

Highland Township Subdivision and Land Development Ordinance No. 2009 - 3
Article VI – Stormwater Management

6. Erodibility of soils.
 7. Land availability and configuration of the topography.
 8. Peak discharge and required volume control.
 9. Stream bank erosion.
 10. Efficiency of the BMPs to mitigate potential water quality problems.
 11. The volume of runoff that will be effectively treated.
 12. The nature of the pollutant being removed.
 13. Maintenance requirements.
 14. Creation/protection of aquatic and wildlife habitat.
 15. Recreational value.
- S. The stormwater management criteria are to be met on-site to the maximum extent possible to comply with the requirements of this chapter. In specific cases where the Applicant has demonstrated, to the satisfaction of the Township Engineer, that the requirements of chapter cannot be achieved on-site with the use of non-structural and structural stormwater BMPs, the Applicant may, with Township approval, meet the stormwater management criteria through off-site stormwater management measures as long as the proposed measures are in the same subwatershed (it is strongly recommended that the off-site area be located upstream of the proposed developed site). It will be the Applicant's responsibility to locate adequate off-site locations and obtain all easements, agreements and permits to construct such facilities on property(s) other than which is proposed to be developed and currently owned by the Applicant. All easements, agreements and permit must be obtained and provided along with the stormwater plan submission to the Township for review and approval prior to the start of any construction activities. Furthermore, these agreements and plans will be recorded at the Office of the Recorder of Deeds for Chester County and two (2) copies of those dated/signed plans shall be provided to the Township.

Section 606 Permit Requirements by Other Governmental Entities

The following permit requirements, where applicable, must be satisfied prior to the commencement of regulated earth disturbance activities:

- A. All regulated earth disturbance activities subject to PADEP permit requirements under regulations at 25 Pennsylvania Code Chapter 102.

Highland Township Subdivision and Land Development Ordinance No. 2009 - 3
Article VI – Stormwater Management

- B. Work within natural drainageways as permitted by PADEP under 25 Pennsylvania Code Chapter 105.
- C. Any stormwater management facility located in or adjacent to the surface waters of the Commonwealth, including wetlands, as permitted by PADEP under 25 Pennsylvania Code Chapter 105.
- D. Any stormwater management facility located on a state highway right-of-way or that requires access from a state highway.
- E. Culverts, bridges, storm sewers, or any other facilities which must convey flows from a tributary area and any facility which is a dam requiring a PADEP permit under 25 Pennsylvania Code Chapter 105.
- F. Any stormwater management facility that alters the flow patterns, flow velocity or volume to negatively affect the drainage patterns of a downstream municipality shall require approval from that municipality.
- G. Any regulated earth disturbance shall comply with the applicable Environmental Protection Agency (EPA) and PADEP Total Maximum Daily Loads (TMDLs) regulations for the Christina River Basin, Brandywine Creek.

Section 607 Nonstructural Project Design / Sequencing to Minimize Stormwater Impacts

- A. The design of all regulated activities shall include the following to minimize stormwater impacts.
 - 1. The Applicant shall find practicable alternatives to the surface discharge of stormwater (such as those listed in Appendix C, Table C-4 hereof), the creation of impervious surfaces, or the degradation of waters of the Commonwealth and maintain the natural hydrologic regime of the site in so far as reasonably possible.
 - 2. An alternative is practicable if it is capable of implementation, taking into consideration existing technology and logistics in light of overall project purposes and otherwise applicable municipal requirements.
 - 3. Practicable alternatives to the discharge of stormwater are presumed to have less adverse impact on quantity and quality of waters of the Commonwealth unless demonstrated to the contrary.
- B. The Applicant shall demonstrate that the regulated activities were designed in the following sequence the goal of which is to minimize increases in stormwater runoff and impacts to water quality resulting from the proposed regulated activity:

Highland Township Subdivision and Land Development Ordinance No. 2009 - 3
Article VI – Stormwater Management

1. Prepare an ERSAP showing environmentally sensitive areas, including, but not limited to, steep slopes, ponds, lakes, streams, wetlands, hydric soils, vernal pools, stream buffers, and hydrologic soil groups. Land development, any existing recharge areas and other requirements as outlined in Section 400 herein shall also be included.
2. Establish a stream buffer in accordance with the applicable Township requirements.
3. Prepare a draft project layout avoiding sensitive areas identified in Section 607.B.1. hereof.
4. Identify site-specific existing conditions, drainage areas, discharge points, recharge areas, and hydrologic soil groups A and B (areas conducive to infiltration).
5. Evaluate nonstructural stormwater management alternatives:
 - a. Minimize earth disturbance.
 - b. Minimize impervious surfaces.
 - c. Break up large impervious surfaces.
 - d. Minimize clearing operations (vegetation removal).
 - e. Protect existing trees.
6. Satisfy the groundwater recharge (infiltration) objective (Section 608 hereof) and provide for stormwater pretreatment prior to infiltration.
7. Provide for water quality protection in accordance with Section 609's water quality requirements.
8. Provide stream bank erosion protection in accordance with Section 610's stream bank erosion requirements.
9. Prepare final project design to maintain existing conditions, drainage areas and discharge points, to minimize earth disturbance and impervious surfaces and, to the maximum extent possible, to ensure that the remaining site development has no surface or point discharge.
10. Conduct a proposed conditions runoff analysis based on the final design compliant with the Peak Rate Control requirements (Section 611 hereof).

11. Manage any remaining runoff prior to discharge through detention, bioretention, direct discharge, or other structural control.

Section 608 Groundwater Recharge

The groundwater recharge capacity of the area being developed shall be maximized. Design of the infiltration facilities shall compensate for the reduction in groundwater recharge that occurs when the ground surface is disturbed or impervious surface is created. Roof runoff shall be directed to infiltration BMPs designed to compensate for the runoff from parking areas. These measures shall be consistent with Section 602 hereof and take advantage of any existing recharge areas.

Infiltration may not be feasible on every site due to site-specific limitations such as soil type. If it cannot be physically accomplished, then the design professional shall be responsible to show that this cannot be physically accomplished (e.g., shallow depth to bedrock or limiting zone, etc.) within the specified time period, to the satisfaction of the Township. In situations where it has been adequately demonstrated that the recharge requirement cannot be fully accomplished, the Applicant shall examine other alternative BMPs, such as green roofs, capture and reuse systems, wet ponds, and low-impact design measures, and employ them to the maximum extent possible to achieve the maximum reduction in volume and water quality protection identified in this article.

A. Infiltration BMPs shall meet the following minimum requirements:

1. Infiltration BMPs intended to receive runoff from developed areas shall be based on the suitability of soils and site conditions and shall be constructed on soils that have the following characteristics:
 - a. A minimum depth of twenty-four (24) inches between the bottom of the BMP and the top of the limiting zone.
 - b. An infiltration rate sufficient to accept the additional stormwater load and dewater completely as determined by field tests conducted by the Applicant's design professional.
 - c. The infiltration facility shall be capable of completely draining the retention (infiltration) volume (Re_v) within three (3) days (72 hours) from the end of the design storm.
 - d. Pretreatment shall be provided prior to infiltration (except for residential roof runoff).
2. The size of the infiltration facility and Re_v shall be based upon the following volume criteria:

Highland Township Subdivision and Land Development Ordinance No. 2009 - 3
Article VI – Stormwater Management

- a. Control Guideline One (CG-1) in PADEP BMP Manual – The retention (infiltration) volume (Re_v) to be captured and infiltrated shall be the net 2-year 24-hour volume. The net volume is the difference between the post-development runoff volume and the predevelopment runoff volume. The post-development total runoff volume for all storms equal to or less than the 2-yr. 24-hr. duration precipitation shall not be increased over the predevelopment total runoff volume. For modeling purposes existing (predevelopment) non-forested pervious areas must be considered meadow in good condition or its equivalent, and twenty (20) percent of existing impervious area, when present, shall be considered meadow in good condition, in the model for existing conditions.
- b. Infiltrating the entire Re_v volume in Section 608.A.2.a. (above) may not be feasible on every site due to site-specific limitations such as shallow depth to bedrock. If it cannot be physically accomplished, then the following criteria from Control Guideline Two (CG-2) in PADEP BMP Manual must be satisfied:

At least the first one inch (1.0”) of runoff from new impervious surfaces shall be permanently removed from the runoff flow -- i.e., it shall not be released into the surface waters of this Commonwealth. Removal options include reuse, evaporation, transpiration, and infiltration.

$$Re_v = 1 \text{ (inch)} * \text{ impervious area (square feet)} \div 12 \text{ (inches)} = \text{cubic feet (cf)}$$

An asterisk (*) in equations denotes multiplication.

- c. If infiltrating the entire Re_v volume in Section 608.A.2.b. (above) is not feasible, then the following minimum criteria from Control Guideline Two (CG-2) in PADEP BMP Manual must be satisfied:

Wherever possible, infiltration facilities should be designed to accommodate infiltration of the entire permanently removed runoff; however, in all cases at least the first one-half inch (0.5”) of the permanently removed runoff should be infiltrated. The minimum infiltration volume (Re_v) required would, therefore, be computed as:

$$Re_v = I * \text{ impervious area (square feet)} \div 12 \text{ (inches)} = \text{cubic feet (cf)}$$

An asterisk (*) in equations denotes multiplication.

Where:

I = The maximum equivalent infiltration amount (inches) that the site can physically accept or 0.50 inch, whichever is greater.

Highland Township Subdivision and Land Development Ordinance No. 2009 - 3
Article VI – Stormwater Management

The retention volume values derived from the methods in Section 608.A.2.a., 608.A.2.b., and/or 608.A.2.c. is the minimum volume the Applicant must control through an infiltration BMP facility. If site conditions preclude capture of runoff from portions of the impervious area, the infiltration volume for the remaining area should be increased an equivalent amount to offset the loss. If the minimum of 0.50 inch of infiltration requirement cannot be achieved, a waiver from the requirements of this Section is required from the Township.

- B. Soils. A detailed soils evaluation of the project site shall be required to determine the suitability of infiltration facilities. The evaluation shall be performed by a qualified design professional and at a minimum address soil permeability, depth to bedrock, and subgrade stability. The general process for designing the infiltration BMP shall be to:
1. Analyze hydrologic soil groups as well as natural and man-made features within the site to determine general areas of suitability for infiltration practices. Where development on fill material is under consideration, geotechnical investigations of sub-grade stability shall be made. Infiltration may not be ruled out without conducting these subgrade suitability tests.
 2. Provide field tests, such as double ring infiltrometer or hydraulic conductivity tests (at the level of the proposed infiltration surface), to determine the appropriate hydraulic conductivity rate. Percolation tests for design purposes shall not be submitted.
 3. Design the infiltration structure for the required retention (Rev) volume based on field determined capacity at the level of the proposed infiltration surface.
 4. If on-lot infiltration structures are proposed, it must be demonstrated that the soils are conducive to infiltrate on the lots identified.
- C. Stormwater “Hotspots.” If a site is designated as a hotspot, untreated stormwater runoff therefrom shall not be allowed to recharge into groundwater. Therefore, the Rev requirement shall NOT be applied to development sites in the hotspot category (the entire Wa_{vy} must still be treated). A greater level of stormwater treatment shall be required at hotspot sites to prevent pollutant wash off after construction. Examples of hotspots include: vehicle salvage yards and recycling facilities, vehicle fueling stations, vehicle and boat service and maintenance facilities, vehicle and equipment cleaning facilities, fleet storage areas (bus, truck, etc.), industrial sites based on Standard Industrial Codes, outdoor liquid container storage, outdoor loading/unloading facilities, public works storage areas, facilities that generate or store hazardous materials, commercial container nursery, and other land uses and activities as designated by an appropriate review authority.

The following land uses and activities are not normally considered hotspots: residential roads and rural highways, residential development, institutional development, office

Highland Township Subdivision and Land Development Ordinance No. 2009 - 3
Article VI – Stormwater Management

- developments, nonindustrial rooftops, pervious areas, except golf courses and nurseries (which may need an integrated pest management (IPM) plan).
- D. Extreme caution shall be exercised where infiltration is proposed in SWPAs (Source Water Protection Areas) as defined by Highland Township, an adjoining municipality or water authority.
 - E. Infiltration facilities shall be used in conjunction with other innovative or traditional BMPs, stormwater control facilities, and nonstructural stormwater management alternatives.
 - F. Extreme caution shall be exercised where salt or chloride (municipal salt storage) is the pollutant since soils do little to filter this pollutant. A qualified design professional shall evaluate the possibility of groundwater contamination from the proposed infiltration facility and do a hydrogeologic justification study if necessary.
 - G. The infiltration requirement in HQ or EV waters is subject to PADEP's Chapter 93 Anti-degradation Regulations.
 - H. An impermeable liner shall be required in detention basins where the possibility of groundwater contamination exists. In such cases, a detailed hydrogeologic investigation may be required.
 - I. The Applicant shall provide safeguards against groundwater contamination for land uses that may cause groundwater contamination should there be a mishap or spill.
 - J. All infiltration practices shall be set back at least fifteen (15) feet from all structures with sub-grade elements (e.g., basements, foundation walls).
 - K. Where roof drains discharge to infiltration practices, they shall have appropriate measures to prevent clogging by unwanted debris (for example, silt, leaves and vegetation). Such measures shall include but are not limited to leaf traps, gutter guards and cleanouts.
 - L. All infiltration practices shall have appropriate positive overflow controls to prevent storage within one (1) foot of the finished surface or grade, unless a specific amount of surface storage away from pedestrian and vehicular traffic is provided and such areas infiltrate the stored volume within forty-eight (48) hours.
 - M. During site construction, all infiltration practice components shall be protected from compaction due to heavy equipment operation or storage of fill or construction material. Infiltration areas shall also be protected from sedimentation. Areas that are accidentally compacted or graded shall be promptly remediated to restore soil composition and porosity. Adequate documentation to this effect shall be submitted for review by the Township Engineer. No areas designated for infiltration shall receive runoff until the contributory drainage area has achieved final stabilization.

- N. The following procedures and materials shall be required during the construction of all subsurface facilities:
1. Excavation for the infiltration facility shall be performed with equipment that will not compact the bottom of the seepage bed/trench or like facility.
 2. The bottom of the bed and/or trench shall be scarified prior to the placement of aggregate.
 3. Only clean aggregate with documented porosity, free of fines, shall be allowed.
 4. The tops and sides of all seepage beds, trenches, or like facilities shall be covered with drainage fabric. This fabric shall meet the specifications of PennDOT Publication 408, Section 735, Construction Class 1. A separation material must be placed at the bottom of all facilities. The material shall be a pervious drainage fabric, geogrid or sand material.
 5. Perforated distribution pipes connected to centralized catch basins and/or manholes with the provision for the collection of debris shall be provided in all facilities unless the municipal engineer agrees that site soils provide superior infiltration (A soils or highly porous B soils). Where perforated pipes are used to distribute stormwater to the infiltration practice, stormwater shall be distributed throughout the entire seepage bed/trench or like facility.
- O. All infiltration practices that serve more than one (1) lot and are considered a common facility shall be in a drainage easement. The easement shall afford the Township the right of access.

Section 609 Water Quality Requirements

The Applicant shall comply with the following water quality requirements:

- A. No regulated earth disturbance activities shall commence until both approval by the Township of a plan compliant with this Article and the post-construction state water quality requirements (NPDES Construction Permit) has been obtained.
- B. The BMPs shall be designed, implemented, and maintained in compliance with state water quality requirements and any other more stringent requirements as determined by the Township.
- C. To control post-construction stormwater impacts from regulated earth disturbance activities, water quality requirements can be met by BMPs, including site design, which provide for replication of pre-construction stormwater infiltration and runoff conditions so that post-construction stormwater discharges do not degrade the physical, chemical, or biological characteristics of the receiving waters. As described in the DEP

Highland Township Subdivision and Land Development Ordinance No. 2009 - 3
Article VI – Stormwater Management

Comprehensive Stormwater Management Policy (#392-0300-002, September 28, 2002), this may be achieved by the following:

1. Infiltration: replication of pre-construction stormwater infiltration conditions;
 2. Treatment: use of water quality treatment BMPs to ensure the filtering out of the chemical and physical pollutants from the stormwater runoff; and
 3. Stream bank and stream bed protection: management of volume and rate of post-construction stormwater discharges to prevent physical degradation of receiving waters (e.g., from scouring).
- D. Developed areas shall provide adequate storage and treatment facilities necessary to capture and treat stormwater runoff. The recharge volume computed under Section 608 may be a component of the water quality volume if the Applicant chooses to manage both components in a single facility. If the calculated Water Quality Volume (WQv) is greater than the volume required to be infiltrated as described in Section 608.A.2., then the difference between the two volumes shall be treated for water quality by acceptable stormwater management practice(s). The required water quality volume (WQv) is the storage capacity needed to capture and treat a portion of stormwater runoff from the developed areas of the site. To achieve this goal, the following criteria are established:
1. From Control Guideline (CG-1) in the PADEP BMP Manual, the Water Quality Volume (WQv) shall be the net 2-year 24-hour volume. The net volume is the difference between the postdevelopment runoff volume and the predevelopment runoff volume. For modeling purposes, existing (predevelopment) non-forested pervious areas must be considered meadow in good condition, or its equivalent, and twenty (20) percent of existing impervious area, when present, shall be considered meadow in good conditions.
 2. This volume requirement can be managed by the permanent volume of a wet basin or other appropriate water quality BMPs. Where appropriate, wet basins shall be utilized for water quality control and shall follow the guidelines of the PA Stormwater BMP manual.
- E. For areas within defined special protection subwatersheds that include EV and HQ waters, the temperature and quality of water and streams shall be maintained through the use of temperature sensitive BMPs and stormwater conveyance systems.
- F. To accomplish the above, the Applicant shall submit original and innovative designs to the Township Engineer for approval. These designs may achieve the required water quality objectives through a combination of different BMPs.
- G. If a perennial or intermittent stream passes through, or a waterbody (i.e., lake, pond, wetland) is present on the site, the Applicant shall create a riparian buffer extending a minimum of twenty-five (25) feet to either side of the top-of-bank of the channel, lake, or

wetland. The buffer area shall be planted and maintained with appropriate native vegetation (Refer to Appendix B, Pennsylvania Native Plant List, contained in the Pennsylvania Stormwater Best Management Practices Manual (Document Number 363-0300-002), December 30, 2006.) If the applicable rear or side yard setback is less than twenty-five (25) feet or a stream traverses the site, the buffer width may be reduced up to twenty-five (25) percent of the setback and/or to a minimum of ten (10) feet. If an existing buffer is legally prescribed (i.e., deed, covenant, easement, etc.) and it exceeds the requirements of this Ordinance, the existing buffer shall be maintained.

Section 610 Stream Bank Erosion Requirements

- A. In addition to the control of water quality volume (in order to minimize the impact of stormwater runoff on downstream stream bank erosion), this ordinance’s primary requirement is to ensure the use of a BMP to detain the proposed 2-year, 24-hour design storm to the existing conditions 1-year flow using the SCS Type II distribution. Additionally, provisions shall be made (such as adding a small orifice at the bottom of the outlet structure) so that the proposed conditions 1-year storm takes a minimum of twenty-four (24) hours to drain from the facility from a point where the maximum volume of water from the 1-year storm is captured (i.e., the maximum water surface elevation is achieved in the facility). Release of water can begin at the start of the storm (i.e., the invert of the water quality orifice is at the invert of the facility).
- B. The minimum orifice size in the outlet structure to the BMP shall be three (3) inches in diameter, where possible, and a trash rack shall be installed to prevent clogging. On sites with small drainage areas contributing to this BMP that do not provide enough runoff volume to allow a 24-hour attenuation with the 3-inch orifice, calculations shall be submitted showing this condition. Orifice sizes less than three (3) inches can be utilized, provided that the design will prevent clogging of the intake.

Section 611 Stormwater Peak Rate Control

- A. Development sites shall control proposed conditions runoff rates to existing conditions runoff rates for the design storms in accordance with the following:

Proposed Condition Design Storm	Reduce to	Existing Conditions Design Storm
2 - year		1 - year
5 - year		2 - year
10 - year		2 - year
25 - year		25 - year

Highland Township Subdivision and Land Development Ordinance No. 2009 - 3
Article VI – Stormwater Management

50 – Year		50 – year
100 - year		100 – year

- B. Calculated peak discharges shall apply regardless of whether the grading plan changes the drainage area by subarea. An exception to the above may be granted if discharges from multiple subareas recombine in proximity to the site. In this case, peak discharge in any direction may be a 100 percent release rate provided that the overall site discharge meets the weighted average release rate.
- C. Off-Site Areas. Off-site areas that drain through a proposed development site are not subject to release rate criteria when determining allowable peak runoff rates.
- D. However, on-site drainage facilities shall be designed to convey safely off-site flows through the development site.
- E. Site Areas. Where the site area to be impacted by a proposed development activity differs significantly from the total site area, only the proposed impact area utilizing stormwater management measures shall be subject to the applicable control standards.
- F. Hardship Option. The standards and criteria outlined in Section 611.A. hereof are designed to maintain existing peak flows and volumes. There may be certain instances, however, where the standards and criteria established are too restrictive. The existing drainage network in some areas may be capable of safely transporting slight increases in flows without causing a problem or increasing flows elsewhere. If an Applicant cannot satisfy the stormwater standards due to lot conditions or if conformance would work a hardship, the Applicant could plead his/her case to the Board with the final determination to be made by the Township. Landowners pleading the "hardship option" assume all liabilities that may arise due to exercising this option. Cost or financial burden is not a hardship. The Applicant may use off-site management controls or contribute to the Municipal Stormwater Control and BMP Operation and Maintenance Fund (Section 616.H.) as long as the stormwater management controls are within the same subwatershed.
- G. Alternate Criteria for Redevelopment Sites. For redevelopment sites, one of the following minimum design parameters shall be used, whichever shall be most appropriate for the given site conditions as determined by Highland Township:
 - 1. The full requirements specified in Table C and Sections 611.A. through 611.D. hereof, or
 - 2. Reduce the total impervious surface on the site by at least twenty percent (20 percent), based upon a comparison of existing impervious surface to proposed impervious surface.

Section 612 Calculation Methodology

- A. Stormwater runoff from development sites with drainage areas of greater than twenty (20) acres shall be calculated using a generally accepted calculation technique based on the NRCS Soil Cover Complex Method. The Township may allow the use of the Standard Rational Method to estimate peak discharges from drainage areas that contain less than twenty (20) acres. The Soil Cover Complex Method shall be used for the determination of the groundwater recharge volume per Section 608 and for water quality volume per Section 609. The averaging or weighting of a composite curve number (CN) or runoff coefficient is prohibited in determining the groundwater recharge volume.

- B. All calculations consistent with this Ordinance using the Soil Cover Complex Method shall use the appropriate design rainfall depths for the various return period storms according to the region in which they are located as per NOAA Atlas 14. If a hydrologic computer model such as PSRM or HEC-1 / HEC-HMS is used for stormwater runoff calculations, then the duration of rainfall shall be twenty-four (24) hours.

- C. The following criteria shall be used for runoff calculations:
 - 1. For development sites not considered redevelopment, the ground cover used in determining the existing conditions flow rates shall be as follows:
 - a. Wooded sites shall use a ground cover of “woods in good condition.” Portions of a site having more than one viable tree of a DBH of six (6) inches or greater per fifteen hundred (1,500) square feet shall be considered wooded where such trees existed within three (3) years of application.
 - b. The undeveloped portion of the site, including agriculture, bare earth, and fallow ground, shall be considered as “meadow in good condition,” unless the natural ground cover generates a lower curve (CN) number or Rational “c” value (i.e., woods) as listed in the Appendix C to this Ordinance.
 - 2. For development and redevelopment sites, the ground cover used in determining the existing conditions flow rates for the developed portion of the site shall be based upon actual land cover conditions.

- D. All calculations using the Rational Method shall use rainfall intensities consistent with appropriate times-of-concentration (duration) and return periods obtained from NOAA Atlas 14 or the latest version of PennDOT's PTD-IDF curves. Times-of-concentration for overland flow shall be calculated using the methodology presented in Chapter 3 of *Urban Hydrology for Small Watersheds*, NRCS, TR-55 (as amended or replaced from time to time by NRCS). Times-of-concentration for channel and pipe flow shall be computed using Manning’s equation.

Highland Township Subdivision and Land Development Ordinance No. 2009 - 3
Article VI – Stormwater Management

- E. Runoff curve numbers (CN) for both existing and proposed conditions used in the Soil Cover Complex Method shall be obtained from Table C-1 in Appendix C to this Ordinance.
- F. Runoff coefficients (c) for both existing and proposed conditions for use in the Standard Rational Method shall be obtained from Table C-2 in Appendix C of this Ordinance. For the Standard Rational Method, Ascending and Receding Limb Factors shall be a minimum of three (3) times the time of concentration.
- G. Where uniform flow is anticipated, the Manning equation shall be used for hydraulic computations and to determine the capacity of open channels, pipes, and storm sewers. Values for Manning's roughness coefficient (n) shall be consistent with Table C-3 in Appendix C to this Ordinance.
- H. Outlet structures for stormwater management facilities shall be designed to satisfy the performance standards of this Ordinance using any generally accepted hydraulic analysis technique or method.
- I. The design of any stormwater detention facilities intended to satisfy the performance standards of this Ordinance shall be verified by routing the design storm hydrograph through these facilities using the Storage-Indication Method. The design storm hydrograph shall be computed using a calculation method that produces a full hydrograph. The Township may approve the use of any generally accepted full hydrograph approximation technique that uses a total runoff volume that is consistent with the volume from a method that produces a full hydrograph.

Section 613 Other Requirements

- A. Any stormwater facility located on state highway rights-of-way shall be subject to approval by PennDOT.
- B. All wet basin designs shall incorporate West Nile Virus biologic controls.
- C. Any stormwater management facility (i.e., detention basin) required or regulated by this Ordinance designed to store runoff and requiring a berm or earthen embankment shall have an emergency spillway large enough to handle flows up to and including the 100-year proposed conditions. The height of embankment must provide a minimum one (1) foot of freeboard above the maximum pool elevation as computed when the facility functions for the 100-year proposed conditions inflow. Should any stormwater management facility require a dam safety permit under PADEP Chapter 105, the facility shall be designed in accordance with and meet the regulations of Chapter 105 concerning dam safety.
- D. Any facilities that constitute water obstructions (e.g., culverts, bridges, outfalls, or stream enclosures) and any work involving wetlands governed by PADEP Chapter 105

Highland Township Subdivision and Land Development Ordinance No. 2009 - 3
Article VI – Stormwater Management

regulations (as amended or replaced from time to time) shall be designed and permitted in accordance with Chapter 105.

- E. Any other drainage conveyance facility not subject to PADEP Chapter 105 regulations must be able to convey, without damage to the drainage structure or roadway, runoff from the 25-year design storm with a minimum one (1.0) foot of freeboard measured below the lowest point along the top of the roadway.
- F. Conveyance facilities to or exiting from stormwater management facilities (i.e., detention basins) shall be designed to convey the design flow to or from that structure. Roadway crossings located within designated floodplain areas must be able to convey runoff from a 100-year design storm.
- G. The design of all stormwater management facilities shall incorporate sound engineering principles and practices. The Township reserves the right to disapprove any design that would result in construction in or continuation of a stormwater problem area.
- H. Outlet Structures. Outlet structures shall possess the following specifications:
 - 1. To minimize clogging and to facilitate cleaning and inspecting, outlet pipes for all basins with a drainage area of one (1) acre or more shall have an internal diameter of at least eighteen (18) inches and a minimum grade of one percent (1 percent).
 - 2. Anti-seep collars shall be provided on all outlet pipes within a constructed berm.
 - 3. All principal outlet structures shall be built using reinforced concrete with watertight construction joints.
 - 4. Outlet pipes shall be constructed of reinforced concrete with rubber gaskets in conformance with AASHTO M170, M198 and M207.
 - 5. Basin outlet structures shall have childproof non-clogging trash racks over all design openings exceeding twelve (12) inches in diameter except those openings designed to carry perennial stream flows. Periodic cleaning of debris from trash racks shall be required in the operation and maintenance plan.
 - 6. Anti-vortex devices, consisting of a thin vertical plate normal to the basin berm, shall be provided at the top of all circular risers or stand pipes.
 - 7. Outlet structures for all basins shall be designed to permit the facility to be completely drained, if needed, for maintenance.
- I. Discharge Points. For all drainage areas of one (1) acre or more, the discharge (or outfall) as well as the emergency spillway, dam breast areas, or water storage area shall be located at least twenty-five (25) feet from the original property line of the parcel being developed. The minimum distance between a proposed discharge point (including the