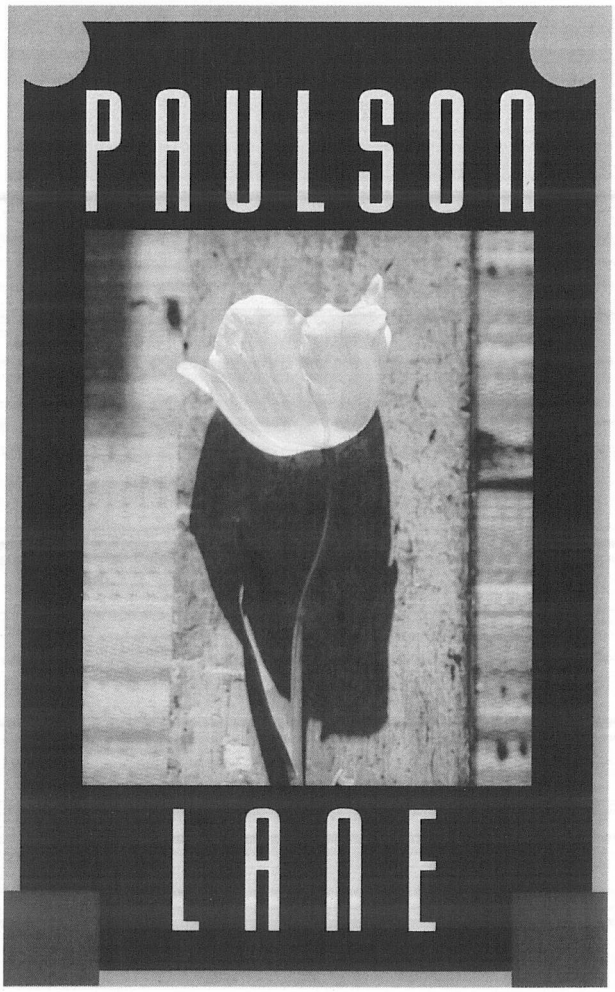
STORMWATER CONTROL OPERATION AND MAINTENANCE PLAN

Subdivision 8939
Paulson Lane

Lots 1-16



SUMMARY OF STORMWATER TREATMENT FACILITIES

The Paulson Lane Project contains 16 residences. The project is divided into a total of 3 Drainage Management Areas (DMAs), each containing one stormwater treatment facility which cleans the stormwater as it flows through and in the device. The stormwater treatment devices convey the treated runoff into a storm drain system that discharges into Las Trampas Creek. The stormwater treatment facilities extend from the curb cuts and yard grading (where water flows from the street and the yards into the vegetated swales and bioretention area) to the storm drain catch basins, where the treated water enters the storm drain system, which conveys it to the creek.

The stormwater treatment facilities include both a bioretention area located on Lot 3 (shown as IMP 1 on the Compliance Exhibit contained within the Stormwater Control Plan) and the vegetated swales located on lots 5, 6, 7, 8, 9, and 10 (shown as IMP3), and on lots 14, and 15 (shown as IMP2).

Please note that a blockage in the storm drain system will cause water to back up into the treatment facilities for extended periods (greater than 72 hours) and may damage them. For this reason, inspection and maintenance of the storm drain system is considered part of the inspection and maintenance of the treatment facilities. Also, topography of yards is designed to direct stormwater runoff toward the treatment facilities and must not be altered in any way that prevents the runoff from reaching the treatment facilities. Please see the maintenance matrix for detailed information about how to care for the storm drain system.

Functions of Vegetated Swales

Vegetated swales are open, shallow channels with vegetation covering the side slopes and the bottom, that collect and slowly convey runoff flow to downstream discharge points. They are designed to treat runoff through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. They trap particulate pollutants (suspended solids and trace metals), promote infiltration, and reduce the flow velocity of stormwater runoff.

Inspection/Maintenance Considerations

It is important to consider that a thick vegetative cover is needed for vegetated swales to function properly. Usually, swales require little more than normal landscape maintenance activities such as irrigation and mowing to maintain pollutant removal efficiency. Swales can become a nuisance due to mosquito breeding in standing water if obstructions develop (e.g., debris accumulation, invasive vegetation) and/or if proper drainage slopes are not implemented and maintained. However, water standing in the swale for up to 72 hours following a storm event is normal and should be expected. The application of fertilizers and pesticides should be minimized and conducted by appropriate professionals. Please see the Responsibility for Maintenance and Maintenance Matrix sections below for further information regarding maintainenance of the vegetated swales; refer to the

Stormwater Control Plan for detailed information about the design specifications of the swales.

Functions of Bioretention Area

The bioretention area functions as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. The bioretention area consists of a vegetated surface, "sandy loam" soil mix, ponding area, organic layer or mulch layer, storage layer, and under drain system. The runoff's velocity is reduced by being distributed evenly along a ponding area and interacting with the soil medium, vegetation, and soil microbes, as it passes through to the storage layer. Exfiltration of the stored water from the bioretention area storage layer into the under drain system occurs over a period of days (after significant storm events). The water is subsequently conveyed to Las Trampas Creek through the storm drain system.

Inspection/Maintenance Considerations

The bioretention area requires frequent landscaping maintenance, including measures to ensure that the area is functioning properly, as well as maintenance of the landscaping. Maintenance tasks can be completed by a qualified landscaping contractor, who may already be hired at the site. Please see the Maintenance Matrix (and the Declaration of Covenants, Conditions, and Restrictions for Paulson Lane) below for information regarding how to care for the bioretention area. As with the swales, normal function of the bioretention area may include retaining water for 72 hours after a storm event.

RESPONSIBILITY FOR MAINTENANCE

Each lot owner is responsible for maintaining the private drainage system, including rain gutters, downspouts, area drains, risers, inlets, outlets, overflows, clean-outs, trench drains, pipelines, and connectors, and yard grades that direct water to the stormwater treatment facilities. Any major maintenance (such as replanting, re-grading, subdrain replacement, soil replacement, or similar effort) of the bioretention area or vegetated swale should only be conducted by a competent professional, such as a licensed landscape contractor.

Landscape contractors retained by the homeowners individually or jointly must familiarize themselves with the purposes, design specifications, features, and mode of operation of the vegetated swales and bioretention area. Maintenance service providers (landscape maintenance and other maintenance), including maintenance supervisors and employees, need to be informed of the specific maintenance requirements for the vegetated swales and bioretention area and should review both the Stormwater Control Plan and the Stormwater Control Operation and Maintenance Plan (this document).

FUNDING FOR OPERATION AND MAINTENANCE

The Covenants, Conditions, and Restrictions for Paulson Lane require the homeowners to maintain the vegetated swales and the bioretention area.

Anticipated Maintenance Costs

- The annual anticipated cost of maintenance for the vegetated swale is $1 per liner foot of swale or $252 for 8 lots.
- The annual cost of maintenance for the bioretention area is $12.50 per lot per year or $200 for all 16 lots per year.
- The cost for complete replacement of all vegetated swale is $5 per square foot of swale or $7,560.
- The cost for complete replacement of the bioretention area is $312.50 per lot or a total replacement cost of $5,000.

It is anticipated that with proper care and maintenance, the vegetated swales and bioretention area should last approximately fifteen years (actual life may vary depending on maintenance and care).

Based upon a replacement cost in 2007 dollars, each owner of a Lot should set aside approximately $21 per year to pay for the replacement of the bioretention area and $32 per year to pay for replacement of the vegetated swales. When setting money aside, each owner should remember that these numbers are all given in 2007 dollars and do not account for inflation, please plan accordingly when setting up a personal reserve account for the replacement of the clean water facilities.

GENERAL MAINTENANCE REQUIREMENTS

Landscape contractors retained by the homeowners individually or jointly must familiarize themselves with the purposes, design specifications, features, and mode of operation of the vegetated swales and bioretention area and should review the Stormwater Control Plan (in addition to this document). As will be reflected in contracts for landscape maintenance and other maintenance services, maintenance supervisors and employees need to be informed of the following specific maintenance requirements for the vegetated swales and bioretention area. Maintenance instructions generally include the following (*please see the Maintenance Matrix for more detailed maintenance instructions*):

- Inspect inlets for channels, exposure of soils, or other evidence of erosion. Clear any obstructions and remove any accumulation of sediment. Examine rock or other material used as a splash pad and replenish if necessary.
- Inspect outlets for erosion or plugging caused by debris.
- Inspect side slopes for evidence of instability or erosion and correct as necessary.
- Observe soils at the bottom of the Stormwater Facility for uniform percolation throughout. If portions of the Stormwater Facility do not drain within 72 hours after the end of a storm, the soil should be tilled and replanted. Remove any debris or accumulation of sediments.
- Confirm that channelization within the Stormwater Facility is effectively prevented.
- Examine the vegetation to ensure that it is healthy and dense enough to provide filtering and to protect soils from erosion. Replenish mulch as necessary, remove fallen leaves and debris, prune large shrubs or trees, and mow turf areas. Confirm that irrigation is adequate and not excessive. Replace dead plants and remove invasive vegetation.
- Abate any potential vectors by filling holes in the ground in and around the Stormwater Facility and by insuring that there are no areas where water stands longer than 72 hours

following a storm. If mosquito larvae are present and persistent, contact the appropriate agency for information and advice. Mosquito larvicide's should be applied only when absolutely necessary and then only by a licensed individual or contractor.

- Applications of pesticides are to be conducted only by a licensed pest control operator trained in the use of Integrated Pest Management.

CHECKLIST FOR ROUTINE INSPECTION AND MAINTENANCE—VEGITATED SWALE
(SEE MAINTENANCE MATRIX FOR ADDITIONAL DETAIL)

- ☐ Examine each area trench drain and clean if necessary.
- ☐ Confirm there is no blockage in the trench drain lines where swales cross the driveways.
- ☐ Check rocks at inlets and repair, replace, or replenish as necessary.
- ☐ Remove any accumulations of sediment, litter, and debris in the swale.
- ☐ Examine the overflow. Remove any debris.
- ☐ Observe the structure of the swales and bioretention area and fix any cracks, or failure.
- ☐ Note condition of vegetation.
- ☐ Replace any dead vegetation.
- ☐ Remove any nuisance or invasive vegetation.
- ☐ Clean up fallen leaves or debris.
- ☐ Confirm that irrigation is adequate and not excessive. If irrigation is producing underflow from the swales or bioretention area, reduce irrigation.
- ☐ Remove any debris from curb cuts leading to swales or bioretention area.

STORMWATER TREATMENT FACILITIES

MAINTENANCE MATRIX

The stormwater treatment facilities extend from where water flows from the street and yards into the vegetated swales and bioretention area (curb cuts and yard areas) to the storm drain catch basins, where the treated water enters the storm drain system, which conveys it to the creek. However, a blockage in the storm drain system will cause water to back up into the treatment facilities and may damage them. For this reason, inspection and maintenance of the storm drain system is considered part of the inspection and maintenance of the treatment facilities. Normal functioning of the facilities may involve retention of water for up to 72 hours following significant storm events.

VEGETATED SWALES - TRENCH DRAINS – *(beneath metal grates crossing driveways)*

Frequency Before each rainy season and after the first heavy rain.	**Observation** Inspect the trench drain through the grates and from each end. Look for obstructions, vegetation, debris, litter, sediment, etc. inside the trench drain. Vegetation or algae growing in the trench drain indicate the presence of standing water. Water backing up out of the trench drain entrance indicates a blockage. During a rainstorm, a blockage will be indicated by slow water flow or by water backing up at the trench drain entrance.	**Maintenance Activity** Clear as much of the trench drain as possible from each end with a long-handled tool such as a hoe. Raise the grates to clean inaccessible portions of the trench drain. Scrape with hoe or similar tool to ensure that water flows freely along the concrete flow-line of the trench drain.
	Observation Inspect the trench drain entrances and exits. Look for obstructions, vegetation, debris, litter, sediment, etc. blocking the entrances and exits of the trench drain.	**Maintenance Activity** Clear entrances and exits by hand and with hand tools. Ensure that water flows freely into and out of the trench drain.
	Observation Inspect the flow line of the swale outside the trench drain. Check whether the flow-line of the swale at the trench-drain entrance or exit has risen through siltation or dropped through erosion. Water ponding at the trench-drain entrance or exit may indicate displacement of the swale flow-line.	**Maintenance Activity** If the flow-line of the swale at the trench-drain entrance or exit has been displaced vertically, then fill or scrape as necessary to flatten and restore the flow-line of the swale. Ensure that water flows freely into and out of the trench drain.
	Observation Inspect for large vegetation growing within 4" of the trench-drain entrance or exit.	**Maintenance Activity** Remove any invasive plants, weeds, shrubs, or any plant with a woody stem within 4" of trench-drain entrance or exit.
	Observation Inspect the gravel and/or rock placed at the entrances and exits of the trench drain for erosion control purposes. Look for places where bare earth is exposed.	**Maintenance Activity** If outside erosion-control gravel is displaced, replace and shape to preserve the flow line of the swale.

STORM DRAIN SYSTEM

Frequency Before each rainy season.	**Observation** Inspect the storm drain outfall at the creek. Look for obstructions, vegetation, debris, litter, sediment, etc. blocking the outfall. Check for bushes, trees, or other dense vegetation growing immediately in front of the outfall.	**Maintenance Activity** Remove obstructions, etc.
	Observation Inspect all catch basins. Look for obstructions, vegetation, debris, litter, sediment, etc. blocking the catch basins.	**Maintenance Activity** Remove obstructions, etc.
Frequency Before each rainy season and after the first heavy rain.	**Observation** Inspect the entire storm drain system from the upstream end to the outfall, including all catch basins. Observe the flow of water. Any evidence of ponding in the catch basins indicates a blockage.	**Maintenance Activity** Find and remove any obstructions. Flushing may be necessary.

VEGETATED SWALES AND BIORETENTION AREA – SUBDRAINS

Frequency Before each rainy season	**Observation** Inspect all subdrain cleanouts. Ensure that all cleanout caps are present. Look for obstructions, debris, trash, leaves, vegetation, etc. growing inside the subdrain or covering the cleanout.	**Maintenance Activity** Remove any obstructions by hand (if near the cleanout entrance) or by flushing (with pressurized water) if too far down the pipe. Replace missing caps and secure to prevent unauthorized removal or accidental displacement.
	Observation Inspect each subdrain where it enters the catch basin to see whether the subdrain pipe is dry, or is clogged with vegetation. Ensure that the subdrain is flowing by testing with water from the cleanout end.	**Maintenance Activity** If water does not flow through the subdrain, rod or flush the line to ensure flow.

VEGETATED SWALES AND BIORETENTION AREA - GENERAL

Frequency Before each rainy season	**Observation** Inspect curb cuts (gaps in curb for water to flow down to treatment facility). Look for any obstructions that will prevent water from leaving the street and flowing into the treatment facility. This includes litter, debris and vegetation. There should be at least a 1-inch drop from the curb cut to the erosion control rock. No vegetation should obstruct the flow of water through the curb cut.	**Maintenance Activity** Remove obstructions, clean litter and cut vegetation.
	Observation Inspect bank between curb cuts and treatment facility. Look for gullies, washouts, evidence of uncontrolled surface water flow or any other evidence of distress to the slope.	**Maintenance Activity** Repair bank by excavating gullies and replacing soil in its original configuration, properly compacted. Replace gravel or other erosion control device so that bank does not erode again.
	Observation Determine whether the bioretention area / swale is draining correctly. Inspect adjacent infrastructure, such as retaining walls, curbs and pavement for signs of failure caused by water intrusion into the surrounding soil. This is a sign of poor drainage from the treatment facility.	**Maintenance Activity** Determine the cause of the poor drainage (i.e. siltation of "sandy loam" soil mix, blocked subdrains, blocked catch basin, blocked storm drain) and repair.
Frequency After the first heavy rain.	**Observation** Determine whether the bioretention area / swale is draining correctly. Look for standing water or soggy, saturated soil. Look for holes containing standing water and permitting mosquitoes. This is a sign of poor drainage from the treatment facility. Water should drain from bioretention area / swale within 72 hours. After 72 hours, there should be no patches of standing water – bioretention area / swale should drain evenly.	**Maintenance Activity** Determine the cause of the poor drainage (siltation of "sandy loam" soil mix, blocked subdrains, blocked catch basin, blocked storm drain) and repair. Fill holes containing standing water with "sandy loam" soil mix. Tilling of "sandy loam" soil mix may be required. After several years, the soil medium may become impermeable because of silt deposition, in which case removal and replacement of the "sandy loam" soil mix and gravel will be required
Frequency Each month	**Observation** Inspect the bioretention area / swale for litter, debris, leaves, dead vegetation and anything else that might interfere with flow, filtration or growth of grass.	**Maintenance Activity** Remove all such litter, debris, leaves, dead vegetation, etc. by hand or with hand tools. Replace dead vegetation as appropriate.
Frequency Each month	**Observation** Inspect for growth of trees or invasive plants in grassy bioretention area / swale areas.	**Maintenance Activity** Remove invasive plants, weeds, shrubs, trees, or anything with a woody stem from grassy bioretention area / swale areas.

Frequency Each month	**Observation** Inspect condition of grass in bioretention area / swale. Grass must be of sufficient density and health to provide filtration and protect from erosion.	**Maintenance Activity** Mow as necessary, fertilize as necessary, note bare spots and reseed as necessary, remove dead grass and reseed as necessary. Fertilization is to be performed by a licensed professional. Only the minimum effective amount of fertilizer is to be used, to prevent downstream eutrification. Fertilizers used should be the most environmentally benign products available.
Frequency Before each dry season and each month throughout the dry season.	**Observation** Test the irrigation system. Observe whether all grassy areas in the bioretention area / swale are receiving the correct amount of water. Observe whether excessive irrigation is creating flow in the subdrains (irrigation should not cause any flow in subdrain).	**Maintenance Activity** Clean out all plugged sprinkler heads and filters. Straighten any displaced sprinkler heads. Replace any damaged sprinkler heads. Adjust for correct direction and throw distance. Set the sprinkler timer to provide enough water depending on the anticipated weather until the next irrigation inspection. Reduce the watering time if excess water flows from the subdrains.
Frequency Each month.	**Observation** Inspect for presence of pests which constitute a nuisance and/or threaten the survival of the grass in the bioretention area / swale.	**Maintenance Activity** Apply pesticide to the minimum amount necessary to control pests. All application of pesticide is to be performed by a licensed professional pest control contractor trained in Integrated Pest Management (IPM) techniques.
Frequency Ongoing	**Observation** Before making any modification to on-lot swales, downspouts, grading, landscaping or drainage patterns, ascertain what effect such modification will have on the flow of water to the treatment swales and/or bioretention area.	**Maintenance Activity** Refrain from any construction, grading, landscaping, piping or any other construction that will affect the flow of water to the treatment swales and/or bioretention area. Correct any changes that divert stormwater away from treatment facilities or otherwise reduce their effectiveness.
Frequency When treatment facilities are substantially failing to perform (estimated 15 years from installation)	**Observation** Treatment facilities are failing to drain and/or discharging "dirty water" into creek. Minor maintenance activities have failed to rectify problem.	**Maintenance Activity** Thorough inspection of stormwater facility by licensed professional (i.e., landscape contractor, landscape architect, civil engineer, etc.) Replacement of failed components and repair of stormwater facility to design specifications (per the Stormwater Control Plan).