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January 28, 2025
File No. 03.0035410.00

Mr. David Morgan
Environmental Planner and Conservation Agent
Arlington Town Hall
730 Massachusetts Avenue
Arlington, MA 02467

Re: Response to January 2025 Redesign
Peer Review of Stormwater Mound Evaluation
Proposed Thorndike Place Residential Development
Arlington, Massachusetts

Dear Mr. Morgan:

In accordance with your request, GZA GeoEnvironmental, Inc. (GZA) prepared this letter to address the BSC Group (BSC)'s January 2025 revised stormwater infiltration design and groundwater mounding analysis associated with the proposed Thorndike Place residential development in Arlington, Massachusetts (the "Site"). BSC performed their work on behalf of the Applicant (Arlington Land Realty, LLC). This letter report is subject to the Limitations provided in **Appendix A.**

BACKGROUND

BSC's June 10, 2024 letter report provided a stormwater mound evaluation and a recommended design groundwater elevation for the Site. GZA's August 1, 2024 peer review of that report recommended that the stormwater infiltration system be redesigned to account for the impacts of groundwater mounding during large storm events and to meet the MassDEP Stormwater Manual's maximum allowable drainage standard of 72-hours. In addition, the redesign was to address peak flow rates that discharge to the stormwater outfall control system (i.e., MassDEP Stormwater Standard 2- Peak Rate attenuation).

BSC subsequently prepared a response letter dated October 4, 2024 that provided a revised stormwater design and associated mounding analysis. GZA's response to that letter, and response to Scott Horsely's August 23, 2024 comment letter, was provided in a letter report dated October 22, 2024.

Thereafter, at the October 24, 2024 public hearing on the Project, GZA requested that the groundwater mound analysis for the underground infiltration system be performed based on the total volume of water infiltrated during the 100 year, 24-hour storm event.

BSC RESPONSE AND REDESIGN

BSC subsequently prepared a response letter dated January 3, 2025 that provided a revised stormwater design and associated mounding analysis. The revised design includes:

1. Five small underground infiltration systems (Infiltration Systems 2 to 6) located in the townhouse driveways near Dorothy Avenue. These systems are located 3.0 feet above the

estimated seasonal high-water table (ESHWT) and include groundwater mound estimates. In larger storm events these systems overflow to a larger underground infiltration system (Infiltration System 1).

2. The former primary infiltration system was modified into two (2) separate underground infiltration systems (Infiltration System 1 and Infiltration System 7).

    a. Infiltration System 1 has a bottom elevation of 8.0 feet which is 4.0 feet above the ESHWT. Because of this 4.0-foot separation distance, a groundwater mound estimate was not provided because it was not required per DEP's Massachusetts Stormwater Handbook. A drawdown analysis using the full volume of water below the lowest system outlet (elevation 9.22 feet) indicates the system will drain in less than the required 72-hours. In larger storm events this system overflows via outlet control structures to a downstream outfall location.

    b. Infiltration System 7 has a bottom elevation of 7.15 feet which is 3.15 feet above the ESHWT and includes a groundwater mound estimate. In larger storm events this system overflows via outlet control structures to a downstream outfall location.

Note that the rooftop detention system that was previously planned for a portion of the multi-unit building roof has been eliminated from the design.

Two new test borings (MA-1 and MA-2) were performed in the area of proposed Infiltration Systems 1 and 7 on November 20, 2024. The test boring logs and a figure depicting the location of the test borings is provided in **Appendix B**. These borings were performed to better understand the depth to a restrictive layer to more accurately determine the initial saturated thickness to be used in the groundwater mounding analysis. The previous groundwater analysis was performed using a saturated thickness of 5 feet, which represented the maximum depth of the test pits below the ESHWT. The two new borings showed a marine clay layer with a highest elevation between -12.1 and -17.4 feet. Based on that data, BSC used an aquifer saturated thickness in their mounding analysis of 16 feet representing the depth between the ESHWT (4.0) and the shallower marine clay layer (-12.1).

BSC's revised peak stormwater flow calculations provided in their January 3, 2025 letter indicated that post development flows remain less than predevelopment flows, which satisfies MassDEP's Stormwater Standard 2.

The locations of proposed Site features are shown on the figure provided in **Appendix C**.

GZA RESPONSE

The Massachusetts Stormwater Handbook states:

> *Mounding analysis is required when the vertical separation from the bottom of an exfiltration system to seasonal high groundwater is less than four (4) feet and the recharge system is proposed to attenuate the peak discharge from a 10-year or higher 24-hour storm (e.g., 10-year, 25 year, or 100-year 24- hour storm). In such cases, the mounding analysis must demonstrate that the Required Recharge Volume (e.g., infiltration basin storage) is fully dewatered with 72 hours (so the next storm can be stored for exfiltration).*

The revised underground stormwater Infiltration System 1 is now 4.0 feet above the ESHWT. As a result, GZA agrees that a groundwater mound evaluation is not required by the MassDEP Stormwater Standards for this system.

GZA's review of the new test boring logs (MA-1 to MA-2) provided in Appendix B indicate that below the upper fill strata, alluvium deposits of stratified sand deposits with trace amounts of silt, and silty sand deposits were encountered in both borings to a depth of 20 to 28 feet below grade (elevation -12 to -17 feet), at which point a low permeability clay layer was encountered. The deeper clay strata was encountered at boring MA-1 which was performed in the area of proposed Infiltration System 7. It is GZA's opinion that this new subsurface information indicates that using an aquifer saturated thickness of 16 feet in the groundwater mound analysis, instead of the previous 5-foot thickness, is a reasonable assumption.

However, we note that a fibrous peat (organic deposit) was encountered in boring MA-2 between a depth of 5.5 and 8 feet (elevation 2.4 to -0.1 feet). Boring MA-2 was performed on the eastern side of Infiltration System 1. It is GZA's opinion that the organic deposit encountered beneath the eastern portion of Infiltration System 1 is a low permeability deposit that may adversely impact the functionality of Infiltration System 1. GZA recommends that the organic deposit be removed from the area of Infiltration System 1 and then be replaced with clean sand backfill up to the bottom of Infiltration System 1.

We note that the bottom of stormwater Infiltration System 1 is now higher than the proposed garage floor level of the new building that is planned to be located 10 feet from the stormwater infiltration system. The proposed garage floor level is elevation 6.0 feet, and the bottom of the stormwater infiltration system is planned to be at elevation 8.0 feet. It is GZA's opinion, that a groundwater underdrain should be designed and constructed beneath the garage floor level in this area to prevent potential water seepage into the building foundation and / or floor slab.

BSC's groundwater mound evaluations for Infiltration Systems 2 to 7, using the volume of groundwater recharge generated during the 100-year storm event, used the same aquifer parameter as the previous analysis but with an aquifer thickness of 16 feet.

Their groundwater mound estimate was 0.76 feet for Infiltration Systems 2 to 6 (i.e., the smaller systems located in the townhouse driveways) which was less than the separation distance of 3.0 feet between the ESHWT and the bottom of the infiltration system. BSC assumed that the entire groundwater recharge volume of 161 cubic feet of water was applied to the 100.7 square foot bottom area of the infiltration system over a one-day period, resulting in an applied recharge rate of 1.60 feet per day. We note that the design vertical hydraulic conductivity value of 0.27-inches per hour (0.54 feet per day) would tend to slow the applied recharge rate to 0.54 feet per day, which would take 2.95 days to drain. GZA performed a groundwater mound analysis using the 0.54 feet per day groundwater recharge rate with a duration of 2.95 days, which resulted in an estimated groundwater mound of 0.31 feet (less than BSC's estimate). Our mound calculations are provided in **Appendix D**.

BSC's groundwater mound estimate was 2.95 feet for Infiltration System 7 which was less than the separation distance of 3.15 feet between the ESHWT and the bottom of the infiltration system. BSC assumed that the entire groundwater recharge volume of 1,606 cubic feet of water was applied to the 2,422 square foot bottom area of the infiltration system over a one-day period, resulting in an applied recharge rate of 0.66 feet per day. We again note that the design vertical hydraulic conductivity value of 0.27-inches per hour (0.54 feet per day) would tend to slow the applied recharge rate to 0.54 feet per day, which would take 1.23 days to drain. GZA performed our groundwater mound analysis using the 0.54 feet per day groundwater recharge rate with a duration of 1.23 days, which resulted in an estimated groundwater mound of 2.62 feet (less than BSC's estimate). Our mound calculations are provided in **Appendix D**.

We note that Infiltration System 7 is about 18 feet west of Infiltration System 1. Due to this proximity, the discharge of stormwater to Infiltration System 1 may have some affect on the groundwater levels beneath Infiltration System 7. However, GZA's mound estimate of 2.62 feet is 0.53 feet lower than the bottom of Infiltration System 7, so there is

additional vertical separation from the bottom of the system and the estimated mound height to account for additional mounding impacts.

CONCLUSIONS

GZA's opinion is as follows:

1. If the nearby building's groundwater underdrain system is installed beside Infiltration System 1 and if the organic deposit (peat layer) in the eastern portion of the Infiltration System 1 is removed and replaced with clean sand up to the bottom of the Infiltration System 1, then we do not anticipate that the adjacent mounding due to Infiltration System 1 will adversely impact the mound conditions at Infiltration System 7.

2. With the implementation of building underdrainage and peat removal as summarized above, the revised stormwater mound evaluations provided in BSC's January 3, 2025 report adequately addresses the Massachusetts Stormwater Handbook's requirements to evaluate impacts of groundwater mounding during large (100-year) storm events and addresses the 72-hour drainage requirement for the infiltration systems. The revised predicted groundwater mound beneath the stormwater infiltration systems is not expected to adversely impact the ability of the infiltration systems to empty in less than 72 hours. We premise these conclusions on the assumption that an underdrain system will be installed beneath the building located near Infiltration System 1 and the organic deposit (peat layer) underlying Infiltration System 1 is removed and replaced with clean sand up to the bottom of the Infiltration System 1.

3. The stormwater redesign appears to adequately addresses the MassDEP Stormwater Standard 2- Peak Rate attenuation requirements.

We trust this information satisfies your current needs. If you have any questions or comments, please feel free to contact the undersigned at (401) 374-2317 or via email at anthony.urbano@gza.com.

Very truly yours,

GZA GEOENVIRONMENTAL, INC.

Anthony B. Urbano, P.E.
Senior Project Manager

Todd Greene, P.E.(RI)
Principal

Attachments: Appendix A – Limitations
Appendix B – New Boring Logs and Exploration Location Plan
Appendix C – Site Location Plan
Appendix D – GZA Groundwater Mound Calculations

Jobs/env/35410.ABU/correspondence/Response to Jan 2025 Redesign/35410-response to redesign 1-28-25.docx

ATTACHMENT A

Limitations

USE OF REPORT

1. GZA GeoEnvironmental, Inc. (GZA) prepared this report on behalf of, and for the exclusive use of our Client for the stated purpose(s) and location(s) identified in the Proposal for Services and/or Report. Use of this report, in whole or in part, at other locations, or for other purposes, may lead to inappropriate conclusions; and we do not accept any responsibility for the consequences of such use(s). Further, reliance by any party not expressly identified in the agreement, for any use, without our prior written permission, shall be at that party's sole risk, and without any liability to GZA.

STANDARD OF CARE

2. GZA's findings and conclusions are based on the work conducted as part of the Scope of Services set forth in the Proposal for Services and/or Report and reflect our professional judgment. These findings and conclusions must be considered not as scientific or engineering certainties, but rather as our professional opinions concerning the limited data gathered during the course of our work. Conditions other than described in this report may be found at the subject location(s).

3. GZA's services were performed using the degree of skill and care ordinarily exercised by qualified professionals performing the same type of services, at the same time, under similar conditions, at the same or a similar property. No warranty, expressed or implied, is made. Specifically, GZA does not and cannot represent that the Site contains no hazardous material, oil, or other latent condition beyond that observed by GZA during its study. Additionally, GZA makes no warranty that any response action or recommended action will achieve all of its objectives or that the findings of this study will be upheld by a local, state or federal agency.

4. In conducting our work, GZA relied upon certain information made available by public agencies, Client and/or others. GZA did not attempt to independently verify the accuracy or completeness of that information. Inconsistencies in this information which we have noted, if any, are discussed in the Report.

SUBSURFACE CONDITIONS

5. The generalized soil profile(s) provided in our Report are based on widely-spaced subsurface explorations and are intended only to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized, and were based on our assessment of subsurface conditions. The composition of strata, and the transitions between strata, may be more variable and more complex than indicated. For more specific information on soil conditions at a specific location refer to the exploration logs. The nature and extent of variations between these explorations may not become evident until further exploration or construction. If variations or other latent conditions then become evident, it will be necessary to reevaluate the conclusions and recommendations of this report.

6. Water level readings have been made, as described in this Report, in and monitoring wells at the specified times and under the stated conditions. These data have been reviewed and interpretations have been made in this report. Fluctuations in the level of the groundwater however occur due to temporal or spatial variations in areal recharge rates, tidal fluctuations, soil heterogeneities, the presence of subsurface utilities, and/or natural or artificially induced perturbations. The observed water table may be other than indicated in the Report.

COMPLIANCE WITH CODES AND REGULATIONS

7. We used reasonable care in identifying and interpreting applicable codes and regulations necessary to execute our scope of work. These codes and regulations are subject to various, and possibly contradictory, interpretations. Interpretations and compliance with codes and regulations by other parties is beyond our control.

SCREENING AND ANALYTICAL TESTING

8. GZA collected environmental samples at the locations identified in the Report. These samples were analyzed for the specific parameters identified in the report. Additional constituents, for which analyses were not conducted, may be present in soil, groundwater, surface water, sediment and/or air. Future Site activities and uses may result in a requirement for additional testing.

9. Our interpretation of field screening and laboratory data is presented in the Report. Unless otherwise noted, we relied upon the laboratory's QA/QC program to validate these data.

10. Variations in the types and concentrations of contaminants observed at a given location or time may occur due to release mechanisms, disposal practices, changes in flow paths, and/or the influence of various physical, chemical, biological or radiological processes. Subsequently observed concentrations may be other than indicated in the Report.

INTERPRETATION OF DATA

11. Our opinions are based on available information as described in the Report, and on our professional judgment. Additional observations made over time, and/or space, may not support the opinions provided in the Report.

ADDITIONAL INFORMATION

12. In the event that the Client or others authorized to use this report obtain additional information on environmental or hazardous waste issues at the Site not contained in this report, such information shall be brought to GZA's attention forthwith. GZA will evaluate such information and, on the basis of this evaluation, may modify the conclusions stated in this report.

ADDITIONAL SERVICES

13. GZA recommends that we be retained to provide services during any future investigations, design, implementation activities, construction, and/or property development/ redevelopment at the Site. This will allow us the opportunity to: i) observe conditions and compliance with our design concepts and opinions; ii) allow for changes in the event that conditions are other than anticipated; iii) provide modifications to our design; and iv) assess the consequences of changes in technologies and/or regulations.

ATTACHMENT B

New Boring Logs and Exploration Location Plan

Project:	Thorndike Place	**Job #:**	7679.2.01
Location:	See Plan	**Date Started:**	11-20-24
City/State:	Arlington, Massachusetts	**Date Finished:**	11-20-24

Boring No.

MA-1

Contractor: Carr-Dee Corp
Driller/Helper: J. DeSimone/C. Smith
Logged By/Reviewed By: T. M. Cormican
Surface Elevation (ft): 11.1

Casing Type/Depth (ft): 2.25" I.D. HSA/NW Casing
Casing Hammer (lbs)/Drop (in): 300 lbs./24 inches
Sampler Size/Type: 1-3/8" I.D. Split Spoon
Sampler Hammer (lbs)/Drop (in): 140 lbs./30 inches

Groundwater Observations

Date	Depth	Elev.	Notes
11-20-24	12	-0.9	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows Per 6"	Sample Description and Boring Notes
1	10			FILL	12	S-1	24/8	0.0-2.0	3 5 7 12	Compact light brown silty SAND and GRAVEL. (FILL)
2	9									
3	8									
4	7									
5	6				70	S-2	24/16	5.0-7.0	14 37 33 49	Very dense, gray-brown SAND and GRAVEL, trace to some silt to BRICK. (FILL)
6	5									
7	4									
8	3									
9	2		9.5 / 1.6							
10	1			ALLUVIUM DEPOSIT	19	S-3	24/0	10.0-12.0	16 12 7 14	No Recovery
11	0				45	S-4	24/14	12.0-14.0	14 23 22 20	Dense, dark gray SAND, trace to some silt. (ALLUVIUM DEPOSIT)
12	-1									
13	-2									
14	-3									
15	-4				23	S-5	24/12	15.0-17.0	9 12 11 12	Compact, gray-brown SAND, trace silt. (ALLUVIUM DEPOSIT)
16	-5									
17	-6									
18	-7									
19	-8									
20	-9				17	S-6	24/18	20.0-22.0	8 8 9 12	Compact, orange-brown and yellow-brown stratified silty SAND to SAND, trace silt. (ALLUVIUM DEPOSIT)
21	-10									
22	-11									

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
1. Used Automatic Hammer for SPT.
2. Drillers switched to casing after obtaining sample from 12-14'.

Weather: Variable

McPHAIL ASSOCIATES, LLC
42 3rd AVENUE
Burlington, MA 01803
TEL: 617-868-1420
FAX: 617-868-1423

Project:	Thorndike Place	**Job #:**	7679.2.01
Location:	See Plan	**Date Started:**	11-20-24
City/State:	Arlington, Massachusetts	**Date Finished:**	11-20-24

Boring No.

MA-1

Contractor: Carr-Dee Corp
Driller/Helper: J. DeSimone/C. Smith
Logged By/Reviewed By: T. M. Cormican
Surface Elevation (ft): 11.1

Casing Type/Depth (ft): 2.25" I.D. HSA/NW Casing
Casing Hammer (lbs)/Drop (in): 300 lbs./24 inches
Sampler Size/Type: 1-3/8" I.D. Split Spoon
Sampler Hammer (lbs)/Drop (in): 140 lbs./30 inches

Groundwater Observations

Date	Depth	Elev.	Notes
11-20-24	12	-0.9	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows Per 6"	Sample Description and Boring Notes
24	-13									
25	-14			ALLUVIUM DEPOSIT	33	S-7	24/18	25.0-27.0	19 17 16 15	Dense, gray stratified silty SAND to SAND, trace silt. (ALLUVIUM DEPOSIT)
26	-15									
27	-16									
28	-17		28.5 / -17.4							
29	-18			MARINE CLAY						
30	-19				9	S-8	24/18	30.0-32.0	3 4 5 3	Stiff, gray silty CLAY with ~ 6 inch layer of sand. (MARINE CLAY)
31	-20									
32	-21									
33	-22									
34	-23									
35	-24									
36	-25				1/24"	S-9	24/22	35.0-37.0	1/24"	Very soft, gray silty CLAY. (MARINE CLAY)
37	-26		37.0 / -25.9							
38	-27			Bottom of Borehole at 37.0 feet below existing grade.						
39	-28									
40	-29									
41	-30									
42	-31									
43	-32									
44	-33									
45	-34									

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
1. Used Automatic Hammer for SPT.
2. Drillers switched to casing after obtaining sample from 12-14'.

Weather: Variable

McPHAIL ASSOCIATES, LLC
42 3rd AVENUE
Burlington, MA 01803
TEL: 617-868-1420
FAX: 617-868-1423

Project:	Thorndike Place	**Job #:**	7679.2.01
Location:	See Plan	**Date Started:**	11-20-24
City/State:	Arlington, Massachusetts	**Date Finished:**	11-20-24

Boring No.

MA-2

Contractor: Carr-Dee Corp
Driller/Helper: J. DeSimone/C. Smith
Logged By/Reviewed By: T. M. Cormican
Surface Elevation (ft): 7.9

Casing Type/Depth (ft): 2.25" I.D. HSA/NW Casing
Casing Hammer (lbs)/Drop (in): 300 lbs./24 inches
Sampler Size/Type: 1-3/8" I.D. Split Spoon
Sampler Hammer (lbs)/Drop (in): 140 lbs./30 inches

Groundwater Observations

Date	Depth	Elev.	Notes
11-20-24	11	-3.1	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows Per 6"	Sample Description and Boring Notes
			23.5 / -15.6	MARINE SAND						
24	-16									
25	-17									
26	-18				2	S-6	24/24	25.0-27.0	1/12' 1 1	Very soft, gray silty CLAY with frequent sand partings in bottom ~ 10 inches of sample. (MARINE CLAY)
27	-19									
28	-20									
29	-21									
30	-22				1	S-7	24/24	30.0-32.0	WOH WOH 1 1	Very soft, gray silty CLAY with frequent sand partings. (MARINE CLAY)
31	-23									
32	-24									
33	-25			MARINE CLAY						
34	-26									
35	-27									
36	-28				1	S-8	24/24	35.0-37.0	WOH WOH 1 1	Very soft, gray silty CLAY, with occasional sand partings. (MARINE CLAY)
37	-29									
38	-30									
39	-31									
40	-32									
41	-33				1	S-9	24/24	40.0-42.0	WOH WOH 1 WOH	Very soft, gray silty CLAY, with occasional sand partings. (MARINE CLAY)
42	-34		42.0 / -34.1							
43	-35			Bottom of Borehole at 42.0 feet below existing grade.						
44	-36									
45	-37									

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
1. Used Automatic Hammer for SPT.
2. Drillers switched to casing after obtaining sample from 10-12'.

Weather: Variable

McPHAIL ASSOCIATES, LLC
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TEL: 617-868-1420
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Project:	Thorndike Place	**Job #:**	7679.2.01
Location:	See Plan	**Date Started:**	11-20-24
City/State:	Arlington, Massachusetts	**Date Finished:**	11-20-24

Boring No.

MA-2

Contractor: Carr-Dee Corp
Driller/Helper: J. DeSimone/C. Smith
Logged By/Reviewed By: T. M. Cormican
Surface Elevation (ft): 7.9

Casing Type/Depth (ft): 2.25" I.D. HSA/NW Casing
Casing Hammer (lbs)/Drop (in): 300 lbs./24 inches
Sampler Size/Type: 1-3/8" I.D. Split Spoon
Sampler Hammer (lbs)/Drop (in): 140 lbs./30 inches

Groundwater Observations

Date	Depth	Elev.	Notes
11-20-24	11	-3.1	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows Per 6"	Sample Description and Boring Notes
			0.4 / 7.5	TOPSOIL						
1	7			FILL	4	S-1	24/16	0.0-2.0	3 2 2 3	Very loose to loose, mottled gray-brown SILT and SAND, trace gravel. (FILL)
2	6									
3	5									
4	4									
5	3		5.5 / 2.4		4	S-2	6/6	5.0-5.5	2	Very loose, mottled orange-brown and black SILT and SAND, with wood, ash and cinders. (FILL)
6	2			ORGANIC DEPOSIT	4	S-2a	18/18	5.5-7.0	2 2 2	Soft to firm, brown FIBROUS PEAT. (ORGANIC DEPOSIT)
7	1									
8	0		8.0 / -0.1							
9	-1			ALLUVIUM DEPOSIT						
10	-2									
11	-3				17	S-3	24/14	10.0-12.0	9 8 9 9	Compact, gray-brown stratified silty SAND to SAND, trace silt. (ALLUVIUM DEOSIT)
12	-4									
13	-5									
14	-6									
15	-7									
16	-8				18	S-4	24/16	15.0-17.0	8 8 10 9	Compact, stratified gray silty SAND to SAND, trace silt. (ALLUVIUM DEPOSIT)
17	-9									
18	-10									
19	-11									
20	-12		20.0 / -12.1							
21	-13		21.0 / -13.1	MARINE CLAY	5	S-5	12/12	20.0-21.0	3 2	Very soft to soft, gray silty CLAY with silt and sand seams. (MARINE CLAY)
22	-14			MARINE SAND	22	S-5a	12/12	21.0-22.0	8 14	Compact, gray stratified silty SAND to SAND, trace silt. (MARINE SAND)

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
1. Used Automatic Hammer for SPT.
2. Drillers switched to casing after obtaining sample from 10-12'.

Weather: Variable

McPHAIL ASSOCIATES, LLC
42 3rd AVENUE
Burlington, MA 01803
TEL: 617-868-1420
FAX: 617-868-1423

FIGURE 2

NORTH

LITTLEJOHN STREET
(PUBLIC - 40' WIDE)

PROPERTY LINE

APPROXIMATE LIMITS OF
PROPOSED TOWNHOUSES

DOROTHY ROAD
(PUBLIC - 40' WIDE)

MA-1

MA-2

APPROXIMATE LOCATION
OF PROPOSED
STORMWATER SYSTEM

APPROXIMATE LIMITS OF PROPOSED
MULTI-FAMILY RESIDENTIAL BUILDING

LEGEND

— APPROXIMATE LOCATION OF BOREHOLE PERFORMED BY CARR-DEE CORP. ON NOVEMBER 20, 2024 FOR McPHAIL ASSOCIATES, LLC

REFERENCE: THIS PLAN WAS PREPARED FROM AN 80-SCALE DRAWING ENTITLED "EXISTING CONDITIONS" DATED SEPTEMBER 6, 2023 BY BSC GROUP, INC.

GRAPHIC SCALE

50 0 50 100

FILE NAME: N:\Acad\OBS\7679\Geotech Data Report\7679-F02.dwg

McPHAIL ASSOCIATES, LLC
42 3rd Avenue
Burlington, MA 01803
617-868-1420
www.mcphailgeo.com

THORNDIKE PLACE

ARLINGTON MASSACHUSETTS

SUBSURFACE EXPLORATION PLAN

FOR

DINOSAUR CAPITAL PARTNERS LLC

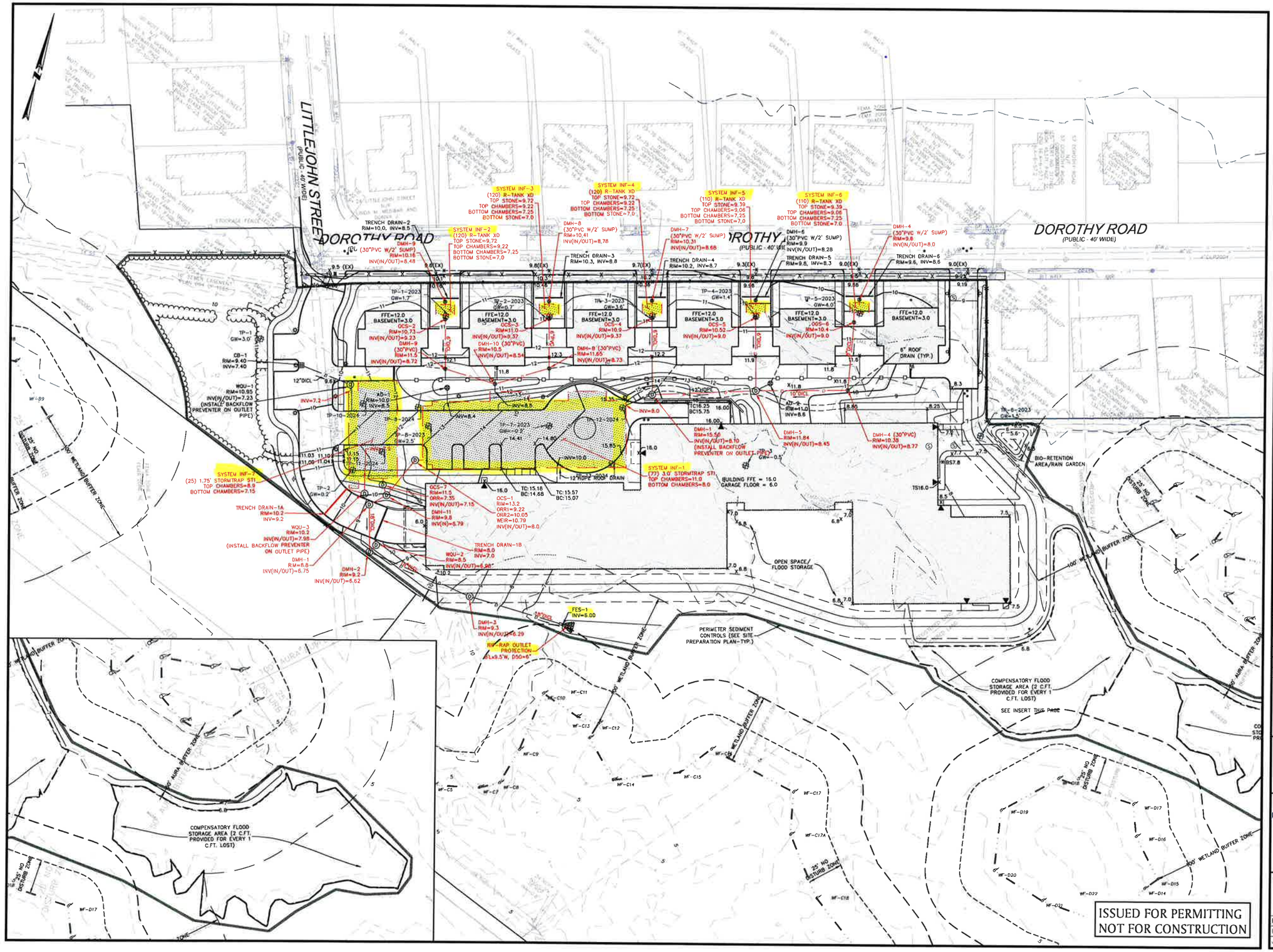
BY

McPHAIL ASSOCIATES, LLC

Date: DECEMBER 2024	Dwn: I.J.M.	Chkd: S.S.S.	Scale: 1" = 50'
Project No: 7679			

ATTACHMENT C

Site Location Plan



PROFESSIONAL ENGINEER

THORNDIKE PLACE
NOTICE OF INTENT

DOROTHY ROAD
IN
ARLINGTON
MASSACHUSETTS
(MIDDLESEX COUNTY)

GRADING & DRAINAGE PLAN

SEPTEMBER 6, 2023

REVISIONS:

NO.	DATE	DESC.
1	9/12/24	INFILTRATION SYSTEM
2	12/10/24	PEER REVIEW REVISIONS

PREPARED FOR:
ARLINGTON LAND REALTY, LLC
84 SHERMAN STREET, 2ND FLOOR
CAMBRIDGE, MA

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

SCALE: 1" = 30'
0 15 30 60 FEET

FILE: 2340702\C\D\2340702-GR
DWG.:
JOB. NO: 23407.02
SHEET C-104

ATTACHMENT D

GZA Groundwater Mound Calculations

Groundwater Mound Estimate for Infiltration System -7

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

hours	days
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

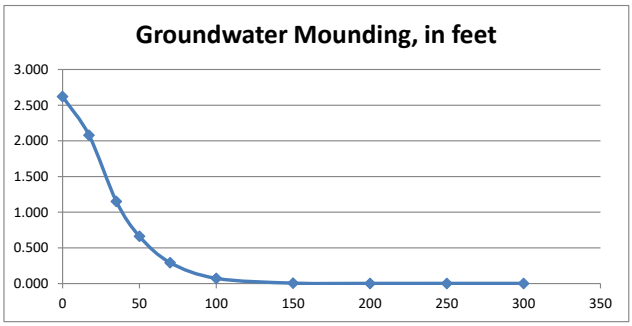
Input Values

0.5400	***R***	**Recharge (infiltration) rate (feet/day)**
0.080	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
5.40	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
17.200	**x**	**1/2 length of basin (x direction, in feet)**
35.200	**y**	**1/2 width of basin (y direction, in feet)**
1.230	**t**	**duration of infiltration period (days)**
16.000	**hi(0)**	**initial thickness of saturated zone (feet)**

18.620	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
2.620	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
2.620	0
2.078	17.2
1.151	35
0.662	50
0.293	70
0.073	100
0.007	150
0.003	200
0.003	250
0.003	300

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

Groundwater Mound Estimate for Inf-2 to Inf-6

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Input Values		
0.5400	***R***	**Recharge (infiltration) rate (feet/day)**
0.080	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
5.40	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
6.900	**x**	**1/2 length of basin (x direction, in feet)**
3.600	**y**	**1/2 width of basin (y direction, in feet)**
2.950	**t**	**duration of infiltration period (days)**
16.000	**hi(0)**	**initial thickness of saturated zone (feet)**

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

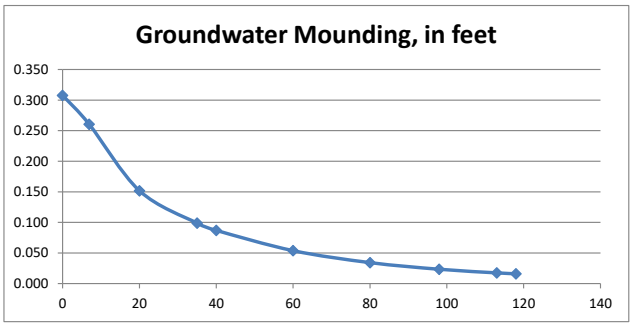
hours	days
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

16.308	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
0.308	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
0.308	0
0.261	6.9
0.152	20
0.099	35
0.087	40
0.054	60
0.034	80
0.023	98
0.018	113
0.016	118

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.