ARTICLE V
Inspections

§ 160-30 Inspections.

A. The municipality shall inspect all phases of the installation of the best management practices (BMPs) and/or stormwater management (SWM) facilities as deemed appropriate by the municipality.

B. During any stage of the work, if the municipality determines that the BMPs and/or stormwater management facilities are not being installed in accordance with the approved SWM Site Plan, the municipality shall revoke any existing permits or other approvals and issue a cease-and-desist order until a revised SWM Site Plan is submitted and approved, as specified in this Ordinance and until the deficiencies are corrected.

C. An inspection of all BMPs and/or stormwater management facilities may be conducted by the municipality to confirm compliance with the approved SWM Site Plan prior to the issuance of any Occupancy Permit.

§ 160-31 As-Built Plans, Completion Certificate, and Final Inspection.

A. The Applicant and/or developer shall be responsible for providing as-built plans of all SWM BMPs included in the approved SWM Site Plan. The as-built plans and an explanation of any discrepancies with the construction plans shall be submitted to the municipality.

B. The as-built submission shall include a certification of completion signed by a qualified professional verifying that all permanent SWM BMPs have been constructed according to the approved plans and specifications. If any licensed qualified professionals contributed to the construction plans, they must sign and seal the completion certificate.

C. The Applicant and/or developer shall be responsible for providing the latitude and longitude coordinates for all permanent SWM BMPs, at the central location of each BMP.

D. After receipt of the completion certification by the Municipality, the Municipality may conduct a final inspection.

ARTICLE VI
Fees and Expenses

§ 160-32 Municipal stormwater management (SWM) Site Plan review and inspection fee.

Fees shall be established by the municipality to cover plan review and construction inspection costs incurred by the municipality. All fees shall be paid by the Applicant at the time of SWM Site Plan submission. A review and inspection fee schedule shall be established by resolution of the municipal governing body based on the size of the regulated activity and based on the municipality's costs for reviewing SWM Site Plans, conducting inspections pursuant to §160-30, and reviewing as-built plans pursuant to §160-31. The municipality shall periodically update the review and inspection fee schedule to ensure that review costs are adequately reimbursed.

§ 160-33 Expenses covered by fees.

The fees required by this Ordinance (unless otherwise waived by the municipality) shall, at a minimum, cover:

A. Administrative costs and clerical processing.

B. Attendance at meetings.

C. The review of the SWM Site Plan by the municipality.

D. The review of Operations and Maintenance responsibilities and agreements, including financial guarantees.

E. The review of as-built plans.

F. The inspection of SWM facilities and drainage improvements during construction.

G. The final inspection at the completion of the construction of the SWM facilities and drainage improvements presented in the SWM Site Plan.

H. Any additional work required to enforce any permit provisions regulated by this Ordinance, correct violations, and assure proper completion of stipulated remedial actions.

ARTICLE VII
Operation and Maintenance Responsibilities

§ 160-34 Performance guarantee.

A. For subdivisions and land developments, the Applicant shall provide a financial guarantee to the municipality for the timely installation and proper construction of all stormwater management (SWM) facilities as:

(1) Required by the approved SWM Site Plan equal to or greater than the full construction cost of the required controls in accordance with the provisions of Sections 509, 510, and 511 of the Pennsylvania Municipalities Planning Code; or

(2) The amount and method of payment provided for in Subdivision and Land Development Ordinance.

B. For other regulated activities, the municipality shall require a financial guarantee from the Applicant in an amount to be reviewed and approved by the Municipal Engineer.

§ 160-35 Responsibilities for operations and maintenance (O&M) of stormwater facilities and BMPs.

A. The owner of any land upon which stormwater facilities and BMPs will be placed, constructed, or implemented, as described in the stormwater facility and BMP O&M plan, shall record the following documents in the Office of the Recorder of Deeds for Monroe County, within 90 days of approval of the SWM and BMP O&M Plan by the municipality:

(1) The O&M Plan, or a summary thereof;

(2) O&M agreements under §160-37; and

(3) Easements under §160-38.

B. The municipality may suspend or revoke any approvals granted for the project site upon discovery of failure on the part of the owner to comply with this section.

C. The following items shall be included in the stormwater facility and BMP O&M Plan:

(1) Map(s) of the project area, in a form that meets the requirements for recording at the offices of the Recorder of Deeds of Monroe County and shall be submitted on 24-inch-by-36-inch sheets, or as approved by the Municipal Engineer. The contents of the map(s) shall include, but not be limited to:

(a) Clear identification of the location and nature of stormwater facilities and BMPs;

(b) The location of the project site relative to highways, municipal boundaries, or other identifiable landmarks;

(c) Existing and final contours at intervals of two feet, or one foot as appropriate;

(d) Existing streams, lakes, ponds, or other bodies of water within the project site area;

(e) Other physical features including flood hazard boundaries, sinkholes, streams, existing drainage courses, and areas of natural vegetation to be preserved;

(f) The locations of all existing and proposed utilities, sanitary sewers, and water lines on site and within 50 feet of property lines of the project site;

(g) Proposed final changes to the land surface and vegetative cover, including the type and amount of impervious area that would be added;

(h) Proposed final structures, roads, paved areas, and buildings; and

(i) A minimum twenty-foot-wide access easement around all stormwater facilities and BMPs that would provide ingress to and egress from a public right-of-way.

(2) A description of how each stormwater facility and BMP will be operated and maintained, and the identity and contact information associated with the person(s) responsible for O&M;

(3) The name of the project site, the name and address of the owner of the property, and the name of the individual or firm preparing the plan; and

(4) A statement, signed by the facility owner, acknowledging that the stormwater facilities and BMPs are fixtures that can be altered or removed only after approval by the municipality.

D. The stormwater facility and BMP O&M Plan for the project site shall establish responsibilities for the continuing O&M of all stormwater facilities and BMPs, as follows:

(1) If a plan includes structures or lots which are to be separately owned and in which streets, sewers and other public improvements are to be dedicated to the municipality, stormwater facilities and BMPs may also be offered for dedication to and maintained by the municipality.

(2) If a plan includes O&M by single ownership, or if sewers and other public improvements are to be privately owned and maintained, the O&M of stormwater facilities and BMPs shall be the responsibility of the owner or private management entity.

E. The municipality shall make the final determination on the continuing O&M responsibilities prior to final approval of the SWM Site Plan. The Municipality may require a dedication of such facilities as part of the requirements for approval of the SWM Plan. Such a requirement is not an indication that the Municipality will accept the facilities. The municipality reserves the right to accept or reject the O&M responsibility for any or all portions of the stormwater facilities and BMPs.

F. Facilities, areas, or structures used as BMPs shall be enumerated as permanent real estate appurtenances and recorded as deed restrictions or conservation easements that run with the land.

G. The O&M Plan shall be recorded as a restrictive deed covenant that runs with the land.

H. The municipality may take enforcement actions against an owner for any failure to satisfy the provisions of this article and this Ordinance.

§ 160-36 Municipal review of stormwater facilities and BMP operations and maintenance (O&M) plan.

A. The municipality shall review the stormwater facilities and BMP O&M Plan for consistency with the

purposes and requirements of this Ordinance, and any permits issued by PADEP.

B. The municipality shall notify the Applicant in writing whether the stormwater facility and BMP O&M Plan is approved.

C. The municipality shall require a "record drawing" of all stormwater facilities and BMPs.

§ 160-37 Operations and maintenance (O&M) agreement for privately owned stormwater facilities and BMPs.

A. Prior to final approval of the SWM Site Plan, the property owner shall sign and record an O&M agreement with the municipality covering all stormwater facilities and BMPs that are to be privately owned. The O&M agreement shall be transferred with transfer of ownership. The agreement shall be substantially similar to the agreement in Appendix A or other form as may be deemed necessary by the Municipality and subject to the satisfaction of the Municipal Solicitor.

(1) The owner, successor, and assigns shall maintain all facilities in accordance with the approved maintenance schedule in the O&M agreement.

(2) The owner shall keep on file with the Municipality the name, address, and telephone number of the person or company responsible for maintenance activities; in the event of a change, new information shall be submitted by the owner to the Municipality within ten (10) working days of the change.

B. Other items may be included in the O&M agreement where determined necessary to guarantee the satisfactory O&M of all stormwater controls and BMPs. The O&M agreement shall be subject to the review and approval of the municipality, including the Municipal Solicitor.

C. The owner is responsible for the O&M of the SWM BMPs. If the owner fails to adhere to the O&M Agreement, the municipality may perform the services required and charge the owner appropriate fees. Nonpayment of fees may result in a lien against the property.

§ 160-38 Stormwater management easements.

A. The owner must obtain all necessary real estate rights to install, operate, and maintain all stormwater facilities in the SWM Site Plan.

B. The owner must provide the municipal easements, or other appropriate real estate rights, to perform inspections and maintenance for the preservation of stormwater runoff conveyance, infiltration, and detention areas.

C. The owner must convey to the Municipality conservation easements to assure access for periodic inspections by the Municipality and maintenance, as necessary.

ARTICLE VIII
Prohibitions

§ 160-39 Prohibited discharges and connections.

A. Any drain or conveyance, whether on the surface or subsurface, that allows any non-stormwater discharge, including sewage, process wastewater, and wash water to enter the regulated small MS4 or to enter the surface waters of this Commonwealth is prohibited.

B. No person shall allow, or cause to allow, discharges into the regulated small MS4, or discharges into surface waters of this Commonwealth which are not composed entirely of stormwater, except:

(1) As provided in Subsection C below; and

(2) Discharges allowed under a state or federal permit.

C. The following discharges are authorized unless they are determined to be significant contributors to pollution to the waters of this Commonwealth:

(1) Discharges or flows from firefighting activities;

(2) Discharges from potable water sources, including water line flushing and fire hydrant flushing, if such discharges do not contain detectable concentrations of Total Residual Chlorine (TRC);

(3) Non-contaminated irrigation water, water from lawn maintenance, landscape drainage and flows from riparian habitats and wetlands;

(4) Diverted stream flows and springs;

(5) Non-contaminated pumped ground water and water from foundation and footing drains and crawl space pumps;

(6) Non-contaminated HVAC condensation and water from geothermal systems;

(7) Residential (i.e., not commercial) vehicle wash water where cleaning agents are not utilized;

(8) Non-contaminated hydrostatic test water discharges, if such discharges do not contain detectable concentrations of TRC.

D. In the event that the municipality or PADEP determines that any of the discharges identified in Subsection C significantly contribute to pollution of a regulated small MS4 or the waters of this Commonwealth, the municipality or PADEP will notify the responsible person(s) to cease the discharge.

§ 160-40 Roof drains and Sump Pumps.

A. Roof drains and sump pumps shall discharge to infiltration or vegetative BMPs where feasible.

B. Considering potential pollutant loading, roof drain runoff in most cases will not require pretreatment.

§ 160-41 Alteration of SWM BMPs.

A. No person shall modify, remove, fill, landscape, or alter any SWM BMPs, facilities, areas, or structures

that were installed as a requirement of this Ordinance unless it is part of an approved maintenance program and written approval of the municipality has been obtained.

B. No person shall place any structure, fill, landscaping, or vegetation into a stormwater facility or BMP or within a drainage easement which would limit or alter the functioning of the stormwater facility or BMP without the written approval of the municipality.

ARTICLE IX
Enforcement and Penalties

§ 160-42 Right-of-entry.

A. Upon presentation of proper credentials, the municipality or duly authorized representatives of the municipality may enter at reasonable times upon any property within the municipality to inspect the implementation, condition, or operation and maintenance of the stormwater structures, facilities, or BMPs in regard to any aspect governed by this Ordinance.

B. Landowners with stormwater facilities and BMPs on their property shall allow persons working on behalf of the municipality ready access to all parts of the premises for the purposes of determining compliance with this Ordinance.

C. Persons working on behalf of the municipality shall have the right to temporarily locate on any stormwater facility or BMP in the municipality such devices as are necessary to conduct monitoring and/or sampling of the discharges from such stormwater facilities or BMP.

§ 160-43 Inspection.

A. The landowner or the owner's designee (including the Municipality for dedicated and owned facilities) shall inspect SWM BMPs, facilities and/or structures installed under this Ordinance according to the following frequencies, at a minimum, to ensure the BMPs, facilities and/or structures continue to function as intended:

   (1) Annually for the first five years;

   (2) Once every three years thereafter;

   (3) During or immediately after the cessation of a ten-year or greater storm; and/or;

   (4) As specified in the operations and maintenance (O&M) agreement.

B. Inspections should be conducted during or immediately following precipitation events. A written inspection report shall be created to document each inspection. The inspection report shall contain the date and time of the inspection, the individual(s) who completed the inspection, the location of the BMP, facility or structure inspected, observations on performance, and recommendations for improving performance, if applicable. Inspection reports shall be submitted to the Municipality within 30 days following completion of the inspection.

§ 160-44 Enforcement.

All inspections regarding compliance with the stormwater management (SWM) Site Plan and this Ordinance shall be the responsibility of the Municipality.

A. It shall be unlawful for a person to undertake any regulated activity except as provided in an approved SWM Site Plan, unless specifically exempted in §160-23.

B. It shall be unlawful to violate §160-41 of this Ordinance.

C. Whenever the municipality finds that a person has violated a prohibition or failed to meet a requirement of this Ordinance, the municipality may order compliance by written notice to the responsible person. Such notice may, without limitation, require the following remedies:

(1) Performance of monitoring, analyses, and reporting;

(2) Elimination of prohibited connections or discharges;

(3) Cessation of any violating discharges, practices, or operations;

(4) Abatement or remediation of stormwater pollution or contamination hazards and the restoration of any affected property;

(5) Payment of a fine to cover administrative and remediation costs;

(6) Implementation of stormwater facilities and best management practices (BMPs); and

(7) Operation and maintenance (O&M) of stormwater facilities and BMPs.

D. Such notification shall set forth the nature of the violation(s) and establish a time limit for correction of these violation(s). Said notice may further advise that, if applicable, should the violator fail to take the required action within the established deadline, the work will be done by the municipality and the expense may be charged to the violator.

E. Failure to comply within the time specified may subject a violator to the penalty provisions of this Ordinance. All such penalties shall be deemed cumulative and shall not prevent the municipality from pursuing any and all other remedies available in law or equity.

§ 160-45 Suspension and revocation of permits and approvals.

A. Any building, land development, or other permit or approval issued by the municipality may be suspended or revoked, in whole or in part, by the municipality for:

(1) Non-compliance with or failure to implement any provision of the approved SWM Site Plan or O&M Agreement;

(2) A violation of any provision of this Ordinance or any other applicable law, Ordinance, rule, or regulation relating to the Regulated Activity; or

(3) The creation of any condition or the commission of any act during construction or development which constitutes or creates a hazard or nuisance, pollution or which endangers the life, health, or property of others.

B. A suspended approval may be reinstated by the municipality when:

(1) The municipality has inspected and approved the corrections to the violations that caused the suspension; and

(2) The municipality is satisfied that all applicable violations in this Ordinance have been corrected.

C. Any permit or approval that has been revoked by the municipality cannot be reinstated. The Applicant may apply for a new permit under the procedures outlined in this Ordinance.

D. If a violation causes no immediate danger to life, public health, or property, at its sole discretion, the Municipality may provide a limited time period for the owner to correct the violation. In these cases, the Municipality will provide the owner, or the owner's designee, with a written notice of the violation and the time period allowed for the owner to correct the violation. If the owner does not correct the

violation within the allowed time period, the Municipality may revoke or suspend any, or all, applicable approvals and permits pertaining to any provision of this Ordinance.

§ 160-46 Violations and penalties.

A. Any person violating the provisions of this Ordinance shall be subject to penalties that may range from liens against the property to fine of not more than $500.00 for each violation, recoverable with costs. Each day that the violation continues shall constitute a separate offense and the applicable fines are cumulative.

B. In addition, the municipality may institute injunctive, mandamus or any other appropriate action or proceeding at law or in equity for the enforcement of this Ordinance. Any court of competent jurisdiction shall have the right to issue restraining orders, temporary or permanent injunctions, mandamus, or other appropriate forms of remedy or relief.

§ 160-47 Appeals.

A. As per the Pennsylvania Municipalities Planning Code (MPC), Section 909.1(9), any person aggrieved by any action pursuant to this Ordinance may appeal to the Municipality within 30 days of that action.

B. Any person aggrieved by any decision of the Municipality, relevant to the provisions of this Ordinance, may appeal to the County Court of Common Pleas in the County where the activity has taken place within 30 days of the municipal decision.

SECTION II. SEVERABILITY.

It is hereby declared to be the legislative intent that if a court of competent jurisdiction declares any provisions of this Ordinance to be invalid or ineffective in whole or in part, the effect of such decision shall be limited to those provisions which are expressly stated in the decision to be invalid or ineffective, and all other provisions of this Ordinance shall continue to be separately and fully effective. The Board of Supervisors hereby declares that it would have passed this Ordinance and each section or part thereof, other than any part declared invalid, if it had advance knowledge that any part would be declared invalid.

SECTION III. REPEALER.

All ordinances or parts of ordinances which are inconsistent herewith are hereby repealed.

SECTION IV. EFFECTIVE DATE.

This Ordinance shall become effective five (5) days after enactment.

DULY ENACTED AND ORDAINED this 13 day of October 2022, by the Board of Supervisors of Middle Smithfield Township, Monroe County, Pennsylvania, in lawful session duly assembled.

Board of Supervisors of Middle Smithfield Township

By: _____
Annette Atkinson, Chair

By: _____
Mark Oney, Vice-Chair

By: _____
Michael J. Dwyer, Supervisor

ATTEST: _____
Township Secretary

[TOWNSHIP SEAL]

APPENDIX A

STANDARD STORMWATER FACILITIES MAINTENANCE AND MONITORING AGREEMENT

THIS AGREEMENT, made and entered into this _____ day of _____, 20__, by and between _____, (hereinafter the "Landowner"), and ____[Municipal Name]____, __ [County Name]__ County; Pennsylvania, (hereinafter "Municipality");

WITNESSETH

WHEREAS, the Landowner is the owner of certain real property as recorded by deed in the land records of [County Name]__County, Pennsylvania, Deed Book _____ at Page _____, (hereinafter "Property").

WHEREAS, the Landowner is proceeding to build and develop the Property; and

WHEREAS, the Subdivision/Land Management Plan (hereinafter "Plan") for the _____ Subdivision which is expressly made a part hereof, as approved or to be approved by the Municipality, provides for detention or retention of stormwater within the confines of the Property; and

WHEREAS, the Municipality and the Landowner, his successors and assigns agree that the health, safety, and welfare of the residents of the Municipality require that on-site stormwater management facilities be constructed and maintained on the Property; and

WHEREAS, the Municipality requires, through the implementation of the _____ Watershed Stormwater Management Plan, that stormwater management facilities as shown on the Plan be constructed and adequately maintained by the Landowner, his successors and assigns.

NOW, THEREFORE, in consideration of the foregoing premises, the mutual covenants contained herein, and the following terms and conditions, the parties hereto agree as follows:

1. The on-site stormwater management facilities shall be constructed by the Landowner, his successors and assigns, in accordance with the terms, conditions and specifications identified in the Plan.

2. The Landowner, his successors and assigns, shall maintain the stormwater management facilities in good working condition, acceptable to the Municipality so that they are performing their design functions

3. The Landowner, his successors and assigns, hereby grants permission to the Municipality, his authorized agents and employees, upon presentation of proper identification, to enter upon the Property at reasonable times, and to inspect the stormwater management facilities whenever the Municipality deems necessary. The purpose of the

inspection is to assure safe and proper functioning of the facilities. The inspection shall cover the entire facilities, berms, outlet structures, pond areas, access roads, etc. When inspections are conducted, the Municipality shall give the Landowner, his successors and assigns, copies of the inspection report with findings and evaluations. At a minimum, maintenance inspections shall be performed in accordance with the following schedule:

- Annually for the first 5 years after the construction of the stormwater facilities,
- Once every 2 years thereafter, or
- During or immediately upon the cessation of a 100 year or greater precipitation event.

4. All reasonable costs for said inspections shall be born by the Landowner and payable to the Municipality.

5. The owner shall convey to the municipality easements and/or rights-of-way to assure access for periodic inspections by the municipality and maintenance, if required.

6. In the event the Landowner, his successors and assigns, fails to maintain the stormwater management facilities in good working condition acceptable to the Municipality, the Municipality may enter upon the Property and take such necessary and prudent action to maintain said stormwater management facilities and to charge the costs of the maintenance and/or repairs to the Landowner, his successors and assigns. This provision shall not be construed as to allow the Municipality to erect any structure of a permanent nature on the land of the Landowner, outside of any easement belonging to the Municipality. It is expressly understood and agreed that the Municipality is under no obligation to maintain or repair said facilities, and in no event shall this Agreement be construed to impose any such obligation on the Municipality.

7. The Landowner, his successors and assigns, will perform maintenance in accordance with the maintenance schedule for the stormwater management facilities including sediment removal as outlined on the approved schedule and/or Subdivision/Land Development Plan.

8. In the event the Municipality, pursuant to this Agreement, performs work of any nature, or expends any funds in performance of said work for labor, use of equipment, supplies, materials, and the like on account of the Landowner's or his successors' and assigns' failure to perform such work, the Landowner, his successors and assigns, shall reimburse the Municipality upon demand, within 30 days of receipt of invoice thereof, for all costs incurred by the Municipality hereunder. If not paid within said 30-day period, the Municipality may enter a lien against the property in the amount of such costs, or may proceed to recover his costs through proceedings in equity or at law as authorized under the provisions of the _____ Code.

9. The Landowner, his successors and assigns, shall indemnify the Municipality and his agents and employees against any and all damages, accidents, casualties, occurrences or claims which might arise or be asserted against the Municipality for the construction, presence, existence or maintenance of the stormwater management facilities by the Landowner, his successors and assigns.

10. In the event a claim is asserted against the Municipality, his agents or employees, the Municipality shall promptly notify the Landowner, his successors and assigns, and they shall defend, at their own expense, any suit based on such claim. If any judgment or claims against the Municipality, his agents or employees shall be allowed, the Landowner, his successors and assigns shall pay all costs and expenses in connection therewith.

11. In the advent of an emergency or the occurrence of special or unusual circumstances or situations, the Municipality may enter the Property, if the Landowner is not immediately available, without notification or identification, to inspect and perform necessary maintenance and repairs, if needed, when the health, safety or welfare of the citizens is at jeopardy. However, the Municipality shall notify the landowner of any inspection, maintenance, or repair undertaken within 5 days of the activity. The Landowner shall reimburse the Municipality for his costs.

This Agreement shall be recorded among the land records of

___[County Name]___ County, Pennsylvania and shall constitute a covenant running with the Property and/or equitable servitude, and shall be binding on the Landowner, his administrators, executors, assigns, heirs and any other successors in interests, in perpetuity.

ATTEST:

WITNESS the following signatures and seals:

(SEAL) For the Municipality:

_____

(SEAL) For the Landowner:

_____

ATTEST:

_____ (City, Borough, Township)

County of _____[County Name]_____, Pennsylvania

I, _____, a Notary Public in and for the County and State aforesaid, whose commission expires on the _____ day of _____, 20__, do hereby certify that _____ whose name(s) is/are signed to the foregoing Agreement bearing date of the _____ day of _____, 20__, has acknowledged the same before me in my said County and State.

GIVEN UNDER MY HAND THIS _____ day of _____, 19___.

_____

NOTARY PUBLIC

(SEAL)

APPENDIX B

STORMWATER MANAGEMENT DESIGN CRITERIA

TABLE B-1
DESIGN STORM RAINFALL AMOUNT
Source: "Field Manual of Pennsylvania Department of Transportation"
STORM INTENSITY-DURATION-FREQUENCY CHARTS
PDT-IDF May 1986

FIGURE B-1
SCS TYPE II RAINFALL DISTRIBUTION
S-CURVE

FIGURE B-2
PENNDOT DELINEATED REGIONS
Source: "Field Manual of Pennsylvania Department of Transportation"
STORM INTENSITY-DURATION-FREQUENCY CHARTS
PDT-IDF May 1986

FIGURE B-3
REGION 4 PENNDOT STORM INTENSITY-DURATION-FREQUENCY CURVE
Source: "Field Manual of Pennsylvania Department of Transportation"
STORM INTENSITY-DURATION-FREQUENCY CHARTS
PDT-IDF May 1986

FIGURE B-4
REGION 5 PENNDOT STORM INTENSITY-DURATION-FREQUENCY CURVE
Source: "Field Manual of Pennsylvania Department of Transportation"
STORM INTENSITY-DURATION-FREQUENCY CHARTS
PDT-IDF May 1986

TABLE B-2
RUNOFF CURVE NUMBERS
Source: NRCS (SCS) TR-55

TABLE B-3
RATIONAL RUNOFF COEFFICIENTS

TABLE B-4
MANNING ROUGHNESS COEFFICIENTS

TABLE B-5
24-HOUR STORM VALUES REPRESENTING 90% OF ANNUAL RAINFALL

TABLE B-6
NONSTANDARD STORMWATER MANAGEMENT
STORMWATER CREDITS FOR COMPUTING PROPOSED CONDITIONS HYDROGRAPH

TABLE B-1
DESIGN STORM RAINFALL AMOUNT (INCHES)

The design storm rainfall amount chosen for design should be obtained from the PennDOT region in which the site is located according to Figure B-2.

Source: "Field Manual of Pennsylvania Department of Transportation"
STORM INTENSITY-DURATION-FREQUENCY CHARTS
PDT-IDF May 1986

Region 4

	Precipitation Depth (in)						
Duration	1 Yr	2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
5 min	0.30	0.35	0.41	0.45	0.50	0.55	0.61
15 min	0.58	0.68	0.80	0.93	1.03	1.13	1.25
1 hr	1.01	1.22	1.48	1.70	1.91	2.16	2.41
2 hrs	1.24	1.50	1.84	2.14	2.46	2.80	3.18
3 hrs	1.38	1.71	2.10	2.43	2.82	3.24	3.69
6 hrs	1.68	2.04	2.52	3.06	3.60	4.14	4.74
12 hrs	2.04	2.52	3.00	3.84	4.56	5.16	6.00
24 hrs	2.40	2.88	3.60	4.56	5.76	6.48	7.44

Region 5

	Precipitation Depth (in)						
Duration	1 Yr	2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
5 min	0.33	0.38	0.45	0.50	0.56	0.63	0.68
15 min	0.64	0.75	0.90	1.00	1.15	1.35	1.50
1 hr	1.10	1.35	1.61	1.85	2.15	2.60	2.98
2 hr	1.34	1.66	2.00	2.34	2.70	3.26	3.76
3 hr	1.50	1.86	2.28	2.67	3.09	3.69	4.29
6 hr	1.86	2.28	2.82	3.36	3.90	4.62	5.40
12 hr	2.28	2.76	3.48	4.20	4.92	5.76	6.72
24 hr	2.64	3.36	4.32	5.28	6.24	7.20	8.40

FIGURE B-1
NRCS (SCS) TYPE II RAINFALL DISTRIBUTION - S CURVE

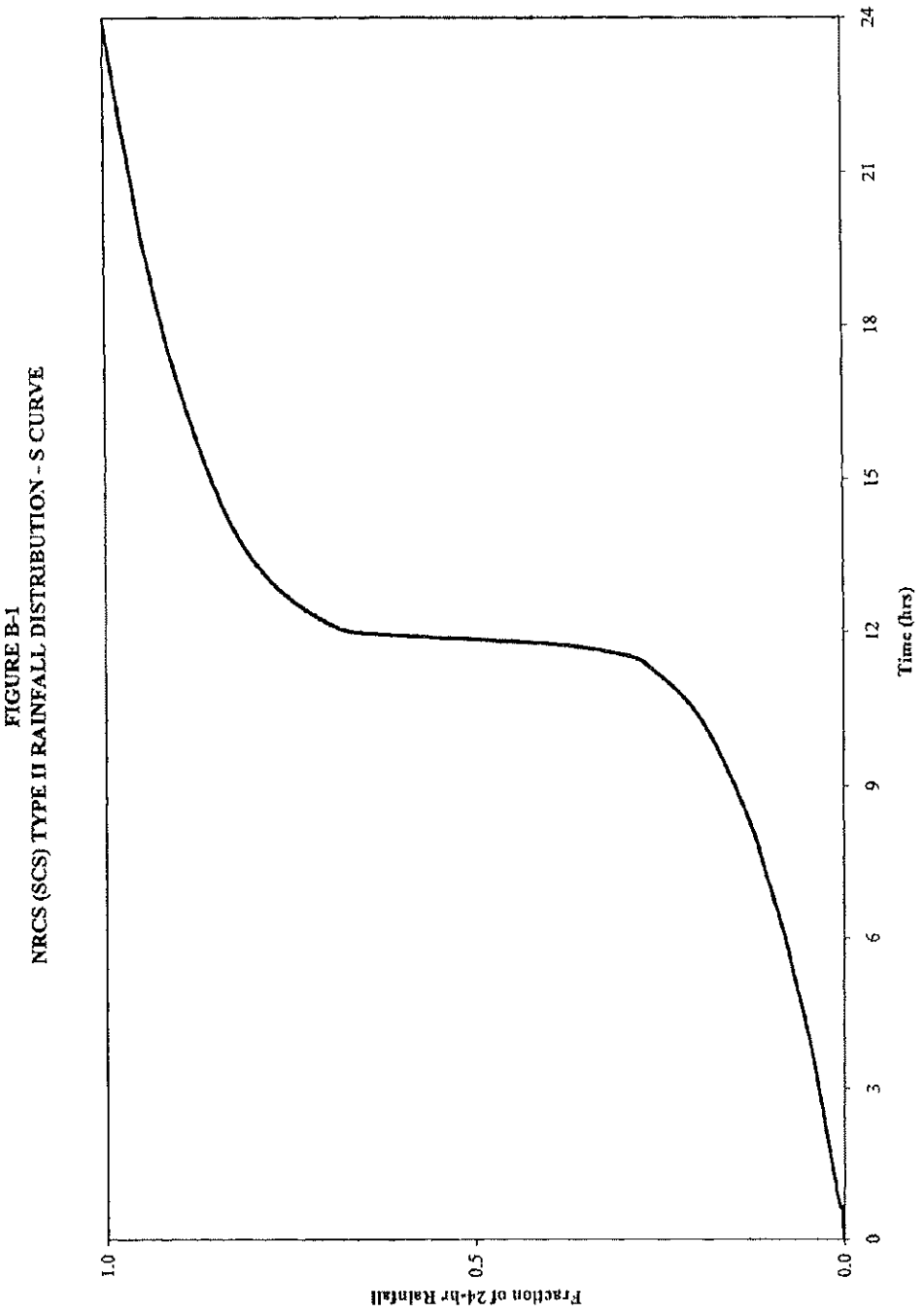


FIGURE B-2
PENNDOT DELINEATED REGIONS

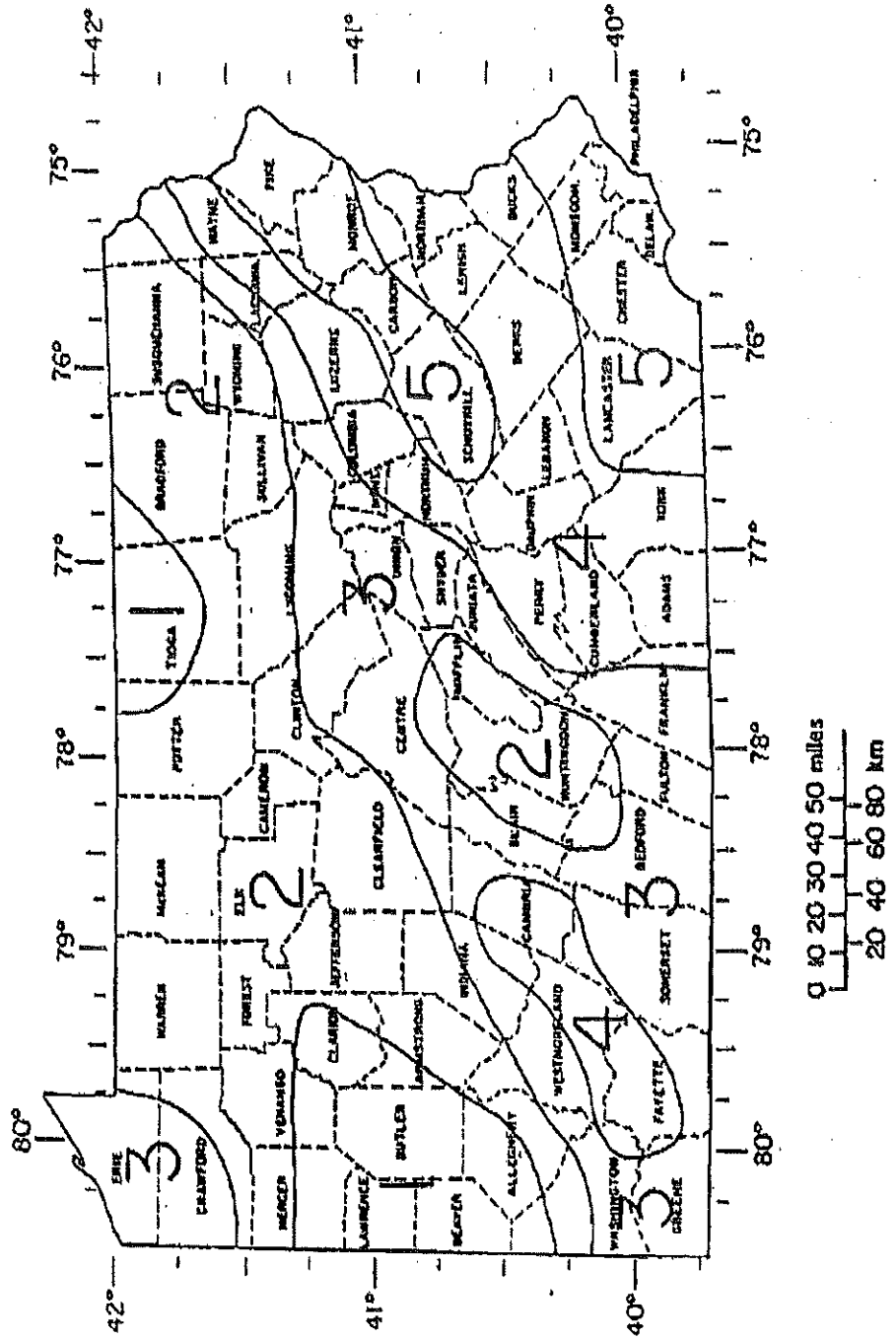


FIGURE B-3
PENNDOT STORM INTENSITY-DURATION-FREQUENCY CURVE

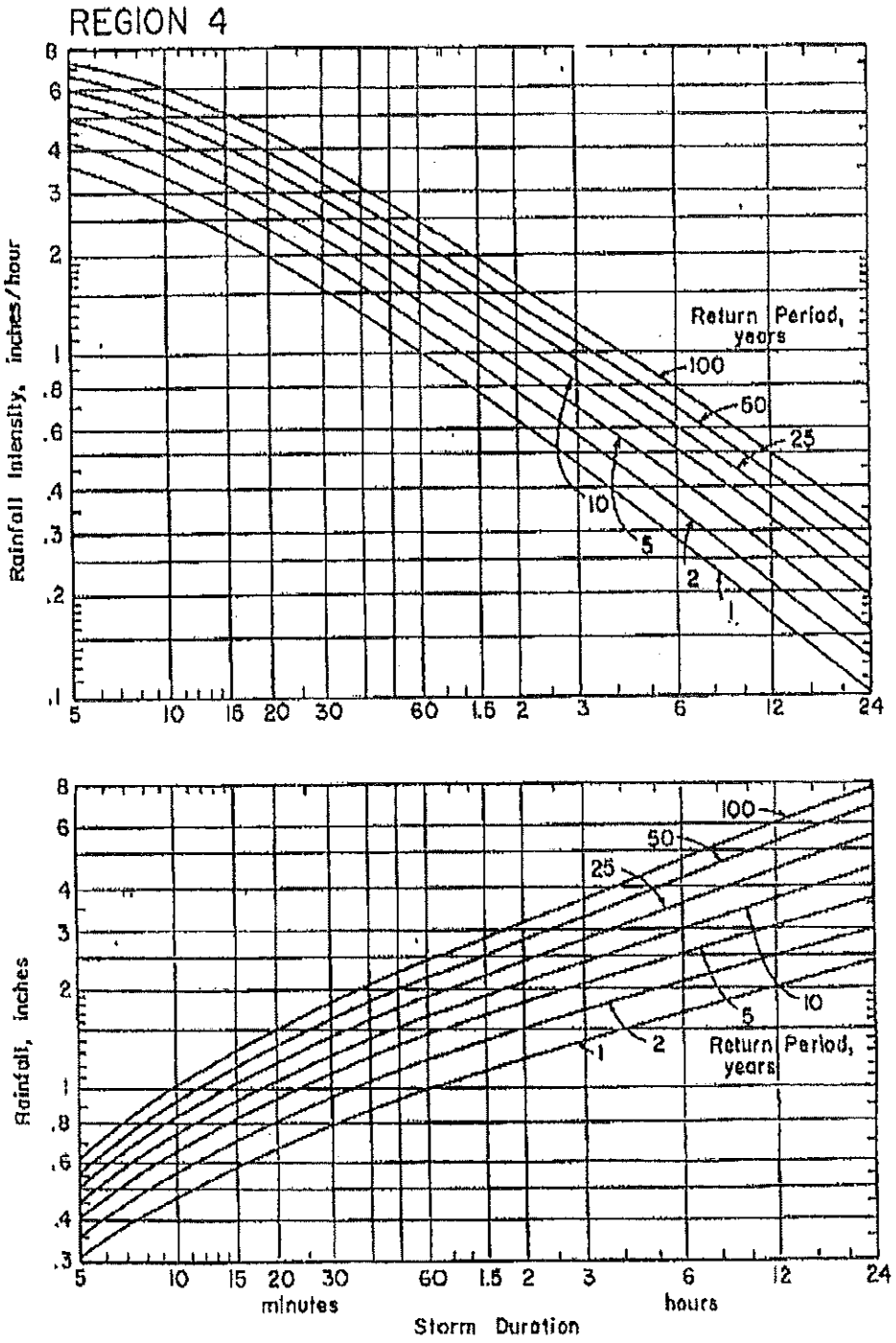


FIGURE B-4
PENNDOT STORM INTENSITY-DURATION-FREQUENCY CURVE

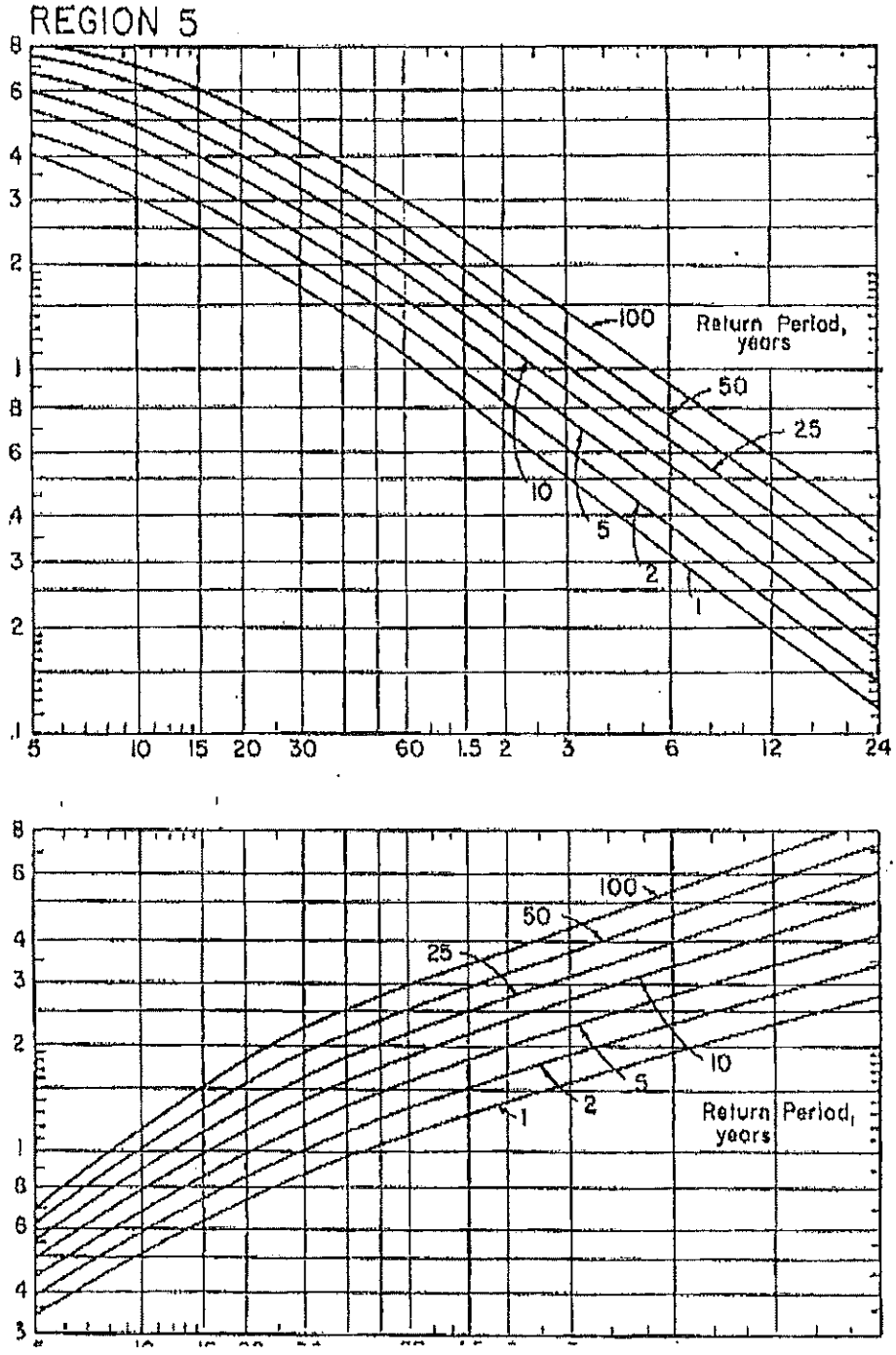


TABLE B-2
RUNOFF CURVE NUMBERS
(From NRCS (SCS) TR-55)

LAND USE DESCRIPTION	Hydrologic Condition	HYDROLOGIC SOIL GROUP A	B	C	D
Open Space					
Grass cover < 50%	Poor	68	79	86	89
Grass cover 50% to 75%	Fair	49	69	79	84
Grass cover > 75%	Good	39	61	74	80
Meadow		30	58	71	78
Agricultural					
Pasture, grassland, or range – Continuous forage for grazing	Poor	68	79	86	89
Pasture, grassland, or range – Continuous forage for grazing.	Fair	49	69	79	84
Pasture, grassland, or range – Continuous forage for grazing	Good	39	61	74	80
Brush-brush-weed-grass mixture with brush the major element.	Poor	48	67	77	83
Brush-brush-weed-grass mixture with brush the major element.	Fair	35	56	70	77
Brush-brush-weed-grass mixture with brush the major element.	Good	30	48	65	73
Fallow Bare soil	-------	77	86	91	94
Crop residue cover (CR)	Poor	76	85	90	93
	Good	74	83	88	90
Woods – grass combination (orchard or tree farm)	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30	55	70	77
Commercial	(85% Impervious)	89	92	94	95
Industrial	(72% Impervious)	81	88	91	93
Institutional	(50% Impervious)	71	82	88	90
Residential districts by average lot size:					
	% Impervious				
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87

1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Farmstead		59	74	82	86
Smooth Surfaces (Concrete, Asphalt, Gravel or Bare Compacted Soil)		98	98	98	98
Water		98	98	98	98
Mining/Newly Graded Areas (Pervious Areas Only)		77	86	91	94

* Includes Multi-Family Housing unless justified lower density can be provided.

Note: Existing site conditions of bare earth or fallow ground shall be considered as meadow when choosing a CN value.

TABLE B-3
RATIONAL RUNOFF COEFFICIENTS

		HYDROLOGIC SOIL GROUP			
LAND USE DESCRIPTION		A	B	C	D
Cultivated Land : without conservation treatment		.49	.67	.81	.88
: with conservation treatment		.27	.43	.61	.67
Pasture or range land : poor condition		.38	.63	.78	.84
: good condition		---*	.25	.51	.65
Meadow : good condition		---*	---*	.44	.61
Wood or Forest Land : thin stand, poor cover, no mulch		---*	.34	.59	.70
: good cover		---*	---*	.45	.59
Open Spaces, lawns, parks, golf courses, cemeteries					
Good condition : grass cover on 75% or more of the area		---*	.25	.51	.65
Fair condition : grass cover on 50% to 75% of the area		---*	.45	.63	.74
Commercial and business areas (85% impervious)		.84	.90	.93	.96
Industrial districts (72% impervious)		.67	.81	.88	.92
Residential :					
Average lot size	Average % Impervious				
1/8 acre or less	65	.59	.76	.86	.90
1/4 acre	38	.25	.49	.67	.78
1/3 acre	30	---*	.49	.67	.78
1/2 acre	25	---*	.45	.65	.76
1 acre	20	---*	.41	.63	.74
Paved parking lots, roofs, driveways, etc.		.99	.99	.99	.99
Streets and roads :					
Paved with curbs and storm sewers		.99	.99	.99	.99
Gravel		.57	.76	.84	.88
Dirt		.49	.69	.80	.84

Notes : Values are based on S.C.S. definitions and are average values.
Values indicated by "---" should be determined by the design engineer based on site characteristics.

Source : New Jersey Department of Transportation, Technical Manual for Stream Encroachment, August, 1984

TABLE B-4
MANNING ROUGHNESS COEFFICIENTS

Roughness Coefficients (Manning's "n") for Overland Flow
(U.S. Army Corps of Engineers, HEC-1 Users Manual)

Surface Description	n		
Dense Growth	0.4	-	0.5
Pasture	0.3	-	0.4
Lawns	0.2	-	0.3
Bluegrass Sod	0.2	-	0.5
Short Grass Prairie	0.1	-	0.2
Sparse Vegetation	0.05	-	0.13
Bare Clay-Loam Soil (eroded)	0.01	-	0.03
Concrete/Asphalt - very shallow depths (less than 1/4 inch)	0.10	-	0.15
- small depths (1/4 inch to several inches)	0.05	-	0.10

Roughness Coefficients (Manning's "n") For Channel Flow

Reach Description	n
Natural stream, clean, straight, no rifts or pools	0.03
Natural stream, clean, winding, some pools or shoals	0.04
Natural stream, winding, pools, shoals, stony with some weeds	0.05
Natural stream, sluggish deep pools and weeds	0.07
Natural stream or swale, very weedy or with timber underbrush	0.10
Concrete pipe, culvert or channel	0.012
Corrugated metal pipe	0.012-0.027(1)
High Density Polyethylene (HDPE) Pipe	
Corrugated	0.021-0.029(2)
Smooth Lined	0.012-0.020(2)

(1) Depending upon type, coating and diameter
(2) Values recommended by the American Concrete Pipe Association, check Manufacturer's recommended value.

TABLE B-5
24-HOUR STORM VALUES
REPRESENTING 90% OF ANNUAL RAINFALL

PennDOT Rainfall Region	P Inches
1	1.13
2	1.48
3	1.60
4	1.95
5	2.04

TABLE B-6
NONSTANDARD STORMWATER MANAGEMENT
STORMWATER CREDITS FOR COMPUTING PROPOSED CONDITIONS HYDROGRAPH

The developer may, subject to approval of the municipal engineer, use the stormwater credits, described in the following table, in computing proposed conditions hydrograph:

Nonstructural Stormwater Measure	Description
Natural Area Conservation	Conservation of natural areas such as forest, wetlands, or other sensitive areas in a protected easement thereby retaining their existing hydrologic and water quality characteristics.
Disconnection of Rooftop Runoff	Rooftop runoff is disconnected and then directed over a pervious area where it may either infiltrate into the soil or filter over it. This is typically obtained by grading the site to promote overland flow or by providing bioretention on single-family residential lots.
Disconnection of Non-Rooftop Runoff	Disconnect surface impervious cover by directing it to pervious areas where it is either infiltrated or filtered though the soil.
Buffers	Buffers effectively treat stormwater runoff. Effective treatment constitutes capturing runoff from pervious and impervious areas adjacent to the buffer and treating the runoff through overland flow across a grass or forested area.
Grass Channel (Open Section Roads)	Open grass channels are used to reduce the volume of runoff and pollutants during smaller storms.
Environmentally Sensitive Rural Development	Environmental site design techniques are applied to low density or rural residential development.

APPENDIX C

SAMPLE DRAINAGE PLAN APPLICATION AND FEE SCHEDULE

(To be attached to the "land subdivision plan or development plan review application or "minor land subdivision plan review application")

Application is hereby made for review of the Stormwater Management and Erosion and Sedimentation Control Plan and related data as submitted herewith in accordance with the _____Township Stormwater Management and Earth Disturbance Ordinance.

_____Final Plan _____Preliminary Plan _____Sketch Plan

Date of Submission _____Submission No._____

1. Name of subdivision or development_____

2. Name of Applicant _____ Telephone No._____

   (if corporation, list the corporation's name and the names of two officers of the corporation)
   _____Officer 1
   _____Officer 2

   Address_____
   Zip_____

   Applicants interest in subdivision or development
   (if other than property owner give owners name and address) .

3. Name of property owner _____Telephone No._____

   Address_____
   Zip_____

4. Name of engineer or surveyor _____Telephone No._____

   Address_____
   Zip_____

5. Type of subdivision or development proposed:

____ Single-Family Lots	____ Townhouses	____ Commercial(Multi-Lot)
____ Two Family Lots	____ Garden Apartments	____ Commercial (One-Lot)
____ Multi-Family Lots	____ Mobile-Home Park	____ Industrial (Multi-Lot)
____ Cluster Type Lots	____ Campground	____ Industrial (One-Lot)
____ Planned Residential Development	____ Other (_____)	

6. Lineal feet of new road proposed_____ L.F.

7. Area of proposed and existing conditions impervious area on entire tract.

   a. Existing (to remain) _____ S.F. _____% of Property
   b. Proposed _____ S.F. _____% of Property

8. Stormwater

   a. Does the peak rate of runoff from proposed conditions exceed that flow which occurred for existing conditions for the designated design storm?_____

   b. Design storm utilized (on-site conveyance systems) (24 hr.)_____
   No. of Subarea_____
   Watershed Name_____

   Explain:_____
   _____
   _____

   c. Does the submission and/or district meet the release rate criteria for the applicable subarea?_____

   d. Number of subarea(s) from Ordinance Appendix D of the Brodhead and McMichaels Creek Watershed Stormwater Management Plan._____

   e. Type of proposed runoff control_____

   f. Does the proposed stormwater control criteria meet the requirement/guidelines of the Stormwater Ordinances?_____

   If not, what variances/waivers are requested?_____
   _____

   Reasons_____

   g. Does the plan meet the requirements of Article iii of the Stormwater Ordinances?_____

   If not, what variances/waivers are requested?_____

   Reasons Why _____
   _____
   _____

   h. Was TR-55, June 1986 utilized in determining the time of concentration?_____
   _____

   i. What hydrologic method was used in the stormwater computations?_____
   _____

j. Is a hydraulic routing through the stormwater control structure submitted?_____

_____

k. Is a construction schedule or staging attached?_____

l. Is a recommended maintenance program attached?_____

9. Erosion and Sediment Pollution Control (E&S):

a. Has the stormwater management and E&S plan, supporting documentation and narrative been submitted to the _____[County Name]___County Conservation District?_____

b. Total area of earth disturbance _____S.F.

10. Wetlands

a. Have the wetlands been delineated by someone trained in wetland delineation?_____

b. Have the wetland lines been verified by a state or federal permitting authority?_____

c. Have the wetland lines been surveyed?_____

d. Total acreage of wetland within the property _____

e. Total acreage of wetland disturbed_____

f. Supporting documentation_____

11. Filing

a. Has the required fee been submitted?_____

Amount_____

b. Has the proposed schedule of construction inspection to be performed by the Applicant's engineer been submitted?_____

c. Name of individual who will be making the inspections_____

d. General comments about stormwater management at the development_____

_____

_____

CERTIFICATE OF OWNERSHIP AND ACKNOWLEDGMENT OF APPLICATION:

COMMONWEALTH OF PENNSYLVANIA
COUNTY OF [County Name] .

On this the _____ day of _____, 20____, before me, the undersigned officer, personally appeared _____who being duly sworn, according to law, deposes and says that _____owners of the property described in this application and that the application was made with _____ knowledge and/or direction and does hereby agree with the said application and to the submission of the same.

_____Property Owner

My Commission Expires_____20_____
Notary Public_____

THE UNDERSIGNED HEREBY CERTIFIES THAT TO THE BEST OF HIS KNOWLEDGE AND BELIEF THE INFORMATION AND STATEMENTS GIVEN ABOVE ARE TRUE AND CORRECT.

SIGNATURE OF APPLICANT_____

//

(Information Below This Line To Be Completed By The Municipality)

_____ (Name of) Municipality official submission receipt:

Date complete application received _____Plan Number_____

Fees _____ date fees paid _____ received by_____

Official submission receipt date _____

Received by_____

_____
Municipality

Drainage Plan
Proposed Schedule Of Fees

Subdivision name_____ Submittal No._____

Owner _____ Date_____

Engineer_____

1. Filing fee $_____

2. Land use
   2a. Subdivision, campgrounds, mobile home parks, and multi-family dwelling where the units are located in the same local watershed. $_____
   2b. Multi-family dwelling where the designated open space is located in a different local watershed from the proposed units. $_____
   2c. Commercial/industrial. $_____

3. Relative amount of earth disturbance
   3a. Residential
   road <500 l.f. $_____
   road 500-2,640 l.f. $_____
   road >2,640 l.f. $_____
   3b. Commercial/industrial and other
   impervious area <3,500 s.f. $_____
   impervious area 3,500-43,460 s.f. $_____
   impervious area >43,560 s.f. $_____

4. Relative size of project
   4a. Total tract area <1 ac $_____
   1-5 ac $_____
   5-25 ac
   25-100 ac $_____
   100-200 ac $_____
   >200 ac $_____

5. Stormwater control measures
   5a. Detention basins & other controls which require a review of hydraulic routings ($ per control). $_____
   5b. Other control facilities which require storage volume calculations but no hydraulic routings. ($ per control) $_____

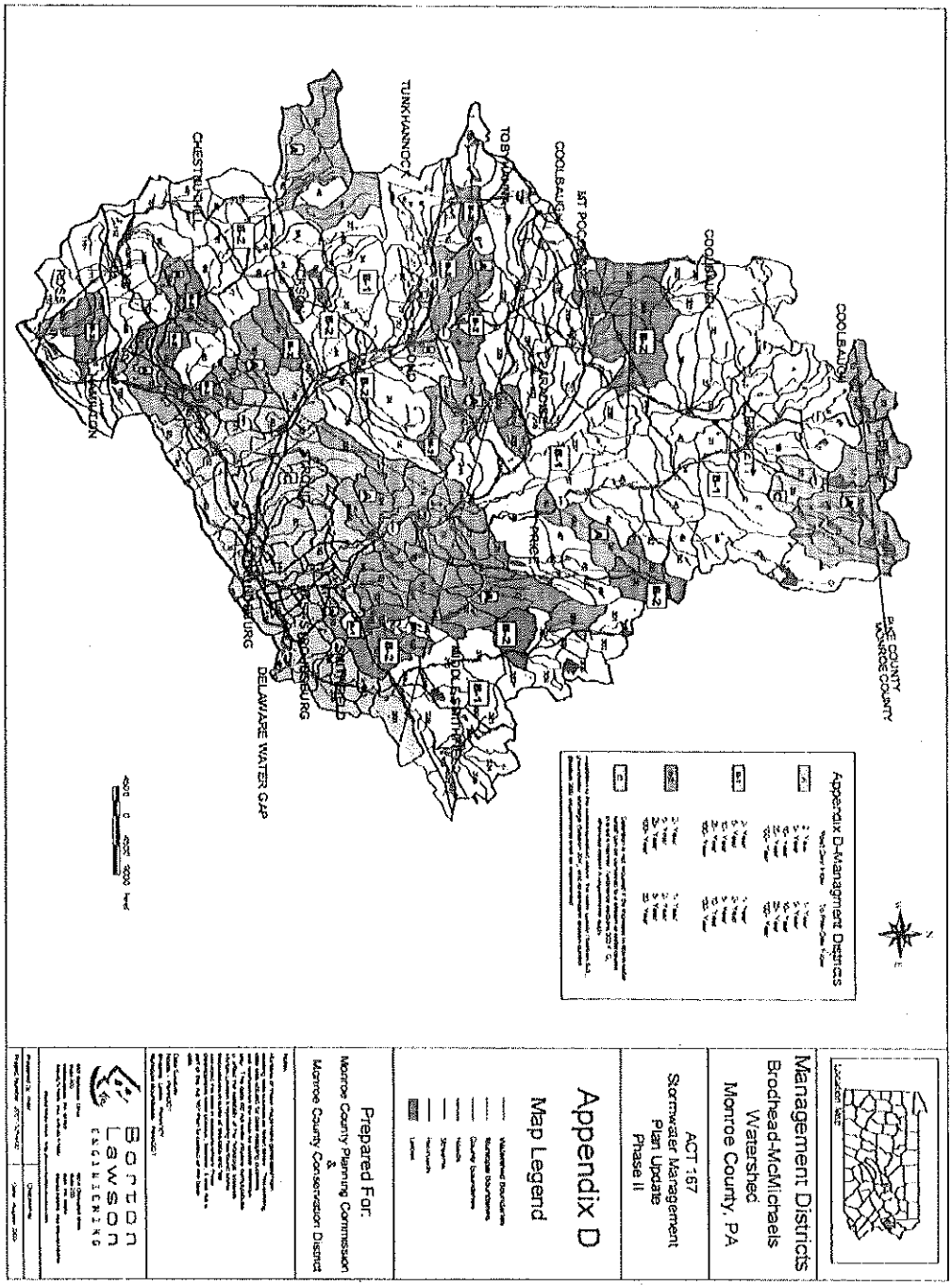
6. Site inspection ($ per inspection) $_____

   Total $_____

All subsequent reviews shall be 1/4 the amount of the initial review fee unless a new application is required as per Section 406 of the stormwater ordinance. A new fee shall be submitted with each revision in accordance with this schedule.

APPENDIX D

STORMWATER MANAGEMENT DISTRICT WATERSHED MAP



APPENDIX E

WEST NILE VIRUS GUIDANCE

Monroe County Conservation District Guidance: Stormwater Management and West Nile Virus

The Monroe County Conservation District recognizes the need to address the problem of non-point source pollution impacts caused by runoff from impervious surfaces. The new stormwater policy being integrated into Act 167 Stormwater Management regulations by the PA Department of Environmental Protection (DEP) will make non-point pollution controls an important component of all future plans and updates to existing plans. In addition, to meet post-construction anti-degradation standards under the state National Pollution Discharge Elimination System (NPDES) permitting program, applicants will be required to employ Best Management Practices (BMPs) to address non-point pollution concerns.

Studies conducted throughout the United States have shown that wet basins and in particular constructed wetlands are effective in traditional stormwater management areas such as channel stability and flood control, and are one of the most effective ways to remove stormwater pollutants (United States Environmental Protection Agency 1991, Center for Watershed Protection 2000). From Maryland to Oregon, studies have shown that as urbanization and impervious surface increase in a watershed, the streams in those watersheds become degraded (CWP 2000). Although there is debate over the threshold of impervious cover when degradation becomes apparent (some studies show as little as 6% while others show closer to 20%), there is agreement that impervious surfaces cause nonpoint pollution in urban and urbanizing watersheds, and that degradation is ensured if stormwater BMPs are not implemented.

Although constructed wetlands and ponds are desirable from a water quality perspective there may be concerns about the possibility of these stormwater management structures becoming breeding grounds for mosquitoes. The Conservation District feels that although it may be a valid concern, **municipalities should not adopt ordinance provisions prohibiting wet basins for stormwater management.**

Mosquitoes

The questions surrounding mosquito production in wetlands and ponds have intensified in recent years by the outbreak of the mosquito-borne West Nile Virus. As is the case with all vector-borne maladies, the life cycle of West Nile Virus is complicated, traveling from mosquito to bird, back to mosquito and then to other animals including humans. *Culex pipiens* was identified as the vector species in the first documented cases from New York in 1999. This species is still considered the primary transmitter of the disease across its range. Today there are some 60 species of mosquitoes that inhabit Pennsylvania. Along with *C. pipiens*, three other species have been identified as vectors of West Nile Virus while four more have been identified as potential vectors.

The four known vectors in NE Pennsylvania are *Culex pipiens, C. restuans, C. salinarius* and *Ochlerotatus japonicus*. All four of these species prefer, and almost exclusively use, artificial containers (old tires, rain gutters, birdbaths, etc.) as larval habitats. In the case of *C. pipiens*, the most notorious of the vector mosquitoes, the dirtier the water the better they like it. The important factor is that these species do not thrive in functioning wetlands where competition for resources and predation by larger aquatic and terrestrial organisms is high.

The remaining four species, *Aedes vexans, Ochlerotatus Canadensis, O. triseriatus* and *O. trivittatus* are currently considered potential vectors due to laboratory tests (except the *O. trivittatus*, which did have one confirmed vector pool for West Nile Virus in PA during 2002). All four of these species prefer vernal habitats and ponded woodland areas following heavy summer rains. These species may be the greatest threat of disease transmission around stormwater basins that pond water for more than four days. This can be mitigated however by establishing ecologically functioning wetlands.

Stormwater Facilities

If a stormwater wetland or pond is constructed properly and a diverse ecological community develops, mosquitoes should not become a problem. Wet basins and wetlands constructed as stormwater management facilities, should be designed to attract a diverse wildlife community. If a wetland is planned, proper hydrologic soil conditions and the establishment of hydrophytic vegetation will promote the population of the wetland by amphibians and other mosquito predators. In natural wetlands, predatory insects and amphibians are effective at keeping mosquito populations in check during the larval stage of development while birds and bats prey on adult mosquitoes.

The design of a stormwater wetland must include the selection of hydrophytic plant species for their pollutant uptake capabilities and for not contributing to the potential for vector mosquito breeding. In particular, species of emergent vegetation with little submerged growth are preferable. By limiting the vegetation growing below the water surface, larvae lose protective cover and there is less chance of anaerobic conditions occurring in the water.

Stormwater ponds can be designed for multiple purposes. When incorporated into an open space design a pond can serve as a stormwater management facility and a community amenity. Aeration fountains and stocked fish should be added to keep larval mosquito populations in check.

Publications from the PA Department of Health and the Penn State Cooperative Extension concerning West Nile Virus identify aggressive public education about the risks posed by standing water in artificial containers (tires, trash cans, rain gutters, bird baths) as the most effective method to control vector mosquitoes.

Conclusion

The Conservation District understands the pressure faced by municipalities when dealing with multifaceted issues such as stormwater management and encourages the

incorporation of water quality management techniques into stormwater designs. As Monroe County continues to grow, conservation design, groundwater recharge and constructed wetlands and ponds should be among the preferred design options to reduce the impacts of increases in impervious surfaces. When designed and constructed appropriately, the runoff mitigation benefits to the community from these design options will far out weigh their potential to become breeding grounds for mosquitoes.

APPENDIX F

CONSUMPTIVE USE TRACKING

CONSUMPTIVE USE TRACKING REPORT

PROJECT NAME: _____ MUNICIPALITY: _____

Type of Project: ___ Residential ___ Commercial ___ Institutional
___ Recreational/Seasonal ___Industrial

1. In which watershed is this project located? If more than one, identify the percentage of the project in each watershed. (See Figure x.x.)

___ Appenzell
___ Brodhead – above Paradise
___ Brodhead – below Paradise
___ Marshalls
___ McMichael
___ Paradise
___ Pocono

2. Water Source

___ On-Site Well ___ Central (source watershed: _____)
(utility company: _____)

3. Sewage Disposal

___ Land Disposal ___ Stream Discharge

4. Stormwater

[_____ cubic feet - _____ cubic feet]/1.6728 = _____ gallons/day
(Required Infiltration)* (Proposed Infiltration) (Net Stormwater)

5. Water Use (*Industrial projects must use project-specific data, not App. J or Table x.x.*)

A. _____ x _____gallons/unit/day = _____ gallons/day
(# of Units Proposed) (Value from App. J) (Gross Water Use)

B. _____ gallons/day x _____ = _____ gallons/day
(Gross Water Use) (Table x.x Multiplier)(Water Use)

6. Consumptive Use

_____ gallons/day + _____ gallons/day = _____ gallons/day
(Stormwater) (Water Use) (Consumptive Use)

*Calculated per Section 304

7. Example

10-Lot Subdivision with On-Site Wells and Central Sewage

Stormwater: -420 gal/day (calculated per Section 304)

Water Use: 10 units x 190 gal/unit/day = 1900 gal/day
1900 gal/day x 1.00 = 1900 gal/day

Consumptive Use: -420 gal/day + 1900 gal/day = 1480 gal/day

****

Table x.x. Multipliers for Water Use Calculation (*Do not use for industrial projects.*)

Sewage Disposal	Central Out of Watershed	Central Within Watershed	On-Site Well
Land Disposal	0	0.14	0.14
Stream Discharge	0	1.00	1.00
	Water Source		

NOTES: A multiplier of 0 will result in a debit to the source watershed *by the reviewing entity.* A multiplier of 0.14, derived from the Pocono Creek Goal-Based Watershed Management Project, is designed to protect aquatic habitat during summer low flows. A multiplier of 1.00 assumes that water is not available to sustain aquatic base flows.

WATER USE FOR CONSUMPTIVE USE TRACKING		
TYPE OF ESTABLISHMENT	*UNIT*	*GALLONS/UNIT/DAY*
Residential		
Hotels and motels	Room	100
Multiple family dwellings and apartments, including townhouses, duplexes and condominiums	Unit	400
Rooming houses	Room	200
Residential Subdivisions (On-Lot Sewage)	Single family residences	400*
+Residential Subdivisions (Central Sewage)	Single family residences	190
*For units of 3 bedrooms or less; for each bedroom	over 3, add 100 gallons	
Commercial		
Airline catering	Meal served	3
Airports - not including food	Passenger	5
Airports	Employee	10
>Barber shops	Chair	54.6
One licensed operator beauty shops	Station	200
>Bowling alleys	Alley	133
Bus service areas - not including food	Patron and employee	5
>Bus/rail depots	Square foot	3.33
>Car washes	Inside square foot	4.78
Country clubs - not including food	Patron and employee	30
>Drive-in restaurants	Car stall	109
Drive-in theaters - not including food	Space	10
Factories and plants exclusive of industrial wastes	Employee	35
Laundries, self-service	Washer	400
>Laundries, non self-service	Square foot	0.25
>Medical Offices	Square foot	0.62
Mobile home parks, independent	Space	400
Movie theaters - not including food	Auditorium seat	5
>Night clubs	Person served	1.33
>Office buildings	Square foot	0.19
Offices	Employee	10
Restaurants (toilet and kitchen wastes)	Patron	10
Restaurants (additional for bars and cocktail lounges)	Patron	2
Restaurants (kitchen and toilet wastes, single-service utensils	Person	8.5
Restaurants (kitchen waste only, single-service utensils	Patron	3
>Service stations	Inside square foot	3.33
Stores	Public toilet	400
Warehouses	Employee	35
Work or construction camps (semipermanent) with flush	Employee	50

Toilets		
Work or construction camps (semipermanent) w/o flush Toilets	Employee	35
TYPE OF ESTABLISHMENT	*UNIT*	*GALLONS/UNIT/DAY*
Institutional		
Churches	Seat	3
Churches (additional kitchen waste)	Meal served	3
Churches (additional with paper service)	Meal served	1.5
Hospitals, with laundry	Bed space	300
Hospitals, without laundry	Bed space	220
Institutional food service	Meal	20
Institutions other than hospitals	Bed space	125
Schools, boarding	Resident	100
Schools, day (without cafeterias, gyms or showers)	Student & employee	15
Schools, day (with cafeterias, but no gyms or showers)	Student & employee	20
Schools, day (with cafeterias, gym and showers)	Student & employee	25
>YMCA/YWCA	Person	33.3
Recreational and Seasonal		
Camps, day (no meals served)	Person	10
Camps, hunting and summer residential (night and day) with limited plumbing including water-carried toilet wastes	Person	50
Campgrounds with individual sewer and water hookup	Space	100
Campgrounds with water hookup only and/or central comfort Station which includes water-carried toilet wastes	Space	50
Fairgrounds and parks, picnic - with bathhouses, showers and flush toilets	Person	15
Fairgrounds and parks, picnic - toilet wastes only	Person	5
Swimming pools and bathhouses	Person	10

NOTE: If type of establishment proposed is not listed or if more project specific values are available, supporting documentation must be provided.

SOURCE: PA Title 25§73.17. Sewage flows, unless otherwise indicated

> Crews, James E. and MaryAnn Miller, 1983. Forecasting Municipal and Industrial Water Use. IWR Research Report 83R-3. U.S. Army Corps of Engineers, Port Belvoir, Virginia.

\+ Watershed Protection Advisory Committee Meeting #3 held at Monroe County Public Safety Center May 16, 2003.

APPENDIX G

SELECTED WETLAND BMP REFERENCES

Technical Note 23

Practical Tips for Establishing Freshwater Wetlands

No shortage of books and manuals exist to design freshwater wetlands for mitigation, restoration or stormwater treatment. A recent series of articles by Garbisch and others, however, suggest that successful establishment of freshwater wetlands often hinges on writing practical and thorough construction specifications for the contractor who implements the design. Lack of attention to these important details can lead to serious problems in establishing a dense and diverse freshwater wetland.

Ed Garbisch founded the nonprofit corporation **Environmental Concern** (EC) in 1972 to educate, research, develop, and apply technology for the restoration and construction of wetlands. Over this period, EC has been involved in hundreds of tidal and non-tidal wetland establishment projects and has gained a great deal of experience in wetland propagation and creation techniques. Some of practical lessons they have learned on how to construct successful wetlands are summarized in Table 23.1.

Matching the design hydrology of the planned wetland with the appropriate wetland plant species is perhaps the most critical task in the design of diverse pondscapes. However, many wetland construction drawings fail to even show the design hydrology on the plan. Without a good understanding of the future water surface elevations and the frequency of inundation it is nearly impossible make the right match. Therefore, it is important to clearly show design hydrology on all construction drawings, both in plan view and cross section.

> Matching design hydrology with appropriate wetland plant species is perhaps the most critical task in planning diverse pondscapes.

Another frequently encountered problem is that while the planting plan may contain an extensive wetland plant list, most of the species may not be available in quantity from local wetland nurseries at the time of construction. As a consequence, plant species are substituted at the last minute that may

Table 23.1: Useful Construction Specifications for Freshwater Wetlands **(adapted from Garbisch, 1993, 1994)**

1. Always clearly specify the proposed wetland hydrology on construction plans and drawings to ensure that proper wetland plants are selected. Be wary of wetland projects that only rely on groundwater for water supply.
2. Consider procuring wetland plants through growing contracts with wetland nurseries. These contracts ensure that the desired species and quantities of wetland plants will be available to implement the planting plan.
3. Use care before automatically requiring topsoil amendments to prepare the substrate for planned wetlands. Topsoiling may not always be needed, can be expensive and may introduce undesirable species from the seedbank.
4. Although it is very important to quickly stabilize disturbed upland areas during construction, avoid specifying the use of Tall Fescue for this purpose, because of its allelopathic character.
5. Be careful when specifying hydroseeding to establish stormwater and other types of wetlands without strong confidence that seeds will germinate and root in the substrate before the site is inundated. Otherwise, both mulch and seeds will float away or be unevenly distributed through the marsh.
6. If seeding is to be used as the key propagation method to establish the wetland, be sure to specify the quantity of pure live seed needed, the commercial source of seed, seeding technique, filler, and window and other key aspects leading to a successful result.
7. Clearly specify watering requirements during the first growing season for seasonally or temporarily inundated wetland areas. Drought conditions can severely reduce growth and survivorship for these wetlands without initial watering by truck or by a shallow aquifer well.

not meet the original intent of the wetland plan. A new approach has been developed to assure the species and quantities of wetland plants are available at the time of construction.

This approach is termed *contract growing*. It involves executing an advance contract with a wetland nursery to grow and deliver a specified number and species of plants at a future date. An up-front deposit of 20 to 30% is normally required prior to growing. While contract growing means more planning and logistics, the practice does provide a better guarantee that the planned and most desirable wetland plant species will be available when needed.

Contract growing assures that species and quantities of wetland plants are available at the time needed for construction.

Garbisch also questions the common specification to topsoil the surface of created herbaceous wetlands prior to planting. Topsoiling can be expensive, and may not always be needed at most sites. This is due to the fact that herbaceous wetland plants typically produce a great deal of below-ground organic matter and quickly dominate the composition of the substrate within a few years. Garbisch does suggest topsoiling in clay, rock, or pyritic soils and topsoiling or soil as well as soil ammendment for forested or scrub shrub wetlands. But generally soil tests should be performed before recommending topsoil at a particular site.

Most wetland plans devote a great deal of attention to the selection of wetland plant species, but give relatively little thought to the ground covers used to vegetate disturbed areas around the pond or wetland. Many plans simply specify that these areas be stabilized through hydroseeding of KY-31 Tall Fescue *(Festuca aruninacea)*. Fescue has been widely specified for years for erosion control during and after construction. It does an admirable job in quickly establishing a dense turf cover. This cool season bunch grass also tolerates a wide range of moisture conditions and can invade many areas of the site.

Burchick (1993) questions the wisdom of specifying Tall Fescue as a ground cover around wetlands and ponds. He argues that Fescue frequently displaces native grass and meadow species, out-competes natural or planted tree seedlings, and can even invade portions of the wetland. Fescue is a tough competitor partly due to its allelopathic characteristics. It secretes organic acids that can impair the germination of native species. Consequently, Burchick recommends that less aggressive cool season grasses be utilized for erosion control purposes around pond and wetland areas.

Direct seeding is often the most economical technique to establish wetlands. Garbsich cautions that construction specifications should be very tight if direct seeding is called for. For example, many wetland seed mixes have relatively low purity and germination rates. Consequently, Garbisch observes that if a pound of pure, live seed is needed to establish a ground cover per unit area, and it has a 10% germination rate and 50% purity, then some 20 pounds will actually need to be broadcast to achieve the desired coverage. Consequently it is recommended to express direct seeding rates in terms of pure, live seed (pls). The specifications should either require that the source(s) of the seed be indicated, or require that they be field collected and tested for purity and germination rate.

Of equal importance are the seeding *window* and *filler*. The window is the optimal seasons and dates for a successful result. The filler represents the sand dilution needed for small seeds to ensure they are uniformly distributed over the planting area. Seeding specifications should also clearly state the technique and implements for the seeding operation, and whether this operation will be done in the wet or the dry. Hydroseeding of wetlands should be avoided unless the contractor has confidence that the seeds will germinate and root before the next runoff event. Otherwise, the mulch, tack and seeds will float away or become unevenly distributed.

The establishment of a dense and diverse wetland is the joint product of the design engineer, landscape architect, wetland nursery, and planting contractor. Thoughtful and clear construction specifications help assure that each individual performs their role well.

—TRS

References:

Burchick, M. 1993. The problems with tall fescue in environmental restoration. Wetland Journal. 5(2)-16.

Garbisch, E. 1993. The need to topsoil with mineral loam soils in planned wetland projects. Wetland Journal 5(2): 18.

Garbisch, E. 1994. The do's and don'ts of wetland planning. Wetland Journal. 6(1): 16-17.

Contact:

Ed Garbisch. President, Environmental Concern, Inc. , P.O. Box P, 210 West Chew Ave. St. Michaels, Maryland, 21663. (410) 745-9620.

Editors Note: Subscriptions to the quarterly *Wetland Journal* are available from Environmental Concern for $30 per year.