STATE OF MAINE

BOARD OF ENVIRONMENTAL PROTECTION

IN THE MATTER OF

NORDIC AQUAFARMS, INC Belfast and Northport Waldo County, Maine	)	APPLICATION FOR AIR EMISSION, SITE LOCATION OF DEVELOPMENT, NATURAL RESOURCES PROTECTION ACT, and MAINE POLLUTANT DISCHARGE ELIMINATION SYSTEM/WASTE DISCHARGE LICENSES
A-1146-71-A-N L-28319-26-A-N L-28319-TG-B-N L-28319-4E-C-N L-28319-L6-D-N L-28319-TW-E-N W-009200-6F-A-N	)	

PRE-FILED DIRECT TESTIMONY OF MAUREEN MCGLONE, P.E.
RANSOM CONSULTING, INC.

1. My name is Maureen P. McGlone, P.E. I hold a Bachelor of Science Degree in Civil Engineering from Worcester Polytechnic Institute. I have 30 years' experience as a civil/environmental engineer. My civil and environmental design engineering experience includes site layout and grading, roadway layout and design, stormwater analysis and treatment, sewer and water line layout and design, and construction administration and oversight. I have been involved in a variety of projects for many different clients including commercial and residential developers, the chemical and petrochemical industries, manufacturing facilities, the pulp and paper industries, municipalities, and several governmental agencies. My professional experience and qualifications are further detailed by my curriculum vitae, which is included as Addendum A.

2. In 2018 Ransom was asked to participate in the conceptual layout of the proposed Nordic Aquafarms, Inc. (Nordic) facility in Belfast, Maine. The conceptual layout was to be prepared within the parameters of the zoning ordinance of the City of Belfast. I was asked to provide stormwater management for the proposed development in compliance with Chapter 500 of Maine Stormwater Management Law and ultimately provide Section 12 of the Site Location of Development Permit Application. As part of this effort I prepared the Stormwater Management Report for the project which is included as Nordic Exhibit 15.

3. The following proposed stormwater management strategies were used to guide the design:

   a) Divert runoff from upgradient of the site around the proposed development to avoid directing upgradient runoff to on-site stormwater treatment measures. The runoff volume from upgradient areas that are not diverted need to be considered in on-site treatment measures.
   b) Provide treatment for 95% of new impervious surfaces and 80% of the developed area of the property in compliance with General Standards of Chapter 500. Treatment to be local to where stormwater occurs to minimize the relative size of treatment structures and ultimately reduce site disturbance.
   c) Avoid stormwater discharge from the developed site towards Reservoir Number One to minimize phosphorus export.

4. Collect and transport treated stormwater flows, as well as flows from larger volume storms, to discharge to the coastal wetland below the dam. This allows for a waiver of the flooding standard, reducing the need for large retention structures and reducing the project impacts.

5. The topography of the undeveloped site slopes generally from north to south/southwest into Reservoir Number One. Groundwater in the area also appears to flow from north to south across the site toward the reservoir. The site slopes steepen within the 250-foot buffer with fingers of notable rivulets, drainage channels, and ravines exiting into the reservoir. The reservoir is controlled by a dam located just west of Route 1 and outlets into Belfast Bay. There is considerable area upgradient of the site which also drains to the south to the reservoir. The proposed grading of the site generally maintains the pre-development flow pattern from the north to the south/southwest. To accommodate the function of the buildings and associated access, the center of the site has less significant grade change while the northern and southern portions of the site include steeper slopes to match the existing grade at the 40-foot "no disturbance" buffer at the site boundary.

6. Diversion of Upgradient Runoff. A stormwater channel has been proposed within the developed area of the site and downgradient of the 40-foot buffer adjacent to the northern property boundary to divert stormwater from off-site areas around the proposed development. Currently, stormwater from upgradient areas travels south/southwest through the site and toward Reservoir Number One through the intermittent streams (#3, #5 and #6) and toward the stream that defines the eastern boundary of the site (#9). The proposed channel will be constructed in the early stages of construction as a stone cutoff channel (see the Erosion Control Plan) to divert upgradient stormwater and groundwater around the site and back into the streams during construction. Perforated piping is proposed in the stone to be discharged to locations east and west of site construction. Once construction is complete, the channel will be mulched, loamed and seeded and converted to multiple collection basins. The basins will be fitted with catch basin rims on concrete structures and connected to the perforated piping already in place. Upgradient runoff will be diverted around the developed site through this system and redeposited

downgradient to plunge pools allowing the stormwater to flow over land toward the streams discharging to Reservoir Number One. An additional channel will divert upgradient stormwater to Stream #9 north of the developed site.

7. Stormwater Quality General Standards. The Best Management Practices (BMPs) chosen for this site to meet the water quality objectives include:

   a) Subsurface Sand Filters: Filtration BMP discussed in *Maine's Stormwater Management Manual, Volume III, Chapter 7.3, Subsurface Sand Filters.*

      Subsurface sand filters are being used exclusively to treat runoff from some of the flat building roofs. The chamber system and stone over the sand filter is designed to store stormwater and discharge it at an attenuated rate to reduce thermal impacts downstream of the system. The subsurface system uses sand and does not provide a source of organic matter for filtration. A pretreatment structure in the form of a fabric wrapped chamber provides the initial settlement and filtration of contaminants, although the intent is to minimize the sediment load (and subsequent maintenance) by using only stormwater runoff from roofs. The roofs of these buildings are an unlikely source of hydrocarbons and therefore hydrocarbon pretreatment is not considered.

      Buildings 1 and 2 are to be built with 3 grow modules each – constructed in succession. Each grow module has an individual subsurface sand filter (SSF) that can be installed at the time of the construction of the module to treat the runoff from the roof. Building 5 (the Central Utility Plant) uses a SSF as does the roof runoff from Building 6 (or the enclosed concrete equipment pad) for a total of eight SSF systems provided. The SSF systems are located primarily beneath paved surfaces. Each is preceded by an inlet control structure which limits the volume of roof runoff discharged to the filter. A weir in the inlet control structure is provided to allow only the equivalent of the treatment volume (as defined by design guidance per Maine Stormwater Technical Design Manual) through a pipe to the chamber system. Storms with volumes in excess of the treatment volume are discharged over the weir to the closed piping network. The treatment volume is filtered through an 18-inch sand filter at a rate no less than 24 hours and no more than 48 hours. The sand filter is underlain with a drainage layer that collects and transports the treated stormwater to the closed pipe network.

   b) Grassed Underdrained Soil Filters: Filtration BMP discussed in *Maine's Stormwater Management Manual, Volume III, Chapter 7.1, Grassed Underdrained Soil Filters.*

      Grassed underdrained soil filters (GSF) are used primarily for treatment of some paved areas as well as landscaped developed areas. The GSF systems capture and retain runoff and pass it through a soil filter media. The media is a mixture of silty sand and organic matter to remove a range of pollutants including suspended solids, phosphorus, nitrogen, metals, hydrocarbons, and other dissolved pollutants. The filter also provides for attenuation of discharge which provides reduction of thermal impacts to downstream areas as well as minimizing potential channel erosion. The system is sized to store the treatment volume above the filter with the larger volume storms bypassing the filter through a catch basin and into the closed piping system. The 18-inch thick filter media is underlain with a drainage system and perforated underdrain collection piping which ultimately discharges to the catch basin and into the closed piping system.

GSF systems are provided in grassed areas adjacent to pavement throughout the site. The size of the system varies depending on the area draining to it but does not exceed 3,000 sf surface area over the soil filter. Locations where the stormwater is transported to the GSF via a channel or a pipe, a sediment forebay is provided to minimize discharge of sediment to the filter basin.

c) Manmade Pervious Paver Systems (MPP): Filtration BMP discussed in *Maine's Stormwater Management Manual, Volume III, Chapter 7.7, Manmade Pervious Surfaces.*

Pervious paver systems are used almost exclusively for the treatment of paved areas on site, though some systems in parking areas may see some runoff from adjacent landscaped areas. The MPP system consists of a permeable surface, base, and subbase materials which allow the penetration of runoff into the underlying soil filter. The area of pervious pavers must be no less than 20% of the area being treated and the flow path to the pervious paver section must be no greater than 50 feet. A storage reservoir is provided below the paver bedding material and above the sand filter layer capable of storing the treatment volume. The 18-inch thick sand filter layer is underlain with a drainage system consisting of R-Tank storage tanks prior to discharge to the closed piping network. Catch basins in the pervious paver area capture overflow from larger storms and discharge to the R-Tank system. The use of the R-Tank system allows for additional storage for attenuation of larger storm events.

The pervious pavers proposed are rated for H25 loading so can be used in higher traffic areas, however the paver systems are proposed for parking areas in the center of the site as well as on the outer access drives adjacent to both Building 1 and Building 2. The interior pavers in the parking areas are proposed along the full length of the parking spaces and pick up runoff from local paved surfaces. The pavers in the access drives are 6 feet wide and are intended to pick up the runoff from the paved access drive itself.

d) Green Roof System: Filtration BMP discussed in *Maine's Stormwater Management Manual, Volume III, Chapter 7.6, Vegetated Roofs*

The vegetated roofs are limited to those roofs which are technically flat and with limited protrusions or equipment and with minimal anticipated foot traffic. Rooftop vegetation provides advantages beyond stormwater treatment including the reduction in the heat island effect with improvements in building insulation and increases in the life expectancy of the base roof material. The vegetated roof also provides attenuation of stormwater runoff and peak flows as well as treatment, under the General Standards of Chapter 500, within a layer of filter media and vegetation. The containment of the treatment volume within the media provides stormwater treatment and enhances the overall effectiveness of the vegetated roof.

Buildings on this site will utilize intensive green roof systems. Buildings 3, 4, and 8 will be constructed with green roofs although Building 3 will be constructed in two phases each with a mechanical penthouse extending through the roof system. The design of each green roof system assumes up to 20 % of the entire roof area is taken up with the penthouse and/or elevated access pathways to access areas on the roof. The remaining area will utilize an intensive modular pre-grown roof system as manufactured by Firestone. The Firestone Skyscape module platforms are 15" x 20" and, with the number of modules that can fit on the roof, can provide storage and subsequent treatment for the treatment volume of the entire roof. Although the roof is vegetated, the area is still considered to be impervious. Roof drains will be provided to collect runoff from the larger storm events and any stormwater that is not able to be stored in the filter media prior to evapotranspiration.

8. As designed, treatment measures provide treatment of approximately 96% of all new impervious surfaces and approximately 84% of the developed area, which exceeds the required 95% and 80% of the General Standards of Chapter 500.

9. Stormwater Quantity – Flooding Standards. A project is eligible for a waiver from the flooding standard for insignificant increases in peak flow rates from a project site. A waiver is also available for a project in the watershed of a coastal wetland, great pond, or major river segment provided the stormwater is conveyed via sheet flow, in a manmade open channel, or in a piped system directly into one of these resources.

   We requested a waiver from the flooding standard for the portion of the project which is currently in the watershed of a great pond and a coastal wetland and which is discharging directly to the coastal wetland, below the dam of the reservoir (great pond) through the existing on-site settling tank.

   We did not request a waiver from the flooding standard for the portion of the project which is currently in the watershed of a coastal wetland but is upstream from an existing culvert on US Route 1. The discharge from this culvert is routed through a downstream property on the opposite side of US Route 1 to the coastal wetland. The project does not intend to upgrade the culvert under US Route 1 or increase the flow to the channel on the downstream property. We prepared stormwater calculations using Hydrocad stormwater modelling software, which demonstrated that the runoff peak flow to the existing culvert after development will be below the pre- development peak runoff rates for the 2-year, 10-year, and 25-year storm events as well as the 100-year frequency storm. In this instance, stormwater from the roof of Building 8 and the paved parking areas adjacent to the building are stored in additional below grade R-Tank storage tanks prior to discharge to attenuate the peak flow.

10. As designed, the project meets the requirements of the Flooding Standards of Chapter 500.

Dated: December 10, 2019

By. ______________________

Maureen P. McGlone, Civil Engineer
Ransom Consulting, Inc.

STATE OF MAINE

December 10, 2019

County of Cumberland, ss.

Personally appeared the above-named Maureen P. McGlone and made oath as to the truth of the foregoing pre-filed testimony.

Before me,

____
Notary

JENNIFER LEONARD
NOTARY PUBLIC - State of Maine
My Commission Expires
January 23, 2024

RANSOM Consulting Engineers and Scientists

MAUREEN P. MCGLONE, P.E.

Lead Design Engineer/Project Manager

EDUCATION

B.S. in Civil Engineering, Worcester Polytechnic Institute, 1989

PROFESSIONAL REGISTRATIONS AND TRAINING

- Professional Engineer: Maine, 7705
- Maine Department of Transportation Local Project Administration Certification
- 40-hour OSHA Hazardous Waste and Emergency Response Training, 8-hour Annual Refreshers
- 8-hour, OSHA 29 CFR 1910.120 Hazardous Waste Supervisor Health and Safety Course
- Multi-Agency Radiation Survey and Site Investigation

GENERAL BACKGROUND

Maureen's 30 years of civil and environmental design engineering experience includes site layout and grading, roadway layout and design, sewer and water line layout and design, construction administration and oversight, water and wastewater treatment process design, design of soil and groundwater remediation systems, treatability studies, field sampling. She has been involved in a variety of projects for many different clients including commercial and residential developers, the chemical and petrochemical industries, manufacturing facilities, the pulp and paper industries, municipalities, and several governmental agencies.

REPRESENTATIVE PROJECT EXPERIENCE

- **AC Hotel Site Development, Portland Norwich Group, LLC, Portland, ME.** As the project manager and senior design engineer Maureen was responsible for the site development of the 6-story AC Hotel in Portland, ME. The project involved master planning for subsequent development on the site including designing and installing stormwater treatment and detention systems to account for future development; coordination with the City of Portland for traffic management; coordination with the Portland Water District during water main revitalization project; connection to the municipal sanitary and storm sewer systems; connection of water and gas service, coordination with the utility company and the City of Portland to provide a subsurface vault transformer beneath the city sidewalk, offsite improvements on city streets and sidewalks; design of environmental controls including a marker layer and cover system; design of a vapor mitigation system in compliance with the VRAP program of the MEDEP; coordination with the adjacent property owners to ensure operations during construction, and stormwater management. The project was further complicated by contaminated soils beneath the hotel requiring remediation, stormwater retention in subsurface structures beneath the driveway turnaround, zero setbacks along city streets with grade changes complicating ADA accessibility.

- **Water Street Water Main Upgrade and Roadway Reconstruction, City of Gardiner, ME.** As the senior design engineer, Maureen was responsible for the reconstruction of portions of Water and Mechanic Streets, Main and River Avenues, and upgrade of water main and stormwater in the downtown of Gardiner, Maine. The project included repaving approximately 7,250 linear feet of an MDOT roadway; upgrade of approximately 1,650 linear feet of water main and installation of new water services; improvements to stormwater; approximately 1200 linear feet of paved sidewalk. The project included production of the design drawings and specifications and public presentation, as well as construction support services including bidding documents, evaluation of bids, and field observation and monitoring during construction.

- **Highland Avenue Water Main Upgrade and Roadway Reconstruction, City of Gardiner, ME.** Maureen was responsible for the design of the reconstruction of Highland Avenue and upgrade of utilities. The project included repaving approximately 8,000 linear feet of an MDOT roadway by 3 different construction methods (shim and overlay, mill and fill, and full depth recycling); upgrade of approximately 3,500 linear feet of water main; installation of new water services; rehabilitation or replacement of approximately 3,500 linear feet of sanitary sewer main and structures; replacement of sanitary service laterals; rehabilitation of approximately 2,400 linear feet of storm sewer and structures; and reconstruction of approximately 2,600 linear feet of paved sidewalk. The project included production of the design drawings and specifications and public presentation, as well as construction support services including bidding documents, evaluation of bids, and field observation and monitoring during construction.

- **Long Beach Avenue Outfall Culvert Replacement, Town of York, York, ME.** Maureen was the senior design engineer responsible for the improvements to culverts discharging to Long Sands Beach. The project included replacing a 36-inch culvert and outfall structure with dual 36-inch culverts to a new concrete outfall structure with two wall-mounted tideflex tide check valves. The project also included replacement of a 24-inch culvert and headwall with a dual 24-inch HDPE culvert to a concrete outfall structure similar to the above mentioned culvert. In addition, a third outlet was upgraded to redirect flow from an outfall to the 36-inch dual system as well as allow installation of an inline tide check valve. In addition to securing State permits, developing design drawings, specifications, public presentation, bidding, Maureen was responsible for construction oversight and administration.

- **Multi-Family Housing Development, Developers Collaborative, Gardiner, ME.** As the Project manager and senior design engineer, Maureen was responsible for 15 units of housing in three buildings in Gardiner, ME. The project included locating the three buildings on a very challenging site being developed as part of the Brownfield program. Ransom incorporated several cover systems installed as part of the site stabilization (rip rap slope stabilization, pavement, gravel) in the site design to minimize the disturbance of contaminated materials and maximize the reuse potential for the site. The project has received approval from the City of Gardiner Planning Board and is currently progressing with construction level contract documents.

- **Twenty Thames Condominiums, EssexNorth Portland LLC, Portland, ME.** As the Project manager and senior design engineer Maureen was responsible for the site development of a 6-story residential condominium building. The building design includes first floor retail space and valet parking at ground level under the upper floors and 5 floors of high-end condominiums. The site is the second to be developed as part of a master plan for development on a VRAP site on the waterfront in Portland, ME. The project was further complicated by contaminated soils beneath the hotel requiring remediation, stormwater retention in subsurface structures beneath the driveway turnaround, zero setbacks along city streets with grade changes complicating ADA accessibility.

RANSOM Consulting, Inc.

Consulting Engineers and Scientists

Nordic Aquafarms Stormwater Management Plan

List of Appendices:

Site Description:

The site (refer to Site Location Map) is an approximately 54-acre development parcel consisting of several parcels under contract with multiple entities including the Belfast Water District (BWD), Mathews Brothers, and Sam Cassida (Refer to the attached Site Location Map). The portion of the site on the Mathews Brothers parcel in the northeast quadrant of the site is primarily grass, with a stand of trees along the drainage channel that defines the eastern boundary of the new parcel. The remainder of the development parcel (from Belfast Water District and Cassida parcels) is primarily vegetated (wooded) with an area in the south currently developed with structures and pavement associated with operations of the BWD. The Belfast Reservoir Number One exists south of the site with a 250-foot strip between the reservoir and the site being retained by the Belfast Water District, within the Resource Protection District, as a buffer to the reservoir.

Portions of the site within the land owned by the Belfast Water District are currently developed with buildings (office building, former filter house, maintenance garages) and associated driveways and parking associated with current BWD operations. A concrete dam controls the water level to the reservoir and piping associated with the former use of the reservoir as the water supply for the City of Belfast still exists adjacent to the dam and office building. Also adjacent to the office building and the dam is a former settling basin previously used in treatment of domestic water supply.

The topography of the undeveloped site slopes generally from north to south/southwest into Reservoir Number One. Groundwater in the area also appears to flow from north to south across the site toward the reservoir. The site slopes steepen within the 250-foot buffer with fingers of notable rivulets, drainage channels, and ravines exiting into the reservoir. The reservoir is controlled by a dam located just west of Route 1 and outlets into Belfast Bay. There is considerable area upgradient of the site which also drains to the reservoir. This Stormwater Management Plan also addresses the offsite areas currently draining onto and through the site.

Table 1: Stormwater Treatment

Subcatchment Area #	Total Area (sq.ft)	Developed Area (sq. ft)	New Impervious (sf)	Treated Impervious (sq. ft)	Landscaped (sq. ft)	Treated Landscaped (sq. ft)	Treatment System
1A	17785	17785	6203	6203	11582	11582	GSF 1A
1B	34018	22308	6832	6832	15476	9245	GSF 1B
2	31049	26280	8052	8052	18228	18228	GSF 2
3	36147	28605	13091	13901	15514	15514	GSF 3
4	8448	8448	0	0	9707	9707	GSF 4
5	10807	10807	0	0	10807	10807	GSF 5
6	13985	13985	4484	4484	9501	9501	GSF 6
7	30345	30345	7846	7846	22499	22499	GSF 7
8	45551	45551	25409	25409	20142	20142	GSF 8
9	27099	27099	17996	17996	9103	9103	GSF 9
10	30932	30932	30932	30932	0	0	MPP 10
11	43174	43174	15881	15881	27293	27293	GSF 11
12	12920	12920	7491	7491	5429	5429	GSF 12
13	45163	45163	20981	20981	24182	24182	GSF 13
14	9378	9378	8849	8849	529	529	MPP 14
15	9157	9157	4974	4974	4183	4183	GSF 15/GR 15
16	15110	15110	5161	5161	9949	9949	GSF 16
17	13300	13300	10855	0	2445	0	-
18A	6339	6339	2593	2593	3746	3746	GSF 18A
18B	4023	4023	2348	2348	1675	1675	GSF 18B
19	13711	13711	11210	11210	2501	2501	MPP 19
20	28459	28459	21010	0	7449	0	-
21	9994	9994	8361	7379	1633	1441	MPP 21
22	13511	13511	10326	10326	3185	3185	MPP 22
23	28475	18834	6249	0	12585	0	-
24	18261	18261	12270	12270	5991	5991	GSF 24
25	118223	21818	0	0	21818	0	-
26	3816	3816	3816	3816	0	0	MPP 26
27	4262	4262	0	0	0	0	-
28	79698	9061	2064	1407	2429	2429	GR 28
29	1306	1306	1306	0	0	0	-
30	31472	31472	24541	24541	6931	6931	MPP 30
31	70616	24011	0	0	24011	0	-
32	4677	4677	2826	0	1851	0	-
33	107893	107893	107893	107893	0	0	GR 33
34	24099	24099	24099	24099	0	0	GR 34
35	20997	20997	20997	20997	0	0	GR 35
36	112560	112560	112560	112560	0	0	SSF 36
37	112560	112560	112560	112560	0	0	SSF 37
38	112560	112560	112560	112650	0	0	SSF 38
39	112560	112560	112560	112560	0	0	SSF 39
40	112560	112560	112560	112560	0	0	SSF 40
41	112560	112560	112560	112560	0	0	SSF 41
42	12000	12000	12000	12000	0	0	SSF 42
43	18983	18983	18983	18983	0	0	SSF 43
44	159363	52028	0	0	97156	0	-
45	64440	5799	0	0	5799	0	-
46	14976	0	0	0	0	0	-
47	79187	15454	0	0	10702	0	-
48	40183	305	0	0	305	0	-
49	84173	3471	548	0	2923	0	-
50	30173	30173	30173	30173	0	0	MPP 50
north channel	135154	59131	0	0	0	0	-
Totals	2338192	1649595	1194010	1150477	429259	235792	

% new impervious treated

96.4%

% new developed area treated

84.0%

A Class B high intensity soil survey (HISS) has been performed on this site and is included in *Section 11, Soils* of this Site Location of Development Act permit application. The results of the HISS mapping are included in the stormwater analysis.

Wetland areas and streams are identified on the existing conditions plans included as an attachment in this Section. In addition, these features are shown on the stormwater plans (also included as an attachment) as well as the HISS mapping discussed in the above paragraph.

Development Description:

Nordic Aquafarms proposes the development of a salmon fish growing operation capable of providing 33,000 metric tons per year of seafood to consumers in the northeastern US. While construction is proposed in two phases (see previous sections of this application for additional information on construction phasing), the stormwater management systems have been considered for the complete project build-out.

The salmon growing operation is done indoors and therefore requires a fair number of buildings to perform that function. Buildings proposed on-site consist of:

Building 1 – Consists of 3 grow modules constructed in succession.

Building 2 – Consists of 3 grow modules constructed in succession.

Building 3 – Smolt Building

Building 4 – Fish Processing Facility

Building 5 – Central Utility Plan

Building 6 – Oxygen generation. This area is currently designated as a building but may be modified based on the requirements of the oxygen generation contractor and their equipment. This may be an outdoor facility that houses generation equipment on a concrete pad. If this is the case, the concrete pad will be surrounded by curbing to collect stormwater runoff.

Building 7 – Office/Maintenance Building

Building 8 – Water/Wastewater Treatment Building

Building 9 – Gate House

The buildings are arranged such that operations central to the needs of the fish growing process will be performed in the middle of the complex, while the larger fish grow module buildings are on the exterior. Water and wastewater treatment will be closer to Route 1 to facilitate intake and discharge of seawater. The building complex will be supported by paved access drives surrounding the facility and between buildings. Efforts were made to group buildings adjacent to one another to minimize the amount of pavement. Loading areas are located adjacent to access drives. Employee parking is scattered throughout the complex in areas that expect to see more employee activity such as the Smolt Building, the processing facility, the office/maintenance garage, and the water/wastewater treatment facility. Additionally, a small parking area is provided adjacent to the entrance gate to facilitate public use of the existing trail system located on the property within the 250-foot resource protection district being retained by the BWD. Among and adjacent to the paved areas are landscaped islands and grassed areas.

Grading of the site post development still slopes from the north to the south/southwest. To accommodate the function of the buildings and associated access, the center of the site has less significant grade change while the northern and southern portions of the site include steeper slopes to match grading at the 40-foot "no disturbance" buffer at the site boundary.

While existing drainage channels in the center of the site will be filled to accommodate development, the channels to the south and through the 250-foot buffer retained by the BWD will remain. In addition, stormwater from off-site areas to the north will be diverted and underdrain piping will be included around building foundations and during construction to facilitate transport of any groundwater encountered toward the existing drainage channels to the south.

Stormwater Management – Basic Standards:

Erosion and sedimentation control measures during construction are detailed within *Section 14, Basic Standards Submissions* of this Site Location of Development Act Permit. Post-Construction stormwater management practices and good housekeeping practices will be in accordance with Maine DEP Best Management Practices. A post construction stormwater management plan as well as inspection and maintenance requirements and third-party inspection contract are provided in *Appendix C* of this Stormwater Management Plan.

Stormwater Management – Quality (General Standards):

A project must meet Maine's *Chapter 500, Stormwater Management* general standards if the project results in one or more acres of impervious area, or 5 acres or more of developed area for projects that are not within the direct watershed of an urban impaired stream or a lake most at risk (as defined by Chapter 502). To meet the general standards, the project's stormwater management system must include treatment measures that will provide pollutant removal or treatment (or both), mitigate for the increased frequency and duration of channel erosive flows due to runoff from smaller storms, and mitigate potential temperature impacts. To do that a project must provide treatment of 95% of the impervious area and no less than 80% of the developed area. In addition, runoff from upgradient areas must either be redirected away from the project's stormwater treatment measures or that measure must be sized to address the runoff volume of the upgradient area at 50% of the sizing requirements. Although the amount of on-site treatment provided may be reduced by providing treatment on a currently untreated off-site area in the same watershed, this is not proposed for this project at this time.

Treatment of stormwater is addressed using Maine's Best Management Practices (BMPs). These BMPs are focused on meeting the following water quality objectives:

- Effective pollutant removal – removal of fine particles that carry nutrient and heavy metal load as well as dissolved pollutants and hydrocarbons.

- Cooling – to protect aquatic life within a river, stream, or brook watershed discharge must effectively cool down.

- Channel protection – discharge within a river, stream, or brook watershed must be released slowly to avoid destabilization and resulting sedimentation of receiving channels.

- Flood control – detention for large, infrequent storm events to avoid flooding infrastructure.

The water quality volume is the initial depth of runoff that is considered to carry the bulk of pollutants deposited since the last rain event. Studies have indicated that the first inch of runoff distributed over the watershed carries 90% of the pollutant load from a storm event. Maine's BMPs identified in Volume III of the Maine Stormwater Management Design Manual consider this when establishing the treatment volume identified within each BMP. The BMPs chosen for this site to meet the water quality objectives include:

- Subsurface Sand Filters: Filtration BMP discussed in *Maine's Stormwater Management Manual, Volume III, Chapter 7.3, Subsurface Sand Filters.*

- Grassed Underdrained Soil Filters: Filtration BMP discussed in *Maine's Stormwater Management Manual, Volume III, Chapter 7.1, Grassed Underdrained Soil Filters.*

- Manmade Pervious Paver Systems: Filtration BMP discussed in *Maine's Stormwater Management Manual, Volume III, Chapter 7.7, Manmade Pervious Surfaces.*

- Green Roof System: Filtration BMP discussed in *Maine's Stormwater Management Manual, Volume III, Chapter 7.6, Vegetated Roofs.*

Project Specific Water Quality Treatment Measures:

The stormwater management facilities identified above are used throughout the developed site. Calculations detailing the sizing of the treatment facilities are in *Appendix A.* The subcatchment areas being treated by each of the stormwater management facilities are identified on 11 x 17 figures at a scale of 1" = 50' within *Appendix B*. The areas are also included on the Post-Development watershed map, which is included as two 24"x36" drawings at a scale of 1" = 120' within *Appendix E*. Table 1 (at the end of this section) indicates the amount of treatment provided within each subcatchment area as well as for the whole site. The results of calculations indicate that greater than 95% of the new impervious surface and greater than 80% of the new developed area are treated by the stormwater management facilities proposed for this development. In addition, each of the stormwater BMPs are further described below with discussions about how they were used on this site.

- Diversion of Upgradient Runoff. A stormwater channel has been provided within the developed area of the site and downgradient of the 40-foot buffer adjacent to the northern property boundary to divert stormwater from off-site areas. Currently, stormwater from upgradient areas travels south/southwest through the site and toward the stream that defines the eastern boundary of the site (Stream 9). Although the channel is currently not anticipated to provide treatment to runoff from the offsite areas, the channel is designed with a minimal slope of 0.5% to reduce velocity and erosion potential. Stone check dams are also provided to minimize release of sediment to the stream. Post-development hydraulic modelling is provided in *Appendix D*.

- Subsurface Sand Filters (SSF): Subsurface sand filters are being used exclusively to treat runoff from some of the flat building roofs. The chamber system and stone over the sand filter is designed to store stormwater and discharge it at an attenuated rate to reduce thermal impacts downstream of the system. The subsurface system with detention/retention uses sand and does not provide a source of organic matter for filtration. A pretreatment structure in the form of a fabric wrapped chamber provides the initial settlement and filtration of contaminants, although the intent is to minimize the sediment load (and subsequent maintenance) by using only stormwater runoff from roofs. The roofs of these buildings are an unlikely source of hydrocarbons and therefore hydrocarbon pretreatment is not considered.

  Buildings 1 and 2 are to be built with 3 grow modules each – constructed in succession. Each grow module has an individual subsurface sand filter that can be installed at the time of the construction of the module to treat the runoff from the roof. Building 5 (the Central Utility Plant) uses a SSF as does the roof runoff from Building 6 (or the enclosed concrete equipment pad) for a total of eight SSF systems provided. The SSF systems are located primarily beneath paved surfaces. Each is preceded by an inlet control structure which limits the volume of roof runoff discharged to the filter. A weir in the inlet control structure is provided to allow only the equivalent of the treatment volume (as defined by design guidance per Maine Stormwater Technical Design Manual) through a pipe to the chamber system. Storms with volumes in excess of the treatment volume of 1.0 inches times the subcatchment's impervious area is discharged over the weir to the closed piping network. The treatment volume is filtered through an 18-inch sand filter at a rate no less than 24 and no more than 48 hours and the sand filter is underlain with a drainage layer that collects and transports the treated stormwater to the discharge pipe network. six-inch slotted underdrain pipes are provided in the drainage layer beneath each chamber. A solid discharge collector pipe connects the underdrain pipe every 50 feet along the chamber length and discharges to the pipe network.

- Grassed Soil Filters (GSF): Grassed underdrained soil filters are used primarily for treatment of some paved areas as well as landscaped developed areas. The GSF systems capture and retain runoff and pass it through a soil filter media. The media is a mixture of silty sand and organic matter to remove a range of pollutants including suspended solids, phosphorus, nitrogen, metals, hydrocarbons, and other dissolved pollutants. The filter also provides for attenuation of discharge which provides reduction of thermal impacts to downstream areas as well as minimizing potential channel erosion. The system is sized to store the treatment volume (1.0 inches times the impervious area and 0.4 inches times the landscaped developed area) above the filter with the larger volume storms bypassing the filter through a catch basin and into the closed piping system. The 18-inch thick filter media is underlain with a drainage system and perforated underdrain collection piping which ultimately discharges to the catch basin.

  GSF systems are provided in grassed areas adjacent to pavement throughout the site. The size of the system varies depending on the area draining to it but does not exceed 3,000 sf surface area over the soil filter. Locations where the stormwater is transported to the GSF via a channel or a pipe, a sediment forebay is provided to minimize discharge of sediment to the filter basin. Refer to calculations in *Appendix A*, and stormwater management facility drawings provided in *Appendix B.*

- Manmade Pervious Pavers (MPP): Pervious paver systems are used almost exclusively for the treatment of paved areas on site, though some systems in parking areas may see some runoff from adjacent landscaped area discharging to the system. The MPP system consists of a permeable surface, base, and subbase materials which allow the penetration of runoff into the underlying soil filter. The area of pervious pavers must be no less than 20% of the area being treated and the flow path to the pervious paver section must be no greater than 50 feet. A storage reservoir is provided below the paver bedding material and above the sand filter layer capable of storing the treatment area equivalent to 1.0 inches times the impervious area and 0.4 inches times the landscaped developed area. The 18-inch thick sand filter layer is underlain with a drainage system consisting of R-Tank storage tanks prior to discharge to the closed piping network. Catch basins in the pervious area capture overflow from larger storms and discharge to the R-Tank system. The use of the R-Tank system allows additional storage for attenuation of larger storm events.

  The pervious pavers proposed are H25 loaded so can be used in higher traffic areas, however the paver systems are proposed for parking areas in the center of the site as well as on the outer access drives adjacent to both Building 1 and Building 2. The interior pavers in the parking areas are the full length of the parking spaces and pick up runoff from local paved surfaces. The pavers in the access drives are 6 feet wide and are intended to pick up the runoff from the paved access drive itself.

- Grassed Roof Systems (GRS): The vegetated roofs are limited to those roofs which are technically flat and with limited protrusions or equipment and with minimal anticipated foot traffic. Rooftop vegetation provides advantages beyond stormwater treatment including the reduction in the heat island effect with improvements in building insulation and increases in the life expectancy of the base roof material. The vegetated roof also provides attenuation of stormwater runoff and peak flows as well as treatment under the General Standards of Chapter 500 within a layer of filter media and vegetation. There are two types of vegetated roof systems: extensive and intensive. The extensive roof systems typically provide coverage over the entire roof with a thinner media depth for the growth of sedums or similar arid plants and also provide little treatment. Intensive systems tend to provide access to the roof itself, provide for more open space on the roof and, with a thicker media, provide more nutrient uptake and greater flow attenuation. The containment of the treatment volume within the media provides stormwater treatment and enhances the overall effectiveness of the vegetated roof.

  Buildings on this site will utilize intensive green roof systems. Buildings 3, 4, and 8 will be constructed with green roofs although Building 3 will be constructed in two phases each with a mechanical penthouse extending through the roof system. The design of each green roof system considers up to 20 % of the entire roof area is taken up with the penthouse and/or elevated access pathways to access areas on the roof. The remaining area will utilize an intensive modular pre-grown roof system as manufactured by Firestone. The Firestone Skyscape module platforms are 15" x 20" and, with the number of modules that can fit on the roof, can provide storage and subsequent treatment for a volume equivalent to 1.0 inches x the impervious surface of the entire roof. Although the roof is vegetated, the area is still considered to be impervious. Roof drains will be provided to collect runoff from the larger storm events and any stormwater that is not able to be stored in the filter media prior to evapotranspiration.

Stormwater Management – Quantity (Flooding Standards):

A project must meet Maine's *Chapter 500, Stormwater Management* flooding standards if the project results in three or more acres of impervious area, or 20 acres or more of developed area. To meet the flooding standard, the project's stormwater management systems must:

- detain, retain, or result in the infiltration of stormwater from 24-hour storms of the 2-year, 10-year, and 25-year frequencies such that peak flow of stormwater from the project site do not exceed the peak flows of stormwater prior to undertaking the project;
- design the piped or open channel systems based on a 10-year, 24-hour storm without overloading or flooding beyond channel limits;
- not flood the primary access road to the project and any public roads bordering the project a s a result of a 25-year, 24-hour storm event

A project is eligible for a waiver from the flooding standard for insignificant increases in peak flow rates from a project site. A waiver is also available for a project in the watershed of a coastal wetland, great pond, or major river segment provided the stormwater is conveyed via sheet flow, in a manmade open channel, or in a piped system directly into one of these resources.

As part of this application, Nordic Aquafarms is requesting a waiver from the flooding standard for the portion of the project which is currently in the watershed of a great pond and a coastal wetland and which is discharging directly to the coastal wetland, below the dam of the reservoir (great pond) through the existing on-site settling tank.

Nordic Aquafarms is not requesting a waiver from the flooding standard for the portion of the project which is currently in the watershed of a coastal wetland but is upstream from an existing culvert on US Route 1. The discharge from this culvert is routed through a downstream property on the opposite side of US Route 1 to the coastal wetland. The project does not intend to upgrade the existing culvert or increase the flow to the channel on the downstream property. It is anticipated that the runoff peak flow to the existing culvert after development will be below peak runoff pre- development for the 2-year, 10-year, and 25-year storm events as well as the 100-year frequency storm. Increase in peak runoff at PT6 (refer to tables below) is primarily due to additional area added to the off-site subcatchment OS 9. The stormwater channel located north of Building 1 to divert off-site runoff is included with OS 9 in the post-development condition.

Stormwater runoff in the pre-development condition is evaluated at multiple analysis points. Runoff from off-site subcatchments of 9, 10, and 11 is evaluated at a point where it enters the stream along the eastern boundary (PT6). Runoff is also evaluated at locations of culverts discharging under US Route 1 (PT7, PT8, and PT9). Runoff toward the Little River is evaluated at PT1. There are three separate analysis points (PT2, PT3, and PT4) which are combined as PT5 for runoff headed toward Reservoir Number One. Runoff from subcatchment 28, which consists of existing roadway and buildings, is evaluated at a point just below the dam (PT10). Pre-development stormwater plans, HydroCAD calculations, and backup calculations are included in *Appendix D*. Subcatchments in the post-development condition were established based on subareas used to define treatment boundaries. The majority of the subcatchments discharge to the closed piping system which ultimately discharges through the existing settling basin below the dam at Reservoir Number One. In addition, there are analysis points that mimic the same locations evaluated in the pre-development condition; PT1, PT5, PT6, PT7, PT8, PT9 and PT10. Post-development stormwater plans, HydroCAD calculations, and backup calculations are included in *Appendix E*.

Hydraulic Analysis:

Stormwater runoff calculations for quantity were made using the HydroCAD 10.0 computer program, which is based on the Soil Conservation Service's TR-20 methodology. Runoff hydrographs are generated based on a standard Type III 24-hour storm for Waldo County identified in Appendix H of *Maine DEP Chapter 500, Stormwater Management.*

Four storm events were evaluated as follows:

1. 2-year frequency flood event: 2.9" rainfall
2. 10-year frequency flood event: 4.2" rainfall
3. 25-year frequency flood event: 5.2" rainfall
4. 100-year frequency flood event: 7.2" rainfall

Runoff Curve numbers were determined based on land coverage and hydro-geological soil type C. Times of concentration were developed based on runoff flow paths for each subarea and shown on the Pre and Post-Development plans. A minimum Tc of 6 minutes was set in the HydroCAD model.

Peak runoff flow rates and runoff volumes are provided at the analysis points, which are identified on the Pre and Post-Development plans. Comparison of the runoff peak flow rates are provided at each analysis point on Tables 2-5 below

Table 2 – 2-year Storm

Analysis Point	Pre-Development	Post-Development
1	1.9 cfs	0.9 cfs
5	11.4 cfs	9.5 cfs
6	11.1 cfs	11.2 cfs
7	0.6 cfs	0.6 cfs
8	0.1 cfs	0.1 cfs
9	14.1 cfs	13.8 cfs
10	3.1 sfs	3.2 cfs

Table 3 – 10-year Storm

Analysis Point	Pre-Development	Post-Development
1	4.8 cfs	2.0 cfs
5	15.0 cfs	3.7 cfs
6	28.0 cfs	29.5 cfs
7	1.4 cfs	1.4 cfs
8	0.3 cfs	0.3 cfs
9	42.0 cfs	40.1 cfs
10	5.8 cfs	5.6 cfs

Table 4 – 25-year Storm

Analysis Point	Pre-Development	Post-Development
1	7.3 cfs	3.5 cfs
5	39.0 cfs	30.0 cfs
6	35.2 cfs	35.5 cfs
7	2.1 cfs	2.1 cfs
8	0.5 cfs	0.5 cfs
9	46.7 cfs	45.2 cfs
10	7.9 cfs	7.5 cfs

Table 5 – 100-year Storm

Analysis Point	Pre-Development	Post-Development
1	12.9 cfs	5.8 cfs
5	66.9 cfs	44.0 cfs
6	40.8 cfs	42.8 cfs
7	3.7 cfs	3.7 cfs
8	0.8 cfs	0.8 cfs
9	79.5 cfs	76.9 cfs
10	12.2 cfs	11.3 cfs

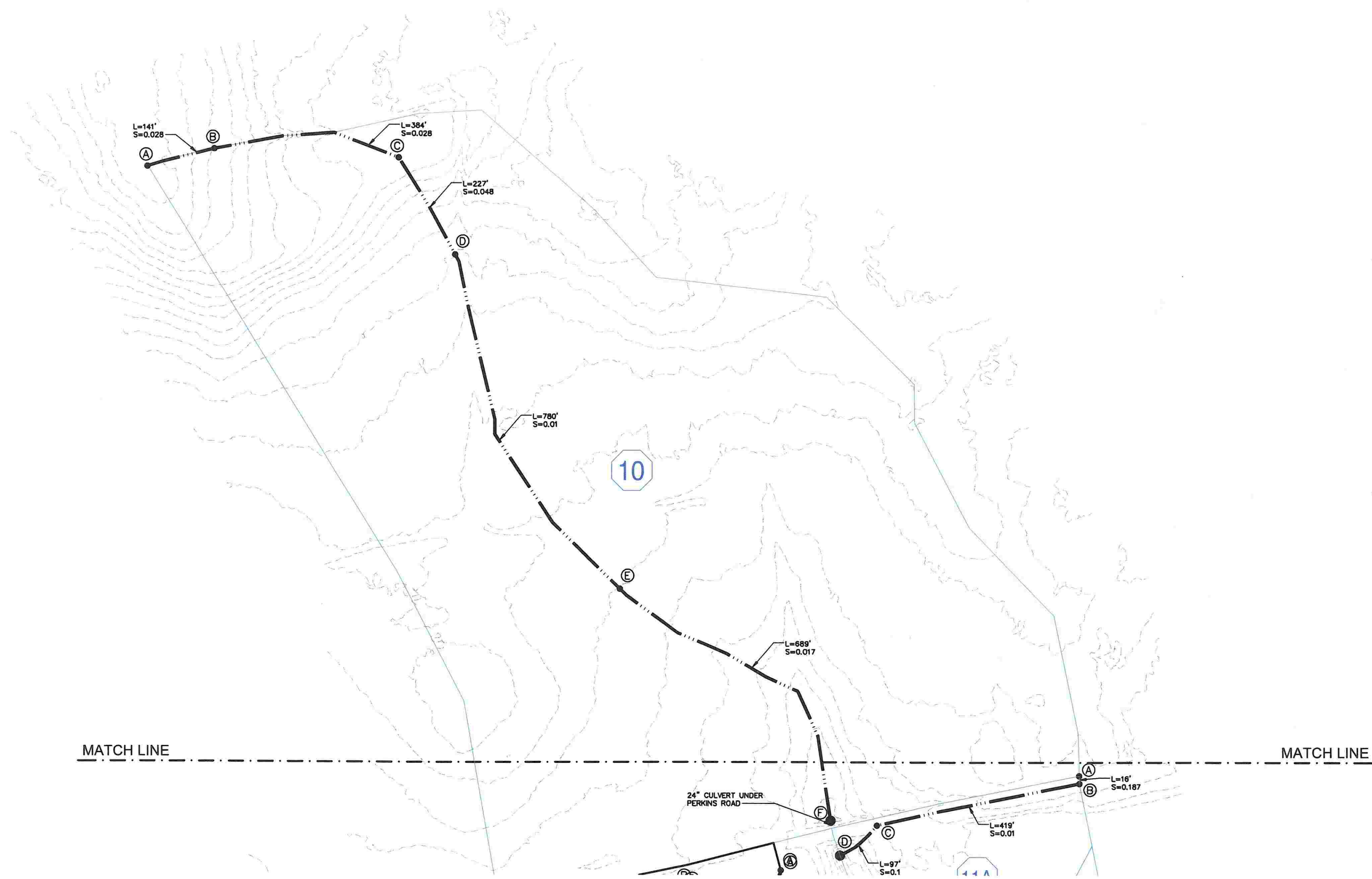
Storm Sewer Piping Capacity:

Stormwater piping was sized to have capacity to handle the 10-year storm event at a minimum. HydroCAD was used to determine the water levels in the upstream and downstream structures, the maximum flow rate in the pipe, and the calculated velocity at the peak of the storm event. The Energy Grade Line (EGL) elevations were calculated from the water levels generated within the software. The pipe was sized to keep the velocity in the pipe between 2.5 feet per second (fps) and 10 fps with a preferred velocity closer to 6 fps. Although the 10-year storm is the basis for design, the 25-year event was also evaluated, and every effort was made to provide increased capacity if possible. The flow rate in the pipe (generated by HydroCAD) was compared to the full-flow capacity of the pipe (using Mannings equation). The slope of the EGL was also compared to the slope of the pipe invert. Piping runs with significant discrepancies were re-evaluated to consider resizing the pipe as necessary. The EGL elevations were compared to the flood elevations (most often the rim of structures) to determine if there was too much pressure building in the lines. Refer to Table 6 – Pipe Capacity attached.

Table 6 - Pipe Capacity

Pipe	Pipe Dia (in.)	From Structure	Flood Elevation	10-yr HGL	10-yr EGL	Invert	To Structure	Flood Elevation	10-yr HGL	10-yr EGL	Invert	Length (ft)	Invert Slope (ft/ft)	EGL Slope (ft/ft)	10-yr Velocity (Q/A)	10-yr Flow (hydrocad)	Full-Flow Capacity
P1	18	B1M1				64.93	ICS-1	69.38	75.88		64.60	13	0.025			10.59	16.77
P2	18	ICS-1	69.38	66.28	66.77	63.50	DMH-2	69.15	65.94	66.43	63.27	23	0.010	0.015	5.61	9.90	10.53
P3	18	DMH-2	69.15	65.94	66.43	63.00	DMH-3	68.85	62.21	62.70	61.50	100	0.015	0.037	5.64	9.97	12.89
P4	24	DMH-3	68.85	62.21	62.37	60.50	DMH-4	68.60	61.69	61.85	59.87	125	0.005	0.004	3.18	9.98	16.10
P5	24	DMH-4	68.60	61.69	61.85	59.84	DMH-5	69.04	61.18	61.34	59.51	66	0.005	0.008	3.18	9.98	16.03
P6	8	CB-16	67.00	67.00	67.27	62.80	DMH-3	68.85	62.21	62.48	62.60	20	0.010	0.240	4.16	1.45	1.21
P7	24	DMH-5	69.04	61.18	61.34	59.48	DMH-6	68.33	60.61	60.77	58.61	173	0.005	0.003	3.18	9.98	16.08
P8	24	DMH-6	68.33	60.61	60.77	58.58	DMH-7	67.50	59.41	59.57	57.73	170	0.005	0.007	3.18	9.98	16.03
P9	24	DMH-7	67.50	59.41	59.57	57.71	DMH-8	66.60	61.15	61.31	56.86	170	0.005	-0.010	3.18	9.98	16.03
P10	24	DMH-8	66.60	61.15	61.78	56.84	DMH-9A	65.74	59.42	60.05	55.66	236	0.005	0.007	6.35	19.94	16.03
P11	18	B1M2				62.17	ICS-9	66.76			62.15	4	0.005			10.59	7.44
P12	18	ICS-9	66.76	65.00	65.49	61.70	DMH-8	66.60	61.15	61.64	61.00	14	0.050	0.275	5.59	9.88	23.54
P13	24	DMH-9A	65.74	59.42	60.05	55.64	DMH-10	65.54	58.37	59.00	54.61	206	0.005	0.005	6.35	19.94	16.03
P14	24	DMH-10	65.54	58.37	59.00	54.59	DMH-11	65.56	56.18	56.81	53.56	206	0.005	0.011	6.35	19.94	16.03
P15	18	B1M3				60.97	ICS-12	65.42			60.95	4	0.005			10.59	7.44
P16	18	ICS-12	65.42	63.78	64.27	60.70	DMH-11	65.56	56.18	56.67	60.66	4	0.010	1.900	5.62	9.92	10.53
P17	30	DMH-11	65.56	56.18	56.49	53.54	DMH-13	65.80	55.74	56.05	53.12	84	0.005	0.005	4.49	22.03	29.07
P18	30	DMH-13	65.80	55.74	56.05	53.10	DMH-14	65.80	54.99	55.30	52.09	201	0.005	0.004	4.49	22.03	29.14
P19	30	DMH-14	65.80	54.99	55.31	52.07	DMH-15	64.33	54.62	54.94	51.95	23	0.005	0.016	4.54	22.26	29.69
P20	30	DMH-15	64.33	54.62	54.94	51.95	DMH-17	63.00	54.25	54.57	51.50	90	0.005	0.004	4.54	22.26	29.07
P20A	8	CB-9	65.00	63.73	63.73	60.70	DMH-17	63.00	54.25	54.25	60.52	18	0.010	0.527	0.34	0.12	1.21
P21	30	DMH-17	63.00	54.25	54.57	51.48	DMH-20	61.50	54.11	54.43	51.30	35	0.005	0.004	4.54	22.27	29.48
P22	30	DMH-20	61.50	54.17	54.52	51.28	DMH-21	58.55	54.45	54.80	50.78	100	0.005	-0.003	4.78	23.45	29.07
P23	15	DMH-22	59.50	53.66	54.00	51.50	DMH-21	58.55	54.45	54.79	51.03	93	0.005	-0.008	4.68	5.74	4.60
P24	12	DMH-59	59.75	61.29	61.96	54.30	DMH-22	59.50	53.66	54.33	52.83	294	0.005	0.026	6.59	5.17	2.52
P25	12	DMH-23	59.50	59.20	59.80	55.19	DMH-59	59.75	61.29	61.89	54.50	138	0.005	-0.015	6.19	4.86	2.52
P26	12	B5				57.89	ICS-18	62.00			57.82	13	0.005			10.59	2.62
P27	12	ICS-18	62.00	60.46	60.49	57.80	DMH-19	61.50	55.17	55.20	56.96	84	0.010	0.063	1.43	1.12	3.57
P28	12	DMH-19	59.50	55.17	55.21	54.48	DMH-20	61.50	54.11	54.15	53.89	59	0.010	0.018	1.63	1.28	3.57
P29	8	CB-10	57.60	57.74	57.89	53.50	DMH-21	58.55	54.45	54.60	52.93	57	0.010	0.058	3.15	1.10	1.21
P30	12	DMH-24	61.30	59.39	59.99	56.10	DMH-23	59.50	59.20	59.80	55.92	72	0.003	0.003	6.19	4.86	1.79
P31	6	CB-43	60.25			56.23	P30				56.13	21	0.005			0.05	0.39
P32	8	B4				57.75	DMH-24	61.30			57.69	12	0.005			10.59	0.86
P33	6	CB-15	61.90	56.69	56.80	56.23	DMH-24	61.30	59.39	59.50	56.12	21	0.005	-0.129	2.70	0.53	0.41
P34	8	DMH-24A	63.30	60.10	60.43	58.00	DMH-24	61.30	59.39	59.72	57.10	95	0.009	0.007	4.64	1.62	1.18
P35	8	CB-15A	62.50	61.95	61.96	58.20	DMH-24A	63.30	60.10	60.11	58.10	21	0.005	0.088	0.80	0.28	0.84
P36	12	DMH-33	59.50	54.33	54.33	54.00	DMH-34	59.50	53.05	53.05	52.01	201	0.010	0.006	0.45	0.35	3.55
P37	8	CB-23	57.90			54.00	P36				53.95	11	0.005			0.01	0.82
P38	8	CB-24	57.40			54.00	P36				53.95	11	0.005			0.03	0.82
P38A	15	B3				55.43	DMH-34	59.50			54.77	33	0.020			10.59	9.16
P39	12	DMH-34	59.50	54.01	54.35	51.99	DMH-35	58.50	52.78	53.12	51.60	39	0.010	0.032	4.69	3.68	3.57
P40	12	DMH-32	58.50	52.72	52.81	51.73	DMH-35	58.50	52.78	52.87	51.57	36	0.004	-0.002	2.34	1.84	2.38
P41	8	CB-20	59.00	57.67	57.69	53.95	DMH-32	58.50	52.72	52.74	53.76	19	0.010	0.261	1.26	0.44	1.21
P42	12	DMH-27	63.00	53.76	53.81	53.03	DMH-32	58.50	52.72	52.77	51.75	256	0.005	0.004	1.78	1.40	2.52
P43	12	DMH-25	67.00	60.19	60.19	60.00	DMH-27	63.00	53.76	53.76	55.00	98	0.051	0.066	0.15	0.12	8.07
P44	8	CB-17	68.00	66.32	66.32	62.55	DMH-25	67.00	60.19	60.19	62.26	27	0.011	0.227	0.34	0.12	1.26
P45	12	DMH-31	63.50	55.08	55.13	54.35	DMH-27	63.00	53.76	53.81	53.05	259	0.005	0.005	1.77	1.39	2.53
P46	12	DMH-30	63.50	55.94	55.96	55.40	DMH-31	63.50	55.08	55.10	54.37	206	0.005	0.004	1.06	0.83	2.52
P47	8	DMH-29	63.50	58.58	58.67	57.85	DMH-30	63.50	55.94	56.03	57.39	46	0.010	0.057	2.38	0.83	1.21
P48	8	ICS-28	63.95	60.62	60.65	58.00	DMH-29	63.50	58.58	58.61	57.90	10	0.010	0.204	1.40	0.49	1.21
P49	8	B6				59.20	ICS-28	63.95			58.85	71	0.005			10.59	0.85
P50	8	CB-19	62.00	62.18	62.20	58.05	DMH-26	63.00	58.51	58.53	57.78	27	0.010	0.136	1.23	0.43	1.21
P51	8	CB-18	62.00	62.09	62.14	58.05	DMH-26	63.00	58.51	58.56	57.82	23	0.010	0.156	1.81	0.63	1.21
P52	12	DMH-26	63.00	58.51	58.54	57.75	DMH-31	63.50	55.00	55.03	57.61	28	0.005	0.125	1.40	1.10	2.52
P53	18	DMH-35	58.50	52.78	52.89	51.55	DMH-36	53.80	51.38	51.49	50.17	276	0.005	0.005	2.61	4.61	7.44
P54	12	CB-25	55.75	55.84	55.85	51.95	DMH-36	53.80	51.38	51.39	51.81	14	0.010	0.319	0.80	0.63	3.57
P55	18	DMH-36	53.80	51.21	51.32	50.15	DMH-40	57.00	51.22	51.33	49.35	159	0.005	0.000	2.61	4.61	7.47
P56	18	B2M4				53.16	ICS-37	57.00			52.50	33	0.020			10.59	14.89
P57	8	CB-26	56.00	55.11	55.11	51.70	DMH-39	56.50	52.36	52.36	51.53	17	0.010	0.162	0.09	0.03	1.21
P58	18	ICS-37	57.00	55.58	56.14	52.50	DMH-38	56.50	53.74	54.30	52.00	51	0.010	0.036	6.00	10.59	10.42
P59	18	DMH-38	56.50	53.74	53.97	51.98	DMH-39	56.50	52.36	52.59	50.92	106	0.010	0.013	3.83	6.77	10.53
P60	18	DMH-39	56.50	52.36	52.59	50.90	DMH-40	57.00	50.93	51.16	50.32	58	0.010	0.025	3.83	6.77	10.53
P61	24	DMH-40	57.00	51.22	51.42	49.33	DMH-43	56.50	51.03	51.23	47.63	340	0.005	0.001	3.61	11.35	16.03
P62	24	DMH-43	56.50	51.03	51.57	47.61	DMH-44	56.00	48.72	49.26	46.64	193	0.005	0.012	5.92	18.60	16.07
P63	18	B2M5				54.20	ICS-42	57.00			53.50	35	0.020			10.59	14.89
P64	18	ICS-42	57.00	55.92	56.48	52.20	DMH-43	56.50	49.84	50.40	51.88	16	0.020	0.380	6.00	10.59	14.89
P66	8	CB-27	55.00	54.61	54.61	51.00	DMH-44	56.00	48.96	48.96	50.95	5	0.010	1.130	0.11	0.04	1.21
P67	30	DMH-44	56.00	48.96	49.18	46.62	DMH-45	56.00	49.77	49.99	46.21	82	0.005	-0.010	3.79	18.60	29.07
P68	30	DMH-45	56.00	49.77	50.32	46.19	DMH-47	55.50	47.58	48.13	44.61	316	0.005	0.007	5.93	29.10	29.07
P69	18	B2M6				48.50	ICS-46	55.50			47.50	30	0.033			10.59	19.22
P70	18	ICS-46	55.50	49.82	50.38	46.20	DMH-47	55.50	46.62	47.18	46.00	22	0.009	0.145	6.00	10.59	10.04
P71	30	DMH-47	55.50	47.58	48.13	44.00	DMH-48	50.50	46.78	47.33	42.96	104	0.010	0.008	5.93	29.10	41.11
P72	30	DMH-48	50.50	46.78	47.39	42.94	DMH-49	50.50	45.23	45.84	42.35	117	0.005	0.013	6.29	30.85	29.19
P73	8	CB-28	50.00	48.27	48.27	44.70	DMH-49	50.50	45.35	45.35	44.53	17	0.010	0.172	0.26	0.09	1.21
P74	36	DMH-49	50.50	45.34	45.64	42.33	DMH-52	50.00	45.41	45.71	42.26	14	0.005	-0.005	4.37	30.86	47.27
P75	30	DMH-51	55.50	47.79	48.34	44.09	DMH-52	50.00	45.41	45.96	43.00	38	0.029	0.063	5.95	29.18	69.62
P76	30	DMH-50	56.00	48.44	48.99	44.75	DMH-51	55.50	47.79	48.34	44.11	64	0.010	0.010	5.95	29.18	41.11
P77	8	CB-29	56.00	54.73	54.73	51.00	DMH-50	56.00	48.44	48.44	50.48	26	0.020	0.242	0.37	0.13	1.71
P78	30	DMH-21	58.55	54.45	55.00	50.76	DMH-50	56.00	48.44	48.99	46.00	281	0.017	0.021	5.94	29.16	53.50
P79	42	DMH-52	50.00	45.41	46.00	41.00	DMH-60	44.00	39.91	40.50	36.00	258	0.019	0.021	6.17	59.31	140.37
P80	42	DMH-60	44.00	39.91	40.50	35.50	DMH-53	41.50	36.49	37.08	33.50	114	0.018	0.030	6.17	59.31	133.55
P81	8	CB-32	42.00	40.68	40.72	36.80	DMH-53	41.50	37.41	37.45	36.00	40	0.020	0.082	1.52	0.53	1.71
P82	42	DMH-53	41.50	37.41	38.00	33.00	DMH-54	38.50	30.50	31.09	30.50	120	0.021	0.058	6.17	59.33	145.53
P83	12	CB-30	53.00			48.00	DMH-57	50.00			45.80	87	0.025			1.56	5.68
P84	12	DMH-58	50.00			44.40	CB-31	46.00			41.50	114	0.025			45.80	5.69
P85	12	CB-31	46.00			41.50	GSF 24			0.00	41.50	78	0.000			1.56	0.00
P87	8	CB-34	38.29	34.89	34.89	34.50	DMH-54	38.50	31.43	31.43	34.34	8	0.020	0.433	0.54	0.19	1.71
P88	42	DMH-54	38.50	31.43	32.02	27.00	DMH-55	30.00	23.43	24.02	22.00	152	0.033	0.053	6.19	59.50	182.87
P89	42	DMH-55	30.00	23.43	24.02	19.00	DMH-56	30.00	16.93	17.52	15.50	115	0.030	0.057	6.19	59.50	175.90
P90	42	DMH-56	30.00	16.93	17.52	12.50	CLARIFIER			0.59	11.00	42	0.036	0.403	6.19	59.50	190.55
P91	12	B8				30.01	R-Tanks	50.00			29.88	13	0.010			10.59	3.57
P92	18	R-TANKS / DMH-58	50.00			29.28	OUTLET	31.78			29.00	25	0.011			45.80	11.14
P93	12	DMH-16	64.00	60.54	60.54	60.50	DMH-17	59.50	54.25	54.25	58.00	215	0.012	0.029	0.01	0.01	3.85
P94	8	CB-8	64.40	60.74	60.74	60.70	DMH-16	50.00	60.54	60.54	60.54	16	0.010	0.013	0.03	0.01	1.21
P95	8	CB-6	62.95			59.00	P18				57.92	54	0.020			1.44	1.71

NOTES: Highlighted piping runs were not evaluated in HydroCAD and therefore were not compared to Manning's full flow capacity.



NOTE

OFF-SITE TOPOGRAPHY PROVIDED BY LIDAR SURVEY. CONTOURS ARE AT 2' INTERVALS.

LEGEND

- SUBCATCHMENT BOUNDARY
- 9 — SUBCATCHMENT ID
- Ⓐ — FLOW LINE BREAK POINTS
- HYDRAULIC FLOW LINE
- PT — ANALYSIS POINT

RANSOM Consulting Engineers and Scientists

WOODARD & CURRAN
41 Hutchins Drive
Portland, Maine 04102
800.426.4262 | www.woodardcurran.com
COMMITMENT & INTEGRITY DRIVE RESULTS

REV	DESCRIPTION	DATE

ISSUED FOR PERMIT - DRAFT
04-15-19
CURRENT ISSUE STATUS:

TRUE NORTH:

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144 Fore Street
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SMRT

NORDIC AQUAFARMS MULTIPHASE PROJECT

158 HIGH STREET, BELFAST, MAINE

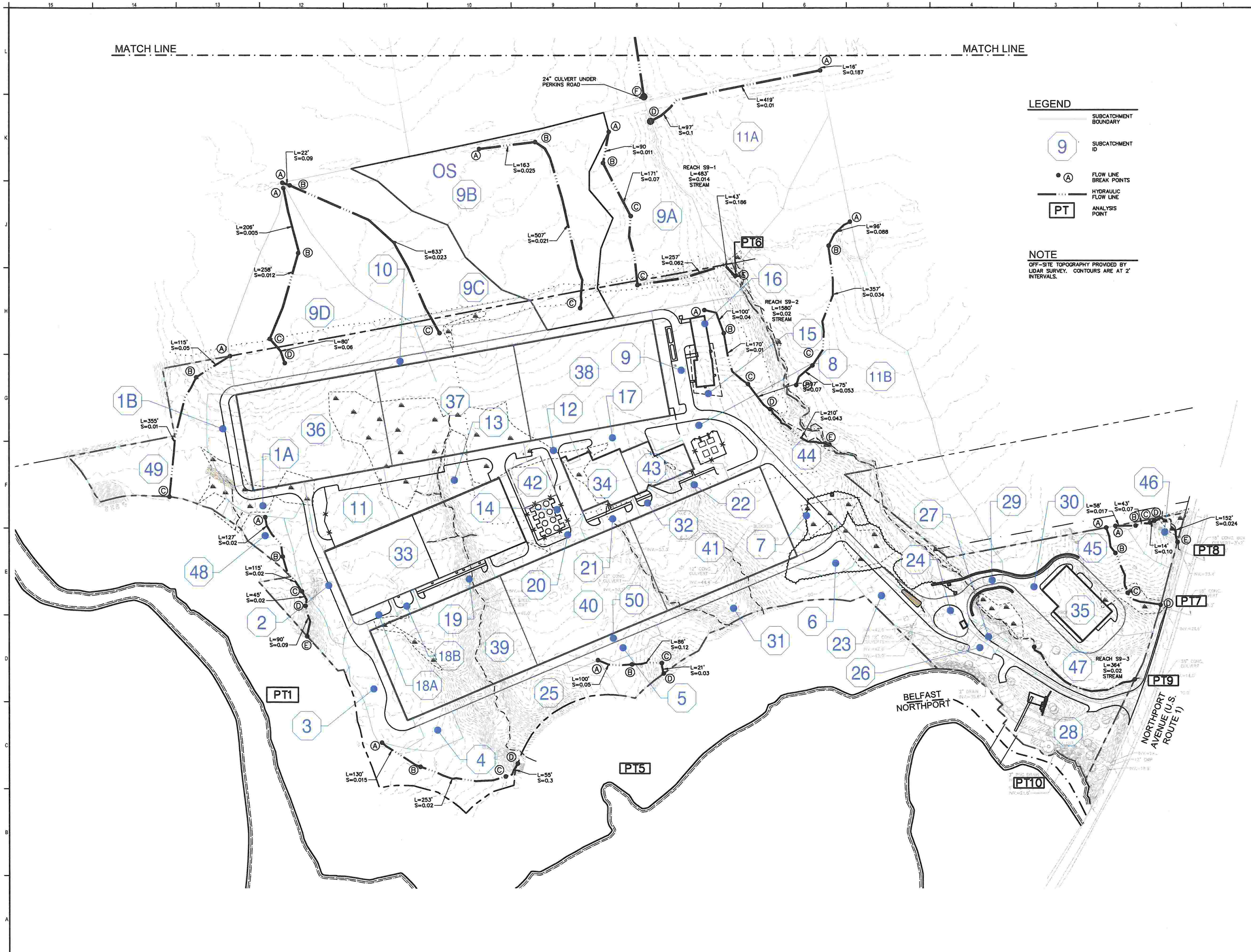
POST-DEVELOPMENT WATERSHED PLAN - OFF-SITE AREAS

0 60 120 240
SCALE in FEET
1"=120'

PROJECT MANAGER: MPM
PROJECT NO: 171.05027
DRAWN BY: JAR

CW-103

NOT FOR CONSTRUCTION



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REV	DESCRIPTION	DATE
1	PER DEP COMMENTS	7-26-19
0	ISSUED FOR PERMIT	5-14-19

ISSUED FOR PERMIT - DRAFT
04-15-19

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158 HIGH STREET, BELFAST, MAINE

POST-DEVELOPMENT
WATERSHED PLAN -
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0 60 120 240
SCALE in FEET
1"=120'

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