Stormwater Control Regulations
for
Work Performed Pursuant to the
Falmouth Wetlands Bylaw, Chapter 235 of the Code of Falmouth
Falmouth Wetlands Regulation, Section 2.00

FWR 2.00 Standards and Specifications for Stormwater Management Systems

Section

FWR 2.01 Introduction

The Falmouth Wetland Regulations, FWR 2.00, is promulgated by the Falmouth Conservation Commission pursuant to the authority granted to them under the Falmouth Wetlands Bylaw, Chapter 235 of the Code of Falmouth. The FWR 2.00 shall complement Chapter 235 of the Code of Falmouth, and shall have the force of law upon their effective date.

FWR 2.00 is intended solely for use in administering Chapter 235 of the Code of Falmouth; nothing contained herein should be construed as preempting or precluding more stringent protection of wetlands or other natural resource areas by other by-laws, ordinance or regulations.

FWR 2.01 through 2.15 pertains to work in both inland and coastal areas subject to protection under Chapter 235 of the Code of the Code off Falmouth.

Control of stormwater runoff shall meet the design criteria for both flood (volume and peak discharge) control and nonpoint source pollution reduction as indicated in FWR 10.16(3). All assumptions, methodologies, and procedures used to design Best Management Practices (BMPs) shall accompany the design.

FWR 2.02 Purpose

FWR 2.00 sets forth a decision-making process by which stormwater management activities affecting Areas Subject to Protection Under Chapter 235 of the Code of Falmouth are to be regulated in order to contribute to the following resource area values:

- protection of public and private water supply
- groundwater
- flood control

2.02 continued

- erosion and sedimentation control
- storm damage prevention
- water pollution control
- fisheries
- shellfish
- wildlife habitat
- agriculture
- aesthetics
- recreation
- aquaculture

In addition to the resource area values above, in the Black Beach/Great Sippewissett Marsh District of Critical Planning Concern, the following resource area values also apply:

- prevention of damage to structures and natural resources as a result of erosion;
- improvement of water quality;
- prevention of loss or degradation of critical wildlife and plant habitat;
- prevention of new stormwater runoff discharges and the improvement of existing stormwater runoff discharges;
- protection of coastal ecosystems which support the continued viability of harvestable shellfish and finfish habitat;
- improvement of groundwater recharge; and
- the minimization of the impact of new development, reconstruction and/or expansion on the resource area values listed above.

The purpose of FWR 2.00 is to define and clarify that process by establishing standard definitions and uniform procedures by which the Commission may determine if the provisions of FWR 10.16(3) are satisfied.

The performance standards in FWR 10.16(3) are intended to identify the level of protection the Commission must impose in order to contribute to the protection of the resource area vales of Chapter 235 of the Code of Falmouth. It is the responsibility of the Commission to order specific measures and requirements for each proposed project which will ensure that the project is designed and carried out consistent with the required level of protection.

FWR 2.03 Additional Definitions for FWR 2.01 through 2.13

Except for the following definitions, terms are defined in the Massachusetts Department of Environmental Protection's Nonpoint Source Management ("The Mega-Manual"), June 1993.

BMPs - Best management practices are structural, non-structural and managerial techniques that are recognized to be the most effective and practical means to prevent and/or reduce nonpoint source pollution.

Extended Detention Pond - an enhanced detention pond that provides both flood control and treatment of the first flush of stormwater runoff. Storage time for the first flush is a minimum of 48 hours.

First Flush - the volume generated by the first 1.25 inches of stormwater runoff. This first 1.25 inches of runoff carries the majority of accumulated pollutants from impervious surfaces. The first flush treatment volume in cubic feet (V_t) is determined by the following formula:

$V_t = (1.25/12 \text{ inches})(R_v)(\text{Site Area in square feet})$

where, $R_v = 0.05 + 0.009(I)$ I = the % impervious area. Impervious area is defined as any manmade cover that is not vegetated. In residential areas, the % impervious is obtained from the TR-55 table "Runoff Curve Numbers for Urban Areas, Residential District by Average Lot Size."

2.03 continued

Forebay - a storage area provided near a BMP inlet to trap incoming sediments before they accumulate in a basin/pond BMP.

Hydrologic Soil Group - a soil characterization classification system defined by the U.S. Natural Resource Conservation Service. Soils within the same group have the same runoff potential under similar storm and cover conditions.

Impervious area means any manmade cover that is not vegetated, but does not include sand pits.

Peak Discharge - the maximum rate of flow during a storm, usually in reference to a specific design storm event (i.e. 2-yr, 10-yr, 25-yr, 100-yr., 24 hour storm event).

Soil Mottling - Redoximorphic features.

Surface Water Quality Classifications - waters designated for protection under 314 CMR 4.04 (2).

TR-20 - a SCS hydrology procedure for complex watersheds. The computer program calculates runoff volumes, peak discharges and hydrographs at various locations in the watershed. Design storms and actual rainfall events can be analyzed.

TR-55 - presents simplified hydrology procedures to calculate runoff volumes and peak discharge in small watersheds. It is based on TR-20 hydrology procedures and actual TR-20 computer runs.

FWR 2.04 Submittal Requirements

(1) It shall be the responsibility of the applicant to submit a Stormwater Management Plan (SMP) detailing the existing environmental and hydrological conditions of the site, proposed alterations of the site, and all proposed components of the drainage system and any measures for the detention, retention, or infiltration of water, for the protection of water quality and protection from flooding. The SMP shall contain sufficient information for the Conservation Commission to evaluate the effectiveness and acceptability of those measures proposed by the applicant for controlling flooding and pollution from stormwater runoff. The SMP shall contain a table of contents, a summary (FWR 2.15), and maps, charts, graphs, tables, photographs, narrative descriptions, calculations, plans showing construction details of all systems and structures, and citations to supporting references, as appropriate, to communicate the information as required by these regulations.

The pre-existing environmental and hydrological conditions of the site, proposed alterations of the site, all proposed components of the drainage system, and any measures for the detention, retention, or infiltration of water shall be described in detail as stipulated in FWR 2.04(2) through (4), with sufficient information to evaluate the proposed Stormwater Management Plan.

(2) Site Characteristic Information to be included in the Stormwater Management Plan (SMP) as shown on a site plan:

(a) Pre-development conditions:

1. the location of all surface waters and wetland resources, on or adjacent to the site;
2. the delineation of the 100 year flood elevation as indicated on the Federal Emergency Management Act (FEMA) maps. If FEMA maps do not exist or if the waterbody or watercourse 100-year flood elevation is not indicated on the FEMA map, the elevation shall be calculated utilizing an appropriate methodologies such as SCS TR-55, TR-20 or HEC2;
3. the topography described at 1 foot intervals, with areas of steep slopes over 15% highlighted;
4. the existing watersheds on the property, as well as upgradient areas contributing runoff to the property;
5. the principal vegetation types sufficient to determine an appropriate runoff curve number;
6. the soil types on the site and the hydrological soil groups based the most current Natural Resource Conservation Service (NRCS, formerly SCS) soils map;
7. the flow path(s);
8. areas of ponding and swamping;
9. design points for each watershed;
10. the location of any public water supplies and mapped or presumed Zone II's on the property as well as private water supplies within 100 feet;

2.04 continued

11. soil logs for each proposed BMP location;
12. soil observation holes shall extend a minimum of four feet below the bottom of any stormwater BMP and be observed by the agent of the Board of Health, and
13. maximum groundwater levels at the proposed BMP locations;

a. the groundwater elevation measurements in soils with a dominant texture of loamy fine sand or coarser shall be determined during the time of probable maximum using monitoring wells, or the reading on a monitoring well corrected by the method outlined in "Predicting Maximum Ground Water Elevations on Cape Cod" (Frimpter, 1989)
b. the groundwater elevation measurements in soils with a dominant texture finer than loamy fine sand shall be determined during the time of probable maximum using monitoring wells, or by soil morphology using redoximorphic features, whichever is greater;
c. monitoring wells shall be installed with the elevation of the top of the casing indicated on the plan or on the casing;
d. the time of probable maximum groundwater shall be determined using the Board of Health's policy.

(b) Post-development conditions:

1. changes in topography at 1 foot intervals;
2. the proposed watersheds on the property, as well as upgradient areas contributing runoff to the property;
3. areas where vegetation will be cleared or otherwise altered;
4. the proposed development layout including;
   a. locations of roadways, common parking areas, and undisturbed lands;
   b. locations of drainage systems and stormwater treatment facilities;
5. areas to be utilized in overland flow, i.e. grass swales and filter strips, showing:
   a. proposed vegetation;
   b. the soil susceptibility to erosion (using the NRCS classification);
6. the flow path(s);
7. design point(s) for each proposed watershed;

(3) Water Quantity/Duration/Quality Information to be submitted in the SMP.

(a) Pre-development conditions in narrative form or calculations, including:

1. peak discharge rate for the 2-, 10-, 25-, and 100-year 24 hour storm event using NRCS TR-55 or TR-20;
2. volume of the surface runoff for the 10-year storm; and
3. existing state surface water quality classifications found in 314 CMR 4.04, if available;

(b) Post-development conditions in narrative form or calculations, including: [All calculations, supporting data, and reference materials relating to the design and construction of flood control and pollution reduction BMPs.]

1. peak discharge rate for the 2-, 10-, 25-, and 100-year 24 hour storm event using NRCS TR-55 or TR-20;
2. volume of the surface runoff for the 10 year storm;
3. detention/retention time, discharge rate, and approximate time of concentration through the BMP for the water quality storm;
4. a description of and calculations for the proposed outlet structure(s); both the principle outlet and emergency spillway; and
5. a discussion regarding whether the proposed BMPs meet or exceed the performance standards identified in FWR 10.16(3), as well as an evaluation of the pollutant removal efficiency of each proposed treatment facility or group of facilities.

(3) Stormwater Management Summary

The pre and post-development conditions shall be summarized for each watershed on the Stormwater Management Summary Form (FWR 2.15).

(4) Maintenance Information to be included in the SMP.

Maintenance plans for each basin including: a maintenance schedule, an outline of responsible parties and owners, and all pertinent agreements to be executed to insure proper maintenance. See FWR 2.11.

FWR 2.05 Performance Standards and Design Specifications

(1) Control of stormwater runoff shall meet the design criteria for both flood (volume and peak discharge) control and nonpoint source pollution reduction as indicated in FWR 10.16(3). All assumptions, methodologies, and procedures used to design stormwater BMPs shall accompany the design.

(2) Notwithstanding the provisions of FWR 10.16(3) and FWR 2.00, any project (except those regulated by FWR 10.39) that contains 12% impervious lot coverage or less, shall not be required to meet the requirements of FWR 10.16(3) and FWR 2.00,

provided said impervious cover is not connected[1] to a resource area specified in FWR 10.02(1)(a) 2. through 4, 6 through 11,. and 10.02(1)(b) through (e).

(3) Notwithstanding the provisions of FWR 10.16(3) and FWR 2.00, a single family house with a impervious lot coverage of less than 2500 square feet, or a total lot impervious less than 4500 square feet with roof infiltration provided for the first flush, shall not be required to meet the requirements of FWR 10.16(3) and FWR 2.00, provided the first flush is infiltrated.

(4) Discharges to Coastal Waters.

(a) Notwithstanding the provisions of FWR 10.16(3)(b), where the discharge of stormwater is to the ocean or an estuary, the project shall maintain the volume of discharge up to the two (2) year, twenty-four (24) hour design storm.

(b) Notwithstanding the provisions of FWR 10.16(3)(b), where the discharge of stormwater is to a coastal resource area, the project shall maintain or reduce the rate of runoff so that said discharge is non-erosive and maintain or reduce the volume of discharge up to the two (2) year, twenty-four (24) hour design storm, provided that there exists no downstream control, such as a bridge or culvert, that restricts the flow of water.

(5) Discharges to Closed Depressions. Notwithstanding the provisions of FWR 10.16(3)(b), where the discharge of stormwater is to a closed depression (*e.g.* kettle hole) with no outlet for storms up to the one hundred (100) year, twenty-four (24) hour design storm, the discharge shall be non-erosive and no other rate or volume standards are required.

FWR 2.06 Stormwater Design Methodology Considerations for Stormwater Management

(1) Runoff calculations for flood control shall be provided utilizing the rational formula, the NRCS TR-20 or TR-55, as appropriate for the site. The appropriate methodology shall be determined from the restrictions on each method described in Basic Hydrological Calculations for Conservation Commissioners: Runoff, Land Subject to Flooding, and Flow in Pipes and Channels, (DEQE 1987). The Rational Method cannot be used to determine volume.

(2) The appropriate pre- and post-development worksheets as shown in Basic Hydrological Calculations for Conservation Commissioners: Runoff, Land Subject to Flooding, and Flow in Pipes and Channels, (DEQE 1987), shall be submitted with the Subdivision Plan.

(3) The flow length for pre-development sheet flow to determine the time of concentration (T_c) or travel time (T_t) shall not exceed 50 feet.

(4) The design point(s) shall be at the:

(a) edge of a resource area as specified in FWR 10.02(1)(a) 2. through 4, 6 through 11,. and 10.02(1)(b) through (e).; or , where the edge of the resource area is off the property under consideration,

(b) property line, unless other wise allowed pursuant to FWR 2.07(1); or where the pre-development discharge is to an existing storm drainage line,

(c) existing storm drain system.

For each pre-development design point there shall be a corresponding post-development design point.

FWR 2.07 General Standards and Specifications

The design, construction, and maintenance of Stormwater BMPs shall be consistent with FWR(1) through (15).

(1) Land not referenced in the Permit Application by book & page and owner shall not be used in the stormwater management plan unless a recordable easement has been granted for such use, and a copy of the easement has been submitted to the Conservation Commission as part of the SMP.

(2) The site shall be graded so that surface water shall be directed into the stormwater management system.

[1] Connected as defined in TR-55.

(3) Intermittent watercourses such as swales shall be vegetated.

(4) Prior to discharging any stormwater runoff into a BMP, the following conditions must also be met:
(a) the BMP shall be installed according to applicable standards and specifications of FWR 2.00;
(b) all components of the BMP shall be stabilized; and
(c) all upland areas contributing stormwater runoff to the BMP shall be stabilized (non-erosive).

(5) All basins/ponds designed for stormwater runoff control shall:
(a) be designed in accordance with current NRCS standards and specifications unless otherwise indicated in FWR 2.09
(b) have a 2-stage design when pollution reduction and flood control are incorporated into one BMP. The upper stage shall provide enough storage to control the post development peak discharge rates for the 2-, 10-, 25- and 100-year, 24 hour storm events to the pre-development levels, the lower stage shall provide enough storage to meet the pollution removal efficiencies as described in FWR 2.09;
(c) have energy dissipators at the outlets of all inflow and outflow pipes;
(d) have outflow pipes designed to minimize clogging (i.e. through the use of trash racks);
(e) have an emergency spillway to allow for the passage of water without damage to the water quality structure for storms greater than their largest design capacity;
(f) have side slopes at a no greater than a 4:1 [Side slopes must be stabilized and planted with vegetation to prevent erosion. A ten foot (10') wide bench at 0% slope shall surround any permanent pool.]; and
(g) except for the sediment forebay, shall have no permanent pool depth in excess of two and one half feet (2.5').

(6) All water quality BMPs shall be designed in accordance with the runoff volume indicated in FWR 10.16(3). Runoff greater than this design criteria shall be controlled using the peak discharge/volume control criteria in FWR 10.16(3).

(7) Infiltration Basins using redundant sediment removal techniques (i.e. sediment forebay, grassed swale and filter fabric) may be designed and utilized to act as BMPs for both water quality and volume control, provided all other standards and specifications are met.

(8) Volume control structures shall not be placed upgradient of any pollution BMP and
(a) volume control shall be by infiltration;
(b) infiltration areas designed and constructed to control the volume of runoff shall be located in areas with a NRCS hydrological soil group of A, B, or C;
(c) infiltration for volume control shall be designed and constructed with the bottom of the infiltration area one foot above the maximum high ground water elevation; and
(d) the calculations to determine the size of the volume control structure shall assume the surface of the structure to be impervious.

(9) All water quality basin/ponds shall have a sediment forebay. These forebays shall:
(a) consist of a separate cell formed by an earthen berm, gabion, or rip-rap wall;
(b) be sized to contain 0.25 inches per impervious acre of contributing drainage, unless otherwise specified by the provisions of FWR 2.09;
(c) be four feet deep; and
(d) have nonerosive exit velocities for the 2 year design storm.

2.08 continued

(10) Where stormwater basins are designed with a permanent pool depth, a post and rail fence with pressure treated posts or locust posts, with a backing of plastic coated wire fencing shall be used when the basin is in close proximity to residential units, and shall further inhibit access by a planting of rugosa rose (*Rosa rugosa*) surrounding the basin; and

(11) All water quality BMP's shall be designed to accept a return storm of 0.5 inches off the impervious area eleven (11) days after the water quality storm.

(12) Water velocities in pipes and gutters shall be between two (2) and ten (10) feet per second. Water velocities in non-paved areas (eg. swales, ditches) shall not be more than published values for "Maximum Permissible Velocities' based on surface cover type and soil types.

(13) Storm drains shall be of at least twelve (12) inches diameter inside, with at least twenty-four (24) inches of cover. All drain pipes except subdrains shall be reinforced concrete or ADS.

(14) Easements and provisions for vehicular access shall be provided along the entire length of storm drain lines.

(15) At cross culverts, drainage easements shall be established upgradient of the culvert and delineated on the Plan of Record based on the projected one hundred (100) year headwater elevation.

FWR 2.08 Selecting a Water Quality BMP

Four designs for water quality BMPs - Micropool Extended Detention Basins, Wet Extended Detention Ponds, Infiltration Basins and Biofilters are listed in FWR 2.09. One of these BMPs may be appropriate for the site. These four BMP types comply with the requirements of the provisions of FWR 10.16(3)(c), however:

(1) Micropool Extended Detention Basins with a 48 hour detention time will not adequately remove bacteria. No Extended Detention Basins proposed within 1000 feet of a sensitive receptor for bacteria shall be approved. In Falmouth, these areas are:
(a) public swimming areas
(b) Zone 2 of public water supply wells,

(2) Due to the high failure rate of conventional infiltration practices, they are not an accepted method of stormwater management unless redundant pretreatment for sediment removal is utilized. No underground infiltration practices, such as leaching catch basins, shall be allowed in residential subdivisions.

(3) Research has shown that biofilters do not reduce fecal coliform bacteria or nitrogen and may actually increase the loading of these two pollutants. Biofilters should not be utilized in areas sensitive to bacteria and/or nitrogen.

(4) Oil/grit separators are not needed for the type of pollutants associated with subdivisions. They shall not be approved for residential subdivisions.

(5) Other water quality BMPs may be approved provided the pollutant removal rate meets or exceeds the requirements of FWR 1.16(3)(c).

FWR 2.09 Specific Standards and Specifications for Water Quality BMP's

(1) Micropool Extended Detention Basin - In order to provide an estimated removal efficiency of 80% for suspended solids, 30% total phosphorus, and 15% total nitrogen, Micropool Extended Detention Basins shall be designed in accordance with FWR 2.05 through 2.08 plus the specific criteria stated below. The design of Micropool Extended Detention Basins shall include:
(a) minimum contributing watershed area of 10 acres;
(b) a minimum of 48 hour detention time for the water quality storm;
2.09 continued

(c) a sediment forebay at the inlet;
(d) a micropool located near the outlet structure to reduce resuspension of sediments;
(e) a minimum of 3:1 length to width ratio with the inlet structure placed a maximum distance from the outlet structure; and
(f) the establishment of, and the methodology with which to maintain, wetland vegetation on the bottom of the basin.

(2) Wet Extended Detention Ponds/Basins (WP) - In order to provide an estimated removal efficiency of 80% for suspended solids, 65% total phosphorus, and 40% total nitrogen, WPs shall be designed in accordance with FWR 2.05 through 2.08 plus the specific criteria stated below. The design of WPs shall include:
(a) a minimum contributing watershed of 25 acres, or measures to maintain a permanent pool of water;
(b) a permanent pool volume within the permanent pool equal to 40% of the water quality (first flush) volume;
(c) a sediment forebay volume of 13 % of the water quality (first flush) volume;
(d) an extended detention storage volume of 47% of the water quality (first flush) volume;
(e) a detention time for the water quality (first flush) volume of 48 hours;

(f) a maximum depth of 2.5 feet;
(g) a marsh component to be established along the pond edges;
(h) a minimum of 3:1 length to width ratio with the inlet structure placed at a maximum distance from the outlet structure;

(3) Infiltration Basin (IB)- In order to provide an estimated removal efficiency of 80% for suspended solids and 90% bacteria, IBs shall be designed in accordance with FWR 2.05 through 2.08 plus the specific criteria stated below. The design of IBs shall include:

(a) three redundant pretreatment mechanisms (such as a sediment forebay or detention pond) adequate to remove and store 80% of the TSS;
(b) adequate volume to infiltrate the first flush of runoff;
(c) compliance with the specifications found in the State of Rhode Island Stormwater Design & Installation Manual, Sept. 1993, when not specified elsewhere in this Section;
1. Section 6.3 (a), (b)(1)(2)(4), Site Suitability, utilizing the Barnstable County Soil Survey,
2. Section 6.4 Infiltration Rates,
3. Section 6.6 (a through i) Design Requirements,
4. Section 6.7 (a)(1-11) Separation Distances,

(4) Biofilters - In order to provide an estimated removal efficiency of 80% for suspended solids, 45% total phosphorus, and 25% total nitrogen, Biofilters shall be designed in accordance with FWR 2.05 through 2.08 plus the specific criteria stated below. The design of Biofilters shall:

(a) be designed in accordance with the site suitability, design criteria, and maintenance requirements of Appendix G of Biofiltration Swale performance Recommendations and Design Considerations, Washington Department of Ecology, Publication #657, October 5, 1992;
(b) be designed to carry only the first flush;.
(c) have a maximum contributing watershed of 5 acres;
(d) stabilized (nonerosive) with dense vegetative cover prior to accepting any stormwater runoff;

FWR 2.10 Treatment for "Hot Spots"

(1) Introduction.
The intent of this section is to provide adequate treatment for stormwater runoff from certain land uses, or "hot spots", which pose a greater threat to wetland and water resource areas. Stormwater from "hot spots" is presumed to be contaminated while stormwater from rooftops (excepting industrial and other specific roofs) is presumed to be relatively uncontaminated.

(2) Definitions.
(a) A hot spot occurs due to land use or activity that generates higher potential pollutant loads than are found in typical stormwater runoff, based on existing data. These activities include but are not limited to:
1. stormwater discharges associated with Standard Industrial Classifications;

2.10 continued

2. auto salvage yards (auto recycle facilities);
3. auto fueling facility (gas station);
4. fleet storage areas (cars, buses, trucks, public works);
5. vehicle service and maintenance areas;
6. vehicle and equipment cleaning facilities;
7. commercial parking lots with average trip generation rates of 100 or greater per day (according to Institute of Transportation Engineers). Such areas typically include fast-food restaurants, convenience stores, high-turnover [chain] restaurants,,shopping centers and supermarkets);
8. road salt storage and loading areas (if exposed to rainfall);
9. commercial nurseries;
10. metal rooftops including roofs made from aluminum, tin, galvanized steel, copper, or rooftops which have been documented to contribute significant pollutant loads;
11. outdoor storage and loading/unloading areas of hazardous substances;
12. SARA 312 generators (if materials or containers are exposed to rainfall); and
13. marinas (service, repainting, and hull maintenance areas).

(b) The hot spots are specific drainage areas where the individual "hot spot" activity or land use occurs. Stormwater which comes in contact with hot spot activity or land use is considered to be contaminated by hot spot pollutants. Areas of the project site, not within the same hot spot drainage area, are not considered to be contaminated by hot spot pollutants.

(c) Areas not normally considered hot spots are:

1. residential development;
2. office and institutional development [when they don't include activity or land uses specified in FWR 2.10(2)(a)]; or
3. roads and streets.

(d) Sufficiently treated means that the stormwater management system incorporates BMPs which are specifically designed to achieve sediment and chemical constituents removal rates that would adequately protect designated uses of ground water or hydrologically connected surface waters.

(3) Required Practices.

(a) The following are required within hot spot areas:

1. source reduction practices which aim to minimize contact between rainfall and contaminated sources to minimize the quantity of contaminated stormwater that must be treated; and
2. pretreatment by the use of water quality inlets, sediment traps, drainage channels, water quality swales, and/or deep sump catch basins;
3. stormwater runoff shall be sufficiently treated; and
4. all other provisions of FWR 10.16(3) and FWR 2.00.

(b) Stormwater management systems in or near public drinking waters and other sensitive resources should incorporate designs which allow for shut-down and containment in the event of an emergency spill or other unexpected contamination event. BMPs with inlets and outlets can be designed with a shutoff and containment mechanism, using available storage in the BMP. Generally, a shut-off valve or gate should be installed at the lowest invert point.

(4) Restricted BMPs.

For the treatment of stormwater runoff from hot spots, the following BMPs shall be used only if sealed or lined to prevent infiltration from the BMP:

(a) sand or organic filters;
(b) detention basins;
(c) wet ponds; or
(d) constructed wetlands.

(5) Prohibited BMPs.

The potential concentrations and types of contaminants found in land uses and activities from hot spots necessitates that certain Water Quality BMPs shall not be used for treating runoff from these sources.

(a) No project shall be approved that requires infiltration of water within 400 feet of a surface public drinking water supply, or within a mapped Zone II or Interim Wellhead Protection Area.

2.10 continued

(b) Infiltration practices for Water Quality BMP's shall not be permitted for the treatment of stormwater runoff from hot spots.

FWR 2.11 Maintenance

(1) All stormwater management systems shall be maintained in accordance with the provisions of FWR 1.00 and FWR 2.00. All stormwater management systems shall be maintained in accordance with the standards set forth in FWR 2.00 at the expense of the owner of the subdivision road. The applicant may be required to establish a home-owner's association, condominium, association, perpetual trust, or some such organization, which meets the approval of the Conservation Commission, that will own and be responsible for the maintenance and inspection of the stormwater management system.

(2) To facilitate maintenance each water quality basin/pond shall be constructed with:

(a) direct maintenance access by heavy equipment to the forebay;
(b) a hardened bottom in the forebay to make sediment removal easier; and
(c) a fixed sediment depth marker installed in the forebay to measure sediment deposition over time.

(3) Routine maintenance and inspections shall conform to the following:

(a) stormwater management systems shall be inspected annually and cleared of debris, sediment and vegetation when they affect the functioning and/or design capacity of the facility;
(b) biofilters shall be inspected monthly and mowed or replanted as necessary. Clippings are to be removed and disposed of properly;
(c) Where lack of maintenance is causing or contributing to a water quality problem, immediate action shall be taken to correct the problem;
(d) an inspection report shall be submitted to the Conservation Commission using the BMP Operation and Maintenance Inspection Report (FWR 2.13);
(e) all actions required to maintain the stormwater management system for the purpose it was designed and constructed must be performed immediately following the maintenance inspection;
(f) accumulated sediment shall be excavated as needed or at the request of Conservation Commission; and
(g) any vegetation uprooted by sediment removal shall be replaced.

(4) To ensure future maintenance each basin design shall have a design life of twenty (20) years, as documented in a peer review publication, third party testing, or other independent means.

FWR 2.12 Inspection

After the stormwater management system has been constructed and before the Performance Guarantee and/or Certificate of Compliance for the project has been released, the applicant shall submit an "as-built" plan detailing the actual stormwater management system as installed. This Commission shall also evaluate the effectiveness of the system in an actual storm. If the system is found to be inadequate by virtue of physical evidence of operational failure, even though it was built as called for in the Permit, it shall be corrected before the performance guarantee is released. Examples of inadequacy shall be considered but not limited to: errors in the infiltrative capability, errors in the maximum ground water elevation, failure to properly define or construct flow paths, or erosive discharges from basins.

FWR 2.13

Applicant Check-off
for
The Submittal of Stormwater Management Plans

I. Site Characteristic Information to be included in the Stormwater Management Plan (SMP).

A. Pre-development conditions:

[ ] 1. the existing watersheds on the property, as well as upgradient areas contributing runoff to the property;

[ ] 2. location of all surface waters and wetlands on or adjacent to the site;

[ ] 3. the delineation of the 100 year flood elevation as indicated on the Federal Emergency Management Act (FEMA) maps. If FEMA maps do not exist or if the waterbody or watercourse 100-year flood elevation is not indicated on the map, the elevation shall be calculated utilizing an appropriate methodologies such as NRCS TR-55 or TR-20 or HEC2. **Note: The floodplain location determined by the FEMA maps are approximate. When a specific elevation is given, the location of the floodplain shall correspond to that elevation.**

[ ] 4. the principal vegetation types sufficient to determine an appropriate curve number;

[ ] 5. a. the topography described at 1 foot intervals;

[ ] b. with areas of steep slopes over 15% highlighted;

[ ] 6. the soil types on the site and the hydrological soil groups based the most current Natural Resource Conservation Service soils map of the site (available at the NRCS office in Barnstable);

[ ] 7. the location of any public or private water supplies within 100 feet of the property, Zone II of public water Supplies or Interim Zone IIs as well as on the property;

[ ] 8. soil logs for each proposed BMPs control system site (documentation should be for a minimum of 4 feet below the bottom of the BMP and be submitted for both flood control BMPs and pollution reduction BMPs) and

[ ] 9. maximum groundwater levels at the proposed BMPs locations.

[ ] 10. the flow path(s);

[ ] 11. design points for each watershed; and

[ ] 12. areas of ponding or swamping.

B. Post development conditions:

[ ] 1. changes in topography at 1 foot intervals;

[ ] 2. areas where vegetation will be cleared or otherwise altered;

[ ] 3. the proposed watersheds on the property, as well as upgradient areas contributing runoff to the property;

4. the proposed development layout including:

[ ] a. locations of roadways, common parking areas, and undisturbed lands;

2.13 continued

[ ] b. locations of drainage systems and stormwater treatment facilities;

5. areas to be utilized in overland flow, i.e. grass swales and filter strips, showing:

[ ] a. proposed vegetation; and

[ ] b. the soil susceptibility to erosion (using the NRCS classification).

[ ] 6. the flow path(s) for the 2-, 10-, 25-, and
[ ] 100-year 24 hour storm event

[ ] 7. design points for each watershed;

II. Water Quantity/Duration/Quality Information to be submitted in the SMP.

A. Pre-development conditions in narrative form or calculations:

[ ] 1. peak discharge rate, based on the 2-,
[ ] 10-,
[ ] 25-, and
[ ] 100-year 24 hour storm event using NRCS TR-55 or TR-20; and

[ ] 2. volume of the surface runoff for 10-year 24 hour storm event using NRCS TR-55 or TR-20;

[ ] 3. existing state surface water quality classifications found in 314 CMR 4.04.

B. Post development conditions:

[ ] 1. peak discharge rate, based on the 2-,
[ ] 10-,
[ ] 25-, and
[ ] 100-year 24 hour storm event using NRCS TR-55 or TR-20; and

[ ] 2. volume of the surface runoff for the 10-year 24 hour storm event using NRCS TR-55 or TR-20;

[ ] 3. design point(s) for each watershed.

[ ] 4. detention/retention time, discharge rate, and approximate time of concentration through the BMP for the water quality storm;

[ ] 5. a description of and calculations for the proposed outlet structure(s); both the principle outlet and emergency spillway; and

[ ] 6. a discussion regarding whether the proposed BMPs meet or exceed the performance standards identified in FWR 1.16(3), as well as an evaluation of the pollutant removal efficiency of each proposed treatment facility or group of facilities;

FWR 2.14

Town of Falmouth Conservation Commission
BMP Operation and Maintenance Inspection Report

Inspector Name _____

Inspection Date _____ Address _____

Type of BMP _____ of Project _____

Project Name _____ File No. _____

ITEM INSPECTED	CHECKED Yes	No	MAINTENANCE Req'd	Not Rq'd	OBSERVATIONS
1. POND FACILITIES A. Pond Dam Embankments and Emergency Spillway					
1. Vegetation and Ground Cover Adequate					
2. Surface Erosion					
3. Animal Burrows					
4. Unauthorized Planting					
5. Cracking, Bulging or Sliding of Dam					
a. Upstream Face					
b. Downstream Face					
c. At or Beyond Toe					
Upstream					
Downstream					
d. Emergency Spillway					
6. Pond, Toe & Chimney Drains Clear & Funct.					
7. Seeps/Leaks on Downstream Face					
8. Slope Protection for Rip Rap Failures					

2.14 continued

ITEM INSPECTED	CHECKED Yes	No	MAINTENANCE Req'd	Not Rq'd	OBSERVATIONS
9. Vertical and Horizontal Alignment of Top of Dam as Per "As-Built" Plans					
10. Emergency Spillway Clear of Obstructions and Debris					
11. Other (Specify)					
B. Riser and Principal Spillway Type:Reinforced Concrete __ Corrugated Pipe ___ Masonry ___ *Indicates Dry Ponds Only 1.*Low flow orifice obstructed					
2.*Low Flow Trash Rack					
a. Debris Removal Necessary b. Corrosion Control					
3. Weir Trash Rack Maintenance					
a. Debris Removal Necessary					
b. Corrosion Control					
4. Excessive Sediment Accumulation Inside Filter					
5. Concrete Masonry Condition Riser & Barrels					
a. Cracks or Displacement					
b. Minor Spalling (<1")					
c. Major Spalling (Rebars Exposed)					
d. Joint Failures					
e. Water Tightness					
6. Metal Pipe Condition					
7. Control Valve					
a. Operational/Exercised					
b. Chained and Locked					

2.14 continued

ITEM INSPECTED	CHECKED Yes	CHECKED No	MAINTENANCE Req'd	MAINTENANCE Not Rq'd	OBSERVATIONS
8. Pond Drain Valve					
a. Operational/Exercised					
b. Chained and Locked					
9. Outfall Channels Functioning					
10. Other (Specify)					
C. Permanent Pool - Wet Pools					
1. Undesirable Vegetative Growth					
2. Floating or Floatable Debris Removal Required					
3. Visible Pollution					
4. Shoreline Problems					
5. Other (Specify)					
D. Dry Pool Areas - Dry Pond					
1. Vegetation Adequate					
2. Undesirable Vegetative Growth					
3. Undesirable Woody Growth					
4. Low Flow Channels Clear or Obstructions					
5. Standing Water or Wet Spots					
6. Sediment and/or Trash Accumulation					
7. Other (Specify)					

FWR 2.15

Town of Falmouth Conservation Commission
Stormwater Management Summary Form

Applicant: _____ Project Name _____

Stormwater Plan Prepared by: _____ Address _____

_____ _____

ITEM	Pre-development	Post- Development
Curve Number		
Time of Concentration		
Rate 2 yr		
Rate 10 yr		
Rate 25 yr		
Rate 100 yr		
Volume 10 yr		
Sq. ft. impervious	XXXXXXXXXXXXXX	
Water Quality Volume	XXXXXXXXXXXXXX	
Other (Specify)		