TERRADYN
CONSULTANTS, LLC
Civil Engineering - Land Planning - Stormwater Design - Environmental Permitting

1636

March 31, 2017

Mr. Ben Smith, AICP, Planning Director
Town of Windham
Planning Department
8 School Road
Windham, ME 04062

**Preliminary Subdivision & Site Plan Application Additional Materials: Highland Views Manufactured Housing Park & Mixed Use Development**

On behalf of Chase Custom Homes & Finance, we are pleased to submit revised plans and information in support of the Preliminary Subdivision & Site Plan Applications for the Highland Views project – a 24 unit manufactured home park and 10 mixed development units. The mixed development units consist of self-storage units on the ground floor with apartments located above. As a reminder, the development parcel is located on the north side of Route 302 at 19 Roosevelt Trail, just west of the Town of Windham/Town of Falmouth & Town of Windham/City of Westbrook town lines. The property is shown as lots #63 & 66 on the Town of Windham Tax Map #7. The 38.3 acre property is located within the Commercial 3 Zone (C-3). Approximately 15 acres of the site is located within the Manufactured Housing Park Overlay Zone (MHPO). The standard net residential density for the C3 Zone is 1 lot or unit per 60,000 SF. The net residential area calculation shows that the area outside of the MHPO Zone can support 10 units. The area within the MHPO Zone is located approximately 300' from the Route 302 property line. The MHPO Zone allows homes to be constructed at a density of 1 home per every 20,000 SF when served by a shared septic system. Manufactured Home Park roads have a minimum right of way width of 23' with a minimum road surface width of 20'. They must have a 50' buffer around the perimeter when abutting residential property. Half of the buffer width must be landscaped.

The Planning Board reviewed the Preliminary Plan application at the January 9, 2017 meeting. We also held a site walk with the Board and abutters on November 12, 2016. Since that time, we have worked with Town staff to solve all of the technical issues. Attached to this cover letter, you will find two rounds of comments & responses with the town engineer. A public hearing was held on the 9th but the meeting was improperly noticed so the board decided to hold another public hearing at our next meeting date.

The plan is generally the same as the one presented at the previous meeting other than some small technical changes brought about the Town review of the project. At the suggestion of the planning board, we examined the intersection of Bailey's Way to ensure that modular home delivery vehicles could negotiate the turn. As a result, we significantly increased the radii at the entrance of Bailey's Way.

The site will be served by public water, a common subsurface septic system and underground power. A water main is located within the Route 302 right of way and it feeds a hydrant that is located right in front of the site. Portland Water District have signed off of our water design and provide us with an ability to serve letter. A new fire hydrant will be constructed at the intersection

of the internal park roads in the location requested by the Fire Chief at the Staff Review Meeting. An engineered septic system will be needed due to the estimated flow. We previously provided a hydrogeologic assessment of the septic system and have attached an updated study that included additional information requested by the town engineer.

Detailed stormwater calculations have been provided that show that the Town's water quantity and quality stormwater regulations are being met by the combination of a gravel wetland, an underdrained filter basin, forested buffers, rain gardens and roof drain filters. We prepared phosphorus export calculations as required by MDEP regulations. The project does not exceed its phosphorus budget due to the extensive use of a variety of BMPs. We have previously provided some introductory literature about gravel wetlands that was produced by the Univerisity of New Hampshire Stormwater Center, per request of the Board.

We have provided an updated Traffic Analysis that was prepared by Traffic Solutions and includes revisions requested by the town engineer. The entrance of the development will be aligned with Land of Nod Road. The sight distance exceeds the required amount.

We presented a building elevations and discussed the adherence to the Commercial District Design Standards. The board members expressed their collective belief that the building elevations, landscaping & lighting met the design standards.

We met with representatives of the Highland Lake Watershed Association in-mid January and presented the project to the president, vice president & a member who was a professional civil/environmental engineer. We talked about the stormwater system in depth. I explained the different BMPs, how they generally worked and the maintenance & inspection guidelines for each. I explained the Manufactured Park Overlay regulations and how our design was significantly below the allowable number of lots. At the end of the meeting, the members expressed a general sentiment that the stormwater and engineering of the project was completed to an appropriate level. Their main concern was the access to Highland Lake that was located on the Falmouth portion of the property. They were concerned that the project would result in an expanded beach area, lake side parking area or dredging of the lake. I explained that although no work has been proposed for the Falmouth parcel, the applicant simply wanted to preserve his rights to the access. It was my belief that dredging of the lake would not be permit-able by the MDEP in this location. Any sort of lake front development would need to go through the planning board process in Falmouth and a land owner's ability to develop within the shoreland zone is extremely limited. I further explained that any sort of development of the Falmouth parcel would be extremely difficult & unlikely due to a large significant wetland system that encumbers most of the Falmouth property. The wetland has its own non-disturbance buffer surrounding it. I left a complete set of plans & stormwater calculations with their engineer. He reviewed the material and provided us with some basic comments that I subsequently responded to.

We are requesting a waiver of the High Intensity Soil Survey. This items was discussed at the previous sketch plan & the initial preliminary plan presentation. The board generally spoke in favor of granting the waiver. The town engineer has suggested that the waiver request is reasonable. This item is a requirement of the Preliminary Subdivision Application. High Intensity Soil Surveys provide information related to the septic suitability of the soils. They can also be used to identify the runoff characteristics of the existing watershed soils, but are usually only required for large developments. The available Medium Intensity Soil Survey will be used for the

basis of the existing soil conditions for the stormwater calculations. A licensed site evaluator will provide test pits in the proposed septic disposal areas that will be used to design the systems. A High Intensity Soil Survey would not add any valuable information to the design of the project. Therefore, we ask the board to grant a waiver.

The following items previously submitted as required by the Preliminary Subdivision & Site Plan Application procedures:

- Preliminary Major Subdivision Application
- Major Site Plan Application
- Preliminary Subdivision Application Fee ($5,500)
- Review Escrow Fee ($4,000)
- Property Deeds
- Certificate of Good Standing
- Hydrogeologic Assessment
- Traffic Analysis
- Stormwater Report
- Commercial District Design Standards
- Gravel Wetland Literature
- Building Elevations
- Cost Estimate & Proof of Financial Capacity to be submitted under separate cover

The following items are attached as required by the Preliminary Subdivision & Site Plan Application procedures:

- Attachment A: Waiver Request Form
- Attachment B: Comment Response to Town Engineer from February 2017 that includes
    - Ability to serve letter from PWD
    - An AutoTURN exhibit that shows a fire truck turning movement around the cul-de-sac.
    - Amended traffic study
    - Amended Hydrogeological Assessment
    - Highland Views Stormwater Report

- Attachment C: Comment Response to Town Engineer from March 2017

We are hopeful that this application can be placed on the agenda for the April 24, 2017 Planning Board Meeting. Thank you for your consideration, and please call me if you have any questions as you review the enclosed plans and information.

Prepared by,
Terradyn Consultants, LLC

Jeffrey D. Amos, P.E.

# TOWN OF WINDHAM
# SUBDIVISION & SITE PLAN APPLICATION

## Performance and Design Standards Waiver Request Form

**(Section 808 – Site Plan Review, Waivers)**
**(Section 908 – Subdivision Review, Waivers)**

For each waiver request from the Performance and Design Standards detailed in Section 811 or Section 911 of the Town of Windham Land Use Ordinance, as applicable, please submit a separate completed copy of this waiver request form.

**Subdivision or Project Name:** Highland Views

**Tax Map:** 7 **Lot:** 63 & 66

**Waivers are requested from the following Performance and Design Standards (add rows as necessary):**

| Ordinance Section | Standard | Mark which waiver this form is for |
|---|---|---|
| 910.C.1.c.1 | High Intensity Soil Survey | |
| | | |
| | | |
| | | |
| | | |

a. Describe how a waiver from the standard indicated above will improve the ability of the project to take the property's pre-development natural features into consideration. Natural features include, but are not limited to, topography, location of water bodies, location of unique or valuable natural resources, relation to abutting properties or land uses. Attach a separate sheet if necessary.

A high intensity soil survey will not provide any information that will be used for this project. Stormwater Calculations will make use of the available medium intensity soil surveys for watershed analysis. All buffer soil types will be verified with test pit information. All storm-water ponds are designed using test pit datas. The soils in the septic area will be evaluated by a licensed site evaluator.

(continued next page)

Ordinance Section: _____

b. Will the waiver have an impact on any of the following criteria?

| | Yes | No |
|---|---|---|
| Water or air pollution | | x |
| Light pollution or glare | | x |
| Water supply | | x |
| Soil erosion | | x |
| Traffic congestion or safety | | x |
| Pedestrian safety or access | | x |
| Supply of parking | | x |
| Sewage disposal capacity | | x |
| Solid waste disposal capacity | | x |
| Scenic or natural beauty, aesthetics, historic sites, or rare or irreplaceable natural areas | | x |
| Flooding or drainage issues on abutting properties | | x |
| The Town's ability to provide the subdivision with public safety services (if subdivision) | | x |

If granting the waiver will result in an impact on any of the criteria above, please provide more detail below.

TERRADYN
CONSULTANTS, LLC
Civil Engineering - Land Planning - Stormwater Design - Environmental Permitting

February 7, 2017

Town of Windham
C/O Mr. Jonathan R. Earle, P.E.
8 School Road
Windham, ME 04069

**Subject: Comment Response – Highland Views**

Mr. Earle:

In response to the recent review provided by Jonathan R. Earle, Town Engineer for Windham, regarding the geology and stormwater review of the Highland Views project, we would like to offer the following responses:

**Jonathan R. Earle Comments & Responses:**

Comment 1: Water Supply. As noted in the cover letter, and ability to serve letter is needed from the Portland Water District. Will the water main extension into the development be a public or private main? If private, the maintenance of the proposed hydrant at the intersection of the internal park roads (including snow removal) would be the responsibility of the property owner.

*Response: The Portland Water District has provided an ability to serve letter (see attached letter). The internal water distribution system (including the hydrants) will be private. Maintenance of the system will be the responsibility of the property owner.*

Comment 2: Hydrogeologic Assessment. The analysis provided is for the 24 manufactured house lots and does not include wastewater generated from the 10 apartments to be located above the self-storage units. The applicant should verify that inclusion of the 10 apartment units meets the requirements of site plan & subdivision ordinances.

*Response: Mark Cenci has provided an updated assessment that includes the apartment complex septic systems.*

Comment 3: Hydrogeologic Assessment. An site plan with contour information showing the reduction of nitrate/nitrogen in the plume from the centralized subsurface wastewater disposal field should be included as part of the hydrogeologic analysis as specified in section 910 of the Subdivision Ordinance *"An analysis and evaluation of the effect of the subdivision on groundwater resources. In the case of residential developments, the evaluation shall, at a minimum, include a projection of post development nitrate/nitrogen concentrations at any wells within the subdivision, or at the subdivision boundaries; or at a distance of 1,000 feet from potential contamination sources, whichever is a shortest distance."*

*Response:* *The nitrate plumes have been added to the utility plan (C-4.0).*

Comment 4: Traffic. Trip generation for the proposed 10 warehouse units was 0.14 trips/unit (AM) and 0.26 trips/unit (PM). These trip factors were based on each 1,000 SF of storage space. The square footage for each unit ranges between 582 SF and 590 SF, well below 1,000 SF/unit. The trip generation for the warehouse units should be corrected to accurately reflect the proposed condition and will still remain below the 50 trips/hour threshold for a traffic impact study.

*Response:* *Bill Bray, P.E. has revised his study to address the above comment. See attached.*

Comment 5: Traffic. The site distances (looking both right and left) are noted exceed 640' in both direction. This information should be added to the approved subdivision plan.

*Response:* *The site distances have been added to the Subdivision Plan C-1.0*

Comment 6: Traffic. Additional information need to be provided indicating the number of bedrooms in the apartments above the self-storage units to verify the site's parking requirements were met.

*Response:* *Section 812.C.2.Table 2 shows that multifamily units with two or more bedrooms require 2 spaces per unit. The 10 units require 20 spaces. It also shows that public warehousing needs at least 0.25 spaces per k.s.f. The storage units feature 5.9 k.s.f. requiring 1.5 spaces. The driveway to each storage unit is at least 18' x 10', effectively bringing the total number of available parking spaces to 30. A sign will be placed on the storage unit that indicates that the driveway is only for the use of the self-storage patrons.*

Comment 7: Traffic. Per the previous comment from Deputy Fire Chief John Wescott, verify that the a fire truck with a 14' ladder can make the turn off Route 302 and maneuver the site's cul-de-sac(s).

*Response:* *The cul-de-sacs meet town road standards. We used AUTOTURN software to analyze the turning movement. The largest ladder truck in their vehicle library (44' long ladder truck) is able to make the turn.*

Comment 8: Stormwater. The site results in the disturbance of greater than 1 AC and is with the NPDES MS4 urbanized area. As such, the application needs to demonstrate compliance with the Town of Windham Post Construction Stormwater Ordinance (Chapter 144).

*Response:* *We have provided the maintenance & inspection documents as part of the updated stormwater report and have designed MDEP approved BMPs as part of the design.*

Comment 9: Stormwater. As previously noted in the staff memo dated November 9, 2016, a DEP stormwater permit will be required as part of the final plan. A construction general permit will also be required prior to any soil disturbing activities.

*Response: We have submitted a MDEP Stormwater Permit that includes the erosion & sedimentation control design. I don't believe that an additional construction general permit is required.*

Comment 10: Stormwater. Worksheet 1 (Project Phosphorous Export) – Calculations submitted indicate post-treatment phosphorous export will be reduced to below predevelopment levels. However, the sheet indicates that there will need to be a negative compensation fee paid as part of the project. The worksheet should be revised to indicate that no compensation fee will be required for the project.

*Response: The worksheet has been corrected.*

Comment 11: Stormwater. Pre-development and post-development watershed plans were not included in the submission. As such, a review of the stormwater quantity calculations was not included in this review.

*Response: We have provided you with a copy of the latest stormwater quantity calculations.*

Comment 12: Solid Waste. The site plan shows a dumpster enclosure located near the 10 apartment units. Will this dumpster enclosure be utilized by the 24 manufactured housing lots as well?

*Response: The dumpster will only serve the apartments & self-storage facility. The manufactured housing park will contract with a private waste hauler that provides curbside pickup.*

Comment 13: Plans. Sheet C-1.0 – Proposed monument locations should be shown in addition to the general note provided on C-1.1.

*Response: Granite monuments & iron pins have been added to the subdivision plans.*

Comment 14: Plans. Sheet C-1.0 – Do the wetland impacts shown on the plan (1,985 SF) include the wetlands located in the building envelopes for lots 23 & 24?

*Response: We have revised the plan to square off wetland impacts on lots 23 & 24. This will make it easier for both the homeowner and the town to understand the limits of fill.*

Comment 15: Plans. Sheet C-3.0 – Is the footprint shown below (south) of the primary septic system the area to be set aside for system failure? If so, it should be labelled accordingly.

*Response: We have labeled the backup septic system location on the Site, Grading & Utility plans.*

Comment 16: Plans. Sheet C-3.0 – Provide a drainage schedule/table for the drainage & sewer structures, or label each individually on the plan.

*Response: The stormwater structures are labeled on both C-3.0 & C-6.0. The sewer structures are labeled on both C-4.0 & C-6.0.*

Comment 17: Plans. Sheet C-5.0 – Demolition notes reference the City of Westbrook and should be revised.

*Response: The Demolition Plan notes have been corrected.*

Comment 18: Plans. Sheet C-7.5 – Detail is labelled as storm drain manhole only. Provide additional detail or label as sanitary sewer manhole.

*Response: A sewer manhole detail is shown on Sheet C-7.3.*

Comment 19: Plans. Provide details for a stop sign and sanitary sewer pump station.

*Response: A stop sign detail has been added to sheet C-7.1. The sewer pump station detail is shown on sheet C-7.3.*

Comment 20: Waiver Request. The cover letter narrative indicates that the applicant will be requesting a waiver of the High Intensity Soil Survey. Based on the information provided and the comments above related to hydrogeologic assessment, the request for this project is reasonable. A waiver request checklist was not included and needs to be provided.

*Response: Comment acknowledged*

We hope that these responses addresses your concerns. Please contact me directly with additional questions or concerns.

Sincerely,
Terradyn Consultants, LLC

Jeffrey D. Amos, P.E.

Portland Water District
FROM SEBAGO LAKE TO CASCO BAY

January 5, 2017

Jeff Amos
Terradyn Consultants, LLC
P.O. Box 339
New Gloucester, ME 04260

Re: 19 Roosevelt Trail, WI
Ability to Serve with PWD Water

Dear Mr. Amos:

The Portland Water District has received your request for an Ability to Serve Determination for the noted site submitted on November 18, 2016. Based on the information provided per plans dated 1/5/17, we can confirm that the District will be able to serve the proposed project as further described in this letter. **Please note that this letter does not constitute approval of this project from the District. Review and approval of final plans is required.**

Conditions of Service

The following conditions of service apply:

- A new 8-inch combined service may be installed from the water main in Roosevelt Trail. The service should enter through the properties frontage on Roosevelt Trail at least 10-feet from any side property lines.

- Since the length of this service line will exceed 300-feet, a fireline meter pit will be required. The meter pit should be located on private property within 10-20 feet of the property line at Roosevelt Trail. Please note that only one meter and one bill will be associated to each domestic service line. This one master meter would be located in a common space that all tenants could gain access to if necessary.

- The existing services(SV33NW1133 and SVNW1134) will no longer be used as a result of the development and they must be retired per PWD standards. This includes shutting the corporation valve and cutting the pipe from the water main.

- Water District approval of water infrastructure plans will be required for the project prior to construction. As your project progresses, we advise that you submit any preliminary design plans to MEANS for review of the water main and water service line configuration. We will work with you to ensure that the design meets our current standards.

- Once the project is ready for construction, the owner or contractor will need to make an appointment to come in and complete a service application form and pay the necessary fees.

Existing Site Service

According to District records, the project site does currently have existing water service. A 3/4-inch copper and a 2-inch copper line provide water service to this site. Please refer to the "Conditions of Service" section of this letter for requirements related to the use of these services.

Water System Characteristics

According to District records, there is an 12-inch diameter cast iron water main in Roosevelt Trail and a public fire hydrant located 75 feet from the site. The most recent static pressure reading was 75 psi on May 3, 2016.

Public Fire Protection

The installation of new public hydrants to be accepted into the District water system will most likely not be required. It is your responsibility to contact the Windham Fire Department to ensure that this project is adequately served by existing and/or proposed hydrants.

Domestic Water Needs

The data noted above indicates there should be adequate pressure and volume of water to serve the domestic water needs of your proposed project.

Private Fire Protection Water Needs

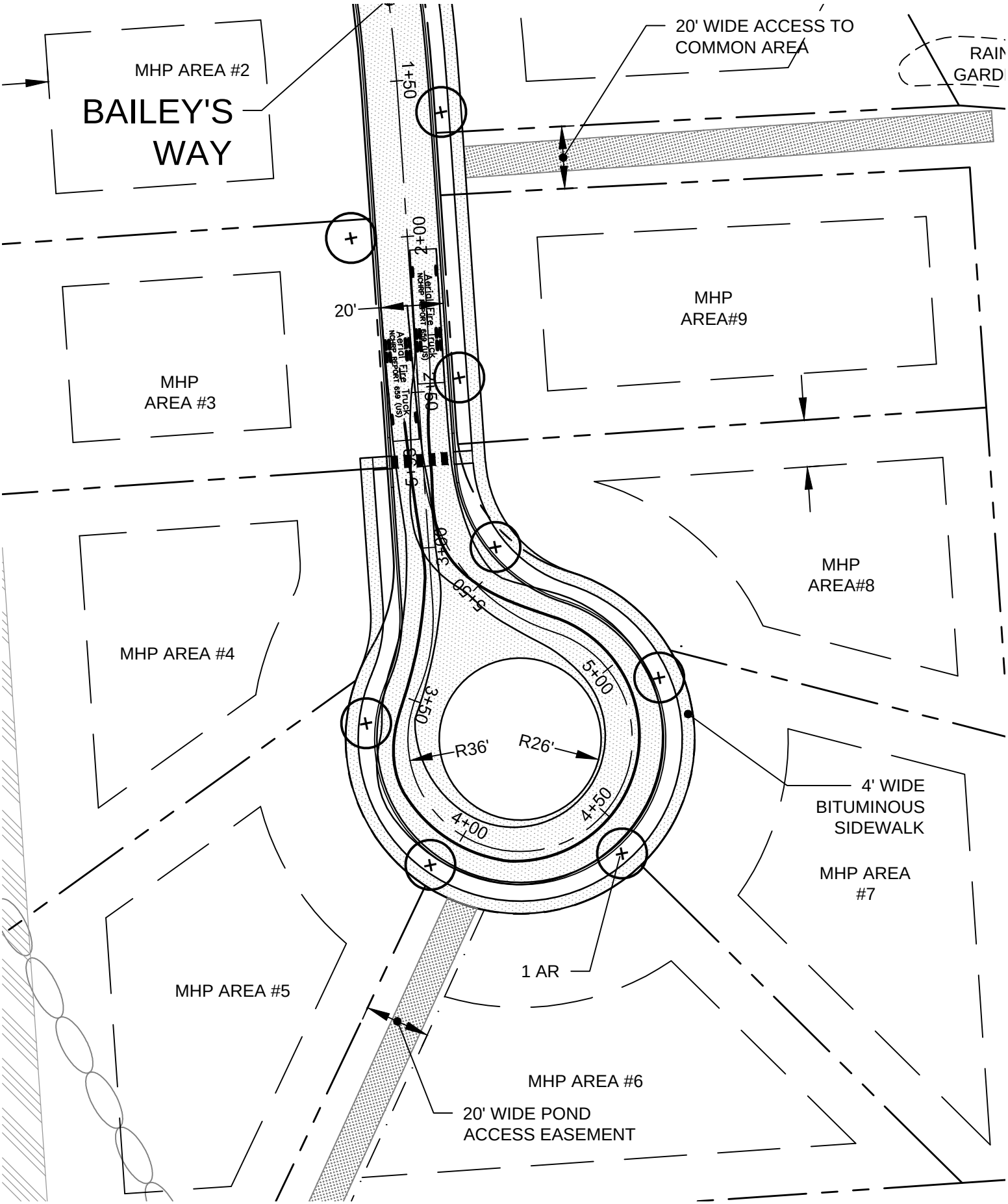
You have indicated that this project will not require water service to provide private fire protection to the site. Please note that the District does not guarantee any quantity of water or pressure through a fire protection service.

Should you disagree with this determination, you may request a review by the District's Internal Review Team. Your request for review must be in writing and state the reason for your disagreement with the determination. The request must be sent to MEANS@PWD.org or mailed to 225 Douglass Street, Portland Maine, 04104 c/o MEANS. The Internal Review Team will undertake review as requested within 2 weeks of receipt of a request for review.

If the District can be of further assistance in this matter, please let us know.

Sincerely,
Portland Water District

Gordon S. Johnson, P.E.
Engineering Services Manager


MHP AREA #2
BAILEY'S WAY
20' WIDE ACCESS TO COMMON AREA
RAIN GARDE
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
5+50
20'
Aerial Fire Truck NCHRP REPORT 659 (US)
MHP AREA#9
MHP AREA #3
MHP AREA#8
MHP AREA #4
R36'
R26'
4' WIDE BITUMINOUS SIDEWALK
MHP AREA #7
1 AR
MHP AREA #5
MHP AREA #6
20' WIDE POND ACCESS EASEMENT

**Traffic Solutions**
*William J. Bray, P.E.*
235 Bancroft Street
Portland, ME 04102
(207) 774-3603
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December 3, 2016
(Revised January 26, 2017)

Traffic Assessment
**Proposed**
# Highland Views Residential Subdivision
# Windham, Maine

## INTRODUCTION

Chase Custom Homes & Finance are proposing a residential subdivision with 24 single-family house lots, 10 market rate apartments, and 10 self storage units on a parcel of property located on Route 302 in the Town of Windham near the Westbrook City Line. Access to the property will be provided with construction a "*new*" roadway intersecting U.S. Route 302 opposite Land of Nod Road.

This document determines peak hour trip generation of the proposed project during both peak commuter time periods; examines current roadway safety trends in the general vicinity of the proposed project, and conducts a review of vehicle sight distance at the proposed street entrance on U.S. Route 302.

## SITE TRAFFIC

**Site Trip Generation:** Trip generation was determined for the proposed project based upon trip tables presented in the ninth edition of the Institute of Transportation Engineers (ITE) "**TRIP GENERATION**" handbook. The following trip rates were used in that effort:

**Land-Use Code #151 – Mini Warehouse (Total of 6,000 sf of Combined Gross Floor Area)**
*Street Peak Hour – AM Peak* = *0.14 trips/1000sf gross floor area*
*Street Peak Hour – PM Peak* = *0.26 trips/1000sf gross floor area*

**Land-Use Code #210 – Single-Family Detached Housing (24 Homes)**
*Street Peak Hour – AM Peak* = *0.75 trips/dwelling unit*
*Street Peak Hour – PM Peak* = *1.00 trips/dwelling unit*

**Land-Use Code #220 – Apartment (10 Market Rate Apartments)**
*Street Peak Hour – AM Peak* = *0.51 trips/dwelling unit*
*Street Peak Hour – PM Peak* = *0.62 trips/dwelling unit*

Table 1, as follows, summarizes the projected peak hour trip generation of the proposed project:

**Table 1**
**Peak Hour Trips Generation**
**Summary**

| Proposed Use | Number of Units | AM Peak Hour Trip Generation | | PM Peak Hour Trip Generation | |
|---|---|---|---|---|---|
| | | Trip Rate | Trips | Trip Rate | Trips |
| Self-Storage Units | 6,000sf gross floor area | 0.14 trips/1000sf | 1 trip | 0.26 trips/1000sf | 2 trips |
| | | | | | |
| Single-Family Home | 24 lots | 0.75 trips/lot | 18 trips | 1.00 trip/lot | 24 trips |
| | | | | | |
| Apartment | 10 units | 0.51 trips/unit | 5 trips | 0.62 trips/unit | 6 trips |
| | | | | | |
| TOTAL | | | 24 trips | | 32 trips |

The proposed residential subdivision can be expected to generate a total of **24** vehicle trips in the "*morning*" peak hour and **32** trips during the "*evening*" peak hour.

## EXISTING SAFETY CONDITIONS

The Maine Department of Transportation's (MaineDOT) Accident Records Section provided the latest three-year (2013 through 2015) crash data for the section of U.S. Route 302 between the Westbrook City Line and Pope Road, a distance of approximately 0.85 miles. Their report is summarized as follows and attached as an appendix to the report:

**2013 -2015 Traffic Accident Summary**

| Location | Total Crashes | Critical Rate Factor |
|---|---|---|
| 1. U.S. Route 302 @ Vance Drive | 2 | 0.39 |
| 2. U.S. Route 302 @ Land of Nod Road | 2 | 0.39 |
| 3. U.S. Route 302 @ Percy Hawkes Road | 1 | 0.18 |
| 4. U.S. Route 302 @ Haven Road | 1 | 0.18 |
| 5. U.S. Route 302 @ Pope Road | 1 | 0.18 |
| 6. U.S. Route 302 btw Westbrook TL and Vance Dr. | 1 | 0.12 |
| 7. U.S. Route 302 btw Vance Dr. and Land of Nod Rd. | 4 | 0.70 |
| 8. U.S. Route 302 btw Land of Nod Rd. and Percy Hawkes Rd. | 6 | 0.40 |
| 9. U.S. Route 302 btw Percy Hawkes Rd. and Haven Rd. | 4 | 0.35 |
| 10. U.S. Route 302 btw Haven Rd. and Pope Rd. | 2 | 0.21 |

The MaineDOT considers any roadway intersection or segment a high crash location if both of the following criteria are met:

- ***8 or more accidents***
- ***A Critical Rate Factor greater than 1.00***

As the data presented in the table shows, the incidence of traffic crashes occurring on each of the noted roadway segments and intersections are below MaineDOT's threshold criteria for identification of a high crash location.

## SIGHT DISTANCE

The Maine Department of Transportation's Highway Entrance and Driveway Rules require the following sight distances for a Retrograde/Mobility roadway:

**Sight Distance Standards**

| Speed Limit | Sight Distance |
|---|---|
| 25 mph | Not Applicable |
| 30 | Not Applicable |
| 35 | Not Applicable |
| 40 | 580 feet |
| 45 | 710 feet |
| 50 | 840 feet |
| 55 | 990 feet |

U.S. Route 302 is currently posted at 40mph across the frontage of the proposed project site, which requires an unobstructed sightline of 580 feet. Sight distance *"looking"* both right and left from the proposed street entrance on U.S. Route 302 exceeds 640 feet in both directions.

## CONCLUSIONS

- The proposed residential subdivision project can be expected to generate 24 trips in the morning peak hour and 32 trips during the afternoon peak commuter hour.

- The Maine Department of Transportation's most recent three-year (2013 to 2015) accident safety report, for the section of U.S. Route 302 between Pope Road and the Westbrook City Line, a distance of roughly 0.85 miles, shows the frequency of traffic crashes for all roadway intersections and segments is less than MaineDOT's threshold criteria for identification of a high crash location.

- Sightline measurements (640 feet plus) recorded at the centerline of the proposed street entrance with U.S. Route 302 exceed MaineDOT's Mobility Highway standard (580 feet) for a posted speed limit of 40mph, which reflects the current posted speed limit of U.S. Route 302 along the frontage of the proposed project site.

- A MaineDOT Highway entrance permit will be required for the proposed street entrance onto U.S. Route 302.

Mark Cenci
Geologic, Inc.

CERTIFIED GEOLOGIST/LICENSED SITE EVALUATOR

93 Mill Road • North Yarmouth, Maine 04097
Cell: 207.329.3524 • mark@markcenci.com
www.markcenci.com

# Addendum to the Hydrogeologic Assessment of the Proposed Highland Views Manufactured Housing Park Roosevelt Trail, Windham

**Date:** February 8, 2017

**Purpose of the Assessment:**

The purpose of this assessment is to predict the location and possible effects of wastewater plumes on ground water from two septic systems serving apartment buildings, not studied in the December 16, 2016 assessment, in order to meet the requirements of the Town of Windham Subdivision Ordinance.

Section 911.H. 1.b. of the Windham Subdivision Ordinance, Impact on Ground Water Quality or Quantity, stipulates, in part:

*No subdivision shall increase any contaminant concentration in the ground water at any ...project boundary to more than the Primary Drinking Water Standards. No subdivision shall increase any contaminant concentration in the ground water at said locations to more than the Secondary Drinking Water Standards.*

**Summary:**

The proposed wastewater disposal systems satisfy the Windham Subdivision Ordinance.

**Information used:**

Information used in this study includes library research of published literature, a plan of the project by Terradyn Consultants, soil test pit information by Mark Cenci Geologic, Inc. and a wetland delineation and analysis by Mark Cenci Geologic, Inc.

**Project summary:**

The two systems will serve two apartment buildings; each with 15 bedrooms. Wastewater disposal will be by on-site subsurface wastewater disposal systems. Water will be provided by the Portland Water District. Because no ground water will be withdrawn from the property, the requirements of the Ordinance regarding ground water quantity are met.

The wastewater disposal areas will each have a design flow of 1,350 gallons per day. The disposal areas will be Eljen Indrain systems comprised of 75 units. It will be constructed in an array of 5 rows of 15 units and will be 19' x 60' in size.

**Summary of geology:**

The site is located on the lower, easterly facing slopes of a northerly trending ridge between Milliken Hill and Jones Hill (see Figure 1 of 12/16/16 assessment). The average surface slope across the property is 4%. Drainage is easterly and southeasterly to Highland Lake via wetlands associated with the lake.

Michael J. Ratelle depicts the surficial geology of the area as glacial till on the *Surficial Geology of the Cumberland Center Quadrangle, Maine* (see Figure 2 of 12/16/16 assessment).

The site is not mapped as a significant surficial aquifer by Craig D. Neil on the *Significant Sand and Gravel Aquifers of the Cumberland Center Quadrangle, Maine*.

Wetlands are mapped on the site on the *National Wetlands Inventory* (see attached photomap of 12/16/16 assessment). The wetlands are classified as Palustrine forested and scrub-shrub. This mapping agrees with on-site wetlands delineation, however, there are also emergent wetlands on the site.

The site is depicted as an association of Paxton very stony fine sandy loam, Woodbridge fine sandy loam, Scantic silt loam, Ridgebury fine sandy loam and Sebago mucky peat on the *National Cooperative Soil Survey* (see attached photomap and descriptions of 12/16/16 assessment). This mapping generally agrees with the published surficial geology and wetland mapping, in addition to on-site soil testing.

**Hydrogeology:**

The source of ground water on this site is precipitation. Precipitation falling on this site seeps into the soil and descends until restrictive soil layers or the water table is encountered. Thereupon, the flow of ground water is down gradient toward the wetlands bordering the southwestern side of Highland Lake.

At both disposal areas the soils are medium to coarse sands. Slopes are gentle. Recharge is above average at these sites. The ground water flow directions on this property can be discerned from topography.

An estimated hydraulic conductivity of the soil is estimated to be 40 feet per day, based on soil test pits and published geologic information. The hydraulic gradient is assumed to be 0.01 (1%), based on the surface slopes. The background concentration of nitrate-nitrogen in ground water is assumed to be minimal, as this is a wooded site.

**Impact on groundwater quality:**

Secondary Drinking Water Standards are not an issue with this project. Nitrate-nitrogen is the chemical to assess for impact on ground water. Nitrate-nitrogen is generated by subsurface wastewater disposal systems. It is a conservative contaminant, meaning it does not readily degrade in ground water, nor does it attenuate or attach itself to soil particles. Nitrate-nitrogen is limited to 10 mg/liter in public drinking water supplies by the Primary Drinking Water Standard. The accepted practice for the analysis of impacts on ground water quality is to estimate the concentration of NO3-N in ground water at the downgradient property line of the project.

The analysis of nitrate-nitrogen impacts was calculated by SOLUTRANS, a 32-bit Windows program for modeling three-dimensional solute transport written by Dr. Charles R. Fitts of Fitts Geosolutions and the University of Southern Maine. The program is based on the analytical solutions of Liej *et. al.* (1991 and 1993). The solutions in SOLUTRANS all assume a uniform one-dimensional flow field, and allow three-dimensional dispersion, retardation and first-order decay. The model is not a dilution/mass balance model, so the requirement that drought conditions be assumed is met.

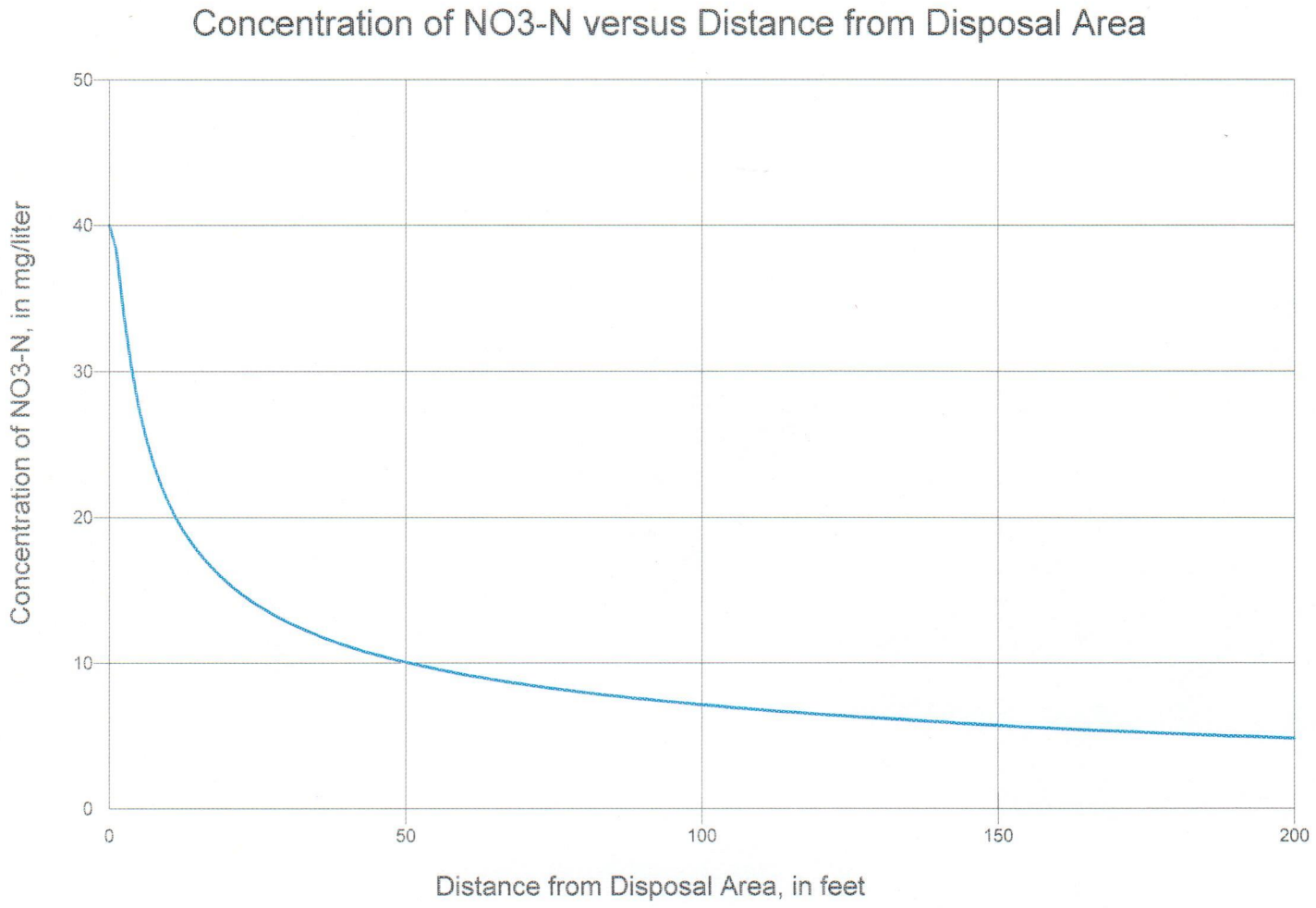
Variables entered into the calculations that are site specific include an estimated seepage velocity of 1.6 feet per day, and a hydraulic gradient of 1%. Other assumed variables include a porosity of 30%, an initial wastewater concentration of 40 mg/liter NO3-N, retardation of 1, a decay constant of zero and longitudinal, lateral and vertical dispersivities of 9 feet, 3 feet and 0.3 foot respectively.

Calculations were made and reveal the 10 mg/liter NO3-N plume will be approximately 50 feet in length. A plot of the concentration versus distance curve is enclosed. Using the inferred ground water flow direction, the calculated 10 mg/liter NO3-N isocon lines were drawn on the plan of the project by Mark Cenci Geologic, Inc. and forwarded to Terradyn Consultants. All plumes will eventually filter through wetland soils before seeping into Highland Lake.

**Conclusions:**

The proposed development of two, 15 bedroom apartments on this parcel meets the standards of the Town of Windham Subdivision Ordinance, with regard to ground water quality. Ground water quantity is not as issue, as the project is served by public water.

Mark Cenci, Certified Maine Geologist #467


Concentration of NO3-N versus Distance from Disposal Area
Concentration of NO3-N, in mg/liter
50
40
30
20
10
0
0
50
100
150
200
Distance from Disposal Area, in feet

# STORMWATER MANAGEMENT PLAN

**Highland Views**
**Windham, Maine**

The following Stormwater Management Plan has been prepared for the Highland Views Project to evaluate stormwater runoff and erosion control for the proposed 24 unit manufactured housing park and 10 unit mixed use development located at 19 Roosevelt Trail, in Windham, Maine.

## Site Calculations

| | |
|---|---|
| Total Property Area | 38.3 Ac (+/-) |
| Existing Impervious Area | 0.67 Ac |
| Re-Development Area | 0.39 Ac |
| Total Project Impervious Area | 3.37 Ac |
| Total New Impervious Area | 2.98 Ac |
| Total Developed Area | 8.04 Ac |

## Existing Conditions

The development parcel is located on the north side of Route 302 at 19 Roosevelt Trail, just west of the Town of Windham/Town of Falmouth & Town of Windham/City of Westbrook town lines. The site contains the remnants of an old RV campground. There are a series of paved and gravel roads that run through the site. There are numerous camp sites throughout. The site is located just upstream of Highland Lake. Highland Lake is identified as a lake watershed most at risk by the Maine DEP. A copy of the composite U.S.G.S. Quadrangle Map (North Windham) is attached to this submittal.

The developed area generally drains into a large forested wetland that lies between the site & Highland Lake. The onsite slopes are generally between 3%-5%. There is a man-made ditch that runs along the outer edge of the park that diverts offsite runoff around the developed area and to Highland Lake. The outlet of the man-made ditch and the forested wetland are modeled as Study Point #1 and Study Point #2, respectively in the attached stormwater calculations.

## Proposed Development

The applicant proposes to create a 24 unit manufactured housing park as well as a 10 unit mixed use development that will be composed of ground floor self-storage units with apartments located above.

Much of the existing development will be removed during construction.

**Flooding**

The development area is not located within an area of flood hazard according to the Federal Insurance Rate Maps 230045 0006 B, 230045 0010 B, 230054 0001 B & 230189 0030 B. See attached map.

**Modeling Assumptions**

The onsite stormwater facilities were sized utilizing the USDA Soil Conservation Service (SCS) TR-20 Runoff Simulation Model, as contained in the HydroCAD computer software program (Version 9.0). Runoff curve numbers were determined for each direct watershed by measuring the area of each hydrologic soil group within each type of land cover. Weighted curve numbers were then calculated using curve numbers for various cover types and hydrologic soil groups, assuming "good" conditions as defined in U.S Soil Conservation Service (SCS) publications. Times of concentration and travel times were determined from site topographic maps in accordance with SCS procedures. A maximum length of 150 feet was used for sheet flow.

All of the watersheds' peak runoff rates were analyzed for the 2, 10, and 25-year frequency, 24-hour duration storm events. A Type III rainfall distribution was applied to these storms. The rainfall amounts for Cumberland County are as follows:

| Storm Frequency Precipitation (in./24 hr) | |
|---|---|
| 2-year | 3.1 |
| 10-year | 4.6 |
| 25-year | 5.8 |

**Onsite Soils**

The soils were delineated from the Cumberland County Medium Intensity Soil Survey as shown on the Soil Data Viewer on the NRCS website (See attached map). The soil survey reports the watershed soils are generally hydrologic group C soils with relatively small inclusions of group B soils. We've taken the conservative approach of modeling all non-wetland soils as HSG C soils and all wetlands as HSG D. See attached map.

**Water Quantity (Flooding Standard)**

The following table summarizes the results of stormwater calculations for the design storm events for the project areas. Calculations and computer modeling sheets are provided with this report.

| Table 1 - Stormwater Runoff Summary Table<br>Pre-Development vs. Post-Development | | | | | | |
|---|---|---|---|---|---|---|
| Study Point # | 2Yr/24Hr (cfs) | | 10Yr/24Hr (cfs) | | 25Yr/24Hr (cfs) | |
| | Pre | Post | Pre | Post | Pre | Post |
| 1 | 21.2 | 20.4 | 48.1 | 48.0 | 72.1 | 72.0 |
| 2 | 9.4 | 7.3 | 21.4 | 19.9 | 32.1 | 31.8 |

As the above result table shows, the post-development flow rates for the 2, 10, and 25-year/24 hour design storm events do not exceed the pre-development conditions.

**Water Quality (Phosphorus Export Calculations)**

Best Management Practices (BMPs) will be implemented to reduce the impacts of site development on downstream water quality. The property is located in the Highland Lake Watershed. Highland Lake is identified by the MDEP as a lake most at risk from development.

Highland Lake Watershed

The allowable per acre allocation of phosphorus export for the portion of the site that is within the Highland Lake Watershed is 0.027 lbs/acre of developable land. There are approximately 38.3 developable acres within the Town of Windham that have an associated allocation of 1.034 9lbs/year of allowable phosphorus export. The applicant also owns 15.02 acres adjacent to the property within the Town of Falmouth that has an associated allocation of 0.062 lbs/year of allowable export. The total amount of allowable export is 1.10 lbs/year. Note: We spoke to Jeff Dennis of MDEP & he advised us to use the Windham allocation of 0.027 lbs/acre for the Falmouth property. Falmouth does not have an allocation and he believed that the Windham allocation would be conservative. See attached NWI Map.

A worksheet that summarizes the phosphorus export has been included in the calculations. An oversized gravel wetland, an oversized underdrained filter basin, a rain gardens, extensive use of roof drain filters and the removal of untreated existing infrastructure were used to reduce the total expected phosphorus export to 1.08 lbs/year. This value is equal to the allocated amount. Calculations have been provided detailing the water quality volume derivations for the gravel wetland.

Housekeeping and Maintenance & Inspection guidelines are attached to this report.

**BMP Sizing**

*Roof Dripline Filter Bed*

We propose to provide treatment for the rear half of the roof for each of the 24 manufactured homes. The bed is required to provide volume for 1" of runoff from the contributing area and store it within a reservoir bed. The bed sizing is as follows:

Area of Watershed: = 291 SF
Treatment Volume Required: Area x runoff depth: 291 SF x 1/12 FT = 24.25 CF
Bed Sizing:
Porosity = 40% Bed Length = 21' Bed Width = 3' Bed Depth = 1.5
Available Volume= 21' x 3' x 1.5' x 0.40 = 37.8 CF.

The design is adequate since the available volume exceeds the required volume. The filter strips meet the standard sizing criteria and will have a corresponding treatment factor of 0.4.

*Filtration Basin*

| STAGE (FT) | AREA (SF) | STORAGE (CF) |
|---|---|---|
| 205.5 | 4200 | 0 |
| 206 | 4627 | 2207 |
| 207 | 5480 | 7260 |
| 208 | 6333 | 13167 |
| 208.5 | 6760 | 16440 |

| | | |
|---|---|---|
| WATERSHED IMPERVIOUS AREA= | 31,374 | SF |
| WATERSHED LANDSCAPED AREA= | 57,272 | SF |
| REQUIRED WATER QUALITY VOLUME= | 4524 | CF (No Pre-Treatment) |
| REQUIRED WATER QUALITY VOLUME= | 7260 | CF (With Pre-Treatment) |
| TREATMENT FACTOR= | 0.25 | (0.25 Max) |

The required water quality volume was calculated by multiplying the impervious area by 1.0" and the landscaped area by 0.4".

*Gravel Wetland*

Forebay

| STAGE (FT) | AREA (SF) | STORAGE (CF) |
|---|---|---|
| 193 | 900 | 0 |
| 194 | 1300 | 1100 |
| 194.5 | 1500 | 1800 |

Cell #1

| STAGE (FT) | AREA (SF) | STORAGE (CF) |
|---|---|---|
| 193 | 4350 | 0 |
| 194 | 5117 | 4733 |
| 194.5 | 5500 | 7388 |

Cell #2

| STAGE (FT) | AREA (SF) | STORAGE (CF) |
|---|---|---|
| 193 | 5300 | 0 |
| 194 | 6033 | 5667 |
| 194.5 | 6400 | 8775 |

Total Pond

| STAGE (FT) | AREA (SF) | STORAGE (CF) |
|---|---|---|
| 193 | 10550 | 0 |
| 194 | 12450 | 11500 |
| 194.5 | 13400 | 17963 |
| 194.51 | 13800 | 17963 |
| 195 | 14046 | 24638 |
| 196 | 15773 | 39547 |
| 197 | 17500 | 56425 |

| | | |
|---|---|---|
| WATERSHED IMPERVIOUS AREA= | 89000 | SF |
| WATERSHED LANDSCAPED AREA= | 121000 | SF |
| REQUIRED WATER QUALITY VOLUME= | 11450 | CF (No Pre-Treatment) |
| REQUIRED WATER QUALITY VOLUME= | 17963 | CF (With Pre-Treatment) |
| TREATMENT FACTOR= | 0.25 | (0.25 Max) |

The required water quality volume was calculated by multiplying the impervious area by 1.0" and the landscaped area by 0.4".

*Forested Buffer with Level Lip Spreader*

The buffer contains soils that are consistent with Soil Group C sandy loam or loamy sand. *Table 6 – Sizing Requirements for a buffer with 0-8% slope and stone bermed level lip spreader* of Chapter 500 shows that standard sizing requires that the berm length for a forested buffer must be 75' per acre of impervious area and 25' per acre of lawn. Evaluation of the watershed shows that it contains the following:

Impervious area = 13,068 SF (0.30 Ac)
Lawn area = 5,000 SF (0.11 Ac)

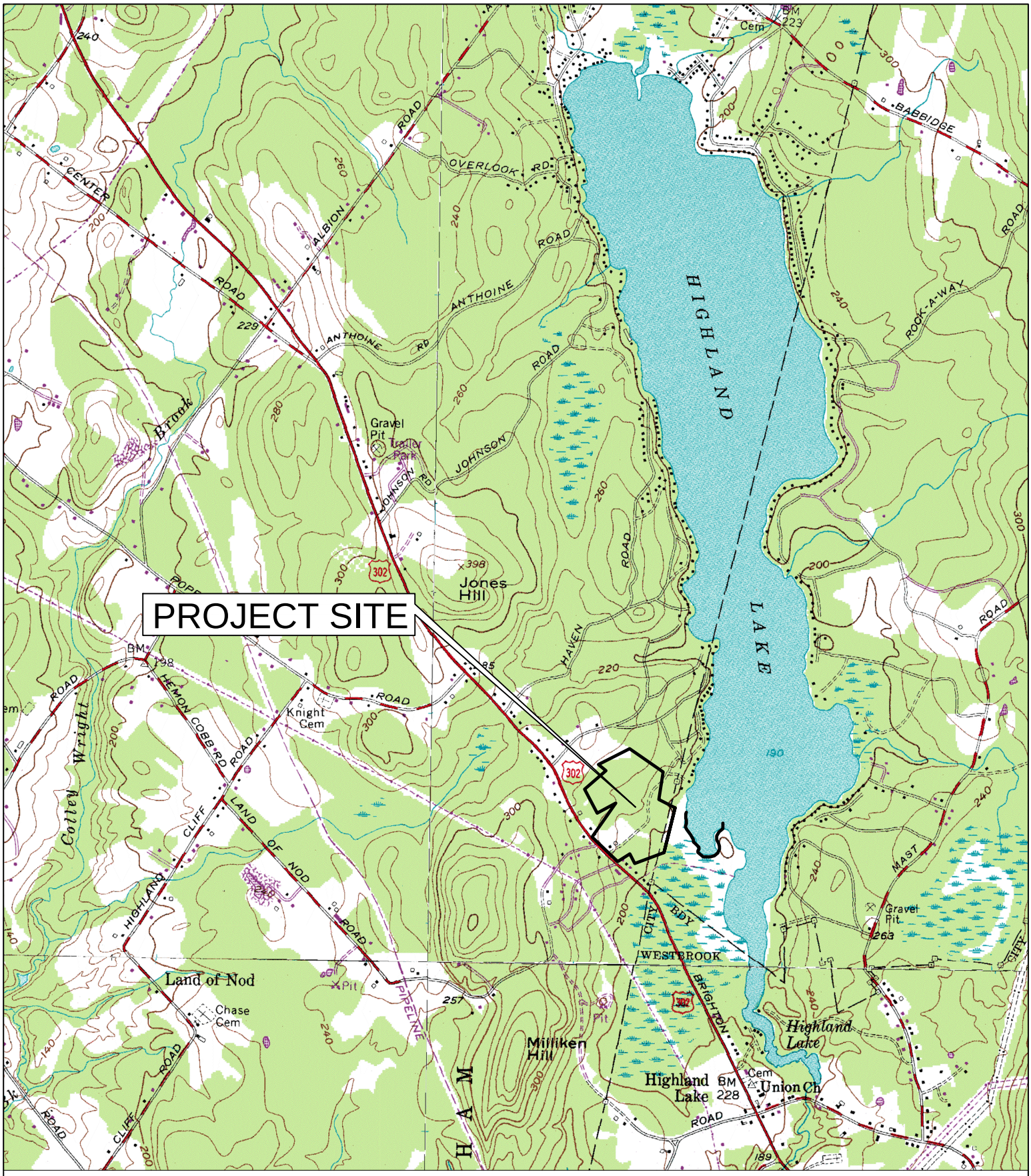
Standard sizing: 75(0.30) + 0.11(25)=22.5'+2.9'=25.4'. 25.4' would yield a treatment factor of 0.4.

Oversized to TF of 0.2: $BMP_{TF}$=0.4($BMP_{TF}$ / TF) = 0.4(25.4/0.2)=50'

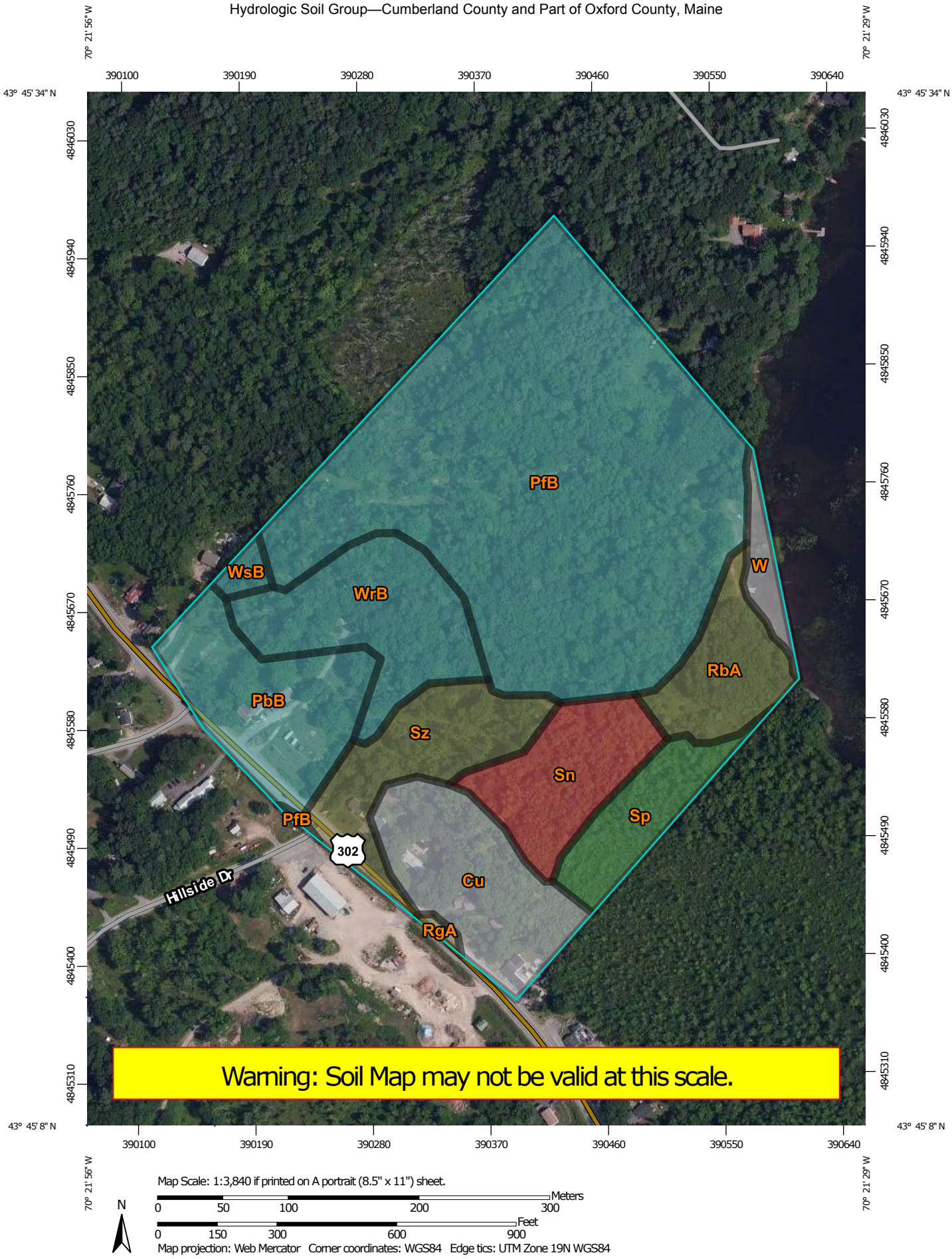
*Forested Buffer Adjacent to Residential Lot*

The buffer contains soils that are consistent with Soil Group C sandy loam or loamy sand. *Table 9 – Buffer Size Requirements Based on Soil & Vegetative Cover Types* of Chapter 500 shows that standard sizing requires that the standard length of flow path for a forested buffer to be 75'. We are proposing a buffer with a 100' long flow path which yields a treatment factor of 0.2:

| SHEET DESCRIPTION | | JOB NO. | FIGURE |
|---|---|---|---|
| AERIAL PHOTO<br>ADRESS, WINDHAM ME | TERRADYN CONSULTANTS, LLC<br>P.O. Box 339<br>111 Elderberry Lane<br>New Gloucester, ME 04260<br>Office: (207) 926-5111<br>Fax: (207) 221-1317<br>www.terradynconsultants.com | 1636 | 3 |
| PREPARED FOR | | DATE | OF |
| CHASE CUSTOM HOME AND FINANCE<br>19 ROOSEVELT TRAIL<br>WINDHAM, ME 04062 | Civil Engineering - Land Planning - Stormwater Design - Environmental Permitting | 9/12/16 | 5 |
| | | SCALE<br>1"=300' | |




| SHEET DESCRIPTION | | JOB NO. | FIGURE |
|---|---|---|---|
| U.S.G.S. QUADRANGLE MAP<br>LOCATION 1636 | TERRADYN CONSULTANTS, LLC<br>P.O. Box 339<br>111 Elderberry Lane<br>New Gloucester, ME 04260<br>Office: (207) 926-5111<br>Fax: (207) 221-1317<br>www.terradynconsultants.com | 1636 | 2 |
| PREPARED FOR | | DATE | OF |
| CHASE CUSTOM HOME AND FINANCE<br>19 ROOSEVELT TRAIL<br>WINDHAM, ME 04062 | Civil Engineering - Land Planning - Stormwater Design - Environmental Permitting | 9/10/16 | 5 |
| | | SCALE | |
| | | 1"=2000' | |




Map Scale: 1:3,840 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

## MAP LEGEND

**Area of Interest (AOI)**

- Area of Interest (AOI)

**Soils**

**Soil Rating Polygons**

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

**Soil Rating Lines**

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

**Soil Rating Points**

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

**Water Features**

- Streams and Canals

**Transportation**

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

**Background**

- Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

Soil Survey Area: Cumberland County and Part of Oxford County, Maine
Survey Area Data: Version 12, Sep 15, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 20, 2010—Jul 18, 2010

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 — Cumberland County and Part of Oxford County, Maine (ME005) | | | | |
|---|---|---|---|---|
| **Map unit symbol** | **Map unit name** | **Rating** | **Acres in AOI** | **Percent of AOI** |
| Cu | Cut and fill land | | 3.6 | 8.9% |
| PbB | Paxton fine sandy loam, 3 to 8 percent slopes | C | 3.7 | 9.1% |
| PfB | Paxton very stony fine sandy loam, 3 to 8 percent slopes | C | 18.8 | 46.4% |
| RbA | Ridgebury fine sandy loam, 0 to 3 percent slopes | C/D | 2.1 | 5.2% |
| RgA | Ridgebury very stony fine sandy loam, 0 to 3 percent slopes | C/D | 0.1 | 0.2% |
| Sn | Scantic silt loam, 0 to 3 percent slopes | D | 2.7 | 6.7% |
| Sp | Sebago mucky peat | A/D | 1.9 | 4.6% |
| Sz | Swanton fine sandy loam | C/D | 3.0 | 7.3% |
| W | Water | | 0.7 | 1.6% |
| WrB | Woodbridge fine sandy loam, 0 to 8 percent slopes | C | 3.7 | 9.2% |
| WsB | Woodbridge very stony fine sandy loam, 0 to 8 percent slopes | C | 0.3 | 0.7% |
| **Totals for Area of Interest** | | | **40.6** | **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.

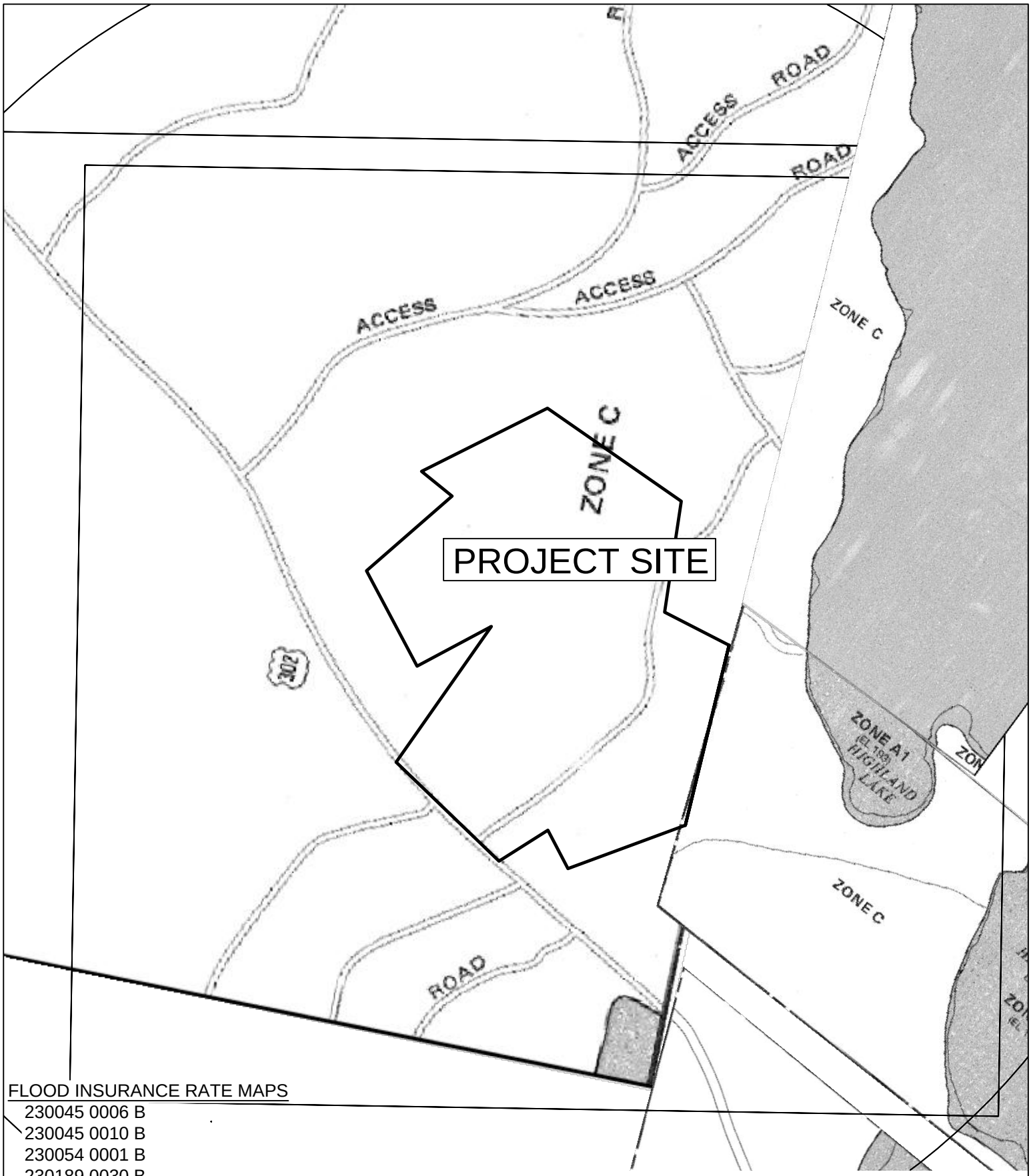
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* *None Specified*

*Tie-break Rule:* Higher



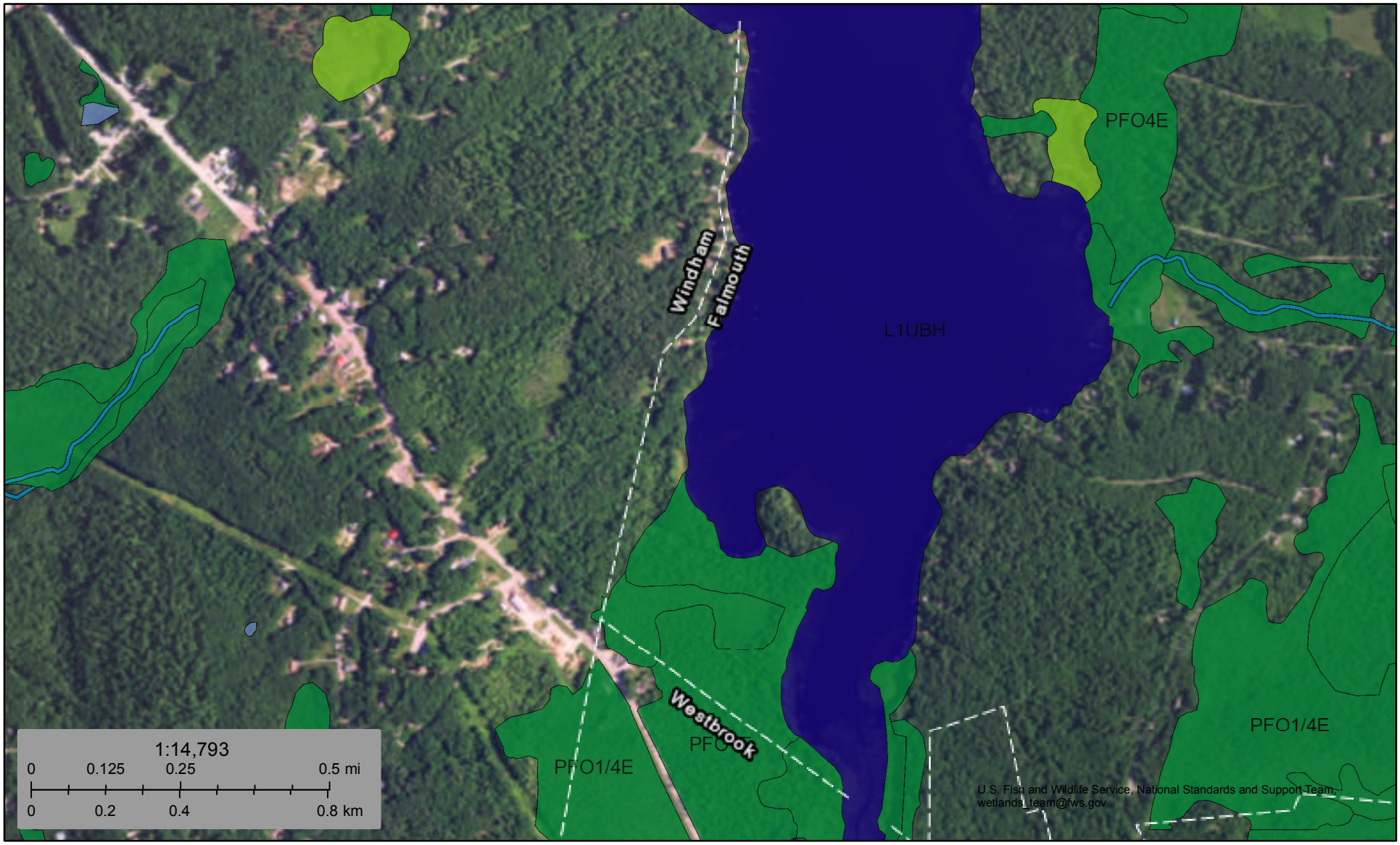

FLOOD INSURANCE RATE MAPS

230045 0006 B
230045 0010 B
230054 0001 B
230189 0030 B

| SHEET DESCRIPTION | | JOB NO. | FIGURE |
|---|---|---|---|
| FEMA FLOOD INSURANCE RATE MAP<br>290 BRIDGTON RD., WIDHAM ME | TERRADYN CONSULTANTS, LLC<br>P.O. Box 339<br>111 Elderberry Lane<br>New Gloucester, ME 04260<br>Office: (207) 926-5111<br>Fax: (207) 221-1317<br>www.terradynconsultants.com | 1636 | 5 |
| PREPARED FOR | | DATE | OF |
| CHASE CUSTOM HOME AND FINANCE<br>290 BRIDGTON ROAD<br>WESTBROOK, ME 04092 | Civil Engineering - Land Planning - Stormwater Design - Environmental Permitting | 9/12/16 | 5 |
| | | SCALE | |
| | | 1"=500' | |

U.S. Fish and Wildlife Service
National Wetlands Inventory

# 1636 Wetlands Inventory Map




December 1, 2016

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

National Wetlands Inventory (NWI)
This page was produced by the NWI mapper

# Worksheet 1
# PPB calculations

Project name: Highland Views

Lake name: Highland Lake

Town name: Windham

**Standard Calculation**

Windham Area

| | | | |
|---|---|---|---|
| Watershed per acre phosphorus budget (Appendix C): | **PAPB** | 0.027 | lbs P/acre/year |
| Total acreage of development parcel: | **TA** | 38.3 | acres |
| NWI wetland acreage: | **WA** | 0 | acres |
| Steep slope acreage: | **SA** | 0 | acres |
| Existing developed area | | 0 | acres |
| Project acreage: A = TA - (WA + SA ) | **A** | 38.3 | acres |
| **Project Phosphorus Budget:** PPB = P x A | **PPB** | 1.0341 | **lbs P/year** |

Falmouth Area

| | | | |
|---|---|---|---|
| Watershed per acre phosphorus budget (Appendix C): | **PAPB** | 0.027 | lbs P/acre/year |
| Total acreage of development parcel: | **TA** | 15.02 | acres |
| NWI wetland acreage: | **WA** | 12.72 | acres |
| Steep slope acreage: | **SA** | 0 | acres |
| Existing developed area | | 0 | acres |
| Project acreage: A = TA - (WA + SA ) | **A** | 2.3 | acres |
| **Project Phosphorus Budget:** PPB = P x A | **PPB** | 0.0621 | **lbs P/year** |
| **Total Project Phosphorus Budget** | **PPB** | 1.0962 | |

Worksheet

# Worksheet 2
## Pre-PPE and Post-PPE Calculations

Calculate phosphorus export from development for before and after treatment
Use as many sheets as needed for each development type (commercial, roads, residential lots, etc.)

**Project name:** Highland Views Project **Development type**: Mixed Sheet #

| | Land Surface Type or Lot #(s) with description | Acres or # of lots | Export Coefficient from Table 3.1 Table 3.2 | Pre-treatment Algal Av. P Export (lbs P/year) | Treatment Factor for BMP(s) from Chapter 6 | Post-treatment Algal Av. P Export (lbs P/year) | Description of BMPs |
|---|---|---|---|---|---|---|---|
| | **Subdivision** | | | | | | |
| WS-1 | | | | | | | |
| | Roadway Impervious | 0.164 | 1.25 | 0.205 | 0.25 | 0.05125 | Gravel Wetland |
| | Roadway Pervious | 0.093 | 0.3 | 0.0279 | 0.25 | 0.006975 | Gravel Wetland |
| WS-2 | | | | | | | |
| | Roadway Impervious | 0.029 | 1.25 | 0.03625 | 0.25 | 0.0090625 | Gravel Wetland |
| | Roadway Pervious | 0.002 | 0.3 | 0.0006 | 0.25 | 0.00015 | Gravel Wetland |
| | Apartment Pervious | 0.046 | 0.3 | 0.0138 | 0.25 | 0.00345 | Gravel Wetland |
| WS-3 | | | | | | | |
| | Roadway Impervious | 0.026 | 1.25 | 0.0325 | 0.25 | 0.008125 | Gravel Wetland |
| | Roadway Pervious | 0.002 | 0.3 | 0.0006 | 0.25 | 0.00015 | Gravel Wetland |
| | Apartment Pervious | 0.034 | 0.3 | 0.0102 | 0.25 | 0.00255 | Gravel Wetland |
| WS-4 | | | | | | | |
| | Roadway Impervious | 0.018 | 1.25 | 0.0225 | 0.25 | 0.005625 | Gravel Wetland |
| | Roadway Pervious | 0.001 | 0.3 | 0.0003 | 0.25 | 0.000075 | Gravel Wetland |
| WS-5 | | | | | | | |
| | Roadway Impervious | 0.046 | 1.25 | 0.0575 | 0.25 | 0.014375 | Gravel Wetland |
| | Roadway Pervious | 0.02 | 0.3 | 0.006 | 0.25 | 0.0015 | Gravel Wetland |
| WS-6 | | | | | | | |
| | Roadway Impervious | 0.031 | 1.25 | 0.03875 | 0.25 | 0.0096875 | Gravel Wetland |
| | Roadway Pervious | 0.042 | 0.3 | 0.0126 | 0.25 | 0.00315 | Gravel Wetland |
| WS-7 | | | | | | | |
| | Roadway Impervious | 0.034 | 1.25 | 0.0425 | 0.25 | 0.010625 | Gravel Wetland |
| | Roadway Pervious | 0.035 | 0.3 | 0.0105 | 0.25 | 0.002625 | Gravel Wetland |
| WS-8 | | | | | | | |
| | Roadway Impervious | 0.019 | 1.25 | 0.02375 | 0.25 | 0.0059375 | Gravel Wetland |
| WS-9 | | | | | | | |
| | Roadway Impervious | 0.029 | 1.25 | 0.03625 | 0.25 | 0.0090625 | Gravel Wetland |
| WS-10 | | | | | | | |
| | Roadway Impervious | 0.035 | 1.25 | 0.04375 | 0.25 | 0.0109375 | Gravel Wetland |
| | Roadway Pervious | 0.017 | 0.3 | 0.0051 | 0.25 | 0.001275 | Gravel Wetland |
| WS-11 | | | | | | | |
| | Roadway Impervious | 0.04 | 1.25 | 0.05 | 0.25 | 0.0125 | Gravel Wetland |
| | Roadway Pervious | 0.017 | 0.3 | 0.0051 | 0.25 | 0.001275 | Gravel Wetland |
| WS-12 | | | | | | | |
| | Roadway Impervious | 0.046 | 1.25 | 0.0575 | 0.25 | 0.014375 | Gravel Wetland |
| | Roadway Pervious | 0.018 | 0.3 | 0.0054 | 0.25 | 0.00135 | Gravel Wetland |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| WS-13 | | | | | | | |
| | Roadway Impervious | 0.084 | 1.25 | 0.105 | 0.25 | 0.02625 | Gravel Wetland |
| | Roadway Pervious | 0.056 | 0.3 | 0.0168 | 0.25 | 0.0042 | Gravel Wetland |
| | Apartment Impervious | 0.1 | 1.25 | 0.125 | 0.25 | 0.03125 | Gravel Wetland |
| | Apartment Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
| | Apartment Pervious | 0.213 | 0.3 | 0.0639 | 0.25 | 0.015975 | Gravel Wetland |
| WS-14 | | | | | | | |
| | Roadway Impervious | 0.103 | 1.25 | 0.12875 | 0.25 | 0.0321875 | Gravel Wetland |
| | Roadway Pervious | 0.042 | 0.3 | 0.0126 | 0.25 | 0.00315 | Gravel Wetland |
| WS-15 | | | | | | | |
| | Roadway Impervious | 0.085 | 1.25 | 0.10625 | 0.25 | 0.0265625 | Gravel Wetland |
| | Roadway Pervious | 0.012 | 0.3 | 0.0036 | 0.25 | 0.0009 | Gravel Wetland |
| WS-15A | | | | | | | |
| | Roadway Impervious | 0 | 1.25 | 0 | 0.25 | 0 | Gravel Wetland |
| | Roadway Pervious | 0 | 0.3 | 0 | 0.25 | 0 | Gravel Wetland |
| WS-16 | | | | | | | |
| | Roadway Impervious | 0.203 | 1.25 | 0.25375 | 0.25 | 0.0634375 | Filter Basin |
| | Roadway Pervious | 0.108 | 0.5 | 0.054 | 0.25 | 0.0135 | Filter Basin |
| WS-FB | | | | | | | |
| | Roadway Impervious | 0 | 1.25 | 0 | 0.25 | 0 | Gravel Wetland |
| | Roadway Pervious | 0 | 0.3 | 0 | 0.25 | 0 | Gravel Wetland |
| WS-GW | | | | | | | |
| | Roadway Impervious | 0 | 1.25 | 0 | 0.25 | 0 | Gravel Wetland |
| | Roadway Pervious | 0 | 0.3 | 0 | 0.25 | 0 | Gravel Wetland |
| WS-LS | | | | | | | |
| | Roadway Impervious | 0 | 1.25 | 0 | 0.2 | 0 | 150' Long Buffer with Level Spreader |
| | Roadway Pervious | 0 | 0.3 | 0 | 0.2 | 0 | 150' Long Buffer with Level Spreader |
| | Apartment Impervious | 0.233 | 1.25 | 0.29125 | 0.2 | 0.05825 | 150' Long Buffer with Level Spreader |
| | Apartment Roof | 0.067 | 0.5 | 0.0335 | 0.2 | 0.0067 | 150' Long Buffer with Level Spreader |
| | Apartment Pervious | 0.12 | 0.3 | 0.036 | 0.2 | 0.0072 | 150' Long Buffer with Level Spreader |
| WS-RD | | | | | | | |
| | Apartments Roof | 0.067 | 0.5 | 0.0335 | 0.4 | 0.0134 | Roof Drain Filter |
| Lots to Gravel Wetland | | | | | | | |
| | Lot 1 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Gravel Wetland |
| | Lot 1 Roof | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Gravel Wetland + Roof Filter |
| | Lot 1 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
| | Lot 1 Grass | 0.126 | 0.3 | 0.0378 | 0.25 | 0.00945 | Gravel Wetland |
| | Lot 2 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Gravel Wetland |
| | Lot 2 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
| | Lot 2 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Gravel Wetland + Roof Filter |
| | Lot 2 Grass | 0.069 | 0.3 | 0.0207 | 0.25 | 0.005175 | Gravel Wetland |
| | Lot 3 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Gravel Wetland |
| | Lot 3 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
| | Lot 3 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Gravel Wetland + Roof Filter |
| | Lot 3 Grass | 0.126 | 0.3 | 0.0378 | 0.25 | 0.00945 | Gravel Wetland |
| | Lot 4 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Gravel Wetland |
| | Lot 4 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |

| | | | | | | |
|---|---|---|---|---|---|---|
| Lot 4 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Gravel Wetland + Roof Filter |
| Lot 4 Grass | 0.069 | 0.3 | 0.0207 | 0.25 | 0.005175 | Gravel Wetland |
| Lot 5 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Gravel Wetland |
| Lot 5 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
| Lot 5 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Gravel Wetland + Roof Filter |
| Lot 5 Grass | 0.103 | 0.3 | 0.0309 | 0.25 | 0.007725 | Gravel Wetland |
| Lot 6 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Gravel Wetland |
| Lot 6 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
| Lot 6 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Gravel Wetland + Roof Filter |
| Lot 6 Grass | 0.195 | 0.3 | 0.0585 | 0.25 | 0.014625 | Gravel Wetland |
| Lot 7 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Gravel Wetland |
| Lot 7 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
| Lot 7 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Gravel Wetland + Roof Filter |
| Lot 7 Grass | 0.195 | 0.3 | 0.0585 | 0.25 | 0.014625 | Gravel Wetland |
| Lot 8 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Gravel Wetland |
| Lot 8 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
| Lot 8 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Gravel Wetland + Roof Filter |
| Lot 8 Grass | 0.15 | 0.3 | 0.045 | 0.25 | 0.01125 | Gravel Wetland |
| Lot 9 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Gravel Wetland |
| Lot 9 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
| Lot 9 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Gravel Wetland + Roof Filter |
| Lot 9 Grass | 0.195 | 0.3 | 0.0585 | 0.25 | 0.014625 | Gravel Wetland |
| Lot 10 Impervious | 0.033 | 1.25 | 0.04125 | 0.25 | 0.0103125 | Gravel Wetland |
| Lot 10 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
| Lot 10 Grass | 0.062 | 0.3 | 0.0186 | 0.25 | 0.00465 | Gravel Wetland |
| Lot 11 Impervious | 0.033 | 1.25 | 0.04125 | 0.25 | 0.0103125 | Gravel Wetland |
| Lot 11 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
| Lot 11 Grass | 0.062 | 0.3 | 0.0186 | 0.25 | 0.00465 | Gravel Wetland |
| Lot 20 Grass | 0.07 | 0.3 | 0.021 | 0.25 | 0.00525 | Gravel Wetland |
| Lot 21 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Gravel Wetland |
| Lot 21 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
| Lot 21 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Gravel Wetland + Roof Filter |
| Lot 21 Grass | 0.195 | 0.3 | 0.0585 | 0.25 | 0.014625 | Gravel Wetland |
| Lot 22 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Gravel Wetland |
| Lot 22 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
| Lot 22 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Gravel Wetland + Roof Filter |
| Lot 22 Grass | 0.195 | 0.3 | 0.0585 | 0.25 | 0.014625 | Gravel Wetland |
| Lot 23 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Gravel Wetland |
| Lot 23 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
| Lot 23 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Gravel Wetland + Roof Filter |
| Lot 23 Grass | 0.195 | 0.3 | 0.0585 | 0.25 | 0.014625 | Gravel Wetland |
| Lot 24 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Gravel Wetland |
| Lot 24 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
| Lot 24 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Gravel Wetland + Roof Filter |
| Lot 24 Grass | 0.126 | 0.3 | 0.0378 | 0.25 | 0.00945 | Gravel Wetland |
| Lots to Filter Basin | | | | | | |
| Lot 16 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Filter Basin |

| | | | | | | |
|---|---|---|---|---|---|---|
| Lot 16 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Filter Basin |
| Lot 16 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Filter Basin + Roof Filter |
| Lot 16 Grass | 0.195 | 0.3 | 0.0585 | 0.25 | 0.014625 | Filter Basin |
| Lot 17 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Filter Basin |
| Lot 17 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Filter Basin |
| Lot 17 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Filter Basin + Roof Filter |
| Lot 17 Grass | 0.103 | 0.3 | 0.0309 | 0.25 | 0.007725 | Filter Basin |
| Lot 18 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Filter Basin |
| Lot 18 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Filter Basin |
| Lot 18 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Filter Basin + Roof Filter |
| Lot 18 Grass | 0.195 | 0.3 | 0.0585 | 0.25 | 0.014625 | Filter Basin |
| Lot 19 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Filter Basin |
| Lot 19 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Filter Basin |
| Lot 19 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Filter Basin + Roof Filter |
| Lot 19 Grass | 0.195 | 0.3 | 0.0585 | 0.25 | 0.014625 | Filter Basin |
| Lot 20 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Filter Basin |
| Lot 20 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Filter Basin |
| Lot 20 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Filter Basin + Roof Filter |
| Lot 20 Grass | 0.125 | 0.3 | 0.0375 | 0.25 | 0.009375 | Filter Basin |
| Lots to Other BMPs | | | | | | |
| Lot 10 Impervious | 0.01 | 1.25 | 0.0125 | 0.4 | 0.005 | Rain Garden |
| Lot 10 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.4 | 0.0034 | Roof Drain Filter |
| Lot 10 Grass | 0.133 | 0.3 | 0.0399 | 0.4 | 0.01596 | Rain Garden |
| Lot 11 Impervious | 0.01 | 1.25 | 0.0125 | 0.4 | 0.005 | Rain Garden #4 |
| Lot 11 Roof Rear | 0.017 | 0.5 | 0.0085 | 0.4 | 0.0034 | Roof Drain Filter |
| Lot 11 Grass | 0.11 | 0.3 | 0.033 | 0.4 | 0.0132 | Rain Garden #4 |
| Lot 12 Impervious | 0.043 | 1.25 | 0.05375 | 0.4 | 0.0215 | Rain Garden #4 |
| Lot 12 Roof | 0.017 | 0.5 | 0.0085 | 0.4 | 0.0034 | Rain Garden #4 |
| Lot 12 Roof Rear | 0.017 | 0.5 | 0.0085 | 0.4 | 0.0034 | Roof Drain Filter |
| Lot 12 Grass | 0.172 | 0.3 | 0.0516 | 0.4 | 0.02064 | Rain Garden #4 |
| Lot 13 Impervious | 0.043 | 1.25 | 0.05375 | 0.27 | 0.0145125 | 110' Forested Buffer, HSG C |
| Lot 13 Roof | 0.017 | 0.5 | 0.0085 | 0.27 | 0.002295 | 110' Forested Buffer, HSG C |
| Lot 13 Roof Rear | 0.017 | 0.5 | 0.0085 | 0.17 | 0.001445 | 100' Forested Buffer + Roof Filter |
| Lot 13 Grass | 0.172 | 0.3 | 0.0516 | 0.27 | 0.013932 | 110' Forested Buffer, HSG C |
| Lot 14 Impervious | 0.043 | 1.25 | 0.05375 | 0.27 | 0.0145125 | 110' Forested Buffer, HSG C |
| Lot 14 Roof | 0.017 | 0.5 | 0.0085 | 0.27 | 0.002295 | 110' Forested Buffer, HSG C |
| Lot 14 Roof Rear | 0.017 | 0.5 | 0.0085 | 0.17 | 0.001445 | 100' Forested Buffer + Roof Filter |
| Lot 14 Grass | 0.161 | 0.3 | 0.0483 | 0.27 | 0.013041 | 110' Forested Buffer, HSG C |
| Lot 15 Impervious | 0.043 | 1.25 | 0.05375 | 0.27 | 0.0145125 | 110' Forested Buffer, HSG C |
| Lot 15 Roof | 0.017 | 0.5 | 0.0085 | 0.27 | 0.002295 | 110' Forested Buffer, HSG C |
| Lot 15 Roof Rear | 0.017 | 0.5 | 0.0085 | 0.17 | 0.001445 | 100' Forested Buffer + Roof Filter |
| Lot 15 Grass | 0.08 | 0.3 | 0.024 | 0.27 | 0.00648 | 110' Forested Buffer, HSG C |
| | | **Total Pre-PPE (lbs P/year)** | 4.84695 | **Total PostPPE (lbs P/year)** | 1.2247155 | |

## Worksheet 1
## Pre-PPE and Post-PPE Calculations

Calculate phosphorus export from development for before and after treatment
Use as many sheets as needed for each development type (commercial, roads, residential lots, etc.)

**Project name:** Vista Project **Development type**: Mixed Sheet #

| Land Surface Type or Lot #(s) with description | Acres or # of lots | Export Coefficient from Table 3.1 Table 3.2 | Pre-treatment Algal Av. P Export (lbs P/year) | Treatment Factor for BMP(s) from Chapter 6 | Post-treatment Algal Av. P Export (lbs P/year) | Description of BMPs |
|---|---|---|---|---|---|---|
| **Subdivision** | | | | | | |
| Existing House | 0.079 | 1.25 | 0.09875 | 0.5 | 0.049375 | 50% of the house that drains to ditches |
| Existing Roads | 0.392 | 0.5 | 0.196 | 0.5 | 0.098 | 50% of roads that have channelized flow |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | **Total Pre-PPE (lbs P/year)** | 0.29475 | **Total PostPPE (lbs P/year)** | 0.147375 | |

# Worksheet 1
# Project Phosphorus Export Summary

Summarizing the project's algal available phosphorus export (PPE)

**Project name:** Highland Views

| | | | |
|---|---|---|---|
| **Project Phosphorus Budget -** Worksheet 1 | **PPB** | 1.10 | lbs P / year |
| **Total Pre-Treatment Phosphorus Export -** Worksheet 2 | **Pre-PPE** | 4.85 | lbs P / year |
| **Total Post-Treatment Phosphorus Export -** Worksheet 2 | **Post-PPE** | 1.22 | lbs P / year |
| **Total Phosphorus Mitigation Credit** - Worksheet 3 | **TMC** | 0.15 | lbs P / year |
| **Project Phosphorus Export** (Post-PPE - TMC) | **PPE** | 1.08 | lbs P / year |

| | | |
|---|---|---|
| **Is the Project Phosphorus Export sufficiently reduced?** (PPE< PPB) | -0.02 | lbs P / year |

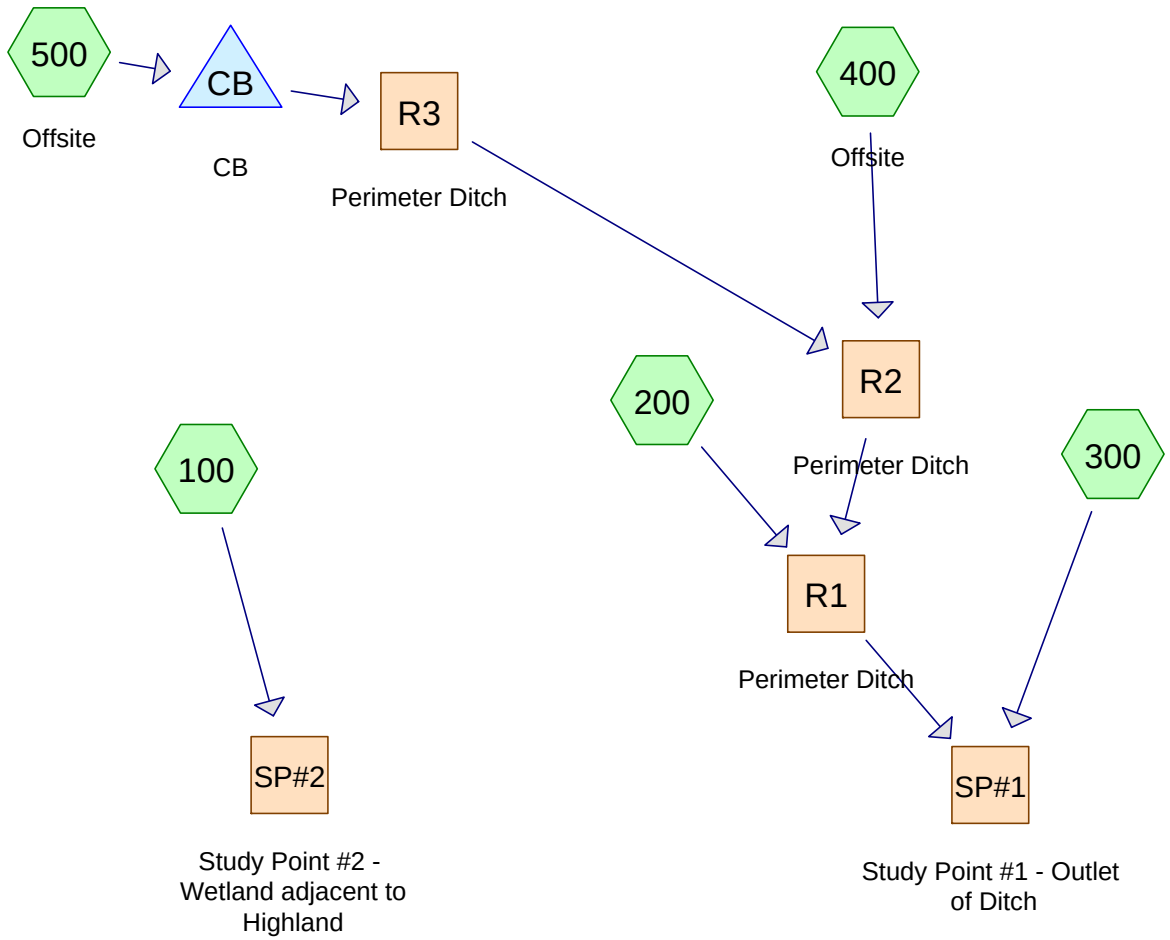
**If PPE is less than or equal to PPB, the project meets its phosphorus budget (neg. #)**
**If PPE is more than PPB, more reduction in phosphorus export may be required (pos. #)**

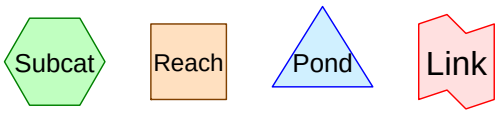
**OTHERWISE:**

| | |
|---|---|
| **Is the Post-Treatment Phosphorus Export less than 40% of the Pre-Treatment Export? It is equivalent to more than 60% removal efficiency.** (Post-PPE < 40% Pre-PPE) | 25.27% |

**If Post-PPE is less than 40% of Pre-PPE, a compensation fee may be appropriate at the cost of $22,733 per pound of phosphorus over budget. (see table 3 Phosphorus Compensation Fee in updated phosphorus manual) The compensation fee option is only available in some lake watersheds. Check with the DEP project manager or with the DEP Division of Watershed Management to see if the watershed in which the project is located is eligible before proposing a project that incorporates a compensation fee.**

| | |
|---|---|
| **The following compensation fee must be paid** $13,9*(PPE-PPB) | **N/A** |




**Drainage Diagram for 1636 Pre**
Prepared by {enter your company name here}, Printed 12/20/2016
HydroCAD® 9.00 s/n 03654 © 2009 HydroCAD Software Solutions LLC

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 100:** Runoff Area=984,874 sf 5.27% Impervious Runoff Depth>0.82"
Flow Length=1,300' Tc=54.5 min CN=73 Runoff=9.36 cfs 1.537 af

**Subcatchment 200:** Runoff Area=136,701 sf 1.99% Impervious Runoff Depth>0.71"
Flow Length=720' Tc=80.8 min CN=71 Runoff=0.87 cfs 0.186 af

**Subcatchment 300:** Runoff Area=58,171 sf 2.75% Impervious Runoff Depth>0.73"
Flow Length=270' Slope=0.1000 '/' Tc=28.9 min CN=71 Runoff=0.66 cfs 0.081 af

**Subcatchment 400: Offsite** Runoff Area=42.600 ac 2.35% Impervious Runoff Depth>0.80"
Flow Length=1,570' Tc=92.8 min CN=73 Runoff=12.52 cfs 2.836 af

**Subcatchment 500: Offsite** Runoff Area=20.180 ac 8.42% Impervious Runoff Depth>0.87"
Flow Length=1,370' Tc=52.5 min CN=74 Runoff=9.13 cfs 1.457 af

**Reach R1: Perimeter Ditch** Avg. Depth=0.69' Max Vel=6.52 fps Inflow=21.00 cfs 4.452 af
n=0.035 L=150.0' S=0.0533 '/' Capacity=512.84 cfs Outflow=20.99 cfs 4.449 af

**Reach R2: Perimeter Ditch** Avg. Depth=0.72' Max Vel=5.94 fps Inflow=20.16 cfs 4.273 af
n=0.040 L=290.0' S=0.0552 '/' Capacity=1,055.19 cfs Outflow=20.13 cfs 4.266 af

**Reach R3: Perimeter Ditch** Avg. Depth=0.78' Max Vel=3.05 fps Inflow=9.13 cfs 1.457 af
n=0.040 L=1,250.0' S=0.0144 '/' Capacity=195.24 cfs Outflow=8.93 cfs 1.438 af

**Reach SP#1: Study Point #1 - Outlet of Ditch** Inflow=21.20 cfs 4.530 af
Outflow=21.20 cfs 4.530 af

**Reach SP#2: Study Point #2 - Wetland adjacent to Highland** Inflow=9.36 cfs 1.537 af
Outflow=9.36 cfs 1.537 af

**Pond CB: CB** Inflow=9.13 cfs 1.457 af
Primary=9.13 cfs 1.457 af

**Total Runoff Area = 89.863 ac Runoff Volume = 6.096 af Average Runoff Depth = 0.81"**
**95.56% Pervious = 85.874 ac 4.44% Impervious = 3.990 ac**

## Summary for Subcatchment 100:

Runoff = 9.36 cfs @ 12.81 hrs, Volume= 1.537 af, Depth> 0.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 20,200 | 92 | Road with Row |
| * | 24,909 | 98 | Camp Roads & House |
| * | 10,950 | 98 | Onsite driveway in easement |
| | 80,000 | 79 | 1 acre lots, 20% imp, HSG C |
| | 80,000 | 74 | >75% Grass cover, Good, HSG C |
| | 643,288 | 70 | Woods, Good, HSG C |
| | 125,527 | 77 | Woods, Good, HSG D |
| | 984,874 | 73 | Weighted Average |
| | 933,015 | | 94.73% Pervious Area |
| | 51,859 | | 5.27% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 33.9 | 150 | 0.0600 | 0.07 | | **Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10" |
| 8.4 | 460 | 0.0330 | 0.91 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 0.1 | 30 | 0.0100 | 4.91 | 3.86 | **Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 |
| 12.1 | 660 | 0.0330 | 0.91 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 54.5 | 1,300 | Total | | | |

## Summary for Subcatchment 200:

Runoff = 0.87 cfs @ 13.20 hrs, Volume= 0.186 af, Depth> 0.71"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 2,722 | 98 | Camp Roads |
| | 133,979 | 70 | Woods, Good, HSG C |
| | 136,701 | 71 | Weighted Average |
| | 133,979 | | 98.01% Pervious Area |
| | 2,722 | | 1.99% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 69.3 | 150 | 0.0100 | 0.04 | | **Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10" |
| 9.0 | 380 | 0.0200 | 0.71 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 0.1 | 20 | 0.0100 | 4.91 | 3.86 | **Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 |
| 2.4 | 170 | 0.0580 | 1.20 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 80.8 | 720 | Total | | | |

## Summary for Subcatchment 300:

Runoff = 0.66 cfs @ 12.46 hrs, Volume= 0.081 af, Depth> 0.73"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 1,600 | 98 | Camp Roads |
| | 56,571 | 70 | Woods, Good, HSG C |
| | 58,171 | 71 | Weighted Average |
| | 56,571 | | 97.25% Pervious Area |
| | 1,600 | | 2.75% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 27.6 | 150 | 0.1000 | 0.09 | | **Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10" |
| 1.3 | 120 | 0.1000 | 1.58 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 28.9 | 270 | Total | | | |

## Summary for Subcatchment 400: Offsite

Runoff = 12.52 cfs @ 13.32 hrs, Volume= 2.836 af, Depth> 0.80"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 2.000 | 92 | Road with Row |
| * | 0.500 | 83 | Commercial Lot |
| | 5.000 | 79 | 1 acre lots, 20% imp, HSG C |
| | 29.900 | 70 | Woods, Good, HSG C |
| | 5.200 | 77 | Woods, Good, HSG D |
| | 42.600 | 73 | Weighted Average |
| | 41.600 | | 97.65% Pervious Area |
| | 1.000 | | 2.35% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 33.9 | 150 | 0.0600 | 0.07 | | **Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10" |
| 4.4 | 380 | 0.0840 | 1.45 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 52.2 | 700 | 0.0020 | 0.22 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 2.3 | 340 | 0.0140 | 2.45 | 5.51 | **Trap/Vee/Rect Channel Flow,** Bot.W=4.00' D=0.50' Z= 1.0 '/' Top.W=5.00' n= 0.040 |
| 92.8 | 1,570 | Total | | | |

## Summary for Subcatchment 500: Offsite

Runoff = 9.13 cfs @ 12.78 hrs, Volume= 1.457 af, Depth> 0.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.800 | 92 | Road with Row |
| * | 0.500 | 98 | Commercial Impervious |
| | 6.000 | 79 | 1 acre lots, 20% imp, HSG C |
| | 12.880 | 70 | Woods, Good, HSG C |
| | 20.180 | 74 | Weighted Average |
| | 18.480 | | 91.58% Pervious Area |
| | 1.700 | | 8.42% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 35.6 | 150 | 0.0530 | 0.07 | | **Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10" |
| 16.9 | 1,220 | 0.0580 | 1.20 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 52.5 | 1,370 | Total | | | |

## Summary for Reach R1: Perimeter Ditch

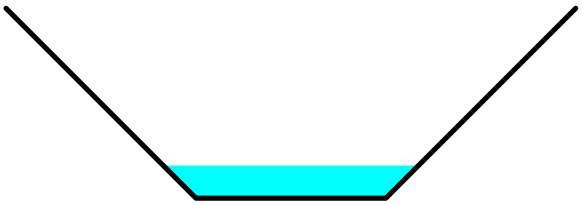
[61] Hint: Exceeded Reach R2 outlet invert by 0.69' @ 13.15 hrs

Inflow Area = 65.918 ac, 4.19% Impervious, Inflow Depth > 0.81"
Inflow = 21.00 cfs @ 13.16 hrs, Volume= 4.452 af
Outflow = 20.99 cfs @ 13.17 hrs, Volume= 4.449 af, Atten= 0%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.52 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.79 fps, Avg. Travel Time= 0.7 min

Peak Storage= 483 cf @ 13.16 hrs, Average Depth at Peak Storage= 0.69'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 512.84 cfs

4.00' x 4.00' deep channel, n= 0.035
Side Slope Z-value= 1.0 '/' Top Width= 12.00'
Length= 150.0' Slope= 0.0533 '/'
Inlet Invert= 206.00', Outlet Invert= 198.00'



## Summary for Reach R2: Perimeter Ditch

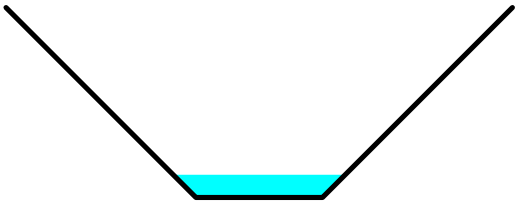
[62] Warning: Exceeded Reach R3 OUTLET depth by 0.14' @ 13.75 hrs

| | | | | | |
|---|---|---|---|---|---|
| Inflow Area = | 62.780 ac, | 4.30% Impervious, | Inflow Depth > | 0.82" | |
| Inflow = | 20.16 cfs @ | 13.12 hrs, | Volume= | 4.273 af | |
| Outflow = | 20.13 cfs @ | 13.15 hrs, | Volume= | 4.266 af, | Atten= 0%, Lag= 2.0 min |

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.94 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 3.50 fps, Avg. Travel Time= 1.4 min

Peak Storage= 983 cf @ 13.14 hrs, Average Depth at Peak Storage= 0.72'
Bank-Full Depth= 6.00', Capacity at Bank-Full= 1,055.19 cfs

4.00' x 6.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 16.00'
Length= 290.0' Slope= 0.0552 '/'
Inlet Invert= 222.00', Outlet Invert= 206.00'



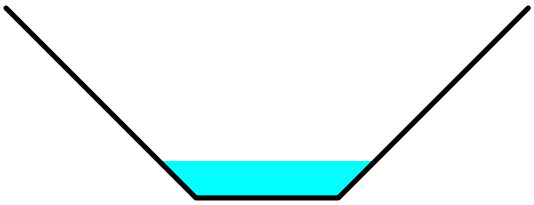
## Summary for Reach R3: Perimeter Ditch

| | | | | | |
|---|---|---|---|---|---|
| Inflow Area = | 20.180 ac, | 8.42% Impervious, | Inflow Depth > | 0.87" | |
| Inflow = | 9.13 cfs @ | 12.78 hrs, | Volume= | 1.457 af | |
| Outflow = | 8.93 cfs @ | 12.97 hrs, | Volume= | 1.438 af, | Atten= 2%, Lag= 11.9 min |

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.05 fps, Min. Travel Time= 6.8 min
Avg. Velocity = 1.62 fps, Avg. Travel Time= 12.9 min

Peak Storage= 3,669 cf @ 12.86 hrs, Average Depth at Peak Storage= 0.78'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 195.24 cfs

3.00' x 4.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 11.00'
Length= 1,250.0' Slope= 0.0144 '/'
Inlet Invert= 240.00', Outlet Invert= 222.00'



## Summary for Reach SP#1: Study Point #1 - Outlet of Ditch

[40] Hint: Not Described (Outflow=Inflow)

| | | | | | |
|---|---|---|---|---|---|
| Inflow Area = | 67.254 ac, | 4.16% Impervious, | Inflow Depth > | 0.81" | |
| Inflow = | 21.20 cfs @ | 13.16 hrs, | Volume= | 4.530 af | |
| Outflow = | 21.20 cfs @ | 13.16 hrs, | Volume= | 4.530 af, | Atten= 0%, Lag= 0.0 min |

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

## Summary for Reach SP#2: Study Point #2 - Wetland adjacent to Highland

[40] Hint: Not Described (Outflow=Inflow)

| | | | | | |
|---|---|---|---|---|---|
| Inflow Area = | 22.610 ac, | 5.27% Impervious, | Inflow Depth > | 0.82" | |
| Inflow = | 9.36 cfs @ | 12.81 hrs, | Volume= | 1.537 af | |
| Outflow = | 9.36 cfs @ | 12.81 hrs, | Volume= | 1.537 af, | Atten= 0%, Lag= 0.0 min |

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

## Summary for Pond CB: CB

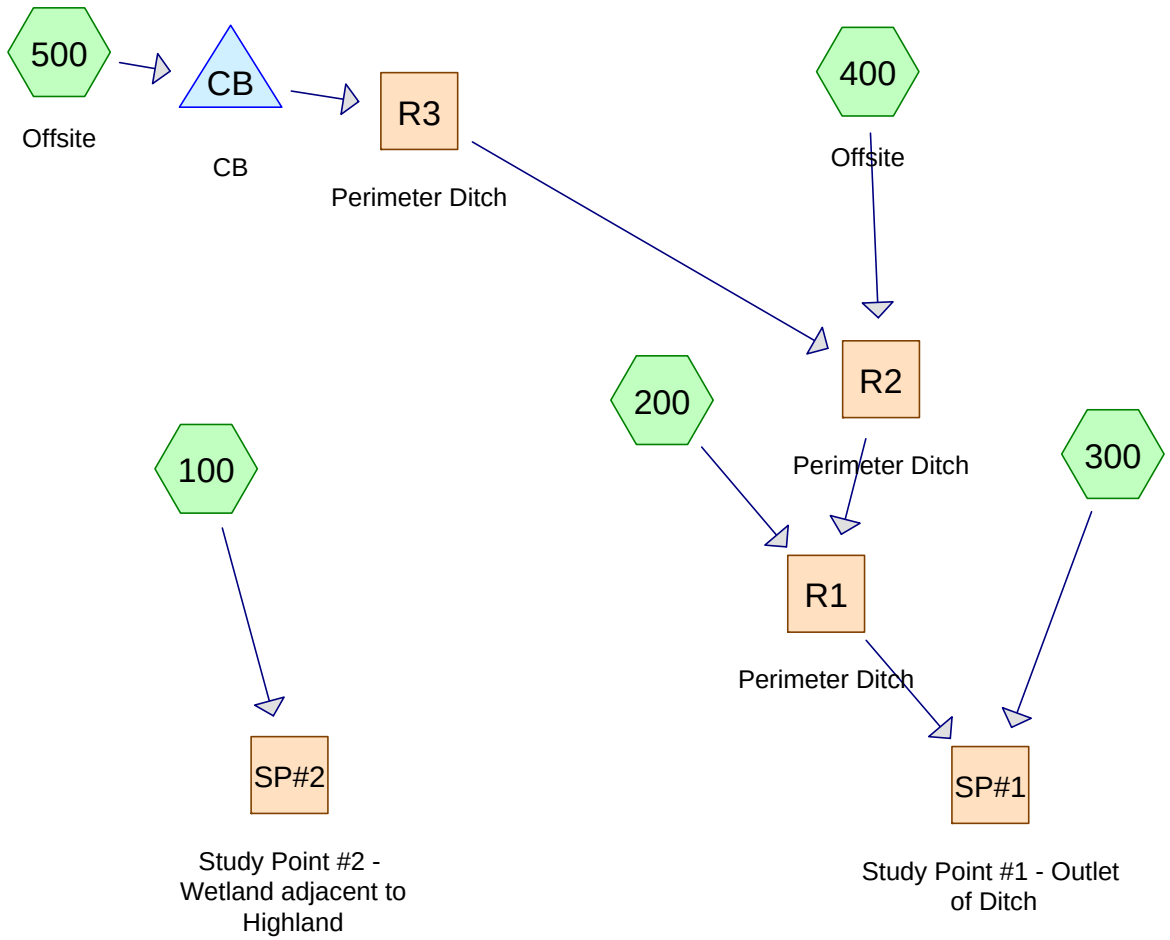
Not modeled because watershed enters closed stormwater system over a series of catch basins.

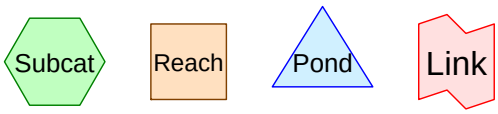
---

[40] Hint: Not Described (Outflow=Inflow)

| | | | | | |
|---|---|---|---|---|---|
| Inflow Area = | 20.180 ac, | 8.42% Impervious, | Inflow Depth > | 0.87" | |
| Inflow = | 9.13 cfs @ | 12.78 hrs, | Volume= | 1.457 af | |
| Primary = | 9.13 cfs @ | 12.78 hrs, | Volume= | 1.457 af, | Atten= 0%, Lag= 0.0 min |

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs




**Drainage Diagram for 1636 Pre**
Prepared by {enter your company name here}, Printed 12/20/2016
HydroCAD® 9.00 s/n 03654 © 2009 HydroCAD Software Solutions LLC

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 100:** Runoff Area=984,874 sf 5.27% Impervious Runoff Depth>1.78"
Flow Length=1,300' Tc=54.5 min CN=73 Runoff=21.36 cfs 3.361 af

**Subcatchment 200:** Runoff Area=136,701 sf 1.99% Impervious Runoff Depth>1.62"
Flow Length=720' Tc=80.8 min CN=71 Runoff=2.11 cfs 0.423 af

**Subcatchment 300:** Runoff Area=58,171 sf 2.75% Impervious Runoff Depth>1.66"
Flow Length=270' Slope=0.1000 '/' Tc=28.9 min CN=71 Runoff=1.59 cfs 0.184 af

**Subcatchment 400: Offsite** Runoff Area=42.600 ac 2.35% Impervious Runoff Depth>1.75"
Flow Length=1,570' Tc=92.8 min CN=73 Runoff=28.76 cfs 6.222 af

**Subcatchment 500: Offsite** Runoff Area=20.180 ac 8.42% Impervious Runoff Depth>1.86"
Flow Length=1,370' Tc=52.5 min CN=74 Runoff=20.31 cfs 3.127 af

**Reach R1: Perimeter Ditch** Avg. Depth=1.11' Max Vel=8.41 fps Inflow=47.61 cfs 9.735 af
n=0.035 L=150.0' S=0.0533 '/' Capacity=512.84 cfs Outflow=47.59 cfs 9.730 af

**Reach R2: Perimeter Ditch** Avg. Depth=1.16' Max Vel=7.64 fps Inflow=45.56 cfs 9.322 af
n=0.040 L=290.0' S=0.0552 '/' Capacity=1,055.19 cfs Outflow=45.51 cfs 9.312 af

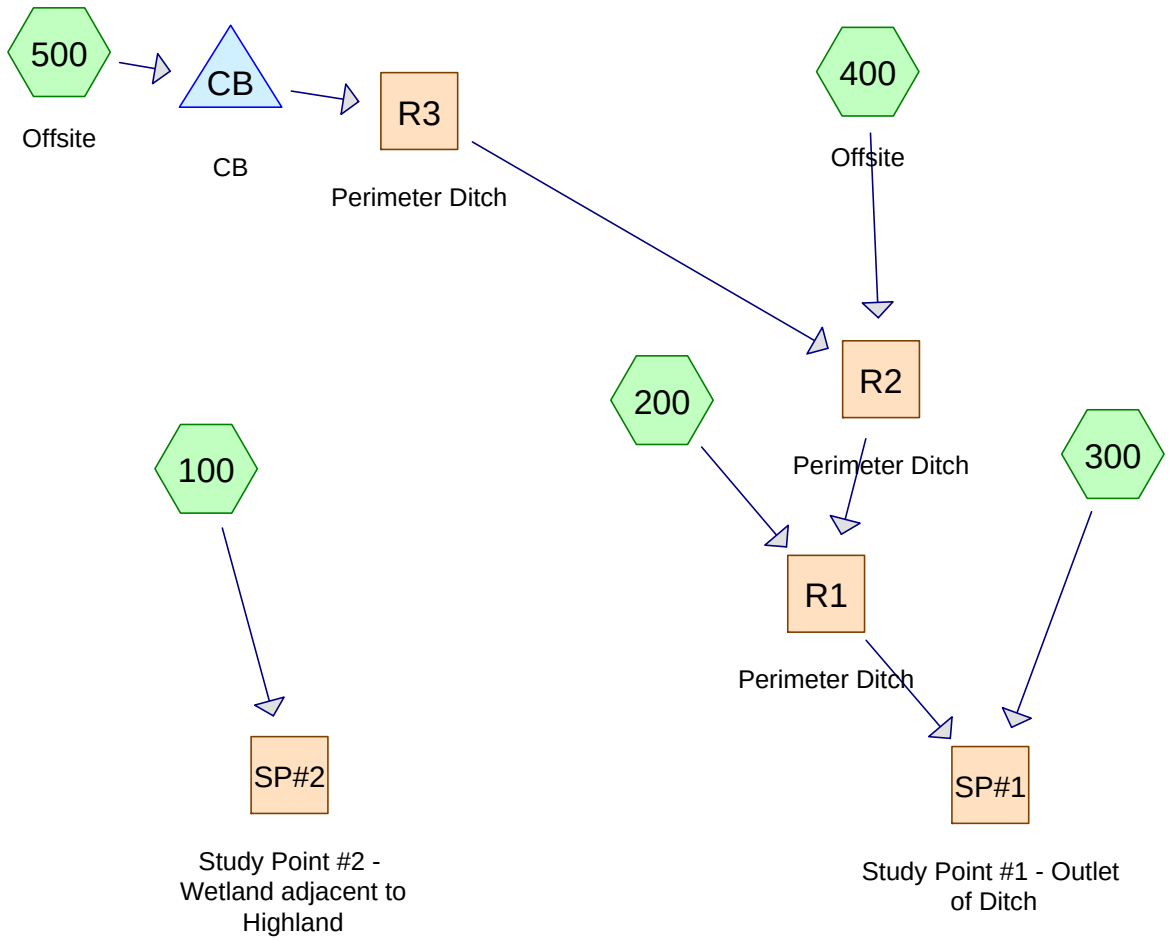
**Reach R3: Perimeter Ditch** Avg. Depth=1.23' Max Vel=3.85 fps Inflow=20.31 cfs 3.127 af
n=0.040 L=1,250.0' S=0.0144 '/' Capacity=195.24 cfs Outflow=20.02 cfs 3.100 af

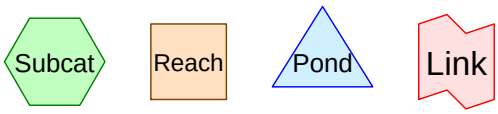
**Reach SP#1: Study Point #1 - Outlet of Ditch** Inflow=48.09 cfs 9.915 af
Outflow=48.09 cfs 9.915 af

**Reach SP#2: Study Point #2 - Wetland adjacent to Highland** Inflow=21.36 cfs 3.361 af
Outflow=21.36 cfs 3.361 af

**Pond CB: CB** Inflow=20.31 cfs 3.127 af
Primary=20.31 cfs 3.127 af

**Total Runoff Area = 89.863 ac Runoff Volume = 13.318 af Average Runoff Depth = 1.78"**
**95.56% Pervious = 85.874 ac 4.44% Impervious = 3.990 ac**




**Drainage Diagram for 1636 Pre**
Prepared by {enter your company name here}, Printed 12/20/2016
HydroCAD® 9.00 s/n 03654 © 2009 HydroCAD Software Solutions LLC

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 100:** Runoff Area=984,874 sf 5.27% Impervious Runoff Depth>2.67"
Flow Length=1,300' Tc=54.5 min CN=73 Runoff=32.10 cfs 5.025 af

**Subcatchment 200:** Runoff Area=136,701 sf 1.99% Impervious Runoff Depth>2.46"
Flow Length=720' Tc=80.8 min CN=71 Runoff=3.24 cfs 0.644 af

**Subcatchment 300:** Runoff Area=58,171 sf 2.75% Impervious Runoff Depth>2.52"
Flow Length=270' Slope=0.1000 '/' Tc=28.9 min CN=71 Runoff=2.44 cfs 0.280 af

**Subcatchment 400: Offsite** Runoff Area=42.600 ac 2.35% Impervious Runoff Depth>2.62"
Flow Length=1,570' Tc=92.8 min CN=73 Runoff=43.31 cfs 9.317 af

**Subcatchment 500: Offsite** Runoff Area=20.180 ac 8.42% Impervious Runoff Depth>2.76"
Flow Length=1,370' Tc=52.5 min CN=74 Runoff=30.23 cfs 4.640 af

**Reach R1: Perimeter Ditch** Avg. Depth=1.40' Max Vel=9.46 fps Inflow=71.34 cfs 14.555 af
n=0.035 L=150.0' S=0.0533 '/' Capacity=512.84 cfs Outflow=71.33 cfs 14.550 af

**Reach R2: Perimeter Ditch** Avg. Depth=1.45' Max Vel=8.60 fps Inflow=68.12 cfs 13.923 af
n=0.040 L=290.0' S=0.0552 '/' Capacity=1,055.19 cfs Outflow=68.11 cfs 13.912 af

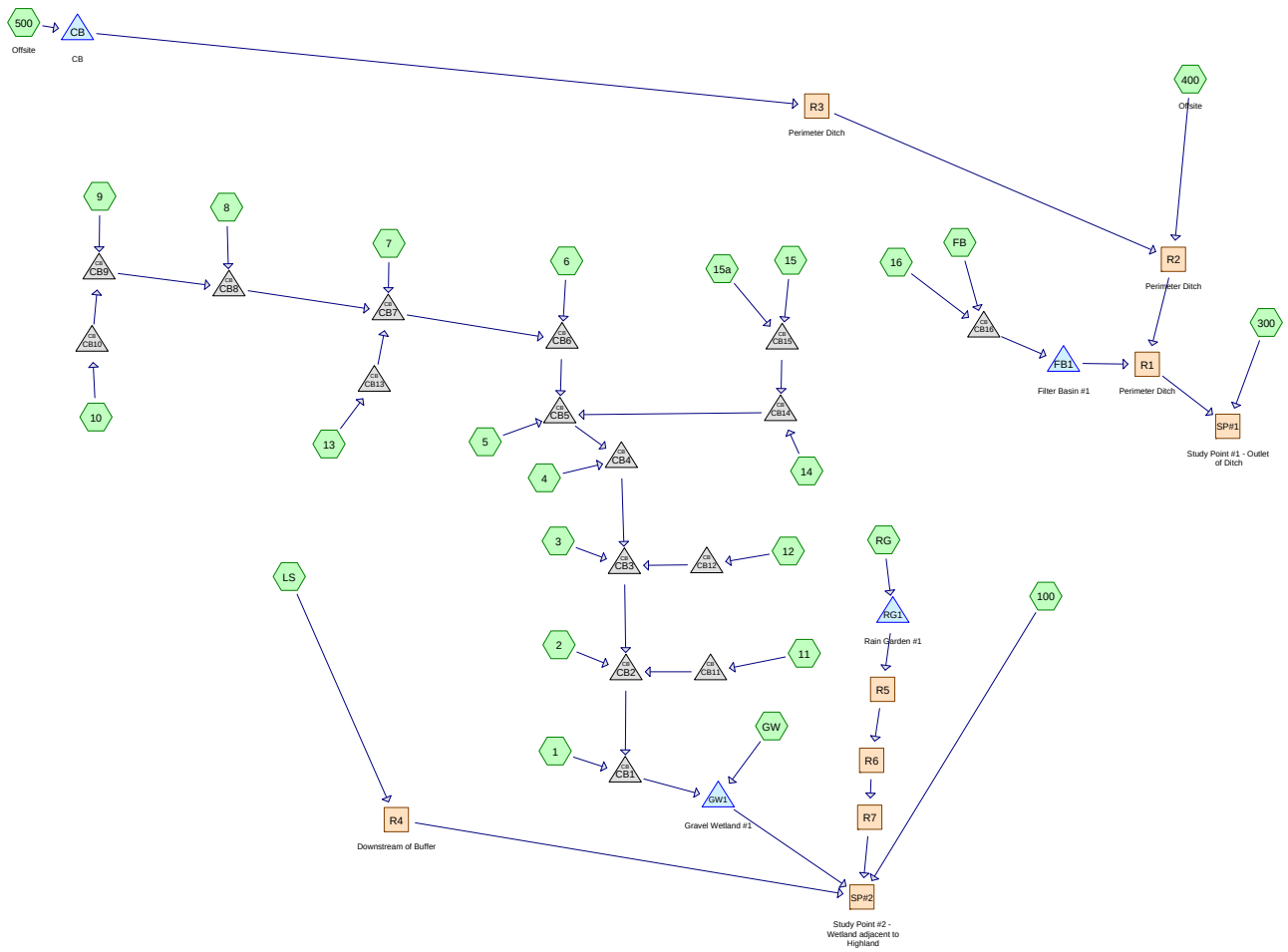
**Reach R3: Perimeter Ditch** Avg. Depth=1.53' Max Vel=4.30 fps Inflow=30.23 cfs 4.640 af
n=0.040 L=1,250.0' S=0.0144 '/' Capacity=195.24 cfs Outflow=29.86 cfs 4.607 af

**Reach SP#1: Study Point #1 - Outlet of Ditch** Inflow=72.08 cfs 14.829 af
Outflow=72.08 cfs 14.829 af

**Reach SP#2: Study Point #2 - Wetland adjacent to Highland** Inflow=32.10 cfs 5.025 af
Outflow=32.10 cfs 5.025 af

**Pond CB: CB** Inflow=30.23 cfs 4.640 af
Primary=30.23 cfs 4.640 af

**Total Runoff Area = 89.863 ac Runoff Volume = 19.906 af Average Runoff Depth = 2.66"**
**95.56% Pervious = 85.874 ac 4.44% Impervious = 3.990 ac**




Subcat Reach Pond Link

**Drainage Diagram for 1636 Post**

Prepared by {enter your company name here}, Printed 1/11/2017

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment1:** Runoff Area=0.540 ac 46.09% Impervious Runoff Depth>1.56"
Flow Length=230' Tc=10.4 min CN=85 Runoff=0.90 cfs 0.070 af

**Subcatchment2:** Runoff Area=0.446 ac 26.21% Impervious Runoff Depth>1.15"
Flow Length=370' Tc=33.5 min CN=79 Runoff=0.35 cfs 0.043 af

**Subcatchment3:** Runoff Area=0.574 ac 23.14% Impervious Runoff Depth>1.09"
Flow Length=300' Tc=30.8 min CN=78 Runoff=0.44 cfs 0.052 af

**Subcatchment4:** Runoff Area=0.019 ac 94.74% Impervious Runoff Depth>2.60"
Tc=2.0 min CN=97 Runoff=0.06 cfs 0.004 af

**Subcatchment5:** Runoff Area=0.066 ac 69.70% Impervious Runoff Depth>2.04"
Tc=2.0 min CN=91 Runoff=0.18 cfs 0.011 af

**Subcatchment6:** Runoff Area=0.297 ac 20.44% Impervious Runoff Depth>1.03"
Flow Length=240' Tc=34.9 min CN=77 Runoff=0.20 cfs 0.026 af

**Subcatchment7:** Runoff Area=0.076 ac 44.74% Impervious Runoff Depth>1.49"
Tc=2.0 min CN=84 Runoff=0.16 cfs 0.009 af

**Subcatchment8:** Runoff Area=0.032 ac 100.00% Impervious Runoff Depth>2.68"
Tc=2.0 min CN=98 Runoff=0.10 cfs 0.007 af

**Subcatchment9:** Runoff Area=0.029 ac 100.00% Impervious Runoff Depth>2.68"
Tc=2.0 min CN=98 Runoff=0.09 cfs 0.006 af

**Subcatchment10:** Runoff Area=0.054 ac 68.52% Impervious Runoff Depth>1.95"
Tc=2.0 min CN=90 Runoff=0.14 cfs 0.009 af

**Subcatchment11:** Runoff Area=0.057 ac 70.18% Impervious Runoff Depth>2.04"
Tc=2.0 min CN=91 Runoff=0.16 cfs 0.010 af

**Subcatchment12:** Runoff Area=0.271 ac 39.89% Impervious Runoff Depth>1.42"
Flow Length=140' Tc=7.2 min CN=83 Runoff=0.46 cfs 0.032 af

**Subcatchment13:** Runoff Area=0.607 ac 33.11% Impervious Runoff Depth>1.28"
Flow Length=294' Tc=13.2 min CN=81 Runoff=0.77 cfs 0.065 af

**Subcatchment14:** Runoff Area=0.145 ac 71.03% Impervious Runoff Depth>2.04"
Tc=2.0 min CN=91 Runoff=0.40 cfs 0.025 af

**Subcatchment15:** Runoff Area=2.638 ac 18.28% Impervious Runoff Depth>0.97"
Flow Length=630' Tc=44.3 min CN=76 Runoff=1.50 cfs 0.214 af

**Subcatchment15a:** Runoff Area=0.704 ac 18.32% Impervious Runoff Depth>1.04"
Flow Length=285' Tc=28.0 min CN=77 Runoff=0.53 cfs 0.061 af

**Subcatchment 16:** Runoff Area=0.690 ac 45.77% Impervious Runoff Depth>1.55"
Flow Length=360' Tc=28.0 min CN=85 Runoff=0.79 cfs 0.089 af

**Subcatchment 100:** Runoff Area=551,455 sf 5.75% Impervious Runoff Depth>0.91"
Flow Length=380' Tc=60.3 min CN=75 Runoff=5.63 cfs 0.964 af

**Subcatchment 300:** Runoff Area=71,335 sf 2.24% Impervious Runoff Depth>0.73"
Flow Length=270' Slope=0.1000 '/' Tc=28.9 min CN=71 Runoff=0.81 cfs 0.100 af

**Subcatchment 400: Offsite** Runoff Area=42.600 ac 2.35% Impervious Runoff Depth>0.80"
Flow Length=1,570' Tc=92.8 min CN=73 Runoff=12.52 cfs 2.836 af

**Subcatchment 500: Offsite** Runoff Area=20.180 ac 8.42% Impervious Runoff Depth>0.87"
Flow Length=1,370' Tc=52.5 min CN=74 Runoff=9.13 cfs 1.457 af

**Subcatchment FB:** Runoff Area=69,332 sf 25.41% Impervious Runoff Depth>1.19"
Flow Length=250' Tc=72.0 min CN=80 Runoff=0.85 cfs 0.158 af

**Subcatchment GW:** Runoff Area=100,679 sf 22.37% Impervious Runoff Depth>1.15"
Flow Length=480' Tc=34.0 min CN=79 Runoff=1.78 cfs 0.221 af

**Subcatchment LS:** Runoff Area=44,374 sf 29.45% Impervious Runoff Depth>1.20"
Flow Length=410' Tc=46.3 min CN=80 Runoff=0.71 cfs 0.102 af

**Subcatchment RG:** Runoff Area=26,952 sf 28.89% Impervious Runoff Depth>1.28"
Flow Length=470' Tc=17.9 min CN=81 Runoff=0.70 cfs 0.066 af

**Reach R1: Perimeter Ditch** Avg. Depth=0.67' Max Vel=6.43 fps Inflow=20.13 cfs 4.344 af
n=0.035 L=150.0' S=0.0533 '/' Capacity=512.84 cfs Outflow=20.12 cfs 4.341 af

**Reach R2: Perimeter Ditch** Avg. Depth=0.72' Max Vel=5.94 fps Inflow=20.16 cfs 4.273 af
n=0.040 L=290.0' S=0.0552 '/' Capacity=1,055.19 cfs Outflow=20.13 cfs 4.266 af

**Reach R3: Perimeter Ditch** Avg. Depth=0.78' Max Vel=3.05 fps Inflow=9.13 cfs 1.457 af
n=0.040 L=1,250.0' S=0.0144 '/' Capacity=195.24 cfs Outflow=8.93 cfs 1.438 af

**Reach R4: Downstream of Buffer** Avg. Depth=0.09' Max Vel=0.72 fps Inflow=0.71 cfs 0.102 af
n=0.080 L=270.0' S=0.0407 '/' Capacity=13.95 cfs Outflow=0.70 cfs 0.101 af

**Reach R5:** Avg. Depth=0.13' Max Vel=0.96 fps Inflow=0.67 cfs 0.048 af
n=0.080 L=78.0' S=0.0538 '/' Capacity=9.53 cfs Outflow=0.65 cfs 0.048 af

**Reach R6:** Avg. Depth=0.26' Max Vel=3.57 fps Inflow=0.65 cfs 0.048 af
15.0" Round Pipe n=0.012 L=40.0' S=0.0100 '/' Capacity=7.00 cfs Outflow=0.64 cfs 0.048 af

**Reach R7:** Avg. Depth=0.12' Max Vel=0.64 fps Inflow=0.64 cfs 0.048 af
n=0.100 L=360.0' S=0.0400 '/' Capacity=6.57 cfs Outflow=0.44 cfs 0.047 af

**Reach SP#1: Study Point #1 - Outlet of Ditch** Inflow=20.39 cfs 4.441 af
Outflow=20.39 cfs 4.441 af

**Reach SP#2: Study Point #2 - Wetland adjacent to Highland** Inflow=6.71 cfs 1.474 af
Outflow=6.71 cfs 1.474 af

**Pond CB: CB** Inflow=9.13 cfs 1.457 af
Primary=9.13 cfs 1.457 af

**Pond CB1:** Peak Elev=201.41' Inflow=3.99 cfs 0.644 af
24.0" Round Culvert n=0.012 L=144.0' S=0.0308 '/' Outflow=3.99 cfs 0.644 af

**Pond CB10:** Peak Elev=232.92' Inflow=0.14 cfs 0.009 af
15.0" Round Culvert n=0.012 L=16.0' S=0.0125 '/' Outflow=0.14 cfs 0.009 af

**Pond CB11:** Peak Elev=203.21' Inflow=0.16 cfs 0.010 af
15.0" Round Culvert n=0.012 L=16.0' S=0.0125 '/' Outflow=0.16 cfs 0.010 af

**Pond CB12:** Peak Elev=208.60' Inflow=0.46 cfs 0.032 af
15.0" Round Culvert n=0.012 L=16.0' S=0.0125 '/' Outflow=0.46 cfs 0.032 af

**Pond CB13:** Peak Elev=223.48' Inflow=0.77 cfs 0.065 af
15.0" Round Culvert n=0.012 L=16.0' S=0.0125 '/' Outflow=0.77 cfs 0.065 af

**Pond CB14:** Peak Elev=213.95' Inflow=1.96 cfs 0.300 af
15.0" Round Culvert n=0.012 L=128.0' S=0.0050 '/' Outflow=1.96 cfs 0.300 af

**Pond CB15:** Peak Elev=214.14' Inflow=1.92 cfs 0.275 af
15.0" Round Culvert n=0.012 L=16.0' S=0.0125 '/' Outflow=1.92 cfs 0.275 af

**Pond CB16:** Peak Elev=213.92' Inflow=1.20 cfs 0.247 af
18.0" Round Culvert n=0.012 L=50.0' S=0.0272 '/' Outflow=1.20 cfs 0.247 af

**Pond CB2:** Peak Elev=202.60' Inflow=3.58 cfs 0.574 af
18.0" Round Culvert n=0.012 L=124.0' S=0.0050 '/' Outflow=3.58 cfs 0.574 af

**Pond CB3:** Peak Elev=207.77' Inflow=3.20 cfs 0.521 af
18.0" Round Culvert n=0.012 L=122.0' S=0.0430 '/' Outflow=3.20 cfs 0.521 af

**Pond CB4:** Peak Elev=213.27' Inflow=2.61 cfs 0.437 af
15.0" Round Culvert n=0.012 L=112.0' S=0.0381 '/' Outflow=2.61 cfs 0.437 af

**Pond CB5:** Peak Elev=213.51' Inflow=2.60 cfs 0.433 af
15.0" Round Culvert n=0.012 L=32.0' S=0.0063 '/' Outflow=2.60 cfs 0.433 af

**Pond CB6:** Peak Elev=216.27' Inflow=1.07 cfs 0.122 af
15.0" Round Culvert n=0.012 L=16.0' S=0.0125 '/' Outflow=1.07 cfs 0.122 af

**Pond CB7:** Peak Elev=223.34' Inflow=0.98 cfs 0.097 af
15.0" Round Culvert n=0.012 L=126.0' S=0.0563 '/' Outflow=0.98 cfs 0.097 af

**Pond CB8:** Peak Elev=229.53' Inflow=0.34 cfs 0.022 af
15.0" Round Culvert n=0.012 L=126.0' S=0.0510 '/' Outflow=0.34 cfs 0.022 af

**Pond CB9:** Peak Elev=232.78' Inflow=0.24 cfs 0.015 af
15.0" Round Culvert n=0.012 L=84.0' S=0.0393 '/' Outflow=0.24 cfs 0.015 af

**Pond FB1: Filter Basin #1** Peak Elev=207.05' Storage=7,537 cf Inflow=1.20 cfs 0.247 af
Outflow=0.30 cfs 0.078 af

**Pond GW1: Gravel Wetland #1** Peak Elev=194.98' Storage=24,443 cf Inflow=5.72 cfs 0.865 af
Outflow=0.90 cfs 0.362 af

**Pond RG1: Rain Garden #1** Peak Elev=208.04' Storage=821 cf Inflow=0.70 cfs 0.066 af
Outflow=0.67 cfs 0.048 af

**Total Runoff Area = 89.863 ac Runoff Volume = 6.636 af Average Runoff Depth = 0.89"**
**92.21% Pervious = 82.864 ac 7.79% Impervious = 6.999 ac**

## Summary for Subcatchment 1:

Runoff = 0.90 cfs @ 12.15 hrs, Volume= 0.070 af, Depth> 1.56"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.164 | 98 | Proposed Roadway Impervious |
| * | 0.093 | 74 | Roadway >75% Grass cover, Good, HSG C, |
| | 0.283 | 81 | 1/3 acre lots, 30% imp, HSG C |
| * | 0.000 | 98 | Apartments Impervious |
| * | 0.000 | 74 | Apartments Grass, HSG C |
| | 0.540 | 85 | Weighted Average |
| | 0.291 | | 53.91% Pervious Area |
| | 0.249 | | 46.09% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 9.3 | 100 | 0.0600 | 0.18 | | **Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10" |
| 1.1 | 130 | 0.0100 | 2.03 | | **Shallow Concentrated Flow,** Paved Kv= 20.3 fps |
| 10.4 | 230 | Total | | | |

## Summary for Subcatchment 2:

Runoff = 0.35 cfs @ 12.49 hrs, Volume= 0.043 af, Depth> 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.029 | 98 | Proposed Roadway Impervious |
| * | 0.002 | 74 | Roadway >75% Grass cover, Good, HSG C, |
| | 0.293 | 81 | 1/3 acre lots, 30% imp, HSG C |
| * | 0.000 | 98 | Apartments Impervious |
| * | 0.046 | 74 | Apartments Grass, HSG C |
| | 0.076 | 70 | Woods, Good, HSG C |
| | 0.446 | 79 | Weighted Average |
| | 0.329 | | 73.79% Pervious Area |
| | 0.117 | | 26.21% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 32.4 | 150 | 0.0670 | 0.08 | | **Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10" |
| 0.5 | 130 | 0.0700 | 3.97 | | **Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps |
| 0.6 | 90 | 0.0150 | 2.49 | | **Shallow Concentrated Flow,** Paved Kv= 20.3 fps |
| 33.5 | 370 | Total | | | |

## Summary for Subcatchment 3:

Runoff = 0.44 cfs @ 12.45 hrs, Volume= 0.052 af, Depth> 1.09"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.026 | 98 | Proposed Roadway Impervious |
| * | 0.002 | 74 | Roadway >75% Grass cover, Good, HSG C, |
| | 0.356 | 81 | 1/3 acre lots, 30% imp, HSG C |
| * | 0.000 | 98 | Apartments Impervious |
| * | 0.034 | 74 | Apartments Grass, HSG C |
| | 0.156 | 70 | Woods, Good, HSG C |
| | 0.574 | 78 | Weighted Average |
| | 0.441 | | 76.86% Pervious Area |
| | 0.133 | | 23.14% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 30.2 | 150 | 0.0800 | 0.08 | | **Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10" |
| 0.5 | 120 | 0.0670 | 3.88 | | **Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps |
| 0.1 | 30 | 0.0800 | 5.74 | | **Shallow Concentrated Flow,** Paved Kv= 20.3 fps |
| 30.8 | 300 | Total | | | |

## Summary for Subcatchment 4:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.06 cfs @ 12.03 hrs, Volume= 0.004 af, Depth> 2.60"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.018 | 98 | Proposed Roadway Impervious |
| * | 0.001 | 74 | Roadway >75% Grass cover, Good, HSG C, |
| | 0.000 | 81 | 1/3 acre lots, 30% imp, HSG C |
| * | 0.000 | 98 | Apartments Impervious |
| * | 0.000 | 74 | Apartments Grass, HSG C |
| | 0.000 | 70 | Woods, Good, HSG C |
| | 0.019 | 97 | Weighted Average |
| | 0.001 | | 5.26% Pervious Area |
| | 0.018 | | 94.74% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 2.0 | | | | | **Direct Entry, Assumed Min Tc** |

## Summary for Subcatchment 5:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.18 cfs @ 12.04 hrs, Volume= 0.011 af, Depth> 2.04"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.046 | 98 | Proposed Roadway Impervious |
| * | 0.020 | 74 | Roadway >75% Grass cover, Good, HSG C, |
| | 0.000 | 81 | 1/3 acre lots, 30% imp, HSG C |
| * | 0.000 | 98 | Apartments Impervious |
| * | 0.000 | 74 | Apartments Grass, HSG C |
| | 0.000 | 70 | Woods, Good, HSG C |
| | 0.066 | 91 | Weighted Average |
| | 0.020 | | 30.30% Pervious Area |
| | 0.046 | | 69.70% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 2.0 | | | | | **Direct Entry, Assumed Min Tc** |

## Summary for Subcatchment 6:

Runoff = 0.20 cfs @ 12.52 hrs, Volume= 0.026 af, Depth> 1.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.031 | 98 | Proposed Roadway Impervious |
| * | 0.042 | 74 | Roadway >75% Grass cover, Good, HSG C, |
| | 0.099 | 81 | 1/3 acre lots, 30% imp, HSG C |
| * | 0.000 | 98 | Apartments Impervious |
| * | 0.000 | 74 | Apartments Grass, HSG C |
| | 0.125 | 70 | Woods, Good, HSG C |
| | 0.297 | 77 | Weighted Average |
| | 0.236 | | 79.56% Pervious Area |
| | 0.061 | | 20.44% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 33.9 | 150 | 0.0600 | 0.07 | | **Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10" |
| 0.9 | 60 | 0.0500 | 1.12 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 0.1 | 30 | 0.0500 | 4.54 | | **Shallow Concentrated Flow,** Paved Kv= 20.3 fps |
| 34.9 | 240 | Total | | | |

## Summary for Subcatchment 7:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.16 cfs @ 12.04 hrs, Volume= 0.009 af, Depth> 1.49"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.034 | 98 | Proposed Roadway Impervious |
| * | 0.035 | 74 | Roadway >75% Grass cover, Good, HSG C, |
| | 0.000 | 81 | 1/3 acre lots, 30% imp, HSG C |
| * | 0.000 | 98 | Apartments Impervious |
| * | 0.000 | 74 | Apartments Grass, HSG C |
| | 0.007 | 70 | Woods, Good, HSG C |
| | 0.076 | 84 | Weighted Average |
| | 0.042 | | 55.26% Pervious Area |
| | 0.034 | | 44.74% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 2.0 | | | | | **Direct Entry, Assumed Min Tc** |

## Summary for Subcatchment 8:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.10 cfs @ 12.03 hrs, Volume= 0.007 af, Depth> 2.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.019 | 98 | Proposed Roadway Impervious |
| * | 0.000 | 74 | Roadway >75% Grass cover, Good, HSG C, |
| | 0.000 | 81 | 1/3 acre lots, 30% imp, HSG C |
| * | 0.013 | 98 | Route 302 |
| * | 0.000 | 74 | Apartments Grass, HSG C |
| | 0.000 | 70 | Woods, Good, HSG C |
| | 0.032 | 98 | Weighted Average |
| | 0.032 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 2.0 | | | | | **Direct Entry, Assumed Min Tc** |

## Summary for Subcatchment 9:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.09 cfs @ 12.03 hrs, Volume= 0.006 af, Depth> 2.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.029 | 98 | Proposed Roadway Impervious |
| * | 0.000 | 74 | Roadway >75% Grass cover, Good, HSG C, |
| | 0.000 | 81 | 1/3 acre lots, 30% imp, HSG C |
| * | 0.000 | 98 | Apartments Impervious |
| * | 0.000 | 74 | Apartments Grass, HSG C |
| | 0.000 | 70 | Woods, Good, HSG C |
| | 0.029 | 98 | Weighted Average |
| | 0.029 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 2.0 | | | | | **Direct Entry, Assumed Min Tc** |

## Summary for Subcatchment 10:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.14 cfs @ 12.04 hrs, Volume= 0.009 af, Depth> 1.95"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.035 | 98 | Proposed Roadway Impervious |
| * | 0.017 | 74 | Roadway >75% Grass cover, Good, HSG C, |
| * | 0.002 | 98 | Route 302 |
| | 0.054 | 90 | Weighted Average |
| | 0.017 | | 31.48% Pervious Area |
| | 0.037 | | 68.52% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 2.0 | | | | | **Direct Entry, Assumed Min Tc** |

## Summary for Subcatchment 11:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.16 cfs @ 12.04 hrs, Volume= 0.010 af, Depth> 2.04"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.040 | 98 | Proposed Roadway Impervious |
| * | 0.017 | 74 | Roadway >75% Grass cover, Good, HSG C, |
| | 0.057 | 91 | Weighted Average |
| | 0.017 | | 29.82% Pervious Area |
| | 0.040 | | 70.18% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 2.0 | | | | | **Direct Entry, Assumed Min Tc** |

## Summary for Subcatchment 12:

Runoff = 0.46 cfs @ 12.11 hrs, Volume= 0.032 af, Depth> 1.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.046 | 98 | Proposed Roadway Impervious |
| * | 0.018 | 74 | Roadway >75% Grass cover, Good, HSG C, |
| | 0.207 | 81 | 1/3 acre lots, 30% imp, HSG C |
| * | 0.000 | 98 | Apartments Impervious |
| * | 0.000 | 74 | Apartments Grass, HSG C |
| | 0.271 | 83 | Weighted Average |
| | 0.163 | | 60.11% Pervious Area |
| | 0.108 | | 39.89% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 7.0 | 70 | 0.0600 | 0.17 | | **Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10" |
| 0.2 | 70 | 0.0800 | 5.74 | | **Shallow Concentrated Flow,** Paved Kv= 20.3 fps |
| 7.2 | 140 | Total | | | |

## Summary for Subcatchment 13:

Runoff = 0.77 cfs @ 12.19 hrs, Volume= 0.065 af, Depth> 1.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.084 | 98 | Proposed Roadway Impervious |
| * | 0.056 | 74 | Roadway >75% Grass cover, Good, HSG C, |
| | 0.000 | 81 | 1/3 acre lots, 30% imp, HSG C |
| * | 0.117 | 98 | Apartments Impervious |
| * | 0.213 | 74 | Apartments Grass, HSG C |
| | 0.137 | 70 | Woods, Good, HSG C |
| | 0.607 | 81 | Weighted Average |
| | 0.406 | | 66.89% Pervious Area |
| | 0.201 | | 33.11% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 12.3 | 100 | 0.0300 | 0.14 | | **Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10" |
| 0.1 | 24 | 0.0200 | 2.87 | | **Shallow Concentrated Flow,** Paved Kv= 20.3 fps |
| 0.3 | 40 | 0.0300 | 2.60 | | **Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps |
| 0.5 | 130 | 0.0420 | 4.16 | | **Shallow Concentrated Flow,** Paved Kv= 20.3 fps |
| 13.2 | 294 | Total | | | |

## Summary for Subcatchment 14:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.40 cfs @ 12.04 hrs, Volume= 0.025 af, Depth> 2.04"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.103 | 98 | Proposed Roadway Impervious |
| * | 0.042 | 74 | Roadway >75% Grass cover, Good, HSG C, |
| | 0.145 | 91 | Weighted Average |
| | 0.042 | | 28.97% Pervious Area |
| | 0.103 | | 71.03% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 2.0 | | | | | **Direct Entry, Assumed Min Tc** |

## Summary for Subcatchment 15:

Runoff = 1.50 cfs @ 12.65 hrs, Volume= 0.214 af, Depth> 0.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.085 | 98 | Proposed Roadway Impervious |
| * | 0.012 | 74 | Roadway >75% Grass cover, Good, HSG C, |
| | 1.237 | 81 | 1/3 acre lots, 30% imp, HSG C |
| * | 0.026 | 98 | Route 302 |
| | 1.278 | 70 | Woods, Good, HSG C |
| | 2.638 | 76 | Weighted Average |
| | 2.156 | | 81.72% Pervious Area |
| | 0.482 | | 18.28% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 36.4 | 150 | 0.0500 | 0.07 | | **Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10" |
| 7.5 | 430 | 0.0370 | 0.96 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 0.4 | 50 | 0.0100 | 2.03 | | **Shallow Concentrated Flow,** Paved Kv= 20.3 fps |
| 44.3 | 630 | Total | | | |

## Summary for Subcatchment 15a:

Runoff = 0.53 cfs @ 12.42 hrs, Volume= 0.061 af, Depth> 1.04"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| Area (ac) | CN | Description |
|---|---|---|
| 0.430 | 81 | 1/3 acre lots, 30% imp, HSG C |
| 0.274 | 70 | Woods, Good, HSG C |
| 0.704 | 77 | Weighted Average |
| 0.575 | | 81.68% Pervious Area |
| 0.129 | | 18.32% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 25.5 | 105 | 0.0600 | 0.07 | | **Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10" |
| 2.5 | 180 | 0.0300 | 1.21 | | **Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps |
| 28.0 | 285 | Total | | | |

## Summary for Subcatchment 16:

Runoff = 0.79 cfs @ 12.39 hrs, Volume= 0.089 af, Depth> 1.55"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.203 | 98 | Proposed Roadway Impervious |
| * | 0.108 | 74 | Roadway >75% Grass cover, Good, HSG C, |
| | 0.376 | 81 | 1/3 acre lots, 30% imp, HSG C |
| | 0.003 | 70 | Woods, Good, HSG C |
| | 0.690 | 85 | Weighted Average |
| | 0.374 | | 54.23% Pervious Area |
| | 0.316 | | 45.77% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 26.5 | 150 | 0.0100 | 0.09 | | **Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10" |
| 1.5 | 210 | 0.0130 | 2.31 | | **Shallow Concentrated Flow,** Paved Kv= 20.3 fps |
| 28.0 | 360 | Total | | | |

## Summary for Subcatchment 100:

Runoff = 5.63 cfs @ 12.87 hrs, Volume= 0.964 af, Depth> 0.91"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 20,200 | 92 | Road with Row |
| * | 10,950 | 98 | Onsite driveway in easement |
| | 40,000 | 79 | 1 acre lots, 20% imp, HSG C |
| | 80,000 | 74 | >75% Grass cover, Good, HSG C |
| | 32,774 | 81 | 1/3 acre lots, 30% imp, HSG C |
| | 239,086 | 70 | Woods, Good, HSG C |
| | 125,527 | 77 | Woods, Good, HSG D |
| * | 2,918 | 98 | Roof area from Apartments (to RD filter strip) |
| | 551,455 | 75 | Weighted Average |
| | 519,755 | | 94.25% Pervious Area |
| | 31,700 | | 5.75% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 23.0 | 100 | 0.0700 | 0.07 | | **Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10" |
| 0.8 | 70 | 0.0100 | 1.50 | | **Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps |
| 35.6 | 150 | 0.0530 | 0.07 | | **Sheet Flow, Level Spreader** Woods: Dense underbrush n= 0.800 P2= 3.10" |
| 0.9 | 60 | 0.0500 | 1.12 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 60.3 | 380 | Total | | | |

## Summary for Subcatchment 300:

Runoff = 0.81 cfs @ 12.46 hrs, Volume= 0.100 af, Depth> 0.73"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 1,600 | 98 | Camp Roads |
| | 69,735 | 70 | Woods, Good, HSG C |
| | 71,335 | 71 | Weighted Average |
| | 69,735 | | 97.76% Pervious Area |
| | 1,600 | | 2.24% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 27.6 | 150 | 0.1000 | 0.09 | | **Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10" |
| 1.3 | 120 | 0.1000 | 1.58 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 28.9 | 270 | Total | | | |

## Summary for Subcatchment 400: Offsite

Runoff = 12.52 cfs @ 13.32 hrs, Volume= 2.836 af, Depth> 0.80"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 2.000 | 92 | Road with Row |
| * | 0.500 | 83 | Commercial Lot |
| | 5.000 | 79 | 1 acre lots, 20% imp, HSG C |
| | 29.900 | 70 | Woods, Good, HSG C |
| | 5.200 | 77 | Woods, Good, HSG D |
| | 42.600 | 73 | Weighted Average |
| | 41.600 | | 97.65% Pervious Area |
| | 1.000 | | 2.35% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 33.9 | 150 | 0.0600 | 0.07 | | **Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10" |
| 4.4 | 380 | 0.0840 | 1.45 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 52.2 | 700 | 0.0020 | 0.22 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 2.3 | 340 | 0.0140 | 2.45 | 5.51 | **Trap/Vee/Rect Channel Flow,** Bot.W=4.00' D=0.50' Z= 1.0 '/' Top.W=5.00' n= 0.040 |
| 92.8 | 1,570 | Total | | | |

## Summary for Subcatchment 500: Offsite

Runoff = 9.13 cfs @ 12.78 hrs, Volume= 1.457 af, Depth> 0.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.800 | 92 | Road with Row |
| * | 0.500 | 98 | Commercial Impervious |
| | 6.000 | 79 | 1 acre lots, 20% imp, HSG C |
| | 12.880 | 70 | Woods, Good, HSG C |
| | 20.180 | 74 | Weighted Average |
| | 18.480 | | 91.58% Pervious Area |
| | 1.700 | | 8.42% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 35.6 | 150 | 0.0530 | 0.07 | | **Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10" |
| 16.9 | 1,220 | 0.0580 | 1.20 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 52.5 | 1,370 | Total | | | |

## Summary for Subcatchment FB:

Runoff = 0.85 cfs @ 13.01 hrs, Volume= 0.158 af, Depth> 1.19"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 58,716 | 81 | 1/3 acre lots, 30% imp, HSG C |
| | 3,616 | 70 | Woods, Good, HSG C |
| * | 7,000 | 74 | Swale & Pond Grass |
| | 69,332 | 80 | Weighted Average |
| | 51,717 | | 74.59% Pervious Area |
| | 17,615 | | 25.41% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 69.3 | 150 | 0.0100 | 0.04 | | **Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10" |
| 2.7 | 100 | 0.0150 | 0.61 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 72.0 | 250 | Total | | | |

## Summary for Subcatchment GW:

Runoff = 1.78 cfs @ 12.50 hrs, Volume= 0.221 af, Depth> 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 75,060 | 81 | 1/3 acre lots, 30% imp, HSG C |
| | 3,400 | 70 | Woods, Good, HSG C |
| * | 22,219 | 74 | Swale & Pond Grass |
| | 100,679 | 79 | Weighted Average |
| | 78,161 | | 77.63% Pervious Area |
| | 22,518 | | 22.37% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 29.3 | 150 | 0.0860 | 0.09 | | **Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10" |
| 4.2 | 220 | 0.0300 | 0.87 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 0.5 | 110 | 0.0200 | 3.41 | 5.96 | **Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=0.50' Z= 3.0 '/' Top.W=5.00' n= 0.030 |
| 34.0 | 480 | Total | | | |

## Summary for Subcatchment LS:

Runoff = 0.71 cfs @ 12.66 hrs, Volume= 0.102 af, Depth> 1.20"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 13,068 | 98 | Apartments Impervious |
| * | 23,000 | 74 | Apartments Grass, HSG C |
| | 8,306 | 70 | Woods, Good, HSG C |
| | 44,374 | 80 | Weighted Average |
| | 31,306 | | 70.55% Pervious Area |
| | 13,068 | | 29.45% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 11.5 | 150 | 0.0800 | 0.22 | | **Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10" |
| 0.9 | 110 | 0.0800 | 1.98 | | **Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps |
| 33.9 | 150 | 0.0600 | 0.07 | | **Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10" |
| 46.3 | 410 | Total | | | |

## Summary for Subcatchment RG:

Runoff = 0.70 cfs @ 12.26 hrs, Volume= 0.066 af, Depth> 1.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 25,952 | 81 | 1/3 acre lots, 30% imp, HSG C |
| * | 1,000 | 74 | Swale & Pond Grass |
| | 26,952 | 81 | Weighted Average |
| | 19,166 | | 71.11% Pervious Area |
| | 7,786 | | 28.89% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 13.2 | 140 | 0.0500 | 0.18 | | **Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10" |
| 4.2 | 220 | 0.0300 | 0.87 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 0.5 | 110 | 0.0200 | 3.41 | 5.96 | **Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=0.50' Z= 3.0 '/' Top.W=5.00' n= 0.030 |
| 17.9 | 470 | Total | | | |

## Summary for Reach R1: Perimeter Ditch

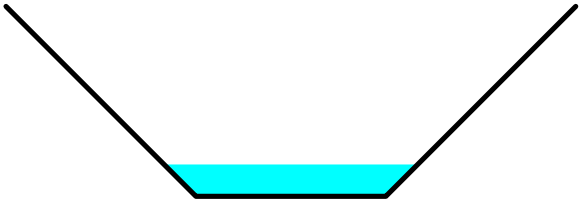
[61] Hint: Exceeded Reach R2 outlet invert by 0.67' @ 13.15 hrs

Inflow Area = 65.062 ac, 5.26% Impervious, Inflow Depth > 0.80"
Inflow = 20.13 cfs @ 13.15 hrs, Volume= 4.344 af
Outflow = 20.12 cfs @ 13.17 hrs, Volume= 4.341 af, Atten= 0%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.43 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.77 fps, Avg. Travel Time= 0.7 min

Peak Storage= 470 cf @ 13.16 hrs, Average Depth at Peak Storage= 0.67'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 512.84 cfs

4.00' x 4.00' deep channel, n= 0.035
Side Slope Z-value= 1.0 '/' Top Width= 12.00'
Length= 150.0' Slope= 0.0533 '/'
Inlet Invert= 206.00', Outlet Invert= 198.00'



## Summary for Reach R2: Perimeter Ditch

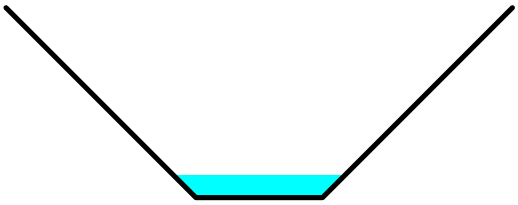
[62] Warning: Exceeded Reach R3 OUTLET depth by 0.14' @ 13.75 hrs

Inflow Area = 62.780 ac, 4.30% Impervious, Inflow Depth > 0.82"
Inflow = 20.16 cfs @ 13.12 hrs, Volume= 4.273 af
Outflow = 20.13 cfs @ 13.15 hrs, Volume= 4.266 af, Atten= 0%, Lag= 2.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.94 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 3.50 fps, Avg. Travel Time= 1.4 min

Peak Storage= 983 cf @ 13.14 hrs, Average Depth at Peak Storage= 0.72'
Bank-Full Depth= 6.00', Capacity at Bank-Full= 1,055.19 cfs

4.00' x 6.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 16.00'
Length= 290.0' Slope= 0.0552 '/'
Inlet Invert= 222.00', Outlet Invert= 206.00'



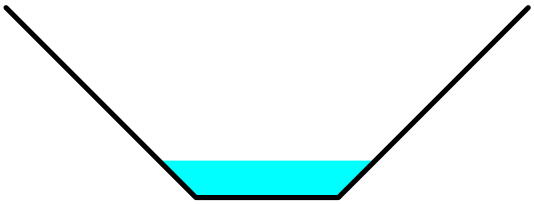
## Summary for Reach R3: Perimeter Ditch

Inflow Area = 20.180 ac, 8.42% Impervious, Inflow Depth > 0.87"
Inflow = 9.13 cfs @ 12.78 hrs, Volume= 1.457 af
Outflow = 8.93 cfs @ 12.97 hrs, Volume= 1.438 af, Atten= 2%, Lag= 11.9 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.05 fps, Min. Travel Time= 6.8 min
Avg. Velocity = 1.62 fps, Avg. Travel Time= 12.9 min

Peak Storage= 3,669 cf @ 12.86 hrs, Average Depth at Peak Storage= 0.78'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 195.24 cfs

3.00' x 4.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 11.00'
Length= 1,250.0' Slope= 0.0144 '/'
Inlet Invert= 240.00', Outlet Invert= 222.00'



## Summary for Reach R4: Downstream of Buffer

Inflow Area = 1.019 ac, 29.45% Impervious, Inflow Depth > 1.20"
Inflow = 0.71 cfs @ 12.66 hrs, Volume= 0.102 af
Outflow = 0.70 cfs @ 12.84 hrs, Volume= 0.101 af, Atten= 2%, Lag= 10.5 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.72 fps, Min. Travel Time= 6.2 min
Avg. Velocity = 0.31 fps, Avg. Travel Time= 14.3 min

Peak Storage= 261 cf @ 12.73 hrs, Average Depth at Peak Storage= 0.09'
Bank-Full Depth= 0.50', Capacity at Bank-Full= 13.95 cfs

10.00' x 0.50' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 8.0 '/' Top Width= 18.00'
Length= 270.0' Slope= 0.0407 '/'
Inlet Invert= 204.00', Outlet Invert= 193.00'

‡

## Summary for Reach R5:

[81] Warning: Exceeded Pond RG1 by 0.08' @ 12.35 hrs

Inflow Area = 0.619 ac, 28.89% Impervious, Inflow Depth > 0.93"
Inflow = 0.67 cfs @ 12.35 hrs, Volume= 0.048 af
Outflow = 0.65 cfs @ 12.41 hrs, Volume= 0.048 af, Atten= 4%, Lag= 3.6 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.96 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 0.38 fps, Avg. Travel Time= 3.4 min

Peak Storage= 59 cf @ 12.37 hrs, Average Depth at Peak Storage= 0.13'
Bank-Full Depth= 0.50', Capacity at Bank-Full= 9.53 cfs

5.00' x 0.50' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 8.0 '/' Top Width= 13.00'
Length= 78.0' Slope= 0.0538 '/'
Inlet Invert= 208.00', Outlet Invert= 203.80'

‡

## Summary for Reach R6:

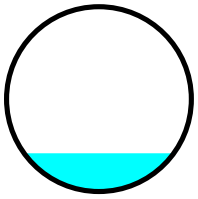
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Warning: Exceeded Reach R5 OUTLET depth by 0.15' @ 12.40 hrs

Inflow Area = 0.619 ac, 28.89% Impervious, Inflow Depth > 0.93"
Inflow = 0.65 cfs @ 12.41 hrs, Volume= 0.048 af
Outflow = 0.64 cfs @ 12.41 hrs, Volume= 0.048 af, Atten= 1%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.57 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.70 fps, Avg. Travel Time= 0.4 min

Peak Storage= 7 cf @ 12.41 hrs, Average Depth at Peak Storage= 0.26'
Bank-Full Depth= 1.25', Capacity at Bank-Full= 7.00 cfs

15.0" Round Pipe
n= 0.012
Length= 40.0' Slope= 0.0100 '/'
Inlet Invert= 203.80', Outlet Invert= 203.40'



## Summary for Reach R7:

[63] Warning: Exceeded Reach R6 INLET depth by 4.60' @ 5.00 hrs

Inflow Area = 0.619 ac, 28.89% Impervious, Inflow Depth > 0.93"
Inflow = 0.64 cfs @ 12.41 hrs, Volume= 0.048 af
Outflow = 0.44 cfs @ 12.74 hrs, Volume= 0.047 af, Atten= 32%, Lag= 19.4 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.64 fps, Min. Travel Time= 9.4 min
Avg. Velocity = 0.31 fps, Avg. Travel Time= 19.6 min

Peak Storage= 246 cf @ 12.58 hrs, Average Depth at Peak Storage= 0.12'
Bank-Full Depth= 0.50', Capacity at Bank-Full= 6.57 cfs

5.00' x 0.50' deep channel, n= 0.100 Earth, dense brush, high stage
Side Slope Z-value= 8.0 '/' Top Width= 13.00'
Length= 360.0' Slope= 0.0400 '/'
Inlet Invert= 208.40', Outlet Invert= 194.00'

‡

## Summary for Reach SP#1: Study Point #1 - Outlet of Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 66.699 ac, 5.18% Impervious, Inflow Depth > 0.80"
Inflow = 20.39 cfs @ 13.16 hrs, Volume= 4.441 af
Outflow = 20.39 cfs @ 13.16 hrs, Volume= 4.441 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

## Summary for Reach SP#2: Study Point #2 - Wetland adjacent to Highland

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 23.163 ac, 15.29% Impervious, Inflow Depth > 0.76"
Inflow = 6.71 cfs @ 12.85 hrs, Volume= 1.474 af
Outflow = 6.71 cfs @ 12.85 hrs, Volume= 1.474 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

## Summary for Pond CB: CB

Not modeled because watershed enters closed stormwater system over a series of catch basins.

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[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 20.180 ac, 8.42% Impervious, Inflow Depth > 0.87"
Inflow = 9.13 cfs @ 12.78 hrs, Volume= 1.457 af
Primary = 9.13 cfs @ 12.78 hrs, Volume= 1.457 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

## Summary for Pond CB1:

[79] Warning: Submerged Pond CB2 Primary device # 1 OUTLET by 0.47'

Inflow Area = 6.555 ac, 27.74% Impervious, Inflow Depth > 1.18"
Inflow = 3.99 cfs @ 12.40 hrs, Volume= 0.644 af
Outflow = 3.99 cfs @ 12.40 hrs, Volume= 0.644 af, Atten= 0%, Lag= 0.0 min
Primary = 3.99 cfs @ 12.40 hrs, Volume= 0.644 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 201.41' @ 12.40 hrs
Flood Elev= 204.74'

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 200.44' | **24.0" Round Culvert**<br>L= 144.0' CPP, projecting, no headwall, Ke= 0.900<br>Outlet Invert= 196.00' S= 0.0308 '/' Cc= 0.900 n= 0.012 |

**Primary OutFlow** Max=3.99 cfs @ 12.40 hrs HW=201.41' (Free Discharge)
└**1=Culvert** (Inlet Controls 3.99 cfs @ 2.65 fps)

## Summary for Pond CB10:

Inflow Area = 0.054 ac, 68.52% Impervious, Inflow Depth > 1.95"
Inflow = 0.14 cfs @ 12.04 hrs, Volume= 0.009 af
Outflow = 0.14 cfs @ 12.04 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min
Primary = 0.14 cfs @ 12.04 hrs, Volume= 0.009 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 232.92' @ 12.04 hrs
Flood Elev= 235.98'

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 232.73' | **15.0" Round Culvert**<br>L= 16.0' CPP, projecting, no headwall, Ke= 0.900<br>Outlet Invert= 232.53' S= 0.0125 '/' Cc= 0.900 n= 0.012 |

**Primary OutFlow** Max=0.14 cfs @ 12.04 hrs HW=232.92' (Free Discharge)
└**1=Culvert** (Inlet Controls 0.14 cfs @ 1.17 fps)

## Summary for Pond CB11:

Inflow Area = 0.057 ac, 70.18% Impervious, Inflow Depth > 2.04"
Inflow = 0.16 cfs @ 12.04 hrs, Volume= 0.010 af
Outflow = 0.16 cfs @ 12.04 hrs, Volume= 0.010 af, Atten= 0%, Lag= 0.0 min
Primary = 0.16 cfs @ 12.04 hrs, Volume= 0.010 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 203.21' @ 12.03 hrs
Flood Elev= 206.26'

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 203.01' | **15.0" Round Culvert**<br>L= 16.0' CPP, projecting, no headwall, Ke= 0.900<br>Outlet Invert= 202.81' S= 0.0125 '/' Cc= 0.900 n= 0.012 |

**Primary OutFlow** Max=0.15 cfs @ 12.04 hrs HW=203.21' (Free Discharge)
└**1=Culvert** (Inlet Controls 0.15 cfs @ 1.19 fps)

## Summary for Pond CB12:

Inflow Area = 0.271 ac, 39.89% Impervious, Inflow Depth > 1.42"
Inflow = 0.46 cfs @ 12.11 hrs, Volume= 0.032 af
Outflow = 0.46 cfs @ 12.11 hrs, Volume= 0.032 af, Atten= 0%, Lag= 0.0 min
Primary = 0.46 cfs @ 12.11 hrs, Volume= 0.032 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 208.60' @ 12.11 hrs
Flood Elev= 211.50'

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 208.25' | **15.0" Round Culvert**<br>L= 16.0' CPP, projecting, no headwall, Ke= 0.900<br>Outlet Invert= 208.05' S= 0.0125 '/' Cc= 0.900 n= 0.012 |

**Primary OutFlow** Max=0.45 cfs @ 12.11 hrs HW=208.60' (Free Discharge)
└─**1=Culvert** (Inlet Controls 0.45 cfs @ 1.59 fps)

## Summary for Pond CB13:

Inflow Area = 0.607 ac, 33.11% Impervious, Inflow Depth > 1.28"
Inflow = 0.77 cfs @ 12.19 hrs, Volume= 0.065 af
Outflow = 0.77 cfs @ 12.19 hrs, Volume= 0.065 af, Atten= 0%, Lag= 0.0 min
Primary = 0.77 cfs @ 12.19 hrs, Volume= 0.065 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 223.48' @ 12.19 hrs
Flood Elev= 226.26'

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 223.01' | **15.0" Round Culvert**<br>L= 16.0' CPP, projecting, no headwall, Ke= 0.900<br>Outlet Invert= 222.81' S= 0.0125 '/' Cc= 0.900 n= 0.012 |

**Primary OutFlow** Max=0.76 cfs @ 12.19 hrs HW=223.48' (Free Discharge)
└─**1=Culvert** (Inlet Controls 0.76 cfs @ 1.83 fps)

## Summary for Pond CB14:

[79] Warning: Submerged Pond CB15 Primary device # 1 INLET by 0.59'

Inflow Area = 3.487 ac, 20.48% Impervious, Inflow Depth > 1.03"
Inflow = 1.96 cfs @ 12.58 hrs, Volume= 0.300 af
Outflow = 1.96 cfs @ 12.58 hrs, Volume= 0.300 af, Atten= 0%, Lag= 0.0 min
Primary = 1.96 cfs @ 12.58 hrs, Volume= 0.300 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 213.95' @ 12.58 hrs
Flood Elev= 216.61'

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 213.16' | **15.0" Round Culvert**<br>L= 128.0' CPP, projecting, no headwall, Ke= 0.900<br>Outlet Invert= 212.52' S= 0.0050 '/' Cc= 0.900 n= 0.012 |

**Primary OutFlow** Max=1.96 cfs @ 12.58 hrs HW=213.95' (Free Discharge)
└─**1=Culvert** (Inlet Controls 1.96 cfs @ 2.39 fps)

## Summary for Pond CB15:

Inflow Area = 3.342 ac, 18.29% Impervious, Inflow Depth > 0.99"
Inflow = 1.92 cfs @ 12.59 hrs, Volume= 0.275 af
Outflow = 1.92 cfs @ 12.59 hrs, Volume= 0.275 af, Atten= 0%, Lag= 0.0 min
Primary = 1.92 cfs @ 12.59 hrs, Volume= 0.275 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 214.14' @ 12.59 hrs
Flood Elev= 216.61'

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 213.36' | **15.0" Round Culvert**<br>L= 16.0' CPP, projecting, no headwall, Ke= 0.900<br>Outlet Invert= 213.16' S= 0.0125 '/' Cc= 0.900 n= 0.012 |

**Primary OutFlow** Max=1.91 cfs @ 12.59 hrs HW=214.14' (Free Discharge)
└─**1=Culvert** (Barrel Controls 1.91 cfs @ 3.38 fps)

## Summary for Pond CB16:

Inflow Area = 2.282 ac, 31.56% Impervious, Inflow Depth > 1.30"
Inflow = 1.20 cfs @ 12.63 hrs, Volume= 0.247 af
Outflow = 1.20 cfs @ 12.63 hrs, Volume= 0.247 af, Atten= 0%, Lag= 0.0 min
Primary = 1.20 cfs @ 12.63 hrs, Volume= 0.247 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 213.92' @ 12.63 hrs
Flood Elev= 216.61'

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 213.36' | **18.0" Round Culvert**<br>L= 50.0' CPP, projecting, no headwall, Ke= 0.900<br>Outlet Invert= 212.00' S= 0.0272 '/' Cc= 0.900 n= 0.012 |

**Primary OutFlow** Max=1.20 cfs @ 12.63 hrs HW=213.92' (Free Discharge)
└─**1=Culvert** (Inlet Controls 1.20 cfs @ 2.01 fps)

## Summary for Pond CB2:

[79] Warning: Submerged Pond CB3 Primary device # 1 OUTLET by 1.04'

| | | | | | |
|---|---|---|---|---|---|
| Inflow Area = | 6.015 ac, | 26.09% Impervious, | Inflow Depth > | 1.14" | |
| Inflow = | 3.58 cfs @ | 12.44 hrs, | Volume= | 0.574 af | |
| Outflow = | 3.58 cfs @ | 12.44 hrs, | Volume= | 0.574 af, | Atten= 0%, Lag= 0.0 min |
| Primary = | 3.58 cfs @ | 12.44 hrs, | Volume= | 0.574 af | |

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 202.60' @ 12.44 hrs
Flood Elev= 206.26'

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 201.56' | **18.0" Round Culvert**<br>L= 124.0' CPP, projecting, no headwall, Ke= 0.900<br>Outlet Invert= 200.94' S= 0.0050 '/' Cc= 0.900 n= 0.012 |

**Primary OutFlow** Max=3.57 cfs @ 12.44 hrs HW=202.60' (Free Discharge)
└─**1=Culvert** (Inlet Controls 3.57 cfs @ 2.74 fps)

## Summary for Pond CB3:

| | | | | | |
|---|---|---|---|---|---|
| Inflow Area = | 5.512 ac, | 25.63% Impervious, | Inflow Depth > | 1.14" | |
| Inflow = | 3.20 cfs @ | 12.44 hrs, | Volume= | 0.521 af | |
| Outflow = | 3.20 cfs @ | 12.44 hrs, | Volume= | 0.521 af, | Atten= 0%, Lag= 0.0 min |
| Primary = | 3.20 cfs @ | 12.44 hrs, | Volume= | 0.521 af | |

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 207.77' @ 12.44 hrs
Flood Elev= 211.50'

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 206.80' | **18.0" Round Culvert**<br>L= 122.0' CPP, projecting, no headwall, Ke= 0.900<br>Outlet Invert= 201.56' S= 0.0430 '/' Cc= 0.900 n= 0.012 |

**Primary OutFlow** Max=3.20 cfs @ 12.44 hrs HW=207.77' (Free Discharge)
└─**1=Culvert** (Inlet Controls 3.20 cfs @ 2.65 fps)

## Summary for Pond CB4:

[79] Warning: Submerged Pond CB5 Primary device # 1 INLET by 0.75'

| | | | | | |
|---|---|---|---|---|---|
| Inflow Area = | 4.667 ac, | 25.11% Impervious, | Inflow Depth > | 1.12" | |
| Inflow = | 2.61 cfs @ | 12.46 hrs, | Volume= | 0.437 af | |
| Outflow = | 2.61 cfs @ | 12.46 hrs, | Volume= | 0.437 af, | Atten= 0%, Lag= 0.0 min |
| Primary = | 2.61 cfs @ | 12.46 hrs, | Volume= | 0.437 af | |

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 213.27' @ 12.46 hrs
Flood Elev= 217.06'

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 212.32' | **15.0" Round Culvert**<br>L= 112.0' CPP, projecting, no headwall, Ke= 0.900<br>Outlet Invert= 208.05' S= 0.0381 '/' Cc= 0.900 n= 0.012 |

**Primary OutFlow** Max=2.61 cfs @ 12.46 hrs HW=213.27' (Free Discharge)
└─**1=Culvert** (Inlet Controls 2.61 cfs @ 2.61 fps)

## Summary for Pond CB5:

[79] Warning: Submerged Pond CB14 Primary device # 1 INLET by 0.35'

Inflow Area = 4.648 ac, 24.82% Impervious, Inflow Depth > 1.12"
Inflow = 2.60 cfs @ 12.47 hrs, Volume= 0.433 af
Outflow = 2.60 cfs @ 12.47 hrs, Volume= 0.433 af, Atten= 0%, Lag= 0.0 min
Primary = 2.60 cfs @ 12.47 hrs, Volume= 0.433 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 213.51' @ 12.47 hrs
Flood Elev= 218.96'

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 212.52' | **15.0" Round Culvert**<br>L= 32.0' CPP, projecting, no headwall, Ke= 0.900<br>Outlet Invert= 212.32' S= 0.0063 '/' Cc= 0.900 n= 0.012 |

**Primary OutFlow** Max=2.60 cfs @ 12.47 hrs HW=213.51' (Free Discharge)
└─**1=Culvert** (Barrel Controls 2.60 cfs @ 3.42 fps)

## Summary for Pond CB6:

[82] Warning: Early inflow requires earlier time span
[79] Warning: Submerged Pond CB7 Primary device # 1 OUTLET by 0.56'

Inflow Area = 1.095 ac, 35.95% Impervious, Inflow Depth > 1.34"
Inflow = 1.07 cfs @ 12.19 hrs, Volume= 0.122 af
Outflow = 1.07 cfs @ 12.19 hrs, Volume= 0.122 af, Atten= 0%, Lag= 0.0 min
Primary = 1.07 cfs @ 12.19 hrs, Volume= 0.122 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 216.27' @ 12.19 hrs
Flood Elev= 218.96'

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 215.71' | **15.0" Round Culvert**<br>L= 16.0' CPP, projecting, no headwall, Ke= 0.900<br>Outlet Invert= 215.51' S= 0.0125 '/' Cc= 0.900 n= 0.012 |

**Primary OutFlow** Max=1.07 cfs @ 12.19 hrs HW=216.27' (Free Discharge)
└─**1=Culvert** (Inlet Controls 1.07 cfs @ 2.01 fps)

## Summary for Pond CB7:

[82] Warning: Early inflow requires earlier time span
[79] Warning: Submerged Pond CB13 Primary device # 1 INLET by 0.33'
[79] Warning: Submerged Pond CB8 Primary device # 1 OUTLET by 0.53'

| | | | | | |
|---|---|---|---|---|---|
| Inflow Area = | 0.798 ac, | 41.73% Impervious, | Inflow Depth > | 1.45" | |
| Inflow = | 0.98 cfs @ | 12.18 hrs, | Volume= | 0.097 af | |
| Outflow = | 0.98 cfs @ | 12.18 hrs, | Volume= | 0.097 af, | Atten= 0%, Lag= 0.0 min |
| Primary = | 0.98 cfs @ | 12.18 hrs, | Volume= | 0.097 af | |

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 223.34' @ 12.18 hrs
Flood Elev= 226.26'

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 222.81' | **15.0" Round Culvert**<br>L= 126.0' CPP, projecting, no headwall, Ke= 0.900<br>Outlet Invert= 215.71' S= 0.0563 '/' Cc= 0.900 n= 0.012 |

**Primary OutFlow** Max=0.97 cfs @ 12.18 hrs HW=223.34' (Free Discharge)
└─**1=Culvert** (Inlet Controls 0.97 cfs @ 1.96 fps)

## Summary for Pond CB8:

[82] Warning: Early inflow requires earlier time span
[79] Warning: Submerged Pond CB9 Primary device # 1 OUTLET by 0.30'

| | | | | | |
|---|---|---|---|---|---|
| Inflow Area = | 0.115 ac, | 85.22% Impervious, | Inflow Depth > | 2.34" | |
| Inflow = | 0.34 cfs @ | 12.03 hrs, | Volume= | 0.022 af | |
| Outflow = | 0.34 cfs @ | 12.03 hrs, | Volume= | 0.022 af, | Atten= 0%, Lag= 0.0 min |
| Primary = | 0.34 cfs @ | 12.03 hrs, | Volume= | 0.022 af | |

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 229.53' @ 12.03 hrs
Flood Elev= 232.48'

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 229.23' | **15.0" Round Culvert**<br>L= 126.0' CPP, projecting, no headwall, Ke= 0.900<br>Outlet Invert= 222.81' S= 0.0510 '/' Cc= 0.900 n= 0.012 |

**Primary OutFlow** Max=0.33 cfs @ 12.03 hrs HW=229.53' (Free Discharge)
└─**1=Culvert** (Inlet Controls 0.33 cfs @ 1.46 fps)

## Summary for Pond CB9:

[82] Warning: Early inflow requires earlier time span
[79] Warning: Submerged Pond CB10 Primary device # 1 INLET by 0.05'

| | | | | | |
|---|---|---|---|---|---|
| Inflow Area = | 0.083 ac, | 79.52% Impervious, | Inflow Depth > | 2.21" | |
| Inflow = | 0.24 cfs @ | 12.03 hrs, | Volume= | 0.015 af | |
| Outflow = | 0.24 cfs @ | 12.03 hrs, | Volume= | 0.015 af, | Atten= 0%, Lag= 0.0 min |
| Primary = | 0.24 cfs @ | 12.03 hrs, | Volume= | 0.015 af | |

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 232.78' @ 12.03 hrs
Flood Elev= 235.98'

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 232.53' | **15.0" Round Culvert**<br>L= 84.0' CPP, projecting, no headwall, Ke= 0.900<br>Outlet Invert= 229.23' S= 0.0393 '/' Cc= 0.900 n= 0.012 |

**Primary OutFlow** Max=0.23 cfs @ 12.03 hrs HW=232.78' (Free Discharge)
└**1=Culvert** (Inlet Controls 0.23 cfs @ 1.33 fps)

## Summary for Pond FB1: Filter Basin #1

| | | | | | |
|---|---|---|---|---|---|
| Inflow Area = | 2.282 ac, | 31.56% Impervious, | Inflow Depth > | 1.30" | |
| Inflow = | 1.20 cfs @ | 12.63 hrs, | Volume= | 0.247 af | |
| Outflow = | 0.30 cfs @ | 14.76 hrs, | Volume= | 0.078 af, | Atten= 75%, Lag= 128.2 min |
| Primary = | 0.30 cfs @ | 14.76 hrs, | Volume= | 0.078 af | |

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 207.05' @ 14.76 hrs Surf.Area= 5,523 sf Storage= 7,537 cf

Plug-Flow detention time= 255.2 min calculated for 0.078 af (32% of inflow)
Center-of-Mass det. time= 152.3 min ( 991.2 - 838.9 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 205.50' | 16,440 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 205.50 | 4,200 | 0 | 0 |
| 206.00 | 4,627 | 2,207 | 2,207 |
| 207.00 | 5,480 | 5,054 | 7,260 |
| 208.00 | 6,333 | 5,907 | 13,167 |
| 208.50 | 6,760 | 3,273 | 16,440 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 207.00' | **10.0' long x 13.0' breadth Broad-Crested Rectangular Weir**<br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60<br>Coef. (English) 2.60 2.64 2.70 2.66 2.65 2.66 2.65 2.63 |

**Primary OutFlow** Max=0.29 cfs @ 14.76 hrs HW=207.05' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 0.29 cfs @ 0.58 fps)

## Summary for Pond GW1: Gravel Wetland #1

Inflow Area = 8.866 ac, 26.34% Impervious, Inflow Depth > 1.17"
Inflow = 5.72 cfs @ 12.44 hrs, Volume= 0.865 af
Outflow = 0.90 cfs @ 14.62 hrs, Volume= 0.362 af, Atten= 84%, Lag= 130.8 min
Primary = 0.90 cfs @ 14.62 hrs, Volume= 0.362 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 194.98' @ 14.62 hrs Surf.Area= 14,006 sf Storage= 24,443 cf

Plug-Flow detention time= 240.2 min calculated for 0.361 af (42% of inflow)
Center-of-Mass det. time= 147.3 min ( 968.7 - 821.4 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 193.00' | 56,317 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 193.00 | 10,550 | 0 | 0 |
| 194.00 | 12,450 | 11,500 | 11,500 |
| 194.50 | 13,400 | 6,463 | 17,963 |
| 194.51 | 13,200 | 133 | 18,095 |
| 195.00 | 14,046 | 6,675 | 24,771 |
| 196.00 | 15,773 | 14,910 | 39,680 |
| 197.00 | 17,500 | 16,637 | 56,317 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 194.50' | **18.0" Round Culvert**<br>L= 40.0' CPP, projecting, no headwall, Ke= 0.900<br>Outlet Invert= 193.00' S= 0.0375 '/' Cc= 0.900 n= 0.012 |
| #2 | Primary | 196.20' | **15.0' long x 13.0' breadth Broad-Crested Rectangular Weir**<br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60<br>Coef. (English) 2.60 2.64 2.70 2.66 2.65 2.66 2.65 2.63 |

**Primary OutFlow** Max=0.90 cfs @ 14.62 hrs HW=194.98' (Free Discharge)
├─**1=Culvert** (Inlet Controls 0.90 cfs @ 1.86 fps)
└─**2=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

## Summary for Pond RG1: Rain Garden #1

Inflow Area = 0.619 ac, 28.89% Impervious, Inflow Depth > 1.28"
Inflow = 0.70 cfs @ 12.26 hrs, Volume= 0.066 af
Outflow = 0.67 cfs @ 12.35 hrs, Volume= 0.048 af, Atten= 4%, Lag= 5.4 min
Primary = 0.67 cfs @ 12.35 hrs, Volume= 0.048 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 208.04' @ 12.35 hrs Surf.Area= 970 sf Storage= 821 cf

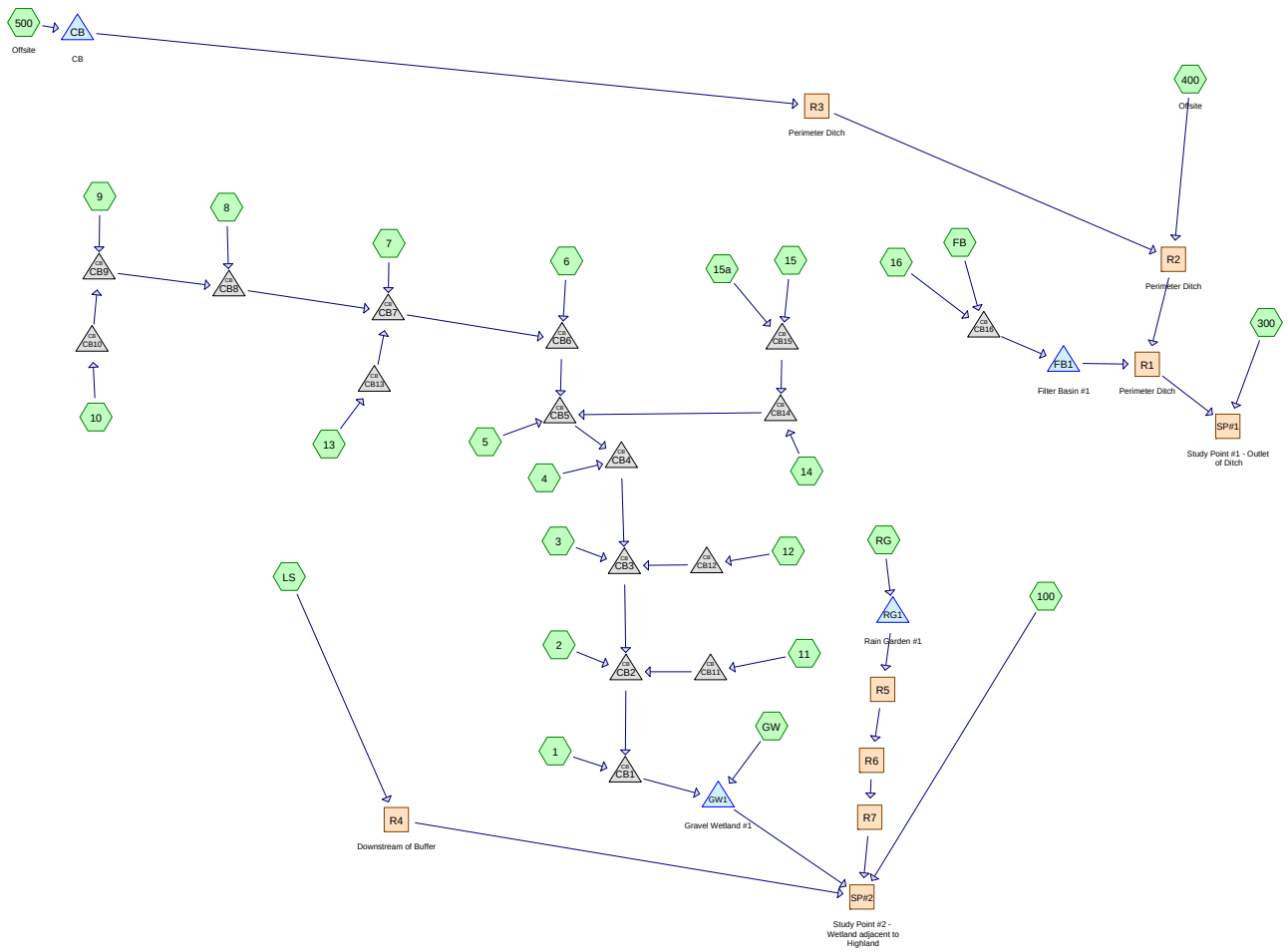
Plug-Flow detention time= 101.3 min calculated for 0.048 af (73% of inflow)
Center-of-Mass det. time= 37.6 min ( 849.3 - 811.7 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 207.00' | 1,385 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 207.00 | 640 | 0 | 0 |
| 208.00 | 920 | 780 | 780 |
| 208.50 | 1,500 | 605 | 1,385 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 208.00' | **30.0' long x 10.0' breadth Broad-Crested Rectangular Weir** |
| | | | Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 |
| | | | Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64 |

**Primary OutFlow** Max=0.66 cfs @ 12.35 hrs HW=208.04' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 0.66 cfs @ 0.51 fps)




Subcat Reach Pond Link

**Drainage Diagram for 1636 Post**

Prepared by {enter your company name here}, Printed 1/11/2017

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment1:** Runoff Area=0.540 ac 46.09% Impervious Runoff Depth>2.81"
Flow Length=230' Tc=10.4 min CN=85 Runoff=1.61 cfs 0.127 af

**Subcatchment2:** Runoff Area=0.446 ac 26.21% Impervious Runoff Depth>2.27"
Flow Length=370' Tc=33.5 min CN=79 Runoff=0.69 cfs 0.084 af

**Subcatchment3:** Runoff Area=0.574 ac 23.14% Impervious Runoff Depth>2.19"
Flow Length=300' Tc=30.8 min CN=78 Runoff=0.89 cfs 0.105 af

**Subcatchment4:** Runoff Area=0.019 ac 94.74% Impervious Runoff Depth>3.98"
Tc=2.0 min CN=97 Runoff=0.09 cfs 0.006 af

**Subcatchment5:** Runoff Area=0.066 ac 69.70% Impervious Runoff Depth>3.40"
Tc=2.0 min CN=91 Runoff=0.29 cfs 0.019 af

**Subcatchment6:** Runoff Area=0.297 ac 20.44% Impervious Runoff Depth>2.11"
Flow Length=240' Tc=34.9 min CN=77 Runoff=0.42 cfs 0.052 af

**Subcatchment7:** Runoff Area=0.076 ac 44.74% Impervious Runoff Depth>2.73"
Tc=2.0 min CN=84 Runoff=0.28 cfs 0.017 af

**Subcatchment8:** Runoff Area=0.032 ac 100.00% Impervious Runoff Depth>4.05"
Tc=2.0 min CN=98 Runoff=0.16 cfs 0.011 af

**Subcatchment9:** Runoff Area=0.029 ac 100.00% Impervious Runoff Depth>4.05"
Tc=2.0 min CN=98 Runoff=0.14 cfs 0.010 af

**Subcatchment10:** Runoff Area=0.054 ac 68.52% Impervious Runoff Depth>3.30"
Tc=2.0 min CN=90 Runoff=0.23 cfs 0.015 af

**Subcatchment11:** Runoff Area=0.057 ac 70.18% Impervious Runoff Depth>3.40"
Tc=2.0 min CN=91 Runoff=0.25 cfs 0.016 af

**Subcatchment12:** Runoff Area=0.271 ac 39.89% Impervious Runoff Depth>2.63"
Flow Length=140' Tc=7.2 min CN=83 Runoff=0.85 cfs 0.059 af

**Subcatchment13:** Runoff Area=0.607 ac 33.11% Impervious Runoff Depth>2.45"
Flow Length=294' Tc=13.2 min CN=81 Runoff=1.47 cfs 0.124 af

**Subcatchment14:** Runoff Area=0.145 ac 71.03% Impervious Runoff Depth>3.40"
Tc=2.0 min CN=91 Runoff=0.64 cfs 0.041 af

**Subcatchment15:** Runoff Area=2.638 ac 18.28% Impervious Runoff Depth>2.02"
Flow Length=630' Tc=44.3 min CN=76 Runoff=3.17 cfs 0.444 af

**Subcatchment15a:** Runoff Area=0.704 ac 18.32% Impervious Runoff Depth>2.11"
Flow Length=285' Tc=28.0 min CN=77 Runoff=1.10 cfs 0.124 af

**Subcatchment 16:** Runoff Area=0.690 ac 45.77% Impervious Runoff Depth>2.80"
Flow Length=360' Tc=28.0 min CN=85 Runoff=1.41 cfs 0.161 af

**Subcatchment 100:** Runoff Area=551,455 sf 5.75% Impervious Runoff Depth>1.93"
Flow Length=380' Tc=60.3 min CN=75 Runoff=12.25 cfs 2.035 af

**Subcatchment 300:** Runoff Area=71,335 sf 2.24% Impervious Runoff Depth>1.66"
Flow Length=270' Slope=0.1000 '/' Tc=28.9 min CN=71 Runoff=1.95 cfs 0.226 af

**Subcatchment 400: Offsite** Runoff Area=42.600 ac 2.35% Impervious Runoff Depth>1.75"
Flow Length=1,570' Tc=92.8 min CN=73 Runoff=28.76 cfs 6.222 af

**Subcatchment 500: Offsite** Runoff Area=20.180 ac 8.42% Impervious Runoff Depth>1.86"
Flow Length=1,370' Tc=52.5 min CN=74 Runoff=20.31 cfs 3.127 af

**Subcatchment FB:** Runoff Area=69,332 sf 25.41% Impervious Runoff Depth>2.32"
Flow Length=250' Tc=72.0 min CN=80 Runoff=1.67 cfs 0.308 af

**Subcatchment GW:** Runoff Area=100,679 sf 22.37% Impervious Runoff Depth>2.27"
Flow Length=480' Tc=34.0 min CN=79 Runoff=3.55 cfs 0.437 af

**Subcatchment LS:** Runoff Area=44,374 sf 29.45% Impervious Runoff Depth>2.34"
Flow Length=410' Tc=46.3 min CN=80 Runoff=1.38 cfs 0.199 af

**Subcatchment RG:** Runoff Area=26,952 sf 28.89% Impervious Runoff Depth>2.45"
Flow Length=470' Tc=17.9 min CN=81 Runoff=1.34 cfs 0.126 af

**Reach R1: Perimeter Ditch** Avg. Depth=1.11' Max Vel=8.40 fps Inflow=47.41 cfs 9.610 af
n=0.035 L=150.0' S=0.0533 '/' Capacity=512.84 cfs Outflow=47.39 cfs 9.605 af

**Reach R2: Perimeter Ditch** Avg. Depth=1.16' Max Vel=7.64 fps Inflow=45.56 cfs 9.322 af
n=0.040 L=290.0' S=0.0552 '/' Capacity=1,055.19 cfs Outflow=45.51 cfs 9.312 af

**Reach R3: Perimeter Ditch** Avg. Depth=1.23' Max Vel=3.85 fps Inflow=20.31 cfs 3.127 af
n=0.040 L=1,250.0' S=0.0144 '/' Capacity=195.24 cfs Outflow=20.02 cfs 3.100 af

**Reach R4: Downstream of Buffer** Avg. Depth=0.13' Max Vel=0.92 fps Inflow=1.38 cfs 0.199 af
n=0.080 L=270.0' S=0.0407 '/' Capacity=13.95 cfs Outflow=1.37 cfs 0.197 af

**Reach R5:** Avg. Depth=0.18' Max Vel=1.18 fps Inflow=1.34 cfs 0.108 af
n=0.080 L=78.0' S=0.0538 '/' Capacity=9.53 cfs Outflow=1.33 cfs 0.108 af

**Reach R6:** Avg. Depth=0.37' Max Vel=4.38 fps Inflow=1.33 cfs 0.108 af
15.0" Round Pipe n=0.012 L=40.0' S=0.0100 '/' Capacity=7.00 cfs Outflow=1.32 cfs 0.108 af

**Reach R7:** Avg. Depth=0.20' Max Vel=0.89 fps Inflow=1.32 cfs 0.108 af
n=0.100 L=360.0' S=0.0400 '/' Capacity=6.57 cfs Outflow=1.19 cfs 0.107 af

**Reach SP#1: Study Point #1 - Outlet of Ditch** Inflow=47.99 cfs 9.831 af
Outflow=47.99 cfs 9.831 af

**Reach SP#2: Study Point #2 - Wetland adjacent to Highland** Inflow=18.54 cfs 3.501 af
Outflow=18.54 cfs 3.501 af

**Pond CB: CB** Inflow=20.31 cfs 3.127 af
Primary=20.31 cfs 3.127 af

**Pond CB1:** Peak Elev=201.90' Inflow=7.99 cfs 1.254 af
24.0" Round Culvert n=0.012 L=144.0' S=0.0308 '/' Outflow=7.99 cfs 1.254 af

**Pond CB10:** Peak Elev=232.98' Inflow=0.23 cfs 0.015 af
15.0" Round Culvert n=0.012 L=16.0' S=0.0125 '/' Outflow=0.23 cfs 0.015 af

**Pond CB11:** Peak Elev=203.27' Inflow=0.25 cfs 0.016 af
15.0" Round Culvert n=0.012 L=16.0' S=0.0125 '/' Outflow=0.25 cfs 0.016 af

**Pond CB12:** Peak Elev=208.74' Inflow=0.85 cfs 0.059 af
15.0" Round Culvert n=0.012 L=16.0' S=0.0125 '/' Outflow=0.85 cfs 0.059 af

**Pond CB13:** Peak Elev=223.68' Inflow=1.47 cfs 0.124 af
15.0" Round Culvert n=0.012 L=16.0' S=0.0125 '/' Outflow=1.47 cfs 0.124 af

**Pond CB14:** Peak Elev=214.57' Inflow=4.13 cfs 0.609 af
15.0" Round Culvert n=0.012 L=128.0' S=0.0050 '/' Outflow=4.13 cfs 0.609 af

**Pond CB15:** Peak Elev=214.74' Inflow=4.05 cfs 0.568 af
15.0" Round Culvert n=0.012 L=16.0' S=0.0125 '/' Outflow=4.05 cfs 0.568 af

**Pond CB16:** Peak Elev=214.16' Inflow=2.29 cfs 0.468 af
18.0" Round Culvert n=0.012 L=50.0' S=0.0272 '/' Outflow=2.29 cfs 0.468 af

**Pond CB2:** Peak Elev=203.48' Inflow=7.27 cfs 1.128 af
18.0" Round Culvert n=0.012 L=124.0' S=0.0050 '/' Outflow=7.27 cfs 1.128 af

**Pond CB3:** Peak Elev=208.50' Inflow=6.54 cfs 1.027 af
18.0" Round Culvert n=0.012 L=122.0' S=0.0430 '/' Outflow=6.54 cfs 1.027 af

**Pond CB4:** Peak Elev=214.27' Inflow=5.38 cfs 0.863 af
15.0" Round Culvert n=0.012 L=112.0' S=0.0381 '/' Outflow=5.38 cfs 0.863 af

**Pond CB5:** Peak Elev=214.47' Inflow=5.36 cfs 0.857 af
15.0" Round Culvert n=0.012 L=32.0' S=0.0063 '/' Outflow=5.36 cfs 0.857 af

**Pond CB6:** Peak Elev=216.52' Inflow=2.03 cfs 0.229 af
15.0" Round Culvert n=0.012 L=16.0' S=0.0125 '/' Outflow=2.03 cfs 0.229 af

**Pond CB7:** Peak Elev=223.56' Inflow=1.81 cfs 0.177 af
15.0" Round Culvert n=0.012 L=126.0' S=0.0563 '/' Outflow=1.81 cfs 0.177 af

**Pond CB8:** Peak Elev=229.61' Inflow=0.53 cfs 0.035 af
15.0" Round Culvert n=0.012 L=126.0' S=0.0510 '/' Outflow=0.53 cfs 0.035 af

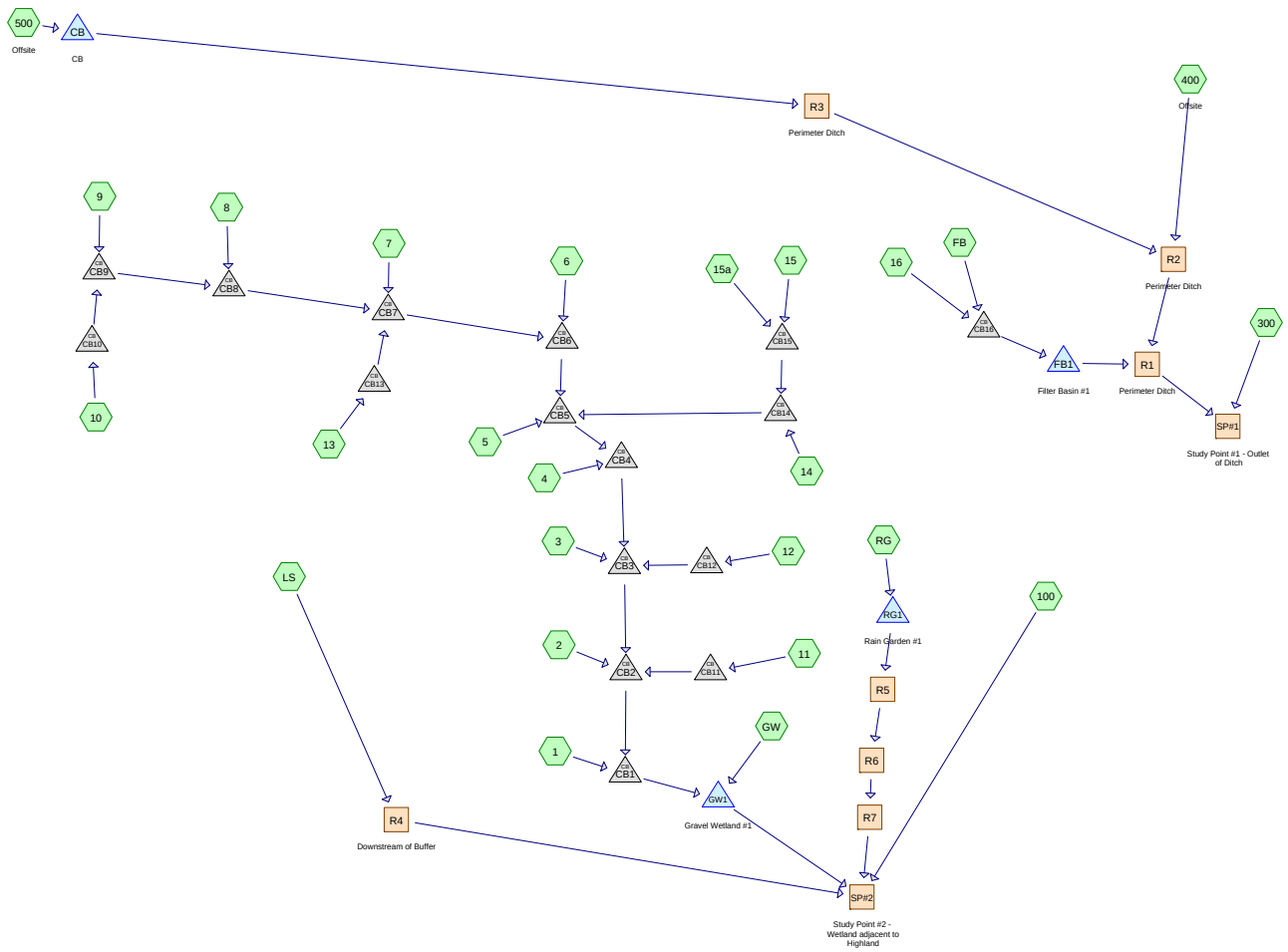
**Pond CB9:** Peak Elev=232.85' Inflow=0.38 cfs 0.025 af
15.0" Round Culvert n=0.012 L=84.0' S=0.0393 '/' Outflow=0.38 cfs 0.025 af

**Pond FB1: Filter Basin #1** Peak Elev=207.18' Storage=8,237 cf Inflow=2.29 cfs 0.468 af
Outflow=1.92 cfs 0.298 af

**Pond GW1: Gravel Wetland #1** Peak Elev=195.74' Storage=35,693 cf Inflow=11.47 cfs 1.691 af
Outflow=4.69 cfs 1.162 af

**Pond RG1: Rain Garden #1** Peak Elev=208.07' Storage=846 cf Inflow=1.34 cfs 0.126 af
Outflow=1.34 cfs 0.108 af

**Total Runoff Area = 89.863 ac Runoff Volume = 14.095 af Average Runoff Depth = 1.88"**
**92.21% Pervious = 82.864 ac 7.79% Impervious = 6.999 ac**




Subcat Reach Pond Link

**Drainage Diagram for 1636 Post**

Prepared by {enter your company name here}, Printed 1/11/2017

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment1:** Runoff Area=0.540 ac 46.09% Impervious Runoff Depth>3.87"
Flow Length=230' Tc=10.4 min CN=85 Runoff=2.19 cfs 0.174 af

**Subcatchment2:** Runoff Area=0.446 ac 26.21% Impervious Runoff Depth>3.25"
Flow Length=370' Tc=33.5 min CN=79 Runoff=0.98 cfs 0.121 af

**Subcatchment3:** Runoff Area=0.574 ac 23.14% Impervious Runoff Depth>3.15"
Flow Length=300' Tc=30.8 min CN=78 Runoff=1.28 cfs 0.151 af

**Subcatchment4:** Runoff Area=0.019 ac 94.74% Impervious Runoff Depth>5.07"
Tc=2.0 min CN=97 Runoff=0.12 cfs 0.008 af

**Subcatchment5:** Runoff Area=0.066 ac 69.70% Impervious Runoff Depth>4.50"
Tc=2.0 min CN=91 Runoff=0.38 cfs 0.025 af

**Subcatchment6:** Runoff Area=0.297 ac 20.44% Impervious Runoff Depth>3.06"
Flow Length=240' Tc=34.9 min CN=77 Runoff=0.61 cfs 0.076 af

**Subcatchment7:** Runoff Area=0.076 ac 44.74% Impervious Runoff Depth>3.78"
Tc=2.0 min CN=84 Runoff=0.38 cfs 0.024 af

**Subcatchment8:** Runoff Area=0.032 ac 100.00% Impervious Runoff Depth>5.15"
Tc=2.0 min CN=98 Runoff=0.20 cfs 0.014 af

**Subcatchment9:** Runoff Area=0.029 ac 100.00% Impervious Runoff Depth>5.15"
Tc=2.0 min CN=98 Runoff=0.18 cfs 0.012 af

**Subcatchment10:** Runoff Area=0.054 ac 68.52% Impervious Runoff Depth>4.40"
Tc=2.0 min CN=90 Runoff=0.31 cfs 0.020 af

**Subcatchment11:** Runoff Area=0.057 ac 70.18% Impervious Runoff Depth>4.50"
Tc=2.0 min CN=91 Runoff=0.33 cfs 0.021 af

**Subcatchment12:** Runoff Area=0.271 ac 39.89% Impervious Runoff Depth>3.67"
Flow Length=140' Tc=7.2 min CN=83 Runoff=1.16 cfs 0.083 af

**Subcatchment13:** Runoff Area=0.607 ac 33.11% Impervious Runoff Depth>3.46"
Flow Length=294' Tc=13.2 min CN=81 Runoff=2.06 cfs 0.175 af

**Subcatchment14:** Runoff Area=0.145 ac 71.03% Impervious Runoff Depth>4.50"
Tc=2.0 min CN=91 Runoff=0.83 cfs 0.054 af

**Subcatchment15:** Runoff Area=2.638 ac 18.28% Impervious Runoff Depth>2.95"
Flow Length=630' Tc=44.3 min CN=76 Runoff=4.62 cfs 0.649 af

**Subcatchment15a:** Runoff Area=0.704 ac 18.32% Impervious Runoff Depth>3.06"
Flow Length=285' Tc=28.0 min CN=77 Runoff=1.59 cfs 0.180 af

**Subcatchment 16:** Runoff Area=0.690 ac 45.77% Impervious Runoff Depth>3.85"
Flow Length=360' Tc=28.0 min CN=85 Runoff=1.91 cfs 0.221 af

**Subcatchment 100:** Runoff Area=551,455 sf 5.75% Impervious Runoff Depth>2.84"
Flow Length=380' Tc=60.3 min CN=75 Runoff=18.12 cfs 2.998 af

**Subcatchment 300:** Runoff Area=71,335 sf 2.24% Impervious Runoff Depth>2.52"
Flow Length=270' Slope=0.1000 '/' Tc=28.9 min CN=71 Runoff=3.00 cfs 0.343 af

**Subcatchment 400: Offsite** Runoff Area=42.600 ac 2.35% Impervious Runoff Depth>2.62"
Flow Length=1,570' Tc=92.8 min CN=73 Runoff=43.31 cfs 9.317 af

**Subcatchment 500: Offsite** Runoff Area=20.180 ac 8.42% Impervious Runoff Depth>2.76"
Flow Length=1,370' Tc=52.5 min CN=74 Runoff=30.23 cfs 4.640 af

**Subcatchment FB:** Runoff Area=69,332 sf 25.41% Impervious Runoff Depth>3.30"
Flow Length=250' Tc=72.0 min CN=80 Runoff=2.36 cfs 0.438 af

**Subcatchment GW:** Runoff Area=100,679 sf 22.37% Impervious Runoff Depth>3.25"
Flow Length=480' Tc=34.0 min CN=79 Runoff=5.05 cfs 0.625 af

**Subcatchment LS:** Runoff Area=44,374 sf 29.45% Impervious Runoff Depth>3.33"
Flow Length=410' Tc=46.3 min CN=80 Runoff=1.96 cfs 0.283 af

**Subcatchment RG:** Runoff Area=26,952 sf 28.89% Impervious Runoff Depth>3.46"
Flow Length=470' Tc=17.9 min CN=81 Runoff=1.88 cfs 0.178 af

**Reach R1: Perimeter Ditch** Avg. Depth=1.39' Max Vel=9.45 fps Inflow=71.04 cfs 14.400 af
n=0.035 L=150.0' S=0.0533 '/' Capacity=512.84 cfs Outflow=71.03 cfs 14.394 af

**Reach R2: Perimeter Ditch** Avg. Depth=1.45' Max Vel=8.60 fps Inflow=68.12 cfs 13.923 af
n=0.040 L=290.0' S=0.0552 '/' Capacity=1,055.19 cfs Outflow=68.11 cfs 13.912 af

**Reach R3: Perimeter Ditch** Avg. Depth=1.53' Max Vel=4.30 fps Inflow=30.23 cfs 4.640 af
n=0.040 L=1,250.0' S=0.0144 '/' Capacity=195.24 cfs Outflow=29.86 cfs 4.607 af

**Reach R4: Downstream of Buffer** Avg. Depth=0.16' Max Vel=1.04 fps Inflow=1.96 cfs 0.283 af
n=0.080 L=270.0' S=0.0407 '/' Capacity=13.95 cfs Outflow=1.94 cfs 0.281 af

**Reach R5:** Avg. Depth=0.21' Max Vel=1.32 fps Inflow=1.88 cfs 0.160 af
n=0.080 L=78.0' S=0.0538 '/' Capacity=9.53 cfs Outflow=1.86 cfs 0.160 af

**Reach R6:** Avg. Depth=0.44' Max Vel=4.82 fps Inflow=1.86 cfs 0.160 af
15.0" Round Pipe n=0.012 L=40.0' S=0.0100 '/' Capacity=7.00 cfs Outflow=1.85 cfs 0.160 af

**Reach R7:** Avg. Depth=0.25' Max Vel=0.99 fps Inflow=1.85 cfs 0.160 af
n=0.100 L=360.0' S=0.0400 '/' Capacity=6.57 cfs Outflow=1.73 cfs 0.158 af

**Reach SP#1: Study Point #1 - Outlet of Ditch** Inflow=71.96 cfs 14.737 af
Outflow=71.96 cfs 14.737 af

**Reach SP#2: Study Point #2 - Wetland adjacent to Highland** Inflow=30.19 cfs 5.302 af
Outflow=30.19 cfs 5.302 af

**Pond CB: CB** Inflow=30.23 cfs 4.640 af
Primary=30.23 cfs 4.640 af

**Pond CB1:** Peak Elev=202.34' Inflow=11.40 cfs 1.787 af
24.0" Round Culvert n=0.012 L=144.0' S=0.0308 '/' Outflow=11.40 cfs 1.787 af

**Pond CB10:** Peak Elev=233.02' Inflow=0.31 cfs 0.020 af
15.0" Round Culvert n=0.012 L=16.0' S=0.0125 '/' Outflow=0.31 cfs 0.020 af

**Pond CB11:** Peak Elev=203.31' Inflow=0.33 cfs 0.021 af
15.0" Round Culvert n=0.012 L=16.0' S=0.0125 '/' Outflow=0.33 cfs 0.021 af

**Pond CB12:** Peak Elev=208.84' Inflow=1.16 cfs 0.083 af
15.0" Round Culvert n=0.012 L=16.0' S=0.0125 '/' Outflow=1.16 cfs 0.083 af

**Pond CB13:** Peak Elev=223.83' Inflow=2.06 cfs 0.175 af
15.0" Round Culvert n=0.012 L=16.0' S=0.0125 '/' Outflow=2.06 cfs 0.175 af

**Pond CB14:** Peak Elev=215.44' Inflow=6.01 cfs 0.883 af
15.0" Round Culvert n=0.012 L=128.0' S=0.0050 '/' Outflow=6.01 cfs 0.883 af

**Pond CB15:** Peak Elev=215.59' Inflow=5.91 cfs 0.829 af
15.0" Round Culvert n=0.012 L=16.0' S=0.0125 '/' Outflow=5.91 cfs 0.829 af

**Pond CB16:** Peak Elev=214.33' Inflow=3.21 cfs 0.659 af
18.0" Round Culvert n=0.012 L=50.0' S=0.0272 '/' Outflow=3.21 cfs 0.659 af

**Pond CB2:** Peak Elev=204.73' Inflow=10.45 cfs 1.612 af
18.0" Round Culvert n=0.012 L=124.0' S=0.0050 '/' Outflow=10.45 cfs 1.612 af

**Pond CB3:** Peak Elev=209.51' Inflow=9.40 cfs 1.470 af
18.0" Round Culvert n=0.012 L=122.0' S=0.0430 '/' Outflow=9.40 cfs 1.470 af

**Pond CB4:** Peak Elev=215.71' Inflow=7.76 cfs 1.237 af
15.0" Round Culvert n=0.012 L=112.0' S=0.0381 '/' Outflow=7.76 cfs 1.237 af

**Pond CB5:** Peak Elev=215.90' Inflow=7.74 cfs 1.228 af
15.0" Round Culvert n=0.012 L=32.0' S=0.0063 '/' Outflow=7.74 cfs 1.228 af

**Pond CB6:** Peak Elev=216.72' Inflow=2.83 cfs 0.321 af
15.0" Round Culvert n=0.012 L=16.0' S=0.0125 '/' Outflow=2.83 cfs 0.321 af

**Pond CB7:** Peak Elev=223.73' Inflow=2.50 cfs 0.245 af
15.0" Round Culvert n=0.012 L=126.0' S=0.0563 '/' Outflow=2.50 cfs 0.245 af

**Pond CB8:** Peak Elev=229.67' Inflow=0.68 cfs 0.046 af
15.0" Round Culvert n=0.012 L=126.0' S=0.0510 '/' Outflow=0.68 cfs 0.046 af

**Pond CB9:** Peak Elev=232.90' Inflow=0.49 cfs 0.032 af
15.0" Round Culvert n=0.012 L=84.0' S=0.0393 '/' Outflow=0.49 cfs 0.032 af

**Pond FB1: Filter Basin #1** Peak Elev=207.24' Storage=8,604 cf Inflow=3.21 cfs 0.659 af
Outflow=3.08 cfs 0.488 af

**Pond GW1: Gravel Wetland #1** Peak Elev=196.36' Storage=45,414 cf Inflow=16.38 cfs 2.412 af
Outflow=9.49 cfs 1.865 af

**Pond RG1: Rain Garden #1** Peak Elev=208.09' Storage=863 cf Inflow=1.88 cfs 0.178 af
Outflow=1.88 cfs 0.160 af

**Total Runoff Area = 89.863 ac Runoff Volume = 20.830 af Average Runoff Depth = 2.78"**
**92.21% Pervious = 82.864 ac 7.79% Impervious = 6.999 ac**

## Summary for Pond FB1: Filter Basin #1

Inflow Area = 2.282 ac, 31.56% Impervious, Inflow Depth > 3.47"
Inflow = 3.21 cfs @ 12.63 hrs, Volume= 0.659 af
Outflow = 3.08 cfs @ 12.87 hrs, Volume= 0.488 af, Atten= 4%, Lag= 14.3 min
Primary = 3.08 cfs @ 12.87 hrs, Volume= 0.488 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 207.24' @ 12.87 hrs Surf.Area= 5,685 sf Storage= 8,604 cf

Plug-Flow detention time= 105.8 min calculated for 0.488 af (74% of inflow)
Center-of-Mass det. time= 48.0 min ( 866.6 - 818.6 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 205.50' | 16,440 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 205.50 | 4,200 | 0 | 0 |
| 206.00 | 4,627 | 2,207 | 2,207 |
| 207.00 | 5,480 | 5,054 | 7,260 |
| 208.00 | 6,333 | 5,907 | 13,167 |
| 208.50 | 6,760 | 3,273 | 16,440 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 207.00' | **10.0' long x 13.0' breadth Broad-Crested Rectangular Weir**<br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60<br>Coef. (English) 2.60 2.64 2.70 2.66 2.65 2.66 2.65 2.63 |

**Primary OutFlow** Max=3.07 cfs @ 12.87 hrs HW=207.24' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 3.07 cfs @ 1.28 fps)

## Summary for Pond GW1: Gravel Wetland #1

[79] Warning: Submerged Pond CB1 Primary device # 1 OUTLET by 0.61'

Inflow Area = 8.866 ac, 26.34% Impervious, Inflow Depth > 3.26"
Inflow = 16.38 cfs @ 12.43 hrs, Volume= 2.412 af
Outflow = 10.62 cfs @ 12.82 hrs, Volume= 1.404 af, Atten= 35%, Lag= 23.5 min
Primary = 10.62 cfs @ 12.82 hrs, Volume= 1.404 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 196.62' @ 12.82 hrs Surf.Area= 16,835 sf Storage= 49,710 cf

Plug-Flow detention time= 151.9 min calculated for 1.404 af (58% of inflow)
Center-of-Mass det. time= 75.1 min ( 876.0 - 801.0 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 193.00' | 56,317 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 193.00 | 10,550 | 0 | 0 |
| 194.00 | 12,450 | 11,500 | 11,500 |
| 194.50 | 13,400 | 6,463 | 17,963 |
| 194.51 | 13,200 | 133 | 18,095 |
| 195.00 | 14,046 | 6,675 | 24,771 |
| 196.00 | 15,773 | 14,910 | 39,680 |
| 197.00 | 17,500 | 16,637 | 56,317 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 194.50' | **18.0" Round Culvert X 0.00**<br>L= 40.0' CPP, projecting, no headwall, Ke= 0.900<br>Outlet Invert= 193.00' S= 0.0375 '/' Cc= 0.900 n= 0.012 |
| #2 | Primary | 196.20' | **15.0' long x 13.0' breadth Broad-Crested Rectangular Weir**<br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60<br>Coef. (English) 2.60 2.64 2.70 2.66 2.65 2.66 2.65 2.63 |

**Primary OutFlow** Max=10.55 cfs @ 12.82 hrs HW=196.61' (Free Discharge)
└─**1=Culvert** ( Controls 0.00 cfs)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 10.55 cfs @ 1.70 fps)

**MAINTENANCE PLAN OF STORMWATER MANAGEMENT FACILITIES**
**FOR:**
**HIGHLAND VIEWS**
**WINDHAM, MAINE**

**Project Developer:** Chase Custom Homes & Finance
290 Bridgton Road
Westbrook, ME 04092

**Responsible Party:** Chase Custom Homes & Finance
290 Bridgton Road
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**Prepared By:** Terradyn Consultants, LLC
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New Gloucester, ME 04260

## LIST OF STORMWATER MEASURES:

Conveyance & Distribution System (Stormwater Channels & Culverts)
Roadways & Parking Surfaces
Catch Basin Systems
Gravel Wetland
Filter Basins:
- Underdrain Soil Filter
- Rain Gardens

Buffers

## INTRODUCTION:

The owner or operator of the proposed project will be responsible for the maintenance of all stormwater management structures except the rain gardens located on individual lots, the establishment of any contract services required to implement the program, and the keeping of records and maintenance log book. Records of all inspections and maintenance work accomplished must be kept on file and retained for a minimum 5 year time span. The maintenance log book will be made available to the DEP upon request. At a minimum, the appropriate and relevant activities for each of the stormwater management systems will be performed on the prescribed schedule.

## INSPECTION & MAINTENANCE TASKS:

Inspections should be performed by qualified erosion control professional. NOTE: The following instruction are excerpts from the Maine Department of Environmental Protection's *Stormwater Management for Maine, Volume III BMPs Technical Design Manual*, dated January 2006.

## CONVEYANCE & DISTRIBUTION SYSTEMS: (STORMWATER CHANNELS & CULVERTS, ETC.)

**1. Inspection schedule:**

**1.1.** Inspect ditches, swales and other open stormwater channels in the spring, in late fall, and after heavy rains to remove any obstructions to flow, remove accumulated sediments and debris, to control vegetated growth that could obstruct flow, and to repair any erosion of the ditch lining. Vegetated ditches must be mowed at least annually or otherwise maintained to control the growth of woody vegetation and maintain flow capacity. Any woody vegetation growing through riprap linings must also be removed. Repair any slumping side slopes as soon as practicable. If the ditch has a riprap lining, replace riprap on areas where any underlying filter fabric or underdrain gravel is showing through the stone or where stones have dislodged. The channel must receive adequate routine maintenance to maintain capacity and prevent or correct any erosion of the channel's bottom or side-slopes.

**1.2.** Inspect culverts in the spring, in late fall, and after heavy rains to remove any obstructions to flow; remove accumulated sediments and debris at the inlet, at the outlet, and within the conduit; and to repair any erosion damage at the culvert's inlet and outlet.

**1.3.** Inspect vegetated areas, particularly slopes and embankments, early in the growing season or after heavy rains to identify active or potential erosion problems. Replant bare areas or areas with sparse growth. Where rill erosion is evident, armor the area with an appropriate lining or divert the erosive flows to on-site areas able to withstand the concentrated flows.

2. **Mowing:** Grass should not be trimmed extremely short, as this will reduce the filtering effect of the swale (MPCA, 1989). The cut vegetation should be removed to prevent the decaying organic litter from adding pollutants to the discharge from the swale. The mowed height of the grass should be 2-4 inches taller than the maximum flow depth of the design water quality storm. A minimum mow height of 6 inches is generally recommended (Galli, 1993).

3. **Erosion:** It is important to install erosion and sediment control measures to stabilize this area as soon as possible and to retain any organic matter in the bottom of the trench.

4. **Fertilization:** Routine fertilization and/or use of pesticides is strongly discouraged. If complete re-seeding is necessary, half the original recommended rate of fertilizer should be applied with a full rate of seed.

5. **Sediment Removal:** The level of sediment deposition in the channel should be monitored regularly, and removed from grassed channels before permanent damage is done to the grassed vegetation, or if infiltration times are longer than 12 hours. Sediment should be removed from riprap channels when it reduces the capacity of the channel.

## ROADWAYS & PARKING SURFACES:

1. Paved surfaces shall be swept or vacuumed at least twice annually in the Spring to remove all Winter sand, and periodically during the year on an as-needed basis to minimize transportation of sediment during rainfall events.

## CATCH BASIN SYSTEMS:

1. Catch basins are designed with a deep sump to trap larger sediment. Catch basins shall be inspected for sediment depth in the spring and fall, and accumulated sediment shall be removed and disposed of lawfully when it reaches 50% of the design capacity of the sump.

## GRAVEL WETLANDS (FROM UNH SUBSURFACE GRAVEL WETLAND DESIGN SPECIFICATIONS MANUAL):

**1ST YEAR POST-CONSTRUCTION:** Inspection frequency should be after every major storm in the first year following construction.

1. Inspect to be certain system drains within 24-72 hrs (within the design period, but also not so quickly as to minimize stormwater treatment)).
2. Watering plants as necessary during the first growing season
3. Re-vegetating poorly established areas as necessary
4. Treating diseased vegetation as necessary
5. Quarterly inspection of soil and repairing eroded areas, especially on slopes
6. Checking inlets, outlets, and overflow spillway for blockage, structural integrity, and evidence of erosion.

**POST-CONSTRUCTION:** Inspection frequency should be at least every 6 months thereafter, as per USEPA Good House-Keeping Requirements. Inspection frequency can be reduced to annual following 2 years of monitoring that indicates the rate of sediment accumulation is less than the cleaning criteria listed below. Inspections should focus on:

1. Checking the filter surface for dense, complete, root mat establishment across the wetland surface. Thorough revegetation with grasses, forbs, and shrubs is necessary. Unlike bioretention, where mulch is commonly used, complete surface coverage with vegetation is needed.
2. Checking the gravel wetland surface for standing water or other evidence of riser clogging, such as discolored or accumulated sediments.
3. Checking the sedimentation chamber or forebay for sediment accumulation, trash, and debris.
4. Inspect to be certain the sedimentation forebay drains within 24 to 72 hrs.
5. Checking inlets, outlets, and overflow spillway for blockage, structural integrity, and evidence of erosion.
6. Removal of decaying vegetation, litter, and debris.

**CLEANING CRITERIA FOR SEDIMENTATION FOREBAY**: Sediment should be removed from the sedimentation chamber (forebay) when it accumulates to a depth of more than 12 inches (30 cm) or 10 percent of the pretreatment volume. The sedimentation forebay should be cleaned of vegetation if persistent standing water and wetland vegetation becomes dominant. The cleaning interval is approximately every 4 years. A dry sedimentation forebay is the optimal condition while in practice this condition is rarely achieved. The sedimentation chamber, forebay, and treatment cell outlet devices should be cleaned when drawdown times exceed 60 to 72 hours. Materials can be removed with heavy construction equipment; however, this equipment should not track on the wetland surface. Revegetation of disturbed areas as necessary. Removed sediments should be dewatered (if necessary) and disposed of in an acceptable manner.

**CLEANING CRITERIA FOR GRAVEL WETLAND TREATMENT CELLS**: Sediment should be removed from the gravel wetland surface when it accumulates to a depth of several inches (>10 cm) across the wetland surface. Materials should be removed with rakes rather than heavy construction equipment to avoid compaction of the gravel wetland surface. Heavy equipment could be used if the system is designed with dimensions that allow equipment to be located outside the gravel wetland, while a backhoe shovel reaches inside the gravel wetland to remove sediment. Removed sediments should be dewatered (if necessary) and disposed of in an acceptable manner.

## FILTER BASINS

### GRASS UNDERDRAINED SOIL FILTER

1. During the first year, the basin will be inspected semi-annually and following major storm events. Debris and sediment buildup shall be removed from the forebay and basin as needed. Any bare area or erosion rills shall be repaired with new filter media or sandy loam then planted and mulched. Maintaining a healthy plant cover will minimize clogging with fine sediments and if ponding exceeds 48 hours, the top of the filter bed must be rototilled to reestablish the soil's filtration capacity.

2. **Soil Filter Inspection:** The soil filter should be inspected after every major storm in the first year to be sure it is functioning properly and that the plants are establishing. Thereafter, the filter should be inspected at least once every six months to ensure that it is draining within 48 hours following a one inch storm or greater. If the system drains too fast, an orifice may need to be added on the underdrain outlet or, if already present, may need to be modified.

3. **Soil Filter Replacement:** The mulch shall be replaced with fresh material on an annual basis.

4. **Sediment Removal:** Sediment and plant debris should be removed from the pretreatment structure at least annually. Removed sediments should be disposed of in an acceptable manner.

5. **Fertilization:** Fertilization of the underdrained filter area should be avoided unless absolutely necessary to establish vegetation.

6. **Harvesting and Weeding:** Harvesting and pruning of excessive growth will need to be done occasionally. Weeding to control unwanted or invasive plants may also be necessary. Plants that are not thriving shall be replaced.

7. **Snow Storage:** Snow should not be pushed from adjacent paved areas directly onto the filter basin. Plowed snow contains a high level of sediment, which can cause premature clogging of the filter media. Snow should be stored in a location that allows it to melt and flow through a pretreatment device, such as a grass swale or filter strip, prior to entering the filter basin.

### RAIN GARDEN

1. **Responsible Party:** The owner of each lot where a rain garden is located is responsible for the maintenance of the rain garden, the establishment of any contract services required to implement the program, and the keeping of records and maintenance log book.

2. The rain garden should be inspected semi-annually and following major storm events. Debris and sediment buildup should be removed from the forebay and basin as needed. Any bare area or erosion rills should be repaired with new filter media, seeded and mulched.

3. **Maintenance Agreement:** A legal entity should be established with responsibility for inspecting and maintaining any filter basin. The legal agreement establishing the entity should list specific maintenance responsibilities (including timetables) and provide for the funding to cover long-term inspection and maintenance.

4. **Drainage:** The rain garden should be draining within 48 hours following a one-inch storm or greater. If the system drains too fast, an orifice may need to be added on the underdrain outlet or may need to be modified if already present.

5. **Sediment Removal:** Sediment and plant debris should be removed from the pretreatment structure at least annually.

6. **Remedial Cover:** The organic mulch should be removed and replaced with a 2-3 inch layer of fresh mulch annually or as needed.

7. **Soil Filter Replacement:** The mulch shall be replaced with fresh material on a yearly basis.

8. **Fertilization:** Fertilization of the filter area should be avoided unless absolutely necessary to establish vegetation.

9. **Harvesting and Weeding:** Harvesting and pruning of excessive growth should be done occasionally. Weeding to control unwanted or invasive plants may also be necessary.

10. **Planting:** Maintaining a healthy vegetative cover will minimize clogging with fine sediments. If ponding exceeds 48 hours, the top of the filter bed should be rototilled to reestablish the soil's filtration capacity.

11. **Soil Filter Replacement:** The top several inches of the filter can be replaced with fresh material if water is ponding for more than 72 hours.

## VEGETATED STORMWATER BUFFERS

Buffers should be inspected annually for evidence of erosion or concentrated flows through or around the buffer. All eroded areas should be repaired, seeded and mulched.

**1. Mowing:** Meadow buffers may be mown no more than twice per year. They may not be maintained as a lawn.

**2. Access and Use:** Buffers should not be traversed by all-terrain vehicles or other vehicles. Activities within buffers should be conducted so as not to damage vegetation, disturb any organic duff layer, or expose soil.

**3. Inspections:** Conduct periodic "buffer walks" to inspect the condition of the buffer network.

**SAMPLE MAINTENANCE LOG SHEET:**

| Maintenance Log Sheet | | | |
|---|---|---|---|
| **BMP's** | **Date Inspected** | **Repairs Needed?** | **Date Repaired** |
| **Example** | 8/17/2017 | Y | 8/27/2017 |
| **1.** Conveyance & Distribution System | | | |
| **2.** Roadways & Parking | | | |
| **3.** Catch Basin Systems | | | |
| **4.** Infiltration Trench | | | |
| **5.** Gravel Wetland | | | |
| **6.** Underdrain Soil Filter | | | |
| **7.** Rain Garden | | | |
| **8.** Vegetated Stormwater Buffer | | | |

| Detailed Repair Notes: | | |
|---|---|---|
| **BMP Type** | **Date** | **Description of Repair Made** |
| 3 | 8/27/2017 | Removed sediment from sump |
| | | |
| | | |
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# HOUSEKEEPING PERFORMANCE STANDARDS
**FOR:**
**HIGHLAND VIEWS**
**WINDHAM, MAINE**

**Project Developer:** Chase Custom Homes & Finance
290 Bridgton Road
Westbrook, ME 04092

**Responsible Party:** Chase Custom Homes & Finance
290 Bridgton Road
Westbrook, ME 04092

**Introduction:**
The contractor shall be responsible for maintaining proper housekeeping standards throughout the construction phase of the project. After the construction phase has been completed, the owner or operator of the project will be responsible.

**Standards:**
In accordance with the housekeeping performance standards required by MDEP chapter 500 stormwater regulations, the following standards shall be met:

1. **Spill prevention.** Controls must be used to prevent pollutants from being discharged from materials on site, including storage practices to minimize exposure of the materials to stormwater, and appropriate spill prevention, containment, and response planning and implementation.
2. **Groundwater protection.** During construction, liquid petroleum products and other hazardous materials with the potential to contaminate groundwater may not be stored or handled in areas of the site draining to an infiltration area. An "infiltration area" is any area of the site that by design or as a result of soils, topography and other relevant factors accumulates runoff that infiltrates into the soil. Dikes, berms, sumps, and other forms of secondary containment that prevent discharge to groundwater may be used to isolate portions of the site for the purposes of storage and handling of these materials.

3. **Fugitive sediment and dust.** Actions must be taken to ensure that activities do not result in noticeable erosion of soils or fugitive dust emissions during or after construction. Oil may not be used for dust control.

   Operations during wet months that experience tracking of mud off the site onto public roads should provide for sweeping of road areas at least once a week and prior to significant storm events. Where chronic mud tracking occurs, a stabilized construction entrance should be provided. Operations during dry months, that experience fugitive dust problems, should wet down the access roads once a week or more frequently as needed.

4. **Debris and other materials.** Litter, construction debris, and chemicals exposed to stormwater must be prevented from becoming a pollutant source.

   To prevent these materials from becoming a source of pollutants, construction and post-construction activities related to a project may be required to comply with applicable

provision of rules related to solid, universal, and hazardous waste, including, but not limited to, the Maine solid waste and hazardous waste management rules; Maine hazardous waste management rules; Maine oil conveyance and storage rules; and Maine pesticide requirements.

5. **Trench or foundation de-watering.** Trench de-watering is the removal of water from trenches, foundations, coffer dams, ponds, and other areas within the construction area that retain water after excavation. In most cases the collected water is heavily silted and hinders correct and safe construction practices. The collected water must be removed from the ponded area, either through gravity or pumping, and must be spread through natural wooded buffers or removed to areas that are specifically designed to collect the maximum amount of sediment possible, like a cofferdam sedimentation basin. Avoid allowing the water to flow over disturbed areas of the site. Equivalent measures may be taken if approved by the department.

6. **Non-stormwater discharges.** Identify and prevent contamination by non-stormwater discharges.

Mark Cenci
Geologic, Inc.

CERTIFIED GEOLOGIST/LICENSED SITE EVALUATOR

93 Mill Road • North Yarmouth, Maine 04097
Cell: 207.329.3524 • mark@markcenci.com
www.markcenci.com

# Soil Investigation for Septic Systems and a Storm Water Control Feature, Windham Line M.H.P & Apartments

**Date:** September 2, 2016

**To:** Jeff Amos, PE
Terradyn Consultants, LLC
PO Box 339
New Gloucester, ME 04260

**Date of Investigation:** August 19, 2016.

**Location, Purpose and Method of Investigation:**

The property investigated is located at the east side of Roosevelt Trail, Windham, opposite the Land of Nod Road intersection.

The purpose of the investigation was to describe the soil at multiple locations for potential septic systems and one specific location for a storm water control feature.

The *Windham Line M.H.P & Apartments Sketch Plan*, by Terradyn Consultants, dated 8/17/2016 was used in the field to locate the areas for the test pits. The pits were dug by an excavator. The test pit sites were located by a Trimble Geo-XH GPS radio device. Location data was post processed for accuracy and sent as an AutoCAD drawing file.

**Results of the Investigation:**

The property is on the lower, easterly slope of Jones Hill, north of Milliken Hill (see Figure 1). These are northerly trending ridges of bedrock covered by glacial till. The *Surficial Geology of the Cumberland Center Quadrangle*, Maine depicts the property as a deposit of glacial till (see Figure 2).

The site is mapped as an association of Paxton fine sandy loam, Paxton very stony fine sandy loam, Swanton fine sandy loam, Ridgebury fine sandy loam and Scantic silt loam on the *National Cooperative Soil Survey* (see attached photomaps and descriptions).

These are soils formed in glacial till in close proximity to a glacio-marine or lacustrine basin filled with silts and clays. Soil testing generally agrees with this mapping.

Twelve test pits were investigated. Soil logs are enclosed. The soil textures vary from sand to fine sandy loamy to silt loam. Higher on the landscape, the soils are more coarse textured, and were deposited from sands washing off the glacial till on the ridges. Lower on the landscape, the sands of the washed tills are finer textured and mix with underlying silts and clays.

The soils are classified as 5B, 3C, and 8D. Wastewater disposal systems will be rated Medium, Medium-Large or Large according to the *Subsurface Wastewater Disposal Rules*, depending on the position on the landscape.

The site of the storm water control feature, at Test Pit #13, is classified as Hydrologic Group D

Mark Cenci
LSE # 262, CG # 467

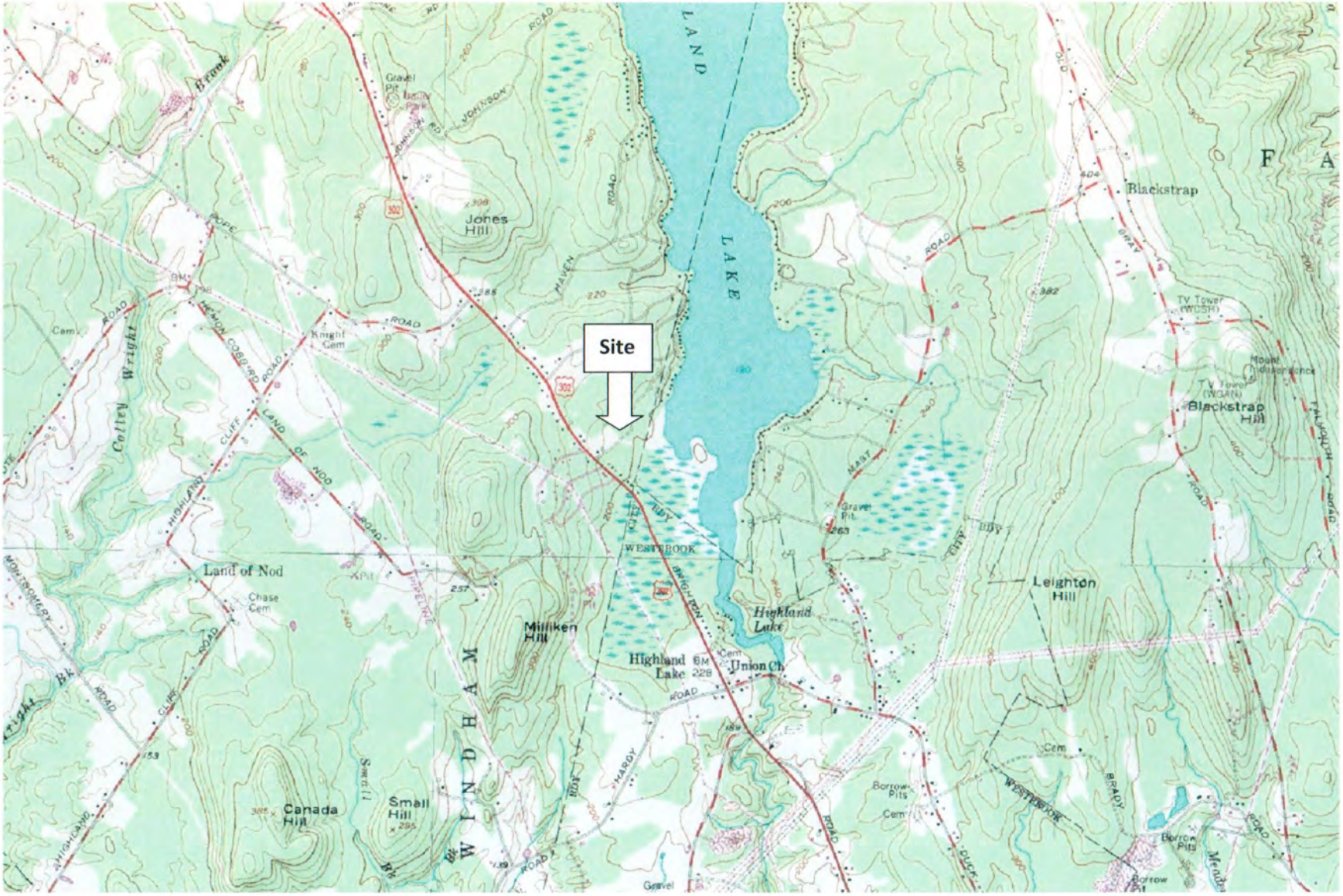



**Figure 1.**

**Topographic Locus Map of the Area of the Chase Property, Roosevelt Trail, Windham**

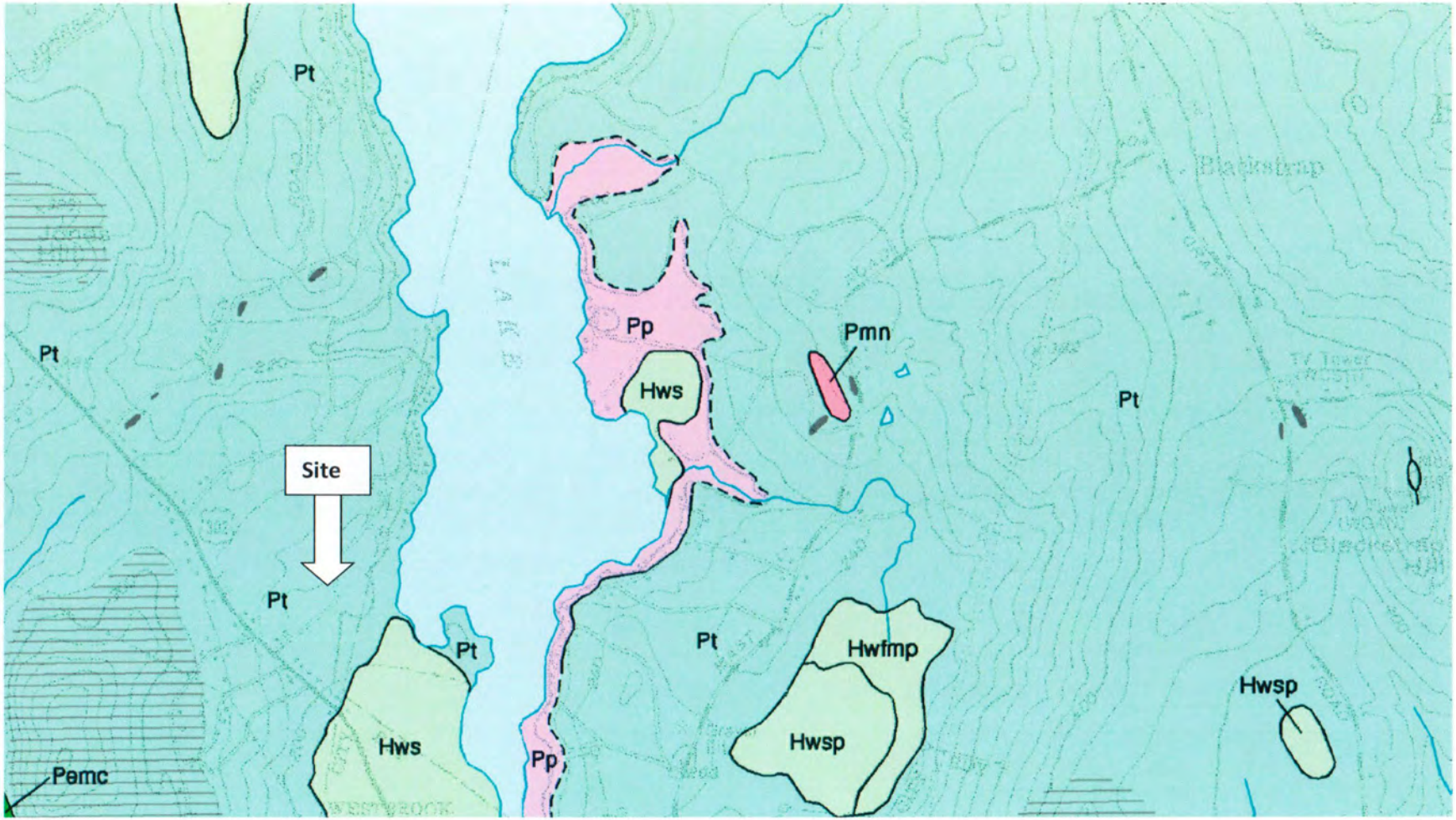


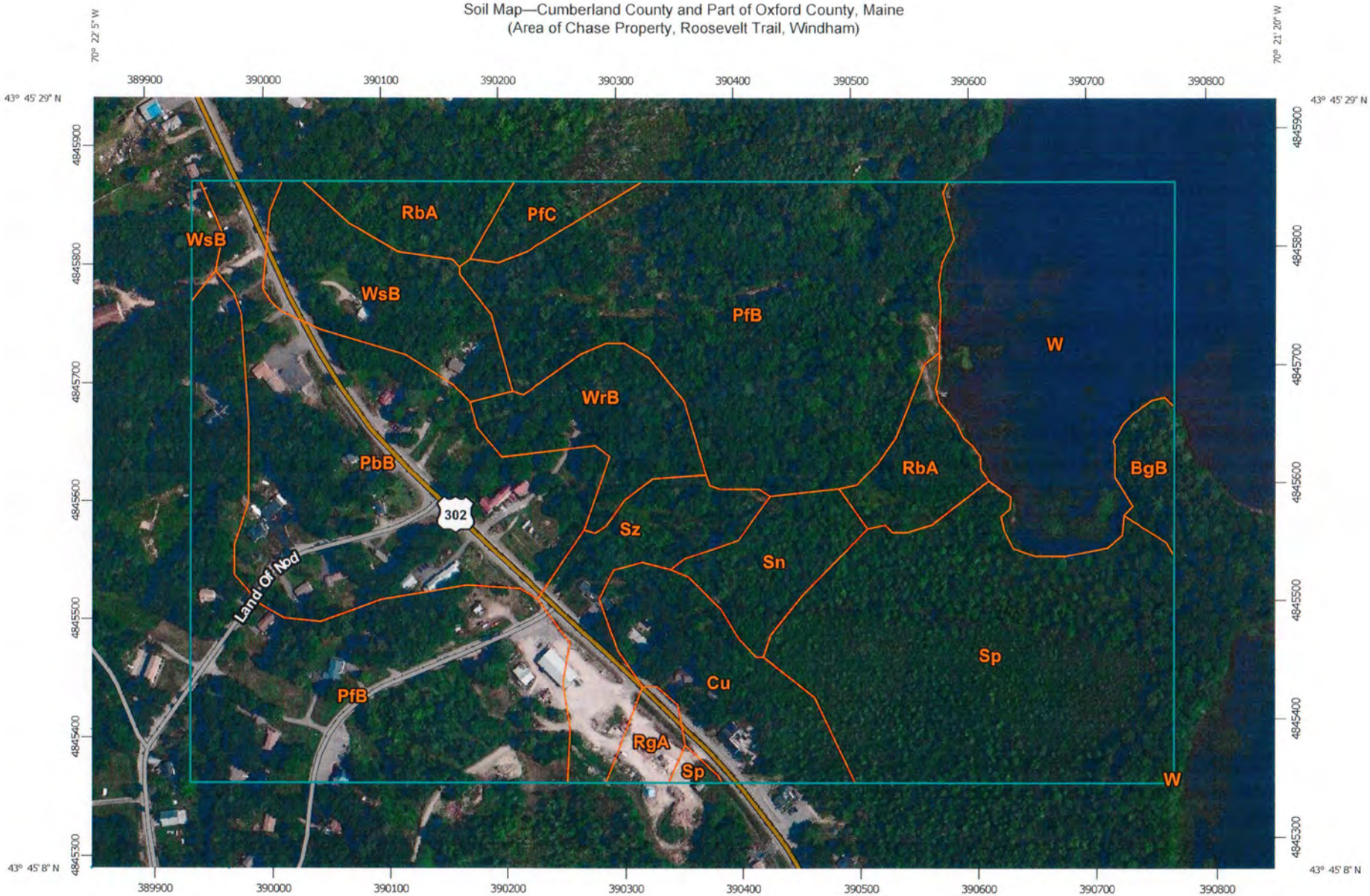

**Figure 2.**

**Detail from *Surficial Geology of the Cumberland Center Quadrangle, Maine***

By Michael J. Ratelle ME Geol. Surv., Open-File # 99-81

Where Pt = Glacial till

Soil Map—Cumberland County and Part of Oxford County, Maine
(Area of Chase Property, Roosevelt Trail, Windham)




Map Scale: 1:4,590 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

## MAP LEGEND

**Area of Interest (AOI)**

- Area of Interest (AOI)

**Soils**

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

**Special Point Features**

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

**Water Features**

- Streams and Canals

**Transportation**

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

**Background**

- Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

Soil Survey Area: Cumberland County and Part of Oxford County, Maine
Survey Area Data: Version 11, Sep 17, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 20, 2010—Jul 18, 2010

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.

# Map Unit Legend

| Cumberland County and Part of Oxford County, Maine (ME005) | | | |
|---|---|---|---|
| **Map Unit Symbol** | **Map Unit Name** | **Acres in AOI** | **Percent of AOI** |
| BgB | Belgrade very fine sandy loam, 0 to 8 percent slopes | 1.2 | 1.1% |
| Cu | Cut and fill land | 5.0 | 4.8% |
| PbB | Paxton fine sandy loam, 3 to 8 percent slopes | 14.6 | 13.9% |
| PfB | Paxton very stony fine sandy loam, 3 to 8 percent slopes | 33.3 | 31.7% |
| PfC | Paxton very stony fine sandy loam, 8 to 15 percent slopes | 1.2 | 1.1% |
| RbA | Ridgebury fine sandy loam, 0 to 3 percent slopes | 4.1 | 3.9% |
| RgA | Ridgebury very stony fine sandy loam, 0 to 3 percent slopes | 0.9 | 0.9% |
| Sn | Scantic silt loam, 0 to 3 percent slopes | 2.7 | 2.6% |
| Sp | Sebago mucky peat | 16.3 | 15.5% |
| Sz | Swanton fine sandy loam | 4.3 | 4.0% |
| W | Water | 12.7 | 12.1% |
| WrB | Woodbridge fine sandy loam, 0 to 8 percent slopes | 3.7 | 3.6% |
| WsB | Woodbridge very stony fine sandy loam, 0 to 8 percent slopes | 5.2 | 4.9% |
| **Totals for Area of Interest** | | **105.3** | **100.0%** |

FORM F Rev. 07/11

# SOIL PROFILE / CLASSIFICATION INFORMATION

**DETAILED DESCRIPTION OF SUBSURFACE CONDITIONS AT PROJECT SITES**

Project Name: WINDHAM LINE M.H.P. & APARTMENTS
Applicant Name: CHASE CUSTOM HOMES
Project Location (municipality): WINDHAM

## Exploration Symbol # TP-1 ☒ Test Pit ☐ Boring ☐ Probe

_____ " Organic horizon thickness  Ground surface elev. _____
_____ " Depth of exploration or to refusal

Depth below mineral soil surface (inches)

| Texture | Consistency | Color | Redox Features |
|---|---|---|---|
| FINE SANDY LOAM TO LOAMY SAND | FRIABLE TO LOOSE | DARK BROWN / RED / BROWN | |
| GRAVELLY STONE / SAND | FIRM | LIGHT BROWN | NONE |
| LIMIT OF EXCAVATION | | | |

Soil Details by S.E. ▸▸ / S.S. ▸▸

| Soil Classification: Profile | Condition | Slope: Percent | Limiting Factor: Depth | |
|---|---|---|---|---|
| 5 | B | | — " | ☐ Groundwater ☐ Restrictive Layer ☐ Bedrock |

Soil Series/Phase Name: ☐ Hydric ☐ Non-hydric
Hydrologic Soil Group

## Exploration Symbol # TP-2 ☒ Test Pit ☐ Boring ☐ Probe

_____ " Organic horizon thickness  Ground surface elev. _____
_____ " Depth of exploration or to refusal

Depth below mineral soil surface (inches)

| Texture | Consistency | Color | Redox Features |
|---|---|---|---|
| FINE SANDY LOAM | FRIABLE / LOOSE | DARK BROWN / RED / BROWN | |
| FINE SAND | | LIGHT BROWN | NONE |
| LIMIT OF EXCAVATION | | | |

Soil Details by S.E. ▸▸ / S.S. ▸▸

| Soil Classification: Profile | Condition | Slope: Percent | Limiting Factor: Depth | |
|---|---|---|---|---|
| 5 | B | | — " | ☐ Groundwater ☐ Restrictive Layer ☐ Bedrock |

Soil Series/Phase Name: ☐ Hydric ☐ Non-hydric
Hydrologic Soil Group

## Exploration Symbol # TP-3 ☒ Test Pit ☐ Boring ☐ Probe

_____ " Organic horizon thickness  Ground surface elev. _____
_____ " Depth of exploration or to refusal

Depth below mineral soil surface (inches)

| Texture | Consistency | Color | Redox Features |
|---|---|---|---|
| FINE SANDY LOAM | FRIABLE | DARK BROWN / YELLOW BROWN | |
| FINE SAND | LOOSE | LIGHT BROWN | NONE |
| LIMIT OF EXCAVATION | | | |

Soil Details by S.E. ▸▸ / S.S. ▸▸

| Soil Classification: Profile | Condition | Slope: Percent | Limiting Factor: Depth | |
|---|---|---|---|---|
| 5 | B | | — " | ☐ Groundwater ☐ Restrictive Layer ☐ Bedrock |

Soil Series/Phase Name: ☐ Hydric ☐ Non-hydric
Hydrologic Soil Group

## Exploration Symbol # TP-4 ☒ Test Pit ☐ Boring ☐ Probe

_____ " Organic horizon thickness  Ground surface elev. _____
_____ " Depth of exploration or to refusal

Depth below mineral soil surface (inches)

| Texture | Consistency | Color | Redox Features |
|---|---|---|---|
| FINE SANDY LOAM | FRIABLE | DARK BROWN | |
| SILT LOAM | FIRM | GRAY BROWN | COMMON |
| LIMIT OF EXCAVATION | | | |

Soil Details by S.E. ▸▸ / S.S. ▸▸

| Soil Classification: Profile | Condition | Slope: Percent | Limiting Factor: Depth | |
|---|---|---|---|---|
| 8 | D | | 12 " | ☒ Groundwater ☐ Restrictive Layer ☐ Bedrock |

Soil Series/Phase Name: ☐ Hydric ☐ Non-hydric
Hydrologic Soil Group

## INVESTIGATOR INFORMATION AND SIGNATURE

Signature: Mark Cenci  Date: 9-1-16
Name Printed: MARK CENCI  Cert/Lic/Reg. #: 262/467
Title: ☒ Licensed Site Evaluator ☐ Certified Soil Scientist ☒ Certified Geologist ☐ Professional Engineer

*affix professional seal*

FORM F Rev. 07/11

# SOIL PROFILE / CLASSIFICATION INFORMATION

**DETAILED DESCRIPTION OF SUBSURFACE CONDITIONS AT PROJECT SITES**

Project Name: WINDHAM LINE MHP & APARTMENTS
Applicant Name: CHASE CUSTOM HOMES
Project Location (municipality): WINDHAM

## Exploration Symbol # TP5

☒ Test Pit ☐ Boring ☐ Probe

_____ " Organic horizon thickness  Ground surface elev. _____

_____ " Depth of exploration or to refusal

Depth below mineral soil surface (inches)

| Texture | Consistency | Color | Redox Features |
|---|---|---|---|
| FINE SANDY LOAM | FRIABLE | DARK BROWN | |
| | | YELLOW BROWN | |
| | FIRM | GRAY BROWN | COMMON |
| LIMIT OF EXCAVATION | | | |

Soil Details by S.E. ▸▸ / S.S. ▸▸

| Soil Classification | | Slope | Limiting Factor | |
|---|---|---|---|---|
| 3 | C | | 17 " | ☒ Groundwater ☒ Restrictive Layer ☐ Bedrock |
| Profile | Condition | Percent | Depth | |

Soil Series/Phase Name: ☐ Hydric ☐ Non-hydric

Hydrologic Soil Group

## Exploration Symbol # TP-6

☒ Test Pit ☐ Boring ☐ Probe

_____ " Organic horizon thickness  Ground surface elev. _____

_____ " Depth of exploration or to refusal

Depth below mineral soil surface (inches)

| Texture | Consistency | Color | Redox Features |
|---|---|---|---|
| | | DARK BROWN | |
| FINE SANDY LOAM | FRIABLE | YELLOW BROWN | |
| | FIRM | GRAY BROWN | COMMON |
| LIMIT OF EXCAVATION | | | |

Soil Details by S.E. ▸▸ / S.S. ▸▸

| Soil Classification | | Slope | Limiting Factor | |
|---|---|---|---|---|
| 3 | C | | 26 " | ☒ Groundwater ☒ Restrictive Layer ☐ Bedrock |
| Profile | Condition | Percent | Depth | |

Soil Series/Phase Name: ☐ Hydric ☐ Non-hydric

Hydrologic Soil Group

## Exploration Symbol # TP-7

☒ Test Pit ☐ Boring ☐ Probe

_____ " Organic horizon thickness  Ground surface elev. _____

_____ " Depth of exploration or to refusal

Depth below mineral soil surface (inches)

| Texture | Consistency | Color | Redox Features |
|---|---|---|---|
| FINE SANDY LOAM | FRIABLE | DARK BROWN | |
| | | YELLOW BROWN | |
| SILT LOAM | FIRM | GRAY BROWN | COMMON |
| LIMIT OF EXCAVATION | | | |

Soil Details by S.E. ▸▸ / S.S. ▸▸

| Soil Classification | | Slope | Limiting Factor | |
|---|---|---|---|---|
| 8 | D | | 12 " | ☒ Groundwater ☒ Restrictive Layer ☐ Bedrock |
| Profile | Condition | Percent | Depth | |

Soil Series/Phase Name: ☐ Hydric ☐ Non-hydric

Hydrologic Soil Group

## Exploration Symbol # TP-8

☒ Test Pit ☐ Boring ☐ Probe

_____ " Organic horizon thickness  Ground surface elev. _____

_____ " Depth of exploration or to refusal

Depth below mineral soil surface (inches)

| Texture | Consistency | Color | Redox Features |
|---|---|---|---|
| FINE SANDY LOAM | FRIABLE | DARK BROWN | |
| | | YELLOW BROWN | |
| SILT LOAM | FIRM | GRAY BROWN | COMMON |
| LIMIT OF EXCAVATION | | | |

Soil Details by S.E. ▸▸ / S.S. ▸▸

| Soil Classification | | Slope | Limiting Factor | |
|---|---|---|---|---|
| 8 | D | | 12 " | ☒ Groundwater ☒ Restrictive Layer ☐ Bedrock |
| Profile | Condition | Percent | Depth | |

Soil Series/Phase Name: ☐ Hydric ☐ Non-hydric

Hydrologic Soil Group

## INVESTIGATOR INFORMATION AND SIGNATURE

Signature: Mark Cenci  Date: 9-1-16

Name Printed: MARK CENCI  Cert/Lic/Reg. #: 262/467

Title: ☒ Licensed Site Evaluator ☐ Certified Soil Scientist ☒ Certified Geologist ☐ Professional Engineer

*affix professional seal*

FORM F Rev. 07/11

# SOIL PROFILE / CLASSIFICATION INFORMATION

**DETAILED DESCRIPTION OF SUBSURFACE CONDITIONS AT PROJECT SITES**

Project Name: WINDHAM LINE M.H.P. & APARTMENTS
Applicant Name: CHASE CUSTOM HOMES
Project Location (municipality): WINDHAM

## Exploration Symbol # TP-9 ☒ Test Pit ☐ Boring ☐ Probe

_____ " Organic horizon thickness  Ground surface elev. _____
_____ " Depth of exploration or to refusal

Depth below mineral soil surface (inches)

| Texture | Consistency | Color | Redox Features |
|---|---|---|---|
| FINE SANDY LOAM | FRIABLE | DARK BROWN / YELLOW BROWN | |
| SILT LOAM | FIRM | GRAY BROWN | COMMON |
| LIMIT OF EXCAVATION | | | |

Soil Details by S.E. ▸▸ / S.S. ▸▸

| Soil Classification: Profile | Condition | Slope: Percent | Limiting Factor: Depth | |
|---|---|---|---|---|
| 8 | D | | 14" | ☒ Groundwater ☒ Restrictive Layer ☐ Bedrock |

Soil Series/Phase Name: ☐ Hydric ☐ Non-hydric  Hydrologic Soil Group

## Exploration Symbol # TP-10 ☒ Test Pit ☐ Boring ☐ Probe

_____ " Organic horizon thickness  Ground surface elev. _____
_____ " Depth of exploration or to refusal

Depth below mineral soil surface (inches)

| Texture | Consistency | Color | Redox Features |
|---|---|---|---|
| FINE SANDY LOAM | FRIABLE | DARK BROWN / YELLOW BROWN | |
| VERY FINE SANDY LOAM | FIRM | GRAY BROWN | COMMON |
| LIMIT OF EXCAVATION | | | |

Soil Details by S.E. ▸▸ / S.S. ▸▸

| Soil Classification: Profile | Condition | Slope: Percent | Limiting Factor: Depth | |
|---|---|---|---|---|
| 3 | C | | 18" | ☒ Groundwater ☒ Restrictive Layer ☐ Bedrock |

Soil Series/Phase Name: ☐ Hydric ☐ Non-hydric  Hydrologic Soil Group

## Exploration Symbol # TP-11 ☒ Test Pit ☐ Boring ☐ Probe

_____ " Organic horizon thickness  Ground surface elev. _____
_____ " Depth of exploration or to refusal

Depth below mineral soil surface (inches)

| Texture | Consistency | Color | Redox Features |
|---|---|---|---|
| FINE SANDY LOAM | FRIABLE | DARK BROWN / YELLOW BROWN | |
| VERY FINE SANDY LOAM | FIRM | GRAY BROWN | COMMON |
| LIMIT OF EXCAVATION | | | |

Soil Details by S.E. ▸▸ / S.S. ▸▸

| Soil Classification: Profile | Condition | Slope: Percent | Limiting Factor: Depth | |
|---|---|---|---|---|
| 8 | D | | 14" | ☒ Groundwater ☐ Restrictive Layer ☐ Bedrock |

Soil Series/Phase Name: ☐ Hydric ☐ Non-hydric  Hydrologic Soil Group

## Exploration Symbol # TP-12 ☒ Test Pit ☐ Boring ☐ Probe

_____ " Organic horizon thickness  Ground surface elev. _____
_____ " Depth of exploration or to refusal

Depth below mineral soil surface (inches)

| Texture | Consistency | Color | Redox Features |
|---|---|---|---|
| FINE SANDY LOAM | FRIABLE | DARK BROWN / YELLOW BROWN | |
| | FIRM | GRAY BROWN | COMMON |
| LIMIT OF EXCAVATION | | | |

Soil Details by S.E. ▸▸ / S.S. ▸▸

| Soil Classification: Profile | Condition | Slope: Percent | Limiting Factor: Depth | |
|---|---|---|---|---|
| 3 | C | | 19" | ☒ Groundwater ☒ Restrictive Layer ☐ Bedrock |

Soil Series/Phase Name: ☐ Hydric ☐ Non-hydric  Hydrologic Soil Group

## INVESTIGATOR INFORMATION AND SIGNATURE

Signature: Mark Cenci  Date: 9-1-16
Name Printed: MARK CENCI  Cert/Lic/Reg. #: 262/467
Title: ☒ Licensed Site Evaluator ☐ Certified Soil Scientist ☒ Certified Geologist ☐ Professional Engineer

*affix professional seal*

FORM F Rev. 07/11

# SOIL PROFILE / CLASSIFICATION INFORMATION

**DETAILED DESCRIPTION OF SUBSURFACE CONDITIONS AT PROJECT SITES**

Project Name: WINDHAM LINE MHP & APARTMENTS
Applicant Name: CHASE CUSTOM HOMES
Project Location (municipality): WINDHAM

Exploration Symbol # TP13 ☒ Test Pit ☐ Boring ☐ Probe
_____ " Organic horizon thickness Ground surface elev. _____
_____ " Depth of exploration or to refusal

Depth below mineral soil surface (inches)

| Depth | Texture | Consistency | Color | Redox Features |
|---|---|---|---|---|
| 0–10 | FINE SANDY LOAM | FRIABLE | DARK BROWN / YELLOW | |
| 10–20 | VERY FINE SANDY LOAM | FIRM | GRAY BROWN | COMMON |
| 20–30 | LIMIT OF EXCAVATION | | | |

Soil Details by S.E. ▶▶ / S.S. ▶▶

| Soil Classification | | Slope | Limiting Factor | |
|---|---|---|---|---|
| Profile: 8 | Condition: D | Percent: | Depth: 10 " | ☒ Groundwater ☒ Restrictive Layer ☐ Bedrock |

Soil Series/Phase Name: ☐ Hydric ☐ Non-hydric
Hydrologic Soil Group: D

Exploration Symbol # _____ ☐ Test Pit ☐ Boring ☐ Probe
_____ " Organic horizon thickness Ground surface elev. _____
_____ " Depth of exploration or to refusal

| Depth | Texture | Consistency | Color | Redox Features |
|---|---|---|---|---|
| 0–60 | | | | |

Soil Details by S.E. ▶▶ / S.S. ▶▶

| Soil Classification | | Slope | Limiting Factor | |
|---|---|---|---|---|
| Profile: | Condition: | Percent: | Depth: " | ☐ Groundwater ☐ Restrictive Layer ☐ Bedrock |

Soil Series/Phase Name: ☐ Hydric ☐ Non-hydric
Hydrologic Soil Group:

Exploration Symbol # _____ ☐ Test Pit ☐ Boring ☐ Probe
_____ " Organic horizon thickness Ground surface elev. _____
_____ " Depth of exploration or to refusal

| Depth | Texture | Consistency | Color | Redox Features |
|---|---|---|---|---|
| 0–60 | | | | |

Soil Details by S.E. ▶▶ / S.S. ▶▶

| Soil Classification | | Slope | Limiting Factor | |
|---|---|---|---|---|
| Profile: | Condition: | Percent: | Depth: " | ☐ Groundwater ☐ Restrictive Layer ☐ Bedrock |

Soil Series/Phase Name: ☐ Hydric ☐ Non-hydric
Hydrologic Soil Group:

Exploration Symbol # _____ ☐ Test Pit ☐ Boring ☐ Probe
_____ " Organic horizon thickness Ground surface elev. _____
_____ " Depth of exploration or to refusal

| Depth | Texture | Consistency | Color | Redox Features |
|---|---|---|---|---|
| 0–60 | | | | |

Soil Details by S.E. ▶▶ / S.S. ▶▶

| Soil Classification | | Slope | Limiting Factor | |
|---|---|---|---|---|
| Profile: | Condition: | Percent: | Depth: " | ☐ Groundwater ☐ Restrictive Layer ☐ Bedrock |

Soil Series/Phase Name: ☐ Hydric ☐ Non-hydric
Hydrologic Soil Group:

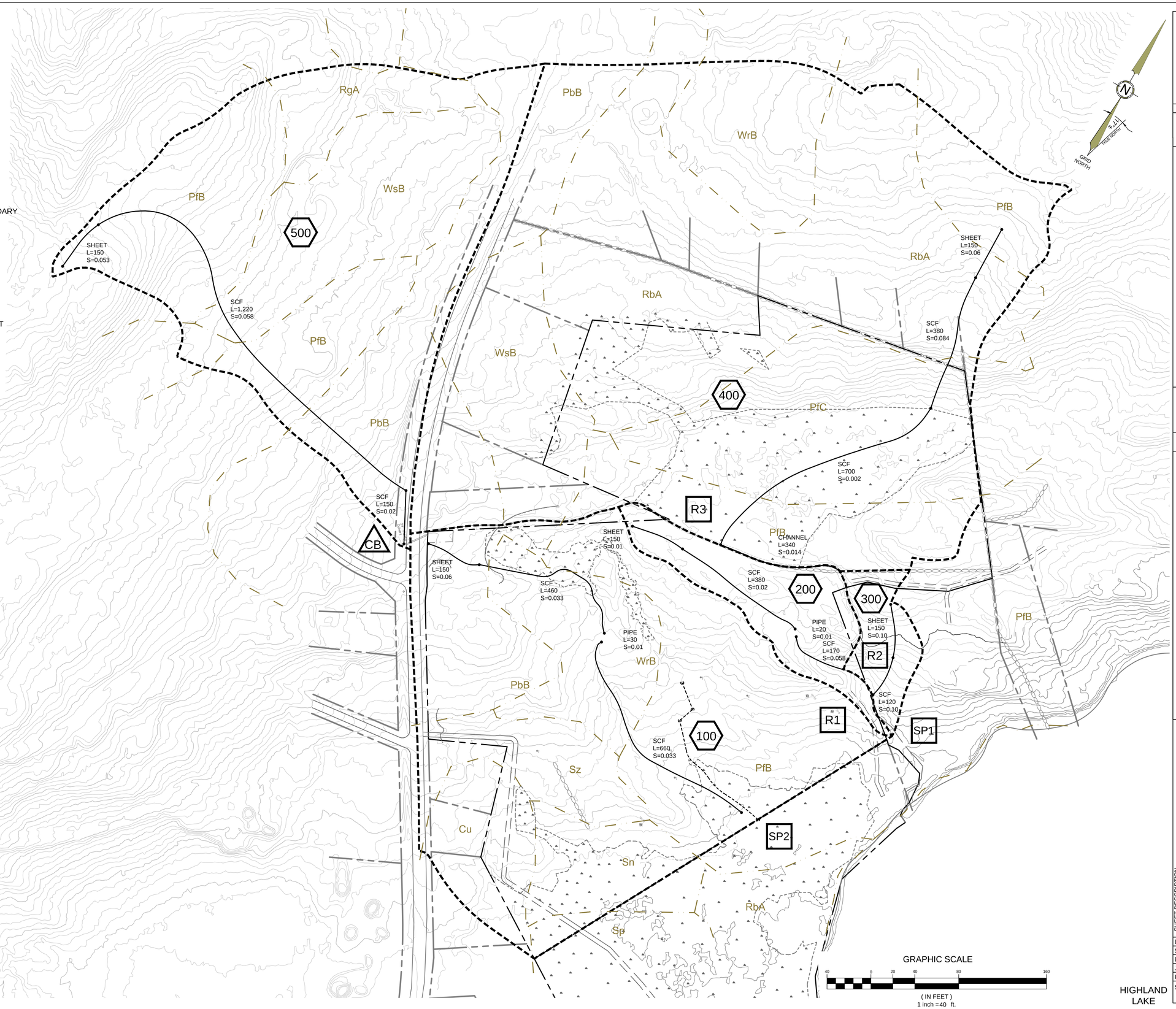
## INVESTIGATOR INFORMATION AND SIGNATURE

Signature: Mark Cenci
Date: 9-1-16
Name Printed: MARK CENCI
Cert/Lic/Reg. #: 262/467
Title: ☒ Licensed Site Evaluator ☐ Certified Soil Scientist ☒ Certified Geologist ☐ Professional Engineer

*affix professional seal*

## LEGEND

- WATERSHED BOUNDARY
- TIME OF CONCENTRATION
- PRE — WATERSHED LABEL
- 1 — REACH
- CB — CATCH BASIN
- DyB — SOIL NAME
- MEDIUM INTENSITY SOIL BOUNDARY
- 100 YEAR FLOOD BOUNDARY
- EXISTING PROPERTY LINE
- PROPOSED PROPERTY LINE
- 124 — EXISTING MINOR CONTOUR
- 124 — EXISTING MAJOR CONTOUR
- 124 — PROPOSED CONTOUR
- SD — EXISTING STORMDRAIN
- SD — PROPOSED STORMDRAIN
- EXISTING EDGE OF PAVEMENT
- PROPOSED EDGE OF PAVEMENT
- EXISTING BUILDING
- PROPOSED PAVED AREA
- WETLAND AREA




STATE OF MAINE
JEFFREY D. JAMES
No. 10167
LICENSED
PROFESSIONAL ENGINEER

SIGNATURE DATE: 1/10/2017

| NO. | DATE | REVISIONS | APP'D BY |
|---|---|---|---|
| 1 | 1/10/2017 | SUBMITTED TO MDEP & REVISED PER TOWN COMMENTS | |


TERRADYN CONSULTANTS, LLC
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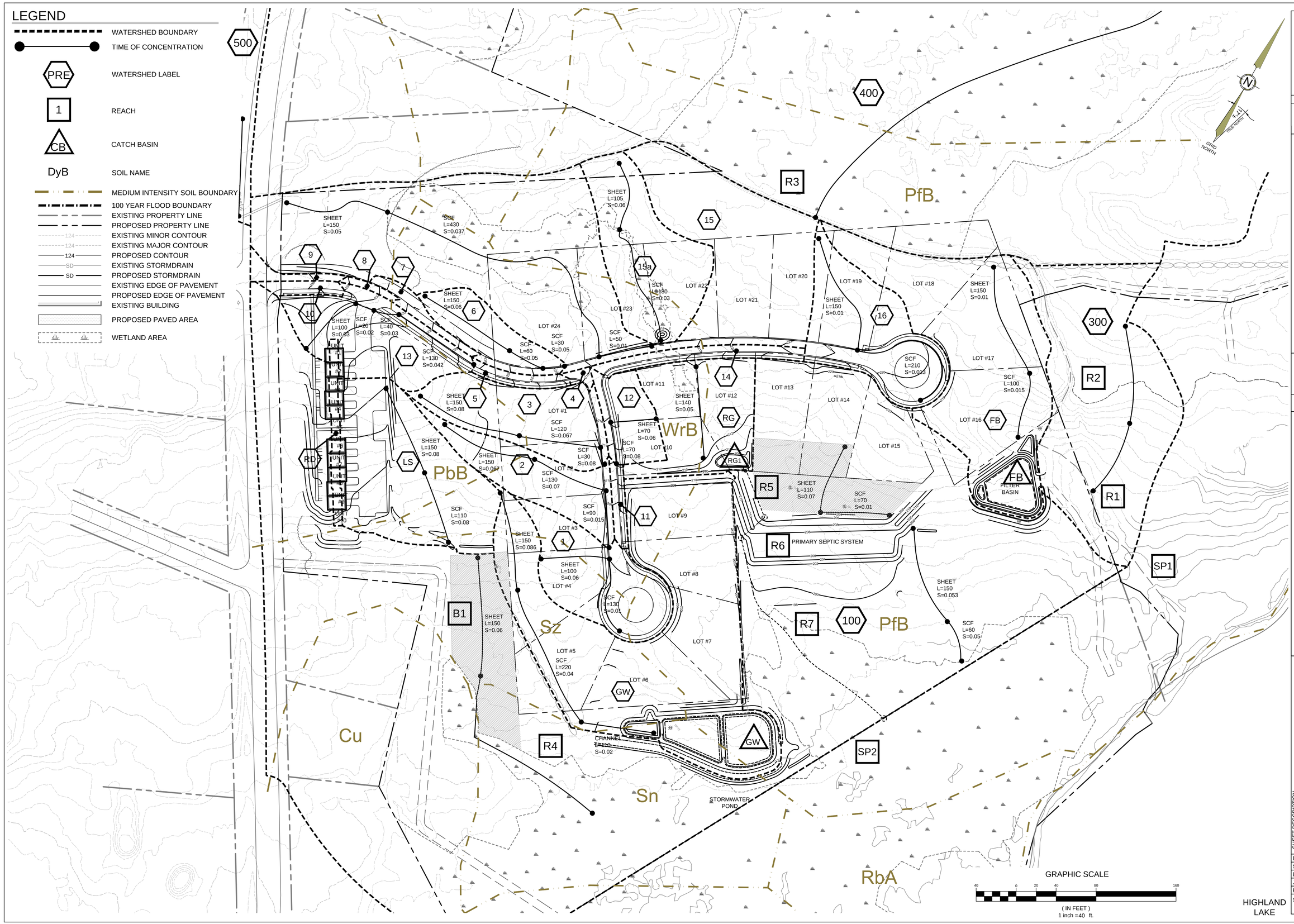
www.terradynconsultants.com
Civil Engineering - Land Planning - Stormwater Design - Environmental Permitting


SHEET DESCRIPTION
HIGHLAND VIEWS
19 ROOSEVELT TRAIL, WINDHAM, ME
PRE-DEVELOPMENT WATERSHED MAP

PREPARED FOR
CHASE CUSTOM HOMES & FINANCE
290 BRIDGTON ROAD
WESTBROOK, MAINE,04092

| | |
|---|---|
| DATE: | 12/5/2016 |
| SCALE: | 1"=40' |
| DESIGNED: | JDA |
| JOB NO: | 1636 |
| FILE: 1636 S | |
| SHEET | C-8.0 |




STATE OF MAINE
JEFFREY D. ADAMS
10167
LICENSED
PROFESSIONAL ENGINEER

SIGNATURE DATE: 1/10/2017

| NO. | DATE | REVISIONS | APP'D BY |
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Civil Engineering - Land Planning - Stormwater Design - Environmental Permitting

SHEET DESCRIPTION
HIGHLAND VIEWS
19 ROOSEVELT TRAIL, WINDHAM, ME
POST DEVELOPMENT WATERSHED MAP

PREPARED FOR
CHASE CUSTOM HOMES & FINANCE
290 BRIDGTON ROAD
WESTBROOK, MAINE 04092

| | |
|---|---|
| DATE: | 12/5/2016 |
| SCALE: | 1"=40' |
| DESIGNED: | JDA |
| JOB NO: | 1636 |
| FILE: 1636 S | |
| SHEET | C-8.1 |

|  | Land Surface Type or Lot #(s) with description | Acres or # of lots | Export Coefficient from Table 3.1 Table 3.2 | Pre-treatment Algal Av. P Export (lbs P/year) | Treatment Factor for BMP(s) from Chapter 6 | Post-treatment Algal Av. P Export (lbs P/year) | Description of BMPs |
|---|---|---|---|---|---|---|---|
|  | **Subdivision** |  |  |  |  |  |  |
| WS-1 |  |  |  |  |  |  |  |
|  | Roadway Impervious | 0.164 | 1.25 | 0.205 | 0.25 | 0.05125 | Gravel Wetland |
|  | Roadway Pervious | 0.093 | 0.3 | 0.0279 | 0.25 | 0.006975 | Gravel Wetland |
| WS-2 |  |  |  |  |  |  |  |
|  | Roadway Impervious | 0.029 | 1.25 | 0.03625 | 0.25 | 0.0090625 | Gravel Wetland |
|  | Roadway Pervious | 0.002 | 0.3 | 0.0006 | 0.25 | 0.00015 | Gravel Wetland |
|  | Apartment Pervious | 0.046 | 0.3 | 0.0138 | 0.25 | 0.00345 | Gravel Wetland |
| WS-3 |  |  |  |  |  |  |  |
|  | Roadway Impervious | 0.026 | 1.25 | 0.0325 | 0.25 | 0.008125 | Gravel Wetland |
|  | Roadway Pervious | 0.002 | 0.3 | 0.0006 | 0.25 | 0.00015 | Gravel Wetland |
|  | Apartment Pervious | 0.034 | 0.3 | 0.0102 | 0.25 | 0.00255 | Gravel Wetland |
| WS-4 |  |  |  |  |  |  |  |
|  | Roadway Impervious | 0.018 | 1.25 | 0.0225 | 0.25 | 0.005625 | Gravel Wetland |
|  | Roadway Pervious | 0.001 | 0.3 | 0.0003 | 0.25 | 0.000075 | Gravel Wetland |
| WS-5 |  |  |  |  |  |  |  |
|  | Roadway Impervious | 0.046 | 1.25 | 0.0575 | 0.25 | 0.014375 | Gravel Wetland |
|  | Roadway Pervious | 0.02 | 0.3 | 0.006 | 0.25 | 0.0015 | Gravel Wetland |
| WS-6 |  |  |  |  |  |  |  |
|  | Roadway Impervious | 0.031 | 1.25 | 0.03875 | 0.25 | 0.0096875 | Gravel Wetland |
|  | Roadway Pervious | 0.042 | 0.3 | 0.0126 | 0.25 | 0.00315 | Gravel Wetland |
| WS-7 |  |  |  |  |  |  |  |
|  | Roadway Impervious | 0.034 | 1.25 | 0.0425 | 0.25 | 0.010625 | Gravel Wetland |
|  | Roadway Pervious | 0.035 | 0.3 | 0.0105 | 0.25 | 0.002625 | Gravel Wetland |
| WS-8 |  |  |  |  |  |  |  |
|  | Roadway Impervious | 0.019 | 1.25 | 0.02375 | 0.25 | 0.0059375 | Gravel Wetland |
| WS-9 |  |  |  |  |  |  |  |
|  | Roadway Impervious | 0.029 | 1.25 | 0.03625 | 0.25 | 0.0090625 | Gravel Wetland |
| WS-10 |  |  |  |  |  |  |  |
|  | Roadway Impervious | 0.035 | 1.25 | 0.04375 | 0.25 | 0.0109375 | Gravel Wetland |
|  | Roadway Pervious | 0.017 | 0.3 | 0.0051 | 0.25 | 0.001275 | Gravel Wetland |
| WS-11 |  |  |  |  |  |  |  |
|  | Roadway Impervious | 0.04 | 1.25 | 0.05 | 0.25 | 0.0125 | Gravel Wetland |
|  | Roadway Pervious | 0.017 | 0.3 | 0.0051 | 0.25 | 0.001275 | Gravel Wetland |
| WS-12 |  |  |  |  |  |  |  |
|  | Roadway Impervious | 0.046 | 1.25 | 0.0575 | 0.25 | 0.014375 | Gravel Wetland |
|  | Roadway Pervious | 0.018 | 0.3 | 0.0054 | 0.25 | 0.00135 | Gravel Wetland |
| WS-13 |  |  |  |  |  |  |  |
|  | Roadway Impervious | 0.084 | 1.25 | 0.105 | 0.25 | 0.02625 | Gravel Wetland |
|  | Roadway Pervious | 0.056 | 0.3 | 0.0168 | 0.25 | 0.0042 | Gravel Wetland |
|  | Apartment Impervious | 0.1 | 1.25 | 0.125 | 0.25 | 0.03125 | Gravel Wetland |
|  | Apartment Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
|  | Apartment Pervious | 0.213 | 0.3 | 0.0639 | 0.25 | 0.015975 | Gravel Wetland |
| WS-14 |  |  |  |  |  |  |  |
|  | Roadway Impervious | 0.103 | 1.25 | 0.12875 | 0.25 | 0.0321875 | Gravel Wetland |
|  | Roadway Pervious | 0.042 | 0.3 | 0.0126 | 0.25 | 0.00315 | Gravel Wetland |
| WS-15 |  |  |  |  |  |  |  |
|  | Roadway Impervious | 0.085 | 1.25 | 0.10625 | 0.25 | 0.0265625 | Gravel Wetland |
|  | Roadway Pervious | 0.012 | 0.3 | 0.0036 | 0.25 | 0.0009 | Gravel Wetland |
| WS-15A |  |  |  |  |  |  |  |
|  | Roadway Impervious | 0 | 1.25 | 0 | 0.25 | 0 | Gravel Wetland |
|  | Roadway Pervious | 0 | 0.3 | 0 | 0.25 | 0 | Gravel Wetland |
| WS-16 |  |  |  |  |  |  |  |
|  | Roadway Impervious | 0.203 | 1.25 | 0.25375 | 0.25 | 0.0634375 | Filter Basin |
|  | Roadway Pervious | 0.108 | 0.5 | 0.054 | 0.25 | 0.0135 | Filter Basin |
| WS-FB |  |  |  |  |  |  |  |
|  | Roadway Impervious | 0 | 1.25 | 0 | 0.25 | 0 | Gravel Wetland |
|  | Roadway Pervious | 0 | 0.3 | 0 | 0.25 | 0 | Gravel Wetland |
| WS-GW |  |  |  |  |  |  |  |
|  | Roadway Impervious | 0 | 1.25 | 0 | 0.25 | 0 | Gravel Wetland |
|  | Roadway Pervious | 0 | 0.3 | 0 | 0.25 | 0 | Gravel Wetland |
| WS-LS |  |  |  |  |  |  |  |
|  | Roadway Impervious | 0 | 1.25 | 0 | 0.2 | 0 | 150' Long Buffer with Level Spreader |
|  | Roadway Pervious | 0 | 0.3 | 0 | 0.2 | 0 | 150' Long Buffer with Level Spreader |
|  | Apartment Impervious | 0.233 | 1.25 | 0.29125 | 0.2 | 0.05825 | 150' Long Buffer with Level Spreader |
|  | Apartment Roof | 0.067 | 0.5 | 0.0335 | 0.2 | 0.0067 | 150' Long Buffer with Level Spreader |
|  | Apartment Pervious | 0.12 | 0.3 | 0.036 | 0.2 | 0.0072 | 150' Long Buffer with Level Spreader |
| WS-RD |  |  |  |  |  |  |  |
|  | Apartments Roof | 0.067 | 0.5 | 0.0335 | 0.4 | 0.0134 | Roof Drain Filter |
| Lots to Gravel Wetland |  |  |  |  |  |  |  |
|  | Lot 1 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Gravel Wetland |
|  | Lot 1 Roof | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Gravel Wetland + Roof Filter |
|  | Lot 1 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
|  | Lot 1 Grass | 0.126 | 0.3 | 0.0378 | 0.25 | 0.00945 | Gravel Wetland |
|  | Lot 2 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Gravel Wetland |
|  | Lot 2 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
|  | Lot 2 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Gravel Wetland + Roof Filter |
|  | Lot 2 Grass | 0.069 | 0.3 | 0.0207 | 0.25 | 0.005175 | Gravel Wetland |
|  | Lot 3 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Gravel Wetland |
|  | Lot 3 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
|  | Lot 3 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Gravel Wetland + Roof Filter |
|  | Lot 3 Grass | 0.126 | 0.3 | 0.0378 | 0.25 | 0.00945 | Gravel Wetland |
|  | Lot 4 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Gravel Wetland |
|  | Lot 4 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
|  | Lot 4 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Gravel Wetland + Roof Filter |
|  | Lot 4 Grass | 0.069 | 0.3 | 0.0207 | 0.25 | 0.005175 | Gravel Wetland |
|  | Lot 5 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Gravel Wetland |
|  | Lot 5 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
|  | Lot 5 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Gravel Wetland + Roof Filter |
|  | Lot 5 Grass | 0.103 | 0.3 | 0.0309 | 0.25 | 0.007725 | Gravel Wetland |
|  | Lot 6 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Gravel Wetland |
|  | Lot 6 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
|  | Lot 6 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Gravel Wetland + Roof Filter |
|  | Lot 6 Grass | 0.195 | 0.3 | 0.0585 | 0.25 | 0.014625 | Gravel Wetland |
|  | Lot 7 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Gravel Wetland |
|  | Lot 7 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
|  | Lot 7 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Gravel Wetland + Roof Filter |
|  | Lot 7 Grass | 0.195 | 0.3 | 0.0585 | 0.25 | 0.014625 | Gravel Wetland |
|  | Lot 8 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Gravel Wetland |
|  | Lot 8 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
|  | Lot 8 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Gravel Wetland + Roof Filter |
|  | Lot 8 Grass | 0.15 | 0.3 | 0.045 | 0.25 | 0.01125 | Gravel Wetland |
|  | Lot 9 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Gravel Wetland |
|  | Lot 9 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
|  | Lot 9 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Gravel Wetland + Roof Filter |
|  | Lot 9 Grass | 0.195 | 0.3 | 0.0585 | 0.25 | 0.014625 | Gravel Wetland |
|  | Lot 10 Impervious | 0.033 | 1.25 | 0.04125 | 0.25 | 0.0103125 | Gravel Wetland |
|  | Lot 10 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
|  | Lot 10 Grass | 0.062 | 0.3 | 0.0186 | 0.25 | 0.00465 | Gravel Wetland |
|  | Lot 11 Impervious | 0.033 | 1.25 | 0.04125 | 0.25 | 0.0103125 | Gravel Wetland |
|  | Lot 11 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
|  | Lot 11 Grass | 0.062 | 0.3 | 0.0186 | 0.25 | 0.00465 | Gravel Wetland |
|  | Lot 20 Grass | 0.07 | 0.3 | 0.021 | 0.25 | 0.00525 | Gravel Wetland |
|  | Lot 21 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Gravel Wetland |
|  | Lot 21 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
|  | Lot 21 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Gravel Wetland + Roof Filter |
|  | Lot 21 Grass | 0.195 | 0.3 | 0.0585 | 0.25 | 0.014625 | Gravel Wetland |
|  | Lot 22 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Gravel Wetland |
|  | Lot 22 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
|  | Lot 22 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Gravel Wetland + Roof Filter |
|  | Lot 22 Grass | 0.195 | 0.3 | 0.0585 | 0.25 | 0.014625 | Gravel Wetland |
|  | Lot 23 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Gravel Wetland |
|  | Lot 23 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
|  | Lot 23 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Gravel Wetland + Roof Filter |
|  | Lot 23 Grass | 0.195 | 0.3 | 0.0585 | 0.25 | 0.014625 | Gravel Wetland |
|  | Lot 24 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Gravel Wetland |
|  | Lot 24 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Gravel Wetland |
|  | Lot 24 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Gravel Wetland + Roof Filter |
|  | Lot 24 Grass | 0.126 | 0.3 | 0.0378 | 0.25 | 0.00945 | Gravel Wetland |
| Lots to Filter Basin |  |  |  |  |  |  |  |
|  | Lot 16 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Filter Basin |
|  | Lot 16 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Filter Basin |
|  | Lot 16 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Filter Basin + Roof Filter |
|  | Lot 16 Grass | 0.195 | 0.3 | 0.0585 | 0.25 | 0.014625 | Filter Basin |
|  | Lot 17 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Filter Basin |
|  | Lot 17 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Filter Basin |
|  | Lot 17 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Filter Basin + Roof Filter |
|  | Lot 17 Grass | 0.103 | 0.3 | 0.0309 | 0.25 | 0.007725 | Filter Basin |
|  | Lot 18 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Filter Basin |
|  | Lot 18 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Filter Basin |
|  | Lot 18 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Filter Basin + Roof Filter |
|  | Lot 18 Grass | 0.195 | 0.3 | 0.0585 | 0.25 | 0.014625 | Filter Basin |
|  | Lot 19 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Filter Basin |
|  | Lot 19 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Filter Basin |
|  | Lot 19 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Filter Basin + Roof Filter |
|  | Lot 19 Grass | 0.195 | 0.3 | 0.0585 | 0.25 | 0.014625 | Filter Basin |
|  | Lot 20 Impervious | 0.043 | 1.25 | 0.05375 | 0.25 | 0.0134375 | Filter Basin |
|  | Lot 20 Roof | 0.017 | 0.5 | 0.0085 | 0.25 | 0.002125 | Filter Basin |
|  | Lot 20 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.16 | 0.00136 | Filter Basin + Roof Filter |
|  | Lot 20 Grass | 0.125 | 0.3 | 0.0375 | 0.25 | 0.009375 | Filter Basin |
| Lots to Other BMPs |  |  |  |  |  |  |  |
|  | Lot 10 Impervious | 0.01 | 1.25 | 0.0125 | 0.4 | 0.005 | Rain Garden |
|  | Lot 10 Roof (Rear) | 0.017 | 0.5 | 0.0085 | 0.4 | 0.0034 | Roof Drain Filter |
|  | Lot 10 Grass | 0.133 | 0.3 | 0.0399 | 0.4 | 0.01596 | Rain Garden |
|  | Lot 11 Impervious | 0.01 | 1.25 | 0.0125 | 0.4 | 0.005 | Rain Garden #4 |
|  | Lot 11 Roof Rear | 0.017 | 0.5 | 0.0085 | 0.4 | 0.0034 | Roof Drain Filter |
|  | Lot 11 Grass | 0.11 | 0.3 | 0.033 | 0.4 | 0.0132 | Rain Garden #4 |
|  | Lot 12 Impervious | 0.043 | 1.25 | 0.05375 | 0.4 | 0.0215 | Rain Garden #4 |
|  | Lot 12 Roof | 0.017 | 0.5 | 0.0085 | 0.4 | 0.0034 | Rain Garden #4 |
|  | Lot 12 Roof Rear | 0.017 | 0.5 | 0.0085 | 0.4 | 0.0034 | Roof Drain Filter |
|  | Lot 12 Grass | 0.172 | 0.3 | 0.0516 | 0.4 | 0.02064 | Rain Garden #4 |
|  | Lot 13 Impervious | 0.043 | 1.25 | 0.05375 | 0.27 | 0.0145125 | 110' Forested Buffer, HSG C |
|  | Lot 13 Roof | 0.017 | 0.5 | 0.0085 | 0.27 | 0.002295 | 110' Forested Buffer, HSG C |
|  | Lot 13 Roof Rear | 0.017 | 0.5 | 0.0085 | 0.17 | 0.001445 | 100' Forested Buffer + Roof Filter |
|  | Lot 13 Grass | 0.172 | 0.3 | 0.0516 | 0.27 | 0.013932 | 110' Forested Buffer, HSG C |
|  | Lot 14 Impervious | 0.043 | 1.25 | 0.05375 | 0.27 | 0.0145125 | 110' Forested Buffer, HSG C |
|  | Lot 14 Roof | 0.017 | 0.5 | 0.0085 | 0.27 | 0.002295 | 110' Forested Buffer, HSG C |
|  | Lot 14 Roof Rear | 0.017 | 0.5 | 0.0085 | 0.17 | 0.001445 | 100' Forested Buffer + Roof Filter |
|  | Lot 14 Grass | 0.161 | 0.3 | 0.0483 | 0.27 | 0.013041 | 110' Forested Buffer, HSG C |
|  | Lot 15 Impervious | 0.043 | 1.25 | 0.05375 | 0.27 | 0.0145125 | 110' Forested Buffer, HSG C |
|  | Lot 15 Roof | 0.017 | 0.5 | 0.0085 | 0.27 | 0.002295 | 110' Forested Buffer, HSG C |
|  | Lot 15 Roof Rear | 0.017 | 0.5 | 0.0085 | 0.17 | 0.001445 | 100' Forested Buffer + Roof Filter |
|  | Lot 15 Grass | 0.08 | 0.3 | 0.024 | 0.27 | 0.00648 | 110' Forested Buffer, HSG C |
|  |  |  | **Total Pre-PPE (lbs P/year)** | 4.84695 | **Total PostPPE (lbs P/year)** | 1.2247155 |  |

## GRAVEL WETLAND

WATERSHED IMPERVIOUS AREA= 89000 SF
WATERSHED LANDSCAPED AREA= 121000 SF
REQUIRED WQV= 11450 CF
PROVIDED WQV= 17963 CF
TREATMENT FACTOR= 0.25 (0.25 Max)

Forebay

| STAGE (FT) | AREA (SF) | STORAGE (CF) |
|---|---|---|
| 193 | 900 | 0 |
| 194 | 1300 | 1100 |
| 194.5 | 1500 | 1800 |

Cell #1

| STAGE (FT) | AREA (SF) | STORAGE (CF) |
|---|---|---|
| 193 | 4350 | 0 |
| 194 | 5117 | 4733 |
| 194.5 | 5500 | 7388 |

Cell #2

| STAGE (FT) | AREA (SF) | STORAGE (CF) |
|---|---|---|
| 193 | 5300 | 0 |
| 194 | 6033 | 5667 |
| 194.5 | 6400 | 8775 |

Total Pond

| STAGE (FT) | AREA (SF) | STORAGE (CF) |
|---|---|---|
| 193 | 10550 | 0 |
| 194 | 12450 | 11500 |
| 194.5 | 13400 | 17963 |
| 194.51 | 13200 | 17963 |
| 195 | 14046 | 24638 |
| 196 | 15773 | 39547 |
| 197 | 17500 | 56425 |

## FILTER BASIN

WATERSHED IMPERVIOUS AREA= 31374 SF
WATERSHED LANDSCAPED AREA= 57272 SF
REQUIRED WQV= 4524 CF
PROVIDED WQV= 7260 CF
TREATMENT FACTOR= 0.25 (0.25 Max)

|  | STAGE (FT) | AREA (SF) | STORAGE (CF) |
|---|---|---|---|
|  | 205.5 | 4200 | 0 |
|  | 206 | 4627 | 2207 |
| WQV EL= | 207 | 5480 | 7260 |
|  | 208 | 6333 | 13167 |
|  | 208.5 | 6760 | 16440 |

## Rain Garden #1

WATERSHED IMPERVIOUS AREA= 2875 SF
WATERSHED LANDSCAPED AREA= 15000 SF
REQUIRED WQV= 740 CF
PROVIDED WQV= 773 CF
TREATMENT FACTOR= 0.38 (0.25 Max)

|  | STAGE (FT) | AREA (SF) | STORAGE (CF) |
|---|---|---|---|
|  | 205 | 630 | 0 |
| WQV EL= | 206 | 916 | 773 |

*Forested Buffer with Level Lip Spreader*

The buffer contains soils that are consistent with Soil Group C sandy loam or loamy sand. *Table 6 – Sizing Requirements for a buffer with 0-8% slope and stone bermed level lip spreader* of Chapter 500 shows that standard sizing requires that the berm length for a forested buffer must be 75' per acre of impervious area and 25' per acre of lawn. Evaluation of the watershed shows that it contains the following:

Impervious area = 13,068 SF (0.30 Ac)
Lawn area = 5,000 SF (0.11 Ac)

Standard sizing: 75(0.30) + 0.11(25)=22.5'+2.9'=25.4'. 25.4' would yield a treatment factor of 0.4.

Oversized to TF of 0.2: $BMP_{TF}$=0.4($BMP_{TF}$ / TF) = 0.4(25.4/0.2)=50'

*Forested Buffer Adjacent to Residential Lot*

The buffer contains soils that are consistent with Soil Group C sandy loam or loamy sand. *Table 9 – Buffer Size Requirements Based on Soil & Vegetative Cover Types* of Chapter 500 shows that standard sizing requires that the standard length of flow path for a forested buffer to be 75'. We are proposing a buffer with a 100' long flow path which yields a treatment factor of 0.2:

Oversized to 110' flow path: TF = 0.4 ($BMP_{st}$/$BMP_{TF}$)= 0.4(75/110)=0.27

*Treatment Factors for Multiple BMPS*

TF=(most efficient BMP) x (least efficient BMP)$^{1/2}$

*Roof drain filter strip with gravel wetland or filter basin*: 0.25 x ($0.4^{1/2}$) = 0.158 = 0.16

*Roof drain filter strip with 110' long buffer*: 0.27 x ($0.4^{1/2}$) = 0.171 = 0.17

| Hydrologic Soil Group— Summary by Map Unit — Cumberland County |  |  |
|---|---|---|
| Map unit symbol | Map unit name | Rating |
| Cu | Cut and fill land |  |
| HsC | Hollis very rocky fine sandy loam, 8 to 20 percent slopes | D |
| HsE | Hollis very rocky fine sandy loam, 20 to 35 percent slopes | D |
| PbB | Paxton fine sandy loam, 3 to 8 percent slopes | C |
| PfB | Paxton very stony fine sandy loam, 3 to 8 percent slopes | C |
| PfC | Paxton very stony fine sandy loam, 8 to 15 percent slopes | C |
| RbA | Ridgebury fine sandy loam, 0 to 3 percent slopes | C/D |
| RgA | Ridgebury very stony fine sandy loam, 0 to 3 percent slopes | C/D |
| Sn | Scantic silt loam, 0 to 3 percent slopes | D |
| Sp | Sebago mucky peat | A/D |
| Sz | Swanton fine sandy loam | C/D |
| W | Water |  |
| WrB | Woodbridge fine sandy loam, 0 to 8 percent slopes | C |
| WsB | Woodbridge very stony fine sandy loam, 0 to 8 percent slopes | C |

PAGE 1 OF 1 — FORM F Rev. 07/11

**SOIL PROFILE / CLASSIFICATION INFORMATION** — DETAILED DESCRIPTION OF SUBSURFACE CONDITIONS AT PROJECT SITES

Project Name: DEER POND SELF STORE — Applicant Name: PATCO CONSTRUCTION — Project Location (municipality): HOLLIS

Exploration Symbol # TP-1 ☒ Test Pit ☐ Boring ☐ Probe
" Organic horizon thickness — Ground surface elev. — " Depth of exploration or to refusal

| Depth | Texture | Consistency | Color | Redox Features |
|---|---|---|---|---|
| 0–10 | LOAMY SAND |  | DARK BROWN |  |
| 10–30 | MEDIUM SAND |  | YELLOW BROWN |  |
| 30–50 |  | LOOSE |  |  |
| 50–60 | GRAVELLY COARSE SAND TO 72" |  |  | NONE |

Soil Classification: — ; Slope: — ; Limiting Factor: — ; ☐ Hydric ☒ Non-hydric ; Hydrologic Soil Group: A

Exploration Symbol # TP-2 ☒ Test Pit ☐ Boring ☐ Probe
" Organic horizon thickness — Ground surface elev. — " Depth of exploration or to refusal

| Depth | Texture | Consistency | Color | Redox Features |
|---|---|---|---|---|
| 10–30 | LOAMY SAND | LOOSE | DARK BROWN |  |
| 30–50 | GRAVELLY SAND | FIRM | RED BROWN | STANDING WATER AT -7' |
| 50–60 | 60"+ COBBLY GRAVELLY SAND |  | DARK RED | MOTTLES 60" |

Slope: 0-3 Percent; Limiting Factor: 60" Depth ☒ Groundwater ☐ Restrictive Layer ☐ Bedrock; ☐ Hydric ☒ Non-hydric; Hydrologic Soil Group: A

HIGHLAND VIEW MANUFACTURED HOUSING, WINDHAM 1-5-17

Observation Hole # TP-14 ☒ Test Pit ☐ Boring — " Depth of organic horizon above mineral soil

| Depth | Texture | Consistency | Color | Mottling |
|---|---|---|---|---|
| 0–12 | SANDY LOAM |  | DARK BROWN |  |
| 12–24 |  | LOOSE | RED BROWN |  |
| 24–48 | LOAMY SAND |  | YELLOW BROWN TO GRAY BROWN | NONE |

Soil Profile 5; Classification Condition B; Limiting Factor —

Observation Hole # TP-15 ☒ Test Pit ☐ Boring — " Depth of organic horizon above mineral soil

| Depth | Texture | Consistency | Color | Mottling |
|---|---|---|---|---|
| 0–12 | FINE SANDY LOAM | FRIABLE | DARK BROWN |  |
| 12–24 | VERY FINE SAND | FIRM | YELLOW BROWN TO OLIVE YELLOW BROWN | COMMON |

PIT DEPTH = -48"

Soil Profile 7; Classification Condition C; Limiting Factor 16" Depth ☒ Groundwater ☒ Restrictive Layer ☐ Bedrock ☐ Pit Depth

Observation Hole # TP-16 ☒ Test Pit ☐ Boring — " Depth of organic horizon above mineral soil

| Depth | Texture | Consistency | Color | Mottling |
|---|---|---|---|---|
| 0–18 | SANDY LOAM | FRIABLE | RED BROWN |  |
| 18–28 | SILT LOAM | FIRM | GRAY BROWN | COMMON |

PIT DEPTH = -28"

Soil Profile 8; Classification Condition C; Limiting Factor 16" Depth ☒ Groundwater ☒ Restrictive Layer ☐ Bedrock ☐ Pit Depth

Observation Hole # TP-17 ☒ Test Pit ☐ Boring — " Depth of organic horizon above mineral soil

| Depth | Texture | Consistency | Color | Mottling |
|---|---|---|---|---|
| 0–24 | FINE SANDY LOAM | FRIABLE | RED BROWN |  |
| 24–36 | SILTY SANDY LOAM |  | GRAY BROWN | COMMON |
| 36–48 | SILT LOAM | FIRM |  |  |

Soil Profile 3; Classification Condition C; Limiting Factor 24" Depth ☒ Groundwater ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth

Site Evaluator Signature [signature] — SE # 262 — Date 1-11-17

HIGHLAND VIEW MANUFACTURED HOUSING, WINDHAM 1-5-17

Observation Hole # TP-18 ☒ Test Pit ☐ Boring — " Depth of organic horizon above mineral soil

| Depth | Texture | Consistency | Color | Mottling |
|---|---|---|---|---|
| 0–18 | FINE SANDY LOAM | FRIABLE | YELLOW BROWN |  |
| 18–42 | SILT LOAM | FIRM | GRAY BROWN | COMMON |

PIT DEPTH = -42"

Soil Profile 3; Classification Condition C; Limiting Factor 18" Depth ☒ Groundwater ☒ Restrictive Layer ☐ Bedrock ☐ Pit Depth

Observation Hole # TP-19 ☒ Test Pit ☐ Boring — " Depth of organic horizon above mineral soil

| Depth | Texture | Consistency | Color | Mottling |
|---|---|---|---|---|
| 0–12 | FINE SANDY LOAM | FRIABLE | YELLOW BROWN |  |
| 12–42 | SILT LOAM | FIRM | GRAY BROWN | COMMON |

PIT DEPTH = -42"

Soil Profile 8; Classification Condition D; Limiting Factor 10" Depth ☒ Groundwater ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth

Observation Hole # ☐ Test Pit ☐ Boring (blank)

Observation Hole # ☐ Test Pit ☐ Boring (blank)

Site Evaluator Signature [signature] — SE # 262 — Date 1-11-17

STATE OF MAINE — JEFFREY D. AMOS — No. 10167 — LICENSED — PROFESSIONAL ENGINEER

SIGNATURE DATE: 1/10/2017

| NO. | DATE | REVISIONS | APP'D BY |
|---|---|---|---|
|  |  |  |  |

TERRADYN CONSULTANTS, LLC
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Civil Engineering - Land Planning - Stormwater Design - Environmental Permitting

SHEET DESCRIPTION
HIGHLAND VIEWS
19 ROOSEVELT TRAIL, WINDHAM, ME
POST DEVELOPMENT WATERSHED MAP

PREPARED FOR
CHASE CUSTOM HOMES & FINANCE
290 BRIDGTON ROAD
WESTBROOK, MAINE,04092

| DATE: | 1/10/2017 |
|---|---|
| SCALE: | NTS |
| DESIGNED: | JDA |
| JOB NO: | 1636 |
| FILE: 1636 S |  |
| SHEET | C-8.2 |

TERRADYN
CONSULTANTS, LLC
Civil Engineering - Land Planning - Stormwater Design - Environmental Permitting



March 31, 2017

Mr. Jonathan R. Earle, Town Engineer
Town of Windham
Planning Department
8 School Road
Windham, ME 04062

**Comment Response: Highland Views Subdivision**

Mr. Earle:

In response to your recent review of the Highland Views project, we would like to offer the following responses:

1. Your response to Comment 12 indicates that the 24 manufactured housing lots will be served by a private waste hauler that will provide curbside pick. I would suggest providing the Board with evidence of an agreement with a private hauler. The Town has experienced issues recently on with private roads bringing their trash to the nearest public road intersection, sometimes causing issues with sight distances, traffic, and safety.

   *The applicant intends upon providing for private curb side pickup and is currently soliciting waste haulers. We will provide you a copy of the agreement prior to final approval.*

2. Reference the installation of roof dripline filter beds on sheet C8.1. The filter beds are called out on the signature/approval plan, but noting this on the post-development watershed plan would provide additional clarification.

   *We've added the entire Stormwater Restrictions note from the subdivision plan to Sheet C8.1.*

3. Similarly, the forested buffer is shaded on the C8.1, but is not called out with a note or referenced in the legend.

   *The forested buffers are now labeled on C8.1. I've also added the buffer hatching to the sheet legend.*

4. The level spreader on sheet C8.1 scales to 20' but is called out as 30' on the grading plan. Please clarify.

   *We have labeled the level spreaders on C8.1. Additionally, sheets C8.0 & C8.1 included incorrect graphical scales. We've corrected the scale.*

**5.** Phosphorous budget calculations – Worksheet 1 indicates there are no wetlands in the Windham portion of the project. The plans are showing a small amount of wetland acreage in Windham, which would slightly decrease the phosphorous budget for the project.

*MDEP methodology stipulates that only that NWI wetlands be deducted. The small forested wetlands are not shown on the NWI map. The NWI wetlands were used by MDEP in generating the per acre allocation. On one past occasion, I was told by the MDEP program coordinator to deduct an area of NWI wetlands from a project even though there were not actually wetlands on the ground. So, NWI wetlands are deducted whether or not they are accurately located on the map.*

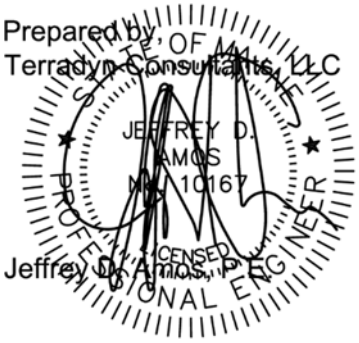
**6.** Predevelopment stormwater plan & calculations – On sheet C8.0, there is a time of concentration segment at the end of the flow path calling out 150' of shallow concentrated flow that's not show in the modelling. Please clarify.

*We have removed the corrected in inconsistency & updated the plan with the correct Tc path & label.*

We received a comment from MDEP about the development area and the lot impervious allowance has been slightly reduced & the corresponding amount of landscaping area has been added to the phosphorus calculations. The updated calculations area shown in their entirety on C8.2 (see attached). The changes resulted in a small decrease in phosphorus production.

We hope that these responses addresses your concerns. Please contact me directly with additional questions or concerns.

Prepared by,
Terradyn Consultants, LLC




Jeffrey D. Amos, P.E.