
DIRIGO ENGINEERING

2 Dirigo Drive Fairfield, Maine 04937 (207) 453-2401 Fax: (207) 453-2405

#54701

August 13, 2021

Planning Board
Town of Rockport, Maine
101 Main Street
Rockport, ME 04856

RE: Hydrogeologic Study

Dear Planning Board Members:

This letter report provides information related to groundwater and septic system impacts related to a proposed 3-lot subdivision in Rockport, Maine titled "M. Richardson Subdivision, Terrier Circle, Rockport, Maine". The analysis concludes that there is sufficient water of good quality available on the proposed lots to support single family residential housing. The analysis also indicated that there is sufficient land area on each lot to provide for subsurface waste disposal without impacting on-site or off-site wells.

Soils

The map provided in Appendix A shows basic soils types on the proposed subdivision. The soils are Lyman-Rock outcrop-Turnbridge complex with 8-15% slopes. These soils are generally described as ablation glacial till derived loam and sandy loam soils. Within this unit, Lyman soils are estimated to cover 39% of the area, Rock outcrop, 26% of the area and Turnbridge and other minor soil types cover 35% of the area. Lyman soils are hydrologic soil group D and Turnbridge soils are hydrologic soil group C.

Test pits (Appendix A) completed by Robert Gilchrist indicate sandy loam soils with bedrock at 24 to 28-inches, indicating Turnbridge type soils in the septic system locations.

Bedrock

The bedrock underlying the site is mapped as Ordovician age Benner Formation. This rock unit is described as a well bedded, medium gray color quartz biotite schist with thin garnet bearing quartzite beds.

Existing Wells in Area

The Maine Geological Survey (MGS) database was searched for existing wells in the vicinity. Records for 16 wells in the adjacent subdivision are available from this database. Pertinent details are summarized in Table 1.

Table 1 – Existing Wells from MGS Database						
Address	Driller	Drilled For:	Date	Depth (ft)	Yield (gpm)	Bedrock Depth
8 Wellington Dr.	Hatch	Catell	1997	320	2	10
30 Wellington Dr.	Cross	-	2003	175	40	7
3 Lexington Lane	Hatch	Brown	2003	420	3	-
2 Lexington Lane	Knowlton	Pease, Jr.	1995	280	4	20
Lot # 1	Knowlton	Mank	2005	225	10	8
Bayridge	Knowlton	Nightingale	1988	240	4	1
Bayridge	Knowlton	Nightingale	11996	300	10	5
Bayridge off Old County Road	Hatch	Catell	1999	220	30	30
Bayridge Drive	Knowlton	Nightingale	1987	120	15	10
Bayridge Dev.	Knowlton	Nightingale	1994	160	6	30
Bayridge Dev.	Knowlton		1998	440	1.5	10
Bayridge Dev.	Knowlton	Pendleton	1998	300	8	10
Bayridge Dev.	Knowlton	Nightingale	1995	260	3	5
Bayridge Dev.	Knowlton	Nightingale	1995	460	1	5
Bay Ridge	Hatch	Pease	2007	300	8	18
21 Bristol Dr.	Reilly	Chrissenger	2002	320	15	2
Averages				284	10	12

The data in Table 1 indicate that there is sufficient groundwater in this area to provide the necessary amount of water to single family residences in the proposed subdivision. On average, a homeowner can expect to drill about 300 feet deep and obtain 10 gpm. A typical three bedroom home is expected to use 270 gallons per day, or less than 0.2 gpm.

Further evidence of the suitability of the area for wells for domestic use is provided in correspondence from several adjacent property owners or persons who are familiar with the water systems. These include statements from:

- Harlan Pease, Jr. of 9 Wellington Drive
- Tom Jurewitz of 8 Fiddlewood Lane
- Deborah and Richard Wong of 3 Wellington Drive
- Marc Stevens, Hatch Well Drilling
- Barb and Leon Bausch of 37 Asley Terrace
- David A. Theriault of 1 Wellington Drive

All these people indicate that there is sufficient groundwater beneath their properties to meet their needs. The correspondence is attached in Appendix 2.

Well Sustainability

Wells are primarily sustained by groundwater recharge from precipitation and snow melt. The smallest lot in the proposed subdivision is 2.04 acres. Assuming that all soils are hydrologic soil group D (least permeable) and knowing the average annual rainfall, we can calculate the amount of groundwater recharge on an individual lot. With 50 inches of annual precipitation and an infiltration rate of 16% of annual precipitation, the smallest lot will receive an average of 1,214 gallons per day of recharge. Under drought conditions, this could be reduced by 40% to 728 gallons per day. As indicated previously, a 3-bedroom home is expected to use 270 gpd which is less than half of the available recharge during a drought. This analysis indicates that the proposed lot sizes are large enough to supply the on-site needs without affecting water levels on any neighboring properties. Calculations are attached in Appendix 3.

Water Quality

The Maine Environment Public Health Tracking Program maintains a database of private well water quality results for several common well water analytes including;

- Arsenic
- Flouride
- Manganese
- Nitrate
- Nitrite
- Uranium

Individual data is not available, but town wide data is. The data available for Rockport is summarized in Table 2.

Table 2. Well Water Quality for Rockland, Maine			
Analyte	Limit	# of Wells Tested	% of Wells Above Limits
Arsenic	10 ug/l	58	31
Fluoride	4 mg/l	75	0
Manganese	0.05 mg/l ¹	49	14.3
Nitrate	10 mg/l	76	0
Nitrite	1 mg/l	76	0
Uranium	30 ug/l	39	0

¹Secondary Standard for aesthetic reasons

The data indicate that arsenic and manganese are potential concerns. In addition, iron is also prevalent in bedrock wells in Maine. Iron and manganese can readily be removed using ion exchange treatment units (softeners) or by oxidation followed by filtration. Arsenic is also commonly removed in Maine using adsorptive filter media or oxidation and co-precipitation with iron, followed by filtration. The water quality in the proposed subdivision will be suitable for domestic use with readily available, proven treatment, if needed.

Nitrate Impact Assessment

Nitrate impact assessments are generally not required for single family lots that are two acres or greater in size because mass balance calculations indicate that on lots of this size or greater, there is sufficient land area to disperse and attenuate subsurface effluent without creating impacts to on-site or adjacent wells. However, we have prepared an analysis that indicates that nitrate concentration from septic systems will not exceed 5 mg/l (1/2 the 10 mg/l standard) at the project boundaries.

Methodology

We used the Quick Domenico Groundwater Fate-and Transport Model to estimate the dimensions of groundwater nitrate plumes emanating from proposed septic systems on the subdivision lots. This is a 3 dimensional analytical model based on Domenico's (1987) solution to the three-dimensional differential equation for solute transport in a saturated porous medium with uniform steady state flow, one dimensional advection, three dimensional dispersion, adsorption and first order decay. We treated nitrate as a conservative solute with no adsorption or decay.

We first estimated the mass of nitrate in the groundwater emanating from the septic system (40 ppm N x 270 GPD), the mass of nitrate from precipitation (0.5 ppm N x amount of precipitation infiltrating bed) and the mass of nitrate from groundwater underflow (1 ppm N x amount of groundwater underflow).

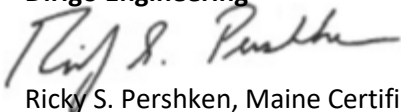
The resulting concentration data was entered in the model and used to develop nitrate concentration plume for each proposed septic system. The model was run to steady state conditions and the 5 mg/l concentration nitrate plume was then drawn on the map that is attached in Appendix 4. The analysis indicates that there is no concern for on-site or offsite contamination of wells if proposed wells are located at least 100 feet from septic disposal fields (required by State Law) and are not within the 5 mg/l nitrate plumes. We always recommend that wells be located uphill of septic fields for additional protection. Model documentation can be found in Appendix 5.

Conclusion

This analysis indicates that the proposed subdivision lots are suitable for both residential water needs from groundwater and subsurface waste disposal needs without creating any negative on-site or off-site effects. The analysis was done for three bedroom homes, but the data indicate that these lots could also support 4 or even 5 bedroom homes.

Sincerely;

Dirigo Engineering



Ricky S. Pershken, Maine Certified Geologist #303



Encl.

CC: R. Nightingale, M. Ingraham, III

References

User's Manual for the Quick Domenico Groundwater Fate-and-Transport Model (2014), Pennsylvania Department of Environmental Protection, Harrisburg, PA

Nitrate-Nitrogen Impact Analysis for Engineered Systems, Maine Department of Health and Human Services, Bureau of Health, Division of Health Engineering Wastewater and Plumbing Control Program, Augusta, ME

Private Well Water Database, Maine Department of Health and Human Services, Maine Environment Public Health Tracking Program, Maine Center for Disease Control and Prevention, Augusta, ME

Maine Geological Survey, Water Well Database, Augusta, ME 04333

Osberg and others (2020), Bedrock Geologic Map of the Camden Quadrangle, Maine. Maine Geological Survey, Augusta, ME

USDA Web Soil Survey, US Department of Agriculture, Washington, DC

Appendix 1 – Soil Information

Soil Map—Knox and Lincoln Counties, Maine



Soil Map may not be valid at this scale.

Map Scale: 1:6,000 if printed on A portrait (8.5" x 11") sheet.

0 50 100 200 300 Meters

0 250 500 1000 1500 Feet

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








































Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

8/10/2021
Page 1 of 3

MAP LEGEND

-  Area of Interest (AOI)
-  Area of Interest (AOI)
- Soils**
-  Soil Map Unit Polygons
-  Soil Map Unit Lines
-  Soil Map Unit Points
- Special Point Features**
-  Blowout
-  Borrow Pit
-  Clay Spot
-  Closed Depression
-  Gravel Pit
-  Gravelly Spot
-  Landfill
-  Lava Flow
-  Marsh or swamp
-  Mine or Quarry
-  Miscellaneous Water
-  Perennial Water
-  Rock Outcrop
-  Saline Spot
-  Sandy Spot
-  Severely Eroded Spot
-  Sinkhole
-  Slide or Slip
-  Sodic Spot
-  Spoil Area
-  Stony Spot
-  Very Stony Spot
-  Wet Spot
-  Other
-  Special Line Features
- Water Features**
-  Streams and Canals
- Transportation**
-  Rails
-  Interstate Highways
-  US Routes
-  Major Roads
-  Local Roads
- Background**
-  Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

Source of Map: Natural Resources Conservation Service
 Web Soil Survey URL:
 Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Knox and Lincoln Counties, Maine
 Survey Area Data: Version 20, May 29, 2020

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

Date(s) aerial images were photographed: Dec 31, 2009—Nov 1, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BtB	Brayton fine sandy loam, 0 to 8 percent slopes, very stony	0.4	1.3%
LmB	Lyman-Brayton variant-Rock outcrop complex, 0 to 8 percent slopes	0.1	0.2%
LrB	Lyman-Rock outcrop-Tunbridge complex, 0 to 8 percent slopes	1.2	3.6%
LrC	Lyman-Rock outcrop-Tunbridge complex, 8 to 15 percent slopes	16.5	49.3%
Na	Naumburg loamy sand	1.7	5.2%
PbB	Peru fine sandy loam, 0 to 8 percent slopes, very stony	1.9	5.7%
StB	Sheepscot fine sandy loam, 0 to 8 percent slopes	4.1	12.2%
TrC	Tunbridge-Lyman complex, 8 to 15 percent slopes, rocky	2.3	7.0%
TrD	Tunbridge-Lyman complex, 15 to 25 percent slopes, rocky	5.2	15.5%
Totals for Area of Interest		33.5	100.0%

Robert Gilchrist
Soil Tests &
Site Evaluations

755 SANDY RIVER ROAD
NORRIDGEWOCK, ME. 04957
Oh. 634-5214

May 9, 2021

Mr. Mark Ingraham III
Ingraham Land Consulting Inc.
1 Fiske Lane
Rockport, Me. 04856

RE: Proposed Subdivision, Terrier Circle, Rockport Maine, Preliminary Soils Investigation

Dear Mark,

I have recently completed a preliminary soils investigation on property owned by M. Richardson LLC. off Terrier Circle in Rockport. The purpose of this investigation was to determine soil suitability for on site wastewater disposal. You propose subdividing the property into four lots. The lots would be limited to single family residential use and are proposed to utilize on site sewer and water to service the proposed lots. The lots range in size from 2.1 acres to 6.7 acres. The total area proposed to be subdivided encompasses approximately 14 acres. The property is wooded and slopes moderately to the southeast toward Old County Road. Observation holes were excavated on each lot using a spade and auger and were located by your firm.

All proposed lots tested exceed the minimum requirements of the Maine subsurface wastewater disposal rules (Rules) as it relates to conditions required for first time systems, based on single family residential detached housing. Test Pit locations are shown on the plan titled Preliminary Plan of Proposed Subdivision by Ingraham Land Consulting Inc.. Soil logs for each of the observation holes are attached for your use and reference. Other locations on each lot are suitable and the eventual homeowner will have to undertake another evaluation for actual construction.

Soils on the property are characterized as a glacial till requiring a medium large disposal field size by the Rules. Bedrock outcrops are observed locally and in some cases are the limiting factor for disposal field installation. All areas tested were moderately well drained and have adequate area to support residential waste water disposal systems.

Please call if you or anyone else has any questions regarding this and let me know if I can be of further assistance.

Sincerely,



Robert Gilchrist
Site Evaluator #288

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

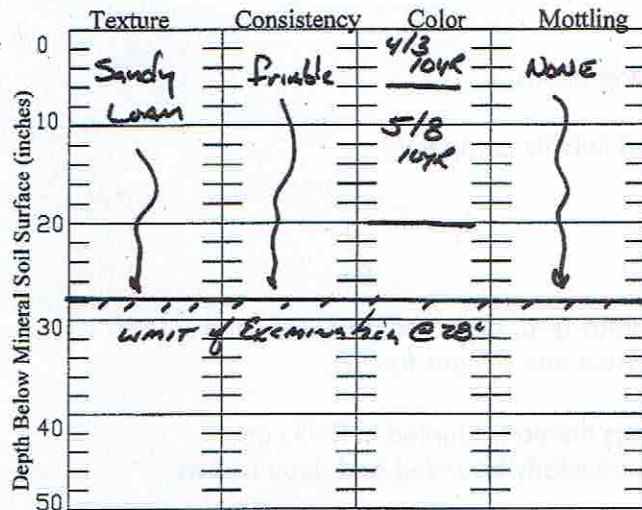
Rockport

Terrier Circle

M. Richardson LLC.

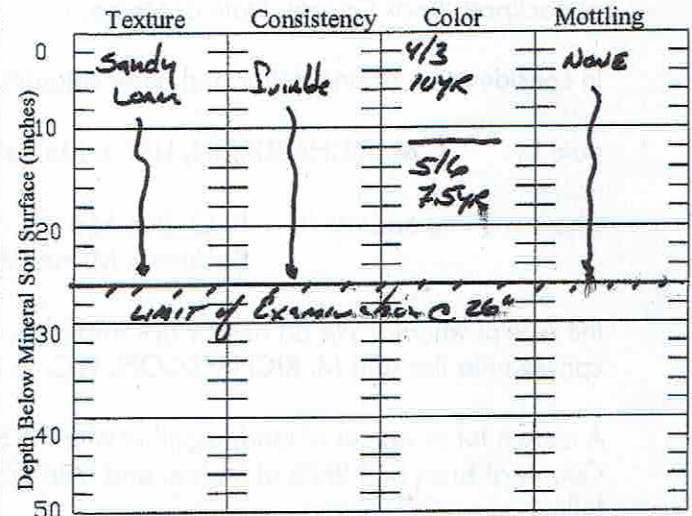
SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP#1 Test Pit Boring
1 " Depth of Organic Horizon Above Mineral Soil



Soil Classification	Slope	Limiting Factor	<input type="checkbox"/> Ground Water
<u>2 C</u>	<u>4</u> %	<u>28</u> "	<input type="checkbox"/> Restrictive Layer
Profile Condition			<input type="checkbox"/> Bedrock
			<input checked="" type="checkbox"/> Pit Depth

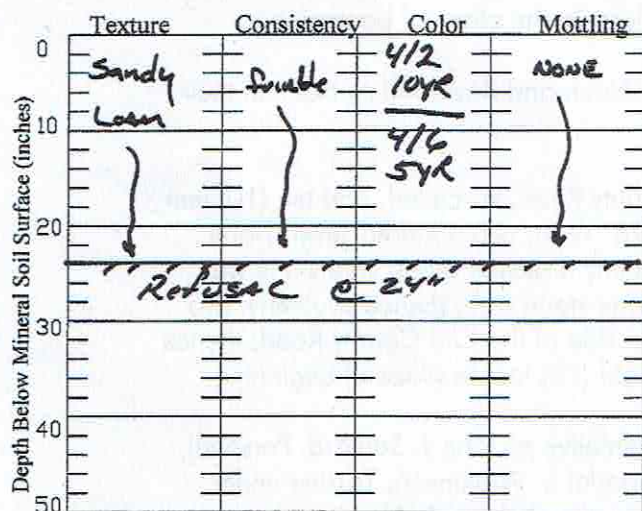
Observation Hole TP#2 Test Pit Boring
1 1/2 " Depth of Organic Horizon Above Mineral Soil



Soil Classification	Slope	Limiting Factor	<input type="checkbox"/> Ground Water
<u>2 C</u>	<u>3</u> %	<u>26</u> "	<input type="checkbox"/> Restrictive Layer
Profile Condition			<input type="checkbox"/> Bedrock
			<input checked="" type="checkbox"/> Pit Depth

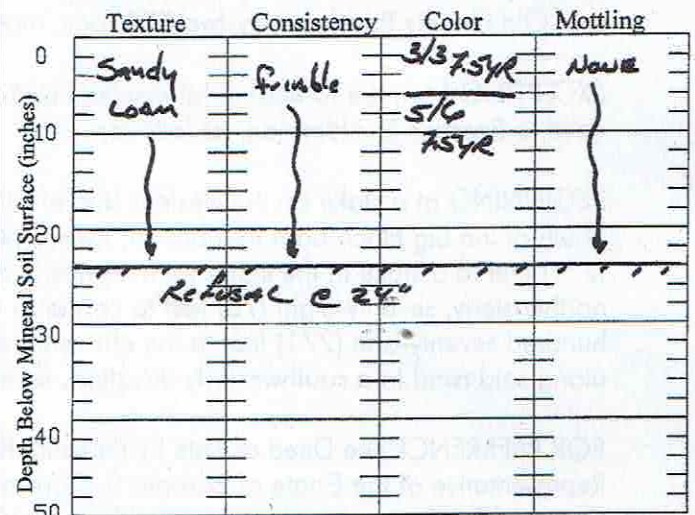
SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP#3 Test Pit Boring
1 " Depth of Organic Horizon Above Mineral Soil



Soil Classification	Slope	Limiting Factor	<input type="checkbox"/> Ground Water
<u>2 AIII</u>	<u>3</u> %	<u>24</u> "	<input type="checkbox"/> Restrictive Layer
Profile Condition			<input type="checkbox"/> Bedrock
			<input checked="" type="checkbox"/> Pit Depth

Observation Hole TP#4 Test Pit Boring
1 " Depth of Organic Horizon Above Mineral Soil



Soil Classification	Slope	Limiting Factor	<input type="checkbox"/> Ground Water
<u>2 AIII</u>	<u>3</u> %	<u>24</u> "	<input type="checkbox"/> Restrictive Layer
Profile Condition			<input type="checkbox"/> Bedrock
			<input checked="" type="checkbox"/> Pit Depth

Robert H. J. J. J.

288

5/9/2021

Site Evaluator Signature

SE #

Date

Appendix 2 – Well Correspondence

Well pump volume

From: Harlan Pease (hpeasejr@roadrunner.com)

To: mnight1520@yahoo.com

Date: Tuesday, July 27, 2021, 01:53 PM EDT

Hi Dick,

The well was drilled in 2007 and produced 8 GPM.

Please let me know if you get this e-mail

Thanks,

Harlan

Harlan Pease jr.

Industrial Instruments

9 wellington Drive

Rockport, Maine

207-596-7633

hpeasejr@roadrunner.com

Find messages, documents, photos or people

Well Info - * Fiddlew

Archive
 Move
 Delete
 Spam

Well Info - * Fiddlewood

AD

Wed, Jun 16 at 12:12 PM



tom.jurewitz@att.net

To: 'Dick and Mary Nightingale'

Hello Dick;
 Attached are images from the well-cap at 8 Fiddlewood Lane. (Town of Rockport Tax map 5B, lot 055-002) (MapGeo parcel: 006-055-022)

Well dug by Reilly Well Drilling, of Bristol, ME
 Depth: 260' - Casing: 40' - G.P.M.: 6 - Date: 4/06

Regards,
 Tom Jurewitz
 8 Fiddlewood Ln

[Download all attachments as a zip file](#)



IMG_202106... .jpg 121.1kB



IMG_202106... .jpg 67.9kB

Inbox 999+

Unread

Starred

Drafts 330

Sent

Archive

Spam

Trash

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Views Hide

Photos

Documents

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Groceries

Deals

Receipts

Travel

Folders

Show

ROYER QUALITY CASTINGS
BOYERTOWN, PA. 19512

WELL DEPTH 260

AMT. CASING 41

E. P. M. 6

DATE 4 06

June 15, 2021

Richard and Deborah Wong
3 Wellington Drive
Rockport, ME 04856

Town of Rockport Planning Board
101 Main Street
Rockport, Maine 04856

RE: Bay Ridge Community

Dear Planning Board Memebers:

My name is Deborah Wong and my husband Richard Wong and I reside at 3 Wellington Drive – which is located at the corner of Wellington Drive and Terrier Circle in the Bay Ridge Community located in Rockport. We have lived at this location since 2015.

The reason for this letter is to advise the Board that since we have lived in our house we have never had a problem with our well going dry and have had adaqute water to support our household.

Regards,

Deborah and Richard Wong



June 4, 2021

Richard nightingale

In my professional opinion due to the location, and lot sizes, of the subdivision on Bay Ridge in Rockport, there should be no problem obtaining potable water.

Sincerely

Marc Stevens
President
Hatch Well Drillers Inc.

HAVE A WELL DAY!

13 East Pond Rd,

Nobleboro ME 04555

For Dick

From: Leon Bausch (leob66@hotmail.com)

To: rnight1520@yahoo.com

Date: Tuesday, June 15, 2021, 02:03 PM EDT

Dick,

We wanted to let you know if anyone has a concern about the water supply here at Bay Ridge. We had a well drilled last July by Reilly Well Drilling of Bristol, Maine for our new home. The well came in at 7 gal/min enough to supply all our needs and then some. We have never run out of water supply even while running the pump full bore watering the lawn running 3 hoses at a time.

I just thought you might be interested.

Barb & Leon Bausch

David A. Theriault
1 Wellington Drive
Rockport, Maine 04856

June 18, 2021

To Whom It May Concern,

I have been the owner of 1 Wellington Drive, Rockport, Maine (BayRidge) since 1995. Recently there has been some controversy by new owners living around Terrier Circle concerning the amount of water available for wells due to the three lots being prepared for sale behind their homes.

I can attest that we have never had a problem with our water pressure or the amount of water available since we have lived in BayRidge.

Frankly, I feel the new owners should have done due diligence prior to buying their properties. They would have seen at that point that those lots would eventually be sold. The road to the lots is clearly visible.

Richard Nightingale has always treated us fairly and with respect.

Sincerely,



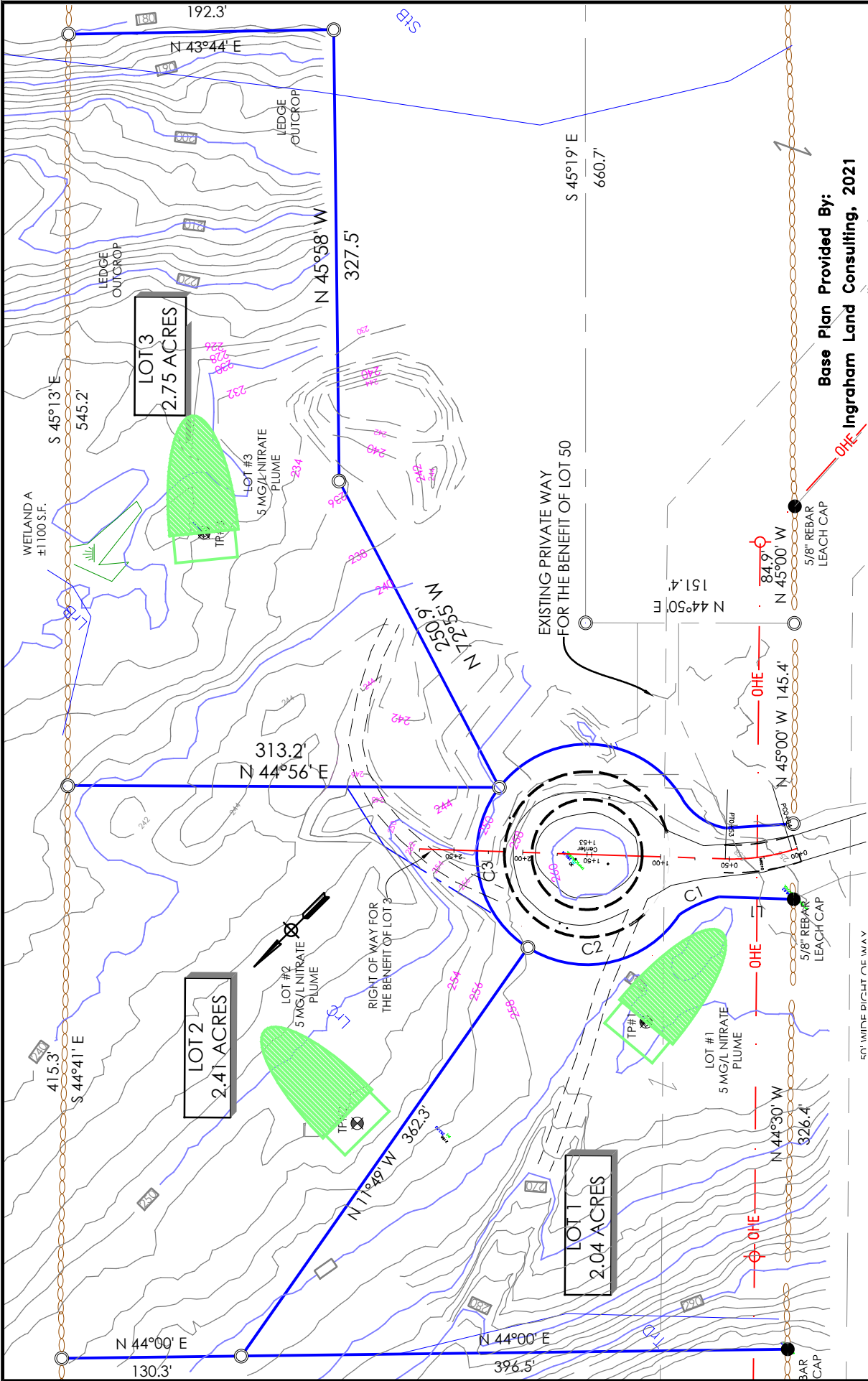
David A. Theriault

Appendix 3 – Well Sustainability Calculations

Lot Recharge

Recharge Estimates										
Lot #	Size (acres)	Annual Rainfall (Inch)	Infiltration Rate %	Volume (GPD)	Drought Vol. (GPD)	Use (GPD)	% of Recharge			
1	2.04	50	16	1214	728	270	22			
2	2.41	50	16	1434	861	270	19			
3	2.75	50	16	1637	982	270	16			
TOTALS				4285	2571	810	58			

Appendix 4 – Nitrate Plume Map



Base Plan Provided By:
Ingraham Land Consulting, 2021
 SCALE: 1" = 100'

**M. RICHARDSON SUBDIVISION
 ROCKPORT, ME**

PROJ.:	54701
FILE:	Nitrate Plan
DATE:	August, 2021

PREDICTED 5 MG/L NITRATE PLUMES

50' WIDE DIGHT CE W.A.V

Appendix 5 – Nitrate Calculations

Source Concentration

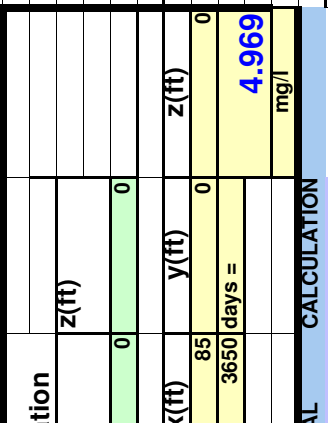
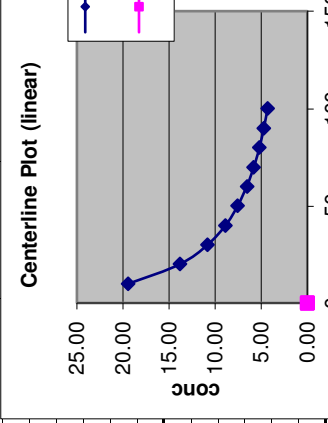
Lot 1			Lot 3		
Soil HSG	C		Soil HSG	C	
Annual Rainfall	50.00	inches	Annual Rainfall	50.00	inches
Bed Width	20.00	feet	Bed Width	20.00	feet
Bed Length	45.00	feet	Bed Length	45.00	feet
% Infiltration	21.00		% Infiltration	21.00	
Rainfall NO3	0.50	ppm	Rainfall NO3	0.50	ppm
Rainfall Volume	2.16	GPD	Rainfall Volume	2.16	GPD
Rainfall VC	1.08		Rainfall VC	1.08	
Design Flow	270.00	GPD	Design Flow	270.00	GPD
Design NO3	40.00	ppm	Design NO3	40.00	ppm
Design VC	10800.00		Design VC	10800.00	
Soil Thickness	2.00	feet	Soil Thickness	2.00	feet
Soil K	1.33	ft/day	Soil K	1.33	ft/day
Ground Surface Slope	4.00	%	Ground Surface Slope	3.00	%
Water Table Slope	0.020	ft/ft	Water Table Slope	0.015	ft/ft
Aquifer Porosity	0.20		Aquifer Porosity	0.20	
Groundwater Velocity	0.13	ft/day	Groundwater Velocity	0.10	ft/day
Through Flow Area	90.00	square feet	Through Flow Area	90.00	square feet
Through Flow Volume	11.97	GPD	Through Flow Volume	8.98	GPD
Through Flow Nitrate	1.00	ppm	Through Flow Nitrate	1.00	ppm
Through Flow VC	11.97		Through Flow VC	8.98	
Initial Nitrate C	38.06	ppm	Initial Nitrate C	38.45	ppm
Lot 2					
Soil HSG	C				
Annual Rainfall	50.00	inches			
Bed Width	20.00	feet			
Bed Length	45.00	feet			
% Infiltration	21.00				
Rainfall NO3	0.50	ppm			
Rainfall Volume	2.16	GPD			
Rainfall VC	1.08				
Design Flow	270.00	GPD			
Design NO3	40.00	ppm			
Design VC	10800.00				
Soil Thickness	2.00	feet			
Soil K	1.33	ft/day			
Ground Surface Slope	3.00	%			
Water Table Slope	0.015	ft/ft			
Aquifer Porosity	0.20				
Groundwater Velocity	0.10	ft/day			
Through Flow Area	90.00	square feet			
Through Flow Volume	8.98	GPD			
Through Flow Nitrate	1.00	ppm			
Through Flow VC	8.98				
Initial Nitrate C	38.45	ppm			

LOT 1 QUICK DOMENICO

ADVECTIVE TRANSPORT WITH THREE DIMENSIONAL DISPERSION, 1ST ORDER DECAY AND RETARDATION - WITH CALIBRATION TOOL																														
Project: Ferrer Circle Lot 1																														
Date:	8/10/2021	Prepared by:	RSP																											
		Contaminant:	Nitrate																											
SOURCE	Ax	Ay	Az	LAMBDA	SOURCE	SOURCE	THICKNESS	Time (days)																						
CONC	(ft)	(ft)	(ft)		WIDTH		(ft)	(days)																						
(MG/L)			>=.001	day-1					3650																					
	38.06	8.50E+00	2.83E+00	4.25E-01	0	45	2																							
Hydraulic	Hydraulic	Porosity	Soil Bulk	Frac.	Retard-	V																								
Cond	Gradient	(dec. frac.)	Density	Org. Carb.	ation																									
(ft/day)	(ft/ft)		(g/cm ³)	KOC	(R)																									
1.33E+00	0.015	0.2	1.7	0	0.00E+00	1	0.09975																							
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>NEW QUICK_DOMENICO.XLS</p> <p>SPREADSHEET APPLICATION OF "AN ANALYTICAL MODEL FOR MULTIDIMENSIONAL TRANSPORT OF A DECAYING CONTAMINANT SPECIES"</p> <p>P.A. Domenico (1987)</p> <p>Modified to Include Retardation</p> </div> <div style="width: 50%;"> <p style="text-align: center;">Centerline Plot (log)</p> </div> </div>																														
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p style="text-align: center;">Centerline Plot (linear)</p> </div> <div style="width: 50%;"> <table border="1"> <thead> <tr> <th>distance</th> <th>Model Output</th> <th>Field Data</th> </tr> </thead> <tbody> <tr><td>70</td><td>2.718</td><td>2.592</td></tr> <tr><td>80</td><td>2.477</td><td>2.369</td></tr> <tr><td>90</td><td>4.003</td><td>3.698</td></tr> <tr><td>100</td><td>4.686</td><td>4.282</td></tr> <tr><td>110</td><td>4.003</td><td>3.698</td></tr> <tr><td>120</td><td>2.477</td><td>2.369</td></tr> </tbody> </table> </div> </div>										distance	Model Output	Field Data	70	2.718	2.592	80	2.477	2.369	90	4.003	3.698	100	4.686	4.282	110	4.003	3.698	120	2.477	2.369
distance	Model Output	Field Data																												
70	2.718	2.592																												
80	2.477	2.369																												
90	4.003	3.698																												
100	4.686	4.282																												
110	4.003	3.698																												
120	2.477	2.369																												
Point Concentration																														
x(ft)	y(ft)	z(ft)																												
85	0	0																												
Conc. At	x(ft)	y(ft)	z(ft)																											
at	85	0	0																											
	3650	days =	4.918																											
			mg/l																											
AREAL CALCULATION																														
MODEL DOMAIN																														
Length (ft)	100																													
Width (ft)	30																													
30	3.080	3.409	3.311	30	40	50	60	70	80	90	100																			
15	16.227	10.760	8.385	3.156	3.000	2.853	2.853	2.718	2.592	2.477	2.369																			
0	19.253	13.683	10.731	6.992	6.045	5.346	5.346	4.803	4.365	4.003	3.698																			
-15	16.227	10.760	8.385	8.836	7.509	6.528	6.528	5.772	5.173	4.686	4.282																			
-30	3.080	3.409	3.311	6.992	6.045	5.346	5.346	4.803	4.365	4.003	3.698																			
				3.156	3.000	2.853	2.853	2.718	2.592	2.477	2.369																			
Field Data: Centerline C Concentration																														
Distance from Source																														
				0	0	0	0	0	0	0	0																			
				0	0	0	0	0	0	0	0																			

LOT 2 QUICK DOMENICO

ADVECTIVE TRANSPORT WITH THREE DIMENSIONAL DISPERSION, 1ST ORDER DECAY and RETARDATION - WITH CALIBRATION TOOL											
Project: Error Circle Lot 2											
Date: 8/10/2021 Prepared by: RSP											
Contaminant: Nitrate											
SOURCE	Ax (ft)	Ay (ft)	Az (ft)	LAMBDA	SOURCE WIDTH (ft)	SOURCE THICKNESS (ft)	SOURCE Time (days)				
CONC (MG/L)	38.45	8.50E+00	2.83E+00	4.25E-01	0	45	2	3650			
Hydraulic Cond (ft/day)	1.33E+00	0.02	0.2	1.7	0	0.00E+00	1	0.133			
Soil Bulk Density (g/cm ³)											
Porosity (dec. frac.)											
KOC (ft/day)											
Frac. Org. Carb. (R)											
Retardation (=K ² /n ² R) (ft/day)											
NEW QUICK_DOMENICO.XLS											
SPREADSHEET APPLICATION OF "AN ANALYTICAL MODEL FOR MULTIDIMENSIONAL TRANSPORT OF A DECAYING CONTAMINANT SPECIES" P.A. Domenico (1987) Modified to Include Retardation											
Point Concentration		z(ft)									
x(ft)	85	0	0								
x(ft)		y(ft)		z(ft)							
Conc. At	85	0	0								
at	3650	days =	4.969								
mg/l											
AREAL CALCULATION											
MODEL DOMAIN											
Length (ft)	100										
Width (ft)	30										
30	3.112	3.444	3.345	30	40	50	60	70	80	90	100
15	16.393	10.870	8.471	3.188	3.030	2.883	2.746	2.619	2.503	2.395	
0	19.450	13.823	10.841	7.063	6.107	5.401	4.853	4.411	4.045	3.738	
-15	16.393	10.870	8.471	8.926	7.586	6.595	5.832	5.227	4.735	4.328	
-30	3.112	3.444	3.345	7.063	6.107	5.401	4.853	4.411	4.045	3.738	
Field Data: Centerline C Concentration		0		0		0		0		0	
Distance from Source		0		0		0		0		0	



LOT 3 QUICK DOMENICO

ADVECTIVE TRANSPORT WITH THREE DIMENSIONAL DISPERSION, 1ST ORDER DECAY and RETARDATION - WITH CALIBRATION TOOL										
Project: Error Circle Lot 3										
Date: 8/10/2021 Prepared by: RSP										
Contaminant: Nitrate										
NEW QUICK_DOMENICO.XLS										
SPREADSHEET APPLICATION OF "AN ANALYTICAL MODEL FOR MULTIDIMENSIONAL TRANSPORT OF A DECAYING CONTAMINANT SPECIES" P.A. Domenico (1987) Modified to Include Retardation										
SOURCE	Ax (ft)	Ay (ft)	Az (ft)	LAMBDA	SOURCE WIDTH (ft)	SOURCE THICKNESS (ft)	SOURCE Time (days)			
CONC (MG/L)	38.45	8.50E+00	2.83E+00	4.25E-01	0	45	2	3650		
Hydraulic Cond (ft/day)	1.33E+00	0.015	0.2	1.7	0	0.00E+00	1	0.09975		
Soil Bulk Density (g/cm ³)										
Porosity (dec. frac.)										
KOC (ft/day)										
Frac. Org. Carb. (R)										
Retardation (=K ² /n ² *R) (ft/day)										
<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Centerline Plot (linear)</p> </div> <div style="text-align: center;"> <p>Centerline Plot (log)</p> </div> </div>										
Point Concentration										
x(ft)										
y(ft)										
z(ft)										
85	0									
x(ft)										
y(ft)										
z(ft)										
Conc. At	85	0								
at	3650	days =								
		4.968								
		mg/l								
AREAL CALCULATION										
MODEL DOMAIN										
Length (ft)	100									
Width (ft)	30									
	10	20	30	40	50	60	70	80	90	100
30	3.112	3.444	3.345	3.188	3.030	2.882	2.745	2.619	2.502	2.394
15	16.393	10.870	8.471	7.063	6.107	5.401	4.852	4.410	4.044	3.736
0	19.450	13.823	10.841	8.926	7.586	6.594	5.831	5.226	4.734	4.326
-15	16.393	10.870	8.471	7.063	6.107	5.401	4.852	4.410	4.044	3.736
-30	3.112	3.444	3.345	3.188	3.030	2.882	2.745	2.619	2.502	2.394
Field Data:	Centerline C Concentration									
	Distance from Source									
	0									
	0									