MRCE
built on firm foundations

PARTNERS
Peter W. Deming
Roderic A. Ellman, Jr.
Francis J. Arland
David R. Good
Walter E. Kaeck
Sitotaw Y. Fantaye

ASSOCIATE PARTNERS
Tony D. Canale
Jan Cermak

SENIOR ASSOCIATES
Domenic D'Argenzio
Robert K. Radske
Ketan H. Trivedi
Hiren J. Shah
Alice Arana
Joel L. Volterra
Anthony DeVito
Steven R. Lowe
Andrew R. Tognon
James M. Tantalla
T. C. Michael Law
Andrew Pontecorvo
Renzo D. Verastegui

ASSOCIATES
Douglas W. Christie
Srinivas Yenamandra
Alex Krutovskiy
Farid Vastani
Jesse L. Richins
Jong W. Choi
Raj S. Chinthamani
Andrew R. Klaetsch
Peter L. Madarasz
Aaron L. Sacks
Sung H. Kong
Fathey N. Elsaid
Colleen Liddy
Dimitrios Iliadelis
Adam M. Dyer

TECHNICAL SPECIALISTS
David M. Cacoilo
Alfred H. Brand
George J. Tamaro
Hugh S. Lacy
Frederick C. Rhyner
Joel Moskowitz
James L. Kaufman
Elmer A. Richards

FINANCE DIRECTOR
Joseph N. Courtade

MARKETING DIRECTOR
Martha J. Huguet

April 11, 2019

Riverside Developers USA, Inc.
299 Broadway, Suite 301
Brooklyn, NY 11201

Attn: Mr. Zelig Weiss

Re: Zero Drawdown Tolerance
376-378 Flushing Avenue
Brooklyn, NY
MRCE File 12904

Dear Mr. Weiss

We summarize herein our evaluation of the practicality of limiting groundwater lowering (drawdown) beyond site boundaries to zero given the site subsurface conditions and limitations in current construction technology.

Geologic Setting

The site subsurface profile consists of 5 to 15 feet of granular fill overlying thick deposits of highly pervious glacial outwash sands. Borings made at the site penetrated to depths of over 100 feet and did not encounter the bottom of the outwash sands. Regional mapping of principal soil formations on Long Island by the United States Geological Society (USGS) indicate that the outwash sands are underlain by the Gardiners clay formation at depths of 110 to 125 feet. Groundwater is at a depth of only about 10 feet. The saturated (water bearing) thickness of outwash sands at the site is thus estimated at over 100 feet.

The combination of high permeability and thickness make the outwash sands a prolific aquifer on Long Island. Most sands are more permeable in the horizontal direction than in the vertical direction. However, experience has shown that the horizontal and vertical permeability of the outwash sands are near equal due to the uniformity in grain size of the sand. Excavations penetrating below the groundwater table must therefore expect to pump significant volumes of groundwater.

Construction Plans

The proposed building will include cellar space. Cellar construction requires excavation to a depth of about 25 feet (Elev. -8), or about 12 feet below the groundwater table. Temporary dewatering of the outwash sands is therefore required to facilitate cellar construction.

The SOE plan currently calls for the installation of relatively impervious secant pile walls installed around two sections of the excavation perimeter to a depth of

about 40 feet, or about 15 feet below the excavation bottom, and the installation of a soldier beam and lagging wall along the remaining sections (along Flushing Avenue and Little Nassau Street), to an equal depth. MRCE has been asked to assume the SOE plan is revised so that secant pile walls are installed around the entire perimeter, to the maximum practical depth, in an effort to achieve "hydraulic containment," and asked to evaluate the feasibility of achieving "zero drawdrown" at an approximate distance of 150 feet beyond the perimeter. The perimeter secant walls will partially cutoff the lateral flow of groundwater to the excavation. Wellpoints are planned for dewatering within the excavation with the wellpoint tips maintained above the wall bottom to promote vertical groundwater flow and thereby limit pumping quantities and offsite drawdown. However, even with these positive and exceptional measures, dewatering will require pumping significant groundwater volumes and, regardless of the use of secant pile walls around the entire perimeter to the maximum practical depth, inevitably will result in off-site drawdown given the highly pervious outwash sand aquifer beneath the excavation bottom. The only means to achieve "zero drawdown" would be the use of a continuous slurry wall, keyed into the bottom aquitard (likely bedrock) on the order of 125 to 150 feet deep. From an engineering perspective, however, slurry walls are not constructible for this site given its small size and the presence of adjacent buildings.

In order to evaluate the depth of the cutoff on drawdown outside the cutoff, a full perimeter secant wall is assumed.

Feasibility of Zero Drawdown

Theoretical evidence and practical experience demonstrate that a groundwater cutoff wall such as a secant pile wall must fully penetrate a pervious aquifer to be effective. Relatively small openings or imperfections within cutoffs or gaps at the base of a cutoff can allow large quantities of water to pass and considerably reduce the efficiency of the cutoff. For example, as shown in Figure 1, a cutoff wall penetrating 90% of the aquifer depth reduces groundwater inflow only about 60%. In other words, the proposed secant pile wall would have to penetrate to a depth of 115 feet (90% of the outwash aquifer) and would only reduce groundwater inflows and resulting off-site drawdown about 60%. Secant pile verticality drifts with depth. The deeper the wall, the greater the chance of significant leakage.

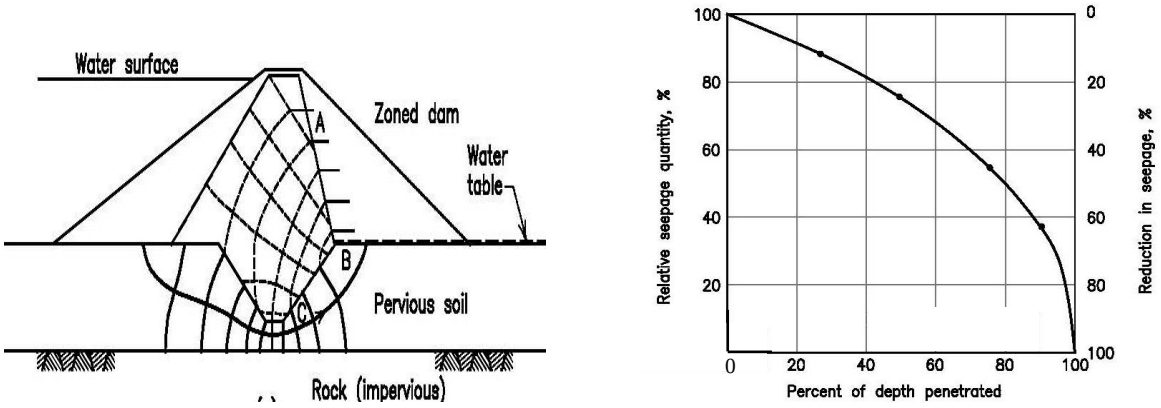


Figure 1 – Effectiveness of Partially Penetrating Cutoffs (Cedergren, 1981)

Significant further reduction in flow and off-site drawdown would require a wall completely penetrating the outwash sand aquifer to depth of 125 feet (or more) or a shallower wall with a grouted bottom across the entire excavation to cutoff vertical flow. However, even with such extraordinary measures, expecting cutoff perfection is unrealistic given the extreme depths of wall construction and expanse of required grout coverage across such a large excavation area. Leakage through small gaps between secant piles

or imperfections in a grouted bottom is inevitable and will result in groundwater inflow and off-site drawdown. Zero off-site drawdown is therefore not a practical expectation given the adverse site conditions and limitations in current construction technology.

Very truly yours,
MUESER RUTLEDGE CONSULTING ENGINEERS

Walter E. Kaeck

Walter E. Kaeck, PE

Document1


Head
6.4
3.1
0.8
-1.5
-3.8
-6.1
-8.4
-10.7
-13.0
Franklin Ave
KENT AVENUE
FLUSHING AVENUE
MW7
MW5
MW8
OB4
OB3
Well with No. 4 Fuel Oil
Figure No. 1
Former Arkansas Chemical Site
755 Kent Avenue, Brooklyn, NY
Monitoring Well Locations Locations
EBC
Environmental Business Consultants
Franklin Ave
Drawdown results utilizing wellpoints within a perimeter secant to el (-) 70

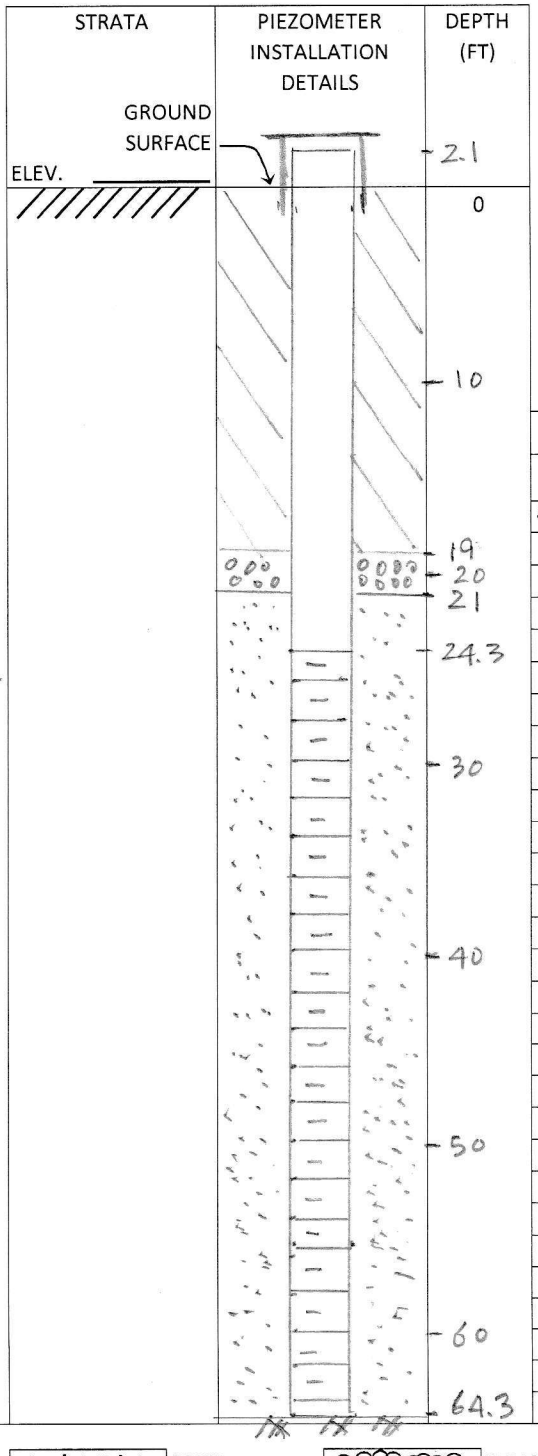
Mueser Rutledge Consulting Engineers
14 Penn Plaza - 225 West 34th Street
New York, NY 10122
T: 917 339-9300 F: 917 339-9400
www.mrce.com

PUMP WELL
~~PIEZOMETER~~ RECORD

PUMP WELL
~~PIEZOMETER OR BORING~~ NO. PW-01
SHEET 1 OF 2
FILE NO. 12904
INSTALLATION DATE 7/17/18
RES ENGR. S. HWANG

PROJECT: 378 FLUSHING AVE
LOCATION: BROOKLYN, NEW YORK
PIEZOMETER LOCATION: SBP

☐ SEE SKETCH ON BACK



PIEZOMETER TYPE PVC

INTAKE POINT
depth to bottom, ft = 64.3
depth to top, ft = 21.0
length, ft = 43.3 = L
diameter, in = 7 , ft = = 2R

STANDPIPE/RISER
elevation of rim, ft =
diameter, in = 4 , ft = = 2r

READING TIME		DEPTH – RIM TO WATER	ELEVATION OF WATER	REMARKS
DATE	CLOCK			
7/17/18	13:00	PUMPED WATER OUT		
		FROM WELL		
	13:06	~PRODUCED	2 GPM	
	13:11	PRODUCED	2 GPM	
	13:21	PRODUCED	2 GPM	
	13:30	PRODUCED	2 GPM	

SAND
GRAVEL
BENTONITE
~~GROUT~~ SOIL CUTTING

GROUND SURFACE ELEV.
PUMP WELL
~~PIEZOMETER~~ NO. PW-01

MRCE
built on firm foundations

Mueser Rutledge Consulting Engineers
14 Penn Plaza, 225 W. 34th Street
New York, NY 10122

BORING NO. PW-01
SHEET 2 OF 2
FILE NO. 12904
SURFACE ELEV.
DATUM

PROJECT 378 FLUSHING AVE
LOCATION BROOKLYN, NEW YORK
BORING LOCATION SBP

TEST/INSPECTION EQUIPMENT
REFERENCE CODES/STANDARDS

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG: TRUCK ____ SKID ____ BARGE ____ OTHER SONIC DRILL RIG

TYPE OF FEED DURING CORING: MECHANICAL ____ HYDRAULIC ____ OTHER ____

CASING USED [X] YES [ ] NO
DIA., IN. 4 DEPTH, FT. FROM 0 TO 65
DIA., IN. 6 DEPTH, FT. FROM 0 TO 65
DIA., IN. ____ DEPTH, FT. FROM ____ TO ____

TYPE AND SIZE OF:
D-SAMPLER
U-SAMPLER
S-SAMPLER N/A
CORE BARREL
CORE BIT
DRILL RODS

DRILLING MUD USED [ ] YES [X] NO
DIAMETER OF ROTARY BIT, IN.
TYPE OF DRILLING MUD

AUGER USED [ ] YES [X] NO
TYPE AND DIAMETER, IN.

CASING HAMMER, LBS. N/A AVERAGE FALL, IN.
SAMPLER HAMMER, LBS. N/A AVERAGE FALL, IN.
TYPE OF HAMMER

WATER LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO WATER	CONDITIONS OF OBSERVATION

WELL ~~PIEZOMETER~~ INSTALLED [X] YES [ ] NO SKETCH SHOWN ON Pg 1

STANDPIPE:	TYPE	PVC SCH 40	ID, IN.	4	LENGTH, FT.	26.4	TOP ELEV.	
INTAKE ELEMENT:	TYPE	PVC 0.020 SCREEN	OD, IN.	4	LENGTH, FT.	40.3	TIP ELEV.	
FILTER:	MATERIAL	SAND W.6. NO 2	OD, IN.	7	LENGTH, FT.	43.3	BOT. ELEV.	

PAY QUANTITIES

3.5" DIA. DRY SAMPLE BORING	LIN. FT.		NO. OF 3" SHELBY TUBE SAMPLES
3.5" DIA. U-SAMPLE BORING	LIN. FT.		NO. OF 3" UNDISTURBED SAMPLES
CORE DRILLING IN ROCK	LIN. FT.		OTHER:

BORING CONTRACTOR AQUIFER DRILLING AND TESTING, INC
DRILLER BRIAN KACSHICK HELPERS ARTIE CARO
REMARKS
RESIDENT ENGINEER S. HWANG DATE 7/19/16

BORING NO. PW-01

Aquifer Drilling & Testing, Inc.
75 E 2nd Street, Mineola, NY 11501
Tel: (800) 238-3745

ADT JOB NO.: 602-18-1094

DAILY JOB & SITE INVESTIGATION REPORT

DAY: TUES
DATE: 7/17/18
CLIENT: MRCE
JOB LOCATION: Rose Castle 380 Flushing Ave Bklyn
DESCRIPTION OF WORK: sonic drilling for 4" pvc well install

DRILLER: BRIAN
HELPER(S): ARTIE
RIG NO.: XLMAX 363
SUPPORT TRK: 423-370 390

TEST BORING DATA & SITE GEOLOGY

BORING NO.	TOTAL DEPTH	SAMPLES SOIL	H2O	BL CT	DTW	GRAVL/CBLE/BLDER SAND/SIL/CLAY
PW-01	65					

GM- finish load @ shop
* M.O.B to Home Depot Woodhaven Blvd
p/u sonic rig
- M.O.B to site.
- Drill 5" to 65'
- Drill 7" to 65'
Install well - sand/chip/install 6" stick up
develop .5 hr.

DRILLING METHOD

HSA / AIR / MUD / (SONIC)

Footage	Size
65'	5"
65	7"

CORING

Footage	Size

MISCELLANEOUS

Steam Clean (hr)	-
Standby (hr)	-
Stage Soils (hr)	-
Well Develop (hr)	.5
Borehole Grout (ft)	-
Poly Tubing (ft)	50'
Concrete Cores (no.)	-
Expend. Points (no.)	-
Drums (no.)	-
Sidewalk Permits (no.)	-

TEMPORARY TEST POINTS

WELL NO.	SIZE	SCRN	RISER	DEPTH	SAND	CHIPS	CMT	BENT	SURF(M/S)
PW-01	4"	40	25	65	12	1	1	1	6" STICK UP

Contact:

Arrive Shop@ 5:00 Leave Shop@ 5:30 Arrive Site @ 8:30 Leave Site @ 3:00 Arrive Shop @ Leave Shop @

PERSONNEL	SIGNATURE	AM SHOP	MOBE*	ON SITE	DEMOBE**	PM SHOP	TOTAL
BRIAN KARSHICK		.5	3	6.5			
ARTIE CARO		.5	3	6.5			

APPROVED: CLIENT REPRESENTATIVE MRCE DATE: 7/12/18

PRINT NAME:

Client's signature approves crews ON SITE hours.

* Indicate if Initial Mobilization

** Indicate if Final Demobilization

White (Client) Yellow (Accounting) Pink (Admin)