

12.0 STORMWATER MANAGEMENT

12.1 STORMWATER ASSESSMENT

The Stormwater analysis for the Bingham Wind Project (project) was conducted separately for the ridgeline and the generator lead.

DeLuca Hoffman Associates, Inc. performed the analysis for the turbines, Operations and Management (O&M) building, substation, DRD facility, and associated access/crane roads (Exhibit 12A).

SGC Engineering performed the analysis for the generator lead and associated access roads (Exhibit 12B).

These assessments, and the accompanying calculations, demonstrate that construction of the project will continue to comply with the applicable Maine Department of Environmental Protection Stormwater Management Requirements in Chapter 500. The stormwater management measures for this development have been designed to meet the Basic Standards, General Standards, Flooding Standards, and Phosphorus Standards of Chapter 500.

Exhibit 12A: Ridgeline Stormwater Management and Control Plan

**SECTION 12
STORMWATER MANAGEMENT**

BINGHAM WIND PROJECT

Submitted to:

MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION



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12.1 BINGHAM WIND POWER PROJECT SUMMARY

Blue Sky West, LLC is proposing an industrial scale wind energy project in the Towns of Bingham, Kingsbury Plantation, Mayfield Township, and Moscow, Maine. The project consists of 62 wind turbine generators, a substation, an Operations and Maintenance (O&M) building, a dynamic reactive device (DRD) enclosure and pad, overhead collection lines, and approximately 23 miles of access and crane roads. The project area consists of road and turbine sites on the series of ridges generally 6 to 15 miles east of the intersection of Route 201 and Route 16. The project area is identified within the C-5 and D-5 area of Map 30 and within the C-1 area of Map 31 of the DeLorme Gazetteer.

The project area consists of mostly undeveloped forestland that has been heavily logged. Numerous existing logging roads allow access throughout the project area and additional ATV and snowmobile trails are located throughout. Within the 4,800 acre area included in this stormwater analysis, approximately 250 acres of impervious area will be created during construction. Following construction, approximately 173 acres of the constructed impervious area in the form of gravel roads or turbine pads will be revegetated or allowed to naturally revegetate, thus making these surfaces more pervious in nature. Approximately 77 acres will remain as new impervious area and will consist of turbine pads, new substation yard, O&M building, DRD enclosure/yard, and associated permanently maintained access roads.

The following narrative describes and quantifies the project area's pre- and post-development stormwater characteristics. The accompanying calculations demonstrate that construction of the Bingham Wind Power Project (the Project) will continue to comply with the applicable Maine Department of Environmental (MeDEP) Stormwater Management Requirements in Chapter 500. The stormwater management measures for this development have been designed to meet the Basic Standards, General Standards, Flooding Standards, and Phosphorus Standards of Chapter 500. A preapplication meeting to discuss the project was held on November 16, 2012.

12.2 SURFACE WATER ON OR ABUTTING THE SITE

The majority of the development activities are located along several ridge tops and hill sides. A schematic of the development areas, and watersheds they are tributary to, is included in Attachment 12-6. The portions of the project south of Route 16 include Turbines 1-20, 73-77, Access Road 1-3, Crane Roads 1-9 and 23, and the operations and maintenance building.

These development areas generally drain to Mayfield Pond, Withee Pond, Smith Pond, Fall Brook, Gulf Stream and Rift Brook.

Portions of the project north of Route 16 include Turbines 21-51; 53-58, Access Roads 3 and 4; substation; DRD and Crane Roads 10-19, 22, 24-25. These development areas generally drain to Mayfield Pond, Kingsbury Pond, Hilton Pond, Baker Flowage, Kingsbury Stream and Thorn Brook.

12.3 DOWNSTREAM PONDS AND LAKES

Portions of the Project area are included in five separate lake watersheds: Kingsbury Pond, Mayfield Pond, Withee Pond, Smith Pond, and Hilton Pond. None of these lake watersheds are listed as a “Lake Most at Risk from Development”, as defined in Chapter 502.

12.4 GENERAL TOPOGRAPHY

The topography of the land surface within the Project area is generally hilly to mountainous, as is common within this portion of the state. Along the ridge tops, slopes range from approximately 5 to 25 percent. Elevations across the area range from approximately 1,300 to 1,800 feet above mean sea level. The two-foot contour information for the Project area was provided by Aerial Survey & Photo, Inc. Where necessary two-foot contour data for the area surrounding the Project location were extrapolated from United States Geological Survey (USGS) topographic mapping.

12.5 FLOODING

Our office has reviewed the 100-year flood zone, based on Q3 Flood Data derived from the Federal Emergency Management Agency Flood Insurance Rate Maps (FIRM) for the Town of Bingham (Community Number 230124B, maps 1-12 effective date September 27, 1985); Town of Moscow (Community Number 230364B, maps 1-16 effective date November 1, 1985). FEMA Flood Insurance Rate Maps are included in Section 19 of the Application for reference. The only mapped flood plain within the project limits is associated with Gulf Stream near T-Road, mapped as Zone A (Areas of 100 year flood, base flood elevations and flood hazard factors not determined). Improvements at this crossing will be limited to plating the existing culvert crossing, embankment fills in this area will be prohibited.

12.6 ALTERATIONS TO NATURAL DRAINAGE WAYS

In the post-development condition, the natural drainage patterns will generally remain unchanged. In order to keep the natural drainage patterns intact, the water management design will consist of incorporating numerous culverts and ditch turnouts spaced evenly along the access and crane roads to collect runoff and then discharge to level spreaders or outlet aprons to return the runoff to sheet flow or to otherwise maintain current hydrologic conditions. The project design also includes the use of the Rock Sandwich Road section that will effectively allow the natural hydrologic conditions to continue in areas where new roads may be constructed in areas of shallow subsurface hydrology.

12.7 ALTERATIONS TO LAND COVER WITHIN THE WATERSHED

Following construction, the wind turbine pads, associated access roads, substation, DRD area, and O&M building will produce approximately 77 acres of new, permanent impervious areas (gravel roads, foundations, concrete pads, and building structures). Approximately 173 acres of the 250 acres of impervious area created for gravel surfaces will be allowed to revert to grass and scrub/brush.

The following is a description of each development activity proposed:

1. **Wind Turbine Pads:** Each wind turbine pad will be constructed within cleared site limits of approximately 2.5 acres. The pad sites will contain a 25-foot diameter concrete turbine foundation pedestal with a 16-foot wide gravel ring surrounding the pedestal, a 100 foot x 75 foot permanent gravel crane pad, and 24 foot access drives path into the pad area off the wind farm access road. Most of the construction area will be restored with erosion control mix and seeding or allowed to revegetate naturally with only the foundation pedestal, gravel ring, gravel crane pad, and access drives remaining as impervious area (approximately 0.28 acre pad).
2. **Substation Site:** The 115kV substation site will consist of a 400 foot x 300 foot crushed stone substation yard and a gravel access drive. The substation yard will be topped with 4" of crushed stone on 18" gravel fill base meeting the MDOT 703.06 Type A specifications. This cross section of materials exceeds the specifications as described in an agreement letter between Central Maine Power Company (CMP) and MeDEP¹, which previously established an acceptable water quality treatment design for electric

¹ See Agreement dated June 5, 2009

substations and switchyards. Vegetated buffers will be used to treat the runoff generated by the access drive where practical.

3. Operations and Maintenance (O&M) Building: The O&M Building will consist of an 84 foot x 70 foot building, access drives, parking areas, and a 100 x 100 foot storage area.
4. Dynamic Reactive Device (DRD) Enclosure and Yard: The DRD area will consist of a 150 foot x 80 foot equipment enclosure and surrounding gravel yard.
5. Access Roads and Crane Roads: The Project will include approximately 23 miles of one of the following: new access roads, crane roads or improved existing land management roads. During construction, the access roads and improved existing roads will be constructed or improved to a 24-foot wide gravel surface. After construction is complete, select areas of the roads within the Mayfield Pond Watershed will be reduced to a 16 foot permanently maintained width by restoring/revegetating the sides to promote vegetative growth and infiltration. All other roads will remain as constructed. The crane roads will be located along the ridge tops and will be constructed as a 38 foot wide gravel surface. Crane Road will be revegetated to permanent width of 24 feet post construction.

12.8 MODELING ASSUMPTIONS

The Department has agreed that stormwater runoff modeling to determine pre- and post-development peak flows is not strictly required for this Project (with the exception of the O&M, DRD and substation areas). Instead, a pre- and post-development curve number comparison analysis for each watershed will be substituted as evidence that the project will have an insignificant impact on the peak stormwater flows in the watershed.

The pre-development study area used for the curve number comparison defines the watershed boundary as a 750-foot offset from the edge of proposed development. The wind farm site footprint extends across several watersheds:

- Withee Pond
- Smith Pond
- Mayfield Pond
- Kingsbury Pond
- Hilton Pond
- Fall Brook
- Gulf Stream
- Rift Brook
- Thorn Brook
- Kingsbury Stream
- Baker Flowage

The watershed boundaries for each of the watersheds are identified on the Watershed Plans contained in the Permit Plan Set. Within the areas proposed for development, the watershed

boundaries were determined using the aerial surveyed two-foot contours. Watershed boundaries outside areas proposed for development were determined from contours extrapolated from the USGS topographic quadrangle map.

The post-development stormwater curve number analysis consists of the same watersheds. As described previously in Section 12.7, the alterations to land cover within the watersheds will consist of wind turbine pads, associated access and crane roads, a substation site, DRD area and O&M building. The collector line right of way is not included in the curve number comparison analysis because, like other vegetated electric transmission line rights of way, its drainage characteristics will remain essentially unchanged following construction of the collector lines.

The results of the curve analysis are presented in Table 12-1 (See Section 12.12).

12.9 MAPS

Mapping used for this stormwater analysis is summarized below:

- Watershed Maps identifying the affected areas are provided in the Permit Plan Set.
- Soils mapping obtained from the U.S. Department of Agriculture Soil Conservation Service (now the Natural Resources Conservation Service (NRCS)) *Soil Survey of Somerset County, Maine*.
- Soils mapping developed from the Class L Soil Survey completed by Albert Frick Associates for the areas affected by Project construction is provided in Section 11.

12.10 DRAINAGE PLANS

DeLuca-Hoffman Associates, Inc. has prepared the Watershed Plans for the proposed development area. The plans include topography, clearing limits, general cover types, soil groups, watershed boundaries, existing features, primary drainage ways, locations of proposed turbine pads and new roads.

12.11 RUNOFF ANALYSIS

A specific pre- and post-development analysis of peak flows has not been performed due to the overall project area size; instead a curve number comparison analysis for each project watershed area was conducted. The analysis includes computations for determining the increase of runoff curve numbers (CN values) for the pre- and post-development project watersheds. The pre- and post-development curve number calculations are provided in Table

12-1 and Appendix 12-1. A runoff curve number (CN) of 77 was used for the predevelopment watershed. This assumes that areas within the watershed consist of wooded areas with Hydrologic Group “D” soils. The purpose of the curve number analysis is to show that the proposed project activities result in an insignificant impact to the overall watershed curve number. A watershed curve number is an indicator for predicting direct runoff or infiltration from rainfall excess. A significant change (increase) in the CN might indicate an increase in stormwater runoff conditions. An insignificant change in the CN indicates there will be no impact to overall stormwater runoff conditions. A summary of the pre- and post-development curve numbers is provided in the following Section.

12.12 PEAK RUNOFF COMPUTATIONS

A. Curve Number Computation for Linear Portions of Project

A summary of the assumed cover types, hydrologic soil group (HSG), and curve numbers for the pre- and post-development watersheds is provided in the stormwater calculation package included as Appendix 12-1.

The soils and hydrologic soil groups within the area to be developed are based on the Class L Soil Survey completed by Albert Frick Associates. Soils and hydrologic soil group information for that portion of the Project outside the Class L survey areas are based on Class D Medium-Intensity soils survey mapping obtained from the NRCS *Soil Survey of Somerset County, Maine*. The soils and hydrologic soil groups within the watershed analysis areas are shown on the Watershed Maps. Soils are generally Hydrologic Group “C” and “D” within the study area. For the purpose of this analysis, all soils within the study area have been assumed to be Hydrologic Group “D”.

The runoff curve numbers are based on the observed cover types and hydrologic soil groups, the stormwater modeling program HydroCAD, and the MeDEP *Maine Stormwater Best Management Practices Manual, Volume III*, Appendix A-12.: “Runoff Curve Numbers for use in TR-55 and TR-20”.

The HydroCAD analysis (provided in Appendix 12-1) assumes that the pre-development cover type is woods, good condition with Hydrologic Soil Group “D” properties. The pre-development CN used is 77. The post-development analysis includes the permanent gravel areas (roads, turbine pads, turbine foundations, O&M Building, and substation). The CN used for these permanent impervious surfaces 91.

A summary of the pre- and post-development curve numbers is provided as follows:

Table 12-1: Pre- and Post-Development Curve Number Comparison			
Location	Pre-Development CN	Post-Development CN	% Increase
Fall Brook	77	77.20	0.26%
Withee Pond	77	77.09	0.11%
Gulf Stream	77	77.20	0.26%
Rift Brook	77	77.23	0.30%
Smith Pond	77	77.06	0.08%
Mayfield Pond	77	77.23	0.30%
Kingsbury Pond	77	77.10	0.12%
Kingsbury Stream	77	77.29	0.38%
Thorn Brook	77	77.17	0.21%
Hilton Pond	77	77.07	0.09%
Baker Flowage	77	77.40	0.52%

The weighted curve number for each watershed changes insignificantly (< 0.8%) from the pre-developed condition to the post-developed condition since there is an insignificant change to the overall impervious cover types. The impact due to the creation of the impervious areas by this development and its small change in land cover in relation to the overall size of the watersheds is negligible.

B. Peak Runoff Calculations for the O&M Site, DRD Area and Substation

The O&M site, DRD area, and substation area are subject to the Flooding Standard. Refer to Section 12.16 for detailed analysis and computations.

12.13 TIME OF CONCENTRATION CALCULATIONS

Time of Concentration Calculations are shown for project watershed in Appendix 12-1. Calculations for the O&M, DRD and substation are shown in Appendix 12-7 and 12-8.

12.14 TRAVEL TIME CALCULATIONS

All culvert sizing has been based on the Rational Method. Runoff travel times within sub-watersheds have been established for use in determining rainfall intensity values for the rational method formula. The travel time for each culvert sub-watershed was calculated using a spreadsheet (See Appendix 12-2) based on equations prepared by the NRCS. These times were then used to determine rainfall intensity based on the IDF curve for Newport as contained in the BMP manual. Refer to Appendices 12-7 and 12-8 for travel time calculations for the O&M, DRD, and substation areas.

12.15 PEAK DISCHARGE CALCULATIONS

The 25-year peak flows are shown in the Culvert Schedules included with Appendix 12-2 and in Appendices 12-7 and 12-8 for the O&M, DRD, and substation areas.

12.16 FLOODING STANDARD

Hydrologic analyses have been performed for pre-development and post-development conditions for 2, 10, and 25-year storm events for the O&M facility, substation, and DRD yard. The analyses conducted are based upon the methodology contained in the USDA Soil Conservation Services Technical Releases No. 20 and 55. For Somerset County (north), a 24-hour SCS Type III distribution was used for the analysis using the following storm frequencies and rainfall amounts:

Storm Event	24-Hour Rainfall
2-Year	2.5 inches
10-Year	3.8 inches
25-Year	4.4 inches

The HydroCAD Stormwater Modeling Software Version 8.5 was used for modeling pre- and post-development conditions.

Calculations for pre- and post-development runoff rates are contained within Appendices 12-7 and 12-8. The following table summarizes the calculated pre- and post-development runoff rates:

Location	Pre-Development (cfs)			Post-Development (cfs)		
	2-Year	10-Year	25-Year	2-Year	10-Year	25-Year
O&M (POI #1)	0.00	0.01	0.02	0.00	0.01	0.11
O&M (POI #2)	0.00	0.03	0.10	0.00	0.00	0.02
Substation/ DRD (POI #1)	2.71	8.23	11.26	1.24	5.32	7.68
Substation/ DRD (POI #2)	2.83	7.80	10.42	2.71	7.68	10.33

12.17 VARIANCE SUBMISSIONS

A variance from the peak flow standard is not necessary for the linear portions of the project. As stated previously, due to the small amount of impervious area created relative to watershed size, the curve number analysis has demonstrated that there will be no significant impact to post-development runoff conditions. As a result, the project will not adversely affect downstream conveyance conditions or properties. For the four smaller subwatershed

areas analyzed during the 25-year storm event, the model for POI #1 (near the O&M area) shows an increase in peak flow of 0.09 cfs. This increase in peak flow is minor and will not create a noticeable impact on downstream conditions.

12.18 SIZING OF CULVERTS

All culvert sizing and placement has been based on the Maine DEP Chapter 500.5.A Standards. These standards require that all projects discharging runoff in the form of concentrated flow must convert the runoff to sheet flow before leaving the project limits. To achieve this objective, flared ends and rip rap outlet aprons are detailed on the plans at locations where sheet flow dispersal is desired. The calculations for sizing the proposed culverts are presented in Appendix 12-2. Detailed drawings for the proposed on-site conveyance structures, including drainage swales, culverts with inlet and outlet protection, and ditch turnouts, are shown on the Plan and Profile Drawings and Construction and Erosion Control Detail drawings in the Permit Plan Set located in Exhibit 1 of this application. Stabilization methods will be designed, constructed and maintained in accordance with the project's Erosion and Sedimentation Control Plan (E&S Plan), which is consistent with the *Maine Erosion and Sedimentation Control Best Management Practices*.

Please refer to Section 14: Basic Standards Submissions for a detailed description of the site-specific erosion control measures and practices to be utilized during construction of the access roads, crane roads, collector system and substation.

12.19 STORMWATER PONDS AND BASINS

Generally water quality treatment will be provided by vegetated buffers. Access and crane roads will be treated by roadside buffers, ditch turnout buffers, and stone bermed level lip spreader buffers. The Operations & Maintenance Building and associated parking areas and access drives will be treated by two vegetated underdrain filters (see calculations for the vegetated underdrain filter in Appendix 12-7). Because of the location of the proposed underdrain filters (within a mapped gravel aquifer) a Low Linear Density Polyethylene liner has been included with the design. The substation will be treated by a specific gravel section as previously mentioned. The DRD area will be treated by a wet pond (see wet pond calculations in Appendix 12-8).

12.20 INFILTRATION SYSTEM

No infiltration systems are proposed.

12.21 DRAINAGE EASEMENT DECLARATIONS

No drainage easements are necessary for this Project.

12.22 STORMWATER QUALITY TREATMENT PLAN

The project lies within several watersheds that directly contribute to nearby ponds and river segments. Water quality has been evaluated for Basic Standards, General Standards, and Phosphorus Standard. See Sections 12.23-12.25 for the project summaries associated with stormwater quality.

A. Basic Standards Submissions

In accordance with the Basic Standards, stormwater conveyance structures will be designed, constructed, and stabilized using Erosion and Sedimentation (E&S) Best Management Practices (BMPs). The stormwater conveyance structures will be maintained to prevent or correct any noted erosion problems to ensure their continued effectiveness. The applicant's E&S Plan outlines the measures that will be utilized to prevent erosion from occurring, and to address any problems that may develop. The E&S Plan is contained within Section 14: Basic Standards of this application, and incorporates the applicable methods and materials presented in the *Maine Erosion and Sediment Control BMPs*, dated March 2003. The E&S Plan contains the details and specifications for general stabilization of the site. These measures will be used to protect exposed soils during construction and during the service life of the project. The primary erosion control measure to be used during construction will be the use of Erosion Control Mix² that will be placed over much of the project's disturbed surfaces. The use of Erosion Control Mix has been found to be most effective for the type of soil disturbance activity proposed.

The stabilization measures for the site will include temporary and permanent E&S controls; appropriate design of swales, culverts, and erosion protection for earthen cut and fill slopes; and provisions for future maintenance of the site.

B. General Standards Submission

The proposed development will have more than one acre of impervious area and will have more than five acres of developed area so compliance with the General Standards is required at a minimum. The development activity generally consists of roads that are considered

² See Maine Department of Environmental Protection – Information Sheet: Erosion Control Mix for Mulch – www.maine.gov/dep/blwq/docstand/stormwater/is-ecmixmulch.htm

linear. The standards for linear projects require that at least 75 percent of the impervious area within the watershed be treated. The accompanying calculations indicate treatment percentages for the Gulf Stream, Rift Brook, Fall Brook, Baker Flowage, Thorn Brook and Kingsbury Stream Watersheds. The Lake Watersheds were analyzed under the Phosphorous Standard, see Section 12.25 for calculations. The treatment percentages achieved for the General Standard watersheds are shown in the following table. Refer to the water quality calculations contained in Appendix 12-3 for additional details.

Table 12-4: Watershed Treatment Percentages	
Watershed	Treatment %
Gulf Stream	85.84%
Fall Brook	80.92%
Kingsbury Stream	75.80%
Rift Brook	76.15%
Baker Flowage	81.38%
Thorn Brook	76.09%

In addition to the linear areas of the project there are three distinct facilities associated with the project that are not considered linear and require 95% treatment for proposed impervious area and 80% treatment for developed area. These facilities include the O&M facility, the substation yard, and the DRD enclosure/yard. (Note: A portion of the substation yard falls within the Mayfield Pond Watershed and was analyzed under the Phosphorus Standard).

Treatment percentages achieved for these areas are shown in the following table. Refer to Appendix 12-7 and 12-8 for detailed calculations.

Table 12-5: Watershed Treatment Percentages		
Area ID	Impervious Area Treatment %	Developed Area Treatment %
O&M Facility	95.32%	80.03%
Substation	100%	80.04%
DRD Area	99.52%	85.10%

C. Phosphorus Control Plan

Portions of the Project are located in one of five different lake watersheds. These include Withee Pond, Smith Pond, Hilton Pond, Kingsbury Pond and Mayfield Pond. None of these lakes are identified as a “Lake Most at Risk from Development”. Nevertheless, Phosphorous Standards apply as greater than one acre of impervious area will be created with the project.

In accordance with MeDEP's Chapter 500 Stormwater Management Rules, the Phosphorus Standards must be met.

To determine the allowable threshold for pounds of phosphorous export that the Project must meet, a per acre phosphorous allocation for each lake watershed is provided in the DEP's *Volume II Phosphorous Control in Lake Watersheds* contained in the Stormwater BMP Manual. The corresponding phosphorous allocation area used to determine the project phosphorous budget for each lake watershed has been established as that area contained within a restricted clearing buffer. This area represents a restricted buffer area that can be effectively controlled by the applicant through landowner agreements. Restricted Buffer Areas are illustrated within the design drawings. Sample deed restriction language is provided in Appendix 12-5. All proposed stormwater vegetative buffers are included in this restricted buffer area around certain areas within the project. This provides protection for the vegetative buffers that are relied on for stormwater treatment.

For the purpose of the phosphorous calculations, only the impervious area to be permanently maintained associated with the new access and crane roads, turbine sites, and the substation was considered. Portions of the existing timber logging roads needed for construction, and all other areas disturbed during the construction such as the lay down areas, will be restored/revegetated and allowed to revert to natural conditions upon the completion of construction. A description of the impervious areas included in the calculations is as follows:

Access Crane Roads:

The new access roads and improved existing roads will be constructed to a 24-foot wide gravel surface. These roads will generally remain 24 feet wide post construction. The crane roads will be located along the ridge top and will be constructed as a 38-foot wide gravel surface. At a minimum all crane roads will be revegetated down to a 24' width post construction. Certain areas within the Mayfield Pond Watershed will be revegetated to a 16' width to reduce phosphorus export. MET Tower roads will be constructed to a 12-foot wide gravel surface and will remain as such post construction.

Turbine sites:

Each wind turbine pad will be constructed within a 2.5 acre +/- cleared site, which includes a 25-foot diameter concrete turbine foundation pedestal with a surrounding 16 foot gravel ring 100 by 75 foot gravel crane pad, and 24 wide access. Most of the pad construction area will be revegetated or allowed to revert to a vegetated condition with only the foundation pedestal,

gravel ring and gravel crane pad remaining as exposed gravel area (approximately 0.28 acres per pad). Restricted clearing buffer areas at the restored turbine pads have been oversized in such a way to allow flexibility in design and construction.

Substation:

The substation site will consist of a 400-foot by 300-foot crushed stone substation yard and a gravel access drive. The substation yard will be built as shown on the Project drawings and will provide water quality treatment through its proposed surface section. The yard will consist of 4" of crushed stone surface layer over an 18" MDOT 703.06 Type A gravel fill base. This cross section of materials exceeds the specifications as described in the aforementioned agreement letter between CMP and MeDEP, which established an acceptable water quality treatment design for electric substation and switchyards. Vegetated buffers will be used to treat the runoff generated by the access drives where practical.

Guidance to determine the appropriate phosphorus controls was provided by the MeDEP's Maine Stormwater Best Management Practices Manual Volume II Phosphorous Control in Lake Watersheds: A Technical Guide for Evaluating New Development. Without controls the proposed development within the Lake watersheds is calculated to export phosphorous in excess of the Project Phosphorous Budget (PPB). In order to reduce the total amount of phosphorous export, buffers consisting of natural vegetation down slope of the access roads, crane roads, turbine pads and the substation will be used to reduce the amount of phosphorous export. The vegetated buffers are conservatively sized using Table 5-4, 5-5, 5-6, 5-7 and 5-8 from Chapter 5, Volume III of the Maine Stormwater BMP's. Generally speaking these natural buffer strips consist of at least a minimum width of 55' up to 80' for roadside buffers, 120 feet for ditch turnout buffers, and 150 feet for stone bermed level lip spreader buffers.

The following Table is a summary of the Phosphorous loading for each watershed.

Table 12-6: Phosphorous Export Summary Watershed		
Sub Watershed	Allowable Project Phosphorous Budget Lbs P/year	Computed Project Phosphorous Export Lbs P/year
Mayfield Pond	5.16	5.14
Kingsbury Pond	3.26	3.26
Hilton Pond	0.96	0.47
Withee Pond	0.38	0.28
Smith Pond	0.21	0.12

As demonstrated in Table 12-6, the various treatment buffers will provide adequate capture of phosphorous to maintain phosphorous export to below allowable limits. For additional details, please refer to the detailed phosphorous control calculations provided in Appendix 12-3.

12.23 OFF-SITE CREDITS

Off-site credits for total suspended solids (TSS) or phosphorous are not proposed for the Project.

12.24 RUNOFF TREATMENT MEASURES

The drainage design for this project will consist of naturally vegetated buffers, vegetated and stone-lined conveyance swales, ditch turnouts, level spreaders and plunge pools. Vegetated and stone-lined swales will collect and direct runoff from the access roads, crane roads, turbine pads and the substation yard to a level spreader or plunge pool. The level spreaders and or plunge pools will convert shallow concentrated flows to sheet flow prior to the runoff leaving the Project area. When built in accordance with the Project design requirements, the substation yard will provide adequate water quality treatment through its surface design. The cross section and materials incorporated in this design exceed the specifications in the CMP/MeDEP agreement letter.

12.25 CONTROL PLAN FOR THERMAL IMPACTS TO COLDWATER FISHERIES

The development activities will not result in thermal impact to downstream conditions based on the insignificant impact to overall runoff conditions in the watersheds.

12.26 CONTROL PLAN FOR OTHER POLLUTANTS

A control plan for other pollutants in stormwater runoff is not required.

12.27 ENGINEERING INSPECTION OF STORMWATER MANAGEMENT FACILITIES

The Applicant will ensure that a professional engineer or qualified representative inspects the construction site periodically to verify that the stormwater conveyance swales, level spreaders, plunge pools, vegetated underdrain filters and wet pond are constructed in accordance with the plans and specifications shown on the permit plan set, and that these structures are functioning properly. These inspections will commence with the initial earth moving activities on the site and will continue, as needed, during any period when construction activity affecting the stormwater management system occurs, until the site is permanently stabilized.

12.28 COMPONENTS OF THE BINGHAM WIND PROJECT POST-CONSTRUCTION STORMWATER MAINTENANCE PLAN

The Bingham Wind Project will be solely-owned, operated, and maintained by Blue Sky West, LLC.

A. Stormwater Management Measures to be Inspected and Maintained

The stormwater management facilities to be maintained at the Bingham Wind Project include:

- Stormwater Conveyance Swales;
- Level Spreaders;
- Vegetated Buffers;
- Culverts with Inlet and Outlet Protection;
- Vegetated Underdrain Filters;
- Wet Pond;
- Permanent Access Roads; and
- Revegetated Areas and Embankments.

B. General Inspection and Maintenance Requirements

Generally, the proposed facility will be operated and maintained in a manner consistent with good utility practices, including monthly visual inspections (from March through November or as directed below) and routine maintenance of stormwater management structures as needed. A post-construction maintenance and inspection log is provided in Appendix 12-4.

Visual inspection and maintenance requirements for these facilities are identified below.

1. Stormwater Conveyance Swales:

Visually inspect for any signs of existing or developing blockage of flow, trash, erosion, channeling or excessive build up of sediment. Vegetated swales/ditches will be mowed or otherwise maintained to control the growth of woody vegetation within the channel, but no more than once per year. Rip rap swales/ditches will be visually inspected for signs of scour beneath rip rap or dislodging of any stones.

2. Level Spreaders:

Visually inspect semi-annually and following major storm events for the first year for signs of channelization. Repairs will be made immediately. After first year inspect annually for signs of channelization and debris/sand build-up. Debris will be removed as needed.

3. Vegetated Buffers:

Visually inspect buffer areas annually for sign of channelization and immediately repair upstream dispersion structure to promote sheet flow condition.

4. Culverts with Inlet/Outlet Protection:

Visually inspect culverts for signs of blockage at inlet and outlet. Remove any debris that is creating blockage as needed.

5. Permanent Access Roads:

The roadways will typically require little on-going maintenance, due to the limited use of heavy vehicles. These areas will be visually inspected monthly, and signs of existing or developing areas of channelized flow, erosion, rutting, trash or unwanted vegetation will be removed/repared as needed.

6. Revegetated Areas and Embankments:

Revegetated areas and embankments will be inspected monthly. Any signs of erosion or inadequate revegetation of these areas will be corrected as needed. Re-seed and mulch any areas with less than 90% cover.

7. Vegetated Underdrain Filters:

Vegetated underdrained filters will be inspected and maintained in accordance with Volume III BMP Technical Design Manual, Chapter 7.1 – Grassed Underdrain Soil Filter BMP, dated December 2012.

8. Wet Pond:

Wet ponds will be inspected and maintained in accordance with Volume III BMP Technical Design Manual, Chapter 4.1 – Wet Pond BMP.

APPENDIX 12-1

Pre- and Post-Development Curve Number Calculations



FALL BROOK



WITHEE POND



GULF STREAM



RIFT BROOK



SMITH POND



MAYFIELD POND



KINGSBURY POND



KINGSBURY STREAM



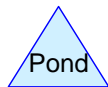
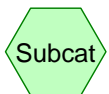
THORN BROOK



HILTON POND



BAKER FLOWAGE



Drainage Diagram for 3048-Pre

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PRE DEVELOPMENT WATERSHED
Type III 24-hr 2 YEAR Rainfall=2.50"
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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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment BAKER: BAKER FLOWAGE Runoff Area=344.730 ac 0.00% Impervious Runoff Depth>0.66"
Flow Length=1,537' Tc=40.9 min CN=77 Runoff=134.94 cfs 18.998 af

Subcatchment FALL: FALL BROOK Runoff Area=678.420 ac 0.00% Impervious Runoff Depth>0.66"
Flow Length=1,546' Tc=46.4 min CN=77 Runoff=247.66 cfs 37.285 af

Subcatchment GULF: GULF STREAM Runoff Area=703.400 ac 0.00% Impervious Runoff Depth>0.64"
Flow Length=3,979' Tc=95.8 min CN=77 Runoff=162.42 cfs 37.628 af

Subcatchment HILT: HILTON POND Runoff Area=191.130 ac 0.00% Impervious Runoff Depth>0.66"
Flow Length=1,074' Tc=35.4 min CN=77 Runoff=80.37 cfs 10.562 af

Subcatchment KING: KINGSBURY POND Runoff Area=543.270 ac 0.00% Impervious Runoff Depth>0.66"
Flow Length=896' Tc=40.8 min CN=77 Runoff=212.62 cfs 29.941 af

Subcatchment KING STR: KINGSBURY Runoff Area=636.240 ac 0.00% Impervious Runoff Depth>0.66"
Flow Length=959' Tc=50.9 min CN=77 Runoff=220.58 cfs 34.886 af

Subcatchment MAY: MAYFIELD POND Runoff Area=580.690 ac 0.00% Impervious Runoff Depth>0.66"
Flow Length=1,285' Tc=30.6 min CN=77 Runoff=261.35 cfs 32.165 af

Subcatchment RIFT: RIFT BROOK Runoff Area=455.300 ac 0.00% Impervious Runoff Depth>0.65"
Flow Length=1,634' Tc=62.2 min CN=77 Runoff=139.54 cfs 24.819 af

Subcatchment SMITH: SMITH POND Runoff Area=50.070 ac 0.00% Impervious Runoff Depth>0.66"
Flow Length=1,587' Tc=34.0 min CN=77 Runoff=21.46 cfs 2.769 af

Subcatchment THORN: THORN BROOK Runoff Area=459.490 ac 0.00% Impervious Runoff Depth>0.64"
Flow Length=3,981' Tc=111.4 min CN=77 Runoff=95.38 cfs 24.344 af

Subcatchment WITH: WITHEE POND Runoff Area=86.980 ac 0.00% Impervious Runoff Depth>0.65"
Flow Length=1,732' Tc=65.0 min CN=77 Runoff=25.99 cfs 4.734 af

Total Runoff Area = 4,729.720 ac Runoff Volume = 258.131 af Average Runoff Depth = 0.65"
100.00% Pervious = 4,729.720 ac 0.00% Impervious = 0.000 ac

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 Type III 24-hr 2 YEAR Rainfall=2.50"
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Summary for Subcatchment BAKER: BAKER FLOWAGE

Runoff = 134.94 cfs @ 12.62 hrs, Volume= 18.998 af, Depth> 0.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2 YEAR Rainfall=2.50"

Area (ac)	CN	Description
344.730	77	Woods, Good, HSG D
344.730		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.8	150	0.0660	0.12		Sheet Flow, B-C Woods: Light underbrush n= 0.400 P2= 2.50"
20.1	1,387	0.0530	1.15		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
40.9	1,537	Total			

Summary for Subcatchment FALL: FALL BROOK

Runoff = 247.66 cfs @ 12.70 hrs, Volume= 37.285 af, Depth> 0.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2 YEAR Rainfall=2.50"

Area (ac)	CN	Description
678.420	77	Woods, Good, HSG D
678.420		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.0	150	0.0466	0.10		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
11.9	1,052	0.0870	1.47		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
10.5	344	0.0120	0.55		Shallow Concentrated Flow, C-D Woodland Kv= 5.0 fps
46.4	1,546	Total			

Summary for Subcatchment GULF: GULF STREAM

Runoff = 162.42 cfs @ 13.38 hrs, Volume= 37.628 af, Depth> 0.64"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2 YEAR Rainfall=2.50"

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PRE DEVELOPMENT WATERSHED

Type III 24-hr 2 YEAR Rainfall=2.50"

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Area (ac)	CN	Description
703.400	77	Woods, Good, HSG D
703.400		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.5	150	0.0400	0.10		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
70.3	3,829	0.0330	0.91		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
95.8	3,979	Total			

Summary for Subcatchment HILT: HILTON POND

Runoff = 80.37 cfs @ 12.54 hrs, Volume= 10.562 af, Depth> 0.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YEAR Rainfall=2.50"

Area (ac)	CN	Description
191.130	77	Woods, Good, HSG D
191.130		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.5	150	0.0400	0.10		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
9.9	924	0.0970	1.56		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
35.4	1,074	Total			

Summary for Subcatchment KING: KINGSBURY POND

Runoff = 212.62 cfs @ 12.62 hrs, Volume= 29.941 af, Depth> 0.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YEAR Rainfall=2.50"

Area (ac)	CN	Description
543.270	77	Woods, Good, HSG D
543.270		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.8	150	0.0270	0.08		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
11.0	746	0.0510	1.13		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
40.8	896	Total			

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Type III 24-hr 2 YEAR Rainfall=2.50"

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Summary for Subcatchment KING STR: KINGSBURY STREAM

Runoff = 220.58 cfs @ 12.76 hrs, Volume= 34.886 af, Depth> 0.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YEAR Rainfall=2.50"

Area (ac)	CN	Description
636.240	77	Woods, Good, HSG D
636.240		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.7	150	0.0150	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
13.2	809	0.0420	1.02		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
50.9	959	Total			

Summary for Subcatchment MAY: MAYFIELD POND

Runoff = 261.35 cfs @ 12.47 hrs, Volume= 32.165 af, Depth> 0.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YEAR Rainfall=2.50"

Area (ac)	CN	Description
580.690	77	Woods, Good, HSG D
580.690		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.5	130	0.0770	0.12		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
13.1	1,155	0.0870	1.47		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
30.6	1,285	Total			

Summary for Subcatchment RIFT: RIFT BROOK

Runoff = 139.54 cfs @ 12.91 hrs, Volume= 24.819 af, Depth> 0.65"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YEAR Rainfall=2.50"

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PRE DEVELOPMENT WATERSHED

Type III 24-hr 2 YEAR Rainfall=2.50"

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Area (ac)	CN	Description
455.300	77	Woods, Good, HSG D
455.300		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.6	150	0.0200	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
28.6	1,484	0.0300	0.87		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
62.2	1,634	Total			

Summary for Subcatchment SMITH: SMITH POND

Runoff = 21.46 cfs @ 12.52 hrs, Volume= 2.769 af, Depth> 0.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YEAR Rainfall=2.50"

Area (ac)	CN	Description
50.070	77	Woods, Good, HSG D
50.070		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.9	150	0.1300	0.16		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
18.1	1,437	0.0700	1.32		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
34.0	1,587	Total			

Summary for Subcatchment THORN: THORN BROOK

Runoff = 95.38 cfs @ 13.60 hrs, Volume= 24.344 af, Depth> 0.64"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YEAR Rainfall=2.50"

Area (ac)	CN	Description
459.490	77	Woods, Good, HSG D
459.490		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.7	150	0.0150	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
73.7	3,831	0.0300	0.87		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
111.4	3,981	Total			

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Type III 24-hr 2 YEAR Rainfall=2.50"
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Summary for Subcatchment WITH: WITHEE POND

Runoff = 25.99 cfs @ 12.95 hrs, Volume= 4.734 af, Depth> 0.65"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YEAR Rainfall=2.50"

Area (ac)	CN	Description
86.980	77	Woods, Good, HSG D
86.980		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
39.6	150	0.0133	0.06		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
25.4	1,582	0.0430	1.04		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
65.0	1,732	Total			

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Type III 24-hr 10 YEAR Rainfall=3.80"
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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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment BAKER: BAKER FLOWAGE Runoff Area=344.730 ac 0.00% Impervious Runoff Depth>1.51"
Flow Length=1,537' Tc=40.9 min CN=77 Runoff=321.43 cfs 43.355 af

Subcatchment FALL: FALL BROOK Runoff Area=678.420 ac 0.00% Impervious Runoff Depth>1.51"
Flow Length=1,546' Tc=46.4 min CN=77 Runoff=591.61 cfs 85.127 af

Subcatchment GULF: GULF STREAM Runoff Area=703.400 ac 0.00% Impervious Runoff Depth>1.47"
Flow Length=3,979' Tc=95.8 min CN=77 Runoff=391.64 cfs 86.315 af

Subcatchment HILT: HILTON POND Runoff Area=191.130 ac 0.00% Impervious Runoff Depth>1.51"
Flow Length=1,074' Tc=35.4 min CN=77 Runoff=191.29 cfs 24.092 af

Subcatchment KING: KINGSBURY POND Runoff Area=543.270 ac 0.00% Impervious Runoff Depth>1.51"
Flow Length=896' Tc=40.8 min CN=77 Runoff=506.56 cfs 68.328 af

Subcatchment KING STR: KINGSBURY Runoff Area=636.240 ac 0.00% Impervious Runoff Depth>1.50"
Flow Length=959' Tc=50.9 min CN=77 Runoff=526.64 cfs 79.684 af

Subcatchment MAY: MAYFIELD POND Runoff Area=580.690 ac 0.00% Impervious Runoff Depth>1.52"
Flow Length=1,285' Tc=30.6 min CN=77 Runoff=622.35 cfs 73.339 af

Subcatchment RIFT: RIFT BROOK Runoff Area=455.300 ac 0.00% Impervious Runoff Depth>1.50"
Flow Length=1,634' Tc=62.2 min CN=77 Runoff=333.79 cfs 56.746 af

Subcatchment SMITH: SMITH POND Runoff Area=50.070 ac 0.00% Impervious Runoff Depth>1.51"
Flow Length=1,587' Tc=34.0 min CN=77 Runoff=51.11 cfs 6.315 af

Subcatchment THORN: THORN BROOK Runoff Area=459.490 ac 0.00% Impervious Runoff Depth>1.46"
Flow Length=3,981' Tc=111.4 min CN=77 Runoff=230.21 cfs 55.936 af

Subcatchment WITH: WITHEE POND Runoff Area=86.980 ac 0.00% Impervious Runoff Depth>1.49"
Flow Length=1,732' Tc=65.0 min CN=77 Runoff=62.21 cfs 10.827 af

Total Runoff Area = 4,729.720 ac Runoff Volume = 590.065 af Average Runoff Depth = 1.50"
100.00% Pervious = 4,729.720 ac 0.00% Impervious = 0.000 ac

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PRE DEVELOPMENT WATERSHED

Type III 24-hr 10 YEAR Rainfall=3.80"

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Summary for Subcatchment BAKER: BAKER FLOWAGE

Runoff = 321.43 cfs @ 12.59 hrs, Volume= 43.355 af, Depth> 1.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=3.80"

Area (ac)	CN	Description			
344.730	77	Woods, Good, HSG D			
344.730		Pervious Area			
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.8	150	0.0660	0.12		Sheet Flow, B-C Woods: Light underbrush n= 0.400 P2= 2.50"
20.1	1,387	0.0530	1.15		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
40.9	1,537	Total			

Summary for Subcatchment FALL: FALL BROOK

Runoff = 591.61 cfs @ 12.66 hrs, Volume= 85.127 af, Depth> 1.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=3.80"

Area (ac)	CN	Description			
678.420	77	Woods, Good, HSG D			
678.420		Pervious Area			
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.0	150	0.0466	0.10		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
11.9	1,052	0.0870	1.47		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
10.5	344	0.0120	0.55		Shallow Concentrated Flow, C-D Woodland Kv= 5.0 fps
46.4	1,546	Total			

Summary for Subcatchment GULF: GULF STREAM

Runoff = 391.64 cfs @ 13.31 hrs, Volume= 86.315 af, Depth> 1.47"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=3.80"

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Type III 24-hr 10 YEAR Rainfall=3.80"

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Area (ac)	CN	Description
703.400	77	Woods, Good, HSG D
703.400		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.5	150	0.0400	0.10		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
70.3	3,829	0.0330	0.91		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
95.8	3,979	Total			

Summary for Subcatchment HILT: HILTON POND

Runoff = 191.29 cfs @ 12.51 hrs, Volume= 24.092 af, Depth> 1.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=3.80"

Area (ac)	CN	Description
191.130	77	Woods, Good, HSG D
191.130		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.5	150	0.0400	0.10		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
9.9	924	0.0970	1.56		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
35.4	1,074	Total			

Summary for Subcatchment KING: KINGSBURY POND

Runoff = 506.56 cfs @ 12.58 hrs, Volume= 68.328 af, Depth> 1.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=3.80"

Area (ac)	CN	Description
543.270	77	Woods, Good, HSG D
543.270		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.8	150	0.0270	0.08		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
11.0	746	0.0510	1.13		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
40.8	896	Total			

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PRE DEVELOPMENT WATERSHED

Type III 24-hr 10 YEAR Rainfall=3.80"

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Summary for Subcatchment KING STR: KINGSBURY STREAM

Runoff = 526.64 cfs @ 12.72 hrs, Volume= 79.684 af, Depth> 1.50"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=3.80"

Area (ac)	CN	Description
636.240	77	Woods, Good, HSG D
636.240		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.7	150	0.0150	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
13.2	809	0.0420	1.02		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
50.9	959	Total			

Summary for Subcatchment MAY: MAYFIELD POND

Runoff = 622.35 cfs @ 12.44 hrs, Volume= 73.339 af, Depth> 1.52"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=3.80"

Area (ac)	CN	Description
580.690	77	Woods, Good, HSG D
580.690		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.5	130	0.0770	0.12		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
13.1	1,155	0.0870	1.47		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
30.6	1,285	Total			

Summary for Subcatchment RIFT: RIFT BROOK

Runoff = 333.79 cfs @ 12.87 hrs, Volume= 56.746 af, Depth> 1.50"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=3.80"

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Type III 24-hr 10 YEAR Rainfall=3.80"

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Area (ac)	CN	Description
455.300	77	Woods, Good, HSG D
455.300		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.6	150	0.0200	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
28.6	1,484	0.0300	0.87		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
62.2	1,634	Total			

Summary for Subcatchment SMITH: SMITH POND

Runoff = 51.11 cfs @ 12.49 hrs, Volume= 6.315 af, Depth> 1.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=3.80"

Area (ac)	CN	Description
50.070	77	Woods, Good, HSG D
50.070		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.9	150	0.1300	0.16		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
18.1	1,437	0.0700	1.32		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
34.0	1,587	Total			

Summary for Subcatchment THORN: THORN BROOK

Runoff = 230.21 cfs @ 13.51 hrs, Volume= 55.936 af, Depth> 1.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=3.80"

Area (ac)	CN	Description
459.490	77	Woods, Good, HSG D
459.490		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.7	150	0.0150	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
73.7	3,831	0.0300	0.87		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
111.4	3,981	Total			

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PRE DEVELOPMENT WATERSHED
Type III 24-hr 10 YEAR Rainfall=3.80"

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Summary for Subcatchment WITH: WITHEE POND

Runoff = 62.21 cfs @ 12.91 hrs, Volume= 10.827 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 10 YEAR Rainfall=3.80"

Area (ac)	CN	Description
86.980	77	Woods, Good, HSG D
86.980		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
39.6	150	0.0133	0.06		Sheet Flow, A-B
					Woods: Light underbrush n= 0.400 P2= 2.50"
25.4	1,582	0.0430	1.04		Shallow Concentrated Flow, B-C
					Woodland Kv= 5.0 fps
65.0	1,732	Total			

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PRE DEVELOPMENT WATERSHED
Type III 24-hr 25 YEAR Rainfall=4.40"
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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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment BAKER: BAKER FLOWAGE Runoff Area=344.730 ac 0.00% Impervious Runoff Depth>1.95"
Flow Length=1,537' Tc=40.9 min CN=77 Runoff=416.52 cfs 56.001 af

Subcatchment FALL: FALL BROOK Runoff Area=678.420 ac 0.00% Impervious Runoff Depth>1.95"
Flow Length=1,546' Tc=46.4 min CN=77 Runoff=767.04 cfs 109.970 af

Subcatchment GULF: GULF STREAM Runoff Area=703.400 ac 0.00% Impervious Runoff Depth>1.90"
Flow Length=3,979' Tc=95.8 min CN=77 Runoff=508.99 cfs 111.640 af

Subcatchment HILT: HILTON POND Runoff Area=191.130 ac 0.00% Impervious Runoff Depth>1.95"
Flow Length=1,074' Tc=35.4 min CN=77 Runoff=247.89 cfs 31.115 af

Subcatchment KING: KINGSBURY POND Runoff Area=543.270 ac 0.00% Impervious Runoff Depth>1.95"
Flow Length=896' Tc=40.8 min CN=77 Runoff=657.28 cfs 88.257 af

Subcatchment KING STR: KINGSBURY Runoff Area=636.240 ac 0.00% Impervious Runoff Depth>1.94"
Flow Length=959' Tc=50.9 min CN=77 Runoff=682.85 cfs 102.949 af

Subcatchment MAY: MAYFIELD POND Runoff Area=580.690 ac 0.00% Impervious Runoff Depth>1.96"
Flow Length=1,285' Tc=30.6 min CN=77 Runoff=806.55 cfs 94.708 af

Subcatchment RIFT: RIFT BROOK Runoff Area=455.300 ac 0.00% Impervious Runoff Depth>1.93"
Flow Length=1,634' Tc=62.2 min CN=77 Runoff=433.15 cfs 73.333 af

Subcatchment SMITH: SMITH POND Runoff Area=50.070 ac 0.00% Impervious Runoff Depth>1.95"
Flow Length=1,587' Tc=34.0 min CN=77 Runoff=66.23 cfs 8.156 af

Subcatchment THORN: THORN BROOK Runoff Area=459.490 ac 0.00% Impervious Runoff Depth>1.89"
Flow Length=3,981' Tc=111.4 min CN=77 Runoff=299.42 cfs 72.379 af

Subcatchment WITH: WITHEE POND Runoff Area=86.980 ac 0.00% Impervious Runoff Depth>1.93"
Flow Length=1,732' Tc=65.0 min CN=77 Runoff=80.71 cfs 13.993 af

Total Runoff Area = 4,729.720 ac Runoff Volume = 762.501 af Average Runoff Depth = 1.93"
100.00% Pervious = 4,729.720 ac 0.00% Impervious = 0.000 ac

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PRE DEVELOPMENT WATERSHED

Type III 24-hr 25 YEAR Rainfall=4.40"

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Summary for Subcatchment BAKER: BAKER FLOWAGE

Runoff = 416.52 cfs @ 12.58 hrs, Volume= 56.001 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 25 YEAR Rainfall=4.40"

Area (ac)	CN	Description
344.730	77	Woods, Good, HSG D
344.730		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.8	150	0.0660	0.12		Sheet Flow, B-C Woods: Light underbrush n= 0.400 P2= 2.50"
20.1	1,387	0.0530	1.15		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
40.9	1,537	Total			

Summary for Subcatchment FALL: FALL BROOK

Runoff = 767.04 cfs @ 12.65 hrs, Volume= 109.970 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 25 YEAR Rainfall=4.40"

Area (ac)	CN	Description
678.420	77	Woods, Good, HSG D
678.420		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.0	150	0.0466	0.10		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
11.9	1,052	0.0870	1.47		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
10.5	344	0.0120	0.55		Shallow Concentrated Flow, C-D Woodland Kv= 5.0 fps
46.4	1,546	Total			

Summary for Subcatchment GULF: GULF STREAM

Runoff = 508.99 cfs @ 13.30 hrs, Volume= 111.640 af, Depth> 1.90"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YEAR Rainfall=4.40"

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PRE DEVELOPMENT WATERSHED
Type III 24-hr 25 YEAR Rainfall=4.40"

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Area (ac)	CN	Description
703.400	77	Woods, Good, HSG D
703.400		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.5	150	0.0400	0.10		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
70.3	3,829	0.0330	0.91		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
95.8	3,979	Total			

Summary for Subcatchment HILT: HILTON POND

Runoff = 247.89 cfs @ 12.50 hrs, Volume= 31.115 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 25 YEAR Rainfall=4.40"

Area (ac)	CN	Description
191.130	77	Woods, Good, HSG D
191.130		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.5	150	0.0400	0.10		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
9.9	924	0.0970	1.56		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
35.4	1,074	Total			

Summary for Subcatchment KING: KINGSBURY POND

Runoff = 657.28 cfs @ 12.57 hrs, Volume= 88.257 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 25 YEAR Rainfall=4.40"

Area (ac)	CN	Description
543.270	77	Woods, Good, HSG D
543.270		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.8	150	0.0270	0.08		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
11.0	746	0.0510	1.13		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
40.8	896	Total			

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PRE DEVELOPMENT WATERSHED

Type III 24-hr 25 YEAR Rainfall=4.40"

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Summary for Subcatchment KING STR: KINGSBURY STREAM

Runoff = 682.85 cfs @ 12.71 hrs, Volume= 102.949 af, Depth> 1.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YEAR Rainfall=4.40"

Area (ac)	CN	Description
636.240	77	Woods, Good, HSG D
636.240		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.7	150	0.0150	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
13.2	809	0.0420	1.02		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
50.9	959	Total			

Summary for Subcatchment MAY: MAYFIELD POND

Runoff = 806.55 cfs @ 12.44 hrs, Volume= 94.708 af, Depth> 1.96"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YEAR Rainfall=4.40"

Area (ac)	CN	Description
580.690	77	Woods, Good, HSG D
580.690		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.5	130	0.0770	0.12		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
13.1	1,155	0.0870	1.47		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
30.6	1,285	Total			

Summary for Subcatchment RIFT: RIFT BROOK

Runoff = 433.15 cfs @ 12.86 hrs, Volume= 73.333 af, Depth> 1.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YEAR Rainfall=4.40"

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Area (ac)	CN	Description
455.300	77	Woods, Good, HSG D
455.300		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.6	150	0.0200	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
28.6	1,484	0.0300	0.87		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
62.2	1,634	Total			

Summary for Subcatchment SMITH: SMITH POND

Runoff = 66.23 cfs @ 12.48 hrs, Volume= 8.156 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 25 YEAR Rainfall=4.40"

Area (ac)	CN	Description
50.070	77	Woods, Good, HSG D
50.070		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.9	150	0.1300	0.16		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
18.1	1,437	0.0700	1.32		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
34.0	1,587	Total			

Summary for Subcatchment THORN: THORN BROOK

Runoff = 299.42 cfs @ 13.50 hrs, Volume= 72.379 af, Depth> 1.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25 YEAR Rainfall=4.40"

Area (ac)	CN	Description
459.490	77	Woods, Good, HSG D
459.490		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.7	150	0.0150	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
73.7	3,831	0.0300	0.87		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
111.4	3,981	Total			

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PRE DEVELOPMENT WATERSHED
 Type III 24-hr 25 YEAR Rainfall=4.40"
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Summary for Subcatchment WITH: WITHEE POND

Runoff = 80.71 cfs @ 12.90 hrs, Volume= 13.993 af, Depth> 1.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25 YEAR Rainfall=4.40"

Area (ac)	CN	Description
86.980	77	Woods, Good, HSG D
86.980		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
39.6	150	0.0133	0.06		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
25.4	1,582	0.0430	1.04		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
65.0	1,732	Total			



FALL BROOK



WITHEE POND



GULF STREAM



RIFT BROOK



SMITH POND



MAYFIELD POND



KINGSBURY POND



KINGSBURY STREAM



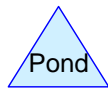
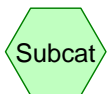
THORN BROOK



HILTON POND



BAKER FLOWAGE



Drainage Diagram for 3048-Post

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POST DEVELOPMENT WATERSHED
Type III 24-hr 2 YEAR Rainfall=2.50"

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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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment BAKER: BAKER FLOWAGE Runoff Area=344.730 ac 0.00% Impervious Runoff Depth>0.66"
Flow Length=1,537' Tc=40.9 min CN=77 Runoff=134.94 cfs 18.998 af

Subcatchment FALL: FALL BROOK Runoff Area=678.420 ac 0.00% Impervious Runoff Depth>0.66"
Flow Length=1,546' Tc=46.4 min CN=77 Runoff=247.66 cfs 37.285 af

Subcatchment GULF: GULF STREAM Runoff Area=703.400 ac 0.00% Impervious Runoff Depth>0.64"
Flow Length=3,979' Tc=95.8 min CN=77 Runoff=162.42 cfs 37.628 af

Subcatchment HILT: HILTON POND Runoff Area=191.130 ac 0.00% Impervious Runoff Depth>0.66"
Flow Length=1,074' Tc=35.4 min CN=77 Runoff=80.37 cfs 10.562 af

Subcatchment KING: KINGSBURY POND Runoff Area=543.270 ac 0.00% Impervious Runoff Depth>0.66"
Flow Length=896' Tc=40.8 min CN=77 Runoff=212.62 cfs 29.941 af

Subcatchment KING STR: KINGSBURY Runoff Area=636.240 ac 0.00% Impervious Runoff Depth>0.66"
Flow Length=959' Tc=50.9 min CN=77 Runoff=220.58 cfs 34.886 af

Subcatchment MAY: MAYFIELD POND Runoff Area=580.690 ac 0.00% Impervious Runoff Depth>0.66"
Flow Length=1,285' Tc=30.6 min CN=77 Runoff=261.35 cfs 32.165 af

Subcatchment RIFT: RIFT BROOK Runoff Area=455.300 ac 0.00% Impervious Runoff Depth>0.65"
Flow Length=1,634' Tc=62.2 min CN=77 Runoff=139.54 cfs 24.819 af

Subcatchment SMITH: SMITH POND Runoff Area=50.070 ac 0.00% Impervious Runoff Depth>0.66"
Flow Length=1,587' Tc=34.0 min CN=77 Runoff=21.46 cfs 2.769 af

Subcatchment THORN: THORN BROOK Runoff Area=459.490 ac 0.00% Impervious Runoff Depth>0.64"
Flow Length=3,981' Tc=111.4 min CN=77 Runoff=95.38 cfs 24.344 af

Subcatchment WITH: WITHEE POND Runoff Area=86.980 ac 0.00% Impervious Runoff Depth>0.65"
Flow Length=1,732' Tc=65.0 min CN=77 Runoff=25.99 cfs 4.734 af

Total Runoff Area = 4,729.720 ac Runoff Volume = 258.131 af Average Runoff Depth = 0.65"
100.00% Pervious = 4,729.720 ac 0.00% Impervious = 0.000 ac

3048-Post

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POST DEVELOPMENT WATERSHED

Type III 24-hr 2 YEAR Rainfall=2.50"

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Summary for Subcatchment BAKER: BAKER FLOWAGE

Runoff = 134.94 cfs @ 12.62 hrs, Volume= 18.998 af, Depth> 0.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YEAR Rainfall=2.50"

Area (ac)	CN	Description
334.930	77	Woods, Good, HSG D
9.800	91	Gravel roads, HSG D
344.730	77	Weighted Average
344.730		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.8	150	0.0660	0.12		Sheet Flow, B-C Woods: Light underbrush n= 0.400 P2= 2.50"
20.1	1,387	0.0530	1.15		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
40.9	1,537	Total			

Summary for Subcatchment FALL: FALL BROOK

Runoff = 247.66 cfs @ 12.70 hrs, Volume= 37.285 af, Depth> 0.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YEAR Rainfall=2.50"

Area (ac)	CN	Description
668.800	77	Woods, Good, HSG D
9.620	91	Gravel roads, HSG D
678.420	77	Weighted Average
678.420		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.0	150	0.0466	0.10		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
11.9	1,052	0.0870	1.47		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
10.5	344	0.0120	0.55		Shallow Concentrated Flow, C-D Woodland Kv= 5.0 fps
46.4	1,546	Total			

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POST DEVELOPMENT WATERSHED

Type III 24-hr 2 YEAR Rainfall=2.50"

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Summary for Subcatchment GULF: GULF STREAM

Runoff = 162.42 cfs @ 13.38 hrs, Volume= 37.628 af, Depth> 0.64"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YEAR Rainfall=2.50"

Area (ac)	CN	Description
693.500	77	Woods, Good, HSG D
9.900	91	Gravel roads, HSG D
703.400	77	Weighted Average
703.400		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.5	150	0.0400	0.10		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
70.3	3,829	0.0330	0.91		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
95.8	3,979	Total			

Summary for Subcatchment HILT: HILTON POND

Runoff = 80.37 cfs @ 12.54 hrs, Volume= 10.562 af, Depth> 0.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YEAR Rainfall=2.50"

Area (ac)	CN	Description
190.200	77	Woods, Good, HSG D
0.930	91	Gravel roads, HSG D
191.130	77	Weighted Average
191.130		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.5	150	0.0400	0.10		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
9.9	924	0.0970	1.56		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
35.4	1,074	Total			

Summary for Subcatchment KING: KINGSBURY POND

Runoff = 212.62 cfs @ 12.62 hrs, Volume= 29.941 af, Depth> 0.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YEAR Rainfall=2.50"

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Type III 24-hr 2 YEAR Rainfall=2.50"

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Area (ac)	CN	Description
539.580	77	Woods, Good, HSG D
3.690	91	Gravel roads, HSG D
543.270	77	Weighted Average
543.270		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.8	150	0.0270	0.08		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
11.0	746	0.0510	1.13		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
40.8	896	Total			

Summary for Subcatchment KING STR: KINGSBURY STREAM

Runoff = 220.58 cfs @ 12.76 hrs, Volume= 34.886 af, Depth> 0.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YEAR Rainfall=2.50"

Area (ac)	CN	Description
623.040	77	Woods, Good, HSG D
13.200	91	Gravel roads, HSG D
636.240	77	Weighted Average
636.240		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.7	150	0.0150	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
13.2	809	0.0420	1.02		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
50.9	959	Total			

Summary for Subcatchment MAY: MAYFIELD POND

Runoff = 261.35 cfs @ 12.47 hrs, Volume= 32.165 af, Depth> 0.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YEAR Rainfall=2.50"

Area (ac)	CN	Description
571.110	77	Woods, Good, HSG D
9.580	91	Gravel roads, HSG D
580.690	77	Weighted Average
580.690		Pervious Area

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Type III 24-hr 2 YEAR Rainfall=2.50"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.5	130	0.0770	0.12		Sheet Flow, A-B
					Woods: Light underbrush n= 0.400 P2= 2.50"
13.1	1,155	0.0870	1.47		Shallow Concentrated Flow, B-C
					Woodland Kv= 5.0 fps
30.6	1,285	Total			

Summary for Subcatchment RIFT: RIFT BROOK

Runoff = 139.54 cfs @ 12.91 hrs, Volume= 24.819 af, Depth> 0.65"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Type III 24-hr 2 YEAR Rainfall=2.50"

Area (ac)	CN	Description
447.710	77	Woods, Good, HSG D
7.590	91	Gravel roads, HSG D
455.300	77	Weighted Average
455.300		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.6	150	0.0200	0.07		Sheet Flow, A-B
					Woods: Light underbrush n= 0.400 P2= 2.50"
28.6	1,484	0.0300	0.87		Shallow Concentrated Flow, B-C
					Woodland Kv= 5.0 fps
62.2	1,634	Total			

Summary for Subcatchment SMITH: SMITH POND

Runoff = 21.46 cfs @ 12.52 hrs, Volume= 2.769 af, Depth> 0.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Type III 24-hr 2 YEAR Rainfall=2.50"

Area (ac)	CN	Description
49.840	77	Woods, Good, HSG D
0.230	91	Gravel roads, HSG D
50.070	77	Weighted Average
50.070		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.9	150	0.1300	0.16		Sheet Flow, A-B
					Woods: Light underbrush n= 0.400 P2= 2.50"
18.1	1,437	0.0700	1.32		Shallow Concentrated Flow, B-C
					Woodland Kv= 5.0 fps
34.0	1,587	Total			

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Type III 24-hr 2 YEAR Rainfall=2.50"

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Summary for Subcatchment THORN: THORN BROOK

Runoff = 95.38 cfs @ 13.60 hrs, Volume= 24.344 af, Depth> 0.64"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YEAR Rainfall=2.50"

Area (ac)	CN	Description
454.060	77	Woods, Good, HSG D
5.430	91	Gravel roads, HSG D
459.490	77	Weighted Average
459.490		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.7	150	0.0150	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
73.7	3,831	0.0300	0.87		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
111.4	3,981	Total			

Summary for Subcatchment WITH: WITHEE POND

Runoff = 25.99 cfs @ 12.95 hrs, Volume= 4.734 af, Depth> 0.65"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YEAR Rainfall=2.50"

Area (ac)	CN	Description
86.430	77	Woods, Good, HSG D
0.550	91	Gravel roads, HSG D
86.980	77	Weighted Average
86.980		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
39.6	150	0.0133	0.06		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
25.4	1,582	0.0430	1.04		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
65.0	1,732	Total			

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Type III 24-hr 10 YEAR Rainfall=3.80"
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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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment BAKER: BAKER FLOWAGE Runoff Area=344.730 ac 0.00% Impervious Runoff Depth>1.51"
Flow Length=1,537' Tc=40.9 min CN=77 Runoff=321.43 cfs 43.355 af

Subcatchment FALL: FALL BROOK Runoff Area=678.420 ac 0.00% Impervious Runoff Depth>1.51"
Flow Length=1,546' Tc=46.4 min CN=77 Runoff=591.61 cfs 85.127 af

Subcatchment GULF: GULF STREAM Runoff Area=703.400 ac 0.00% Impervious Runoff Depth>1.47"
Flow Length=3,979' Tc=95.8 min CN=77 Runoff=391.64 cfs 86.315 af

Subcatchment HILT: HILTON POND Runoff Area=191.130 ac 0.00% Impervious Runoff Depth>1.51"
Flow Length=1,074' Tc=35.4 min CN=77 Runoff=191.29 cfs 24.092 af

Subcatchment KING: KINGSBURY POND Runoff Area=543.270 ac 0.00% Impervious Runoff Depth>1.51"
Flow Length=896' Tc=40.8 min CN=77 Runoff=506.56 cfs 68.328 af

Subcatchment KING STR: KINGSBURY Runoff Area=636.240 ac 0.00% Impervious Runoff Depth>1.50"
Flow Length=959' Tc=50.9 min CN=77 Runoff=526.64 cfs 79.684 af

Subcatchment MAY: MAYFIELD POND Runoff Area=580.690 ac 0.00% Impervious Runoff Depth>1.52"
Flow Length=1,285' Tc=30.6 min CN=77 Runoff=622.35 cfs 73.339 af

Subcatchment RIFT: RIFT BROOK Runoff Area=455.300 ac 0.00% Impervious Runoff Depth>1.50"
Flow Length=1,634' Tc=62.2 min CN=77 Runoff=333.79 cfs 56.746 af

Subcatchment SMITH: SMITH POND Runoff Area=50.070 ac 0.00% Impervious Runoff Depth>1.51"
Flow Length=1,587' Tc=34.0 min CN=77 Runoff=51.11 cfs 6.315 af

Subcatchment THORN: THORN BROOK Runoff Area=459.490 ac 0.00% Impervious Runoff Depth>1.46"
Flow Length=3,981' Tc=111.4 min CN=77 Runoff=230.21 cfs 55.936 af

Subcatchment WITH: WITHEE POND Runoff Area=86.980 ac 0.00% Impervious Runoff Depth>1.49"
Flow Length=1,732' Tc=65.0 min CN=77 Runoff=62.21 cfs 10.827 af

Total Runoff Area = 4,729.720 ac Runoff Volume = 590.065 af Average Runoff Depth = 1.50"
100.00% Pervious = 4,729.720 ac 0.00% Impervious = 0.000 ac

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POST DEVELOPMENT WATERSHED

Type III 24-hr 10 YEAR Rainfall=3.80"

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Summary for Subcatchment BAKER: BAKER FLOWAGE

Runoff = 321.43 cfs @ 12.59 hrs, Volume= 43.355 af, Depth> 1.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=3.80"

Area (ac)	CN	Description
334.930	77	Woods, Good, HSG D
9.800	91	Gravel roads, HSG D
344.730	77	Weighted Average
344.730		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.8	150	0.0660	0.12		Sheet Flow, B-C Woods: Light underbrush n= 0.400 P2= 2.50"
20.1	1,387	0.0530	1.15		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
40.9	1,537	Total			

Summary for Subcatchment FALL: FALL BROOK

Runoff = 591.61 cfs @ 12.66 hrs, Volume= 85.127 af, Depth> 1.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=3.80"

Area (ac)	CN	Description
668.800	77	Woods, Good, HSG D
9.620	91	Gravel roads, HSG D
678.420	77	Weighted Average
678.420		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.0	150	0.0466	0.10		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
11.9	1,052	0.0870	1.47		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
10.5	344	0.0120	0.55		Shallow Concentrated Flow, C-D Woodland Kv= 5.0 fps
46.4	1,546	Total			

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POST DEVELOPMENT WATERSHED
 Type III 24-hr 10 YEAR Rainfall=3.80"
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Summary for Subcatchment GULF: GULF STREAM

Runoff = 391.64 cfs @ 13.31 hrs, Volume= 86.315 af, Depth> 1.47"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10 YEAR Rainfall=3.80"

Area (ac)	CN	Description
693.500	77	Woods, Good, HSG D
9.900	91	Gravel roads, HSG D
703.400	77	Weighted Average
703.400		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.5	150	0.0400	0.10		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
70.3	3,829	0.0330	0.91		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
95.8	3,979	Total			

Summary for Subcatchment HILT: HILTON POND

Runoff = 191.29 cfs @ 12.51 hrs, Volume= 24.092 af, Depth> 1.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10 YEAR Rainfall=3.80"

Area (ac)	CN	Description
190.200	77	Woods, Good, HSG D
0.930	91	Gravel roads, HSG D
191.130	77	Weighted Average
191.130		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.5	150	0.0400	0.10		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
9.9	924	0.0970	1.56		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
35.4	1,074	Total			

Summary for Subcatchment KING: KINGSBURY POND

Runoff = 506.56 cfs @ 12.58 hrs, Volume= 68.328 af, Depth> 1.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10 YEAR Rainfall=3.80"

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Type III 24-hr 10 YEAR Rainfall=3.80"

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Area (ac)	CN	Description
539.580	77	Woods, Good, HSG D
3.690	91	Gravel roads, HSG D
543.270	77	Weighted Average
543.270		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.8	150	0.0270	0.08		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
11.0	746	0.0510	1.13		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
40.8	896	Total			

Summary for Subcatchment KING STR: KINGSBURY STREAM

Runoff = 526.64 cfs @ 12.72 hrs, Volume= 79.684 af, Depth> 1.50"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=3.80"

Area (ac)	CN	Description
623.040	77	Woods, Good, HSG D
13.200	91	Gravel roads, HSG D
636.240	77	Weighted Average
636.240		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.7	150	0.0150	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
13.2	809	0.0420	1.02		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
50.9	959	Total			

Summary for Subcatchment MAY: MAYFIELD POND

Runoff = 622.35 cfs @ 12.44 hrs, Volume= 73.339 af, Depth> 1.52"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=3.80"

Area (ac)	CN	Description
571.110	77	Woods, Good, HSG D
9.580	91	Gravel roads, HSG D
580.690	77	Weighted Average
580.690		Pervious Area

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Type III 24-hr 10 YEAR Rainfall=3.80"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.5	130	0.0770	0.12		Sheet Flow, A-B
					Woods: Light underbrush n= 0.400 P2= 2.50"
13.1	1,155	0.0870	1.47		Shallow Concentrated Flow, B-C
					Woodland Kv= 5.0 fps
30.6	1,285	Total			

Summary for Subcatchment RIFT: RIFT BROOK

Runoff = 333.79 cfs @ 12.87 hrs, Volume= 56.746 af, Depth> 1.50"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=3.80"

Area (ac)	CN	Description
447.710	77	Woods, Good, HSG D
7.590	91	Gravel roads, HSG D
455.300	77	Weighted Average
455.300		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.6	150	0.0200	0.07		Sheet Flow, A-B
					Woods: Light underbrush n= 0.400 P2= 2.50"
28.6	1,484	0.0300	0.87		Shallow Concentrated Flow, B-C
					Woodland Kv= 5.0 fps
62.2	1,634	Total			

Summary for Subcatchment SMITH: SMITH POND

Runoff = 51.11 cfs @ 12.49 hrs, Volume= 6.315 af, Depth> 1.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=3.80"

Area (ac)	CN	Description
49.840	77	Woods, Good, HSG D
0.230	91	Gravel roads, HSG D
50.070	77	Weighted Average
50.070		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.9	150	0.1300	0.16		Sheet Flow, A-B
					Woods: Light underbrush n= 0.400 P2= 2.50"
18.1	1,437	0.0700	1.32		Shallow Concentrated Flow, B-C
					Woodland Kv= 5.0 fps
34.0	1,587	Total			

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Type III 24-hr 10 YEAR Rainfall=3.80"

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Summary for Subcatchment THORN: THORN BROOK

Runoff = 230.21 cfs @ 13.51 hrs, Volume= 55.936 af, Depth> 1.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=3.80"

Area (ac)	CN	Description
454.060	77	Woods, Good, HSG D
5.430	91	Gravel roads, HSG D
459.490	77	Weighted Average
459.490		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.7	150	0.0150	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
73.7	3,831	0.0300	0.87		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
111.4	3,981	Total			

Summary for Subcatchment WITH: WITHEE POND

Runoff = 62.21 cfs @ 12.91 hrs, Volume= 10.827 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 10 YEAR Rainfall=3.80"

Area (ac)	CN	Description
86.430	77	Woods, Good, HSG D
0.550	91	Gravel roads, HSG D
86.980	77	Weighted Average
86.980		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
39.6	150	0.0133	0.06		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
25.4	1,582	0.0430	1.04		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
65.0	1,732	Total			

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POST DEVELOPMENT WATERSHED
Type III 24-hr 25 YEAR Rainfall=4.40"
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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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment BAKER: BAKER FLOWAGE Runoff Area=344.730 ac 0.00% Impervious Runoff Depth>1.95"
Flow Length=1,537' Tc=40.9 min CN=77 Runoff=416.52 cfs 56.001 af

Subcatchment FALL: FALL BROOK Runoff Area=678.420 ac 0.00% Impervious Runoff Depth>1.95"
Flow Length=1,546' Tc=46.4 min CN=77 Runoff=767.04 cfs 109.970 af

Subcatchment GULF: GULF STREAM Runoff Area=703.400 ac 0.00% Impervious Runoff Depth>1.90"
Flow Length=3,979' Tc=95.8 min CN=77 Runoff=508.99 cfs 111.640 af

Subcatchment HILT: HILTON POND Runoff Area=191.130 ac 0.00% Impervious Runoff Depth>1.95"
Flow Length=1,074' Tc=35.4 min CN=77 Runoff=247.89 cfs 31.115 af

Subcatchment KING: KINGSBURY POND Runoff Area=543.270 ac 0.00% Impervious Runoff Depth>1.95"
Flow Length=896' Tc=40.8 min CN=77 Runoff=657.28 cfs 88.257 af

Subcatchment KING STR: KINGSBURY Runoff Area=636.240 ac 0.00% Impervious Runoff Depth>1.94"
Flow Length=959' Tc=50.9 min CN=77 Runoff=682.85 cfs 102.949 af

Subcatchment MAY: MAYFIELD POND Runoff Area=580.690 ac 0.00% Impervious Runoff Depth>1.96"
Flow Length=1,285' Tc=30.6 min CN=77 Runoff=806.55 cfs 94.708 af

Subcatchment RIFT: RIFT BROOK Runoff Area=455.300 ac 0.00% Impervious Runoff Depth>1.93"
Flow Length=1,634' Tc=62.2 min CN=77 Runoff=433.15 cfs 73.333 af

Subcatchment SMITH: SMITH POND Runoff Area=50.070 ac 0.00% Impervious Runoff Depth>1.95"
Flow Length=1,587' Tc=34.0 min CN=77 Runoff=66.23 cfs 8.156 af

Subcatchment THORN: THORN BROOK Runoff Area=459.490 ac 0.00% Impervious Runoff Depth>1.89"
Flow Length=3,981' Tc=111.4 min CN=77 Runoff=299.42 cfs 72.379 af

Subcatchment WITH: WITHEE POND Runoff Area=86.980 ac 0.00% Impervious Runoff Depth>1.93"
Flow Length=1,732' Tc=65.0 min CN=77 Runoff=80.71 cfs 13.993 af

Total Runoff Area = 4,729.720 ac Runoff Volume = 762.501 af Average Runoff Depth = 1.93"
100.00% Pervious = 4,729.720 ac 0.00% Impervious = 0.000 ac

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POST DEVELOPMENT WATERSHED

Type III 24-hr 25 YEAR Rainfall=4.40"

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Summary for Subcatchment BAKER: BAKER FLOWAGE

Runoff = 416.52 cfs @ 12.58 hrs, Volume= 56.001 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 25 YEAR Rainfall=4.40"

Area (ac)	CN	Description
334.930	77	Woods, Good, HSG D
9.800	91	Gravel roads, HSG D
344.730	77	Weighted Average
344.730		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.8	150	0.0660	0.12		Sheet Flow, B-C Woods: Light underbrush n= 0.400 P2= 2.50"
20.1	1,387	0.0530	1.15		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
40.9	1,537	Total			

Summary for Subcatchment FALL: FALL BROOK

Runoff = 767.04 cfs @ 12.65 hrs, Volume= 109.970 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 25 YEAR Rainfall=4.40"

Area (ac)	CN	Description
668.800	77	Woods, Good, HSG D
9.620	91	Gravel roads, HSG D
678.420	77	Weighted Average
678.420		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.0	150	0.0466	0.10		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
11.9	1,052	0.0870	1.47		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
10.5	344	0.0120	0.55		Shallow Concentrated Flow, C-D Woodland Kv= 5.0 fps
46.4	1,546	Total			

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 Type III 24-hr 25 YEAR Rainfall=4.40"
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Summary for Subcatchment GULF: GULF STREAM

Runoff = 508.99 cfs @ 13.30 hrs, Volume= 111.640 af, Depth> 1.90"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25 YEAR Rainfall=4.40"

Area (ac)	CN	Description
693.500	77	Woods, Good, HSG D
9.900	91	Gravel roads, HSG D
703.400	77	Weighted Average
703.400		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.5	150	0.0400	0.10		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
70.3	3,829	0.0330	0.91		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
95.8	3,979	Total			

Summary for Subcatchment HILT: HILTON POND

Runoff = 247.89 cfs @ 12.50 hrs, Volume= 31.115 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 25 YEAR Rainfall=4.40"

Area (ac)	CN	Description
190.200	77	Woods, Good, HSG D
0.930	91	Gravel roads, HSG D
191.130	77	Weighted Average
191.130		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.5	150	0.0400	0.10		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
9.9	924	0.0970	1.56		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
35.4	1,074	Total			

Summary for Subcatchment KING: KINGSBURY POND

Runoff = 657.28 cfs @ 12.57 hrs, Volume= 88.257 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 25 YEAR Rainfall=4.40"

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Type III 24-hr 25 YEAR Rainfall=4.40"

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Area (ac)	CN	Description
539.580	77	Woods, Good, HSG D
3.690	91	Gravel roads, HSG D
543.270	77	Weighted Average
543.270		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.8	150	0.0270	0.08		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
11.0	746	0.0510	1.13		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
40.8	896	Total			

Summary for Subcatchment KING STR: KINGSBURY STREAM

Runoff = 682.85 cfs @ 12.71 hrs, Volume= 102.949 af, Depth> 1.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YEAR Rainfall=4.40"

Area (ac)	CN	Description
623.040	77	Woods, Good, HSG D
13.200	91	Gravel roads, HSG D
636.240	77	Weighted Average
636.240		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.7	150	0.0150	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
13.2	809	0.0420	1.02		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
50.9	959	Total			

Summary for Subcatchment MAY: MAYFIELD POND

Runoff = 806.55 cfs @ 12.44 hrs, Volume= 94.708 af, Depth> 1.96"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YEAR Rainfall=4.40"

Area (ac)	CN	Description
571.110	77	Woods, Good, HSG D
9.580	91	Gravel roads, HSG D
580.690	77	Weighted Average
580.690		Pervious Area

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Type III 24-hr 25 YEAR Rainfall=4.40"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.5	130	0.0770	0.12		Sheet Flow, A-B
					Woods: Light underbrush n= 0.400 P2= 2.50"
13.1	1,155	0.0870	1.47		Shallow Concentrated Flow, B-C
					Woodland Kv= 5.0 fps
30.6	1,285	Total			

Summary for Subcatchment RIFT: RIFT BROOK

Runoff = 433.15 cfs @ 12.86 hrs, Volume= 73.333 af, Depth> 1.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YEAR Rainfall=4.40"

Area (ac)	CN	Description
447.710	77	Woods, Good, HSG D
7.590	91	Gravel roads, HSG D
455.300	77	Weighted Average
455.300		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.6	150	0.0200	0.07		Sheet Flow, A-B
					Woods: Light underbrush n= 0.400 P2= 2.50"
28.6	1,484	0.0300	0.87		Shallow Concentrated Flow, B-C
					Woodland Kv= 5.0 fps
62.2	1,634	Total			

Summary for Subcatchment SMITH: SMITH POND

Runoff = 66.23 cfs @ 12.48 hrs, Volume= 8.156 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 25 YEAR Rainfall=4.40"

Area (ac)	CN	Description
49.840	77	Woods, Good, HSG D
0.230	91	Gravel roads, HSG D
50.070	77	Weighted Average
50.070		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.9	150	0.1300	0.16		Sheet Flow, A-B
					Woods: Light underbrush n= 0.400 P2= 2.50"
18.1	1,437	0.0700	1.32		Shallow Concentrated Flow, B-C
					Woodland Kv= 5.0 fps
34.0	1,587	Total			

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POST DEVELOPMENT WATERSHED

Type III 24-hr 25 YEAR Rainfall=4.40"

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Summary for Subcatchment THORN: THORN BROOK

Runoff = 299.42 cfs @ 13.50 hrs, Volume= 72.379 af, Depth> 1.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YEAR Rainfall=4.40"

Area (ac)	CN	Description
454.060	77	Woods, Good, HSG D
5.430	91	Gravel roads, HSG D
459.490	77	Weighted Average
459.490		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.7	150	0.0150	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
73.7	3,831	0.0300	0.87		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
111.4	3,981	Total			

Summary for Subcatchment WITH: WITHEE POND

Runoff = 80.71 cfs @ 12.90 hrs, Volume= 13.993 af, Depth> 1.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YEAR Rainfall=4.40"

Area (ac)	CN	Description
86.430	77	Woods, Good, HSG D
0.550	91	Gravel roads, HSG D
86.980	77	Weighted Average
86.980		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
39.6	150	0.0133	0.06		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
25.4	1,582	0.0430	1.04		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
65.0	1,732	Total			

APPENDIX 12-2

Culvert Schedule

**Bingham Wind Project
CULVERT SCHEDULE - SOUTH**

Culvert ID	Station Location	Diameter (inches)	Length (ft)	Invert In	Invert Out	Slope	Impervious Area (acres)	Vegetated Area (acres)	Runoff Coefficient	Rainfall Intensity	Area (acres)	Q ₂₅ (cfs)
C-S1	109+47	12"	60'	1,494.40	1,492.50	0.0317	0.12	1.57	0.25	4.80	1.69	2.03
C-S2	106+71	12"	80'	1,480.40	1,480.10	0.0038	0.00	2.02	0.20	4.20	2.02	1.70
C-S3	103+07	24"	140'	1,477.00	1,476.79	0.0015	1.39	0.67	0.67	6.00	2.06	8.31
C-S4	99+81	12"	90'	1,449.31	1,447.10	0.0246	0.15	0.82	0.31	4.10	0.97	1.23
C-S5	96+88	24"	110'	1,428.40	1,427.00	0.0127	0.00	9.34	0.20	4.20	9.34	7.85
C-S6	92+92	24"	70'	1,426.47	1,426.37	0.0014	1.98	2.77	0.49	4.90	4.75	11.46
C-S7	90+36	15"	90'	1,442.35	1,439.65	0.0300	0.36	0.81	0.42	4.70	1.17	2.30
C-S8	82+84	15"	90'	1,438.45	1,437.25	0.0133	0.66	0.79	0.52	4.00	1.45	3.01
C-S9	80+99	12"	50'	1,418.00	1,417.50	0.0100	0.00	0.42	0.20	4.40	0.42	0.37
C-S10	78+78	24"	50'	1,402.35	1,402.28	0.0015	0.00	11.80	0.20	2.50	11.80	5.90
C-S11	73+19	12"	60'	1,395.99	1,395.76	0.0038	0.00	3.51	0.20	2.90	3.51	2.04
C-S12	70+45	15"	80'	1,397.15	1,396.95	0.0025	0.00	5.79	0.20	2.80	5.79	3.24
C-S13	43+58	12"	105'	1,492.10	1,489.60	0.0238	0.00	0.63	0.20	4.20	0.63	0.53
C-S14	40+57	12"	56'	1,507.90	1,506.60	0.0232	0.00	0.75	0.20	3.70	0.75	0.56
C-S15	35+86	12"	105'	1,518.00	1,517.60	0.0038	0.00	0.53	0.20	4.40	0.53	0.47
C-S16	25+22	12"	60'	1,496.46	1,495.71	0.0125	0.00	1.39	0.20	3.10	1.39	0.86
C-S17	16+05	12"	120'	1,498.90	1,498.44	0.0038	0.00	3.45	0.20	2.50	3.45	1.73
C-S18	10+55	15"	109'	1,501.25	1,500.94	0.0028	0.71	1.24	0.45	2.80	1.95	2.48
C-S19	200+71	12"	90'	1,502.00	1,501.66	0.0038	0.01	0.19	0.24	6.00	0.20	0.29
C-S20	203+02	12"	60'	1,503.00	1,502.20	0.0133	0.00	1.32	0.20	3.20	1.32	0.84
C-S21	205+63	15"	65'	1,500.95	1,500.15	0.0123	0.49	2.75	0.31	2.90	3.24	2.87
C-S22	208+35	30"	50'	1,497.60	1,496.80	0.0160	1.76	52.18	0.22	1.40	53.94	16.83
C-S23	210+99	12"	50'	1,470.19	1,469.22	0.0194	0.00	4.12	0.20	2.10	4.12	1.73
C-S24	420+99	18"	75'	1,426.10	1,425.94	0.0021	1.24	0.92	0.60	3.30	2.16	4.29
C-S25	410+25	15"	60'	1,417.35	1,417.18	0.0028	0.60	2.95	0.32	2.30	3.55	2.61
C-S26	406+11	30"	50'	1,409.50	1,409.44	0.0012	0.30	39.28	0.21	2.50	39.58	20.31
C-S27	403+95	12"	75'	1,415.70	1,415.00	0.0093	0.00	2.06	0.20	2.40	2.06	0.99
C-S28	401+05	12"	75'	1,421.70	1,421.40	0.0040	0.00	1.66	0.20	2.50	1.66	0.83
C-S29	2102+70	12"	54'	1,416.70	1,414.60	0.0389	0.60	0.20	0.73	6.00	0.80	3.48
C-S30	2206+31	18"	55'	1,372.86	1,371.94	0.0167	0.14	6.56	0.21	3.30	6.70	4.75
C-S31	513+66	24"	105'	1,326.90	1,325.09	0.0172	0.98	21.64	0.23	2.50	22.62	13.03
C-S32	2201+14	12"	60'	1,327.44	1,327.00	0.0073	0.00	0.70	0.20	6.00	0.70	0.84
C-S33	318+16	15"	130'	1,419.33	1,416.18	0.0242	0.16	2.35	0.24	4.00	2.51	2.46
C-S36	331+59	12"	60'	1,448.53	1,446.93	0.0267	0.00	2.59	0.20	2.30	2.59	1.19
C-S37	334+23	12"	54'	1,441.40	1,440.43	0.0180	0.00	0.78	0.20	2.20	0.78	0.34
C-S38	341+12	15"	65'	1,436.55	1,435.57	0.0151	0.00	7.50	0.20	2.20	7.50	3.30
C-S39	344+28	12"	60'	1,434.10	1,433.09	0.0168	0.00	2.43	0.20	2.30	2.43	1.12
C-S40	347+03	12"	55'	1,431.44	1,430.68	0.0138	0.00	3.70	0.20	2.30	3.70	1.70
C-S41	348+50	12"	63'	1,432.81	1,431.59	0.0194	0.00	2.08	0.20	2.20	2.08	0.92
C-S42	350+64	12"	60'	1,436.74	1,435.33	0.0235	0.00	2.34	0.20	2.25	2.34	1.05
C-S45	364+63	12"	100'	1,466.00	1,458.00	0.0800	0.00	2.98	0.20	2.40	2.98	1.43
C-S46	370+69	24"	100'	1,486.32	1,486.00	0.0032	0.63	30.07	0.21	2.00	30.70	13.16
C-S47	376+57	12"	65'	1,503.72	1,502.39	0.0205	0.00	1.57	0.20	4.00	1.57	1.26
C-S48	378+32	15"	75'	1,506.45	1,505.11	0.0179	0.00	7.35	0.20	2.40	7.35	3.53
C-S49	384+00	18"	60'	1,518.28	1,515.97	0.0385	0.00	9.33	0.20	2.30	9.33	4.29

**Bingham Wind Project
CULVERT SCHEDULE - SOUTH**

Culvert ID	Station Location	Diameter		Invert In	Invert Out	Slope	Impervious Area (acres)	Vegetated Area (acres)	Runoff Coefficient	Rainfall		Q ₂₅ (cfs)
		(inches)	Length (ft)							Intensity	Area (acres)	
C-S50	386+57	12"	50'	1,529.78	1,528.80	0.0196	0.00	3.82	0.20	2.40	3.82	1.83
C-S51	390+00	12"	85'	1,536.48	1,535.45	0.0121	0.00	1.22	0.20	4.00	1.22	0.98
C-S52	394+77	12"	125'	1,539.77	1,538.20	0.0126	0.00	2.24	0.20	2.50	2.24	1.12
C-S53	403+21	18"	110'	1,535.02	1,534.63	0.0035	0.00	8.70	0.20	2.30	8.70	4.00
C-S54	554+25	18"	130'	1,487.50	1,486.20	0.0100	0.48	6.43	0.25	2.80	6.91	4.81
C-S55	542+65	18"	280'	1,567.80	1,564.84	0.0106	1.34	2.08	0.48	3.40	3.42	5.52
C-S56	540+42	12"	130'	1,569.10	1,568.30	0.0062	0.00	3.92	0.20	2.50	3.92	1.96
C-S57	632+71	12"	60'	1,580.20	1,579.97	0.0038	0.04	2.29	0.21	3.10	2.33	1.53
C-S58	528+44	18"	120'	1,577.60	1,577.34	0.0022	0.00	5.37	0.20	3.40	5.37	3.65
C-S59	526+30	15"	90'	1,576.51	1,576.25	0.0029	0.54	0.67	0.51	4.00	1.21	2.48
C-S60	523+52	15"	70'	1,561.35	1,560.15	0.0171	0.43	3.36	0.28	2.80	3.79	2.97
C-S61	521+21	12"	50'	1,551.00	1,550.80	0.0040	0.00	1.15	0.20	3.10	1.15	0.71
C-S62	517+96	12"	54'	1,540.50	1,539.60	0.0167	0.00	1.41	0.20	3.10	1.41	0.87
C-S63	514+97	12"	54'	1,513.20	1,511.60	0.0296	0.00	2.18	0.20	2.80	2.18	1.22
C-S64	512+71	12"	80'	1,499.70	1,499.39	0.0039	0.00	1.35	0.20	2.80	1.35	0.76
C-S65	97+58	30"	55'	1,440.80	1,440.30	0.0091	2.30	25.50	0.26	2.80	27.80	20.08
C-S66	101+00	24"	39'	1,452.80	1,452.32	0.0123	1.13	10.88	0.27	2.80	12.01	8.94
C-S67	104+00	12"	50'	1,470.80	1,470.30	0.0100	0.00	1.60	0.20	6.00	1.60	1.92
C-S68	106+98	12"	85'	1,485.00	1,484.30	0.0082	0.64	0.00	0.90	6.00	0.64	3.46
C-S69	107+70	18"	115'	1,486.30	1,484.60	0.0148	0.00	7.00	0.20	4.00	7.00	5.60
C-S70	439+80	24"	90'	1,408.00	1,404.00	0.0444	0	10.23	0.20	4.8	10.23	9.82

**Bingham Wind Project
CULVERT SCHEDULE - NORTH**

Culvert ID	Station Location	Diameter (inches)	Length (ft)	Invert In	Invert Out	Slope	Impervious Area (acres)	Vegetated Area (acres)	Runoff Coefficient	Rainfall Intensity	Area (acres)	Q ₂₅ (cfs)
C-N1	719+03	12"	50'	1,410.72	1,408.54	0.0436	0.00	0.78	0.20	3.70	0.78	0.58
C-N2 (incl flow from N3)	1602+93	12"	180'	1,447.85	1,447.17	0.0038	0.25	1.66	0.29	3.60	1.91	2.00
C-N3	707+11	12"	50'	1,492.62	1,490.50	0.0424	0.00	0.33	0.20	5.20	0.33	0.34
C-N4	705+33	24"	75'	1,514.67	1,511.79	0.0384	1.81	0.67	0.71	5.20	2.48	9.17
C-N5	700+67	12"	75'	1,528.06	1,526.92	0.0152	0.00	0.79	0.20	5.20	0.79	0.82
C-N6	692+10	15"	130'	1,510.41	1,509.14	0.0098	0.00	4.48	0.20	3.10	4.48	2.78
C-N7	686+79	24"	90'	1,496.00	1,494.00	0.0222	2.04	0.37	0.79	4.50	2.41	8.60
C-N8	683+23	12"	50'	1,466.81	1,465.07	0.0348	0.00	3.74	0.20	2.20	3.74	1.65
C-N9	675+49	18"	60'	1,464.65	1,463.53	0.0187	0.00	8.88	0.20	2.80	8.88	4.97
C-N10	673+00	12"	70'	1,467.24	1,466.18	0.0151	0.00	0.46	0.20	2.60	0.46	0.24
C-N11	668+00	24"	70'	1,459.94	1,459.12	0.0117	2.60	4.16	0.47	2.70	6.76	8.57
C-N12	665+29	15"	80'	1,468.17	1,466.88	0.0161	0.75	1.30	0.46	3.40	2.05	3.18
C-N13	658+83	15"	165'	1,491.98	1,490.81	0.0071	0.00	4.96	0.20	2.80	4.96	2.78
C-N14	756+58	15"	85'	1,490.38	1,489.63	0.0088	0.00	4.52	0.20	2.80	4.52	2.53
C-N14a	754+13	12"	80'	1,501.92	1,501.04	0.0110	0.00	0.61	0.20	3.60	0.61	0.44
C-N15	758+93	12"	55'	1,483.30	1,482.54	0.0138	0.00	1.08	0.20	4.60	1.08	0.99
C-N16	760+11	12"	60'	1,483.88	1,483.12	0.0127	0.00	1.01	0.20	3.70	1.01	0.75
C-N17	762+91	15"	110'	1,484.61	1,484.33	0.0025	0.43	0.49	0.53	4.70	0.92	2.29
C-N18	763+44	15"	90'	1,487.17	1,485.45	0.0191	0.00	4.84	0.20	3.40	4.84	3.29
C-N19	1806+51	12"	50'	1,513.68	1,512.74	0.0188	0.00	2.24	0.20	2.70	2.24	1.21
C-N20	1809+00	18"	55'	1,516.96	1,515.94	0.0185	0.00	7.43	0.20	3.10	7.43	4.61
C-N21	1811+65	12"	60'	1,520.90	1,520.04	0.0143	0.00	1.32	0.20	3.00	1.32	0.79
C-N22	764+49	12"	65'	1,494.55	1,490.94	0.0555	0.00	2.94	0.20	3.80	2.94	2.23
C-N23	781+26	15"	80'	1,602.53	1,601.18	0.0169	0.49	1.92	0.34	3.10	2.41	2.56
C-N24	793+66	18"	100'	1,498.50	1,498.28	0.0022	0.41	6.74	0.24	3.00	7.15	5.14
C-N25	401+66	24"	70'	1,493.65	1,493.55	0.0015	1.53	11.75	0.28	3.10	13.28	11.55
C-N26 (incl flow from N24)	797+91	30"	90'	1,497.31	1,496.57	0.0082	0.00	17.26	0.20	2.50	17.26	8.63
C-N27	802+14	15"	70'	1,500.48	1,499.55	0.0133	0.00	6.47	0.20	2.50	6.47	3.24
C-N28	804+49	18"	135'	1,501.48	1,499.86	0.0120	0.00	8.21	0.20	2.50	8.21	4.11
C-N29	810+55	24"	55'	1,503.82	1,503.17	0.0118	0.00	16.27	0.20	2.40	16.27	7.81
C-N35	833+57	24"	78'	1,484.58	1,483.64	0.0121	0.40	28.60	0.21	1.90	29.00	11.55
C-N36	414+60	12"	60'	1,498.41	1,497.13	0.0213	0.23	0.25	0.54	6.00	0.48	1.54
C-N37	842+68	12"	120'	1,523.75	1,521.33	0.0202	0.00	0.42	0.20	5.00	0.42	0.42
C-N38	1105+19	24"	240'	1,598.74	1,598.33	0.0017	0.47	9.25	0.23	3.00	9.72	6.81
C-N39	912+81	12"	70'	1,703.01	1,702.42	0.0084	0.00	2.03	0.20	3.20	2.03	1.30
C-N40	941+52	12"	140'	1,696.52	1,695.46	0.0076	0.00	2.47	0.20	2.90	2.47	1.43
C-N41	949+48	24"	65'	1,653.27	1,652.49	0.0120	3.55	9.52	0.39	2.50	13.07	12.75

**Bingham Wind Project
CULVERT SCHEDULE - NORTH**

Culvert ID	Station Location	Diameter		Invert In	Invert Out	Slope	Impervious Area (acres)	Vegetated Area (acres)	Runoff Coefficient	Rainfall		Q ₂₅ (cfs)
		(inches)	Length (ft)							Intensity	Area (acres)	
C-N42	951+83	12"	65'	1,653.08	1,652.31	0.0118	0.00	3.53	0.20	2.90	3.53	2.05
C-N43	954+57	18"	65'	1,645.59	1,644.57	0.0157	0.00	10.21	0.20	2.50	10.21	5.11
C-N44	1104+47	18"	60'	1,645.35	1,644.57	0.0130	0.00	10.22	0.20	2.60	10.22	5.31
C-N45	2003+90	24"	55'	1,595.48	1,595.11	0.0067	0.38	30.53	0.21	1.85	30.91	11.93
C-N47	2014+15	24"	50'	1,599.34	1,598.65	0.0138	3.61	5.24	0.49	2.80	8.85	12.03
C-N48	2017+65	12"	60'	1,612.88	1,611.22	0.0277	0.05	0.74	0.24	3.30	0.79	0.63
C-N49	2027+37	12"	90'	1,626.88	1,625.54	0.0149	0.00	1.39	0.20	2.90	1.39	0.81
C-N51	2032+76	12"	90'	1,620.82	1,618.77	0.0228	0.00	2.72	0.20	2.80	2.72	1.52
C-N52	2035+42	12"	75'	1,612.79	1,610.44	0.0313	0.00	3.34	0.20	2.90	3.34	1.94
C-N53	2037+79	12"	50'	1,605.23	1,604.44	0.0158	0.00	3.57	0.20	2.90	3.57	2.07
C-N54	2044+84	18"	55'	1,599.97	1,598.96	0.0184	0.29	6.09	0.23	3.40	6.38	5.04
C-N55 (incl flow from C-N60))	1009+19	30"	63'	1,640.58	1,640.51	0.0011	1.75	11.29	0.29	3.10	13.04	11.88
C-N57	1306+93	12"	70'	1,550.57	1,550.30	0.0038	0.00	1.46	0.20	4.00	1.46	1.17
C-N58	1423+64	30"	55'	1,547.37	1,546.64	0.0133	0.00	15.10	0.20	2.40	15.10	7.25
C-N59	1421+27	12"	75'	1,548.10	1,547.82	0.0038	0.00	1.63	0.20	4.10	1.63	1.34
C-N61	1519+74	30"	50'	1,588.50	1,587.77	0.0146	0.50	38.30	0.21	1.80	38.80	14.60
C-N62	1522+87	15"	60'	1,588.26	1,587.50	0.0127	0.08	4.23	0.21	2.90	4.31	2.66
C-N63	1526+39	12"	60'	1,592.46	1,591.67	0.0132	0.06	2.94	0.21	2.50	3.00	1.61
C-N64	1538+88	30"	60'	1,574.49	1,573.67	0.0137	0.66	40.64	0.21	2.50	41.30	21.81
C-N65	1550+29	18"	65'	1,597.49	1,596.81	0.0105	0.00	13.80	0.20	1.80	13.80	4.97
C-N66	1564+42	12"	210'	1,577.80	1,577.00	0.0038	0.00	5.34	0.20	1.90	5.34	2.03
C-N67	1420+00	18"	60'	1,548.39	1,547.48	0.0152	0.00	10.76	0.20	2.40	10.76	5.16
C-N68	1415+11	18"	55'	1,551.44	1,550.38	0.0193	0.54	8.86	0.24	2.50	9.40	5.65
C-N69	1407+34	30"	50'	1,564.91	1,564.10	0.0162	0.34	29.96	0.21	1.90	30.30	11.97
C-N70	1402+44	15"	85'	1,608.00	1,602.00	0.0706	0.78	0.00	0.90	4.80	0.78	3.37
C-N71	1205+83	12"	90'	1,621.41	1,620.39	0.0113	0.00	1.28	0.20	4.50	1.28	1.15
C-N72	1115+20	18"	95'	1,641.62	1,641.00	0.0065	0.28	2.70	0.27	4.80	2.98	3.80
C-N73	856+00	12"	125'	1,583.41	1,581.64	0.0142	0.00	1.10	0.20	4.80	1.10	1.06

APPENDIX 12-3

**Water Quality Calculations
(Access Roads and Turbine Pads)**

**Bingham Wind Project
Mayfield Township and Moscow, Maine
Gulf Stream Watershed Treatment Calculations**

Impervious Area Road ID Descriptions:	
CR1	CRANE ROAD
AR1	ACCESS ROAD
13	TURBINE PAD SITE
METR	M.E.T. Road
Misc.	Miscellaneous Imp. Area

BMP ID DESCRIPTIONS	
AD	Roadside Buffer
DT	Ditch Turnout Buffer
LS	Level Spreader Buffer

Existing Average Width of T Road (AR1) and Access Rd 2 is 18 ft.
Calculations assume that new impervious areas in untreated areas are 6 ft wide

Road ID	Start Station	End Station	BMP ID	Buffer Slope (%)	Buffer Length (ft)	New Impervious Area (ac)	Impervious Area Treated (ac)	Required Berm Length (ft)	Impervious Area Untreated (ac)
AR1	10+00	- 11+50	-	-	-	0.02	0.00		0.02
AR1	11+50	- 16+00	AD-S36	2.4%	80.00	0.25	0.25		0.00
AR1	16+00	- 23+00	LS-S75	3.5%	150.00	0.39	0.39	58.00	0.00
AR1	23+00	- 24+50	-	-	-	0.08	0.00		0.08
AR1	24+50	- 26+50	DT-S76	3.9%	120.00	0.11	0.11		0.00
AR1	26+50	- 30+00	-	-	-	0.05	0.00		0.05
AR1	30+00	- 32+50	DT-S77	4.8%	120.00	0.03	0.03		0.00
AR1	32+50	- 35+00	DT-S78	7.8%	120.00	0.14	0.14		0.00
AR1	35+00	- 37+50	DT-S79	4.3%	120.00	0.14	0.14		0.00
AR1	37+50	- 40+00	DT-S80	15.0%	120.00	0.14	0.14		0.00
AR1	40+00	- 42+50	DT-S81	10.6%	120.00	0.14	0.14		0.00
AR1	42+50	- 45+00	DT-S82	4.8%	120.00	0.14	0.14		0.00
AR1	45+00	- 47+50	DT-S83	5.5%	120.00	0.14	0.14		0.00
AR1	47+50	- 51+00	DT-S84	4.8%	120.00	0.19	0.19		0.00
AR1	51+00	- 55+00	-	-	-	0.06	0.00		0.06
AR1	55+00	- 57+50	DTS-85	1.7%	120.00	0.14	0.14		0.00
AR1	57+50	- 59+50	DTS-86	1.9%	120.00	0.11	0.11		0.00
AR1	59+50	- 62+00	DTS-87	4.8%	120.00	0.14	0.14		0.00
AR1	62+00	- 64+50	DTS-88	4.6%	120.00	0.14	0.14		0.00
AR1	64+50	- 67+00	DTS-89	2.5%	120.00	0.14	0.14		0.00
AR1	67+00	- 70+50	DTS-90	1.9%	120.00	0.19	0.19		0.00
AR1	70+50	- 73+00	DTS-91	2.8%	120.00	0.14	0.14		0.00
AR1	73+00	- 79+00	LS-S92	5.3%	150.00	0.33	0.33	50.00	0.00
AR1	79+00	- 82+00	DTS-95	6.9%	120.00	0.17	0.17		0.00
AR1	82+00	- 84+00	-	-	-	0.11	0.00		0.11
AR1	84+00	- 87+00	AD-S37	6.0%	55.00	0.17	0.17		0.00
AR1	87+00	- 90+50	-	-	-	0.05	0.00		0.05
AR1	90+50	- 93+00	DT-96A	7.8%	120.00	0.03	0.03		0.00
AR1	93+00	- 97+00	AD-S38	11.0%	55.00	0.22	0.22		0.00
AR1	97+00	- 99+00	-	-	-	0.03	0.00		0.03
AR1	99+00	- 107+00	AD-S38A	6.8%	80.00	0.44	0.44		0.00
AR1	107+00	- 112+00	LS-S72	6.7%	150.00	0.28	0.28	84.00	0.00
AR1	112+00	- 113+50	LS-S73	4.0%	150.00	0.08	0.08	55.00	0.00
CR3	200+00	- 217+00	AD-S2	4.3%	55.00	0.94	0.94		0.00
T11		-	AD-S2	4.3%	55.00	0.28	0.28		0.00
CR2	100+00	- 105+00	LS-S73	4.0%	150.00	0.28	0.28	55.00	0.00
T10		-	AD-S19	2.4%	55.00	0.28	0.28		0.00
CR1	10+00	- 15+16	LS-S72	6.7%	150.00	0.28	0.28	84.00	0.00
CR1	15+16	- 22+00	-	-	-	0.38	0.00		0.38
CR1	22+00	- 25+50	AD-S4	2.4%	80.00	0.19	0.19		0.00
CR1	25+50	- 28+00	AD-S5	3.1%	80.00	0.14	0.14		0.00
CR1	28+00	- 35+75	LS-S6	4.0%	150.00	0.43	0.43	65.00	0.00
MET1	10+00	- 12+97	AD-S4	2.4%	80.00	0.08	0.08		0.00
MET5	500+00	- 508+55	LS-S49	2.7%	150.00	0.24	0.24	78.00	0.00
T73		-	LS-S49	2.7%	150.00	0.28	0.28		0.00
CR6	435+00	- 447+00	LS-S51	2.0%	150.00	0.66	0.66	100.00	0.00
AR2	200+00	- 246+89	-	-	-	0.65	0.00		0.65
Totals						9.99	8.58		1.42

Impervious Area Treatment Calculations (Linear project)

Total Proposed Impervious Area=	9.99	ac
Total Treated Proposed Impervious Area=	8.58	ac
Total Untreated Proposed Impervious Area=	1.42	ac
Proposed Impervious Area Treatment Percentage=	85.84	%

**Bingham Wind Project
Bingham, Maine
Fall Brook Watershed Treatment Calculations**

Impervious Area Road ID Descriptions:	
CR1	CRANE ROAD
AR1	ACCESS ROAD
13	TURBINE PAD SITE
METR	M.E.T. Road
Misc.	Miscellaneous Imp. Area

BMP ID DESCRIPTIONS	
AD	Roadside Buffer
DT	Ditch Turnout Buffer
LS	Level Spreader Buffer

SOIL GROUPS	
Abram	D
Lyman	C/D
Monson	C/D
Plaised	C
Telos	C
Monarda	D
Dixmont	C
Dixfield	C
Colonel	C
Chesunco	C
Elliotsville	B
Thorndike	C/D

Road ID	Start Station	End Station	BMP ID	Buffer Slope (%)	Buffer Length (ft)	New Impervious Area (ac)	Impervious Area Treated (ac)	Required Berm Length (ft)	Impervious Area Untreated (ac)
CR1	38+40	40+00	DT-S9	6.0%	120.0	0.09	0.09		0.00
CR1	40+00	45+00	LS-S11	6.7%	150.0	0.28	0.28	42.00	0.00
CR1	45+00	52+50	AD-S7	9.0%	55.0	0.41	0.41		0.00
CR1	52+50	54+50	DT-S13	3.3%	120.0	0.11	0.11		0.00
CR1	54+50	64+50	AD-S9	8.3%	80.0	0.55	0.55		0.00
CR1	64+50	68+00	LS-S17	9.3%	150.00	0.19	0.19	35.00	0.00
CR1	68+00	71+50	AD-S11	1.6%	55.0	0.19	0.19		0.00
CR1	71+50	77+00	LS-S18	8.0%	150.0	0.30	0.30	46.00	0.00
CR1	77+00	78+50	AD-S12	13.7%	55.0	0.08	0.08		0.00
CR1	78+50	79+50	-	-	-	0.06	0.00		0.06
CR1	79+50	81+00	DT-S19	13.8%	120.0	0.08	0.08		0.00
CR1	81+00	95+50	AD-S13	14.5%	120.0	0.80	0.80		0.00
CR1	95+50	98+50	-	-	-	0.17	0.00		0.17
CR1	98+50	110+00	AD-S15	20.0%	55.0	0.63	0.63		0.00
CR1	110+00	111+50	-	-	-	0.08	0.00		0.08
CR1	111+50	114+00	DT-S21	32.0%	120.0	0.14	0.14		0.00
CR5	327+00	333+00	AD-S24	4.5%	80.0	0.33	0.33		0.00
CR5	333+00	335+50	-	-	-	0.14	0.00		0.14
CR5	335+50	338+50	AD-S24A	4.9%	80.0	0.17	0.17		0.00
CR5	338+50	340+00	-	-	-	0.08	0.00		0.08
CR5	340+00	359+00	AD-S24B	-	80 / 55	1.05	1.05		0.00
CR4	250+00	255+50	LS-S25	10.0%	150.0	0.30	0.30	55.00	0.00
T9	-	-	AD-S3	3.5%	55.0	0.28	0.14		0.14
T8	-	-	AD-S6	9.0%	55.0	0.28	0.14		0.14
T7 ALT	-	-	AD-S18	12.0%	55.0	0.28	0.20		0.08
T7	-	-	AD-S8	10.4%	55.0	0.28	0.28		0.00
T6	-	-	AD-S10	15.8%	55.0	0.28	0.28		0.00
T5	-	-	AD-S11	12.7%	55.0	0.28	0.28		0.00
T4	-	-	-	-	-	0.28	0.00		0.28
T3	-	-	-	-	-	0.28	0.00		0.28
T2	-	-	-	-	-	0.28	0.00		0.28
T1	-	-	AD-S16	24.0%	55.0	0.28	0.28		0.00
Totals						9.03	7.31		1.72

Impervious Area Treatment Calculations (Linear project)

Total Proposed Impervious Area=	9.03	ac
Total Treated Proposed Impervious Area=	7.31	ac
Total Untreated Proposed Impervious Area=	1.72	ac
Proposed Impervious Area Treatment Percentage=	80.92	%

**Bingham Wind Project
Kingsbury Plantation, Maine
Kingsbury Stream Watershed Treatment Calculations**

Impervious Area Road ID Descriptions:	
CR1	CRANE ROAD
AR1	ACCESS ROAD
13	TURBINE PAD SITE
METR	M.E.T. Road
Misc.	Miscellaneous Imp. Area

BMP ID DESCRIPTIONS	
AD	Roadside Buffer
DT	Ditch Turnout Buffer
LS	Level Spreader Buffer

Road ID	Start Station	End Station	BMP ID	Buffer Slope (%)	Buffer Length (ft)	New Impervious Area (ac)	Impervious Area Treated (ac)	Required Berm Length (ft)	Impervious Area Untreated (ac)
CR19	1500+00	- 1533+50	AD-N40	14.0%	55.00	1.85	1.85		0.00
CR19	1533+50	- 1536+00	DT-N104	8.7%	120.00	0.14	0.14		0.00
CR19	1536+00	- 1538+50	DT-N105	9.1%	120.00	0.14	0.14		0.00
CR19	1538+50	- 1541+00	AD-N41	9.8%	55.00	0.14	0.14		0.00
CR19	1541+00	- 1543+50	-	-	-	0.14	0.00		0.14
CR19	1543+50	- 1546+00	DT-N106	11.0%	120.00	0.14	0.14		0.00
CR19	1546+00	- 1555+00	AD-N42	9.5%	55.00	0.50	0.50		0.00
CR19	1555+00	- 1558+00	DT-N108	11.0%	120.00	0.17	0.17		0.00
CR19	1558+00	- 1563+00	LS-N110	8.7%	150.00	0.28	0.28	42.00	0.00
T42	-	-	AD-N43	8.8%	55.00	0.28	0.28		0.00
T43	-	-	-	-	-	0.28	0.00		0.28
T44	-	-	AD-N40	14.0%	55.00	0.28	0.28		0.00
CR12	904+50	- 913+00	AD-N17A	11.0%	55.00	0.47	0.47		0.00
CR12	913+00	- 917+50	LS-N46	6.7%	150.00	0.25	0.25	38.00	0.00
CR12	917+50	- 929+40	LS-N48	7.3%	150.00	0.66	0.66	99.00	0.00
CR12	929+40	- 933+50	LS-N54	11.0%	120.00	0.23	0.23	41.00	0.00
CR12	933+50	- 942+00	LS-N57	10.0%	150.00	0.47	0.47	85.00	0.00
CR12	942+00	- 946+50	-	-	-	0.25	0.00		0.25
CR12	946+50	- 950+50	AD-N21	7.8%	80.00	0.22	0.22		0.00
CR12	950+50	- 952+50	-	-	-	0.11	0.00		0.11
CR12	952+50	- 953+50	AD-N23	9.2%	80.00	0.06	0.06		0.00
CR12	953+50	- 955+00	-	-	-	0.08	0.00		0.08
CR12	955+00	- 956+50	AD-N24	10.0%	80.00	0.08	0.08		0.00
CR12	956+50	- 959+18	-	-	-	0.15	0.00		0.15
T41	-	-	AD-N20	15.3%	55.00	0.28	0.28		0.00
CR15	1100+00	- 1102+50	AD-N25	8.1%	55.00	0.14	0.14		0.00
CR25	1102+50	- 1103+50	-	-	-	0.06	0.00		0.06
CR15	1103+50	- 1105+00	AD-N25	8.1%	55.00	0.08	0.08		0.00
CR15	1105+00	- 1108+00	-	-	-	0.17	0.00		0.17
CR15	1108+00	- 1110+30	DT-N57	2.5%	120.00	0.13	0.13		0.00
T46	-	-	-	-	-	0.28	0.00		0.28
CR16	1213+10	- 1215+00	DT-N72	6.7%	120.00	0.10	0.10		0.00
CR16	1215+00	- 1219+50	AD-N29	13.0%	55.00	0.25	0.25		0.00
CR16	1219+50	- 1222+50	-	-	-	0.17	0.00		0.17
CR16	1222+50	- 1225+50	DT-N91	11.7%	120.00	0.17	0.17		0.00
CR16	1225+50	- 1227+00	-	-	-	0.08	0.00		0.08
CR16	1227+00	- 1233+00	LS-N92	6.0%	150.00	0.33	0.33	50.00	0.00
CR16	1233+00	- 1235+00	-	-	-	0.11	0.00		0.11
CR16	1235+00	- 1241+00	AD-N36	12.0%	55.00	0.33	0.33		0.00
CR16	1241+00	- 1249+00	LS-N95	5.3%	150.00	0.44	0.44	67.00	0.00
CR16	1249+00	- 1255+00	-	-	-	0.33	0.00		0.33
CR16	1255+00	- 1257+50	DT-N98	4.2%	120.00	0.14	0.14		0.00
CR16	1257+50	- 1259+00	-	-	-	0.08	0.00		0.08
CR16	1259+00	- 1266+50	AD-N38A	6.4%	55.00	0.41	0.00		0.41
CR16	1266+50	- 1269+50	-	-	-	0.17	0.00		0.17
T47	-	-	AD-N30	-	-	0.28	0.00		0.28
T49	-	-	AD-N37	6.3%	55.00	0.28	0.28		0.00
T50	-	-	AD-N38	6.5%	55.00	0.28	0.28		0.00
T51	-	-	AD-N39	10.8%	55.00	0.28	0.28		0.00
T36	-	-	AD-N15A	5.5%	55.00	0.28	0.28		0.00
Totals						12.96	9.82		3.14

Impervious Area Treatment Calculations (Linear project)

Total Proposed Impervious Area=	12.96	ac
Total Treated Proposed Impervious Area=	9.82	ac
Total Untreated Proposed Impervious Area=	3.14	ac
Proposed Impervious Area Treatment Percentage=	75.80	%

**Bingham Wind Project
Mayfield Township, Maine
Rift Brook Watershed Treatment Calculations**

Impervious Area Road ID Descriptions:	
CR1	CRANE ROAD
AR1	ACCESS ROAD
13	TURBINE PAD SITE
METR	M.E.T. Road
Misc.	Miscellaneous Imp. Area

BMP ID DESCRIPTIONS	
AD	Roadside Buffer
DT	Ditch Turnout Buffer
LS	Level Spreader Buffer

Crane 7 extends through an existing gravel pit from Station 500+00 to 507+00, this area has not been included with the proposed impervious areas calculations
From 507+00 to 526+00 the proposed access road follows an existing Road. Calculations assume that new impervious areas in untreated areas are 10 ft wide

Road ID	Start Station	End Station	BMP ID	Buffer Slope (%)	Buffer Length (ft)	New Impervious Area (ac)	Impervious Area Treated (ac)	Required Berm Length (ft)	Impervious Area Untreated (ac)
CR8	534+00	- 540+50	LS-S56	5.3%	150.00	0.36	0.36	54.00	0.00
CR8	540+50	- 543+50	AD-S33	2.9%	55.00	0.17	0.17		0.00
CR8	543+50	- 549+50	LS-S54	8.0%	150.00	0.33	0.33	50.00	0.00
CR8	549+50	- 556+00	AD-S35	21.0%	55.00	0.36	0.36		0.00
T16		-	AD-S35	21.0%	55.00	0.28	0.28		0.00
T17/CR 23		-	AD-S34	9.8%	55.00	0.38	0.38		0.00
CR5	317+86	- 324+00	-	-	-	0.34	0.00		0.34
CR5	324+00	- 326+50	DT-S34	4.0%	120.00	0.14	0.14		0.00
CR5	359+00	- 360+50	-	-	-	0.08	0.00		0.08
CR5	360+50	- 371+50	AD-S23	7.6%	80.00	0.61	0.61		0.00
CR5	371+50	- 374+00	DT-S31	6.6%	120.00	0.14	0.14		0.00
CR5	374+00	- 382+50	AD-S22	5.3%	55.00	0.47	0.47		0.00
CR5	382+50	- 385+50	LS-S29	6.0%	150.00	0.17	0.17	25.00	0.00
CR5	385+50	- 388+00	-	-	-	0.14	0.00		0.14
CR5	388+00	- 393+00	AD-S21	4.9%	80.00	0.28	0.28		0.00
CR5	393+00	- 398+00	LS-S27	3.3%	150.00	0.28	0.28	42.00	0.00
CR5	398+00	- 400+50	DT-S30	4.2%	120.00	0.14	0.14		0.00
CR5	400+50	- 403+00	DT-S32	5.8%	120.00	0.14	0.14		0.00
CR5	403+00	- 404+00	AD-S20	4.0%	55.00	0.06	0.06		0.00
T12		-	-	-	-	0.28	0.00		0.28
T13		-	AD-S22	5.3%	55.00	0.28	0.28		0.00
T14		-	-	-	-	0.28	0.00		0.28
CR7	500+00	- 507+00	-	-	-	0.00	0.00		0.00
CR7	507+00	- 526+00	-	-	-	0.44	0.00		0.44
CR7	526+00	- 529+50	AD-S29	3.3%	55.00	0.19	0.19		0.00
CR7	529+50	- 531+10	-	-	-	0.09	0.00		0.09
CR26	2100+00	- 2102+50	AD-S26	4.9%	55.00	0.14	0.14		0.00
CR26	2102+50	- 2105+00	LS-S39	2.0%	150.00	0.14	0.14	52.00	0.00
T76		-	AD-S27	2.6%	55.00	0.28	0.28		0.00
CR27	2200+00	- 2207+50	-	-	-	0.28	0.00		0.28
T77		-	AD-S28	7.0%	80.00	0.28	0.28		0.00
CR6	400+00	- 401+50	-	-	-	0.08	0.00		0.08
CR6	401+50	- 405+24	LS-S41	4.0%	150.00	0.21	0.21	31.00	0.00
CR6	405+24	- 409+00	LS-S39	2.0%	150.00	0.21	0.21	52.00	0.00
CR6	409+00	- 413+00	AD-S26	4.9%	55.00	0.22	0.22		0.00
CR6	413+00	- 413+50	-	-	-	0.03	0.00		0.03
CR6	413+50	- 415+00	AD-S26	4.9%	55.00	0.08	0.08		0.00
CR6	415+00	- 419+00	-	-	-	0.22	0.00		0.22
CR6	419+00	- 430+26	LS-S44	4.0%	150.00	0.62	0.62	94.00	0.00
T75		-	AD-S29	3.4%	55.00	0.28	0.28		0.00
Totals						9.45	7.19		2.25

Impervious Area Treatment Calculations (Linear project)

Total Proposed Impervious Area=	9.45	ac
Total Treated Proposed Impervious Area=	7.19	ac
Total Untreated Proposed Impervious Area=	2.25	ac
Proposed Impervious Area Treatment Percentage=	76.15	%

**Bingham Wind Project
Mayfield Township, Maine
Baker Flowage Watershed Treatment Calculations**

Impervious Area Road ID Descriptions:	
CR1	CRANE ROAD
AR1	ACCESS ROAD
13	TURBINE PAD SITE
METR	M.E.T. Road
Misc.	Miscellaneous Imp. Area

BMP ID DESCRIPTIONS	
AD	Road Side Buffer
DT	Ditch Turnout Buffer
LS	Level Spreader Buffer

Road ID	Start Station	End Station	BMP ID	Buffer Slope (%)	Buffer Length (ft)	New Impervious Area (ac)	Impervious Area Treated (ac)	Required Berm Length (ft)	Impervious Area Untreated (ac)
CR11	787+00	- 796+50	-	-	-	0.52	0.00		0.52
CR11	796+50	- 802+50	AD-N12	4.7%	55.00	0.33	0.33		0.00
CR11	802+50	- 804+00	-	-	-	0.08	0.00		0.08
CR11	804+00	- 807+50	AD-N13	6.8%	80.00	0.19	0.19		0.00
CR11	807+50	- 810+00	DT-N27	3.5%	120.00	0.14	0.14		0.00
CR11	810+00	- 812+00	-	-	-	0.11	0.00		0.11
CR11	812+00	- 815+50	LS-N28	5.3%	150.00	0.19	0.19	29.00	0.00
CR11	815+50	- 818+50	AD-N14	6.6%	80.00	0.17	0.17		0.00
CR11	818+50	- 824+00	LS-N31	5.0%	150.00	0.30	0.30	46.00	0.00
CR11	824+00	- 827+00	DT-N32	9.1%	120.00	0.17	0.17		0.00
CR11	827+00	- 831+00	-	-	-	0.22	0.00		0.22
CR11	831+00	- 833+50	AD-N14A	3.1%	55.00	0.14	0.14		0.00
CR11	833+50	- 841+50	AD-N14B	8.0%	80.00	0.44	0.44		0.00
CR11	841+50	- 842+50	-	3.0%	-	0.06	0.00		0.06
CR11	842+50	- 855+50	LS-N34	6.0%	150.00	0.72	0.72	108.00	0.00
CR11	855+50	- 862+30	LS-N37	8.0%	150.00	0.37	0.37	57.00	0.00
T31	-	-	-	-	-	0.28	0.00		0.28
T32	-	-	AD-N13	3.9%	80.00	0.28	0.28		0.00
T33	-	-	AD-N14	6.7%	80.00	0.28	0.28		0.00
T34	-	-	AD-N14A	3.0%	80.00	0.28	0.28		0.00
T35	-	-	AD-N15	10.0%	55.00	0.28	0.28		0.00
T36	-	-	AD-N15A	6.0%	55.00	0.28	0.28		0.00
T37	-	-	AD-N16	8.1%	55.00	0.28	0.00		0.28
CR14	1100+00	- 1104+50	LS-N40	6.7%	150.00	0.25	0.25	75.00	0.00
CR12	900+00	- 904+50	LS-N40	6.7%	150.00	0.25	0.25	75.00	0.00
T38	-	-	AD-N17	14.7%	55.00	0.28	0.28		0.00
T39	-	-	AD-N18	10.3%	55.00	0.28	0.28		0.00
AR4	400+00	- 402+50	AD-N12	4.7%	55.00	0.14	0.14		0.00
AR4	402+50	- 404+00	-	-	-	0.02	0.00		0.02
AR4	404+00	- 406+50	DT-N26	8.3%	120.00	0.14	0.14		0.00
AR4	406+50	- 409+00	DT-N27	11.7%	120.00	0.14	0.14		0.00
AR4	409+00	- 410+50	DT-N28	13.3%	120.00	0.08	0.08		0.00
AR4	410+50	- 415+50	-	-	-	0.28	0.00		0.28
SUBSTATION*						1.95	1.95		0.00
Totals						9.90	8.06		1.84

*Portion of Substation will be treated by a gravel filter, see design memo appended to application.

Impervious Area Treatment Calculations (Linear project)

Total Proposed Impervious Area=	9.90	ac
Total Treated Proposed Impervious Area=	8.06	ac
Total Untreated Proposed Impervious Area=	1.84	ac
Proposed Impervious Area Treatment Percentage=	81.38	%

**Bingham Wind Project
Kingsbury Plantation, Maine
Thorn Brook Watershed Treatment Calculations**

Impervious Area Road ID Descriptions:	
CR1	CRANE ROAD
AR1	ACCESS ROAD
13	TURBINE PAD SITE
METR	M.E.T. Road
Misc.	Miscellaneous Imp. Area

BMP ID DESCRIPTIONS	
AD	Roadside Buffer
DT	Ditch Turnout Buffer
LS	Level Spreader Buffer

Road ID	Start Station	End Station	BMP ID	Buffer Slope (%)	Buffer Length (ft)	New Impervious Area (ac)	Impervious Area Treated (ac)	Required Berm Length (ft)	Impervious Area Untreated (ac)
T55		-	AD-N33	7.8%	55.00	0.28	0.28		0.00
T56		-	-	-	-	0.28	0.00		0.28
CR15	1110+30	- 1115+50	LS-N60	6.7%	150.00	0.29	0.29	43.00	0.00
CR15	1115+50	- 1118+00	DT-N61	5.7%	120.00	0.14	0.14		0.00
CR15	1118+00	- 1122+77	-	-	-	0.26	0.00		0.26
CR16	1200+00	- 1202+50	DT-N70	6.7%	120.00	0.14	0.14		0.00
CR16	1202+50	- 1207+50	AD-N30	13.0%	55.00	0.28	0.28		0.00
CR16	1207+50	- 1213+10	LS-N71	12.0%	150.00	0.31	0.31	47.00	0.00
METR4	40+00	- 44+42	DT-N68	9.1%	120.00	0.12	0.12		0.00
CR24	2000+00	- 2004+00	AD-N26	11.5%	55.00	0.22	0.22		0.00
T45		-	AD-N26	11.5%	55.00	0.28	0.28		0.00
CR25	2010+00	- 2014+00	AD-N26	11.5%	55.00	0.22	0.22		0.00
CR25	2014+00	- 2014+50	-	-	-	0.03	0.00		0.03
CR25	2014+50	- 2018+00	AD-N26	11.5%	55.00	0.19	0.19		0.00
CR25	2018+00	- 2024+00	LS-N63	10.0%	150.00	0.33	0.33	60.00	0.00
CR25	2024+00	- 2031+00	LS-N66	10.7%	150.00	0.39	0.39	95.00	0.00
CR25	2031+00	- 2036+00	AD-N27	8.7%	55.00	0.28	0.28		0.00
CR25	2036+00	- 2037+00	-	-	-	0.06	0.00		0.06
CR25	2037+00	- 2045+50	AD-N28	20.0%	55.00	0.47	0.47		0.00
CR25	2045+50	- 2051+00	-	-	-	0.30	0.00		0.30
CR25	2051+00	- 2052+50	DT-N69	11.6%	120.00	0.08	0.08		0.00
CR13	1000+00	- 1001+50	AD-N31	13.3%	55.00	0.08	0.08		0.00
T57		-	AD-N31	13.3%	55.00	0.28	0.28		0.00
CR18	1400+00	- 1402+50	LS-N66	10.7%	150.00	0.14	0.14	95.00	0.00
CR18	1402+50	- 1411+30	-	-	-	0.48	0.00		0.48
CR18	1411+30	- 1415+00	LS-N89	6.7%	150.00	0.20	0.20	31.00	0.00
CR18	1415+00	- 1420+50	AD-N33	7.8%	55.00	0.30	0.30		0.00
CR18	1420+50	- 1424+00	-	-	-	0.19	0.00		0.19
CR18	1424+00	- 1429+00	AD-N32	8.1%	55.00	0.28	0.28		0.00
CR18	1429+00	- 1430+00	-	-	-	0.06	0.00		0.06
CR18	1430+00	- 1431+50	AD-N32	8.1%	55.00	0.08	0.08		0.00
CR18	1431+50	- 1436+00	LS-N84	14.7%	150.00	0.25	0.25	45.00	0.00
T40		-	-	-	-	0.28	0.00		0.28
T53		-	AD-N29	13.8%	55.00	0.28	0.28		0.00
T54		-	AD-N28	20.0%	55.00	0.28	0.28		0.00
Totals						8.12	6.18		1.94

Impervious Area Treatment Calculations (Linear project)

Total Proposed Impervious Area=	8.12	ac
Total Treated Proposed Impervious Area=	6.18	ac
Total Untreated Proposed Impervious Area=	1.94	ac
Proposed Impervious Area Treatment Percentage=	76.09	%

**Bingham Wind Project
Mayfield Township, Maine
Withee Pond Watershed Treatment Calculations**

Impervious Area Road ID Descriptions:	
CR1	CRANE ROAD
AR1	ACCESS ROAD
13	TURBINE PAD SITE
METR	M.E.T. Road
Misc.	Miscellaneous Imp. Area

BMP ID DESCRIPTIONS	
AD	Roadside Buffer
DT	Ditch Turnout Buffer
LS	Level Spreader Buffer

SOIL GROUPS	
Abram	D
Lyman	C/D
Monson	C/D
Plaisted	C
Telos	C
Monarda	D
Dixmont	C
Dixfield	C
Colonel	C
Chesuncook	C
Elliotsville	B
Thorndike	C/D

Road ID	Start Station	End Station	BMP ID	HSG	Buffer Slope	Buffer Length (ft)	New Impervious Area (ac)	Required Berm Length (ft)	Export Coefficient	Pre-Treat Export (lbs P/yr)	BMP Treatment Factor	Post-Treat Export (lbs P/yr)	Road Width After Revegetation (ft)
CR6/T74	430+26	- 435+00	LS-S50	C	4.0%	150.00	0.54	82.00	1.75	0.95	0.30	0.28	24
			Totals				0.54			0.95		0.28	

Project Phosphorus Calculations

Project Phosphorus Budget (PPB)	0.38	lbs/yr
Project Phosphorus Export (PPE)	0.28	lbs/yr
Mitigation credit	0.00	lbs/yr
Project Phosphorus Export (PPE)	0.28	lbs/yr

**Bingham Wind Project
Brighton Plantation, Maine
Smith (Weeks) Pond Watershed Treatment Calculations**

Impervious Area Road ID Descriptions:	
CR1	CRANE ROAD
AR1	ACCESS ROAD
13	TURBINE PAD SITE
METR	M.E.T. Road
Misc.	Miscellaneous Imp. Area

BMP ID DESCRIPTIONS	
AD	Roadside Buffer
DT	Ditch Turnout Buffer
LS	Level Spreader Buffer

SOIL GROUPS	
Abram	D
Lyman	C/D
Monson	C/D
Plaiisted	C
Telos	C
Monarda	D
Dixmont	C
Dixfield	C
Colonel	C
Chesuncook	C
Elliotsville	B
Thorndike	C/D

Road ID	Start Station	End Station	BMP ID	HSG	Buffer Slope	Buffer Length (ft)	New Impervious Area (ac)	Required Berm Length (ft)	Export Coefficient	Pre-Treat Export (lbs P/yr)	BMP Treatment Factor	Post-Treat Export (lbs P/yr)	Road Width After Revegetation (ft)
T15		-	AD-S20	C	4.0%	55.00	0.23		1.75	0.40	0.30	0.12	24
						Totals	0.23			0.40		0.12	

Project Phosphorus Calculations

Project Phosphorus Budget (PPB)	0.21	lbs/yr
Project Phosphorus Export (PPE)	0.12	lbs/yr
Mitigation credit	0.00	lbs/yr
Project Phosphorus Export (PPE)	0.12	lbs/yr

**Bingham Wind Project
Kingsbury Plantation, Maine
Hilton Pond #1 Watershed Treatment Calculations**

Impervious Area Road ID Descriptions:	
CR1	CRANE ROAD
AR1	ACCESS ROAD
13	TURBINE PAD SITE
METR	M.E.T. Road
Misc.	Miscellaneous Imp. Area

BMP ID DESCRIPTIONS	
AD	Roadside Buffer
DT	Ditch Turnout Buffer
LS	Level Spreader Buffer

SOIL GROUPS	
Abram	D
Lyman	C/D
Monson	C/D
Plaisted	C
Telos	C
Monarda	D
Dixmont	C
Dixfield	C
Colonel	C
Chesuncook	C
Elliotsville	B
Thorndike	C/D

CRANE RD 18 FOLLOWS AN EXISTING ROAD THAT IS APPROXIMATELY 18 FT WIDE FROM STA. 1440+00 TO 1447+00
CALCULATIONS ASSUME THAT A 6' WIDTH OF NEW ROADWAY WILL BE CONSTRUCTED.

Road ID	Start Station	End Station	BMP ID	HSG	Buffer Slope	Buffer Length (ft)	New Impervious Area (ac)	Required Berm Length (ft)	Export Coefficient	Pre-Treat Export (lbs P/yr)	BMP Treatment Factor	Post-Treat Export (lbs P/yr)	Road Width After Revegetation (ft)
CR18	1436+00	- 1437+50	-	-	-	-	0.08		1.75	0.14	1.00	0.14	
CR18	1437+50	- 1447+00	LS-N87	C	9.3%	150.00	0.13	95.00	1.75	0.23	0.30	0.07	
T58	-	-	AD-N34	C	13.3%	55.00	0.30		1.75	0.53	0.30	0.16	
T48	-	-	AD-N35	C	10.0%	55.00	0.18		1.75	0.32	0.30	0.09	
Totals							0.69			1.21		0.47	

Project Phosphorus Calculations

Project Phosphorus Budget (PPB)	0.96	lbs/yr	Hilton Pond #1
Project Phosphorus Export (PPE)	0.47	lbs/yr	
Mitigation credit	0.00	lbs/yr	
Project Phosphorus Export (PPE)	0.47	lbs/yr	

**Bingham Wind Project
Mayfield Township, Maine
Kingsbury Pond Watershed Treatment Calculations**

Impervious Area Road ID Descriptions:	
CR1	CRANE ROAD
AR1	ACCESS ROAD
13	TURBINE PAD SITE
METR	M.E.T. Road
Misc.	Miscellaneous Imp. Area

BMP ID DESCRIPTIONS	
AD	Roadside Bufer
DT	Ditch Turnout Buffer
LS	Level Spreader Buffer

SOIL GROUPS	
Abram	D
Lyman	C/D
Monson	C/D
Plaisted	C
Telos	C
Monarda	D
Dixmont	C
Dixfield	C
Colonel	C
Chesuncook	C
Elliotsville	B
Thordike	C/D

NEW HAYDEN POND RD (AR3) IS APPROXIMATELY 18 TO 20 FT WIDE
CALCULATIONS ASSUME THAT A 5' WIDTH OF NEW ROADWAY WILL BE CONSTRUCTED.

Road ID	Start Station	End Station	BMP ID	HSG	Buffer Slope	Buffer Length (ft)	New Impervious Area (ac)	Required Berm Length (ft)	Export Coefficient	Pre-Treat Export (lbs P/yr)	BMP Treatment Factor	Post-Treat Export (lbs P/yr)	Road Width After Revegetation (ft)
T28		-	AD-N8	C	12.0%	55.00	0.29		1.75	0.51	0.30	0.15	
CR11	750+00	- 751+50	DT-N18	C	1.1%	120.00	0.08		1.75	0.14	0.30	0.04	
CR11	751+50	- 762+50	AD-N8	C	12.0%	55.00	0.61		1.75	1.06	0.30	0.32	
CR11	762+50	- 764+00	LS-N22	C	7.0%	150.00	0.08	54.00	1.75	0.14	0.30	0.04	
CR11	764+00	- 773+50	LS-N21	C	8.0%	150.00	0.52	79.00	1.75	0.92	0.30	0.27	
CR11	773+50	- 787+00	AD-N11	C	11.7%	55.00	0.74		1.75	1.30	0.30	0.39	
AR3	300+00	- 394+47	-	-	-	-	1.08		1.75	1.90	1.00	1.90	
CR22	1800+00	- 1805+00	LS-N22	C	7.0%	55.00	0.28	54.00	1.75	0.48	0.30	0.14	
Totals							3.69			6.45		3.26	

Project Phosphorus Calculations

Project Phosphorus Budget (PPB)	3.26	lbs/yr
Project Phosphorus Export (PPE)	3.26	lbs/yr
Mitigation credit	0.00	lbs/yr
Project Phosphorus Export (PPE)	3.26	lbs/yr

**Bingham Wind Project
Mayfield Township, Maine
Mayfield Pond Watershed Treatment Calculations**

Impervious Area Road ID Descriptions:	
CR1	CRANE ROAD
AR1	ACCESS ROAD
13	TURBINE PAD SITE
METR	M.E.T. Road
Misc.	Miscellaneous Imp. Area

BMP ID DESCRIPTIONS	
AD	Roadside Buffer
DT	Ditch Turnout Buffer
LS	Level Spreader Buffer

SOIL GROUPS	
Abram	D
Lyman	C/D
Monson	C/D
Plaisted	C
Telos	C
Monarda	D
Dixmont	C
Dixfield	C
Colonel	C
Chesuncook	C
Elliotsville	B
Thorndike	C/D

Road ID	Start Station	End Station	BMP ID	HSG	Buffer Slope	Buffer Length (ft)	New Impervious Area (ac)	Required Berm Length (ft)	Export Coefficient	Pre-Treat Export (lbs P/yr)	BMP Treatment Factor	Post-Treat Export (lbs P/yr)	Road Width After Revegetation (ft)
CR8	500+00	- 504+50	-	-	-	-	0.17		1.75	0.29	1.00	0.29	16
CR8	504+50	- 511+50	AD-S30	C/D	10.0%	55.00	0.26		1.75	0.45	0.35	0.16	16
CR8	511+50	- 518+00	LS-S65	C	9.5%	150.00	0.24	43.00	1.75	0.42	0.30	0.13	16
CR8	518+00	- 520+50	DT-S63A	C	8.3%	120.00	0.09		1.75	0.16	0.30	0.05	16
CR8	520+50	- 534+50	AD-S32	C/D	5.0%	55.00	0.51		1.75	0.90	0.35	0.31	16
T18	-	-	AD-S32	C	5.0%	55.00	0.29		1.75	0.51	0.30	0.15	16
METR2	20+00	- 24+50	AD-S32	C	5.0%	55.00	0.17		1.75	0.29	0.30	0.09	12
METR2	24+50	- 26+73	DT-S58	C	6.7%	120.00	0.06		1.75	0.11	0.30	0.03	12
CR9	600+00	- 602+50	AD-S32	D	5.0%	55.00	0.09		1.75	0.16	0.40	0.06	16
CR9	602+50	- 607+50	LS-S62	C	4.7%	150.00	0.18	28.00	1.75	0.32	0.30	0.10	16
T19	-	-	DT-S60	C/D	8.6%	120.00	0.14		1.75	0.25	0.35	0.09	16
T19	-	-	DT-S59	C/D	7.7%	120.00	0.14		1.75	0.25	0.35	0.09	16
T20	-	-	AD-S31	C	9.6%	55.00	0.29		1.75	0.51	0.30	0.15	16
CR10	651+50	- 659+50	LS-N16	C	8.0%	150.00	0.29	45.00	1.75	0.51	0.30	0.15	16
CR10	659+50	- 676+50	AD-N6	C	5.2%	55.00	0.62		1.75	1.09	0.30	0.33	16
CR10	676+50	- 678+50	DT-N13	C	8.1%	120.00	0.07		1.75	0.13	0.30	0.04	16
CR10	678+50	- 681+50	AD-N5	C	8.0%	55.00	0.11		1.75	0.19	0.30	0.06	16
CR10	681+50	- 687+00	LS-N10	C	8.7%	150.00	0.20	31.00	1.75	0.35	0.30	0.11	16
CR10	687+00	- 692+00	AD-N4	C	7.0%	80.00	0.18		1.75	0.32	0.30	0.10	16
CR10	692+00	- 698+00	LS-N9	C	8.0%	150.00	0.22	34.00	1.75	0.39	0.30	0.12	16
CR10	698+00	- 707+50	AD-N3	C	20.0%	55.00	0.35		1.75	0.61	0.30	0.18	16
CR10	707+50	- 710+00	LS-N7	C	8.5%	150.00	0.09	14.00	1.75	0.16	0.30	0.05	16
CR10	710+00	- 723+00	LS-N2	C	9.0%	150.00	0.48	72.00	1.75	0.84	0.30	0.25	16
T21	-	-	AD-N1	C	10.3%	55.00	0.28		1.75	0.49	0.30	0.15	16
T22	-	-	AD-N2	C	15.3%	55.00	0.46		1.75	0.81	0.30	0.24	16
T23	-	-	AD-N3	C	20.0%	80.00	0.28		1.75	0.49	0.30	0.15	16
T24	-	-	AD-N4	C	7.0%	80.00	0.28		1.75	0.49	0.30	0.15	16
T25	-	-	AD-N5	C	8.0%	55.00	0.28		1.75	0.49	0.30	0.15	16
T26	-	-	AD-N6	C	5.2%	80.00	0.28		1.75	0.49	0.30	0.15	16
T27	-	-	AD-N7	C	73.0%	55.00	0.28		1.75	0.49	0.30	0.15	16
T29	-	-	AD-N9	C	17.4%	55.00	0.28		1.75	0.49	0.30	0.15	16
T30	-	-	AD-N10	C	9.8%	55.00	0.37		1.75	0.65	0.30	0.19	16
METR3	30+00	- 34+03	-	-	-	-	0.11		1.75	0.19	1.00	0.19	16
SUBSTATION							2.00		1.25	2.50	0.25	0.63	
CR22	1805+00	- 1812+50	AD-N9	C	17.4%	55.00	0.28		1.75	0.48	0.30	0.14	16
Totals							10.43			17.26		5.50	

Project Phosphorus Calculations

Project Phosphorus Budget (PPB)	5.16	lbs/yr
Project Phosphorus Export (PPE)	5.50	lbs/yr
Mitigation credit	0.36	lbs/yr
Project Phosphorus Export (PPE)	5.14	lbs/yr

Worksheet 1 PPB calculations

Project name: Bingham Wind
 Lake name: Withee Pond
 Town name: Mayfield Township

Standard Calculation

Watershed per acre phosphorus budget (Appendix C):	PAPB	<u>0.058</u>	lbs P/acre/year
Total acreage of development parcel:	TA	<u>13.32</u>	acres
NWI wetland acreage:	WA	<u>0</u>	acres
Steep slope acreage:	SA	<u>0</u>	acres
Existing developed area		<u> </u>	acres
Project acreage: $A = TA - (WA + SA)$	A	<u>13.32</u>	acres

Project Phosphorus Budget: $PPB = P \times A$	PPB	<u>0.77256</u>	lbs P/year
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Small Watershed Adjustment

If Project Acreage (A) is greater than the threshold acreage for the small watershed threshold (SWT, from pertinent lake and town info in the table in Appendix C), calculate an alternative PPB using the analysis below and use this value if it is less than

Small Watershed Threshold (Appendix C):	SWT	<u>5</u>	acres
Project acreage:	A	<u>13.32</u>	acres
Allowable increase in town's share of annual phosphorus load to lake (Appendix C):	FC	<u>1.21</u>	lbs P/year
Area available for development (Appendix C):	AAD	<u>104</u>	acres
Ratio of A to AAD ($R=A/AAD$)	R	<u>0.128076923</u>	

If $R < 0.5$, Project Phosphorus Budget $PPB = [(FC \times R)/2] + [FC/4]$	PPB	<u>0.379986538</u>	lbs P/year
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If $R > 0.5$, Project Phosphorus Budget $PPB = FC \times R$	PPB	0.154973077	lbs P/year
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Worksheet 1 PPB calculations

Project name: Bingham Wind
 Lake name: Smith (Weeks) Pond
 Town name: Brighton Plantation

Standard Calculation

Watershed per acre phosphorus budget (Appendix C):	PAPB	<u>0.048</u>	lbs P/acre/year
Total acreage of development parcel:	TA	<u>4.4</u>	acres
NWI wetland acreage:	WA	<u>0</u>	acres
Steep slope acreage:	SA	<u>0</u>	acres
Existing developed area		<u> </u>	acres
Project acreage: $A = TA - (WA + SA)$	A	<u>4.4</u>	acres

Project Phosphorus Budget: $PPB = P \times A$	PPB	<u>0.2112</u>	lbs P/year
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Small Watershed Adjustment

If Project Acreage (A) is greater than the threshold acreage for the small watershed threshold (SWT, from pertinent lake and town info in the table in Appendix C), calculate an alternative PPB using the analysis below and use this value if it is less than

Small Watershed Threshold (Appendix C):	SWT	<u>137</u>	acres
Project acreage:	A	<u>4.4</u>	acres
Allowable increase in town's share of annual phosphorus load to lake (Appendix C):	FC	<u>26.21</u>	lbs P/year
Area available for development (Appendix C):	AAD	<u>2735</u>	acres
Ratio of A to AAD ($R=A/AAD$)	R	<u>0.001608775</u>	

If $R < 0.5$, Project Phosphorus Budget $PPB = [(FC \times R)/2] + [FC/4]$	PPB	<u>6.573582998</u>	lbs P/year
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If $R > 0.5$, Project Phosphorus Budget $PPB = FC \times R$	PPB	<u>0.042165996</u>	lbs P/year
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Worksheet 1 PPB calculations

Project name: Bingham Wind

Lake name: Hilton Pond 1

Town name: Kingsbury Plantation

Standard Calculation

Watershed per acre phosphorus budget (Appendix C):	PAPB	<u>0.042</u>	lbs P/acre/year
Total acreage of development parcel:	TA	<u>22.48</u>	acres
NWI wetland acreage:	WA	<u>0</u>	acres
Steep slope acreage:	SA	<u>0.5</u>	acres
Existing developed area		<u> </u>	acres
Project acreage: $A = TA - (WA + SA)$	A	<u>21.98</u>	acres

Project Phosphorus Budget: $PPB = P \times A$	PPB	<u>0.92316</u>	lbs P/year
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Small Watershed Adjustment

If Project Acreage (A) is greater than the threshold acreage for the small watershed threshold (SWT, from pertinent lake and town info in the table in Appendix C), calculate an alternative PPB using the analysis below and use this value if it is less than

Small Watershed Threshold (Appendix C):	SWT	<u>21</u>	acres
Project acreage:	A	<u>21.98</u>	acres
Allowable increase in town's share of annual phosphorus load to lake (Appendix C):	FC	<u>3.46</u>	lbs P/year
Area available for development (Appendix C):	AAD	<u>414</u>	acres
Ratio of A to AAD ($R=A/AAD$)	R	<u>0.053091787</u>	

If $R < 0.5$, Project Phosphorus Budget $PPB = [(FC \times R)/2] + [FC/4]$	PPB	<u>0.956848792</u>	lbs P/year
If $R > 0.5$, Project Phosphorus Budget $PPB = FC \times R$	PPB	<u>0.183697585</u>	lbs P/year

Worksheet 1 PPB calculations

Project name: Bingham Wind

Lake name: Kingsbury Pond

Town name: Mayfield Township

Standard Calculation

Watershed per acre phosphorus budget (Appendix C):	PAPB	<u>0.047</u>	lbs P/acre/year
Total acreage of development parcel:	TA	<u>72.3</u>	acres
NWI wetland acreage:	WA	<u>0</u>	acres
Steep slope acreage:	SA	<u>2.9</u>	acres
Existing developed area		<u>4.12</u>	acres
Project acreage: $A = TA - (WA + SA)$	A	<u>69.4</u>	acres

Project Phosphorus Budget: $PPB = P \times A$	PPB	<u>3.2618</u>	lbs P/year
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Small Watershed Adjustment

If Project Acreage (A) is greater than the threshold acreage for the small watershed threshold (SWT, from pertinent lake and town info in the table in Appendix C), calculate an alternative PPB using the analysis below and use this value if it is less than

Small Watershed Threshold (Appendix C):	SWT	<u>116</u>	acres
Project acreage:	A	<u>69.4</u>	acres
Allowable increase in town's share of annual phosphorus load to lake (Appendix C):	FC	<u>21.65</u>	lbs P/year
Area available for development (Appendix C):	AAD	<u>2319</u>	acres
Ratio of A to AAD ($R=A/AAD$)	R	<u>0.029926693</u>	

If $R < 0.5$,	Project Phosphorus Budget	PPB	<u>5.736456447</u>	lbs P/year
	$PPB = [(FC \times R)/2] + [FC/4]$			

If $R > 0.5$,	Project Phosphorus Budget	PPB	0.647912893	lbs P/year
	$PPB = FC \times R$			

Worksheet 1 PPB calculations

Project name: Bingham Wind

Lake name: Mayfield Pond

Town name: Mayfield Township

Standard Calculation

Watershed per acre phosphorus budget (Appendix C):	PAPB	<u>0.032</u>	lbs P/acre/year
Total acreage of development parcel:	TA	<u>183.25</u>	acres
NWI wetland acreage:	WA	<u>0</u>	acres
Steep slope acreage:	SA	<u>1.21</u>	acres
Existing developed area		<u> </u>	acres
Project acreage: $A = TA - (WA + SA)$	A	<u>182.04</u>	acres

Project Phosphorus Budget: $PPB = P \times A$	PPB	<u>5.82528</u>	lbs P/year
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Small Watershed Adjustment

If Project Acreage (A) is greater than the threshold acreage for the small watershed threshold (SWT, from pertinent lake and town info in the table in Appendix C), calculate an alternative PPB using the analysis below and use this value if it is less than

Small Watershed Threshold (Appendix C):	SWT	<u>141</u>	acres
Project acreage:	A	<u>182.04</u>	acres
Allowable increase in town's share of annual phosphorus load to lake (Appendix C):	FC	<u>18.29</u>	lbs P/year
Area available for development (Appendix C):	AAD	<u>2826</u>	acres
Ratio of A to AAD ($R=A/AAD$)	R	<u>0.064416136</u>	

If $R < 0.5$, Project Phosphorus Budget $PPB = [(FC \times R)/2] + [FC/4]$	PPB	<u>5.161585563</u>	lbs P/year
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If $R > 0.5$, Project Phosphorus Budget $PPB = FC \times R$	PPB	<u>1.178171125</u>	lbs P/year
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Appendix D: Worksheet 3 - Mitigation credit

Project name: _____ Bingham Wind Project Development type: _____ Wind Power Sheet # _____ 1 _____

Mitigation credit when a pre-existing source is being eliminated

Mitigation Source Area Land Use	Acres	Export Coefficient (lbs P/acre/year)	Modifier	Pre-treatment Historical P Export (lbs P/year)	Treatment Factor for Historical BMP(s) (1.0 if no BMPs)	Historical P Export (lbs P/year)		Mitigation Credit (lbs P/year)	Comments
Existing Land Mgmt Rd in Mayfield Pond Wshed	0.41	1.75	0.5	0.35875	1	0.35875		0.35875	
						0		0	
						0		0	
Total source elimination mitiagion credit (SEC)								0.35875	lbs P/year

Mitigation credit when a pre-existing source is treated by a new BMP

Mitigation Source Area Land Use	Acres	Export Coefficient (lbs P/acre/year)	Modifier	Pre-treatment Historical P Export (lbs P/year)	Treatment Factor for Historical BMP(s) (1.0 if no BMPs)	Historical P Export (lbs P/year)		Treatment Factor for New BMP(s) Chapter 6	Mitigation Credit (lbs P/year)	Comments
			0.5	0	1	0	1 -		0	
			0.5	0	1	0	1 -		0	
			0.5	0	1	0	1 -		0	
Total source treatment mitiagion credit (STC)								0	lbs P/year	

TOTAL MITIGATION CREDIT (SEC + STC)								0.35875	lbs P/year
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Bingham Wind Project Level Spreader Calculations

Buffer ID	Impervious Area (acres)	Vegetated Area (acres)	Runoff Coefficient	Rainfall Intensity	Total Area (acres)	Q ₁₀ (cfs)	Calculated Buffer Length (ft)	Buffer Length Used (ft)
LS-S6	0.43	1.15	0.39	5.20	1.58	3.20	12.79	65.00
LS-S11	0.28	1.65	0.30	5.20	1.93	3.01	12.04	42.00
LS-S17	0.19	2.23	0.26	5.20	2.42	3.22	12.87	35.00
LS-S18	0.30	4.45	0.24	5.20	4.75	6.04	24.17	46.00
LS-S27	0.28	2.20	0.28	5.20	2.48	3.58	14.33	42.00
LS-S29	0.17	4.73	0.22	5.20	4.90	5.70	22.79	25.00
LS-S39	0.21	1.72	0.28	5.20	1.93	2.76	11.05	52.00
LS-S41	0.21	0.69	0.36	5.20	0.90	1.69	6.74	31.00
LS-S44	0.62	6.70	0.26	5.20	7.32	9.87	39.48	94.00
LS-S49	0.52	2.97	0.30	5.20	3.49	5.51	22.02	78.00
LS-S50	0.54	0.85	0.47	5.20	1.39	3.42	13.66	82.00
LS-S51	0.66	10.78	0.24	5.20	11.44	14.30	57.22	100.00
LS-S54	0.33	1.00	0.37	5.20	1.33	2.59	10.35	50.00
LS-S56	0.36	5.30	0.24	5.20	5.66	7.19	28.76	54.00
LS-S62	0.18	1.59	0.27	5.20	1.77	2.51	10.04	28.00
LS-S65	0.24	7.20	0.22	5.20	7.44	8.61	34.43	43.00
LS-N2	0.48	2.75	0.30	5.20	3.23	5.10	20.39	72.00
LS-N7	0.09	3.73	0.22	5.20	3.82	4.31	17.23	18.00
LS-N9	0.22	6.67	0.22	5.20	6.89	7.97	31.87	34.00
LS-N10	0.20	5.91	0.22	5.20	6.11	7.09	28.36	31.00
LS-N16	0.29	6.54	0.23	5.20	6.83	8.17	32.69	45.00
LS-N21	0.52	3.55	0.29	5.20	4.07	6.14	24.55	79.00
LS-N22	0.36	0.49	0.49	5.20	0.85	2.19	8.75	54.00
LS-N28	0.19	0.28	0.49	5.20	0.47	1.19	4.76	29.00
LS-N31	0.30	0.80	0.39	5.20	1.10	2.25	8.99	46.00
LS-N34	0.72	4.88	0.29	5.20	5.60	8.43	33.72	108.00
LS-N37	0.37	2.02	0.31	5.20	2.39	3.85	15.40	57.00
LS-N40	0.50	9.70	0.23	5.20	10.20	12.41	49.65	75.00
LS-N46	0.25	0.27	0.53	5.20	0.52	1.44	5.77	38.00
LS-N48	0.66	1.05	0.47	5.20	1.71	4.16	16.66	99.00
LS-N54	0.23	0.40	0.45	5.20	0.63	1.48	5.91	41.00
LS-N57	0.47	3.20	0.29	5.20	3.67	5.52	22.09	85.00
LS-N60	0.29	2.71	0.27	5.20	3.00	4.16	16.65	43.00
LS-N63	0.33	1.10	0.36	5.20	1.43	2.69	10.76	60.00
LS-N66	0.39	2.40	0.30	5.20	2.79	4.31	17.22	95.00
LS-N71	0.31	0.35	0.53	5.20	0.66	1.81	7.24	47.00
LS-N84	0.25	1.62	0.29	5.20	1.87	2.85	11.39	45.00
LS-N87	0.52	1.59	0.37	5.20	2.11	4.10	16.40	95.00
LS-N89	0.20	9.20	0.22	5.20	9.40	10.52	42.07	43.00
LS-N92	0.33	0.46	0.49	5.20	0.79	2.02	8.10	50.00
LS-N95	0.44	1.18	0.39	5.20	1.62	3.29	13.16	67.00
LS-N110	0.28	10.57	0.22	5.20	10.85	12.29	49.15	50.00

APPENDIX 12-4

Post Construction Stormwater Inspection and Maintenance Log

Bingham Wind Project				
Stormwater Management System Inspection & Maintenance Log				
	Schedule			
	Monthly Inspection	Maintenance	Inspector Initials and Date	Inspector Comments
Revegetated Areas and Embankments:				
Inspect all revegetated areas and embankments	X			
Replant bare areas or areas with sparse growth		As Required		
Armor areas with rill erosion with an appropriate lining or divert the erosive flows to on-site		As Required		
Drainage Conveyance Systems:				
Inspect swales, level spreaders and plunge pools for evidence of erosion, debris, woody growth and excessive sediment	X			
Remove any obstructions and accumulated sediments or debris		As Required		
Control vegetated growth and woody vegetation		As Required		
Repair any erosion of the swale lining		As Required		
Mow vegetated swales		Annually		
Remove woody vegetation growing through riprap		As Required		
Repair any slumping side slopes		As Required		
Replace riprap where underlying filter fabric is showing or where stones have dislodged		As Required		
Culverts:				
Inspect culvert inlet, outlet, and structure	X			
Remove accumulated sediment and debris at the inlet, at the outlet, and within the conduit		As Required		
Repair any erosion at the culvert's inlet and outlet		As Required		

Bingham Wind Project				
Stormwater Management System Inspection & Maintenance Log				
	Schedule			
	Monthly Inspection	Maintenance	Inspector Initials and Date	Inspector Comments
Roadway Surfaces:				
Inspect access road surfaces and shoulders for erosion, false ditches, and excess accumulation of sand that could impede water flow				
Remove excess sand either manually or with a front-end loader		As Required		
Grade gravel roads and shoulders		As Required		
Substation Yard:				
Inspect for existing or developing erosion, rutting, trash, and unwanted vegetation	X			
Correct any erosion/rutting and/or remove trash or vegetation		As Required		
Water Quality Treatment Buffer:				
Inspect treatment buffers for evidence of erosion or concentrated flow	X			
Inspect and repair down slope of all spreaders for erosion	X	As Required		
Repair, reseed areas of erosion or damaged vegetation in the buffers		As Required		
Maintenance Needed and When:				

APPENDIX 12-5

Declaration of Restrictions

Appendix 12-5

Templates for Deed Restrictions & Conservation Easements

1. FORESTED BUFFER, LIMITED DISTURBANCE

DECLARATION OF RESTRICTIONS (Forested Buffer, Limited Disturbance)

THIS DECLARATION OF RESTRICTIONS is made this _____ day of _____, 20____, by _____,
(name)

_____, _____,
(street address) (city or town)

_____ County, Maine, _____, (herein referred to as the "Declarant"),
(county) (zipcode)

pursuant to a permit received from the Maine Department of Environmental Protection under the Stormwater Management Law, to preserve a buffer area on a parcel of land near

_____, _____,
(road name) (known feature and/or town)

WHEREAS, the Declarant holds title to certain real property situated in _____,
(town)

Maine described in a deed from _____ to _____
(name) (name of Declarant)

dated _____, 20____, and recorded in Book ____ Page ____ at the _____ County Registry of Deeds, herein referred to as the "property"; and

WHEREAS, Declarant desires to place certain restrictions, under the terms and conditions herein, over a portion of said real property (hereinafter referred to as the "Restricted Buffer") described as follows: (Note: Insert description of restricted buffer area location here)

WHEREAS, pursuant to the Stormwater Management Law, 38 M.R.S.A. Section 420-D and Chapter 500 of rules promulgated by the Maine Board of Environmental Protection ("Stormwater Management Rules"), Declarant has agreed to impose certain restrictions on the Restricted Buffer Area as more particularly set forth herein and has agreed that these restrictions may be enforced by the Maine Department of Environmental Protection or any successor (hereinafter the "MDEP"),

NOW, THEREFORE, the Declarant hereby declares that the Restricted Buffer Area is and shall forever be held, transferred, sold, conveyed, occupied and maintained subject to the conditions and restrictions set forth herein. The Restrictions shall run with the Restricted Buffer Area and shall be binding on all parties having any right, title or interest in and to the Restricted Buffer Area, or any portion thereof, and their heirs, personal representatives, successors, and assigns. Any present or future owner or occupant of the Restricted Buffer Area or any portion thereof, by the accept-

ance of a deed of conveyance of all or part of the Covenant Area or an instrument conveying any interest therein, whether or not the deed or instrument shall so express, shall be deemed to have accepted the Restricted Buffer Area subject to the Restrictions and shall agree to be bound by, to comply with and to be subject to each and every one of the Restrictions hereinafter set forth.

1. **Restrictions on Restricted Buffer Area.** Unless the owner of the Restricted Buffer Area, or any successors or assigns, obtains the prior written approval of the MDEP, the Restricted Buffer Area must remain undeveloped in perpetuity. To maintain the ability of the Restricted Buffer Area to filter and absorb stormwater, and to maintain compliance with the Stormwater Management Law and the permit issued thereunder to the Declarant, the use of the Restricted Buffer Area is hereinafter limited as follows.
 - a. No soil, loam, peat, sand, gravel, concrete, rock or other mineral substance, refuse, trash, vehicle bodies or parts, rubbish, debris, junk waste, pollutants or other fill material may be placed, stored or dumped on the Restricted Buffer Area, nor may the topography of the area be altered or manipulated in any way;
 - b. Any removal of trees or other vegetation within the Restricted Buffer Area must be limited to the following:
 - (i) No purposefully cleared openings may be created and an evenly distributed stand of trees and other vegetation must be maintained. An "evenly distributed stand of trees " is defined as maintaining a minimum rating score of 24 points in any 25 foot by 50 foot square (2500 square feet) area, as determined by the following rating scheme:

Diameter of tree at 4 1/2 feet above ground level	Points
2-4 inches	1
4-8 inches	2
8-12 inches	4
>12 inches	8

Where existing trees and other vegetation result in a rating score less than 24 points, no trees may be cut or sprayed with biocides except for the normal maintenance of dead, wind-blown or damaged trees and for pruning of tree branches below a height of 12 feet provided two thirds of the tree's canopy is maintained;

- (ii) No undergrowth, ground cover vegetation, leaf litter, organic duff layer or mineral soil may be disturbed except that one winding path, that is no wider than six feet and that does not provide a downhill channel for runoff, is allowed through the area;
- c. No building or other temporary or permanent structure may be constructed, placed or permitted to remain on the Restricted Buffer Area, except for a sign, utility pole or fence;
- d. No trucks, cars, dirt bikes, ATVs, bulldozers, backhoes, or other motorized vehicles or mechanical equipment may be permitted on the Restricted Buffer Area;

- e. Any level lip spreader directing flow to the Restricted Buffer Area must be regularly inspected and adequately maintained to preserve the function of the level spreader.

Any activity on or use of the Restricted Buffer Area inconsistent with the purpose of these Restrictions is prohibited. Any future alterations or changes in use of the Restricted Buffer Area must receive prior approval in writing from the MDEP. The MDEP may approve such alterations and changes in use if such alterations and uses do not impede the stormwater control and treatment capability of the Restricted Buffer Area or if adequate and appropriate alternative means of stormwater control and treatment are provided.

- 2. Enforcement. The MDEP may enforce any of the Restrictions set forth in Section 1 above.
- 3. Binding Effect. The restrictions set forth herein shall be binding on any present or future owner of the Restricted Buffer Area. If the Restricted Buffer Area is at any time owned by more than one owner, each owner shall be bound by the foregoing restrictions to the extent that any of the Restricted Buffer Area is included within such owner's property.
- 4. Amendment. Any provision contained in this Declaration may be amended or revoked only by the recording of a written instrument or instruments specifying the amendment or the revocation signed by the owner or owners of the Restricted Buffer Area and by the MDEP.
- 5. Effective Provisions of Declaration. Each provision of this Declaration, and any agreement, promise, covenant and undertaking to comply with each provision of this Declaration, shall be deemed a land use restriction running with the land as a burden and upon the title to the Restricted Buffer Area.
- 6. Severability. Invalidity or unenforceability of any provision of this Declaration in whole or in part shall not affect the validity or enforceability of any other provision or any valid and enforceable part of a provision of this Declaration.
- 7. Governing Law. This Declaration shall be governed by and interpreted in accordance with the laws of the State of Maine.

(NAME)

STATE OF MAINE

_____ County, _____, 20__.

(County)

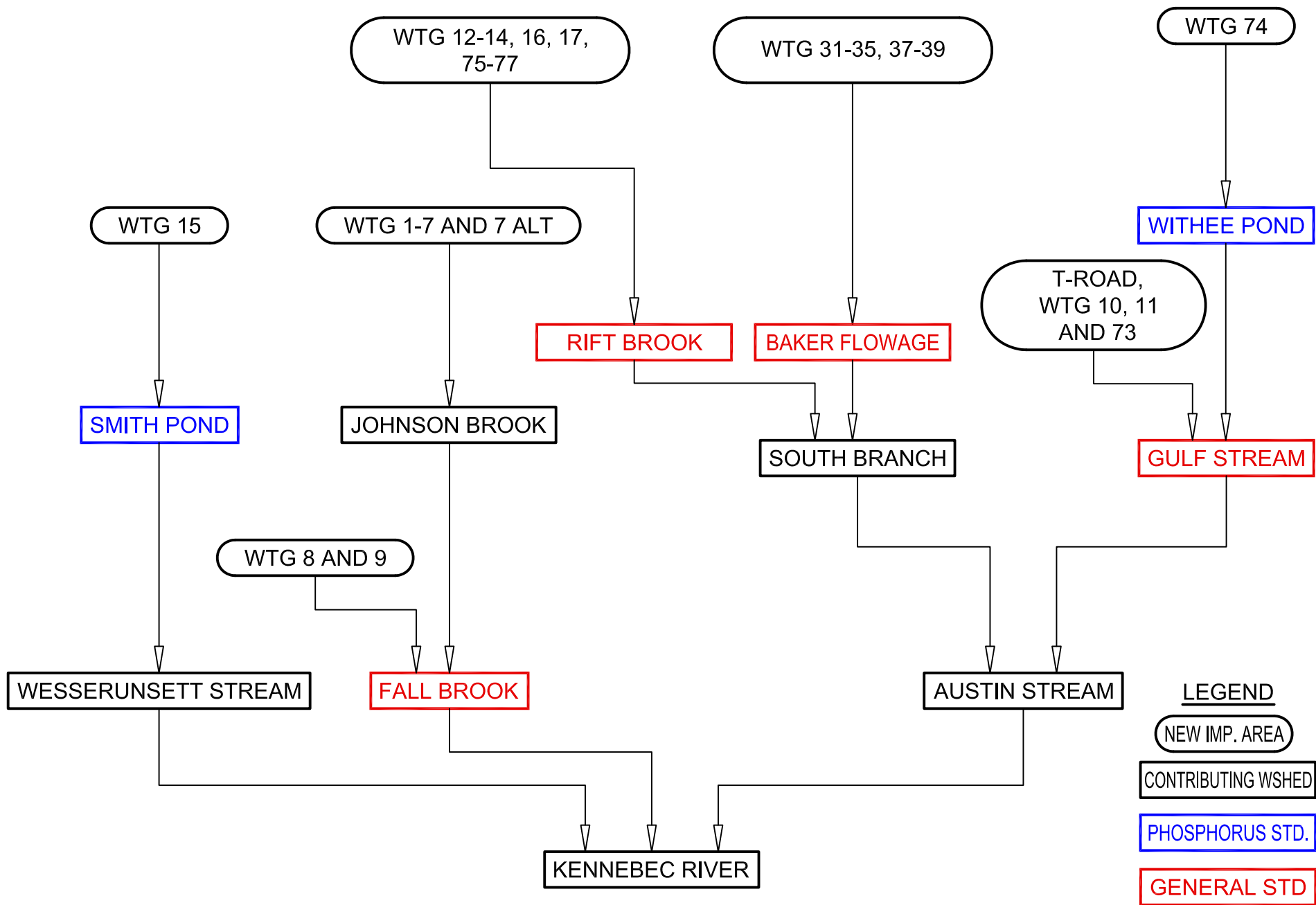
(date)

Personally appeared before me the above named _____, who swore to the truth of the foregoing to the best of (his/her) knowledge, information and belief and acknowledged the foregoing instrument to be (his/her) free act and deed.

Notary Public

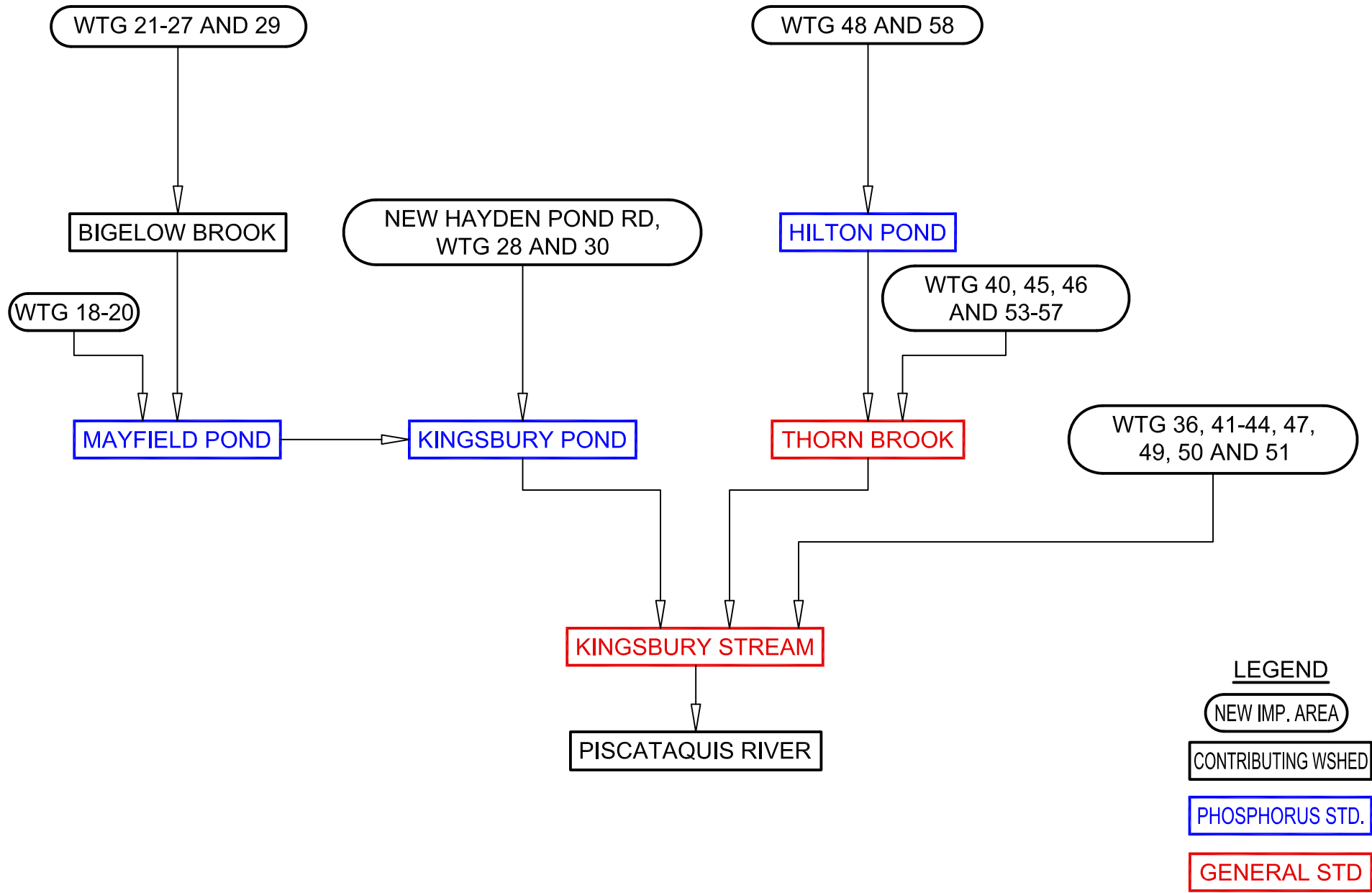
APPENDIX 12-6

Schematic Watershed Flow Chart



LEGEND

- NEW IMP. AREA
- CONTRIBUTING WSHD
- PHOSPHORUS STD.
- GENERAL STD

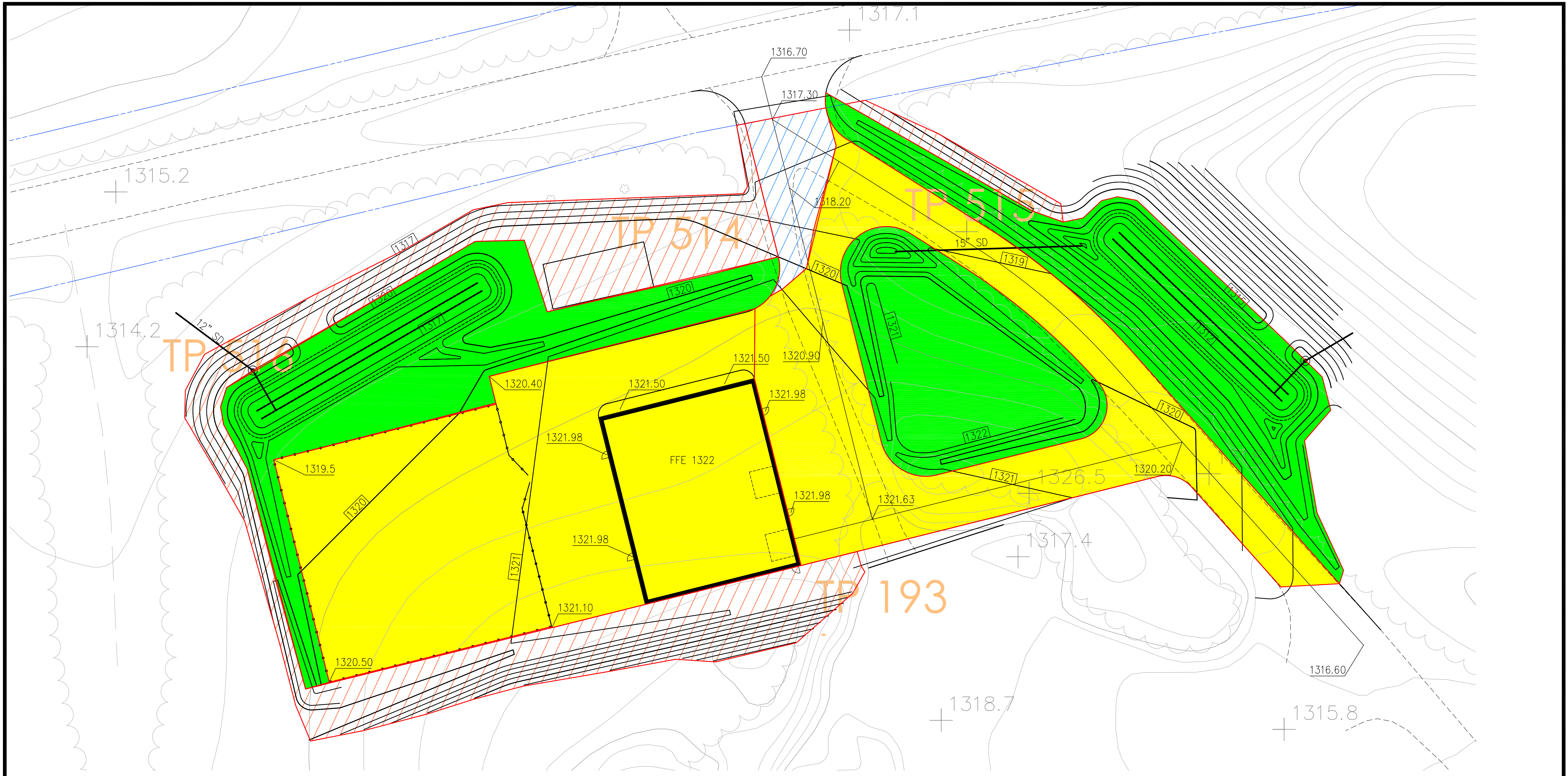


LEGEND

- NEW IMP. AREA
- CONTRIBUTING WSHED
- PHOSPHORUS STD.
- GENERAL STD.

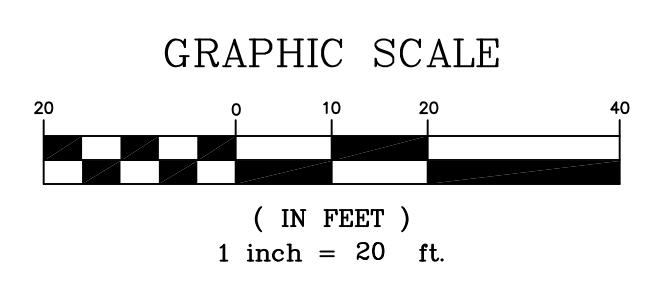
APPENDIX 12-7

**Operations & Maintenance Site General and Flooding Standard
Calculations and Figures**



TREATMENT LEGEND

- PROPOSED IMPERVIOUS AREA TREATED
- PROPOSED LANDSCAPE AREA TREATED
- PROPOSED IMPERVIOUS AREA UNTREATED
- PROPOSED LANDSCAPE AREA UNTREATED



REV	DATE	DESCRIPTION	P.E. LIC. #
REVISIONS			

PROJECT BINGHAM WIND PROJECT		DeLUCA-HOFFMAN ASSOCIATES, INC. 778 MAIN STREET, SUITE 8 SOUTH PORTLAND, ME 04106 207.775.1121 WWW.DELUCAHOFFMAN.COM
SHEET TITLE O&M WATER QUALITY AREAS (GENERAL STD.)		
CLIENT BLUE SKY WEST LLC		DRAWN: SJB DATE: APRIL 2013 DESIGNED: SJB SCALE: 1"=20' CHECKED: SJB JOB NO. 3048 FILE NAME: 3048-OM SHEET: FIGURE 1

Bingham Wind Project

Substation/DRD/O&M Water Quality Treatment Calculations (General Standard)

Area ID	Total Area (sf)	Imp. Area (sf)	Imp.Area Treated (sf)	Grass Area (sf)	Grass Area Treated (sf)	Dev. Area (sf)	Dev. Area Treated (sf)	Treatment Method
Substation ¹	37890	20104	20104	17786	10261	37890	30365	Gravel Section/DT
DRD	89981	52401	51623	37580	24949	89981	76572	Wet Pond/DT
O&M Storage/Bldg	47691	22797	22797	24894	10895	47691	33692	VUF 1
O&M Access Drives	34952	16731	14880	18221	17571	34952	32451	VUF 2

Substation Area Treatment Calculations

Total Impervious area	20104 sf
Total Treated Impervious area	20104 sf
<u>Impervious Area Treatment Percentage</u>	<u>100.00</u> %
Total Developed Area	37890 sf
Total Treated Developed Area	30365 sf
<u>Developed Area Treatment Percentage</u>	<u>80.14</u> %

DRD Area Treatment Calculations

Total Impervious area	52401 sf
Total Treated Impervious area	51623 sf
<u>Impervious Area Treatment Percentage</u>	<u>98.52</u> %
Total Developed Area	89981 sf
Total Treated Developed Area	76572 sf
<u>Developed Area Treatment Percentage</u>	<u>85.10</u> %

O&M Area Treatment Calculations

Total Impervious area	39528 sf
Total Treated Impervious area	37677 sf
<u>Impervious Area Treatment Percentage</u>	<u>95.32</u> %
Total Developed Area	82643 sf
Total Treated Developed Area	66143 sf
<u>Developed Area Treatment Percentage</u>	<u>80.03</u> %

1. This does not include the area within the Mayfield Pond Watershed. See phosphorus calculations in Appendix 12-3

**Bingham Wind Project
O+M Building
Vegetated Underdrain Filter System #1 - Water Quality Volume Sizing**

Water Quality Volume (VUF #1)

Description	Total Area	Impervious Area	Impervious Area	WQ Impervious Factor	WQ Impervious Volume	WQ Landscape Area	Landscape Area	WQ Landscape Factor	WQ Landscape Volume	Total WQ Volume
Storage/Building	22,797 ft ²	22,797 ft ²	0.523 Acres	1	1,899.75 ft ³	0 ft ²	0.000 Acres	0.4	000.00 ft ³	1,899.75 ft ³
LS Area	10,895 ft ²		0.000 Acres	1	000.00 ft ³	10,895 ft ²	0.250 Acres	0.4	363.17 ft ³	363.17 ft ³
TOTAL	33,692 ft²	22,797 ft²	0.523 Acres		1,899.75 ft³	10,895 ft²	0.250 Acres		363.17 ft³	2,262.92 ft³

Total WQ Volume Due to Impervious Surface: 1,899.75 ft³

Total WQ Volume Due to Landscape Surface: 363.17 ft³

Required Treatment Volume: 2,262.92 ft³

Bottom of Basin 1317.00
Max WQ Depth 1318.50
Depth of Underdrain Below Bottom 2.67

Invert of Underdrain Filter 1314.33

Water Quality Volume Provided 3,019.50 ft³

5% of tributary Impervious Area 1,140 ft²
2% of tributary landscape Area 218 ft²

Filter Area Required 1,358 ft²

Bottom Surface Area Provided 1,414 ft²

Elevation	Surface Area	Average Stage Area	Stage Volume	Cumulative Volume
1317	1,414 ft ²			000 ft ³
		1,811 ft ²	1,811 ft ³	
1318	2,208 ft ²			1,811 ft ³
		2,417 ft ²	1,209 ft ³	
1318.5	2,626 ft ²			3,020 ft ³
Water Quality Volume Provided (at Elevation 1318.50):				3,020 ft ³

Orifice Eqn: $t = (2A / (Ca^2g)) (h_1^{3/2} - h_2^{3/2})$

Discharge Coefficient C = 0.62
Orifice Size = 0.67 in
Orifice Size = 0.06 ft
Cross sectional Area of Orifice (a) = 0.002 ft²
Vessel (A) = 1,414 ft²
Orifice Centerline Elevation = 1314.58

t (sec)	Stage Elevation	Starting Water Level Above	Ending Water Level Above	Pond Area	t (hrs)
0.00 sec	1317.00	3.42 ft	3.42 ft	1,414 ft ²	0.00 hrs
47334 sec	1318.00	3.92 ft	3.42 ft	2,208 ft ²	13.1 hrs
52805.7 sec	1318.50	4.42 ft	3.92 ft	2,626 ft ²	14.67 hrs
Total Drawdown Time					27.8 hrs

**Bingham Wind Project
O+M Building
Vegetated Underdrain Filter System #2 - Water Quality Volume Sizing**

Water Quality Volume (VUF #2)

Description	Total Area	Impervious Area	Impervious Area	WQ Impervious Factor	WQ Impervious Volume	WQ Landscape Area	Landscape Area	WQ Landscape Factor	WQ Landscape Volume	Total WQ Volume
Access Drives	14,880 ft ²	14,880 ft ²	0.342 Acres	1	1,240.00 ft ³	0 ft ²	0.000 Acres	0.4	000.00 ft ³	1,240.00 ft ³
LS Area	17,390 ft ²	0 ft ²	0.000 Acres	1	000.00 ft ³	17,390 ft ²	0.399 Acres	0.4	579.67 ft ³	579.67 ft ³
TOTAL	32,270 ft²	14,880 ft²	0.342 Acres		1,240.00 ft³	17,390 ft²	0.399 Acres		579.67 ft³	1,819.67 ft³

Total WQ Volume Due to Impervious Surface: 1,240.00 ft³

Total WQ Volume Due to Landscape Surface: 579.67 ft³

Required Treatment Volume: 1,819.67 ft³

Bottom of Basin 1312.00
Max WQ Depth 1313.50
Depth of Underdrain Below Bottom 2.67

Invert of Underdrain Filter 1309.33

Water Quality Volume Provided 2,796.75 ft³

5% of tributary Impervious Area 744 ft²
2% of tributary landscape Area 348 ft²

Filter Area Required 1,092 ft²

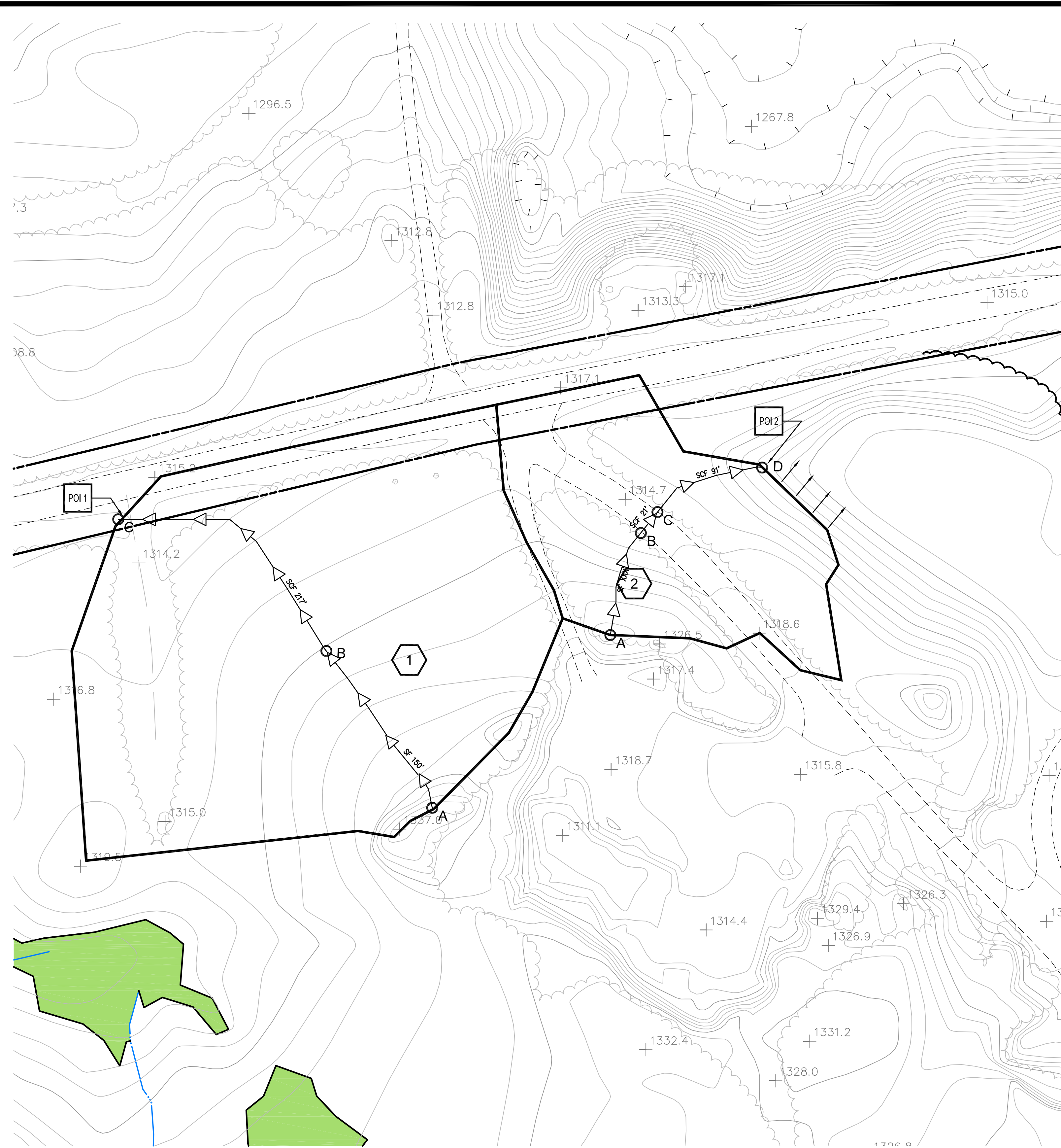
Bottom Surface Area Provided 1,306 ft²

Elevation	Surface Area	Average Stage Area	Stage Volume	Cumulative Volume
1312	1,306 ft ²			000 ft ³
		1,676 ft ²	1,676 ft ³	
1313	2,046 ft ²			1,676 ft ³
		2,242 ft ²	1,121 ft ³	
1313.5	2,437 ft ²			2,797 ft ³
Water Quality Volume Provided (at Elevation 1313.50):				2,797 ft ³

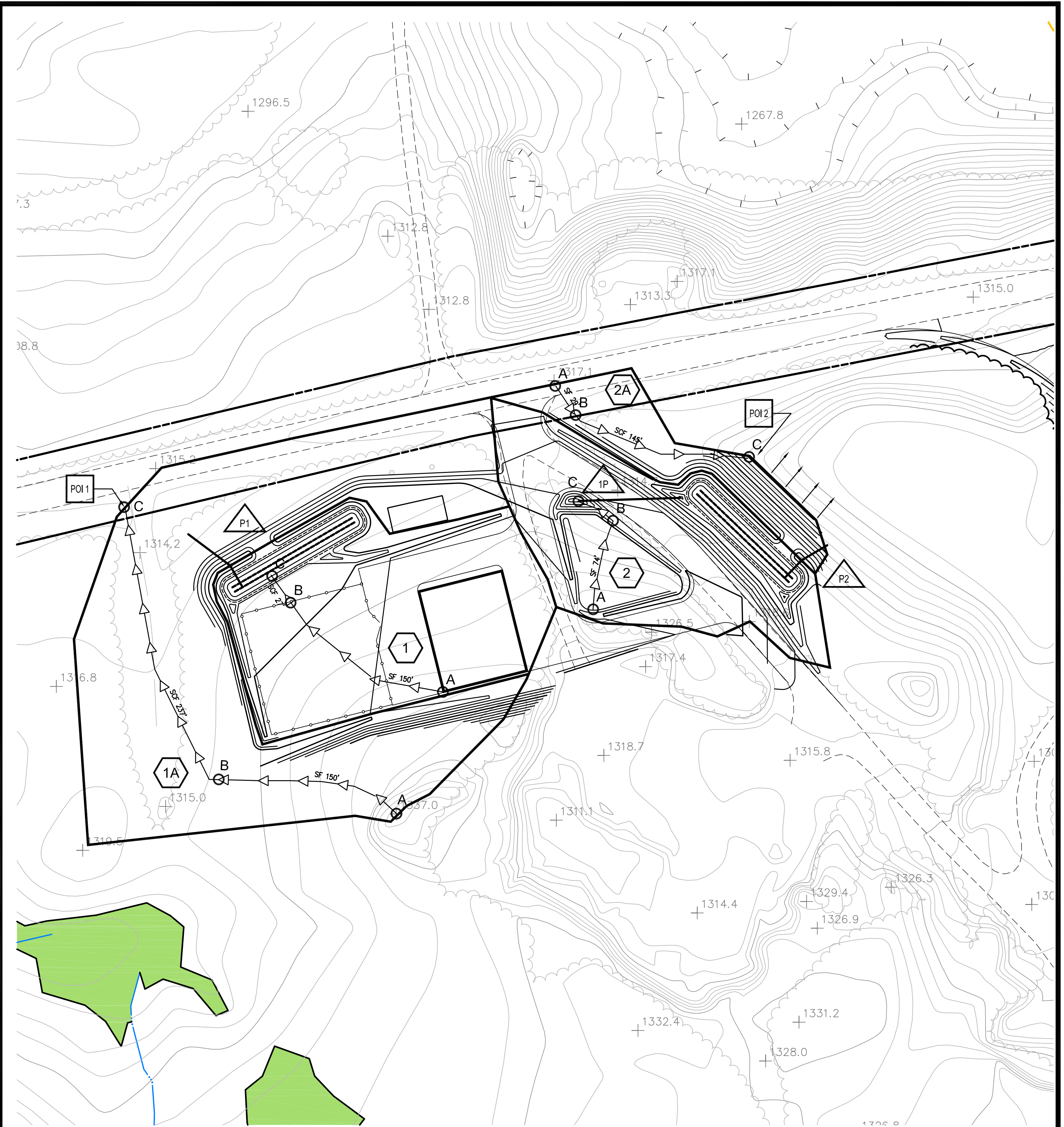
Orifice Eqn: $t = (2A / (Ca^2g)) (h_1^{1/2} - h_2^{1/2})$

Discharge Coefficient C = 0.62
Orifice Size = 0.67 in
Orifice Size = 0.06 ft
Cross sectional Area of Orifice (a) = 0.002 ft²
Vessel (A) = 1,306 ft²
Orifice Centerline Elevation = 1309.58

t (sec)	Stage Elevation	Starting Water Level Above	Ending Water Level Above	Pond Area	t (hrs)
0.00 sec	1312.00	3.42 ft	3.42 ft	1,306 ft ²	0.00 hrs
43861 sec	1313.00	3.92 ft	3.42 ft	2,046 ft ²	12.2 hrs
49005.1 sec	1313.50	4.42 ft	3.92 ft	2,437 ft ²	13.61 hrs
Total Drawdown Time					25.8 hrs

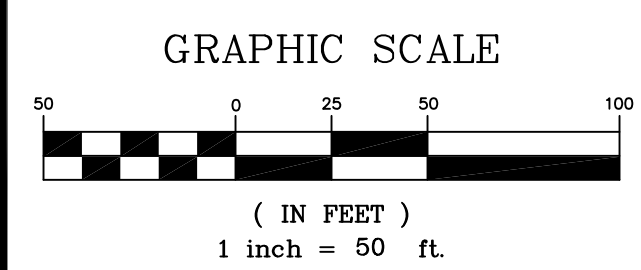


O&M SITE PRE DEVELOPMENT WATERSHED MAP



O&M SITE POST DEVELOPMENT WATERSHED MAP

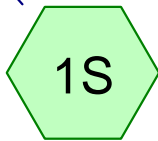
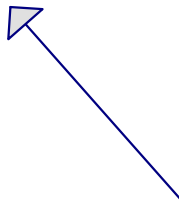
WATERSHED LEGEND			
	WATERSHED BOUNDARY	SF	SHEET FLOW
	WATERSHED FLOW PATH	SCF	SHALLOW CONCENTRATED FLOW
	SUBCATCHMENT	PF	PIPE FLOW
	REACH	CF	CHANNEL FLOW
	POND		



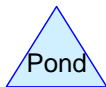
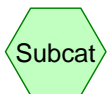
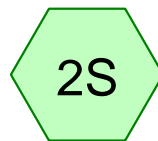
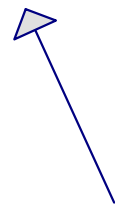
REV	DATE	DESCRIPTION	P.E.

PROJECT	BINGHAM WIND PROJECT	DeLUCA-HOFFMAN ASSOCIATES, INC. 778 MAIN STREET, SUITE 8 SOUTH PORTLAND, ME 04106 207.775.1121 WWW.DELUCAHOFFMAN.COM
SHEET TITLE	O&M WATERSHED MAP	
CLIENT	BLUE SKY WEST LLC	DRAWN: SJB DATE: APRIL 2013 DESIGNED: SJB SCALE: 1"=50' CHECKED: SJB JOB NO. 3048 FILE NAME: 3048-OM WSHED SHEET FIGURE 2

POI 1



POI 2



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Page 2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
3.022	36	Woods, Fair, HSG A (1S,2S)
0.183	76	Gravel roads, HSG A (2S)
0.085	98	Paved parking & roofs (1S,2S)
3.289		TOTAL AREA

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Page 3

Soil Listing (all nodes)

Area (acres)	Soil Goup	Subcatchment Numbers
3.204	HSG A	1S, 2S
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.085	Other	1S, 2S
3.289		TOTAL AREA

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O&M SITE PRE DEVELOPMENT WATERSHED

Type III 24-hr 2 YEAR Rainfall=2.50"

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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

Subcatchment 1S: Runoff Area=103,324 sf 2.59% Impervious Runoff Depth=0.00"
Flow Length=367' Tc=21.5 min CN=38 Runoff=0.00 cfs 0.000 af

Subcatchment 2S: Runoff Area=39,949 sf 2.56% Impervious Runoff Depth>0.00"
Flow Length=197' Tc=11.2 min CN=46 Runoff=0.00 cfs 0.000 af

Reach POI 1: Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach POI 2: Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 3.289 ac Runoff Volume = 0.000 af Average Runoff Depth = 0.00"
97.42% Pervious = 3.204 ac 2.58% Impervious = 0.085 ac

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Page 5

Summary for Subcatchment 1S:

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YEAR Rainfall=2.50"

Area (sf)	CN	Description
2,678	98	Paved parking & roofs
100,646	36	Woods, Fair, HSG A
103,324	38	Weighted Average
100,646		Pervious Area
2,678		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.2	150	0.1070	0.15		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
4.3	217	0.0280	0.84		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
21.5	367	Total			

Summary for Subcatchment 2S:

Runoff = 0.00 cfs @ 20.00 hrs, Volume= 0.000 af, Depth> 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YEAR Rainfall=2.50"

Area (sf)	CN	Description
1,024	98	Paved parking & roofs
7,950	76	Gravel roads, HSG A
30,975	36	Woods, Fair, HSG A
39,949	46	Weighted Average
38,925		Pervious Area
1,024		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.1	85	0.1290	0.14		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
0.2	21	0.0200	2.28		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
0.9	91	0.1090	1.65		Shallow Concentrated Flow, C-D Woodland Kv= 5.0 fps
11.2	197	Total			

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O&M SITE PRE DEVELOPMENT WATERSHED

Type III 24-hr 2 YEAR Rainfall=2.50"

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Page 6

Summary for Reach POI 1:

Inflow Area = 2.372 ac, 2.59% Impervious, Inflow Depth = 0.00" for 2 YEAR event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 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 POI 2:

Inflow Area = 0.917 ac, 2.56% Impervious, Inflow Depth > 0.00" for 2 YEAR event
Inflow = 0.00 cfs @ 20.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 20.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

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

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O&M SITE PRE DEVELOPMENT WATERSHED
Type III 24-hr 10 YEAR Rainfall=3.80"

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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

Subcatchment 1S: Runoff Area=103,324 sf 2.59% Impervious Runoff Depth>0.01"
Flow Length=367' Tc=21.5 min CN=38 Runoff=0.01 cfs 0.002 af

Subcatchment 2S: Runoff Area=39,949 sf 2.56% Impervious Runoff Depth>0.13"
Flow Length=197' Tc=11.2 min CN=46 Runoff=0.03 cfs 0.010 af

Reach POI 1: Inflow=0.01 cfs 0.002 af
Outflow=0.01 cfs 0.002 af

Reach POI 2: Inflow=0.03 cfs 0.010 af
Outflow=0.03 cfs 0.010 af

Total Runoff Area = 3.289 ac Runoff Volume = 0.011 af Average Runoff Depth = 0.04"
97.42% Pervious = 3.204 ac 2.58% Impervious = 0.085 ac

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Summary for Subcatchment 1S:

Runoff = 0.01 cfs @ 20.00 hrs, Volume= 0.002 af, Depth> 0.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=3.80"

Area (sf)	CN	Description
2,678	98	Paved parking & roofs
100,646	36	Woods, Fair, HSG A
103,324	38	Weighted Average
100,646		Pervious Area
2,678		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.2	150	0.1070	0.15		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
4.3	217	0.0280	0.84		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
21.5	367	Total			

Summary for Subcatchment 2S:

Runoff = 0.03 cfs @ 12.55 hrs, Volume= 0.010 af, Depth> 0.13"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=3.80"

Area (sf)	CN	Description
1,024	98	Paved parking & roofs
7,950	76	Gravel roads, HSG A
30,975	36	Woods, Fair, HSG A
39,949	46	Weighted Average
38,925		Pervious Area
1,024		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.1	85	0.1290	0.14		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
0.2	21	0.0200	2.28		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
0.9	91	0.1090	1.65		Shallow Concentrated Flow, C-D Woodland Kv= 5.0 fps
11.2	197	Total			

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Type III 24-hr 10 YEAR Rainfall=3.80"

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Summary for Reach POI 1:

Inflow Area = 2.372 ac, 2.59% Impervious, Inflow Depth > 0.01" for 10 YEAR event
Inflow = 0.01 cfs @ 20.00 hrs, Volume= 0.002 af
Outflow = 0.01 cfs @ 20.00 hrs, Volume= 0.002 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 POI 2:

Inflow Area = 0.917 ac, 2.56% Impervious, Inflow Depth > 0.13" for 10 YEAR event
Inflow = 0.03 cfs @ 12.55 hrs, Volume= 0.010 af
Outflow = 0.03 cfs @ 12.55 hrs, Volume= 0.010 af, Atten= 0%, Lag= 0.0 min

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

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O&M SITE PRE DEVELOPMENT WATERSHED

Type III 24-hr 25 YEAR Rainfall=4.40"

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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

Subcatchment 1S: Runoff Area=103,324 sf 2.59% Impervious Runoff Depth>0.05"
Flow Length=367' Tc=21.5 min CN=38 Runoff=0.02 cfs 0.010 af

Subcatchment 2S: Runoff Area=39,949 sf 2.56% Impervious Runoff Depth>0.25"
Flow Length=197' Tc=11.2 min CN=46 Runoff=0.10 cfs 0.019 af

Reach POI 1: Inflow=0.02 cfs 0.010 af
Outflow=0.02 cfs 0.010 af

Reach POI 2: Inflow=0.10 cfs 0.019 af
Outflow=0.10 cfs 0.019 af

Total Runoff Area = 3.289 ac Runoff Volume = 0.029 af Average Runoff Depth = 0.11"
97.42% Pervious = 3.204 ac 2.58% Impervious = 0.085 ac

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Summary for Subcatchment 1S:

Runoff = 0.02 cfs @ 15.38 hrs, Volume= 0.010 af, Depth> 0.05"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YEAR Rainfall=4.40"

Area (sf)	CN	Description
2,678	98	Paved parking & roofs
100,646	36	Woods, Fair, HSG A
103,324	38	Weighted Average
100,646		Pervious Area
2,678		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.2	150	0.1070	0.15		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
4.3	217	0.0280	0.84		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
21.5	367	Total			

Summary for Subcatchment 2S:

Runoff = 0.10 cfs @ 12.44 hrs, Volume= 0.019 af, Depth> 0.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YEAR Rainfall=4.40"

Area (sf)	CN	Description
1,024	98	Paved parking & roofs
7,950	76	Gravel roads, HSG A
30,975	36	Woods, Fair, HSG A
39,949	46	Weighted Average
38,925		Pervious Area
1,024		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.1	85	0.1290	0.14		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
0.2	21	0.0200	2.28		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
0.9	91	0.1090	1.65		Shallow Concentrated Flow, C-D Woodland Kv= 5.0 fps
11.2	197	Total			

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O&M SITE PRE DEVELOPMENT WATERSHED
Type III 24-hr 25 YEAR Rainfall=4.40"
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Summary for Reach POI 1:

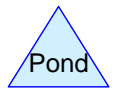
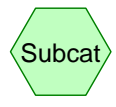
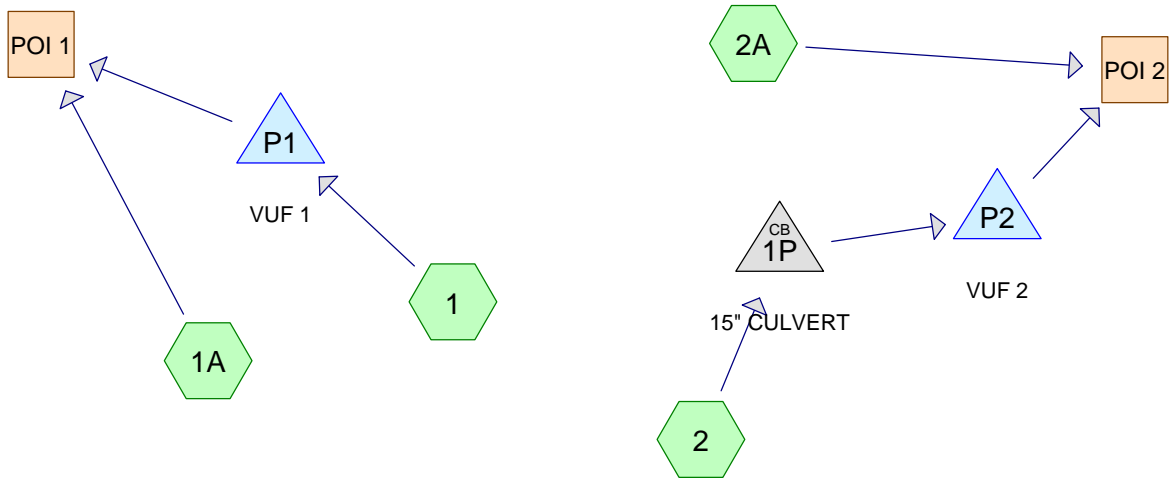
Inflow Area = 2.372 ac, 2.59% Impervious, Inflow Depth > 0.05" for 25 YEAR event
Inflow = 0.02 cfs @ 15.38 hrs, Volume= 0.010 af
Outflow = 0.02 cfs @ 15.38 hrs, Volume= 0.010 af, Atten= 0%, Lag= 0.0 min

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

Summary for Reach POI 2:

Inflow Area = 0.917 ac, 2.56% Impervious, Inflow Depth > 0.25" for 25 YEAR event
Inflow = 0.10 cfs @ 12.44 hrs, Volume= 0.019 af
Outflow = 0.10 cfs @ 12.44 hrs, Volume= 0.019 af, Atten= 0%, Lag= 0.0 min

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



Drainage Diagram for 3048 OM BLDG POST
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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.177	36	Woods, Fair, HSG A (1A)
1.189	39	>75% Grass cover, Good, HSG A (1,1A,2,2A)
0.703	76	Gravel roads, HSG A (1,2)
0.220	98	Paved parking & roofs (1,1A,2A)
3.289		TOTAL AREA

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Soil Listing (all nodes)

Area (acres)	Soil Goup	Subcatchment Numbers
3.069	HSG A	1, 1A, 2, 2A
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.220	Other	1, 1A, 2A
3.289		TOTAL AREA

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O&M SITE POST DEVELOPMENT WATERSHED

Type III 24-hr 2 YEAR Rainfall=2.50"

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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

Subcatchment 1: Runoff Area=36,768 sf 15.99% Impervious Runoff Depth>0.34"
Flow Length=177' Slope=0.0200 '/' Tc=2.4 min CN=68 Runoff=0.30 cfs 0.024 af

Subcatchment 1A: Runoff Area=66,557 sf 4.02% Impervious Runoff Depth=0.00"
Flow Length=387' Tc=20.7 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment 2: Runoff Area=29,801 sf 0.00% Impervious Runoff Depth>0.04"
Flow Length=107' Tc=4.0 min CN=53 Runoff=0.01 cfs 0.002 af

Subcatchment 2A: Runoff Area=10,148 sf 10.09% Impervious Runoff Depth=0.00"
Flow Length=174' Tc=2.6 min CN=45 Runoff=0.00 cfs 0.000 af

Reach POI 1: Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach POI 2: Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Pond 1P: 15" CULVERT Peak Elev=1,315.04' Inflow=0.01 cfs 0.002 af
15.0" x 81.0' Culvert Outflow=0.01 cfs 0.002 af

Pond P1: VUF 1 Peak Elev=1,317.63' Storage=1,047 cf Inflow=0.30 cfs 0.024 af
Outflow=0.00 cfs 0.000 af

Pond P2: VUF 2 Peak Elev=1,312.07' Storage=100 cf Inflow=0.01 cfs 0.002 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 3.289 ac Runoff Volume = 0.026 af Average Runoff Depth = 0.10"
93.31% Pervious = 3.069 ac 6.69% Impervious = 0.220 ac

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Type III 24-hr 2 YEAR Rainfall=2.50"

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Summary for Subcatchment 1:

Runoff = 0.30 cfs @ 12.07 hrs, Volume= 0.024 af, Depth> 0.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YEAR Rainfall=2.50"

Area (sf)	CN	Description
5,880	98	Paved parking & roofs
19,652	76	Gravel roads, HSG A
11,236	39	>75% Grass cover, Good, HSG A
36,768	68	Weighted Average
30,888		Pervious Area
5,880		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	150	0.0200	1.32		Sheet Flow, A-B Smooth surfaces n= 0.011 P2= 2.50"
0.5	27	0.0200	0.99		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
2.4	177	Total			

Summary for Subcatchment 1A:

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YEAR Rainfall=2.50"

Area (sf)	CN	Description
12,600	39	>75% Grass cover, Good, HSG A
2,678	98	Paved parking & roofs
51,279	36	Woods, Fair, HSG A
66,557	39	Weighted Average
63,879		Pervious Area
2,678		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.4	150	0.1200	0.15		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
4.3	237	0.0170	0.91		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
20.7	387	Total			

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Type III 24-hr 2 YEAR Rainfall=2.50"

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Summary for Subcatchment 2:

Runoff = 0.01 cfs @ 14.80 hrs, Volume= 0.002 af, Depth= 0.04"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2 YEAR Rainfall=2.50"

Area (sf)	CN	Description
10,962	76	Gravel roads, HSG A
18,839	39	>75% Grass cover, Good, HSG A
29,801	53	Weighted Average
29,801		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	74	0.1600	0.33		Sheet Flow, A-B Grass: Short n= 0.150 P2= 2.50"
0.2	33	0.2000	3.13		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
4.0	107	Total			

Summary for Subcatchment 2A:

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2 YEAR Rainfall=2.50"

Area (sf)	CN	Description
1,024	98	Paved parking & roofs
9,124	39	>75% Grass cover, Good, HSG A
10,148	45	Weighted Average
9,124		Pervious Area
1,024		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	29	0.0200	0.95		Sheet Flow, A-B Smooth surfaces n= 0.011 P2= 2.50"
2.1	145	0.0550	1.17		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
2.6	174	Total			

Summary for Reach POI 1:

Inflow Area = 2.372 ac, 8.28% Impervious, Inflow Depth = 0.00" for 2 YEAR event
 Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
 Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

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 Type III 24-hr 2 YEAR Rainfall=2.50"
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Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach POI 2:

Inflow Area = 0.917 ac, 2.56% Impervious, Inflow Depth = 0.00" for 2 YEAR event
 Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
 Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 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 1P: 15" CULVERT

Inflow Area = 0.684 ac, 0.00% Impervious, Inflow Depth > 0.04" for 2 YEAR event
 Inflow = 0.01 cfs @ 14.80 hrs, Volume= 0.002 af
 Outflow = 0.01 cfs @ 14.80 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min
 Primary = 0.01 cfs @ 14.80 hrs, Volume= 0.002 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 1,315.04' @ 14.80 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	1,315.00'	15.0" x 81.0' long Culvert CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 1,312.00' S= 0.0370 '/' Cc= 0.900 n= 0.012

Primary OutFlow Max=0.00 cfs @ 14.80 hrs HW=1,315.04' (Free Discharge)
 ↑**1=Culvert** (Inlet Controls 0.00 cfs @ 0.50 fps)

Summary for Pond P1: VUF 1

Inflow Area = 0.844 ac, 15.99% Impervious, Inflow Depth > 0.34" for 2 YEAR event
 Inflow = 0.30 cfs @ 12.07 hrs, Volume= 0.024 af
 Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 1,317.63' @ 20.00 hrs Surf.Area= 1,897 sf Storage= 1,047 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description			
#1	1,317.00'	7,927 cf	Custom Stage Data (Irregular) Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
1,317.00	1,414	255.0	0	0	1,414	
1,318.00	2,208	274.0	1,796	1,796	2,256	
1,319.00	3,063	293.0	2,624	4,420	3,159	
1,320.00	3,971	312.0	3,507	7,927	4,123	

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Type III 24-hr 2 YEAR Rainfall=2.50"

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Device	Routing	Invert	Outlet Devices
#1	Primary	1,318.50'	10.0' long x 6.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=1,317.00' (Free Discharge)
 ↳1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond P2: VUF 2

Inflow Area = 0.684 ac, 0.00% Impervious, Inflow Depth > 0.04" for 2 YEAR event
 Inflow = 0.01 cfs @ 14.80 hrs, Volume= 0.002 af
 Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 1,312.07' @ 20.00 hrs Surf.Area= 1,356 sf Storage= 100 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description		
#1	1,312.00'	8,052 cf	Custom Stage Data (Irregular) Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1,312.00	1,306	237.0	0	0	1,306
1,313.00	2,046	256.0	1,662	1,662	2,091
1,314.00	3,206	339.0	2,604	4,267	6,032
1,315.00	4,396	370.0	3,785	8,052	7,817

Device	Routing	Invert	Outlet Devices
#1	Primary	1,313.50'	10.0' long x 6.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=1,312.00' (Free Discharge)
 ↳1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

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O&M SITE POST DEVELOPMENT WATERSHED

Type III 24-hr 10 YEAR Rainfall=3.80"

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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

Subcatchment 1: Runoff Area=36,768 sf 15.99% Impervious Runoff Depth>0.98"
Flow Length=177' Slope=0.0200 '/' Tc=2.4 min CN=68 Runoff=1.09 cfs 0.069 af

Subcatchment 1A: Runoff Area=66,557 sf 4.02% Impervious Runoff Depth>0.02"
Flow Length=387' Tc=20.7 min CN=39 Runoff=0.00 cfs 0.002 af

Subcatchment 2: Runoff Area=29,801 sf 0.00% Impervious Runoff Depth>0.32"
Flow Length=107' Tc=4.0 min CN=53 Runoff=0.13 cfs 0.018 af

Subcatchment 2A: Runoff Area=10,148 sf 10.09% Impervious Runoff Depth>0.11"
Flow Length=174' Tc=2.6 min CN=45 Runoff=0.00 cfs 0.002 af

Reach POI 1: Inflow=0.01 cfs 0.002 af
Outflow=0.01 cfs 0.002 af

Reach POI 2: Inflow=0.00 cfs 0.002 af
Outflow=0.00 cfs 0.002 af

Pond 1P: 15" CULVERT Peak Elev=1,315.18' Inflow=0.13 cfs 0.018 af
15.0" x 81.0' Culvert Outflow=0.13 cfs 0.018 af

Pond P1: VUF 1 Peak Elev=1,318.50' Storage=3,004 cf Inflow=1.09 cfs 0.069 af
Outflow=0.00 cfs 0.000 af

Pond P2: VUF 2 Peak Elev=1,312.54' Storage=801 cf Inflow=0.13 cfs 0.018 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 3.289 ac Runoff Volume = 0.091 af Average Runoff Depth = 0.33"
93.31% Pervious = 3.069 ac 6.69% Impervious = 0.220 ac

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Summary for Subcatchment 1:

Runoff = 1.09 cfs @ 12.05 hrs, Volume= 0.069 af, Depth> 0.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=3.80"

Area (sf)	CN	Description
5,880	98	Paved parking & roofs
19,652	76	Gravel roads, HSG A
11,236	39	>75% Grass cover, Good, HSG A
36,768	68	Weighted Average
30,888		Pervious Area
5,880		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	150	0.0200	1.32		Sheet Flow, A-B Smooth surfaces n= 0.011 P2= 2.50"
0.5	27	0.0200	0.99		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
2.4	177	Total			

Summary for Subcatchment 1A:

Runoff = 0.00 cfs @ 17.31 hrs, Volume= 0.002 af, Depth> 0.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=3.80"

Area (sf)	CN	Description
12,600	39	>75% Grass cover, Good, HSG A
2,678	98	Paved parking & roofs
51,279	36	Woods, Fair, HSG A
66,557	39	Weighted Average
63,879		Pervious Area
2,678		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.4	150	0.1200	0.15		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
4.3	237	0.0170	0.91		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
20.7	387	Total			

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Type III 24-hr 10 YEAR Rainfall=3.80"

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Summary for Subcatchment 2:

Runoff = 0.13 cfs @ 12.13 hrs, Volume= 0.018 af, Depth> 0.32"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=3.80"

Area (sf)	CN	Description
10,962	76	Gravel roads, HSG A
18,839	39	>75% Grass cover, Good, HSG A
29,801	53	Weighted Average
29,801		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	74	0.1600	0.33		Sheet Flow, A-B Grass: Short n= 0.150 P2= 2.50"
0.2	33	0.2000	3.13		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
4.0	107	Total			

Summary for Subcatchment 2A:

Runoff = 0.00 cfs @ 12.45 hrs, Volume= 0.002 af, Depth> 0.11"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=3.80"

Area (sf)	CN	Description
1,024	98	Paved parking & roofs
9,124	39	>75% Grass cover, Good, HSG A
10,148	45	Weighted Average
9,124		Pervious Area
1,024		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	29	0.0200	0.95		Sheet Flow, A-B Smooth surfaces n= 0.011 P2= 2.50"
2.1	145	0.0550	1.17		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
2.6	174	Total			

Summary for Reach POI 1:Inflow Area = 2.372 ac, 8.28% Impervious, Inflow Depth > 0.01" for 10 YEAR event
Inflow = 0.01 cfs @ 20.00 hrs, Volume= 0.002 af
Outflow = 0.01 cfs @ 20.00 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min

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Type III 24-hr 10 YEAR Rainfall=3.80"
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Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach POI 2:

Inflow Area = 0.917 ac, 2.56% Impervious, Inflow Depth > 0.03" for 10 YEAR event
Inflow = 0.00 cfs @ 12.45 hrs, Volume= 0.002 af
Outflow = 0.00 cfs @ 12.45 hrs, Volume= 0.002 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 1P: 15" CULVERT

Inflow Area = 0.684 ac, 0.00% Impervious, Inflow Depth > 0.32" for 10 YEAR event
Inflow = 0.13 cfs @ 12.13 hrs, Volume= 0.018 af
Outflow = 0.13 cfs @ 12.13 hrs, Volume= 0.018 af, Atten= 0%, Lag= 0.0 min
Primary = 0.13 cfs @ 12.13 hrs, Volume= 0.018 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 1,315.18' @ 12.15 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	1,315.00'	15.0" x 81.0' long Culvert CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 1,312.00' S= 0.0370 '/' Cc= 0.900 n= 0.012

Primary OutFlow Max=0.13 cfs @ 12.13 hrs HW=1,315.18' (Free Discharge)
↑**1=Culvert** (Inlet Controls 0.13 cfs @ 1.15 fps)

Summary for Pond P1: VUF 1

Inflow Area = 0.844 ac, 15.99% Impervious, Inflow Depth > 0.98" for 10 YEAR event
Inflow = 1.09 cfs @ 12.05 hrs, Volume= 0.069 af
Outflow = 0.00 cfs @ 20.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 476.9 min
Primary = 0.00 cfs @ 20.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 1,318.50' @ 20.00 hrs Surf.Area= 2,619 sf Storage= 3,004 cf

Plug-Flow detention time= 534.4 min calculated for 0.000 af (0% of inflow)
Center-of-Mass det. time= 378.5 min (1,200.0 - 821.5)

Volume	Invert	Avail.Storage	Storage Description			
#1	1,317.00'	7,927 cf	Custom Stage Data (Irregular) Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
1,317.00	1,414	255.0	0	0	1,414	
1,318.00	2,208	274.0	1,796	1,796	2,256	
1,319.00	3,063	293.0	2,624	4,420	3,159	
1,320.00	3,971	312.0	3,507	7,927	4,123	

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Type III 24-hr 10 YEAR Rainfall=3.80"

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Device	Routing	Invert	Outlet Devices
#1	Primary	1,318.50'	10.0' long x 6.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=0.00 cfs @ 20.00 hrs HW=1,318.50' (Free Discharge)
 ↳1=Broad-Crested Rectangular Weir (Weir Controls 0.00 cfs @ 0.07 fps)

Summary for Pond P2: VUF 2

Inflow Area = 0.684 ac, 0.00% Impervious, Inflow Depth > 0.32" for 10 YEAR event
 Inflow = 0.13 cfs @ 12.13 hrs, Volume= 0.018 af
 Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 1,312.54' @ 20.00 hrs Surf.Area= 1,683 sf Storage= 801 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description		
#1	1,312.00'	8,052 cf	Custom Stage Data (Irregular) Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1,312.00	1,306	237.0	0	0	1,306
1,313.00	2,046	256.0	1,662	1,662	2,091
1,314.00	3,206	339.0	2,604	4,267	6,032
1,315.00	4,396	370.0	3,785	8,052	7,817

Device	Routing	Invert	Outlet Devices
#1	Primary	1,313.50'	10.0' long x 6.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=1,312.00' (Free Discharge)
 ↳1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

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O&M SITE POST DEVELOPMENT WATERSHED

Type III 24-hr 25 YEAR Rainfall=4.40"

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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

Subcatchment 1: Runoff Area=36,768 sf 15.99% Impervious Runoff Depth>1.34"
Flow Length=177' Slope=0.0200 '/' Tc=2.4 min CN=68 Runoff=1.53 cfs 0.094 af

Subcatchment 1A: Runoff Area=66,557 sf 4.02% Impervious Runoff Depth>0.07"
Flow Length=387' Tc=20.7 min CN=39 Runoff=0.02 cfs 0.009 af

Subcatchment 2: Runoff Area=29,801 sf 0.00% Impervious Runoff Depth>0.52"
Flow Length=107' Tc=4.0 min CN=53 Runoff=0.31 cfs 0.030 af

Subcatchment 2A: Runoff Area=10,148 sf 10.09% Impervious Runoff Depth>0.22"
Flow Length=174' Tc=2.6 min CN=45 Runoff=0.02 cfs 0.004 af

Reach POI 1: Inflow=0.11 cfs 0.034 af
Outflow=0.11 cfs 0.034 af

Reach POI 2: Inflow=0.02 cfs 0.004 af
Outflow=0.02 cfs 0.004 af

Pond 1P: 15" CULVERT Peak Elev=1,315.29' Inflow=0.31 cfs 0.030 af
15.0" x 81.0' Culvert Outflow=0.31 cfs 0.030 af

Pond P1: VUF 1 Peak Elev=1,318.52' Storage=3,058 cf Inflow=1.53 cfs 0.094 af
Outflow=0.09 cfs 0.025 af

Pond P2: VUF 2 Peak Elev=1,312.82' Storage=1,301 cf Inflow=0.31 cfs 0.030 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 3.289 ac Runoff Volume = 0.137 af Average Runoff Depth = 0.50"
93.31% Pervious = 3.069 ac 6.69% Impervious = 0.220 ac

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Type III 24-hr 25 YEAR Rainfall=4.40"

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Summary for Subcatchment 1:

Runoff = 1.53 cfs @ 12.05 hrs, Volume= 0.094 af, Depth> 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YEAR Rainfall=4.40"

Area (sf)	CN	Description
5,880	98	Paved parking & roofs
19,652	76	Gravel roads, HSG A
11,236	39	>75% Grass cover, Good, HSG A
36,768	68	Weighted Average
30,888		Pervious Area
5,880		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	150	0.0200	1.32		Sheet Flow, A-B Smooth surfaces n= 0.011 P2= 2.50"
0.5	27	0.0200	0.99		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
2.4	177	Total			

Summary for Subcatchment 1A:

Runoff = 0.02 cfs @ 15.08 hrs, Volume= 0.009 af, Depth> 0.07"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YEAR Rainfall=4.40"

Area (sf)	CN	Description
12,600	39	>75% Grass cover, Good, HSG A
2,678	98	Paved parking & roofs
51,279	36	Woods, Fair, HSG A
66,557	39	Weighted Average
63,879		Pervious Area
2,678		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.4	150	0.1200	0.15		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 2.50"
4.3	237	0.0170	0.91		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
20.7	387	Total			

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Type III 24-hr 25 YEAR Rainfall=4.40"

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Summary for Subcatchment 2:

Runoff = 0.31 cfs @ 12.10 hrs, Volume= 0.030 af, Depth> 0.52"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YEAR Rainfall=4.40"

Area (sf)	CN	Description
10,962	76	Gravel roads, HSG A
18,839	39	>75% Grass cover, Good, HSG A
29,801	53	Weighted Average
29,801		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	74	0.1600	0.33		Sheet Flow, A-B Grass: Short n= 0.150 P2= 2.50"
0.2	33	0.2000	3.13		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
4.0	107	Total			

Summary for Subcatchment 2A:

Runoff = 0.02 cfs @ 12.33 hrs, Volume= 0.004 af, Depth> 0.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YEAR Rainfall=4.40"

Area (sf)	CN	Description
1,024	98	Paved parking & roofs
9,124	39	>75% Grass cover, Good, HSG A
10,148	45	Weighted Average
9,124		Pervious Area
1,024		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	29	0.0200	0.95		Sheet Flow, A-B Smooth surfaces n= 0.011 P2= 2.50"
2.1	145	0.0550	1.17		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
2.6	174	Total			

Summary for Reach POI 1:Inflow Area = 2.372 ac, 8.28% Impervious, Inflow Depth > 0.17" for 25 YEAR event
Inflow = 0.11 cfs @ 14.93 hrs, Volume= 0.034 af
Outflow = 0.11 cfs @ 14.93 hrs, Volume= 0.034 af, Atten= 0%, Lag= 0.0 min

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Type III 24-hr 25 YEAR Rainfall=4.40"
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Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach POI 2:

Inflow Area = 0.917 ac, 2.56% Impervious, Inflow Depth > 0.06" for 25 YEAR event
 Inflow = 0.02 cfs @ 12.33 hrs, Volume= 0.004 af
 Outflow = 0.02 cfs @ 12.33 hrs, Volume= 0.004 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 1P: 15" CULVERT

Inflow Area = 0.684 ac, 0.00% Impervious, Inflow Depth > 0.52" for 25 YEAR event
 Inflow = 0.31 cfs @ 12.10 hrs, Volume= 0.030 af
 Outflow = 0.31 cfs @ 12.10 hrs, Volume= 0.030 af, Atten= 0%, Lag= 0.0 min
 Primary = 0.31 cfs @ 12.10 hrs, Volume= 0.030 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 1,315.29' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	1,315.00'	15.0" x 81.0' long Culvert CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 1,312.00' S= 0.0370 '/' Cc= 0.900 n= 0.012

Primary OutFlow Max=0.31 cfs @ 12.10 hrs HW=1,315.29' (Free Discharge)
 ↑**1=Culvert** (Inlet Controls 0.31 cfs @ 1.45 fps)

Summary for Pond P1: VUF 1

Inflow Area = 0.844 ac, 15.99% Impervious, Inflow Depth > 1.34" for 25 YEAR event
 Inflow = 1.53 cfs @ 12.05 hrs, Volume= 0.094 af
 Outflow = 0.09 cfs @ 14.92 hrs, Volume= 0.025 af, Atten= 94%, Lag= 172.5 min
 Primary = 0.09 cfs @ 14.92 hrs, Volume= 0.025 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 1,318.52' @ 14.92 hrs Surf.Area= 2,636 sf Storage= 3,058 cf

Plug-Flow detention time= 288.4 min calculated for 0.025 af (26% of inflow)
 Center-of-Mass det. time= 188.4 min (1,002.8 - 814.4)

Volume	Invert	Avail.Storage	Storage Description			
#1	1,317.00'	7,927 cf	Custom Stage Data (Irregular) Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
1,317.00	1,414	255.0	0	0	1,414	
1,318.00	2,208	274.0	1,796	1,796	2,256	
1,319.00	3,063	293.0	2,624	4,420	3,159	
1,320.00	3,971	312.0	3,507	7,927	4,123	

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Type III 24-hr 25 YEAR Rainfall=4.40"

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Device	Routing	Invert	Outlet Devices
#1	Primary	1,318.50'	10.0' long x 6.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=0.07 cfs @ 14.92 hrs HW=1,318.52' (Free Discharge)
 ↳1=Broad-Crested Rectangular Weir (Weir Controls 0.07 cfs @ 0.35 fps)

Summary for Pond P2: VUF 2

Inflow Area = 0.684 ac, 0.00% Impervious, Inflow Depth > 0.52" for 25 YEAR event
 Inflow = 0.31 cfs @ 12.10 hrs, Volume= 0.030 af
 Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 1,312.82' @ 20.00 hrs Surf.Area= 1,898 sf Storage= 1,301 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

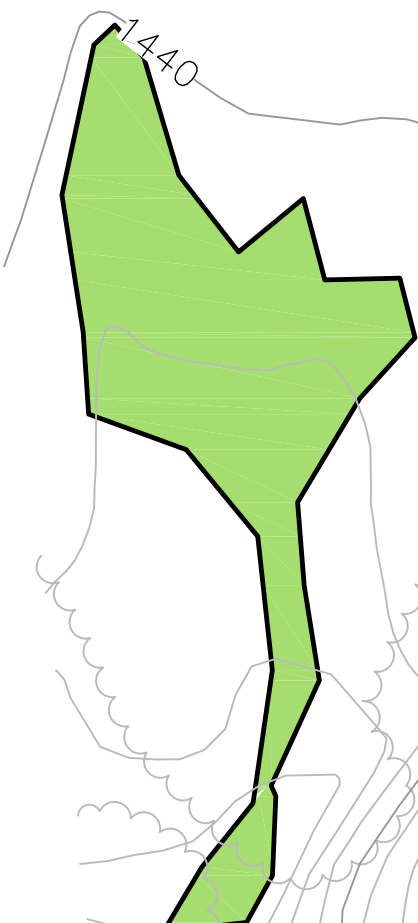
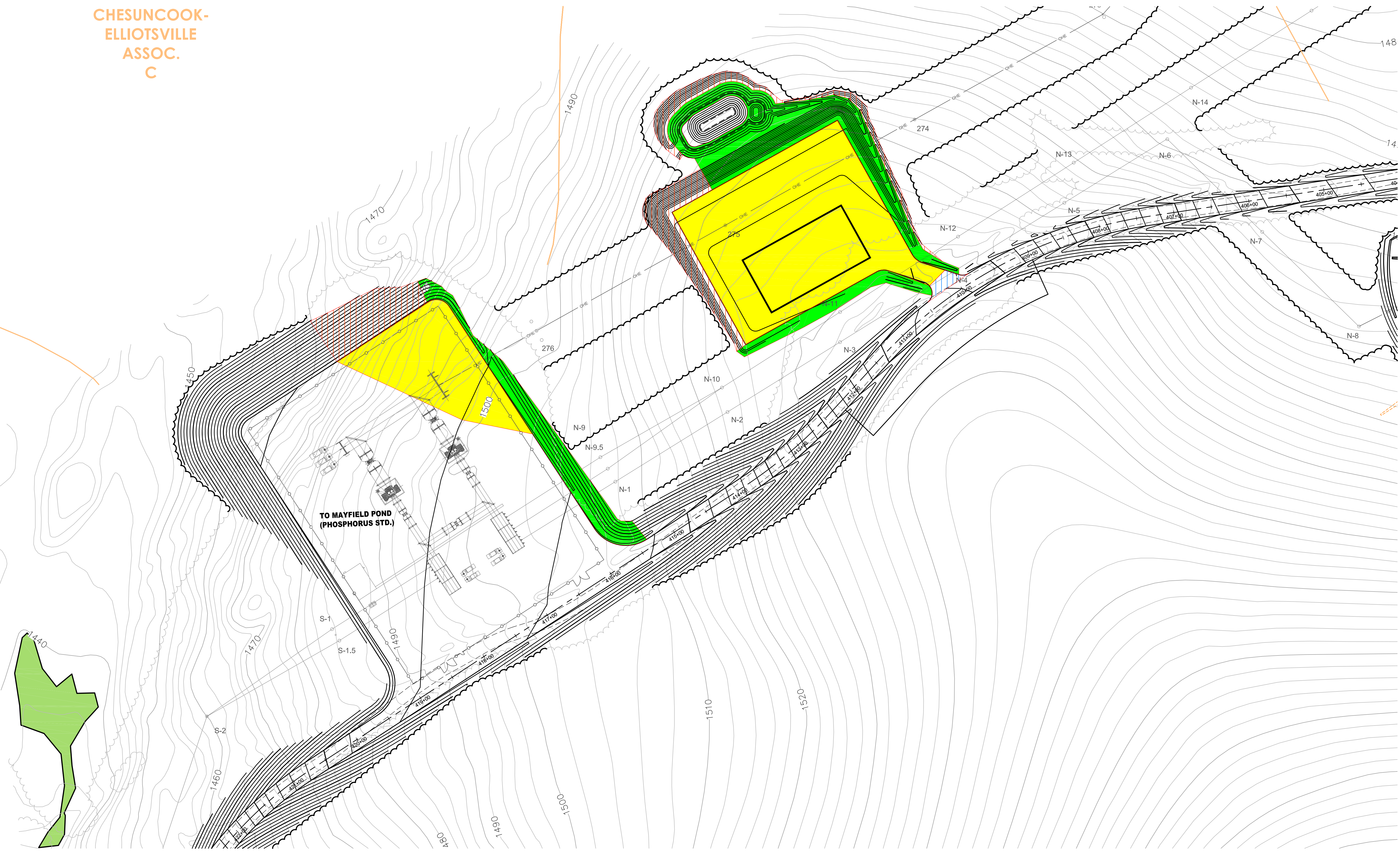
Volume	Invert	Avail.Storage	Storage Description		
#1	1,312.00'	8,052 cf	Custom Stage Data (Irregular) Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1,312.00	1,306	237.0	0	0	1,306
1,313.00	2,046	256.0	1,662	1,662	2,091
1,314.00	3,206	339.0	2,604	4,267	6,032
1,315.00	4,396	370.0	3,785	8,052	7,817

Device	Routing	Invert	Outlet Devices
#1	Primary	1,313.50'	10.0' long x 6.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83


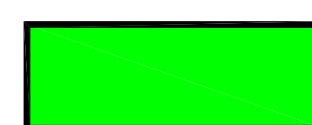
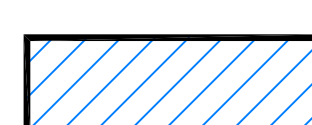

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=1,312.00' (Free Discharge)
 ↳1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

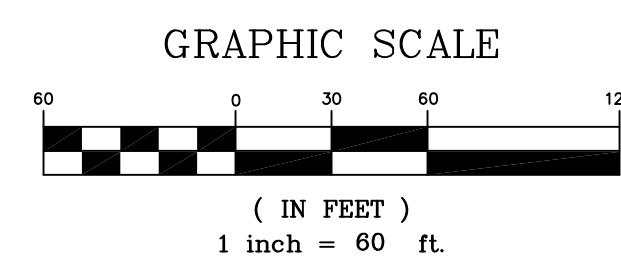
APPENDIX 12-8

**Substation and DRD Pad General and Flooding Standard
Calculations and Figures**




TREATMENT LEGEND

-  PROPOSED IMPERVIOUS AREA TREATED
-  PROPOSED LANDSCAPE AREA TREATED
-  PROPOSED IMPERVIOUS AREA UNTREATED
-  PROPOSED LANDSCAPE AREA UNTREATED



REV	DATE	DESCRIPTION	P.E.
REVISIONS			LIC. #

PROJECT BINGHAM WIND PROJECT		 DeLUCA-HOFFMAN ASSOCIATES, INC. 778 MAIN STREET, SUITE 8 SOUTH PORTLAND, ME 04106 207.775.1121 WWW.DELUCAHOFFMAN.COM
SHEET TITLE SUBSTATION/DRD WATER QUALITY MAP (GENERAL STD.)		
CLIENT BLUE SKY WEST LLC		DRAWN: SJB DATE: APRIL 2013 DESIGNED: SJB SCALE: 1"=60' CHECKED: SJB JOB NO. 3048 FILE NAME: 3048-SUBSTATION WSHED SHEET FIGURE 3

Bingham Wind Project

Substation/DRD/O&M Water Quality Treatment Calculations (General Standard)

Area ID	Total Area (sf)	Imp. Area (sf)	Imp.Area Treated (sf)	Grass Area (sf)	Grass Area Treated (sf)	Dev. Area (sf)	Dev. Area Treated (sf)	Treatment Method
Substation ¹	37890	20104	20104	17786	10261	37890	30365	Gravel Section/DT
DRD	89981	52401	51623	37580	24949	89981	76572	Wet Pond/DT
O&M Storage/Bldg	47691	22797	22797	24894	10895	47691	33692	VUF 1
O&M Access Drives	34952	16731	14880	18221	17571	34952	32451	VUF 2

Substation Area Treatment Calculations

Total Impervious area	20104 sf
Total Treated Impervious area	20104 sf
<u>Impervious Area Treatment Percentage</u>	<u>100.00 %</u>
Total Developed Area	37890 sf
Total Treated Developed Area	30365 sf
<u>Developed Area Treatment Percentage</u>	<u>80.14 %</u>

DRD Area Treatment Calculations

Total Impervious area	52401 sf
Total Treated Impervious area	51623 sf
<u>Impervious Area Treatment Percentage</u>	<u>98.52 %</u>
Total Developed Area	89981 sf
Total Treated Developed Area	76572 sf
<u>Developed Area Treatment Percentage</u>	<u>85.10 %</u>

O&M Area Treatment Calculations

Total Impervious area	39528 sf
Total Treated Impervious area	37677 sf
<u>Impervious Area Treatment Percentage</u>	<u>95.32 %</u>
Total Developed Area	82643 sf
Total Treated Developed Area	66143 sf
<u>Developed Area Treatment Percentage</u>	<u>80.03 %</u>

1. This does not include the area within the Mayfield Pond Watershed. See phosphorus calculations in Appendix 12-3

**Bingham Wind Project
PROPOSED WET POND #1 STAGE - STORAGE CALCULATIONS**

Stage Elev.	Surf. Area	Inc. Vol	Cum. Vol	Vol Above PP	Notes
1502.5	0,431 ft ²	0	0		
1503	0,578 ft ²	0,252 ft ³	0,252 ft ³		
1504	0,900 ft ²	0,739 ft ³	0,991 ft ³		
1505	1,262 ft ²	1,081 ft ³	2,072 ft ³		
1506	1,662 ft ²	1,462 ft ³	3,534 ft ³		
1507	2,103 ft ²	1,882 ft ³	5,416 ft ³		
1508	2,583 ft ²	2,343 ft ³	7,759 ft ³	3.00	Mean Depth
1509	3,422 ft ²	3,002 ft ³	10,761 ft ³		WQV Elevation
1510	4,622 ft ²	4,022 ft ³	14,783 ft ³	4,022 ft ³	
1510.5	5,074 ft ²	2,424 ft ³	17,207 ft ³	6,446 ft ³	CPV Elevation

Wetpond WQV Required	7,700 ft ³
Wetpond WQV Provided	10,761 ft ³
Wetpond WQV Elev.	1509.00
Permanent Pool Elev.	1509.00
Wetpond CPV Required	5,134 ft ³
Wetpond CPV Provided	6,446 ft ³
Channel Protection Volume Elev.	1510.50
Flow length across permanent pool from inlet to outlet =	104 ft
Width of Permanent Pool =	41 ft
Length to Width Ratio =	2.54 :1
Underdrain length Required= (3 ft/1000 cf CPV)	19.3 ft

Orifice Eqn: $t=(2A/ (Ca2g)) (h_1^{A/2} -h_2^{A/2})$	
Discharge Coefficient C =	0.62
Orifice Size =	1.12 in
Orifice Size =	0.09 ft
Cross sectional Area of Orifice (a) =	0.007 ft ²
Vessel (A) =	5,074 ft ²
Orifice Centerline Elevation =	1506.50

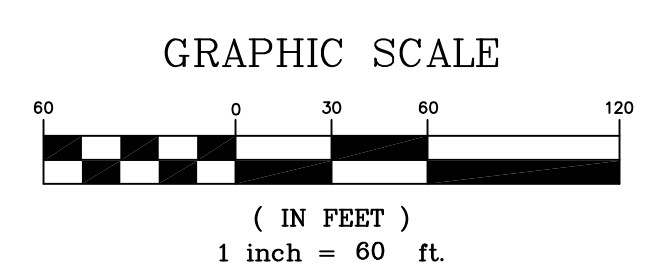
t (sec)	Stage Elevation	Starting Water Level Above Orifice (h1)	Ending Water Level Above Orifice (h2)	Pond Area	t (hrs)
0.00 sec	1509.00	2.50 ft	2.50 ft	3,422 ft ²	0.00 hrs
78248 sec	1510.00	3.50 ft	2.50 ft	4,622 ft ²	21.74 hrs
38302 sec	1510.50	4.00 ft	3.50 ft	5,074 ft ²	10.64 hrs

Total Drawdown Time 32.38 hrs



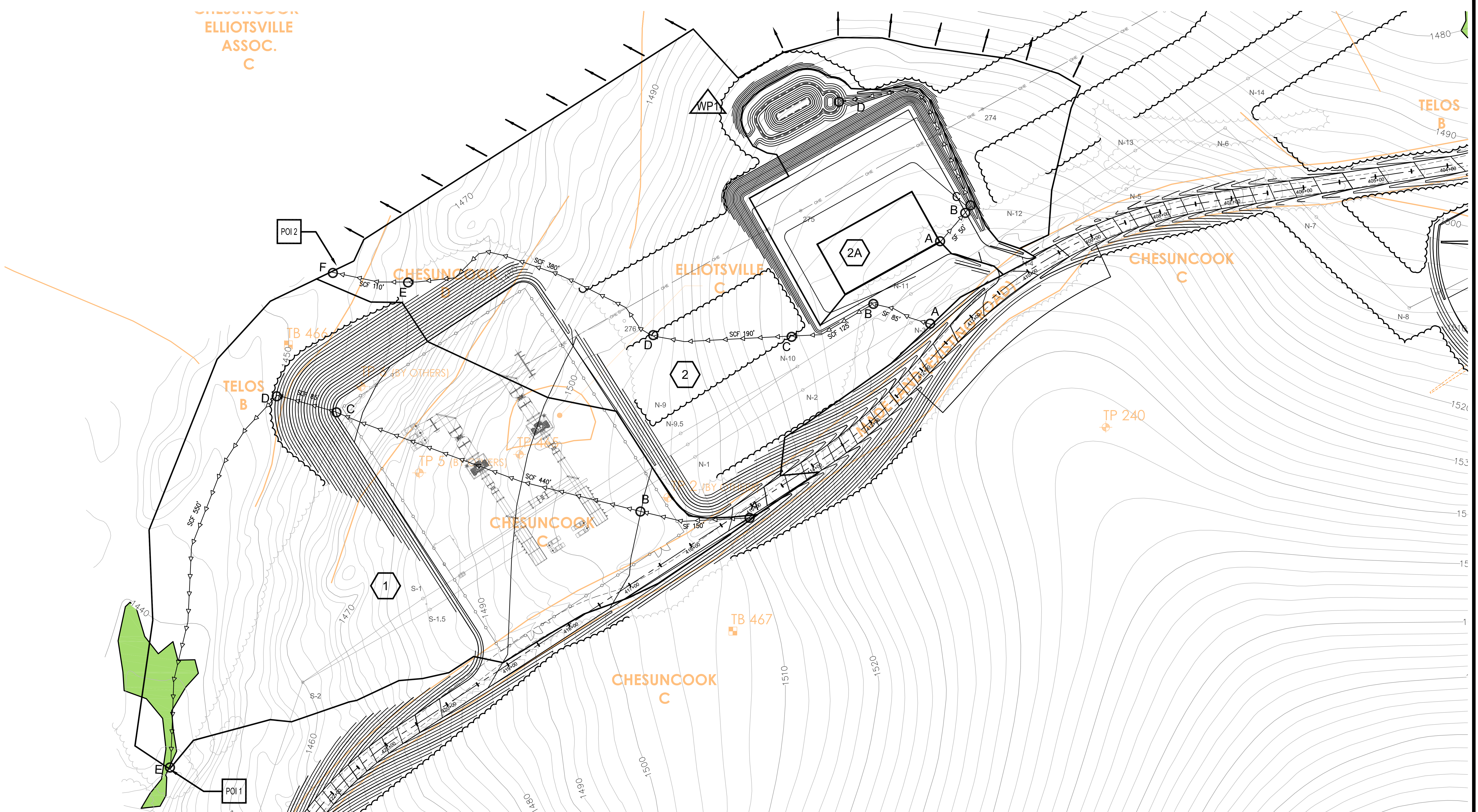
WATERSHED LEGEND

- | | | | |
|--|---------------------|-----|---------------------------|
| | WATERSHED BOUNDARY | SF | SHEET FLOW |
| | WATERSHED FLOW PATH | SCF | SHALLOW CONCENTRATED FLOW |
| | SUBCATCHMENT | PF | PIPE FLOW |
| | REACH | CF | CHANNEL FLOW |
| | POND | | |



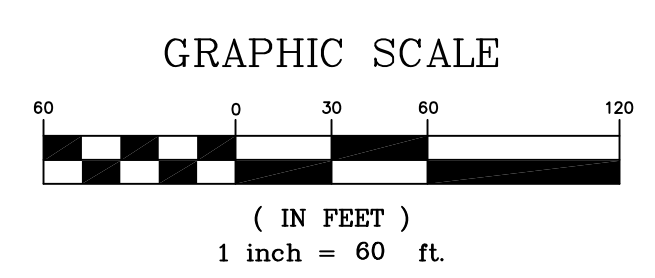
REV	DATE	DESCRIPTION	P.E.
REVISIONS			LIC. #

PROJECT BINGHAM WIND PROJECT		DeLUCA-HOFFMAN ASSOCIATES, INC. 778 MAIN STREET, SUITE 8 SOUTH PORTLAND, ME 04106 207.775.1121 WWW.DELUCAHOFFMAN.COM
SHEET TITLE SUBSTATION/DRD PRE DEVELOPMENT WATERSHED MAP		
CLIENT BLUE SKY WEST LLC	DRAWN: SJB DATE: APRIL 2013 DESIGNED: SJB SCALE: 1"=60' CHECKED: SJB JOB NO. 3048 FILE NAME: 3048-SUBSTATION WSHED SHEET FIGURE 4	



WATERSHED LEGEND

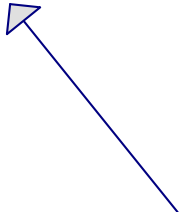
	WATERSHED BOUNDARY	SF	SHEET FLOW
	WATERSHED FLOW PATH	SCF	SHALLOW CONCENTRATED FLOW
	SUBCATCHMENT	PF	PIPE FLOW
	REACH	CF	CHANNEL FLOW
	POND		



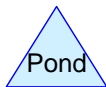
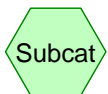
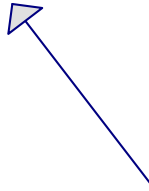
REV	DATE	DESCRIPTION	P.E.
		REVISIONS	LIC. #

PROJECT BINGHAM WIND PROJECT		DeLUCA-HOFFMAN ASSOCIATES, INC. 778 MAIN STREET, SUITE 8 SOUTH PORTLAND, ME 04106 207.775.1121 WWW.DELUCAHOFFMAN.COM
SHEET TITLE SUBSTATION/DRD POST DEVELOPMENT WATERSHED MAP		
DRAWN: SJB	DATE: APRIL 2013	FILE NAME: 3048-SUBSTATION WSHED SHEET FIGURE 5
CHECKED: SJB	SCALE: 1"=60'	
CLIENT BLUE SKY WEST LLC		

POI 1



POI 2



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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.190	56	Brush, Fair, HSG B (1S)
5.570	70	Brush, Fair, HSG C (1S,2S)
10.407	73	Woods, Fair, HSG C (1S,2S)
0.305	89	Gravel roads, HSG C (1S,2S)
16.472		TOTAL AREA

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Soil Listing (all nodes)

Area (acres)	Soil Goup	Subcatchment Numbers
0.000	HSG A	
0.190	HSG B	1S
16.281	HSG C	1S, 2S
0.000	HSG D	
0.000	Other	
16.472		TOTAL AREA

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SUBSTATION PRE DEVELOPMENT WATERSHED

Type III 24-hr 2 YEAR Rainfall=2.50"

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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

Subcatchment 1S: Runoff Area=373,731 sf 0.00% Impervious Runoff Depth>0.43"
Flow Length=1,485' Tc=18.8 min CN=71 Runoff=2.71 cfs 0.311 af

Subcatchment 2S: Runoff Area=343,770 sf 0.00% Impervious Runoff Depth>0.50"
Flow Length=900' Tc=23.2 min CN=73 Runoff=2.83 cfs 0.332 af

Reach POI 1: Inflow=2.71 cfs 0.311 af
Outflow=2.71 cfs 0.311 af

Reach POI 2: Inflow=2.83 cfs 0.332 af
Outflow=2.83 cfs 0.332 af

Total Runoff Area = 16.472 ac Runoff Volume = 0.642 af Average Runoff Depth = 0.47"
100.00% Pervious = 16.472 ac 0.00% Impervious = 0.000 ac

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Type III 24-hr 2 YEAR Rainfall=2.50"

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Summary for Subcatchment 1S:

Runoff = 2.71 cfs @ 12.32 hrs, Volume= 0.311 af, Depth> 0.43"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YEAR Rainfall=2.50"

Area (sf)	CN	Description
12,692	89	Gravel roads, HSG C
141,393	73	Woods, Fair, HSG C
211,366	70	Brush, Fair, HSG C
8,280	56	Brush, Fair, HSG B
373,731	71	Weighted Average
373,731		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	60	0.0200	1.10		Sheet Flow, A-B Smooth surfaces n= 0.011 P2= 2.50"
5.0	395	0.0700	1.32		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
3.5	440	0.0900	2.10		Shallow Concentrated Flow, C-D Short Grass Pasture Kv= 7.0 fps
9.4	590	0.0440	1.05		Shallow Concentrated Flow, D-E Woodland Kv= 5.0 fps
18.8	1,485	Total			

Summary for Subcatchment 2S:

Runoff = 2.83 cfs @ 12.38 hrs, Volume= 0.332 af, Depth> 0.50"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YEAR Rainfall=2.50"

Area (sf)	CN	Description
311,919	73	Woods, Fair, HSG C
31,268	70	Brush, Fair, HSG C
583	89	Gravel roads, HSG C
343,770	73	Weighted Average
343,770		Pervious Area

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.6	140	0.0430	0.15		Sheet Flow, A-B Grass: Dense n= 0.240 P2= 2.50"
4.8	435	0.0910	1.51		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
1.5	220	0.1270	2.49		Shallow Concentrated Flow, C-D Short Grass Pasture Kv= 7.0 fps
1.3	105	0.0760	1.38		Shallow Concentrated Flow, D-E Woodland Kv= 5.0 fps
23.2	900	Total			

Summary for Reach POI 1:

Inflow Area = 8.580 ac, 0.00% Impervious, Inflow Depth > 0.43" for 2 YEAR event
 Inflow = 2.71 cfs @ 12.32 hrs, Volume= 0.311 af
 Outflow = 2.71 cfs @ 12.32 hrs, Volume= 0.311 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 POI 2:

Inflow Area = 7.892 ac, 0.00% Impervious, Inflow Depth > 0.50" for 2 YEAR event
 Inflow = 2.83 cfs @ 12.38 hrs, Volume= 0.332 af
 Outflow = 2.83 cfs @ 12.38 hrs, Volume= 0.332 af, Atten= 0%, Lag= 0.0 min

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

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SUBSTATION PRE DEVELOPMENT WATERSHED

Type III 24-hr 10 YEAR Rainfall=3.80"

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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

Subcatchment 1S: Runoff Area=373,731 sf 0.00% Impervious Runoff Depth>1.14"
Flow Length=1,485' Tc=18.8 min CN=71 Runoff=8.23 cfs 0.817 af

Subcatchment 2S: Runoff Area=343,770 sf 0.00% Impervious Runoff Depth>1.26"
Flow Length=900' Tc=23.2 min CN=73 Runoff=7.80 cfs 0.829 af

Reach POI 1: Inflow=8.23 cfs 0.817 af
Outflow=8.23 cfs 0.817 af

Reach POI 2: Inflow=7.80 cfs 0.829 af
Outflow=7.80 cfs 0.829 af

Total Runoff Area = 16.472 ac Runoff Volume = 1.646 af Average Runoff Depth = 1.20"
100.00% Pervious = 16.472 ac 0.00% Impervious = 0.000 ac

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Type III 24-hr 10 YEAR Rainfall=3.80"

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Summary for Subcatchment 1S:

Runoff = 8.23 cfs @ 12.28 hrs, Volume= 0.817 af, Depth> 1.14"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=3.80"

Area (sf)	CN	Description
12,692	89	Gravel roads, HSG C
141,393	73	Woods, Fair, HSG C
211,366	70	Brush, Fair, HSG C
8,280	56	Brush, Fair, HSG B
373,731	71	Weighted Average
373,731		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	60	0.0200	1.10		Sheet Flow, A-B Smooth surfaces n= 0.011 P2= 2.50"
5.0	395	0.0700	1.32		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
3.5	440	0.0900	2.10		Shallow Concentrated Flow, C-D Short Grass Pasture Kv= 7.0 fps
9.4	590	0.0440	1.05		Shallow Concentrated Flow, D-E Woodland Kv= 5.0 fps
18.8	1,485	Total			

Summary for Subcatchment 2S:

Runoff = 7.80 cfs @ 12.34 hrs, Volume= 0.829 af, Depth> 1.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=3.80"

Area (sf)	CN	Description
311,919	73	Woods, Fair, HSG C
31,268	70	Brush, Fair, HSG C
583	89	Gravel roads, HSG C
343,770	73	Weighted Average
343,770		Pervious Area

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.6	140	0.0430	0.15		Sheet Flow, A-B Grass: Dense n= 0.240 P2= 2.50"
4.8	435	0.0910	1.51		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
1.5	220	0.1270	2.49		Shallow Concentrated Flow, C-D Short Grass Pasture Kv= 7.0 fps
1.3	105	0.0760	1.38		Shallow Concentrated Flow, D-E Woodland Kv= 5.0 fps
23.2	900	Total			

Summary for Reach POI 1:

Inflow Area = 8.580 ac, 0.00% Impervious, Inflow Depth > 1.14" for 10 YEAR event
 Inflow = 8.23 cfs @ 12.28 hrs, Volume= 0.817 af
 Outflow = 8.23 cfs @ 12.28 hrs, Volume= 0.817 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 POI 2:

Inflow Area = 7.892 ac, 0.00% Impervious, Inflow Depth > 1.26" for 10 YEAR event
 Inflow = 7.80 cfs @ 12.34 hrs, Volume= 0.829 af
 Outflow = 7.80 cfs @ 12.34 hrs, Volume= 0.829 af, Atten= 0%, Lag= 0.0 min

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

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SUBSTATION PRE DEVELOPMENT WATERSHED

Type III 24-hr 25 YEAR Rainfall=4.40"

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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

Subcatchment 1S: Runoff Area=373,731 sf 0.00% Impervious Runoff Depth>1.53"
Flow Length=1,485' Tc=18.8 min CN=71 Runoff=11.26 cfs 1.093 af

Subcatchment 2S: Runoff Area=343,770 sf 0.00% Impervious Runoff Depth>1.67"
Flow Length=900' Tc=23.2 min CN=73 Runoff=10.42 cfs 1.096 af

Reach POI 1: Inflow=11.26 cfs 1.093 af
Outflow=11.26 cfs 1.093 af

Reach POI 2: Inflow=10.42 cfs 1.096 af
Outflow=10.42 cfs 1.096 af

Total Runoff Area = 16.472 ac Runoff Volume = 2.189 af Average Runoff Depth = 1.59"
100.00% Pervious = 16.472 ac 0.00% Impervious = 0.000 ac

3048 SUBSTATION PRE

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SUBSTATION PRE DEVELOPMENT WATERSHED

Type III 24-hr 25 YEAR Rainfall=4.40"

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Summary for Subcatchment 1S:

Runoff = 11.26 cfs @ 12.27 hrs, Volume= 1.093 af, Depth> 1.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YEAR Rainfall=4.40"

Area (sf)	CN	Description
12,692	89	Gravel roads, HSG C
141,393	73	Woods, Fair, HSG C
211,366	70	Brush, Fair, HSG C
8,280	56	Brush, Fair, HSG B
373,731	71	Weighted Average
373,731		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	60	0.0200	1.10		Sheet Flow, A-B Smooth surfaces n= 0.011 P2= 2.50"
5.0	395	0.0700	1.32		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
3.5	440	0.0900	2.10		Shallow Concentrated Flow, C-D Short Grass Pasture Kv= 7.0 fps
9.4	590	0.0440	1.05		Shallow Concentrated Flow, D-E Woodland Kv= 5.0 fps
18.8	1,485	Total			

Summary for Subcatchment 2S:

Runoff = 10.42 cfs @ 12.34 hrs, Volume= 1.096 af, Depth> 1.67"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YEAR Rainfall=4.40"

Area (sf)	CN	Description
311,919	73	Woods, Fair, HSG C
31,268	70	Brush, Fair, HSG C
583	89	Gravel roads, HSG C
343,770	73	Weighted Average
343,770		Pervious Area

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.6	140	0.0430	0.15		Sheet Flow, A-B Grass: Dense n= 0.240 P2= 2.50"
4.8	435	0.0910	1.51		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
1.5	220	0.1270	2.49		Shallow Concentrated Flow, C-D Short Grass Pasture Kv= 7.0 fps
1.3	105	0.0760	1.38		Shallow Concentrated Flow, D-E Woodland Kv= 5.0 fps
23.2	900	Total			

Summary for Reach POI 1:

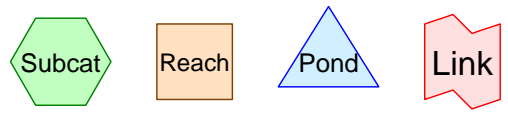
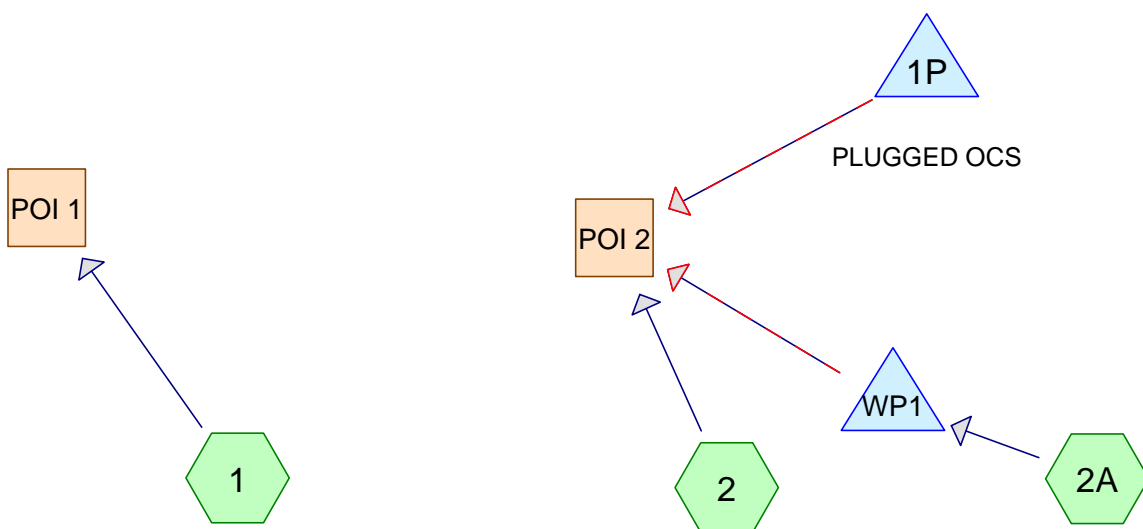
Inflow Area = 8.580 ac, 0.00% Impervious, Inflow Depth > 1.53" for 25 YEAR event
 Inflow = 11.26 cfs @ 12.27 hrs, Volume= 1.093 af
 Outflow = 11.26 cfs @ 12.27 hrs, Volume= 1.093 af, Atten= 0%, Lag= 0.0 min

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

Summary for Reach POI 2:

Inflow Area = 7.892 ac, 0.00% Impervious, Inflow Depth > 1.67" for 25 YEAR event
 Inflow = 10.42 cfs @ 12.34 hrs, Volume= 1.096 af
 Outflow = 10.42 cfs @ 12.34 hrs, Volume= 1.096 af, Atten= 0%, Lag= 0.0 min

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



Drainage Diagram for 3048 SUBSTATION POST
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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.463	55	Substation Pad, HSG C (2)
2.607	55	Substation Section HSG C (1)
6.245	70	Brush, Fair, HSG C (1,2,2A)
5.248	73	Woods, Fair, HSG C (1,2)
0.281	89	Gravel roads, HSG C (1,2)
1.109	98	Paved parking & roofs (2A)
0.079	98	Water Surface (2A)
16.031		TOTAL AREA

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Soil Listing (all nodes)

Area (acres)	Soil Goup	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
14.843	HSG C	1, 2, 2A
0.000	HSG D	
1.188	Other	2A
16.031		TOTAL AREA

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SUBSTATION POST DEVELOPMENT WATERSHED

Type III 24-hr 2 YEAR Rainfall=2.50"

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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

Subcatchment 1: Runoff Area=312,219 sf 0.00% Impervious Runoff Depth>0.28"
Flow Length=1,225' Tc=15.5 min CN=66 Runoff=1.24 cfs 0.169 af

Subcatchment 2: Runoff Area=311,703 sf 0.00% Impervious Runoff Depth>0.43"
Flow Length=890' Tc=16.9 min CN=71 Runoff=2.34 cfs 0.259 af

Subcatchment 2A: Runoff Area=74,388 sf 69.56% Impervious Runoff Depth>1.36"
Flow Length=342' Tc=1.4 min CN=89 Runoff=3.17 cfs 0.194 af

Reach POI 1: Inflow=1.24 cfs 0.169 af
Outflow=1.24 cfs 0.169 af

Reach POI 2: Inflow=2.71 cfs 0.437 af
Outflow=2.71 cfs 0.437 af

Pond 1P: PLUGGED OCS Peak Elev=0.00' Storage=0 cf
Primary=0.00 cfs 0.000 af

Pond WP1: Peak Elev=1,510.00' Storage=4,017 cf Inflow=3.17 cfs 0.194 af
Primary=0.38 cfs 0.178 af Secondary=0.00 cfs 0.000 af Outflow=0.38 cfs 0.178 af

Total Runoff Area = 16.031 ac Runoff Volume = 0.622 af Average Runoff Depth = 0.47"
92.59% Pervious = 14.843 ac 7.41% Impervious = 1.188 ac

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SUBSTATION POST DEVELOPMENT WATERSHED

Type III 24-hr 2 YEAR Rainfall=2.50"

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Summary for Subcatchment 1:

Runoff = 1.24 cfs @ 12.33 hrs, Volume= 0.169 af, Depth> 0.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YEAR Rainfall=2.50"

Area (sf)	CN	Description
9,545	89	Gravel roads, HSG C
88,766	73	Woods, Fair, HSG C
100,349	70	Brush, Fair, HSG C
* 113,559	55	Substation Section HSG C
312,219	66	Weighted Average
312,219		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	150	0.0200	1.32		Sheet Flow, A-B Smooth surfaces n= 0.011 P2= 2.50"
4.6	440	0.0100	1.61		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
0.3	85	0.5000	4.95		Shallow Concentrated Flow, C-D Short Grass Pasture Kv= 7.0 fps
8.7	550	0.0440	1.05		Shallow Concentrated Flow, D-E Woodland Kv= 5.0 fps
15.5	1,225	Total			

Summary for Subcatchment 2:

Runoff = 2.34 cfs @ 12.29 hrs, Volume= 0.259 af, Depth> 0.43"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YEAR Rainfall=2.50"

Area (sf)	CN	Description
139,851	73	Woods, Fair, HSG C
149,027	70	Brush, Fair, HSG C
* 20,147	55	Substation Pad, HSG C
2,678	89	Gravel roads, HSG C
311,703	71	Weighted Average
311,703		Pervious Area

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	85	0.0580	0.15		Sheet Flow, A-B Grass: Dense n= 0.240 P2= 2.50"
1.5	125	0.0400	1.40		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
1.9	190	0.1110	1.67		Shallow Concentrated Flow, C-D Woodland Kv= 5.0 fps
2.8	380	0.1070	2.29		Shallow Concentrated Flow, D-E Short Grass Pasture Kv= 7.0 fps
1.4	110	0.0720	1.34		Shallow Concentrated Flow, E-F Woodland Kv= 5.0 fps
16.9	890	Total			

Summary for Subcatchment 2A:

Runoff = 3.17 cfs @ 12.03 hrs, Volume= 0.194 af, Depth> 1.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Type III 24-hr 2 YEAR Rainfall=2.50"

Area (sf)	CN	Description
48,322	98	Paved parking & roofs
3,421	98	Water Surface
22,645	70	Brush, Fair, HSG C
74,388	89	Weighted Average
22,645		Pervious Area
51,743		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	50	0.0200	1.06		Sheet Flow, A-B Smooth surfaces n= 0.011 P2= 2.50"
0.0	12	0.3300	4.02		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
0.6	280	0.0500	7.65	91.82	Channel Flow, C-D Area= 12.0 sf Perim= 20.9' r= 0.57' n= 0.030
1.4	342	Total			

Summary for Reach POI 1:

Inflow Area = 7.168 ac, 0.00% Impervious, Inflow Depth > 0.28" for 2 YEAR event

Inflow = 1.24 cfs @ 12.33 hrs, Volume= 0.169 af

Outflow = 1.24 cfs @ 12.33 hrs, Volume= 0.169 af, Atten= 0%, Lag= 0.0 min

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

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SUBSTATION POST DEVELOPMENT WATERSHED

Type III 24-hr 2 YEAR Rainfall=2.50"

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Summary for Reach POI 2:

Inflow Area = 8.863 ac, 13.40% Impervious, Inflow Depth > 0.59" for 2 YEAR event
 Inflow = 2.71 cfs @ 12.29 hrs, Volume= 0.437 af
 Outflow = 2.71 cfs @ 12.29 hrs, Volume= 0.437 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 1P: PLUGGED OCS

Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 0.00' @ 0.00 hrs Surf.Area= 0 sf Storage= 0 cf

Plug-Flow detention time= (not calculated)
 Center-of-Mass det. time= (not calculated)

Volume	Invert	Avail.Storage	Storage Description
#1	1,509.00'	30,644 cf	Custom Stage Data (Irregular) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1,509.00	3,422	233.0	0	0	3,422
1,510.00	4,622	296.0	4,007	4,007	6,087
1,511.00	5,561	323.0	5,084	9,091	7,453
1,512.00	6,595	364.0	6,071	15,162	9,720
1,513.00	7,724	407.0	7,152	22,314	12,387
1,514.00	8,952	449.0	8,330	30,644	15,279

Device	Routing	Invert	Outlet Devices
#1	Primary	1,512.00'	10.0' long x 8.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
 ↑1=**Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond WP1:

Inflow Area = 1.708 ac, 69.56% Impervious, Inflow Depth > 1.36" for 2 YEAR event
 Inflow = 3.17 cfs @ 12.03 hrs, Volume= 0.194 af
 Outflow = 0.38 cfs @ 12.60 hrs, Volume= 0.178 af, Atten= 88%, Lag= 34.8 min
 Primary = 0.38 cfs @ 12.60 hrs, Volume= 0.178 af
 Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

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

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Type III 24-hr 2 YEAR Rainfall=2.50"

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Peak Elev= 1,510.00' @ 12.60 hrs Surf.Area= 4,624 sf Storage= 4,017 cf

Plug-Flow detention time= 139.0 min calculated for 0.177 af (91% of inflow)

Center-of-Mass det. time= 111.2 min (894.1 - 783.0)

Volume	Invert	Avail.Storage	Storage Description
#1	1,509.00'	30,644 cf	Custom Stage Data (Irregular) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1,509.00	3,422	233.0	0	0	3,422
1,510.00	4,622	296.0	4,007	4,007	6,087
1,511.00	5,561	323.0	5,084	9,091	7,453
1,512.00	6,595	364.0	6,071	15,162	9,720
1,513.00	7,724	407.0	7,152	22,314	12,387
1,514.00	8,952	449.0	8,330	30,644	15,279

Device	Routing	Invert	Outlet Devices
#1	Secondary	1,512.00'	10.0' long x 8.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
#2	Primary	1,506.40'	24.0" x 27.0' long Culvert CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,505.00' S= 0.0519 '/' Cc= 0.900 n= 0.012
#3	Device 2	1,512.00'	6.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Device 2	1,509.00'	4.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.38 cfs @ 12.60 hrs HW=1,510.00' (Free Discharge)

- ↳ **2=Culvert** (Passes 0.38 cfs of 24.40 cfs potential flow)
- ↳ **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
- ↳ **4=Orifice/Grate** (Orifice Controls 0.38 cfs @ 4.40 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=1,509.00' (Free Discharge)

- ↳ **1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

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SUBSTATION POST DEVELOPMENT WATERSHED

Type III 24-hr 10 YEAR Rainfall=3.80"

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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

Subcatchment 1: Runoff Area=312,219 sf 0.00% Impervious Runoff Depth>0.87"
Flow Length=1,225' Tc=15.5 min CN=66 Runoff=5.32 cfs 0.519 af

Subcatchment 2: Runoff Area=311,703 sf 0.00% Impervious Runoff Depth>1.14"
Flow Length=890' Tc=16.9 min CN=71 Runoff=7.18 cfs 0.682 af

Subcatchment 2A: Runoff Area=74,388 sf 69.56% Impervious Runoff Depth>2.48"
Flow Length=342' Tc=1.4 min CN=89 Runoff=5.69 cfs 0.353 af

Reach POI 1: Inflow=5.32 cfs 0.519 af
Outflow=5.32 cfs 0.519 af

Reach POI 2: Inflow=7.68 cfs 0.993 af
Outflow=7.68 cfs 0.993 af

Pond 1P: PLUGGED OCS Peak Elev=0.00' Storage=0 cf
Primary=0.00 cfs 0.000 af

Pond WP1: Peak Elev=1,510.76' Storage=7,766 cf Inflow=5.69 cfs 0.353 af
Primary=0.53 cfs 0.311 af Secondary=0.00 cfs 0.000 af Outflow=0.53 cfs 0.311 af

Total Runoff Area = 16.031 ac Runoff Volume = 1.555 af Average Runoff Depth = 1.16"
92.59% Pervious = 14.843 ac 7.41% Impervious = 1.188 ac

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Summary for Subcatchment 1:

Runoff = 5.32 cfs @ 12.25 hrs, Volume= 0.519 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 10 YEAR Rainfall=3.80"

Area (sf)	CN	Description
9,545	89	Gravel roads, HSG C
88,766	73	Woods, Fair, HSG C
100,349	70	Brush, Fair, HSG C
* 113,559	55	Substation Section HSG C
312,219	66	Weighted Average
312,219		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	150	0.0200	1.32		Sheet Flow, A-B Smooth surfaces n= 0.011 P2= 2.50"
4.6	440	0.0100	1.61		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
0.3	85	0.5000	4.95		Shallow Concentrated Flow, C-D Short Grass Pasture Kv= 7.0 fps
8.7	550	0.0440	1.05		Shallow Concentrated Flow, D-E Woodland Kv= 5.0 fps
15.5	1,225	Total			

Summary for Subcatchment 2:

Runoff = 7.18 cfs @ 12.25 hrs, Volume= 0.682 af, Depth> 1.14"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=3.80"

Area (sf)	CN	Description
139,851	73	Woods, Fair, HSG C
149,027	70	Brush, Fair, HSG C
* 20,147	55	Substation Pad, HSG C
2,678	89	Gravel roads, HSG C
311,703	71	Weighted Average
311,703		Pervious Area

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	85	0.0580	0.15		Sheet Flow, A-B Grass: Dense n= 0.240 P2= 2.50"
1.5	125	0.0400	1.40		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
1.9	190	0.1110	1.67		Shallow Concentrated Flow, C-D Woodland Kv= 5.0 fps
2.8	380	0.1070	2.29		Shallow Concentrated Flow, D-E Short Grass Pasture Kv= 7.0 fps
1.4	110	0.0720	1.34		Shallow Concentrated Flow, E-F Woodland Kv= 5.0 fps
16.9	890	Total			

Summary for Subcatchment 2A:

Runoff = 5.69 cfs @ 12.02 hrs, Volume= 0.353 af, Depth> 2.48"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=3.80"

Area (sf)	CN	Description
48,322	98	Paved parking & roofs
3,421	98	Water Surface
22,645	70	Brush, Fair, HSG C
74,388	89	Weighted Average
22,645		Pervious Area
51,743		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	50	0.0200	1.06		Sheet Flow, A-B Smooth surfaces n= 0.011 P2= 2.50"
0.0	12	0.3300	4.02		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
0.6	280	0.0500	7.65	91.82	Channel Flow, C-D Area= 12.0 sf Perim= 20.9' r= 0.57' n= 0.030
1.4	342	Total			

Summary for Reach POI 1:

Inflow Area = 7.168 ac, 0.00% Impervious, Inflow Depth > 0.87" for 10 YEAR event

Inflow = 5.32 cfs @ 12.25 hrs, Volume= 0.519 af

Outflow = 5.32 cfs @ 12.25 hrs, Volume= 0.519 af, Atten= 0%, Lag= 0.0 min

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

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Type III 24-hr 10 YEAR Rainfall=3.80"

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Summary for Reach POI 2:

Inflow Area = 8.863 ac, 13.40% Impervious, Inflow Depth > 1.34" for 10 YEAR event
 Inflow = 7.68 cfs @ 12.25 hrs, Volume= 0.993 af
 Outflow = 7.68 cfs @ 12.25 hrs, Volume= 0.993 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 1P: PLUGGED OCS

Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

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

Peak Elev= 0.00' @ 0.00 hrs Surf.Area= 0 sf Storage= 0 cf

Plug-Flow detention time= (not calculated)

Center-of-Mass det. time= (not calculated)

Volume	Invert	Avail.Storage	Storage Description
#1	1,509.00'	30,644 cf	Custom Stage Data (Irregular) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1,509.00	3,422	233.0	0	0	3,422
1,510.00	4,622	296.0	4,007	4,007	6,087
1,511.00	5,561	323.0	5,084	9,091	7,453
1,512.00	6,595	364.0	6,071	15,162	9,720
1,513.00	7,724	407.0	7,152	22,314	12,387
1,514.00	8,952	449.0	8,330	30,644	15,279

Device	Routing	Invert	Outlet Devices
#1	Primary	1,512.00'	10.0' long x 8.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)

↑1=**Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond WP1:

Inflow Area = 1.708 ac, 69.56% Impervious, Inflow Depth > 2.48" for 10 YEAR event
 Inflow = 5.69 cfs @ 12.02 hrs, Volume= 0.353 af
 Outflow = 0.53 cfs @ 12.83 hrs, Volume= 0.311 af, Atten= 91%, Lag= 48.4 min
 Primary = 0.53 cfs @ 12.83 hrs, Volume= 0.311 af
 Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

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

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Type III 24-hr 10 YEAR Rainfall=3.80"

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Peak Elev= 1,510.76' @ 12.83 hrs Surf.Area= 5,324 sf Storage= 7,766 cf

Plug-Flow detention time= 175.4 min calculated for 0.311 af (88% of inflow)

Center-of-Mass det. time= 137.3 min (906.0 - 768.7)

Volume	Invert	Avail.Storage	Storage Description
#1	1,509.00'	30,644 cf	Custom Stage Data (Irregular) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1,509.00	3,422	233.0	0	0	3,422
1,510.00	4,622	296.0	4,007	4,007	6,087
1,511.00	5,561	323.0	5,084	9,091	7,453
1,512.00	6,595	364.0	6,071	15,162	9,720
1,513.00	7,724	407.0	7,152	22,314	12,387
1,514.00	8,952	449.0	8,330	30,644	15,279

Device	Routing	Invert	Outlet Devices
#1	Secondary	1,512.00'	10.0' long x 8.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
#2	Primary	1,506.40'	24.0" x 27.0' long Culvert CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,505.00' S= 0.0519 '/' Cc= 0.900 n= 0.012
#3	Device 2	1,512.00'	6.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Device 2	1,509.00'	4.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.53 cfs @ 12.83 hrs HW=1,510.76' (Free Discharge)

- ↑ 2=Culvert (Passes 0.53 cfs of 27.71 cfs potential flow)
- ↑ 3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)
- ↑ 4=Orifice/Grate (Orifice Controls 0.53 cfs @ 6.07 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=1,509.00' (Free Discharge)

- ↑ 1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

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SUBSTATION POST DEVELOPMENT WATERSHED

Type III 24-hr 25 YEAR Rainfall=4.40"

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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

Subcatchment 1: Runoff Area=312,219 sf 0.00% Impervious Runoff Depth>1.21"
Flow Length=1,225' Tc=15.5 min CN=66 Runoff=7.68 cfs 0.721 af

Subcatchment 2: Runoff Area=311,703 sf 0.00% Impervious Runoff Depth>1.53"
Flow Length=890' Tc=16.9 min CN=71 Runoff=9.78 cfs 0.913 af

Subcatchment 2A: Runoff Area=74,388 sf 69.56% Impervious Runoff Depth>3.02"
Flow Length=342' Tc=1.4 min CN=89 Runoff=6.86 cfs 0.430 af

Reach POI 1: Inflow=7.68 cfs 0.721 af
Outflow=7.68 cfs 0.721 af

Reach POI 2: Inflow=10.33 cfs 1.277 af
Outflow=10.33 cfs 1.277 af

Pond 1P: PLUGGED OCS Peak Elev=0.00' Storage=0 cf
Primary=0.00 cfs 0.000 af

Pond WP1: Peak Elev=1,511.10' Storage=9,634 cf Inflow=6.86 cfs 0.430 af
Primary=0.58 cfs 0.364 af Secondary=0.00 cfs 0.000 af Outflow=0.58 cfs 0.364 af

Total Runoff Area = 16.031 ac Runoff Volume = 2.063 af Average Runoff Depth = 1.54"
92.59% Pervious = 14.843 ac 7.41% Impervious = 1.188 ac

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Type III 24-hr 25 YEAR Rainfall=4.40"

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Summary for Subcatchment 1:

Runoff = 7.68 cfs @ 12.24 hrs, Volume= 0.721 af, Depth> 1.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YEAR Rainfall=4.40"

Area (sf)	CN	Description
9,545	89	Gravel roads, HSG C
88,766	73	Woods, Fair, HSG C
100,349	70	Brush, Fair, HSG C
* 113,559	55	Substation Section HSG C
312,219	66	Weighted Average
312,219		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	150	0.0200	1.32		Sheet Flow, A-B Smooth surfaces n= 0.011 P2= 2.50"
4.6	440	0.0100	1.61		Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
0.3	85	0.5000	4.95		Shallow Concentrated Flow, C-D Short Grass Pasture Kv= 7.0 fps
8.7	550	0.0440	1.05		Shallow Concentrated Flow, D-E Woodland Kv= 5.0 fps
15.5	1,225	Total			

Summary for Subcatchment 2:

Runoff = 9.78 cfs @ 12.25 hrs, Volume= 0.913 af, Depth> 1.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YEAR Rainfall=4.40"

Area (sf)	CN	Description
139,851	73	Woods, Fair, HSG C
149,027	70	Brush, Fair, HSG C
* 20,147	55	Substation Pad, HSG C
2,678	89	Gravel roads, HSG C
311,703	71	Weighted Average
311,703		Pervious Area

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	85	0.0580	0.15		Sheet Flow, A-B Grass: Dense n= 0.240 P2= 2.50"
1.5	125	0.0400	1.40		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
1.9	190	0.1110	1.67		Shallow Concentrated Flow, C-D Woodland Kv= 5.0 fps
2.8	380	0.1070	2.29		Shallow Concentrated Flow, D-E Short Grass Pasture Kv= 7.0 fps
1.4	110	0.0720	1.34		Shallow Concentrated Flow, E-F Woodland Kv= 5.0 fps
16.9	890	Total			

Summary for Subcatchment 2A:

Runoff = 6.86 cfs @ 12.02 hrs, Volume= 0.430 af, Depth> 3.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Type III 24-hr 25 YEAR Rainfall=4.40"

Area (sf)	CN	Description
48,322	98	Paved parking & roofs
3,421	98	Water Surface
22,645	70	Brush, Fair, HSG C
74,388	89	Weighted Average
22,645		Pervious Area
51,743		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	50	0.0200	1.06		Sheet Flow, A-B Smooth surfaces n= 0.011 P2= 2.50"
0.0	12	0.3300	4.02		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
0.6	280	0.0500	7.65	91.82	Channel Flow, C-D Area= 12.0 sf Perim= 20.9' r= 0.57' n= 0.030
1.4	342	Total			

Summary for Reach POI 1:

Inflow Area = 7.168 ac, 0.00% Impervious, Inflow Depth > 1.21" for 25 YEAR event

Inflow = 7.68 cfs @ 12.24 hrs, Volume= 0.721 af

Outflow = 7.68 cfs @ 12.24 hrs, Volume= 0.721 af, Atten= 0%, Lag= 0.0 min

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

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SUBSTATION POST DEVELOPMENT WATERSHED

Type III 24-hr 25 YEAR Rainfall=4.40"

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Summary for Reach POI 2:

Inflow Area = 8.863 ac, 13.40% Impervious, Inflow Depth > 1.73" for 25 YEAR event
Inflow = 10.33 cfs @ 12.25 hrs, Volume= 1.277 af
Outflow = 10.33 cfs @ 12.25 hrs, Volume= 1.277 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 1P: PLUGGED OCS

Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 0.00' @ 0.00 hrs Surf.Area= 0 sf Storage= 0 cf

Plug-Flow detention time= (not calculated)
Center-of-Mass det. time= (not calculated)

Volume	Invert	Avail.Storage	Storage Description
#1	1,509.00'	30,644 cf	Custom Stage Data (Irregular) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1,509.00	3,422	233.0	0	0	3,422
1,510.00	4,622	296.0	4,007	4,007	6,087
1,511.00	5,561	323.0	5,084	9,091	7,453
1,512.00	6,595	364.0	6,071	15,162	9,720
1,513.00	7,724	407.0	7,152	22,314	12,387
1,514.00	8,952	449.0	8,330	30,644	15,279

Device	Routing	Invert	Outlet Devices
#1	Primary	1,512.00'	10.0' long x 8.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
↑1=**Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond WP1:

Inflow Area = 1.708 ac, 69.56% Impervious, Inflow Depth > 3.02" for 25 YEAR event
Inflow = 6.86 cfs @ 12.02 hrs, Volume= 0.430 af
Outflow = 0.58 cfs @ 12.90 hrs, Volume= 0.364 af, Atten= 91%, Lag= 52.7 min
Primary = 0.58 cfs @ 12.90 hrs, Volume= 0.364 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

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

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Type III 24-hr 25 YEAR Rainfall=4.40"

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Peak Elev= 1,511.10' @ 12.90 hrs Surf.Area= 5,657 sf Storage= 9,634 cf

Plug-Flow detention time= 186.9 min calculated for 0.363 af (84% of inflow)

Center-of-Mass det. time= 142.2 min (906.2 - 764.0)

Volume	Invert	Avail.Storage	Storage Description			
#1	1,509.00'	30,644 cf	Custom Stage Data (Irregular) Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
1,509.00	3,422	233.0	0	0	3,422	
1,510.00	4,622	296.0	4,007	4,007	6,087	
1,511.00	5,561	323.0	5,084	9,091	7,453	
1,512.00	6,595	364.0	6,071	15,162	9,720	
1,513.00	7,724	407.0	7,152	22,314	12,387	
1,514.00	8,952	449.0	8,330	30,644	15,279	

Device	Routing	Invert	Outlet Devices											
#1	Secondary	1,512.00'	10.0' long x 8.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74											
#2	Primary	1,506.40'	24.0" x 27.0' long Culvert CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,505.00' S= 0.0519 '/' Cc= 0.900 n= 0.012											
#3	Device 2	1,512.00'	6.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32											
#4	Device 2	1,509.00'	4.0" Vert. Orifice/Grate C= 0.600											

Primary OutFlow Max=0.58 cfs @ 12.90 hrs HW=1,511.10' (Free Discharge)

- ↑ 2=Culvert (Passes 0.58 cfs of 29.08 cfs potential flow)
- ↑ 3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)
- ↑ 4=Orifice/Grate (Orifice Controls 0.58 cfs @ 6.69 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=1,509.00' (Free Discharge)

- ↑ 1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

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WET POND PLUGGED OCS
 Type III 24-hr 25 YEAR Rainfall=4.40"
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 Page 1

Summary for Pond 1P: PLUGGED OCS

Inflow Area = 1.708 ac, 69.56% Impervious, Inflow Depth > 3.02" for 25 YEAR event
 Inflow = 6.86 cfs @ 12.02 hrs, Volume= 0.430 af
 Outflow = 0.26 cfs @ 15.03 hrs, Volume= 0.079 af, Atten= 96%, Lag= 180.4 min
 Primary = 0.26 cfs @ 15.03 hrs, Volume= 0.079 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 1,512.05' @ 15.03 hrs Surf.Area= 6,648 sf Storage= 15,484 cf

Plug-Flow detention time= 382.4 min calculated for 0.079 af (18% of inflow)
 Center-of-Mass det. time= 234.0 min (998.0 - 764.0)

Volume	Invert	Avail.Storage	Storage Description			
#1	1,509.00'	30,644 cf	Custom Stage Data (Irregular) Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
1,509.00	3,422	233.0	0	0	3,422	
1,510.00	4,622	296.0	4,007	4,007	6,087	
1,511.00	5,561	323.0	5,084	9,091	7,453	
1,512.00	6,595	364.0	6,071	15,162	9,720	
1,513.00	7,724	407.0	7,152	22,314	12,387	
1,514.00	8,952	449.0	8,330	30,644	15,279	

Device	Routing	Invert	Outlet Devices													
#1	Primary	1,512.00'	10.0' long x 8.0' breadth Broad-Crested Rectangular Weir													
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00													
			2.50 3.00 3.50 4.00 4.50 5.00 5.50													
			Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64													
			2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74													

Primary OutFlow Max=0.26 cfs @ 15.03 hrs HW=1,512.05' (Free Discharge)
 ↑1=Broad-Crested Rectangular Weir (Weir Controls 0.26 cfs @ 0.54 fps)

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WET POND PLUGGED OCS
 Type III 24-hr 100 YEAR Rainfall=5.30"
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 Page 2

Summary for Pond 1P: PLUGGED OCS

Inflow Area = 1.708 ac, 69.56% Impervious, Inflow Depth > 3.84" for 100 YEAR event
 Inflow = 8.61 cfs @ 12.02 hrs, Volume= 0.546 af
 Outflow = 0.83 cfs @ 12.76 hrs, Volume= 0.195 af, Atten= 90%, Lag= 44.5 min
 Primary = 0.83 cfs @ 12.76 hrs, Volume= 0.195 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 1,512.10' @ 12.76 hrs Surf.Area= 6,709 sf Storage= 15,859 cf

Plug-Flow detention time= 245.5 min calculated for 0.194 af (36% of inflow)
 Center-of-Mass det. time= 140.2 min (898.7 - 758.5)

Volume	Invert	Avail.Storage	Storage Description			
#1	1,509.00'	30,644 cf	Custom Stage Data (Irregular) Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
1,509.00	3,422	233.0	0	0	3,422	
1,510.00	4,622	296.0	4,007	4,007	6,087	
1,511.00	5,561	323.0	5,084	9,091	7,453	
1,512.00	6,595	364.0	6,071	15,162	9,720	
1,513.00	7,724	407.0	7,152	22,314	12,387	
1,514.00	8,952	449.0	8,330	30,644	15,279	

Device	Routing	Invert	Outlet Devices											
#1	Primary	1,512.00'	10.0' long x 8.0' breadth Broad-Crested Rectangular Weir											
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00											
			2.50 3.00 3.50 4.00 4.50 5.00 5.50											
			Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64											
			2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74											

Primary OutFlow Max=0.82 cfs @ 12.76 hrs HW=1,512.10' (Free Discharge)
 ↑1=Broad-Crested Rectangular Weir (Weir Controls 0.82 cfs @ 0.79 fps)

Channel Report

Wet Pond Spillway Velocity Calculation (100 Year Storm with Plugged OCS)

Trapezoidal

Bottom Width (ft) = 10.00
Side Slopes (z:1) = 2.00, 2.00
Total Depth (ft) = 2.00
Invert Elev (ft) = 1512.00
Slope (%) = 2.00
N-Value = 0.030

Highlighted

Depth (ft) = 0.07
Q (cfs) = 0.830
Area (sqft) = 0.71
Velocity (ft/s) = 1.17
Wetted Perim (ft) = 10.31
Crit Depth, Yc (ft) = 0.06
Top Width (ft) = 10.28
EGL (ft) = 0.09

Calculations

Compute by: Known Q
Known Q (cfs) = 0.83 FROM HYDROCAD (100 YEAR STORM)

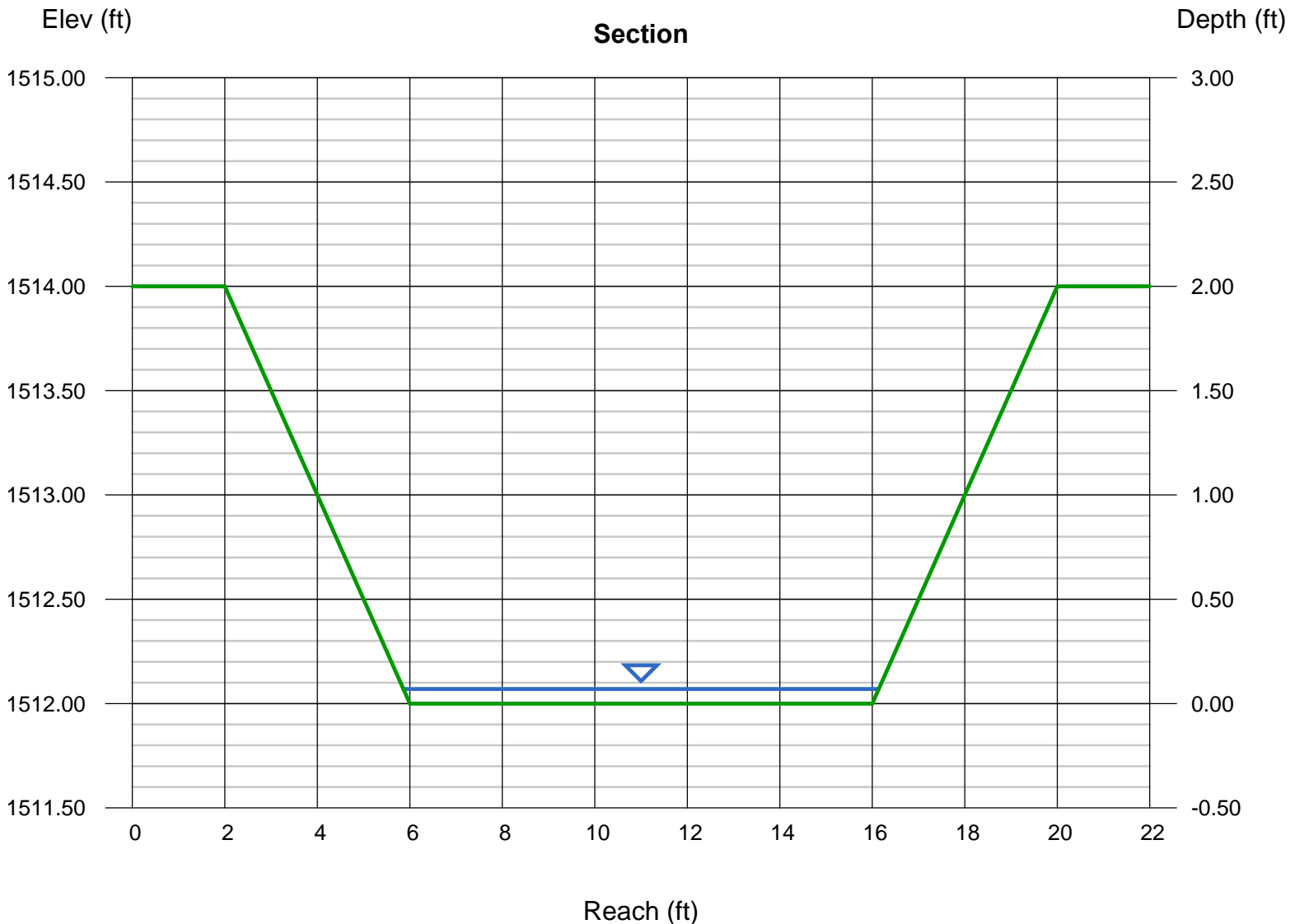


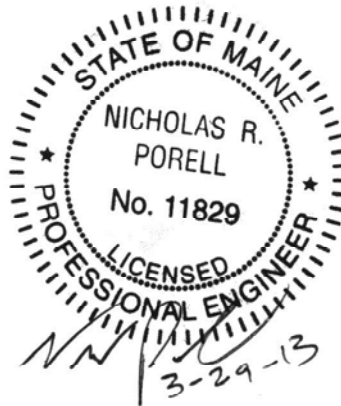
Exhibit 12B: Generator Lead Stormwater Management and Control Plan

STORMWATER MANAGEMENT REPORT
MDEP SITE LOCATION OF DEVELOPMENT PERMIT APPLICATION

**Blue Sky West II, LLC 115kV Generator Lead
Construction Access Roads**

MAYFIELD TOWNSHIP TO PARKMAN, MAINE

March 2013



Prepared for:
Blue Sky West II, LLC
c/o First Wind Energy, LLC
129 Middle Street, 3rd Floor
Portland, ME 04101

Prepared by:
SGC Engineering, LLC
501 County Road
Westbrook, Maine 04092

Project No. 782001



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Appendices

Appendix 12-1 Stormwater Quality Treatment Calculations

Appendix 12-2 USDA Soil Listing

Appendix 12-3 Culvert Sizing Calculations and Schedule

Appendix 12-4 Watershed/Impervious Area Summary

Appendix 12-5 Post-Construction Stormwater Inspection and Maintenance Log

Appendix 12-6 Forested Buffer Declaration of Restrictions



1.0 Project Description

Blue Sky West II, LLC proposes the construction of an approximately 17-mile long 115kV electrical transmission line between the towns of Mayfield Township and Parkman in Piscataquis County. Construction of the transmission line will necessitate the clearing of the transmission line right of way (ROW) and removal of the felled timber via conventional timber harvesting equipment and logging trucks. An assessment of the existing transportation infrastructure into and out of the proposed ROW was conducted by SGC Engineering during February 2013 with the roads under partial snow cover. This assessment resulted in the identification of access roads that were currently suitable for travel by logging equipment, as well as, access roads in need of improvement to support the necessary construction traffic. Whereas the assessment was completed with snow cover as noted above, some of the proposed roadway improvements (e.g. road widening, placement of additional gravel) included in this assessment may prove unnecessary.

The access assessment noted above resulted in the identification of seven (7) access roads totaling approximately 2.0 miles in need of substantial improvements to support logging and construction traffic. Some of the access roads have been divided into segments A, B, C, etc. for clarification in classifying the necessary improvements as shown on Sheet AR-00 – Access Road Location Plan. Generally, in their current state, these roads are moderately improved “winter-only” roads and skidder roads used for pre-existing timber harvesting operations, gravel roads too narrow to support construction traffic in their current condition or are proposed new roads altogether. The roads identified for improvement were selected based on their proximity to the transmission line ROW, as well as, connectivity to good transportation corridors for timber removal. The inclusion of these roadway improvements within the overall transmission line construction project will result in fewer trips by construction traffic along sections of the transmission line ROW that contain large wetlands, streams and associated poor/erodible soils.

The existing roads themselves vary in width but are generally between 8'-12' wide in their current condition. Some of the roadways have been improved with compacted gravel while others are rudimentary skidder roads. In their current condition, the access roads would not be suitable for repeated trips by construction traffic as will be necessary for clearing and construction of the proposed 115kV transmission line.

The proposed improvements for the access roads include widening the roads to a consistent 12-foot travel width, installation of properly-sized drainage culverts, and construction of stormwater conveyance ditches and level spreaders where necessary to provide for stable, long-term access roads that can be utilized for construction activities, as well as future maintenance efforts. As specified by the proposed project plans and construction details, approximately 12"-18" of MDOT Spec 703.12 gravel will be placed and compacted along the roadway alignments. A layer of geotextile fabric will be placed between the native material and the imported gravel. In areas of vegetation and organic topsoil, the organic layer will be removed prior to placement of the geotextile fabric to assist in developing a suitable roadway base.



The Access Road Location Plan provides a general overview of the location of the access road improvements in relation to the overall transmission line project and the surrounding roadways. This plan also illustrates the roads identified for use during construction that do not necessitate improvements, and as such, are not included in this permit application. Construction requirements, as well as stormwater treatment and erosion control provisions are specified on the Access Road Plan & Profile sheets and the associated construction details.

2.0 Maine Stormwater Statutes and Regulations

The project is subject to the Maine Site Location of Development, Erosion and Sedimentation Control, and Stormwater Management statutes. This report will focus on the methods proposed to comply with the Chapter 500 Stormwater Management Rules administered by the Maine Department of Environmental Protection (MDEP).

All disturbed areas, with the exception of the improved access road travel surface, will be re-vegetated to establish a stabilized cover of grass that will be allowed to revert to natural conditions following an 8-12 month construction period. Therefore, this project will not create areas defined as maintained developed/landscaped area, as defined in Chapter 500 that would be subject to stormwater treatment. The rules and standards in Chapter 500 are considered applicable to only the impervious areas associated with the upgrades to the access roads.

The linear nature and disconnected construction of the access roads will not involve greater than three acres of impervious area in any of the project's sub-watersheds with a total proposed impervious area of 2.92 acres. The new impervious areas associated with the corridor access roads will represent a minor change in land use when each sub-watershed/access road is reviewed individually. Section 7.0 and Appendix 12-4 of this report summarize the areas that contribute to the total new impervious surface throughout the project area. Compliance with the Chapter 500 flooding standard is required as the Generator Lead construction access roads are part of the larger Bingham Wind Power project.

With regard to Stormwater Quality, the project is subject to Chapter 500 General Standards and Basic Standards. The project proposes new impervious area in the Piscataquis River watershed and associated tributaries. General and Basic Standards apply in all of the river watersheds, as greater than one acre of new impervious area will be created.

This report presents a stormwater management program and supporting calculations that demonstrates compliance with stormwater quantity and stormwater quality rules administered by the MDEP.

3.0 Stormwater Modeling Methodology

For this study, SGC Engineering, LLC utilized the Rational Method for computing stormwater runoff. The Rational Method calculations were used to determine culvert sizes based on a 25-



year storm event. The 25-year rainfall intensity was taken from an Intensity-Duration-Frequency (IDF) Curve. Data for the IDF curve was taken from Appendix A-8, IDF Curve for the Town of Newport, MDEP Stormwater Management for Maine, Volume III. Appendix 12-3 contains the supporting data for all stormwater runoff calculations presented in this report.

4.0 Soil Conditions

The USDA Natural Resources Conservation Service Soil Survey for Piscataquis County (Southern Part), Maine were utilized for the stormwater quality assessment/buffering calculations included in this report. According to this source, the project area contains hydrologic soil group (HSG) types B, C and D. Generally, soils are comprised of gravelly loams in upland areas and silt loams in areas of C or D soils and/or wetland areas. A table listing the USDA soils is provided in Appendix 12-2. Soil types are also identified on the road plan and profile sheets and accounted for in the Stormwater Quality calculation table Appendix 12-1.

5.0 Pre-Development Drainage Conditions

The areas encompassing the proposed access roads are generally gently sloping. Elevations generally range from 400 feet at the low point near the Piscataquis River to 1,600 feet above sea level. As previously mentioned, the project lies in the Piscataquis River watershed and associated tributaries. The Piscataquis drains to the Penobscot River in Howland, Maine, which discharges to the Atlantic Ocean. The topography and land cover types are relatively similar for the entire project area. The areas are forested with limited access provided by means of forestry roads as described above.

As noted above, in their current condition the roadways are “winter-only” roads that, lacking any major improvements, would require frozen ground to support heavy loads. Drainage is currently managed via an inadequate number of cross culverts and overland flow.

6.0 Post-Development Drainage Conditions

The existing alignments of the access roads will be maintained. Existing drainage patterns will be maintained and improved by the use of properly sized and located cross culverts. Stormwater treatment and erosion control BMP’s that meet the Chapter 500 rules and standards will be implemented to minimize impacts to down gradient resources. The project achieves these goals by maintaining existing drainage patterns with the use of cross culverts, level spreaders, and ditch turnouts to redistribute stormwater via sheet flow to vegetated buffers. Frequently redistributing channelized flow to buffers avoids aggregating flow that results in increased peak stormwater runoff rates. This strategy works to evenly distribute stormwater to vegetative buffers and thereby providing effective stormwater quality control by maintaining existing drainage patterns and associated peak rates.



7.0 Stormwater Quantity Analysis

As noted above, the project will create/upgrade approximately 2.0 miles of roadway. Together, this represents approximately 2.92 acres of impervious area. As noted in Section 5.0, the project area is within the Piscataquis River watershed. Within the major watershed are four (4) sub-watersheds consisting of named streams and brooks that are tributary to the Piscataquis River. Appendix 12-4 includes a table summarizing the distribution of the roadway segments and associated impervious area throughout the four sub-watersheds. As illustrated in Appendix 12-4, no individual sub-watershed contains more than 3 acres of impervious area associated with the access road segments. Also summarized within the table are the total acreages of the individual sub-watersheds and the percentage of the total watershed area that the access road impervious area represents. Please note, for river and stream segments, the watershed area represents only the area between tributaries to that river/stream segment, and not the total major watershed area thereby excluding the up-gradient areas. Watershed areas were obtained from the Maine Office of GIS (*mrdrdvd* data layer) and are based on USGS topographic mapping. In all instances, access road segments represent less than 0.07% of the total sub-watershed area, and in most cases, substantially less.

Whereas the roadway segments do not represent a significant change to the surface cover within each of the watersheds, the approach to stormwater quantity management for the project is to avoid significant modifications to existing drainage patterns by installing cross culverts, ditch turnouts, and level spreaders. These devices return stormwater flow to the same pattern for the post-development condition as the pre-development conditions by dispersing stormwater in sheet flow to down gradient vegetated buffers. Spreading stormwater runoff across wide vegetated areas mitigates any potential down gradient impacts by minimizing channelized stormwater from discharging from the road segments. These measures are further described in Section 8.0.

8.0 Stormwater Quality Analysis

The Chapter 500 Basic Standards and General Standards are considered applicable to the project, as greater than one acre of impervious area is proposed within the Piscataquis River watershed. The project does present the characteristics of a linear project that requires stormwater treatment of 75% of the new impervious area.

As previously mentioned, only the impervious area associated with the access roads will be considered when performing stormwater treatment calculations. All other areas disturbed during project construction are proposed to be re-vegetated and not mowed, and allowed over time to revert to natural vegetated conditions following a 8-12 month construction period. Therefore, there is no landscaped/developed area to factor into the treatment calculations.

The impervious area will be treated exclusively via the use of vegetated buffers. No structural measures are proposed. The vegetated buffer standards specified in Appendix F of Chapter 500: Stormwater Management Rules were used to comply with the General stormwater treatment



standards. Buffers adjacent to the downhill side of a road and ditch turnouts were all applied as the available topographic and vegetative buffer conditions permitted. Vegetative buffer lengths were assigned according to land cover type, slope, and HSG soil types. Buffer locations and identifications are depicted on the project plans. Stormwater quality calculations for each watershed, including the physical characteristics of each buffer utilized, are provided in Appendix 12-1. Included in Appendix 12-6 is a draft Declaration of Restrictions for the proposed forested buffers. All stormwater quality calculations demonstrate compliance with Chapter 500: Stormwater Management Rules and Standards.

The following is a summary of each buffer type as described in Chapter 500 Appendix F that has been applied throughout the project.

- 1) Ditch turnout buffers are proposed in accordance with the table provided in Ch. 500 Appendix F, part 5. Buffers with HSG B, C and D soils are assigned within the given slope and length parameters.
- 2) Buffers adjacent to the downhill side of a road are proposed as frequently as possible, as this is the simplest and most effective means for stormwater treatment. All buffers meet the maximum 20% slope design criteria.

9.0 Culvert Sizing Analysis

In accordance with the Chapter 500 Flooding Standards, all proposed culverts for the project have been sized to convey stormwater runoff from the 25-year storm event without overtopping the access road. High density polyethylene (HDPE) pipe is proposed for all culverts. Each culvert has been sized using the Rational Method to determine the 25-year peak flow and using Manning's equation to confirm pipe flow capacity at a minimum slope between 1% and 4% based on the necessary capacity. Rational Method calculations are provided in Appendix 12-3. All culvert locations are depicted on the road plans. The culvert sizes, length, minimum slopes, and multipliers (i.e. multiple culverts) are provided in a schedule included in the design plans as well as in Appendix 12-3. A minimum culvert diameter of 15" has been used to minimize risk of blockage due to debris buildup.

10.0 Erosion and Sedimentation Control

Numerous erosion control measures are specified on the plans including silt fence, erosion control mix berms, culvert inlet stone check dams, stone construction entrances, stone check dams in drainage ditches, and erosion control matting on embankments. The plans also contain erosion control notes that outline procedures and actions that must be taken during construction in addition to the erosion control measures depicted on the plans. If the erosion control measures are implemented correctly and procedures outlined in the erosion control notes are followed, the project should not result in significant erosion of disturbed areas or transport of sedimentation to down gradient resources. It is the responsibility of the owner and their designated contractor to take actions during construction beyond the erosion control measures specified on the plans and implement additional erosion control measures as may be



dictated by specific site and weather conditions. The detailed project erosion control plan narrative is included in Section 14 of the permit application.



Appendix 12-1

Stormwater Quality Treatment Calculations



Project: Bingham Gen Lead Access Roads
 Prepared for: Blue Sky West II, LLC
 Prepared by: SGC Engineering
 Project No.: 782001

Stormwater Treatment Calculations

River Watersheds

Ch. 500 4.B Stormwater Management General Standards - (Linear Project)

Stormwater treatment of new impervious area required = 75.00%

BMP ID Descriptions

- BM = Meadow buffer adjacent to road
- BF = Forested buffer adjacent to road
- DM = Meadow ditch turnout buffer
- DF = Forested ditch turnout buffer

Road ID	Roadway Segment Treated (Stations)	Buffer Location (Looking Upstation) R=right side road L=left side road	Road Length (ft) Total/Treated	Road Width (ft)	BMP TYPE	BMP ID	Level Spreader Length (ft)	USDA Soil	Soil HSG	Buffer Slope (%)	Buffer Length (ft)	Impervious Area (sq-ft)	Impervious Area Treated (sq-ft)	Treatment Percentage
Piscataquis River Watersheds														
Piscataquis River (direct)														
AR-120-B&C			1,000	12								12,000		
	1+00 to 2+00	R	100		BF	1	-	PhB	C	3	35		1,200	10.00%
	2+00 to 4+00	R	200		DF	2	20	HrB	C	14	90		2,400	20.00%
	4+00 to 6+00	R	200		DF	3	20	HrB	C	8	75		2,400	20.00%
	6+00 to 9+50	R	350		BF	4	-	HrB	C	8	35		4,200	35.00%
Sub-Watershed Total												12,000	10,200	85.00%
Gales Brook > Piscataquis River														
AR-212			1,900	12								22,800		
	0+50 to 3+50	R	300		BF/BM	1	-	HrB	C	5	50		3,600	15.79%
	4+50 to 7+50	R	300		DF	2	20	HrB	C	7	100		3,600	15.79%
	7+50 to 10-50	R	300		DF	3	20	HrB	C	7	100		3,600	15.79%
	10+50 to 13+50	R	300		DF	4	20	HrB	C	8	100		3,600	15.79%
	13+50 to 16+50	R	300		DF	5	20	HrB	C	8	100		3,600	15.79%
AR-230			3,465	12								41,580		
	0+00 to 2+50	R	250		DF	1	20	PfC	C	8	100		3,000	7.22%
	4+50 to 6+50	R	200		DF	2	20	HrB	C	20	90		2,400	5.77%
	7+00 to 17+00	R	1,000		BF	3	-	HrB	C	15-20	35		12,000	28.86%
	17+00 to 30+00	R	1,300		BF	4	-	TsC	D	9-20	35		15,600	37.52%
Sub-Watershed Total												64,380	51,000	79.22%

BMP Type:

- BM=Meadow Buffer Adjacent to Road
- BF=Forested Buffer Adjacent to Road
- DM=Meadow Ditch Turnout Buffer
- DF=Forested Ditch Turnout Buffer

Appendix 12-1: Stormwater Quality Treatment Calculations

Blue Sky West II, LLC 115kV Gen Lead Construction Access Roads – Mayfield TWP to Parkman, Maine

Road ID	Roadway Segment Treated (Stations)	Buffer Location (Looking Upstation) R=right side road L=left side road	Road Length (ft) Total/Treated	Road Width (ft)	BMP TYPE	BMP ID	Level Spreader Length (ft)	USDA Soil	Soil HSG	Buffer Slope (%)	Buffer Length (ft)	Impervious Area (sq-ft)	Impervious Area Treated (sq-ft)	Treatment Percentage
Carlton Stream > Kingsbury Stream > Piscataquis River														
AR-300			1,300	12								15,600		
	0+25 to 2+50	L	225		BM	1	-	HrB/PwC	C	3-15	50		2,700	17.31%
	6+00 to 8+00	L	200		DM	2	20	HrB	C	6	120		2,400	15.38%
	8+00 to 11+00	L	300		DF	3	20	PwC	C	6	100		3,600	23.08%
	11+00 to 13+00	L	200		DM	4	20	PwC	C	3	120		2,400	15.38%
Sub-Watershed Total												15,600	11,100	71.15%
Kingsbury Stream > Piscataquis River														
AR-355			850	12								10,200		
	0+25 to 2+75	L	250		BF/BM	1	-	CpB	D	5	50		3,000	29.41%
	6+40 to 8+50	L	210		BF/BM	2	-	CpB	D	5	50		2,520	24.71%
AR-390			1,575	12								18,900		
	1+00 to 15+00	R	1,400		BF/BM	1	-	DbC	B	10-15	50		16,800	88.89%
AR-460-B			525	12								6,300		
	1+25 to 3+25	R	200		DF	1	20	DyC	D	8	100		2,400	38.10%
	3+25 to 5+25	R	200		DF	1	20	DyC	D	8	100		2,400	38.10%
Sub-Watershed Total												35,400	27,120	76.61%
PROJECT TOTAL												127,380	99,420	78.05%

BMP Type:

BM=Meadow Buffer Adjacent to Road

BF=Forested Buffer Adjacent to Road

DM=Meadow Ditch Turnout Buffer

DF=Forested Ditch Turnout Buffer

Appendix 12-2

USDA Soil Listing

Road ID	Soil ID	Soil Name	Slope	HSG
<i>Piscataquis County Soils</i>				
AR-120	HRB	Howland-Monarda association	3-8	C
	PHB	Penquis-Thorndike complex	3-8	C
AR-212	HRB	Howland-Monarda association	3-8	C
AR-230	PFC	Penquis-Plaisted-Berkshire complex	3-15	C
	PWC	Plaisted-Howland-Penquis association	8-15	C
	TSC	Thorndike-Penquis complex	3-25	D
	HRB	Howland-Monarda association	3-8	C
AR-300	HRB	Howland-Monarda association	3-8	C
	PWC	Plaisted-Howland-Penquis association	8-15	C
AR-355	CPB	Colonel-Brayton-Dixfield association	1-8	D
	DYC	Dixfield-Colonel-Lyman association	3-15	D
AR-390	DBC	Danforth channery silt loam	3-15	B
	CPB	Colonel-Brayton-Dixfield association	1-8	D
AR-460	DYC	Dixfield-Colonel-Lyman association	3-15	D

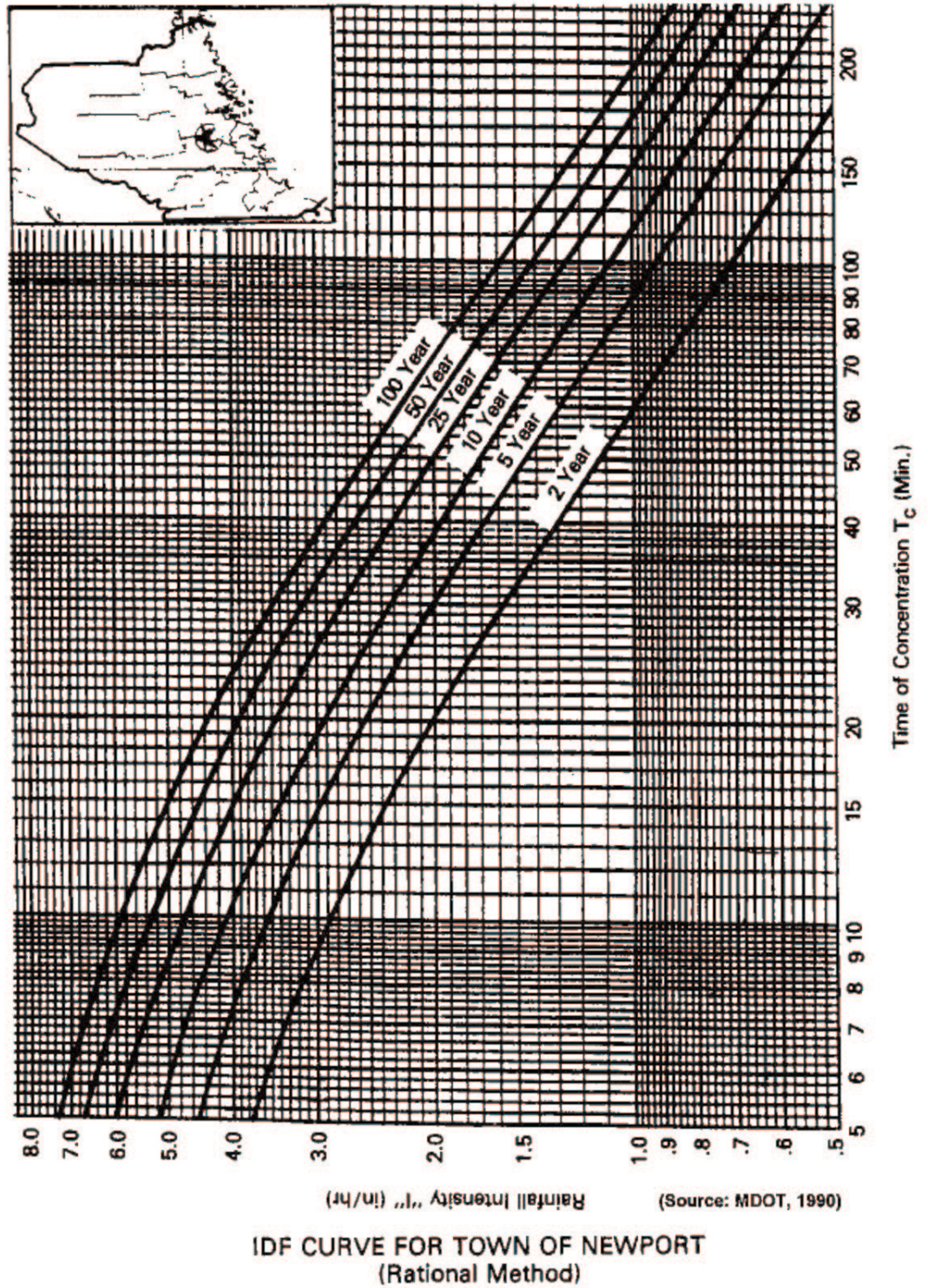
Appendix 12-3

Culvert Sizing Calculations and Schedule

CULVERT SIZING TABLE									
Mannings Equation		$Q \text{ (cfs)} = \frac{kAR^{2/3}S^{1/2}}{n}$		k= 1.486 (US Units)	R=	A/P			
Rational Method		$Q \text{ (cfs)} = C*I*A$		n= 0.013 HDPE Pipe	S=	slope (ft/ft)			
				A= Pipe Area (full), ft²					
				P= Wetted Perimeter (full), ft					
				C= 0.3 (Moderately Sloped Timberland, C/D Soils)					
				I= 6 (Rainfall Intensity, Inches/hr, Newport, ME)					
				A= Area, acres					
Road ID	Culvert ID	Tributary Area		Calculated Runoff, Rational Method (cfs)	Length (ft)	Diameter (in) (15" Min)	# of Culverts **	Min Slope (ft/ft)	Mannings Culvert Capacity (cfs)
		sq-ft	acres						
AR-120									
AR-212									
AR-230									
	C-230-1	130,000	2.984	5.37	25	15	1	0.02	9.14
	C-230-2	200,000	4.591	8.26	25	15	1	0.03	11.19
	C-230-3	735,000	16.873	30.37	25	24	1	0.04	45.24
	C-230-4	220,000	5.051	9.09	25	15	1	0.03	11.19
	C-230-5	205,000	4.706	8.47	25	15	1	0.03	11.19
AR-300									
AR-355									
	C-355-1	86,000	1.974	3.55	30	15	1	0.01	6.46
	C-355-2	80,000	1.837	3.31	25	15	1	0.01	6.46
AR-390									
AR-460-B									

** Use Manufactured Headwall and Endwall for Multiple Culvert Installations
(EX) Denotes location of Existing Culvert

Appendix A-8: IDF Curve for Town of Newport



Appendix 12-4

Watershed/Impervious Area Summary

Appendix 12-4: Watershed/Impervious Area Summary

Blue Sky West II, LLC 115kV Gen Lead Construction Access Roads – Mayfield TWP to Parkman, Maine

Road ID	Total Watershed Area (ac)	Road Length (ft)	Road Width (ft)	Impervious Area (sq-ft)	Impervious Area (acres)	Percent of Watershed Area
<i>Piscataquis River Watersheds</i>						
<i>Piscataquis River (direct)</i>						
AR-120-B & C	2,190	1,000	12	12,000	0.28	0.013%
Sub-Watershed Total				12,000	0.28	0.013%
<i>Gales Brook > Piscataquis River</i>						
AR-212	2,230	1,900	12	22,800	0.52	0.023%
AR-230		3,465	12	41,580	0.95	0.043%
Sub-Watershed Total				64,380	1.48	0.066%
<i>Carlton Stream > Kingsbury Stream > Piscataquis River</i>						
AR-300	11,150	1,300	12	15,600	0.36	0.003%
Sub-Watershed Total				15,600	0.36	0.003%
<i>Kingsbury Stream > Piscataquis River</i>						
AR-355	12,400	850	12	10,200	0.23	0.002%
AR-390		1,575	12	18,900	0.43	0.003%
AR-460-B		525	12	6,300	0.14	0.001%
Sub-Watershed Total				35,400	0.81	0.007%
<i>Project Total</i>				<u>127,380</u>	<u>2.92</u>	<u>n/a</u>

Appendix 12-5

Post-Construction Stormwater Inspection and Maintenance Log

Refer to **Section 12 – Stormwater Management** prepared by **DeLuca-Hoffman Associates, Inc.** for the project Post-Construction Stormwater Inspection and Maintenance Log

Appendix 12-6

Forested Buffer Declaration of Restrictions

Refer to **Section 12 – Stormwater Management** prepared by **DeLuca-Hoffman Associates, Inc.** for the project Forested Buffer Declaration of Restrictions