# Stormwater Management Plan

# TACONIC TRACT

## TOWN OF MOUNT PLEASANT
## WESTCHESTER COUNTY

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October 2007
Revised: September 2009

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**STORMWATER MANAGEMENT PLAN**
**TACONIC TRACT**
**TOWN OF MOUNT PLEASANT, NY**

**Table of Contents**

A) Project Overview


INTRODUCTION ..... 2
EXISTING CONDITIONS ..... 2
HYDROLOGICAL ANALYSIS ..... 4
METHODOLOGY ..... 4
PRE-DEVELOPMENT STORMWATER RUNOFF ..... 4
POST-DEVELOPMENT STORMWATER RUNOFF ..... 5
STORMWATER MANAGEMENT ..... 6
STORMWATER QUANTITY ..... 6
STORMWATER QUALITY ..... 7
ALTERNATIVES ..... 9
CONVENTIONAL SUBDIVISION ..... 9
CONSERVATION SUBDIVISION ..... 10
EROSION AND SEDIMENT CONTROL ..... 11
TEMPORARY EROSION AND SEDIMENT CONTROL FACILITIES ..... 11
STRUCTURAL MEASURES ..... 11
VEGETATIVE MEASURES ..... 12
MAINTENANCE AND INSPECTION OF TEMPORARY CONTROL MEASURES ..... 13
PERMANENT EROSION AND SEDIMENT CONTROL FACILITIES ..... 14


B) Hydrologic Soil Group Map and Data

C) Calculations


PRE-DEVELOPMENT DRAINAGE ANALYSIS
POST-DEVELOPMENT DRAINAGE ANALYSIS - CONVENTIONAL LAYOUT
POST-DEVELOPMENT DRAINAGE ANALYSIS - CONSERVATION LAYOUT
POST-DEVELOPMENT WATER QUALITY - CONVENTIONAL LAYOUT
POST-DEVELOPMENT WATER QUALITY - CONSERVATION LAYOUT


D) Plan Figures


Figure 1: Soil Types
Figure 1A: Existing Soil Types. Conventional Layout
Figure 1B: Existing Soil Types. Conservation Layout
Figure 2: Pre-Development Drainage Areas
Figure 3: Post-Development Drainage Areas. Conventional Layout
Figure 4: Post-Development Drainage Areas. Conservation Layout
Figure 5: Post-Development Drainage Facilities. Conventional Layout
Figure 6: Post-Development Drainage Facilities. Conservation Layout

**STORMWATER MANAGEMENT PLAN**
**TACONIC TRACT**
**TOWN OF MOUNT PLEASANT, NY**

## List of Tables

Table 1: Design Storm Precipitation Amounts .....4
Table 2: Existing (Pre-Development) Drainage Conditions .....5
Table 3: Post-Development Drainage Conditions. Coventional Layout (without Mitigation).....6
Table 4: Pre- Versus Post-Development Peak Discharges. Conventional Layout (without Mitigation) .....6
Table 5: Pre- Versus Post-Development Peak Discharges. Conventional Layout (with Mitigation) .....6
Table 6: Water Quality Swales. Required Volumes and Dimensions. Conventional Layout…….7
Table 7: Water Quality Swales. Discharges and Depths. Conventional Layout…….8
Table 8: Roof Buildings water Quality requirements……..8

# Section A:

# Project Overview

## INTRODUCTION

This Stormwater Management Plan is being prepared in conjunction with the development of the Taconic Tract site. The purpose of this plan is to outline design and operational measures of drainage facilities that will meet the requirements of the New York State Department of Environmental Protection (NYSDEC) Phase II Stormwater Regulations to mitigate stormwater runoff quality and quantity impacts, as well as impacts from erosion and sedimentation during site construction.

The applicant, Taconic Tract Development, LLC, proposes to develop the 30.00 acre property as a conventional 17 lot subdivision. The site is located in the Town of Mount Pleasant in a R-40 zoning district. The lot is located between the Taconic State Parkway (east), Washburn Road (south), Todd Lane (west) and Carleton Avenue (north). The proposed lots will vary in size from 0.92 acres to 7.58 acres. The proposed construction includes construction of 16 single family residential dwellings, access roads, driveways and landscaping in addition to the stormwater management facilities. In total the project could ultimately disturb approximately 8.32 acres or 27.7% of the property.

Construction activities are expected to commence in 2010 and continue until 2011. The initial phase of the work would be the construction of the detention facilities, utilities including the drainage system and access roads. The activity will continue with the construction of the single home residences.

Soil disturbing activities associated with construction will include: clearing and grubbing; installing a stabilized construction entrance; installing erosion and sediment controls; excavating for and placing water, sewer, electric and communications lines, stormwater management facilities, and house foundations; constructing access roads, and retaining walls; grading; preparing for final planting and seeding.

Drainage facilities and the erosion and sedimentation control measures will be designed and implemented, in accordance with *New York State Stormwater Management Design Manual* (NYSDEC, Aug. 2003) and the *New York State Standards and Specifications for Erosion and Sediment Control* (NYSDEC Aug. 2005), as well as the requirements for a SPDES General Permit GP-0-08-001 for Stormwater Discharges From Construction Activities.

## EXISTING CONDITIONS

Stormwater runoff within the project site is generally in a north to south direction towards an existing pond at Washburn Road. The developed area of the site is situated in a watershed of approximately 36 acres. Within the overall watershed, 20 acres drain towards the existing pond located just outside of the south east corner of the property. The runoff, from the other 16 acres, also drains south crossing Washburn Road towards a few properties located on the south side of the property.

**None of the site is within the New York City reservoir watershed.**

According to the "Soil Survey of Westchester County" by the U.S. Department of Agriculture, Soil Conservation Service, on-site soils predominantly include Charlton-Chatfield complex,

rolling (CrC), Chatfield-Charlton complex, hilly (CsD) and Paxton (PnD). Soil characteristics are as follows:

- *Charlton-Chatfield complex, rolling (CrC)*: This soil is moderately steep, very deep and well drained. It is on side slopes of broad ridges and small hills. Individual areas are irregularly shaped or are long and narrow on slopes ranging from 15% to 25%. The typical sequence is 2-8 inches of top soil, 8 to 24 inches of yellowish brown sandy loam and 24 to 60 inches of dark grayish or brown sandy loam. Water table is usually perched from February to April above the dense substratum of sandy loam. Permeability is moderate (0.6-20. in/hr) in the subsurface layer and slow (less than 0.2 in/hr) in the substratum. This unit covers approximately 41.2% of the site, primarily at the north portion of site.
- *Chatfield-Charlton complex, hilly, very rocky (CsD)*: This unit consists of very deep and moderately deep, well drained and somehow excessively drained Chatfield soil and the well drained Charlton soil. It is located on the tops and side of hills that are underlain by highly folded bedrock. Slopes range from 15 to 35 percent. Individual areas are highly irregular in shape and range from 3 to 75 acres in size. The typical sequence is 0 to 7 inches of topsoil, 7 to 24 inches of dark grayish brown sandy loam and 24 to 60 inches of dark brown or grayish sandy loam. In Chatfield soils fractured bedrock could be encountered as close as 24 inches from the surface. Water table is at a depth of more than 6 feet throughout the year and the permeability is moderate or moderately rapid (0.6-6in/hr). The central and southwestern sections are covered with Chatfield-Charlton type of soils and represent approximately 39.7% of the site.
- *Paxton fine sandy loam (PnD)*: This unit consists of moderately steep, very deep, and well drained soil. It is located on side slopes of broad ridges and small hills. Individual areas are irregularly shaped or are long and narrow. They range from 2 to 75 acres in size. The typical sequence is 0 to 10 inches of topsoil, 10 to 20 inches of yellowish or loam and 20 to 60 inches of firm grayish sandy or gravely loam. The water table is usually perched above the firm substratum and the permeability is moderate (0.6-2.0 in/hr) in the surface layer and slow (less than 0.2 in/hr) in the substratum. Paxton soils are located on the east side of the property towards the Taconic Parkway and represents approximately 14.7% of the site.

The soil type map for the site is shown in *Section B – Hydrologic Soil Group Map and Data* and *Section D – Plan Figures – Figure 1: Soil Types*. *Figures 1A and 1B: Existing Soil Types* show the soil type map along with the two proposed layouts.

Most of the project site is wooded. There are also areas of grass along the existing paved roads. The central western section of the site is nicely forested and has an orchard aspect. There are no wetlands or watercourses on the site. The highest part of the parcel is found in the northwestern section of the property approximately 200 feet west of the existing tennis court, where the elevation is 415.0 feet. The lowest area of the property is at an elevation of 250.0 feet and is located at the south eastern section of the property. In general, the land slopes east and south.

## HYDROLOGICAL ANALYSIS

### *METHODOLOGY*

Computations of existing runoff amounts were completed for the Type III, 1-, 2-, 10-, 25-, 50- and 100-year, 24-hour design storms using the United States Department of Agriculture (USDA) Natural Resources Conservation Service (former Soil Conservation Service), Technical Release – 55 (TR-55) methodology. The TR-55 method of stormwater modeling is accepted by both the USDA and the U.S. Army Corps of Engineers, and meets the SEQRA scoping goals for this project, as well as the requirements of NYSDEC. PondPack®, Version 10.0 by Haestad System, which uses a hybrid of the strengths of HEC-1 (U.S. Army Corps of Engineers) and TR-20 (SCS) was used for completing the stormwater analyses for the project.

The software forecasts the rate of surface water runoff and watercourse flow rates based on several factors. The input data includes information on land use, soil types, vegetation, watershed areas, time of concentration, rainfall data, storage volumes, and hydraulic capacities of the hydraulic structures. The computer model predicts the amount of runoff as a function of time, including the attenuation effect due to dams, lakes, large wetlands, and floodplains. Runoff rates during specific rainstorms may vary due to different assumptions concerning soil moisture, water levels in ponds, snowmelt, and rainfall patterns. The input data for rainfalls with statistical recurrence frequencies of 1-, 2-, 10-, 25-, 50- and 100-year were obtained from the U.S. Weather Bureau Technical Papers. The National Weather Service developed four synthetic storms to simulate rainfall patterns around the country. For analysis in Westchester County, the Type III rainfall pattern with a 24-hour duration is valid.

The design storms analyzed correlate to the requirements of the NYSDEC for the Phase II Stormwater Regulations in which stormwater management practices must mitigate the $C_{Pv}$ (Channel Protection Volume – 1 Year Storm Event), the $Q_P$ (Overbank Flood Control – 10 Year Storm Event) and $Q_F$ (Extreme Flood Control – 100 Year Storm Event) storm events. Precipitation for the required storms is contained in Table 1.

**Table 1: Design Storm Precipitation Amounts**

| Design Storm | Precipitation Amount (Inches) |
|---|---|
| 1-Year ($C_{Pv}$) | 2.8 |
| 2-Year | 3.5 |
| 10-Year ($Q_P$) | 5.0 |
| 25-Year | 6.0 |
| 50-Year | 7.0 |
| 100-Year ($Q_F$) | 7.5 |

### *PRE-DEVELOPMENT STORMWATER RUNOFF*

In order to determine the pre-development conditions for the site, two analysis points (A and B) with the corresponding watersheds were chosen in relationship with the possible impact

downstream of the developed areas (*see Section D: Plan Figures - Figure 2, Pre-Development Drainage Areas*). The pre-development conditions will ultimately be used in determining the stormwater detention needs for the proposed development. An analysis of the drainage basins was done to compute the peak runoff rates during each of the design storms. A printout of the complete results is contained in *Section C: Calculations – PRE-DEVELOPMENT DRAINAGE ANALYSIS*. The input parameters for drainage area, time of concentration ($T_C$) and composite curve number (CN), as well as the analysis results for pre-development are summarized in Table 2.

**Table 2: Existing (Pre-Development) Drainage Conditions**

| Drainage Basin | Drainage Area (Acres) | Curve No. (CN) | Travel Time ($T_C$) (hr) | Peak Runoff Rate (cfs) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 1-Year ($C_{Pv}$) | 2-Year | 10-Year ($Q_P$) | 25-Year | 50-Year | 100-Year ($Q_F$) |
| A | 20.1 | 65 | 0.34 | 4.5 | 9.7 | 24.1 | 35.3 | 47.3 | 53.6 |
| B | 16.0 | 65 | 0.23 | 4.1 | 8.9 | 22.0 | 32.1 | 42.9 | 48.5 |

***POST-DEVELOPMENT STORMWATER RUNOFF***

For the post-development condition similar watersheds were used, however both drainage areas were subdivided and modified to reflect the changes of the site to analyze the hydrology under proposed conditions (*see Section D: Plan Figures - Figure 3, Post-Development Drainage Areas, Conventional Layout*). Input parameters were modified to reflect changes in the drainage basin boundaries, plus changes to the times of concentration and curve numbers that resulted because of the development of the site. The complete analysis for the post-development condition is contained in *Section C: Calculations – POST-DEVELOPMENT DRAINAGE ANALYSIS – CONVENTIONAL LAYOUT*. The input parameters for drainage area, $T_C$ and CN, as well as the analysis results for post-development are summarized in Table 3 for the Conventional Layout. These values reflect the peak runoff rate prior to the design of any stormwater peak discharge mitigation measures.

**Table 3: Post-Development Drainage Conditions**
**Conventional Layout**
**(without Mitigation)**

| Drainage Basin | Drainage Area (Acres) | Curve No, CN | Travel Time, $T_C$ (hr) | Peak Runoff Rate (cfs) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 1-Year ($C_{Pv}$) | 2-Year | 10-Year ($Q_P$) | 25-Year | 50-Year | 100-Year ($Q_F$) |
| A1 | 17.1 | 63 | 0.34 | 2.9 | 6.9 | 18.4 | 27.5 | 37.4 | 42.5 |
| A2 | 4.3 | 76 | 0.20 | 3.3 | 5.2 | 9.9 | 13.2 | 16.6 | 18.3 |
| A1+A2 | 21.4 | | | 5.3 | 11.1 | 26.8 | 38.7 | 51.5 | 58.2 |
| B1 | 5.4 | 68 | 0.16 | 2.2 | 4.3 | 9.5 | 13.5 | 17.6 | 19.8 |
| B2 | 9.3 | 69 | 0.22 | 3.8 | 7.2 | 15.7 | 22.1 | 28.8 | 32.3 |
| B1+B2 | 14.7 | | | 6.0 | 11.3 | 25.0 | 35.3 | 46.0 | 51.6 |

## STORMWATER MANAGEMENT

### *STORMWATER QUANTITY*

As mentioned earlier to evaluate the change from pre- and post-development conditions, the peak flows for several of the subwatersheds were hydrologically added to compute peak runoff rates at common downstream points. Using the common discharge points a comparison was made for pre- and post-development peak runoff rates for the site and is shown in Table 4.

**Table 4: Pre- Versus Post-Development Peak Discharges**
**Conventional Layout**
**(without Mitigation)**

| Drainage Basin | Pre-Development Peak Runoff Rate (cfs) | | | | | | Post-Development Peak Runoff Rate (cfs) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1-Year ($C_{Pv}$) | 2-Year | 10-Year ($Q_P$) | 25-Year | 50-Year | 100-Year ($Q_F$) | 1-Year ($C_{Pv}$) | 2-Year | 10-Year ($Q_P$) | 25-Year | 50-Year | 100-Year ($Q_F$) |
| A (A1+A2) | 4.5 | 9.7 | 24.1 | 35.3 | 47.3 | 53.6 | (5.3) | (11.1) | (26.8) | (38.7) | (51.5) | (58.2) |
| B (B1+B2) | 4.1 | 8.9 | 22.0 | 32.1 | 42.9 | 48.5 | (6.0) | (11.3) | (25.0) | (35.3) | (46.0) | (51.6) |

As can be seen in the above tabulation, without detention there would be small increases in the peak runoff rates. To mitigate any increases, a detention basin has been proposed as shown in Table 5. The detention basin will collect the runoff from Drainage Areas A2 and B1. The peak flows will be conveyed through a closed storm sewer system. The basin shall have approximately 1.3 acre-feet (56,650 cubic feet) of storage and will mitigate any increase in peak

runoff for the 1-, 2-, 10-, 25-, 50- and 100-year design storms at the common discharge point A. In general, this includes runoff collected by the proposed access roads and diverted towards the detention basin. The proposed drainage system will be capable of conveying a 100-year frequency storm to the detention basin.

**Table 5: Pre- Versus Post-Development Peak Discharges**
**Conventional Layout**
**(with Mitigation)**

| Drainage Basin | Pre-Development Peak Runoff Rate (cfs) | | | | | | Post-Development Peak Runoff Rate (cfs) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1-Year ($C_{Pv}$) | 2-Year | 10-Year ($Q_P$) | 25-Year | 50-Year | 100-Year ($Q_F$) | 1-Year ($C_{Pv}$) | 2-Year | 10-Year ($Q_P$) | 25-Year | 50-Year | 100-Year ($Q_F$) |
| A (A1+A2) | 4.5 | 9.7 | 24.1 | 35.3 | 47.3 | 53.6 | 4.5 | 9.7 | 24.1 | 35.3 | 47.3 | 53.6 |
| B (B1+B2) | 4.1 | 8.9 | 22.0 | 32.1 | 42.9 | 48.5 | 4.1 | 8.9 | 22.0 | 32.1 | 42.9 | 48.5 |

***STORMWATER QUALITY***

Several Stormwater Management Practices (SMPs) are incorporated into the stormwater management system design to maintain water quality. The methodology used for the design of the SMPs will follow the guidelines contained in *New York State Stormwater Design Manual* to meet the Phase II Stormwater Regulations.

Several SMPs were used to mitigate water quality. These include dry swales, plunge pools and dry wells/infiltrator chambers (*see Section D: Plan Figures – Figures 3 & 4: Post-Development Drainage Areas*).

- Grassed, dry swales will be constructed in several locations near the proposed detention basin on the site. These swales will be used to provide water quality treatment before peak discharges enter the detention pond. At the upstream end of the dry swales, plunge pools will be constructed to pre-treat 25% of the water quality volume. In order to treat the water quality flow up to the channel protection discharge (CPv), a diversion structure will be constructed upstream of each plunge pool. The diversion structure will allow smaller flows toward the plunge pool and larger flows to enter directly into the detention basin. A water quality swale is also directed to the plunge pool. The swale reduces the velocity, temporarily stores stormwater runoff and promotes infiltration. Pollutant removal mechanisms in water quality swales include sedimentation, adsorption, biological treatment and microbial breakdown. The swales will be trapezoidal with a 3:1 side slope, 3.0 foot bottom and 0.008 slope. The swales are designed to carry the water

quality discharge at a minimum of 10 minutes detention time and allowed to pass the overbank flood (Qp). Table 6 and Table 7 show the quality swale design data.

**Table 6: Water Quality Swales**
**Required Volumes and Dimensions**
**Conventional Layout**

| Water Quality Swale | Drainage Area (Acres) | Water Quality Volume, WQV (cfs) | Required Length (ft) |
|---|---|---|---|
| Drainage Area A2 | 4.3 | 7,041 | 210 |
| Drainage Area B1 | 5.4 | 5,173 | 192 |

**Table 7: Water Quality Swales**
**Discharges and Depths**
**Conventional Layout**

| Water Quality Swale | Proposed Condition Discharges (cfs) | | | | Proposed Condition Water Depth (ft) | | | |
|---|---|---|---|---|---|---|---|---|
| | $C_{Pv}$ | $Q_P$ | $Q_F$ | $Q_{WQ}$ | $C_{Pv}$ | $Q_P$ | $Q_F$ | $Q_{WQ}$ |
| Drainage Area A2 | 3.3 | 9.9 | 18.3 | 1.5 | N/A | N/A | N/A | 0.8 |
| Drainage Area B1 | 2.2 | 9.5 | 19.8 | 1.1 | N/A | N/A | N/A | 0.7 |

- Dry Wells/Infiltration Trenches. First flush runoff volumes from roof and drive areas will be collected in infiltration trenches as required, to provide the volume of water quality treatment prescribed by NYSDEC guidelines. Dwellings which do not drain directly to the detention basin watershed will be provided with infiltration trenches (Figure 4). The required roof runoff quality volumes are shown in Table 8.

**Table 8: Roof Buildings**
**Water Quality Requirements**

| Source | Area (Ac) | I | Rv | WQV (ft3) | WQV (gal) |
|---|---|---|---|---|---|
| House & Drive | 0.13 | 100 | 0.95 | 583 | 4,360 |

- The use of infiltrator chambers (12- Cultec 150HD surrounded in stone, with a volume of 36.7 $ft^3$/unit) was recommended.

- Micropool Extended Detention Pond: As necessary, to enhance stormwater quality and reduce peak discharges, a micropool and extended detention areas will be incorporated into the detention basin. If used, it is suggested that the pond be constructed early in the development of the site, so that it can act as an effective means of trapping sediment from construction activities.

## ALTERNATIVES

### *CONVENTIONAL SUBDIVISION*

The conventional layout was designed as a standard 17-lot subdivision, with the smallest parcel being 40,050 square feet and the largest, the existing Waterhouse Lot, is 330,368 square feet. Refer to *Section D: Plan Figures – Figure 6: Proposed Drainage Facilities – Conventional Layout.*

Two roads are planned in this layout. Road A enters the subdivision from Washburn Road and ends at proposed Road B. Nine of the lots will be located along this street. The street drains from Road B toward Washburn Road, north to south, into a closed system through a series of catch basins. The drainage system is connected to a diversion structure, which will be placed in line of the system going from the last collection structure to the detention basin. The diversion structure diverts flow between a plunge pool and the detention basin.

Road B enters the subdivision from Carleton Avenue and continues east creating a cul-de-sac. There are seven lots located along this street. Storm drainage flows from Carleton Avenue east toward the end of the cul-de-sac. Catch basins have been proposed along Road B to capture the street drainage into the closed system that also connects to a diversion structure and eventually empties into the detention pond.

The infiltration galleries proposed are to capture overland flow and roof drainage from the seven properties which do not drain toward the street or into a water quality swale. These infiltrator chambers help to prevent any increase in the peak runoff rate (as shown in Table 5 above) and improve the stormwater quality.

### *CONSERVATION SUBDIVISION*

The conservation layout is the preferred layout. It is a combination of nine conventional lots with a "cluster" of eight smaller lots. The smallest parcel is 10,560 square feet and the largest will remain the same in both layouts, the existing Waterhouse Lot, at 330,368 square feet. Refer to *Section D: Plan Figures – Figure 5: Proposed Drainage Facilities – Conservation Layout.*

The conservation layout consists of three roads. Roads A and B for the conservation layout mimic Roads A and B of the conventional layout, respectively. Their alignments differ to accommodate for the lot layout change. Road A has five lots located along it, while Road B has three. Even the drainage concept between the conventional and conservation layouts is similar. Road C parallels Road A to the east. It intersects Road B just as Road A does, except that Road C terminates as a cul-de-sac, not outletting to Washburn Road. The eight clustered properties are located along this street. Drainage for Road C travels from Road B toward the end of the cul-de-sac through a closed system, connected to a diversion structure and ultimately flowing to the detention basin.

There are five infiltration galleries proposed for the conservation layout. These chambers will serve the same purpose as in the conventional layout, to prevent any increase in the peak runoff rate and improve the stormwater quality.

Overall, the conventional and conservation layouts are similar in their approaches of land use. Demands on community services will not significantly differ between the two alternatives. Reforestation requirements are negligible for both layouts as per the replacement density factor (RDF) in the Town Code of Mount Pleasant for Tree Preservation. Steep slope disturbance is reduced for the conservation layout.

## EROSION AND SEDIMENT CONTROL

### *TEMPORARY EROSION AND SEDIMENT CONTROL FACILITIES*

Land disturbance at the proposed site will be carefully sequenced so that grading operations can begin and end as quickly as possible, thus minimizing the exposed areas subject to erosion. Site clearing, access roads, rough land grading, and installation of underground utilities (storm, water, electric, telephone, etc.), will commence initially. All material from excavation will be stockpiled in-situ to concentrate the area of loose soil exposed to runoff. At the stock pile, silt fences will be installed and temporary dikes/swales will be placed if necessary during construction.

During this stage, soil in areas previously covered will be exposed to runoff. Erosion of these areas will be controlled by establishing temporary seeding and mulch, and by placing straw bale dikes and silt fences. The purpose of the temporary seeding and mulch is to reduce sediment carried by the runoff from the exposed areas and to control dust. Temporary seeding and mulch will be placed as soon as the removal activity is completed. During development, areas where construction has temporarily or permanently ceased will be stabilized within 14 days unless construction will resume within 21 days.

Construction of the buildings and their associated site improvements will commence once site work has been substantially completed and stabilized. Prior to starting these activities, silt fences will be placed along the perimeter of the cleared areas and temporary seeding will be done as necessary to install the silt fences.

### *STRUCTURAL MEASURES*

Straw Bale Dike

Straw bale barriers will be provided down-gradient of all construction activities. The purpose of a bale barrier is to trap sediment from sheet erosion before it travels overland to down-gradient properties. The straw bale dikes will be placed as construction progresses on the site.

Silt Fence

Silt fence sediment barriers will be installed down-slope of disturbed areas with minimal slope to filter sediment runoff from sheet flow. Silt fences will also be provided around stockpile areas and between construction areas and property lines to reduce sediment laden runoff from traveling off-site. Additional silt fences will be installed as required during construction activities.

Anti-tracking Apron at Site Entrance

A temporary stabilized construction entrance of gravel will be installed where the access area intersects with Washburn Road and Carleton Avenue. During muddy conditions, drivers of construction vehicles will be required to wash their wheels before exiting the site.

Storm Drain Inlet Protection

All storm catch basin inlets will be protected to prevent sediment laden runoff from clogging the drain pipes during construction. Filter fabric inlet protection and/or inlet sediment devices should be used on each inlet until upland areas are stabilized.

Diversion Dike/Swale

Diversion dikes/swales will be included in the erosion and sedimentation plan to control and reduce the amount of sediments leaving the site. These diversion dikes/swales will be placed downgrade of disturbed areas, whenever these areas become larger than the areas allowed to be controlled by only a straw bale or silt fence. The diversion dikes/swales will be placed following the existing topography and will be temporarily seeded with a fast-germinating grass, and riprap protected at any discharge points.

Check Dams

Check dams will be added to diversion swales/channels, as well as any temporary drainage swales to reduce the flow velocity in the channels. This will help to reduce erosion of those temporary drainage facilities.

Water Bars

Water bars will be provided across the proposed roads, particularly in areas where the grades are in excess of 5%. The water bars will limit the accumulation of erosive velocities of stormwater runoff by diverting the surface water to diversion or temporary drainage swales/channels.

Temporary Sediment Basins

Temporary sediment basins will be constructed at the permanent detention basin locations to intercept sediment ladened runoff and to trap and retain the sediment. The size of the basin will be in accordance with the *New York State Standards and Specifications for Erosion and Sediment Control* for the area contributing to the basin during a particular construction phase.

***VEGETATIVE MEASURES***

Temporary Seeding

All cleared areas which will not reach final grading for a period of more than 30 days will be seeded temporarily with fast germinating temporary grasses to reduce erosion potential, immediately following grading. Selection of the seed mixture will depend on the time of year it is applied, as recommended in Section 3 of the *New York State Standards and Specifications for Erosion and Sediment Control*.

Erosion Control Blankets or Mulch

North American Green biodegradable erosion control blankets will be installed to provide immediate erosion protection and vegetation establishment on excavated or fill slopes or low flow channels which have been brought to final grade and have been seeded to protect the slopes from rill and gully erosion and to allow the seeds to germinate properly. The erosion control blankets will be double netting with degradable thread. This practice shall be applied especially at areas where slopes exceed 5 percent. Mulch (straw or fiber) will be used to control dust resulting from construction activity.

### *MAINTENANCE AND INSPECTION OF TEMPORARY CONTROL MEASURES*

In general, all erosion and sediment control measures will be checked weekly and after each significant rainfall of 0.5 inches or greater, unless otherwise specified. The following items will be checked in particular:

1. Existing riprap protection outlets will be inspected to determine if high flows have caused scouring beneath the riprap or filter fabric. If repairs are needed, they should be done immediately.
2. Temporary dikes/swales shall be inspected for proper functioning or signs of erosion and shall be repaired as necessary. Sediment accumulated to an elevation one foot below the crest of the earth barrier shall be removed and placed in the stockpile.
3. Silt fence barriers shall be inspected for damage resulting from deterioration or undercutting and shall be repaired or replaced as necessary. Sediment shall be removed when the level of sediment deposition reaches halfway to the top of the barrier.
4. Catchbasins and drainage outlets will be checked for accumulation of sediment.
5. Straw bale dikes shall be inspected immediately after each rainfall. All damaged bales, end runs and undercutting beneath bales shall be replaced or repaired. Sediment deposits shall be removed after each rainfall or when the level of deposition reaches half the height of the barrier.
6. Sediment shall be removed from temporary sediment basins whenever their capacity has been reduced by fifty percent from the design capacity.
7. Construction entrance shall be inspected for evidence of off-site sediment tracking. The paved street adjacent to the site entrance will be swept daily to remove any excess mud, dirt or rock tracked from the site. Repair road and/or add stone as necessary. Dump trucks hauling material from the construction site will be covered with a tarp.
8. The paved street adjacent to the site entrance will be swept daily to remove any excess mud, dirt or rock tracked from the site.
9. Areas that have received final stabilization shall be inspected at least once per month until the entire site has been stabilized.
10. Disturbed areas and exposed areas used for storage/stockpiling that have not received final stabilization shall be inspected for their potential sediment contribution to stormwater.

11. The seeded areas shall be inspected regularly to ensure that a good stand is maintained. Areas where vegetation is missing or damaged shall be fertilized and reseeded as needed.
12. Inspection schedule will be completed and maintained on-site and will contain the following information: date, name of person conduction inspection, areas inspected, problems/conditions encountered, actions taken to correct problem.
13. Employees will be trained to recognize any pollution source and report such immediately. Training will be provided before the construction activity begins.
14. A maintenance schedule will be kept on-site to record and describe any discharge incidents occurring during construction activity, including actions taken to correct the problem, date, name of person conducting the maintenance.

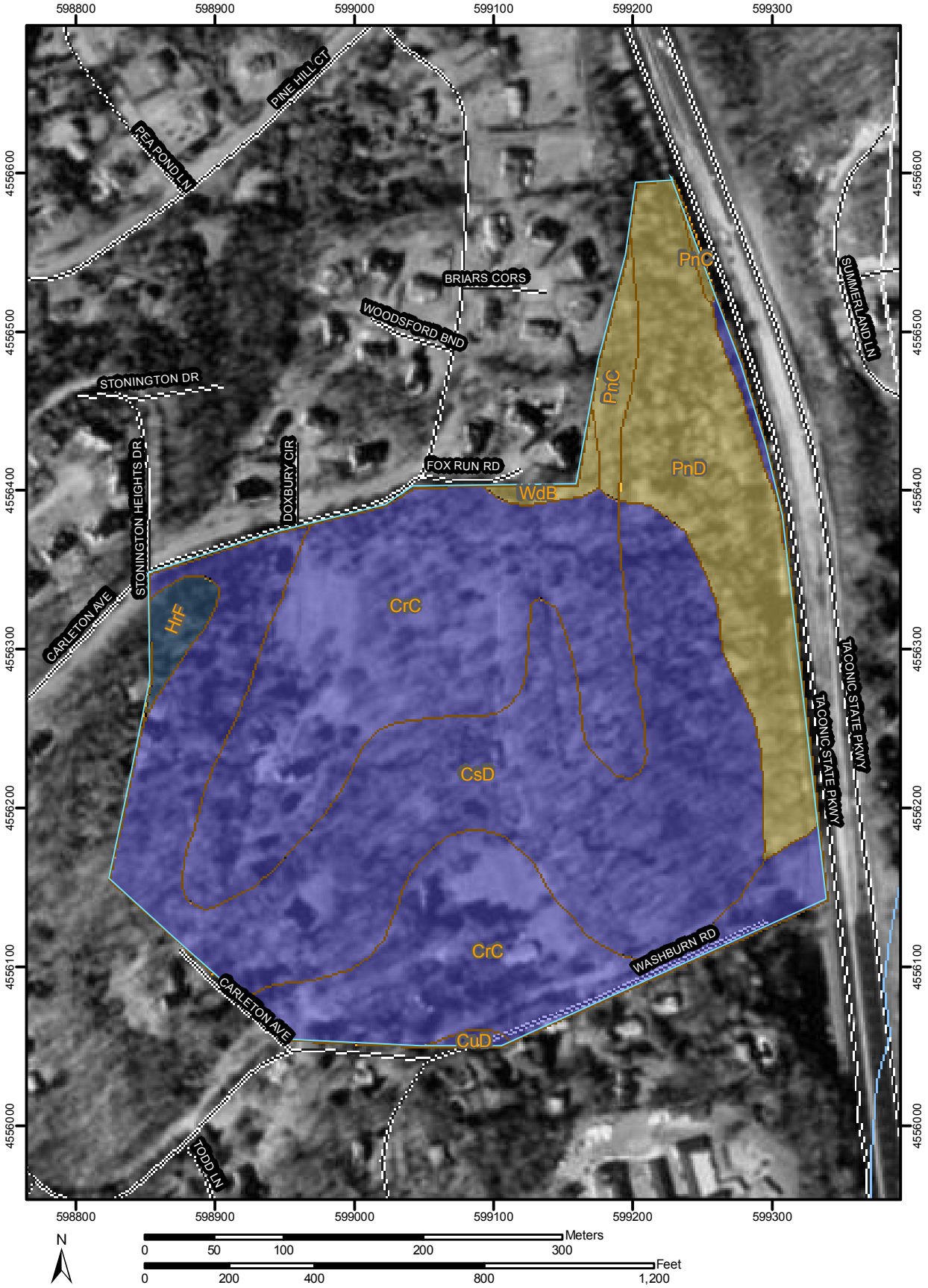
## *PERMANENT EROSION AND SEDIMENT CONTROL FACILITIES*

Grading of the existing surface will be required in and around the proposed buildings and roadway areas. Runoff from rooftops and drives will be drywells/infiltration galleries to reduce the quantity of runoff and a treatment for stormwater quality. Surface runoff from access roads, paths, and landscaped areas will be directed to drainage swales and channels, and where appropriate catch basins for ultimate connection to the grass dry swales and detention basin. Drainage swale and channels will be permanently stabilized with vegetative material or rip-rap to prevent erosion and control runoff velocities.

In order to disperse or “spread” the concentrated flow from the detention basin outlet thinly over the existing undisturbed vegetated ground, a level spreader was provided. Its purpose is to spread the concentrated outflow over a wide area so that the erosion does not occur. The level spreader will also remove other pollutants from runoff by filtration, infiltration, adsorption and decomposition.

# Section B:

# Hydrologic Soil Group Map and Data


598800
598900
599000
599100
599200
599300
4556600
4556500
4556400
4556300
4556200
4556100
4556000
PINE HILL CT
PEA POND LN
BRIARS CORS
WOODSFORD BND
STONINGTON DR
STONINGTON HEIGHTS DR
DOXBURY CIR
FOX RUN RD
CARLETON AVE
SUMMERLAND LN
TACONIC STATE PKWY
WASHBURN RD
TODD LN
PnC
PnD
WdB
HrF
CrC
CsD
CuD
N
Meters
0
50
100
200
300
Feet
0
200
400
800
1,200

## MAP LEGEND

**Area of Interest (AOI)**

Area of Interest (AOI)

**Soils**

Soil Map Units

**Soil Ratings**

A

A/D

B

B/D

C

C/D

D

Not rated or not available

**Political Features**

**Municipalities**

Cities

Urban Areas

**Water Features**

Oceans

Streams and Canals

**Transportation**

Rails

**Roads**

Interstate Highways

US Routes

State Highways

Local Roads

Other Roads

## MAP INFORMATION

Original soil survey map sheets were prepared at publication scale. Viewing scale and printing scale, however, may vary from the original. Please rely on the bar scale on each map sheet for proper map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 18N

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Westchester County, New York
Survey Area Data: Version 4, Dec 14, 2006

Date(s) aerial images were photographed: 1994

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# Hydrologic Soil Group

| Hydrologic Soil Group— Summary by Map Unit — Westchester County, New York | | | | |
|---|---|---|---|---|
| **Map unit symbol** | **Map unit name** | **Rating** | **Acres in AOI** | **Percent of AOI** |
| CrC | Charlton-Chatfield complex, rolling, very rocky | B | 19.2 | 41.2% |
| CsD | Chatfield-Charlton complex, hilly, very rocky | B | 18.5 | 39.7% |
| CuD | Chatfield-Hollis-Rock outcrop complex, hilly | B | 0.1 | 0.3% |
| HrF | Hollis-Rock outcrop complex, very steep | C/D | 0.7 | 1.4% |
| PnC | Paxton fine sandy loam, 8 to 15 percent slopes | C | 0.9 | 2.0% |
| PnD | Paxton fine sandy loam, 15 to 25 percent slopes | C | 6.9 | 14.7% |
| WdB | Woodbridge loam, 3 to 8 percent slopes | C | 0.3 | 0.7% |
| Totals for Area of Interest (AOI) | | | 46.6 | 100.0% |

## Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* *None Specified*

*Tie-break Rule:* Lower

# Section C:

# Calculations

Comp. By Dr Date 4/2/07 Project TALONIC TRACT Sheet No. ..... of .....
Chkd. By ..... Date ..... Subject Stormwater Management Existing Condition Job No. 050078

EXISTING CONDITION – CN

The existing drainage area subject to development shows two discharge points: pond located at the SE corner of the property (pond) and along Washburn Road

Drainage Area "A"

$DA_A = 42 + 42.6 = 84.6\ in^2 \rightarrow 19.4\ Ac$ (+2.9, 20.1)

- Total Type B – 9.8 Ac
  - $C_r C$ – Charlton Type B
  - $C_s D$ – Chatfield Type B
- Total Type C – 45 $in^2$ → 10.3 Ac
  - $P_m D$ – Paxton Type C
  - $P_m C$ – " –
  - $W_d B$ – Woodbridge Type C

o Imperv. roads – 1000 + 200

1200 x 10 = 12000 $ft^2$ + 20,000 road

o Drives 200 x 15 = 3,000 $ft^2$

o Parkings 40x35 + 30x30 + 25x40 = 3300 $ft^2$

o Dwellings 40x70x3 = 8,400 $ft^2$ +

o Tennis court 25x45 = 1,125 $ft^2$

~~27,825 $ft^2$ = 0.64 Ac~~

47825 $ft^2$ = 1.10 Ac

Woods – fair cond – 5.36 Ac

Tall Grass – 1.1 Ac

Lawns – 2.24 Ac

o Imperv. roads 2100x10 = 21,000 $ft^2$ = 0.50 Ac

o Tall Grass – 73,500 $ft^2$ = 1.70 Ac

o Woods fair cond. 8.1 Ac

Comp. By ji Date 4/2/07 Project TACONIC TRACT Sheet No ..... of .....

Chkd. By ..... Date ..... Subject Stormwater Management Existing Condition Job No 050 078

Drainage Area "B"

$DA_B = 37.4 + 32.3 = 69.7 \text{ in}^2 \rightarrow 16.0 \text{ Ac}$

All Type B Soils

- Impervious (pvmt, dwellings, drives, parkings)

  $2.3 + 1.1 + 2.6 + 1.2 + 1.3 = 5.9 \text{ in}^2 \rightarrow 59{,}000 \text{ ft}^2 = 1.35 \text{ Ac}$

- Wooded (orchard type) - grass combo good cond. $20 \text{ in}^2 \rightarrow 4.6 \text{ Ac}$

- wooded fair cond. $12.5 + 3.0 + 2.2 + 5.6 + 1.6 + 1.4 + 0.4 + 0.3 + 0.6 = 27.6 \text{ in}^2 \rightarrow 6.3 \text{ Ac}$

- lawn good condition 3.2 Ac

- Tall grass 0.55 Ac

Comp. By Dj Date 4/2/07 Project TACONIC TRACT Sheet No. ..... of .....

Chkd. By ..... Date ..... Subject Storm Water Management Existing Condition Job No. 050078

EXISTING CONDITION – $T_c$

Drainage Area "A"

D.A. = 19.4 Ac

- Sheet Flow (AB) L = 100 ft $S = \frac{368.3 - 365.5}{100} = 0.028$
- Shallow Conc (BC) L = 740 ft $S = \frac{365.5 - 278}{740} = 0.118$
- Channel flow (CD) L = 1130 ft $S = \frac{278 - 237}{1130} = 0.036$

Drainage Area "B"

D.A. = 16.70

- Sheet flow (EF) L = 100 ft $S = \frac{392 - 376}{100} = 0.16$
- Shallow Conc (FG) L = 1290 ft $S = \frac{376 - 264}{1290} = 0.087$

**Pre-D.A. "A"**

Worksheet 2: Runoff curve number and runoff

| Project | By | Date |
|---|---|---|
| Taconic Tract. Existing Condition | Dan Ionescu | 4/2/2007 |
| Location | Checked | Date |
| Mt. Pleasant, NY (Westchester County) | | |

Check one: [X] Present [ ] Developed

**1. Runoff Curve Number**

| Soil Name and Hydrologic group (appendix A) | Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnectied/connected impervious ratio) | CN Table 2-2 | CN Figure 2-4 | CN Figure 2-4 | Area [X] acres [ ] mi² [ ] % | Product of CN x area |
|---|---|---|---|---|---|---|
| CrC & CsD, TypeB | Impervious-asphalt walk/driveway, parkings, buildings | 98 | | | 1.10 | 107.80 |
| CrC & CsD, TypeB | Woods-fair to good condition | 60 | | | 5.36 | 321.60 |
| CrC & CsD, TypeB | Open space (lawns)-good condition | 61 | | | 2.24 | 136.64 |
| CrC & CsD, TypeB | Mixture of grass, weeds, some brush-fair condition | 71 | | | 1.10 | 78.10 |
| PnD, PnC & | Impervious-asphalt walk/driveway, parkings, buildings | 98 | | | 0.50 | 49.00 |
| WdB, TypeC | | | | | | |
| PnD, PnC & | Woods-fair to good condition | 60 | | | 8.1 | 486.00 |
| WdB, TypeC | | | | | | |
| PnD, PnC & | Mixture of grass, weeds, some brush-fair condition | 71 | | | 1.7 | 120.70 |
| WdB, TypeC | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | **Totals** | 20.10 | 1299.84 |

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{1299.84}{20.1} = 64.67$$

**Use CN** **65**

**Pre-D.A. "B"**

Worksheet 2: Runoff curve number and runoff

| Project | By | Date |
|---|---|---|
| Taconic Tract. Existing Condition | Dan Ionescu | 4/2/2007 |
| Location | Checked | Date |
| Mt. Pleasant, NY (Westchester County) | | |

Check one: [X] Present [ ] Developed

**1. Runoff Curve Number**

| Soil Name and Hydrologic group (appendix A) | Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnectied/connected impervious ratio) | CN Table 2-2 | CN Figure 2-4 | CN Figure 2-4 | Area [X] acres [ ] mi² [ ] % | Product of CN x area |
|---|---|---|---|---|---|---|
| CrC & CsD, TypeB | Impervious-asphalt walk/driveway, parkings, buildings | 98 | | | 1.35 | 132.30 |
| CrC & CsD, TypeB | Woods-fair to good condition | 60 | | | 6.30 | 378.00 |
| CrC & CsD, TypeB | Open space (lawns)-good condition | 61 | | | 3.20 | 195.20 |
| CrC & CsD, TypeB | Mixture of grass, weeds, some brush-fair condition | 71 | | | 0.55 | 39.05 |
| CrC & CsD, TypeB | Woods-grass combination-fair to good condition | 65 | | | 4.60 | 299.00 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | Totals | 16.00 | 1043.55 |

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{1043.55}{16} = 65.22$$

**Use CN** [ 65 ]

**Pre-D.A. "A"**

**Worksheet 3: Time of Concentration ($T_c$) or travel time ($T_t$)**

| Project | By | Date |
|---|---|---|
| **Taconic Tract. Present Condition** | **Dan Ionescu** | **4/2/2007** |
| Location | Checked | Date |
| **Mt. Pleasant, NY (Westchester County)** | | |

Check one: [X] Present [ ] Developed

Check one: [X] $T_c$ [ ] $T_t$ through subarea

Notes: Space for as many as tow segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

**Sheet flow (Applicable to $T_c$ only)**

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Segment ID | AB | | | |
| 1. Surface description (table 3-1) | | | grass | | | |
| 2. Manning's Roughness coeff., n (table 3-1) | | | 0.24 | | | |
| 3. Flow length, L (total ≤ 300 ft) | | ft | 100 | | | |
| 4. Two year 24-hour rainfall, $P_2$ | | in | 3.5 | | | |
| 5. Land slope, s | | ft/ft | 0.028 | | | |
| 6. $T_t$ = | $\frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute $T_t$ | hr | 0.20 | | | 0.20 |

**Shallow concentrated flow**

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Segment ID | BC | | | |
| 7. Surface description (paved or unpaved) | | | unpaved | | | |
| 8. Flow length , L | | ft | 740 | | | |
| 9. Watercourse slope,s | | ft/ft | 0.118 | | | |
| 10. Average velocity (figure 3-1) | | ft/s | 4.8 | | | |
| 11. $T_t$ = | $\frac{L}{3600V}$ Compute $T_t$ | hr | 0.04 | | | 0.04 |

**Channel flow**

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Segment ID | CD | | | |
| 12. Cross secional flow area, a | | $ft^2$ | | | | |
| 13. Wetted perimeter, $p_w$ | | ft | | | | |
| 14. Hydraulic radius, r = | $\frac{a}{p_w}$ Compu | ft | | | | |
| 15. Channel slope,s | | ft/ft | 0.036 | | | |
| 16. Manning's roughness coefficient, n | | | 0.035 | | | |
| 17. V = | $\frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V | ft/s | 3.30 | | | |
| 18. Flow length, L | | ft | 1130 | | | |
| 19. $T_t$ = | $\frac{L}{3600V}$ Compute $T_t$ | hr | 0.10 | | | 0.10 |

20. Watershed or subarea $T_c$ of $T_t$ (add $T_t$ in steps 6, 11 and 19)

hr. = 0.34

min. = 20

**Pre-D.A. "B"**

**Worksheet 3: Time of Concentration (Tc) or travel time (Tt)**

| Project | By | Date |
|---|---|---|
| **Taconic Tract. Present Condition** | **Dan Ionescu** | **4/3/2007** |
| Location | Checked | Date |
| **Mt. Pleasant, NY (Westchester County)** | | |

Check one: [X] Present [ ] Developed

Check one: [X] $T_c$ [ ] $T_t$ through subarea

Notes: Space for as many as tow segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

**Sheet flow (Applicable to $T_c$ only)**

| | | Segment ID | EF | | | |
|---|---|---|---|---|---|---|
| 1. Surface description (table 3-1) | | | woods | | | |
| 2. Manning's Roughness coeff., n (table 3-1) | | | 0.40 | | | |
| 3. Flow length, L (total ≤ 300 ft) | | ft | 100 | | | |
| 4. Two year 24-hour rainfall, $P_2$ | | in | 3.5 | | | |
| 5. Land slope, s | | ft/ft | 0.16 | | | |
| 6. $T_t$ = | $\frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute $T_t$ | hr | 0.15 | | | 0.15 |

**Shallow concentrated flow**

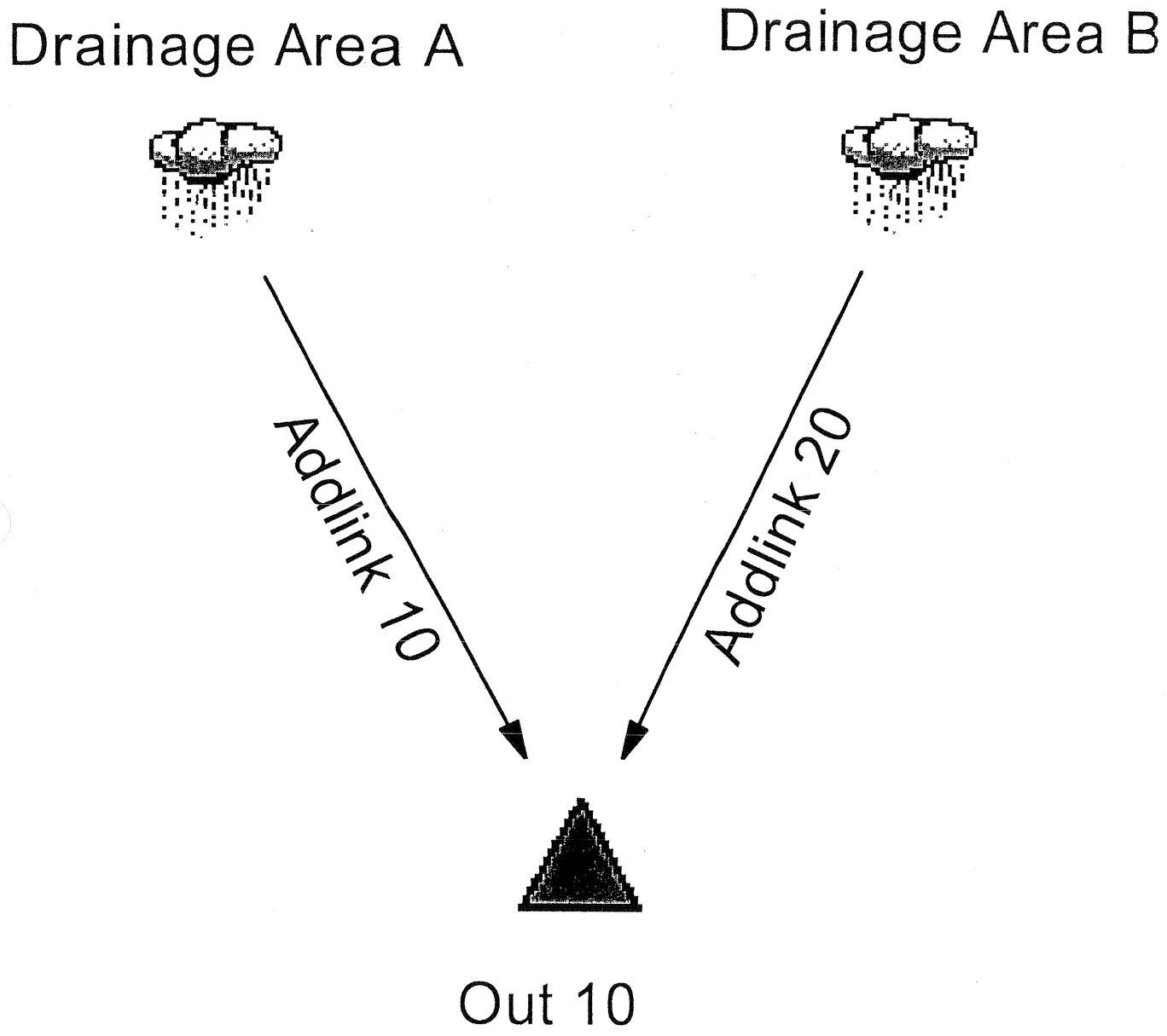
| | | Segment ID | FG | | | |
|---|---|---|---|---|---|---|
| 7. Surface description (paved or unpaved) | | | unpaved | | | |
| 8. Flow length , L | | ft | 1290 | | | |
| 9. Watercourse slope,s | | ft/ft | 0.087 | | | |
| 10. Average velocity (figure 3-1) | | ft/s | 4.5 | | | |
| 11. $T_t$ = | $\frac{L}{3600V}$ Compute $T_t$ | hr | 0.080 | | | 0.080 |

**Channel flow**

| | | Segment ID | | | | |
|---|---|---|---|---|---|---|
| 12. Cross secional flow area, a | | $ft^2$ | | | | |
| 13. Wetted perimeter, $p_w$ | | ft | | | | |
| 14. Hydraulic radius, r = | $\frac{a}{p_w}$ Compu | ft | | | | |
| 15. Channel slope,s | | ft/ft | | | | |
| 16. Manning's roughness coefficient, n | | | | | | |
| 17. V = | $\frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V | ft/s | | | | |
| 18. Flow length, L | | ft | | | | |
| 19. $T_t$ = | $\frac{L}{3600V}$ Compute $T_t$ | hr | | | | |

20. Watershed or subarea $T_c$ of $T_t$ (add $T_t$ in steps 6, 11 and 19)

hr. = 0.23
min. = 14


Drainage Area A
Drainage Area B
Addlink 10
Addlink 20
Out 10

********** MASTER SUMMARY **********

Watershed..... Master Network Summary ..... 1.01

********** DESIGN STORMS SUMMARY **********

Westchester Coun Design Storms ..... 2.01

********** TC CALCULATIONS **********

DRAINAGE AREA A Tc Calcs ..... 3.01

DRAINAGE AREA B Tc Calcs ..... 3.03

********** CN CALCULATIONS **********

DRAINAGE AREA A Runoff CN-Area ..... 4.01

DRAINAGE AREA B Runoff CN-Area ..... 4.02

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Westchester Coun

| Return Event | Total Depth in | Rainfall Type | RNF ID |
|---|---|---|---|
| Pre 1 | 2.8000 | Synthetic Curve | TypeIII 24hr |
| Pre 2 | 3.5000 | Synthetic Curve | TypeIII 24hr |
| Pre 5 | 4.5000 | Synthetic Curve | TypeIII 24hr |
| Pre 10 | 5.0000 | Synthetic Curve | TypeIII 24hr |
| Pre 25 | 6.0000 | Synthetic Curve | TypeIII 24hr |
| Pre 50 | 7.0000 | Synthetic Curve | TypeIII 24hr |
| Pre100 | 7.5000 | Synthetic Curve | TypeIII 24hr |

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

| Node ID | Type | Return Event | HYG Vol ac-ft | Trun | Qpeak hrs | Qpeak cfs | Max WSEL ft | Max Pond Storage ac-ft |
|---|---|---|---|---|---|---|---|---|
| DRAINAGE AREA A | AREA | 1 | .700 | | 12.3300 | 4.53 | | |
| DRAINAGE AREA A | AREA | 2 | 1.260 | | 12.2900 | 9.74 | | |
| DRAINAGE AREA A | AREA | 5 | 2.228 | | 12.2800 | 18.99 | | |
| DRAINAGE AREA A | AREA | 10 | 2.770 | | 12.2800 | 24.13 | | |
| DRAINAGE AREA A | AREA | 25 | 3.938 | | 12.2400 | 35.32 | | |
| DRAINAGE AREA A | AREA | 50 | 5.197 | | 12.2400 | 47.33 | | |
| DRAINAGE AREA A | AREA | 100 | 5.852 | | 12.2400 | 53.55 | | |
| DRAINAGE AREA B | AREA | 1 | .557 | | 12.2400 | 4.08 | | |
| DRAINAGE AREA B | AREA | 2 | 1.003 | | 12.2100 | 8.88 | | |
| DRAINAGE AREA B | AREA | 5 | 1.774 | | 12.2000 | 17.28 | | |
| DRAINAGE AREA B | AREA | 10 | 2.205 | | 12.1800 | 21.98 | | |
| DRAINAGE AREA B | AREA | 25 | 3.135 | | 12.1800 | 32.12 | | |
| DRAINAGE AREA B | AREA | 50 | 4.137 | | 12.1800 | 42.92 | | |
| DRAINAGE AREA B | AREA | 100 | 4.658 | | 12.1800 | 48.50 | | |

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

| Node ID | Type | Return Event | HYG Vol ac-ft | Trun | Qpeak hrs | Qpeak cfs | Max WSEL ft | Max Pond Storage ac-ft |
|---|---|---|---|---|---|---|---|---|
| *OUT 10 | JCT | 1 | 1.257 | | 12.2900 | 8.36 | | |
| *OUT 10 | JCT | 2 | 2.262 | | 12.2400 | 18.12 | | |
| *OUT 10 | JCT | 5 | 4.002 | | 12.2400 | 35.45 | | |
| *OUT 10 | JCT | 10 | 4.974 | | 12.2300 | 45.04 | | |
| *OUT 10 | JCT | 25 | 7.073 | | 12.2100 | 65.79 | | |
| *OUT 10 | JCT | 50 | 9.333 | | 12.2100 | 88.06 | | |
| *OUT 10 | JCT | 100 | 10.511 | | 12.2000 | 99.61 | | |

Title... Project Date: 4/3/2007
Project Engineer: Dan Ionescu
Project Title: Taconic Tract. Existing Condition
Project Comments:

DESIGN STORMS SUMMARY

Design Storm File,ID = Westchester Coun

Storm Tag Name = Pre 1
---
Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 1 yr
Total Rainfall Depth= 2.8000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Pre 2
---
Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 2 yr
Total Rainfall Depth= 3.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Pre 5
---
Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 5 yr
Total Rainfall Depth= 4.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Pre 10
---
Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 10 yr
Total Rainfall Depth= 5.0000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Pre 25
---
Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 6.0000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Title... Project Date: 4/3/2007
Project Engineer: Dan Ionescu
Project Title: Taconic Tract. Existing Condition
Project Comments:

DESIGN STORMS SUMMARY

Design Storm File,ID = Westchester Coun

Storm Tag Name = Pre 50

---

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 50 yr
Total Rainfall Depth= 7.0000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Pre100

---

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 100 yr
Total Rainfall Depth= 7.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
TIME OF CONCENTRATION CALCULATOR
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

---

Segment #1: Tc: User Defined

Segment #1 Time: .3400 hrs

---

==========
Total Tc: .3400 hrs
==========

---

Tc Equations used...

---

==== User Defined ==========

Tc = Value entered by user

Where: Tc = Time of concentration

::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
TIME OF CONCENTRATION CALCULATOR
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

---

Segment #1: Tc: User Defined

Segment #1 Time: .2300 hrs

---

==========
Total Tc: .2300 hrs
==========

---

Tc Equations used...

---

==== User Defined ==========

Tc = Value entered by user

Where: Tc = Time of concentration

File.... P:\050078\2_Design\Calcs\ExistingRevised.ppw

RUNOFF CURVE NUMBER DATA

| Soil/Surface Description | CN | Area acres | Impervious Adjustment %C | %UC | Adjusted CN |
|---|---|---|---|---|---|
| Area 1 | 65 | 20.100 | | | 65.00 |
| COMPOSITE AREA & WEIGHTED CN ---> | | 20.100 | | | 65.00 (65) |

RUNOFF CURVE NUMBER DATA

| Soil/Surface Description | CN | Area acres | Impervious Adjustment %C | %UC | Adjusted CN |
|---|---|---|---|---|---|
| Area 2 | 65 | 16.000 | | | 65.00 |
| COMPOSITE AREA & WEIGHTED CN ---> | | 16.000 | | | 65.00 (65) |

Index of Starting Page Numbers for ID Names

----- D -----
DRAINAGE AREA A... 3.01, 4.01
DRAINAGE AREA B... 3.03, 4.02

----- W -----
Watershed... 1.01
Westchester Coun... 2.01

# POST-DEVELOPMENT DRAINAGE ANALYSIS
# CONVENTIONAL LAYOUT

CHAS. H. SELLS, INC.
Consulting Engineers, Surveyors & Photogrammetrists

Comp. By: N Date: 4/4/07 | Project: TACONIC TRACT | Sheet No. ____ of ____

Chkd. By: ____ Date: ____ | Subject: Stormwater Management "Conventional Option" | Job No. 050078

PROPOSED CONDITION - CN

Drainage Area A2

D.A. $A_2 = 18.8\ in^2 \rightarrow 4.3\ Ac$

All is Type B soils

- Impervious (dwellings, drives, road) 4.8 $in^2$ prop.
  Exist. 0.2 + 0.25 + 0.8 = 1.25
  6.05 $in^2 \rightarrow 1.4\ Ac$
- Lawn along drives and houses 0.9 + 1.2 + 0.9 = 3 $in^2 \rightarrow 0.69\ Ac$
- woods 2 + 1.7 + 0.4 + 0.3 + 0.2 = 4.6 $in^2 \rightarrow 1.0\ Ac$
- Tall grass 1.21 Ac

Drainage Area A1

D.A. $A_1 = 46.7 + 27.7 = 74.4\ in^2 \rightarrow 17.1\ Ac$ $A_1 + A_2 = 21.2\ Ac$

Total Type B - 6.8 Ac

- Imperv. 0.3 + 0.5 + 0.5 + 0.2 = 1.5 $in^2 \rightarrow 0.3\ Ac$
- Grass 1.0 + 0.8 + 1.3 + 1.0 = 4.1 $in^2 \rightarrow 0.94\ Ac$
  - Grass exist. houses 2.24 Ac
  3.18 Ac
- Woods 1.8 + 3.7 + 0.2 + 0.9 = 6.6 $in^2 \rightarrow 1.5\ Ac$
- Tall grass 1.82 Ac

Total Type C - 10.3 Ac

- Imperv. old roads - gone
  - new houses 1 $in^2 \rightarrow 10{,}000\ ft^2 = 0.23\ Ac$
- Woods 36.6 $in^2 \rightarrow 8.41\ Ac$
- grass 2.0 houses $\rightarrow 0.46\ Ac$
- tall grass (old roads) (960 + 150 + 660) 30 = = 53,700 $ft^2$ = 1.2 Ac

Comp. By Di Date 4/5/07 Project TACONIC TRACT Sheet No. ..... of .....
Chkd. By ..... Date ..... Subject Stormwater Management "Conventional Option" Job No 050078

Drainage Area B1 (Type B)

D.A. B1 23.7 in² → 5.4 Ac

- impervious 5 + 0.6 + 2 × 0.5 = 4 in² → 0.92 Ac
- grass 0.9 + 1.9 + 1.8 + 1.2 + 0.5 + 0.6 + 1.5 + 0.8 = 9.2 in² → 2.1 Ac
- Tall grass (on and along old roads) 1.5 in² → 0.34 Ac
- Woods 8.9 in² → 2.04 Ac

Drainage Area B2 (Type B)

D.A. B2 40.5 in² → 9.3 Ac

- impervious
  - existing 1.35 Ac
  - prop. 1.0 + 0.5 + 0.6 + 0.3 = 2.4 in² → 0.60 Ac

  1.95 Ac
- grass
  - existing 3.2 Ac
  - prop 6.09 in² → 1.4 Ac

  4.6 Ac
- woods 5.1 + 1.2 = 6.3 in² → 1.45 Ac
- wooded (orchard type) 5.7 in² → 1.3 Ac

Comp. By DI Date 3/5/07 Project TACONIC TRACT Sheet No. ..... of .....
Chkd. By ..... Date ..... Subject Stormwater Management "Conventional Option" Job No. 050078

PROPOSED CONDITION – $T_c$

Drainage Area $A_1$

same as existing D.A. A – $t_c = 0.34\,h = 20$ min

Drainage Area $A_2$

- Sheet Flow (EF) $L_{sh} = 50'$ $S = \frac{362.5 - 360}{50} = 0.05$
  wooded $n = 0.50$ (semi light underbrush)

- Shallow Conc (FG) $L_{sc} = 80'$ $S = \frac{360 - 349}{80} = 0.134$
  unpaved ave. $V = 5.5$ ft/s

- Gutter Flow (Shallow Conc.) (GH) $L = 200'$ $S = \frac{349 - 345}{200} = 0.02$
  paved ave. $V = 2.8$ ft/s

- Pipe Flow (HI)
  preliminary assume channel flow $L = 250'$
  assume $V = 7.0$ ft/s

Comp. By: BI Date: 3/5/07 Project: TACONIC TRACT Sheet No. ..... of .....

Chkd. By ..... Date ..... Subject: Stormwater Management "Conventional Option" Job No: 050078

Drainage Area B1

- Sheet flow (JJ1) $L_{sh} = 50'$ $S = \frac{371 - 365.5}{50} = 0.11$
- Shallow conc. (JK) $L_{sc} = 120'$ $S = \frac{365.5 - 355}{120} = 0.088$ $V \simeq 4.8$ ft/s
- Gutter Flow (KL) $L_{sc} = 640'$ $S = \frac{355 - 284}{640} = 0.11$ $V \simeq 6.7$ ft/s
- Pipe Flow assume similar to channel flow $V_{assumed} = 4$ ft/s

$L_{ch} = 420'$

Drainage Area B2

- Sheet Flow $L_{sh} = 75'$ $S = \frac{382.6 - 374.5}{75} = 0.108$
- Shallow conc $L_{sc} = 440'$ $S = \frac{374.5 - 295}{440} = 0.18$ $V \simeq 6.8$ ft/s
- Shallow conc $L_{sc} = 700'$ $S = \frac{295 - 264}{700} = 0.044$ $V \simeq 3.4$ ft/s

**Post-D.A. "A1"**

Worksheet 2: Runoff curve number and runoff

| Project | By | Date |
|---|---|---|
| Taconic Tract. "Conventional" Layout | Dan Ionescu | 4/5/2007 |
| Location | Checked | Date |
| Mt. Pleasant, NY (Westchester County) | | |

Check one: [ ] Present [X] Developed

**1. Runoff Curve Number**

| Soil Name and Hydrologic group (appendix A) | Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnectied/connected impervious ratio) | CN Table 2-2 | CN Figure 2-4 | CN Figure 2-4 | Area [X] acres [ ] mi² [ ] % | Product of CN x area |
|---|---|---|---|---|---|---|
| CrC & CsD, TypeB | Impervious-asphalt walk/driveway, parkings, buildings | 98 | | | 0.30 | 29.40 |
| CrC & CsD, TypeB | Woods-fair to good condition | 60 | | | 1.50 | 90.00 |
| CrC & CsD, TypeB | Open space (lawns)-good condition | 61 | | | 3.18 | 193.98 |
| CrC & CsD, TypeB | Mixture of grass, weeds, some brush-fair condition | 71 | | | 1.82 | 129.22 |
| PnD, TypeC | Impervious-asphalt walk/driveway, parkings, buildings | 98 | | | 0.23 | 22.54 |
| | | | | | | |
| PnD, PnC & | Woods-fair to good condition | 60 | | | 8.41 | 504.60 |
| WdB, TypeC | Open space (lawns)-good condition | 61 | | | 0.46 | 28.06 |
| PnD, PnC & | Mixture of grass, weeds, some brush-fair condition | 71 | | | 1.2 | 85.20 |
| WdB, TypeC | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | Totals | 17.10 | 1083 |

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{1083}{17.1} = 63.33$$

Use CN **63**

**Post-D.A. "A2"**

Worksheet 2: Runoff curve number and runoff

| Project | By | Date |
|---|---|---|
| Taconic Tract. "Conventional" Layout | Dan Ionescu | 4/5/2007 |
| Location | Checked | Date |
| Mt. Pleasant, NY (Westchester County) | | |

Check one: [ ] Present [X] Developed

1. Runoff Curve Number

| Soil Name and Hydrologic group (appendix A) | Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnectied/connected impervious ratio) | CN Table 2-2 | CN Figure 2-4 | CN Figure 2-4 | Area [X] acres [ ] mi² [ ] % | Product of CN x area |
|---|---|---|---|---|---|---|
| CrC & CsD, TypeB | Impervious-asphalt walk/driveway, parkings, buildings | 98 | | | 1.40 | 137.20 |
| CrC & CsD, TypeB | Woods-fair to good condition | 60 | | | 1.00 | 60.00 |
| CrC & CsD, TypeB | Open space (lawns)-good condition | 61 | | | 0.69 | 42.09 |
| CrC & CsD, TypeB | Mixture of grass, weeds, some brush-fair condition | 71 | | | 1.21 | 85.91 |
| | | | | | | |
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| | | | | | | |
| | | | | Totals | 4.30 | 325.2 |

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{325.2}{4.3} = 75.63$$

**Use CN** 76

**Post-D.A. "B1"**

Worksheet 2: Runoff curve number and runoff

| Project | By | Date |
|---|---|---|
| Taconic Tract. "Conventional" Layout | Dan Ionescu | 4/5/2007 |
| Location | Checked | Date |
| Mt. Pleasant, NY (Westchester County) | | |

Check one: [X] Present [ ] Developed

**1. Runoff Curve Number**

| Soil Name and Hydrologic group (appendix A) | Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnectied/connected impervious ratio) | CN Table 2-2 | CN Figure 2-4 | CN Figure 2-4 | Area [X] acres [ ] mi² [ ] % | Product of CN x area |
|---|---|---|---|---|---|---|
| CrC & CsD, TypeB | Impervious-asphalt walk/driveway, parkings, buildings | 98 | | | 0.92 | 90.16 |
| CrC & CsD, TypeB | Woods-fair to good condition | 60 | | | 2.04 | 122.40 |
| CrC & CsD, TypeB | Open space (lawns)-good condition | 61 | | | 2.10 | 128.10 |
| CrC & CsD, TypeB | Mixture of grass, weeds, some brush-fair condition | 71 | | | 0.34 | 24.14 |
| | | | | | | |
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| | | | | | | |
| | | | | | | |
| | | | | Totals | 5.40 | 364.8 |

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{364.8}{5.4} = 67.56$$

**Use CN** 68

**Post-D.A. "B2"**

Worksheet 2: Runoff curve number and runoff

| Project | By | Date |
|---|---|---|
| Taconic Tract. "Conventional" Layout | Dan Ionescu | 4/5/2007 |
| Location | Checked | Date |
| Mt. Pleasant, NY (Westchester County) | | |

Check one: [ ] Present [X] Developed

**1. Runoff Curve Number**

| Soil Name and Hydrologic group (appendix A) | Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnectied/connected impervious ratio) | CN Table 2-2 | CN Figure 2-4 | CN Figure 2-4 | Area [X] acres [ ] mi² [ ] % | Product of CN x area |
|---|---|---|---|---|---|---|
| CrC & CsD, TypeB | Impervious-asphalt walk/driveway, parkings, buildings | 98 | | | 1.95 | 191.10 |
| CrC & CsD, TypeB | Woods-fair to good condition | 60 | | | 1.45 | 87.00 |
| CrC & CsD, TypeB | Open space (lawns)-good condition | 61 | | | 4.60 | 280.60 |
| | | | | | | |
| CrC & CsD, TypeB | Woods-grass combination-fair to good condition | 65 | | | 1.30 | 84.50 |
| | | | | | | |
| | | | | | | |
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| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | Totals | 9.30 | 643.2 |

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{643.2}{9.3} = 69.16$$

**Use CN** 69

**Post-D.A. "A1"**

**Worksheet 3: Time of Concentration ($T_c$) or travel time ($T_t$)**

| Project | By | Date |
|---|---|---|
| **Taconic Tract. "Conventional" Layout** | **Dan Ionescu** | **4/5/2007** |
| Location | Checked | Date |
| **Mt. Pleasant, NY (Westchester County)** | | |

Check one: [ ] Present [X] Developed

Check one: [X] $T_c$ [ ] $T_t$ through subarea

Notes: Space for as many as tow segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

**Sheet flow (Applicable to $T_c$ only)**

| | | Segment ID | AB | | | |
|---|---|---|---|---|---|---|
| 1. Surface description (table 3-1) | | | grass | | | |
| 2. Manning's Roughness coeff., n (table 3-1) | | | 0.24 | | | |
| 3. Flow length, L (total ≤ 300 ft) | | ft | 100 | | | |
| 4. Two year 24-hour rainfall, $P_2$ | | in | 3.5 | | | |
| 5. Land slope, s | | ft/ft | 0.028 | | | |
| 6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ | Compute $T_t$ | hr | 0.20 | | | 0.20 |

**Shallow concentrated flow**

| | | Segment ID | BC | | | |
|---|---|---|---|---|---|---|
| 7. Surface description (paved or unpaved) | | | unpaved | | | |
| 8. Flow length , L | | ft | 740 | | | |
| 9. Watercourse slope,s | | ft/ft | 0.118 | | | |
| 10. Average velocity (figure 3-1) | | ft/s | 4.8 | | | |
| 11. $T_t = \frac{L}{3600V}$ | Compute $T_t$ | hr | 0.04 | | | 0.04 |

**Channel flow**

| | | Segment ID | CD | | | |
|---|---|---|---|---|---|---|
| 12. Cross secional flow area, a | | $ft^2$ | | | | |
| 13. Wetted perimeter, $p_w$ | | ft | | | | |
| 14. Hydraulic radius, $r = \frac{a}{p_w}$ | Compu | ft | | | | |
| 15. Channel slope,s | | ft/ft | 0.036 | | | |
| 16. Manning's roughness coefficient, n | | | 0.035 | | | |
| 17. $V = \frac{1.49\, r^{2/3}\, s^{1/2}}{n}$ | Compute V | ft/s | 3.30 | | | |
| 18. Flow length, L | | ft | 1130 | | | |
| 19. $T_t = \frac{L}{3600V}$ | Compute $T_t$ | hr | 0.10 | | | 0.10 |

20. Watershed or subarea $T_c$ of $T_t$ (add $T_t$ in steps 6, 11 and 19)

hr. = 0.34

min. = 20

**Post-D.A. "A2"**

**Worksheet 3: Time of Concentration ($T_c$) or travel time ($T_t$)**

| Project | By | Date |
|---|---|---|
| **Taconic Tract. "Conventional" Layout** | **Dan Ionescu** | **4/5/2007** |
| Location | Checked | Date |
| **Mt. Pleasant, NY (Westchester County)** | | |

Check one: [ ] Present [X] Developed

Check one: [X] $T_c$ [ ] $T_t$ through subarea

Notes: Space for as many as tow segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

**Sheet flow (Applicable to $T_c$ only)**

| | | Segment ID | EF | | | |
|---|---|---|---|---|---|---|
| 1. Surface description (table 3-1) | | | woods | | | |
| 2. Manning's Roughness coeff., n (table 3-1) | | | 0.5 | | | |
| 3. Flow length, L (total ≤ 300 ft) | | ft | 50 | | | |
| 4. Two year 24-hour rainfall, $P_2$ | | in | 3.5 | | | |
| 5. Land slope, s | | ft/ft | 0.05 | | | |
| 6. $T_t$ = | $\frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute $T_t$ | hr | 0.16 | | | 0.16 |

**Shallow concentrated flow**

| | | Segment ID | FG | GH | | |
|---|---|---|---|---|---|---|
| 7. Surface description (paved or unpaved) | | | unpaved | paved | | |
| 8. Flow length , L | | ft | 80 | 200 | | |
| 9. Watercourse slope,s | | ft/ft | 0.134 | 0.02 | | |
| 10. Average velocity (figure 3-1) | | ft/s | 5.5 | 2.8 | | |
| 11. $T_t$ = | $\frac{L}{3600V}$ Compute $T_t$ | hr | 0.004 | 0.020 | | 0.024 |

**Channel flow**

| | | Segment ID | HI | | | |
|---|---|---|---|---|---|---|
| 12. Cross secional flow area, a | | $ft^2$ | | | | |
| 13. Wetted perimeter, $p_w$ | | ft | | | | |
| 14. Hydraulic radius, r = | $\frac{a}{p_w}$ Compu | ft | | | | |
| 15. Channel slope,s | | ft/ft | | | | |
| 16. Manning's roughness coefficient, n | | | | | | |
| 17. V = | $\frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V | ft/s | 7.00 | | | |
| 18. Flow length, L | | ft | 250 | | | |
| 19. $T_t$ = | $\frac{L}{3600V}$ Compute $T_t$ | hr | 0.01 | | | 0.01 |

20. Watershed or subarea $T_c$ of $T_t$ (add $T_t$ in steps 6, 11 and 19)

hr. = 0.20

min. = 12

**Post-D.A. "B1"**

**Worksheet 3: Time of Concentration ($T_c$) or travel time ($T_t$)**

| Project | By | Date |
|---|---|---|
| **Taconic Tract. "Conventional" Layout** | **Dan Ionescu** | **4/5/2007** |
| Location | Checked | Date |
| **Mt. Pleasant, NY (Westchester County)** | | |

Check one: [ ] Present [X] Developed

Check one: [X] $T_c$ [ ] $T_t$ through subarea

Notes: Space for as many as tow segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

**Sheet flow (Applicable to $T_c$ only)**

| | | Segment ID | JJ1 | | | |
|---|---|---|---|---|---|---|
| 1. Surface description (table 3-1) | | | woods light | | | |
| 2. Manning's Roughness coeff., n (table 3-1) | | | 0.4 | | | |
| 3. Flow length, L (total ≤ 300 ft) | | ft | 50 | | | |
| 4. Two year 24-hour rainfall, $P_2$ | | in | 3.5 | | | |
| 5. Land slope, s | | ft/ft | 0.11 | | | |
| 6. $T_t$ = | $\frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute $T_t$ | hr | 0.10 | | | 0.10 |

**Shallow concentrated flow**

| | | Segment ID | J1K | KL | | |
|---|---|---|---|---|---|---|
| 7. Surface description (paved or unpaved) | | | unpaved | paved | | |
| 8. Flow length , L | | ft | 120 | 640 | | |
| 9. Watercourse slope,s | | ft/ft | 0.088 | 0.11 | | |
| 10. Average velocity (figure 3-1) | | ft/s | 4.8 | 6.7 | | |
| 11. $T_t$ = | $\frac{L}{3600V}$ Compute $T_t$ | hr | 0.007 | 0.027 | | 0.033 |

**Channel flow**

| | | Segment ID | LM | | | |
|---|---|---|---|---|---|---|
| 12. Cross secional flow area, a | | $ft^2$ | | | | |
| 13. Wetted perimeter, $p_w$ | | ft | | | | |
| 14. Hydraulic radius, r = | $\frac{a}{p_w}$ Compu | ft | | | | |
| 15. Channel slope,s | | ft/ft | | | | |
| 16. Manning's roughness coefficient, n | | | | | | |
| 17. V = | $\frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V | ft/s | 4.00 | | | |
| 18. Flow length, L | | ft | 420 | | | |
| 19. $T_t$ = | $\frac{L}{3600V}$ Compute $T_t$ | hr | 0.03 | | | 0.03 |

20. Watershed or subarea $T_c$ of $T_t$ (add $T_t$ in steps 6, 11 and 19)

hr. = 0.16

min. = 10

**Post-D.A. "B2"**

**Worksheet 3: Time of Concentration ($T_c$) or travel time ($T_t$)**

| Project | By | Date |
|---|---|---|
| **Taconic Tract. "Conventional" Layout** | **Dan Ionescu** | **4/5/2007** |
| Location | Checked | Date |
| **Mt. Pleasant, NY (Westchester County)** | | |

Check one: [ ] Present [X] Developed

Check one: [X] $T_c$ [ ] $T_t$ through subarea

Notes: Space for as many as tow segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

**Sheet flow (Applicable to $T_c$ only)**

| | | Segment ID | NO | | | |
|---|---|---|---|---|---|---|
| 1. Surface description (table 3-1) | | | woods light | | | |
| 2. Manning's Roughness coeff., n (table 3-1) | | | 0.4 | | | |
| 3. Flow length, L (total ≤ 300 ft) | | ft | 75 | | | |
| 4. Two year 24-hour rainfall, $P_2$ | | in | 3.5 | | | |
| 5. Land slope, s | | ft/ft | 0.108 | | | |
| 6. $T_t$ = | $\frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute $T_t$ | hr | 0.14 | | | 0.14 |

**Shallow concentrated flow**

| | | Segment ID | OP | PQ | | |
|---|---|---|---|---|---|---|
| 7. Surface description (paved or unpaved) | | | unpaved | unpaved | | |
| 8. Flow length , L | | ft | 440 | 770 | | |
| 9. Watercourse slope,s | | ft/ft | 0.18 | 0.044 | | |
| 10. Average velocity (figure 3-1) | | ft/s | 6.8 | 3.4 | | |
| 11. $T_t$ = | $\frac{L}{3600V}$ Compute $T_t$ | hr | 0.018 | 0.063 | | 0.081 |

**Channel flow**

| | | Segment ID | | | | |
|---|---|---|---|---|---|---|
| 12. Cross secional flow area, a | | $ft^2$ | | | | |
| 13. Wetted perimeter, $p_w$ | | ft | | | | |
| 14. Hydraulic radius, r = | $\frac{a}{p_w}$ Compu | ft | | | | |
| 15. Channel slope,s | | ft/ft | | | | |
| 16. Manning's roughness coefficient, n | | | | | | |
| 17. V = | $\frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V | ft/s | | | | |
| 18. Flow length, L | | ft | | | | |
| 19. $T_t$ = | $\frac{L}{3600V}$ Compute $T_t$ | hr | | | | |

20. Watershed or subarea $T_c$ of $T_t$ (add $T_t$ in steps 6, 11 and 19)

hr. = 0.22

min. = 13

Comp. By DI Date 4/5/07 | Project TRONIC TRACT | Sheet No. ..... of .....

Chkd. By ..... Date ..... | Subject Stormwater Management "Conventional Option" | Job No .....

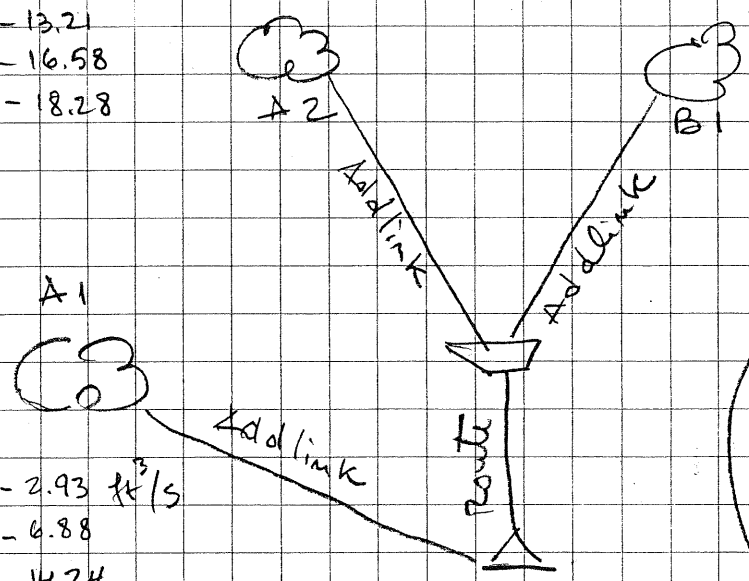
## POST

A2

1 - 3.27 ft³/s
2 - 5.23
5 - 8.30
10 - 9.91
25 - 13.21
50 - 16.58
100 - 18.28

B1

1 - 2.22 ft³/s
2 - 4.25
5 - 7.67
10 - 9.54
25 - 13.48
50 - 17.62
100 - 19.75




A1

1 - 2.93 ft³/s
2 - 6.88
5 - 14.24
10 - 18.41
25 - 27.45
50 - 37.36
100 - 42.51

B2

OK < B

Add link

1 - 3.84
2 - 7.16
5 - 12.71
10 - 15.74
25 - 22.14
50 - 28.84
100 - 32.27

## PRE

A - 1 - 4.53 ft³/s
2 - 9.74
5 - 18.99
10 - 24.13
25 - 35.32
50 - 47.33
100 - 53.55

B - 1 - 4.08 ft³/s
2 - 8.88
5 - 17.28
10 - 21.98
25 - 32.12
50 - 42.92
100 - 48.50

OUT

1 - 8.36
2 - 18.12
5 - 35.45
10 - 45.04
25 - 65.79
50 - 88.06
100 - 99.61

TACONIC TRACT - "Conventional Layout"
Mount Pleasant, N.Y.

File: EstimatedStorageConventional.xls

## STORMWATER STORAGE REQUIREMENT. CONVENTIONAL LAYOUT (ESTIMATE)

| Frequency Discharge | Q D.A. "A" (ft3/s) | Q D.A. "A1" (ft3/s) | Q D.A. "A2" (ft3/s) | Q D.A. "B1" (ft3/s) | Target - qo (ft3/s) | Target -qo (CSM) | D.A."A2" (Ac) | D.A."B1" (Ac) | Q after dev.-qi (ft3/s) | qo0/qi | Vs/Vr (Fig. 6-1) | P (in) | CN composite | S (in) | Q (in) | Vr (Ac-ft) | Vs (Ac-ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 100-year | 53.55 | 42.51 | 18.28 | 19.75 | 11.0 | 728 | 4.3 | 5.4 | 38.03 | 0.29 | 0.38 | 7.5 | 72 | 3.9 | 4.3 | 3.4 | 1.31 |
| 50-year | 47.33 | 37.36 | 16.58 | 17.62 | 10.0 | 658 | 4.3 | 5.4 | 34.20 | 0.29 | 0.38 | 7.0 | 72 | 3.9 | 3.8 | 3.1 | 1.18 |
| 25-year | 35.32 | 27.45 | 13.21 | 13.48 | 7.9 | 519 | 4.3 | 5.4 | 26.69 | 0.29 | 0.38 | 6.0 | 72 | 3.9 | 3.0 | 2.4 | 0.92 |
| 10-year | 24.13 | 18.41 | 9.91 | 9.54 | 5.7 | 377 | 4.3 | 5.4 | 19.45 | 0.29 | 0.38 | 5.0 | 72 | 3.9 | 2.2 | 1.8 | 0.68 |
| 5-year | 18.99 | 14.24 | 8.3 | 7.67 | 4.8 | 313 | 4.3 | 5.4 | 15.97 | 0.30 | 0.38 | 4.5 | 72 | 3.9 | 1.8 | 1.5 | 0.56 |
| 2-year | 9.74 | 6.88 | 5.23 | 4.25 | 2.9 | 189 | 4.3 | 5.4 | 9.48 | 0.30 | 0.38 | 3.5 | 72 | 3.9 | 1.1 | 0.9 | 0.34 |
| 1-year | 4.53 | 2.93 | 3.27 | 2.22 | 1.6 | 106 | 4.3 | 5.4 | 5.49 | 0.29 | 0.38 | 2.8 | 72 | 3.9 | 0.7 | 0.6 | 0.21 |

qo = Q D.A."A" - Q D.A."A1" - maximum peak outflow allowed (ft3/s)
qi = Q D.A."A2" + Q D.A."B1 - peak inflow without storage (ft3/s)
Vs = storage volume required (Ac-ft)
Vr = runoff volume from the developed drainage areas before storage (Ac-ft)
P = rainfal depth (in)
CN = composite curve number between D. A."A2" and D.A."B1"
S = retention after runoff begins (in)
Q = runoff (in)

## Input requirements and procedures

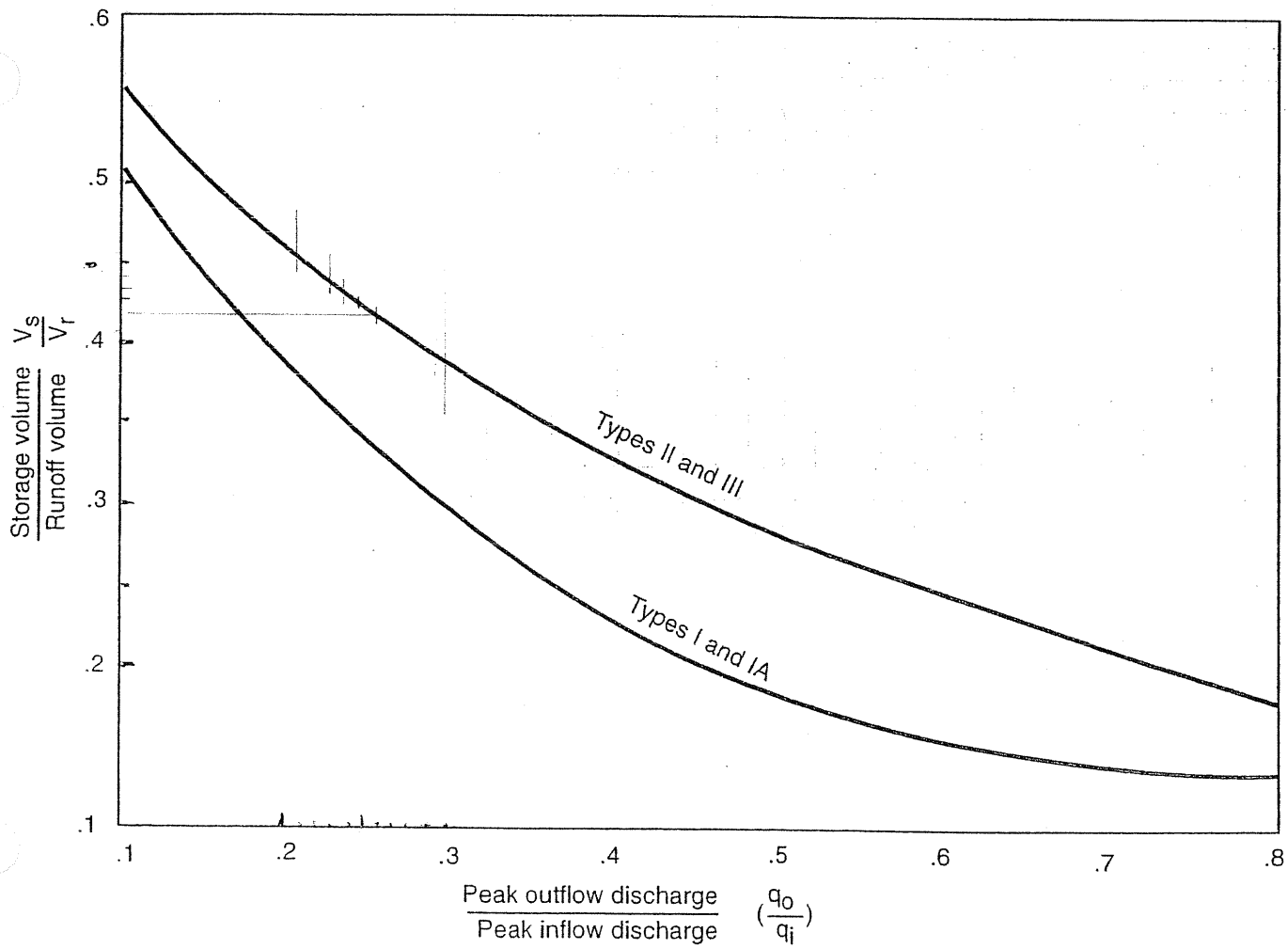
Use figure 6-1 estimate storage volume ($V_s$) required or peak outflow discharge ($q_o$). The most frequent application is to estimate $V_s$, for which the required inputs are runoff volume ($V_r$), $q_o$, and peak inflow discharge ($q_i$). To estimate $q_o$, the required inputs are $V_r$, $V_s$, and $q_i$.

### Estimating $V_s$

Use worksheet 6a to estimate $V_s$, storage volume required, by the following procedure.

1. Determine $q_o$. Many factors may dictate the selection of peak outflow discharge. The most common is to limit downstream discharges to a desired level, such as predevelopment discharge. Another factor may be that the outflow device has already been selected.
2. Estimate $q_i$ by procedures in chapters 4 or 5. Do not use peak discharges developed by other procedure. When using the Tabular Hydrograph method to estimate $q_i$ for a subarea, only use peak discharge associated with $T_t = 0$.

**Figure 6-1** Approximate detention basin routing for rainfall types I, IA, II, and III



Comp. By DI Date 4/6/07 Project TACONIC TRACT Sheet No. ..... of .....

Chkd. By ..... Date ..... Subject Stormwater Management "Conventional Option" Job No 050078

| EL | Area | V (ft³) |
|---|---|---|
| 273 | 5776 | |
| | | 6,105 |
| 274 | 6433 | |
| | | 12,878 |
| 275 | 7114 | |
| | | 19,651 |
| 276 | 7821 | |
| | | 27,838 |
| 277 | 8553 | |
| | | 45,999 = 1.06 Ac-ft |
| 278 | 9608 | |

ILT.

| | |
|---|---|
| 272 | 4672 |
| 273 | 5274 |
| 274 | 5902 |
| 275 | 6555 |
| 276 | 7233 |
| 277 | 7936 |
| 277.5 | 8307 |

~~2yr $Q_1 = 3.27 + 2.22 =$~~

10yr $Q_{A2} = 9.91\ ft^3/s$ $Q_{B1} = 9.54\ ft^3/s$

$Q_{A2} + Q_{B1} = 19.45\ ft^3/s = Q_i$ - peak flow

inflow runoff Q (in)

$q_o = 24.13 - 18.41 = 5.72\ ft^3/s$ - peak outflow rate

$$V_s/V_r = C_0 + C_1\left(\frac{q_o}{q_i}\right) + C_2\left(\frac{q_o}{q_i}\right) + C_3\left(\frac{q_o}{q_i}\right)^3$$

$V_s/V_r =$ $V_{storage}/V_{runoff}$

$$\frac{q_o}{q_i} = \frac{5.72}{19.45} = 0.29$$

$$5.72\ ft^3/s = \frac{5.72\ ft^3/s\,(640\ ft/mi^2)}{9.7\ mi^2} =$$

$= 377$ CSM

DA $A_2$ = 4.3 ac - CN=76

DA $B_1$ = 5.4 ac - CN=68

9.7 A

Fig. 7-2 (old TR-55)

$$\Rightarrow \frac{V_s}{V_r} = 0.425$$

$$V_r = \text{Area (ac)} \times \frac{Q\,(in)}{12\ in/ft}$$

$$Q = \frac{(P - I_a)^2}{(P - I_a) + S} \qquad S = \frac{1000}{CN} - 10 = \frac{1000}{72} - 10 = 3.9\ in$$

$$CN_{comp} = \frac{4.3 \times 76 + 5.4 \times 68}{9.7} = 72$$

$P_{10yr} = 5.0$ in

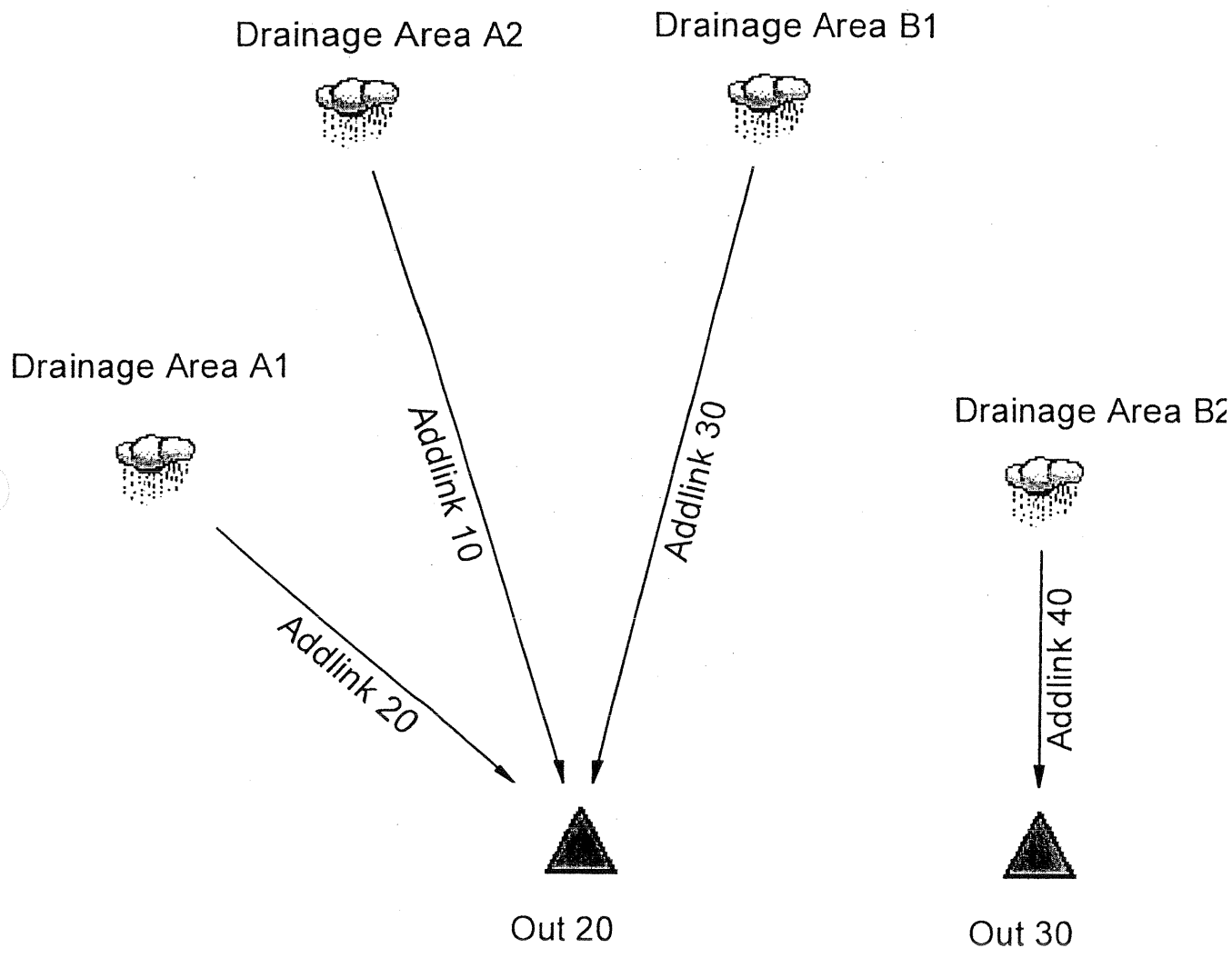
$$Q = \frac{(P - 0.2S)^2}{P + 0.8S} = \frac{(5 - 0.2 \times 3.9)^2}{5 + 0.8 \times 3.9} = 2.19 \text{ in}$$

$$V_r = 9.7 \text{ Ac} \times \frac{2.19 \text{ in}}{12 \text{ in/ft}} = 1.77 \text{ Ac-ft-vol}$$

of runoff after developm.

$$\frac{V_s}{V_r} = 0.425$$

$$V_s = V_r \times 0.425 = 1.77 \times 0.425 = 0.75 \text{ Ac-ft}$$


Drainage Area A2
Drainage Area B1
Drainage Area A1
Drainage Area B2
Addlink 10
Addlink 30
Addlink 20
Addlink 40
Out 20
Out 30

********** MASTER SUMMARY **********

Watershed..... Master Network Summary ..... 1.01

********** DESIGN STORMS SUMMARY **********

Westchester Coun Design Storms ..... 2.01

Westchester Coun Dev 1
Design Storms ..... 2.03

********** TC CALCULATIONS **********

DRAINAGE AREA A1 Tc Calcs ..... 3.01

DRAINAGE AREA A2 Tc Calcs ..... 3.03

DRAINAGE AREA B1 Tc Calcs ..... 3.05

DRAINAGE AREA B2 Tc Calcs ..... 3.07

********** CN CALCULATIONS **********

DRAINAGE AREA A1 Runoff CN-Area ..... 4.01

DRAINAGE AREA A2 Runoff CN-Area ..... 4.02

DRAINAGE AREA B1 Runoff CN-Area ..... 4.03

DRAINAGE AREA B2 Runoff CN-Area ..... 4.04

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Westchester Coun

| Return Event | Total Depth in | Rainfall Type | RNF ID |
|---|---|---|---|
| Dev 1 | 2.8000 | Synthetic Curve | TypeIII 24hr |
| Dev 2 | 3.5000 | Synthetic Curve | TypeIII 24hr |
| Dev 5 | 4.5000 | Synthetic Curve | TypeIII 24hr |
| Dev 10 | 5.0000 | Synthetic Curve | TypeIII 24hr |
| Dev 25 | 6.0000 | Synthetic Curve | TypeIII 24hr |
| Dev 50 | 7.0000 | Synthetic Curve | TypeIII 24hr |
| Dev100 | 7.5000 | Synthetic Curve | TypeIII 24hr |

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

| Node ID | Type | Return Event | HYG Vol ac-ft | Trun | Qpeak hrs | Qpeak cfs | Max WSEL ft | Max Pond Storage ac-ft |
|---|---|---|---|---|---|---|---|---|
| DRAINAGE AREA A1 | AREA | 1 | .502 | | 12.3800 | 2.93 | | |
| DRAINAGE AREA A1 | AREA | 2 | .940 | | 12.3300 | 6.88 | | |
| DRAINAGE AREA A1 | AREA | 5 | 1.713 | | 12.2800 | 14.24 | | |
| DRAINAGE AREA A1 | AREA | 10 | 2.150 | | 12.2800 | 18.41 | | |
| DRAINAGE AREA A1 | AREA | 25 | 3.101 | | 12.2400 | 27.45 | | |
| DRAINAGE AREA A1 | AREA | 50 | 4.134 | | 12.2400 | 37.36 | | |
| DRAINAGE AREA A1 | AREA | 100 | 4.674 | | 12.2400 | 42.51 | | |
| DRAINAGE AREA A2 | AREA | 1 | .316 | | 12.1600 | 3.27 | | |
| DRAINAGE AREA A2 | AREA | 2 | .489 | | 12.1600 | 5.23 | | |
| DRAINAGE AREA A2 | AREA | 5 | .763 | | 12.1600 | 8.30 | | |
| DRAINAGE AREA A2 | AREA | 10 | .909 | | 12.1600 | 9.91 | | |
| DRAINAGE AREA A2 | AREA | 25 | 1.211 | | 12.1600 | 13.21 | | |
| DRAINAGE AREA A2 | AREA | 50 | 1.526 | | 12.1600 | 16.58 | | |
| DRAINAGE AREA A2 | AREA | 100 | 1.686 | | 12.1600 | 18.28 | | |

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

| Node ID | Type | Return Event | HYG Vol ac-ft | Trun | Qpeak hrs | Qpeak cfs | Max WSEL ft | Max Pond Storage ac-ft |
|---|---|---|---|---|---|---|---|---|
| DRAINAGE AREA B1 | AREA | 1 | .237 | | 12.1600 | 2.22 | | |
| DRAINAGE AREA B1 | AREA | 2 | .406 | | 12.1600 | 4.25 | | |
| DRAINAGE AREA B1 | AREA | 5 | .690 | | 12.1400 | 7.67 | | |
| DRAINAGE AREA B1 | AREA | 10 | .846 | | 12.1400 | 9.54 | | |
| DRAINAGE AREA B1 | AREA | 25 | 1.179 | | 12.1400 | 13.48 | | |
| DRAINAGE AREA B1 | AREA | 50 | 1.535 | | 12.1400 | 17.62 | | |
| DRAINAGE AREA B1 | AREA | 100 | 1.718 | | 12.1400 | 19.75 | | |
| DRAINAGE AREA B2 | AREA | 1 | .438 | | 12.2000 | 3.84 | | |
| DRAINAGE AREA B2 | AREA | 2 | .739 | | 12.2000 | 7.16 | | |
| DRAINAGE AREA B2 | AREA | 5 | 1.242 | | 12.1800 | 12.71 | | |
| DRAINAGE AREA B2 | AREA | 10 | 1.517 | | 12.1700 | 15.74 | | |
| DRAINAGE AREA B2 | AREA | 25 | 2.102 | | 12.1700 | 22.14 | | |
| DRAINAGE AREA B2 | AREA | 50 | 2.723 | | 12.1700 | 28.84 | | |
| DRAINAGE AREA B2 | AREA | 100 | 3.044 | | 12.1700 | 32.27 | | |
| *OUT 20 | JCT | 1 | 1.055 | | 12.2100 | 7.22 | | |
| *OUT 20 | JCT | 2 | 1.835 | | 12.2000 | 14.79 | | |
| *OUT 20 | JCT | 5 | 3.166 | | 12.1900 | 27.97 | | |
| *OUT 20 | JCT | 10 | 3.904 | | 12.1900 | 35.24 | | |
| *OUT 20 | JCT | 25 | 5.492 | | 12.1900 | 50.76 | | |
| *OUT 20 | JCT | 50 | 7.194 | | 12.1900 | 67.24 | | |
| *OUT 20 | JCT | 100 | 8.078 | | 12.1900 | 75.74 | | |
| *OUT 30 | JCT | 1 | .438 | | 12.2000 | 3.84 | | |
| *OUT 30 | JCT | 2 | .739 | | 12.2000 | 7.16 | | |
| *OUT 30 | JCT | 5 | 1.242 | | 12.1800 | 12.71 | | |
| *OUT 30 | JCT | 10 | 1.517 | | 12.1700 | 15.74 | | |
| *OUT 30 | JCT | 25 | 2.102 | | 12.1700 | 22.14 | | |
| *OUT 30 | JCT | 50 | 2.723 | | 12.1700 | 28.84 | | |
| *OUT 30 | JCT | 100 | 3.044 | | 12.1700 | 32.27 | | |

Title... Project Date: 4/5/2007
Project Engineer: Dan Ionescu
Project Title: Taconic Tract. Proposed Condition.
"Conventional" Layout
Project Comments:

DESIGN STORMS SUMMARY

Design Storm File,ID = Westchester Coun

Storm Tag Name = Dev 1
---
Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 1 yr
Total Rainfall Depth= 2.8000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 2
---
Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 2 yr
Total Rainfall Depth= 3.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 5
---
Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 5 yr
Total Rainfall Depth= 4.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 10
---
Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 10 yr
Total Rainfall Depth= 5.0000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 25
---
Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 6.0000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Title... Project Date: 4/5/2007
Project Engineer: Dan Ionescu
Project Title: Taconic Tract. Proposed Condition.
"Conventional" Layout
Project Comments:

DESIGN STORMS SUMMARY

Design Storm File,ID = Westchester Coun

Storm Tag Name = Dev 50

---

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 50 yr
Total Rainfall Depth= 7.0000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev100

---

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 100 yr
Total Rainfall Depth= 7.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

DESIGN STORMS SUMMARY

Design Storm File,ID = Westchester Coun

Storm Tag Name = Dev 1
---
Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 1 yr
Total Rainfall Depth= 2.8000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 2
---
Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 2 yr
Total Rainfall Depth= 3.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 5
---
Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 5 yr
Total Rainfall Depth= 4.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 10
---
Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 10 yr
Total Rainfall Depth= 5.0000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 25
---
Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 6.0000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

DESIGN STORMS SUMMARY

Design Storm File,ID = Westchester Coun

Storm Tag Name = Dev 50

---

Data Type, File, ID = Synthetic Storm  TypeIII 24hr
Storm Frequency = 50 yr
Total Rainfall Depth= 7.0000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs  Step= .1000 hrs  End= 24.0000 hrs

Storm Tag Name = Dev100

---

Data Type, File, ID = Synthetic Storm  TypeIII 24hr
Storm Frequency = 100 yr
Total Rainfall Depth= 7.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs  Step= .1000 hrs  End= 24.0000 hrs

::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
TIME OF CONCENTRATION CALCULATOR
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

---

Segment #1: Tc: User Defined

Segment #1 Time: .3400 hrs

---

==========
Total Tc: .3400 hrs
==========

---

Tc Equations used...

---

==== User Defined ==========

Tc = Value entered by user

Where: Tc = Time of concentration

::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
TIME OF CONCENTRATION CALCULATOR
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

---

Segment #1: Tc: User Defined

Segment #1 Time: .2000 hrs

---

==========
Total Tc: .2000 hrs
==========

---

Tc Equations used...

---

==== User Defined ==========

Tc = Value entered by user

Where: Tc = Time of concentration

::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
TIME OF CONCENTRATION CALCULATOR
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

---

Segment #1: Tc: User Defined

Segment #1 Time: .1600 hrs

---

==========
Total Tc: .1600 hrs
==========

---

Tc Equations used...

---

==== User Defined ==========

Tc = Value entered by user

Where: Tc = Time of concentration

::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
TIME OF CONCENTRATION CALCULATOR
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

---

Segment #1: Tc: User Defined

Segment #1 Time: .2200 hrs

---

==========
Total Tc: .2200 hrs
==========

---

Tc Equations used...

---

==== User Defined ==========

Tc = Value entered by user

Where: Tc = Time of concentration

RUNOFF CURVE NUMBER DATA

| Soil/Surface Description | CN | Area acres | Impervious Adjustment %C | Impervious Adjustment %UC | Adjusted CN |
|---|---|---|---|---|---|
| | 63 | 17.100 | | | 63.00 |
| COMPOSITE AREA & WEIGHTED CN ---> | | 17.100 | | | 63.00 (63) |

File.... P:\050078\2_Design\Calcs\ProposedConventionalNoPond.ppw

RUNOFF CURVE NUMBER DATA

| Soil/Surface Description | CN | Area acres | Impervious Adjustment %C | %UC | Adjusted CN |
|---|---|---|---|---|---|
| Area 1 | 76 | 4.300 | | | 76.00 |
| COMPOSITE AREA & WEIGHTED CN ---> | | 4.300 | | | 76.00 (76) |

File.... P:\050078\2_Design\Calcs\ProposedConventionalNoPond.ppw

RUNOFF CURVE NUMBER DATA

| Soil/Surface Description | CN | Area acres | Impervious Adjustment %C | Impervious Adjustment %UC | Adjusted CN |
|---|---|---|---|---|---|
| Area 2 | 68 | 5.400 | | | 68.00 |
| COMPOSITE AREA & WEIGHTED CN ---> | | 5.400 | | | 68.00 (68) |

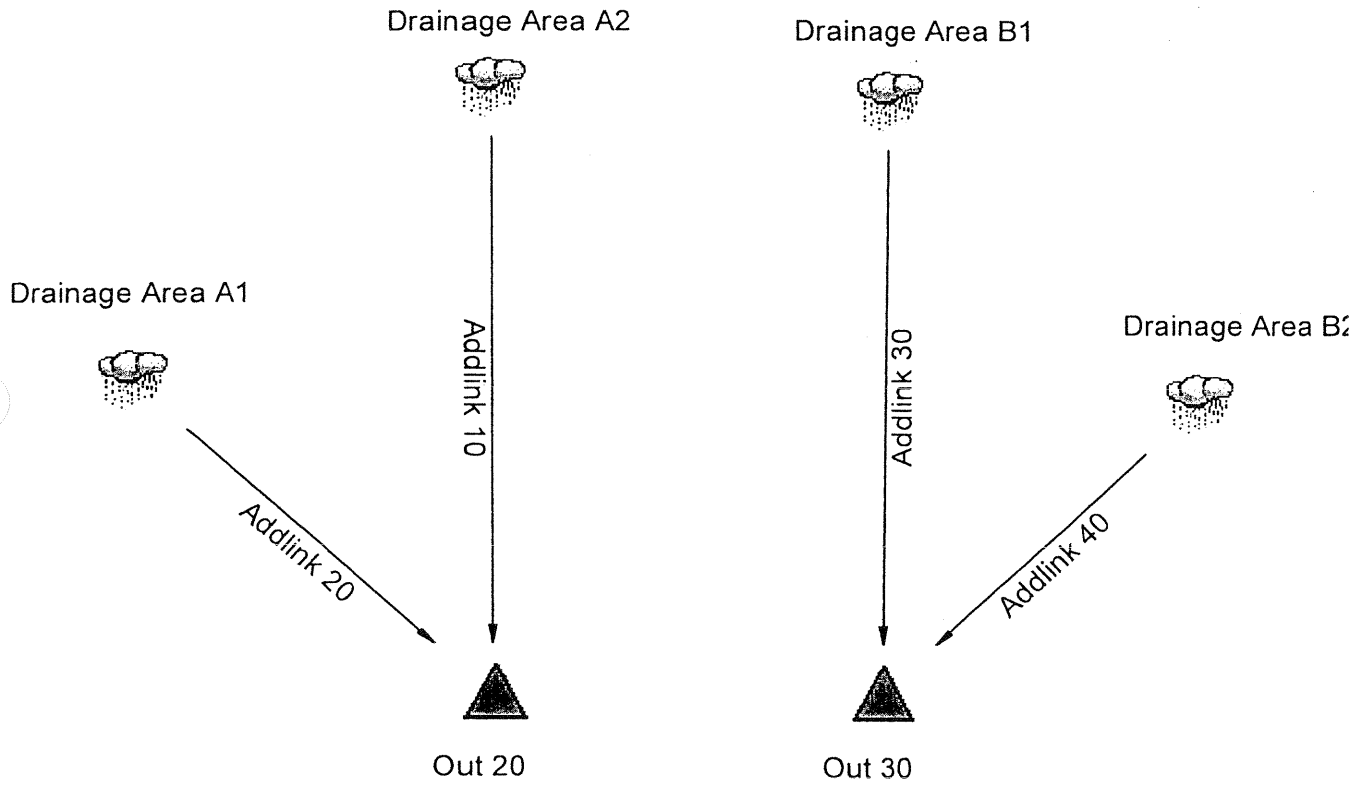
RUNOFF CURVE NUMBER DATA

| Soil/Surface Description | CN | Area acres | Impervious Adjustment %C | %UC | Adjusted CN |
|---|---|---|---|---|---|
| | 69 | 9.300 | | | 69.00 |
| COMPOSITE AREA & WEIGHTED CN ---> | | 9.300 | | | 69.00 (69) |

Index of Starting Page Numbers for ID Names

----- D -----
DRAINAGE AREA A1... 3.01, 4.01
DRAINAGE AREA A2... 3.03, 4.02
DRAINAGE AREA B1... 3.05, 4.03
DRAINAGE AREA B2... 3.07, 4.04

----- W -----
Watershed... 1.01
Westchester Coun... 2.01, 2.03


Drainage Area A2
Drainage Area B1
Drainage Area A1
Drainage Area B2
Addlink 10
Addlink 30
Addlink 20
Addlink 40
Out 20
Out 30

********** MASTER SUMMARY **********

Watershed..... Master Network Summary ..... 1.01

********** DESIGN STORMS SUMMARY **********

Westchester Coun Design Storms ..... 2.01

Westchester Coun Dev 1
Design Storms ..... 2.03

********** TC CALCULATIONS **********

DRAINAGE AREA A1 Tc Calcs ..... 3.01

DRAINAGE AREA A2 Tc Calcs ..... 3.03

DRAINAGE AREA B1 Tc Calcs ..... 3.05

DRAINAGE AREA B2 Tc Calcs ..... 3.07

********** CN CALCULATIONS **********

DRAINAGE AREA A1 Runoff CN-Area ..... 4.01

DRAINAGE AREA A2 Runoff CN-Area ..... 4.02

DRAINAGE AREA B1 Runoff CN-Area ..... 4.03

DRAINAGE AREA B2 Runoff CN-Area ..... 4.04

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Westchester Coun

| Return Event | Total Depth in | Rainfall Type | RNF ID |
|---|---|---|---|
| Dev 1 | 2.8000 | Synthetic Curve | TypeIII 24hr |
| Dev 2 | 3.5000 | Synthetic Curve | TypeIII 24hr |
| Dev 5 | 4.5000 | Synthetic Curve | TypeIII 24hr |
| Dev 10 | 5.0000 | Synthetic Curve | TypeIII 24hr |
| Dev 25 | 6.0000 | Synthetic Curve | TypeIII 24hr |
| Dev 50 | 7.0000 | Synthetic Curve | TypeIII 24hr |
| Dev100 | 7.5000 | Synthetic Curve | TypeIII 24hr |

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

| Node ID | Type | Return Event | HYG Vol ac-ft | Trun | Qpeak hrs | Qpeak cfs | Max WSEL ft | Max Pond Storage ac-ft |
|---|---|---|---|---|---|---|---|---|
| DRAINAGE AREA A1 | AREA | 1 | .502 | | 12.3800 | 2.93 | | |
| DRAINAGE AREA A1 | AREA | 2 | .940 | | 12.3300 | 6.88 | | |
| DRAINAGE AREA A1 | AREA | 5 | 1.713 | | 12.2800 | 14.24 | | |
| DRAINAGE AREA A1 | AREA | 10 | 2.150 | | 12.2800 | 18.41 | | |
| DRAINAGE AREA A1 | AREA | 25 | 3.101 | | 12.2400 | 27.45 | | |
| DRAINAGE AREA A1 | AREA | 50 | 4.134 | | 12.2400 | 37.36 | | |
| DRAINAGE AREA A1 | AREA | 100 | 4.674 | | 12.2400 | 42.51 | | |
| DRAINAGE AREA A2 | AREA | 1 | .316 | | 12.1600 | 3.27 | | |
| DRAINAGE AREA A2 | AREA | 2 | .489 | | 12.1600 | 5.23 | | |
| DRAINAGE AREA A2 | AREA | 5 | .763 | | 12.1600 | 8.30 | | |
| DRAINAGE AREA A2 | AREA | 10 | .909 | | 12.1600 | 9.91 | | |
| DRAINAGE AREA A2 | AREA | 25 | 1.211 | | 12.1600 | 13.21 | | |
| DRAINAGE AREA A2 | AREA | 50 | 1.526 | | 12.1600 | 16.58 | | |
| DRAINAGE AREA A2 | AREA | 100 | 1.686 | | 12.1600 | 18.28 | | |

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

| Node ID | Type | Return Event | HYG Vol ac-ft | Trun | Qpeak hrs | Qpeak cfs | Max WSEL ft | Max Pond Storage ac-ft |
|---|---|---|---|---|---|---|---|---|
| DRAINAGE AREA B1 | AREA | 1 | .237 | | 12.1600 | 2.22 | | |
| DRAINAGE AREA B1 | AREA | 2 | .406 | | 12.1600 | 4.25 | | |
| DRAINAGE AREA B1 | AREA | 5 | .690 | | 12.1400 | 7.67 | | |
| DRAINAGE AREA B1 | AREA | 10 | .846 | | 12.1400 | 9.54 | | |
| DRAINAGE AREA B1 | AREA | 25 | 1.179 | | 12.1400 | 13.48 | | |
| DRAINAGE AREA B1 | AREA | 50 | 1.535 | | 12.1400 | 17.62 | | |
| DRAINAGE AREA B1 | AREA | 100 | 1.718 | | 12.1400 | 19.75 | | |
| DRAINAGE AREA B2 | AREA | 1 | .438 | | 12.2000 | 3.84 | | |
| DRAINAGE AREA B2 | AREA | 2 | .739 | | 12.2000 | 7.16 | | |
| DRAINAGE AREA B2 | AREA | 5 | 1.242 | | 12.1800 | 12.71 | | |
| DRAINAGE AREA B2 | AREA | 10 | 1.517 | | 12.1700 | 15.74 | | |
| DRAINAGE AREA B2 | AREA | 25 | 2.102 | | 12.1700 | 22.14 | | |
| DRAINAGE AREA B2 | AREA | 50 | 2.723 | | 12.1700 | 28.84 | | |
| DRAINAGE AREA B2 | AREA | 100 | 3.044 | | 12.1700 | 32.27 | | |
| *OUT 20 | JCT | 1 | .818 | | 12.2800 | 5.29 | | |
| *OUT 20 | JCT | 2 | 1.429 | | 12.2400 | 11.10 | | |
| *OUT 20 | JCT | 5 | 2.476 | | 12.2400 | 21.21 | | |
| *OUT 20 | JCT | 10 | 3.059 | | 12.2400 | 26.80 | | |
| *OUT 20 | JCT | 25 | 4.313 | | 12.2200 | 38.74 | | |
| *OUT 20 | JCT | 50 | 5.659 | | 12.2100 | 51.53 | | |
| *OUT 20 | JCT | 100 | 6.360 | | 12.2100 | 58.15 | | |
| *OUT 30 | JCT | 1 | .675 | | 12.1800 | 5.97 | | |
| *OUT 30 | JCT | 2 | 1.145 | | 12.1700 | 11.31 | | |
| *OUT 30 | JCT | 5 | 1.931 | | 12.1600 | 20.19 | | |
| *OUT 30 | JCT | 10 | 2.363 | | 12.1600 | 25.04 | | |
| *OUT 30 | JCT | 25 | 3.282 | | 12.1600 | 35.27 | | |
| *OUT 30 | JCT | 50 | 4.258 | | 12.1500 | 46.03 | | |
| *OUT 30 | JCT | 100 | 4.763 | | 12.1500 | 51.56 | | |

Title... Project Date: 4/5/2007
Project Engineer: Dan Ionescu
Project Title: Taconic Tract. Proposed Condition.
"Conventional" Layout
Project Comments:

DESIGN STORMS SUMMARY

Design Storm File,ID = Westchester Coun

Storm Tag Name = Dev 1

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 1 yr
Total Rainfall Depth= 2.8000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 2

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 2 yr
Total Rainfall Depth= 3.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 5

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 5 yr
Total Rainfall Depth= 4.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 10

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 10 yr
Total Rainfall Depth= 5.0000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 25

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 6.0000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Title... Project Date: 4/5/2007
Project Engineer: Dan Ionescu
Project Title: Taconic Tract. Proposed Condition.
"Conventional" Layout
Project Comments:

DESIGN STORMS SUMMARY

Design Storm File,ID = Westchester Coun

Storm Tag Name = Dev 50

---

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 50 yr
Total Rainfall Depth= 7.0000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev100

---

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 100 yr
Total Rainfall Depth= 7.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

DESIGN STORMS SUMMARY

Design Storm File,ID = Westchester Coun

Storm Tag Name = Dev 1
---
Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 1 yr
Total Rainfall Depth= 2.8000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 2
---
Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 2 yr
Total Rainfall Depth= 3.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 5
---
Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 5 yr
Total Rainfall Depth= 4.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 10
---
Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 10 yr
Total Rainfall Depth= 5.0000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 25
---
Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 6.0000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

DESIGN STORMS SUMMARY

Design Storm File,ID = Westchester Coun

Storm Tag Name = Dev 50

---

Data Type, File, ID = Synthetic Storm  TypeIII 24hr
Storm Frequency = 50 yr
Total Rainfall Depth= 7.0000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs  Step= .1000 hrs  End= 24.0000 hrs

Storm Tag Name = Dev100

---

Data Type, File, ID = Synthetic Storm  TypeIII 24hr
Storm Frequency = 100 yr
Total Rainfall Depth= 7.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs  Step= .1000 hrs  End= 24.0000 hrs

::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
TIME OF CONCENTRATION CALCULATOR
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

---

Segment #1: Tc: User Defined

Segment #1 Time: .3400 hrs

---

==========
Total Tc: .3400 hrs
==========

---

Tc Equations used...

---

==== User Defined ==========

Tc = Value entered by user

Where: Tc = Time of concentration

::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
TIME OF CONCENTRATION CALCULATOR
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

---

Segment #1: Tc: User Defined

Segment #1 Time: .2000 hrs

---

==========
Total Tc: .2000 hrs
==========

---

Tc Equations used...

---

==== User Defined ==========

Tc = Value entered by user

Where: Tc = Time of concentration

::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
TIME OF CONCENTRATION CALCULATOR
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

---

Segment #1: Tc: User Defined

Segment #1 Time: .1600 hrs

---

==========
Total Tc: .1600 hrs
==========

---

Tc Equations used...

---

==== User Defined ==========

Tc = Value entered by user

Where: Tc = Time of concentration

::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
TIME OF CONCENTRATION CALCULATOR
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

---

Segment #1: Tc: User Defined

Segment #1 Time: .2200 hrs

---

==========
Total Tc: .2200 hrs
==========

---

Tc Equations used...

---

==== User Defined ==========

Tc = Value entered by user

Where: Tc = Time of concentration

File.... P:\050078\2_Design\Calcs\ProposedConventionalCombinedNoPond.ppw

RUNOFF CURVE NUMBER DATA

| Soil/Surface Description | CN | Area acres | Impervious Adjustment %C | %UC | Adjusted CN |
|---|---|---|---|---|---|
| | 63 | 17.100 | | | 63.00 |

COMPOSITE AREA & WEIGHTED CN ---> 17.100 63.00 (63)

File.... P:\050078\2_Design\Calcs\ProposedConventionalCombinedNoPond.ppw

RUNOFF CURVE NUMBER DATA

| Soil/Surface Description | CN | Area acres | Impervious Adjustment %C | %UC | Adjusted CN |
|---|---|---|---|---|---|
| Area 1 | 76 | 4.300 | | | 76.00 |
| COMPOSITE AREA & WEIGHTED CN ---> | | 4.300 | | | 76.00 (76) |

RUNOFF CURVE NUMBER DATA

| Soil/Surface Description | CN | Area acres | Impervious Adjustment %C | Impervious Adjustment %UC | Adjusted CN |
|---|---|---|---|---|---|
| Area 2 | 68 | 5.400 | | | 68.00 |
| COMPOSITE AREA & WEIGHTED CN ---> | | 5.400 | | | 68.00 (68) |

RUNOFF CURVE NUMBER DATA

| Soil/Surface Description | CN | Area acres | Impervious Adjustment %C | %UC | Adjusted CN |
|---|---|---|---|---|---|
| | 69 | 9.300 | | | 69.00 |

COMPOSITE AREA & WEIGHTED CN ---> 9.300 69.00 (69)

Index of Starting Page Numbers for ID Names

----- D -----
DRAINAGE AREA A1... 3.01, 4.01
DRAINAGE AREA A2... 3.03, 4.02
DRAINAGE AREA B1... 3.05, 4.03
DRAINAGE AREA B2... 3.07, 4.04

----- W -----
Watershed... 1.01
Westchester Coun... 2.01, 2.03

# POST-DEVELOPMENT DRAINAGE ANALYSIS
# CONSERVATION LAYOUT

CHAS. H. SELLS, INC.
Consulting Engineers, Surveyors & Photogrammetrists

Comp. By bi Date 4/9/07 Project TACONIC TRACT Sheet No. ..... of .....

Chkd. By ..... Date ..... Subject Storm water Management "Conservation Option" Job No 050078

PROPOSED CONDITION - CN

Drainage Area $A_2$

D.A. $A_2 = 8.7\ in^2 \rightarrow 2\ Ac$ All Type B

- impervious $2.0\ in^2 \rightarrow 0.46\ Ac$
- grass/lawn $0.75 + 0.80 + 0.50 + 0.60 = 2.65\ in^2 \rightarrow 0.61\ Ac$
- Tall grass $0.50\ in^2 \rightarrow 0.11\ Ac$
- woods $0.82\ Ac$

Drainage Area $A_3$

All Type B

D.A. $A_3 = 11.2\ in^2 \rightarrow 2.6\ Ac$

- impervious $3.2 + 0.20 + 0.25 + 0.35 + 0.5 = 4.5\ in^2 \rightarrow 1.03\ Ac$
- grass/lawn $0.7 + 0.5 + 1.7 = 2.9\ in^2 \rightarrow 0.70\ Ac$
- Tall Grass $0.43\ in^2 \rightarrow 0.1\ Ac$
- woods $3.35\ in^2 \rightarrow 0.77\ Ac$

Comp. By Di Date 4/9/07 Project TACONIC TRACT Sheet No. ..... of .....

Chkd. By ..... Date ..... Subject Stormwater Management "Conservation Option" Job No. 050078

Drainage Area $A_1$ - 17.2

D.A. $A_1$ = 17.2 Ac

Type B - 6.9 Ac

- impervious 0.6 + 0.3 + 0.6 + 0.4 + + 0.10 = 2 in² → 0.50 Ac
- Grass - exist. houses 2.24 Ac
  - by new road 1 in² → 0.23 Ac

  2.47 Ac

- woods 1.4 + 3.4 + 2.6 + 2.5 = 9.9 in² → → 2.3 Ac
- Tall grass 1.63 Ac

Type C - 10.3 Ac

- impervious - 2 houses (new) 2 × 0.65 = 1.3 in² → 0.30 Ac
  - 2 old houses 0.55 in² → 0.13 Ac
- grass/lawns 0.55 Ac
- tall grass (old roads) (700 + 550 + 80 + 320) 30 = 49,500 ft² = = 1.14 Ac
- woods 8.18 Ac

Comp. By: Dr Date: 4/9/07 Project: TALONIC TRACT Sheet No. ____ of ____

Chkd. By: ____ Date: ____ Subject: Stormwater Management "Conservation Option" Job No: 050078

Drainage Area B1 – 3.8 Ac. All Type B

D.A. = 16.6 in² → 3.8 Ac

- impervious 3.5 + 0.60 = 4.10 in² → 0.94 Ac
- woods 3.4 in² → 0.78 Ac
- Tall Grass 0.35 + 0.60 = 0.95 in² → 0.22 Ac
- grass/lawn 1.86 Ac

Drainage Area B2 – 10.5 Ac

- impervious – existing 1.35 Ac
  - proposed 1.5 in² → 0.34 Ac
  - 1.69 Ac
- grass – existing 3.2 Ac
  - proposed 5.0 in² → 1.15 Ac
- wooded (orchard type) 5.7 in² → 1.3 Ac
- woods 3.2 + 0.3 + 1.2 = 4.7 in² → 1.1 Ac
- tall grass 2.06 Ac

Comp. By DI Date 4/10/07 Project TRONIC TRACT Sheet No. ..... of .....
Chkd. By ..... Date ..... Subject Stormwater Management "Conservation" Layout Job No 050078

PROPOSED CONDITION - $T_c$

Drainage Area A1

Same as "conventional" & existing condition

$t_c = 0.34h = 20$ min

Drainage Area A2 - assumed grading

- sheet flow (EF) $s = \frac{363.4 - 360}{50} = 0.068$ $L = 50$ ft
- gutter flow (FG) - shallow conc. assume 1.5% gutter slope $s = 0.015$ $L = 340'$
  $V \simeq 2.4$ ft/s
- Pipe Flow (GH) - assume channel flow $L = 330$ ft
  $V \simeq 7$ ft/s

Drainage Area A3 - assumed grading

- sheet flow (IJ) $s = \frac{380 - 376}{50} = 0.08$ $L = 50'$
- shallow conc. (JK) $L = 95'$ $s = \frac{376 - 374.5}{95} = 0.016$
  $V \simeq 2.5$ ft/s
- gutter flow (KL) - assume 4% slope $V \simeq 4$ ft/s $L \simeq 730$ ft
- Pipe Flow (LM) - preliminary assume channel flow $L = 430'$
  $V \simeq 6$ ft/s

Comp. By Dr Date 4/10/07 Project TACONIC TRACT Sheet No. ..... of .....
Chkd. By ..... Date ..... Subject Stormwater Management "Conservation Layout" Job No. 050078

Drainage Area B1 - assumed grading

- Sheet flow (NO) L = 50' $s = \frac{371 - 365}{50} = 0.12$
- Shallow conc (OP)

  L = 170' $s = \frac{365 - 355}{170} = 0.059$

  $V \simeq 5.3$ ft/s
- Gutter Flow (PQ) shallow conc L = 620'

  $s = \frac{355 - 279}{620} = 0.12$ $V \simeq 7$ ft/s
- Pipe Flow (QR) assume channel flow L = 380'; $V \simeq 6$ ft/s

Drainage Area B2

Same as "Conventional" Layout

$t_c = 13$ min $= 0.22$ h

**Post-D.A. "A1"**

Worksheet 2: Runoff curve number and runoff

| Project | By | Date |
|---|---|---|
| Taconic Tract. "Conservation" Layout | Dan Ionescu | 4/9/2007 |
| Location | Checked | Date |
| Mt. Pleasant, NY (Westchester County) | | |

Check one: [ ] Present [X] Developed

**1. Runoff Curve Number**

| Soil Name and Hydrologic group (appendix A) | Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnectied/connected impervious ratio) | CN Table 2-2 | CN Figure 2-4 | CN Figure 2-4 | Area [X] acres [ ] mi² [ ] % | Product of CN x area |
|---|---|---|---|---|---|---|
| CrC & CsD, TypeB | Impervious-asphalt walk/driveway, parkings, buildings | 98 | | | 0.50 | 49.00 |
| CrC & CsD, TypeB | Woods-fair to good condition | 60 | | | 2.30 | 138.00 |
| CrC & CsD, TypeB | Open space (lawns)-good condition | 61 | | | 2.47 | 150.67 |
| CrC & CsD, TypeB | Mixture of grass, weeds, some brush-fair condition | 71 | | | 1.63 | 115.73 |
| PnD, TypeC | Impervious-asphalt walk/driveway, parkings, buildings | 98 | | | 0.43 | 42.14 |
| | | | | | | |
| PnD, PnC & | Woods-fair to good condition | 60 | | | 8.18 | 490.80 |
| WdB, TypeC | Open space (lawns)-good condition | 61 | | | 0.55 | 33.55 |
| PnD, PnC & | Mixture of grass, weeds, some brush-fair condition | 71 | | | 1.14 | 80.94 |
| WdB, TypeC | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | **Totals** | 17.20 | 1100.83 |

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{1100.83}{17.2} = 64.00$$

**Use CN** **64**

**Post-D.A. "A2"**

Worksheet 2: Runoff curve number and runoff

| Project | By | Date |
|---|---|---|
| Taconic Tract. "Conservation" Layout | Dan Ionescu | 4/9/2007 |
| Location | Checked | Date |
| Mt. Pleasant, NY (Westchester County) | | |

Check one: [ ] Present [X] Developed

**1. Runoff Curve Number**

| Soil Name and Hydrologic group (appendix A) | Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnectied/connected impervious ratio) | CN Table 2-2 | CN Figure 2-4 | CN Figure 2-4 | Area [X] acres [ ] mi² [ ] % | Product of CN x area |
|---|---|---|---|---|---|---|
| CrC & CsD, TypeB | Impervious-asphalt walk/driveway, parkings, buildings | 98 | | | 0.46 | 45.08 |
| CrC & CsD, TypeB | Woods-fair to good condition | 60 | | | 0.82 | 49.20 |
| CrC & CsD, TypeB | Open space (lawns)-good condition | 61 | | | 0.61 | 37.21 |
| CrC & CsD, TypeB | Mixture of grass, weeds, some brush-fair condition | 71 | | | 0.11 | 7.81 |
| | | | | | | |
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| | | | | | | |
| | | | | **Totals** | 2.00 | 139.3 |

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{139.3}{2} = 69.65$$

**Use CN** 70

**Post-D.A. "A3"**

Worksheet 2: Runoff curve number and runoff

| Project | By | Date |
|---|---|---|
| Taconic Tract. "Conservation" Layout | Dan Ionescu | 4/9/2007 |
| Location | Checked | Date |
| Mt. Pleasant, NY (Westchester County) | | |

Check one: [ ] Present [X] Developed

**1. Runoff Curve Number**

| Soil Name and Hydrologic group (appendix A) | Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnectied/connected impervious ratio) | CN Table 2-2 | CN Figure 2-4 | CN Figure 2-4 | Area [X] acres [ ] mi² [ ] % | Product of CN x area |
|---|---|---|---|---|---|---|
| CrC & CsD, TypeB | Impervious-asphalt walk/driveway, parkings, buildings | 98 | | | 1.03 | 100.94 |
| CrC & CsD, TypeB | Woods-fair to good condition | 60 | | | 0.77 | 46.20 |
| CrC & CsD, TypeB | Open space (lawns)-good condition | 61 | | | 0.70 | 42.70 |
| CrC & CsD, TypeB | Mixture of grass, weeds, some brush-fair condition | 71 | | | 0.10 | 7.10 |
| | | | | | | |
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| | | | | | | |
| | | | | Totals | 2.60 | 196.94 |

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{196.94}{2.6} = 75.75$$

**Use CN** [ 76 ]

**Post-D.A. "B1"**

Worksheet 2: Runoff curve number and runoff

| Project | By | Date |
|---|---|---|
| Taconic Tract. "Conservation" Layout | Dan Ionescu | 4/9/2007 |
| Location | Checked | Date |
| Mt. Pleasant, NY (Westchester County) | | |

Check one: [X] Present [ ] Developed

**1. Runoff Curve Number**

| Soil Name and Hydrologic group (appendix A) | Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnectied/connected impervious ratio) | CN Table 2-2 | CN Figure 2-4 | CN Figure 2-4 | Area [X] acres [ ] mi² [ ] % | Product of CN x area |
|---|---|---|---|---|---|---|
| CrC & CsD, TypeB | Impervious-asphalt walk/driveway, parkings, buildings | 98 | | | 0.94 | 92.12 |
| CrC & CsD, TypeB | Woods-fair to good condition | 60 | | | 0.78 | 46.80 |
| CrC & CsD, TypeB | Open space (lawns)-good condition | 61 | | | 1.86 | 113.46 |
| CrC & CsD, TypeB | Mixture of grass, weeds, some brush-fair condition | 71 | | | 0.22 | 15.62 |
| | | | | | | |
| | | | | | | |
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| | | | | | | |
| | | | | Totals | 3.80 | 268 |

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{268}{3.8} = 70.53$$

**Use CN** 71

**Post-D.A. "B2"**

Worksheet 2: Runoff curve number and runoff

| Project<br>**Taconic Tract. "Conservation" Layout** | By<br>**Dan Ionescu** | Date<br>**4/9/2007** |
|---|---|---|
| Location<br>**Mt. Pleasant, NY (Westchester County)** | Checked | Date |

Check one: [ ] Present [X] Developed "Conservation" Layout

**1. Runoff Curve Number**

| Soil Name and Hydrologic group (appendix A) | Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnectied/connected impervious ratio) | CN Table 2-2 | CN Figure 2-4 | CN Figure 2-4 | Area [X] acres [ ] mi² [ ] % | Product of CN x area |
|---|---|---|---|---|---|---|
| CrC & CsD, TypeB | Impervious-asphalt walk/driveway, parkings, buildings | 98 | | | 1.69 | 165.62 |
| CrC & CsD, TypeB | Woods-fair to good condition | 60 | | | 1.10 | 66.00 |
| CrC & CsD, TypeB | Open space (lawns)-good condition | 61 | | | 4.35 | 265.35 |
| CrC & CsD, TypeB | Mixture of grass, weeds, some brush-fair condition | 71 | | | 2.06 | 146.26 |
| CrC & CsD, TypeB | Woods-grass combination-fair to good condition | 65 | | | 1.30 | 84.50 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | **Totals** | 10.50 | 727.73 |

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{727.73}{10.5} = 69.31$$

**Use CN** **69**

**Post-D.A. "A1"**

**Worksheet 3: Time of Concentration ($T_c$) or travel time ($T_t$)**

| Project | By | Date |
|---|---|---|
| **Taconic Tract. "Conservation" Layout** | **Dan Ionescu** | **4/10/2007** |
| Location | Checked | Date |
| **Mt. Pleasant, NY (Westchester County)** | | |

Check one: [ ] Present [X] Developed

Check one: [X] $T_c$ [ ] $T_t$ through subarea

Notes: Space for as many as tow segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

**Sheet flow (Applicable to $T_c$ only)**

| | | Segment ID | AB | | | |
|---|---|---|---|---|---|---|
| 1. Surface description (table 3-1) | | | grass | | | |
| 2. Manning's Roughness coeff., n (table 3-1) | | | 0.24 | | | |
| 3. Flow length, L (total ≤ 300 ft) | | ft | 100 | | | |
| 4. Two year 24-hour rainfall, $P_2$ | | in | 3.5 | | | |
| 5. Land slope, s | | ft/ft | 0.028 | | | |
| 6. $T_t$ = | $\frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute $T_t$ | hr | 0.20 | | | 0.20 |

**Shallow concentrated flow**

| | | Segment ID | BC | | | |
|---|---|---|---|---|---|---|
| 7. Surface description (paved or unpaved) | | | unpaved | | | |
| 8. Flow length , L | | ft | 740 | | | |
| 9. Watercourse slope,s | | ft/ft | 0.118 | | | |
| 10. Average velocity (figure 3-1) | | ft/s | 4.8 | | | |
| 11. $T_t$ = | $\frac{L}{3600V}$ Compute $T_t$ | hr | 0.04 | | | 0.04 |

**Channel flow**

| | | Segment ID | | | | |
|---|---|---|---|---|---|---|
| 12. Cross secional flow area, a | | $ft^2$ | | | | |
| 13. Wetted perimeter, $p_w$ | | ft | | | | |
| 14. Hydraulic radius, r = | $\frac{a}{p_w}$ Compu | ft | | | | |
| 15. Channel slope,s | | ft/ft | 0.036 | | | |
| 16. Manning's roughness coefficient, n | | | 0.035 | | | |
| 17. V = | $\frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V | ft/s | 3.30 | | | |
| 18. Flow length, L | | ft | 1130 | | | |
| 19. $T_t$ = | $\frac{L}{3600V}$ Compute $T_t$ | hr | 0.10 | | | 0.10 |

20. Watershed or subarea $T_c$ of $T_t$ (add $T_t$ in steps 6, 11 and 19) hr. = 0.34
min. = 20

**Post-D.A. "A2"**

**Worksheet 3: Time of Concentration ($T_c$) or travel time ($T_t$)**

| Project | By | Date |
|---|---|---|
| **Taconic Tract. "Conservation" Layout** | **Dan Ionescu** | **4/10/2007** |
| Location | Checked | Date |
| **Mt. Pleasant, NY (Westchester County)** | | |

Check one: [ ] Present [X] Developed

Check one: [X] $T_c$ [ ] $T_t$ through subarea

Notes: Space for as many as tow segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

**Sheet flow (Applicable to $T_c$ only)**

| | | Segment ID | EF | | | |
|---|---|---|---|---|---|---|
| 1. Surface description (table 3-1) | | | grass | | | |
| 2. Manning's Roughness coeff., n (table 3-1) | | | 0.24 | | | |
| 3. Flow length, L (total ≤ 300 ft) | | ft | 50 | | | |
| 4. Two year 24-hour rainfall, $P_2$ | | in | 3.5 | | | |
| 5. Land slope, s | | ft/ft | 0.068 | | | |
| 6. $T_t$ = | $\frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute $T_t$ | hr | 0.08 | | | 0.08 |

**Shallow concentrated flow**

| | | Segment ID | FG | | | |
|---|---|---|---|---|---|---|
| 7. Surface description (paved or unpaved) | | | paved | | | |
| 8. Flow length , L | | ft | 340 | | | |
| 9. Watercourse slope,s | | ft/ft | 0.015 | | | |
| 10. Average velocity (figure 3-1) | | ft/s | 2.4 | | | |
| 11. $T_t$ = | $\frac{L}{3600V}$ Compute $T_t$ | hr | 0.039 | | | 0.039 |

**Channel flow**

| | | Segment ID | GH | | | |
|---|---|---|---|---|---|---|
| 12. Cross secional flow area, a | | $ft^2$ | | | | |
| 13. Wetted perimeter, $p_w$ | | ft | | | | |
| 14. Hydraulic radius, r = | $\frac{a}{p_w}$ Compu | ft | | | | |
| 15. Channel slope,s | | ft/ft | | | | |
| 16. Manning's roughness coefficient, n | | | | | | |
| 17. V = | $\frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V | ft/s | 7.00 | | | |
| 18. Flow length, L | | ft | 330 | | | |
| 19. $T_t$ = | $\frac{L}{3600V}$ Compute $T_t$ | hr | 0.01 | | | 0.01 |

20. Watershed or subarea $T_c$ of $T_t$ (add $T_t$ in steps 6, 11 and 19)

hr. = 0.13

min. = 8

**Post-D.A. "A3"**

**Worksheet 3: Time of Concentration ($T_c$) or travel time ($T_t$)**

| Project | By | Date |
|---|---|---|
| **Taconic Tract. "Conservation" Layout** | **Dan Ionescu** | **4/10/2007** |
| Location | Checked | Date |
| **Mt. Pleasant, NY (Westchester County)** | | |

Check one: [ ] Present [X] Developed

Check one: [X] $T_c$ [ ] $T_t$ through subarea

Notes: Space for as many as tow segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

**Sheet flow (Applicable to $T_c$ only)**

| | | Segment ID | IJ | | | |
|---|---|---|---|---|---|---|
| 1. Surface description (table 3-1) | | | grass | | | |
| 2. Manning's Roughness coeff., n (table 3-1) | | | 0.24 | | | |
| 3. Flow length, L (total ≤ 300 ft) | | ft | 50 | | | |
| 4. Two year 24-hour rainfall, $P_2$ | | in | 3.5 | | | |
| 5. Land slope, s | | ft/ft | 0.08 | | | |
| 6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ | Compute $T_t$ | hr | 0.08 | | | 0.08 |

**Shallow concentrated flow**

| | | Segment ID | JK | KL | | |
|---|---|---|---|---|---|---|
| 7. Surface description (paved or unpaved) | | | unpaved | paved | | |
| 8. Flow length , L | | ft | 95 | 730 | | |
| 9. Watercourse slope,s | | ft/ft | 0.016 | 0.04 | | |
| 10. Average velocity (figure 3-1) | | ft/s | 2.5 | 4 | | |
| 11. $T_t = \frac{L}{3600V}$ | Compute $T_t$ | hr | 0.011 | 0.051 | | 0.062 |

**Channel flow**

| | | Segment ID | LM | | | |
|---|---|---|---|---|---|---|
| 12. Cross secional flow area, a | | $ft^2$ | | | | |
| 13. Wetted perimeter, $p_w$ | | ft | | | | |
| 14. Hydraulic radius, $r = \frac{a}{p_w}$ | Compu | ft | | | | |
| 15. Channel slope,s | | ft/ft | | | | |
| 16. Manning's roughness coefficient, n | | | | | | |
| 17. $V = \frac{1.49\, r^{2/3}\, s^{1/2}}{n}$ | Compute V | ft/s | 7.00 | | | |
| 18. Flow length, L | | ft | 430 | | | |
| 19. $T_t = \frac{L}{3600V}$ | Compute $T_t$ | hr | 0.02 | | | 0.02 |

20. Watershed or subarea $T_c$ of $T_t$ (add $T_t$ in steps 6, 11 and 19)

hr. = 0.15

min. = 9

**Post-D.A. "B1"**

**Worksheet 3: Time of Concentration ($T_c$) or travel time ($T_t$)**

| Project | By | Date |
|---|---|---|
| **Taconic Tract. "Conservation" Layout** | **Dan Ionescu** | **4/10/2007** |
| Location | Checked | Date |
| **Mt. Pleasant, NY (Westchester County)** | | |

Check one: [ ] Present [X] Developed

Check one: [X] $T_c$ [ ] $T_t$ through subarea

Notes: Space for as many as tow segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

**Sheet flow (Applicable to $T_c$ only)**

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Segment ID | NO | | | |
| 1. Surface description (table 3-1) | | | Grass | | | |
| 2. Manning's Roughness coeff., n (table 3-1) | | | 0.24 | | | |
| 3. Flow length, L (total ≤ 300 ft) | | ft | 50 | | | |
| 4. Two year 24-hour rainfall, $P_2$ | | in | 3.5 | | | |
| 5. Land slope, s | | ft/ft | 0.12 | | | |
| 6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ | Compute $T_t$ | hr | 0.06 | | | 0.06 |

**Shallow concentrated flow**

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Segment ID | OP | PQ | | |
| 7. Surface description (paved or unpaved) | | | unpaved | paved | | |
| 8. Flow length , L | | ft | 170 | 620 | | |
| 9. Watercourse slope,s | | ft/ft | 0.059 | 0.12 | | |
| 10. Average velocity (figure 3-1) | | ft/s | 5.3 | 7 | | |
| 11. $T_t = \frac{L}{3600V}$ | Compute $T_t$ | hr | 0.009 | 0.025 | | 0.034 |

**Channel flow**

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Segment ID | QR | | | |
| 12. Cross secional flow area, a | | $ft^2$ | | | | |
| 13. Wetted perimeter, $p_w$ | | ft | | | | |
| 14. Hydraulic radius, $r = \frac{a}{p_w}$ | Compu | ft | | | | |
| 15. Channel slope,s | | ft/ft | | | | |
| 16. Manning's roughness coefficient, n | | | | | | |
| 17. $V = \frac{1.49\, r^{2/3}\, s^{1/2}}{n}$ | Compute V | ft/s | 6.00 | | | |
| 18. Flow length, L | | ft | 380 | | | |
| 19. $T_t = \frac{L}{3600V}$ | Compute $T_t$ | hr | 0.02 | | | 0.02 |

20. Watershed or subarea $T_c$ of $T_t$ (add $T_t$ in steps 6, 11 and 19)

hr. = 0.11

min. = 7

**Post-D.A. "B2"**

**Worksheet 3: Time of Concentration ($T_c$) or travel time ($T_t$)**

| Project | By | Date |
|---|---|---|
| **Taconic Tract. "Conservation" Layout** | **Dan Ionescu** | **4/10/2007** |
| Location | Checked | Date |
| **Mt. Pleasant, NY (Westchester County)** | | |

Check one: [ ] Present [X] Developed

Check one: [X] $T_c$ [ ] $T_t$ through subarea

Notes: Space for as many as tow segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

**Sheet flow (Applicable to $T_c$ only)**

| | | Segment ID | ST | | | |
|---|---|---|---|---|---|---|
| 1. Surface description (table 3-1) | | | woods light | | | |
| 2. Manning's Roughness coeff., n (table 3-1) | | | 0.4 | | | |
| 3. Flow length, L (total ≤ 300 ft) | | ft | 75 | | | |
| 4. Two year 24-hour rainfall, $P_2$ | | in | 3.5 | | | |
| 5. Land slope, s | | ft/ft | 0.108 | | | |
| 6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ | Compute $T_t$ | hr | 0.14 | | | 0.14 |

**Shallow concentrated flow**

| | | Segment ID | TU | UV | | |
|---|---|---|---|---|---|---|
| 7. Surface description (paved or unpaved) | | | unpaved | unpaved | | |
| 8. Flow length , L | | ft | 440 | 770 | | |
| 9. Watercourse slope,s | | ft/ft | 0.18 | 0.044 | | |
| 10. Average velocity (figure 3-1) | | ft/s | 6.8 | 3.4 | | |
| 11. $T_t = \frac{L}{3600V}$ | Compute $T_t$ | hr | 0.018 | 0.063 | | 0.081 |

**Channel flow**

| | | Segment ID | | | | |
|---|---|---|---|---|---|---|
| 12. Cross secional flow area, a | | $ft^2$ | | | | |
| 13. Wetted perimeter, $p_w$ | | ft | | | | |
| 14. Hydraulic radius, $r = \frac{a}{p_w}$ | Compu | ft | | | | |
| 15. Channel slope,s | | ft/ft | | | | |
| 16. Manning's roughness coefficient, n | | | | | | |
| 17. $V = \frac{1.49\, r^{2/3}\, s^{1/2}}{n}$ | Compute V | ft/s | | | | |
| 18. Flow length, L | | ft | | | | |
| 19. $T_t = \frac{L}{3600V}$ | Compute $T_t$ | hr | | | | |

20. Watershed or subarea $T_c$ of $T_t$ (add $T_t$ in steps 6, 11 and 19) hr. = 0.22 min. = 13

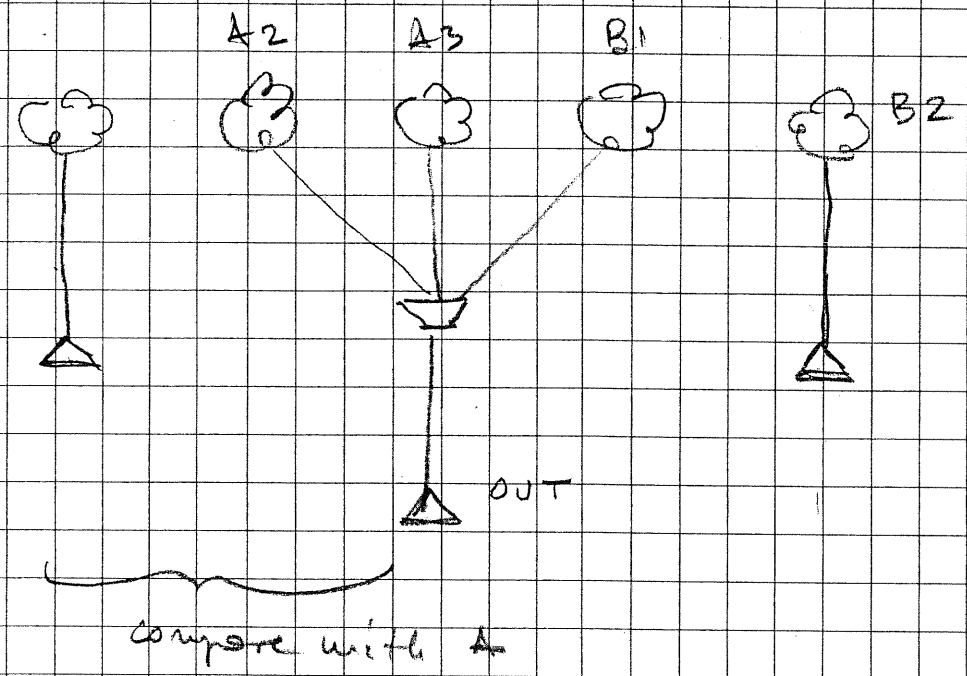
Comp. By DJ Date 4/10/07 Project TALONIC TRACT Sheet No. ..... of .....

Chkd. By ..... Date ..... Subject Storm water Management Job No. 050078

PRE - DEVELOPMENT

| | D.A. A | D.A. B |
|---|---|---|
| 1-yr | 4.53 ft³/s | 4.08 ft³/s |
| 2 | 9.74 | 8.88 |
| 5 | 18.99 | 17.28 |
| 10 | 24.13 | 21.98 |
| 25 | 35.32 | 32.12 |
| 50 | 47.33 | 42.92 |
| 100 | 53.55 | 48.50 |

POST - DEVELOPMENT




| | A1 |
|---|---|
| 1-yr | 3.4 |
| 2 | 7.6 |
| 5 | 15.28 |
| 10 | 19.58 |
| 25 | 28.92 |
| 50 | 39.04 |
| 100 | 44.29 |

| | |
|---|---|
| 4.33 x | 1-yr |
| 8.08 | 2 |
| 14.35 | 5 |
| 17.77 | 10 |
| 24.99 | 25 |
| 32.56 | 50 |
| 36.44 | 100 |

$$CN\ Comp = \frac{2 \times 70 + 2.6 \times 76 + 3.8 \times 71}{2 + 2.6 + 3.8} = \frac{607.4}{8.4} = 72.3$$

$Q\,DA_{100} = 53.55\ ft^3/s$

$Q\,DAA1_{100} = 44.29$

$q_o = 53.55 - 44.29 = 9.26\ ft^3/s$

$q_i = 8.02 + 11.78 + 15.98 = 35.78$

$\frac{q_o}{q_i} = \frac{9.26}{35.78} = 0.26 \Rightarrow \frac{V_s}{V_r} = 0.42$

$S = \frac{1000}{72} - 10 = 3.9$

$Q = \frac{(P - 0.2S)^2}{P + 0.8S} = \frac{(7.5 - 0.2 \times 3.9)^2}{7.5 + 0.8 \times 3.9} = 4.25\ in$

$V_r = \frac{4.25(2 + 2.6 + 3.8)}{12} = 2.975$

$V_r = 53.33\, Q(in)\, A_m(mi^2)$

$\frac{V_r}{V_s} = 0.42 \qquad V_s = 2.975 \times 0.42 = 1.25$

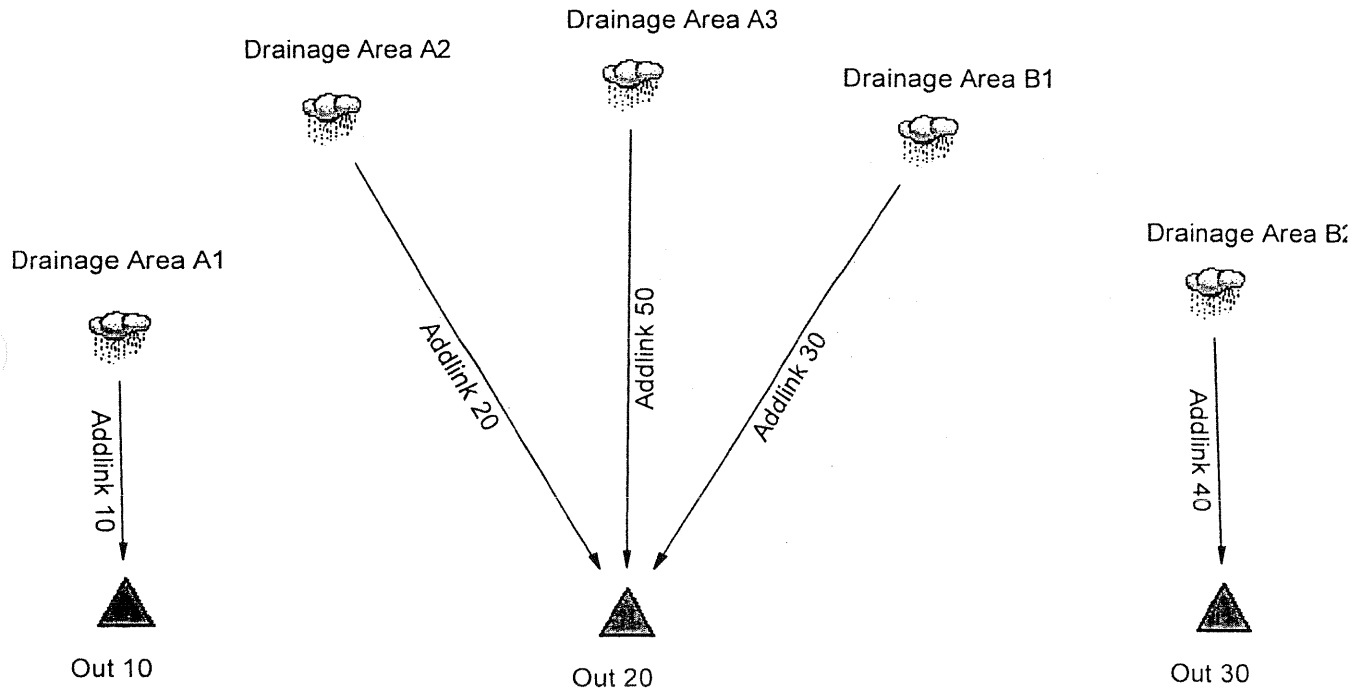
**TACONIC TRACT - "Conservation Layout"**
Mount Pleasant, N.Y.

File: EstimatedStorageConservation.xls

## STORMWATER STORAGE REQUIREMENT, CONSERVATION LAYOUT (ESTIMATE)

| Frequency Discharge | Q D.A. "A" (ft3/s) | Q D.A. "A1" (ft3/s) | Q D.A. "A2" (ft3/s) | Q D.A. "A3" (ft3/s) | Q D.A. "B1" (ft3/s) | Target - qo (ft3/s) | Target -qc (CSM) | D.A."A2" (Ac) | D.A."A3" (Ac) | D.A."B1" (Ac) | Q after dev.-qi (ft3/s) | qo0/qi | Vs/Vr (Fig. 6-1) | P (in) | CN composite | S (in) | Q (in) | Vr (Ac-ft) | Vs (Ac-ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 100-year | 53.55 | 44.29 | 8.02 | 11.78 | 15.98 | 9.3 | 723 | 2 | 2.6 | 3.6 | 35.78 | 0.26 | 0.420 | 7.5 | 72 | 3.9 | 4.3 | 2.9 | 1.22 |
| 50-year | 47.33 | 39.04 | 7.19 | 10.68 | 14.36 | 8.3 | 647 | 2 | 2.6 | 3.6 | 32.23 | 0.26 | 0.420 | 7.0 | 72 | 3.9 | 3.8 | 2.6 | 1.10 |
| 25-year | 35.32 | 28.92 | 5.57 | 8.51 | 11.2 | 6.4 | 500 | 2 | 2.6 | 3.6 | 25.28 | 0.25 | 0.430 | 6.0 | 72 | 3.9 | 3.0 | 2.0 | 0.88 |
| 10-year | 24.13 | 19.58 | 4.02 | 6.4 | 8.16 | 4.6 | 355 | 2 | 2.6 | 3.6 | 18.58 | 0.24 | 0.435 | 5.0 | 72 | 3.9 | 2.2 | 1.5 | 0.65 |
| 5-year | 18.99 | 15.28 | 3.28 | 5.38 | 6.7 | 3.7 | 290 | 2 | 2.6 | 3.6 | 15.36 | 0.24 | 0.435 | 4.5 | 72 | 3.9 | 1.8 | 1.2 | 0.54 |
| 2-year | 9.74 | 7.6 | 1.9 | 3.41 | 3.97 | 2.1 | 167 | 2 | 2.6 | 3.6 | 9.28 | 0.23 | 0.440 | 3.5 | 72 | 3.9 | 1.1 | 0.8 | 0.34 |
| 1-year | 4.53 | 3.4 | 1.06 | 2.14 | 2.29 | 1.1 | 88 | 2 | 2.6 | 3.6 | 5.49 | 0.21 | 0.455 | 2.8 | 72 | 3.9 | 0.7 | 0.5 | 0.22 |

qo = Q D.A."A" - Q D.A."A1" - maximum peak outflow allowed (ft3/s)
qi = Q D.A."A2"+ Q D.A."A3"+ Q D.A."B1" - peak inflow without storage (ft3/s)
Vs = storage volume required (Ac-ft)
Vr = runoff volume from the developed drainage areas before storage (Ac-ft)
P = rainfal depth (in)
CN = composite curve number between D. A."A2", D.A."A3" and D.A."B1"
S = retention after runoff begins (in)
Q = runoff (in)


Drainage Area A3
Drainage Area A2
Drainage Area B1
Drainage Area A1
Drainage Area B2
Addlink 20
Addlink 50
Addlink 30
Addlink 10
Addlink 40
Out 10
Out 20
Out 30

********** MASTER SUMMARY **********

Watershed..... Master Network Summary ..... 1.01

********** DESIGN STORMS SUMMARY **********

Westchester Coun Design Storms ..... 2.01

********** TC CALCULATIONS **********

DRAINAGE AREA A1 Tc Calcs ..... 3.01

DRAINAGE AREA A2 Tc Calcs ..... 3.03

DRAINAGE AREA A3 Tc Calcs ..... 3.05

DRAINAGE AREA B1 Tc Calcs ..... 3.07

DRAINAGE AREA B2 Tc Calcs ..... 3.09

********** CN CALCULATIONS **********

DRAINAGE AREA A1 Runoff CN-Area ..... 4.01

DRAINAGE AREA A2 Runoff CN-Area ..... 4.02

DRAINAGE AREA A3 Runoff CN-Area ..... 4.03

DRAINAGE AREA B1 Runoff CN-Area ..... 4.04

DRAINAGE AREA B2 Runoff CN-Area ..... 4.05

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Westchester Coun

| Return Event | Total Depth in | Rainfall Type | RNF ID |
|---|---|---|---|
| Dev 1 | 2.8000 | Synthetic Curve | TypeIII 24hr |
| Dev 2 | 3.5000 | Synthetic Curve | TypeIII 24hr |
| Dev 5 | 4.5000 | Synthetic Curve | TypeIII 24hr |
| Dev 10 | 5.0000 | Synthetic Curve | TypeIII 24hr |
| Dev 25 | 6.0000 | Synthetic Curve | TypeIII 24hr |
| Dev 50 | 7.0000 | Synthetic Curve | TypeIII 24hr |
| Dev100 | 7.5000 | Synthetic Curve | TypeIII 24hr |

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

| Node ID | Type | Return Event | HYG Vol ac-ft | Trun | Qpeak hrs | Qpeak cfs | Max WSEL ft | Max Pond Storage ac-ft |
|---|---|---|---|---|---|---|---|---|
| DRAINAGE AREA A1 | AREA | 1 | .551 | | 12.3700 | 3.40 | | |
| DRAINAGE AREA A1 | AREA | 2 | 1.011 | | 12.2900 | 7.60 | | |
| DRAINAGE AREA A1 | AREA | 5 | 1.814 | | 12.2800 | 15.28 | | |
| DRAINAGE AREA A1 | AREA | 10 | 2.265 | | 12.2800 | 19.58 | | |
| DRAINAGE AREA A1 | AREA | 25 | 3.244 | | 12.2400 | 28.92 | | |
| DRAINAGE AREA A1 | AREA | 50 | 4.302 | | 12.2400 | 39.04 | | |
| DRAINAGE AREA A1 | AREA | 100 | 4.854 | | 12.2400 | 44.29 | | |
| DRAINAGE AREA A2 | AREA | 1 | .101 | | 12.1400 | 1.06 | | |
| DRAINAGE AREA A2 | AREA | 2 | .168 | | 12.1300 | 1.90 | | |
| DRAINAGE AREA A2 | AREA | 5 | .279 | | 12.1300 | 3.28 | | |
| DRAINAGE AREA A2 | AREA | 10 | .339 | | 12.1300 | 4.02 | | |
| DRAINAGE AREA A2 | AREA | 25 | .468 | | 12.1300 | 5.57 | | |
| DRAINAGE AREA A2 | AREA | 50 | .603 | | 12.1200 | 7.19 | | |
| DRAINAGE AREA A2 | AREA | 100 | .673 | | 12.1200 | 8.02 | | |

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

| Node ID | Type | Return Event | HYG Vol ac-ft | Trun | Qpeak hrs | Qpeak cfs | Max WSEL ft | Max Pond Storage ac-ft |
|---|---|---|---|---|---|---|---|---|
| DRAINAGE AREA A3 | AREA | 1 | .191 | | 12.1400 | 2.14 | | |
| DRAINAGE AREA A3 | AREA | 2 | .296 | | 12.1400 | 3.41 | | |
| DRAINAGE AREA A3 | AREA | 5 | .461 | | 12.1400 | 5.38 | | |
| DRAINAGE AREA A3 | AREA | 10 | .549 | | 12.1400 | 6.40 | | |
| DRAINAGE AREA A3 | AREA | 25 | .732 | | 12.1400 | 8.51 | | |
| DRAINAGE AREA A3 | AREA | 50 | .922 | | 12.1200 | 10.68 | | |
| DRAINAGE AREA A3 | AREA | 100 | 1.019 | | 12.1200 | 11.78 | | |
| DRAINAGE AREA B1 | AREA | 1 | .205 | | 12.1300 | 2.29 | | |
| DRAINAGE AREA B1 | AREA | 2 | .337 | | 12.1300 | 3.97 | | |
| DRAINAGE AREA B1 | AREA | 5 | .553 | | 12.1200 | 6.70 | | |
| DRAINAGE AREA B1 | AREA | 10 | .670 | | 12.1200 | 8.16 | | |
| DRAINAGE AREA B1 | AREA | 25 | .918 | | 12.1200 | 11.20 | | |
| DRAINAGE AREA B1 | AREA | 50 | 1.179 | | 12.1100 | 14.36 | | |
| DRAINAGE AREA B1 | AREA | 100 | 1.314 | | 12.1100 | 15.98 | | |
| DRAINAGE AREA B2 | AREA | 1 | .495 | | 12.2000 | 4.33 | | |
| DRAINAGE AREA B2 | AREA | 2 | .835 | | 12.2000 | 8.08 | | |
| DRAINAGE AREA B2 | AREA | 5 | 1.402 | | 12.1800 | 14.35 | | |
| DRAINAGE AREA B2 | AREA | 10 | 1.713 | | 12.1700 | 17.77 | | |
| DRAINAGE AREA B2 | AREA | 25 | 2.373 | | 12.1700 | 24.99 | | |
| DRAINAGE AREA B2 | AREA | 50 | 3.075 | | 12.1700 | 32.56 | | |
| DRAINAGE AREA B2 | AREA | 100 | 3.437 | | 12.1700 | 36.44 | | |
| *OUT 10 | JCT | 1 | .551 | | 12.3700 | 3.40 | | |
| *OUT 10 | JCT | 2 | 1.011 | | 12.2900 | 7.60 | | |
| *OUT 10 | JCT | 5 | 1.814 | | 12.2800 | 15.28 | | |
| *OUT 10 | JCT | 10 | 2.265 | | 12.2800 | 19.58 | | |
| *OUT 10 | JCT | 25 | 3.244 | | 12.2400 | 28.92 | | |
| *OUT 10 | JCT | 50 | 4.302 | | 12.2400 | 39.04 | | |
| *OUT 10 | JCT | 100 | 4.854 | | 12.2400 | 44.29 | | |

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

| Node ID | Type | Return Event | HYG Vol ac-ft | Trun | Qpeak hrs | Qpeak cfs | Max WSEL ft | Max Pond Storage ac-ft |
|---|---|---|---|---|---|---|---|---|
| *OUT 20 | JCT | 1 | .497 | | 12.1300 | 5.46 | | |
| *OUT 20 | JCT | 2 | .801 | | 12.1300 | 9.26 | | |
| *OUT 20 | JCT | 5 | 1.293 | | 12.1300 | 15.32 | | |
| *OUT 20 | JCT | 10 | 1.559 | | 12.1200 | 18.54 | | |
| *OUT 20 | JCT | 25 | 2.118 | | 12.1200 | 25.27 | | |
| *OUT 20 | JCT | 50 | 2.705 | | 12.1200 | 32.23 | | |
| *OUT 20 | JCT | 100 | 3.006 | | 12.1200 | 35.76 | | |
| *OUT 30 | JCT | 1 | .495 | | 12.2000 | 4.33 | | |
| *OUT 30 | JCT | 2 | .835 | | 12.2000 | 8.08 | | |
| *OUT 30 | JCT | 5 | 1.402 | | 12.1800 | 14.35 | | |
| *OUT 30 | JCT | 10 | 1.713 | | 12.1700 | 17.77 | | |
| *OUT 30 | JCT | 25 | 2.373 | | 12.1700 | 24.99 | | |
| *OUT 30 | JCT | 50 | 3.075 | | 12.1700 | 32.56 | | |
| *OUT 30 | JCT | 100 | 3.437 | | 12.1700 | 36.44 | | |

Title... Project Date: 4/10/2007
Project Engineer: Dan Ionescu
Project Title: Taconic Tract. Proposed "Consrvation"
Layout. No Pond
Project Comments:

DESIGN STORMS SUMMARY

Design Storm File,ID = Westchester Coun

Storm Tag Name = Dev 1
---
Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 1 yr
Total Rainfall Depth= 2.8000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 2
---
Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 2 yr
Total Rainfall Depth= 3.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 5
---
Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 5 yr
Total Rainfall Depth= 4.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 10
---
Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 10 yr
Total Rainfall Depth= 5.0000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev 25
---
Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 6.0000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Title... Project Date: 4/10/2007
Project Engineer: Dan Ionescu
Project Title: Taconic Tract. Proposed "Consrvation"
Layout. No Pond
Project Comments:

DESIGN STORMS SUMMARY

Design Storm File,ID = Westchester Coun

Storm Tag Name = Dev 50

---

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 50 yr
Total Rainfall Depth= 7.0000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev100

---

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 100 yr
Total Rainfall Depth= 7.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
TIME OF CONCENTRATION CALCULATOR
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

---

Segment #1: Tc: User Defined

Segment #1 Time: .3400 hrs

---

==========
Total Tc: .3400 hrs
==========

---

Tc Equations used...

---

==== User Defined ==========

Tc = Value entered by user

Where: Tc = Time of concentration

::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
TIME OF CONCENTRATION CALCULATOR
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

---

Segment #1: Tc: User Defined

Segment #1 Time: .1300 hrs

---

==========
Total Tc: .1300 hrs
==========

---

Tc Equations used...

---

==== User Defined ==========

Tc = Value entered by user

Where: Tc = Time of concentration

::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
TIME OF CONCENTRATION CALCULATOR
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

---

Segment #1: Tc: User Defined

Segment #1 Time: .1500 hrs

---

==========
Total Tc: .1500 hrs
==========

---

Tc Equations used...

---

==== User Defined ==========

Tc = Value entered by user

Where: Tc = Time of concentration

::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
TIME OF CONCENTRATION CALCULATOR
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

---

Segment #1: Tc: User Defined

Segment #1 Time: .1100 hrs

---

==========
Total Tc: .1100 hrs
==========

---

Tc Equations used...

---

==== User Defined ==========

Tc = Value entered by user

Where: Tc = Time of concentration

::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
TIME OF CONCENTRATION CALCULATOR
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

---

Segment #1: Tc: User Defined

Segment #1 Time: .2200 hrs

---

==========
Total Tc: .2200 hrs
==========

---

Tc Equations used...

---

==== User Defined ==========

Tc = Value entered by user

Where: Tc = Time of concentration

File.... P:\050078\2_Design\Calcs\ProposedConservationNoPond.ppw

RUNOFF CURVE NUMBER DATA

| Soil/Surface Description | CN | Area acres | Impervious Adjustment %C | Impervious Adjustment %UC | Adjusted CN |
|---|---|---|---|---|---|
| | 64 | 17.200 | | | 64.00 |
| COMPOSITE AREA & WEIGHTED CN ---> | | 17.200 | | | 64.00 (64) |

File.... P:\050078\2_Design\Calcs\ProposedConservationNoPond.ppw

RUNOFF CURVE NUMBER DATA

| Soil/Surface Description | CN | Area acres | Impervious Adjustment %C | Impervious Adjustment %UC | Adjusted CN |
|---|---|---|---|---|---|
| Area 1 | 70 | 2.000 | | | 70.00 |
| COMPOSITE AREA & WEIGHTED CN ---> | | 2.000 | | | 70.00 (70) |

RUNOFF CURVE NUMBER DATA

| Soil/Surface Description | CN | Area acres | Impervious Adjustment %C | Impervious Adjustment %UC | Adjusted CN |
|---|---|---|---|---|---|
| | 76 | 2.600 | | | 76.00 |
| COMPOSITE AREA & WEIGHTED CN ---> | | 2.600 | | | 76.00 (76) |

RUNOFF CURVE NUMBER DATA

| Soil/Surface Description | CN | Area acres | Impervious Adjustment %C | %UC | Adjusted CN |
|---|---|---|---|---|---|
| Area 2 | 71 | 3.800 | | | 71.00 |
| COMPOSITE AREA & WEIGHTED CN ---> | | 3.800 | | | 71.00 (71) |

RUNOFF CURVE NUMBER DATA

| Soil/Surface Description | CN | Area acres | Impervious Adjustment %C | %UC | Adjusted CN |
|---|---|---|---|---|---|
| | 69 | 10.500 | | | 69.00 |
| COMPOSITE AREA & WEIGHTED CN ---> | | 10.500 | | | 69.00 (69) |

Index of Starting Page Numbers for ID Names

----- D -----
DRAINAGE AREA A1... 3.01, 4.01
DRAINAGE AREA A2... 3.03, 4.02
DRAINAGE AREA A3... 3.05, 4.03
DRAINAGE AREA B1... 3.07, 4.04
DRAINAGE AREA B2... 3.09, 4.05

----- W -----
Watershed... 1.01
Westchester Coun... 2.01

# POST-DEVELOPMENT WATER QUALITY CONVENTIONAL LAYOUT

4/18/07

Comp. By DN Date ~~4/11/07~~

Chkd. By ..... Date .....

Project TACONIC TRACT

Subject Stormwater Quality

"~~Conservation~~" Layout
Conventional

Sheet No. 36 of .....

Job No. 050078

WATER QUALITY

Post-Dev Area $A_1$

2 proposed houses & drives

Impervious: house $80 \times 50 = 4000\ ft^2$
drive $110 \times 15 = 1650\ ft^2$
$5650\ ft^2 = 0.13\ Ac$

use Dry Well / Infiltration Gallery via grass swale and roof leaders

Pretreatment: grass swale and/or plunge pool (25% WQv)

Feasibility: PnD - Paxton: fine sandy loam (0.6 - 2.0"/hr) in the surface layer

0.5"/hr min = 1" in 30 min. minimum.

x x use shallow infiltration galleries as per Cultec 100HD or 150HD.

100HD: H = 12.5, W = 36", L = 8', V = 1.86 ft³/ft, $V_{stone}$ = 28.8 ft³/unit

150HD: H = 18.5", W = 33", L = 8.5', V = 2.65 ft³/ft, $V_{stone}$ = 36.7 ft³/unit

$$WQ_v = \frac{P \cdot R_v \cdot A}{12}$$

P - 90% Rainfall Event number - P = 1.3

I - % impervious cover I = 100

$R_v = 0.05 + 0.009(I) = 0.05 + 0.009 \times 100 = 0.95$

A = 0.13 Ac

## Section 4.2 Water Quality Volume ($WQ_v$)

The Water Quality Volume (denoted as the $WQ_v$) is designed to improve water quality sizing to capture and treat 90% of the average annual stormwater runoff volume. The $WQ_v$ is directly related to the amount of impervious cover created at a site. Contour lines of the 90% rainfall event are presented in Figure 4.1.

The following equation can be used to determine the water quality storage volume $WQ_v$ (in acre-feet of storage):

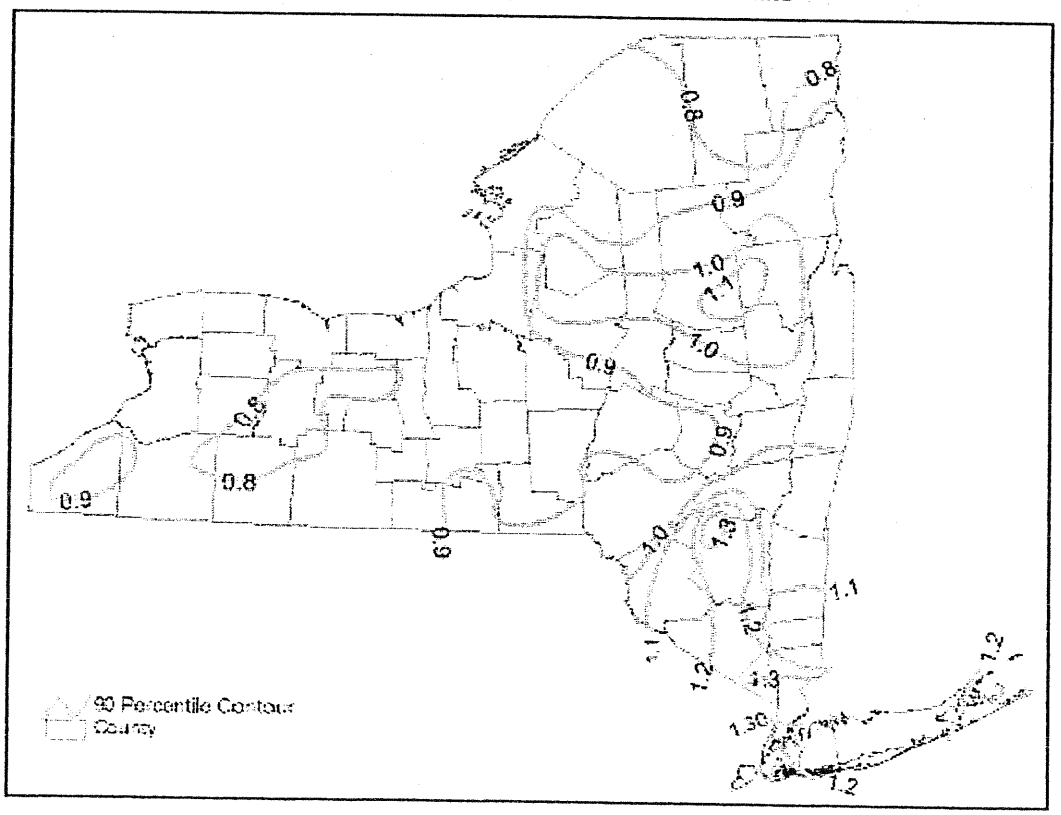
$$WQ_v = \frac{(P)(R_v)(A)}{12}$$

where:

- $WQ_v$ = water quality volume (in acre-feet)
- $P$ = 90% Rainfall Event Number (see Figure 4.1)
- $R_v$ = 0.05 + 0.009(I), where I is percent impervious cover
- $A$ = site area in acres

A minimum $WQ_v$ of 0.2 inches per acre shall be met at residential sites that have less than 17% impervious cover.

**Figure 4.1 90% Rainfall in New York State**



Comp. By DJ Date ~~4/4/07~~ 4/17/07 Project TRONIC TRACT Sheet No. 38 of

Chkd. By Date Subject Stormwater Quality ~~"Conservation"~~ Conventional Layout Job No 050078

$WQ_v = \frac{(P)(R_v)(A)}{12} = \frac{1.3 \times 0.95 \times 0.13}{12} = 0.0133 \text{ Ac-ft} = 583 \text{ ft}^3$

$25\% \; WQ_v = 146 \text{ ft}^3$ — grass swale

$L_{100 HD \; req'd} = \frac{583}{1.86} = 313 \text{ ft} \rightarrow 313/8 = 40$ units >>

$L_{150 HD \; req'd} = \frac{583}{2.65} = 220 \text{ ft} \rightarrow 220/8.5 = 26$ units >>

Use units surrounded in stone $\frac{0.75(583)}{36.7} = 12$ units

per Cultec

** use 12 - Cultec 150 HD surrounded in stone.

Post-Dev. Area A2

D.A. = ~~2.0~~ 4.3 Ac

Impervious ~~0.46~~ 1.4 Ac or $\frac{\cancel{0.46}\ 1.4}{\cancel{4.3}\ 4.3} = \cancel{0.23}\ 0.33 \rightarrow \cancel{23\%}\ 33\%$

$R_v = 0.05 + 0.009(I) = 0.05 + 0.009 \times \cancel{23}\ 33 = \cancel{0.257}\ 0.347$

$WQ_v = \frac{(1.3)(\cancel{0.257}\ 0.347)(\cancel{2}\ 4.3)}{12} = \cancel{0.0557}\ 0.1616 \text{ Ac-ft} = \cancel{2426}\ 7041 \text{ ft}^3$

$0.25 \; WQ_v = 0.25 \times \cancel{2426}\ 7041 = \cancel{606}\ 1760 \text{ ft}^3 \rightarrow \cancel{20}\ 26' \times \cancel{20}\ 26' \times \cancel{1.5}\ 2.5'$ pool - pretreatment or sediment chamber (p. 7 - water quality)

$0.75 \; WQ_v = 0.75 \times \cancel{2426}\ 7041 = \cancel{1820}\ 5280 \text{ ft}^3$

Comp. By Di Date 4/17/07 (~~4/4/07~~)

Chkd. By ..... Date .....

Project TALONIC TRACT

Subject Stormwater Quality, ~~"Conservation"~~ Layout Conventional

Sheet No. 39 (~~4~~) of .....

Job No. 050078

From PondPack output (file ProposedConservationNoPond.ppw)

$Q_1$ = ~~1.06~~ 3.3 $ft^3/s$ – $CP_v$ – channel protection

$Q_2$ = ~~1.90~~ 5.2

$Q_5$ = ~~3.28~~ 8.3

$Q_{10}$ = ~~4.02~~ 9.9 – $Q_p$ – overbank flood

$Q_{25}$ = ~~5.57~~ 13.2

$Q_{50}$ = ~~7.19~~ 16.6

$Q_{100}$ = ~~8.02~~ 18.3 – $Q_f$ – extreme storm

Compute the modified CN for 1.3", 90% rainfall

$$CN = 1000 / \left[10 + 5P + 10Q - 10\left(Q^2 + 1.25QP\right)^{1/2}\right]$$

$$Q_a = \frac{WQ_v}{A} = \frac{\cancel{2426}\ 7041\ ft^3}{\cancel{2}\ 4.3 \times 43560\ ft^2} = \cancel{0.0278}\ 0.0376\ ft = \cancel{0.33}\ 0.45\ in$$

$$CN = 1000 / \left[10 + 5 \times 1.3 + 10 \times \cancel{0.33}\ 0.45 - 10\left(\cancel{0.33}\ 0.45^2 + 1.25 \times \cancel{0.33}\ 0.45 \times 1.3\right)^{1/2}\right] =$$

$$= \frac{1000}{\cancel{117}\ 11.67} = \cancel{84.9} \simeq \cancel{85}\ 86$$

TR-55 p.4-1 Table 4-1: For CN = ~~85~~ 86 => $I_a$ = ~~0.353~~ 0.326 in – initial abstraction

$$\frac{I_a}{P} = \frac{\cancel{0.353}\ 0.326}{1.3} = \cancel{0.27}\ 0.25$$

$t_c$ = ~~0.13~~ 0.20 h = ~~8~~ 12 min

TR-55 Exhibit 4-III => $q_u$ = ~~530~~ 500 csm/in

$$Q_{wq} = (\cancel{530}\ 500\ csm/in) \times (\cancel{3.0}\ 4.3\ Ac / 640\ Ac/mi^2) \times \cancel{0.33}\ 0.45\ in = \cancel{9.6}\ 1.5\ ft^3/s$$

# Chapter 4 Graphical Peak Discharge Method

This chapter presents the Graphical Peak Discharge method for computing peak discharge from rural and urban areas. The Graphical method was developed from hydrograph analyses using TR-20, "Computer Program for Project Formulation—Hydrology" (SCS 1983). The peak discharge equation used is:

$$q_p = q_u A_m Q F_p \qquad \text{[eq. 4-1]}$$

where:

$q_p$ = peak discharge (cfs)
$q_u$ = unit peak discharge (csm/in)
$A_m$ = drainage area ($mi^2$)
$Q$ = runoff (in)
$F_p$ = pond and swamp adjustment factor

The input requirements for the Graphical method are as follows: (1) $T_c$ (hr), (2) drainage area ($mi^2$), (3) appropriate rainfall distribution (I, IA, II, or III), (4) 24-hour rainfall (in), and (5) CN. If pond and swamp areas are spread throughout the watershed and are not considered in the $T_c$ computation, an adjustment for pond and swamp areas is also needed.

## Peak discharge computation

For a selected rainfall frequency, the 24-hour rainfall (P) is obtained from appendix B or more detailed local precipitation maps. CN and total runoff (Q) for the watershed are computed according to the methods outlined in chapter 2. The CN is used to determine the initial abstraction ($I_a$) from table 4-1. $I_a$ / P is then computed.

If the computed $I_a$ / P ratio is outside the range in exhibit 4 (4-I, 4-IA, 4-II, and 4-III) for the rainfall distribution of interest, then the limiting value should be used. If the ratio falls between the limiting values, use linear interpolation. Figure 4-1 illustrates the sensitivity of $I_a$ / P to CN and P.

Peak discharge per square mile per inch of runoff ($q_u$) is obtained from exhibit 4-I, 4-IA, 4-II, or 4-III by using $T_c$ (chapter 3), rainfall distribution type, and $I_a$ / P ratio. The pond and swamp adjustment factor is obtained from table 4-2 (rounded to the nearest table value). Use worksheet 4 in appendix D to aid in computing the peak discharge using the Graphical method.

**Figure 4-1** Variation of $I_a$ / P for P and CN

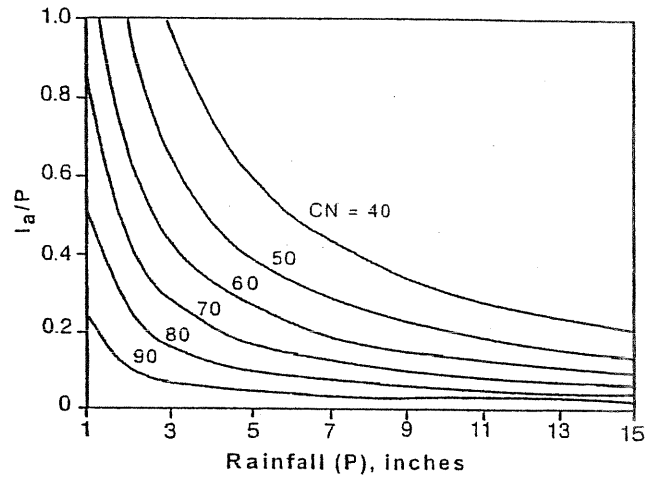
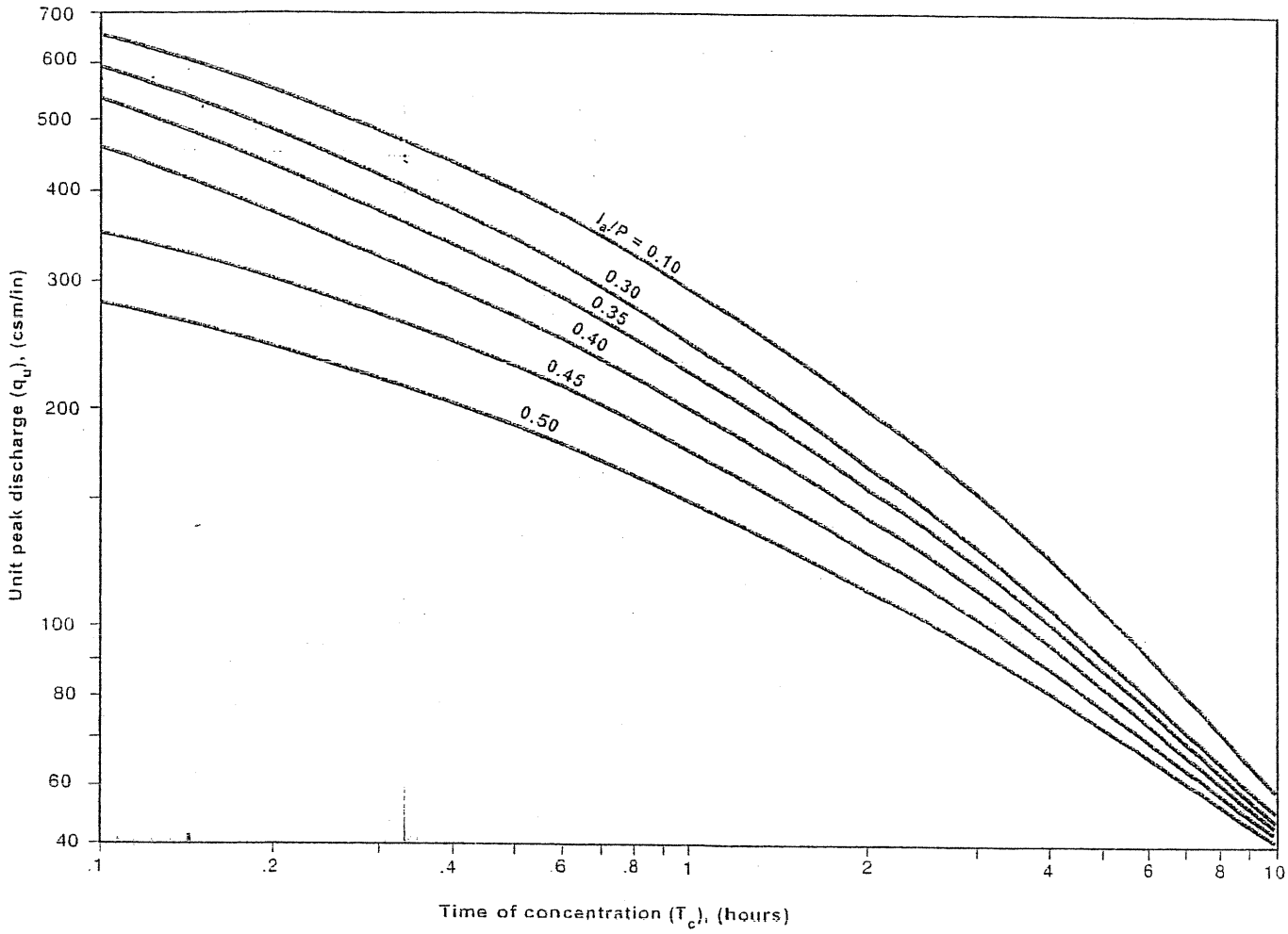



**Table 4-1** $I_a$ values for runoff curve numbers

| Curve number | $I_a$ (in) | Curve number | $I_a$ (in) |
|---|---|---|---|
| 40 | 3.000 | 70 | 0.857 |
| 41 | 2.878 | 71 | 0.817 |
| 42 | 2.762 | 72 | 0.778 |
| 43 | 2.651 | 73 | 0.740 |
| 44 | 2.545 | 74 | 0.703 |
| 45 | 2.444 | 75 | 0.667 |
| 46 | 2.348 | 76 | 0.632 |
| 47 | 2.255 | 77 | 0.597 |
| 48 | 2.167 | 78 | 0.564 |
| 49 | 2.082 | 79 | 0.532 |
| 50 | 2.000 | 80 | 0.500 |
| 51 | 1.922 | 81 | 0.469 |
| 52 | 1.846 | 82 | 0.439 |
| 53 | 1.774 | 83 | 0.410 |
| 54 | 1.704 | 84 | 0.381 |
| 55 | 1.636 | 85 | 0.353 |
| 56 | 1.571 | 86 | 0.326 |
| 57 | 1.509 | 87 | 0.299 |
| 58 | 1.448 | 88 | 0.273 |
| 59 | 1.390 | 89 | 0.247 |
| 60 | 1.333 | 90 | 0.222 |
| 61 | 1.279 | 91 | 0.198 |
| 62 | 1.226 | 92 | 0.174 |
| 63 | 1.175 | 93 | 0.151 |
| 64 | 1.125 | 94 | 0.128 |
| 65 | 1.077 | 95 | 0.105 |
| 66 | 1.030 | 96 | 0.083 |
| 67 | 0.985 | 97 | 0.062 |
| 68 | 0.941 | 98 | 0.041 |
| 69 | 0.899 | | |

**Exhibit 4-III** Unit peal discharge ($q_u$) for NRCS (SCS) type III rainfall distribution



Comp. By M Date 4/~~4~~20/07 Project TECONIC TRACT Sheet No. ~~7~~ 42 of

Chkd. By Date Subject Stormwater Quality "~~Conservation~~ Conventional" Layout Job No 050078

Estimate filtration bed chamber:

- assume average head on filter $h_f = 2.0$ ft
- $d_f = 1.5'$ - filter thickness
- $k = 3.5$ ft/day - flow rate through filter (sand)
- $t_f = 40$ hours - drain time (as recommended)

$$A_f = \frac{WQ_v (d_f)}{k(h_f + d_f) t_f} = \frac{\cancel{2426}\ 7041 \times 1.5}{3.5(2+1.5)40/24} = \cancel{178}\ 345\ ft^2$$

use Rotomolo underground sand filter 10 ft wide

$$L_{Req'd} = \frac{\cancel{178}\ 345}{10} = \cancel{17.8}\ 34.5\ ft$$ ×× use ~~18'~~ × ~~10~~ 35' × 10' filter chamber

Estimate sedimentation chamber:

- use 2.5 ft water depth in the sedimentation chamber

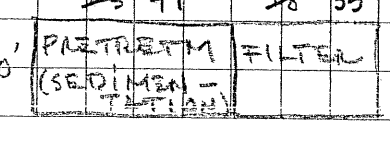
$$P_v = 0.25 \times \cancel{2426}\ 7041 = \cancel{607}\ 1760\ ft^3$$ - volume to be pretreated

$$A_s = \frac{\cancel{607}\ 1760}{2.5} = \cancel{243}\ 704\ ft^2$$

use the same 10 ft width

$$L_{Req'd} = \frac{\cancel{243}\ 704}{10} = \cancel{24.3}\ 70.4\ ft$$ ×× use ~~25'~~ 71' × 10' sedimentation chamber

~~25~~ 71' ~~18~~ 35



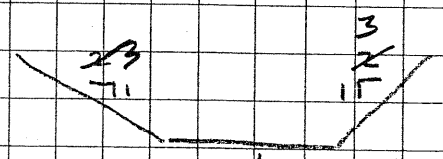
Comp. By TN Date 4/11/07 | Project TACONIC TRACT | Sheet No. 11 of 46

Chkd. By ..... Date ..... | Subject Stormwater Quality "Conservation" Layout | Job No. 050078

Try grass swale:

$Q_{wq} = \cancel{0.6}\ 1.5\ ft^3/s$ (p.4 water quality)

use detention time = 10 min = 600 sec.




$S = 0.008$

$\Rightarrow V \simeq \cancel{0.27}\ 0.35\ ft/s$ ; $H \simeq \cancel{0.5}\ 0.80'$

$L_{req'd} = \cancel{0.27}\ 0.35 \times 600 = \cancel{161}\ 210\ ft$

For $Q_{10} = \cancel{4.02}\ 9.9\ ft^3/s \Rightarrow V \simeq \cancel{0.50}\ 0.58\ ft/s$ $H \simeq \cancel{1.3'}\ 1.95'$

$L_{wq} = \cancel{0.50}\ 0.58 \times 600 = \cancel{300}\ 348\ ft$

o Diversion (weir) or MH to bypass larger storms is req'd for L=162

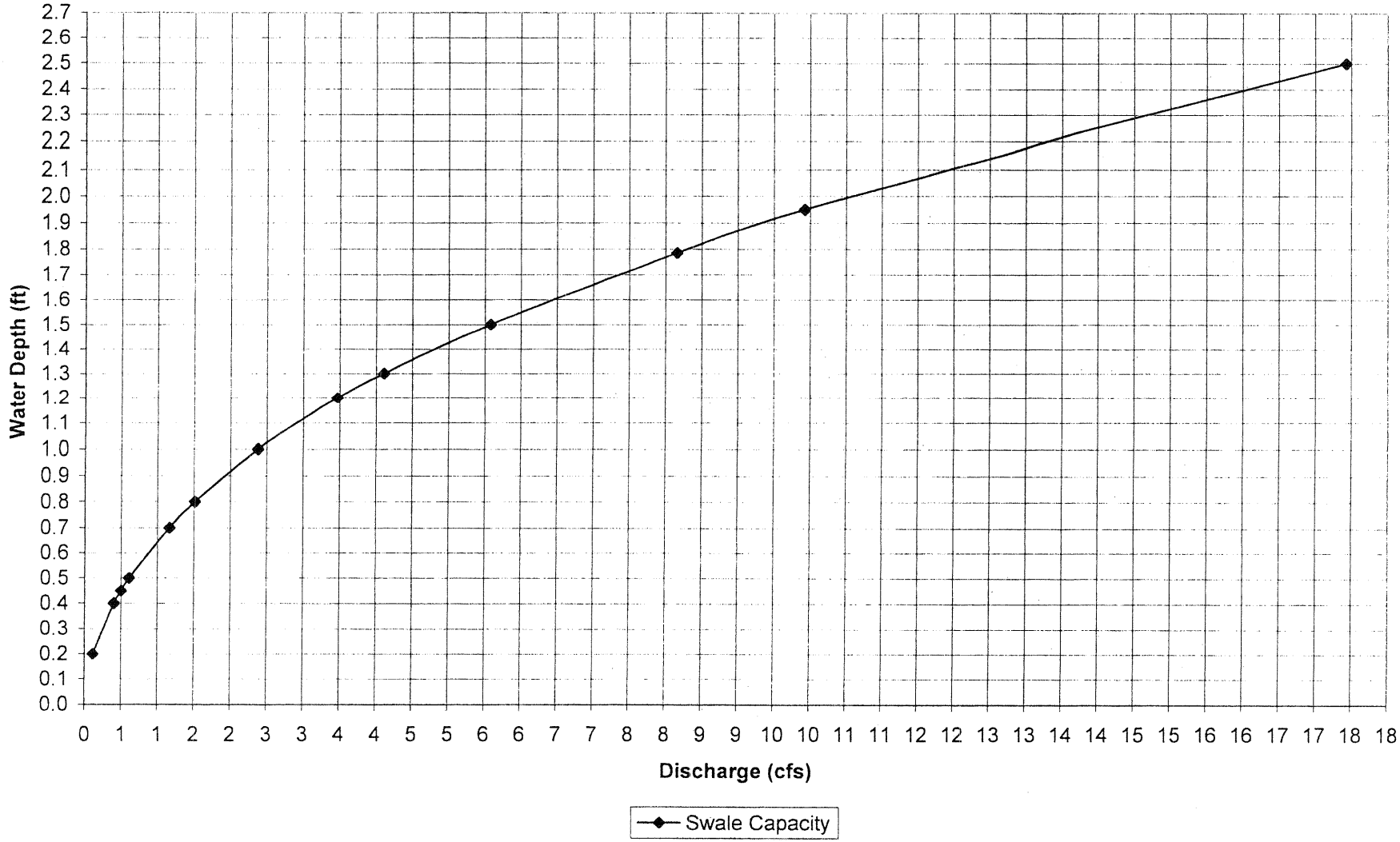
**TACONIC TRACT**
Town of Mount Pleasant
Westchester, NY

File: Swale3.xls
Compiled: D. Ionescu
Date: 4/12/2007

## SWALE DESIGN

| H (ft) | Bottom (ft) | Side Slope | Area (ft2) | Top Width (ft) | Wetted Perim. (ft) | Hydr. Radius (ft) | n | Slope | Velocity (ft/s) | Discharge (ft3/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.20 | 3.0 | 3 | 0.7 | 4.2 | 4.3 | 0.17 | 0.25 | 0.008 | 0.16 | 0.12 |
| 0.40 | 3.0 | 3 | 1.7 | 5.4 | 5.5 | 0.30 | 0.25 | 0.008 | 0.24 | 0.40 |
| 0.45 | 3.0 | 3 | 2.0 | 5.7 | 5.8 | 0.33 | 0.25 | 0.008 | 0.26 | 0.50 |
| 0.50 | 3.0 | 3 | 2.3 | 6.0 | 6.2 | 0.37 | 0.25 | 0.008 | 0.27 | 0.61 |
| 0.70 | 3.0 | 3 | 3.6 | 7.2 | 7.4 | 0.48 | 0.25 | 0.008 | 0.33 | 1.16 |
| 0.80 | 3.0 | 3 | 4.3 | 7.8 | 8.1 | 0.54 | 0.25 | 0.008 | 0.35 | 1.52 |
| 1.00 | 3.0 | 3 | 6.0 | 9.0 | 9.3 | 0.64 | 0.25 | 0.008 | 0.40 | 2.38 |
| 1.20 | 3.0 | 3 | 7.9 | 10.2 | 10.6 | 0.75 | 0.25 | 0.008 | 0.44 | 3.47 |
| 1.30 | 3.0 | 3 | 9.0 | 10.8 | 11.2 | 0.80 | 0.25 | 0.008 | 0.46 | 4.11 |
| 1.50 | 3.0 | 3 | 11.3 | 12.0 | 12.5 | 0.90 | 0.25 | 0.008 | 0.50 | 5.58 |
| 1.79 | 3.0 | 3 | 14.9 | 13.7 | 14.3 | 1.04 | 0.25 | 0.008 | 0.55 | 8.16 |
| 1.95 | 3.0 | 3 | 17.3 | 14.7 | 15.3 | 1.13 | 0.25 | 0.008 | 0.58 | 9.93 |
| 2.50 | 3.0 | 3 | 26.3 | 18.0 | 18.8 | 1.40 | 0.25 | 0.008 | 0.66 | 17.43 |

## Grassed Swale Rating Curve
## Widht = 3.0 ft; 3:1 side slope; S = 0.008



Comp. By M Date ~~4/12/07~~ 4/17/07 Project TRICONIC TRACT Sheet No. ~~21~~ 49 of

Chkd. By Date Subject Stormwater Quality "~~Conservation~~" "Conventional" Layout Job No. 056078

## Post-Dev. Area B1

D.A. = ~~3.8~~ 5.4 Ac

Impervious ~~0.94~~ 0.92 Ac $I = \frac{\cancel{0.94}\ 0.92}{\cancel{3.8}\ 5.4} = \cancel{0.25}\ 0.17$ or ~~25~~ 17 %

$R_v = 0.05 + 0.009(I) = 0.05 + 0.009 \times \cancel{25}\ 17 = \cancel{0.275}\ 0.203$

$WQ_v = \frac{(1.3)(\cancel{0.275}\ 0.203)(\cancel{3.8}\ 5.4)}{12} = \cancel{0.11}\ 0.119$ Ac-ft $= \cancel{4931}\ 5173\ ft^3$

$0.25\ WQ_v = 0.25 \times \cancel{4931}\ 5173 = \cancel{1233}\ 1293\ ft^3$

$23 \times 23 \times 2.5 = 1322\ ft^3$ × 23' × 23' × 2.5' plunge pool for pretreatment

$Q_a = \frac{WQ_v}{A} = \frac{\cancel{4931}\ 5173}{\cancel{3.8}\ 5.4 \times 43560} = \cancel{0.0298}\ 0.022\ ft = \cancel{0.36}\ 0.26\ in$

CN = modified CN for 1.3", 90% rainfall

$CN = 1000\left[10 + 5 \times 1.3 + 10 \times \frac{\cancel{0.36}\ 0.26}{0.26} - 10\left(\frac{\cancel{0.36}\ 0.26^2}{0.26} + 1.25 \times \frac{\cancel{0.36}\ 0.26}{0.26} \times 1.3\right)^{1/2}\right] = \cancel{86}\ 83$

For CN = ~~86~~ 83 => $I_a$ = ~~0.326~~ 0.410

$I_a/P = \frac{\cancel{0.326}\ 0.410}{1.3} = \cancel{0.25}\ 0.315$

$t_c = \cancel{0.11}\ 0.16\ h = \cancel{7}\ 10\ min$ => $q_u = \cancel{550}\ 515$ csm/in

$Q_{WQ_v} = \frac{\cancel{550}\ 515}{} csm/in \times \left(\frac{\cancel{3.8}\ 5.4\ Ac}{640\ Ac/mi^2}\right) \times \frac{\cancel{0.36}\ 0.26}{} in = \cancel{1.17}\ 1.13\ ft^3/s$

Comp. By DJ Date 4/12/07 Project TACONIC TRACT Sheet No. ~~22~~ 50 of

Chkd. By Date Subject Stormwater Quality "~~Conservation~~" layout Conventional Job No 050078

Estimate filtration bed chamber:

- Assume $h_f = 2.0$ ft, $d_f = 1.5$ ft, $K = 3.5$ ft/day, $t_f = 40$ h

$$A_f = \frac{WQ_v(d_f)}{K(h_f + d_f)t_f} = \frac{\cancel{493}\,517 \times 1.5}{3.5(2+1.5)40/24} = \cancel{362}\,380 \text{ ft}^2$$

$$L_{req'd} = \frac{\cancel{362}\,380}{10} = \cancel{36.2}\,38 \text{ ft}$$

*** use $\cancel{36'}\,38' \times 10'$ filter chamber

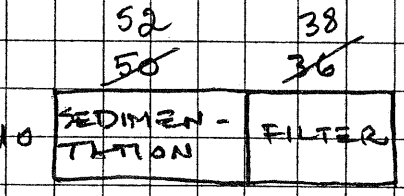
Estimate sedimentation chamber:

- use 2.5 ft water depth in the sedimentation chamber
- $P_v = 0.25 \times \cancel{4931}\,5173 = \cancel{1233}\,1293 \text{ ft}^3$

$$A_s = \frac{\cancel{1233}\,1293}{2.5} = \cancel{493}\,517 \text{ ft}^2$$

$$L_{req'd} = \frac{\cancel{493}\,517}{10} = \cancel{49.3}\,51.7 \text{ ft}$$

*** use $\cancel{50' \times 10'}$ $52 \times 10$ sedimentation chamber



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Chkd. By ..... Date .....

Project TALONIC TRACT

Subject Stormwater Quality ~~"Conservation"~~ Conventional layout

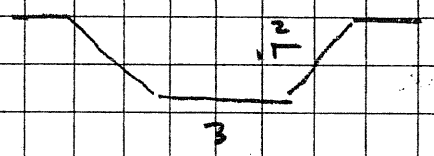
Sheet No. ~~29~~ 52 of .....

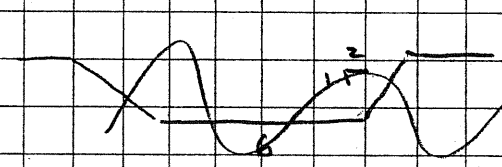
Job No. 050078

Gross Swale:

$Q_{WQ_v} = \cancel{1.17}\ 1.13\ ft^3/s \rightarrow H = \cancel{0.70}\ 0.69,\ V = \cancel{0.35}\ 0.32\ ft/s \rightarrow L = 600 \times \cancel{0.33}\ 0.32 = \cancel{198}\ 192\ ft$

$Q_{10} = \cancel{8.16}\ 9.54\ ft^3/s \rightarrow H = \cancel{1.79}\ 1.91',\ V = \cancel{0.55}\ 0.57\ ft/s \rightarrow L = 600 \times \cancel{0.55}\ 0.57 = \cancel{330}\ 342\ ft$




$\cancel{H = 0.52',\ V = 0.30\ ft/s \rightarrow L = 0.3 \times 600 = 180\ ft}$

$\cancel{H = 1.47',\ V = 0.53 \rightarrow L = 0.53 \times 600 = 318\ ft}$

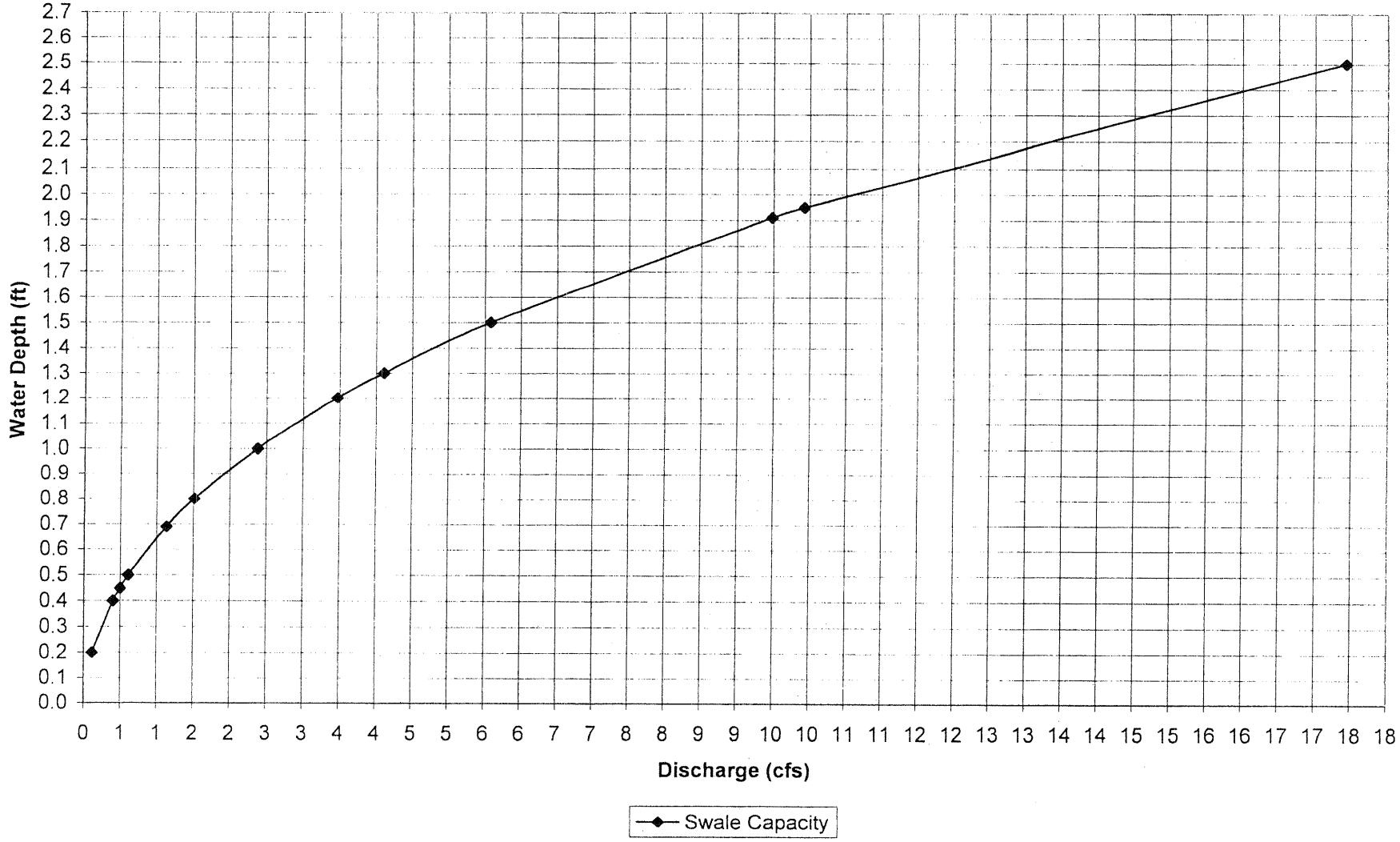
**TACONIC TRACT**
Town of Mount Pleasant
Westchester, NY

File: Swale3.xls
Compiled: D. Ionescu
Date: 4/12/2007

## SWALE DESIGN

| H (ft) | Bottom (ft) | Side Slope | Area (ft2) | Top Width (ft) | Wetted Perim. (ft) | Hydr. Radius (ft) | n | Slope | Velocity (ft/s) | Discharge (ft3/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.20 | 3.0 | 3 | 0.7 | 4.2 | 4.3 | 0.17 | 0.25 | 0.008 | 0.16 | 0.12 |
| 0.40 | 3.0 | 3 | 1.7 | 5.4 | 5.5 | 0.30 | 0.25 | 0.008 | 0.24 | 0.40 |
| 0.45 | 3.0 | 3 | 2.0 | 5.7 | 5.8 | 0.33 | 0.25 | 0.008 | 0.26 | 0.50 |
| 0.50 | 3.0 | 3 | 2.3 | 6.0 | 6.2 | 0.37 | 0.25 | 0.008 | 0.27 | 0.61 |
| 0.69 | 3.0 | 3 | 3.5 | 7.1 | 7.4 | 0.48 | 0.25 | 0.008 | 0.32 | 1.13 |
| 0.80 | 3.0 | 3 | 4.3 | 7.8 | 8.1 | 0.54 | 0.25 | 0.008 | 0.35 | 1.52 |
| 1.00 | 3.0 | 3 | 6.0 | 9.0 | 9.3 | 0.64 | 0.25 | 0.008 | 0.40 | 2.38 |
| 1.20 | 3.0 | 3 | 7.9 | 10.2 | 10.6 | 0.75 | 0.25 | 0.008 | 0.44 | 3.47 |
| 1.30 | 3.0 | 3 | 9.0 | 10.8 | 11.2 | 0.80 | 0.25 | 0.008 | 0.46 | 4.11 |
| 1.50 | 3.0 | 3 | 11.3 | 12.0 | 12.5 | 0.90 | 0.25 | 0.008 | 0.50 | 5.58 |
| 1.91 | 3.0 | 3 | 16.7 | 14.5 | 15.1 | 1.11 | 0.25 | 0.008 | 0.57 | 9.48 |
| 1.95 | 3.0 | 3 | 17.3 | 14.7 | 15.3 | 1.13 | 0.25 | 0.008 | 0.58 | 9.93 |
| 2.50 | 3.0 | 3 | 26.3 | 18.0 | 18.8 | 1.40 | 0.25 | 0.008 | 0.66 | 17.43 |

## Grassed Swale Rating Curve
## Widht = 3.0 ft; 3:1 side slope; S = 0.008




54

Comp. By [illegible] Date 4/~~13~~17/07 Project TACONIC TRACT Sheet No. ~~32~~ 55 of

Chkd. By Date Subject Water Quality Job No 050078

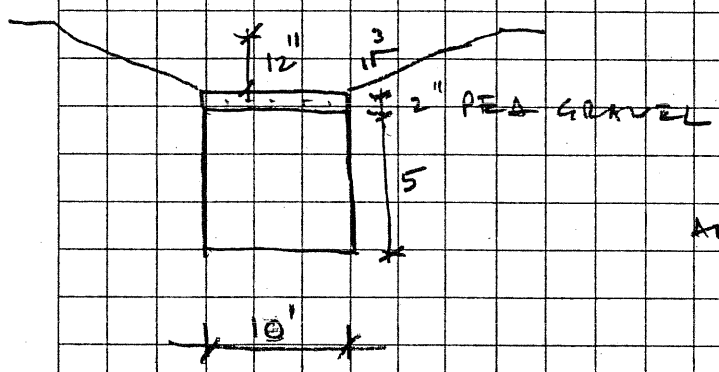
"~~Conservation~~ Conventional" Layout

A2 INFILTRATION TRENCH

$WQ_v = \cancel{2426}\ 7041\ ft^3$

$0.25\ WQ_v = 0.25 \times \cancel{2426}\ 7041 = \cancel{606}\ 1740\ ft^3$ → ~~20'~~ 26' × ~~20'~~ 26' × ~~1.5'~~ 2.5 - plunge pool for pretreatment

$0.75\ WQ_v = \cancel{1820}\ 5280$




AREA TRENCH $A = \frac{WQ_v}{n \cdot d} = \frac{\cancel{2426}\ 7041}{0.4 \times 5} = \cancel{1213}\ 3521$

$L = \cancel{1213}\ 3521 / 10 = \cancel{122}\ 352\ ft$

- PEA GRAVEL VOLUME
  - Assume 0.32 porosity = n - pea gravel
  - $d = \cancel{4}\ 5\ ft$ - trench depth

$P_v\ pea = 0.32 \times 2/12 \times 10 \times \cancel{90}\ 352 = \cancel{10}\ 188\ ft^3$

- GRASS CHANNEL VOLUME

$Q_{WQ_v} = \cancel{0.6}\ 1.5\ ft^3/s$ $H = \cancel{0.31}\ 0.53\ ft$ $V = \cancel{0.18}\ 0.26\ ft/s$

Use 10 minutes = 600 sec detention time $L = \cancel{0.18}\ 0.26 \times 600 = \cancel{108}\ 156\ ft$ < ~~122~~ 352

$Q_{10} = 9.91\ ft^3/s$ → $H = 1.57\ ft$ $V = 0.48\ ft/s$

17 56

Comp. By DR Date 4/~~15~~/07 Project TACONIC TRACT Sheet No. ~~33~~ of

Chkd. By Date Subject Water Quality Job No 050078

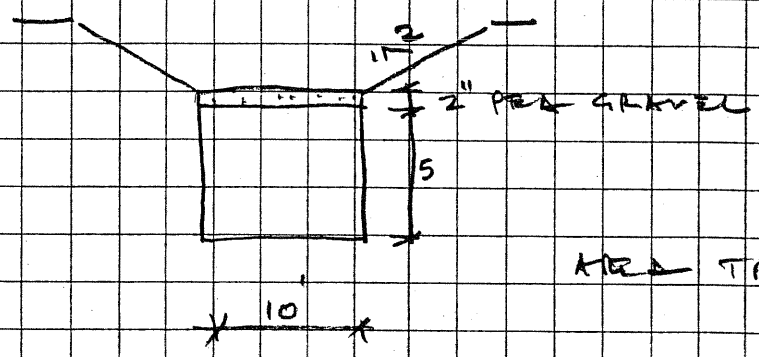
~~"Conservation"~~ Conventional layout

~~A3~~ B1

$WQ_v = \cancel{6135}\ 5173\ ft^3$

$0.25\ WQ_v = \cancel{1534}\ 1293\ ft^3$

~~25'~~ 23' × ~~25'~~ 23' × 2.5 plunge pool for pretreatment




AREA TRENCH $A = \frac{WQ_v}{n \cdot d} = \frac{\cancel{6135}\ 5173}{0.4 \times 5} = \cancel{3068}\ 2587$

$L = \frac{\cancel{3068}\ 2587}{10} = \cancel{307}\ 259\ ft$

$Q_{wq_v} = \cancel{1.55}\ 1.13\ ft^3/s \rightarrow H = \cancel{0.59}\ 0.45\ ft \quad V = \cancel{0.26}\ 0.23\ ft/s \rightarrow L = \frac{\cancel{0.26}\ 0.23}{} \times 600 = \cancel{156}\ 138$

$Q_{10} = 9.54\ ft^3/s \rightarrow H = 1.54\ ft$

$V = 0.47\ ft/s$

~~B1~~ $WQ_v = 4931\ ft^3$

$0.25\ WQ_v = 1233\ ft^3$

29' × 29' × 1.5 plunge pool for treatment

AREA TRENCH $A = \frac{WQ_v}{n \cdot d} = \frac{4931}{0.4 \times 5} = 2466\ ft^2$

$L = \frac{2466}{10} = 247\ ft$

$Q_{wq_v} = 1.17\ ft^3/s \quad H = 0.46\ ft \quad V = 0.23\ ft/s \rightarrow L = 600 \times 0.23 = 138$

# POST-DEVELOPMENT WATER QUALITY CONSERVATION LAYOUT

Comp. By DJ Date 4/11/07
Chkd. By ..... Date .....

Project TACONIC TRACT
Subject Stormwater Quality "Conservation" Layout

Sheet No. 1 of .....
Job No. 050078

WATER QUALITY

Post-Dev. Area A1

2 proposed houses & drives

Impervious: house 80 x 50 = 4000 ft²
drive 110 x 15 = 1650 ft²
5650 ft² = 0.13 Ac

use Dry Well / Infiltration Gallery via grass swale and roof leaders

Pretreatment: grass swale and/or plunge pool (25% WQv)

Feasibility: PnD - Paxton: fine sandy loam (0.6 - 2.0"/hr) in the surface layer

0.5"/hr min = 1" in 30 min. minimum.

x x use shallow infiltration galleries as per Cultec 100 HD or 150 HD.

100 HD: H = 12.5, W = 36" ; L = 8', V = 1.86 ft³/ft ; V stone = 28.8 ft³/unit

150 HD: H = 18.5", W = 33" ; L = 8.5', V = 2.65 ft³/ft ; V stone = 36.7 ft³/unit

$$WQv = \frac{P \cdot R_v \cdot A}{12}$$

P - 90% Rainfall Event number - P = 1.3

I - % impervious cover I = 100

$R_v = 0.05 + 0.009(I) = 0.05 + 0.009 \times 100 = 0.95$

A = 0.13 Ac

## Section 4.2 Water Quality Volume ($WQ_v$)

The Water Quality Volume (denoted as the $WQ_v$) is designed to improve water quality sizing to capture and treat 90% of the average annual stormwater runoff volume. The $WQ_v$ is directly related to the amount of impervious cover created at a site. Contour lines of the 90% rainfall event are presented in Figure 4.1.

The following equation can be used to determine the water quality storage volume $WQ_v$ (in acre-feet of storage):

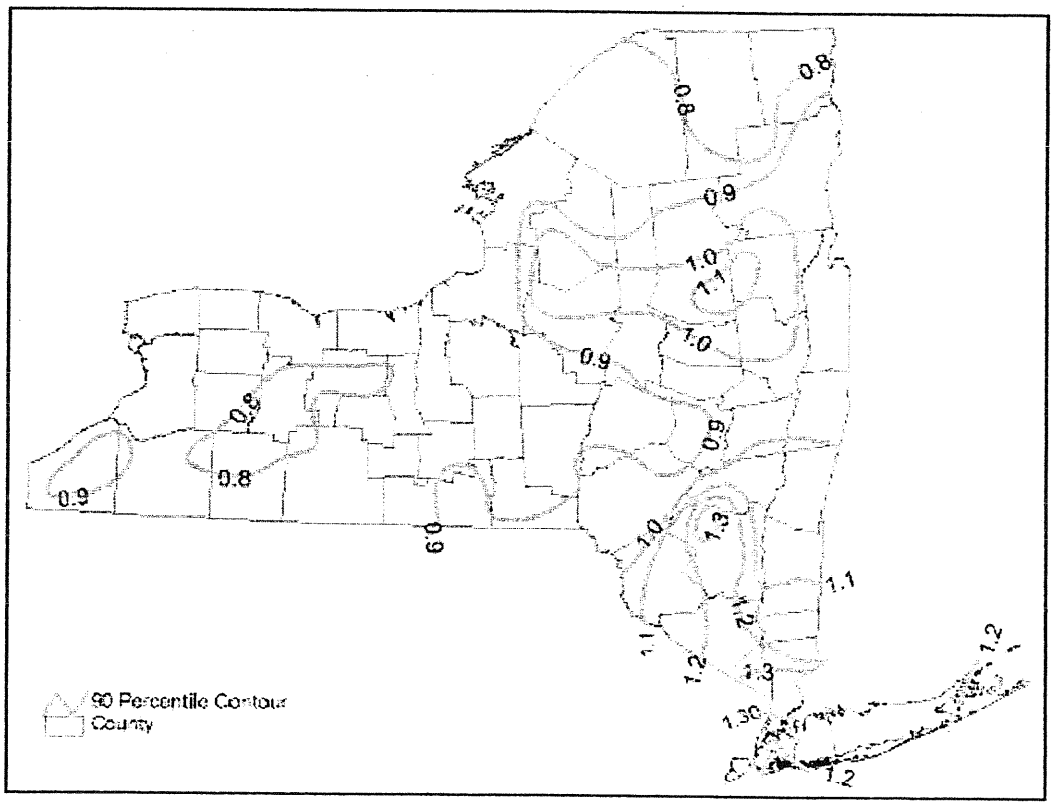
$$WQ_v = \frac{(P)(R_v)(A)}{12}$$

where:

- $WQ_v$ = water quality volume (in acre-feet)
- P = 90% Rainfall Event Number (see Figure 4.1)
- $R_v$ = 0.05 + 0.009(I), where I is percent impervious cover
- A = site area in acres

A minimum $WQ_v$ of 0.2 inches per acre shall be met at residential sites that have less than 17% impervious cover.

**Figure 4.1 90% Rainfall in New York State**



Comp. By DJ Date 4/11/07 Project TAconic Tract Sheet No. 3 of
Chkd. By Date Subject Stormwater Quality "Conservation" Layout Job No. 050078

$$WQ_v = \frac{(P)(R_v)(A)}{12} = \frac{1.3 \times 0.95 \times 0.13}{12} = 0.0133 \text{ Ac-ft} = 583 \text{ ft}^3$$

$25\% \; WQ_v = 146 \text{ ft}^3$ – grass swale

$L_{100 \text{ HD req'd}} = \frac{583}{1.86} = 313 \text{ ft} \rightarrow 313/8 = 40$ units >>

$L_{150 \text{ HD req'd}} = \frac{583}{2.65} = 220 \text{ ft} \rightarrow 220/8.5 = 26$ units >>

Use units surrounded in stone $\frac{0.75(583)}{36.7} = 12$ units

per Cultec

** use 12 - Cultec 150 HD surrounded in stone.

Post-Dev. Area $A_2$

D.A. = 2.0 Ac

Impervious 0.46 Ac or $\frac{0.46}{2} = 0.23$ – 23%

$R_v = 0.05 + 0.009(I) = 0.05 + 0.009 \times 23 = 0.257$

$$WQ_v = \frac{(1.3)(0.257)(2)}{12} = 0.0557 \text{ Ac-ft} = 2426 \text{ ft}^3$$

$0.25 \; WQ_v = 0.25 \times 2426 = 606 \text{ ft}^3$ → 20' × 20' × 1.5' pool - pretreatment of sediment chamber (p. 7 - water quality)

$0.75 \; WQ_v = 0.75 \times 2426 = 1820 \text{ ft}^3$

Comp. By Di Date 4/11/07 Project TALONIC TRACT Sheet No. 4 of
Chkd. By Date Subject Stormwater Quality "Conservation" Layout Job No

From PondPack output (file ProposedConservationNoPond.ppw)

$Q_1 = 1.06\ ft^3/s$ – $CP_v$ – channel protection
$Q_2 = 1.90$
$Q_5 = 3.28$
$Q_{10} = 4.02$ – $Q_p$ – overbank flood
$Q_{25} = 5.57$
$Q_{50} = 7.19$
$Q_{100} = 8.02$ – $Q_f$ – extreme storm

Compute the modified CN for 1.3", 90% rainfall

$$CN = 1000 / \left[10 + 5P + 10Q - 10\left(Q^2 + 1.25QP\right)^{1/2}\right]$$

$$Q_a = \frac{WQ_v}{A} = \frac{2426\ ft^3}{2 \times 43560\ ft^2} = 0.0278\ ft = 0.33\ in$$

$$CN = 1000 / \left[10 + 5 \times 1.3 + 10 \times 0.33 - 10\left(0.33^2 + 1.25 \times 0.33 \times 1.3\right)^{1/2}\right] =$$

8.03

$$= \frac{1000}{11.77} = 84.9 \simeq 85$$

TR-55 p.4-1 Table 4-1: For CN = 85 => $I_a = 0.353$ in – initial abstraction

$$\frac{I_a}{P} = \frac{0.353}{1.3} = 0.27$$

$t_c = 0.13\ h = 8\ min$

TR-55 Exhibit 4-III => $q_u = 580$ csm/in

$$Q_{wq} = (580\ csm/in) \times (2.0\ Ac / 640\ Ac/mi^2) \times 0.33\ in = 0.6\ ft^3/s$$

# Chapter 4 Graphical Peak Discharge Method

This chapter presents the Graphical Peak Discharge method for computing peak discharge from rural and urban areas. The Graphical method was developed from hydrograph analyses using TR-20, "Computer Program for Project Formulation—Hydrology" (SCS 1983). The peak discharge equation used is:

$$q_p = q_u A_m Q F_p \qquad \text{[eq. 4-1]}$$

where:

$q_p$ = peak discharge (cfs)
$q_u$ = unit peak discharge (csm/in)
$A_m$ = drainage area (mi²)
$Q$ = runoff (in)
$F_p$ = pond and swamp adjustment factor

The input requirements for the Graphical method are as follows: (1) $T_c$ (hr), (2) drainage area (mi²), (3) appropriate rainfall distribution (I, IA, II, or III), (4) 24-hour rainfall (in), and (5) CN. If pond and swamp areas are spread throughout the watershed and are not considered in the $T_c$ computation, an adjustment for pond and swamp areas is also needed.

## Peak discharge computation

For a selected rainfall frequency, the 24-hour rainfall (P) is obtained from appendix B or more detailed local precipitation maps. CN and total runoff (Q) for the watershed are computed according to the methods outlined in chapter 2. The CN is used to determine the initial abstraction ($I_a$) from table 4-1. $I_a$ / P is then computed.

If the computed $I_a$ / P ratio is outside the range in exhibit 4 (4-I, 4-IA, 4-II, and 4-III) for the rainfall distribution of interest, then the limiting value should be used. If the ratio falls between the limiting values, use linear interpolation. Figure 4-1 illustrates the sensitivity of $I_a$ / P to CN and P.

Peak discharge per square mile per inch of runoff ($q_u$) is obtained from exhibit 4-I, 4-IA, 4-II, or 4-III by using $T_c$ (chapter 3), rainfall distribution type, and $I_a$ / P ratio. The pond and swamp adjustment factor is obtained from table 4-2 (rounded to the nearest table value). Use worksheet 4 in appendix D to aid in computing the peak discharge using the Graphical method.

**Figure 4-1** Variation of $I_a$ / P for P and CN

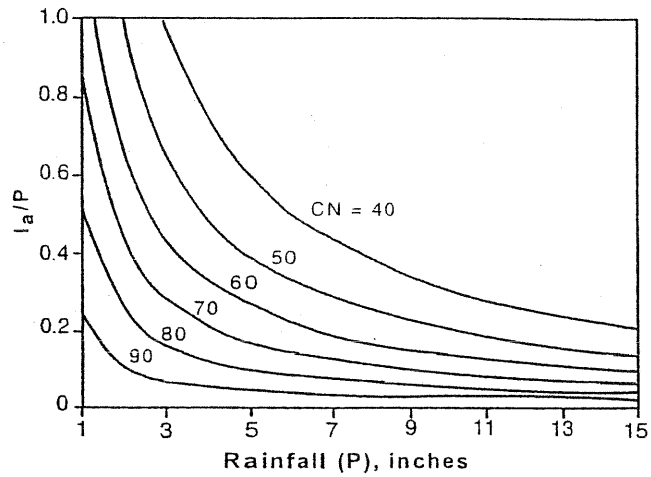
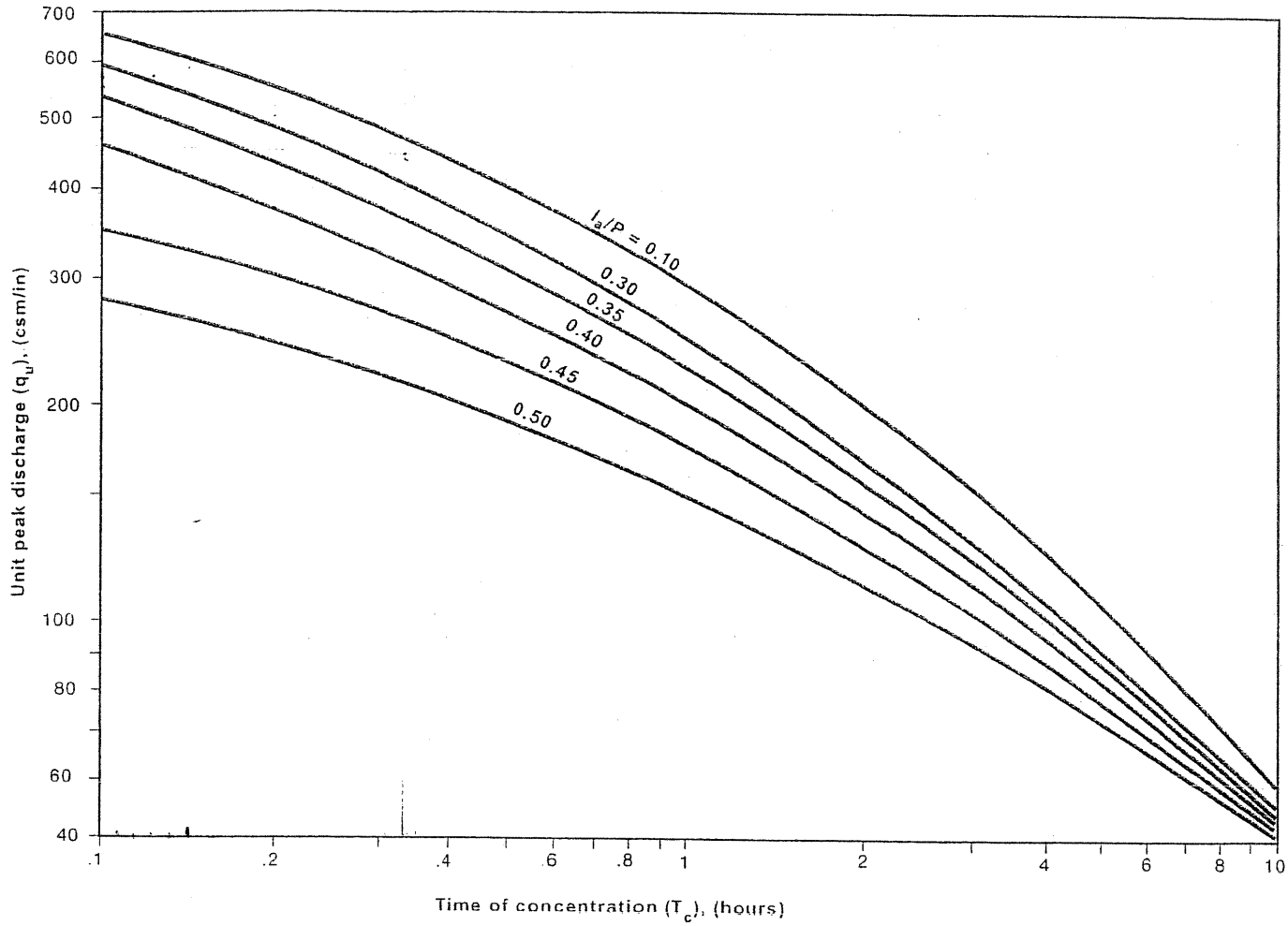



**Table 4-1** $I_a$ values for runoff curve numbers

| Curve number | $I_a$ (in) | Curve number | $I_a$ (in) |
|---|---|---|---|
| 40 | 3.000 | 70 | 0.857 |
| 41 | 2.878 | 71 | 0.817 |
| 42 | 2.762 | 72 | 0.778 |
| 43 | 2.651 | 73 | 0.740 |
| 44 | 2.545 | 74 | 0.703 |
| 45 | 2.444 | 75 | 0.667 |
| 46 | 2.348 | 76 | 0.632 |
| 47 | 2.255 | 77 | 0.597 |
| 48 | 2.167 | 78 | 0.564 |
| 49 | 2.082 | 79 | 0.532 |
| 50 | 2.000 | 80 | 0.500 |
| 51 | 1.922 | 81 | 0.469 |
| 52 | 1.846 | 82 | 0.439 |
| 53 | 1.774 | 83 | 0.410 |
| 54 | 1.704 | 84 | 0.381 |
| 55 | 1.636 | 85 | 0.353 |
| 56 | 1.571 | 86 | 0.326 |
| 57 | 1.509 | 87 | 0.299 |
| 58 | 1.448 | 88 | 0.273 |
| 59 | 1.390 | 89 | 0.247 |
| 60 | 1.333 | 90 | 0.222 |
| 61 | 1.279 | 91 | 0.198 |
| 62 | 1.226 | 92 | 0.174 |
| 63 | 1.175 | 93 | 0.151 |
| 64 | 1.125 | 94 | 0.128 |
| 65 | 1.077 | 95 | 0.105 |
| 66 | 1.030 | 96 | 0.083 |
| 67 | 0.985 | 97 | 0.062 |
| 68 | 0.941 | 98 | 0.041 |
| 69 | 0.899 | | |

**Exhibit 4-III** Unit peal discharge ($q_u$) for NRCS (SCS) type III rainfall distribution



Comp. By M Date 4/11/07 Project TACONIC TRACT Sheet No. 7 of
Chkd. By Date Subject Stormwater Quality "Conservation" Layout Job No 050078

Estimate filtration bed chamber:

- assume average head on filter $h_f = 2.0$ ft
- $d_f = 1.5'$ - filter thickness
- $k = 3.5$ ft/day - flow rate through filter (sand)
- $t_f = 40$ hours - drain time (as recommended)

$$A_f = \frac{WQ_v (d_f)}{k(h_f + d_f)\, t_f} = \frac{2426 \times 1.5}{3.5(2+1.5)\,40/24} = 178 \text{ ft}^2$$

use Rotondo underground sandfilter 10 ft wide

$$L_{req'd} = \frac{178}{10} = 17.8 \text{ ft}$$ xxx use 18' x 10' filter chamber

Estimate sedimentation chamber:

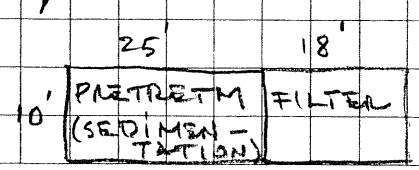
- use 2.5 ft water depth in the sedimentation chamber

$P_v = 0.25 \times 2426 = 607 \text{ ft}^3$ - volume to be pretreated

$$A_s = \frac{607}{2.5} = 243 \text{ ft}^2$$

use the same 10 ft width

$$L_{req'd} = \frac{243}{10} = 24.3 \text{ ft}$$ xxx use 25' x 10' sedimentation chamber



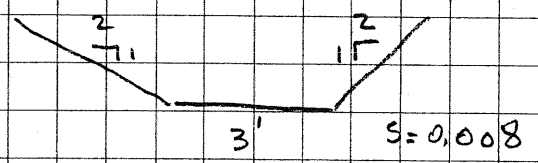
Comp. By M Date 4/11/07 Project TACONIC TRACT Sheet No. 11 of

Chkd. By Date Subject Stormwater Quality "Conservation" Layout Job No 050078

Try grass swale:

$Q_{wq} = 0.6\ ft^3/s$ (p.4 water quality)

use detention time = 10 min = 600 sec.




$\Rightarrow V \simeq 0.27\ ft/s$ ; $H \simeq 0.5'$

$L_{req'd} = 0.27 \times 600 = 162\ ft$

For $Q_{10} = 4.02\ ft^3/s \Rightarrow V \simeq 0.50\ ft/s$ $H \simeq 1.3'$

$L_{wq} = 0.50 \times 600 = 300\ ft$

o Diversion (weir) or MH to bypass larger storms is req'd for L=162

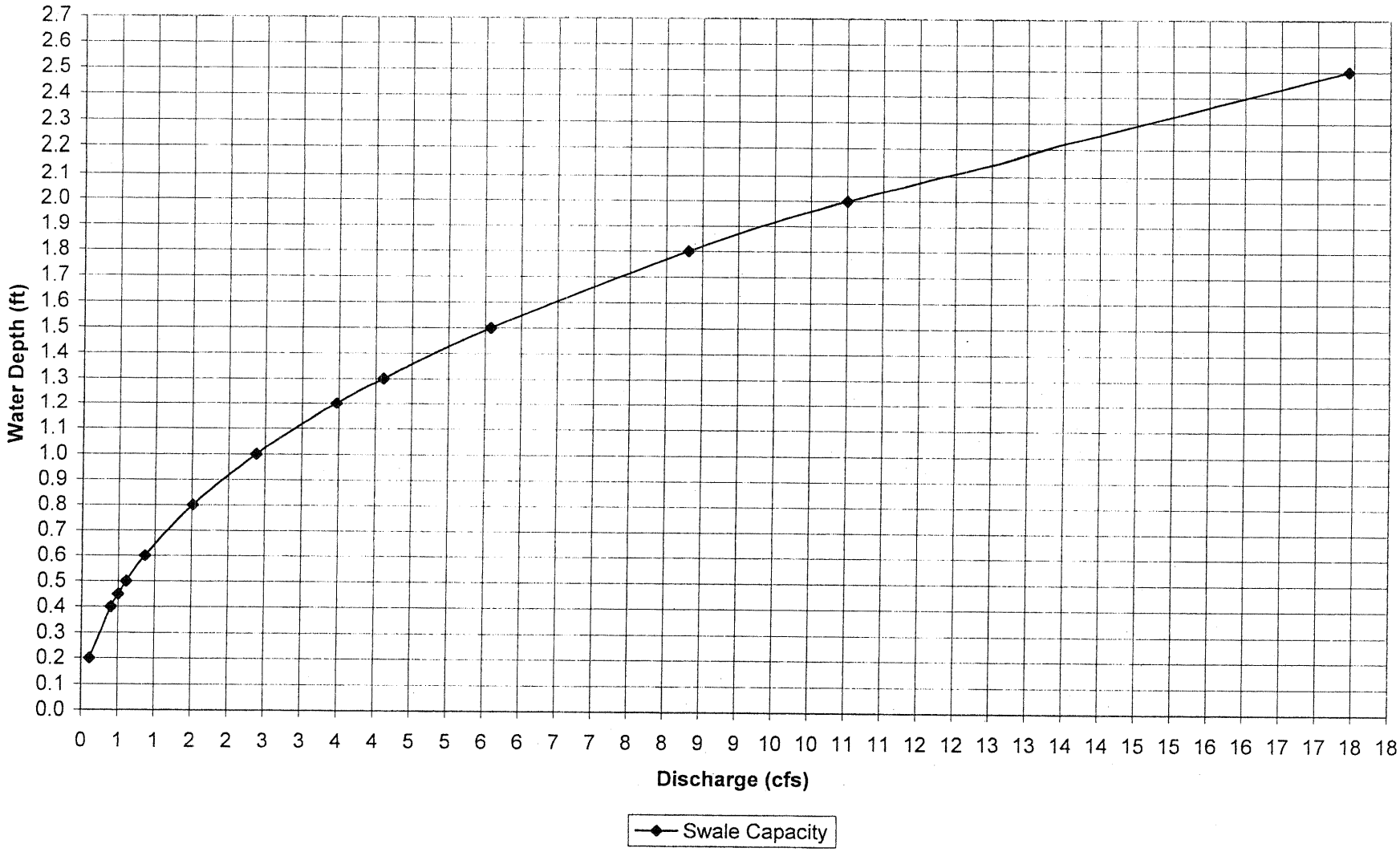
**TACONIC TRACT**
Town of Mount Pleasant
Westchester, NY

File: Swale3.xls
Compiled: D. Ionescu
Date: 4/12/2007

## SWALE DESIGN

| H (ft) | Bottom (ft) | Side Slope | Area (ft2) | Top Width (ft) | Wetted Perim. (ft) | Hydr. Radius (ft) | n | Slope | Velocity (ft/s) | Discharge (ft3/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.20 | 3.0 | 3 | 0.7 | 4.2 | 4.3 | 0.17 | 0.25 | 0.008 | 0.16 | 0.12 |
| 0.40 | 3.0 | 3 | 1.7 | 5.4 | 5.5 | 0.30 | 0.25 | 0.008 | 0.24 | 0.40 |
| 0.45 | 3.0 | 3 | 2.0 | 5.7 | 5.8 | 0.33 | 0.25 | 0.008 | 0.26 | 0.50 |
| 0.50 | 3.0 | 3 | 2.3 | 6.0 | 6.2 | 0.37 | 0.25 | 0.008 | 0.27 | 0.61 |
| 0.60 | 3.0 | 3 | 2.9 | 6.6 | 6.8 | 0.42 | 0.25 | 0.008 | 0.30 | 0.86 |
| 0.80 | 3.0 | 3 | 4.3 | 7.8 | 8.1 | 0.54 | 0.25 | 0.008 | 0.35 | 1.52 |
| 1.00 | 3.0 | 3 | 6.0 | 9.0 | 9.3 | 0.64 | 0.25 | 0.008 | 0.40 | 2.38 |
| 1.20 | 3.0 | 3 | 7.9 | 10.2 | 10.6 | 0.75 | 0.25 | 0.008 | 0.44 | 3.47 |
| 1.30 | 3.0 | 3 | 9.0 | 10.8 | 11.2 | 0.80 | 0.25 | 0.008 | 0.46 | 4.11 |
| 1.50 | 3.0 | 3 | 11.3 | 12.0 | 12.5 | 0.90 | 0.25 | 0.008 | 0.50 | 5.58 |
| 1.80 | 3.0 | 3 | 15.1 | 13.8 | 14.4 | 1.05 | 0.25 | 0.008 | 0.55 | 8.31 |
| 2.00 | 3.0 | 3 | 18.0 | 15.0 | 15.6 | 1.15 | 0.25 | 0.008 | 0.58 | 10.51 |
| 2.50 | 3.0 | 3 | 26.3 | 18.0 | 18.8 | 1.40 | 0.25 | 0.008 | 0.66 | 17.43 |

## Grassed Swale Rating Curve
## Widht = 3.0 ft; 3:1 side slope; S = 0.008



Comp. By M Date 4/11/07 Project TACONIC TRACT Sheet No. 14 of

Chkd. By Date Subject Stormwater Quality "Conservation" Layout Job No 050078

Post-Dev. Area A3

D.A. = 2.6 Ac

Impervi. 1.3 Ac $I = \frac{1.3}{2.6} = 0.5$ or 50%

$R_v = 0.05 + 0.009\,(I) = 0.05 + 0.009 \times 50 = 0.5$

$WQ_v = \frac{(1.3)(0.5)(2.6)}{12} = 0.1408$ Ac-ft $= 6135\ ft^3$

$0.25\ WQ_v = 0.25 \times 6135 = 1534\ ft^3$

$32' \times 32' \times 1.5'$ plunge pool for pretreatment

$Q_a = \frac{WQ_v}{A} = \frac{6135}{2.6 \times 43560} = 0.054\ ft = 0.65\ in$

CN = modified CN for 1.3", 90% rainfall

$CN = 1000 / \left[10 + 5 \times 1.3 + 10 \times 0.65 - 10\left(0.65^2 + 1.25 \times 0.65 \times 1.3\right)^{1/2}\right] = 92$

12.16

For CN = 92 → $I_a = 0.174$ in $I_a/P = 0.174/1.3 = 0.133$

$t_c = 0.152\ h = 9$ min

TR-55 Exibit 4-111 → $q_u = 590$ csm/in

$Q_{wq} = 590 \times 2.6 / 640 \times 0.65 = 1.55\ ft^3/s$

Comp. By TJ Date 4/11/07 | Project TACONIC TRACT | Sheet No. 15 of

Chkd. By Date | Subject Stormwater Quality "Conservation" Layout | Job No 050078

o Estimate filtration bed chamber:

$$A_f = \frac{WQ_v(d_f)}{k(h_f + d_f)t_f} = \frac{6135 \times 1.5}{3.5(2+1.5)40/24} = 451 \text{ ft}^2$$

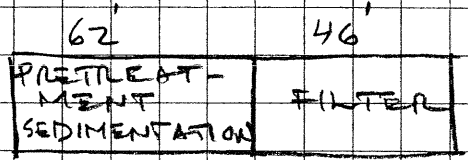
$L_{req'd} = \frac{451}{10} = 45.1$ ft ** 46' × 10' filter chamber

o Estimate sedimentation chamber:

$P_v = 0.25 \times 6135 = 1534 \text{ ft}^3$ - to be pretreated

$A_s = \frac{1534}{2.5} = 614 \text{ ft}^2$

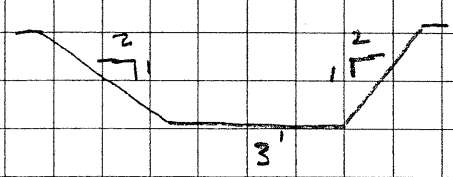
$L_{req'd} = \frac{614}{10} = 61.4$ ft ** use 62' × 10' sedimentation chamber



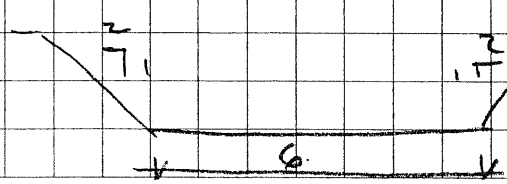

o Gross swale - preliminary

$Q_{WQ_v} = 1.55 \text{ ft}^3/s \rightarrow h = 0.85', \; v \simeq 0.35 \text{ ft/s} \rightarrow L = 0.35 \times 600 = 210$

$Q_{10} = 6.4 \text{ ft}^3/s \rightarrow h = 1.60', \; v \simeq 0.52 \text{ ft/s} \rightarrow L = 0.52 \times 600 = 312$




$S = 0.008$ Try 6' bottom




$Q_{WQ_v} = 1.55 \rightarrow h = 0.61, v = 0.33 \Rightarrow L = 198'$

$Q_{10} = 6.4 \rightarrow h = 1.3, v = 0.50 \Rightarrow L = 300'$

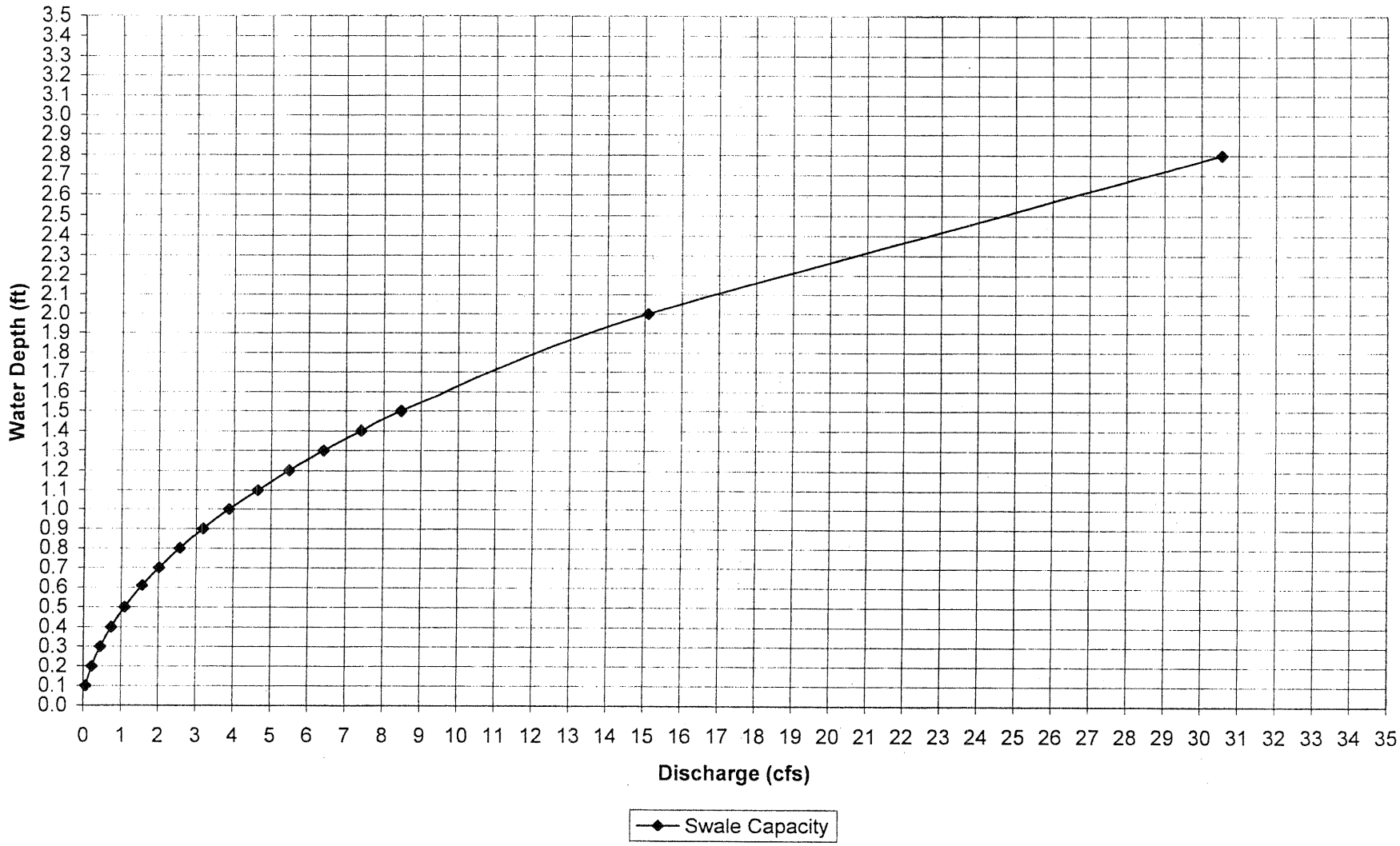
**TACONIC TRACT**
Town of Mount Pleasant
Westchester, NY

File: Swale6.xls
Compiled: D. Ionescu
Date: 4/12/2007

## SWALE DESIGN

| H (ft) | Bottom (ft) | Side Slope | Area (ft2) | Top Width (ft) | Wetted Perim. (ft) | Hydr. Radius (ft) | n | Slope | Velocity (ft/s) | Discharge (ft3/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.10 | 6.0 | 3 | 0.6 | 6.6 | 6.6 | 0.09 | 0.25 | 0.008 | 0.11 | 0.07 |
| 0.20 | 6.0 | 3 | 1.3 | 7.2 | 7.3 | 0.18 | 0.25 | 0.008 | 0.17 | 0.22 |
| 0.30 | 6.0 | 3 | 2.1 | 7.8 | 7.9 | 0.26 | 0.25 | 0.008 | 0.22 | 0.45 |
| 0.40 | 6.0 | 3 | 2.9 | 8.4 | 8.5 | 0.34 | 0.25 | 0.008 | 0.26 | 0.74 |
| 0.50 | 6.0 | 3 | 3.8 | 9.0 | 9.2 | 0.41 | 0.25 | 0.008 | 0.29 | 1.10 |
| 0.61 | 6.0 | 3 | 4.8 | 9.7 | 9.9 | 0.48 | 0.25 | 0.008 | 0.33 | 1.57 |
| 0.70 | 6.0 | 3 | 5.7 | 10.2 | 10.4 | 0.54 | 0.25 | 0.008 | 0.35 | 2.01 |
| 0.80 | 6.0 | 3 | 6.7 | 10.8 | 11.1 | 0.61 | 0.25 | 0.008 | 0.38 | 2.56 |
| 0.90 | 6.0 | 3 | 7.8 | 11.4 | 11.7 | 0.67 | 0.25 | 0.008 | 0.41 | 3.19 |
| 1.00 | 6.0 | 3 | 9.0 | 12.0 | 12.3 | 0.73 | 0.25 | 0.008 | 0.43 | 3.88 |
| 1.10 | 6.0 | 3 | 10.2 | 12.6 | 13.0 | 0.79 | 0.25 | 0.008 | 0.45 | 4.65 |
| 1.20 | 6.0 | 3 | 11.5 | 13.2 | 13.6 | 0.85 | 0.25 | 0.008 | 0.48 | 5.49 |
| 1.30 | 6.0 | 3 | 12.9 | 13.8 | 14.2 | 0.90 | 0.25 | 0.008 | 0.50 | 6.40 |
| 1.40 | 6.0 | 3 | 14.3 | 14.4 | 14.9 | 0.96 | 0.25 | 0.008 | 0.52 | 7.39 |
| 1.50 | 6.0 | 3 | 15.8 | 15.0 | 15.5 | 1.02 | 0.25 | 0.008 | 0.54 | 8.47 |
| 2.00 | 6.0 | 3 | 24.0 | 18.0 | 18.6 | 1.29 | 0.25 | 0.008 | 0.63 | 15.10 |
| 2.80 | 6.0 | 3 | 40.3 | 22.8 | 23.7 | 1.70 | 0.25 | 0.008 | 0.76 | 30.55 |

## Grassed Swale Rating Curve
## Widht = 6.0 ft; 3:1 side slope; S = 0.008



Comp. By TN Date 4/12/07 Project TKONIC TRACT Sheet No. 21 of
Chkd. By Date Subject Stormwater Quality "Conservation" Layout Job No. 050078

Post-Dev. Area B1

D.A. = 3.8 Ac

Impervious 0.94 Ac $I = \frac{0.94}{3.8} = 0.25$ or 25%

$R_v = 0.05 + 0.009(I) = 0.05 + 0.009 \times 25 = 0.275$

$WQ_v = \frac{(1.3)(0.275)(3.8)}{12} = 0.11$ Ac-ft $= 4931$ ft$^3$

$0.25\ WQ_v = 0.25 \times 4931 = 1233$ ft$^3$

$23 \times 23 \times 2.5 = 1322$ ft$^3$ $\times$ 23' x 23' x 2.5' plunge pool for pretreatment

$Q_a = \frac{WQ_v}{A} = \frac{4931}{3.8 \times 43560} = 0.0298$ ft $= 0.36$ in

CN = modified CN for 1.3", 90% rainfall

$CN = 1000\left[10 + 5 \times 1.3 + 10 \times 0.36 - 10\left(0.36^2 + 1.25 \times 0.36 \times 1.3\right)^{1/2}\right] = 86$

8.45

For CN = 86 => $I_a = 0.326$

$I_a/P = 0.326/1.3 = 0.25$

$t_c = 0.11$ hr = 7 min => $q_u = 550$ csm/in

$Q_{wq} = 550$ csm/in $\times (3.8$ Ac$/640$ Ac/mi$^2) \times 0.36$ in $= 1.17$ ft$^3$/s

Comp. By DJ Date 4/12/07 Project TACONIC TRACT Sheet No. 22 of
Chkd. By Date Subject Stormwater Quality "Conservation" Layout Job No. 050078

Estimate filtration bed chamber:

- Assume $h_f = 2.0$ ft, $d_f = 1.5$ ft, $k = 3.5$ ft/day, $t_f = 40$ h

$$A_f = \frac{W Q_v (d_f)}{k (h_f + d_f) t_f} = \frac{4931 \times 1.5}{3.5(2+1.5)40/24} = 362 \text{ ft}^2$$

$$L_{req'd} = \frac{362}{10} = 36.2 \text{ ft}$$

** use 36' x 10' filter chamber

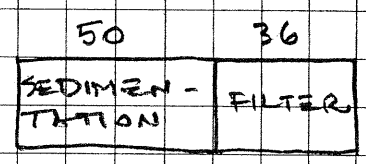
Estimate sedimentation chamber:

- use 2.5 ft water depth in the sedimentation chamber
- $P_v = 0.25 \times 4931 = 1233 \text{ ft}^3$

$$A_s = \frac{1233}{2.5} = 493 \text{ ft}^2$$

$$L_{req'd} = \frac{493}{10} = 49.3 \text{ ft}$$

** use 50' x 10' sedimentation chamber



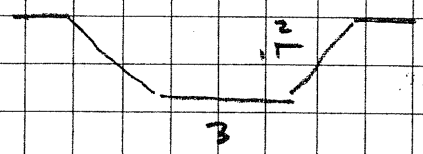
Comp. By: M Date: 4/12/07 Project: TALONIC TRACT Sheet No. 29 of

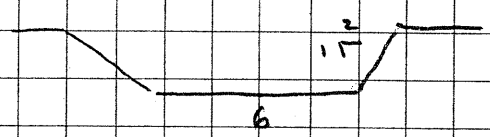
Chkd. By: Date: Subject: Stormwater Quality "Conservation" Layout Job No. 050078

Gross grade:

$Q_{WQ_v} = 1.17\ ft^3/s \rightarrow H = 0.70',\ v = 0.33\ ft/s \rightarrow L = 600 \times 0.33 = \underline{198\ ft}$

$Q_{10} = 8.16\ ft^3/s \rightarrow H = 1.79',\ v = 0.55\ ft/s \rightarrow L = 600 \times 0.55 = 330\ ft$




$H = 0.52',\ v = 0.30\ ft/s \rightarrow L = 0.3 \times 600 = \underline{180\ ft}$

$H = 1.47',\ v = 0.53 \rightarrow L = 0.53 \times 600 = \underline{318\ ft}$

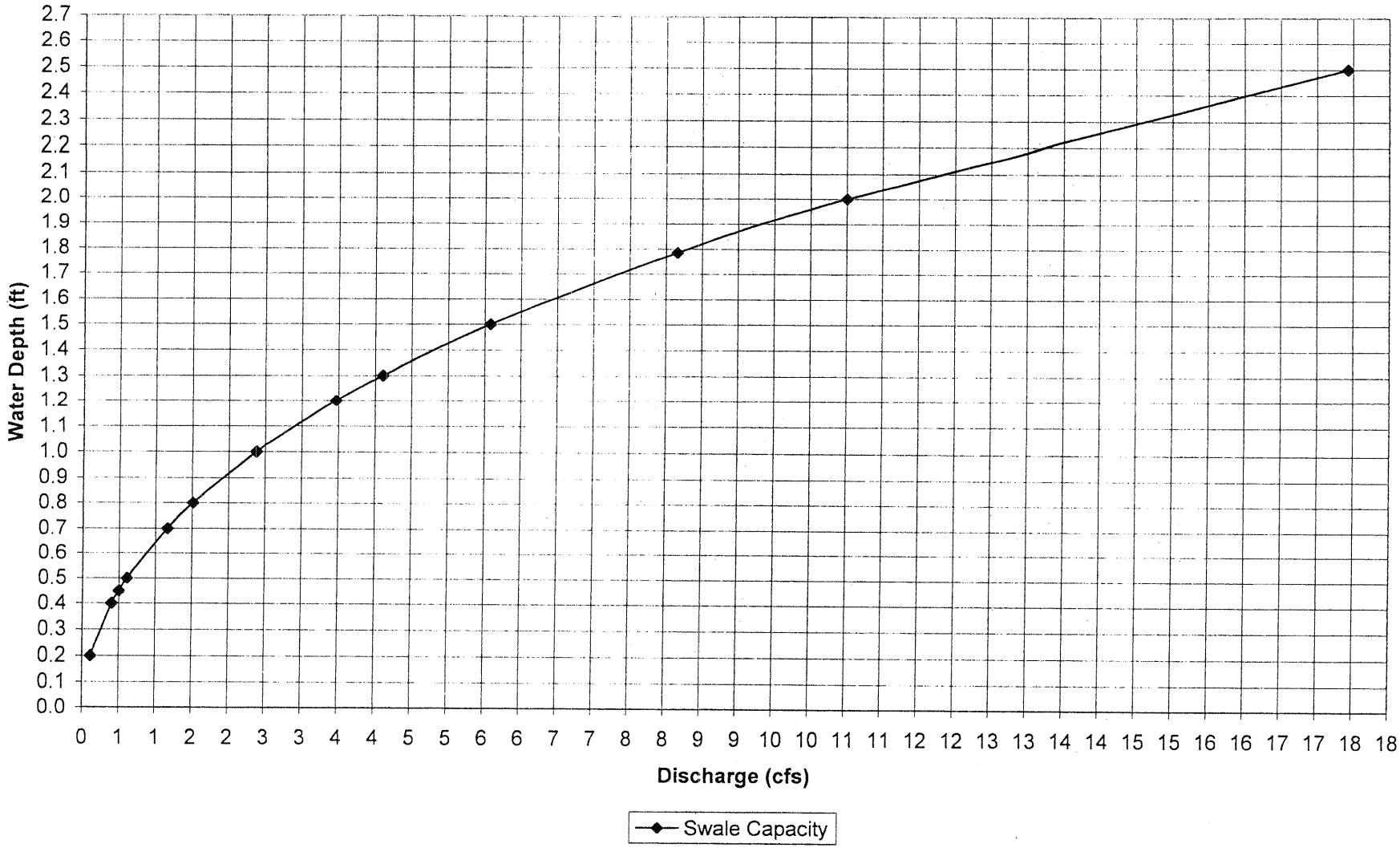
**TACONIC TRACT**
Town of Mount Pleasant
Westchester, NY

File: Swale3.xls
Compiled: D. Ionescu
Date: 4/12/2007

## SWALE DESIGN

| H (ft) | Bottom (ft) | Side Slope | Area (ft2) | Top Width (ft) | Wetted Perim. (ft) | Hydr. Radius (ft) | n | Slope | Velocity (ft/s) | Discharge (ft3/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.20 | 3.0 | 3 | 0.7 | 4.2 | 4.3 | 0.17 | 0.25 | 0.008 | 0.16 | 0.12 |
| 0.40 | 3.0 | 3 | 1.7 | 5.4 | 5.5 | 0.30 | 0.25 | 0.008 | 0.24 | 0.40 |
| 0.45 | 3.0 | 3 | 2.0 | 5.7 | 5.8 | 0.33 | 0.25 | 0.008 | 0.26 | 0.50 |
| 0.50 | 3.0 | 3 | 2.3 | 6.0 | 6.2 | 0.37 | 0.25 | 0.008 | 0.27 | 0.61 |
| 0.70 | 3.0 | 3 | 3.6 | 7.2 | 7.4 | 0.48 | 0.25 | 0.008 | 0.33 | 1.16 |
| 0.80 | 3.0 | 3 | 4.3 | 7.8 | 8.1 | 0.54 | 0.25 | 0.008 | 0.35 | 1.52 |
| 1.00 | 3.0 | 3 | 6.0 | 9.0 | 9.3 | 0.64 | 0.25 | 0.008 | 0.40 | 2.38 |
| 1.20 | 3.0 | 3 | 7.9 | 10.2 | 10.6 | 0.75 | 0.25 | 0.008 | 0.44 | 3.47 |
| 1.30 | 3.0 | 3 | 9.0 | 10.8 | 11.2 | 0.80 | 0.25 | 0.008 | 0.46 | 4.11 |
| 1.50 | 3.0 | 3 | 11.3 | 12.0 | 12.5 | 0.90 | 0.25 | 0.008 | 0.50 | 5.58 |
| 1.79 | 3.0 | 3 | 14.9 | 13.7 | 14.3 | 1.04 | 0.25 | 0.008 | 0.55 | 8.16 |
| 2.00 | 3.0 | 3 | 18.0 | 15.0 | 15.6 | 1.15 | 0.25 | 0.008 | 0.58 | 10.51 |
| 2.50 | 3.0 | 3 | 26.3 | 18.0 | 18.8 | 1.40 | 0.25 | 0.008 | 0.66 | 17.43 |

## Grassed Swale Rating Curve
## Widht = 3.0 ft; 3:1 side slope; S = 0.008



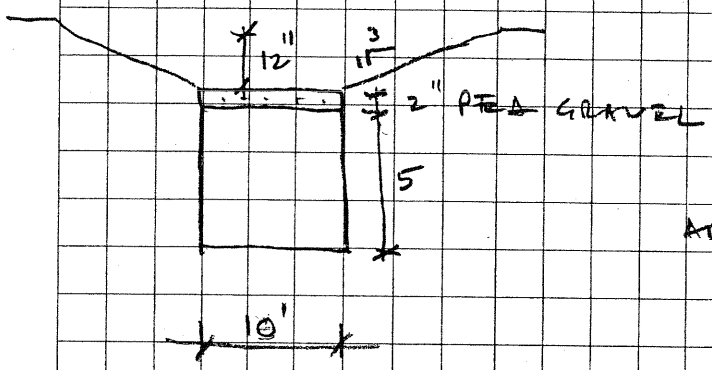
Comp. By [illegible] Date 4/13/07 Project TACONIC TRACT Sheet No. 32 of
Chkd. By Date Subject Water Quality "Conservation" Layout Job No 050078

A2 INFILTRATION TRENCH

$WQ_v = 2426\ ft^3$

$0.25\ WQ_v = 0.25 \times 2426 = 606\ ft^3$ → 20' × 20' × 1.5' - plunge pool for pretreatment

$0.75\ WQ_v = \quad = 1820$




AREA TRENCH $A = \frac{WQ_v}{n \cdot d} = \frac{2426}{0.4 \times 5} = 1213\ ft^2$

$L = 1213/10 = 122\ ft$

- PEA GRAVEL VOLUME
  - Assume 0.32 porosity = n - pea gravel
  - d = 4 ft - trench depth

$P_v\ \text{feet} = 0.32 \times 2/12 \times 10 \times 190 = 101\ ft^3$

- GRASS CHANNEL VOLUME

$Q_{wq} = 0.6\ ft^3/s \qquad H = 0.31\ ft \qquad v = 0.18\ ft/s$

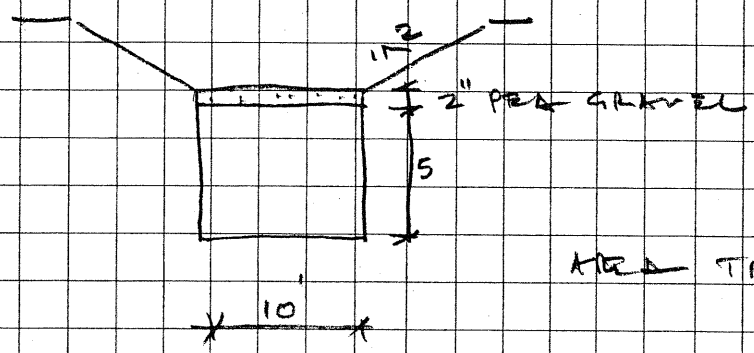
Use 10 minutes = 600 sec detention time $L = 0.18 \times 600 = 108\ ft < 122$

Comp. By DR Date 4/13/07 Project TACONIC TRACT Sheet No. 33 of
Chkd. By Date Subject Water Quality "Conservation" layout Job No. 050078

A3

$WQ_v = 6135\ ft^3$

$0.25\ WQ_v = 1534\ ft^3$ 25' x 25' x 2.5 plunge pool for pretreatment




AREA TRENCH $A = \frac{WQ_v}{n \cdot d} = \frac{6135}{0.4 \times 5} = 3068\ ft^2$

$L = \frac{3068}{10} = 307\ ft$

$Q_{wq_v} = 1.55\ ft^3/s \rightarrow H = 0.54\ ft \quad V = 0.26\ ft/s \rightarrow L = 0.26 \times 600 = 156\ ft$

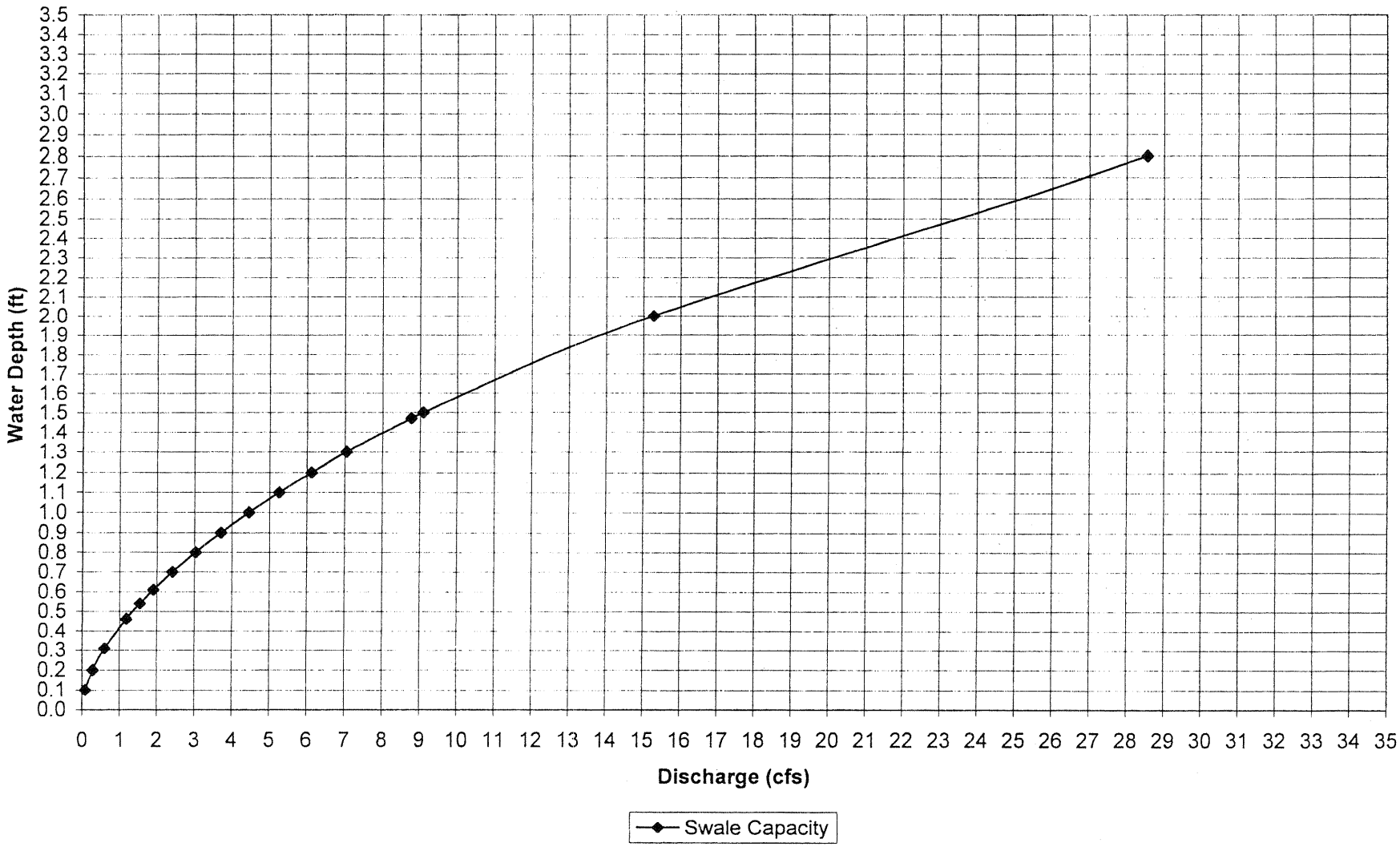
B1 $WQ_v = 4931\ ft^3$
$0.25\ WQ_v = 1233\ ft^3$ 29' x 29' x 1.5' plunge pool for treatment

AREA TRENCH $A = \frac{WQ_v}{n \cdot d} = \frac{4931}{0.4 \times 5} = 2466\ ft^2$

$L = \frac{2466}{10} = 247\ ft$

$Q_{wq_v} = 1.17\ ft^3/s \quad H = 0.46\ ft \quad V = 0.23\ ft/s \rightarrow L = 600 \times 0.23 = 138\ ft$

## Grassed Swale Rating Curve
## Widht = 10 ft; 2:1 side slope; S = 0.005



**TACONIC TRACT**
Town of Mount Pleasant
Westchester, NY

File: Swale6.xls
Compiled: D. Ionescu
Date: 4/13/2007

## SWALE DESIGN

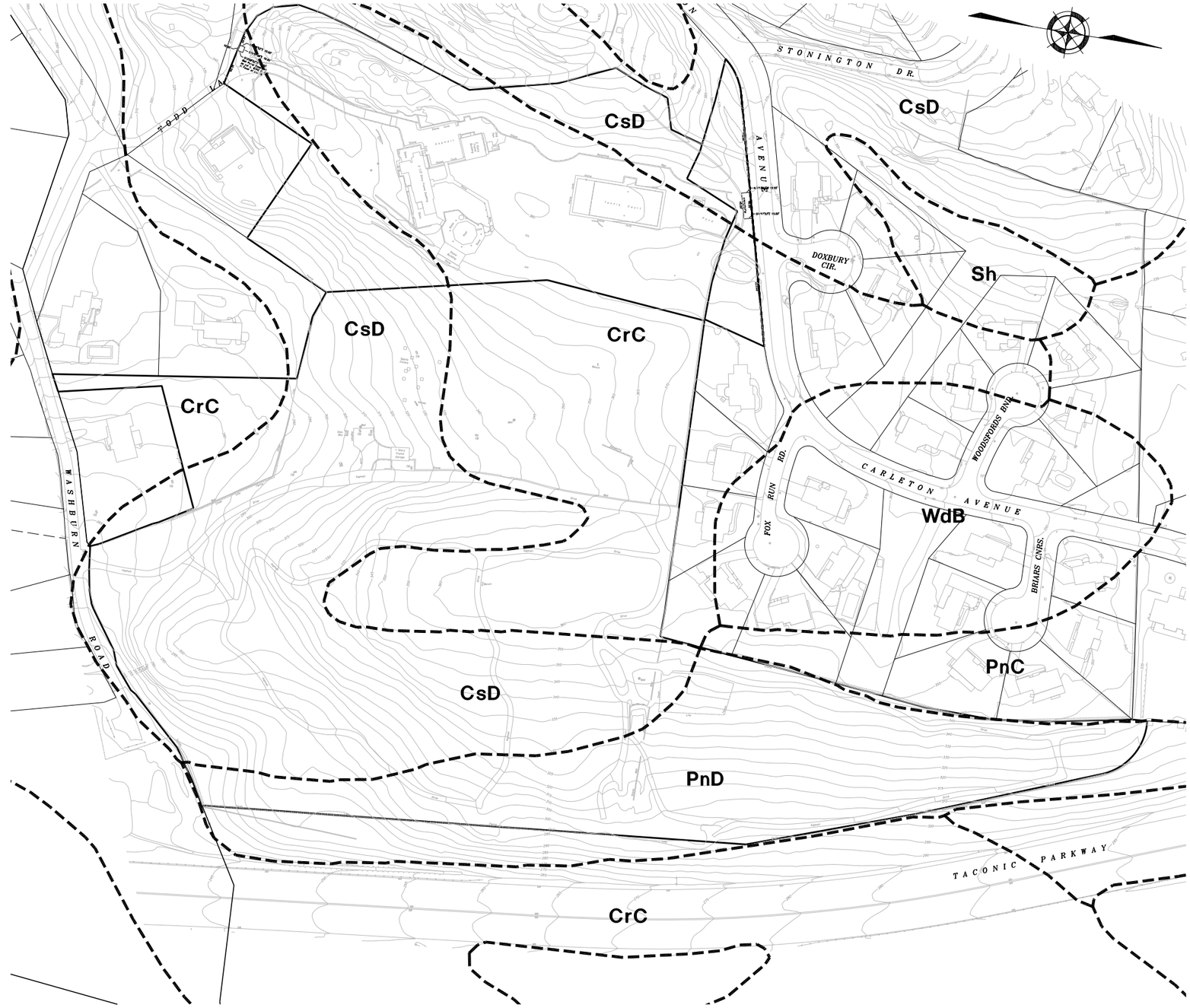
| H (ft) | Bottom (ft) | Side Slope | Area (ft2) | Top Width (ft) | Wetted Perim. (ft) | Hydr. Radius (ft) | n | Slope | Velocity (ft/s) | Discharge (ft3/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.10 | 10.0 | 2 | 1.0 | 10.4 | 10.4 | 0.10 | 0.25 | 0.005 | 0.09 | 0.09 |
| 0.20 | 10.0 | 2 | 2.1 | 10.8 | 10.9 | 0.19 | 0.25 | 0.005 | 0.14 | 0.29 |
| 0.31 | 10.0 | 2 | 3.3 | 11.2 | 11.4 | 0.29 | 0.25 | 0.005 | 0.18 | 0.60 |
| 0.46 | 10.0 | 2 | 5.0 | 11.8 | 12.1 | 0.42 | 0.25 | 0.005 | 0.23 | 1.18 |
| 0.54 | 10.0 | 2 | 6.0 | 12.2 | 12.4 | 0.48 | 0.25 | 0.005 | 0.26 | 1.55 |
| 0.61 | 10.0 | 2 | 6.8 | 12.4 | 12.7 | 0.54 | 0.25 | 0.005 | 0.28 | 1.90 |
| 0.70 | 10.0 | 2 | 8.0 | 12.8 | 13.1 | 0.61 | 0.25 | 0.005 | 0.30 | 2.41 |
| 0.80 | 10.0 | 2 | 9.3 | 13.2 | 13.6 | 0.68 | 0.25 | 0.005 | 0.33 | 3.03 |
| 0.90 | 10.0 | 2 | 10.6 | 13.6 | 14.0 | 0.76 | 0.25 | 0.005 | 0.35 | 3.71 |
| 1.00 | 10.0 | 2 | 12.0 | 14.0 | 14.5 | 0.83 | 0.25 | 0.005 | 0.37 | 4.45 |
| 1.10 | 10.0 | 2 | 13.4 | 14.4 | 14.9 | 0.90 | 0.25 | 0.005 | 0.39 | 5.26 |
| 1.20 | 10.0 | 2 | 14.9 | 14.8 | 15.4 | 0.97 | 0.25 | 0.005 | 0.41 | 6.12 |
| 1.30 | 10.0 | 2 | 16.4 | 15.2 | 15.8 | 1.04 | 0.25 | 0.005 | 0.43 | 7.05 |
| 1.47 | 10.0 | 2 | 19.0 | 15.9 | 16.6 | 1.15 | 0.25 | 0.005 | 0.46 | 8.76 |
| 1.50 | 10.0 | 2 | 19.5 | 16.0 | 16.7 | 1.17 | 0.25 | 0.005 | 0.47 | 9.09 |
| 2.00 | 10.0 | 2 | 28.0 | 18.0 | 18.9 | 1.48 | 0.25 | 0.005 | 0.55 | 15.27 |
| 2.80 | 10.0 | 2 | 43.7 | 21.2 | 22.5 | 1.94 | 0.25 | 0.005 | 0.65 | 28.56 |

# Section D:

# Plan Figures

| MAP SYMBOL | SOIL NAME | AREA (ACRES) | % OF AREA |
|---|---|---|---|
| CrC | Charlton | 11.462 | 38.20 % |
| CsD | Chatfield | 12.753 | 42.51 % |
| PnC | Paxton | 0.065 | 0.22 % |
| PnD | Paxton | 5.722 | 19.07 % |

= SOIL TYPE BOUNDARY

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0 200 400
SCALE

**FIGURE 1: SOIL TYPES**

TACONIC TRACT DEVELOPMENTS, LLC
TOWN OF MOUNT PLEASANT, NY

SOURCE: WSP SELLS AUGUST 2009

Drawing Path\Name: P:\050078\3_Drawings\1_Working\Submissions\2009\DEIS\050078-Conventional Plans.dwg Date Printed: Sep 16, 2009, 1:36pm
Xref's Attached: tacocad; xref Adjoiner Prop Lines; xref Village Line; xref Prop Lines and Bearings; xref Soils; xref Trees; xref Slopes Existing 30 Acre Parcel; xref LOD Slopes DEIS Conventional

| MAP SYMBOL | SOIL NAME | AREA (ACRES) | % OF AREA |
|---|---|---|---|
| CrC | Charlton | 11.462 | 38.20 % |
| CsD | Chatfield | 12.753 | 42.51 % |
| PnC | Paxton | 0.065 | 0.22 % |
| PnD | Paxton | 5.722 | 19.07 % |

= SOIL TYPE BOUNDARY

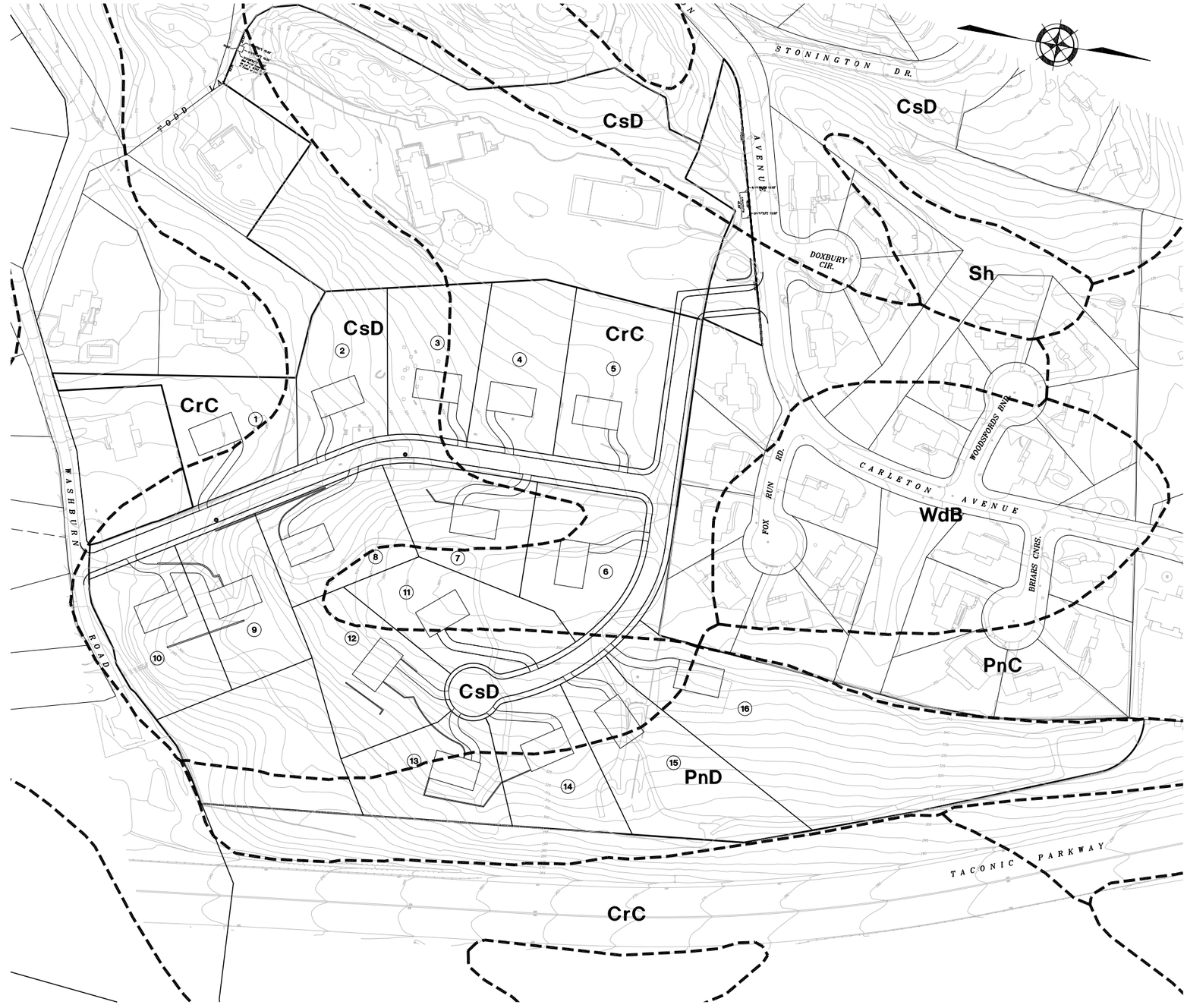


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**FIGURE 1A: EXISTING SOIL TYPES CONVENTIONAL LAYOUT**

TACONIC TRACT DEVELOPMENTS, LLC
TOWN OF MOUNT PLEASANT, NY

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| MAP SYMBOL | SOIL NAME | AREA (ACRES) | % OF AREA |
|---|---|---|---|
| CrC | Charlton | 11.462 | 38.20 % |
| CsD | Chatfield | 12.753 | 42.51 % |
| PnC | Paxton | 0.065 | 0.22 % |
| PnD | Paxton | 5.722 | 19.07 % |

- - - - - - = SOIL TYPE BOUNDARY

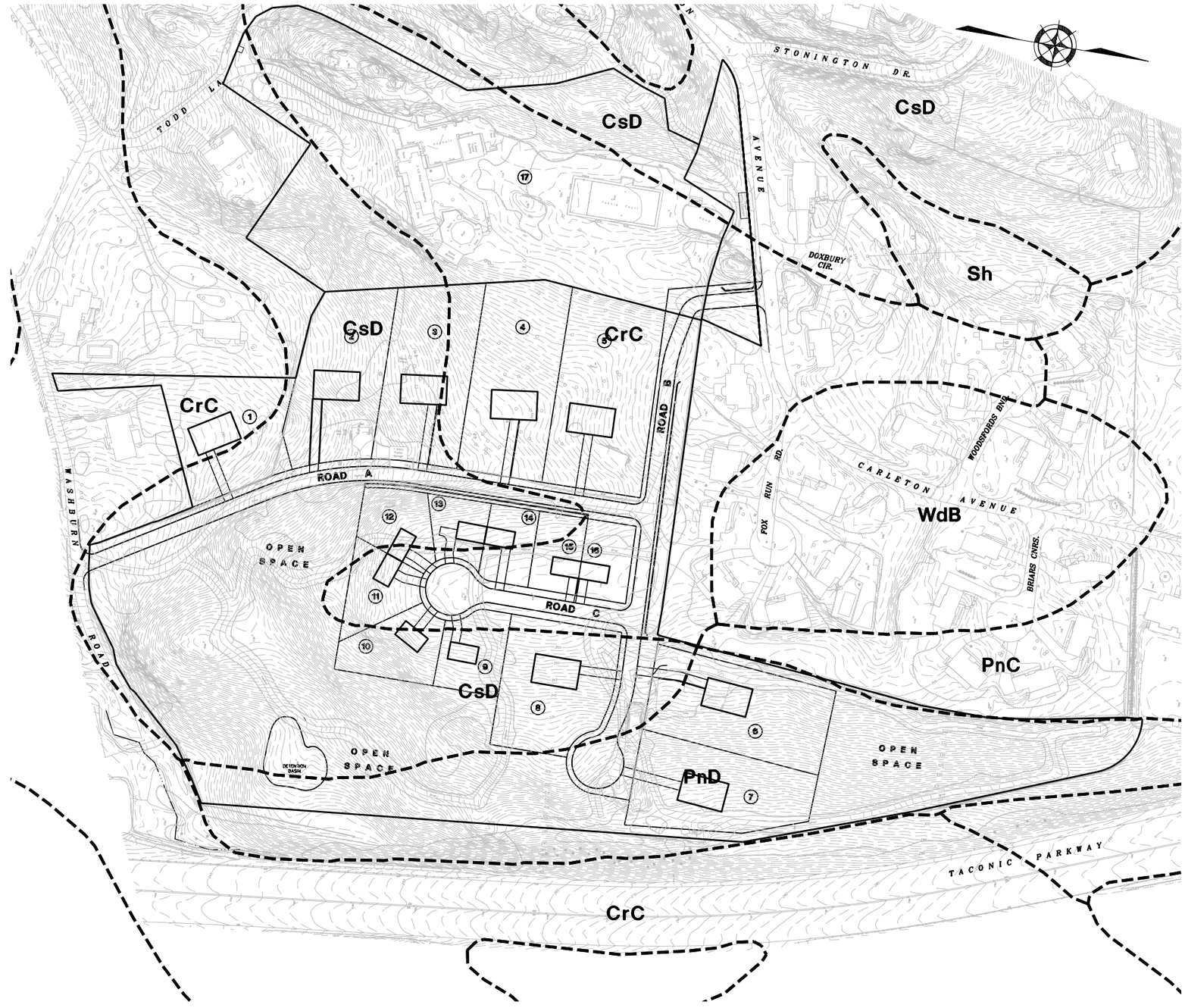


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**FIGURE 1B: EXISTING SOIL TYPES CONSERVATION LAYOUT**

TACONIC TRACT DEVELOPMENTS, LLC
TOWN OF MOUNT PLEASANT, NY

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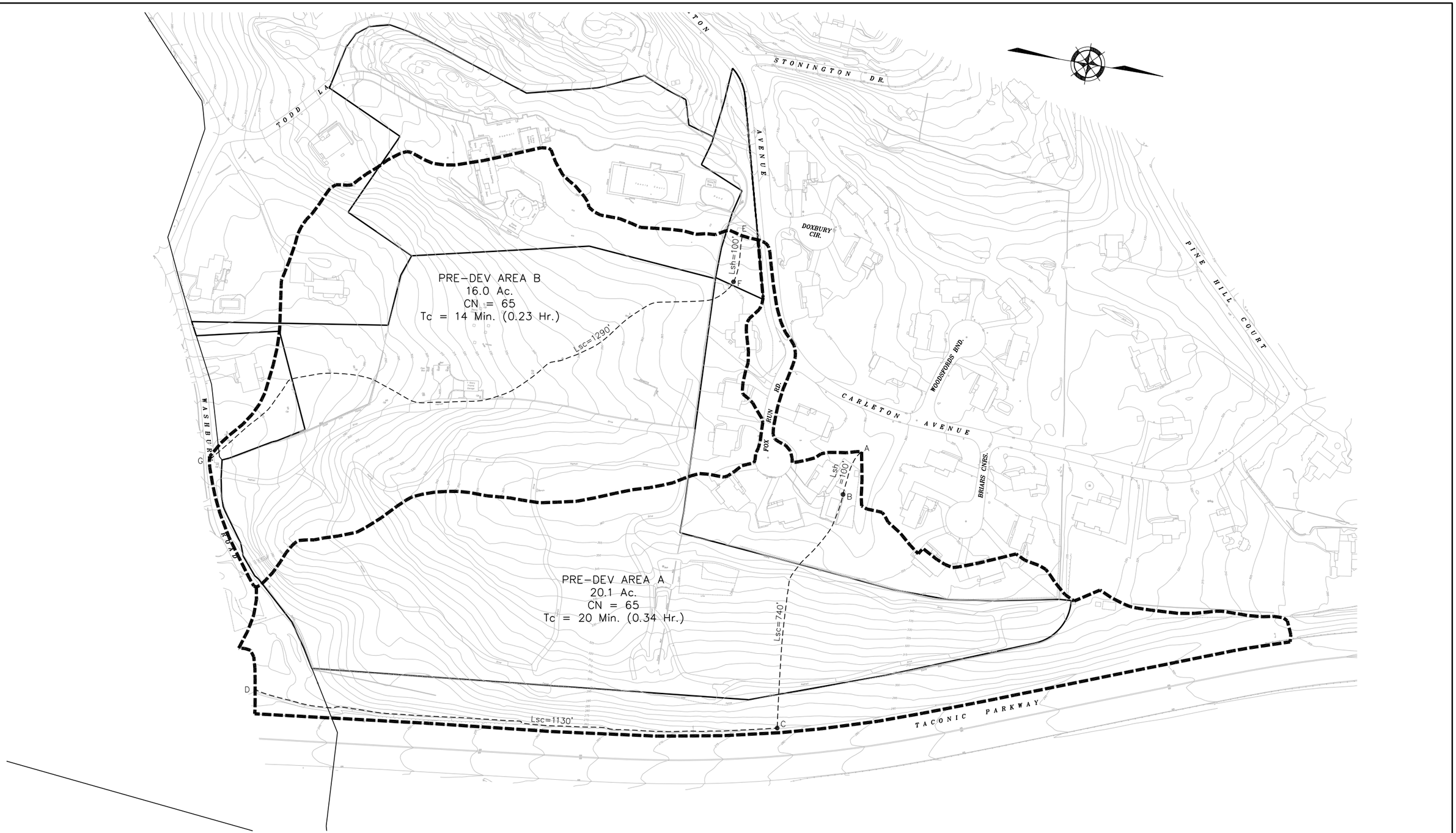


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**FIGURE 2: PRE-DEVELOPMENT DRAINAGE AREAS**

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TOWN OF MOUNT PLEASANT, NY

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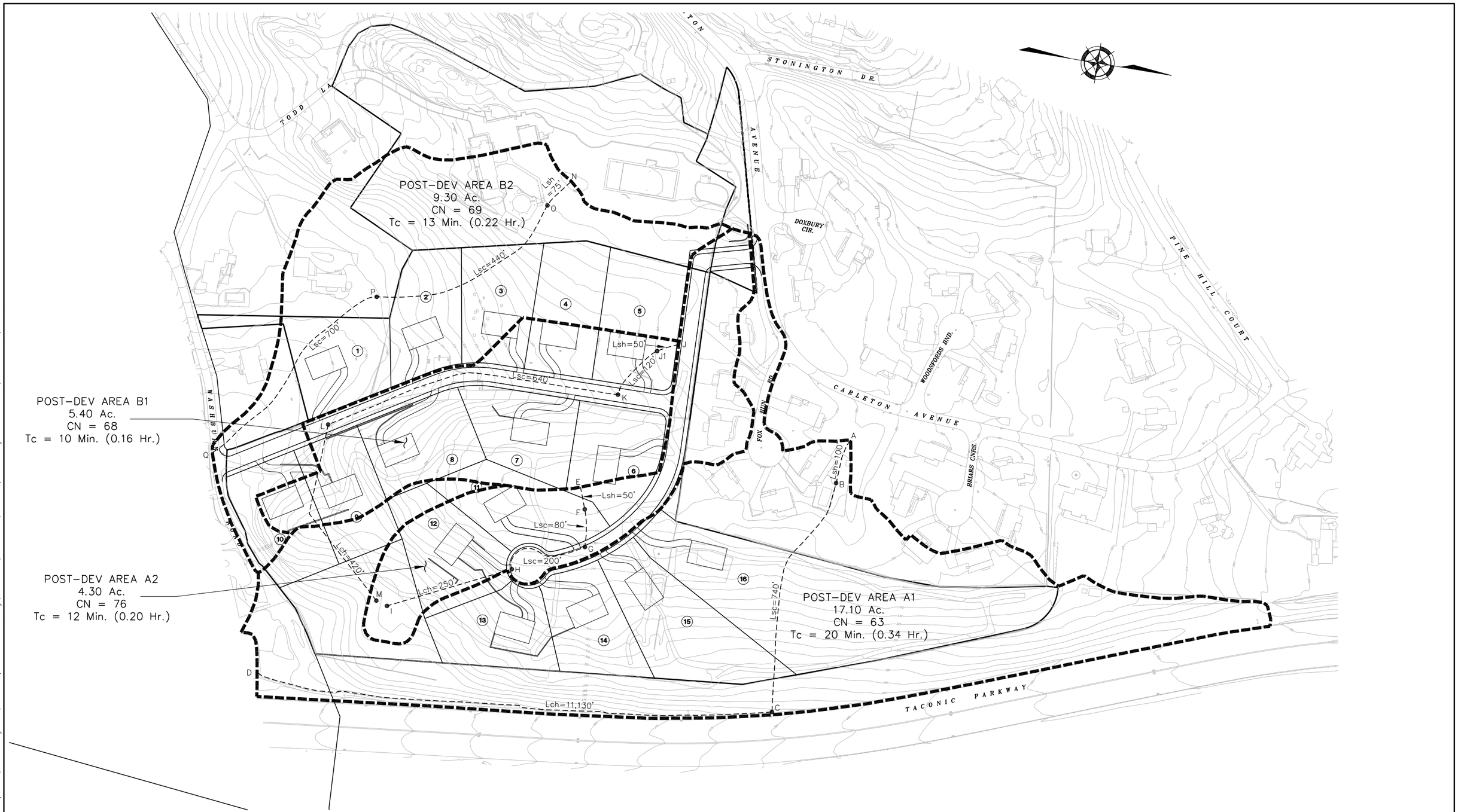


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**FIGURE 3: POST-DEVELOPMENT DRAINAGE AREAS CONVENTIONAL LAYOUT**

TACONIC TRACT DEVELOPMENTS, LLC
TOWN OF MOUNT PLEASANT, NY

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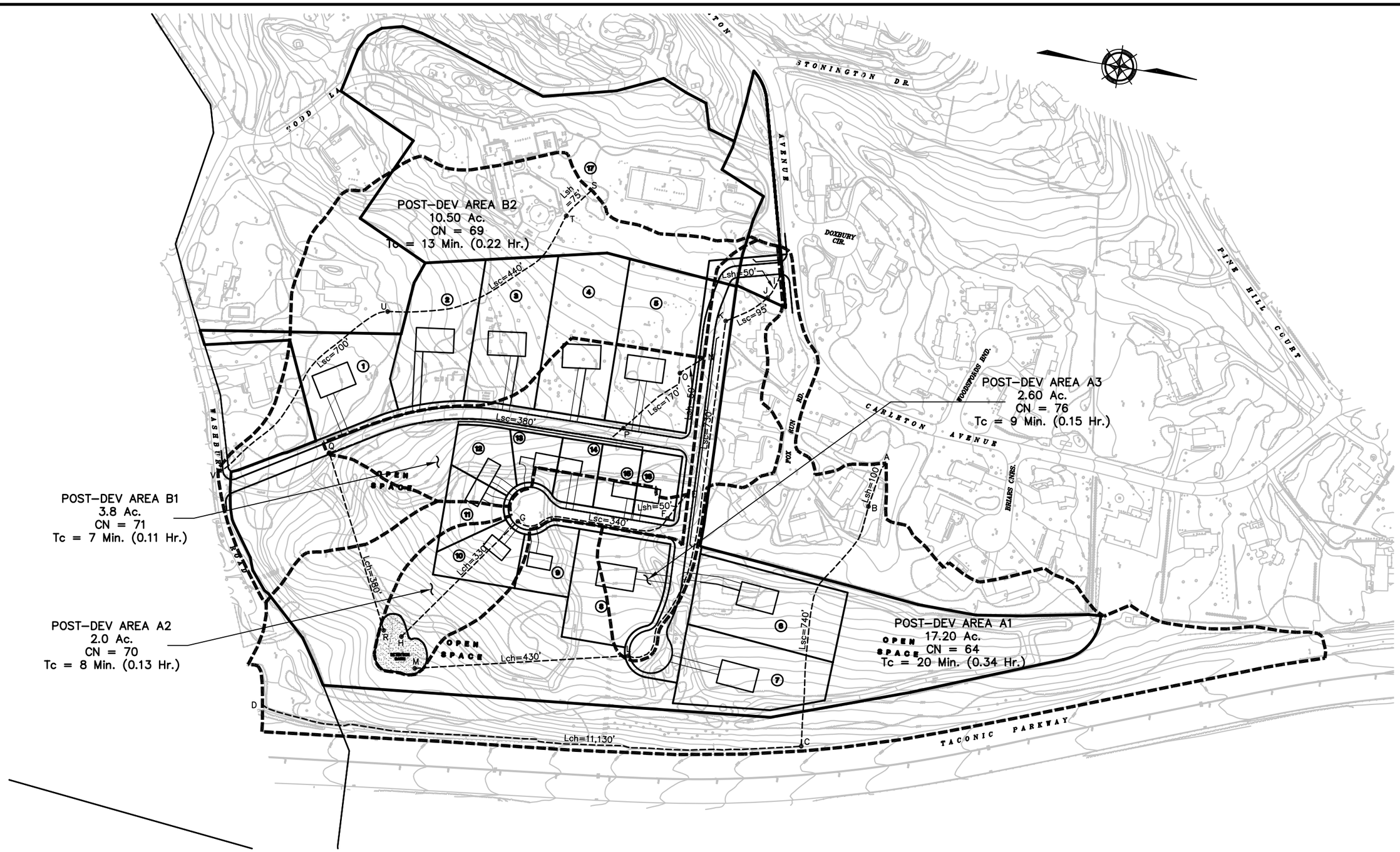


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0 100 200
SCALE

**FIGURE 4: POST-DEVELOPMENT DRAINAGE AREAS CONSERVATION LAYOUT**

TACONIC TRACT DEVELOPMENTS, LLC
TOWN OF MOUNT PLEASANT, NY

SOURCE: WSP SELLS AUGUST 2009

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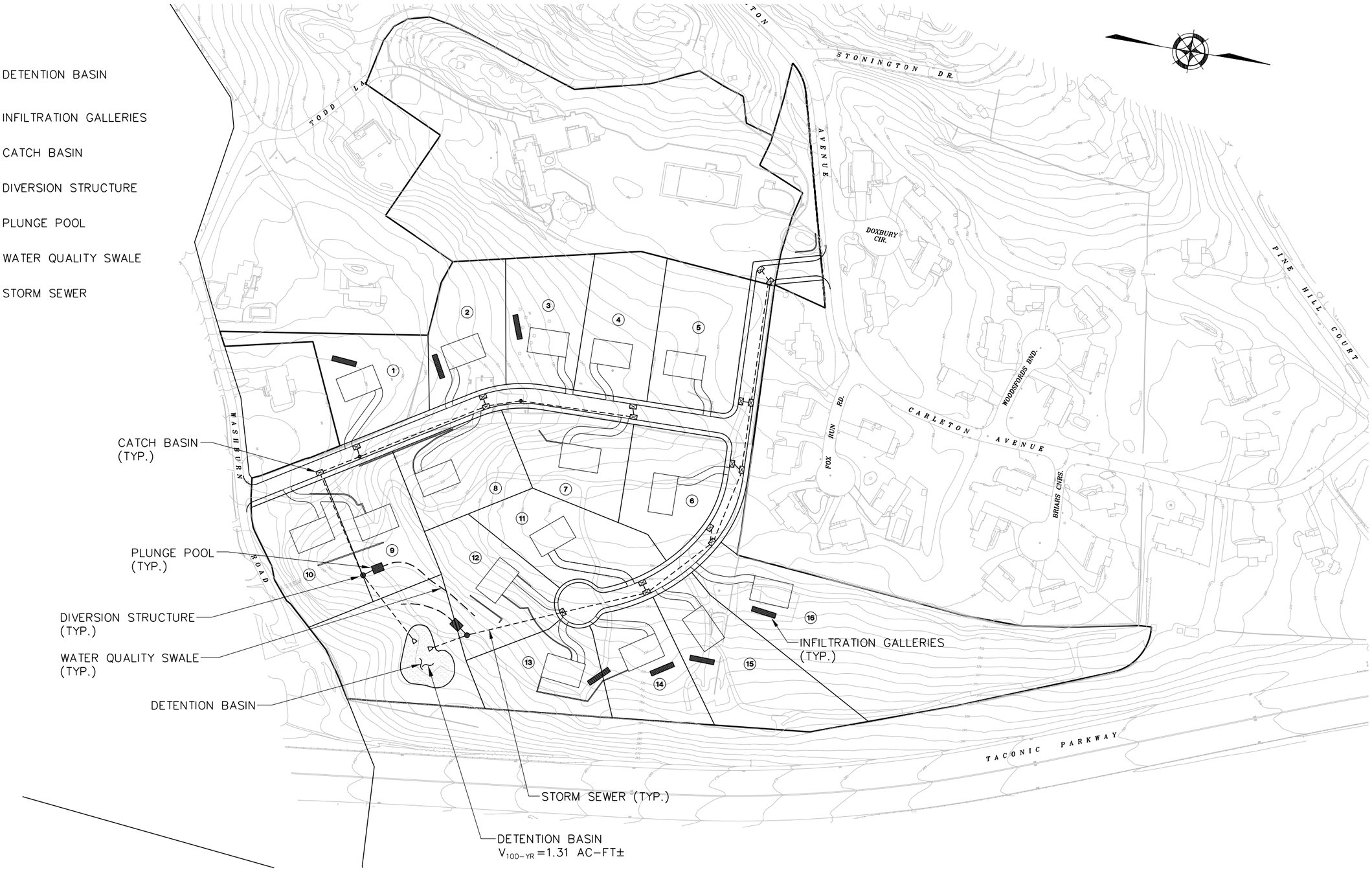


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SCALE

**FIGURE 5: PROPOSED DRAINAGE FACILITIES CONVENTIONAL LAYOUT**

TACONIC TRACT DEVELOPMENTS, LLC
TOWN OF MOUNT PLEASANT, NY

SOURCE: WSP SELLS AUGUST 2009

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**FIGURE 6: PROPOSED DRAINAGE FACILITIES CONSERVATION LAYOUT**

TACONIC TRACT DEVELOPMENTS, LLC
TOWN OF MOUNT PLEASANT, NY

SOURCE: WSP SELLS AUGUST 2009

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