HYDROGEOLOGICAL STUDY
OF
FORMER NORTH YARMOUTH MEMORIAL SCHOOL PROPERTY
NORTH YARMOUTH, MAINE

Prepared for

THE TOWN OF NORTH YARMOUTH

August 2015

SME

Sevee & Maher Engineers, Inc.

ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE

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TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES

LIST OF TABLES

HYDROGEOLOGICAL STUDY OF FORMER
NORTH YARMOUTH MEMORIAL SCHOOL PROPERTY
NORTH YARMOUTH, MAINE

1.0 EXECUTIVE SUMMARY

At the request and authorization of the Town of North Yarmouth (hereafter referred to as the Town), Sevee & Maher Engineers, Inc. (SME) has prepared this report summarizing our hydrogeological investigation of the former North Yarmouth Memorial School property (Site). The purpose of the investigation was to estimate the maximum hydraulic capacity for subsurface wastewater disposal at the Site using leachfields, and to identify the optimum location(s) for leachfields that avoid adverse impacts to off-Site water quality. Our investigation focused on the outwash sand deposit at the Site since it has the hydraulic capacity most practical for disposal of relatively large volumes of domestic (i.e. non-industrial) wastewater.

Our investigation included: (1) subsurface exploration by test pits, soil borings, and groundwater monitoring wells to characterize the hydrogeology of the Site, and to measure the thickness of the sand deposit; (2) test pit observations to determine whether suitable soils exist on-Site for wastewater disposal based on the current Maine Subsurface Wastewater Disposal Rules; (3) analysis of baseline groundwater quality at the Site; (4) measurement of the hydraulic conductivity of the encountered soils; (5) measurement of groundwater levels to estimate the direction(s) of groundwater flow and depth to groundwater; and (6) a survey of existing water supply sources at downgradient abutting properties.

The data collected during the Site investigation were used to perform an analysis of the hydraulic capacity of the Site's sand deposit relative to subsurface wastewater disposal. These analyses include groundwater mounding and groundwater nitrate transport calculations. The data collected, as well as our analyses, can be used to support future wastewater disposal permitting requirements of the Maine Department of Health and Human Services (MEDHHS) and the Maine Department of Environmental Protection (MEDEP).

Our principal findings are:

(1) The hydraulic capacity for treated wastewater at the Site is calculated to be about 45,000 gallons per day.

(2) The capacity for untreated wastewater at the Site is currently estimated at about 7,000 gallons per day.

(3) In either case, additional wastewater can be disposed of at the former school property without having adverse impacts to off-Site groundwater, residential water supply wells, or the Yarmouth Water District's water supply well.

(4) Wastewater usage should be developed in phases, as needed, to minimize project costs.

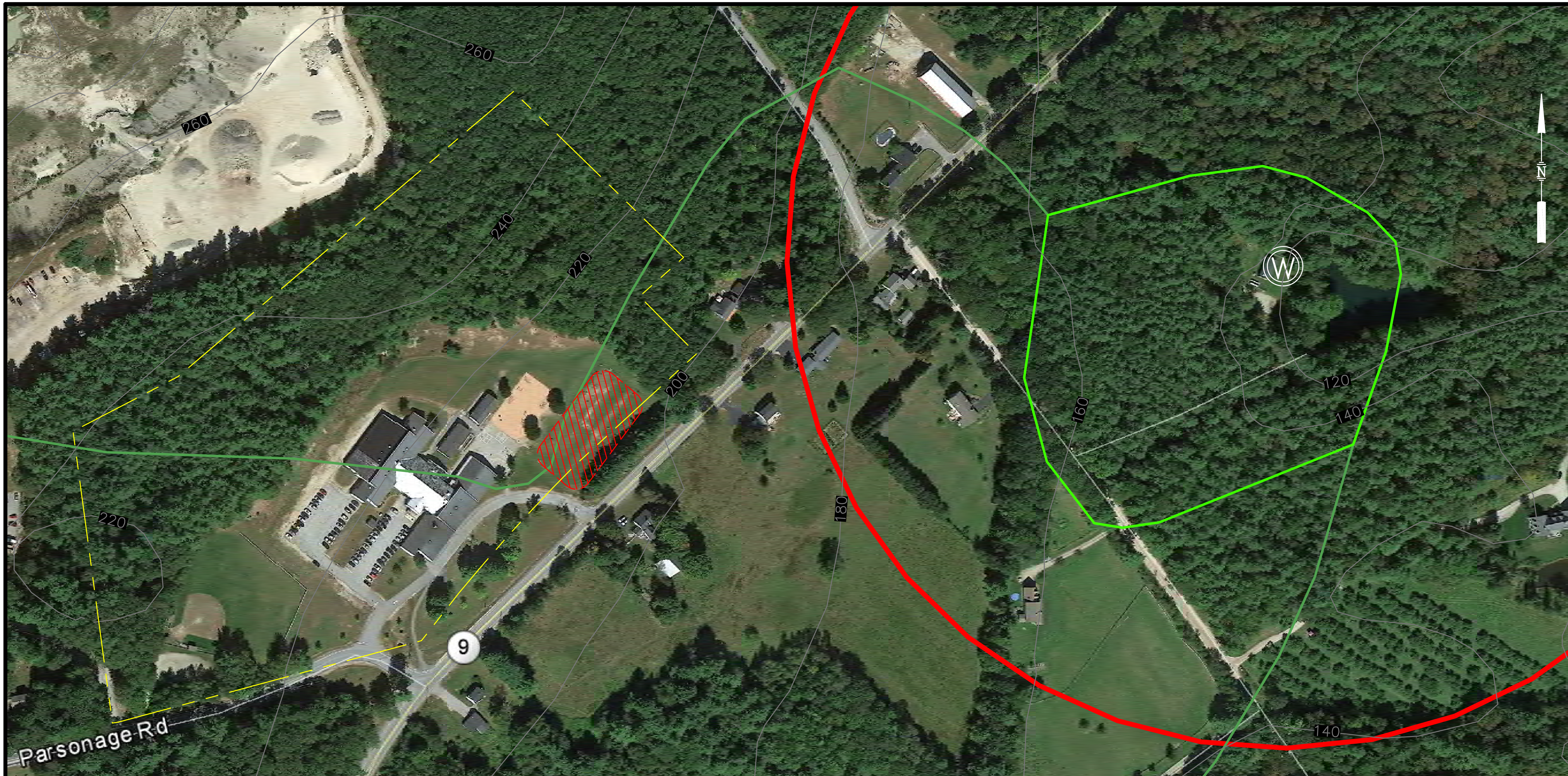
(5) Long-term maintenance of the leachfields will likely be limited based on the soils present but any field that does fail can be replaced within the same footprint.

This report documents our investigation and findings, and concludes with our recommendations.

1.1 Site Setting

The former North Yarmouth Memorial School is located at 120 Memorial Highway (Route 9) in North Yarmouth, Maine. The Site location is illustrated on Figure 1. The school closed in 2014. The school property is reportedly approximately 20 acres in size. It is surrounded by residential lots on three sides and by gravel pit operations to the north. Some of the abutting residences are supplied with public water and others obtain their potable water from drilled or dug wells.

The Yarmouth Water District owns and operates a public drinking water supply well, located approximately 1,200 feet east of the closest Site property boundary. The well is referred to herein as 'Hayes Well, 1954.' The well location is shown on Figure 1, along with a 1,000-foot buffer boundary surrounding the well and the estimated 200-day and 2,500-day groundwater time-of-travel boundaries for the well. While the 'Hayes Well, 1954' is located in an area mapped by the Maine Geological Survey as having silt and clay surficial deposits, the well is understood to pump from underlying sand and gravel deposits.



NOTES

TAX MAP PROPERTY LINES ARE OFFSET FROM AERIAL PHOTOGRAPHY. ACTUAL SCHOOL PROPERTY LINE IS BELIEVED TO BE DOWN SLOPE FROM EXISTING DISPOSAL FIELDS. THE OFFSET MAY ALSO IMPACT THE POTENTIAL SUITABLE DISPOSAL FIELD AREAS.

LEGEND (MAINE DRINKING WATER PROGRAM GIS DATABASE)

- PUBLIC DRINKING WATER SUPPLY 1000 FOOT BUFFER
- MODEL-BASED SOURCE WATER PROTECTION AREA (200 DAY TRAVEL TIME)
- MODEL-BASED SOURCE WATER PROTECTION AREA (2500 DAY TRAVEL TIME)

LEGEND

- (W) HAYES WELL 53, YARMOUTH WATER DISTRICT
- APPROXIMATE EXISTING DISPOSAL FIELD AREA
- MAINE TAX PARCELS (ME GIS DATA CATALOG)

100 0 200 FEET

FIGURE 1
SITE PLAN
FORMER NORTH YARMOUTH MEMORIAL SCHOOL
HYDROGEOLOGICAL STUDY
TOWN OF NORTH YARMOUTH

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DWG: BASE-GIS LMN: SITE PLAN CTB: SME-STD REV: 8/13/2015

An existing disposal field area is located east of the school building at the location shown in Figure 1. The leachfield consists of four 30-foot by 100-foot beds. In April 2014, Sweet Associates of Falmouth, Maine inspected the leachfield and found it to be viable for continued wastewater disposal, although several maintenance issues were identified.[1] Their inspection was done while the system was still in use by the school. Testing of the wastewater influent from a septic tank showed a total nitrogen concentration of about 110 mg N/L based on the total Kjeldahl nitrogen analysis. They also estimated an average wastewater influent flow of about 2,000 gallons per day at the time of their inspection. Although designed in 1976 with an original capacity of 12,000 gallons per day, based on the current Maine Subsurface Wastewater Disposal Rules, we currently calculate its disposal capacity for wastewater as 4,848 gallons per day.

1.2 Geologic Setting

Maine Geological Survey (MGS) mapping indicates that the Site is situated over a glacial outwash sand and gravel deposit.[2] This deposit is regionally extensive and almost completely surrounds the school. To the south and east, as the land surface drops in elevation, the sand and gravel deposit becomes overlain by clays of the Presumpscot Formation. The sand and gravel outwash deposit has been mapped by MGS as a significant sand and gravel aquifer.[3]

The MGS mapping is consistent with Soil Conservation Service (SCS) mapping of the surficial soils. SCS classifies the Site soils as Hinckley glacial outwash sands.[4] This soil is characterized as excessively drained sands with a deep water table.

Bedrock is exposed on the higher hills in the vicinity of the school indicating an absence of the sand and gravel deposit at these higher topographic elevations. Bedrock underlies the sand and gravel outwash deposit. The bedrock has been mapped by MGS as the Hutchins Corner

[1] Sweet Associates, 2014. Letter dated June 2, 2014 concerning Septic System Inspection, North Yarmouth Memorial School.
[2] Retelle, M.J., 1999. Surficial Geology of the Yarmouth Quadrangle, Maine; Maine Geological Survey; Open-File No. 99-105.
[3] Neil, C.D., 1999. Significant Sand and Gravel Aquifers, Yarmouth Quadrangle, Maine; Maine Geological Survey; Open-File No. 99-28.
[4] Hedstrum, G., 1974. Soil Survey Cumberland County Maine, Soil Conservation Service, USDA.

Formation consisting of metamorphosed sandstone and muds, properly referred to as quartz-biotite-feldspar granofels.[5] Tolman, 2010 documents a significant number of high-yield bedrock wells in the vicinity of the Site.[6] This suggests the bedrock is fractured and the fractures allow movement of groundwater.

With the above information in mind, we performed a reconnaissance of the Site and surrounding vicinity. The purposes of the reconnaissance was two-fold: (1) map geologic features as a check against the MGS and SCS mapping information; and (2), map hydrogeologic boundaries such as streams for use in our hydraulic capacity calculations. Exposures of sands were apparent along Toddy Brook and its tributaries, where the streams had eroded into the natural soils. Seeps and springs were observed along the stream bed indicating groundwater discharge. This observation is consistent with Toddy Brook and its tributaries acting as hydrologic boundaries for groundwater migration. Along Sweetser Road, erosion exposed a limited clay deposit overlying the sandy outwash, consistent with the MGS mapping. An ice contact feature, likely a moraine, was observed along Sweetser Road between the Site and Toddy Brook. Bedrock was observed at the higher ground surface elevations along the Oak Hill Road. Glacial till was also exposed along the Oak Hill Road. This is consistent with regional mapping which suggests the higher hill tops are not covered with sand and gravel outwash but have exposures of rock and till. This is also consistent with bedrock outcrop outside the northeast corner of the former school property (see Section 2.2). Glacial till was also observed at the ground surface near the northeast corner of the school property. North of the school Site, gravel pit operations have exposed 70 to 80 feet of the sand and gravel outwash. The water table is exposed in the deeper portion of the pit and has a surface elevation of about 180 feet-NAVD88. The gravel pit exposures are useful for examining the textural characteristics and variability of the outwash deposit. Thus, our reconnaissance confirmed the regional geologic mapping, is consistent with our Site findings as discussed below, and provided useful information on the regional behavior and fate of groundwater.

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[5] Berry IV, H.N. and A.M. Hussey II, 1998, Bedrock Geology of the Portland 1:100,000 Quadrangle, Maine and New Hampshire; Maine Geological Survey; Open-File No. 98-1.

[6] Tolman, S.S., 2010. Bedrock Well Yield, Portland 30- X 60-Minute Quadrangle, Maine Geological Survey; Open-File No. 10-66.

2.0 SUBSURFACE INVESTIGATION

2.1 Summary of Drilling Program

Subsurface geology was investigated using Standard Penetration Test (SPT) soil borings. The borings allowed soils samples to be collected and the installation of groundwater monitoring wells. The borings were completed by New England Boring Contractors of Hampden, Maine between July 13, 2015 and July 23, 2015. Six borings were completed across the school Site; their locations are illustrated on Figure 2. Borings B15-01, B15-02, and B15-03 are located along the downslope portion of the property, while B15-04, B15-05, and B15-06 are positioned along the upslope portions of the property. Monitoring wells were installed at each boring with screens below the groundwater table. The monitoring wells provide groundwater level data and access for collection of groundwater quality samples. The locations and elevations of the six monitoring wells were surveyed by SME.

The retrieved soil samples were classified by an SME geologist. Representative soils samples were selected for grain size analysis and hydraulic conductivity testing. The encountered soils consisted predominantly of stratified sands, which is consistent with the sand and gravel glacial outwash deposit mapped by the MGS. The texture of the samples ranged from very fine silty sand to gravelly medium to coarse sand. At boring B15-06, located along the southwest perimeter of the Site, silt and clay of the Presumpscot Formation was encountered between depths of 10.5 to 24 feet below the existing ground surface (feet-bgs). The clay layer terminated approximately 26 feet above the static groundwater level at this location. Silt or clay soils were not encountered at the other five borings completed within the Site.

Borings B15-01, B15-02, and B15-03 were terminated at drilling refusal, which is likely the bedrock surface. B15-04 was advanced, using a rotary-bit, about 7 feet into what appeared to be competent bedrock. The rotary-bit cuttings were visually consistent with the Hutchins Corner Formation mapped by MGS and bedrock outcrops in this area. The sand deposit at these borings lies directly atop drilling refusal. The refusal surface appears to slope downwards to the south from a high elevation of about 185 feet-NAVD88 at boring B15-04 to a low elevation

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NOTES

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RESIDENTIAL WELL LOCATIONS ARE APPROXIMATE BASED ON VISUAL OBSERVATIONS IN THE FIELD.

LEGEND

- B15-01 — BORING LOCATION
- TP15-01 — TEST PIT LOCATION
- APPROX. RESIDENTIAL WELL LOCATION
- MW-1 — APPROX. YARMOUTH WATER DISTRICT MONITORING WELL LOCATION
- APPROXIMATE EXISTING DISPOSAL FIELD AREA

75 0 150 FEET

FIGURE 2
SUBSURFACE EXPLORATION LOCATIONS
FORMER NORTH YARMOUTH MEMORIAL
SCHOOL HYDROGEOLOGICAL STUDY

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DWG: AERIAL-BASE LMN: BORING-LOC CTB: SME-STD REV: 8/19/2015

\\Nserver\cfs\NYarm\2015MemorialHydrogeoStudy\Acad\Figures\AERIAL-BASE.dwg, 8/19/2015 8:13:36 AM, pdf of about 112 feet-NAVD88 at B15-03. The direction of the refusal surface slope is also consistent with the bedrock outcrop nearest to the Site, observed during SME's reconnaissance of the area. The approximate location of this observed bedrock outcrop is shown on Figure 2. Borings B15-05 and B15-06 were terminated in the sand deposit at about Elevation 168 feet-NAVD88 and Elevation 159 feet-NAVD88, respectively. Boring and well installation logs were prepared by SME and are included in Appendix A. A summary of the individual boring and monitoring well data is included on Table 1.

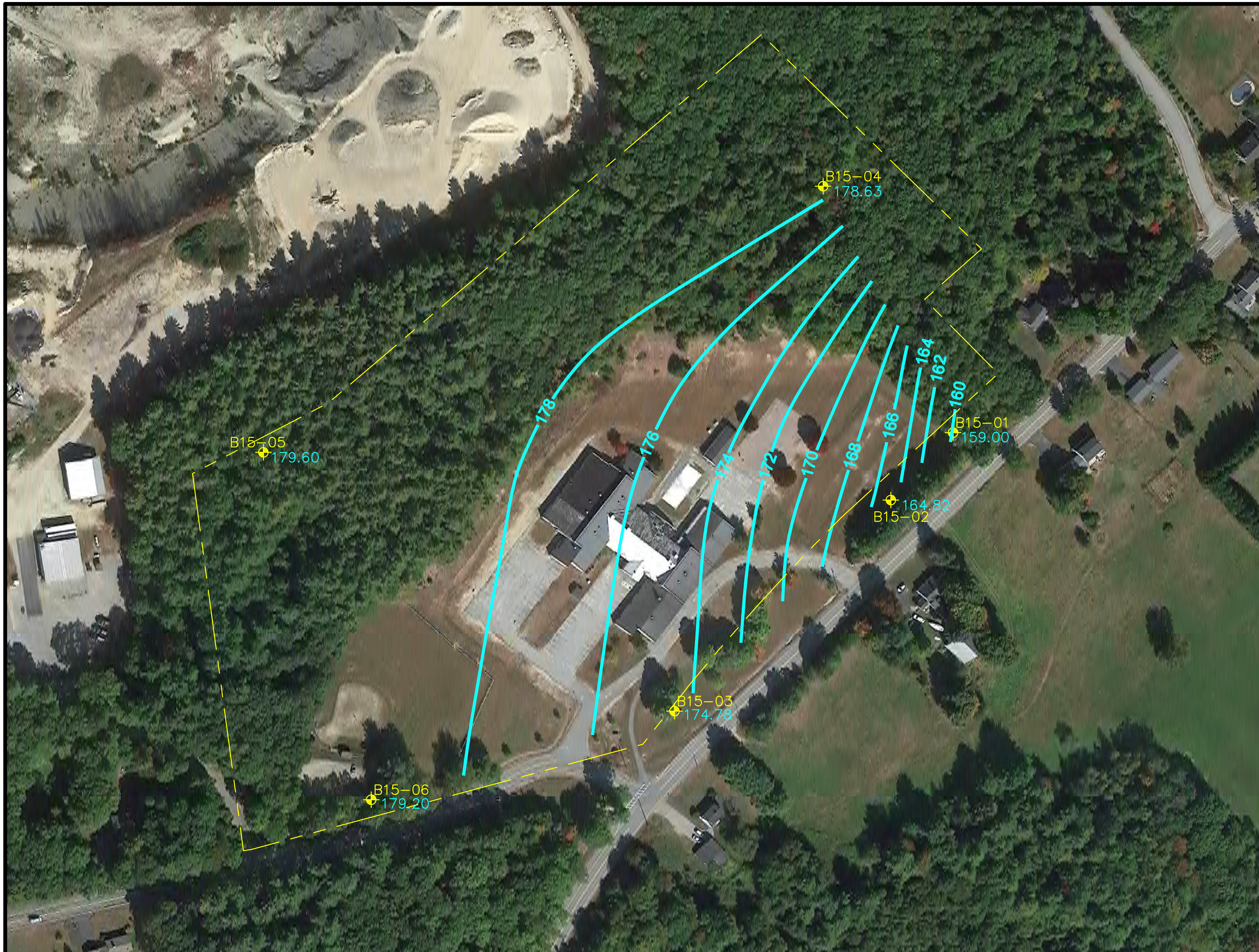
TABLE 1

SUMMARY OF BORINGS

Well Location	Depth of Boring (feet-bgs)	Depth to Refusal (feet-bgs)	Screened Interval (feet-bgs)	Ground Surface Elevation (feet-NAVD88)	Static Groundwater Depth (feet-bgs)	Top of Well Casing Elevation (feet-NAVD88)	Groundwater Elevation (feet-NAVD88)
B15-01	78.5	78.2	61.0 to 46.0	208.1	49.1	210.78	159.0
B15-02	80.5	79.5	55.5 to 40.5	209.1	44.3	212.01	164.8
B15-03	103.5	102.8	49.0 to 34.0	214.5	39.7	217.22	174.8
B15-04	60.0	48.0	60.0 to 50.0	232.7	54.1	235.35	178.6
B15-05	75.0	Not Encountered	73.0 to 58.0	242.9	63.3	245.60	179.6
B15-06	70.0	Not Encountered	70.0 to 55.0	229.3	50.1	231.95	179.2

Notes:
1. Depth to water measured July 24, 2015
2. bgs = below ground surface
3. NAVD88 = North American Vertical Datum of 1988

The depth to groundwater was measured in each of the six monitoring wells over the course of several days to confirm that the groundwater levels in the wells had reached equilibrium. These measurements are documented in Appendix B. The groundwater measurements taken on July 24, 2015 were used to interpret a groundwater table (i.e., phreatic surface) contour map for the Site, which is illustrated on Figure 3. Based on the groundwater table map, groundwater is interpreted to flow generally towards the east-southeast. The groundwater table is relatively flat along the upgradient portions of the property with an average horizontal hydraulic gradient of approximately 0.004. The horizontal hydraulic gradient at the downgradient portions of the property near Route 9 (i.e., in the vicinity of B15-01 and B15-02) is steeper and estimated at approximately 0.063. The depth to groundwater (i.e., the unsaturated thicknesses of the sand



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LEGEND

B15–04 178.63 — BORING LOCATION GROUNDWATER ELEVATION IN FEET–NAVD88 (JULY 24, 2015)

—164— INTERPRETED GROUNDWATER SURFACE CONTOUR IN FEET–NAVD88

75 0 150 FEET

FIGURE 3
INTERPRETED GROUNDWATER SURFACE
FORMER NORTH YARMOUTH MEMORIAL
SCHOOL HYDROGEOLOGICAL STUDY

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DWG: AERIAL-BASE LMN: GW-CONTOURS-JUL2015 CTB: SME-STD REV: 8/18/2015

\\Nserver\cfs\NYarm\2015MemorialHydrogeoStudy\Acad\Figures\AERIAL-BASE.dwg, 8/18/2015 9:51:21 AM, paf deposit) at the borings, based on the July 24, 2015 groundwater measurements, ranges from about 40 to 65 feet.

Our interpreted groundwater surface, as shown in Figure 3, is consistent with the water table mapping prepared by Drumlin Environmental, LLC of Portland, Maine (Drumlin) for the Yarmouth Water District.[7] Although the contours differ slightly, their pattern is the same as ours and shows groundwater flow across the school Site to the east-southeast. Thus, our findings are consistent with the more regional groundwater mapping for the village of North Yarmouth, as presented by Drumlin.

Eight SPT soil samples were selected for laboratory falling-head permeability testing. The samples selected are representative of soils encountered in the borings across the Site. At least one soil sample was selected from each boring. Grain size distributions were also analyzed for three samples and show the sand deposit to consist of coarse to medium sands. The results of the falling-head permeability testing are summarized on Table 2, and all soil laboratory testing results are included in Appendix C.

TABLE 2

SUMMARY OF LABORATORY FALLING-HEAD PERMEABILITY TESTS

Well Location		Depth Below Ground Surface (feet-bgs)	Measured Hydraulic Conductivity (feet/day)	Dry Density of Sample (pounds per cubic foot)
B15-01		50 to 52	0.4	99.4
B15-02		25 to 26.3	1.7	117.9
B15-02		50 to 52	1.9	105.5
B15-03		40 to 42	3.3	104.7
B15-04		40 to 42	5.3	95.4
B15-05		50 to 52	14.2	109.6
B15-05		60 to 62	1.0	103.7
B15-06		40 to 42	1.6	96.1

[7] Drumlin Environmental, LLC. Letter to Robert MacKinnon, Superintendent of the Yarmouth Water District, dated July 21, 2015, concerning 2015 North Yarmouth monitoring well data.

The results of the laboratory falling-head permeability testing indicate a range in hydraulic conductivities for the sand deposit from 0.4 to 14.2 feet per day. The geometric mean of the eight samples tested is calculated at 2.2 feet per day. Using the dry densities from the permeability tests, along with an assumed specific gravity for the sands of 2.67, total soil porosities ranging from 0.29 to 0.43 were calculated.

2.2 Soil Test Pit Observations

On July 16, 2015, eleven soil test pits (TP15-01 through TP15-11) were dug and the encountered soils were classified by an SME Maine Licensed Site Evaluator. The soil test pits were located in the areas where the greatest hydraulic capacity of the Site was judged to be. In addition, since groundwater moves toward Route 9, the test pits were dug away from the downgradient school property boundary to maximize the potential for untreated wastewater disposal and, simultaneously, avoid adverse impacts to off-Site groundwater quality. Thus, the tests pits were mostly in the northern, undeveloped wooded portions of the property, and in non-wooded grassy areas north of the former school building. The soil test pit locations are illustrated on Figure 2. The soil test pits confirmed that suitable soil conditions exist at the Site for wastewater disposal based on the Maine Subsurface Wastewater Disposal Rules.

The soil test pits were dug using a backhoe with total depths ranging from about 48 inches-bgs to 70 inches-bgs. The soils encountered in the eleven test pits were all classified as Profile 5 soils, which are soils with stratified glacial drift parent materials. There were no observed limiting factors (e.g., bedrock, groundwater, or restrictive layers) encountered in the pits. Based on the soil conditions observed in the test pits, the Maine Subsurface Wastewater Disposal Rules sizing factor is 2.6 square feet per gallon of wastewater per day (e.g., the minimum square feet of bottom and side wall area per gallon of wastewater per day required below the pipe invert for a standard stone-bed disposal field).

On August 14, 2015, one additional test pit (TP15-12) was hand dug in the northeast wooded corner of the Site. This test pit location was selected due to its proximity to the nearby bedrock outcrop observed by SME. The test pit was classified as a Profile 3C soil, which are soils with glacial basal till parent materials. The upper portion of the test pit consisted of a very stony loamy sand, with a mix of rounded and platy rock fragments. This stony soil overlaid a cemented, very fine sand, restrictive layer at about 34 inches-bgs. While the soils in the vicinity of TP15-12 meet the requirements for subsurface wastewater disposal, the northeast corner of the Site was excluded from SME's hydraulic capacity calculations due its restrictions in comparison to the deeper unsaturated outwash sand deposit at the rest of the Site.

Test pit logs are included in Appendix D.

2.3 Water Quality

Three of the monitoring wells, B15-01, B15-02, and B15-05, were sampled to establish baseline groundwater nitrate levels at the Site. Monitoring wells B15-01 and B15-02 are located hydraulically downgradient from the existing stone-bed disposal fields at the Site, which are assumed to have received limited use since the North Yarmouth Memorial School was closed in July 2014. Monitoring wells B15-01 and B15-02 were sampled on August 3, 2015 and July 17, 2015, respectively. Monitoring well B15-05 is located hydraulically upgradient at the Site and was sampled on July 23, 2015. The groundwater samples were collected from the selected monitoring wells using a submersible pump. Specific conductance, pH, dissolved oxygen, turbidity, and temperature were measured in a flow-through cell at the time of sample collection. Once these parameters stabilized, groundwater samples were collected for nitrate analysis. After collection, the water samples were delivered to Maine Environmental Laboratory in Yarmouth, Maine under Chain-of-Custody protocols. The laboratory analytical data and field sheets from the groundwater sampling at B15-01, B15-02, and B15-05 are included in Appendix E.

The nitrate results for the samples collected from B15-01, B15-02, and B15-05 were 0.8 mg N/L, 0.9 mg N/L, and 1.2 mg N/L, respectively. The results of the sampling by SME are considered representative of background groundwater nitrate concentrations for the school Site.

The results of our groundwater nitrate testing are consistent with previously reported groundwater nitrate testing by Drumlin for three monitoring wells located proximate to the Site. One of the monitoring wells, MW-1, is located hydraulically downgradient from (and proximate to) the former school's existing disposal field area. Drumlin's historical nitrate data for MW-1 ranges from below detection (i.e. less than 0.1 mg N/L) to 1.0 mg N/L. The other two wells, MW-11 and MW-12, are located hydraulically upgradient from the Site. MW-11 has a historical nitrate concentration range of 0.5 mg N/L to 0.8 mg N/L. MW-12 has a historical nitrate concentration range of 0.6 mg N/L to 0.7 mg N/L.[8] The locations of these wells are shown on Figure 2.

[8] Letter report from Drumlin Environmental, LLC to Yarmouth Water District dated July 21, 2015, Subject: North Yarmouth Monitoring Wells – 2015 Data.

3.0 WATER SUPPLY SURVEY FOR DOWNGRADIENT ABUTTING PROPERTIES

The former North Yarmouth Memorial School receives its water supply from the Yarmouth Water District water main located along Route 9. SME performed a door-to-door survey on July 24, 2015 at abutting, hydraulically-downgradient properties to determine whether those properties were connected to the Yarmouth Water District's public water supply, or obtained their water from private wells. Six properties were included in the survey identified by SME as potentially hydraulically downgradient from the Site. Their locations and the results of the survey are summarized on Table 3.

TABLE 3

SUMMARY OF WATER SUPPLY SURVEY FOR DOWNGRADIENT ABUTTING PROPERTIES

Property Location	Owner's Name	Water Supply Type	Water Usage	Well Depth	Type of Well	Known Water Quality Problems
99 Memorial Highway	Gertrude Sappington	Yarmouth Water District [1]	Normal Residential	Unknown [1]	Dug Well	Not Applicable
119 Memorial Highway	Peter Wiles	Yarmouth Water District	Normal Residential	No Well	No Well	No Well
133 Memorial Highway	Martha McConnell	Private Well	Normal Residential	Unknown	Unknown [2]	Sediment
139 Memorial Highway	Gertrude Sappington	Private Well	Normal Residential	Approximately 120 feet	Bedrock	No Known Problems
147 Memorial Highway	Diana Theriault	Private Well	Normal Residential	Unknown	Unknown [2]	Iron and Sediment
140 Memorial Highway	Jason Mills [3]	Private Well	Normal Residential	Unknown	Unknown [2]	Sulfur [4]

Notes:
1. Dug well on property still connected to home for irrigation purposes.
2. Wells at 133, 140, and 147 Memorial Highway are likely bedrock wells based on well casings and covers.
3. SME spoke with Tiffany Mills during survey.
4. Current resident does not drink well water due to known water quality issues.

Residential well locations were shown to SME by the residents that participated in the survey at 133, 139, 140, and 147 Memorial Highway. Their approximate well locations are shown on Figure 2. These locations were approximated visually; they were not surveyed. It should be noted that the McConnell well, and possibly the Mills well, appear to be located within 300 feet of the existing disposal field area at the Site, which is less than the current required setback established by the Maine Subsurface Wastewater Disposal Rules for a leachfield of its rated capacity. The Yarmouth Water District's 'Hayes Well, 1954' is about 1,200 feet downgradient of the school property (see Figure 1).

4.0 EFFLUENT MOUNDING AND TRANSPORT ANALYSES

The principle purpose of our hydrogeologic investigation was to evaluate how and where to maximize the subsurface wastewater disposal capacity of the former school property. The collected Site-specific data, as described above, has allowed us to calculate the capacity consistent with Maine regulations for wastewater disposal and water quality protection, and to determine how that capacity can be maximized. Three features largely control the hydraulic capacity for subsurface wastewater disposal: (1) the Maine Subsurface Wastewater Disposal Rules; (2) the extent of hydraulic mounding; and (3) protection of off-Site water quality. Details on these features are discussed below:

(1) The Maine Subsurface Wastewater Disposal Rules control the rate of wastewater application based on soil types. The more permeable the soil (e.g., well drained sands), the greater the allowable application rate. Therefore, it is important to characterized the surficial soils so that an application rate can be selected based on these Rules. This is why the test pits were excavated and logged by a Maine Licensed Site Evaluator during our investigation.

(2) Hydraulic mounding refers to the rise in the water table beneath the leachfields where the wastewater is being applied. The water table rises in response to the need to move the applied wastewater laterally away from the leachfields. The amount of hydraulic mounding allowed is determined by the depth to the groundwater table or, in other words, the thickness of the unsaturated zone above the water table. The greater the unsaturated thickness, the greater the allowable mounding and, therefore, the greater the wastewater application rate (other things being equal). The amount of hydraulic mounding is a function of the soil or bedrock permeability, the distance to groundwater discharge locations, water table configuration, and the rate of wastewater application. Needed data on the unsaturated soil thickness and permeability, the water table, and groundwater boundaries were the object of our borings, permeability testing, and groundwater mapping.

(3) In the case of treated wastewater, the Sites hydraulic capacity is defined by items (1) and (2) above. The degree of treatment must be such that the treated effluent does not adversely impact off-Site groundwater quality and cause the groundwater to become non-potable or unusable. If the wastewater is not treated, at some point, the subsurface soils are no longer capable of filtering and treating the wastewater effluent from the leachfields. The more effluent applied, typically, the greater the travel distance required for the effluent plume to become filtered to below water quality standards (e.g. drinking water standards). On a limited size property, such as the approximately 20-acre former school property, the distances required for large wastewater application rates can extend well beyond the property boundaries. Thus, to maximize the disposal capacity for untreated wastewater, the wastewater disposal travel distance within the Site should be maximized. Also, the application rate may have to be controlled or limited if the desire is to apply untreated wastewater.

This section summarizes our estimates of the Site's hydraulic capacities for treated and untreated wastewater application via subsurface leachfields. We began our analyses by determining the allowable application rate based on the Maine Subsurface Wastewater Disposal Rules and the encountered soil type. The Site essentially consists of Profile 5 soils with an allowable design application rate of 2.6 square feet per gallon per day. Since the depth to the groundwater table is greatest along the north side of the property, and since groundwater moves from north to east-southeast, we examined potential systems along the north side of the Site, in the vicinity of where trees currently are growing, north of the former school building. We assumed that the ballfield, existing building, roadways and parking areas, and areas immediately around the building would not be disturbed. We also avoided the area between the school and Route 9, even for the treated wastewater scenario since the unsaturated soil thickness was decreasing toward the road. The optimum locations identified to maximize wastewater disposal is shown as the cross-hatched area in Figure 4. The optimum area lies outside of the Yarmouth Water District's 1,000-foot buffer zone for its 'Hayes Well, 1954' (see Figure 1). It is important to note that the property boundaries included on Figure 4 are taken from tax maps, which typically have limited accuracy. Thus, it is possible that the actual property boundary position may slightly alter the extent or configuration of the optimum area identified in Figure 4. A survey of the Site's property boundaries prior to additional planning and design will be required. The following sections present the results of our hydraulic mounding analyses and groundwater quality assessment relating to wastewater disposal at the Site.

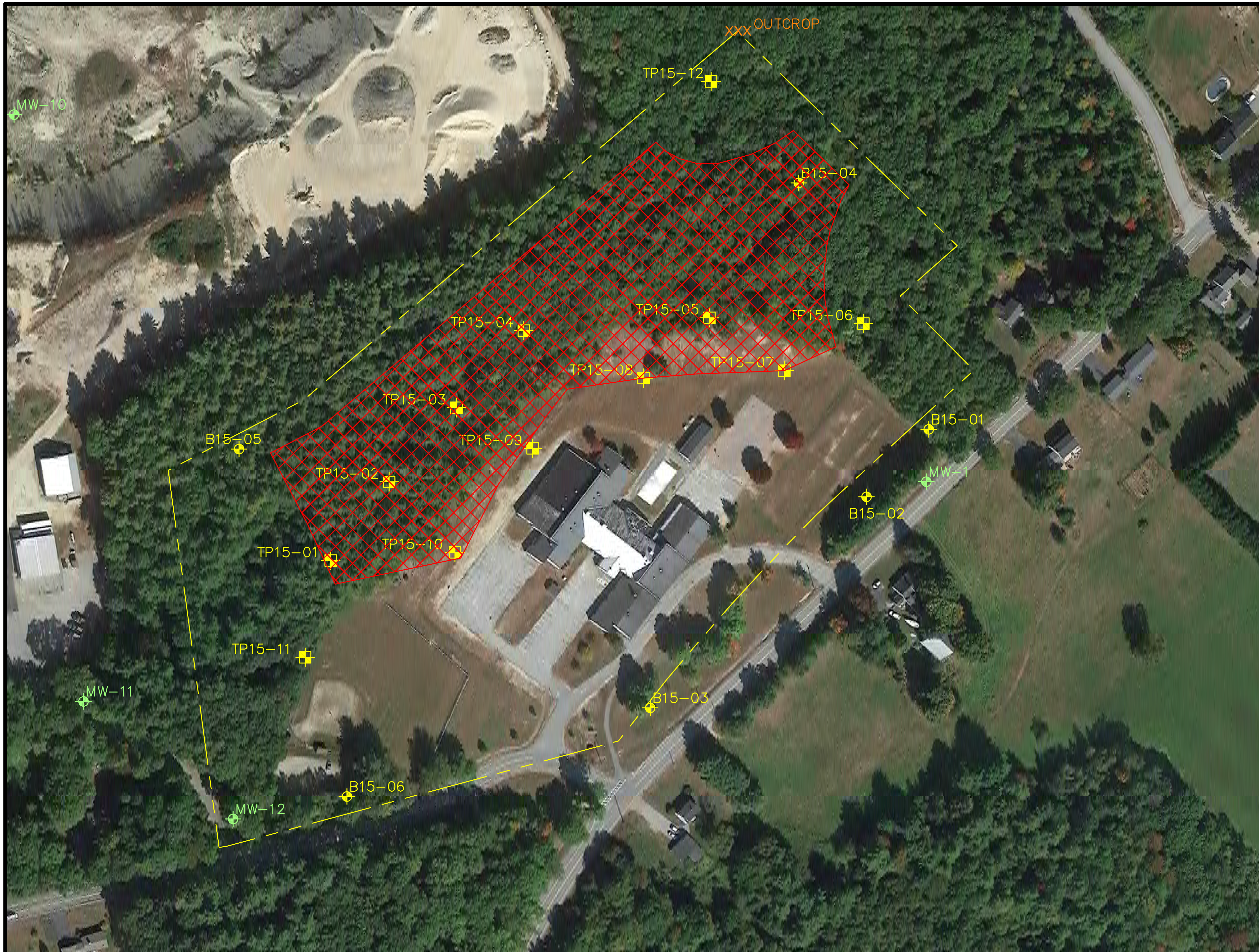
4.1 Hydraulic Mounding Analyses

Four different methods were utilized to estimate the hydraulic mounding beneath and surrounding the wastewater disposal fields. The four methods were: (1) a one-dimensional interpretation of Darcy's Law;[9] (2) flow net analysis;[10] (3) treating the leachfields as equivalent recharge wells, supplemented with image well theory:[11] and (4) Hantush's transient mounding solution. The primary input parameter for these calculations was the average soil permeability, which as noted above in Section 2.1 was measured throughout the Site. We attempted to remain conservative in our calculations and assumptions so that mounding would be overestimated. Consistency of the results using multiple methods of estimating mounding provided an assurance that the results were reasonable.

The mounding analysis was performed by first maximizing the wastewater application into leachfields until hydraulic mounding became excessive. In this case, the mounding did not reach the base of the leachfields but became excessive off-Site to the north and south. To the north, the concern was that excessive mounding could lead to seeps developing on the south wall of the sand and gravel pit. Such seepage would tend to potentially destabilize the slopes. To the south, mounding was kept well below building foundations and basements of existing residences.

Further analysis was completed by systematically decreasing the wastewater application into leachfields until the hydraulic mounding in the surrounding areas was no longer of concern. Based on this approach, a maximum capacity of about 40,000 gallons per day of wastewater could be applied to the optimum area shown in Figure 4. During detailed design of the leachfield

[9] Freeze, R.A. and J.A. Cherry, 1979. Groundwater; Prentice-Hall, Inc.
[10] deMarsily, G., 1966. Quantitative Hydrogeology; Academic Press.
[11] Hantush, M.S., 1967. Growth and Decay of Groundwater Mounds in Response to Uniform Percolation; Water Resources Research, Vol. 3.



NOTES

TAX MAP PROPERTY LINES ARE OFFSET FROM AERIAL PHOTOGRAPHY. ACTUAL SCHOOL PROPERTY LINE IS BELIEVED TO BE DOWN SLOPE FROM EXISTING DISPOSAL FIELDS. THE OFFSET MAY ALSO IMPACT THE POTENTIAL SUITABLE DISPOSAL FIELD AREAS.

LEGEND

B15-01 BORING LOCATION

TP15-01 TEST PIT LOCATION

MW-1 APPROX. YARMOUTH WATER DISTRICT MONITORING WELL LOCATION

OPTIMUM SUBSURFACE WASTEWATER DISPOSAL AREA

75 0 150 FEET

FIGURE 4
OPTIMUM SUBSURFACE WASTEWATER DISPOSAL AREA
FORMER NORTH YARMOUTH MEMORIAL SCHOOL HYDROGEOLOGICAL STUDY

SME
Sevee & Maher Engineers, Inc.
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE

DWG: AERIAL-BASE LMN: HYDRAULIC CAPACITY CTB: SME-STD REV: 8/18/2015

\\Nserver\cfs\NYarm\2015MemorialHydrogeoStudy\Acad\Figures\AERIAL-BASE.dwg, 8/18/2015 10:23:41 AM, paf locations, along with some encroachment onto the ballfield and/or lawn areas, this capacity could possibly be increased slightly, but likely by no more than ten percent.

Based on the above estimated hydraulic capacity of 40,000 gallons per day for leachfields along the northern side of the former school property, and 4,848 gallons per day for the existing leachfields that served the former school (see Section 1.1 above), the greatest groundwater mounding beneath the proposed leachfields was estimated at about 30 to 35 feet, which leaves about 20 to 30 feet of unsaturated soil thickness beneath the fields. Mounding beneath the existing leachfields was calculated at about 30 feet or slightly less, leaving about 15 feet or more of unsaturated soil beneath the existing leachfields. Off-site mounding was estimated at less than 25 feet next to the Site, decreasing at greater distances. Given the measured depth to groundwater, the estimated amount of mounding will not flood the bases of leachfields placed at or near the ground surface.

4.2 Transport Analyses

Potential groundwater quality impacts from the leachfields were estimated based on nitrate concentrations in groundwater downgradient from the proposed and existing wastewater leachfields. Nitrate is commonly selected because, based on typical residential wastewater quality, other wastewater constituents are typically low enough in concentration not to be of concern or are renovated to applicable groundwater quality standards close to the leachfield. For instance, calculation of viral and bacterial transport in the sandy soils at this Site suggests a travel distance of less than 10 feet from the leachfields.

The analyses utilized a common, and accepted, three-dimensional, steady-state solute transport equation to simulate nitrate movement with distance through the groundwater.[12] The analyses assume that the nitrate does not degrade over distance or time. This is actually not the case but there is limited scientific evidence to reliably calculate the natural, in-situ treatment of nitrate in the subsurface. The analysis does allow for dispersion of the nitrate in the groundwater,

[12] Wexler, E.J., 1992. Analytical Solutions to One-, Two-, and Three-Dimensional Solute Transport in Groundwater Systems with Uniform Flow, USGS, Series No. 03-B7.

thereby, reducing its concentration over increasing travel distances. Therefore, our approach is considered conservative when evaluating groundwater nitrate impacts.

Our analyses of groundwater impacts had two separate approaches. The first was to determine what the required wastewater influent pre-treatment requirements are, with respect to nitrate, to fully maximize the Site's hydraulic capacity of approximately 45,000 gallons per day. The second was to determine the appropriate reduction in the wastewater application rate, assuming that there is no pre-treatment of the wastewater influent that would maintain applicable water quality standards in the off-site groundwater.

Assuming no treatment (neither pre-treatment, nor natural treatment in the unsaturated sands beneath leachfields), nitrate in the wastewater effluent is expected to be about 40 mg N/L below the leachfields.[13] Our analysis shows that, based on an untreated wastewater effluent application rate of 45,000 gallons per day at the Site, nitrates are reduced to about 30 mg N/L as the effluent plume travels with the groundwater between the north side of the Site and Route 9. Therefore, wastewater treatment is required for a design flow of 45,000 gallons per day in order to meet the nitrate water quality standard of 10 mg N/L. Under this scenario, properly treated wastewater is necessary to maintain off-Site groundwater and surface water quality and protect off-site water supply wells, including the Yarmouth Water District's well. Given the results of the analysis with a wastewater application rate of 45,000 gallons per day, wastewater pre-treatment would essentially need to lower total nitrogen concentrations in the effluent to around 10 mg N/L, when considering a background groundwater nitrate concentration of 1 mg N/L.

A similar nitrate analysis of untreated wastewater suggests that the capacity of a new leachfield system along the northern edge of the school property (positioned to maximize the plume travel distance to off-site groundwater) is about 5,000 gallons per day in order to meet applicable water quality standards at the Site boundaries (e.g. Route 9). This would be accomplished by building five leachfields, each with a capacity of about 1,000 gallons per day. The five leachfields would be uniformly separated along the north edge of the school property. Nitrate-

[13] MEDEP, 1989. Hydrogeologic Assessment Guidelines for Determining Adverse Effects on Water Quality from Subsurface Wastewater Disposal Systems Under the Site Location of Development Law.

nitrogen in the groundwater at the property boundary would be 10 mg N/L and, therefore, off-site groundwater would be potable under this scenario. Hydraulic mounding is negligible in this scenario.

The calculated capacity of the Site's existing leachfields, based on nitrate concentrations, is on the order of a few hundred gallons per day under current water quality regulations. This is due to the close proximity of the leachfield to the assumed downgradient property boundary (i.e., Route 9). When this system was designed in the mid-1970s, potential nitrate impact to groundwater was not a consideration. However, it is understood that the existing subsurface wastewater disposal system was operating prior to the school closing in 2014 at about 2,000 gallons per day,[14] and that nitrate concentrations approximately 50 feet downgradient from the leachfields in the monitoring well MW-1 were never detected at more than about 1 mg N/L when sampled by Drumlin in 2007, 2009, 2012, and 2015.[15] This is much less than the water quality criterion of 10 mg N/L, and much less than the nitrate concentrations estimated at the property boundary in SME's nitrate transport analysis. It is possible that the discrepancy between the calculated nitrate concentrations and the measured nitrate concentrations in monitoring well MW-1 is due to the relatively deep separation distance between the bottom of the existing leachfields and the water table at the Site (i.e., about 50 feet or more). Since the unsaturated soils underlying the disposal fields consist of stratified sands, wastewater effluent through these layers of sand may be performing similarly to the treatment of effluent through intermittent sand filter systems, for which studies by U.S.EPA and others have indicated effective removal of total nitrogen and total Kjeldahl nitrogen.[16] Based on the known historical usage of the existing subsurface wastewater disposal system, and the known downgradient water quality (i.e., rather than calculated conditions), it seems reasonable to present to MEDEP that the existing leachfield has a capacity of 2,000 gallons per day without wastewater treatment and maintain nitrate concentrations, and other wastewater constituents, below applicable groundwater quality standards at the Site's downgradient property boundary (i.e. Route 9).

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[14] Sweet Associates, Inc. 2014. Septic System Inspection, North Yarmouth Memorial School, dated June 2, 2014; performed at the request of the North Yarmouth Selectmen.

[15] Letter report from Drumlin Environmental, LLC to Yarmouth Water District dated July 21, 2015, Subject: North Yarmouth Monitoring Wells – 2015 Data.

[16] US Environmental Protection Agency, 1999, Wastewater Technology Fact Sheet, Intermittent Sand Filters. Office of Water, Washington, D.C. EPA 932-F-99-067, September 1999.

It is also important to reiterate that the existing leachfield appears to be within 300 feet of the McConnell well across Route 9, and possibly the Mills well. Current Maine Subsurface Wastewater Disposal Rules require a 300-foot setback between water supply wells and subsurface wastewater disposal systems with capacities of 2,000 gallons per day or greater; however, this existing leachfield is likely “grandfathered” since it was built in 1976 and has been in continuous operation. The installation dates of the McConnell and Mills wells are not known by SME. Survey of the Mills and McConnell wells relative to the closest edge of the existing leachfields is required to verify the actual separation distances.

The residential well setbacks and calculated versus actual nitrate concentration below the former school’s existing leachfields will require discussions with MEDHHS and MEDEP in order to establish the system’s capacity. Monitoring of the water quality downgradient of this leachfield would likely be a part of its continued use at 2,000 gallons per day, which could be conducted at new monitoring wells B15-01 and B15-02.

Based on the nitrate transport calculations for new subsurface wastewater disposal systems along the upgradient property boundary and assuming continued use of the existing subsurface wastewater disposal system at 2,000 gallons per day (pending approval by MEDEP and MEDHHS), the Site’s total hydraulic capacity without wastewater treatment is estimated at about 7,000 gallons per day, which is significantly less that with wastewater treatment (i.e. about 45,000 gallons per day). As shown herein, untreated wastewater disposal at 7,000 gallons per day can be done without adversely impacting off-Site groundwater quality, residential water supply wells, or the Yarmouth Water District’s ’Hayes Well, 1954’. Depending on the Town’s intended use of the former school property for wastewater disposal, it is unlikely that the entire Site’s treated wastewater capacity will be needed immediately. Therefore, beginning development of the Site with untreated wastewater, at or near the 7000 gallons per day rate, along with groundwater quality monitoring, may prove to be a cost-effective way of using the Site. Such an approach would allow refining hydraulic mounding estimates and defining any natural, in situ renovation of the wastewater as it migrates to the groundwater table through the unsaturated zone and with the groundwater. Periodic groundwater monitoring of the Site during a phased development of wastewater application at the Site could potentially demonstrate that our estimated pre-treatment requirements are overly conservative. Actual monitoring data of groundwater quality could potentially result in less aggressive pre-treatment and significant cost savings for later future applications of more wastewater.

As an aside, the calculations provided above support MEDHHS's mounding and transmission analysis requirements and show that the wastewater effluent will remain below ground and not break out on the ground surface prior to renovation. The mounding analysis results show that the rise in water table beneath the leachfields will not reach within 15 feet of the base of the leachfields, which is more than adequate to prevent flooding of the bases of leachfields.

5.0 CONCLUSIONS

Based on our investigation and calculations, we have reached the following conclusions:

(1) The former school property has favorable hydrogeologic characteristics for wastewater disposal: a deep water table, a thick unsaturated zone, and permeable soils.

(2) The property's size, nearby abutting residences with wells, and the proximity of the Yarmouth Water District's 'Hayes Well, 1954' restricts the hydraulic capacity of the Site for untreated wastewater.

(3) The Site's untreated wastewater capacity is about 7,000 gallons per day based on current MEDEP and MEDHHS regulations and rules and requires future leachfields to be placed within the northern side of the Site.

(4) The Site's treated wastewater capacity is about 45,000 gallons per day but requires placement of future leachfields within the northern side of the Site. Application of wastewater at maximum capacity is estimated to require influent pre-treatment, and must consider background groundwater concentrations of applicable groundwater quality parameters.

(5) The calculated treated and untreated capacities can be met without adversely impacting off-Site groundwater quality, residential water supply wells, and the Yarmouth Water District's 'Hayes Well, 1954'.

(6) There appears to be significant natural in situ treatment or renovation of the wastewater applied through the existing leachfield based on groundwater monitoring by Drumlin. This may be due to the deep unsaturated soil zone beneath the existing leachfield.

(7) The existing leachfield appears to lie within 300 feet of two residential water supply wells.

(8) Long-term maintenance of properly designed future leachfields would likely be limited based on the soils present at the Site. When a leachfield fails due to clogging, the field can be replaced within the same footprint after removal of the clogged surface layer.

6.0 RECOMMENDATIONS

Based on our conclusions and findings, we make the following recommendations to the Town:

(1) The first step for future wastewater disposal at the former school Site is to share the findings of this investigation with MEDEP and MEDHHS to discuss and agree on a capacity for the existing leachfield. Survey of the Site's property boundaries, precise location of the existing leachfield, and the McConnell and Mills wells are recommended prior to this meeting to corroborate the findings of this investigation.

(2) The Town should begin to evaluate how much wastewater may be directed toward the Site and from where. This exercise will help the Town understand how a phased development approach might evolve and also provide information for estimating costs for transportation pipelines, wastewater treatment capital and operating costs, site development costs, and engineering and permitting costs. The Town should identify designated areas at the former school property for future wastewater disposal since that may create some constraints on use of the property.

(3) Develop the Site for additional wastewater disposal over time, in a phased approach, monitoring each leachfield as it is built. We would recommend beginning with applying untreated wastewater to the Site. By monitoring any untreated wastewater leachfields (such as the existing leachfield) the actual behavior of the leachfields (i.e., rather than the calculated behavior) on the school Site would be determined. Actual mounding can then be used to project future mounding with more reliability and accuracy. Actual water quality downgradient of the leachfields would be used to define the in-situ nitrate removal and renovation, so that the degree of wastewater treatment can be minimized. Monitoring will potentially result in long-term savings as the Site is developed for more wastewater application in the future, assuming the entire Site capacity is not needed immediately. Periodic groundwater monitoring of the Site during a phased development of subsurface wastewater disposal leachfields could potentially demonstrate that our estimated pre-treatment requirements are

overly conservative and monitoring could potentially result in less aggressive pre-treatment requirements.

(4) In a phased development approach, any leachfield used for untreated wastewater can later be used for disposal of treated wastewater.

(5) All downgradient water supply wells, including the Yarmouth Water District's 'Hayes Well, 1954', should be sampled prior to expanded use of the school property for wastewater disposal. Water samples from the wells should be tested for nitrate, nitrite, total Kjeldahl nitrogen, ammonia, total suspended solids, biochemical oxygen demand (BOD5), chloride, sodium, arsenic, iron, manganese, fecal coliform bacteria, pH, specific conductance, dissolved oxygen, Eh, temperature, turbidity, taste, and odor.

(6) Regardless of the type and amount of future wastewater use of the property, groundwater monitoring will be required because of the downgradient proximity of residential water supply wells and the Yarmouth Water District's 'Hayes Well, 1954.'

(7) Any future wastewater expansion of the school property must meet all State and Town permitting requirements, including applicable setbacks and water quality protection.

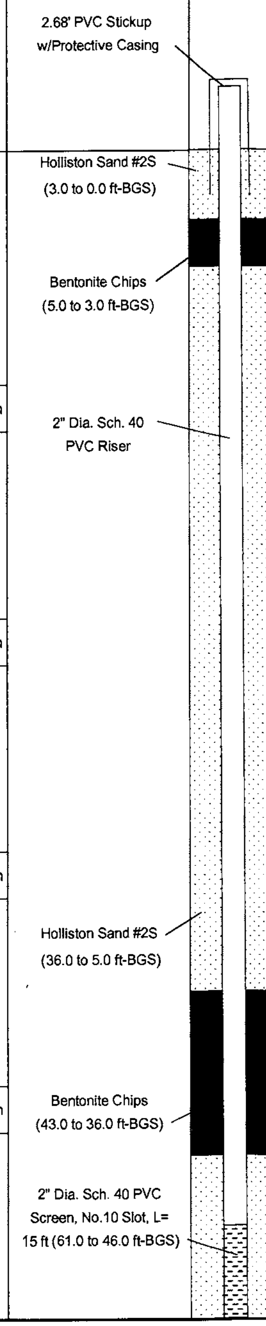
APPENDIX A

SOIL BORING AND WELL INSTALLATION LOGS

PROJECT: North Yarmouth Memorial School		**JOB NO.:** 15087.00	**BORING NO.:** B15-01
DATE STARTED: 07/14/2015	**DATE FINISHED:** 7/15/2015	**DRILLING METHOD:** Drive & Wash w/4" Dia. Casing	
GROUND SURFACE ELEVATION (FT): 208.10 ft-NAVD88	**DRILLING CONTRACTOR:** New England Boring Contractors (Tom Schaefer)		**LOGGED BY:** Sevee & Maher (APG)
BOREHOLE DIA.: 4-inch	**WELL SCREEN/RISER DIA.:** 2-inch		**SHEET 1 OF 2**

DEPTH (FT)	SAMPLE NO.	MATERIAL DESCRIPTION	Blows per 6" on Sampler	Recovery	DEPTH (FT)
0					0
10	1D	10 to 12 ft-BGS - light gray, well sorted, FINE TO MEDIUM SAND, trace coarse sand, medium dense sand	18-13-15-20	13/24 inch	10
20	2D	20 to 22 ft-BGS - light gray, well sorted, FINE SAND, little medium to coarse sand, trace gravel (≤0.5 inch dia.), medium dense sand	8-11-15-27	14/24 inch	20
30	3D	30 to 32 ft-BGS - pale yellow, well sorted, FINE SAND, little silt, medium dense sand	12-14-18-22	14/24 inch	30
40	4D	40 to 42 ft-BGS - light yellowish brown, well sorted, FINE SAND, some fine sandy silt layers, medium dense to dense sand	19-25-29-42	14/24 inch	40
50					50

WELL LOG



NOTES:

Monitoring Point Elevation = 210.78 ft-NAVD88 (top of PVC casing)

Water level measured on 7/24/2015: 51.78 ft-below monitoring point, 159.00 ft-NAVD88 elevation

Soil Key

- Marine Nearshore Sand and Gravel Deposits
- Presumpscot Formation (Silt and Clay)
- Bedrock

PROJECT: North Yarmouth Memorial School		**JOB NO.:** 15087.00	**BORING NO.:** B15-01
DATE STARTED: 07/14/2015	**DATE FINISHED:** 7/15/2015	**DRILLING METHOD:** Drive & Wash w/4" Dia. Casing	
GROUND SURFACE ELEVATION (FT): 208.10 ft-NAVD88	**DRILLING CONTRACTOR:** New England Boring Contractors (Tom Schaefer)		**LOGGED BY:** Sevee & Maher (APG)
BOREHOLE DIA.: 4-inch	**WELL SCREEN/RISER DIA.:** 2-inch		**SHEET 2 OF 2**

DEPTH (FT)	SAMPLE NO.	MATERIAL DESCRIPTION	Blows per 6" on Sampler	Recovery		WELL LOG	DEPTH (FT)
50							50
	5D	50 to 52 ft-BGS - light olive brown, well sorted, SILTY VERY FINE SAND, medium dense to dense sand	12-21-38-48	13/24 inch	Holliston Sand #2S (61.0 to 43.0 ft-BGS) 2" Dia. Sch. 40 PVC Screen, No.10 Slot, L= 15 ft (61.0 to 46.0 ft-BGS)		
60							60
	6D	60 to 62 ft-BGS - light brownish gray, well sorted, SILTY VERY FINE SAND, medium dense sand	12-18-25-28	14/24 inch	Formation Collapse or Holliston Sand #2S (78.5 to 61.0 ft-BGS)		
70		Wash Sample at 70 ft-BGS - SILTY FINE SAND					70
		Wash Sample at 76 ft-BGS - Cuttings from possible cobble zone					
		Wash Sample at 78.2 ft-BGS - Bedrock (Mapped as Granofels by MGS)					
80		Bottom of Exploration - 78.5 ft-BGS					80
90							90
100							100

NOTES:

Monitoring Point Elevation = 210.78 ft-NAVD88 (top of PVC casing)

Water level measured on 7/24/2015: 51.78 ft-below monitoring point, 159.00 ft-NAVD88 elevation

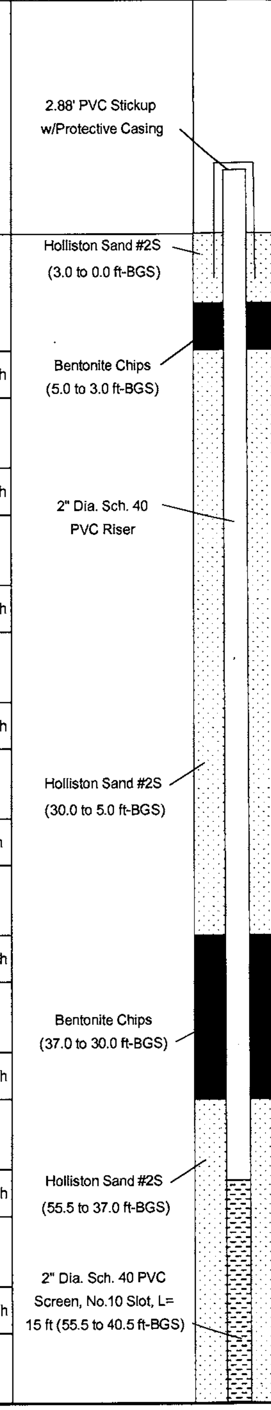
Soil Key

- Marine Nearshore Sand and Gravel Deposits
- Presumpscot Formation (Silt and Clay)
- Bedrock

PROJECT: North Yarmouth Memorial School		**JOB NO.:** 15087.00	**BORING NO.:** B15-02
DATE STARTED: 07/13/2015	**DATE FINISHED:** 7/14/2015	**DRILLING METHOD:** Drive & Wash w/4" Dia. Casing	
GROUND SURFACE ELEVATION (FT): 209.13 ft-NAVD88	**DRILLING CONTRACTOR:** New England Boring Contractors (Tom Schaefer)		**LOGGED BY:** Sevee & Maher (APG)
BOREHOLE DIA.: 4-inch	**WELL SCREEN/RISER DIA.:** 2-inch		**SHEET 1 OF 2**

DEPTH (FT)	SAMPLE NO.	MATERIAL DESCRIPTION	Blows per 6" on Sampler	Recovery	DEPTH (FT)
0					0
	1D	5 to 7 ft-BGS - pale yellow, well sorted, FINE TO MEDIUM SAND, loose sand	5-6-7-12	18/24 inch	
10					10
	2D	10 to 12 ft-BGS - light gray, well sorted, FINE TO MEDIUM SAND, medium dense sand	12-14-16-24	13/24 inch	
	3D	15 to 17 ft-BGS - light gray, moderately sorted, MEDIUM TO COARSE SAND, trace gravel (≤0.25 inch dia.), medium dense sand; over FINE SAND	6-15-15-22	12/24 inch	
20					20
	4D	20 to 22 ft-BGS - light yellowish brown, moderately sorted, FINE TO MEDIUM SAND, trace coarse sand and gravel (≤0.25 inch dia.), medium dense sand	7-15-20-26	12/24 inch	
	5D	25 to 26.3 ft-BGS - light gray, poorly sorted, MEDIUM TO COARSE SAND AND GRAVEL (≤1 inch dia.), dense sand	44-35-50/0.3R	7/16 inch	
30					30
	6D	30 to 32 ft-BGS - light yellowish brown, well sorted, FINE TO MEDIUM SAND, medium dense sand	20-18-20-35	15/24 inch	
	7D	35 to 37 ft-BGS - light brownish gray, well sorted, MEDIUM TO COARSE SAND, medium dense sand	12-13-15-30	13/24 inch	
40					40
	8D	40 to 42 ft-BGS - light brownish gray, well sorted, FINE TO MEDIUM SAND, medium dense sand	15-18-20-23	12/24 inch	
	9D	45 to 47 ft-BGS - light olive gray, well sorted, SILT AND VERY FINE SAND, medium dense sand	12-15-15-18	15/24 inch	
50					50

WELL LOG



NOTES:

Monitoring Point Elevation = 212.01 ft-NAVD88 (top of PVC casing)

Water level measured on 7/24/2015: 47.19 ft-below monitoring point, 164.82 ft-NAVD88 elevation

Soil Key

- Marine Nearshore Sand and Gravel Deposits
- Presumpscot Formation (Silt and Clay)
- Bedrock

N:\NYarm\2015MemorialHydrogeoStudy\SSI\Well Log\sme boring logs.xls

PROJECT: North Yarmouth Memorial School		JOB NO.: 15087.00	BORING NO.: B15-02
DATE STARTED: 07/13/2015	DATE FINISHED: 7/14/2015	DRILLING METHOD: Drive & Wash w/4" Dia. Casing	
GROUND SURFACE ELEVATION (FT): 209.13 ft-NAVD88	DRILLING CONTRACTOR: New England Boring Contractors (Tom Schaefer)		LOGGED BY: Sevee & Maher (APG)
BOREHOLE DIA.: 4-inch	WELL SCREEN/RISER DIA.: 2-inch		SHEET 2 OF 2

DEPTH (FT)	SAMPLE NO.	MATERIAL DESCRIPTION	Blows per 6" on Sampler	Recovery		WELL LOG	DEPTH (FT)
50							50
	10D	50 to 52 ft-BGS - light yellowish brown, well sorted, FINE SAND, some medium sand, trace silt, medium dense sand	16-16-17-20	13/24 inch	Holliston Sand #2S (55.5 to 37.0 ft-BGS)		
					2" Dia. Sch. 40 PVC Screen, No.10 Slot, L= 15 ft (55.5 to 40.5 ft-BGS)		
	11D	55 to 57 ft-BGS - light yellowish brown, moderately sorted, FINE SAND, some medium sand and silt, medium dense sand	15-18-20-25	10/24 inch			
60							60
	12D	60 to 62 ft-BGS - light brownish gray, well sorted, FINE SAND, trace silt and medium sand, medium dense to dense sand	15-23-27-37	10/24 inch			
					Formation Collapse or Holliston Sand #2S (80.5 to 55.5 ft-BGS)		
	13D	65 to 67 ft-BGS - light brownish gray, well sorted, FINE SAND, trace silt, medium dense sand	14-20-20-22	7/24 inch			
70		Wash Sample at 70 ft-BGS - silty FINE SAND					70
80		Wash Sample at 78 to 79 ft-BGS - FINE SAND over MEDIUM SAND Wash Sample at 79 to 80 ft-BGS - Bedrock (Mapped as Granofels by MGS) Bedrock at 79.5 ft-BGS					80
		Bottom of Exploration - 80.5 ft-BGS					
90							90
100							100

NOTES:

Monitoring Point Elevation = 212.01 ft-NAVD88 (top of PVC casing)

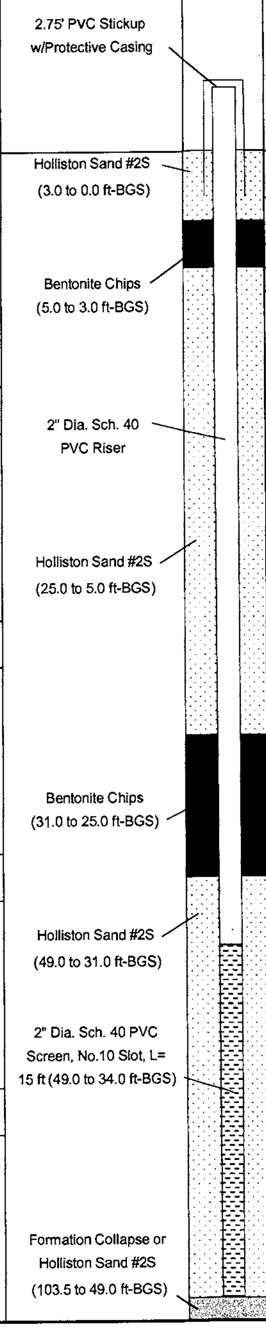
Water level measured on 7/24/2015: 47.19 ft-below monitoring point, 164.82 ft-NAVD88 elevation

Soil Key

- Marine Nearshore Sand and Gravel Deposits
- Presumpscot Formation (Silt and Clay)
- Bedrock

PROJECT: North Yarmouth Memorial School		**JOB NO.:** 15087.00	**BORING NO.:** B15-03
DATE STARTED: 07/15/2015	**DATE FINISHED:** 7/16/2015	**DRILLING METHOD:** Drive & Wash w/4" Dia. Casing	
GROUND SURFACE ELEVATION (FT): 214.47 ft-NAVD88	**DRILLING CONTRACTOR:** New England Boring Contractors (Tom Schaefer)		**LOGGED BY:** Sevee & Maher (APG)
BOREHOLE DIA.: 4-inch	**WELL SCREEN/RISER DIA.:** 2-inch		**SHEET 1 OF 3**

DEPTH (FT)	SAMPLE NO.	MATERIAL DESCRIPTION	Blows per 6" on Sampler	Recovery	WELL LOG	DEPTH (FT)
0						0
10	1D	10 to 12 ft-BGS - pale yellow, well sorted, FINE TO MEDIUM SAND, medium dense sand	13-16-18-16	14/24 inch		10
20	2D	20 to 22 ft-BGS - light yellow, well sorted, FINE TO MEDIUM SAND, loose to medium dense sand	7-8-10-13	14/24 inch		20
30	3D	30 to 32 ft-BGS - pale yellow, well sorted, FINE TO MEDIUM SAND, medium dense sand	11-13-15-20	11/24 inch		30
40	4D	40 to 42 ft-BGS - light yellowish brown, well sorted, FINE TO MEDIUM SAND, little silty fine sand, medium dense sand	13-15-16-22	12/24 inch		40
50						50



NOTES:
Monitoring Point Elevation = 217.22 ft-NAVD88 (top of PVC casing)
Water level measured on 7/24/2015: 42.44 ft-below monitoring point, 174.78 ft-NAVD88 elevation

Soil Key
- Marine Nearshore Sand and Gravel Deposits
- Presumpscot Formation (Silt and Clay)
- Bedrock

PROJECT: North Yarmouth Memorial School		**JOB NO.:** 15087.00	**BORING NO.:** B15-03
DATE STARTED: 07/15/2015	**DATE FINISHED:** 7/16/2015	**DRILLING METHOD:** Drive & Wash w/4" Dia. Casing	
GROUND SURFACE ELEVATION (FT): 214.47 ft-NAVD88	**DRILLING CONTRACTOR:** New England Boring Contractors (Tom Schaefer)		**LOGGED BY:** Sevee & Maher (APG)
BOREHOLE DIA.: 4-inch	**WELL SCREEN/RISER DIA.:** 2-inch		**SHEET 2 OF 3**

DEPTH (FT)	SAMPLE NO.	MATERIAL DESCRIPTION	Blows per 6" on Sampler	Recovery		WELL LOG	DEPTH (FT)
50							50
	5D	50 to 52 ft-BGS - light olive gray, moderately sorted, SILTY FINE SAND, trace silty clay (gray), medium dense sand	10-10-15-22	15/24 inch			
60							60
	6D	60 to 62 ft-BGS - light gray, well sorted, SILTY FINE SAND, loose to medium dense sand	8-10-12-18	15/24 inch			
70							70
		Wash Sample at 70 ft-BGS - SILTY FINE SAND					
					Formation Collapse or Holliston Sand #2S (103.5 to 49.0 ft-BGS)		
80							80
		Wash Sample at 80 ft-BGS - SILTY FINE SAND, trace medium sand					
90							90
		Wash Sample at 90 ft-BGS - SILTY FINE SAND					
100							100

NOTES:

Monitoring Point Elevation = 217.22 ft-NAVD88 (top of PVC casing)

Water level measured on 7/24/2015: 42.44 ft-below monitoring point, 174.78 ft-NAVD88 elevation

Soil Key

- Marine Nearshore Sand and Gravel Deposits
- Presumpscot Formation (Silt and Clay)
- Bedrock

PROJECT: North Yarmouth Memorial School		JOB NO.: 15087.00	BORING NO.: B15-03
DATE STARTED: 07/15/2015	DATE FINISHED: 7/16/2015	DRILLING METHOD: Drive & Wash w/4" Dia. Casing	
GROUND SURFACE ELEVATION (FT): 214.47 ft-NAVD88	DRILLING CONTRACTOR: New England Boring Contractors (Tom Schaefer)		LOGGED BY: Sevee & Maher (APG)
BOREHOLE DIA.: 4-inch	WELL SCREEN/RISER DIA.: 2-inch		SHEET 3 OF 3

DEPTH (FT)	SAMPLE NO.	MATERIAL DESCRIPTION	Blows per 6" on Sampler	Recovery		WELL LOG	DEPTH (FT)
100							100
		Wash Sample at 100 ft-BGS - FINE TO COARSE SAND			Formation Collapse or Holliston Sand #2S (103.5 to 49.0 ft-BGS)		
		Wash Sample at 102.8 to 103.5 ft-BGS - Bedrock (Mapped as Granofels by MGS)					
		Bedrock at 102.8 ft-BGS					
		Bottom of Exploration - 103.5 ft-BGS					
110							110
120							120
130							130
140							140
150							150

NOTES:

Monitoring Point Elevation = 217.22 ft-NAVD88 (top of PVC casing)

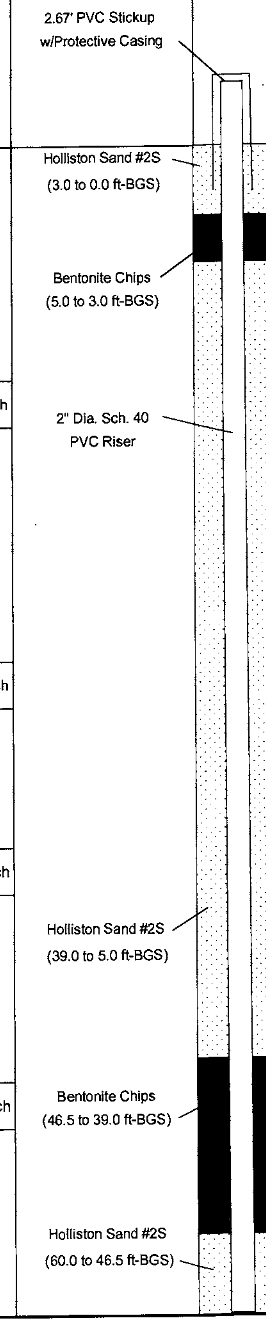
Water level measured on 7/24/2015: 42.44 ft-below monitoring point, 174.78 ft-NAVD88 elevation

Soil Key

- Marine Nearshore Sand and Gravel Deposits
- Presumpscot Formation (Silt and Clay)
- Bedrock

PROJECT: North Yarmouth Memorial School		**JOB NO.:** 15087.00	**BORING NO.:** B15-04
DATE STARTED: 07/17/2015	**DATE FINISHED:** 7/20/2015	**DRILLING METHOD:** Drive & Wash w/4" Dia. Casing	
GROUND SURFACE ELEVATION (FT): 232.68 ft-NAVD88	**DRILLING CONTRACTOR:** New England Boring Contractors (Tom Schaefer)		**LOGGED BY:** Sevee & Maher (APG)
BOREHOLE DIA.: 4-inch	**WELL SCREEN/RISER DIA.:** 2-inch		**SHEET 1 OF 2**

DEPTH (FT)	SAMPLE NO.	MATERIAL DESCRIPTION	Blows per 6" on Sampler	Recovery	WELL LOG	DEPTH (FT)
0						0
10						10
	1D	10 to 12 ft-BGS - pale yellow, well sorted, FINE SAND, medium dense sand	12-16-17-27	15/24 inch		
20						20
	2D	21.5 to 23.5 ft-BGS - pale yellow, well sorted, FINE SAND, trace medium to coarse sand, medium dense sand	11-12-12-15	12/24 inch		
30						30
	3D	30 to 32 ft-BGS - pale yellow, well sorted, FINE SAND, trace medium to coarse sand, medium dense sand	10-15-17-20	13/24 inch		
40						40
	4D	40 to 42 ft-BGS - light yellowish brown, well sorted, FINE TO MEDIUM SAND, medium dense to dense sand	10-10-12-16	12/24 inch		
50		Wash Sample at 48 ft-BGS - Cuttings from white weathered rock Wash Sample at 49.5 ft-BGS - Cuttings from dark weathered rock				50



NOTES:

Monitoring Point Elevation = 235.35 ft-NAVD88 (top of PVC casing)

Water level measured on 7/24/2015: 56.72 ft-below monitoring point, 178.63 ft-NAVD88 elevation

Soil Key

- Marine Nearshore Sand and Gravel Deposits
- Presumpscot Formation (Silt and Clay)
- Bedrock

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PROJECT: North Yarmouth Memorial School		JOB NO.: 15087.00	BORING NO.: B15-04
DATE STARTED: 07/17/2015	DATE FINISHED: 7/20/2015	DRILLING METHOD: Drive & Wash w/4" Dia. Casing	
GROUND SURFACE ELEVATION (FT): 232.68 ft-NAVD88	DRILLING CONTRACTOR: New England Boring Contractors (Tom Schaefer)		LOGGED BY: Sevee & Maher (APG)
BOREHOLE DIA.: 4-inch	WELL SCREEN/RISER DIA.: 2-inch		SHEET 2 OF 2

DEPTH (FT)	SAMPLE NO.	MATERIAL DESCRIPTION	Blows per 6" on Sampler	Recovery		WELL LOG	DEPTH (FT)
50							50
	5D	50.5 to 51 ft-BGS - dark reddish brown, WEATHERED ROCK	70/0.5R	4/6 inch	Holliston Sand #2S (60.0 to 46.5 ft-BGS)		
		Wash Sample at 53 ft-BGS - Bedrock (Mapped as Granofels by MGS)			2" Dia. Sch. 40 PVC Screen, No.10 Slot, L= 10 ft (60.0 to 50.0 ft-BGS)		
60		Bottom of Exploration - 60.0 ft-BGS					60
70							70
80							80
90							90
100							100

NOTES:

Monitoring Point Elevation = 235.35 ft-NAVD88 (top of PVC casing)

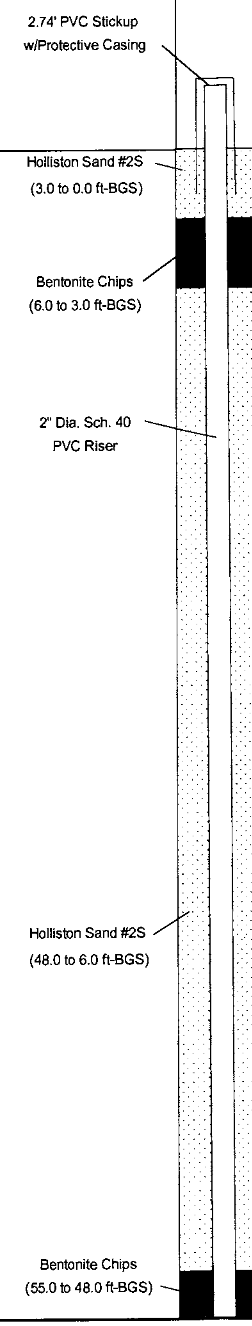
Water level measured on 7/24/2015: 56.72 ft-below monitoring point, 178.63 ft-NAVD88 elevation

Soil Key

- Marine Nearshore Sand and Gravel Deposits
- Presumpscot Formation (Silt and Clay)
- Bedrock

PROJECT: North Yarmouth Memorial School		**JOB NO.:** 15087.00	**BORING NO.:** B15-05
DATE STARTED: 07/20/2015	**DATE FINISHED:** 7/21/2015	**DRILLING METHOD:** Drive & Wash w/4" Dia. Casing	
GROUND SURFACE ELEVATION (FT): 242.86 ft-NAVD88	**DRILLING CONTRACTOR:** New England Boring Contractors (Tom Schaefer)		**LOGGED BY:** Sevee & Maher (APG)
BOREHOLE DIA.: 4-inch	**WELL SCREEN/RISER DIA.:** 2-inch		**SHEET 1 OF 2**

DEPTH (FT)	SAMPLE NO.	MATERIAL DESCRIPTION	Blows per 6" on Sampler	Recovery	WELL LOG	DEPTH (FT)
0						0
10						10
	1D	10 to 12 ft-BGS - pale yellow, moderately sorted, FINE TO MEDIUM SAND, trace coarse sand and gravel, medium dense sand	18-18-15-15	11/24 inch		
20						20
	2D	20 to 22 ft-BGS - light gray, well sorted, FINE SAND, trace medium sand, medium dense sand	16-20-28-30	14/24 inch		
30						30
	3D	30 to 32 ft-BGS - light gray, well sorted, FINE TO MEDIUM SAND to 31.5 ft-BGS, FINE TO COARSE SAND and trace gravel below, medium dense sand	19-23-28-30	15/24 inch		
40						40
	4D	40 to 42 ft-BGS - light yellowish brown, well sorted, FINE SAND, some fine sandy silt layers, trace gravel, medium dense to dense sand	23-33-30-28	15/24 inch		
50						50



NOTES:

Monitoring Point Elevation = 245.60 ft-NAVD88 (top of PVC casing)

Water level measured on 7/24/2015: 66.00 ft-below monitoring point, 179.60 ft-NAVD88 elevation

Soil Key

- Marine Nearshore Sand and Gravel Deposits
- Presumpscot Formation (Silt and Clay)
- Bedrock

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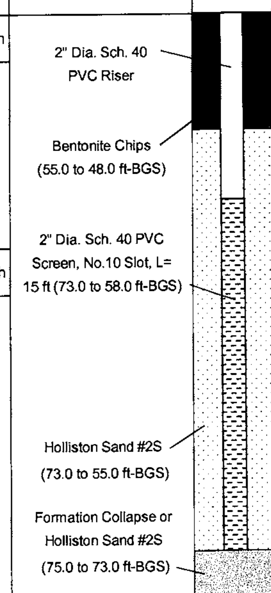
PROJECT: North Yarmouth Memorial School		JOB NO.: 15087.00	BORING NO.: B15-05
DATE STARTED: 07/20/2015	DATE FINISHED: 7/21/2015	DRILLING METHOD: Drive & Wash w/4" Dia. Casing	
GROUND SURFACE ELEVATION (FT): 242.86 ft-NAVD88	DRILLING CONTRACTOR: New England Boring Contractors (Tom Schaefer)		LOGGED BY: Sevee & Maher (APG)
BOREHOLE DIA.: 4-inch	WELL SCREEN/RISER DIA.: 2-inch		SHEET 2 OF 2

DEPTH (FT)	SAMPLE NO.	MATERIAL DESCRIPTION	~~Blows per 6" on~~ Sampler	Recovery	WELL LOG	DEPTH (FT)
50						50
	5D	50 to 52 ft-BGS - light gray, well sorted, FINE TO COARSE SAND, medium dense sand	16-22-28-29	12/24 inch		
60						60
	6D	60 to 62 ft-BGS - light gray, well sorted, SILTY FINE SAND, medium dense sand	16-22-26-28	14/24 inch		
		Wash Sample at 67 ft-BGS - FINE SAND				
70						70
		Wash Sample at 70 ft-BGS - MEDIUM TO COARSE SAND				
		Bottom of Exploration - 75 ft-BGS				
80						80
90						90
100						100



NOTES:

Monitoring Point Elevation = 245.60 ft-NAVD88 (top of PVC casing)

Water level measured on 7/24/2015: 66.00 ft-below monitoring point, 179.60 ft-NAVD88 elevation

Soil Key

- Marine Nearshore Sand and Gravel Deposits
- Presumpscot Formation (Silt and Clay)
- Bedrock

PROJECT: North Yarmouth Memorial School		**JOB NO.:** 15087.00	**BORING NO.:** B15-06
DATE STARTED: 07/22/2015	**DATE FINISHED:** 7/23/2015	**DRILLING METHOD:** Drive & Wash w/4" Dia. Casing	
GROUND SURFACE ELEVATION (FT): 229.31 ft-NAVD88	**DRILLING CONTRACTOR:** New England Boring Contractors (Tom Schaefer)		**LOGGED BY:** Sevee & Maher (APG)
BOREHOLE DIA.: 4-inch	**WELL SCREEN/RISER DIA.:** 2-inch		**SHEET 1 OF 2**

DEPTH (FT)	SAMPLE NO.	MATERIAL DESCRIPTION	Blows per 6" on Sampler	Recovery	WELL LOG	DEPTH (FT)
					2.64' PVC Stickup w/Protective Casing	
0					Holliston Sand #2S (3.0 to 0.0 ft-BGS)	0
					Bentonite Chips (5.0 to 3.0 ft-BGS)	
10		Wash Sample at 9 to 10 ft-BGS - GRAVELLY FINE TO COARSE SAND Driller Note: Silty Clay from 10.5 to 24 ft-BGS				10
	1D	11 to 13 ft-BGS - gray, SILTY CLAY, thin layers of fine to coase sand and gravel, soft	4-4-4-4	13/24 inch	2" Dia. Sch. 40 PVC Riser	
20	2D	20 to 22 ft-BGS - gray, SILTY CLAY, thin layers of fine to medium sand and gravel, very soft	2-2-1-4	24/24 inch		20
30	3D	30 to 32 ft-BGS - light gray, well sorted, SILTY VERY FINE SAND, medium dense sand	20-25-25-30	16/24 inch	Holliston Sand #2S (45.0 to 5.0 ft-BGS)	30
40	4D	40 to 42 ft-BGS - light gray, well sorted, FINE SAND, medium dense sand to dense sand	16-27-35-42	13/24 inch		40
50					Bentonite Chips (52.0 to 45.0 ft-BGS)	50

NOTES:

Monitoring Point Elevation = 231.95 ft-NAVD88 (top of PVC casing)

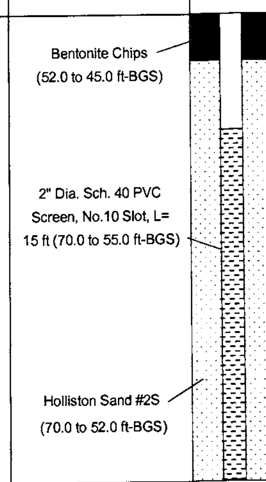
Water level measured on 7/24/2015: 52.75 ft-below monitoring point, 179.20 ft-NAVD88 elevation

Soil Key

- Marine Nearshore Sand and Gravel Deposits
- Presumpscot Formation (Silt and Clay)
- Bedrock

PROJECT: North Yarmouth Memorial School		**JOB NO.:** 15087.00	**BORING NO.:** B15-06
DATE STARTED: 07/22/2015	**DATE FINISHED:** 7/23/2015	**DRILLING METHOD:** Drive & Wash w/4" Dia. Casing	
GROUND SURFACE ELEVATION (FT): 229.31 ft-NAVD88	**DRILLING CONTRACTOR:** New England Boring Contractors (Tom Schaefer)		**LOGGED BY:** Sevee & Maher (APG)
BOREHOLE DIA.: 4-inch	**WELL SCREEN/RISER DIA.:** 2-inch		**SHEET 2 OF 2**

DEPTH (FT)	SAMPLE NO.	MATERIAL DESCRIPTION	Blows per 6" on Sampler	Recovery		WELL LOG	DEPTH (FT)
50							50
60		Wash Sample at 60 ft-BGS - MEDIUM TO COARSE SAND					60
70		Wash Sample at 70 ft-BGS - FINE TO COARSE SAND					70
		Bottom of Exploration - 70 ft-BGS					
80							80
90							90
100							100



NOTES:

Monitoring Point Elevation = 231.95 ft-NAVD88 (top of PVC casing)

Water level measured on 7/24/2015: 52.75 ft-below monitoring point, 179.20 ft-NAVD88 elevation

Soil Key

- Marine Nearshore Sand and Gravel Deposits
- Presumpscot Formation (Silt and Clay)
- Bedrock

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APPENDIX B

GROUNDWATER LEVEL MEASUREMENTS IN MONITORING WELLS

GROUNDWATER LEVEL MEASUREMENTS IN MONITORING WELLS
HYDROGEOLOGICAL STUDY OF FORMER NORTH YARMOUTH MEMORIAL SCHOOL PROPERTY

Well ID	Date	Time	Depth to Water from TPVC (feet)	TPVC Elevation (feet-NAVD88)	Groundwater Elevation (feet-NAVD88)
B15-01	7/23/2015	8:24	51.76	210.78	159.02
	7/23/2015	13:55	51.77		159.01
	7/24/2015	14:47	51.78		159.00
B15-02	7/23/2015	8:27	47.16	212.01	164.85
	7/23/2015	13:51	47.18		164.83
	7/24/2015	14:45	47.19		164.82
B15-03	7/23/2015	8:31	42.41	217.22	174.81
	7/23/2015	13:46	42.42		174.80
	7/24/2015	14:41	42.44		174.78
B15-04	7/23/2015	8:19	56.65	235.35	178.70
	7/23/2015	13:36	56.68		178.67
	7/24/2015	14:53	56.72		178.63
B15-05	7/23/2015	8:12	65.94	245.60	179.66
	7/23/2015	10:56	65.97		179.63
	7/24/2015	15:01	66.00		179.60
B15-06	7/23/2015	8:06	52.72	231.95	179.23
	7/23/2015	14:01	52.74		179.21
	7/24/2015	15:08	52.75		179.20

Notes:

TPVC - top of PVC casing

NAVD88 - North Americal Vertical Datum of 1988

APPENDIX C

FALLING-HEAD PERMEABILITY AND GRAIN SIZE ANALYSIS RESULTS

LABORATORY PERMEABILITY TEST

PROJECT NAME: N. Yarmouth Memorial School DATE: 4 Aug 15

PROJECT NUMBER: 15087 OPERATOR: EJL / JMM

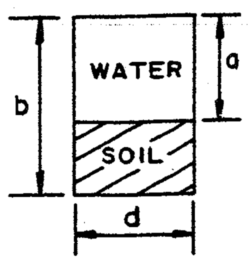
EXPLORATION NO. B15-01

SAMPLE NO. D-5

SAMPLE DEPTH 50-52 FT.

SAMPLE DESCRIPTION:
Brown f-SAND, tr silt.

A



a = 3.875 in
b = 7.045 in
d = 2.033 in

SOIL VOLUME = $V_S = 0.7854\ d^2\ (b-a)$ = 10.29 in^3

WT. DRY SOIL & TARE = 491.4 gm

WT. TARE (A16) = 222.67 gm

WT. DRY SOIL = W_S = 268.73 gm

DENSITY DRY SOIL = $\frac{W_S}{V_S} \times 3.806$ = 99.4 pcf

WATER TEMPERATURE = 22.3 °C

TIME	WATER LEVEL BELOW TOP OF CYLINDER	ELAPSED TIME (SEC)	h HEAD INCHES
0:02:45	0.5		6.545
2:12:25	1.5	7900	5.545
0	0.5		6.545
1:00:30	1.0	3630	6.045

h = DIFFERENCE BETWEEN HEAD WATER AND TAIL WATER AT TIME, t

$k_t = \frac{b-a}{t_2-t_1}\ \ln \frac{h_1}{h_2}$ =

$\left(\frac{3.17}{t}\ \ln \frac{6.545}{h_2}\right)2.5$ 1.69×10^{-4} cm/s

1.76×10^{-4}

$k_{10°C} = \frac{.9579\ \text{centipoise}}{1.3077\ \text{centipoise}} \times \frac{0.9997\ gm/cm^3}{.9978\ gm/cm^3} \times k_t$

$k_{10°C}$ = 1.27×10^{-4} cm/sec

=

= 0.36 ft/day

in/sec → ft/day multiply by 7200
cm/sec → ft/day multiply by 2834.6

SEVEE & MAHER ENGINEERS

LABORATORY PERMEABILITY TEST

PROJECT NAME: N. Yarmouth Memorial School

DATE: 7 Aug 15

PROJECT NUMBER: 15087

OPERATOR: EJL / JMM

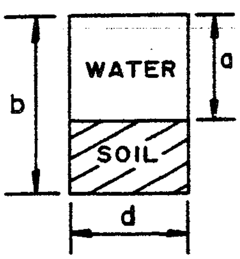
EXPLORATION NO. B15-02

SAMPLE NO. 5D

SAMPLE DEPTH 25-26.3 FT.

SAMPLE DESCRIPTION:
Brown gravelly c-f SAND

B



a = 4.625 in
b = 6.98 in
d = 2.028 in

SOIL VOLUME = V_S = 0.7854 d^2 (b-a) = 7.607 in^3

wet soil = 579.3

WT. DRY SOIL & TARE = 458.7 gm

WT. TARE (A24) = 223.29 gm

WT. DRY SOIL = W_S = 235.41 gm

DENSITY DRY SOIL = $\frac{W_S}{V_S}$ x 3.806 = 117.8 pcf

WATER TEMPERATURE = 20.6 °C

TIME	WATER LEVEL BELOW TOP OF CYLINDER	ELAPSED TIME (SEC)	h HEAD INCHES
8:08	0.5		6.48
40:25	2.0	1937	4.98
4:25	0.5		6.48
36:23	2.0	1918	4.98

h = DIFFERENCE BETWEEN HEAD WATER AND TAIL WATER AT TIME, t

$k_t = \frac{b-a}{t_2-t_1} \ln \frac{h_1}{h_2}$ = _____ (b - a = 2.355)

8.13×10^{-4} cm/sec
8.21×10^{-4}

$k_{10°C} = \frac{.9579 \text{ centipoise}}{1.3077 \text{ centipoise}} \times \frac{0.9997 \text{ gm/cm}^3}{.99802 \text{ gm/cm}^3} \times k_t$

$k_{10°C}$ = 5.99×10^{-4} cm/sec

= _____

= 1.70 ft/day

in/sec → ft/day multiply by 7200
cm/sec → ft/day multiply by 2834.6

SEVEE & MAHER ENGINEERS

LABORATORY PERMEABILITY TEST

PROJECT NAME: N. Yarmouth Memorial School

DATE: 7 Aug 15

PROJECT NUMBER: 15087

OPERATOR: EJL / JMM

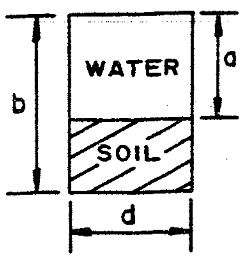
EXPLORATION NO. B15-02

SAMPLE NO. 10D

SAMPLE DEPTH 50-52 FT.

SAMPLE DESCRIPTION: Brown m-f SAND, trace silt.

A



a = 4.125 in

b = 7.045 in

d = 2.033 in

SOIL VOLUME = $V_S = 0.7854\, d^2\,(b-a)$ = 9.479 in^3

Wet Soil = 611.9

WT. DRY SOIL & TARE = 488.3 gm

WT. TARE (A23) = 225.55 gm

WT. DRY SOIL = W_S = 262.75 gm

DENSITY DRY SOIL = $\frac{W_S}{V_S} \times 3.806$ = 105.5 pcf

WATER TEMPERATURE = 21.6 °C

TIME	WATER LEVEL BELOW TOP OF CYLINDER	ELAPSED TIME (SEC)	h HEAD INCHES
0	0.5		6.545
36:29	2.0	2189	5.045
0	0.5		6.545
36:03	2.0	2163	5.045

h = DIFFERENCE BETWEEN HEAD WATER AND TAIL WATER AT TIME, t

$k_t = \frac{b-a}{t_2 - t_1} \ln \frac{h_1}{h_2}$ = ______ (b − a = 2.92)

4.75 x 10⁻⁴ cm/sec

8.93 x 10⁻⁴

$k_{10°C} = \frac{.9810 \text{ centipoise}}{1.3077 \text{ centipoise}} \times \frac{0.9997 \text{ gm/cm}^3}{.9978 \text{ gm/cm}^3} \times k_t$

$k_{10°C}$ = 6.0 x 10⁻⁴ cm/sec

= ______

= 1.88 ft/day

in/sec → ft/day multiply by 7200

cm/sec → ft/day multiply by 2834.6

SEVEE & MAHER ENGINEERS

LABORATORY PERMEABILITY TEST

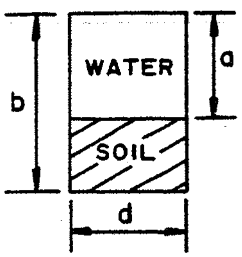
PROJECT NAME: N. YARMOUTH MEMORIAL SCHOOL
DATE: 6 Aug 15

PROJECT NUMBER: 15087
OPERATOR: EJL / JMM

EXPLORATION NO. B15-03
SAMPLE NO. D4
SAMPLE DEPTH 40-42 FT.

SAMPLE DESCRIPTION:
Brown m-f SAND, trace silt

B



a = 3.5 in
b = 6.98 in
d = 2.028 in

SOIL VOLUME = V_S = $0.7854\, d^2\, (b-a)$ = 11.24 in^3

WT. DRY SOIL & TARE = 535.7 gm

WT. TARE (A9) = 226.62 gm

WT. DRY SOIL = W_S = 309.1 gm

DENSITY DRY SOIL = $\frac{W_S}{V_S} \times 3.806$ = 104.67 pcf

WATER TEMPERATURE = 18.9 °C

TIME	WATER LEVEL BELOW TOP OF CYLINDER	ELAPSED TIME (SEC)	h HEAD INCHES
0	0.5		6.48
27:04	2.0	1624	4.98
0	0.5		6.48
26:14	2.0	1574	4.98

h = DIFFERENCE BETWEEN HEAD WATER AND TAIL WATER AT TIME, t

$k_t = \frac{b-a}{t_2-t_1} \ln \frac{h_1}{h_2}$ = ______

$\frac{3.48}{1624} \ln \frac{6.48}{4.98}$ = 5.64×10^{-4} in/sec = 1.43×10^{-3} cm/sec

5.82×10^{-4} in/sec

1.48×10^{-3} cm/sec

$k_{10°C} = \frac{1.0299 \text{ centipoise}}{1.3077 \text{ centipoise}} \times \frac{0.9997 \text{ gm/cm}^3}{.99843 \text{ gm/cm}^3} \times k_t$

$k_{10°C}$ = 1.15×10^{-3} cm/sec

= ______

= 3.25 ft/day

in/sec → ft/day multiply by 7200
cm/sec → ft/day multiply by 2834.6

SEVEE & MAHER ENGINEERS

LABORATORY PERMEABILITY TEST

PROJECT NAME: N. Yarmouth Memorial School

DATE: 4 Aug 15

PROJECT NUMBER: 15087

OPERATOR: EJL / JMM

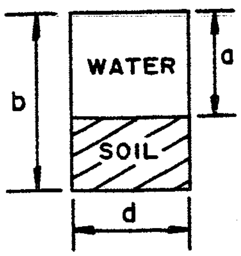
EXPLORATION NO. B15-04

SAMPLE NO. 4D

SAMPLE DEPTH 40-42 FT.

SAMPLE DESCRIPTION:
Brown m-f SAND tr silt.

B



a = 4.0 in
b = 6.98 in
d = 2.028 in

SOIL VOLUME = $V_s = 0.7854\, d^2\, (b-a)$ = 9.63 in^3

WT. DRY SOIL & TARE = 465.1 gm

WT. TARE (A12) = 223.81 gm

WT. DRY SOIL = W_s = 241.29 gm

DENSITY DRY SOIL = $\frac{W_s}{V_s} \times 3.806$ = 95.4 pcf

WATER TEMPERATURE = 21.7 °C

TIME	WATER LEVEL BELOW TOP OF CYLINDER	ELAPSED TIME (SEC)	h HEAD INCHES
0	0.5	0	6.48
12:51	2.0	771	4.98
16:06	0.5		6.48
29:07	2.0	781	4.98

h = DIFFERENCE BETWEEN HEAD WATER AND TAIL WATER AT TIME, t

$k_t = \frac{b-a}{t_2-t_1} \ln \frac{h_1}{h_2}$ = ______

$\frac{2.98}{\;} \ln \frac{6.48}{4.98}$

$1.02\times10^{-3} \times 2.54$
$1.00\times10^{-3} \times 2.54$

2.59×10^{-3}
2.54×10^{-3}

$k_{10°C} = \frac{.9579 \text{ centipoise}}{1.3077 \text{ centipoise}} \times \frac{0.9997 \text{ gm/cm}^3}{.99780 \text{ gm/cm}^3} \times k_t$

$k_{10°C}$ = 1.88×10^{-3} cm/sec
= ______
= 5.33 ft/day

in/sec → ft/day multiply by 7200
cm/sec → ft/day multiply by 2834.6

SEVEE & MAHER ENGINEERS

LABORATORY PERMEABILITY TEST

PROJECT NAME: N. YARMOUTH MEMORIAL SCHOOL DATE: 5 Aug 15

PROJECT NUMBER: 15087 OPERATOR: EJL / JMM

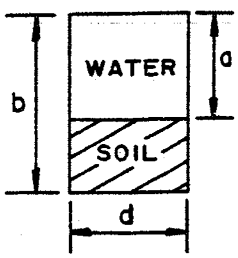
EXPLORATION NO. B15-05

SAMPLE NO. 5-D

SAMPLE DEPTH 50-52 FT.

SAMPLE DESCRIPTION:
Br m-f SAND, tr s'lt.

B



a = 3.875 in
b = 6.98 in
d = 2.028 in

SOIL VOLUME = $V_S = 0.7854\ d^2\ (b-a)$ = 10.03 in^3

WT. DRY SOIL & TARE = 515.2 gm

WT. TARE (A15) = 226.48 gm

WT. DRY SOIL = W_S = 288.72 gm

DENSITY DRY SOIL = $\frac{W_S}{V_S} \times 3.806$ = 109.6 pcf

WATER TEMPERATURE = 19.0 °C

TIME	WATER LEVEL BELOW TOP OF CYLINDER	ELAPSED TIME (SEC)	h HEAD INCHES
1:27:05	0.5		6.48
1:32:22	2.0	317	4.98
1:34:01	0.5		6.48
1:39:38	2.0	337	4.98

h = DIFFERENCE BETWEEN HEAD WATER AND TAIL WATER AT TIME, t

$k_t = \frac{b-a}{t_2-t_1} \ln \frac{h_1}{h_2}$ = ____

$\left(\frac{3.105}{t}\ \ln \frac{6.48}{4.98}\right) 2.54$ 6.55×10^{-3} cm/sec
6.16×10^{-3}

$k_{10°C} = \frac{1.0299 \text{ centipoise}}{1.3077 \text{ centipoise}} \times \frac{0.9997 \text{ gm/cm}^3}{.99843 \text{ gm/cm}^3} \times k_t$

$k_{10°C}$ = 5.01×10^{-3} cm/sec

= ____

= 14.2 ft/day

in/sec → ft/day multiply by 7200
cm/sec → ft/day multiply by 2834.6

SEVEE & MAHER ENGINEERS

LABORATORY PERMEABILITY TEST

PROJECT NAME: N. Yarmouth Memorial School DATE: 5 Aug 15

PROJECT NUMBER: 15087 OPERATOR: EJL / JMM

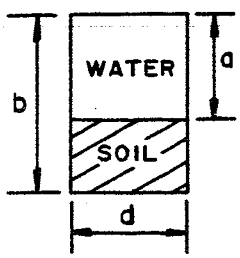
EXPLORATION NO. B15-05

SAMPLE NO. 6D

SAMPLE DEPTH 60-62 FT.

SAMPLE DESCRIPTION: Br fine SAND, l: silt.

β



a = 4.0 in
b = 6.98 in
d = 2.028 in

SOIL VOLUME = $V_S = 0.7854\ d^2\ (b-a)$ = 9.63 in^3

WT. DRY SOIL & TARE = 486.7 gm

WT. TARE (A-21) = 224.28 gm

WT. DRY SOIL = W_S = 262.42 gm

DENSITY DRY SOIL = $\frac{W_S}{V_S} \times 3.806$ = 103.7 pcf

WATER TEMPERATURE = 22.2 °C

TIME	WATER LEVEL BELOW TOP OF CYLINDER	ELAPSED TIME (SEC)	h HEAD INCHES
8:45	0.5		6.48
1:30:11	2.0	4886	4.48
0	0.5		6.48
24:37	1.0	1477	5.98

h = DIFFERENCE BETWEEN HEAD WATER AND TAIL WATER AT TIME, t

$$k_t = \frac{b-a}{t_2 - t_1} \ln \frac{h_1}{h_2} = \underline{\qquad}$$

$\left(\frac{2.98}{t} \ln \frac{6.48}{h}\right) 2.54$ 5.72×10^{-4} cm/sec
4.12×10^{-4}

$$k_{10°C} = \frac{.9579 \text{ centipoise}}{1.3077 \text{ centipoise}} \times \frac{0.9997 \text{ gm/cm}^3}{.9978 \text{ gm/cm}^3} \times k_t$$

$k_{10°C}$ = 3.61×10^{-4} cm/sec

=

= 1.02 ft/day

in/sec → ft/day multiply by 7200
cm/sec → ft/day multiply by 2834.6

LABORATORY PERMEABILITY TEST

PROJECT NAME: N. Yarmouth Memorial School DATE: 5 Aug 15

PROJECT NUMBER: 15087 OPERATOR: EJL / JMM

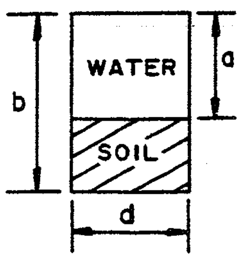
EXPLORATION NO. B15-06

SAMPLE NO. 4D

SAMPLE DEPTH 40-42 FT.

SAMPLE DESCRIPTION: Lt Brown fine SAND, tr silt

A



a = 3.875 in
b = 7.045 in
d = 2.032 in

SOIL VOLUME = $V_S = 0.7854\ d^2\ (b-a)$ = 10.29 in^3

WT. DRY SOIL & TARE = 487.5 gm

WT. TARE (A20) = 227.57 gm

WT. DRY SOIL = W_S = 259.93 gm

DENSITY DRY SOIL = $\frac{W_S}{V_S} \times 3.806$ = 96.1 pcf

WATER TEMPERATURE = 21.9 °C

TIME	WATER LEVEL BELOW TOP OF CYLINDER	ELAPSED TIME (SEC)	h HEAD INCHES
0	0.5		6.545
44:59	2.0	2699	5.045
49:23	0.5		6.545
1:36:22	2.0	2819	5.045

h = DIFFERENCE BETWEEN HEAD WATER AND TAIL WATER AT TIME, t

$k_t = \frac{b-a}{t_2-t_1} \ln \frac{h_1}{h_2}$ = ______

$\left(\frac{3.17}{t} \ln \frac{6.545}{5.045}\right) 2.54$ 7.77×10^-4 cm/sec

7.43×10^-4 cm/sec

$k_{10°C} = \frac{.9579 \text{ centipoise}}{1.3077 \text{ centipoise}} \times \frac{0.9997 \text{ gm/cm}^3}{.9978 \text{ gm/cm}^3} \times k_t$

$k_{10°C}$ = 5.58×10^-4 cm/sec

= ______

= 1.58 ft/day

in/sec → ft/day multiply by 7200

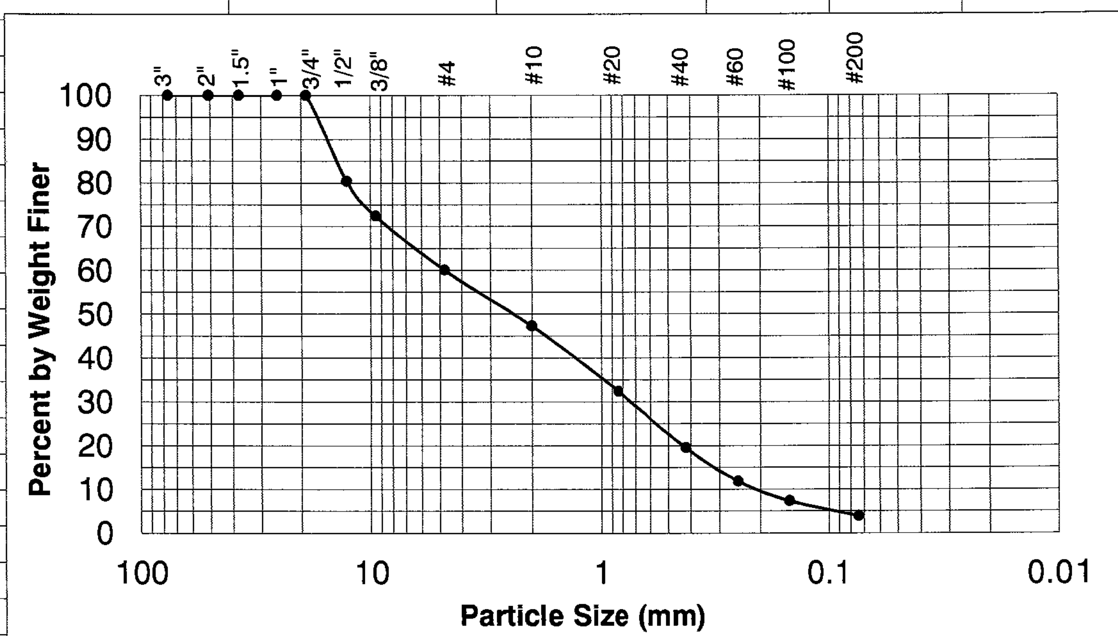
cm/sec → ft/day multiply by 2834.6

SEVEE & MAHER ENGINEERS

SEVEE & MAHER ENGINEERS
4 BLANCHARD ROAD
CUMBERLAND CTR., MAINE 04021
(207) 829-5016

GRAIN SIZE ANALYSIS - ASTM D422

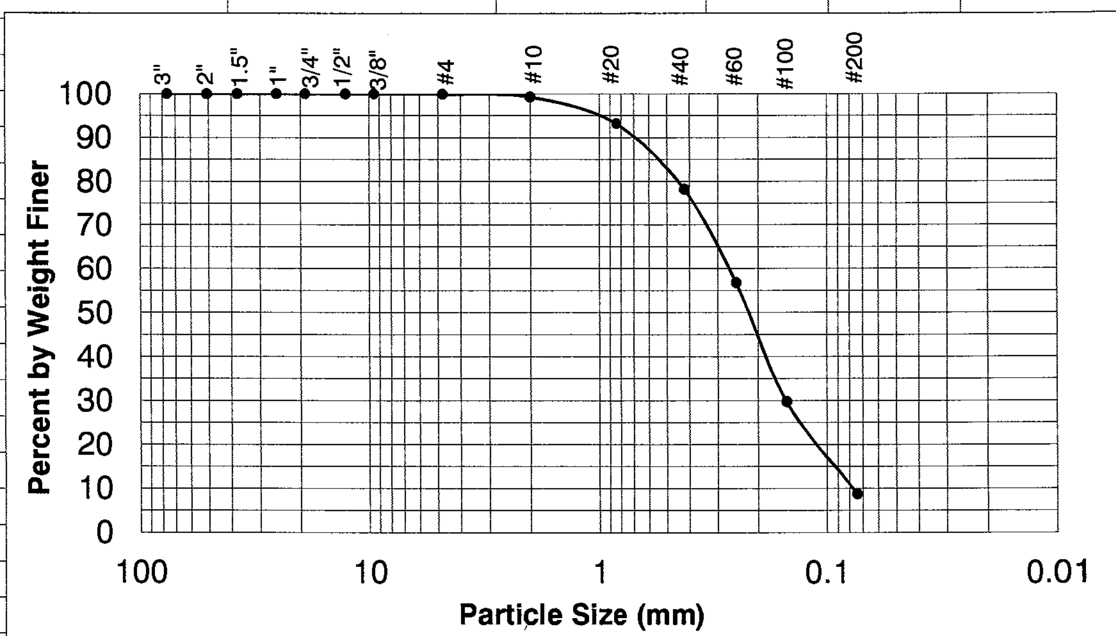
PROJECT NAME:	North Yarmouth Memorial School			PROJECT No:	15087
	HydroGeo Investigation			DATE:	6-Aug-15
SAMPLE SOURCE:	Boring Samples			BORING No:	B15-02
SAMPLE DESCRIP:	Brown gravelly c-f SAND			SAMPLE No:	5D
				DEPTH (ft):	25-26.3
		DATA			
			SPECIFICATION		
U.S Std SIEVE (in.)	PARTICLE SIZE (mm)	% by WT. FINER	Min	Max	P / F
3	76.2	**100.0**			
2	50.8	**100.0**			
1.5	37.5	**100.0**			
1	25.4	**100.0**			
3/4	19.1	**100.0**			
1/2	12.7	**80.4**			
3/8	9.5	**72.4**			
#4	4.76	**60.1**			
#10	2.0	**47.3**			
#20	0.84	**32.4**			
#40	0.42	**19.6**			
#60	0.25	**11.9**			
#100	0.149	**7.3**			
#200	0.074	**3.9**			



SEVEE & MAHER ENGINEERS
4 BLANCHARD ROAD
CUMBERLAND CTR., MAINE 04021
(207) 829-5016

GRAIN SIZE ANALYSIS - ASTM D422

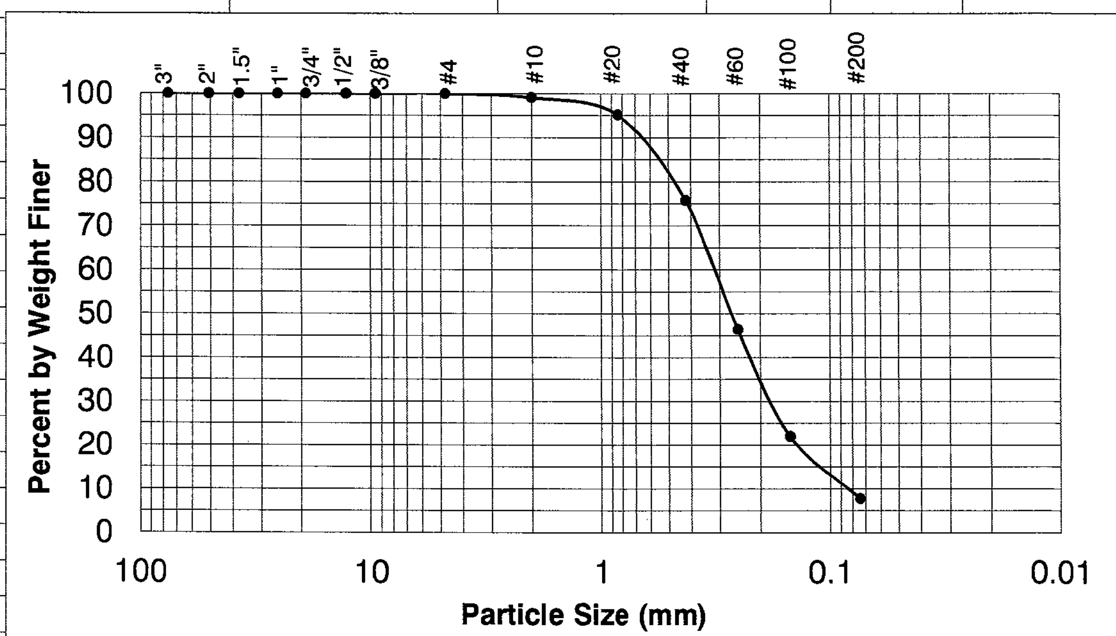
PROJECT NAME:	North Yarmouth Memorial School			PROJECT No:	15087
	HydroGeo Investigation			DATE:	6-Aug-15
SAMPLE SOURCE:	Boring Samples			BORING No:	B15-02
SAMPLE DESCRIP:	Brown m-f SAND, trace silt			SAMPLE No:	10D
				DEPTH (ft):	50-52
		DATA			
			SPECIFICATION		
U.S Std SIEVE (in.)	PARTICLE SIZE (mm)	% by WT. FINER	Min	Max	P / F
3	76.2	**100.0**			
2	50.8	**100.0**			
1.5	37.5	**100.0**			
1	25.4	**100.0**			
3/4	19.1	**100.0**			
1/2	12.7	**100.0**			
3/8	9.5	**100.0**			
#4	4.76	**99.9**			
#10	2.0	**99.3**			
#20	0.84	**93.1**			
#40	0.42	**78.2**			
#60	0.25	**56.8**			
#100	0.149	**29.7**			
#200	0.074	**8.7**			



SEVEE & MAHER ENGINEERS
4 BLANCHARD ROAD
CUMBERLAND CTR., MAINE 04021
(207) 829-5016

GRAIN SIZE ANALYSIS - ASTM D422

PROJECT NAME:	North Yarmouth Memorial School			PROJECT No:	15087
	HydroGeo Investigation			DATE:	6-Aug-15
SAMPLE SOURCE:	Boring Samples			BORING No:	B15-03
SAMPLE DESCRIP:	Brown m-f SAND, trace silt			SAMPLE No:	4D
				DEPTH (ft):	40-42
		DATA			
			SPECIFICATION		
U.S Std SIEVE (in.)	PARTICLE SIZE (mm)	% by WT. FINER	Min	Max	P / F
3	76.2	**100.0**			
2	50.8	**100.0**			
1.5	37.5	**100.0**			
1	25.4	**100.0**			
3/4	19.1	**100.0**			
1/2	12.7	**100.0**			
3/8	9.5	**100.0**			
#4	4.76	**100.0**			
#10	2.0	**99.1**			
#20	0.84	**95.1**			
#40	0.42	**75.7**			
#60	0.25	**46.4**			
#100	0.149	**22.0**			
#200	0.074	**7.7**			



APPENDIX D

SOIL TEST PIT LOGS

SUBSURFACE WASTEWATER DISPOSAL SYSTEM APPLICATION

Maine Dept.Health & Human Services
Division of Environmental Health
(207) 287-5672 Fax: (207) 287-3165

Town, City, Plantation	Street, Road, Subdivision	Owner's Name
North Yarmouth	120 Memorial Highway	Town of North Yarmouth

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP15-01 [X] Test Pit [ ] Boring

3 " Depth of Organic Horizon Above Mineral Soil

Depth Below Mineral Soil Surface (inches)	Texture	Consistency	Color	Mottling
0	Fine Sandy Loam	Friable to Loose	Very Dark Gray	
	Fine Loamy Sand		Yellowish Brown	
10–30	Fine to Medium Sand	Loose	Brownish Yellow	
30–50	Medium to Coarse Sand w/ Cobbles to >48"		Pale Yellow	None to >48"

Soil Classification	Slope	Limiting Factor	
5 Profile, B Condition	0-3 %	>48 "	[ ] Ground Water [ ] Restrictive Layer [ ] Bedrock [X] Pit Depth

Observation Hole TP15-02 [X] Test Pit [ ] Boring

2 " Depth of Organic Horizon Above Mineral Soil

Depth Below Mineral Soil Surface (inches)	Texture	Consistency	Color	Mottling
0	Fine Sandy Loam	Friable	Dark Grayish Brown	
5–24	Loamy Fine Sand		Yellowish Brown	
24–30	Fine to Coarse Sand w/ Gravel and Cobbles to >57"	Loose	Brownish Yellow	
30–50			Yellow	None to >57"

Soil Classification	Slope	Limiting Factor	
5 Profile, B Condition	0-3 %	>57 "	[ ] Ground Water [ ] Restrictive Layer [ ] Bedrock [X] Pit Depth

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP15-03 [X] Test Pit [ ] Boring

3 " Depth of Organic Horizon Above Mineral Soil

Depth Below Mineral Soil Surface (inches)	Texture	Consistency	Color	Mottling
0	Fine Sandy Loam	Friable	Dark Yellowish Brown	
	Fine Loamy Sand		Yellowish Brown	
10	Gravelly Medium Sand		Brownish Yellow	
30–50	Medium to Coarse Sand w/ Gravel and Cobbles to >55"	Loose	Pale Yellow	None to >55"

Soil Classification	Slope	Limiting Factor	
5 Profile, B Condition	0-3 %	>55 "	[ ] Ground Water [ ] Restrictive Layer [ ] Bedrock [X] Pit Depth

Observation Hole TP15-04 [X] Test Pit [ ] Boring

1 " Depth of Organic Horizon Above Mineral Soil

Depth Below Mineral Soil Surface (inches)	Texture	Consistency	Color	Mottling
0	Very Fine Sandy Loam	Friable	Gray	
0–20	Fine Loamy Sand	Friable to Loose	Yellowish Brown	
20			Brownish Yellow	
30–50	Medium to Coarse Sand w/ Gravel and Cobbles to >59"	Loose	Pale Yellow	None to >59"

Soil Classification	Slope	Limiting Factor	
5 Profile, B Condition	0-3 %	>59 "	[ ] Ground Water [ ] Restrictive Layer [ ] Bedrock [X] Pit Depth

Andrew Gold (signature) — Site Evaluator Signature

#370 — SE #

July 16, 2015 — Date

SUBSURFACE WASTEWATER DISPOSAL SYSTEM APPLICATION	Maine Dept.Health & Human Services Division of Environmental Health (207) 287-5672 Fax: (207) 287-3165

Town, City, Plantation	Street, Road, Subdivision	Owner's Name
North Yarmouth	**120 Memorial Highway**	**Town of North Yarmouth**

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP15-05 [X] Test Pit [ ] Boring

2 " Depth of Organic Horizon Above Mineral Soil

Depth Below Mineral Soil Surface (inches)

Depth	Texture	Consistency	Color	Mottling
0	Fine Sandy Loam	Friable	Yellowish Brown	
~7			Dark Grayish Brown	
~8			Yellowish Brown	
~14	Medium to Coarse Sand w/ Gravel and Cobbles	Loose	Yellow	
~22	Fine to Medium Sand			
~26			Pale Yellow	
~34				
40–50	Fine Sand to >62"			None to >62"

Soil Classification		Slope	Limiting Factor	
5 (Profile)	B (Condition)	0-3 %	>62 "	[ ] Ground Water [ ] Restrictive Layer [ ] Bedrock [X] Pit Depth

Observation Hole TP15-06 [X] Test Pit [ ] Boring

2 " Depth of Organic Horizon Above Mineral Soil

Depth Below Mineral Soil Surface (inches)

Depth	Texture	Consistency	Color	Mottling
0	Fine Loamy Sand	Friable to Loose	Light Brownish Gray	
~1			Yellowish Brown	
~14	Medium to Coarse Sand w/ Gravel and Cobbles to >58"	Loose	Pale Yellow	
40–50				None to >58"

Soil Classification		Slope	Limiting Factor	
5 (Profile)	B (Condition)	0-3 %	>58 "	[ ] Ground Water [ ] Restrictive Layer [ ] Bedrock [X] Pit Depth

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP15-07 [X] Test Pit [ ] Boring

0 " Depth of Organic Horizon Above Mineral Soil

Depth Below Mineral Soil Surface (inches)

Depth	Texture	Consistency	Color	Mottling
0	Silt Loam	Friable	Pale Olive	
~8	Medium to Coarse Sand w/ Gravel and Cobbles	Loose	Yellowish Brown	
~13			Pale Yellow	
~42	Fine Sand to >59"			None to >59"

Soil Classification		Slope	Limiting Factor	
5 (Profile)	B (Condition)	0-3 %	>59 "	[ ] Ground Water [ ] Restrictive Layer [ ] Bedrock [X] Pit Depth

Observation Hole TP15-08 [X] Test Pit [ ] Boring

0 " Depth of Organic Horizon Above Mineral Soil

Depth Below Mineral Soil Surface (inches)

Depth	Texture	Consistency	Color	Mottling
0	Silt Loam	Friable	Light Olive Brown	
~5	Gravelly Fine to Medium Sand	Loose	Yellowish Brown	
~12	Fine Sand		Pale Yellow	
~18	Fine to Coarse Sand w/ Gravel and Cobbles to >61"			None to >61"

Soil Classification		Slope	Limiting Factor	
5 (Profile)	B (Condition)	0-3 %	>61 "	[ ] Ground Water [ ] Restrictive Layer [ ] Bedrock [X] Pit Depth

[signature]	#370	July 16, 2015	Page 2 of 3
Site Evaluator Signature	SE #	Date	HHE-200 Rev. 05/08

SUBSURFACE WASTEWATER DISPOSAL SYSTEM APPLICATION

Maine Dept.Health & Human Services
Division of Environmental Health
(207) 287-5672 Fax: (207) 287-3165

Town, City, Plantation	Street, Road, Subdivision	Owner's Name
North Yarmouth	120 Memorial Highway	Town of North Yarmouth

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP15-09 [X] Test Pit [ ] Boring

0 " Depth of Organic Horizon Above Mineral Soil

Depth Below Mineral Soil Surface (inches)	Texture	Consistency	Color	Mottling
0–13	Very Fine Sandy Loam	Friable	Dark Yellowish Brown	
13–>70	Fine to Coarse Sand w/ Gravel and Cobbles to >70"	Loose	Pale Yellow	None to >70"

Soil Classification	Slope	Limiting Factor	
5 Profile, B Condition	0-3 %	>70 "	[ ] Ground Water [ ] Restrictive Layer [ ] Bedrock [X] Pit Depth

Observation Hole TP15-10 [X] Test Pit [ ] Boring

0 " Depth of Organic Horizon Above Mineral Soil

Depth Below Mineral Soil Surface (inches)	Texture	Consistency	Color	Mottling
0–12	Very Fine Sandy Loam	Friable	Dark Yellowish Brown	
12–23	Fine to Medium Sand w/ Trace Gravel and Cobbles to >62"	Loose	Brownish Yellow	
23–>62			Pale Yellow	None to >62"

Soil Classification	Slope	Limiting Factor	
5 Profile, B Condition	0-3 %	>62 "	[ ] Ground Water [ ] Restrictive Layer [ ] Bedrock [X] Pit Depth

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP15-11 [X] Test Pit [ ] Boring

0 " Depth of Organic Horizon Above Mineral Soil

Depth Below Mineral Soil Surface (inches)	Texture	Consistency	Color	Mottling
0–10	Fine Loamy Sand	Friable	Yellowish Brown / Dark Yellowish Brown	
10–24	Fine to Coarse Sand w/ Gravel and Cobbles	Loose	Brownish Yellow	
24–45	Coarse Sand w/ Gravel and Cobbles		Yellow	
45–>58	Fine to Medium Sand to >58"		Pale Yellow	None to >58"

Soil Classification	Slope	Limiting Factor	
5 Profile, B Condition	0-3 %	>58 "	[ ] Ground Water [ ] Restrictive Layer [ ] Bedrock [X] Pit Depth

Observation Hole TP15-12 [X] Test Pit [ ] Boring

1 " Depth of Organic Horizon Above Mineral Soil

Depth Below Mineral Soil Surface (inches)	Texture	Consistency	Color	Mottling
0–4	Very Stony Loamy Sand	Friable to Loose	Dark Yellowish Brown	
4–16			Brownish Yellow	
16–34			Pale Yellow	None to >36"
34–36	Very Fine Sand	Firm	Yellow	
	Limit of Pit 36"			

Soil Classification	Slope	Limiting Factor	
3 Profile, C Condition	0-3 %	34 "	[ ] Ground Water [X] Restrictive Layer [ ] Bedrock [ ] Pit Depth

Site Evaluator Signature	SE #	Date
[signature]	#370	July 16, 2015 and August 14, 2015

APPENDIX E

GROUNDWATER QUALITY SAMPLING LABORATORY ANALYTICAL RESULTS AND FIELD SHEETS

Eastern Analytical, Inc.

professional laboratory & drilling services

Jackie Villinski
Maine Environmental Laboratory
One Main Street
Yarmouth , ME 04096

ACCREDITED IN ACCORDANCE WITH nelac

Subject: Laboratory Report

Eastern Analytical, Inc. ID:	146403
Client Identification:	SAM1933-15
Date Received:	8/4/2015

Dear Ms. Villinski :

Enclosed please find the laboratory report for the above identified project. All analyses were performed in accordance with our QA/QC Program. Unless otherwise stated, holding times, preservation techniques, container types, and sample conditions adhered to EPA Protocol. Samples which were collected by Eastern Analytical, Inc. (EAI) were collected in accordance with approved EPA procedures. Eastern Analytical, Inc. certifies that the enclosed test results meet all requirements of NELAP and other applicable state certifications. Please refer to our website at www.eailabs.com for a copy of our NELAP certificate and accredited parameters.

The following standard abbreviations and conventions apply to all EAI reports:

Solid samples are reported on a dry weight basis, unless otherwise noted
< : "less than" followed by the reporting limit
> : "greater than" followed by the reporting limit
%R : % Recovery

Eastern Analytical Inc. maintains certification in the following states: Connecticut (PH-0492), Maine (NH005), Massachusetts (M-NH005), New Hampshire/NELAP (1012), Rhode Island (269) and Vermont (VT1012).

The following information is contained within this report: Sample Conditions summary, Analytical Results/Data, Quality Control data (if requested) and copies of the Chain of Custody. This report may not be reproduced except in full, without the the written approval of the laboratory.

If you have any questions regarding the results contained within, please feel free to directly contact me or the chemist(s) who performed the testing in question. Unless otherwise requested, we will dispose of the sample(s) 30 days from the sample receipt date.

We appreciate this opportunity to be of service and look forward to your continued patronage.

Sincerely,

Lorraine Olashaw (signature)	8.10.15	3
Lorraine Olashaw, Lab Director	Date	# of pages (excluding cover letter)

SAMPLE CONDITIONS PAGE

EAI ID#: **146403**

Client: **Maine Environmental Laboratory**

Client Designation: **SAM1933-15**

Temperature upon receipt (°C): 3.1 **Received on ice or cold packs (Yes/No): Y**

Acceptable temperature range (°C): 0-6

Lab ID	Sample ID	Date Received	Date Sampled	Sample Matrix	% Dry Weight	Exceptions/Comments (other than thermal preservation)
146403.01	B15-01	8/4/15	8/3/15	aqueous		Adheres to Sample Acceptance Policy

Samples were properly preserved and the pH measured when applicable unless otherwise noted. Analysis of solids for pH, Flashpoint, Ignitibility, Paint Filter, Corrosivity, Conductivity and Specific Gravity are reported on an "as received" basis.

Immediate analyses, pH, Total Residual Chlorine, Dissolved Oxygen and Sulfite, performed at the laboratory were run outside of the recommended 15 minute hold time.

All results contained in this report relate only to the above listed samples.

References include:

1) EPA 600/4-79-020, 1983

2) Standard Methods for Examination of Water and Wastewater,20th Edition, 1998 and 22nd Edition, 2012

3) Test Methods for Evaluating Solid Waste SW 846 3rd Edition including updates IVA and IVB

4) Hach Water Analysis Handbook, 2nd edition, 1992

LABORATORY REPORT

EAI ID#: **146403**

Client: **Maine Environmental Laboratory**
Client Designation: **SAM1933-15**

Client Sample ID: B15-01
Lab Sample ID: 146403.01
Matrix: aqueous
Date Sampled: 8/3/15
Date Received: 8/4/15

	Result	RL	Dilution Factor	Units	Date / Time Analyzed		Date Prepared	Method	Analyst
Nitrate-N	**0.8**	0.5	1	mg/L	8/4/15	15:33	8/4/15	300.0	KD

EAI

MAINE ENVIRONMENTAL LABORATORY- Chain of Custody

One Main Street Yarmouth, ME 04096-6716 Tel: (207) 846-6569 Fax: (207) 846-9066
Email: melab@mel-lab.com Web: MaineEnvironmentalLaboratory.com

FOR LAB USE ONLY: 146403

REPORT TO: J. Villinski
TELEPHONE:
EMAIL:
COMPANY:
BILL TO / PURCHASE ORDER #:
ADDRESS:
PROJECT NAME: SAM1933-15
SAMPLER NAME:

ANALYSES (Specify Method: RCRA, NPDES, DW) — DW circled

SAMPLE IDENTIFICATION	# CONTAINERS	TYPE OF CONTAINERS	FIELD FILTRATION YES	FIELD FILTRATION NO	SAMPLE TYPE	GRAB	COMP.	METHOD PRESERVED	SAMPLING DATE	SAMPLING TIME	Nitrate-N	LAB ID/SUBCONTRACTOR
815-01	1	P		X	GW	X		≤4°C	8/3/15	13:20	X	

Within Hold Time? ☐Yes ☐No ☐N/A
Good Condition? ☐Yes ☐No ☐N/A
Preserved? ☐Yes ☐No ☐N/A
Custody Seal? ☐Yes ☐No ☐N/A
Del. by:
Temp. °C

TURNAROUND REQUEST
~~Standard~~ 8/10
☒ Priority (SURCHARGE)
MEL3120101-35

REPORTING REQUIREMENTS?
☒ Standard Report
☐ ME DEP EDD
☐ DW Compliance (sent to State)
☐ CC Results to

COMMENTS
EPA 300.0 method
3.1°C

	DATE	TIME	
RELINQUISHED BY SAMPLER:			RECEIVED BY:
RELINQUISHED BY: [signature]	8-4-15	1115	RECEIVED BY: [signature]
RELINQUISHED BY: [signature]	8/4/15	12:57	RECEIVED BY LABORATORY: [signature]

COC 12414 It is the client's responsibility to check for accuracy prior to relinquishing samples. By executing this COC, the client has read and agrees to be bound by MEL's Terms & Conditions.

MAINE ENVIRONMENTAL LABORATORY- Chain of Custody

One Main Street Yarmouth, ME 04096-6716 Tel: (207) 846-6569 Fax: (207) 846-9066
Email: melab@mel-lab.com Web: MaineEnvironmentalLaboratory.com

REPORT TO: Andrew Gobeil
TELEPHONE: 207 829 5016
EMAIL: apg@smemaine.com
COMPANY: Sevee + Maher
BILL TO / PURCHASE ORDER #: 15087
ADDRESS: Po Box 85A Cumberland ME 04021
SAMPLER NAME: Andrew Gobeil
PROJECT NAME: North Yarmouth Memorial School

ANALYSES (Specify Method: RCRA, NPDES, DW, etc.)

FOR LAB USE ONLY
LABORATORY REPORT #: SAM1933-15

SAMPLE RECEIVING
Within Hold Time? ☒ Yes ☐ No ☐ N/A
Good Condition? ☒ Yes ☐ No ☐ N/A
Preserved? ☒ Yes ☐ No ☐ N/A
Custody Seal? ☒ Yes ☐ No ☐ N/A
Del. by: Andrew
Temp. °C: 4.0

SAMPLE IDENTIFICATION	# CONTAINERS	TYPE OF CONTAINERS	FIELD FILTRATION YES	FIELD FILTRATION NO	SAMPLE TYPE	GRAB	COMP.	METHOD PRESERVED	SAMPLING DATE	SAMPLING TIME	nitrate-nitrogen (NO3-N)	LAB ID/SUBCONTRACTOR
815-01	1	Pl		✓	GW	✓		ice	8/3/15	13:20	✓	~~-01~~ EAI KH 8/4/15

TURNAROUND REQUEST
☐ Standard
☒ Priority (SURCHARGE)
1 week TAT

REPORTING REQUIREMENTS?
☒ Standard Report
☐ ME DEP EDD
☐ DW Compliance (sent to State)
☐ CC Results to ________

COMMENTS
Nitrate-N subcontracted to EAI due to equipment malfunction. KH 8/4/15

	DATE	TIME	
RELINQUISHED BY SAMPLER: Andrew Gobeil	8/3/15	14:12	RECEIVED BY:
RELINQUISHED BY: [signature]			RECEIVED BY:
RELINQUISHED BY:	8/3/15	1412	RECEIVED BY LABORATORY: [signature]

Maine Environmental Laboratory

Report of Analyses

One Main Street Yarmouth, Maine 04096 Tel.: (207) 846-6569 Fax: (207) 846-9066 Email: melab@mel-lab.com

Andrew Gobeil
Sevee & Maher Engineers
4 Blanchard Road
Cumberland, Maine 04021

July 20, 2015

Report No.: SAM1929-15

Enclosed are the results of the analyses requested for your samples as received by the laboratory. Samples were received in acceptable condition and analyzed within method holding times. All quality control data was within laboratory acceptance limits unless noted. The Limit of Quantitation (LOQ) is the minimum level for reporting quantitative data. The Limit of Detection (LOD) is the minimum level for reporting estimated data. Data reported between the Limit of Quantitation and Limit of Detection are J flagged as estimated. Maine Environmental Laboratory is certified by Maine (cert. #2015007) and New Hampshire NELAP (NH ELAP) (cert. #2031). A list of certified parameters is available on request. The results reported herein conform to the most current NELAP standards where applicable unless otherwise narrated in this report. This report shall not be reproduced except in full without the written consent of the laboratory.

The complete report consists of the following sections:

- Maine Environmental Laboratory report
- Chain of Custody form

References

EPA - EPA600/4-79-020, Methods for Chemical Analysis of Water and Wastes, USEPA, Cincinnati, Ohio, March 1983.
EPA1 - EPA/600/R-93/100 Methods for the Determination of Inorganic Substances in Environmental Samples, Aug. 1993.
EPA2 - EPA/600R-94/111, Methods for the Determination of Metals in Environmental Samples, Supplement 1, May, 1994.
EPA3-EPA/600/R-06/115,Determination of Trace Elements in DW by Axially Viewed ICP-Atomic Emission Spectrometry,Rev 4.2 Oct. 2003
STM - Standard Methods for the Examination of Water and Wastewater, 18th edition, APHA,AWWA,WPCF, 1992.
SW8- SW846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, USEPA, third edition. Updates I-IV, 2007.
CLP - USEPA CLP Statement of Work for Inorganic Superfund Methods, ISM01.2, Exh. D, Sec. 1.6, Jan. 2010.
AST - ASTM D2974-87 Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Organic Soils.
HACH - Chemical Oxygen Demand, Method 8000, Hach Handbook of Water Analysis, Hach Chemical Company, 1979.
HEX - EPA-821-R-98-002, Method 1664, Rev. A: N-Hexane Extractable Material by Extraction and Gravimetry, Feb. 1999.
AOA - Official Methods of Analysis of the Association of Official Analytical Chemists, 14th edition, 1984.

Authorized signature Jacquelyn R. Villinski

Jacquelyn R. Villinski, Laboratory Director

Maine Environmental Laboratory

Report of Analyses

One Main Street Yarmouth, Maine 04096 Tel.:(207) 846-6569 Fax: (207) 846-9066 Email: melab@mel-lab.com

Andrew Gobeil
Sevee & Maher Engineers
4 Blanchard Road
Cumberland, Maine 04021

July 20, 2015

Report No:	SAM1929-15	Sampler:	A. Gobeil
Date received:	07/17/15	Sampling date & time:	07/17/15 - 1015
Project ID:	North Yarmouth Memorial School	Sample matrix:	GW - Grab
Laboratory ID:	SAM192915-01	Sample ID:	B-15-02

Parameter	Results	units	Date-Time Analyzed	LOD	LOQ	Method	Reference
Nitrate-N	0.9	mg/L	07/17/15-1128	0.1	0.3	300.0	EPA1

ND = not detected J = estimated B = detected in blank S = DLs increased due to sample matrix

MAINE ENVIRONMENTAL LABORATORY- Chain of Custody

One Main Street Yarmouth, ME 04096-6716 Tel: (207) 846-6569 Fax: (207) 846-9066
Email: melab@mel-lab.com Web: MaineEnvironmentalLaboratory.com

REPORT TO: Andrew Gobeil
TELEPHONE: 207 829 5016
EMAIL: apg@swemaine.com

COMPANY: Sevee & Maher
BILL TO / PURCHASE ORDER #:

ADDRESS: PO Box 85A Cumberland ME 04021

PROJECT NAME: North Yarmouth Memorial School
SAMPLER NAME: Andrew Gobeil

ANALYSES (Specify Method: RCRA, NPDES, DW, etc.)

SAMPLE IDENTIFICATION	# CONTAINERS	TYPE OF CONTAINERS	FIELD FILTRATION YES	FIELD FILTRATION NO	SAMPLE TYPE	GRAB	COMP.	METHOD PRESERVED	SAMPLING DATE	SAMPLING TIME	nitrate-nitrogen (NO3-N)	LAB ID/SUBCONTRACTOR
B-15-02	1	P		✓	GW	✓		ice	7/17/15	10:15	✓	

FOR LAB USE ONLY

LABORATORY REPORT #: SAM1929.15

SAMPLE RECEIVING
- Within Hold Time? ☒ Yes ☐ No ☐ N/A
- Good Condition? ☒ Yes ☐ No ☐ N/A
- Preserved? ☒ Yes ☐ No ☐ N/A
- Custody Seal? ☐ Yes ☒ No ☐ N/A
- Del. by: Andrew
- Temp. °C 2.0

TURNAROUND REQUEST
- ☐ Standard
- ☒ Priority (SURCHARGE) 1 week

REPORTING REQUIREMENTS?
- ☒ Standard Report
- ☐ ME DEP EDD
- ☐ DW Compliance (sent to State)
- ☐ CC Results to ______

COMMENTS

	DATE	TIME	
RELINQUISHED BY SAMPLER: Andrew Gobeil	7/17/15	10:42	RECEIVED BY:
RELINQUISHED BY:			RECEIVED BY:
RELINQUISHED BY:	7/17/15	10:47	RECEIVED BY LABORATORY: [signature]

Maine Environmental Laboratory

Report of Analyses

One Main Street Yarmouth, Maine 04096 Tel.: (207) 846-6569 Fax: (207) 846-9066 Email: melab@mel-lab.com

Andrew Gobeil
Sevee & Maher Engineers
4 Blanchard Road
Cumberland, Maine 04021

July 27, 2015

Report No.: SAM1932-15

Enclosed are the results of the analyses requested for your samples as received by the laboratory. Samples were received in acceptable condition and analyzed within method holding times. All quality control data was within laboratory acceptance limits unless noted. The Limit of Quantitation (LOQ) is the minimum level for reporting quantitative data. The Limit of Detection (LOD) is the minimum level for reporting estimated data. Data reported between the Limit of Quantitation and Limit of Detection are J flagged as estimated. Maine Environmental Laboratory is certified by Maine (cert. #2015007) and New Hampshire NELAP (NH ELAP) (cert. #2031). A list of certified parameters is available on request. The results reported herein conform to the most current NELAP standards where applicable unless otherwise narrated in this report. This report shall not be reproduced except in full without the written consent of the laboratory.

The complete report consists of the following sections:

- Maine Environmental Laboratory report
- Chain of Custody form

References

EPA - EPA600/4-79-020, Methods for Chemical Analysis of Water and Wastes, USEPA, Cincinnati, Ohio, March 1983.
EPA1 - EPA/600/R-93/100 Methods for the Determination of Inorganic Substances in Environmental Samples, Aug. 1993.
EPA2 - EPA/600R-94/111, Methods for the Determination of Metals in Environmental Samples, Supplement 1, May, 1994.
EPA3-EPA/600/R-06/115,Determination of Trace Elements in DW by Axially Viewed ICP-Atomic Emission Spectrometry,Rev 4.2 Oct. 2003
STM - Standard Methods for the Examination of Water and Wastewater, 18th edition, APHA,AWWA,WPCF, 1992.
SW8- SW846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, USEPA, third edition. Updates I-IV, 2007.
CLP - USEPA CLP Statement of Work for Inorganic Superfund Methods, ISM01.2, Exh. D, Sec. 1.6, Jan. 2010.
AST - ASTM D2974-87 Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Organic Soils.
HACH - Chemical Oxygen Demand, Method 8000, Hach Handbook of Water Analysis, Hach Chemical Company, 1979.
HEX - EPA-821-R-98-002, Method 1664, Rev. A: N-Hexane Extractable Material by Extraction and Gravimetry, Feb. 1999.
AOA - Official Methods of Analysis of the Association of Official Analytical Chemists, 14th edition, 1984.

Authorized signature Jacquelyn R. Villinski

Jacquelyn R. Villinski, Laboratory Director

Maine Environmental Laboratory

Report of Analyses

One Main Street Yarmouth, Maine 04096 Tel.:(207) 846-6569 Fax: (207) 846-9066 Email: melab@mel-lab.com

Andrew Gobeil
Sevee & Maher Engineers
4 Blanchard Road
Cumberland, Maine 04021

July 27, 2015

Report No:	SAM1932-15	Sampler:	A. Gobeil
Date received:	07/23/15	Sampling date & time:	07/23/15-1146
Project ID:	North Yarmouth Memorial School #15087	Sample matrix:	GW - Grab
Laboratory ID:	SAM193215-01	Sample ID:	B-15-05

Parameter	Results	units	Date-Time Analyzed	LOD	LOQ	Method	Reference
Nitrate-N	1.2	mg/L	07/24/15-0759	0.1	0.3	300.0	EPA1

SAM1932-15

CHAIN-OF-CUSTODY RECORD

PAGE ____ OF ____

SEVEE & MAHER ENGINEERS, INC. • P.O. BOX 85A • 4 BLANCHARD ROAD • CUMBERLAND CENTER, MAINE 04021 • (207)829-5016 • FAX (207)829-5692

CLIENT: Sevee & Maher
PROJECT NAME: North Yarmouth Memorial School
PROJECT/P.O. #: 15087
REPORT TO: Andrew Gobeil
ADDRESS: apg@smemaine.com
INVOICE TO: Peter Maher
ADDRESS: PO Box 85A Cumberland ME 04021
SAMPLED BY (PRINT): Andrew Gobeil
SAMPLER SIGNATURE: [signature]

FILTERED (Y/N): N
PRESERVED: ice
ANALYSIS REQUIRED: nitrate-nitrogen

LEGEND FOR PRESERVATIVE
1 — 4° CELSIUS
2 — HCL
3 — HNO_3
4 — H_2SO_4
5 — $Na_2SO_3 + H_2SO_4$
6 — NaOH

ITEM NO.	SAMPLE IDENTIFICATION	DATE	TIME	COMPOSITE OR GRAB	W-WATER L-LIQUID S-SOLID	TOTAL NUMBER OF CONTAINERS	nitrate-nitrogen								REMARKS	LAB SAMPLE #
1	B-15-05	7/23/15	11:46	Grab	W	1	✓								1 week TAT	-01
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14															Cooler temp = 3.7°C	
15																KH 7/23/15

RELINQUISHED BY:	DATE:	TIME:	RECEIVED BY:	DATE:	TIME:
Andrew Gobeil	7/23/15	13:10	L Hoppe	7/23/15	1310

D:\FORM\ACAD\SME11 REV.1/3/95

A CHAIN OF CUSTODY IS REQUESTED WITH EACH SET OF SAMPLES

MONITORING WELL SAMPLE PURGING FORM

SITE: North Yarmouth Memorial PROJECT NO: 15087 DATE: 8/3/2015

SAMPLE LOCATION: B15-01 WEATHER: sunny 70s

SAMPLE ID: NA START TIME: 12:30 END: 13:20

(DUPS) NA TRIP BLANK ID: NA

WELL DEPTH: 63.6 FT
(✓) TOP OF WELL pvc ( ) TOP OF CASING
( ) MEASURED ( ) HISTORICAL

WATER DEPTH: 51.92 FT
(✓) TOP OF WELL pvc ( ) TOP OF CASING
( ) MEASURED ( ) HISTORICAL

CONDITION OF WELL:
SURFACE SEAL: (✓) GOOD ( ) CRACKED
( ) OTHER:
PROTECTIVE CASING: (✓) LOCKED
( ) NO LOCK
( ) SECURE
( ) NEEDS REPAIR (ABLE TO MOVE)

TUBING INLET (TPVC) 60 ft
TUBING DIAMETER 3/8" (ID)
SCREENED INTERVAL (TPVC) 63.6 ft TO 48.6 ft

WELL: (✓) CAP ( ) NO CAP
WELL MATL: (✓) PVC ( ) SS ( ) OTHER:

PUMPING START TIME: 12:40 PUMPING END TIME: 13:20

EQUIPMENT DECONTAMINATION

PURGING	SAMPLING	
( )	( )	PERISTALTIC PUMP ISCO
( )	( )	PERISTALTIC PUMP GEOTECH
(✓)	(✓)	SUBMERSIBLE PUMP
( )	( )	BLADDER PUMP
( )	( )	AIR LIFT PUMP
( )	( )	BAILER I.D. ______
( )	( )	LDPE/SILICON TUBING
( )	( )	TEFLON/SILICON TUBING
( )	( )	IN-LINE FILTER
( )	( )	DEDICATED SIL. TUBING
( )	( )	DEDICATED POLY. TUBING

DECONTAMINATION FLUIDS USED

(✓) DISTILLED/DEIONIZED WATER
( ) TAP WATER
( ) NON-PHOSPHATE DETERGENT
( ) 10% NITRIC ACID
( ) HIGH-PRESSURE STEAM CLEAN
( ) ______

AMOUNT OF WATER CONTAINED IN DEDICATED SYSTEM:
AMOUNT OF WATER PURGED PRIOR TO GRAB SAMPLE COLLECTION:

NOTES: Instruments calibrated by TEW

SAMPLED BY: Andrew Gobeil

SME008.DOC
October 24, 1996

MONITORING WELL SAMPLE PURGING FORM - PART II

SITE: North Yarmouth Memorial

DATE: 8/3/15

SAMPLE LOCATION: B15-01

ORP OFFSET: NA mV

Elapsed Time (min)	Liters Pumped	Flow Rate (ml/min)	WL TPVC (ft)	WL Top of Casing (ft)	Turb NTU (1)	pH (2)	Spec Cond µS/cm @ 25C (3)	Temp °C (4)	DO mg/L (5)	ORP (6)	Comments
Unit ID Number:											
Model ID :					lamotte	oakton pH 11 Series	oakton con 6 Acorn	oakton pH 11 series	Chemets R-7512		
10		2,600	53.92		14.5	5.42	187.1	12.1	5.5		
20		↓	53.83		6.33	5.58	212	12.2	6		
25		↓	53.58		4.94	5.58	211	12.3	6		
30		1,100	53.12		5.59	5.62	211	13.3	6		Flow reduced
35		↓	53.12		5.11	5.64	212	13.4	6		
40		↓	53.12		5.72	5.64	211	13.4	6		

NOTES:

(1) TURBIDITY (NTU)
(2) pH (STD UNITS)
(3) SPECIFIC CONDUCTANCE (umhos/cm @25C)
(4) TEMPERATURE (C)
(5) DISSOLVED OXYGEN (ppm)
(6) UNADJUSTED OXIDATION REDUCTION POTENTIAL (+- mV)

MONITORING WELL SAMPLE PURGING FORM

SITE: North Yarmouth Memorial PROJECT NO: 15087 DATE: 7/17/15

SAMPLE LOCATION: B15-02 WEATHER: 60s, sunny

SAMPLE ID: NA START TIME: 09:30 END: 10:15

(DUPS) NA TRIP BLANK ID: NA

WELL DEPTH: 55.4 FT
(✓) TOP OF WELL pvc ( ) TOP OF CASING
( ) MEASURED ( ) HISTORICAL

WATER DEPTH: 47.12 FT
(✓) TOP OF WELL pvc ( ) TOP OF CASING
( ) MEASURED ( ) HISTORICAL

CONDITION OF WELL:
SURFACE SEAL: (✓) GOOD ( ) CRACKED
( ) OTHER:
PROTECTIVE CASING: (✓) LOCKED
( ) NO LOCK
( ) SECURE
( ) NEEDS REPAIR (ABLE TO MOVE)

TUBING INLET (TPVC) 50 ft
TUBING DIAMETER 3/8" (ID)
SCREENED INTERVAL (TPVC) 55.4 ft TO 40.4 ft

WELL: (✓) CAP ( ) NO CAP
WELL MATL: (✓) PVC ( ) SS ( ) OTHER:

PUMPING START TIME: 09:37 PUMPING END TIME: 10:15

EQUIPMENT DECONTAMINATION

PURGING	SAMPLING	
( )	( )	PERISTALTIC PUMP ISCO
( )	( )	PERISTALTIC PUMP GEOTECH
(✓)	(✓)	SUBMERSIBLE PUMP
( )	( )	BLADDER PUMP
( )	( )	AIR LIFT PUMP
( )	( )	BAILER I.D. ______
( )	( )	LDPE/SILICON TUBING
( )	( )	TEFLON/SILICON TUBING
( )	( )	IN-LINE FILTER
( )	( )	DEDICATED SIL. TUBING
( )	( )	DEDICATED POLY. TUBING

DECONTAMINATION FLUIDS USED

(✓) DISTILLED/DEIONIZED WATER
( ) TAP WATER
( ) NON-PHOSPHATE DETERGENT
( ) 10% NITRIC ACID
( ) HIGH-PRESSURE STEAM CLEAN
( ) ______

AMOUNT OF WATER CONTAINED IN DEDICATED SYSTEM: ______
AMOUNT OF WATER PURGED PRIOR TO GRAB SAMPLE COLLECTION: ______

NOTES: ______

SAMPLED BY: Andrew Gobeil

MONITORING WELL SAMPLE PURGING FORM - PART II

SITE: North Yarmouth Memorial DATE: 7/17/15

SAMPLE LOCATION: B15-02 ORP OFFSET: NA mV

Elapsed Time (min)	Liters Pumped	Flow Rate (ml/min)	WL TPVC (ft)	WL Top of Casing (ft)	Turb NTU (1)	pH (2)	Spec Cond μS/cm @ 25°C (3)	Temp °C (4)	DO mg/L (5)	ORP (6)	Comments
Unit ID Number:											
Model ID :					lamotte	ysi pro plus	ysi pro plus	ysi pro plus	ysi pro plus		
13		2500	47.56		11.77	7.34	233.2	11.5	4.80		
18		↓	47.56		5.94	6.83	232.9	11.6	4.69		
23			47.56		3.43	6.71	233.7	11.3	4.65		
28			47.56		2.73	6.68	233.6	11.5	4.63		
32			47.56		2.63	6.66	234.2	11.4	4.61		
37			47.56		3.00	6.64	234.0	11.5	4.61		

NOTES:

(1) TURBIDITY (NTU)
(2) pH (STD UNITS)
(3) SPECIFIC CONDUCTANCE (umhos/cm @25C)
(4) TEMPERATURE (C)
(5) DISSOLVED OXYGEN (ppm)
(6) UNADJUSTED OXIDATION REDUCTION POTENTIAL (+- mV)

MONITORING WELL SAMPLE PURGING FORM

SITE: North Yarmouth Memorial PROJECT NO: 15087 DATE: 7/23/15

SAMPLE LOCATION: B15-05 WEATHER: 60s sunny

SAMPLE ID: NA START TIME: 10:50 END: 11:46

(DUPS) NA TRIP BLANK ID: NA

WELL DEPTH: 75.5 FT
(✓) TOP OF WELL pvc ( ) TOP OF CASING
( ) MEASURED ( ) HISTORICAL

WATER DEPTH: 65.97 FT
(✓) TOP OF WELL pvc ( ) TOP OF CASING
( ) MEASURED ( ) HISTORICAL

CONDITION OF WELL:
SURFACE SEAL: (✓) GOOD ( ) CRACKED
( ) OTHER: ______
PROTECTIVE CASING: (✓) LOCKED
( ) NO LOCK
( ) SECURE
( ) NEEDS REPAIR (ABLE TO MOVE)

TUBING INLET (TPVC) 61 ft
TUBING DIAMETER 3/8" (ID)
SCREENED INTERVAL (TPVC) 75.5 ft TO 60.5 ft

WELL: (✓) CAP ( ) NO CAP
WELL MATL: (✓) PVC ( ) SS ( ) OTHER: ______

PUMPING START TIME: 11:16 PUMPING END TIME: 11:46

EQUIPMENT DECONTAMINATION

PURGING	SAMPLING	
( )	( )	PERISTALTIC PUMP ISCO
( )	( )	PERISTALTIC PUMP GEOTECH
(✓)	(✓)	SUBMERSIBLE PUMP
( )	( )	BLADDER PUMP
( )	( )	AIR LIFT PUMP
( )	( )	BAILER I.D. ______
( )	( )	LDPE/SILICON TUBING
( )	( )	TEFLON/SILICON TUBING
( )	( )	IN-LINE FILTER
( )	( )	DEDICATED SIL. TUBING
( )	( )	DEDICATED POLY. TUBING

DECONTAMINATION FLUIDS USED

(✓) DISTILLED/DEIONIZED WATER
( ) TAP WATER
( ) NON-PHOSPHATE DETERGENT
( ) 10% NITRIC ACID
( ) HIGH-PRESSURE STEAM CLEAN
( ) ______

AMOUNT OF WATER CONTAINED IN DEDICATED SYSTEM: ______
AMOUNT OF WATER PURGED PRIOR TO GRAB SAMPLE COLLECTION: ______

NOTES: ______

SAMPLED BY: Andrew Gobeil

MONITORING WELL SAMPLE PURGING FORM - PART II

SITE: North Yarmouth Memorial DATE: 9/23/15

SAMPLE LOCATION: B15-05 ORP OFFSET: NA mV

Elapsed Time (min)	Liters Pumped	Flow Rate (ml/min)	WL TPVC (ft)	WL Top of Casing (ft)	Turb NTU (1)	pH (2)	Spec Cond µS/cm @ 25°C (3)	Temp °C (4)	DO mg/L (5)	ORP (6)	Comments
Unit ID Number:											
Model ID :					lamotte	ysi pro plus	ysi pro plus	ysi pro plus	ysi pro plus		
2		1500			1919	8.06	283.5	13.1	10.88		
5		↓			121	7.47	281.8	13.1	10.06		
10					22.4	6.97	278.2	12.9	9.78		
15					16.4	6.88	274.5	12.9	9.78		
20					4.43	6.88	272.5	12.9	9.59		
25					1.89	6.86	270.1	12.9	9.49		
30		↓			3.07	6.84	267.8	12.8	9.42		

NOTES:

(1) TURBIDITY (NTU)
(2) pH (STD UNITS)
(3) SPECIFIC CONDUCTANCE (umhos/cm @25C)
(4) TEMPERATURE (C)
(5) DISSOLVED OXYGEN (ppm)
(6) UNADJUSTED OXIDATION REDUCTION POTENTIAL (+- mV)

FIELD INSTRUMENT CALIBRATION
DAILY OPERATING LOG

CLIENT: NYMS

DATE/TIME: 7-16-15 1000

PROJECT SITE:

JOB NUMBER:

Meter Set	INSTRUMENT	MODEL ID NUMBER	UNIT ID NUMBER	STANDARD(S) USED FOR CALIBRATION*[1]	WAS CALIBRATION SUCCESSFULLY COMPLETED? (IF YES, PLACE ✔ IN APPROPRIATE AREA) (For ORP, Place Results Of Calibration In Appropriate Box)		MIDDAY STANDARD(S) CHECK*[1] (Check off Appropriate Standard if Meter is in Calibration) Standard	Reading	OPERATOR INITIALS
A	pH	YSI PRO PLUS	SME001	4.01 7.00 ___	4 ✓ reading 4.04 7 ✓ reading 6.99 10___ reading___		___ ___ ___	___ ___ ___	A.G.
	Specific Conductivity	YSI PRO PLUS	SME001	445 Microsiemens	✓ reading 445.3		___ Microsiemens	___	↓
	DO	YSI PRO PLUS	SME001	✓ 100% ✓ ZERO	✓ 100% reading 100.6 ✓ ZERO reading 0.05		100%	___	
	ORP	YSI PRO PLUS	SME001	240 Mv ORP Solution	✓ 240 Mv	Reading 240.1	240 Mv ORP	___	
	Turbidity	LaMotte 2020we	Box: G	✓ 1.0 NTU ___10 NTU	1.0 reading	___reading	___1 NTU ___10 NTU	___1 NTU ___10 NTU	
B	pH	YSI PRO PLUS	SME002	___ ___ ___	4___ reading___ 7___ reading___ 10___ reading___		___ ___ ___	___ ___ ___	
	Specific Conductivity	YSI PRO PLUS	SME002	___ Microsiemens	___ reading___		___ Microsiemens	___	
	DO	YSI PRO PLUS	SME002	___ 100% ___ ZERO	___100% reading___ ___ZERO reading___		100%	___	
	ORP	YSI PRO PLUS	SME002	240 Mv ORP Solution	___240 Mv	Reading___	240 Mv ORP	___	
	Turbidity	LaMotte 2020we	Box:	___1.0 NTU ___10 NTU	___reading	___reading	___1 NTU ___10 NTU	___1 NTU ___10 NTU	

*[1] Calibration of meters is completed once daily before work starts – a standards check for pH, conductivity and turbidity should be completed midway through each day or if a particular field value falls outside of historic ranges.

ADDITIONAL NOTES:

FIELD INSTRUMENT CALIBRATION
DAILY OPERATING LOG

CLIENT: NYMS | DATE/TIME: 7/23/15

PROJECT SITE: | JOB NUMBER:

Meter Set	INSTRUMENT	MODEL ID NUMBER	UNIT ID NUMBER	STANDARD(S) USED FOR CALIBRATION*[1]	WAS CALIBRATION SUCCESSFULLY COMPLETED? (IF YES, PLACE ✔ IN APPROPRIATE AREA) (For ORP, Place Results Of Calibration In Appropriate Box)		MIDDAY STANDARD(S) CHECK*[1] (Check off Appropriate Standard if Meter is in Calibration		OPERATOR INITIALS
							Standard	Reading	
A	pH	YSI PRO PLUS	SME001	___ ___ ___	4___ reading___ 7___ reading___ 10___ reading___		___ ___ ___	___ ___ ___	
	Specific Conductivity	YSI PRO PLUS	SME001	___ Microsiemens	___ reading___		___ Microsiemens	___	
	DO	YSI PRO PLUS	SME001	___ 100% ___ ZERO	___100% reading___ ___ZERO reading___		100%	___	
	ORP	YSI PRO PLUS	SME001	240 Mv ORP Solution	___240 Mv	Reading___	240 Mv ORP	___	
	Turbidity	LaMotte 2020we	Box:	___1.0 NTU ___10 NTU	___reading	___reading	___1 NTU ___10 NTU	___1 NTU ___10 NTU	
B	pH	YSI PRO PLUS	SME002	4.01 7.00 ___	4___ reading 4.01 7___ reading 7.02 10___ reading___		___ ___ ___	___ ___ ___	A.G.
	Specific Conductivity	YSI PRO PLUS	SME002	445 Microsiemens	___ reading 447		___ Microsiemens	___	↓
	DO	YSI PRO PLUS	SME002	✓ 100% ___ ZERO	___100% reading 104% ___ZERO reading___		100%	___	↓
	ORP	YSI PRO PLUS	SME002	240 Mv ORP Solution	___240 Mv	Reading___	240 Mv ORP	___	↓
	Turbidity	LaMotte 2020we	Box: G	✓1.0 NTU ___10 NTU	1.0 reading	___reading	___1 NTU ___10 NTU	___1 NTU ___10 NTU	↓

*[1] Calibration of meters is completed once daily before work starts – a standards check for pH, conductivity and turbidity should be completed midway through each day or if a particular field value falls outside of historic ranges.

ADDITIONAL NOTES:

MAINE ENVIRONMENTAL LABORATORY- Chain of Custody

One Main Street Yarmouth, ME 04096-6716 Tel: (207) 846-6569 Fax: (207) 846-9066
Email: melab@mel-lab.com Web: MaineEnvironmentalLaboratory.com

REPORT TO: Andrew Gobeil
TELEPHONE: 207 829 5016
EMAIL: apg@smemaine.com
COMPANY: Sevee + Maher
BILL TO / PURCHASE ORDER #: 15087
ADDRESS: PO Box 85A Cumberland ME 04021 Andrew Gobeil
PROJECT NAME: North Yarmouth Memorial School
SAMPLER NAME:

ANALYSES (Specify Method: RCRA, NPDES, DW, etc.)

FOR LAB USE ONLY
LABORATORY REPORT #

SAMPLE RECEIVING
Within Hold Time? ☒ Yes ☐ No ☐ N/A
Good Condition? ☒ Yes ☐ No ☐ N/A
Preserved? ☒ Yes ☐ No ☐ N/A
Custody Seal? ☒ Yes ☐ No ☐ N/A
Del. by: Andrew
Temp. °C 4.0

SAMPLE IDENTIFICATION	# CONTAINERS	TYPE OF CONTAINERS	FIELD FILTRATION YES	FIELD FILTRATION NO	SAMPLE TYPE	GRAB	COMP.	METHOD PRESERVED	SAMPLING DATE	SAMPLING TIME	nitrate-nitrogen (NO3-N)									LAB ID/SUBCONTRACTOR
B15-01	1	Pl		✓	GW	✓		ice	8/3/15	13:20	✓									

TURNAROUND REQUEST
☐ Standard
☒ Priority (SURCHARGE)
1 week TAT

REPORTING REQUIREMENTS?
☒ Standard Report
☐ ME DEP EDD
☐ DW Compliance (sent to State)
☐ CC Results to ______

COMMENTS

	DATE	TIME	
RELINQUISHED BY SAMPLER: Andrew Gobeil	8/3/15	14:12	RECEIVED BY:
RELINQUISHED BY: [signature]	DATE	TIME	RECEIVED BY:
RELINQUISHED BY:	8/3/15	1412	RECEIVED BY LABORATORY: [signature]

COC 12414 **It is the client's responsibility to check for accuracy prior to relinquishing samples. By executing this COC, the client has read and agrees to be bound by MEL's Terms & Conditions.** page _____ of _____

MAINE ENVIRONMENTAL LABORATORY- Chain of Custody

One Main Street Yarmouth, ME 04096-6716 Tel: (207) 846-6569 Fax: (207) 846-9066
Email: melab@mel-lab.com Web: MaineEnvironmentalLaboratory.com

REPORT TO: Andrew Gobeil
TELEPHONE: 207 629 5016
EMAIL: apg@smemaine.com
COMPANY: Sevee & Maher
BILL TO / PURCHASE ORDER #:
ADDRESS: PO Box 85A Cumberland ME 04021
PROJECT NAME: North Yarmouth Memorial School
SAMPLER NAME: Andrew Gobeil

SAMPLE IDENTIFICATION	# CONTAINERS	TYPE OF CONTAINERS	FIELD FILTRATION YES	FIELD FILTRATION NO	SAMPLE TYPE	GRAB	COMP.	METHOD PRESERVED	SAMPLING DATE	SAMPLING TIME	ANALYSES: Nitrate-nitrogen (NO3-N)									
B-15-02	1	P		✓	GW	✓		ice	7/17/15	10:15	✓									

ANALYSES (Specify Method: RCRA, NPDES, DW, etc.)

FOR LAB USE ONLY
LABORATORY REPORT #

SAMPLE RECEIVING
Within Hold Time? ☒ Yes ☐ No ☐ N/A
Good Condition? ☒ Yes ☐ No ☐ N/A
Preserved? ☒ Yes ☐ No ☐ N/A
Custody Seal? ☐ Yes ☒ No ☐ N/A
Del. by: Andrew
Temp. °C 2.0

LAB ID/SUBCONTRACTOR

TURNAROUND REQUEST
☐ Standard
☒ Priority (SURCHARGE)
1 week

REPORTING REQUIREMENTS?
☒ Standard Report
☐ ME DEP EDD
☐ DW Compliance (sent to State)
☐ CC Results to ________

COMMENTS

	DATE	TIME	
RELINQUISHED BY SAMPLER: Andrew Gobeil	7/17/15	10:42	RECEIVED BY:
RELINQUISHED BY:			RECEIVED BY:
RELINQUISHED BY:	7/17/15	1042	RECEIVED BY LABORATORY: [signature]

CHAIN-OF-CUSTODY RECORD

PAGE ____ OF ____

SEVEE & MAHER ENGINEERS, INC. • P.O. BOX 85A • 4 BLANCHARD ROAD • CUMBERLAND CENTER, MAINE 04021 • (207)829-5016 • FAX (207)829-5692

CLIENT: Sevee & Maher

REPORT TO: Andrew Gobeil

INVOICE TO: Peter Maher

SAMPLED BY: (PRINT) Andrew Gobeil

PROJECT NAME: North Yarmouth Memorial School

PROJECT/ P.O. #: 15087

ADDRESS: apg@smemaine.com

ADDRESS: PO Box 85A Cumberland ME 04021

SAMPLER SIGNATURE: [signature]

FILTERED (Y/N): N

PRESERVED: ice

ANALYSIS REQUIRED: nitrate-nitrogen

LEGEND FOR PRESERVATIVE
1 – 4° CELSIUS
2 – HCL
3 – HNO_3
4 – H_2SO_4
5 – $Na_2SO_3 + H_2SO_4$
6 – NaOH

ITEM NO.	SAMPLE IDENTIFICATION	DATE	TIME	COMPOSITE OR GRAB	W-WATER L-LIQUID S-SOLID	TOTAL NUMBER OF CONTAINERS	nitrate-nitrogen								REMARKS	LAB SAMPLE #
1	B-15-05	7/23/15	11:46	Grab	W	1	✓								1 week TAT	
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14															cooler temp = 3.7°C	
15															KH 7/23/15	

RELINQUISHED BY: Andrew Gobeil	DATE: 7/23/15	TIME: 13:10	RECEIVED BY: K Hopper	DATE: 7/23/15	TIME: 1310
RELINQUISHED BY:	DATE:	TIME:	RECEIVED BY:	DATE:	TIME:
RELINQUISHED BY:	DATE:	TIME:	RECEIVED BY:	DATE:	TIME:

D:\FORM\ACAD\SME11 REV.1/3/95

A CHAIN OF CUSTODY IS REQUESTED WITH EACH SET OF SAMPLES