Project:	**Police Memorial and North Cove Marina Electrical Vault Resilience Project Construction Services**	**Date:**	**10/16/15**
		RE:	**Addendum # 3**
		# of Pages:	**(12 page)**

The following revisions and/or clarifications are to be made to the Request for Proposal for "**Police Memorial and North Cove Marina Electrical Vault Resilience Project Construction Services.**"

Clarifications / Revisions:

1. The original due date for the Police Memorial and North Cove Marina Electrical Vault Resilience Project Construction Services was October 19, 2015 by 3:00 p.m. As per this addendum, the due date is changed to **October 23, 2015 at 3:00 pm.**

2. The attached Geotechnical Investigation Report is provided for reference and shall be incorporated into the scope of work indicated in the original RFP posting.

By signing the line below, I am acknowledging that all pages of the addendum have been received, reviewed and understood, and will be incorporated into the bid price submitted. This document must be attached to the Proposal for consideration.

_____ _____

Print Name Signature Date

Number of pages received: _____ <fill in>

Geo Tech Consultants, LLC
52 E 2nd Street, Mineola, NY 11501 Tel: 516 355 0168 Fax: 516 355 0271

March 5, 2015

LMW Engineering Group, LLC
2539 Brunswick Ave
Linden, NJ 07036

Attn: Mr. Jieming Wang

Re: Geotechnical Investigation Report
Proposed North Cove Vault
Police Memorial
Battery Park City, NY
GTC Job No.: LMW11915

Dear Mr. Wang:

This report presents the results of a limited geotechnical investigation performed by Geo Tech Consultants (GTC) for the above referenced project. The work was performed in accordance with our proposal dated January 20, 2015 and your subsequent authorization.

The scope of our investigation performed for this project included:

- Installation and full-time inspection of two (2) test borings;
- Engineering analysis of boring data to determine the stratification and physical characteristics of the subsoil, and to develop recommendations for the design and construction of foundation systems for support of the proposed building;
- Preparation of a written report complete with boring data, analysis, conclusions, and recommendations.

1. PROJECT AND SITE DESCRIPTION

The subject property, known as Lot 3, Block 16, of the Borough of Manhattan, New York, is located on the higher portion of the Gateway Plaza, which is at the end of Liberty Street and west of South End Avenue. The level of the higher Gateway Plaza stands at elevation 14.65' (above NAVD), which is base elevation for a 500 year flood.

It is our understanding that the project consists of 2 schemes. Scheme 1 involves the installation of a rectangular-shaped electric vault on the southern end of the Gateway at a location immediately south of an existing underground pump house. The new electric vault

measures 9' (W) x 9' (H) x 48' (L) (or 8' by 46' interior) and is to be set to a depth around 4' below existing grade.

Scheme 2 involves the installation of two square-shaped electrical vaults of 17' (w) x 17' (L) x 18' (H) and a new staircase between them that links the higher Gateway Plaza to the lower Plaza level. Both new vaults are to be established into the ground at a depth of about 12' below plaza level.

Preliminary design information suggests that the rectangular-shaped electric vault weighs about 650 kips while the square-shaped vault weighs around 400 kips.

2. FIELD EXPLORATION

Two (2) test borings, labeled as B-1 and B-2, were performed as per project requirements on the higher side of the Gateway Plaza adjacent to the sites of the two proposed schemes at the locations as shown on drawing G-001, which is attached at the end of this report. These locations were selected as results of an underground utility survey.

Borings were performed by Craig Test Boring, Inc. of Mays Landing, New Jersey during the period from February 26th, 2015 to February 27th, 2015 and inspected by GTC's Professional Engineering staff.

The borings were advanced with a standard truck drill rig. Soils encountered were sampled at two (2) feet intervals for the first 12' and at five (5) foot intervals thereafter. Each soil sample was extracted using a Standard Split-Spoon sampler by performing a Standard Penetration Test (SPT) in accordance with ASTM D 1586. Where encountered, bedrock was cored with NX core barrels.

During drilling operations, extracted soil samples and rock cores were visually examined and classified by our field engineer. The samples were then placed in sealed glass jars and rock cores in wooden boxes. Both samples and rock cores were later returned to driller's shop for storage.

Detailed descriptions of the soil samples encountered in the borings were documented in the boring logs, which are presented on drawing G-001.

3. SUBSURFACE CONDITIONS

The following provides a general description of the soil profile inferred from the test borings. While the borings may indicate that the subsurface conditions appear to be uniform across the site, it should be recognized that the number of borings was small compared to the size of the site, and that the existence of anomalies cannot be precluded.

3.1 Soil Profile

The test borings installed at this site revealed a soil profile that depicts three distinguishable layers, which are described below in the order of increasing depth.

Stratum F – Fill (NYC Class 7)

Miscellaneous fill was encountered in borings B-1and B-2 to respective depth of 10' and 22' below existing grade. Given the wide variation in the depth of fill encountered between these two closely-spaced borings, one should expect the same in other areas as well.

The fill was described to consist mostly of sands with some concrete, rock and brick fragments, which is a NYC Class 7 material. The fill materials registered dense to very dense compact condition, suggesting that it was placed and compacted in a controlled compacted manner, and may be considered a control fill.

Stratum Ad - Alluvial Deposit – Organic clay, some sand and gravel (OH, NYC Class 6)

Below the fill, the borings encountered alluvial deposit to depths about 55'- 60' below grade. The alluvial deposit consists of organic clay with some sand, silt and gravel, which is consistent with OH Group of the Unified Soil Classification System (USCS). While the material registered generally medium stiff and stiff consistency, it is considered a Class 6 material, according to NYC Building Code.

Stratum Dr – Decomposed Rock (NYC Class 1d)

The alluvial deposit was underlain by a thin layer of decomposed rock that extends between 55'-60' below grade in B-1 and 59'-62' in B-2. The decomposed rock stratum consists of broken rock fragments with trace clay and sand. The material registered very dense compact condition with penetration resistance exceeding 50 blows per foot, matching NYC soil class 1d.

Stratum R – Rock (NYC Class 1b or better)

Bedrock was encountered in both borings at a depth around 59'-62' below existing grade, and was cored with one 5' run at each boring location. Both 5' core runs recovered well and registered Rock Quality Designation (R.Q.D.), between 73% and 90%, matching NYC Class 1b and 1a respectively.

Examination of the retrieved rock core specimen suggests that the bedrock is of slightly fractured gray mica schist.

3.2 Groundwater

Groundwater was observed in both borings at depth around 10' below existing grade. It should be noted that the aforementioned groundwater table was estimate based on observation of the soil samples retrieved from the borings. Accurate groundwater table can only be measured from groundwater observation wells.

It should also be pointed out that groundwater table is known to fluctuate with seasonal, climatic, and tidal conditions, particularly the tidal given the close proximity of the site to the adjacent Hudson River.

4. DISCUSSION AND RECOMMENDATIONS

The test borings revealed a generalized soil profile that consists of 10'-22' of fill, followed by approximately 33'-50' of alluvial organic clay that mix with sand and silt, and then 2'-5' of decomposed rock before reaching competent bedrock at 59'-62' below existing grade.

It should be pointed out that the two test borings installed for this project are located outside the footprint of the proposed vaults due to limited site access and concern over hitting existing underground utilities.

For the purpose of our analysis, it is assumed that the findings from these two borings are representative of the soil conditions below the proposed vaults.

4.1 Feasibility of wall footing support

Our analysis of the boring logs suggests that the existing fill materials encountered in the two borings are marginally suitable for the use of shallow spread footing foundation for support of the proposed construction because it was underlain by inferior soil of organic clay.

The results of our analysis are presented below.

SCHEME 1 - New 9' x 48' electric vault in Gateway

Scheme 1 involves the installation of a new electric vault of 9' x 48' (approximate outside dimension) on the southern end of the Gateway Plaza, at a location approximately 2.5' south of the existing underground WTC river water pump room. The bottom of the pump room is reported to have been established at a depth around 12' below plaza level.

Assuming the subsurface conditions revealed from boring B-1 (where 10' of fill was encountered and followed by 50' of organic clay) are uniform and representative of the soil conditions across the entire length of the proposed vault, then it is possible to support the vault on wall footings bearing on competent fill material.

Wall footings bearing on competent fill material and established at the required frost depth of 4' below grade can be designed for an allowable bearing capacity up to 1 tsf or 2 ksf. Based on this capacity and a wall footing width of 3.5', our analysis suggests that wall footings established at 4' below grade will yield settlements less than 1/2", assuming the underlying organic clay is normally consolidated.

However as the new vault is to be situated 2.5' from the adjacent lower level pump house, portion of the vault will fall into the influence line of the pump house. To avoid exerting pressures on the lower pump house, the north wall footing for the new vault will have to extend to depths below the influence line or to the same level of the adjacent footings, which would bring the bottom of the north wall footing closer to the top of or even into the inferior organic clay layers, resulting in larger settlements.

Our analysis suggests that if the north wall footing were to be established at 12' below grade to bear on organic clay, it could yield settlements ¾" to 1-1/4".

Assuming a 500 yr flood were to occur after the new electric vault has been installed and fully loaded, the vault should have enough weight to overcome the buoyant force resulting from the hydrostatic pressures due to the rising 500 yrs flood water.

SCHEME 2 – Two 17' x 17' Electric Vaults and Stairs

Each of the two electric vaults to be installed under Scheme 2 measures 17' by 17' and about 18' tall. The bottom of the vault will be established at a depth of about 12' below plaza grade.

The soil profile in this area as reveled from boring B-2, which was installed close to but not within the project site, depicts 22' of granular fill, followed by 32' of organic clay, then decomposed rock and bedrock.

If the subsurface conditions revealed from boring B-2 are uniform and representative of the soil conditions below each of the new vaults, then it is possible to support both vaults on wall footings bearing on competent fill material.

Wall footings bearing on competent fill material and established at depth of 12' below grade can be designed for an allowable bearing capacity up to 1 tsf or 2 ksf. Based on this capacity and a wall footing width of 3.0', our analysis suggests that the wall footings established at this level are likely to yield settlements less than 1/2", assuming the underlying organic clay is normally consolidated.

However if the thickness of the fill is much less than 22', then the resulting settlements would be much higher. For instance if the soil conditions encountered in B-1, where fill is only 10' thick, also prevail in this area, then the wall footings for these square vaults will

likely bear on organic clay, which could yield settlements exceeding 1", similar to the north wall footing for the vault of Scheme 1.

Assuming a 500 yr flood were to occur after the new electric vaults have been installed and fully loaded, the vaults should have enough weight to overcome the buoyant force resulting from the hydrostatic pressures due to the rising 500 yrs flood water. The critical period is during the period before the vaults are fully loaded.

Notes:

In any case, if wall footings are to be used for foundation support, it must be placed on at last 2' of controlled compacted fill, either existing competent fill or new fill, over in-situ organic clay material. Wall footing bearing directly on organic clay is not recommended.

In area where new fill is required, the organic material encountered at the subgrade shall be undercut at least 2' and replaced it with new controlled compacted fill. See section 5.3 for fill material specifications and compaction requirements. Natural ¾" crushed stone can be used as control fill but it needs to be wrapped around with a filter fabric such as Mirafi 500X.

All footing subgrade shall be subject to special inspection and shall be approved by a qualified inspector prior to placing concrete. At the discretion of the inspecting engineer, any soft material encountered at the footing bottom that is deemed unsuitable for bearing should be removed and replaced with controlled compacted fill.

4.2 Pile Foundation Support

4.2.1 Caisson Piles

Pile Design Criteria

Wall footings are applicable only if the above estimated settlements are deemed tolerable by the design team and the concern over excessive hydrostatic pressures acting against the vaults during construction is addressed. Otherwise, the vaults should be supported on deep foundations such as caisson piles.

Caisson piles are smaller diameter (generally 8"-12") piles that are installed by drilling, which generates little vibration and noise and thus is favored by reviewing agency.

By design, caisson piles are drilled and socketed into bedrock, deriving bearing capacity through bonding between pile grout and surrounding competent bedrock material.

Based on the soil profile established above, it is our opinion that caisson piles of 8" nominal diameter or larger may be used for this project. The final design capacity should be selected by project structural engineer based on the loading requirements and cost consideration.

Caisson piles are generally contracted out as performance specifications with contractor responsible for design, installation and quality assurance and control. The design of caisson piles shall satisfy both the geotechnical and structural requirements as stipulated in the NYC Building Code. A shop drawing with calculations prepared by contractor's engineer should be submitted to project engineer of record for review and approval prior to installation.

For the estimation of geotechnical capacities of caisson piles, a bonding strength of 200 psi between pile grout and the surrounding competent bedrock of NYC Class 1b or better may be used.

To ensure proper loading transfer from piling material to bedrock, steel casing shall be used and shall extend at least one foot into the competent bedrock. The competency of the bedrock shall be verified by a qualified geotechnical engineer. Visual inspection of the bedrock via video camera is acceptable to DOB.

Uplift capacity for a successfully installed caisson pile can be assumed at a value not to exceed 50% of the allowable compressive capacity it achieved.

Pile Lateral resistance

The lateral resistance of a caisson pile will depend upon its size and penetration depth and material. Our analysis suggests that for caisson pile of 8" in diameter that sockets at least 5' into bedrock can develop an allowable lateral resistance up to 2 tons.

Pile Load Tests

According to NYC Building Code, pile load tests are not required for caisson pile provided the competency of the bedrock where piles embedded are inspected and approved by a qualified geotechnical engineer via video camera or other approved methods.

4.2.2 Driven Piles

Driven piles such as open-end steel pipe piles or H-piles can be considered for use if some vibration and noise associated with the pile driving can be tolerated.

Steel pipe piles or H-piles can be driven to bedrock and designed for capacity suitable for the project.

4.3 Liquefaction Potential

The existing site soil conditions possess slight liquefaction potential. Liquefaction of the in-situ soil is not a concern.

4.4 Site Classification for Seismic Design

The boring data suggest that the in-situ site soil can be classified as site Class E for seismic design purpose.

4.5 Design Groundwater Level

Groundwater was encountered in all borings at a depth of about 10' below existing grade. As the site is to be designed for 500 year flood, design groundwater table should be assumed at the current grade level or elevation 14.65'.

4.6 Lateral Earth Pressures

Permanent basement walls should be designed to withstand long-term, at rest equivalent fluid pressures of 60 pounds per cubic foot (pcf) for the portion of wall above design groundwater level and 90 pcf for wall below design groundwater level.

Temporary walls, such as excavation shoring, if required, should be designed to withstand equivalent fluid pressure of 40 pcf for walls above groundwater level and 80 pcf for wall below groundwater level.

4.7 Damp proofing and Waterproofing

Any portion of the structure that will be submerged in water permanently (below design groundwater) shall be waterproofed, subject to discretion of the designing architect and engineer.

4.8 Dewatering

Dewatering is likely to be required for excavation to be below 7' below existing surface grade. In general, groundwater should be lowered and maintained at a level at least 2' below the bottom of the excavation to allow for placement of concrete.

5. CONSTRUCTION MONITORING

5.1 Protection of Adjacent Structures and Sidewalk

The excavation of the foundation may require shoring, bracing, and underpinning of the adjacent structures and sidewalks, which should be designed by a professional structural engineer engaged by the contractor. The design drawings should be submitted to the project engineer for review and approval prior to installation. The installation work shall be subject to control inspection by a qualified professional engineer as required per NYC Code.

5.2 Pre-construction Survey

It is recommended that a pre-construction survey be conducted to document the existing conditions of the adjacent structures and underground utility systems prior to commencement of any construction activities particularly during pile driving.

5.3 Filing and Backfilling

Filling and backfilling against pile caps shall utilize qualified fill material. Qualified fill should meet the grading requirement for control fill as stipulated in the NYC Building Code. Control fill should be placed in maximum 12" loose lifts and each lift should be compacted to at least 95% of its maximum dry density as determined in accordance with ASTM D1557.

6. LIMITATIONS

The conclusions and recommendations contained in this report are based on the subsurface data obtained during this investigation and on the details stated in this report. Should conditions be encountered which differ specifically from those stated in this report, we should be notified immediately so that our recommendations may be reviewed and/or revised, if necessary.

7. CONSTRUCTION CONSULTATION AND INSPECTION

Due to the nature of the soils and subsurface conditions at this site and the recommendations set forth herein, consultation and inspection services by a qualified soil engineer are recommended for the following:

1. Preparation of the site including all clearing, stripping of undesirable material, and initial proofrolling and compaction of the in-situ soils.

2. Placement of all controlled backfill and/or fill, if any.

3. Special inspection of piling installation.

We trust the above information will allow you to proceed with the design and construction of the proposed vaults.

We thank you for the opportunity of providing this service to you. Should you have any questions regarding this report, or if we can be of further assistance, please do not hesitate to contact us.

Respectfully Submitted
Geo Tech Consultants LLC.

Steve J. J. Lin, P.E.

Attachments:

Drawing G-001 Record of boring logs with boring location plan

B-1

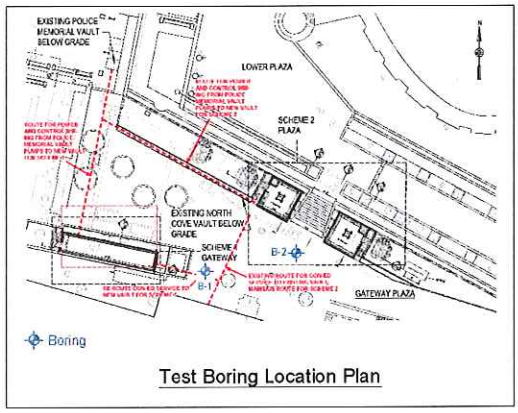
Depth (ft)	Soil Descriptions
0	2" Concrete
1	Crnf sand, sm. rock & brick fr./ bn.mst.v.dense;Fill;(Class 7)
5	Same / dense (Fill;(Class 7)
10	Same / v. dense (Fill;(Class 7)
15	Same / m.dense (Fill;(Class 7)
20	Organic clay fr.sand & silt /blk wet, m. stiff (OH);(Class 6)
25	Same, sm. sand / stiff (OH);(Class 6)
30	Same, fr. sand / m. stiff (OH);(Class 6)
35	Same, sm. sand / v stiff (OH);(Class 6)
40	Same, fr. sand / stiff (OH);(Class 6)
45	Same /m. stiff (OH);(Class 6)
50	Same / stiff (OH);(Class 4b)
55	Same / v. soft (OH);(Class 6)
60	Same (OH);(Class 6)
65	Same (OH);(Class 6)
67	Decomposed rock (Class 1d)
67	Gray slightly fractured schist with mica (Class 1b)
67	TEST BORING COMPLETED @ 67

Date drilled 2/26/2015
Groundwater was encountered at 10' below grade

B-2

Depth (ft)	Soil Descriptions
0	2" Concrete
1	Crnf sand, sm conc & brick fr./ bn.mast dense (Fill);(Class 7)
5	Same / v. dense (Fill);(Class 7)
10	Same (Fill);(Class 7)
15	Same (Fill);(Class 7)
20	Same / wet, m. dense (Fill);(Class 7)
25	Gravel, sm, conc, & brick fr./ blv. wet, dense (Fill);(Class 7)
30	Same / v dense (Fill);(Class 7)
35	Organic clay, fr. gravel / blk. wet. stiff (OH);(Class 6)
40	Same, sm. sand & silt / stiff (OH/SP);(Class 6)
45	Same, fr. gravel / v. stiff (OH);(Class 6)
50	Same, fr. sand & gravel / blk. wet. m. stiff (OH);(Class 6)
55	Same (OH);(Class 6)
60	Same / v. soft (OH);(Class 6)
64	Decomposed rock, fr. clay (Class 1d)
64	Gray slightly fractured schist with mica (Class 1a)
64	TEST BORING COMPLETED @ 64

Date drilled 2/27/2015
Groundwater was encountered at 10' below grade



Test Boring Location Plan

PROJECT: Battery Park City, New York, NY 10004

CLIENT: LMW Engineering Group, LLC

Geo Tech Consultants, LLC
Tel: 516-355-0100
Fax: 516-355-0277

DRAWING TITLE: Record of Boring Logs with Boring Location Plan

SEAL AND SIGNATURE:

DRAWN BY	L. Tom
DATE	3-2-2015
SCALE	N.T.S.
PROJECT NO.	LMW15-15
DRAWING NO.	G-001