
**GEOTECHNICAL HISTORIC
DATA REPORT**

**GOVERNORS ISLAND DEVELOPMENT
NEW YORK, NEW YORK**

Prepared For:

**Turner Construction Company
Governors Island
10 South Street, Slip 7
New York, NY 10004**

Prepared By:

**Langan Engineering and Environmental Services
360 West 31st Street, Eight Floor
New York New York 10001**

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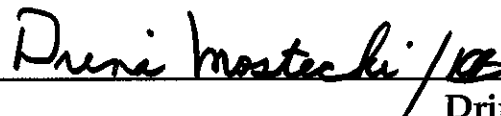
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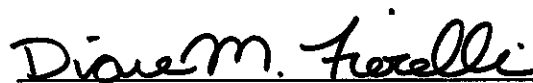
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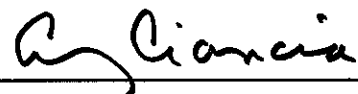
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INTRODUCTION

This report provides the results of the Geotechnical Historic Data Search performed by Langan Engineering and Environmental Services, P.C. (Langan) for Turner Construction. All services were performed in accordance with an agreement between Langan and Turner Construction dated, 29 November 2005.

The purposes of this Historic Data Search were to compile available geotechnical data for Governors Island, to evaluate the existing subsurface conditions, and to develop a supplemental subsurface investigation program to fill in the "gap" in subsurface data. The subsurface investigation program will be part of a separate due diligence study to evaluate suitable foundation types for proposed development on Governors Island.

Langan performed the following services during this study:

1. Obtained available plans, reports, data and files regarding Governors Island that were provided by the Governors Island computer databases;
2. Contacted local government agencies and drilling companies to supplement these data; and,
3. Compiled and summarized data.

Elevations referenced in this report refer to Governors Island Datum, unless otherwise noted. The datum of Governors Island is based on mean low water in 1932 when United Service Coast Guard monument number six was established. Governors Island datum is about 1.7 ft below the National Geodetic Vertical Datum (Mean Sea Level at Sandy Hook, New Jersey, 1929).

The following presents a brief site description, our understanding of the project, and a summary of the available geotechnical data for Governors Island. Also included are our recommendations for a due diligence investigation. A summary of sources from the Historic Data Search investigation is included in Appendices B & C.

GENERAL SITE DESCRIPTION

Governors Island is located in the upper New York Harbor within the East River approximately one-half mile south of Battery Park in Lower Manhattan and one-quarter mile west of the Brooklyn waterfront. A site location map is included as Figure 1. The site is approximately 170 acres, of which more than half is man-made. The historic shoreline is superimposed on an existing Governors Island site plan in Figure 2.

The original land area was about 70 acres with a surface elevation ranging from about el 9 to 40 ft. This land area is generally north of Clayton Road and Hay Road. The

southern portion of the island, which was created by various filling operations, is about 100 acres and is relatively flat with surface elevations ranging from approximately el 9 to 15 ft.

There are about 200 buildings on the Island of which about 60 are historic. Most of the structures are presently unoccupied. The historic buildings include Fort Jay, a military structure and Castle Williams, which were built immediately following the American Revolution. About twenty-two acres of the site comprise the Governors Island National Monument, which is operated by the National Park Service (NPS).

Most of the Island outboard of the historic shoreline is within Flood Zone B, based on the 1983 FEMA Flood Insurance Map (flood map). The perimeter of the Island is in Flood Zone A6. Flood Zone A6 are areas below the 100 year flood elevation, while Flood Zone B is defined as areas between the 100 and 500 year flood elevation, or areas less than 1 ft below the 100 year flood elevation. The 100 year flood elevation is about el 11.7. A copy of the flood map is included as Appendix D.

PROPOSED CONSTRUCTION

It is our understanding that the portion of Governors Island that is not part of the National Monument is to be developed. The actual new scope of the development has not been determined, however, it will likely include a new 40 acre park and water front esplanade. The non-historic buildings within the southern side of the island will likely be demolished with exception of the Fire House Building (Number 960) and the Switchgear Building (Number 920). This study is to be part of a package to use in obtaining solicitations from teams to develop Governors Island.

GOVERNORS ISLAND HISTORY

Governors Island was originally referred to as "Paggank" (Nut Island) by the Native Americans of the Manhattan region. In 1637, the Dutch acquired the Island from the Native Americans and in 1664 the British took possession of the Island. The Island housed the British Governor and therefore it was called "Governors Island". Subsequently, due to the island's strategic location, it was used by the British and United States as a military facility. In 2003, after two centuries of restricted military use, the land was transferred from the Federal Government to the State and City of New York and the National Park Service.

As previously noted, the original footprint of Governors Island included mainly the northern side of the Island with about 70 acres of land mass. Historic maps indicate that Clayton Road was adjacent to the original shoreline as shown in Figure 2. The maps are included in Appendix A. From 1901 to 1912, the Army Corps of Engineers supervised the deposit of about 4,787,000 cubic yards of fill which added about 100

acres of flat land. This fill was primarily backfilled with excavated material from the Lexington Avenue Subway Construction.

HISTORIC DATA SEARCH

Our historic data search included compilation of available soil boring and building foundation data for the island. To accomplish this search, we reviewed the Governors Island Archive files, contacted the Coast Guard (former owner's of the site), and contacted local drilling companies and city agencies. Almost all of the available information was found in the Governors Island Archives. A summary of what was compiled is provided herein.

Available Subsurface Data

Available subsurface information at this site includes 122 geotechnical borings performed over a span of six decades between the dates of 1931 to 1994. The approximate locations of available data are shown in Figure 3; the sources of data are summarized in Appendix B.

In general, the borings were advance using rotary drilling techniques with steel casing. Soil samples were obtained using a standard 2 inch outside diameter split spoon driven by 140 lb hammer falling 30 inches. The older borings used a 300 lb hammer falling 30 inches. The type of hammer used is unknown. Standard Penetration Resistance (N-values) were recorded for some of the borings, but for the older borings no N-values were recorded. The depths of borings ranged from about 10 ft to 115 ft below the existing ground surface. The northern side of the Island (inboard of historic shoreline) had limited boring information. Most of the borings were drilled by the piers and along the perimeter of the island. No laboratory test data was found by Langan.

Subsurface Conditions

The soil conditions can roughly be categorized as two typical profiles:

1. Soil profiles inboard of the historic shoreline
2. Soil profiles outboard of the historic shoreline.

General subsurface profiles are presented in Figures 4a, 4b, 5a, 5b, 5c, 6a, 6b, 7a and 7b. The locations of the profiles are shown on the plan in Figure 3. The following description provides an overview of the subsurface conditions on Governors Island.

Inboard of Historic Shoreline

The subsurface conditions at the inboard of the historic shoreline generally consist of miscellaneous fill, overlaying glacial soils, decomposed rock, and bedrock.

The miscellaneous fill consisted of sands with varying amounts of silt and gravel, with occasional inclusions of brick, wood, ashes and cinder. The density of the fill varied significantly from loose to very dense in areas where cobbles and boulders were encountered. The layer was generally 5 to 10 ft thick.

The glacial soils consist of medium to very dense, fine to coarse sands with varying amounts of silt, clay, gravel. In addition, numerous boulders and cobbles were encountered within this strata.

Weathered rock was observed at the interface of the sands and bedrock. In one boring rock was encountered at a depth of about 60 ft below grade. This is not anticipated to be consisted through this side of the island, as some borings were drill to depth of 80 ft and bedrock was not encountered. It appears that the depth to the top of bedrock typically increases from the north to south side of the island.

Outboard of Historic Shoreline

The subsurface conditions at the outboard of the historic shoreline generally consist of miscellaneous fill, organic silt and clay, overlying glacial soils, decomposed rock, and bedrock.

The miscellaneous fill generally consists of sand with varying amount of silt and gravel. The density of these strata varied significantly from very loose to dense. Based on boring data the miscellaneous fill stratum extends to about 40 ft deep. Obstructions were noted throughout the fill; these obstructions include metal, cobbles, boulders, brick, and cement.

Organic silt and clay was encountered beneath the fill. At the historic shoreline, the organic layer is about 10 ft thick. This layer is thicker than 40 ft at the southern edge of the island.

Beneath the organic soils are glacial soils. The glacial soils consist of dense to very dense, fine to coarse sand containing varying components of silt, clay and gravel and boulders. Most of the deeper borings were terminated in this layer.

Two available borings were terminated in weather rock. The weathered rock was encountered at a depth of about 115 ft below existing grade. Bedrock is present below the weathered rock; however, none of the available borings on the southern part of the island were advanced to rock.

Groundwater

The groundwater elevations, obtained from the drawings, varied from about el 0 ft to el 6 ft. The East River is a tidal river; therefore, the groundwater elevations near the river will be impacted by tide changes. The groundwater elevations may also be influenced by seasonal changes.

Existing Foundations

The available information regarding foundation systems on the island is limited. Foundation information was found for about 50 of the existing buildings, with a total of 82 drawings reviewed that relate to these foundations. A list of these drawings and a summary of the existing foundation systems are shown in Figure 8 and listed in Appendix C.

Based on the available data, most of the structures on Governors Island are supported on a shallow foundation system; typically spread footings with an allowable bearing pressure of less than 1.5 tons per square ft. Only one building (Building 108) was found to have higher capacity spread footings, this building is located inboard of the historic shoreline. Those buildings supported on shallow foundations are shown in green on the Existing Foundation plan which is included as Figure 8.

The buildings that are supported on deep foundation elements are typically outboard of the historic shoreline. The locations of these buildings are shown in blue on Figure 8. Most of the deep foundation elements consist of timber piles. Most of the piles are about 50 ft long; however, in one area of the site the piles are reported to be only about 10 ft long. The timber piles have capacities of about 15 or 20 tons. Based on the drawings, three buildings, the seven-story Family Housing Buildings (Buildings Number 844, 855, 866) are supported on a "composite pile", with an installed length of about 100 ft. The reported capacity of this composite pile is about 20 tons.

The highest capacity pile elements that have been found in the records are for Building 825. Building 825 is supported on concrete steel pipe piles with an allowable load of 45 to 55 tons. The lengths of the steel pipe piles are unknown.

A large amount of the buildings have a basement level. The basements are likely at or within a few feet of the ground water table. The slabs and walls are typically waterproofed or have a gravel underdrain system.

FEASIBLE FOUNDATION SYSTEMS

Based on the available data, feasible foundation systems for new development will depend on the size of the building. Smaller light weight structures could potential be supported on a shallow foundation system bearing on the fill with a bearing pressure of around 1 tsf. For foundations to be supported on these soils, additional borings would need to be performed to verify the consistency of the fill; also, surcharging of the organic soils may be required to reduce long term-settlement. Laboratory test results including consolidation test of the organic soils are required to estimate potential long-term settlements and confirm the need for surcharging.

For larger buildings, piles driven into the glacial soils may achieve capacities ranging from about 60 to 150 tons. Foundation capacities of over 1000 tons are considered realistic for caissons in rock at the site.

Additional borings will be required to better define the deep foundation elements that are feasible for the site (i.e., depths, types, capacity). Soil property data, specifically from the cohesive soils will need to be determined to evaluate strength characteristics of the soils and the potential for long term settlements. Additional information regarding the fill on site is recommended to better define the thickness and composition of this layer.

GROUNDWATER CONSIDERATIONS

The design groundwater level will likely be the 100 year flood level or el 11.7. Presently, large areas of the island are below the 100 year flood elevation. Generally, insurance companies require that the first floor slabs for new construction be set a minimum of 1 ft above the design groundwater level and 100 year flood level. Regrading in the vicinity of new structures may be required to accommodate the higher building slabs. Below grade space will need to be designed to accommodate potential flood water. This could be accommodated through sumps and pumps pressure slabs and walls, or for unfinished spaces, allowing the below grade levels to flood during 100 year events.

ADDITIONAL INVESTIGATION RECOMMENDATIONS

We recommend performing a limited due diligence investigation to help fill in the "gaps" in this data. The investigation should consist of geotechnical borings and laboratory testing so that the bearing soils can be defined and the nature of the fill and organic soils characteristics can be determined.

The available data is concentrated mainly on the western side of the island, along the shoreline. There is some data available at the eastern side of the island and basically no data available for the middle part of the island which is presently occupied by ball fields. Of the data that is available, there is little information about the soil and rock strata that are present below the organic soil layers. There is almost no data available about bedrock. There is also no available laboratory data for the soils, so the engineering characteristics of the organic soils can not be determined.

About 12 borings are recommended as part of this investigation. The proposed boring locations are shown in plan on Figure 9. The borings are scattered throughout the island, and are located to fill in data gaps as well as supplement and confirm existing boring data. Borings should be drilled a minimum of 10 ft into bedrock at each location.

Undisturbed Shelby tube samples should be obtained during this investigation and laboratory testing including triaxial and consolidation testing as well as index testing should be performed so that the properties of the soils can be defined.

Groundwater observation wells should be installed in three of the completed boreholes so that the level of the groundwater table, including any fluctuations with tide can be accurately determined. The proposed observation well locations are also shown in Figure 9.

LIMITATIONS

The conclusions and recommendations provided herein are based on information obtained through our historic archive review, information provided by drilling companies and the information provided to us by the Coast Guard and Turner Construction Corporation. The recommendations are given contingent upon one another and no recommendation shall be followed independently of the others. This report has been prepared to assist Turner Construction in planning the development at Governors Island. If additional information becomes available, Langan should be advised to assess the impact on our findings and recommendations.