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Effective, Affordable, and Sustainable Solutions for Land & Water Environment

June 12, 2018

To: Town of Wayland- Conservation Commission
Ms. Linda Hansen
41 Cochituate Road
Wayland, MA 01778

Subject: 24 School Street – Mounding Calculations/Stormwater Review

Dear Ms. Hansen and Commissioners:

We received and reviewed the second review comments on groundwater mounding calculations/stormwater by Nover-Armstrong Associates, Inc. (NAA) dated June 6, 2018. The groundwater mounding analysis has been updated to incorporate the recommendations in the review comment letter. This letter briefly addresses the comments in the same sequence as in the comment letter by NAA. To facilitate the next round review, we quoted the comments first in italic and then followed by our response in Bold.

2.0 GENERAL COMMENT

The plans and calculations may be adequate for the ZBA Comprehensive Permit process but are not sufficient to describe the effect of the work on the interests identified in the MA Wetlands Protection Act (the Act). The Massachusetts Wetland Regulations, 310 CMR 10.00 (the Regulations) specify that the information submitted by the Applicant with the Notice of Intent must be "sufficient to describe the site, the work or the effect of the work on the interests identified in the Act.

Local conservation commissions have an important role in determining whether proposed projects comply with the requirements of the Act and the Regulations and must be provided sufficient information from the project proponent to make that determination. Otherwise, a project proponent can make an end run around a local conservation commission by failing to provide sufficient information and proceed to DEP with a Superseding Order of Conditions request presenting new information under the guise of "de novo" review. [1]

Response: The project wetland scientist had provided detailed wetland performance analysis to show that there will be no significant impact on wetland interests. The recent review correspondences are addressing some technical design issues to groundwater mounding impact for both wastewater and stormwater infiltration. No resource wetland will be directly altered by the project. The disturbance setback from wetland will actually increase from the existing condition and updated stormwater and wastewater treatment system..

[1] *Matter of David A. Bosworth Co., Inc. Docket No. WET-2015-015 Recommended Final Decision (February 17, 2016), adopted by Final Decision (March 16, 2016).*

3.0 SAS MOUNDING CALCULATION COMMENTS

3.1 SAS mounding analysis as per 310 CMR 15.000: (Title 5 Regulations) Section 15.240: Soil Absorption Systems (12) for systems with a design flow of 2,000 gpd or greater, the separation distance to the high groundwater elevation required by 310 CMR 15.212 shall be determined by adding the effect of groundwater mounding to the high groundwater elevation.

Response: Agreed.

3.2 CREATIVE's estimate of the mounding height beneath the SAS is based on a 17.3 foot depth of aquifer (initial saturated thickness) using MW 1's bottom elevation of 142.7 and an estimated seasonal high groundwater (ESHGW) of 160.0.

Response: This is correct. The 160 ft high water table used for calculating the aquifer depth was based on the MWE's ESHGW at DTH-1 and DTH-2 with 0.45' safety buffer added to it.

3.3 Nover-Armstrong does not agree with using elevation 160.0 as the ESHGW or the bottom of MW 1 to estimate an aquifer depth. The depth of the aquifer is shallower as you go down the slope towards the wetland. The aquifer depth at MW 2 is about 11.5 feet.

Response: We have explained our rationale why we used the parameters for the groundwater mounding analysis, which was also explained to NAA at our phone conference prior to our last response. No comments were given at the phone conference. We also agreed to conduct more mounding analysis to address the new comments.

3.4 In our opinion, the depth of the aquifer should be based on a MWE's ESHGW elevation in the middle of the SAS compared to an average of the bottom elevations of MW 1 and MW 2. We estimate an average aquifer depth closer to 14.4 feet.

Response: Based on our review of the MWE soil testing information in the center of the SAS, the ESHGW by MWE, we will just use the average ESHGW 159.55 ft at DTH-1 and DTH-2, and the average bottom elevation of MW 1 and MW2, 144.45 ft as MWE used the soil morphology ESHGW for the design, which is higher than monitoring water tables.. So the estimated average aquifer depth is 15.10 ft. We will use this new depth for analysis.

3.5 Nover-Armstrong also has reservations regarding the use of the hydraulic conductivity estimated from the slug tests in MW 1 and MW 2 to estimate the mound height under the SAS. In our March 8, 2018 comments we had noted that the hydraulic conductivity estimated in MW 3 was about 4 times slower than was found in MW 1 and MW 2.

Response: We have also explained why the testing results of hydraulic conductivity were different in three monitoring wells. As MW 1 and MW 2 are the two located in the SAS area, we used the less of the two. MW 3 was located 80 ft downgradient of the SAS. See site plan and soil map overlay in attached Figure 1.

3.6 CREATIVE explained the difference as possibly due to boulders and/or micro soil limitations in the specific drilling location. Although we acknowledged this possibility during the conference call, Nover-Armstrong is now suggesting that the difference in hydraulic conductivities could be a result of the differences in the soil properties of Hinckley loamy sand and Narragansett silt loam soil types present on the Project site.

Response: We provided the soil map to show where Hinckley and Narragansett soil are located. Sandy loam and silty loam appeared intervened to each other. Given the Hydrologic Group A and B soil rating, the limited silt loam would be less portion of the overall soil condition on the site from MWE soil evaluation. See 3.7 response.

3.7 DTH -2, DTH-3, DTH-8, and DTH-10 all have silt loam horizons at the top of the aquifer that may reflect a different hydraulic conductivity than what was found by the slug tests in MW 1 and MW 2.

Response: As we can also see that DTH-4 and DTH-5 have sandy loam soil which are next to MW 3 while the tested hydraulic conductivity is the smallest. So, the large boulder or lens of silt loam impact on MW 3 would be more likely while the macro soil hydraulic conductivity would not be impacted

under large recharge area. As six out of 10 test pits has sandy loam soil while four had silt loam in part of the profile. Based on our detailed review of the soil condition, we believe that the average of MW 1, MW 2, and MW 3 would be more representative to the site. To show the impact is very limited, we also analyzed the mounding using average of MW1 and MW 3. See Table 3 for comparison.

3.8 Nover-Armstrong recommends that the SAS mound height estimate be checked using an average of the hydraulic conductivities estimated for MW 1 and MW 3 and an average depth of the aquifer.

Response: We agree that the average depth of bedrock at MW1 and MW 2 will be conservative to calculate the average aquifer depth though we think the bedrock under the SAS will be more like at the elevation of MW1 as the well is located in the most upper gradient area and bedrock normally follows the surface landscape pitch. We used the average of MWE's ESHGW at DTH-1 and DTH-2 for the water table. The previous water table 160 ft was based on the ESHGW with a safety factor of 0.45 ft. See revised Table 3 attached for details. The highest mound case SCN-5 is used to interpolate the water table under the SAS as shown in Table 4.

4.0 STORMWATER MOUNDING CALCULATION COMMENTS

4.1 CREATIVE's May 8, 2018 Letter to the Commission for the most part provides adequate responses to Nover-Armstrong's March 9, 2018 stormwater infiltration system mounding comments.

Response: No comments.

4.2 Nover-Armstrong cannot however confirm that there will be no impact on the stormwater mounding height from the proposed building foundations. The foundations are less than 20 feet from the infiltration system and would appear to have frost wall footings lower than the elevation of the estimated mound height.

Response: As for the frost wall footing concern on stormwater mounding height, we checked the depth when we plotted the four profiles as requested last time and addressed the unlikely impact as the site will have significant fill, the footing of the wall will be located above water table. The mounding height at the foundation reduces to about 0.5 ft while the water table also pitch down toward the wetland, the footing depth will be 4 ft below the garage floor 167.5 ft, which is at 163.5 ft. This is about 3 ft above the mounded water table at the footing, which is below 160.5 ft. So, the foundation will have no impact on the mounding. See also our response in the last correspondence on this concern "[F]our profiles across septic SAS and the stormwater infiltration area are plotted to show that the groundwater movement and mounding will not be impacted by the retain wall or building foundation as there will be no basement for all the buildings, which will built on quite amount of fill above groundwater. See the profiles for details. As the retaining wall footing in some locations may get close the high water table, it should be checked in the field to make sure the retaining wall footing will be set at or slightly above the seasonal high groundwater table to assure the proper groundwater movement. To add a safety factor here, a 6" thick crushed stones is recommended as the subbase of the retaining wall to facilitate the water move, which would be equivalent to more than 3 ft sandy soil flow passing capacity."

4.3 CREATIVE's Groundwater Mounding Analysis Report demonstrates that the stormwater infiltration system will meet the DEP mounding standards to drain in less than 72 hours.

Response: Agreed.

4.4 The stormwater recharge volume used in the mounding analysis is consistent with MWE's Revised Hydrologic Analysis.

Response: Agreed.

4.5 *CREATIVE estimated groundwater mounding under the SAS and stormwater infiltration system will have minor impact on each other's mounding heights. Four cross sections were provided with the Letter to Wayland Conservation Commission, prepared by CREATIVE Land and Water Engineering, LLC; dated May 8, 2018 showing the mounding impacts on each other.*

Response: No further response needed.

4.6 *The elevation of the seasonal high groundwater was raised to 160.14 (about 3 feet - CREATIVE) at the location of the stormwater infiltration system BMP based on a reading of MW 3 on March 12, 2018.*

Response: As agreed with NAA. No further response needed

4.7 *The stormwater infiltration system was raised in elevation based on the new groundwater elevation and was redesigned to reduce the amount of infiltration and have more discharge to the outlets. The system will overflow and discharge to the wetlands for storm events equal to or larger than the 2-year 24-hour storm event (3.2 inches).*

Response: No further response needed

4.8 *The mounding height under the stormwater infiltration system was estimated using two different aquifer depths based on the different bottom elevations of MW 1 and MW 3.*

Response: No further response needed

4.9 *MW 3 is located at the stormwater infiltration system and MW 1 is located within the footprint of the SAS near School Street. It is CREATIVE's opinion that they are being conservative using a shallower aquifer depth based on MW 3 as they feel the depth of the well was limited by perhaps a boulder.*

Response: No further response needed

4.10 *CREATIVE estimated the 100-year storm 3-day residual mounding height under the stormwater infiltration system to be less than the required 2 feet in both cases.*

Response: No further response needed

5.0 STORMWATER MANAGEMENT COMMENTS

5.1 *The September 2017 Stormwater Report narrative and O & M Plan should be updated to reflect the revisions to the proposed stormwater management system provided in the May 2018 Revised Hydrologic Analysis.*

Response: Areed. MWE to complete.

5.2 *Under the Stormwater Standards, this project is classified as a mix of new and redevelopment as there is an increase in impervious surface of 11,283 square feet (MWE -Revised Hydrologic Analysis).*

Response: It speaks itself.

5.3 *Due to the fact that there is an increase in the amount of impervious surface, the project is classified as a mix of "New" and "Redevelopment". The Wetland Regulations Stormwater Standards require that the runoff from the new impervious surface fully meet the Standards and the existing or redeveloped impervious surface meet the Standards to the maximum extent practicable but must at the very least improve existing conditions.*

Response: Agreed.

5.4 *It appears that the proposed stormwater infiltration system could meet full compliance with the Standards for the 11,283 square feet increase in impervious surface reported in MWE's Revised Hydrologic Analysis. This system is designed to treat a total of 14,145 square feet of impervious* *surface. The capacity of the system to treat more impervious than the new impervious surface be considered as improvement of the existing conditions.*

Response: Agreed.

5.5 *There is little difference between the pre-development and post-development runoff Time of Concentration. Nover-Armstrong recommends that the Velocity Method found in TR-55 versus the Lag Method be used to estimate the times of concentrations and that the overland flow paths cross perpendicular to the topographic contour lines.*

Response: MWE to follow up.

5.6 *Part 630 Hydrology, National Engineering Handbook states that the velocity method (TR-55 overland flow) is "the best method for calculating time of concentration for an urbanizing watershed or if hydraulic changes to the watercourse are being considered." Our experience has found using the Lag Method versus the Velocity Method estimates smaller peak rates of runoff.*

Response: MWE to follow up.

5.7 *The CN value used for the existing block driveway and walk should be adjusted to reflect some level of perviousness instead of considering it as a complete impervious paved surface.*

Response: MWE to follow up. We need to come up an agreed CN value for the well silt and compacted drive. Water was observed puddle in the drive. We recommend to use CN = 90.

6.0 STORMWATER SYSTEM COMMENTS

6.1 Subsurface Infiltration BMP

6.1.1 *The subsurface infiltration system BMP does not have the required 2 feet of separation from seasonal high groundwater. The March 12, 2018 groundwater level in MW 3 was 160.14 feet. On the plans and calculations by MWE, the bottom of the 3.0' high subsurface infiltration precast structure is 162.25. The bottom of crushed stone under the BMP is 161.25 feet. The bottom of the stone needs to be 2 feet above groundwater. The mounding calculations by CREATIVE used 162.25 as the bottom of the stone.*

Response: As for the stormwater infiltration trench groundwater separation, I had one time phone discussion with Tom McGuire in DEP, the major concern is the hydraulic impact that need to be dewater in 72 hours. The separation for treatment was not an issue as the pretreatment requirement for infiltration trench is already much higher than a wet pond that may intrude into water table (Fore bay only has 25% TSS removal compared with 44% TSS removal for infiltration trench). So, We believe that the addition 12" stones below the chamber will only be a safety guard rather than negative impact on dewatering as we provided 80% TSS removal pretreatment. If NAA and the Town deem necessary to have natural 2 ft soil under the infiltration area, we can eliminate the stones and replace with filter fabric. However, we discourage this change for the reason of long term hydraulic impact on mounding and infiltration rate as filter fabric could be clogged with very fine particulates than stones

6.1.2 *The manifold inlet fittings to the infiltration BMP should be detailed. The fitting layout is conceptual. Nover-Armstrong does not recommend 12" diameter connections to an 8" diameter manifold.*

Response: MWE to address this to agreeable way. (Brian, I only see 8" to 8" connections to the from manhole to galley, not sure where is NAA referred to for 12" to 8")

6.1.3 *The two 6" diameter outlets from the infiltration BMP are labelled as 8" diameter on the plans and should be corrected.*

Response: MWE to address this to agreeable way.

6.1.4 *Design information should be provided to support the diversion manhole outlet invert elevations to the Stormceptor units and the infiltration BMP*

Response: MWE to address this.

6.1.5 The pipe run from CB 2 to DMH 3 should not be located within the SAS reserve area.

Response: MWE to fix this.

6.1.6 Design information to support the Level Spreader manifold sizing needs to be provided. The Detail and plan view of its layout are inconsistent. Additional detail of the inspection cover should be provided as it is conceptual in nature. A second inspection point on the manifold inside of the wall should be provided. Future access for maintenance and/or repair of the manifolds and the outlet pipe on the south side of Unit 1B will be difficult.

Response: MWE to address this.

6.1.7 The location of the gutter downspouts and pipe connections to the subsurface infiltration BMP should be added to the plans. Nover-Armstrong is of the opinion that the roof runoff collection system would not be able to capture and convey the roof runoff from large storm events. Depending on the roof configuration, overflow from the gutters may by-pass the infiltration BMP, particularly from Units 1A and 1B.

Response: The infiltration system is designed to handle 2-year storm, all above will have overflow. As most of the roof overflow will end up in the catch basins, some overflow for unit 1A and 1B will not impact the overall function the infiltration system. It is a good suggestion to identify the locations of downspouts and check on the gutter capacity so we can assess the use of the system capacity.

6.1.8 The grading at the top of the driveway from East Plain Street will allow runoff to by-pass CB 3 and discharge out to East Plain Street.

Response: This is a small portion that will be handled by the catch basins in East Plain Street as redevelopment condition. See Figure 2 of the existing aerial photo. Existing condition had more impervious area draining to East Plain Street. The proposed condition will reduce impervious area to East Plain Street significantly.

6.1.9 Subsurface Infiltration System BMPs have an expected TSS removal rate of 80% versus the 99% reported. Requisite pretreatment BMPs receive no additional TSS removal credit per the Handbook

Response: We would agree that the stormceptor will provide higher than 44% TSS removal in general. So, the total system TSS removal will be higher than 80% than DEP standard practice. We know that we will not agree fully as how much better the system will perform than DEP required 80% TSS removal. However, the later part is not necessary for meeting the performance standard.

6.2 Rain Garden BMP

6.2.4 The design of the Rain Garden BMP is not consistent with the Stormwater Handbook. The planting soil and stone specifications and thicknesses do not match the Handbook detail.

Response: We will change the name of rain garden to landscaped infiltration basin. As it only take runoff from roof and vegetated backyard strip, which is considered meeting 80% TSS removal standard.

6.2.5 Rain Garden BMPs have an expected TSS removal rate of 90% if designed in accordance with the Handbook. The BMP better resembles a landscaped infiltration basin that has an expected TSS removal rate of 80%.

Response: Agreed. See above.

6.2.6 Separation of the bottom of the Rain Garden BMP and seasonal high groundwater appears to be about 2.5 feet.

Response: Agreed.

6.2.7 The limits of the bottom of the Rain Garden (elevation 103.5) should be shown on the plans.

Response: Agreed.

6.2.8 The two specification notes for seeding the bottom of the Rain Garden are inconsistent. We don't think "New England Wet Mix" is appropriate considering the amount of groundwater separation.

Response: Agreed. We will change to "New England Detention Basin Seed Mix".

6.2.9 There are a lot of plants proposed for the Rain Garden. The planting schedule should be reviewed for spacing guidelines.

Response: Agreed. The shrubs will be spaced 8 ft to center. Trees will be 12 ft to center.

6.3 Stormceptor Proprietary BMP

6.3.1 The Stormceptor 450i was originally designed by the manufacturer to be used as a stand- alone inlet. The manufacturer claims it will remove 93% of the annual TSS loading on this Project. It is Nover-Armstrong's opinion that the removal efficiency of proprietary BMPs claimed by the manufactures exceed actual rates found in the field.

Response: That is what the manufacturer tested under some market agreed sediment composition. We do not see MADEP's requirements on this. If NAA could provide a DEP acceptable sediment grading curve, we can do a detailed TSS removal analysis to provide a more accurate TSS removal rate for record. Nevertheless, we believe that the unit will provide the manufacture's claim TSS removal rate if the sediment in the onsite runoff is in line with the protocol used by the manufacturer.

6.3.2 As the unit is provided here in an "off-line" configuration and captures a relatively small amount of impervious area, it is our opinion however that the units combined with the Deep- Sump Catch Basin BMPs will remove at a minimum the 44% TSS required for discharges near or to critical areas or within an area of soils with rapid infiltration.

Response: Agreed. The removal rate would much better than 44%.

7.0 SUMMARY

Based on our technical review of the plans provided with the NOI, the Applicant has not provided sufficient information for the Commission to issue an Order of Conditions at this time. They should address the comments presented herein and submit revised, more detailed design plans for further review.

Response: With all the above responses and additional information provided in the attachment, we believe that the applicant had provided more than normal design would provide to address all potential impact concerns on wetland resources and therefore, it should be able to issue an Order of Conditions to assure the implementation of the design.

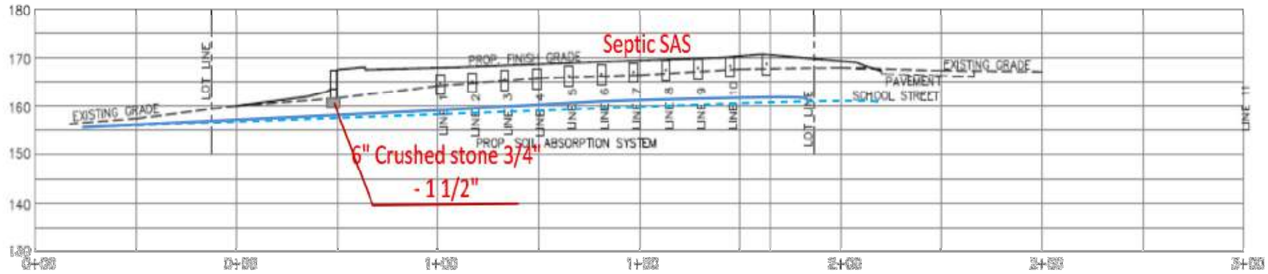
Please feel free to contact us if you have any questions.

Sincerely,
Creative Land & Water Engineering, LLC
by

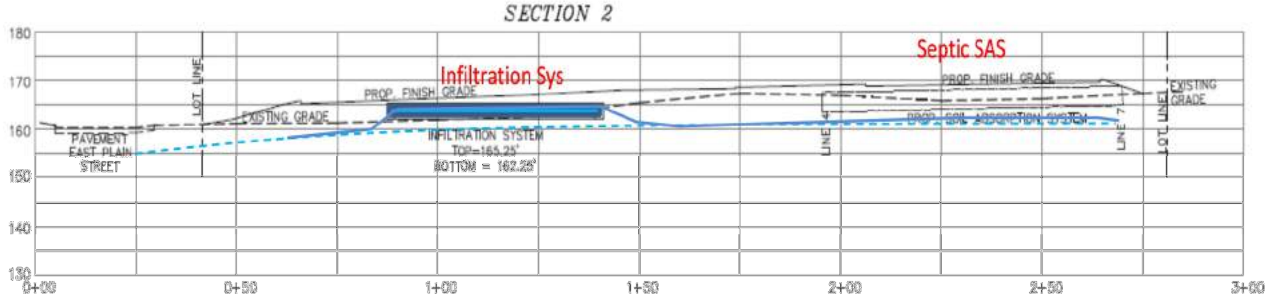
Desheng Wang, Ph.D., P.E.
Hydrogeologist and
Certified Wetland Scientist

cc: DEP NERO, Wetland Division, 205B Lowell Street, Wilmington, MA 01801
Chris D'Antonio, Chadwick Homes, LLC.
Mark Kablack, esq., M.A. Kablack & Associates, P.C.
Brian Nelson, Metrowest Engineering

SECTION 1



SECTION 2



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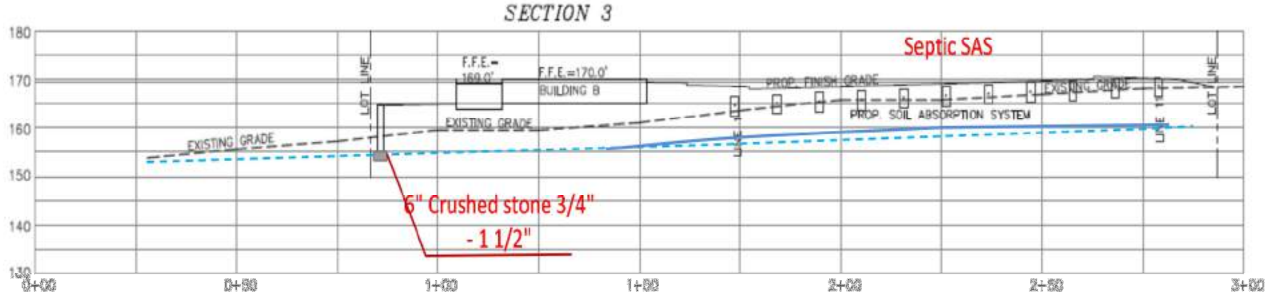
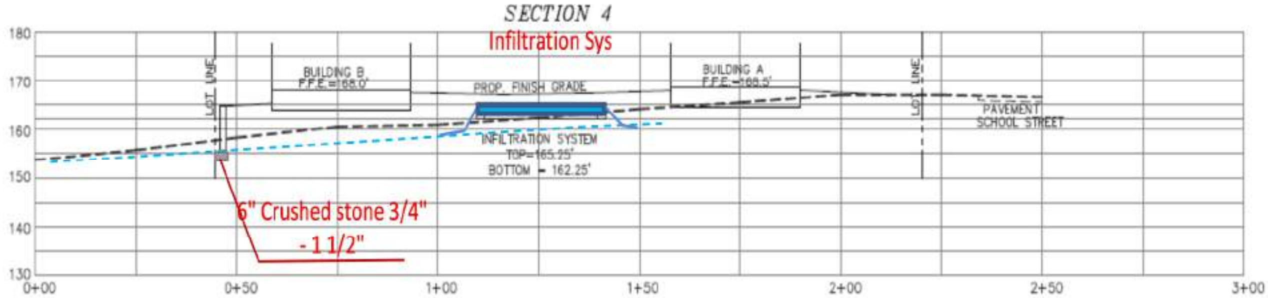
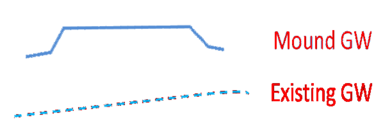


SECTION 4





Grading Profiles

Figure 1. NRCS Soil Map

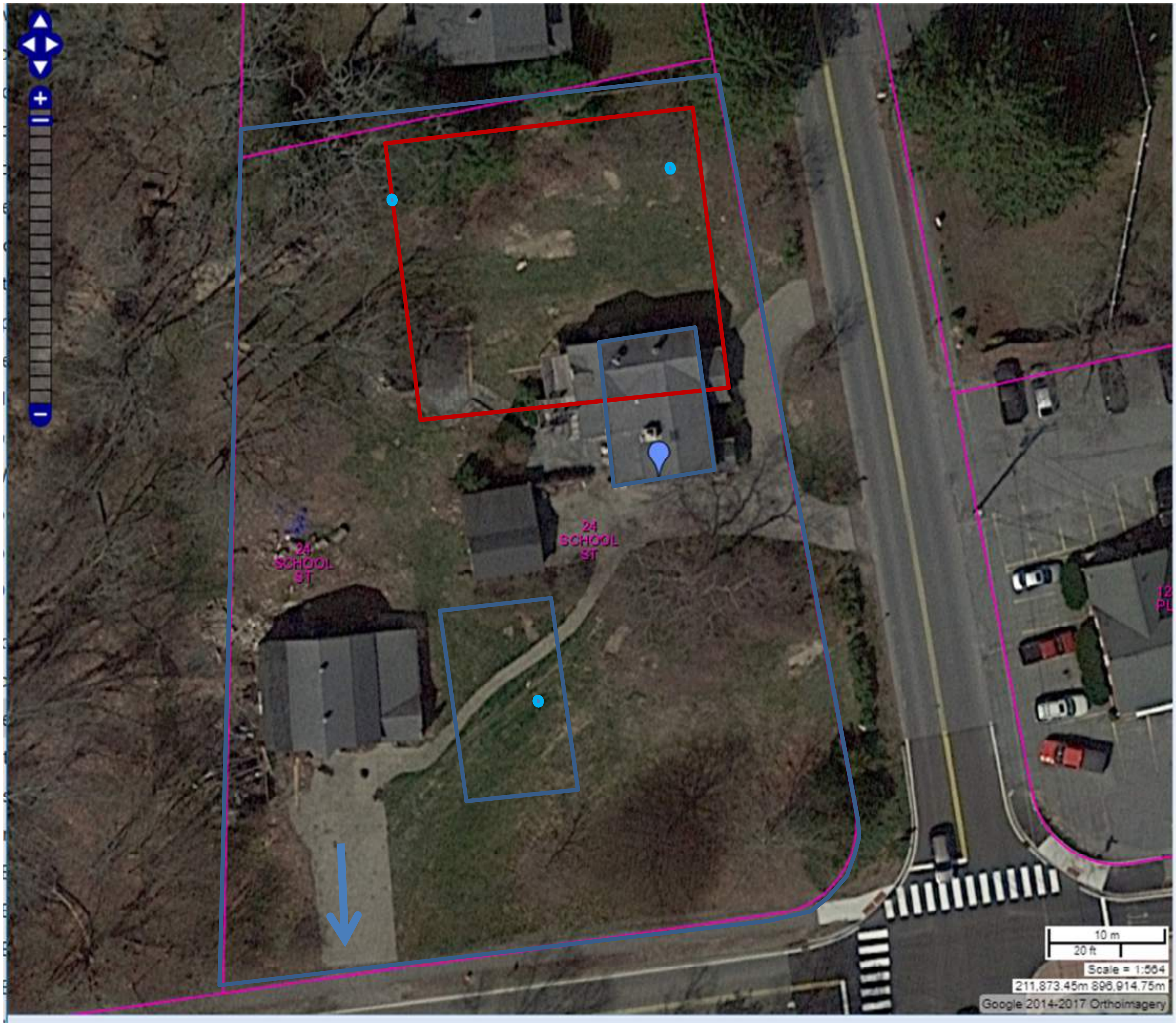


Figure 2. Existing Site Condition Aerial Photo

Table 1a. Soil Evaluation Estimated High Groundwater - MetroWest v.s. MW measurements
Revised 6-10-2018

Test Pit	GSE, ft		EHGW	Location	Measured from MW		Use for Mounding
DTH-1	165.7		159.87	CN SAS			
DTH-2	165.9		159.23	CS SAS	(MW1+ MW2)/2	158.62	**159.55**
DTH-3	161.7		154.87	CW SAS			
DTH-4	164.1		<154	Center STM Infil			
DTH-5	162.6		156.6	NW STM infil	MW 3	160.14	160.14
DTH-6	167.7		161.87	NE SAS	MW 1	160.2	
DTH-7	166.8		<157.3	NE SAS			
DTH-8	168.2		161.53	SE SAS			
DTH-9	163		157.8	NW SAS	MW 2	157.04	
DTH-10	160.75		155.08	SW off SAS			
DTH-11	166		161	E off STM Infil			
DTH-12	168.2		161	SE off SAS			

* SAS used average water table of DTH-1 and DTH-2 for mounding analysis

Table 3. Summary of Updated Mounding Analysis, revsied 6-11-2018

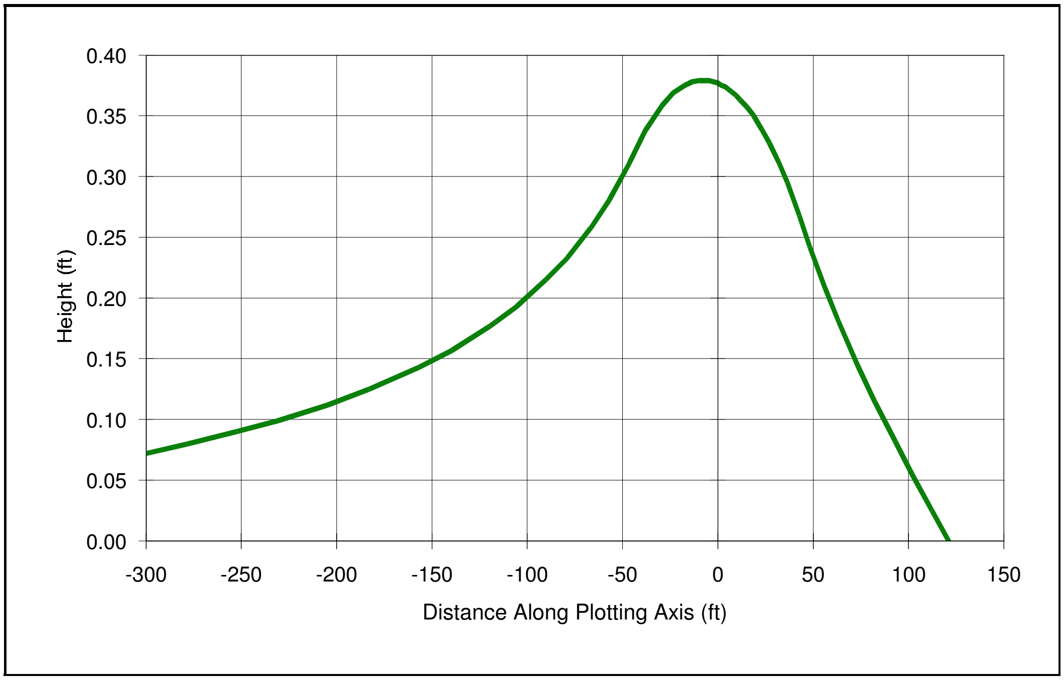
Parameters	100-year Storm		Wastewater				
Recharge area	Infiltration- Norm	Infiltration-cons	SAS, K1	SAS, K1,2,3, WT DTH1,2	SAS - K1,3, WT DTH 1,2	SAS, K1,2,3, WT MW1,2	SAS - K1,3, WT MW 1,2
Scenarios	Inf-1	Inf-2	SCN 1	SCN 2	SCN 3	SCN4	SCN 5
Dimension, ft	32x52	32x52	86 x 72	86 x 72	86 x 72	86 x 72	86 x 72
Area, sq. ft	1664	1664	6192	6192	6192	6192	6192
Recharge Vol. Cu ft (per day or event)	4344	4344	358.24	358.24	358.24	358.24	358.24
Duration, day	1	1	90	90	90	90	90
Recharge rate, cu ft/day/sq. ft	2.61	2.61	0.0579	0.0579	0.0579	0.0579	0.0579
Dewater time, day	3	3	90	90	90	90	90
GW Separation, ft	2.11	2.11	4	4	4	4	4
Maximum mounding height, ft	5.18	6.17	0.27	0.38	0.49	0.4	0.52
Estimated effective Max MH, ft	**2.764**	**2.962**	**0.31**	**0.42**	**0.53**	**0.44**	**0.56**
Impact mounding height by other systems, ft	**0.2**	**0.2**	0.04	0.04	0.04	0.04	0.04
Combined Mound height, ft	**5.38**	**6.37**	**0.31**	**0.42**	**0.53**	**0.44**	**0.56**
3-day residual height, ft	1.24	1.75					
5-day residual height, ft	**0.65**	**0.93**					
Estimated effective 3d MH, ft	**1.24**	**1.75**					
Estimated effective 5d MH, ft	**0.65**	**0.93**					
Bottom of stones, ft	**162.25**	**162.25**	**163.25 to 166**	**163.25 to 166**	**163.25 to 166**	**163.25 to 166**	**163.25 to 166**
Top of stones, ft							
EHGW, ft	**160.14 MW#3**	**160.14 MW#3**	**156.12 to 158.16 160**	**(DTH 1+DTH2)/2 159.55**	**(DTH 1+DTH2)/2 159.55**	**(MW1+MW2)/2 158.62**	**(MW1+MW2)/2 158.62**
Bottom aquifer, ft	**142.7**	**148.1**	**142.7**	**144.45**	**144.45**	**144.45**	**144.45**
3 day elevation, ft	**158.25**	**160.22**					
Flood routing elev, ft	**162.904**	**163.10**					
Top of grade, ft	167	167					
Aquafer depth, ft	17.44	12.04	17.3	15.1	15.1	15.1	15.1
Hydraulic Conductivity, ft/day	6.51, MW#3	6.51, MW#3	25.97 Min(MW#1, MW#2)	21.19 (MW#1+2+3)/3	16.24 (MW#1+3)/2	21.19 (MW#1+2+3)/3	16.24 (MW#1+3)/2

* mounded water tables for stormwater management area are at 3-day.

Table 4. Mounded Water table along the leaching Field - SCN 5

Distance from Center of SAS, ft	Total Mound height, ft	Pre-mound, WT, ft	Mounded WT, ft	Note
-43	0.47	157.04	157.51	MW 1
-20	0.55	157.95	158.50	
0	0.56	158.74	159.30	center
20	0.52	159.53	160.04	
43	0.40	160.44	160.84	MW2+

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



COMPANY: CLAWE

PROJECT: 24 School Street - SAS K1,2,3 WDTH1,2

ANALYST: Desheng Wang

DATE: 6/12/2018 TIME: 12:38:29 PM

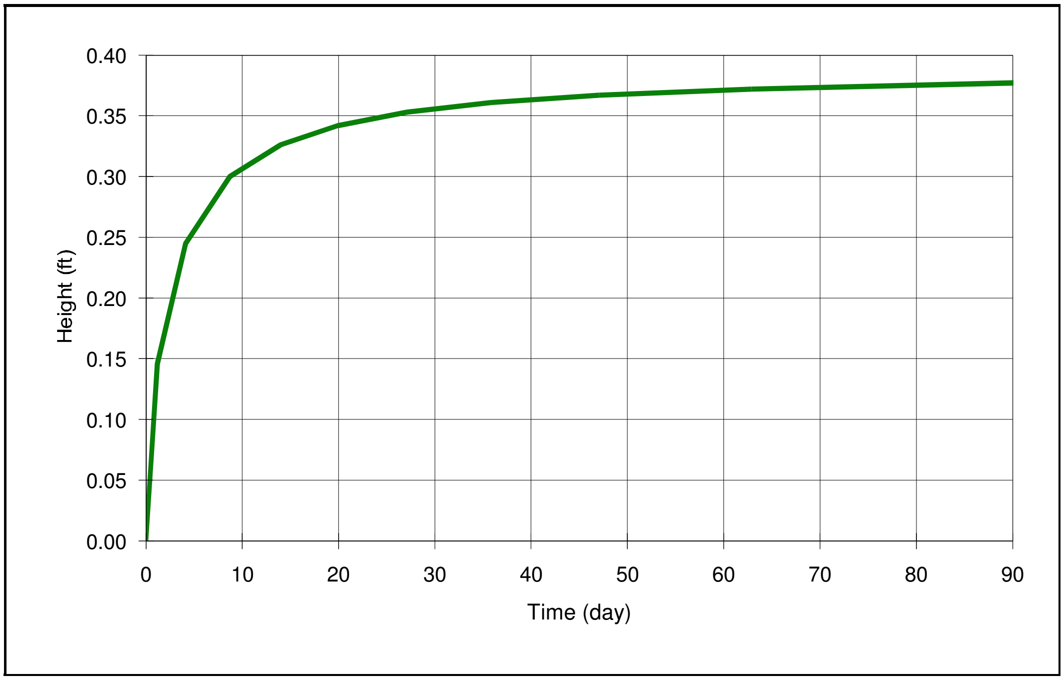
INPUT PARAMETERS

Application rate: 0.0579 c.ft/day/sq. ft
Duration of application: 90 days
Fillable porosity: 0.26
Hydraulic conductivity: 21.19 ft/day
Initial saturated thickness: 15.1 ft
Length of application area: 72 ft
Width of application area: 86 ft
Constant head boundary used at: 121 ft
Plotting axis from Y-Axis: 90 degrees
Edge of recharge area:
positive X: 43 ft
positive Y: 0 ft
Total volume applied: 32266.51 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-300	0	-300	0.07
-252.3	0	-252	0.09
-204.6	0	-205	0.11
-156.9	0	-157	0.14
-119.4	0	-119	0.18
-90.3	0	-90	0.22
-66.5	0	-67	0.26
-46.5	0	-46	0.31
-29.1	0	-29	0.36
-17.4	0	-17	0.38
-9.4	0	-9	0.38
0	0	0	0.38
3.8	0	4	0.37
7	0	7	0.37
11.7	0	12	0.36
18.7	0	19	0.35
26.8	0	27	0.33
36.4	0	36	0.3
48.1	0	48	0.24
63.3	0	63	0.18
82.5	0	83	0.11
101.8	0	102	0.06
121	0	121	0

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



COMPANY: CLAWE

PROJECT: 24 School Street - SAS K1,2,3 WDTH1,2

ANALYST: Desheng Wang

DATE: 6/12/2018 TIME: 12:38:43 PM

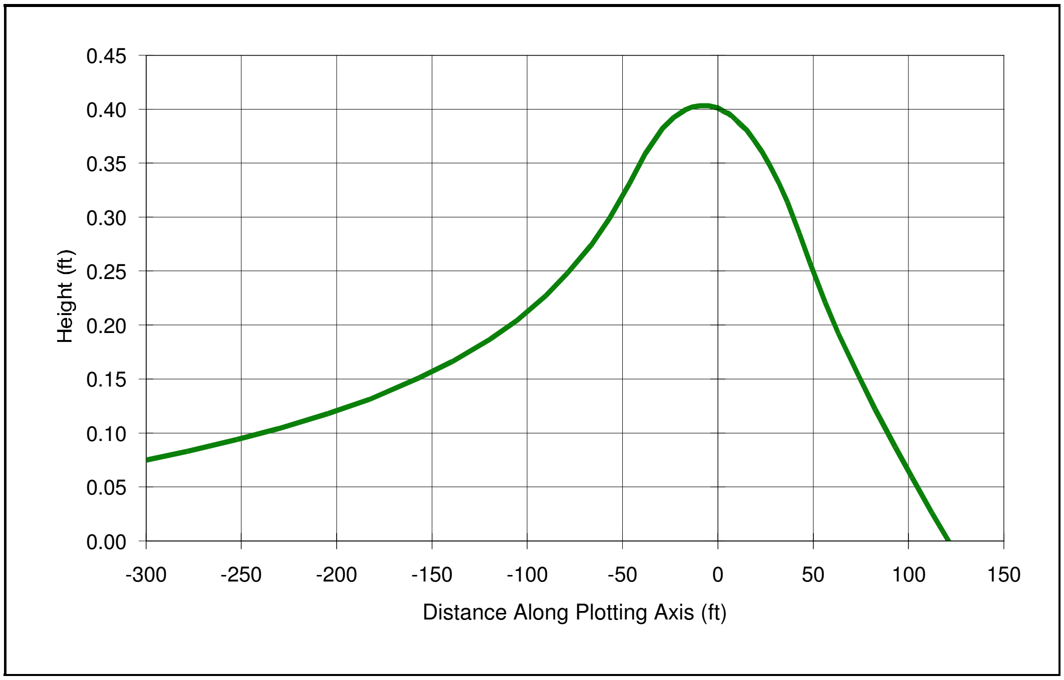
INPUT PARAMETERS

Application rate: 0.0579 c.ft/day/sq. ft
Duration of application: 90 day
Total simulation time: 90 day
Fillable porosity: 0.26
Hydraulic conductivity: 21.19 ft/day
Initial saturated thickness: 15.1 ft
Length of application area: 72 ft
Width of application area: 86 ft
Constant head boundary used at: 121 ft
Groundwater mounding @
X coordinate: 0 ft
Y coordinate: 0 ft
Total volume applied: 32266.51 cft

MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
1	0.15
4	0.24
9	0.3
14	0.33
20	0.34
27	0.35
36	0.36
47	0.37
63	0.37
90	0.38

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



COMPANY: CLAWE

PROJECT: 24 School Street - SAS K1,2,3 WM1,2

ANALYST: Desheng Wang

DATE: 6/12/2018 TIME: 12:39:29 PM

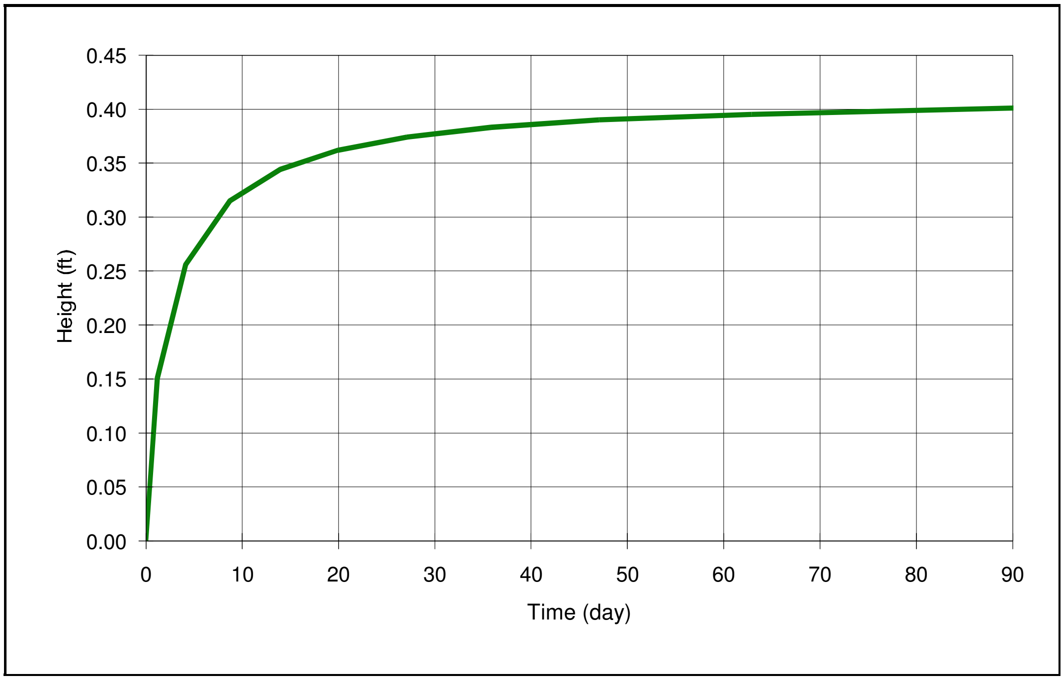
INPUT PARAMETERS

Application rate: 0.0579 c.ft/day/sq. ft
Duration of application: 90 days
Fillable porosity: 0.26
Hydraulic conductivity: 21.19 ft/day
Initial saturated thickness: 14.17 ft
Length of application area: 72 ft
Width of application area: 86 ft
Constant head boundary used at: 121 ft
Plotting axis from Y-Axis: 90 degrees
Edge of recharge area:
positive X: 43 ft
positive Y: 0 ft
Total volume applied: 32266.51 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-300	0	-300	0.08
-252.3	0	-252	0.09
-204.6	0	-205	0.12
-156.9	0	-157	0.15
-119.4	0	-119	0.19
-90.3	0	-90	0.23
-66.5	0	-67	0.27
-46.5	0	-46	0.33
-29.1	0	-29	0.38
-17.4	0	-17	0.4
-9.4	0	-9	0.4
0	0	0	0.4
3.8	0	4	0.4
7	0	7	0.39
11.7	0	12	0.39
18.7	0	19	0.37
26.8	0	27	0.35
36.4	0	36	0.31
48.1	0	48	0.26
63.3	0	63	0.19
82.5	0	83	0.12
101.8	0	102	0.06
121	0	121	0

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



COMPANY: CLAWE

PROJECT: 24 School Street - SAS K1,2,3 WM1,2

ANALYST: Desheng Wang

DATE: 6/12/2018 TIME: 12:39:42 PM

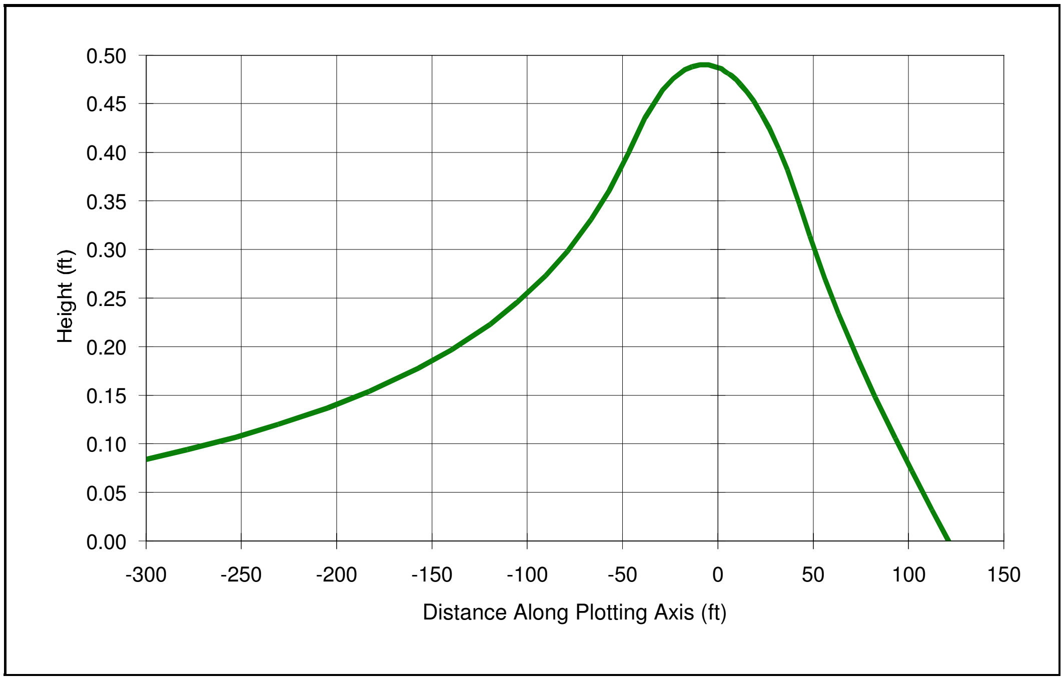
INPUT PARAMETERS

Application rate: 0.0579 c.ft/day/sq. ft
Duration of application: 90 day
Total simulation time: 90 day
Fillable porosity: 0.26
Hydraulic conductivity: 21.19 ft/day
Initial saturated thickness: 14.17 ft
Length of application area: 72 ft
Width of application area: 86 ft
Constant head boundary used at: 121 ft
Groundwater mounding @
X coordinate: 0 ft
Y coordinate: 0 ft
Total volume applied: 32266.51 cft

MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
1	0.15
4	0.26
9	0.32
14	0.34
20	0.36
27	0.37
36	0.38
47	0.39
63	0.4
90	0.4

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



COMPANY: CLAWE

PROJECT: 24 School Street - SAS K1,3 WDTH1,2

ANALYST: Desheng Wang

DATE: 6/12/2018 TIME: 12:40:16 PM

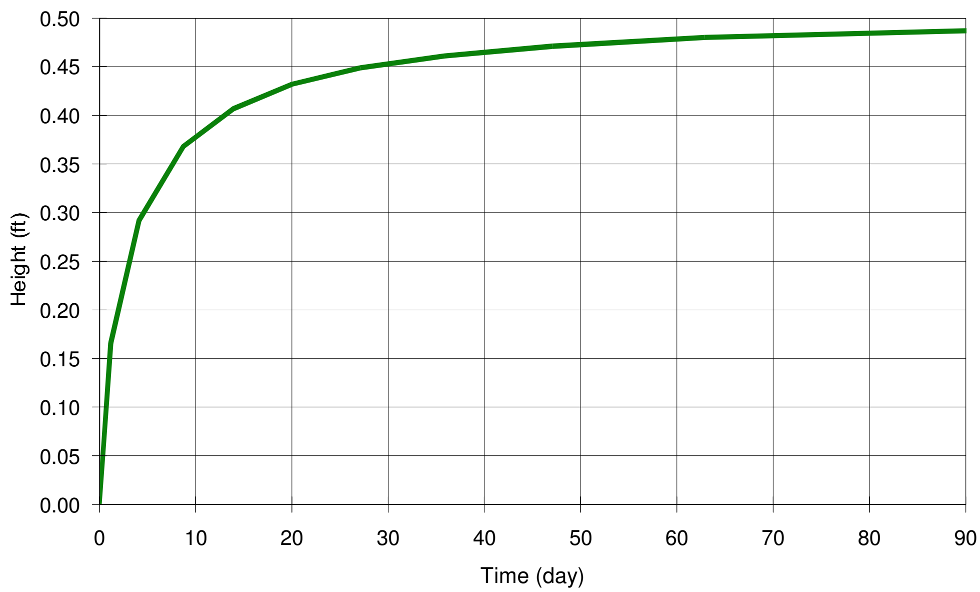
INPUT PARAMETERS

Application rate: 0.0579 c.ft/day/sq. ft
Duration of application: 90 days
Fillable porosity: 0.26
Hydraulic conductivity: 16.24 ft/day
Initial saturated thickness: 15.1 ft
Length of application area: 72 ft
Width of application area: 86 ft
Constant head boundary used at: 121 ft
Plotting axis from Y-Axis: 90 degrees
Edge of recharge area:
positive X: 43 ft
positive Y: 0 ft
Total volume applied: 32266.51 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-300	0	-300	0.08
-252.3	0	-252	0.11
-204.6	0	-205	0.14
-156.9	0	-157	0.18
-119.4	0	-119	0.22
-90.3	0	-90	0.27
-66.5	0	-67	0.33
-46.5	0	-46	0.4
-29.1	0	-29	0.46
-17.4	0	-17	0.48
-9.4	0	-9	0.49
0	0	0	0.49
3.8	0	4	0.48
7	0	7	0.48
11.7	0	12	0.47
18.7	0	19	0.45
26.8	0	27	0.42
36.4	0	36	0.38
48.1	0	48	0.31
63.3	0	63	0.23
82.5	0	83	0.15
101.8	0	102	0.07
121	0	121	0

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



COMPANY: CLAWE

PROJECT: 24 School Street - SAS K1,3 WDTH1,2

ANALYST: Desheng Wang

DATE: 6/12/2018 TIME: 12:40:25 PM

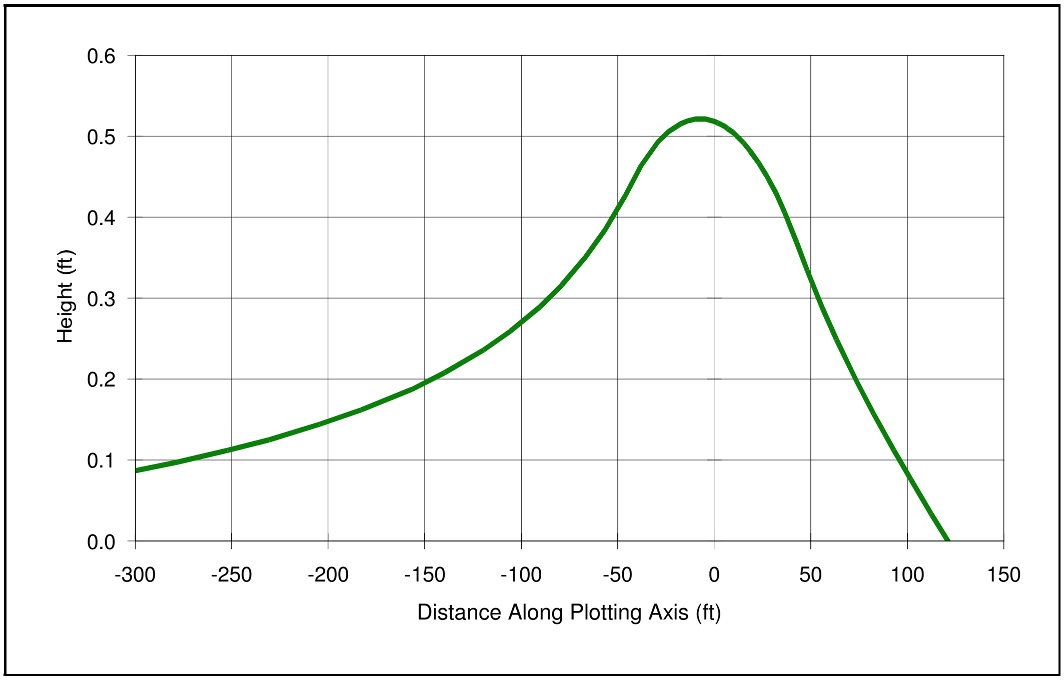
INPUT PARAMETERS

Application rate: 0.0579 c.ft/day/sq. ft
Duration of application: 90 day
Total simulation time: 90 day
Fillable porosity: 0.26
Hydraulic conductivity: 16.24 ft/day
Initial saturated thickness: 15.1 ft
Length of application area: 72 ft
Width of application area: 86 ft
Constant head boundary used at: 121 ft
Groundwater mounding @
X coordinate: 0 ft
Y coordinate: 0 ft
Total volume applied: 32266.51 cft

MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
1	0.17
4	0.29
9	0.37
14	0.41
20	0.43
27	0.45
36	0.46
47	0.47
63	0.48
90	0.49

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



COMPANY: CLAWE

PROJECT: 24 School Street - SAS K1,3 WM1,2

ANALYST: Desheng Wang

DATE: 6/12/2018 TIME: 12:40:53 PM

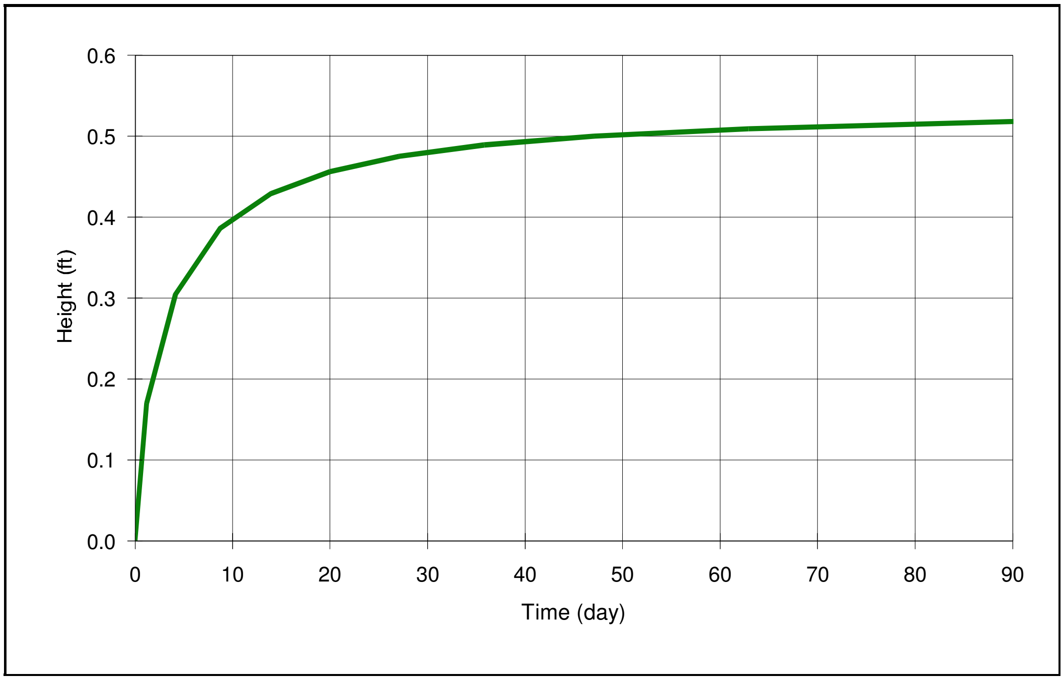
INPUT PARAMETERS

Application rate: 0.0579 c.ft/day/sq. ft
Duration of application: 90 days
Fillable porosity: 0.26
Hydraulic conductivity: 16.24 ft/day
Initial saturated thickness: 14.17 ft
Length of application area: 72 ft
Width of application area: 86 ft
Constant head boundary used at: 121 ft
Plotting axis from Y-Axis: 90 degrees
Edge of recharge area:
positive X: 43 ft
positive Y: 0 ft
Total volume applied: 32266.51 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-300	0	-300	0.09
-252.3	0	-252	0.11
-204.6	0	-205	0.14
-156.9	0	-157	0.19
-119.4	0	-119	0.24
-90.3	0	-90	0.29
-66.5	0	-67	0.35
-46.5	0	-46	0.42
-29.1	0	-29	0.49
-17.4	0	-17	0.52
-9.4	0	-9	0.52
0	0	0	0.52
3.8	0	4	0.51
7	0	7	0.51
11.7	0	12	0.5
18.7	0	19	0.48
26.8	0	27	0.45
36.4	0	36	0.41
48.1	0	48	0.33
63.3	0	63	0.25
82.5	0	83	0.16
101.8	0	102	0.08
121	0	121	0

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



COMPANY: CLAWE

PROJECT: 24 School Street - SAS K1,3 WM1,2

ANALYST: Desheng Wang

DATE: 6/12/2018 TIME: 12:41:04 PM

INPUT PARAMETERS

Application rate: 0.0579 c.ft/day/sq. ft
Duration of application: 90 day
Total simulation time: 90 day
Fillable porosity: 0.26
Hydraulic conductivity: 16.24 ft/day
Initial saturated thickness: 14.17 ft
Length of application area: 72 ft
Width of application area: 86 ft
Constant head boundary used at: 121 ft
Groundwater mounding @
X coordinate: 0 ft
Y coordinate: 0 ft
Total volume applied: 32266.51 cft

MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
1	0.17
4	0.3
9	0.39
14	0.43
20	0.46
27	0.48
36	0.49
47	0.5
63	0.51
90	0.52