

## Appendix I

# Operation and Maintenance Standard Operating Procedures



## City of Kirkland

Public Works Department - Surface Water Division



Standard Operating Procedures (SOP's)

May, 2014

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**ACTIVITY: 710 – Storm Manhole Cleaning**

**DESIRED RESULT:**

Storm manholes are cleaned and free of debris by vacuuming.

**RESOURCES:**

Crew

- 1 - Senior Maintenance
- 1 - Utility Person
- 2 - Flaggers (as needed)

Material

Water

Equipment

- 1 - Eductor truck
- 1 – Back-up truck with overhead arrow for traffic control (if needed)
- PPE (gloves, hardhat, safety glasses, rain gear, rubber boots, hearing protection)
- Laptop, charger and cleaning sheets

Contractor/Vendor Costs

Debris – decant spoils  
Kirkland-approved decant location

**GENERAL WORK METHOD:**

1. Lead identifies area to be inspected by studying the video inspection data.
2. Lead prepares work schedule and dispatches staff.
3. Place traffic control signs and safety devices as required at jobsite.
4. Use proper PPE.
5. Apply all confined space equipment.
6. Senior Maintenance and Utility Person work together to position equipment, remove manhole lid, and insert rod to measure sediment level.
7. Note in comments of Hansen WO# if illicit discharge or connection (KMC 15.52.090) is observed and initiate a service request for Activity 781: respond by following procedures in City of Kirkland Illicit Discharge and Spill Guidance Manual.
8. If cleaning is needed, staff cleans all areas within structure so that base of manhole is exposed. Vacuum debris from storm manhole. Clean all surfaces, walls, brick, concrete, inlet and outfall.
9. Inspect condition of inlet, outfall, and brick/concrete structure.
10. Clean inlets and outfalls if accumulated sediment is 20% or more of the pipe.
11. Replace and secure lid to avoid noise from traffic driving over it.
12. Clean up jobsite, tools and truck.
13. Remove traffic control signs and safety devices as required at jobsite.
14. Decant eductor truck in decant spoils bay.
15. Make notes about any further work that is needed.
16. Accurately report manholes cleaned in computer and on production sheet.

**BMP(S):**

1. Refer to current Western Washington Phase II Municipal Stormwater Permit (August 1, 2013 - July 31, 2018).
2. Refer to King County Surface Water Design Manual Maintenance Requirements for Conveyance Systems for proper actions.
3. Refer to City of Kirkland Municipal Code, Illicit Discharges and Illicit Connections (KMC 15.52.090) for Code clarification.
4. Refer to City of Kirkland Illicit Discharge and Spill Guidance Manual for spill response procedures.
5. If in, adjacent to, or upstream from sensitive area:
  - Complete "concurrency form" and submit to Planning Supervisor.
  - Coordinate with Environmental Supervisor and Environmental unit regarding site-specific permit requirements and BMPs.
  - Follow Environmental Review process located in the Endangered Species Act Program Proposal, Appendix B.
6. Haul all Environmental/Regulatory permits on site during construction or maintenance work.
7. Have "SPILL KITS" (and employees trained to use) onsite.
8. Monitor BMPs during and following construction until site conditions stabilize.
9. Remove BMPs according to guidelines.
10. Help reduce operation impacts to climate change - minimize carbon outputs by not idling equipment and work to reduce two stroke equipment use as much as possible.

**GENERAL FREQUENCY:**

All catch basins and inlets will be inspected at least once no later than August 1, 2017 and every two years thereafter (per current NPDES permit requirements S5.C.5.d).

**TIME STANDARD:**

Average production – 10-15 minutes per manhole.

**ACTIVITY: 711 – Storm Conveyance Vault Cleaning**

**DESIRED RESULT:**

Storm conveyance vaults are free of debris by vacuuming.

**RESOURCES:**

Crew

1 - Senior Maintenance  
1 - Utility Person

Material

Water

Equipment

1 - Eductor truck  
PPE (gloves, hardhat, safety glasses, rain gear, rubber boots, hearing protection)  
Laptop, charger and cleaning sheets

Contractor/Vendor Costs

Debris – decant spoils  
Kirkland-approved decant location

**GENERAL WORK METHOD:**

1. Lead conducts visual inspection and inserts rod to check level of sediment depth.
2. Lead prepares work schedule and dispatches staff.
3. Place traffic control signs and safety devices as required at jobsite.
4. Use proper PPE.
5. Apply all confined space equipment.
6. Senior Maintenance and Utility Person work together to position equipment and remove manhole lid or open vault hatch.
7. Inspect condition of inlet, outfall, and brick/concrete structure.
8. Note in comments of Hansen WO# if illicit discharge or connection (KMC 15.52.090) is observed and initiate a service request for Activity 781; respond by following procedures in City of Kirkland Illicit Discharge and Spill Guidance Manual.
9. Clean inlets and outfalls if accumulated sediment is 20% or more of the pipe.
10. Clean vault if accumulation of sediment depth exceeds 10% of the diameter of the conveyance vault.
11. If cleaning is needed, staff vacuums all areas within structure so that visual inspection can be conducted.
12. Wash inside of the structure completely.
13. Remove eductor tube and replace lid or close hatch to avoid noise from traffic driving over it.
14. Clean up jobsite, tools and truck.
15. Remove traffic control signs and safety devices as required at jobsite.
16. Make notes about any further work that is needed.
17. Decant eductor truck in decant spoils bay.
18. Accurately report manholes and vaults cleaned in computer and on production sheet.

**BMP(S):**

1. Refer to current Western Washington Phase II Municipal Stormwater Permit (August 1, 2013 - July 31, 2018).
2. Refer to King County Surface Water Design Manual Maintenance Requirements for Conveyance Systems for proper actions.
3. Refer to City of Kirkland Municipal Code, Illicit Discharges and Illicit Connections (KMC 15.52.090) for Code clarification.
4. Refer to City of Kirkland Illicit Discharge and Spill Guidance Manual for spill response procedures.
5. If in, adjacent to, or upstream from sensitive area:
  - Complete "concurrency form" and submit to Planning Supervisor.
  - Coordinate with Environmental Supervisor and Environmental unit regarding site-specific permit requirements and BMPs.
  - Follow Environmental Review process located in the Endangered Species Act Program Proposal, Appendix B.
6. Haul all Environmental/Regulatory permits on site during construction or maintenance work.
7. Have "SPILL KITS" (and employees trained to use) onsite.
8. Monitor BMPs during and following construction until site conditions stabilize.
9. Remove BMPs according to guidelines.
10. Help reduce operation impacts to climate change - minimize carbon outputs by not idling equipment and work to reduce two stroke equipment use as much as possible.

**GENERAL FREQUENCY:**

All catch basins and inlets will be inspected at least once no later than August 1, 2017 and every two years thereafter (per current NPDES permit requirements S5.C.5.d).

**TIME STANDARD:**

2-3 hours per vault.

**ACTIVITY: 712 – Storm Catch Basin Cleaning**

**DESIRED RESULT:**

Type I catch basins are free of debris by vacuuming.

**RESOURCES:**

Crew

- 1 - Senior Maintenance
- 1 - Utility Person
- 2 - Flaggers (as needed)

Material

Water

Equipment

- 1 - Eductor truck
- 1 – Back-up truck with overhead arrow for traffic control
- PPE (gloves, hardhat, safety glasses, rain gear, rubber boots, hearing protection)
- Laptop, charger and cleaning sheets

Contractor/Vendor Costs

Debris – decant spoils  
Kirkland-approved decant location

**GENERAL WORK METHOD:**

1. Lead prepares work schedule and dispatches staff.
2. Place traffic control signs and safety devices as required at jobsite.
3. Use proper PPE.
4. Apply all confined space equipment.
5. Senior Maintenance and Utility Person work together to remove catch basin lid and position equipment.
6. Insert rod to measure sediment level to determine if cleaning is needed.
7. Note in comments of Hansen WO# if illicit discharge or connection (KMC 15.52.090) is observed and initiate a service request for Activity 781; respond by following procedures in City of Kirkland Illicit Discharge and Spill Guidance Manual.
8. If cleaning is needed, staff vacuums all areas within structure so that visual inspection can be conducted.
9. Clean all surfaces, walls, brick, concrete, inlet and outfall.
10. Inspect condition of inlet, outfall, and brick/concrete structure.
11. Clean inlets and outfalls if accumulated sediment is 20% or more of the pipe.
12. Remove eductor tube and replace lid or close hatch to avoid noise from traffic driving over it.
13. Clean up jobsite, tools and truck.
14. Remove traffic control signs and safety devices as required at jobsite.
15. Make notes about any further work that is needed.
16. Decant eductor truck in decant spoils bay.
17. Accurately report catch basins cleaned in computer and on production sheet.

**BMP(S):**

1. Refer to current Western Washington Phase II Municipal Stormwater Permit (August 1, 2013 - July 31, 2018).
2. Refer to King County Surface Water Design Manual Maintenance Requirements for Conveyance Systems for proper actions.
3. Refer to City of Kirkland Municipal Code, Illicit Discharges and Illicit Connections (KMC 15.52.090) for Code clarification.
4. Refer to City of Kirkland Illicit Discharge and Spill Guidance Manual for spill response procedures.
5. If in, adjacent to, or upstream from sensitive area:
  - Complete “concurrence form” and submit to Planning Supervisor.
  - Coordinate with Environmental Supervisor and Environmental unit regarding site-specific permit requirements and BMPs.
  - Follow Environmental Review process located in the Endangered Species Act Program Proposal, Appendix B.
6. Haul all Environmental/Regulatory permits on site during construction or maintenance work.
7. **Have “SPILL KITS” (and employees trained to use) onsite.**
8. Monitor BMPs during and following construction until site conditions stabilize.
9. Remove BMPs according to guidelines.
10. Help reduce operation impacts to climate change - minimize carbon outputs by not idling equipment and work to reduce two stroke equipment use as much as possible.

**GENERAL FREQUENCY:**

All catch basins and inlets will be inspected at least once no later than August 1, 2017 and every two years thereafter (per current NPDES permit requirements S5.C.5.d).

**TIME STANDARD:**

Average production – 5-10 minutes per catch basin.

**ACTIVITY: 714 – Storm Main Cleaning**

**DESIRED RESULT:**

Storm mains are free of debris by rodding pipes and cleaning structures as needed.

**RESOURCES:**

Crew

- 1 - Senior Maintenance
- 1 - Utility Person
- 2 - Flaggers (as needed)

Material

Water

Equipment

- 1 - Eductor truck
- 1 – Back-up truck with overhead arrow for traffic control
- PPE (gloves, hardhat, safety glasses, rain gear, rubber boots, hearing protection)
- Laptop, charger and cleaning sheets

Contractor/Vendor Costs

Debris – decant spoils  
Kirkland-approved decant location

**GENERAL WORK METHOD:**

1. Lead or Senior Maintenance identifies area to be inspected by studying the ongoing list, priority list, and video inspection list.
2. Lead prepares work schedule and dispatches staff.
3. Place traffic control signs and safety devices as required at jobsite.
4. Use proper PPE.
5. Clean inlets and outfalls if accumulated sediment is 20% or more of the pipe.
6. Senior Maintenance and Utility Person work together to remove manhole/catch basin lid and position equipment.
7. Note in comments of Hansen WO# if illicit discharge or connection (KMC 15.52.090) is observed and initiate a service request for Activity 781; respond by following procedures in City of Kirkland Illicit Discharge and Spill Guidance Manual.
8. Hydro jet the line as needed to clean out debris, roots, etc.
9. Eductor ALL debris during cleaning or screening.
10. Spray out structure.
11. Inspect condition of inlet and outfall for deficiencies.
12. Remove equipment.
13. Replace and secure lid to avoid noise from traffic driving over it.
14. Clean up jobsite, tools and truck.
15. Remove traffic control signs and safety devices as required at jobsite.
16. Decant eductor truck in decant spoils bay.
17. Make notes about any further work that is needed.
18. Accurately report lineal feet cleaned in computer and on production sheet.

**BMP(S):**

1. Refer to current Western Washington Phase II Municipal Stormwater Permit (August 1, 2013 - July 31, 2018).
2. Refer to King County Surface Water Design Manual Maintenance Requirements for Conveyance Systems for proper actions.
3. Refer to City of Kirkland Municipal Code, Illicit Discharges and Illicit Connections (KMC 15.52.090) for Code clarification.
4. Refer to City of Kirkland Illicit Discharge and Spill Guidance Manual for spill response procedures.
5. If in, adjacent to, or upstream from sensitive area:
  - Complete “**concurrence form**” and submit to Planning Supervisor.
  - Coordinate with Environmental Supervisor and Environmental unit regarding site-specific permit requirements and BMPs.
  - Follow Environmental Review process located in the Endangered Species Act Program Proposal, Appendix B.
6. Haul all Environmental/Regulatory permits on site during construction or maintenance work.
7. **Have “SPILL KITS” (and employees trained to use) onsite.**
8. Monitor BMPs during and following construction until site conditions stabilize.
9. Remove BMPs according to guidelines.
10. Help reduce operation impacts to climate change - minimize carbon outputs by not idling equipment and work to reduce two stroke equipment use as much as possible.

**GENERAL FREQUENCY:**

All catch basins and inlets will be inspected at least once no later than August 1, 2017 and every two years thereafter (per current NPDES permit requirements S5.C.5.d).

**TIME STANDARD:**

Varies depending on size of pipe and amount of debris that has accumulated.

**ACTIVITY: 716 – Storm Main Video Inspection**

**DESIRED RESULT:**

Use camera to inspect and evaluate the condition of storm mains and manholes for defects and condition ratings. Generate CCTV reporting to record pipe imperfections.

**RESOURCES:**

Crew

- 1 - Senior Maintenance
- 1 - Utility Person
- 2 - Flaggers (as needed)

Material

Equipment

- 1 – Camera truck
- 1 – Back-up truck with overhead arrow for traffic control
- PPE (gloves, hardhat, safety glasses, rain gear, rubber boots, hearing protection)

Contractor/Vendor Costs

**GENERAL WORK METHOD:**

1. Lead prepares work schedule and dispatches staff.
2. Place traffic control signs and safety devices as required at jobsite.
3. Use proper PPE.
4. Apply all confined space equipment and complete forms for atmosphere testing.
5. Senior Maintenance and Utility Person work together to position equipment and remove manhole or catch basin lid.
6. Inspect condition of inlet, outfall, and brick/concrete structure.
7. Note in comments of Hansen WO# if illicit discharge or connection (KMC 15.52.090) is observed and initiate a service request for Activity 781; respond by following procedures in City of Kirkland Illicit Discharge and Spill Guidance Manual.
8. Install video camera in pipe.
9. Begin video inspection.
10. Remove camera.
11. Replace and secure lid to avoid noise from traffic driving over it.
12. Clean up jobsite, tools and truck.
13. Make note on report about any further work that is needed.
14. Accurately report lineal feet of pipe inspected in computer and on production sheet.

**BMP(S):**

1. Refer to King County Surface Water Design Manual Maintenance Requirements for Conveyance Systems for proper actions.
2. Refer to City of Kirkland Municipal Code, Illicit Discharges and Illicit Connections (KMC 15.52.090) for Code clarification.
3. Refer to City of Kirkland Illicit Discharge and Spill Guidance Manual for spill response procedures.
4. If in, adjacent to, or upstream from sensitive area:
  - Complete "concurrency form" and submit to Planning Supervisor.
  - Coordinate with Environmental Supervisor and Environmental unit regarding site-specific permit requirements and BMPs.
  - Follow Environmental Review process located in the Endangered Species Act Program Proposal, Appendix B.
5. Haul all Environmental/Regulatory permits on site during construction or maintenance work.
6. Have "SPILL KITS" (and employees trained to use) onsite.
7. Monitor BMPs during and following construction until site conditions stabilize.
8. Remove BMPs according to guidelines.
9. Help reduce operation impacts to climate change - minimize carbon outputs by not idling equipment and work to reduce two stroke equipment use as much as possible.

**GENERAL FREQUENCY:**

Driven by annual overlay program, as storm crew requires video inspection, and ongoing.

**TIME STANDARD:**

500 - 1,000' per day.



**ACTIVITY: 718 – Storm Video Truck - Repair, Downtime, Record Update**

**DESIRED RESULT:**

Perform maintenance and repair to storm video truck; download and upload video files.

**RESOURCES:**

Crew

- 1 – Senior Maintenance
- 1 - Utility Person

Material

Equipment

- 1 – Camera truck

Contractor/Vendor Costs

**GENERAL WORK METHOD:**

1. Lead prepares work schedule and dispatches staff.
2. Perform daily, weekly, and monthly software updates to GraniteXP, GeoResults, and mapping software.
3. Maintain/repair four cameras and adjacent operating systems – mechanical, electrical, and software.
4. Coordinate with PW engineers, managers, leads, Senior Utility staff to perform CCTV inspections on requested lines.
5. Maintain K-1 (camera truck #1) and generator – all systems to ensure availability of equipment.
6. Complete daily and monthly reports of CCTV inspections.
7. Clean up jobsite, tools and truck.
8. Make note on report about any further work that is needed.

**BMP(S):**

1. Refer to King County Surface Water Design Manual Maintenance Requirements for Conveyance Systems for proper actions.
2. Refer to City of Kirkland Municipal Code, Illicit Discharges and Illicit Connections (KMC 15.52.090) for Code clarification.
3. Refer to City of Kirkland Illicit Discharge and Spill Guidance Manual for spill response procedures.
4. If in, adjacent to, or upstream from sensitive area:
  - Complete “concurrency form” and submit to Planning Supervisor.
  - Coordinate with Environmental Supervisor and Environmental unit regarding site-specific permit requirements and BMPs.
  - Follow Environmental Review process located in the Endangered Species Act Program Proposal, Appendix B.
5. Haul all Environmental/Regulatory permits on site during construction or maintenance work.
6. **Have “SPILL KITS” (and employees trained to use) onsite.**
7. Monitor BMPs during and following construction until site conditions stabilize.
8. Remove BMPs according to guidelines.
9. Help reduce operation impacts to climate change - minimize carbon outputs by not idling equipment and work to reduce two stroke equipment use as much as possible.

**GENERAL FREQUENCY:**

As needed.

**TIME STANDARD:**

Dependent on repairs required.

**ACTIVITY: 720 – Storm Catch Basin Cleaning By Hand**

**DESIRED RESULT:**

Manually clean and repair catch basins to improve drainage.

**RESOURCES:**

Crew

- 1 - Senior Maintenance
- 1 - Utility Person

Material

Equipment

- 1 – Service truck
- 2 – Flat shovels
- 1 – Broom
- 1 - Pick
- PPE (gloves, hardhat, safety glasses, rain gear, rubber boots, hearing protection)
- Laptop, charger and cleaning sheets

Contractor/Vendor Costs

Red-E-Trucking to Seattle

**GENERAL WORK METHOD:**

1. Lead prepares work schedule and dispatches staff.
2. Place traffic control signs and safety devices as required at jobsite.
3. Remove grate and inspect to determine if repairs are needed and can be done onsite.
4. Inspect condition of inlet, outfall, and brick/concrete structure.
5. Note in comments of Hansen WO# if illicit discharge or connection (KMC 15.52.090) is observed and initiate a service request for Activity 781; respond by following procedures in City of Kirkland Illicit Discharge and Spill Guidance Manual.
6. Clean inlets and outfalls if accumulated sediment is 20% or more of the pipe.
7. Use shovel and broom to remove leaves and debris in and around catch basin grate and gutter line.
8. Collect debris and place in service truck.
9. If work is **required, use proper PPE's.**
10. Clean up jobsite, tools and truck.
11. Remove traffic control signs and safety devices as required at jobsite.
12. Make notes about any further work that is needed.
13. Accurately report catch basins cleaned and repaired in computer and on production sheet.

**BMP(S):**

1. Refer to current Western Washington Phase II Municipal Stormwater Permit (August 1, 2013 - July 31, 2018).
2. Refer to King County Surface Water Design Manual Maintenance Requirements for Conveyance Systems for proper actions.
3. Refer to City of Kirkland Municipal Code, Illicit Discharges and Illicit Connections (KMC 15.52.090) for Code clarification.
4. Refer to City of Kirkland Illicit Discharge and Spill Guidance Manual for spill response procedures.
5. If in, adjacent to, or upstream from sensitive area:
  - Complete **"concurrence form" and submit to Planning Supervisor.**
  - Coordinate with Environmental Supervisor and Environmental unit regarding site-specific permit requirements and BMPs.
  - Follow Environmental Review process located in the Endangered Species Act Program Proposal, Appendix B.
6. Haul all Environmental/Regulatory permits on site during construction or maintenance work.
7. **Have "SPILL KITS" (and employees trained to use) onsite.**
8. Monitor BMPs during and following construction until site conditions stabilize.
9. Remove BMPs according to guidelines.
10. Help reduce operation impacts to climate change - minimize carbon outputs by not idling equipment and work to reduce two stroke equipment use as much as possible.

**GENERAL FREQUENCY:**

All catch basins and inlets will be inspected at least once no later than August 1, 2017 and every two years thereafter (per current NPDES permit requirements S5.C.5.d).

**TIME STANDARD:**

2-10 manholes or catch basins per day on average.

**ACTIVITY: 722 – Catch Basin Rehab.**

**DESIRED RESULT:**

Repair catch basins or rehab. to ensure structural integrity and improve flow.

**RESOURCES:**

Crew

- 1 – Senior Maintenance
- 2 - Utility Persons
- 2 – Flaggers (as needed)

Material

Risers of varied thickness, frame, cover  
Grout (Ocean)

**5/8" rock**

- Portland
- Washed rock
- Construction sand
- Asphalt (cold mix, Easy Street, or hot mix)

Equipment

- 1 – Flatbed
- 1 – Jackhammer
- 1 – Compressor
- 1 – Mini Excavator with breaker and trailer
- 1 – Back-up truck with overhead arrow for traffic control
- PPE (gloves, hardhat, safety glasses, rain gear, rubber boots, hearing protection)

Contractor/Vendor Costs

Debris – decant spoils

**GENERAL WORK METHOD:**

1. Lead identifies catch basins to be rehabbed by visual inspection or studying the video inspection data.
2. Lead prepares work schedule and dispatches staff.
3. Place traffic control signs and safety devices as required at jobsite.
4. Use proper PPE.
5. Inspect condition of inlet, outfall, and brick/concrete structure.
6. Note in comments of Hansen WO# if illicit discharge or connection (KMC 15.52.090) is observed and initiate a service request for Activity 781; respond by following procedures in City of Kirkland Illicit Discharge and Spill Guidance Manual.
7. Clean inlets and outfalls if accumulated sediment is 20% or more of the pipe.
8. Apply all confined space equipment.
9. Notify front desk who will email Police, Fire, and PW if access to road will be impacted.
10. Determine flow line, lid style and repairs needed for structure.
11. Use jackhammer or breaker to remove curb and gutter or asphalt if needed.
12. Demo any brick from the structure.
13. Remove ALL jetset if there is any.
14. Grout around pipes if needed.
15. Use risers and grout to bring structure back to grade.
16. Install new iron to flowline and at proper elevation to collect water.
17. Backfill area with 5/8" crushed rock and compact.
18. Prep, form, and pour concrete if needed.
19. Remove forms and prep for paving.
20. Clean up jobsite, tools and truck.
21. Remove traffic control signs and safety devices as required at jobsite.
22. Notify front desk who will email Police, Fire, and PW that access to road has been returned.
23. Accurately report catch basins rehabbed and compile material and debris sheet.

**BMP(S):**

1. Refer to King County Surface Water Design Manual Maintenance Requirements for Conveyance Systems for proper actions.
2. Refer to City of Kirkland Municipal Code, Illicit Discharges and Illicit Connections (KMC 15.52.090) for Code clarification.
3. Refer to City of Kirkland Illicit Discharge and Spill Guidance Manual for spill response procedures.
4. If in, adjacent to, or upstream from sensitive area:
  - Complete "concurrency form" and submit to Planning Supervisor.
  - Coordinate with Environmental Supervisor and Environmental unit regarding site-specific permit requirements and BMPs.
  - Follow Environmental Review process located in the Endangered Species Act Program Proposal, Appendix B.
5. Haul all Environmental/Regulatory permits on site during construction or maintenance work.
6. Have "SPILL KITS" (and employees trained to use) onsite.
7. Monitor BMPs during and following construction until site conditions stabilize.
8. Remove BMPs according to guidelines.
9. Help reduce operation impacts to climate change - minimize carbon outputs by not idling equipment and work to reduce two stroke equipment use as much as possible.

**GENERAL FREQUENCY:**

Per inspection program.

**TIME STANDARD:**

1 - 6 per day.

## **ACTIVITY: 724 – Catch Basin Remove and Replace**

### **DESIRED RESULT:**

Remove substandard and replace with new catch basin that meets updated specs to improve structural integrity.

### **RESOURCES:**

#### Crew

- 1 – Senior Maintenance
- 2 - Utility Persons
- 2 – Flaggers (as needed)

#### Material

- Catch basin
- Risers (**min. of one, 2"**), frame, cover
- Grout (Ocean)
- Pipe to reconnect to new structure
- Fitting to reconnect new pipe if unable to save existing
- 5/8" rock**
- Portland concrete
- Washed rock
- Cold mix, Easy Street, or leave prepped for Street Division

#### Equipment

- 1 – Dump truck
- 1 – Equipment trailer
- 1 – Jackhammer and compressor
- 1 – Trackhoe with breaker and bucket
- 1 – Service truck or flatbed
- 1 – Back-up truck with overhead arrow for traffic control
- 1 – Backhoe
- 1 – Compressor if breaker and trackhoe not available

PPE (gloves, hardhat, safety glasses, rain gear, rubber boots, hearing protection)

#### Contractor/Vendor Costs

Debris – decant spoils

### **GENERAL WORK METHOD:**

1. Lead identifies catch basin to be replaced by visual inspection or studying the video inspection data.
2. Lead prepares work schedule and dispatches staff.
3. Place traffic control signs and safety devices as required at jobsite.
4. Use proper PPE.
5. Inspect condition of inlet, outfall, and brick/concrete structure.
6. Note in comments of Hansen WO# if illicit discharge or connection (KMC 15.52.090) is observed and initiate a service request for Activity 781; respond by following procedures in City of Kirkland Illicit Discharge and Spill Guidance Manual.
7. Clean inlets and outfalls if accumulated sediment is 20% or more of the pipe.
8. Apply all confined space equipment.
9. Notify front desk who will email Police, Fire, and PW if access to road will be impacted.
10. Determine flow line, lid style needed for structure.
11. Use jackhammer or breaker to remove curb and gutter or asphalt if needed, bypassing flowing water as needed.
12. Demo any brick from the structure.
13. Remove ALL Jetset if there is any.
14. Dig down and remove old structure, trying to save existing pipe.
15. Establish elevation for new structure, and over **-excavate leaving room for a 4" compacted rock base.**
16. Install catch basin on grade. Prep catch basin for pipe prior to installing if working in a small excavation with no room to swing hammer.
17. Grout around pipes if needed.
18. **Backfill area with 5/8" crushed rock and compact.**
19. Prep, form, and pour concrete if needed.
20. Remove forms and prep for paving.
21. Clean up jobsite, tools and truck.
22. Remove traffic control signs and safety devices as required at jobsite.
23. Notify front desk who will email Police, Fire, and PW that access to road has been returned.
24. Accurately report catch basins replaced and compile material and debris sheet.

### **BMP(S):**

1. Refer to King County Surface Water Design Manual Maintenance Requirements for Conveyance Systems for proper actions.
2. Refer to City of Kirkland Municipal Code, Illicit Discharges and Illicit Connections (KMC 15.52.090) for Code clarification.
3. Refer to City of Kirkland Illicit Discharge and Spill Guidance Manual for spill response procedures.
4. If in, adjacent to, or upstream from sensitive area:
  - **Complete "concurrence form" and submit to Planning Supervisor.**
  - Coordinate with Environmental Supervisor and Environmental unit regarding site-specific permit requirements and BMPs.
  - Follow Environmental Review process located in the Endangered Species Act Program Proposal, Appendix B.
5. Haul all Environmental/Regulatory permits on site during construction or maintenance work.
6. **Have "SPILL KITS" (and employees trained to use) onsite.**
7. Monitor BMPs during and following construction until site conditions stabilize.
8. Remove BMPs according to guidelines.
9. Help reduce operation impacts to climate change - minimize carbon outputs by not idling equipment and work to reduce two stroke equipment use as much as possible.

### **GENERAL FREQUENCY:**

Per inspection program.

### **TIME STANDARD:**

1 -2 per day.

**ACTIVITY: 728 – Catch Basin/Manhole Sediment Inspection**

**DESIRED RESULT:**

Measure the sediment level in catch basin or manhole to determine if cleaning is required and inspect for structural repairs needed.

**RESOURCES:**

Crew

1 – Utility Person

Material

Equipment

1 – Service vehicle

1 – Measuring tool (tape, pole, etc.)

PPE (gloves, hardhat, safety glasses, rain gear, rubber boots, hearing protection)

Laptop, charger and cleaning sheets

Contractor/Vendor Costs

**GENERAL WORK METHOD:**

1. Lead or Senior Maintenance identifies area to be inspected by studying the ongoing list, priority list, and video inspection list.
2. Lead prepares work schedule and dispatches staff.
3. Place traffic control signs and safety devices as required at jobsite.
4. Use proper PPE.
5. Inspect condition of inlet, outfall, and brick/concrete structure.
6. Note in comments of Hansen WO# if illicit discharge or connection (KMC 15.52.090) is observed and initiate a service request for Activity 781; respond by following procedures in City of Kirkland Illicit Discharge and Spill Guidance Manual.
7. Clean inlets and outfalls if accumulated sediment is 20% or more of the pipe.
8. Remove catch basin or manhole lid and insert measuring device.
9. Document amount of sediment.
10. If catch basin or manhole is more than 60% full, document that cleaning is needed.
11. Inspect remaining parts of structure.
12. Replace and secure lid to avoid noise from traffic driving over it.
13. Clean up jobsite, tools and truck.
14. Remove traffic control signs and safety devices as required at jobsite.
15. Make notes about any further work that is needed.
16. Accurately report quantity inspected in computer and on production sheet.

**BMP(S):**

1. Refer to current Western Washington Phase II Municipal Stormwater Permit (August 1, 2013 - July 31, 2018).
2. Refer to King County Surface Water Design Manual Maintenance Requirements for Conveyance Systems for proper actions.
3. Refer to City of Kirkland Municipal Code, Illicit Discharges and Illicit Connections (KMC 15.52.090) for Code clarification.
4. Refer to City of Kirkland Illicit Discharge and Spill Guidance Manual for spill response procedures.
5. If in, adjacent to, or upstream from sensitive area:
  - Complete "concurrence form" and submit to Planning Supervisor.
  - Coordinate with Environmental Supervisor and Environmental unit regarding site-specific permit requirements and BMPs.
  - Follow Environmental Review process located in the Endangered Species Act Program Proposal, Appendix B.
6. Haul all Environmental/Regulatory permits on site during construction or maintenance work.
7. Have "SPILL KITS" (and employees trained to use) onsite.
8. Monitor BMPs during and following construction until site conditions stabilize.
9. Remove BMPs according to guidelines.
10. Help reduce operation impacts to climate change - minimize carbon outputs by not idling equipment and work to reduce two stroke equipment use as much as possible.

**GENERAL FREQUENCY:**

All catch basins, manholes and inlets will be inspected at least once no later than August 1, 2017 and every two years thereafter (per current NPDES permit requirements S5.C.5.d).

**TIME STANDARD:**

5 - 15 minutes per location on average.

**ACTIVITY: 730 – Storm Culvert Cleaning By Hand**

**DESIRED RESULT:**

Manually remove leaves, debris, etc. from the inlets and outlets of culverts and pipes to improve drainage.

**RESOURCES:**

Crew

- 1 - Senior Maintenance
- 1 - Utility Person

Material

Equipment

- 1 – Service truck
- 2 – Flat shovels
- 1 – Broom
- 1 - Pick
- PPE (gloves, hardhat, safety glasses, rain gear, rubber boots, hearing protection)
- Laptop, charger and cleaning sheets

Contractor/Vendor Costs

Debris – decant spoils

**GENERAL WORK METHOD:**

1. Lead or Senior Maintenance identifies area to be inspected by studying the ongoing list, priority list, and video inspection list.
2. Lead prepares work schedule and dispatches staff.
3. Place traffic control signs and safety devices as required at jobsite.
4. **Use proper PPE's.**
5. Note in comments of Hansen WO# if illicit discharge or connection (KMC 15.52.090) is observed and initiate a service request for Activity 781; respond by following procedures in City of Kirkland Illicit Discharge and Spill Guidance Manual.
6. Clean inlets and outfalls if accumulated sediment is 20% or more of the pipe.
7. Use shovel and broom to remove leaves and debris in inlets and outlets of culvert pipes.
8. Collect debris and place in service truck.
9. Clean up jobsite, tools and truck.
10. Remove traffic control signs and safety devices as required at jobsite.
11. Make notes about any further work that is needed.
12. Accurately report culverts cleaned in computer and on production sheet.

**BMP(S):**

1. Refer to current Western Washington Phase II Municipal Stormwater Permit (August 1, 2013 - July 31, 2018).
2. Refer to King County Surface Water Design Manual Maintenance Requirements for Conveyance Systems for proper actions.
3. Refer to City of Kirkland Municipal Code, Illicit Discharges and Illicit Connections (KMC 15.52.090) for Code clarification.
4. Refer to City of Kirkland Illicit Discharge and Spill Guidance Manual for spill response procedures.
5. If in, adjacent to, or upstream from sensitive area:
  - **Complete "concurrence form" and submit to Planning Supervisor.**
  - Coordinate with Environmental Supervisor and Environmental unit regarding site-specific permit requirements and BMPs.
  - Follow Environmental Review process located in the Endangered Species Act Program Proposal, Appendix B.
6. Haul all Environmental/Regulatory permits on site during construction or maintenance work.
7. **Have "SPILL KITS" (and employees trained to use) onsite.**
8. Monitor BMPs during and following construction until site conditions stabilize.
9. Remove BMPs according to guidelines.
10. Help reduce operation impacts to climate change - minimize carbon outputs by not idling equipment and work to reduce two stroke equipment use as much as possible.

**GENERAL FREQUENCY:**

All catch basins and inlets will be inspected at least once no later than August 1, 2017 and every two years thereafter (per current NPDES permit requirements S5.C.5.d).

**TIME STANDARD:**

Varies depending on size of pipe and amount of debris that has accumulated.

**ACTIVITY: 732 – Storm Culvert Repair or Replace**

**DESIRED RESULT:**

Repair or replace pipe and culvert as needed to improve structural integrity and flow.

**RESOURCES:**

Crew

- 1 - Senior Maintenance
- 2 - Utility Persons
- 2 – Eductor crew if needed
- 2 – Flaggers (as needed)

Material

- Pipe
- Bands or couplings (sand collar if at basin)
- 5/8" rock
- Asphalt cold mix

Equipment

- 1 – Dump truck
- 1 – Equipment trailer
- 1 – Trackhoe with breaker and bucket
- 1 – Service truck
- 1 – Eductor (if needed)
- 1 – Back-up truck with overhead arrow for traffic control
- PPE (gloves, hardhat, safety glasses, rain gear, rubber boots, hearing protection)
- Laptop, charger and cleaning sheets

Contractor/Vendor Costs

- Disposal – pipe, asphalt, concrete, dirt

**GENERAL WORK METHOD:**

1. Lead identifies area to be inspected by studying the video inspection data.
2. Lead prepares work schedule and dispatches staff.
3. Place traffic control signs and safety devices as required at jobsite.
4. Use proper PPE.
5. Notify front desk who will email Police, Fire, and PW if access to road will be impacted.
6. Apply all confined space equipment and complete forms for atmosphere testing as needed.
7. Note in comments of Hansen WO# if illicit discharge or connection (KMC 15.52.090) is observed and initiate a service request for Activity 781; respond by following procedures in City of Kirkland Illicit Discharge and Spill Guidance Manual.
8. Remove asphalt, sidewalk, or curb and gutter as needed.
9. Dig or hydro-excavate to expose damaged pipe.
10. Cut and remove the damaged section.
11. Prepare ditch for new section. Install compacted rock base of 2-4" as needed.
12. Install new pipe with couplings.
13. Backfill and compact.
14. Clean inlets and outfalls if accumulated sediment is 20% or more of the pipe.
15. **If work required inside manhole, use proper PPE's.**
16. Clean up jobsite, tools and truck.
17. Remove traffic control signs and safety devices as required at jobsite.
18. Notify front desk who will email Police, Fire, and PW that access to road has been returned.
19. Accurately report lineal feet of main repaired or replaced in computer and on production sheet.

**BMP(S):**

1. Refer to King County Surface Water Design Manual Maintenance Requirements for Conveyance Systems for proper actions.
2. Refer to City of Kirkland Municipal Code, Illicit Discharges and Illicit Connections (KMC 15.52.090) for Code clarification.
3. Refer to City of Kirkland Illicit Discharge and Spill Guidance Manual for spill response procedures.
4. If in, adjacent to, or upstream from sensitive area:
  - Complete "concurrence form" and submit to Planning Supervisor.
  - Coordinate with Environmental Supervisor and Environmental unit regarding site-specific permit requirements and BMPs.
  - Follow Environmental Review process located in the Endangered Species Act Program Proposal, Appendix B.
5. Haul all Environmental/Regulatory permits on site during construction or maintenance work.
6. **Have "SPILL KITS" (and employees trained to use) onsite.**
7. Monitor BMPs during and following construction until site conditions stabilize.
8. Remove BMPs according to guidelines.
9. Help reduce operation impacts to climate change - minimize carbon outputs by not idling equipment and work to reduce two stroke equipment use as much as possible.

**GENERAL FREQUENCY:**

Per inspection program.

**TIME STANDARD:**

6 - 8 hours per repair.

**ACTIVITY: 734 – Storm Culvert and Pipe Root Cutting**

**DESIRED RESULT:**

Roots in storm mains are removed using jet root saw. Then, video inspection is done to assure that storm main is free of roots.

**RESOURCES:**

Crew

- 1 – Equipment Operator
- 1 – Utility Person
- 2 – Flaggers (as needed)

Material

Water

Equipment

- 1 - Eductor truck
- 1 – Back-up truck with overhead arrow for traffic control
- PPE (gloves, hardhat, safety glasses, rain gear, rubber boots, hearing protection)
- Laptop, charger and cleaning sheets

Contractor/Vendor Costs

- Debris – decant spoils
- Kirkland-approved decant location

**GENERAL WORK METHOD:**

1. Lead identifies area to be inspected by studying the video inspection data.
2. Lead prepares work schedule and dispatches staff.
3. Place traffic control signs and safety devices as required at jobsite.
4. Use proper PPE.
5. Note in comments of Hansen WO# if illicit discharge or connection (KMC 15.52.090) is observed and initiate a service request for Activity 781; respond by following procedures in City of Kirkland Illicit Discharge and Spill Guidance Manual.
6. Clean inlets and outfalls if accumulated sediment/roots are 20% or more of the pipe.
7. Senior Maintenance and Utility Person work together to remove manhole lid and position equipment.
8. Hydro jet with root cutter the line as needed to clean out debris, roots, etc.
9. Eductor ALL debris during cleaning or screening.
10. Spray out structure.
11. Remove equipment.
12. Replace and secure lid to avoid noise from traffic driving over it.
13. If cleaning is needed, staff cleans all areas within structure so that base of manhole is exposed. Vacuum debris from storm manhole. Clean all surfaces, walls, brick, concrete, inlet and outfall.
14. Inspect condition of inlet, outfall, and brick/concrete structure.
15. Replace and secure lid to avoid noise from traffic driving over it.
16. Clean up jobsite, tools and truck.
17. Remove traffic control signs and safety devices as required at jobsite.
18. Make notes about any further work that is needed.
19. Decant eductor truck in decant spoils bay.
20. Accurately report mains and manholes cleaned in computer and on production sheet.

**BMP(S):**

1. Refer to current Western Washington Phase II Municipal Stormwater Permit (August 1, 2013 - July 31, 2018).
2. Refer to King County Surface Water Design Manual Maintenance Requirements for Conveyance Systems for proper actions.
3. Refer to City of Kirkland Municipal Code, Illicit Discharges and Illicit Connections (KMC 15.52.090) for Code clarification.
4. Refer to City of Kirkland Illicit Discharge and Spill Guidance Manual for spill response procedures.
5. If in, adjacent to, or upstream from sensitive area:
  - Complete “concurrency form” and submit to Planning Supervisor.
  - Coordinate with Environmental Supervisor and Environmental unit regarding site-specific permit requirements and BMPs.
  - Follow Environmental Review process located in the Endangered Species Act Program Proposal, Appendix B.
6. Haul all Environmental/Regulatory permits on site during construction or maintenance work.
7. **Have “SPILL KITS” (and employees trained to use) onsite.**
8. Monitor BMPs during and following construction until site conditions stabilize.
9. Remove BMPs according to guidelines.
10. Help reduce operation impacts to climate change - minimize carbon outputs by not idling equipment and work to reduce two stroke equipment use as much as possible.

**GENERAL FREQUENCY:**

All catch basins and inlets will be inspected at least once no later than August 1, 2017 and every two years thereafter (per current NPDES permit requirements S5.C.5.d).

**TIME STANDARD:**

Varies depending on size of pipe and amount of debris that has accumulated.



**ACTIVITY: 740 – Replace Defective Storm Manhole****DESIRED RESULT:**

Remove substandard and replace with new manhole that meets updated specs to improve structural integrity.

**RESOURCES:**Crew

- 1 – Senior Maintenance
- 2 - Utility Persons
- 2 – Flaggers (as needed)

Material

- Manhole
- Risers (min. of **one, 2"**), **frame, cover**
- Grout (Ocean)
- Pipe to reconnect to new structure
- Fitting to reconnect new pipe if unable to save existing
- 5/8" rock**
- Portland concrete
- Washed rock
- Cold mix, Easy Street, or leave prepped for Street Division

Equipment

- 1 – Dump truck
- 1 – Equipment trailer
- 1 – Jackhammer and compressor
- 1 – Trackhoe with breaker and bucket
- 1 – Service truck or flatbed
- 1 – Back-up truck with overhead arrow for traffic control
- 1 – Backhoe
- 1 – Compressor if breaker and trackhoe not available
- PPE (gloves, hardhat, safety glasses, rain gear, rubber boots, hearing protection)

Contractor/Vendor Costs

Debris – decant spoils

**GENERAL WORK METHOD:**

1. Lead identifies manhole to be replaced by visual inspection or studying the video inspection data.
2. Lead prepares work schedule and dispatches staff.
3. Place traffic control signs and safety devices as required at jobsite.
4. Use proper PPE.
5. Apply all confined space equipment.
6. Notify front desk who will email Police, Fire, and PW if access to road will be impacted.
7. Determine flow line, lid style needed for structure.
8. Note in comments of Hansen WO# if illicit discharge or connection (KMC 15.52.090) is observed and initiate a service request for Activity 781; respond by following procedures in City of Kirkland Illicit Discharge and Spill Guidance Manual.
9. Use jackhammer or breaker to remove curb and gutter or asphalt if needed, bypassing flowing water as needed.
10. Demo any brick from the structure.
11. Remove ALL Jetset if there is any.
12. Dig down and remove old structure, trying to save existing pipe.
13. Establish elevation for new structure, and over-**excavate leaving room for a 4" compacted rock base.**
14. Install manhole on grade. Prep manhole for pipe prior to installing.
15. Grout around pipes if needed.
16. **Backfill area with 5/8" crushed rock** and compact.
17. Prep, form, and pour concrete if needed.
18. Clean inlets and outfalls if accumulated sediment is 20% or more of the pipe.
19. Remove forms and prep for paving.
20. Clean up jobsite, tools and truck.
21. Remove traffic control signs and safety devices as required at jobsite.
22. Notify front desk who will email Police, Fire, and PW that access to road has been returned.
23. Accurately report manhole replaced and compile material and debris sheet.

**BMP(S):**

1. Refer to King County Surface Water Design Manual Maintenance Requirements for Conveyance Systems for proper actions.
2. Refer to City of Kirkland Municipal Code, Illicit Discharges and Illicit Connections (KMC 15.52.090) for Code clarification.
3. Refer to City of Kirkland Illicit Discharge and Spill Guidance Manual for spill response procedures.
4. If in, adjacent to, or upstream from sensitive area:
  - **Complete "concurrence form" and submit to Planning Supervisor.**
  - Coordinate with Environmental Supervisor and Environmental unit regarding site-specific permit requirements and BMPs.
  - Follow Environmental Review process located in the Endangered Species Act Program Proposal, Appendix B.
5. Haul all Environmental/Regulatory permits on site during construction or maintenance work.
6. **Have "SPILL KITS" (and employees trained to use) onsite.**
7. Monitor BMPs during and following construction until site conditions stabilize.
8. Remove BMPs according to guidelines.
9. Help reduce operation impacts to climate change - minimize carbon outputs by not idling equipment and work to reduce two stroke equipment use as much as possible.

**GENERAL FREQUENCY:**

Per inspection program.

**TIME STANDARD:**

Average of 8 hours per manhole.

**ACTIVITY: 742 – Storm Manhole Rehab.**

**DESIRED RESULT:**

Storm manholes are repaired to include frames, covers, steps, re-mortar bricks, and pipe inverts to improve structural integrity.

**RESOURCES:**

Crew

- 1 - Senior Maintenance
- 3 - Utility Persons

Material

- Risers of different thickness
- Frame and cover
- Grout (Ocean)
- 5/8" rock**
- Asphalt cold mix

Equipment

- 1 – Dump truck
- 1 - Service truck
- 1 – Mini excavator with breaker
- 1 – Mini excavator trailer
- 1 – Compressor (if excavator unavailable)
- PPE (gloves, hardhat, safety glasses, rain gear, rubber boots, hearing protection)

Contractor/Vendor Costs

- Disposal – pipe, asphalt, concrete, dirt

**GENERAL WORK METHOD:**

1. Lead identifies manholes to be rehabbed by visual inspection or studying the video inspection data.
2. Lead prepares work schedule and dispatches staff.
3. Place traffic control signs and safety devices as required at jobsite.
4. Use proper PPE.
5. Apply all confined space equipment.
6. Notify front desk who will email Police, Fire, and PW if access to road will be impacted.
7. Determine flow line, lid style and repairs needed for structure.
8. Note in comments of Hansen WO# if illicit discharge or connection (KMC 15.52.090) is observed and initiate a service request for Activity 781; respond by following procedures in City of Kirkland Illicit Discharge and Spill Guidance Manual.
9. Use jackhammer or breaker to remove curb and gutter or asphalt if needed.
10. Demo any brick from the structure.
11. Remove ALL jetset if there is any.
12. Grout around pipes if needed.
13. Use risers and grout to bring structure back to grade.
14. Install new iron to flowline and at proper elevation to collect water.
15. **Backfill area with 5/8" crushed rock** and compact.
16. Prep, form, and pour concrete if needed.
17. Clean inlets and outfalls if accumulated sediment is 20% or more of the pipe.
18. Remove forms and prep for paving.
19. Clean up jobsite, tools and truck.
20. Remove traffic control signs and safety devices as required at jobsite.
21. Notify front desk who will email Police, Fire, and PW that access to road has been returned.
22. Accurately report manholes rehabbed and compile material and debris sheet.

**BMP(S):**

1. Refer to King County Surface Water Design Manual Maintenance Requirements for Conveyance Systems for proper actions.
2. Refer to City of Kirkland Municipal Code, Illicit Discharges and Illicit Connections (KMC 15.52.090) for Code clarification.
3. Refer to City of Kirkland Illicit Discharge and Spill Guidance Manual for spill response procedures.
4. If in, adjacent to, or upstream from sensitive area:
  - **Complete "concurrence form" and submit to Planning Supervisor.**
  - Coordinate with Environmental Supervisor and Environmental unit regarding site-specific permit requirements and BMPs.
  - Follow Environmental Review process located in the Endangered Species Act Program Proposal, Appendix B.
5. Haul all Environmental/Regulatory permits on site during construction or maintenance work.
6. **Have "SPILL KITS" (and employees trained to use) onsite.**
7. Monitor BMPs during and following construction until site conditions stabilize.
8. Remove BMPs according to guidelines.
9. Help reduce operation impacts to climate change - minimize carbon outputs by not idling equipment and work to reduce two stroke equipment use as much as possible.

**GENERAL FREQUENCY:**

Per inspection program.

**TIME STANDARD:**

2-8 hours per manhole depending on extent of repairs required.

**ACTIVITY: 750 – Retention/Detention Pond Maintenance**

**DESIRED RESULT:**

Remove noxious weeds, contamination, and pollutant materials from pond. Clean inlets and outlets. Remove vegetation, grass, leaves, debris and trees by hand or use of machinery.

**RESOURCES:**

Crew

- 1 – Senior Maintenance
- 2 - Utility Persons

Material

Equipment

- 1 – Dump truck
- 1 - Service truck
- 2 - Weedeaters
- 1 – Chainsaw
- 1 – Various handtools
- 1 – Track hoe with mower if needed
- PPE (gloves, hardhat, safety glasses, rain gear, rubber boots, hearing protection)

Contractor/Vendor Costs

Debris – decant spoils

**GENERAL WORK METHOD:**

1. Lead identifies area to be maintained.
2. Lead prepares work schedule and dispatches staff.
3. Place traffic control signs and safety devices as required at jobsite.
4. **Put on proper PPE's.**
5. Note in comments of Hansen WO# if illicit discharge or connection (KMC 15.52.090) is observed and initiate a service request for Activity 781; respond by following procedures in City of Kirkland Illicit Discharge and Spill Guidance Manual.
6. Remove accumulated sediment that exceeds 10% of designed pond depth.
7. Remove noxious vegetation which may constitute a hazard to City personnel or public according to applicable regulations.
8. Grass and ground cover is not to **exceed 18" in height.**
9. Cut or trim vegetation to be between **3-6" in height.**
10. Remove any trash or debris from the pond.
11. Fill all rodent holes. Repair dam or berms as needed.
12. Load debris into service truck as needed and dispose of it in the yard.
13. Clean up jobsite, tools and truck.
14. Remove traffic control signs and safety devices as required at jobsite.
15. Give appropriate paperwork to Grounds Division for spraying if needed.
16. Accurately report ponds maintained in computer and on production sheet.

**BMP(S):**

1. Refer to current Western Washington Phase II Municipal Stormwater Permit (August 1, 2013 - July 31, 2018).
2. Refer to King County Surface Water Design Manual Maintenance Requirements for Conveyance Systems for proper actions.
3. Refer to City of Kirkland Municipal Code, Illicit Discharges and Illicit Connections (KMC 15.52.090) for Code clarification.
4. Refer to City of Kirkland Illicit Discharge and Spill Guidance Manual for spill response procedures.
5. If in, adjacent to, or upstream from sensitive area:
  - **Complete "concurrence form" and submit to Planning Supervisor.**
  - Coordinate with Environmental Supervisor and Environmental unit regarding site-specific permit requirements and BMPs.
  - Follow Environmental Review process located in the Endangered Species Act Program Proposal, Appendix B.
6. Haul all Environmental/Regulatory permits on site during construction or maintenance work.
7. **Have "SPILL KITS" (and employees trained to use) onsite.**
8. Monitor BMPs during and following construction until site conditions stabilize.
9. Remove BMPs according to guidelines.
10. Help reduce operation impacts to climate change - minimize carbon outputs by not idling equipment and work to reduce two stroke equipment use as much as possible.

**GENERAL FREQUENCY:**

All catch basins and inlets will be inspected at least once no later than August 1, 2017 and every two years thereafter (per current NPDES permit requirements S5.C.5.d). Sites on Manhole Weedeating List are maintained every two weeks during growing season. Maintenance is needed when grass or groundcover exceeds 18 inches in height. Grass or groundcover needs to be mowed to a height no greater than 6 inches.

**TIME STANDARD:**

1-2 hours per site.

**ACTIVITY: 752 – Retention/Detention Pond Facility Repair**

**DESIRED RESULT:**

Repair of underground manholes, vaults, etc. including steps, control tees, shear gates, chains, and rods; re-mortar bricks and pipe inverts.

**RESOURCES:**

Crew

- 1 – Senior Maintenance
- 2 - Utility Persons

Material

Equipment

- 1 – Service truck
- 1 – Eductor if needed
- PPE (gloves, hardhat, safety glasses, rain gear, rubber boots, hearing protection)

Contractor/Vendor Costs

Debris – Decant spoils; recycle scrap metal

**GENERAL WORK METHOD:**

1. Lead identifies area to be inspected by studying the video inspection data.
2. Lead prepares work schedule and dispatches staff.
3. Place traffic control signs and safety devices as required at jobsite.
4. **Put on proper PPE's.**
5. Note in comments of Hansen WO# if illicit discharge or connection (KMC 15.52.090) is observed and initiate a service request for Activity 781; respond by following procedures in City of Kirkland Illicit Discharge and Spill Guidance Manual.
6. Remove any trash or debris from the pond.
7. Eductor out structure as needed.
8. Remove damaged parts.
9. Install new parts.
10. Clean inlets and outfalls if accumulated sediment is 20% or more of the pipe.
11. Load debris into service truck as needed and dispose of it in the yard.
12. Clean up jobsite, tools and truck.
13. Remove traffic control signs and safety devices as required at jobsite.
14. Accurately report ponds repaired in computer and on production sheet.

**BMP(S):**

1. Refer to King County Surface Water Design Manual Maintenance Requirements for Conveyance Systems for proper actions.
2. Refer to City of Kirkland Municipal Code, Illicit Discharges and Illicit Connections (KMC 15.52.090) for Code clarification.
3. Refer to City of Kirkland Illicit Discharge and Spill Guidance Manual for spill response procedures.
4. If in, adjacent to, or upstream from sensitive area:
  - **Complete "concurrence form" and submit to Planning Supervisor.**
  - Coordinate with Environmental Supervisor and Environmental unit regarding site-specific permit requirements and BMPs.
  - Follow Environmental Review process located in the Endangered Species Act Program Proposal, Appendix B.
5. Haul all Environmental/Regulatory permits on site during construction or maintenance work.
6. **Have "SPILL KITS" (and employees trained to use) onsite.**
7. Monitor BMPs during and following construction until site conditions stabilize.
8. Remove BMPs according to guidelines.
9. Help reduce operation impacts to climate change - minimize carbon outputs by not idling equipment and work to reduce two stroke equipment use as much as possible.

**GENERAL FREQUENCY:**

Per inspection program.

**TIME STANDARD:**

1-2 hours per site.

**ACTIVITY: 754 – Retention/Detention Pond Facility Inspection**

**DESIRED RESULT:**

Inspect underground manholes, vaults, including steps, control tees, shear gates, chains, rods, and depth of debris.

**RESOURCES:**

Crew

1 – Senior Maintenance  
1 - Utility Person

Material

Equipment

1 – Service truck  
PPE (gloves, hardhat, safety glasses, rain gear, rubber boots, hearing protection)

Contractor/Vendor Costs

**GENERAL WORK METHOD:**

1. Lead schedules inspections following major rain storms or annually.
2. Lead prepares work schedule and dispatches staff.
3. Place traffic control signs and safety devices as required at jobsite.
4. **Put on proper PPE's.**
5. Note in comments of Hansen WO# if illicit discharge or connection (KMC 15.52.090) is observed and initiate a service request for Activity 781; respond by following procedures in City of Kirkland Illicit Discharge and Spill Guidance Manual.
6. Clean inlets and outfalls if accumulated sediment is 20% or more of the pipe.
7. Remove any trash or debris from the pond.
8. Inspect pond and/or facility.
9. Record information as required.
10. Clean up jobsite, tools and truck.
11. Remove traffic control signs and safety devices as required at jobsite.
12. Accurately report ponds inspected in computer and on production sheet.

**BMP(S):**

1. Refer to current Western Washington Phase II Municipal Stormwater Permit (August 1, 2013 - July 31, 2018).
2. Refer to King County Surface Water Design Manual Maintenance Requirements for Conveyance Systems for proper actions.
3. Refer to City of Kirkland Municipal Code, Illicit Discharges and Illicit Connections (KMC 15.52.090) for Code clarification.
4. Refer to City of Kirkland Illicit Discharge and Spill Guidance Manual for spill response procedures.
5. If in, adjacent to, or upstream from sensitive area:
  - **Complete "concurrence form" and submit to Planning Supervisor.**
  - Coordinate with Environmental Supervisor and Environmental unit regarding site-specific permit requirements and BMPs.
  - Follow Environmental Review process located in the Endangered Species Act Program Proposal, Appendix B.
6. Haul all Environmental/Regulatory permits on site during construction or maintenance work.
7. **Have "SPILL KITS" (and employees trained to use) onsite.**
8. Monitor BMPs during and following construction until site conditions stabilize.
9. Remove BMPs according to guidelines.
10. Help reduce operation impacts to climate change - minimize carbon outputs by not idling equipment and work to reduce two stroke equipment use as much as possible.

**GENERAL FREQUENCY:**

All catch basins and inlets will be inspected at least once no later than August 1, 2017 and every two years thereafter (per current NPDES permit requirements S5.C.5.d). Following major rain storms or annually.

**TIME STANDARD:**

15-20 minutes per location, on average.

**ACTIVITY: 756 – Clean Storm Treatment Cartridge Vault**

**DESIRED RESULT:**

Remove and clean spent canisters. Rinse vault and clean out under-drain system. Install exchange canisters.

**RESOURCES:**

Crew

1 – Senior Maintenance  
3 - Utility Persons

Material

Equipment

1 – Eductor  
2 - Service trucks  
Fresh exchange canisters  
Flex tubes  
PPE (gloves, hardhat, safety glasses, rain gear, rubber boots, hearing protection)

Contractor/Vendor Costs

Debris – Decant spoils

**GENERAL WORK METHOD:**

1. Lead schedules inspections following major rain storms or annually.
2. Lead prepares work schedule and dispatches staff.
3. Place traffic control signs and safety devices as required at jobsite.
4. **Put on proper PPE's.**
5. Note in comments of Hansen WO# if illicit discharge or connection (KMC 15.52.090) is observed and initiate a service request for Activity 781; respond by following procedures in City of Kirkland Illicit Discharge and Spill Guidance Manual.
6. Remove any trash or debris from the vault.
7. Clean inlets and outfalls if accumulated sediment is 20% or more of the pipe.
8. Remove and Eductor out spent canisters.
9. Rinse out vault and clean under-drain.
10. Install exchange canisters.
11. Clean up jobsite, tools and truck.
12. Remove traffic control signs and safety devices as required at jobsite.
13. Accurately report vaults cleaned in computer and on production sheet.

**BMP(S):**

1. Refer to current Western Washington Phase II Municipal Stormwater Permit (August 1, 2013 - July 31, 2018).
2. Refer to King County Surface Water Design Manual Maintenance Requirements for Conveyance Systems for proper actions.
3. Refer to City of Kirkland Municipal Code, Illicit Discharges and Illicit Connections (KMC 15.52.090) for Code clarification.
4. Refer to City of Kirkland Illicit Discharge and Spill Guidance Manual for spill response procedures.
5. If in, adjacent to, or upstream from sensitive area:
  - **Complete "concurrence form" and submit to Planning Supervisor.**
  - Coordinate with Environmental Supervisor and Environmental unit regarding site-specific permit requirements and BMPs.
  - Follow Environmental Review process located in the Endangered Species Act Program Proposal, Appendix B.
6. Haul all Environmental/Regulatory permits on site during construction or maintenance work.
7. **Have "SPILL KITS" (and employees trained to use) onsite.**
8. Monitor BMPs during and following construction until site conditions stabilize.
9. Remove BMPs according to guidelines.
10. Help reduce operation impacts to climate change - minimize carbon outputs by not idling equipment and work to reduce two stroke equipment use as much as possible.

**GENERAL FREQUENCY:**

All catch basins and inlets will be inspected at least once no later than August 1, 2017 and every two years thereafter (per current NPDES permit requirements S5.C.5.d). Following major rain storms or annual filter inspection.

**TIME STANDARD:**

30 minutes to two hours, depending on number of canisters.

**ACTIVITY: 758 – Underground Storm Retention/Detention Cleaning**

**DESIRED RESULT:**

Vacuum material from retention/detention facilities.

**RESOURCES:**

Crew

- 1 – Senior Maintenance
- 3 - Utility Persons

Material

Equipment

- 1 – Eductor
- 2 - Service trucks
- Cleaning hoses
- Flex tubes
- PPE (gloves, hardhat, safety glasses, rain gear, rubber boots, hearing protection)

Contractor/Vendor Costs

Debris – Decant spoils

**GENERAL WORK METHOD:**

1. Lead schedules inspections following major rain storms or annually.
2. Lead prepares work schedule and dispatches staff.
3. Place traffic control signs and safety devices as required at jobsite.
4. **Put on proper PPE's.**
5. Note in comments of Hansen WO# if illicit discharge or connection (KMC 15.52.090) is observed and initiate a service request for Activity 781; respond by following procedures in City of Kirkland Illicit Discharge and Spill Guidance Manual.
6. Remove any trash or debris from the vault.
7. Clean inlets and outfalls if accumulated sediment is 20% or more of the pipe.
8. Remove and Eductor out debris from retention/detention facility.
9. Rinse out vault.
10. Clean up jobsite, tools and truck.
11. Remove traffic control signs and safety devices as required at jobsite.
12. Decant eductor truck in decant spoils bay.
13. Accurately report vaults cleaned in computer and on production sheet.

**BMP(S):**

1. Refer to current Western Washington Phase II Municipal Stormwater Permit (August 1, 2013 - July 31, 2018).
2. Refer to King County Surface Water Design Manual Maintenance Requirements for Conveyance Systems for proper actions.
3. Refer to City of Kirkland Municipal Code, Illicit Discharges and Illicit Connections (KMC 15.52.090) for Code clarification.
4. Refer to City of Kirkland Illicit Discharge and Spill Guidance Manual for spill response procedures.
5. If in, adjacent to, or upstream from sensitive area:
  - **Complete "concurrence form" and submit to Planning Supervisor.**
  - Coordinate with Environmental Supervisor and Environmental unit regarding site-specific permit requirements and BMPs.
  - Follow Environmental Review process located in the Endangered Species Act Program Proposal, Appendix B.
6. Haul all Environmental/Regulatory permits on site during construction or maintenance work.
7. **Have "SPILL KITS" (and employees trained to use) onsite.**
8. Monitor BMPs during and following construction until site conditions stabilize.
9. Remove BMPs according to guidelines.
10. Help reduce operation impacts to climate change - minimize carbon outputs by not idling equipment and work to reduce two stroke equipment use as much as possible.

**GENERAL FREQUENCY:**

All catch basins and inlets will be inspected at least once no later than August 1, 2017 and every two years thereafter (per current NPDES permit requirements S5.C.5.d). Following major rain storms or annually.

**TIME STANDARD:**

2-4 hours per site, depending on size of facility.

**ACTIVITY: 770 – Ditch Cleaning - Hoe**

**DESIRED RESULT:**

Remove sediment, leaves, and debris with backhoe or excavator to improve flow.

**RESOURCES:**

Crew

1 – Senior Maintenance  
2 - Utility Persons

Material

Straw  
Grass seed  
Quarry rock  
Waddle with stakes

Equipment

1 – Dump truck  
1 – Equipment trailer  
1 – Service truck  
1 – Excavator or backhoe with ditching bucket  
PPE (gloves, hardhat, safety glasses, rain gear, rubber boots, hearing protection)

Contractor/Vendor Costs

Debris – ditching

**GENERAL WORK METHOD:**

1. Lead prepares work schedule based on crew reports and annual maintenance list and dispatches staff.
2. Place traffic control signs and safety devices as required at jobsite.
3. Use proper PPE.
4. Notify front desk who will email Police, Fire, and PW if access to road will be impacted.
5. Note in comments of Hansen WO# if illicit discharge or connection (KMC 15.52.090) is observed and initiate a service request for Activity 781; respond by following procedures in City of Kirkland Illicit Discharge and Spill Guidance Manual.
6. Remove accumulated sediment in ditch that exceeds 20% of designed ditch depth.
7. Remove noxious vegetation which may constitute a hazard to City personnel or public according to applicable regulations.
8. Clean inlets and outfalls if accumulated sediment is 20% or more of the pipe.
9. Remove debris from ditch to provide adequate flow.
10. Straw or seed as needed.
11. Quarry rock outfalls and around outlet pipe from ditch as needed.
12. Install waddles with stakes as needed.
13. Clean up jobsite, tools and truck.
14. Remove traffic control signs and safety devices as required at jobsite.
15. Notify front desk who will email Police, Fire, and PW that access to road has been returned.
16. Accurately report lineal feet of ditch cleaned and compile material and debris sheet.

**BMP(S):**

1. Refer to current Western Washington Phase II Municipal Stormwater Permit (August 1, 2013 - July 31, 2018).
2. Refer to King County Surface Water Design Manual Maintenance Requirements for Conveyance Systems for proper actions.
3. Refer to City of Kirkland Municipal Code, Illicit Discharges and Illicit Connections (KMC 15.52.090) for Code clarification.
4. Refer to City of Kirkland Illicit Discharge and Spill Guidance Manual for spill response procedures.
5. If in, adjacent to, or upstream from sensitive area:
  - Complete “**concurrence form**” and submit to Planning Supervisor.
  - Coordinate with Environmental Supervisor and Environmental unit regarding site-specific permit requirements and BMPs.
  - Follow Environmental Review process located in the Endangered Species Act Program Proposal, Appendix B.
6. Haul all Environmental/Regulatory permits on site during construction or maintenance work.
7. **Have “SPILL KITS” (and employees trained to use) onsite.**
8. Monitor BMPs during and following construction until site conditions stabilize.
9. Remove BMPs according to guidelines.
10. Help reduce operation impacts to climate change - minimize carbon outputs by not idling equipment and work to reduce two stroke equipment use as much as possible.

**GENERAL FREQUENCY:**

All ditches will be inspected for cleaning at least once no later than August 1, 2017 and every two years thereafter (per current NPDES permit requirements S5.C.5.d).

**TIME STANDARD:**

Varies depending on depth of ditch and amount of debris that has accumulated.



**ACTIVITY: 772 – Ditch Cleaning – By Hand**

**DESIRED RESULT:**

Remove sediment, leaves, and debris manually to improve flow.

**RESOURCES:**

Crew

2 - Utility Persons

Material

Straw

Grass seed

Quarry rock

Waddle with stakes

Equipment

1 – Service truck

PPE (gloves, hardhat, safety glasses, rain gear, rubber boots, hearing protection)

Contractor/Vendor Costs

Debris – ditching

**GENERAL WORK METHOD:**

1. Lead prepares work schedule based on customer requests and dispatches staff.
2. Place traffic control signs and safety devices as required at jobsite.
3. Use proper PPE.
4. Notify front desk who will email Police, Fire, and PW if access to road will be impacted.
5. Note in comments of Hansen WO# if illicit discharge or connection (KMC 15.52.090) is observed and initiate a service request for Activity 781; respond by following procedures in City of Kirkland Illicit Discharge and Spill Guidance Manual.
6. Remove accumulated sediment in ditch that exceeds 20% of designed ditch depth.
7. Remove noxious vegetation which may constitute a hazard to City personnel or public according to applicable regulations.
8. Clean inlets and outfalls if accumulated sediment is 20% or more of the pipe.
9. Remove sediment and debris from ditch to provide adequate flow.
10. Straw or seed as needed.
11. Quarry rock outfalls and around outlet pipe from ditch as needed.
12. Install waddles with stakes as needed.
13. Clean up jobsite, tools and truck.
14. Remove traffic control signs and safety devices as required at jobsite.
15. Notify front desk who will email Police, Fire, and PW that access to road has been returned.
16. Accurately report lineal feet of ditch cleaned and compile material and debris sheet.

**BMP(S):**

1. Refer to current Western Washington Phase II Municipal Stormwater Permit (August 1, 2013 - July 31, 2018).
2. Refer to King County Surface Water Design Manual Maintenance Requirements for Conveyance Systems for proper actions.
3. Refer to City of Kirkland Municipal Code, Illicit Discharges and Illicit Connections (KMC 15.52.090) for Code clarification.
4. Refer to City of Kirkland Illicit Discharge and Spill Guidance Manual for spill response procedures.
5. If in, adjacent to, or upstream from sensitive area:
  - Complete "concurrency form" and submit to Planning Supervisor.
  - Coordinate with Environmental Supervisor and Environmental unit regarding site-specific permit requirements and BMPs.
  - Follow Environmental Review process located in the Endangered Species Act Program Proposal, Appendix B.
6. Haul all Environmental/Regulatory permits on site during construction or maintenance work.
7. Have "SPILL KITS" (and employees trained to use) onsite.
8. Monitor BMPs during and following construction until site conditions stabilize.
9. Remove BMPs according to guidelines.
10. Help reduce operation impacts to climate change - minimize carbon outputs by not idling equipment and work to reduce two stroke equipment use as much as possible.

**GENERAL FREQUENCY:**

All ditches will be inspected for cleaning at least once no later than August 1, 2017 and every two years thereafter (per current NPDES permit requirements S5.C.5.d).

**TIME STANDARD:**

Varies depending on depth of ditch and amount of debris that has accumulated.

**ACTIVITY: 781 – Spill Response**

**DESIRED RESULT:**

Respond to illicit discharges, including spills that discharge or have the potential to discharge into the MS4 (municipal separated storm sewer system).

**RESOURCES:**

Crew

- 1 – Senior Maintenance
- 1 - Utility Person
- 2 – Flaggers (as needed)

Material

Spill materials vary on work vehicle. Examples of materials are:

- Spill pads (oil and universal)
- Spill booms (varied sizes)
- Absorbent (Fiber Sorb, X-Sorb, Safety Absorbent, Florco-X)
- Clear plastic bags for disposal
- Drain cover

Equipment

- Spark-proof shovel
- Broom
- Eductor truck (as needed)
- Sweeper truck (as needed)
- Back-up truck with overhead arrow for traffic control
- Laptop, charger
- PPE (gloves, hardhat, safety glasses, rain gear, rubber boots, hearing protection)

Contractor/Vendor Costs

Additional spill response (as needed)

**GENERAL WORK METHOD:**

1. Notify Lead of incident, if already not informed.
2. Use proper PPE.
3. Place traffic control signs and safety devices as required for safety.
4. Notify front desk who will email Police, Fire, and PW if access to road will be impacted.
5. Implement spill response procedures per City of Kirkland Illicit Discharge and Spill Guidance Manual.
  - \* If spill material is gasoline or hazardous materials, City eductor trucks should not be used. Contractor should be called for response.
6. Clean effected structures using appropriate activity.
7. After spill response, remove traffic control signs and safety devices.
8. Notify front desk who will email Police, Fire, and PW that access to road has been returned.
9. Note in comments of Hansen WO# that Illicit Discharge was observed in identified structures and that have been cleaned.
10. Complete IDDE/Spill form and place in Spill inbox located in crew lead area.
11. Notify Ryeann-Marie, or other Water Quality Team member, as well as other regulatory agencies identified in Illicit Discharge & Spill Guidance Manual.

**BMP(S):**

1. Refer to current Western Washington Phase II Municipal Stormwater Permit (August 1, 2013 - July 31, 2018).
2. Refer to King County Surface Water Design Manual Maintenance Requirements for Conveyance Systems for proper actions.
3. Refer to City of Kirkland Municipal Code, Illicit Discharges and Illicit Connections (KMC 15.52.090) for Code clarification.
4. Refer to City of Kirkland Illicit Discharge and Spill Guidance Manual for spill response procedures.
5. If in, adjacent to, or upstream from sensitive area:
  - Complete "concurrency form" and submit to Planning Supervisor.
  - Coordinate with Environmental Supervisor and Environmental unit regarding site-specific permit requirements and BMPs.
  - Follow Environmental Review process located in the Endangered Species Act Program Proposal, Appendix B.
6. Haul all Environmental/Regulatory permits on site during construction or maintenance work.
7. Have "SPILL KITS" (and employees trained to use) onsite.
8. Monitor BMPs during and following construction until site conditions stabilize.
9. Remove BMPs according to guidelines.
10. Help reduce operation impacts to climate change - minimize carbon outputs by not idling equipment and work to reduce two stroke equipment use as much as possible.

**GENERAL FREQUENCY:**

As unplanned event occurs.

**TIME STANDARD:**

Dependent on type and quantity of spill.

**ACTIVITY: 790 – Install New Storm Manhole**

**DESIRED RESULT:**

Install new manhole that meets updated specs to improve structural integrity.

**RESOURCES:**

Crew

- 1 – Senior Maintenance
- 2 - Utility Persons
- 2 – Flaggers (as needed)

Material

Manhole

Risers (min. of one, 2”), frame, cover

Grout (Ocean)

Pipe to reconnect to new structure

Fitting to reconnect new pipe if unable to save existing

**5/8” rock**

Portland concrete

Washed rock

Cold mix, Easy Street, or leave prepped for Street Division

Equipment

- 1 – Dump truck
  - 1 – Equipment trailer
  - 1 – Jackhammer and compressor
  - 1 – Trackhoe with breaker and bucket
  - 1 – Service truck or flatbed
  - 1 – Back-up truck with overhead arrow for traffic control
  - 1 – Backhoe
  - 1 – Compressor if breaker and trackhoe not available
- PPE (gloves, hardhat, safety glasses, rain gear, rubber boots, hearing protection)

Contractor/Vendor Costs

Debris – decant spoils

**GENERAL WORK METHOD:**

1. Lead identifies new manhole to be installed.
2. Lead prepares work schedule and dispatches staff.
3. Place traffic control signs and safety devices as required at jobsite.
4. Use proper PPE.
5. Apply all confined space equipment.
6. Notify front desk who will email Police, Fire, and PW if access to road will be impacted.
7. Clean inlets and outfalls if accumulated sediment is 20% or more of the pipe.
8. Determine flow line, lid style needed for structure.
9. Note in comments of Hansen WO# if illicit discharge or connection (KMC 15.52.090) is observed and initiate a service request for Activity 781; respond by following procedures in City of Kirkland Illicit Discharge and Spill Guidance Manual.
10. Use jackhammer or breaker to remove curb and gutter or asphalt if needed, bypassing flowing water as needed.
11. Dig down and try to save existing pipe if needed.
12. Establish elevation for new structure, and over-excavate leaving room for a 4” compacted rock base.
13. Install manhole on grade. Prep manhole for pipes prior to installing.
14. Install new storm pipes if needed.
15. Grout around pipes if needed.
16. **Backfill area with 5/8” crushed rock and compact.**
17. Prep, form, and pour concrete if needed.
18. Remove forms and prep for paving.
19. Clean up jobsite, tools and truck.
20. Remove traffic control signs and safety devices as required at jobsite.
21. Notify front desk who will email Police, Fire, and PW that access to road has been returned.
22. Accurately report manhole replaced and compile material and debris sheet.

**BMP(S):**

1. Refer to King County Surface Water Design Manual Maintenance Requirements for Conveyance Systems for proper actions.
2. Refer to City of Kirkland Municipal Code, Illicit Discharges and Illicit Connections (KMC 15.52.090) for Code clarification.
3. Refer to City of Kirkland Illicit Discharge and Spill Guidance Manual for spill response procedures.
4. If in, adjacent to, or upstream from sensitive area:
  - Complete “concurrency form” and submit to Planning Supervisor.
  - Coordinate with Environmental Supervisor and Environmental unit regarding site-specific permit requirements and BMPs.
  - Follow Environmental Review process located in the Endangered Species Act Program Proposal, Appendix B.
5. Haul all Environmental/Regulatory permits on site during construction or maintenance work.
6. **Have “SPILL KITS” (and employees trained to use) onsite.**
7. Monitor BMPs during and following construction until site conditions stabilize.
8. Remove BMPs according to guidelines.
9. Help reduce operation impacts to climate change - minimize carbon outputs by not idling equipment and work to reduce two stroke equipment use as much as possible.

**GENERAL FREQUENCY:**

As installation of manhole is required.

**TIME STANDARD:**

Average of 8 hours per manhole.

**ACTIVITY: 792 – Install New Catch Basin**

**DESIRED RESULT:**

Install new catch basin that meets updated specs to improve structural integrity.

**RESOURCES:**

Crew

- 1 – Senior Maintenance
- 2 - Utility Persons
- 2 – Flaggers (as needed)

Material

Catch basin

**Risers (min. of one, 2”), frame, cover**

Grout (Ocean)

Pipe to reconnect to new structure

Fitting to reconnect new pipe if unable to save existing

**5/8” rock**

Portland concrete

Washed rock

Cold mix, Easy Street, or leave prepped for Street Division

Equipment

- 1 – Dump truck
- 1 – Equipment trailer
- 1 – Jackhammer and compressor
- 1 – Trackhoe with breaker and bucket
- 1 – Service truck or flatbed
- 1 – Back-up truck with overhead arrow for traffic control
- 1 – Backhoe
- 1 – Compressor if breaker and trackhoe not available

PPE (gloves, hardhat, safety glasses, rain gear, rubber boots, hearing protection)

Contractor/Vendor Costs

Debris – decant spoils

**GENERAL WORK METHOD:**

1. Lead identifies catch basin to be installed.
2. Lead prepares work schedule and dispatches staff.
3. Place traffic control signs and safety devices as required at jobsite.
4. Use proper PPE.
5. Apply all confined space equipment.
6. Notify front desk who will email Police, Fire, and PW if access to road will be impacted.
7. Clean inlets and outfalls if accumulated sediment is 20% or more of the pipe.
8. Determine flow line, lid style needed for structure.
9. Note in comments of Hansen WO# if illicit discharge or connection (KMC 15.52.090) is observed and initiate a service request for Activity 781; respond by following procedures in City of Kirkland Illicit Discharge and Spill Guidance Manual.
10. Use jackhammer or breaker to remove curb and gutter or asphalt if needed, bypassing flowing water as needed.
11. Dig down and try to save existing pipe if needed.
12. Establish elevation for new structure, and over-excavate leaving room for a 4” compacted rock base.
13. Install catch basin on grade. Prep catch basin for pipe prior to installing.
14. Install new storm pipes if needed.
15. Grout around pipes if needed.
16. **Backfill area with 5/8” crushed rock and compact.**
17. Prep, form, and pour concrete if needed.
18. Remove forms and prep for paving.
19. Clean up jobsite, tools and truck.
20. Remove traffic control signs and safety devices as required at jobsite.
21. Notify front desk who will email Police, Fire, and PW that access to road has been returned.
22. Accurately report catch basins replaced and compile material and debris sheet.

**BMP(S):**

1. Refer to King County Surface Water Design Manual Maintenance Requirements for Conveyance Systems for proper actions.
2. Refer to City of Kirkland Municipal Code, Illicit Discharges and Illicit Connections (KMC 15.52.090) for Code clarification.
3. Refer to City of Kirkland Illicit Discharge and Spill Guidance Manual for spill response procedures.
4. If in, adjacent to, or upstream from sensitive area:
  - **Complete “concurrence form” and submit to Planning Supervisor.**
  - Coordinate with Environmental Supervisor and Environmental unit regarding site-specific permit requirements and BMPs.
  - Follow Environmental Review process located in the Endangered Species Act Program Proposal, Appendix B.
5. Haul all Environmental/Regulatory permits on site during construction or maintenance work.
6. **Have “SPILL KITS” (and employees trained to use) onsite.**
7. Monitor BMPs during and following construction until site conditions stabilize.
8. Remove BMPs according to guidelines.
9. Help reduce operation impacts to climate change - minimize carbon outputs by not idling equipment and work to reduce two stroke equipment use as much as possible.

**GENERAL FREQUENCY:**

As installation of catch basin is required.

**TIME STANDARD:** 1 -2 per day.

**ACTIVITY: 794 – Install New Storm Drain Pipe or Culvert**

**DESIRED RESULT:**

Install new pipe and culvert as needed to improve structural integrity and flow.

**RESOURCES:**

Crew

- 1 - Senior Maintenance
- 3 - Utility Persons
- 2 – Flaggers (as needed)

Material

- Pipe
- Bands or couplings (sand collar if at basin)
- 5/8" rock
- Asphalt cold mix

Equipment

- 1 – Dump truck
- 1 – Equipment trailer
- 1 – Trackhoe with breaker and bucket
- 1 – Service truck
- 1 – Eductor (if needed)
- 1 – Back-up truck with overhead arrow for traffic control
- PPE (gloves, hardhat, safety glasses, rain gear, rubber boots, hearing protection)
- Laptop, charger and cleaning sheets

Contractor/Vendor Costs

- Debris – decant spoils

**GENERAL WORK METHOD:**

1. Lead identifies storm drain pipe or culvert to be installed.
2. Lead prepares work schedule and dispatches staff.
3. Place traffic control signs and safety devices as required at jobsite.
4. Use proper PPE.
5. Notify front desk who will email Police, Fire, and PW if access to road will be impacted.
6. Apply all confined space equipment and complete forms for atmosphere testing as needed.
7. Note in comments of Hansen WO# if illicit discharge or connection (KMC 15.52.090) is observed and initiate a service request for Activity 781; respond by following procedures in City of Kirkland Illicit Discharge and Spill Guidance Manual.
8. Remove asphalt, sidewalk, or curb and gutter as needed.
9. Dig or hydro-excavate ditch for new storm drain pipe or culvert.
10. Prepare ditch for new pipe or culvert. Install compacted rock base of 2-4" as needed.
11. Install new pipe with couplings.
12. Backfill and compact.
13. **If work required inside manhole, use proper PPE's.**
14. Clean up jobsite, tools and truck.
15. Remove traffic control signs and safety devices as required at jobsite.
16. Notify front desk who will email Police, Fire, and PW that access to road has been returned.
17. Accurately report lineal feet of pipe or culvert installed in computer and on production sheet.

**BMP(S):**

1. Refer to King County Surface Water Design Manual Maintenance Requirements for Conveyance Systems for proper actions.
2. Refer to City of Kirkland Municipal Code, Illicit Discharges and Illicit Connections (KMC 15.52.090) for Code clarification.
3. Refer to City of Kirkland Illicit Discharge and Spill Guidance Manual for spill response procedures.
4. If in, adjacent to, or upstream from sensitive area:
  - Complete "concurrency form" and submit to Planning Supervisor.
  - Coordinate with Environmental Supervisor and Environmental unit regarding site-specific permit requirements and BMPs.
  - Follow Environmental Review process located in the Endangered Species Act Program Proposal, Appendix B.
5. Haul all Environmental/Regulatory permits on site during construction or maintenance work.
6. **Have "SPILL KITS" (and employees trained to use) onsite.**
7. Monitor BMPs during and following construction until site conditions stabilize.
8. Remove BMPs according to guidelines.
9. Help reduce operation impacts to climate change - minimize carbon outputs by not idling equipment and work to reduce two stroke equipment use as much as possible.

**GENERAL FREQUENCY:**

As installation of pipe or culvert is required.

**TIME STANDARD:**

Varies, depending on size, depth, location, and access.

# APPENDIX A

## MAINTENANCE REQUIREMENTS FOR FLOW CONTROL, CONVEYANCE, AND WQ FACILITIES

This appendix contains the maintenance requirements for the following typical stormwater control facilities and components:

- No. 1 – Detention Ponds (p. A-2)
- No. 2 – Infiltration Facilities (p. A-3)
- No. 3 – Detention Tanks and Vaults (p. A-5)
- No. 4 – Control Structure/Flow Restrictor (p. A-7)
- No. 5 – Catch Basins and Manholes (p. A-9)
- No. 6 – Conveyance Pipes and Ditches (p. A-11)
- No. 7 – Debris Barriers (e.g., Trash Racks) (p. A-12)
- No. 8 – Energy Dissipaters (p. A- 13)
- No. 9 – Fencing (p. A-14)
- No. 10 – Gates/Bollards/Access Barriers (p. A-15)
- No. 11 – Grounds (Landscaping) (p. A-16)
- No. 12 – Access Roads (p. A-17)
- No. 13 – Basic Biofiltration Swale (grass) (p. A-18)
- No. 14 – Wet Biofiltration Swale (p. A-19)
- No. 15 – Filter Strip (p. A-20)
- No. 16 – Wetpond (p. A-21)
- No. 17 – Wetvault (p. A-23)
- No. 18 – Stormwater Wetland (p. A-24)
- No. 19 – Sand Filter Pond (p. A-26)
- No. 20 – Sand Filter Vault (p. A-28)
- No. 21 – Stormfilter (Cartridge Type) (p. A-30)
- No. 22 – Baffle Oil/Water Separator (p. A-32)
- No. 23 – Coalescing Plate Oil/Water Separator (p. A-33)
- No. 24 – Catch Basin Insert (p. A-35)

<b>NO. 1 – DETENTION PONDS</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance Is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Site	Trash and debris	Any trash and debris which exceed 1 cubic foot per 1,000 square feet (this is about equal to the amount of trash it would take to fill up one standard size office garbage can). In general, there should be no visual evidence of dumping.	Trash and debris cleared from site.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Grass/groundcover	Grass or groundcover exceeds 18 inches in height.	Grass or groundcover mowed to a height no greater than 6 inches.
Top or Side Slopes of Dam, Berm or Embankment	Rodent holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents removed or destroyed and dam or berm repaired.
	Tree growth	Tree growth threatens integrity of slopes, does not allow maintenance access, or interferes with maintenance activity. If trees are not a threat or not interfering with access or maintenance, they do not need to be removed.	Trees do not hinder facility performance or maintenance activities.
	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted slope.	Slopes stabilized using appropriate erosion control measures. If erosion is occurring on compacted slope, a licensed civil engineer should be consulted to resolve source of erosion.
	Settlement	Any part of a dam, berm or embankment that has settled 4 inches lower than the design elevation.	Top or side slope restored to design dimensions. If settlement is significant, a licensed civil engineer should be consulted to determine the cause of the settlement.
Storage Area	Sediment accumulation	Accumulated sediment that exceeds 10% of the designed pond depth.	Sediment cleaned out to designed pond shape and depth; pond reseeded if necessary to control erosion.
	Liner damaged (If Applicable)	Liner is visible or pond does not hold water as designed.	Liner repaired or replaced.
Inlet/Outlet Pipe.	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than 1/2-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than 1/4-inch wide at the joint of the inlet/outlet pipe.
Emergency Overflow/Spillway	Tree growth	Tree growth impedes flow or threatens stability of spillway.	Trees removed.
	Rock missing	Only one layer of rock exists above native soil in area five square feet or larger or any exposure of native soil on the spillway.	Spillway restored to design standards.

<b>NO. 2 – INFILTRATION FACILITIES</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance Is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Site	Trash and debris	Any trash and debris which exceed 1 cubic foot per 1,000 square feet (this is about equal to the amount of trash it would take to fill up one standard size office garbage can). In general, there should be no visual evidence of dumping.	Trash and debris cleared from site.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Grass/groundcover	Grass or groundcover exceeds 18 inches in height.	Grass or groundcover mowed to a height no greater than 6 inches.
Infiltration Pond, Top or Side Slopes of Dam, Berm or Embankment	Rodent holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents removed or destroyed and dam or berm repaired.
	Tree growth	Tree growth threatens integrity of dams, berms or slopes, does not allow maintenance access, or interferes with maintenance activity. If trees are not a threat to dam, berm, or embankment integrity or not interfering with access or maintenance, they do not need to be removed.	Trees do not hinder facility performance or maintenance activities.
	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted slope.	Slopes stabilized using appropriate erosion control measures. If erosion is occurring on compacted slope, a licensed civil engineer should be consulted to resolve source of erosion.
	Settlement	Any part of a dam, berm or embankment that has settled 4 inches lower than the design elevation.	Top or side slope restored to design dimensions. If settlement is significant, a licensed civil engineer should be consulted to determine the cause of the settlement.
Infiltration Pond, Tank, Vault, Trench, or Small Basin Storage Area	Sediment accumulation	If two inches or more sediment is present or a percolation test indicates facility is working at or less than 90% of design.	Facility infiltrates as designed.
Infiltration Tank Structure	Plugged air vent	Any blockage of the vent.	Tank or vault freely vents.
	Tank bent out of shape	Any part of tank/pipe is bent out of shape more than 10% of its design shape.	Tank repaired or replaced to design.
	Gaps between sections, damaged joints or cracks or tears in wall	A gap wider than ½-inch at the joint of any tank sections or any evidence of soil particles entering the tank at a joint or through a wall.	No water or soil entering tank through joints or walls.
Infiltration Vault Structure	Damage to wall, frame, bottom, and/or top slab	Cracks wider than ½-inch, any evidence of soil entering the structure through cracks or qualified inspection personnel determines that the vault is not structurally sound.	Vault is sealed and structurally sound.



<b>NO. 2 – INFILTRATION FACILITIES</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance Is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Inlet/Outlet Pipes	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than 1/2-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than 1/4-inch wide at the joint of the inlet/outlet pipe.
Access Manhole	Cover/lid not in place	Cover/lid is missing or only partially in place. <b>Any open manhole requires immediate maintenance.</b>	Manhole access covered.
	Locking mechanism not working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to remove	One maintenance person cannot remove cover/lid after applying 80 lbs of lift.	Cover/lid can be removed and reinstalled by one maintenance person.
	Ladder rungs unsafe	Missing rungs, misalignment, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Large access doors/plate	Damaged or difficult to open	Large access doors or plates cannot be opened/removed using normal equipment.	Replace or repair access door so it can be opened as designed.
	Gaps, doesn't cover completely	Large access doors not flat and/or access opening not completely covered.	Doors close flat and covers access opening completely.
	Lifting Rings missing, rusted	Lifting rings not capable of lifting weight of door or plate.	Lifting rings sufficient to lift or remove door or plate.
Infiltration Pond, Tank, Vault, Trench, or Small Basin Filter Bags	Plugged	Filter bag more than 1/2 full.	Replace filter bag or redesign system.
Infiltration Pond, Tank, Vault, Trench, or Small Basin Pre-settling Ponds and Vaults	Sediment accumulation	6" or more of sediment has accumulated.	Pre-settling occurs as designed
Infiltration Pond, Rock Filter	Plugged	High water level on upstream side of filter remains for extended period of time or little or no water flows through filter during heavy rain storms.	Rock filter replaced evaluate need for filter and remove if not necessary.
Infiltration Pond Emergency Overflow Spillway	Rock missing	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of out flow path of spillway. Rip-rap on inside slopes need not be replaced.	Spillway restored to design standards.
	Tree growth	Tree growth impedes flow or threatens stability of spillway.	Trees removed.

<b>NO. 3 – DETENTION TANKS AND VAULTS</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Site	Trash and debris	Any trash and debris which exceed 1 cubic foot per 1,000 square feet (this is about equal to the amount of trash it would take to fill up one standard size office garbage can). In general, there should be no visual evidence of dumping.	Trash and debris cleared from site.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Grass/groundcover	Grass or groundcover exceeds 18 inches in height.	Grass or groundcover mowed to a height no greater than 6 inches.
Tank or Vault Storage Area	Trash and debris	Any trash and debris accumulated in vault or tank (includes floatables and non-floatables).	No trash or debris in vault.
	Sediment accumulation	Accumulated sediment depth exceeds 10% of the diameter of the storage area for ½ length of storage vault or any point depth exceeds 15% of diameter. Example: 72-inch storage tank would require cleaning when sediment reaches depth of 7 inches for more than ½ length of tank.	All sediment removed from storage area.
Tank Structure	Plugged air vent	Any blockage of the vent.	Tank or vault freely vents.
	Tank bent out of shape	Any part of tank/pipe is bent out of shape more than 10% of its design shape.	Tank repaired or replaced to design.
	Gaps between sections, damaged joints or cracks or tears in wall	A gap wider than ½-inch at the joint of any tank sections or any evidence of soil particles entering the tank at a joint or through a wall.	No water or soil entering tank through joints or walls.
Vault Structure	Damage to wall, frame, bottom, and/or top slab	Cracks wider than ½-inch, any evidence of soil entering the structure through cracks or qualified inspection personnel determines that the vault is not structurally sound.	Vault is sealed and structurally sound.
Inlet/Outlet Pipes	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.

<b>NO. 3 – DETENTION TANKS AND VAULTS</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Access Manhole	Cover/lid not in place	Cover/lid is missing or only partially in place. <b>Any open manhole requires immediate maintenance.</b>	Manhole access covered.
	Locking mechanism not working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to remove	One maintenance person cannot remove cover/lid after applying 80 lbs of lift.	Cover/lid can be removed and reinstalled by one maintenance person.
	Ladder rungs unsafe	Missing rungs, misalignment, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Large access doors/plate	Damaged or difficult to open	Large access doors or plates cannot be opened/removed using normal equipment.	Replace or repair access door so it can be opened as designed.
	Gaps, doesn't cover completely	Large access doors not flat and/or access opening not completely covered.	Doors close flat and covers access opening completely.
	Lifting Rings missing, rusted	Lifting rings not capable of lifting weight of door or plate.	Lifting rings sufficient to lift or remove door or plate.

<b>NO. 4 – CONTROL STRUCTURE/FLOW RESTRICTOR</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Structure	Trash and debris	Trash or debris of more than ½ cubic foot which is located immediately in front of the structure opening or is blocking capacity of the structure by more than 10%.	No Trash or debris blocking or potentially blocking entrance to structure.
		Trash or debris in the structure that exceeds ⅓ the depth from the bottom of basin to invert the lowest pipe into or out of the basin.	No trash or debris in the structure.
		Deposits of garbage exceeding 1 cubic foot in volume.	No condition present which would attract or support the breeding of insects or rodents.
	Sediment	Sediment exceeds 60% of the depth from the bottom of the structure to the invert of the lowest pipe into or out of the structure or the bottom of the FROP-T section or is within 6 inches of the invert of the lowest pipe into or out of the structure or the bottom of the FROP-T section.	Sump of structure contains no sediment.
	Damage to frame and/or top slab	Corner of frame extends more than ¾ inch past curb face into the street (If applicable).	Frame is even with curb.
		Top slab has holes larger than 2 square inches or cracks wider than ¼ inch.	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than ¾ inch of the frame from the top slab.	Frame is sitting flush on top slab.
	Cracks in walls or bottom	Cracks wider than ½ inch and longer than 3 feet, any evidence of soil particles entering structure through cracks, or maintenance person judges that structure is unsound.	Structure is sealed and structurally sound.
		Cracks wider than ½ inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering structure through cracks.	No cracks more than ¼ inch wide at the joint of inlet/outlet pipe.
	Settlement/misalignment	Structure has settled more than 1 inch or has rotated more than 2 inches out of alignment.	Basin replaced or repaired to design standards.
	Damaged pipe joints	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering the structure at the joint of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of inlet/outlet pipes.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
Ladder rungs missing or unsafe	Ladder is unsafe due to missing rungs, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.	
FROP-T Section	Damage	T section is not securely attached to structure wall and outlet pipe structure should support at least 1,000 lbs of up or down pressure.	T section securely attached to wall and outlet pipe.
		Structure is not in upright position (allow up to 10% from plumb).	Structure in correct position.
		Connections to outlet pipe are not watertight or show signs of deteriorated grout.	Connections to outlet pipe are water tight; structure repaired or replaced and works as designed.
		Any holes—other than designed holes—in the structure.	Structure has no holes other than designed holes.
Cleanout Gate	Damaged or missing	Cleanout gate is missing.	Replace cleanout gate.

<b>NO. 4 – CONTROL STRUCTURE/FLOW RESTRICTOR</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
		Cleanout gate is not watertight.	Gate is watertight and works as designed.
		Gate cannot be moved up and down by one maintenance person.	Gate moves up and down easily and is watertight.
		Chain/rod leading to gate is missing or damaged.	Chain is in place and works as designed.
Orifice Plate	Damaged or missing	Control device is not working properly due to missing, out of place, or bent orifice plate.	Plate is in place and works as designed.
	Obstructions	Any trash, debris, sediment, or vegetation blocking the plate.	Plate is free of all obstructions and works as designed.
Overflow Pipe	Obstructions	Any trash or debris blocking (or having the potential of blocking) the overflow pipe.	Pipe is free of all obstructions and works as designed.
	Deformed or damaged lip	Lip of overflow pipe is bent or deformed.	Overflow pipe does not allow overflow at an elevation lower than design
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than 1/2-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than 1/4-inch wide at the joint of the inlet/outlet pipe.
Metal Grates (If Applicable)	Unsafe grate opening	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and debris	Trash and debris that is blocking more than 20% of grate surface.	Grate free of trash and debris. footnote to guidelines for disposal
	Damaged or missing	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.
Manhole Cover/Lid	Cover/lid not in place	Cover/lid is missing or only partially in place. <b>Any open structure requires urgent maintenance.</b>	Cover/lid protects opening to structure.
	Locking mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to Remove	One maintenance person cannot remove cover/lid after applying 80 lbs. of lift.	Cover/lid can be removed and reinstalled by one maintenance person.

<b>NO. 5 – CATCH BASINS AND MANHOLES</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Structure	Sediment	Sediment exceeds 60% of the depth from the bottom of the catch basin to the invert of the lowest pipe into or out of the catch basin or is within 6 inches of the invert of the lowest pipe into or out of the catch basin.	Sump of catch basin contains no sediment.
	Trash and debris	Trash or debris of more than ½ cubic foot which is located immediately in front of the catch basin opening or is blocking capacity of the catch basin by more than 10%.	No Trash or debris blocking or potentially blocking entrance to catch basin.
		Trash or debris in the catch basin that exceeds ⅓ the depth from the bottom of basin to invert the lowest pipe into or out of the basin.	No trash or debris in the catch basin.
		Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within catch basin.
		Deposits of garbage exceeding 1 cubic foot in volume.	No condition present which would attract or support the breeding of insects or rodents.
	Damage to frame and/or top slab	Corner of frame extends more than ¼ inch past curb face into the street (If applicable).	Frame is even with curb.
		Top slab has holes larger than 2 square inches or cracks wider than ¼ inch.	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than ¼ inch of the frame from the top slab.	Frame is sitting flush on top slab.
	Cracks in walls or bottom	Cracks wider than ½ inch and longer than 3 feet, any evidence of soil particles entering catch basin through cracks, or maintenance person judges that catch basin is unsound.	Catch basin is sealed and structurally sound.
		Cracks wider than ½ inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	No cracks more than ¼ inch wide at the joint of inlet/outlet pipe.
	Settlement/ misalignment	Catch basin has settled more than 1 inch or has rotated more than 2 inches out of alignment.	Basin replaced or repaired to design standards.
	Damaged pipe joints	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering the catch basin at the joint of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of inlet/outlet pipes.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.
Trash and debris		Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
Damaged		Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.

<b>NO. 5 – CATCH BASINS AND MANHOLES</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Metal Grates (Catch Basins)	Unsafe grate opening	Grate with opening wider than $\frac{7}{8}$ inch.	Grate opening meets design standards.
	Trash and debris	Trash and debris that is blocking more than 20% of grate surface.	Grate free of trash and debris. footnote to guidelines for disposal
	Damaged or missing	Grate missing or broken member(s) of the grate. <b>Any open structure requires urgent maintenance.</b>	Grate is in place and meets design standards.
Manhole Cover/Lid	Cover/lid not in place	Cover/lid is missing or only partially in place. <b>Any open structure requires urgent maintenance.</b>	Cover/lid protects opening to structure.
	Locking mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to Remove	One maintenance person cannot remove cover/lid after applying 80 lbs. of lift.	Cover/lid can be removed and reinstalled by one maintenance person.

<b>NO. 6 – CONVEYANCE PIPES AND DITCHES</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Pipes	Sediment & debris accumulation	Accumulated sediment or debris that exceeds 20% of the diameter of the pipe.	Water flows freely through pipes.
	Vegetation/roots	Vegetation/roots that reduce free movement of water through pipes.	Water flows freely through pipes.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Damage to protective coating or corrosion	Protective coating is damaged; rust or corrosion is weakening the structural integrity of any part of pipe.	Pipe repaired or replaced.
	Damaged	Any dent that decreases the cross section area of pipe by more than 20% or is determined to have weakened structural integrity of the pipe.	Pipe repaired or replaced.
Ditches	Trash and debris	Trash and debris exceeds 1 cubic foot per 1,000 square feet of ditch and slopes.	Trash and debris cleared from ditches.
	Sediment accumulation	Accumulated sediment that exceeds 20% of the design depth.	Ditch cleaned/flushed of all sediment and debris so that it matches design.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Vegetation	Vegetation that reduces free movement of water through ditches.	Water flows freely through ditches.
	Erosion damage to slopes	Any erosion observed on a ditch slope.	Slopes are not eroding.
	Rock lining out of place or missing (If Applicable)	One layer or less of rock exists above native soil area 5 square feet or more, any exposed native soil.	Replace rocks to design standards.



<b>NO. 7 – DEBRIS BARRIERS (E.G., TRASH RACKS)</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed.</b>
Site	Trash and debris	Trash or debris plugging more than 20% of the area of the barrier.	Barrier clear to receive capacity flow.
	Sediment accumulation	Sediment accumulation of greater than 20% of the area of the barrier	Barrier clear to receive capacity flow.
Structure	Cracked broken or loose	Structure which bars attached to is damaged - pipe is loose or cracked or concrete structure is cracked, broken or loose.	Structure barrier attached to is sound.
Bars	Bar spacing	Bar spacing exceeds 6 inches.	Bars have at most 6 inch spacing,
	Damaged or missing bars	Bars are bent out of shape more than 3 inches.	Bars in place with no bends more than ¼ inch.
		Bars are missing or entire barrier missing.	Bars in place according to design.
		Bars are loose and rust is causing 50% deterioration to any part of barrier.	Repair or replace barrier to design standards.

<b>NO. 8 – ENERGY DISSIPATERS</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed.</b>
Site	Trash and debris	Trash and/or debris accumulation.	Dissipater clear of trash and/or debris.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
Rock Pad	Missing or moved Rock	Only one layer of rock exists above native soil in area five square feet or larger or any exposure of native soil.	Rock pad prevents erosion.
Dispersion Trench	Pipe plugged with sediment	Accumulated sediment that exceeds 20% of the design depth.	Pipe cleaned/flushed so that it matches design.
	Not discharging water properly	Visual evidence of water discharging at concentrated points along trench (normal condition is a "sheet flow" of water along trench).	Water discharges from feature by sheet flow.
	Perforations plugged.	Over 1/4 of perforations in pipe are plugged with debris or sediment.	Perforations freely discharge flow.
	Water flows out top of "distributor" catch basin.	Water flows out of distributor catch basin during any storm less than the design storm.	No flow discharges from distributor catch basin.
	Receiving area over-saturated	Water in receiving area is causing or has potential of causing landslide problems.	No danger of landslides.
Gabions	Damaged mesh	Mesh of gabion broken, twisted or deformed so structure is weakened or rock may fall out.	Mesh is intact, no rock missing.
	Corrosion	Gabion mesh shows corrosion through more than ¼ of its gage.	All gabion mesh capable of containing rock and retaining designed form.
	Collapsed or deformed baskets	Gabion basket shape deformed due to any cause.	All gabion baskets intact, structure stands as designed.
	Missing rock	Any rock missing that could cause gabion to loose structural integrity.	No rock missing.
Manhole/Chamber	Worn or damaged post, baffles or side of chamber	Structure dissipating flow deteriorates to ½ or original size or any concentrated worn spot exceeding one square foot which would make structure unsound.	Structure is in no danger of failing.
	Damage to wall, frame, bottom, and/or top slab	Cracks wider than ½-inch or any evidence of soil entering the structure through cracks, or maintenance inspection personnel determines that the structure is not structurally sound.	Manhole/chamber is sealed and structurally sound.
	Damaged pipe joints	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering the structure at the joint of the inlet/outlet pipes.	No soil or water enters and no water discharges at the joint of inlet/outlet pipes.

<b>NO. 9 – FENCING</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Site	Erosion or holes under fence	Erosion or holes more than 4 inches high and 12-18 inches wide permitting access through an opening under a fence.	No access under the fence.
Wood Posts, Boards and Cross Members	Missing or damaged parts	Missing or broken boards, post out of plumb by more than 6 inches or cross members broken	No gaps on fence due to missing or broken boards, post plumb to within 1½ inches, cross members sound.
	Weakened by rotting or insects	Any part showing structural deterioration due to rotting or insect damage	All parts of fence are structurally sound.
	Damaged or failed post foundation	Concrete or metal attachments deteriorated or unable to support posts.	Post foundation capable of supporting posts even in strong wind.
Metal Posts, Rails and Fabric	Damaged parts	Post out of plumb more than 6 inches.	Post plumb to within 1½ inches.
		Top rails bent more than 6 inches.	Top rail free of bends greater than 1 inch.
		Any part of fence (including post, top rails, and fabric) more than 1 foot out of design alignment.	Fence is aligned and meets design standards.
		Missing or loose tension wire.	Tension wire in place and holding fabric.
	Deteriorated paint or protective coating	Part or parts that have a rusting or scaling condition that has affected structural adequacy.	Structurally adequate posts or parts with a uniform protective coating.
	Openings in fabric	Openings in fabric are such that an 8-inch diameter ball could fit through.	Fabric mesh openings within 50% of grid size.

<b>NO. 10 – GATES/BOLLARDS/ACCESS BARRIERS</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Chain Link Fencing Gate	Damaged or missing members	Missing gate.	Gates in place.
		Broken or missing hinges such that gate cannot be easily opened and closed by a maintenance person.	Hinges intact and lubed. Gate is working freely.
		Gate is out of plumb more than 6 inches and more than 1 foot out of design alignment.	Gate is aligned and vertical.
		Missing stretcher bar, stretcher bands, and ties.	Stretcher bar, bands, and ties in place.
	Locking mechanism does not lock gate	Locking device missing, no-functioning or does not link to all parts.	Locking mechanism prevents opening of gate.
	Openings in fabric	Openings in fabric are such that an 8-inch diameter ball could fit through.	Fabric mesh openings within 50% of grid size.
Bar Gate	Damaged or missing cross bar	Cross bar does not swing open or closed, is missing or is bent to where it does not prevent vehicle access.	Cross bar swings fully open and closed and prevents vehicle access.
	Locking mechanism does not lock gate	Locking device missing, no-functioning or does not link to all parts.	Locking mechanism prevents opening of gate.
	Support post damaged	Support post does not hold cross bar up.	Cross bar held up preventing vehicle access into facility.
Bollards	Damaged or missing	Bollard broken, missing, does not fit into support hole or hinge broken or missing.	No access for motorized vehicles to get into facility.
	Does not lock	Locking assembly or lock missing or cannot be attached to lock bollard in place.	No access for motorized vehicles to get into facility.
Boulders	Dislodged	Boulders not located to prevent motorized vehicle access.	No access for motorized vehicles to get into facility.
	Circumvented	Motorized vehicles going around or between boulders.	No access for motorized vehicles to get into facility.

<b>NO. 11 – GROUNDS (LANDSCAPING)</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Site	Trash or litter	Any trash and debris which exceed 1 cubic foot per 1,000 square feet (this is about equal to the amount of trash it would take to fill up one standard size office garbage can). In general, there should be no visual evidence of dumping.	Trash and debris cleared from site.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Grass/groundcover	Grass or groundcover exceeds 18 inches in height.	Grass or groundcover mowed to a height no greater than 6 inches.
Trees and Shrubs	Hazard	Any tree or limb of a tree identified as having a potential to fall and cause property damage or threaten human life. <b>A hazard tree identified by a qualified arborist must be removed as soon as possible.</b>	No hazard trees in facility.
	Damaged	Limbs or parts of trees or shrubs that are split or broken which affect more than 25% of the total foliage of the tree or shrub.	Trees and shrubs with less than 5% of total foliage with split or broken limbs.
		Trees or shrubs that have been blown down or knocked over.	No blown down vegetation or knocked over vegetation. Trees or shrubs free of injury.
	Trees or shrubs which are not adequately supported or are leaning over, causing exposure of the roots.	Tree or shrub in place and adequately supported; dead or diseased trees removed.	

<b>NO. 12 – ACCESS ROADS</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Site	Trash and debris	Trash and debris exceeds 1 cubic foot per 1,000 square feet (i.e., trash and debris would fill up one standard size garbage can).	Roadway drivable by maintenance vehicles.
		Debris which could damage vehicle tires or prohibit use of road.	Roadway drivable by maintenance vehicles.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Blocked roadway	Any obstruction which reduces clearance above road surface to less than 14 feet.	Roadway overhead clear to 14 feet high.
Any obstruction restricting the access to a 10- to 12 foot width for a distance of more than 12 feet or any point restricting access to less than a 10 foot width.		At least 12-foot of width on access road.	
Road Surface	Erosion, settlement, potholes, soft spots, ruts	Any surface defect which hinders or prevents maintenance access.	Road drivable by maintenance vehicles.
	Vegetation on road surface	Trees or other vegetation prevent access to facility by maintenance vehicles.	Maintenance vehicles can access facility.
Shoulders and Ditches	Erosion	Erosion within 1 foot of the roadway more than 8 inches wide and 6 inches deep.	Shoulder free of erosion and matching the surrounding road.
	Weeds and brush	Weeds and brush exceed 18 inches in height or hinder maintenance access.	Weeds and brush cut to 2 inches in height or cleared in such a way as to allow maintenance access.
Modular Grid Pavement	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Damaged or missing	Access surface compacted because of broken or missing modular block.	Access road surface restored so road infiltrates.

<b>NO. 13 – BASIC BIOFILTRATION SWALE (GRASS)</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Site	Trash and debris	Any trash and/or debris accumulated on the bioswale site.	No trash or debris on the bioswale site.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
Swale Section	Sediment accumulation	Sediment depth exceeds 2 inches in 10% of the swale treatment area.	No sediment deposits in grass treatment area of the bioswale.
		Sediment inhibits grass growth over 10% of swale length.	Grass growth not inhibited by sediment.
		Sediment inhibits even spreading of flow.	Flow spreads evenly through swale
	Erosion/scouring	Eroded or scoured swale bottom due to channelization or high flows.	No eroded or scoured areas in bioswale. Cause of erosion or scour addressed.
	Poor vegetation coverage	Grass is sparse or bare or eroded patches occur in more than 10% of the swale bottom.	Swale has no bare spots and grass is thick and healthy.
	Grass too tall	Grass excessively tall (greater than 10 inches), grass is thin or nuisance weeds and other vegetation has taken over.	Grass is between 3 and 4 inches tall, thick and healthy. No clippings left in swale. No nuisance vegetation present.
	Excessive shade	Grass growth is poor because sunlight does not reach swale.	Health grass growth or swale converted to a wet bioswale.
	Constant baseflow	Continuous flow through the swale, even when it has been dry for weeks or an eroded, muddy channel has formed in the swale bottom.	Baseflow removed from swale by a low-flow pea-gravel drain or bypassed around the swale.
	Standing water	Water pools in the swale between storms or does not drain freely.	Swale freely drains and there is no standing water in swale between storms.
	Channelization	Flow concentrates and erodes channel through swale.	No flow channels in swale.
Flow Spreader	Concentrated flow	Flow from spreader not uniformly distributed across entire swale width.	Flows are spread evenly over entire swale width.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than 1/2-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than 1/4-inch wide at the joint of the inlet/outlet pipe.

<b>NO. 14 – WET BIOFILTRATION SWALE</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Site	Trash and debris	Any trash and/or debris accumulated at the site.	No trash or debris at the site.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
Swale Section	Sediment accumulation	Sediment depth exceeds 2 inches in 10% of the swale treatment area.	No sediment deposits in treatment area.
	Erosion/scouring	Eroded or scoured swale bottom due to channelization or high flows.	No eroded or scoured areas in bioswale. Cause of erosion or scour addressed.
	Water depth	Water not retained to a depth of about 4 inches during the wet season.	Water depth of 4 inches through out swale for most of wet season.
	Vegetation ineffective	Vegetation sparse, does not provide adequate filtration or crowded out by very dense clumps of cattail or nuisance vegetation.	Wetland vegetation fully covers bottom of swale and no cattails or nuisance vegetation present.
	Insufficient water	Wetland vegetation dies due to lack of water.	Wetland vegetation remains healthy (may require converting to grass lined bioswale)
Flow Spreader	Concentrated flow	Flow from spreader not uniformly distributed across entire swale width.	Flows are spread evenly over entire swale width.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.



<b>NO. 15 – FILTER STRIP</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Site	Trash and debris	Any trash and debris accumulated on the filter strip site.	Filter strip site free of any trash or debris
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
Grass Strip	Sediment accumulation	Sediment accumulation on grass exceeds 2 inches depth.	No sediment deposits in treatment area.
	Erosion/scouring	Eroded or scoured swale bottom due to channelization or high flows.	No eroded or scoured areas in bioswale. Cause of erosion or scour addressed.
	Grass too tall	Grass excessively tall (greater than 10 inches), grass is thin or nuisance weeds and other vegetation has taken over.	Grass is between 3 and 4 inches tall, thick and healthy. No clippings left in swale. No nuisance vegetation present.
	Vegetation ineffective	Grass has died out, become excessively tall (greater than 10 inches) or nuisance vegetation is taking over.	Grass is healthy, less than 9 inches high and no nuisance vegetation present.
Flow Spreader	Concentrated flow	Flow from spreader not uniformly distributed across entire swale width.	Flows are spread evenly over entire swale width.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than 1/2-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than 1/4-inch wide at the joint of the inlet/outlet pipe.

<b>NO. 16 – WETPOND</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Site	Trash and debris	Any trash and debris accumulated on the wetpond site.	Wetpond site free of any trash or debris.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Grass/groundcover	Grass or groundcover exceeds 18 inches in height.	Grass or groundcover mowed to a height no greater than 6 inches.
Side Slopes of Dam, Berm, internal berm or Embankment	Rodent holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents removed or destroyed and dam or berm repaired.
	Tree growth	Tree growth threatens integrity of dams, berms or slopes, does not allow maintenance access, or interferes with maintenance activity. If trees are not a threat to dam, berm or embankment integrity, are not interfering with access or maintenance or leaves do not cause a plugging problem they do not need to be removed.	Trees do not hinder facility performance or maintenance activities.
	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted slope.	Slopes stabilized using appropriate erosion control measures. If erosion is occurring on compacted slope, a licensed civil engineer should be consulted to resolve source of erosion.
Top or Side Slopes of Dam, Berm, internal berm or Embankment	Settlement	Any part of a dam, berm or embankment that has settled 4 inches lower than the design elevation.	Top or side slope restored to design dimensions. If settlement is significant, a licensed civil engineer should be consulted to determine the cause of the settlement.
	Irregular surface on internal berm	Top of berm not uniform and level.	Top of berm graded to design elevation.
Pond Areas	Sediment accumulation (except first wetpool cell)	Accumulated sediment that exceeds 10% of the designed pond depth.	Sediment cleaned out to designed pond shape and depth.
	Sediment accumulation (first wetpool cell)	Sediment accumulations in pond bottom that exceeds the depth of sediment storage (1 foot) plus 6 inches.	Sediment storage contains no sediment.
	Liner damaged (If Applicable)	Liner is visible or pond does not hold water as designed.	Liner repaired or replaced.
	Water level (first wetpool cell)	First cell empty, doesn't hold water.	Water retained in first cell for most of the year.
	Algae mats (first wetpool cell)	Algae mats develop over more than 10% of the water surface should be removed.	Algae mats removed (usually in the late summer before Fall rains, especially in Sensitive Lake Protection Areas.)
Gravity Drain	Inoperable valve	Valve will not open and close.	Valve opens and closes normally.
	Valve won't seal	Valve does not seal completely.	Valve completely seals closed.
Emergency Overflow Spillway	Tree growth	Tree growth impedes flow or threatens stability of spillway.	Trees removed.

<b>NO. 16 – WETPOND</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
	Rock missing	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of out flow path of spillway. Rip-rap on inside slopes need not be replaced.	Spillway restored to design standards.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.

<b>NO. 17 – WETVAULT</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Site	Trash and debris	Trash and debris accumulated on facility site.	Trash and debris removed from facility site.
Treatment Area	Trash and debris	Any trash and debris accumulated in vault (includes floatables and non-floatables).	No trash or debris in vault.
	Sediment accumulation	Sediment accumulation in vault bottom exceeds the depth of the sediment zone plus 6 inches.	No sediment in vault.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
Vault Structure	Damage to wall, frame, bottom, and/or top slab	Cracks wider than ½-inch, any evidence of soil entering the structure through cracks, vault does not retain water or qualified inspection personnel determines that the vault is not structurally sound.	Vault is sealed and structurally sound.
	Baffles damaged	Baffles corroding, cracking, warping and/or showing signs of failure or baffle cannot be removed.	Repair or replace baffles or walls to specifications.
	Ventilation	Ventilation area blocked or plugged.	No reduction of ventilation area exists.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.
Gravity Drain	Inoperable valve	Valve will not open and close.	Valve opens and closes normally.
	Valve won't seal	Valve does not seal completely.	Valve completely seals closed.
Access Manhole	Access cover/lid damaged or difficult to open	Access cover/lid cannot be easily opened by one person. Corrosion/deformation of cover/lid.	Access cover/lid can be opened by one person.
	Locking mechanism not working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to remove	One maintenance person cannot remove cover/lid after applying 80 lbs of lift.	Cover/lid can be removed and reinstalled by one maintenance person.
	Access doors/plate has gaps, doesn't cover completely	Large access doors not flat and/or access opening not completely covered.	Doors close flat and covers access opening completely.
	Lifting Rings missing, rusted	Lifting rings not capable of lifting weight of door or plate.	Lifting rings sufficient to lift or remove door or plate.
	Ladder rungs unsafe	Missing rungs, misalignment, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.

<b>NO. 18 – STORMWATER WETLAND</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Site	Trash and debris	Trash and debris accumulated on facility site.	Trash and debris removed from facility site.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Grass/groundcover	Grass or groundcover exceeds 18 inches in height.	Grass or groundcover mowed to a height no greater than 6 inches.
Side Slopes of Dam, Berm, internal berm or Embankment	Rodent holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents removed or destroyed and dam or berm repaired.
	Tree growth	Tree growth threatens integrity of dams, berms or slopes, does not allow maintenance access, or interferes with maintenance activity. If trees are not a threat to dam, berm, or embankment integrity or not interfering with access or maintenance, they do not need to be removed.	Trees do not hinder facility performance or maintenance activities.
	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted slope.	Slopes stabilized using appropriate erosion control measures. If erosion is occurring on compacted slope, a licensed civil engineer should be consulted to resolve source of erosion.
Top or Side Slopes of Dam, Berm, internal berm or Embankment	Settlement	Any part of a dam, berm or embankment that has settled 4 inches lower than the design elevation.	Top or side slope restored to design dimensions. If settlement is significant, a licensed civil engineer should be consulted to determine the cause of the settlement.
	Irregular surface on internal berm	Top of berm not uniform and level.	Top of berm graded flat to design elevation.
Pond Areas	Sediment accumulation (first cell/forebay)	Sediment accumulations in pond bottom that exceeds the depth of sediment storage (1 foot) plus 6 inches.	Sediment storage contains no sediment.
	Sediment accumulation (wetland cell)	Accumulated sediment that exceeds 10% of the designed pond depth.	Sediment cleaned out to designed pond shape and depth.
	Liner damaged (If Applicable)	Liner is visible or pond does not hold water as designed.	Liner repaired or replaced.
	Water level (first cell/forebay)	Cell does not hold 3 feet of water year round.	3 feet of water retained year round.
	Water level (wetland cell)	Cell does not retain water for at least 10 months of the year or wetland plants are not surviving.	Water retained at least 10 months of the year or wetland plants are surviving.
	Algae mats (first cell/forebay)	Algae mats develop over more than 10% of the water surface should be removed.	Algae mats removed (usually in the late summer before Fall rains, especially in Sensitive Lake Protection Areas.)
	Vegetation	Vegetation dead, dying, or overgrown (cattails) or not meeting original planting specifications.	Plants in wetland cell surviving and not interfering with wetland function.

<b>NO. 18 – STORMWATER WETLAND</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Gravity Drain	Inoperable valve	Valve will not open and close.	Valve opens and closes normally.
	Valve won't seal	Valve does not seal completely.	Valve completely seals closed.
Emergency Overflow Spillway	Tree growth	Tree growth impedes flow or threatens stability of spillway.	Trees removed.
	Rock missing	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of out flow path of spillway. Rip-rap on inside slopes need not be replaced.	Spillway restored to design standards.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.

<b>NO. 19 – SAND FILTER POND</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Site	Trash and debris	Trash and debris accumulated on facility site.	Trash and debris removed from facility site.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Grass/groundcover (not in the treatment area)	Grass or groundcover exceeds 18 inches in height.	Grass or groundcover mowed to a height no greater than 6 inches.
Pre-Treatment (if applicable)	Sediment accumulation	Sediment accumulations in pond bottom that exceeds the depth of sediment storage (1 foot) plus 6 inches.	Sediment storage contains no sediment.
	Liner damaged (If Applicable)	Liner is visible or pond does not hold water as designed.	Liner repaired or replaced.
	Water level	Cell empty, doesn't hold water.	Water retained in first cell for most of the year.
	Algae mats	Algae mats develop over more than 10% of the water surface should be removed.	Algae mats removed (usually in the late summer before Fall rains, especially in Sensitive Lake Protection Areas.)
Pond Area	Sediment accumulation	Sediment or crust depth exceeds ½-inch over 10 % of surface area of sand filter.	No sediment or crust deposit on sand filter that would impede permeability of the filter section.
	Grass (if applicable)	Grass becomes excessively tall (greater than 6 inches) or when nuisance weeds and other vegetation start to take over or thatch build up occurs.	Mow vegetation and/or remove nuisance vegetation.
Side Slopes of Pond	Rodent holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents removed or destroyed and dam or berm repaired.
	Tree growth	Tree growth threatens integrity of dams, berms or slopes, does not allow maintenance access, or interferes with maintenance activity. If trees are not a threat to dam, berm, or embankment integrity or not interfering with access or maintenance, they do not need to be removed.	Trees do not hinder facility performance or maintenance activities.
	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted slope.	Slopes stabilized using appropriate erosion control measures. If erosion is occurring on compacted slope, a licensed civil engineer should be consulted to resolve source of erosion.

<b>NO. 19 – SAND FILTER POND</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Sand Filter Media	Plugging	Drawdown of water through the sand filter media, takes longer than 24 hours, and/or flow through the overflow pipes occurs frequently. A sieve analysis of >4% -100 or >2% -200 requires replacing sand filter media.	Sand filter media surface is aerated and drawdown rate is normal.
	Prolonged flows	Sand is saturated for prolonged periods of time (several weeks) and does not dry out between storms due to continuous base flow or prolonged flows from detention facilities.	Excess flows bypassed or confined to small portion of filter media surface.
	Short circuiting	Flows become concentrated over one section of the sand filter rather than dispersed or drawdown rate of pool exceeds 12 inches per hour.	Flow and percolation of water through the sand filter is uniform and dispersed across the entire filter area and drawdown rate is normal.
	Media thickness	Sand thickness is less than 6 inches.	Rebuild sand thickness to a minimum of 6 inches and preferably to 18 inches.
Underdrains and Clean-Outs	Sediment/debris	Underdrains or clean-outs partially plugged or filled with sediment and/or debris. Junction box/cleanout wyes not watertight.	Underdrains and clean-outs free of sediment and debris and are watertight.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.
Rock Pad	Missing or out of place	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil.	Rock pad restored to design standards.
Flow spreader	Concentrated flow	Flow from spreader not uniformly distributed across sand filter.	Flows spread evenly over sand filter.



<b>NO. 20 – SAND FILTER VAULT</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Site	Trash and debris	Trash and debris accumulated on facility site.	Trash and debris removed from facility site.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Grass/groundcover	Grass or groundcover exceeds 18 inches in height.	Grass or groundcover mowed to a height no greater than 6 inches.
Pre-Treatment Chamber	Sediment accumulation	Sediment accumulation exceeds the depth of the sediment zone plus 6 inches.	Sediment storage contains no sediment.
Sand Filter Media	Sediment accumulation	Sediment depth exceeds ½-inch on sand filter media.	Sand filter freely drains at normal rate.
	Trash and debris	Trash and debris accumulated in vault (floatables and non-floatables).	No trash or debris in vault.
	Plugging	Drawdown of water through the sand filter media, takes longer than 24 hours, and/or flow through the overflow pipes occurs frequently. A sieve analysis of >4% -100 or >2% -200 requires replacing sand filter media.	Sand filter media drawdown rate is normal.
	Short circuiting	Seepage or flow occurs along the vault walls and corners. Sand eroding near inflow area. Cleanout wyes are not watertight.	Sand filter media section re-laid and compacted along perimeter of vault to form a semi-seal. Erosion protection added to dissipate force of incoming flow and curtail erosion.
Vault Structure	Damaged to walls, frame, bottom and/or top slab.	Cracks wider than ½-inch, any evidence of soil entering the structure through cracks or qualified inspection personnel determines that the vault is not structurally sound.	Vault replaced or repaired to provide complete sealing of the structure.
	Ventilation	Ventilation area blocked or plugged.	No reduction of ventilation area exists.
Underdrains and Cleanouts	Sediment/debris	Underdrains or clean-outs partially plugged, filled with sediment and/or debris or not watertight.	Underdrains and clean-outs free of sediment and debris and sealed.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ¼-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.

<b>NO. 20 – SAND FILTER VAULT</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Access Manhole	Cover/lid not in place	Cover/lid is missing or only partially in place. Any open manhole requires immediate maintenance.	Manhole access covered.
	Locking mechanism not working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to remove	One maintenance person cannot remove cover/lid after applying 80 lbs of lift.	Cover/lid can be removed and reinstalled by one maintenance person.
	Ladder rungs unsafe	Missing rungs, misalignment, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Large access doors/plate	Damaged or difficult to open	Large access doors or plates cannot be opened/removed using normal equipment.	Replace or repair access door so it can be opened as designed.
	Gaps, doesn't cover completely	Large access doors not flat and/or access opening not completely covered.	Doors close flat and covers access opening completely.
	Lifting Rings missing, rusted	Lifting rings not capable of lifting weight of door or plate.	Lifting rings sufficient to lift or remove door or plate.

<b>NO. 21 – STORMFILTER (CARTRIDGE TYPE)</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Site	Trash and debris	Any trash or debris which impairs the function of the facility.	Trash and debris removed from facility.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oils, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Life cycle	System has not been inspected for three years.	Facility is re-inspected and any needed maintenance performed.
Vault Treatment Area	Sediment on vault floor	Greater than 2 inches of sediment.	Vault is free of sediment.
	Sediment on top of cartridges	Greater than ½ inch of sediment.	Vault is free of sediment.
	Multiple scum lines above top of cartridges	Thick or multiple scum lines above top of cartridges. Probably due to plugged canisters or underdrain manifold.	Cause of plugging corrected, canisters replaced if necessary.
Vault Structure	Damage to wall, Frame, Bottom, and/or Top Slab	Cracks wider than ½-inch and any evidence of soil particles entering the structure through the cracks, or qualified inspection personnel determines the vault is not structurally sound.	Vault replaced or repaired to design specifications.
	Baffles damaged	Baffles corroding, cracking warping, and/or showing signs of failure as determined by maintenance/inspection person.	Repair or replace baffles to specification.
Filter Media	Standing water in vault	9 inches or greater of static water in the vault for more than 24 hours following a rain event and/or overflow occurs frequently. Probably due to plugged filter media, underdrain or outlet pipe.	No standing water in vault 24 hours after a rain event.
	Short circuiting	Flows do not properly enter filter cartridges.	Flows go through filter media.
Underdrains and Clean-Outs	Sediment/debris	Underdrains or clean-outs partially plugged or filled with sediment and/or debris.	Underdrains and clean-outs free of sediment and debris.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.
Access Manhole	Cover/lid not in place	Cover/lid is missing or only partially in place. <b>Any open manhole requires immediate maintenance.</b>	Manhole access covered.
	Locking mechanism not working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to remove	One maintenance person cannot remove cover/lid after applying 80 lbs of lift.	Cover/lid can be removed and reinstalled by one maintenance person.
	Ladder rungs unsafe	Missing rungs, misalignment, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Large access doors/plate	Damaged or difficult to open	Large access doors or plates cannot be opened/removed using normal equipment.	Replace or repair access door so it can be opened as designed.

**NO. 21 – STORMFILTER (CARTRIDGE TYPE)**

<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
	Gaps, doesn't cover completely	Large access doors not flat and/or access opening not completely covered.	Doors close flat and cover access opening completely.
	Lifting Rings missing, rusted	Lifting rings not capable of lifting weight of door or plate.	Lifting rings sufficient to lift or remove door or plate.

<b>NO. 22 – BAFFLE OIL/WATER SEPARATOR</b>			
<b>Maintenance Component</b>	<b>Defect</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Site	Trash and debris	Any trash or debris which impairs the function of the facility.	Trash and debris removed from facility.
	Contaminants and pollution	Floating oil in excess of 1 inch in first chamber, any oil in other chambers or other contaminants of any type in any chamber.	No contaminants present other than a surface oil film.
Vault Treatment Area	Sediment accumulation	Sediment accumulates exceeds 6 inches in the vault.	No sediment in the vault.
	Discharge water not clear	Inspection of discharge water shows obvious signs of poor water quality- effluent discharge from vault shows thick visible sheen.	Effluent discharge is clear.
	Trash or debris accumulation	Any trash and debris accumulation in vault (floatables and non-floatables).	Vault is clear of trash and debris.
	Oil accumulation	Oil accumulations that exceed 1 inch, at the surface of the water in the oil/water separator chamber.	No visible oil depth on water.
Vault Structure	Damage to Wall, Frame, Bottom, and/or Top Slab	Cracks wider than ½-inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determines that the vault is not structurally sound.	Vault replaced or repaired to design specifications.
	Baffles damaged	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance inspection personnel.	Repair or replace baffles to specifications.
Gravity Drain	Inoperable valve	Valve will not open and close.	Valve opens and closes normally.
	Valve won't seal	Valve does not seal completely.	Valve completely seals closed.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.
Access Manhole	Cover/lid not in place	Cover/lid is missing or only partially in place. <b>Any open manhole requires immediate maintenance.</b>	Manhole access covered.
	Locking mechanism not working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to remove	One maintenance person cannot remove cover/lid after applying 80 lbs of lift.	Cover/lid can be removed and reinstalled by one maintenance person.
	Ladder rungs unsafe	Missing rungs, misalignment, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Large access doors/plate	Damaged or difficult to open	Large access doors or plates cannot be opened/removed using normal equipment.	Replace or repair access door so it can be opened as designed.
	Gaps, doesn't cover completely	Large access doors not flat and/or access opening not completely covered.	Doors close flat and cover access opening completely.
	Lifting Rings missing, rusted	Lifting rings not capable of lifting weight of door or cover/lid.	Lifting rings sufficient to lift or remove cover/lid.

<b>NO. 23 – COALESCING PLATE OIL/WATER SEPARATOR</b>			
<b>Maintenance Component</b>	<b>Defect</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Site	Trash and debris	Any trash or debris which impairs the function of the facility.	Trash and debris removed from facility.
	Contaminants and pollution	Floating oil in excess of 1 inch in first chamber, any oil in other chambers or other contaminants of any type in any chamber.	No contaminants present other than a surface oil film.
Vault Treatment Area	Sediment accumulation in the forebay	Sediment accumulation of 6 inches or greater in the forebay.	No sediment in the forebay.
	Discharge water not clear	Inspection of discharge water shows obvious signs of poor water quality - effluent discharge from vault shows thick visible sheen.	Repair function of plates so effluent is clear.
	Trash or debris accumulation	Trash and debris accumulation in vault (floatables and non-floatables).	Trash and debris removed from vault.
	Oil accumulation	Oil accumulation that exceeds 1 inch at the water surface in the in the coalescing plate chamber.	No visible oil depth on water and coalescing plates clear of oil.
Coalescing Plates	Damaged	Plate media broken, deformed, cracked and/or showing signs of failure.	Replace that portion of media pack or entire plate pack depending on severity of failure.
	Sediment accumulation	Any sediment accumulation which interferes with the operation of the coalescing plates.	No sediment accumulation interfering with the coalescing plates.
Vault Structure	Damage to Wall, Frame, Bottom, and/or Top Slab	Cracks wider than ½-inch and any evidence of soil particles entering the structure through the cracks, or maintenance inspection personnel determines that the vault is not structurally sound.	Vault replaced or repaired to design specifications.
	Baffles damaged	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.	Repair or replace baffles to specifications.
Ventilation Pipes	Plugged	Any obstruction to the ventilation pipes.	Ventilation pipes are clear.
Shutoff Valve	Damaged or inoperable	Shutoff valve cannot be opened or closed.	Shutoff valve operates normally.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.
Access Manhole	Cover/lid not in place	Cover/lid is missing or only partially in place. <b>Any open manhole requires immediate maintenance.</b>	Manhole access covered.
	Locking mechanism not working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to remove	One maintenance person cannot remove cover/lid after applying 80 lbs of lift.	Cover/lid can be removed and reinstalled by one maintenance person.
	Ladder rungs unsafe	Missing rungs, misalignment, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.

<b>NO. 23 – COALESCING PLATE OIL/WATER SEPARATOR</b>			
<b>Maintenance Component</b>	<b>Defect</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Large access doors/plate	Damaged or difficult to open	Large access doors or plates cannot be opened/removed using normal equipment.	Replace or repair access door so it can be opened as designed.
	Gaps, doesn't cover completely	Large access doors not flat and/or access opening not completely covered.	Doors close flat and cover access opening completely.
	Lifting Rings missing, rusted	Lifting rings not capable of lifting weight of door or plate.	Lifting rings sufficient to lift or remove door or plate.

<b>NO. 24 – CATCH BASIN INSERT</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Media Insert	Visible Oil	Visible oil sheen passing through media	Media inset replaced.
	Insert does not fit catch basin properly	Flow gets into catch basin without going through media.	All flow goes through media.
	Filter media plugged	Filter media plugged.	Flow through filter media is normal.
	Oil absorbent media saturated	Media oil saturated.	Oil absorbent media replaced.
	Water saturated	Catch basin insert is saturated with water, which no longer has the capacity to absorb.	Insert replaced.
	Service life exceeded	Regular interval replacement due to typical average life of media insert product, typically one month.	Media replaced at manufacturer's recommended interval.
	Seasonal maintenance	When storms occur and during the wet season.	Remove, clean and replace or install new insert after major storms, monthly during the wet season or at manufacturer's recommended interval.



## 15.52.090 Illicit discharges and connections.

---

(a) Prohibition of Illicit Discharges. No person shall throw, drain, or otherwise discharge, cause or allow others under its control to throw, drain or otherwise discharge into the municipal storm drain system and/or surface and ground waters any materials other than storm water. Illicit discharges are prohibited and constitute a violation of this chapter. Examples of prohibited contaminants include, but are not limited to, the following:

- (1) Trash or debris.
- (2) Construction materials.
- (3) Petroleum products including but not limited to oil, gasoline, grease, fuel oil and heating oil.
- (4) Antifreeze and other automotive products.
- (5) Metals in either particulate or dissolved form.
- (6) Flammable or explosive materials.
- (7) Radioactive material.
- (8) Batteries.
- (9) Acids, alkalis, or bases.
- (10) Paints, stains, resins, lacquers, or varnishes.
- (11) Degreasers and/or solvents.
- (12) Drain cleaners.
- (13) Pesticides, herbicides, or fertilizers.
- (14) Steam cleaning wastes.
- (15) Soaps, detergents, or ammonia.
- (16) Swimming pool or spa filter backwash.
- (17) Chlorine, bromine, or other disinfectants.

(18) Heated water.

(19) Domestic animal wastes.

(20) Sewage.

(21) Recreational vehicle waste.

(22) Animal carcasses.

(23) Food wastes.

(24) Bark and other fibrous materials.

(25) Lawn clippings, leaves, or branches.

(26) Silt, sediment, concrete, cement or gravel.

(27) Dyes.

(28) Chemicals not normally found in uncontaminated water.

(29) Any other process-associated discharge except as otherwise allowed in this section.

(30) Any hazardous material or waste not listed above.

(b) Allowable Discharges. The following types of discharges shall not be considered illicit discharges for the purposes of this chapter unless the director determines that the type of discharge, whether singly or in combination with others, is causing or is likely to cause pollution of surface water or groundwater:

(1) Diverted stream flows.

(2) Rising ground waters.

(3) Uncontaminated ground water infiltration – as defined in [40 CFR 35.2005](#)(20).

(4) Uncontaminated pumped ground water.

(5) Foundation drains.

(6) Air conditioning condensation.

(7) Irrigation water from agricultural sources that is commingled with urban storm water.

(8) Springs.

(9) Water from crawl space pumps.

(10) Footing drains.

(11) Flows from riparian habitats and wetlands.

(12) Discharges from emergency fire fighting activities.

(c) Conditional Discharges. The following types of discharges shall not be considered illicit discharges for the purpose of this chapter if they meet the stated conditions, or unless the director determines that the type of discharge, whether singly or in combination with others, is causing or is likely to cause pollution of surface water or groundwater:

(1) Potable water, including water from water line flushing, hyperchlorinated water line flushing, fire hydrant system flushing, and pipeline hydrostatic test water. Planned discharges shall be dechlorinated to a concentration of 0.1 ppm or less, pH-adjusted, if necessary and in volumes and velocities controlled to prevent resuspension of sediments in the storm water system.

(2) Lawn watering and other irrigation runoff are permitted but shall be minimized.

(3) Dechlorinated swimming pool discharges. These discharges shall be dechlorinated to a concentration of 0.1 ppm or less, pH-adjusted, if necessary and in volumes and velocities controlled to prevent resuspension of sediments in the storm water system.

(4) Street and sidewalk wash water, water used to control dust, and routine external building wash down that does not use detergents are permitted if the amount of street wash and dust control water used is minimized. At active construction sites, street sweeping must be performed prior to washing the street.

(5) Non-storm water discharges covered by another NPDES permit; provided, that the discharger is in full compliance with all requirements of the permit, waiver, or order and other applicable laws and regulations; and provided, that written approval has been granted for any discharge to the storm drain system.

(d) Prohibition of Illicit Connections.

(1) The construction, use, maintenance, or continued existence of illicit connections to the storm drain system are prohibited and constitute a violation of this chapter.

(2) This prohibition expressly includes, without limitation, illicit connections made in the past, regardless of whether the connection was permissible under law or practices applicable or prevailing at the time of connection.


(3) A person is considered to be in violation of this section if the person connects a line conveying sewage to the MS4, or allows such a connection to continue.























































(e) Implementation of structural BMPs shall be required if operational BMPs are not effective at reducing or eliminating an illicit discharge. Guidance for design of structural BMPs is provided in Volume IV of the 2005 Stormwater Management Manual for Western Washington, herein incorporated by reference. (Ord. 4200 § 19, 2009; Ord. 3711 § 4 (part), 1999)

# APPENDIX C: BMP OUTCOME CATEGORY MATRIX




## BMP Outcome Category Matrix












































 = Recommended BMP Application but not limited to

BMP	PAGE	BMP OUTCOME CATEGORY							
		Keep Water From Work Area	Reduce Potential for Soil Erosion	Filter / Perimeter Protection	Settling	Reduce Water Velocity / Erosive Forces	Containment	Habitat Protection / Maintenance	Reduce Potential for Contaminants Falling Into Water
<b>AQUA BARRIER</b>	2.20								
BACK OF SLOPE PLANTING	2.23								
<b>COFFERDAM</b>	2.25								
COIR FABRIC	2.28								
COIR LOG	2.30								
CONCRETE CONTAINMENT (1)	2.33								
CONCRETE CONTAINMENT (2)	2.36								
CONSTRUCTION ACCESS ROAD	2.38								
CONTINUOUS BERM	2.41								
CURB INLET SEDIMENT TRAP	2.44								
DEWATERING	2.49								
DIAPER NETTING	2.51								
DITCH LINING	2.53								
DIVERSION BERM	2.55								
<b>DIVERSION CHANNEL</b>	2.57								
DUST CONTROL	2.60								
EXCELSIOR FILLED LOG	2.62								
<b>FILTER FABRIC</b>	2.64								
GRASS LINED CHANNEL	2.66								
GRAVEL FILLED SUMP	2.70								
HALF ROUND FILTER	2.71								
HAND SEEDING	2.73								
HYDROSEEDING	2.75								
INLET PROTECTION	2.77								
KIMBLE FILTER PIPE	2.84								
LARGE WOODY MATERIAL	2.86								
<b>LIVE STAKING</b>	2.91								
MULCHING	2.95								
PLASTIC COVERING	2.97								
PLYWOOD WORK PLATFORM	2.99								



## BMP Outcome Category Matrix

 = Recommended BMP Application but not limited to

BMP	PAGE	BMP OUTCOME CATEGORY							
		Keep Water From Work Area	Reduce Potential for Soil Erosion	Filter / Perimeter Protection	Settling	Reduce Water Velocity / Erosive Forces	Containment	Habitat Protection / Maintenance	Reduce Potential for Contaminants Falling Into Water
RIP RAP	2.101								
ROCK CHECK DAM	2.103								
<b>SANDBAG</b>	2.107								
SEDIMENTATION SUMP	2.111								
<b>SILT FENCE</b>	2.112								
SILT MAT	2.115								
SILTATION POND/SETTLING TANK	2.117								
SOIL STABILIZATION (Blankets/Matting)	2.120								
STRAW BALE BARRIER (1)	2.125								
STRAW BALE BARRIER (2)	2.128								
STRAW BALE BARRIER (3)	2.133								
STRAW LOG	2.136								
<b>STREAM BANK STABILIZATION</b>	2.139								
STREAM BYPASS	2.140								
STREAMBED GRAVEL	2.144								
SURFACE ROUGHENING	2.146								
SWEEPING	2.150								
TEMPORARY SEDIMENT TRAP	2.153								
TRIANGULAR SILT DIKE	2.156								
TURBIDITY CURTAIN	2.160								
<b>VACTORING</b>	2.164								
VEGETATIVE BUFFER	2.166								
WASHED ROCK	2.168								

A photograph of a pond with lily pads and surrounding green vegetation. The pond is in the center, with lily pads floating on the water. The surrounding area is covered in green grass and other plants. The image is framed by a yellow border.

Center for Watershed Protection

***Stormwater Pond  
& Wetland  
Maintenance  
Guidebook***

Produced for Tetra Tech, Inc.  
DRAFT September, 2004

# STORMWATER POND AND WETLAND MAINTENANCE GUIDEBOOK

## DRAFT

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# Introduction

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Prior to 1991, a relatively small number of states and municipalities had formal programs in place requiring that Stormwater Treatment Practices (STPs) be constructed to mitigate runoff pollution. Then, beginning in the early 1990's with the advent of Phase I of the federal National Pollutant Discharge Elimination System (NPDES) stormwater program, many additional municipalities began programs to limit stormwater pollution. These programs typically include STPs as one tool to help mitigate pollution from runoff. As a result, numerous STPs have been constructed throughout the United States. Unfortunately, the push to construct them has been substantially stronger than the push to actively maintain them. The realizations of budget constraints, lack of staffing, and limited knowledge about STP maintenance needs is still setting in for many community stormwater programs.

With the preponderance of stormwater ponds and wetlands across community landscapes, the specific need for detailed and representative pond and wetland maintenance guidance that spans the design, construction, and post-construction phases has arisen as a priority for many communities. The current federal stormwater regulations (e.g., Phase I and Phase II NPDES rules) make it incumbent upon permitting authorities and permittees to address stormwater treatment practice operation and maintenance as a major programmatic component.

This Guidebook has been developed expressly to address this need and assist communities in meeting the stormwater pond and wetland maintenance challenges that face them. A set of web-based tools was produced to accompany the Guidebook and can be found on the Stormwater Manager's Resource Center ([www.stormwatercenter.net](http://www.stormwatercenter.net), click on Program Resources then STP Maintenance). The website material focuses on programmatic tools (e.g. inspection checklists, performance bonds) and includes information for STPs other than ponds and wetlands.

## Purpose of the Guidebook

This Stormwater Pond and Wetland Maintenance Guidebook (Guidebook) provides guidance for maintenance considerations associated with ponds and wetlands during the design, construction, and post-construction phases aimed at minimizing the burden of long-term maintenance.

The primary audience for the Guidebook is Phase I and Phase II NPDES communities. For Phase I communities that may have a maintenance program in place, the Guidebook provides technical data and information to help improve existing design standards or inspection and maintenance standards. For Phase II communities, the Guidebook provides a technical resource.

This guidebook provides the inspector, program manager, designer, and owner (i.e., responsible party) with an understanding of common stormwater pond and wetland maintenance problems and possible solutions. A secondary audience is community/homeowner's associations, small watershed organizations, or other entities that may own or monitor stormwater ponds and wetlands. These groups may be responsible for routine maintenance and repairs. The Guidebook will help these public and private entities budget for maintenance, supervise routine maintenance, and identify problems that require additional assistance from a contractor or engineer with specialized knowledge.

## Organization of the Guidebook

The Guidebook is organized in five chapters, with accompanying technical appendices as follows:

### Introduction

Stormwater maintenance programs are put into context with overall stormwater programs, and the organization of the chapters is discussed.

### Chapter 1 – Pond and Wetland Maintenance Concerns

This chapter discusses the major pond and wetland maintenance concerns in the framework of the top eight concerns. It is recommended reading for program managers, designers, inspectors and owners to understand the problems that can occur in stormwater ponds and wetlands.

### Chapter 2. Designing for Low Maintenance Ponds and Wetlands

Pond and wetland design can reduce maintenance frequency and costs. This chapter is organized by design elements for use by design engineers and plan reviewers.

### Chapter 3. Construction for Maintenance Problem Prevention

Good construction practices and stringent construction inspection can prevent future maintenance problems. This chapter highlights critical areas for program managers and construction inspectors. Designers can use this information to clarify construction plans and specifications.

### Chapter 4: Post-Construction Inspection of Ponds and Wetlands

Ongoing inspection of stormwater facilities ensures that routine maintenance is occurring and identifies problems to be corrected. This chapter addresses various parties that conduct inspections, suggests maintenance/inspection frequencies, and outlines inspection procedures. While written for the program manager and inspector, this chapter will also be of interest to owners and citizen monitoring groups.

### Chapter 5: Maintenance Activities

This chapter provides detailed information about inspection and maintenance activities, focusing on the top eight maintenance concerns for stormwater ponds and wetlands. This information is valuable for inspectors and maintenance crew leaders, as well as program managers, owners or other decision-makers.

### Appendix A. Cost Data

This appendix provides a table of unit costs and recommended frequencies for typical pond and wetland maintenance items.

### Appendix B. Inspection Checklists

Sample checklists are presented for construction phase and post-construction.

## Terminology

Stormwater management terminology is often confusing and can convey multiple meanings. This Guidebook uses several terms throughout the text that merit upfront explanation and definition to provide the reader with a foundation for the understanding the context of the subsequent text.

**Stormwater Ponds** (Figure A) – practices with a permanent pool, or a combination of extended detention (ED) or shallow marsh with a permanent pool that provides storage equivalent to the entire Water Quality Volume (WQv). Stormwater ponds may also provide channel protection storage volume (Cpv) and overbank flood control (Qp) through stormwater detention above the WQv storage. Pond design variants include micropool ED ponds, wet ponds, wet ED ponds, and multiple pond systems.

**Stormwater wetlands** (Figure B) – shallow marsh areas that treat urban stormwater, and often incorporate small permanent pools and/or extended detention storage to achieve the full WQv. Stormwater wetlands may also provide peak discharge control (Qp) and channel protection storage volume (Cpv) through stormwater detention above the WQv storage. Wetland design variants include shallow marsh, ED/shallow marsh, and shallow marsh/wet pond.

**Extended Detention (ED)** - Design feature that provides for the gradual release of a volume of water to increase settling of pollutants and protect downstream channels from frequent storm events.

**Water Quality Volume (WQv)** – Storage volume needed to capture and treat runoff associated with smaller, frequently occurring storms (e.g., 0.5” – 1” rainfall depth).

**Channel Protection Volume (Cpv)** - Storage volume for the control of downstream channel erosion.

**Overbank Flood Control, (i.e., Peak Discharge Protection Volume (Qp))** – Storage volume needed to control the magnitude of flows associated with larger, out of bank flooding events (e.g., 10-year return frequency storm events).

**Micropool** – Small permanent pool used to avoid resuspension of particles and minimize impact to adjacent natural features.

**Permanent Pool** – Open area of water impounded by a dam, embankment or berm, designed to retain water at all times.

**Shallow Marsh** - Human-made wetland with water depths ranging from <6” to 18”, planted with native wetland vegetation.

**Forebay** – Additional storage space located near a stormwater practice inlet that serves to trap incoming coarse sediments before they accumulate in the main treatment area.

**Riser** – A vertical pipe which extends from the bottom of a pond stormwater practice and houses the control devices (weirs/orifices) to achieve the discharge rates for specified designs.

**Barrel** – The closed conduit used to convey water under or through an embankment: part of the principal spillway.

**Pond Drain** – A pipe or other structure used to drain a permanent pool within a specified time period.

*Principal Spillway* – The primary pipe or weir that carries baseflow and storm flow through the embankment.

*Emergency Spillway* – A dam spillway designed and constructed to discharge flow in excess of the principal spillway design discharge.

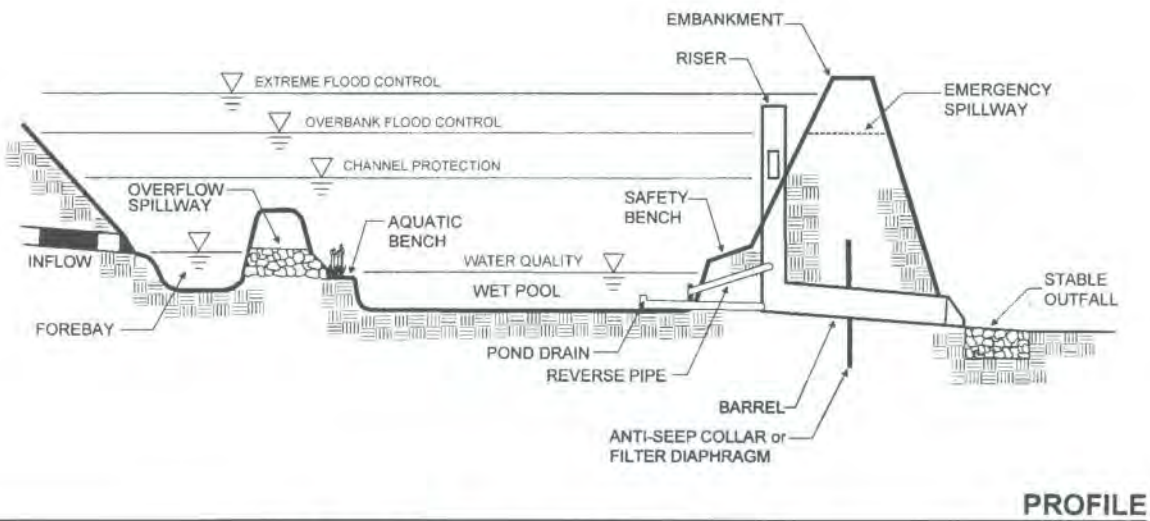
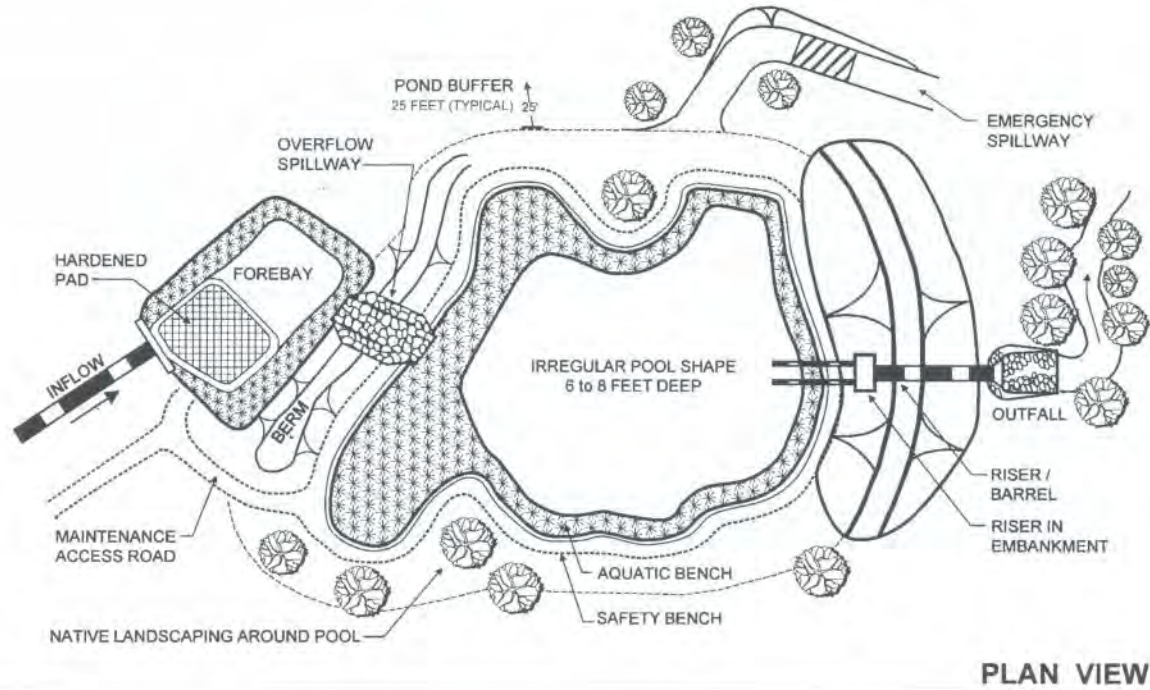
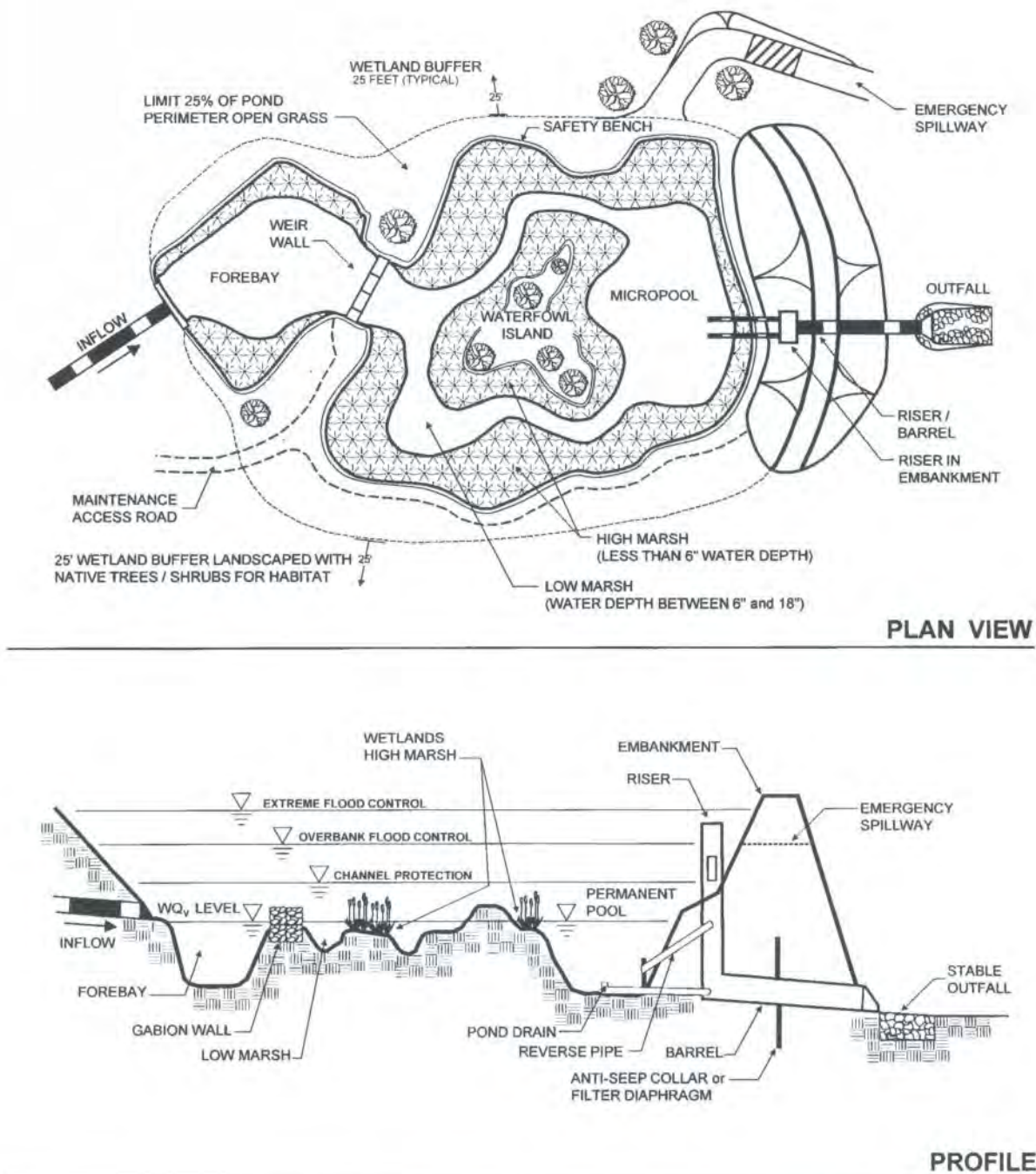


Figure A: Stormwater Pond Schematic





**Figure B: Stormwater Wetland Schematic**

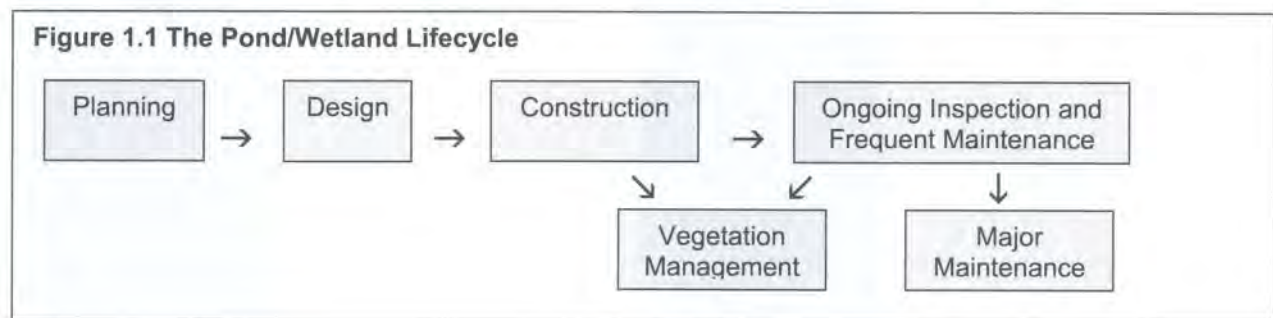
This Guidebook does not explicitly address maintenance needs of dry ponds or underground detention. These practices are not widely recommended as stand alone practices that provide both water quality and water quantity benefits. Dry ponds, however, exist in many communities, as flood control facilities, and many of the maintenance considerations for stormwater ponds and wetlands presented in this Guidebook are relevant to dry ponds.

# Chapter 1: Pond and Wetland Maintenance Concerns

## 1.1 Maintaining Pond and Wetland Function

Stormwater ponds and wetlands are popular stormwater treatment practices (STPs) for a number of reasons including aesthetics, pollutant removal capability, habitat value and relatively low maintenance burden. Stormwater ponds can be pleasing to look at, in fact there have been studies linking increases in property value associated with proximity to wet ponds (Brown and Schueler, 1997; CWP, 2001). Stormwater wetlands can provide diverse habitat for aquatic and terrestrial species. The large permanent pool volume of ponds and wetlands enhances pollutant removal because of relatively long residence times<sup>1</sup>, reduced flow velocities and their ability to retain settled sediments and pollutants (Winer, 2000). Stormwater wetlands also provide biological uptake of pollutants through contact between wetland plants and stormwater runoff.

Stormwater pond maintenance is related to the entire pond lifecycle, depicted in Figure 1.1.



Maintenance is necessary for a stormwater pond or wetland to operate as designed on a long-term basis. The pollutant removal, channel protection, and flood control capabilities of ponds and wetlands will decrease if:

- Sediment accumulates in the pond, reducing the storage volume
- Debris blocks the outlet structure
- Pipes or the riser are damaged
- Invasive plants out compete the wetland plants
- Slope stabilizing vegetation is lost
- The structural integrity of the embankment, weir, or riser is compromised.

Pond and wetland maintenance activities range in terms of the level of effort and expertise required to perform them. Routine pond and wetland maintenance, such as mowing and removing debris or trash, is needed multiple times each year, but can be performed by citizen volunteers. More significant maintenance such as removing accumulated sediment is needed less frequently, but requires more skilled labor and special equipment. Inspection and repair of critical structural features such as embankments and risers, needs to be performed by a qualified professional (e.g., structural engineer) that has experience in the construction, inspection, and repair of these features.

<sup>1</sup> Residence time is the length of time for water to pass through the pond or wetland.

This Guidebook identifies appropriate frequencies and skill levels needed for each maintenance activity to provide program managers and responsible parties with an understanding of the relative effort and expertise that may be required.

Program managers and responsible parties need to recognize and understand that neglecting routine maintenance and inspection can lead to more serious problems that threaten public safety, impact water quality, and require more expensive corrective actions. Appendix A of this Guidebook provides program managers with specific maintenance activity unit cost and frequency information.

## 1.2 Top 8 Maintenance Concerns

Eight broad issues are identified in this Guidebook as the most frequent problems encountered in maintaining stormwater ponds and wetlands (Figure 1.2).



Notably absent from the list are structural stability issues associated with embankments and pipes (e.g., earth, concrete and metal repairs). While earth, concrete and metal repairs are essential elements of stormwater pond and wetland maintenance, the assessment and design for repair of such items should be performed by a qualified structural or geotechnical engineer and is beyond the scope of this document. Where applicable, the importance of conducting a more thorough inspection of structural stability is called out in this Guidebook. More detailed guidance on structural inspections and repairs for ponds and wetlands can frequently be obtained from state dam safety agencies or local Natural Resources Conservation Service (NRCS) offices.

### ***Permanent Pool***

For stormwater ponds and wetlands, a common maintenance issue is abnormally high or low permanent pool levels.

Permanent pools (Figure 1.3) are normally designed for a stable water surface elevation between storm events that will rise during and shortly after a significant rain event. Pond elevations should not dip appreciably below the specified level unless under extreme conditions, such as drought. Ponds used as an alternative water supply for irrigation or other reuse are also an exception.



**Figure 1.3: Permanent pool**

### ***Permanent Pools Too Low***

Permanent pools provide functions including aquatic habitat, water quality enhancement, and visual aesthetics. When pool levels drop too low water quality is threatened by algal blooms and anoxic conditions, which can lead to fish kills.

Pond and wetland facilities should keep their permanent pool at or near the elevation of the low flow orifice or weir. Low permanent pools that are not drought-induced are usually caused by leaks either (1) in the pond embankment/perimeter, (2) in the principal spillway, or (3) in the pond bottom.

Leaks within the facility embankment or through the bottom of the pond are often difficult to locate unless they are large or severe. Active dam leaks often produce a vortex, an unmistakable indication of a leak. Water may leak through sinkholes formed in pond bottoms or infiltrate through porous underlying soils.

Leaks in the principal spillway riser are fairly easy to spot. Leaks in the barrel are harder to locate, as they require either manual entry or remote TV inspection. Broken or missing valves can also lead toward abnormally low water levels in ponds.

If a low permanent pool occurs during or immediately following construction, it can be a sign of poorly compacted berms or dams or damaged or leaking barrels and risers, items that should be inspected during and immediately following construction. A low pool may also signify that the water budget was miscalculated during design.

### ***Permanent Pools Too High***

A clogged low flow orifice is the most common reason for a higher than normal permanent pool level (Figure 1.4). Clogging is discussed in detail in the next section.

The high permanent pool disrupts the pond or wetland function in the following ways:

- Storage volume is decreased, reducing the ability to attenuate flood flows
- Flows leave the pond or wetland at velocities greater than design release rates, increasing downstream channel erosion.



**Figure 1.4: Abnormally high permanent pool – Water spills into 2- year weir because beavers have clogged the low flow orifice.**

- Water quality is compromised because runoff short-circuits<sup>2</sup> the pond and enters the downstream channel without adequate residence time for quality treatment.
- High pools kill riparian trees by flooding roots that are not normally submerged.
- Public access and safety can be compromised when adjacent pathways and recreational use areas are flooded.
- By saturating areas designed to be outside the permanent pool, mosquito-breeding habitat may be created.

### *Clogging*

Clogged low flow orifices<sup>3</sup> and weirs represent the most frequent, persistent maintenance item common to all types of ponds or wetlands. Serious impacts can easily be minimized through design and retrofit. However, without frequent maintenance, even openings with trash racks can become clogged.

Clogging occurs when debris or sediment accumulates at riser/weir openings or outfalls, blocking the flow of water (Figures 1.5 and 1.6). Debris includes vegetative material such as dead plants, twigs, branches and leaves as well as litter and trash. Large storms transport significant amounts of debris. Vandalism and nuisance problems such as beavers contribute to clogging as well.



**Figure 1.5: Flattop riser covered with debris.**



**Figure 1.6: Riser without trash rack**

<sup>2</sup> Short circuiting is the term used when stormwater runoff residence times in the pond are reduced.

<sup>3</sup> Low flow orifices or openings pass baseflow and control detention time in ponds and wetlands.

In addition to the permanent pool fluctuation problems noted above, clogged orifices can cause the following concerns:

- Obscuring the upstream slope of embankments, preventing adequate inspection.
- Blocking low flow openings causing overtopping of the embankment or dam in the event of a flood.
- Blocking underwater spillway inlets such as ‘reverse slope’ pipes once floating debris becomes waterlogged and sinks

### **Pipe Repairs**

Pipes and riser structures are designed to convey stormwater safely and at a controlled rate. If pipes or risers are damaged, these functions will be affected. Often, risers are made from the same materials as pipes, and therefore can be treated as such with respect to maintenance and repair.

Pipes through the embankment – the principal spillway and other utilities – are designed to be watertight. If damaged, pipes may leak water into the embankment through holes or separated joints (Figure 1.7). This can lead to piping of water along the pipe, which results in erosion (Figure 1.8) and can lead to embankment failure.



**Figure 1.7: Pipe invert abrasion**



**Figure 1.8: Severe erosion around riser and barrel**

Pipe damage can occur at any point in a pond or wetland lifecycle: improper design, poor construction practice, inadequate maintenance, or wear and tear. While problems with design and construction are preventable, wear and tear is a wild card. Extreme storm events, chemical attack, abrasion, or other unforeseen circumstances may challenge the longevity of the design.

Table 1.1 presents mechanisms of pipe failure and the lifecycle point where the failure typically occurs.

**Table 1.1: Mechanisms of Pipe Failure**

Mechanism	Lifecycle Point		
	Design	Construction	Wear and Tear
<u>Joint Separation</u> The physical separation of different sections of pipe along the barrel typically caused by differential settlement or improper pipe compaction.	✓	✓	
<u>Buoyancy Failure</u> Trapped air in the pipe creates uplift forces, bending pipe ends up or displacing entire culverts.	✓	✓	
<u>Static and Dynamic Loading</u> Overburdening (placing too much static weight on the pipe) or inappropriate dynamic loading (e.g. driving a heavy piece of equipment over a pipe with insufficient backfill) causes failure.	✓	✓	
<u>Material Compatibility</u> Designs with several pipe materials may not bond well, especially if dissimilar pipe materials are placed in pre-cast forms on holes, and then grouted to be water-tight. Most noncementitious materials do not bond well to concrete or masonry as these materials tend to shrink over time. It is common to see leaks in the control structures where plastic or steel pipes enter through concrete.	✓	✓	
<u>Installation Technique</u> See Chapter 3 for description.		✓	
<u>Insufficient Compaction</u> See Chapter 3 for description.		✓	
<u>Vandalism</u> Acts include filling with rubble and debris and crushing exposed ends of plastic and clay piping.	✓		✓
<u>Corrosion Fatigue</u> Fatigue type cracking of metal caused by repeated or fluctuating stresses in a corrosive environment characterized by shorter life than would be encountered as a result of either the repeated or fluctuating stress alone or the corrosive environment alone.	✓		✓
<u>UV Deterioration</u> Plastic piping is susceptible to deterioration from sunlight and even UV resistant material will become brittle and fracture given enough exposure.			✓
<u>Freezing and Cracking</u> Water pockets in the pipes, which are constantly exposed to surface water, freeze and thaw several times each winter, stressing and weakening the pipe.			✓
<u>Internal Corrosion</u> Corrosion that occurs inside a pipe because of the physical, chemical, or biological interactions between the pipe and the water.			✓
<u>Abrasion</u> Deterioration of a surface by the abrasive action of moving fluids - this is accelerated by the presence of solid particles or gas bubbles in suspension			✓

## Vegetation Management

Vegetation management involves sustaining the landscaping as designed and preventing the growth of unwanted species. There are three primary types of vegetation that require management and maintenance in stormwater ponds and wetlands.

### Turf and Grasses

Native and non-native grasses are the most common vegetative stabilization used in stormwater pond and wetland construction today for reasons of aesthetics, ease of maintenance, and price (Figure 1.9). The root system of any vegetative cover holds the surface soil in place and protects the slopes from wind and surface runoff erosion.

A regularly scheduled program of cutting and trimming of grass at facilities during the growing season will help to maintain a tightly knit turf and will also help prevent diseases, pests and the intrusion of weeds.



**Figure 1.9: Mowed dry pond bottom**

### Wetland Plantings

Native wetland plants promote biological uptake of pollutants (Figure 1.10). Though the natural propagation is desirable, vegetation will still need to be managed to meet the design goals. Depending on the design of the system, vegetation harvesting<sup>4</sup> and control of aquatic plants (such as cattails and phragmites) may be required.

### Trees and Forested Areas

Trees are often planted for aesthetic, stabilization and temperature control reasons. They have to be maintained to prevent clogging of orifices with debris and the spread to unwanted areas.

Vegetation management is probably the most frequent maintenance activity that occurs in association with the upkeep of stormwater ponds and wetlands. While the activity requires little expertise or special equipment, there are still important site conditions to be aware of in order to maintain a properly functioning stormwater pond or wetland. Examples of common vegetative problems include:



**Figure 1.10: Wetland vegetation**

- Trees and brush with extensive woody root systems can destabilize dams, embankments, and side slopes due to the creation of seepage routes (Figure 1.11).
- Monolithic stands of cattails (*Typha sp*) and Common Reed (*Phragmites australis*) can take over shallow marsh wetlands and drainage swales, out-competing other useful native emergent plants that would otherwise establish more varied, mature marsh plant ecology. Nuisance aquatic weeds are like any other pest; they are opportunistic and invasive. Small shallow ponds provide optimal conditions for their proliferation.
- Misunderstanding of which areas of a stormwater pond or wetland require mowing or

<sup>4</sup> Vegetation harvesting is removing vegetation on a routine basis and land applying it in an upland location. The purpose of harvesting is to remove plant material before winter die-off to prevent nutrients from reentering the water column and being flushed downstream.



- management can lead to under or over management.
- Unseen areas may be neglected. For example, the downstream dam face of an embankment is the most commonly neglected and most critical area requiring regular clearing.
  - Heavy pedestrian use, particularly along the top of dams and along pond edges can create patches of bare soil.
  - Industrial pollutants can cause alteration in the chemical composition and pH of the discharge water, which, in turn, can affect plant growth even when the source of contamination is intermittent. Nutrients increase plant growth and acidic discharges can decrease vegetation.
  - Un-maintained vegetation can obscure large portions of the dam, preventing adequate visual inspection and limiting access to the dam and surrounding areas. Access is critical in emergency situations (Figure 1.12).
  - Excessive vegetation often provides habitat for rodents and burrowing animals. (See Nuisance Issues.)
  - Excessive vegetation can affect the flow rates through earthen spillways.



**Figure 1.11: Woody vegetation on embankment**



**Figure 1.12: Excessive vegetative growth obscures riser**

### ***Dredging and Muck Removal***

Sediment accumulates in stormwater ponds and wetlands by design and eventually requires removal to maintain efficiency and safety (Figure 1.13). The maintenance interval for removing accumulated sediment will vary based on the design parameters.

Stormwater ponds and wetlands are frequently presumed to be 80% efficient in trapping total suspended solids. Sources of solid and semisolid wastes retained in a pond or wetland include:

- Soil loss from lawns and open areas
- Litter and yard waste
- Sand from winter sanding operations
- Natural leaf litter and down branches
- Grit from roofing shingles
- Atmospheric deposition wash off
- Construction sediments
- Erosion from upstream conveyance swales



**Figure 1.13: Sediment accumulation in a dry pond**



**Figure 1.14: Muck removal and slope dressing by long reach backhoe**

As sediment accumulation is expected, stormwater ponds and wetlands should be designed with sediment forebays, pond drains, access for sediment removal, and a designated onsite disposal area. These considerations will reduce eventual costs of sediment removal, as major cost items in dredging include dewatering, transport of sediment for off-site disposal, re-establishment of wetland communities, and accessing the site (Figure 1.14).

### Access

Access is needed to all parts of the stormwater treatment facility for inspection maintenance. Key access points include:

- Riser structure
- Embankments
- All outfalls and infalls
- Forebays and pond bottoms
- Aerators and electrical panels

Additionally, public access should be limited to some pond or wetland components to prevent vandalism.

#### Access for Regular Inspection and Maintenance:

Frequent maintenance items usually involve small pieces of equipment such as mowers and light trucks. Access also involves facilitating inspector access to, into and through a stormwater pond or wetland to note items in need of repair. Figure 1.15 shows good maintenance access to a facility. Critical appurtenances should be easily and safely accessed for inspection and minor maintenance, such as lubricating a pond valve. Figure 1.16 shows good manhole access.

Typical problems that impede maintenance access include:

- Inadequate or unsafe ingress to and egress



**Figure 1.15: Pond with good access to public road.**

- from facility components
- Fencing that does not have gates.
- Pond risers installed without provision for access. (The riser may still be entered safely through the barrel under certain conditions.)
- Manhole blocked by debris.
- Air monitoring results are unsafe.
- Steps/ladder are missing, broken, unsecured, non-aligned, or under water.
- Trash racks or valves are blocking safe access to riser.
- Heavy gratings and hatches
- Corroded locks
- Aerators that require special considerations, such as a boat or manual power disconnects.



Figure 1.16: Ladder and steps in riser.

Infrequent Maintenance Access

Less frequent maintenance items, such as dredging, will require site access for heavy equipment (e.g. Figure 1.17) including backhoes, dump trucks, and vacuum trucks. Maintaining ingress and egress points for the facility at all times is wise in case emergency repairs are needed. Lack of a permanent access route necessitates the creation of a temporary route (Figure 1.18) which may be disruptive to plant life and community aesthetics.



Figure 1.17: Typical large maintenance equipment.

Access for major repairs is similar to construction access and involves protecting existing trees, pavement, utilities, and signage against damage while accessing the areas needing repair.

Many older stormwater ponds and wetlands do not adequately provide stable access and staging areas for repair equipment. Older facilities typically include a designated ingress point, but they often suffer from one of the following shortfalls:

- There is no way to safely move equipment over existing curbs and pavement without damage.
- The slope of the access path is too steep, especially if wet.
- The path is not wide enough to accommodate heavy repair equipment.
- The path is overgrown with significant vegetation or has been planted with landscape quality material.
- Smaller structures such as decks and sheds are built in access areas (gardens and dump areas are also common).
- There is no legal access easement allowing for access from a public right-of-way to the facility;

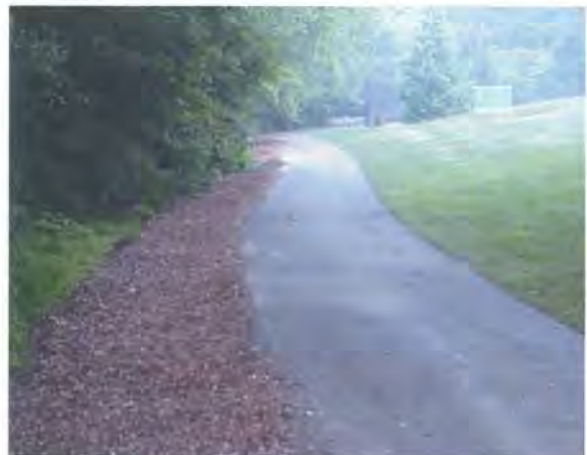


Figure 1.18: Temporary access road widening

this can be a contentious issue if the only practical access is across land not owned by the pond or wetland owner.

- No staging or equipment area is available once heavy equipment is onsite (contractors often need material storage space and a place to securely park heavy equipment overnight)

Vandalism protection:

Vandalism protection involves common sense measures such as chaining and locking mechanical components (valves and security manhole accesses). It also includes the use of well-designed trash racks to discourage vandalism and reduce clogging.

Although there are many passive options to keep people away from a facility, including screening with vegetation and locating the pond or wetland out of eyesight, the most common method of exclusion is fencing. Fences can be damaged by many factors, including vandalism and storm events. Timely repair will maintain the security of the site and reduce potential liability.

Appurtenances should be locked with key locks as opposed to more corrosion-prone combination locks. The design life of the typical lock left exposed to the elements is one to five years. They often become corroded and cannot be opened at time of inspection or maintenance. Therefore this often requires that the chain be cut and a new lock placed. For municipalities, one master key should open all stormwater facility locks to avoid confusion if keys are lost.

Typical locations for locks include the following:

- Chaining all valves with hand wheels
- Sluice gates
- Entrance points through fencing

**Mechanical Components**

Pond and wetland mechanical components tend to be simple and few in numbers. They include:

- Valves
- Sluice gates and flap gates
- Anti-vortex devices
- Pumps
- Access hatches
- Aerators (fountains, bubblers, diffusers)
- Electric control panels for aerators

These components should be inspected at least annually and repaired according to manufacturer's recommendations. Mechanical components may be damaged as a result of:

- Clogging
- Sediment accumulation
- Vandalism
- Weathering or corrosion (Figure 1.19)
- Extended use
- Lack of preventative maintenance such as lubrication



**Figure 1.19: Corroded plumbing and valve.**

Design considerations and preventative maintenance can address most of these issues. Failure to maintain these items could prevent the pond from functioning as designed, cause the problems described in the Clogging and Access sections, or, in the case of aerators, affect water quality.

### ***Nuisance Issues***

The main nuisance issues that concern most stormwater pond and wetland owners and maintenance staff can be broken down into groups, as follows:

#### ***Burrows and Dens***

Rodents usually damage ponds or wetlands through burrowing or dam building. Burrowing may jeopardize embankment stability for dams and berms; beaver dam building reduces live storage and creates clogging problems.

The following animals routinely cause destruction to embankments and berms: groundhogs/woodchucks, muskrats, prairie dogs, badgers, pocket gophers and Richardson ground squirrels. Animal burrows can deteriorate the structural integrity of dams, embankments and slopes (Figure 1.20). Muskrats in particular will burrow tunnels up to 6 inches in diameter.



**Figure 1.20: Animal burrow in pond embankment.**

Beaver activity in urban areas usually results in tree and vegetation mortality, flooding from dam building that causes water to encroach into unwanted areas, and impairment of stormwater management facilities. Beaver activity can be either an aesthetic issue that detracts from the visual appeal of the community, or a property damage issue that poses liability concerns. Management options for beaver control include trapping, dam and lodge removal and the use of beaver “baffles”.

#### ***Waterfowl***

Geese and mallards may become undesirable year-round residents of a pond (Figure 1.21) or wetland if structural complexity is not included in the pond design (i.e., features that limit large contiguous open water areas and open short grass loafing areas favored by these birds). Waterfowl residing in vast numbers eat available grasses and emergent plants. Water quality in permanent pools often degrades due to increased fecal coliform counts from geese and duck droppings. Though generally well tolerated by the public, geese behavior can be noisy during breeding seasons.



**Figure 1.21: Geese can affect water quality and aesthetics of ponds.**

#### ***Mosquitoes***

Although mosquito populations may have little to do with stormwater pond or wetland function, their presence is none the less perceived by the public to be related to the facility and is held in similar importance to water quality issues. Mosquito population control also factors into many community health issues such as West Nile Virus.

The proliferation of mosquitoes, particularly in dry ponds, is usually an early indication that there is a maintenance problem. Mosquitoes reproduce by laying eggs in still pools of water or on mud or fallen leaves. A few inches of standing water such as found in dry pond depressions, voids in riprap linings, or other inconspicuous places can become mosquito-breeding areas. It is possible for mosquitoes to complete their life cycle in 7 to 10 days, with approximately half being spent in the aquatic stage. Therefore if a shallow pool is stagnant for only 4 to 5 days and no predator habitat is available, one generation of mosquitoes can be bred.

*Water Clarity and Excess Nutrients*

Most ponds suffer water quality issues such as poor water color/clarity/odor or algal plant problems during warm weather months. Though really symptoms of degraded water quality (not a cause), much time, money and attention from both public and private maintenance entities is given to these perceived water quality problems.

Stormwater ponds and wetlands are designed and constructed to be a repository for pollutants that flush off of the landscape. Among the pollutants typically found in stormwater runoff, excess nutrients, namely nitrogen and phosphorous, that accumulate in stormwater ponds and wetlands can lead to degraded conditions such as low dissolved oxygen, algae blooms, unsightly conditions and odors. Homeowners adjacent to stormwater ponds and wetlands sometimes complain about degraded conditions resulting from excess nutrients during dryer months. When nutrient concentrations exceed certain thresholds, the trophic state<sup>5</sup> of the system can change. Other sources of nutrients to ponds and wetlands are a result of human behavior. The amount of fertilizer applied to lawn areas or the method for disposing of leaves and yard waste in residential and other developed land uses can affect nutrient loads delivered to ponds and wetlands.

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<sup>5</sup> Trophic state is a measure of algae biomass in the water of a pond or wetland (Brown and Simpson, 2002).

## Chapter 2: Designing for Low Maintenance Ponds and Wetlands

Pond and wetland design can minimize the need for maintenance and make regular inspection and maintenance easier. These considerations range through the design process from practice selection to grading to the details of final design and specifications.

The top eight maintenance concerns discussed in the previous chapter can be addressed during multiple parts of the design process. Broad design areas, listed on the left side of Table 2.1, affect maintenance concerns. The design choices in these categories are detailed in this chapter.

**Table 2.1: Preventing the Top 8 Maintenance Concerns**

Design Category	Maintenance Concerns							
	Permanent Pool	Clogging	Pipe Repairs	Vegetation Management	Sediment Removal	Access	Mechanical Components	Nuisance Issues
Selecting the Right STP	✓	✓		✓	✓			✓
Site Layout/Grading Plan	✓	✓		✓	✓	✓		✓
Pre-treatment	✓	✓		✓	✓	✓		
Access			✓	✓	✓		✓	✓
Embankments/ Dams	✓		✓	✓		✓	✓	✓
Conveyance	✓	✓	✓	✓		✓		✓
Riser	✓	✓	✓			✓	✓	
Miscellaneous	✓	✓	✓			✓	✓	✓
Landscaping		✓		✓	✓	✓		✓
ESC Plans	✓	✓		✓	✓	✓		

For detailed performance criteria including all aspects of STP design the reader is referred to the Stormwater Manager's Resource Center (SMRC) website at: <http://www.stormwatercenter.net> (click on "Manual Builder" then "Performance Criteria"). Note that the design elements provided on the website include all elements of design, not just those elements that focus specifically on maintenance.

### 2.1 Selecting the Right Stormwater Treatment Practice

Selecting the right practice for a site is one key to ensuring the success of the stormwater treatment. Historically, poor practice selection has contributed to large-scale failure and chronic maintenance problems. Some key features to remember when considering a stormwater pond or wetlands for a site from a maintenance perspective include: water budget, nutrient and sediment loading, climate concerns, and public acceptance.

#### *Water Budget*

Data regarding the sustainability of a permanent pool must be evaluated, especially in arid and semi-arid regions. Performing a water budget calculation may be necessary. Stormwater ponds should have a minimum contributing drainage area of ten acres or more (25 or more is preferred), unless groundwater is

confirmed as the primary water source.

### ***Nutrients and Sediment***

The amount and type of sediment and nutrients in the runoff should be considered. Appropriately selecting and sizing a stormwater pond or wetland can prevent excessive vegetation growth. For reducing dredging needs, the more treatment volume or sediment storage volume that is provided in a pond or wetland system, the less frequent maintenance will be required.

### ***Climate Concerns***

Both arid and cold climates can affect the performance, and thereby the long term maintenance requirements, of ponds and wetlands. In arid climates, designers should ensure that the permanent pool in pond and wetland designs can be maintained. The arid conditions may also influence landscaping choices. Finally, the high rate of upland erosion in arid climates may call for increased sediment removal.

In cold climates, factors such as frost heaving, freezing of inlet and outlet pipes, and high salinity in meltwater can make continuous operation of stormwater practices challenging. The SMRC Manual Builder highlights cold and arid climate considerations for each stormwater practice type, and can be accessed from the following web address: <http://www.stormwatercenter.net>

### ***Public Acceptance***

If the stormwater facility is in the public eye, it should be an attractive and safe asset to the community. Signage can be a useful way to educate a community on the purpose and benefits of a stormwater pond or wetland. Ongoing education is also important for the long-term upkeep of ponds and wetlands. For example, mosquito control has recently been elevated in importance for various reasons, most notably connections to transmission of West Nile Virus. Disseminating information about the risks associated with ponds and wetlands relative to other breeding sources can increase homeowner awareness and promote participation in routine maintenance activities such as trash removal and vegetation management.

Studies on stormwater ponds in Florida (Santana, 1994) have shown that mosquitoes are more likely to be found in dry ponds and pockets of standing water, such as old tires behind the garage, than in wet ponds and stormwater wetlands. The reason given for this conclusion is that even the best dry ponds may allow pockets of standing water for up to 3 days following a rainfall event, which is all that is needed for mosquitoes to reproduce.

## **2.2 Site Layout and Grading Plan**

### ***Pre-treatment***

Pretreatment refers to various techniques employed to provide storage or filtering of coarse materials, such as sediment and debris, before they enter the stormwater pond or wetland. Nutrients are typically attached to sediment particles; therefore pre-treatment can limit the supply of nutrients to the main body of the pond. Proper pretreatment can enhance practice performance by preserving a greater fraction of the water treatment volume over time, and preventing large particles from clogging orifices.

Pretreatment can be provided in a number of different ways including forebays, sedimentation chambers, grass channels, filter strips, vegetated swales, and proprietary devices. In ponds and wetlands it is typically provided through inclusion of a forebay. Forebays are specifically designed to remove the coarse fraction of sediments from runoff through velocity dissipation, minimizing resuspension of settled materials, and some attenuation. A common forebay sizing criterion is that it should constitute at least 10 percent of the total water quality volume (WQv) or accommodate 0.1 inch of runoff from impervious surfaces in the catchment area.



Pretreatment forebays should be easy to access to perform sediment removal. Hard surfaces for the bottom of the forebay, such as concrete pavers or concrete slabs should be considered. Knowledge of the maintenance equipment to be used for sediment removal can help guide the forebay bottom material selection.

### **Access**

Maintenance access should extend to all the major pond features, including the forebay, safety bench, and outlet/riser area. Risers should be located in embankments for access from land. Access roads should be constructed of load bearing materials. Minimum access road dimensions of 12 feet in width and maximum profile grade of 15% should be observed to facilitate safe equipment access. Turnaround areas may also be needed. Access to a dredge spoil area should also be a design consideration.

### **Access Paths**

The frequency of vehicle access and type of vehicles to be used should be considered when selecting the material for the access path. Ensure that access to the riser structure is possible during a storm event that may submerge the safety benches. If a heavy vehicle such as a pump-truck is needed, consider adding grass pavers for additional stability.

### **Curvilinear Shores**

Employ long, narrow (i.e. length to width ratios of 1.5:1 or greater), curvilinear designs using natural features to break up open water areas such as boulders, large logs or other methods. Geese and other waterfowl need a clear approach, landing and departure zones. If a design inhibits clear access, the geese are likely to move on.

### **Minimum Depth**

Design permanent pools to be at least 4 feet deep to minimize the potential for freezing solid in winter and to allow fish that feed on mosquitoes to survive.

### **Dead Zones**

Ensure that the stormwater pond or wetland design promotes adequate flow circulation throughout the system without creating dead zones where flushing does not occur frequently.

### **Dredge Spoils Area**

Several design features can simplify both the frequent and infrequent removal of sediment and debris from ponds and wetlands. In some cases where the sediment loads are expected to be high, the designer may include an area for placement of dredged sediment on site. At a minimum, a dewatering area should be specified to dewater sediments before wasting or transport to a waste site.

## **2.3 Embankments/Dams**

Dam safety regulations typically provide guidance to ensure that embankments are designed to minimize the potential of dam failure, and to ensure stormwater flows pass safely through the principal spillway and the emergency spillway, if applicable. Proper application of dam design criteria can limit the potential for seepage and leakage through a dam, affecting the permanent pool level.

Many states require use of design guidance developed by the United States Department of Agriculture, Natural Resources Conservation Service (NRCS) in preparing pond embankment designs. State and local regulations may be more stringent than the generic Code 378, so consult the dam safety program in the

appropriate jurisdiction prior to beginning embankment design.

Erosion can occur beneath the surface of the practice. A major cause of this erosion is “piping,” which happens when flow travels along the outside of the principal spillway of a pond or wetland. Piping can be prevented through techniques that either interrupt or control the flow path around the principal spillway such as anti-seep collars and filter diaphragms. The Natural Resources Conservation Service (NRCS) Pond Code 378 provides design assistance to minimize the potential for piping and subsequent failures with respect to pond principal spillways.

Appropriate pond lining material may be required to inhibit or prevent infiltration from occurring. A pond liner is typically a synthetic sheet or natural clay material (e.g., bentonite) spread on the pond bottom (and dam face if necessary) and anchored into place. Clay pond liners usually consist of a layer of clay soils laid in a 4” to 12” layer. It is recommended that a qualified geotechnical engineer be involved in the design and specifications of a liner.

Another dam safety issue is fences constructed across the emergency spillway (Figure 2.1). If high flows come that necessitate use of the emergency spillway, they typically carry floatable debris. The debris can load up the fence, inhibit proper emergency spillway functioning and often damage or destroy the fence. Fencing in the vicinity of the emergency spillway should be relocated to the toe of the upstream (preferably) or downstream dam face slope, with the top of fence elevation at or lower than the emergency spillway crest elevation. If relocated to the downstream toe of slope, damage to fencing can be expected.

Table 2.2 summarizes key dam safety design elements that will help minimize long-term maintenance burdens when designed and constructed properly.



**Figure 2.1: Fence across Emergency Spillway**

**Table 2.2: Key Dam Safety Design Elements**

Component	Design Elements
Embankment	<ul style="list-style-type: none"> <li>▪ Minimum Top Width Requirements</li> <li>▪ Maximum Slopes (front and back)</li> <li>▪ Maximum Height</li> <li>▪ Compaction</li> <li>▪ Material (embankment and impermeable cutoff and core trenches)</li> <li>▪ Freeboard</li> <li>▪ Vegetative Stabilization</li> </ul>
Principal Spillway	<ul style="list-style-type: none"> <li>▪ Crest Elevation</li> <li>▪ Capacity</li> <li>▪ Material</li> <li>▪ Seepage Control Requirements</li> <li>▪ Compaction</li> <li>▪ Anti-vortex Devices</li> <li>▪ Trash Racks</li> </ul>
Emergency Spillway	<ul style="list-style-type: none"> <li>▪ Minimum Capacity</li> <li>▪ Minimum Control Section Width</li> <li>▪ Stabilization (grass, stone, etc.)</li> </ul>
Other Items	<ul style="list-style-type: none"> <li>▪ Pond Drain</li> <li>▪ Vegetation Management</li> </ul>

## 2.4 Conveyance

### *Open Channels*

Many of the most common repair items for channels result from erosion caused by concentrated stormwater flows into, through and out of the practice. Key areas of design to minimize erosion include inlet and outlet protection and conveyance channels.

Minimize scouring at inlets and outlets by avoiding steep drop-offs from the pipe to the ground. Features to reduce the velocity of flow leaving a pipe such as a stilling basin, riprap apron, or a partially submerged inlet pipe can also minimize erosion. Permanent stabilization, including hard armoring of inlets and outlets may be needed to reduce the potential for scour.

Conveyance channels can be an important part of the stormwater treatment system, but they can be a maintenance burden if sediment accumulates in the channel or storm flows cause erosion.

Channels should be designed so that velocities within the channel are non-erosive, and preferably with pretreatment such as a small plunge pool or filter diaphragm to prevent coarse sediment from settling within the channel. Relatively flat longitudinal slopes (e.g., 1-2%) can limit velocities within the channel. However, a minimum channel slope should also be observed to minimize the potential for nuisance waters that may impede mowing or promote mosquito habitat. Gently sloping side slopes (3H:1V maximum) typically result in shallower flow depths, which reduces erosion potential, provides greater pollutant removal, and allows for easier access for mowing and other vegetation management.

If stabilization fabrics are used, consult manufacturers and other local practitioners regarding their design requirements and effectiveness. Give attention to the sequence of installation and the placement of topsoil and seed.

## Pipes

Problems typically associated with pipe design can most likely be avoided or minimized with adequate consideration during design. Sufficient background information about local soils, groundwater and other environmental features can provide the designer with the information needed to make informed decisions on how to address most of the wear and tear type problems. Researching appropriate pipe and connection properties can minimize the potential for problems associated with joint separation, loadings and displaced linings. Tight construction specifications for backfill, compaction and construction sequencing will minimize the potential for a contractor to install pipes improperly.

Consultation with geotechnical and structural engineers or manufacturers about material applicability and design life is usually time well spent. Geotechnical and structural engineers can provide specifications relative to material thickness and bedding and compaction requirements for maximum longevity. Local town engineers, inspectors, and contractors will also know which materials perform well in your locality. Manufacturers are typically apprised of the latest construction techniques, special coatings, and pipe tolerances so that they are qualified to recommend certain pipe materials for certain applications. Discuss material properties of various pipe types with competing suppliers to obtain sufficient information to make an informed choice.

The following are the different types of pipe materials typically used in stormwater ponds and wetlands.

- *Metal Pipe:* Usually refers to corrugated steel pipe (CSP), which is often coated with protective layers such as zinc-oxide or bituminous asphalt. CSP has ridges (corrugations) going around it to make it stiffer and stronger - the corrugations are usually in the form of a sine wave and are usually made of galvanized steel or aluminum, and may be perforated, if desired. Table 2.3 presents a list of common CSP abbreviations with an expanded title for each.

<b>CSP Abbreviations</b>	<b>Common Description</b>
CMP or CSP	Galvanized Corrugated Metal Pipe or Corrugated Steel Pipe
BCCMP	Bituminous coated CSP
ACCMP	Aluminum-coated CSP
AL-CMP	Aluminum pipe, little or no steel

- *Ductile iron pipe (DIP)* is another kind of metal pipe used extensively in public water lines and occasionally in stormwater pond and wetland designs. It is known for its high bursting/crushing strength. Often a section of DIP is used in place of a plastic pipe where the end of the plastic pipe sticks through a slope subject to mowing.
- *Clay Pipe:* Vitriified clay pipes are composed of crushed and blended clay that are formed into tubes, then dried and fired at a succession of temperatures. The final firing gives the pipes a glassy, reddish brown finish. Vitriified clay pipes have been used for hundreds of years and are strong, resistant to chemical corrosion, internal abrasion and external chemical attack. They are also heat resistant. However, these pipes have an increased risk of failure when mortar is used in joints because mortar is more susceptible to chemical attack than the clay. Clay pipe was used extensively in the 19<sup>th</sup> and 20<sup>th</sup> centuries and was often used for farm field drainage but it is not often used today.
- *Concrete Pipe:* Reinforced concrete pipe (RCP) is pre-cast at a foundry with varying compression strength and joining mechanisms such as tongue and groove or steel bell and spigot. Written code

governs the manufacture of all pipe types and in the case of RCP, it specifies parameters such as internal diameter, loadings (classes), and wall thickness (schedule).

- *Plastic Pipe:* Usually refers to either polyvinyl chloride pipe (PVC), which is usually white and inflexible or high-density polyethylene pipe (HDPE) which is often black and flexible. Sometimes PVC and HDPE come perforated with holes at select opening diameters and spacing. Plastic pipe is made from either thermoplastic or thermoset plastics. Fluorocarbon plastics are the most resistant to attack from acids, alkalis, and organic compounds, but other plastics also have high chemical resistance. HDPE pipe is typically corrugated on the outside and can be smooth walled on the inside, and most people are familiar with it for its use in small diameter underdrain systems. HDPE is gaining wider applicability because it now comes in larger pipe sizes (up to 48”).

## 2.5 Risers

Appropriate pipe and riser materials are essential to pond operation. Improper design or construction can lead to draw down of the permanent pool, clogging, or riser failure.

### *Low Flow Orifices*

Changes in conventional approaches to stormwater treatment have resulted in smaller orifice sizes, leading to increased clogging risks. A 3-inch diameter hole used as an orifice is the minimum dimension rule of thumb for surface-fed openings. Smaller openings, down to 1-inch diameter, can be used at the release point for orifices (using internal orifice plates).

Non-clogging low-flow orifice designs include the reverse-slope pipe, half-round corrugated metal pipe (Figure 2.2), trash racks, and perforated pipe. The reverse-slope pipe (Figure 2.3) draws water from below the surface, thus preventing floating debris from flowing into the outlet.

Some pond and wetland designs incorporate a perforated horizontal or vertical pipe, usually covered with filter cloth and may be fully or partially covered with gravel or pea stone. Often the low flow control orifice is located at the interface with this perforated pipe and the riser. These designs, although effective at removing particulate pollutants, can become maintenance intensive because they are prone to frequent maintenance due to clogging of the filter cloth and are typically not recommended.

If fitting a perforated pipe with a gravel jacket, consideration should be given to first wrapping the perforated pipe with a galvanized wire mesh having ½ inch square openings, then wrapping with a fairly porous geotextile or filter cloth, before encasing in pea stone or highly porous gravel. The ½ inch “hardware cloth” helps keep the geotextile from sealing against smooth walled pipe (like PVC) and allows lateral movement of water between the geotextile and the pipe wall.



**Figure 2.2: Half round CMP low flow opening and trash rack**

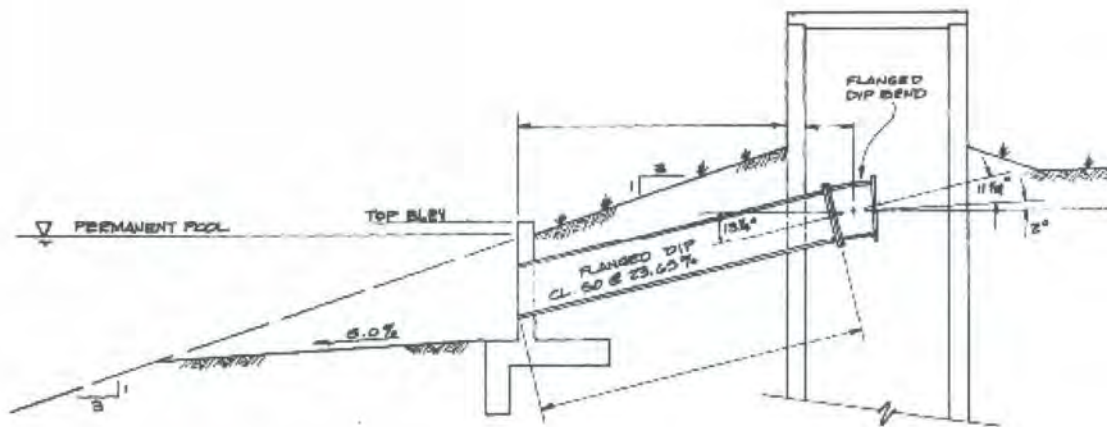


Figure 2.3: Reverse slope pipe design

### Trash Racks

For larger orifices such as weir slots in the riser, use of trash racks or similar devices reduces the risk of floating debris clogging the principle spillway. However, poorly designed trash racks can cause clogging.

Trash racks should be included on all riser designs in accordance with local dam safety criteria or stormwater management design criteria to minimize the problems associated with clogging. Design considerations are presented in Table 2.4.

Table 2.4: Design Of Anti-Clogging Trash Racks And Hoods	
Design Considerations	Issues
Material Durability	Ensure that corrosion, dissimilar materials and structural properties of trash rack are appropriate for the intended use
Aesthetics	Careful selection of materials, colors and designs to minimize rust stains and other objectionable features.
Connection to riser	How is the device to be connected to the riser? Bolted or welded? Can the connection specified cause damage to the riser?
Access	Does the trash rack inhibit access to the riser? Can a lock and hinge be accommodated?
Minimum Opening Dimensions	Ensure that opening sizes do not violate embankment safety criteria.
Configuration	Dam safety criteria may not allow flat trash racks on top of open-topped risers. Check local dam safety requirements.
Hydraulic Properties	If hood is used, make sure it does not become a flow restriction unless it has intentionally been designed as such.

### Pond Drain

Two challenges of removing accumulated sediment and debris in ponds and wetlands are working within a permanent pool of water and accessing small underground pipes. Providing a pond drain is an important design feature that allows maintenance crews to drain ponds or wetlands before removing accumulated sediment. The pond drain should be located at the lowest elevation of the permanent pool with an upturned elbow. The pipe should be protected against maintenance actions such as dredging.

### Riser Access

Providing safe access to the riser structure involves the following considerations:

- Place risers in embankments, where the openings or the access hatch can be accessed from shore. If orifices are clogged or a storm event is occurring, inspection and maintenance staff can access risers without requiring a boat or draining the pond. (Figure 2.4)
- Valves and other maintenance items should be located inside the riser, in a location that provides access even under high water conditions. Use of hand wheel extensions should be considered when valves are located a substantial distance below the access hatch.
- Oversized manhole covers or access hatches should be provided where feasible to facilitate safe ingress and egress for inspectors carrying a multitude of equipment. Ladder rungs should line up with access hatches and extend the entire height of the riser or manhole. OSHA fall height safety design requirements should be followed. A safe access manhole is one that is clean, clear of debris and well lit. The distance to the first manhole step should be less than 18 inches and the distance between each subsequent step should be 12 inches. Ideally, the steps should each have reflective tape so that they reflect brightly as light is passed over them. Alternatively, a ladder may be employed instead of individual steps
- Riser manholes should be locked and any openings in the riser should be fenced with an appropriate trash rack to prevent public access to the structure. Manhole lids are usually secured by their own weight. Frame and covers with locking bolts are available, however their use is not advised as the bolts corrode over time and not all inspection parties will have the correct set of wrenches to loosen the bolts. The use of a lock bar for anti-vandalism chain is suggested (Figure 2.5).
- Handwheels that operate valves for the low flow orifice and the pond drain should be chained and locked to prevent unauthorized use or vandalism.



**Figure 2.4: Riser located near pool edge for easier access.**



**Figure 2.5: Lock bars**

## 2.6 Miscellaneous Details

### *Fencing and Gates*

Fencing should be selected to inhibit reasonable access without compromising aesthetics and facility operation and regular maintenance needs. The three most popular fencing materials for stormwater ponds and wetlands are galvanized or plastic-coated chain link (Figure 2.6), three rail wooden fencing with a welded wire mesh backing (Figure 2.7), and plastic fencing.

When selecting gates, identify the type of vehicles to be used for maintenance as well as the type of locking mechanism to be employed. Gates should have sufficient width (possibly considering a turning vehicle) and proper location with respect to access roads and spoil sites.



**Figure 2.6: Chain link fence**

### *Staff Gauge*

In ponds and wetlands, sediment markers (graded measuring sticks) placed in forebays and/or permanent pools can consistently measure the depth of sediment in the practice so that build-up can be monitored at each inspection. Similar markers can be used to measure the depth of the permanent pool, and ensure that the elevation of the permanent pool remains relatively constant over time.

### *Mechanical Components*

Specifying appropriate coatings for weather susceptible components can increase longevity. Coatings include galvanizing, PVC coatings and paint for bare metal pieces. Contracts for installation of mechanical components should include provision for touch up if damage should occur during installation.



**Figure 2.7: Post and rail with mesh backing**

## 2.7 Landscaping

Landscaping can help prevent access of ponds by geese and children, stabilize banks, and prevent upland erosion. In some ponds and wetlands, the vegetation in and around the practice is an important component of practice performance. For example, stormwater wetlands rely on plant uptake for at least a portion of the overall nutrient removal. Ponds may rely on adjacent trees and shrubs for shading to reduce ambient water temperatures. Other factors affecting vegetative establishment to consider during design include climate, wildlife attraction, and pollutant removal capability. Additionally, landscape design is vital to community acceptance of a stormwater pond or wetland.

Designing stormwater ponds and wetlands to minimize vegetative maintenance problems should be the responsibility of landscape architects, aquatic biologists, agronomists, horticulturists, biologists, master



gardeners, or some combination thereof. Although there are volumes of publications about plant selection for certain applications, the best advice is generally to find someone with local, native plant experience to address the entire pondscape, within the context of local regulatory requirements.

### *Climate and Hydrology*

Climate and inundation frequency are primary factors to consider when selecting plant material for ponds and wetlands. Careful attention to plant selection should be given to ponds and wetlands affected by substantial fluctuation in groundwater levels or facilities incorporating extended detention (ED). Stresses on plants caused by frequent inundation for short periods can create landscaping challenges.

### *Wildlife Attraction*

Wildlife attraction is another issue that can drive plant selection decisions. Planting tall vertical grasses and shrubs at the waters edge and strategically placing boulders or logs to break up the water surface can inhibit waterfowl from landing and minimize the attraction. Minimize mowing at the perimeter of the practice with a no-mow fringe. With a thick stand of tall vegetation surrounding a pond or wetland, waterfowl access to adjacent areas is limited, and, as a result, they are less likely to land and stay because they fear predators may be in the tall vegetation.

In some cases, wildlife attraction may be encouraged for desired species, such as those that predate on mosquitoes or are pleasing to watch, by carefully selecting vegetative material and managing it through active maintenance routines. In stormwater ponds and wetlands, create a marsh fringe surrounding wet pools to create mosquito predator habitat and refuge for birds, amphibians and insects that are likely to prey on mosquitoes.

### *Pollutant Removal*

Careful plant selection can have an effect on the pollutant removal efficiency of the stormwater pond or wetland. Some dense growing species may be well suited for filtering sediments while others may more easily uptake nutrients. The design should include a plan for supplementing wetland vegetation after the first year of operation, and a detailed plan for species to be included within the wetland.

### *Invasive Plants*

Check with the local environmental agency that has jurisdiction over a project site before selecting plant materials, as certain invasive plants may be prohibited. For example, the Maryland Department of the Environment disallows use of Kentucky-31 fescue in non-tidal wetlands and 25-foot buffer areas because K-31 is an aggressive and hearty grass that inhibits natural succession within those areas. Phragmites and cattails commonly dominate wetland areas (Figure 2.8) and can be limited by creating complex microtopography on wetland bottoms and specifying diverse plant communities. Be sure to obtain local lists of invasive species and preferred native plants for stormwater facilities when developing planting plans.



**Figure 2.8: Phragmites dominated wetland plantings**

## 2.8 Erosion and Sediment Control Plans

### *Converting Sediment Basin*

Add notes to the construction drawing clearly indicating that if the stormwater pond or wetland is used as a sediment basin during construction, it will be dredged to design dimensions and planting specification when construction is complete.

### *Tree Protection*

Tree protection is inexpensive and should be used to protect trees adjacent to access roads. The best protection is to keep the tree fenced off from construction/maintenance traffic with a temporary tree-save fence. To protect the critical root zone, place the fence outside the drip line or at least 1-½ feet away from the tree for every inch in diameter at breast height at a minimum. Consider the impacts to root zones when selecting access paths. Root zones should not be more than 1/3 impacted.

## Chapter 3: Construction for Maintenance Problem Prevention

Construction methods significantly impact the future maintenance needs and longevity of stormwater ponds and wetlands. Regular inspection of stormwater facilities during construction can ensure proper construction methods are employed and facilities are built to the design specifications. Immediate recourse should be pursued if the facilities are constructed improperly.

Counties and municipalities may employ construction inspectors trained in the techniques used for specific stormwater treatment practices. Alternatively, the design engineer may be required to supervise construction. Supervision by a geotechnical engineer will also be needed at some points.

It is out of the scope of this Guidebook to provide specific detail and guidance on construction techniques. However, the Natural Resources Conservation Service's Pond Code 378 provides useful specifications, guidance and checklists that can be used during construction to ensure a quality job.

Examples of such guidance are given below:

### Compaction of Backfill

Compacting the pipe haunches (the area immediately below the pipe from the 5 to 7 o'clock position) is the most difficult aspect of pipe backfilling, as most pipes are installed using trenches that limit access to the haunches. Insufficient compaction can lead to weaker soil strengths adjacent to the pipe where soil strength for piping resistance is most critical. An alternative to compacting the haunch area is backfilling with concrete or flowable fill (Figure 3.1).

### Pipe Installation

Many pipe systems age prematurely due to improper care of pipe prior to and during installation. Corrugated steel pipe (relatively light, flexible material) can be damaged by the heavy equipment, chains, and harnesses used in installation. Pipes not aligned correctly at installation are nudged with heavy toothed equipment, stressing and potentially puncturing pipes. Concrete bell and spigot sections are 'brought true' by forcing one end into another section with an excavator or backhoe. The equipment operator may not be aware of the damage; therefore, unless



**Figure 3.1: Barrel laid in concrete cradle**

#### **Design Engineer to Inspect:**

- Core trench dimension and location
- Barrel class, joints, location & dimension
- Concrete cradle dimensions
- Anti-seep collar location, dimension, and rebar
- Riser dimensions, rebar, joints, opening dimensions, integrity
- Valve and orifice plates
- Outfall protection
- Embankment location and dimensions
- Contours and storage volumes

#### **Geotechnical Engineer to Inspect:**

- Dewatering methods
- Core trench excavation, backfill, and compaction
- Pipe subgrade, lifts, and compaction
- Concrete strength tests for concrete collar, concrete cradle, riser footings, and cast-in-place riser
- Filter diaphragm
- Backfilling of principal spillway
- Embankments lifts, compaction, and soil material

vigilant construction inspection is enforced, damage may not be discovered until it has become a problem.

The typical critical construction elements requiring the attention of qualified professionals are listed below, in Table 3.1. For additional details on the sequence and specific inspection items, refer to the sample Stormwater Pond/Stormwater Wetland Construction Inspection Checklist included in Appendix B.

<b>Table 3.1: Key Construction Inspection Items</b>	
<b>Pond/Wetland Feature</b>	<b>Key Inspection Points</b>
Erosion and sediment control	<ul style="list-style-type: none"> <li>▪ Initial installation</li> <li>▪ Dewatering</li> <li>▪ Stream diversion</li> <li>▪ Maintenance of ESC devices</li> </ul>
Core Trench	<ul style="list-style-type: none"> <li>▪ Dimensions</li> <li>▪ Locations</li> <li>▪ Backfill and compaction</li> </ul>
Principal spillway	<ul style="list-style-type: none"> <li>▪ Material</li> <li>▪ Watertight joints</li> <li>▪ Subgrade</li> <li>▪ Backfill and compaction</li> <li>▪ Concrete cradle – dimensions, concrete strength</li> </ul>
Riser	<ul style="list-style-type: none"> <li>▪ Dimensions</li> <li>▪ Orifice sizes and elevations</li> <li>▪ Watertight connections to pipes</li> <li>▪ Trash racks</li> <li>▪ Materials and structural integrity</li> </ul>
Embankments	<ul style="list-style-type: none"> <li>▪ Soil compaction</li> <li>▪ Soil material</li> <li>▪ Location and dimensions</li> </ul>
Emergency spillway	<ul style="list-style-type: none"> <li>▪ Location (should always be in cut)</li> <li>▪ Dimensions</li> <li>▪ Linings</li> </ul>
Storage volumes and grading	<ul style="list-style-type: none"> <li>▪ Design volumes for pond are achieved at appropriate elevations</li> <li>▪ Safety benches are as designed</li> <li>▪ Microtopography correct for wetland vegetation</li> <li>▪ Permanent pool elevations correct</li> </ul>
Vegetative stabilization	<ul style="list-style-type: none"> <li>▪ Proper planting material</li> <li>▪ Proper surface preparation and soil amendments</li> <li>▪ Timing the delivery and installation of wetland plants with consideration for seasonal requirements</li> <li>▪ Stabilization prior to removal of ESC measures</li> </ul>

Upon completion of construction, as-built drawings of facilities should be prepared by qualified engineers and surveyors for permanent record of the facility. The as-built plans are a critical element of future inspections. As-builts should include orifice sizes, locations and elevations, final pond grading including field changes, appropriately documented pipe sizes/materials/shapes and locations, and

**TIP – Require Sign-off**

Require sign off from the inspector or engineer at key points to ensure that the contractor will notify these parties prior to proceeding with the key elements, such as placing the core trench or installing the principal spillway. These signatures can be a part of the as-built package for final approval.

constructed elevations for all embankment features. Construction photographs, not usually provided with as-builts, are a useful form of documentation. Construction photographs can answer some of the questions that often arise once a problem has been identified.

Below is an example of a series of construction photographs taken by the design engineer during the embankment construction process. The engineer was on site to document the installation of critical elements of the facility.



Figure 3.2: Dam construction - Photo 1



Figure 3.3 Dam construction – Photo 2



Figure 3.4 Dam construction – Photo 3



Figure 3.5 Dam construction – Photo 4

# Chapter 4: Post-Construction Inspection of Ponds and Wetlands

To ensure high quality, long-term functioning stormwater practices, inspections need to occur on a regular basis by community stakeholders and stormwater management professionals. These inspections help the stormwater manager monitor the safety, longevity, and effectiveness of these practices over time. This section outlines some tips for inspecting ponds and wetlands, focusing on the inspection frequency, inspection checklists, documentation photographs, and repair item documentation.

## 4.1 Inspectors

Ongoing post-construction inspections of stormwater ponds and wetlands can be conducted by a variety of stakeholders including:

- Concerned citizens and adjacent homeowners
- Homeowners Associations
- Property Managers
- Commercial, Institutional, and Municipal Owners
- Municipal Inspectors and Maintenance Crews
- Professional engineers and specialized contractors

Property owners should reach an agreement with the property management, maintenance team or landscaping contractor to conduct frequent inspection and maintenance items such as mowing, checking for clogs, and debris removal. Clearly identify the expectations so that the landscaping design is preserved for optimal stormwater treatment.

Attentive landscapers, adjacent homeowners, and homeowner associations can be the first to identify potential problems. A homeowner checklist is included in Appendix B. Several local maintenance guidebooks aimed at citizens are also available on the SMRC website ([www.stormwatercenter.net](http://www.stormwatercenter.net)) under Program Resources, STP Maintenance, STP Maintenance Educational Materials.

The range of experience needed to diagnose a problem during inspection is quantified below in Table 4.1. These skill levels are used to describe the inspection items in Table 4.2 in the next section.

<b>Skill Level</b>	<b>Description</b>
0	No special skills or prior experience required
1	Inspector, maintenance crew member or citizen with prior experience with ponds and wetlands
2	Inspector or contractor with extensive experience with pond and wetland maintenance issues
3	Professional engineering consultant

## 4.2 Inspection Frequency

Ponds and wetlands should ideally be inspected on a monthly basis for minor items, and annually for major inspection items, such as structural components. In reality, many communities are unable to

inspect all of their ponds this frequently, and a more typical scenario is providing inspection once every three years. This less frequent full inspection can be supplemented with a routine inspection conducted by a property owner or contractor responsible for maintenance. In the case of wetlands, an additional inspection may be required after the first year to ensure that wetland plantings remain viable.

Table 4.2 shows the frequency timeline with typical inspection and maintenance items at these times. Inspection frequency may be refined by the maintenance history of the practice as generated by ground crews charged with maintenance and mowing, or other interested parties. The profile sheets referenced under maintenance items are provided in Chapter 5.

<b>Table 4.2: Typical Inspection/Maintenance Frequencies for Ponds And Wetlands</b>		
<b>Frequency</b>	<b>Inspection Items (Skill Level)</b>	<b>Maintenance Items (Related Profile Sheet)</b>
One time - After First Year	<ul style="list-style-type: none"> <li>▪ Ensure that at least 50% of wetland plants survive (0)</li> <li>▪ Check for invasive wetland plants. (0)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Replant wetland vegetation (M-4 Vegetation Management)</li> </ul>
Monthly to Quarterly or After Major Storms (>1")	<ul style="list-style-type: none"> <li>▪ Inspect low flow orifices and other pipes for clogging (0)</li> <li>▪ Check the permanent pool or dry pond area for floating debris, undesirable vegetation. (0)</li> <li>▪ Investigate the shoreline for erosion (0)</li> <li>▪ Monitor wetland plant composition and health. (0-1)</li> <li>▪ Look for broken signs, locks, and other dangerous items. (0)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Mowing – minimum Spring and Fall (M-4 Vegetation Management)</li> <li>▪ Remove debris (M-2 Clogging)</li> <li>▪ Repair undercut, eroded, and bare soil areas. (M-4 Vegetation Management)</li> </ul>
Semi-annual to annual	<ul style="list-style-type: none"> <li>▪ Monitor wetland plant composition and health. (0-1)</li> <li>▪ Identify invasive plants (0-1)</li> <li>▪ Mechanical components are functional (0-1)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Trash and debris clean-up day</li> <li>▪ Remove invasive plants (M-4 Vegetation Management)</li> <li>▪ Harvest wetland plants (M-4 Vegetation Management)</li> <li>▪ Replant wetland vegetation (M-4 Vegetation Management)</li> <li>▪ Repair broken mechanical components if needed (M-7 Mechanical Components)</li> </ul>
Every 1 to 3 years	<ul style="list-style-type: none"> <li>▪ All routine inspection items above (0)</li> <li>▪ Inspect riser, barrel, and embankment for damage (1-2)</li> <li>▪ Inspect all pipes (2)</li> <li>▪ Monitor sediment deposition in facility and forebay (2)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Pipe and Riser Repair (M-3 Pipe Repair)</li> <li>▪ Forebay maintenance and sediment removal when needed (M-5 Dredging and Muck Removal)</li> </ul>
2-7 years	<ul style="list-style-type: none"> <li>▪ Monitor sediment deposition in facility and forebay (2)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Forebay maintenance and sediment removal when needed (M-5 Dredging and Muck Removal)</li> </ul>
5-25 years	<ul style="list-style-type: none"> <li>▪ Remote television inspection of reverse slope pipes, underdrains, and other hard to access piping (2-3)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Sediment removal from main pond/wetland (M-5 Dredging and Muck Removal)</li> <li>▪ Pipe replacement if needed (M-3 Pipe Repair)</li> </ul>

### 4.3 Inspection Checklists

A community should use standard inspection checklists to record the condition of all practices, and particularly those that need frequent maintenance. Most communities will find it easier to track maintenance electronically, using either a database or spreadsheet, rather than relying on paper files. Well-designed checklists can be integrated with these systems to prioritize maintenance, track performance over time, and relate design characteristics to particular problems. To effectively achieve these goals, the checklist should:

- Be quantitative, so that maintenance can be easily prioritized
- Be very specific about possible problems to reduce subjectivity.
- Limit the use of text, particularly if integrated with a database.
- Link problems to specific actions.
- Where possible, track the function of the pond or wetland over time for future research and design.

Inspection checklists should also be grouped in the order the inspector would inspect the practice. For example, ponds should typically be inspected from downstream to upstream, so the investigation begins with the outfall channel. Sample checklists are presented in Appendix B.

For additional example checklists, consult SMRC ([www.stormwatercenter.net](http://www.stormwatercenter.net)). Checklists can be found by clicking “Program Resources” then “STP Maintenance” and “Maintenance Checklists, Reminders, and Notifications.” In addition to providing detailed “professional” checklists for various STPs, it also includes a simplified pond inspection checklist for homeowners.

### 4.4 Documentation of Inspection Findings

Inspectors should clearly identify the extent and location of problems identified during inspection. In addition to clearly describing problem areas on the checklists, inspectors should help repair crews locate repairs both at the site and on design plans.

#### Immediate Concerns

While all maintenance and inspection items are important, some maintenance concerns actually pose an immediate safety concern. Many of these are caused by missing or damaged elements that would prevent access by the public. Examples include missing manhole covers or trash racks, missing or damaged fencing when that fence prevents access to a pond with steep side slopes, or a missing or damaged grate at a large inflow or outfall pipe.

Another set of immediate pond and wetland repairs involve dam safety or flooding hazards. If a practice shows signs of embankment failure, or if an inspector is unsure, an appropriately qualified person or engineer should be called in to investigate the situation immediately. Similarly, cracks in a concrete riser that drains a large area may pose a dam safety threat.

#### As-built Drawings

The inspector should bring a copy of the as-built plan of the practice to mark potential corrections and problem areas on this plan. The marked up as-built plan should be stored either digitally or in a paper file system so that it can be brought out to confirm that maintenance was performed correctly on the follow-up inspection.



Photographs

Inspectors should take a core set of documentation photographs of practices being inspected. In addition, specific problem areas should be photo documented. A recommended set of core photographs for ponds and wetlands include:

- Vehicle access points.
- Overview of practice.
- Overview of principal spillway structure.
- Upstream face of dam embankment.
- Downstream face of dam embankment.
- Outfall to practice and downstream outfall from practice.
- Emergency spillway (if applicable).

In addition, because of the large number of photographs that will likely be generated, a digital camera should be used to allow photographs to be stored electronically. (In advanced database programs, these photographs can be retrieved digitally). Finally, photographs should be named using a standard convention. The photograph name should indicate the practice identification number, feature (or problem) being photographed, and date of photograph.

Field Marking

Inspectors can highlight key areas of concern with spray paint or other marker. This is particularly useful for problems that may otherwise be difficult to find by others. Marking should be used as discretely as possible. For example, only dots sprayed at the base of trees should be used to mark limits of clearing for vegetation removal. Figures 4.1 to 4.4 shows examples of helpful spray paint markings.



Figure 4.1: Marking outfall deficiencies.



Figure 4.2: Marking trees to be removed.



Figure 4.3: Marking pipe joint separation



Figure 4.4: Marking a hole in gabion fabric

## Chapter 5: Maintenance Activities

Specific activities for maintaining stormwater ponds and wetlands are detailed in the following profile sheets, which are organized by the top eight maintenance concerns introduced in Chapter 1. Each profile sheet provides the following major sections:

- Problems to Inspect For
- Corrective Actions
- Cautions and Safety Tips

In addition, a subjective rating of skill level is presented with many of the maintenance activities to aid the program managers and responsible parties in understanding the severity of the problems described. Ratings and descriptions of the required skill levels can be found in Table 5.1 below.

Skill Level	Description
0	No special skills required.
1	Ordinary maintenance crew skill level.
2	Contractor familiar with pond and wetland maintenance issues.
3	Professional engineering consultant.

Lastly, Appendix A provides useful unit cost information for specific maintenance activities along with typical maintenance frequencies to be expected.

A directory of maintenance activity profile sheets is provided below.

Profile Sheet	Page
M-1 Permanent Pool .....	43
M-2 Clogging .....	47
M-3 Pipe Repairs .....	49
M-4 Vegetation Management .....	55
M-5 Dredging and Muck Removal .....	59
M-6 Access .....	63
M-7 Mechanical Components .....	65
M-8 Nuisance Issues .....	69



## M-1 Permanent Pool

### Problems to Inspect For

An important aspect of any pond or wetland inspection is having sufficient background information. In the absence of familiarity, a good set of as-built drawings can present a considerable amount of information about the way a pond was built and how it should function. Construction drawings or as-built drawings will include anticipated levels for permanent pools and sizes and locations of orifices.

The best tool for confirming pool elevation fluctuation is familiarity. Abnormally high or low levels are more likely to be noticed in a pond that has been frequently inspected at normal levels. Signs that the permanent pool is too high include:

- Water levels remain high for more than 2 or 3 days after a storm.
- Pond edges normally visible are covered in water and plant species normally above permanent pool are now immersed in water.

If a stormwater pond or wetland is well constructed, with an adequately sized and protected low flow orifice, it will only suffer from an abnormally high pool when outside forces act on it. Examples are clogging, vandalism (damaged riser or low flow valve being opened), or rodent activity.

Signs that the permanent pool is too low include:

- Stain marks on the riser or flow control structure
- Exposure of a non-vegetated pond bottom around the pool perimeter.

To review a dam embankment for possible seepage, look for vegetative color, species and density, particularly in dry weather. The presence of some or all of these features may indicate seepage or leaking on the downstream dam face. Embankment leaks on the downstream side of a berm or dam are usually easily discovered if the vegetative cover has been recently mowed and the slope is not too steep (generally, 2H:1V or flatter). Leaks on the upstream dam face are usually impossible to locate visually, unless it is at the surface (such as a flooded animal burrow) or there is an active vortex. Slow leaks that are only apparent over long time periods are particularly difficult to observe and may require a dye test or complete pond dewatering.

Often, inspections of stormwater ponds and wetlands falsely report leaks during warm weather when droughts or improper water budget analysis may be the problem. This latter scenario makes a pond prone to frequent lowered pools due to natural evaporation.

#### INSPECTION TIP:

Stormwater ponds and wetlands often have higher than normal water surface elevations after storm events, sometimes for a number of days. This is a normal part of the design. Consider the last significant rainfall event when determining your inspection schedule. Try to avoid examining permanent pool levels within 2 to 3 days of a significant rainstorm to give the facility time to discharge the runoff temporarily stored in the pond. Exceptions to this rule apply if vortexing or another problem that may be more apparent at higher stage is suspected.

Conversely, larger facilities or facilities fed by constant inflow (surface streams, springs, or seeps) may have leaks or excessive seepage that is masked by the apparent normal permanent pool supported by a strong water source. Recorded measurements over time are the best way to confirm this problem.

## Corrective Actions

Fixing the problems associated with permanent pool fluctuation can vary in difficulty, from relatively simple to complex and expensive. Regardless of the level of skill required for fixing the problem, only properly trained and authorized personnel should perform the maintenance.

Table 5.2 includes a list of problems, potential solutions, a subjective analysis of problem classification, and an estimate of the skill level recommended to correct problems associated with permanent pool issues. Estimated costs to fix the types of problems outlined here are included in the Maintenance Cost / Frequency Table in Appendix A.

<b>Finding</b>	<b>Solution</b>	<b>Classification</b>	<b>Level of Skill Recommended</b>
Clogged low flow	Clear low flow, install trash rack if not present or inadequate. See M-2 – Clogging.	Minor maintenance	(0) See cautions in M-2.
Low flow or pond drain valve opened	Shut valve and lock shut with chain and lock. See M-2 – Clogging.	Minor maintenance	(0) See cautions in M-2.
Rodent activity (dams, lodges, burrows)	Fill burrows. See M-8 – Nuisance Issues	Minor to major repair	(1)
Leak in riser	Seal leak. See M-3 – Pipe Repairs.	Major repair	(2)
Leak in barrel	Seal leak. See M-3 – Pipe Repairs.	Major repair	(2)
Leak in upstream dam face or pond bottom	Drain remainder of permanent pool and install waterproof liner; dye test recommended.	Major repair	(2)
Leak or seepage in downstream dam face	Dye test recommended; seal leak source if found; liner may need to be installed and dam or principal spillway repair or replacement may be required depending on leak severity.	Major repair	(3)
Vortexing <sup>1</sup>	Consider a call to civil authorities immediately as dam failure may be imminent and down stream evacuation may be necessary; do not attempt to repair without professional help.	Usually major repair	(3)

Inspection frequency beyond typical annual inspection should be set by the pond or wetland maintenance history and/or its use. For example, ponds with chronic clogging due to beaver activity should be put on a more frequent inspection schedule.

<sup>1</sup> Swirling action of water caused by submerged orifice flow, usually in the vicinity of the dam, riser or principal spillway.

## Cautions and Safety Tips

Risers near the shore or located in the embankment are often easy to examine from the surface (See Figure 5.1). Normal personal protection equipment (PPE) as defined by the U.S. Occupational Safety and Health Administration (OSHA) is sufficient to view from the top and photograph and/or measure with a drop tape. Risers located out in the permanent pool, or those with inaccessible tops (such as the typical round anti-vortex shell CMP riser) are more difficult and may require confined space entry and/or boat access. Similarly, barrels may require confined space entry to examine for leaks or to gain access to the riser itself; some barrels are too small for entry or are damaged or clogged. In these situations, remote TV inspection from either or both ends may be the only practical way to examine for leaks. However, if a leak in a riser or barrel is large and obvious, it may be easy to spot, particularly if it is a hole in a metal riser that now acts as a “low flow orifice”.



**Figure 5.1: Riser located near pool edge for easier access.**



## M-2 Clogging

### Problems to Inspect For

External clogging can easily be identified through routine visual inspection. Clogging within low flow pipes and underdrains can be more difficult to find. A well functioning opening and trash rack should be clear of debris. Trash racks should show little or no corrosion and should be completely visible. Examine design or as-built records to determine which weir/orifice is supposed to set the permanent pool.

Record water surface elevations by leaving a stake or marker at a high water mark and recheck at regular intervals to determine if pond or wetland permanent pool levels are staying higher than designed for longer periods than expected following a rainfall event (see Profile Sheet M-1). If pool levels are higher than expected for long durations, then a clogged low flow pipe or orifice, or internal clogging of a low flow drain may be the problem.



**Figure 5.2: Clogged valve**

### Corrective Actions

Trash and debris removal should occur during the regularly scheduled inspection and maintenance to reduce the chance of outlet structures, trash racks, and other components becoming clogged and inoperable during storm events. Proper preventative maintenance includes removal of debris from pond bottoms, embankments and side slopes, perimeter areas, and access areas that can lead to clogging, as well as debris jams at outlet structures and trash racks.

Metal trash racks should be inspected, and any exposed steel should be brushed free of corrosion and coated or spray coated with protectant or water sealant.



**Figure 5.3: Clogged low flow orifice (before maintenance)**

Techniques for removing clogs depend on the accessibility and severity of the clog. They include:

- Manual removal of debris by hand or by machine (Figures 5.3 and 5.4)
- Jetting, back flushing, or routing a clogged pipe. High velocity spray and hydraulic head pressure devices include high velocity jet cleaners, cleaning balls, and hinged disc cleaners.
- Sediment or muck removal around the low flow structure, to locate the opening and return it to design conditions. (See M-5 – Dredging and Muck Removal)
- A professional diver may be needed for deeply clogged facilities.
- Dewatering of facility via pumping or other means to reveal the source of clogging and allow access (if regulatory laws permit).

Disposal of debris and trash must comply with all local, county, state, and federal waste regulations. Only suitable disposal and recycling sites should be utilized.

### Cautions and Safety Tips

Clearing clogged openings may be easy or difficult depending on access to the opening. If removing an obstruction or clog seems like it might be unsafe, it probably is - leave it to a qualified contractor. Clogged openings can cause dangerous headwater conditions behind the blocked orifice. In addition to the normal hazards associated with low flow maintenance (confined space entry, poor footing, and potential for sharp objects including syringes and glass), strong flow can be generated instantaneously.



**Figure 5.4: After clog is removed**

If a facility has had deep backwater for a long period of time, sudden de-clogging may actually cause damage due to the slumping of un-vegetated, waterlogged slopes. Further, the downstream receiving swale, storm drain or stream may not be stable enough to withstand the instantaneous plug of release water. The released water will probably be silt-laden, passing an unacceptable amount of sediment, nutrients and possibly toxics. Employ a professional to conduct slow, safe draw-down and probable muck removal.

OSHA approved personal protection equipment will be needed and confined space entry may be required. See M-6 Access for additional riser and manhole access concerns.



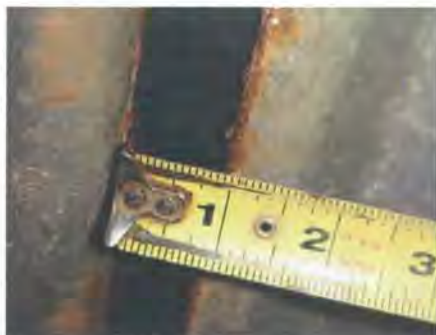
### M-3 Pipe Repairs

## Problems to Inspect For

Pipes are the most challenging feature of ponds and wetlands to thoroughly inspect. Repairs are often expensive and require specialized equipment. Table 5.3 presents a summary of maintenance concerns typical for different pipe materials. Following Table 5.3 are a number of inspection tips to inform an inspector or lay person about things to look for with respect to pipes when inspecting stormwater ponds and wetlands:

Table 5.3: Common Pipe Uses, Material and Maintenance Concerns		
Use	Most Common Material	Typical Maintenance Concerns
Principal spillway or barrel	CSP and RCP	Scour damage, leaking joints, misaligned joints
Under drains, internal drains	PVC, HDPE and Clay	Filter media failure, crushing
Infalls	RCP and CSP	Blockages, frost heave, undercutting
Hydraulic control	All types	Clogging, corrosion, vandalism
Quantity control	CSP	Construction rips and tears, misalignments and non-soil-tight joints

Notes:  
 CSP – corrugated steel pipe; RCP – reinforced concrete pipe; PVC - polyvinyl chloride pipe; HDPE – high density polyethylene pipe



**Figure 5.5: Improper pipe joint but rubber seal is visible.**

*Joint Tightness:* All pipe sections should abut evenly with little or no gap. In particular, no barrel should leak. Barrel pipes for ponds should not pass soil or water. CSP joints should meet smoothly, be free of rough or jagged edges, and have a butyl rubber seal surrounding the outside of the joint (Figure 5.5). The seal should not be torn, dry-rotted or bulging. CSP joints are not expected to be watertight (only soil tight<sup>2</sup>) except when used as principal spillways. Figure 5.6 illustrates a joint that is neither soil nor watertight.

Concrete bell and spigot pipe joints may have a gap up to the allowable dimension as described by local ordinance or as determined by the manufacturer. Joints are usually parged with high strength non-shrink grout, but this does not guarantee water

<sup>2</sup> Soil tight means that pipe joints can pass water but they do not allow soil intrusion.



tightness. The tongue and groove end sections of individual pipe sections should be free from damage, especially damage that exposes the underlying reinforcing steel.

Plastic and clay piping are used in small diameter applications such as underdrains and splitter pipes. HDPE piping is usually installed in long sections without joints but PVC is usually installed with a rubber-coated bell and spigot connections similar to RCP. The use of clay pipes for the principal spillway is discouraged as clay joints are not watertight.

*Misalignment:* Pipe misalignment (Figure 5.7) is one of the main pipe repair items. Misalignment is often apparent at or shortly after construction. Otherwise, alignment changes occur due to differential settlement, freeze-thaw cycles, or dynamic loads such as traffic.



Figure 5.6: Soil entering open pipe joint.



Figure 5.7: Misalignment in RCP (left and right) and CSP (center) applications.

*Pitting and corrosion:* Unprotected CSP usually has a relatively long design life on its soil side but is very susceptible to erosive scour, pitting and corrosion on its flow side, particularly along the invert of the pipe. Pitting is highly localized corrosion causing perforations large enough to infiltrate or exfiltrate water. Soil side design life often exceeds 50 years, but flow side design life is usually between 20 and 35 years before the first pitting appears. CSP manufacturers coat piping with various substances to lengthen design life such as bituminous asphalt, aluminum, or concrete poured along the invert of the pipe.

*Staining and Calcification:* Rust stains inside RCP often indicate infiltration (and probable repair need) due to acidic groundwater leaching in through a crack or hole, slowly dissolving the steel rebar and precipitating it back into a ferrous oxide form on the inside of the pipe (Figure 5.8). Once the anaerobic water comes in contact with the oxygen within the pipe interior the reaction occurs.



Figure 5.8: Rust intrusion demonstrates improper pipe joint.



Figure 5.9: Calcification.

Calcification occurs when acidic water enters concrete cracks from the inside of the pipe, dissolving and reconstituting the hydrated Portland cement in the RCP (Figure 5.9). Calcification may or may not mean that a crack has breached the entire thickness of the pipe and adequate experience is necessary to determine when repairs are truly necessary.

*Root Intrusion:* Root intrusion into pipe systems is an especially difficult and damaging phenomenon but fortunately is relatively easy to observe. Roots typically enter loose pipe joints and can cause clogging by snagging debris. Willows (*Salix sp.*) are notorious for root intrusion.

By following the described pipe inspection tips above, the lay person or inspector can better understand the types of problems likely to be encountered during stormwater pond and wetland maintenance inspection. Once experience is gained in performing inspections, inspectors can foresee potential problems and plan preventative maintenance.

## Corrective Actions

Fixing pipe problems can be approached from two directions: repair or replacement. Different methods for pipe repair and replacement are presented below, as well as a recommended skill level. All involve the need for professional contractor or engineer assistance. Consult an engineer to determine the most appropriate technique.

Common pipe repair methods include:

*Joint Sealing:* In the injection grouting method, RCP leaking joints and concrete cracks can be sealed with high strength non-shrink grout or epoxy. Holes are drilled all the way through the pipe to the soil beyond. The grout is injected to the other side where it reacts with groundwater and hardens. This method is often used for difficult access areas such as a buried concrete pipe barrel joints. OSHA confined space entry training may be required. CSP joints are similarly sealed, except polyurethane foam water stop material is injected. Recommended skill level (3).

Another joint sealing method utilizes an inflatable packer inserted into a pipeline to span a leaking joint. Resin or grout is then injected into cracks and cavities until the joint is sealed, after which the packer is removed. This localized repair of pipes prevents leakage and further deterioration and may increase the structural strength of the pipeline. Recommended skill level (3).

*Invert Protection:* This method involves protecting the lower segment of a corrugated metal pipe by lining it with a smooth bituminous or concrete material that completely fills the corrugations. This approach is intended to give resistance to scour/erosion and to improve flow. Recommended skill level (2).

*Chemical Stabilization:* Chemical stabilization involves isolating a length of pipeline between two access points by sealing the access points. One or more compounds in solution is introduced into the pipe, and the surrounding ground produces a chemical reaction that forms a stable protective coating over cracks and cavities. Recommended skill level (3).

Pipe rehabilitation typically involves more intensive and comprehensive correction of pipe problems aimed at restoring or upgrading the performance of an existing pipe system. Often, rehabilitation is needed when there is major structural and/or hydraulic weakness. Common pipe rehabilitation methods, all involving the need for professional contractor or engineer assistance, include:

*Folded Liners:* A PVC or HDPE liner is folded to reduce its cross sectional area. The liner is pulled into a failing pipe system and reverted to its original size using pressure and heat to form a tight fit with the host pipe wall. Recommended skill level (3).

*Cured-in-place pipe (CIPP):* CIPP is a thin flexible tube of polymer or glass fiber fabric that is impregnated with thermoset resin and expanded by means of fluid pressure onto the inner wall of a defective pipeline before curing the resin to harden the material. Recommended skill level (3).

*Ferro-cement:* Steel fabric mesh, usually in multiple layers, is fixed to the existing pipe, then covered in high strength grout. It is either placed in situ to form a structural lining (in large diameter pipes with human access) or pre-formed into segments for later installation. Recommended skill level (3).

*Pipe bursting:* Also known as in-line expansion, this is a method by which the existing pipe is demolished and a new pipe is installed in its void. Recommended skill level (3).

*Pipe eating:* A pipe replacement technique usually based on micro tunneling to excavate defective pipe with the surrounding soil as for a new installation. Recommended skill level (3).

*Pipe pulling:* Method of replacing small diameter pipes where a new product pipe is attached to the existing pipe which is then pulled out of the ground. Recommended skill level (3).

*Slip-lining:* Insertion of a new pipe by pulling or pushing it into the existing pipe and grouting the annular space. The new pipe may be continuous or a string of discrete pipe sections. The latter is also referred to as segmental slip-lining. Recommended skill level (3).

*Modified slip-lining:* A range of techniques in which the liner is reduced in diameter before insertion into the carrier pipe, then restored to its original diameter, forming a close fit with the original pipe. Recommended skill level (3).

*Spray lining:* A technique for applying a lining of cement mortar or resin by rotating a spray head, which is winched through the existing pipeline. Recommended skill level (3).

Table 5.4 summarizes the limitations of the different types of pipe rehabilitation methods mentioned above.

<b>Table 5.4: Limitations of common pipe rehabilitation methods</b>	
<b>Method</b>	<b>Limitations</b>
CIPP	<ul style="list-style-type: none"> <li>• Bypass or diversion of flow required</li> <li>• Curing can be difficult for long pipe segments</li> <li>• Must allow adequate curing time</li> <li>• Defective installation may be difficult to rectify</li> <li>• Resin may clump together on bottom of pipe</li> <li>• Reduces pipe diameter</li> </ul>
Pipe bursting	<ul style="list-style-type: none"> <li>• Bypass or diversion of flow required</li> <li>• Insertion pit required</li> <li>• Percussive action can cause significant ground movement</li> <li>• May not be suitable for all materials</li> </ul>
Slip-lining	<ul style="list-style-type: none"> <li>• Insertion pit required</li> <li>• Reduces pipe diameter</li> <li>• Not well suited for small diameter pipes</li> </ul>
Modified Slip-lining	<ul style="list-style-type: none"> <li>• Bypass or diversion of flow required</li> <li>• Cross section may shrink or unfold after expansion</li> <li>• Reduces pipe diameter</li> <li>• Infiltration may occur between liner and host pipe unless sealed</li> <li>• Liner may not provide adequate structural support</li> </ul>

### Cautions and Safety Tips

Most stormwater pond and wetland pipe work can be visually inspected from a daylighted end or manhole access. However, some piping is difficult to inspect due to being buried, flooded, cramped, or deteriorated. In this case, inspection work should be left to qualified professionals versed in confined space entry and exit as defined and regulated by state and federal OSHA standards. Some piping is impossible to inspect manually (such as a 6-inch underdrain), and remote TV video inspection or complete unearthing are the only options.



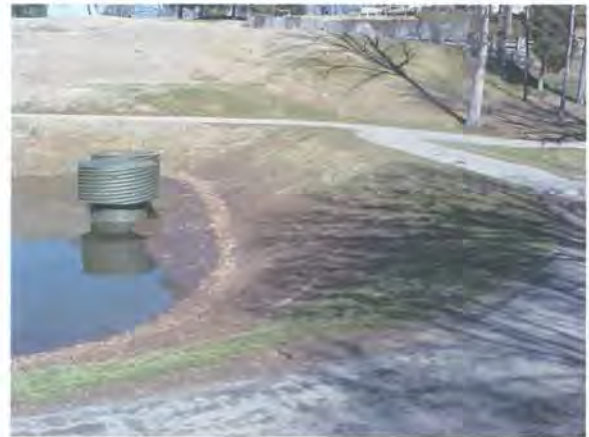
## M-4 Vegetation Management

### Problems to Inspect For

Vegetation management is the most frequent type of maintenance conducted on stormwater ponds and wetlands. In most instances, vegetation management is straightforward and does not require special expertise or equipment. However, if facilities have gone long periods of time without proper vegetation maintenance, then the level of effort and complexity of the activity can become significant.

Telltale signs of vegetative problems include the following:

- Standing water and emergent plant growth where none should be present
- Poor or spotty grass growth or completely bare areas (Figure 5.10)
- Soggy surfaces
- Excessive sedimentation at pond infalls or outfalls with corresponding emergent plant growth (Figure 5.11)
- Limited visibility or access to the principal spillway or embankment areas due to vegetation
- Deep-rooted woody vegetation (trees and shrubs) on any areas of a dam
- Woody vegetation growing in riprap on slope areas meant for erosion protection
- Signs of seepage around any tree stumps or decaying root systems on embankment areas
- Changes in vegetative color, species or height due to possible groundwater or seepage problems
- Areas where local residents have been dumping yard waste
- Pond embankments with newly planted ornamental trees or shrubs not originally included in the design
- Damaged or torn erosion control matting (ECM)
- Ruts or erosion channels in vegetated swales or level spillways
- Tree or shrub growth in or around major pond appurtenances such as the principal spillway
- Monoculture vegetation in wetland



**Figure 5.10: Bare soils on embankment and slopes**



**Figure 5.11: Excessive vegetation near an outfall**

## Corrective Actions

The following describe specific activities associated with maintaining the vegetation in and around stormwater ponds and wetlands as well as the recommended skill level of the person performing the maintenance in parentheses (reference Table 5.1):

### *Grass and Turf*

Consistent mowing and monitoring should control any unwanted vegetation. Typical mowing areas include pond bottoms (dry ponds), embankments, side slopes, perimeter areas, and access areas (Figure 5.12). The actual mowing requirements of an area should be tailored to the specific condition and grass type. Other actions to maintain grassed areas include periodic fertilizing, de-thatching, soil conditioning and re-seeding.

Most grass is hardiest when maintained as an upland meadow, cut no shorter than 6 to 8 inches. If a more manicured look is desired, special attention to the health of the turf is needed. Grass should not be cut below 4 inches. Typical mowing schedules for grass on embankments are at least twice during both the spring and fall growing seasons and once during the summer. Recommended skill level (0).



**Figure 5.12: Representative mowing for wetland**

### *Vegetated Buffer*

A 10-foot un-maintained vegetated buffer around the perimeter of the pond or wetland (exclusive of the dam embankment) may be established to filter pollutants from adjacent properties and help prevent shoreline erosion (Figure 5.13). Areas set aside for pond access such as fishing can be secured with stone, timber wall or one of many commercially available plastic retaining wall products. Recommended skill level (0).



**Figure 5.13: Vegetated buffer**

### *Vegetation Harvesting*

In stormwater wetlands, vegetation harvesting<sup>3</sup> may be required. To perform wetland harvesting, selected plant materials are tagged for removal by a qualified professional, then cut and hauled to an upland disposal location. Recommended skill level (1 - 2).

<sup>3</sup> Vegetation harvesting is removing vegetation on a routine basis and land applying it in an upland location. The purpose for vegetation harvesting is to remove plant material before winter die-off to prevent nutrients from reentering the water column and being flushed downstream.

*Bare areas*

Vegetation can be established by any of five methods: mulching; allowing volunteer vegetation to become established; planting nursery vegetation; planting underground dormant parts of a plant; and seeding. Seeding can come in the form of broad-cast seeding, hydro-seeding or sodding. Donor soils from existing wetlands can be used to establish vegetation within a wetland. If the soil has become compacted, it will require aeration. Areas without grass or vegetation should be vigorously raked, backfilled if needed, and covered with topsoil. Disturbed areas should be seeded and mulched if necessary. A tall fescue grass seed is often recommended; however consult the local NRCS office for the best native mixes for the project location. Recommended skill level (0).

Bare or monoculture stormwater pond and wetland slopes and bottoms offer the best opportunities to enhance areas with native trees, shrubs, and groundcovers to help the water soak into the ground. Select species that need little fertilizer or pest control and are adapted to specific site conditions. Again, contact your local NRCS office for guidance.

*Unwanted vegetation*

Some vegetation, such as that on embankments (Figure 5.14), requires complete removal, including root masses, to ensure that it does not return; this is often best done with landscaping Brush Hogs™ or small earthmoving equipment. Stump removal may also require tractor and chain. The removal of large trees may require the skills of a professional arborist. The use of herbicides should be avoided; however if deemed necessary, they must be applied by a state-licensed herbicide applicator. Recommended skill level range (0 - 2).



**Figure 5.14: Unwanted vegetation - tree on embankment**

*Root removal*

Roots shall be removed in the designated sections where root intrusion is a problem. To remove roots from a pipe, use mechanical devices such as rodding machines, bucket machines, and winches using root cutters and ‘porcupines’ or equipment such as high-velocity jet cleaners. Chemical root treatment is available but discouraged and herbicides must be applied by licensed applicators.

Roots should be removed from the embankment to prevent their decomposition within the embankment. Excavate to remove roots, then plug or cap root voids. Recommended skill level (2).

*Dumping areas*

Grass clippings, leaves, soil and trash are often dumped directly into storm drain inlets or stormwater ponds and wetlands. Any of these items can lead to clogging, and leaves and grass clippings release bacteria, oxygen consuming materials, and nutrients. Removal is easy assuming a suitable disposal area or trash pickup location is available. Posting signage explaining the importance of non-dumping will help dissuade the good intentioned. Signage may also advise natural lawn care to minimize the use of chemicals and pesticides. Recommended skill level (0).

*Inadequate drainage slopes*

To promote proper conveyance and to prevent standing water, conveyances to and from ponds and wetlands should have a minimum slope of one to two percent. Inadequate slopes typically result in the conveyances filling with sediment and vegetation (Figure 5.15). Removal of muck and vegetation from

conveyances can be accomplished with small equipment. See Section M-5 – Dredging and Muck Removal. Recommended skill level range (1 - 2).



**Figure 5.15: Vegetation establishment where the inflow channel slope is inadequate to drain properly.**

### Cautions and Safety Tips

Although the removal of unwanted vegetation is not a professional skill, it is not without hazards. Possible hazards include cuts and scrapes from the brambles and thorns of species such as Multiflora Rose (*Rosa multiflora*) and Tear thumb (*Polygonum perfoliatum*). Overgrown vegetation can also obscure ledges, burrows, drop-offs, stumps and wasp nests.





## M-5 Dredging and Muck Removal

### Problems to Inspect For

The need for dredging may be indicated by sediment plumes or deltas at storm drain infalls that feed stormwater ponds and wetlands, as most sediment falls to the pond floor quickly and within a short distance from storm drain inflow points (Figure 5.16). Alternatively, accumulated sediment can be measured through use of a staff gauge<sup>4</sup>.

The best way to estimate dredging needs for a pond or wetland with is to perform a bathymetric study. A bathymetric survey involves taking field measurements to calculate the volume of water within a pond or lake. The survey is similar to a topographic measurement of the contours below the permanent pool surface of a pond. The end result of the survey is a two-dimensional map indicating depth contours at all locations within the permanent pool. Bathymetric surveys indicate the amount of silt or muck that has accumulated within a pond or lake; consequently, estimates of remaining stormwater pond life, dredging volumes and associated costs can be made. A pond that appears full may still have adequate volume for settling suspended solids and for meeting stormwater management design criteria purposes, yet the owner may wish to have the pond dredged for aesthetic value.

Bathymetric surveys require use of level rods, electric distance measurement equipment (EDM), small watercraft, sediment probes or depth finders to gather pond depth information (Figure 5.17). Usually, staff measures the depth with a canoe or johnboat. On shore, another staff uses EDM equipment to determine distance and azimuth (angle) measurements to the test location. Existing volume measurements can be compared against design volumes to determine the amount of muck requiring removal (Figure 5.18). If no previous design records exist, the procedure is basically the same, but additional sediment depth probing must be done to measure muck levels.



Figure 5.16: Sediment delta.



Figure 5.17: Measuring pond depth from canoe.

<sup>4</sup> A staff gauge is a fixed marker rod that enables easy reading of sediment levels in a pond once the pond has been drained.

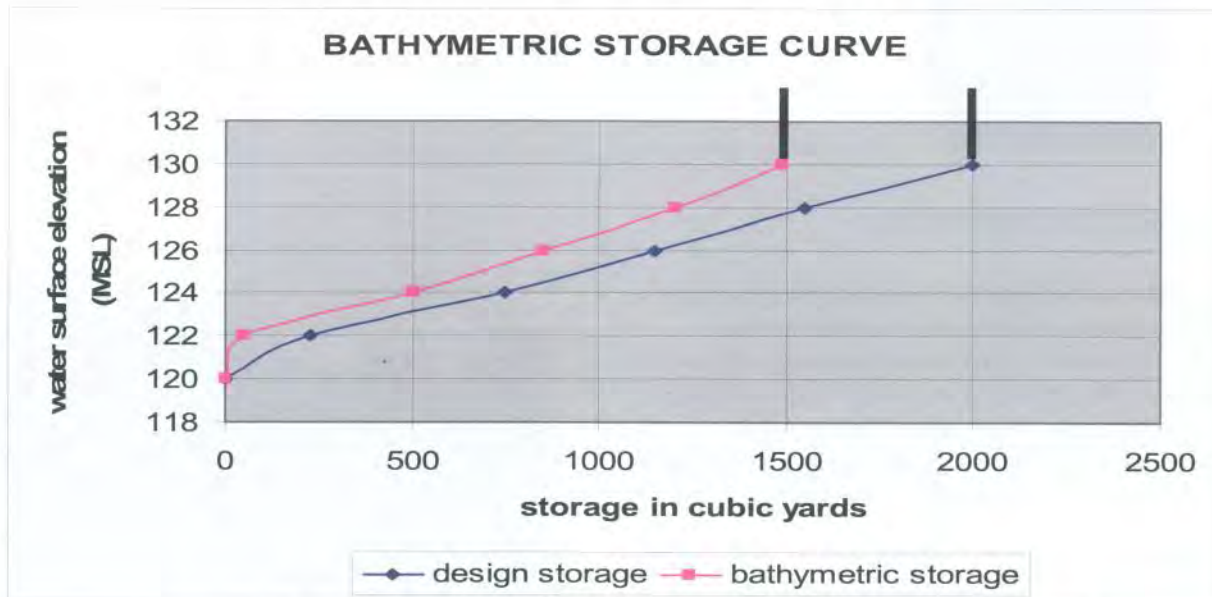


Figure 5.18: Plot of elevation vs. storage for existing and design conditions.

Dredging needs for dry ponds are easier to identify. There may be a profusion of vegetation, particularly wetland species, at the bottom of the facility. Pilot channels may disappear due to the accumulation of sediment and trash. An obvious sign for quick action is a buried low flow opening. Sediment in a dry pond can also be measured with a preset staff gauge; but hand-taped or simple field surveys can also suffice.

## Corrective Actions

In smaller ponds and wetlands, the pond level may be drawn down to a point where the residuals can begin to dry in place. After the material is dried, heavy equipment can remove the sediment from the bottom of the pond, a process referred to as mechanical dredging. Mechanical dredging may be accomplished with a standard or long reach backhoe, front end loader, dipper, bucket dredge, drag line or clamshell dredge (Figure 5.19).

Where dredging cannot be accomplished mechanically from the shore, it may be necessary to remove sediment using hydraulic dredging methods<sup>5</sup>. Larger ponds that cannot be drained are often de-mucked via hydraulic suction or with the use of draglines operated from barges. In ponds not



Figure 5.19: Mechanical dredging with backhoe.

<sup>5</sup> Hydraulic dredging uses a combination of water jet and vacuum to resuspend settled material and pump it to an upland location or other place for dewatering.

large enough to warrant hydraulic dredging, mechanical dredge methods are used and removed material is de-watered to minimize trucking requirements and potential spilling.

Dry ponds are typically dredged with conventional earth moving equipment such as backhoes, trackhoes, dozers, and excavators. Material is disposed of in a similar fashion to wet ponds but removal is often easier as muck has already had an appreciable time to de-water.

#### **WETLAND DREDGING TIP:**

Maintenance dredging of a stormwater wetland can significantly damage the wetland community that has developed over the life of the practice, and may be met with resistance from regulators and adjacent property owners. Typically, if a wetland was constructed specifically for stormwater treatment and not as mitigation for other wetland impacts, owners can maintain them without permits. However, permitting authorities having jurisdiction over the site should be informed prior to disturbing any wetland area for maintenance or other purposes.

If a diverse native wetland plant community is present in a stormwater wetland, for maintenance purposes it may be advisable to scrape and stockpile the surface soil layer in a designated location for future reapplication. The surface layer may contain seedbank that, when reapplied, can help the wetland plant material reestablish after the excess sediment has been removed. If a non-native or invasive wetland plant community has been established, conduct removal with care or during a dormant season to discourage seed distribution.

Sediments from ponds and wetlands are usually dewatered and then disposed of onsite or land filled. It is not unusual to spread this material out on a site for use as a soil amendment. Onsite disposal usually entails digging a pit, wasting the muck material, covering the pit with previously removed topsoil and planting the appropriate native plantings. Once a dredge area disposal site is established, it cannot be used for structural support or building foundations as long-term settlement will occur.

If on-site storage is not specified, sediment can typically be landfilled. Wet sediment is not accepted at many disposal sites; therefore, the material must be dewatered prior to disposal. This extra step adds to the cost and requires a location where wet material can be temporarily and safely placed to dry.

If the practice drains a stormwater hotspot, such as a gas station, a Toxic Contaminant Leachate Procedure (TCLP) or other analytical analysis should be performed in accordance with receiving landfill requirements to determine if the removed sediment should be considered a hazardous waste. If the residual solids are determined to be hazardous, they must be managed according to Resource Conservation and Recovery Act of 1976 (RCRA), which requires either treatment to decrease the concentration of the hazardous constituent or disposal in a hazardous waste landfill.

## **Cautions and Safety Tips**

Economic and safety risks involved in dredging and muck removal include proper disposal, confined space work, permitting and utility damage. This work is best left to general contractors and specialty maintenance companies with adequate training and bonding. The recommended skill level range for all dredging issues is (3).



## M-6 Access

### Problems to Inspect For

Inadequate access is typically discovered by inspectors or maintenance contractors who cannot enter a site or particular site features (e.g. risers). Inspectors should be cognizant of the types of equipment needed to maintain a stormwater pond or wetland, so they can note potential access issues (Figure 5.20). If potential access issues are noted up front, the maintenance contractor can be warned and can plan accordingly.

Risers and manhole access can be particularly challenging and dangerous, particularly when access steps are missing (Figure 5.21) or no manhole access has been provided. In these cases, it is necessary to lower staff by winch once the atmosphere has been tested. Therefore, mandatory fall protection should be used when accessing risers or manholes.

If no manhole access is provided and water enters a riser through weirs or orifices that are too small to allow direct access, the riser may still be entered safely through the barrel (principal spillway) if certain conditions are present. In Howard and Montgomery Counties, Maryland, safe barrel access is defined by the following conditions:

- Conducted by qualified confined space entry-trained staff (team of two with proper equipment).
- The barrel is open to daylight at both ends and no atmospheric dangers are present.
- The diameter of the barrel is 36 inches or greater.
- There is little to no tailwater making access unsafe, defined as blocking more than a third of the opening (Figure 5.22).

Given these conditions, the barrel may be crawled. Verbal contact should be kept with the crawler at all times. Each joint may be examined by hand for leaks and discontinuities. The inspector may enter the riser to inspect it once he or she has traversed the barrel.



**Figure 5.20: Poor vehicle access.**



**Figure 5.21: Missing manhole step**



**Figure 5.22: Forced access location.**

## Corrective Actions

Many access issues are best addressed during the design of ponds and wetlands (see Chapter 2). However, there are routine maintenance activities that will also be required. Most notably, it is important and advisable to maintain primary access features as they were designed. This typically involves removal of woody vegetation from access roads and the upkeep of gravel areas. Risers with missing steps, manhole covers, or trash racks that present unsafe situations should also be repaired so that future access for inspection is not compromised.

In some cases, where major work needs to be performed, temporary construction access for large, heavy equipment will need to be provided. In these situations, special provisions should be taken to minimize impacts to adjacent areas, particularly if they are forested. Common tree protection measures include fencing that is sufficiently set off to provide protection of the critical root zone and protective sheathing (Figure 5.23).

Heavy vehicle access will also impact areas with paving, curbs and decking (Figure 5.24). For the mutual protection of both the owner and contractor, these access points should be clearly marked or flagged and then photographed prior to equipment arrival onsite. Temporary pavement protection devices include:

- Steel sheeting
- Timbering and mats
- Stabilized stone and gravel construction accesses and mountable berms
- Unloading and ‘walking’ equipment in on rubber tires

If a fenced pond or wetland does not have vehicle gates large enough to accommodate heavy equipment, sections of fence will need to be temporarily removed to allow access.

## Cautions and Safety Tips

Mandatory fall protection should be used when accessing risers or manholes. Risers and manholes may be missing access steps, and lowering staff by winch may be required once the atmosphere has been tested.



**Figure 5.23: Tree scar protection**



**Figure 5.24: Paved access road**



## M-7 Mechanical Components

### Problems to Inspect For

Early identification of problems and speedy repair is important to ensure the maximum design life of mechanical components, most of which are metal. Signs of common mechanical failures include:

- Loose trash rack pieces
- Rust and corrosion
- Original lift lugs still in place for pre cast concrete structures
- Nicks and cuts in protective coatings
- Loose or corroded bolts
- Form nails and ties still present for cast-in-place concrete structures
- Leaking valves
- Corroded locks
- Hand wheels that won't turn
- Missing tools necessary for valve maintenance
- Pock marks
- Standing water
- Flaking

### Corrective Actions

Although most mechanical component maintenance is straightforward, it is usually out of the range of normal services provided by landscaping staff. Therefore, repairing and replacing these components should be left up to general contractors. For mechanical component problems external to confined spaces (Figure 5.25), the recommended maintenance skill level would be (1). For mechanical components in confined spaces, the recommended maintenance skill level would be (2).

#### *Valves*

Appurtenances with moving parts, especially valves, require annual exercising and lubrication. Most valves are hand-wheel valves that take several turns to completely open (often over thirty turns); however, exercising or temporarily opening a valve does not necessarily involve opening it completely. Staff need only rotate the wheel enough times to make sure the metal gate moves up and down. This procedure may involve two or three wheel rotations and a small amount of water may be released. After the valve is exercised, the staff should slowly close the valve, making sure the gate properly re-seats to a watertight closure position or to the appropriate opening dimension. If a valve gate won't move, it may need to be



**Figure 5.25: Valve outside riser.**

serviced or replaced. If the valve won't close after being opened a few turns, it will also need service.

Valve service typically means applying lubrication. Lubrication involves greasing the valve corkscrew stem and should only be done once it is determined that the valve will safely close again. Water will be released during this five to 15 minute operation as most valves must be completely open during lubrication.

Most valves draw water from at or near the pond bottom where sediment accumulates. Avoid the quick opening of valves as water released will be turbid and sediment will be introduced to downstream receiving areas. Open the valve slowly and allow the conditions at the permanent pool end to stabilize prior to complete opening.

#### *Extended length and non-hand wheel valves*

Some valves are installed with extended stems to allow safer opening from well-above the actual valve itself. Some valve types do not have hand wheels and are more vandal-resistant but require either a cog or 'T' key to open. The key may or may not be present in the riser box. If it is, it should be securely stored in a place where it cannot be removed and preferably as far removed from running water as possible. If the key is stored off-site, this may pose a problem if the pond needs to be dewatered in an emergency.

#### *Rust-proofing*

Although some plastic, aluminum or PVC appurtenances are available, most mechanical components are galvanized metal. Metal oxidization is an inherent maintenance concern in stormwater pond and wetland environments, so several methods of rust protection are employed including painting with zinc-rich or galvanizing paint, coating with bituminous tar or rubber and the use of stainless steel. Water chemistry, temperature extremes, clogging and vandalism will speed oxidization.

Repair work usually involves the removal of all rust with a wire brush to expose clean metal, if still present. Exposed metal is painted with a rust-proofing agent. Metal that has rusted through should be patch welded or replaced.

#### *Securing bolts*

The weakest metal component is usually the bolts securing the metal to a concrete wall. An under-strength or under-protected bolt may meet temperature and shear stress extremes, as well as the concrete chemistry or other potential chemical attack. Often, bolts securing a trash rack or orifice plate fail long before the appurtenance fails. Once bolts have rusted through, they must be replaced. Usually the original drill hole has been compromised and a new drill hole must be installed.

#### *Aerators*

Aerators will be wired to an outside electricity source and they will most likely have an air hose running out to the underwater diffuser head (Figure 5.26). Both types of lines (electrical and air) should be inspected for kinks, exposed wire and dry rot and replaced as necessary.

Ponds having bubblers, aerators, fountains or diffusers may require specialty contractors or manufacturer representatives for repairing severe maintenance problems. Pump clogging, air hose deterioration or diffuser head clogging may be simple repair items, but an assessment of the difficulty must be made prior to



Figure 5.26: Surface aerator / fountain.

making a judgment call about who is suited to perform the maintenance activity.

## Cautions and Safety Tips

The opening of valves is an inherently risky procedure, especially when carried out in under confined space conditions. There is a small potential that valve opening may cause an uncontrolled quick release of ponded water, which will flood the access area. Therefore, it is critical that correct confined space procedures be adhered to and suitable removal gear (such as a winch and harness system) be employed for emergency retrieval of maintenance staff that may be momentarily overcome by water under high pressure flow, slick, or cold conditions.

Servicing of electrical components and welding repairs should be performed by professional contractors. Inherent wet conditions can pose safety threats to inexperienced inspectors and maintenance crews where electricity is involved. If inspecting electric-dependent mechanical components, shut off power prior to inspection and use full body rubber coverage, including gloves.





## M-8 Nuisance Issues

### Animals

#### Problems to Inspect For

Animal burrows, dams, and dens can be significant maintenance issues associated with proper pond and wetland operation and structural stability (Figure 5.27).

Groundhog/woodchuck burrows are above the permanent pool and are easier to spot than muskrat burrows, which are located both at and below the permanent pool. Overgrown dam embankments may be riddled with burrow complexes that are not visible to the eye until the brush has been cleared. Usually, if one burrow is found, more are present, as rodent burrowing complexes usually have several ingress/egress points.

Beaver dams and dens (Figure 5.28) tend to be obvious in all but the most neglected stormwater ponds and wetlands where damming may have been present for so long that the original appearance has been almost permanently altered.

Musk rats tend to be elusive but are occasionally visible. Groundhogs tend to be less shy and sometimes can be seen either feeding or loafing in grassy areas. Beavers are visible in relation to how comfortable they are with human presence. Another indication of rodent activity is the 'slide trail' located on slopes where rodents have created paths for commuting and dragging brush.



**Figure 5.27: Animal burrow in pond embankment.**



**Figure 5.28: Beaver dam.**

#### Corrective Actions

Rodent management is a contentious issue with strong feelings both for and against the presence of these animals in a suburban setting.

Existing burrows should be plugged by filling with material similar to the existing material and capped just below grade with a 50/50 mix of soil and concrete. If plugging of burrows does not discourage the animals from returning, further measures should be taken to either remove the animal population or make

critical areas of the facility unattractive to them.

Management options for beaver control include complete tolerance, evaluation on a site-by-site basis, and complete removal. Beaver populations typically will only respond to trapping, dam and lodge removal, or the use of beaver “baffles”. Beavers usually do not remain in unsuitable areas. If their dams are breached and their lodges are damaged on a regular basis, the animals typically move on to another location. For instance, their lodges and dams may be removed by simple mechanical methods over two to three seasons. Once these structures are destroyed, regular maintenance of the facilities is often adequate to prevent their activity from becoming a future problem.

However, maintenance staff should be prepared for the displaced animals to be persistent in their efforts to maintain their dams and lodges. Monthly site checks are recommended to ensure that dams and lodges are not rebuilt in the weeks after the initial removal. Once there is no evidence of recent beaver activity, normal less frequent maintenance usually suffices to keep the facility functioning properly.

If there can be no tolerance of beaver activity, then the parties responsible for beaver control must consider trapping or relocating the unwanted animals. It is important to keep in mind that whatever features make the community appealing to one beaver will also make the area desirable to other beaver. Once one animal or family is removed, the pond will likely be re-occupied by other beaver, as young males are forced to find their own habitat areas each spring. Animal specialists perform trapping. If removal or trapping is utilized as a management tool, expect to continue trapping the area on a regular (i.e., seasonal) basis to maintain the level of control desired by the community. There are two additional points to consider concerning trapping:

- Beaver relocation is much more expensive and challenging than straight trapping (killing beaver with standard beaver traps).
- The existence of jurisdictions willing to accept relocated beavers is limited.

The final option for minimizing the impact of beaver activity is the use of proprietary beaver baffles. The baffles do not eliminate the beaver impoundments, but are intended to minimize their size. The purpose of the baffle is to reduce the impact of rising water levels on real property (bridges, open areas, private property, pathways, etc.) by providing a manual method for changing the water level in the ponds (thus, making dam building more difficult).

## Waterfowl Problems to Inspect For

Waterfowl damage usually takes the form of either reduced vegetative species due to overgrazing, or poor water quality due to high fecal coliform counts. Waterfowl issues usually involve the overpopulation of year-round duck (Figure 5.29) and geese populations (usually Canadian Geese, *Branta canadensis*). Geese and duck droppings on asphalt paths, pond side slopes, docks and cart ways are also easy aesthetic nuisances to spot.



Figure 5.29: Duck family.

## Corrective Actions

In addition to the design options presented in Chapter 2, the following actions can control waterfowl impacts:

- Adding shoreline vegetation and no-mow zones.
- Proprietary products for managing/discouraging waterfowl/goose populations
- Trained canines to intimidate geese - Border Collies are the most common species used.
- Egg addling - shaking the eggs of nesting geese to make the eggs nonviable while still allowing the female goose to perform her breeding duties.
- Predator introduction such as hunters and snapping turtles.

## Mosquitoes

### Problems to Inspect For

Mosquito problems are usually brought to the attention of the maintenance authority by adjacent homeowners. Judgment and education are necessary for maintenance staff to assess whether existing mosquito populations near stormwater ponds and wetlands are out of balance with normal populations for the area. Well designed stormwater ponds and wetlands often provide enough predator habitat that mosquito populations are kept in check.

### Corrective Actions

The most effective mosquito control program is one that eliminates potential breeding habitats. Most stagnant pools of water can be attractive to mosquitoes, and the source of a large mosquito population. Ponded water such as open cans and bottles, debris and sediment accumulations, and areas of ground settlement provide ideal locations for mosquito breeding. A maintenance program dedicated to eliminating potential breeding areas is preferable to controlling the health and nuisance effects of flying mosquitoes.

Contract with a private company to perform the work or participate in a state mosquito control program, if available. State programs typically provide comprehensive adulticide and larvicide programs, whereas private companies tend to be restricted to the larvicide program. Adulticide programs often employ evening spray applications using restricted use pesticides. Larvicide programs target potential breeding areas and treat them with non-restricted-use pesticides or biological controls such as specific bacteria, mosquito fish, and growth regulators. Seasonal stocking of predator fish keeps mosquito populations under control by reducing the number of mosquito larvae. Gambusia fish are typically used in warmer climates and black striped top minnow (*Notropis fundulus*) is used in colder climates.

## Undesirable Plant Communities

### Problems to Inspect For

Diverse plant communities support diverse and balanced aquatic communities that host beneficial species such as mosquito predators. Poorly maintained ponds and wetlands are particularly susceptible to the establishment of undesirable plant communities that include monocultures and non-native invasives. Aquatic plant species such as cattails and common reed are typical monocultures seen in ponds and wetlands. Similarly, side slopes and embankments are susceptible to rapid colonization by non-natives such as multiflora rose, kudzu (southeastern states), purple loosestrife, and porcelain berry.

## Corrective Actions

Management of monolithic plant communities and weeds requires a long-term commitment to action to prevent large-scale problems. Mechanical and hand removal of monocultures such as cattails and common reed is often necessary in conjunction with replanting with other appropriate native emergent species. Algaecides and herbicides are often used to eradicate existing weed species. This method treats the problem as an ongoing maintenance issue and generally requires multiple treatments throughout the growing season. It is often the most effective method of maintaining the desired aesthetic standard for a pond.

Caution should be exercised in performing chemical applications in that some applications may have the desired affect of removing unwanted vegetation, but may increase toxic risks to other resident species. The removal of one weed species creates an opportunity for the growth of another. Once the initial weed is eliminated, the ecological niche previously occupied by the species becomes available to other opportunistic species. Note that multiple applications may be necessary to maintain the desired aesthetic standard for a stormwater pond or wetland.

Maintaining and/or planting upland buffer zones can help to reduce the introduction of nuisance plant species. Planting emergent vegetation may also reduce nuisance algae blooms and waterfowl access. These plants compete with the algae for the available nutrients stored in the pond substrate. As fewer nutrients are available for the algae, their prolific growth potential can be suppressed. Another vegetation management technique is through the establishment of buffer strips or “no mow areas” around the perimeter of stormwater wet ponds and wetlands. These zones help intercept and filter nutrient laden runoff as well as stabilize pond banks. To minimize the protection mosquitoes are offered by taller plants, the use of low growing plants is recommended.

## Water Quality Degradation Problems to Inspect For

Stormwater ponds and wetlands are susceptible to poor water quality when upland land uses are highly urbanized, deliver large quantities of nutrients, or contain illicit discharges containing high concentrations of bacteria and other pollutants. Pond and wetland designs with inefficient turn over (i.e., poor flow circulation) also contribute to water quality degradation. Common indications of poor water quality include an off color (e.g., bright green sheen from algae) or unpleasant odor (e.g., presence of bacteria).

## Corrective Actions

Maintaining water quality in stormwater ponds and wetlands is challenging, as they are designed to retain constituents in stormwater that can degrade receiving waters. However, a number of water quality related fixes are noted below:

### *Dyes and shading*

As a photosynthetic organism, algae requires the presence of light to survive. Dyes artificially shade the pond reducing light transmission through the water column. This limits the available habitat conducive to algae growth within the pond to the top first inches of the pond. If water clarity is maintained low enough, bottom growing weeds and algae can be controlled. However, rainfall can dilute the dyes and force repeat applications. Also some people find that the dyes create an objectionable artificial color to the water.

*Bacterial Improvements*

Excessive sediments in a pond can contribute to algae problems. If sediment layers become anaerobic, harmful chemicals, noxious odors, and phosphorus can be released into the water column. These conditions can be minimized through the introduction of bacteria in the pond. The bacteria, in the presence of adequate aeration, “digest” the muck layer without producing the harmful side effects, such as odor, associated with anaerobic decomposition. Through the reduction of available phosphorus, algae growth can be limited. Treatments usually start in early April and continue through September.

*Barley Straw*

Introduction of bales of barley straw to the pond can help control algae blooms. When barley straw is placed into the water, it decomposes releasing chemicals, which inhibit the growth of algae. It takes usually from six to eight weeks to work when water temperatures are below 50 degrees Fahrenheit, and one to two weeks when the water is above 68 degrees Fahrenheit (Newman, 1997).

*Diffusers and surface aerators*

Air can be introduced into the pond or wetland through various systems to facilitate biological decomposition of pond muck, de-stratify thermal layers in the water and improve the ecological health of the system. In general air promotes biological activity, which reduces the amount of available nutrients for algae.

Diffusers use an air compressor and hoses to bring air into the water column of the pond or wetland. Diffuser systems are low maintenance and are often compared to aquarium compressors on a larger scale. They require annual maintenance and are not recommended for permanent pools less than eight feet deep.

Aerators resemble fountains in their appearance. They require a motor mounted to an impeller or other type of agitator to “splash” the water. This physical action introduces air to the water. They should be removed from the pond in the late fall to prevent freeze damage and returned to the pond in the spring, after the last freeze. Trash, debris, algae, pond weeds and aquatic plants can bind up moving parts, causing excessive wear and generally cause motors to burn out prematurely. Because these aerators typically draw from the surface of the pond, they are generally not recommended for reducing algae bloom potential or increasing dissolved oxygen in the system, but may provide visual enhancement.

*Flocculants*

Flocculants are chemicals applied to ponds to act indirectly on the algae through promotion of settling. The application of flocculates of buffered alum products to the water causes phosphorus and other materials suspended in the water column to settle. Removal of the phosphorus from the water column limits the amount of this nutrient available to support algal growth. This works best when water clarity is greater than 24 inches. However, soils with excessive nutrients introduce phosphorous with every rain event and as a result, phosphorus levels are quickly recharged and the value of floccing the pond is minimized.

**Cautions and Safety Tips**

Addressing nuisance issues has few associated safety hazards when appropriately trained individuals conduct the specific tasks (e.g., trapping, chemical application).

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# Appendix A:

## Unit Costs for Pond and Wetland Maintenance

TABLE A-1. UNIT COSTS FOR POND AND WETLAND MAINTENANCE<sup>1</sup>

Maintenance Item	Unit Price (\$)	Unit	Mobilization Cost (\$) <sup>2</sup>	Maintenance Interval (yrs) <sup>3</sup>
<b>Permanent Pool Issues</b>				
<i>Dam/ Embankment</i>				
unclog internal drains for embankments	10	lf	1,500	R (10)
repair low spots in dam or berm	170	cy	1,500	R (5)
<b>Clogging</b>				
debris removal (preventative)	350	event	0	0.25-1
clear outfall channel of sediment	130	cy	0	5-15
clogged low flow	750	event	800	0.25-1
<b>Pipe Repairs</b>				
<i>Structural - Riser and Barrel</i>				
re-tar CMP barrel	11	sf	800	15-20
install new elbow underground	1,200	ea	800	R
repair CMP barrel joint leak	530	ea	800	R (3-5)
repair leaking concrete principal spillway joint	1,200	ea	0	R (5-10)
replace riser (CMP)	12,000	ea	>2,500	R (25)
replace riser (concrete)	20,000	ea	>2,500	R (50)
replace barrel	1,000	lf	>2,500	R (25-50)
<p>1) These costs were largely derived from data from the Maryland region, based on bid proposal and actual project data.</p> <p>2) Cost at four levels: \$0 for no mobilization; \$800 for minimal mobilization; \$1,500 for small project mobilization; &gt;\$2,500 for large project mobilization. Note that these are approximations. For items with no mobilization cost, it is assumed that the mobilization cost is incorporated into the overall unit cost, or that the maintenance can be completed during inspection.</p> <p>3) Bottom number in range represents ideal maintenance interval. Top number represents maximum interval between maintenance activities. R indicates repair items, whose frequency is somewhat unpredictable. The frequencies sometimes reported in parentheses represent an estimate of typical repair frequency.</p>				



Maintenance Item	Unit Price (\$)	Unit	Mobilization Cost (\$)²	Maintenance Interval (yrs)³
<i>Structural - Pipes</i>				
replace existing underground elbow	1,400	ea	800	R (10)
slip line failing pipes	90	lf	>2,500	R
replace end sections <36"	600	ea	1,500	R
remote control TV video pipes	1	lf	800	5-25
<i>Structural - Other Concrete</i>				
concrete work under ground	600	cy	1,500	R
concrete work above ground	450	cy	1,500	R
grout cracks	50	lf	0	R
parge spalling	25	sf	0	R
repair gutter spalling	230	event	800	R
injection grout concrete leaks	180	lf	800	R
<i>Structural: Metal</i>				
new low flow trash rack	1,700	ea	800	R (5-10)
install high stage trash rack 4'x2'	1,100	ea	1,500	R (20+)
replace CMP anti-vortex device <48"	1,500	ea	1,500	R (10-15)
replace CMP anti-vortex device >48"	4,600	ea	1,500	R (10-15)
remove bolts, lift lugs, form nails	80	ea	800	R
1. These costs were largely derived from data from the Maryland region, based on bid proposal and actual project data. 2. Cost at four levels: \$0 for no mobilization; \$800 for minimal mobilization; \$1,500 for small project mobilization; >\$2,500 for large project mobilization. Note that these are approximations. For items with no mobilization cost, it is assumed that the mobilization cost is incorporated into the overall unit cost, or that the maintenance can be completed during inspection. 3. Bottom number in range represents ideal maintenance interval. Top number represents maximum interval between maintenance activities. R indicates repair items, whose frequency is somewhat unpredictable. The frequencies sometimes reported in parentheses represent an estimate of typical repair frequency.				

Maintenance Item	Unit Price (\$)	Unit	Mobilization Cost (\$) <sup>2</sup>	Maintenance Interval (yrs) <sup>3</sup>
<b>Vegetation Management</b>				
sod	3.30	sy	800	1-2
seed and top soil bare areas (3 inch depth)	4.40	sy	800	1-2
plant 1.5 inch tree	84	ea	0	R <sup>3</sup>
plant shrub	15	ea	0	R
mowing	300	ac	0	0.5-1
clear outfall and channel of trees	5.50	sy	800	0.5-1
clear embankment of small trees by hand	3.30	sy	800	0.5-1
clear embankment trees with Ambusher or Brushhog	0.90	sy	800	0.5-1
remove live tree (<12 inches)	130	ea	800	R (1-10)
remove live trees larger than 12 inches, <24 inches	250	ea	800	R (10-25)
remove downed timber (up to 40 cy of material)	2,200	event	0	0.25-1
remove dumped vegetative material (up to 40 cy)	2,600	event	0	0.25-1
install wetland plant	6	ea	800	R (3-5)
remove invasive wetland vegetation (machine remove phragmites) (up to 40 cy)	3,000	event	0	R
spray for algae (0.25 ac pond)	600	ea	0	R
spray for cattails (0.25 ac pond)	330	ea	0	R
repair low spots in dry pond bottom	25	sy	1,500	R
remove woody vegetation from dry pond bottom	1,700	event	0	5-10
<ol style="list-style-type: none"> <li>1. These costs were largely derived from data from the Maryland region, based on bid proposal and actual project data.</li> <li>2. Cost at four levels: \$0 for no mobilization; \$800 for minimal mobilization; \$1,500 for small project mobilization; &gt;\$2,500 for large project mobilization. Note that these are approximations. For items with no mobilization cost, it is assumed that the mobilization cost is incorporated into the overall unit cost, or that the maintenance can be completed during inspection.</li> <li>3. Bottom number in range represents ideal maintenance interval. Top number represents maximum interval between maintenance activities. R indicates repair items, whose frequency is somewhat unpredictable. The frequencies sometimes reported in parentheses represent an estimate of typical repair frequency.</li> </ol>				

Maintenance Item	Unit Price (\$)	Unit	Mobilization Cost (\$) <sup>2</sup>	Maintenance Interval (yrs) <sup>3</sup>
<b>Dredging and Mucking</b>				
dredge wet ponds (jobs larger than 1000 cy) haul offsite	60	cy	>2,500	5-15
dry pond sediment removal	7,600	event	0	15-25
dewater pond	900	event	0	15-25
muck out undergrounds	390	cy	0	0.5-1
dewater and remove sludge from underground facilities	1	gal	0	0.25-1
typical sediment dump fee (not including trucking)	66	ton	0	NA
truck day for landfill to transport underground dredge materials (minimum, assume 2 to 4 trips in one day)	800	trip-day	0	NA
<b>Access/ Safety</b>				
install warning signs	210	ea	0	R
add manhole steps	100	ea	800	R
new manhole cover	250	ea	0	R
create 12' access road (permanent, cut/fill balances)	40	lf	1,500	R
create 12' access road (permanent, cut/fill non-balance)	65	lf	1,500	R
create 12' access road (temp)	12	lf	1,500	R
install chainlink fence	26	lf	800	R
install ladder (8 foot)	220	each	800	R
install three rail fence	15	lf	800	R
repair asphalt path	26	cy	800	R
supply lock and chain for first one (additional at \$30 apiece)	130	ea	0	4-8
<ol style="list-style-type: none"> <li>1. These costs were largely derived from data from the Maryland region, based on bid proposal and actual project data.</li> <li>2. Cost at four levels: \$0 for no mobilization; \$800 for minimal mobilization; \$1,500 for small project mobilization; &gt;\$2,500 for large project mobilization. Note that these are approximations. For items with no mobilization cost, it is assumed that the mobilization cost is incorporated into the overall unit cost, or that the maintenance can be completed during inspection.</li> <li>3. Bottom number in range represents ideal maintenance interval. Top number represents maximum interval between maintenance activities. R indicates repair items, whose frequency is somewhat unpredictable. The frequencies sometimes reported in parentheses represent an estimate of typical repair frequency.</li> </ol>				

Maintenance Item	Unit Price (\$)	Unit	Mobilization Cost (\$) <sup>2</sup>	Maintenance Interval (yrs) <sup>3</sup>
<b>Mechanical Components</b>				
remove old valve	300	ea	800	R (10)
install new valve (<36 inches)	4,600	ea	1,500	R
install new valve (< 24 inches)	3,100	ea	1,500	R
install new valve (<11 inches)	1,300	ea	1,500	R
install new valve (<7 inches)	460	ea	800	R
lubricate valves (same price for first four)	300	ea	0	1-2
<b>Nuisance Issues</b>				
pond/ wetland aeration	560	ea	0	1
treat pond for mosquitoes	1,000	acre	0	R
trap beavers (one week, one location, family of 6)	1,000	event	0	R
fill animal burrows	23	sy	800	R (5-10)
remove graffiti	310	day	800	1-3
<b>Erosion/ Channel Maintenance</b>				
establish new riprap pilot channels (8' wide, 1' deep)	38	lf	1,500	5-15
remove and replace rip rap or pea gravel	160	sy	1,500	15-25
shoreline protection	50	lf	1,500	R
new riprap (general)	80	cy	1,500	R (5-10)
erosion repair	1,100	event	0	R (2-5)
jet clean rip rap (6X 15, 1' silt)	2,500	event	0	15-25
<p>4) These costs were largely derived from data from the Maryland region, based on bid proposal and actual project data.</p> <p>5) Cost at four levels: \$0 for no mobilization; \$800 for minimal mobilization; \$1,500 for small project mobilization; &gt;\$2,500 for large project mobilization. Note that these are approximations. For items with no mobilization cost, it is assumed that the mobilization cost is incorporated into the overall unit cost, or that the maintenance can be completed during inspection.</p> <p>6) Bottom number in range represents ideal maintenance interval. Top number represents maximum interval between maintenance activities. R indicates repair items, whose frequency is somewhat unpredictable. The frequencies sometimes reported in parentheses represent an estimate of typical repair frequency.</p>				



# Appendix B: Pond and Wetland Checklists

# STORMWATER POND / STORMWATER WETLAND CONSTRUCTION INSPECTION CHECKLIST

Date:

Time:

Project:

Location:

Site Status (active, inactive, completed):

Inspector(s):

Type of Practice:

- |   |  |
|---|--|
| <input type="checkbox"/> Micropool ED Pond    | <input type="checkbox"/> Shallow Wetland       |
| <input type="checkbox"/> Wet Pond             | <input type="checkbox"/> Shallow ED Wetland    |
| <input type="checkbox"/> Multiple Pond System | <input type="checkbox"/> Pond / Wetland System |
| <input type="checkbox"/> Pocket Pond          | <input type="checkbox"/> Pocket Wetland        |

Construction Sequence	Satisfactory	Unsatisfactory	Comments
<b>I. Pre-Construction / Materials and Equipment</b>			
Pre-construction meeting			
Pipe and appurtenances on-site prior to construction and dimensions checked			
1. Material (including protective coating, if specified)			
2. Diameter			
3. Dimensions of metal or pre-cast concrete riser			
4. Required dimensions between water control structures (orifices, weirs, etc.) are in accordance with approved plans			
5. Barrel stub for prefabricated pipe structures at proper angle for design barrel slope			
6. Number and dimensions of prefabricated anti-seep collars			
7. Watertight connectors and gaskets			
8. Outlet drain valve			
Project benchmark near pond site			
Equipment for temporary de-watering / sediment and erosion control			
<b>II. Subgrade Preparation</b>			
Area beneath embankment stripped of all vegetation, topsoil, and organic matter			
Core trench excavated and backfilled			
<b>III. Pipe Spillway Installation</b>			
Method of installation detailed on plans			
A. Bed preparation			
Installation trench excavated with specified side slopes			
Stable, uniform, dry subgrade of relatively impervious material (If subgrade is wet, contractor shall have defined steps before proceeding with installation)			
Invert at proper elevation and grade			

**STORMWATER POND / STORMWATER WETLAND CONSTRUCTION INSPECTION CHECKLIST**

<b>Construction Sequence</b>	<b>Satisfactory</b>	<b>Unsatisfactory</b>	<b>Comments</b>
<b>B. Pipe placement</b>			
Metal / plastic pipe			
1. Watertight connectors and gaskets properly installed			
2. Anti-seep collars properly spaced and having watertight connections to pipe			
3. Backfill placed and tamped by hand under "haunches" of pipe			
4. Remaining backfill placed in max. 8 inch lifts using small power tamping equipment until 2 feet cover over pipe is reached			
Concrete pipe			
1. Pipe set on blocks or concrete slab for pouring of low cradle			
2. Pipe installed with rubber gasket joints with no spalling in gasket interface area			
3. Excavation for lower half of anti-seep collar(s) with reinforcing steel set			
4. Entire area where anti-seep collar(s) will come in contact with pipe coated with mastic or other approved waterproof sealant			
5. Low cradle and bottom half of anti-seep collar installed as monolithic pour and of an approved mix			
6. Upper half of anti-seep collar(s) formed with reinforcing steel set			
7. Concrete for collar of an approved mix and vibrated into place (protected from freezing while curing, if necessary)			
8. Forms stripped and collar inspected for honeycomb prior to backfilling. Parge if necessary.			
<b>C. Backfilling</b>			
Fill placed in maximum 8 inch lifts			
Backfill taken minimum 2 feet above top of anti-seep collar elevation before traversing with heavy equipment			
<b>IV. Riser / Outlet Structure Installation</b>			
Riser located within embankment			
<b>A. Metal riser</b>			
Riser base excavated or formed on stable subgrade to design dimensions			
Set on blocks to design elevations and plumbed			
Reinforcing bars placed at right angles and projecting into sides of riser			
Concrete poured so as to fill inside of riser to invert of barrel			
<b>B. Pre-cast concrete structure</b>			



**STORMWATER POND / STORMWATER WETLAND CONSTRUCTION INSPECTION CHECKLIST**

<b>Construction Sequence</b>	<b>Satisfactory</b>	<b>Unsatisfactory</b>	<b>Comments</b>
Dry and stable subgrade			
Riser base set to design elevation			
If more than one section, no spalling in gasket interface area; gasket or approved caulking material placed securely			
Watertight and structurally sound collar or gasket joint where structure connects to pipe spillway			
<b>C. Poured concrete structure</b>			
Footing excavated or formed on stable subgrade, to design dimensions with reinforcing steel set			
Structure formed to design dimensions, with reinforcing steel set as per plan			
Concrete of an approved mix and vibrated into place (protected from freezing while curing, if necessary)			
Forms stripped & inspected for honeycomb prior to backfilling; parge if necessary			
<b>V. Embankment Construction</b>			
Fill material			
Compaction			
Embankment			
1. Fill placed in specified lifts and compacted with appropriate equipment			
2. Constructed to design cross-section, side slopes and top width			
3. Constructed to design elevation plus allowance for settlement			
<b>VI. Impounded Area Construction</b>			
Excavated / graded to design contours and side slopes			
Inlet pipes have adequate outfall protection			
Forebay(s)			
Pond benches			
<b>VII. Earth Emergency Spillway Construction</b>			
Spillway located in cut or structurally stabilized with riprap, gabions, concrete, etc.			
Excavated to proper cross-section, side slopes and bottom width			
Entrance channel, crest, and exit channel constructed to design grades and elevations			
<b>VIII. Outlet Protection</b>			
A. End section			
Securely in place and properly backfilled			
B. Endwall			
Footing excavated or formed on stable subgrade, to design dimensions and reinforcing steel set, if specified			

**STORMWATER POND / STORMWATER WETLAND CONSTRUCTION INSPECTION CHECKLIST**

<b>Construction Sequence</b>	<b>Satisfactory</b>	<b>Unsatisfactory</b>	<b>Comments</b>
Endwall formed to design dimensions with reinforcing steel set as per plan			
Concrete of an approved mix and vibrated into place (protected from freezing, if necessary)			
Forms stripped and structure inspected for honeycomb prior to backfilling; parge if necessary			
<b>C. Riprap apron / channel</b>			
Apron / channel excavated to design cross-section with proper transition to existing ground			
Filter fabric in place			
Stone sized as per plan and uniformly place at the thickness specified			
<b>IX. Vegetative Stabilization</b>			
Approved seed mixture or sod			
Proper surface preparation and required soil amendments			
Excelsior mat or other stabilization, as per plan			
<b>X. Miscellaneous</b>			
Drain for ponds having a permanent pool			
Trash rack / anti-vortex device secured to outlet structure			
Trash protection for low flow pipes, orifices, etc.			
Fencing (when required)			
Access road			
Set aside for clean-out maintenance			



# POND / WETLAND MAINTENANCE INSPECTION FORM

Facility Number: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_  
 Subdivision Name: \_\_\_\_\_ Watershed: \_\_\_\_\_  
 Weather: \_\_\_\_\_ Inspector(s): \_\_\_\_\_  
 Date of Last Rainfall: \_\_\_\_\_ Amount: \_\_\_\_\_ Inches Streets: \_\_\_\_\_  
 Mapbook Location: \_\_\_\_\_ GPS Coordinates: \_\_\_\_\_  
 Property Classification: Residential 9 Government 9 Commercial 9 Other: \_\_\_\_\_

**Type of Practice:** Wet Pond 9 Dry Pond 9 Micropool ED 9 Multiple Pond System 9 Pocket Pond 9  
 Shallow Wetland 9 Shallow ED 9 Pond/ Wetland 9 Pocket Wetland 9

Confined 9 Unconfined 9 Barrel Size \_\_\_\_\_ As-built Plan Available? Yes 9 No 9  
 Is Facility Inspectable? Yes 9 No 9 Why? \_\_\_\_\_ Comments Specific Location(s): \_\_\_\_\_

**Scoring Breakdown:**

N/A = Not Applicable	1 = Monitor (potential for future problem exists)	* Use open space in each section to further explain scoring as needed
N/I = Not Investigated	2 = Routine Maintenance Required	
0 = Not a Problem	3 = Immediate Repair Necessary	

## 1. Outfall Channel(s) from Pond

	N/A	N/I	0	1	2	3
Woody growth within 5' of outfall barrel						
Outfall channel functioning						
Manholes, Frames and Covers						
Released water undercutting outlet						
Erosion						
Displaced rip rap						
Excessive sediment deposits						
Other:						

## 2. Downstream Dam Bank

	N/A	N/I	0	1	2	3
Cracking, bulging, or sloughing of dam						
Erosion and/or loss of dam material						
Animal burrows						
Soft spots or boggy areas						
Woody growth or unauthorized plantings on dam						
Other:						

## 3. Upstream Dam Bank

	N/A	N/I	0	1	2	3
Cracking, bulging, or sloughing of dam						
Erosion and/or loss of dam material						
Animal Burrows						
Soft spots or boggy areas						
Woody growth or unauthorized plantings on dam						
Other:						

N/A = Not Applicable      1 = Monitor for Future Repairs  
 N/I = Not Investigated    2 = Routine Repairs Needed  
 0 = Not a Problem         3 = Immediate Repair Needed

POND / WETLAND MAINTENANCE INSPECTION FORM

**4. Emergency Spillway**

Woody growth or unauthorized plantings	N/A	N/I	0	1	2	3
Erosion or back cutting	N/A	N/I	0	1	2	3
Soft or boggy areas	N/A	N/I	0	1	2	3
Obstructions / debris	N/A	N/I	0	1	2	3

**5. Principal Spillway Built to Plans**

# of Barrels: _____ Size: _____	RCP	CMP	PVC	STEEL	or	MASONRY	(Circle One)
Confined space entry permit required for entry into all riser and barrels			Entry Approved 9		Entry Denied 9		
Minor spalling or parging (<1")	N/A	N/I	0	1	2	3	
Major spalling (exposed rebar)	N/A	N/I	0	1	2	3	
Joint failure	N/A	N/I	0	1	2	3	
Loss of joint material	N/A	N/I	0	1	2	3	
Leaking	N/A	N/I	0	1	2	3	
Corrosion	N/A	N/I	0	1	2	3	
Protective material deficient	N/A	N/I	0	1	2	3	
Misalignment or split seams / joints	N/A	N/I	0	1	2	3	
Other:	N/A	N/I	0	1	2	3	

**6. Riser Built to Plans**

Size: _____	CONC	CMP	or	MASONRY	(Circle One)	
Minor spalling or parging (<1")	N/A	N/I	0	1	2	3
Major spalling (exposed rebar)	N/A	N/I	0	1	2	3
Joint failure	N/A	N/I	0	1	2	3
Loss of joint material	N/A	N/I	0	1	2	3
Leaking	N/A	N/I	0	1	2	3
Manhole access and steps acceptable	N/A	N/I	0	1	2	3
Corrosion	N/A	N/I	0	1	2	3
Protective material deficient	N/A	N/I	0	1	2	3
Misalignment or split seams / joints	N/A	N/I	0	1	2	3
Anti-vortex device secure / acceptable	N/A	N/I	0	1	2	3
Sediment Accumulation within riser	N/A	N/I	0	1	2	3
Woody or vegetative growth within 25' of riser	N/A	N/I	0	1	2	3
Safety Rebar/pipes in place	N/A	N/I	0	1	2	3
Safety Rebar/pipes corroded	N/A	N/I	0	1	2	3
Other:	N/A	N/I	0	1	2	3

**7. Low Flow Built to Plans**

Orifice and/or trash rack obstructed	N/A	N/I	0	1	2	3
Trash Rack Corrosion	N/A	N/I	0	1	2	3
Other:	N/A	N/I	0	1	2	3

**8. Weir Trash Rack**

Structurally sound	N/A	N/I	0	1	2	3
Debris removal necessary	N/A	N/I	0	1	2	3
Corrosion	N/A	N/I	0	1	2	3

N/A = Not Applicable      1 = Monitor for Future Repairs  
 N/I = Not Investigated    2 = Routine Repairs Needed  
 0 = No Repair Needed      3 = Repair Needed

POND / WETLAND MAINTENANCE INSPECTION FORM

9. Control Valve(s) Built to Plans							
Size: _____		Type: _____					
Operation limited	N/A	N/I	0	1	2	3	
Exercised	N/A	N/I	0	1	2	3	
Leaks	N/A	N/I	0	1	2	3	
Chains & Locks	N/A	N/I	0	1	2	3	
Set to design opening	N/A	N/I	0	1	2	3	
Other:	N/A	N/I	0	1	2	3	
10. Pond Drain Valve							
Operation limited	N/A	N/I	0	1	2	3	
Exercised	N/A	N/I	0	1	2	3	
Leaks	N/A	N/I	0	1	2	3	
Chained & locked correctly	N/A	N/I	0	1	2	3	
Other:	N/A	N/I	0	1	2	3	
<b>11. Toe &amp; Chimney Drains Clear &amp; Functioning</b>	N/A	N/I	0	1	2	3	
12. Rip-Rap Pilot Channel (Micropool only)							
Sediment or debris build up	N/A	N/I	0	1	2	3	
Erosion/ Undermining	N/A	N/I	0	1	2	3	
13. Permanent Pool							
Visible pollution	N/A	N/I	0	1	2	3	
Shoreline and / or side slope erosion	N/A	N/I	0	1	2	3	
Aquatic bench inadequately vegetated	N/A	N/I	0	1	2	3	
Abnormally high or low water (pool) levels	N/A	N/I	0	1	2	3	
Sediment / debris accumulation	N/A	N/I	0	1	2	3	
Bathometric study recommended			No	Yes			
Other?	N/A	N/I	0	1	2	3	
14. Dry Storage							
Vegetation sparse	N/A	N/I	0	1	2	3	
Undesirable woody or vegetative growth	N/A	N/I	0	1	2	3	
Low flow channels obstructed	N/A	N/I	0	1	2	3	
Standing water or spots	N/A	N/I	0	1	2	3	
Sediment or debris accumulation	N/A	N/I	0	1	2	3	
Bathometric study recommended			No	Yes			
Other:	N/A	N/I	0	1	2	3	
15. Pretreatment							
Maintenance access	N/A	N/I	0	1	2	3	
Is pretreatment a practice other than a forebay			No	Yes	Of so, _____ (code)		
Dredging required			No	Yes			
Hard pad condition (Wet pond only)	N/A	N/I	0	1	2	3	
Fixed vertical sediment depth marker present			No	Yes			
Marker Reading _____							
Sediment accumulation	N/A	N/I	0	1	2	3	Estimated % full _____ %

N/A = Not Applicable      1 = Monitor for Future Repairs  
 N/I = Not Investigated    2 = Routine Repairs Needed  
 0 = No problem            3 = Immediate Repair Needed

**POND / WETLAND MAINTENANCE INSPECTION FORM**

<b>16. Inflow Points</b>						
Number of inflow pipes: _____	Direction:		N	E	W	S
Endwalls, headwalls, end sections	N/A	N/I	0	1	2	3
Outfall pipes	N/A	N/I	0	1	2	3
Discharge undercutting outlet or displacing rip-rap	N/A	N/I	0	1	2	3
Discharge water is causing outfall to erode	N/A	N/I	0	1	2	3
Sediment accumulation	N/A	N/I	0	1	2	3
<b>17. Wet Pond Vegetation</b>						
Invasive plants	N/A	N/I	0	1	2	3
% cover _____						
Vegetation matches landscape design plan	N/A	N/I	0	1	2	3
Planting needed	N/A	N/I	0	1	2	3
Shore erosion	N/A	N/I	0	1	2	3
Coverage needs improvement	N/A	N/I	0	1	2	3
<b>18. Pond Buffer</b>						
Encroachment by structures	N/A	N/I	0	1	2	3
Clearing of vegetation	N/A	N/I	0	1	2	3
Planting needed	N/A	N/I	0	1	2	3
Predominant vegetation types:	Forested 9	Shrubs 9	Meadow 9	Maintained Grass 9	Other: _____	
<b>19. Special Structures</b>						
Manhole access (steps, ladders)	N/A	N/I	0	1	2	3
Vehicular access	N/A	N/I	0	1	2	3
Concrete/masonry condition	N/A	N/I	0	1	2	3
Trash racks	N/A	N/I	0	1	2	3
Elbows	N/A	N/I	0	1	2	3
Sediment / trash removal	N/A	N/I	0	1	2	3
Manhole lockable nuts	N/A	N/I	0	1	2	3
<b>20. Miscellaneous</b>						
Encroachment in pond area and/or easement area	N/A	N/I	0	1	2	3
Fence condition	N/A	N/I	0	1	2	3
Safety signs	N/A	N/I	0	1	2	3
Complaints from local residents	N/A	N/I	0	1	2	3
Graffiti	N/A	N/I	0	1	2	3
Public hazards	N/A	N/I	0	1	2	3
Were any pad locks cut and replaced			No	Yes	How Many? _____	

N/A = Not Applicable      1 = Monitor for Future Repairs  
 N/I = Not Investigated      2 = Routine Repairs Needed  
 3 = Significant Repair Needed

**Overall Condition of Facility**

Total number of concerns receiving a: (1) \_\_\_\_\_ - Need Monitoring  
 (2) \_\_\_\_\_ - Routine Repair  
 (3) \_\_\_\_\_ - Immediate Repair Needed

**Inspector's Summary**

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Pictures		Clock/Degrees	Prin. Spill. Barrel Joints		Clock/Degrees
1.	_____	_____	1.	_____	_____
2.	_____	_____	2.	_____	_____
3.	_____	_____	3.	_____	_____
4.	_____	_____	4.	_____	_____
5.	_____	_____	5.	_____	_____
6.	_____	_____	6.	_____	_____
7.	_____	_____	7.	_____	_____
8.	_____	_____	8.	_____	_____
9.	_____	_____	9.	_____	_____
10.	_____	_____	10.	_____	_____
11.	_____	_____	11.	_____	_____
12.	_____	_____	12.	_____	_____
13.	_____	_____	13.	_____	_____
14.	_____	_____	14.	_____	_____
15.	_____	_____	15.	_____	_____

N/A = Not Applicable      1 = Monitor for Future Repairs  
 NI = Not Investigated    2 = Routine Repairs Needed  
 0 = Not a Problem        3 = Immediate Repair Needed



Sketches, If Necessary:

A large empty rectangular box with a thin black border, intended for drawing sketches of the pond or wetland being inspected.

N/A = Not Applicable      1 = Monitor for Future Repairs  
N/I = Not Investigated    2 = Routine Repairs Needed  
0 = No Repair Needed      3 = Immediate Repair Needed

## Home Owner Pond Inspection Checklist

We encourage you to copy this checklist and maintain a record of your inspections. (Adapted from Hampton Roads: A Guide for Maintaining and Operating BMPs.) Answering YES to any of these questions indicates a need for corrective action or consultation with a professional inspector.

Date: \_\_\_\_\_ Inspected by: \_\_\_\_\_

### What to look for . . .

Yes No

- Does the facility show signs of settling, cracking, bulging, misalignment or other structural deterioration?
- Do the embankments, emergency spillways, side slopes or inlet/outlet structures show signs of erosion?
- Are the pipes going into and/or out of the pond clogged or obstructed?
- Do the impoundment and inlet areas show erosion, low spots or lack of stabilization?
- Are there trees present on the banks?
- Is there evidence of animal burrows?
- Are contributing areas unstabilized with evidence or erosion?
- Do vegetated areas need mowing or is there a build up of clippings that could clog the facility?
- Does sedimentation greatly decrease the BMPs capacity to hold water within the structure?
- Is there standing water in appropriate or inappropriate areas?
- Is there accumulation of trash or debris?
- Is there evidence of encroachment or improper use of the impounded areas?
- Are there signs of vandalism?
- Do any safety devices such as fences, gates or locks need repair?
- Is there excessive algae or dominance of one type of vegetation?
- Is there evidence of automotive fluids entering or clogging the facility?
- Is there evidence of a fish kill?

Additional Observations: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

# Table of Contents

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- ✓ **Surface Water Crew Spill Response Procedures**
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- ✓ **Lab Analysis**

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- ✓ **Drainage Maintenance Contractors**
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- ✓ **Storm Drain Markers**
- ✓ **Car Washing Options**
- ✓ **Hazardous Waste Disposal**

# Top 10 Illicit Discharges/Spills

<u>Material</u>	<u>Example Activity/Source of Material</u>
➤ Antifreeze, oil, gas.....	Leaking vehicles, messy vehicle maintenance
➤ Concrete, cement.....	Construction
➤ Chlorine (e.g., drinking water).....	Water main breaks, vehicle & equipment washing
➤ Degreasers, solvents.....	Parking lot cleaning
➤ Dirt, silt, sediment.....	Water main breaks, construction
➤ Food waste (e.g., grease).....	Messy waste grease storage & garbage dumpsters
➤ Lawn clippings, leaves, branches.....	Landscaping, commercial and residential
➤ Paint, stains, lacquers.....	Building, vehicle, & equipment improvement
➤ Soap, detergents.....	Car, equipment, & building washing
➤ Sewage.....	Sewage overflows, RV discharges

## When to Notify / Call Ecology

### YES, Call Ecology

Oil / Hazardous materials

Anything discharge into stream, wetland, or lake

Dirty water from large construction site (>1 acre)

### NO, Don't Call Ecology

Other than Oil / Hazardous materials, contained in MS4

Water line breaks and when BMPs are used

Dirty water from small construction site

## Illicit Discharge/Spill

### *(Fill out IDDE/Spill form)*

Any discharge to MS4 that is not composed entirely of stormwater or of non-stormwater discharges allowed as specified in this permit.

## MS4 (Municipal Separated Storm Sewer System)

Any conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains.

# ***Surface Water Crew***

## ***Spill Response Procedures***

- NOTIFY**
  - ✓ Hotline (x3900)
  
- IDENTIFY:**
  - ✓ **Who** is spiller/source?
  - ✓ **What** is it (odor, color, placards, and amount)?
  - ✓ **When** (date and time)?
  - ✓ **Where** is it going (storm conveyance)?
  
- RESPOND (*PUBLIC OR PRIVATE?*):**
  - ✓ **Stop the Source**
  - ✓ **Contain**
    - Personal Protective Equipment (gloves, boots, eye wear, upwind)
    - Public Safety (cones, caution tape, traffic control)
    - Spill Kit (pads, booms, granular, plastic bags, drain cover, floor mat)
  - ✓ **Sample** (if needed)
    - Sampling Procedures (Whirl-pak bags)
  - ✓ **Cleanup**
    - Spill Kit (pads, booms, granular, plastic bags, drain cover, floor mat)
    - Equipment (Eductor Truck, Sweeper, Vendor List)
  - ✓ **Disposal**
    - Disposal Procedures
  
- REGULATORY NOTIFICATION**
  - ✓ IDDE/Spill form
  - ✓ Spill Notification List
  
- REPORT:**
  - ✓ Complete IDDE/Spill Form

# SPILL NOTIFICATION LIST

*Responsible party is given 1<sup>st</sup> priority to clean-up & notify. If unknown responsible party or no response and threat to public infrastructure or environment, COK clean up and notify regulatory agencies.*

**Life & Safety, Traffic Control Assistance:** x 911

## All Spills in Storm System:

- City of Kirkland Spill Hotline (Maintenance Center – Storm Crew): 425-587-3900
- Surface Water Team (see below - Seppo, Jenny, or Ryeann-Marie)  
Seppo: 206-300-6905    Jenny: 425-587-3850    Ryeann-Marie: 425-466-1801
- Ecology -ERTS (Notification Only or Request Help) 425-649-7000

## Spills of Oil or Hazardous Materials in Storm System:

*Ask Department of Ecology Spill Responder if need to notify:*

- Emergency Management Division (EMD) 800-258-5990
- National Response Center (NRC) 800-424-8802

## Additional Notifications:

### Spill to Public Street/Sidewalk/ROW:

- Streets & Grounds 425-587-3900

### Spill to Public Access:

- Department of Health (300' public access ) (DOH) 360-789-8962

### Additional Spills Materials and/or Spills to Lake WA:

- KC Marine Unit – Dispatch 206-296-3311

### Discharge to Juanita or Totem Lake Sanitary:

- Northshore Utility District 425-398-4402

### Fish or Wildlife Kill:

- WA State Department of Fish and Wildlife 425-775-1311

### Natural Gas Odor or Leak:

- Puget Sound Energy 888-225-5773

### Release to Air:

- Puget Sound Clean Air Agency 206-343-8800

### Major Disruption to Public Service, City Property Damage, Crime, Fire, Public Health Threat, or Critical Injury/Death:

- Marie Stake or City Manager Designee (office) 425-587-3021  
(cell) 425-984-7078

# Spill Response Contractors

## General Spill Response

Business	Contact Number (24/7)	Response Time
Bravo	425-424-9000	1-1.5 hrs
Davidson-Macri	425-864-2215	1-3 hrs
Emerald Services	<b>206-832-3000</b> Frank Flanagan: 206-795-0916 Leanne Lyon: 206-491-3334 Chris Stuart: 206-713-5142	1-2 hrs
Everson's Econo-Vac	206-730-3183	1-2 hrs
Mar Vac	contract not signed yet	1-2 hrs

## General Spill Response

Business	Contact Number (Business Hours Only)	Response Time
Whirlwind Services	contract not signed yet	1-2 hrs

## Gasoline & Hazmat Spills

Business	Contact Number (24/7)	Response Time
Emerald Services	<b>206-832-3000</b> Frank Flanagan: 206-795-0916 Leanne Lyon: 206-491-3334 Chris Stuart: 206-713-5142	1-2 hrs
Everson's Econo-Vac	206-730-3183	1-2 hrs
Mar Vac	contract not signed yet	1-2 hrs

### Things to mention when calling a contractor:

- \* Location of discharge (street, drains, stream, lake)
- \* Texture/Type of material (liquid, viscous, gasoline)
- \* Size (approximate in gallons)

# Waste Disposal Procedures

## Double bag waste materials:

Type of Waste	Waste Material Disposal Method
Oil	Everything together in one bag (e.g., booms, pads, X-Sorb, Fiber-Sorb, Kitty Litter)
Hazardous Materials (e.g., antifreeze, oil-based paint, gasoline)	<ul style="list-style-type: none"><li>• Booms, Pads, &amp; X-Sorb – bag together</li><li>• Fiber-Sorb– bag by itself</li><li>• Kitty Litter – bag by itself</li></ul>
Buckets & containers of any material (e.g., gasoline, paint, degreaser)	Leave in bucket or container – no additional bagging needed

**\*\*\*Waste material should not be dripping. If so, add more absorbent\*\*\***

## Label the bag:

- Your name
- Your contact number
- Your dept.
- Date
- Address (location picked-up)
- Description of material (e.g., oil)

## Leave bag, bucket, or container of waste material on secondary containment in front of drums, which is located next to the City of Kirkland Fleet Shop, 904 8<sup>th</sup> St.

**\*\*\*\*\*YARD STAFF WILL PLACE WASTE IN DRUMS\*\*\*\*\***



## Call Larry McLean's (425-587-3921) voice mail, leave the following information:

- Your name
- Your contact number
- Your department
- Date
- Address (location material picked-up)
- Description of material (e.g., oil)



# Sampling Guidelines for Field Turbidity & pH (black case)

**Turbidity** – To measure turbidity, a light beam is passed through a sample. A sensor measures the amount of light that is scattered by the particles in the sample. The more particles that are in the sample, the higher the reading (turbidity) will be. Soil/sediment, wastewater material, or algal growth can influence turbidity.

## 1. **Prep Turbidity Meter:**

- a) Turn on meter by pressing the ON/OFF button.
- b) When screen show “- - - -”, it is ready to test.

## 2. **Collect sample:**





- a) With turbidity meter on-site, use sample bottles (in black case) –
  - i) Rinse sample bottle 3 times with sample before collecting final sample. Dump any waste sample downstream of sample site.
  - ii) Collect sample within top 6” of the flowing section of water level. This is a surface sample. Fill sample bottle up to just above white line but leaving enough air on top to shake sample bottle, if needed.
  - iii) Place black lid on sample bottle.
- b) Without turbidity meter on-site, use Whirl-pak bags –
  - i) Tear off top of bag along perforation just before sampling. Do not touch inside of bag.
  - ii) Hold two white pull tabs, place bag opening facing upstream.
  - iii) Fill bag  $\frac{3}{4}$  full from within top 6” of the flowing section of water level.
  - iv) Pull on the wire tabs to close bag. Continue holding the wire tabs and flip the bag over at least 4-6 times quickly to seal bag. Leave extra air in bag.
  - v) Fold the ends of the wire tabs together at the top of bag, twist together for forming a loop.

## 3. **Analyze sample:**

- a) If collected the sample using Whirl-pak bag, agitate Whirl-pak bag sample. **Rinse sample bottle (in black case) with Whirl-pak bag sample.** Fill sample bottle up to just above white line but leaving enough air on top to shake sample bottle, if needed. Place black lid on sample bottle.
- b) Allow bubbles in sample bottle to escape before analyze. You may need to gently tap sides of the sample bottle to eliminate bubbles.
- c) Use Curvette Wipes to clean off any debris, fingerprints, and oil, or anything else on sample bottle that could alter turbidity reading.
- d) Place sample in meter. Notch on black lid of sample should match up with arrow on meter.
- e) Press the READ button on meter.
- f) Meter will display SIP (Sample in Process).
- g) Turbidity value will display after approx. 25 seconds. **Take 2 readings, write down both readings.**
- h) If any ERROR message display, see page 20 of manual (located in case).

**pH** – Water Quality Standards for fresh water pH: 6.5 – 8.5 (173.201A WAC)

- Acidic (less than 7). Examples: vinegar and lemon  
or
- Basic (more than 7). Examples: Laundry detergents, concrete, or ammonia

1. Remove cap (white crystals might grow around lid – completely safe).
2. Press  to turn meter on.
3. **First, rinse probe with sample. Then, place meter in clean container or Whirl-pak bag of sample.**
4. Stir meter gently in sample at first, then let reading stabilize.
5. To hold reading, press . Screen will flash HO once and then display measurement with blinking (pH) unit.  
Press  again to cancel hold mode. **Take 2 readings – write down both readings.**
6. Rinse probe well with DI water (in black case) before taking new sample reading.
7. Press  to turn meter off.

### **IMPORTANT**

**\*\*Surface Water Staff will routinely calibrate meters (see yellow notebook in lab). If sample readings seem to drift, meters might need to be re-calibrated. See calibration instructions in manual (in black case) or you can call Surface Water Staff for assistance.\*\***

November 2014  
Updated last on 4/21/14 RMT

# Sampling Guidelines for Lab Analysis

**Follow these procedures if you feel compliance may be an issue.**

**PPE:** Wear PVC or Latex gloves, eye wear, knee or hip boots, or hip waders.

**Fecal Bacteria** - Sample Collection using preservative filled bottle:

1. Label bottles with specific sample location, date, and your initials (e.g., 123 5<sup>th</sup> Ave, 9/3/13, RMT). RMT)
2. Enter stream down-current and sample facing upstream to avoid disturbing the sample.
3. Remove lid, keep lid facing down to prevent collection of fallen debris.
4. Avoid touching inside of bottle and inside of cap. Avoid collecting debris. If do, LEAVE in sample.
5. At 45 degree angle facing upstream, place bottle at least one inch below surface and fill to shoulder of bottle.
  - a. Remember bottles contain preservative. Do not overfill! If do, note on chain of custody (COC) or use new sample bottle.
  - b. Try to sample below top inch of sample source but avoid disturbing sediment. If shallow, sample top layer and note on COC.
6. Remove bottle from sample source, replace cap.
7. **Store sample in cooler on ice (ice packs in freezer or buy at store).**
8. Complete COC, including all samples taken with matching labels from labeled bottles (see box below).
9. Transport to a certified lab for analysis (see back for list of certified labs). **Holding time for a bacteria sample is 24-hrs.**

**Turbidity** - Use Whirl-pak bags

1. Label bags with specific sample location, date, and your initials (e.g., 123 5<sup>th</sup> Ave, 9/3/13, RMT).
2. Tear off top of bag along perforation just before sampling. Do not touch inside of bag.
3. Hold two white pull tabs, place bag opening facing upstream.
4. Fill bag  $\frac{3}{4}$  full from top 6" of the flowing section of water level.
5. Pull on the wire tabs to close bag. Continue holding the wire tabs and flip the bag over at least 4-6 times quickly to seal bag. Leave extra air in bag.
6. Fold the ends of the wire tabs together at the top of bag, twist together forming a loop.
7. Complete COC, including all samples taken with matching labels from Whirl-pak bag and any comments from sampling (see box below).



Fecal Bacteria bottle

Whirl-pak bag

**Comments for Chain of Custody (COC) form:**

- Date of sample
- Time of sample
- If overfill sample
- If pour some sample out
- If shallow sample source
- Suspect high bacteria count
- Stagnant (vary slow moving water) water

**Collect and keep the following documents:**

- Chain of Custody (COC – yellow copy)
- Photographs of sampling or site location
- IDDE form – Summary of actions

**NOTIFY SURFACE WATER TEAM SAMPLE SUBMITTED**

# IDDE /Spill Form

**Person filling out form:** \_\_\_\_\_ **Date:** \_\_\_\_\_ **Time of call:** \_\_\_\_\_

**IDENTIFY:**

**Weather:**  Sunny  Overcast  Raining  Snowing **Time arrived on-site:** \_\_\_\_\_

**Referral Source:**  Public/Hotline  Standby  COK Crew  Emergency Service (Fire/Police)  COK Parks  
 Direct (Spiller)  Ecology  COK Construction Inspector  Other \_\_\_\_\_

**Address/Intersection:** \_\_\_\_\_

**CALLER NAME:** \_\_\_\_\_ **CALLER NUMBER:** \_\_\_\_\_

**SPILLER NAME:** \_\_\_\_\_ **SPILLER NUMBER:** \_\_\_\_\_

**Source/Cause of Spill:**  Unknown  City Activity  Private Property

**Material:**  OIL/HAZARDOUS  Water Break  Food Waste  Soap  Sewage  Construction  Unknown

**Quantity:**  < 1 Gallons  1-5 Gallons  > 5 Gallons

**Discharge to:**  Storm Drain  Ditch  Pond  Stream  Wetland  Lake  Streets  Sidewalk  Other

**RESPOND:**

**Photos?** **Samples taken:**  Whirlpak Bag  Turbidity  pH  Fecal

**Location Sample taken:** \_\_\_\_\_

**Stormwater BMPs**  dechlor mat  gravel bag  filter fabric  waddle  sod  other

**Spill Kit/Materials**  pad  boom  loose absorbent  Fiber Sorb  X-sorb  kitty litter  waddle

**Equipment Used**  vactor #cb \_\_\_\_\_ #mh \_\_\_\_\_ other \_\_\_\_\_  sweeper

**NOTIFICATION: \*\*Need HELP Anytime, Call Ecology \*\***

<b><u>YES, Call Ecology</u></b>	<b><u>NO, Don't Call Ecology</u></b>
Oil / Hazardous materials	Other than Oil / Hazardous materials, contained in MS4
Anything discharge into stream, wetland, or lake	Water line breaks when BMPs are used
Dirty water from large construction site (>1 acre)	Dirty water from small construction site

**Ecology Notified (425-649-7000):**  **Need Help or Oil/Hazardous Material**  **Notification Only**

**ERTS #** \_\_\_\_\_ **State Incident # (after-hours)** \_\_\_\_\_

**Ask Ecology Spill Responder if you should call the following:**

Emergency Management Division Notified?  Yes  No      National Response Center Notified?  Yes  No

-----Reference Regulatory List (See Spill Notification List)-----

- Ryeann-Marie (425-466-1801)**       Seppo (206-300-6905)       Jenny (425-587-3850)
- Ecology (425-649-7000 - ERTS)       Emergency Management Division (800-258-5990)
- National Response Center (800-424-8802)       King County Department of Health (360-789-8962)

-----**Complete form and put in Spills inbox located in crew area**-----



# Outreach & Education

- **Drainage Maintenance Contractors**
- **Code – Prohibited and Allowed Discharges**
- **Storm Drain Markers**
- **Car Washing Options**
- **Hazardous Waste Disposal**

Issuance Date: August 1, 2012  
Effective Date: August 1, 2013  
Expiration Date: July 31, 2018

# Western Washington Phase II Municipal Stormwater Permit

National Pollutant Discharge Elimination System and  
State Waste Discharge General Permit  
for discharges from Small Municipal Separate Storm Sewers  
in Western Washington

**State of Washington**  
**Department of Ecology**  
Olympia, Washington 98504-7600

In compliance with the provisions of  
The State of Washington Water Pollution Control Law  
Chapter 90.48 Revised Code of Washington  
and  
The Federal Water Pollution Control Act  
(The Clean Water Act)  
Title 33 United States Code, Section 1251 et seq.

Until this permit expires, is modified, or revoked, Permittees that have properly obtained coverage under this permit are authorized to discharge to waters of the state in accordance with the special and general conditions which follow.

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Kelly Susewind, P.E., P.G.  
Water Quality Program Manager  
Department of Ecology

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## SPECIAL CONDITIONS

### S1. PERMIT COVERAGE AREA AND PERMITTEES

#### A. Geographic Area of Permit Coverage

This Permit is applicable to owners or operators of regulated small municipal separate storm sewer systems (MS4s) located west of the eastern boundaries of the following counties: Whatcom, Skagit, Snohomish, King, Pierce, Lewis and Skamania.

1. For all cities required to obtain coverage under this permit, the geographic area of coverage is the entire incorporated area of the city.

2. For all counties required to have coverage under this Permit, the geographic area of coverage is the urbanized areas and urban growth areas associated with permitted cities under the jurisdictional control of the county. -The geographic area of coverage also includes any urban growth area contiguous to permitted urbanized areas under the jurisdictional control of the county.

For Whatcom County, the geographic area of coverage also includes the unincorporated Birch Bay urban growth area.

2.3. For sSecondary pPermittees required to obtain coverage under this permit, the minimum geographic area of coverage is all areas identified under S1.A.1 and S1.A.2. -At the time of permit coverage, Ecology may establish a geographic area of coverage specific to an individual sSecondary pPermittee.

3.4. All regulated small MS4s owned or operated by the pPermittees named in S1.D.2.a-(i) and (ii),-and -S1.D.2.b and located in another city or county area requiring coverage under this permit oreither the *Phase I Municipal Stormwater Permit* or the *Eastern Washington Phase II Municipal Stormwater Permit* are also covered under this permit.

#### B. Regulated Small Municipal Separate Storm Sewer Systems (MS4s)

All operators of regulated small ~~municipal separate storm sewer systems~~ (MS4s) are required to apply for and obtain coverage under this Permit or be permitted under a separate individual permit, unless waived or exempted in accordance with condition S1.C.

1. A regulated small MS4:

- a. Is a “Small MS4” as defined in the *Definitions and Acronyms* section at the end of this Permit; and
- b. Is located within, or partially located within, an urbanized area as defined by the latest decennial census conducted by the U.S. Bureau of Census, or

- designated by ~~the Department Ecology~~ pursuant to 40 CFR 123.35(b) or 40 CFR 122.26(f); and
- c. Discharges stormwater from the MS4 to a surface water of Washington State; and
  - d. Is not eligible for a waiver or exemption under S1.C. below.
2. All other operators of MS4s, including special purpose districts, which meet the criteria for a regulated small MS4 shall obtain coverage under this Permit. Other operators of ~~small MS4s~~~~municipal separate storm sewers~~ may include, but are not limited to: flood control, or diking and drainage districts, schools including universities, and correctional facilities that own or operate a small MS4 serving non-agricultural land uses.
  3. Any other operators of small MS4s may be required by ~~the Department Ecology~~ to obtain coverage under this permit or an alternative NPDES permit if ~~the Department Ecology~~ determines the small MS4 is a significant source of pollution to surface waters of the state. -Notification of ~~the Department Ecology~~'s determination that permit coverage is required will be through the issuance of an Administrative Order issued in accordance with RCW 90.48.
  4. The owner or operator of a regulated small MS4 may obtain coverage under this Permit as a ~~p~~Permittee, ~~e~~C~~o~~-permittee, or ~~s~~Secondary ~~p~~Permittee as defined in S1.D.1. below.
  5. Pursuant to 40 CFR 122.26(f), any person or organization may petition Ecology to require that additional ~~municipal separate storm sewers~~~~small MS4s~~ obtain coverage under this ~~p~~Permit. -The process for petitioning Ecology is:
    - a. The person or organization shall submit a complete petition in writing to Ecology. -A complete petition shall address each of the relevant factors for petitions outlined on Ecology's website.
    - b. In making its determination on the petition, Ecology may request additional information from either the petitioner or the ~~jurisdiction entity that is the subject of the petition~~.
    - c. Ecology will make a final determination on a complete petition within 180 days of receipt of the petition and inform both the petitioner and the ~~MS4~~~~municipal separate storm sewer~~ of the decision, in writing.
    - d. If Ecology's final determination is that the candidate ~~MS4~~~~municipal separate storm sewer~~ will be regulated, Ecology will issue an order to the ~~operator of the MS4~~~~municipal separate storm sewer~~ requiring them to obtain coverage under this Permit. -The order will specify:
      - i. The geographic area of permit coverage for the ~~MS4~~~~municipal separate storm sewer system~~;

- ii. Any modified dates or deadlines for developing and implementing ~~this Permit Stormwater Management Program in S5. or S6.~~, as appropriate to the ~~MS4municipal separate storm sewer system~~, and for submitting their first annual report; and
  - iii. A deadline for the operator of the ~~MS4municipal separate storm sewer system~~ to submit a complete Notice of Intent (see Appendix 5) to Ecology.
- C. Owners and operators of an otherwise regulated small MS4 are not required to obtain coverage under this Permit if:
1. The small MS4 is operated by:
    - a. ~~The~~ federal entity, including any department, agency or instrumentality of the executive, legislative, and judicial branches of the Federal government of the United States. government on military bases or other federal lands; or by the United States Military, the Bureau of Land Management, the United States Park Service or other federal agencies;
    - b. Federally recognized Indian Tribes located within Indian Country ~~Lands,~~ including all trust or restricted lands within the 1873 Survey Area of the Puyallup Tribe of Indians; or
    - c. The Washington State Department of Transportation.

or:
  2. The portions of the small MS4 located within the census defined urban area(s) serve a total population of less than 1000 people and a, b, and c, below all apply:
    - a. The small MS4 is not contributing substantially to the pollutant loadings of a physically interconnected MS4 that is regulated by the NPDES stormwater program.
    - b. The discharge of pollutants from the small MS4 ~~has~~ not been identified as a cause of impairment of any water body to which the MS4 discharges.
    - c. In areas where an EPA approved TMDL has been completed, stormwater controls on the MS4 have not been identified as being necessary.

In determining the total population served, both resident and commuter populations shall be included. -For example:

    - For publicly operated school complexes including universities and colleges the total population served would include the sum of the average annual student enrollment plus staff.

- For flood control, diking, and drainage districts the total population served would include residential population and any non-residents regularly employed in the areas served by the small MS4.

D. Obtaining coverage under this Permit

All operators of regulated small MS4s are required to apply for and obtain coverage in accordance with this section, unless waived or exempted in accordance with section S1.C.

1. Permittees: ~~u~~Unless otherwise noted, the term “Permittee” shall include a city, town or county Permittee, New Permittee, Co-Permittee, ~~and~~ Secondary Permittee, and New Secondary Permittee as defined below:
  - a. “Permittee” is a city, town, or county owning or operating a regulated small MS4 applying and receiving a permit as a single entity.
  - b. “New Permittee” is a city, town or county that is subject to the *Western Washington Phase II Municipal Stormwater General Permit* and was not subject to the permit prior to August 1, 2013.
  - ~~b.c.~~ “Co-Permittee” is any owner or operator of a regulated small MS4 that is applying jointly in a cooperative agreement with at least one other applicant for coverage under this Permit. ~~Co-Permittees own or operate a regulated small MS4 located within or adjacent in proximity to another regulated small MS4.~~
  - d. A “Secondary Permittee” is an operator of a regulated small MS4 that is not a city, town or county. Secondary Permittees include special purpose districts and other MS4s that meet the criteria for a regulated small MS4 in S1.B. above.
  - ~~e.e.~~ “New Secondary Permittee” is a Secondary Permittee that is covered under a municipal stormwater general permit and was not covered by the permit prior to August 1, 2013.
2. Operators of regulated small MS4s have submitted or shall submit to Ecology either an individual application to the Department Notice of Intent (NOI) for Coverage under National Pollutant Discharge Elimination System (NPDES) Municipal Stormwater General Permit provided in Appendix 5 or a Duty to Reapply - Notice of Intent (NOI). Applications submitted after January 17, 2007 must be made using the NOI provided in Appendix 5. The NOI is also available on Ecology’s website.
  - ~~a. All cities, towns and counties listed in i and ii below and operating regulated small MS4s shall apply as either a Permittee or Co-Permittee.~~

- i. ~~Cities of: Aberdeen, Algona, Anacortes, Arlington, Auburn, Bainbridge Island, Battle Ground, Bellevue, Bellingham, Black Diamond, Bonney Lake, Bothell, Bremerton, Brier, Buckley, Burien, Burlington, Camas, Centralia, Clyde Hill, Covington, Des Moines, DuPont, Duvall, Edgewood, Edmonds, Enumelaw, Everett, Federal Way, Ferndale, Fife, Firerest, Gig Harbor, Granite Falls, Issaquah, Kelso, Kenmore, Kent, Kirkland, Lacey, Lake Forest Park, Lake Stevens, Lakewood, Longview, Lynnwood, Maple Valley, Marysville, Medina, Mercer Island, Mill Creek, Milton, Monroe, Mountlake Terrace, Mount Vernon, Mukilteo, Newcastle, Normandy Park, Oak Harbor, Olympia, Orting, Pacific, Port Orchard, Port Angeles, Poulsbo, Puyallup, Redmond, Renton, Sammamish, SeaTac, Sedro Woolley, Shoreline, Snohomish, Steilacoom, Sumner, Tukwila, Tumwater, University Place, Vancouver, Washougal, Woodinville, and Yarrow Point.~~
- ii. ~~Counties: Cowlitz, Kitsap, Thurston, Skagit, and Whateom.~~
- b. ~~All other **regulated small MS4s** shall apply as a Secondary Permittee or as a Co-Permittee.~~
- e.a. ~~The following **Permittees and Secondary Permittees** ~~cities, towns and counties~~ submitted ~~either an application or a *Duty to Reapply - NOI* for coverage~~ to Ecology prior to ~~August 19, 2011~~ January 17, 2007:~~

  - i. ~~Cities and towns: Aberdeen, Algona, Anacortes, Arlington, Auburn, Bainbridge Island, Battle Ground, Bellevue, Bellingham, Black Diamond, Bonney Lake, Bothell, Bremerton, Brier, Buckley, Burien, Burlington, Camas, Centralia, Clyde Hill, Covington, Des Moines, DuPont, Duvall, Edgewood, Edmonds, Enumclaw, Everett, Federal Way, Ferndale, Fife, Fircrest, Gig Harbor, Granite Falls, Issaquah, Kelso, Kenmore, Kent, Kirkland, Lacey, Lake Forest Park, Lake Stevens, Lakewood, Longview, Lynnwood, Maple Valley, Marysville, Medina, Mercer Island, Mill Creek, Milton, Monroe, Mountlake Terrace, Mount Vernon, Mukilteo, Newcastle, Normandy Park, Oak Harbor, Olympia, Orting, Pacific, Port Orchard, Port Angeles, Poulsbo, Puyallup, Redmond, Renton, Sammamish, SeaTac, Sedro-Woolley, Shoreline, Snohomish, Steilacoom, Sumner, Tukwila, Tumwater, University Place, Vancouver, Washougal, and Woodinville, ~~and Yarrow~~~~
  - i. ~~\_\_\_\_\_~~
  - ii. ~~Point~~
  - ii. ~~Cou~~Counties: Cowlitz, Kitsap, Thurston, Skagit, and Whatcom.
  - iii. ~~Secondary Permittees: Bainbridge Island School District #303, Bellingham School District, Bellingham Technical College,~~

Cascadia College, Central Kitsap School District, Centralia College, Clark College, Consolidated Diking Improvement District #1 of Cowlitz County, Edmonds Community College, Evergreen College, Highline Community College, Kelso School District, Kent School District, Longview School District, Lower Columbia College, Port of Anacortes, Port of Bellingham, Port of Olympia, Port of Skagit County, Port of Vancouver, Skagit County Drainage District #19, Skagit Valley College, University of Washington Bothell, Washington State University Vancouver, Washington State General Administration (Capitol Campus), Washington Department of Corrections, Western Washington University, and Whatcom Community College.

~~d.b.~~ All operators of regulated small MS4s located in jurisdictions listed in S1.D.2.a. have submitted or shall submit to Ecology a *Notice of Intent (NOI) for Coverage under National Pollutant Discharge Elimination System (NPDES) Municipal Stormwater General Permit provided in Appendix 5* NOI or individual permit application before the effective date of this permit, with the following exceptions:

- i. Operators of regulated small MS4s located in the Cities of Lynden and Snoqualmie Aberdeen, Anacortes, Centralia, Oak Harbor, and Port Angeles shall submit a NOI or application to Ecology no later than 30 days after the effective date of this permit.
- ii. Operators of regulated small MS4s listed in S1.D.2.~~ea.~~ do not need to submit a new application to be covered under this permit.

~~e.~~ For operators of regulated small MS4s listed in S1.D.2.~~ea.~~, coverage under this permit is automatic and begins on the effective date of this permit, unless:

- ~~i.~~ The operator chooses to reapply before the effective date of this permit; or
- ~~ii.~~ The operator will be relying on another entity to satisfy one or more of their permit obligations in accordance with S1.D.2.g. and S1.D.3.d. below; or
- ~~iii.~~ The operator chooses to be a Co-Permittee in accordance with S1.D.2.f. and S1.D.3.c. below; or

~~f.c.~~ The operator chooses to opt out of this General Permit. Any operator of a regulated small MS4 that is opting out of this permit shall submit an application for an individual MS4 permit in accordance with 40 CFR 122.33(b)(2)(ii) no later than the effective date of this permit.

~~g.d.~~ Operators of regulated small MS4s which want to be covered under this permit as Co-Permittees shall each submit a NOI to Ecology ~~a joint NOI~~.

~~h.e.~~ Operators of regulated small MS4s which are relying on another entity to satisfy ~~one or more~~ all of their permit obligations shall submit a NOI to Ecology.

i.f. Operators of small MS4s designated by Ecology pursuant to S1.B.3. of this permit shall submit a NOI to Ecology within 120 days of receiving notification from Ecology that permit coverage is required.

3. Application Requirements

a. ~~NOIs shall be submitted to:~~

~~Department of Ecology  
Water Quality Program  
Municipal Stormwater Permits  
P.O. Box 47696  
Olympia, WA 98504-7696~~

b.a. For NOIs submitted after ~~January 17, 2007~~ the issuance date of this Permit, the ~~permit~~ applicant shall ~~provide public notice of the application in accordance with WAC 173-226-130(5). The applicant or co-applicant shall~~ include a certification that the public notification requirements of WAC 173-226-130(5) have been satisfied. ~~Unless Ecology responds will notify applicants~~ in writing of their status concerning coverage under this Permit ~~will be effective 6~~ within 90 days ~~after of Ecology's~~ receipt of a complete NOI. ~~A complete NOI shall include the certification of public notice.~~

e.b. Each Permittees applying as ~~ea~~ Co-applicants-Permittee shall submit a ~~joint~~ NOI provided in Appendix 5. ~~The joint NOI shall clearly identify the areas of the MS4 for which each of the eCo-Permittee applicants are is~~ responsible.

d.c. Permittees relying on another entity or entities to satisfy one or more of their permit obligations shall notify Ecology in writing. The notification shall include a summary of the permit obligations that will be carried out by another entity. ~~The summary shall identify the other entity or entities and shall be signed by the other entity or entities. During the term of the permit, permittees may terminate or amend shared responsibility arrangements by notifying Ecology, provided this does not alter implementation deadlines.~~

e.d. Secondary ~~p~~ Permittees required to ~~have obtain~~ coverage under this Permit, and the Phase I Municipal Stormwater Permit or the Eastern Washington Phase II Municipal Stormwater Permit NPDES and State Waste Discharge Permit for Discharges from Small Municipal Separate Storm Sewers in Eastern Washington or the NPDES and State Waste Discharge Permit for Discharges from Large and Medium Municipal Separate Storm Sewers, may obtain coverage by submitting a single NOI.



## S2. AUTHORIZED DISCHARGES

- A. This Permit authorizes the discharge of stormwater to surface waters and to ground waters of the state from ~~MS4s~~~~municipal separate storm sewer systems~~ owned or operated by each Permittee covered under this permit, in the geographic area covered pursuant to S1.A. -These discharges are subject to the following limitations:
1. Discharges to ground waters of the state through facilities regulated under the Underground Injection Control (UIC) program, ~~C~~chapter 173-218 WAC, are not ~~covered~~~~authorized~~ under this Permit.
  2. Discharges to ground waters not subject to regulation under the federal Clean Water Act are ~~covered~~~~authorized~~ in this permit only under state authorities, ~~C~~chapter 90.48 RCW, the Water Pollution Control Act.
- B. This Permit authorizes discharges of non-stormwater flows to surface waters and to ground waters of the state from ~~municipal separate storm sewer system~~~~MS4s~~ owned or operated by each Permittee covered under this permit, in the geographic area covered pursuant to S1.A, only under one or more of the following conditions:
1. The discharge is authorized by a separate ~~National Pollutant Discharge Elimination System~~ (NPDES) or State Waste Discharge permit.
  2. The discharge is from emergency fire fighting activities.
  3. The discharge is from another illicit or non-stormwater discharge that is managed by the Permittee as provided in Special Condition S5.C.3.~~b~~ or S6.C.3.~~b~~.
- These discharges are also subject to the limitations in S2.A.1~~7~~ and S.2.A.2~~7~~ above.
- C. This Permit does not relieve entities that cause illicit discharges, including spills, of oil or hazardous substances, from responsibilities and liabilities under state and federal laws and regulations pertaining to those discharges.
- D. Discharges from ~~municipal separate storm sewers~~~~MS4s~~ constructed after the effective date of this permit shall receive all applicable state and local permits and use authorizations, including compliance with ~~C~~chapter 43.21C RCW (the State Environmental Policy Act).
- E. This Permit does not authorize discharges of stormwater to waters within Indian ~~Reservations~~Country or to waters subject to water quality standards of Indian Tribes, including portions of the Puyallup River and other waters on trust or restricted lands within the 1873 Survey Area of the Puyallup Tribe of Indians Reservation, except where authority has been specifically delegated to Ecology by the U.S. Environmental Protection Agency. -The exclusion of such discharges from this Permit does not waive any rights the State may have with respect to the regulation of the discharges.

### S3. RESPONSIBILITIES OF PERMITTEES

- A. Each Permittee covered under this Permit is responsible for compliance with the terms of this Permit for the regulated small MS4s that they own or operate. Compliance with (1) or (2) below is required as applicable to each pPermittee, whether the pPermittee has applied for coverage as a pPermittee, eCo-pPermittee, or sSecondary pPermittee.
1. All city, town and county pPermittees are required to comply with all conditions of this Permit, including any appendices referenced therein, except for Special Condition S6 Stormwater Management Program for Secondary Permittees.
  2. All sSecondary pPermittees are required to comply with all conditions of this Permit, including any appendices referenced therein, except for ~~Special Conditions S8.C. Monitoring and~~ section S5 Stormwater Management Program for Cities, Towns and Counties [and S8.B, S8.C, and S8.D Monitoring.](#)
- B. Permittees may rely on another entity to satisfy one or more of the requirements of this Permit. -Permittees that are relying on another entity to satisfy one or more of their permit obligations remain responsible for permit compliance if the other entity fails to implement permit conditions. -Permittees may rely on another entity provided all the requirements of 40 CFR 122.35(a) are satisfied, including but not limited to:
1. The other entity, in fact, implements the Permit requirements.
  2. The other entity agrees to take on responsibility for implementation of the Permit requirement(s) as indicated on the NOI.

### S4. COMPLIANCE WITH STANDARDS

- A. In accordance with RCW 90.48.520, the discharge of toxicants to waters of the state of Washington which would violate any water quality standard, including toxicant standards, sediment criteria, and dilution zone criteria is prohibited. The required response to such discharges is defined in section S4.F., below.
- B. This Permit does not authorize a discharge which would be a violation of Washington State Surface Water Quality Standards (chapter 173-201A WAC), Ground Water Quality Standards (chapter 173-200 WAC), Sediment Management Standards (chapter 173-204 WAC), or human health-based criteria in the national Toxics Rule (Federal Register, Vol. 57, NO. 246, Dec. 22, 1992, pages 60848-60923). The required response to such discharges is defined in section S4.F., below.
- C. The Permittee shall reduce the discharge of pollutants to the maximum extent practicable (MEP).
- D. The Permittee shall use all known, available, and reasonable methods of prevention, control and treatment (AKART) to prevent and control pollution of waters of the state of Washington.

- E. In order to meet the goals of the Clean Water Act, and comply with S4.A., S4.B., S4.C., and S4.D., each Permittee shall comply with all of the applicable requirements of this Permit as identified in S3 Responsibilities of Permittees.
- F. A Permittee remains in compliance with S4. despite any discharges prohibited by S4.A. or S4.B., when the Permittee undertakes the following response toward long-term water quality improvement:
1. A Permittee shall notify Ecology in writing within 30 days of becoming aware, based on credible site-specific information, that a discharge from the ~~MS4 municipal separate storm sewer~~ owned or operated by the Permittee is causing or contributing to a known or likely violation of Water Quality Standards in the receiving water. Written notification provided under this subsection shall, at a minimum, identify the source of the site-specific information, describe the nature and extent of the known or likely violation in the receiving water, and explain the reasons why the MS4 discharge is believed to be causing or contributing to the problem. For ongoing or continuing violations, a single written notification to Ecology will fulfill this requirement.
  2. In the event that Ecology determines, based on a notification provided under S4.F.1. or through any other means, that a discharge from an ~~an MS4 municipal separate storm sewer~~ owned or operated by the Permittee is causing or contributing to a violation of Water Quality Standards in a receiving water, Ecology will notify the Permittee in writing that an adaptive management response outlined in S4.F.3. below is required, unless: ~~Ecology also determines that~~
    - a. ~~(a) Ecology also determines that~~ the violation of Water Quality Standards is already being addressed by a Total Maximum Daily Load (TMDL) or other enforceable water quality cleanup plan; or
    - a.b. ~~(b)~~ Ecology concludes the MS4 contribution to the violation will be eliminated through implementation of other permit requirements.
- 2.3. Adaptive Management Response
- a. Within 60 days of receiving a notification under S4.F.2., or by an alternative date established by Ecology, the Permittee shall review its Stormwater Management Program (SWMP) and submit a report to Ecology. The report shall include:
    - i. A description of the operational and/or structural BMPs that are currently being implemented to prevent or reduce any pollutants that are causing or contributing to the violation of Water Quality Standards, including a qualitative assessment of the effectiveness of each best management practice (BMP).
    - ii. A description of potential additional operational and/or structural BMPs that will or may be implemented in order to apply AKART on

a site-specific basis to prevent or reduce any pollutants that are causing or contributing to the violation of Water Quality Standards.

- iii. A description of the potential monitoring or other assessment and evaluation efforts that will or may be implemented to monitor, assess, or evaluate the effectiveness of the additional BMPs.
- iv. A schedule for implementing the additional BMPs including, as appropriate: funding, training, purchasing, construction, monitoring, and other assessment and evaluation components of implementation.
- b. Ecology will, in writing, acknowledge receipt of the report within a reasonable time and notify the Permittee when it expects to complete its review of the report. - Ecology will either approve the additional BMPs and implementation schedule or require the Permittee to modify the report as needed to meet AKART on a site-specific basis. -If modifications are required, Ecology will specify a reasonable time frame in which the Permittee shall submit and Ecology will review the revised report.
- c. The Permittee shall implement the additional BMPs, pursuant to the schedule approved by Ecology, beginning immediately upon receipt of written notification of approval.
- d. The Permittee shall include with each subsequent annual report a summary of the status of implementation and the results of any monitoring, assessment or evaluation efforts conducted during the reporting period. If, based on the information provided under this subsection, Ecology determines that modification of the BMPs or implementation schedule is necessary to meet AKART on a site-specific basis, the Permittee shall make such modifications as Ecology directs. - In the event there are ongoing violations of water quality standards despite the implementation of the BMP approach of this section, the Permittee may be subject to compliance schedules to eliminate the violation under WAC 173-201A-510(4) and WAC 173-226-180 or other enforcement orders as Ecology deems appropriate during the term of this permit.
- e. A TMDL or other enforceable water quality cleanup plan that has been approved and is being implemented to address the MS4's contribution to the Water Quality Standards violation supersedes and terminates the S4.F.3 implementation plan.
- e.f. Provided the Permittee is implementing the approved adaptive management response under this section, the Permittee remains in compliance with Condition S4., despite any on-going violations of Water Quality Standards identified under S4.F.A or B above.
- f.g. The adaptive management process provided under Section S.4.F is not intended to create a shield for the Permittee from any liability it may face under 42 U.S.C. 9601 *et seq.* or [RCW-chapter 70.105D](#) [RCW](#).

- G. Ecology may modify or revoke and reissue this General Permit in accordance with G14 General Permit Modification and Revocation, if Ecology becomes aware of additional control measures, management practices or other actions beyond what is required in this Permit that are necessary to:
1. Reduce the discharge of pollutants to the MEP,
  2. Comply with the state AKART requirements, or
  3. Control the discharge of toxicants to waters of the State of Washington.

## S5. STORMWATER MANAGEMENT PROGRAM FOR CITIES, TOWNS AND COUNTIES

A. Each Permittee shall develop and implement a Stormwater Management Program (SWMP). A SWMP is a set of actions and activities comprising the components listed in ~~S5.B. and S5.C.1. through S5.C.5.~~, and any additional actions necessary, to meet the requirements of applicable TMDLs pursuant to S7 Compliance with TMDL Requirements, and S8 Monitoring and Assessment. ~~The SWMP shall be designed to reduce the discharge of pollutants from the regulated small MS4 to the maximum extent practicable and to protect water quality.~~ This section applies to all cities, towns and counties covered under this Permit, including cities, towns and counties that are eCo-permittees. ~~Where the term "Permittee" is used in this section the requirements apply to all cities, towns and counties covered under this Permit.~~

New Permittees subject to this permit as described in S1.D.1.b shall fully meet the requirements in S5 as modified in footnotes below, or as specified in an alternate schedule as a condition of coverage by Ecology. Permittees obtaining coverage after the issuance date of this permit shall fully meet the requirements in S5 as specified in an alternate schedule as a condition of coverage by Ecology.

1. ~~The SWMP shall be developed and implemented in accordance with the schedules contained in this section and shall be fully developed and implemented no later than 180 days prior to the expiration date of this Permit.~~ At a minimum the Permittee's SWMP shall be implemented throughout the geographic area subject to this Permit as described in S1.A.<sup>1</sup>
2. Each Permittee shall prepare written documentation of the SWMP, called the SWMP Plan. ~~The SWMP Plan documentation~~ shall be organized according to the program components in S5.C. or a format approved by Ecology, and shall be updated at least annually for submittal with the Permittee's annual reports to Ecology (see S9 Reporting and Record Keeping). ~~The SWMP Plan documentation~~ shall be written to inform the public of the planned SWMP activities for the upcoming calendar year, and shall include a description of:

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<sup>1</sup> New Permittees shall fully develop and implement the SWMP in accordance with the schedules contained in this section no later than February 2, 2018.

- a. ~~A description of p~~Planned activities for each of the program components included in S5.C., ~~and~~
  - ~~Any additional actions implemented by the Permittee pursuant to S5.C., and~~
  - b. Any additional planned actions ~~necessary~~ to meet the requirements of applicable TMDLs pursuant to S7 Compliance with Total Maximum Daily Load Requirements.
  - ~~b.c.~~ Any additional planned actions to meet the requirements of S8 Monitoring.
3. The SWMP shall include an ongoing program for gathering, tracking, maintaining, and using information to evaluate SWMP development, implementation and permit compliance and to set priorities.
  - a. ~~Beginning no later than January 1, 2009, e~~Each Permittee shall track the cost or estimated cost of development and implementation of each component of the SWMP.<sup>2</sup> This information shall be provided to Ecology upon request.
  - b. Each Permittee shall track the number of inspections, official enforcement actions and types of public education activities as ~~stipulated~~required by the respective program component. This information shall be included in the annual report.
- ~~4. The SWMP described herein supersedes SWMP descriptions provided by permit applicants in individual applications submitted to the Department prior to the effective date of this permit.~~
- ~~4. Notwithstanding the schedules for implementation of SWMP components contained in this permit, Permittees that are already implementing some or all of the SWMP components in this section shall continue implementation of existing stormwater management programs until they begin implementation of the updated stormwater management program in accordance with the terms of this permit, including implementation schedules. those components of their SWMP~~
  - ~~Permittees shall not repeal existing local requirements to control stormwater that go beyond the requirements of this permit for new development and redevelopment sites.~~
5. Coordination among ~~p~~Permittees
  - a. Coordination among entities covered under municipal stormwater NPDES permits may be necessary to comply with certain conditions of the SWMP. The SWMP should include, when needed, coordination mechanisms

<sup>2</sup> New Permittees shall begin implementing the requirements of S5.A.3.a no later than August 1, 2015.

among entities covered under a municipal stormwater NPDES permit to encourage coordinated stormwater-related policies, programs and projects within adjoining or shared areas, including:-

- i. Coordination mechanisms ~~shall~~ clarify roles and responsibilities for the control of pollutants between physically interconnected MS4s ~~permittees~~ covered by a municipal stormwater permit.
  - ii. ~~Coordinating mechanisms shall coordinate~~ stormwater management activities for shared water bodies among ~~p~~Permittees to avoid conflicting plans, policies and regulations.
- b. The SWMP ~~should~~shall include coordination mechanisms among departments within each jurisdiction to eliminate barriers to compliance with the terms of this permit. Permittees shall include a written description of internal coordination mechanisms in the Annual Report due no later than March 31, 2015.

~~A.B.~~ The SWMP shall be designed to reduce the discharge of pollutants from regulated small MS4s to the ~~maximum extent practicable (MEP)~~, meet state AKART requirements, and protect water quality. ~~Notwithstanding the schedules for implementation of SWMP components contained in this Permit, permittees who are implementing some or all of the SWMP components in this section shall continue implementation of those components of their SWMP.~~

~~B.C.~~ The SWMP shall include the components listed below. To the extent allowable under state or federal law, all components are mandatory for city, town or county ~~p~~Permittees covered under this ~~P~~Permit. ~~In accordance with 40 CFR 122.35(a) and Special Condition S3, a city, town or county may rely on another entity to implement one or more of the components in this section.~~

1. Public Education and Outreach

The SWMP shall include an education and outreach program ~~designed aimed at residents, businesses, industries, elected officials, policy makers, planning staff and other employees of the Permittee. The goal of the education program is to~~ reduce or eliminate behaviors and practices that cause or contribute to adverse stormwater impacts and encourage the public to participate in stewardship activities. ~~An~~The education program may be developed and implemented locally or regionally.

The minimum performance measures are:

- a. ~~No later than two years after the effective date of this Permit, the~~Each Permittee shall provide an education and outreach program for the area served by the MS4. The ~~outreach~~ program shall be designed to educate target audiences about the stormwater problem and provide specific

~~actions they can follow to minimize the problem.<sup>3</sup> achieve measurable improvements in the target audience's understanding of the problem and what they can do to solve it.~~

i. ~~Education and outreach efforts shall be prioritized to target~~To build general awareness, Permittees shall select from the following target audiences and subject areas:

(a) ~~General public, (including school age children), and businesses, (including home-based and mobile businesses)~~

- ~~General impacts of stormwater flows into~~on surface waters.
- ~~Impacts from impervious surfaces.~~
- Impacts of illicit discharges and how to report them.
- Low impact development (LID) principles and LID BMPs.
- Opportunities to become involved in stewardship activities.
- ~~Source control BMPs and environmental stewardship actions and opportunities in the areas of pet waste, vehicle maintenance, landscaping and buffers.~~

~~(2)(b)~~Engineers, contractors, developers and land use planners

- Technical standards for stormwater site and erosion control plans.
- LID principles and LID BMPs.
- Stormwater treatment and flow control BMPs/facilities.

ii. To effect behavior change, Permittees shall select from the following target audiences and BMPs:

(a) ~~General public (which may include school age children), businesses, (including home-based and mobile businesses)~~

- ~~BMPs for u~~Use and storage of automotive chemicals, hazardous cleaning supplies, carwash soaps and other hazardous materials.

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<sup>3</sup> New Permittees shall begin implementing the requirements of S5.C.1 no later than August 1, 2015.



- ~~Impacts of illicit discharges and how to report them.~~Equipment maintenance.

- Prevention of illicit discharges.

(b) ~~Homeowners~~Residents, landscapers and property managers/owners

- Yard care techniques protective of water quality.

- ~~BMPs for u~~Use and storage of pesticides and fertilizers and other household chemicals.

- ~~BMPs for e~~Carpet cleaning and auto repair and maintenance.

- Vehicle, equipment and home/building maintenance.

- Pet waste management and disposal.

- ~~Low-Impact-Development principles and LID BMPs.techniques, including site design, pervious paving, retention of forests and mature trees.~~

- Stormwater pond~~facility~~ maintenance.

- Dumpster and trash compactor maintenance.

- ~~\_\_\_\_\_~~

b. ~~Engineers, contractors, developers, review staff and land use planners~~

- ~~Technical standards for stormwater site and erosion control plans.~~

- ~~Low Impact Development techniques, including site design, pervious paving, retention of forests and mature trees.~~

b. ~~Stormwater treatment and flow control BMPs.~~Each Permittee shall create stewardship opportunities and/or partner with existing organizations to encourage residents to participate in activities such as stream teams, storm drain marking, volunteer monitoring, riparian plantings and education activities.

c. Each Permittee shall measure the understanding and adoption of the targeted behaviors for at least one targeted audience in at least one subject area. No later than February 2, 2016, Permittees shall use ~~the~~ resulting measurements ~~shall be used~~ to direct education and outreach resources most effectively, as well as to evaluate changes in adoption of the targeted

behaviors.<sup>4</sup> Permittees may meet this requirement individually or as a member of a regional group.

~~d. Each Permittee shall track and maintain records of public education and outreach activities.~~

2. Public Involvement and Participation

Permittees ~~The SWMP~~ shall ~~include~~provide ongoing opportunities for public involvement and participation through advisory councils, public hearings, watershed committees, participation in developing rate-structures, ~~stewardship programs, environmental activities~~ or other similar activities. Each Permittee shall comply with applicable State and local public notice requirements when developing elements of their SWMP.

The minimum performance measures are:

a. ~~No later than one year from the effective date of this Permit, all p~~Permittees shall create opportunities for the public to participate in the decision-making processes involving the development, implementation and update of the Permittee's entire SWMP.<sup>5</sup> ~~Each Permittee shall develop and implement a process for consideration of public comments on their SWMP.~~

b. Each Permittee shall post on their website ~~make~~ their SWMP Plan, and the annual report required under S9.A ~~and all other submittals required by this Permit, available to the public no later than May 31 each year. All other submittals shall be available to the public upon request. The annual report, and SWMP that was submitted with the latest annual report, shall be posted on the permittee's website.~~ To comply with the posting requirement, a pPermittee that does not maintain a website may submit the updated SWMP in electronic format to Ecology~~the Department~~ for posting on ~~the Department~~Ecology's website.

3. Illicit Discharge Detection and Elimination

The SWMP shall include an ongoing program designed to prevent, detect, characterize, trace and eliminate~~and remove~~ illicit connections and illicit discharges into the MS4, as defined in 40 CFR 122.26(b)(2), including any spills not under the purview of another responding authority, into the municipal

<sup>4</sup> By no later than August 1, 2017, New Permittees shall begin using the results of measurements to direct education and outreach resources more effectively, as well as to evaluate changes in adopted behaviors.

<sup>5</sup> New Permittees shall develop and begin to implement requirements of S5.C.2.a no later than August 1, 2014.

~~separate storm sewers owned or operated by the Permittee. Permittees shall fully implement an ongoing illicit discharge detection and elimination program no later than 180 days prior to the expiration date of this Permit.~~

The minimum performance measures are:

a. ~~Mapping of the MS4 municipal storm sewer system map shall continue on an ongoing basis.~~<sup>6</sup> ~~be developed no later than four years from the effective date of this permit. Municipal storm sewer system MS4 maps shall be periodically updated. At a minimum, maps and~~ shall include the following information:

~~i. The location of all known MS4 municipal separate storm sewer outfalls.~~

~~ii. and Receiving waters, other than ground water, and s~~

~~iii. structural stormwater treatment and flow control BMPs/facilities owned, or operated, or maintained by the Permittee. Each Permittee shall map the attributes listed below~~

~~iv. Tributary conveyances for all known storm sewer outfalls with a 24 inch nominal diameter or larger, or an equivalent cross-sectional area for non-pipe systems. The following attributes shall be mapped:~~

- ~~• Tributary conveyances (indicate type, material, and size where known).~~

- ~~• Associated drainage areas.~~

- ~~•~~

- ~~• Land use.~~

~~v. Each Permittee shall initiate a program to develop and maintain a map of a~~ All connections to the MS4 municipal separate storm sewer authorized or allowed by the Permittee after February 16, 2007.<sup>7</sup> ~~the effective date of this Permit.~~

~~vi. Geographic areas served by the Permittee's MS4 that do not discharge stormwater to surface waters.~~

~~vii. To the extent consistent with national security laws and directives,~~ Each Permittee shall make available to Ecology; upon request,

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<sup>6</sup> New Permittees shall meet the requirements to map the MS4 according to S5.C.3.a no later than August 1, 2017, except where otherwise noted in this section.

<sup>7</sup> New Permittees shall meet the requirements of S5.C.3.a.v. after August 1, 2013 for all connections to the MS4 authorized after August 1, 2013.

~~municipal storm sewer system~~MS4 map(s) depicting the information required in S5.C.3.a.i- through ~~ii~~vi above. -The preferred format ~~for mapping of submission~~ will be an electronic format with fully described mapping standards. -An example description is ~~available provided~~ on Ecology ~~website~~WebPages under Core Services, GIS Data.

~~v~~.viii. Upon request, and to the extent appropriate, ~~p~~Permittees shall provide mapping information to ~~federally-recognized Indian Tribes, municipalities, and other~~ Permittees. ~~This permit does not preclude Permittees from recovering reasonable costs associated with fulfilling mapping information requests by -federally-recognized Indian Tribes, municipalities, and other~~ Permittees.

b. Each Permittee shall ~~develop and~~ implement an ordinance or other regulatory mechanism to effectively prohibit non-stormwater, illicit discharges into the Permittee's ~~MS4municipal separate storm sewer system~~ to the maximum extent allowable under ~~S~~state and ~~F~~federal law.<sup>8</sup> ~~The ordinance or other regulatory mechanism shall be adopted no later than 30 months from the effective date of this Permit.~~

i. Allowable Discharges: The regulatory mechanism does not need to prohibit the following categories of non-stormwater discharges:

- Diverted stream flows-
- Rising ground waters-
- Uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20))-
- Uncontaminated pumped ground water-
- Foundation drains-
- Air conditioning condensation-
- Irrigation water from agricultural sources that is commingled with urban stormwater-
- Springs-
- Uncontaminated wWater from crawl space pumps-
- Footing drains-
- Flows from riparian habitats and wetlands-

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<sup>8</sup> New Permittees shall meet the requirements of S5.C.3.b no later than February 2, 2016.

- Non-stormwater discharges ~~covered~~authorized by another NPDES or state waste discharge permit.
  - Discharges from emergency fire fighting activities in accordance with S2 Authorized Discharges.
- ii. Conditionally Allowable Discharges: The regulatory mechanism ~~shall~~may allow ~~prohibit~~ the following categories of non-stormwater discharges ~~unless~~only if the stated conditions are met:
- Discharges from potable water sources, including but not limited to water line flushing, hyperchlorinated water line flushing, fire hydrant system flushing, and pipeline hydrostatic test water. Planned discharges shall be de-chlorinated to a total residual chlorine concentration of 0.1 ppm or less, pH-adjusted, if necessary, and volumetrically and velocity controlled to prevent re-suspension of sediments in the MS4.
  - Discharges from lawn watering and other irrigation runoff. These discharges shall be minimized through, at a minimum, public education activities (see section S5.C.1) and water conservation efforts.
  - Dechlorinated swimming pool, spa and hot tub discharges. The discharges shall be dechlorinated to a total residual chlorine concentration of 0.1 ppm or less, pH-adjusted and reoxygenized if necessary, volumetrically and velocity controlled to prevent re-suspension of sediments in the MS4. Discharges shall be thermally controlled to prevent an increase in temperature of the receiving water. -Swimming pool cleaning wastewater and filter backwash shall not be discharged to the MS4.
  - Street and sidewalk wash water, water used to control dust, and routine external building wash-down that does not use detergents. -The Permittee shall reduce these discharges through, at a minimum, public education activities (see section S5.C.1) and/or water conservation efforts. -To avoid washing pollutants into the MS4, Permittees ~~must~~shall minimize the amount of street wash and dust control water used. ~~-At active construction sites, street sweeping must be performed prior to washing the street.~~
  - Other non-stormwater discharges. -The discharges shall be in compliance with the requirements of a ~~stormwater~~ pollution prevention plan reviewed by the Permittee, which addresses control of such discharges.

~~iii. The Permittee's SWMP shall, at a minimum, address each category in ii above in accordance with the conditions stated therein.~~

~~iv.iii.~~ The Permittee SWMP shall further address any category of discharges in (i) or (-ii) above if the discharges are identified as significant sources of pollutants to waters of the State.

~~v.iv.~~ The ordinance or other regulatory mechanism shall include escalating enforcement procedures and actions.

v. The Permittee shall ~~develop~~ implement a compliance and enforcement strategy that includes informal compliance actions such as public education and technical assistance as well as ~~and implement~~ the enforcement provisions of the ordinance or other regulatory mechanism. To implement an effective compliance strategy, the Permittee's ordinance or other regulatory mechanism may need to include the following tools:

- The application of operational and/or structural source control BMPs for pollutant generating sources associated with existing land uses and activities where necessary to prevent illicit discharges. The source control BMPs referenced in this subsection are in Volume IV of the 2012 Stormwater Management Manual for Western Washington, or an equivalent manual approved by Ecology under the 2013 Phase I Permit.
- The maintenance of stormwater facilities which discharge into the Permittee's MS4 in accordance with maintenance standards established under S5.C.4 and/or S5.C.5 where necessary to prevent illicit discharges.

vi. The Permittee's ordinance or other regulatory mechanism in effect as of the effective date of this permit shall be revised if necessary to meet the requirements of this section no later than February 2, 2018.

c. Each Permittee shall ~~develop and~~ implement an ongoing program designed to detect and identify ~~detect and address~~ non-stormwater discharges, ~~including spills,~~ and illicit connections ~~into the Permittee's MS4.~~<sup>9</sup> municipal separate storm sewer system. The program shall ~~be fully implemented no later than 180 days prior to the expiration date of this Permit and shall include~~ the following components:

i. Procedures for conducting investigations of the Permittee's MS4, including field screening and methods for ~~to~~ identifying potential sources. ~~locating priority areas likely to have illicit discharges,~~

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<sup>9</sup> New Permittees shall fully implement the requirements of S5.C.3.c no later than February 2, 2018, except where otherwise noted in this section.

~~including at a minimum: evaluating land uses and associated business/industrial activities present; areas where complaints have been registered in the past; and areas with storage of large quantities of materials that could result in spills.~~

- ~~ii. Field assessment activities, including visual inspection of priority outfalls identified in i, above, during dry weather and for the purposes of verifying outfall locations, identifying previously unknown outfalls, and detecting illicit discharges.~~
- ~~• Receiving waters shall be prioritized for visual inspection no later than three years from the effective date of this Permit, with field assessments of three high priority water bodies made no later than four years from the effective date of this Permit. Field assessments on at least one high priority water body shall be made each year thereafter.~~

~~The Permittee shall implement a field screening methodology appropriate to the characteristics of the MS4 and water quality concerns. Screening for illicit connections shall may be conducted using: *Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments*, Center for Watershed Protection, October 2004, or another methodology of comparable or improved effectiveness. The Permittee shall document the field screening methodology in the relevant Annual Report.~~

~~All Permittees, except for the City of Aberdeen, shall complete field screening for at least 40% of the MS4 no later than December 31, 2017,<sup>10</sup> and on average 12% each year thereafter. The City of Aberdeen shall complete field screening for at least 40% of the system no later than June 30, 2018 and on average 12% each year thereafter.~~

- ~~ii. A publicly listed and publicized hotline or other telephone number for public reporting of spills and other illicit discharges.<sup>11</sup>~~
- ~~iii. An ongoing training program for all municipal field staff, who, as part of their normal job responsibilities, might come into contact with or otherwise observe an illicit discharge and/or illicit connection to the MS4, on the identification of an illicit discharge and/or connection, and on the proper procedures for reporting and responding to the illicit discharge and/or connection. Follow-up~~

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<sup>10</sup> ~~New Permittees shall complete S5.C.3.c.i requirements for field screening covering at least 12% of the MS4 within the Permittee's coverage area no later than December 31, 2017, and on average 12% each year thereafter.~~

<sup>11</sup> ~~New Permittees shall implement the requirements of S5.C.3.c.ii no later than August 1, 2015.~~

training shall be provided as needed to address changes in procedures, techniques, requirements, or staffing. Permittees shall document and maintain records of the trainings provided and the staff trained.<sup>12</sup>

iv. ~~Material to~~ Permittees shall inform public employees, businesses, and the general public of hazards associated with illicit discharges and improper disposal of waste.<sup>13</sup>

d. Each Permittee shall implement an ongoing program designed to address illicit discharges, including spills and illicit connections, into the Permittee's MS4.<sup>14</sup> The program shall include:

~~i.~~ Procedures for characterizing the nature of, and potential public or environmental threat posed by, any illicit discharges found by or reported to the Permittee. ~~Procedures shall~~ address the evaluation of ~~include detailed instructions for evaluating~~ whether the discharge must be immediately contained and steps to be taken for containment of the discharge.

~~i.~~ ~~Compliance with this provision shall be achieved by investigating (or referring to the appropriate agency) within 7 days, on average, any complaints, reports or monitoring information that indicates a potential illicit discharge, including spills; and immediately investigating (or referring) problems and violations determined to be emergencies or otherwise judged to be urgent or severe.~~

~~ii.~~ Procedures for tracing the source of an illicit discharge; including visual inspections, and when necessary, opening manholes, using mobile cameras, collecting and analyzing water samples, and/or other detailed inspection procedures.

~~ii.~~

iii. Procedures for ~~removing the source of~~ eliminating the discharge; including notification of appropriate authorities; notification of the property owner; technical assistance ~~for eliminating the discharge~~; follow-up inspections; and use of the compliance strategy developed pursuant to S5.C.3.b.v, including escalating enforcement and legal actions if the discharge is not eliminated.

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<sup>12</sup> New Permittees shall develop and begin implementing the ongoing training program described in S5.C.3.c.iii no later than February 2, 2016.

<sup>13</sup> New Permittees shall inform public employees, businesses, and the general public of hazards associated with illicit discharges no later than February 2, 2017.

<sup>14</sup> New Permittees shall fully develop and implement the requirements of S5.C.3.d no later than February 2, 2018.



iv. Compliance with the provisions in (i), (ii), and (iii), above, shall be achieved by meeting the following timelines:

- Immediately respond to all illicit discharges, including spills, which are determined to constitute a threat to human health, welfare, or the environment, consistent with General Condition G3.
  - Investigate (or refer to the appropriate agency with the authority to act) within 7 days, on average, any complaints, reports or monitoring information that indicates a potential illicit discharge.
  - Initiating an investigation within 21 days of any report or discovery of a suspected illicit connection to determine the source of the connection, the nature and volume of discharge through the connection, and the party responsible for the connection.
  - Upon confirmation of thean illicit nature of a storm drain connection, Permittees shall use their the compliance strategy enforcement authority in a documented effort to eliminate the illicit connection within 6 months. All known illicit connections to the MS4 shall be eliminated.
- ~~d. Permittees shall inform public employees, businesses, and the general public of hazards associated with illegal discharges.~~
- ~~i. No later than 180 days prior to the expiration date of this Permit, distribute appropriate information to target audiences identified pursuant to S5.C.1.~~
  - ~~ii. No later than two years from the effective date of this Permit, publicly list and publicize a hotline or other local telephone number for public reporting of spills and other illicit discharges. Keep a record of calls received and follow up actions taken in accordance with S5.C.3.c.ii. through v. above; include a summary in the annual report (see section S9 Reporting and Record Keeping Requirements).~~
- e. Permittees shall train staff who are responsible for identification, investigation, termination, cleanup, and reporting of illicit discharges, including spills, and illicit connections, to conduct these activities. Follow-up training shall be provided as needed to address changes in procedures, techniques, requirements or staffing. Permittees shall document and maintain records of the training provided and the staff trained.<sup>15</sup>
- ~~e. Recordkeeping: Permittees shall track and maintain records of the activities conducted to meet the requirements of this section. Permittees~~

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<sup>15</sup> New Permittees shall meet the requirements of S5.C.3.e no later than February 2, 2016.

~~shall adopt and implement procedures for program evaluation and assessment, including tracking the number and type of illicit discharges, including spills, identified; inspections made; and any feedback received from public education efforts. A summary of this information shall be included in the Permittee's annual report (see section S9 Reporting and Recordkeeping Requirements).~~

~~f. Each Permittee will provide appropriate training for municipal field staff on the identification and reporting of illicit discharges into MS4s.~~

~~g. No later than thirty months after the effective date of this Permit, each Permittee shall ensure that all municipal field staff who are responsible for identification, investigation, termination, cleanup, and reporting illicit discharges, including spills, and illicit connections are trained to conduct these activities. Follow-up training shall be provided as needed to address changes in procedures, techniques or requirements. Permittees shall document and maintain records of the training provided and the staff trained.~~

~~f. No later than three years after the effective date of this Permit, an ongoing training program shall be developed and implemented for all municipal field staff, which, as part of their normal job responsibilities, might come into contact with or otherwise observe an illicit discharge or illicit connection to the storm sewer system shall be trained on the identification of an illicit discharge/connection, and on the proper procedures for reporting and responding to the illicit discharge/connection. Follow-up training shall be provided as needed to address changes in procedures, techniques or requirements. Permittees shall document and maintain records of the training provided and the staff trained.~~

4. Controlling Runoff from New Development, Redevelopment and Construction Sites

Each Permittee shall ~~develop,~~ implement, and enforce a program to reduce pollutants in stormwater runoff to a regulated small MS4 from new development, redevelopment and construction site activities. ~~This program shall be applied to all sites that disturb a land area 1 acre or greater, including projects less than one acre that are part of a larger common plan of the development or sale.~~ The program shall apply to private and public development, including roads.<sup>16</sup> ~~The "Technical Thresholds" in Appendix I shall be applied to all sites 1 acre or greater, including projects less than one acre that are part of a larger common plan of the development or sale.~~

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<sup>16</sup> New permittees shall meet the requirements of S5.C.4 no later than December 31, 2017, except where otherwise specified in this section.

The minimum performance measures are:

a. ~~The program shall include~~implement an ordinance or other enforceable mechanism that addresses runoff from new development, redevelopment, and construction site projects. ~~Pursuant to S5.A.4., in adopting this ordinance or other regulatory mechanism, existing local requirements to apply stormwater controls at smaller sites, or at lower thresholds than required pursuant to S5.C.4., shall be retained. Except for Permittees in Lewis and Cowlitz counties and the City of Aberdeen, T~~the ordinance or other enforceable mechanism to implement (i) through (iii), below, shall be adopted and effective no later than ~~February 16, 2010~~December 31, 2016. ~~The local program adopted to meet the requirements of S5.C.5.a(i) through (iii), below shall apply to all applications<sup>17</sup> submitted on or after January 1, 2017 and shall apply to projects approved prior to January 1, 2016~~7, which have not started construction<sup>18</sup> by January 1, 2022<sup>19</sup>.

For permittees in Lewis and Cowlitz counties the ordinance or other enforceable mechanism to implement (i) through (iii), below, shall be adopted and effective no later than June 30, 2017. The local program adopted to meet the requirements of S5.C.5.a(i) through (iii), below shall apply to all applications submitted on or after July 1, 2017 and shall apply to projects approved prior to July 1, 2017, which have not started construction by June 30, 2022.

For the City of Aberdeen the ordinance or other enforceable mechanism to implement (i) through (iii), below, shall be adopted and effective no later than June 30, 2018. The local program adopted to meet the requirements of S5.C.5.a(i) through (iii), below shall apply to all applications submitted on or after July 1, 2018 and shall apply to projects approved prior to July 1, 2018, which have not started construction by June 30, 2023.

The ordinance or other enforceable mechanism shall include, at a minimum:

- i. The Minimum Requirements, ~~technical~~ thresholds, and definitions in Appendix 1 or a ~~program~~equivalent approved by Ecology under

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<sup>17</sup> In this context, “application” means, at a minimum a complete project description, site plan, and, if applicable, SEPA checklist. Permittees may establish additional elements of a completed application.

<sup>18</sup> In this context “started construction” means the site work associated with, and directly related to the approved project has begun. For example: grading the project site to final grade or utility installation. Simply clearing the project site does not constitute the start of construction. Permittees may establish additional requirements related to the start of construction.

<sup>19</sup> New Permittees shall meet the requirements of S5.C.4.a no later than December 31, 2017. The local program shall apply to all applications submitted on or after January 1, 2018 and shall apply to projects approved prior to -January 1, 2018, which have not started construction by January 1, 2023.

the 2013 NPDES Phase I Municipal Stormwater Permit, for new development, redevelopment, and construction sites. -Adjustment and variance criteria equivalent to those in Appendix 1 shall be included. -More stringent requirements may be used, and/or certain requirements may be tailored to local circumstances through the use of Ecology-approved basin plans or other similar water quality and quantity planning efforts. -Such local requirements and thresholds shall provide equal protection of receiving waters and equal levels of pollutant control to those provided in Appendix 1.

ii. The local requirements shall include the following requirements, limitations, ~~A site planning process and BMP selection~~ and ~~design~~ criteria that, when used to implement the minimum requirements in Appendix 1 (or ~~equivalent program~~ approved by Ecology under the 2013 Phase I Permit) will protect water quality, reduce the discharge of pollutants to the MEP, maximum extent practicable and satisfy the State requirement under ~~Chapter~~ 90.48 RCW to apply ~~all known, available and reasonable methods of prevention, control and treatment~~ (AKART) prior to discharge.:

(a) Site planning requirements

~~(a) BMP selection criteria~~

(b)

~~(b) BMP design criteria~~

(c)

~~(c) BMP infeasibility criteria~~

(d)

~~(d) LID competing needs criteria~~

(e)

(f) BMP limitations

Permittees shall document how the criteria and requirements will protect water quality, reduce the discharge of pollutants to the MEP maximum extent practicable, and satisfy State AKART requirements.

Permittees who choose to use the requirements, limitations, site planning process and BMP selection and design and criteria above in the ~~2005~~2012 *Stormwater Management Manual for Western Washington*, or a ~~program equivalent manual~~ approved by ~~the Department~~Ecology under the 2013 Phase I Permit, may cite this choice as their sole documentation to meet this requirement.

~~ii.iii.~~ The legal authority, through the approval process for new development and redevelopment, to inspect and enforce maintenance standards for private stormwater facilities approved under the provisions of this section that discharge to the Permittee's MS4.

~~iii.~~ Provisions to allow non-structural preventive actions and source reduction approaches such as Low Impact Development Techniques (LID), measures to minimize the creation of impervious surfaces and measures to minimize the disturbance of native soils and vegetation. Provisions for LID should take into account site conditions, access and long-term maintenance.

~~iv.~~ If the Permittee chooses to allow construction sites to apply the "Erosivity Waiver" in Appendix 1, Minimum Requirement #2, the ordinance or regulatory mechanism shall include appropriate, escalating enforcement sanctions for construction sites that provide notice to the Permittee of their intention to apply the waiver but do not meet the requirements (including timeframe restrictions, limits on activities that result in non-stormwater discharges, and implementation of appropriate BMPs to prevent violations of water quality standards) to qualify for the waiver.

~~a-b.~~ The program shall include a permitting process with site plan review, inspection and enforcement capability to meet the standards listed in (i) through (iv) below, for both private and public projects, using qualified personnel (as defined in *Definitions and Acronyms*). At a minimum, this program shall be applied to all sites that meet the minimum thresholds adopted pursuant to S5.C.4.a.i, above. disturb a land area 1 acre or greater, including projects less than one acre that are part of a larger common plan of the development or sale. The process shall be in place no later than February 16, 2010.

~~i.~~ Except as provided in S5.C.4.b.vii. below, rReview of all stormwater site plans for proposed development activities.

~~ii.~~ Except as provided in S5.C.4.b.vii. below, iInspect, prior to clearing and construction, all permittedknown development sites that have a high potential for sediment transport as determined through plan review based on definitions and requirements in Appendix 7 Determining Construction Site Sediment Damage Potential. -As an alternative to evaluating each site according to Appendix 7, Permittees may choose to inspect all construction sites that meet the minimum thresholds adopted pursuant to S5.C.4.a.i, above.

~~iii.~~ Except as provided in S5.C.4.b.vii. below, iInspect all known permitted development sites during construction to verify proper installation and maintenance of required erosion and sediment controls. -Enforce as necessary based on the inspection.

- iv. Inspect all permitted development sites upon completion of construction and prior to final approval or occupancy to ensure proper installation of permanent ~~stormwater controls such as~~ stormwater facilities ~~and structural BMPs. Verify that. Also, verify a~~ maintenance plan is completed and responsibility for maintenance is assigned for stormwater treatment and flow control BMPs/facilities. Enforce as necessary based on the inspection.
- v. Compliance with the inspection requirements in (ii), (iii) and (iv) ~~z~~ above, shall be determined by the presence and records of an established inspection program designed to inspect all sites. Compliance during this permit term shall be determined by achieving at least 80% of scheduled inspections.
- ~~vi.~~ An enforcement strategy shall be developed and implemented to respond to issues of non-compliance.
- ~~vi.~~ If the Permittee chooses to allow construction sites to apply the “Erosivity Waiver” in Appendix 1, Minimum Requirement #2, the Permittee is not required to review the construction stormwater pollution prevention plans as part of the site plan review in (i) above, and is not required to perform the construction phase inspections identified in (ii) and (iii) above related to construction sites which are eligible for the erosivity waiver.
- b.c. The program shall include provisions to verify adequate long-term operation and maintenance (O&M) of ~~post-construction~~ stormwater treatment and flow control BMPs/facilities and BMPs that are permitted and constructed pursuant to (b) above. Except for Permittees located in Lewis or Cowlitz Counties and the City of Aberdeen, these provisions shall be in place no later than December 31, 2016.<sup>20</sup> For Permittees in Lewis and Cowlitz counties, the provisions shall be in place no later than June 30, 2017. For the City of Aberdeen, the provisions shall be in place no later than June 30, 2018. The provisions February 16, 2010 and shall include:
  - i. Adoption/Implementation of an ordinance or other enforceable mechanism that clearly identifies the party responsible for maintenance, requires inspection of facilities in accordance with the requirements in (ii) through (iv) below, and establishes enforcement procedures.
  - ii. Each Permittee shall establish maintenance standards that are as protective or more protective of facility function than those specified in Chapter 4 of Volume V of the ~~2005~~2012 *Stormwater Management*

<sup>20</sup> New Permittees shall meet the requirements of S5.C.4.c no later than December 31, 2017.

*Manual for Western Washington.* For facilities which do not have maintenance standards, the Permittee shall develop a maintenance standard.

The purpose of the maintenance standard is to determine if maintenance is required. -The maintenance standard is not a measure of the ~~facili~~facility' ties required condition at all times between inspections. -Exceeding the maintenance standard between the period of inspections is not a permit violation.

iii. Annual inspections of all stormwater treatment and flow control BMPs/facilities that discharge to the MS4 and were permitted by the Permittee according to S5.C.4.b, including those permitted in accordance with requirements adopted pursuant to the 2007-2012 Ecology municipal stormwater of the permits first issued by Ecology in 2007, unless there are maintenance records to justify a different frequency.

Permittees may reduce the inspection frequency based on maintenance records of double the length of time of the proposed inspection frequency. In the absence of maintenance records, the Permittee may substitute written statements to document a specific less frequent inspection schedule. Written statements shall be based on actual inspection and maintenance experience and shall be certified in accordance with G19 Certification and Signature.

iv. Inspections of all permanent stormwater treatment and flow control BMPs/facilities and catch basins in new residential developments every six months until 90% of the lots are constructed (or when construction is stopped and the site is fully stabilized) to identify maintenance needs and enforce compliance with maintenance standards as needed.

v. Compliance with the inspection requirements in (iii) and (iv) above shall be determined by the presence and records of an established inspection program designed to inspect all sites. Compliance during this permit term shall be determined by achieving at least 80% of scheduled inspections.

~~iii~~.vi. Unless there are circumstances beyond the Permittee's control, when an inspection identifies an exceed~~e~~ance of the maintenance standard, maintenance shall be performed:

- Within 1 year for typical maintenance of facilities, except catch basins.
- Within 6 months for catch basins.

- Within 2 years for maintenance that requires capital construction of less than \$25,000.

Circumstances beyond the Permittee's control include denial or delay of access by property owners, denial or delay of necessary permit approvals, and unexpected reallocations of maintenance staff to perform emergency work. For each exceed~~ea~~nce of the required timeframe, the Permittee ~~must~~shall document the circumstances and how they were beyond their control.

~~iv. Annual inspections of all stormwater treatment and flow control facilities (other than catch basins) permitted by the Permittee according to S5.C.4.b. unless there are maintenance records to justify a different frequency.~~

~~Reducing the inspection frequency shall be based on maintenance records of double the length of time of the proposed inspection frequency. In the absence of maintenance records, the Permittee may substitute written statements to document a specific less frequent inspection schedule. Written statements shall be based on actual inspection and maintenance experience and shall be certified in accordance with G19 Certification and Signature.~~

~~v. Inspections of all new flow control and water quality treatment facilities, including catch basins, for new residential developments that are a part of a larger common plan of development or sale, every 6 months during the period of heaviest house construction (i.e., 1 to 2 years following subdivision approval) to identify maintenance needs and enforce compliance with maintenance standards as needed.~~

~~vi.vii.~~ The program shall include a procedure for keeping records of inspections and enforcement actions by staff, including inspection reports, warning letters, notices of violations, and other enforcement records. ~~Records of maintenance inspections and maintenance activities shall be maintained. Permittees shall keep records of all projects disturbing more than one acre, and all projects of any size that are part of a common plan of development or sale that is greater than one acre that are approved after the effective date of this Permit.~~

~~e.d.~~ The program shall make available as applicable copies of the "Notice of Intent for Construction Activity" and copies of the "Notice of Intent for Industrial Activity" to representatives of proposed new development and redevelopment. ~~Permittees will~~shall continue to enforce local ordinances



controlling runoff from sites that are also covered by stormwater permits issued by Ecology.<sup>21</sup>

e. ~~No later than February 16, 2010, e~~Each Permittee shall ensure~~verify~~ that all staff ~~responsible~~whose primary job duties are for implementing the program to control stormwater runoff from new development, redevelopment, and construction sites, including permitting, plan review, construction site inspections, and enforcement, are trained to conduct these activities. -Follow-up training shall be provided as needed to address changes in procedures, techniques or staffing. -Permittees shall document and maintain records of the training provided and the staff trained.<sup>22</sup>

f. Low impact development code-related requirements.

i. No later than December 31, 2016,<sup>23</sup> Permittees shall review, revise and make effective their local development-related codes, rules, standards, or other enforceable documents to incorporate and require LID principles and LID BMPs. For Permittees in Lewis and Cowlitz counties, the deadline for this requirement is no later than June 30, 2017; for the City of Aberdeen the deadline for this requirement is no later than June 30, 2018.

The intent of the revisions shall be to make LID the preferred and commonly-used approach to site development. The revisions shall be designed to minimize impervious surfaces, native vegetation loss, and stormwater runoff in all types of development situations. Permittees shall conduct a similar review and revision process, and consider the range of issues, outlined in the following document: *Integrating LID into Local Codes: A Guidebook for Local Governments* (Puget Sound Partnership, 20142).

ii. Except for Permittees in Lewis and Cowlitz Counties and the City of Aberdeen, eEach Permittee shall submit a summary of the results of the review and revision process in (i) above with the Annual Rreport due no later than March 31, 2017<sup>24</sup>. Permittees in Lewis and Cowlitz counties shall submit the summary with the annual report due no later than March 31, 2018. The City of Aberdeen shall submit the summary with the Fifth Year annual report. This summary shall include, at a minimum, a list of the participants (job title, brief job description, and department represented), the codes, rules, standards, and other enforceable documents reviewed, and the revisions made to those documents which incorporate

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<sup>21</sup> New Permittees shall meet the requirements of S5.C.4.d beginning no later than August 1, 2013.

<sup>22</sup> New Permittees shall meet the requirements of S5.C.4.e no later than December 31, 2017.

<sup>23</sup> New Permittees shall meet the requirements of S5.C.4.f.i no later than December 31, 2017.

<sup>24</sup> New Permittees shall meet the S5.C.4.f.ii reporting requirement in the annual report covering calendar year 2017 and due no later than March 31, 2018.

and require LID principles and LID BMPs. The summary shall include existing requirements for LID principles and LID BMPs in development-related codes. The ~~description of revisions~~summary shall be organized as follows:

- (a) Measures to minimize impervious surfaces;
- (b) Measures to minimize loss of native vegetation; and
- (c) Other measures to minimize stormwater runoff.

g. Watershed-scale stormwater planning

Each Permittee that has all or part of its coverage area under this Permit in a watershed selected by a Phase I county for watershed-scale stormwater planning under condition S5.C.4.c of the *Phase I Municipal Stormwater General Permit* shall participate with the watershed-scale stormwater planning process led by the Phase I county.<sup>25</sup> ~~As needed and as appropriate, the permittee shall~~This includes:

- i. Provide existing water quality and flow records.
- ii. Provide existing and future land use and zoning maps to facilitate land cover projections.
- iii. Participate in the development of strategies to prevent future and address existing impacts, including:
  - (a) Possible changes in development codes, rules, and standards-
  - (b) Possible changes in land use management plans.
  - (c) Providing land ownership information and drainage conveyance maps to facilitate watershed modeling and regional facility siting.
- iv. Provide monitoring locations.

~~5. Pollution Prevention and Municipal Operations~~ and Maintenance for Municipal Operations

~~Within three years of the effective date of this Permit, e~~Each Permittee shall develop and implement an operations and maintenance (O&M) program that includes a training component and has the ultimate goal of preventing or reducing pollutant runoff from municipal operations.<sup>26</sup>

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<sup>25</sup> For a description of the watershed-scale stormwater planning details, see Special Condition S5.C.5.c of the 2013 *Phase I Municipal Stormwater Permit*.

<sup>26</sup> New Permittees shall develop and implement the requirements of S5.C.5 no later than December 31, 2017 except where otherwise noted in this section.

The minimum performance measures are:

- a. Each Permittee shall ~~establish~~implement maintenance standards that are as protective, or more protective, of facility function than those specified in Chapter 4 of Volume V of the ~~2012~~2015 *Stormwater Management Manual for Western Washington*. ~~For facilities which do not have maintenance standards, the Permittee shall develop a maintenance standard. Except for Permittees located in Lewis and Cowlitz Counties and the City of Aberdeen, no later than December 31, 2016, Permittees shall update their maintenance standards as necessary to meet the requirements of this section.~~<sup>27</sup> For Permittees in Lewis and Cowlitz counties, this requirement shall apply no later than June 30, 2017; for the City of Aberdeen this requirement shall apply no later than June 30, 2018.
  - i. The purpose of the maintenance standard is to determine if maintenance is required. The maintenance standard is not a measure of the facility's required condition at all times between inspections. Exceeding the maintenance standard between inspections and/or maintenance is not a permit violation.
  - ii. Unless there are circumstances beyond the Permittee's control, when an inspection identifies an exceedance of the maintenance standard, maintenance shall be performed:
    - Within 1 year for typical maintenance of facilities, except catch basins.
    - Within 6 months for catch basins.
    - Within 2 years for maintenance that requires capital construction of less than \$25,000.

Circumstances beyond the Permittee's control include denial or delay of access by property owners, denial or delay of necessary permit approvals, and unexpected reallocations of maintenance staff to perform emergency work. For each exceedance of the required timeframe, the Permittee shall document the circumstances and how they were beyond their control.
- b. Annual inspection of all municipally owned or operated permanent stormwater treatment and flow control BMPs/facilities, ~~other than catch basins~~, and taking appropriate maintenance actions in accordance with the

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<sup>27</sup> New Permittees shall adopt the updated maintenance standards in Chapter 4 of Volume V of the 2012 *Stormwater Management Manual for Western Washington* or an Ecology-approved program under the 2013 Phase I Permit no later than December 31, 2017.

adopted maintenance standards.<sup>28</sup> ~~The annual inspection requirement may be reduced based on inspection records.~~

~~Permittees may r~~Reducing the inspection frequency ~~shall be~~ based on maintenance records of double the length of time of the proposed inspection frequency. -In the absence of maintenance records, the Permittee may substitute written statements to document a specific less frequent inspection schedule. -Written statements shall be based on actual inspection and maintenance experience and shall be certified in accordance with G19 Certification and Signature.

- c. Spot checks of potentially damaged permanent stormwater treatment and flow control BMPs/facilities (~~other than catch basins~~) after major storm events (24 hour storm event with a 10 year or greater than 24 hour 10-year recurrence interval rainfall) ~~storm events~~. If spot checks indicate widespread damage/maintenance needs, inspect all stormwater treatment and flow control BMPs/facilities that may be affected. -Conduct repairs or take appropriate maintenance action in accordance with maintenance standards established above, based on the results of the inspections.
- d. Except for the City of Aberdeen, inspection of all catch basins and inlets owned or operated by the Permittee at least once no later than August 1, 2017 and every two years thereafter before the end of the permit term.<sup>29</sup> For the City of Aberdeen, the deadline for this requirement shall be no later than June 30, 2018. Clean catch basins if the inspection indicates cleaning is needed to comply with maintenance standards established in the 201205 *Stormwater Management Manual for Western Washington*. Decant water shall be disposed of in accordance with Appendix 6 *Street Waste Disposal*.

~~As an a~~The following alternatives to the standard approach of inspecting all catch basins once no later than August 1, 2017 and every two years thereafter (except no later than June 30, 2018 and every two years thereafter for the City of Aberdeen) may be applied to all or portions of the system on a “circuit basis.”:

- i. The catch basin inspection schedule of every two years may be changed as appropriate to meet the maintenance standards based on maintenance records of double the length of time of the proposed inspection frequency. In the absence of maintenance records for catch basins, the Permittee may substitute written statements to document a

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<sup>28</sup> New Permittees shall begin annual inspections of municipally owned and operated stormwater treatment and flow control facilities/BMPs no later than December 31, 2017.

<sup>29</sup> New Permittees shall inspect and, if needed, clean all catch basins and inlets owned or operated by the Permittee in accordance with the requirements of S5.C.5.c once during the permit term, to be completed no later than February 2, 2018.

specific, less frequent inspection schedule. Written statements shall be based on actual inspection and maintenance experiences and shall be certified in accordance with G19 Certification and Signature.

~~±~~ii. Inspections at least once by August 1, 2017 and every two years thereafter may be conducted on a “circuit basis” whereby ~~a~~ sampling 25% of catch basins and inlets within each circuit ~~is~~ are inspected to identify maintenance needs. ~~Include in the sampling~~ an inspection of the catch basin immediately upstream of any system outfall, if applicable. ~~Clean all catch basins within a given circuit for which the inspection indicates cleaning is needed to comply with maintenance standards established under S5.C.45.ea-, above.~~

iii. The Permittee may clean all pipes, ditches, catch basins, and inlets within a circuit once during the permit term. Circuits selected for this alternative must drain to a single point. inspect all catch basins, and clean only catch basins where cleaning is needed to comply with maintenance standards.

e. Compliance with the inspection requirements in b, c, and d above shall be determined by the presence of an established inspection program designed to inspect all sites. ~~Compliance during this permit term shall be determined by and achieving an annual rate of~~ at least 95% of inspections, ~~no later than 180 days prior to the expiration date of this permit.~~

f. ~~Establishment and Implementation of~~ practices, policies and procedures to reduce stormwater impacts associated with runoff from all lands streets, parking lots, roads or highways owned or maintained by the Permittee, and road maintenance activities ~~conducted by~~ under the functional control of the Permittee. ~~Lands owned or maintained by the Permittee include, but are not limited to, streets, parking lots, roads, highways, buildings, parks, open space, road right-of-ways, maintenance yards, and stormwater treatment and flow control BMPs/facilities.~~ The following activities shall be addressed:

- Pipe cleaning
- Cleaning of culverts that convey stormwater in ditch systems
- Ditch maintenance
- Street cleaning
- Road repair and resurfacing, including pavement grinding
- Snow and ice control
- Utility installation

- Pavement striping maintenance
  - Maintaining roadside areas, including vegetation management
  - Dust control
  - Application of fertilizers, pesticides, and herbicides according to the instructions for their use, including reducing nutrients and pesticides using alternatives that minimize environmental impacts.
  - Sediment and erosion control.
  - Landscape maintenance and vegetation disposal.
  - Trash and pet waste management.
  - Building exterior cleaning and maintenance.
- ~~g. Establishment and implementation of policies and procedures to reduce pollutants in discharges from all lands owned or maintained by the Permittee and subject to this Permit, including but not limited to: parks, open space, road right of way, maintenance yards, and stormwater treatment and flow control facilities. These policies and procedures shall address, but are not limited to:~~
- ~~• Application of fertilizer, pesticides, and herbicides including the development of nutrient management and integrated pest management plans.~~
  - ~~• Sediment and erosion control.~~
  - ~~• Landscape maintenance and vegetation disposal.~~
  - ~~• Trash management.~~
  - ~~• Building exterior cleaning and maintenance.~~
- ~~h.g. Develop and i~~Implement an ongoing training program for employees of the Permittee whose primary construction, operations or maintenance job functions may impact stormwater quality. -The training program shall address the importance of protecting water quality, ~~the requirements of this Permit,~~ operation and maintenance standards, inspection procedures, selecting appropriate BMPs, ways to perform their job activities to prevent or minimize impacts to water quality, and procedures for reporting water quality concerns, ~~including potential illicit discharges.~~ -Follow-up training shall be provided as needed to address changes in procedures, techniques, ~~or requirements,~~ or staffing. -Permittees shall document and maintain records of training provided and the staff trained.

~~i.h.~~ ~~Development and implementation of~~ a Stormwater Pollution Prevention Plan (SWPPP) for all heavy equipment maintenance or storage yards, and material storage facilities owned or operated by the Permittee in areas subject to this Permit that are not required to have coverage under the *General NPDES Permit for Stormwater Discharges Associated with Industrial Activities* or another NPDES permit that ~~covers~~authorizes stormwater discharges associated with the activity. ~~Implementation of non-structural BMPs shall begin immediately after the pollution prevention plan is developed.~~ A schedule for implementation of structural BMPs shall be included in the SWPPP. Generic SWPPPs that can be applied at multiple sites may be used to comply with this requirement. The SWPPP shall include periodic visual observation of discharges from the facility to evaluate the effectiveness of the BMP.

~~i.~~ ~~Maintain r~~Records of inspections and maintenance or repair activities conducted by the Permittee ~~shall be maintained in accordance with S9 Reporting Requirements.~~

## S6. STORMWATER MANAGEMENT PROGRAM FOR SECONDARY PERMITTEES

A. This section applies to all ~~s~~Secondary pPermittees and all New Secondary Permittees, whether coverage under this Permit is obtained individually or as a ~~e~~Co-pPermittee with a city, town, ~~or~~ county or another ~~s~~Secondary pPermittee.

New Secondary Permittees subject to this Permit shall fully meet the requirements of this section as modified in footnotes in S6.D below, or as established as a condition of coverage by Ecology.

1. To the extent allowable under state, federal or local law, all components are mandatory for each Secondary Permittee covered under this Permit, whether covered as an individual ~~p~~PPermittee or as a ~~e~~Co-pPermittee.
2. Each Secondary Permittee shall develop and implement a stormwater management program (SWMP). A SWMP is a set of actions and activities comprising the components listed in S6 and any additional actions necessary to meet the requirements of this permit applicable TMDLs pursuant to S7 Compliance with TMDL Requirements, and S8 Monitoring and Assessment. The SWMP shall be designed to reduce the discharge of pollutants from regulated small MS4s to the ~~MEP~~maximum extent practicable and protect water quality.
3. Unless an alternate implementation schedule is established by Ecology as a condition of permit coverage, the SWMP shall be developed and implemented in accordance with the schedules contained in this section and shall be fully developed and implemented no later than four and one-half years from the initial permit coverage date~~180 days before the expiration date of this Permit.~~

~~Notwithstanding the schedules in this Permit, s~~Secondary ~~p~~Permittees that are already implementing some or all of the required SWMP components shall continue implementation of those components.

4. Secondary ~~p~~Permittees may implement parts of their SWMP in accordance with the schedule for cities, towns and counties in S5, provided they have signed a memorandum of understanding or other agreement to jointly implement the activity or activities with one or more jurisdictions listed in S1.D.2.a: or S1.D.2.b, and submitted a copy of the agreement to Ecology.

~~5. — Each Secondary Permittee shall prepare written documentation of the SWMP, called the SWMP Plan. The SWMP documentation Plan shall include a description of program activities for the upcoming calendar year. be organized according to the program components in S6.D below and shall be updated at least annually for submittal with the Permittee’s annual reports to Ecology (see S9 Reporting Requirements). The SWMP documentation shall include:~~

~~6. — A description of each of the program components included in S6.D.1. through S6.D.6., and~~

~~7. — Any additional actions necessary to meet the requirements of applicable TMDLs pursuant to S7 Compliance with Total Maximum Daily Load Requirements.~~

~~8.5. Coordination~~

#### B. Coordination

~~The SWMP~~Secondary Permittees shall ~~include mechanisms to encourage~~ coordinated stormwater-related policies, programs and projects within a watershed and interconnected MS4s. Where relevant and appropriate, the SWMP shall ~~also include~~ coordination among departments of the Secondary Permittee to ensure compliance with the terms of this Permit.

#### A.C. Legal Authority

To the extent allowable under state law and federal law, each Secondary Permittee shall be able to demonstrate that they can operate pursuant to legal authority which authorizes or enables the Secondary Permittee to control discharges to and from ~~municipal separate storm sewer~~MS4s owned or operated by the Secondary Permittee.

This legal authority may be a combination of statutes, ordinances, permits, contracts, orders, interagency agreements, or similar instruments.

#### B.D. Stormwater Management Program for Secondary Permittees

~~The term “Secondary Permittees” means drainage, diking, flood control, or diking and drainage districts, ports (other than the ports of Seattle and Tacoma), public colleges and universities, and any other owners or operators of municipal separate storm sewers located within the municipalities that are listed as permittees in S1.B.~~



~~Permittees that are already implementing some or all of the SWMP components in this section shall continue implementation of those components of their SWMP.~~

The SWMP for Secondary Permittees SWMP shall include the following components:

1. Public Education and Outreach

Each Secondary Permittee shall implement the following stormwater education strategies:

- a. Storm drain inlets owned ~~and~~or operated by the Secondary Permittee that are located in maintenance yards, in parking lots, along sidewalks, and at pedestrian access points shall be clearly ~~and permanently~~ labeled with ~~the~~a message similar to “Dump no waste – Drains to water body” ~~and indicating the point of discharge as a river, lake, bay, or groundwater.~~<sup>30</sup>
  - ~~i. — No later than three years from the date of permit coverage, at least 50 percent of these inlets shall be labeled.~~
  - ~~ii. — No later than 180 days prior expiration date of this Permit, or as established as a condition of coverage by Ecology, all of these inlets shall be labeled.~~

As identified during visual inspection and regular maintenance of storm drain inlets per the requirements of S6.D.3.d~~7~~ and S6.D.6.a.i~~7~~ below, or as otherwise reported to the Secondary Permittee, any inlet having a label that is no longer clearly visible and/or easily readable shall be re-labeled within 90 days.

- b. Each year beginning no later than three years from the initial date of permit coverage, public ports, colleges, and universities shall distribute educational information to tenants and residents on the impact of stormwater discharges on receiving waters, and steps that can be taken to reduce pollutants in stormwater runoff. ~~Distribution may be by hard copy or electronic means. Different combinations of~~Appropriate topics ~~shall be addressed each year, and, before the expiration date of this Permit, where relevant, tenants and residents shall receive educational information about the following topics may include:~~
  - i. How stormwater runoff affects local water bodies.
  - ii. Proper use and application of pesticides and fertilizers.
  - iii. Benefits of using well-adapted vegetation.

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<sup>30</sup> New Secondary Permittees shall label all inlets as described in S6.D.1.a no later than four years from the initial date of permit coverage.

- iv. Alternative equipment washing practices, including cars and trucks, that minimize pollutants in stormwater.
- v. Benefits of proper vehicle maintenance and alternative transportation choices; proper handling and disposal of vehicle wastes, including the location of hazardous waste collection facilities in the area.
- vi. Hazards associated with illicit connections and illicit discharges.
- vii. Benefits of litter control and ~~proper~~ disposal of pet waste.

~~Compliance with this requirement can be achieved through participation in the local jurisdiction's public education and outreach programs.~~

## 2. Public Involvement and Participation

~~Each year no later than May 31, No later than 180 days before the expiration date of this Permit, or as established as a condition of coverage by the Ecology,~~ each Secondary Permittee shall:

- a. ~~Publish a public notice in the local newspaper or~~ Make the annual report available on the Permittee's website, ~~and solicit public review of their SWMP.~~
- b. Make available on the Permittee's website the latest updated version of the SWMP Plan.
- ~~b.c. To comply with the posting requirement, a~~ Secondary Permittee that does not maintain a website may submit the updated SWMP Plan and annual report in electronic format to Ecology for posting on Ecology's website. available to the public. If the Secondary Permittee maintains a website, the SWMP shall be posted on the Secondary Permittee's website.

## 3. Illicit Discharge Detection and Elimination

Each Secondary Permittee shall:

- a. From the initial date of permit coverage, comply with all relevant ordinances, rules, and regulations of the local jurisdiction(s) in which the Secondary Permittee is located that govern non-stormwater discharges.
- b. ~~No later than one year from the date of permit coverage, develop and adopt~~ Implement appropriate policies prohibiting illicit discharges,<sup>31</sup> and ~~identify possible enforcement mechanisms for those policies. No later than eighteen months from the date of permit coverage, develop and~~

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<sup>31</sup> New Secondary Permittees shall develop and implement appropriate policies prohibiting illicit discharges, and identify possible enforcement mechanisms as described in S6.D.3.b no later than one year from the initial date of permit coverage.

~~implement~~ an enforcement plan ~~using these mechanisms~~ to ensure compliance with illicit discharge policies.<sup>32</sup> These policies shall address, at a minimum: illicit connections, ~~and~~ non-stormwater discharges, including spills of hazardous materials, and improper disposal of pet waste and litter.

~~i. Non-stormwater discharges covered by another NPDES permit and discharges from emergency fire fighting activities are allowed in the MS4 in accordance with S2 Authorized Discharges.~~

~~ii.i. Allowable discharges:~~ The policies do not need to prohibit the following categories of non-stormwater discharges:

- ~~• Diverted stream flows.~~
- ~~• Rising ground waters.~~
- ~~• Uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20)).~~
- ~~• Uncontaminated pumped ground water.~~
- ~~• Foundation drains.~~
- ~~• Air conditioning condensation.~~
- ~~• Irrigation water from agricultural sources that is commingled with urban stormwater.~~
- ~~• Springs.~~
- ~~• Uncontaminated Wwater from crawl space pumps.~~
- ~~• Footing drains.~~
- ~~• Flows from riparian habitats and wetlands.~~
- ~~• Discharges from emergency fire fighting activities in accordance with S2 Authorized Discharges.~~
- ~~• Non-stormwater discharges authorized by another NPDES or state waste discharge permit.~~

~~ii.i. Conditionally allowable discharges:~~ The policies ~~shall prohibit~~ ~~may allow~~ the following categories of non-stormwater discharges ~~unless only if~~ the stated conditions are met ~~and such discharges are allowed by local codes:~~

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<sup>32</sup> ~~New Secondary Permittees shall develop and implement an enforcement plan as described in S6.D.3.b no later than 18 months from the initial date of permit coverage.~~

- Discharges from potable water sources, including but not limited to water line flushing, hyperchlorinated water line flushing, fire hydrant system flushing, and pipeline hydrostatic test water. -Planned discharges shall be de-chlorinated to a total residual chlorine concentration of 0.1 ppm or less, pH-adjusted if necessary, and volumetrically and velocity controlled to prevent resuspension of sediments in the MS4.
- Discharges from lawn watering and other irrigation runoff. These discharges shall be minimized through, at a minimum, public education activities and water conservation efforts conducted by the Secondary Permittee and/or the local jurisdiction.
- Dechlorinated swimming pool, spa and hot tub discharges. The discharges shall be dechlorinated to a total residual chlorine concentration of 0.1 ppm or less, pH-adjusted and reoxygenated if necessary, and volumetrically and velocity controlled to prevent resuspension of sediments in the MS4. Discharges shall be thermally controlled to prevent an increase in temperature of the receiving water. Swimming pool cleaning wastewater and filter backwash shall not be discharged to the MS4.
- Street and sidewalk wash water, water used to control dust, and routine external building wash-down that does not use detergents. -The Secondary Permittee shall reduce these discharges through, at a minimum, public education activities and/or water conservation efforts conducted by the Secondary Permittee and/or the local jurisdiction. -To avoid washing pollutants into the MS4, the Secondary Permittee shall minimize the amount of street wash and dust control water used.
- ~~At active construction sites, street sweeping shall be performed prior to washing the street.~~
- Other non-stormwater discharges shall be in compliance with the requirements of a stormwater pollution prevention plan reviewed by the Permittee which addresses control of such discharges.

~~iv. The Secondary Permittee's SWMP shall, at a minimum, address each category in iii above in accordance with the conditions stated therein.~~

v.iii. The ~~SWMP~~ Secondary Permittee shall ~~further~~ address any category of discharges in ~~(ii)~~ or ~~(iii)~~ above if the discharge is identified as a significant source of pollutants to waters of the State.

- c. ~~No later than 180 days before the expiration date of this Permit, or as established as a condition of coverage by Ecology, develop~~ Maintain a storm sewer system map showing the locations of all known storm drain outfalls, labeled ing the receiving waters, ~~(other than ground water);~~ and delineated ing the areas contributing runoff to each outfall. ~~Make the map (or completed portions of the map) available on request to the Ecology Department and/or to the extent appropriate, to other Permittees or Secondary Permittees. The preferred, but not required, format of submission will be~~ for mapping is an electronic format with fully described mapping standards. ~~An example description is provided on Ecology's Website Pages.~~<sup>33</sup>
- d. Conduct field inspections and visually inspect for illicit discharges at all known MS4 outfalls ~~that discharge to surface waters.~~ Visually inspect at least one third (on average) of all known outfalls each year beginning no later than two years from the initial date of permit coverage. ~~Develop and i~~ Implement procedures to identify and remove any illicit discharges. Keep records of inspections and follow-up activities.<sup>34</sup>
- e. ~~No later than 180 days before the expiration date of this Permit, or as established as a condition of coverage by the Ecology, develop and i~~ Implement a spill response plan that includes coordination with a qualified spill responder.<sup>35</sup>
- f. No later than two years from initial date of permit coverage ~~date~~, provide staff training or coordinate with existing training efforts to educate ~~relevant~~ staff on proper best management practice BMPs for preventing illicit discharges, including spills. Train All Secondary relevant Permittee staff who, as part of their normal job responsibilities, have a role in preventing such illicit discharges. shall be trained.

#### 4. Construction Site Stormwater Runoff Control

From the initial date of permit coverage, each Secondary Permittee shall:

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<sup>33</sup> New Secondary Permittees shall meet the requirements of S6.D.3.c no later than four and one-half years from the initial date of permit coverage.

<sup>34</sup> New Secondary Permittees shall develop and implement procedures described in S6.D.3.d no later than two years from the initial date of permit coverage.

<sup>35</sup> New Secondary Permittees shall develop and implement a spill response plan as described in S6.D.3.e no later than four and one-half years from the initial date of permit coverage.

- a. Comply with all relevant ordinances, rules, and regulations of the local jurisdiction(s) in which the Secondary Permittee is located that govern construction phase stormwater pollution prevention measures.
  - b. ~~For~~Ensure that all construction projects under the functional control of the Secondary Permittee which; require a construction stormwater permit; ~~Secondary Permittees shall~~ obtain coverage under the *NPDES General Permit for Stormwater Discharges Associated with Construction Activities* or an alternative individual NPDES permit prior to discharging construction related stormwater.
  - c. Coordinate with the local jurisdiction regarding projects owned and-or operated by other entities which discharge into the Secondary Permittee's MS4, to assist the local jurisdiction with achieving compliance with all relevant ordinances, rules, and regulations of the local jurisdiction(s).
  - d. Provide training or coordinate with existing training efforts to educate relevant staff in erosion and sediment control BMPs and requirements, or hire trained contractors to perform the work.
  - e. Coordinate as requested with ~~the Department~~Ecology or the local jurisdiction to provide access for inspection of construction sites or other land disturbances; which are under the functional control of the Secondary Permittee during ~~the active grading~~land disturbing activityies and/or construction period.
5. Post-Construction Stormwater Management for New Development and Redevelopment

From the initial date of permit coverage, each Secondary Permittee shall:

- a. Comply with all relevant ordinances, rules and regulations of the local jurisdiction(s) in which the Secondary Permittee is located that govern post-construction stormwater pollution prevention measures.
  - b. Coordinate with the local jurisdiction regarding projects owned and-or operated by other entities which discharge into the Secondary Permittee's MS4, to assist the local jurisdiction with achieving compliance with all relevant ordinances, rules; and regulations of the local jurisdiction(s).
6. Pollution Prevention and Good Housekeeping for Municipal Operations

Each Secondary Permittee shall:

- a. ~~No later than three years from the date of permit coverage, develop and~~ iImplement a municipal operation and maintenance (O&M) plan to minimize stormwater pollution from activities conducted by the Secondary Permittee. ~~The O&M Plan shall include appropriate pollution prevention and good housekeeping procedures for all of the following operations, activities, and/or types of facilities that are present within the Secondary~~

Permittee's boundaries and under the functional control of the Secondary Permittee.<sup>36</sup>

- i. Stormwater collection and conveyance systems, including catch basins, stormwater ~~sewer~~ pipes, open channels, culverts, and structural stormwater controls, and structural runoff stormwater treatment and/or flow control BMPs/facilities. -The O&M Plan shall address, but is not limited to at a minimum: scheduled inspections and maintenance activities, including cleaning and proper disposal of waste removed from the system. -Secondary Permittees shall properly maintain stormwater collection and conveyance systems owned or operated by the Secondary Permittee and regularly inspect and maintain all ~~structural post construction~~ stormwater BMPs/facilities to ensure facility function.

~~For facilities located in Western Washington,~~ Secondary Permittees shall establish maintenance standards that are as protective or more protective of facility function than those specified in Chapter 4 Volume V of the 200512 Stormwater Management Manual for Western Washington<sup>5</sup>.

Secondary Permittees shall review their maintenance standards to ensure they are consistent with the requirements of this section.

~~For facilities located in Eastern Washington, Secondary Permittees shall establish maintenance standards that are as protective or more protective of facility function than those specified in Chapters 5, 6 and 8 of the Stormwater Management Manual for Eastern Washington (2004);~~

Secondary Permittees shall conduct spot checks of potentially damaged permanent stormwater treatment and flow control BMPs/facilities following a 24 hour storm major storm events (24 hour storm event with a 10 year or greater recurrence interval) with a 10-year or greater recurrence interval.

- ii. Roads, highways, and parking lots. - The O&M Plan shall address, but is not limited to: deicing, anti-icing, and snow removal practices; snow disposal areas; material (e.g. salt, sand, or other chemical) storage areas; all-season BMPs to reduce road and parking lot debris and other pollutants from entering the MS4.

- ~~iii.~~ Vehicle fleets. -The O&M Plan shall address, but is not limited to: storage, washing, and maintenance of Secondary Permittee vehicle

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<sup>36</sup> New Secondary Permittees shall develop and implement the operation and maintenance plan described in S6.D.6.a no later than three years from initial date of permit coverage.

fleets; and fueling facilities. -Secondary Permittees shall conduct all vehicle and equipment washing and maintenance in a self-contained covered building or in designated wash and/or maintenance areas.

~~iii~~.iv. External building maintenance. The O&M Plan shall address, building exterior cleaning and maintenance including cleaning, washing, painting; ~~and other maintenance activities, including and~~ maintenance and management of dumpsters; and other maintenance activities.

~~iv~~.v. Parks and open space. The O&M Plan shall address, but is not limited to: proper application of fertilizer, pesticides, and herbicides; sediment and erosion control; BMPs for landscape maintenance and vegetation disposal; and trash and pet waste management.

~~v~~.vi. Material storage areasfacilities; and heavy equipment maintenance or storage yardsareas; and maintenance areas. -Secondary Permittees shall develop and implement a Stormwater Pollution Prevention Plan to protect water quality at each of these facilities owned or operated by the Secondary Permittee and not covered under the *General NPDES Permit for Stormwater Discharges Associated with Industrial Activities* or under another NPDES permit that ~~covers~~authorizes stormwater discharges associated with the activity.

~~vi~~.vii. Other facilities that would reasonably be expected to discharge contaminated runoff. -The O&M Plan shall address proper stormwater pollution prevention practices for each facility.

- b. From the initial date ~~of of permit~~ coverage ~~under this Permit~~, Secondary Permittees shall also have permit coverage for all facilities operated by the Secondary Permittee that are required to be covered under the *General NPDES Permit for Stormwater Discharges Associated with Industrial Activities* or another NPDES permit that authorizes surface water discharges associated with the activity.
- c. The O&M Plan shall include sufficient documentation and records as necessary to demonstrate compliance with the O&M Plan requirements in S6.D.6.a.(i) through (vii) above.
- d. No later than three years from the initial date of permit coverage, Secondary Permittees shall implement a program designed to train all employees whose primary construction, operations, or maintenance job functions may impact stormwater quality. -The training shall address:
  - i. The importance of protecting water quality<sub>;</sub>
  - ii. The requirements of this Permit<sub>;</sub>
  - iii. Operation and maintenance requirements<sub>;</sub>



- iv. Inspection procedures~~;~~
- v. Ways to perform their job activities to prevent or minimize impacts to water quality~~;~~ ~~and~~
- vi. Procedures for reporting water quality concerns, including potential illicit discharges~~;~~ (including spills).

## **S7. COMPLIANCE WITH TOTAL MAXIMUM DAILY LOAD REQUIREMENTS**

The following requirements apply if an applicable ~~Total Maximum Daily Load~~ (TMDL) is approved for stormwater discharges from MS4s owned or operated by the Permittee. Applicable TMDLs are TMDLs which have been approved by EPA on or before the issuance date of this permit or prior to the date that Ecology issues coverage under this permit, whichever is later. ~~coverage is granted.~~

- A. For applicable TMDLs listed in Appendix 2, affected ~~p~~Permittees shall comply with the specific requirements identified in Appendix 2. Each Permittee shall keep records of all actions required by this Permit that are relevant to applicable TMDLs within their jurisdiction. The status of the TMDL implementation shall be included as part of the annual report submitted to Ecology~~-. Each annual report shall include a summary of relevant SWMP and Appendix 2 activities conducted in the TMDL area to address the applicable TMDL parameter(s).~~

~~Where monitoring is required in Appendix 2, the Permittee shall conduct the monitoring according to a Quality Assurance Project Plan (QAPP) approved by Ecology.~~

- B. For applicable TMDLs not listed in Appendix 2, compliance with this Permit shall constitute compliance with those TMDLs.
- C. For TMDLs that are approved by EPA after this Permit is issued, Ecology may establish TMDL related permit requirements through future permit modification if Ecology determines implementation of actions, monitoring or reporting necessary to demonstrate reasonable further progress toward achieving TMDL waste load allocations, and other targets, are not occurring and shall be implemented during the term of this Permit or when this Permit is reissued. Permittees are encouraged to participate in development of TMDLs within their jurisdiction and to begin implementation.

## **S8. MONITORING AND ASSESSMENT**

- A. All Permittees including Secondary Permittees shall provide, in each annual report, a description of any stormwater monitoring or stormwater-related studies conducted by the Permittee during the reporting period. If other stormwater monitoring or

stormwater-related studies were conducted on behalf of the Permittee during the reporting period, or if stormwater-related investigations conducted by other entities were reported to the Permittee during the reporting period, a brief description of the type of information gathered or received shall be included in the annual report.

Permittees are not required to provide descriptions of any monitoring, studies, or analyses conducted as part of the Regional Stormwater Management Program (RSMP) in annual reports. If a Permittee conducts independent monitoring in accordance with requirements in S8.B or S8.C below, annual reporting of such monitoring must follow the requirements specified in those sections.

B. Status and trends monitoring. By December 1, 2013, each city and county Permittee listed in S1.D.2.a(i) and S1.D.2.a(ii) located in Clallam, Island, King, Kitsap, Pierce, Skagit, Snohomish, Thurston, or Whatcom County shall notify Ecology in writing which of the following two options for status and trends monitoring the Permittee chooses to carry out during this permit cycle. Either option will fully satisfy the Permittee’s obligations under this section (S8.B). Each Permittee shall select a single option for the duration of this permit term.

1. Status and Trends Monitoring Option #1: Each Permittee that chooses this option shall pay into a collective fund to implement RSMP small streams and marine nearshore status and trends monitoring in Puget Sound. The payments into the collective fund are due to Ecology annually beginning August 15, 2014. The payment amounts are (Permittees are listed alphabetically, by county):

<u>Permittee</u>	<u>Annual payment amount</u>	<u>Permittee</u>	<u>Annual payment amount</u>
<u>Clallam Co.</u>	<u>N/A</u>	<u>Pierce Co.</u>	<u>N/A</u>
<u>Port Angeles</u>	<u>\$4,732</u>	<u>Bonney Lake</u>	<u>\$4,075</u>
<u>Island Co.</u>	<u>N/A</u>	<u>Buckley</u>	<u>\$1,129</u>
<u>Oak Harbor</u>	<u>\$5,719</u>	<u>DuPont</u>	<u>\$1,936</u>
<u>King Co.</u>	<u>N/A</u>	<u>Edgewood</u>	<u>\$2,350</u>
<u>Algona</u>	<u>\$678</u>	<u>Fife</u>	<u>\$2,005</u>
<u>Auburn</u>	<u>\$16,914</u>	<u>Fircrest</u>	<u>\$1,549</u>
<u>Bellevue</u>	<u>\$30,009</u>	<u>Gig Harbor</u>	<u>\$1,836</u>
<u>Black Diamond</u>	<u>\$1,023</u>	<u>Lakewood</u>	<u>\$14,367</u>
<u>Bothell</u>	<u>\$8,163</u>	<u>Milton</u>	<u>\$1,597</u>
<u>Burien</u>	<u>\$11,238</u>	<u>Orting</u>	<u>\$1,525</u>
<u>Clyde Hill</u>	<u>\$695</u>	<u>Puyallup</u>	<u>\$9,498</u>
<u>Covington</u>	<u>\$4,307</u>	<u>Steilacoom</u>	<u>\$1,538</u>

<u>Des Moines</u>	<u>\$7,152</u>	<u>Sumner</u>	<u>\$2,217</u>
<u>Duvall</u>	<u>\$1,463</u>	<u>University Place</u>	<u>\$7,704</u>
<u>Enumclaw</u>	<u>\$2,806</u>	<u>Skagit Co.</u>	<u>\$1,257</u>
<u>Federal Way</u>	<u>\$21,673</u>	<u>Burlington</u>	<u>\$2,194</u>
<u>Issaquah</u>	<u>\$6,632</u>	<u>Anacortes</u>	<u>\$4,102</u>
<u>Kenmore</u>	<u>\$5,042</u>	<u>Mount Vernon</u>	<u>\$7,574</u>
<u>Kent</u>	<u>\$27,441</u>	<u>Sedro- Woolley</u>	<u>\$2,452</u>
<u>Kirkland</u>	<u>\$12,116</u>	<u>Snohomish Co.</u>	<u>N/A</u>
<u>Lake Forest Park</u>	<u>\$3,135</u>	<u>Arlington</u>	<u>\$4,219</u>
<u>Maple Valley</u>	<u>\$5,648</u>	<u>Brier</u>	<u>\$1,585</u>
<u>Medina</u>	<u>\$728</u>	<u>Edmonds</u>	<u>\$9,987</u>
<u>Mercer Island</u>	<u>\$5,589</u>	<u>Everett</u>	<u>\$25,419</u>
<u>Newcastle</u>	<u>\$2,431</u>	<u>Granite Falls</u>	<u>\$824</u>
<u>Normandy Park</u>	<u>\$1,597</u>	<u>Lake Stevens</u>	<u>\$6,512</u>
<u>Pacific</u>	<u>\$1,540</u>	<u>Lynnwood</u>	<u>\$8,829</u>
<u>Redmond</u>	<u>\$13,143</u>	<u>Marysville</u>	<u>\$14,172</u>
<u>Renton</u>	<u>\$21,055</u>	<u>Mill Creek</u>	<u>\$4,566</u>
<u>Sammamish</u>	<u>\$10,028</u>	<u>Monroe</u>	<u>\$4,073</u>
<u>SeaTac</u>	<u>\$6,322</u>	<u>Mountlake Terrace</u>	<u>\$5,118</u>
<u>Shoreline</u>	<u>\$13,327</u>	<u>Mukilteo</u>	<u>\$4,920</u>
<u>Tukwila</u>	<u>\$4,444</u>	<u>Snohomish</u>	<u>\$2,276</u>
<u>Woodinville</u>	<u>\$2,771</u>	<u>Thurston Co.</u>	<u>\$12,841</u>
<u>Kitsap Co.</u>	<u>\$17,133</u>	<u>Lacey</u>	<u>\$9,799</u>
<u>Bainbridge Island</u>	<u>\$5,709</u>	<u>Olympia</u>	<u>\$11,110</u>
<u>Bremerton</u>	<u>\$8,837</u>	<u>Tumwater</u>	<u>\$4,095</u>
<u>Port Orchard</u>	<u>\$2,664</u>	<u>Whatcom Co.</u>	<u>\$3,714</u>
<u>Poulsbo</u>	<u>\$2,187</u>	<u>Bellingham</u>	<u>\$18,936</u>
		<u>Ferndale</u>	<u>\$2,737</u>

Or

2. Status and Trends Monitoring Option #2: Each Permittee that chooses this option shall conduct status and trends monitoring as follows:

a. Beginning no later than July 31, 2014, conduct wadeable stream water quality, benthos, habitat, and sediment chemistry monitoring according to

the Ecology-approved Quality Assurance Project Plan (QAPP) for RSMP Small Streams Status and Trends Monitoring.

- i. Permittees with population less than 10,000 in the permit coverage area shall conduct this monitoring at the first two qualified monitoring locations (as listed sequentially among the potential monitoring locations defined in the RSMP QAPP) that are located within the jurisdiction's boundaries. Counties shall monitor the first location inside UGA boundaries and the first location outside UGA boundaries.
- ii. Permittees with population equal to or greater than 10,000 and fewer than 50,000 in the permit coverage area shall conduct this monitoring at the first four qualified monitoring locations (as listed sequentially among the potential monitoring locations defined in the RSMP QAPP) that are located within the jurisdiction's boundaries. Counties shall monitor the first two locations inside UGA boundaries and the first two locations outside UGA boundaries.
- iii. Permittees with population equal to or greater than 50,000 in the permit coverage area shall conduct this monitoring at the first eight qualified monitoring locations (as listed sequentially among the potential monitoring locations defined in the RSMP QAPP) that are located within the jurisdiction's boundaries. Counties shall monitor the first four locations inside UGA boundaries and the first four locations outside UGA boundaries.

Permittees with population equal to or greater than 50,000 in the permit coverage area and located entirely inland (i.e., having no Puget Sound shoreline boundary) shall conduct this monitoring at an additional four monitoring locations (as listed sequentially among the potential monitoring locations defined in the RSMP QAPP), for a total of 12 monitoring locations.

And

- b. Beginning no later than October 1, 2015, Permittees with Puget Sound shoreline shall conduct sediment chemistry, mussel, and bacteria monitoring according to the Ecology-approved QAPPs for RSMP Marine Nearshore Status and Trends Monitoring.
  - i. Permittees with population less than 10,000 shall conduct this monitoring at the first two qualified monitoring locations each, for sediment and for mussels and bacteria (as listed sequentially among the potential monitoring locations defined in the RSMP QAPPs), that are located adjacent to the jurisdiction's Puget Sound shoreline boundary.

- ii. Permittees with population equal to or greater than 10,000 and fewer than 50,000 in the permit coverage area shall conduct this monitoring at the first four qualified monitoring locations each, for sediment and for mussels and bacteria (as listed sequentially among the potential monitoring locations defined in the RSMP QAPPs), that are located adjacent to the jurisdiction’s Puget Sound shoreline boundary.
- iii. Permittees with population equal to or greater than 50,000 in the permit coverage area shall conduct this monitoring at the first six qualified monitoring locations each, for sediment and for mussels and bacteria (as listed sequentially among the potential monitoring locations defined in the RSMP QAPPs), that are located adjacent to the jurisdiction’s Puget Sound shoreline boundary.

And

- c. Data and analyses shall be reported annually in accordance with the Ecology-approved QAPPs.

C. Stormwater management program effectiveness studies. By December 1, 2013, each city and county Permittee listed in S1.D.2.a(i) and S1.D.2.a(ii) shall notify Ecology in writing which of the following two options for effectiveness studies the Permittee chooses to carry out during this permit cycle. Either option will fully satisfy the Permittee’s obligations under this section (S8.C). Each Permittee shall select a single option for the duration of this permit term.

- 1. Effectiveness Studies Option #1: Each Permittee that chooses this option shall pay into a collective fund to implement RSMP effectiveness studies. The payments into the collective fund are due to Ecology annually beginning August 15, 2014. The payment amounts are (Permittees are listed alphabetically, by county):

<u>Permittee</u>	<u>Annual payment amount</u>	<u>Permittee</u>	<u>Annual payment amount</u>
<u>Clallam Co.</u>	<u>N/A</u>	<u>Lewis Co.</u>	<u>N/A</u>
<u>Port Angeles</u>	<u>\$7,885</u>	<u>Centralia</u>	<u>\$6,334</u>
<u>Clark Co.</u>	<u>N/A</u>	<u>Pierce Co.</u>	<u>N/A</u>
<u>Battle Ground</u>	<u>\$7,079</u>	<u>Bonney Lake</u>	<u>\$6,790</u>
<u>Camas</u>	<u>\$7,002</u>	<u>Buckley</u>	<u>\$1,882</u>
<u>Vancouver</u>	<u>\$67,335</u>	<u>DuPont</u>	<u>\$3,226</u>
<u>Washougal</u>	<u>\$5,716</u>	<u>Edgewood</u>	<u>\$3,916</u>
<u>Cowlitz Co.</u>	<u>\$1,384</u>	<u>Fife</u>	<u>\$3,340</u>
<u>Kelso</u>	<u>\$4,793</u>	<u>Fircrest</u>	<u>\$2,581</u>

<u>Longview</u>	<u>\$14,687</u>	<u>Gig Harbor</u>	<u>\$3,059</u>
<u>Grays Harbor Co.</u>	<u>N/A</u>	<u>Lakewood</u>	<u>\$23,938</u>
<u>Aberdeen</u>	<u>\$6,693</u>	<u>Milton</u>	<u>\$2,661</u>
<u>Island Co.</u>	<u>N/A</u>	<u>Orting</u>	<u>\$2,541</u>
<u>Oak Harbor</u>	<u>\$9,528</u>	<u>Puyallup</u>	<u>\$15,826</u>
<u>King Co.</u>	<u>N/A</u>	<u>Steilacoom</u>	<u>\$2,563</u>
<u>Algona</u>	<u>\$1,129</u>	<u>Sumner</u>	<u>\$3,694</u>
<u>Auburn</u>	<u>\$28,182</u>	<u>University Place</u>	<u>\$12,836</u>
<u>Bellevue</u>	<u>\$50,001</u>	<u>Skagit Co.</u>	<u>\$2,094</u>
<u>Black Diamond</u>	<u>\$1,705</u>	<u>Burlington</u>	<u>\$3,655</u>
<u>Bothell</u>	<u>\$13,601</u>	<u>Anacortes</u>	<u>\$6,835</u>
<u>Burien</u>	<u>\$18,724</u>	<u>Mount Vernon</u>	<u>\$12,620</u>
<u>Clyde Hill</u>	<u>\$1,157</u>	<u>Sedro- Woolley</u>	<u>\$4,085</u>
<u>Covington</u>	<u>\$7,177</u>	<u>Snohomish Co.</u>	<u>N/A</u>
<u>Des Moines</u>	<u>\$11,916</u>	<u>Arlington</u>	<u>\$7,030</u>
<u>Duvall</u>	<u>\$2,437</u>	<u>Brier</u>	<u>\$2,640</u>
<u>Enumclaw</u>	<u>\$4,675</u>	<u>Edmonds</u>	<u>\$16,640</u>
<u>Federal Way</u>	<u>\$36,111</u>	<u>Everett</u>	<u>\$42,352</u>
<u>Issaquah</u>	<u>\$11,050</u>	<u>Granite Falls</u>	<u>\$1,373</u>
<u>Kenmore</u>	<u>\$8,401</u>	<u>Lake Stevens</u>	<u>\$10,850</u>
<u>Kent</u>	<u>\$45,721</u>	<u>Lynnwood</u>	<u>\$14,711</u>
<u>Kirkland</u>	<u>\$20,187</u>	<u>Marysville</u>	<u>\$23,613</u>
<u>Lake Forest Park</u>	<u>\$5,224</u>	<u>Mill Creek</u>	<u>\$7,608</u>
<u>Maple Valley</u>	<u>\$9,410</u>	<u>Monroe</u>	<u>\$6,786</u>
<u>Medina</u>	<u>\$1,212</u>	<u>Mountlake Terrace</u>	<u>\$8,527</u>
<u>Mercer Island</u>	<u>\$9,313</u>	<u>Mukilteo</u>	<u>\$8,198</u>
<u>Newcastle</u>	<u>\$4,050</u>	<u>Snohomish</u>	<u>\$3,792</u>
<u>Normandy Park</u>	<u>\$2,661</u>	<u>Thurston Co.</u>	<u>\$21,395</u>
<u>Pacific</u>	<u>\$2,565</u>	<u>Lacey</u>	<u>\$16,326</u>
<u>Redmond</u>	<u>\$21,899</u>	<u>Olympia</u>	<u>\$18,511</u>
<u>Renton</u>	<u>\$35,082</u>	<u>Tumwater</u>	<u>\$6,823</u>
<u>Sammamish</u>	<u>\$16,709</u>	<u>Whatcom Co.</u>	<u>\$6,188</u>
<u>SeaTac</u>	<u>\$10,533</u>	<u>Bellingham</u>	<u>\$31,550</u>

<u>Shoreline</u>	<u>\$22,205</u>	<u>Ferndale</u>	<u>\$4,561</u>
<u>Tukwila</u>	<u>\$7,405</u>		
<u>Woodinville</u>	<u>\$4,618</u>		
<u>Kitsap Co.</u>	<u>\$28,547</u>		
<u>Bainbridge Island</u>	<u>\$9,512</u>		
<u>Bremerton</u>	<u>\$14,724</u>		
<u>Port Orchard</u>	<u>\$4,439</u>		
<u>Poulsbo</u>	<u>\$3,643</u>		

Or

2. Effectiveness Studies Option #2: Each Permittee that chooses this option shall conduct stormwater discharge monitoring in accordance with Appendix 9 and the following:

- a. By February 2, 2014, each Permittee shall submit to Ecology a draft stormwater discharge monitoring QAPP for review and approval. If Ecology does not request changes within 90 days, the draft QAPP is considered approved. Final QAPPs shall be submitted to Ecology as soon as possible following finalization.
  - i. Each Permittee with population fewer than 10,000 in the permit coverage area shall conduct stormwater discharge monitoring at one discharge monitoring location.
  - ii. Each Permittee with population equal to or greater than 10,000 but fewer than 50,000 in the permit coverage area shall conduct stormwater discharge monitoring at two discharge monitoring locations.
  - iii. Each Permittee with population equal to or greater than 50,000 but fewer than 100,000 in the permit coverage area shall conduct stormwater discharge monitoring at three discharge monitoring locations.
  - iv. Each Permittee with population 100,000 or more in the permit coverage area shall conduct stormwater discharge monitoring at four discharge monitoring locations.
- b. Permittees shall document in the QAPP why selected discharge monitoring locations are of interest for long term stormwater discharge monitoring and associated stormwater management program effectiveness evaluations. Permittees are encouraged to monitor at locations chosen and submitted in the annual reports that were due March 31, 2011.

c. Flow monitoring at discharge monitoring locations shall be implemented beginning no later than October 1, 2014. Stormwater discharge monitoring shall be fully implemented no later than October 1, 2015. All monitoring shall be conducted in accordance with an Ecology-approved QAPP.

D. Source identification and diagnostic monitoring. Each city and county Permittee listed in S1.D.2.a(i) and S1.D.2.a(ii) shall pay into a collective fund to implement the RSMP Source Identification Information Repository (SIDIR). The payments into the collective fund are due to Ecology annually beginning August 15, 2014. The payment amounts are (Permittees are listed alphabetically, by county):

<u>Permittee</u>	<u>Annual payment amount</u>	<u>Permittee</u>	<u>Annual payment amount</u>
<u>Clallam Co.</u>	<u>N/A</u>	<u>Lewis Co.</u>	<u>N/A</u>
<u>Port Angeles</u>	<u>\$731</u>	<u>Centralia</u>	<u>\$587</u>
<u>Clark Co.</u>	<u>N/A</u>	<u>Pierce Co.</u>	<u>N/A</u>
<u>Battle Ground</u>	<u>\$657</u>	<u>Bonney Lake</u>	<u>\$630</u>
<u>Camas</u>	<u>\$649</u>	<u>Buckley</u>	<u>\$175</u>
<u>Vancouver</u>	<u>\$6,245</u>	<u>DuPont</u>	<u>\$299</u>
<u>Washougal</u>	<u>\$530</u>	<u>Edgewood</u>	<u>\$363</u>
<u>Cowlitz Co.</u>	<u>\$128</u>	<u>Fife</u>	<u>\$310</u>
<u>Kelso</u>	<u>\$444</u>	<u>Fircrest</u>	<u>\$239</u>
<u>Longview</u>	<u>\$1,362</u>	<u>Gig Harbor</u>	<u>\$284</u>
<u>Grays Harbor Co.</u>	<u>N/A</u>	<u>Lakewood</u>	<u>\$2,220</u>
<u>Aberdeen</u>	<u>\$621</u>	<u>Milton</u>	<u>\$247</u>
<u>Island Co.</u>	<u>N/A</u>	<u>Orting</u>	<u>\$236</u>
<u>Oak Harbor</u>	<u>\$884</u>	<u>Puyallup</u>	<u>\$1,468</u>
<u>King Co.</u>	<u>N/A</u>	<u>Steilacoom</u>	<u>\$238</u>
<u>Algona</u>	<u>\$105</u>	<u>Sumner</u>	<u>\$343</u>
<u>Auburn</u>	<u>\$2,614</u>	<u>University Place</u>	<u>\$1,190</u>
<u>Bellevue</u>	<u>\$4,637</u>	<u>Skagit Co.</u>	<u>\$194</u>
<u>Black Diamond</u>	<u>\$158</u>	<u>Burlington</u>	<u>\$339</u>
<u>Bothell</u>	<u>\$1,261</u>	<u>Anacortes</u>	<u>\$634</u>
<u>Burien</u>	<u>\$1,736</u>	<u>Mount Vernon</u>	<u>\$1,170</u>
<u>Clyde Hill</u>	<u>\$107</u>	<u>Sedro- Woolley</u>	<u>\$379</u>
<u>Covington</u>	<u>\$666</u>	<u>Snohomish Co.</u>	<u>N/A</u>



<u>Des Moines</u>	<u>\$1,105</u>	<u>Arlington</u>	<u>\$652</u>
<u>Duvall</u>	<u>\$226</u>	<u>Brier</u>	<u>\$245</u>
<u>Enumclaw</u>	<u>\$434</u>	<u>Edmonds</u>	<u>\$1,543</u>
<u>Federal Way</u>	<u>\$3,349</u>	<u>Everett</u>	<u>\$3,928</u>
<u>Issaquah</u>	<u>\$1,025</u>	<u>Granite Falls</u>	<u>\$127</u>
<u>Kenmore</u>	<u>\$779</u>	<u>Lake Stevens</u>	<u>\$1,006</u>
<u>Kent</u>	<u>\$4,240</u>	<u>Lynnwood</u>	<u>\$1,364</u>
<u>Kirkland</u>	<u>\$1,872</u>	<u>Marysville</u>	<u>\$2,190</u>
<u>Lake Forest Park</u>	<u>\$484</u>	<u>Mill Creek</u>	<u>\$706</u>
<u>Maple Valley</u>	<u>\$873</u>	<u>Monroe</u>	<u>\$629</u>
<u>Medina</u>	<u>\$112</u>	<u>Mountlake Terrace</u>	<u>\$791</u>
<u>Mercer Island</u>	<u>\$864</u>	<u>Mukilteo</u>	<u>\$760</u>
<u>Newcastle</u>	<u>\$376</u>	<u>Snohomish</u>	<u>\$352</u>
<u>Normandy Park</u>	<u>\$247</u>	<u>Thurston Co.</u>	<u>\$1,984</u>
<u>Pacific</u>	<u>\$238</u>	<u>Lacey</u>	<u>\$1,514</u>
<u>Redmond</u>	<u>\$2,031</u>	<u>Olympia</u>	<u>\$1,717</u>
<u>Renton</u>	<u>\$3,253</u>	<u>Tumwater</u>	<u>\$633</u>
<u>Sammamish</u>	<u>\$1,550</u>	<u>Whatcom Co.</u>	<u>\$574</u>
<u>SeaTac</u>	<u>\$977</u>	<u>Bellingham</u>	<u>\$2,926</u>
<u>Shoreline</u>	<u>\$2,059</u>	<u>Ferndale</u>	<u>\$423</u>
<u>Tukwila</u>	<u>\$687</u>		
<u>Woodinville</u>	<u>\$428</u>		
<u>Kitsap Co.</u>	<u>\$2,647</u>		
<u>Bainbridge Island</u>	<u>\$882</u>		
<u>Bremerton</u>	<u>\$1,365</u>		
<u>Port Orchard</u>	<u>\$412</u>		
<u>Poulsbo</u>	<u>\$338</u>		

**S9. REPORTING REQUIREMENTS**

- A. No later than March 31 of each year beginning in 201508, each Permittee shall submit an annual report. -The reporting period for the first annual report will be from ~~the effective date of this permit~~ January 1, 2014 through December 31, 201407. The

reporting period for all subsequent annual reports will be the previous calendar year unless otherwise specified.

Permittees shall submit annual reports electronically using Ecology's WQWebDMR available on Ecology's website at <http://www.ecy.wa.gov/programs/wq/permits/paris/webdmr.html> unless otherwise directed by Ecology.

Permittees unable to submit electronically through Ecology's WQWebDMR must contact Ecology to request a waiver and obtain instructions on how to submit an annual report in an alternative format.

~~Two printed copies and an electronic (PDF) copy of each document shall be submitted to Ecology. All submittals shall be delivered to:~~

~~Department of Ecology  
Water Quality Program  
Municipal Stormwater Permits  
P.O. Box 47696  
Olympia, WA 98504-7696~~

- B. Each Permittee is required to keep all records related to this permit and the SWMP for at least five years. ~~Except for the requirements of the annual reports described in this permit, records shall be submitted to Ecology only upon request,~~
- C. Each Permittee shall make all records related to this permit and the Permittee's SWMP available to the public at reasonable times during business hours. The Permittee will provide a copy of the most recent annual report to any individual or entity, upon request.
1. A reasonable charge may be assessed by the Permittee for making photocopies of records.
  2. The Permittee may require reasonable advance notice of intent to review records related to this Permit.
- D. The annual report for cities, towns, and counties

Each annual report shall include the following:

- ~~1.~~ A copy of the Permittee's current ~~Stormwater Management Program-SWMP Plan~~ as required by S5.A.2.
- ~~2.~~ Submittal of ~~the annual report form as provided by Ecology pursuant to S9.A, describing the status of implementation of the requirements of this permit during the reporting period. Appendix 3—Annual Report Form for Cities, Towns, and Counties, which is intended to summarize the Permittees compliance with the conditions of this permit, including:~~
- ~~1.3.~~ Attachments to the annual report form including summaries, descriptions, reports, and other information as required, or as applicable, to meet the

requirements of this permit during the reporting period. Refer to Appendix 3 for annual report questions.

- ~~2. Status of implementation of each component of the SWMP in section S5 Stormwater Management Program for Cities, Towns and Counties. An assessment of the Permittee's progress in meeting the minimum performance standards established for each of the minimum control measures of the SWMP.~~
- ~~3. A description of activities being implemented to comply with each component of the SWMP, including the number and type of inspections, enforcement actions, public education and involvement activities, and illicit discharges detected and eliminated.~~
- ~~4. The Permittee's SWMP implementation schedule and plans for meeting permit deadlines, and the status of SWMP implementation to date. If permit deadlines are not met, or may not be met in the future, include: reasons why, corrective steps taken and proposed, and expected dates that the deadlines will be met.~~
- ~~5. A summary of the Permittee's evaluation of their SWMP, according to sections S5.A.4. and S8.B.2.~~
4. If applicable, notice that the MS4 is relying on another governmental entity to satisfy any of the obligations under this permit.
  
- ~~6. Updated information from the prior annual report plus any new information received during the reporting period, pursuant to S8.B.2. above.~~
5. Certification and signature pursuant to G19.D, and notification of any changes to authorization pursuant to G19.C.
  
- ~~7.6. Permittees shall include with the annual report, A notification of any annexations, incorporations or jurisdictional boundary changes resulting in an increase or decrease in the Permittee's geographic area of permit coverage during the reporting period, and implications for the SWMP.~~
- ~~8. Permittees shall include with the annual report submitted no later than March 31, 2011 information that at a minimum includes:~~
- ~~9. A summary of identified barriers to the use of low impact development (LID) within the area covered by the permit and measures to address the barriers. Each individual Permittee must complete this summary.~~
- ~~10. A report completed by an individual Permittee or in cooperation with multiple Permittees describing, at a minimum:~~
- ~~11. LID practices that are currently available and that can reasonably be implemented within this permit term.~~
- ~~12. Potential or planned non-structural actions and LID techniques to prevent stormwater impacts.~~
- ~~13. Goals and metrics to identify, promote, and measure LID use.~~

~~14. Potential or planned schedules for the Permittee(s) to require and implement the non-structural and LID techniques on a broader scale in the future.~~

E. Annual report for Secondary Permittees

~~All Secondary Permittees shall complete the Annual Report Form for Secondary Permittees (Appendix 4) and submit it along with any supporting documentation to Ecology. Each annual report shall include the following:~~

- ~~1. Submittal of the annual report form as provided by Ecology pursuant to S9.A, describing the status of implementation of the requirements of this permit during the reporting period.~~
- ~~2. Attachments to the annual report form including summaries, descriptions, reports, and other information as required, or as applicable, to meet the requirements of this permit during the reporting period. Refer to Appendix 4 for annual report questions.~~
- ~~1. The Annual Report Form for Secondary Permittees is intended to summarize the Permittees compliance with the conditions of this permit, including:~~
  - ~~2. Status of implementation of each component of the SWMP in section S6 Stormwater Management Program for Secondary Permittees of this permit.~~
  - ~~3. An assessment of the Permittee's progress in meeting the minimum performance standards established for each of the minimum control measures of the SWMP.~~
  - ~~4. A summary of the Permittee's evaluation of their SWMP, according to section S8.B.2.~~
- ~~5.3. If applicable, notice that the MS4 is relying on another governmental entity to satisfy any of the obligations under this permit.~~
- ~~6. Updated information from the prior annual report plus any new information received during the reporting period pursuant to S8.B.1 and S8.B.2.~~
- ~~7.4. Certification and signature pursuant to G19.D, and notification of any changes to authorization pursuant to G19.C.~~
- ~~8.5. Secondary Permittees shall include with the annual report a A notification of any jurisdictional boundary changes resulting in an increase or decrease in the Secondary Permittee's geographic area of permit coverage during the reporting period, and implications for the SWMP.~~

## GENERAL CONDITIONS

### G1. DISCHARGE VIOLATIONS

All discharges and activities authorized by this Permit shall be consistent with the terms and conditions of this Permit.

### G2. PROPER OPERATION AND MAINTENANCE

The Permittee shall at all times properly operate and maintain all facilities and systems of collection, treatment, and control (and related appurtenances) which are installed or used by the Permittee for pollution control to achieve compliance with the terms and conditions of this Permit.

### G3. NOTIFICATION OF DISCHARGE, INCLUDING SPILLS

If a Permittee has knowledge of a discharge, including spills, into or from a ~~MS4 municipal storm sewer~~ which could constitute a threat to human health, welfare, or the environment, the Permittee shall

- A. Take appropriate action to correct or minimize the threat to human health, welfare and/or the environment. ~~and;~~
- B. Notify the Ecology regional office and other appropriate spill response authorities immediately but in no case later than within 24 hours of obtaining that knowledge. The Ecology Northwest Regional Office 24-hour number is 425-649-7000 and for the Southwest Regional Office the number is 360-407-6300.
- C. Immediately report ~~spills or other~~ discharges, ~~including spills~~, which might cause bacterial contamination of ~~shellfish marine waters~~, such as ~~might~~ discharges resulting from broken sewer lines and failing onsite septic systems, to the Ecology regional office and to the Department of Health, Shellfish Program. The Department of Health's shellfish ~~24-hour~~ number is 360-236-3330 (business hours) or 360-789-8962 (24-hours).
- D. Immediately report spills or discharges of oils or hazardous ~~materials~~ substances to the Ecology regional office and to the Washington Emergency Management Division at 1-800-258-5990.

### G4. BYPASS PROHIBITED

The intentional bypass of stormwater from all or any portion of a stormwater treatment BMP whenever the design capacity of the treatment BMP is not exceeded, is prohibited unless the following conditions are met:

- A. Bypass is: (1) unavoidable to prevent loss of life, personal injury, or severe property damage; or (2) necessary to perform construction or maintenance-related activities essential to meet the requirements of the Clean Water Act (CWA); and

- B. There are no feasible alternatives to bypass, such as the use of auxiliary treatment facilities, retention of untreated stormwater, or maintenance during normal dry periods.

"Severe property damage" means substantial physical damage to property, damage to the treatment facilities which would cause them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass.

#### **G5. RIGHT OF ENTRY**

The Permittee shall allow an authorized representative of Ecology, upon the presentation of credentials and such other documents as may be required by law at reasonable times:

- A. To enter upon the Permittee's premises where a discharge is located or where any records must be kept under the terms and conditions of this Permit;
- B. To have access to, and copy at reasonable cost and at reasonable times, any records that must be kept under the terms of the Permit;
- C. To inspect at reasonable times any monitoring equipment or method of monitoring required in the Permit;
- D. To inspect at reasonable times any collection, treatment, pollution management, or discharge facilities; and
- E. To sample at reasonable times any discharge of pollutants.

#### **G6. DUTY TO MITIGATE**

The Permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this Permit which has a reasonable likelihood of adversely affecting human health or the environment.

#### **G7. PROPERTY RIGHTS**

This permit does not convey any property rights of any sort, or any exclusive privilege.

#### **G8. COMPLIANCE WITH OTHER LAWS AND STATUTES**

Nothing in the Permit shall be construed as excusing the Permittee from compliance with any other applicable federal, state, or local statutes, ordinances, or regulations.

#### **G9. MONITORING**

- A. Representative Sampling:

Samples and measurements taken to meet the requirements of this Permit shall be representative of the volume and nature of the monitored discharge, including representative sampling of any unusual discharge or discharge condition, including bypasses, upsets, and maintenance-related conditions affecting effluent quality.

B. Records Retention:

The Permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original recordings for continuous monitoring instrumentation, copies of all reports required by this Permit, and records of all data used to complete the application for this permit, for a period of at least five years. -This period of retention shall be extended during the course of any unresolved litigation regarding the discharge of pollutants by the ~~p~~P Permittee or when requested by the Ecology. On request, monitoring data and analysis shall be provided to Ecology.

C. Recording of Results:

For each measurement or sample taken, the Permittee shall record the following information: (1) the date, exact place and time of sampling; (2) the individual who performed the sampling or measurement; (3) the dates the analyses were performed; (4) who performed the analyses; (5) the analytical techniques or methods used; and (6) the results of all analyses.

D. Test Procedures:

All sampling and analytical methods used to meet the monitoring requirements in this ~~p~~P Permit shall conform to the Guidelines Establishing Test Procedures for the Analysis of Pollutants contained in 40 CFR Part 136, unless otherwise specified in this permit or approved in writing by Ecology.

E. Flow Measurement:

Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be selected and used to ensure the accuracy and reliability of measurements of the volume of monitored discharges. -The devices shall be installed, calibrated, and maintained to ensure that the accuracy of the measurements ~~are~~is consistent with the accepted industry standard for that type of device. Frequency of calibration shall be in conformance with manufacturer's recommendations or at a minimum frequency of at least one calibration per year. -Calibration records should be maintained for a minimum of three years.

F. Lab Accreditation:

All monitoring data, except for flow, temperature, conductivity, pH, total residual chlorine, and other exceptions approved by Ecology, shall be prepared by a laboratory registered or accredited under the provisions of, Accreditation of Environmental Laboratories, ~~C~~chapter 173-50 WAC. -Soils and hazardous waste data are exempted from this requirement pending accreditation of laboratories for analysis of these media by Ecology. Quick methods of field detection of pollutants including nutrients, surfactants, salinity, and other parameters are exempted from this requirement when the purpose of the sampling is identification and removal of a suspected illicit discharge.

G. Additional Monitoring:

Ecology may establish specific monitoring requirements in addition to those contained in this permit by administrative order or permit modification.

#### **G10. REMOVED SUBSTANCES**

With the exception of decant from street waste vehicles, the Permittee shall not allow collected screenings, grit, solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of stormwater to be resuspended or reintroduced to the storm sewer system or to waters of the state. ~~Decant from street waste vehicles resulting from cleaning stormwater facilities may be reintroduced only when other practical means are not available and only in accordance with the Street Waste Disposal Guidelines in Appendix 46.~~ Solids generated from maintenance of the MS4 may be reclaimed, recycled, or reused when allowed by local codes and ordinances. Soils that are identified as contaminated pursuant to Chapter 173-350 WAC shall be disposed at a qualified solid waste disposal facility (see Appendix 6).

#### **G11. SEVERABILITY**

The provisions of this Permit are severable, and if any provision of this Permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this Permit shall not be affected thereby.

#### **G12. REVOCATION OF COVERAGE**

The director may terminate coverage under this General Permit in accordance with ~~Chapter~~ 43.21B RCW and ~~Chapter~~ 173-226 WAC. ~~Cases where coverage may be terminated include, but are not limited to the following:~~

- A. Violation of any term or condition of this general permit;
- B. Obtaining coverage under this general permit by misrepresentation or failure to disclose fully all relevant facts;
- C. A change in any condition that requires either a temporary or permanent reduction or elimination of the permitted discharge;
- D. A determination that the permitted activity endangers human health or the environment, or contributes significantly to water quality standards violations;
- E. Failure or refusal of the ~~p~~Permittee to allow entry as required in ~~Chapter~~ 90.48.090 RCW;
- F. Nonpayment of permit fees assessed pursuant to ~~Chapter~~ 90.48.465 RCW;

Revocation of coverage under this general permit may be initiated by Ecology or requested by any interested person.



### **G13. TRANSFER OF COVERAGE**

The director may require any discharger authorized by this General Permit to apply for and obtain an individual permit in accordance with [Chapter 43.21B RCW](#) and [Chapter 173-226 WAC](#).

### **G14. GENERAL PERMIT MODIFICATION AND REVOCATION**

This General Permit may be modified, revoked and reissued, or terminated in accordance with the provisions of WAC 173-226-230. -Grounds for modification, revocation and reissuance, or termination include, but are not limited to the following:

- A. A change occurs in the technology or practices for control or abatement of pollutants applicable to the category of dischargers covered under this General Permit;
- B. Effluent limitation guidelines or standards are promulgated pursuant to the CWA or [Chapter 90.48 RCW](#), for the category of dischargers covered under this General Permit;
- C. A water quality management plan containing requirements applicable to the category of dischargers covered under this General Permit is approved; or
- D. Information is obtained which indicates that cumulative effects on the environment from dischargers covered under this General Permit are unacceptable.
- E. Changes in state law that reference this permit.

### **G15. REPORTING A CAUSE FOR MODIFICATION OR REVOCATION**

A Permittee who knows or has reason to believe that any activity has occurred or will occur which would constitute cause for modification or revocation and reissuance under Condition G12, G14, or 40 CFR 122.62 must report such plans, or such information, to Ecology so that a decision can be made on whether action to modify, or revoke and reissue this Permit will be required. Ecology may then require submission of a new or amended application. -Submission of such application does not relieve the Permittee of the duty to comply with this Permit until it is modified or reissued.

### **G16. APPEALS**

- A. The terms and conditions of this General Permit, as they apply to the appropriate class of dischargers, are subject to appeal within thirty days of issuance of this General Permit, in accordance with [Chapter 43.21B RCW](#), and [Chapter 173-226 WAC](#).
- B. The terms and conditions of this General Permit, as they apply to an individual discharger, are appealable in accordance with [Chapter 43.21B RCW](#) within thirty days of the effective date of coverage of that discharger. -Consideration of an appeal of General Permit coverage of an individual discharger is limited to the General Permit's applicability or nonapplicability to that individual discharger.

- C. The appeal of General Permit coverage of an individual discharger does not affect any other dischargers covered under this General Permit. -If the terms and conditions of this General Permit are found to be inapplicable to any individual discharger(s), the matter shall be remanded to Ecology for consideration of issuance of an individual permit or permits.
- D. Modifications of this Permit are appealable in accordance with [Chapter 43.21B RCW](#) and [Chapter 173-226 WAC](#).

## **G17. PENALTIES**

40 CFR 122.41(a)(2) and (3), 40 CFR 122.41(j)(5), and 40 CFR 122.41(k)(2) are hereby incorporated into this Permit by reference.

## **G18. DUTY TO REAPPLY**

The Permittee ~~must~~**shall** apply for permit renewal at least 180 days prior to the specified expiration date of this permit.

## **G19. CERTIFICATION AND SIGNATURE**

All ~~applications, reports, or information~~**formal submittals submitted to the DepartmentEcology** shall be signed and certified.

- A. All permit applications shall be signed by either a principal executive officer or ranking elected official.
- B. All ~~reports~~**formal submittals** required by this Permit ~~and other information requested by the Department~~ shall be signed by a person described above or by a duly authorized representative of that person. -A person is a duly authorized representative only if:
  - 1. The authorization is made in writing by a person described above and submitted to ~~the DepartmentEcology~~, and
  - 2. The authorization specifies either an individual or a position having responsibility for the overall development and implementation of the stormwater management program. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)
- C. Changes to authorization. -If an authorization under condition G19.B.2 is no longer accurate because a different individual or position has responsibility for the overall development and implementation of the stormwater management program, a new authorization satisfying the requirements of condition G19.B.2 must be submitted to ~~the DepartmentEcology~~ prior to or together with any reports, information, or applications to be signed by an authorized representative.
- D. Certification. Any person signing a ~~document~~**formal submittal** under this Permit shall make the following certification:

“I certify, under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that Qualified Personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for willful violations.”

## G20. NON-COMPLIANCE NOTIFICATION

In the event ~~the~~ **Permittee** is unable to comply with any of the terms and conditions of this ~~the~~ **Permit**, the Permittee must:

- A. Notify Ecology of the failure to comply with the permit terms and conditions in writing within 30 days of becoming aware that the non-compliance has occurred. The written notification must include all of the following:
  1. A description of the non-compliance, including dates.
  2. Beginning and end dates of the non-compliance, and if the compliance has not been corrected, the anticipated date of correction.
  3. Steps taken or planned to reduce, eliminate, or prevent reoccurrence of the non-compliance.
- B. Take appropriate action to stop or correct the condition of non-compliance.

## G21. UPSETS

Permittees must meet the conditions of 40 CFR 122.41(n) regarding “Upsets.” The conditions are as follows:

- A. Definition. “Upset” means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the Permittee. -An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.
- B. Effect of an upset. -An upset constitutes an affirmative defense to an action brought for noncompliance with such technology based permit effluent limitations if the requirements of paragraph (C) of this condition are met. -Any determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, will not constitute final administrative action subject to judicial review.
- C. Conditions necessary for demonstration of upset. -A ~~the~~ **Permittee** who wishes to establish the affirmative defense of upset must demonstrate, through properly signed contemporaneous operating logs, or other relevant evidence that:

1. An upset occurred and that the Permittee can identify the cause(s) of the upset;
  2. The permitted facility was at the time being properly operated; and
  3. The Permittee submitted notice of the upset as required in 40 CFR 122.41(l)(6)(ii)(B) (24-hour notice of noncompliance).
  4. The Permittee complied with any remedial measures required under 40 CFR 122.41(d) (Duty to Mitigate).
- D. Burden of proof. In any enforcement proceeding, the Permittee seeking to establish the occurrence of an upset has the burden of proof.

## DEFINITIONS AND ACRONYMS

This section includes definitions for terms used in the body of the permit and in all the appendices except Appendix 1. -Terms defined in Appendix 1 are necessary to implement requirements related to Appendix 1.

40 CFR means Title 40 of the Code of Federal Regulations, which is the codification of the general and permanent rules published in the Federal Register by the executive departments and agencies of the federal government.

**AKART** means all known, available, and reasonable methods of prevention, control and treatment. See also State Water Pollution Control Act, [chapter 90.48.010 RCW](#) and [chapter 90.48.520 RCW](#).

**All known, available and reasonable methods of prevention, control and treatment** refers to the State Water Pollution Control Act, [chapter 90.48.010 RCW](#) and [chapter 90.48.520 RCW](#).

**Applicable TMDL** means a TMDL which has been approved by EPA on or before the issuance date of this Permit, or prior to the date that Ecology issues coverage under this permit, whichever is later. ~~the Permittee's application is received by Ecology, or prior to a modification of this Permit, whichever is later.~~

**Beneficial Uses** means uses of waters of the states which include but are not limited to use for domestic, stock watering, industrial, commercial, agricultural, irrigation, mining, fish and wildlife maintenance and enhancement, recreation, generation of electric power and preservation of environmental and aesthetic values, and all other uses compatible with the enjoyment of the public waters of the state.

**Best Management Practices ("BMPs")** are the schedules of activities, prohibitions of practices, maintenance procedures, and structural and/or managerial practices approved by Ecology~~the Department~~ that, when used singly or in combination, prevent or reduce the release of pollutants and other adverse impacts to waters of Washington State.

**BMP** means Best Management Practice.

**Bypass** means the diversion of stormwater from any portion of a stormwater treatment facility.

**Census defined urban area** means ~~an~~ Urbanized Area.

**Circuit** means a portion of a ~~municipal separate storm sewer system (MS4)~~ discharging to a single point or serving a discrete area determined by traffic volumes, land use, topography or the configuration of the MS4.

~~**Common plan of development or sale** means a site where multiple separate and distinct construction activities may be taking place at different times on different schedules, but still under a single plan. Examples include: phased projects and projects with multiple filings or lots, even if the separate phases or filings/lots will be constructed under separate contract or by separate owners (e.g. a development where lots are sold to separate builders); a development plan that may be phased over multiple years, but is still under a consistent plan for long term development; and projects in a contiguous area that may be unrelated but still under the same contract, such as construction of a building extension and a new parking lot at the same facility. If the project is part of a common plan of development or sale, the disturbed area of the entire plan shall be used in determining permit requirements.~~

**Component or Program Component** means an element of the Stormwater Management Program listed in S5 Stormwater Management Program for Cities, Towns, and Counties or S6 Stormwater Management Program for Secondary Permittees, ~~or S7 Compliance with Total Maximum Daily Load Requirements, or S8 Monitoring~~ -of this permit.

**Co-~~p~~Permittee** means an owner or operator of an ~~regulated small~~ MS4 which is in a cooperative agreement with at least one applying jointly with an other applicant for coverage under this permit. -A ~~e~~C-~~p~~Permittee is an owner or operator of a regulated ~~small~~ MS4 located within or adjacent in proximity to another regulated MS4. A ~~e~~C-~~p~~Permittee is only responsible ~~for complying with the conditions of this~~ conditions relating to discharges from the MS4 the ~~e~~C-~~p~~Permittee owns or operates. -See also 40 CFR 122.26(b)(1)

**CWA** means Clean Water Act (formerly referred to as the Federal Water Pollution Control Act or Federal Water Pollution Control Act Amendments of 1972) Pub.L. 92-500, as amended Pub. L. 95-217, Pub. L. 95-576, Pub. L. (6-483 and Pub. L. 97-117, 33 U.S.C. 1251 et.seq).

~~**Detailed Implementation Plan** means the formal implementation plan for a Total Maximum Daily Load (TMDL) or water quality clean-up plan.~~

~~**DIP** means Detailed Implementation Plan.~~

**Director** means the Director of the Washington State Department of Ecology, or an authorized representative.

~~**Discharge** for the purpose of this permit means, unless indicated otherwise, any discharge from a MS4 owned or operated by the permittee.~~

**Entity** means ~~another~~ governmental body, or a public or private organization, ~~such as another permittee, a conservation district, or volunteer organization.~~

~~**40 CFR** means Title 40 of the Code of Federal Regulations, which is the codification of the general and permanent rules published in the Federal Register by the executive departments and agencies of the federal government.~~

EPA means the U.S. Environmental Protection Agency.

**General Permit** means a permit which covers multiple dischargers of a point source category within a designated geographical area, in lieu of individual permits being issued to each discharger.

**Ground water** means water in a saturated zone or stratum beneath the surface of the land or below a surface water body. -Refer to Chapter 173-200 WAC.

**Hazardous substance** means any liquid, solid, gas, or sludge, including any material, substance, product, commodity, or waste, regardless of quantity, that exhibits any of the physical, chemical, or biological properties described in WAC 173-303-090 or WAC 173-303-100.

**Heavy equipment maintenance or storage yard** means an uncovered area where any heavy equipment, such as mowing equipment, excavators, dump trucks, backhoes, or bulldozers are washed or maintained, or where at least five pieces of heavy equipment are stored on a long-term basis.

**Highway** means a main public road connecting towns and cities.

**Hydraulically Near** means runoff from the site discharges to the sensitive feature without significant natural attenuation of flows that allows for suspended solids removal. -See Appendix 7 Determining Construction Site Sediment Damage Potential for a more detailed definition.

**Hyperchlorinated** means water that contains more than 10 mg/Liter chlorine.

~~Disinfection of water mains and appurtenances requires a chlorine residual of 10 mg/L at the end of the disinfection period. This level is well above the Maximum Residual Disinfectant Level of an annual average of 4 mg/Liter chlorine for potable water.~~

**Illicit connection** means any infrastructure connection to the MS4 that is not intended, permitted or used for collecting and conveying stormwater or non-stormwater discharges allowed as specified in this permit (S5.C.3 and S6.D.3). ~~man-made conveyance that is connected to a municipal separate storm sewer without a permit, excluding roof drains and other similar type connections.~~ Examples include sanitary sewer connections, floor drains, channels, pipelines, conduits, inlets, or outlets that are connected directly to the MS4 municipal separate storm sewer system.

**Illicit discharge** means any discharge to a ~~municipal separate storm sewer~~ MS4 that is not composed entirely of storm-water or of non-stormwater discharges allowed as specified in this except discharges pursuant to a NPDES permit (S5.C.3 and S6.D.3). ~~(other than the NPDES permit for discharges from the municipal separate storm sewer) and discharges resulting from fire fighting activities.~~

~~**Large Municipal Separate Storm Sewer System** means all municipal separate storm sewer systems located in an incorporated place with a population of 250,000 or more, a county with unincorporated urbanized areas with a population of 250,000 or more according to the 1990 decennial census by the Bureau of Census.~~

**Impervious surface** means a non-vegetated surface area that either prevents or retards the entry of water into the soil mantle as under natural conditions prior to development. A non-vegetated surface area which causes water to run off the surface in greater quantities or at an

increased rate of flow from the flow present under natural conditions prior to development. Common impervious surfaces include, but are not limited to, roof tops, walkways, patios, driveways, parking lots or stormwater areas, concrete or asphalt paving, gravel roads, packed earthen materials, and oiled, macadam or other surfaces which similarly impede the natural infiltration of stormwater.

**Land disturbing activity** means any activity that results in a change in the existing soil cover (both vegetative and non-vegetative) and/or the existing soil topography. Land disturbing activities include, but are not limited to clearing, grading, filling and excavation. Compaction that is associated with stabilization of structures and road construction shall also be considered land disturbing activity. Vegetation maintenance practices, including landscape maintenance and gardening, are not considered land disturbing activity. Stormwater facility maintenance is not considered land disturbing activity if conducted according to established standards and procedures.

**LID** means Low Impact Development.

**Low Density Residential Land Use** means, for the purpose of permit section S8 Monitoring, one unit per 1-5 acres.

**LID BMP** means low impact development best management practices.

**LID Principles** means land use management strategies that emphasize conservation, use of on-site natural features, and site planning to minimize impervious surfaces, native vegetation loss, and stormwater runoff.

~~**LID BMP** means low impact development best management practices.~~

**Low Impact Development (LID)** means a stormwater and land use management and land development strategy that strives to mimic pre-disturbance hydrologic processes of infiltration, filtration, storage, evaporation and transpiration by emphasizing conservation, use of on-site natural features, site planning, and distributed stormwater management practices that are integrated into a project design, applied at the parcel and subdivision scale that emphasizes conservation and use of on-site natural features integrated with engineered, small-scale hydrologic controls to more closely mimic pre-development hydrologic functions.

**Low impact development best management practices** means distributed stormwater management practices, integrated into a project design, that emphasize pre-disturbance hydrologic processes of infiltration, filtration, storage, evaporation and transpiration. LID BMPs include, but are not limited to, bioretention/rain gardens, permeable pavements, roof downspout controls, dispersion, soil quality and depth, vegetated roofs, minimum excavation foundations, and water re-use.

**Major Municipal Separate Storm Sewer Outfall** means a municipal separate storm sewer outfall from a single pipe with an inside diameter of 36 inches or more, or its equivalent (discharge from a single conveyance other than circular pipe which is associated with a drainage area of more than 50 acres); or for municipal separate storm sewers that receive stormwater from lands zoned for industrial activity (based on comprehensive zoning plans or the equivalent), an outfall that discharges from a single pipe with an inside diameter of 12

~~inches or more or from its equivalent (discharge from other than a circular pipe associated with a drainage area of 12 acres or more).~~

**Material Storage Facilities** means an uncovered area where bulk materials (liquid, solid, granular, etc.) are stored in piles, barrels, tanks, bins, crates, or other means.

**Maximum Extent Practicable (MEP)** refers to paragraph 402(p)(3)(B)(iii) of the federal Clean Water Act which reads as follows: Permits for discharges from municipal storm sewers shall require controls to reduce the discharge of pollutants to the maximum extent practicable, including management practices, control techniques, and system, design, and engineering methods, and other such provisions as the Administrator or the State determines appropriate for the control of such pollutants.

~~**Medium Municipal Separate Storm Sewer System** means municipal separate storm sewer systems located in an incorporated place with a population of more than 100,000 but less than 250,000, or a county with unincorporated urbanized areas of more than 100,000 but less than 250,000 according to the 1990 decennial census by the Bureau of Census.~~

MEP means Maximum Extent Practicable.

~~**MS4** means municipal separate storm sewer system.~~

~~**MTRs** means Minimum Technical Requirements.~~

**Municipal Separate Storm Sewer System (MS4)** means a conveyance, or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains):

- (i) ~~e~~**O**wned or operated by a state, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to ~~S~~**s**tate ~~L~~**l**aw) having jurisdiction over disposal of wastes, storm-water, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the CWA that discharges to waters of ~~Washington State~~**the United States**.
- (ii) ~~d~~**D**esigned or used for collecting or conveying stormwater.
- (iii) ~~w~~**W**hich is not a combined sewer; ~~and~~
- (iv) ~~w~~**W**hich is not part of a Publicly Owned Treatment Works (POTW) as defined at 40 CFR 122.2.; ~~and~~
- (v) Which is defined as “large” or “medium” or “small” or otherwise designated by Ecology pursuant to 40 CFR 122.26.

**National Pollutant Discharge Elimination System (NPDES)** means the national program for issuing, modifying, revoking, and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under sections 307, 402, 318, and 405 of the Federal Clean Water Act, for the discharge of pollutants to surface waters of the state from point sources. These permits are referred to as NPDES permits and, in Washington State, are administered by the Washington Department of Ecology.



**Native vegetation** means vegetation comprised of plant species, other than noxious weeds, that are indigenous to the coastal region of the Pacific Northwest and which reasonably could have been expected to naturally occur on the site. Examples include trees such as Douglas Fir, western hemlock, western red cedar, alder, big-leaf maple; shrubs such as willow, elderberry, salmonberry, and salal; and herbaceous plants such as sword fern, foam flower, and fireweed.

**New development** means land disturbing activities, including Class IV ~~General~~ Forest Practices that are conversions from timber land to other uses; structural development, including construction or installation of a building or other structure; creation of hard surfaces; and subdivision, short subdivision and binding site plans, as defined and applied in Chapter 58.17 RCW. Projects meeting the definition of redevelopment shall not be considered new development. Refer to Appendix 1 for a definition of hard surfaces.

**New Permittee** means a city, town, or county that is subject to the *Western Washington Municipal Stormwater General Permit* and was not subject to the permit prior to August 1, 2013.

**New Secondary Permittee** means a Secondary Permittee that is covered under a municipal stormwater general permit and was not covered by the permit prior to August 1, 2013.

**NOI** means Notice of Intent.

**Notice of Intent (NOI)** means the application for, or a request for coverage under ~~this~~ General Permit pursuant to WAC 173-226-200.

**Notice of Intent for Construction Activity** ~~and~~ means the application form for coverage under the *Construction Stormwater General Permit.*

**Notice of Intent for Industrial Activity** means the application forms for coverage under the *Baseline General Permit for Stormwater Discharges Associated with Industrial Activities.*

**NPDES** means National Pollutant Discharge Elimination System.

**Outfall** means point source as defined by 40 CFR 122.2 at the point where a ~~municipal-separate storm-sewer discharge leaves the MS4 and~~ discharges to waters of the State. ~~Outfall and~~ does not include ~~open conveyances connecting two municipal-separate storm-sewer systems, or pipes, tunnels, or other conveyances which connect segments of the same stream or other waters of the States~~ surface waters and are used to convey primarily surface waters (i.e. culverts) of the State.

**Permittee** unless otherwise noted, the term “Permittee” includes city, town, or county Permittee, Co-Permittee, ~~New Permittee, and~~ Secondary Permittee, ~~and~~ New Secondary Permittee. as defined below:

- ~~(i) A “Permittee” is a city, town, or county owning or operating a regulated small MS4 applying and receiving a permit as a single entity.~~
- ~~(ii) A “Co-Permittee” is any operator of a regulated small MS4 that is applying jointly with another applicant for coverage under this Permit. Co-Permittees own or operate a regulated small MS4 located within or adjacent to another regulated small MS4.~~

~~(iii) A “Secondary Permittee” is an operator of regulated small MS4 that is not a city, town or county.~~

**Physically Interconnected** means that one MS4 is connected to ~~another second MS4 storm sewer system~~ in such a way that it allows for direct discharges to the second system. For example, the roads with drainage systems and municipal streets of one entity are physically connected directly to a ~~MS4 storm sewer system~~ belonging to another entity.

~~**Pollutant Generating Impervious Surfaces (PGIS)** are surfaces considered to be significant sources of pollutants in stormwater runoff. Such surfaces include those that are subject to vehicular use, industrial activities, or storage of erodible or leachable materials that receive direct rainfall or run-on or blow-in of rainfall. Metal roofs are considered to be PGIS unless coated with an inert, non-leachable material. Roofs that are subject to venting of indoor pollutants from manufacturing, commercial or other operations or processes are also considered PGIS. A surface, whether paved or not, shall be considered PGIS if it is regularly used by motor vehicles. The following are considered regularly used surfaces: roads, unvegetated road shoulders, bike lanes within the traveled lane of a roadway, driveways, parking lots, unfenced fire lanes, vehicular equipment storage yards, and airport runways.~~

~~**Process Wastewater** means any water which, during manufacture or processing, comes into direct contact with or results from the production or use of any raw material, intermediate product, finished product, by product, or waste product.~~

~~**Project site** means that portion of a property, properties, or right-of-ways subject to land disturbing activities, new hard surfaces, or replaced hard surfaces. Refer to Appendix 1 for a definition of hard surfaces.~~

~~**QAPP** means Quality Assurance Project Plan.~~

~~**Qualified Personnel or Consultant** means someone who has had professional training in the aspects of stormwater management for which they are responsible and are under the functional control of the Permittee. Qualified Personnel may be staff members, contractors, or volunteers.~~

~~**Quality Assurance Project Plan** means a document that describes the objectives of an environmental study and the procedures to be followed to achieve those objectives.~~

~~**RCW** means the Revised Code of Washington State.~~

~~**Receiving waters** means bodies of water or surface water systems to which surface runoff is discharged via a point source of stormwater or via sheet flow. Receiving waters may also be ground water to which surface runoff is directed by infiltration.~~

~~**Redevelopment** means, on a site that is already substantially developed (i.e., has 35% or more of existing hard surface coverage), the creation or addition of hard surfaces; the expansion of a building footprint or addition or replacement of a structure; structural development including construction, installation or expansion of a building or other structure; replacement of hard surface that is not part of a routine maintenance activity; and land disturbing activities. Refer to Appendix 1 for a definition of hard surfaces.~~

Receiving waters mean bodies of water or surface water systems to which surface runoff is discharged via a point source of stormwater or via sheet flow. Ground water to which surface runoff is directed by infiltration.

Regional Stormwater Monitoring Program means, for all of western Washington, a stormwater-focused monitoring and assessment program consisting of these components: status and trends monitoring in small streams and marine nearshore areas, stormwater management program effectiveness studies, and a source identification information repository (SIDIR). The priorities and scope for the RSMP are set by a formal stakeholder group. For this permit term, RSMP status and trends monitoring will be conducted in the Puget Sound basin only.

**Regulated Small Municipal Separate Storm Sewer System (MS4)** means a Municipal Separate Storm Sewer System which is automatically designated for inclusion in the Phase II stormwater permitting program by its location within an Urbanized Area, or by designation by ~~Ecology~~the NPDES permitting authority and is not eligible for a waiver or exemption under S1.C.

~~Replaced impervious surfaces means, for structures, the removal and replacement of any exterior impervious surfaces or foundation; or, for other impervious surfaces, the removal down to bare soil, or base course, and replacement. Exemptions and partial exemptions are defined in Appendix 1 of this Permit.~~

RSMP means Regional Stormwater Monitoring Program.

**Runoff** is water that travels across the land surface and discharges to water bodies either directly or through a collection and conveyance system. -See also “Stormwater.”

**Secondary Permittee** is an operator of a regulated small municipal separate storm sewer system~~MS4~~ which is not a city, town or county. Secondary Permittees include special purpose districts and other MS4public entities that meet the criteria ~~for a regulated small MS4~~ in S1.B.

Sediment/Erosion-Sensitive Feature means an area subject to significant degradation due to the effect of construction runoff, or areas requiring special protection to prevent erosion. See Appendix 7 Determining Construction Site Sediment Transport Potential for a more detailed definition.

**Shared ~~W~~water bodies** means water bodies, including downstream segments, lakes and estuaries that receive discharges from more than one ~~p~~Permittee.

SIDIR means Source Identification Information Repository.

**Significant contributor** means a discharge that contributes a loading of pollutants considered to be sufficient to cause or exacerbate the deterioration of receiving water quality or instream habitat conditions.

~~**Small Municipal Separate Storm Sewer System or Small MS4** means an MS4 that is is a conveyance or system of conveyances including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels and/or storm drains which is:~~

~~a. Owned or operated by a city, town, county, district, association or other public body created pursuant to State law having jurisdiction over disposal of sewage, industrial wastes,~~

~~stormwater, or other wastes, including special districts under State law such as a sewer districts, flood control districts or drainage districts, or similar entity.~~

~~b. Designed or used for collecting or conveying stormwater.~~

~~c. Not a combined sewer system,~~

~~d. Not part of a Publicly Owned Treatment Works (POTW) as defined at 40 CFR 122.2.~~

~~Not defined as “large” or “medium” pursuant to 40 CFR 122.26(b)(4) & (7) or designated under 40 CFR 122.26 (a)(1)(v).~~

~~**Source control BMP** means a structure or operation that is intended to prevent pollutants from coming into contact with stormwater through physical separation of areas or careful management of activities that are sources of pollutants. -The *SWMMWW* (2012) separates source control BMPs into two types. -Structural Source Control BMPs are physical, structural, or mechanical devices, or facilities that are intended to prevent pollutants from entering stormwater. -Operational BMPs are non-structural practices that prevent or reduce pollutants from entering stormwater. See Volume IV of the *SWMMWW* (2012) for details.~~

~~Small MS4s include systems similar to separate storm sewer systems in municipalities such as: universities, large publicly owned hospitals, prison complexes, highways and other thoroughfares. Storm sewer systems in very discrete areas such as individual buildings do not require coverage under this Permit.~~

~~Small MS4s do *not* include storm drain systems operated by non-governmental entities such as: individual buildings, private schools, private colleges, private universities, and industrial and commercial entities.~~

**Stormwater** means runoff during and following precipitation and snowmelt events, including surface runoff, ~~and~~ drainage or interflow.

**Stormwater Associated with Industrial and Construction Activity** means the discharge from any conveyance which is used for collecting and conveying stormwater, which is directly related to manufacturing, processing or raw materials storage areas at an industrial plant, or associated with clearing, grading and/or excavation, and is required to have an NPDES permit in accordance with 40 CFR 122.26.

~~**Stormwater Management Manual for Western Washington** means the 5-volume technical manual (Publication Nos. 99-11 through 15 for the 2001 version and Publication Nos. 05-10-029-033 for the 2005 version (The 2005 version replaces the 2001 version) prepared by Ecology for use by local governments that contains BMPs to prevent, control, or treat pollution in storm water.~~

**Stormwater Management Program (SWMP)** means a set of actions and activities designed to reduce the discharge of pollutants from the ~~regulated small~~-MS4 to the MEP maximum extent practicable and to protect water quality, and comprising the components listed in S5 (for cities, towns and counties) or S6 (for Secondary Permittees) of this Permit and any additional actions necessary to meet the requirements of applicable TMDLs pursuant to S7 Compliance with TMDL Requirements, and S8 Monitoring and Assessment.

**Stormwater Treatment and Flow Control BMPs/Facilities** means detention facilities, treatment BMPs/facilities, bioretention, vegetated roofs, and permeable pavements that help meet Appendix 1 Minimum Requirements #6 (treatment), #7 (flow control), or both.

**SWMMWW** means *Stormwater Management Manual for Western Washington (2005)*.

**SWMP** means Stormwater Management Program.

**TMDL** means Total Maximum Daily Load.

**Total Maximum Daily Load (TMDL)** means a water cleanup plan. A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources. -A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. The calculation must include a margin of safety to ensure that the water body can be used for the purposes the state has designated. -The calculation must also account for seasonable variation in water quality. -Water quality standards are set by states, territories, and tribes. They identify the uses for each water body, for example, drinking water supply, contact recreation (swimming), and aquatic life support (fishing), and the scientific criteria to support that use. -The Clean Water Act, section 303, establishes the water quality standards and TMDL programs.

**Tributary conveyance** means pipes, ditches, catch basins, and inlets owned or operated by the Permittee and designed or used for collecting and conveying stormwater.

**UGA** means Urban Growth Area.

**Urban Growth Area** means those areas designated by a county pursuant to RCW 36.70A.110.

**Urbanized Area (UA)** is a federally-designated land area comprising one or more places and the adjacent densely settled surrounding area that together have a residential population of at least 50,000 and an overall population density of at least 1,000 people per square mile.

Urbanized Areas are designated by the U.S. Census Bureau based on the most recent decennial census.

~~For the year 2000 Census, the U.S. Census Bureau classified "urban" as all territory, population, and housing units located within an Urbanized Area (UA) or an Urban Cluster (UC). It delineated UA and UC boundaries to encompass densely settled territory, which consists of: core census block groups or blocks that have a population density of at least 1,000 people per square mile and surrounding census blocks that have an overall density of at least 500 people per square mile. In addition, under certain conditions, less densely settled territory may be part of each UA or UC. The U.S. Census Bureau announced the "Census 2000 Urbanized Areas" on May 1, 2002. More information can be found at the U.S. Census Bureau website.~~

~~**Urban/higher density rural subbasins** means any subbasin or portion thereof that is within or proposed to be within the urban growth area (UGA), or any rural area subbasin or portion thereof fifty percent or more of which is comprised of lots smaller than 5 acres in size.~~

**Vehicle Maintenance or Storage Facility** means an uncovered area where any vehicles are regularly washed or maintained, or where at least 10 vehicles are stored.

**Water Quality Standards** means Surface Water Quality Standards, chapter 173-201A WAC, Ground Water Quality Standards, chapter 173-200 WAC, and Sediment Management Standards, chapter 173-204 WAC.

**Waters of the State** includes those waters as defined as "waters of the United States" in 40 CFR Subpart 122.2 within the geographic boundaries of Washington State and "waters of the state" as defined in chapter 90.48 RCW which includes lakes, rivers, ponds, streams, inland waters, underground waters, salt waters and all other surface waters and water courses within the jurisdiction of the State of Washington.

**Waters of the United States** refers to the definition in 40 CFR 122.2.

~~**Water Quality Standards** means Surface Water Quality Standards, Chapter 173-201A WAC, Ground Water Quality Standards, Chapter 173-200 WAC, and Sediment Management Standards, Chapter 173-204 WAC.~~

Lead	Senior Maintenance	Utility Person	Laborer
<ol style="list-style-type: none"> <li>1. Monitor and maintain inventory of parts and supplies on the job site and ensure crews have adequate hand and power tools and equipment to perform the work.</li> <li>2. Coordinates, on the work site, work of assigned crew.</li> <li>3. Maintains current knowledge of rules and regulations regarding operations, safety, maintenance, and construction of Public Works facilities and is responsible to ensure compliance to these rules.</li> <li>4. Resolves citizen complaints including follow-up investigation and research regarding street, water, sewer, or drainage related problems.</li> <li>5. Trains less experienced employees in both equipment operation and operator safety.</li> <li>6. Plans, implements, and maintains Operations and Maintenance Division field crew training program.</li> <li>7. Evaluates and prioritizes situations/work requests.</li> <li>8. Records materials, hours and equipment used for assigned crew.</li> <li>9. Other duties as assigned by supervisor.</li> <li>10. May be required to return to the City during off hours in case of emergency.</li> <li>11. Implement training programs, record and maintain training records.</li> </ol>	<ol style="list-style-type: none"> <li>1. Performs, on work site, activities regarding street maintenance, traffic control (signs and signals), and vegetation control.</li> <li>2. Performs, on work site, activities regarding sewer maintenance including mains, pumping stations, and appurtenances.</li> <li>3. Performs, on work site, activities regarding water system maintenance of mains, valves, hydrants, meters, PRVs, and appurtenances.</li> <li>4. Performs, on work site, activities regarding storm drain maintenance including mains, catch basins, detention/retention facilities, and channelization.</li> <li><b>5. Operates all Public work's</b> equipment and machinery including, but not limited to: backhoe loader, street sweeper, vactor, sewer jet, motor grader, dozer, and dump trucks.</li> <li>6. In absence of a Lead or Supervisor, coordinates field activities at a crew level.</li> <li>7. May be required to perform standby duty if there are not enough volunteers to fill the need.</li> </ol>	<ol style="list-style-type: none"> <li>1. Performs, on work site, activities regarding street maintenance, traffic control (signs and signals) and vegetation control; such as temporary and permanent asphalt patching and concrete work.</li> <li>2. Performs, on work site, activities regarding sewer maintenance including mains, pumping stations, and appurtenances; such as repairing and cleaning mains, troubleshooting pump problems at lift station and safety observer.</li> <li>3. Performs, on work site, activities regarding water system maintenance of mains, valves, hydrants, meters, PRVs and appurtenances; such as reading meters, repair hydrants, install and services mains.</li> <li>4. Performs, on work site, activities regarding storm drain maintenance including mains, catch basins, detention/retention facilities and channelization.</li> <li>5. Acts as flagperson to control traffic while road work is being accomplished.</li> <li>6. Assists Senior Maintenance Person in performing tasks.</li> <li>7. May be required to return to the City during off hours in case of emergency.</li> <li>8. May be required to perform standby duty if there are not enough volunteers to fill the need.</li> </ol>	<ol style="list-style-type: none"> <li>1. Perform work-site activities for street maintenance, traffic control (signs and signals), and vegetation control such as temporary or permanent asphalt patching, concrete work, irrigation, weed spraying, lawn mowing, landscaping, tree trimming, and graffiti removal.</li> <li>2. Perform work-site activities for wastewater maintenance on wastewater mains, pumping stations, and appurtenances such as repairing or cleaning mains, rehabilitation and repair of live sewer manholes, troubleshooting pump problems at lift stations, and safety observations.</li> <li>3. Performs work-site activities for water maintenance on mains, valves, hydrants, meters, pressure reducing valves, and appurtenances such as reading meters, repairing/painting hydrants, installing and rehabilitation of mains.</li> <li>4. Performs work-site activities for storm and surface water maintenance on mains, catch basins, detention/retention facilities, and channelization such as cleaning, repairing, and installing systems.</li> <li>5. Performs work-site activities for public grounds such as landscaping, planting and transplanting trees, vegetation and shrubbery pruning, weeding, mowing and other grounds maintenance.</li> <li>6. Performs work-site activities associated with City properties such as elementary level skills of carpentry, plumbing, electrical, painting, cement finishing and mechanical repairs/construction.</li> <li>7. Acts as flagperson to control traffic while work in the right-of-way is being completed.</li> <li>8. May be required to return to the City during off hours in case of emergency.</li> </ol>