

**UTILITIES
SURFACE WATER MAINTENANCE STANDARDS
FOR PUBLIC AND PRIVATE SYSTEMS**

December 2002



Issued by

**CITY OF BELLEVUE
UTILITIES DEPARTMENT**

Lloyd Warren
Director

Damon Diessner
Assistant Director
Environment Division

Dennis Vidmar
Assistant Director
Operations and Maintenance Division

11511 MAIN STREET
P.O. BOX 90012
BELLEVUE, WASHINGTON 98009-9012

TABLE OF CONTENTS

CHAPTER M1 - GENERAL	3
M1-01 Purpose.....	3
M1-02 Repair and Replacement of Facilities	3
M1-04 Recordkeeping	3
M1-05 Definitions.....	3
M1-06 References.....	7
CHAPTER M2 - MAINTENANCE STANDARDS.....	7
M2-01 General.....	7
M2-02 Ponds.....	7
M2-03 Infiltration Basins, Trenches, and Swales.....	14
M2-04 Vaults, Tanks, and Pipes.....	15
M2-05 Biofilters (Swales and Filter Strips).....	18
M2-06 Sand Filters	22
M2-07 Media Filters	25
M2-08 Oil/water Separators.....	26
M2-09 Catch Basin Inserts	29
M2-10 Catch Basins, Manholes and Inlets	30
M2-11 Control Structures, Flow Regulators, Flow Splitters and Energy Dissipators..	32
M2-12 Conveyance (Pipes, Ditches, and Culverts).....	34
M2-13 Stream Systems.....	36
CHAPTER M3 - INSPECTIONS.....	39
M3-01 General.....	39
M3-02 Inspection Frequencies.....	39
CHAPTER M4 - SOURCE CONTROL.....	41
M4-01 General.....	41
M4-02 Source Control BMPs	41

CHAPTER M1 - GENERAL

M1-01 PURPOSE

These Maintenance Standards set forth the minimum standards for the maintenance of public and private storm and surface water systems.

The Storm and Surface Water Code, part of Chapter 24.06 of the Bellevue City Code, adopted April 3, 1995, amended November 27, 1995 (or as subsequently amended), is the basis for these Maintenance standards.

M1-02 REPAIR AND REPLACEMENT OF FACILITIES

All parts of the drainage system shall be maintained or replaced as required when the facility becomes or may become inoperative or as directed by the Utility Director. Responsibility for repair or replacement is with the Utility for Utility facilities, with the owners for private property, and with the appropriate agency for other public properties.

M1-04 RECORDKEEPING

Property owners and the Utility shall retain records of all maintenance activities of public and private storm and surface water systems. These records shall be made available to the Utility upon request.

M1-05 DEFINITIONS

The following terms as used in this document shall be defined and interpreted as follows:

"Best Management Practice"

Best management practice (BMP) means those physical, structural and/or managerial practices that, when used individually or in combination, prevent or reduce pollution of water. BMPs include, but are not limited to, structural solutions covered by the terms "best available technology" (BAT) and "all known available and reasonable methods of treatment" (AKART).

"Catch Basin"

A chamber or well, usually built at the curb line of a street, for the admission of surface water to a storm drain, having at its base a sediment sump designed to retain grit and detritus below the point of overflow.

"Channel"

A feature that conveys surface water and is open to the air.

"Channel, constructed"

Channels or ditches constructed (or reconstructed natural channels) to convey surface water.

"Channel, natural"

Streams, creeks, or swales that convey surface or ground water and have existed long enough to establish a stable route and/or biological community.

"Conveyance"

A mechanism for transporting water from one point to another, including pipes, ditches, and channels.

"Flow Control Facility"

A drainage facility designed to mitigate the impacts of increased surface and stormwater runoff flow rates generated by development. Flow control facilities include detention ponds, vaults, control structures, and combination wetpool facilities. Also known as a "detention facility".

"Forebay"

An easily maintained, extra storage area provided near an inlet of a BMP to trap incoming sediments before they accumulate in a pond or wetland BMP.

"Industrial Activities"

Material handling, transportation, or storage; manufacturing; maintenance; treatment; or disposal. Areas with industrial activities include plant yards, access roads and rail lines used by carriers of raw materials, manufactured products, waste material, or by-products; material handling sites; refuse sites; sites used for the application or disposal of process waste waters; sites used for the storage and maintenance of material handling equipment; sites used for residual treatment, storage, or disposal; shipping and receiving areas; manufacturing buildings; storage areas for raw materials, and intermediate and finished products; and areas where industrial activity has taken place in the past and significant materials remain and are exposed to stormwater.

"Leachate"

Liquid that has percolated through solid waste and contains contaminants in solution or suspension.

"Maintenance"

Maintenance includes repair and maintenance activities conducted on currently serviceable structures, facilities, and equipment that involves no expansion or use beyond that previously existing and resulting in no significant adverse hydrologic impact. It includes those usual activities taken to prevent a decline, lapse, or cessation in the use of structures and systems and includes replacement of disfunctioning facilities, including cases where environmental permits require replacing an existing structure with a different type structure, as long as the functioning characteristics of the original structure are not changed. For example, removing sediments and roots from catch basins and pipes in order to restore sediment removal capability and flow capacity.

"Major Storm Event"

Major storm events include storms that cause road closures, property damage, and/or areas of generalized flooding.

"Noxious Weed"

Opportunistic species of inferior biological value that tend to out-compete more desirable forms and become dominant; applied to non-native species in these standards. The noxious weed list established by the Noxious Weed Control Board can be found at: www.wa.gov/agr/weedboard/weed_list/weed_listhome.html.

"Native Vegetation"

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, and Vine Maple; shrubs such as willow, elderberry, salmonberry, and salal; and herbaceous plants such as sword fern, foam flower, and fireweed.

"Ordinary High Water Line"

The mark on the shores of all waters that will be found by examining the bed and banks and ascertaining where the presence and action of waters are so common and usual and so long continued in ordinary years, as to mark upon the soil or vegetation a character distinct from that of the abutting upland. Any area where the ordinary high water line cannot be found, the ordinary high water line shall be the elevation of the mean annual flood.

"Operational Source Control BMPs"

Operational BMPs are a type of source control BMP that include schedules of activities, prohibition of practices, and other managerial practices to prevent or reduce pollutants from entering stormwater.

"Private System or Private Drainage Facility"

Private system or private drainage facility means any element of the storm and surface water system which is not a part of the public drainage system.

"Public Storm and Surface Water System or Public Drainage System"

Public Storm and Surface Water System or Public Drainage System means those elements of the storm and surface water system maintained and operated by the city:

1. Located on property owned by the city or in public right-of-way; or
2. Located on property on which the city has an easement, license or other right of use for utility purposes.

"Sediment"

Fragmented material that originates from weathering and erosion of rocks or unconsolidated deposits, and is transported by, suspended in, or deposited by water.

"Storm and Surface Water System"

Also referred to as the drainage system – the entire system within the City, both public and private, naturally existing and man-made, for the drainage, conveyance, detention, treatment or storage of storm and surface waters.

"Structural Source Control BMPs"

Physical, structural, or mechanical devices or facilities that are intended to prevent pollutants from entering stormwater. Structural source control BMPs typically include:

- Enclosing and/or covering the pollutant source (building or other enclosure, a roof over storage and working areas, temporary tarp, etc.)
- Segregating the pollutant source to prevent run-on of stormwater, and to direct only contaminated stormwater to appropriate treatment BMPs.
- Directing polluted water (i.e., car wash water, restaurant grease, and dumpster leachate) to sanitary sewer.

"Watercourse" and "river or stream"

Any portion of a channel, bed, bank, or bottom waterward of the ordinary high water line of waters of the state including areas in which fish may spawn, reside, or through which they may pass, and tributary waters with defined bed or banks, which influence the quality of fish habitat downstream. This includes watercourses which flow on an intermittent basis or which fluctuate in level during the year and applies to the entire bed of such watercourse whether or not the water is at peak level. This definition does not

include irrigation ditches, canals, stormwater runoff devices, or other entirely artificial watercourses, except where they exist in a natural watercourse which has been altered by humans.

“Waters of the State”

All salt waters and fresh waters waterward of the ordinary high water lines and within the territorial boundaries of the state.

"Water Quality Treatment Facility"

A stormwater facility that is intended to remove pollutants from stormwater. A few examples of water quality treatment facilities are wetponds, sand filters, oil/water separators, biofiltration swales, and constructed wetlands.

M1-06 REFERENCES

Bellevue. 1996. Utilities Engineering Standards, City of Bellevue Utilities Department.

Ecology. 2001. Stormwater Management Manual for Western Washington, 99-11 through 99-15. Washington Department of Ecology, Olympia, WA.

King County. 1998. Surface Water Design Manual, King County, Washington. King County Department of Natural Resources, Seattle, WA.

Tri-County. 2000. Draft Tri-County 4(d) Stormwater Proposal.

CHAPTER M2 - MAINTENANCE STANDARDS

M2-01 GENERAL

The facility-specific maintenance standards contained in this chapter are measures for determining if maintenance actions are required as identified through inspection. They are not intended to be measures of the facility's required condition at all times between inspections. In other words, exceedence of these thresholds or measures at any time between inspections and/or scheduled maintenance does not automatically constitute a violation of these standards. However, when maintenance actions are required as identified through inspection and no action is taken, this constitutes a violation of these standards.

M2-02 PONDS

There are several different types of stormwater ponds:

Detention ponds. In Bellevue, detention (i.e., dry) ponds are the most common BMP. Detention ponds are designed primarily for stormwater quantity control to maintain post-development peak discharges to as near as possible to the pre-development flow rates. Runoff enters the pond and is temporarily stored as water is slowly released to the downstream drainage system. Detention storage is often referred to as “live” storage. Controlling peak discharge rates from developed sites reduces stream bank erosion and minimizes flooding in downstream areas. Detention ponds are designed to drain completely following storm events. Although not specifically designed to provide water quality treatment, these ponds can remove some pollutants if the storage volume is large enough to adequately detain incoming runoff. Typically a storage time of 24 hours or more is needed for a detention pond to provide any significant amount of pollutant removal. Removal occurs primarily via sedimentation as suspended solids and particulate-bound pollutants settle out in the pond. If these sediments are not removed through routine maintenance, they may be resuspended and washed out of the detention pond.

Water quality ponds. Water quality ponds (wetpools) contain a large permanent pool (wetpool) that functions as an energy dissipater, slowing the velocity of incoming stormwater and allowing suspended sediment to settle, providing stormwater treatment. The permanent pool volume is generally referred to as “dead” storage. The wetpool also provides a suitable environment and adequate hydraulic residence time to promote biological and chemical reactions. In addition, aquatic plants that establish in the wetpool can also enhance sedimentation and promote pollutant uptake. Water quality ponds typically provide no live storage for flow control purposes and function only as water quality treatment devices.

Combined ponds. Combined ponds simply incorporate the live storage of a detention pond with the dead storage (wetpool) of a water quality pond into a single facility. Consequently, these facilities provide both flow control and water quality treatment. Pollutant removal mechanisms in a combined pond are similar to those described above under water quality ponds.

Detention Ponds Maintenance Requirements

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	Any trash and debris which exceed 1 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping. If less than threshold all trash and debris will be removed as part of next scheduled maintenance.	Trash and debris cleared from site.
	Sediment	Six inches of accumulated sediment across pond bottom or accumulation that affects inletting or outletting condition of the facility.	Sediment cleaned out to designed pond shape and depth; pond reseeded if necessary to control erosion.
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants.	No contaminants or pollutants present.
	Noxious Weeds	Any evidence of noxious weeds. The noxious weed list can be found at: www.wa.gov/agr/weedboard/weed_list/weed_listhome.html	Eradicate all class A noxious weeds; control and prevent the spread of all class B noxious weeds designated for control in King County; and control and prevent the spread of all class B and class C noxious weeds listed on the county weed list. Use Integrated Pest Management techniques.
	Beaver Dams	Dam results in change or function of the facility.	Facility is returned to design function. (Coordinate trapping of beavers and breaching of dams with appropriate permitting agencies)
	Tree Growth and Hazard Trees	Tree growth does not allow maintenance access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements). If trees are not interfering with access or maintenance, do not remove. If dead, diseased, or dying trees are identified.	Trees do not hinder maintenance activities. Remove hazard trees as approved by the City. (Use a certified Arborist to determine health of tree or removal requirements)

Detention Ponds Maintenance Requirements

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
	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 berm embankment.	Slopes should be stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction.
	Liner (If Applicable)	Liner is visible and has more than three 1/4-inch holes in it.	Liner repaired or replaced. Liner is fully covered.
Pond Berms (Dikes)	Settlements	If settlement is apparent. Settling can be an indication of more severe problems with the berm or outlet works. A civil engineer should be consulted to determine the source of the settlement if the dike/berm is serving as a dam.	Dike is built back to the design elevation.
Emergency Overflow/ Spillway and Berms over 4 feet in Height	Piping	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. A geotechnical engineer should be called in to inspect and evaluate condition and recommend repair of condition.	Piping eliminated. Erosion potential resolved and berm stability achieved.
	Tree Growth/Large Vegetation	Tree growth on emergency spillways creates blockage problems and trees may cause failure of berms due to uncontrolled overtopping. Tree growth on berms over 4 feet in height may lead to piping through the berm which could lead to failure of the berm.	Trees should be removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A civil engineer should be consulted for proper berm/spillway restoration.
	Rock Missing	Rock is missing and soil is exposed at top of spillway or outside slope.	Rocks and pad depth are restored to design standards.

Wetponds Maintenance Requirements

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Water level	First cell is empty, doesn't hold water.	Line the first cell to maintain water. Although the second cell may drain, the first cell must retain water to control turbulence of the incoming flow and reduce sediment resuspension.
	Sediment Accumulation in Pond Bottom	Sediment accumulations in pond bottom that exceeds 12 inches on average, usually in the first cell or accumulation that affects inletting or outletting condition of the facility.	Sediment removed from pond bottom to original design elevation.
	Oil Sheen on Water	Prevalent and visible oil sheen.	Oil removed from water using oil-absorbent pads or vacuor truck. Source of oil located and corrected. If chronic low levels of oil persist, plant wetland plants such as <i>Juncus effusus</i> (soft rush) which can uptake small concentrations of oil.
	Trash & Debris	Any trash and debris which exceed 1 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping. If less than threshold all trash and debris will be removed as part of next scheduled maintenance.	Trash and debris cleared from site.
	Noxious Weeds	Any evidence of noxious weeds. The noxious weed list can be found at: www.wa.gov/agr/weedboard/weed_list/weed_listhome.html	Eradicate all class A noxious weeds; control and prevent the spread of all class B noxious weeds designated for control in King County; and control and prevent the spread of all class B and class C noxious weeds listed on the county weed list. Apply requirements of adopted IPM policies for the use of herbicides.
	Beaver Dams	Dam results in change or function of the facility.	Facility is returned to design function. (Coordinate trapping of beavers and breaching of dams with appropriate permitting agencies)
	Tree Growth, Hazard Trees, and Large Vegetation	Tree growth does not allow maintenance access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements). If trees are not interfering with access or maintenance, do not remove. If dead, diseased, or dying trees are identified.	Trees do not hinder maintenance activities. Remove hazard trees. (Use a certified Arborist to determine health of tree or removal requirements)

Wetponds Maintenance Requirements

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
	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 berm embankment.	Slopes should be stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction.
	Liner (If Applicable)	Liner is visible and has more than three 1/4-inch holes in it.	Liner repaired or replaced. Liner is fully covered.
Pond Berms/Dikes	Dike Settlement	If settlement is apparent. Settling can be an indication of more severe problems with the berm or outlet works. A civil engineer should be consulted to determine the source of the settlement if the dike/berm is serving as a dam.	Dike is built back to the design elevation.
	Internal Berm	Berm dividing cells should be level.	Berm surface is leveled so that water flows evenly over entire length of berm.
Emergency Overflow/ Spillway and Berms over 4 feet in Height	Piping	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. A geotechnical engineer should be called in to inspect and evaluate condition and recommend repair of condition.	Piping eliminated. Erosion potential resolved and berm stability achieved.
	Tree Growth/Large Vegetation	Tree growth on emergency spillways creates blockage problems and trees may cause failure of berms due to uncontrolled overtopping. Tree growth on berms over 4 feet in height may lead to piping through the berm which could lead to failure of the berm.	Trees should be removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A civil engineer should be consulted for proper berm/spillway restoration.
	Rock Missing	Rock is missing and soil is exposed at top of spillway or outside slope.	Rocks and pad depth are restored to design standards.

Debris Barriers (e.g., Trash Racks) Maintenance Requirements (if present)

Maintenance Components	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris	Trash or debris that is plugging more than 20% of the openings in the barrier.	Barrier cleared to design flow capacity.
	Damaged/ Missing Bars	Bars are bent out of shape, missing (or entire barrier is missing), loose, and/or rust is causing significant deterioration to any part of barrier.	Barrier replaced or repaired to design standards.

Fencing and Gate Maintenance Requirements (if present)

Maintenance Components	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Missing or broken parts	Any defect in the fence that permits easy entry to a facility. Missing gate or locking devices.	Parts in place to provide adequate security.
		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.
	Erosion	Erosion under a fence that permits easy entry to a facility.	No opening under the fence that permits access.
Wire Fences	Damaged Parts	Part or parts that are bent, broken, out of plumb, torn, loose, or missing such that structural adequacy has been affected.	Structurally adequate parts
	Deteriorating 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.

M2-03 INFILTRATION BASINS, TRENCHES, AND SWALES

An infiltration facility is typically an open basin (pond), trench, or buried perforated pipe used for distributing stormwater runoff into the underlying soil. Coarser, more permeable soils are necessary for infiltration facilities to be used for flow control. Water quality treatment for removal of total suspended solids, oil, and/or soluble pollutants is necessary prior to conveyance to an infiltration facility for protection of the facility and ground water quality. Since permeable soils are not common in Bellevue, there are few infiltration facilities located in the city.

A stormwater infiltration treatment facility is an impoundment, typically a basin, trench, or bio-infiltration swale whose underlying soil removes pollutants from stormwater. Infiltration treatment soils must contain sufficient organic matter and/or clays to sorb, decompose, and/or filter stormwater pollutants. Pollutant/soil contact time, soil sorptive capacity, and soil aerobic conditions are important design considerations.

Infiltration Maintenance Requirements

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	See "Detention Ponds"	See "Detention Ponds"
	Poisonous/Noxious Vegetation	See "Detention Ponds"	See "Detention Ponds"
	Contaminants and Pollution	See "Detention Ponds"	See "Detention Ponds"
	Rodent Holes	See "Detention Ponds"	See "Detention Ponds"
Storage Area	Sediment	Water ponding after rainfall ceases and appropriate time allowed for infiltration.	Sediment is removed and/or facility is maintained so that infiltration system works according to design.
Rock Filters	Sediment and Debris	Water ponding after rainfall ceases and appropriate time allowed for filtration.	Gravel in rock filter is replaced.
Side Slopes of Pond	Erosion	See "Detention Ponds"	See "Detention Ponds"
Emergency Overflow Spillway and Berms over 4 feet in height.	Tree Growth/Large Vegetation	See "Detention Ponds"	See "Detention Ponds"
	Piping	See "Detention Ponds"	See "Detention Ponds"
	Rock Missing	See "Detention Ponds"	See "Detention Ponds"
Pre-settling Ponds and Vaults	Facility or Sump Filled with Sediment and/or Debris	6" or designed sediment trap depth of sediment.	Sediment is removed to original design depth.

M2-04 VAULTS, TANKS, AND PIPES

Like ponds, vaults, tanks, and pipes are storage facilities that can be designed as detention, water quality, or combined systems, except that vaults are underground rather than above ground facilities. Underground facilities are generally used to manage stormwater from smaller sites (e.g., less than 5 acres). Vaults are typically constructed of reinforced concrete, while tanks and pipes are usually made of corrugated metal or plastic pipe.

Vaults, Tanks, and Pipes Maintenance Requirements

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Storage Area	Plugged Air Vents	One-half of the cross section of a vent is blocked at any point or the vent is damaged.	Vents open and functioning.
	Debris and Sediment	<p>Vaults: accumulated sediment depth exceeds 6-inches for more than ½ of the vault length or any point depth exceeds 12-inches.</p> <p>Tanks: accumulated sediment depth exceeds 10% of the diameter of the storage area for more than ½ of the length of the tank or any point depth exceeds 15% of the diameter.</p> <p>(Example: 72-inch storage tank would require cleaning when sediment reaches depth of 7 inches for more than 1/2 length of tank.)</p>	Sediment and debris removed.
	Joints Between Tank/Pipe Section	<p>Any openings or voids allowing material to be transported into facility.</p> <p>Review required by a licensed civil engineer to determine structural stability.</p>	All joint between tank/pipe sections are sealed.
	Tank Pipe Bent Out of Shape	<p>Any part of tank/pipe is bent out of shape more than 10% of its design shape.</p> <p>Review required by a licensed civil engineer to determine structural stability.</p>	Tank/pipe repaired or replaced to design.
	Access Cover Damaged/Not Working	Cover cannot be opened or removed, especially by one person.	Cover repaired or replaced to proper working specifications.
	Vault Structure Includes Cracks in Wall, Bottom, or Pipe Joints/Damage to Frame and/or Top Slab	<p>Cracks wider than 1/2-inch and any evidence of soil particles entering the structure through the cracks.</p> <p>Review required by a licensed civil engineer to determine structural stability.</p>	Vault replaced or repaired to design specifications and is structurally sound.
	Access Ladder Damage	Ladder is corroded or deteriorated, not functioning properly, not attached to structure wall, missing rungs, has cracks and/or misaligned.	Ladder replaced or repaired to specifications, and is safe to use as determined by inspection personnel.
Catch Basins/Manholes	See "Catch Basins"	See "Catch Basins"	See "Catch Basins"

Wetvaults Maintenance Requirements

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash/Debris Accumulation	Trash and debris accumulated in vault which exceed 1 cubic feet per 1,000 square feet, pipe or inlet/outlet (includes floatables and non-floatables).	Remove trash and debris from vault.
	Sediment Accumulation in Vault	Accumulated sediment depth exceeds 6-inches for more than ½ of the vault length, any point depth along vault floor exceeds 12-inches, or sediment sump is full.	Remove sediment from vault.
	Damaged Pipes	Inlet/outlet piping damaged or broken and in need of repair.	Pipe repaired and/or replaced.
	Access Cover Damaged/Not Working	Cover cannot be opened or removed, especially by one person.	Cover repaired or replaced to proper working specifications.
	Ventilation	Ventilation area blocked or plugged.	Blocking material removed or cleared from ventilation area.
	Vault Structure Includes Cracks in Wall, Bottom, or Pipe Joints/Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch and any evidence of soil particles entering the structure through the cracks. Review required by a licensed civil engineer to determine structural stability.	Vault replaced or repaired to design specifications and is structurally sound.
	Baffles	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection staff.	Baffles repaired or replaced to specifications.
	Access Ladder Damage	Ladder is corroded or deteriorated, not functioning properly, not attached to structure wall, missing rungs, has cracks and/or misaligned.	Ladder replaced or repaired to specifications, and is safe to use as determined by inspection personnel.

M2-05 BIOFILTERS (SWALES AND FILTER STRIPS)

Two types of biofilters are commonly used in stormwater treatment applications: biofiltration swales and vegetated filter strips. Both are land treatment systems that serve both conveyance and treatment functions. They are usually planted with grass, however other vegetation such as emergent wetland species can be used depending on site conditions. As runoff passes through the vegetation, combined effects from filtration, infiltration, adsorption, and biological uptake remove pollutants. The vegetation also decreases the velocity of flow and allows for particulates to settle.

Swales are broad, gently sloped channels that are designed to spread stormwater flows over a wide, flat-bottomed channel to reduce flow velocity and promote contact with the vegetation. The longitudinal slope of a swale should be greater than 1 percent to convey flow, but not overly steep, to prevent erosion damage and to provide adequate time of contact between the stormwater and vegetation. Slopes of between 2 and 4 percent are generally recommended for swales. If the slope is too great, check dams can be installed to slow down the flow.

Filter strips are broad vegetated surfaces that are designed to receive runoff in the form of sheet flow, rather than concentrated channel flow like swales. One disadvantage of filter strips is the difficulty in maintaining sheet flow due to the tendency for rills and channels to form as a result of unevenly distributed or excessive flow. Filter strips are generally most effective in locations where the contributing area is less than 5 acres and with slopes less than 10 percent.

Typical Biofiltration Swale Maintenance Requirements

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Sediment Accumulation on Grass	Sediment depth exceeds 2 inches.	Sediment deposits on grass treatment area of the bioswale removed. When finished, swale should be level from side to side and drain freely toward outlet. There should be no areas of standing water once inflow has ceased.
	Standing Water	When water stands in the swale between storms and does not drain freely.	There should be no areas of standing water once inflow has ceased. Any of the following may apply: sediment or trash blockages removed, improved grade from head to foot of swale, removed clogged check dams, added underdrains or converted to a wet biofiltration swale.
	Flow spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed through entire swale width.	Spreader leveled and cleaned so that flows are spread evenly over entire swale width.
	Constant Baseflow	When small quantities of water continually flow through the swale, even when it has been dry for weeks, and an eroded, muddy channel has formed in the swale bottom.	No eroded, muddy channel on the bottom. A low-flow pea-gravel drain may be added the length of the swale.
	Poor Vegetation Coverage	When grass is sparse or bare or eroded patches occur in more than 10% of the swale bottom.	Vegetation coverage in more than 90% of the swale bottom. Determine why grass growth is poor and correct that condition. Re-plant with plugs of grass from the upper slope: plant in the swale bottom at 8-inch intervals, or re-seed into loosened, fertile soil.
	Vegetation	When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other vegetation starts to take over.	Vegetation mowed or nuisance vegetation removed so that flow is not impeded. Grass should be mowed to a height of 3 to 4 inches. Remove grass clippings.
	Excessive Shading	Grass growth is poor because sunlight does not reach swale.	Healthy grass growth. If possible, trim back over-hanging limbs and remove brushy vegetation on adjacent slopes.
	Inlet/Outlet	Inlet/outlet areas clogged with sediment and/or debris.	Material removed so that there is no clogging or blockage in the inlet and outlet area.
	Trash and Debris Accumulation	Trash and debris accumulated in the bioswale which exceeds 1 cubic feet.	Trash and debris removed from bioswale.
	Erosion/Scouring	Eroded or scoured swale bottom due to flow channelization, or higher flows.	No erosion or scouring in swale bottom. For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel. If bare areas are large, generally greater than 12 inches wide, the swale should be re-graded and re-seeded. For smaller bare areas, overseed when bare spots are evident, or take plugs of grass from the upper slope and plant in the swale bottom at 8-inch intervals.

Wet Biofiltration Swale Maintenance Requirements

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance Is Performed
General	Sediment Accumulation	Sediment depth exceeds 2-inches in 10% of the swale treatment area.	Sediment deposits in treatment area removed.
	Water Depth	Water not retained to a depth of about 4 inches during the wet season.	Water retained during the wet season. Build up or repair outlet berm so that water is retained in the wet swale.
	Wetland Vegetation	Vegetation becomes sparse and does not provide adequate filtration OR vegetation is crowded out by very dense clumps of cattail, which do not allow water to flow through the clumps.	Vigorous wetland vegetation. Determine cause of lack of vigor and correct. Replant as needed. For excessive cattail growth, cut cattail shoots back and compost off-site. Note: normally wetland vegetation does not need to be harvested unless die-back is causing oxygen depletion in downstream waters.
	Inlet/Outlet	Inlet/outlet area clogged with sediment and/or debris.	Clogging or blockage in the inlet and outlet areas removed.
	Trash and Debris Accumulation	Trash and debris accumulated in the bioswale which exceeds 1 cubic feet.	Trash and debris removed.
	Erosion/Scouring	Swale has eroded or scoured due to flow channelization, or higher flows.	No erosion or scouring in swale bottom. Check design flows to assure swale is large enough to handle flows. Replant eroded areas with fibrous-rooted plants such as <i>Juncus effusus</i> (soft rush) in wet areas or snowberry (<i>Symphoricarpos albus</i>) in dryer areas.

Filter Strips Maintenance Requirements

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance Is Performed
General	Sediment Accumulation on Grass	Sediment depth exceeds 2 inches.	Sediment deposits removed, re-leveled so slope is even and flows pass evenly through strip.
	Vegetation	When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other vegetation starts to take over.	Grass mowed, nuisance vegetation controlled, such that flow is not impeded. Grass should be mowed to a height between 3-4 inches.
	Trash and Debris Accumulation	Trash and debris accumulated on the filter strip.	Trash and debris removed from filter.
	Erosion/Scouring	Eroded or scoured areas due to flow channelization, or higher flows.	For ruts or bare areas less than 12 inches wide, damaged areas repaired by filling with crushed gravel. The grass will creep in over the rock in time. If bare areas are large, generally greater than 12 inches wide, the filter strip should be re-graded and re-seeded. For smaller bare areas, overseed when bare spots are evident.
	Flow spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed through entire filter width.	Spreader leveled and cleaned so that flows are spread evenly over entire filter width.

M2-06 SAND FILTERS

Sand can be used to filter suspended solids, phosphorus, and oils from stormwater. A typical sand filtration system consists of a presettling basin, a flow spreader over the sand bed, and an underdrain system. After treatment in the filter, runoff is collected in the underdrain system and is discharged. Structures may be constructed either above ground in a basin or below ground in a vault. Sand filter vaults can either be rectangular or linear.

Filters require special care to prevent the filter surface from becoming clogged. Once a filter begins to clog, the hydraulic capacity drops dramatically, causing the filter to go into overflow stage much more frequently than usual. As a result, treatment performance is severely reduced. Therefore, pretreatment systems such as biofilters, wet ponds, or wet vaults are often installed immediately upstream of filtration systems to prolong the life of the filter media.

Sand Filters (above ground/open) Maintenance Requirements

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Above Ground (open sand filter)	Sediment Accumulation on top layer	Sediment depth exceeds 1/2-inch.	No sediment deposit on surface of sand filter that would impede permeability of the filter section.
	Trash and Debris Accumulation	Trash and debris accumulated on sand filter bed which exceeds 1 cubic feet per 1,000 square feet.	Trash and debris removed from sand filter bed.
	Sediment/ Debris in Clean-Outs	When the clean-outs become full or partially plugged with sediment and/or debris.	Sediment removed from clean-outs.
	Sand Filter Media	Drawdown of water through the sand filter media takes longer than 24-hours, and/or flow through the overflow pipes occurs frequently.	Drawdown of water takes less than 24 hours. Top several inches of sand are scraped. May require replacement of entire sand filter depth depending on extent of plugging (a sieve analysis is helpful to determine if the lower sand has too high a proportion of fine material).
	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.	Low, continuous flows are limited to a small portion of the facility by using a low wooden divider or slightly depressed sand surface.
	Short Circuiting	When flows become concentrated over one section of the sand filter rather than dispersed.	Flow and percolation of water through sand filter is uniform and dispersed across the entire filter area.
	Erosion Damage to Slopes	Erosion over 2-inches deep where cause of damage is prevalent or potential for continued erosion is evident.	Slopes stabilized using proper erosion control measures.
	Rock Pad Missing or Out of Place	Soil beneath the rock is visible.	Rock pad replaced or rebuilt to design specifications.
	Flow Spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed across sand filter.	Spreader leveled and cleaned so that flows are spread evenly over sand filter.
	Damaged Pipes	Any part of the piping that is crushed or deformed more than 10% or any other failure to the piping.	Pipe repaired or replaced.

Sand Filters (below ground/enclosed) Maintenance Requirements

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Below Ground Vault	Sediment Accumulation on Sand Media Section	Sediment depth exceeds 1/2-inch.	No sediment deposits on sand filter section that which would impede design permeability of the filter section.
	Sand Filter Media	Drawdown of water through the sand filter media takes longer than 24-hours, and/or flow through the overflow pipes occurs frequently.	Top several inches of sand are scraped. May require replacement of entire sand filter depth depending on extent of plugging (a sieve analysis is helpful to determine if the lower sand has too high a proportion of fine material).
	Sediment Accumulation in Pre-Settling Portion of Vault	Sediment accumulation in vault bottom exceeds the depth of the sediment zone plus 6-inches.	No sediment deposits in first chamber of vault.
	Trash/Debris Accumulation	Trash and debris accumulated in vault, or pipe inlet/outlet, floatables and non-floatables.	Trash and debris removed from vault and inlet/outlet piping.
	Sediment in Drain Pipes/Cleanouts	When drain pipes, cleanouts become full with sediment and/or debris.	Sediment and debris removed and pipes flow freely.
	Short Circuiting	When seepage/flow occurs along the vault walls and corners. Sand eroding near inflow area.	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.
	Damaged Pipes	Inlet or outlet piping damaged or broken and in need of repair.	Pipe repaired and/or replaced.
	Access Cover Damaged/Not Working	Cover cannot be opened, corrosion/deformation of cover. Maintenance person cannot remove cover using normal lifting pressure.	Cover repaired to proper working specifications or replaced.
	Ventilation	Ventilation area blocked or plugged	Blocking material removed or cleared from ventilation area. A specified % of the vault surface area must provide ventilation to the vault interior (see design specifications).
	Vault Structure Includes Cracks in Wall, Bottom, or Pipe Joints/Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch and any evidence of soil particles entering the structure through the cracks. Review required by a licensed civil engineer to determine structural stability.	Vault replaced or repaired to design specifications and is structurally sound.
	Baffles/Internal walls	Baffles or walls corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.
Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired to specifications, and is safe to use as determined by inspection personnel.	

M2-07 MEDIA FILTERS

Media filter technology has been under development in the Pacific Northwest since the early 1990s. During the early stages of development, a leaf compost medium was used in fixed beds, replacing sand. Continued development of this technology replaced the fixed bed with vertical cartridges. Many different media have been developed for use in the vertical cartridges, including perlite, zeolite, CSF[®] Leaf Media, pleated fabric inserts, granulated activated carbon, and iron-infused media. The different media target and remove specific pollutants. Media should be selected with an understanding of the pollutants generated from the site. Many media filter systems have been installed in Bellevue due to their placement in underground vaults and relative ease of maintenance compared to sand filter vaults. Site specific Operations and Maintenance Manuals are required based upon manufacturer’s recommendations. Where conflicts between these standards and the manufacturer’s recommendations exist, the manufacturer’s recommendations shall take precedence.

Stormfilter™ Maintenance Requirements

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
StormFilter Cartridges and Containment Vault	Sediment Accumulation in Filter Media/Vault	Sediment depth exceeds 6-inches on the bottom of the vault or sediment has accumulated on top of the cartridges (overflow occurs).	No sediment deposits in vault bottom. Media cartridges replaced.
	Trash/Debris Accumulation	Trash and debris accumulated in vault which exceeds 1 cubic feet.	Trash and debris removed from vault.
	Access Cover Damaged/Not Working	Cover cannot be opened; one person cannot open the cover using normal lifting pressure, corrosion/deformation of cover.	Cover repaired to proper working specifications or replaced.
	Vault Structure Includes Cracks in Wall, Bottom, or Pipe Joints/Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch and any evidence of soil particles entering the structure through the cracks. Review required by a licensed civil engineer to determine structural stability.	Vault replaced or repaired to design specifications and is structurally sound.
	Baffles	Baffles corroding, cracking warping, and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.
	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.

M2-08 OIL/WATER SEPARATORS

Oil/water separators are used to treat stormwater runoff from high use developments that generate relatively large quantities of oil and grease (e.g., shopping centers, roadways, and parking lots). There are three types of oil/water separators: the conventional gravity API (American Petroleum Institute) separator, coalescing plate separators (CPS), and floatable material separators (FMS).

The conventional gravity API separator consists of a large vault equipped with baffles to prevent oil and other floating debris from passing through the separator. The baffles extend down vertically from the top of vault, trapping floatable material within the vault chambers. In addition, a baffle is usually installed on the bottom at the upstream end of the vault to trap suspended sediment. Oil absorbent pads or mechanical skimmers can also be installed in the main chamber to remove separated oil.

Coalescing plate separators are similar to API separators except that a bank of closely spaced, inclined, corrugated plates is inserted into the separator chamber to improve removal efficiency. Consequently, these systems are usually smaller in size than the conventional API separator. The plates are usually constructed of fiberglass, stainless steel, or polypropylene. Because of the closely spaced configuration of the plates, sediment and other debris can easily clog these systems. Therefore, to work effectively, the coalescing plates must be kept clean.

FMS separators are simple containment devices capable of trapping floatable materials. They consist of a vault or manhole structure that is equipped with a downturned elbow on the outlet. These devices are not as effective as CPS and API separators in separating oil; they function primarily for spill containment and as floating debris traps.

Baffle Oil/Water Separators (API Type) Maintenance Requirements

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Oily Discharge	Inspection of discharge water for obvious signs of poor water quality.	Effluent discharge from vault should be clear without thick visible sheen.
	Sediment Accumulation	Sediment depth in bottom of vault exceeds 6-inches in depth.	No sediment deposits on vault bottom that would impede flow through the vault and reduce separation efficiency.
	Trash and Debris Accumulation	Trash and debris accumulation in vault which exceeds 1 cubic feet, or clogs pipe inlet/outlet, floatables and non-floatables.	Trash and debris removed from vault, and inlet/outlet piping.
	Oil Accumulation	Measurable oil accumulation at the water surface.	No oil accumulation.
	Damaged Pipes	Inlet or outlet piping damaged or broken and in need of repair.	Pipe repaired or replaced.
	Access Cover Damaged/Not Working	Cover cannot be opened, corrosion/deformation of cover.	Cover repaired to proper working specifications or replaced.
	Vault Structure Includes Cracks in Wall, Bottom, or Pipe Joints/Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch and any evidence of soil particles entering the structure through the cracks. Review required by a licensed civil engineer to determine structural stability.	Vault replaced or repaired to design specifications and is structurally sound.
	Baffles	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.
	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.

Coalescing Plate Oil/Water Separators Maintenance Requirements

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Oily Discharge	Inspection of discharge water for obvious signs of poor water quality.	Effluent discharge from vault should be clear with no visible sheen.
	Sediment Accumulation	Sediment depth in bottom of vault exceeds 6-inches in depth and/or visible signs of sediment on plates.	No sediment deposits on vault bottom and plate media which would impede flow through the vault and reduce separation efficiency.
	Trash and Debris Accumulation	Trash and debris accumulated in vault which exceeds 1 cubic feet, or clogs pipe inlet/outlet, floatables and non-floatables.	Trash and debris removed from vault, and inlet/outlet piping.
	Oil Accumulation	Measurable oil accumulation at the water surface.	No oil accumulation. Coalescing plates cleaned.
	Damaged Coalescing Plates	Plate media broken, deformed, cracked and/or showing signs of failure.	Plate pack is repaired or replaced.
	Damaged Pipes	Inlet or outlet piping damaged or broken and in need of repair.	Pipe repaired and or replaced.
	Vault Structure Includes Cracks in Wall, Bottom, or Pipe Joints/Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch and any evidence of soil particles entering the structure through the cracks. Review required by a licensed civil engineer to determine structural stability.	Vault replaced or repaired to design specifications and is structurally sound.
	Baffles	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.
	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.

M2-09 CATCH BASIN INSERTS

A catch basin insert is a device installed underneath a catch basin inlet that treats stormwater through filtration, settling, absorption, adsorption, or a combination of these mechanisms. Catch basin inserts vary greatly in form, some being rectangular, tray-like structures, some more like oil absorbent bags or pillows. Catch basin inserts are not typically allowed in the City of Bellevue except for temporary erosion control uses.

Testing has shown that catch basin insert performance and removal rates to be highly variable, depending on system configuration, pollutant particle size distribution and concentration, and maintenance frequency. Maintenance frequencies of monthly or even more frequent are common.

Catchbasin Inserts Maintenance Requirements

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Sediment Accumulation	When sediment forms a cap over the insert media of the insert and/or unit.	No sediment cap on the insert media and its unit.
	Trash and Debris Accumulation	Trash and debris accumulates on insert unit creating a blockage/restriction.	Trash and debris removed from insert unit. Runoff freely flows into catch basin.
	Media Insert Not Removing Oil	Effluent water from media insert has a visible sheen.	Effluent water from media insert is free of oils and has no visible sheen.
	Media Insert Water Saturated	Catch basin insert is saturated with water and no longer has the capacity to absorb.	Media insert removed and replaced.
	Media Insert-Oil Saturated	Media oil saturated due to petroleum spill that drains into catch basin.	Media insert removed and replaced.
	Media Insert Use Beyond Normal Product Life	Media has been used beyond the typical average life of media insert product.	Media insert removed and replaced.

M2-10 CATCH BASINS, MANHOLES AND INLETS

Grated and curb inlet type catch basins are designed to collect and direct runoff into the storm drainage system, as well as to trap debris and litter present in roadway runoff. Unlike manholes, catch basins and inlets contain a sump at the bottom of the structure that is below the invert of the outflow pipe. This sump provides a storage area for sediment and other debris. The purpose of the sump is to prevent the downstream pipes from becoming clogged and to prevent sediment and debris from being discharged into receiving waters. Once this sump has filled to approximately 60 percent of its depth or within 6 inches of the outlet invert, additional sediment and debris will be washed out. Therefore, in order for catch basins to remove sediment they must be maintained routinely.

Catch Basins, Manholes, and Inlets Maintenance Requirements

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Sediment, Trash & Debris	Sediment, trash or debris in the basin that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe.	No sediment, trash or debris in the catch basin.
		Trash or debris in any inlet or outlet pipe blocking more than 1/4 of its height.	Inlet and outlet pipes free of trash or debris.
		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 the catch basin.
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch (Intent is to make sure no material is running into basin).	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached.	Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound.	Basin replaced or repaired to design standards.
		Grout has separated or cracked wider than 1/2 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.	Pipe is regouted and secure at basin wall.
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Contamination and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants.	No pollution present.
	Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place.

Catch Basins, Manholes, and Inlets Maintenance Requirements

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Metal Grates (If Applicable)	Trash and Debris/Vegetation	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.

M2-11 CONTROL STRUCTURES, FLOW REGULATORS, FLOW SPLITTERS AND ENERGY DISSIPATORS

Control structures and flow regulators are catch basins or manholes with a restrictor device for controlling outflow from a facility to meet the desired performance. Riser type restrictor devices (“tees” or “Drop-Ts”) also provide some incidental oil/water separation and provide for spill control. The restrictor device is usually multiple orifice, consisting of two or more orifices and/or a weir section sized to meet performance requirements.

Energy dissipators include any means by which the total energy of flowing water is reduced. In stormwater design, it is usually a mechanism that reduces the velocity prior to, or at, discharge from an outfall in order to prevent erosion. Energy dissipators include rock splash pads, drop manholes, concrete stilling basins or baffles, and check dams.

Control Structure/Flow Restrictor/Flow Splitter Maintenance Requirements

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Sediment, Trash and Debris	Material exceeds 60% of depth between the bottom of the sump and the orifice plate or 1 foot below the orifice plate.	Control structure orifice is not blocked. All sediment, trash and debris removed.
	Structural Damage	Structure is not securely attached to manhole wall.	Structure 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 and show signs of rust.	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 not watertight or is missing.	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.
		Gate deterioration has significantly weakened gate.	Gate is repaired or replaced to meet design standards.
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.

Control Structure/Flow Restrictor/Flow Splitter Maintenance Requirements

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
	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.
Catch Basin/Manhole	See "Catch Basins"	See "Catch Basins"	See "Catch Basins"

Energy Dissipators Maintenance Requirements

Maintenance Components	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
External:			
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 replaced to design standards.
	Erosion	Soil erosion in or adjacent to rock pad.	Rock pad replaced to design standards.
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). Intent is to prevent erosion damage.	Trench redesigned or rebuilt to standards.
	Perforations Plugged	Over 1/2 of perforations in pipe are plugged with debris and sediment.	Perforated pipe cleaned or replaced.
	Water Flows Out Top of "Distributor" Catch Basin*	Maintenance person observes or receives credible report of water flowing out during any storm less than the design storm or its causing or appears likely to cause damage.	Facility rebuilt or redesigned to standards.
	Receiving Area Over-Saturated	Water in receiving area is causing or has potential of causing landslide problems.	No danger of landslides.
Internal:			
Manhole/Chamber	Worn or Damaged Post, Baffles, Side of Chamber	Maintenance person judges that structure is unsound.	Structure replaced or repaired to design standards.
	Other Defects	See "Catch Basins"	See "Catch Basins"

M2-12 CONVEYANCE (PIPES, DITCHES, AND CULVERTS)

Pipe and open ditches are used to convey stormwater. Culverts are enclosed conveyance structures that are typically installed along drainage ditches and streams to provide crossings at roadways, driveways, or other obstructions. They are most commonly pipes (e.g., circular, elliptical, or arch-shaped), but can also be rectangular concrete structures (i.e., box culverts). Improperly designed and constructed culverts can create barriers to fish passage and migration in natural stream channels. Also, culverts can cause serious erosion problems in adjacent stream channels if not appropriately designed and constructed.

Conveyance (Pipes & Ditches) Maintenance Requirements

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Pipes/Culverts	Sediment, Debris & Vegetation	Sediment, debris, or vegetation that exceeds ¼ of the diameter of the pipe/culvert and/or inhibits ability to inspect the pipe.	Pipe/culvert cleaned of all sediment, debris, and vegetation.
	Damaged Pipe	Protective coating is damaged; rust is causing more than 50% deterioration to any part of pipe/culvert.	Pipe/culvert repaired or replaced.
		Any dent or deformation that decreases the cross section area of pipe/culvert by more than 10% or puncture that impacts performance.	Pipe/culvert repaired or replaced.
	Culvert Headwall Damage	Cracks >0.5 inches wide, buckled/bulging headwall, erosion behind or around ends of headwall.	Headwall repaired or replaced.
Open Ditches	Trash & Debris	Any trash and debris which exceed 1 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping.	Trash and debris cleared from ditches.
	Sediment	Accumulated sediment that impedes flows or is eroding.	Ditch cleaned of all sediment and debris so that it matches design conveyance capacity.
	Vegetation	Vegetation that reduces free movement of water through ditches.	Water flows freely through ditches.
	Erosion Damage to Slopes and Channel Bottom	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 berm embankment.	Slopes should be stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction.
	Rock Lining Out of Place or Missing (If Applicable).	Maintenance person can see native soil beneath the rock lining.	Rock lining replaced to design standards.
Catch Basins	See "Catch Basins"	See "Catch Basins"	See "Catch Basins"

In-Stream Culverts Maintenance Requirements

Maintenance Components	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Fish Passage	Minimum flow depth	<12 inches during low flow conditions.	Fish passage restored (as permitted by WDFW)
	Downstream pipe end <i>(culvert outlet)</i>	Pool depth in stream immediately below culvert less than 1.25 times the culvert drop height.	Fish passage restored(as permitted by WDFW)
	Drop height <i>(downstream end)</i>	Vertical distance between pipe invert and downstream water surface > 12 inches	Fish passage restored.(as permitted by WDFW).
	Upstream pipe end <i>(culvert inlet)</i>	Channel bottom immediately upstream of culvert <12 inches below the culvert inlet.	Fish passage restored(as permitted by WDFW).

M2-13 STREAM SYSTEMS

Streams are natural or reconstructed natural channels of either perennial or intermittently running water, and which in a typical condition consist of a bed, lower banks, and upper banks. Upper banks include water dependant as well as upland vegetation.

Riparian corridors are Sensitive Areas that include a vegetation community integrated with the water course ecosystem which provides food, shelter, breeding, and rearing areas for aquatic and terrestrial animals and birds.

Stream Maintenance Requirements

Maintenance Components	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Engineered Structures (Fish Ladders and Utility Structures such as gabions, weirs, high-flow bypasses, bank armoring)	Trash & debris	Visual evidence of dumping and/or impediment to stream flow.	Trash and debris removed.
	Sediment	Sediment accumulation that compromises plunge pools, approaches, or stream flows.	Sediment cleaned out.
	Seeps	Any water seepage through a weir.	Weir is repaired or replaced. No water seepage through the weir.
	Erosion	Erosion around ends of a weir or downstream of a weir.	Erosion points stabilized and revegetated.
	Broken gabions	Broken or bent baskets, rocks missing, soil exposed, loose wire. (Loose wires can descale fish and compromise structural stability of the basket.)	Gabion repaired or replaced to design specifications.
	Structural damage	Cracks wider than 1/2-inch and any evidence of soil particles entering the structure through the cracks. Review required by a licensed civil engineer to determine structural stability.	Structure replaced or repaired to design specifications and is structurally sound.

Stream Maintenance Requirements

Maintenance Components	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Stream Components	Noxious Weeds	Any evidence of noxious weeds. The noxious weed list established by the Noxious Weed Control Board. The list can be found at: www.wa.gov/agr/weedboard/weed_list/weed_listhome.html	Eradicate all class A noxious weeds; control and prevent the spread of all class B noxious weeds designated for control in King County; and control and prevent the spread of all class B and class C noxious weeds listed on the county weed list. Use manual techniques or apply requirements of adopted IPM policies for the use of herbicides.
	Impassible Barriers	Where there is evidence that the barrier is restricting the use of known upstream spawning habitat. Removal of barriers must be permitted or approved by WDFW.	Fish passage restored.
	Trash & Debris	Visual evidence of dumping. Large accumulations of debris that are causing stream channel modifications.	Trash and debris removed.
	Stream Buffer Impacts	Vegetation removed or fences installed in native buffer or other protected areas, and/or evidence of surface water withdrawal.	Document and report to permit authorities (PCD or Department of Ecology).
Regional Detention Facilities	Trash & Debris	Visual evidence of dumping and/or large accumulations of debris that are causing stream channel modifications.	Trash and debris removed.
	Noxious Weeds	Any evidence of noxious weeds. The noxious weed list established by the Noxious Weed Control Board. The list can be found at: www.wa.gov/agr/weedboard/weed_list/weed_listhome.html	Eradicate all class A noxious weeds; control and prevent the spread of all class B noxious weeds designated for control in King County; and control and prevent the spread of all class B and class C noxious weeds listed on the county weed list. Apply requirements of adopted IPM policies for the use of herbicides.
	Sediment	Sediment accumulation that affects stilling wells, inletting or outletting of the facility, including any upstream or downstream weirs. Sediment sump area is full.	Sediment cleaned out.

Stream Maintenance Requirements

Maintenance Components	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
	Structural damage	Cracks wider than 1/2-inch and any evidence of soil particles entering the structure through the cracks. Review required by a licensed civil engineer to determine structural stability.	Structure replaced or repaired to design specifications and is structurally sound.
	Piping through Berms or Embankments	Discernable water flow through pond berm or embankment. Ongoing erosion with potential for erosion to continue. A Geotechnical engineer should be called in to inspect and evaluate condition and recommend repair of condition.	Piping eliminated. Erosion potential resolved.
	Gate Valve Damaged	Gate cannot be moved up and down by one maintenance person.	Gate moves up and down easily.
		Rod leading to gate is missing or damaged.	Rod is in place and works as designed.
		Gate is rusted over 50% of its surface area.	Gate is repaired or replaced to meet design standards.
Telemetry Probe Damaged	Telemetry probe not functioning properly or at all.	Repair or replace telemetry probe.	

CHAPTER M3 - INSPECTIONS

M3-01 GENERAL

M3-01.1 Purpose

The purpose of these standards is to assure that the surface water drainage systems in the City of Bellevue are operated and maintained to provide satisfactory quality and flow control. The inspection and maintenance schedules shall be adjusted to minimize the length of time that a facility is in a condition that requires a maintenance action.

M3-02 INSPECTION FREQUENCIES

M3-02.1 Public and Private Flow Control and Water Quality Treatment Facilities

On-site inspections of public and private flow control and water quality treatment facilities shall be made. Inspection may be made by request, planned programs, and/or as part of normal maintenance operations.

1. Inspect all public and private flow control and water quality treatment facilities biennially, unless a lesser or greater inspection frequency is determined to be appropriate to ensure compliance with the maintenance standards. A determination to allow an alternate inspection frequency shall be based on an inspection of maintenance records from the number of years equal to twice the proposed alternative inspection frequency.
2. Inspect all public flow control and water quality treatment facilities after major storm events if spot checks of some facilities indicate widespread damage/maintenance needs.
3. Inspect all new storm and surface water systems in subdivisions periodically during the period of heaviest construction to identify maintenance needs and enforce compliance with the maintenance standards as needed.

M3-02.2 Public Conveyance (Pipes, Catch Basins, Manholes, and Inlets)

All Utility drainage systems shall be inspected as part of the planned operations and maintenance activities.

1. Perform annual inspections of public catch basins on a "circuit basis," whereby a sampling of catch basins within each circuit is inspected to identify maintenance needs. Include in the sampling an inspection of the catchbasin immediately upstream of any system outfall. Clean all catch basins within a given circuit at one time if the inspection sampling indicates cleaning is needed to comply with the maintenance standards.

M3-02.3 Private Conveyance (Pipes, Catch Basins, Manholes, and Inlets)

1. All private drainage systems shall be inspected biennially unless a lesser or greater inspection frequency is determined to be appropriate to ensure compliance with the maintenance standards. A determination to allow an alternate inspection frequency shall be based on an inspection of maintenance records from the number of years equal to twice the proposed alternative inspection frequency.
2. Private drainage systems shall be maintained by the private property owner whenever they are found to be out of compliance with the maintenance standards

M3-02.4 Streams

The following shall be inspected as part of the planned operations and maintenance activities. Responsibility is the Utility for public drainage systems and the private property owner for private drainage systems.

1. Public and private culverts with a history of maintenance-related fish passage problems on salmon-bearing streams shall be inspected once in the spring and once in late summer, after major storm events and in response to complaints.
2. All trash racks on public and private stream culverts that could cause flooding or impede fish passage shall be inspected once in the spring and once in late summer, after major storm events, and in response to complaints.
3. All fish ladders shall be inspected once in the spring and once in late summer and in response to complaints.
4. Regional detention facilities shall be inspected for debris accumulation on a daily basis during major storm events and weekly between November 1st and May 1st. Perform a complete inspection annually during the dry season.
5. Streamside Utility properties shall be inspected annually to evaluate encroachment by non-native vegetation, to identify potential restoration needs, and to monitor previous projects.
6. Primary salmon spawning areas shall be inspected annually during the summer, prior to September 1st, for impassible barriers, debris, and other urban impacts.
7. All in-stream and riparian structures such as gabions, weirs, high-flow bypasses, bank armoring, and other structures shall be inspected annually.

CHAPTER M4 - SOURCE CONTROL

M4-01 GENERAL

Source Control is the prevention of the release of pollutants associated with site activities to the storm and surface water system. Source control is a much more effective method of protecting surface water quality than water quality treatment, which acts after the contamination has occurred. Source control BMPs include both operational and structural BMPs. Structural source control BMPs may be required through either the new development/redevelopment permitting process or through the application of these maintenance standards.

M4-02 OPERATIONAL SOURCE CONTROL BMPS

M4-02.1 Good Housekeeping

1. Promptly contain and clean up solid and liquid pollutant leaks and spills such as oils, solvents, fuels, dust from manufacturing operations, garbage and leachate from dumpsters on any exposed soil, vegetation, or paved area.
2. Clean up pollutant liquid leaks and spills in impervious uncovered containment areas at the end of each working day.
3. Sweep paved material handling and storage areas regularly as needed, for the collection and disposal of dust and debris that could contaminate stormwater. Do not hose down pollutants from any area to the ground, storm drain, conveyance ditch, or receiving water unless approved by the Utility.
4. Repair or replace all substantially cracked or otherwise damaged paved secondary containment, high-intensity parking and any other drainage areas which are subjected to pollutant material leaks or spills.
5. Promptly repair or replace all leaking connections, tanks, pipes, hoses, and valves which can contaminate stormwater.
6. Use solid absorbents for cleanup of liquid spills/leaks, where practicable.
7. Recycle materials such as oils, solvents, and wood waste to the maximum extent practicable.

M4-02.2 Preventative Maintenance

1. Prevent the discharge of unpermitted liquid or solid wastes, process wastewater, and sewage to ground water, surface water, storm drains, or to the ground.
2. Do not connect floor drains to storm drains, surface water, or to the ground.
3. Conduct all oily parts cleaning, steam cleaning, or pressure washing of equipment or containers inside a building or on an impervious contained area

such as a concrete pad. Direct contaminated stormwater from such an area to a sanitary sewer where allowed by the Utility, or to other approved treatment.

4. Do not pave over contaminated soil unless it has been determined that ground water has not been and will not be contaminated by the soil. Call the Washington State Department of Ecology for assistance.
5. Construct impervious areas using compatible materials with the materials handled. Portland cement concrete, asphalt, or equivalent material may be considered.
6. Use drip pans to collect leaks and spills from industrial/commercial equipment which are stored outside.
7. Drain oil and fuel filters before disposal. Discard empty oil and fuel filters, oily rags and other oily solid waste into appropriately closed and properly labeled containers, and in compliance with the Uniform Fire Code.
8. Store liquids in containers, such as steel and plastic drums, that are rigid and durable, corrosion resistant to the weather and fluid content, non-absorbent, water tight, rodent-proof, and equipped with a close fitting cover.
9. Keep solid wastes contaminated with liquids or other potential pollutant materials in containers which are durable, corrosion resistant, non-absorbent, non-leaking, and equipped with either a solid cover or screen cover to prevent littering. If covered with a screen, the container must be stored under a lean-to or equivalent structure.
10. Where exposed to stormwater, use containers, piping, tubing, pumps, fittings, and valves that are appropriate for their intended use and for the contained liquid.
11. Where feasible, store potential stormwater pollutant materials inside a building or under a cover and/or containment.
12. Minimize the use of toxic cleaning solvents, such as chlorinated solvents, and other toxic chemicals.
13. Substitute environmentally safer raw materials, products, and additives where feasible.
14. Recycle waste materials such as solvents, coolants, oils, degreasers, and batteries to the maximum extent feasible.
15. Empty drip pans immediately after a spill or leak is collected.
16. Stencil warning signs at stormwater catch basins and drains, e.g., "Dump no waste."

M4-02.3 Spill Prevention and Cleanup

1. Immediately upon discovery, stop, contain, and clean up all spills.
2. If pollutant materials are stored on-site, have spill containment and cleanup kits readily accessible.

3. If the spill has reached or may reach a sanitary or a storm sewer, ground water, or surface water notify the Utility immediately. Notification must comply with all state and federal spill reporting requirements. Spills into the storm and surface water system are a violation of Bellevue City Code 24.06.195.
4. Do not flush absorbent materials or other spill cleanup materials to a storm drain. Collect the contaminated absorbent material as a solid and place in appropriate disposal containers.
5. Place and maintain emergency spill containment and cleanup kit(s) at outside areas where there is a potential for fluid spills. These kits should be appropriate for the materials being handled and the size of the potential spill.

It is recommended that the kit(s) include salvage drums or containers, such as high density polyethylene, polypropylene or polyethylene sheet-lined steel; polyethylene or equivalent disposal bags; an emergency response guidebook; safety gloves/clothes/equipment; shovels or other soil removal equipment; and oil containment booms and absorbent pads; all stored in an impervious container.

M4-02.4 Employee Training

Train all employees that work in pollutant source areas in identifying pollutant sources and in understanding pollutant control measures, spill response procedures, and environmentally acceptable material handling practices - particularly those related to vehicle/equipment liquids such as fuels, and vehicle/equipment cleaning. Use the Washington Department of Ecology's "Stormwater Pollution Prevention Planning for Industrial Facilities" (WQ-R-93-015, 9/93) as a training reference. Provide ongoing refresher training for existing employees as well as training for new employees.

M4-03 **STRUCTURAL SOURCE CONTROL BMPS**

Structural source control BMPs shall be designed and implemented in compliance with the City of Bellevue Utilities Department Surface Water Engineering Standards and Volume IV of the Washington Department of Ecology's Stormwater Management Manual for Western Washington (2001 or as subsequently revised).