

Appendix E: Operations and Maintenance

E1. Trail Operations and Maintenance Tasks

Weekly Routine Maintenance Tasks:

Trash Removal

Blowing or Sweeping

Aquatic Invasive Species Prevention through Clean, Drain, Dry Program

Monthly Routine Maintenance Tasks:

Inspection and Maintenance of Active Use Amenities

Inspection and Maintenance of Water Access Facilities

Seasonal or Annual Maintenance Tasks

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Clearing, Brushing, and Pruning

Mowing, Trimming, and Weed Abatement

Vegetation Management for Fire Safety

Pavement Inspection and Asphalt Crack Patching

Replacing and Refreshing Signage and Striping

Inspection and Maintenance of “Passive” Amenities

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Landscaping and Irrigation Maintenance

Bridge Inspection and Repair

Retaining Wall, Steps, and Ramps Inspection and Repair

Invasive Species Removal/

Native Species Reintroduction

E2. Routine Maintenance Tasks

Tasks that require weekly or monthly attention. Tasks with an asterisk (*) are generally required regardless of how the trail facility is designed. Tasks without an asterisk may not be required, depending on the design of the trail facility.

Trash Removal*

The purpose of removing trash on trail systems is to protect public health and safety and to improve conditions for wild animals and for air, water, and soil quality. Trash removal includes removing ground trash, including broken glass, and emptying trash containers where they are present. Trailheads where dogs are allowed should also have dog waste stations with disposable bags.

Trash removal should occur at least weekly. The most common approach to removing trash from trail systems is to implement an ongoing trash removal and an as needed trash management program. Where resources are limited, trash receptacles should be located at entry points to trails so that the trash cans can be easily accessed and serviced by maintenance staff.

A less common, and often less effective, approach to trash removal is implement a “carry in/carry out” trash policy in which trail users are supposed to be responsible for removing all trash. Trash cans are not provided. Especially with dog waste, people are not inclined to take it with them and tend to leave it bagged on the trail.

Blowing or Sweeping*

To keep a paved trail safe, especially where there are nearby trees and shrubs, it is important to blow or sweep the surface clear of leaves and debris. Blowing with an electric hand-held power blower should be done weekly during peak times of leaf or bark litter, and more effective sweeping with a small truck or tractor-based sweeper should be done monthly.

Inspection and Maintenance of Active Use Trailside Elements

Trailside elements are features along the trail designed to enhance the safety and enjoyment of trail users. Some elements are actively used and require frequent, regular cleaning or inspection to ensure they are working properly. These types of amenities include picnic tables, drinking fountains, or bicycle repair stations. Because of their higher maintenance requirements, these elements may be restricted to a few strategic locations or corridors, only installed within parks where they can be maintained as part of an overall park facility, or even not installed at all along trails.

Inspection and Maintenance of Water Access Facilities

In the Delta, water access facilities, such as launch sites, will require frequent inspection for routine maintenance. Launch sites each have unique environments — slope, soil type, and rainfall — and may be near or in wetlands, requiring special care. Note that additional requirements for work on levees may apply. Access on the waterside of a levee will typically require an encroachment permit with provisions to prevent harm to the levee, for reporting, and repercussions for failing to abide by the permit conditions. (See California Code of Regulations, Title 23, Division 1, Chapter 1, Article 3, Section 16, Permit Conditions and Title 23, Division 1, Chapter 1, Article 4, Enforcement Actions.)

Aquatic Invasive Species Prevention - Clean, Drain, Dry Program

Aquatic invasive species — plants, quagga, and zebra mussels — are invading the Delta. These invasive species displace native species, clogging waterways and creating hazardous conditions for navigation and recreation. Controlling these aquatic invasive species is a multi-million dollar project in California and requires routine watercraft inspections.

E3. Seasonal or Annual Maintenance Tasks

Tasks that may have more seasonal requirements or may be scheduled annually or as needed.

Landscaping and Irrigation Inspection

See Landscaping and Irrigation Maintenance under Special Maintenance Tasks, below.

Clearing, Brushing, and Pruning

Clearing is the removal of windfall trees, protruding roots, leaning trees, and loose limbs or large pieces of bark from the trail tread to the recommended buffer zone. Brushing is the removal of all living or dead vegetation from the outside of the trail tread to the recommended buffer zone. Overhanging branches should be pruned to 12 feet on shared-use, limited-use, and single-use trails for equestrians and bicycles. Vegetation should be pruned to the minimum clearance of 2 feet on each side of the trail. All cut tree limbs and other cuttings should be removed from the trail edge and discarded from drainages, to avoid creating a fire hazard.

Mowing, Trimming, and Weed Abatement*

Ensuring that shrubs and grasses do not intrude on or above the trail tread is essential to trail safety, functionality, and longevity. It also helps protect against fire risk, which may include more extensive mowing, or grazing. At minimum, mowing is the clearing of shrubs and grasses with a minimum clearance of 2 feet on each side of the trail. Paved trails should have compacted aggregate shoulders 2 feet wide on each side of the trail, which helps prevent encroachment by vegetation. Grass around fencing may need to be cut manually with a hand-held trimmer rather than a tractor-mounted mower. Use of pesticides, poisons, or fertilizers is strongly discouraged, particularly near sensitive habitat.

Vegetation Management for Fire Safety

To reduce the likelihood of unusually large wildland fires, hazardous surface and ladder fuels, such as (continuous brush, downed vegetation or small trees), should be periodically thinned and removed. Dense tree stands may also require thinning. The California Department of Forestry and Fire Protection funds and carries out various types of wildland fuels treatments, for the purpose of reducing fire hazard or severity.

Pavement Inspection and Asphalt Crack Patching*

Annual pavement inspection is part of a comprehensive pavement management plan. Pavement management plans should evaluate four trail characteristics: roughness (ride), surface distress (condition), surface (skid characteristics), and structure (pavement strength and deflection). Preserving the trail surface condition through preventive maintenance keeps trails safe, extends pavement life, and reduces long-term expenses. The asphalt pavement must routinely be inspected for cracks, raveling, and disintegration. Cracks that are more than 1/4 inch to 1/2 inch wide should be thoroughly cleaned, dried, and filled with a sealant. With proper design and construction, asphalt pavement requires minimal maintenance. A significant advantage of asphalt pavement over concrete pavement is that asphalt pavement repairs can be quick and cost effective.

Replacing and Refreshing Signage and Striping*

Trail markings (centerline striping, crossings, and other markings) and signage (regulatory, wayfinding, and interpretive signs) need to be regularly refreshed and/or replaced as they become damaged, faded, or out of date.

Inspection and Maintenance of “Passive” Trailside Elements

Some trailside elements do not require frequent, active maintenance, but should still be inspected on a regular basis, with minor repairs performed as needed. These elements include: benches, bicycle parking, fencing, railing, gates, and bollards. Typical inspection includes checking for:

- Damage, deterioration or rusting on metal parts, requiring cleaning, painting or replacement;
- Deterioration of wood elements, including vandalism, rotting, splintering or other condition that presents a hazard, requiring repair or replacement; and
- Cracks or other failure in concrete benches, tables, pads, or footings.

E4. As-Needed Maintenance Tasks

Graffiti Removal*

The key to a successful graffiti control program is pretreating walls or surfaces with anti-graffiti coatings, crime prevention through environmental design (making sure that the surfaces are highly visible), and prompt graffiti removal – especially offensive writing and drawing. A successful graffiti control program discourages vandalism, ensuring that trails are safe places for people to bike and walk. Graffiti removal may occur weekly in conjunction with other regular maintenance, or on as-needed basis.

Lighting Inspection and Maintenance

Some trails may serve commuters who may travel during dusk hours in winter. The chief concern with lighting maintenance is tracking and fixing outages. Bulbs also need to be kept clean. Posting signage on fixtures and trailheads requesting that trail users report outages along the trail helps with lighting maintenance. Solar power lighting may be considered for some corridors where running conduit presents issues. Solar power lighting introduces different maintenance needs.

Addressing Homeless Encampments

Addressing the homeless encampments along the trails is a complex project that would likely be a special project. Increasing housing, providing shelter options, and providing debris removal services would be required.

E5. Capital Maintenance

The following maintenance tasks would generally happen as standalone, capital improvement projects (CIP), or as major rehabilitation is needed (on a multi-year cycle).

Rehabilitation of Paved Trails

Well-maintained asphalt trails typically need resealing every 5 to 7 years, depending on wear and type of pavement deterioration. Well-maintained concrete trails need replacing roughly every 25 years.

Resealing Asphalt Trails

Asphalt trails can be resealed using a slurry seal or seal coat application.

Slurry sealing asphalt is a preventive maintenance treatment that extends the life of the paved trail by applying a mixture of asphalt emulsion and aggregate (crushed stone and/or sand) to the trail. Slurry seals preserve and protect the underlying pavement structure and provide a new surface. The expected life of a slurry seal is three to five years.

Seal coating is a preventive maintenance treatment that extends the service life of the paved trail by waterproofing the surface, sealing small cracks, reducing oxidation of the pavement surface, and improving friction. A seal coat is an application of a layer of asphalt followed immediately with an aggregate (crushed stone and/or sand) cover. Two-layer applications are referred to as a double chip seal. Dry, raveled pavement can be seal coated. The seal coat itself may only last three to six years, but it may extend the life of the treated pavement by ten years.

Maintenance and Repair of Aggregate Trails and Trail Shoulders

Some trails currently have portions that are surfaced with compacted aggregate (base rock that typically underlies pavement). Ideally this aggregate surface would be carefully designed with a binder to make it smoother and firmer than typical aggregate base rock roads. Most asphalt trails also require compacted aggregate shoulders, ideally 2 feet wide or more, on each side of the asphalt surface to prevent paved edges from crumbling.

Compacted aggregate tends to wear more quickly than pavement and needs to be refilled, smoothed, and compacted where it has been damaged or deteriorated. Frequency of maintenance depends on the trail use: trail shoulders that are used by runners and walkers may only need to be regraded every few years, while trails that support maintenance trucks may need to be regraded every year.

Trailside Elements Major Repairs or Replacement

The trailside elements and facilities listed above will ultimately require major repairs or replacement, usually over a period of 10 years.

E6. Special Maintenance Tasks

The following tasks relate to drainage, landscaping, or structural features that may or may not be present in all trail segments. To the extent that the design requires maintenance of these elements, these maintenance tasks may be required on a seasonal, annual, or as needed basis.

Drainage Maintenance

Drainage facilities control or direct the flow of water under or around a trail. Drainage maintenance work is critical to prevent damage to trails during storms, and to keep them open for use. Common drainage maintenance activities include clearing ditches and culverts.

Clearing Ditches – Ditches may be parallel to the trail tread or leading away from the trail or to a culvert. They must be deep and wide enough to carry the anticipated volume of water in a serious storm. Clearing ditches requires removing vegetation and/or trash that may block water flow and fixing bank slumping that may block the ditch. Ditches are often maintained by the landowner or utility company that created them.

Clearing Culverts – When surface flow or subterranean springs cross a trail, culverts may be placed perpendicular to the trail or at an angle to redirect the water under the trail to the downhill side. Culverts need to be checked and cleared, particularly before big storms, to ensure that they function properly to avoid damage to or closure of the trail. Culverts are often maintained by the landowner or utility company that created the culverts.

Landscaping and Irrigation Maintenance

To make trails attractive for users, landscaping is also often a desired amenity. Any landscaping along trails should be low-maintenance, and ideally rely on native and low-water use plants. Such landscaping, including the required water-conserving irrigation system, will require regular inspection and occasional weed control, mulch placement, replanting and irrigation repair. Landscaping can be minimized as a part of

the design of trails if greater levels of funding for trail maintenance are not available, or if maintenance is not conditioned on an associated development.

Note, irrigation and landscaping on levees overseen by the Central Valley Flood Protection Board (CVFPB) is generally not allowed on the slope of levees. If new vegetation is allowed, it is often only irrigated on a temporary basis. The possibility for erosion from a broken pipe is just too high of a risk. If vegetation is found to be interfering with the successful function of the flood system it must be removed by the owner. In addition, there is a limited list of plants that are allowed. This list of plants has been incorporated into the CVFPB's permit applications. The landscape architect for the trail should be made aware of this restrictive list. (See California Code of Regulations, Title 23, Division 1, Chapter 1, Article 8, Section 131, Vegetation and Tables 8.2, 8.3, 8.4, and 8.5.)

Bridge Inspection and Repair

Concrete and metal bridges are generally more durable than wood, but metal may rust and require cleaning and repainting. Wooden bridges require more regular inspection for damage or deterioration, particularly related to the wooden decking.

Retaining Wall, Steps, and Ramps Inspection and Repair

Concrete or masonry unit retaining walls and steps are generally more durable than wood. Wooden retaining walls require more frequent checking for damage or deterioration.

Invasive Species Removal/Reintroduction of Native Species

Invasive plant species can poison wildlife and out-compete native species, harming a trail's environment. Often the removal of invasive plant species and re-introduction of native species involves coordinated volunteer efforts. If there are invasive species or weeds located along a corridor, the use of synthetic weed killers is a last resort.