

CHAPTER 6: OPERATIONS & MAINTENANCE (O&M) AGREEMENT

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OPERATIONS & MAINTENANCE (O&M) AGREEMENT

To function as intended over the long term, BMPs must be periodically maintained. Privately owned facilities such as rain gardens, stormwater planters, and porous pavements on private property are the sole responsibility of the property owner to maintain. Prior to issuance of a development permit, the owner must sign an O&M agreement with the City of Grants Pass (O&M Form, included below), committing the owner and future owners to certain operation and maintenance activities. This agreement must be recorded with the deed in the City of Grants Pass's during the site plan review process.

Maintenance responsibility of BMPs located within public street right-of-ways or easements dedicated to the City will be the responsibility of the City. The City's maintenance responsibility will include periodic removal of accumulated trash, debris, and sediment, and repair or replacement of curbing, inlet drains, or rock check-dams. Weeding and trimming or replacement of shrubs, grasses, or other plantings will be the responsibility of the adjacent private property owner. Under no circumstance shall a private property owner place fill, trash, lawn trimmings, leaves, or unapproved plants into public or private BMPs.

FORM O&M INSTRUCTIONS

Read the form thoroughly prior to filling it out. If you have any questions about how to fill it out, or the responsibilities the form commits the owner to, please call Parks & Community Development at 541-450-6060.

- Fill out Box 1, including owner's name, telephone number, mailing address, site address, and site legal description.
- For Box 2, depending on which types of BMPs are being installed on the site, attach the corresponding BMP Maintenance Activities to the O&M Form, and check the applicable box (or boxes).
- Fill out Box 3, including party responsible for O&M, contact information if other than owner, anticipated installation date of the facility, and name of the person preparing the form.
- In Box 4, either sketch the property or include a separate site plan sheet including street frontage (label street name); means of access and access easements, if necessary; buildings; parking lots; walkways; and driveways. Indicate with *'s and/or polygons where each BMP is to be located, and label each one.
- Read the legal requirements in Box 5.
- Under witness of a certified notary, sign the form in Box 6, and have it notarized.
- Submit the completed Form O&M with the building permit application for review by the City of Grants Pass.



This Box for City of Grants Pass Recording Use Only

AFTER RECORDING, RETURN TO:

Public Works
 101 NW A St.
 Grants Pass, OR 97526

FORM O&M: Operations & Maintenance Agreement for Best Management Practices

Permit Application #: _____ Project #: _____

BOX 1

Owner's Name: _____ Phone Number: (____) ____-____

Mailing Address: _____

Site Address: _____

Site Legal Description: _____

BOX 2

Type of Practices. *Check all that apply:* Wet Pond Extended Wet Pond Dry Detention Facility
 Cluster Development Tree Protection Tree Planting Depaving and/or Restored Soils Contained Planter
 Vegetated Roof Porous Pavement (Type: _____) Rain Garden Stormwater Planter LID Swale
 Soakage Trench Drywell WQ Conveyance Swale Dispersion BMP Level Spreader

BOX 3

Party Responsible for maintenance of Best Management Practice (BMP). Check One:
 Property Owner Homeowner's Association Other (describe) _____

Contact Information (only if other than owner)

Maintenance Contact Name: _____ Phone Number: (____) ____-____

Maintenance Contact Address: _____

Estimated Date of Installation (mm/yyyy): _____

Prepared By: _____

BOX 4 Insert site plan here or attach separate sheet.

The practices located on this site plan are a required condition of permit approval for the identified property. The owner of the identified property is required to operate and maintain these facilities in accordance with the attached O&M plans. The requirement to operate and maintain these facilities in accordance with the O&M plans is binding on all current and future owners of the property. The O&M plan may be modified under written consent of new owners with written approval by and re-filling with the City of Grants Pass. Call (541)450-6110 for information or assistance.

BOX 5: LEGAL REQUIREMENTS

- I. OWNER INSPECTIONS. OWNER shall provide inspections of the Facilities as needed to ensure proper function on a continual basis. Proper function for each facility type is described in the Operations and Maintenance (O&M) Plan.
- II. DEFICIENCIES. All aspects in which the Facilities fail to satisfy the O&M Plan shall be noted as "Deficiencies".
- III. OWNER CORRECTIONS. All Deficiencies shall be corrected at OWNER'S expense within thirty (30) days after completion of the inspection. If more than 30 days is reasonably needed to correct a Deficiency, OWNER shall have a reasonable period to correct the Deficiency so long as the correction is commenced within the 30-day period and is diligently prosecuted to completion.
- IV. CITY OF GRANTS PASS INSPECTIONS. OWNER grants to the CITY OF GRANTS PASS the right to inspect the private stormwater Facilities. The CITY OF GRANTS PASS will endeavor to give ten (10) days prior written notice (as courtesy to OWNER), except that no notice shall be required in case of an emergency. The CITY OF GRANTS PASS shall determine whether Deficiencies need to be corrected. OWNER (at the address provided in this Agreement, or such other address as OWNER may designate in writing to CITY OF GRANTS PASS) will be notified in writing through the US Mail of the Deficiencies and shall make corrections within 30 days of the date of the notice.
- V. CITY OF GRANTS PASS CORRECTIONS. If correction of all OWNER or CITY OF GRANTS PASS identified Deficiencies is not completed within thirty (30) days after OWNER'S inspection or CITY OF GRANTS PASS notice, CITY OF GRANTS PASS shall have the right to have any Deficiencies corrected. The CITY OF GRANTS PASS (i) shall have access to the Facilities for the purpose of correcting such Deficiencies and (ii) shall bill OWNER for all costs reasonably incurred by CITY OF GRANTS PASS for work performed to correct such Deficiencies ("CITY OF GRANTS PASS Correction Costs") following OWNER'S failure to correct any Deficiencies in the Facilities. OWNER shall pay to CITY OF GRANTS PASS the City of Grants Pass Correction Costs within thirty (30) days of the date of the invoice. If payment is not made within 30 days, the CITY OF GRANTS PASS shall collect pursuant to APPROPRIATE CITY OF GRANTS PASS STATUTE OR CODE regarding enforcement of cost assessment. OWNER understands and agrees that upon non-payment, City of Grants Pass Correction Costs shall be secured by a lien on OWNER'S property for the CITY OF GRANTS PASS Correction Cost amount plus interest and penalties.
- VI. EMERGENCY MEASURES. If at any time the CITY OF GRANTS PASS reasonably determines that the Facilities create any imminent threat to public health, safety or welfare, the CITY OF GRANTS PASS may immediately and without prior notice to the Owner take measures reasonably designed to remedy the threat. The CITY OF GRANTS PASS shall provide notice to OWNER of the threat and the measures taken as soon as reasonably practicable, and charge OWNER for the cost of corrective measures.
- VII. FORCE AND EFFECT. This Agreement has the same force and effect as any deed covenant running with the land and shall benefit and bind all owners of the site, present and future, and their heirs, successors and assigns.
- VIII. ASSIGNMENT TO HOMEOWNERS ASSOCIATION; PROPERTY OWNERS LIABLE. The OWNER may assign this Agreement to a homeowner's association comprised of the owners of the benefiting properties. However, the respective owners of each property shall be jointly and severally liable for CITY OF GRANTS PASS Correction Costs if not otherwise paid. All notices to OWNER shall be sent to the address designated in writing by the homeowner's association.
- IX. AMENDMENTS. The terms of this Agreement may be amended only by mutual agreement of the parties. Any amendments shall be in writing, shall refer specifically to this Agreement, and shall be valid only when executed by both parties to this Agreement and recorded in the Official Records of Josephine County.
- X. PREVAILING PARTY. In any action brought by either party to enforce the terms of this Agreement, the prevailing party shall be entitled to recover all costs, including reasonable attorney's fees as may be determined by the court having jurisdiction, including any appeal.
- XI. SEVERABILITY. The invalidity of any section, clause, sentence, or provision of this Agreement shall not affect the validity of any other part of this Agreement, which can be given effect without such invalid part or parts.

BOX 6

BY SIGNING BELOW, filer accepts and agrees to the terms and conditions contained in this operations and maintenance plan and in any document executed by filer and recorded with it.

Filer _____

NOTARIZATION: GIVEN under my hand and official seal
this _____ day of _____, _____.
Notary Public in and for the State of Oregon:
My Appointment Expires on:

CLUSTER DEVELOPMENT BMP MAINTENANCE ACTIVITIES FORM

The following activities apply to natural areas (e.g. forests, riparian areas, meadows, etc.) outside of the developed area of a project/development site, as shown on the site plan in Box 4. Maintenance of natural areas should be minimal to none. Maintain natural areas as follows:

- Avoid pruning, watering, fertilizing, spraying, and mulching of natural areas unless directed by an International Society of Arboriculture certified arborist or a qualified forest or other landscape manager.
- Weed and pest management should be performed with integrated pest management (IPM) techniques, which are a systematic approach to reducing toxics use in landscapes. (See Appendix E: Plant Specifications of “LID Guidance: A Practical Guide to Watershed Health.”)
- Steep slopes that are graded during construction and left grassy as open space tend to have problems with erosion and sometimes even landslides. Managing soils from these areas could become very high maintenance. Under the definition of limiting disturbance, which is to preserve and protect natural resources, these areas are not natural areas, but might appear to be to maintenance staff seeing the site for the first time. In this case, steep slopes should be re-vegetated with vegetation that can resist erosion as appropriate (e.g. shrubs, trees, and other deeply rooted plants).

TREE PROTECTION BMP MAINTENANCE ACTIVITIES

The following activities apply to trees within the developed area of a project/development site, as shown on the site plan in Box 4. The level of maintenance of existing protected trees may vary with how well trees were protected in previous development phase. Activities include:

- Fertilize trees immediately with phosphorus, potassium, calcium, magnesium, and other macro- and micro-nutrients as indicated by a soil test. Do not over fertilize with an off-the-shelf nitrogen-phosphorus-potassium (NPK) or weed-and-seed products, which can pollute downstream waterways and groundwater.
- Fertilize lightly with nitrogen after 1 year. If recommended by an arborist, light annual applications of nitrogen may be made for the next 3 to 5 years.
- Mulch trees once a year with organic matter compost or wood chips to maintain 2-4 inches of mulch. Pull mulch away from tree trunk to avoid rotting the trunk.
- In the absence of adequate rainfall, apply at least 1 inch of water per week by deep soaking methods for a minimum of 2 (smaller trees) to 5 years (larger trees) or as recommended.
- Inspect trees annually for at least 3 to 5 years after construction to look for changes in condition and signs of insects or disease.
- Remove trees that are badly damaged or are in irreversible decline if unsuitable for wildlife habitat. For more information on proper tree removal and replacement, see the Oregon State University Extension publication “*Tree Protection on Construction and Development Sites*”. For deciduous trees, a pruning schedule and specific guidance to improve tree stability during storms is provided in “*Developing a Preventative Pruning Program: Young Trees*”¹. If the tree is located in a less public area and can be cut to be short, consider leaving some of the trunk of removed trees standing, to serve as habitat for wildlife.
- Develop a regular maintenance program that incorporates fertilization and integrated pest management techniques to get best results at lowest cost.
- Pruning is the deliberate removal of tree branches and limbs to achieve a specific objective in the alteration of a tree’s health and form. Regular inspections to determine a tree’s pruning needs

¹ University of Florida, IFAS Extension. Retrieved from: <http://edis.ifas.ufl.edu/pdf/EP/EP31500.pdf>

should be a part of every tree maintenance program. Always determine the objective for pruning before beginning the work. For detailed information on pruning techniques, see the Oregon State University Extension publication “Tree Protection on Construction and Development Sites”². In addition, the American National Standards Institute (ANSI) publishes tree pruning and safety standards, known as ANSI A300 (Part 1): Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices (Pruning). The ISA has developed BMPs for pruning in relationship to the ANSI standards; these guidance documents are available for sale through the ISA Web site³.

TREE PLANTING BMP MAINTENANCE ACTIVITIES

The following maintenance activities apply to newly planted trees, as shown on the site plan in Box 4. The amount of maintenance a tree requires depends on the species, the tree’s location in the landscape, its age, and the care (or abuse) it has been given throughout its lifetime. Basic tree maintenance begins with regular inspections to determine a tree’s needs, which may include pruning, mulching, fertilization, irrigation, and pest management.

New Tree Care after Planting.

Maintenance specific to new trees is as follows:

- Prune only dead, broken, crossed, or rubbing branches; inspect for pruning needs annually.
- Irrigate trees during the 2-year establishment period. Irrigate trees more in the first year and less to much less in subsequent years. In addition, trees benefit from varying irrigation seasonally. At the beginning of summer, after the rains stop, water a little. Increase irrigation volume as the summer/dry season continues. Taper off irrigation as the rains return. Depending on your area and rainfall patterns, irrigation may be needed from May to October. Apply 5-10 gallons to each newly planted tree, once/week, as appropriate for the tree.
- Inspect newly planted trees quarterly for the first 5 years to evaluate condition and maintenance needs.
- Remove tree watering rings after one year.
- Remove stakes and guying materials, if used, after one year.
- Develop an integrated maintenance and care program using fertilization BMPs and integrated pest management practices to reduce costs as well as negative impacts on the environment.

Long-term maintenance

- Pruning is the deliberate removal of tree branches and limbs to achieve a specific objective in the alteration of a tree’s health and form. Regular inspections to determine a tree’s pruning needs should be a part of every tree maintenance program. Always determine the objective for pruning before beginning the work. For detailed information on pruning techniques, see the Oregon State University Extension publication “Tree Protection on Construction and Development Sites”⁴. In addition, the American National Standards Institute (ANSI) publishes tree pruning and safety standards, known as ANSI A300 (Part 1): Tree, Shrub, and Other Woody Plant Maintenance –

² Oregon State University, Extension Services. (2009). *Tree Protection on Construction and Development Sites*. Retrieved from: <http://goo.gl/Tl5kOU>

³ International Society of Arboriculture. Retrieved from: <http://www.isa-arbor.com/>

⁴ Oregon State University, Extension Services. (2009). *Tree Protection on Construction and Development Sites*. Retrieved from: <http://goo.gl/Tl5kOU>

Standard Practices (Pruning). The ISA has developed BMPs for pruning in relationship to the ANSI standards; these guidance documents are available for sale through the ISA Web site⁵.

- Properly remove and replace trees as needed. For more information on proper tree removal and replacement, see the Oregon State University Extension publication “Tree Protection on Construction and Development Sites”. For deciduous trees, a pruning schedule and specific guidance to improve tree stability during storms is provided in “Developing a Preventative Pruning Program: Young Trees”⁶.
- Mulch trees once a year with organic matter compost or wood chips to maintain 2-4 inches of mulch. Pull mulch away from tree trunk to avoid rotting the trunk.

DEPAVE EXISTING PAVEMENT & RESTORED SOILS BMPS MAINTENANCE ACTIVITIES

The following activities apply to landscape areas within the developed area of a project/development site where the Restored Soils BMP has been implemented, which includes Depave (*i.e.* demolish) Existing Pavement BMP. See the site plan in Box 4.

Maintenance of restored soils is similar to any landscape area.

- Remove weeds twice a year, around May and October or as needed before weeds go to seed.
- Replenish compost in gardens to a depth of 2-3 inches and lawns 1/4 inch, annually.
- Reduce or eliminate the use of fertilizers, herbicides, pesticides, and permanent irrigation, especially if using all or predominantly native plants.
- Leaf litter left on grass over the winter may kill it; however, leaf litter left to decompose landscape areas, instead of raking in the fall is an effective mulch.
- If the leaf litter aesthetic is not desirable, Mulch once a year with 2-4” of organic matter compost (see Specifications in Grants Pass Stormwater Management Manual, **Appendix D**⁷) in perennial garden areas or for turf areas, aerate and top-dress with 1/4” fine mulch.
- Alternative: Mulch once a year with 2-4” of wood chips for perennial gardens and single trees. See Tree Planting BMP Maintenance Activities for more information on maintenance of individual trees.
- To establish perennial plants, irrigate more in the first year and less to much less in subsequent years. Vary irrigation seasonally. At the beginning of summer, after the rains stop, water a little. Increase irrigation volume as the summer/dry season continues. Taper off irrigation as the rains return. Depending on your area and rainfall patterns, irrigation may be needed from May to October.

The volume of water and frequency of watering varies with the type of plant:

- Trees: 5-10 gallons, once/week
- Shrubs: 3-5 gallons once/week
- Groundcover: 1-2 gallons, once or twice/week
- Perennial herbs: 1/2 gallon, twice/week

CONTAINED PLANTERS BMP MAINTENANCE ACTIVITIES

The following activities apply to contained planters located over impervious hardscapes, as shown on the site plan in Box 4. Since contained planters are above ground, depending on the soil and wind regime, they are more subject to freezing and may dry out faster than the soil around plants that are in the ground.

^{5 5} International Society of Arboculture website. Retrieved from: <http://www.isa-arbor.com/>

⁶ University of Florida, IFAS Extension. Retrieved from: <http://edis.ifas.ufl.edu/pdf/EP/EP31500.pdf>

⁷ City of Grants Pass should provide information here in the footnote on where to find this document

Maintenance for contained planters is similar to conventional landscape maintenance practices:

- Remove weeds twice a year, around May and October or as needed before weeds go to seed.
- Replenish compost to a depth of 2-3 inches annually. Avoid NPK fertilizers (nitrogen -- phosphorus -- potassium) as nitrogen is a common pollutant found in waterways and will easily dissolve in water, flow out of the container bottom onto an impervious surface, and likely into a pipe that drains to a waterway. Replenishing the 2-3" of organic compost every year should provide adequate nutrition slowly and safely.
- Repot plants as needed with native soil (compost amended if necessary) or imported topsoil. Avoid potting soil, which will over nourish plants and cause nutrient pollution as described above.
- Replace dead plants. Consider that some plants are not well-suited to containers. Avoid or minimize flowering plants, which require more fertilizer than non-flowering plants.
- Irrigate perennial plants more in the first year and less to much less in subsequent years. Vary irrigation seasonally. At the beginning of summer, after the rains stop, water a little. Increase irrigation volume as the summer/dry season continues. Taper off irrigation as the rains return. Depending on your area and rainfall patterns, irrigation may be needed from May to October.

The volume of water and frequency of watering varies with the type of plant:

- Shrubs: 3-5 gallons once/week
- Groundcover: 1-2 gallons, once or twice/week
- Perennial herbs: ½ gallon, twice/week.

Since contained planters will be placed over and presumably surrounded by impervious pavement or hot roofs, water plants once a week from July to mid-September after establishment period.

Vegetables and other annuals may need a different volume of water than specified above.

VEGETATED ROOF (GREEN ROOF) BMP MAINTENANCE ACTIVITIES

Experience in the Pacific Northwest has shown vegetated roofs are surprisingly easy to maintain after the establishment period. The following maintenance activities apply to vegetated roof areas as shown on the site plan in Box 4. Maintenance is most demanding during the 3-year plant establishment period. Ongoing inspection and maintenance activities (including during the plant establishment period), include:

Ongoing inspection and maintenance activities (including during the plant establishment period), include:

- For roofs designed without irrigation, watering is left to nature. Where some plants may die, they can be replaced by casting sedum cuttings over the soil in the fall at less cost than watering all summer.
- For roofs with irrigation, water plants during the dry season with no more than 1 inch of water every 10 days. During the wet season, do not irrigate at all. Wet summers or over-irrigation may encourage weed growth.
- Inspect plants in early summer and early fall for overall health and coverage. Replace plants as needed in the fall. Perform weeding at the same visits and more often as needed, removing weeds before they go to seed. In Western Oregon, checking for weeds in late May or early June may limit the necessary weeding to once a year. Remember, irrigation encourages weed growth, so weeding may be needed more often. Do not apply herbicides or pesticides since these pollutants will be efficiently exported downstream.
- Inspect structures such as membrane (if visible), irrigation system, drains, parapets, and access structures annually. As necessary, remove sediment and debris around drains and unclog. Repair the structural integrity of the systems. Contact the manufacturer to repair leaks or tears in the membrane.

- Inspect plant health. If plants are struggling, correct the causes, which may include too much or too little water, pests, condensate from the HVAC system, or chemical spills from rooftop equipment maintenance.
- Inspect for and correct any erosion after large storms (i.e. 2 inches in 24 hours or extreme/high intensity cloud bursts) until plant coverage has been achieved.
- Some vegetated roofs may be designed to receive many visitors, who may not understand what they are visiting. This may increase the level of maintenance, for example by requiring more frequent trash pickups.
- Inspect the irrigation system annually. Look for exposed piping, broken irrigation heads, and especially leaks, which could be very detrimental to the stormwater performance of the vegetated roof and greatly increase vegetation related maintenance activities. Winterize and de-winterize the irrigation system make repairs as needed.
- Install erosion control fabrics against wind as needed to prevent loss of growing medium when replanting.

POROUS PAVEMENT BMP MAINTENANCE ACTIVITIES

The following maintenance activities apply to all porous pavement types (i.e. porous asphalt, pervious concrete, permeable pavers, & porous gravel), as shown on the site plan in Box 4. Maintenance activities for porous pavements are as follows:

Prevent Clogging

- Inspect landscape areas twice a year for erosion. Implement erosion prevention and sediment control measures as needed per the Oregon DEQ Construction Stormwater Erosion and Sediment Control and replant as soon as possible.
- Remove trash and litter, which may carry dirt. Frequency will vary with foot traffic. Busy commercial districts will need more frequent litter pick-ups than suburban or rural residential streets.
- Notify all landscape contractors of their responsibility to help maintain the pavement by requiring them to identify an alternative place to dump landscape materials.
- Never apply cinders to porous pavement. Remove snow and ice with snowplows or liquid deicers. Snowplowing is best; however, raise the plow when snowplowing over pavers, since the plow could catch edges. A number of environmentally sound, salt-free, liquid deicers are available and should be used. According to the National Ready Mixed Concrete Association, deicers should not be applied to pervious concrete in the first year after installation⁸. Other pavements, do not appear to have this sensitivity.
- Remove moss mechanically once a year during the dry season. All pavement in the Pacific Northwest is susceptible to moss. Do not apply mossicides. Some moss is acceptable.
- Maintain porous pavement and surrounding landscapes with integrated pest management. Fertilizers, pesticides, herbicides, or fungicides are all pollutants likely to leach through porous pavement.

Maintain Structures

- Control structures, such as catch basins and manholes should be cleaned out twice a year.
- Inspect and maintain permanent signage, if applicable.

⁸ Stormwater Solutions website. Retrieved from: <http://www.estormwater.com/maintenance-pervades-pervious-concrete>

POROUS ASPHALT AND PERVIOUS CONCRETE SPECIFIC MAINTENANCE ACTIVITIES

In addition to the maintenance activities necessary for all porous pavements, perform the following maintenance activities for porous asphalt and pervious concrete areas as shown on the site plan in Box 4.

- Never seal coat porous asphalt.
- Damaged areas of 50 square feet or less may be patched with conventional asphalt, up to 10% of the total porous pavement area.
- Remove material on surface. The cleaning interval, which might range from every 6 months to every 3 years, should be based on possible exposure to sediments. Use one or more of the following methods:
 - Vacuum twice per year. If the pavement is in a public ROW where agencies sweep the streets with a vacuum truck, then porous pavements will receive this recommended maintenance. It's difficult to get suction on a porous pavement that hasn't at least partially clogged, so this may not be a useful alternative until years into the pavement's life cycle.
 - Pressure washing can be done at an angle to the pavement and not directly into it. Employ erosion control measures when pressure washing. Vactor truck pressure washing once per year is especially good at removing moss. Leaf blowers during the dry season, when material can be blown, are also an option.
 - Leaf/Litter vacuums have been used successfully, the City of Olympia uses a Minuteman Parker Vac-35⁹.
 - Propane torches are useful to kill moss on concrete, but avoid using them on asphalt, which can be damaged by the heat.

Test Surface Permeability Specific to Porous Asphalt and Pervious Concrete. If the infiltration rate of the pavement slows over time, it may be desirable to test the infiltration rate. When the pavement is suspected of draining slower than needed for the design storm, test pervious concrete or porous asphalt surfaces per ASTM C1701.

PERMEABLE PAVERS SPECIFIC MAINTENANCE ACTIVITIES

In addition to the maintenance activities necessary for all porous pavements, perform the following maintenance activities for permeable paver areas as shown on the site plan in Box 4.

- Manage weeds. Permeable paver surfaces have a tendency to grow plants in the infill spaces. Use integrated pest management approaches such as hand-pulling or by using a torch. Commercial maintenance services with trucks that will burn all the weeds off at once are available in Oregon.
- Remove material on surface for maintenance or to unclog a clogged surface. Vacuuming, pressure washing, and leaf blowing may all be used on these systems; however, operations may remove or disturb the infill rock. Replenish it with clean rock meeting the AASHTO No. 8 or equivalent specification (see **Appendix D**).

Test Surface Permeability Specific to Permeable Pavers. Same as porous asphalt and pervious concrete, but test permeability per ASTM C1781.

POROUS FLEXIBLE PAVING SYSTEMS SPECIFIC MAINTENANCE ACTIVITIES

In addition to the maintenance activities necessary for all porous pavements, perform the following maintenance activities for porous flexible paving system areas as shown on the site plan in Box 4.

⁹, Gwilym, K. (2014). *WSU & Puget Sound Partnership Permeable Pavement LID Workshop: Operations and Maintenance: Page 23*. Retrieved from: <http://qoo.gl/hSergF>

Refer the specific manufacturer's maintenance requirements to this O&M Agreement:

Manufacturer: _____

Some general guidance is as follows:

- For porous flexible paving systems with grass, maintenance is similar to turf.
- For flexible paving systems with gravel, broom or rake dislodged gravel back in place.
- Manage weeds. Use integrated pest management approaches such as hand-pulling (during the wet weather when soils are softer and roots can be effectively removed), or by burning or pouring hot water on weeds.
- Inspect for bare soil, exposed ruts, ruts, poorly growing grass from too much shade, and thatch.
- In the case of spills, ruts, or disturbance to access underground utilities, the flexible paving systems may be cut with a sod cutter, set aside, and put back in place after subgrade has been reconstructed.
- Avoid aeration since this machinery will damage the pavement.
- Snow plowing may be done by "using standard truck-mounted snow plowing blades with small skids on the corners to keep the bottom of the blade"¹⁰ about 1" above the grass surface.

POROUS GRAVEL SPECIFIC MAINTENANCE ACTIVITIES

In addition to the maintenance activities necessary for all porous pavements, perform the following maintenance activities for porous gravel areas as shown on the site plan in Box 4.

- Manage weeds. Hand pull, burn with a torch, or pour hot water on them in May and October.
- If the rock surface gets clogged, carefully shovel the first 1 to 2 inches of rock and rinse it off in a disconnected landscape area, which is an area that does not drain to any sort of structured inlet or towards any surface like a driveway or road that drains to a structured inlet. Employ appropriate erosion control techniques during the washing, as necessary to prevent erosion and capture sediment.

RAIN GARDEN, STORMWATER PLANTER, & LID SWALE BMP MAINTENANCE ACTIVITIES

The following maintenance activities apply to rain gardens, stormwater planters, LID swales, and/or water quality conveyance swales, as shown on the site plan in Box 4.

- Do not mow these facilities, regardless of whether they are planted with lawn/sod or bunch grasses. This greatly reduces the capacity for the facility to slow flows and settle out solids.

Inspect the facility a minimum of 4 times per year and perform needed maintenance as follows:

- Maintain a calm flow of water entering the facility via downspout pipes or other inlets.
 - Identify erosion sources and control them when soil is exposed, or erosion channels are forming. A settling basin or other effective means shall be placed around the point where water is discharged into the facility to slow the water and prevent erosion. Fill erosion channels with approved soil mix, not mulch, compost, or rock, and replant using a species of plant in the facility adjacent to the eroded channel.
 - Identify and correct sources of sediment and debris.
- Remove sediment and debris from:
 - The pretreatment sump

¹⁰ Marine Amazing website. Stormwater Management. Retrieved from: http://www.psparchives.com/publications/our_work/stormwater/lid/2009_Local_Assistance/005_Appendices/Grasspave2MaintenanceGuide.pdf

- Facility surface when more than 1" thick or damaging vegetation. Minimize damage to vegetation.
- The facility outlet, such as overflow drain or conveyance swale.
- Curb cuts when depth exceeds ¼ inch.
- Stabilize slopes with plants and appropriate erosion control measures when soil is exposed, or erosion channels are forming. Fill eroded channels with approved soil and replant. If flows can be redirected temporarily, redirect flows until plants establish. Check for erosion as a result of redirected flows on the next site visit.
- Maintain the design ponding depth by:
 - Repairing any structural elements that may leak from cracks or worn sealant
 - Maintaining the design elevation of check dams
- Soil should allow storm water to infiltrate uniformly through the BMP.
 - If the facility does not drain within 48 hours, scrape 1 inch of soil out of the facility and replace with imported soil meeting the specifications provided in Appendix D: Specifications "Treatment Soil". Infiltration test the facility to confirm drainage by either soaking the entire facility with water or by observing the facility during the next rain event.
 - If facility does not drain after scraping 1", try another 1" depth.
 - If facility does not drain after scraping 2", salvage plants, till and replant the facility.
 - Debris in quantities that inhibit infiltration shall be removed routinely (e.g., no less than quarterly), or upon discovery.
- Vegetation should be healthy and dense enough to provide filtering while protecting underlying soils from erosion with at least 95% coverage of bare soil in three years.
 - Replenish mulch until vegetation is established and shading the bottom of the facility.
 - Remove fallen leaves and debris from deciduous plant foliage, especially if the facility is in a roadway with trees located upstream from a curb.
 - Don't string trim ornamental grasses, sedges or rushes. These may be raked.
 - Remove nuisance (i.e. plants blocking the inlet) and non-native and invasive vegetation (i.e. weeds such as Himalayan blackberries and English Ivy) when discovered.
 - Remove dead vegetation and woody material before it covers 10% of the rain garden surface area. Vegetation shall be replaced within 3 months, or immediately if required to maintain cover density and control erosion where soils are exposed.
 - Maintain vegetation using integrate pest management approaches such as hand pulling weeds. Avoid the use of fertilizers, pesticides, and herbicides, as these are common pollutants found in waterways.
 - Irrigate during the establishment period. Watering and weeding may be needed frequently within the first 1 to 3 years during Oregon's very dry summers, but this should taper off dramatically if you choose native perennial plants. The goal during the establishment period is to make plants as "drought proof" as possible by watering deeply and infrequently. Shallow, frequent watering will only make plants dependent on continued watering.
 - To establish perennial plants, you'll need to irrigate more in the first year and less to much less in subsequent years. In addition, plants benefit from varying irrigation seasonally. At the beginning of summer, after the rains stop, water a little. Increase irrigation volume as the summer/dry season continues. Taper off irrigation as the rains return. Depending on your area and rainfall patterns, irrigation may be needed from May to October.
 - The volume of water and frequency of watering varies with the type of plant:
 - Trees: 5-10 gallons, once/week
 - Shrubs: 3-5 gallons once/week

- Groundcover: 1-2 gallons, once or twice/week
 - Perennial herbs: ½ gallon, twice/week.
 - After the 2 – 3 year establishment period, irrigation would theoretically not be needed; however, plantings surrounded by impervious pavement will probably require occasional irrigation beyond the establishment period, indefinitely.
- Exercise spill prevention measures when handling substances that can contaminate stormwater.
 - Correct releases of pollutants as soon as identified:
 - Make sure the area is safe to enter
 - Block the outflow of the BMP
 - Block the inflow of the BMP
 - Stop the release of the hazmat
 - Clean up the flow path to the BMP
 - Clean out the BMP, replacing soil, amended soil and vegetation as necessary.

SOAKAGE TRENCH BMP MAINTENANCE ACTIVITIES

The following maintenance activities apply to soakage trenches, as shown on the site plan in Box 4. Inspect the facility a minimum of 4 times per year during each season and after major storms and perform needed maintenance as follows:

- Confirm via the observation port or other structure that the facility is emptying out/infiltrating. Clogged facilities (*i.e.* not draining within 30 hours) must be completely reconstructed or relocated.
- Remove debris from pipes and other conveyance.
- Repair or replace damaged pipes.
- For soakage trenches that receive runoff from adjacent surfaces, sediment and debris will tend to clog the surface of the facility. Vacuum sediment from rocks. If water can no longer drain into the facility, clogging of the top geotextile has occurred. Using sediment control techniques such as compost berms and biobags, carefully remove and clean rock on the surface. Replace the geotextile fabric on the top, being careful not to damage the fabric on the sides. Place the cleaned rock back over the geotextile fabric. Dispose of sediment in trash. Sweeping regularly will reduce the likelihood of clogging. High traffic areas will clog faster than low traffic areas.
- Maintain manufactured structures like silt basins and water quality manholes per manufacturer’s operations and maintenance guidelines. The manufacturers of structures on this site include (continue listing below if more than two):

Manufacturer: _____

Manufacturer: _____

DRYWELL BMP MAINTENANCE ACTIVITIES

The following maintenance activities apply to drywells as shown on the site plan in Box 4. Properly cared for drywells in Oregon are still functioning after 80 years. It is unlikely that a facility can be repaired when it becomes clogged, so proper maintenance is critical.

Maintenance activities include:

- Remove excess debris from all structures twice a year.
- Control erosion from areas draining to drywell.
- Pick up and remove trash.
- Maintain piping to and from drywell using industry standard best practices. Remove any vegetation that might clog these.

- Inspections should occur frequently and decline in frequency with larger facilities. Vacuum excess sediment from the pretreatment sump and the sump installed on the bottom of the drywell itself on an annual basis in the fall or more often as dictated by site conditions.

WATER QUALITY CONVEYANCE SWALE BMP MAINTENANCE ACTIVITIES

The following maintenance activities apply to water quality conveyance swales as shown on the site plan in Box 4.

Inspect the facility a minimum of 4 times per year and perform needed maintenance as follows:

- Maintain a calm flow of water entering the facility via downspout pipes or other inlets.
 - Identify erosion sources and control them when soil is exposed, or erosion channels are forming. A settling basin or other effective means should be placed at the point where water is discharged into the facility to slow the water and prevent erosion. Fill erosion channels with approved soil mix, not mulch, compost, or rock, and replant using a plant species found in the facility adjacent to the eroded channel.
 - Identify sources of sediment and debris and correct.
- Remove sediment and debris from:
 - Pretreatment sump
 - Facility surface when more than 1" thick or damaging vegetation. Minimize damage to vegetation.
 - Facility outlet, such as overflow drain or conveyance swale.
 - Curb cuts when depth exceeds ¼ inch.
- Stabilize slopes with plants and appropriate erosion control measures when soil is exposed, or erosion channels are forming. Fill eroded channels with approved soil and replant. If flows can be redirected temporarily, redirect flows until plants establish. Check for erosion due to redirected flows on the next site visit.
- Maintain the design ponding depth by:
 - Repairing any structural elements that may leak from cracks or worn sealant
 - Maintaining the design elevation of check dams
- Vegetation should be healthy and dense enough to provide filtering while protecting underlying soils from erosion with at least 95% coverage of bare soil in three years.
 - Replenish mulch until vegetation in the bottom of the WQ conveyance swale is established and shading the bottom of the facility.
 - Remove fallen leaves and debris from deciduous plant foliage, especially if the facility is in a roadway with trees located upstream from a curb.
 - Don't string trim ornamental grasses, sedges or rushes. These may be raked.
 - Remove nuisance (*i.e.* plants blocking the inlet) and non-native and invasive vegetation (*i.e.* weeds such as Himalayan blackberries and English Ivy).
 - Remove dead vegetation and woody material before they cover 10% of the rain garden surface area. Vegetation should be replaced within 3 months, or immediately if required to maintain cover density and control erosion where soils are exposed.
 - Maintain vegetation using integrate pest management such as hand pulling weeds. Avoid use of fertilizers, pesticides, and herbicides, as these are common pollutants found in waterways.
- Exercise spill prevention measures when handling substances that can contaminate stormwater. Correct releases of pollutants as soon as identified:
 - Make sure the area is safe to enter
 - Block the outflow of the BMP
 - Block the inflow of the BMP

- Stop the release of the hazmat
- Clean up the flow path to the BMP
- Clean out the BMP, replacing soil, amended soil and vegetation as necessary.
- Mow if required by ODOT.

DISPERSION BMP MAINTENANCE ACTIVITIES

The following maintenance activities apply to dispersion BMPs (*i.e.* vegetated filter strips or downspout disconnection) as shown on the site plan in Box 4.

Common maintenance tasks are as follows:

- Mow and trim grasses (when dry) to lengths appropriate to the type and species of grass. Longer grass is generally better, and mowing is not required if it is not desired.
- Identify and correct sources of sediment and debris.
- Inspect for and remove excess sediment (maximum depth of 2 inches) that may affect vegetation growth in the dispersion area or the level spreader. Dispose of sediment in the trash.
- Replace vegetation as needed. If a plant did not do well, choose a different plant.
- Repair eroded areas where channels have formed by filling them with soil, lightly compacting them with tamping or boot compaction, and reestablish vegetation. Do not fill eroded channels with mulch. If possible, redirect flows around the establishing vegetation for three (3) months. Inspect other areas around redirecting device (ex. sandbag) to ensure that this redirection is not causing additional erosion. If plants receiving redirected flows are small or not very sturdy and erosion is or may occur, biobags (a sediment control measure, which is a bag with compost or wood chips) will allow water to enter the vegetated filter strip slowly and may be a better way to prevent erosion than redirecting flows.
- Because vegetated filter strips look very similar to a regular garden, some sort of permanent demarcation, such as fencing (even something as simple and attractive as a 2-foot-tall post and chain fence) should be installed if the area is receiving regular foot traffic that is compacting soils and/or impacting plant health.

LEVEL SPREADER MAINTENANCE ACTIVITIES

The following maintenance activities apply to level spreaders, as shown on the site plan in Box 4.

In high sediment areas, level spreaders will be high maintenance elements of a BMP. Spreading water out so that it cascades over a level spreader instead of concentrating at a single point and causing erosion is difficult to achieve. While the level spreader design recommended here may be high maintenance, it will reduce problems with erosion and is considered an effective means of spreading out flows.

The main maintenance activity with a level spreader is keeping the rock clean, so that the rough edges of the angular rock remain exposed to the runoff and are able to slow and spread it. This slowing of runoff causes sediments to settle out and serves as pretreatment for a best management practice such as a vegetated filter strip or a rain garden.

Maintenance activities include:

- Remove weeds twice a year if enough sediment accumulates to grow weeds but not enough accumulates to warrant cleaning the rock.
- Clean rock before the angular rock is completely buried in sediment. Frequency will depend on the type of pavement and if any uphill landscape areas draining across the pavement are stabilized. Roofs generally contribute the least amount of sediment, although roofs near highways will have more particulates deposited on their surface. Generally, for roads, sediment will increase

with the number of cars on them. Lawns will contribute the highest volume of sediment, if they happen to be uphill of the pavement that drains to the vegetated filter strip.

Using a flat shovel, remove the rock to a depth of at least 6 inches. Install appropriate erosion control techniques (See the DEQ's "Construction Stormwater Erosion and Sediment Control Manual"¹¹) such as biobags or wattles. On a plastic tarp, hose off the rock, ideally located in an area that is hydraulically isolated and will not drain to a catch basin or other conveyance system. Place the clean rock back and dispose of sediment and organic matter in the trash.

- Stabilize landscapes draining to the level spreader to reduce maintenance.
- Maintain and re-establish, if necessary, if flows into the facility are not well distributed across the level spreader.
- Sweep rocks back into place as needed to prevent a tripping hazard condition.

WET, EXTENDED WET, AND DRY DETENTION PONDS

Maintenance activities for ponds will be unique each project. Project planner must submit an adapted maintenance plan with application package. The maintenance plan below should serve as a minimum guideline to maintenance activities.

Ponds are constructed ponds with a permanent pool of water. Pollutants are removed from stormwater through gravitational settling and biologic processes. Extended Wet Ponds are constructed ponds with a permanent pool of water and open storage space above for short-term detention of large storm events. Pollutants are removed from stormwater through gravitational settling and biologic processes. Dry Detention Ponds are constructed ponds with temporary storage for the detention of large storm events. The stormwater is stored and released slowly over a matter of hours.

All facility components, vegetation, and source controls shall be inspected for proper operations and structural stability. Gauges located at the opposite ends of the wet pond shall be maintained to monitor sedimentation. Gauges shall be checked 2 times per year. These inspections shall occur, at a minimum, quarterly for the first 2 years from the date of installation, and 2 times per year thereafter, and within 48 hours after each major storm event.

Training and/or Written Guidance information for operating and maintaining Ponds shall be provided to all property owners and tenants. A copy of the O & M Plan shall be provided to all property owners and tenants.

Inspection Logs shall be kept by the facility owner demonstrating the following items have been inspected and are being maintained properly:

- **Access** to Ponds shall be safe and efficient. Vehicular routes shall be maintained to design standards to accommodate size and weight of vehicles. Obstacles preventing maintenance personnel and/or equipment access shall be removed.
- **Debris and Litter** shall be removed to prevent channelization, clogging, and interference with plant growth. Fallen leaves and debris from deciduous plant foliage shall be raked and removed.
- **Erosion Damage** shall be identified and controlled when native soil is exposed or erosion channels are forming.
- **Inlets** shall be cleared when conveyance capacity is plugged to ensure unrestricted stormwater

¹¹ Oregon Department of Environmental Quality. (2013). Water Quality Division. Construction Stormwater Erosion and Sediment Control manual. Retrieved from: <http://www.deq.state.or.us/wg/wqpermit/docs/general/npdes1200c/ErosionSedimentControl.pdf>

flow to the wet pond.

- **Nuisance or Prohibited Vegetation** from the Eugene Plant List (such as blackberries or English Ivy) shall be removed when discovered. Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced.
- **Outlets and Overflow Structures** shall be cleared when 50% of the conveyance capacity is plugged.
- **Piping** shall be examined and re-installed if more than 1-inch of settlement. Remove sediment deposits to maintain flow capacity.
- **Rocks or Other Armoring** shall be replaced when only one layer of rock exists above native soil.
- **Sedimentation** build-up near or exceeding 50% of the facility capacity shall be removed every 2-5 years, or sooner if performance is being affected. Wet Ponds shall be dredged when 1 foot of sediment accumulates in the pond.
- **Slopes** shall be stabilized using appropriate measures when native soil is exposed.
- **Vegetation** shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion and minimizing solar exposure of open water areas. Vegetation producing foul odors shall be eliminated. Dead vegetation shall be removed to maintain less than 10% of area coverage or when wet pond function is impaired. Vegetation shall be replaced within 3 months, or immediately if required to maintain cover density and control erosion where soils are exposed. Vegetation, large shrubs or trees that limit access or interfere with wet pond operation shall be pruned or removed. Grass (where applicable) shall be mowed to 4"-9" high and grass clippings shall be removed.

Spill Prevention Measures shall be exercised on site when handling substances that contaminate stormwater. Releases of pollutants shall be corrected as soon as identified. Gravel or ground cover shall be added if erosion occurs, e.g., due to vehicular or pedestrian traffic.

Non-Chemical Pest Control measures shall be taken to prevent development of insects, mosquitoes, and rodents.

- If a complaint is received or an inspection reveals that the pond is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee will be required to eliminate the infestation. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City.
- Acceptable methods include but are not limited to the following:
 - Installation of predacious bird or bat nesting boxes.
 - Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles.
- If non-chemical methods have proved unsuccessful, contact the City prior to use of chemical methods such as the mosquito larvicides *Bacillus thurengensis* var. *israeliensis* or other approved larvicides. These materials may only be used with City approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor.