water needs of planting.

Continued Action: Quarterly adjustment of irrigation controller for current water needs of plants. Correct both frequency and duration of irrigation run times.

Mediocre, Modify Maintenance Routine



Condition: Mismatched irrigation schedule. Plants begin to show signs of struggle.

Immediate Action: Adjust irrigation controller for current water needs of plants. Correct both frequency and duration of irrigation run times.

Poor, Overhaul Maintenance Routine



Condition: Irrigation schedule severely mismatched to current watering needs. Plants are dying or dead.

Immediate Action: Adjust irrigation controller for current water needs of plants. Correct both frequency and duration of irrigation run times. Replace dying or dead plants.

IRRIGATION COMPONENTS CONDITION

Good, Continue Maintenance Routine



Condition: All irrigation system components are in working order and adequately protected.

Continued Action: Monthly check for condition of irrigation components.

Mediocre, Modify Maintenance Routine



Condition: Irrigation lines/valves are exposed and prone to damage and/or vandalism.

Immediate Action: Correct/repair any minor breaks in irrigation components.

Poor, Overhaul Maintenance Routine



Condition: Irrigation system components are damaged/compromised due to exposure and damage.

Immediate Action: Replace irrigation components for proper irrigation function.

SEDIMENT LOAD MANAGEMENT AT CURB CUTS

Good, Continue Maintenance Routine



Condition: Sediment is removed from curb cut area on a regular basis

Continued Action: Maintain current sediment removal maintenance program.

Mediocre, Modify Maintenance Routine



Condition: Sediment build up is occurring but not yet impacting the flow of water entering the landscape.

Immediate Action: Remove sediment build up.
Determine source of sediment load and take corrective action and/or modify maintenance program.

Poor, Overhaul Maintenance Routine



Condition: Sediment build up is severe enough to impede flow and inhibit landscape infiltration.

Immediate Action: Remove sediment build up.
Determine source of sediment load and take corrective action and/or modify maintenance program. May need to also replace plant material and mulch/soil layers.

TRASH REMOVAL

Good, Continue Maintenance Routine



Condition: Landscape is free of any large or small trash.

Continued Action: Continue monthly trash removal maintenance program.

Mediocre, Modify Maintenance Routine



Condition: Landscape has some trash captured, but it is of minimal size and quantity.

Immediate Action: Remove all trash. Modify maintenance schedule.

Poor, Overhaul Maintenance Routine



Condition: Landscape contains considerable amount of trash to impact aesthetics and public health.

Immediate Action: Remove all trash. Modify maintenance schedule. Locate source of trash production and take corrective actions.

PERVIOUS PAVING SWEEPING

Good, Continue Maintenance Routine



Condition: Pervious paving joints are free of debris and sediment.

Continued Action: Maintain current pervious paving sweeping schedule.

Mediocre, Modify Maintenance Routine



Condition: Some pervious paving joints are beginning to fill with sediment and debris slowing infiltration.

Immediate Action: Remove areas of sedimentation. Adjust frequency of sweeping schedule.

Poor, Overhaul Maintenance Routine



Condition: Excessive build-up of sediment inhibits infiltration between pervious paver joints.

Immediate Action: Remove areas of sedimentation.

May require interlocking pavers to be removed,
cleaning the joints, and re-applied. Adjust frequency of
sweeping schedule.

CURB CUT EROSION CONTROL

Good, Continue Maintenance Routine



Condition: Curb cuts are properly graded and armored for erosion control.

Continued Action: Curb cuts are maintained to control soil/mulch erosion.

Mediocre, Modify Maintenance Routine



Condition: Curb cuts have some erosion control measures, but are still prone to erosion.

Immediate Action: Modify curb cut construction with additional hardscape to control erosion.

Poor, Overhaul Maintenance Routine



Condition: Little or no provisions for erosion control at curb cut entries.

Immediate Action: Repair or replace curb cuts to control soil/mulch erosion.

SPLASH PADS FOR EROSION CONTROL

Good, Continue Maintenance Routine



Condition: Splash pad at water flow point is adequately controlling erosion.

Continued Action: Splash pads adequately control erosions at water flow points.

Mediocre, Modify Maintenance Routine



Condition: Water flow point only uses piled rock as a splash point. Some signs of erosion/rock movement.

Immediate Action: Modify water flow points with additional hardscape/splash pad to control erosion.

Poor, Overhaul Maintenance Routine



Condition: No splash pad is present causing severe erosion at water flow point.

Immediate Action: Repair or replace water flow points with a splash pad to control soil/mulch erosion.

6.5 Operations and Maintenance Annual Maintenance Actions

Ongoing Processes

- 1. Maintain monthly documentation of irrigation checks and as-built plans of any changes or adjustments to the system.
- 2. If pesticides, herbicides, etc. are used, submit a pest management record as part of a monthly maintenance report.



Observation

- Observe site for the following conditions and adjust as necessary:
 - Monitor mulch levels.
 - Check for proper irrigation coverage. Signs of improper coverage include standing water, irrigation run-off and dry spots within the landscape.
 - Check irrigation system for function and leaks. Report any evidence of damage or malfunction to the Owner.
 - Observe plant material for signs of stress, indicating excessive or insufficient watering.
 - Inspect site for any plants that are dead, damaged, diseased, stressed or missing. Remove dead and diseased plants.
 - Inspect site for proper plant coverage. If, by visual assessment, the planter is determined to have inadequate plant coverage, schedule the installation of additional plants.
 - Inspect site for any signs of disease or pest infestation where non-chemical treatments have failed. Develop a treatment plan with the Owner.
 - Inspect site for poor visibility, obstructed views and hiding spaces. Prune to maintain safety where necessary.
 - Inspect site for excessive sediment/trash build up, erosion issues, clogging of pervious paving, and issues with water retention levels.



Mulch Layer Maintenance

Add or redistribute bark mulch within planting areas where the mulch has been reduced to less than 3 inches deep. Place mulch that has been knocked or washed out of planters back and smooth into place.



Trimming & Weeding

- Remove dead, broken, damaged or diseased branches of trees and shrubs.
- Remove suckers growing from the base of trees.
- Trim shrub branches and groundcovers back from all sidewalks, curbs and paved areas. Cut the edges of groundcovers at an angle for a more natural appearance and healthier plants.
- Trim any tree branches that interfere with public safety, including visibility clearances.
- Remove all visible weeds located in planted areas, sidewalks, gutters and pavement. Remove as much of the root system as possible. Dispose of weeds off-site.



Fertilization

Obtain a minimum of two separate agronomy reports.



 Apply granular fertilizers to planting areas, if required, per Agronomy Report to trees, shrubs, perennials and grasses.
 Be sure to make application prior to a moderate rainfall so the rain will wash the fertilizer in.

6.5 Operations and Maintenance Annual Maintenance Actions



Irrigation

 Adjust irrigation controller for current water needs of plants. Correct both frequency and duration of irrigation run times.



- Conduct a comprehensive irrigation system test by performing the following tasks:
 - Check irrigation system pressure.
 - Ensure all flush valve/cap locations are visible.
 - Ensure valve boxes are visible and can be opened.
 - Clean valve boxes of dirt and debris.
 - Inspect valves, filters and pressure regulators for damage or leaks. Check wire splices.
 - Flush out the irrigation system and check for proper operation of each valve zone. Flush laterals.
 - Inspect and clean filters. A hose can be attached to the flush cap to keep water out of the valve box. Replace damaged or torn filters.
 - Clean or replace plugged sprinkler nozzles.
 - Make sure plants have adequate numbers of drip emitters for their size, if applicable.
 - Replace batteries to irrigation controller and sensor, as applicable.
 - Test soil sensors per manufacturer's instructions.



Structural Pruning



- Prune shrubs as needed to maintain their proper shape.
 Prune young trees for up to five years after planting to develop a strong branch structure.
- Reduce weight on heavy branches to pre-empt branch weakening. No more than 20% of live foliage should be removed or else cause unnecessary stress to a tree.



Plant Replacement & Addition

- Refer to as-built drawings to determine the species and size of plants to be installed. If drawings are not available, match additional plants to the species present within the planter area. Add or replace plants under the following circumstances:
 - Replace any dead or missing plants.
 - If the site is determined to lack proper plant coverage, add plants until a minimum coverage of 70% is achieved.
 - Replace ill-adapted plants with a species better adapted to a permanently altered environmental condition.

Sediment & Trash Removal

- Remove sediment/trash from curb cuts and landscape areas on a monthly basis:
 - For streets, work with adjacent property owners to sweep the gutter line to help reduce the burden of sediment flowing into street facilities.
 - Observe areas prone to clogging due to sediment loading and suggest adding forebays, etc. to help ease the removal of sediment.

Hardscape Maintenance

- Check hardscape areas such as curb cuts, weirs/ checkdams, inlets for proper function and grading during the rainy season.
 - Replace/adjust hardscape features as needed.
- Clean pervious paving on at least an annual basis.
- Perform a pervious paving infiltration test on an annual basis.

6.6 Operations and Maintenance Annual Landscape & Hardscape Maintenance Schedule

	Maintenance Task	Frequency Description
	Observation	Monthly
	Mulch Layer Maintenance	Twice a year, or as necessary
	Trimming & Weeding	Quarterly, or as necessary
	Fertilization: Obtain agronomy reports	Once yearly in early February
NPK	Fertilization: Apply fertilizer, if required	Once yearly in late February, if required
	Irrigation: Adjust irrigation controller for seasonal water needs	Quarterly
	Irrigation: Conduct a comprehensive irrigation system test	Once yearly in early April
	Structural Pruning: Prune shrubs to maintain shape and trees to develop branch structures	Prune spring- and winter-flowering shrubs and trees in June; Prune summer- and fall-flowering shrubs and trees in December
A A	Structural Pruning: Reduce branch weight	Once yearly in early June, or as necessary
Y	Plant Replacement & Addition	Twice yearly in April and October, as necessary

6.6 Operations and Maintenance Annual Landscape & Hardscape Maintenance Schedule

Maintenance Task	Frequency Description
Check for structural damage/graffiti	Monthly
Remove trash and sediment throughout the facility	Monthly
Remove sediment at curb cut locations	Quarterly, or as necessary
Check curb cuts, valley gutters, roof downspouts, and other conveyance systems for proper function	Quarterly, or as necessary
Clean/Sweep/Vacuum pervious paving	Once yearly, or as necessary
Check overflow inlets, check dams, and weirs for proper retention depths or escape routes of water	Quarterly, or as necessary
Conduct a pervious paving infiltration test	Once yearly, or as necessary
Check for areas of erosion at curb cuts, check dams, roof downspouts, or weirs	Quarterly, or as necessary
Check for underdrain malfunction	Twice yearly in November and February as necessary
Check for areas of damage from pedestrian or vehicular traffic	Monthly

Property Owner	Property Owner F	hone:		
Project Address	Treatment Meas	ure No.		Water Pollution Prevention Program Clean Water, Healthy Community.
Supervisor Name:	Maintenance Perso	nnel Type:	Facility Type:	Type of Inspection:
Supervisor Phone: Maintenance Date: Maintenance Duration:	☐ City Crew ☐ Contractor ☐ Property Owne ☐ Site Manager ☐ Volunteer	r	 □ Bioretention/Rain Garden □ Stormwater Planter □ Stormwater Curb Extension □ Green Gutter □ Vegetated Swale 	 ☐ Monthly ☐ Pre-Wet Season ☐ After Storm Event ☐ End of Wet Season ☐ Other
	□ Other		Other	
Critical Maintenance Observations:	Van	No	Comments:	
Is there standing water in the facility for more than 5 days rainfall event?	Yes after a 🔲	No		
Is runoff allowed to freely enter and exit the landscape fac	ility?			
Is there significant sediment build up at stormwater entry throughout the facility's landscape?	points or			
Is there any structural damage to hardscape elements?				
Are plants in a healthy condition?				
Are plants overgrown and/or posing a safety hazard?				
Are there visible signs of soil erosion along stormwater entor side slopes of facilities?	ry points			
Are there any leaks, damage, improper coverage, exposed overwatering from the irrigation system?	piping, or			
Does the facility have at least 70% plant coverage?				
Is there any evidence of contamination or hazardous waste facility?	e in the			

4. ENTRY POINT EROSION ACTIONS:		Expected Positive Results:	Issue Re	medied?
Provide additional hardscape at curb cuts/splash pads to dissipate water energy		Entry points of stormwater are properly graded and armored for erosion control.	Yes	No
Repair or replace curb cuts to control soil/mulch erosion		Comments:		
Adjust overflow inlets to limit ponding depth of water		comments.		
May need to also replace or repair mulch/soil layers				
Additional actions needed				
5. MULCH APPLICATION ACTIONS:		Expected Positive Results:	Issue Re	medied?
Determine if appropriate mulch material used is working		All bare earth is covered in an even	Yes	No
Add or redistribute mulch where it has been reduced to less than 3 inches deep		appearance, to a depth of 3 inches. Comments:		
Place mulch that has been knocked or washed out of landscape back into place	e 🗆	comments.		
Additional actions needed				
6. PLANT COVERAGE ACTIONS:		Expected Positive Results:	Issue Re	medied?
Determine if there is at least 70% plant coverage on the ground plane	d 🗆	There should be at least 70% coverage of plant material on the ground plane.	Yes	No
If not, schedule the installation of additional plants				
Refer to as-built drawings for plant species and size		Comments:		
Replace ill-adapted plants with a species better adapted site conditions.				

7. PLANT HEALTH ACTIONS:		Expected Positive Results:	Issue Remedied?
Determine if any plants are dead, damaged, diseased, stressed or missing		All plants are healthy, disease-free and suited to the environmental conditions.	Yes No □
Determine the cause of poor plant health conditions Remove struggling plants unlikely to recover or plants likely to infect surrounding plants May need to also replace plant material		Comments:	
Additional actions needed			
8. TRIMMING GRASS-LIKE PLANT ACTIONS	5:	Expected Positive Results:	Issue Remedied?
Determine if grasses and/or grass like plants are overgrown Trim grasses and/or grass like plants no less than 12" high If plants are suffering from past aggressive trimming techniques replace with new plant material and trim plants appropriately Additional actions needed	, .	Plants appear natural in appearance and are lightly trimmed to maintain at least 12 inches of height. Comments:	Yes No
9. VISUAL SAFETY & PUBLIC SAFETY ACTIO	NS:	Expected Positive Results:	Issue Remedied?
Determine if plant material obstructs visibility or if safety is compromised Trim any tree branches or shrubs that interfere with public safety, including visibility clearances May need to also replace plant material with species better suited for the site's safety conditions		Visibility is maintained throughout the site including proper clearances and site triangles. Comments:	Yes No
Additional actions needed			

10. PLANT HEALTH ACTIONS:	Expected Positive Results:	Issue Remedied?
Determine if any plants are dead, damaged, diseased, stressed or missing	All plants are healthy, disease-free and suited to the environmental conditions.	Yes No □
Determine the cause of poor plant health conditions	Comments:	
Remove struggling plants unlikely to recover or plants likely to infect surrounding plants	Comments.	
May need to also replace plant material		
Additional actions needed		
11. TREE HEALTH ACTIONS:	Expected Positive Results:	Issue Remedied?
Determine if trees are struggling, have trunk damage, weak branches, or have suckers growing from trunk Remove dead, damaged or diseased branches of trees Adjust tree grates openings at trunk base, if applicable Cut out suckers at trunk base Remove trees unlikely to recover Replace removed or missing trees with a healthy tree. Additional actions needed	Trees of all ages are healthy, free from damage and disease. Branches are strong and are pruned as necessary to reduce weight. Comments:	Yes No
12. YOUNG TREE STRUCTURE ACTIONS:	Expected Positive Results:	Issue Remedied?
Determine if branch structure can be corrected without compromising tree health	Young trees are structurally pruned annually. Branch structure is strong.	Yes No □
Instate annual pruning during young tree development		
Additional actions needed	Comments:	

13. HAND WEEDING ACTIONS:		Expected Positive Results:	Issue Remedied?
Remove all visible weeds located in planted areas, sidewalks, gutters and pavement.		Little to no weeds visible within the planting area, sidewalks, gutters and pavement.	Yes No □
Remove as much of the root system as possible		Weeds are removed by hand only.	
Dispose of weeds off-site		Comments:	
If absolutely necessary, use only the least toxic herbicides			
Additional actions needed			
14. TRIMMING PLANTS AT SIDEWALKS ACT	TIONS:	Expected Positive Results:	Issue Remedied?
Determine if plants are overgrown over the sidewalk and are impeding accessible pedestrian travel		Plants are in scale with their surroundings and do not impede pedestrian circulation.	Yes No □
Trim shrub branches and groundcovers back from all sidewalks, curbs and paved areas.		Comments:	
Cut the edges of groundcovers at an angle for a more natural appearance			
May need to replace plant material with less vigorous species			
Additional actions needed			
15. IRRIGATION SCHEDULE ACTIONS:		Expected Positive Results:	Issue Remedied?
Determine if irrigation schedule severely mismatched to current watering needs. Plants are dying or dead	t 🗆	Irrigation schedule matches the seasonal water needs of planting.	Yes No □
Adjust irrigation controller for current water needs of plants			
May need to replace dead or dying plant material		Comments:	
Additional actions needed			

16. IRRIGATION COMPONENTS	ACTIONS:	Expected Positive Results:	Issue Re	medied?
Determine if any Irrigation system component compromised due to exposure, vandalism, or g	ss are damaged/	All irrigation system components are in working order and adequately protected.	Yes	No
Correct/repair any minor breaks in irrigation c	omponents \square	Comments:		
Replace irrigation components for proper irrigation	ation function			
Test irrigation system after repair or componer	nt replacement			
Additional actions needed				
Additional Comments:				
Supervisor Name:	Supervisor Signa	ature:	Date:	

