MALCOLM PIRNIE

INDEPENDENT ENVIRONMENTAL
ENGINEERS, SCIENTISTS
AND CONSULTANTS

Malcolm Pirnie, Inc.
104 Corporate Park Drive, Box 751
White Plains, NY 10602
T: 914.694.2100 F: 914.694.9286
www.pirnie.com

November 14, 2008

Mr. Lawrence S. Schopfer
Village Administrator
Village of Irvington
85 Main Street
Irvington, New York 10533

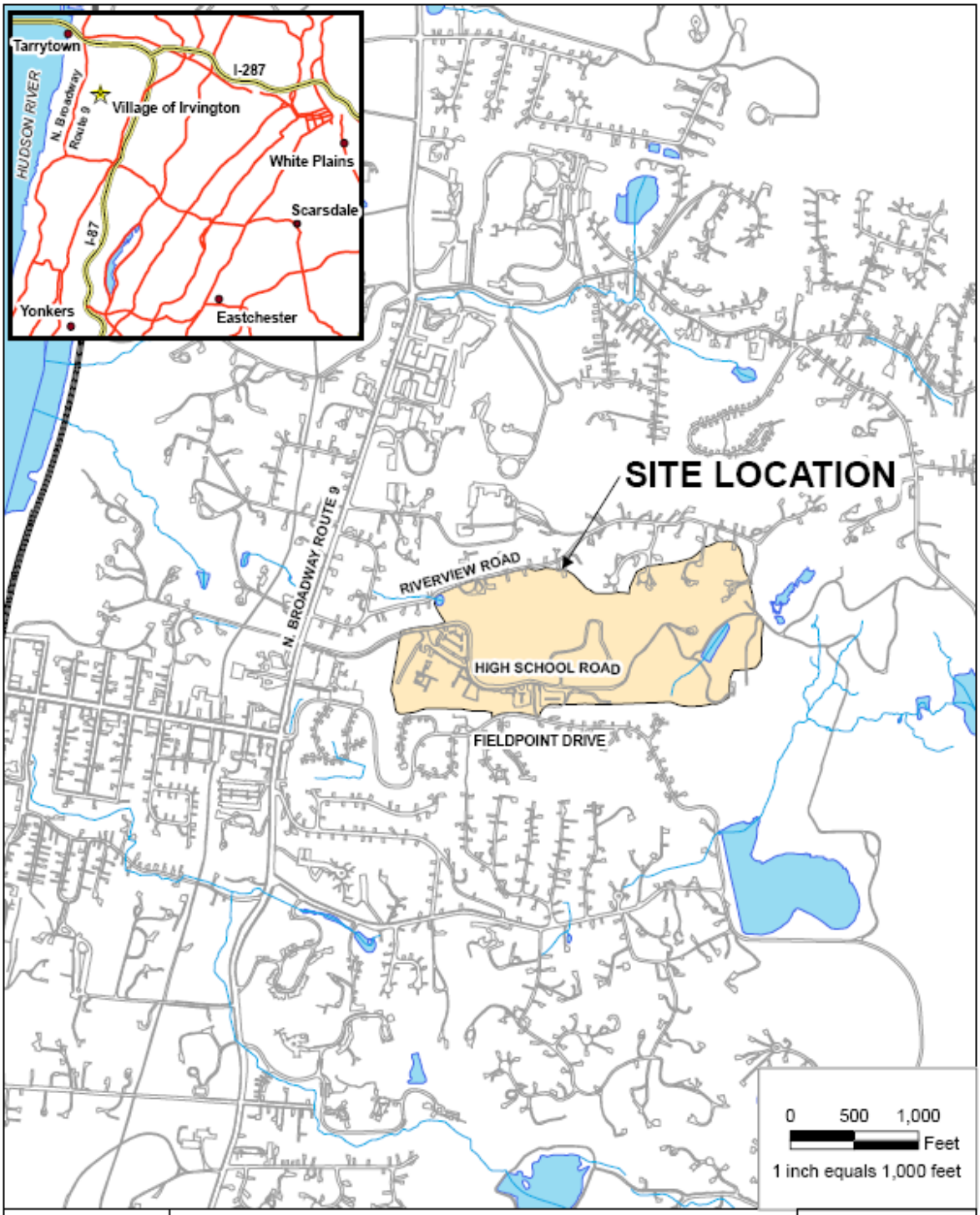
Re: Irvington Union Free School District's High School/Intermediate School Drainage Analysis – Final Submittal

Dear Mr. Lawrence:

This letter report documents Malcolm Pirnie Inc.'s review of the LAN Associates EPAS, Inc. (LAN) drainage report entitled *Draft Drainage Report for Irvington Union Free School District* and dated October 29, 2007. As part of the review, Malcolm Pirnie performed an independent analysis of pre-2003 stormwater conditions on the Irvington Union Free School District's High School/Intermediate School (IUFSD) property and areas draining through the school property.

The school property is located at the intersection of Route 9 and High School Road in the Village Irvington, Westchester County, New York. A vicinity map showing the property location is included as Figure 1. Downstream land owners to the north, west and south of the school property have reported increased stormwater runoff and degraded stormwater quality since improvements were made on the school property in 2003. The IUFSD is currently proposing additional improvements involving the following:

1. Replacement of the existing track infield with an artificial turf playing field;
2. Addition of tennis courts and associated parking; and
3. Expansion of existing playing fields on the east end of the school property.



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IUFSD High School/Intermediate School Drainage Assessment

Vicinity Map

Village of Irvington, New York

FIGURE 1

June 2008

The IUFSD is proposing to use current site conditions as the pre-development condition to analyze stormwater impacts associated with the improvements. To validate this approach, the Village of Irvington retained Malcolm Pirnie to review LAN's drainage report and to generate pre-development stormwater runoff estimates for the school property considering pre-2003 land conditions.

1. Review of LAN Associates EPAS, Inc. Drainage Report

Malcolm Pirnie performed a review of LAN's report entitled *Draft Drainage Report for Irvington Union Free School District* dated October 29, 2007. This report is included in digital format as Attachment 1 and summarizes LAN's analysis of stormwater discharges from the school property under both pre-development (pre-2003) and post-development (current) conditions. The analysis included the contribution of offsite runoff that flows through the school property.

The report document assumes that the 2003 improvements on the school property did not require coverage under the New York State Pollutant Discharge Elimination System (SPDES) general permit (GP). The GP-93-06 permit was applicable from August, 2 1998 through January 7, 2003. A copy of the GP-93-06 permit is included as Attachment 2. GP-93-06 was applicable for construction sites which disturbed five or more acres and the GP identified, at a minimum, the following requirements:

- Treatment of the first ½-inch of rainfall from improved areas (first flush); and
- Control of post-development peak flows for the 2-year design storm to pre-development levels.

Based on Malcolm Pirnie's review of the LAN report and comparison of pre- and post-2003 aerial photography, it appears that more than five acres of disturbance was proposed as part of the school improvements constructed in 2003 (designed in 2001). If more than five acres were disturbed as part of the improvements to the school property, coverage under the SPDES general permit should have been required. The original analysis performed as part of the school improvements and documented in the LAN report document did not address the first flush or 2-year design storm control requirements. These control requirements were also not addressed by the LAN post-construction analysis documented in the report document.

Malcolm Pirnie recommends that the Village of Irvington obtain the construction drawings associated with the 2003 school improvements along with the original drainage analysis to confirm the amount of disturbance that occurred associated with the project. If the disturbance exceeded five acres, the village could have the opportunity to discuss with IUFSD potential mitigation measures that could be incorporated into the design of future improvements.

The other omission noted in the LAN analysis is an evaluation of the pipe improvements referenced in the third paragraph of the introduction. Piping improvements have the potential to introduce flows to downstream drainage systems at higher peaks over shorter time periods. Given complaints received adjacent to Route 9, the potential impact of the pipe improvement project should be investigated.

The following Sections summarize our review of the LAN report. These Sections correspond with the sections in the LAN report document.

1.1 Introduction

As previously identified the piping improvements discussed in the introduction of the report document were not considered as part of the documented stormwater analysis. The impact of these piping improvements should be investigated further.

1.2 Public Meetings

Homeowners on Riverview Drive, Fieldpoint Drive and Route 9 all indicated that runoff quantity seemed to increase after the 2003 school construction while runoff quality deteriorated.

1.3 Methods of Analysis

The methods of analysis described in the drainage report were reasonable and in line with industry standard practices. However, no backup documentation of the analysis was included. Therefore, we cannot confirm reasonableness of the assumptions made for the analysis.

Survey data including locations and characteristics of storm sewer structures as well as topographic data were collected for the school property. These data were referenced in the Methods of Analysis section but not provided with the drainage report.

1.4 Pre-Construction Conditions

For the pre-development analysis, LAN divided the drainage area into five sub-basins as shown in Figure DA.01 taken from the drainage report. The following observations were made regarding the pre-development analysis documented in the drainage report:

- It appears that the proposed improvements disturbed more than five acres. If more than five acres were disturbed, in accordance with GP-93-06 requirements applicable at the time of design, the pre-development analysis should consider control of the 2-year design storm to pre-development levels. The analysis did not consider this requirement.

NJ Certificate of Authorization	
Eng'r. Nos.	GA0798876
Arch. Nos.	AC12A
Date	08/13/07
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RICHARD A. WOSTBROCK, PE

Title PROFESSIONAL ENGINEER License No. NY PE 079364

Revisions:

LAN ASSOCIATES

engineering • planning • architecture • surveying

448 GODWIN AVENUE, MIDLAND PARK, N.J. 07432 (201)447-8400

PRE-CONSTRUCTION DRAINAGE AREAS

IRVINGTON HIGH SCHOOL
40 NORTH BROADWAY
VILLAGE OF IRVINGTON
WESTCHESTER COUNTY, NEW YORK

Job No. 4.1091.01

File No. 10910102

DA.01

- Sub-basins A and E were associated with single discharge points but represent a combination of point and diffuse discharges. A distinction should be made to allow for clearer evaluation of post-development impacts.

- Sub-basin A includes offsite area between the school property line and Fieldpoint Drive. Based on a field investigation performed by Malcolm Pirnie on April 29, 2008, this area does not appear to be tributary to sub-basin A.

- Delineations for sub-basins B, C and D appear reasonable. However our interpretation of available pre-2003 topographic data and the associated boundaries of these sub-basins differs from the LAN report. These differences are likely due to the low resolution of topographic data available for review by Malcolm Pirnie.

- The area of 21.2 acres provided for sub-basin E appears low, particularly when compared with associated post-development sub-basin 9 (shown on Figure DA.02) which is smaller in size but reported to have an area of 24.0 acres.

- Curve numbers (CN), time of concentration (Tc), routing, stormwater management practice (SMP) characteristics and rainfall depth data used for model inputs were NOT included in the drainage report. Based on our assessment, the estimated pre-development peak flows for sub-basins A, B, C and D appear reasonable. The estimated pre-development peak flows for sub-basin E appear high considering sub-basin acreage. It appears the acreage for sub-basin E was incorrectly reported as described above.

The primary concern with the LAN analysis is the lack of consideration given to the control of the 2-year design storm. Otherwise, our stormwater analysis compared reasonably well with LAN's pre-construction analysis results. Malcolm Pirnie's stormwater analysis is documented in Section 2 of this letter report.

1.5 Post-Construction Conditions and Flow Comparison Analysis

For the post-development conditions, LAN divided the drainage area into ten sub-basins as shown on Figure DA.02. The following observations were made as part of our review of the post-development conditions analysis documentation:

- It appears that the proposed improvements disturbed more than five acres. If more than five acres were disturbed, in accordance with GP-93-06 requirements applicable at the time of design, the pre-development analysis should consider treatment of the

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RICHARD A. WOSTBROCK, PE

Title PROFESSIONAL ENGINEER License No. NY PE 079364

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LAN ASSOCIATES

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POST-CONSTRUCTION DRAINAGE AREAS

IRVINGTON HIGH SCHOOL
40 NORTH BROADWAY
VILLAGE OF IRVINGTON
WESTCHESTER COUNTY, NEW YORK

Job No. 4.1091.01

File No. 10910102

DA.02

- first ½-inch of runoff from improved areas as well as control of the 2-year design storm to pre-development levels. The analysis did not consider these requirements.
- While pre- and post-development sub-basin areas are roughly correlated in the report, it is ideal to establish common points for evaluation. As such, the table which summarizes these correlations omits post-development conditions from sub-basin 8.
- The report text for post-development sub-basins 1, 2 and 3 inadvertently refers to the eastern portion of the site as opposed to the western part of the site.
- Post-development sub-basin 2 includes the offsite area between the school property line and Fieldpoint Drive. However, based on field investigation, this area does not appear to be tributary to sub-basin A.
- The acreage for sub-basins 6 and 8 were not provided.
- The flow comparison analysis table provided on page 7 of the LAN report appears to add pre-development peak flows to the Fieldpoint collection pond while properly applying hydrograph addition techniques to calculate post-development peak flows at the same point. A standard method of calculating aggregate peak flows should be applied.
- The comparison of total site flows is not applicable and provides no technical value to the report document.
- CN, Tc, routing, SMP characteristics and rainfall depth data used for model inputs were not included in the drainage report. This information is needed to truly evaluate the reasonableness of post-construction peak flows provided in the drainage report.

When the LAN report is compared with our stormwater analysis which considers pre-2003 conditions, the post-construction flows presented in the LAN report appear reasonable. However, without performing a post-development stormwater analysis or without information on the assumptions made during LAN's post-construction stormwater analysis, it is difficult to draw firm conclusions regarding LAN's analysis.

The primary concern is the lack of consideration given to the control of the first flush and the 2-year design storm.

1.6 Stormwater Quality

The following observations were made during the review of the Stormwater Quality portion of the drainage report:

- Control of the first flush was not discussed in this section of the drainage report.
- The third paragraph refers to the east side of the Westwood development and the majority of the main school parking lot draining to the pond north of the school property. The third paragraph should state that the west side of the Westwood development drains to the pond north of the school property. During the cursory field visit, Malcolm Pirnie confirmed that the main school parking lot drains to the stormwater detention facility at the west end of the school property. It appears that the LAN analysis was performed correctly and was simply documented incorrectly.
- Given the nature and timing of construction in the areas draining to the pond north of the school property and the Fieldpoint basin, if the degradation of stormwater quality has occurred as alleged by area residents, it is likely that both the school and the Westwood development contributed to the degradation.

1.7 Catch Basin Grate Elevations

The point raised regarding the potential impact of catch basin grate elevations appears valid. The village should make an effort to investigate stormwater patterns during rainfall events and consider temporary or permanent solutions to address the issue of raised catch basins.

1.8 Analysis of Original Drainage Report & Design

The original stormwater analysis performed by John Meyer Consulting (JMC) dated May 15, 2001 was not provided to or reviewed by Malcolm Pirnie. However, the JMC analysis was described in the LAN report document as evaluating the 10-, 25-, 50- and 100-year storms. LAN offers the opinion that the JMC analysis was in compliance with the applicable stormwater requirements in 2001. As stated earlier, it appears that more than five acres were disturbed as part of the school improvements meaning coverage under the SPDES general permit would have been required. This would have required treatment of the first flush from the improved areas and control of the 2-year design storm to pre-development levels. It does not appear that the project design addressed these requirements.

1.9 Review of Conceptual Future Improvements

Three areas were identified for conceptual future improvements:

1. *Tennis Courts and Associated Parking* – Located in the vicinity of LAN pre-construction sub-basins D or E (sub-basins D and E shown on Figure DA.01 taken from the LAN drainage report). The described project has a likelihood of reducing long term sediment loads generated by the gravel parking areas which would be replaced with impervious surface. However, the construction process has the potential of increasing sediment loads from the site. Proper design of associated

construction and post-construction stormwater measures would be critical to control runoff quantities to pre-development levels and to protect receiving water quality. Depending on the actual location of the proposed improvements and the stormwater controls selected, dispersed surface runoff could be transformed into concentrated runoff.

2. *East Field Improvements* - Consists of expanding the baseball field located in LAN pre-construction sub-basin E (sub-basin E shown on Figure DA.01 taken from the LAN drainage report) and adding additional fields. Development in this area would require careful analysis of runoff patterns to ensure that pre-development conditions are maintained. As with proposed improvements identified in Item 1-Tennis *Courts and Associated Parking*, depending on the stormwater controls selected, dispersed surface runoff could be transformed into concentrated runoff.

3. *Meszaro Field Improvements* - Consists of replacing the existing grass track infield located in LAN pre-construction sub-basin C (sub-basin C shown on Figure DA.01 taken from the LAN drainage report) with artificial turf. The impact of the field improvements to stormwater runoff quantities will rely heavily upon design of the field subgrade and sub-surface drainage system.

With any proposed development, a change in land cover has the potential of increasing the magnitude and duration of stormwater runoff in a way that is noticeable to downstream property owners; even when post-development runoff peak flows are controlled to pre-development levels. Increased runoff durations can lead to the erosion of receiving channels and degradation of water quality. Sediment loads during construction can also degrade receiving water quality. All of these issues should be considered when designing proposed improvements such as those summarized above.

1.10 Drainage Improvements Independent from the Proposed Field Improvements

As drainage improvement alternatives outside of those associated with proposed field improvements, LAN discusses either providing additional storage of existing runoff or achieving the original 2003 design intent for gymnasium roof drainage by connecting the gymnasium roof drain to the underground detention system which was installed in 2003. Of the two solutions discussed in this section, only additional storage of existing runoff from the school property is likely to be noticeable by downstream property owners. Based on the post-construction analysis documented in the drainage report, connection of the gymnasium roof leader to the existing underground detention system will cause negligible impacts to downstream runoff levels.

1.11 Rainfall Data

The historical rainfall data referenced as Attachment 3 in this section of the LAN drainage report was not included with the drainage report provided to Malcolm Pirnie. Trends in rainfall patterns can affect perceptions of runoff magnitude and frequency. As was stated previously, changes in land use can also affect such perceptions.

1.12 Conclusions

The LAN drainage report concluded that stormwater detention on the school property would be necessary to influence the downstream property owners' perceptions of increased stormwater runoff quantities. The report further concludes that the proposed athletic field improvements would provide a suitable venue for adding this stormwater detention. It is unclear whether this conclusion refers to all three proposed improvement projects referenced in the drainage report or only the East Field and Meszaro Field improvements.

While the proposed improvements at Meszaro field could serve to further reduce stormwater peak flows to the small pond north of the school property, Malcolm Pirnie raises the following concerns:

1. The Meszaro Field improvements do not address apparent increased runoff to the Fieldpoint basin;

2. The Meszaro Field improvements depend upon the capability of the sub-surface drainage system to mimic or improve existing infiltration rates while also providing stormwater storage. This will require thorough analysis and design;

3. Further changes in land use have the potential to increase stormwater runoff volumes resulting in sustained stormwater releases. These sustained releases can in turn degrade receiving channels;

4. The proposed improvements could potentially impact runoff patterns by transforming diffuse surface runoff into point source runoff; and

5. Construction site runoff from the proposed improvements could potentially degrade receiving water quality.

It will be necessary for the Village of Irvington to perform a thorough review of any proposed improvements on the school property.

Conclusions in the LAN report related to stormwater quality improvements relied on potential benefits of converting selected gravel parking areas on the school property to pavement. For a net stormwater quality benefit to be realized in this manner, it will be imperative to effectively

control erosion and sedimentation during the construction process. Control of the first flush (now referred to as the water quality volume (WQv) in the current New York State Stormwater Management Manual) would also be necessary. If the original school improvements are determined to have been subject to SPDES general permit requirements, any future design should consider changes with respect to pre-2003 conditions.

In addition to the stormwater quality improvements discussed in the drainage report, Malcolm Pirnie recommends that the village evaluate the feasibility of performing maintenance on the small pond north of the school property. During Malcolm Pirnie's field visit to the school property, it was noted that normal pool volume of the small pond was greatly diminished due to deposits of sediment and organic material. This loss of volume does not impact the capability of the pond to attenuate stormwater peak flows. However, sediments and organic material in the pond are readily available for re-suspension and transport downstream during periods of high flow. Malcolm Pirnie recommends investigating the feasibility of removing the organic material and sediment from the pond and returning the pond bottom to its original grade.

2. Independent Stormwater Analysis of Pre-2003 Conditions

Malcolm Pirnie performed an independent stormwater analysis of pre-2003 conditions on the school property. The analysis was intended to validate the pre-construction analysis documented in the LAN drainage report. The analysis was also intended to determine whether the use of existing site stormwater peak flows as the benchmark for evaluating the stormwater impacts of future proposed development on the school property is appropriate.

The independent stormwater analysis was performed using Bentley's PondPack, version 10.0. PondPack utilizes the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) Technical Release 55 (TR-55) methodology. This method of analysis requires the development of drainage area sub-basins along with associated CN, Tc and flow routing data. PondPack also allows the modeler to incorporate storage characteristics associated with SMPs.

The following sections summarize data collection efforts, model development, model results and conclusions.

2.1 Data Collection

Various datasets were collected in support of the pre-2003 stormwater analysis for the school property. These datasets are described below.

2.1.1 Contours

Best available contour data with ten foot intervals were obtained from the Westchester County GIS Department to support the development of sub-basin delineations and likely stormwater flow paths. The contours were derived by Westchester County using a photogrammetric base map of the county from the spring of 2000. Due to the course resolution of the contour data, sub-basin delineations and flow path interpretations developed during the analysis are approximate.

2.1.2 Aerial Photography

Available aerial photography was used to supplement and validate land use coverages for the school property and surrounding areas. Land use data, when coupled with soil characteristic data, is useful for estimating runoff potential in a drainage area through the calculation of CN values. Two aerial photography datasets were obtained from Terraserver. The first dataset was collected in 2001 with a six inch resolution. The photographs were taken during land clearing on the school property and showed the extents of grading and resurfacing during the 2001 construction. The second dataset was collected in 2002 with a two foot resolution and showed the stabilized school property prior to 2003 construction activity. Due to the poor resolution of the 2002 aerial photography, likely pre-2003 land use coverages were interpreted utilizing both the 2001 and 2002 data.

A third aerial photography dataset was obtained from the New York State GIS Clearinghouse. This dataset was collected in 2004 with a six inch resolution and was used to validate interpretations made from the 2001 and 2002 data.

2.1.3 Land Use

Land use data were obtained from the Westchester County GIS Department and depicted existing structure, road and water features on the school property and in the surrounding areas. The structure coverage was derived by Westchester County using photogrammetric methods applied to the county's 2004 base map. Land use data were checked against pre-2003 aerial photography and edited as necessary to properly depict pre-2003 conditions. The final land use coverage was used along with soil characteristic data to calculate CN values. Figures 2a, 2b and 2c show the land use coverage developed for the school property and the surrounding area. The figures also demonstrate the available aerial photography available from 2001, 2002 and 2004, respectively.

2.1.4 Soils

Soil data was obtained from the NRCS to support the development of CN values. The data is from the 2006 Soil Survey (SSURGO) for Westchester County. Soil types on the school

property and the surrounding areas are predominantly hydrologic soil group (HSG) B. Some Udorthents (smoothed) soils were present within the area of interest and had no HSG classification. These soils were assumed to be HSG B for analysis purposes. Figure 3 shows the soil data collected for the school property and the surrounding area.

NOTE: AERIAL PHOTOGRAPH SOURCE: TERRASERVER. PHOTOGRAPHS WERE TAKEN IN 2001.

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0 100 200 300 Feet

1 inch equals 300 feet

IUFSD High School/Intermediate School Drainage Assessment

Landuse Coverage

Village of Irvington, New York

FIGURE 2a

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NOTE: AERIAL PHOTOGRAPH SOURCE: TERRASERVER. PHOTOGRAPHS WERE TAKEN IN 2002.

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0 100 200 300 Feet

1 inch equals 300 feet

IUFSD High School/Intermediate School Drainage Assessment

Landuse Coverage

Village of Irvington, New York

FIGURE 2b

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NOTE: AERIAL PHOTOGRAPH SOURCE: TERRASERVER. PHOTOGRAPHS WERE TAKEN IN 2004.

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0 100 200 300 Feet

1 inch equals 300 feet

IUFSD High School/Intermediate School Drainage Assessment

Landuse Coverage

Village of Irvington, New York

FIGURE 2c

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NOTE: AERIAL PHOTOGRAPH SOURCE: TERRASERVER. PHOTOGRAPHS WERE TAKEN IN 2001. SOIL DATA IS FROM THE 2006 SOIL SURVEY (SSURGO) FOR WESTCHESTER COUNTY.

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0 100 200 300 Feet

1 inch equals 300 feet

IUFSD High School/Intermediate School Drainage Assessment

Soil Characterization

Village of Irvington, New York

FIGURE 3

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2.1.5 Site Plans

The Village of Irvington provided Malcolm Pirnie with construction drawings developed by Cronin Engineering and entitled *Subdivision and Site Development for Westwood (revision 10, 12/11/02)*. The Westwood development is adjacent to the school property and was also under construction in 2003. A large portion of the Westwood development drains through the school property. The drawing set did not include proposed access road or school improvements and did not provide supporting data for the drainage analysis. However, the drawings were used to interpret pre-2003 conditions for the Westwood property.

The Village of Irvington also provided a scan of sheet SP-1.3 from the above-referenced drawing set. This sheet shows the proposed access road and school improvements associated with the Westwood Development. The sheet was used to interpret pre-2003 conditions for the portion of the school property shown. Sheet SP-1.3 is included with this letter report as Attachment 3.

2.1.6 Site Visit

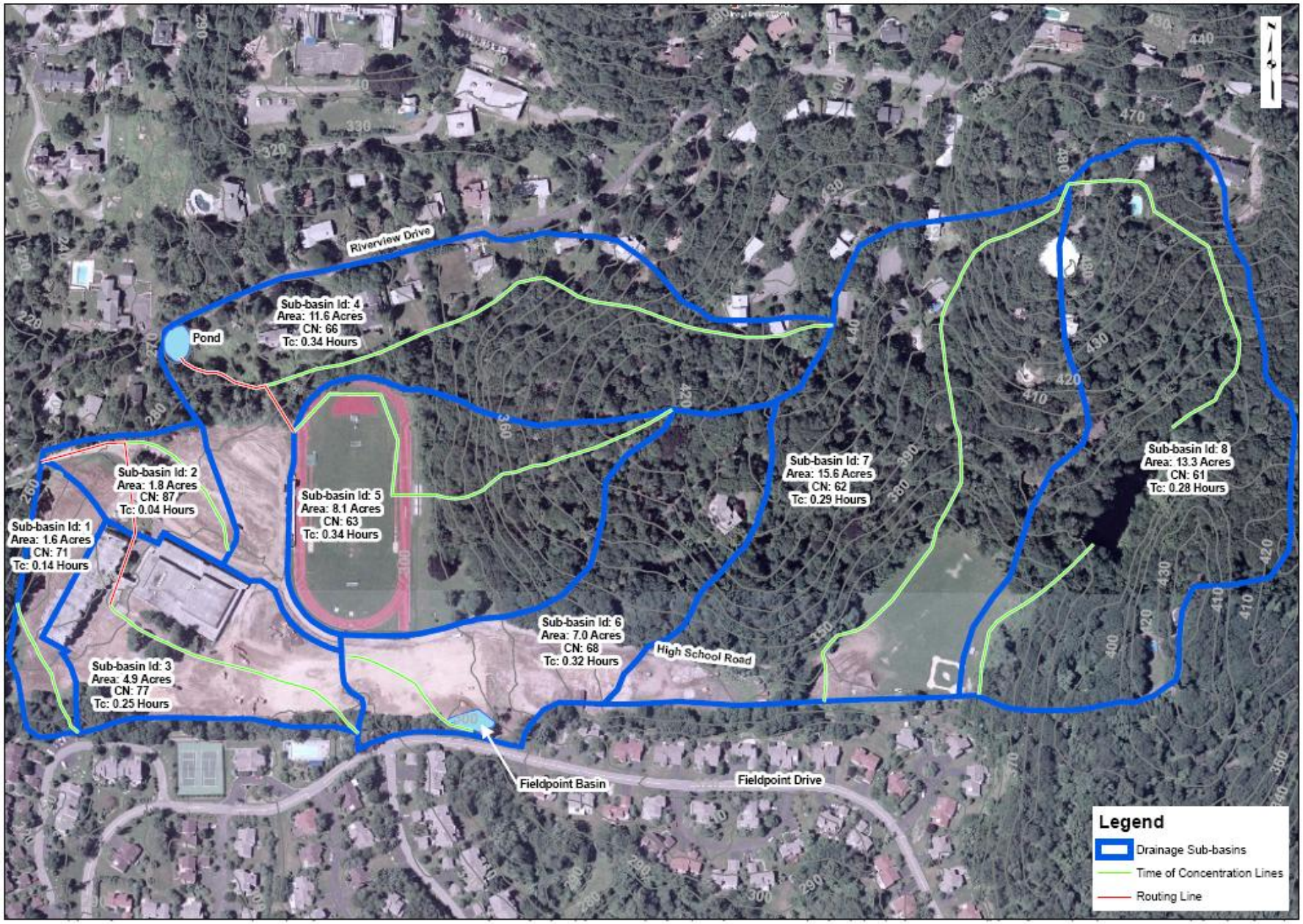
A cursory site visit was conducted on April 29, 2008 to assess current conditions on and surrounding the school property, to support the review of the LAN drainage report and to validate the datasets summarized above. Approximate field measurements of pertinent drainage features were collected and used during model development.

2.2 Model Development

The PondPack model requires the following information:

- Sub-basin Areas
- CN Values
- Tc Values
- Routing Data
- SMP Characteristics
- Rainfall Data

Figure 4 shows the sub-basin areas, Tc paths and routing paths along with associated CN and Tc values. Figure 5 shows the model schematic representing the drainage characteristics of the



NOTE: AERIAL PHOTOGRAPH SOURCE: TERRASERVER. PHOTOGRAPHS WERE TAKEN IN 2001.

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0 100 200 300 Feet

1 inch equals 300 feet

IUFSD High School/Intermediate School Drainage Assessment

Sub-basin Overview

Village of Irvington, New York

FIGURE 4

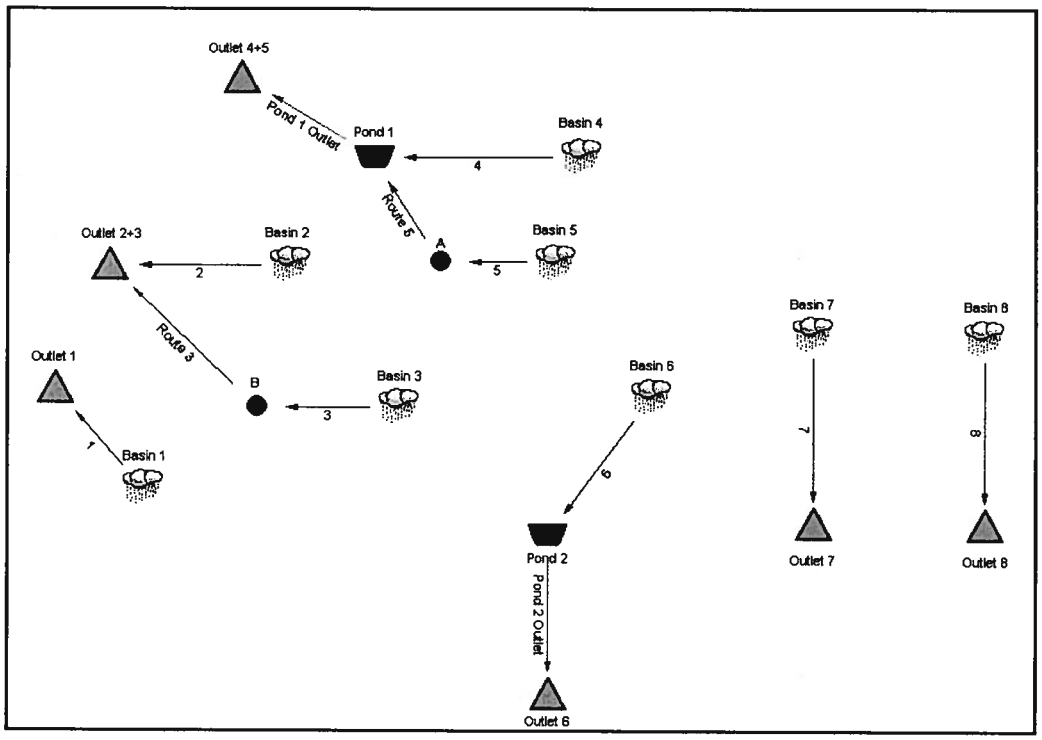
June 2008

school property and surrounding areas. The development of each of these datasets is described below.

2.2.1 Sub-basin Areas

Malcolm Pirnie identified points where stormwater was released from the school property under pre-2003 conditions. In some cases, stormwater was released from the school property as diffuse surface flow rather than at a discrete discharge point. In such cases, the property boundary was considered to be the analysis boundary to facilitate comparison with the LAN analysis. Sub-basins were delineated to each point or downstream property boundary in ESRI's ArcView GIS software, version 9.1 based on the datasets described in Section 2.1.

Figure 5 – Model Schematic



2.2.2 CN Values

CN values help to determine the amount of rainfall that will be converted into runoff. These values were calculated in ArcView based on the soil and land use coverage datasets. Table 1 provides the CN values, by land use, applied during the analysis. Composite CN values for each sub-basin are provided on Figure 4.

Table 1 – Soil and Land Use

			Curve Number by Hydrologic Soil Group			
Code	Land Use	Detail	A	B	C	D
52	Lakes	Body of water	100	100	100	100
76	Transitional Areas	Fair	75	80	85	90
141	Paved	Parking Lots & Roofs	98	98	98	98
144	Gravel Road	Gravel with Right of Way	76	85	89	91
181	Urban Open-space	Grass <50%	68	79	86	89
182	Urban Open-space	Grass 50%-75%	49	69	79	84
183	Urban Open-space	Grass >75%	39	61	74	80
434	Woods	Poor	45	66	77	83
435	Woods	Fair	36	60	73	79
436	Woods	Good	30	55	70	77

2.2.3 Tc Values

Tc values represent the time it takes for a drop of water to flow from the hydraulically most distant point in a sub-basin to that sub-basin's outfall. These values were developed for each sub-basin using TR-55 methodology which considers the total travel time associated with sheet flow, shallow concentrated flow and channel flow regimes. Tc calculation sheets are included with this letter report as Attachment 4. Tc paths and values for each sub-basin are shown on Figure 4.

Table 2 – Rainfall Depth by Return Period

1-year	2-year	10-year	25-year	50-year	100-year
2.8 inches	3.5 inches	5.0 inches	6.0 inches	7.0 inches	7.5 inches

The modeling was performed considering the SCS Type III rainfall distribution which is appropriate for Westchester County.

2.3 Model Results

Malcolm Pirnie's interpretation of critical outlet points and associated sub-basin delineations differed from those documented in the LAN drainage report. For this reason, a direct comparison of results cannot be made for some of the sub-basins. However, results from the Malcolm Pirnie analysis can be used to evaluate the reasonableness of the LAN pre-construction analysis results. The routing and SMP Characteristics model inputs are provide in Attachments 5 and 6 respectively.

Table 3 provides a summary of peak flows by sub-basin and return period.

Table 3 – Sub-basin Peak Flow by Return Period

		Peak Flow (cfs)					
Sub-basin	Area (acre)	1-year	2-year	10-year	25-year	50-year	100-year
1	1.6	0.9	1.6	3.3	4.6	5.9	6.5
2	1.8	2.9	4.0	6.4	8.0	9.5	10.3
3	4.9	4.0	6.2	11.4	15.0	18.7	20.5
4[a]	11.6	3.4	7.1	16.9	24.3	32.3	36.5
5[a]	8.1	1.4	3.3	8.8	13.1	17.8	20.2
6[b]	7.0	2.4	4.4	9.4	13.2	17.0	19.0
7	15.6	2.8	6.6	17.7	26.3	35.7	40.6
8	13.3	1.8	4.6	13.6	20.7	28.7	32.8

[a]*Peak flows provided do not reflect attenuation impacts of the small pond north of the school property.*
[b]*Peak flows provided reflect attenuation impacts of the Fieldpoint basin.*

Table 4 provides a general correlation between the LAN pre-construction sub-basins documented in the drainage report and the Malcolm Pirnie pre-2003 sub-basins.

Table 4 – Correlation between LAN and Malcolm Pirnie Sub-basins

LAN Pre-construction Sub-basin	Malcolm Pirnie Pre-2003 Sub-basin
A	1, 2 and 3
B	4
C	5
D	6
E	7 and 8

Table 5 summarizes the pre-construction peak flows provided in the LAN drainage report to facilitate comparison with the Malcolm Pirnie flows provided in Table 2. Note that the drainage report did not provide peak flow values for the 2-year storm.

Table 5 – LAN Pre-construction Peak Flow by Return Period

		Peak Flow (cfs)					
LAN Pre-construction Sub-basin	Area (acre)	1-year	2-year	10-year	25-year	50-year	100-year
A	10.7	4.558	N/A	16.20	22.30	27.35	31.86
B	6.4	2.111	N/A	9.416	13.34	16.63	19.58
C	10.5	2.794	N/A	13.97	20.17	25.40	30.13
D	5.3	1.412	N/A	7.058	10.19	12.84	15.22
E	21.2	4.820	N/A	30.70	45.83	58.75	70.52

The sub-basins providing the clearest basis for comparison are Malcolm Pirnie's sub-basins 4, 5 and 6 and LAN's pre-construction sub-basins B, C and D. While drainage area estimates differ, peak flows compare reasonably well.

As stated in Section 1.5, Malcolm Pirnie was not able to make a clear determination regarding the adequacy of the post-construction analysis documented in the drainage report. A comparison of flow per acre values for the pre- and post-construction peak flows documented in the drainage report show an increase as would be expected. Malcolm Pirnie would need additional supporting information or would need to perform an independent post-2003 stormwater analysis to determine the accuracy of the LAN post-construction analysis.

2.4 Conclusions

The pre-construction flows in the LAN drainage report appear to be reasonable and reflect conditions on the school property prior to the construction that occurred in 2003. However, the LAN analysis did not consider the 2-year storm as is required for projects disturbing five acres or more. Malcolm Pirnie recommends the following action items for the Village of Irvington:

1. Obtain the construction drawings associated with the 2003 school improvements along with the original drainage analysis to confirm the amount of disturbance that occurred associated with the project. If the disturbance exceeded five acres, the village could discuss potential mitigation measures with the IUFSD that could be incorporated into the design of future improvements.

2. Verify the acreages for pre-construction sub-basin E and post-construction sub-basins 6, 8 and 9.

3. Identify the nature of the piping improvements mentioned in the LAN drainage report introduction and evaluate the likely impact caused by these improvements.

4. Perform inspections during at least two substantial rain events at key catch basins both inside the Westwood development and on the school property to evaluate potential impacts of raised catch basins and the potential need for modifications.

5. Track proposed improvements on the school property and perform a thorough review of associated stormwater controls.

6. Investigate the feasibility of removing the organic material and sediment that has accumulated in the small pond north of the school property.

Malcolm Pirnie greatly appreciates the opportunity to service the stormwater needs of the Village of Irvington. Please contact me at 914-641-2731 should you have any questions regarding the information provided in this letter report.

Very truly yours,

MALCOLM PIRNIE, INC.

Richard Franzetti, PE, BCEE

Project Manager

CH

0162079

Attachment 1- LAN's report entitled *Draft Drainage Report for Irvington Union Free School District* dated October 29, 2007

VILLAGE
cc BOT
H Neale
E Marron
G Nilsson
E. Schopfer

NOV 20 2007

—DRAFT—
DRAINAGE REPORT
FOR
IRVINGTON UNION FREE SCHOOL DISTRICT
40 NORTH BROADWAY
VILLAGE OF IRVINGTON
WESTCHESTER COUNTY, NEW YORK

EXECUTIVE SUMMARY

LAN Associates EPAS, Inc. was retained by the Irvington Union Free School District to analyze stormwater drainage conditions at the Irvington Union Free School District's High School/Intermediate School (IMS/IHS) campus as well as to address the IUSFD's conformance with NYS stormwater regulations on the IMS/HIS campus.

LAN's analysis was performed in order to determine the nature and possible causes for apparent additional runoff as reported by owners of neighboring properties as well as to predict the effects of proposed field improvements on future stormwater runoff. LAN performed a detailed survey of the campus and a review of all pertinent documents and records.

LAN has determined that stormwater runoff that leaves the campus originates from both on-campus and off-campus sources. Off-campus runoff originates from uphill properties adjacent to and beyond the campus. These include much of the Westwood development as well as other residential properties. Stormwater runoff leaves the campus from the north, south and west.

LAN identified 4 causes for the apparent changes to the drainage conditions on and around the campus:

1. The 2003 school construction affected some drainage patterns on the campus as follows:
   - a total outflows are now less than the total pre-construction outflows
   - b peak-flows to the pond north of the school property have increased slightly for 1-year storms
   - c peak-flows to the Fieldpoint drainage pond south of the school property have increased slightly for the 100-year storm
   - d peak-flows to High School Road have decreased,

2. The Westwood development, as designed and built to-date, redirected some stormwater flow from the pond north of the school property to the Fieldpoint pond and:
   - a was reviewed and approved by the Village of Irvington
   - b flows to Fieldpoint from Westwood via the school campus, per regulation, should be less than or equal to flows prior to construction
   - c Westwood construction is not yet complete and runoff may change (a full review of the entire Westwood development was not performed as part of this analysis)

3. A number of catch basins on both the IMS/IHS campus as well as Westwood (in their current, apparently unfinished condition) are above the pavement level; though difficult to quantify, this condition may prevent some stormwater from entering those catch basins and would result in flow increases to the Fieldpoint basin as well as to the pond north of the campus

4. Based on 10 years of measurement from nearby Dobbs Ferry, total monthly rainfall has increased 40% from an average of 3.75 inches per month to 5.25 inches per month

LAN advises that campus stormwater management can be improved by:

1. adding additional stormwater storage
2. releasing stormwater at a slower rate over a longer period of time
3. Westwood immediately improving or completing their catch basins to more effectively collect stormwater
4. adjusting some campus catch basins to more effectively collect and direct stormwater

LAN's conclusions include the following:

1. accompanied by adding increased stormwater storage, implementation of Meszaros Field playing surface improvements would achieve decreases to outflow directed to the pond north of the campus
2. accompanied by adding increased stormwater storage, improvements made to East Field access, layout and playing surfaces could help achieve reductions to south outflows
3. independently implemented lesser stormwater management improvements, repairs and corrections on the campus could, in part, counteract the small increases in flow associated with the 2003 construction but would not benefit the campus itself
4. completion of the Westwood project, especially in street paving as it affects catch basin efficiency, will cause significant improvement to campus inflows and outflows though it may not be easily quantifiable
5. adjustments to IMS/IHS street paving in order to affect catch basin efficiency will cause some improvement to campus outflows though it may not be significant
6. because stormwater regulations regulate proposed changes to a site and not existing conditions, stormwater that currently leaves the IMS/IHS site is permissible insofar as the school site design was reviewed and approved by the Village of Irvington under stormwater regulations in force at the time and it was built according to those approved plans
7. IMS/IHS site outflows could also be reduced if the IUFSD were to provide storm water management <u>beyond</u> that required by New York State stormwater regulations

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* stormwater outflow is legal (conforming) when all improvements made to a site were made in conformance with approval from all governmental agencies having jurisdiction over said project; the 2003 IUSFD IMS/IHS school construction design was designed and reviewed per contemporary applicable stormwater regulations and permits were granted for said construction; insofar as the improvements were constructed per an approved design, stormwater that leaves the site is legally permissible

INTRODUCTION:

LAN Associates EPAS, Inc. has been retained by the Irvington Union Free School District to perform a comprehensive drainage study of the stormwater drainage from their property on High School Road in Irvington, NY. The school has heard concerns from neighboring property owners regarding the quantity and quality of stormwater leaving the site. In an effort to determine if there exist stormwater problems with the quantity/quality of stormwater leaving the High School/Middle School site, the district has hired LAN to analyze the stormwater condition at the site, and, based on the results of the analysis; provide recommendations to the district for ways to mitigate any stormwater problems. Furthermore, LAN was asked to review the proposed athletic field improvements for their potential effect to the stormwater condition on the site.

In 2003, a number of improvements were made to the site. Three new buildings were constructed, as well as a new parking lot to replace the old main parking lot. A number of stormwater improvements were made at this time, including an extended detention basin as well as a subsurface stormwater detention structure, and associated piping and stormwater infrastructure.

Also in 2003, a separate project to upgrade the stormwater piping in High School Road was performed. The purpose of this project was to safely capture and convey stormwater from the High School/Middle School site down High School Road into the stormwater system in NYS Route 9.

PUBLIC MEETINGS:

LAN attended two public meetings set up by the Irvington Union Free School district to interact with the neighbors and bring to light any apparent drainage problems that may or may not be occurring on or adjacent to the school property. Attachment #1 are the field memos prepared by William T. Manning of LAN, who attended both meetings, as well as a list of neighbors that identified themselves as having problems with drainage.

The drainage issues that were discussed included Riverview Drive, Fieldpoint Drive, and Route 9 (specifically one dwelling on the opposite side of Route 9). The homeowners on Riverview Drive and Fieldpoint Drive, both downhill from the school property, all indicate that runoff seems to have increased since the 2003 school improvements, and that stormwater quality has degraded.

As a result of the information brought to light in these public meetings, LAN paid particular attention to these areas of drainage, performing both extra surveying and extra field investigations along both Riverview Drive and Fieldpoint Drive.

METHODS OF ANALYSIS:

To determine if the 2003 school construction may have resulted in any changes in stormwater flow to its downhill neighbors, LAN performed an analysis of the stormwater conditions before and after the 2003 construction. Pre-construction topographic data was obtained primarily from the "Existing Conditions" plans for the school construction, prepared by Peter Gisolfi Associates, and dated 1/19/00. Because the High School/Middle School property receives stormwater flow from its uphill neighbors, additional uphill topography was required for the stormwater analysis. This information was gathered from a number of sources. United States Geological Survey (USGS) maps of the area were used to provide offsite topographical information (White Plains Quadrangle). Approved plans for the uphill "Westwood" development (by Cronin Engineering, P.E., P.C.) were helpful to determine topography both before and after construction of the road and drainage infrastructure of the Westwood development. Sections of the Westwood development were constructed at roughly the same time as the school construction. For the purposes of our analysis, the pre-construction conditions were assumed to include the original paved driveway that serviced the Augusto House, but none of the new Westwood roads. The post-construction conditions include any part of the Westwood development built to date. Aerial photographs were also used to locate off-site roads, houses, and other structures that would contribute to stormwater flow.

The post-construction conditions are based on current conditions at the High School/Middle School property. In order to properly model the current stormwater patterns of the subject site, LAN performed a topographic survey of the site. LAN's surveyors collected detailed topographic information of the entire High School/Middle School campus, paying particular attention to drainage. Stormwater structures were surveyed, and inverts were measured to provide a survey with sufficient detail to determine the stormwater patterns of the site. This survey has been made enclosure #1. Offsite information was gathered from the same sources as existing conditions, including the USGS maps, aerial photographs, and the Westwood development plans.

Based on all this data for pre and post-construction conditions, a stormwater computer model was built to model the stormwater conditions before and after the school construction.

The pre and post-construction site flows were analyzed using the SCS Unit Hydrograph Method. Pre-construction and post-construction site features, impervious areas, curve numbers, times of concentration, rainfall data, and other variables were input into the drainage analysis software, including volume and overflow characteristics of the subsurface retention structure.

The hydrographs were computed using Hydraflow Hydrographs 2004 software, utilizing the SCS Unit Hydrograph Method for 24 hour storm calculations and a Type III unit hydrograph with 24-hour rainfall for Westchester County based on TR55 rainfall charts, as well as Westchester County stormwater standards.

PRE-CONSTRUCTION CONDITIONS:

Before the 2003 construction, the school property consisted of two buildings, a paved parking lot, and a number of athletic facilities, including two athletic fields. For the purpose of analysis, the site was broken up into five separate drainage areas that each receive and outflow stormwater to a different outfall location or in a different manner (i.e. via a pipe vs. via surface flow).

Pre-Construction Stormwater Area "A":
This area, consisting of 10.7 acres, encompasses the two original school buildings and their surrounding area, including a portion of the original paved main parking lot. This area drains to High School Road.

Pre-Construction Stormwater Area "B":
This area, consisting of both onsite and offsite areas, contains the northern part of the original paved parking lot and a portion of the roadway leading from the parking lot to the eastern portion of the site. This area also contains the offsite area north and east of the main athletic field. This entire area drains via surface flow into the small pond north of the school property. This area contains 6.4 acres.

Pre-Construction Stormwater Area "C":
This area represents the area that drains to Meszaro Field, including the field itself and areas uphill of the field that that drain to the field drainage system, which is collected on and around the field and discharged into a swale that eventually leads to the small pond north of the school property. The field drainage system receives flow from the onsite area south of the field, as well as from a large section of land uphill and to the east of the field, which consists of onsite and offsite areas, including a large portion of the Westwood development. This area contains 10.5 acres.

Pre-Construction Stormwater Area "D":
This area consists of onsite and offsite areas that drain via surface flow into the stormwater collection basin at the south side of the school property, straddling the property line between the school property and the Fieldpoint development. This area also contains a portion of the uphill land that is part of the Westwood development, as well as much of the school property between the school buildings and East Field. This area contains 5.3 acres.

Pre-Construction Stormwater Area "E":

This area contains all of East Field, as well as the large area to the north and east of the field, all of which drains via surface flow onto the properties along Fieldpoint drive, south of the school property. Part of this area is collected by a drainage ditch that flows down the slope near the south-east corner of East Field onto the neighboring property to the south. The entire area totals 21.2 acres.

The following table represents the peak flows (in cubic feet per second) for each analyzed storm event for each of the pre-construction drainage areas:

Drainage Area	1-Year Storm	10-Year Storm	25-Year Storm	50-Year Storm	100-Year Storm
A	4.558	16.20	22.30	27.35	31.86
B	2.111	9.416	13.34	16.63	19.58
C	2.794	13.97	20.17	25.40	30.13
D	1.412	7.058	10.19	12.84	15.22
E	4.820	30.70	45.83	58.75	70.52

POST-CONSTRUCTION CONDITIONS:

As previously discussed, the post construction conditions reflect the current conditions at the site. The post-construction site was broken into nine areas, with one subarea, totaling ten areas. The site was broken down into more areas because with the improvements to the site, there are more distinct areas that collect stormwater runoff in different ways. The pre-construction and the post-construction drainage areas are roughly correlated in the following way:

Pre-Construction Area	Post-Construction Areas
A	1, 2, & 3
B	4 & 5
C	6
D	7 & 7U
E	9

It should be noted that these correlations are based on common outfall locations. The pre-construction and post-construction areas are not equal in area, and the drainage boundaries have changed considerably between the two conditions.

The descriptions of the post-construction areas are as follows:

Post-Construction Stormwater Area "1":
This area consists of the eastern portion of the site that drains via surface flow in the easterly direction from the site. Generally, it is the area of the subject site downhill from the east detention basin. This area consists of 1.9 acres.

Post-Construction Stormwater Area "2":
This area includes areas that drain into the east detention basin, including all or part of all five of the school buildings, and their surrounding areas. This area consists of 7.5 acres.

Post-Construction Stormwater Area "3":
This area consists of the majority of the front parking lot that is collected by catch basins and piped into the east detention basin. This area consists of 1.7 acres.

Post-Construction Stormwater Area "4":
This area consists of the area that drains into the small pond north of the school property via surface flow. The majority of this area is offsite area, generally east of the pond, extending into the Westwood development, and up to the edge of the High School/Middle School track and the edge of the main parking

lot. This area is similar to pre-construction area "B", but missing the large portion of the pre-construction parking lot. Area "4" consists of 5.0 acres.

Post-Construction Stormwater Area "5":
The area is a small area of the center of the High School/Middle School site that consists of a portion of the proposed parking lot, access road, and some of the courtyards between the buildings. This area is collected by catch basins in the access road and piped into a drainage swale that leads to the small pond north of the school property. This area consists of 1.2 acres.

Post-Construction Stormwater Area "6":
This area consists of the post-construction area that drains to the Meszaro Field. This area is similar to pre-construction area "C", but with a different southern boundary due to onsite construction of new drainage structures, and a different eastern boundary due to construction of a new road (Stearns Ridge) with associated drainage at the Westwood Development.

Post-Construction Stormwater Area "7":
This area drains to the stormwater collection basin at the south side of the school property, straddling the property line between the school property and the Fieldpoint development. It includes a portion of the gymnasium building and the gravel parking lots to the east of the gymnasium. A sub-section of this drainage area drains into a subsurface detention basin. This sub-section is labeled "7U" and is described below. Area "7" is 2.4 acres.

Post-Construction Stormwater Area "7U":
As discussed in area "7" above, this area drains specifically to the subsurface detention structure beneath the parking lot east of the gymnasium building. This detention structure was constructed during the 2003 school improvements, and consists of a series of "Cultec" infiltration chambers. This detention structure drains via an outlet structure and into the adjacent stormwater collection basin. According to the design drawings, the subsurface structure was meant to receive flow from both the parking lot that it was built beneath, as well as approximately half of the gymnasium building. Based on field inspections, it appears that the pipe that was meant to convey the stormwater from the roof leaders of the gymnasium to the catch basin in the parking lot does not do so. Instead, it appears that this pipe was run directly into the stormwater collection basin, bypassing the subsurface detention structure. Area "7U" consists of 0.6 acres.

Post-Construction Stormwater Area "8":
This area consists of a large portion of the Westwood development and a section of High School Road that runs toward East Field. The area within the Westwood development is collected by a series of catch basins and pipes and directed into the stormwater basin at the downhill side of the Westwood development. The outfall from this basin, as well as areas downhill of the basin that are collected by basins in High School Road, are piped through an easement across the High School/Middle School property and to the stormwater collection basin. The Westwood basin was modeled as part of the analysis, reflecting the current conditions at the site. It should be noted that the Westwood basin seems to have been designed to accommodate flow from the fully built-out condition of Westwood.

The current state of the development produces considerably less runoff than the fully built-out condition, and this would reflect higher peak flows from this area when the time comes that Westwood is fully constructed.

Post-Construction Stormwater Area "9":
This area is the post-construction area that drains from the area of East Field. Like pre-construction area "E", this area drains via surface flow onto the properties along Fieldpoint drive. A portion of the area that previously drained to this area is now collected by the Westwood stormwater collection system. Other than that, this area remains the same as area "E". Area "9" consists of 24.0 acres.

The following table represents the peak flows for each analyzed storm event for each of the post-construction drainage areas (in cubic feet per second): The storm periods shown indicate the peak

(maximum intensity) rainfall volume (measured in cubic feet per second) that would theoretically occur in that given time period. For example, the 25-Year storm numbers would represent the maximum intensity of a storm that would have a 1 in 25 chance of occurring in one year (or that you would statistically expect once every 25 years).

Drainage Area	1-Year Storm	10-Year Storm	25-Year Storm	50-Year Storm	100-Year Storm
1	0.627	2.797	3.962	4.939	5.816
2	5.975	15.69	20.34	24.09	27.38
3	2.097	4.671	5.848	6.786	7.605
4	1.033	5.992	8.839	11.26	13.46
5	1.169	2.758	3.496	4.087	4.602
6	3.143	13.12	18.42	22.85	26.82
7	0.712	3.352	4.792	6.004	7.095
7U	0.535	1.429	1.857	2.204	2.508
8	1.935	9.676	13.97	17.60	20.87
9	3.625	25.54	38.62	49.84	60.08

FLOW COMPARISON ANALYSIS:

The following chart sums up the differences in the different site outfalls, comparing the pre-construction and post-construction conditions:

Site Outfall	1-Year Storm	10-Year Storm	25-Year Storm	50-Year Storm	100-Year Storm	Contributing Drainage Areas
Pre-Construction Flow to High School Road	4.558	16.20	22.30	27.35	31.86	A
Post-Construction Flow to High School Road	**2.748**	**5.556**	**15.46**	**23.89**	**29.98**	**1,2,3**
Pre-Construction Flow to the small pond north of the school property	4.904	23.39	33.51	42.03	49.71	B,C
Post-Construction Flow to the small pond north of the school property	**5.287**	**21.65**	**30.49**	**37.90**	**44.56**	**4,5,6**
Pre-Construction Flow to Fieldpoint Collection Pond	1.412	7.058	10.19	12.84	15.22	D
Post-Construction Flow to Fieldpoint Collection Pond	**0.975**	**6.002**	**8.081**	**10.12**	**15.77**	**7, 7U, 8**
Pre-Construction Surface Flow south from East Field	4.820	30.70	45.83	58.75	70.52	E
Post-Construction Surface Flow south from East Field	**3.625**	**25.54**	**38.62**	**49.84**	**60.08**	**9**
Pre-Construction Total Flow	15.58	75.41	109.42	138.21	164.25	All
Post-Construction Total Flow	**12.52**	**58.62**	**84.27**	**105.81**	**125.23**	**All**

It should be noted that "combined site outflow" is merely a theoretical number, as at no point directly downstream of the site does flow from the entire site combine into one flow. Only two analyzed storm conditions show an increase in post-construction flow. The one-year storm flow to the small pond north of the school property indicates an increase from 4.9 cfs (cubic feet per second) to 5.3 cfs. This 0.4 cfs is approximately 180 gallons per minute. The other increase would be the 100-Year storm flow going to the Fieldpoint basin. This increase, from 15.22 to 15.77 cfs, is an increase of 0.57 cfs, or 256 gallons per

minute. This increase is likely due to the apparent error in piping from the roof leaders of the gymnasium to the Fieldpoint basin, instead of to the parking lot catch basin.

The remainder of the analyzed storms indicates a reduction in peak flows from each analyzed drainage areas when comparing the conditions before and after the 2003 school construction.

STORMWATER QUALITY:

Adjacent neighbors have expressed concerns about the quality of runoff coming from the High School/Middle School site. Specifically, complaints have been made about the quality of the stormwater flowing to the small pond north of the school property and the Fieldpoint stormwater collection basin. Stormwater quality, in this case, refers mainly to the presence of suspended sediment in the stormwater flow. Drainage areas that include bare soil that is not stabilized with grass or other plant cover often erode during rain events. The soil that is picked up and transported by the stormwater flow would tend to be deposited downstream, where stormwater flow slows down enough for the suspended soil to settle out of the stormwater.

All stormwater flow contains some level of suspended solids, and all waterways suffer, to some extent, from sedimentation that comes from up-stream erosion. Detention basins and ponds, in particular, suffer from sedimentation, because any suspended solids will settle out in the detention basin or pond. Without cleaning, dredging, or other intervention, most detention basins will eventually lose volume as a result of accumulated sediment. LAN cannot comment on the degree of sedimentation in either the pond north of the school property or the Fieldpoint basin, as LAN does not have any information as to the past condition of either pond, their past degrees of sedimentation, or their scheduled maintenance.

Flow to the small pond north of the school property comes from areas on and off the school property. These areas include residential lots east of the pond, the east side of the Westwood development, the majority of the main school parking lot, and Meszaro Field. Field investigations indicate that the drainage area from the school site comes from an area of the site that appears to be stabilized. In other words, the soil areas that drain in this direction have healthy growing grass that appears to be stable enough preclude any significant soil erosion that may have contributed to degradation of the stormwater leading to the pond from the school site.

The eastern portion of the drainage area leading to the small pond north of the school property borders on the Westwood development. As there has been active construction in this development for quite some time, it is possible that suspended sediment from soil erosion may have washed downhill, eventually flowing into the small pond north of the school property. It should be noted that LAN did not observe site conditions that would indicate that Westwood is responsible for sedimentation problems in the small pond north of the school property. As such, LAN cannot come to a definite conclusion as to the source of the reported increase in sediment in the small pond north of the school property.

Members of the Fieldpoint homeowner's association have noted that the quality of stormwater in the Fieldpoint basin had degraded since the time of the school construction. During field inspections, LAN staff noticed evidence of erosion in the gravel parking lots on the school property that drain into the Fieldpoint basin. It is likely that erosion from these gravel lots is partially the cause of sedimentation in the Fieldpoint basin. It should be noted, though, that large portions of the Westwood development also drain to this basin. As noted earlier, construction activity at Westwood may also have contributed to water quality problems in the Fieldpoint basin.

CATCH BASIN GRATE ELEVATIONS:

Based on field investigations at the site, it is evident that many of the catch basins on the school site and the Westwood development are set in such a way that stormwater may not be captured in the way in which it was intended. It is common construction practice to set catch basin grates at the proposed elevation of the final proposed asphalt surface, even before the final asphalt surface is installed. Asphalt paving is most commonly installed in two separate layers of asphalt. The asphalt "base course" layer is

applied first, and is often driven upon for quite some time before the final surface course is applied. Once construction is complete, with an end to construction traffic that might mar the final asphalt surface, the final surface course is applied (and striped).

The problem with this practice is that in the time between the application of the base course and surface course, the catch basins are typically 1½" to 2½" inches higher than the road surface. This makes capturing stormwater difficult. Asphalt is typically "ramped" up to the grate, but this does not always solve the problem.

It would be very difficult to numerically determine the extent of this problem on the school property and the Westwood development. Even if certain catch basins are clearly too high in elevation to capture any stormwater, downstream catch basins may capture the stormwater that bypassed the problematic catch basins. Even though numerical analysis would be infeasible, a qualitative analysis is possible.

Individuals that have been on the school property during periods of rainfall have noted that the Westwood roadways (specifically Stearns Ridge) have deep surface flow during a heavy rain event, indicating that it is likely that the Westwood catch basins are not capturing the stormwater that they were designed to capture. If stormwater flow is not captured by the Westwood storm system, than it would not be directed into the Westwood detention basins, and would flow via surface flow onto High School Road. Depending on the flow volume at this point, stormwater flow may act in any or all of the following ways:

1. Any stormwater captured by the catch basins in High School Road adjacent to the gravel parking lot would flow into the Fieldpoint basin. This water, originating mainly from the Westwood development, would not have been treated by the detention basin and would have peak flow rates much higher than they were designed to have. Any stormwater taking this path of flow would add stormwater flow to drainage area #7.

2. Any stormwater bypassing the High School Road drainage at this point on the south side of the road would flow onto the gravel parking lot (there is evidence of erosion in this area), and eventually into the Fieldpoint basin, likely carrying sediment from the gravel lot. Any stormwater taking this path of flow would add stormwater flow to drainage area #7.

3. Any stormwater bypassing the High School Road drainage at this point on the north side of the road would flow further down High School Road and eventually be picked up by the catch basins in High School Road adjacent to the south end of the running track. This point is a low-point in the road, and stormwater would have nowhere else to go. Any stormwater taking this path of flow would add peak flow to drainage area #6, eventually leading to the small pond north of the school property.

The raised catch basins on the school property would not allow stormwater from proposed drainage areas #3 and #6 to be collected by the catch basins in these areas. Instead, stormwater would flow via surface flow further down High School Road, and would likely by captured by the catch basins further down the road, where there are a number of catch basins that are constructed at grade, and appear to function as intended.

Stormwater that bypasses the catch basins in drainage area #3 would bypass the west detention basin, and would thus leave the site (down High School Road) at higher peak flow rates than designed.

Stormwater problems stemming from catch basin elevation problems are usually alleviated by the application of the surface asphalt layer, such that the catch basins function as designed. There are also some other temporary measures that are sometimes applied to solve problems such as these, such as constructing asphalt berms to direct stormwater into the raised catch basins.

ANALYSIS OF ORIGINAL DRAINAGE REPORT & DESIGN:

LAN was provided a copy of the original drainage report associated with the then proposed improvements to the school property. This report was prepared by John Meyer Consulting and dated May 15, 2001. LAN compared the JMC analysis to the LAN analysis of the same existing and proposed site conditions.

Both JMC and LAN produced drainage area maps of the site under existing and proposed conditions. The drainage area boundaries and methods of stormwater flow analysis were similar in nature. Some minor differences in site interpretation were noted in analysis. One major difference in analysis was that LAN included more offsite drainage areas in its analysis, including large portions of land draining to East Field and some other small areas draining onto the school property. JMC did not analyze East Field at all, as no improvements were proposed to East Field.

JMC analyzed the 10-Year, 25-Year, 50-Year, and 100-Year frequency storms. LAN also analyzed the 1-Year storm, as a 1-Year storm analysis is required under current NY State regulations. JMC did not analyze the 1-Year storm event, as it was not required at the time. As such, the minor increase in stormwater flow to the small pond north of the school property could have been overlooked as part of the analysis, and still been approved by the reviewing agency if a 1-Year storm analysis was not required as part of the stormwater analysis.

The discrepancy in flow to the Fieldpoint basin appears to have been an error or change in construction. The JMC analysis was for the gymnasium roof leader piping to flow into the subsurface detention structure. Instead, it appears that this pipe runs directly into the Fieldpoint basin. As such, the JMC analysis appears correct, based on the original design.

Based on the approved drainage report and plans, it is our opinion that the design was in compliance with the applicable stormwater requirements in 2001.

REVIEW OF CONCEPTUAL FUTURE IMPROVEMENTS:

LAN reviewed the conceptual plans for the proposed future improvements at the High School/Middle School site, as prepared by Eberlin and Eberlin, P.C.. These improvements include the following:

1. Tennis Courts – Proposed tennis courts and associated parking.
2. East Field – Proposed expansion of existing playing fields.
3. Meszaros Field – Replacement of grass field with artificial turf, with drainage improvements.

Tennis Courts:
The proposed tennis courts and parking lot would solve the erosion problems currently being experienced in the existing gravel lots that the tennis courts and paved parking lot would replace. Drainage improvements could be incorporated into the design to collect stormwater that would fall upon the parking area and tennis court surface. A subsurface stormwater structure similar to that beneath the parking lot adjacent to the existing gymnasium could be installed beneath the proposed parking lot. A properly designed subsurface detention basin in this location would be able to reduce proposed flows to rates less than existing conditions, and with the replacement of gravel with pavement, suspended sediment that was leaving the site could be eliminated.

East Field:
The proposed improvements to the East Field involve the expansion of the existing field in the easterly direction, apparently to accommodate both a regulation baseball field as well as regulation soccer, field hockey, and lacrosse fields. One apparent issue that will need to be overcome is that the proposed baseball field encroaches upon an existing drainage ditch that intercepts and conveys stormwater flow from the uphill areas to the north and east of the field. Should this ditch be disturbed by the proposed field improvements, a suitable conveyance would need to be designed and build to safely convey the stormwater that would otherwise be conveyed by this ditch. As this existing ditch seems to convey a large stormwater flow to downstream properties on Fieldpoint Drive, alteration of this conveyance would be to the benefit of the downhill neighbors of East Field. A review of tax maps of the area show what appears to be a drainage easement from the East Field area between two of the residential properties on Fieldpoint

Drive, and into the stormwater conveyance system in the Fieldpoint development. Should this be a feasible route for stormwater from the school property, the stormwater that is currently conveyed by the existing drainage ditch could be piped beneath the proposed field, through the drainage easement, and into the Fieldpoint drainage system, effectively bypassing the homes that are currently experiencing drainage problems as a result of the drainage that leaves East Field via surface flow.

To further improve downstream stormwater conditions, subsurface detention could be incorporated into the design to reduce stormwater flow to levels beneath those of the existing conditions at the site. Furthermore, as part of the proposed improvements, a swale, french drain, or other drainage improvements could be used to intercept surface flow from the field itself to help further alleviate surface flow that flows directly from the field to the downhill properties.

Should the district wish to pursue such, it is LAN's opinion that an artificial turf surface would also be feasible for the East Field. Fields of this sort have excellent drainage characteristics. The artificial turf would allow stormwater to pass directly through the field surface, virtually eliminating surface flow from the field. The subsurface gravel layer beneath the turf field could be used as stormwater storage to mitigate peak flows from the field to levels lesser than current peak flows.

Meszaro Field:
The replacement of the existing grass with artificial turf could improve the stormwater conditions on and off the site. Artificial turf is underlain by a gravel layer that could be used for stormwater storage for the stormwater that already drains to the field. This storage volume could be used to reduce peak flows that leave the field and flow downstream into the small pond north of the school property. Depending on the depth of the gravel layer and the configuration of the proposed outlet structure, peak flows could be considerably reduced.

DRAINAGE IMPROVEMENTS INDEPENDENT FROM THE PROPOSED FIELD IMPROVEMENTS:

There are drainage improvements that could be made to improve the site drainage independent from the proposed athletic field improvements. Stormwater detention could be added to any of the current drainage areas to reduce the peak flows that leave these areas. Depending on the level of stormwater flow reduction that the IUFSD wishes to achieve, stormwater detention could be designed to accommodate any flow reduction. Cost would be the only limiting factor in the magnitude of detention structure built.

To address the Fieldpoint basin flow, the pipe that was originally designed to convey the roof leader flow from the gymnasium to the subsurface detention structure could be removed and installed as per the original design plans. This would bring the flow to the Fieldpoint basin in line with the approved stormwater design.

RAINFALL DATA:

LAN has acquired historical rainfall data for the area in question to determine if any complaints of increases in stormwater flow could be attributed to natural variations in stormwater flow. Attachment #3 shows historical rainfall data from the nearest rainfall gauging station of Dobbs Ferry, from 1998 to 2007. The data was graphed and a trend line established for cumulative monthly rainfall totals. This trend line shows an increase in monthly rainfall totals from 1998 to 2007.

While this indicates that there have been apparent rainfall increases in the Irvington area, LAN cannot necessarily conclude that perceived stormwater runoff increases can be attributed to natural rainfall quantity increases. What is clear is that in the same period where people in the area have noticed apparent increases in stormwater runoff volumes; there has also been an increase in total rainfall that has fallen upon the area.

CONCLUSIONS:

Based on all available information, many of the observations of the neighboring property owners appear, in large part, to be valid. Stormwater flow seems to have increased over the time period that includes the 2003 school construction and the construction of the Westwood development due, in part, to the 2003 school construction, the construction at the Westwood development, catch basins that aren't functioning as they were designed, and a natural increase in rainfall. The magnitude of the effect of each of these factors differs from drainage area to drainage area.

The design of the 2003 school improvements appears to have been in compliance with the stormwater requirements for which they were designed. Because the LAN and the JMC analyses were slightly different in some regards, the LAN analysis of the pre and post-construction does show a slight increase in flow to the pond north of the school property, and a construction piping error causes an increase in flow to the Fieldpoint basin above the design flow. The combination of these minor increases and natural increases in rainfall and the temporary problem of raised catch basin grates, seem to have caused the reported increases in stormwater flow for neighboring property owners.

In order to reduce the stormwater flow that leaves the school site in a way that is noticeable to the neighbors, stormwater detention/storage must be incorporated into the site drainage. The addition of stormwater detention would allow stormwater to be stored during storm events and released at a controlled rate. This would reduce the peak stormwater flow from the site, making the runoff to the downstream neighbors less intense.

With proper stormwater design, the proposed athletic field improvements would be an appropriate venue for the construction of stormwater improvements such as these. This would provide for the most cost-effective drainage improvements, as part of a larger project that would already be disturbing the area where detention would be situated.

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cc: File #4.1091.01

Attachment 2 New York State Pollutant Discharge Elimination System (SPDES) general permit (GP). The GP-93-06

Working Copy

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

SPDES GENERAL PERMIT

FOR STORM WATER DISCHARGES FROM CONSTRUCTION ACTIVITIES

THAT ARE CLASSIFIED AS "ASSOCIATED WITH CONSTRUCTION ACTIVITY"

Permit No. GP-93-06

Issued Pursuant to Article 17, Titles 7, 8 and Article 70
of the Environmental Conservation Law

518 457 6781
Robin Warrender

OR- Ken Stevens
518-457 3656

Effective Date: August 1, 1993 Expiration Date: August 1, 1998

George A. Danskin
Chief Permit Administrator
George A Danskin
Authorized Signature

Address:
50 Wolf Road
Albany, N.Y. 12233-1750

Date: July 14, 1993

PREFACE

The Clean Water Act ("CWA")[1] provides that storm water discharges associated with industrial activity from a point source[2] (including discharges through a municipal separate storm sewer system) to waters of the United States[3] are unlawful, unless authorized by a National Pollutant Discharge Elimination System ("NPDES") permit. In New York which is a NPDES-delegated state, this is accomplished through the administration of the state Pollutant Discharge Elimination System ("SPDES") program.

A discharger which is subject to the federal storm water (NPDES) regulations may be eligible to obtain coverage under a general permit by submitting a Notice of Intent ("NOI") to the address given on the NOI form.

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[1] Also referred to as the Federal Water Pollution Control Act or Federal Water Pollution Control Act Amendments of 1972 (Pub.L. 92-500, as amended Pub. L. 95-217, Pub. L. 95-576, Pub. L. 96-483 and Pub. L. 97-117, 33 U.S.C. 1251 et.seq.)

[2] "Point Source" means any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or other floating craft from which pollutants are or may be discharges. This term does not include return flows from irrigated agriculture or agricultural storm water runoff.

[3] "Waters of the United States" means:

(a) All waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;

(b) All interstate waters, including interstate "wetlands";

(c) All other waters such as interstate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce including any such waters:

(1) Which are or could be used by interstate or foreign travelers for recreational or other purposes;

(2) From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or

(3) Which are used or could be used for industrial purposes by industries in interstate commerce;

(d) All impoundments of waters otherwise defined as waters of the United States under this definition;

(e) Tributaries of waters identified in paragraphs (a) through (d) of this definition;

(f) The territorial sea;

(g) Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (a) through (f) of this definition.

Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of the CWA are not waters of the United States. This exclusion applies only to manmade bodies of water with neither were originally created in waters of the United States (such as disposal areas in wetlands) nor resulted from the impoundment of waters of the United States.

Copies of the General Permit and the Notice of Intent forms for New York are available by calling 1-(800)-952-2490. The United States Environmental Protection Agency (EPA) has established the Stormwater Hotline at (703) 821-4823 to provide information pertaining to the NPDES stormwater regulations.

If you have questions whether federal regulations require you to obtain a permit for your storm water discharge, contact the EPA Storm Water Hotline. If you have questions concerning the applicability and coverage of the SPDES Storm Water General Permits, contact the New York State Department of Environmental Conservation in Albany at (518) 457-9601. In order to cancel your coverage under the General Permit, you must submit a Notice of Termination ("NOT") form. Failure to submit a NOT will result in the continued obligation to pay a yearly Regulatory Fee.

Additionally, copies of the general permit, the NOI form and the NOT form can be obtained by calling the New York State Department of Environmental Conservation ("DEC") Storm Water Information Line at (800) 952-2490 (in New York State), any DEC Regional Office (See Appendix B), or directly from DEC in Albany at the telephone number given above.

Coverage under this general permit is available August 1, 1993 and expires on August 1, 1998.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
SPDES GENERAL PERMIT
FOR STORM WATER DISCHARGES FROM CONSTRUCTION ACTIVITIES
THAT ARE CLASSIFIED AS "ASSOCIATED WITH INDUSTRIAL ACTIVITY"

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Part I. COVERAGE UNDER THIS PERMIT

A. **Permit Area & Applicability**. The permit covers all areas of New York State where New York State implements Section 402 of the CWA. Except as in compliance with this general permit or with a duly authorized individual permit from DEC, discharge of stormwater associated with industrial activity from construction activity by any person shall be unlawful.

B. **Eligibility**.

1. This permit may authorize all discharges of storm water associated with industrial activity from construction activity[4], (those sites or common plans of development or sale that will result in the disturbance of five or more acres total land area[5]), (henceforth referred to as storm water discharges from construction activities) occurring after the effective date of this permit, including discharges occurring after the effective date of this permit where the construction activity was initiated before the effective date of this permit, except for discharges identified under paragraph I.C (see below).

2. This permit may only authorize a storm water discharge from construction activities that is mixed with a storm water discharge associated with industrial activities other than construction, where:

   a. the industrial activity other than construction is located on the same site as the construction activity;

   b. storm water discharges from construction activities are in compliance with the terms of this permit; and

   c. storm water discharges associated with industrial activity other than construction are occurring (including storm water discharges from dedicated asphalt plants and dedicated concrete plants) are covered by a different SPDES general permit or individual permit authorizing such discharges.

C. **Limitations on Coverage**. The following storm water discharges from construction activities are not authorized by this permit:

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[4] "Storm Water Discharges Associated With Industrial Activity" covered under this general permit includes those defined in 40 CFR Section 122.26(b)(14)(x).

[5] On June 4, 1992, the United States Court of Appeals for the Ninth Circuit remanded the exemption for construction sites of less than five acres to the EPA for further rule making. (Nos. 90-70671 and 91-70200). Any effect of this decision on construction sites of less than five acres will not apply until further EPA or DEC action. Regulations for construction sites of five acres or more remain in effect.

1. Discharges associated with industrial activity after construction activities have been completed and the site has undergone final stabilization[6];

2. Discharges that are mixed with sources of non-storm water other than those expressly authorized under this permit (Part II.A, Page 7 and Part III.D.5, Page 15);

3. Discharges that are subject to an existing SPDES individual or general permit or which are issued an individual or alternative general permit (Page 19); and

4. Discharges that are likely to adversely affect a listed or proposed to be listed endangered or threatened species or its critical habitat.

D. **Authorization.**

1. An operator[7] must submit a completed Notice of Intent ("NOI") form approved and provided by the State Director[8] (or a photocopy thereof), in order to be authorized to discharge under this general permit[9]. The NOI shall be signed in accordance with Part V.G (see Page 18) of this permit and submitted to the address indicated on the approved NOI form.

2. All contractors and subcontractors of the operator identified under Part III.E.1 (Page 16) must provide certification under Part III.E.2 (Page 16) of this permit in order to be authorized to discharge storm water under this permit.

3. Unless notified by the State Director to the contrary, operators who submit an NOI in accordance with the requirements of this permit are authorized to discharge storm water from construction activities under the terms and conditions of this permit 2 days after the date that the NOI is postmarked. The State Director may deny coverage under this permit and require submittal of an application for an individual SPDES permit at any time based on a review of the NOI or other information (see Part V.J of this permit, Page 19).

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[6] "Final Stabilization" means that all soil disturbing activities at the site have been completed, and that a uniform perennial vegetative cover with a density of 70% the cover for the area has been established or equivalent stabilization measures (such as the use of mulches or geotextiles) have been employed.

[7] For the purposes of this permit, the term "operator" means the person, persons, or legal entity which owns or leases the property on which the construction activity is occurring.

[8] "State Director" means the New York State Commissioner of Environmental Conservation, or an authorized representative.

[9] A copy of the approved NOI form is provided in Appendix A of this notice.

4. A copy of the NOI or other indication that storm water discharges from the site are covered under a SPDES permit, and a brief description of the project shall be posted at the construction site in a prominent place for public viewing (such as alongside a building permit).

5. A signed copy of the NOI shall also be submitted concurrently to the local governing body and any other authorized agency[10] having jurisdiction or regulatory control over the construction project.

6. New storm water discharges from construction activities which require any other Uniform Procedures Act permit (Environmental Conservation Law, 6 NYCRR Part 621) must submit the information specified in Appendix G.

   Upon review of this information, DEC may authorize the applicant to submit an NOI to obtain coverage under this general permit.

7. **Renotification.** Upon renewal of this general permit or issuance of a new general permit, the permittee is required to notify the State Director of his intent to be covered by the new general permit.

E. **Deadlines for Notification.**

1. Operators who intend to obtain coverage under this general permit for storm water discharges from construction activities shall submit an NOI in accordance with the requirements of this Part at least 2 days prior to the commencement of construction[11] activities ;

2. For storm water discharges from construction activities where the operator changes, a new NOI in accordance with the requirements of this Part shall be submitted by the new operator at least 2 days prior to the change in operator. Additionally, the operator being replaced must submit a Notice of Termination ("NOT") in accordance with Part VI (Page 21) of this permit and notify the new operator of the requirement to submit a new NOI to obtain coverage under this permit. The new operator must also review and sign the pollution prevention plan in accordance with Part III.B.

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[10] For the purposes of this general permit, "any other authorized agency" shall include any local, regional, or state entity or agency except the Department of Environmental Conservation (DEC) which has authority to review storm water discharge from the project, including authority under any approved watershed protection plan or regulations.

[11] "Commencement of Construction" means the initial disturbance of soils associated with clearing, grading, or excavating activities. or other construction activities

Part II. SPECIAL CONDITIONS AND PROHIBITIONS

A. **Prohibition On Non-Stormwater Discharges.**

Discharges other than storm water must be in compliance with a SPDES permit (other than this permit). However, the following non-storm water discharges are authorized by this permit: discharges from fire fighting activities; fire hydrant flushings; waters used to wash vehicles or control dust in accordance with Part III.D.2.e.(2) (Page 13); routine external building washdown which does not use detergents; pavement washwaters where spills or leaks of toxic or hazardous materials have not occurred (unless all spilled material has been removed) and where detergents are not used; air conditioning condensate; springs; and foundation or footing drains where flows are not contaminated with process materials such as solvents. Except for flows from fire fighting activities, these discharges must be included in the storm water pollution prevention plan (See Part III).

B. **Maintaining Water Quality** - The discharge authorized by this general permit shall neither cause nor contribute to a violation of water quality standards as contained in Parts 700 through 705 of Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York including, but not limited to:

1. There shall be no increase in turbidity that will cause a substantial visible contrast to natural conditions;

2. There shall be no suspended, colloidal and settleable solids that will cause deposition or impair the waters for their best usages; and

3. There shall be no: residue from oil and floating substances; visible oil film; globules; or grease.

Part III. STORM WATER POLLUTION PREVENTION PLANS

A storm water pollution prevention plan shall be developed by the operator for construction activities at each site to be covered by this permit. Storm water pollution prevention plans shall be prepared in accordance with good engineering practices. The plan shall identify potential sources of pollution which may reasonably be expected to affect the quality of storm water discharges. In addition, the plan shall describe and ensure the implementation of practices which will be used to reduce the pollutants in storm water discharges and to assure compliance with the terms and conditions of this permit. Operators are responsible for implementing the provisions of the storm water pollution prevention plan and ensuring that all contractors and

subcontractors who perform professional services at the site provide certification of the pollution prevention plan in accordance with Part I.D.2. (Page 5) and Part III.E.2. (Page 14) of this permit. All contractors and subcontractors identified in the storm water pollution prevention plan in accordance with Part III.E.1 (Page 16) of this permit must agree to implement applicable provisions of the pollution prevention plan and satisfy the certification requirement of Part III.E.2 (Page 16). Contractors and subcontractors which are not operators, as defined in this permit (Page 5), do not have to submit a NOI in addition to the NOI submitted by the operator.

A. **Deadlines for Plan Preparation and Compliance.**

1. For construction activities that have begun on or before February 1, 1994, the plan shall be developed prior to, and provide compliance with the terms and schedule of the plan beginning on, February 1, 1994. However, the plan for sedimentation basins shall provide for compliance no later that April 1, 1994.

2. For construction activities that begin after February 1, 1994, the plan shall be developed prior to the submittal of an NOI and provide for compliance with the terms and schedule of the plan beginning with the initiation of construction activities.

B. **Signature and Plan Review**

1. The plan shall be signed in accordance with Part V.G (Page 18), and be retained at the site where the construction activity occurs in accordance with Part IV (retention of records, Page 17) of this permit.

2. The permittee shall submit a copy of the pollution prevention plan and any amendments thereto to the local governing body and any other authorized agency having jurisdiction or regulatory control over the construction activity. The operator shall make plans available upon request to the State Director and any local agency having jurisdiction; or in the case of a storm water discharge associated with industrial activity which discharges through a municipal separate storm sewer system , to the municipal operator of the system.

3. The State Director, or authorized representative, may notify the permittee at any time that the plan does not meet one or more of the minimum requirements of this Permit. Such notification shall identify those provisions of the permit which are not being met by the plan, and identify which provisions of the plan requires modifications in order to meet the minimum requirements of this Permit. Within 7 days of such notification, (or

as otherwise provided by the State Director), the permittee shall make the required changes to the plan and shall submit to the State Director a written certification that the requested changes have been made.

C. **Keeping Plans Current**. The permittee shall amend the plan whenever:

1. There is a change in design, construction, operation, or maintenance, which has a significant effect on the potential for the discharge of pollutants to the waters of the United States and which has not otherwise been addressed in the plan; or

2. The storm water pollution prevention plan proves to be ineffective in:

   a. Eliminating or significantly minimizing pollutants from sources identified under Part III.D.2 (See below) of this permit, or in otherwise

   b. Achieving the general objectives of controlling pollutants in storm water discharges from construction activity.

3. Additionally, the plan shall be amended to identify any new contractor and/or subcontractor that will implement a measure of the storm water pollution prevention plan (See Part III.E, Page 16). Amendments to the plan may be reviewed by the State Director in the same manner as provided by Part III.B above.

D. **Contents of Plan**. The storm water pollution prevention plan shall include the following items and shall be prepared in accordance with Appendix F (THE STORMWATER MANAGEMENT AND EROSION CONTROL PLAN). Any deviation from Appendix F or the requireents listed below shall be explained and justified in the storm water pollution prevention plan.

1. **Site Description**. Each plan shall provide a description of pollutant sources and other information as indicated:

   a. A description of the nature of the construction activity;

   b. A description of the intended sequence of major activities which disturb soils for major portions of the site (e.g. grubbing, excavation, grading);

   c. Estimates of the total area of the site and the total area of the site that is expected to be disturbed by excavation, grading, or other activities;

d. An estimate of the runoff coefficient[12] of the site after construction activities are completed and existing data describing the soil or the quality of any discharge from the site;

e. A site map indicating drainage patterns and approximate slopes anticipated after major grading activities, areas of soil disturbance, an outline of areas which will not be disturbed, the location of major structural and nonstructural controls identified in the plan, the location of areas where stabilization practices are expected to occur, surface waters (including wetlands), and locations where storm water is discharged to surface or ground water(s); and

f. The name of the receiving water(s) and areal extent of wetland acreage at the site.

2. **Controls**. Each plan shall include a description of appropriate controls and measures that will be implemented at the construction site. The plan will clearly describe for each major activity identified in Part III.D.1.b above, appropriate control measures and the timing during the construction process that the measures will be implemented. For example, the plan might provide the following: perimeter controls for one portion of the site will be installed after the clearing and grubbing necessary for installation of the measure, but before the clearing and grubbing for the remaining portions of the site; perimeter controls will be actively maintained until final stabilization of those portions of the site upward of the perimeter control; temporary perimeter controls will be removed after final stabilization. The description and implementation of controls shall address the following minimum components:

a. **Erosion and Sediment Controls**

Except as noted below in Part III.D.2.b, the erosion and sediment control component of a storm water pollution prevention plan shall conform to and be implemented in a manner consistent with the technical standards set forth in Appendix E. Where conformance to Appendix E is not attainable, the operator shall describe what equivalent erosion and sediment control practices will be implemented together with an explanation as to why conformance with Appendix E cannot be achieved. This explanation, together with the alternative erosion and sediment control measures and design specifications, shall be presented in the storm water pollution prevention plan.

[12] "Runoff coefficient" means the fraction of total rainfall that will appear at the conveyance as runoff.

A description of interim and permanent stabilization practices, including site-specific scheduling of the implementation of the practices. Site plans should ensure that existing vegetation is preserved where attainable and that disturbed portions of the site are stabilized. Stabilization practices may include: temporary seeding, permanent seeding, mulching, geotextiles, sod stabilization, vegetative buffer strips, protection of trees, preservation of mature vegetation, and other appropriate measures. A record of the dates when major grading activities occur, when construction activities temporarily or permanently cease on a portion of the site, and when stabilization measures are initiated shall be included in the plan. Except as provided in Parts III.D.2.(a)(1)and (2) below, stabilization measures shall be initiated as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased.

(1). Where the initiation of stabilization measures by the 14th day after construction activity temporary or permanently cease is precluded by snow cover, stabilization measures shall be initiated as soon as practicable.

(2). Where construction activity will resume on a portion of the site within 21 days from when activities ceased, (e.g. the total time period that construction activity is temporarily ceased is less than 21 days) then stabilization measures do not have to be initiated on that portion of site by the 14th day after construction activity temporarily ceased.

b. **Erosion and Sediment Controls - Structural Practices**.

A description of structural practices to divert flows from exposed soils, store flows or otherwise limit runoff and the discharge of pollutants from exposed areas of the site to the degree attainable. Such practices may include silt fences, earth dikes, drainage swales, sediment traps, check dams, subsurface drains, pipe slope drains, level spreaders, storm drain inlet protection, rock outlet protection, reinforced soil retaining systems, gabions, and temporary or permanent sediment basins. Structural practices should be placed on upland soils to the degree attainable.

(1) For common drainage locations that serve an area with 10 or more disturbed acres at one time, a

temporary (or permanent) sediment basin providing 3,600 cubic feet of storage per acre drained, or equivalent control measures, shall be provided where attainable until final stabilization of the site. The 3,600 cubic feet of storage area per acre drained does not apply to flows from offsite areas and flows from onsite areas that are either undisturbed or have undergone final stabilization where such flows are diverted around both the disturbed area and the sediment basin. For drainage locations which serve 10 or more disturbed acres at one time and where a temporary sediment basin providing 3,600 cubic feet of storage per acre drained, or equivalent controls is not attainable, smaller sediment basins and/or traps shall be used.

(2) For drainage locations serving less than 10 acres, sediment basins and/or sediment traps should be used. At a minimum, silt fences or equivalent sediment controls are required for all sideslope and downslope boundaries of the construction area unless a sediment basin providing storage for 3,600 cubic feet of storage per acre drained is provided.

c. **Storm Water Management**.

Storm water management controls shall conform to and be implemented in a manner consistent with the technical standards set forth in Appendix D). Where conformance to Appendix D is not attainable, the operator shall describe what practices will be implemented together with an explanation as to why conformance with Appendix D cannot be achieved. This explanation, together with the alternative storm water management practices and design specifications shall be presented in the storm water pollution prevention plan.

A description of measures that will be installed during the construction process to control storm water discharges that will occur after construction operations have been completed. Structural measures should be placed on upland soils to the degree attainable.

(1) Such practices may include: storm water detention structures (including wet ponds); storm water retention structures; flow attenuation by use of open vegetated swales and natural depressions; infiltration of runoff onsite; and sequential systems (which combine several practices). The pollution prevention plan shall include an explanation of the technical basis used to select the practices to control pollution where flows exceed predevelopment levels.

(2) Velocity dissipation devices shall be placed at discharge locations and along the length of any outfall channel for the purpose of providing a non-erosive velocity flow from the structure to a water course so that the natural physical and biological characteristics and functions are maintained and protected (e.g., no significant changes in the hydrological regime of the receiving water).

d. **Other Controls**.

(1) **Waste Disposal**. No solid materials, including building materials, shall be discharged to waters of the United States, except as authorized by a federal or State law.

(2) Off-site vehicle tracking of sediments and the generation of dust shall be minimized.

(3) The plan shall ensure and demonstrate compliance with applicable State and local waste disposal, sanitary sewer or septic system regulations.

e. **Approved Local or Regional Control Plans**.

(1) Storm water pollution prevention plans must include procedures and requirements specified in applicable sediment and erosion site plans, site permits, storm water management site plans or site permits or duly adopted regulations approved by local officials or any authorized agency. Permittees shall provide a certification in their storm water pollution prevention plan that their storm water pollution prevention plan complies with all requirements applicable to protecting surface and ground water resources in sediment and erosion site plans or site permits, storm water management site plans, site permits, or duly adopted regulations approved by local governing bodies or any authorized agency. Permittees shall comply with any such requirements during the term of the permit.

(2) Storm water pollution prevention plans must be amended to reflect any change applicable to protecting surface and ground water resources in sediment and erosion site plans or site permits, storm water management site plans or site permits, or duly adopted regulations approved by local officials or any authorized agency for which the permittee receives written notice. Where the permittee receives such written notice of a change, the permittee shall provide a recertification in

the storm water pollution prevention plan that the storm water pollution prevention plan has been modified to address such changes.

(3) Operators seeking alternative permit requirements shall submit an individual permit application in accordance with Part V.J (Page 19) of the permit at the address indicated in Part IV.C (Page 17) of this permit for the appropriate DEC Office, along with a description of why requirements in approved local or regional plans, permits or regulations or changes to such plans, permits, or regulations, should not be applicable as a condition of a SPDES permit.

3. **Maintenance**. A description of procedures to ensure the timely maintenance of vegetation, erosion and sediment control measures and other protective measures identified in the site plan in good and effective operating condition.

In cases where the installed structural controls are designed, in whole or part, to provide for storm water management after construction activity is completed and final stabilization of the site, a description of the post-construction operation and maintenance needs shall be included.

A description of any arrangements that have been made to ensure long term maintenance of storm water facilities after construction operations have been completed and permit coverage is terminated, and a statement describing who will be responsible for maintenance shall be included.

4. **Inspections**. The operator or qualified personnel of the operator shall inspect disturbed areas of the construction site that have not been finally stabilized, areas used for storage of materials that are exposed to precipitation that have not been finally stabilized, structural control measures, and locations where vehicles enter or exit the site at least once every seven calendar days and within 24 hours of the end of a storm that is 0.5 inches or greater. Where portions of the construction area have been finally stabilized, inspection of such portions shall be conducted at least once every month until the entire site is finally stabilized.

a. Disturbed areas and areas used for storage of materials that are exposed to precipitation shall be inspected for evidence of, or the potential for, pollutants entering the drainage system. Erosion and sediment control measures identified in the plan shall be

observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters. Locations where vehicles enter or exit the site shall be inspected for evidence of offsite sediment tracking.

b. Based on the results of the inspection, the site description identified in the plan in accordance with paragraph III.D.1 (Page 9) of this permit and pollution prevention measures identified in the plan in accordance with paragraph III.D.2 (Page 10) of this permit shall be revised as appropriate, but in no case later than 7 calendar days following the inspection. Such modifications shall provide for timely implementation of any changes to the plan within 7 calendar days following the inspection.

c. A report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the storm water pollution prevention plan, and actions taken in accordance with paragraph III.D.4.b (See above) of the permit shall be made and retained as part of the storm water pollution prevention plan for at least three years from the date that the site is finally stabilized. Such reports shall identify any incidents of non-compliance. Where a report does not identify any incidents of non-compliance, the report shall contain a certification that the facility is in compliance with the storm water pollution prevention plan and this permit. The report shall be signed in accordance with Part V.G (Page 18) of this permit.

5. **Non-Storm Water Discharges** - Except for flows from fire fighting activities, sources of non-storm water listed in Part II.A (Page 7) of this permit that are combined with storm water discharges from the construction activity must be identified in the plan. The plan shall identify and ensure the implementation of appropriate pollution prevention measures for the non-storm water component(s) of the discharge.

E. **Contractors**

1. The storm water pollution prevention plan must clearly identify for each measure identified in the plan, the contractor(s) and/or subcontractor(s) that will implement the measure. All contractors and subcontractors identified in the plan must sign a copy of the certification statement in Part III.E.2 (See below) of this permit in accordance with Part V.G (Page 18) of this permit. All certifications must be included in the storm water pollution prevention plan.

2. **Certification Statement**. All contractors and subcontractors identified in a storm water pollution prevention plan in accordance with Part III.E.1 (Page 16) of this permit shall sign a copy of the following certification statement before undertaking any construction activity at the site identified in the storm water pollution prevention plan:

   "I certify under penalty of law that I understand and agree to comply with the terms and conditions of the pollution prevention plan for the construction site identified in such plan as a condition of authorization to discharge storm water. I also understand that the operator must comply with the terms and conditions of the New York State Pollutant Discharge Elimination System ("SPDES") general permit for storm water discharges from construction activities and that it is unlawful for any person to cause or contribute to a violation of water quality standards."

   The certification must include the name and title of the person providing the signature in accordance with Part V.G (Page 18) of this permit; the name, address and telephone number of the contracting firm; the address (or other identifying description) of the site; and the date the certification is made.

Part IV. RETENTION OF RECORDS

A. The operator shall retain copies of storm water pollution prevention plans and all reports required by this permit, and records of all data used to complete the NOI to be covered by this permit, for a period of at least three years from the date that the site is finally stabilized. This period may be extended by the State Director at any time upon written notification.

B. The operator shall retain a copy of the storm water pollution prevention plan required by this permit at the construction site from the date of initiation of construction activities to the date of final stabilization.

C. **Addresses.** Except for the submittal of NOIs and NOTs, all written correspondence under this permit directed to the DEC, including the submittal of individual permit applications, shall be sent to the address of the appropriate DEC Office as listed in Appendix B.

Part V. STANDARD PERMIT CONDITIONS

A. **Duty to Comply.**

The operator must comply with all conditions of this permit. All contractors and subcontractors must comply with the terms of the pollution prevention plan. Any permit noncompliance constitutes a violation of the CWA and the Environmental Conservation Law and is grounds for enforcement action; for permit revocation or modification; or for denial of a permit renewal application.

B. **Continuation of the Expired General Permit.**

This permit expires on August 1, 1998. However, an expired general permit continues in force and effect until a new general permit is issued. Operators seeking authorization under a new general permit must submit a new NOI in accordance with the terms of such new general permit.

C. **Need to halt or reduce activity not a defense.** It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the construction activity in order to maintain compliance with the conditions of this permit.

D. **Duty to Mitigate.** The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

E. **Duty to Provide Information.** The permittee shall furnish to the State Director; or local, or any other agency approving sediment and erosion plans, grading plans, or storm water management plans, or with regulatory control over the project; or in the case of a storm water discharge associated with industrial activity which discharges through a municipal separate storm sewer system with a SPDES permit, to the municipal operator of the system, any information which is requested to determine compliance with this permit or other information.

F. **Other Information.** When the permittee becomes aware that he or she failed to submit any relevant facts or submitted incorrect information in the NOI or in any other report to the State Director, he or she shall promptly submit such facts or information.

G. **Signatory Requirements**. All NOIs, NOTs, storm water pollution prevention plans, reports, certifications or information required by this permit or submitted pursuant to this permit, shall be signed as follows:

1. All NOIs and NOTs shall be signed as follows:

   a. For a corporation: by (1) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person authorized to and who performs similar policy or decision-making functions for the corporation; or (2) the manager of one or more manufacturing, production or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding $25,000,000 (in second-quarter 1980 dollars) if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;

   b. For a partnership or sole proprietorship: by a general partner or the proprietor, respectively; or

   c. For a municipality, State, Federal, or other public agency: by either a principal executive officer or ranking elected official. For purposes of this section, a principal executive officer of a Federal agency includes (1) the chief executive officer of the agency, or (2) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrators of EPA).

2. The pollution prevention plan and all reports required by the permit and other information requested by the State Director or local agency shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

   a. The authorization is made in writing by a person described above and submitted to the State Director.

   b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of manager, operator, superintendent, or position of equivalent responsibility or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position).

   c. **Certification**. Any person signing documents under paragraph V.G (Page 18) shall make the following certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that false statements made herein are punishable as a class A misdemeanor pursuant to Section 210.45 of the Penal Law."

H. **Property Rights**. The issuance of this permit does not convey any property rights of any sort, nor any exclusive privileges, nor does it authorize any injury to private property nor any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

I. **Severability**. The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit shall not be affected thereby.

J. **Requiring an individual permit or an alternative general permit.**

1. The State Director may require any person authorized by this permit to apply for and/or obtain either an individual SPDES permit or an alternative SPDES general permit. Where the State Director requires a discharger authorized to discharge under this permit to apply for an individual SPDES permit, the State Director shall notify the discharger in writing that a permit application is required. This notification shall include a brief statement of the reasons for this decision, an application form, a statement setting a deadline for the discharger to file the application, and a statement that on the effective date of issuance or denial of the individual SPDES permit or the alternative general permit as it applies to the individual permittee, coverage under this general permit shall automatically terminate. Applications shall be submitted to the appropriate DEC Office indicated in Appendix B of this permit. The State Director may grant additional time to submit the application upon request of the applicant. If a discharger fails to submit in a timely manner an individual SPDES permit application as required by the State Director under this paragraph, then the applicability of this permit to the individual SPDES permittee is automatically terminated at the end of the day specified by the State Director for application submittal.

2. Any discharger authorized by this permit may request to be excluded from the coverage of this permit by applying for an individual permit. In such cases, the permittee shall submit an individual application in accordance with the requirements of 40 CFR 122.26(c)(1)(ii) and 6 NYCRR Part 621, with reasons supporting the request, to the State Director at the address for the appropriate DEC Office (see addresses in Appendix B of this permit). The request may be granted by issuance of an individual permit or an alternative general permit at the discretion of the State Director.

3. When an individual SPDES permit is issued to a discharger otherwise subject to this permit, or the discharger is authorized to discharge under an alternative SPDES general permit, the applicability of this permit to the individual SPDES permittee is automatically terminated on the effective date of the individual permit or the date of authorization of coverage under the alternative general permit, whichever the case may be. When an individual SPDES permit is denied to an operator otherwise subject to this permit, or the operator is denied for coverage under an alternative SPDES general permit, the applicability of this permit to the individual SPDES permittee is automatically terminated on the date of such denial, unless otherwise specified by the State Director.

K. **Proper Operation and Maintenance**. The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit and with the requirements of storm water pollution prevention plans. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. Proper operation and maintenance requires the operation of backup or auxiliary facilities or similar systems, installed by a permittee only when necessary to achieve compliance with the conditions of the permit.

L. **Inspection and Entry**. The permittee shall allow the State Director or an authorized representative of EPA, the State, or, in the case of a construction site which discharges through a municipal separate storm sewer, an authorized representative of the municipal operator or the separate storm sewer receiving the discharge, upon the presentation of credentials and other documents as may be required by law, to:

1. Enter upon the permittee's premises where a regulated facility or activity is located or conducted or where records must be kept under the conditions of this permit;

2. Have access to and copy at reasonable times, any records that must be kept under the conditions of this permit; and

3. Inspect at reasonable times any facilities or equipment (including monitoring and control equipment).

M. **Permit Actions**. This permit may, at any time, be modified, revoked, and renewed. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition.

Part VI. TERMINATION OF COVERAGE

A. **Notice of Termination** ("NOT"). Where a site has been finally stabilized and all storm water discharges from construction activities that are authorized by this permit are eliminated[13], the operator must submit an NOT form approved and provided by the State Director (or photocopy thereof).The NOT shall be signed in accordance with Part V.G (Page 18) of this permit and submitted to the address indicated on the approved NOT form.

[13] For the purposes of this certification, elimination of storm water discharges from construction activity means that all disturbed soils at the identified facility have been finally stabilized and temporary erosion and sediment control measures have been removed or will be removed at an appropriate time, or that all storm water discharges associated with industrial activities from the identified site that are authorized by a SPDES general permit have otherwise been eliminated.

See Reverse for Instructions

SPDES FORM

DEC

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233-3505

Notice of Intent (NOI) for Storm Water Discharges Associated with Industrial Activity Under the SPDES General Permit

Submission of this Notice of Intent constitutes notice that the party identified in Section I of this form intends to be authorized by a SPDES permit issued for storm water discharges associated with industrial activity in the State in Section II of this form. Becoming a permittee obligates such discharger to comply with the terms and conditions of the permit. ALL NECESSARY INFORMATION MUST BE PROVIDED ON THIS FORM.

I. Facility Operator Information

Name: Phone:

Address: Status of Owner/Operator:

City: State: ZIP Code:

II. Facility/Site Location Information

Name: Is the Facility Located on Indian Lands? (Y or N)

Address:

City: State: ZIP Code:

Latitude: Longitude: Quarter: Section: Township: Range:

III. Site Activity Information

MS4 Operator Name:

Receiving Water Body:

If You are Filing as a Co-permittee, Enter Storm Water General Permit Number: Are There Existing Quantitative Data? (Y or N) Is the Facility Required to Submit Monitoring Data? (1, 2, or 3)

SIC or Designated Activity Code: Primary: 2nd: 3rd: 4th:

If This Facility is a Member of a Group Application, Enter Group Application Number:

If You Have Other Existing NPDES Permits, Enter Permit Numbers:

IV. Additional Information Required for Construction Activities Only

Project Start Date: Completion Date: Estimated Area to be Disturbed (in Acres): Is the Storm Water Pollution Prevention Plan in Compliance with State and/or Local Sediment and Erosion Plans? (Y or N)

V. Certification: I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Print Name: Date:

Signature:

Permit Number: NYR100000 (Construction)

Expiration: August 1, 1998

91-19-12 (9/92)—10g

Printed on Recycled Paper

Instruction—NYSDEC Form 91-19-12 (9/92)

Notice of Intent (NOI)

For Storm Water Discharges Associated With Industrial Activity to Be Covered Under the SPDES General Permit

Who Must File A Notice Of Intent Form

Federal law at 40 CFR Part 122 prohibits point source discharges of storm water associated with industrial activity to a water body(ies) of the U.S. without a National Pollutant Discharge Elimination System (NPDES) permit. New York State has been delegated the NPDES program and administers its State Pollutant Discharge Elimination System (SPDES) program in lieu of EPA's NPDES program. Wherever the term "NPDES" is used in the NOI form, the reader should substitute "SPDES". The operator of an industrial activity that has a storm water discharge that qualifies for coverage under a SPDES Storm Water General Permit must submit the NOI form to obtain coverage. If you have questions about whether federal regulations require you to obtain a permit for your storm water discharge, contact the EPA Storm Water Hotline at (703) 821-4823. If you have questions concerning the applicability and coverage of the SPDES Storm Water General Permits, contact the New York State of Environmental Conservation at (518) 457-9601. In order to cancel your coverage under the General Permit you must submit a Notice of Termination (NOT) form. Failure to submit a NOT will result in the obligation to pay a yearly Regulatory Fee.

Where To File The NOI Form

New York State intends on using EPA's information management system. Therefore, NOIs must be sent to the following address:

Storm Water Notice of Intent
PO Box 1215
Newington, VA 22122

Completing The Form

You must type or print using upper-case letters, in the appropriate areas only. Please place each character between the marks. Abbreviate if necessary to stay within the number of characters allowed for each item. Use one space for breaks between words, but not for punctuation marks unless they are needed to clarify your response. If you have any questions on this form, call the EPA Storm Water Hotline at (703) 821-4823.

Section I—Facility Operator Information

Give the legal name of the person, firm, public organization, or any other entity that operates the facility or site described in this application. The name of the operator may or may not be the same as the name of the facility. The responsible party is the legal entity that controls the facility's operation, rather than the plant or site manager. Do not use a colloquial name. Enter the complete address and telephone number of the operator.

Enter the appropriate letter to indicate the legal status of the operator of the facility:

F—Federal	M—Public (other than federal or state)
S—State	P—Private

Section II—Facility/Site Location Information

Give the facility's or site's official or legal name and complete street address, including city, state, and ZIP code. If the facility or site lacks a street address, indicate the state, the latitude and longitude of the facility to the nearest 15 seconds, or the quarter, section, township, and range (to the nearest quarter section) of the approximate center of the site.

Indicate whether the facility is located on Indian lands.

Section III—Site Activity Information

If the storm water discharges to a municipal separate storm sewer system (MS4), enter the name of the operator of the MS4 (e.g. municipality name, county name) and the receiving water of the discharge from the MS4. (A MS4 is defined as a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains) that is owned or operated by a state, city, town, borough, county, parish, district, association, or other public body which is designed or used for collecting or conveying storm water.)

If the facility discharges storm water directly to receiving water(s), enter the name of the receiving water.

If you are filing as a co-permittee and a storm water general permit number has been issued, enter that number in the space provided.

Indicate whether or not the owner or operator of the facility has existing quantitative data that represent the characteristics and concentration of pollutants in storm water discharges.

Indicate whether the facility is required to submit monthly data by entering one of the following:

1 Not required to submit monitoring date;
2 Required to submit monitoring data;
3 Not required to submit monitoring data: submitting certification for monitoring exclusion.

Those facilities that must submit monitoring data (e.g. choice 2) are: Section 313 EPCRA facilities; primary metal industries; land disposal units/incinerators/BIFs; wood treatment facilities; facilities with coal pile runoff; and, battery reclaimers.

List, in decreasing order of significance, up to four 4-digit standard industrial classification (SIC) codes that best describe the principal products or services provided at the facility or site identified in Section II of this application.

For industrial activities defined in 40 CFR 122.26(b)(14)(i)-(xi) that do not have SIC codes that accurately describe the principal products produced or services provided, the following 2-character codes are to be used:

HZ Hazardous waste treatment, storage, or disposal facilities, including those that are operating under interim status or a permit under subtitle C of RCRA [40 CFR 122.26(b)(14)(iv)];

LF Landfills, land application sites, and open dumps that receive or have received any industrial wastes, including those that are subject to regulation under subtitle D of RCRA [40 CFR 122.26(b)(14)(v)];

SE Steam electric power generating facilities, including coal handling sites [40 CFR 122.26(b)(14)(vii)];

TW Treatment works treating domestic sewage or any other sewage sludge or wastewater treatment device or system, used in the storage, treatment, recycling, and reclamation of municipal or domestic sewage [40 CFR 122.26(b)(14)(ix)];

CO Construction activities [40 CFR 122.26(b)(14)(x)].

If the facility listed in Section II has participated in Part 1 of an approved storm water group application and a group number has been assigned, enter the group application number in the space provided.

If there are other SPDES permits presently issued for the facility or site listed in Section II, list the permit numbers. If an application for the facility has been submitted but no permit number has been assigned, enter the application number.

Section IV—Additional Information Required for Construction Activities Only

Construction activities must complete Section IV in addition to Sections I through III. Only construction activities need to complete Section IV.

Enter the project start date and the estimated completion date for the entire development plan.

Provide an estimate of the total number of acres of the site on which soil will be disturbed (round to the nearest acre).

Indicate whether the storm water pollution prevention plan for the site is in compliance with approved state and/or local sediment and erosion plans, or storm water management plans.

Section V—Certification

Federal statutes provide for severe penalties for submitting false information on this application form. Federal regulations require this application to be signed as follows:

For a corporation: by a responsible corporate officer, which means: (i) president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions, or (ii) the manage of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding $25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

For a partnership or sole proprietorship: by a general partner or the proprietor; or

For a municipality, state, federal, or other public facility: by either a principal executive officer or ranking elected official.

Paperwork Reduction Notice

Public reporting burden for this application is estimated to average 0.5 hours per application, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate, any other aspect of the collection of information, or suggestions for improving this form, including any suggestions which may decrease or reduce the burden to: Chief, Information Policy Branch, PM-223, U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20490, or Director, Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, D.C. 20603.

APPENDIX B - Filing Locations

- Notices of Intent should be sent to: Storm Water Notice of Intent, P. O. Box 1215, Newington, VA 22122;
- Notices of Termination should be sent to: Storm Water Notice of Termination, P. O. Box 1185, Newington, VA 22212
- Discharge Monitoring Reports ("DMRs") should be sent to DEC, Division of Water, 50 Wolf Road, Albany, NY 12233-3506;
- Written reports submitted in accordance with 6 NYCRR Part 595 (Chemical Bulk Storage) should be sent to DEC, Division of Spill Prevention, Response and Remediation, 50 Wolf Road, Albany, NY 12233-3520.

All other reports and submittals required by this permit, including individual SPDES applications, should be submitted in accordance with the table below.

The filing location depends on the county in which the discharge is located. To determine the mailing address for the proper Filing Location, find the county in which the discharge is located in the table below. Use the letter in the "KEY" column to the right of the county name to find the proper mailing address in the list at the right.

Discharge Location - County	NYSDEC Region	KEY	Discharge Location - County	NYSDEC Region	KEY
Albany	4	F	Ontario	8	N
Allegany	9	O	Orange	3	E
Broome	7	L	Orleans	8	N
Cattaraugus	9	O	Oswego	7	L
Cayuga	7	L	Otsego	4	G
Chautauqua	9	O	Putnam	3	E
Chemung	8	N	Rensselaer	4	F
Chenango	7	L	Rockland	3	E
Clinton	5	H	St. Lawrence	6	J
Columbia	4	F	Saratoga	5	I
Cortland	7	L	Schenectady	4	F
Delaware	4	G	Schoharie	4	G
Dutchess	3	E	Schuyler	8	N
Erie	9	O	Seneca	8	N
Essex	5	H	Steuben	8	N
Franklin	5	H	Suffolk	1	A
Fulton	5	I	Sullivan	3	E
Genesee	8	N	Tioga	7	L
Greene	4	F	Tompkins	7	L
Hamilton	5	H	Ulster	3	E
Herkimer	6	K	Warren	5	I
Jefferson	6	J	Washington	5	I
Lewis	6	J	Wayne	8	N
Livingston	8	N	Westchester	3	E
Madison	7	L	Wyoming	9	O
Monroe	8	N	Yates	8	N
Montgomery	4	F	Bronx	2	D
Nassau	1	A	Kings	2	D
Niagara	9	O	New York	2	D
Oneida	6	K	Queens	2	D
Onondaga	7	L	Richmond	2	D

KEY	
A	NYSDEC REGION 1, Bldg. 40 SUNY Stony Brook, NY 11794; Phone: (516) 751-7900
D	NYSDEC REGION 2, One Hunters Point Plaza, 47-40 21st St, Long Island City, NY 11101; Phone: (718) 482-4851
E	NYSDEC REGION 3, 21 South Putt Corners Rd., New Paltz, NY 12561; Phone: (914) 255-5453
F	NYSDEC REGION 4, 2176 Guilderland Ave., Schenectady, NY 12306; Phone: (518) 382-0680
G	NYSDEC REGION 4 SUB-OFFICE, Route 10, Jefferson Road, Stamford, NY 12167; Phone: (607) 652-7364
H	NYSDEC REGION 5, Route 86, Ray Brook. NY 12977; Phone: (518) 891-1370
I	NYSDEC REGION 5 SUB-OFFICE, Hudson St., Warrensburg, NY 12885; Phone: (518) 623-3671
J	NYSDEC REGION 6, State Office Bldg.,317 Washington St., Watertown, NY 13601; Phone: (315) 785-2245
K	NYSDEC REGION 6 SUB-OFFICE, State Office Building., 207 Genesee St., Utica NY 13501-2885; Phone: (315) 793-2554
L	NYSDEC REGION 7, 615 Erie Boulevard West, Syracuse, NY 13204; Phone: (315) 426-7400
N	NYSDEC REGION 8, 6274 East Avon-Lima Rd., Avon, NY 14414; Phone: (716) 226-2466
O	NYSDEC REGION 9, 270 Michigan Ave., Buffalo, NY 14203; Phone: (716) 851-7000
	Mail individual SPDES permit applications to "Division of Regulatory Affairs"

Please See Instructions Before Completing This Form

SPDES FORM

DEC

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233-3505

Notice of Termination (NOT) for Coverage Under the SPDES General Permit for Storm Water Discharges Associated with Industrial Activity

Submission of this Notice of Termination constitutes notice that the party identified in Section II of this form is no longer authorized to discharge storm water associated with industrial activity under the SPDES program. ALL NECESSARY INFORMATION MUST BE PROVIDED ON THIS FORM.

I. Permit Information

NPDES Storm Water General Permit Number: _____

Check Here if You are No Longer the Operator of the Facility: ☐

Check Here if the Storm Water Discharge is Being Terminated: ☐

II. Facility Operator Information

Name: _____ Phone: _____

Address: _____

City: _____ State: _____ ZIP Code: _____

III. Facility/Site Location Information

Name: _____

Address: _____

City: _____ State: _____ ZIP Code: _____

Latitude: _____ Longitude: _____ Quarter: _____ Section: _____ Township: _____ Range: _____

IV. Certification: I certify under penalty of law that all storm water discharges associated with industrial activity from the identified facility that are authorized by a NPDES general permit have been eliminated or that I am no longer the operator of the facility or construction site. I understand that by submitting this Notice of Termination, I am no longer authorized to discharge storm water associated with industrial activity under this general permit, and that discharging pollutants in storm water associated with industrial activity to waters of the United States is unlawful under the Clean Water Act where the discharge is not authorized by a NPDES permit. I also understand that the submittal of this Notice of Termination does not release an operator from liability for any violations of this permit or the Clean Water Act.

Print Name: _____ Date: _____

Signature: _____

Instructions For Completing Notice of Termination (NOT) Form

Who Should File A Notice of Termination (NOT) Form

Permittees who are presently covered under the New York State issued State Pollutant Discharge Elimination System (SPDES) General Permit for Storm Water Associated with Industrial Activity should submit a Notice of Termination (NOT) form when their facilities no longer have any storm water discharges associated with industrial activity as defined in the storm water regulations at 40 CFR 122.26(b)(14), or when they are no longer the operator of the facilities. Failure to file a Notice of Termination will result in the continued obligation to pay a yearly Regulatory Fee.

For construction activities, elimination of all storm water discharges associated with industrial activity occurs when disturbed soils at the construction site have been finally stabilized and temporary erosion and sediment control measures have been removed or will be removed at an appropriate time, or that all storm water discharges associated with industrial activity from the construction site that are authorized by a SPDES general permit have otherwise been eliminated. Final stabilization means that all soil-disturbing activities at the site have been completed, and that a uniform perennial vegetative cover with a density of 70% of the cover for unpaved areas and areas not covered by permanent structures has been established, or equivalent permanent stabilization measures (such as the use of riprap, gabions, or geotextiles) have been employed.

Where to File NOT Form

New York State is using EPA's information management system. Therefore, NOTs must be sent to the following address:

Storm Water Notice of Termination
Box 1185
Newington, VA 22122

Completing the Form

Type or print, using upper-case letters, in the appropriate areas only. Please place each character between the marks. Abbreviate if necessary to stay within the number of characters allowed for each item. Use only spaces for breaks between words, but not for punctuation marks unless they are needed to clarify your response. If you have any questions about this form, call the EPA Storm Water Hotline at (703) 821-4823.

SEE REVERSE SIDE OF THIS FORM FOR FURTHER INSTRUCTIONS

Permit Number: NYR100000 (Construction)

Expiration: August 1, 1998

91-19-13 (9/92)—10g

Printed on Recycled Paper

Instructions—NYSDEC Form 91-19-13(9/92)
Notice of Termination (NOT) of Coverage Under The SPDES General Permit for Storm Water Discharges Associated With Industrial Activity

Section I Permit Information

Enter the existing SPDES Storm Water General Permit number assigned to the facility or site identified in Section III. If you do not know the permit number, contact the EPA Storm Water Hotline at (703) 821-4823.

Indicate your reason for submitting this Notice of Termination by checking the appropriate box.

If there has been a change of operator and you are no longer the operator of the facility or site identified in Section III, check the corresponding box.

If all storm water discharges at the facility or site identified in Section III have been terminated, check the corresponding box.

Section II Facility Operator Information

Give the legal name of the person, firm, public organization, or any other entity that operates the facility or site described in this application. The name of the operator may or may not be the same name as the facility. The operator of the facility is the legal entity which controls the facility's operation, rather than the plant or site manager. Do not use a colloquial name. Enter the complete address and telephone number of the operator.

Section III Facility/Site Location Information

Enter the facility's or site's official or legal name and complete address, including city, state and ZIP code. If the facility lacks a street address, indicate the state, the latitude and longitude of the facility to the nearest 15 seconds, or the quarter, section, township, and range (to the nearest quarter section) of the approximate center of the site.

Section IV Certification

Federal statutes provide for severe penalties for submitting false information on this application form. Federal regulations require this application to be signed as follows:

For a corporation: by a responsible corporate officer, which means: (I) president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions, or (II) the manage of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding $25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

For a partnership or sole proprietorship: by a general partner or the proprietor; or

For a municipality, state, federal, or other public facility: by either a principal executive officer or ranking elected official.

Paperwork Reduction Notice

Public reporting burden for this application is estimated to average 0.5 hours per application, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate, any other aspect of the collection of information, or suggestions for improving this form, including any suggestions which may decrease or reduce the burden to: Chief, Information Policy Branch, PM-223, U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20490, or Director, Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, D.C. 20603.

APPENDIX D
STORMWATER MANAGEMENT GUIDELINES FOR NEW DEVELOPMENT

I. BACKGROUND

Stormwater runoff from developing areas can lead to off-site problems including flooding and erosion and water quality degradation. By changing land cover on developed sites, there can be reduced infiltration into the soil, decreased interception of precipitation by vegetation, and changes in the timing of runoff. Large runoff volumes and high rates of discharge from these sites can cause flooding and erosion if not properly controlled and conveyed from the sites. Additionally, pollutants, such as sediment, oil, grease, metals and nutrients, can be washed off impervious areas during storm events and be transported to lakes and streams and may contribute to water quality degradation. This is reflected in the Nonpoint Source Assessment Report published in February 1989.

To minimize the effects of development, ideally the quantity and quality of stormwater runoff that reaches surface waters during and after development should not be altered from pre–development conditions. A variety of structural and non–structural measures -- for example, detention ponds, recharge basins, infiltration pits and trenches, diversion ditches, storage terraces and vegetative swales and other vegetative measures including artificial wetlands -- may be used to control and alleviate the adverse impacts of stormwater runoff.

The following guidelines, which include guidance for siting, sizing, and design of stormwater management measures, may be considered in the preparation and review of stormwater management plans to ensure that runoff during and after development is not substantially altered from pre–development conditions. Of course, such preparation and review should proceed on a case–by–case basis, attendant to the facts and circumstances surrounding the particular project involved.

Generally, appropriate stormwater management plans will achieve the following water and natural resource management objectives:

- reduce the rate of runoff from new land development to prevent increases in flooding and flood damage;
- reduce the erosion potential from a development or construction project; assure the adequacy of existing and proposed culverts and bridges; increase water recharge into the ground; decrease nonpoint source pollution and water quality degradation;
- maintain stream channels for their biological functions as well as for drainage through reduced streambank erosion;
- increase opportunities for preserving open space through stream corridor and flood plain protection; and
- increase recreational opportunities through the multiple use of stormwater management facilities.

II. GUIDANCE

The attached guidelines were developed as an aid to persons preparing and reviewing stormwater management plans. They provide guidance on sound management practices, but are not fixed and inflexible rules to be applied in reviewing stormwater management plans without considering the particular facts and circumstances of a particular project. Local conditions, for example the protection of a sensitive lake or trout stream from the influence of urbanization, may indicate the need for additional control measures.

It should be noted that some communities may have duly adopted stormwater management requirements, and that they should be consulted and complied with. For example, special regulations for controlling stormwater runoff in the Lake George Park are being promulgated under Article 43–0112 of the Environmental Conservation Law and watershed rules and regulations for certain water supply watersheds have been adopted.

STORMWATER MANAGEMENT GUIDELINES FOR NEW DEVELOPMENT

1. DEFINITIONS

Baseflow – The portion of stream flow that is not due to storm runoff, is supported by groundwater discharge into a channel.

Conditional negative declaration – A negative declaration may be issued by a lead agency for an unlisted action (under SEQR), in which the action as initially proposed may result in one or more significant adverse environmental effects; however mitigation measures will modify the proposed action so that no significant adverse environmental impacts will result (6 NYCRR 617.6(h)).

Drywell – Similar to infiltration trench but smaller with inflow from pipe; commonly covered with soil and used for drainage areas of less than 1 acre such as roadside inlets and rooftop runoff.

EIS – An Environmental Impact Statement.

Extended detention – A practice designed to store stormwater run–off by collection as a temporary pool of water, usually having at least a 24 hour residence time. A practice which is used to control peak discharge rates, and which provides gravity settling of pollutants.

First flush – The delivery of a disproportionately large load of pollutants during the early part of storms due to the rapid runoff of accumulated pollutants. The first flush in these guidelines is defined as one–half inch of runoff per acre of land which has been made more impervious from pre–development (natural) conditions through land clearing, land grading and construction/development activities.

Flood plain – For a given flood event, that area of land adjoining a continuous watercourse which has been covered temporarily by water.

Forebay – An extra storage area or treatment area, such as a sediment pond or created wetland, near an inlet of a stormwater management facility to trap incoming sediments or take up nutrients before they reach a retention or extended detention pond.

HEC–2 – U.S. Army Corp of Engineers Computer Program 723–X6–L202A intended for calculating water surface profiles for steady or gradually varied flow in natural or man–made channels.

Impervious area – Impermeable surfaces, such as pavement or rooftops, which prevent the infiltration of water into the soil.

Infiltration – A practice designed to promote the recharge of groundwater by containment and concentration of stormwater in porous soils.

Infiltration basin – An impoundment made by excavation or embankment construction; commonly serves a drainage area of 5 to 50 acres; usually closer to 50.

Outfall – The terminus of a storm drain where the contents are released.

Peak flow – The maximum instantaneous flow of water during a storm, usually in reference to a specific design storm event.

Peak flow attenuation – The reduction of the peak discharge of storm runoff by storage and gradual release of that storage.

Retention – A practice designed to store stormwater run–off by collection as a permanent pool of water without release except by means of evaporation, infiltration, or attenuated release when runoff volume exceeds the permanent storage capacity of the permanent pool.

Riparian area – A relatively narrow strip of land that borders a stream or river.

Riprap – A combination of large stone, cobbles and boulders used to line channels, stabilize stream banks, reduce runoff velocities, or filter out sediment.

Riser – A vertical pipe extending from the bottom of a pond that is used to control the discharge rate from the pond for a specified design storm.

Sand attenuating filter – A chamber open to the surface containing a surface layer of sand over a high void aggregate base; these are innovative but apparently effective practices for atypical situations such as where a site is unsuitable for stormwater infiltration or retention.

SEQR – An acronym for the State Environmental Quality Review Act; Article 8 of the Environmental Conservation Law.

Sheetflow – Runoff which flows over the ground surface as a thin, even layer, not concentrated in a channel.

Special flood hazard area – an area in a community that has been identified as susceptible to a 1% or greater chance of flooding in any given year. A 1% probability flood also is known as the 100–year flood.

SPDES – An acronym for the State Pollutant Discharge Elimination System; A regulatory/permit program administered under Article 17 of the Environmental Conservation Law, by the NYS Department of Environmental Conservation to control point source discharges of water pollution.

Storm frequency – The average frequency of occurrence of events having a given volume and duration. For example: a 2–year; 10–year; or 100–year storm.

Storm drain – Any open or closed conduit designed to convey stormwater.

Storm duration – The length of time over which a precipitation event occurs (e.g., 24–hours).

Storm volume – The total amount of precipitation occurring over the storm duration.

Swale – A natural depression or wide shallow ditch used to temporarily route, or filter runoff.

TR–20 – A rainfall runoff model developed by the USDA Soil Conservation Service for hydrologic analyses of a watershed under present conditions of land cover/use and structural or channel modifications using single event storm rainfall–frequency data. Output consists of peaks and/or flood hydrographs, their time of occurrence and water surface elevations at any desired cross section or structure.

2. FLOOD CONTROL GUIDELINES

The following guidelines should be used to ensure that stormwater runoff is safely conveyed through a development site during and after construction. Also through peak flow attenuation, the guidelines can be used to facilitate the control of stormwater runoff so as to minimize or alleviate flooding and stream bank erosion associated with land development and urbanization. The guidelines are as follows:

A. **Peak Flow Attenuation**

(1) The release of stormwater runoff from development should not exceed pre–development (natural) conditions. To accomplish this, stormwater runoff should be controlled so that during and after development, the site will generate no greater peak than prior to development for a 2–year, 10–year, and 100–year 24–hour storm considered individually.

- Attenuation of the 2–year storm is intended to achieve the stream channel erosion control objective.
- Attenuation of the 10–year storm is intended to assure the adequacy of existing and proposed culverts and storm drain systems.
- Attenuation of the 100–year storm is intended to reduce the rate of runoff from development to prevent expansion of the 100–year flood plain so as to alleviate flooding of improved properties and roadways.

(2) It is not necessary that peak flow attenuation requirements be satisfied only by means of detention basins. For example, infiltration trenches, dry wells, or stone reservoirs underneath paving, may be used for the purpose of attenuating peak flows for smaller storms with appropriate consideration for length of life of the stormwater facility, and feasibility of maintenance.

(3) Where dams are to be constructed for attenuating peak flows, approval may have to be obtained from DEC pursuant to Article 15–0503 of the Environmental Conservation Law.

B. **100–Year Flood Plains**

(1) At a minimum, encroachment into the special flood hazard area should be allowed only in compliance with local restrictions adopted for community participation in the National Flood Insurance Program (NFIP). A permit is required for encroachment into flood plains in Part 500 communities [1].

(2) A 50' buffer (building restriction line) should be established from the flood hazard area as a safety factor to allow for inaccuracy in the determination. Pursuant to Article 24 (ECL), a 100-foot buffer is required around a protected wetland.

(3) The stormwater management plan for all developments of 5 or more acres or containing 5 or more dwelling units located wholly or partially within a 100–year flood plain where flood elevation data are not available through the NFIP, must include a study to determine 100–year flood plain elevations in accordance with TR–20, HEC–2 or other standard engineering methods. Such elevation data shall be used to regulate flood plain encroachments in accordance with the NFIP. The 100–year flood plain elevation and the building restriction line should be shown on the plan.

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[1] Part 500 community – A community for which flood insurance regulations are administered by the State of New York under 6 NYCRR 500 pursuant to Article 36 of the Environmental Conservation Law.

C. **Runoff Conveyance Systems**

(1) Priority should be given to maintaining natural drainage systems, including perennial and intermittent streams, swales and drainage ditches in an open condition.

(2) Where closed storm drain systems (i.e., those involving a culvert or similar conduit) are deemed essential, justification should be made as to why it is necessary to have a closed system. When justified, the closed system should be designed to:

(a) convey the 10–year storm flow within the closed storm drain system; and

(b) provide for safe overland conveyance of flow of the 100–year storm through the development (generally over the top of the closed storm drain system). All overland flow conveyance structures should be at least 1' above the 100–year flood plain elevation and the outfalls of such convenances should be stabilized with rip–rap or other suitable material to reduce erosion.

(3) Any alteration to a protected stream, a stream bed or the banks thereof, including the installation of stormwater conveyance systems will require an Article 15, Protection of Water Permit and may require an Article 24, Freshwater Wetlands Permit. When stream protection measures are mandated on a protected stream, a fisheries habitat technician should be involved with the planning and design of such measures.

(4) Any culvert or stormwater structure placed in a stream should not impede fish migration.

D. **Stream Corridor Management**

(1) Consistent with the State's Stream Corridor Management Program, land clearing and land grading within a stream corridor should be avoided or minimized, except at stream crossing so that stream and drainage courses remain in a natural state. [2]

(2) Care should be exercised to ensure that riparian vegetation, including grasses, shrubs and trees in the stream corridor or along the watercourse, remain undisturbed during land clearing, land grading and land development.

3. WATER QUALITY MANAGEMENT GUIDELINES

The following guidelines should be used in conjunction with the flood control guidelines to protect water quality from runoff associated with land clearing, land grading and construction activities. The guidelines should be followed by a project applicant/sponsor in preparing and implementing a stormwater management plan (SMP). The guidelines should apply to all land areas where soil permeability has been changed as a result of land clearing, land grading and land development.

A. **Control of "First Flush"**

Control of the "first flush" is important in stormwater management because most runoff–related water quality contaminants are transported from land, particularly impervious surfaces, during the initial stages of a storm event. For example, from 70% to 95% of the contaminants in stormwater can be removed by capturing the first flush of runoff

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[2] New York State Department of Environmental Conservation, "Stream Corridor Management: A Basic Reference Manual". Albany, 1986.

through infiltration practices [3]. Regardless of whether infiltration, retention or extended detention practices are used to capture the first flush, the guideline is as follows:

> Provide for control of the first 1/2-inch of runoff from all land areas for which the perviousness has been changed over pre–development (natural) conditions due to land clearing, land grading and construction [4].

B. **Control of Thermal Discharges**

Control of thermal energy in stormwater runoff in watersheds having streams which support cold water fisheries is essential. Impervious surfaces, for example, asphalt parking areas and roofs, store large quantities of heat during hot weather in summer. The heat from such surfaces is released to stormwater through conduction during storm events. Stormwater runoff having elevated temperatures can, in turn, increase stream temperatures during storm events and adversely impact cold water fisheries. Accordingly:

> Stormwater discharges should be consistent with the thermal criteria found in Part 704 of the Water Quality Regulations, Title 6, Chapter X, New York State Codes, Rules and Regulations.

C. **Hierarchy of Methods for Managing Stormwater Quality**

The following stormwater management systems, summarized in descending order of preference, should be used to control the first flush when designing stormwater facilities. The practices are: (1) infiltration, (2) retention, and (3) extended detention. When a stream supporting a cold water fishery is the object of protection, extended detention should be placed ahead of retention in the hierarchy. A combination of these practices, including stormwater management adjuncts (number 4 in the hierarchy), may be used to achieve first flush control objectives. The project sponsor/applicant should provide justification for the rejection of practices listed as priority 1, 2, or 3.

(1) **Infiltration** - Infiltration of runoff on–site by use of vegetated depressions and buffer areas, pervious surfaces, drywells, infiltration basins and trenches permits immediate recharge of groundwater and aids quality treatment through soil filtration. This practice eliminates or minimizes direct stormwater discharges to a waterbody and provides thermal benefits to cold water fisheries.

(2) **Retention** - Retention by use of wet ponds and wetlands constructed in upland areas provides for the storage of collected runoff in a holding area prior to release in a waterway allowing quality treatment by sedimentation, flocculation, and biological removal. Retention is used when post-development runoff volume is expected to exceed the capabilities of infiltration. However, summer temperatures of water in a retention facility may exceed temperatures required to sustain a cold water fishery. Therefore, retention is not appropriate where stored (warm) water in a retention facility is displaced by storm runoff and discharged to a trout stream in contravention of Part 704 standards.

(3) **Extended Detention** - Extended detention provides for the temporary storage of collected runoff in a holding area prior to release into a waterway. Settling is the primary pollutant removal mechanism associated with extended detention. As such, the degree of removal is dependent on whether a given pollutant is in particulate or soluble form. Removal is likely

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[3] Maryland Department of Natural Resources, "Minimum Water Quality Objectives and Planning Guidelines for Infiltration Practices," Water Resources Administration, Sediment and Stormwater Division, Annapolis, MD, April,1986.

[4] Note that, in addition to paved surface areas and land areas connected to buildings, the contributory area for which the first 1/2-inch of runoff should be controlled includes lawn and similarly landscaped surfaces.

to be quite high if a pollutant is a particulate, whereas very limited removal can be expected for soluble pollutants.

Extended detention can provide thermal benefits to a trout stream. By using a perforated, low flow drain pipe encased in a gravel jacket having an adequate mass, extended detention may be used to dissipate heat and cool stormwater runoff prior to its discharge to a trout stream.

(4) **Stormwater Management Adjuncts** - Flow and pollutant attenuation by use of open vegetated swales, vegetated buffer zones, or filter strips, provides water quality treatment by filtration, attenuation, buffering, sedimentation, biological and removal and particle retention. These practices should be used to compliment infiltration, retention or extended detention.

4. DESIGN GUIDELINES FOR CONTROLLING THE FIRST ONE-HALF INCH OF RUNOFF

Following are design guidelines for controlling the first 1/2-inch of runoff from the contributory drainage.

A. Infiltration

(1) Infiltration systems should be designed to capture the first one-half inch of stormwater runoff from impervious surfaces, lawns and similarly landscaped areas in the development site. Stormwater volumes in excess of this amount should be managed for quantity control by supplemental practices.

(2) Infiltration systems should incorporate measures which:

a. Recognize that the recommended design time to drain stored runoff from an infiltration system depends on the specific method or practice. Accordingly, the following ponding or storage times represent the maximum design time period for the referenced facility:

TYPE	TIME (24–hour days)
Infiltration Basin	5
Infiltration Trench	15
Dry Wells	15
Porous Pavement	2
Vegetated Depression	1

b. Ensure that infiltration measures are placed at least 100' from septic systems and water supply wells.

c. Recognize that soils with infiltration rates less than .5 inches per hour are unsuitable for infiltration measures.

d. Provide for a vertical separation distance of at least 4 feet between the bottom of the infiltration system and the seasonably high groundwater table or bedrock. (The excavation of an inspection trench/pit or soil borings at the proposed site of the infiltration facilities to determine the elevation of bedrock and groundwater, and the documentation of such tests must be conducted under the direction of a professional engineer, architect, or landscape architect licensed to practice in New York State.)

e. Trap excess loads of sediment, grease, oils, and settleable solids and other objectionable materials including floatable organics, materials from roadways, parking surfaces, and similar paved areas before they enter the infiltration system.

f. Route design runoff flows through an infiltration basin without scouring or eroding the basin floor and clogging the surface soil pores.

g. Route base flow (if any exists) rapidly through the basin to prevent ponding or standing water.

h. Distribute storm runoff volume evenly over the floor of the basin to maximize exfiltration rates.

i. Provide for safe emergency overflow with measures to provide a non–erosive velocity or flow along its length and at the outfall.

In addition to the above;

j. Infiltration systems should not receive runoff until the entire contributory drainage area to the infiltration system is permanently stabilized.

k. Placement of infiltration facilities in areas which have been filled is unacceptable. Compacted fill material loses permeability and the in situ/fill material interface may cause slope failure due to slippage.

l. If on–site septic systems are to be used, soils must be able to accommodate loading from both on–site infiltration facilities and on–site septic systems.

B. **Retention**

(1) **Retention (Wet) Ponds**

a. Retention is the preferred method of stormwater management when the water table or bedrock is too high for infiltration and soils are poorly drained. Retention improves stormwater quality by gravity settling, naturally occurring chemical flocculation, and biological uptake.

b. Wet ponds (another term for retention pond) should not be constructed by impounding existing wetlands unless authorized by the DEC under Article 24 Freshwater Wetlands Act. If existing wetlands are to be located in an anticipated permanent pool area, the maximum normal pool elevation should not increase mean water depth in the wetland area.

c. Retention ponds should be enhanced with areas of shallow water habitat for additional water quality benefits. Retention ponds also can be part of a created shallow water wetland design, (see use of wetlands for stormwater management).

d. Retention ponds (other than shallow marshes addressed later) should be designed as follows:

i. pond geometry should provide for complete mixing of inflow before discharging.

ii. in larger ponds, diversion barriers such as small islands should be used to increase effective length of flow and permit maximum mixing.

iii. the depth of the pond will vary depending on its intended use. The pond contour should include:

- an average pond depth of 3–6 feet;
- a shallow area 0.5' to 2' deep at the inlet;
- a littoral area or bench 10 feet in width along the perimeter to promote marsh habitat for filtering and nutrient removal; and
- an area 8' to 14' in depth to promote gravity settling and fish habitat.

iv. the minimum drainage area to be served by a wet (retention) pond should be approximately 10 acres. Soils should have infiltration rates less than 0.5 inches/hour.

v. if soils are so porous that an unreasonably large drainage area is required to sustain a relatively small pond, then infiltration practices should be used.

vi. the residence time of pond water should be 24 to 40 hours to remove a minimum of two–thirds of the suspended solids and other pollutants from the incoming stormwater. For removal of phosphorus compounds in lake watersheds where eutrophication is a threat or problem, larger volume ponds should be designed to provide a 14–day residence time.

vii. retention ponds should accommodate up to 10–year storm volumes. The minimum volume retained should be that associated with the first one–half inch of runoff. Excess volumes, for example, the 100–year storm, may be detained.

viii. velocity dissipation devices should be placed at the outfall of all retention structures and along the length of any outfall channel as necessary to provide a non–erosive velocity of flow from the structure to water course. Velocity dissipation devices may be required in stream channels at outfall locations to prevent erosion and fisheries habitat degradation. Pursuant to Article 15 (ECL), a Protection of Waters Permit may have to be obtained in order to install in–stream velocity dissipation devices in protected streams.

ix. the construction of wet (retention) ponds in and around class AA, A, B, C(T) and (TS) streams (water suitable for trout) may not be appropriate to protect these waters and should not be permitted except where, pursuant to 6 NYCRR Part 704 of the Water Quality Regulations, Title 6, Chapter X, retention will not be injurious to cold water fisheries or their habitat. This practice may elevate water temperatures as well as reduce dissolved oxygen levels.

x. pursuant to Article 15–0503 of the Environmental Conservation Law, approval for construction of a dam for a stormwater retention facility may have to be obtained from DEC.

(2) **Use of Wetlands in Stormwater Management**

The use of wetlands for stormwater management is receiving increased attention. Wetlands are known to provide water quality benefits by filtering and trapping suspended solids including sediment, chemical adsorption, biological assimilation, microbial decomposition and chemical decomposition.

a. **Use of Existing Wetlands** - It is generally not acceptable to discharge untreated stormwater directly into naturally existing wetlands. Direct, untreated discharges may overload the natural system, and make it impractical to manage (e.g., by periodic sediment removal) resulting in contamination of the wetland and accelerated succession. Direct discharges also may alter the hydrology and hydroperiod of the wetland, which may significantly alter the vegetative community therein.

However, incorporating an existing wetland in its natural state into a well–designed stormwater management plan may be an acceptable method of stormwater management when adverse impacts to the wetland can be avoided. Natural wetlands should be used only for final polishing after pre–treatment by preliminary practices, such as infiltration, retention or extended detention. In these situations, ultimate discharge to the natural wetland may maintain base flow into the system, thereby helping to maintain the health of the wetland.

Except as provided for in section B. (1) b.,natural wetlands should not be impounded for the creation of either wet or dry ponds.

b. **Use of Artificially Created Wetlands** - Wetlands may be created as part of a stormwater management plan to provide water quality improvement. They may enhance treatment provided by wet ponds and create extended detention areas by enlarging the wetland portions of existing basins.

A created wetland also can provide first–flush treatment when one or more smaller ponds are included. Such a design would be essential if no other pre–treatment practices are used. In the winter when vegetative uptake mechanisms are absent, a pond in the wetland retains higher levels of nitrogen compounds which would otherwise escape downstream.

c. **Factors for Consideration in Designing Created Wetlands** -

i. Location -- the preferred locations are: upland areas adjacent to, but separated from, existing streams and wetlands by vegetated filter

strips wide enough to provide a buffer; in an upland extended detention basin; or as a forebay to a wet pond or detention basin.

ii. Hydraulic design -- specific stormwater management plan criteria must be determined for each site to ensure the created wetland is sufficient to meet the demands being place on it and to determine hydrologic impacts to receiving wetlands, if any.

iii. Expected inflows -- inflows may be composed of stormwater surface water or groundwater. Stormwater should be introduced to wetlands as sheet flow whenever possible. If inflow is conveyed through the outfall, a forebay is necessary. Incoming velocities should not exceed 4 fps during two–year storm events.

iv. Shape and depth -- shallow ponds do not have as long a residence time as deeper ponds. Therefore, caution should be used in substituting deep ponds with shallow marshes. However, the water quality values provided by the substrate, biota and vegetation in wetlands may provide services not provided by deeper ponds. It is important to determine what water quality improvement is needed and whether ponds or wetlands better serve that need.

When creating wetlands, 75% of the wetland should be 18 inches or shallower. Twenty–five percent of the total surface area should be reserved for open water areas that are deeper than 18 inches. However, if the water exits the wetland through an outlet structure, the outlet should be located in water approximately 3 feet deep. Similarly, if a forebay is used, it should be at least 3 feet deep and comprise 10% of the total wetland and pond volume.

v. Vegetative composition -- the plant species selected should be compatible with the physical nature of the wetland (e.g., depth), the climate conditions of the area, and their tolerance to the presence of pollutants. A planting scheme and schedule should be incorporated into the stormwater management plan.

C. **Extended Detention**

(1) Extended detention ponds may be used to enhance water quality in stormwater runoff. Extending the detention time of dry or wet ponds is an effective, low cost means of removing particulate pollutants and controlling increases in downstream bank erosion. Extended detention is preferred over retention where there is a need to maintain stream temperatures in support of a trout fishery pursuant to the thermal criteria found in Part 704 of the Water Quality Regulations, Title 6, Chapter X.

(2) When extended detention ponds are used, they may be acceptable with the following conditions:

a. The "first–flush" runoff volume (i.e., the first one–half inch of runoff from the contributory drainage) should be extended over a 24–hour detention period.

b. Stormwater runoff volume generated from a one–inch storm should be released over a 24–hour detention period. The control device should be adjusted so that smaller runoff events (0.1 to 0.2 inches), which normally pass through the pond quickly, are detained for at least a minimum of six hours. In larger watersheds, up to 40 hours of extended detention may be needed for streambank erosion control.

c. Pond outfall velocities should not exceed 4 fps during 2–year storm events.

d. Velocity dissipation devices should be placed at the outfall of all extended detention structures and along the length of any outfall length channel as necessary to provide a non–erosive velocity of flow from the structure to a water course. Velocity dissipation devices may be required in stream channels at outfall locations to prevent erosion and fisheries habitat degradation. Pursuant to Article 15 (ECL), a Protection of Waters Permit may have to be obtained in order to install in–stream velocity dissipation devices in protected streams.

e. Pursuant to Article 15–0503 of the Environmental Conservation Law, approval for construction of a dam for a stormwater detention facility may have to be obtained from DEC.

D. Stormwater Management Adjuncts

Generally, relatively small volumes of stormwater (i.e., drainage from less than 1 acre or relatively small storms) can be managed entirely by flow and pollution attenuation practices including vegetative swales, filter strips, and water quality inlets. These practices usually are used to supplement other practices such as those described above; therefore, they are referred to herein as stormwater management adjuncts. Where vegetative swales and filter strips will be used, stormwater should to the extent possible be managed as sheetflow and have velocities less than 4 fps during 2–year storm events. The following design criteria should be considered when swales, filter strips and water quality inlets are used to control stormwater runoff.

(1) **Vegetative swales** [5] - Vegetative swales typically are applied in single family residential developments and highway medians as an alternative to curb and gutter drainage systems. When individual lots are greater than 0.5 acre, open section roadways with vegetated swales and check dams are preferred over curb and gutter management systems for stormwater conveyance. In designing and constructing swales:

a. small slopes in the flow of swales should be graded as close to zero as drainage will permit. Side–slopes of swales should be no greater than 3:1.

b. a dense cover of water tolerant, erosion resistant grass must be established. Reed canary grass is recommended for this purpose. Swale grasses should not be mowed close to the ground, as this impedes the filtering and hydraulic functions of the swale. Also, if a swale is adjacent to a roadway, sensitive species with a low salt tolerance (e.g., bluegrass) should be avoided.

c. underlying soils should have a percolation rate of at least 0.5 inches per hour.

d. the swale should be tilled before the grass cover is established to restore infiltration capacity lost as a result of prior construction activities.

e. Check dams can be installed in swales to promote additional infiltration. A preferred method is to sink a railroad tie halfway into the swale, and place stones on the downstream side to prevent a scour hole from forming. If a check dam is used, the designer should make sure that the maximum ponding time of runoff backed up behind the check dam does not exceed 24 hours.

(2) **Filter Strips** [6] - Filter strips do not provide enough storage or infiltration to effectively reduce peak discharges to pre-development levels for design storms. Filter strips are however, viewed as one component of an integrated stormwater management system.

a. The top edge of the filter strip should follow across the same elevational contour. If a section on the top edge of the strips dips below the contour, it is likely that runoff will eventually form a channel toward the low spot.

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5 Adopted from: Schueler, T.R.. "Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs", Department of Environmental Programs, Metropolitan Washington Council of Governments, Washington, D.C. July, 1987.

6 Ibid.

b. A shallow stone trench which follows the contour can be used as level spreader at the top of the strip to distribute flow evenly. This also can serve to protect the strip from anthropogenic damage.

c. The top edge of the filter strip should directly abut the contributing impervious area. Otherwise, runoff may travel along the top of the filter strip rather than through it. Berms can be placed at 50–100 foot intervals perpendicular to the top edge of the filter strip to prevent runoff from by–passing the strip.

d. As an absolute minimum, a grass strip should be at least 20 feet wide. Improved performance can be achieved if the strip is 50–75 feet wide, plus an additional four feet wide per each one percent of slope at the site (particularly if it is a forested strip).

e. Wooded filter strips are preferred to grassed strips. If an existing wooded belt cannot be preserved at the project site, the grassed strip should be managed to gradually become wooded by intentional plantings.

f. If a filter strip has been used as a sediment control measure during the construction phase, it is advisable to regrade and reseed the top edge of the strip. Otherwise, the sediment trapped in the filter strip may affect the flow patterns across the strip, thereby reducing its effectiveness.

(3) **Water Quality Inlets (oil/grit separators)** - The primary function of a water quality inlet (also known as an oil/grit separator) is to remove sediment and hydrocarbon loadings from impervious surfaces such as parking lots less than one acre in size before runoff reaches an infiltration basin or other stormwater management facility. If contaminants such as sediment and oil or other petroleum–based products found on parking lots and street surfaces are not removed, they will clog soil pores and prevent infiltration of runoff in the soil in infiltration basins or trenches.

A water quality inlet usually is designed as an underground, reinforced concrete vault consisting of three chambers: a sediment/grit removal chamber, an oil separation chamber and an outlet chamber. Owing to their limited capacity, water quality inlets store only a small fraction of the 2–year design storm volume. Therefore, they play no role in attenuating the post–development peak discharge rate. Furthermore, since runoff rapidly flows through an inlet, only moderate removal of coarse sediment, oil/grease, and debris can be expected, while removal of fine–grained particulate pollutants such as silt and clay will be more limited. Water quality inlets have little effect on removing soluble pollutants such as phosphorus. <u>It is to be noted that a State Pollutant Discharge Elimination System (SPDES) Permit may be needed for parking lots or impervious storage areas associated with industrial and commercial activities.</u>

a. oil/grit separators generally should be designed for areas less than one acre in size.

b. the depth of the permanent pool in each chamber should be at least 4 feet, and there should be at least 400 cubic feet of wet storage in the chambers for each impervious acre in the contributory drainage.

c. the first chamber should be designed for grit and sediment removal. The first and second chamber should be separated by a trash rack to prevent clogging orifices between the two chambers.

d. the second chamber should be designed for separation of oil and other hydrocarbons from runoff. Separation can be achieved by installing an inverted pipe with a 90° elbow in the baffle or wall that separates the second from third chamber.

e. the grit/oil separator should be equipped with manholes to facilitate cleanout and maintenance.

5. REFERENCES

The basic design criteria, methodologies and construction specifications for stormwater management should be those of the Soil Conservation Service, the Soil and Water Conservation Society, the Department of Environmental Conservation, and the Metropolitan Council of Governments which may be found in the most current edition of the following publications and their subsequent revisions:

A. Empire State Chapter, Soil and Water Conservation Society, New York Guidelines for Urban Erosion and Sediment Control, Syracuse, 1988.

B. Soil Conservation Service. "Urban Hydrology for Small Watersheds", Technical Release No., 55. June 1986.

C. Soil Conservation Service. "Engineering Field Manual", latest edition, as applicable.

E. "Soil Conservation Service Standards and Specifications for Ponds." Specifications No, 378. July 1981. (This document allows for use of metal pipe risers. Steel structures may corrode in 20 years or less. Therefore, use materials other than steel, especially in aggressive environments.)

F. U.S. Department of Agriculture, Soil Conservation Service, Ponds-Planning Design, Construction. Agriculture Handbook No. 590. 1982.

G. New York State Department of Environmental Conservation, "Guidelines for Design of Dams", Revised January 1988.

H. New York State Department of Environmental Conservation, "An Owners Guidance Manual for the Inspection and Maintenance of Dams in New York State". June 1987.

I. New York State Department of Environmental Conservation. "Stream Corridor Management: A Basic Reference Manual." Albany, 1986

J. Metropolitan Washington Council of Governments, Controlling Urban Runoff-A Practical Manual for Planning and Designing Urban BMPs. July 1987.

NYS DEPARTMENT OF ENVIRONMENTAL CONSERVATION
STORMWATER MANAGEMENT
SELF–ASSESSMENT CHECKLIST

File No.: _____ Date Initiated: _____

Project Name: _____

Location: _____
(Address)

_____
(County Region

Applicant: _____
(Last Name) (First Name) (MI)

FLOOD CONTROL

A. Peak Flow Attenuation

- The pre–development peak discharge rates from the project site are:

  2–year storm _____ cfs
  10–year storm _____ cfs
  100–year storm _____ cfs

- The post–development peak discharge rates from the project site are:

  2–year storm _____ cfs
  10–year storm _____ cfs
  100–year storm _____ cfs

- A dam(s) _____ (will/will not) be constructed for attenuating peak flows. If a dam is to be constructed, a permit for Dam Construction will/will not), pursuant to Article 15–0503 of the Conservation Law, be required.

- The proposed development project _____ (is/is not) in compliance with local restrictions adopted pursuant to the National Flood Insurance Program.

- All closed stormwater drainage systems on the project site are, at a minimum, designed to convey the _____-year storm while providing for the _____- year storm through the development.

- The proposed project _____(is/is not) in compliance with all provisions of Article 15 (Protection of Waters Act), Article 24 (Freshwater Wetlands Act), and Article 25 (Tidal Wetlands Act) of the Environmental Conservation Law.

WATER QUALITY MANAGEMENT

The Stormwater Management Facilities _____ (have, don't have) water quality improvement features.

If they do, what management facilities are included

Infiltration _____

Retention _____

Extended Detention _____

Is the first 1/2 inch of runoff from the altered land area being treated?

_____ (Yes) _____ (No)

If not, how much runoff will be captured and treated?

_____

If the proposed stormwater facilities do not provide for water quality management, or if less than the first 1/2 inch is managed, explain why:

_____

_____

_____

_____

_____

_____

The classification of the waters which receive the stormwater is

_____

The thermal criteria contained in 6 NYCRR Part 704 _____ (will/will not) be met.

_____

(Signature)

_____

(License No.)

APPENDIX E
EROSION AND SEDIMENT CONTROL GUIDELINES

I. BACKGROUND

Sediment in runoff from construction sites can have a significant effect on the quality of downstream waters. Construction sites have also been identified as a significant source category in the State Nonpoint Source Assessment Report.

The potential effects of increased sediment are varied:

> Sediment may destroy fish habitat through blanketing of fish spawning and feeding areas and elimination of certain food organisms, directly impact fish through gill abrasion and fin rot, and reduce sunlight penetration, thereby impairing photosynthesis of aquatic plants. Suspended sediment decreases recreational values, reduces fishery habitat, adds to the mechanical wear of water supply pumps and distribution systems, and adds to treatment costs for water supplies. Nutrients and toxic substances attached to sediment particles are transported to waterbodies and may enter aquatic food chains, cause fish toxicity problems, contribute to algal blooms, impair recreational uses, and degrade the water as a drinking water source. [1]

The following guidelines are designed for consideration by both government officials and project sponsors in the preparation and review of erosion and sediment control plans for a land development project. If implemented properly, the guidelines herein will assist in achieving the following water and natural resource management objectives.

- reduce the erosion potential from a development or construction project;
- decrease nonpoint source pollution and water quality degradation;
- maintain stream channels for their biological functions, as well as for drainage, through reduced sediment deposition.

II. GUIDANCE

The attached guidelines were developed to aid persons in preparing and reviewing erosion and sediment control plans. They provide guidance on sound management practices, but are not fixed and inflexible rules to be applied in reviewing erosion control plans without considering the particular facts and circumstances of a particular project.

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[1] Nonpoint Source Management Program. January, 1990.

EROSION AND SEDIMENT CONTROL GUIDELINES FOR NEW DEVELOPMENT

A. Existing vegetation on a project site should be retained and protected as much as possible to minimize soil loss on a project site and to minimize erosion control costs.

B. Sediment control practices/measures, where necessary, should be designed to protect the natural character of rivers, streams, lakes, coastal waters or other waterbodies on–site and minimize erosion and sedimentation off-site from the start of land disturbance activities to establishment of permanent stabilization.

1. The off-site impacts of erosion and sedimentation related to land clearing, grading and construction activities should not be any greater during and following land disturbance activities than under pre–development conditions.

2. Pursuant to Part 700 et seq. of Title 6, Chapter X of NYCRR:

   a. toxic and other deleterious substances shall not be discharged in amounts that will adversely affect the taste, color or odor thereof, or impair the waters of the state for their best (classified) usages,

   b. suspended, colloidal and settleable solids shall not be discharged in amounts that causes substantial visible contrast to natural conditions, or causes deposition or impairs the waters for their best (classified) usages.

This means that stream reaches on-site and downstream of construction areas should not have substantial visible contrast relative to color, taste, odor, turbidity and sediment deposition from the reaches upstream of the construction area. Impacts such as these which result from construction or developmental activities are a violation of Part 700 water quality standards and may be subject to enforcement actions.

C. Erosion and sediment control measures should be constructed in accordance with an erosion and sediment control plan. The plan should:

1. describe the temporary and permanent structural and vegetative measures that will be used to control erosion and sedimentation for each stage of the project from land clearing to the finished stage.

2. provide a map showing the location of erosion and sediment control measures.

3. provide dimensional details of proposed erosion and sediment control facilities as well as calculations used in the siting and sizing sediment basins. (Guidance for performing calculations can be obtained in the reference cited in Section E.8.)

4. identify temporary erosion and sediment control facilities which will be converted to permanent stormwater management facilities.

5. provide an implementation schedule for staging temporary and permanent erosion and sediment control facilities.

6. provide a maintenance schedule for soil erosion and sediment control facilities and describe maintenance activities to be performed.

D. Erosion and sediment control measures should be constructed prior to beginning any other land disturbances. The devices should not be removed until the disturbed land areas are stabilized.

E. Specify guidance.

1. Exposure Restrictions: No more than 5 acres of unprotected soil should be exposed at any one time. Previous earthwork should be stabilized in accord with approved design standards and specifications referenced in Section E.8 before additional area is exposed. (Site factors including topography, soil erosion potential, proximity to wetlands and water courses may require limiting the amount of raw earth that can be exposed at any one time to less than 5 acres.)

2. Grading: Perimeter grading should blend with adjoining properties.

3. Vegetative Protection: Where protection of trees and/or other vegetation is required, the location of the site to be protected should be shown on the erosion control plan. The method of protecting vegetation during construction should conform to the design criteria referenced in Section E.8.

4. Drainage control.

   a. Surface runoff that is relatively clean and sediment free should be diverted or otherwise prevented from flowing through areas of construction activity on the project site. This will greatly reduce sediment loading in surface runoff.

   b. A fill associated with an approved temporary sediment control structure or permanent stormwater management structure, should not be created which causes water to pond off–site on adjacent property, without first having obtained ownership or permanent easement for such use from the owner of the off–site or adjacent property.

   c. Natural drainage channels should not be altered or relocated without the proper approvals. Pursuant to Article 15 of the Environmental Conservation Law, a protected stream and the bed and banks thereof should not be altered or relocated without the approval of the Department of Environmental Conservation. [2]

   d. Runoff from any land disturbing activity should not be discharged or have the potential to be discharged off-site or into storm drains or into watercourses unless such discharge is directed through a properly designed, installed and maintained structure, such as a sediment trap, to retain sediment on-site. Accumulated sediment should be removed when 60% of the storage capacity of the sediment retention structure is filled with sediment.

   e. For finished grading, adequate gradients should be provided so as to prevent water from standing on the surface of lawns for more than 24 hours after the end of a rainfall, except in a swale flow area which may drain as long as 48 hours after the end of rainfall.

   f. Permanent swales or other points of concentrated water flow should be stabilized with sod, rip–rap, paving, or covered with a approved erosion control matting as provided for in the design criteria referenced in Section E.8.

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[2] A natural drainage channel refers to a swale, water course in a gully, or a protected or unprotected stream. Natural drainage channels should not be altered or relocated on adjacent properties without first having obtained ownership or a permanent easement for the altered or relocated drainage channel from the owner of the off-site or adjacent property.

g. Surface flows over cut and fill slopes should be controlled as provided for in the design criteria for vegetating waterways referenced in Section E.8.

5. Timing.

a. Except as noted below, all sites should be seeded and stabilized with erosion control materials, such as straw mulch, jute mesh, or excelsior within 15 days of final grading. If construction has been suspended, or sections completed, areas should be seeded immediately and stabilized with erosion control materials. Maintenance should be performed as necessary to ensure continued stabilization.

i. For active construction areas such as borrow or stockpile areas, roadway improvements, and areas within 50 ft. of a building under construction, a perimeter sediment control system consisting, for example, of silt fencing or hay bales, should be installed and maintained to contain soil.

ii. On cut side of roads, ditches should be stabilized immediately with rock rip–rap or other non-erodible liners, or where appropriate, vegetative measures such as sod. When seeding is approved, an anchor mulch should be used and soil should be limed and fertilized in accord with recommendations referenced in Section E.8.

iii. Permanent seeding should optimally be undertaken in the spring from March 21 through May 20, and in late summer and early fall from August 25 to October 15. During the peak summer months and in the fall after October 15 when seeding is found to be impracticable, an appropriate mulch should be applied. Permanent seeding may be undertaken during summer if plans provide for adequate watering of the seedbed.

iv. All slopes steeper than 3:1 (h:v), as well as basin or trap embankments, and perimeter dikes should, upon completion, be immediately stabilized with sod, seed and anchored straw mulch, or other approved stabilization measures. Areas outside of the perimeter sediment control system should not be disturbed. Maintenance should be performed as necessary to ensure continued stabilization.

b. Temporary sediment trapping devices should be removed within thirty (30) calendar days following establishment of permanent stabilization in all contributory drainage areas. Stormwater management structures used temporarily for sediment control should be converted to the permanent configuration within this time period as well.

6. Stream protection.

a. The bed and banks of all on-site and off-site streams that may be impacted by land clearing, grading, and construction activities should be protected to prevent stream, river, lake or coastal sedimentation, streambank erosion, stream enlargement and degradation or loss of fisheries habitat. Measures for protecting the bed and/or banks of a stream may include; for example, gabion baskets, rip-rap, log cribbing, and vegetative measures. [3]

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[3] Whenever possible, vegetative streambank stabilization practices are recommended over structural practices such as rip-rap and gabion linings which may unnecessarily alter the existing stream ecosystem.

b. Where temporary work roads or haul roads cross stream channels, adequate waterway openings must be constructed using spans, culverts, washed rock backfill or other acceptable, clean methods that will ensure that road construction and use do not result in turbidity and sediment downstream. All stream crossing activities and appurtenances shall be in compliance with a permit issued pursuant to Article 15 of the Environmental Conservation Law, where applicable, and should be carried out in conformance with guidelines in DEC's Stream Corridor Management manual. [4]

7. Maintenance.

a. An erosion control plan for a project site should identify maintenance requirements for erosion and sediment control practices utilized, and it should provide a maintenance schedule. All erosion and sediment control measures should be inspected periodically and maintained in conformance with the schedule so as to ensure they remain in effective, operating condition until such times as they are removed.

b. All points of construction ingress and egress should be protected to prevent the deposition of materials onto traversed public thoroughfare, either by installing and maintaining a stabilized construction entrance, or by washing all vehicle wheels In a safe disposal area. All materials deposited onto public thoroughfares should be removed immediately. Proper precautions should be taken to ensure that materials deposited onto public thoroughfares are removed so that they do not enter catch basins, storm sewers, or combined sewers.

c. Accumulated sediment should be removed when 60% of the storage capacity of the retention structure is filled with sediment.

8. Design specifications.

Designs, standards and specifications for controlling erosion and sedimentation are found in the following publication and should be identified and shown in the erosion control plan:

Empire State Chapter, Soil & Water Conservation Society, New York Guidelines for Urban Erosion and Sediment Control, Syracuse. March 1988.

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[4] New York State Department of Environmental Conservation, "Stream Corridor Management: A Basic Reference Manual," Albany, 1986.

Appendix F

THE STORMWATER MANAGEMENT AND EROSION CONTROL PLAN (Structure and Content)

INTRODUCTION

Water quality impacts and flooding associated with land development can be mitigated by installing structural and vegetative stormwater control measures. In order to properly choose, size and site a stormwater management measure or a combination of measures for a specific project or development site, certain information must be gathered and analyzed beforehand. Such information gathering and analyses can best be accomplished within the framework of a stormwater management and erosion control plan. Such a plan should be required for all development proposals that meet applicability criteria set forth by the locality. Suggested criteria are presented in Chapter III. The purpose of this chapter is to provide local planning agencies, developers and consultants with a framework for (1) structuring a stormwater management and erosion control plan, (2) identifying the kinds of information that should be gathered, and (3) describing the kinds of analyses that should be made.

STORMWATER MANAGEMENT PLAN: STRUCTURE AND CONTENT

At a minimum, a stormwater management and erosion control plan should:

- provide background information about the scope of the project.
- provide a statement of stormwater management objectives.
- compare post-development stormwater runoff conditions with pre-development conditions.
- describe proposed structural and vegetative stormwater measures to ensure that the quantity, temporal distribution and quality of stormwater runoff during and after development is not substantially altered from pre-development conditions.
- identify the type and frequency of maintenance required by the stormwater management and erosion control facilities utilized.

Within the above context, the following outline details the structure and content of a stormwater management and erosion control plan.

I. BACKGROUND INFORMATION

A. PROJECT DESCRIPTION

1. Describe what is being proposed (i.e., residential lot subdivision, planned unit development, commercial/retail development, or industrial development).

2. Describe project size (i.e., number of acres, number of dwelling units, other buildings, and density).

3. Describe other improvements which will be made on project site, including streets and roads, utilities (water, sewer, etc.), and give particular attention to acreage of land that will become paved and covered with buildings. Lawn acreage also should be specified.

4. Provide a location map.* Include watersheds in the community that may be impacted by project. Also, show highways, roads, and proximity of project to nearest city, village or hamlet, and to the nearest waterbody, and other prominent features.

5. Provide a base map containing boundary lines of the project site, sub-catchments, and contributory watersheds at a scale agreed upon by the municipality and developer. **

6. Provide an analysis of site limitations and development constraints by including such factors as slope, soil erodibility, depth to bedrock, depth to seasonal high water, soil percolation, etc., to facilitate evaluation of site suitability for proposed stormwater and erosion control facilities in relation to the overall development proposal.

7. Provide a statement describing how this project will meet stormwater management objectives established by the municipality.

8. Provide a general description of the approaches which will be taken to control erosion and sedimentation and stormwater runoff.

9. Provide a statement indicating when project is to begin and the expected date of completion.

10. Provide a map and descripiton of all critical environmental areas, conservation areas, wildlife habitats, easements, etc., to be protected. (These areas should be marked in the field.)

11. Provide an analysis of potential impacts from the proposed development to natural resource features on-site and off-site such as streams, lakes, wetlands, water supplies, coastal estuaries, etc. A determination as to whether the proposed development will affect any designated primary or principal aquifer should also be included.

B. EXISTING (PRE-DEVELOPMENT) CONDITIONS

1. Provide map showing topography (contours) under existing conditions. On this same map, show drainage patterns, including ditches, culverts, permanent streams, intermittent/ephemeral streams or drainages, wetlands, or other waterbodies, and existing roads. Indicate sizes of existing culverts. Delineate watershed and sub-watershed boundaries on the map.

2. Provide a map showing existing land use, open space, public facilities, utility lines, water supply wells on site, and predominant vegetation cover types (forested, brushland, grassland, cropland, pasture, etc.).

3. Obtain soils survey information and, by sub-catchment, provide tabular information detailing the area in acres that are in each of the Soil Conservation Service (SCS) Hydrologic Soil Groups A, B, C or D in Table 10 in Chapter III. Soils information should be obtained by conducting a site-specific soil survey.

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* Include a north arrow on all maps.

** For subdivision review purposes, maps typically have a scale ranging from 1" = 50' to 1" = 200'. Map scales in the range of 1" = = 1' to 1" = 40' are not uncommon depending on project size and amount of detail required. Maps for stormwater management planning can adopt any of the above scales. The contour interval for the maps should be two feet or an appropriate interval selected on the basis of site conditions and agreed upon by the municipality and developer.

4. Where applicable, provide a map showing designated 100-year flood plain boundaries in affected drainage basins in the community including any available 100-year flood elevations and floodways. Show culverts downstream of project and culvert size. Show existing easements for storm drains, sewers, and other utilities. Show the extent of the drainage area served by a man-made stormwater drainage network if that network system is collecting runoff from outside of the natural drainage basin and is discharging into the basin of concern.

5. Provide hydrologic data describing rainfall characteristics. This should include:

   a. Precipitation data for several return periods (i.e., the 1-year, 2-year, 10-year, and 100-year storms for a 24-hour duration).

   b. Provide stream channel survey data by sub-catchment showing channel conditions including roughness and vegetation.

C. PROPOSED FUTURE (DEVELOPMENT) CONDITIONS

1. Provide a map showing by sub-catchment, the completed project, including lot layout, approximate location of buildings, streets, and other paved surfaces, final contours, utility lines, water supply wells, individual sewage disposal systems, and location and types of easements.

2. Provide tabular information, by sub-catchment, showing the acres of impervious area created in the proposed development as well as the extent of lawn and areas where the land has been made more impervious than pre-development conditions.

3. By sub-catchment, show on a map changes to land surface, including areas of cuts and fills, changes in vegetative cover types, and final contours. Indicate by sub-catchment, land-clearing and earth moving start-up and completion dates.

4. Indicate construction schedule including estimated completion date(s) and proposed winter shutdowns.

II. COMPARISON OF PRE-DEVELOPMENT WITH POST-DEVELOPMENT RUNOFF

A. METHODOLOGIES

1. Describe or identify the methodology used to compare and evaluate pre- with post-development runoff conditions in terms of volumes, peak rates of runoff, routing, and hydrographs. (Chapter III. describes several commonly used hydrologic models for computing runoff.)

   - Peak discharge rates and total runoff volumes from the project area for existing site conditions and post-development conditions for the 2-year and 10-year, 24 hour storm events should be calculated. The relevant variables used in this determination, such as curve number and time of concentration should be included.

   - Downstream analysis of the 100-year, 24 hour event, including peak discharge rates, total runoff volumes and evaluation of impacts to receiving waters and/or wetlands should be evaluated.

- Storage volume and surface area requirements necessary to provide flood control for runoff generated during 2-year, 10-year and 100-year, 24 hour storm events should be calculated.

- Discharge provisions for the proposed control measures, including peak discharge rates, outlet design, discharge capacity for each stage, outlet channel design, and a description of the point of discharge should be provided.

- Sufficient detail should be provided to show that the stormwater facility(ies) is/are capable of withstanding the discharge from the 100-year storm event.

2. Describe or identify the methodology used to compare and evaluate pre- with post-development pollutant loading. Contaminants to be compared include total suspended solids, total phosphorus, total nitrogen, and biological oxygen demand. Pollutant loading coefficients may be used. (Chapter III. describes several commonly used models for calculating pollutant loading.)

- Water quality treatment facilities should be designed to control the first 1/2 inch of runoff or runoff from the 1-year, 24 hour storm event, or whichever is greater.

- The necessary storage volumes should be calculated and the proposed stormwater measure(s) should be described in detail. The plans should provide sufficient detail of the water quality control measures to ensure that the relevant design criteria will be met.

- Specific information may include surface area dimensions, depths, inlet designs, planting specifications for use of aquatic vegetation, percent solids removal expected, discharge rates and outlet design.

B. CALCULATIONS

1. State any assumptions used in making the calculations.

2. Provide assumptions and coefficient values used in the hydrologic calculations for making above comparisons. Evaluate the post-development effect of stormwater runoff on identified flood plains or designated flood hazard areas in the community.

3. Compare pollutant loading between before and after conditions. Provide computations.

III. STORMWATER MANAGEMENT

A. STORMWATER MANAGEMENT FACILITIES

1. Describe in a narrative and show on a map, by sub-catchment, proposed stormwater management facilities. A soil profile to at least one foot below the stormwater management facility should be provided.

2. Provide designs of proposed structural stormwater management facilities. Pursuant to the provisions in Chapter V. for peak flow attenuation and water quality management, indicate which facilities will be used to attenuate peak flows, which will be used to enhance stormwater runoff quality, and which facilities will serve a dual role. Identify the materials to be used in constructing these facilities.

3. Calculations for sizing stormwater facilities should be provided.

4. Provide designs and calculations for siting and sizing such specialized measures and devices as filter strips, water quality inlets (oil/grit separator) forebays, etc., which will be used to remove sediment, oil-based products, and other contaminants found in urban runoff.

5. Provide an evaluation of the amount of treatment or level of pollutant reduction that can be expected from the proposed stormwater management facility(ies). Contaminants to be considered in this evaluation include total suspended solids (TSS), total phosphorus (P), total nitrogen (N), biological oxygen demand (BOD) and thermal pollution. Evaluation of the effectiveness of stormwater management practices can be based on reports on the effectiveness of comparable stormwater facilities on similar sites. Pollutant loading coefficients for total P, total N and BOD, and models for making this evaluation are identified and briefly discussed in Chapter III.

   Guidance for evaluating the level of reduction of TSS (and other pollutants attached thereto) that can be expected from selected stormwater management facilities can be found in the publication entitled "Methodology for Analysis of Detention Basins for Control of Urban Runoff Quality". [1] Also, the BMPSOFT model and P8 Urban Catchment Model referred to in Table 14 in Chapter VI may be used to calculate the level of reduction of TSS (and other pollutants) that can be expected from selected stormwater management facilities.

6. Provide information on the design provisions that address safety considerations (e.g., gentle slopes and benches in ponds) and accommodate maintenance needs (including access to conduct maintenance operations).

B. STORMWATER CONVEYANCE SYSTEM

1. Describe in a narrative and map by sub-catchment the stormwater conveyance (drainage) system. Indicate which segments of the drainage system are open channels and which segments are piped (culverts). Provide rationale and justification for installing piped segments.

2. Provide plan view and cross-sectional designs of stormwater conveyance systems. Hydrologic calculations for siting and sizing the stormwater conveyance system should be provided. Identify materials to be used.

3. Provide plans, designs and identify materials to be used for preventing erosion in channel sections of stormwater conveyance systems. Show how erosion at culvert inlets and outfalls will be prevented.

C. RECREATIONAL AND/OR LANDSCAPE FEATURES (Optional)

1. Describe and illustrate any recreational or landscape features which are to be factored into the stormwater management system to enhance the aesthetics of the facility(ies) and provide multiple use options.

2. On the map prepared under Section I.C.1., show the location of recreational facilities.

3. Provide landscaping sketches and designs for the stormwater management facilities.

IV. EROSION AND SEDIMENT CONTROL

A. TEMPORARY EROSION AND SEDIMENT CONTROL FACILITIES
(to be used during land clearing, land grading and the construction phases)

1. Describe temporary structural facilities and vegetative measures which will be used to control erosion and sedimentation.

2. Provide a map showing, by sub-catchment, the location of temporary vegetative and structural erosion and sediment control facilities.

3. Provide dimensional details of proposed erosion and sediment control facilities and identify the materials that will be used in developing these facilities. Calculations used in siting and sizing sediment basins should be provided (see New York Guidelines for Urban Erosion and Sediment Control).

4. Identify temporary erosion and sediment control facilities which will be converted to permanent stormwater management facilities.

5. Provide an implementation schedule for the staging of temporary erosion and sediment control facilities.

6. Provide a maintenance schedule for soil erosion and sediment control facilities.

B. PERMANENT EROSION AND SEDIMENT CONTROL FACILITIES

1. Describe permanent structural and vegetative practices which will be used to provide long-term control of erosion and sedimentation when construction activities are completed and the project site is restored.

2. Provide a map showing, by catchment, the location of permanent erosion control facilities, including both structural and vegetative.

3. By sub-catchment, provide an implementation schedule for restoring the project site with permanent erosion and sediment control facilities.

V. IMPLEMENTATION SCHEDULE AND MAINTENANCE

A. Provide an implementation schedule for staging of all stormwater management facilities. Describe how this schedule will be coordinated with the staging of erosion and sediment control facilities and construction activities.

B. Provide a description of the arrangements which will be made for ensuring long-term maintenance of stormwater management and erosion control facilities. Back-up contingency plans should be provided and described. Those responsible for performing maintenance should be identified.

ACCOUNTABILITY DURING PLAN IMPLEMENTATION

Significant progress has been made in preparing improved development plans that address stormwater and erosion control concerns. Quite often, however, there is a breakdown between what is called for in the plan and what is actually delivered during the plan implementation phase. Frequently erosion and sediment controls during construction tend to fail because they are either not properly installed or properly maintained. Deposition of sediment in a stream, lake, or other receiving waterbody is the end result.

There are two things that a municipality can do to ensure that stormwater management and erosion and sediment control practices are being properly installed and maintained during the construction phase of the project:

1. If the municipality has an inadequate inspection and enforcement staff, it can extract a fee from the developer(s) to retain staff to do the inspections and provide enforcement.

2. The municipality also can require the developer(s) to establish a dedicated fund, such as a surety bond or irrevocable letter of credit. In the event the developer fails to properly install and maintain required stormwater management and erosion control practices, the municipality can draw upon the fund to do the necessary work itself or to have it done by another firm. In such case, the municipality should require an easement for the purpose of entering onto the property to install, maintain or repair stormwater and erosion control practices.

APPENDIX G

Items In An Application For An Individual Permit For The Construction Category

A. The location (including a map) and the nature of the construction activity;

B. The total area of the site and the area of the site that is expected to undergo excavation during the life of the permit;

C. Proposed measures, including best management practices, to control pollutants in storm water discharges during construction, including a brief description of applicable State and local erosion and sediment control requirements;

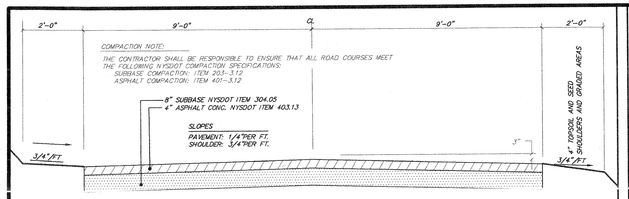
D. Proposed measures to control pollutants in storm water discharges that will occur after construction operations have been completed, including a brief description of applicable State or local erosion and sediment control requirements;

E. An estimate of the runoff coefficient of the site and the increase in impervious area after the construction addressed in the permit application is completed, the nature of the fill material and existing data describing the soil or the quality of the discharge; and

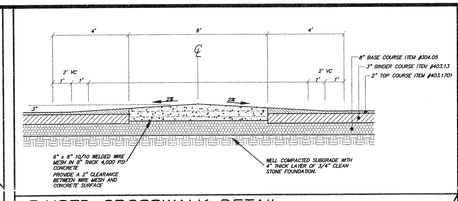
F. The name of the receiving water.

Source: Federal Register, November 16, 1990, Section 122.26(c)(1)(ii).

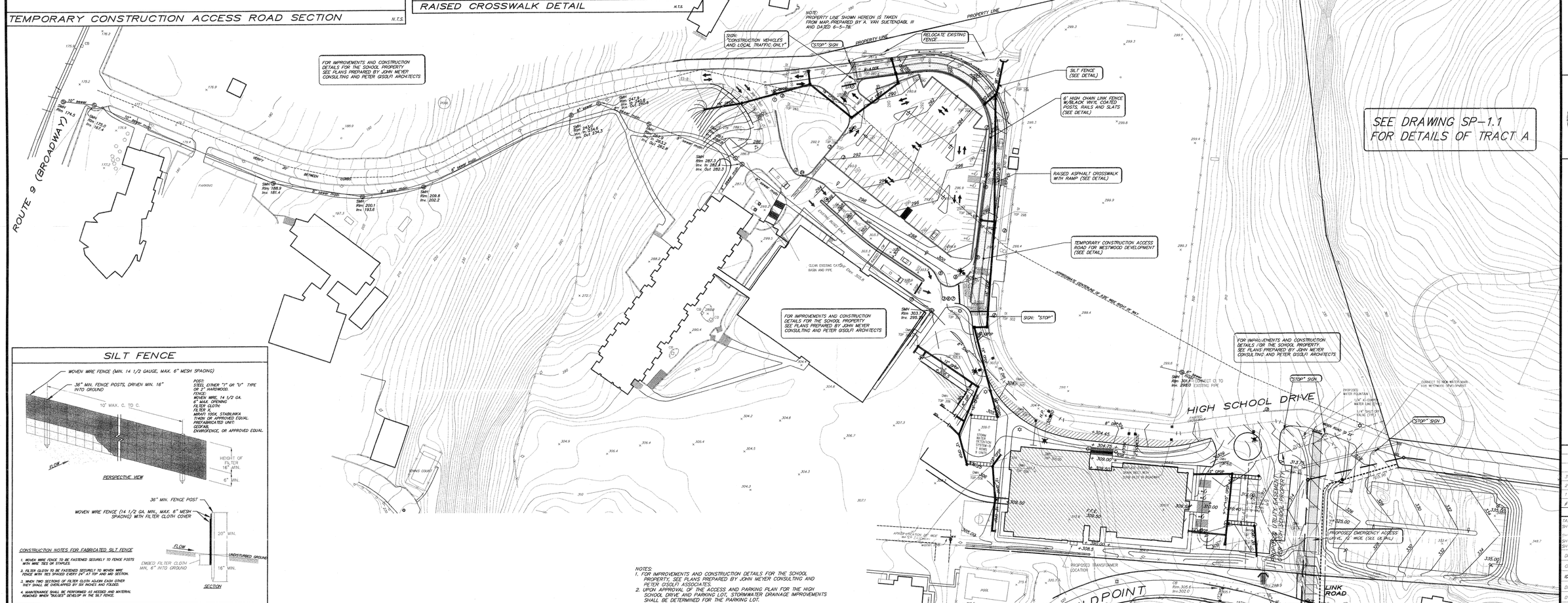
Attachment 3 – Sheet SP-1.3 from the Westwood Drawing Set



TEMPORARY CONSTRUCTION ACCESS ROAD SECTION N.T.S.



RAISED CROSSWALK DETAIL N.T.S.



NOTES:
1. FOR IMPROVEMENTS AND CONSTRUCTION DETAILS FOR THE SCHOOL PROPERTY; SEE PLANS PREPARED BY JOHN MEYER CONSULTING AND PETER GISOLFI ASSOCIATES.
2. UPON APPROVAL OF THE ACCESS AND PARKING PLAN FOR THE HIGH SCHOOL DRIVE AND PARKING LOT, STORMWATER DRAINAGE IMPROVEMENTS SHALL BE DETERMINED FOR THE PARKING LOT.

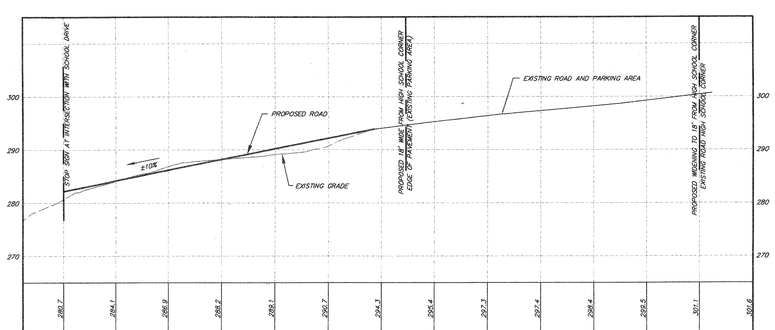
SILT FENCE

CONSTRUCTION NOTES FOR FABRICATED SILT FENCE

1. WOVEN WIRE FENCE TO BE FASTENED SECURELY TO FENCE POSTS WITH WIRE TIES OR STAPLES.
2. FILTER CLOTH TO BE FASTENED SECURELY TO WOVEN WIRE FENCE WITH TIES SPACED EVERY 24" AT TOP AND MID SECTION.
3. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHALL BE OVERLAPPED BY SIX INCHES AND FOLDED.
4. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN "BULGES" DEVELOP IN THE SILT FENCE.

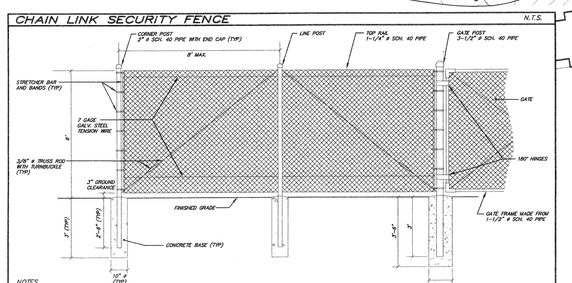
PROFILE THROUGH CENTER LINE OF PROPOSED ROAD

SCALE: 1"=50' HOR. SCALE: 1"=10' VERT.



CHAIN LINK SECURITY FENCE

N.T.S.



NOTES
1. GATES TO BE PAD LOCKED AND CHAINED AT ALL TIMES CONSTRUCTION IS DORMANT.
2. INSTALL SECURITY FENCE IN LOCATIONS AS SHOWN ON THIS PLAN.

LEGEND

330	EXISTING CONTOURS
328	PROPOSED CONTOURS
316 ⊗	PROPOSED SPOT ELEVATION
STOP	STOP SIGN
	TRAFFIC FLOW
	UTILITY EASEMENTS
	COMMON DRIVEWAY RIGHT OF WAY
	EXISTING FENCE

UTILITY LEGEND

	PROPOSED FIRE HYDRANTS
	PROPOSED WATER MAIN 8" D.I.P. CLASS 54
	PROPOSED GATE VALVE
	PROPOSED SANITARY SEWER (8" PVC SDR35)
	PROPOSED MISC. UTILITIES (TELEPHONE, CABLE TV, ETC.)
	PROPOSED CATCH BASINS AND STORM PIPING 15",18" HDPE
	END SECTION WITH STONE RIP RAP DISSIPATION PAD
	STREET LIGHTS - 8' POSTS WITH 150 WATT METAL HALIDE LAMPS

NOTE

UNAUTHORIZED ALTERATION OR ADDITIONS TO THIS MAP ARE A VIOLATION OF SECTION 7209 (2) OF THE NEW YORK STATE EDUCATION LAW.

CIVIL ENGINEER

CRONIN ENGINEERING P.E. P.C.

PROFESSIONAL ENGINEERS AND PLANNING CONSULTANTS
2 JOHN W. LINDY BUILDING, SUITE 200
TEL. 914/738-5664 FAX 914/738-5693
E-MAIL: CRONINPE@AOL.COM

TIMOTHY L. CRONIN, III, P.E.
LICENSE # 062460

OWNER/APPLICANT

WESTWOOD DEVELOPMENT ASSOCIATES, INC.

PRINCIPALS:

PAGANAS STEINSCHNEIDER
328 BROADWAY, STE. 5
DOBBS FERRY, NY 10522
(914) 693-5093

FRANK RAGANELLI
122 EAST SUNNYSIDE LN
IRVINGTON, NY 10533
(914) 693-4448

CHARLES M. PATEMAN
CH. PATEMAN/PATEMAN
303 BROADWAY, SUITE 310
TARRYTOWN, NY 10591
(914) 332-1400

#	REASON	DATE
3	PB COMMENTS, RGM	02-09-02
2	PB COMMENTS	01-14-02
1	VILLAGE COMMENTS	09-25-00

REVISION

TAX MAP #:
SHT: 10 BLK: - LOTS: P25J2 & P25K2
SHT: 10* BLK: 2* LOTS: 1*4 & 34*
SHT: 11 BLK: - LOT: P25
SHT: 11 BLK: - LOT: P25J

DRAWN: JCA
CHECKED: KCS/TCJ
IDJ#: PB MATTER #94-03
DATE: 07-28-00
DWG. FILE: WW-A-FINAL.DWG
JOB #: 940811

TRACT A, ACCESS ROAD & SCHOOL IMPROVEMENTS

SUBDIVISION AND SITE DEVELOPMENT FOR WESTWOOD

LOCATION:
FIELDPOINT DR./ RIVERVIEW RD./ PETER BONT RD
VILLAGE OF IRVINGTON, WESTCHESTER COUNTY

SP-1.3

Attachment 4 – Tc Calculation Worksheets

Time of Concentration (Tc) Calculations - TR-55 Method

Village of Irvington

Pre - 2003 Development
Drainage Area - 1

Sheet flow (Applicable to T_c only)		Segment ID	1		
1	Surface description		Grass		
2	Manning's roughness coeff.n		0.24		
3	Flow length, L (total L less than 100 ft)	ft	100		
4	Two-yr 24-hr rainfall, P_2	in	3.5		
5	Land slope, s	ft/ft	0.080		
6	$T_t=(0.007*(n*L)^{0.8})/(P_2^{0.5}*s^{0.4})$	hr	0.13		0.13
Shallow concentrated flow					
7	Surface description		Unpaved		
8	Flow length, L	ft	227		
9	Watercourse slope, s	ft/ft	0.167		
10a	Average velocity, $V_{unpaved}=16.1345(s)^{0.5}$	ft/s	6.6		
10b	Average velocity, $V_{paved}=20.3282(s)^{0.5}$	ft/s			
11a	$T_t=L/3600*V_{unpaved}$	hr	0.01		
11b	$T_t=L/3600*V_{paved}$	hr			0.01
Channel Flow		Surface Description			
12	Cross sectional flow area, a	ft^2			
13	Wetted perimeter, P_w	ft			
14	Hydraulic radius, $r=a/P_w$	ft			
15	Channel slope, s	ft/ft			
16	Manning's roughness coeff., n				
17	$V=(1.49*r^{2/3}*s^{1/2})/n$	ft/s			
18	Flow length, L	ft			
19	$T_t=L/3600*V$	hr			0.00
20	Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)			**Totals:**	**0.14 hr**
					8 min

MALCOLM PIRNIE

VILLAGE OF IRVINGTON

Attachment B

Time of Concentration (Tc) Calculations - TR-55 Method

Village of Irvington

Pre - 2003 Development
Drainage Area - 2

Sheet flow (Applicable to T_c only)		Segment ID	1		
1	Surface description		Pavement		
2	Manning's roughness coeff.n		0.013		
3	Flow length, L (total L less than 100 ft)	ft	100		
4	Two-yr 24-hr rainfall, P_2	in	3.5		
5	Land slope, s	ft/ft	0.050		
6	$T_t=(0.007*(n*L)^{0.8})/(P_2^{0.5}*s^{0.4})$	hr	0.02		0.02
Shallow concentrated flow					
7	Surface description		Pavement		
8	Flow length, L	ft	465		
9	Watercourse slope, s	ft/ft	0.101		
10a	Average velocity, $V_{unpaved}=16.1345(s)^{0.5}$	ft/s	6.5		
10b	Average velocity, $V_{paved}=20.3282(s)^{0.5}$	ft/s			
11a	$T_t=L/3600*V_{unpaved}$	hr	0.02		
11b	$T_t=L/3600*V_{paved}$	hr			0.02
Channel Flow		Surface Description			
12	Cross sectional flow area, a	ft^2			
13	Wetted perimeter, P_w	ft			
14	Hydraulic radius, $r=a/P_w$	ft			
15	Channel slope, s	ft/ft			
16	Manning's roughness coeff., n				
17	$V=(1.49*r^{2/3}*s^{1/2})/n$	ft/s			
18	Flow length, L	ft			
19	$T_t=L/3600*V$	hr			0.00
20	Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)			**Totals:**	**0.04 hr**
					2 min

Note: Due to limited data on the stormwater collection system drainage before 2003 improvements, flow was assumed to be shallow concentrated. The minimum Tc is 0.1 hr according to TR-55. A value of 0.1 hr will be used for model calculations.

Time of Concentration (Tc) Calculations - TR-55 Method

Village of Irvington

Pre - 2003 Development
Drainage Area - 3

Sheet flow (Applicable to T_c only)		Segment ID	1		
1	Surface description		Grass		
2	Manning's roughness coeff.n		0.24		
3	Flow length, L (total L less than 100 ft)	ft	100		
4	Two-yr 24-hr rainfall, P_2	in	3.5		
5	Land slope, s	ft/ft	0.030		
6	$T_t=(0.007*(n*L)^{0.8})/(P_2^{0.5}*s^{0.4})$	hr	0.19		0.19
Shallow concentrated flow					
7	Surface description		Unpaved		
8	Flow length, L	ft	545		
9	Watercourse slope, s	ft/ft	0.028		
10a	Average velocity, $V_{unpaved}=16.1345(s)^{0.5}$	ft/s	2.7		
10b	Average velocity, $V_{paved}=20.3282(s)^{0.5}$	ft/s			
11a	$T_t=L/3600*V_{unpaved}$	hr	0.06		
11b	$T_t=L/3600*V_{paved}$	hr			0.06
Channel Flow		Surface Description			
12	Cross sectional flow area, a	ft^2			
13	Wetted perimeter, P_w	ft			
14	Hydraulic radius, $r=a/P_w$	ft			
15	Channel slope, s	ft/ft			
16	Manning's roughness coeff., n				
17	$V=(1.49*r^{2/3}*s^{1/2})/n$	ft/s			
18	Flow length, L	ft			
19	$T_t=L/3600*V$	hr			0.00
20	Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)			**Totals:**	**0.25 hr**
					15 min

Note: Outlet for Drainage Area 3 is located at the catchbasin shown on sheet SP 1.3 of the Subdivision and Site Development for Westwood by Cronin Engineering Feb 9, 2002. Travel time for channel flow from the catch basin is assumed negligible, compared to sheet and shallow concentrated flow time. Sheet flow for this drainage area will be greater than an order of magnitude larger than channel flow with a flow length of approximately 200 ft.

MALCOLM PIRNIE

VILLAGE OF IRVINGTON

Attachment B

Time of Concentration (Tc) Calculations - TR-55 Method

Village of Irvington

Pre - 2003 Development
Drainage Area - 4

Sheet flow (Applicable to T_c only)		Segment ID	1		
1	Surface description		Wooded		
2	Manning's roughness coeff.n		0.50		
3	Flow length, L (total L less than 100 ft)	ft	100		
4	Two-yr 24-hr rainfall, P_2	in	3.5		
5	Land slope, s	ft/ft	0.050		
6	$T_t=(0.007*(n*L)^{0.8})/(P_2^{0.5}*s^{0.4})$	hr	0.28		0.28
Shallow concentrated flow					
7	Surface description		Unpaved		
8	Flow length, L	ft	276		
9	Watercourse slope, s	ft/ft	0.145		
10a	Average velocity, $V_{unpaved}=16.1345(s)^{0.5}$	ft/s	6.1		
10b	Average velocity, $V_{paved}=20.3282(s)^{0.5}$	ft/s			
11a	$T_t=L/3600*V_{unpaved}$	hr	0.01		
11b	$T_t=L/3600*V_{paved}$	hr			0.01
Channel Flow		Surface Description	Natural		
12	Cross sectional flow area, a	ft^2	1.49		
13	Wetted perimeter, P_w	ft	4.23		
14	Hydraulic radius, $r=a/P_w$	ft	0.35		
15	Channel slope, s	ft/ft	0.109		
16	Manning's roughness coeff., n		0.035		
17	$V=(1.49*r^{2/3}*s^{1/2})/n$	ft/s	7.00		
18	Flow length, L	ft	1,195		
19	$T_t=L/3600*V$	hr	0.05		0.05
20	Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)			**Totals:**	**0.34 hr**
					21 min

Note: Hydraluic radius calculated assuming: average flow of 10.4 cfs from the rational method, 11% channel slope from GIS topography, channel geometry trapeziodal with 2:1 side slopes and a 2 foot bottom width based on swale detail on EC-7.3 of the Subdivision and Site Development for Westwood by Cronin Engineering Feb 9, 2002 and channel alignment based on Subdivision and Site Development for Westwood by Cronin Engineering Feb 9, 2002 and site visit conducted by Malcolm Pirnie on April 29, 2008

MALCOLM PIRNIE

VILLAGE OF IRVINGTON

Attachment B

Time of Concentration (Tc) Calculations - TR-55 Method

Village of Irvington

Pre - 2003 Development
Drainage Area - 5

Sheet flow (Applicable to T_c only)		Segment ID	1	2	
1	Surface description		Wooded		
2	Manning's roughness coeff.n		0.50		
3	Flow length, L (total L less than 100 ft)	ft	100		
4	Two-yr 24-hr rainfall, P_2	in	3.5		
5	Land slope, s	ft/ft	0.050		
6	$T_t=(0.007*(n*L)^{0.8})/(P_2^{0.5}*s^{0.4})$	hr	0.28		0.28
Shallow concentrated flow					
7	Surface description		Unpaved		
8	Flow length, L	ft	480		
9	Watercourse slope, s	ft/ft	0.229		
10a	Average velocity, $V_{unpaved}=16.1345(s)^{0.5}$	ft/s	7.7		
10b	Average velocity, $V_{paved}=20.3282(s)^{0.5}$	ft/s			
11a	$T_t=L/3600*V_{unpaved}$	hr	0.02		
11b	$T_t=L/3600*V_{paved}$	hr			0.02
Channel Flow		Surface Description	CMP		
12	Cross sectional flow area, a	ft^2	1.79		
13	Wetted perimeter, P_w	ft	3.39		
14	Hydraulic radius, $r=a/P_w$	ft	0.53		
15	Channel slope, s	ft/ft	0.010		
16	Manning's roughness coeff., n		0.024		
17	$V=(1.49*r^{2/3}*s^{1/2})/n$	ft/s	4.06		
18	Flow length, L	ft	568		
19	$T_t=L/3600*V$	hr	0.04		0.04
20	Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)			**Totals:**	**0.34 hr**
					20 min

Note: Channel hydraulic radius was calculated assuming average flow of 7.3 cfs from the rational method, 1% pipe grade based available site information, a roughness coeffiecient of 0.024 for corrugated metal pipe and a diameter of 30 inches based on site observations conducted by Malcolm Pirnie on April 29, 2008.

MALCOLM PIRNIE

VILLAGE OF IRVINGTON

Attachment B

Time of Concentration (Tc) Calculations - TR-55 Method

Village of Irvington

Pre - 2003 Development
Drainage Area - 6

Sheet flow (Applicable to T_c only)		Segment ID	1		
1	Surface description		Grass		
2	Manning's roughness coeff.n		0.24		
3	Flow length, L (total L less than 100 ft)	ft	100		
4	Two-yr 24-hr rainfall, P_2	in	3.5		
5	Land slope, s	ft/ft	0.010		
6	$T_t=(0.007*(n*L)^{0.8})/(P_2^{0.5}*s^{0.4})$	hr	0.30		0.30
Shallow concentrated flow					
7	Surface description		Unpaved		
8	Flow length, L	ft	243		
9	Watercourse slope, s	ft/ft	0.041		
10a	Average velocity, $V_{unpaved}=16.1345(s)^{0.5}$	ft/s	3.3		
10b	Average velocity, $V_{paved}=20.3282(s)^{0.5}$	ft/s			
11a	$T_t=L/3600*V_{unpaved}$	hr	0.02		
11b	$T_t=L/3600*V_{paved}$	hr			0.02
Channel Flow		Surface Description			
12	Cross sectional flow area, a	ft^2			
13	Wetted perimeter, P_w	ft			
14	Hydraulic radius, $r=a/P_w$	ft			
15	Channel slope, s	ft/ft			
16	Manning's roughness coeff., n				
17	$V=(1.49*r^{2/3}*s^{1/2})/n$	ft/s			
18	Flow length, L	ft			
19	$T_t=L/3600*V$	hr			0.00
20	Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)			**Totals:**	**0.32 hr**
					19 min

MALCOLM PIRNIE

VILLAGE OF IRVINGTON

Attachment B

Time of Concentration (Tc) Calculations - TR-55 Method

Village of Irvington

Pre - 2003 Development
Drainage Area - 7

Sheet flow (Applicable to T_c only)		Segment ID	1		
1	Surface description		Wooded		
2	Manning's roughness coeff.n		0.50		
3	Flow length, L (total L less than 100 ft)	ft	100		
4	Two-yr 24-hr rainfall, P_2	in	3.5		
5	Land slope, s	ft/ft	0.100		
6	$T_t=(0.007*(n*L)^{0.8})/(P_2^{0.5}*s^{0.4})$	hr	0.21		0.21
Shallow concentrated flow					
7	Surface description		Unpaved		
8	Flow length, L	ft	1342		
9	Watercourse slope, s	ft/ft	0.104		
10a	Average velocity, $V_{unpaved}=16.1345(s)^{0.5}$	ft/s	5.2		
10b	Average velocity, $V_{paved}=20.3282(s)^{0.5}$	ft/s			
11a	$T_t=L/3600*V_{unpaved}$	hr	0.07		
11b	$T_t=L/3600*V_{paved}$	hr			0.07
Channel Flow		Surface Description			
12	Cross sectional flow area, a	ft^2			
13	Wetted perimeter, P_w	ft			
14	Hydraulic radius, $r=a/P_w$	ft			
15	Channel slope, s	ft/ft			
16	Manning's roughness coeff., n				
17	$V=(1.49*r^{2/3}*s^{1/2})/n$	ft/s			
18	Flow length, L	ft			
19	$T_t=L/3600*V$	hr			0.00
20	Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)			**Totals:**	**0.29 hr**
					17 min

MALCOLM PIRNIE

VILLAGE OF IRVINGTON

Attachment B

Time of Concentration (Tc) Calculations - TR-55 Method

Village of Irvington

Pre - 2003 Development
Drainage Area - 8

Sheet flow (Applicable to T_c only)		Segment ID	1		
1	Surface description		Wooded		
2	Manning's roughness coeff.n		0.50		
3	Flow length, L (total L less than 100 ft)	ft	100		
4	Two-yr 24-hr rainfall, P_2	in	3.5		
5	Land slope, s	ft/ft	0.100		
6	$T_t=(0.007*(n*L)^{0.8})/(P_2^{0.5}*s^{0.4})$	hr	0.21		0.21
Shallow concentrated flow					
7	Surface description		Unpaved		
8	Flow length, L	ft	776		
9	Watercourse slope, s	ft/ft	0.112		
10a	Average velocity, $V_{unpaved}=16.1345(s)^{0.5}$	ft/s	5.4		
10b	Average velocity, $V_{paved}=20.3282(s)^{0.5}$	ft/s			
11a	$T_t=L/3600*V_{unpaved}$	hr	0.04		
11b	$T_t=L/3600*V_{paved}$	hr			0.04
Channel Flow		Surface Description	Natural		
12	Cross sectional flow area, a	ft^2	2.16		
13	Wetted perimeter, P_w	ft	5.65		
14	Hydraulic radius, $r=a/P_w$	ft	0.38		
15	Channel slope, s	ft/ft	0.062		
16	Manning's roughness coeff., n		0.035		
17	$V=(1.49*r^{2/3}*s^{1/2})/n$	ft/s	5.59		
18	Flow length, L	ft	483		
19	$T_t=L/3600*V$	hr	0.02		0.02
20	Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)			**Totals:**	**0.28 hr**
					17 min

Note: Channel hydraulic radius was calculated assuming average flow of 12 cfs from the rational method, 6.2% channel slope from GIS topography, a roughness coeffiecient of 0.035 for a vegetal channel and geometry of a trapeziodal channel with 3:1 side slopes and a 2 foot bottom width based on site visit observations conducted by Malcolm Pirnie on April 29, 2008.

MALCOLM PIRNIE

VILLAGE OF IRVINGTON

Attachment B

Attachment 5 – Routing Model Inputs

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .040000 ft/ft
Mannings n = 0.01300
Invert Elev. = 267.00 ft
Top of Channel = 269.00 ft
Diameter = 2.0000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
267.000	.00	.00	.00	.0000	.00	.00	.00	0.00
267.040	.04	.03	2.03	.0150	.56	.57	.03	2.18
267.080	.08	.13	3.20	.0421	.78	.81	.05	2.43
267.120	.12	.32	4.16	.0770	.95	.99	.08	2.58
267.160	.16	.59	5.01	.1177	1.09	1.15	.11	2.68
267.200	.20	.94	5.78	.1635	1.20	1.29	.14	2.76
267.240	.24	1.38	6.48	.2135	1.30	1.41	.16	2.82
267.280	.28	1.91	7.13	.2673	1.39	1.53	.19	2.87
267.320	.32	2.51	7.74	.3245	1.47	1.65	.22	2.90
267.360	.36	3.20	8.32	.3845	1.54	1.75	.25	2.93
267.400	.40	3.96	8.86	.4473	1.60	1.85	.28	2.95
267.440	.44	4.80	9.37	.5125	1.66	1.95	.31	2.97
267.480	.48	5.71	9.86	.5798	1.71	2.05	.34	2.98
267.520	.52	6.70	10.32	.6490	1.75	2.14	.37	2.99
267.560	.56	7.75	10.76	.7201	1.80	2.23	.40	3.00
267.600	.60	8.86	11.18	.7927	1.83	2.32	.43	3.00
267.640	.64	10.03	11.58	.8667	1.87	2.41	.46	2.99
267.680	.68	11.26	11.96	.9419	1.89	2.49	.50	2.99
267.720	.72	12.54	12.32	1.0182	1.92	2.57	.53	2.98
267.760	.76	13.87	12.66	1.0955	1.94	2.66	.56	2.97
267.800	.80	15.25	12.99	1.1735	1.96	2.74	.60	2.96
267.840	.84	16.66	13.30	1.2522	1.97	2.82	.63	2.95
267.880	.88	18.11	13.60	1.3314	1.99	2.90	.67	2.93
267.920	.92	19.59	13.88	1.4110	1.99	2.98	.71	2.91
267.960	.96	21.09	14.15	1.4908	2.00	3.06	.75	2.89
268.000	1.00	22.62	14.40	1.5708	2.00	3.14	.79	2.86
268.040	1.04	24.16	14.64	1.6508	2.00	3.22	.83	2.84
268.080	1.08	25.72	14.86	1.7306	1.99	3.30	.87	2.81
268.120	1.12	27.28	15.07	1.8102	1.99	3.38	.91	2.78
268.160	1.16	28.84	15.26	1.8894	1.97	3.46	.96	2.75
268.200	1.20	30.40	15.44	1.9681	1.96	3.54	1.00	2.72
268.240	1.24	31.94	15.61	2.0461	1.94	3.63	1.05	2.68
268.280	1.28	33.47	15.76	2.1234	1.92	3.71	1.11	2.64
268.320	1.32	34.97	15.90	2.1997	1.89	3.79	1.16	2.60
268.360	1.36	36.44	16.02	2.2749	1.87	3.88	1.22	2.56
268.400	1.40	37.88	16.13	2.3489	1.83	3.96	1.28	2.51
268.440	1.44	39.27	16.22	2.4215	1.80	4.05	1.35	2.46

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .040000 ft/ft
Mannings n = 0.01300
Invert Elev. = 267.00 ft
Top of Channel = 269.00 ft
Diameter = 2.0000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
268.480	1.48	40.61	16.29	2.4926	1.75	4.14	1.42	2.41
268.520	1.52	41.89	16.35	2.5618	1.71	4.24	1.50	2.35
268.560	1.56	43.09	16.39	2.6291	1.66	4.33	1.59	2.29
268.600	1.60	44.22	16.41	2.6943	1.60	4.43	1.68	2.23
268.640	1.64	45.26	16.42	2.7571	1.54	4.53	1.79	2.16
268.680	1.68	46.20	16.40	2.8171	1.47	4.64	1.92	2.09
268.720	1.72	47.01	16.36	2.8743	1.39	4.75	2.07	2.00
268.760	1.76	47.69	16.29	2.9281	1.30	4.87	2.25	1.91
268.800	1.80	48.22	16.19	2.9781	1.20	5.00	2.48	1.81
268.840	1.84	48.56	16.06	3.0238	1.09	5.14	2.79	1.70
268.876	1.88	48.67	15.90	3.0612	.96	5.28	3.18	1.57
268.880	1.88	48.67	15.88	3.0646	.95	5.29	3.23	1.56
268.920	1.92	48.47	15.64	3.0995	.78	5.48	3.95	1.39
268.960	1.96	47.81	15.29	3.1266	.56	5.72	5.58	1.14
269.000	2.00	45.24	14.40	3.1416	.00	6.28	****	****

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .038000 ft/ft
Mannings n = 0.03500
Invert Elev. = 269.17 ft
Top of Channel = 274.00 ft
Base width = 3.00 ft
Rt Side slope = 4.000 horizontal :1 vert.
Lt Side slope = 4.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
269.167	.00	.00	.00	.0000	.00	.00	.00	0.00
269.177	.01	.01	.38	.0304	3.08	3.08	.01	0.68
269.267	.10	.56	1.65	.3400	3.80	3.82	.09	0.97
269.367	.20	1.88	2.47	.7601	4.60	4.65	.17	1.07
269.467	.30	3.92	3.11	1.2599	5.40	5.47	.23	1.13
269.567	.40	6.70	3.64	1.8400	6.20	6.30	.30	1.18
269.667	.50	10.29	4.12	2.5000	7.00	7.12	.36	1.21
269.767	.60	14.74	4.55	3.2400	7.80	7.95	.42	1.24
269.867	.70	20.10	4.95	4.0601	8.60	8.77	.47	1.27
269.967	.80	26.44	5.33	4.9599	9.40	9.60	.53	1.29
270.067	.90	33.79	5.69	5.9399	10.20	10.42	.58	1.31
270.167	1.00	42.23	6.03	7.0000	11.00	11.25	.64	1.33
270.267	1.10	51.81	6.36	8.1401	11.80	12.07	.69	1.35
270.367	1.20	62.56	6.68	9.3602	12.60	12.90	.74	1.37
270.467	1.30	74.56	6.99	10.6598	13.40	13.72	.80	1.38
270.567	1.40	87.85	7.30	12.0399	14.20	14.54	.85	1.40
270.667	1.50	102.47	7.59	13.5000	15.00	15.37	.90	1.41
270.767	1.60	118.49	7.88	15.0401	15.80	16.19	.95	1.42
270.867	1.70	135.94	8.16	16.6602	16.60	17.02	1.00	1.44
270.967	1.80	154.86	8.43	18.3598	17.40	17.84	1.06	1.45
271.067	1.90	175.33	8.71	20.1399	18.20	18.67	1.11	1.46
271.167	2.00	197.37	8.97	22.0000	19.00	19.49	1.16	1.47
271.267	2.10	221.03	9.23	23.9401	19.80	20.32	1.21	1.48
271.367	2.20	246.36	9.49	25.9603	20.60	21.14	1.26	1.49
271.467	2.30	273.39	9.74	28.0597	21.40	21.97	1.31	1.50
271.567	2.40	302.19	9.99	30.2399	22.20	22.79	1.36	1.51
271.667	2.50	332.78	10.24	32.5000	23.00	23.62	1.41	1.52
271.767	2.60	365.22	10.48	34.8402	23.80	24.44	1.46	1.53
271.867	2.70	399.53	10.72	37.2603	24.60	25.26	1.51	1.54
271.967	2.80	435.76	10.96	39.7597	25.40	26.09	1.57	1.54
272.067	2.90	473.97	11.19	42.3398	26.20	26.91	1.62	1.55
272.167	3.00	514.18	11.43	45.0000	27.00	27.74	1.67	1.56
272.267	3.10	556.44	11.66	47.7402	27.80	28.56	1.72	1.57
272.367	3.20	600.79	11.88	50.5604	28.60	29.39	1.77	1.58
272.467	3.30	647.25	12.11	53.4596	29.40	30.21	1.82	1.58

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .038000 ft/ft
Mannings n = 0.03500
Invert Elev. = 269.17 ft
Top of Channel = 274.00 ft
Base width = 3.00 ft
Rt Side slope = 4.000 horizontal :1 vert.
Lt Side slope = 4.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
272.567	3.40	695.89	12.33	56.4398	30.20	31.04	1.87	1.59
272.667	3.50	746.74	12.55	59.5000	31.00	31.86	1.92	1.60
272.767	3.60	799.83	12.77	62.6402	31.80	32.69	1.97	1.60
272.867	3.70	855.20	12.99	65.8604	32.60	33.51	2.02	1.61
272.967	3.80	912.87	13.20	69.1596	33.40	34.34	2.07	1.62
273.067	3.90	972.92	13.41	72.5398	34.20	35.16	2.12	1.62
273.167	4.00	1035.37	13.62	76.0000	35.00	35.98	2.17	1.63
273.267	4.10	1100.25	13.83	79.5402	35.80	36.81	2.22	1.64
273.367	4.20	1167.59	14.04	83.1605	36.60	37.63	2.27	1.64
273.467	4.30	1237.43	14.25	86.8595	37.40	38.46	2.32	1.65
273.567	4.40	1309.82	14.45	90.6398	38.20	39.28	2.37	1.65
273.667	4.50	1384.79	14.65	94.5000	39.00	40.11	2.42	1.66
273.767	4.60	1462.38	14.86	98.4403	39.80	40.93	2.47	1.67
273.867	4.70	1542.62	15.06	102.4605	40.60	41.76	2.52	1.67
273.967	4.80	1625.51	15.25	106.5595	41.40	42.58	2.57	1.68
274.000	4.83	1653.77	15.32	107.9449	41.67	42.86	2.59	1.68

Attachment 6 – SMP Characteristic Model Inputs

Elevation (ft)	Planimeter (sq.in)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	Volume (ac-ft)	Volume Sum (ac-ft)
269.17	-----	.0662	.0000	.000	.000
270.00	-----	.0662	.1987	.055	.055
270.00	-----	.0706	.2052	.000	.055
271.00	-----	.0750	.2184	.073	.128
272.00	-----	.0794	.2316	.077	.205
273.00	-----	.0838	.2448	.082	.287
274.00	-----	.0926	.2645	.088	.375

POND VOLUME EQUATIONS

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

REQUESTED POND WS ELEVATIONS:

Min. Elev.= 269.17 ft
Increment = .10 ft
Max. Elev.= 274.00 ft

```
*********************************************
                OUTLET CONNECTIVITY
*********************************************

 ---> Forward Flow Only (UpStream to DnStream)
<---  Reverse Flow Only (DnStream to UpStream)
<---> Forward and Reverse Both Allowed
```

Structure	No.		Outfall	E1, ft	E2, ft
Weir-XY Points	W0	--->	C0	269.167	274.000
Culvert-Circular	C0	--->	TW	260.000	274.000
TW SETUP, DS Channel					

OUTLET STRUCTURE INPUT DATA

Structure ID = W0
Structure Type = Weir-XY Points

# of Openings = 1
WEIR X-Y GROUND POINTS

X, ft	Elev, ft
.00	274.00
12.00	270.00
14.00	270.00
14.00	269.17
15.75	269.17
15.75	270.00
17.75	270.00
29.75	274.00

Lowest Elev. = 269.17 ft

Weir Coeff. = 2.640000

Weir TW effects (Use adjustment equation)

OUTLET STRUCTURE INPUT DATA

```
Structure ID      = C0
Structure Type    = Culvert-Circular
------------------------------------
No. Barrels       =         1
Barrel Diameter   =    3.0000 ft
Upstream Invert   =    260.00 ft
Dnstream Invert   =    250.00 ft
Horiz. Length     =    100.00 ft
Barrel Length     =    100.50 ft
Barrel Slope      =    .10000 ft/ft

OUTLET CONTROL DATA...
Mannings n        =     .0130
Ke                =     .5000  (forward entrance loss)
Kb                =   .007228  (per ft of full flow)
Kr                =     .5000  (reverse entrance loss)
HW Convergence    =      .001  +/- ft

INLET CONTROL DATA...
Equation form     =         1
Inlet Control K   =     .0098
Inlet Control M   =    2.0000
Inlet Control c   =    .03980
Inlet Control Y   =     .6700
T1 ratio (HW/D)   =     1.110
T2 ratio (HW/D)   =     1.257
Slope Factor      =     -.500

Use unsubmerged inlet control Form 1 equ. below T1 elev.
Use   submerged inlet control Form 1 equ. above T2 elev.

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...
At T1 Elev =    263.33 ft  --->  Flow =     42.85 cfs
At T2 Elev =    263.77 ft  --->  Flow =     48.97 cfs


Structure ID      = TW
Structure Type    = TW SETUP, DS Channel
------------------------------------
FREE OUTFALL CONDITIONS SPECIFIED

CONVERGENCE TOLERANCES...
Maximum Iterations=    30
Min. TW tolerance =    .01 ft
Max. TW tolerance =    .01 ft
Min. HW tolerance =    .01 ft
Max. HW tolerance =    .01 ft
Min.  Q tolerance =    .10 cfs
Max.  Q tolerance =    .10 cfs
```

Elevation (ft)	Planimeter (sq.in)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	Volume (ac-ft)	Volume Sum (ac-ft)
298.90	-----	.0037	.0000	.000	.000
300.00	-----	.0765	.0970	.036	.036
302.00	-----	.2382	.4495	.300	.335
304.00	-----	.5411	1.1382	.759	1.094

POND VOLUME EQUATIONS

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

REQUESTED POND WS ELEVATIONS:

Min. Elev.= 298.90 ft
Increment = .10 ft
Max. Elev.= 304.00 ft

```
*********************************************
                OUTLET CONNECTIVITY
*********************************************

 ---> Forward Flow Only (UpStream to DnStream)
<---  Reverse Flow Only (DnStream to UpStream)
<---> Forward and Reverse Both Allowed
```

Structure	No.		Outfall	E1, ft	E2, ft
Culvert-Circular	C0	--->	TW	298.900	304.000
TW SETUP, DS Channel					

OUTLET STRUCTURE INPUT DATA

```
Structure ID      = C0
Structure Type    = Culvert-Circular
-----------------------------------
No. Barrels       =         1
Barrel Diameter   =    3.0000 ft
Upstream Invert   =    298.90 ft
Dnstream Invert   =    293.90 ft
Horiz. Length     =    100.00 ft
Barrel Length     =    100.12 ft
Barrel Slope      =    .05000 ft/ft

OUTLET CONTROL DATA...
Mannings n        =     .0240
Ke                =     .5000  (forward entrance loss)
Kb                =   .024635  (per ft of full flow)
Kr                =     .5000  (reverse entrance loss)
HW Convergence    =      .001  +/- ft

INLET CONTROL DATA...
Equation form     =         1
Inlet Control K   =     .0078
Inlet Control M   =    2.0000
Inlet Control c   =    .03790
Inlet Control Y   =     .6900
T1 ratio (HW/D)   =      .000
T2 ratio (HW/D)   =     1.271
Slope Factor      =     -.500

Use unsubmerged inlet control Form 1 equ. below T1 elev.
Use   submerged inlet control Form 1 equ. above T2 elev.

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...
At T1 Elev =    298.90 ft  --->  Flow =     42.85 cfs
At T2 Elev =    302.71 ft  --->  Flow =     48.97 cfs
```

OUTLET STRUCTURE INPUT DATA

```
Structure ID      = TW
Structure Type    = TW SETUP, DS Channel
------------------------------------
FREE OUTFALL CONDITIONS SPECIFIED

CONVERGENCE TOLERANCES...
Maximum Iterations=    40
Min. TW tolerance =    .01 ft
Max. TW tolerance =    .01 ft
Min. HW tolerance =    .01 ft
Max. HW tolerance =    .01 ft
Min.  Q tolerance =    .00 cfs
Max.  Q tolerance =    .00 cfs
```