APPENDIX B – UNDERDRAINS

Where underdrains are specified, the following information provides guidance for underdrain requirements.

Underdrain Material Types
Underdrain pipe shall be 6-inch diameter ABS pipe or PVC pipe. ABS pipe shall meet the requirements of ASTM Designation D-2751, SDR 23.5, and PVC pipe shall meet the requirements of ASTM Designation D-2665. Perforations shall be as described in ASTM Designation C-700. It should be noted that placing the pipe such that the perforations are oriented upward may help to maximize infiltration in unlined BMP's with underdrains. If the BMP is constructed with an impermeable liner, the perforations should be angled downward to maximize the volume of water that will be drained from the BMP.

Underdrain Connections
Pipe joints and storm drain structure connections must be adequately sealed to avoid piping conditions (water seeping through pipe or structure joints). Pipe sections shall be coupled using suitable connection rings and flanges. Field connections to storm drain structures and pipes shall be sealed with polymer grout material that is capable of adhering to surfaces. Underdrain pipe shall be capped (at structure) until completion of site construction. Underdrains connected directly to a storm drainage structure shall be non-perforated for an appropriate distance from the structure interface to avoid possible piping problems.

Underdrain Slope
Underdrains must "daylight" or connect to an existing drainage system to achieve positive flow. All underdrains must be placed with a minimum slope of 0.5% (s = 0.005 ft/ft).

Underdrains Layout and Spacing
Typically, there are two main layouts for underdrains. One is a non-perforated central collector pipe with perforated lateral feeder pipes, the other is simply a series of longitudinal perforated pipes. Both layouts connect to a non-perforated outlet pipe before "daylighting" or connecting to an existing drainage system. The minimum spacing is shown below.

BMP Type	Underdrains Center to Center Spacing
Sand Filter Basin	20'
Extended Detention Basins (Bottom stage 500 sq ft. or greater)	20'
Extended Detention Basins (Bottom stage < 500 sq ft.)	10'
Bioretention Facility	5'

Underdrain Gravel

Gravel bed materials should be used to protect an underdrain pipe and to reduce clogging potential. Placement of gravel over the underdrain must be done with care. Avoid dropping the gravel from excessive heights from a backhoe or front-end loader bucket. Spill directly over underdrain and spread manually.

Recommended construction specifications for gravel used to protect underdrains are as follows:

- AASHTO #57 stone preferred
- Geotextile fabrics should be avoided because tearing and/or plugging can dramatically affect performance. If the designer is concerned about the engineered soil media migrating into the underdrain, a 3-inch thick layer of "pea gravel" may be added to create a “choker” course.

Maintenance

Access for cleaning underdrains is required for each system. Clean-outs, with diameters equal to the underdrain, should extend 6 inches above the media and have a lockable screw cap for easy access. Cleanouts should be located for every 50 feet of lateral, at the collector drain line connection, and at any bends.

Underdrain Orifice Plate

When designing a BMP to meet Hydraulic Conditions of Concern (HCOC) criteria in addition to water quality criteria, it is sometimes necessary to install an orifice plate near the downstream end of the underdrain system. The orifice plate restricts the opening of the underdrain to mitigate flows to a specific lower flow threshold. Proper maintenance access should be provided to the orifice plate location to facilitate maintenance activities, specifically the removal of accumulated sediment and debris upstream of the orifice plate.