ONSITE ENGINEERING INC.

Water, Wastewater and Stormwater Specialists

October 25, 2021

Mr. Ron Tiberi, P.E.
9 Massachusetts Avenue
Natick, MA 01760

Re: 63 County Street, Dover, MA
Mounding Evaluation Report-Stormwater Management System and Effluent Disposal System
Project No: 01566

Dear Mr. Tiberi:

We are pleased to submit this mounding evaluation report for the proposed 63 County Street development located in Dover, Massachusetts. As requested, we have performed model simulation of the mounding effect associated with runoff discharge to groundwater from the stormwater management system as well as the site's effluent disposal system. The mounding evaluation was generated using the Hantush method of groundwater modeling by using site specific information generated and provided to us by your office.

To complete the analyses for this project, a mounding program created to solve the Glover's solution to the Hantush method, by GeoHydroCycle, Inc., was utilized. This program requires that several site specific configuration and soil parameters be entered into the program. These include the hydraulic conductivity of the soil, the soil's porosity, the discharge time until stabilization, the presence of any sensitive receptors (or constant head boundaries) such as wetlands or waterways, the bottom area of the stormwater best management practice (BMP) and effluent disposal system, and the total loading rate over those areas. Once this information is inputted, the program provides a maximum mound height and the anticipated location of that mound in relation to the edges of the infiltration area. In this case, as the areas in question for this project are essentially rectangular/square, we anticipate the highest mound height to occur in the center of the proposed area.

The information provided to us by your office, which is used as the basis of the mounding analysis, is as follows:

- Sheet C1, and Sheets C3 through C7 of the drawing set for Red Robin Pastures, Dover, Massachusetts prepared by Signature Designs Architecture;
- Soil evaluation logs for deep holes associated with the effluent disposal system;
- Boring information for monitoring well MW-1 with corresponding water level information;
- Design seasonal high groundwater elevations for the effluent disposal system and stormwater recharge system;
- HydroCAD stormwater model report.

STORMWATER RECHARGE SYSTEM MODEL

As requested, we have performed a simulation of the mounding associated with the runoff directed to the stormwater best management practice. In accordance with the Massachusetts Stormwater Handbook, the mounding analysis must demonstrate that the mound that forms under the recharge system from the required recharge volume, which is associated with Standard 3 of the Stormwater Management Regulations, will not breakout above the land or wetland resource area. Under Standard 3, the required infiltration depth is determined by soil type. Given that this site consists of a Class A soil type, using the MassDEP required infiltration depth for the particular NRCS Hydrologic Soil Group, the recharge volume was calculated based on 0.60 inches precipitation over the impervious surfaces in the watershed.

Stormwater Recharge System

Using the data from the stormwater hydrologic model in HydroCAD, the impervious surfaces associated with the subject watershed amount to 48,002 square feet (sf), thereby requiring 2,400.1 cubic feet (cf) of recharge volume to be analyzed. In addition, a constant head boundary of 84 feet was utilized in the model to simulate the bordering vegetated wetland to the northeast.

Compiling information detailed on the design drawings and soil logs, the following data was used in preparing the stormwater mounding model.

Parameter	Value
Volume	2,400.1 cf
Infiltration System Area	2,832.32 sf
Distance to Constant Head Boundary	84 feet
Hydraulic Conductivity(1)	16.54 feet/day
Season High Groundwater(2)	274.30 feet
Bottom of Excavation(3)	256.30 feet
Application Period	1 day
Duration Period(4)	3 days

(1) *Saturated hydraulic conductivity based on Rawls Rate of 8.27 inches/hour (16.54 feet per day) based on a sand parent material.*
(2) *Water level measured in monitoring well MW-1 on July 10, 2021.*
(3) *Bottom of excavation, for the purposes of determining saturated thickness, was based on monitoring well MW-1.*
(4) *Per MassDEP Stormwater Handbook*

Using the above-mentioned information, the mound developed from the required recharge volume is 1.31 feet at the center of the system. The results of the model simulation are included in Attachment A.

SUBSURFACE SEWAGE DISPOSAL SYSTEM MODEL

In accordance with 310 CMR 15.000, Title 5, any subsurface sewage disposal system with a design flow equal to or greater than 2,000 gallons per day (gpd) must consider groundwater mounding when providing the required separation from the bottom of the effluent disposal system to seasonal high groundwater. As indicated on the proposed design drawings, the proposed system is based on 77 bedrooms resulting in a Title 5 Design Flow of 8,500 gpd. The system, using a Presby System technology, will have an installed footprint of 46.55 feet wide by 202.82 feet long. The overall size of the effluent disposal system was designed using the Title 5 loading rate of 0.63 gpd/sf in accordance with the Presby System approval. The center of the effluent disposal system is located approximately 153 linear feet from the constant head boundary.

Using information detailed on the design drawings and soil logs, the following data was used in preparing the subsurface sewage disposal system mounding model.

Parameter	Value
Title 5 Design Flow	8,500 gpd
Effluent Disposal System Area	9,441 sf
Distance to Constant Head Boundary	153.1 feet
Hydraulic Conductivity(1)	16.54 feet/day
Season High Groundwater(2)	274.30 feet
Bottom of Excavation(3)	256.30 feet
Application Period(4)	90 days
Duration Period(4)	180 days

(1) *Saturated hydraulic conductivity based on Rawls Rate of 8.27 inches/hour (16.54 feet per day) based on a sand parent material.*
(2) *Water level measured in monitoring well MW-1 on July 10, 2021.*
(3) *Bottom of excavation, for the purposes of determining saturated thickness, was based on monitoring well MW-1.*
(4) *Per MassDEP Guidelines for the Design of Small Wastewater Treatment Facilities, 2018.*

Using the above-mentioned information, the mound developed from the discharge of 8,500 gallons of effluent results in a mound of 1.11 feet at the center of the effluent disposal system. The results of the model simulations are included in Attachment B.

We wish to note that, given that the Title 5 Design Flow represents a maximum day flow, the actual developed mounding should be less as the actual day sewage generation should generally be 50% to 60% of the maximum day flow. Therefore, this analysis of the mounding conditions created by the discharge is conservative since the maximum day flow conditions will not be constant from the discharge.

MOUNDING EFFECTS ASSOCIATED WITH ADJACENT SYSTEMS

As the final step of our evaluation, we modeled the subsequent mounding effects upon each of the adjacent subsurface systems. In general, the mound associated with the stormwater recharge will be intermittent and unlikely to develop a long term mounding effect on the site. However, in order to provide a conservative mounding analysis, the mounding effect at the center of each system was used to determine the overall mounding effect on each adjacent system as summarized in the Table below. We have included the Hantush model reports for each system analysis within each system's respective attachment section.

System	Calculated Mound (Feet)	Mound from Subsurface Sewage Disposal System (Feet)	Mound from Stormwater Recharge System (Feet)	Total Mound (Feet)
Subsurface Sewage Disposal System	1.11	-	0.00	1.11
Stormwater Recharge System	1.31	0.00	-	0.76

We trust this letter report addresses your current needs. In the event you have any questions or require any additional information, please feel free to contact us.

Sincerely,

Onsite Engineering, Inc.

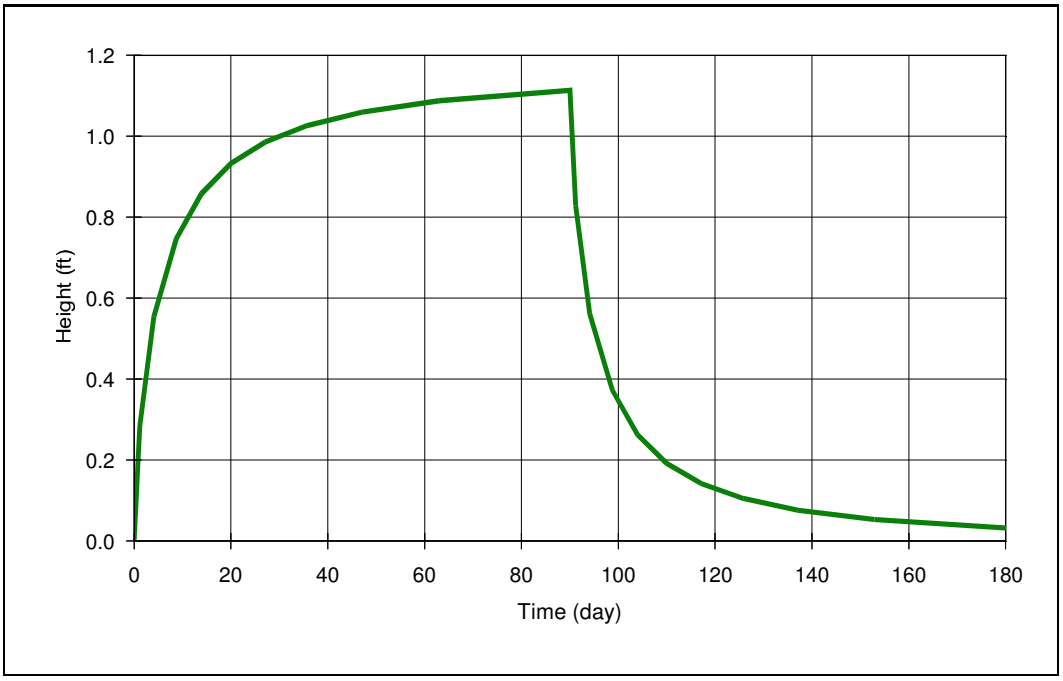
Raymond L. Willis, III, P.E.
Vice President

Enclosures

ATTACHMENT A

SUBSURFACE SEWAGE DISPOSAL SYSTEM
MOUNDING ANALYSIS

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Onsite Engineering, Inc.

PROJECT: County Street - EDS

ANALYST: RLW

DATE: 10/21/2021 TIME: 8:40:41 AM

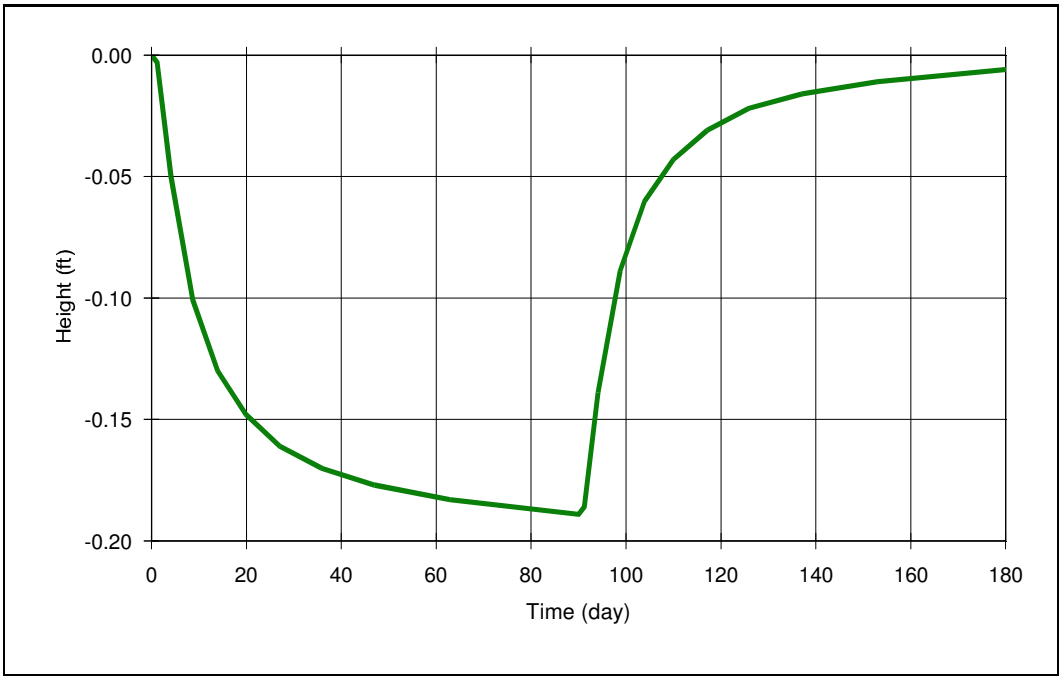
INPUT PARAMETERS

Application rate: 0.12 c.ft/day/sq. ft
Duration of application: 90 day
Total simulation time: 180 day
Fillable porosity: 0.27
Hydraulic conductivity: 16.54 ft/day
Initial saturated thickness: 18 ft
Length of application area: 46.55 ft
Width of application area: 202.82 ft
Constant head boundary used at: 153.1 ft
Groundwater mounding @
X coordinate: 0 ft
Y coordinate: 0 ft
Total volume applied: 101965.7 cft

MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
1	0.28
4	0.55
9	0.75
14	0.86
20	0.93
27	0.98
36	1.03
47	1.06
63	1.09
90	1.11
91	0.83
94	0.56
99	0.37
104	0.26
110	0.19
117	0.14
126	0.1
137	0.08
153	0.05
180	0.03

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Onsite Engineering, Inc.

PROJECT: County Street - EDS @ Recharge

ANALYST: RLW

DATE: 10/21/2021 TIME: 9:18:43 AM

INPUT PARAMETERS

Application rate: 0.12 c.ft/day/sq. ft
Duration of application: 90 day
Total simulation time: 180 day
Fillable porosity: 0.27
Hydraulic conductivity: 16.54 ft/day
Initial saturated thickness: 18 ft
Length of application area: 46.55 ft
Width of application area: 202.82 ft
Constant head boundary used at: 153.1 ft
Groundwater mounding @
X coordinate: 112 ft
Y coordinate: 146 ft
Total volume applied: 101965.7 cft

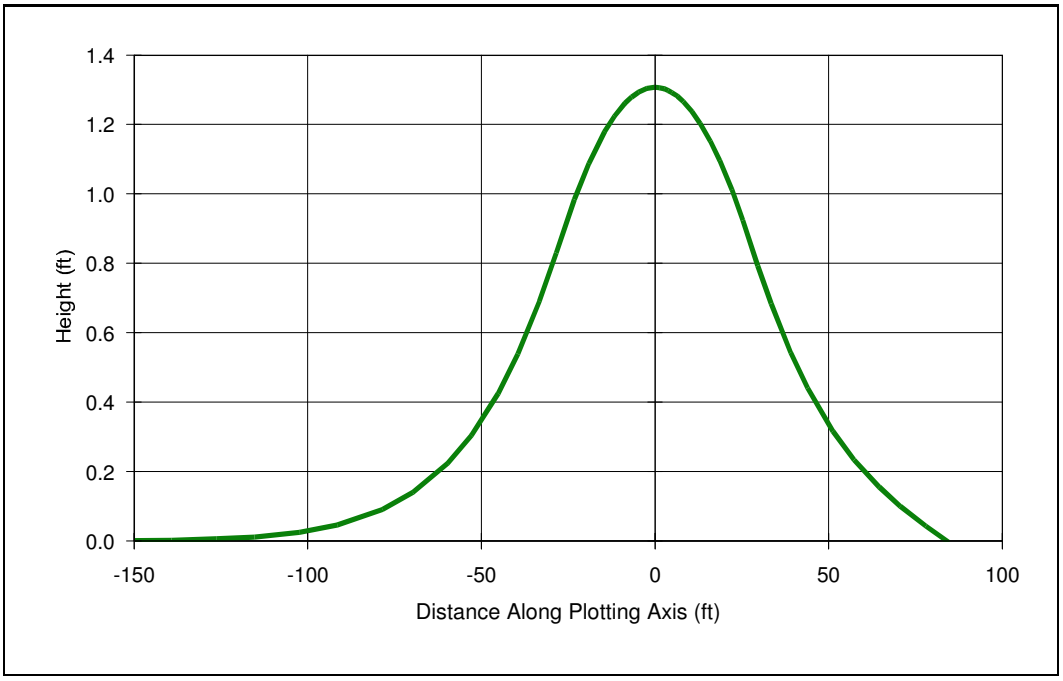
MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
1	0
4	-0.05
9	-0.1
14	-0.13
20	-0.15
27	-0.16
36	-0.17
47	-0.18
63	-0.18
90	-0.19
91	-0.19
94	-0.14
99	-0.09
104	-0.06
110	-0.04
117	-0.03
126	-0.02
137	-0.02
153	-0.01
180	-0.01

ATTACHMENT B

STORMWATER RECHARGE SYSTEM MOUNDING ANALYSIS

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Onsite Engineering, Inc.

PROJECT: County Street - Recharge System

ANALYST: RLW

DATE: 10/25/2021 TIME: 11:44:13 AM

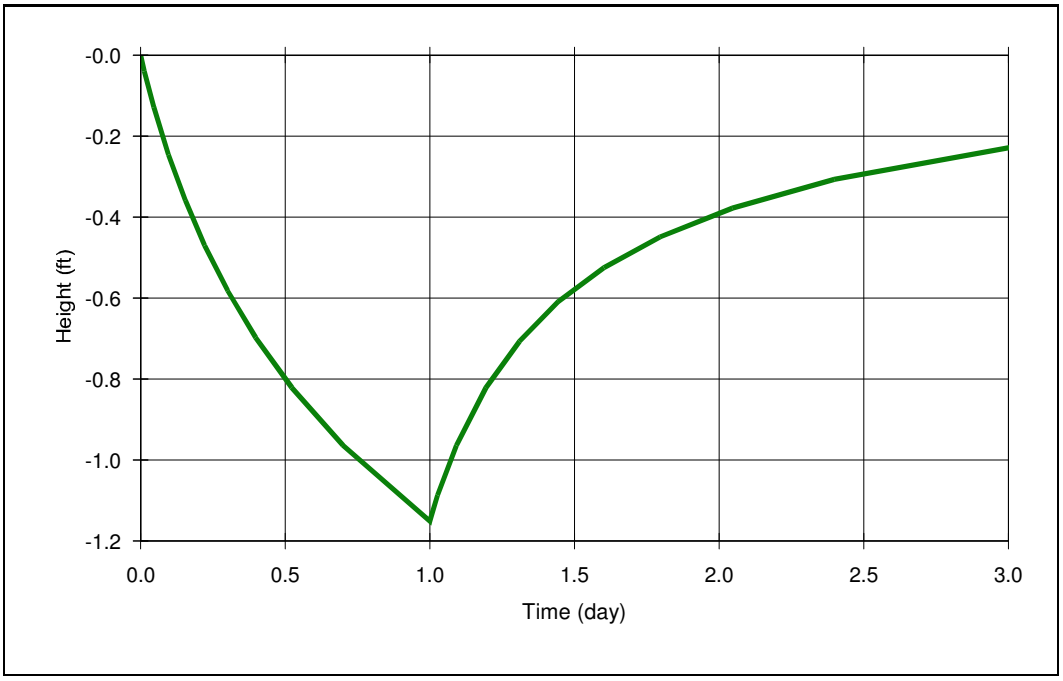
INPUT PARAMETERS

Application rate: 0.847 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.27
Hydraulic conductivity: 16.54 ft/day
Initial saturated thickness: 18 ft
Length of application area: 42.06 ft
Width of application area: 67.34 ft
Constant head boundary used at: 84 ft
Plotting axis from Y-Axis: 40 degrees
Edge of recharge area:
positive X: 17.6 ft
positive Y: 21 ft
Total volume applied: 2398.975 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-96.4	-114.9	-150	0
-81.1	-96.6	-126	0.01
-65.7	-78.4	-102	0.02
-50.4	-60.1	-78	0.09
-38.4	-45.7	-60	0.22
-29	-34.6	-45	0.42
-21.4	-25.5	-33	0.69
-14.9	-17.8	-23	0.98
-9.3	-11.1	-15	1.18
-5.6	-6.7	-9	1.26
-3	-3.6	-5	1.29
0	0	0	1.31
1.7	2	3	1.3
3.1	3.7	5	1.29
5.2	6.2	8	1.27
8.4	10	13	1.2
12	14.3	19	1.1
16.3	19.4	25	0.92
21.5	25.6	33	0.68
28.2	33.6	44	0.44
36.8	43.9	57	0.23
45.4	54.1	71	0.1
54	64.3	84	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Onsite Engineering, Inc.

PROJECT: County Street - Recharge System @ EDS

ANALYST: RLW

DATE: 10/25/2021 TIME: 11:45:45 AM

INPUT PARAMETERS

Application rate: 0.847 c.ft/day/sq. ft
Duration of application: 1 day
Total simulation time: 3 day
Fillable porosity: 0.27
Hydraulic conductivity: 16.54 ft/day
Initial saturated thickness: 18 ft
Length of application area: 42.06 ft
Width of application area: 67.34 ft
Constant head boundary used at: 84 ft
Groundwater mounding @
X coordinate: 112 ft
Y coordinate: 146 ft
Total volume applied: 2398.975 cft

MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
0	-0.04
0	-0.13
0.1	-0.25
0.2	-0.36
0.2	-0.47
0.3	-0.58
0.4	-0.7
0.5	-0.82
0.7	-0.96
1	-1.15
1	-1.09
1.1	-0.96
1.2	-0.82
1.3	-0.71
1.4	-0.61
1.6	-0.52
1.8	-0.45
2	-0.38
2.4	-0.31
3	-0.23