

STORMWATER MANAGEMENT REGULATIONS

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Section 1. Purpose

The purpose of these Stormwater Regulations is to protect, maintain and enhance the public health, safety, general welfare, and environment by establishing minimum requirements and procedures to control the adverse effects of increased runoff, decreased ground water recharge, erosion and sedimentation, and nonpoint source pollution associated with new development and redevelopment of land, as identified in Chapter 232 Stormwater Management of the Town of Foxborough Bylaws.

Development of land including loss of vegetative cover to introduce impervious surfaces, regrading, and other land use changes, permanently alter the hydrologic system of local watersheds by decreasing transpiration and infiltration and increasing stormwater runoff rates and volumes, causing an increase flooding, stream channel erosion, and sediment transport and deposition. Additional runoff also contributes to increased nonpoint source pollution and degradation of receiving waters.

Stormwater management systems that are properly designed utilizing low impact design (LID) techniques and appropriate best management practices (BMPs) can better simulate the natural (existing) hydrologic condition and reduce adverse impacts.

During the construction process, soil is often exposed for periods of time and most vulnerable to erosion by wind and water. The eroded soil endangers water resources by reducing water quality, and causing the siltation of valuable wetland resources including swamps, streams, rivers, lakes and aquatic habitat for fish and other desirable species.

The impacts of construction and post-development stormwater runoff quantity and quality can adversely affect public safety, public and private property, surface water drinking water supplies, groundwater resources including drinking water supplies, recreation, aquatic habitats, fish and other aquatic life, property values and other uses of lands and waters.

These Stormwater Regulations have been established to provide reasonable guidance for the regulation of design, construction and post-development stormwater runoff for the purpose of protecting local water resources from degradation. It is in the public interest to regulate construction and post-development stormwater runoff discharges in order to control and minimize increases in stormwater runoff rates and volumes, soil erosion and sedimentation, stream channel erosion, and nonpoint source pollution associated with construction site and post-development stormwater runoff.

Section 2. Definitions

ABUTTER: The owner(s) of land abutting the activity.

AGRICULTURE: The normal maintenance or improvement of land in agricultural or aquacultural use, as defined by the Massachusetts Wetlands Protection Act and its implementing regulations.

ALTERATION OF DRAINAGE CHARACTERISTICS: Any activity on an area of land that changes the water quality, force, direction, timing or location of runoff flowing from the area. Such changes include: change from distributed runoff to confined, discrete discharge; change in the volume of runoff from the area; change in the peak rate of runoff from the area; and change in the recharge to groundwater on the area.

APPLICANT: Any person, individual, partnership, association, firm, company, corporation, trust, authority, agency, department, or political subdivision, of the Commonwealth or the Federal government to the extent permitted by law requesting a Land Disturbance Permit for proposed land-disturbance activity.

BEST MANAGEMENT PRACTICE (BMP): An activity, procedure, restraint, or structural improvement that helps to reduce the quantity or improve the quality of stormwater runoff.

CERTIFICATE OF COMPLETION (COC): A document issued by the Stormwater Authority after all construction activities have been completed, which states that all conditions of an issued Land Disturbance Permit have been met and that a project has been completed in compliance with the conditions set forth in the SWMP.

CLEAN WATER ACT: The Federal Water Pollution Control Act (33 U.S.C. § 1251 et seq.) as hereafter amended.

CLEARING: Any activity that removes the vegetative surface cover.

CONSTRUCTION AND WASTE MATERIALS: Excess or discarded building or site materials, including but not limited to concrete truck washout, chemicals, litter and sanitary waste at a construction site that may adversely impact water quality.

DEVELOPMENT: The modification of land to accommodate a new use or expansion of use, usually involving construction.

DISCHARGE OF POLLUTANTS: The addition from any source of any pollutant or combination of pollutants into the municipal storm drain system or into the waters of the United States or Commonwealth from any source.

DISTURBANCE OF LAND: Any action that causes a change in the position, location, or arrangement of soil, sand, rock, gravel or similar earth material.

DRAINAGE EASEMENT: A legal right granted by a landowner to a grantee allowing the use of private land for stormwater management purposes.

EROSION: The wearing away of the land surface by natural or artificial forces such as wind, water, ice, gravity, or vehicle traffic and the subsequent detachment and transportation of soil particles.

EROSION AND SEDIMENTATION CONTROL PLAN: A document containing a narrative, drawings and details developed by a qualified professional engineer (PE) or a Certified

Professional in Erosion and Sedimentation Control (CPESC), which includes best management practices, or equivalent measures designed to control surface runoff and erosion and sedimentation during pre-construction and construction related land disturbance activities.

EROSION CONTROL: The prevention or reduction of the movement of soil particles or rock fragments due to stormwater runoff.

ESTIMATED HABITAT OF RARE WILDLIFE AND CERTIFIED VERNAL POOLS: Habitats delineated for state-protected rare wildlife and certified vernal pools for use with the Wetlands Protection Act Regulations (310 CMR 10.00) and the Forest Cutting Practices Act Regulations (304 CMR 11.00).

FLOODING: A local and temporary inundation or rise in the surface of a body of water, such that covers land not usually under water.

GRADING: Changing the level or shape of the ground surface.

GROUNDWATER: Water beneath the surface of the ground.

GRUBBING: The act of clearing land surface by digging up roots and stumps.

HAZARDOUS MATERIAL OR WASTE: Any material which, because of its quantity, concentration, chemical, corrosive, flammable, reactive, toxic, infectious or radioactive characteristics, either separately or in combination with any substance or substances, constitutes a present or potential threat to human health, safety, welfare, or to the environment. Toxic or hazardous materials include any synthetic organic chemical, petroleum product, heavy metal, radioactive or infectious waste, acid and alkali, and any substance defined as "toxic" or "hazardous" under MGL c.21C and c.21E, and the regulations at 310 CMR 30.000 and 310 CMR 40.0000.

ILLICIT CONNECTION: A surface or subsurface drain or conveyance which allows an illicit discharge into the municipal storm drain system, including without limitation sewage, process wastewater, or wash water, and any connections from indoor drains, sinks, or toilets, regardless of whether said connection was previously allowed, permitted, or approved before the effective date of the Stormwater Management Bylaw.

ILLICIT DISCHARGE: Direct or indirect discharge to the municipal storm drain system that is not composed entirely of stormwater, except as exempted in Chapter 232 Article II Section 202.D. The term does not include a discharge in compliance with an NPDES stormwater discharge permit or resulting from fire-fighting activities exempted pursuant to Chapter 232 Article II Section 202.D.(1) of the Stormwater Management Bylaw.

IMPERVIOUS SURFACE: Any material or structure on or above the ground that prevents water from infiltrating the underlying soil. "Impervious surface" includes without limitation roads, paved parking lots, sidewalks, and rooftops.

IMPOUNDMENT: A stormwater pond created by either constructing an embankment or excavating a pit which retains a permanent pool of water.

INFILTRATION: The act of conveying surface water into the ground to permit groundwater recharge and the reduction of stormwater runoff from a project site.

LAND-DISTURBING ACTIVITY: Any activity that causes a change in the position or location

of soil, sand, rock, gravel, or similar earth material.

LAND USE OF HIGHER POTENTIAL POLLUTANT LOAD (LUHPPL): Land uses or activities with higher potential pollutant loadings, as defined in the Massachusetts Stormwater Management Standards (see Standard 5 of the MassDEP Stormwater Handbook, as amended) such as auto salvage yards, auto fueling facilities, fleet storage yards, commercial parking lots with high intensity use, road salt storage areas, commercial nurseries and landscaping, outdoor storage and loading areas of hazardous substances or marinas.

MASSACHUSETTS ENDANGERED SPECIES ACT: G.L. c.131A and its implementing regulations 321 CMR 10.00 which prohibit the “taking” of any rare plant or animal species listed as Endangered, Threatened, or of Special Concern.

MASSACHUSETTS STORMWATER MANAGEMENT STANDARDS: The Standards issued by the Department of Environmental Protection, and as amended, that coordinates the requirements prescribed by state regulations promulgated under the authority of the Massachusetts Wetlands Protection Act G.L. c. 131 §. 40 and Massachusetts Clean Waters Act G.L. c. 21, §. 23-56. The Policy addresses stormwater impacts through implementation of performance standards to reduce or prevent pollutants from reaching water bodies and control the quantity of runoff from a site.

MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4) or MUNICIPAL STORM DRAIN SYSTEM: The system of conveyances designed or used for collecting or conveying stormwater, including any road with a drainage system, street, gutter, curb, inlet, piped storm drain, pumping facility, retention or detention basin, natural or man-made or altered drainage channel, reservoir, and other drainage structure that together comprise the storm drainage system owned or operated by the Town of Foxborough.

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) STORMWATER DISCHARGE PERMIT: A permit issued by United States Environmental Protection Agency or jointly with the Commonwealth of Massachusetts that authorizes the discharge of pollutants to waters of the United States.

NEW DEVELOPMENT: Any construction activities or land alteration resulting in total earth disturbances equal to or greater than 1 acre (or activities that are part of a larger common plan of development disturbing greater than 1 acre) on an area that has not previously been developed to include impervious cover.

NONSTORMWATER DISCHARGE: Discharge to the municipal storm drain system not composed entirely of stormwater.

OPERATION AND MAINTENANCE PLAN: A plan setting up the functional, financial and organizational mechanisms for the ongoing operation and maintenance of a stormwater management system to ensure that it continues to function as designed.

OUTFALL: The point at which stormwater flows out from a point source into waters of the Commonwealth.

OUTSTANDING RESOURCE WATERS (ORWs): Waters designated by Massachusetts Department of Environmental Protection as ORWs. These waters have exceptional sociologic, recreational, ecological and/or aesthetic values and are subject to more stringent

requirements under both the Massachusetts Water Quality Standards (314 CMR 4.00) and the Massachusetts Stormwater Management Standards. ORWs include vernal pools certified by the Natural Heritage Program of the Massachusetts Department of Fisheries and Wildlife and Environmental Law Enforcement, all Class A designated public water supplies including their bordering vegetated wetlands, and other waters specifically designated.

OWNER: A person with a legal or equitable interest in property.

PERSON: An individual, partnership, association, firm, company, trust, corporation, agency, authority, department or political subdivision of the Commonwealth or the federal government, to the extent permitted by law, and any officer, employee, or agent of such person.

POINT SOURCE: Any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, or container from which pollutants are or may be discharged.

PRE-CONSTRUCTION: All activity in preparation for construction.

POLLUTANT: Any element or property of sewage, agricultural, industrial or commercial waste, runoff, leachate, heated effluent, or other matter, whether originating at a point or nonpoint source, that is or may be introduced into any sewage treatment works or waters of the commonwealth. Pollutants shall include without limitation:

- A. Paints, varnishes, and solvents;
- B. Oil and other automotive fluids;
- C. Nonhazardous liquid and solid wastes and yard wastes;
- D. Refuse, rubbish, garbage, litter, or other discarded or abandoned objects, ordnance, accumulations and floatables;
- E. Pesticides, herbicides, and fertilizers;
- F. Hazardous materials and wastes; sewage, fecal coliform and pathogens;
- G. Dissolved and particulate metals;
- H. Animal wastes;
- I. Rock; sand; salt; soils;
- J. Construction wastes and residues; and
- K. Noxious or offensive matter of any kind.

PRIORITY HABITAT OF RARE SPECIES: Habitats delineated for rare plant and animal populations protected pursuant to the Massachusetts Endangered Species Act and its regulations.

PROCESS WASTEWATER: Water which, during manufacturing or processing, comes into direct contact with or results from the production or use of any material, intermediate product, finished product, or waste product.

RECHARGE: The process by which groundwater is replenished by precipitation through the percolation of runoff and surface water through the soil.

REDEVELOPMENT: Development, rehabilitation, expansion, demolition or phased projects that disturb the ground surface, including impervious surfaces on previously developed sites.

RUNOFF: Rainfall, snowmelt, or irrigation water flowing over the ground surface.

SEDIMENT: Mineral or organic soil material that is transported by wind or water, from its origin to another location; the product of erosion processes.

SEDIMENTATION: The process or act of deposition of sediment.

SITE: Any lot or parcel of land or area of property where land-disturbing activities are, were, or will be performed.

SLOPE: The incline of a ground surface expressed as a ratio of horizontal distance to vertical distance.

SOIL: Any earth, sand, rock, gravel, or similar material.

STABILIZATION: The use, singly or in combination, of mechanical, structural, or vegetative methods, to prevent or retard erosion.

STORMWATER AUTHORITY: Town of Foxborough Planning Board or its authorized agent(s).

STORMWATER: Runoff from precipitation or snow melt and surface water runoff and drainage.

STORMWATER MANAGEMENT PLAN (SWMP): A document containing narrative, drawings, details and reporting requirements developed by a qualified professional engineer (PE), which describes structural and non-structural best management practices designed to control the discharge of pollutants from impervious surfaces and onsite activities as well as the volume and peak rate of surface runoff from a site on an ongoing basis after construction has been completed.

STRIP: Any activity which removes the vegetative ground surface cover, including tree removal, clearing, grubbing, and storage or removal of topsoil.

TOTAL SUSPENDED SOLIDS (TSS): Undissolved organic or inorganic particles in water.

TOXIC MATERIAL OR WASTE: See definition of HAZARDOUS MATERIAL OR WASTE.

VERNAL POOLS: Temporary bodies of freshwater which provide critical habitat for a number of vertebrate and invertebrate wildlife species. Vernal pools shall have been certified by the Division of Fisheries and Wildlife and the National Heritage Endangered Species Program.

WASTEWATER: Any sanitary waste, sludge, or septic tank or cesspool overflow, and water that during manufacturing, cleaning or processing comes into direct contact with or results from the production or use of any raw material, intermediate product, finished product, by-product or waste product.

WATERCOURSE: A natural or man-made channel through which water flows or a stream of water, including a river, brook or underground stream.

WATERS OF THE COMMONWEALTH: All waters within the jurisdiction of the Commonwealth, including, without limitation, rivers, streams, lakes, ponds, springs, impoundments, estuaries, wetlands, coastal waters, and groundwater.

WETLAND RESOURCE AREA: Areas specified in the Massachusetts Wetlands Protection Act G.L. c.131, §40 and in the Town of Foxborough Wetlands Protection Bylaw Chapter 267

WETLANDS: Tidal and non-tidal areas characterized by the presence of hydrophytic (water dependent or tolerant) plant communities and evidence of hydrology (e.g., hydric soils) generally located between terrestrial (land-based) and aquatic (water) environments.

Section 3. Authority

- A. The Regulations have been adopted by the Foxborough Planning Board in accordance with the Town of Foxborough Stormwater Management Bylaw.
- B. Nothing in these Regulations is intended to replace or be in derogation of the of the requirements of the Town of Foxborough Zoning Bylaw, Wetlands Protection Bylaw, Subdivision Control Law, or any other Regulations adopted thereunder.

Section 4. Administration

- A. The Town of Foxborough Planning Board is designated as the Stormwater Authority under the Stormwater Management Bylaw and shall administer, implement and enforce these regulations. Any powers granted to or duties imposed upon the Stormwater Authority may be delegated in writing by Stormwater Authority to its employees or agent(s).
- B. Waiver. Stormwater Authority may waive strict compliance with any requirement of these regulations promulgated hereunder, where:
 - (1) such action is allowed by federal, state and local statutes and/or regulations,
 - (2) is in the public interest, and
 - (3) is not inconsistent with the purpose and intent of these regulations.
- C. The Stormwater Authority may amend regulations after holding a public hearing. Notice of the time, place and subject matter shall be published in a newspaper of general circulation in Foxborough once, not less than 14 days before the day of such a hearing.

Section 5. Applicability

- A. The Bylaw and these regulations shall apply to all activities that result in disturbance of one acre or more of land that drains to the municipal separate storm sewer system (MS4). Except as authorized by the Stormwater Authority in a Land Disturbance Permit or as otherwise provided in the Stormwater Regulations, no person shall perform any activity that results in disturbance of one acre (43,560 square feet) of land or more. Normal maintenance and improvement of land in agricultural or aquacultural use, as defined by the Wetlands Protection Act regulation 310 CMR 10.04, are exempt. In addition, as authorized in the Phase II Small MS4 General Permit for Massachusetts, stormwater discharges resulting from the above activities that are subject to jurisdiction under the Wetlands Protection Act or require other permits from the Planning Board and demonstrate compliance with the Massachusetts Stormwater Management Standards as reflected in an Order of Conditions issued by the Conservation Commission or permitted by the Planning Board are exempt from compliance with these regulations. Any activity proposed or undertaken outside the areas specified in this bylaw is not subject to regulation and does not require the filing of a Land Disturbance Permit, unless and until that activity actually alters an area subject to protection under the bylaw. In the event that the Stormwater Authority determines that such activity has in fact altered an area subject to protection under the bylaw, it may require the filing of a Land Disturbance Permit and/or issuance of an Enforcement Order and shall impose such conditions on the activity or any portion thereof as it deems necessary to contribute to the protection of the interests identified in Article I, Section I. A Land Disturbance Permit is required for disturbance of one acre (43,560 square feet) or more of land or if the proposed use is listed as a land use of higher

potential pollutant loads as defined in the Massachusetts Stormwater Management Standards, regardless of the area of disturbance.

B. Exemptions:

- (1) Maintenance of existing landscaping, gardens or lawn areas associated with a single family dwelling conducted in such a way as not to cause a nuisance;
- (2) Construction of fencing that will not substantially alter existing terrain or drainage patterns;
- (3) Construction of utilities other than drainage (gas, water, electric, telephone, etc.) which will not alter terrain or drainage patterns or result in discharge of sediment to the MS4;
- (4) Normal maintenance and improvement of land in agricultural or aquacultural use; and
- (5) Disturbance or redevelopment of land that is subject to jurisdiction under the Wetlands Protection Act (M.G.L. Ch. 131, § 40), Foxborough Wetlands Protection Bylaw (Chapter 267) or requires other permits from the Planning Board and demonstrates compliance with the Massachusetts Stormwater Management Standards and the Town of Foxborough Stormwater Management Regulations as reflected in a valid Order of Conditions issued by the Conservation Commission or permitted by the Planning Board.

Section 6. Land Disturbance Permit and Procedure

- A. Application.** A completed application for a Land Disturbance Permit shall be filed with Stormwater Authority. A permit must be obtained prior to the commencement of land disturbing activity that may result in the disturbance of an area of one acre (43,560, sq. ft.) or more. The Land Disturbance Permit Application package shall include:
- (1) A completed Application Form with original signatures of all owners;
 - (2) A list of abutters within 100 feet of the property, certified by the Assessor's Office;
 - (3) Three (3) copies of the:
 - a. Stormwater Management Plan.
 - b. Erosion and Sediment Control Plan.
 - c. Operation and Maintenance Plan.
 - (4) Payment of the application and review fees; and,
 - (5) One (1) copy each of the Application Form and the list of abutters to be filed with the Town Clerk.
- B. Information requests.** The applicant shall submit all additional information requested by the Stormwater Authority to issue a decision on the application.
- C. Determination of Completeness.** The Stormwater Authority shall make a determination as to the completeness of the application and adequacy of the materials submitted. No review shall take place until the application has been found to be complete.

- D. **Fee Structure.** Each application must be accompanied by the appropriate application fee as established by the Stormwater Authority. Applicants shall pay review fees as determined by the Stormwater Authority sufficient to cover any expenses connected with the public hearing and review of the Land Disturbance Permit Application before the review process commences. The Stormwater Authority is authorized to retain a Registered Professional Engineer or other professional consultant to advise the Stormwater Authority on any or all aspects of the Application.
- E. **Entry to Perform Duties** under this Bylaw. To the extent permitted by state law, or if authorized by the owner or other party in control of the property, the Stormwater Authority, its agents, officers, and employees may enter upon privately owned property for the purpose of performing their duties under this Bylaw and Regulations and may make or cause to be made such examinations, surveys or sampling as the Stormwater Authority deems reasonably necessary.
- F. **Other Boards.** The Stormwater Authority shall notify the Town Clerk of receipt of the application, and shall give one copy of the application package to each of the other relevant boards and notify the Planning Board, Conservation Commission, or Department of Public Works as appropriate.
- G. **Public Hearing.** The Stormwater Authority shall hold a public hearing within twenty-one (21) days of the receipt of a complete application and shall take final action within twenty-one (21) days from the time of the close of the hearing unless such time is extended by agreement between the applicant and the Stormwater Authority. Notice of the public hearing shall be given by publication and posting and by first-class mailings to abutters at least seven (7) days prior to the hearing. The Stormwater Authority shall make the application available for inspection by the public during business hours at the office of the Town of Foxborough Conservation Commission.
- H. **Action by the Stormwater Authority.**

The Stormwater Authority may:

- (1) Approve the Land Disturbance Permit Application and issue a permit if it finds that the proposed plan will protect water resources and meets the objectives and requirements of the by-law and these regulations;
- (2) Approve the Land Disturbance Permit Application and issue a permit with conditions, modifications or restrictions that the Stormwater Authority determines are required to ensure that the project will protect water resources and meets the objectives and requirements of the bylaw and these regulations;
- (3) Disapprove the Land Disturbance Permit Application and deny the permit if it finds that the proposed plan will not protect water resources or fails to meet the objectives and requirements of the bylaw and these regulations.
- (4) Disapprove the Land Disturbance Permit Application “without prejudice” where an applicant fails to provide requested additional information or review fees that in the Stormwater Authority’s opinion is needed to adequately describe or review the proposed project.

- I. Final Approval. Final approval, if granted, shall be endorsed on the Stormwater Management Permit by the signature of the majority of the Stormwater Authority (or by the signature of the person officially authorized by the Stormwater Authority).
- J. Project Changes. The permittee, or their agent, must notify the Stormwater Authority in writing of any change or alteration of a land-disturbing activity authorized in a Land Disturbance Permit before any change or alteration occurs. If the Stormwater Authority determines that the change or alteration is significant, based on the design requirements listed in Section 7.B. and accepted construction practices, the Stormwater Authority may require that an amended Land Disturbance Permit application be filed and a public hearing held. If any change or alteration from the Land Disturbance Permit occurs during any land disturbing activities, the Stormwater Authority may require the installation of interim erosion and sedimentation control measures before approving the change or alteration.

Section 7. Stormwater Management Plan

- A. The application for a Land Disturbance Permit shall include the submittal of a Stormwater Management Plan to the Stormwater Authority. This Stormwater Management Plan shall contain sufficient information for the Stormwater Authority to evaluate the environmental impact, effectiveness, and acceptability of the site planning process and the measures proposed by the applicant to reduce adverse impacts from stormwater runoff during construction, and on a long-term basis.
- B. The Plan shall be designed to meet the Massachusetts Stormwater Management Standards as further defined in the Massachusetts Stormwater Handbook and any additional standards required by these regulations or regulations adopted hereunder. To the extent that any project within the jurisdiction of these regulations is located in an area subject to one or more pollutant-specific Total Maximum Daily Loads (TMDLs), such project is required to implement structural and non-structural stormwater best management practices (BMPs) that are consistent with each such TMDL and its associated Waste Load Allocation (for point sources) and Load Allocation (for nonpoint sources). The Stormwater Authority may develop, publish and periodically revise one or more pollutant-specific guidance documents describing the geographic applicability of each TMDL and identifying BMPs that individually or in combination are considered to be consistent with the TMDL(s).
- C. The Stormwater Management Plan shall fully describe the project in narrative, drawings, and calculations. It shall at a minimum include:
 - (1) Contact Information. The name, address, and telephone number of all persons having a legal interest in the property and the tax reference number and parcel number of the property or properties affected;
 - (2) Narrative describing:
 - (a) Purpose
 - (b) Methodologies and assumptions
 - (c) Existing and proposed uses and conditions
 - (d) Project impacts and mitigation techniques including:
 - i. Summary of proposed land area to be cleared, proposed impervious area, work within proximity of regulated wetland resources, aquifer

- protection zones, earthwork within 4 feet of seasonal high groundwater elevations, and other sensitive environmental areas.
- ii. Low impact development (LID) techniques considered for this project and an explanation as to why they were included or excluded from the project.
 - iii. Best management practices proposed for this project.
 - iv. Identifying the immediate down gradient waterbody(s) that stormwater runoff from the project site discharges to, EPA's waterbody assessment and TMDL status of the waterbody(s), <http://www.epa.gov/region1/npdes/stormwater/ma.html> and the LIDs and BMPs included in the project to address the pollutant(s) of concern
- (e) Summary of pre and post development peak rates of stormwater runoff to show no adverse impacts to down-gradient properties, stormwater management systems and wetland resources. The Stormwater Authority reserves the right to require a summary of pre and post stormwater runoff volumes, where in the Stormwater Authority's opinion unique down gradient conditions warrant analysis of pre and post stormwater runoff volumes.
- (f) Conclusions
- (3) Plans
- (a) Portion of the USGS Map indicating the site locus and properties within a minimum of 500 feet of project property line
 - (b) Existing conditions and proposed design plans showing:
 - i. Buildings and/or structures including materials, approximate height and
 - ii. Utilities including size, material and invert data, where necessary
 - iii. Regulated wetland resource areas within proximity of the site
 - (c) Stormwater management design plan(s) and details showing:
 - i. Location, size, material, invert data and details for all existing and proposed stormwater management system components including structures, pipes, swales, detention, retention, and infiltration systems and any other LID techniques or BMPs.
 - ii. Profiles of drainage trunk lines
 - iii. Drainage easements
 - (d) Separate pre and post condition watershed plans indicating:
 - i. Structures, pavements, surface vegetation and other ground cover materials
 - ii. Topography sufficient to delineate watershed areas
 - iii. Point(s) of analysis
 - iv. Watershed areas including upgradient areas that contribute stormwater flow onto the project site, labeled to be easily identified

- in calculations. Total pre and post watershed areas must be equivalent.
 - v. Breakdown summary of various surface conditions by soil hydrologic group rating
 - vi. Flow path for time of concentration (Tc) calculation
- (4) Calculations
- (a) Hydrologic calculations to determine pre and post peak rates and volumes, where required by the Stormwater Authority, of stormwater runoff for 2, 10, 25 and 100 year 24 hour storm events
 - (b) Groundwater recharge calculations and BMP drawdown (time to empty)
 - (c) Water quality calculations including (if applicable):
 - i. TSS removal calculation for each watershed
 - ii. Specific BMPs utilized in critical areas
 - iii. Specific BMPs utilized for land uses of higher potential pollutant loads
 - iv. Specific treatment for pollutants causing impairment of down-gradient waterbody(s), identified by EPA and MassDEP
 - (d) Hydraulic calculations to size drainage pipes, swales and culverts
 - (e) Supplemental calculations for sizing LID and BMPs and addressing impairments to waterbodies
- (5) Soil mapping and test data
- (6) MassDEP Checklist for Stormwater Report completed, stamped and signed by a Professional Engineer (PE) licensed in the Commonwealth of Massachusetts to certify that the Stormwater Management Plan is in accordance with the criteria established in the MassDEP Stormwater Management Standards, Foxborough Stormwater Management Bylaw and these Regulations.
- (7) Any other information requested by the Stormwater Authority.

Section 8. Erosion and Sedimentation Control Plan

- A. The Erosion and Sediment Control Plan shall be designed to ensure compliance with these Regulations and if applicable, the NPDES General Permit for Storm Water Discharges
- B. From Construction Activities. In addition, the plan shall ensure that the Massachusetts Surface Water Quality Standards (314 CMR 4.00) are met in all seasons.
- C. If a project requires a Stormwater Pollution Prevention Plan (SWPPP) per the NPDES General Permit for Storm Water Discharges From Construction Activities (and as amended), then the permittee is required to submit a complete copy of the SWPPP (including the signed Notice of Intent and approval letter). If the SWPPP meets the requirements of the General Permit, it will be considered equivalent to the Erosion and Sediment Control Plan described in this section.

- D. The Erosion and Sediment Control Plan shall remain on file with the Stormwater Authority. Refer to the latest version of the *Massachusetts Erosion and Sediment Control Guidelines for Urban & Suburban Areas* for detailed guidance.
- E. The Erosion and Sediment Control Plan shall contain sufficient information to describe the nature and purpose of the proposed development, pertinent conditions of the site and the adjacent areas, and proposed erosion and sedimentation controls. The plan shall also describe measures to control construction wastes including but not limited to construction materials, concrete truck wash out and chemicals. The applicant shall submit such material as is necessary to show that the proposed development will comply with the design requirements listed in Section 7.B. below.
- F. Erosion and Sedimentation Control Plan Content. The Plan shall contain the following information:
- (1) Names, addresses, and telephone numbers of the owner, applicant, and person(s) or firm(s) preparing the plan;
 - (2) Title, date, north arrow, names of abutters, scale, legend, and locus map;
 - (3) Location and description of natural features including:
 - (a) Watercourses and waterbodies, wetland resource areas and all floodplain information, including the 100-year flood elevation based upon the most recent Flood Insurance Rate Map;
 - (b) The Stormwater Authority reserves the right to require a hydrological study by a registered professional engineer to determine the 100-year flood elevation, where the Flood Insurance Rate Map has not determined the 100-year flood elevation;
 - (c) Existing vegetation including tree lines, canopy layer, shrub layer, and ground cover, and trees with a caliper twelve (12) inches or larger, noting specimen trees and forest communities; and
 - (d) Habitats mapped by the Massachusetts Natural Heritage & Endangered Species Program as Endangered, Threatened or of Special Concern, Estimated Habitats of Rare Wildlife and Certified Vernal Pools, and Priority Habitats of Rare Species within five hundred (500) feet of any construction activity.
 - (4) Lines of existing abutting streets showing drainage and driveway locations and curb cuts, where necessary;
 - (5) Existing soils, volume and nature of imported soil materials;
 - (6) Topographical features including existing and proposed contours at intervals no greater than two (2) feet with spot elevations provided where needed;
 - (7) Surveyed property lines showing distances and monument locations, all existing and proposed easements, rights-of-way, and other encumbrances, the size of the entire parcel, and the delineation and number of square feet of the land area to be disturbed;

- (8) Drainage patterns and approximate slopes anticipated after major grading activities (Construction Phase Grading Plans);
- (9) Location and details of erosion and sediment control measures with a narrative of the construction sequence/phasing of the project, including both operation and maintenance for structural and non-structural measures, interim grading, and material stockpiling areas;
- (10) Path and mechanism to divert uncontaminated water around disturbed areas, to the maximum extent practicable;
- (11) Location and description of industrial discharges, including stormwater discharges from dedicated asphalt plants and dedicated concrete plants, which are covered by this permit, and where such discharges may impact the project under review;
- (12) Stormwater runoff calculations in accordance with the Department of Environmental Protection's Stormwater Management Policy;
- (13) Location and description of and implementation schedule for temporary and permanent seeding, vegetative controls, and other stabilization measures;
- (14) A description of construction and waste materials expected to be stored on-site. The Plan shall include a description of controls to reduce pollutants from these materials, including storage practices to minimize exposure of the materials to stormwater, and spill prevention and response;
- (15) A description of provisions for phasing the project where necessary or where determined to be necessary by the Stormwater Authority;
- (16) Plans must be stamped and certified by a qualified Professional Engineer registered in Massachusetts or a Certified Professional in Erosion and Sediment Control; and
- (17) Such other information as is required by the Stormwater Authority.

Section 9. Operation and Maintenance Plan

- A. A stand-alone Operation and Maintenance Plan (O&M Plan) is required at the time of application for all projects with constructed stormwater BMPs and stormwater management practices. The O&M Plan shall be designed to ensure compliance with the Permit and these Regulations. The Operation and Maintenance Plan shall remain on file with the Stormwater Authority and shall be an ongoing requirement. The Applicant shall provide copies of the Operation and Maintenance Plan to all persons responsible for maintenance and repairs.
- B. The O&M Plan shall include:
 - (1) The name(s) of the owner(s) for all components of the system;
 - (2) A map showing the location of the systems and facilities including all structural and nonstructural stormwater best management practices (BMPs), catch basins, manholes/access lids, pipes, and other stormwater devices. The plan showing such systems and facilities to be privately maintained, including associated easements shall be recorded with the Norfolk County Registry of Deeds prior to issuance of a Certificate of Compliance by the Stormwater Authority.

- (3) Maintenance Agreement with the Stormwater Authority that specifies:
 - (a) The names and addresses of the person(s) responsible for operation and maintenance;
 - (b) The person(s) financially responsible for maintenance and emergency repairs;
 - (c) An Inspection and Maintenance Schedule for all stormwater management facilities including routine and non-routine maintenance tasks to be performed. Where applicable, this schedule shall refer to the Maintenance Criteria provided in the Stormwater Handbook or the EPA National Menu of Stormwater Best Management Practices or equivalent;
 - (d) Instructions for routine and long-term operation and maintenance shall have sufficient detail for responsible parties to perform necessary maintenance activities and prevent actions that may adversely affect the performance of each structural and/or nonstructural stormwater BMP.
 - (e) A list of easements with the purpose and location of each; and
 - (f) The signature(s) of the owner(s) and all persons responsible for operation and maintenance, financing, and emergency repairs, as defined in the Maintenance Agreement, if maintenance is to be performed by an entity other than the owner.
- (4) Stormwater Management Easement(s)
 - (a) Stormwater Management easements for facilities that will be privately maintained shall be provided by the property owner(s) as necessary for:
 - i. Access for facility inspections and maintenance;
 - ii. Preservation of stormwater runoff conveyance, treatment, infiltration, and detention areas and facilities, including flood ways for the 100-year storm event; and
 - iii. Direct maintenance access by heavy equipment to structures requiring maintenance a minimum of 20 feet wide.
 - iv. For right of entry to the Foxborough Planning Board or its duly authorized representative to observe inspections and maintenance operations.
 - (b) The purpose of each easement shall be specified in the Maintenance Agreement signed by the property owner.
 - (c) Stormwater Management easements are required for all areas used for permanent stormwater control, unless a waiver is granted by the Stormwater Authority.
 - (d) Easements shall be recorded with the Norfolk Registry of Deeds with proof of recording provided to the Foxborough Planning Board prior to issuance of a Certificate of Compliance by the Stormwater Authority.
- (5) Stormwater Management easements for subdivisions with approval under the

Subdivision Control Law shall be determined through the subdivision approval process, in which the Foxborough Planning Board shall determine the metes and bounds and purposes of the easements.

- (a) During construction of the stormwater management and conveyance facilities, inspections shall be made as required under the Foxborough Subdivision Regulations.
 - (b) The easements shown on the approved subdivision plans shall be conveyed to the Town as stipulated in the Foxborough Subdivision Regulations.
 - (c) Proof of recording of the easements at the Norfolk County Registry of Deeds shall be provided to the Foxborough Planning Board.
- (6) Changes to Operation and Maintenance Plans
- (a) The owner(s) of record of the Stormwater Management system must notify the Stormwater Authority of changes in ownership, assignment of Operation and Maintenance responsibilities, or assignment of financial responsibility within 30 days of the change in ownership. The owner of record shall be responsible for Operation and Maintenance activities until a copy of the updated Operation and Maintenance Plan has been furnished to the Stormwater Authority signed by the new owner or any new responsible person.
 - (b) The maintenance schedule in the Maintenance Agreement may be amended to achieve the purposes of the Stormwater Management By-law by mutual agreement of the Stormwater Authority and the Responsible Parties. Amendments must be in writing and signed by all Responsible Parties. Responsible Parties shall include owner(s), persons with financial responsibility, and persons with operational and/or maintenance responsibility.

Section 10. Performance and Design Standards

- A. Design of stormwater management system(s) and components for New Developments:
- (1) Low Impact Development (LID) site planning and design strategies must be used to the maximum extent feasible.
 - (2) The design of treatment and infiltration practices should follow the guidance in Volume 2 of the Massachusetts Stormwater Handbook, as amended, or other federally or State approved BMP design guidance.
 - (3) Stormwater management systems on new development sites shall be designed to:
 - (a) Not allow new stormwater conveyances to discharge untreated stormwater in accordance with Massachusetts Stormwater Handbook Standard 1;
 - (b) Control peak runoff rates in accordance with Massachusetts Stormwater Handbook Standard 2;
 - (c) Recharge groundwater in accordance with Massachusetts Stormwater Handbook Standard 3;

- (d) Eliminate or reduce the discharge of pollutants from land uses with higher pollutant loads as defined in the Massachusetts Stormwater Handbook in accordance with Massachusetts Stormwater Handbook Standard 5;
- (e) Protects Zone II or Interim Wellhead Protection Areas of public water supplies in accordance with Massachusetts Stormwater Handbook Standard 6;
- (f) Implement long term maintenance practices in accordance with Massachusetts Stormwater Handbook Standard 9; and
- (g) Require that all stormwater management systems be designed to:
 - 1) Retain the volume of runoff equivalent to, or greater than, one (1.0) inch multiplied by the total post-construction impervious surface area on the site AND/OR
 - 2) Remove 90% of the average annual load of Total Suspended Solids (TSS) generated from the total post-construction impervious area on the site AND 60% of the average annual load of Total Phosphorus (TP) generated from the total post-construction impervious surface area on the site. Pollutant removal shall be calculated consistent with EPA Region 1's BMP Performance Extrapolation Tool or other BMP performance evaluation tool provided by EPA Region 1, where available. If EPA Region 1 tools do not address the planned or installed BMP performance any federally approved or State approved BMP design guidance or performance standards (e.g. State stormwater handbooks and design guidance manuals) may be used to calculate BMP performance.

B. Design of stormwater management systems and components shall include the following:

- (1) Stormwater management systems for Redevelopment shall meet the below Massachusetts DEP Stormwater Standards to the maximum extent feasible:
 - (a) Massachusetts Stormwater Standard 1 – No new stormwater conveyances to discharge untreated stormwater
 - (b) Massachusetts Stormwater Standard 2 – Control peak runoff rates
 - (c) Massachusetts Stormwater Standard 3 – Recharge groundwater
 - (d) Massachusetts Stormwater Standard 5 and 6 – Eliminate or reduce the discharge of pollutants from lands with higher pollutants loads and protection of Zone II or Interim Wellhead Protection Areas of public water supplies.
- (2) Stormwater management systems on Redevelopment sites shall also improve existing conditions by requiring that stormwater management systems be designed to:
 - (a) Retain the volume of runoff equivalent to, or greater than, 0.80 inch multiplied by the total post-construction impervious surface area on the site

AND/OR

- (b) Remove 80% of the average annual post-construction load of Total Suspended Solids (TSS) generated from the total post-construction impervious area on the site AND 50% of the average annual load of Total Phosphorus (TP) generated from the total postconstruction impervious surface area on the site. Pollutant removal shall be calculated consistent with EPA Region 1's BMP Performance Extrapolation Tool or other BMP performance evaluation tool provided by EPA Region 1 where available. If EPA Region 1 tools do not address the planned or installed BMP performance any federally or State approved BMP design guidance or performance standards (e.g. State stormwater handbooks and design guidance manuals) may be used to calculate BMP performance.
- (3) Stormwater management systems on redevelopment sites may utilize offsite mitigation within the same USGS HUC10 as the redevelopment site to meet the equivalent retention or pollutant removal requirements in Section 10.B(2)(a) & (b).
- (4) Redevelopment activities that are exclusively limited to maintenance and improvement of existing roadways, (including widening less than a single lane, adding shoulders, correcting substandard intersections, improving existing drainage systems, and repaving projects) shall improve existing conditions to the maximum extent practicable. Roadway widening or improvements that increase the amount of impervious area on the redevelopment site by greater than or equal to a single lane width shall meet the requirements of §11.A.(3)(a) – (c) fully.
- (5) Structural BMPs and LID techniques suitable to address TMDLs and/or impairments as listed on MassDEP's most recent *Integrated List of Waters Map* are to be utilized to the maximum extent feasible where adequate soil conditions, groundwater elevations, and topographic conditions allow. BMP's must be optimized for phosphorus and nitrogen removal under MS4 §2.2 and Appendix H. Provide evaluation process narrative with supporting calculations in the stormwater report.
- (6) Provisions are to be made for the adequate disposal of surface runoff so that no increase in flow rate is conducted over Town ways, or over land not owned by or controlled by the Applicant unless an easement in proper form is obtained permitting such discharge.
- (7) LID techniques are to be used to the maximum extent feasible where adequate soil, groundwater and topographic conditions allow. These may include but not be limited to reduction in impervious surfaces, disconnection of impervious surfaces, bioretention (rain gardens) and infiltration systems (see Appendix A for LID credits and incentives)
- (8) Hydrologic calculations, to document that there is no increase in the peak rate of runoff from pre development to post development condition, are to be completed utilizing TR-55 and TR-20 methodologies. The Stormwater Authority reserves the right to require a summary of pre and post stormwater runoff volumes, where in the

Stormwater Authority's opinion unique down gradient conditions warrant analysis of pre and post stormwater runoff volumes.

- (9) Watershed area for hydrologic analysis and BMP sizing calculations are to include at a minimum the site area and all upgradient areas from which stormwater runoff flows onto the site.
- (10) Length of sheet flow used for times of concentration is to be no more the 50 feet.
- (11) Utilize the 24 hour rainfall data as recognized by MassDEP's Stormwater Management Standards.
- (12) Soils tests to be conducted by a Registered Professional Engineer or Massachusetts Soil Evaluator, performed at the location of all proposed infiltration BMPs and LID techniques, to identify soil descriptions, depth to estimated seasonal high groundwater, depth to bedrock, and soil texture.
- (13) The design infiltration rate shall be determined from the on-site soil texture and published Rawls rates or saturated hydraulic conductivity tests.
- (14) Size drainage pipes to accommodate the 25 year storm event and maintain velocities between 3 and 10 feet per second using the Rational Method.
- (15) Size drainage swales to accommodate the 25 year storm event and velocities below 4 feet per second
- (16) Size culverts to accommodate the 50 year storm event and design adequate erosion protection. Design stream crossing culverts in accordance with the latest edition of the Massachusetts Stream Crossing Handbook.
- (17) Size stormwater basins to accommodate the 100 storm event with a minimum of one foot of freeboard
- (18) All drainage structures are to be able to accommodate HS-20 loading.
- (19) Catch basins structures are to be as detailed in Foxborough DPW Standard Details and spaced a maximum of 300 feet apart in roadways.
- (20) Catch basins adjacent to curbing are to be built with a granite curb inlet as shown in Foxborough DPW Standard Details.
- (21) Catch basins at low points of road and on roads with profile grades greater than 5% are to be fitted with double grates (parallel with curb) as detailed in Foxborough DPW Standard Details. The Stormwater Authority will consider high capacity specialty grates in lieu of double grate catch basins based on submission of inlet calculations.
- (22) All drain pipes are to be reinforced concrete pipe or HDPE pipe and have a minimum diameter of 12 inches
- (23) Drainage pipes are to be installed with a minimum of 2.5 feet of cover and O-rings as detailed in Foxborough DPW Standard Details.
- (24) Drainage manholes structures are to be as detailed in Foxborough DPW Standard Details and spaced at a maximum of every 300 feet.

- (25) Outfalls are to be designed to prevent erosion of soils and pipes 18 inches or larger are to be fitted with grates or bars to prevent ingress.
 - (26) Drainage easements are to provide sufficient access for maintenance and repairs of system components and be at least 20 feet wide.
 - (27) Minimize permanently dewatering soils by:
 - a. Limiting grading within 4 feet of seasonal high groundwater elevation (SHGWE);
 - b. Raising roadways to keep the bottom of roadway section above SHGWE; and
 - c. Setting bottom floor elevation of building(s) a minimum of 2 feet above SHGWE.
- C. Design of erosion controls(s) to include the following:
- (1) Minimize total area of disturbance;
 - (2) Sequence activities to minimize simultaneous areas of disturbance;
 - (3) Minimize peak rate of runoff in accordance with the MassDEP Stormwater Standards;
 - (4) Minimize soil erosion and control sedimentation during construction;
 - (5) Divert uncontaminated water around disturbed areas, where feasible and necessary;
 - (6) Maximize groundwater recharge;
 - (7) Design, install and maintain all Erosion and Sediment Control measures in accordance with the latest edition of the *Massachusetts Erosion and Sedimentation Control Guidelines for Urban and Suburban Areas*, manufacturer's specifications and good engineering practices;
 - (8) Prevent off-site transport and vehicle tracking of sediment;
 - (9) Protect and manage on and off-site material storage areas (overburden and stockpiles of dirt, borrow areas, or other areas used solely by the permitted project are considered a part of the project);
 - (10) Comply with applicable Federal, State and local laws and regulations including waste disposal, sanitary sewer or septic system regulations, and air quality requirements, including dust control;
 - (11) Prevent significant alteration of habitats mapped by the Massachusetts Natural Heritage & Endangered Species Program as Endangered, Threatened or Of Special Concern, Estimated Habitats of Rare Wildlife and Certified Vernal Pools, and Priority Habitats of Rare Species from the proposed activities;
 - (12) Institute interim and permanent stabilization measures, which shall be instituted on a disturbed area as soon as practicable but no more than fourteen (14) days after construction activity has temporarily or permanently ceased on that portion of the site, where deemed necessary;

- (13) Properly manage on-site construction and waste materials, including truck washing and cement concrete washout facilities; and
- (14) Inspect stormwater controls at consistent intervals.

Section 11. Inspection and Site Supervision

- A. **Pre-construction Meeting.** Prior to starting the clearing, excavation, construction, redevelopment or land disturbing activity, the applicant, the applicant's technical representative, the general contractor or any other person with authority to make changes to the project, may be required to meet with the Stormwater Authority, to review the approved plans and their implementation. The need for a pre-construction meeting shall be determined by the Stormwater Authority based on the project scope.
- B. **Stormwater Authority Inspection.** The Stormwater Authority or its designated agent shall make inspections as hereinafter required and shall either approve that portion of the work completed or shall notify the applicant wherein the work fails to comply with the Erosion and Sedimentation Control Plan or the Stormwater Management Plan as approved. The approved Erosion and Sedimentation Control Plan and associated plans for grading, stripping, excavating, and filling work, bearing the signature of approval of the Stormwater Authority, shall be maintained at the site during the progress of the work. In order to obtain inspections, the applicant shall notify the Stormwater Authority at least two (2) working days before each of the following events:
 - (1) Erosion and sedimentation control measures are in place and stabilized;
 - (2) Site clearing has been substantially completed;
 - (3) Rough grading has been substantially completed;
 - (4) Final grading has been substantially completed;
 - (5) Close of the construction season; and,
 - (6) Final landscaping (permanent stabilization) and project final completion.
- C. **Applicant Inspections.** The applicant or his/her agent shall conduct and document inspections of all control measures no less than weekly or as specified in the permit, and prior to and following anticipated storm events. The purpose of such inspections will be to determine the overall effectiveness of the Erosion and Sedimentation Control Plan, and the need for maintenance or additional control measures as well as verifying compliance with the Stormwater Management Plan. The applicant or his/her agent shall submit monthly reports to the Stormwater Authority or designated agent in a format approved by the Stormwater Authority.
- D. **Ongoing Inspections.** The applicant or his/her agent shall conduct and document inspections in accordance with the approved Long Term Operations and Maintenance Plan. The applicant or his/her agent shall submit annual reports to the Stormwater
- E. Authority or designated agent in a format approved by the Stormwater Authority.

Section 12. Surety

The Stormwater Authority may require the permittee to post before the start of land disturbance activity, a surety bond, irrevocable letter of credit, cash, or other acceptable security. The form of the bond shall be approved by town counsel, and be in an amount deemed sufficient by Stormwater Authority to ensure that the work will be completed in accordance with the permit. If the project is phased, the Stormwater Authority may release part of the bond as each phase is completed in compliance with the permit but the bond may not be fully released until the Stormwater Authority has received the final report as required by Section 10 and issued a certificate of completion.

Section 13. Final Reports

Upon completion of the work, the permittee shall submit a report (including certified as-built construction plan) from a Professional Engineer (P.E.), or Professional Land Surveyor (PLS) certifying that all erosion and sediment control devices, stormwater management facilities and all erosion and sediment control devices, and approved changes and modifications, have been completed in accordance with the conditions of the approved permit. Any discrepancies should be noted in the cover letter.

Section 14. Certificate of Completion

The issuing authority will issue a letter certifying completion upon receipt and approval of the final reports, recording of the O&M plan with the Norfolk County registry of deeds and/or upon otherwise determining that all work of the permit has been satisfactorily completed in conformance with these regulations.

Land Disturbance Permit Application

To Stormwater Authority:

The undersigned wishes to submit a Land Disturbance Permit Application as defined in the Zoning By-Laws of the Town of Foxborough Section 270 and requests a review and determination by the Stormwater Authority of said Land Disturbance Plan.

The Land Disturbance Plan involves property where owner’s title to the land is derived under deed from _____, dated _____, and recorded in the Norfolk County Registry of Deeds, Book _____, Page _____, or Land Court Certificate of Title No. ____, Registered in _____ District, Book _____, Page _____

Project	Description:
_____	_____
_____	_____
_____	_____

The property (building) is described as being located at _____; it is currently used as _____ and the changes proposed to be made are _____.

The project is located on the parcel shown on Assessors Map _____, Parcel _____.

Applicant’s Signature _____ Owner’s Signature(s) _____

Applicant’s Name (print) _____ Owner’s Names(s) _____

Applicant’s Address _____ Owner’s Address _____

Date Received by Town Clerk: _____

Signature _____

Please note: 1) An applicant for a Land Disturbance Plan Review must file with the Stormwater Authority a completed Land Disturbance Permit Package (see Land Disturbance Permit Application Checklist. 2) The applicant shall also file a copy of the Land Disturbance Plan and the application with the Town Clerk. The date of receipt by the Town Clerk shall be the official filing date.

Land Disturbance Permit Application Checklist

The Stormwater Authority shall make a determination as to the completeness of the application and adequacy of the materials submitted. No review shall take place until the application has been found to be complete. The Land Disturbance Permit Application package shall include:

- (1) A completed Application Form with original signatures of all owners;
 - (2) A certified list of abutters within 100 feet of the property;
 - (3) Payment of the application and review fees; and,
 - (4) One (1) copy each of the Application Form and the list of abutters filed with the Town Clerk.
- Stormwater Management Plan (3 copies) shall at a minimum include:
- (1) Name, address, and telephone number of all persons having a legal interest in the property and the tax reference number and parcel number of the property or properties affected;
 - (2) Narrative describing project
 - (3) Plan(s)
 - (4) Calculations to show compliance with regulations
 - (5) Soil mapping and test data
 - (6) Completed MassDEP Checklist for Stormwater Report
- Erosion and Sedimentation Control Plan (3 copies) shall at a minimum include:
- (1) Names, addresses, and telephone numbers of the owner, applicant, and person(s) or firm(s) preparing the plan;
 - (2) Narrative describing existing and proposed conditions, construction sequencing and phasing and methods to control erosion and sedimentation during construction.
 - (3) Plan(s)
 - (4) Calculations to show compliance with regulations
- Operation and Maintenance Plan (3 copies) shall at a minimum include:
- (1) The name(s) of the owner(s) for all components of the system;
 - (2) A map showing the location of the stormwater systems and facilities;
 - (3) Maintenance Agreement with the Stormwater Authority; and
 - (4) Stormwater Management Easement(s)

Application and Review Fee Schedule

The following fee schedules are minimum fees. The Stormwater Authority may require higher fees if deemed necessary for proper review of an application or to ensure compliance.

<u>Proposed Disturbance Requires</u>	<u>Application Fee</u>	<u>Review Fee</u>
Land Disturbance Permit	\$1,000	TBD per project*

*Review fees include engineering review, legal review, and clerical fees associated with the public hearing and permit processing. A fee estimate may be provided by the Stormwater Authority, its agent, or consulting engineer.

GENERAL

1. Any application not accompanied by the appropriate fee shall be deemed incomplete. Payment must be made to the Stormwater Authority in cash, money order, bank or certified check payable to the Town of Foxborough.
2. An Applicant’s failure to pay any additional review or inspection fee within five (5) business days of receipt of the notice that further fees are required shall be grounds for disapproval.
3. Stormwater Authority will publish the public notice and send abutter notifications. Abutter notification shall be by first class mail. The applicant shall pay all costs associated with the publication and notification requirements.

APPENDIX A: Low Impact Development (LID) Credits and Incentives

Low-Impact Development encourages minimization of impervious surfaces, protection of critical environmental resource areas, and preservation of naturally-vegetated buffers. Any reductions in impervious cover result in reduced stormwater runoff and, consequently, smaller land consumption areas and lower construction costs. In an effort to apply a more holistic approach to stormwater management, five specific non-structural practices called *LID credits*, or incentives for better environmental site design, are provided for designers that will significantly reduce the size and cost of structural practices.

Non-structural practices are increasingly recognized as a critical feature of effective stormwater management, particularly with respect to site design. In most cases, non-structural practices will need to be combined with structural practices to meet stormwater requirements. The key benefit of non-structural practices is that they can reduce the generation of stormwater from the site. In addition, they can provide partial removal of many pollutants and contribute to groundwater recharge. The five proposed non-structural LID credits are:

- Credit 1. Environmentally Sensitive Development
- Credit 2. Disconnection of Rooftop Runoff
- Credit 3. Disconnection of Non-Rooftop Runoff
- Credit 4. Stream Buffers
- Credit 5. Grass Channels

This section describes each of the credits for the five groups of non-structural practices and specifies minimum criteria to be eligible for the credit.

The application of these credits does not relieve the design engineer or reviewer from the standard of engineering practice associated with safe conveyance of stormwater runoff and good drainage design.

Several of the stormwater credits apply towards meeting the Massachusetts Stormwater Management Standard recharge requirement. The Massachusetts Stormwater Policy currently only recognizes a volume based approach to meeting this criterion. Recently however, it has been demonstrated that disconnecting impervious area to drain over pervious areas can result in significant recharge to groundwater. Therefore, some jurisdictions (most notably the States of Vermont and Maryland) have developed recharge criterion that credit recharge based on an “area method,” as opposed to strictly a volume method. To better understand this approach both the “volume method” and “area method” are described as follows.

The intent of the recharge criteria is to maintain pre-developed groundwater recharge rates at development sites to preserve existing water table elevations, thereby helping to support baseflow to streams and wetlands, as well as to help augment drinking water supplies.

The objective of the criteria is to mimic the average annual recharge rate for the prevailing hydrologic soil group(s) (HSG) present at a development site. Therefore, the recharge volume can be determined as a function of annual predevelopment recharge for a given soil group, average annual rainfall volume, and amount of impervious cover at a site. Being a function of site impervious cover, the criterion provides an incentive to engineers and developers to reduce site imperviousness.

The recharge can be satisfied by one of two methods or a combination of both. The first is

designated as the “**Percent Volume Method,**” and is based on infiltrating the recharge volume using one or more of the approved structural practices (such as infiltration trench, infiltration basins, or drywells). The second method is designated as the “**Percent Area Method,**” and is based on draining runoff from some or all of a site impervious area through one or more of the approved nonstructural practices.

Based on this approach, the **Percent Volume Method** is as follows:

$$Re_v = (F)(A)(I)/12$$

- Where: Re_v = Recharge volume (acre-feet)
- F=Recharge factor (in inches, see below)
- A =Site area (in acres)
- I =Site imperviousness (expressed as a decimal)

Hydrologic Soil Group	Recharge Factor (F)
A	0.60
B	0.35
C	0.25
D	0.10

An example calculation of this method is provided below.

Example: A 50-acre site is to be developed as a residential subdivision near Burlington, MA. The impervious area for the development will be 20 acres (i.e., 40% imperviousness). Half of the impervious area overlays HSG “B” soils and half of the impervious area overlays HSG “C” soils. The recharge requirement would be calculated as follows:

$$\text{Compute a weighted } F = [(0.35 \text{ in})(10 \text{ ac}) + (0.25 \text{ in})(10 \text{ ac})]/20 \text{ ac} = 0.30 \text{ inches}$$

$$Re_v = (0.30 \text{ in}) (50 \text{ ac}) (0.4)/(12 \text{ in/ft}) = 0.50 \text{ ac-ft}$$

The “percent area” method is an option to the volume method to allow nonstructural practices to meet the volume-based re-charge criteria.

Under the **Percent Area Approach**, the recharge requirement can be met by draining a calculated recharge area through one or more of several nonstructural approaches (this is where stormwater credits are most applicable). The calculation is as follows:

$$Re_a = (F)(A)(I)$$

- Where: Re_a = Recharge
- F = Recharge factor based on Hydrologic Soil Group (HSG) (same values as above, but dimensionless)
- A =Site area in acres
- I =Site imperviousness (expressed as a decimal)

The required recharge area (Re_a) is equivalent to the recharge volume and can be achieved by a non-structural practice (e.g., filtration of sheet flow from disconnected impervious surfaces). In addition, a combination of both of the methods can be used to meet the recharge requirement at a site.

If an applicant elects to utilize both the Percent Volume and Percent Area Methods to meet the recharge requirement, the following applies:

1. Calculate both the Re_v and Re_a for the site;
2. The site impervious area draining to an approved nonstructural practice is subtracted from the Re_a calculation from step 1, above;
3. The remaining Re_a is divided by the original Re_a to calculate a pro-rated percentage that needs to be met by the Percent Volume Method;
4. The pro-rated percent is multiplied by the original Re_v to calculate a new Re_v that must be met by an approved structural practice(s).

With this basic understanding of how the recharge requirement can be met on a project, it is now appropriate to review the suite of stormwater credits that can meet both recharge, water quality and, in a few cases, some of the quantity controls as well.

Credit No. 1: Environmentally Sensitive Development Credit

This credit is given when a group of environmental site design techniques are applied to lower density or rural residential development. The credit eliminates the need for structural practices to treat both the Re and water quality and can reduce required volumes for peak control of the 2-year, 10-year and 100-year storms.

Minimum Criteria for Credit

The re_v and water quality requirements are completely met without the use of structural practices in certain low density (less than 1 dwelling unit per acre) residential developments when the following conditions are met:

- The total impervious cover footprint is less than 15 % of lot area;
- A minimum of 25% of the site is protected in natural conservation areas;
- Rooftop runoff is disconnected in accordance with the criteria outlined under Credit 2;
- Grass channels are used to convey runoff versus curb and gutter for roads and/or driveways (with no specific constraints on water quality volume, velocity or minimum retention time); and
- Stream buffers are incorporated into the site design on both perennial and intermittent streams (where applicable).
- The designer must still address applicable stormwater detention for all roadway and connected impervious surfaces (i.e, 2-year, 10-year, and 100-year control).

Environmentally Sensitive Rural Development Credit Example Application

Base Data

Site Data: a single-family lot that is part of an 8-acre low density subdivision in a critical area

Lot Area = 2.5 ac

Conservation Area = 0.65 ac

Impervious Area = .35 ac = 14%

Site Soils Types: 100% "B"

F = 0.35

Original water quality volume = $1.0'' (.35) (43,560/12) = 1,270.5 \text{ ft}^3$

Original $Re_v = (2.5) (0.14) (.35) (43,560/12) = 445 \text{ ft}^3$

Environmentally Sensitive Rural Credit (see Figure 1)

Required recharge is considered met by site design.

Required water quality volume is considered met by site design.

2-year, 10-year & 100-year control: No change in CN, t_c may be longer which would reduce storage requirements.

Percent Reductions Using Environmentally Sensitive Rural Credit:

- $Re_v = 100\%$
- Water quality requirement = 100%

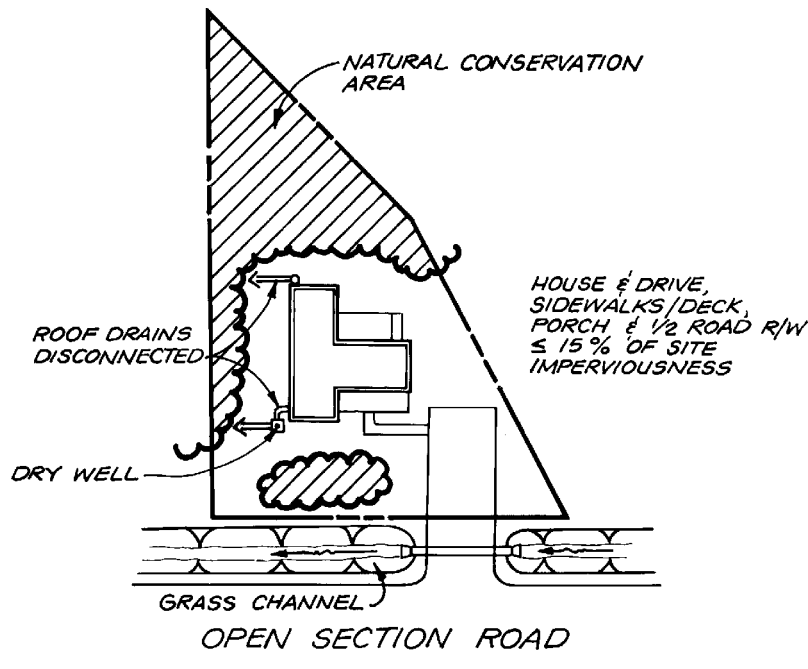


Figure 1. Schematic of Environmentally Sensitive Rural Development Credit

Credit No. 2: Disconnection of Rooftop Runoff Credit

A credit is given when rooftop runoff is “disconnected” and then directed over to a pervious area where it can either infiltrate into the soil or flow over it with sufficient time and velocity to allow for filtering. The credit is typically obtained by grading the site to promote overland flow through vegetated channels or by providing bioretention¹ areas either on-lot or in common areas.

If a rooftop is adequately disconnected, the disconnected impervious area can be deducted from total impervious cover, therefore reducing water quality volume requirements. In addition,

¹ Bioretention systems (also referred to as “rain gardens” or “biofilters”) are so-called low impact development stormwater management systems that manage and treat stormwater runoff using a conditioned planting soil bed and planting materials to filter runoff stored within a shallow depression. The method combines physical filtering and adsorption with bio-geochemical processes to remove pollutants. The system consists of an inflow component, a pretreatment element, an overflow structure, a shallow ponding area (less than 9” deep), a surface organic layer of mulch, a planting soil bed, plant materials, and an underdrain system to convey treated runoff to a downstream facility.

disconnected rooftops can be used to meet the recharge requirement as a non-structural practice under the **Percent Area Method**.

Restrictions on the Credit

The rooftop disconnection credit is subject to the following restrictions:

- Disconnection must be designed to adequately address the issue of basement seepage;
- The rooftop contributing area to any one discharge location cannot exceed 1,000 ft²;
- The length of the "disconnection" (in feet) shall be equal to or greater than the contributing rooftop area (in ft²) divided by 13.3 (e.g. for 1000 ft² roof/13.3 = 75 ft)
- Disconnections will only be credited for residential lot sizes greater than 6,000 sq. ft;
- The entire vegetative "disconnection" shall be on a slope less than or equal to 5.0%;
- Where provided, downspouts must be at least 10 feet away from the nearest impervious surface to discourage re-connection to the drainage network;
- Where a gutter/downspout system is not used, the rooftop runoff must drain as either sheetflow from the structure or drain to a subsurface drain field that is not directly connected to the drainage network;
- Disconnections are encouraged on relatively permeable soils (HSGs A and B); therefore, no soil evaluation is required;
- In less permeable soils (HSGs C and D), the water table depth and permeability shall be evaluated by a responsible professional engineer to determine if a spreading device is needed to provide sheetflow over grass surfaces. In some cases, dry wells (see Figure 2), french drains or other temporary underground storage devices may be needed to compensate for a poor infiltration capability;
- For those rooftops draining directly to a stream buffer, one can only use either the rooftop disconnection credit or the stream buffer credit (Credit 3), not both; and
- To take credit for rooftop disconnection for a designated hotspot land use, the rooftop runoff must not co-mingle with runoff from any paved surfaces.

An example of this credit is provided below.

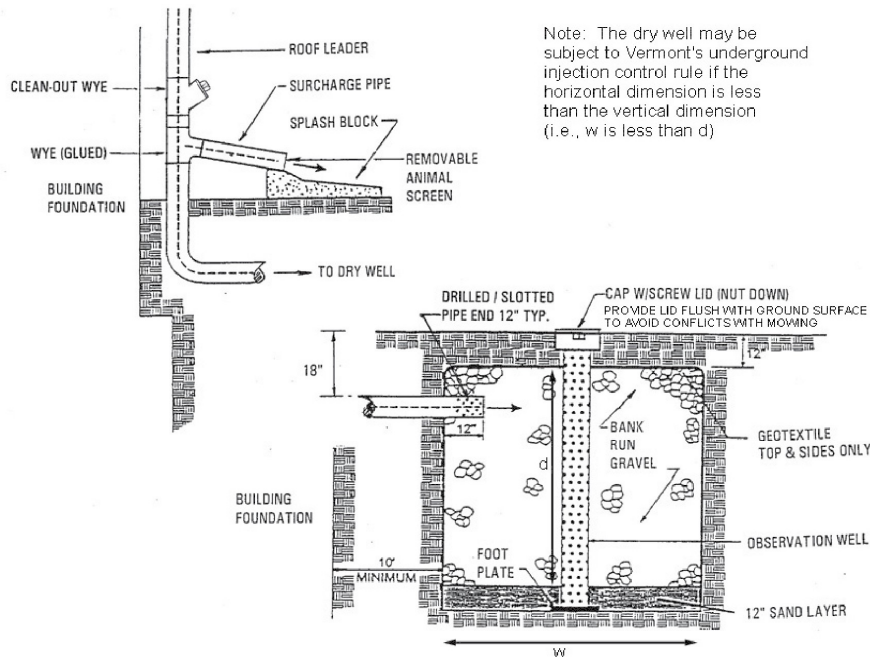


Figure 2. Schematic of Dry Well (Source: adapted after Howard County, MD)

Rooftop Disconnection Credit Example Application

Given the following base data:

Site Data: 108 Single-Family Residential Lots (~ 1/2-acre lots)

Site Area = 45.1 ac

Original Impervious Area = 12.0 ac;

Site Soils Types: 78% “C”, 22% “D”

Composite Recharge Factor, $F = .78 (0.25) + .22 (0.1) = 0.217$

Original $Re_v = [(0.217)(45.1 \text{ ac})(12\text{ac}/45.1 \text{ ac})] / 12 = 0.22$ acre feet; $Re_a = (0.217)(45.1)(12/45.1) = 2.60$ ac

Original water quality requirement = 1.0”/impervious acre = 1.0”(12.0 ac)/12 = 1.0 acre-foot (site is located in a critical area)

Rooftop Credit (see Figure 3)

42 houses disconnected Average house area = 2,500 ft²

Net impervious area reduction = $(42)(2,500 \text{ ft}^2) / (43,560 \text{ ft}^2/\text{ac}) = 2.41$ acres

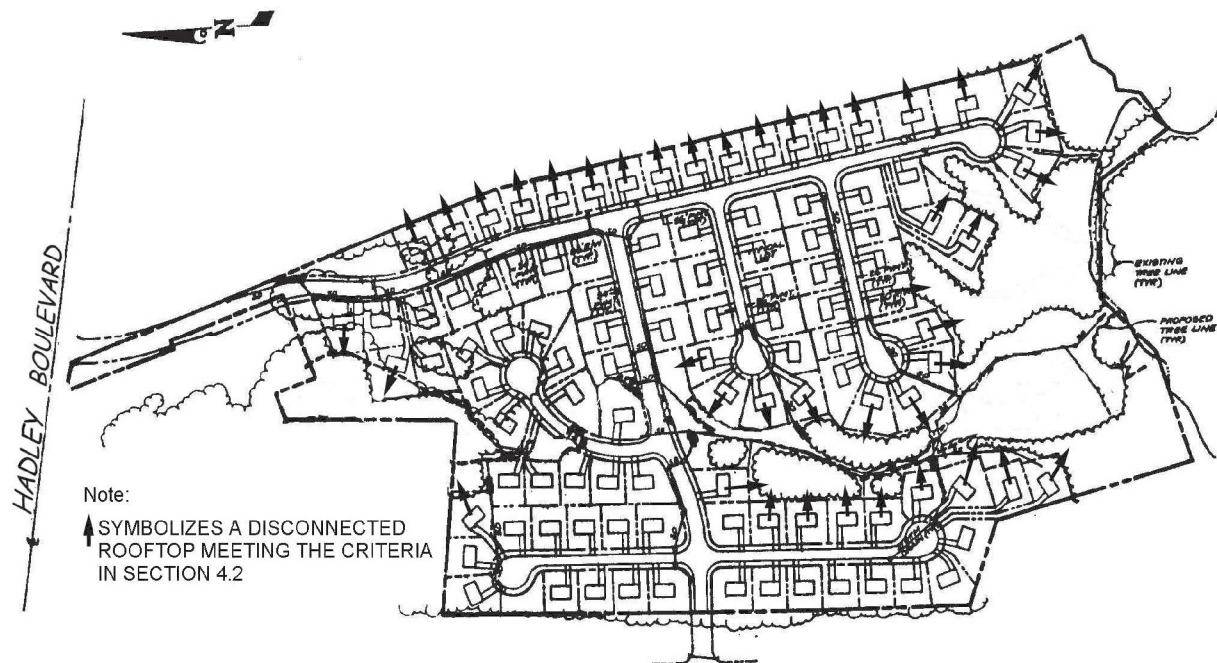
New impervious area = 12.0 – 2.41 = 9.59 acres;

Required recharge area (Re_a) is 2.60 acres and 2.41 acres were disconnected therefore 0.19 ac of impervious cover need to be met by an approved structural practice. New $Re_v = (0.19/2.60)(0.22 \text{ ac-ft}) = 0.016 \text{ ac-ft}$

New water quality volume = 1.0” (9.59)/12 = 0.80 acre-feet; or a 0.20 acre-foot reduction

Percent Reductions Using Rooftop Disconnection Credit:

- $Re_v = (0.22-0.016)/0.22 = 92.7\%$
- Water quality = $(1.0 - 0.8) / 1.0 = 20.0\%$



Credit No 3: Disconnection of Non-Rooftop Runoff Credit

Credit is given for practices that disconnect surface impervious cover runoff by directing it to pervious areas where it is either infiltrated into the soil or filtered (by overland flow). This credit can be obtained by grading the site to promote overland vegetative filtering.

These “disconnected” areas can be subtracted from the site impervious area when computing the water quality treatment volume. In addition, disconnected surface impervious cover can be used to meet the recharge requirement as a non-structural practice under the **Percent Area Method**.

Restrictions on the Credit

The credit is subject to the following restrictions:

- The maximum contributing impervious flow path length shall be 75 feet;
- Runoff cannot come from a designated hotspot land use;
- The length of the "disconnection" must be equal to or greater than the contributing length;
- The entire vegetative "disconnection" shall be on a slope less than or equal to 5.0%;
- The surface impervious area to any one discharge location cannot exceed 1,000 ft²;
- Disconnections are encouraged on relatively permeable soils (HSGs A and B); therefore, no soil evaluation is required;
- In less permeable soils (HSGs C and D), the water table depth and permeability shall be evaluated by a professional engineer to determine if a spreading device such as a french drain, gravel trench or other temporary storage device is needed to compensate for poor infiltration capability; and
- For those areas draining directly to a wetlands or stream buffer, only the non-rooftop disconnection credit or the stream buffer credit can be used, not both.

Credit No. 4: Stream Buffer Credit

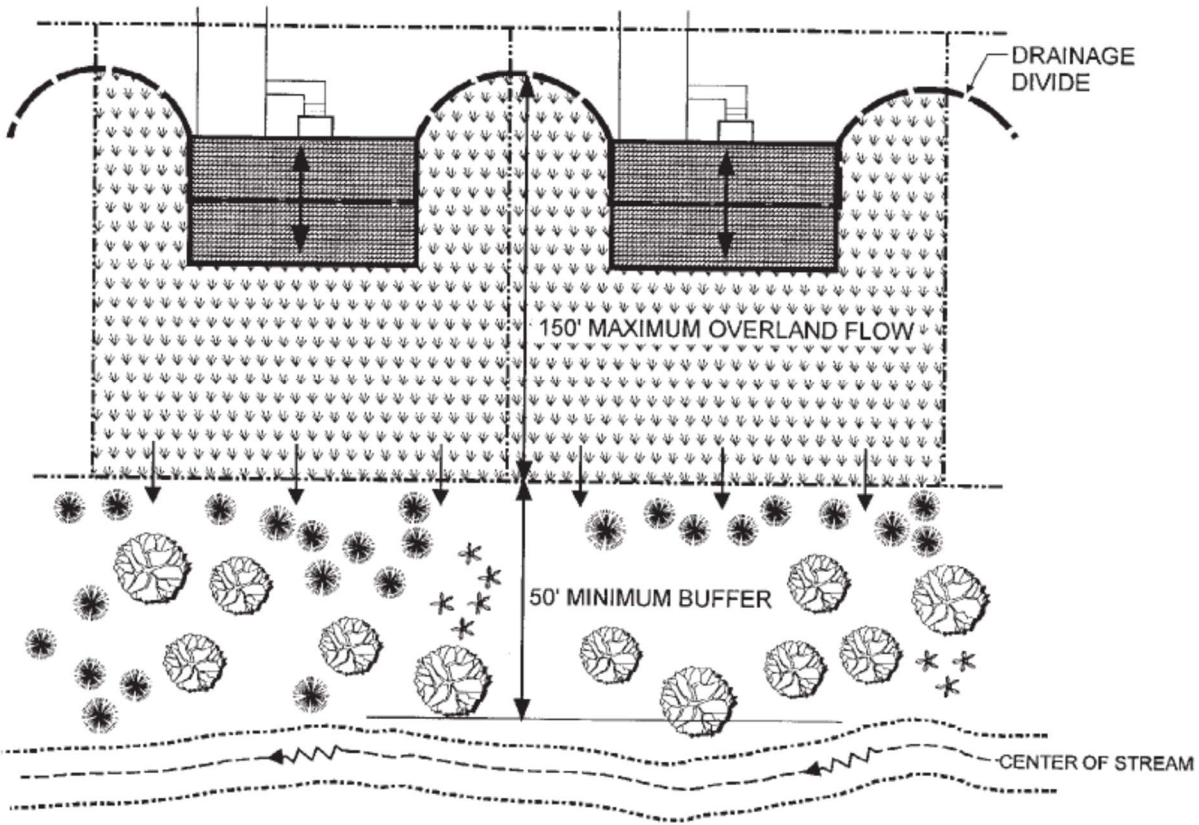
This credit is given when stormwater runoff is effectively treated by a stream buffer. Effective treatment constitutes capturing runoff from pervious and impervious areas adjacent to a stream buffer and treating runoff through the overland flow in a natural vegetative or forested buffer. The use of a filter strip is also recommended to treat overland flow in the green space of a development site (see Figure 4). The credits include:

- The impervious area draining by sheet flow to a stream buffer is subtracted from the site's initial impervious area in the water quality calculation.
- The impervious area draining to stream buffer contributes to the recharge requirement, (Rev), under the **Percent Area Method**.

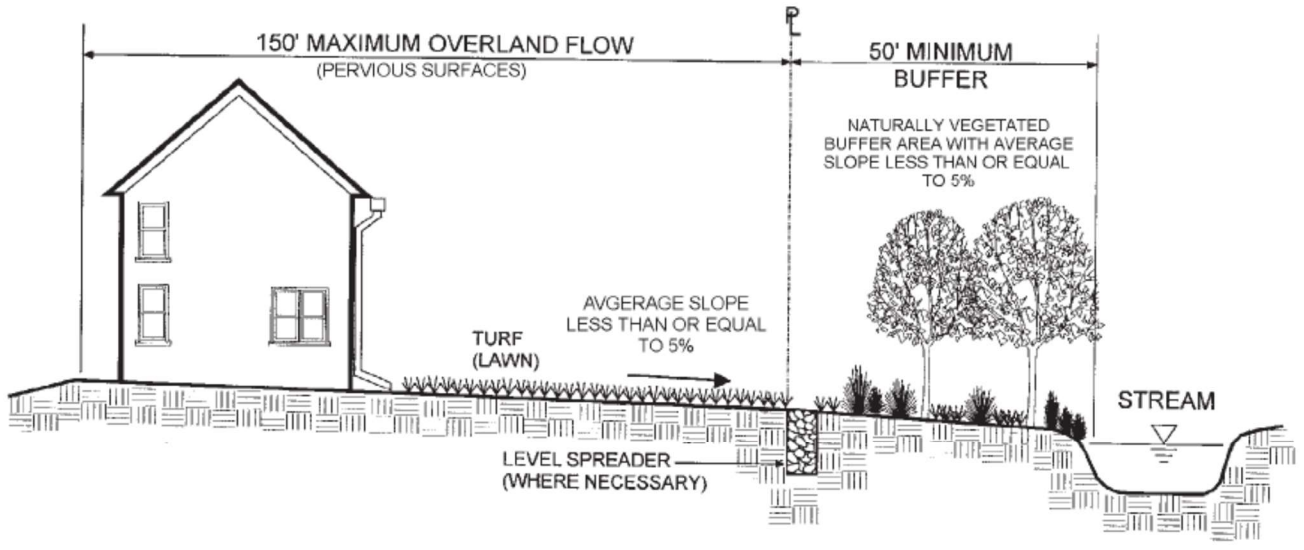
Restrictions on the Credit

The credit is subject to the following conditions:

- The minimum stream buffer width (i.e., perpendicular to the stream flow path) shall be 50 feet as measured from the bank elevation of a stream or the boundary of a wetland;
- The maximum contributing path shall be 150 feet for pervious surfaces and 75 feet for impervious surfaces;
- The average contributing overland slope to and across the stream buffer shall be less than or equal to 5.0%;
- Runoff shall enter the stream buffer as sheet flow. A level spreading device shall be utilized where local site conditions prevent sheet flow from being maintained;
- The credit is not applicable if rooftop or non-rooftop disconnection is already provided (i.e., no double counting); and
- Stream buffers shall remain ungraded and uncompacted, and the over-story and under-story vegetation shall be maintained in a natural condition.



PLAN VIEW



SECTION

Figure 4. Example of Stream Buffer Credit Option

Credit No. 5: Grass Channel Credit

Credit may be given when open grass channels are used to reduce the volume of runoff and pollutants during smaller storms (i.e., 1.0 inches and less).

Use of a grass channel will automatically meet the minimum recharge Re_v requirement (under the **Percent Area Method**) regardless of the geometry or slope. If designed according to the following design criteria, the grass channel will meet the water quality treatment requirements for certain kinds of residential development.

Note: Runoff curve numbers (CNs) for 2-year, 10-year, and 100-year control will not change.

Grass Channel Design Criteria

The credit is obtained if a grass channel meets the following criteria.

- Land use is moderate to low density residential (maximum density of 4 dwelling unit/ac);
- The bottom width shall be 2 foot minimum and 6 foot maximum (if a larger channel is needed, a compound cross section may be used);
- The side slopes shall be 3Horizontal:1Vertical or flatter;
- The channel slope shall be less than or equal to 4.0%; and
- The length of the grass channel shall be equal to the roadway or parking lot length.

Grass Channel Credit Example ApplicationBase Data

Site Data: 108 Single Family Residential Lots (~ 1/2 acre lots)

Site Area = 45.1 ac

Original Impervious Area = 12.0 ac; or $I = 12.0/45.1 = 26.6\%$

Site Soils Types: 78% "C", 22% "D"

Composite $F = 0.78(0.25) + 0.22(0.10) = 0.217$

Original $Re_v = 0.22$ ac-ft; $Re_a = 2.60$ acres

Original $WQ_v = 1.0$ acre-feet

Grass Channel Credit (see Figure 5)

Entire site is open section road, but only 11.2 acres meet the water quality requirement design criteria for the grass channel credit (i.e., 3:1 sideslopes, 2 foot bottom width and slope less than or equal to 4%).

Required recharge (Re_a) is 2.60 acres and the full site is drained by grass channels, thereby meeting 100% of the recharge requirement.

New water quality Area = $(45.1 - 11.2) = 33.9$ acres, assume new impervious cover = $0.266(33.9 \text{ ac}) = 9.0$ acres. New $WQ_v = 1.0(9.0 \text{ acres})/12 \text{ inches/foot} = 0.75$ acre-feet; or a 0.25 acre-foot reduction

Percent Reductions Using Grass Channel Credit:

- $Re_v = 100\%$
- $WQ_v = (1.0 \text{ acre-feet} - 0.75) / 1.0 \text{ acre-feet} = 25.0\%$

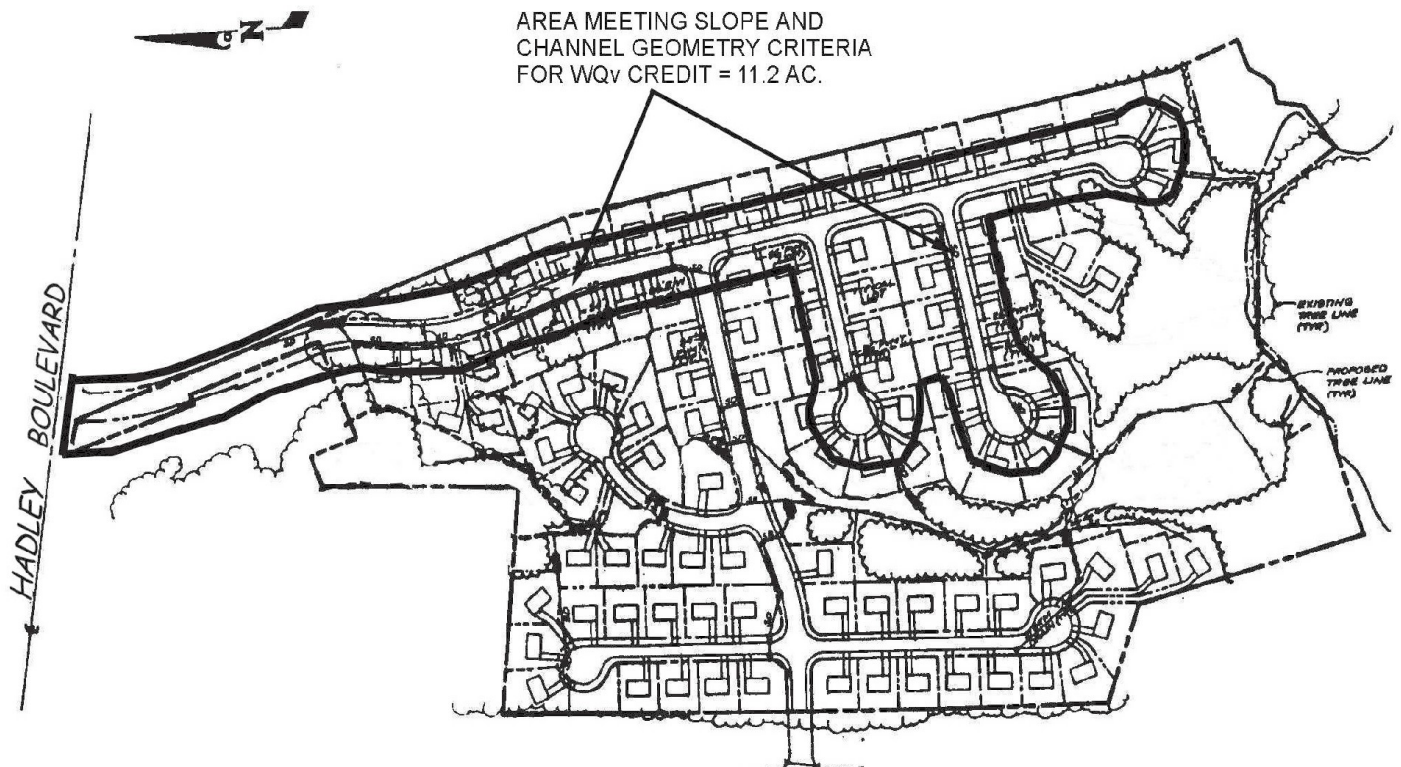


FIGURE 3. SCHEMATIC OF GRASS CHANNEL CIRCUIT

Dealing with Multiple Credits

Site designers are encouraged to utilize as many credits as they can on a site. Greater reductions in stormwater storage volumes can be achieved when many credits are combined together (e.g., disconnecting rooftops and utilizing grass channel for drainage design). However, credits cannot be claimed twice for an identical area of the site (e.g., claiming credit for stream buffers and disconnecting rooftops over the same site area, draining to the same location).

Other Strategies to Reduce Impervious Cover

Site planning practices that reduce the creation of impervious area in new residential and commercial developments and therefore reduce the water quality requirements for the site should be encouraged whenever feasible². Examples of progressive site design practices that minimize the creation of impervious cover include:

- Narrower residential road sections;
- Shorter road lengths;
- Smaller turnarounds and cul-de-sac radii;

² The reader is referred to the following two references for a more detailed presentation of better site design and low impact development: 1) Center for Watershed Protection. 1998. *Better Site Design A Handbook for Changing Development Rules in Your Community*. Ellicott City, MD; and 2) Prince George's County MD Dept. of Environmental Resources. 1999. *Low Impact Development Design Strategies: An Integrated Design Approach*. Largo, MD.

- Permeable spill-over parking areas (these areas should be valued as 50% impervious, unless designed specifically for infiltration);
- Smaller parking demand ratios;
- Smaller parking stalls for a percentage of lots;
- Angled one way parking;
- Cluster subdivisions;
- Smaller front yard setbacks;
- Shared parking and driveways; and
- More creatively designed pedestrian networks.

Where these techniques are employed, it may be possible to reduce stormwater storage volumes. For example, since the water quality treatment volume is directly based on impervious cover, a reduction in impervious cover reduces required storage. For 2-year, 10-year, and 100-year management, the designer can compute curve numbers (CNs) based on the actual measured impervious area at a site using the following equation (adopted from TR-55, 1986):

$$(98) I + (CN) P = CN$$

where: I = percent impervious area at the site
P = percent pervious area at the site
CN = curve number for the appropriate pervious cover

Figures 6 and 7 show an example of a retail site designed as a conventional development, and as a site planned using improved site design practices and techniques, respectively. Some of the noteworthy features of the innovative site plan include: preservation of some forested areas, establishment of a stream buffer, reduced parking ratios, compact and pervious overflow parking spaces, and use of vegetated stormwater practices such as filter strips and bioretention areas.

Though not all land use types and developments are amenable to every approach described here, there are more opportunities for flexibility and creativity in site design than many realize. Redevelopment sites also can utilize several of these practices and techniques in the redesign of an area.

The following example (using Figures 6 and 7) quantifies the water quality and recharge requirement reductions that can be realized by implementing several of these practices and design techniques.

Base Data (see Figure 6)

Site Area = 9.3 ac

Original Impervious Area = 6.5 ac; or $I = 6.5/9.3 = 69.9\%$

Site Soils Types: 50% "B", 50% "C," split evenly over the impervious area

Composite $F = [0.35 (6.5/2) + 0.25 (6.5/2)]/6.5 = 0.30$

Original $Re_v = 0.30 (6.5)/12 = 0.16$ acre-feet

Original Water Quality Requirement = $1.0''(6.5 \text{ ac})/12 = 0.54$ acre-feet

Site Planning Strategies (see Figure 7)

The revised site incorporates the following features:

- 1.8 acres preserved in a conservation easement.

- 0.46 acres of parking lot drain to a buffer with an overland flow path less than 75 feet (Credit No. 3: stream buffer credit).
- 0.28 acres of parking lot/loading area drain to a filter strip with an overland flow path less than 75 feet (Credit No. 2: disconnection of non-rooftop runoff credit).
- The total site impervious area was reduced from 6.3 acres to 5.8 acres by the site design revision; the new site I = $5.8/9.3 = 62.4\%$.

The new storage requirements for Re_v :

- New composite F = $[0.35 (5.8 \text{ ac}/2) + 0.25(5.8 \text{ ac}/2)]/5.8 = 0.30$
- New Re_v (Percent Volume Method) = $0.30 (5.8 \text{ ac})/12 = 0.15$ acre-feet
- New Re_a (Percent Area Method) = FAI = $0.30 (9.3 \text{ ac})(.624) = 1.74$ acres
- Using the Percent Area Method and noting that 0.46 acres drain to the buffer and 0.28 acres drain to a filter strip, then $Re_a = 1.74 \text{ ac} - (0.46 \text{ ac} + 0.28 \text{ ac}) = 1.0$ acres
- Therefore, the remaining $Re_v = (1.0 \text{ ac}/1.74 \text{ ac}) (0.15 \text{ ac-ft}) = 0.086$ acre-feet

0.086 acre-feet must be managed by an approved “structural” practice.

The new storage requirement for water quality control is:

- New Impervious Area (to take credit for non-rooftop disconnection and buffer credits) = $5.8 \text{ ac} - (0.28 \text{ ac} + 0.46 \text{ ac}) = 5.06$ acres;
- New water quality requirement = $1.0''(5.06 \text{ ac})/12 = 0.42$ acre-feet; or a 0.12 acre-foot reduction

Percent Reductions Using Site Planning Strategies:

- $Re_v = (0.16 - 0.086) / 0.16 = 46.3\%$
- $WQ_v = (0.54 - 0.42) / 0.54 = 22.0\%$

Also, with a 0.5-acre net reduction in site imperviousness, the CN for computing the 2-year, 10-year and 100-year control will be lower, thereby reducing the storage requirements for these storms by a modest amount.

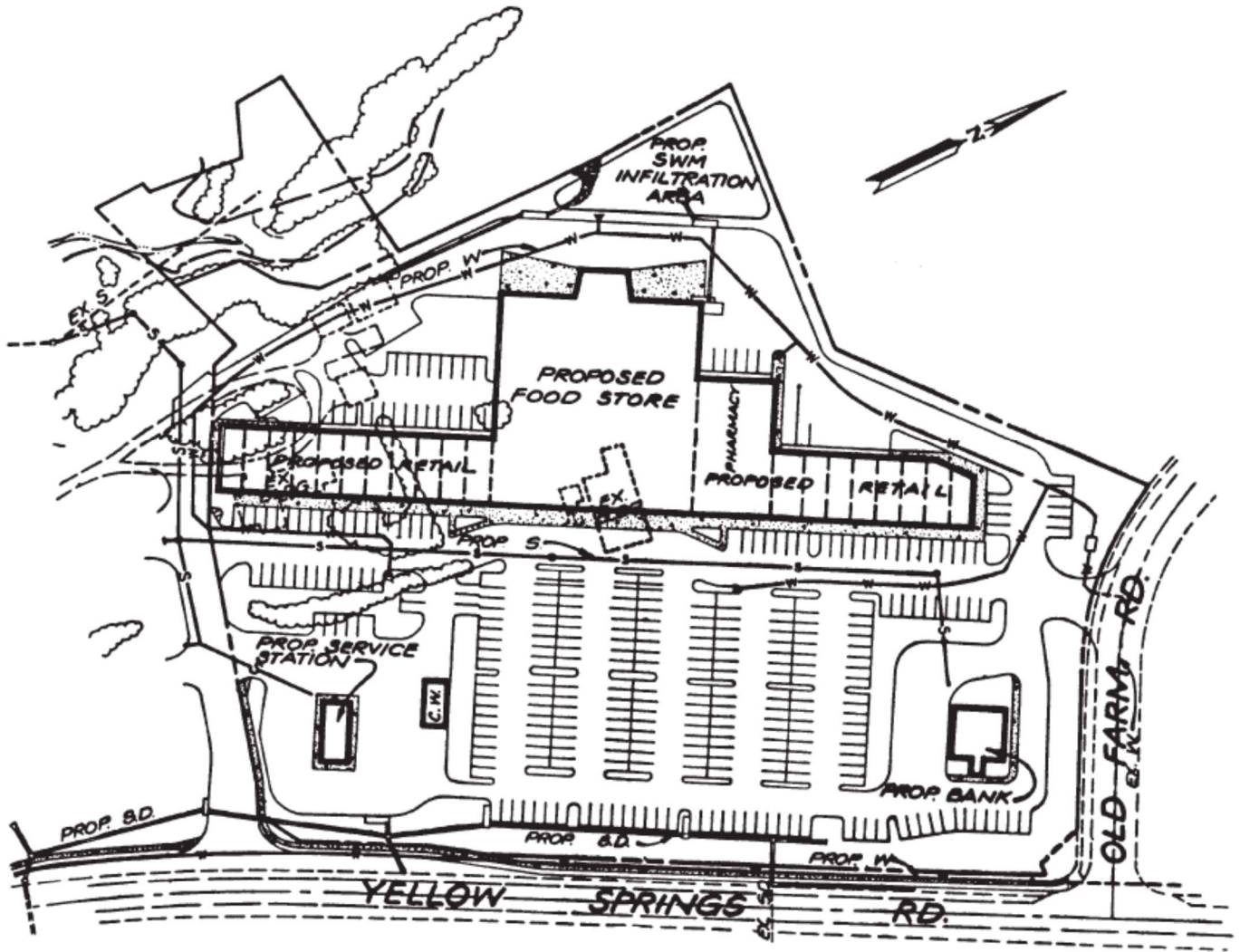


Figure 6. Example of Conventional Retail Site Design

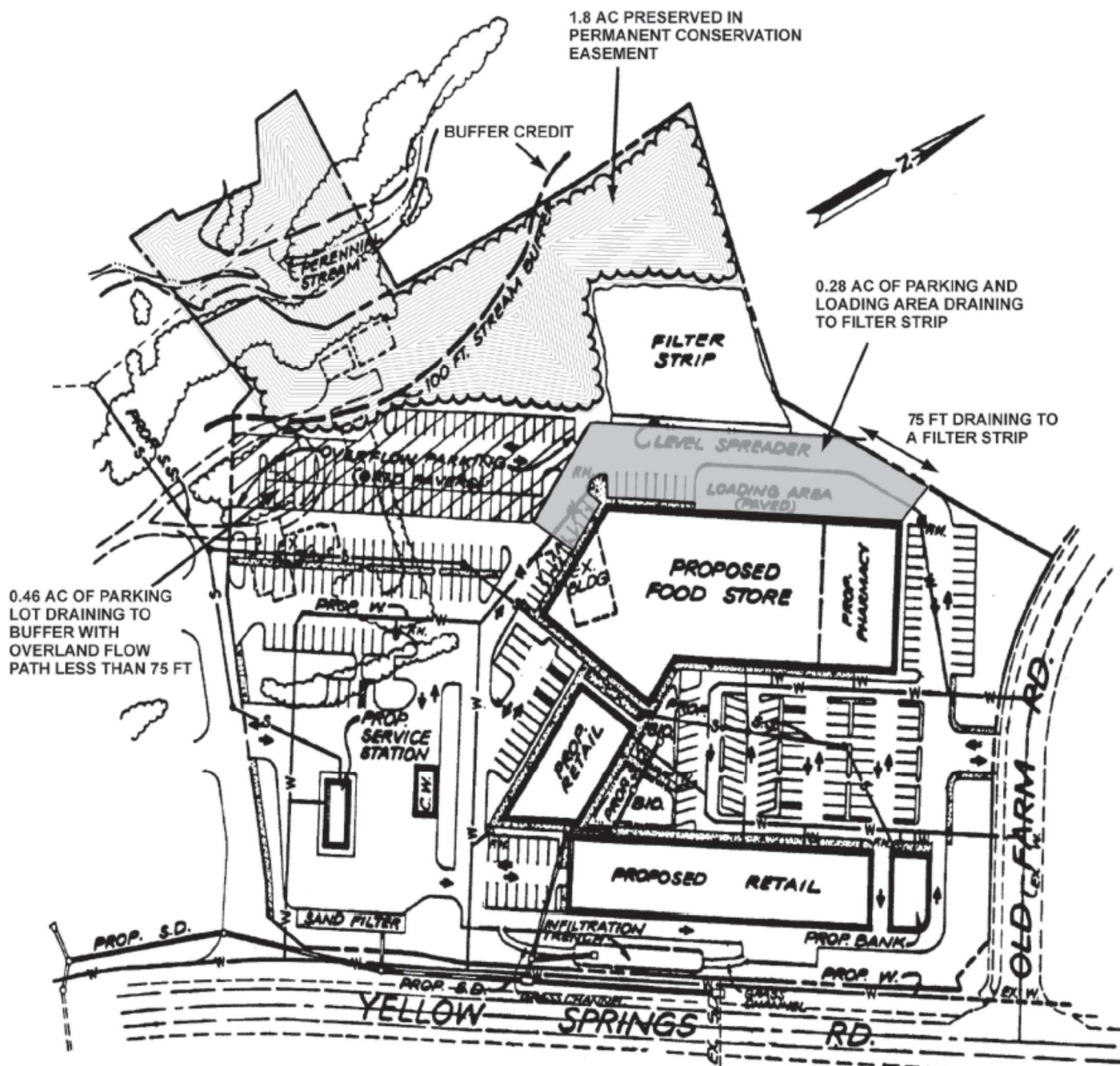


Figure 7. Example of Improved Retail Site Design