STORMWATER MANAGEMENT
&
SEDIMENT AND EROSION CONTROL PLAN

Prepared for:

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BENDING BROOK RESIDENTIAL DEVELOPMENT

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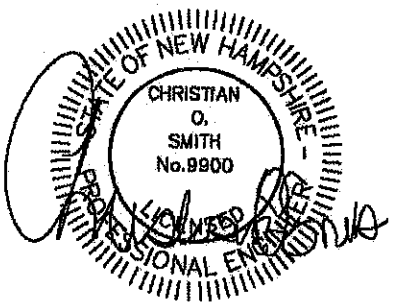
Project Number:
NH-1443
Mallego Road
Barrington, New Hampshire

November 14, 2022
Revised 1-17-23



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DESIGN METHOD OBJECTIVES

Joseph Falzone proposes a 15-lot single family open-space development on approximately 43-acres of land located off Mallego Road in Barrington, NH that includes 2-conventional lots with frontage on Mallego Road. A drainage analysis of the proposed development was conducted for the purpose of estimating the peak rate of stormwater run-off and to subsequently design adequate drainage structures. Two models were compiled, one for the area in its existing (pre-construction) condition, and a second for its proposed (post-construction) condition. The analysis was conducted using data for the 2, 10, 25 and 50Yr – 24 Hr storm events using the USDA SCS TR-20 method within the HydroCAD Stormwater Modeling System environment. The purpose of this analysis is to estimate the peak rates of run-off from the site for swale adequacy purposes, and to compare the peak rate of run-off between the existing and proposed conditions. Rainfall data utilized is as provided in the Extreme Precipitation tables by Cornell University. Infiltration rates, for the pond that is designed to recharge stormwater, have been taken from the published SSSNNE Ksat values for the soils delineated. The published values were then divided by 2 as a factor of safety as required by the NH Stormwater Manual.

ANALYSIS COMPONENT PEAK RATE of DISCHARGE (CFS)

	2 YR		10 YR		25 YR		50 YR	
	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
Reach #100	0.56	0.36	6.51	5.51	15.27	14.30	25.63	25.05
Subcat #2	4.23	0.75	21.21	6.37	38.39	13.38	56.37	20.99

STORMWATER VOLUME COMPARISON (2-YR STORM IN AF)

	Existing	Proposed
Reach #100	0.326	0.226

The existing property is located on a parcel consisting of forest, woods roads, , wetlands and an open area utilized as a landing for historic mineral excavation activity. The existing topography is such that the site analysis is divided into two subcatchments. Reach 100 flows offsite to a large wetland complex, northerly to Mallego Brook. Subcatchment #2 consists of the gravel pit area with stockpiles, gravel roads and terminates onsite through infiltration within the very porous soils. Directions as can be seen on the existing conditions watershed plan (Sheet W1).

The proposed Lot development includes a proposed public roadway that is in a cul-de-sac terminus configuration and intersects Mallego Road. This road provides the required frontage for the residential conservation lots. The proposed layout will divide the parcel into eight different subcatchments. The peak rate of run-off from the proposed development is equal to or decreased from that of the existing conditions under all design storms evaluated. The addition of swales, culverts, a filtration pond, and level spreaders direct the treated run off overland to the wetlands or recharge it back into the ground water matrix. All roadway runoff receives treatment through the bioretention filtration pond prior to discharge into overland areas or infiltration. All ponds have been designed with pretreatment sediment fore bays as a portion of the runoff is generated from paved roads/drives. In addition, the potential for increased erosion and sedimentation is handled by way of stone check dams, erosion matting int he swales and/or erosion control berms. The proposed bioretention pond is well oversized to provide for future municipal connection to mitigate existing drainage issues along Mallego Road. The developer will be constructing a system of manholes that extend from Mallego Road (the town tie-in point) to sediment forebays. It is anticipated this tie-in would not take place for several years. The use of Best Management Practices per the New Hampshire Stormwater Manual has been applied to the design of

these structures and will be observed during all stages of construction. All land disturbed during construction will be permanently stabilized within 60 days of groundbreaking, and existing wetlands and abutters will suffer no adversity resulting from this development.

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1.0 RAINFALL CHARACTERISTICS

This stormwater management plan includes an existing conditions analysis of the area involved in the proposed development, as well as proposed conditions, or post-construction analysis of the same location. These analyses were accomplished using the USDA SCS TR-20 Method within the HydroCAD Stormwater Modeling System. The curve numbers were developed using the SCS TR-55 Runoff Curve numbers for Urban Areas. A Type III SCS 24-hour rainfall distribution was utilized in analyzing the data for the 2, 10 and 50Yr – 24 Hr storm events using the USDA SCS TR-20 method within the HydroCAD Stormwater Modeling System environment.

ANALYSIS COMPONENT PEAK RATE of DISCHARGE (CFS)

	2 YR		10 YR		25 YR		50 YR	
	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
Reach #100	0.56	0.36	6.51	5.51	15.27	14.30	25.63	25.05
Subcat #2	4.23	0.75	21.21	6.37	38.39	13.38	56.37	20.99

STORMWATER VOLUME COMPARISON (2-YR STORM IN AF)

	Existing	Proposed
Reach #100	0.326	0.226

2.0 EXISTING CONDITIONS

Reference: Sheet W-1, Existing Conditions Watershed Plan (Enclosed)
Existing Conditions Plans

The existing property is located on a parcel consisting of forest, woods roads, , wetlands and an open area utilized as a landing for historic mineral excavation activity. The existing topography is such that the site analysis is divided into two subcatchments. Reach 100 flows offsite to a large wetland complex, northerly to Mallego Brook. Subcatchment #2 consists of the gravel pit area with stockpiles, gravel roads and terminates onsite through infiltration within the very porous soils. Directions as can be seen on the existing conditions watershed plan (Sheet W1).
Classified by Site Specific Soil Mapping, the land within the drainage analysis is composed of slopes ranging from 3% to <25%, and soils categorized into the Hydrologic Soil Groups (HSG) A, B, C and D. No flood hazard zone exists on the parcel, though the parcel is within the Towns aquifer protection district..

3.0 PROPOSED CONDITIONS

Reference: W-Sheets Proposed Conditions Watershed Plan (Enclosed)
C Sheets Proposed Conditions Plans

The addition of the impervious area from the 22' wide paved roadway, and the proposed house lots cause an increase in the curve number (Cn) and a decrease in the time of concentration (Tc), the net result being a potential increase in peak rates of run-off from the site. The proposed development includes a proposed public roadway that is in a cul-de-sac terminus configuration and intersects Mallego Road. This road provides the required frontage for the residential conservation lots. The

proposed layout will divide the parcel into eight different subcatchments. The peak rate of run-off from the proposed development is equal to or decreased from that of the existing conditions under all design storms evaluated. The addition of swales, culverts, a filtration pond, and level spreaders direct the treated run off overland to the wetlands or recharge it back into the ground water matrix. All roadway runoff receives treatment through the bioretention filtration pond prior to discharge into overland areas or infiltration. All ponds have been designed with pretreatment sediment fore bays as a portion of the runoff is generated from paved roads/drives. In addition, the potential for increased erosion and sedimentation is handled by way of stone check dams, erosion matting int he swales and/or erosion control berms. The proposed bioretention pond is well oversized to provide for future municipal connection to mitigate existing drainage issues along Mallego Road. The developer will be constructing a system of manholes that extend from Mallego Road (the town tie-in point) to sediment forebays. It is anticipated this tie-in would not take place for several years. The use of Best Management Practices per the New Hampshire Stormwater Manual has been applied to the design of these structures and will be observed during all stages of construction. All land disturbed during construction will be permanently stabilized within 60 days of groundbreaking, and existing wetlands and abutters will suffer no adversity resulting from this development.

Impervious area take-offs were calculated digitally from the proposed road pavement and utilizing HydroCAD's "1/2-acre, 25% impervious" designation for the developed lots. Seasonal high-water tables for the treatment ponds and infiltration areas were modeled based on actual test pits logged within the proposed BMP areas. The run-off is treated and infiltrated or outletted toward wetlands areas modeled as HydroCAD "reaches" and "ponds". These consist of constructed swales, existing flow paths through larger subcatchments, roadway culverts, and a bioretention basin. Required groundwater recharge will be exceeded by a single 1" storm (2,976 c.f. required and 5,619 c.f. provided by a 1-year storm).

In an effort to prevent the sedimentation of adjacent wetlands or abutting property, the roadway is equipped with roadside swales that terminate into culverts, catch basins or directly into sediment forebays for the mentioned BMP treatment pond. Ksat values were utilized based on published data in SSSNNE Special Publication No. 5 (copy in appendices) with the requisite factor of safety applied. Post development stormwater flows reduced from existing for the 2YR through the 50YR storm events, and the pond safely passes the 50YR storm event as required by NHDES AoT. It should also be noted that the stormwater volume to each analysis point is equal or reduced compared to the existing conditions under the 2-YR frequency storm event. All BMP's have been designed per the New Hampshire Stormwater Manual and design worksheets appear in the appendices. During construction, appropriate temporary and/or permanent BMP's will be applied so as to negate the potential for sediment-laden run-off to discharge into wetlands prior to the final stabilization of the proposed grading. The structures outlined in this proposal provide for compliant treatment of stormwater run-off and for sediment control.

4.0 SEDIMENT & EROSION CONTROL PLANS BEST MANAGEMENT PRACTICES (BMP's)

Reference: C Sheets Proposed Conditions Plan
E Sheet Erosion & Sediment Control Details

The proposed site development is protected from erosion and the roadways and abutting properties are protected from sediment by the use of Best Management Practices as outlined in the New Hampshire Stormwater Manual. Any area disturbed by construction will be permanently re-stabilized within 60 days and abutting properties and wetlands will not be adversely affected by this development. All swales and drainage structures will be constructed and stabilized prior to having run-off directed to them.

4.1 Silt Fence / Erosion Control Berm and Construction Fence

The plan set demonstrates the location of silt fence or Erosion Control Berm for sediment control. In areas where the limits of construction need to be emphasized to operators, construction fence for added visibility will be installed. Sheet E-1, Erosion and Sediment Control Details, has the specifications for installation and maintenance of the silt fence. Orange construction fence will be VISI Perimeter Fence by Conwed Plastic Fencing, or equal. The four-foot fencing to be installed using six-foot posts at least two feet in the ground with spacing of six to eight feet.

4.2 Drainage Swales / Stormwater Conveyance Channels

Drainage swales will be stabilized with vegetation for long term cover as outlined below, and on Sheet E-1 using seed mixture C. As a general rule, velocities in the swale should not exceed 3.0 feet per second for a vegetated swale although velocities as high as 4.5 FPS are allowed under certain soil conditions.

4.3 Vegetated Stabilization

All areas that are disturbed during construction will be stabilized with vegetated material within 60 days of breaking ground. Construction will be managed in such a manner that erosion is prevented and that no abutter's property will be subjected to any siltation, unless otherwise permitted. All areas to be planted with grass for long-term cover will follow the specification and on Sheet E-1 using seeding mixture C, as follows:

Mixture	**Pounds** per Acre	**Pounds per** 1,000 Sq. Ft.
Tall Fescue	20	0.45
Creeping Red Fescue	28	0.65
Total	48	1.10

4.4 Stabilized Construction Entrance

A temporary gravel construction entrance provides an area where mud can be dislodged from tires before the vehicle leaves the construction site to reduce the amount of mud and sediment transported onto paved municipal and state roads. The stone size for the pad should be between 1 and 2-inch coarse aggregate, and the pad itself constructed to a minimum length of 50' for the full width of the

access road. The aggregate should be placed at least six inches thick. A plan view and profile are shown on Sheet E1 - Sediment and Erosion Control Detail Plan.

4.5 Level Spreaders

As mentioned above, the proposed site plan includes stone level spreaders above a vegetated buffer. Level spreaders must be more than six feet in width per the "New Hampshire Stormwater Maual." Stone Level spreaders enable any run-off directed towards them to be spread evenly into sheet flow prior to discharge into wetlands or treatment by a vegetated buffer, thus allowing for better buffer efficiency and a lesser potential for erosion.

4.6 Vegetated Buffers

Vegetated buffers are areas of land with natural or planted vegetation designed to receive sheet run-off from upgradient development. These natural areas, preferably wooded, are effective in removing sediment and sediment-laden pollutants from such run-off, although their effectiveness is severely diminished when forced to deal with concentrated flow and must therefore be equipped with a level-spreading device. Vegetated buffers should not have a slope exceeding fifteen percent and have a minimum length of seventy-five feet.

4.7 Environmental Dust Control

Dust will be controlled on the site by the use of multiple Best Management Practices. Mulching and temporary seeding will be the first line of protection to be utilized where problems occur. If dust problems are not solved by these applications, the use of water and calcium chloride can be applied. Calcium chloride will be applied at a rate that will keep the surface moist but not cause pollution.

4.8 Construction Sequence

1. Construct and/or install temporary and permanent sediment erosion and detention control facilities (silt fence/erosion control berm, vegetated swales, level spreaders, and constructed Vegetated buffers), as required. Erosion, sediment and facilities shall be installed and stabilized prior to any earth moving operation, and prior to directing run-off to them.

2. Clear, cut, grub, and dispose of debris in approved facilities.

3. Excavate and stockpile topsoil / loam. All disturbed areas shall be stabilized immediately after grading.

4. Construct the roadway and its associated drainage structures.

5. Begin permanent and temporary seeding and mulching. All cut and fill slopes and disturbed areas shall be seeded and mulched as required, or directed.

6. Daily, or as required, construct temporary berms, drainage ditches, sediment traps, etc. to prevent erosion on the site and prevent any siltation of abutting waters or property.

7. Inspect and maintain all erosion and sediment control measures during construction every two weeks and after every storm event with 0.5" or more rain.

9. Complete permanent seeding and landscaping.

9. Remove temporary erosion control measures after seeding areas have established themselves and site improvements are complete. Smooth and re-vegetate all disturbed areas.

10. All swales and all drainage ponds and structures will be constructed and fully stabilized prior to having run-off being directed to them.

11. Finish graveling all roadways/parking.

4.9 Temporary Erosion Control Measures

1. The smallest practical area of open soil shall be exposed at any one time.

2. Erosion, sediment control measures shall be installed as shown on the plans and at locations as required, or directed by the engineer.

3. All disturbed areas shall be returned to original grades and elevations. Disturbed areas shall be loamed with a minimum of 4" of loam and seeded with not less than 1.10 pound of seed per 1,000 square feet (48 pounds per acre) of area.

4. Silt fences and other barriers shall be inspected periodically and after every rainstorm during the life of the project. All damaged areas shall be repaired; sediment deposits shall periodically be removed and properly disposed of.

5. After all disturbed areas have been stabilized, the temporary erosion control measures are to be removed and the area disturbed by the removal smoothed and revegetated.

6. Areas must be seeded and mulched within 5 days of final grading, permanently stabilized within 15 days of final grading, or temporarily stabilized within 30 days of initial disturbance of soil.

4.10 Inspection and Maintenance Schedule

Fencing/Erosion Control Berm will be inspected during and after storm events to ensure that the fence still has integrity and is not allowing sediment to pass. Sediment build-up in swales and level spreaders will be removed if it is deeper than six inches.

5.0 CONCLUSION

This proposed development off of NH Mallego Road in Barrington, NH will have no adverse effect on abutting property owners by way of storm water run-off or siltation. The post-construction peak rate of run-off for the site has been decreased from that of the existing conditions for the analyzed design storms and roadway run-off will treatment by either constructed or natural methods. Appropriate steps will be taken to eliminate erosion and sedimentation; these will be accomplished through the construction of a drainage system consisting of swales, driveway culverts, pre-treatment areas, and an oversized filtration basin. The Best Management Practices developed by the State of New Hampshire have been utilized in the design of this system and these applications will be enforced throughout the construction process.

A Terrain Alteration Permit (RSA 485: A-17) is required for this project due to the area of disturbance being more than 100,000 square feet.

Respectfully Submitted,

BEALS ASSOCIATES, *PLLC.*

Christian O. Smith

Christian O. Smith, PE
Principal

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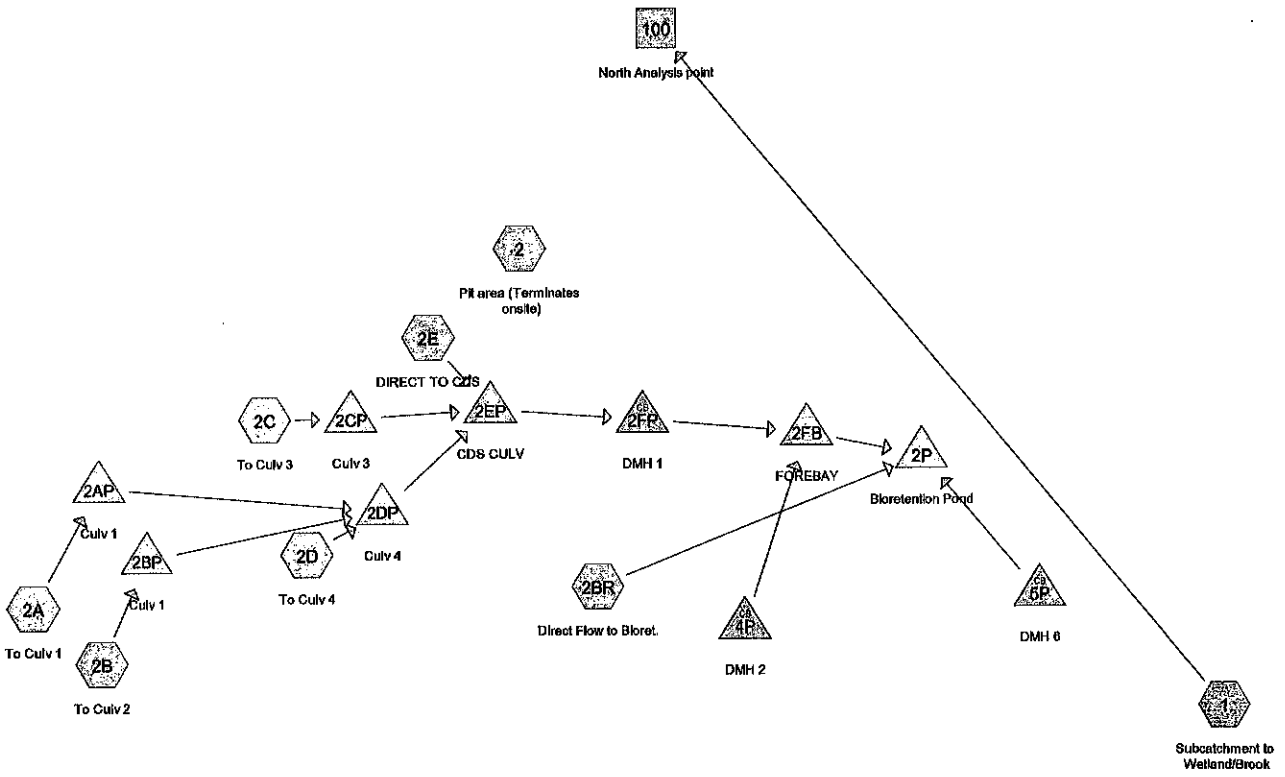
APPENDIX II

Proposed Conditions Drainage Analysis

Summary 2 YR - 24 HR rainfall = 3.08"
Complete 10 YR - 24 HR rainfall = 4.64"
Summary 25 YR - 24 HR rainfall = 5.86"
Summary 50 YR - 24 HR rainfall = 7.00"
Sheet W-2 Proposed Conditions Watershed Plan



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Subcat Reach Pond Link

Routing Diagram for NH-1443-Proposed
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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
4.932	51	1 acre lots, 20% imp, HSG A (1)
2.029	54	1/2 acre lots, 25% imp, HSG A (1)
5.824	70	1/2 acre lots, 25% imp, HSG B (1, 2, 2BR)
2.845	46	2 acre lots, 12% imp, HSG A (1)
2.677	39	>75% Grass cover, Good, HSG A (1, 2, 2A, 2B, 2BR)
4.302	61	>75% Grass cover, Good, HSG B (1, 2, 2A, 2B, 2BR, 2C, 2D, 2E)
0.365	82	Dirt roads, HSG B (1)
0.137	96	Gravel surface, HSG A (2BR)
0.116	96	Gravel surface, HSG B (1, 2, 2BR)
0.052	98	Paved parking, HSG B (2C, 2D)
0.192	98	Paved roads w/curbs & sewers, HSG A (2A, 2B)
0.785	98	Paved roads w/curbs & sewers, HSG B (2A, 2B, 2C, 2D, 2E)
1.261	83	Paved roads w/open ditches, 50% imp, HSG A (1)
15.646	30	Woods, Good, HSG A (1, 2, 2BR)
4.033	55	Woods, Good, HSG B (1, 2, 2BR)
4.634	70	Woods, Good, HSG C (1, 2)
0.850	77	Woods, Good, HSG D (1, 2)
50.680	**51**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
29.718	HSG A	1, 2, 2A, 2B, 2BR
15.477	HSG B	1, 2, 2A, 2B, 2BR, 2C, 2D, 2E
4.634	HSG C	1, 2
0.850	HSG D	1, 2
0.000	Other	
50.680		**TOTAL AREA**

Time span=1.00-72.00 hrs, dt=0.01 hrs, 7101 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Subcatchment to Runoff Area=1,353,019 sf 8.39% Impervious Runoff Depth=0.09"
Flow Length=709' Tc=37.5 min CN=49 Runoff=0.36 cfs 0.226 af

Subcatchment 2: Pit area (Terminates Runoff Area=392,981 sf 9.23% Impervious Runoff Depth=0.22"
Tc=6.0 min CN=55 Runoff=0.75 cfs 0.163 af

Subcatchment 2A: To Culv 1 Runoff Area=15,983 sf 24.93% Impervious Runoff Depth=0.33"
Tc=6.0 min CN=59 Runoff=0.07 cfs 0.010 af

Subcatchment 2B: To Culv 2 Runoff Area=17,622 sf 39.51% Impervious Runoff Depth=0.50"
Tc=6.0 min CN=64 Runoff=0.17 cfs 0.017 af

Subcatchment 2BR: Direct Flow to Bioret. Runoff Area=377,608 sf 5.56% Impervious Runoff Depth=0.11"
Tc=6.0 min CN=50 Runoff=0.13 cfs 0.076 af

Subcatchment 2C: To Culv 3 Runoff Area=17,422 sf 70.46% Impervious Runoff Depth=1.81"
Tc=6.0 min CN=87 Runoff=0.85 cfs 0.060 af

Subcatchment 2D: To Culv 4 Runoff Area=14,908 sf 86.26% Impervious Runoff Depth=2.33"
Tc=6.0 min CN=93 Runoff=0.91 cfs 0.066 af

Subcatchment 2E: DIRECT TO CDS Runoff Area=18,075 sf 48.36% Impervious Runoff Depth=1.25"
Tc=6.0 min CN=79 Runoff=0.60 cfs 0.043 af

Reach 100: North Analysis point Inflow=0.36 cfs 0.226 af
Outflow=0.36 cfs 0.226 af

Pond 2AP: Culv 1 Peak Elev=181.12' Storage=1 cf Inflow=0.07 cfs 0.010 af
15.0" Round Culvert n=0.013 L=49.0' S=0.0100 '/' Outflow=0.07 cfs 0.010 af

Pond 2BP: Culv 1 Peak Elev=182.19' Storage=2 cf Inflow=0.17 cfs 0.017 af
15.0" Round Culvert n=0.013 L=26.0' S=0.0573 '/' Outflow=0.17 cfs 0.017 af

Pond 2CP: Culv 3 Peak Elev=177.17' Storage=122 cf Inflow=0.85 cfs 0.060 af
15.0" Round Culvert n=0.013 L=40.0' S=0.0100 '/' Outflow=0.76 cfs 0.060 af

Pond 2DP: Culv 4 Peak Elev=177.09' Storage=21 cf Inflow=1.12 cfs 0.094 af
15.0" Round Culvert n=0.013 L=42.0' S=0.0100 '/' Outflow=1.12 cfs 0.093 af

Pond 2EP: CDS CULV Peak Elev=176.70' Storage=310 cf Inflow=2.45 cfs 0.197 af
18.0" Round Culvert n=0.013 L=200.0' S=0.0100 '/' Outflow=2.33 cfs 0.197 af

Pond 2FB: FOREBAY Peak Elev=174.72' Storage=2,708 cf Inflow=2.33 cfs 0.197 af
Outflow=1.70 cfs 0.142 af

Pond 2FP: DMH 1 Peak Elev=174.71' Inflow=2.33 cfs 0.197 af
18.0" Round Culvert n=0.013 L=137.0' S=0.0050 '/' Outflow=2.33 cfs 0.197 af

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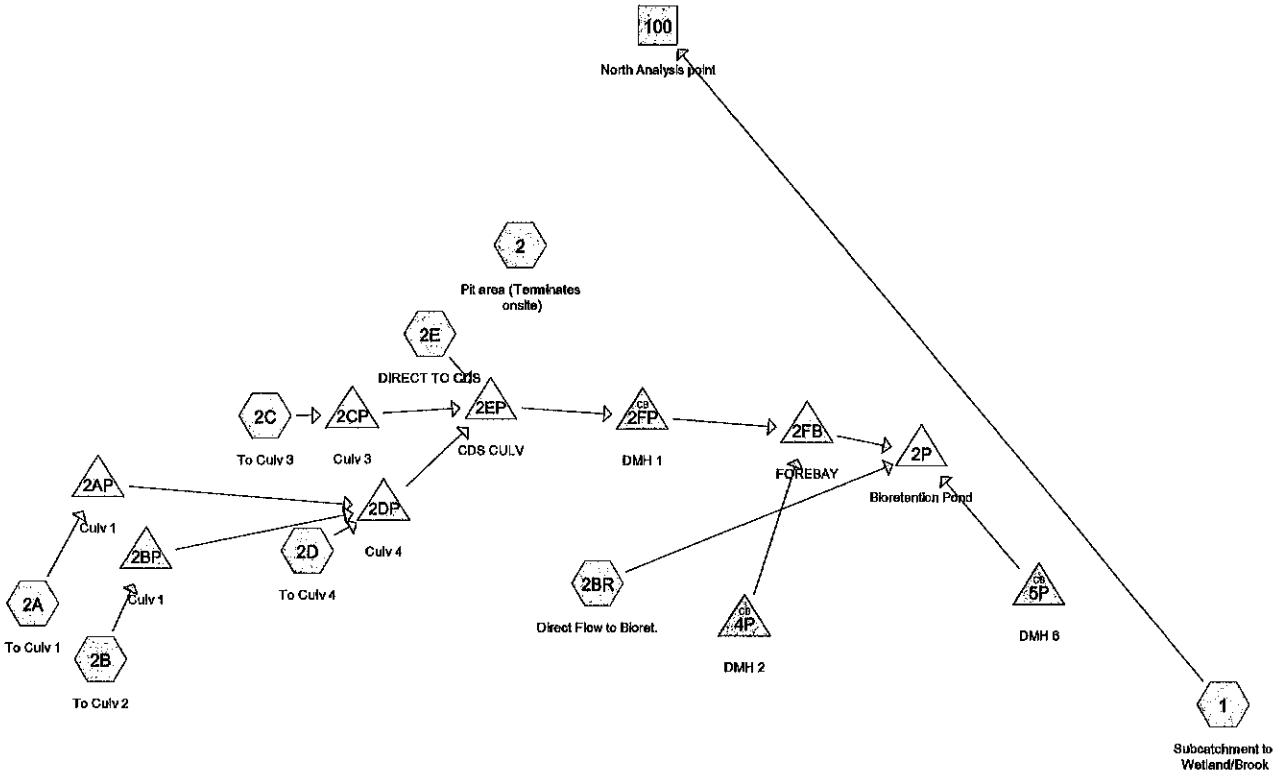
Pond 2P: Bioretention Pond Peak Elev=171.02' Storage=128 cf Inflow=1.70 cfs 0.218 af
Outflow=1.64 cfs 0.218 af

Pond 4P: DMH 2 Peak Elev=0.00'
24.0" Round Culvert n=0.013 L=32.0' S=0.0100 '/' Primary=0.00 cfs 0.000 af

Pond 5P: DMH 6 Peak Elev=0.00'
24.0" Round Culvert n=0.013 L=32.0' S=0.0100 '/' Primary=0.00 cfs 0.000 af

Total Runoff Area = 50.680 ac Runoff Volume = 0.662 af Average Runoff Depth = 0.16"
90.23% Pervious = 45.730 ac 9.77% Impervious = 4.950 ac



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Subcat Reach Pond Link

Routing Diagram for NH-1443-Proposed
Prepared by Beals Associates, PLLC, Printed 1/18/2023
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Time span=1.00-72.00 hrs, dt=0.01 hrs, 7101 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Subcatchment to Runoff Area=1,353,019 sf 8.39% Impervious Runoff Depth=0.50"
Flow Length=709' Tc=37.5 min CN=49 Runoff=5.51 cfs 1.307 af

Subcatchment 2: Pit area (Terminates Runoff Area=392,981 sf 9.23% Impervious Runoff Depth=0.81"
Tc=6.0 min CN=55 Runoff=6.37 cfs 0.606 af

Subcatchment 2A: To Culv 1 Runoff Area=15,983 sf 24.93% Impervious Runoff Depth=1.04"
Tc=6.0 min CN=59 Runoff=0.38 cfs 0.032 af

Subcatchment 2B: To Culv 2 Runoff Area=17,622 sf 39.51% Impervious Runoff Depth=1.35"
Tc=6.0 min CN=64 Runoff=0.59 cfs 0.046 af

Subcatchment 2BR: Direct Flow to Bioret. Runoff Area=377,608 sf 5.56% Impervious Runoff Depth=0.55"
Tc=6.0 min CN=50 Runoff=2.96 cfs 0.398 af

Subcatchment 2C: To Culv 3 Runoff Area=17,422 sf 70.46% Impervious Runoff Depth=3.23"
Tc=6.0 min CN=87 Runoff=1.49 cfs 0.108 af

Subcatchment 2D: To Culv 4 Runoff Area=14,908 sf 86.26% Impervious Runoff Depth=3.84"
Tc=6.0 min CN=93 Runoff=1.46 cfs 0.110 af

Subcatchment 2E: DIRECT TO CDS Runoff Area=18,075 sf 48.36% Impervious Runoff Depth=2.49"
Tc=6.0 min CN=79 Runoff=1.21 cfs 0.086 af

Reach 100: North Analysis point Inflow=5.51 cfs 1.307 af
Outflow=5.51 cfs 1.307 af

Pond 2AP: Culv 1 Peak Elev=181.29' Storage=2 cf Inflow=0.38 cfs 0.032 af
15.0" Round Culvert n=0.013 L=49.0' S=0.0100 '/' Outflow=0.38 cfs 0.032 af

Pond 2BP: Culv 1 Peak Elev=182.36' Storage=5 cf Inflow=0.59 cfs 0.046 af
15.0" Round Culvert n=0.013 L=26.0' S=0.0573 '/' Outflow=0.59 cfs 0.046 af

Pond 2CP: Culv 3 Peak Elev=177.33' Storage=226 cf Inflow=1.49 cfs 0.108 af
15.0" Round Culvert n=0.013 L=40.0' S=0.0100 '/' Outflow=1.33 cfs 0.108 af

Pond 2DP: Culv 4 Peak Elev=177.39' Storage=33 cf Inflow=2.42 cfs 0.187 af
15.0" Round Culvert n=0.013 L=42.0' S=0.0100 '/' Outflow=2.41 cfs 0.187 af

Pond 2EP: CDS CULV Peak Elev=177.05' Storage=564 cf Inflow=4.89 cfs 0.381 af
18.0" Round Culvert n=0.013 L=200.0' S=0.0100 '/' Outflow=4.64 cfs 0.381 af

Pond 2FB: FOREBAY Peak Elev=174.90' Storage=2,983 cf Inflow=4.64 cfs 0.381 af
Outflow=4.52 cfs 0.326 af

Pond 2FP: DMH 1 Peak Elev=175.13' Inflow=4.64 cfs 0.381 af
18.0" Round Culvert n=0.013 L=137.0' S=0.0050 '/' Outflow=4.64 cfs 0.381 af

Pond 2P: Bioretention Pond Peak Elev=171.22' Storage=1,813 cf Inflow=7.44 cfs 0.724 af
Outflow=4.78 cfs 0.724 af

Pond 4P: DMH 2 Peak Elev=0.00'
24.0" Round Culvert n=0.013 L=32.0' S=0.0100 '/' Primary=0.00 cfs 0.000 af

Pond 5P: DMH 6 Peak Elev=0.00'
24.0" Round Culvert n=0.013 L=32.0' S=0.0100 '/' Primary=0.00 cfs 0.000 af

Total Runoff Area = 50.680 ac Runoff Volume = 2.692 af Average Runoff Depth = 0.64"
90.23% Pervious = 45.730 ac 9.77% Impervious = 4.950 ac

Summary for Subcatchment 1: Subcatchment to Wetland/Brook

Runoff = 5.51 cfs @ 12.71 hrs, Volume= 1.307 af, Depth= 0.50"
Routed to Reach 100 : North Analysis point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.64"

Area (sf)	CN	Description
431,940	30	Woods, Good, HSG A
99,318	55	Woods, Good, HSG B
196,129	70	Woods, Good, HSG C
15,891	77	Woods, Good, HSG D
49,382	39	>75% Grass cover, Good, HSG A
35,915	61	>75% Grass cover, Good, HSG B
15,886	82	Dirt roads, HSG B
123,916	46	2 acre lots, 12% imp, HSG A
214,824	51	1 acre lots, 20% imp, HSG A
88,394	54	1/2 acre lots, 25% imp, HSG A
24,630	70	1/2 acre lots, 25% imp, HSG B
1,875	96	Gravel surface, HSG B
54,919	83	Paved roads w/open ditches, 50% imp, HSG A
1,353,019	49	Weighted Average
1,239,469		91.61% Pervious Area
113,550		8.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.6	50	0.0120	0.05		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 3.00"
20.6	554	0.0080	0.45		**Shallow Concentrated Flow, Sheet to slope** Woodland Kv= 5.0 fps
1.3	105	0.0700	1.32		**Shallow Concentrated Flow, slope to wetland** Woodland Kv= 5.0 fps
37.5	709	Total			

Summary for Subcatchment 2: Pit area (Terminates onsite)

Runoff = 6.37 cfs @ 12.11 hrs, Volume= 0.606 af, Depth= 0.81"
Routed to nonexistent node 200

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.64"

Area (sf)	CN	Description
2,034	96	Gravel surface, HSG B
145,144	70	1/2 acre lots, 25% imp, HSG B
12,736	39	>75% Grass cover, Good, HSG A
42,379	61	>75% Grass cover, Good, HSG B
107,990	30	Woods, Good, HSG A
55,801	55	Woods, Good, HSG B
5,746	70	Woods, Good, HSG C
21,151	77	Woods, Good, HSG D
392,981	55	Weighted Average
356,695		90.77% Pervious Area
36,286		9.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Direct**

Summary for Subcatchment 2A: To Culv 1

Runoff = 0.38 cfs @ 12.10 hrs, Volume= 0.032 af, Depth= 1.04"
Routed to Pond 2AP : Culv 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.64"

Area (sf)	CN	Description
2,645	98	Paved roads w/curbs & sewers, HSG A
1,339	98	Paved roads w/curbs & sewers, HSG B
8,475	39	>75% Grass cover, Good, HSG A
3,524	61	>75% Grass cover, Good, HSG B
15,983	59	Weighted Average
11,999		75.07% Pervious Area
3,984		24.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Direct**

Summary for Subcatchment 2B: To Culv 2

Runoff = 0.59 cfs @ 12.10 hrs, Volume= 0.046 af, Depth= 1.35"
Routed to Pond 2BP : Culv 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.64"

Area (sf)	CN	Description
5,700	98	Paved roads w/curbs & sewers, HSG A
1,262	98	Paved roads w/curbs & sewers, HSG B
8,925	39	>75% Grass cover, Good, HSG A
1,735	61	>75% Grass cover, Good, HSG B
17,622	64	Weighted Average
10,660		60.49% Pervious Area
6,962		39.51% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Direct**

Summary for Subcatchment 2BR: Direct Flow to Bioret.

Runoff = 2.96 cfs @ 12.13 hrs, Volume= 0.398 af, Depth= 0.55"
Routed to Pond 2P : Bioretention Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.64"

Area (sf)	CN	Description
83,910	70	1/2 acre lots, 25% imp, HSG B
5,946	96	Gravel surface, HSG A
1,146	96	Gravel surface, HSG B
87,320	61	>75% Grass cover, Good, HSG B
37,110	39	>75% Grass cover, Good, HSG A
141,620	30	Woods, Good, HSG A
20,556	55	Woods, Good, HSG B
377,608	50	Weighted Average
356,631		94.44% Pervious Area
20,978		5.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Direct**

Summary for Subcatchment 2C: To Culv 3

Runoff = 1.49 cfs @ 12.09 hrs, Volume= 0.108 af, Depth= 3.23"
Routed to Pond 2CP : Culv 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.64"

Area (sf)	CN	Description
11,015	98	Paved roads w/curbs & sewers, HSG B
1,261	98	Paved parking, HSG B
5,146	61	>75% Grass cover, Good, HSG B
17,422	87	Weighted Average
5,146		29.54% Pervious Area
12,276		70.46% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Direct**

Summary for Subcatchment 2D: To Culv 4

Runoff = 1.46 cfs @ 12.08 hrs, Volume= 0.110 af, Depth= 3.84"
Routed to Pond 2DP : Culv 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.64"

Area (sf)	CN	Description
11,852	98	Paved roads w/curbs & sewers, HSG B
1,008	98	Paved parking, HSG B
2,048	61	>75% Grass cover, Good, HSG B
14,908	93	Weighted Average
2,048		13.74% Pervious Area
12,860		86.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Direct**

Summary for Subcatchment 2E: DIRECT TO CDS

Runoff = 1.21 cfs @ 12.09 hrs, Volume= 0.086 af, Depth= 2.49"
Routed to Pond 2EP : CDS CULV

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.64"

Area (sf)	CN	Description
8,741	98	Paved roads w/curbs & sewers, HSG B
9,334	61	>75% Grass cover, Good, HSG B
18,075	79	Weighted Average
9,334		51.64% Pervious Area
8,741		48.36% Impervious Area

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, DIRECT**

Summary for Reach 100: North Analysis point

Inflow Area = 31.061 ac, 8.39% Impervious, Inflow Depth = 0.50" for 10 YR event
Inflow = 5.51 cfs @ 12.71 hrs, Volume= 1.307 af
Outflow = 5.51 cfs @ 12.71 hrs, Volume= 1.307 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 2AP: Culv 1

Inflow Area = 0.367 ac, 24.93% Impervious, Inflow Depth = 1.04" for 10 YR event
Inflow = 0.38 cfs @ 12.10 hrs, Volume= 0.032 af
Outflow = 0.38 cfs @ 12.10 hrs, Volume= 0.032 af, Atten= 0%, Lag= 0.1 min
Primary = 0.38 cfs @ 12.10 hrs, Volume= 0.032 af
Routed to Pond 2DP : Culv 4

Routing by Stor-Ind method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 181.29' @ 12.10 hrs Surf.Area= 13 sf Storage= 2 cf

Plug-Flow detention time= 0.2 min calculated for 0.032 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (884.9 - 884.7)

Volume	Invert	Avail.Storage	Storage Description
#1	181.00'	150 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
181.00	4	0	0
184.00	96	150	150

Device	Routing	Invert	Outlet Devices
#1	Primary	181.00'	**15.0" Round Culvert** L= 49.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 181.00' / 180.51' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=0.38 cfs @ 12.10 hrs HW=181.29' (Free Discharge)
↑**1=Culvert** (Barrel Controls 0.38 cfs @ 2.66 fps)

Summary for Pond 2BP: Culv 1

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Inflow Area = 0.405 ac, 39.51% Impervious, Inflow Depth = 1.35" for 10 YR event
Inflow = 0.59 cfs @ 12.10 hrs, Volume= 0.046 af
Outflow = 0.59 cfs @ 12.10 hrs, Volume= 0.046 af, Atten= 0%, Lag= 0.1 min
Primary = 0.59 cfs @ 12.10 hrs, Volume= 0.046 af
Routed to Pond 2DP : Culv 4

Routing by Stor-Ind method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 182.36' @ 12.10 hrs Surf.Area= 18 sf Storage= 5 cf

Plug-Flow detention time= 0.3 min calculated for 0.046 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (868.9 - 868.6)

Volume	Invert	Avail.Storage	Storage Description
#1	182.00'	72 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
182.00	8	0	0
184.00	64	72	72

Device	Routing	Invert	Outlet Devices
#1	Primary	182.00'	**15.0" Round Culvert** L= 26.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 182.00' / 180.51' S= 0.0573 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=0.59 cfs @ 12.10 hrs HW=182.36' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 0.59 cfs @ 2.04 fps)

Summary for Pond 2CP: Culv 3

Inflow Area = 0.400 ac, 70.46% Impervious, Inflow Depth = 3.23" for 10 YR event
Inflow = 1.49 cfs @ 12.09 hrs, Volume= 0.108 af
Outflow = 1.33 cfs @ 12.13 hrs, Volume= 0.108 af, Atten= 11%, Lag= 2.5 min
Primary = 1.33 cfs @ 12.13 hrs, Volume= 0.108 af
Routed to Pond 2EP : CDS CULV

Routing by Stor-Ind method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 177.33' @ 12.13 hrs Surf.Area= 780 sf Storage= 226 cf

Plug-Flow detention time= 2.7 min calculated for 0.108 af (100% of inflow)
Center-of-Mass det. time= 2.7 min (806.7 - 804.0)

Volume	Invert	Avail.Storage	Storage Description
#1	176.75'	3,650 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
176.75	4	0	0
178.00	1,685	1,056	1,056
179.00	3,504	2,595	3,650

Device	Routing	Invert	Outlet Devices
#1	Primary	176.75'	**15.0" Round Culvert** L= 40.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 176.75' / 176.35' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=1.33 cfs @ 12.13 hrs HW=177.33' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 1.33 cfs @ 3.52 fps)

Summary for Pond 2DP: Culv 4

Inflow Area = 1.114 ac, 49.07% Impervious, Inflow Depth = 2.01" for 10 YR event
Inflow = 2.42 cfs @ 12.09 hrs, Volume= 0.187 af
Outflow = 2.41 cfs @ 12.09 hrs, Volume= 0.187 af, Atten= 0%, Lag= 0.2 min
Primary = 2.41 cfs @ 12.09 hrs, Volume= 0.187 af
Routed to Pond 2EP : CDS CULV

Routing by Stor-Ind method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 177.39' @ 12.09 hrs Surf.Area= 46 sf Storage= 33 cf

Plug-Flow detention time= 1.4 min calculated for 0.187 af (100% of inflow)
Center-of-Mass det. time= 0.9 min (820.7 - 819.8)

Volume	Invert	Avail.Storage	Storage Description
#1	176.15'	67 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
176.15	8	0	0
178.00	64	67	67

Device	Routing	Invert	Outlet Devices
#1	Primary	176.57'	**15.0" Round Culvert** L= 42.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 176.57' / 176.15' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=2.41 cfs @ 12.09 hrs HW=177.39' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 2.41 cfs @ 4.02 fps)

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Summary for Pond 2EP: CDS CULV

Inflow Area = 1.929 ac, 53.35% Impervious, Inflow Depth = 2.37" for 10 YR event
Inflow = 4.89 cfs @ 12.10 hrs, Volume= 0.381 af
Outflow = 4.64 cfs @ 12.13 hrs, Volume= 0.381 af, Atten= 5%, Lag= 1.8 min
Primary = 4.64 cfs @ 12.13 hrs, Volume= 0.381 af
Routed to Pond 2FP : DMH 1

Routing by Stor-Ind method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 177.05' @ 12.13 hrs Surf.Area= 821 sf Storage= 564 cf

Plug-Flow detention time= 3.9 min calculated for 0.381 af (100% of inflow)
Center-of-Mass det. time= 3.9 min (822.3 - 818.3)

Volume	Invert	Avail.Storage	Storage Description
#1	176.00'	4,737 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
176.00	248	0	0
178.00	1,334	1,582	1,582
179.50	2,872	3,155	4,737

Device	Routing	Invert	Outlet Devices
#1	Primary	176.00'	**18.0" Round Culvert** L= 200.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 176.00' / 174.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=4.64 cfs @ 12.13 hrs HW=177.05' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 4.64 cfs @ 3.50 fps)

Summary for Pond 2FB: FOREBAY

Inflow Area = 1.929 ac, 53.35% Impervious, Inflow Depth = 2.37" for 10 YR event
Inflow = 4.64 cfs @ 12.13 hrs, Volume= 0.381 af
Outflow = 4.52 cfs @ 12.15 hrs, Volume= 0.326 af, Atten= 3%, Lag= 1.5 min
Primary = 4.52 cfs @ 12.15 hrs, Volume= 0.326 af
Routed to Pond 2P : Bioretention Pond

Routing by Stor-Ind method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 174.90' @ 12.15 hrs Surf.Area= 1,509 sf Storage= 2,983 cf
Flood Elev= 175.50' Surf.Area= 1,696 sf Storage= 3,938 cf

Plug-Flow detention time= 101.4 min calculated for 0.326 af (86% of inflow)
Center-of-Mass det. time= 36.6 min (858.8 - 822.3)

Volume	Invert	Avail.Storage	Storage Description
#1	172.00'	3,938 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
172.00	541	0	0	541
174.00	1,247	1,740	1,740	1,277
175.50	1,696	2,199	3,938	1,770

Device	Routing	Invert	Outlet Devices
#1	Primary	174.50'	**7.0' 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=4.51 cfs @ 12.15 hrs HW=174.90' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 4.51 cfs @ 1.60 fps)

Summary for Pond 2FP: DMH 1

Inflow Area = 1.929 ac, 53.35% Impervious, Inflow Depth = 2.37" for 10 YR event
Inflow = 4.64 cfs @ 12.13 hrs, Volume= 0.381 af
Outflow = 4.64 cfs @ 12.13 hrs, Volume= 0.381 af, Atten= 0%, Lag= 0.0 min
Primary = 4.64 cfs @ 12.13 hrs, Volume= 0.381 af
Routed to Pond 2FB : FOREBAY

Routing by Stor-Ind method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 175.13' @ 12.13 hrs
Flood Elev= 177.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	173.90'	**18.0" Round Culvert** L= 137.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 173.90' / 173.22' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=4.64 cfs @ 12.13 hrs HW=175.13' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 4.64 cfs @ 4.07 fps)

Summary for Pond 2P: Bioretention Pond

Inflow Area = 10.597 ac, 14.25% Impervious, Inflow Depth = 0.82" for 10 YR event
Inflow = 7.44 cfs @ 12.14 hrs, Volume= 0.724 af
Outflow = 4.78 cfs @ 12.09 hrs, Volume= 0.724 af, Atten= 36%, Lag= 0.0 min
Discarded = 4.78 cfs @ 12.09 hrs, Volume= 0.724 af

Routing by Stor-Ind method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs

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Peak Elev= 171.22' @ 12.35 hrs Surf.Area= 20,671 sf Storage= 1,813 cf
Flood Elev= 175.00' Surf.Area= 23,113 sf Storage= 50,392 cf

Plug-Flow detention time= 2.4 min calculated for 0.724 af (100% of inflow)
Center-of-Mass det. time= 2.3 min (897.6 - 895.4)

Volume	Invert	Avail.Storage	Storage Description
#1	171.00'	62,158 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
171.00	20,671	0.0	0	0	20,671
172.00	20,671	40.0	8,268	8,268	21,181
173.50	20,671	30.0	9,302	17,570	21,945
174.00	21,471	100.0	10,535	28,105	22,786
175.50	23,956	100.0	34,053	62,158	25,396

Device	Routing	Invert	Outlet Devices
#1	Discarded	171.00'	**10.000 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=4.78 cfs @ 12.09 hrs HW=171.05' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 4.78 cfs)

Summary for Pond 4P: DMH 2

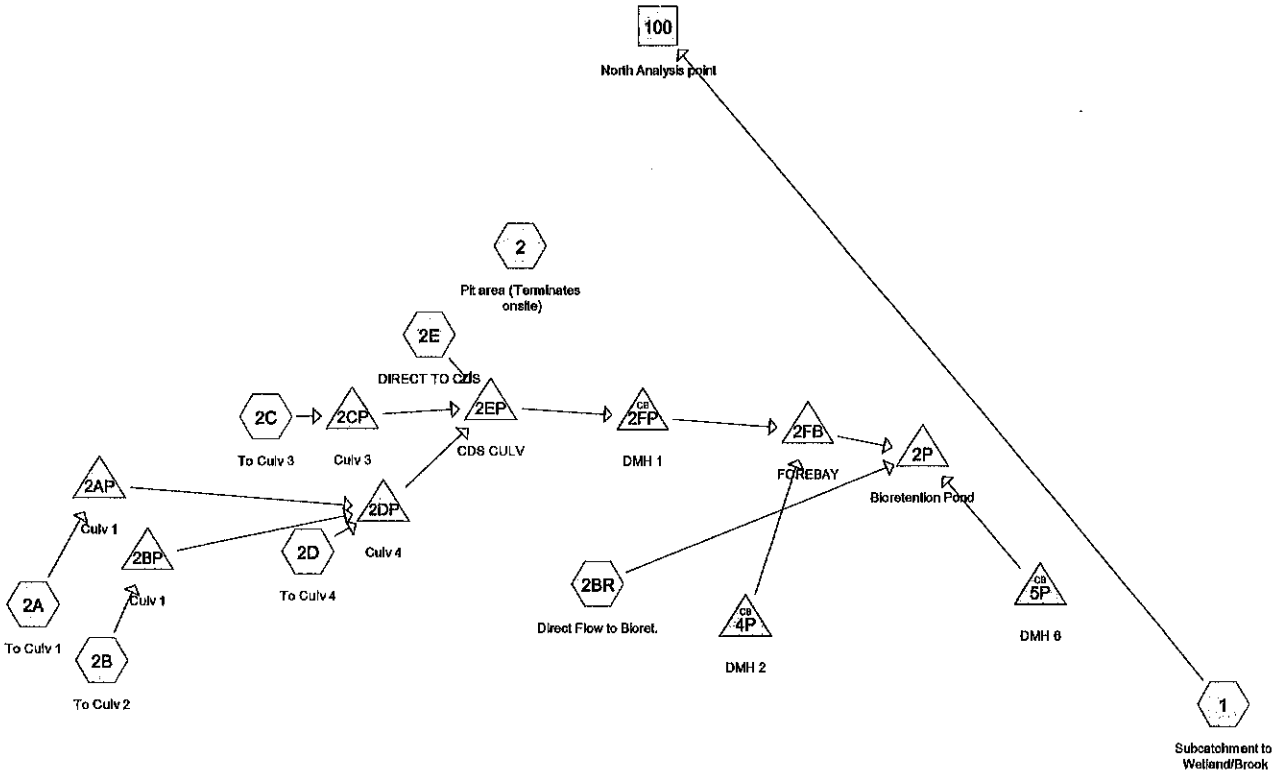
Device	Routing	Invert	Outlet Devices
#1	Primary	173.70'	**24.0" Round Culvert** L= 32.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 173.70' / 173.38' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=0.00' (Free Discharge)
↑—**1=Culvert** (Controls 0.00 cfs)

Summary for Pond 5P: DMH 6

Device	Routing	Invert	Outlet Devices
#1	Primary	173.70'	**24.0" Round Culvert** L= 32.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 173.70' / 173.38' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=0.00' (Free Discharge)
↑—**1=Culvert** (Controls 0.00 cfs)



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Subcat Reach Pond Link

Routing Diagram for NH-1443-Proposed
Prepared by Beals Associates, PLLC, Printed 1/18/2023
HydroCAD® 10.20-2d s/n 01754 © 2021 HydroCAD Software Solutions LLC

Time span=1.00-72.00 hrs, dt=0.01 hrs, 7101 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Subcatchment to Runoff Area=1,353,019 sf 8.39% Impervious Runoff Depth=1.01"
Flow Length=709' Tc=37.5 min CN=49 Runoff=14.30 cfs 2.605 af

Subcatchment 2: Pit area (Terminates Runoff Area=392,981 sf 9.23% Impervious Runoff Depth=1.44"
Tc=6.0 min CN=55 Runoff=13.38 cfs 1.081 af

Subcatchment 2A: To Culv 1 Runoff Area=15,983 sf 24.93% Impervious Runoff Depth=1.75"
Tc=6.0 min CN=59 Runoff=0.70 cfs 0.054 af

Subcatchment 2B: To Culv 2 Runoff Area=17,622 sf 39.51% Impervious Runoff Depth=2.16"
Tc=6.0 min CN=64 Runoff=1.00 cfs 0.073 af

Subcatchment 2BR: Direct Flow to Bioret. Runoff Area=377,608 sf 5.56% Impervious Runoff Depth=1.08"
Tc=6.0 min CN=50 Runoff=8.42 cfs 0.777 af

Subcatchment 2C: To Culv 3 Runoff Area=17,422 sf 70.46% Impervious Runoff Depth=4.38"
Tc=6.0 min CN=87 Runoff=2.00 cfs 0.146 af

Subcatchment 2D: To Culv 4 Runoff Area=14,908 sf 86.26% Impervious Runoff Depth=5.04"
Tc=6.0 min CN=93 Runoff=1.88 cfs 0.144 af

Subcatchment 2E: DIRECT TO CDS Runoff Area=18,075 sf 48.36% Impervious Runoff Depth=3.55"
Tc=6.0 min CN=79 Runoff=1.73 cfs 0.123 af

Reach 100: North Analysis point Inflow=14.30 cfs 2.605 af
Outflow=14.30 cfs 2.605 af

Pond 2AP: Culv 1 Peak Elev=181.40' Storage=4 cf Inflow=0.70 cfs 0.054 af
15.0" Round Culvert n=0.013 L=49.0' S=0.0100 '/' Outflow=0.70 cfs 0.054 af

Pond 2BP: Culv 1 Peak Elev=182.47' Storage=7 cf Inflow=1.00 cfs 0.073 af
15.0" Round Culvert n=0.013 L=26.0' S=0.0573 '/' Outflow=1.00 cfs 0.073 af

Pond 2CP: Culv 3 Peak Elev=177.43' Storage=314 cf Inflow=2.00 cfs 0.146 af
15.0" Round Culvert n=0.013 L=40.0' S=0.0100 '/' Outflow=1.76 cfs 0.146 af

Pond 2DP: Culv 4 Peak Elev=177.62' Storage=45 cf Inflow=3.57 cfs 0.270 af
15.0" Round Culvert n=0.013 L=42.0' S=0.0100 '/' Outflow=3.56 cfs 0.270 af

Pond 2EP: CDS CULV Peak Elev=177.33' Storage=810 cf Inflow=6.96 cfs 0.539 af
18.0" Round Culvert n=0.013 L=200.0' S=0.0100 '/' Outflow=6.51 cfs 0.539 af

Pond 2FB: FOREBAY Peak Elev=175.00' Storage=3,126 cf Inflow=6.51 cfs 0.539 af
Outflow=6.39 cfs 0.484 af

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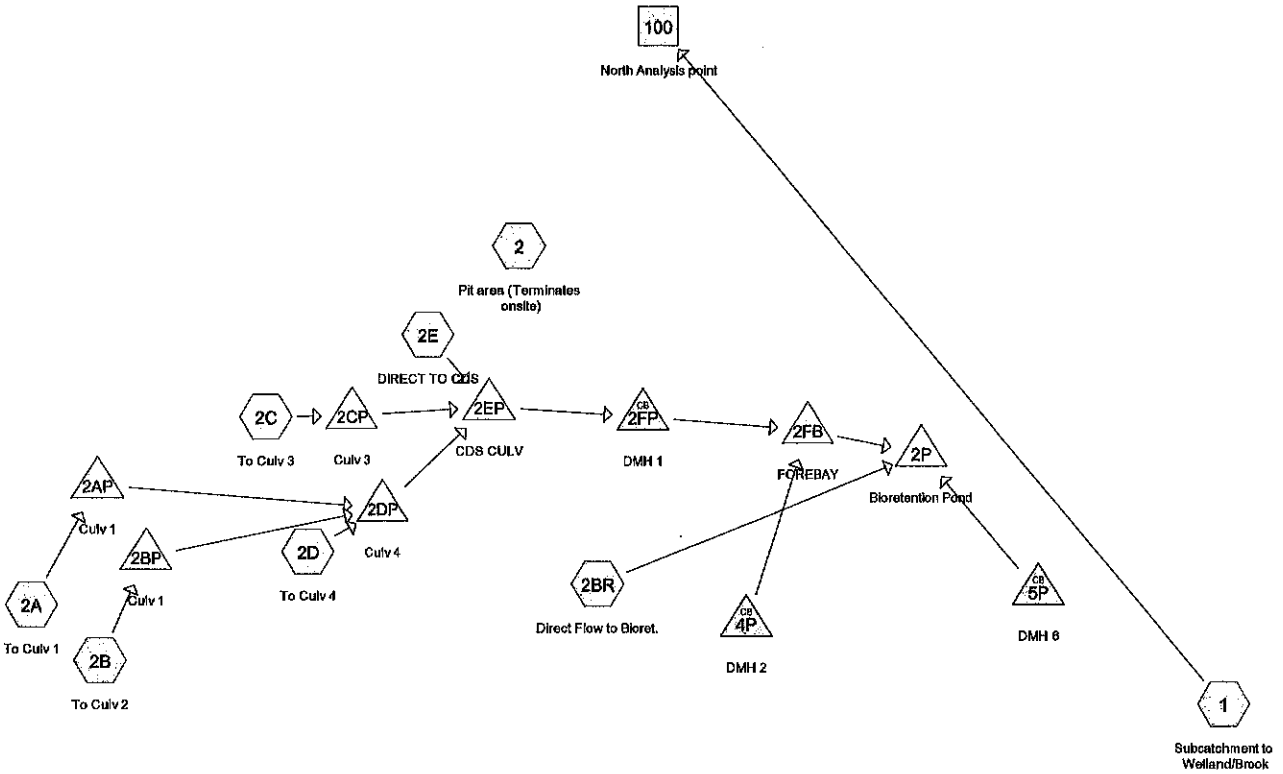
Pond 2FP: DMH 1 Peak Elev=175.47' Inflow=6.51 cfs 0.539 af
18.0" Round Culvert n=0.013 L=137.0' S=0.0050 '/' Outflow=6.51 cfs 0.539 af

Pond 2P: Bioretention Pond Peak Elev=172.18' Storage=9,415 cf Inflow=14.47 cfs 1.261 af
Outflow=4.78 cfs 1.261 af

Pond 4P: DMH 2 Peak Elev=0.00'
24.0" Round Culvert n=0.013 L=32.0' S=0.0100 '/' Primary=0.00 cfs 0.000 af

Pond 5P: DMH 6 Peak Elev=0.00'
24.0" Round Culvert n=0.013 L=32.0' S=0.0100 '/' Primary=0.00 cfs 0.000 af

Total Runoff Area = 50.680 ac Runoff Volume = 5.002 af Average Runoff Depth = 1.18"
90.23% Pervious = 45.730 ac 9.77% Impervious = 4.950 ac



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Subcat Reach Pond Link

Routing Diagram for NH-1443-Proposed
Prepared by Beals Associates, PLLC, Printed 1/18/2023
HydroCAD® 10.20-2d s/n 01754 © 2021 HydroCAD Software Solutions LLC

Time span=1.00-72.00 hrs, dt=0.01 hrs, 7101 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Subcatchment to Runoff Area=1,353,019 sf 8.39% Impervious Runoff Depth=1.58"
Flow Length=709' Tc=37.5 min CN=49 Runoff=25.05 cfs 4.085 af

Subcatchment 2: Pit area (Terminates Runoff Area=392,981 sf 9.23% Impervious Runoff Depth=2.12"
Tc=6.0 min CN=55 Runoff=20.99 cfs 1.597 af

Subcatchment 2A: To Culv 1 Runoff Area=15,983 sf 24.93% Impervious Runoff Depth=2.51"
Tc=6.0 min CN=59 Runoff=1.04 cfs 0.077 af

Subcatchment 2B: To Culv 2 Runoff Area=17,622 sf 39.51% Impervious Runoff Depth=3.00"
Tc=6.0 min CN=64 Runoff=1.41 cfs 0.101 af

Subcatchment 2BR: Direct Flow to Bioret. Runoff Area=377,608 sf 5.56% Impervious Runoff Depth=1.67"
Tc=6.0 min CN=50 Runoff=14.74 cfs 1.204 af

Subcatchment 2C: To Culv 3 Runoff Area=17,422 sf 70.46% Impervious Runoff Depth=5.48"
Tc=6.0 min CN=87 Runoff=2.47 cfs 0.183 af

Subcatchment 2D: To Culv 4 Runoff Area=14,908 sf 86.26% Impervious Runoff Depth=6.17"
Tc=6.0 min CN=93 Runoff=2.28 cfs 0.176 af

Subcatchment 2E: DIRECT TO CDS Runoff Area=18,075 sf 48.36% Impervious Runoff Depth=4.58"
Tc=6.0 min CN=79 Runoff=2.21 cfs 0.159 af

Reach 100: North Analysis point Inflow=25.05 cfs 4.085 af
Outflow=25.05 cfs 4.085 af

Pond 2AP: Culv 1 Peak Elev=181.50' Storage=6 cf Inflow=1.04 cfs 0.077 af
15.0" Round Culvert n=0.013 L=49.0' S=0.0100 '/' Outflow=1.04 cfs 0.077 af

Pond 2BP: Culv 1 Peak Elev=182.57' Storage=9 cf Inflow=1.41 cfs 0.101 af
15.0" Round Culvert n=0.013 L=26.0' S=0.0573 '/' Outflow=1.41 cfs 0.101 af

Pond 2CP: Culv 3 Peak Elev=177.52' Storage=401 cf Inflow=2.47 cfs 0.183 af
15.0" Round Culvert n=0.013 L=40.0' S=0.0100 '/' Outflow=2.16 cfs 0.183 af

Pond 2DP: Culv 4 Peak Elev=177.86' Storage=58 cf Inflow=4.71 cfs 0.354 af
15.0" Round Culvert n=0.013 L=42.0' S=0.0100 '/' Outflow=4.71 cfs 0.354 af

Pond 2EP: CDS CULV Peak Elev=177.64' Storage=1,140 cf Inflow=8.96 cfs 0.695 af
18.0" Round Culvert n=0.013 L=200.0' S=0.0100 '/' Outflow=8.04 cfs 0.695 af

Pond 2FB: FOREBAY Peak Elev=175.07' Storage=3,232 cf Inflow=8.04 cfs 0.695 af
Outflow=7.95 cfs 0.640 af

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Pond 2FP: DMH 1 Peak Elev=176.07' Inflow=8.04 cfs 0.695 af
18.0" Round Culvert n=0.013 L=137.0' S=0.0050 '/' Outflow=8.04 cfs 0.695 af

Pond 2P: Bioretention Pond Peak Elev=173.60' Storage=19,628 cf Inflow=22.00 cfs 1.844 af
Outflow=4.82 cfs 1.844 af

Pond 4P: DMH 2 Peak Elev=0.00'
24.0" Round Culvert n=0.013 L=32.0' S=0.0100 '/' Primary=0.00 cfs 0.000 af

Pond 5P: DMH 6 Peak Elev=0.00'
24.0" Round Culvert n=0.013 L=32.0' S=0.0100 '/' Primary=0.00 cfs 0.000 af

Total Runoff Area = 50.680 ac Runoff Volume = 7.581 af Average Runoff Depth = 1.80"
90.23% Pervious = 45.730 ac 9.77% Impervious = 4.950 ac

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NEW HAMPSHIRE DEPARTMENT OF Environmental Services

FILTRATION PRACTICE DESIGN CRITERIA
(Env-Wq 1508.07)

Type/Node Name: **Bioret/2P**

Enter the type of filtration practice (e.g., bioretention system) and the node name in the drainage analysis, if applicable.

YES		Check if you reviewed the restrictions on unlined systems outlined in Env-Wq 1508.07(a).	
10.60	ac	A = Area draining to the practice	
1.51	ac	A_I = Impervious area draining to the practice	
0.14	decimal	I = Percent impervious area draining to the practice, in decimal form	
0.18	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
1.89	ac-in	WQV= 1" x Rv x A	
6,857	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
1,714	cf	25% x WQV (check calc for sediment forebay volume)	
5,142	cf	75% x WQV (check calc for surface sand filter volume)	
Forebay		Method of Pretreatment? (not required for clean or roof runoff)	
3,938	cf	V_{SED} = Sediment forebay volume, if used for pretreatment	≥ 25%WQV
Calculate time to drain if system IS NOT underdrained:			
20,671	sf	A_{SA} = Surface area of the practice	
10.00	iph	$Ksat_{DESIGN}$ = Design infiltration rate[1]	
N/A	Yes/No	If Ksat (prior to factor of safety) is < 0.50 iph, has an underdrain been provided? (Use the calculations below)	
0.4	hours	T_{DRAIN} = Drain time = V / (A_{SA} * I_{DESIGN})	≤ 72-hrs
Calculate time to drain if system IS underdrained:			
	ft	E_{WQV} = Elevation of WQV (attach stage-storage table)	
	cfs	Q_{WQV} = Discharge at the E_{WQV} (attach stage-discharge table)	
-	hours	T_{DRAIN} = Drain time = 2WQV/Q_{WQV}	≤ 72-hrs
172.00	feet	E_{FC} = Elevation of the bottom of the filter course material[2]	
N/A	feet	E_{UD} = Invert elevation of the underdrain (UD), if applicable	
171.00	feet	E_{SHWT} = Elevation of SHWT (if none found, enter the lowest elevation of the test pit)	
167.80	feet	E_{ROCK} = Elevation of bedrock (if none found, enter the lowest elevation of the test pit)	
#VALUE!	feet	$D_{FC\ to\ UD}$ = Depth to UD from the bottom of the filter course	≥ 1'
4.20	feet	$D_{FC\ to\ ROCK}$ = Depth to bedrock from the bottom of the filter course	≥ 1'
1.00	feet	$D_{FC\ to\ SHWT}$ = Depth to SHWT from the bottom of the filter course	≥ 1'
173.60	ft	Peak elevation of the 50-year storm event (infiltration can be used in analysis)	
175.50	ft	Elevation of the top of the practice	
YES		50 peak elevation ≤ Elevation of the top of the practice	← yes
If a surface sand filter or underground sand filter is proposed:			
NO	ac	Drainage Area check.	< 10 ac
	cf	V = Volume of storage[3] (attach a stage-storage table)	≥ 75%WQV
	inches	D_{FC} = Filter course thickness	18", or 24" if within GPA
Sheet		Note what sheet in the plan set contains the filter course specification.	
	Yes/No	Access grate provided?	← yes

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If a bioretention area is proposed:			
NO	ac	Drainage Area no larger than 5 ac?	← yes
62,158	cf	V = Volume of storage[3] (attach a stage-storage table)	≥ WQV
18.0	inches	D_{FC} = Filter course thickness	18", or 24" if within GPA
Sheet 17		Note what sheet in the plan set contains the filter course specification	
3.0	:1	Pond side slopes	≥ 3:1
Sheet 17		Note what sheet in the plan set contains the planting plans and surface cover	
If porous pavement is proposed:			
		Type of pavement proposed (Concrete? Asphalt? Pavers? Etc.)	
	acres	A_{SA} = Surface area of the pervious pavement	
	:1	Ratio of the contributing area to the pervious surface area	≤ 5:1
	inches	D_{FC} = Filter course thickness	12", or 18" if within GPA mod. 304.1 (see spec)
Sheet		Note what sheet in the plan set contains the filter course spec.	

1. Rate of the limiting layer (either the filter course or the underlying soil). $Ksat_{design}$ includes factor of safey. See Env-Wq 1504.14 for guidance on determining the infiltration rate.
2. See lines 34, 40 and 48 for required depths of filter media.
3. Volume without depending on infiltration. The volume includes the storage above the filter (but below the invert of the outlet stucture, if any), the filter media voids, and the pretreatment area. The storage above the filter media shall not include the volume above the outlet structure, if any.

Designer's Notes:

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Stage-Area-Storage for Pond 2FB: FOREBAY

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
172.00	541	0
172.05	555	27
172.10	569	56
172.15	584	84
172.20	599	114
172.25	613	144
172.30	628	175
172.35	644	207
172.40	659	240
172.45	675	273
172.50	690	307
172.55	706	342
172.60	722	378
172.65	739	414
172.70	755	452
172.75	772	490
172.80	789	529
172.85	806	569
172.90	823	609
172.95	840	651
173.00	858	693
173.05	875	737
173.10	893	781
173.15	911	826
173.20	930	872
173.25	948	919
173.30	967	967
173.35	986	1,016
173.40	1,005	1,065
173.45	1,024	1,116
173.50	1,043	1,168
173.55	1,063	1,220
173.60	1,083	1,274
173.65	1,102	1,329
173.70	1,123	1,384
173.75	1,143	1,441
173.80	1,163	1,499
173.85	1,184	1,557
173.90	1,205	1,617
173.95	1,226	1,678
174.00	1,247	1,740
174.05	1,261	1,802
174.10	1,275	1,866
174.15	1,289	1,930
174.20	1,303	1,995
174.25	1,317	2,060
174.30	1,331	2,126
174.35	1,346	2,193
174.40	1,360	2,261
174.45	1,374	2,329
174.50	1,389	2,398
174.55	1,404	2,468
174.60	1,418	2,539
174.65	1,433	2,610
174.70	1,448	2,682
174.75	1,463	2,755
174.80	1,478	2,828
174.85	1,493	2,902
174.90	1,508	2,978
174.95	1,523	3,053
175.00	1,539	3,130
175.05	1,554	3,207
175.10	1,570	3,285
175.15	1,585	3,364
175.20	1,601	3,444
175.25	1,616	3,524
175.30	1,632	3,605
175.35	1,648	3,687
175.40	1,664	3,770
175.45	1,680	3,854
175.50	**1,696**	**3,938**